Серво- и пропорциональные клапаны

Технические характеристики

RE 29 055-M/08.00

Replaces: 03.00

engineering mannesmann Rexroth

4/2 and 4/3 proportional directional control valve, direct operated, without electrical position feedback, sea water resistant Type 4WRA 6…JK31

Features of the sea water resistant version

The following modifications have been carried out to the standard version:

– The external metal components have been zinc galvanised (solenoid, housing), aluminium nickel plated (component plug) and plastic (electronics housing)

– Sea water resistance is identified by the code „**JK31**" in the ordering code

Note:

The valve fixing screws have to be separately ordered:

4 off M5 x 50, DIN 912-10.9 NEL[1), M_A = 8,9 Nm, material no.: **00011396**

1) The code NEL stands for non-electrolytically applied zinc coatings which contain a lubrication additive for the reduction of friction in accordance with ISO/WD 10683, colour silver.

Further information can be obtained from the standard documentation RE 29 055.

Ordering details, preferred types

4WRA		**6**		**– 2X / G24**		**J**	**K31/**		**V**	*****

Nominal size 6 **= 6**

K31 = With component plug to E DIN 43 563-AM6-3 **Without** plug-in connector Plug-in connector – separate order, see standard documentation RE 29 055

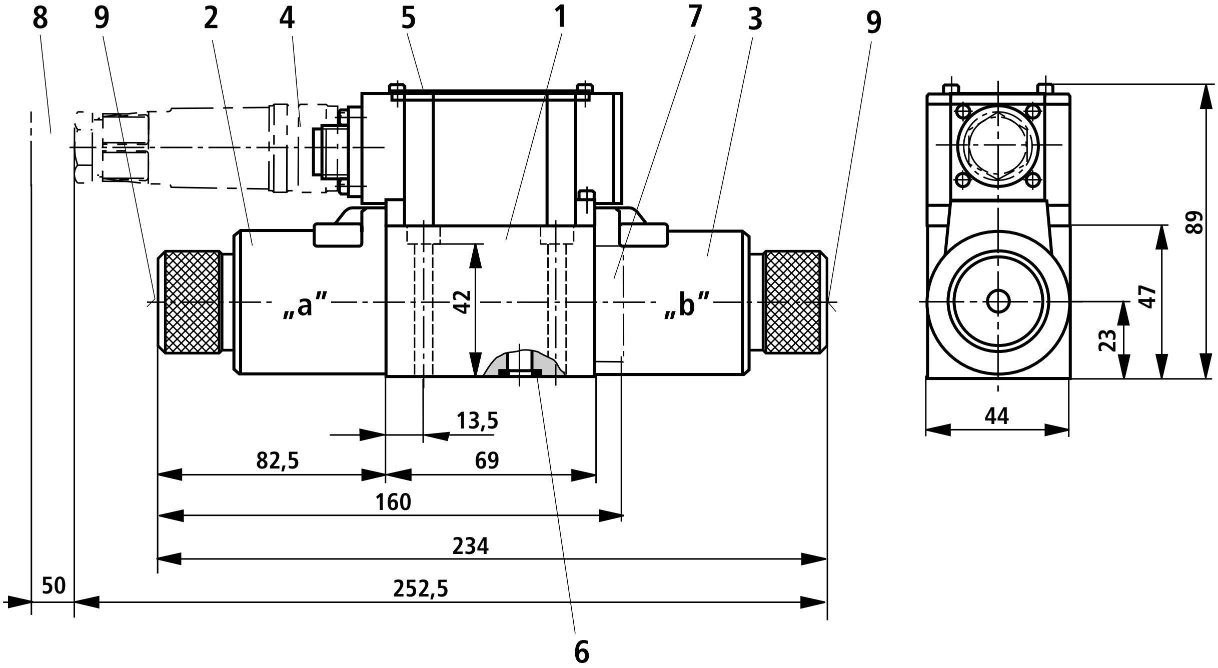
J = Sea water resistant

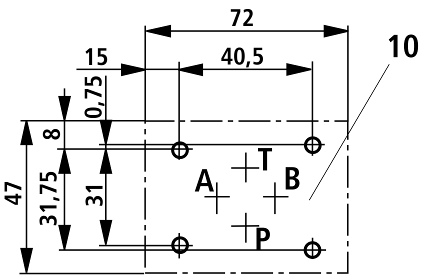
No code = Without hand override
N = With hand override

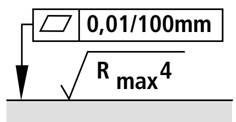
Preferred types	
Type	**Material number**
4WRA 6 EA15-2X/G24NJK31/V	00952255
4WRA 6 EA30-2X/G24NJK31/V	00952256

Unit dimensions

(Dimensions in mm)







Required surface finish of mating piece

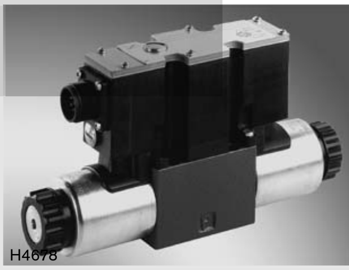
- **1** Valve housing
- **2** Proportional solenoid "a"
- **3** Proportional solenoid "b"
- **4** Plug-in connector to E DIN 43 563-BF6-3/Pg11, separate order
- **5** Name plate
- **6** R-ring 9.81 x 1.5 x 1.78 (Ports A, B, P, T)
- **7** Plug for valves with one solenoid (2 switching positions, versions **EA** or **WA**)
- **8** Space required for the connection cable and to be able to remove the plug-in connector
- **9** Hand override
- **10** Machined valve mounting surface, connection locations to DIN 24 340 form A, ISO 4401 and CETOP-RP 121 H

4/2- and 4/3-way proportional directional valves, direct operated, without electrical position feedback, without/with integrated electronics (OBE)

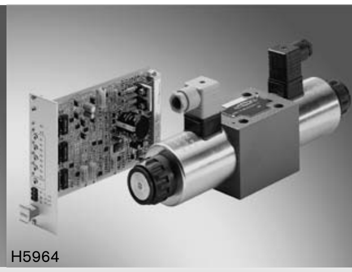
RE 29055/10.05
Replaces: 08.01

Types 4WRA and 4WRAE

Nominal sizes 6 and 10
Component series 2X
Maximum operating pressure 315 bar
Maximum flow: 42 l/min (NS6)
75 l/min (NS10)



Type 4WRAE 6 …-2X/G24K31/.V with integrated electronics (OBE)



Typ 4WRA 10 …-2X/G24…K4/V with plug-in connectors and associated control electronics (separate order)

Overview of contents

Contents	Page

Features

– Direct operated proportional directional valve without electrical position feedback and integrated electronics (OBE) for type 4WRAE
– Control the direction and magnitude of a flow
– Actuation by means of proportional solenoids with central thread and removable coil
– For subplate mounting:
  Connection position to ISO 4401
  Subplates to catalogue sheets RE 45052 (NS6) or RE 45054 (NS10) separate order, see page 12 to 15
– Spring centred control spool
– Control electronics
  • 4WRAE:
    - integrated electronics (OBE) with voltage input or current input (A1 resp. F1)
  • 4WRA:
    - digital or analogue amplifier in Eurocard format (separate order)
    - analogue module amplifier

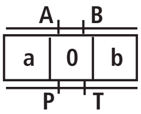
Ordering details

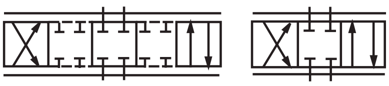
4WRA				–2X/ G24		/	V	*

Without integrated electronics (OBE) **= No code**
With integrated electronics (OBE) **= E**

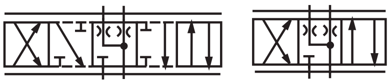
Nominal size 6 **= 6**
Nominal size 10 **= 10**

Spool symbols

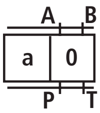




= E
E1–



= W
W1–



= EA

= WA

With spool symbols E1– and W1–:
P → A: $q_{V\,max}$ B → T: $q_V/2$
P → B: $q_V/2$ A → T: $q_{V\,max}$

Note:
With spools W and WA, in the neutral position, there is a connection from A to T and B to T with approx. 3 % of the relevant nominal cross-section.

Nominal flow at a valve pressure differential Δp = 10 bar

	NS6
07 =	7 l/min
15 =	15 l/min
30 =	26 l/min
	NS10
30 =	30 l/min
60 =	60 l/min

2X = Component series 20 to 29
(20 to 29: unchanged installation and connection dimensions)

G24 = Supply voltage 24 VDC

Special protection
No code = Without special protection
J [1] **=** Sea water resistant (only for NS6)
For details regarding the sea water resistant versions see RE 29055-M

Electrical connections
for 4WRA:
K4 [2] **= Without** plug-in connector, with component plug to DIN EN 175301-803
plug-in connector – separate order, see page 7
for 4WRAE:
K31 [2] **= Without** plug-in connector, with component plug to DIN EN 175201-804
plug-in connector – separate order, see page 7

Electronic interfaces A1 or F1 for 4WRAE
A1 = Command value input ± 10 V
F1 = Command value input 4 to 20 mA
No code = For 4WRA

Seal material
V = FKM seals, suitable for mineral oil (HL, HLP) to DIN 51524

Further details in clear text

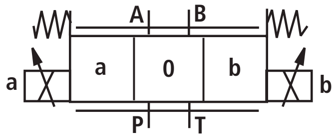
[1] Other types of electrical protection on request

[2] Only for NS6: for version **"J"** = sea water resistant only state **"K31"**!

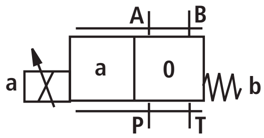
Symbols

Without integrated electronics

Type 4WRA…

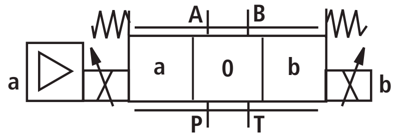


Types 4WRA…**EA**…; 4WRA…**WA**…

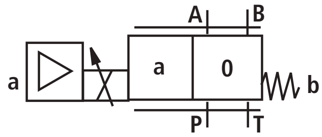


With integrated electronics (OBE)

Type 4WRAE…



Types 4WRAE…**EA**…; 4WRAE…**WA**…



Function, section

The 4/2- and 4/3-way proportioanl directional valves are designed as direct operated components for subplate mounting. They are actuated by means of proportional solenoids with central thread and removable coil. The solenoids are controlled either by external control electronics (type 4WRA) or by integrated control electronics (type 4WRAE).

Design:

The valves basically consist of:

– Housing (1) with mounting surface
– Control spool (2) with compression springs (3 and 4)
– Solenoids (5 and 6) with central thread
– Optional integrated electronics (7)

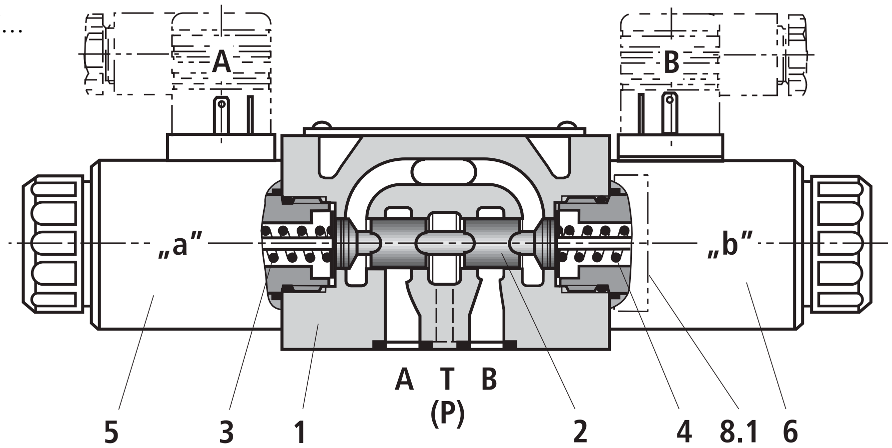
Function:

– With the solenoids (5 and 6) de-energised, the control spool (2) is held in the central position by compression springs (3 and 4)

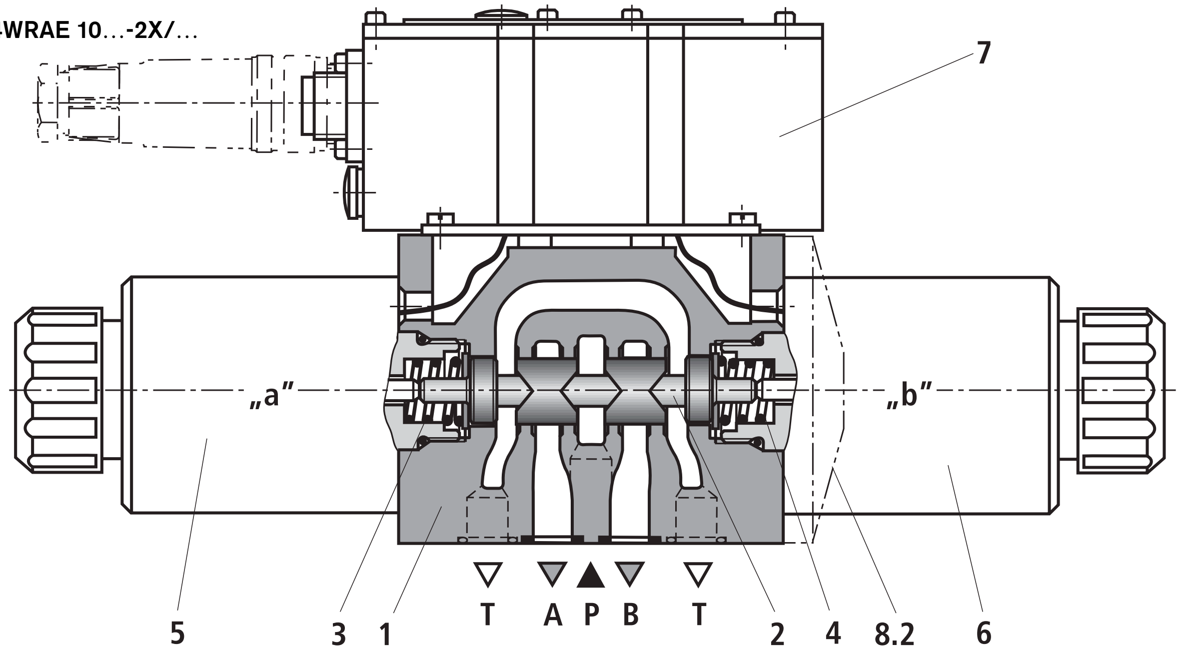
– Direct actuation of the control spool (2) by energising a proportional solenoid
E.g. energinsaion of solenoid "b" (6)
→ The control spool (2) is moved to the left in proportion to the electrical input signal
→ connection from P to A and B to T via orifice-like cross-sections with progressive flow characterisics

– De-energisation of the solenoid (6)
→ The control spool (2) is returned to the central position by compression spring (3)

Type 4WRA 6…-2X/…



Type 4WRAE 10…-2X/…



Valve with 2 spool positions:

(Type 4WRA…**A**…)

In principle, the function of this valve version corresponds to that of the valve with 3 spool positions. However, the valves with 2 spool positions are **only fitted with solenoid "a"**. Instead of the the 2nd proportional solenoid a plug (8.1) is fitted for NS 6 or for NS 10 a cover (8.2).

Note for type 4WRA 6…-2X/…:

Draining of the tank line is to be avoided. With the appropriate installation conditions, a back pressure valve is to be installed (back pressure approx. 2 bar).

Technical data (for applications outside these parameters, please consult us!)

General

Nominal size		NS	**6**	**10**
Installation			optional, preferably horizontal	
Storage temperature range		°C	–20 to +80	
Ambient temperature range	4WRA	°C	–20 to +70	
	4WRAE	°C	–20 to +50	
Weight	4WRA	kg	2.0	6.6
	4WRAE	kg	2.2	6.8

Hydraulic (measured with HLP46, $\vartheta_{oil} = 40\ °C \pm 5\ °C$)

Max. operating pressure	Ports A, B, P	bar	315	
	Port T	bar	210	
Nominal flow $q_{V\ nom}$ at $\Delta p = 10$ bar		l/min	7, 15, 26	30, 60
Max. permissible flow		l/min	42 (80) [1]	75 (140) [1]
Pressure fluid			mineral oil (HL, HLP) to DIN 51524 other pressure fluids on request!	
Pressure fluid temperature range		°C	–20 to +80 (preferably +40 to +50)	
Viscosity range		mm^2/s	20 to 380 (preferably 30 to 46)	
Max. permissible degree of pressure fluid contamination cleanlisness class to ISO 4406 (c)			class 20/18/15 [2]	
Hysteresis		%	≤ 5	
Reversal error		%	≤ 1	
Response sensitivity		%	≤ 0.5	

[1] Max. permissible flow with a dual flow path

[2] The cleanliness class stated for the components must be adhered too in hydraulic systems. Effective filtration prevents faults from occurring and at the same time increases the component service life.
For the selection of filters see catalogue sheets RE 50070, RE 50076, RE 50081, RE 50086 and RE 50088.

Technical data (for applications outside these parameters, please consult us!)

Electical

Nominal size		NS	**6**	**10**
Voltage type			DC	
Command value signal	Voltage input „A1“	V	±10	
with type WRAE	Current input „F1“	mA	4 to 20	
Max. current per solenoid		A	2.5	
Solenoid coil	Cold value at 20 °C	Ω	2	
resistance	Max. warm value	Ω	3	
Duty		%	100	
Max. coil temperature 1)		°C	150	
Electrical connections	4WRA		with component plug to DIN EN 175301-803 or ISO 4400	
see page 7			plug-in connector to DIN EN 175301-803 or ISO 4400 2)	
	4WRAE		with component plug to DIN EN 175201-804	
			plug-in connector DIN EN 175201-804 2)	
Valve protection to EN 60529			IP65 with mounted and fixed plug-in connector	

Control electronics

For 4WRA	Digital amplifier in Eurocard format 2)		VT-VSPD-1-2X (to RE 30523 - middle of 2006)
	Analogue amplifier in Eurocard format 2)		VT-VSPA2-1-2X/… to RE 30110
	Analogue module amplifier 2)		VT-MSPA2-1-1X to RE 30228
For 4WRAE			integrated into the valves, see page 8
	Analogue command value module		VT- SWMA-1-1X/... to RE 29902
	Analogue command value module		VT-SWMKA-1-1X/... to RE 29903
	Digital command value card		VT-HACD-1-1X/… to RE 30143
	Analogue command value card		VT-SWKA-1-1X/... to RE 30255
Supply voltage	Nominal voltage	VDC	24
4WRAE, 4WRA 3)	Lower limiting value	V	21 / 22 (4WRA); 19 (4WRAE)
	Upper limiting value	V	35
Amplifier current	I_{max}	A	1.8
consumption	Max. impulse current	A	3

1) Due to the occurring surface temperature of the solenoid coils, the European Standards DIN EN 563 and DIN EN 982 must be taken into account!

2) Separate order

3) With Bosch Rexroth AG control electronics

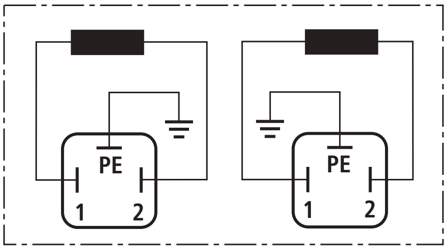
☞ **Note:** For details regarding the **environmental simulation test** covering EMC (electro-magnetic compatibility), climate and mechanical loading see RE 29055-U (declaration regarding environmental compatibility).

Electrical connection, plug-in connectors

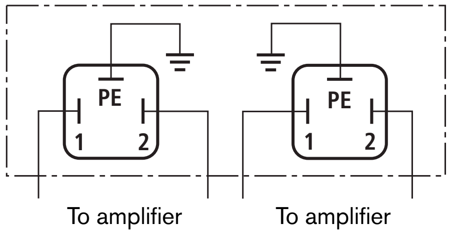
For type WRA

(**without** integrated electronics – **not** for version "**J**" = sea water resistant)

Connection on component plug



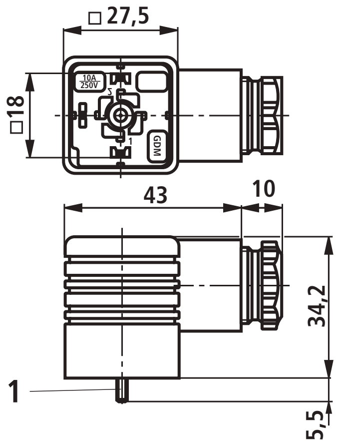
Connection on plug-in connector



Plug-in connector CECC 75 301-803-A002FA-H3D08-G to DIN EN 175301-803 or ISO 4400

Solenoid **a**, colour grey
Separate order: Material No. **R901017010**

Solenoid **b**, colour black
Separate order: Material No. **R901017011**



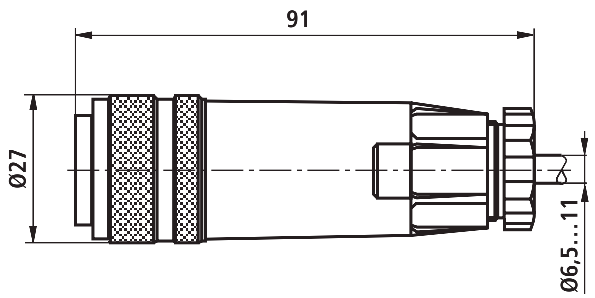
1 Fixing screws M3
Tightening torque M_A = 0.5 Nm

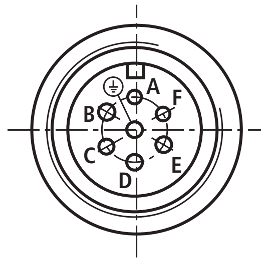
For type WRAE

(**with** integrated electronics (OBE) and for version "**J**" = sea water resistant)

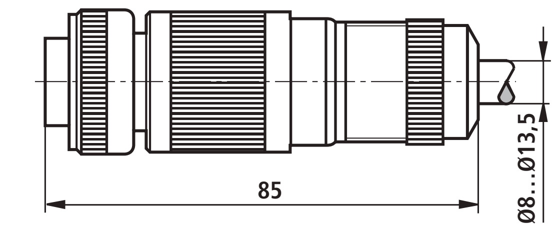
For pin allocation, see block circuit diagram on page 8

Plug-in connector to DIN EN 175201-804
Separate order: Material No. **R900021267**
(plastic version)



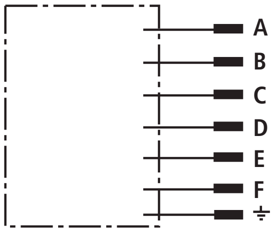


Plug-in connector to DIN EN 175201-804
Separate order: Material No. **R900223890**
(metal version)



Integrated electronics (OBE) for type WRAE

Pin allocation of the component plug



Integrated control electronics (see below)

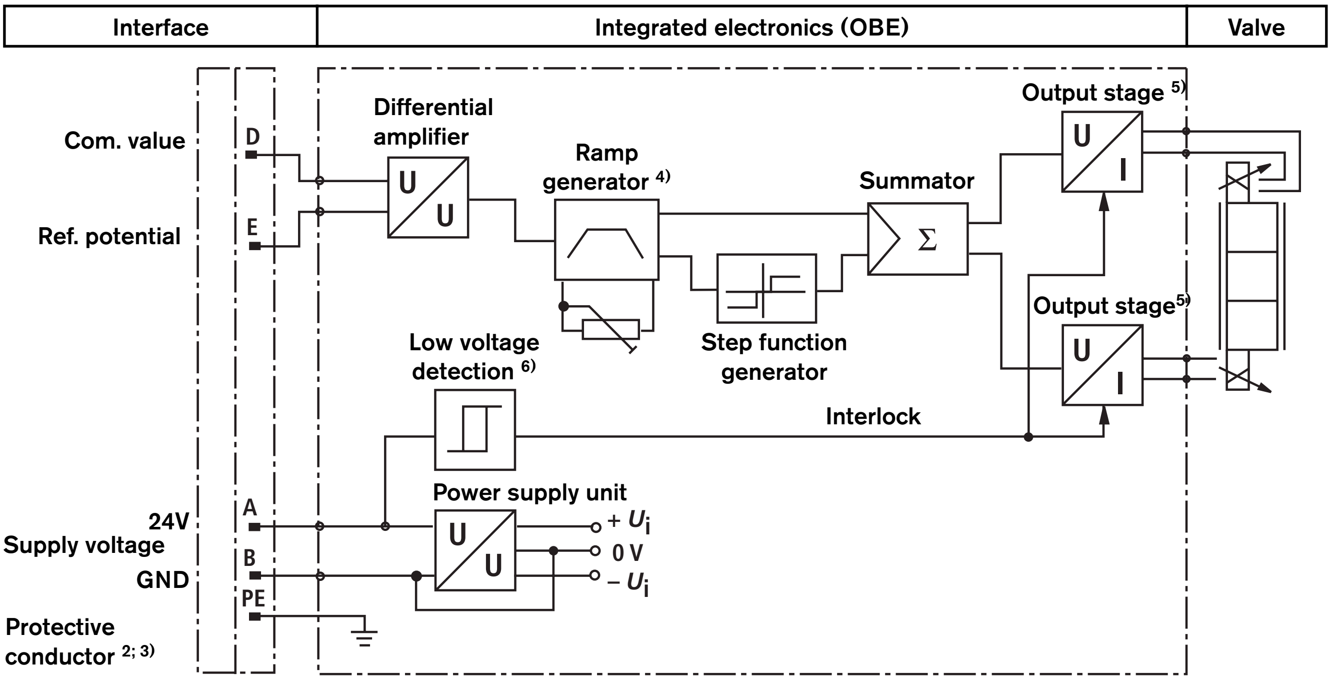
Pin allocation	Contact	Signal
Supply voltage	A	24 VDC (19 to 35 VDC)
	B	GND
	C	n.c. [1]
Differential amplifier input	D	Com. value (± 10 V / 4 to 20 mA)
	E	reference potential
	F	n.c.

Com. value: Positive command value (0 to 10 V or 12 to 20 mA) at D and reference potential to E causes flow from P to A and B to T.
Negative command value (0 to – 10 V or 12 to 4 mA) at D and reference potential to E causes flow from P to B and A to T.
For valves with a solenoid on side „A“ (spool variants **EA** and **WA**) a positive command value at D and reference potential to E (NS 6: 4 to 20 mA and NS 10: 12 to 20 mA) causes flow from P to B and A to T.

Connection cable: Recommendation: – up to 25 m cable length type LiYCY 5 x 0.75 mm^2
– up to 50 m calbe length type LiYCY 5 x 1.0 mm^2
External diameter 6.5 to 11 mm
Connect screen to PE only on the supply side.

[1] Contacts C and F must not be connected!

Block circuit diagram / connection allocation



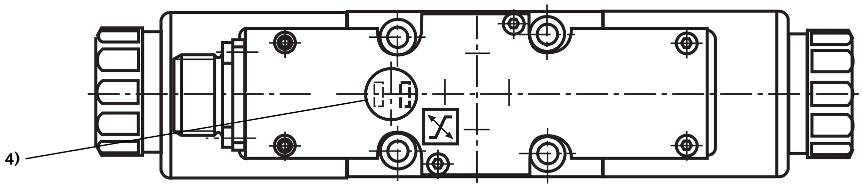
[2] PE is connected to the cooling body and the valve housing

[3] Protective conductor screwed to the valve housing and cover

[4] Ramp can be externally adjusted from 0 to 2.5 s; the same applies for T_{up} and T_{down}

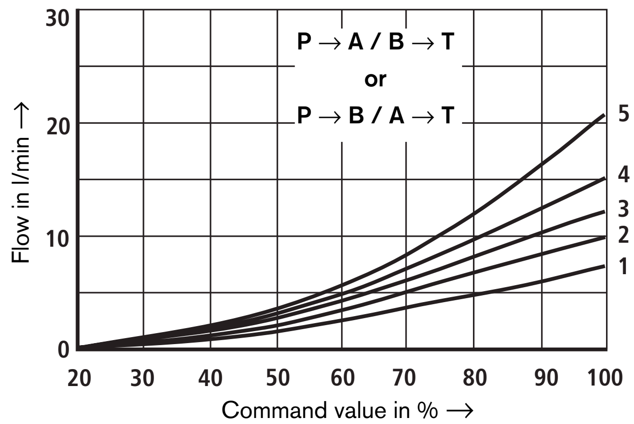
[5] Output stages current regulated

[6] Low voltage detection is **not** carried out for component type 4WRAE 10-2X.

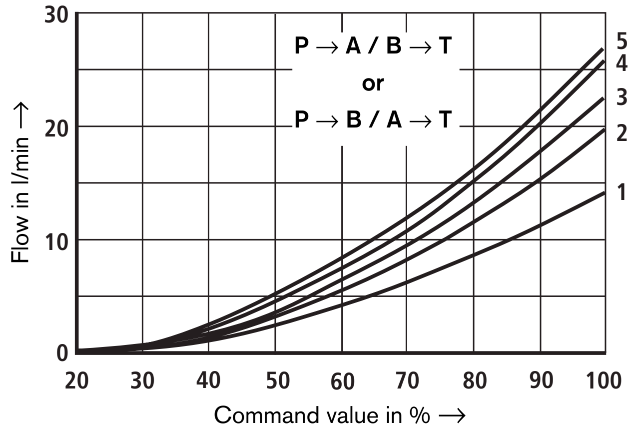


Characteristic curves (measured with HLP46, $\vartheta_{oil} = 40\ °C \pm 5\ °C$) NS6

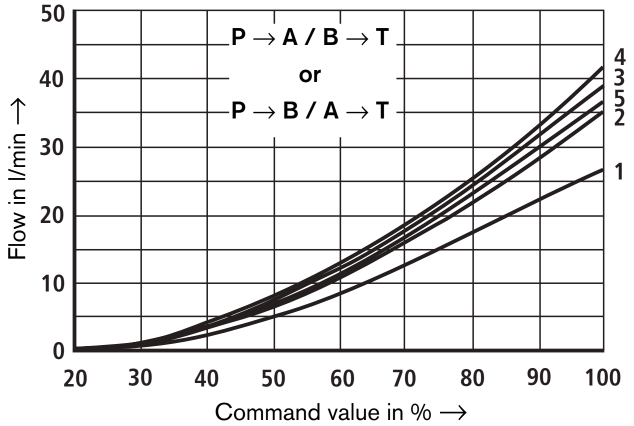
7 l/min nominal flow at 10 bar valve pressure differential



15 l/min nominal flow at 10 bar valve pressure differential



30 l/min nominal flow at 10 bar valve pressure differential

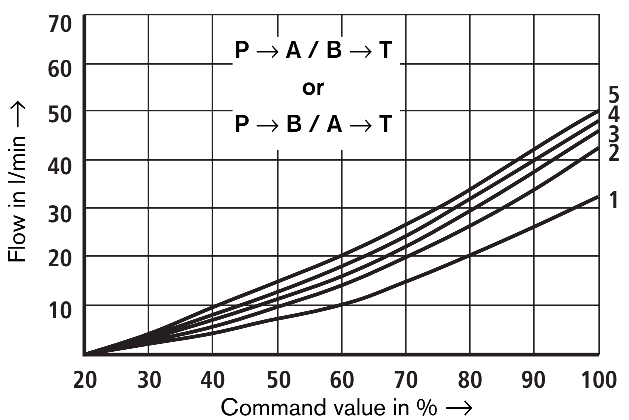


1 $\Delta p = 10$ bar constant
2 $\Delta p = 20$ bar constant
3 $\Delta p = 30$ bar constant
4 $\Delta p = 50$ bar constant
5 $\Delta p = 100$ bar contant

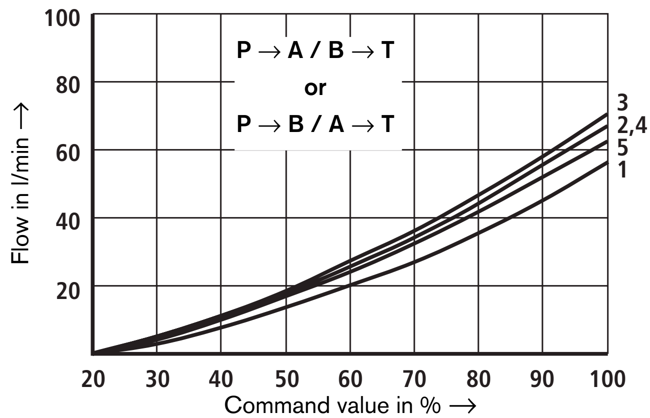
Δp = Valve pressure differential (inlet pressure p_P minus load pressure p_L and minus return pressure p_T)

Characteristic curves (measured with HLP46, $\vartheta_{oil} = 40\ °C \pm 5\ °C$) NS10

30 l/min nominal flow at 10 bar valve pressure differential



60 l/min nominal flow at 10 bar valve pressure differential



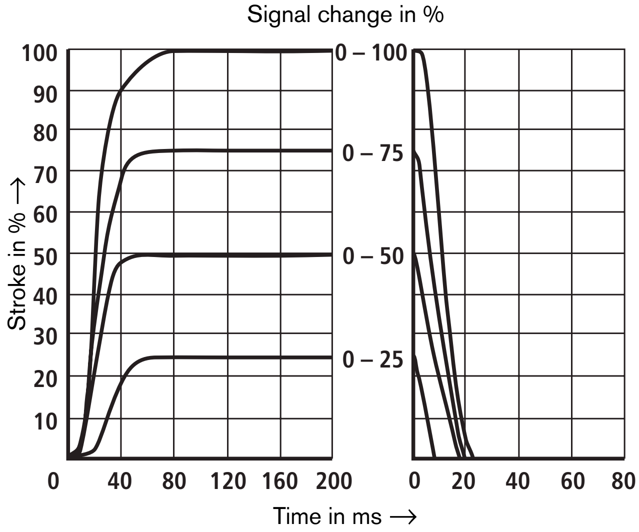
1 $\Delta p = 10$ bar constant
2 $\Delta p = 20$ bar constant
3 $\Delta p = 30$ bar constant
4 $\Delta p = 50$ bar constant
5 $\Delta p = 100$ bar contant

Δp = Valve pressure differential (inlet pressure p_P minus load pressure p_L and minus return pressure p_T)

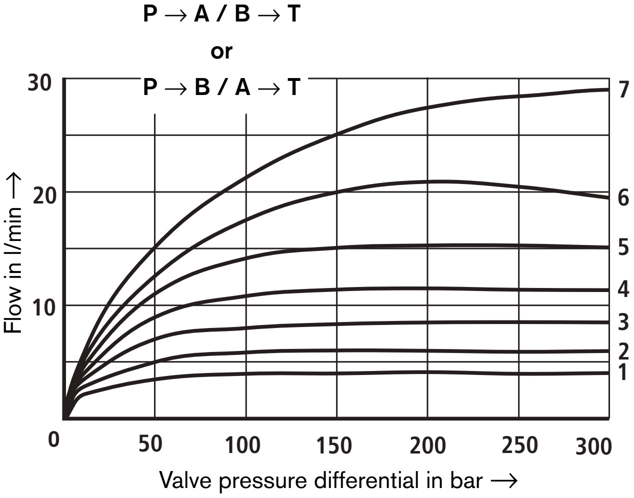
Characteristic curves (measured with HLP46, $\vartheta_{oil} = 40\ °C \pm 5\ °C$) **NS6**

Transient functions with stepped form of electrical input signals

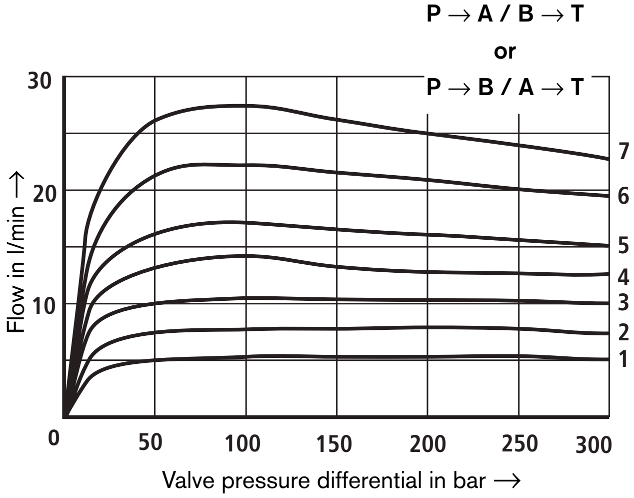
Types 4WRA and 4WRAE



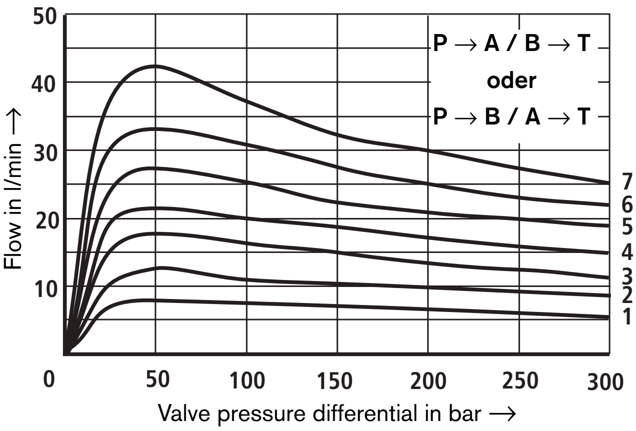
Performance limit, nominal flow 7 l/min



Performance limit, nominal flow 15 l/min



Performance limit, nominal flow 30 l/min

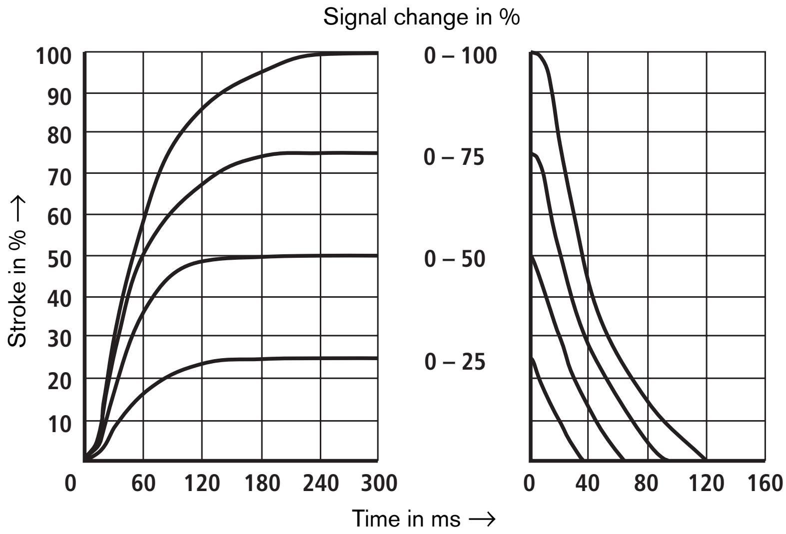


1 Com. value = 40 %
2 Com. value = 50 %
3 Com. value = 60 %
4 Com. value = 70 %
5 Com. value = 80 %
6 Com. value = 90 %
7 Com. value = 100 %

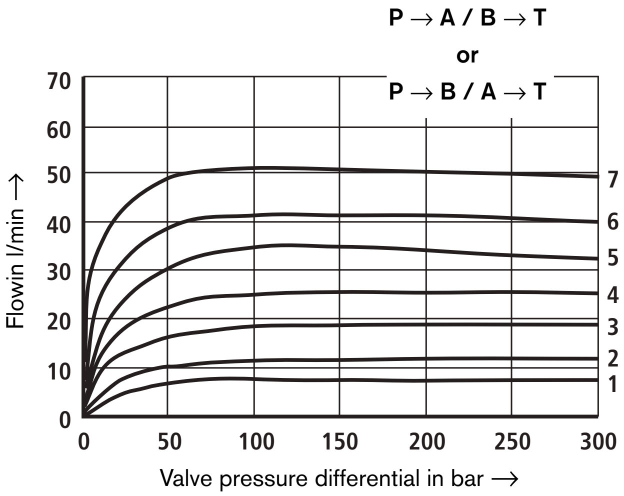
If the performance limits are exceeded then flow forces occur which lead to uncontrolled spool movements.

Characteristic curves (measured with HLP46, $\vartheta_{oil} = 40\ °C \pm 5\ °C$) NS10

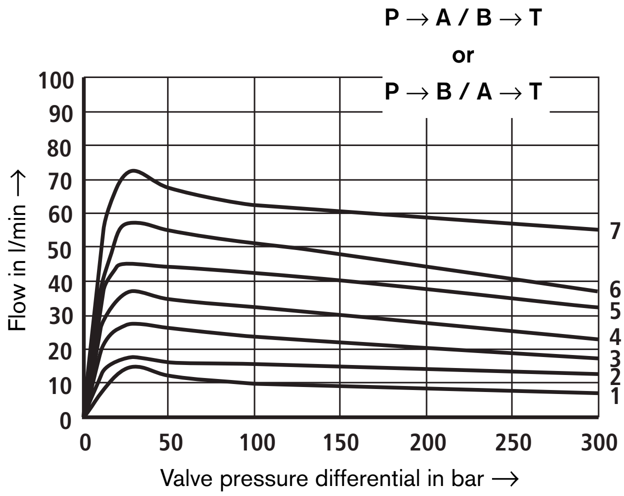
Transient functions with stepped form of electrical input signals



Performance limit, nominal flow 30 l/min



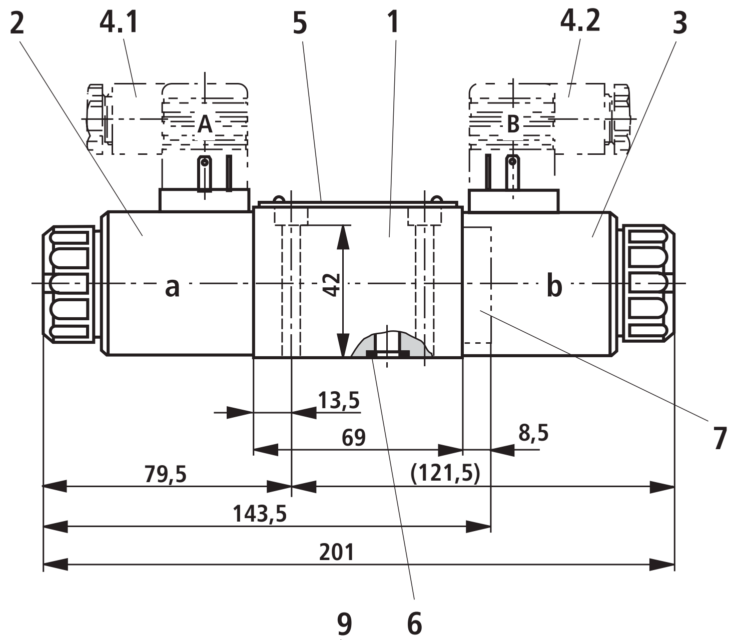
Performance limit, nominal flow 60 l/min

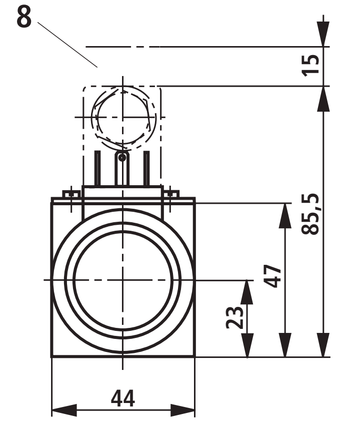


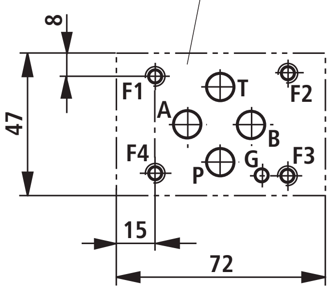
1 Com. value = 40 %
2 Com. value = 50 %
3 Com. value = 60 %
4 Com. value = 70 %
5 Com. value = 80 %
6 Com. value = 90 %
7 Com. value = 100 %

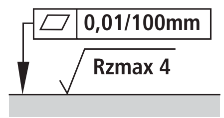
If the performance limits are exceeded then flow forces occur which lead to uncontrolled spool movements.

Unit dimensions: Type 4WRA 6 (nominal dimensions in mm) NS6









Required surface finish of the valve mounting surface

Tolerances to: – General tolerances ISO 2768-mK

1 Valve hounsing

2 Proportional solenoid "a"

3 Proportional solenoid "b"

4.1 Plug-in connector "A", colour grey, separate order, see page 7

4.2 Plug-in connector "B", colour black, separate order, see page 7

5 Name plate

6 Identical seal rings for ports A, B, P and T

7 Plug for valves with one solenoid (2 switched positions, versions **EA** or **WA**)

8 Space required to remove the plug-in connector

9 Machined valve mounting surface,
Connection location to ISO 4401 (**with** locating pin hole)
Code: 4401-03-02-0-94 (explanation to ISO 5783)
Deviation from the standard:
- without locating pin hole „G"
- ports P, A, B and T mit Ø8 mm

Subplates to catalogue sheet RE 45052 and valve fixing screws must be ordered separately.

Subplates: G341/01 (G1/4)
G342/01 (G3/8)
G502/01 (G1/2)

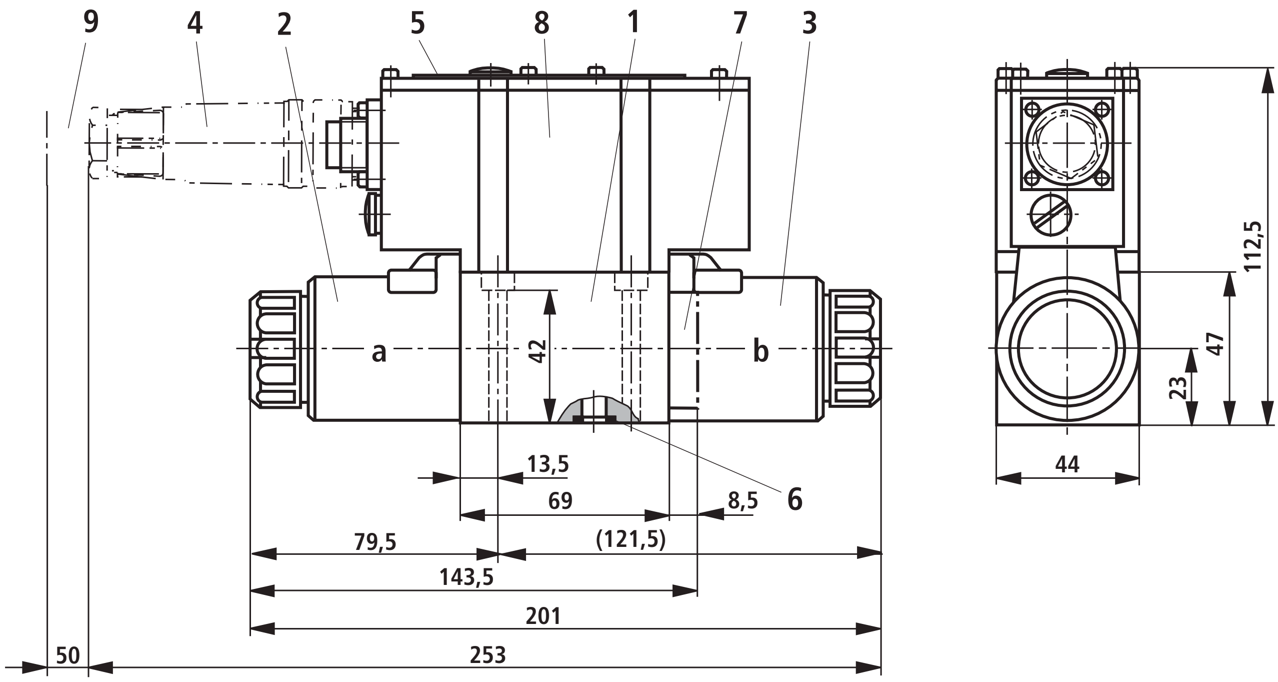
Valve fixing screws (separate order)
The following valve fixing screws are recommended:

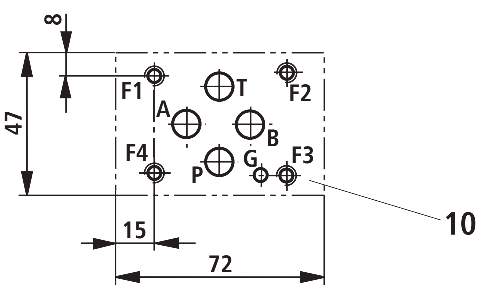
– **4 S.H.C.S. ISO 4762 - M5 x 50 - 10.9-flZn-240h-L**
(friction value μ_{total} = 0.09 to 0.14)
Tightening torque M_A = 7 Nm ± 10%
Material No. **R913000064** (separate order)

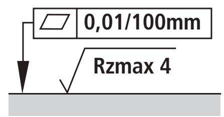
or

– **4 S.H.C.S. ISO 4762 - M5 x 50 - 10.9**
(friction value μ_{total} = 0.12 to 0.17)
Tightening torque M_A = 8.9 Nm ± 10%

Unit dimensions: Type 4WRAE 6 …K31/..V (nominal dimensions in mm) NS6







Required surface finish of the valve mounting surface

Tolerance to: – General tolerances to ISO 2768-mK

1 Valve housing
2 Proportional solenoid "a"
3 Proportional solenoid "b"
4 Plug-in connector to DIN EN 175201-804, separate order, see page 7
5 Name plate
6 Identical seal rings for ports A, B, P und T
7 Plug for valves with one solenoid (2 switched positions, versions **EA** or **WA**)
8 Integrated electronics (OBE)
9 Space required for the connection cable and to remove the plug-in connector
10 Machined valve mounting surface, Connection location to ISO 4401 (**with** locating pin hole) Code: 4401-03-02-0-94 (explanation to ISO 5783) Deviation from the standard:
- without locating pin hole „G“
- ports P, A, B and T mit Ø8 mm

Subplates to catalogue sheet RE 45052 and valve fixing screws must be ordered separately.

Subplates: G341/01 (G1/4)
G342/01 (G3/8)
G502/01 (G1/2)

Valve fixing screws (separate order)
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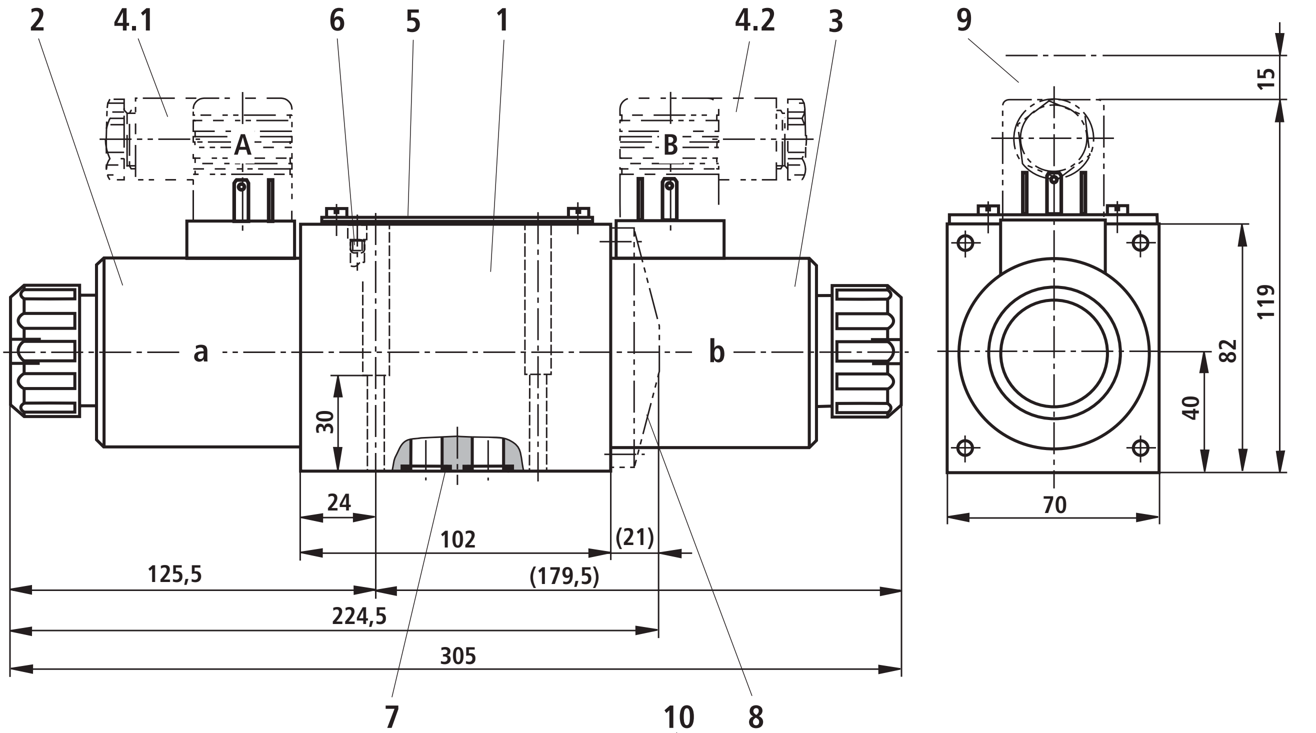
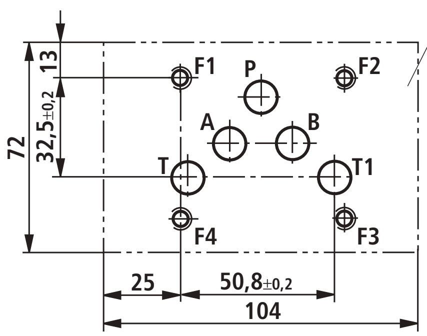
(friction value μ_{total} = 0.09 to 0.14)
Tightening torque M_A = 7 Nm ± 10%
Material No. **R913000064** (separate order)

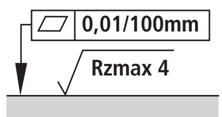
or

– **4 S.H.C.S. ISO 4762 - M5 x 50 - 10.9**
(friction value μ_{total} = 0.12 to 0.17)
Tightening torque M_A = 8.9 Nm ± 10%

Unit dimensions: Type 4WRA 10 (nominal dimensions in mm) NS10







Required surface finish of the valve mounting surface

Tolerances to: – General tolerances to ISO 2768-mK

1 Valve housing

2 Proportional solenoid "a"

3 Proportional solenoid "b"

4.1 Plug-in connector "A", colour grey, separate order, see page 7

4.2 Plug-in connector "B", colour black, separate order, see page 7

5 Name plate

6 Valve bleed screw
Note: The valves are bled before delivery.

7 Identical seal rings for ports A, B, P and T (T1)

8 Cover for valves with one solenoid (2 switched positions, versions **EA** or **WA**)

9 Space required to remove the plug-in connector

10 Machined valve mounting surface,
Connection location to ISO 4401 (**with** locating pin hole)
Code: 4401-05-04-0-94 (explanation to ISO 5783)
Deviation from the standard: Port T1 Ø11.2 mm

Subplates to catalogue sheet RE 45054 and valve fixing screws must be ordered separately.

Subplates: G66/01 (G3/8)
G67/01 (G1/2)
G534/01 (G3/4)

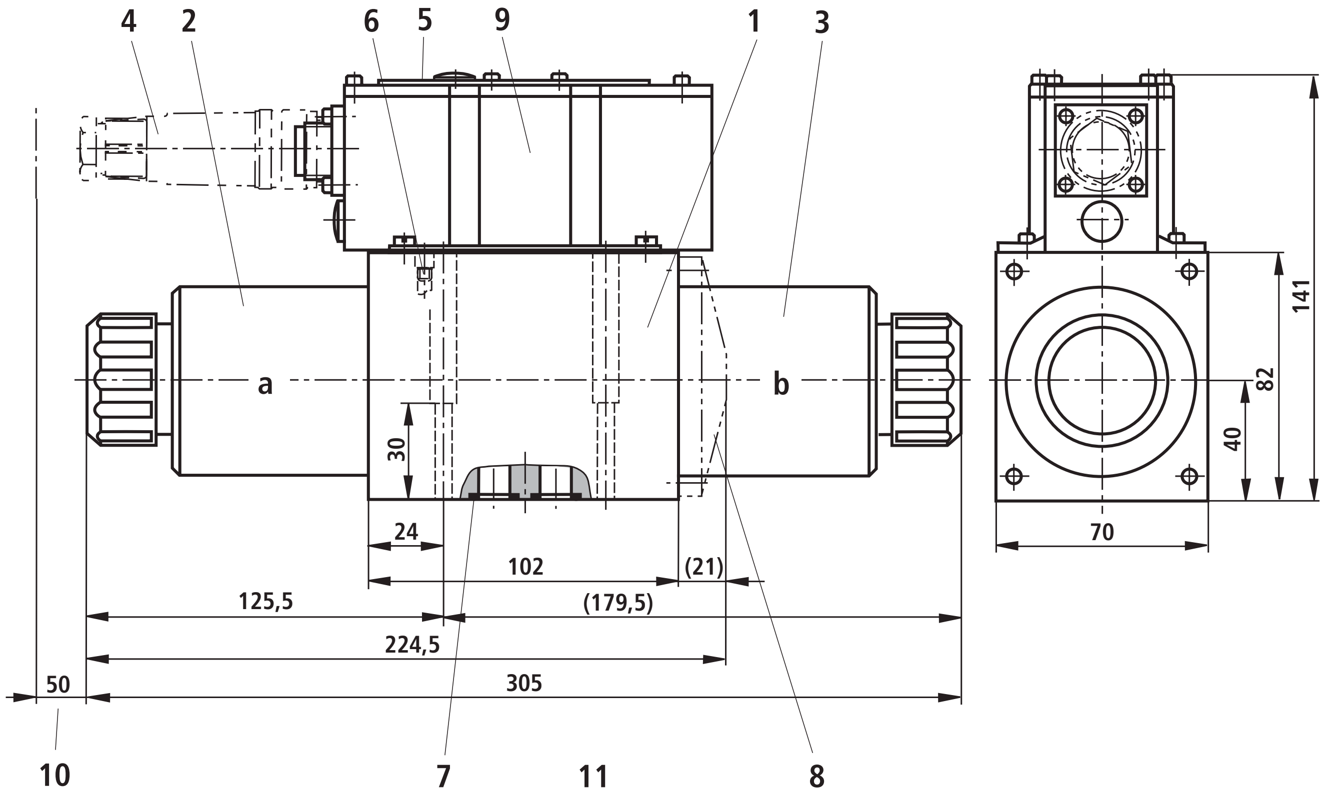
Valve fixing screws (separate order)
The following valve fixing screws are recommended:

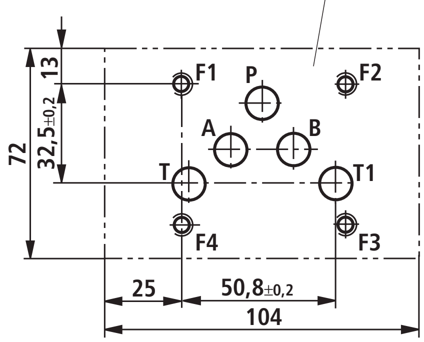
– **4 S.C.H.S. ISO 4762 - M6 x 40 - 10.9-flZn-240h-L**
(friction value μ_{total} = 0.09 to 0.14)
Tightening torque M_A = 12.5 Nm ± 10%,
Material No. **R913000058** (separate order)

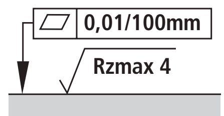
or

– **4 S.C.H.S. ISO 4762 - M6 x 40 - 10.9**
(friction value μ_{total} = 0.12 to 0.17)
Tightening torque M_A = 15,5 Nm ± 10%

Unit dimensions: Type 4WRAE 10 (nominal dimensions in mm) NS10







Required surface finish of the valve mounting surface

1 Valve housing
2 Proportional solenoid "a"
3 Proportional solenoid "b"
4 Plug-in connector to DIN EN 175201-804, separate order, see page 7
5 Name plate
6 Valve bleed screw
Note: The valves are bled before delivery.
7 Identical seal rings for ports A, B, P, T
8 Cover for valves with one solenoid (2 switched positions, versions **EA** or **WA**)
9 Integrated electronics (OBE)
10 Space required for the connection cable and to remove the plug-in connector
11 Machined valve mounting surface, connection location to ISO 4401 (**with** locating pin hole)
Code: 4401-05-04-0-94 (explanation to ISO 5783)
Deviation from the standard: Port T1 Ø11.2 mm

Tolerances to: – General tolerances to ISO 2768-mK

Subplates to catalogue sheet RE 45054 and valve fixing screws must be ordered separately.

Subplates: G66/01 (G3/8)
G67/01 (G1/2)
G534/01 (G3/4)

Valve fixing screws(separate order)
The following valve fixing screws are recommended:

– **4 S.H.C.S. ISO 4762 - M6 x 40 - 10.9-flZn-240h-L**
(friction value μ_{total} = 0.09 to 0.14)
Tightening torque M_A = 12.5 Nm ± 10%,
Material No. **R913000058** (separate order)

or

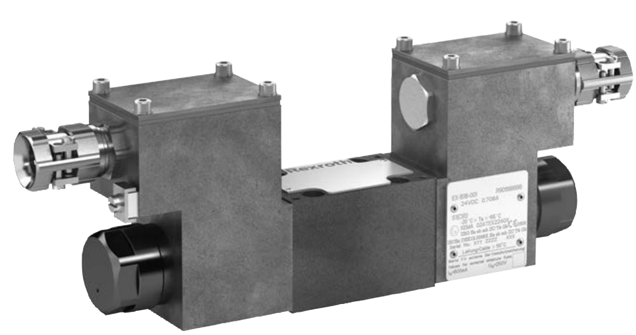
– **4 S.H.C.S. ISO 4762 - M6 x 40 - 10.9**
(friction value μ_{total} = 0.12 to 0.17)
Tightening torque M_A = 15,5 Nm ± 10%

RE 29055-XE
Edition: 2019-09
Replaces: 2016-04
RA78494041_AA

rexroth
A Bosch Company

Proportional directional valve, direct operated without electrical position feedback

Type WRA ...XE


H8091

- Size 6
- Component series 2X
- Maximum operating pressure 315 bar
- Maximum flow 22 l/min

ATEX units
For potentially explosive atmospheres

Information on explosion protection:
- Area of application in accordance with the Explosion Protection Directive 2014/34/EU: **II 2G**
- Type of protection valve: Ex h IIC T4 Gb X according to EN 80079-36
- Type of protection valve solenoids: Ex eb mb IIC T4 Gb according to EN 60079-7 / EN 60079-18
- Valve solenoid certified according to IECEx

Features

- 4/2 or 4/3-way version
- For intended use in potentially explosive atmosphere
- Controlling the direction and size of a flow
- For subplate mounting
- Porting pattern according to ISO 4401-03-02-05 (but without locating hole)
- Spring-centered control spool
- Seawater-resistant
- Wet-pin DC solenoids
- Solenoid coil is rotatable by 90°
- Electrical connection as individual connection with Cable gland

Contents

Ordering code

01	02	03	04		05		06	07	08		09
4WRA	6			–	2X	/	G24	XE	J	/	V

01	Proportional directional valve, for external control electronics	**4WRA**
02	Size 6	**6**
03	Symbols; possible versions, see below	

Rated flow

04	6 l/min	**07**
	10 l/min	**15**
	18 l/min	**30**

05	Component series 20 ... 29 (20 ... 29: unchanged installation and connection dimensions)	**2X**

Supply voltage of the control electronics

06	Direct voltage 24 V	**G24**

Explosion protection

07	"Increased safety"	**XE**
	For details, see information on the explosion protection page 6	

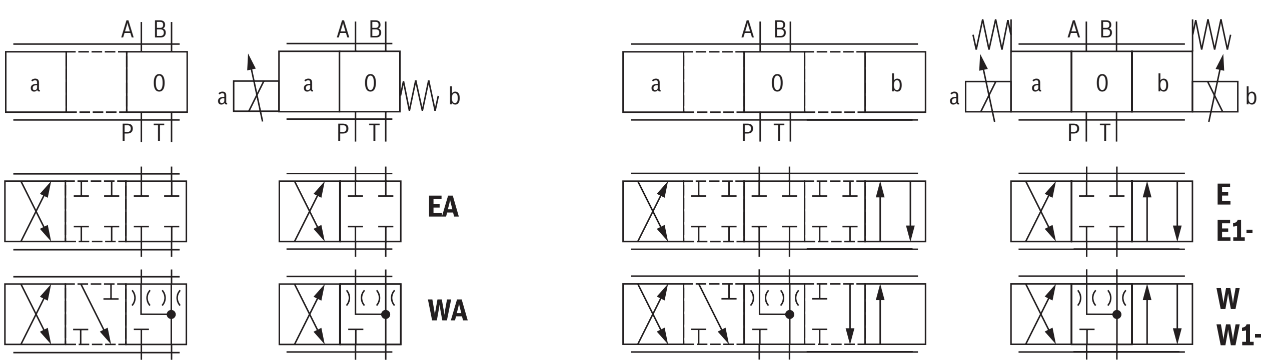
Corrosion resistance (outside)

08	Seawater-resistant, galvanized	**J**

Seal material (observe compatibility of seals with hydraulic fluid used, see page 5)

09	NBR seals	**M**
	FKM seals	**V**

Symbols



With symbol E1– and W1–:

P → A: $q_{V\,max}$ B → T: $q_V/2$

P → B: $q_V/2$ A → T: $q_{V\,max}$

Notice:
- In spool position "0", symbols W, W1-, and WA have a connection from A → T and B → T with approx. 3% of the relevant nominal cross-section.
- Representation according to DIN ISO 1219-1.
- Hydraulic interim positions are shown by dashes.

Function, section

Valves Type 4WRA ...XE are direct operated proportional directional valves in plate design. Operation is effected by means of proportional solenoids for potentially explosive atmospheres. The solenoids are actuated by external control electronics.

Set-up

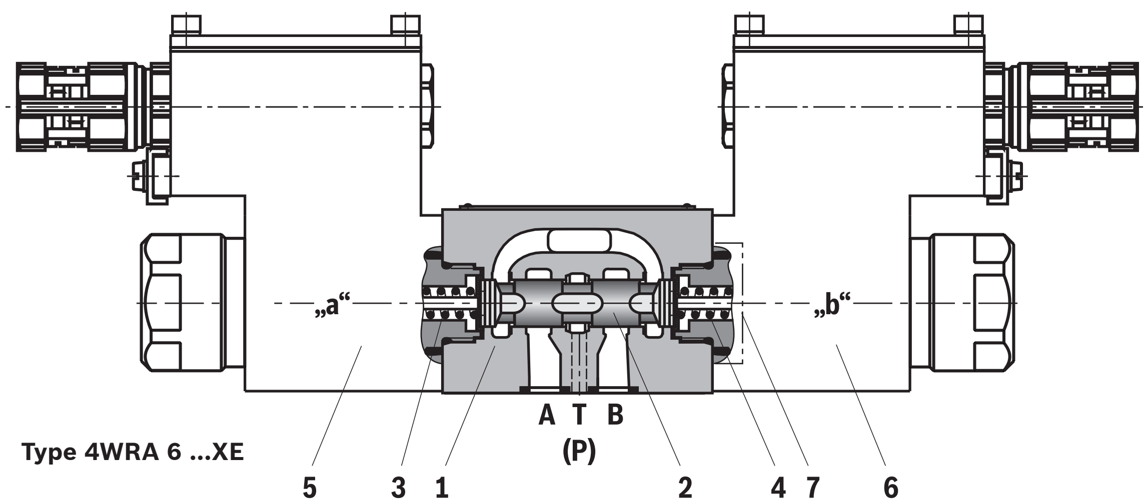
The valve basically consists of:

- Housing (1) with connection surface
- Control spool (2) with compression springs (3 and 4)
- Solenoids (5 and 6) with central thread

Functional description

- With de-energized solenoids (5 and 6), central position of the control spool (2) by compression springs (3 and 4)
- Direct actuation of the control spool (2) by energization of a proportional solenoid e.g. control of solenoid "b" (6)
  - Movement of the control spool (2) to the left proportionally to the electrical input signal
  - Connection from P → A and B → T via orifice-type cross-sections with progressive flow characteristic
- De-excitation of the solenoid (6)
  - The compression spring (3) brings the control spool (2) back into the central position

☞ **Notice:**
Regarding the 4/3-way version of the valves, only one solenoid may be actuated at a time.



Type 4WRA 6 ...XE

Valve with 2 spool positions (type 4WRA 6 .**A**...)
The function of this valve version basically corresponds to the valve with three spool positions. The 2 spool position valves are, however, only equipped with solenoid "a" (5). Instead of the 2nd proportional solenoid, there is a plug screw (7).

☞ **Notice:**
The tank line must not be allowed to run empty. With corresponding installation conditions, a preload valve (preload pressure approx. 2 bar) must be installed.

Technical data
(for applications outside these values, please consult us!)

General			
Installation position			Any, preferably horizontal
Storage temperature range		°C	+5 ... +40
Maximum storage time		Years	1
Ambient temperature range		°C	–20 ... +60
Weight	▶ 3 spool positions	kg	4.4
	▶ 2 spool positions	kg	2.7
Surface protection			galvanized
Maximum surface temperature		°C	See information on explosion protection, page 6

Hydraulic			
Maximum operating pressure	▶ Ports P, A, B	bar	315
	▶ Port T	bar	210
Rated flows $q_{v\ rated}$ with Δp = 10 bar		l/min	6; 10; 18
Maximum flow		l/min	22
Hydraulic fluid			see table page 5
Hydraulic fluid temperature range		°C	–20 ... +80 (NBR seals) –15 ... +80 (FKM seals)
Viscosity range		mm^2/s	20 ... 380 (preferably 30 ... 46)
Maximum admissible degree of contamination of the hydraulic fluid; cleanliness class according to ISO 4406 (c)			Class 17/15/12 [1]
Hysteresis		%	≤ 6
Response sensitivity		%	≤ 1
Range of inversion		%	≤ 2

[1] The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and simultaneously increases the life cycle of the components.

Technical data
(for applications outside these values, please consult us!)

Hydraulic fluid		Classification	Suitable sealing materials	Standards	Data sheet
Mineral oils		HL, HLP, HLPD, HVLP, HVLPD	NBR, FKM	DIN 51524	90220
Bio-degradable	▶ Insoluble in water	HETG	FKM	ISO 15380	90221
		HEES	FKM		
	▶ Soluble in water	HEPG	FKM	ISO 15380	
Flame-resistant	▶ Water-free	HFDU (glycol base)	FKM	ISO 12922	90222
		HFDU (ester base)	FKM		
		HFDR	FKM		
	▶ Containing water	HFC (Fuchs: Hydrotherm 46M, Renosafe 500; Petrofer: Ultra Safe 620; Houghton: Safe 620; Union: Carbide HP5046)	NBR	ISO 12922	90223

Important notices on hydraulic fluids:
- For further information and data on the use of other hydraulic fluids, please refer to the data sheets above or contact us.
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.).
- The ignition temperature of the hydraulic fluid used must be 50 K higher than the maximum surface temperature.
- **Bio-degradable and flame-resistant – containing water:** If components with galvanic zinc coating (e.g. version "J3" or "J5") or parts containing zinc are used, small amounts of dissolved zinc may get into the hydraulic system and cause accelerated aging of the hydraulic fluid. Zinc soap may form as a chemical reaction product, which may clog filters, nozzles and solenoid valves – particularly in connection with local heat input.
- **Flame-resistant – containing water:**
  - Due to increased cavitation tendency with HFC hydraulic fluids, the life cycle of the component may be reduced by up to 30% as compared to the use with mineral oil HLP. In order to reduce the cavitation effect, it is recommended – if possible specific to the installation – to back up the return flow pressure in ports T to approx. 20% of the pressure differential at the component.
  - Dependent on the hydraulic fluid used, the maximum ambient and hydraulic fluid temperature must not exceed 50 °C. In order to reduce the heat input into the component, the command value profile is to be adjusted for proportional and high-response valves.

Technical data
(for applications outside these values, please consult us!)

Electric		
Voltage type		Direct voltage
Type of signal		analog
Maximum current per solenoid	A	1.03
Duty cycle	%	100

Information on explosion protection		
Area of application of Directive 2014/34/EU		II 2G
Type of protection of valve according to EN 80079-36 [2]		Ex h IIC T4 Gb X
Type of protection valve solenoid according to EN 60079-7 / EN 60079-18		Ex eb mb IIC T4 Gb
Maximum surface temperature [3]	°C	120
Temperature class		T4
Type examination certificate solenoid		KEMA 02ATEX2240 X
"IECEx Certificate of Conformity" solenoid		IECEx DEK 12.0068X

[2] Ex h: structural safety c according to EN 80079-37.
[3] Surface temperature > 50 °C, provide contact protection.

Special application conditions for safe application:
- Connection lines must be passed in a strain-relieved way. The first mounting point must be within 150 mm of the cable and line entry.
- In case of bank assembly, only one solenoid of all valves may be energized at a time.
- In case of valves with two solenoids, maximally one of the solenoids may be energized at a time.
- Only direct voltage or a pulse-width modulated signal with a pulse voltage ≤ 28 V and a frequency ≥ 160 Hz ... maximum 500 Hz may be used for operation.

Control electronics [4]	
Amplifier module for the control of explosion-proof proportional directional valves 4WRA...XE, 3DREP 6...XE and 4WRZ...XE	VT-MSPA2-200-1X/V0/0 according to data sheet 30228-200
Module for monitoring and limiting the solenoid currents with proportional valves	VT-MUXA2-2-1X/V0/1A according to data sheet 30290

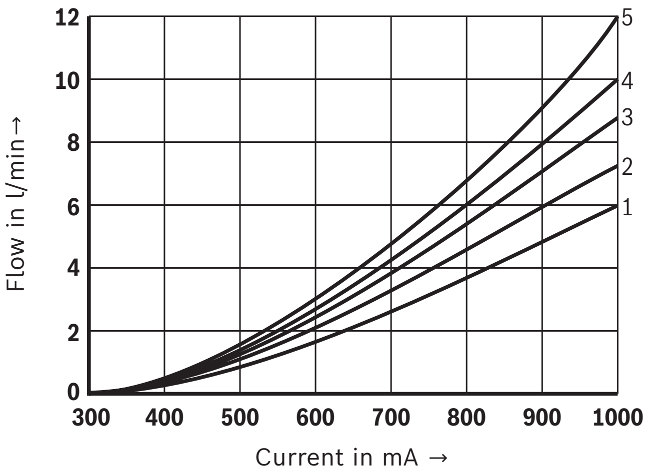
[4] A monitoring circuit is to be provided for the monitoring of the solenoid current. We recommend operating the valves with the assemblies described herein.

Notice:
The control electronics must be operated outside the potentially explosive atmosphere!

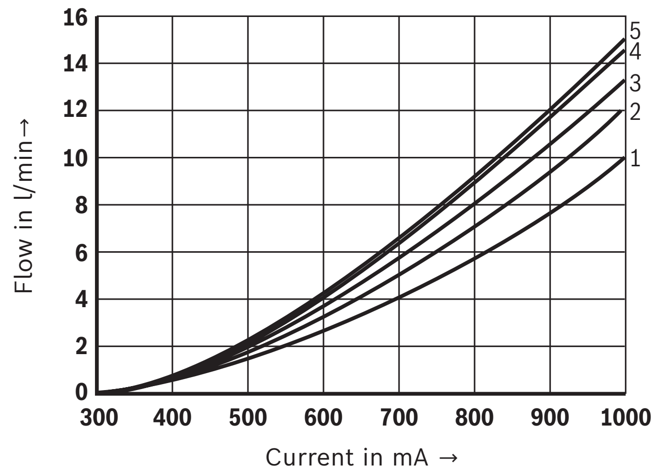
Characteristic curves

(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

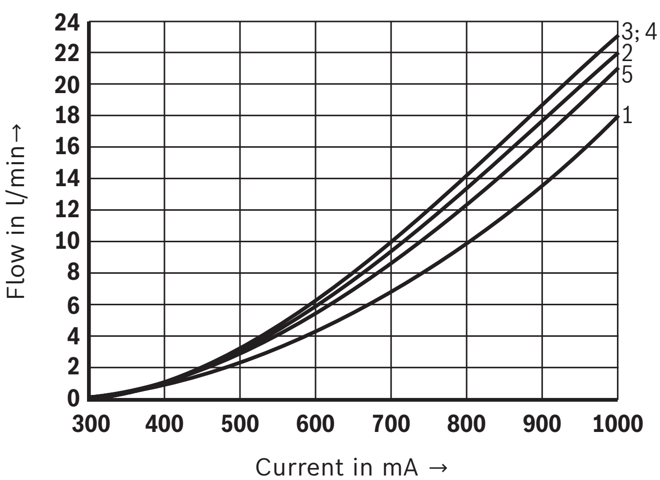
Version "07"



Version "15"



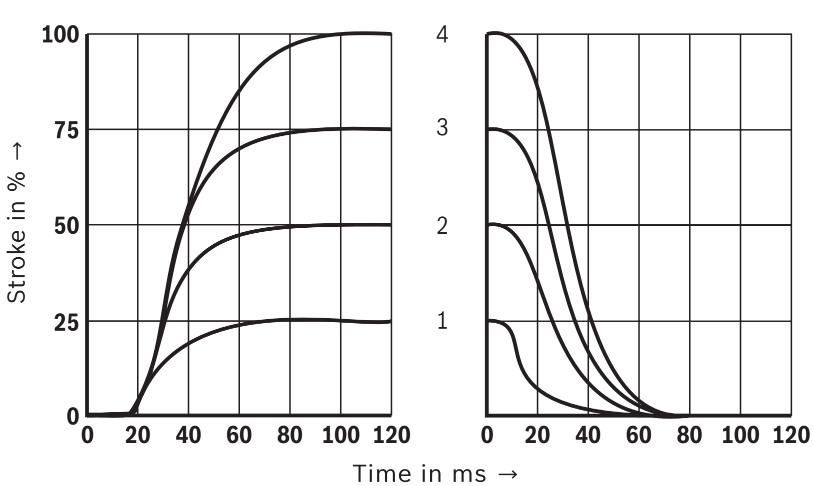
Version "30"



1 ***Δp*** = 10 bar constant
2 ***Δp*** = 20 bar constant
3 ***Δp*** = 30 bar constant
4 ***Δp*** = 50 bar constant
5 ***Δp*** = 100 bar constant

Δp = valve pressure differential according to DIN 24311 (inlet pressure minus load pressure and minus return flow pressure)

Transition function with stepped electric input signals

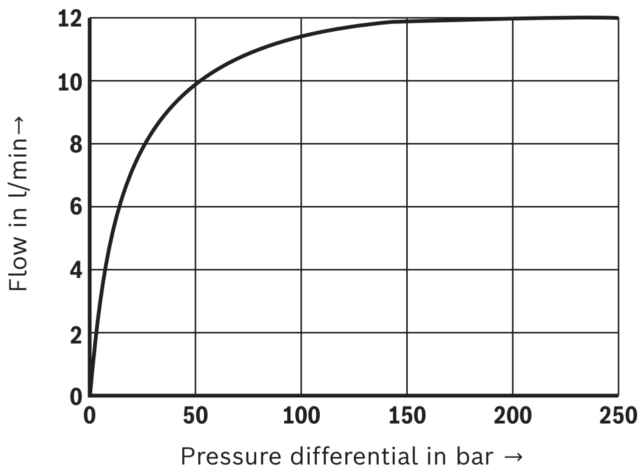


	Change of input signal in %
1	0 → 25 → 0
2	0 → 50 → 0
3	0 → 75 → 0
4	0 → 100 → 0

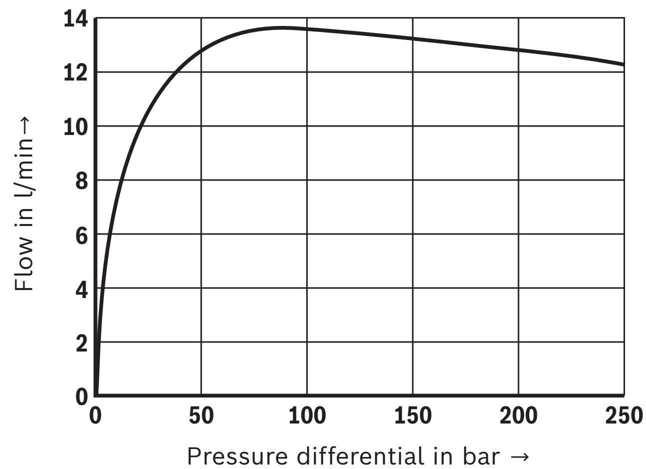
Measured with pilot pressure $\boldsymbol{p}_{ST}$ = 10 bar

Performance limits
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

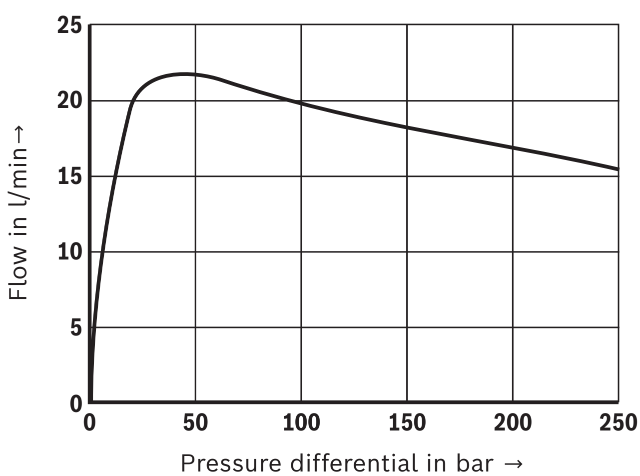
Version "07"



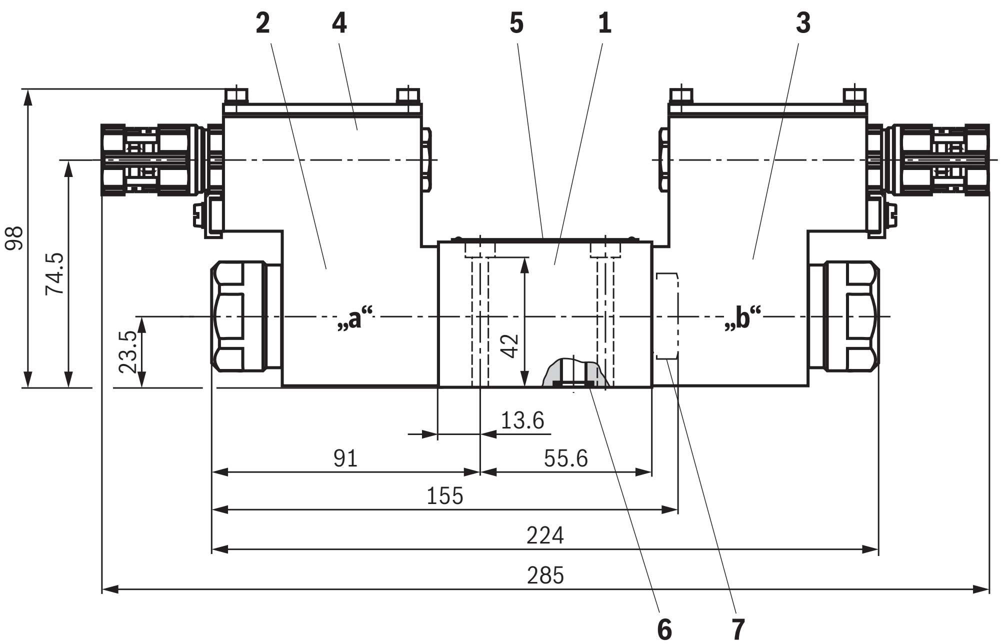
Version "15"

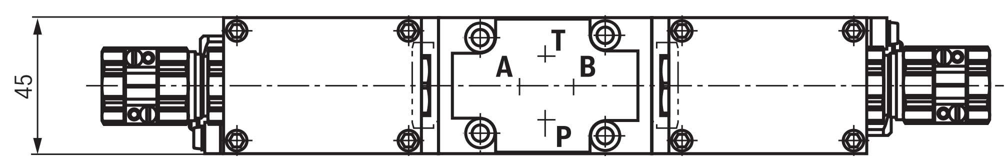


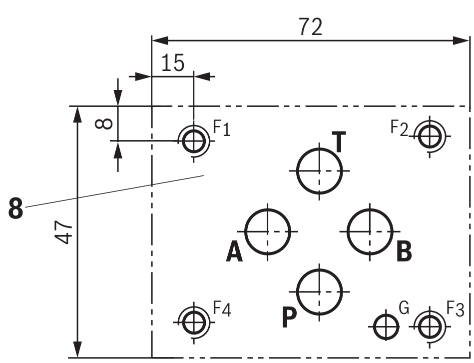
Version "30"

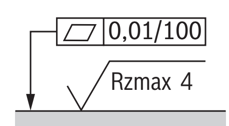


Dimensions
(dimensions in mm)









Required surface quality of the valve contact surface

Subplates (separate order) with porting pattern according to ISO 4401-03-02-0-05, see data sheet 45100.

Valve mounting screws (separate order)
Only use valve mounting screws with the subsequently listed thread diameters and strength properties. Observe the screw-in depth.
4 hexagon socket head cap screws ISO 4762 - M5 x 50 - 10.9
(Friction coefficient μ_{total} = 0.09 ... 0.14)
Tightening torque M_A = 7 Nm ±10%,
Material no. **R913043758**

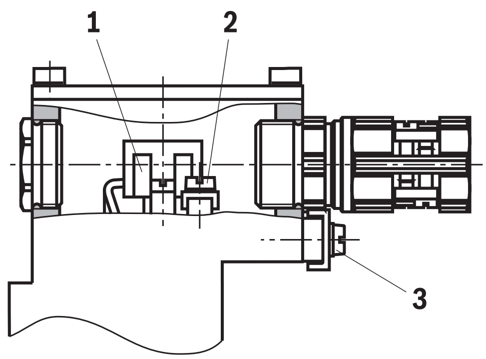
1 Valve housing
2 Proportional solenoid "a"
3 Proportional solenoid "b"
4 Terminal box
5 Name plate
6 Identical seal rings for A, B, P and T
7 Plug screw for valve with one solenoid (2 spool positions, version EA or WA)
8 Porting pattern according to ISO 4401-03-02-0-05 (however, without locating hole)

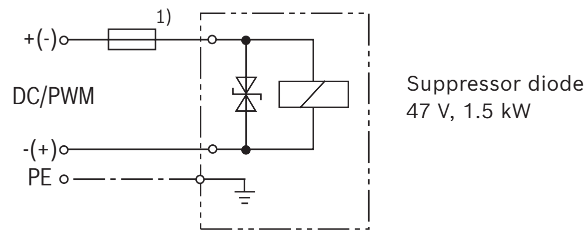
Notice:
Subplates are no components in the sense of Directive 2014/34/EU and can be used after the manufacturer of the overall system has conducted an assessment of the risk of ignition.
The "G...J3" versions are free from aluminum and/or magnesium and galvanized.

Electrical connection

The type-examination tested valve solenoid of the valve is equipped with one terminal box and a type-tested cable entry.
The connection is polarity-independent.

Notice:
When establishing the electrical connection, the protective grounding conductor (PE ⏚) has to be connected properly.





1) Recommended pre-fuse characteristics medium time-lag according to DIN 41571, 1.25 A.

Properties of the connection terminals and mounting elements

Position	Function	Connectable line cross-section
1	Operating voltage connection	single-wire 0.75 ... 2.5 mm² finely stranded 0.75 ... 1.5 mm²
2	Connection for protective grounding conductor	single-wire max. 2.5 mm² finely stranded max. 1.5 mm²
3	Connection for potential equalization conductor	single-wire max. 6 mm² finely stranded max. 4 mm²

Cable gland		
Type approval		II 2G Ex e IIC Gb
Threaded connection		M20 x 1.5
Protection class according to EN 60529		IP66 (With correctly installed electrical connection)
Line diameter	mm	7 ... 10.5
Sealing		Outer sheath sealing

Connection line		
Line type		**non-armored** cables and lines (outer sheath sealing)
Temperature range	°C	≤ -20 ... ≥ +110

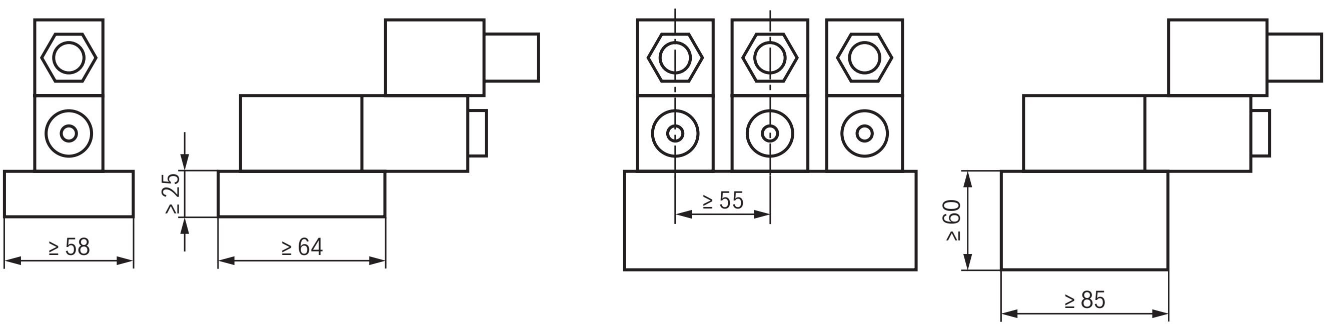
Notice:
A fuse which corresponds to the rated current according to DIN 41571 and EN / IEC 60127 has to be connected upstream of every valve solenoid (max. 3 x I_{rated}).
The shut-off threshold of the fuse has to match the prospective short-circuit current of the supply source.
The prospective short-circuit current of the supply source may amount to a maximum of 1500 A.
This fuse may only be installed outside the potentially explosive atmospheres or must be of an explosion-proof design.

Notice:
Only use finely stranded conductors if they have pressed-on wire end ferrules.

Installation conditions
(dimensions in mm)

	Individual assembly	Bank assembly
Subplate dimensions	Minimum dimensions Length ≥ 64, width ≥ 58, height ≥ 25	Minimum cross-section Height ≥ 60, width ≥ 85
Thermal conductivity of the subplate (referred to 300 °C)	≥ 36.2 W/mK	
Minimum distance between the longitudinal valve axes	≥ 55	

Individual assembly **Bank assembly**



Notice:
Observe the "Special application conditions for safe application" on page 6.

Further information

- Subplates — Data sheet 45100
- Hydraulic fluids on mineral oil basis — Data sheet 90220
- Environmentally compatible hydraulic fluids — Data sheet 90221
- Flame-resistant, water-free hydraulic fluids — Data sheet 90222
- Flame-resistant hydraulic fluids - containing water (HFAE, HFAS, HFB, HFC) — Data sheet 90223
- Proportional directional valve, direct operated, without electrical position feedback — Operating instructions 29055-XE-B
- Selection of filters
- Information on available spare parts

Notes

Rexroth
Bosch Group

4/3 proportional directional valve direct operated, with integrated electronics

RE 29064/03.13
Replaces: 12.12

Type 4WREEM

Sizes 6 and 10
Component series 2X
Maximum operating pressure 315 bar
Maximum flow: 90 l/min (size 6)
180 l/min (size 10)

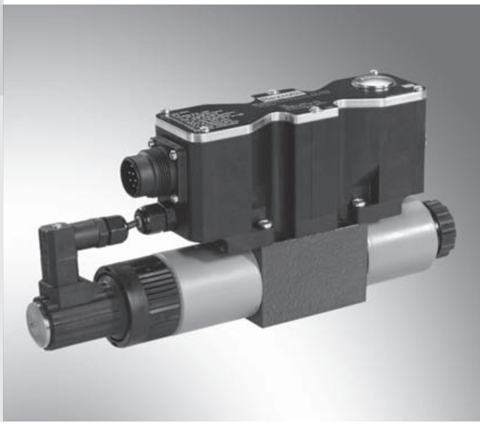


Table of contents

Features

- Direct operated proportional directional valve for controlling flow direction and flow size
- Operation by means of proportional solenoids with central thread and detachable coil
- Electrical position feedback
- Integrated electronics (OBE) with B6 interface
- Monitoring of control spool position
- With or without step function
- Spring-centered control spool
- For subplate mounting: Porting pattern according to ISO 4401

Ordering code

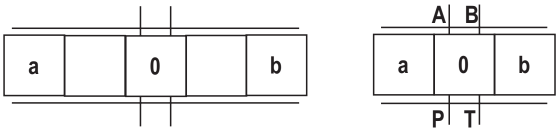
4WRE	E	M				–2X	/	G24	K34	/	B6	V	*

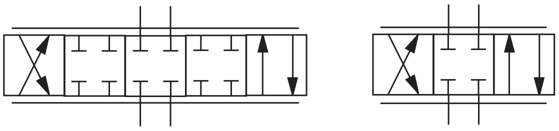
With integrated electronics (OBE) = **E**

Monitoring of control spool position = **M**

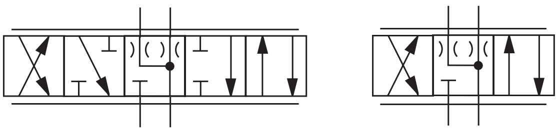
Size 6 = **6**
Size 10 = **10**

Control spool symbols





= E; E1–



= W; W1–

With symbols E1– and W1–:
P → A: $q_{V\ max}$ B → T: $q_V/2$
P → B: $q_V/2$ A → T: $q_{V\ max}$

Notice:
In the zero position, spools W and WA have a connection from A to T and B to T with approx. 3 % of the relevant nominal cross-section.

Rated flow with valve pressure differential Δp = 10 bar

Size 6
04 = 4 l/min
08 = 8 l/min
16 = 16 l/min
32 = 32 l/min

Size 10
25 = 25 l/min
50 = 50 l/min
75 = 75 l/min

Option
no code = Without step function
J = Electr. compensation of the control spool overlap

2X = 20 to 29
(20 to 29: Unchanged installation and connection dimensions)

Supply voltage
G24 = Direct voltage 24 V

Electrical connection
K34 = Without mating connector with connector according to DIN 43 651
Mating connector - separate order, see page 5

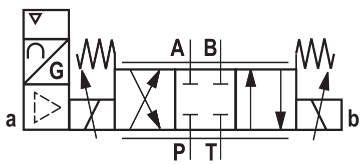
Electronics interface
B6 = Command value ±10 VDC

Seal material
V = FKM seal

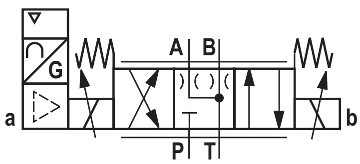
Further details in the plain text

Symbols

Type 4WREEM . **E**…



Type 4WREEM . **W**…



Function, section

The 4/3 proportional directional valves are designed as direct operated devices in plate design. Operation is effected by proportional solenoids with central thread and detachable coil. The solenoids are controlled by the internal electronics.
In version 4WREEM..., the valve is equipped with a symmetric spool overlap and features an operating direction and spool central position monitoring function.
In addition, the 4WREEM...J... model has a step function to compensate this overlap. This means that the spool overlap is quickly passed. The valve is mainly used in machines with high safety requirements, e.g. in hydraulic press controls.

Set-up:
The valve basically consists of:

– Housing (1) with connection surface
– Control spool (2) with compression springs (3 and 4)
– Solenoids (5 and 6) with central thread
– Position transducer (7)
– Integrated electronics (8)

Functional description:

– With de-energized solenoids (5 und 6), central position of the control spool (2) by compression springs (3 and 4)
– Direct operation of the control spool (2) by controlling a proportional solenoid, e.g. solenoid "b" (6)
  → Displacement of the control spool (2) to the left proportional to the electric input signal
  → Connection from P to A and B to T via orifice-type cross-sections with progressive flow characteristic
– Switching off of the solenoid "b" (6)
  → The compression spring (3) brings the control spool (2) back into the central position

If no enable signal is available, the output stage is locked and the valve is not functional. The readiness for operation of the output stages can be queried via pin 8. If the supply voltage fails or if no command value is available, the valve control spool is maintained in the central position by centering springs. In this spool position of the E spool: A, B, P and T are blocked and in the W spool: A and B are connected to T

Monitoring function:

– Monitoring the control spool position via an inductive position transducer
– Output signals of the integrated electronics can be evaluated by an external safety control in order to detect any malfunction of the valve
– The power output stages are blocked by switching off the voltage for release (pin 3)
  Notice: Not released for switching-off according to EN13849!
– The output stages are enabled via the enable input (pin 3). The status message is sent via pin 8
– Leading out the signals to the signal outputs pin 9, pin 10 and pin 11 of the connector
  Triggering of the logic switching status signals when the threshold values (+ Xw and – Xw) are exceeded
– Use of the switching signals in a superior control for monitoring functions

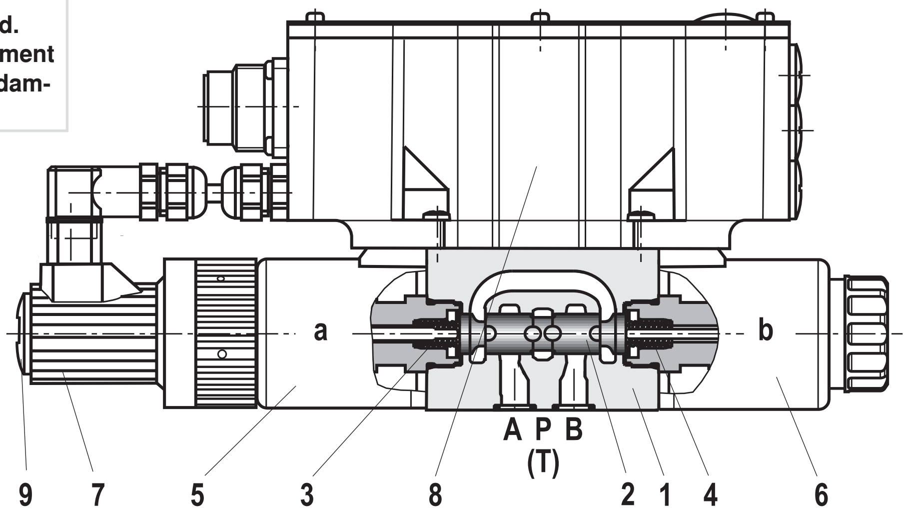
Precondition for the use as safety-relevant component in hydraulic circuits:

– The entire control must meet the requirements of the standards that are relevant for the application, such as e.g. EN693, EN12622 or EN13849
– If the safety is called up or if the control detects an error, switching off the supply voltage (pin 1 and pin 2) and release (pin 3) must cause the valve to be switched off
– The valve must not be operated vertically with the spool position sensor hanging upside down

☞ **Important notice!**
The PG fitting (9) must not be opened. Mechanical adjustment of the adjustment nut located below is prohibited and damages the valve!

☞ **Notice!**
Due to the design principle, internal leakage is inherent to the valves, which may increase over the life cycle.

The tank line must not be allowed to run empty. With corresponding installation conditions, a preload valve (preload pressure approx. 2 bar) is to be installed.



Technical data (For applications outside these parameters, please consult us!)

general

Sizes	Size	6	10
Weight	kg	2.4	6.5
Installation position		Horizontal, must not be installed vertically	
Ambient temperature range	°C	–20 to +50	
Storage temperature range	°C	–20 to +80	
$MTTF_d$ values according to EN ISO 13849	Years	150 [1] (for more information see data sheet 08012)	

hydraulic (measured using HLP46, ϑ_{oil} = 40 °C ±5 °C)

Maximum operating pressure	– Port A, B, P	bar	Up to 315	
	– Port T	bar	Up to 210	
Rated flow $q_{V\,nom}$ at Δp = 10 bar		l/min	4, 8, 16, 32	25, 50, 75
Maximum admissible flow		l/min	90	180
Maximum admissible zero flow with p_e = 100 bar		l/min	≤ 0.3	≤ 0.6
Hydraulic fluid			See table below	
Hydraulic fluid temperature range		°C	–20 to +80 (preferably +40 to +50)	
Viscosity range		mm^2/s	20 to 380 (preferably 30 to 46)	
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)			Class 20/18/15 [1]	
Hysteresis		%	≤ 0.1	
Range of inversion		%	≤ 0.05	
Response sensitivity		%	≤ 0.05	
Zero shift upon change of hydraulic fluid temperature and operating pressure		%/10 K	< 0.15	
		%/100 bar	< 0.1	

[1] The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the life cycle of the components.

Hydraulic fluid		**Classification**	**Suitable sealing materials**	**Standards**
Mineral oils and related hydrocarbons		HL, HLP	NBR, FKM	DIN 51524
Flame-resistant	– containing water	HFC (Fuchs HYDROTHERM 46M, Petrofer Ultra Safe 620)	NBR	ISO 12922

Important information on hydraulic fluids!

- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.)!
- The flash point of the process and operating medium used must be 40 K higher than the maximum solenoid surface temperature.
- **Flame-resistant – containing water**: Maximum pressure differential per control edge 175 bar. Pressure pre-loading at the tank port > 20 % of the pressure differential; otherwise, increased cavitation.

  Life cycle as compared to operation with mineral oil HL, HLP 50 % to 100 %.

Technical data (For applications outside these parameters, please consult us!)

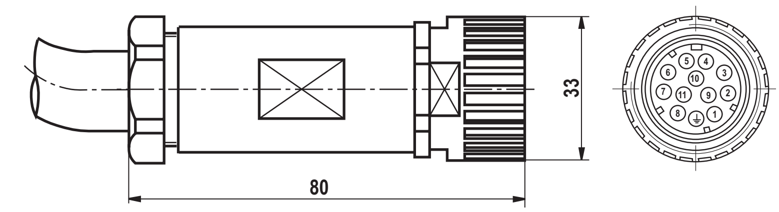
electric			
Supply voltage	Nominal voltage	VDC	24
	Lower limit value	VDC	19
	Upper limit value	VDC	35
Current consumption of the amplifier	I_{max}	A	2.0 plus load of switching outputs
	Impulse current	A	3.0 plus load of switching outputs
Command value input	Voltage input "B6"	V	±10 with Re = 100 kΩ
Command value output		V	±10
Duty cycle		%	100
Maximum coil temperature [1]		°C	Up to 150
Protection class according to DIN 40050			IP 65 with mounted and locked plug-in connectors

[1] Due to the temperatures occurring at the surfaces of the solenoid coils, the European standards ISO 13732-1 and EN ISO 4413 must be adhered to!

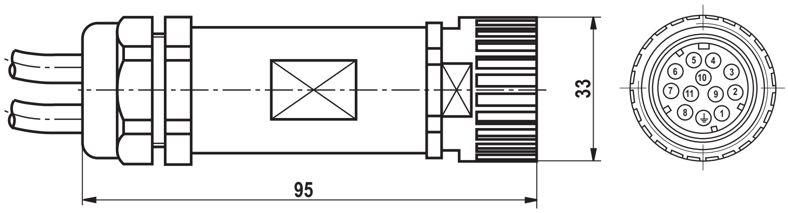
Notice!
Information on the environment simulation testing for the areas EMC (Electromagnetic compatibility), climate and mechanical load see RE 29048-U (declaration on environmental compatibility).64

Electrical connection, mating connectors (dimensions in mm)

Mating connector according to DIN EN 175201-804 separate order under the material no. **R900752278** (plastic version) one cable duct with Ø 12 to 14 mm, pin assignment see below



Mating connector according to DIN EN 175201-804 separate order under the material no. **R900884671** (plastic version) two cable ducts with Ø 6 to 8 mm, pin assignment see below



Pin	Allocation interface B6	
1	24 VDC (u(t) = 19.0 V to 35 V), I_{max} = 2 A voltage supply	
2	0 V	
3	Enable input 8.5 VDC to 35 VDC	
4, 5	Differential amplifier input ±10 V command value	
6, 7	Differential amplifier input ±10 V actual value	
8	Power output stages signal output 0 V or U_B	
9	Control spool position P → B	24 VDC
10	Control spool position P → A	
11	Control spool position zero position	
PE	Connected to cooling element and valve housing	

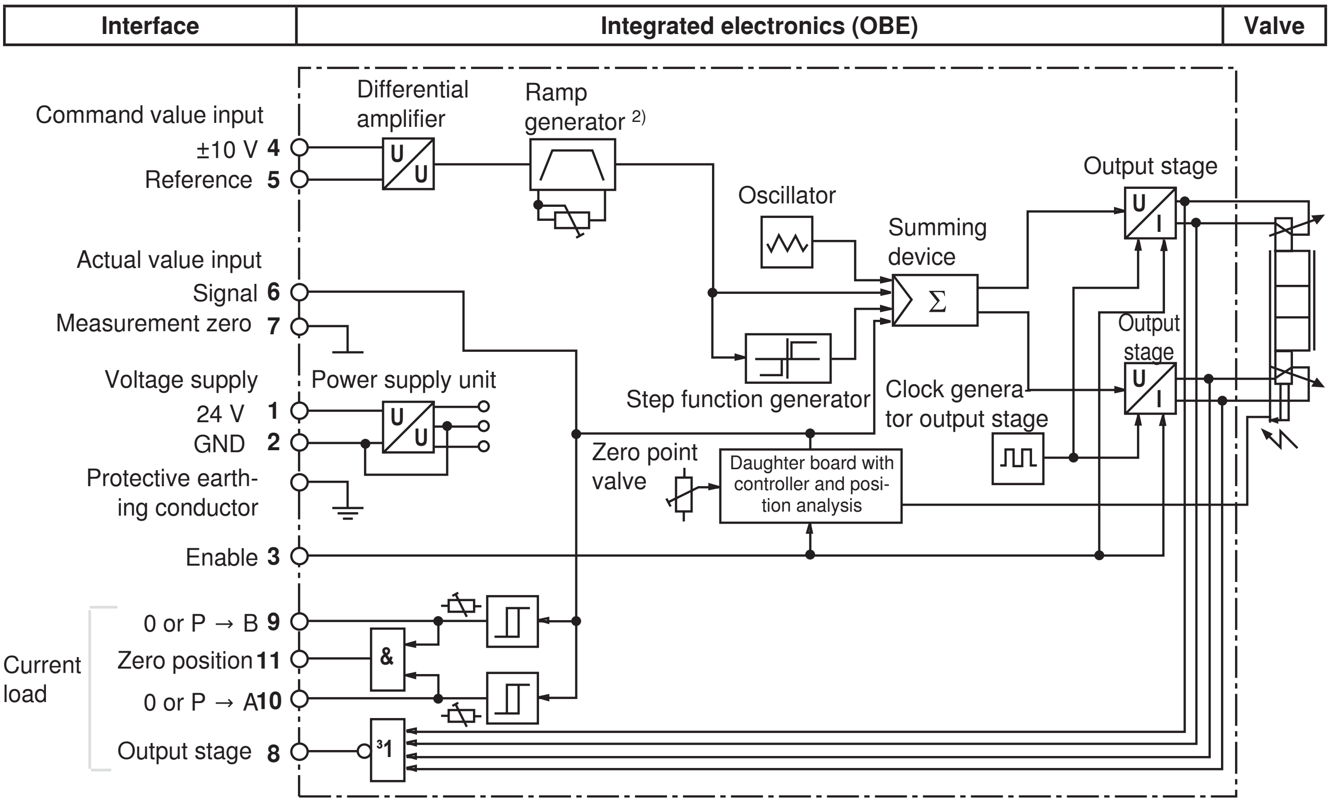
Command value: Positive command value 0 to +10 V at pin 4 and reference potential at pin 5 result in flow from P → A and B → T.
Negative command value 0 to –10 V at pin 4 and reference potential at pin 5 result in flow from P → B and A → T.

Actual value: Positive actual value 0 to +10 V at pin 6 and reference potential at pin 7 result in flow from P → A and B → T.
Negative actual value 0 to –10 V at pin 6 and reference potential at pin 7 result in flow from P → B and A → T.

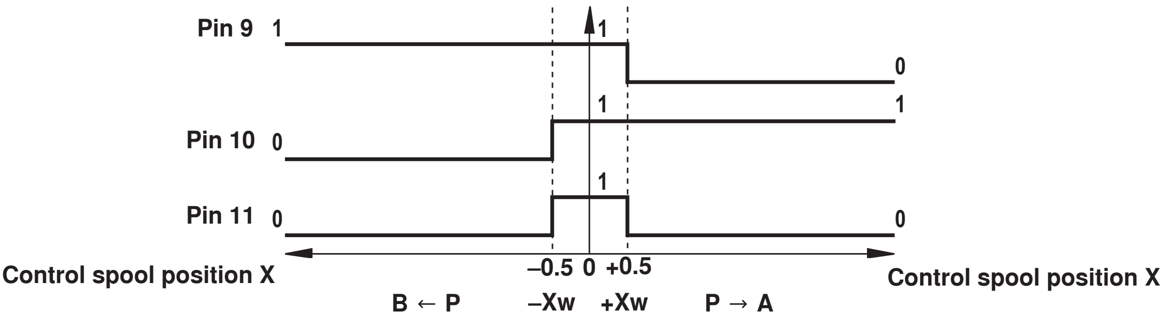
Connection cables: Recommendation: – Up to 25 m cable length type LiYCY 7 x 0.75 mm²
– Up to 50 m cable length type LiYCY 7 x 1.0 mm²

Integrated electronics

Block diagram



Logic switching statuses for control spool position monitoring



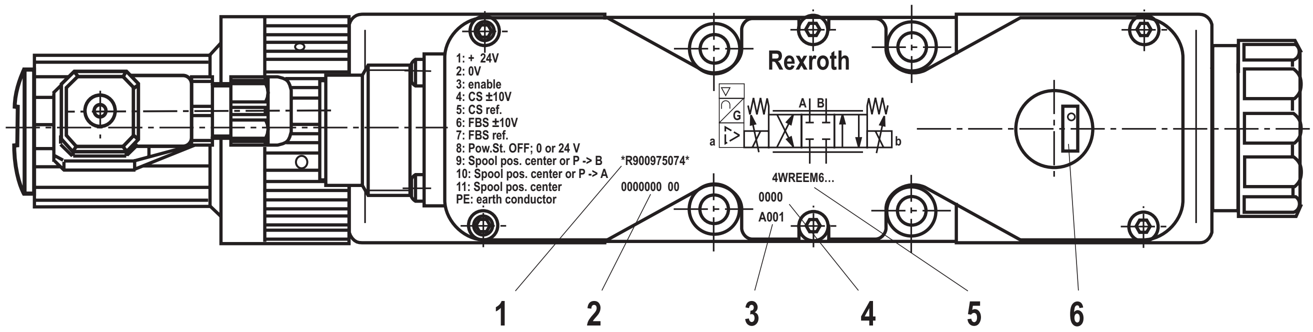
Logic signal linking

Control spool position	Direction of flow	Logic switching statuses		
		Pin 9	Pin 10	Pin 11
X < – Xw	B ← P	1	0	0
– Xw ≤ X ≤ Xw	-	1	1	1
X > Xw	P → A	0	1	0

0 ≙ 0 V
1 ≙ 24 VDC (19.0 V to 35 V)

Integrated electronics

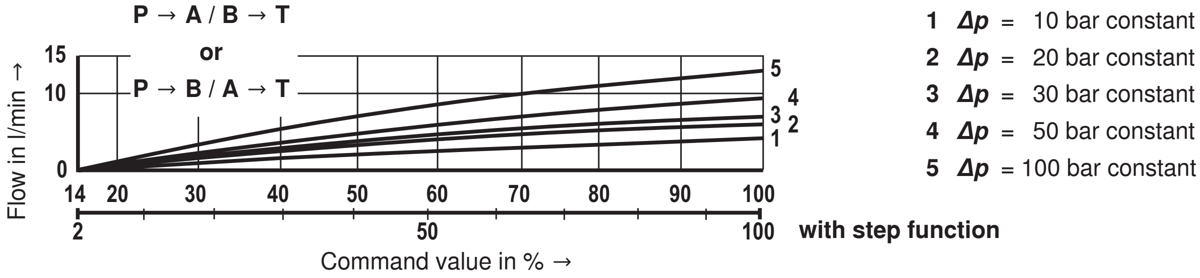
Marking and adjustment elements



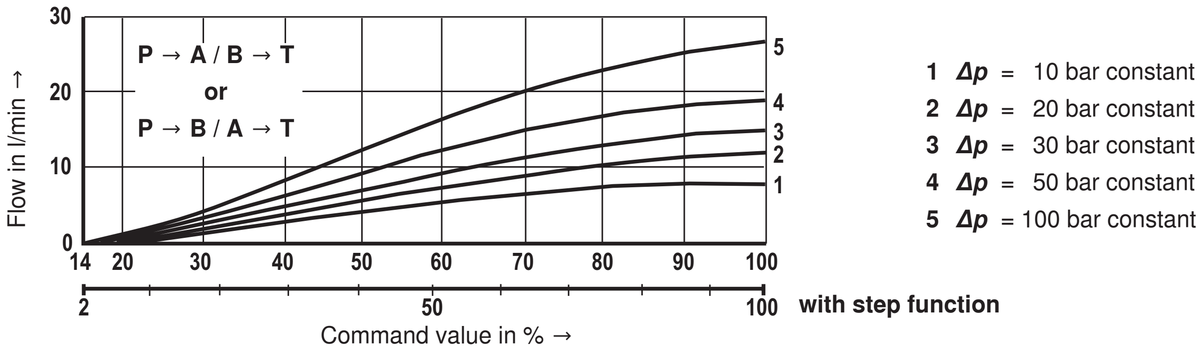
1 Material no.
2 Production order number
3 Date of production
4 Serial number
5 Type designation
6 Setting the ramp time

Characteristic curves: Size 6 (measured using HLP46, ϑ_{oil} = 40 °C ±5 °C, *p* = 100 bar)

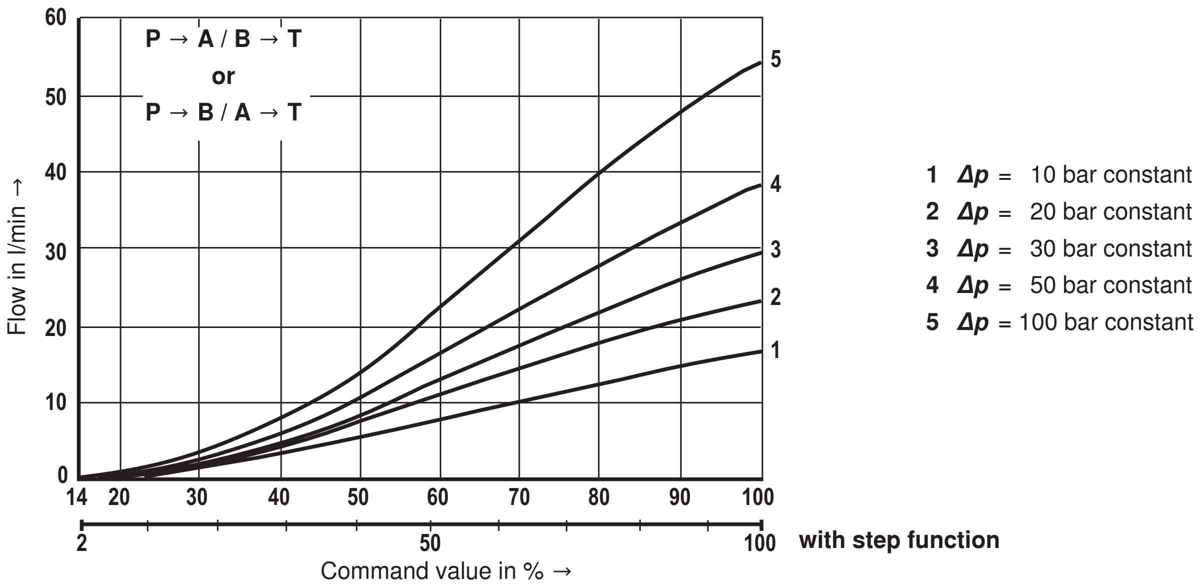
4 l/min rated flow at 10 bar valve pressure differential



8 l/min rated flow at 10 bar valve pressure differential



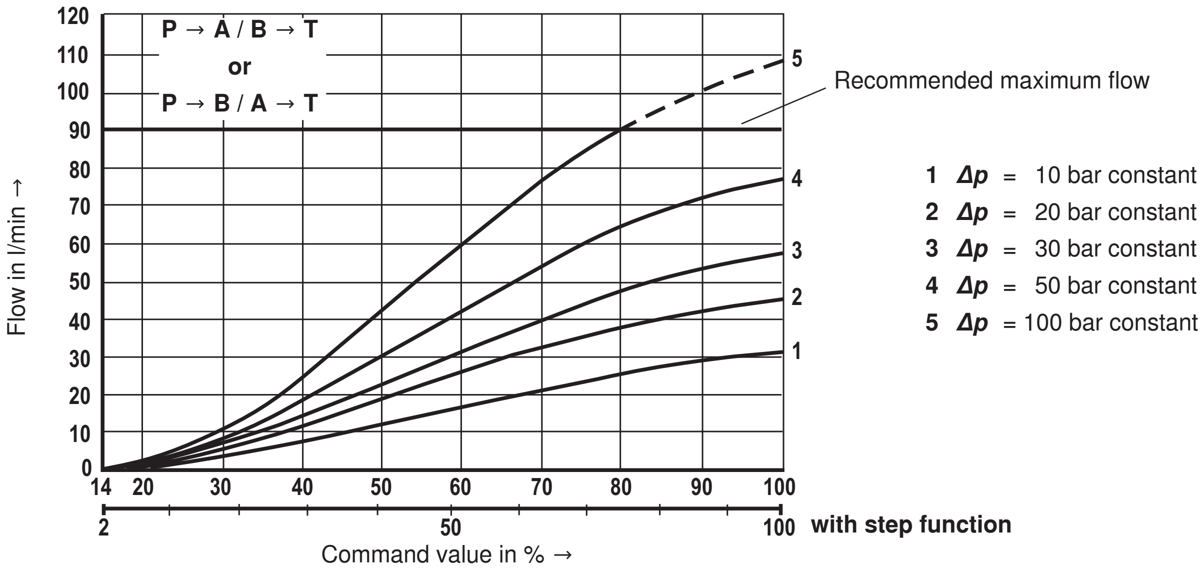
16 l/min rated flow at 10 bar valve pressure differential



Δp = valve pressure differential (inlet pressure p_P minus load pressure p_L minus return flow pressure p_T)

Characteristic curves: Size 6 (measured using HLP46, ϑ_{oil} = 40 °C ±5 °C, *p* = 100 bar)

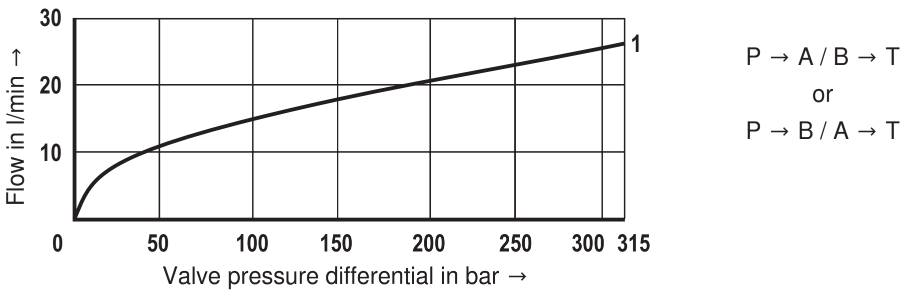
32 l/min rated flow at 10 bar valve pressure differential



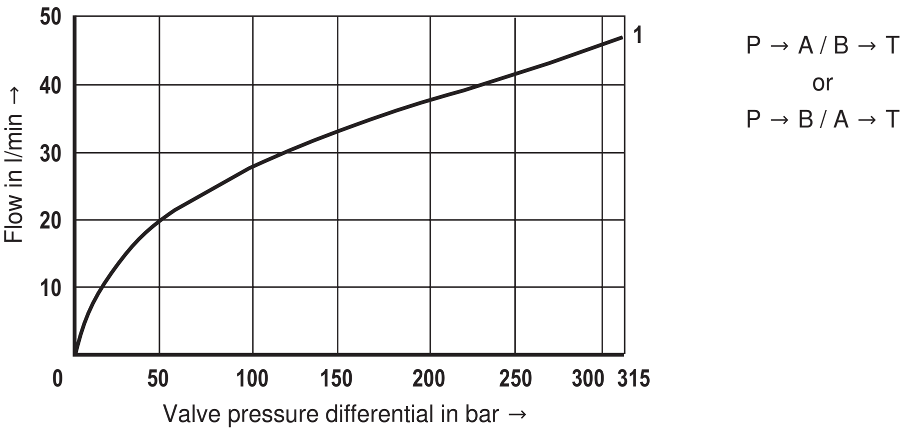
Δp = valve pressure differential (inlet pressure p_P minus load pressure p_L minus return flow pressure p_T)

Performance limit: Size 6 (measured using HLP46, ϑ_{oil} = 40 °C ±5 °C)

Rated flow 4 l/min



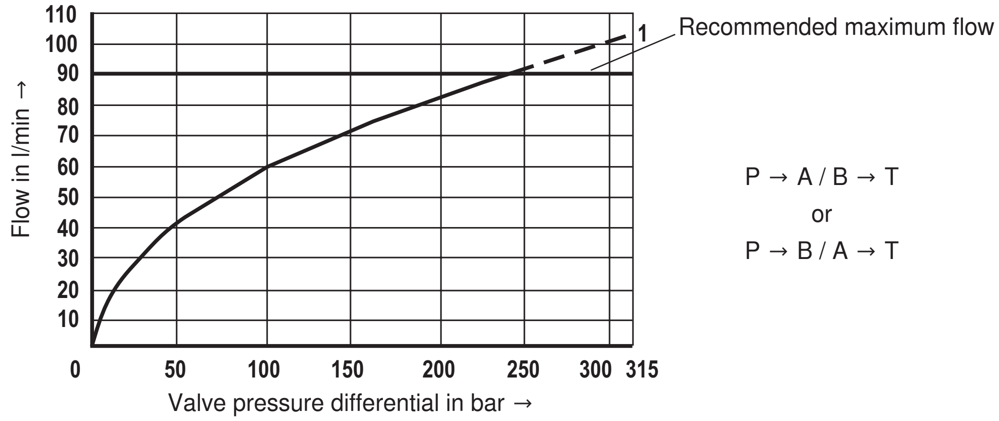
Rated flow 8 l/min



1 Command value = 100 %

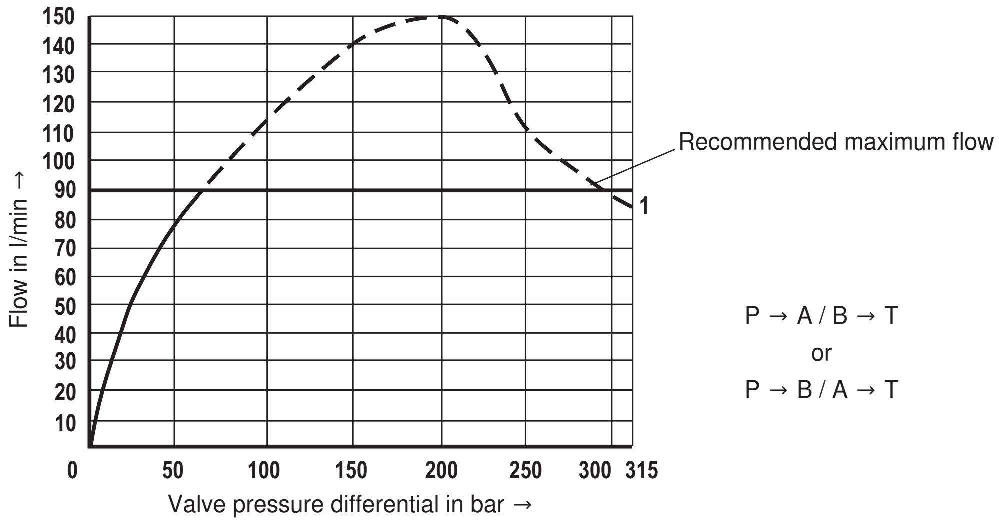
Performance limit: Size 6 (measured using HLP46, ϑ_{oil} = 40 °C ±5 °C)

Rated flow 16 l/min



P → A / B → T
or
P → B / A → T

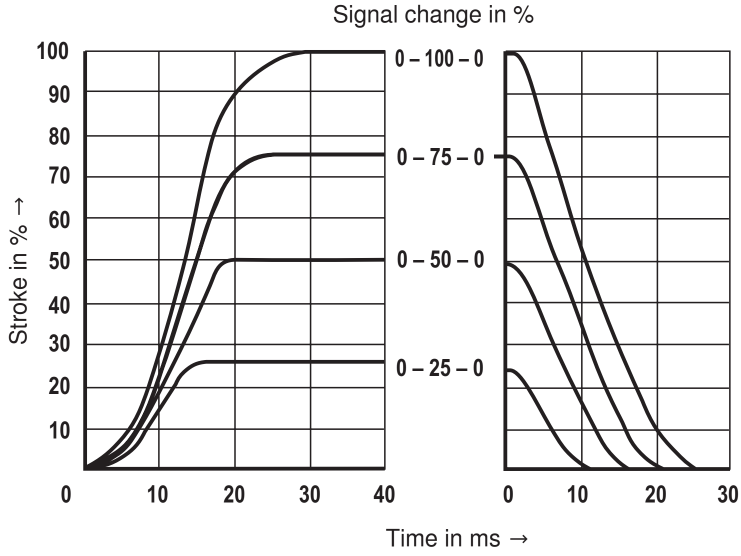
Rated flow 32 l/min



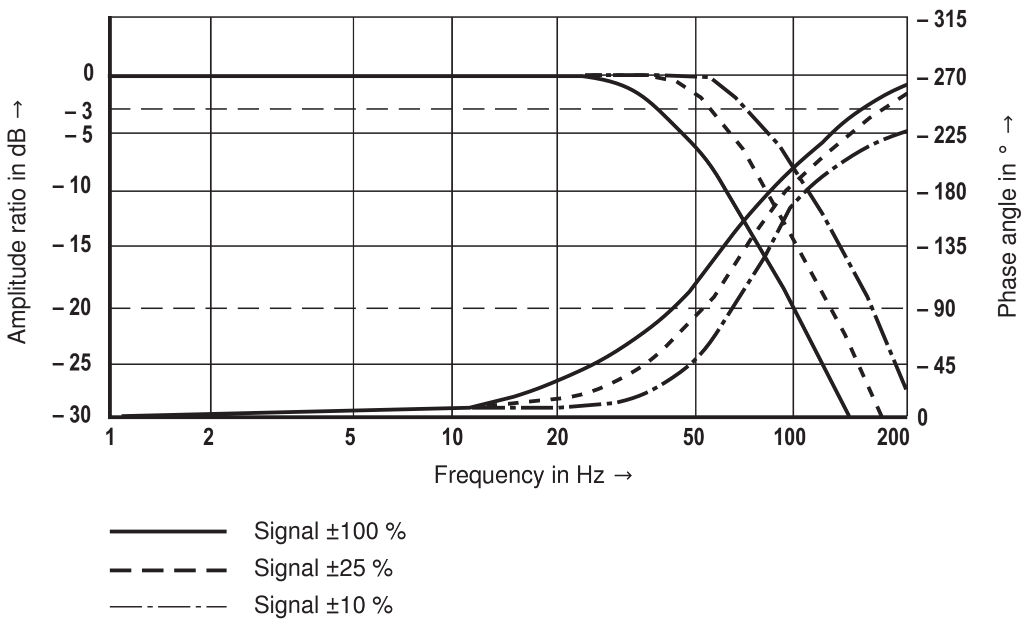
P → A / B → T
or
P → B / A → T

1 Command value = 100 %

Transition function with stepped electric input signals: Size 6
(measured using HLP46, ϑ_{oil} = 40 °C ±5 °C, p_s = 10 bar)

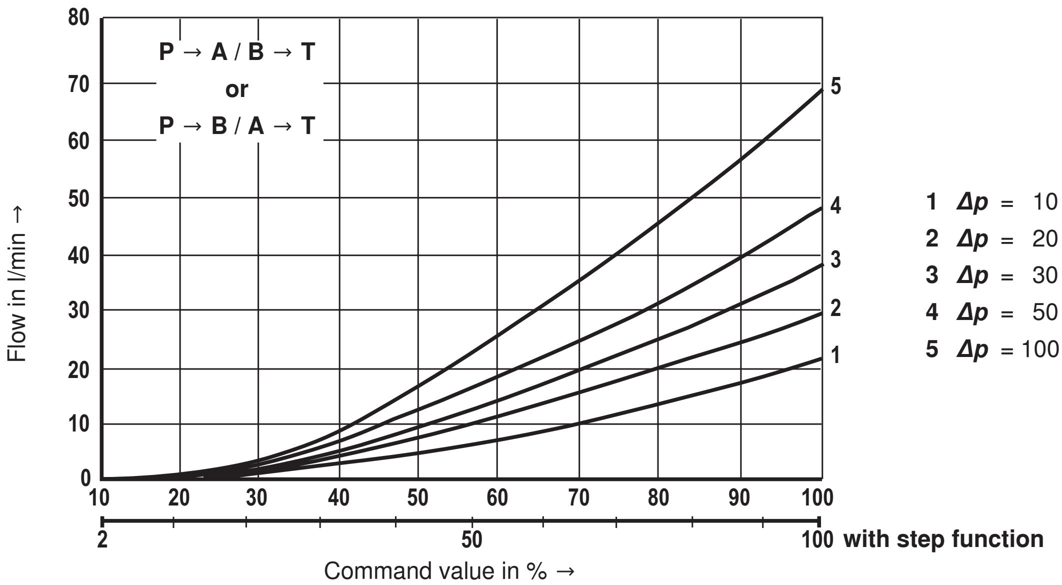


Frequency response characteristic curves: Size 6
(measured using HLP46, ϑ_{oil} = 40 °C ±5 °C, p_s = 10 bar)



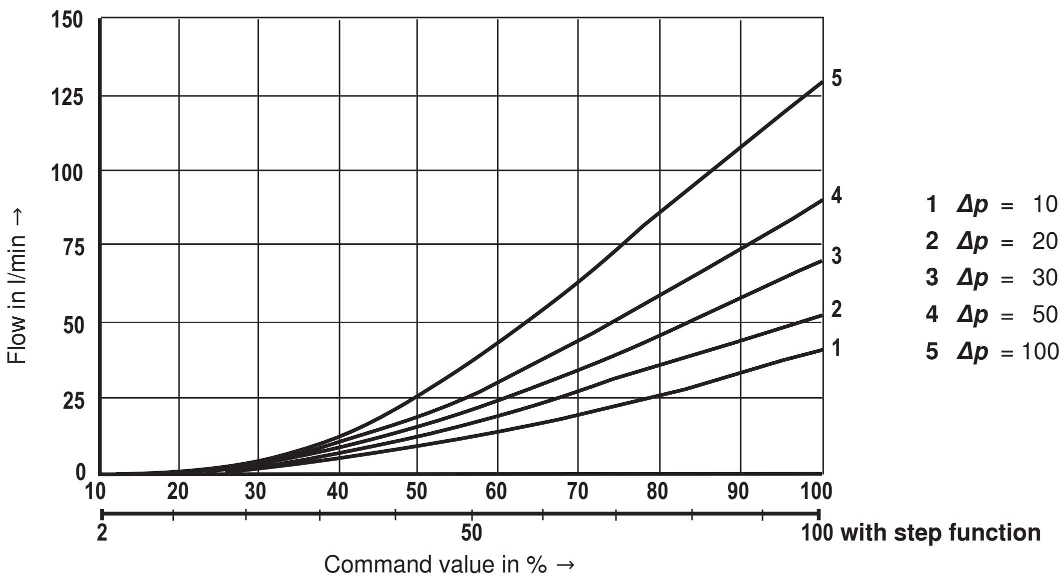
Characteristic curves: Size 10 (measured using HLP46, ϑ_{oil} = 40 °C ±5 °C, p = 100 bar)

25 l/min rated flow at 10 bar valve pressure differential



1 **Δp** = 10 bar constant
2 **Δp** = 20 bar constant
3 **Δp** = 30 bar constant
4 **Δp** = 50 bar constant
5 **Δp** = 100 bar constant

50 l/min rated flow at 10 bar valve pressure differential

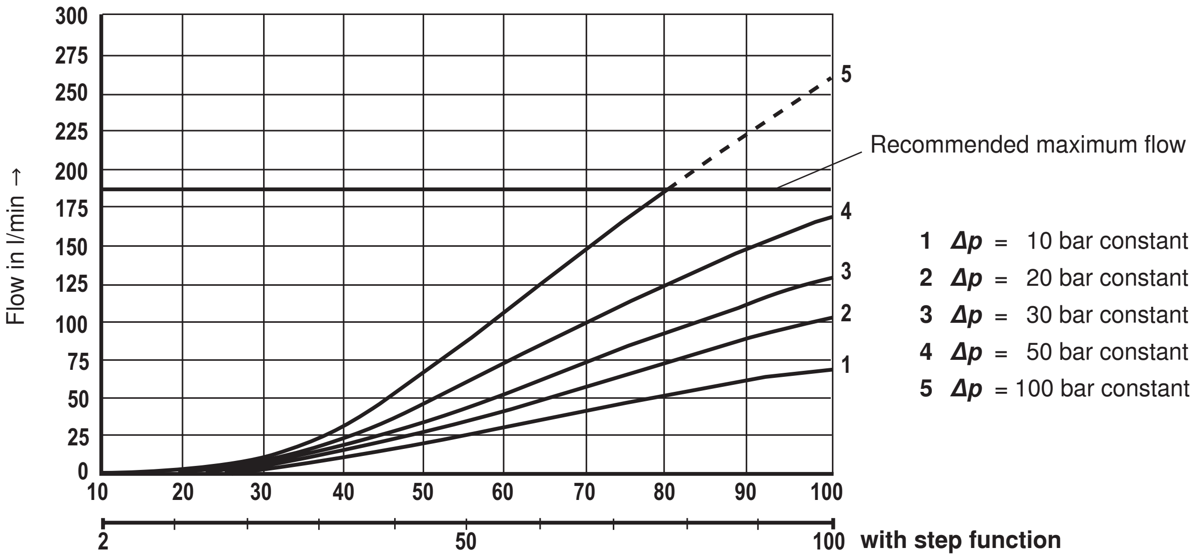


1 **Δp** = 10 bar constant
2 **Δp** = 20 bar constant
3 **Δp** = 30 bar constant
4 **Δp** = 50 bar constant
5 **Δp** = 100 bar constant

Δp = valve pressure differential (inlet pressure $\boldsymbol{p}_P$ minus load pressure $\boldsymbol{p}_L$ minus return flow pressure $\boldsymbol{p}_T$)

Characteristic curves: Size 10 (measured using HLP46, ϑ_{oil} = 40 °C ±5 °C, p = 100 bar)

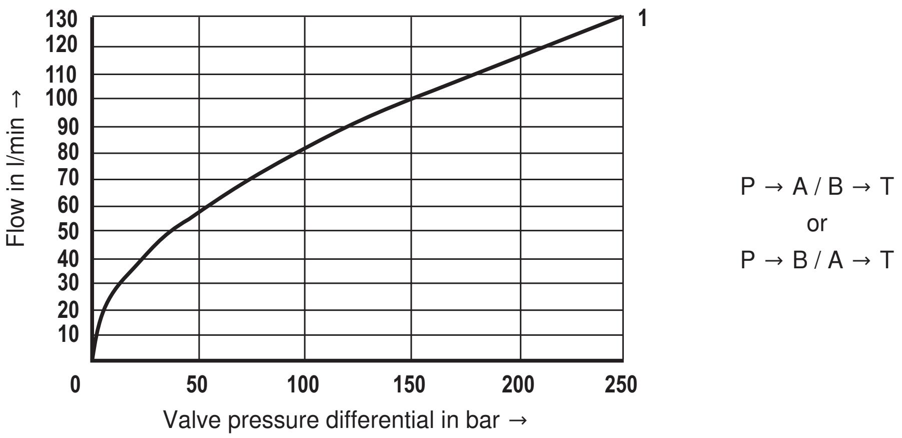
75 l/min rated flow at 10 bar valve pressure differential



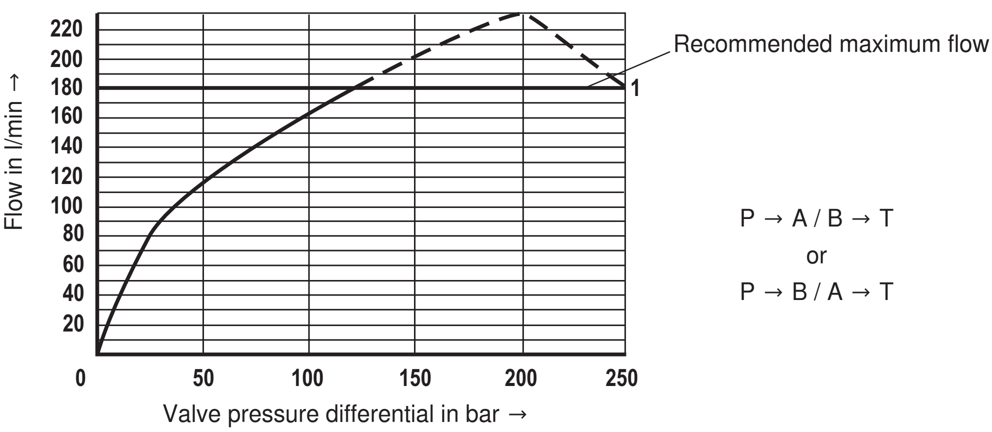
Δp = valve pressure differential (inlet pressure p_P minus load pressure p_L minus return flow pressure p_T)

Performance limit: Size 10 (measured using HLP46, ϑ_{oil} = 40 °C ±5 °C)

Rated flow 25 l/min



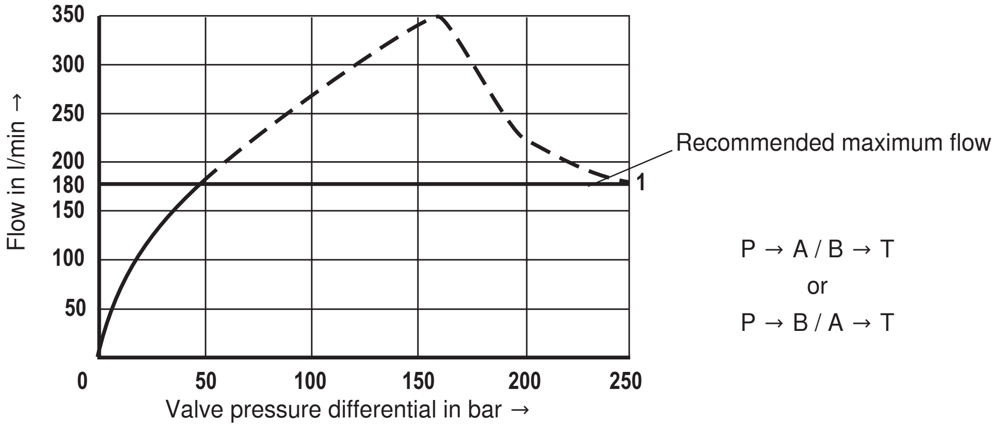
Rated flow 50 l/min



1 Command value = 100 %

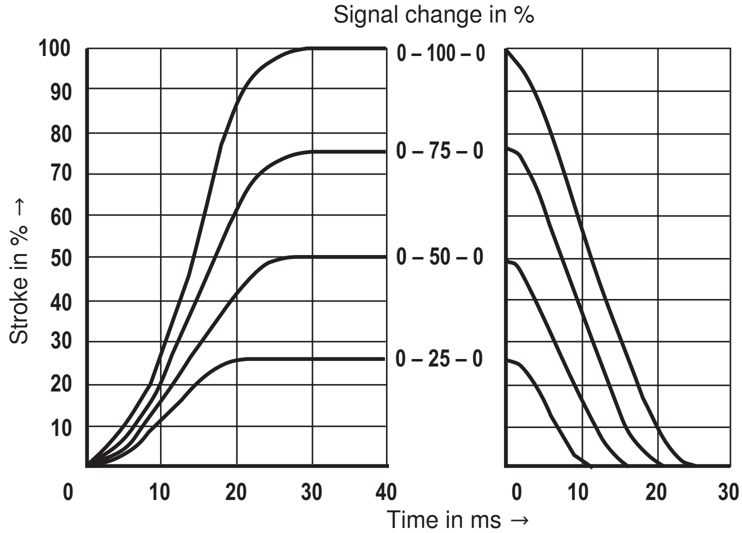
Performance limit: Size 10 (measured using HLP46, ϑ_{oil} = 40 °C ±5 °C)

Rated flow 75 l/min

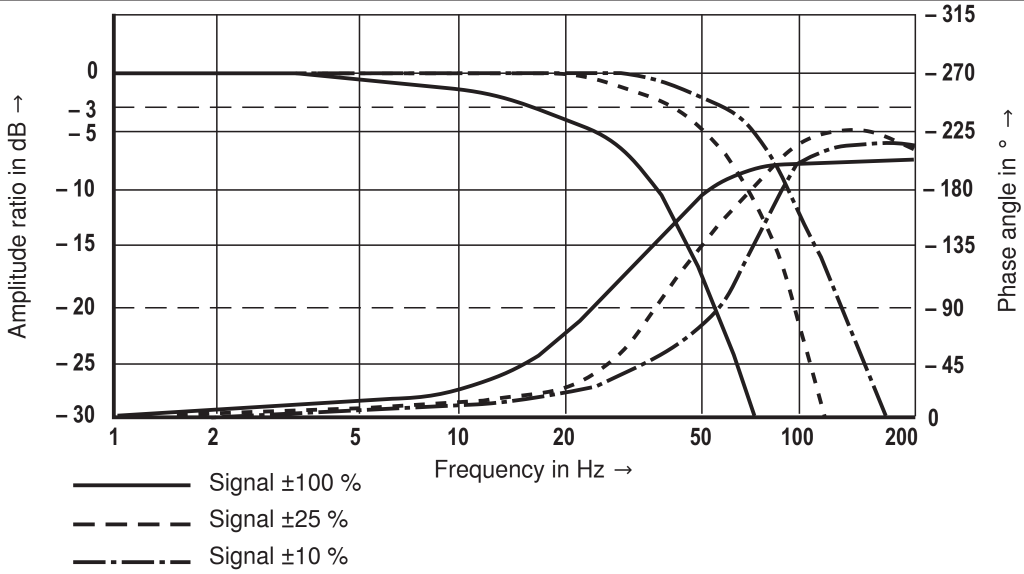


1 Command value = 100 %

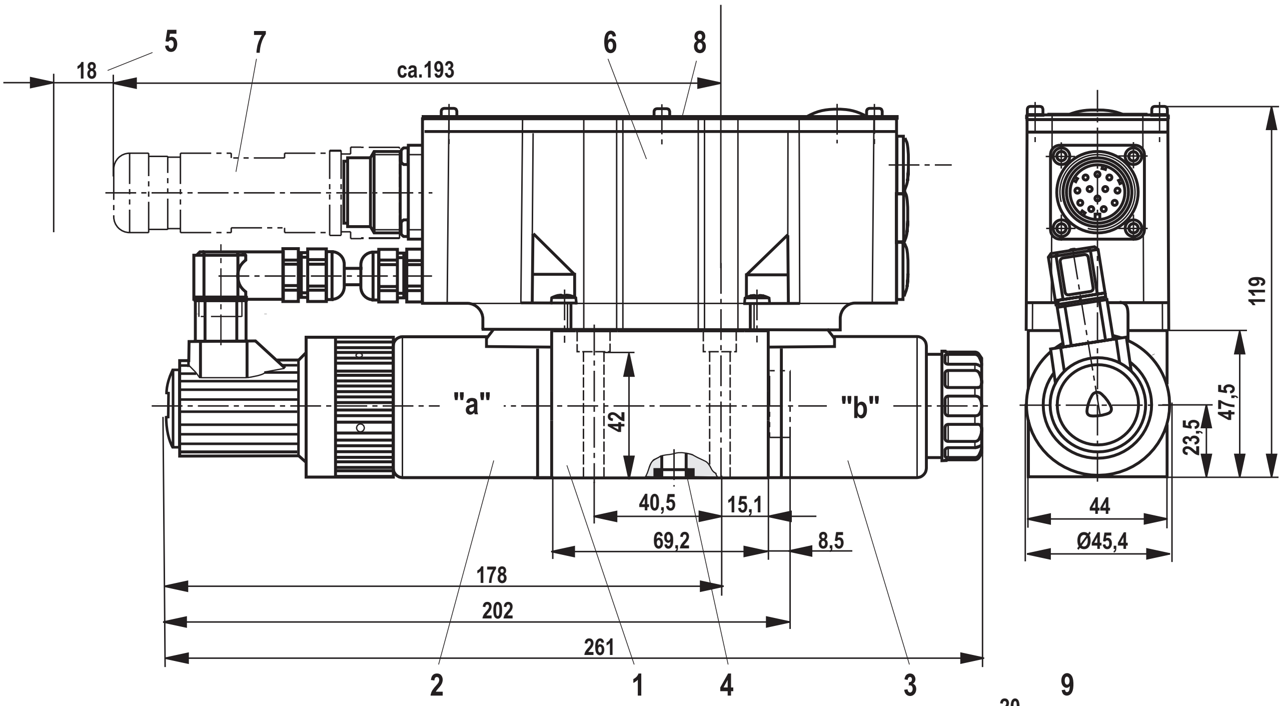
Transition function with stepped electric input signals: Size 10 (measured using HLP46, ϑ_{oil} = 40 °C ±5 °C, p_s = 10 bar)

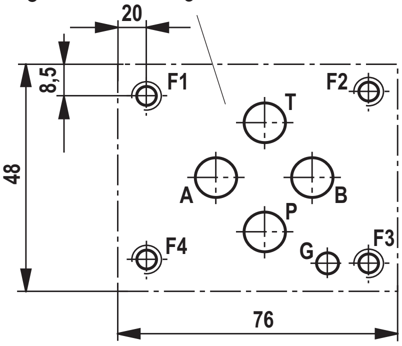


Frequency response characteristic curves: Size 10 (measured using HLP46, ϑ_{oil} = 40 °C ±5 °C, p_s = 10 bar)

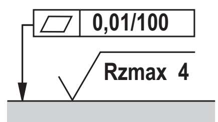


Dimensions: Size 6 (dimensions in mm)





1 Valve housing
2 Proportional solenoid "a" with inductive position transducer
3 Proportional solenoid "b"
4 R-ring 9.81 x 1.5 x 1.78 (ports P, A, B, T)
5 Space required to remove the mating connector
6 Integrated control electronics
7 Mating connector according to DIN EN 175201-804, order separately, see page 5
8 Name plate
9 Processed valve contact surface, porting pattern according to ISO 4401-03-02-0-05
Deviating from the standard:
– Ports P, A, B, T Ø8 mm
– Bore G can be eliminated, as there is no pin in the valve.

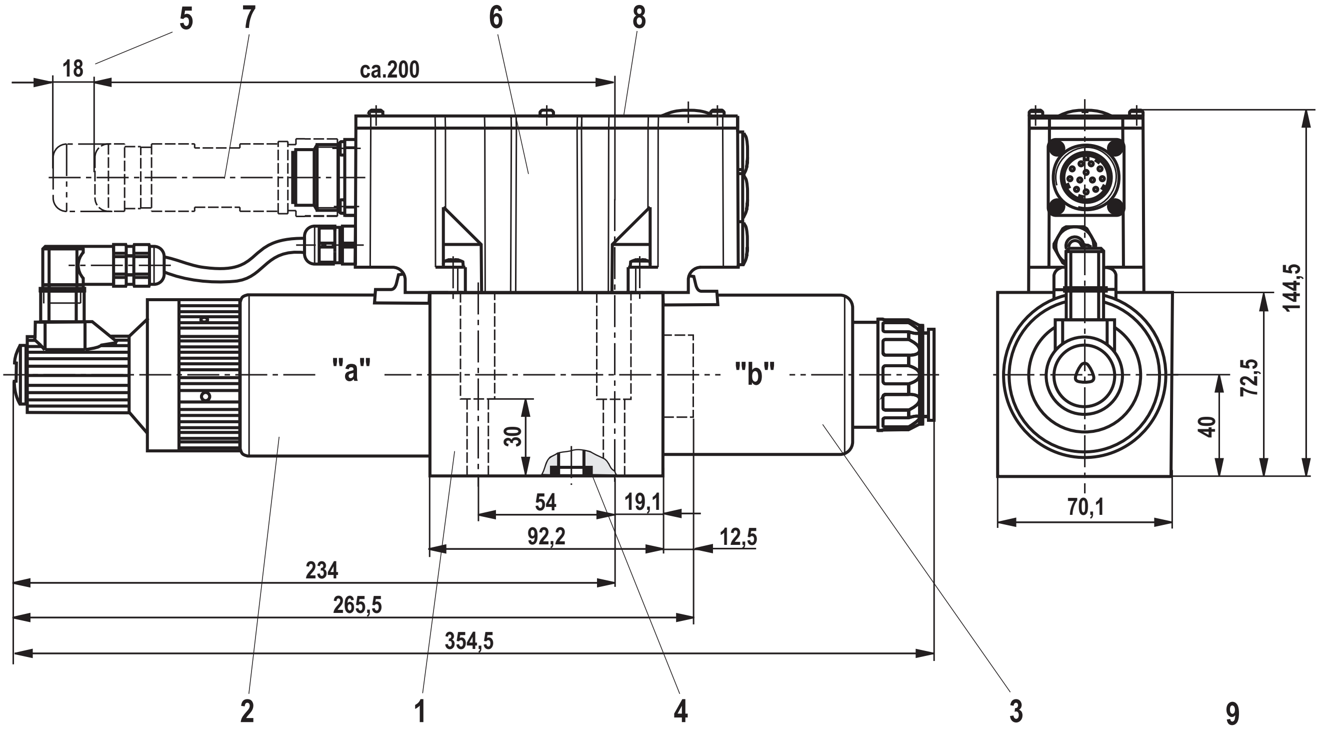


Required surface quality of the valve contact surface

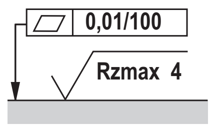
Notice!
The dimensions are nominal dimensions which are subject to tolerances.

Subplates and valve mounting screws see page 16

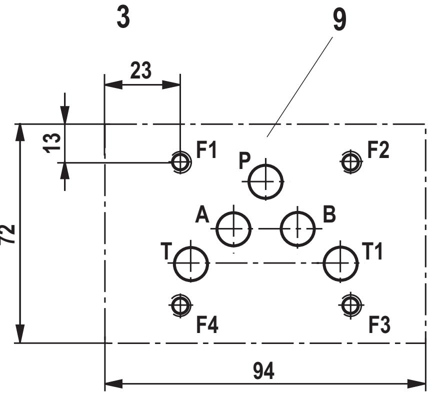
Dimensions: Size 10 (dimensions in mm)



1 Valve housing
2 Proportional solenoid "a" with inductive position transducer
3 Proportional solenoid "b"
4 R-ring 13.0 x 1.6 x 2.0 (ports P, A, B, T, T1)
5 Space required to remove the mating connector
6 Integrated control electronics
7 Mating connector according to DIN EN 175201-804, order separately, see page 5
8 Name plate
9 Processed valve contact surface, porting pattern according to ISO 4401-05-04-0-05



Required surface quality of the valve contact surface



Hexagon socket head cap screws		Material number
Size 6	4x ISO 4762 - M5 x 50 - 10.9 Tightening torque M_A = 8,9 Nm ±10 %	
Size 10	4x ISO 4762 - M6 x 40 - 10.9 Tightening torque M_A = 15.5 Nm ±10 %	

Notice: The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure!

Subplates	Data sheet
Size 6	45052
Size 10	45054

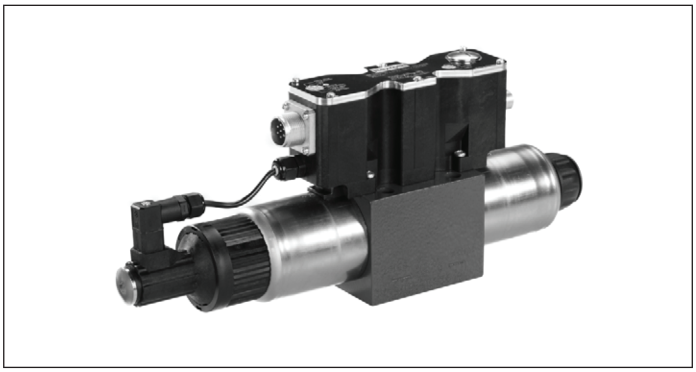
Notice!

The dimensions are nominal dimensions which are subject to tolerances.

4/3 proportional directional valve with integrated digital electronics and field bus interface (IFB-P)

Type 4WREF

RE 29048
Edition: 2014-01
Replaces: 02.13



- Sizes 6 and 10
- Component series 2X
- Maximum operating pressure 315 bar
- Maximum flow: 80 l/min (size 6)
- Maximum flow: 180 l/min (size 10)

Features

- Direct operated proportional directional valve with integrated digital electronics and field bus interface (Integrated Field Bus IFB-P)
- Operation by means of proportional solenoids with central thread and detachable coil
- Position-controlled valve control spool
- Analog interface for command and actual value
- Command value (flow) analog or via bus
- Design for CAN bus with CANopen protocol DS 408 or Profibus-DP
- Quick commissioning via PC and WIN-PED 6 commissioning software

Contents

Ordering code

01	02	03	04	05	06	07		08		09	10	11	12
4	**WRE**	**F**				**2X**	**/**	**V**	**–**	**24**			*****

01	4 main ports	**4**
02	Proportional directional valve	**WRE**
03	With integrated digital electronics and field bus interface	**F**
04	Size 6	**6**
	Size 10	**10**
05	Symbols e.g. E, E1, V etc.: possible design see page 3	

Rated flow for size 6

06	8 l/min	**08**
	16 l/min	**16**
	32 l/min	**32**

Rated flow for size 10

06	25 l/min	**25**
	50 l/min	**50**
	75 l/min	**75**
07	Component series 20 ... 29 (20 ... 29: Unchanged installation and connection dimensions)	**2X**
08	FKM seals	**V**
09	Supply voltage 24 V	**24**

Bus interface

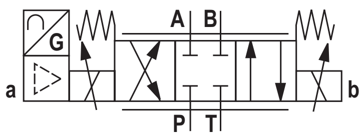
10	CANBus DS 408	**C**
	Profibus DP V0/V1	**P**

Electrical interface

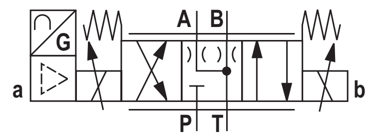
11	Command value ±10 V	**A1**
	Command value 4 to 20 mA	**F1**
12	Further details in the plain text	

Symbols

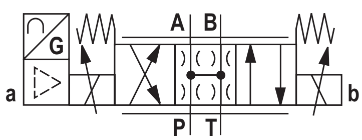
Type 4WREF...E...



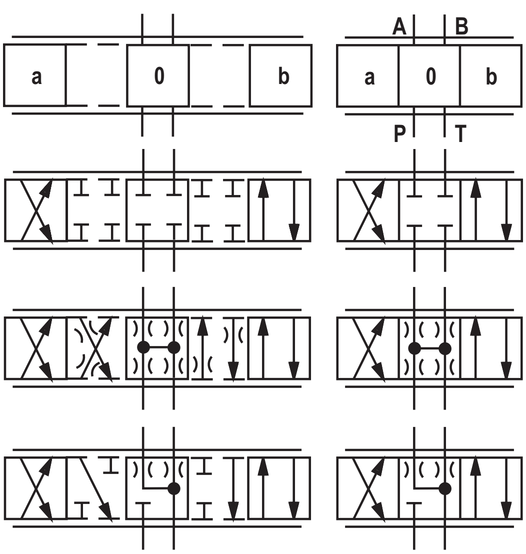
Type 4WREF...W...



Type 4WREF...V...



Control spool symbols



= E, E1

= V

= W, W1

With symbols E1 and W1:

P → A: $\boldsymbol{q}_{\mathrm{vmax}}$	B → T: $\boldsymbol{q}_{\mathrm{v}}/2$
P → B: $\boldsymbol{q}_{\mathrm{v}}/2$	A → T: $\boldsymbol{q}_{\mathrm{vmax}}$

Function, section

Set-up

The valve basically consists of:

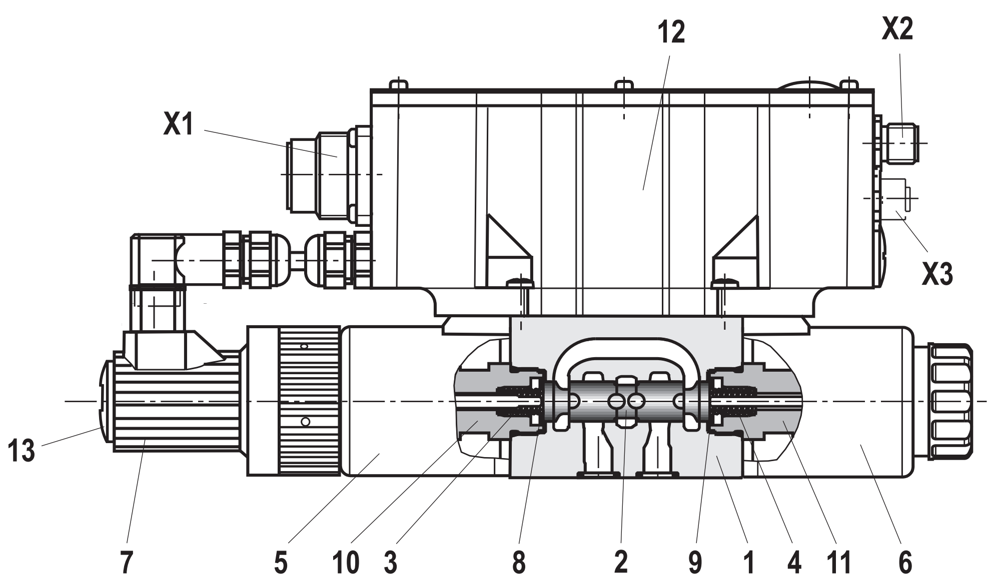
- Housing (1) with connection surface
- Control spool (2) with compression springs (3 and 4) and spring plates (8 and 9)
- Coils (5 and 6) and pole tubes (10 and 11) with central thread
- Position transducer (7)
- Integrated digital control electronics IFB-P (12)

Functional description

With de-energized solenoids (5 and 6), the control spool (2) is brought into the central position by the compression springs (3 and 4) between the spring plates (8 and 9) (with V control spool without spring plate). With V control spools, the mechanical zero position does not correspond to the hydraulic one.

Functions:

- Control of the valve spool position
- The command value can alternatively be specified via an analog interface (X1) or via the field bus interface (X2, X3).
- The actual value signals are provided via an analog interface (X1) and can additionally be read out via the field bus (X2, X3).
- The controller parameters are set via the field bus.



☞ **Notice!** The PG fitting (13) must not be opened. Mechanical adjustment of the adjustment nut located below is prohibited and damages the valve!

☞ **Notice!** Due to the design principle, internal leakage is inherent to the valves and may increase over the life cycle.
The tank line must not be allowed to run empty. With corresponding installation conditions, a preload valve is to be installed.

Function, section

The integrated digital electronics enables the following fault detection:

- Undervoltage
- Cable break in position transducer (7)
- Communication error
- Watchdog
- Cable break in command value input (only with current interface)

The following additional functions are available:

- Ramp generator
- Internal command value profile
- Enable function, digital
- Overlap compensation
- Zero point correction

WIN-PED PC program (version 6 or higher):
To implement the project planning task and to parameterize the IFB-P valves, the user may use the WIN-PED commissioning software.

- Parameterization
- Diagnosis
- Convenient data management on a PC

System requirements

- IBM PC or compatible system
- Windows 2000 or Windows XP
- RAM (recommendation: 256 MB)
- 150 MB of available hard disk capacity

Notice
The "WIN-PED" PC program is not included in the scope of delivery. It can be downloaded on the Internet free of charge! (See page 18)

Technical data
(for applications outside these parameters, please consult us!)

general			**Size 6**	**Size 10**
Installation position			Any, preferably horizontal	
Storage temperature range		°C	–20 ... +80	
Ambient temperature range		°C	–20 ... +50	
Weight without sandwich plate		kg	2.4	6.5
MTTFd values according to EN ISO 13849		Years	150 (for further details see data sheet 08012)	
Climate			Environmental audit according to EN 60068-2	

hydraulic (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C)				
Maximum operating pressure	– Ports A, B and P	bar	Up to 315	
	– Port T	bar	Up to 210	
Rated flow q_{Vnom} with Δp = 10 bar		l/min	8	25
			16	50
			32	75
Maximum admissible flow		l/min	80	180
Hydraulic fluid			See table page 6	
Hydraulic fluid temperature range		°C	–20 ... +70, preferably +40 ... +50	
Viscosity range		mm²/s	20 to 380, preferably 30 to 46	
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)			Class 20/18/15 [1]	
Hysteresis (position control - valve control spool)		%	≤ 0.1	
Range of inversion (position control - valve control spool)		%	≤ 0.05	
Response sensitivity (position control - valve control spool)		%	≤ 0.05	
Zero shift valve control spool upon change of hydraulic fluid temperature and operating pressure		%/10K	< 0.15	
		%/100 bar	< 0.1	

[1] The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the life cycle of the components.

Technical data
(for applications outside these parameters, please consult us!)

Hydraulic fluid	Classification	Suitable sealing materials	Standards
Mineral oils and related hydrocarbons	HL, HLP	NBR, FKM	DIN 51524

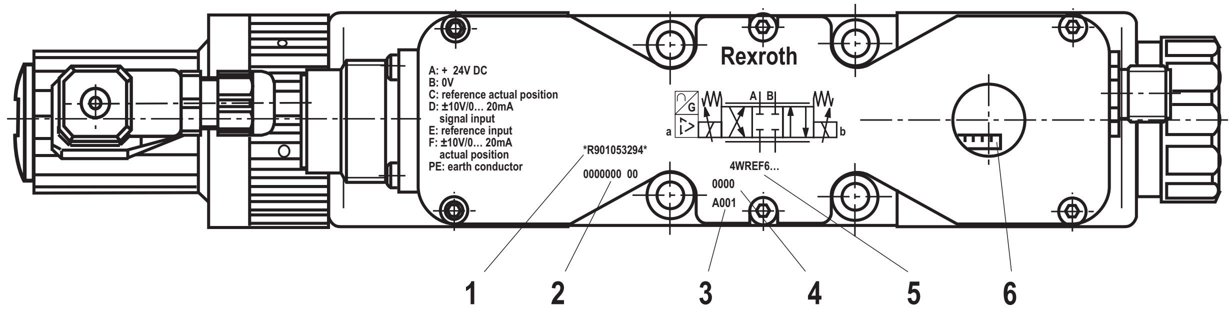
☞ **Important information on hydraulic fluids!**
- For more information and data on the use of other hydraulic fluids, refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.)!
- The flash point of the hydraulic fluid used must be 40 K higher than the maximum solenoid surface temperature.

electric			
Duty cycle [1]		%	100
Supply voltage	– Nominal voltage	VDC	24
	– Lower limit value	VDC	19.4
	– Upper limit value	VDC	35
	– Maximum admissible residual ripple	Vpp	2
Total current consumption	– I_{max}	A	2
	– Impulse current	A	3
Command and actual value signals	– Voltage "A1"	V	±10
	– Current "F1"	mA	4 to 20
Converter resolution (command/actual value signals)		Bit	10
Maximum coil temperature [2]		°C	Up to 150
Protection class of the valve according to EN 60529			IP 65 with mounted and locked plug-in connectors
EMC (electromagnetic compatibility)			Interference resistance prEN 50082-2:1994 Interference emission EN 50081-1:1992

[1] Connect the valve to the supply voltage only when this is required for the functional processes of the machine.

[2] Due to the temperatures occurring at the surfaces of the solenoid coils, the European standards ISO 13732-1 and EN ISO 4413 must be adhered to.

Integrated electronics (IFB-P), marking and adjustment elements



1 Material number
2 Production order number
3 Date of production
4 Serial number
5 Type designation
6 DIL switch for address and baud rate setting
(position B0 on the right)

Electrical connection and allocation

Connector pin assignment X1, 6-pole + PE according to DIN EN 175201-804

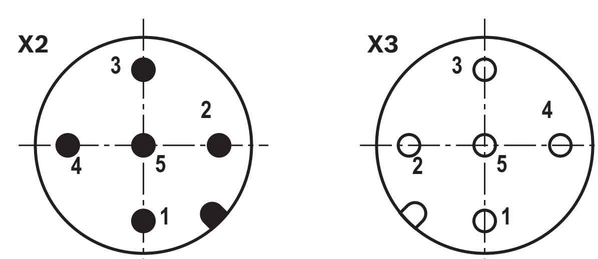
Pin	Signal	Interface A1 pin assignment	Interface F1 pin assignment
A	Supply voltage	24 VDC ($\boldsymbol{u}(\boldsymbol{t})$ = 19.4 to 35 V); $\boldsymbol{I}_{max}$ = 2 A	
B		0 V	
C	Reference potential actual value	Reference potential actual value	
D	Differential amplifier input	±10 V command value; $\boldsymbol{R}_e$ > 50 kΩ	4 to 20 mA command value; $\boldsymbol{R}_e$ = 100 Ω
E		Reference potential command value	
F	Measuring output	±10 V actual valve control spool value (limit load 5 mA)	4 to 20 mA actual valve control spool value (load resistance maximum 300 Ω)
PE		Protective earthing conductor (directly connected to cooling element and valve housing)	

Connector pin assignment for CAN bus "X2"/"X3" (coding A), M12, 5-pole, pins/socket

Pin	Assignment
1	n. c.
2	n. c.
3	CAN_GND
4	CAN_H
5	CAN_L

Transmission rate kbit/s	20 to 1000
Bus address	1 to 127

CAN-specific settings:
Baud rate and identifier can be set via the bus system and/or the DIL switches.

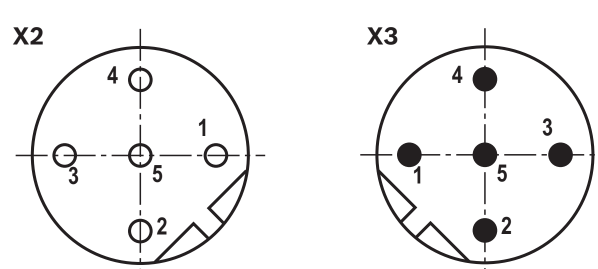


Connector pin assignment for Profibus DP "X2"/"X3" (coding B), M12, 5-pole, socket/pins

Pin	Assignment
1	+5 V
2	RxD/TxD-N (A line)
3	D GND
4	RxD/TxD-P (B line)
5	Shield

Transmission rate MBaud	up to 12
Bus address	1 to 126

Setting via DIL switch.
The +5 V voltage of the IFB-P serves to supply an external bus terminator (as required).



Integrated electronics (IFB-P), settings for CANopen and Profibus DP

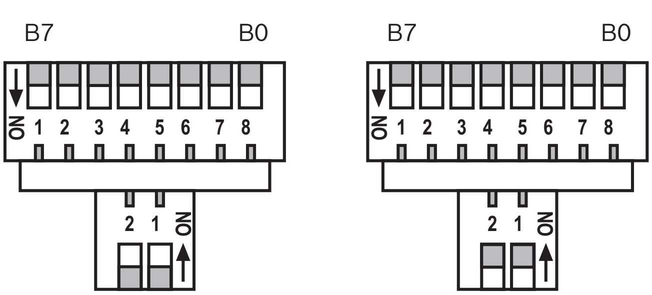
CANopen

B7	B6	B5	B4	B3	B2	B1	B0	HEX	Baud rate: B7, B6	Address range: B5 to B0
0	0	0	0	0	0	0	0	00 [1]	Standard 20 kBaud or re-programmed	1 = Standard or re-programmed
0	0	0	0	0	0	0	1	01	20 kBaud	1 to 63
				to				to		
0	0	1	1	1	1	1	1	3F		
0	1	0	0	0	0	0	0	40	125 kBaud	1 = Standard or re-programmed
0	1	0	0	0	0	0	1	41	125 kBaud	1 to 63
				to				to		
0	1	1	1	1	1	1	1	7F		
1	0	0	0	0	0	0	0	80	250 kBaud	1 = Standard or re-programmed
1	0	0	0	0	0	0	1	81	250 kBaud	1 to 63
				to				to		
1	0	1	1	1	1	1	1	BF		
1	1	0	0	0	0	0	0	C0	500 kBaud	1 = Standard or re-programmed
1	1	0	0	0	0	0	1	C1	500 kBaud	1 to 62
				to				to		
1	1	1	1	1	1	1	0	FE		
1	1	1	1	1	1	1	1	FF	250 kBaud	Monitor mode/programming mode 1 = fixed

Profibus DP

B7	B6	B5	B4	B3	B2	B1	B0	HEX	Address range
0	0	0	0	0	0	0	0	00 [1]	125 = Standard or re-programmed
0	0	0	0	0	0	0	1	01	1 to 126 with parameter channel
				to				to	
0	1	1	1	1	1	1	0	7E	
1	0	0	0	0	0	0	0	80	1 to 126 without parameter channel
				to				to	
1	1	1	1	1	1	1	0	FE	
1	1	1	1	1	1	1	1	FF	Monitor operation address 125

[1] Factory setting

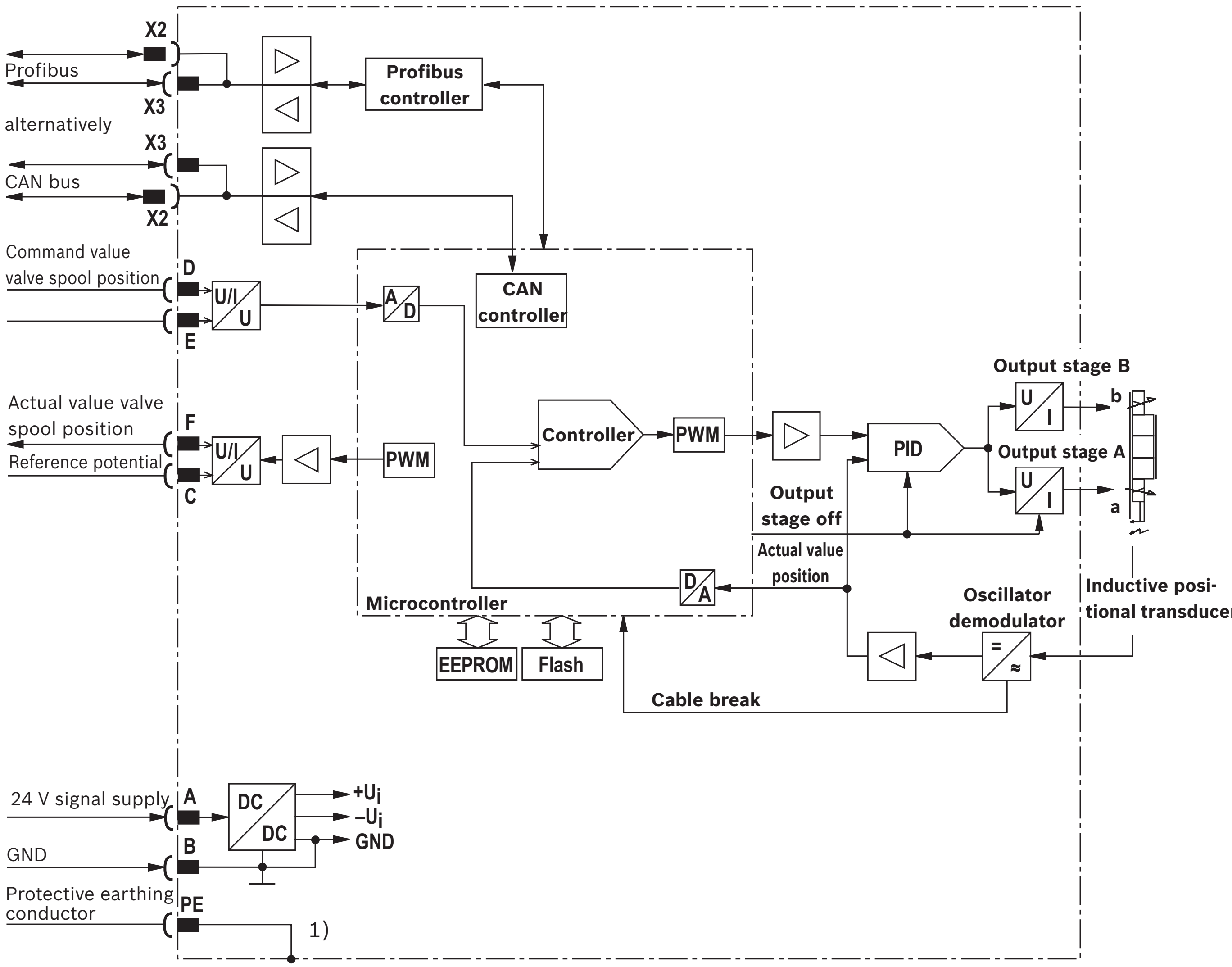


Connection of the bus terminator using the two lower switches (only with Profibus):

Left figure: Bus terminator not connected

Right figure: Bus terminator connected (both switches to "ON")

Integrated electronics (IFB-P), block diagram



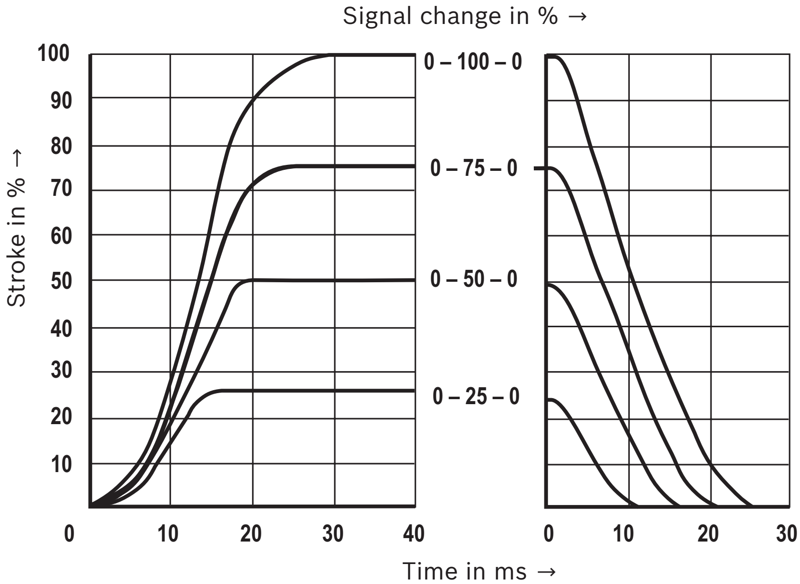
1) The protective earthing conductor (PE) is connected to cooling element and valve housing.

Command value	Positive command value 0 to +10 V (or 12 to 20 mA) at pin D and reference potential at pin E result in flow from P → A and B → T. Negative command value 0 to –10 V (or 12 to 4 mA) at pin D and reference potential at pin E result in flow from P → B and A → T.
Actual value	Positive actual value 0 to +10 V (or 12 to 20 mA) at pin F and reference potential at pin C result in flow from P → A and B → T.
Connection line	Recommendation: Up to 25 m line length type LiYCY 7 x 0.75 mm² Up to 50 m line lenght type LiYCY 7 x 1.00 mm² External diameter see sketch of mating connector

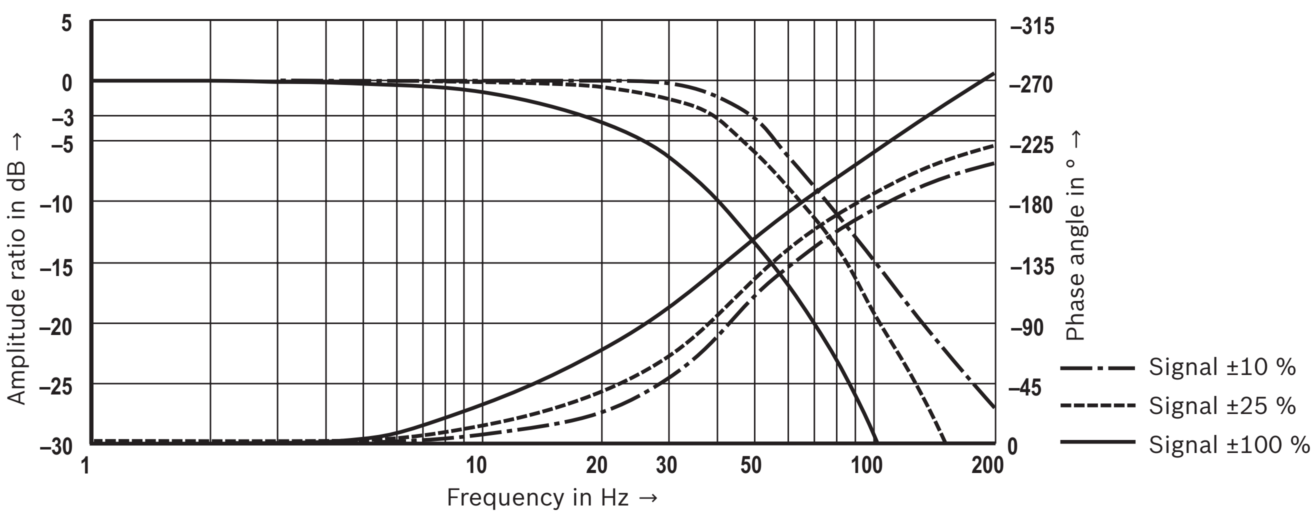
Characteristic curves size 6

(measured with HLP46, ϑ_{oil} = 40 ±5 °C and p_s = 10 bar)

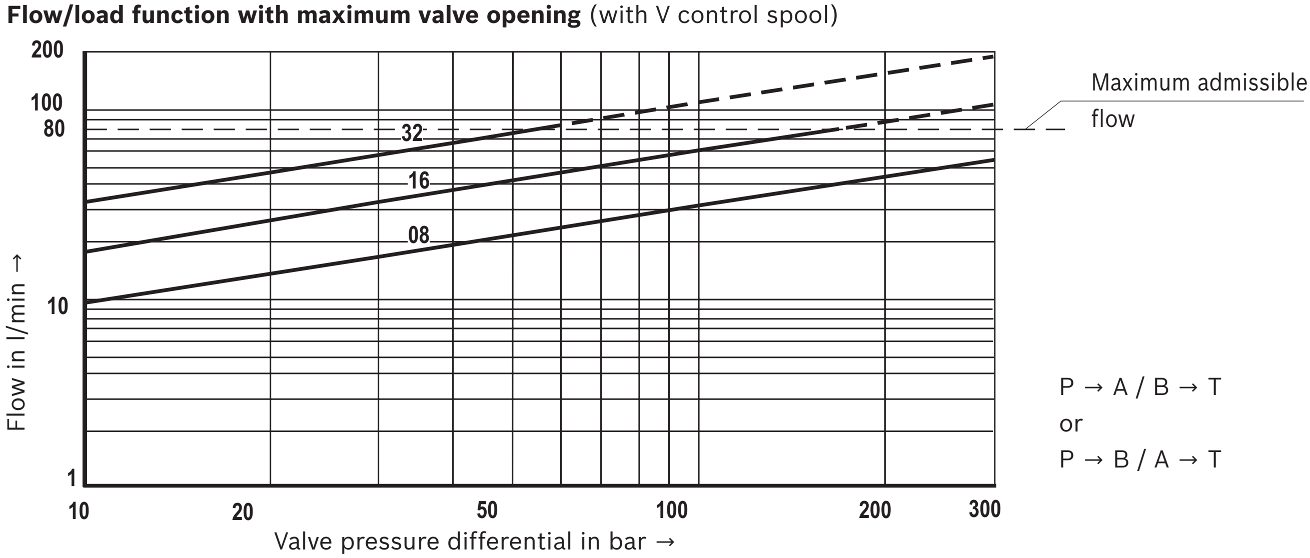
Transition function with stepped electric input signals (4/3 valve version; V control spool)



Frequency response (with V control spool)



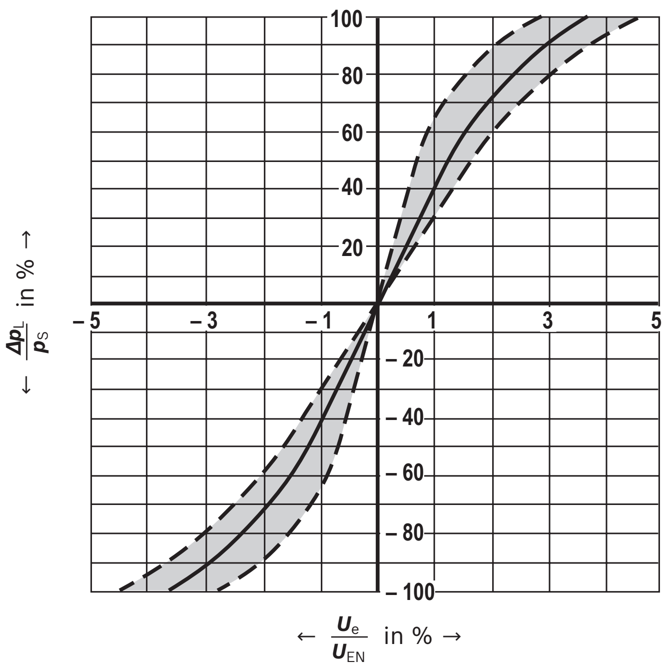
Flow/load function with maximum valve opening (with V control spool)



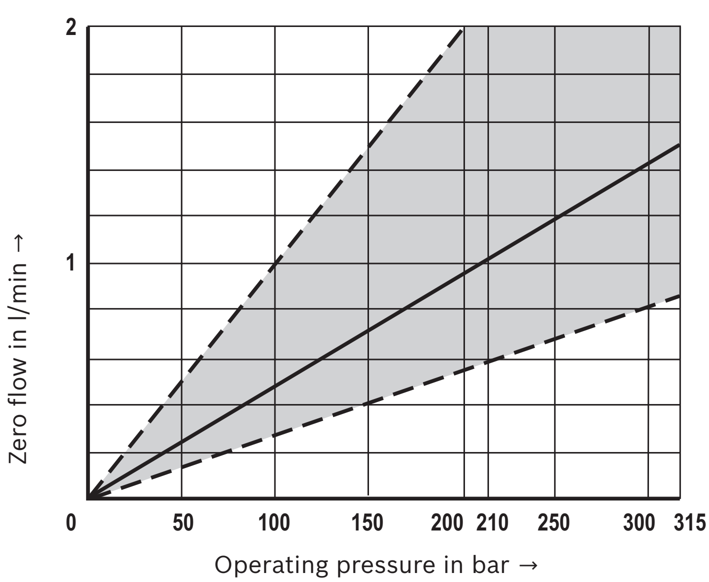
Characteristic curves size 6

(measured with HLP46, ϑ_{oil} = 40 ±5 °C and p_s = 10 bar)

Pressure/signal characteristic curve (V control spool), p_s = 100 bar

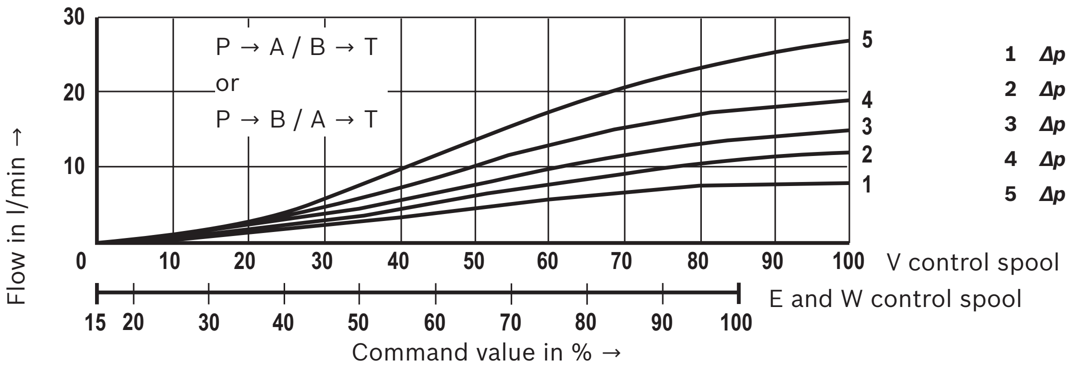


Zero flow (with central control spool position - V control spool)



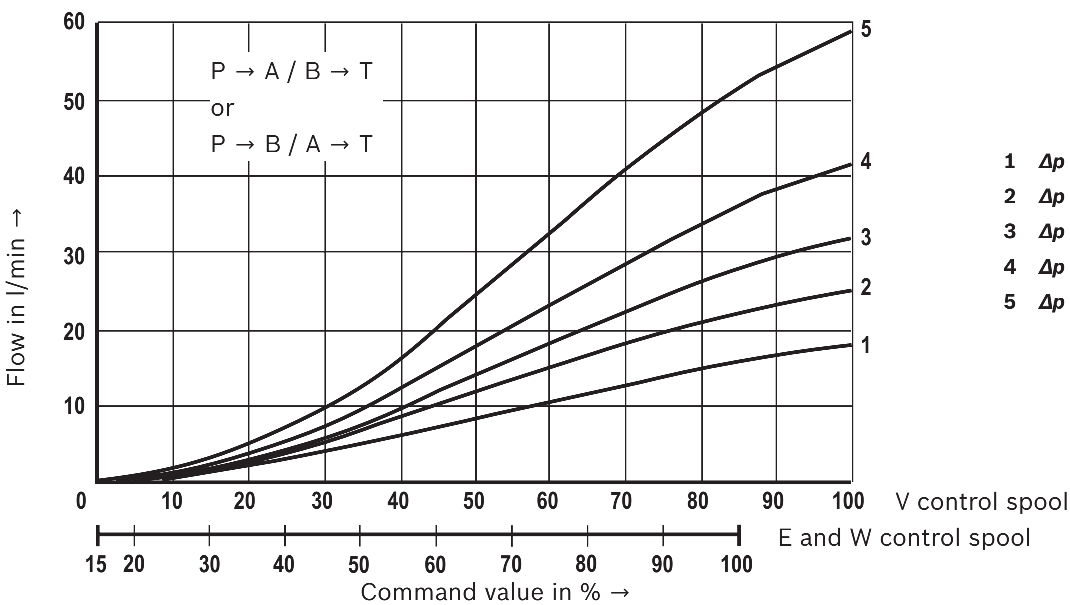
Characteristic curves size 6
(measured with HLP46, ϑ_{oil} = 40 ±5 °C and p = 100 bar)

8 l/min rated flow



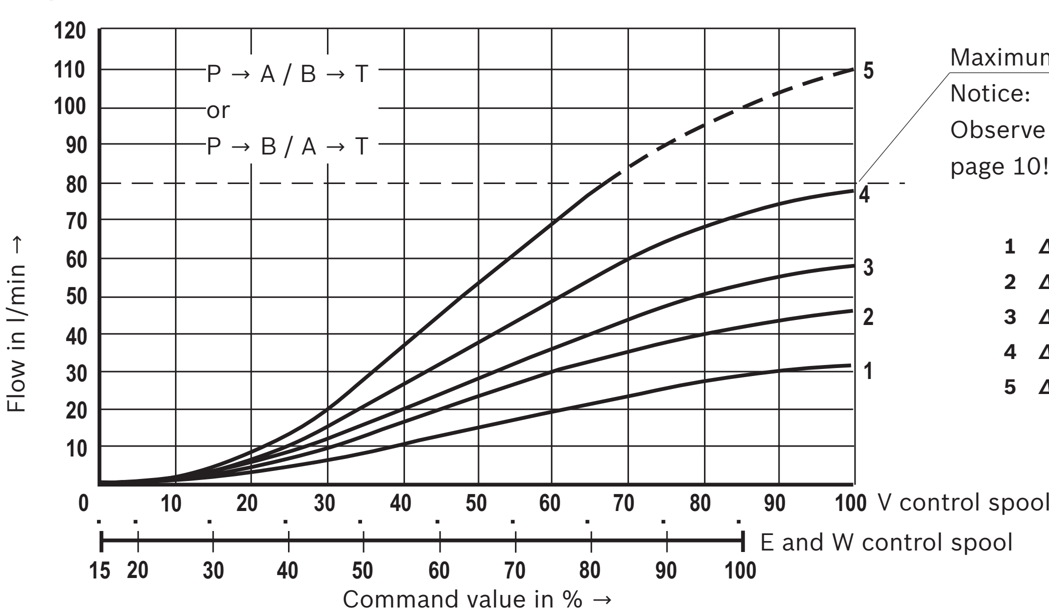
1 Δp = 10 bar constant
2 Δp = 20 bar constant
3 Δp = 30 bar constant
4 Δp = 50 bar constant
5 Δp = 100 bar constant

16 l/min rated flow



1 Δp = 10 bar constant
2 Δp = 20 bar constant
3 Δp = 30 bar constant
4 Δp = 50 bar constant
5 Δp = 100 bar constant

32 l/min rated flow

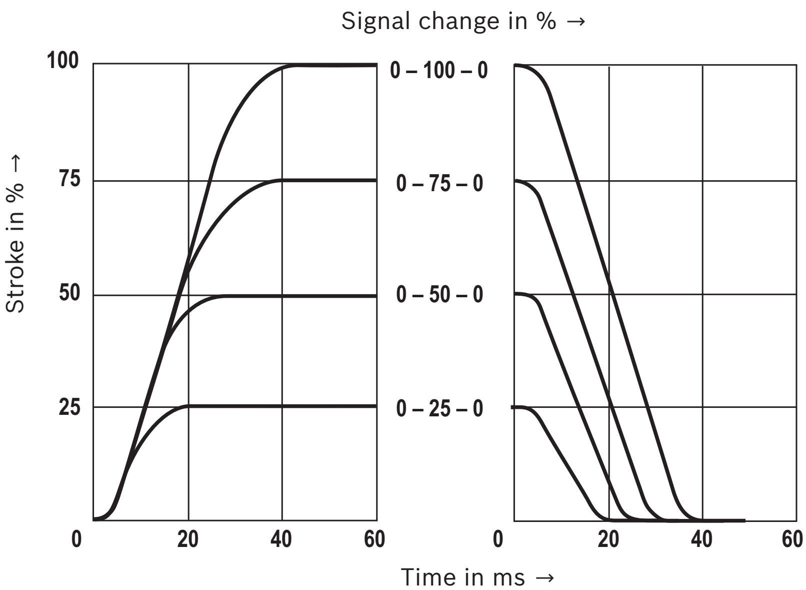


Maximum admissible flow
Notice:
Observe the flow/load function on page 10!

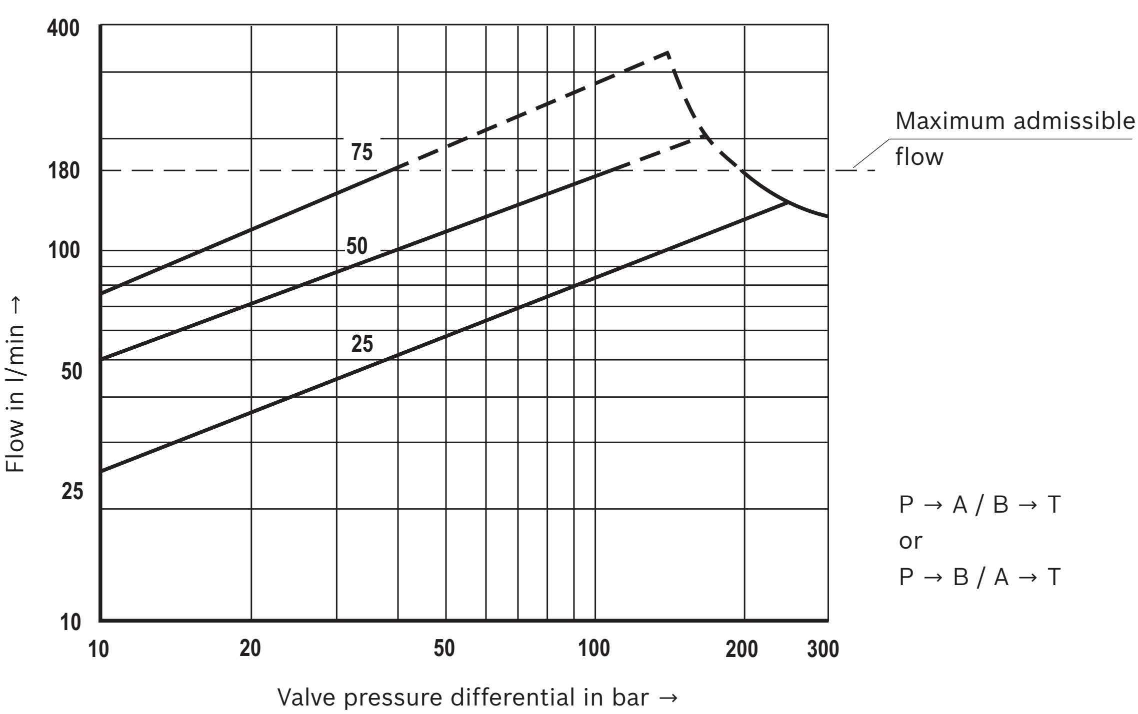
1 Δp = 10 bar constant
2 Δp = 20 bar constant
3 Δp = 30 bar constant
4 Δp = 50 bar constant
5 Δp = 100 bar constant

Characteristic curves size 10
(measured with HLP46, ϑ_{oil} = 40 ±5 °C and p_s = 10 bar)

Transition function with stepped electric input signals (4/3 valve version; V control spool)



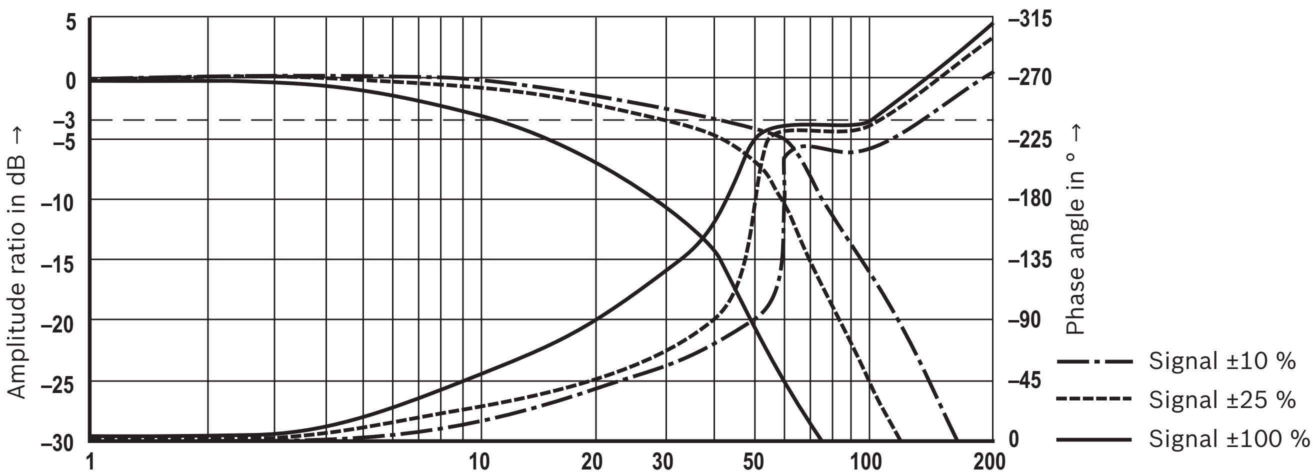
Flow/load function with maximum valve opening (with V control spool)



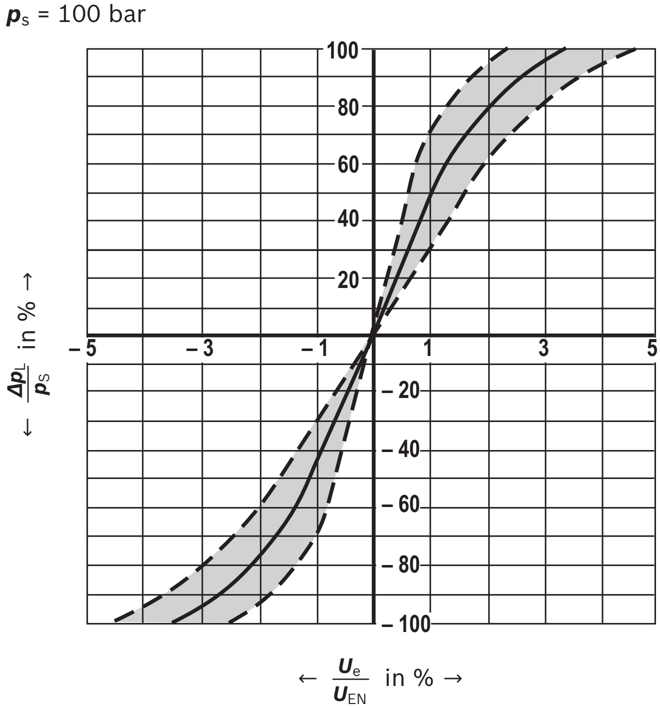
Characteristic curves size 10

(measured with HLP46, ϑ_{oil} = 40 ±5 °C and p_s = 10 bar)

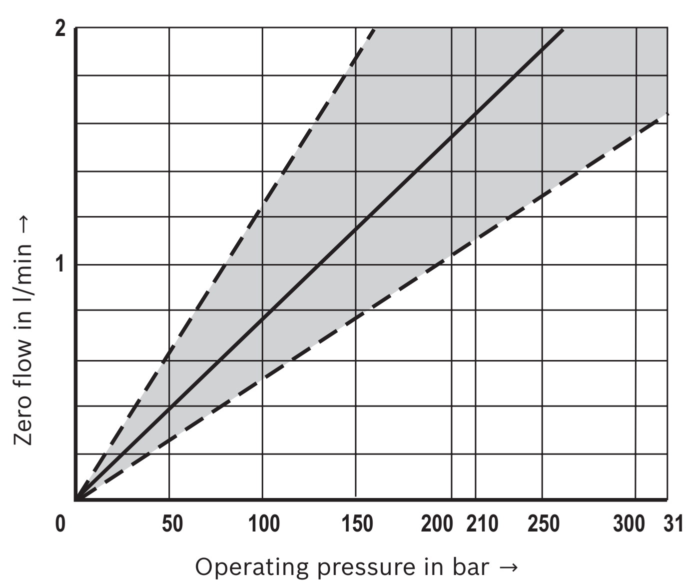
Frequency response (with V control spool)



Pressure/signal characteristic curve (V control spool), p_s = 100 bar



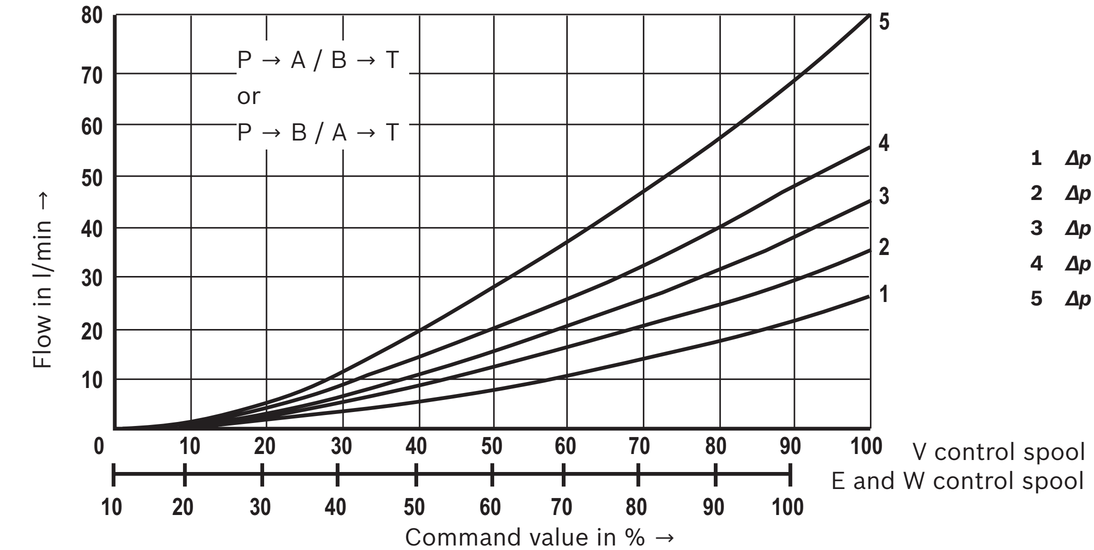
Zero flow (with central control spool position - V control spool)



Characteristic curves size 10

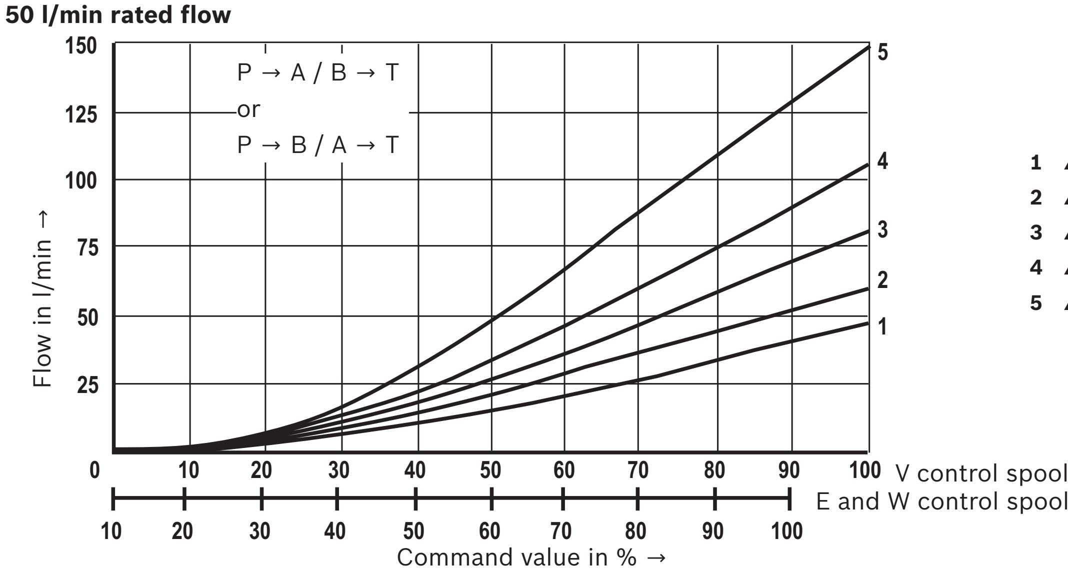
(measured with HLP46, ϑ_{oil} = 40 ±5 °C and ***p*** = 100 bar)

25 l/min rated flow



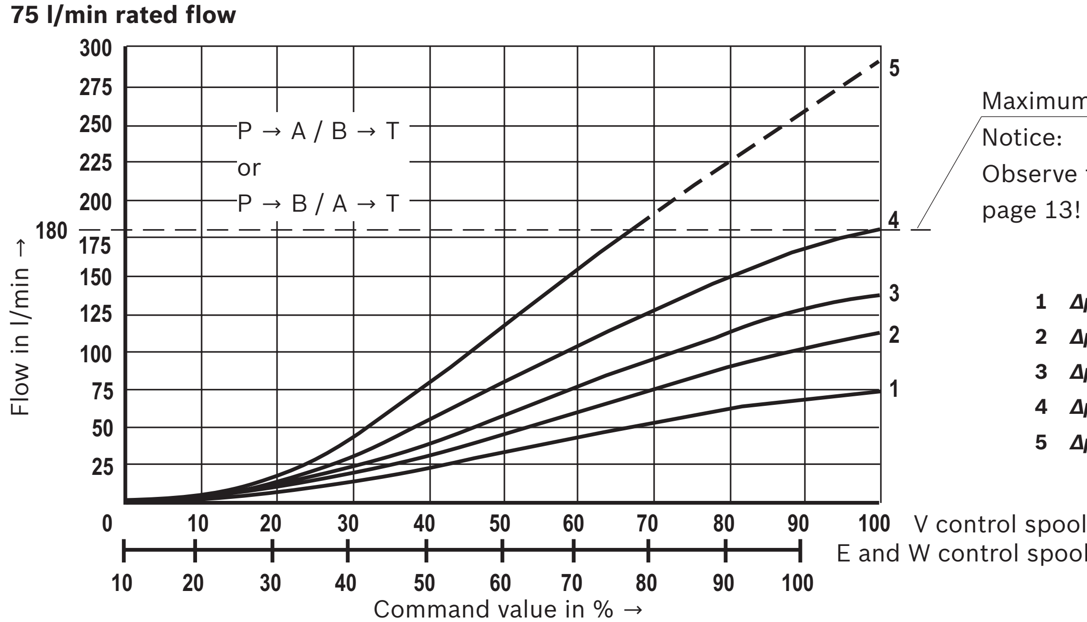
1 ***Δp*** = 10 bar constant
2 ***Δp*** = 20 bar constant
3 ***Δp*** = 30 bar constant
4 ***Δp*** = 50 bar constant
5 ***Δp*** = 100 bar constant

50 l/min rated flow



1 ***Δp*** = 10 bar constant
2 ***Δp*** = 20 bar constant
3 ***Δp*** = 30 bar constant
4 ***Δp*** = 50 bar constant
5 ***Δp*** = 100 bar constant

75 l/min rated flow

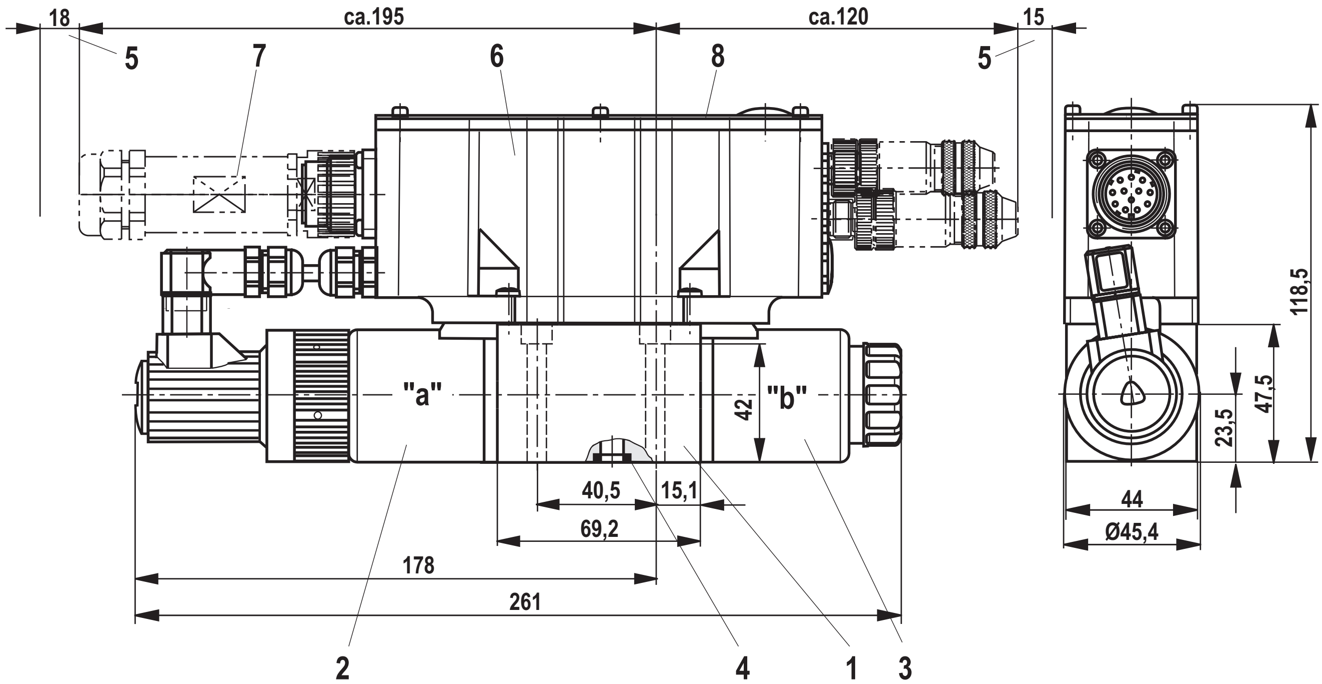


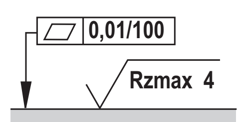
Maximum admissible flow

Notice:
Observe the flow/load function on page 13!

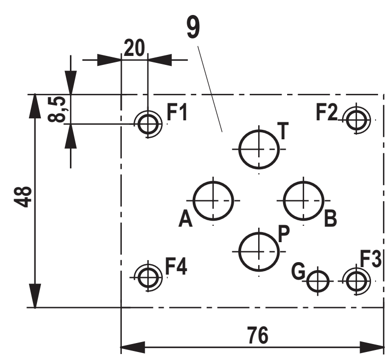
1 ***Δp*** = 10 bar constant
2 ***Δp*** = 20 bar constant
3 ***Δp*** = 30 bar constant
4 ***Δp*** = 50 bar constant
5 ***Δp*** = 100 bar constant

Dimensions for size 6:
(dimensions in mm)





Required surface quality of
the valve connection surface

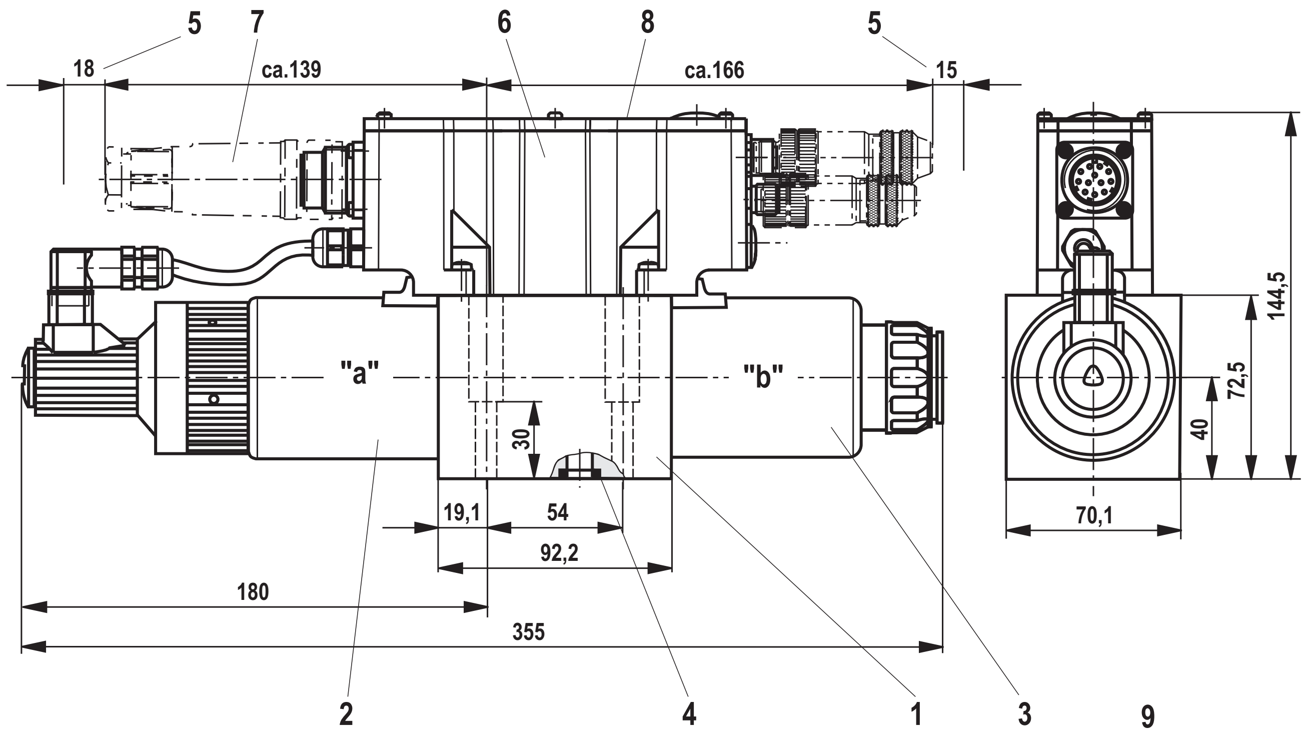


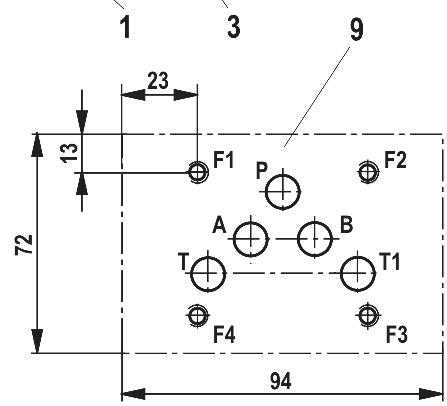
1 Valve housing
2 Proportional solenoid "a" with inductive position transducer
3 Proportional solenoid "b"
4 R-ring 9.81 x 1.5 x 1.78 for ports P, T, A and B
5 Space required to remove the mating connectors
6 Integrated digital control electronics
7 Mating connector according to DIN EN 175201-804; separate order, see page 19
8 Name plate
9 Machined valve contact surface,
porting pattern according to ISO 4401-03-02-0-05
Deviating from the standard:
Ports P, A, B, T Ø8 mm
Bore G may not be required since there is no pin in the valve.

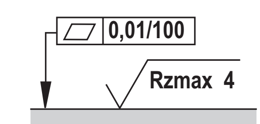
Notice!
The dimensions are nominal dimensions and subject to tolerances.

For valve mounting screws and **subplates,** see page 18.

Dimensions for size 10:
(dimensions in mm)







Required surface quality of
the valve connection surface

1 Valve housing
2 Proportional solenoid "a" with inductive position transducer
3 Proportional solenoid "b"
4 R-ring 13.0 x 1.6 x 2.0 for ports P, T, T1, A and B
5 Space required to remove the mating connectors
6 Integrated digital control electronics
7 Mating connector according to DIN EN 175201-804; separate order, see page 19
8 Name plate
9 Machined valve contact surface, porting pattern according to ISO 4401-05-04-0-05

Notice!
The dimensions are nominal dimensions and subject to tolerances.

For valve mounting screws and **subplates,** see page 18.

Dimensions

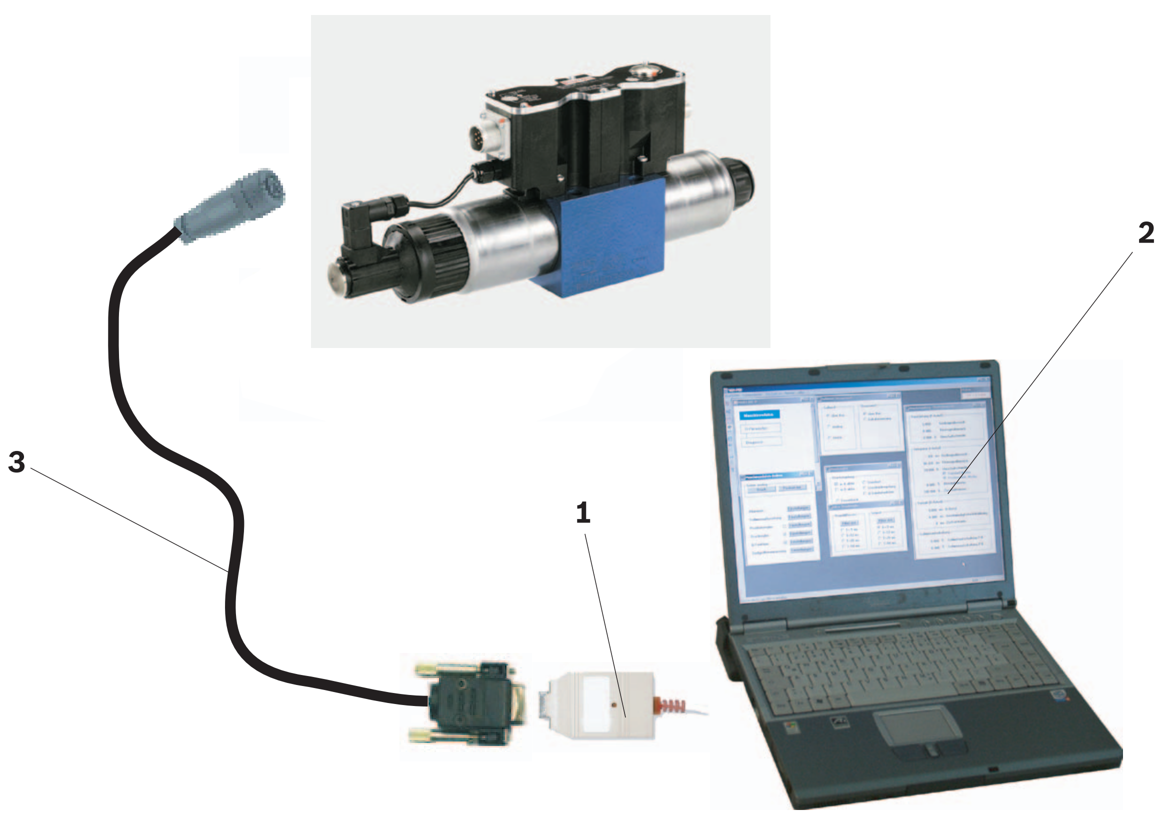
Hexagon socket head cap screws		Material number
Size 6	4x ISO 4762 - M5 x 50 - 10.9-flZn-240h-L Tightening torque M_A = 7 Nm ± 10 % or 4x ISO 4762 - M5 x 50 - 10.9 Tightening torque M_A = 8.9 Nm ± 10 %	R913000064
Size 10	4x ISO 4762 - M6 x 40 - 10.9-flZn-240h-L Tightening torqueM_A = 12.5 Nm ± 10 % or 4x ISO 4762 - M6x 40 - 10.9 Tightening torque M_A = 15.5 Nm ± 10 %	R913000058

Notice: The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure!

Subplates	Data sheet
Size 6	45052
Size 10	45054

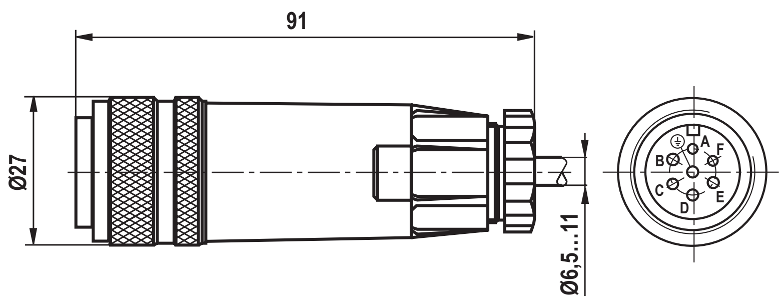
Accessories (not included in the scope of delivery)

	The following is required for the parameter-ization via PC:	CANopen	Profibus DP
1	Interface converter (USB)	VT-ZKO-USB/CA-1-1X/V0/0 Mat. no. R901071963	VT-ZKO-USB/P-1-1X/V0/0 Mat. no. R901071962
2	Commissioning software	WIN-PED 6	
3	Connection cable, 3 m	D-Sub / M12, coding A Mat. no. R900751271	D-Sub / M12, coding B Mat. no. R901078053

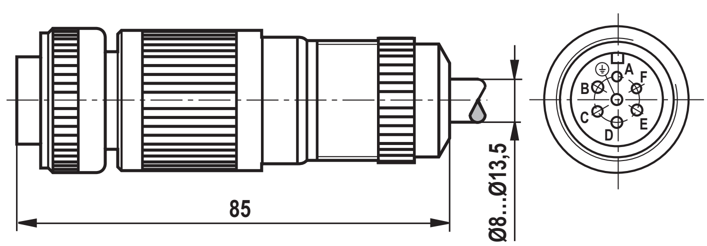


Accessories, port X1 (not included in the scope of delivery)

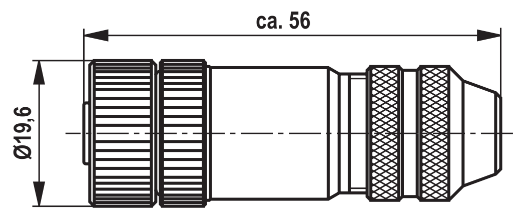
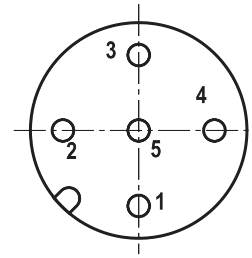
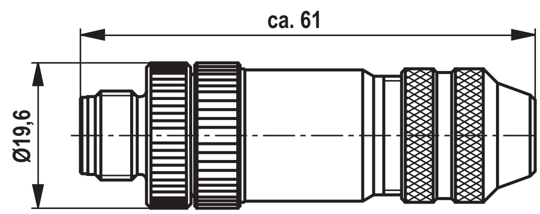
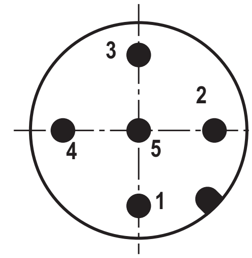
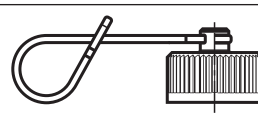
Mating connector for X1	Version	Material number
Mating connector according to DIN EN 175201-804 (6-pole)	Mating connector (plastic)	R900021267
	Mating connector (angular design)	R900217845



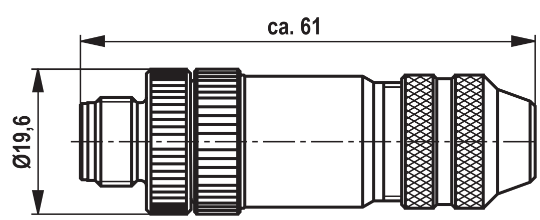
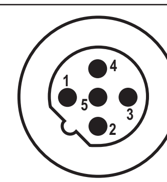
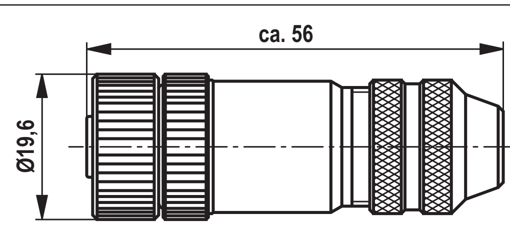
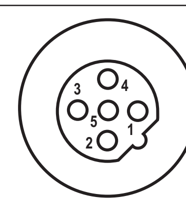
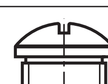
Mating connector for X1	Version	Material number
Mating connector according to DIN EN 175201-804 (6-pole)	Mating connector (metal)	R900223890



Accessories, CAN bus (A coding) (not included in the scope of delivery)

Description	View, dimensions	Pole pattern, order details
X2 Round connector, 5-pole, M12, can be assembled Straight mating connector in metal design		 Mat. no. R901076910 (cable diameter 6 to 8 mm)
X3 Round connector, 5-pole, M12, can be assembled Straight line connector in metal design		 Mat. no. R901076906 (cable diameter 6 to 8 mm)
M12 cap Dust protection (only for pins)		Mat. no. R901075564

Accessories, Profibus (B coding) (not included in the scope of delivery)

Description	View, dimensions	Pole pattern, order details
X2 Round connector, 5-pole, M12, can be assembled Straight line connector in metal design		 Mat. no. R901075545 (cable diameter 6 to 8 mm)
X3 Round connector, 5-pole, M12, can be assembled Straight mating connector in metal design		 Mat. no. R901075550 (cable diameter 6 to 8 mm)
M12 protective cap (only for socket)		Mat. no. R901075563

Project planning/maintenance instructions/additional information

Product documentation for IFB-P

- Data sheet 29048 (this data sheet)
- Operating manual 29015-B
- CAN bus protocol description data sheet 29015-01-Z
- Profibus protocol description data sheet 29015-02-Z
- General information on the maintenance and commissioning of hydraulic components 07800/07900
- General operating instructions: Hydraulic valves for industrial applications 07600-B

Maintenance instructions:

- The devices have been tested in the plant and are supplied with default settings.
- Only complete units can be repaired. Repaired devices are returned with default settings. User-specific settings will not be applied. The machine end-user will have to retransfer the corresponding user parameters.

Notices:

- Connect the valve to the supply voltage only when this is required for the functional processes of the machine.
- Do not use electrical signals provided via control electronics (e.g. "No error" signal) for switching safety-relevant machine functions (see also EN ISO 13849 "Safety of machinery – safety-related parts of control systems").
- If electro-magnetic interference is to be anticipated, suitable measures must be taken to ensure the function (depending on the application, e.g. shielding, filtration)!
- For more information, refer to the operating instructions and the WIN-PED online help.

Rexroth
Bosch Group

4/3-proportional directional valve direct operated, with *pQ* functionality

RE 29050/03.13
Replaces: 12.12

Type 4WREQ

Size 6 and 10
Component series 2X
Maximum operating pressure 315 bar
Maximum flow 180 l/min

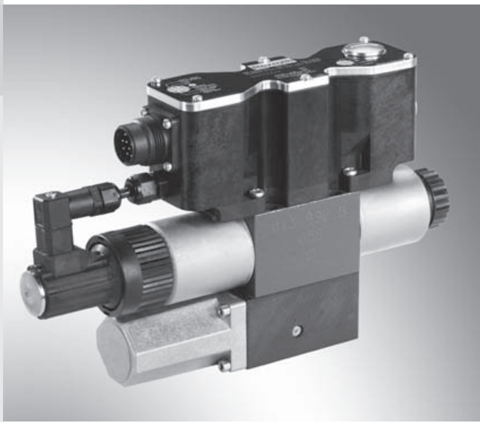


Table of contents

Features

- Direct operated proportional directional valve with integrated digital control electronics for the pressure, force and flow control (Integrated Axis Controller IAC-P)
- Completely adjusted unit consisting of valve, pressure sensor(s) (optional), digital control electronics and field bus connection
- Operation by means of proportional solenoids with central thread and detachable coil
- Valve spool position-controlled
- Integrated pressure sensor plate (optional)
- For subplate mounting: Porting pattern according to ISO 4401
- Analog interfaces for command and actual values
- Design for CAN bus with CANopen protocol DS 408 or PROFIBUS-DP V0/V1
- Quick commissioning via PC and commissioning software WIN-PED 6

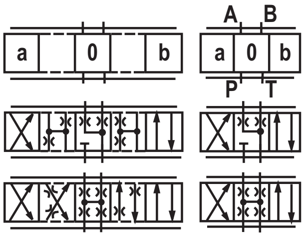
Ordering code

4WRE	Q			–2X/	V		–24				*

With integrated digital electronics and ***pQ*** functionality = **Q**

Size 6 = **6**
Size 10 = **10**

Control spool symbols



= **Q5-**

= **V**

Rated flow 1)

Size 6
8 l/min = **08**
16 l/min = **16**
32 l/min = **32**

Size 10
25 l/min = **25**
50 l/min = **50**
75 l/min = **75**

Component series 20 to 29 = **2X**
(20 to 29: Unchanged installation and connection dimensions)

Seal material
FKM seals = **V**

Pressure rating with internal sensors
100 bar 2) = **4**
160 bar 2) = **5**
250 bar 2) = **8**
400 bar 3) = **B**
External sensor = **0**

Position of the pressure sensors
0 = External sensor
Internal sensor in the channel
A = A
B = B
C = A + B
F = P + A + B

Application	Ordering code
Q control	F
p control only in A	A
p control only in B	B
p control in A + B or ***Δp*** control	C

Supply voltage
24 = Direct voltage 24 V

Bus interface
C = CANBus DS 408
P = PROFIBUS-DP V0/V1

Electronics interface 5)
A6 = ±10 VDC
F6 = 4 to 20 mA

Sensor interface with external pressure sensor 4)
2 = 4 to 20 mA
3 = 0 to 10 V
4 = 0 to 5 V
9 = 0.5 to 5 V
0 = Without external sensor interface

Further details in the plain text

1) See flow characteristic curves from page 12.

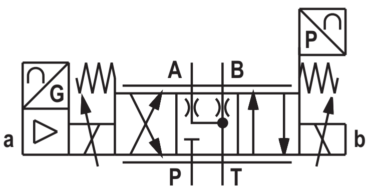
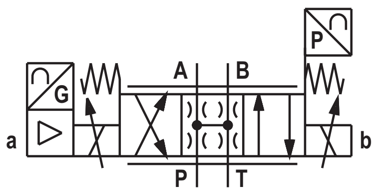
2) The selected pressure rating limits the maximum valve pressure.

3) Note: Maximum valve pressure is 315 bar.

4) If internal pressure sensors are used, no external pressure sensor can be connected.

5) With command value input "A6", only the sensor interfaces "3", "4" or "9" are possible.
With command value input "F6", only the sensor interface "2" is possible.

Symbols

Type 4WREQ.**Q5**-...	Type 4WREQ.**V**...
	

Set-up, function, section (valve with integrated sensors)

Set-up

The valve basically consists of:

- Housing (1) and pressure sensor plate (12) with connection surface
- Control spool (2) with compression springs (3 and 4) and spring plate (8 and 9)
- Coils (5 and 6) and pole tubes (14 and 15) with central thread
- Position transducer (7)
- Integrated pressure sensors (10)
- Integrated digital control electronics IAC-P (11)

Functional description

- With de-energized solenoids (5 and 6), the control spool (2) is brought into the central position by compression springs (3 and 4) between the spring plates (8 and 9) (with V spool valve without spring plate). With V spool valves, the mechanical zero position does not correspond to the hydraulic one.
- Depending on the valve type, the following functions result (some of them can be combined):
  - Flow control (***Q***)
  - Flow control (***Q***)
  - Pressure control in A and/or B (***p***)
  - Force control (***p***)
  - Substitutional control ***p/Q***
- The command value can alternatively be specified via an analog interface (X1) or via the field bus interface (X2, X3).
- The actual value signals are provided via an analog interface (X1) and can additionally be read out via the field bus (X2, X3).
- The controller parameters are set via the field bus
- Separate supply voltage for bus/controller and power part (output stage) for safety reasons

The digital integrated control electronics enables the following fault detection:

- Cable break pressure sensor (10)
- Undervoltage
- Cable break position transducer (7)
- Communication errors
- Watchdog
- Cable break command value inputs (only with current interface)

The following additional functions are available:

- Ramp generator
- Internal command value profile
- Enable function analog/digital
- Error output 24 V

PC program WIN-PED 6

To implement the project planning task and to parameterize the IAC-P valves, the user may use the commissioning software WIN-PED 6.

- Parameterization
- Diagnosis
- Comfortable data administration on the PC

System requirements

- IBM PC or compatible system
- Windows 2000 or Windows XP
- RAM (recommendation 256 MB)
- 150 MB of available hard disk capacity

Notice

- The "WIN-PED 6" PC program is not included in the scope of delivery. It can be downloaded on the Internet free of charge! (see page 26)

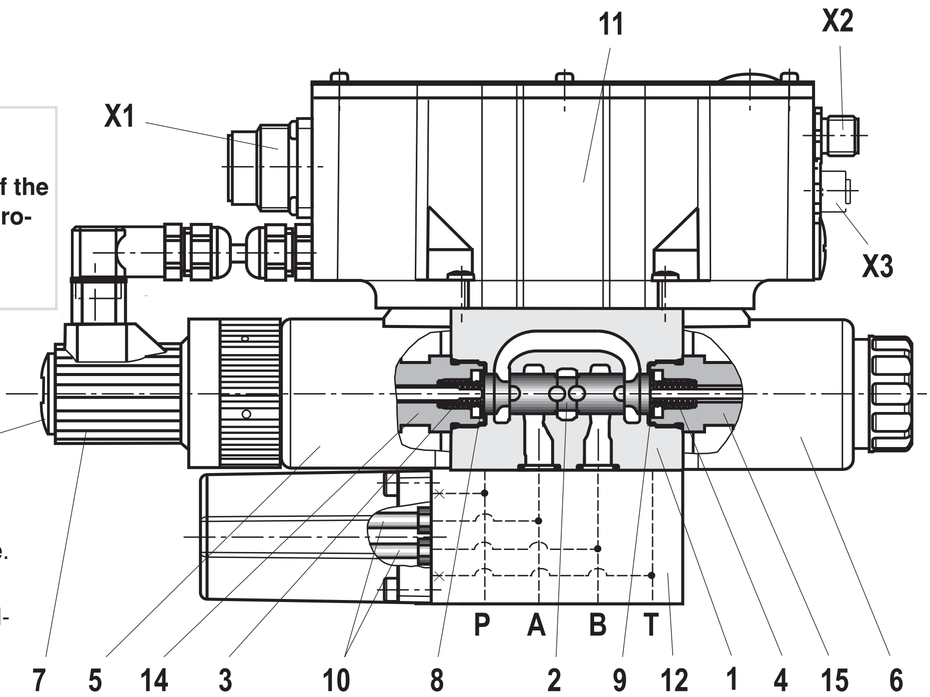
☞ **Important notice!**

The PG fitting (13) must not be opened. Mechanical adjustment of the adjustment nut located below is prohibited and damages the valve!

☞ **Notice!**

Due to the design principle, internal leakage is inherent to the valves, which may increase over the life cycle.

The tank line must not be allowed to run empty. With corresponding installation conditions, a preload valve is to be installed.



Set-up, function, section (valve for external sensor)

Set-up

The valve basically consists of:

- Housing (1) with connection surface
- Control spool (2) with compression springs (3 and 4) and spring plate (8 and 9)
- Coils (5 and 6) and pole tubes (14 and 15) with central thread
- Position transducer (7)
- Integrated digital control electronics IAC-P (11)
- Port (X4) for an external pressure sensor (12)

Functional description

- With de-energized solenoids (5 and 6), the control spool (2) is brought into the central position by compression springs (3 and 4) between the spring plates (8 and 9) (with V spool valve without spring plate). With V spool valves, the mechanical zero position does not correspond to the hydraulic one.
- Functions:
  - Flow control (***Q***)
  - Pressure control (***p***)
  - Substitutional control ***p/Q***
- The command value can alternatively be specified via an analog interface (X1) or via the field bus interface (X2, X3).
- The actual value signals are provided via an analog interface (X1) and can additionally be read out via the field bus (X2, X3).
- The controller parameters are set via the field bus
- Separate supply voltage for bus/controller and power part (output stage) for safety reasons

The digital integrated control electronics enables the following fault detection:

- Cable break pressure sensor (depending on sensor interface)
- Undervoltage
- Cable break position transducer (7)
- Communication errors
- Watchdog
- Cable break command value inputs (only with current interface)

The following additional functions are available:

- Ramp generator
- Internal command value profile
- Enable function analog / digital
- Error output 24 V

PC program WIN-PED 6

To implement the project planning task and to parameterize the IAC-P valves, the user may use the commissioning software WIN-PED 6.

- Parameterization
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System requirements

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Notice

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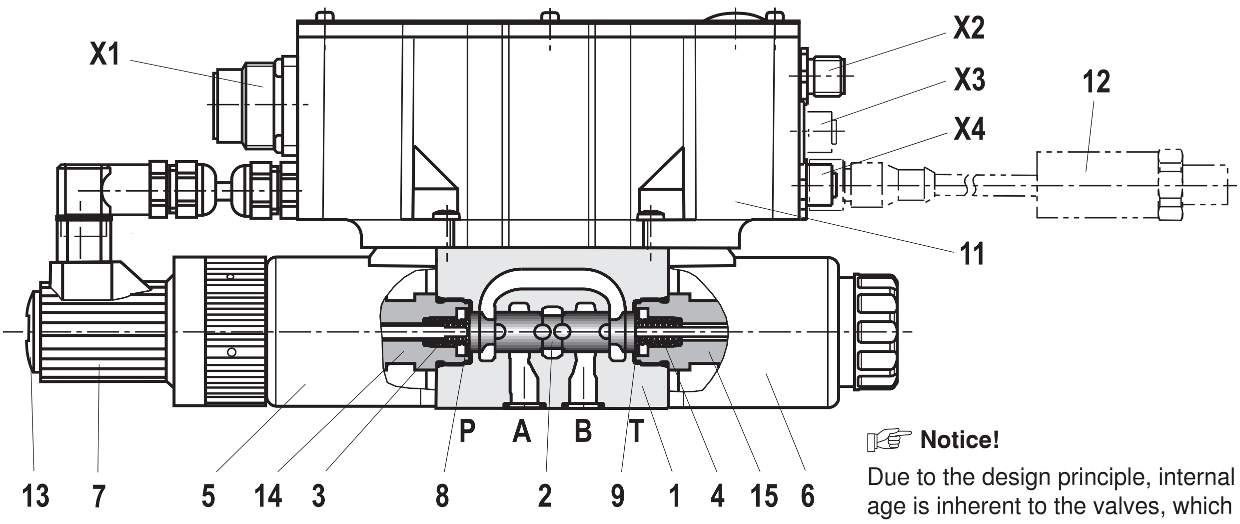


Important notice!

The PG fitting (13) must not be opened. Mechanical adjustment of the adjustment nut located below is prohibited and damages the valve!

Notice!

Due to the design principle, internal leakage is inherent to the valves, which may increase over the life cycle.

The tank line must not be allowed to run empty. With corresponding installation conditions, a preload valve is to be installed.

Technical data (For applications outside these parameters, please consult us!)

general

Sizes		6	10
Weight with sandwich plate (3 sensors)	kg	3.6	8.5
Weight without sandwich plate	kg	2.4	6.5
Installation position		Any, preferably horizontal	
Ambient temperature range	°C	–20 to +50	
Storage temperature range	°C	–20 to +80	

hydraulic (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)

Operating pressure 1) Ports P, A, B	with sensor	100 bar	bar	Up to 100	
		160 bar	bar	Up to 160	
		250 bar	bar	Up to 250	
		400 bar	bar	Up to 315	
Port T	with sensor	100 bar	bar	Up to 100	
		160 bar	bar	Up to 160	
		250 bar	bar	Up to 210	
		400 bar	bar	Up to 210	
Rated flow $q_{V\,nom}$ with Δp = 10 bar			l/min	8, 16, 32	25, 50, 75
Maximum admissible flow			l/min	80	180
Hydraulic fluid				See table below	
Hydraulic fluid temperature range			°C	–20 to +70, preferably +40 to +50	
Viscosity range			mm²/s	20 to 380, preferably 30 to 46	
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)				Class 20/18/15 2)	
Hysteresis			%	≤ 0.1	
Range of inversion			%	≤ 0.05	
Response sensitivity			%	≤ 0.05	
Zero shift upon change of hydraulic fluid temperature and operating pressure			%/10 K	< 0.15	
			%/100 bar	< 0.1	

1) Operating pressure, determined by valve and sensor

2) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the life cycle of the components.

Hydraulic fluid		Classification	Suitable sealing materials	Standards
Mineral oils and related hydrocarbons		HL, HLP	NBR, FKM	DIN 51524
Flame-resistant	– containing water	HFC (Fuchs HYDROTHERM 46M, Petrofer Ultra Safe 620)	NBR	ISO 12922

Important information on hydraulic fluids!

- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.)!
- The flash point of the process and operating medium used must be 40 K higher than the maximum solenoid surface temperature.
- **Flame-resistant – containing water**: Maximum pressure differential per control edge 175 bar. Pressure pre-loading at the tank port > 20 % of the pressure differential; otherwise, increased cavitation.

  Life cycle as compared to operation with mineral oil HL, HLP 50 % to 100 %.

Technical data (For applications outside these parameters, please consult us!)

electric

Supply voltage	Nominal voltage	VDC	24
	Lower limit value	VDC	19.4
	Upper limit value	VDC	35
	Maximum admissible residual ripple	Vss	2
Current consumption	I_{max}	A	2
	Impulse current	A	3
Command and actual value signals	Voltage "A6" U_Q	V	±10
	U_p	V	0 to 10
	Current "F6" I_Q and I_p	mA	4 to 20
Converter resolution (command/actual value signals)		Bit	10
Duty cycle [1]		%	100
Maximum coil temperature [2]		°C	Up to 150
Protection class of the valve according to EN 60529:1991+A1:2000			IP 65 with mounted and locked plug-in connectors

[1] Connect the valve to the supply voltage only when this is required for the functional sequence of the machine.

[2] Due to the temperatures occurring at the surfaces of the solenoid coils, the European standards ISO 13732-1 and EN ISO 4413 need to be adhered to.

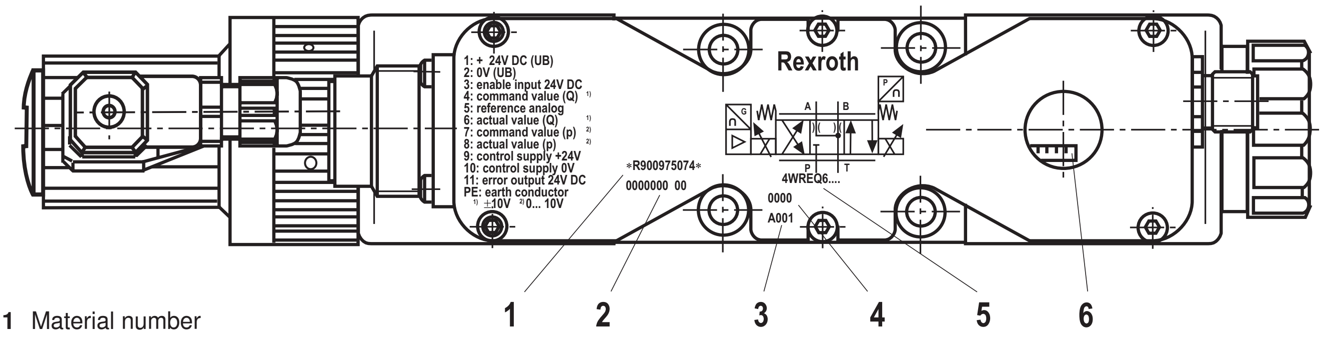
Sensor technology

Measurement range	p_N	bar	**100**	**160**	**250**	**400**
Overload protection	p_{max}	bar	200	320	500	800
Bursting pressure	p	bar	400	640	1000	1600
Compensation error						
Zero point			< 0.25 % of the end value			
End value			< 0.5 %			
Temperature coefficients in the nominal temperature range						
Largest TK of the zero point			< 0.2 % / 10 K			
Largest TK of the range			< 0.2 % / 10 K			
Characteristic curve deviation			< 0.2 %			
Hysteresis			< 0.1 %			
Repeatability			< 0.05 %			
Long-term drift (1 year) with reference conditions			< 0.2 %			

With external pressure sensors, the accuracy of the pressure control depends on the accuracy class of the sensor used.

Notice!
Information on the environment simulation testing for the areas EMC (Electromagnetic compatibility), climate and mechanical load see RE 29050-U (declaration on environmental compatibility).

Control electronics (IAC-P), marking and adjustment elements



1 Material number
2 Production order number
3 Date of production
4 Serial number
5 Type designation, e.g. 4WREQ…-2X/…
6 DIL switch for address and baud rate setting (position B0 right), see page 10

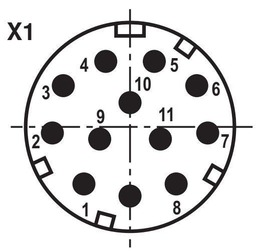
Control electronics (IAC-P), Electrical connections and allocation

Connector pin assignment X1, 11-pin + PE according to DIN EN 175201-804

Pin	No. and/or litz wire color [1]	Allocation interface A6	Allocation interface F6
1	1	24 VDC (u(t) = 19.4 V to 35 V), I_{max} = 1.7 A (for output stage)	
2	2	0 V ≙ load zero, reference for pins 1 and 9	
3	White	Enable input 9 to 35 V ≙ enable on	
4	Yellow	±10 V command value ***Q*** R_e > 50 kΩ	4 to 20 mA command value ***Q*** R_e = 100 Ω
5	Green	Reference for command values ***Q*** and ***p***	
6	Purple	±10 V actual value ***Q*** (limit load 5 mA)	4 to 20 mA actual value ***Q*** (load resistance max. 300 Ω)
7	Pink	0 to 10 V command value ***p*** R_e > 50 kΩ	4 to 20 mA command value ***p*** R_e = 100 Ω
8	Red	0 to 10 V actual value ***p*** (limit load 5 mA)	4 to 20 mA actual value ***p*** (load resistance max. 300 Ω)
9	Brown	Control voltage, level as pin 1, I_{max} = 0.3 A (for signal part and bus)	
10	Black	0 V reference potential for pins 3, 6, 8 and 11 (in the valve connected to pin 2)	
11	Blue	Error output 24 V (19.4 V to 35 V), 200 mA max. load	
PE	Green-yellow	Connected to cooling element and valve housing	

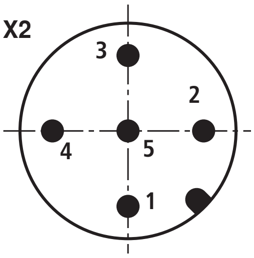
Connect shield to PE only on the supply side!

[1] Litz wire colors of the connection lines for mating connector with cable set (see accessories)

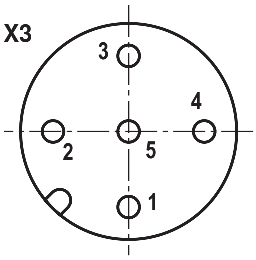


Control electronics (IAC-P), electrical connections and allocation

X2



X3



Connector pin assignment for CAN bus "X2"/"X3" (coding A), M12, 5-pin, pins/sockets

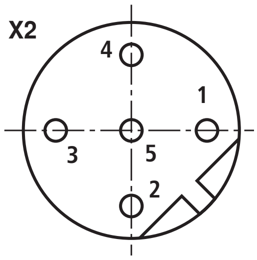
Pin	Allocation
1	n. c.
2	n. c.
3	CAN_GND
4	CAN_H
5	CAN_L

Transmission rate kbit/s	20 to 1000
Bus address	1 to 127

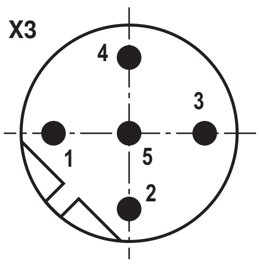
CAN-specific settings:

Baud rate and identifier can be set via the bus system and/or the DIL switches.

X2



X3



Connector pin assignment for PROFIBUS-DP, "X2"/"X3" (coding B), M12, 5-pin, socket/pins

Pin	Allocation
1	+5 V
2	RxD/TxD-N (A line)
3	D GND
4	RxD/TxD-P (B line)
5	Shield

Transmission rate	up to 12 MBaud
Bus address	1 to 126

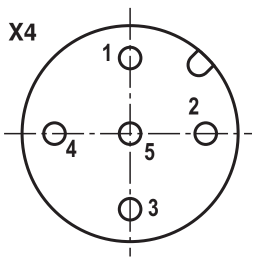
Setting via DIL switches

The +5 V voltage of the IAC-P is available for an external terminating resistor.

External pressure sensor port "X4" (coding A), M12, 5-pin, socket

Pin	Allocation of voltage interface	Allocation of current interface
1	Supply 24 VDC	Supply 24 VDC
2	Signal (0...+5 V)	Signal (4...20 mA)
3	Zero 0 V (GND)	Zero 0 V (GND)
4	n. c.	n. c.
5	n. c.	n. c.

X4



Notice:

We recommend connecting the shields on both sides over the metallic housings of the plug-in connectors.
Using connector pins will affect the shielding effect!
Internal screens are not required.

Control electronics (IAC-P), settings for CANopen and PROFIBUS-DP

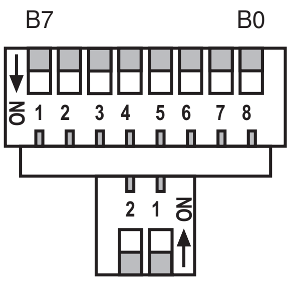
CANopen

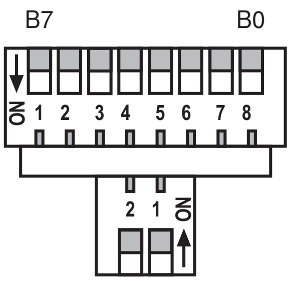
B7	B6	B5	B4	B3	B2	B1	B0	HEX	Baud rate: B7, B6	Address range: B5 to B0
0	0	0	0	0	0	0	0	00 [1]	Standard 20 kBaud or re-programmed	1 = standard or re-programmed
0 0	0 0	0 1	0 1	0 1	0 to 1	0 1	1 1	01 to 3F	20 kBaud	1 to 63
0	1	0	0	0	0	0	0	40	125 kBaud	1 = standard or re-programmed
0 0	1 1	0 1	0 1	0 1	0 to 1	0 1	1 1	41 to 7F	125 kBaud	1 to 63
1	0	0	0	0	0	0	0	80	250 kBaud	1 = standard or re-programmed
1 1	0 0	0 1	0 1	0 1	0 to 1	0 1	1 1	81 to BF	250 kBaud	1 to 63
1	1	0	0	0	0	0	0	C0	500 kBaud	1 = standard or re-programmed
1 1	1 1	0 1	0 1	0 1	0 to 1	0 1	1 0	C1 to FE	500 kBaud	1 to 62
1	1	1	1	1	1	1	1	FF	250 kBaud	Monitor modus/ programming mode 1 = fixed

PROFIBUS-DP

B7	B6	B5	B4	B3	B2	B1	B0	HEX	Address range
0	0	0	0	0	0	0	0	00 [1]	125 = standard or re-programmed
0 0	0 1	0 1	0 1	0 1	0 to 1	0 1	1 0	01 to 7E	1 to 126 with parameter channel
1 1	0 1	0 1	0 1	0 1	0 to 1	0 1	0 0	80 to FE	1 to 126 without parameter channel
1	1	1	1	1	1	1	1	FF	Monitor operation address 125

[1] Factory setting



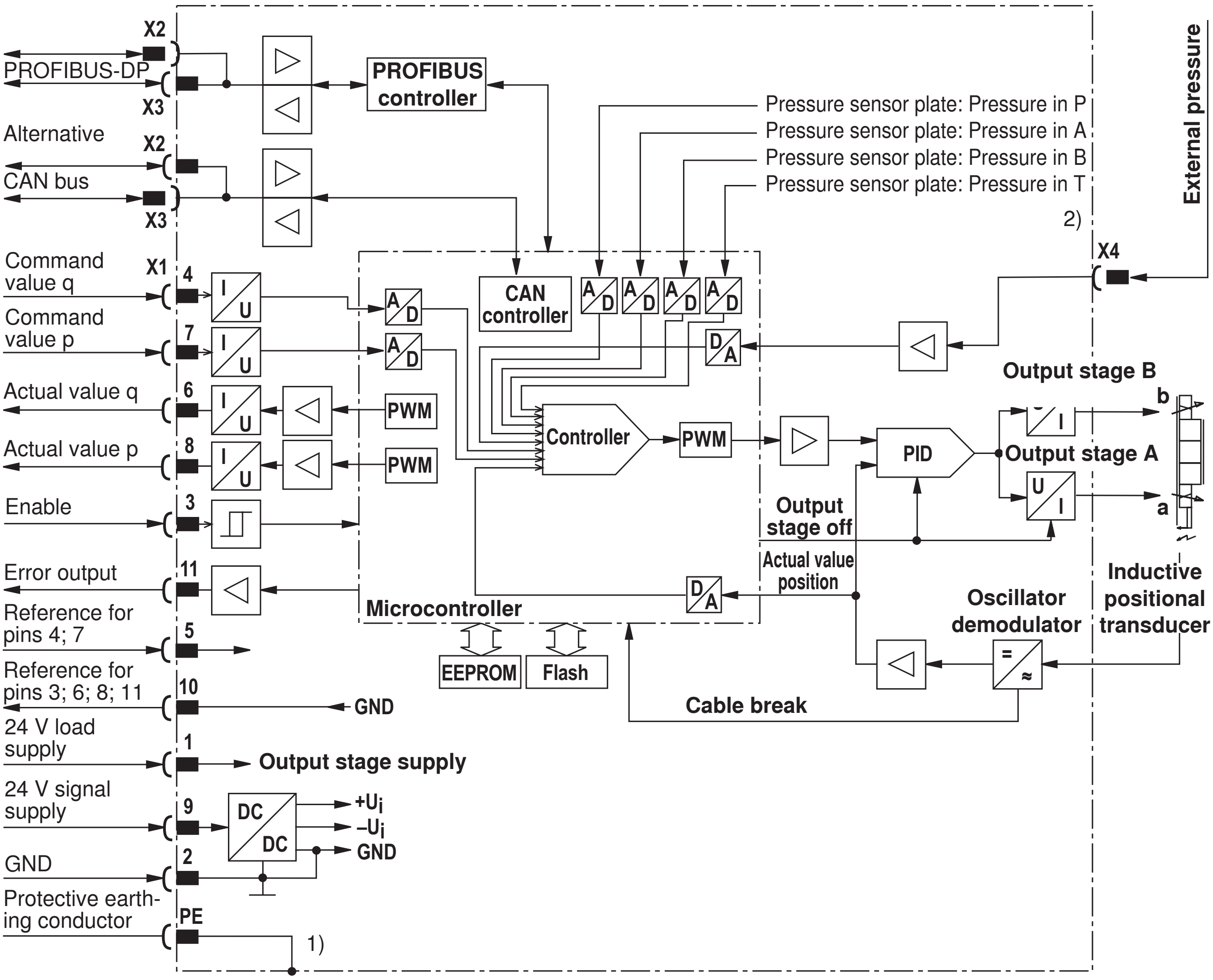


Connection of the bus terminator with the two lower switches (only with PROFIBUS-DP):

Left figure: Bus terminator not connected

Right figure: Bus terminator connected (both switches to "ON")

Control electronics (IAC-P), block diagram



Command value: Positive command value 0 to +10 V (or 12 to 20 mA) at pin 4 and reference potential at pin 5 result in flow from P → A and B → T.

Negative command value 0 to –10 V (or 12 to 4 mA) at pin 4 and reference potential at pin 5 result in flow from P → B and A → T.

Actual value: Positive actual value 0 to +10 V (or 12 to 20 mA) at pin 6 and reference potential at pin 10 result in flow from P → A and B → T.

Negative actual value 0 to –10 V (or 12 to 4 mA) at pin 6 and reference potential at pin 10 result in flow from P → B and A → T.

Connection line: Recommendation:
– Up to 25 m line length for pins 1; 2 and PE: 0.75 mm^2, otherwise 0.25 mm^2
– Up to 50 m line length for pins 1; 2 and PE: 1.00 mm^2

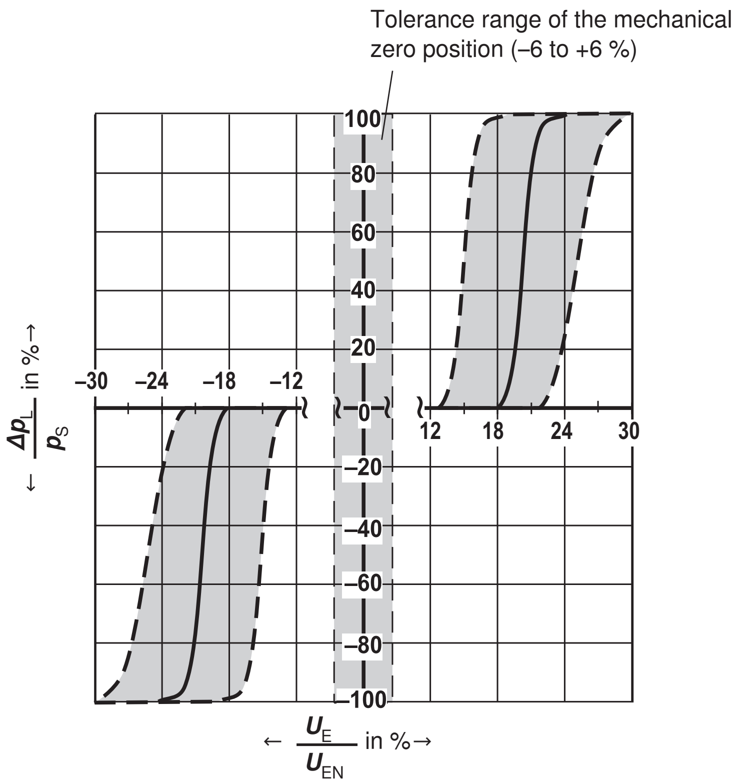
External diameter see sketch of mating connector

[1] The protective earthing conductor (PE) is connected to cooling element and valve housing

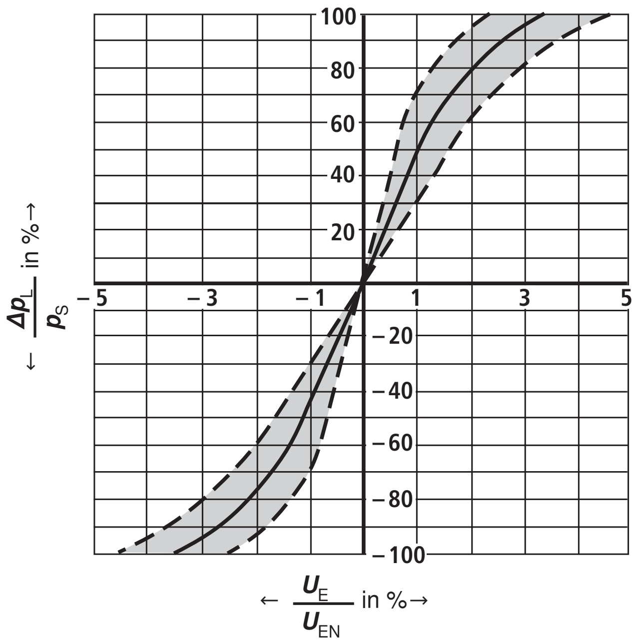
[2] Pressure transducer in P, A, B and T depending on ordering code or an external pressure sensor via the 5-pin M12 mating connector X4

Characteristic curves: Size 6 (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)

Pressure signal characteristic curve (Q5 control spool), p_s = 100 bar

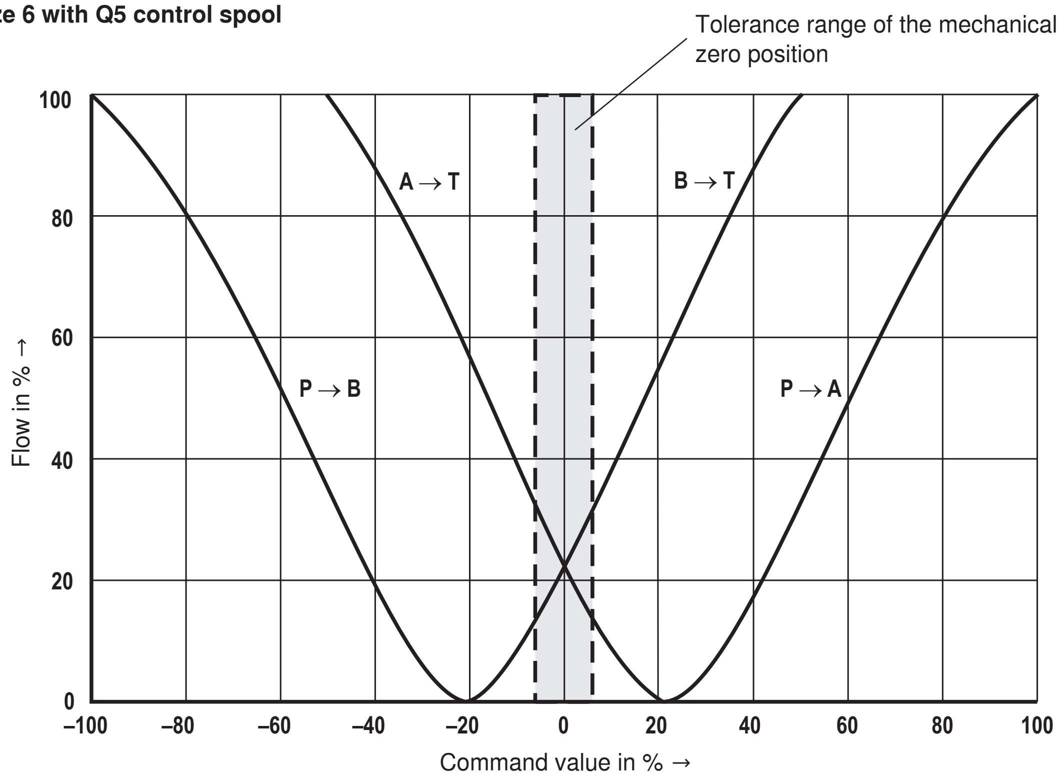


Pressure signal characteristic curve (V control spool), p_s = 100 bar

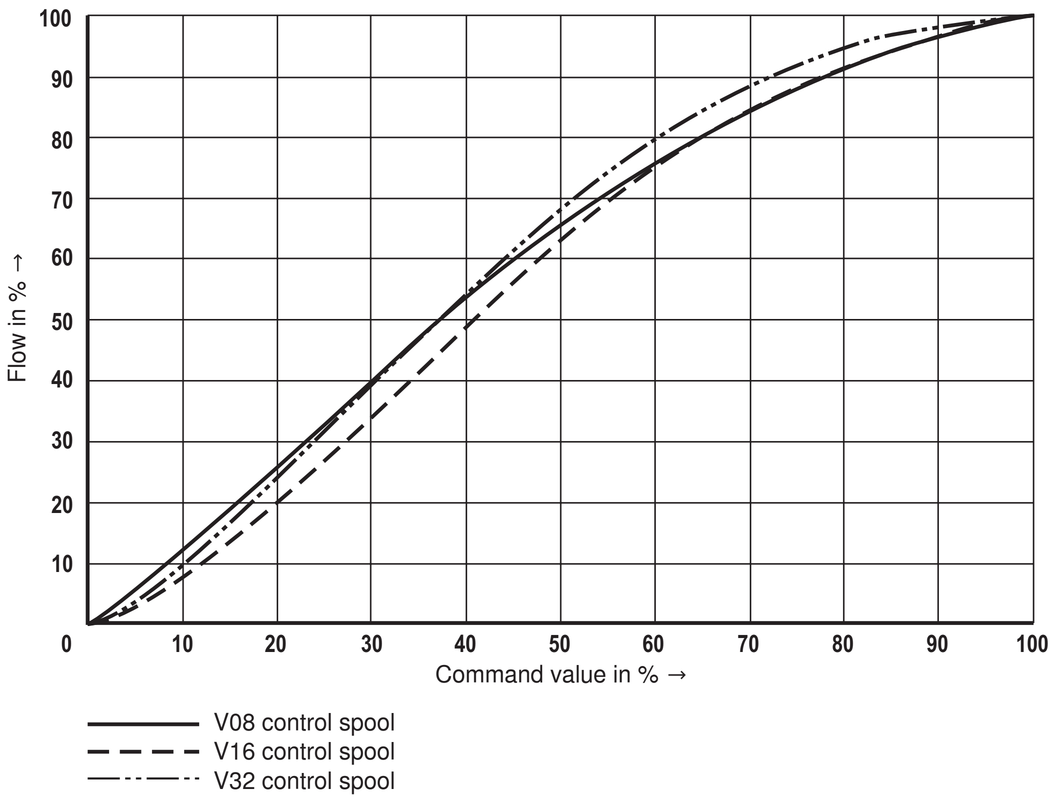


Characteristic curves: Size 6 (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)

Flow, size 6 with Q5 control spool

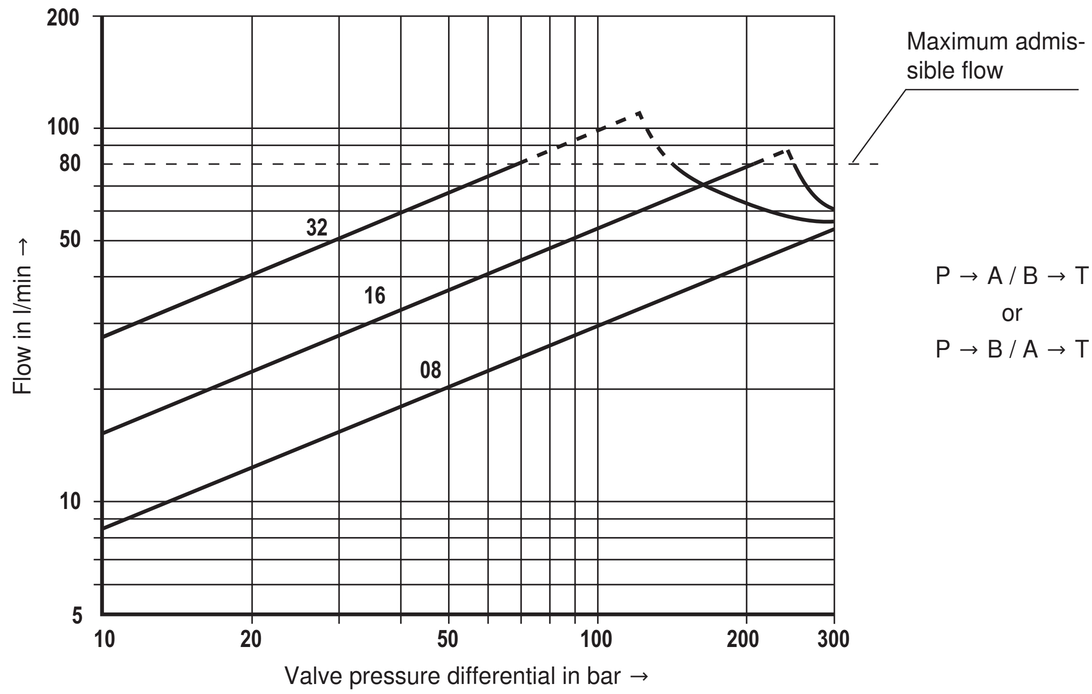


Flow, size 6 with V control spool

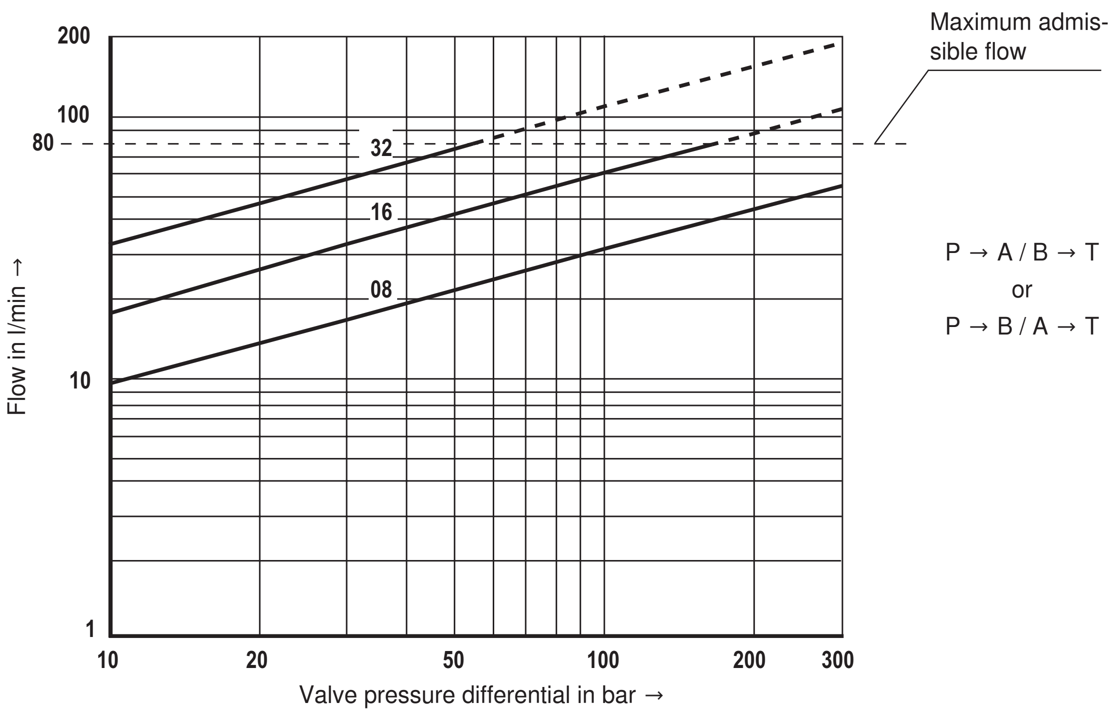


Characteristic curves: Size 6 (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)

Flow/load function size 6 with Q5 control spool with maximum valve opening

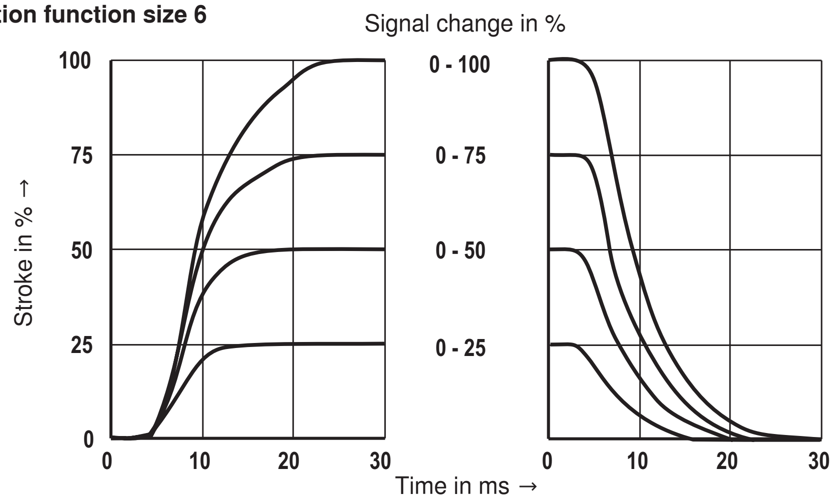


Flow/load function size 6 with V control spool with maximum valve opening

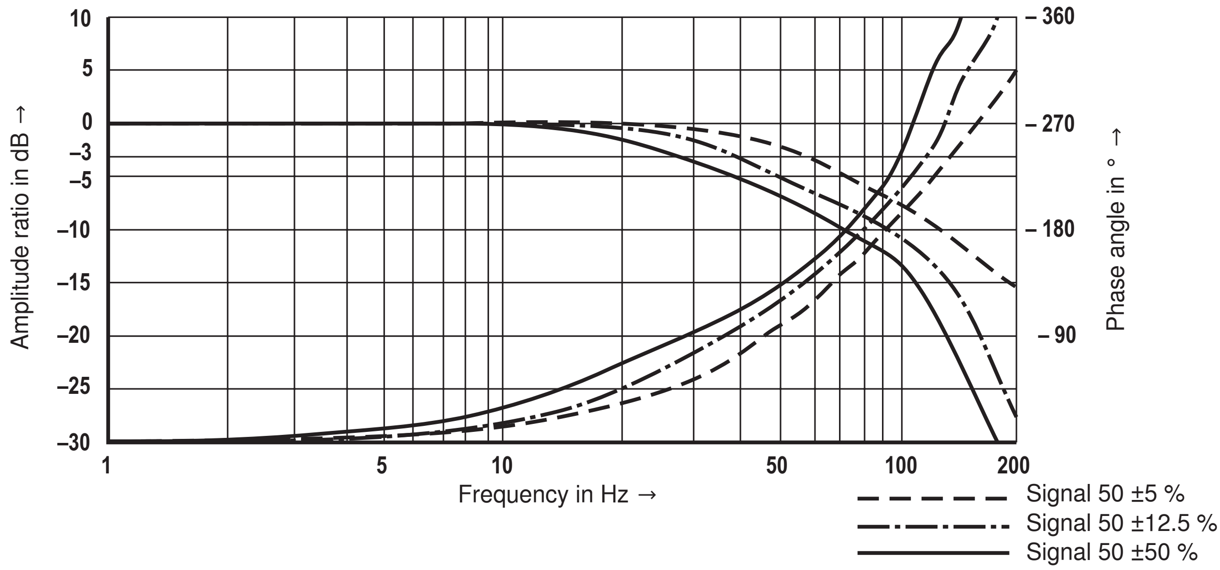


Characteristic curves: Size 6 (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)

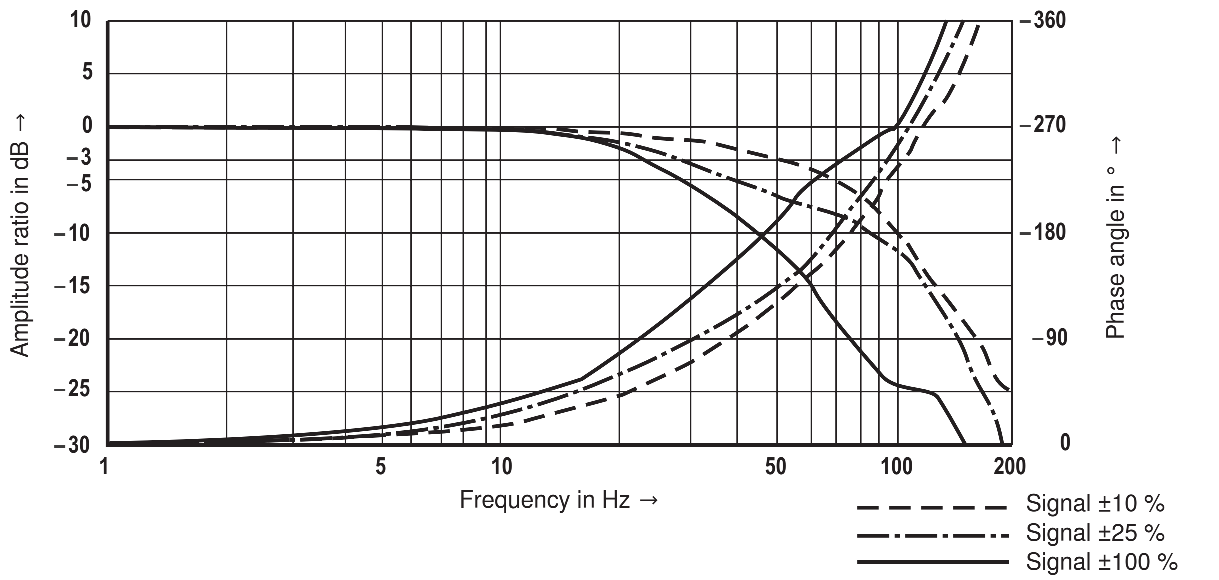
Transition function size 6



Frequency response size 6 with Q5 control spool, p_s = 10 bar

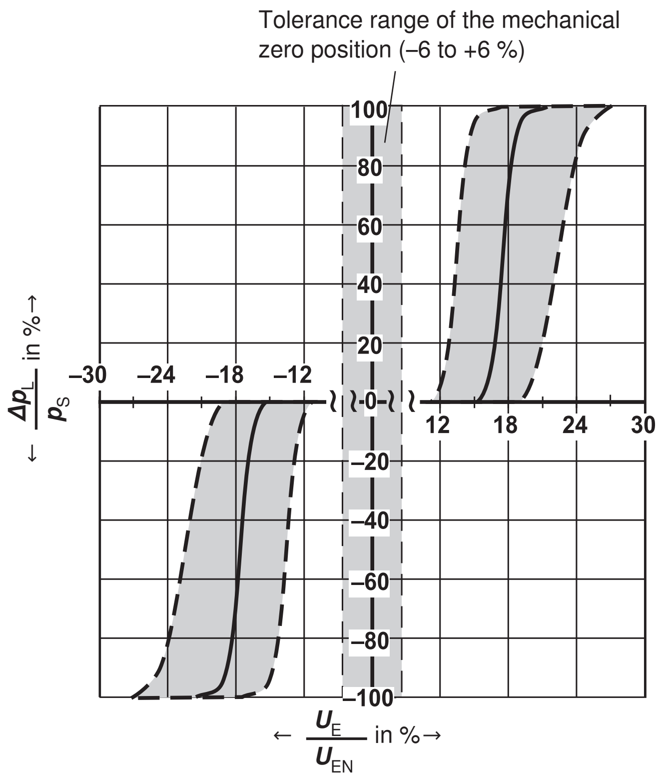


Frequency response size 6 with V control spool, p_s = 10 bar

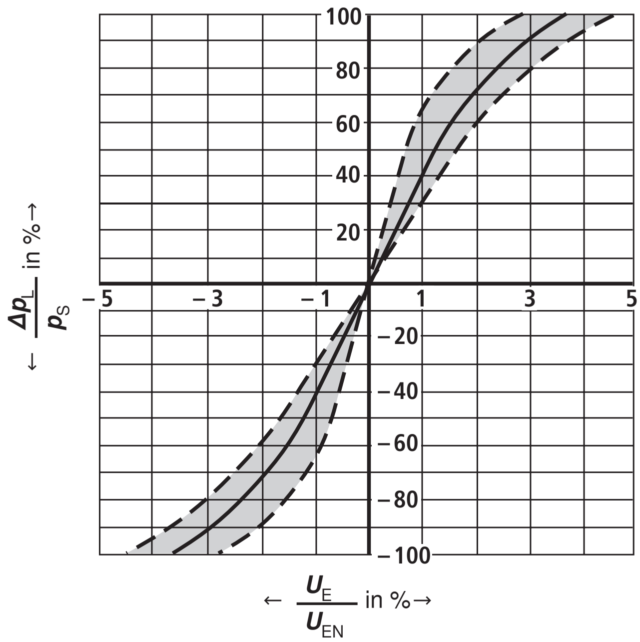


Characteristic curves: Size 10 (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)

Pressure signal characteristic curve (Q5 control spool), p_s = 100 bar

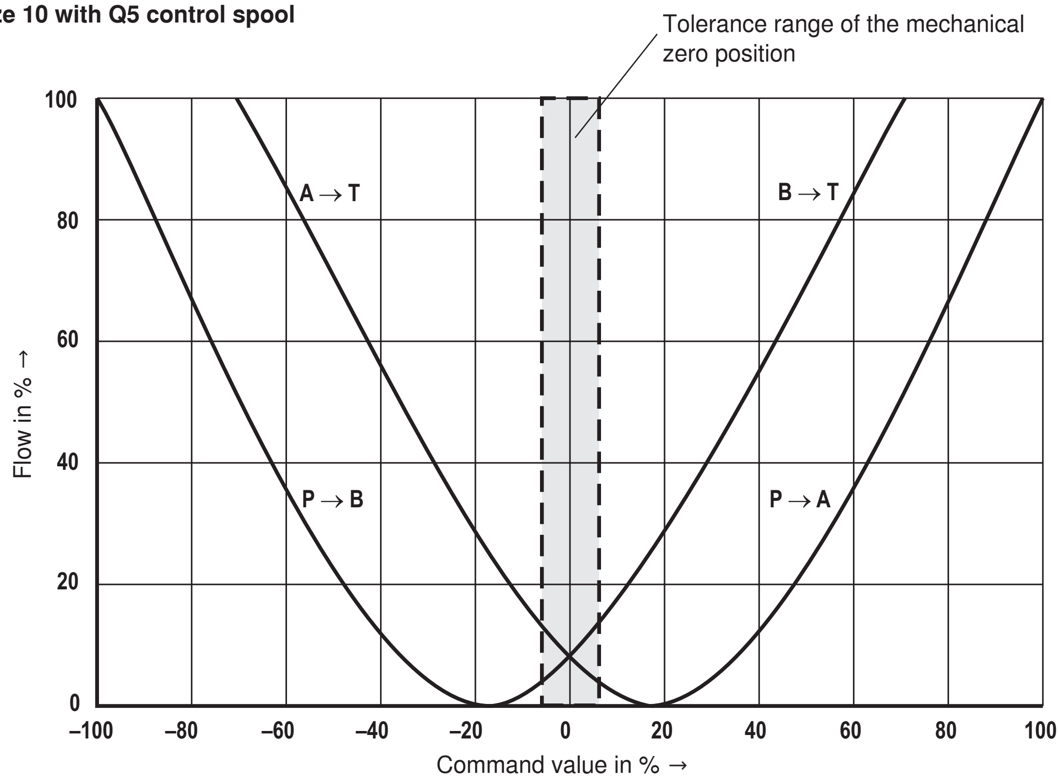


Pressure signal characteristic curve (V control spool), p_s = 100 bar

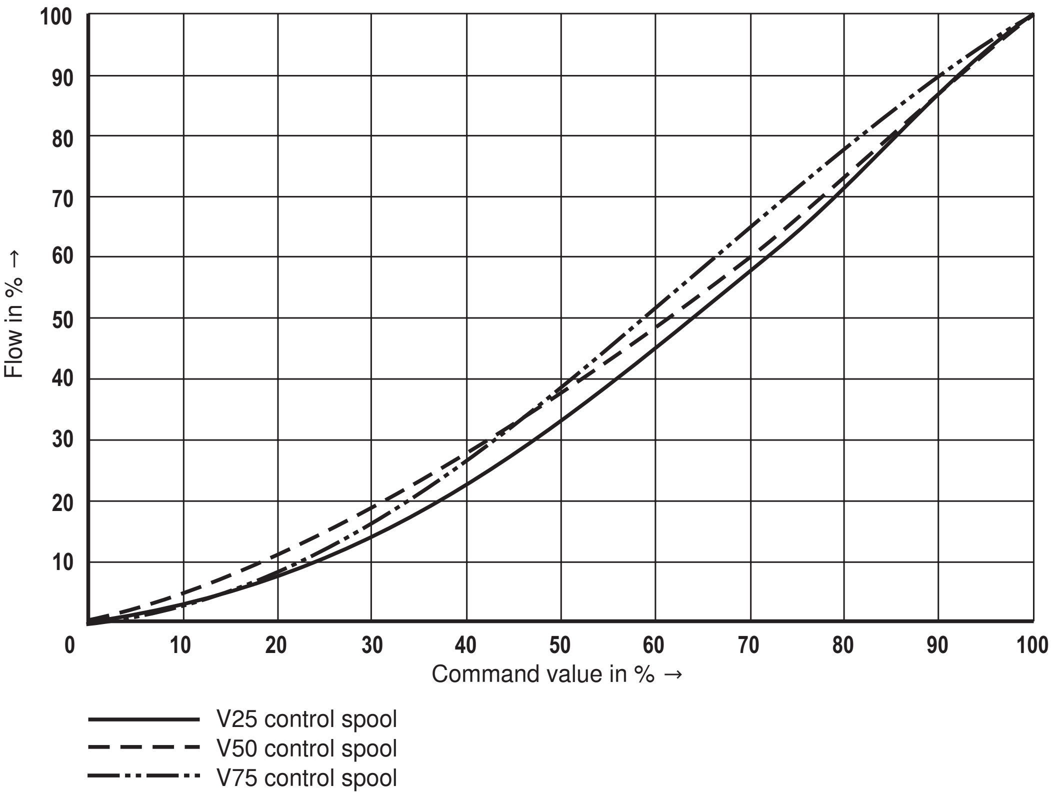


Characteristic curves: Size 10 (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)

Flow, size 10 with Q5 control spool

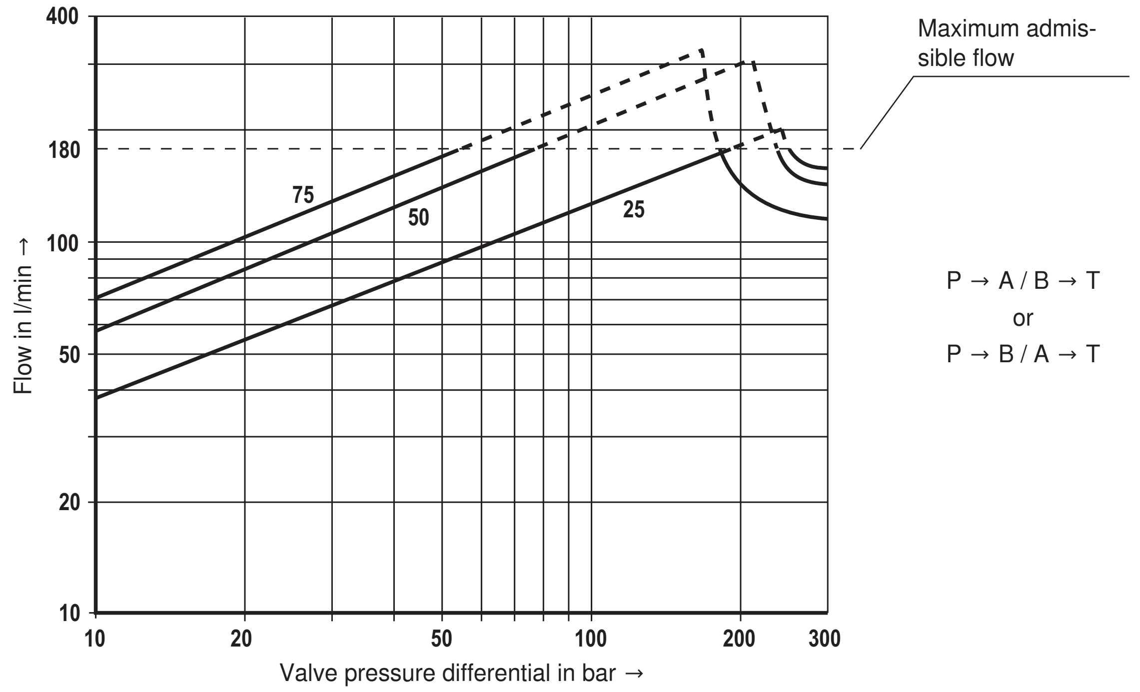


Flow, size 10 with V control spool

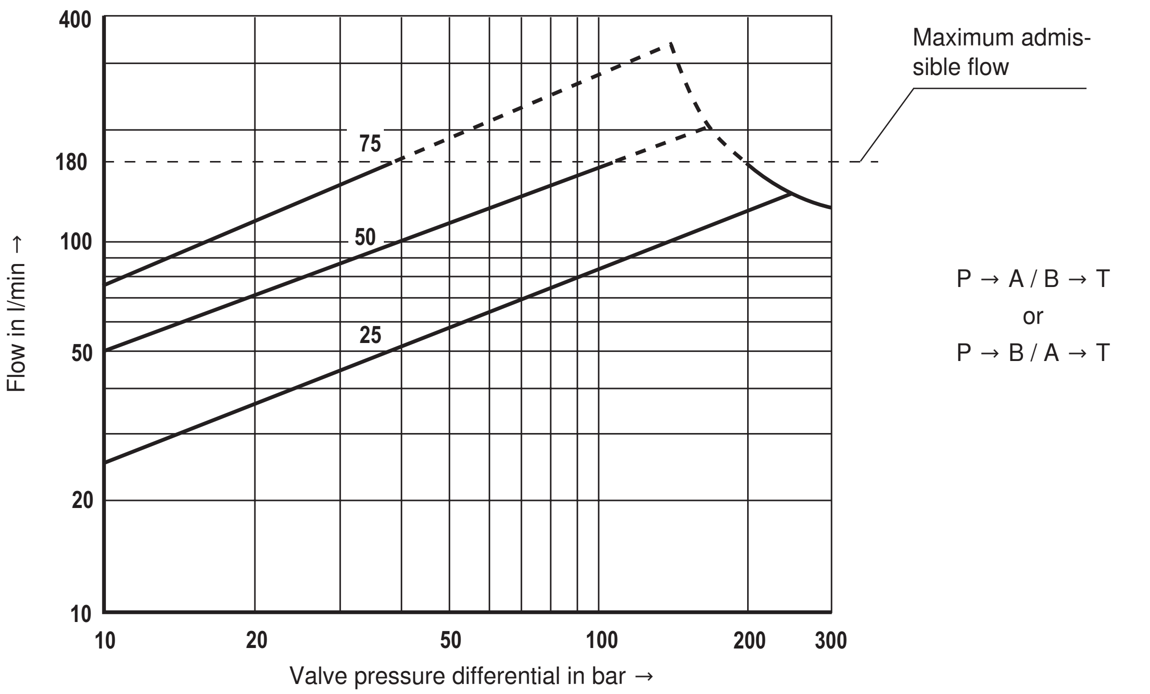


Characteristic curves: Size 10 (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)

Flow/load function size 10 with Q5 control spool with maximum valve opening

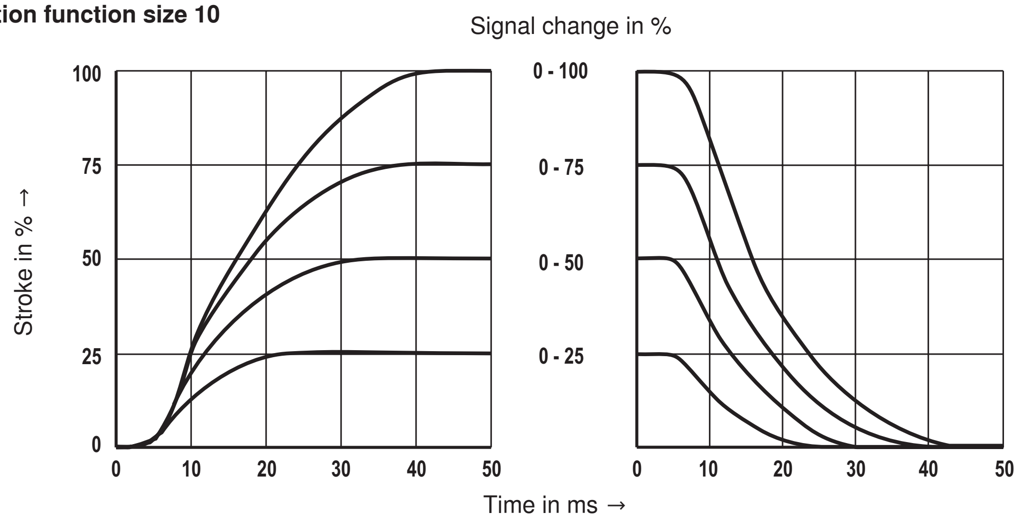


Flow/load function size 10 with V control spool with maximum valve opening

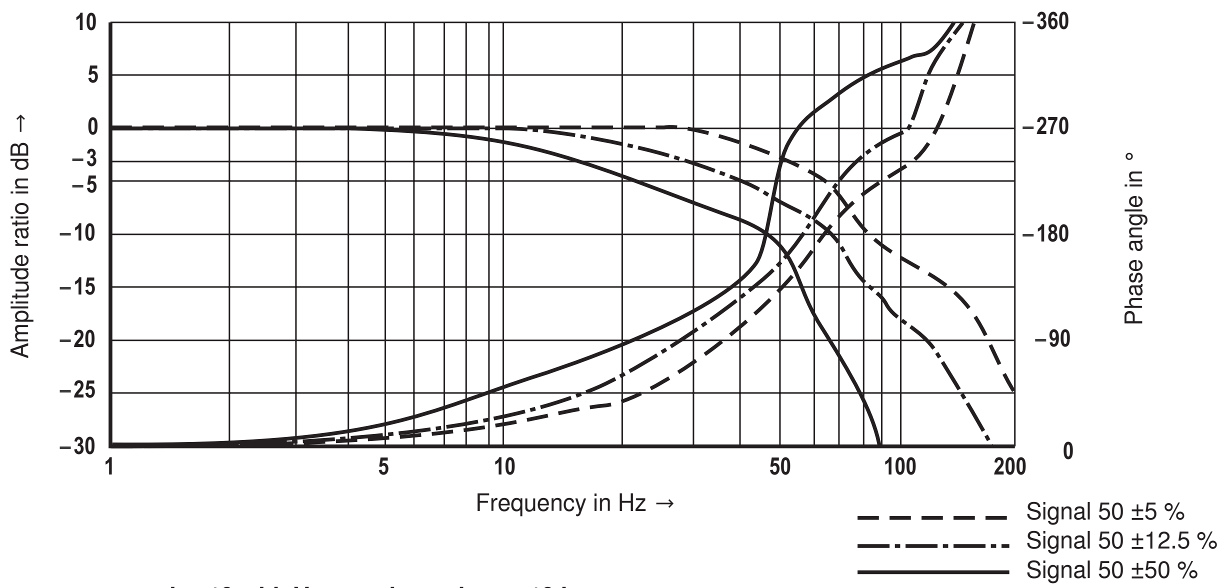


Characteristic curves: Size 10 (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)

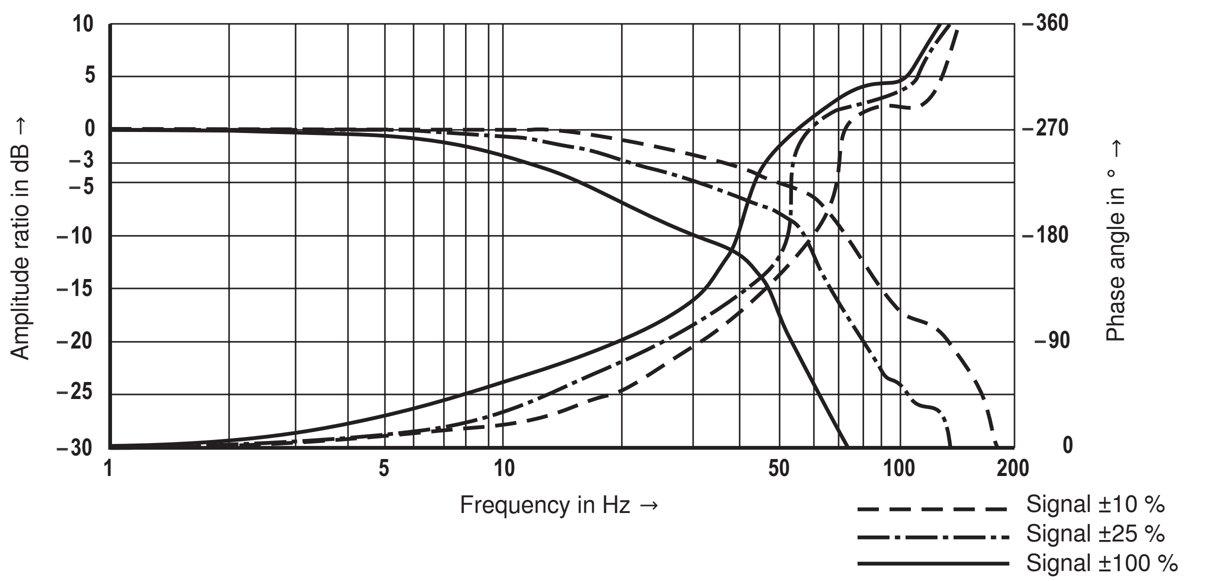
Transition function size 10



Frequency response size 10 with Q5 control spool, p_s = 10 bar

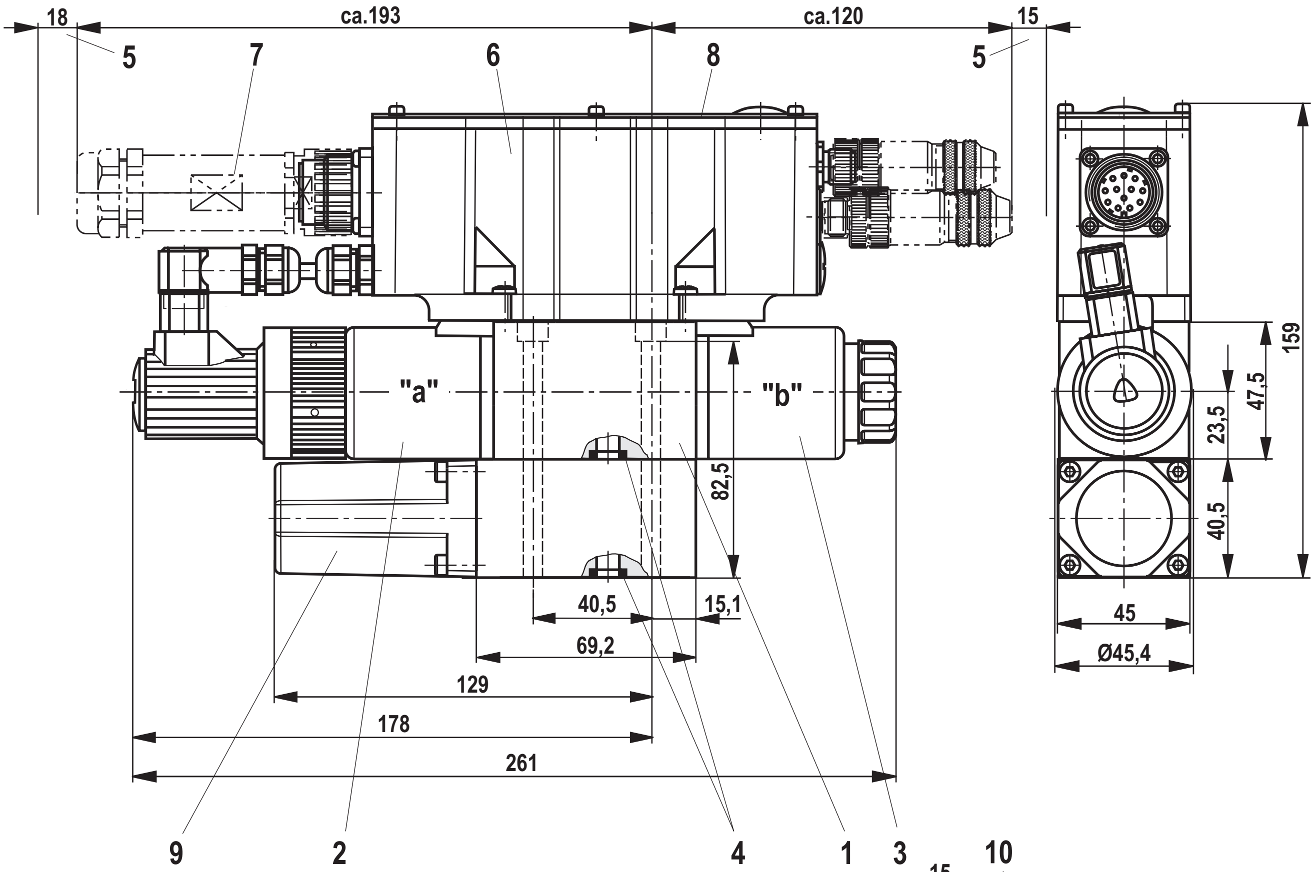


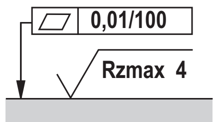
Frequency response size 10 with V control spool, p_s = 10 bar



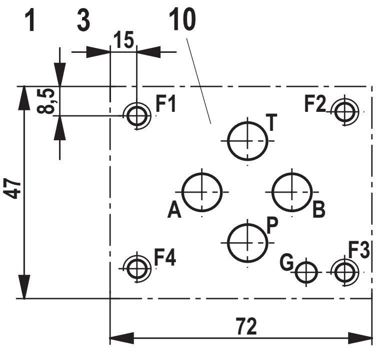
Dimensions: Size 6 (dimensions in mm)

Type 4WREQ with integrated pressure sensors





Required surface quality of the valve contact surface



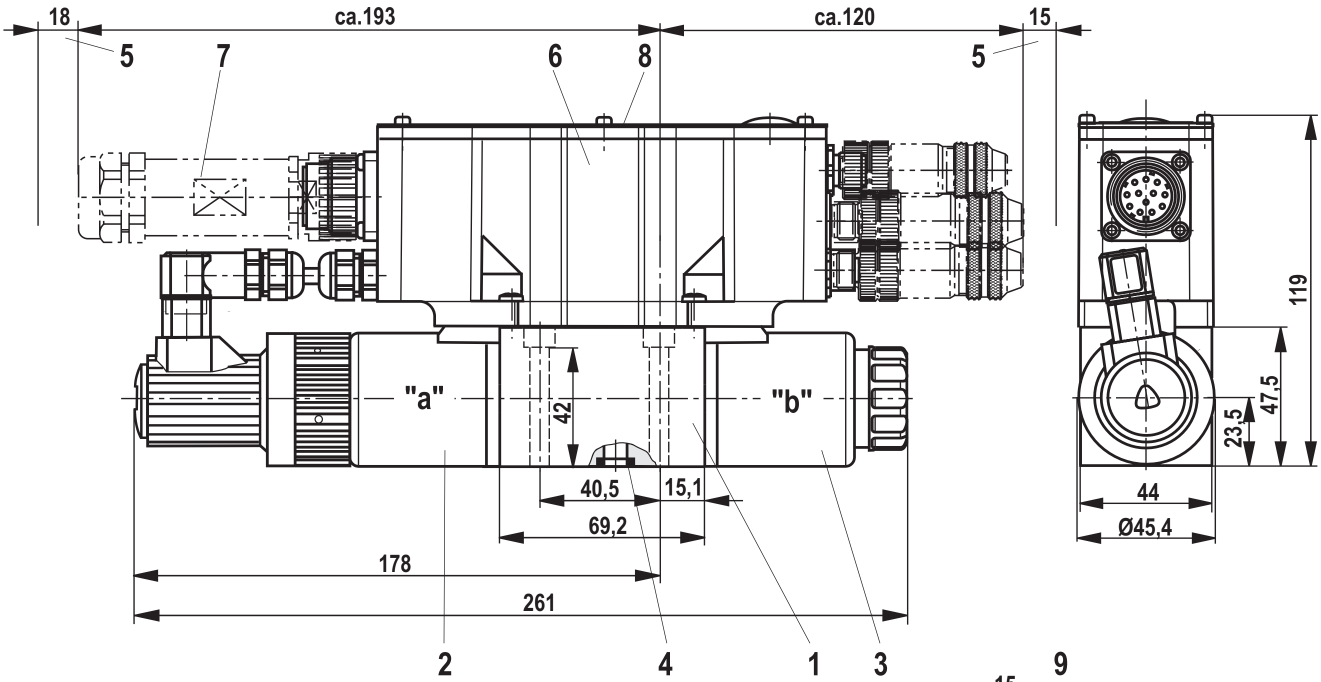
1 Valve housing
2 Proportional solenoid "a" with inductive position transducer
3 Proportional solenoid "b"
4 R-ring 9.81 x 1.5 x 1.78 (ports P, A, B, T)
5 Space required to remove the mating connector
6 Integrated digital control electronics
7 Mating connector according to DIN EN 175201-804; separate order, see page 25
8 Name plate
9 Integrated pressure transducer
10 Processed valve contact surface, porting pattern according to ISO 4401-03-02-0-05
   Deviating from the standard:
   – Ports P, A, B, T Ø 8 mm
   – Bore G can be omitted as the valve does not have a pin.

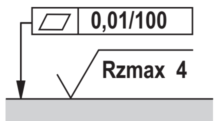
Notice!
The dimensions are nominal dimensions which are subject to tolerances.

Subplates and valve mounting screws see page 23

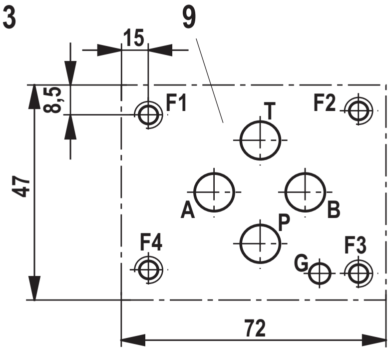
Dimensions: Size 6 (dimensions in mm)

Type 4WREQ for external pressure sensor





Required surface quality of the valve contact surface



1 Valve housing
2 Proportional solenoid "a" with inductive position transducer
3 Proportional solenoid "b"
4 R-ring 9.81 x 1.5 x 1.78 (ports P, A, B, T)
5 Space required to remove the mating connector
6 Integrated digital control electronics
7 Mating connector according to DIN EN 175201-804; separate order, see page 25
8 Name plate
9 Processed valve contact surface, porting pattern according to ISO 4401-03-02-0-05

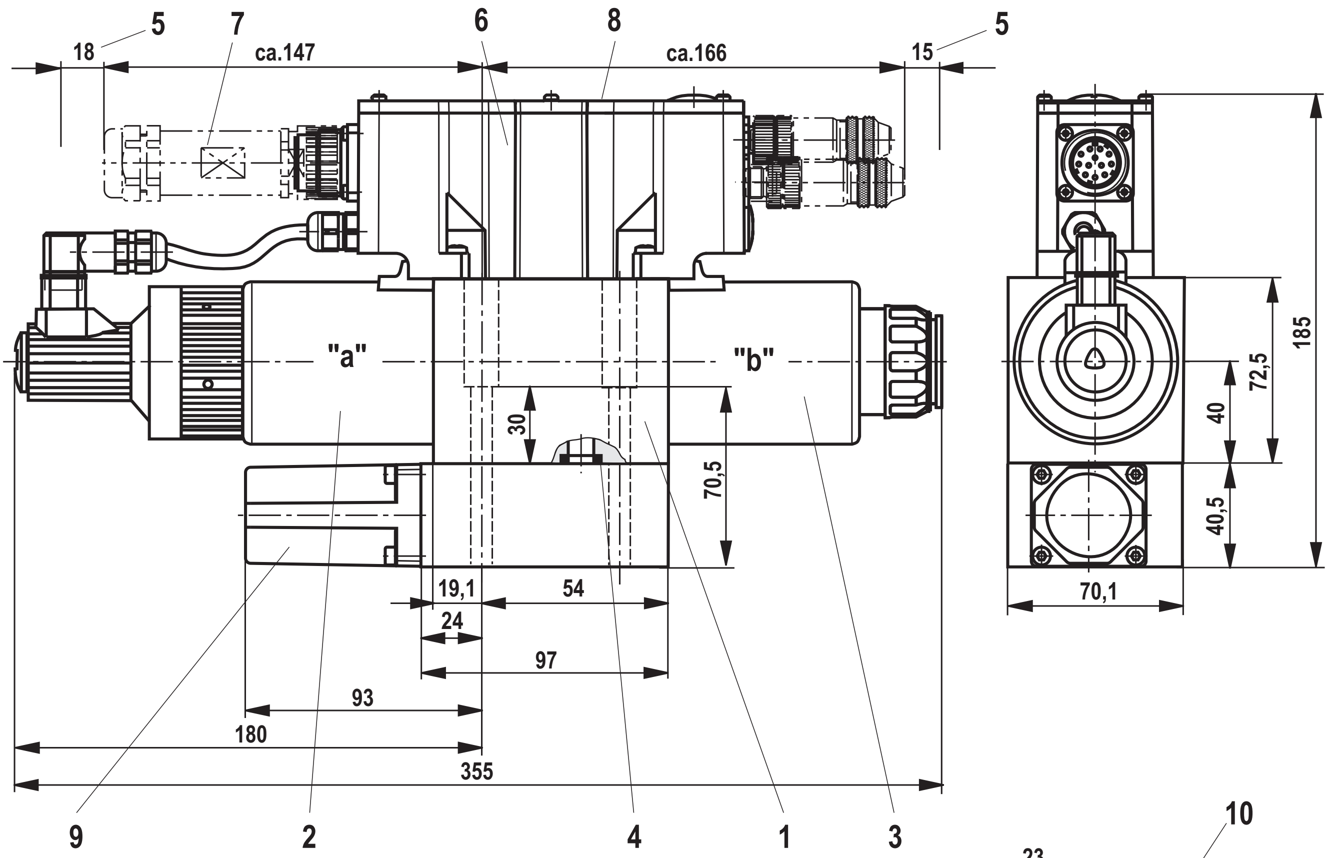
Deviating from the standard:
– Ports P, A, B, T Ø 8 mm
– Bore G can be omitted as the valve does not have a pin.

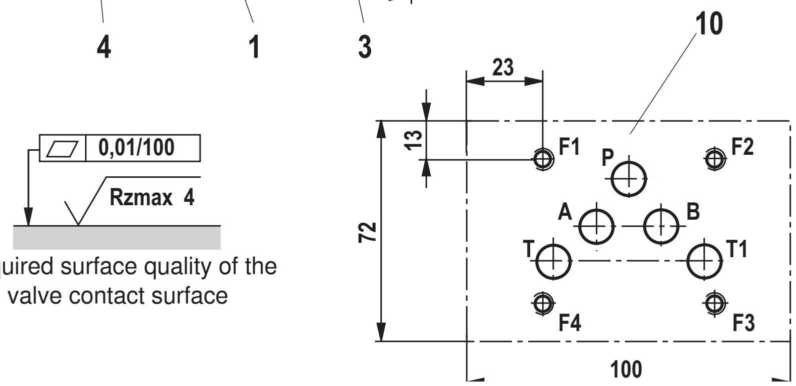
Notice!
The dimensions are nominal dimensions which are subject to tolerances.

Subplates and valve mounting screws see page 23

Dimensions: Size 10 (dimensions in mm)

Type 4WREQ with integrated pressure sensors





Required surface quality of the valve contact surface

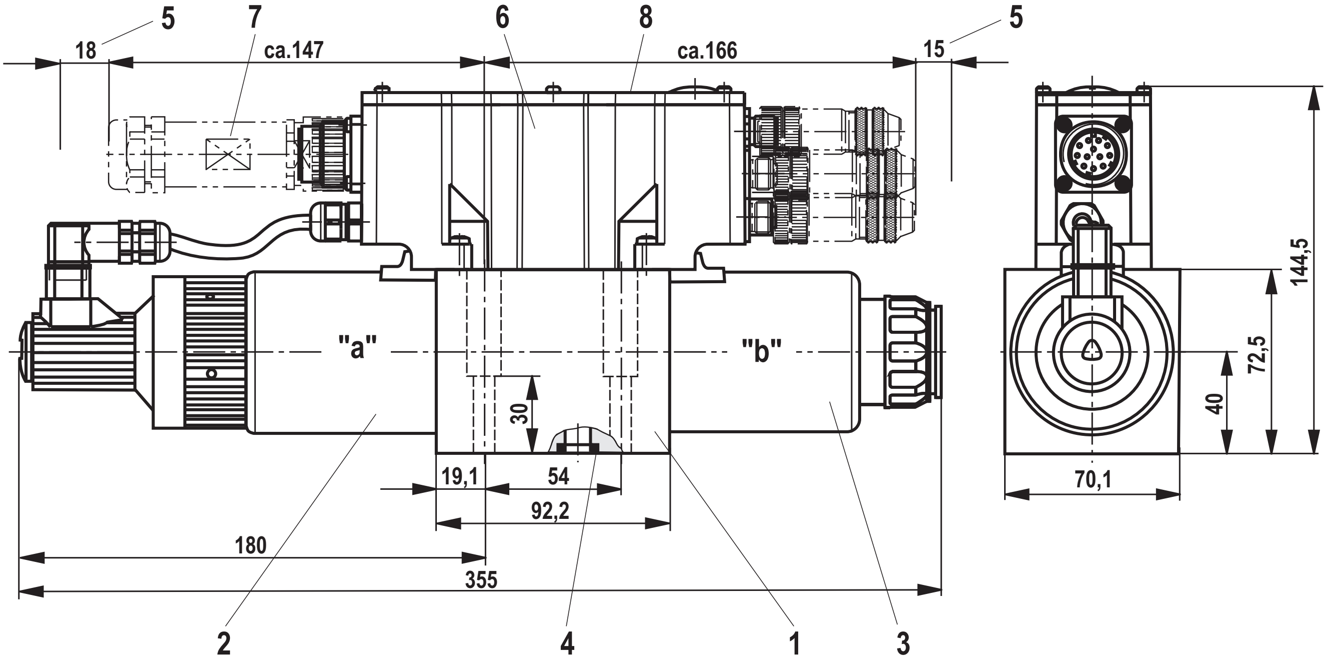
1 Valve housing
2 Proportional solenoid "a" with inductive position transducer
3 Proportional solenoid "b"
4 R-ring 13.0 x 1.6 x 2.0 (ports P, A, B, T1, T2)
5 Space required to remove the mating connector
6 Integrated digital control electronics
7 Mating connector according to DIN EN 175201-804; separate order, see page 25
8 Name plate
9 Integrated pressure transducer
10 Processed valve contact surface, porting pattern according to ISO 4401-05-04-0-05

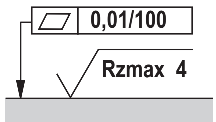
Notice!
The dimensions are nominal dimensions which are subject to tolerances.

Subplates and valve mounting screws see page 23

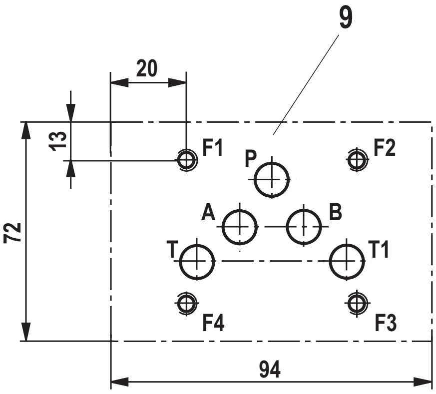
Dimensions: Size 10 (dimensions in mm)

Type 4WREQ for external pressure sensor





Required surface quality of the valve contact surface



1 Valve housing
2 Proportional solenoid "a" with inductive position transducer
3 Proportional solenoid "b"
4 R-ring 13.0 x 1.6 x 2.0 (ports A, B, P, T, T1)
5 Space required to remove the mating connector
6 Integrated digital control electronics
7 Mating connector according to DIN EN 175201-804; separate order, see page 25
8 Name plate
9 Processed valve contact surface, porting pattern according to ISO 4401-05-04-0-05

Notice!
The dimensions are nominal dimensions which are subject to tolerances.

Subplates and valve mounting screws see page 23

Dimensions

Hexagon socket head cap screws		**Material number**
Size 6 with integrated pressure sensors	4x ISO 4762 - M5 x 90 - 10.9-flZn-240h-L Tightening torque M_A = 7 Nm ±10 %	R913000222
Size 6 with external pressure sensor	4x ISO 4762 - M5 x 50 - 10.9-flZn-240h-L Tightening torque M_A = 7 Nm ±10 % or 4x ISO 4762 - M5 x 50 - 10.9 Tightening torque M_A = 8.9 Nm ±10 %	R913000064
Size 10 with integrated pressure sensors	4x ISO 4762 - M6 x 80 - 10.9-flZn-240h-L Tightening torque M_A = 12.5 Nm ±10 % or 4x ISO 4762 - M6 x 80 - 10.9 Tightening torque M_A = 15.5 Nm ±10 %	R913000512
Size 10 with external pressure sensor	4x ISO 4762 - M6 x 40 - 10.9-flZn-240h-L Tightening torque M_A = 12.5 Nm ±10 % or 4x ISO 4762 - M6 x 40 - 10.9 Tightening torque M_A = 15.5 Nm ±10 %	R913000058

Notice: The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure!

Subplates	**Data sheet**
Size 6	45052
Size 10	45054

Accessories (not included in the scope of delivery)

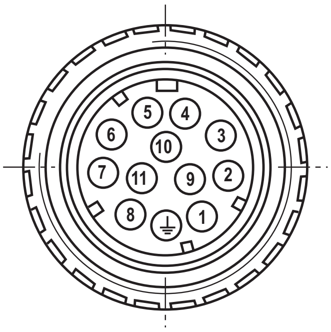
The following is required for the parameterization with PC:		CANopen	PROFIBUS-DP
1	Interface converter (USB)	VT-ZKO-USB/CA-1-1X/V0/0 Mat.no. **R901071963**	VT-ZKO-USB/P-1-1X/V0/0 Mat.no. **R901071962**
2	Commissioning software	WIN-PED 6	
3	Connection cable, 3 m	D-Sub / M12, coding A Mat.no. **R900751271**	D-Sub / M12, coding B Mat.no. **R901078053**

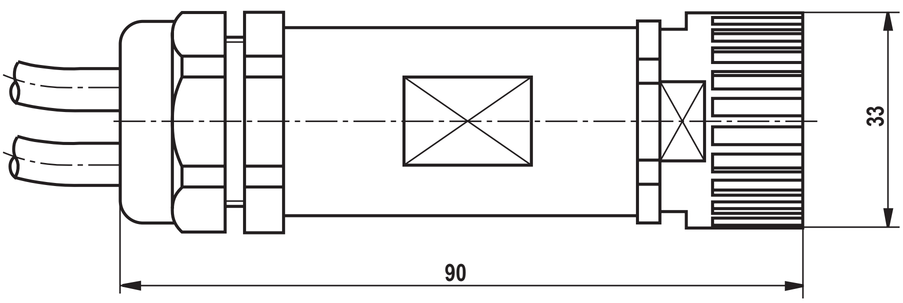
Accessories, port X1 (not included in the scope of delivery)

Mating connector for X1

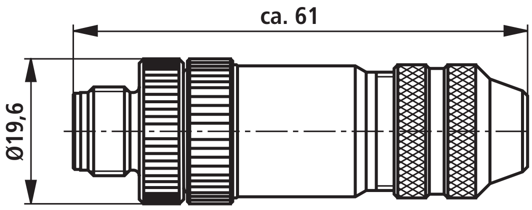
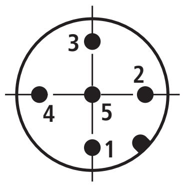
Mating connector according to DIN EN 175201 - 804 (11-pin + PE), plastic variant

- Mating connector without cable (assembly kit) Material no. **R900884671**
- Mating connector with cable set 2 x 5 m 12-pin Material no. **R900032356**
- Mating connector with cable set 2 x 20 m 12-pin Material no. **R900860399**

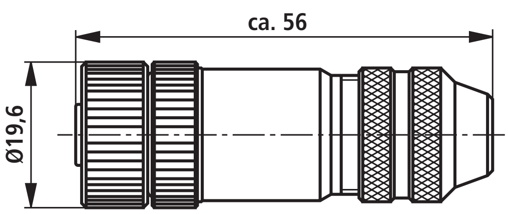
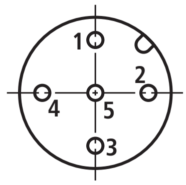
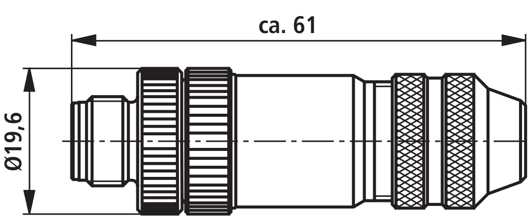
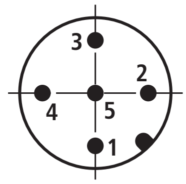
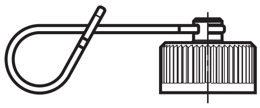




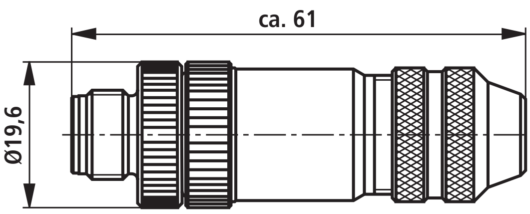
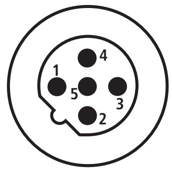
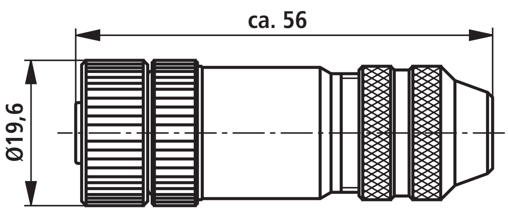
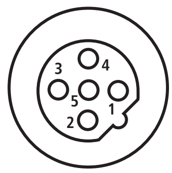
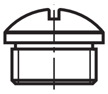
Accessories, sensor connection (not included in the scope of delivery)

Description	View, dimensions	Pole pattern, order details
X4 (analog sensor) Plug-in connector, 5-pin, M12, pin, A coding, straight line connector in metal design		 Mat no.: **R901075542** (cable diameter 4 to 6 mm)

Accessories, CAN bus (A coding) (not included in the scope of delivery)

Description	View, dimensions	Pole pattern, order details
X2 Round plug-in connector, can be assembled, 5-pin, M12 Straight mating connector in metal design.		 Mat no.: **R901076910** (line diameter 6 to 8 mm)
X3 Round plug-in connector, can be assembled, 5-pin, M12 Straight line connector in metal design.		 Mat no.: **R901076906** (line diameter 6 to 8 mm)
M12 cap Dust protection only for line connector.		Mat no.: **R901075564**

Accessories, PROFIBUS (B coding) (not included in the scope of delivery)

Description	View, dimensions	Pole pattern, order details
X2 Round plug-in connector, can be assembled, 5-pin, M12 Straight line connector in metal design.		 Mat no.: **R901075545** (line diameter 6 to 8 mm)
X3 Round plug-in connector, can be assembled, 5-pin, M12 Straight mating connector in metal design.		 Mat no.: **R901075550** (line diameter 6 to 8 mm)
M12 protective cap (only for mating connector)		Mat no.: **R901075563**

Project planning/maintenance instructions/additional information

Product documentation for IAC-P

- **Product information data sheet 29015-P**
- **Technical data sheet** (this data sheet)
- **Operating manual 29015-B**
- **CAN bus protocol description data sheet 29015-01-Z**
  PROFIBUS protocol description data sheet 29015-02-Z
- **General information on the maintenance and commissioning of hydraulic components**
  Data sheet 07800/07900

Maintenance instructions:

– The devices have been tested in the factory and are supplied with default settings.

– Only complete devices can be repaired. Repaired devices are returned with default settings. User-specific settings are not accepted. The machine end-user will have to retransfer the corresponding user parameters.

Notices:

– Connect the valve to the supply voltage only when this is required for the functional sequence of the machine.

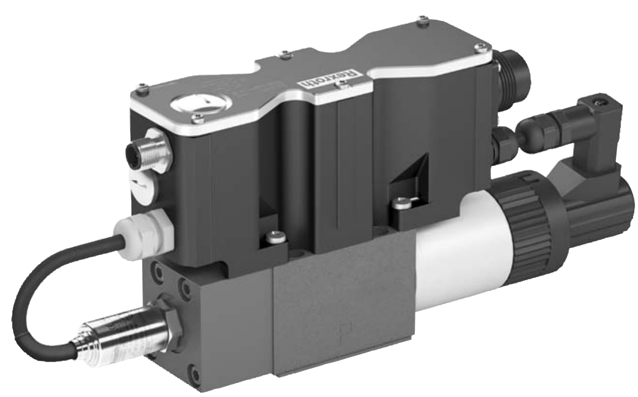
– Do not use electrical signals led out via control electronics (e.g. "No error" signal) for switching safety-relevant machine functions (In this connection also refer to EN ISO 13849 "Safety of machinery - Safety-related parts of control systems").

– If electro-magnetic interference must be expected, take appropriate measures to ensure the function (depending on the application, e.g. shielding, filtering)!

Proportional directional valve, direct operated, with *pQ* functionality

Type STW 0195 and STW 0196

RE 29014
Edition: 2015-05
Replaces: 2013-03



H8064

- Sizes: 6 and 10
- Component series 1X, 2X

Features

- 3-way proportional directional valve with integrated IAC-P digital control electronics
- Completely adjusted unit consisting of position-controlled valve, pressure sensor and field bus connection
- Operation via a proportional solenoid with central thread and detachable coil
- Valve spool, position-controlled
- Integrated pressure sensor plate (optional)
- ISO 4401 porting pattern
- Analog interfaces for command and actual values
- Design for CAN bus with DS 408 CANopen protocol or DP Profibus
- Quick commissioning via PC and WINPED commissioning software

Contents

Ordering codes

01	02		03		04	05	06		07	08	09		10
STW		**–**		**/**		**V**		**–**	**24**			**–**	*****

01	3-way proportional directional valve with integrated IAC-P digital control electronics	**STW**

02	Size 6	**0195**
	Size 10	**0196**

03	Component series 10 ... 19 (10 ... 19: unchanged installation and connection dimensions) - size 10	**1X**
	Component series 20 ... 29 (20 ... 29: unchanged installation and connection dimensions) - size 6	**2X**

Rated flow

04	**– Size 6** (model “0195”)	
	P → A: 10 l/min, A → T: 20 l/min	**1**
	P → A: 20 l/min, A → T: 20 l/min	**2**
	– Size 10 (model “0196”)	
	P → A: 65 l/min, A → T: 60 l/min, B → T: 60 l/min	**1**

Seal material

05	FKM seals	**V**
	Observe compatibility of seals with hydraulic fluid used! (Other seals upon request)	

Pressure rating of the integrated pressure sensor

06	Nominal pressure: 50 bar	**3**
	Nominal pressure: 160 bar	**5**
	Nominal pressure: 250 bar	**8**

Supply voltage

07	Direct voltage 24 V	**24**

Bus interface

08	CANBus DS - 408	**C**
	Profibus DP V0/V1	**P**

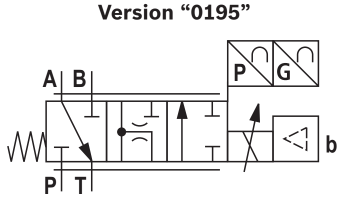
Interface

09	± 10 VDC	**A6**
	4 ... 20 mA	**F6**

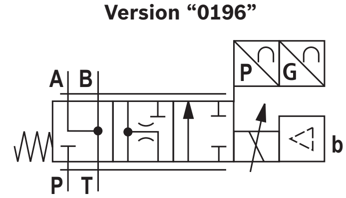
10	Further details in the plain text	*****

Symbols

Version “0195”



Version “0196”



Set-up, function, section

Set-up
- The IAC-P valve basically consists of:
- Housing (1) with connection surface
- Control spool (2) with compression spring (3)
- Solenoid and pole tube (4) with central thread
- Position transducer (5)
- Pressure sensor (6)
- Integrated IAC-P digital control electronics (7) with bus connection (X2) and central connector (X1).

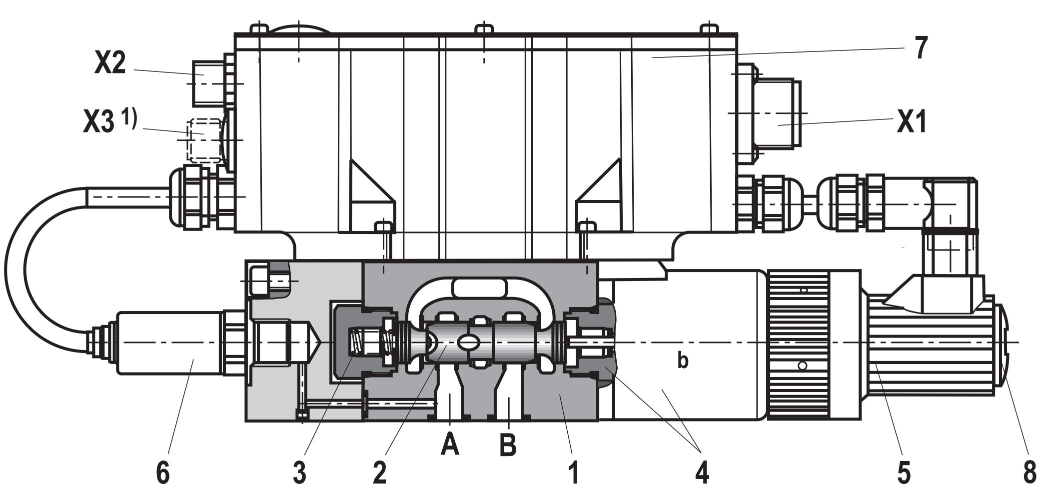
Functional description
- If solenoids (4) are not operated, spool position A → T (with type STW 0196-1X/1 additionally B → T)
- Functions:
  - Flow control (***Q***)
  - Pressure control (***p***)
  - Override control ***p/Q***
- The command value can be defined either via an analog interface (X1) or via the field bus interface (X2, X3).
- The actual value signals are provided via an analog interface (X1) and may be read additionally via the field bus (X2, X3).
- The controller parameters are set via the field bus (X2, X3).
- Separate supply voltage for bus/controller and power part (output stage) for safety reasons

The digital integrated control electronics enables the following fault detection (diagnostics):
- Cable break of pressure sensor supply line (6)
- Undervoltage
- Cable break position transducer (5)
- Communication error
- Watchdog
- Cable break of command value inputs

The following additional functions are available:
- Pressure ramp
- Internal command value profile
- Release function analog/digital
- Error output 24 V.

WINPED PC program
To implement the project planning task and to parameterize the IAC-P valves, the user may use the WINPED commissioning software (see accessories).
- Parameterization
- Diagnostics
- Comfortable data administration on a PC
- PC operating systems: Windows 2000 or Windows XP

$Q_{command}$	***Q*** control	***p*** closed-loop control
< 12 mA	A → T	inactive
> 12 mA	Override closed-loop control: (A → T or P → A) ***Q*** control ($Q_{command}$) with pressure limitation ($p_{command}$) if pressure limitation is active, the following applies: $Q_{actual} \leq Q_{command}$	



Type STW0195-2X/...

1) Only available with Profibus

Notice:
Due to the design principle, internal leakage is inherent to the valves, which may increase over the life cycle.
The tank line must not be allowed to run empty. If required by the installation conditions, use a suitable preload valve.

Notice:
The PG fitting (8) must not be opened. Mechanical adjustment of the adjustment nut located below is prohibited and damages the valve!

Technical data
(For applications outside these parameters please consult us!)

General			
Size	S	6 (“0195”)	10 (“0196”)
Weight	kg	2.4	6.5
Installation position		any, preferably horizontal	
Ambient temperature range	°C	-20 ... +50	
Storage temperature range	°C	-20 ... +80	

Hydraulic [1]					
Operating pressure [2]	▶ Ports P, A, B (with sensor)	“3”	bar	50	
		“5”	bar	160	
		“8”	bar	250	
	▶ Port T (with sensor)	“3”	bar	50	
		“5”	bar	160	
		“8”	bar	210	
Rated flow $q_{V\ nom}$ (with Δp = 5 bar; see also characteristic curves starting on page 7)	▶ P → A	“1”	l/min	10	65
		“2”	l/min	20	–
	▶ A → T	“1”	l/min	20	–
		“2”	l/min	20	–
	▶ A → T, B → T	“1”	l/min	–	60
Max. flow			l/min	See performance limit starting on page 9	
Hydraulic fluid				See table below	
Hydraulic fluid temperature range (at the valve operating ports)			°C	-20 ... +80; preferably +40 ... +50	
Viscosity range			mm^2/s	20 ... 380; preferably 30 ... 46	
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)				Class 20/18/15 [3]	
Hysteresis			%	≤ 0.1	
Range of inversion			%	≤ 0.05	
Response sensitivity			%	≤ 0.05	
Zero shift			%10 K	≤ 0.15	
			%100 bar	≤ 0.1	

Hydraulic fluid		**Classification**	**Suitable sealing materi-als**	**Standards**	**Data sheet**
Mineral oils		HL, HLP, HLPD, HVLP, HVLPD	NBR, FKM	DIN 51524	90220
Bio-degradable	▶ Insoluble in water	HETG	NBR, FKM	ISO 15380	90221
		HEES	FKM		
	▶ Soluble in water	HEPG	FKM	ISO 15380	
Flame-resistant	▶ Water-free	HFDU, HFDR	FKM	ISO 12922	90222
	▶ Containing water	HFC (Fuchs Hydrotherm 46M, Petrofer Ultra Safe 620)	NBR	ISO 12922	90223

Important information on hydraulic fluids:
- For more information and data about the use of other hydraulic fluids, refer to data sheets above or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.)!
- The flash point of the hydraulic fluid used must be 40 K higher than the maximum solenoid surface temperature.
- **Flame-resistant – containing water**:
  - Maximum pressure differential per control edge 50 bar
  - Pressure pre-loading at the tank port > 20% of the pressure differential, otherwise increased cavitation
  - Life cycle as compared to operation with mineral oil HL, HLP 50 to 100%
- **Bio-degradable and flame-resistant:** When using these hydraulic fluids that are simultaneously zinc-solving, zinc may accumulate (700 mg zinc per pole tube).

1) Measured using HLP 46; ϑ_{Oil} = 40 °C ± 5 °C and p = 100 bar

2) Operating pressure, dependent on valve and sensor

3) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the life cycle of the components.

Technical data
(For applications outside these parameters please consult us!)

electrical			
Supply voltage	▶ Nominal voltage	VDC	24
	▶ Lower limit value	VDC	19.4
	▶ Upper limit value	VDC	35
Maximum admissible residual ripple		Vpp	2
Current consumption	▶ I_{max}	A	2
	▶ Impulse current	A	3
Command value signals		mA	4 ... 20 (or via CAN bus)
Duty cycle [1]		%	100
Maximum coil temperature [2]		°C	150
Protection class according to DIN EN 60529			IP 65 with mating connector correctly mounted and locked

Sensor technology					
Measurement range	▶ p_N	bar	50	160	250
Overload protection	▶ p_{max}	bar	110	320	500
Bursting pressure	▶ p	bar	200	640	1000
Temperature coefficient for zero point and range within the nominal temperature range [3]			< 0.1% / 10 K		
Characteristic curve deviation			< 0.2%		
Hysteresis			< 0.1%		
Repetition accuracy			< 0.05%		
Setting time (10 ... 90%)		t	< 1 ms		
Long-term drift (1 year) under reference conditions			< 0.1%		
Conformity			CE according EMC directive EN 61000-6-2 / EN 61326-2-3 and EN 61000-6-3 / EN 61326-2-3		

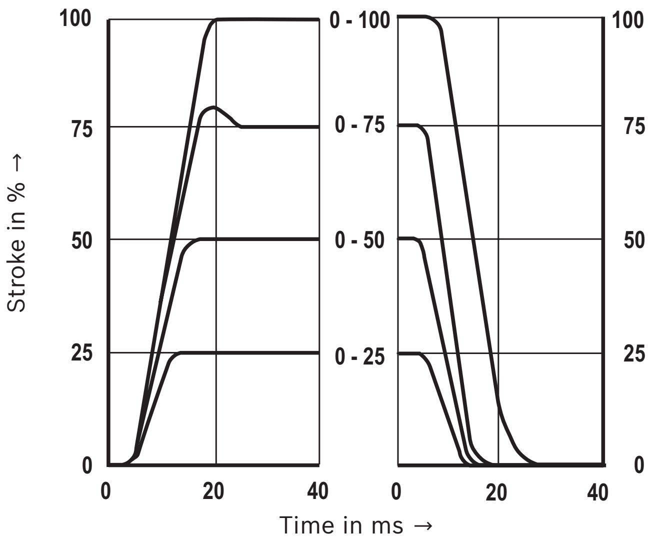
1) Connect the valve to the supply voltage only when this is required for the functional processes of the machine.

2) Due to the surface temperatures of the solenoid coils, the standards ISO 13732-1 and ISO 4413 need to be adhered to!

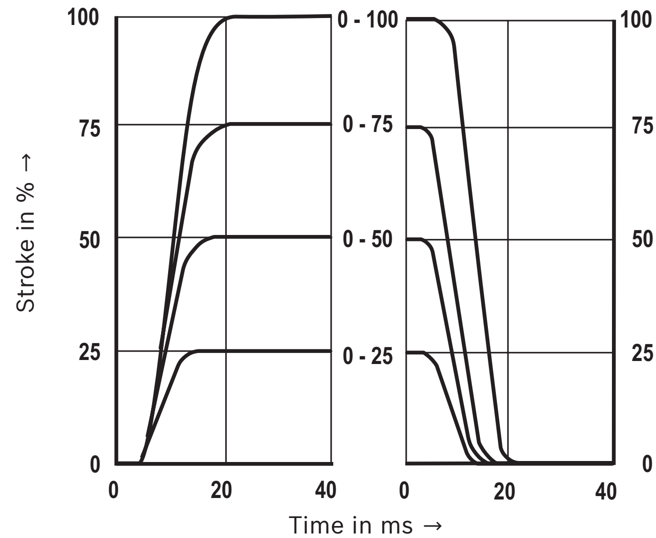
3) related to the complete measurement range, including non-linearity, hysteresis, zero point and end value deviation (corresponds to the measuring deviation according to IEC 61298-2)

Characteristic curves: Size 6 ("0195...1")
(measured with HLP46, ϑ_{Oil} = 40 ± 5 °C)

Transition function (A → T)

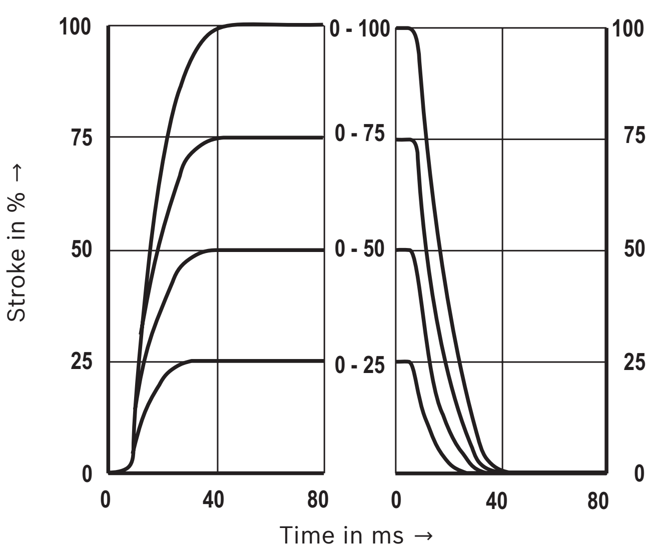


Transition function (P → A)

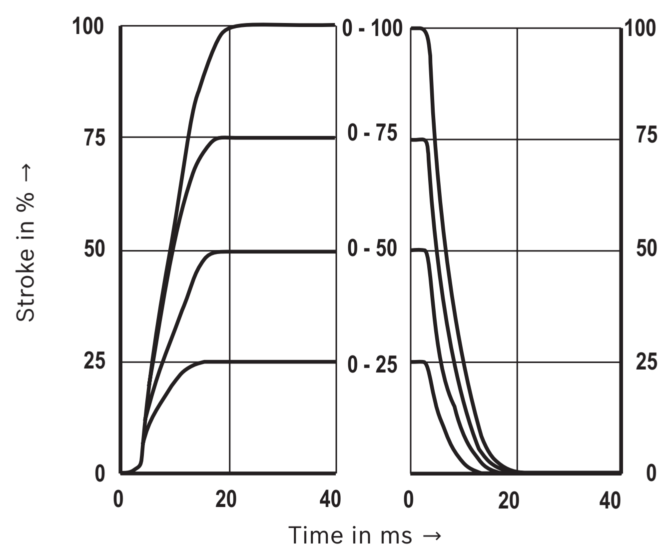


Characteristic curves: Size 10 ("0196...1")
(measured with HLP46, ϑ_{Oil} = 40 ± 5 °C)

Transition function (A → T and B → T)

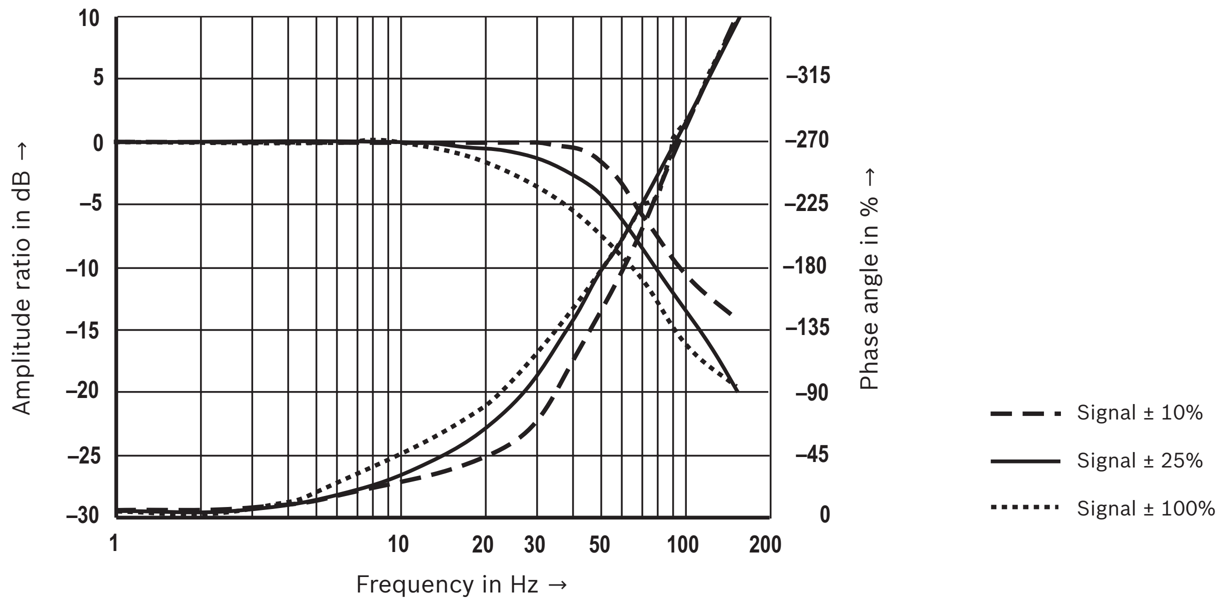


Transition function (P → A)

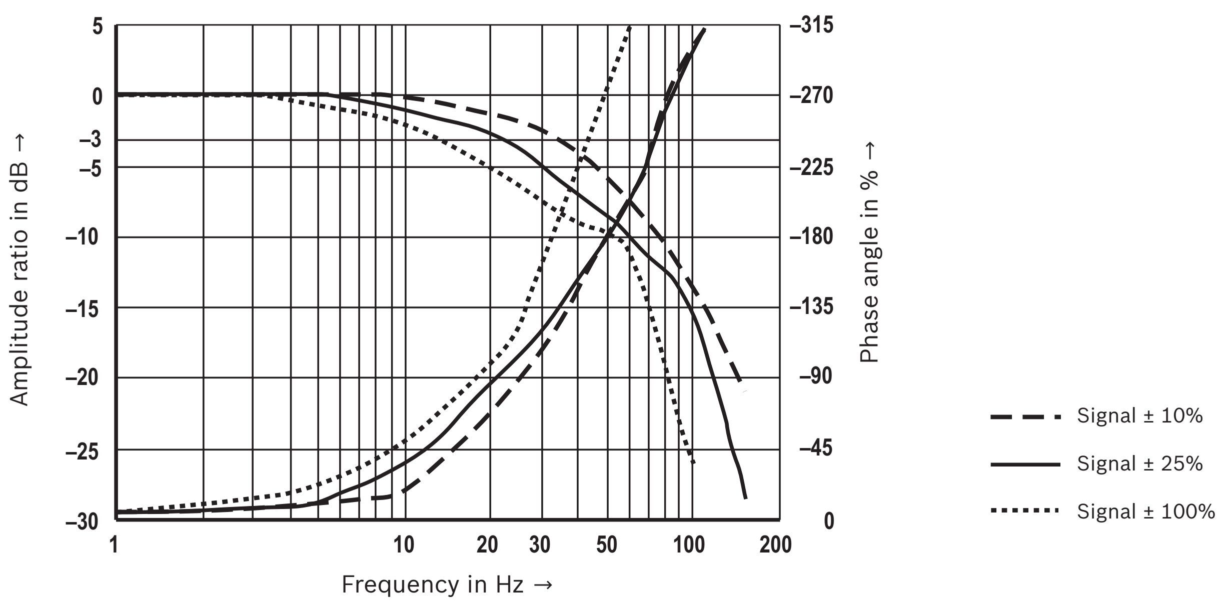


Characteristic curves
(measured with HLP46, ϑ_{Oil} = 40 ± 5 °C)

Frequency response, Size 6 (“0195...1”)

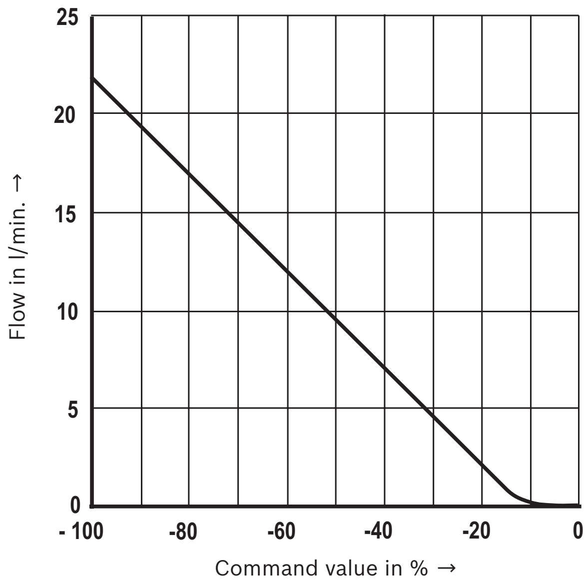


Frequency response, Size 10 (“0196...1”)

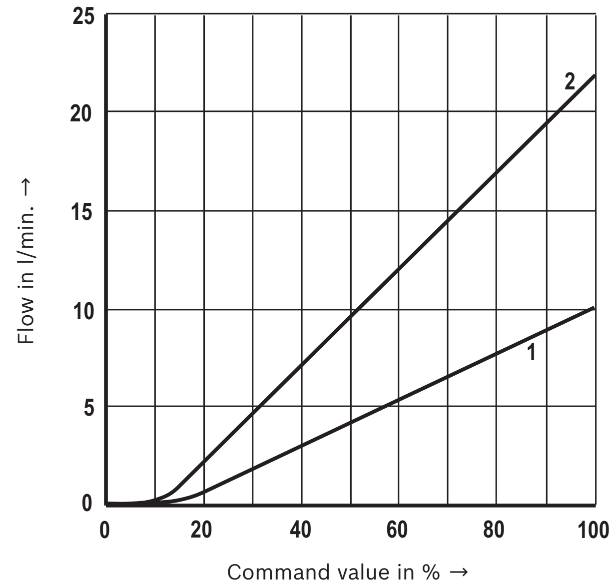


Characteristic curves: Size 6 (“0195...”) (measured with HLP46, ϑ_{Oil} = 40 ± 5 °C)

Flow characteristic curve (A → T, ***Δp*** = 5 bar)



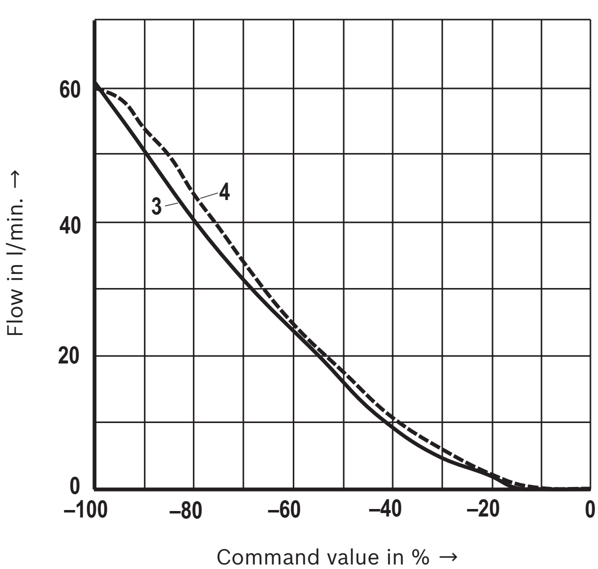
Flow characteristic curve (P → A, ***Δp*** = 5 bar)



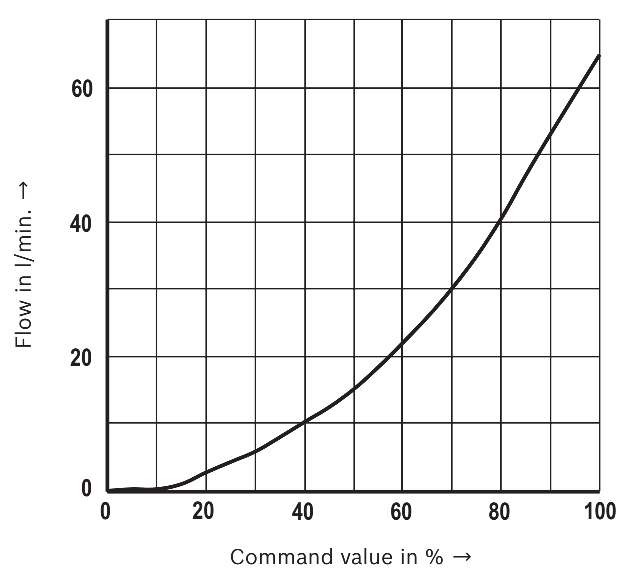
1 Version “0195...1”)
2 Version “0195...2”)

Characteristic curves: Size 10 (“0196”) (measured with HLP46, ϑ_{Oil} = 40 ± 5 °C)

Flow characteristic curve (A/B → T, ***Δp*** = 5 bar)



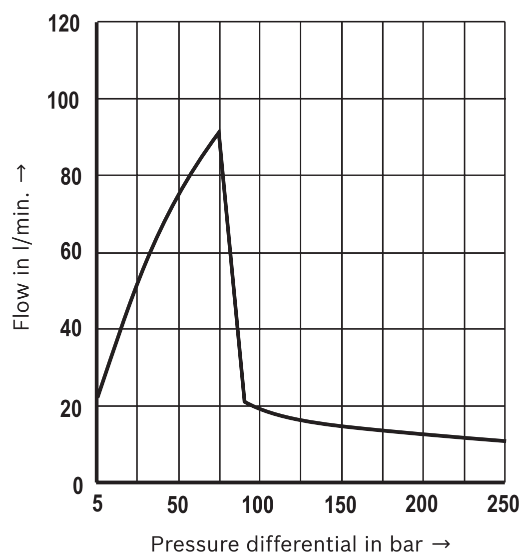
Flow characteristic curve (P → A, ***Δp*** = 5 bar)



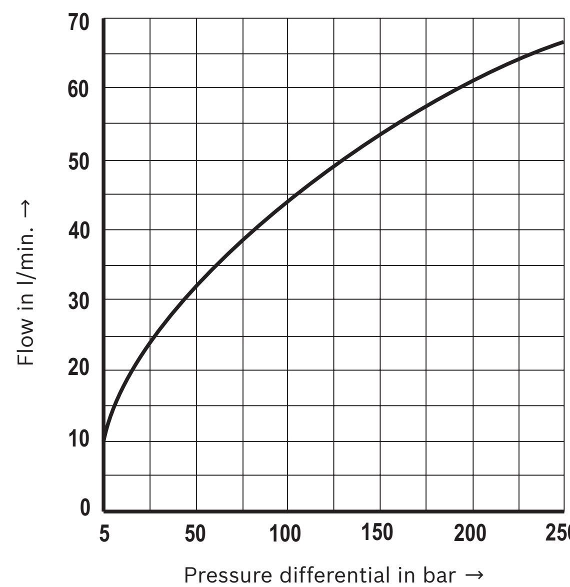
3 A → T
4 B → T

Performance limits: Size 6 (“0195...”)
(measured with HLP46, ϑ_{Oil} = 40 ± 5 °C)

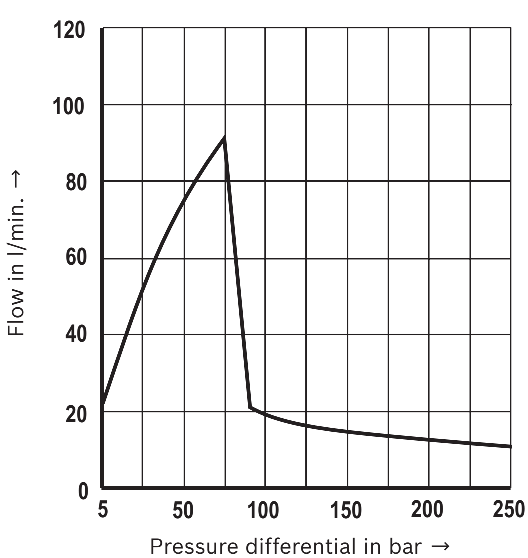
Position-controlled
(P → A: 10 l/min, A → T: 20 l/min – **A** → **T**)



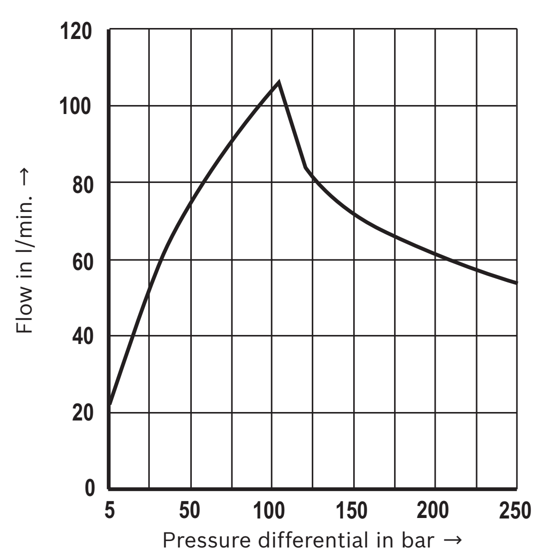
Position-controlled
(P → A: 10 l/min, A → T: 20 l/min – **P** → **A**)



Position-controlled
(P → A: 20 l/min, A → T: 20 l/min – **A** → **T**)

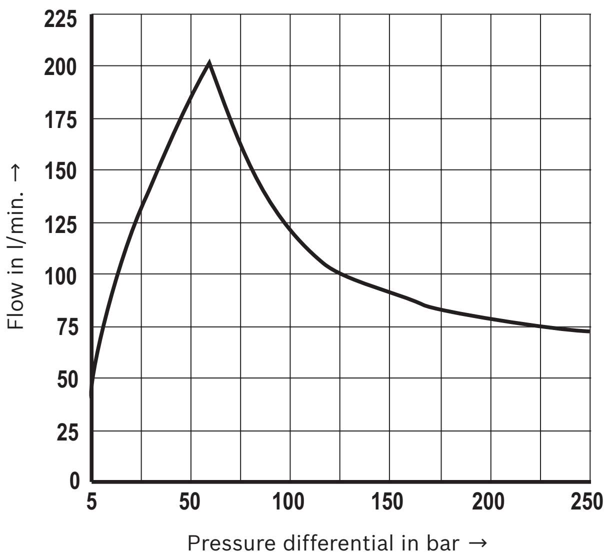


Position-controlled
(P → A: 20 l/min, A → T: 20 l/min – **P** → **A**)

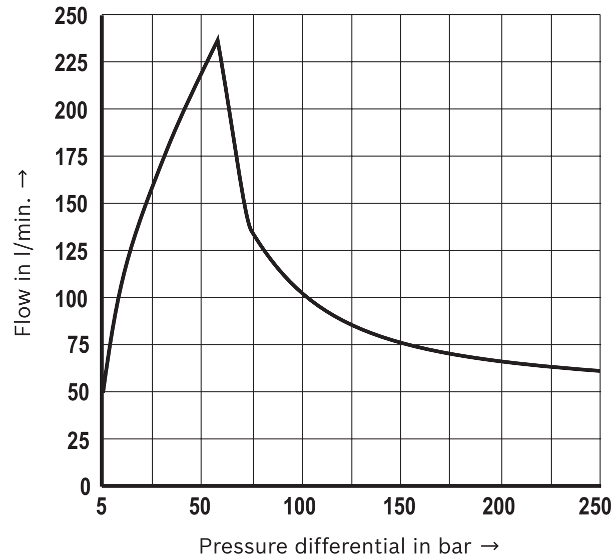


Performance limits: Size 10 (“0196”)
(measured with HLP46, ϑ_{Oil} = 40 ± 5 °C)

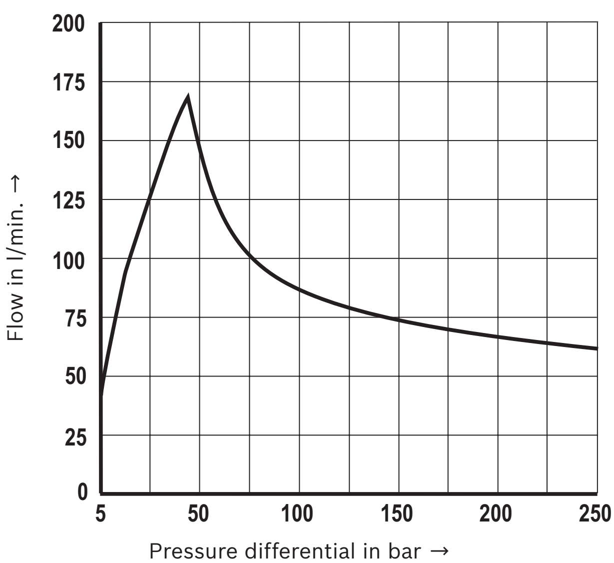
Position-controlled (A → T)



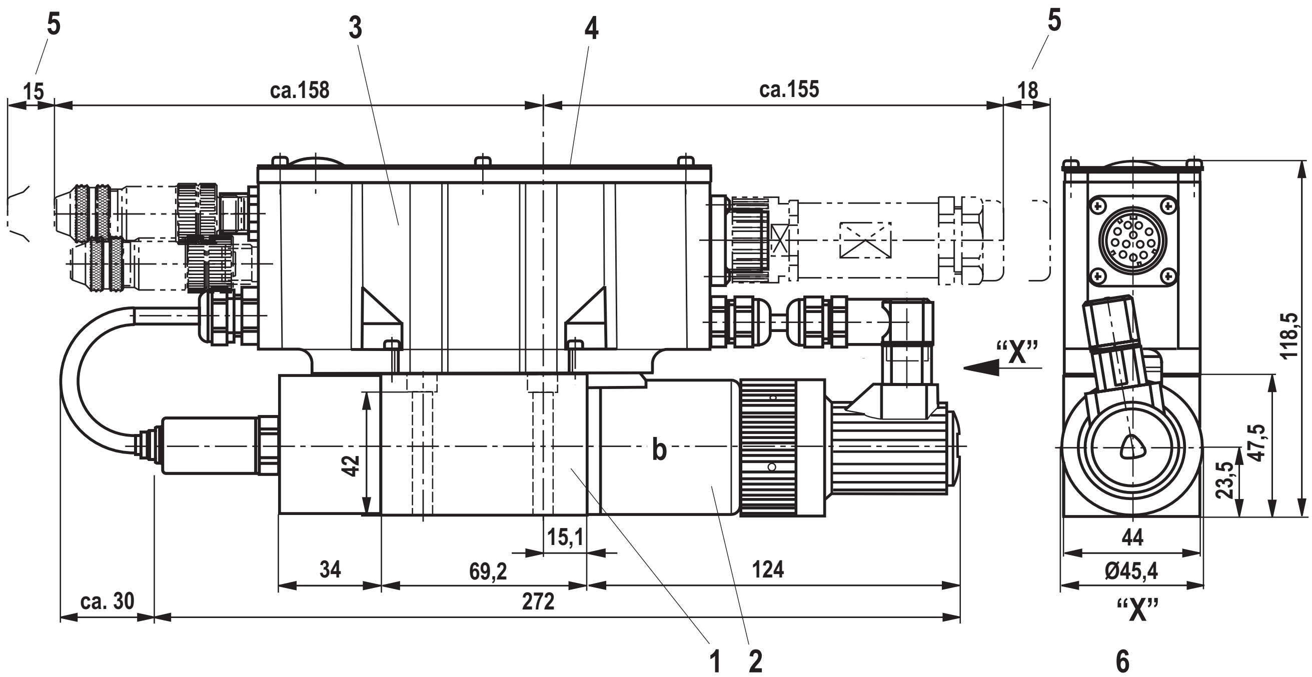
Position-controlled (P → A)

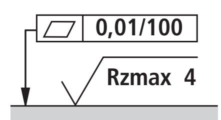


Position-controlled (B → T)

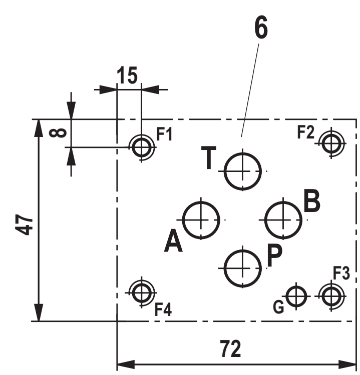


Dimensions: Size 6 (“0195”)
(dimensions in mm)





Required surface quality
of the valve contact surface

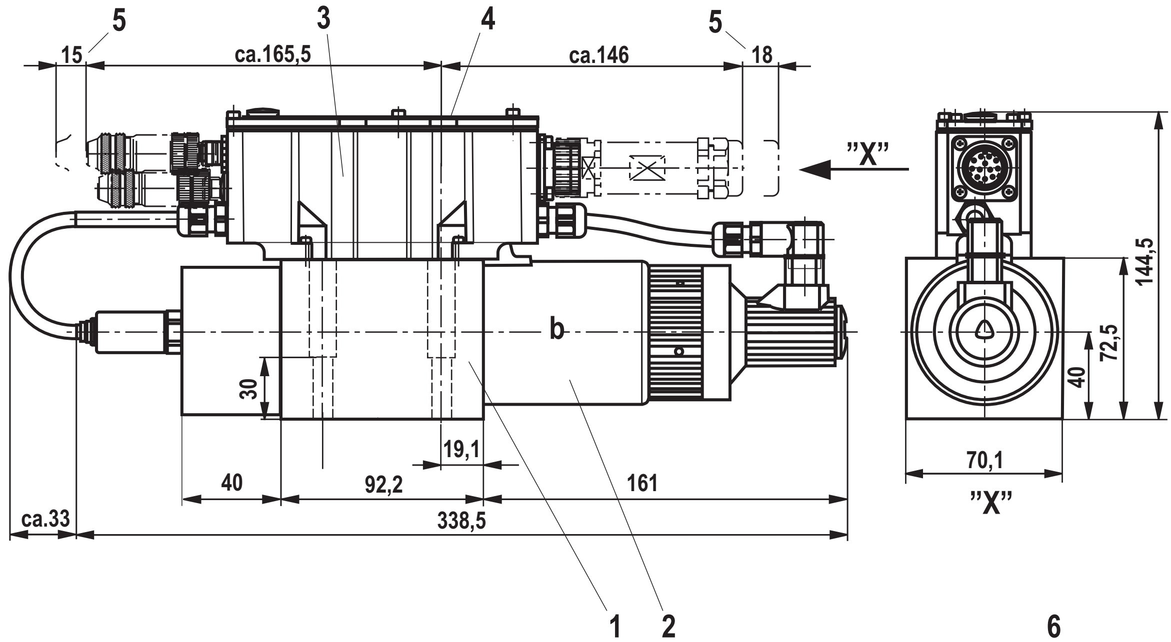


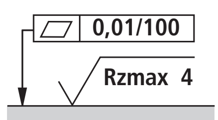
- **1** Valve housing
- **2** Proportional solenoid “b” with inductive position transducer
- **3** Integrated digital control electronics
- **4** Name plate
- **5** Space required to remove the connector
- **6** Machined valve contact surface
  porting pattern according to ISO 4401-03-02-0-05
  Deviating from the standard:
  - ▶ Ports P, A, B and T with Ø 8 mm
  - ▶ Locating pin not available

Note:
The dimensions are nominal dimensions which are subject to tolerances.

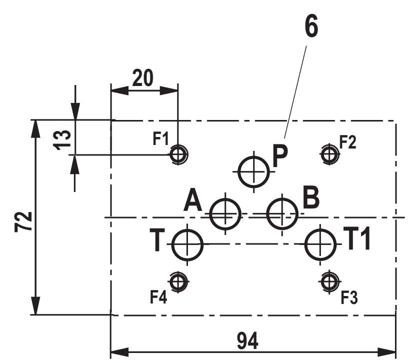
Subplates and valve mounting screws see page 13.

Dimensions: Size 10 (“0196”)
(dimensions in mm)





Required surface quality of the
valve contact surface



1 Valve housing
2 Proportional solenoid “b” with inductive position transducer
3 Integrated digital control electronics
4 Name plate
5 Space required to remove the connector
6 Machined valve contact surface
Porting pattern in accordance with ISO 4401-05-04-0-05
Deviating from the standard:
Port T1 exists additionally

Note:
The dimensions are nominal dimensions which are subject to tolerances.

Subplates and valve mounting screws see page 13.

Dimensions

Valve mounting screws (separate order)

Size	Hexagon socket head cap screws	Material number
6 (“0195”)	**4 hexagon socket head cap screws ISO 4762 - M5 x 50 - 10.9-flZn-240h-L** tightening torque M_A = 7 Nm ± 10%	**R913000064**
	4 hexagon socket head cap screws ISO 4762 - M5 x 50 Tightening torque M_A = 8.9 Nm ± 10%	Not in the Rexroth delivery range
10 (“0196”)	**4 hexagon socket head cap screws ISO 4762 - M6 x 40 - 10.9-flZn-240h-L** tightening torque M_A = 12.5 Nm ± 10%	**R913000058**
	4 hexagon socket head cap screws ISO 4762 - M6 x 40 - 10.9 tightening torque M_A = 15.5 Nm ± 10%	Not in the Rexroth delivery range

☞ **Notice:**
The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure.

Subplates (separate order)

Size	Data sheet	Material number
6 (“0195”)	45052	–
10 (“0196”)	45054	–

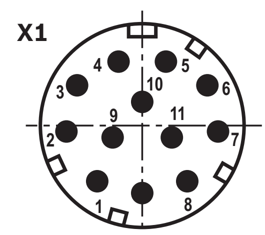
Electrical connections, assignment

Connector pin assignment X1, 11-pole + PE according to DIN EN 175201-804

Pin	Core marking 1)	Interface A6 allocation	Allocation Interface F6
1	1	24 VDC (u(t) = 19.4 V ... 35 V), $\boldsymbol{I}_{max}$ = 1.7 A (for output stage)	
2	2	0 V ≙ load zero, reference for pins 1 and 9	
3	white	enable input 9 ... 35 V ≙ enable on	
4	yellow	± 10 V command value ***Q***, $\boldsymbol{R}_e$ > 50 kΩ	4 ... 20 mA command value ***Q***, $\boldsymbol{R}_e$ = 100 Ω
5	green	Reference for command values ***Q*** and ***p***	
6	purple	± 10 V actual value ***Q***	4 ... 20 mA actual value ***Q*** (load resistance max. 300 Ω)
7	pink	0 ... 10 V command value ***p***, $\boldsymbol{R}_e$ > 50 kΩ	4 ... 20 mA command value ***p***, $\boldsymbol{R}_e$ = 100 kΩ
8	red	0 ... 10 V actual value ***p***	4 ... 20 mA actual value ***p*** (load resistance max. 300 Ω)
9	brown	Control voltage, level as pin 1, $\boldsymbol{I}_{max}$ = 0.3 A (for signal part and bus)	
10	black	0 V reference potential for pins 3, 6, 8 and 11 (connected with pin 2 in valve)	
11	blue	Error output 24 V (19.4 V ... 35 V), 200 mA max. load	
PE	green-yellow	Connected to cooling element and valve housing	

☞ **Notice:**
Connect shield to PE only on the supply side.

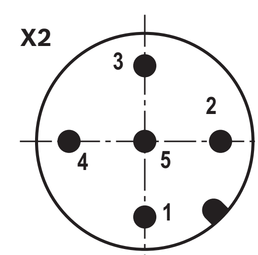
1) Litz wire colors of the connection line for mating connector with cable set (see accessories page 17)



Connector pin assignment X2, CAN bus, (coding A), M12 x 1, 5-pole, pins

Pin	Assignment
1	n.c.
2	n.c.
3	CAN_GND
4	CAN_H
5	CAN_L

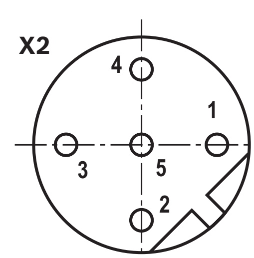
Transmission rate 20 ... 1000 kBit/s
Bus address 1 ... 127
CAN-specific settings:
Baud rate and identifier must be set via the bus system.



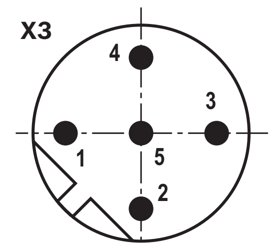
Connector pin assignment for Profibus DP, “X2” / “X3” (coding B), M12 x 1, 5-pole, socket / pins

Pin	Assignment
1	+5V
2	RxD/TxD-N (A line)
3	D GND
4	RxD/TxD-P (B line)
5	Shield

Transmission rate up to 12 MBaud
Bus address 1 ... 126
Setting via DIL switch



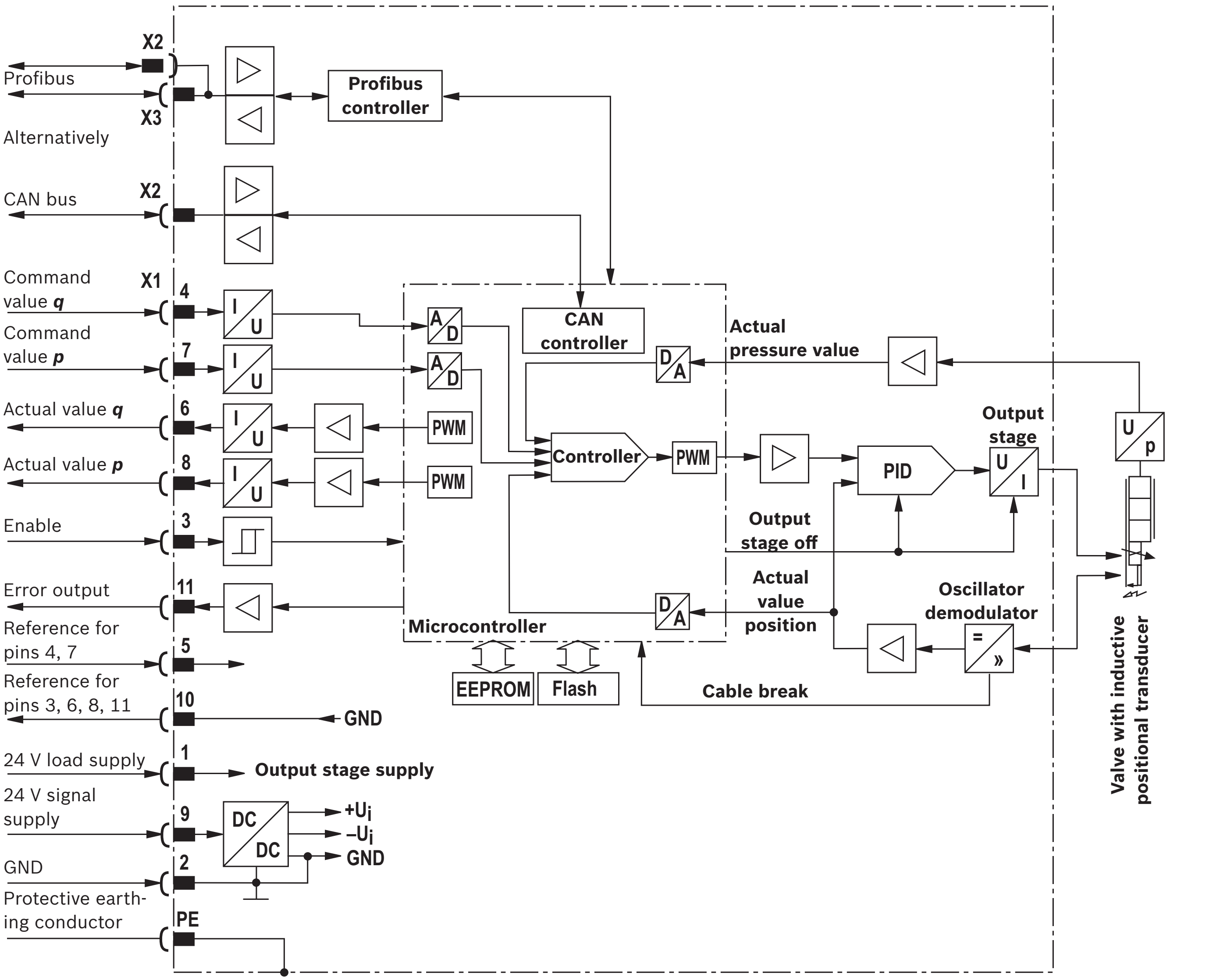
The +5V voltage of the IAC-P is available for an external terminating resistor.



☞ **Notice:**
We recommend connecting the shields on both sides via the metal housings of the plug-in connectors.
Using connector pins will affect the shielding effect! Internal screens are not required.

Electrical connections, assignment

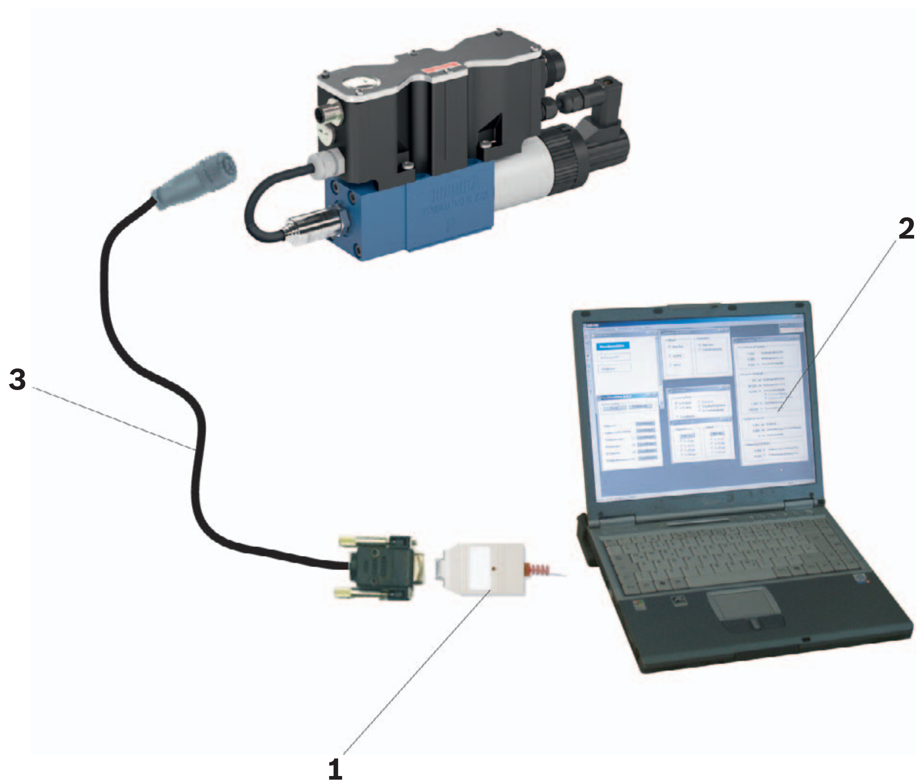
Block diagram, integrated control electronics



Command value	Command value 12 to 20 mA at pin 4 and reference potential at pin 5 result in flow from P → A.
	Command value 4 to 12 mA at pin 4 and reference potential at pin 5 result in flow from A → T.
Actual value	Actual value 12 to 20 mA at pin 6 and reference potential at pin 10 result in flow from P → A.
	Actual value 4 to 12 mA at pin 6 and reference potential at pin 10 result in flow from A → T.
Connection line (recommended):	▶ up to 25 m line length for pins 1, 2 and PE: 0.75 mm²,, otherwise 0.25 mm² ▶ up to 50 m line length for pins 1, 2 and PE: 1.00 mm² External diameter see sketch of mating connector

Accessories (separate order)

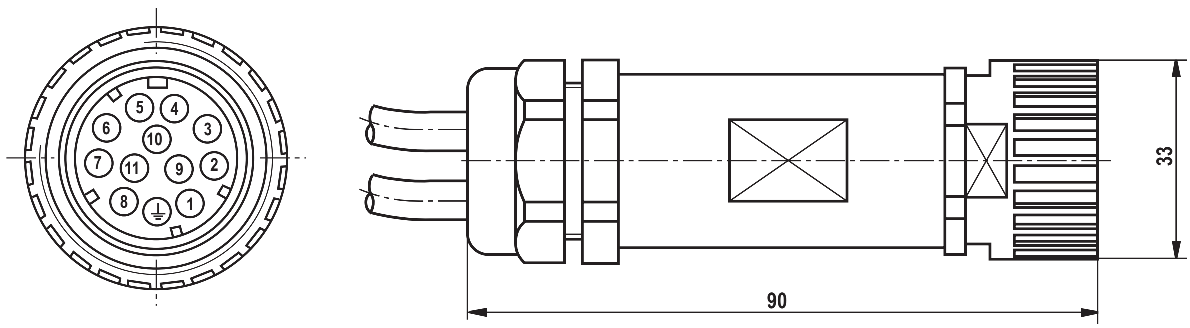
The following is required for the parameterization via PC:	**CANopen**	**Profibus DP**
1 interface converter (USB)	VT-ZKO-USB/CA-1-1X/V0/0 Material no.: **R901071963**	VT-ZKO-USB/P-1-1X/V0/0 Material no.: **R901071962**
2 Commissioning software	WINPED	
3 Connection cable, 3 m	D-Sub / M12, coding A Material no.: **R900751271**	D-Sub / M12, coding B Material no.: **R901078053**



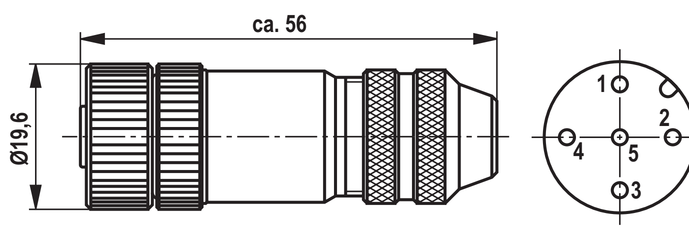
Accessories (separate order)

Port X1

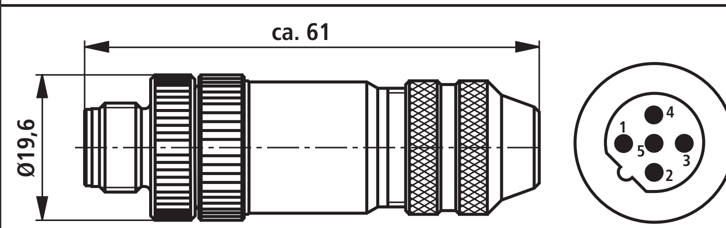
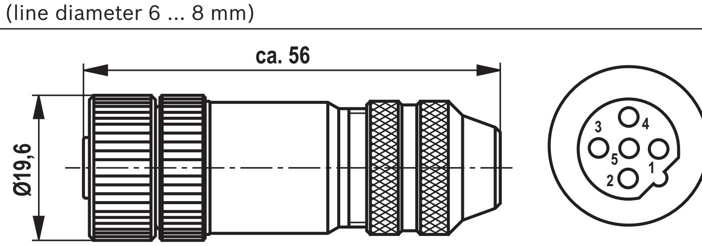
Mating connector for X1	Dimensions	Material number
Mating connector according to DIN EN 17520-804 (11-pole + PE), plastic variant	Without cable (assembly kit)	**R900884671**
	With cable set 2 x 5 m 12-pole	**R900032356**
	With cable set 2 x 20 m 12-pole	**R900860399**



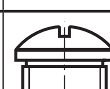
CAN bus (A coding)

Plug-in connector for X2	View, dimensions	Material number
Round connector, processable, 5-pole, M12 x 1 Straight mating connector in metal design	 (line diameter 6 ... 8 mm)	**R901076910**

Profibus (B coding)

Plug-in connector for X2 and X3	View, dimensions	Material number
X2 Round connector, processable, 5-pole, M12 x 1 Straight mating connector in metal design	 (line diameter 6 ... 8 mm)	**R901075545**
X3 Round connector, processable, 5-pole, M12 x 1 Straight mating connector in metal design	 (line diameter 6 ... 8 mm)	**R901075550**

Protective cap

Protective cap M12	Version	Material number
		**R901075563**

Project planning and maintenance instructions

- Connect the valve to the supply voltage only when this is required for the functional processes of the machine.
- Do not use electrical signals provided via control electronics (e.g. “No error” signal) for switching safety-relevant machine functions (see also EN ISO 13849 “Safety of machinery – safety-related parts of control systems”).
- If electro-magnetic interference must be expected, take appropriate measures to ensure the function (depending on the application, e.g. shielding, filtration).
- The devices have been tested in the plant and are supplied with default settings.
- Only complete units can be repaired. Repaired devices are returned with default settings. User-specific settings are not maintained. The machine end-user will have to retransfer the corresponding user parameters.

Further information

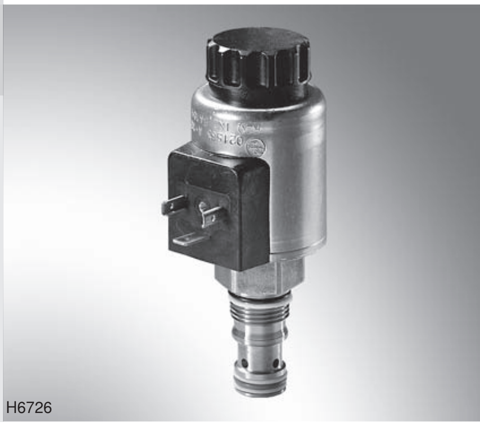
▶ Subplates	Data sheets 45052, 45054
▶ Hydraulic fluids on mineral oil basis	Data sheet 90220
▶ Environmentally compatible hydraulic fluids	Data sheet 90221
▶ Flame-resistant, water-free hydraulic fluids	Data sheet 90222
▶ Hydraulic valves for industrial applications	Data sheet 07600-B
▶ Assembly, commissioning and maintenance of hydraulic systems	Data sheet 07900
▶ CANopen protocol for IFB-P and IAC-P valves, protocol description	Data sheet 29015-01-Z
▶ Profibus protocol for IFB and IAC-P valves, protocol description	Data sheet 29015-02-Z
▶ Proportional directional valves with field bus interface, with and without integrated axis controller (IAC-P and IFB-P), operating instructions	Data sheet 29015-B
▶ Commissioning software and documentation on the Internet	
▶ Selection of the filters	

Rexroth
Bosch Group

2/2 proportional directional valve, direct operated

Type KKDS (High Performance)

Component size 1
Component series B
Maximum operating pressure 350 bar
Maximum flow 38 l/min



H6726

Table of contents

Features

– Cartridge valve
– Mounting cavity R/T-13A
– Direct operated proportional valve for controlling the flow size
– Operation by means of proportional solenoid with central thread and detachable coil
– Rotatable solenoid coil
– Free-flowing in both directions
– With concealed manual override, optional

– Control electronics:	Data sheet
• Plug-in proportional amplifier type VT-SSPA1…	30116
• Analog amplifier type RA…	95230

Ordering code

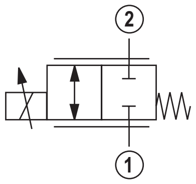
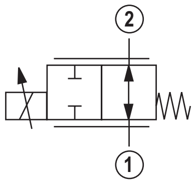
KKDS	R	1		B / H	C				V	*

Proportional directional valve, direct operated

Maximum operating pressure 350 bar = **R**

Component size = **1**

2 main ports

Symbols			
		normally closed	= **N**
		normally open	= **P**

Component series = **B**

High Performance and mounting cavity R/T-13A (see page 10) = **H**

C = Proportional solenoid, wet-pin

Supply voltage

G24 = Control electronics 24 V DC

G12 = Control electronics 12 V DC

N0 = **Without** manual override

N9 = **With** concealed manual override

Electrical connection [1)]

K4 = Without mating connector, with connector according to DIN EN 175301-803

K40 = Without mating connector, with connector DT 04-2PA (Deutsch plug)

C4 = Without mating connector, with connector AMP Junior-Timer

Seal material

V = FKM seals

Attention! Observe compatibility of seals with hydraulic fluid used!

Further details in the plain text

[1)] Mating connectors, separate order, see data sheet 08006

Preferred types

Type	Material no.
KKDSR1NB/HCG24N0K4V	R901023172
KKDSR1PB/HCG24N0K4V	R901024015
KKDSR1NB/HCG12N0K4V	R901024009
KKDSR1PB/HCG12N0K4V	R901024034

Function, cross-sections, symbols

General

The 2/2 proportional directional valve is a direct operated cartridge spool valve. It steplessly controls the flow from main port ① to ② and from ② to ① in proportion to the input signal.

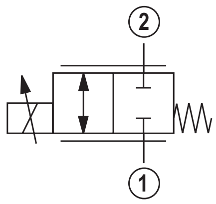
The valve basically consists of a bushing (6) with male thread for the mounting cavity, a socket (3), a control spool (5) with compression spring (8) as well as of a proportional solenoid (7) with central thread and removable coil.

Function (version "N" – normally closed)

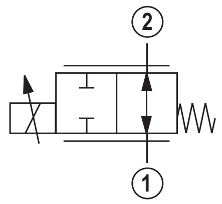
When the solenoid (7) is de-energized, the control spool (5) that is always pressure-compensated in relation to the actuating forces due to its constructive design, is held in the initial position by the compression spring (8) and blocks the flow between main port ① and ②. When the solenoid (7) is energized, the control spool (5) is adjusted directly – in proportion to the electrical input signal – and connects main port ① and ② via orifice-like cross-sections in the spool with progressive flow characteristics. When the solenoid (7) is de-energized, the compression spring (8) returns the control spool (5) to the initial position.

The manual override (4) allows for the switching of the valve without solenoid energization.

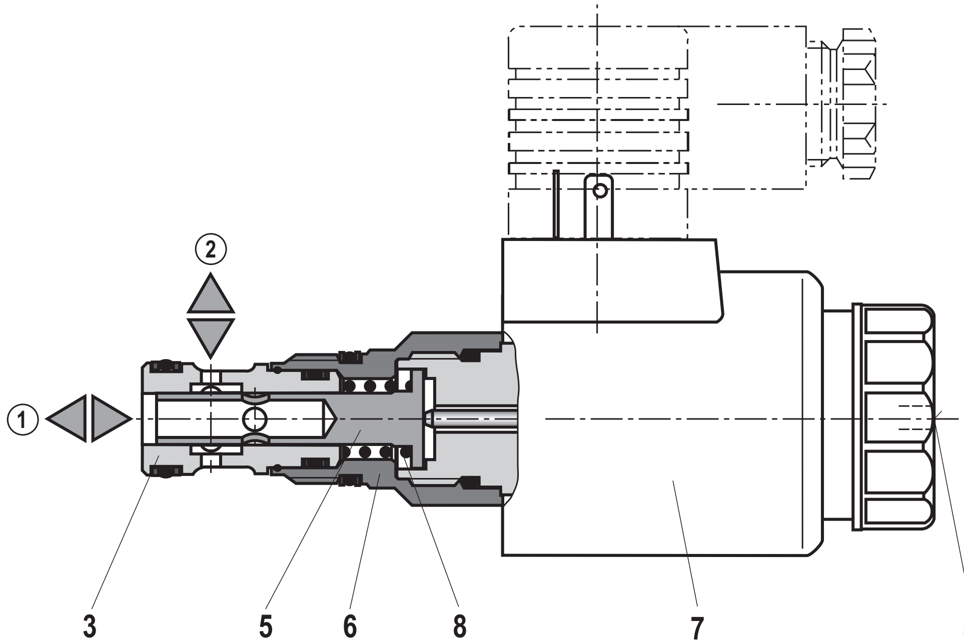
Symbol "N" – normally closed



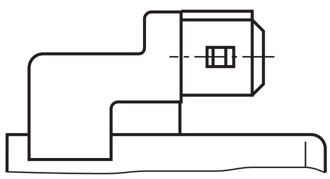
Symbol "P" – normally open



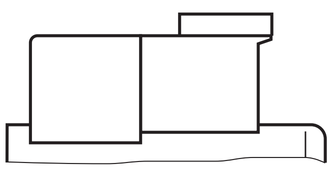
Version "K4"
(with mating connector)



Version "C4"



Version "K40"



Type KKDSR1NB/HC.N9K4V

Technical data (For applications outside these parameters, please consult us!)

general

Weight		kg	0.66
Installation position			Any - if it is ensured that no air can collect upstream of the valve. Otherwise, we recommend that the valve be mounted in a suspended position.
Ambient temperature range		°C	–40 to +100 (see minimum terminal voltage page 8)
Storage temperature range		°C	–20 to +80

Environmental audits

Salt spray test according to DIN 50021		h	720
Surface protection proportional solenoid			Coating according to DIN 50962-Fe//ZnNi with thick film passivation

hydraulic

Maximum operating pressure		bar	350
Maximum flow	– Symbol "N"	l/min	38 (①→ ②), 34 (② → ①); other flows upon request!
	– Symbol "P"	l/min	32 (①→ ②), 45 (② → ①)
Leakage		ml/min	< 30 (at $\Delta \boldsymbol{p}$ = 100 bar in ①; HLP46, ϑ_{oil} = 40 °C)
Step response	0 to 100 %; 100 to 0 %	ms	< 65 (at $\boldsymbol{p}_S$ = 10 bar)
Hydraulic fluid			See table page 5
Hydraulic fluid temperature range		°C	–40 to +100 (preferably +40 to +50)
Viscosity range		mm^2/s	5 to 400 (preferably 10 to 100)
Maximum admissible degree of contamination of the hydraulic fluid cleanliness class according to ISO 4406 (c)			Class 20/18/15 [1]
Hysteresis [2]		%	≤ 5
Range of inversion [2]		%	≤ 2
Response sensitivity [2]		%	≤ 1
Load cycles			2 million

[1] The cleanliness classes specified for the components must be complied with in hydraulic systems. An effective filtration prevents faults and at the same time increases the service life of the components.

[2] Measured with analog amplifier type RA2-1/10, see data sheet 95230

Technical data (For applications outside these parameters, please consult us!)

hydraulic

Hydraulic fluid		Classification	Suitable sealing materials	Standards
Mineral oils and related hydrocarbons		HL, HLP, HLPD, HVLP, HVLPD	FKM	DIN 51524
Environmentally compatible	– Insoluble in water	HEES	FKM	ISO 15380
		HEPR	FKM	
	– Soluble in water	HEPG	FKM	ISO 15380
Flame-resistant	– Water-free	HFDU, HFDR	FKM	ISO 12922
	– Water-containing	HFAS	FKM	ISO 12922

Important information on hydraulic fluids!

- For more information and data on the use of other hydraulic fluids, refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, service life, maintenance intervals, etc.)!
- The flash point of the process and operating medium used must be 40 K higher than the maximum solenoid surface temperature.
- **Flame-resistant – water-containing**: Maximum pressure differential per control edge 175 bar, otherwise increased cavitation erosion!
  Tank pre-loading < 1 bar or > 20 % of the pressure differential. The pressure peaks should not exceed the maximum operating pressures!
- **Environmentally compatible:** When using environmentally compatible hydraulic fluids that are simultaneously zinc-solving, zinc may accumulate in the medium (700 mg zinc per pole tube).

electric

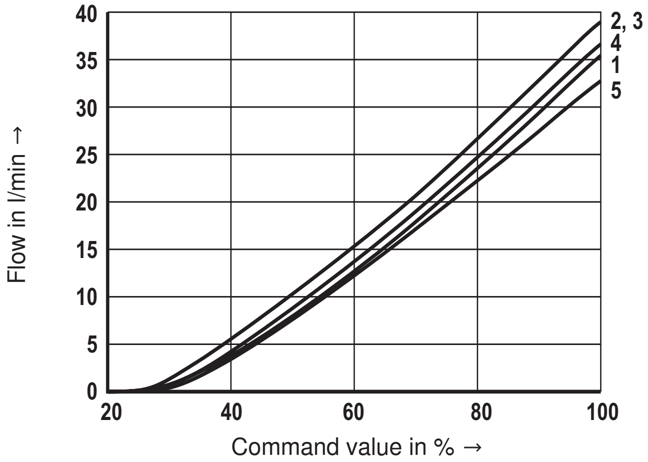
Voltage type			Direct voltage DC	
Supply voltage		V	12	24
Maximum solenoid current		A	1.8	1.2
Coil resistance	– Cold value at 20 °C	Ω	3.3	7.2
	– Max. hot value	Ω	5.0	10.8
Duty cycle		%	100 (see minimum terminal voltage page 8)	
Maximum coil temperature [3]		°C	150	
Protection class according to DIN EN 60529	– Version "K4"		IP 65 with mating connector mounted and locked	
	– Version "K40"		IP 69K with mating connector mounted and locked	
	– Version "C4"		IP 66 with mating connector mounted and locked	
			IP 69K with Rexroth mating connector (material no. R901022127)	
Control electronics (separate order)			– Plug-in proportional amplifier type VT-SSPA1…, see data sheet 30116 – Analog amplifier type RA ..., see data sheet 95230	
Design according to VDE 0580				

[3] Due to the surface temperatures of the solenoid coils, the standards ISO 13732-1 and EN 982 are to be observed!

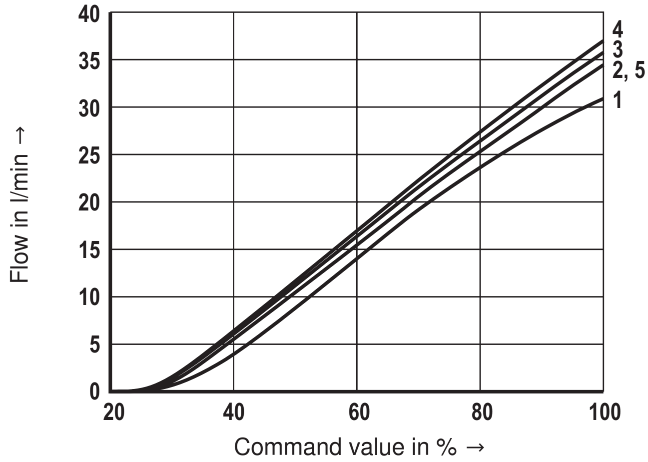
When establishing the electrical connection, the protective earthing conductor (PE ⏚) is to be connected properly.

Characteristic curves (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C)

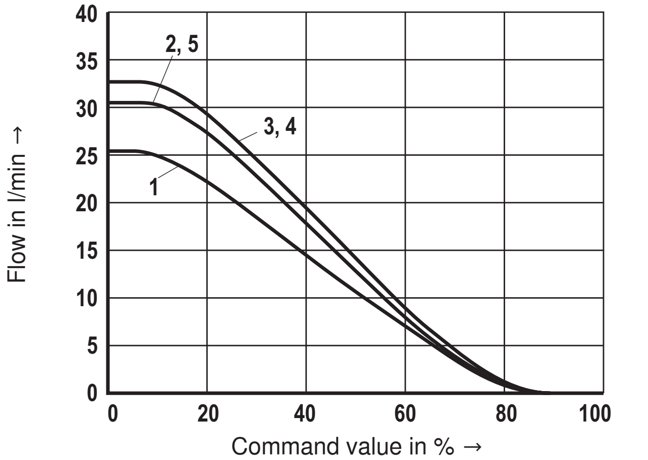
Direction of flow ① → ②
Symbol "N"



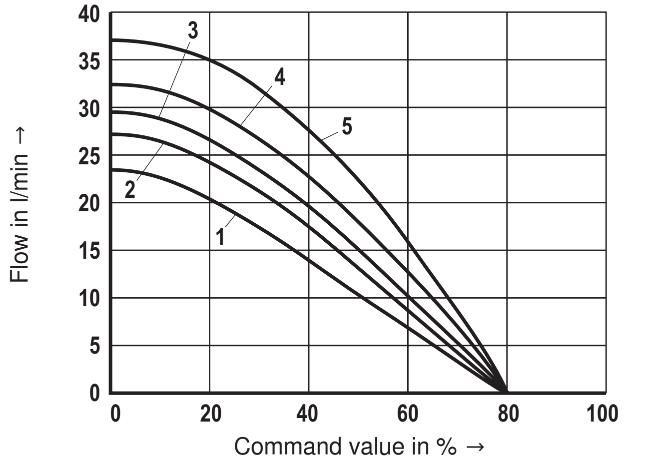
Direction of flow ② → ①
Symbol "N"



Direction of flow ① → ②
Symbol "P"



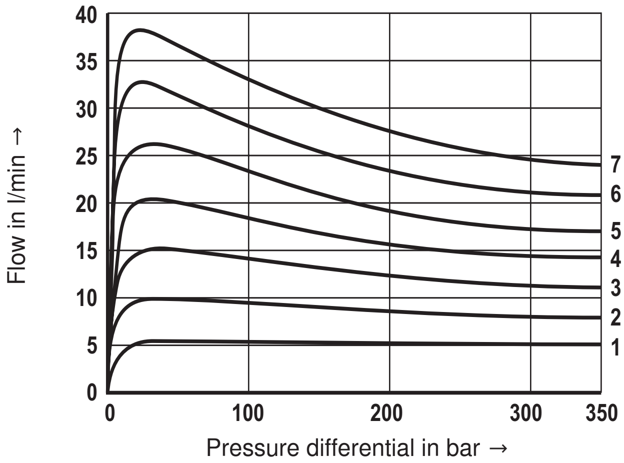
Direction of flow ② → ①
Symbol "P"



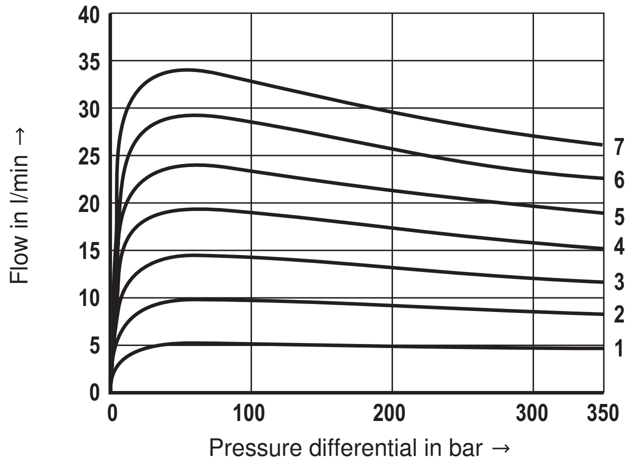
1 ***Δp*** = 10 bar constant
2 ***Δp*** = 20 bar constant
3 ***Δp*** = 30 bar constant
4 ***Δp*** = 50 bar constant
5 ***Δp*** = 100 bar constant

Performance limits (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C)

Direction of flow ①→ ②
Symbol "N"

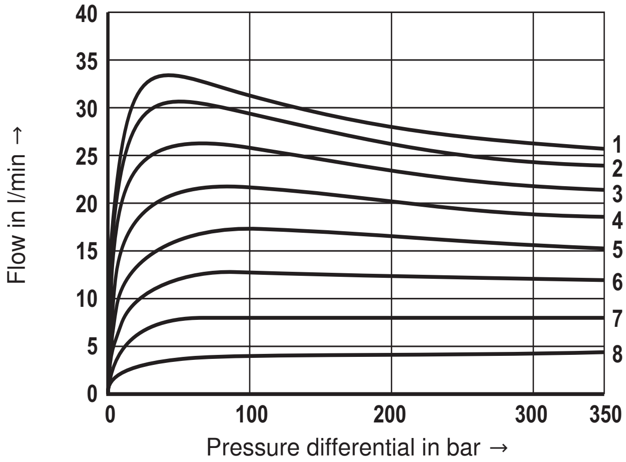


Direction of flow ② → ①
Symbol "N"

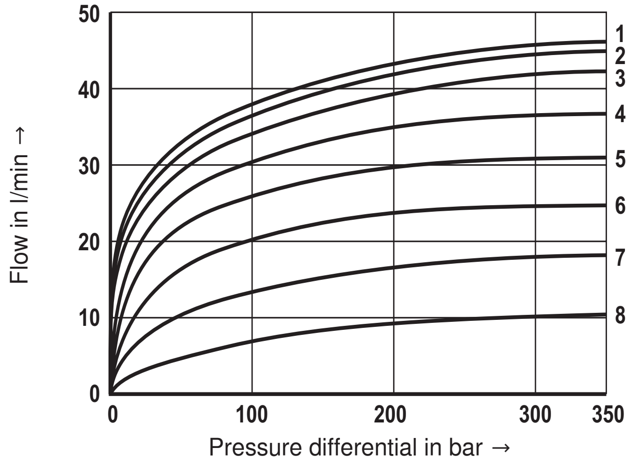


- **1** Command value = 40 %
- **2** Command value = 50 %
- **3** Command value = 60 %
- **4** Command value = 70 %
- **5** Command value = 80 %
- **6** Command value = 90 %
- **7** Command value = 100 %

Direction of flow ①→ ②
Symbol "P"



Direction of flow ② → ①
Symbol "P"

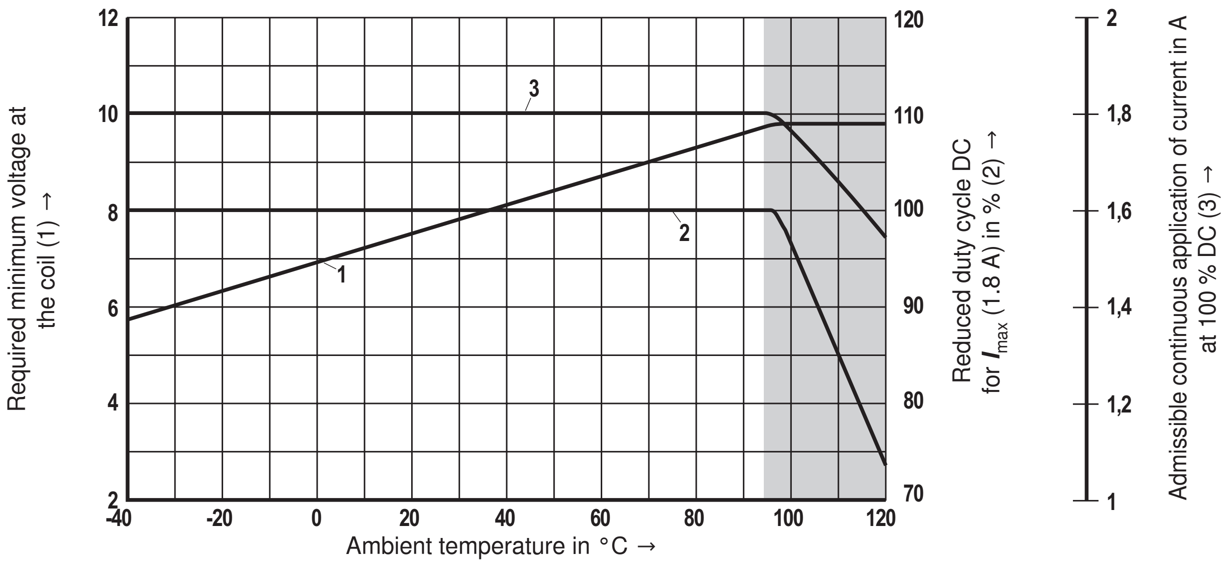


- **1** Command value = 0 %
- **2** Command value = 10 %
- **3** Command value = 20 %
- **4** Command value = 30 %
- **5** Command value = 40 %
- **6** Command value = 50 %
- **7** Command value = 60 %
- **8** Command value = 70 %

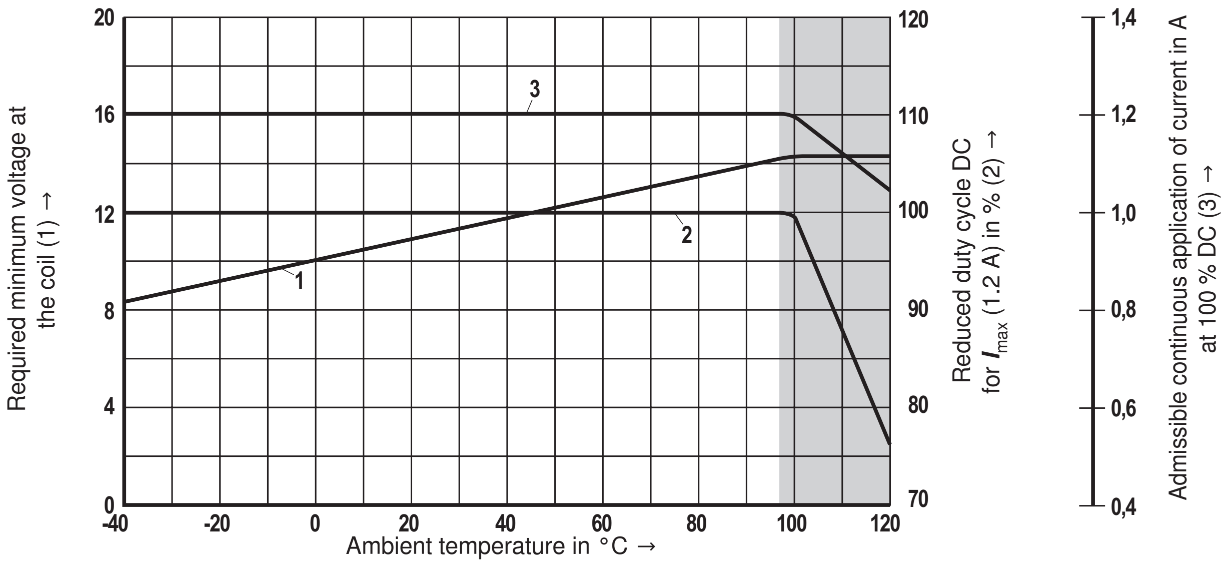
Minimum terminal voltage at the coil and relative duty cycle

Admissible working range depending on the ambient temperature

– Version "G12"



– Version "G24"



Limited valve performance

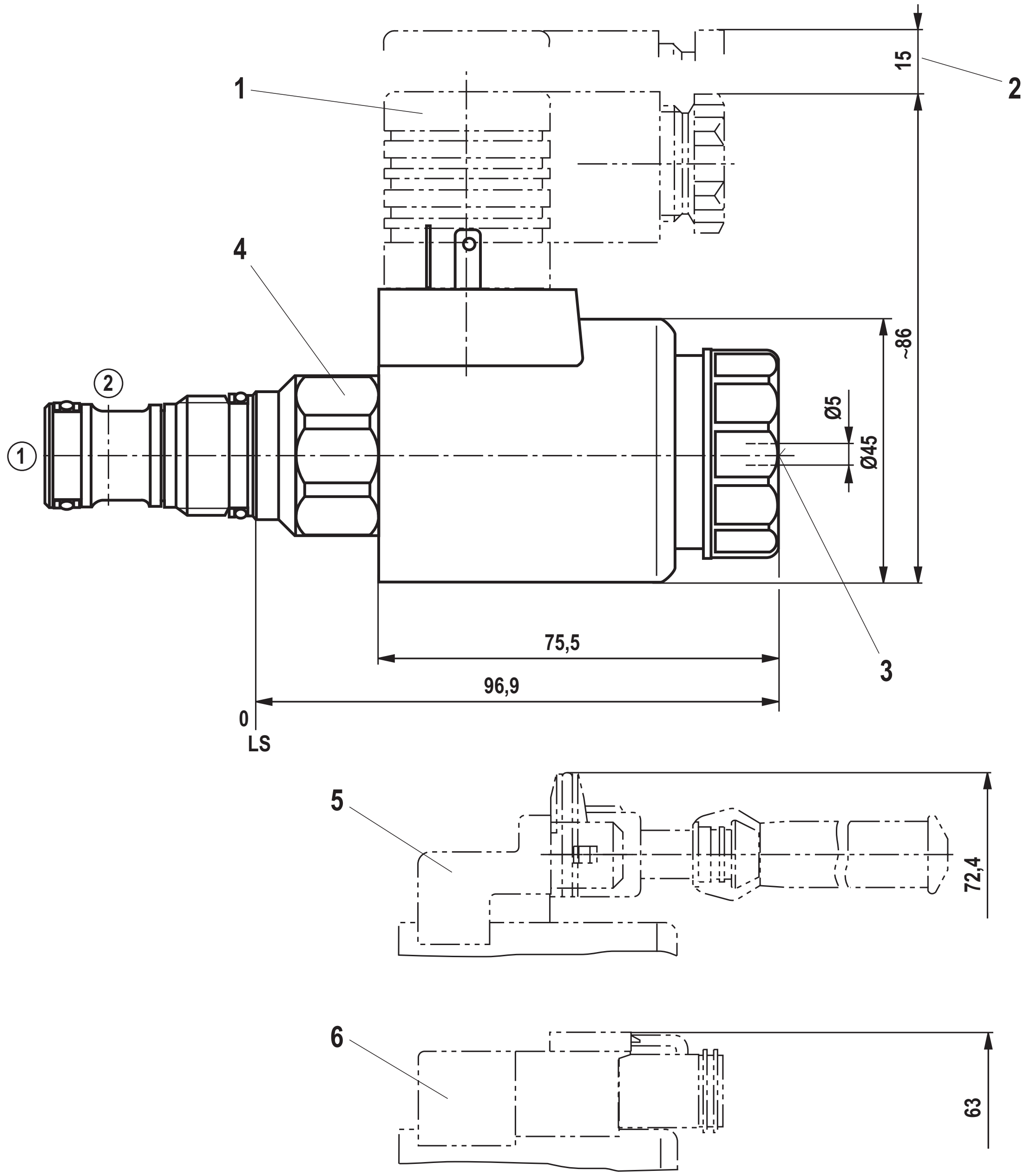
Notice!

The characteristic curves have been determined for coils with valve and medium test block size (80 x 80 x 80 mm), without flow in calm air.

Depending on the installation conditions (block size, flow, air circulation, etc.), there may be a better heat dissipation. This results in an increased area of application.

In single cases, more unfavorable conditions may lead to limitations of the area of application.

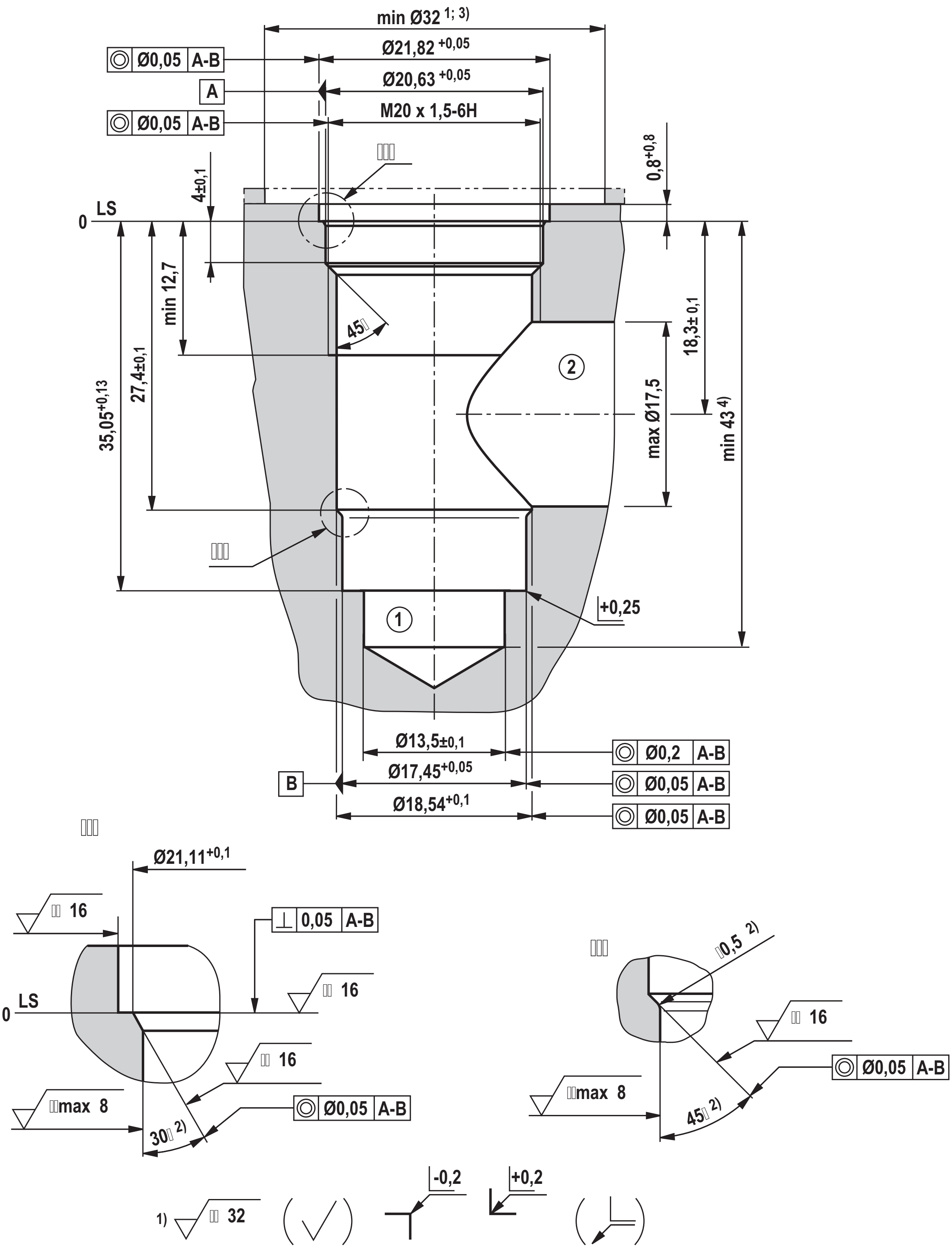
Unit dimensions (dimensions in mm)



① = Main port 1
② = Main port 2
LS = Location Shoulder

1 Mating connector without circuitry for connector "K4" (separate order, see data sheet 08006)
2 Space required for removing the mating connector
3 Concealed manual override "N9"
4 SW27, tightening torque M_A = 45 to 50 Nm
5 Mating connector for connector "C4" (separate order, see data sheet 08006)
6 Mating connector for connector "K40" (separate order, see data sheet 08006)

Mounting cavity R/T-13A[1]; 2 main ports; thread M20 x 1.5 (dimensions in mm)



[1] Differing from T-13A

[2] All seal ring insertion faces are rounded and free of burrs

[3] With counterbore

[4] Depth for moving parts

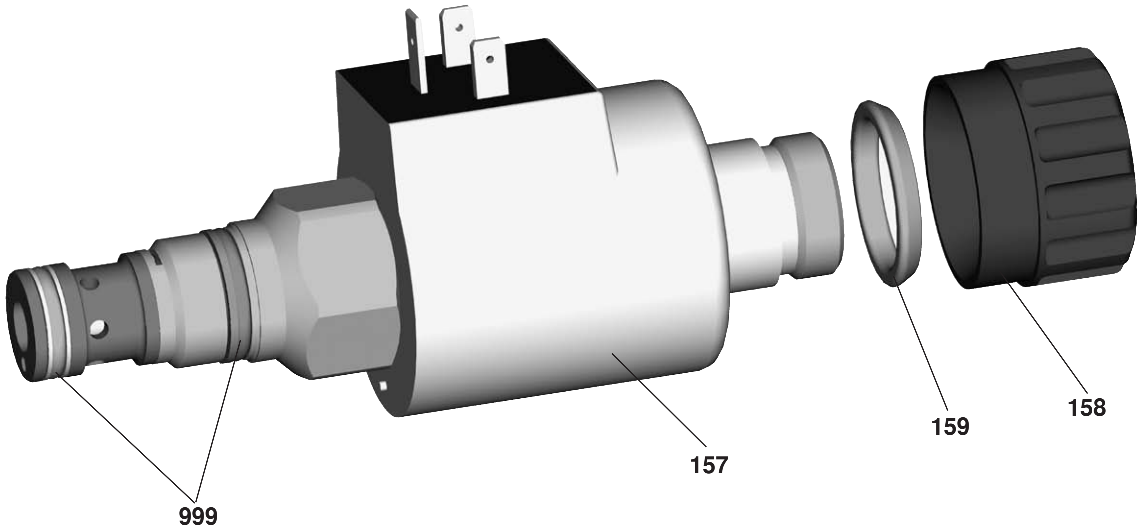
1 = Main port 1

2 = Main port 2

LS = Location Shoulder

Tolerance for all angles ±0.5°

Available individual components



Item	Denomination		Direct voltage	Material no.
157	Coil for individual connection	Version "K4"	12 V	R901022180
			24 V	R901022174
		Version "K40"	12 V	R901272648
			24 V	R901272647
		Version "C4"	12 V	R901022680
			24 V	R901022683
158	Nut			R900029574
159	O-ring for pole tube			R900071532
999	Seal kit of the valve			R900733593

2/2 proportional directional valve, direct operated

RE 18139-09/12.11
Replaces: 04.09

Type KKDS (High Performance)

Component size 2
Component series A
Maximum operating pressure 350 bar
Maximum flow 58 l/min

H7568

Table of contents

Features

– Cartridge valve
– Mounting cavity R/T-5A
– Direct operated proportional valve for controlling the flow size
– Operation by means of proportional solenoid with central thread and detachable coil
– Rotatable solenoid coil
– With concealed manual override, optional

– Control electronics:	Data sheet
• Proportional plug-in amplifier type VT-SSPA1…	30116
• Analog amplifier type RA…	95230

Ordering code

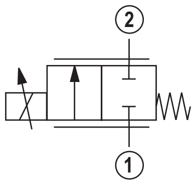
KKDS	R	2	N	A /	H	C				V	*

Proportional directional valve, direct operated

Maximum operating pressure 350 bar = R

Component size = 2

2 main ports

Symbol			
Symbol		Normally closed	= N

Component series = A

High Performance and mounting cavity R/T-5A (see page 9) = H

Proportional solenoid, wet-pin = C

[1)] Mating connectors, separate order, see data sheet 08006

Further details in the plain text

Seal material

V = FKM seals

Attention!

Observe compatibility of seals with hydraulic fluid used!

Electrical connection [1)]

K4 = Without mating connector, with connector according to DIN EN 175301-803

K40 = Without mating connector, with connector DT 04-2PA (Deutsch plug)

C4 = Without mating connector, with connector AMP Junior-Timer

N0 = **Without** manual override

N9 = **With** concealed manual override

Supply voltage

G24 = Control electronics DC 24 V

G12 = Control electronics DC 12 V

Preferred types

Type	Material no.
KKDSR2NA/HCG24N9K4V	R901074596
KKDSR2NA/HCG12N9K4V	R901036359
KKDSR2NA/HCG24N9C4V	R901055340

Function, section, symbol

General

The 2/2 proportional directional valve is a direct operated cartridge spool valve. It regulates the flow proportionally to the input signal in a continuous form from main port ① to ②.

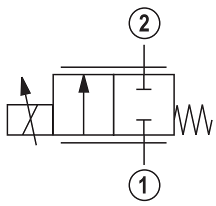
The valve basically comprises of a bushing (6) with male thread for the mounting cavity, socket (3), control spool (5) with compression spring (8) as well as proportional solenoid (7) with central thread and removable coil.

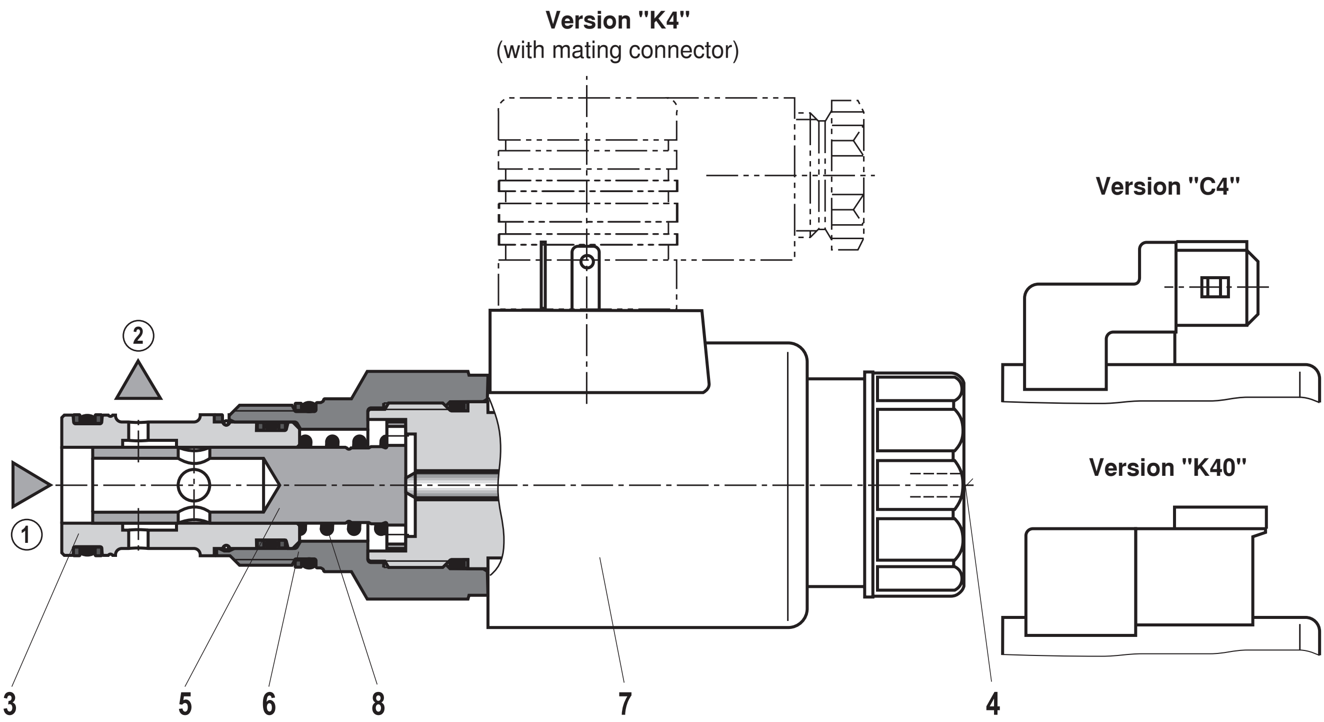
Function

With de-energized solenoid (7), the control spool (5) that is always pressure-compensated to the actuating forces due to its constructive design is held in the initial position by the compression spring (8) and blocks the flow between main port ① and ②. By energizing the solenoid (7), the control spool (5) is directly adjusted – proportional to the electric input signal – and, via orifice-like cross-sections with progressive flow characteristic in the spool, connects the main ports ① and ②. Upon de-excitation of the solenoid (7), the control spool (5) is brought back into the initial position by the compression spring (8).

The manual override (4) allows for the switching of the valve without solenoid energization.

Symbol





Type KKDSR2NA/HC.N9K4V

Technical data (For applications outside these parameters, please consult us!)

general

Weight	kg	0.84
Installation position		Any – if it is ensured that no air can collect upstream the valve. Otherwise, we recommend suspended installation of the valve.
Ambient temperature range	°C	–40 to +100 (see Minimum terminal voltage page 7)
Storage temperature range	°C	–20 to +80

Environmental audits

Salt spray test according to DIN 50021	h	720
Surface protection Proportional solenoid		Coating according to DIN 50962-Fe//ZnNi with thick layer passivation

hydraulic

Maximum operating pressure	bar	350
Maximum flow	l/min	58
Leakage	ml/min	< 60 (with $\Delta \boldsymbol{p}$ = 100 bar in 1; HLP46, ϑ_{oil} = 40 °C)
Step response 0 to 100 %; 100 to 0 %	ms	< 180 (with $\boldsymbol{p}_S$ = 10 bar)
Hydraulic fluid		See table page 5
Hydraulic fluid temperature range	°C	–40 to +100 (preferably +40 to +50)
Viscosity range	mm^2/s	5 to 400 (preferably 10 to 100)
Maximum permitted degree of contamination of the hydraulic fluid - cleanliness class according to ISO 4406 (c)		Class 20/18/15 [1)]
Hysteresis [2)]	%	≤ 5
Range of inversion [2)]	%	≤ 2
Response sensitivity [2)]	%	≤ 1
Load cycles		10 million

[1)] The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the service life of the components.

[2)] Measured with analog amplifier type RA2-1/10, see data sheet 95230.

Technical data (For applications outside these parameters, please consult us!)

hydraulic

Hydraulic fluid		Classification	Suitable sealing materials	Standards
Mineral oils and related hydrocarbons		HL, HLP, HLPD, HVLP, HVLPD	FKM	DIN 51524
Environmentally compatible	– Insoluble in water	HEES	FKM	ISO 15380
		HEPR	FKM	
	– Soluble in water	HEPG	FKM	ISO 15380
Flame-resistant	– Water-free	HFDU, HFDR	FKM	ISO 12922
	– Water-containing	HFAS	FKM	ISO 12922

Important information on hydraulic fluids!

- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, service life, maintenance intervals, etc.)!
- The flash point of the process and operating medium used must be 40 K higher than the maximum solenoid surface temperature.
- **Flame-resistant – water-containing:** Maximum pressure differential per control edge 175 bar, otherwise, increased cavitation erosion!
  Tank pre-loading < 1 bar or > 20 % of the pressure differential. Pressure peaks should not exceed maximum operating pressures!
- **Environmentally compatible:** When using environmentally compatible hydraulic fluids that are simultaneously zinc-solving, zinc may accumulate in the medium (700 mg zinc per pole tube).

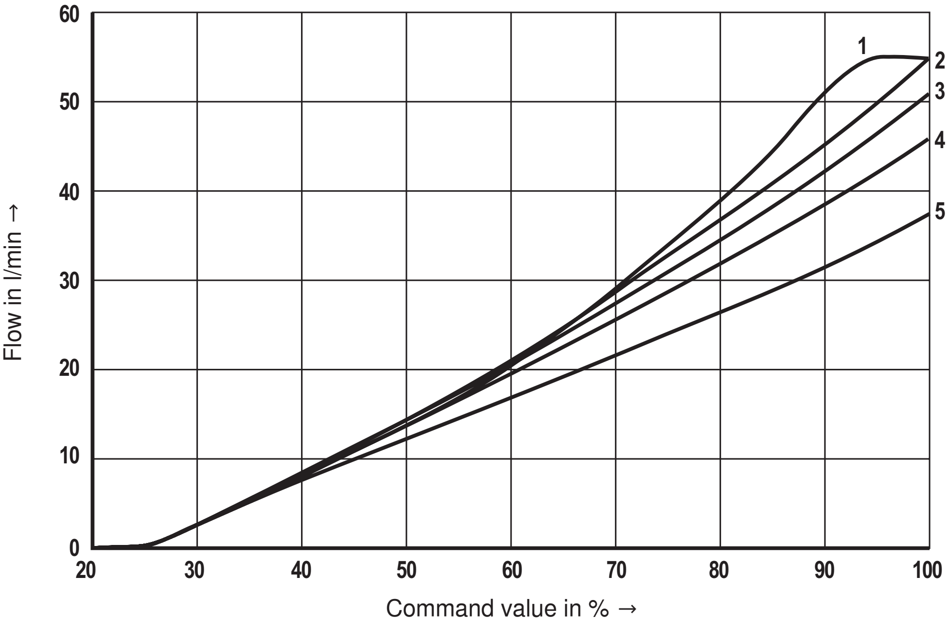
electric

Voltage type			Direct voltage (DC)	
Supply voltage		V	12	24
Maximum solenoid current		A	1.8	1.2
Coil resistance	– Cold value at 20 °C	Ω	3.3	7.2
	– Max. hot value	Ω	5.8	13.0
Switch-on duration		%	100 (see minimum terminal voltage page 7)	
Maximum coil temperature [3]		°C	150	
Protection class according to DIN EN 60529	– Version "K4"		IP 65 with mating connector mounted and locked	
	– Version "K40"		IP 69K with mating connector mounted and locked	
	– Version "C4"		IP 66 with mating connector mounted and locked	
			IP 69K with Rexroth mating connector (Material no. R901022127)	
Control electronics (separate order)			– Proportional plug-in amplifier type VT-SSPA1…, see data sheet 30116 – Analog amplifier type RA..., see data sheet 95230	
Design according to VDE 0580				

[3] Due to the surface temperatures of the solenoid coils, the standards ISO 13732-1 and EN 982 need to be adhered to!

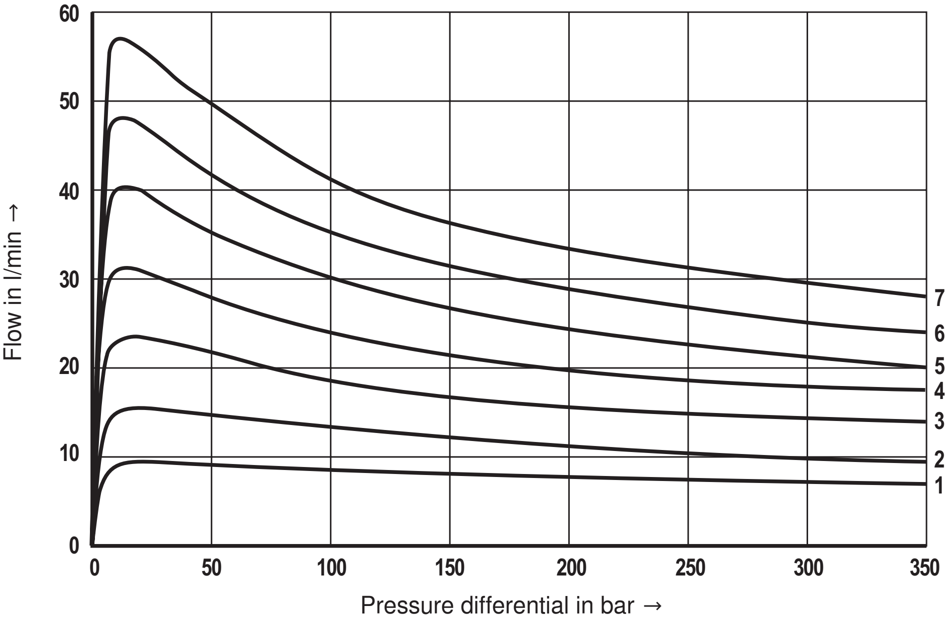
In the electrical connection, the protective earthing conductor (PE ⏚) must be connected properly.

Characteristic curves (measured with HLP46, ϑ_{oil} = 40 ± 5 °C)



1 Δp = 10 bar constant
2 Δp = 20 bar constant
3 Δp = 30 bar constant
4 Δp = 50 bar constant
5 Δp = 100 bar constant

Limits of performance (measured with HLP46, ϑ_{oil} = 40 ± 5 °C)

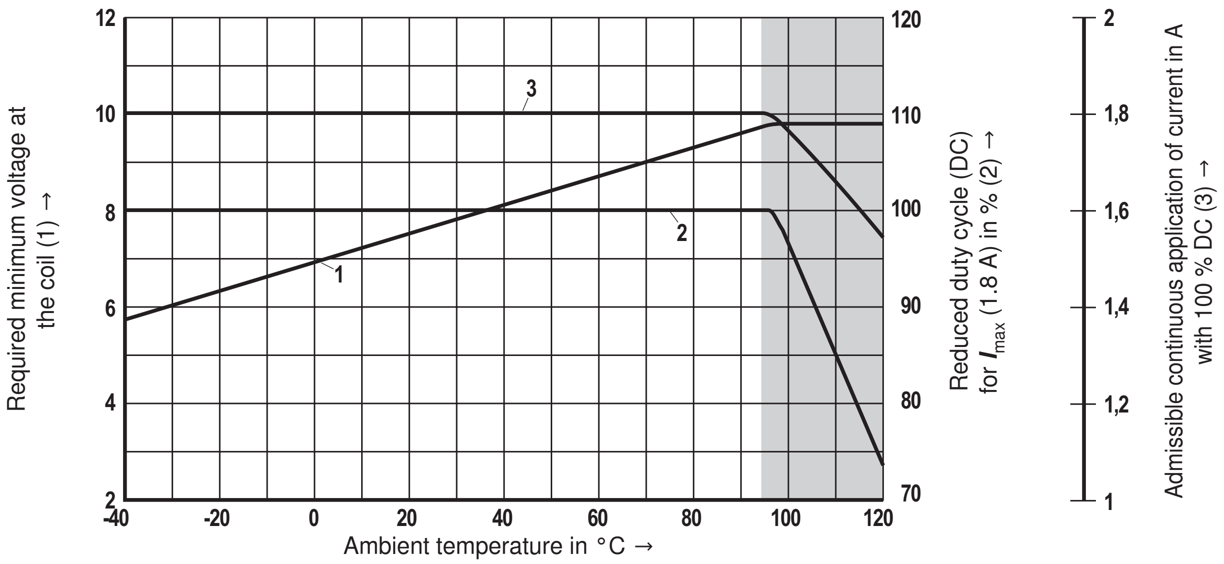


1 Command value = 40 %
2 Command value = 50 %
3 Command value = 60 %
4 Command value = 70 %
5 Command value = 80 %
6 Command value = 90 %
7 Command value = 100 %

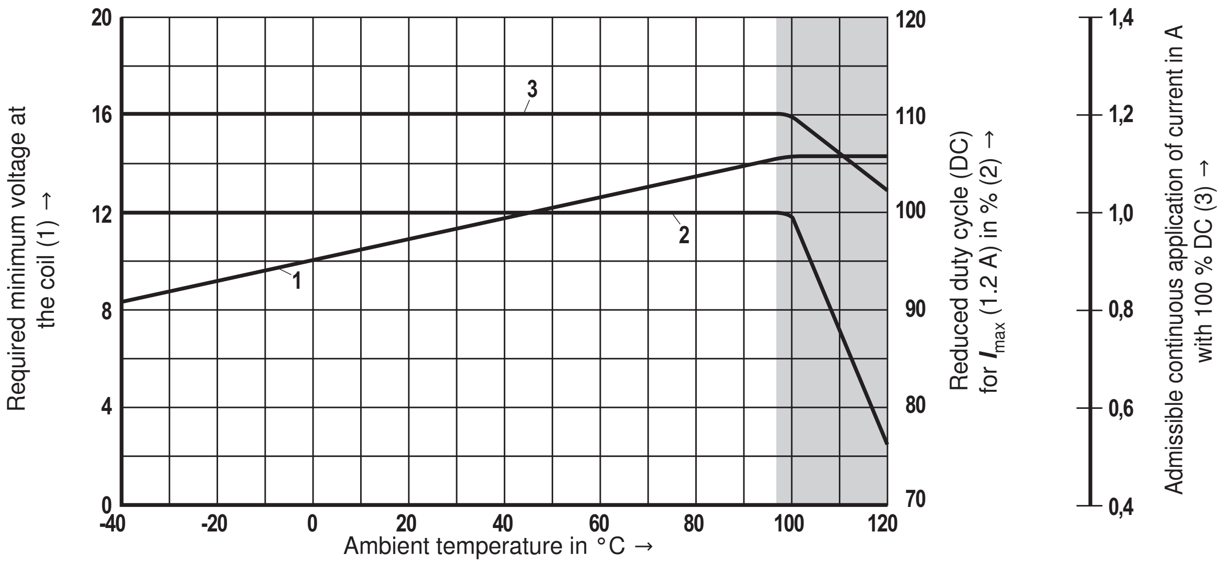
Minimum terminal voltage at the coil and relative duty cycle

Admissible working range against the ambient temperature

– Version "G12"



– Version "G24"



Limited valve performance

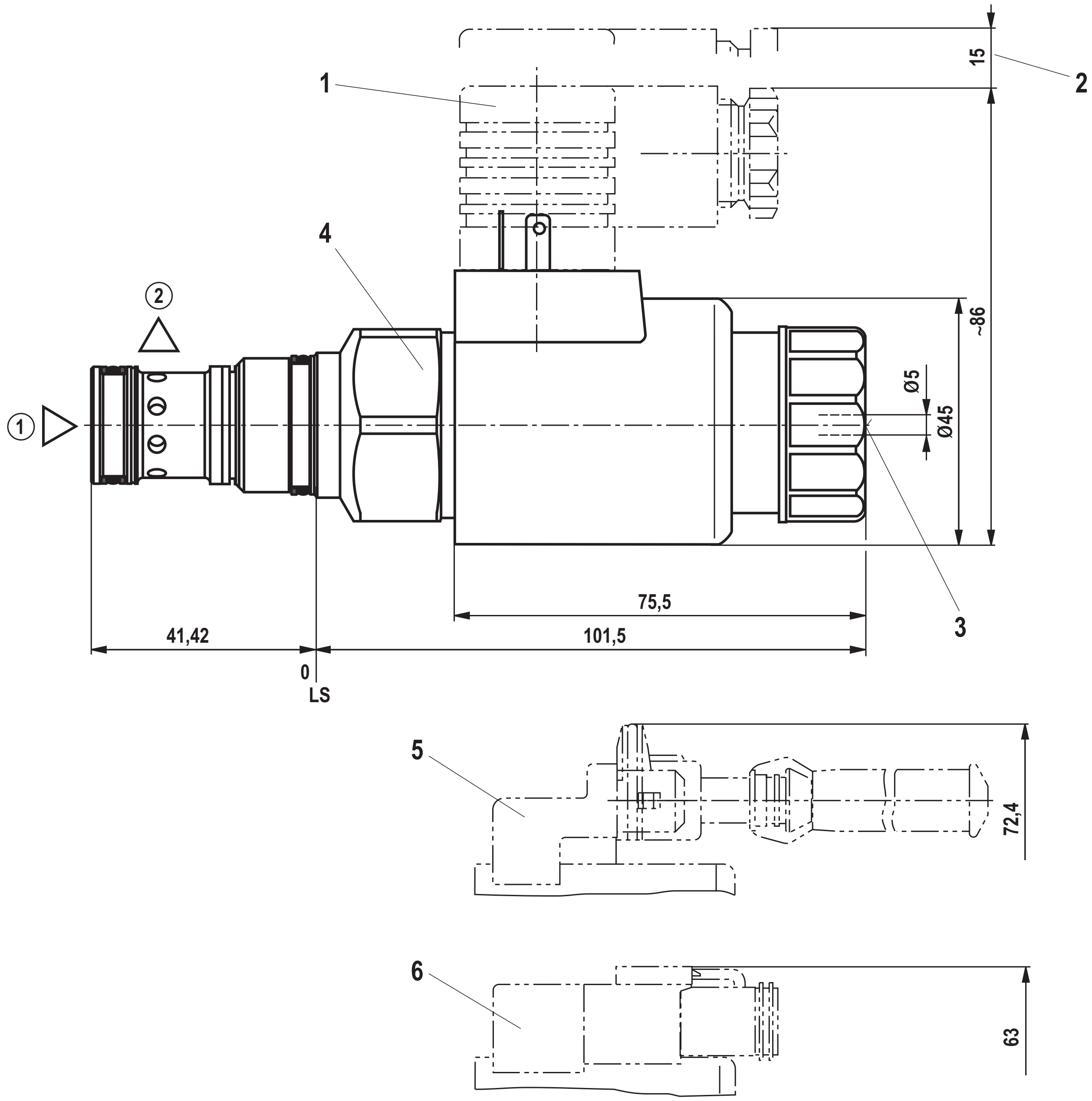
Notice!

The characteristic curves have been determined for coils with valve with medium test block size (80 x 80 x 80 mm), without flow in calm air.

Depending on the installation conditions (block size, flow, air circulation, etc.) there may be a better heat dissipation. This increases the area of application.

In single cases, more unfavorable conditions may lead to limitations of the range of application.

Unit dimensions (dimensions in mm)



① = Main port 1

② = Main port 2

LS = Location Shoulder

1 Mating connector without circuitry for connector "K4" (separate order, see data sheet 08006)

2 Space required for removing the mating connector

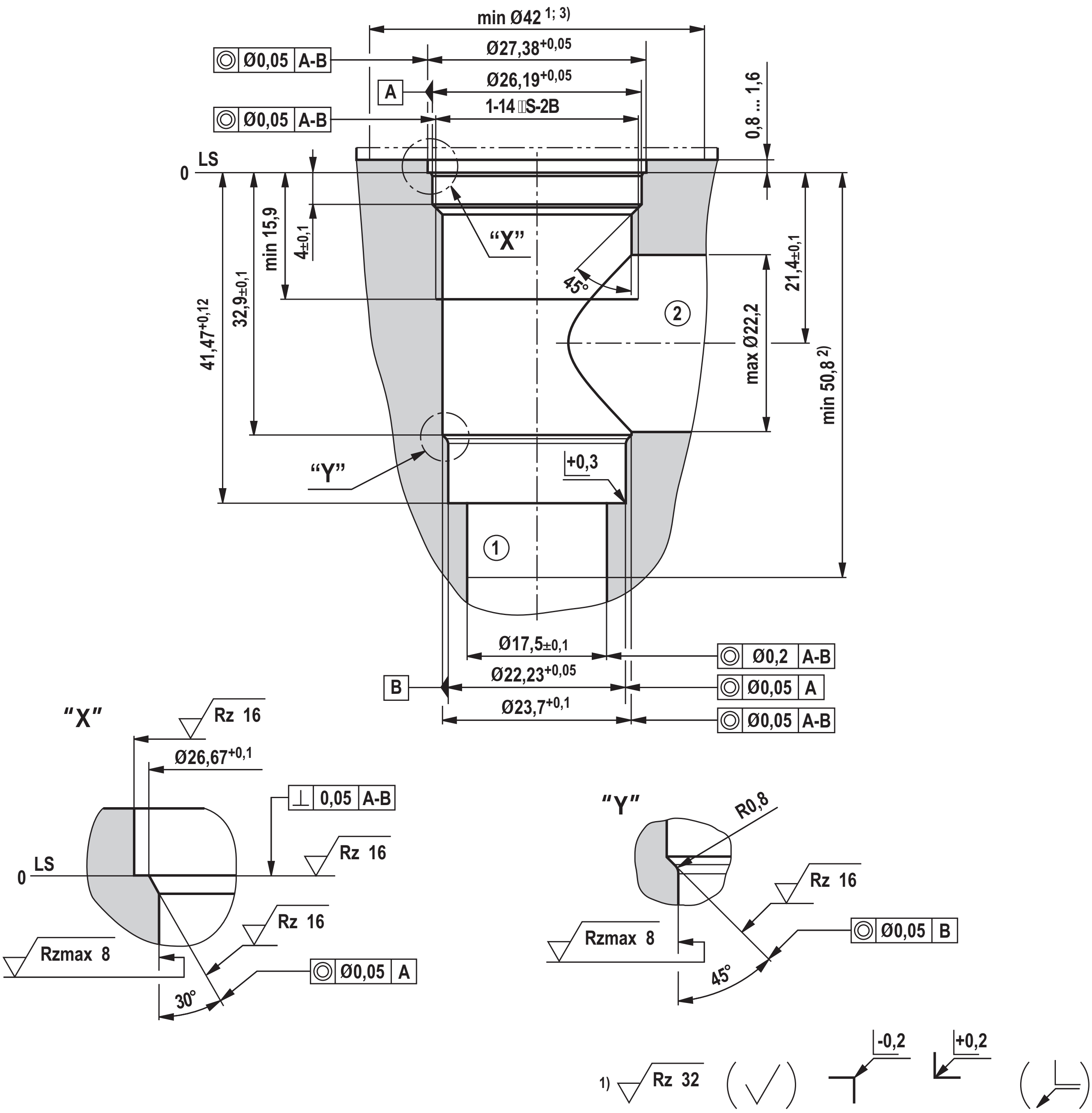
3 Concealed manual override "N9"

4 SW36, tightening torque M_A = 60 to 65 Nm

5 Mating connector for connector "C4" (separate order, see data sheet 08006)

6 Mating connector for connector "K40" (separate order, see data sheet 08006)

Mounting cavity R/T-5A[1]; 2 main ports; thread 1-14 UNS-2B (dimensions in mm)



① = Main port 1
② = Main port 2
LS = Location Shoulder

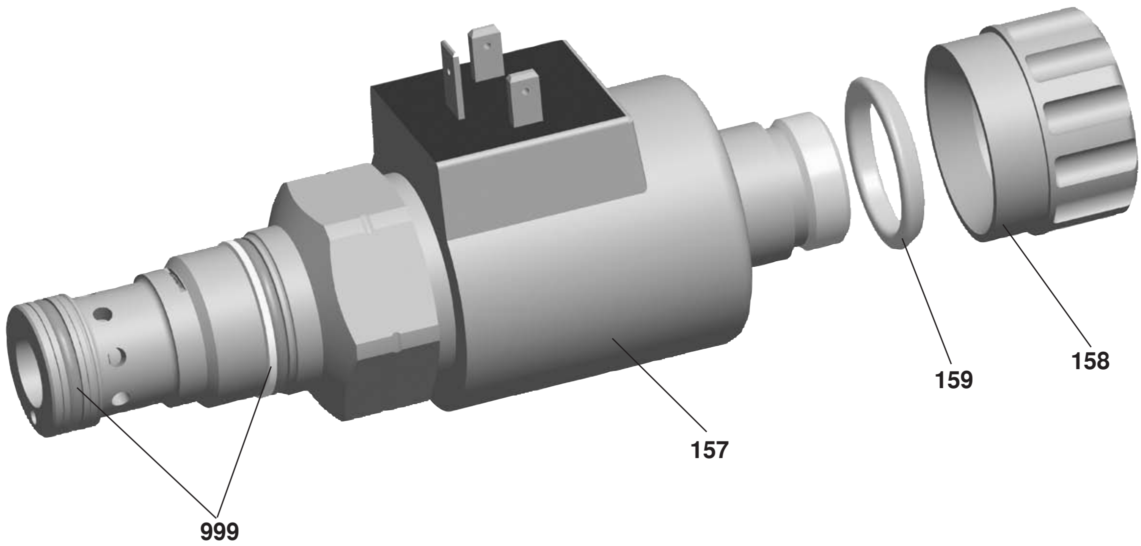
[1] Differing from T-5A
[2] Depth for moving parts
[3] With counterbore

All seal ring insertion faces are rounded and free of burrs
Tolerance for all angles ±0.5°

Standards:

Workpiece edges	DIN ISO 13715
Form and position tolerance	DIN EN ISO 1101
General tolerances for metal-cutting procedures	DIN ISO 2768-mK
Tolerance	DIN ISO 8015
Surface quality	DIN EN ISO 1302

Available individual components



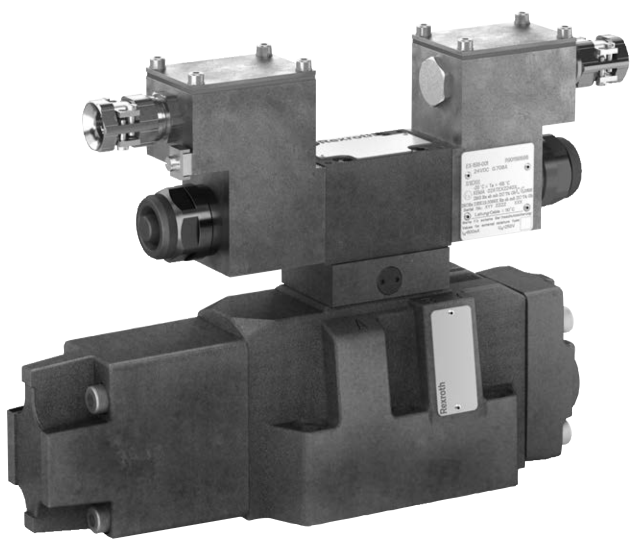
Item	Denomination		Direct voltage	Material no.
157	Coil for individual connection	Version "K4"	12 V	R901022180
			24 V	R901022174
		Version "K40"	12 V	R901272648
			24 V	R901272647
		Version "C4"	12 V	R901022680
			24 V	R901022683
158	Nut			R900029574
159	O-ring for pole tube			R900002507
999	Seal kit of the valve			R961004435

RE 29115-XE
Edition: 2021-04
Replaces: 2019-09
RA78494166_AB

rexroth
A Bosch Company

Proportional directional valves, pilot-operated, without electrical position feedback

Type 4WRZ ...XE



H8104

- Sizes 10 ... 32
- Component series 7X
- Maximum operating pressure 350 bar
- Maximum flow 1600 l/min

ATEX units
For potentially explosive areas

Information on explosion protection:

- Area of application in accordance with the Explosion Protection Directive 2014/34/EU: **II 2G; II 2D**
- Type of protection valve:
  - Ex h IIC T4 Gb X according to EN 80079-36
  - Ex h IIIC T115°C Db X according to EN 80079-36
- Type of protection solenoid coil:
  - Ex eb mb IIC T4 Gb according to EN 60079-7 / EN 60079-18
  - Ex tb IIIC T115°C Db according to EN 60079-31
- Solenoid coil IECEx-certified

Features

- 4/2 and 4/3-way version
- For intended use in a potentially explosive atmosphere
- For the control of flow direction and size
- For subplate mounting
- Porting pattern according to ISO 4401
- Spring-centered control spool
- Actuation by means of the pilot control valve (3-way pressure reducing valve)
- Solenoid coil is rotatable by 90°
- Electrical connection as individual connection with cable gland

Contents

☞ **Notice:** The documentation version with which the product was supplied is valid.

Ordering code

01	02	03	04	05		06		07	08	09	10	11		12	13
4WR	Z				–	7X	/	6E	G24	XE	J		/	D3	

01	Proportional directional valve	**4WR**
02	Electro-hydraulic actuation	**Z**
03	Size 10	**10**
	Size 16	**16**
	Size 25	**25**
	Size 32	**32**
04	Symbols; possible version see page 3	

Nominal flow

05	**– Size 10**	
	25 l/min	**25**
	50 l/min	**50**
	85 l/min	**85**
	– Size 16	
	125 l/min	**125**
	180 l/min	**180**
	– Size 25	
	220 l/min	**220**
	325 l/min	**325**
	– Size 32	
	360 l/min	**360**
	520 l/min	**520**

06	Component series 70 ... 79 (70 ... 79: unchanged installation and mounting dimensions)	**7X**
07	Proportional solenoid	**6E**

Supply voltage of the control electronics

08	Direct voltage 24 V	**G24**

Explosion protection

09	"Increased safety"	**XE**
	For details, see information on explosion protection, page 8	

Corrosion resistance (outside)

10	Increased corrosion protection, galvanized	**J**

Pilot oil supply and pilot oil return (see also page 5)

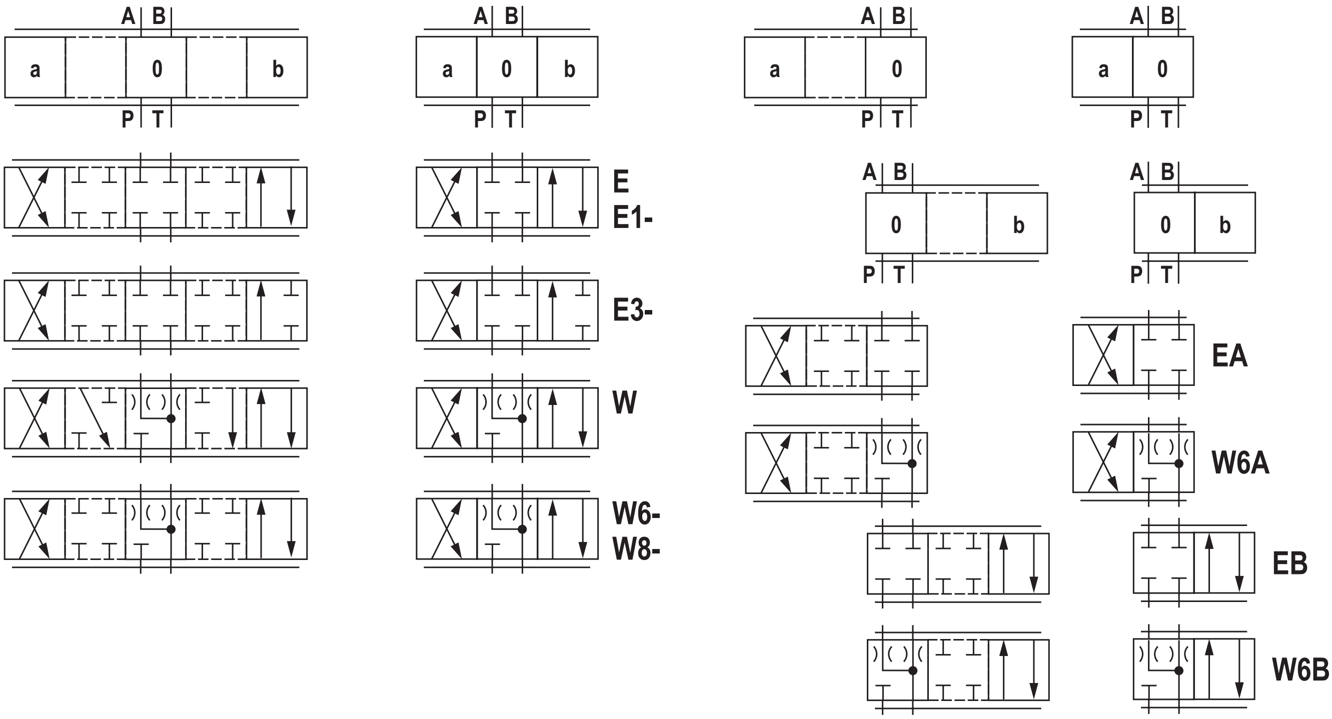
11	External pilot oil supply, external pilot oil return	**no code**
	Internal pilot oil supply, external pilot oil return	**E**
	Pilot oil supply internal, pilot oil return internal	**ET**
	Pilot oil supply external, pilot oil return internal	**T**

12	**With**pressure reducing valve (preset)	**D3**

Seal material (observe compatibility of seals with hydraulic fluid used, see page 7)

13	NBR seals	**M**
	FKM seals	**V**

Symbols



With symbols E1- and W8-:

P → A: $q_{V\,max}$ B → T: $q_V/2$

P → B: $q_V/2$ A → T: $q_{V\,max}$

With symbols E3- and W9-:

P → A: $q_{V\,max}$ B → T: blocked

P → B: $q_V/2$ A → T: $q_{V\,max}$

(Differential circuit, piston top at port A)

Notice:

- With symbols W, W6-, W8-, W6A and W6B, in spool position "0", there is a connection from A → T and from B → T with less than 2% of the relevant nominal cross-section.
- Representation according to DIN ISO 1219-1.
- Hydraulic interim positions are shown by dashes.

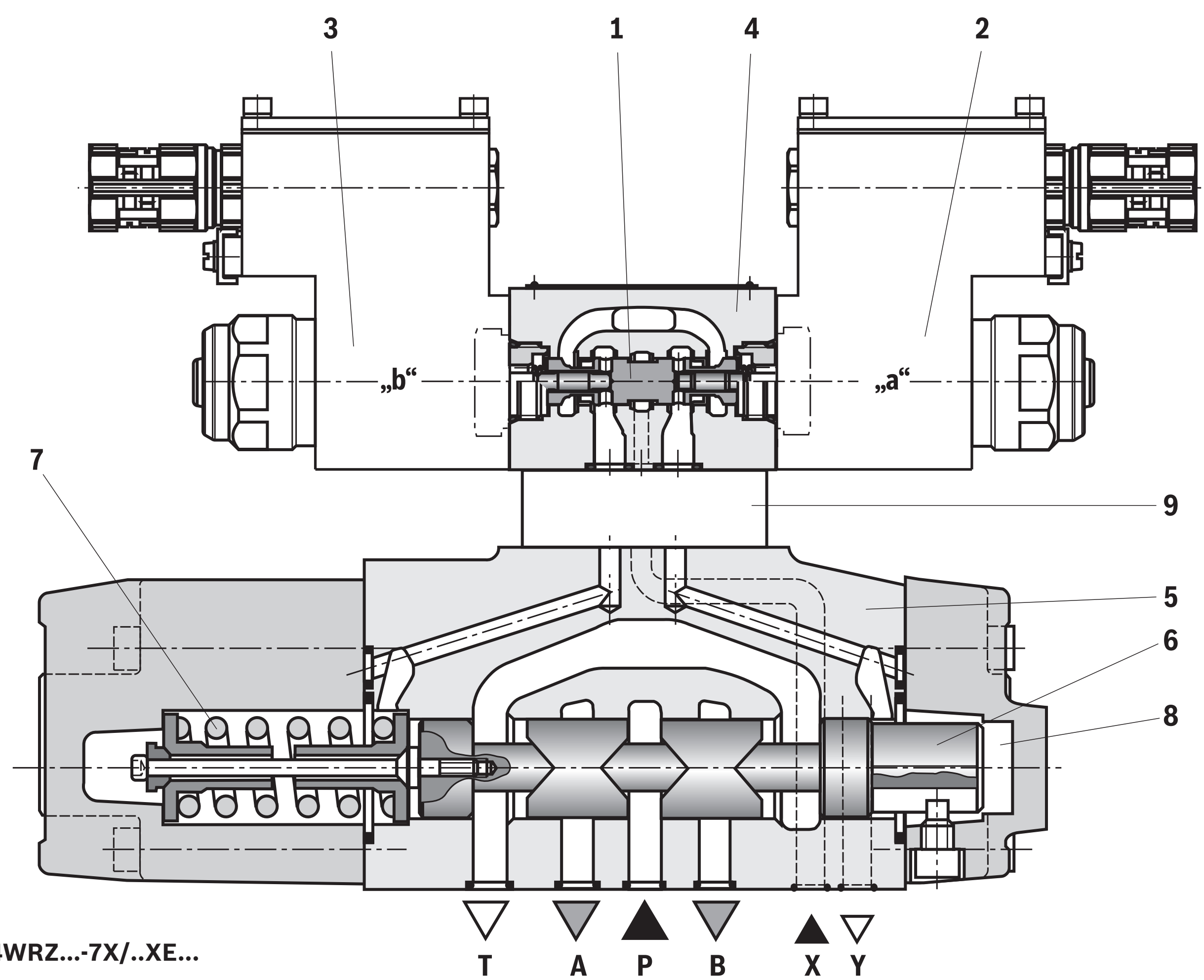
Function, section

Valves of the type 4WRZ... are pilot-operated proportional directional valves that are actuated by means of proportional solenoids. Their function is to control the flow direction and size.
The proportional solenoids are controlled by external control electronics.

Set-up
The valve basically consists of:
- Pilot control valve (4) with proportional solenoids (2 and 3)
- Pressure reducing valve (9)
- Main valve (5) with main control spool (6) and centering spring (7)

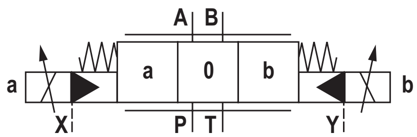
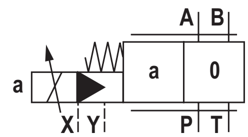
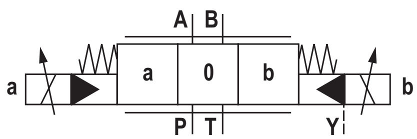
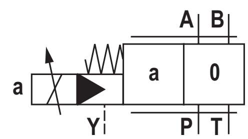
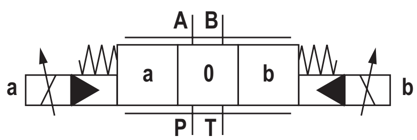
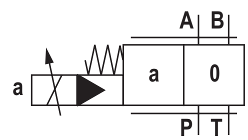
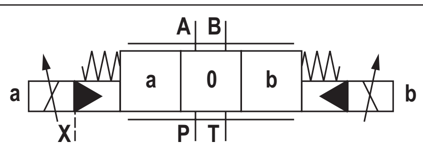
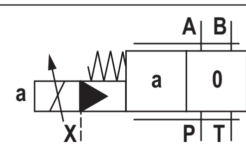
Function
- With de-energized solenoids (2 and 3), the main control spool (6) is held in central position by means of a centering spring (7)
- The main control spool (6) is controlled by the pilot control valve (4); the main control spool is proportionally moved, e.g. by actuating solenoid "b" (3)
  → The control spool (1) is moved to the right, pilot oil enters the pressure chamber (8) via the pilot control valve (4) and deflects the main control spool (6) proportionally to the electric input signal to the left
  → Connection from P → A and B → T via orifice-type cross-sections with progressive flow characteristic
- Pilot oil supply to the pilot control valve internally via port P or externally via port X
- Switching off the solenoid (3)
  → The control spool (1) and main control spool (6) are moved back into the central position
- Flow depending on spool position from P → A and B → T or P → B and A → T.

☞ **Notice:**
With pilot control valves of the version "3DREP 6 **C"**, only one solenoid may be actuated at a time.



Type 4WRZ...-7X/..XE...

Pilot oil supply

3 spool positions	2 spool positions (Version ".A")	
		**Type 4WRZ ...** **External pilot oil supply, external pilot oil return** The pilot oil is supplied from a separate control circuit (external). The pilot oil return is not directed into channel T of the main valve but is separately directed to the tank via port Y (external).
		**Type 4WRZ ...E...** **Internal pilot oil supply, external pilot oil return** The pilot oil supply is implemented from channel P of the main valve (internally). The pilot oil return is not directed into channel T of the main valve but is separately directed to the tank via port Y (external). In the subplate, port X is to be closed.
		**Type 4WRZ ...ET...** **Pilot oil supply internal, pilot oil return internal** The pilot oil supply is implemented from channel P of the main valve (internally). The pilot oil is directly returned to channel T of the main valve (internal). In the subplate, ports X and Y are to be closed.
		**Type 4WRZ ...T...** **Pilot oil supply external, pilot oil return internal** The pilot oil is supplied from a separate control circuit (external). The pilot oil is directly returned to channel T of the main valve (internal). In the subplate, port Y is to be closed.

Technical data
(For applications outside these values, please consult us!)

General						
Size			10	16	25	32
Installation position			Any, preferably horizontal			
Storage temperature range		°C	+5 … +40			
Maximum storage time		Years	1			
Ambient temperature range		°C	–20 … +60			
Weight	▶ Valve with one solenoid	kg	8.5	12.5	18.5	44.5
	▶ Valve with two solenoids, spring-centered	kg	10	14	20	46
Surface protection			Galvanized			
Maximum surface temperature		°C	See information on explosion protection, page 8			

Hydraulic						
Maximum operating pressure	▶ Port A, B, P					
	– Internal pilot oil supply	bar	315	315	315	315
	– External pilot oil supply	bar	350	350	350	350
	▶ Port T					
	– Internal pilot oil return	bar	30	30	30	30
	– External pilot oil return	bar	315	250	250	150
	▶ Port X	bar	315	315	315	315
	▶ Port Y	bar	30	30	30	30
Minimum pilot pressure (pilot control valve)		bar	30	30	30	30
Pilot volume for switching process 0 → 100%		cm^3	1.7	4.6	10	26.5
Pilot flow at port X and Y with stepped input signal 0 → 100%		l/min	3.5	5.5	7	15.9
Maximum flow of the main valve		l/min	170	460	870	1600
Hydraulic fluid			see table page 7			
Hydraulic fluid temperature range		°C	–20 … +80 (NBR seals) –15 … +80 (FKM seals)			
Viscosity range		mm^2/s	20 … 380 (preferably 30 … 46)			
Maximum admissible degree of contamination of the hydraulic fluid Cleanliness class according to ISO 4406 (c)	▶ Pilot control valve		Class 17/15/12 [1]			
	▶ Main valve		Class 18/16/13 [1]			
Hysteresis		%	≤ 6			

1) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the life cycle of the components.

Technical data

(For applications outside these values, please consult us!)

Hydraulic fluid		Classification	Suitable sealing materials	Standards	Data sheet
Mineral oils		HL, HLP, HLPD, HVLP, HVLPD	NBR, FKM	DIN 51524	90220
Bio-degradable	▶ Insoluble in water	HETG	FKM	ISO 15380	90221
		HEES	FKM		
	▶ Soluble in water	HEPG	FKM	ISO 15380	
Flame-resistant	▶ Water-free	HFDU (glycol base)	FKM	ISO 12922	90222
		HFDU (ester base)	FKM		
		HFDR	FKM		
	▶ Containing water	HFC (Fuchs: Hydrotherm 46M, Renosafe 500; Petrofer: Ultra Safe 620; Houghton: Safe 620; Union: Carbide HP5046)	NBR	ISO 12922	90223

☞ **Important notices on hydraulic fluids:**

- For further information and data on the use of other hydraulic fluids, please refer to the data sheets above or contact us.
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.).
- The ignition temperature of the hydraulic fluid used must be 50 K higher than the maximum surface temperature.
- **Bio-degradable and flame-resistant – containing water:** If components with galvanic zinc coating (e.g. version "J3" or "J5") or parts containing zinc are used, small amounts of dissolved zinc may get into the hydraulic system and cause accelerated aging of the hydraulic fluid. Zinc soap may form as a chemical reaction product, which may clog filters, nozzles and solenoid valves – particularly in connection with local heat input.
- **Flame-resistant – containing water**:
  - Due to the increased cavitation tendency with HFC hydraulic fluids, the life cycle of the component may be reduced by up to 30% as compared to the use with mineral oil HLP. In order to reduce the cavitation effect, it is recommended – if possible specific to the installation – backing up the return flow pressure in ports T to approx. 20% of the pressure differential at the component.
  - Dependent on the hydraulic fluid used, the maximum environment and hydraulic fluid temperature must not exceed 50 °C. In order to reduce the heat input into the component, the command value profile is to be adjusted for proportional and high-response valves.

Technical data
(For applications outside these values, please consult us!)

Electric		
Voltage type		Direct current or pulse-width modulated signal with a pulse voltage ≤ 28 V and a frequency ≥ 160 Hz up to max. 500 Hz
Type of signal		analog
Maximum solenoid current	A	1.03
Duty cycle	%	100

Control electronics [2]	
Valve amplifier for proportional valves without electrical position feedback; maximum current limitation 1 A	VT-MSPA2-2X/A5/1A0/000 according to data sheet 30232-01
Module for monitoring and limiting the solenoid currents with proportional valves	VT-MUXA2-2-1X/V0/1A according to data sheet 30290

Information on explosion protection			
Area of application according to directive 2014/34/EU		II 2G	II 2D
Type of protection valve according to EN 80079-36 [3]		Ex h IIC T4 Gb X	Ex h IIIC T115°C Db X
Maximum surface temperature [4]	°C	115	
Temperature class		T4	–
Type of protection solenoid coil according to EN 60079-7 / EN 60079-18 / EN 60079-31		Ex eb mb IIC T4 Gb	Ex tb IIIC T115°C Db
Type examination certificate solenoid coil		BVS 20 ATEX E 009 X	
"IECEx Certificate of Conformity" solenoid coil		IECEx BVS 20.0007X	

2) A monitoring circuit is to be provided for the monitoring of the solenoid current. We recommend operating the valves with the assemblies described herein. The valve amplifier and the monitoring module may only be installed outside the potentially explosive atmosphere.

3) Ex h: Structural safety c according to EN 80079-37.

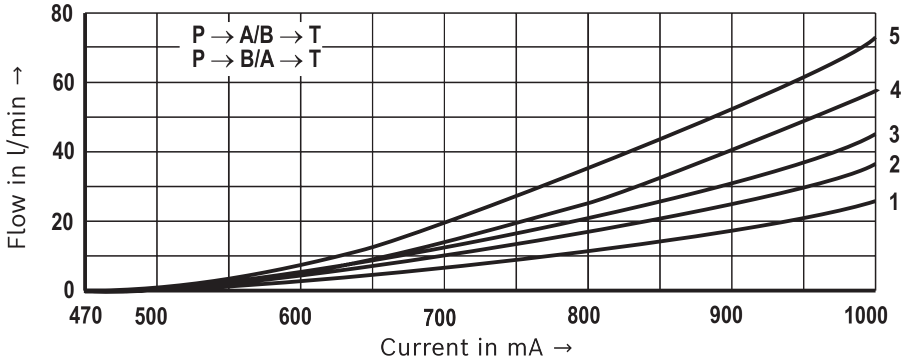
4) Surface temperature > 50 °C, provide contact protection.

Special application conditions for safe application:

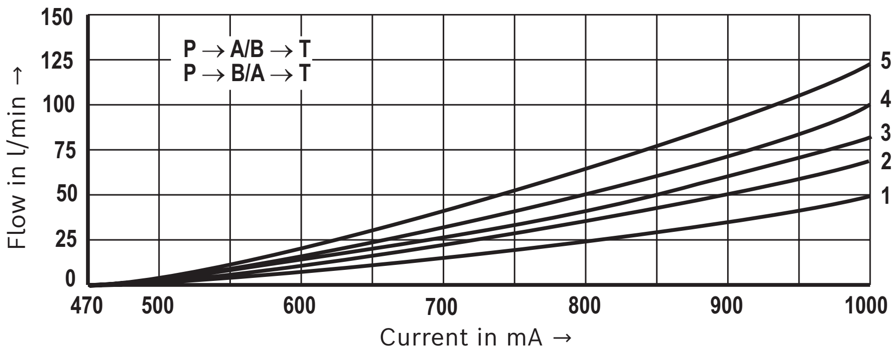
- Connection lines must be installed in a strain-relieved way. The first mounting point must be within 150 mm of the cable and line entry.
- In case of valves with two solenoids, maximally one of the solenoids may be energized at a time.
- Only direct voltage or a pulse-width modulated signal with a pulse voltage ≤ 28 V and frequency ≥ 160 Hz … up to max. 500 Hz may be used.
- The maximum temperature of the surface of the valve jacket is 115 °C. This has to be considered when selecting the connection cable and/or contact of the connection cable with the surface of the jacket is to be prevented.

Characteristic curves: Size 10
(measured with symbol E, W6-, EA, W6A, HLP46, ϑ_{oil} = 40 ±5 °C)

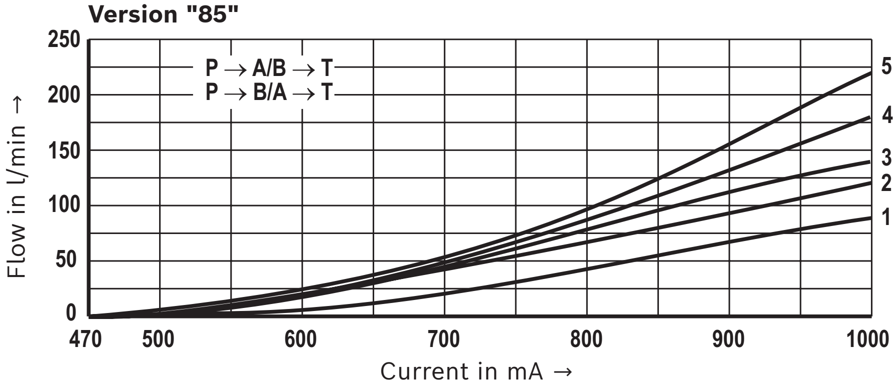
Version "25"



Version "50"



Version "85"

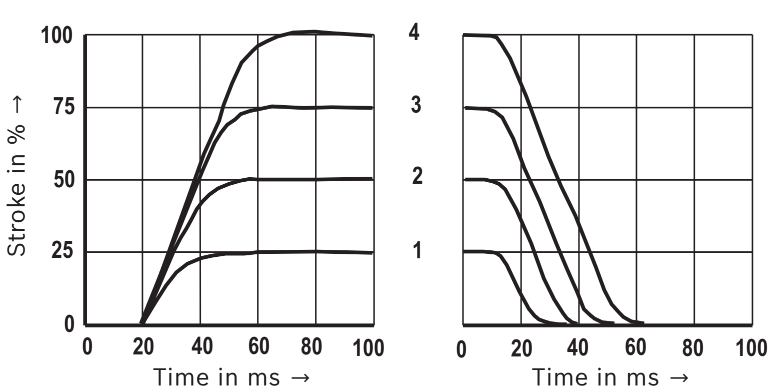


1 Δp = 10 bar constant
2 Δp = 20 bar constant
3 Δp = 30 bar constant
4 Δp = 50 bar constant
5 Δp = 100 bar constant

$\Delta p = p_P - p_L - p_T$ (according to DIN 24311)

Δp Valve pressure differential
p_P Inlet pressure
p_L Load pressure
p_T Return flow pressure

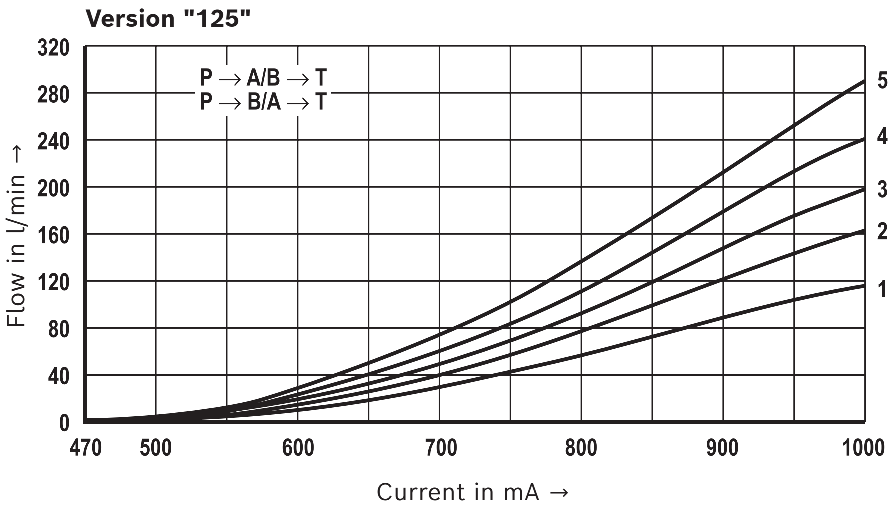
Transition function with stepped electric input signals

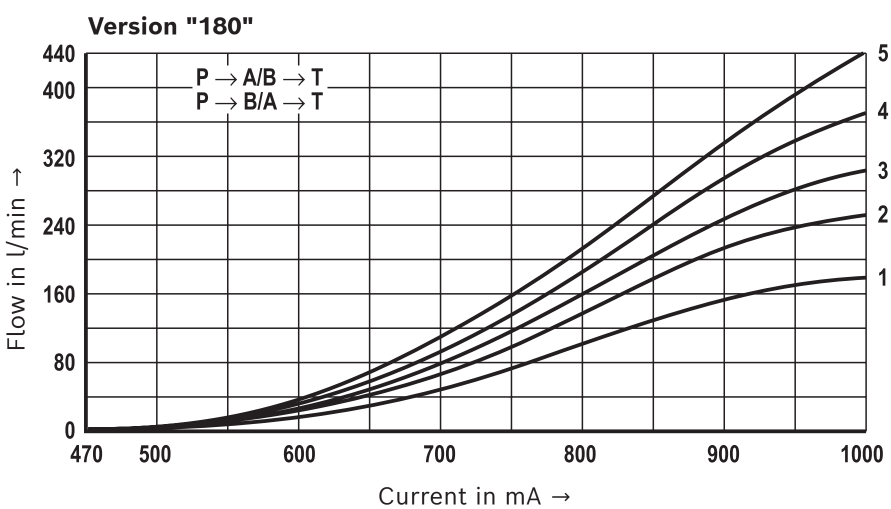


	Change of input signal in %
1	0 → 25 → 0
2	0 → 50 → 0
3	0 → 75 → 0
4	0 → 100 → 0

Measured at pilot pressure p_{ST} = 50 bar

Characteristic curves: Size 16
(measured with symbol E, W6-, EA, W6A, HLP46, ϑ_{oil} = 40 ±5 °C)



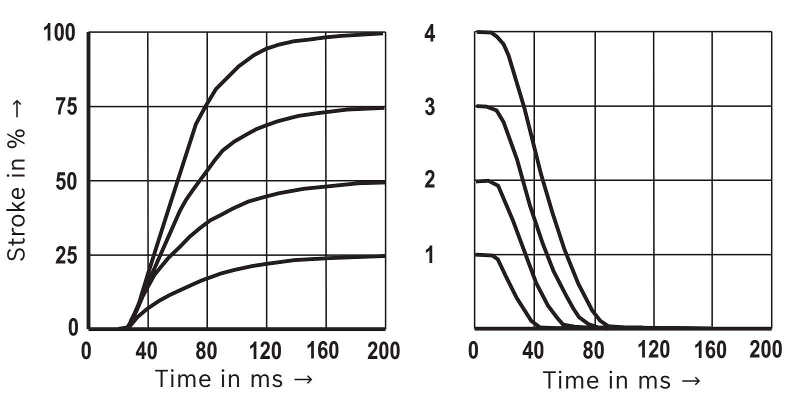


1 Δp = 10 bar constant
2 Δp = 20 bar constant
3 Δp = 30 bar constant
4 Δp = 50 bar constant
5 Δp = 100 bar constant

$\Delta p = p_P - p_L - p_T$ (according to DIN 24311)

Δp Valve pressure differential
p_P Inlet pressure
p_L Load pressure
p_T Return flow pressure

Transition function with stepped electric input signals

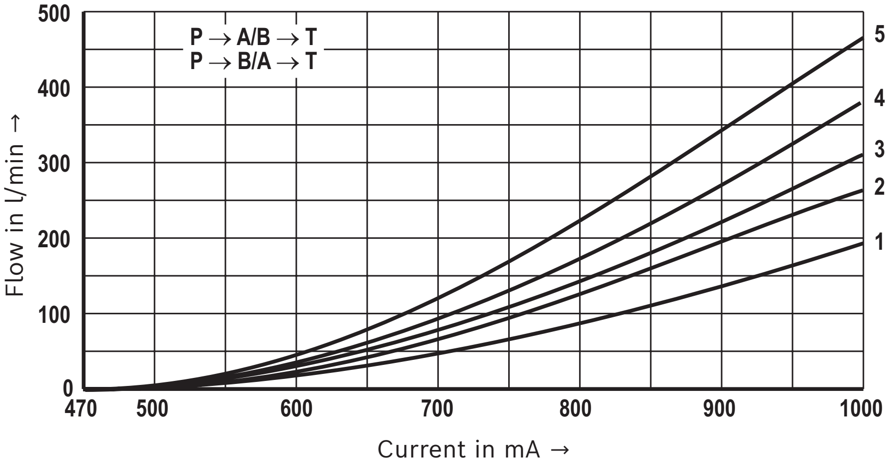


	Change of input signal in %
1	0 → 25 → 0
2	0 → 50 → 0
3	0 → 75 → 0
4	0 → 100 → 0

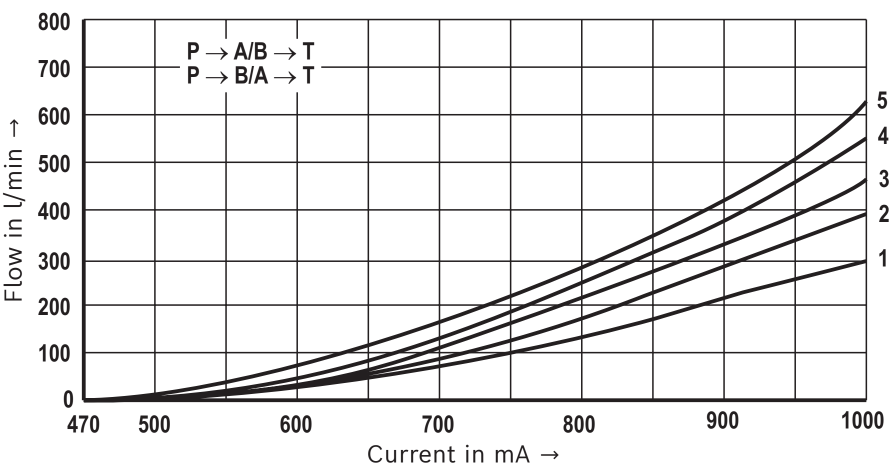
Measured at pilot pressure p_{ST} = 50 bar

Characteristic curves: Size 25
(measured with symbol E, W6-, EA, W6A, HLP46, ϑ_{oil} = 40 ±5 °C)

Version "220"



Version "325"

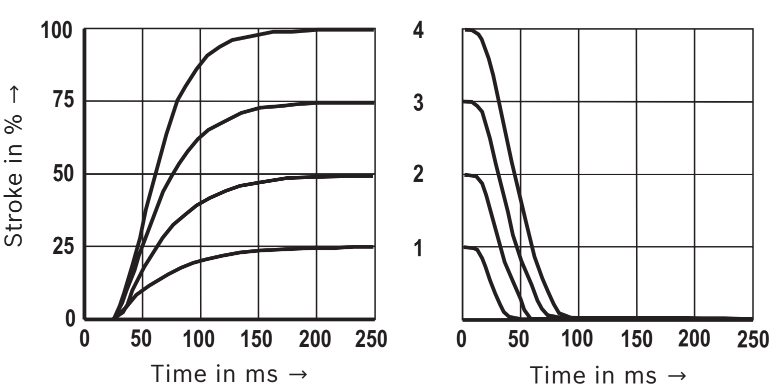


1 ***Δp*** = 10 bar constant
2 ***Δp*** = 20 bar constant
3 ***Δp*** = 30 bar constant
4 ***Δp*** = 50 bar constant
5 ***Δp*** = 100 bar constant

$\Delta p = p_P - p_L - p_T$ (according to DIN 24311)

Δp	Valve pressure differential
p_P	Inlet pressure
p_L	Load pressure
p_T	Return flow pressure

Transition function with stepped electric input signals

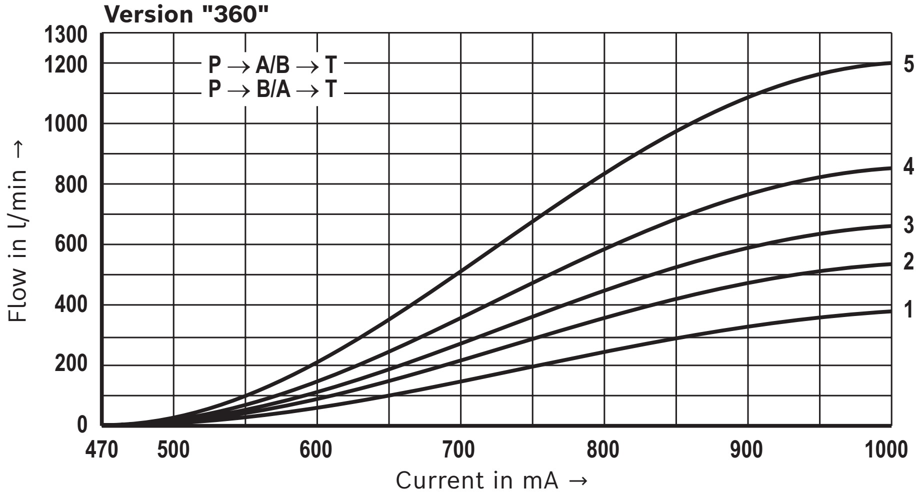


	Change of input signal in %
1	0 → 25 → 0
2	0 → 50 → 0
3	0 → 75 → 0
4	0 → 100 → 0

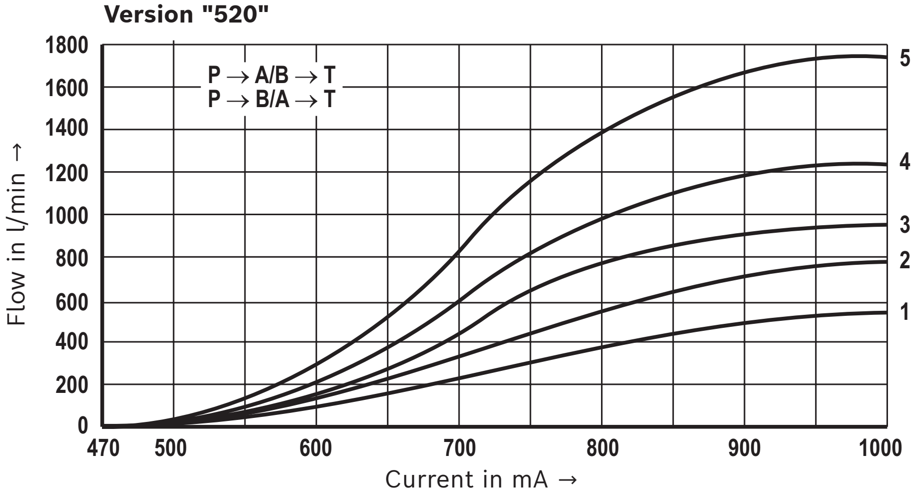
Measured at pilot pressure p_{ST} = 50 bar

Characteristic curves: Size 32
(measured with symbol E, W6-, EA, W6A, HLP46, ϑ_{oil} = 40 ±5 °C)

Version "360"



Version "520"

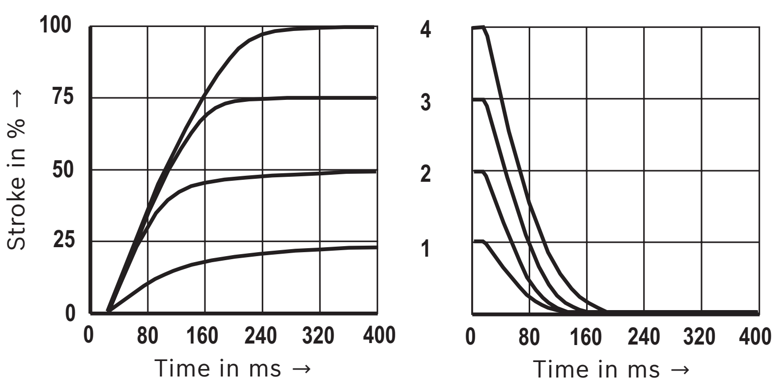


1 ***Δp*** = 10 bar constant
2 ***Δp*** = 20 bar constant
3 ***Δp*** = 30 bar constant
4 ***Δp*** = 50 bar constant
5 ***Δp*** = 100 bar constant

$\Delta p = p_P - p_L - p_T$ (according to DIN 24311)

Δp	Valve pressure differential
p_P	Inlet pressure
p_L	Load pressure
p_T	Return flow pressure

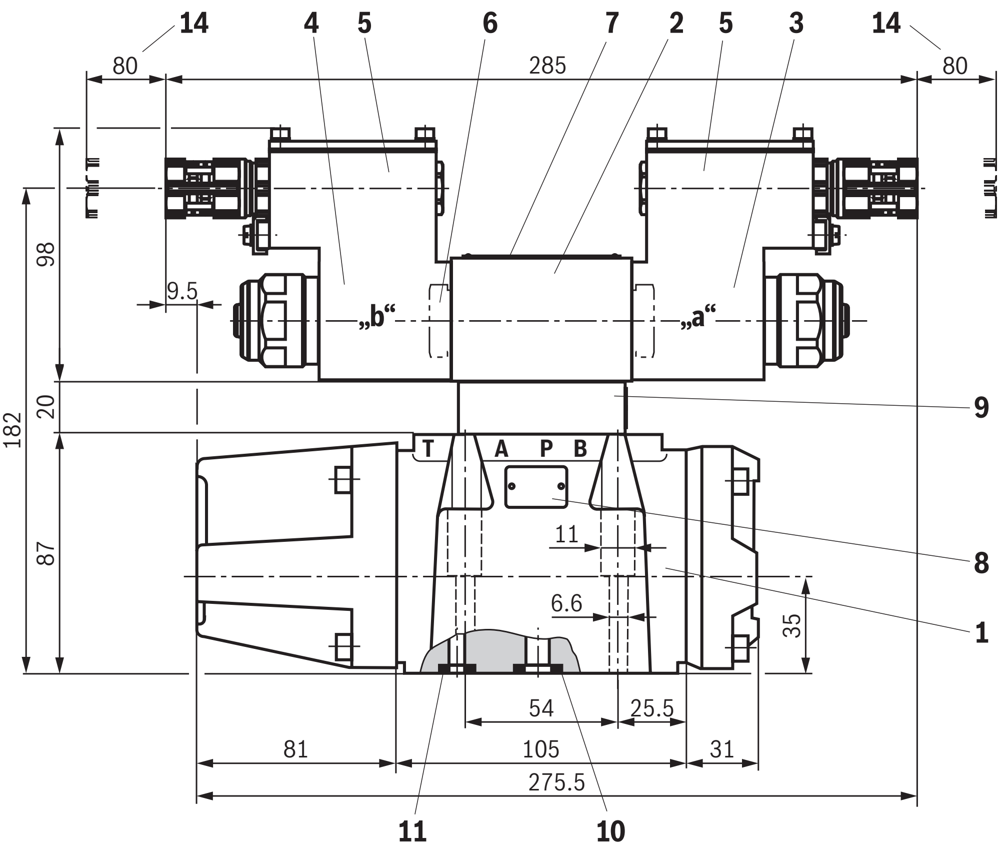
Transition function with stepped electric input signals

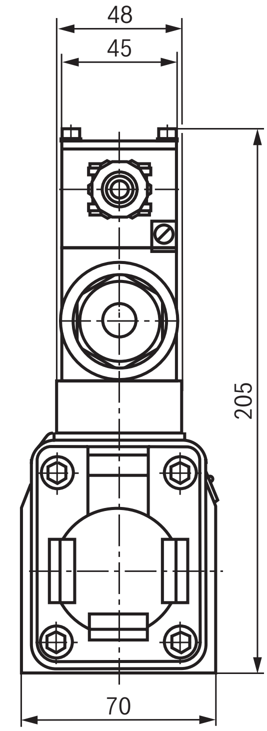


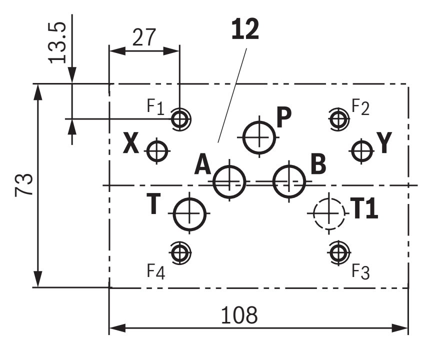
	Change of input signal in %
1	0 → 25 → 0
2	0 → 50 → 0
3	0 → 75 → 0
4	0 → 100 → 0

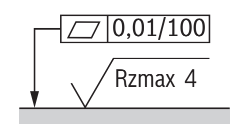
Measured at pilot pressure p_{ST} = 50 bar

Dimensions: Size 10
(dimensions in mm)









Required surface quality of the valve contact surface

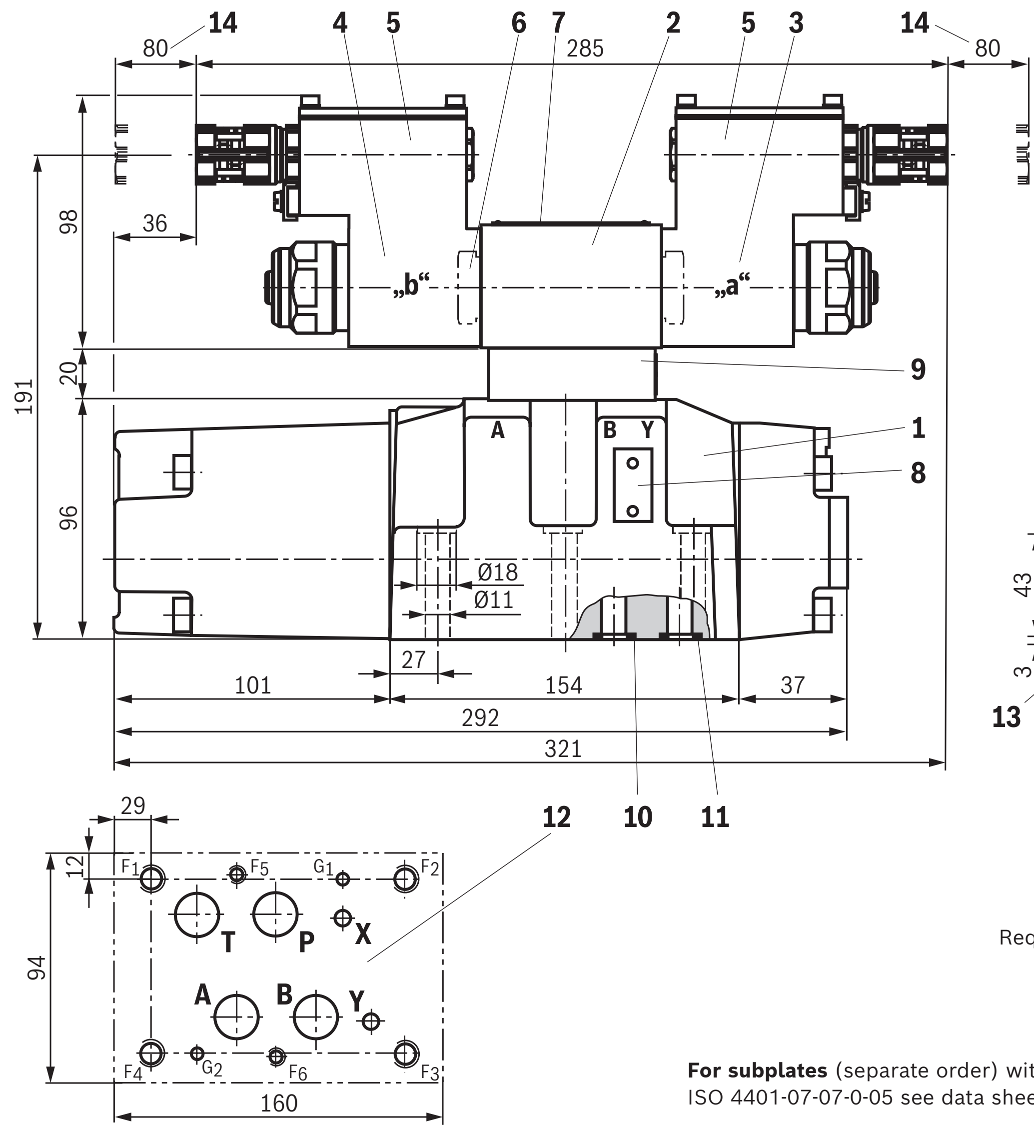
For subplates (separate order) with porting pattern according to ISO 4401-05-05-0-05, see data sheet 45100.

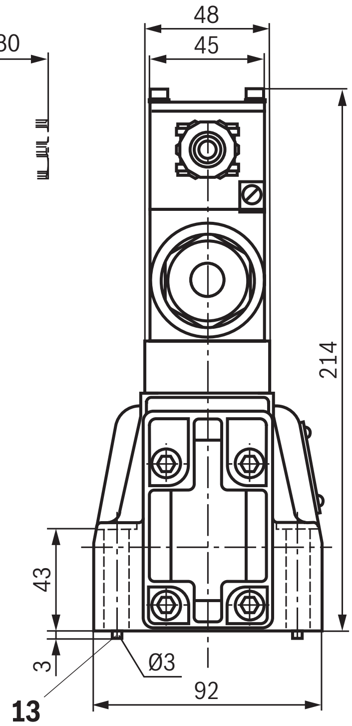
- **1** Main valve
- **2** Pilot control valve
- **3** Proportional solenoid "a"
- **4** Proportional solenoid "b"
- **5** Terminal box
- **6** Plug screw for valves with one solenoid
- **7** Name plate pilot control valve
- **8** Name plate main valve
- **9** Pressure reducing valve (always available)
- **10** Identical seal rings for ports P, A, B, T and T1
- **11** Identical seal rings for X and Y
- **12** Machined valve contact surface, porting pattern according to ISO 4401-05-05-0-05 (X, Y as required, T1 is available at the valve and can optionally be provided)
- **14** Space required to remove the solenoid coil

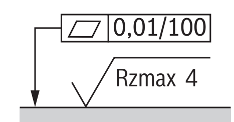
Valve mounting screws (separate order)
Only use valve mounting screws with the thread diameters and strength properties listed below. The screw-in depth must be complied with.
4 hexagon socket head cap screws ISO 4762 - M6 x 45 - 10.9
(Friction coefficient $\boldsymbol{\mu}_{\text{total}}$ = 0.09 ... 0.14)
Tightening torque $\boldsymbol{M}_{\text{A}}$ = 13.5 Nm ±10%,
Material no. **R913043777**

☞ **Notices:**
- ▶ The dimensions are nominal dimensions which are subject to tolerances.
- ▶ Subplates are not components in the sense of directive 2014/34/EU and can be used after the manufacturer of the overall system has conducted an assessment of the risk of ignition. The "G...J3" versions are free from aluminum and / or magnesium and galvanized.

Dimensions: Size 16
(dimensions in mm)







Required surface quality of the valve contact surface

1 Main valve
2 Pilot control valve
3 Proportional solenoid "a"
4 Proportional solenoid "b"
5 Terminal box
6 Plug screw for valves with one solenoid
7 Name plate pilot control valve
8 Name plate main valve
9 Pressure reducing valve (always available)
10 Identical seal rings for P, A, B and T (not with version "100" and "150")
11 Identical seal rings for X and Y
12 Machined valve contact surface; porting pattern according to ISO 4401-07-07-0-05 (X and Y as required)
Deviating from the standard: Ports P, A, B and T with Ø 20 mm; with version "100" and "150" T with Ø13 mm
13 Locating pin
14 Space required to remove the solenoid coil

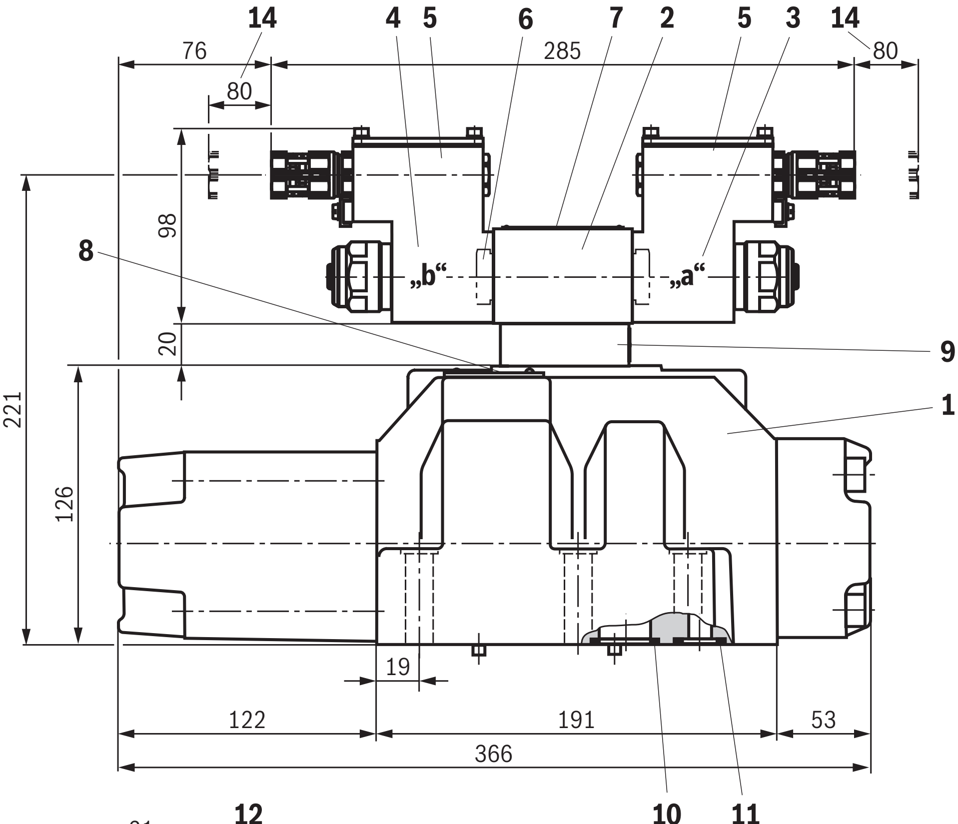
For subplates (separate order) with porting pattern according to ISO 4401-07-07-0-05 see data sheet 45100.

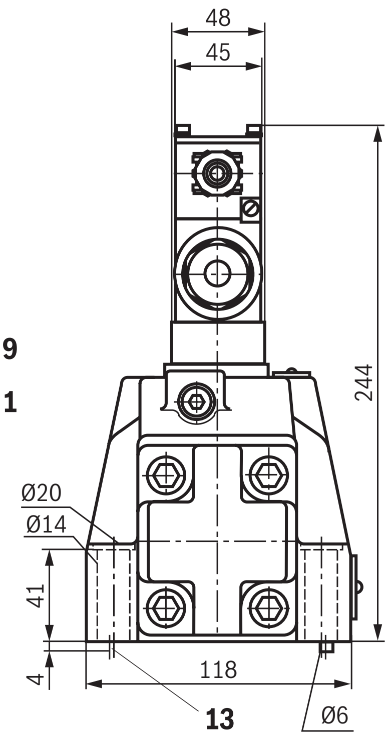
Valve mounting screws (separate order)
Only use valve mounting screws with the thread diameters and strength properties listed below. The screw-in depth must be complied with.
2 hexagon socket head cap screws ISO 4762 - M6 x 60 - 10.9
(Friction coefficient μ_{total} = 0.09 ... 0.14)
Tightening torque M_A = 12.2 Nm ±20%,
Material no. **R913043410**

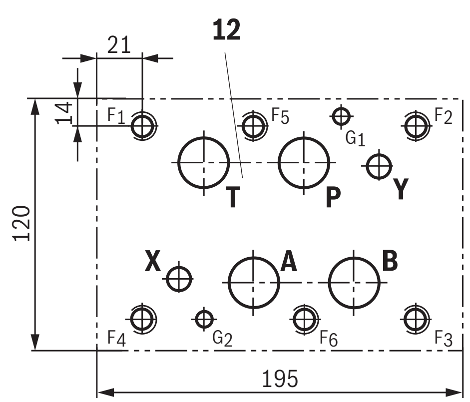
4 hexagon socket head cap screws ISO 4762 - M10 x 60 - 10.9
(Friction coefficient μ_{total} = 0.09 ... 0.14)
Tightening torque M_A = 58 Nm ±20%,
Material no. **R913014770**

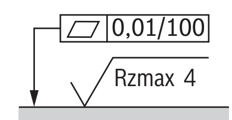
Notices:
- The dimensions are nominal dimensions which are subject to tolerances.
- Subplates are not components in the sense of directive 2014/34/EU and can be used after the manufacturer of the overall system has conducted an assessment of the risk of ignition. The "G...J3" versions are free from aluminum and / or magnesium and galvanized.

Dimensions: Size 25
(dimensions in mm)









Required surface quality of the valve contact surface

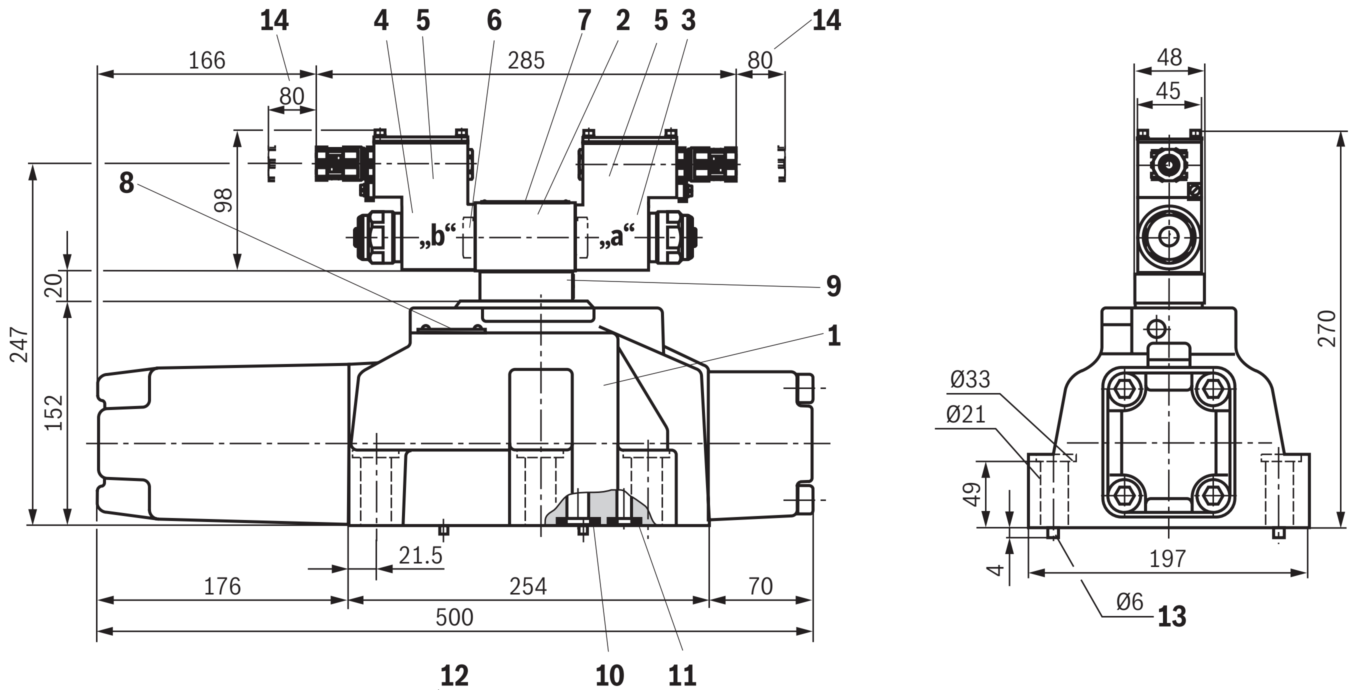
1 Main valve
2 Pilot control valve
3 Proportional solenoid "a"
4 Proportional solenoid "b"
5 Terminal box
6 Plug screw for valves with one solenoid
7 Name plate pilot control valve
8 Name plate main valve
9 Pressure reducing valve (always available)
10 Identical seal rings for ports P, A, B and T
11 Identical seal rings for X and Y
12 Machined valve contact surface; porting pattern according to ISO 4401-08-08-0-05 (ports X and Y as required)
13 Locating pin
14 Space required to remove the solenoid coil

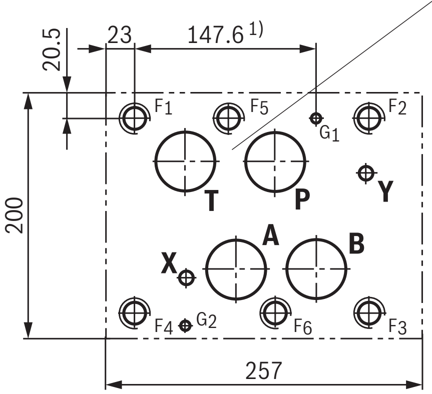
For subplates (separate order) with porting pattern according to ISO 4401-08-08-0-05 see data sheet 45100.

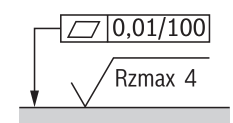
Valve mounting screws (separate order)
Only use valve mounting screws with the thread diameters and strength properties listed below. The screw-in depth must be complied with.
6 hexagon socket head cap screws ISO 4762 - M12 x 60 - 10.9
(Friction coefficient μ_{total} = 0.09 … 0.14)
Tightening torque M_A = 100 Nm ±20%,
Material no. **R913015613**

Notices:
- The dimensions are nominal dimensions which are subject to tolerances.
- Subplates are not components in the sense of directive 2014/34/EU and can be used after the manufacturer of the overall system has conducted an assessment of the risk of ignition. The "G…J3" versions are free from aluminum and / or magnesium and galvanized.

Dimensions: Size 32
(dimensions in mm)







Required surface quality of the valve contact surface

- **1** Main valve
- **2** Pilot control valve
- **3** Proportional solenoid "a"
- **4** Proportional solenoid "b"
- **5** Terminal box
- **6** Plug screw for valves with one solenoid
- **7** Name plate pilot control valve
- **8** Name plate main valve
- **9** Pressure reducing valve (always available)
- **10** Identical seal rings for ports P, A, B and T
- **11** Identical seal rings for X and Y
- **12** Machined valve contact surface; porting pattern according to ISO 4401-10-09-0-05 (ports X and Y as required)
  Deviating from the standard: Ports P, A, B and T with Ø 38 mm; position G1 [1)] according to DIN 24340 form A
- **13** Locating pin
- **14** Space required to remove the solenoid coil

For subplates (separate order) with porting pattern according to ISO 4401-10-09-0-05 see data sheet 45100.

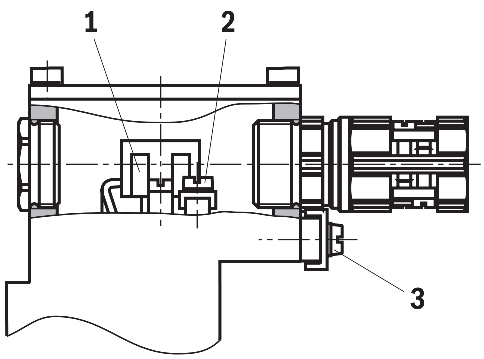
Valve mounting screws (separate order)
Only use valve mounting screws with the thread diameters and strength properties listed below. The screw-in depth must be complied with.
6 hexagon socket head cap screws ISO 4762 - M20 x 80 - 10.9
(Friction coefficient $\boldsymbol{\mu}_{\text{total}}$ = 0.09 ... 0.14)
Tightening torque $\boldsymbol{M}_{\text{A}}$ = 340 Nm ±20%,
Material no. **R913008472**

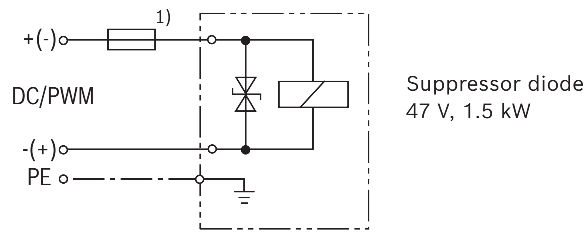
☞ **Notices:**
- The dimensions are nominal dimensions which are subject to tolerances.
- Subplates are not components in the sense of directive 2014/34/EU and can be used after the manufacturer of the overall system has conducted an assessment of the risk of ignition. The "G...J3" versions are free from aluminum and / or magnesium and galvanized.

Electrical connection

The type-examination tested solenoid coil of the valve is equipped with a terminal box, a type-examination tested cable entry and a type-examination tested blind plug. The connection is polarity-independent.

Notice:
When establishing the electrical connection, the protective grounding conductor (PE ⏚) has to be connected properly.





1) Recommended pre-fuse characteristics medium time-lag according to DIN 41571, 1.25 A.

Properties of the connection terminals and mounting elements

Position	Function	Connectable line cross-section
1	Operating voltage connection	single-wire 0.75 ... 2.5 mm² finely stranded 0.75 ... 1.5 mm²
2	Connection for protective grounding conductor	single-wire max. 2.5 mm² finely stranded max. 1.5 mm²
3	Connection for potential equalization conductor	single-wire max. 6 mm² finely stranded max. 4 mm²

Connection line		
Line type		non-armored and unshielded connection lines
Temperature rating	°C	≤–20 ... ≥+110
Line diameter	mm	7 ... 10.5

Notice:
Use finely stranded conductors only if they have pressed-on wire end ferrules.

Over-current fuse and switch-off voltage peaks

Voltage data in the valve type code	Nominal voltage solenoid coil	Rated current Solenoid coil	Rated current for external miniature fuse: Medium time-lag (M) according to DIN41571 and EN/IEC 60127	Rated voltage of external miniature fuse: Medium time-lag (M) according to DIN41571 and EN/IEC 60127	Maximum voltage value when switching off	Interference protection circuit
G24	24 VDC	1.03 ADC	1.25 A	250 V	–70 V	Suppressor diode bi-directional

Notice:
Corresponding to the rated current, a fuse according to DIN 41571 and EN / IEC 60127 has to be connected upstream of every solenoid coil (max. 3 x I_{rated}).
The shut-off threshold of the fuse has to match the prospective short-circuit current of the supply source.
The prospective short-circuit current of the supply source may amount to a maximum of 1500 A.
This fuse may only be installed outside the potentially explosive atmosphere or must be of an explosion-proof design.
When inductivities are switched off, voltage peaks occur, which may cause faults in the connected control electronics. For this reason, the solenoid coil comprise an interference protection circuit which dampens this voltage peak to the voltage value shown in the table.

Further information

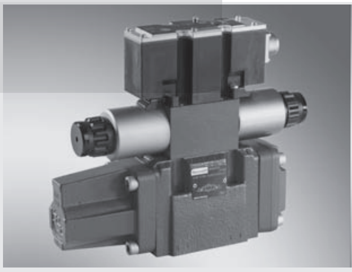
- Subplates — Data sheet 45100
- Hydraulic fluids on mineral oil basis — Data sheet 90220
- Environmentally compatible hydraulic fluids — Data sheet 90221
- Flame-resistant, water-free hydraulic fluids — Data sheet 90222
- Flame-resistant hydraulic fluids - containing water (HFAE, HFAS, HFB, HFC) — Data sheet 90223
- Use of non-electrical hydraulic components in an explosive environment (ATEX) — Data sheet 07011
- Selection of filters
- Information on available spare parts

Rexroth Bosch Group

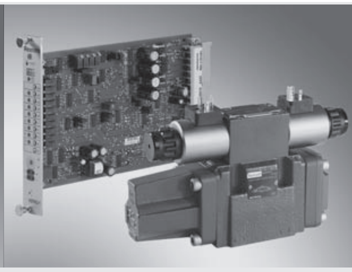
4/2, 4/3, and 5/2, 5/3 proportional directional valve, pilot operated, without electrical position feedback without/with integrated electronics (OBE)

RE 29115/08.13
Replaces: 10.05

Type .WRZ…, .WRZE… and .WRH…



Type 4WRZE 10 …-7X/...K31/...
with integrated electronics (OBE)



Type 4WRZ 10 …-7X/…K4/...
with the corresponding control electronics (separate order)

Sizes 10 to 52
Component series 7X
Maximum operating pressure 350 bar
Maximum flow 2800 l/min

Table of contents

Features

– Pilot operated, 2-stage proportional directional valve with integrated electronics (OBE) with type 4WRZE
– Control of flow direction and size
– Operation by means of proportional solenoids with central thread and detachable coil
– For subplate mounting:
Porting pattern according to ISO 4401
– Manual override, optional
– Spring-centered control spool
– Control electronics
  • Type .WRZE…
    - Integrated electronics (OBE) with voltage or current input (A1 and/or F1)
  • Type .WRZ…
    - Digital or analog amplifier in Euro-card format
    - Analog amplifier in modular design

Ordering codes (types 4WRZ and 4WRH; sizes 10 to 32 subplate mounting; size 52 flange connection)

4WR_ | | | | –7X | / | | | | |

Hydraulic actuation	**= H**
Electro-hydraulic actuation	**= Z**
Type WRZ:	
For external electronics	**= no code**
With integrated electronics	**= E**
Size 10	**= 10**
Size 16	**= 16**
Size 25	**= 25**
Size 32	**= 32**
Size 52	**= 52**
For **control spool symbols,** see page 3	
Rated flow in l/min at valve pressure differential Δp = 10 bar	
Size 10	
25 l/min	**= 25**
50 l/min	**= 50**
85 l/min	**= 85**
Size 16	
100 l/min	**= 100**
125 l/min	**= 125**
150 l/min	**= 150**
180 l/min	**= 180**
Size 25	
220 l/min	**= 220**
325 l/min	**= 325**
Size 32	
360 l/min	**= 360**
520 l/min	**= 520**
Size 52	
1000 l/min	**= 1000**
Component series 70 to 79 (70 to 79: Unchanged installation and connection dimensions)	**= 7X**
For subplate mounting	**= no code**
For flange connection (size 52 only)	**= F**
Pilot control valve size 6	
Proportional solenoid with detachable coil	**= 6E** [1)]
Supply voltage	
Direct voltage 24 V	**= G24** [1)]
Without manual override	**= no code**
With concealed manual override	**= N9** [1, 2)]
Without special type of protection	**= no code**
Seawater-resistant	**= J** [3)]
Pilot oil supply and return	
External pilot oil supply, external pilot oil return	**= no code**
Internal pilot oil supply, external pilot oil return	**= E**
Internal pilot oil supply, internal pilot oil return	**= ET**
External pilot oil supply, internal pilot oil return (only possible without code for size 52 and type 4WRH)	**= T**

				*

For further details, see the plain text

M = NBR seals
V = FKM seals

no code = Without pressure reducing valve
D3 [1] **=** With pressure reducing valve ZDR 6 DP0-4X/40YM-W80 (not adjustable)

Electronics interface
A1 = Command value ±10 V
F1 = Command value 4 to 20 mA
no code = For types WRZ and WRH

Electrical connection type WRZ:
K4 [1, 4] **=** **Without** mating connector, with connector according to DIN EN 175301-803
Mating connector, separate order, see page 27

Type WRZE:
K31 [1, 4] **=** **Without** mating connector, with connector according to DIN EN 175201-804
Mating connector, separate order, see page 27

[1] Not applicable with types 4WRH

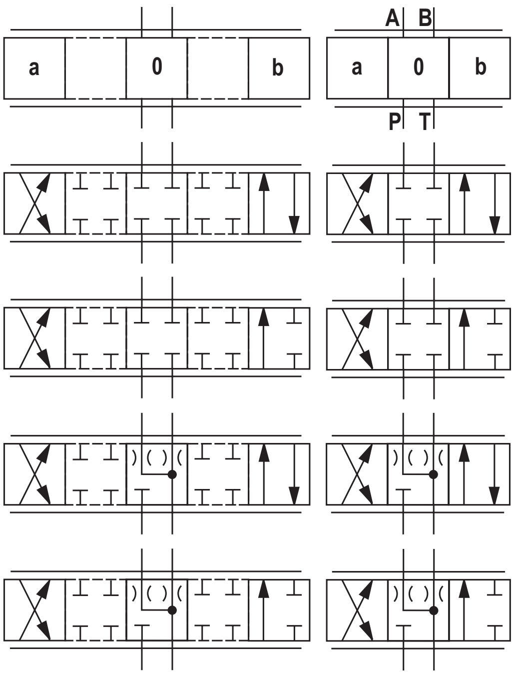
[2] For version "J"→"N" instead of "N9"

[3] For information on the seawater-resistant version, see data sheet 29115-M

[4] For version "J" = seawater-resistant **only** "K31"

Electric special types of protection available on request.

Control spool symbols

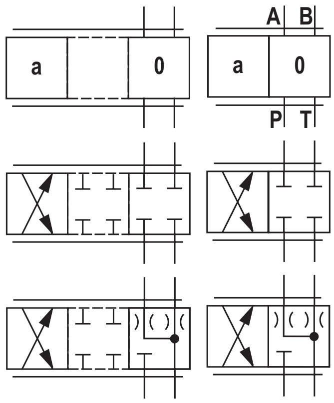


= E
E1-

= E3-

= W6-
W8-

= W9-



= EA [1]

= W6A [1]

[1] Not for type 4WRH

With symbols E1- and W8-: P → A: q_V B → T: q_V/2
P → B: q_V/2 A → T: q_V

With symbols E3- and W9-: P → A: q_V B → T: Blocked
P → B: q_V/2 A → T: q_V

(differential circuit, piston top at port A)

Notice: With symbols W6-, W8-, W9-, W6A, there is a connection from A → T and B → T with less than 2% of the respective nominal cross-section in switching position "0".

Ordering codes (types 4WRZ 52 and 4WRH 52; subplate mounting)

5WR_		52		1000 – 7X/									*

Hydraulic actuation	= **H**
Electro-hydraulic actuation	= **Z**
Type WRZ:	
For external electronics	= **no code**
With integrated electronics	= **E**
Size 52	= **52**
For **control spool symbols,** see page 5	
Rated flow in l/min at valve pressure differential Δp = 10 bar	
1000 l/min	= **1000**
Component series 70 to 79 (70 to 79: Unchanged installation and connection dimensions)	= **7X**
Pilot control valve size 6	
Proportional solenoid with detachable coil	= **6E** [1)]
Supply voltage	
Direct voltage 24 V	= **G24** [1)]
Without manual override	= **no code**
With concealed manual override	= **N9** [1, 2)]
Without special type of protection	= **no code**
Seawater-resistant	= **J** [3)]
Electrical connection type WRZ:	
Without mating connector, with connector according to DIN EN 175301-803; Mating connector, separate order, see page 27	= **K4** [1, 4]
Type WRZE:	
Without mating connector, with connector according to DIN EN 175201-804; Mating connector, separate order, see page 27	= **K31** [1, 4]
Electronics interface	
Command value ±10 V	= **A1**
Command value 4 to 20 mA	= **F1**
For types WRZ and WRH	= **no code**
Without pressure reducing valve	= **no code**
With pressure reducing valve ZDR 6 DP0-4X/40YM-W80 (not adjustable)	= **D3** [1)]
NBR seals	= **M**
FKM seals	= **V**
For further details, see the plain text	

[1)] Not applicable with types 4WRH

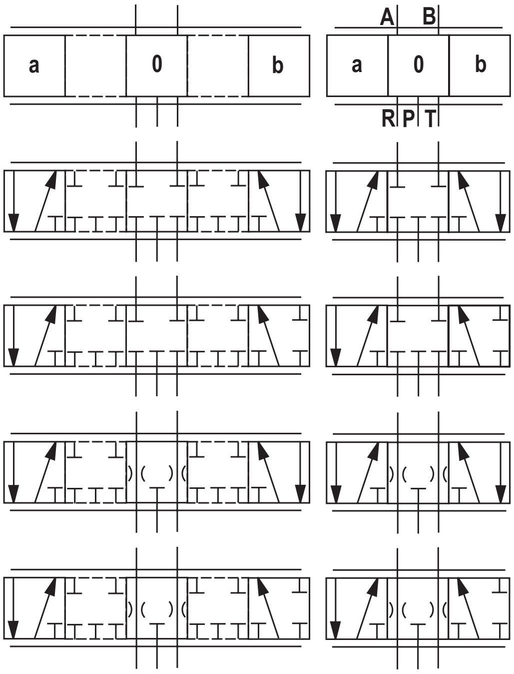
[2)] For version "J"→"N" instead of "N9"

[3)] For information on the seawater-resistant version, see data sheet 29115-M

[4)] For version "J" = seawater-resistant **only** "K31"

Electric special types of protection available on request.

Control spool symbols

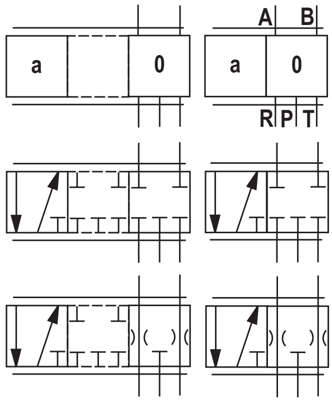


= E
E1-

= E3-

= W6-
W8-

= W9-



= EA [1)]

= W6A [1)]

[1)] Not for type 4WRH

With symbols E1- and W8-: P → A: q_V B → T: $q_V/2$
P → B: $q_V/2$ A → R: q_V
With symbols E3- and W9-: P → A: q_V B → T: Blocked
P → B: $q_V/2$ A → R: q_V
(differential circuit, piston top at port A)

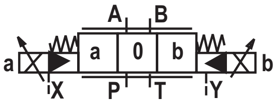
Notice:

- Only external pilot oil supply and return possible
- With control spool W6-, W8-, W9-, W6A, there is a connection from A → R and B → T with less than 2% of the respective nominal cross-section in switching position "0".

Symbols (simplified)

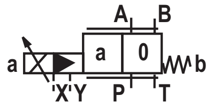
With electro-hydraulic actuation and for external electronics

Type 4WRZ…-7X./… and
type 4WRZ 52…-7XF/…

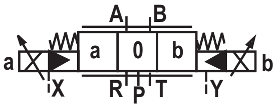


X = external
Y = external

Type 4WRZ…A-7X./… and
type 4WRZ 52 A…-7XF/…

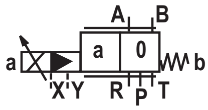


Type 5WRZ 52-7X./…

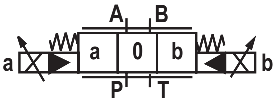


X = external
Y = external

Type 5WRZ 52 A-7X./…

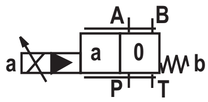


Type 4WRZ…-7X./…ET…



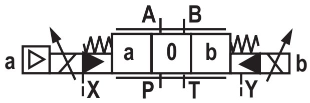
X = internal
Y = internal

Type 4WRZ.A…-7X./…ET…



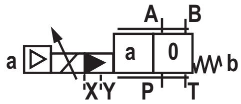
With electro-hydraulic actuation and for integrated electronics

Type 4WRZE…-7X./… and
type 4WRZE 52…-7XF/…

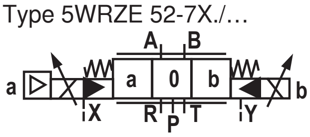


X = external
Y = external

Type 4WRZE…A-7X./… and
type 4WRZE 52 A…-7XF/…

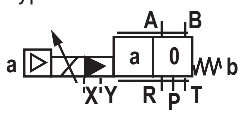


Type 5WRZE 52-7X./…

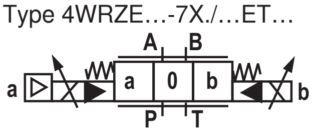


X = external
Y = external

Type 5WRZE 52 A-7X./…

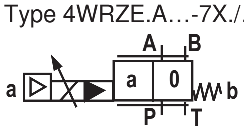


Type 4WRZE…-7X./…ET…



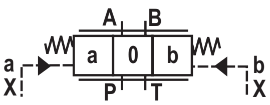
X = internal
Y = internal

Type 4WRZE.A…-7X./…ET…



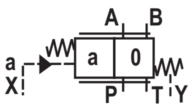
With hydraulic actuation

Type 4WRH…-7X./… and
type 4WRH 52…-7XF/…

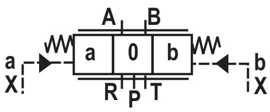


X = external
Y = external

Type 4WRH…A…-7X./… and
type 4WRH 52…-7XF/…

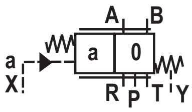


Type 5WRH 52…-7X.



X = external
Y = external

Type 5WRH 52 A…-7X./…



Function, section

Pilot control valve type 3DREP 6…

The pilot control valve is a 3-way pressure reducing valve that is actuated by a proportional solenoid. It converts an electrical input signal into a proportional pressure output signal and is used for all valves of the type 4WRZ... and 5WRZ...

The proportional solenoids are controllable, wet-pin DC solenoids with a central thread and a detachable coil. The solenoids are controlled by external electronics (type .WRZ...).

Set-up:

The valve basically consists of:
- Housing (1)
- Control spool (2) with pressure measuring spool (3 and 4)
- Solenoids (5 and 6) with central threads

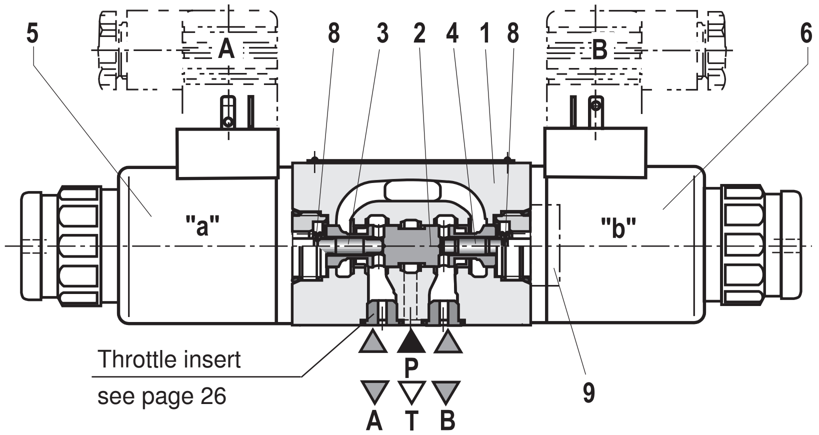
Function:

The pressure in A or B is set by means of the proportional solenoids. The amount of the pressure depends on the current. With de-energized solenoids (5, 6), the control spool (2) is held in the central position by means of the pressure springs (8). Ports A and B are connected with T so that the hydraulic fluid can flow to the tank without obstructions.

By energizing a proportional solenoid, e.g. solenoid "a" (5), the pressure measuring spool (3) and with it the control spool (2) are moved to the right. This opens the connection from P to B and A to T via orifice-type cross-sections with progressive flow characteristic. With the surface of the pressure measuring spool (4) the pressure that builds up in channel B acts on the control spool and against the solenoid force. The pressure measuring spool (4) is supported by solenoid "b". If the pressure exceeds the value set at solenoid "a", the control spool (2) is pushed back against the solenoid force and connects B with T until the set pressure is reached again. The pressure is proportional to the solenoid current.

When the solenoid is switched off, the control spool (2) is returned into the central position by the compression springs (8).

Type 3DREP 6…



Pilot control valve with two switching positions
(type 3DREP 6…B…)

The operation of this valve version basically corresponds to the valve with 3 switching positions. However, this 2 spool position valve is only equipped with solenoid "a" (5). In the place of the second proportional solenoid there is a plug screw (9).

Information on type 3DREP 6:
Prevent the tank line from draining. If this is possible due to installation conditions, install a preload valve (with a preload pressure of approx. 2 bar).

Function, section

Pilot control valve type 3DREPE 6…

The pilot control valve is a 3-way pressure reducing valve that is actuated by a proportional solenoid. It converts an electrical input signal into a proportional pressure output signal and is used for all valves of the type 4WRZE... and 5WRZE...

The proportional solenoids are controllable, wet-pin DC solenoids with a central thread and a detachable coil. The solenoids are controlled by the integrated electronics (type .WRZE...).

Set-up:

The valve basically consists of:
- Housing (1)
- Control spool (2) with pressure measuring spool (3 and 4)
- Solenoids (5 and 6) with central threads
- Integrated electronics (7)

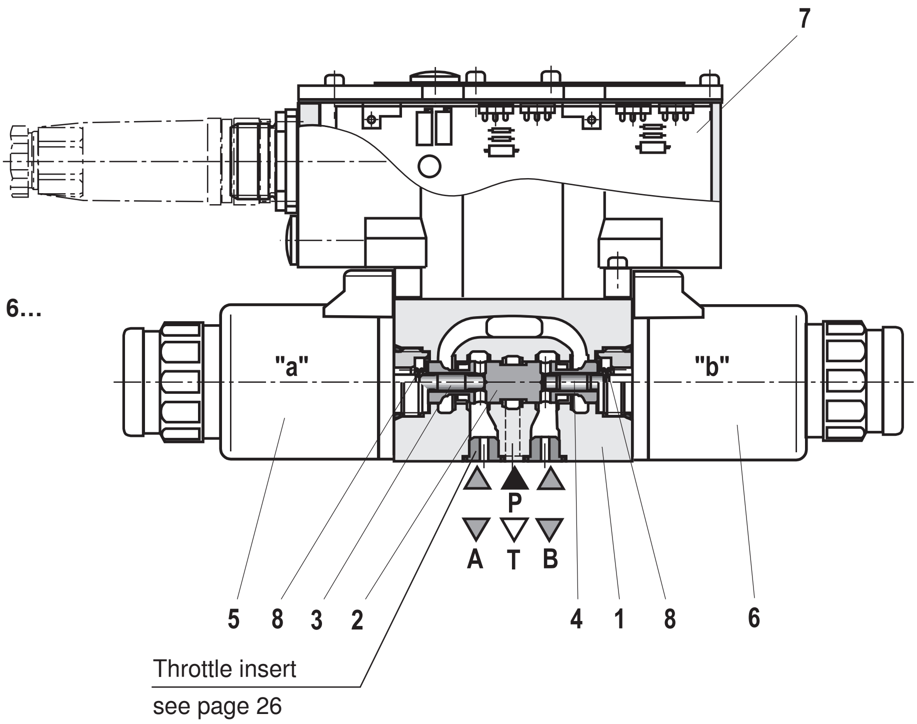
Function:

The pressure in A or B is set by means of the proportional solenoids. The amount of the pressure depends on the current. With de-energized solenoids (5, 6), the control spool (2) is held in the central position by means of the pressure springs (8). Ports A and B are connected with T so that the hydraulic fluid can flow to the tank without obstructions.

By energizing a proportional solenoid, e.g. solenoid "a" (5), the pressure measuring spool (3) and with it the control spool (2) are moved to the right. This opens the connection from P to B and A to T via orifice-type cross-sections with progressive flow characteristic. With the surface of the pressure measuring spool (4) the pressure that builds up in channel B acts on the control spool and against the solenoid force. The pressure measuring spool (4) is supported by solenoid "b". If the pressure exceeds the value set at solenoid "a", the control spool (2) is pushed back against the solenoid force and connects B with T until the set pressure is reached again. The pressure is proportional to the solenoid current.

When the solenoid is switched off, the control spool (2) is returned into the central position by the compression springs (8).

Type 3DREPE 6…



Function, section

Pilot operated proportional directional valves
Types 4WRZ… and 5WRZ.52…

Valves of type 4WRZ... are pilot operated 4-way directional valves that are actuated by proportional solenoids. They control the flow direction and size.

Valves of type 5WRZ... are equipped with an additional port "R" (only size 52).

Set-up:

The valve basically consists of:
- Pilot control valve (9) with proportional solenoids (5 and 6)
- Main valve (10) with main control spool (11) and centering spring (12)

☞ **Notice!**

Due to the design principle, internal leakage is inherent to the valves, which may increase over the life cycle.

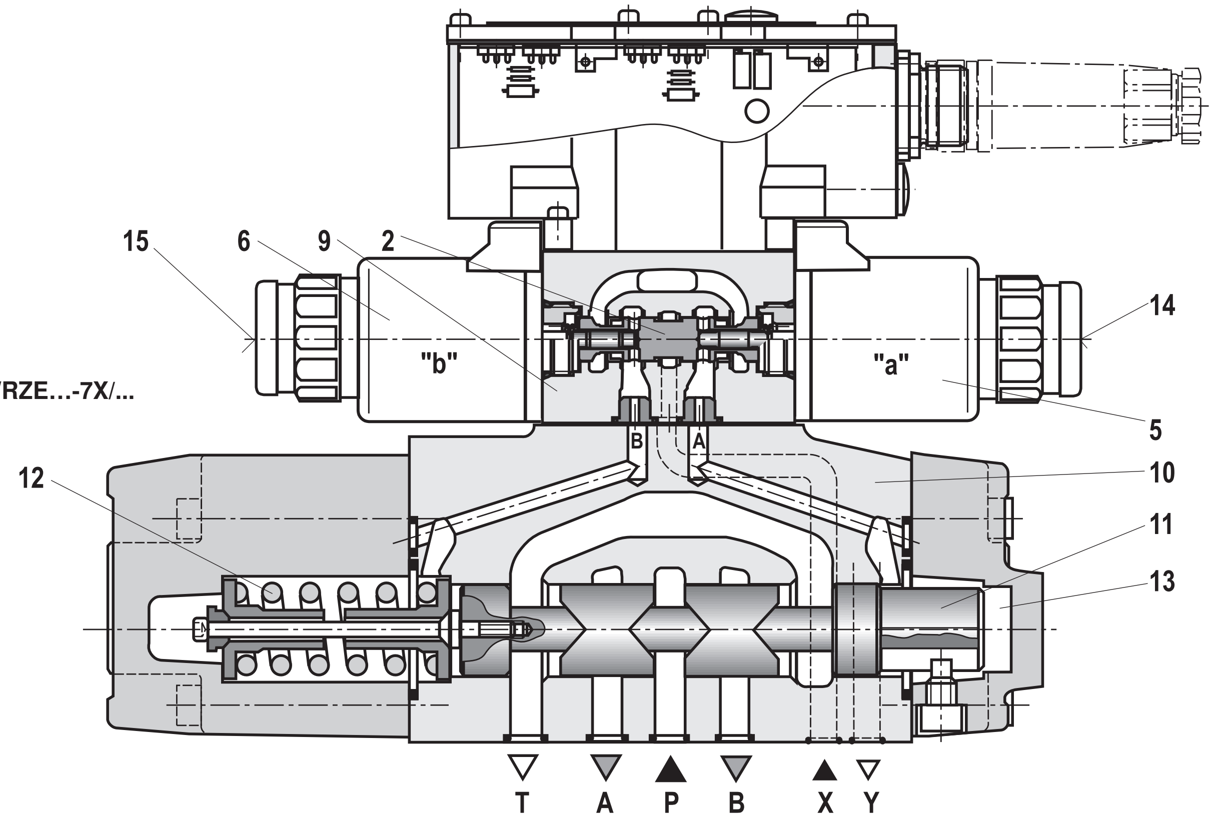
Function:

- With de-energized solenoids (5, 6), the main control spool (11) is held in the central position by means of the centering spring (12).
- The main control spool (11) is controlled by the pilot control valve (9); the main control spool is proportionally moved, e.g. by actuating solenoid "b" (6).
  - → The control spool (2) is moved to the right, pilot oil enters the pressure chamber (13) via the pilot control valve (9) and deflects the main control spool (11) according to the electric input signal.
  - → This opens the connection from P to B and A to T via orifice-type cross-sections with progressive flow characteristic.
- Pilot oil is internally supplied to the pilot control valve via port P or externally via port X.
- Switching the solenoid off (6)
  - → The control spool (2) and main control spool (11) are moved back into the central position.
- Depending on the switching position, flow occurs from P to A and B to T or P to B and A to T (R).

An optional manual override (14 and 15) can be used to move the control spool (2) without solenoid energization.

☞ **Notice:**
Inadvertent activation of the manual override may result in uncontrollable machine movements.

Type 4WRZE…-7X/...



Function, section

Externally pilot operated proportional directional valves Types 4WRH… and 5WRH.52…

Valves of the type .WRH... are pilot operated proportional directional valves for external actuation via pressure control valves.

Set-up:

The valve basically consists of:
- Main valve (10) with main control spool (11) and centering spring (12)
- Diversion plate (16)

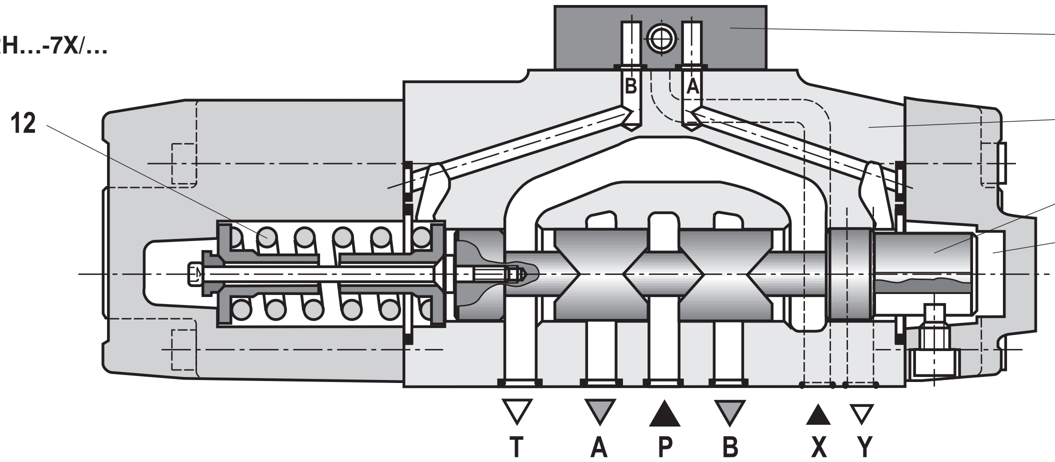
Notice!

Due to the design principle, internal leakage is inherent to the valves, which may increase over the life cycle.

Function:
- The diversion plate (16) connects control port A that leads to the pressure chamber (13) with port Y and control port B with port X.
- If port X is pressurized, the main control spool (11) is moved to the right (P to B and A to T). If port Y is pressurized, the main control spool is moved to the left (P to A and B to T).

The pilot pressure at the main valve must not exceed 25 bar (16 bar with size 52)!

Type .WRH…-7X/…



Technical data (for applications outside these parameters, please consult us!)

general

				.WRZ	.WRZE	.WRH
Valve type				.WRZ	.WRZE	.WRH
Installation position				Any, preferably horizontal (for commissioning information, see data sheet 07800)		
Storage temperature range			°C	–20 to +80		
Ambient temperature range			°C	–20 to +70	–20 to +50	–20 to +70
Weight	– Subplate mounting	Size 10	kg	7.8	8.0	6.1
		Size 16	kg	11.9	12.1	9.7
		Size 25	kg	18.2	18.4	18.0
		Size 32	kg	42.2	42.2	41.5
		Size 52	kg	79.5	79.7	
	– Flange connection	Size 52	kg	77.5	77.7	
	– With "D3"		kg	+0.5 in addition		
Sine test according to DIN EN 60068-2-6:2008				10 cycles, 10...2000...10 Hz with logarithmic frequency changing speed of 1 oct./min., 5 to 57 Hz, amplitude 1.5 mm (p-p), 57 to 2000 Hz, amplitude 10 g, 3 axes		
Random test according to DIN EN 60068-2-64:2009				20…2000 Hz, amplitude 0.05 g^2/Hz (10 g_{RMS}) 3 axes, 30 min testing time per axis		
Shock test according to DIN EN 60068-2-27:2010				Half sine 15 g/11 ms, 3 times in positive/3 times in negative direction per axis, 3 axes		
Humid heat, cyclic according to DIN EN 60068-2-30:2006				Variant 2 +25 °C to +55 °C, 90% to 97% relative humidity, 2 cycles at 24 hours each		

Technical data (for applications outside these parameters, please consult us!)

hydraulic (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C and p = 100 bar)

Size		Size	10	16	25	32	52
Operating pressure							
– Pilot control valve	External pilot oil supply	bar	30 to 100				20 to 100
	Internal pilot oil supply						–
		bar	100 to 315 only with "D3"	100 to 350 only with "D3"			
– Main valve		bar	Up to 315	Up to 350	Up to 350	Up to 350	Up to 350
Return flow pressure	– Port T (port R) (external pilot oil return)	bar	Up to 315	Up to 250	Up to 250	Up to 150	Up to 250
	– Port T (internal pilot oil return)	bar	Up to 30	Up to 30	Up to 30	Up to 30	–
	– Port Y	bar	Up to 30	Up to 30	Up to 30	Up to 30	Up to 30
Flow of the main valve		l/min	Up to 170	Up to 460	Up to 870	Up to 1600	Up to 2800
Pilot flow at ports X and Y with stepped input signal 0 → 100%		l/min	3.5	5.5	7	15.9	7
Pilot volume for switching process 0 → 100%		cm^3	1.7	4.6	10	26.5	54.3
Hydraulic fluid			See table below				
Hydraulic fluid temperature range (at the valve working ports)		°C	–20 to +80 (preferably +40 to +50)				
Viscosity range		mm^2/s	20 to 380 (preferably 30 to 46)				
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)							
	– Pilot control valve		Class 18/16/13 [1)]				
	– Main valve		Class 20/18/15 [1)]				
Hysteresis		%	≤ 6				

1) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the life cycle of the components.

Hydraulic fluid		Classification	Suitable sealing materials	Standards
Mineral oils and related hydrocarbons		HL, HLP	NBR, FKM	DIN 51524
Flame-resistant	– containing water	HFC (Fuchs HYDROTHERM 46M, Petrofer Ultra Safe 620)	NBR	ISO 12922

Important information on hydraulic fluids!

- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.)!
- The flash point of the process and operating medium used must be 40 K greater than the maximum solenoid surface temperature.
- **Flame-resistant – containing water**: The maximum pressure differential per control edge is 175 bar. Pressure preloading at the tank port > 20% of the pressure differential; otherwise, increased cavitation.
- Life cycle as compared to operation with mineral oil HL, HLP 50% to 100%

Technical data (for applications outside these parameters, please consult us!)

electric

Valve type			.WRZ [1]	.WRZE
Voltage type			Direct voltage	
Command value overlap		%	15	
Maximum current		A	1.5	2.5
Solenoid coil resistance	– Cold value at 20 °C	Ω	4.8	2
	– Maximum hot value	Ω	7.2	3
Duty cycle		%	100	
Maximum coil temperature [3]		°C	150	
Protection class of the valve according to EN 60529			IP65 with mating connectors mounted and locked	

Control electronics

Type 4WRZ	Digital amplifier in Euro-card format [2]		VT-VSPD-1-2X/... according to data sheet 30523	
	Analog amplifier in Euro-card format [2] with 1 ramp time		VT-VSPA2-1-2X/V0/T1, according to data sheet 30110	
	Analog amplifier in Euro-card format [2] with 5 ramp times		VT-VSPA2-1-2X/V0/T5, according to data sheet 30110	
	Analog module amplifier [2]		VT-11118-1X/... according to data sheet 30218	
Type 4WRZE			Integrated in the valve, see page 14	
	Analog command value module [2]		VT- SWMA-1-1X/... according to data sheet 29902	
	Analog command value module [2]		VT-SWMAK-1-1X/... according to data sheet 29903	
	Digital command value card [2]		VT-HACD-1-1X/… according to data sheet 30143	
	Analog command value card [2]		VT-SWKA-1-1X/... according to data sheet 30255	
Current consumption	I_{max}	A	–	1.8
	– Impulse current	A	–	3
Command value signal	– Voltage input "A1"	V	–	±10
	– Current input "F1"	mA	–	4 to 20

1) With Bosch Rexroth AG control electronics

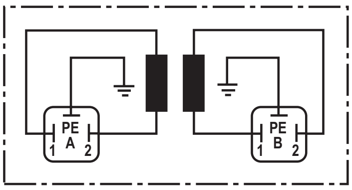
2) Separate order

3) Due to the temperatures occurring at the surfaces of the solenoid coils, the European standards ISO 13732-1 and EN 982 need to be adhered to.

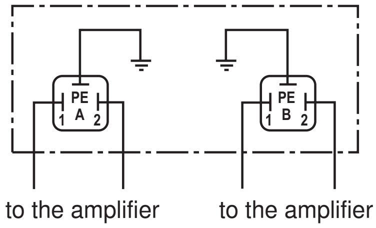
Electrical connection

For type .WRZ... (**for** external electronics – **not** with version **"J"** = seawater-resistant)
For mating connectors, see page 27

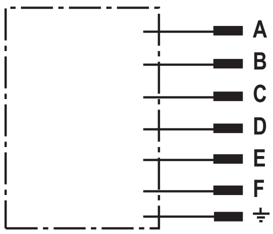
Connection at the connector



Connection to mating connector



For type .WRZ... (**for** external electronics – with version **"J"** = seawater-resistant)
For mating connectors, see page 27



External electronics

Contact	Connection with
A	Solenoid A
B	Solenoid B
C	Solenoid A
D	Solenoid B
E	n.c.
F	n.c.
PE	Valve housing

For type .WRZE... (**with** integrated electronics (OBE) and with version **"J"** = seawater-resistant)
For mating connectors, see page 27

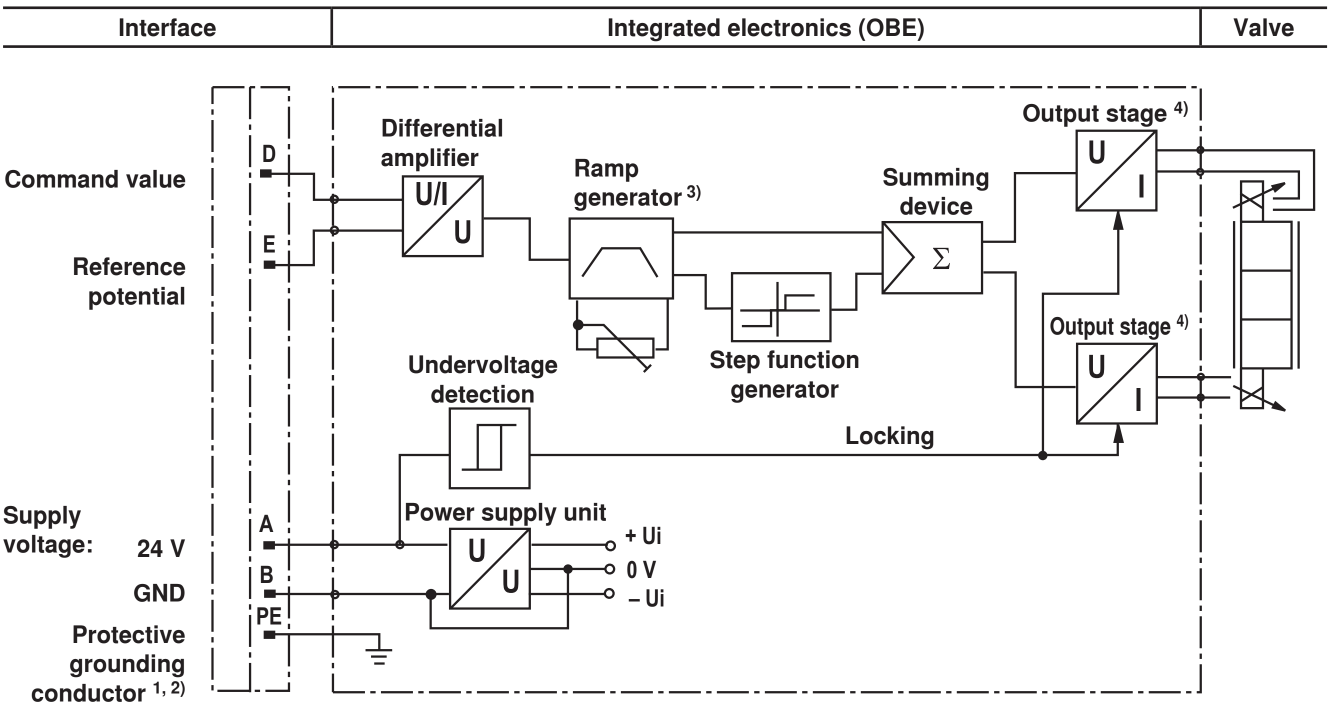
Connector pin assignment	Contact	Signal with A1	Signal at F1
Supply voltage	A	24 VDC ($\boldsymbol{u}$(t) = 19.4 to 35 V); $\boldsymbol{I}_{max}$ = 2 A	
	B	0 V	
Reference (actual value)	C	Cannot be used [1]	
Differential amplifier input	D	±10 V; $\boldsymbol{R}_e$ > 50 kΩ	4 to 20 mA; $\boldsymbol{R}_e$ > 100 Ω
(Command value)	E	Command value reference potential	
	F	Cannot be used [1]	
Protective grounding conductor	PE	Connected to cooling element and valve housing	

[1] Contacts C and F must not be connected!

Command value: A positive command value (0 to 10 V or 12 to 20 mA) at D and a reference potential at E result in a flow from P to A and B to T.
A negative command value (0 to –10 V or 12 to 4 mA) at D and a reference potential at E result in a flow from P to B and A to T.
If the valve and the solenoid are on side "a" (control spool variants EA and W6A), a positive command value at D and a reference potential at E result in flow from P to B and A to T.

Connection cable: Recommendation: – Up to 25 m cable length, type LiYCY 5 x 0.75 mm^2
– Up to 50 m 25 m cable length, type LiYCY 5 x 1.0 mm^2
External diameter 6.5 to 11 mm
Only install the shield on the supply side on the protective grounding conductor.

Block diagram of the integrated electronics (OBE) for type WRZE

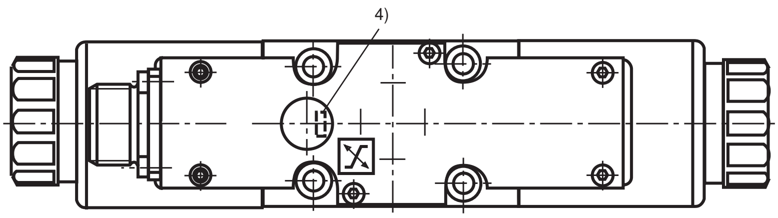


1) Port PE is connected to the cooling element and the valve housing

2) The protective grounding conductor is screwed to the valve housing and cover

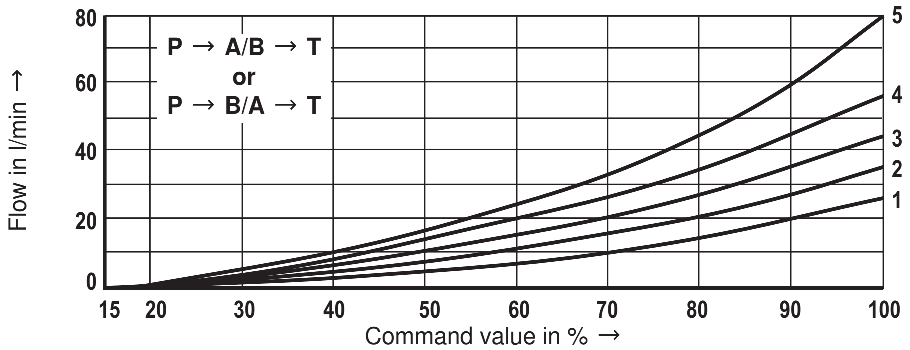
3) Ramp can be set from 0 to 2.5 s from the outside, identical for T_{up} and T_{down}

4) The output stages are current-controlled



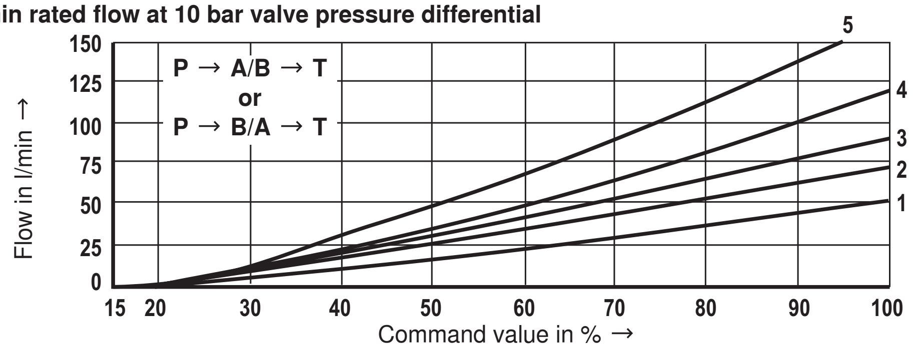
Characteristic curves size 10 (control spool "E, W6-, EA, W6A" as well as HLP46, ϑ_{oil} = 40 °C ±5 °C and p = 100 bar)

25 l/min rated flow at 10 bar valve pressure differential



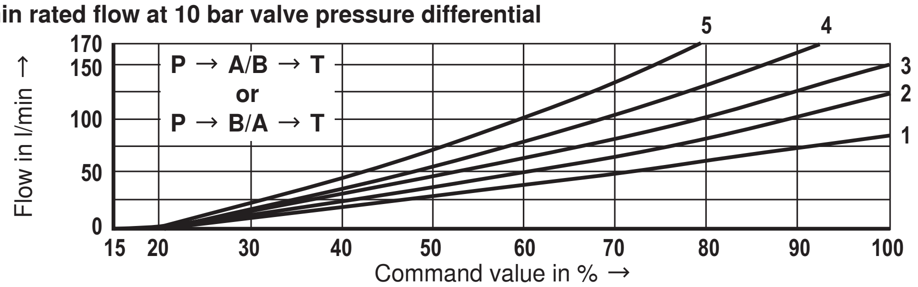
1 **Δp** = 10 bar, constant
2 **Δp** = 20 bar, constant
3 **Δp** = 30 bar, constant
4 **Δp** = 50 bar, constant
5 **Δp** = 100 bar, constant

50 l/min rated flow at 10 bar valve pressure differential



1 **Δp** = 10 bar, constant
2 **Δp** = 20 bar, constant
3 **Δp** = 30 bar, constant
4 **Δp** = 50 bar, constant
5 **Δp** = 100 bar, constant

85 l/min rated flow at 10 bar valve pressure differential

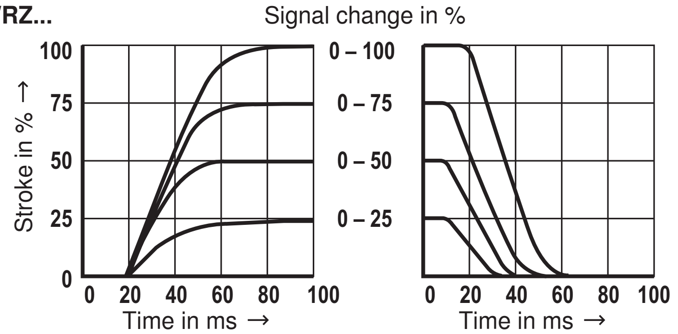


1 **Δp** = 10 bar, constant
2 **Δp** = 20 bar, constant
3 **Δp** = 30 bar, constant
4 **Δp** = 50 bar, constant
5 **Δp** = 100 bar, constant

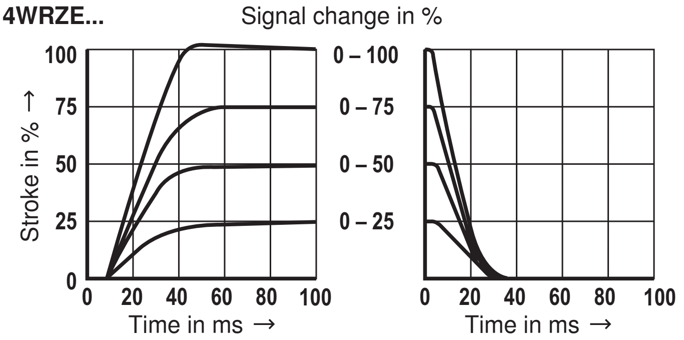
Δp = valve pressure differential according to DIN 24311 (inlet pressure p_P minus load pressure p_L minus return flow pressure p_T)

Transition functions with stepped, electric input signals, measured at p_{St} = 50 bar

Type 4WRZ...

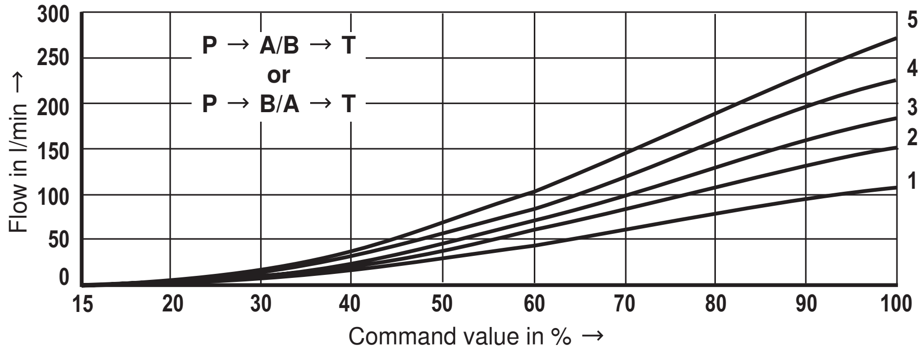


Type 4WRZE...



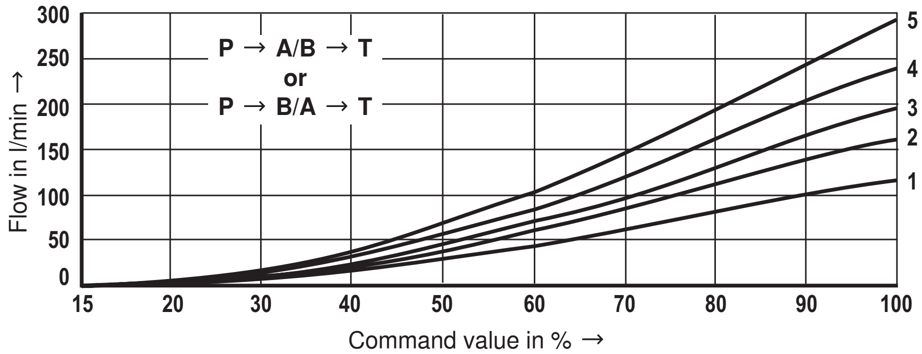
Characteristic curves size 16 (control spool "E, W6-, EA, W6A" as well as HLP46, ϑ_{oil} = 40 °C ±5 °C and p = 100 bar)

100 l/min rated flow at 10 bar valve pressure differential



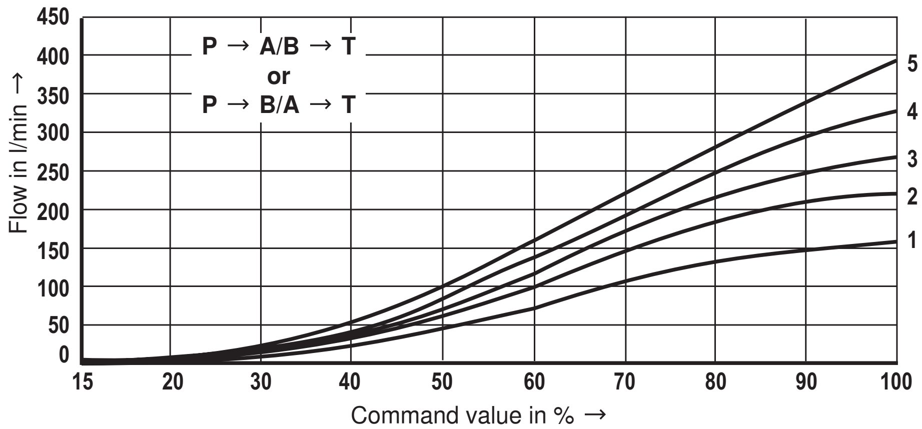
1 **Δp** = 10 bar, constant
2 **Δp** = 20 bar, constant
3 **Δp** = 30 bar, constant
4 **Δp** = 50 bar, constant
5 **Δp** = 100 bar, constant

125 l/min rated flow at 10 bar valve pressure differential



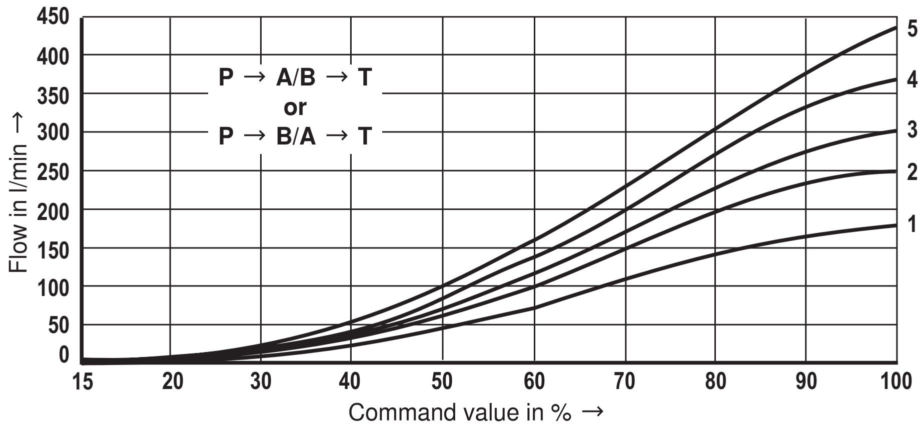
1 **Δp** = 10 bar, constant
2 **Δp** = 20 bar, constant
3 **Δp** = 30 bar, constant
4 **Δp** = 50 bar, constant
5 **Δp** = 100 bar, constant

150 l/min rated flow at 10 bar valve pressure differential



1 **Δp** = 10 bar, constant
2 **Δp** = 20 bar, constant
3 **Δp** = 30 bar, constant
4 **Δp** = 50 bar, constant
5 **Δp** = 100 bar, constant

180 l/min rated flow at 10 bar valve pressure differential



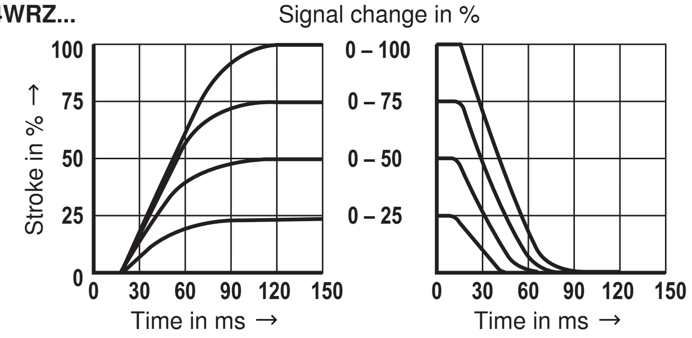
1 **Δp** = 10 bar, constant
2 **Δp** = 20 bar, constant
3 **Δp** = 30 bar, constant
4 **Δp** = 50 bar, constant
5 **Δp** = 100 bar, constant

Δp = valve pressure differential according to DIN 24311 (inlet pressure p_P minus load pressure p_L minus return flow pressure p_T)

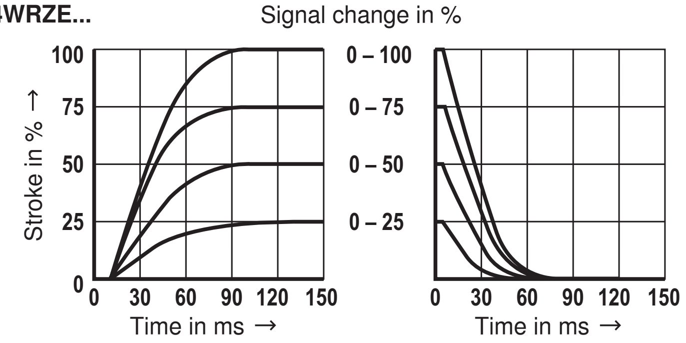
Characteristic curves size 16 (control spool "E, W6-, EA, W6A" as well as HLP46, ϑ_{oil} = 40 °C ±5 °C and p = 100 bar)

Transition functions with stepped, electric input signals, measured at p_{St} = 50 bar

Type 4WRZ...

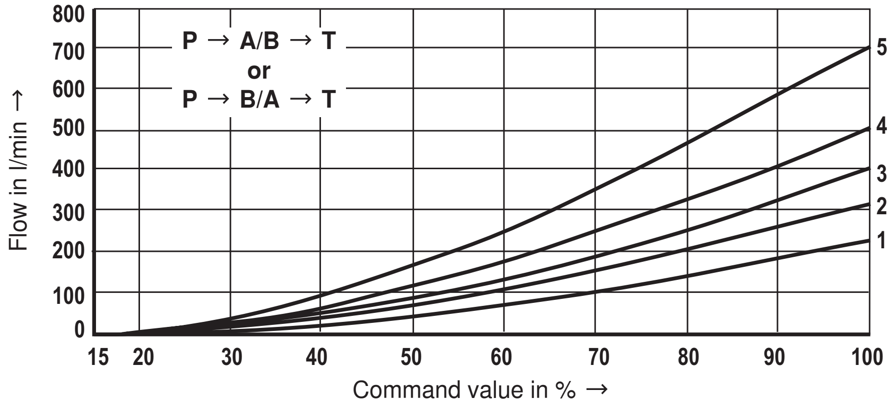


Type 4WRZE...



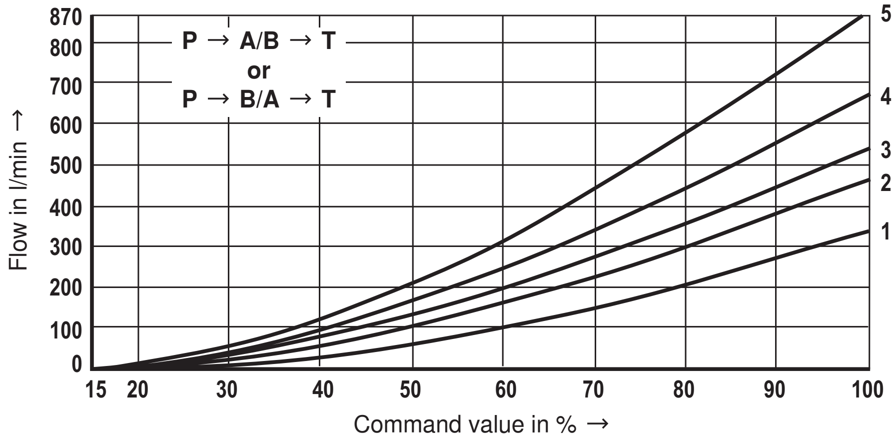
Characteristic curves size 25 (control spool "E, W6-, EA, W6A" as well as HLP46, ϑ_{oil} = 40 °C ±5 °C and p = 100 bar)

220 l/min rated flow at 10 bar valve pressure differential



1 Δp = 10 bar, constant
2 Δp = 20 bar, constant
3 Δp = 30 bar, constant
4 Δp = 50 bar, constant
5 Δp = 100 bar, constant

325 l/min rated flow at 10 bar valve pressure differential

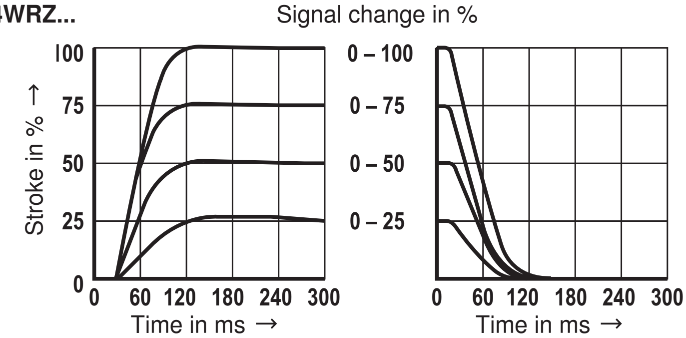


1 Δp = 10 bar, constant
2 Δp = 20 bar, constant
3 Δp = 30 bar, constant
4 Δp = 50 bar, constant
5 Δp = 100 bar, constant

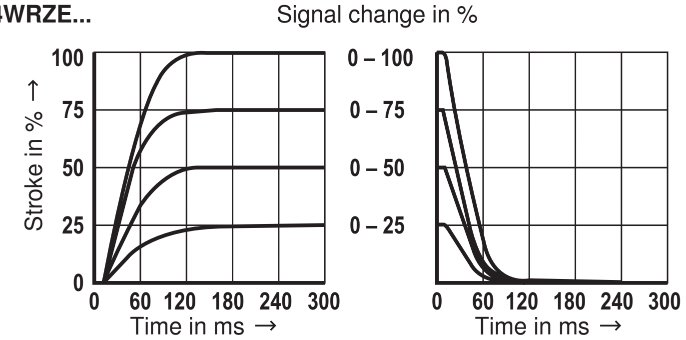
Δp = valve pressure differential according to DIN 24311 (inlet pressure p_P minus load pressure p_L minus return flow pressure p_T)

Transition functions with stepped, electric input signals, measured at p_{St} = 50 bar

Type 4WRZ...

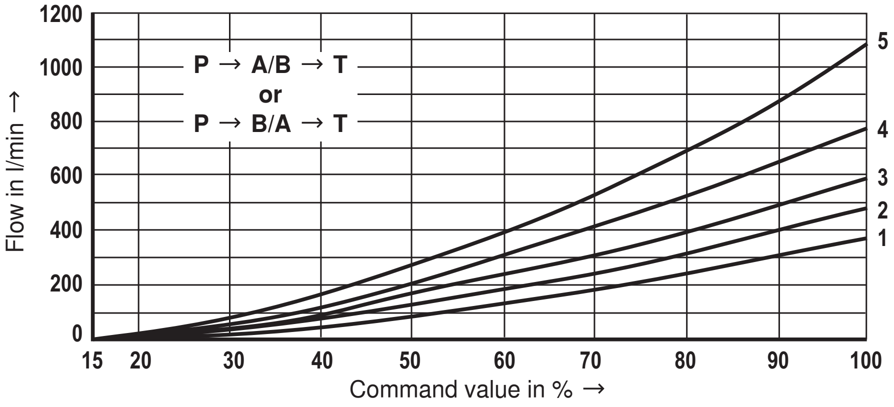


Type 4WRZE...



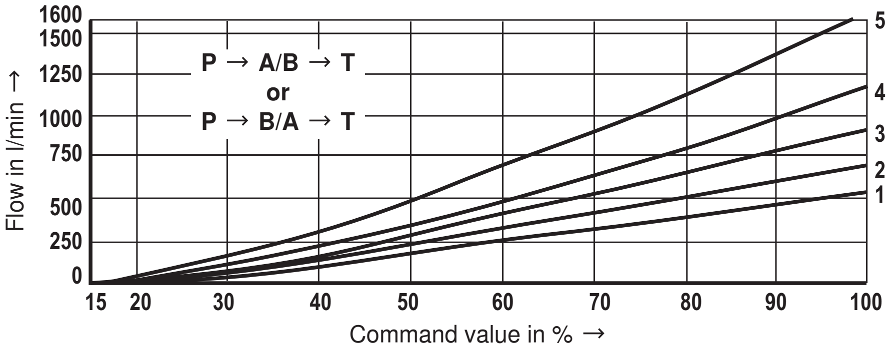
Characteristic curves size 32 (control spool "E, W6-, EA, W6A" as well as HLP46, ϑ_{oil} = 40 °C ±5 °C and p = 100 bar)

360 l/min rated flow at 10 bar valve pressure differential



1 **Δp** = 10 bar, constant
2 **Δp** = 20 bar, constant
3 **Δp** = 30 bar, constant
4 **Δp** = 50 bar, constant
5 **Δp** = 100 bar, constant

520 l/min rated flow at 10 bar valve pressure differential

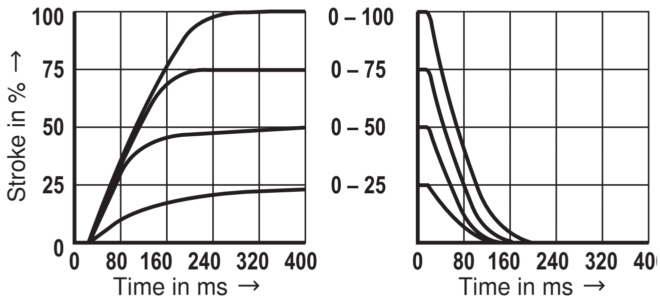


1 **Δp** = 10 bar, constant
2 **Δp** = 20 bar, constant
3 **Δp** = 30 bar, constant
4 **Δp** = 50 bar, constant
5 **Δp** = 100 bar, constant

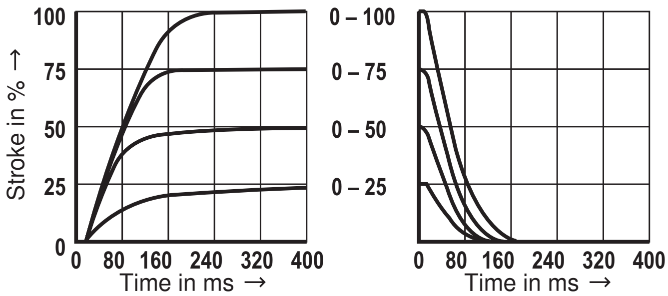
Δp = valve pressure differential according to DIN 24311 (inlet pressure p_P minus load pressure p_L minus return flow pressure p_T)

Transition functions with stepped, electric input signals, measured at p_{St} = 50 bar

Type 4WRZ... Signal change in %

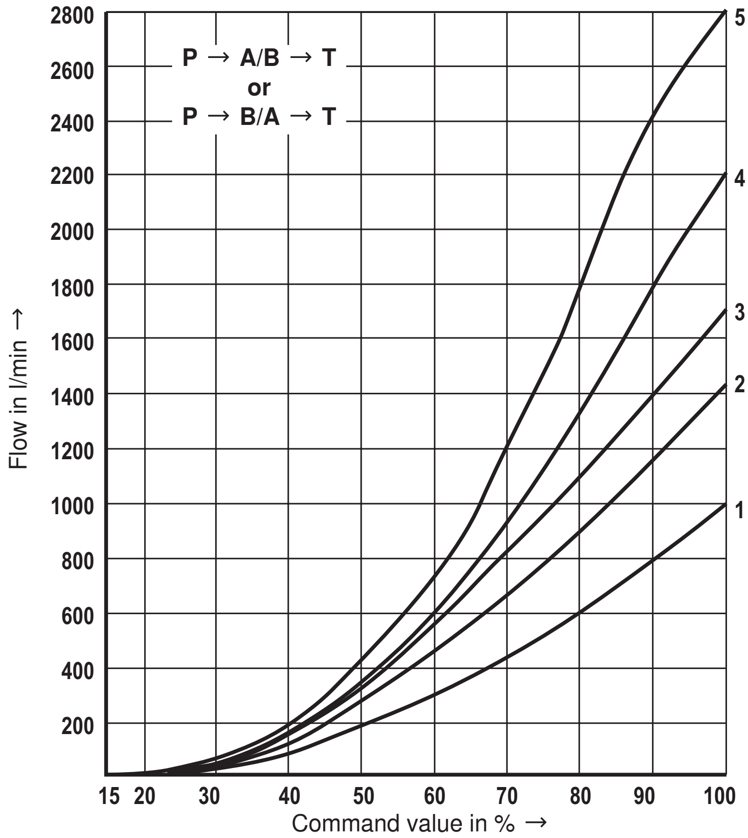


Type 4WRZE... Signal change in %



Characteristic curves size 52 (control spool "E, W6-, EA, W6A" as well as HLP46, ϑ_{oil} = 40 °C ±5 °C and p = 100 bar)

1000 l/min rated flow at 10 bar valve pressure differential

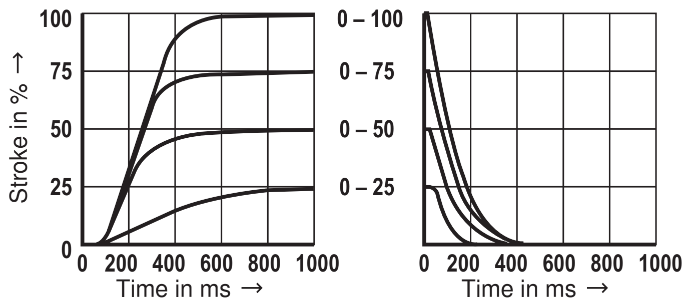


1 Δp = 10 bar, constant
2 Δp = 20 bar, constant
3 Δp = 30 bar, constant
4 Δp = 50 bar, constant
5 Δp = 100 bar, constant

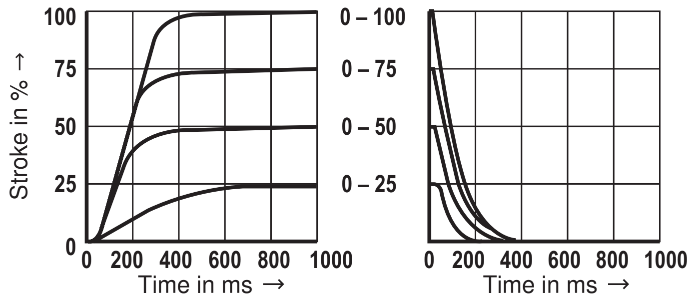
Δp = valve pressure differential according to DIN 24311 (inlet pressure p_P minus load pressure p_L minus return flow pressure p_T)

Transition functions with stepped, electric input signals, measured at p_{St} = 50 bar

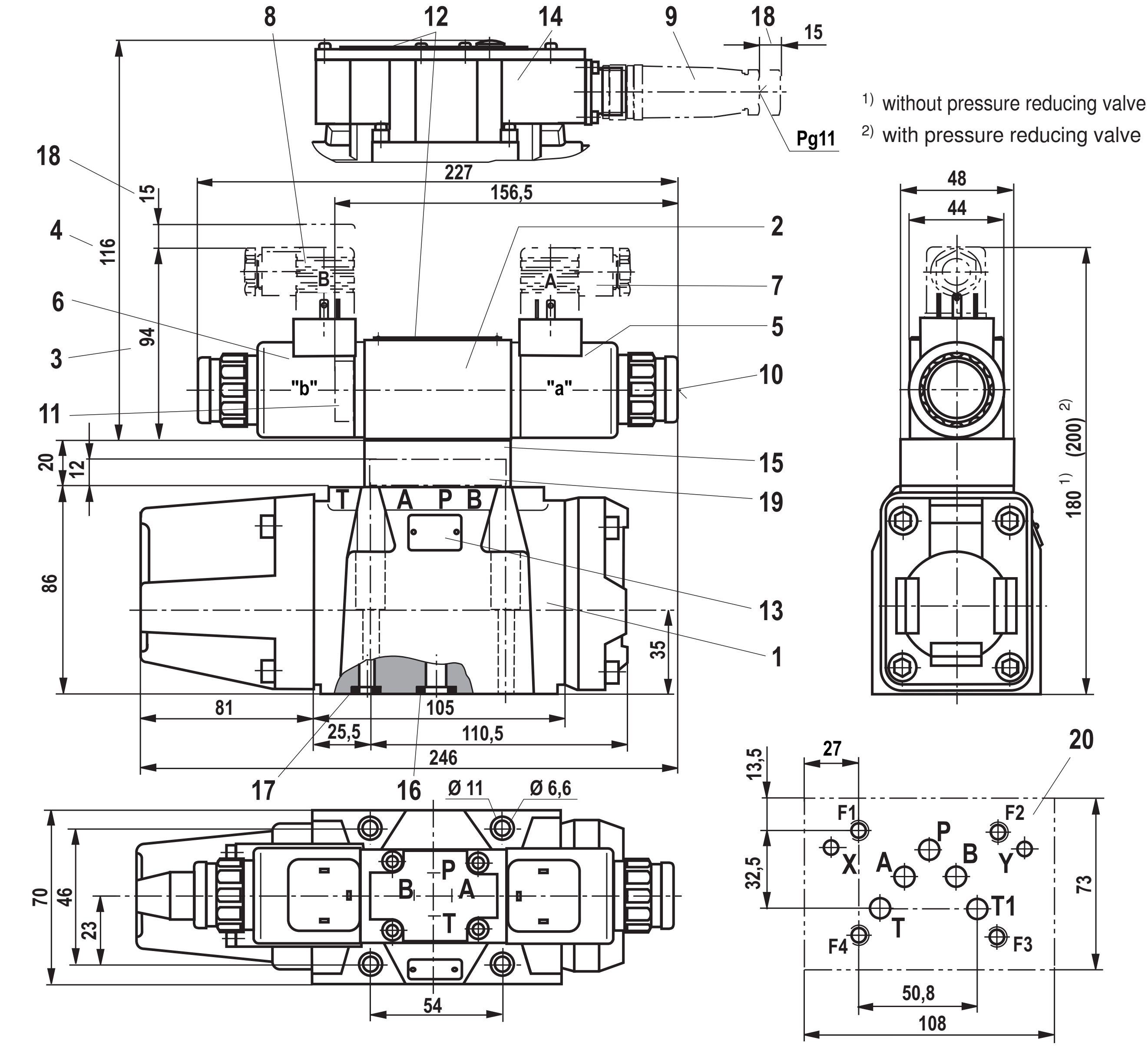
Type .WRZ...



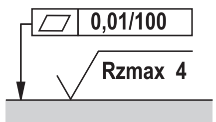
Type .WRZE...



Dimensions: Size 10 (dimensions in mm)



1) without pressure reducing valve
2) with pressure reducing valve

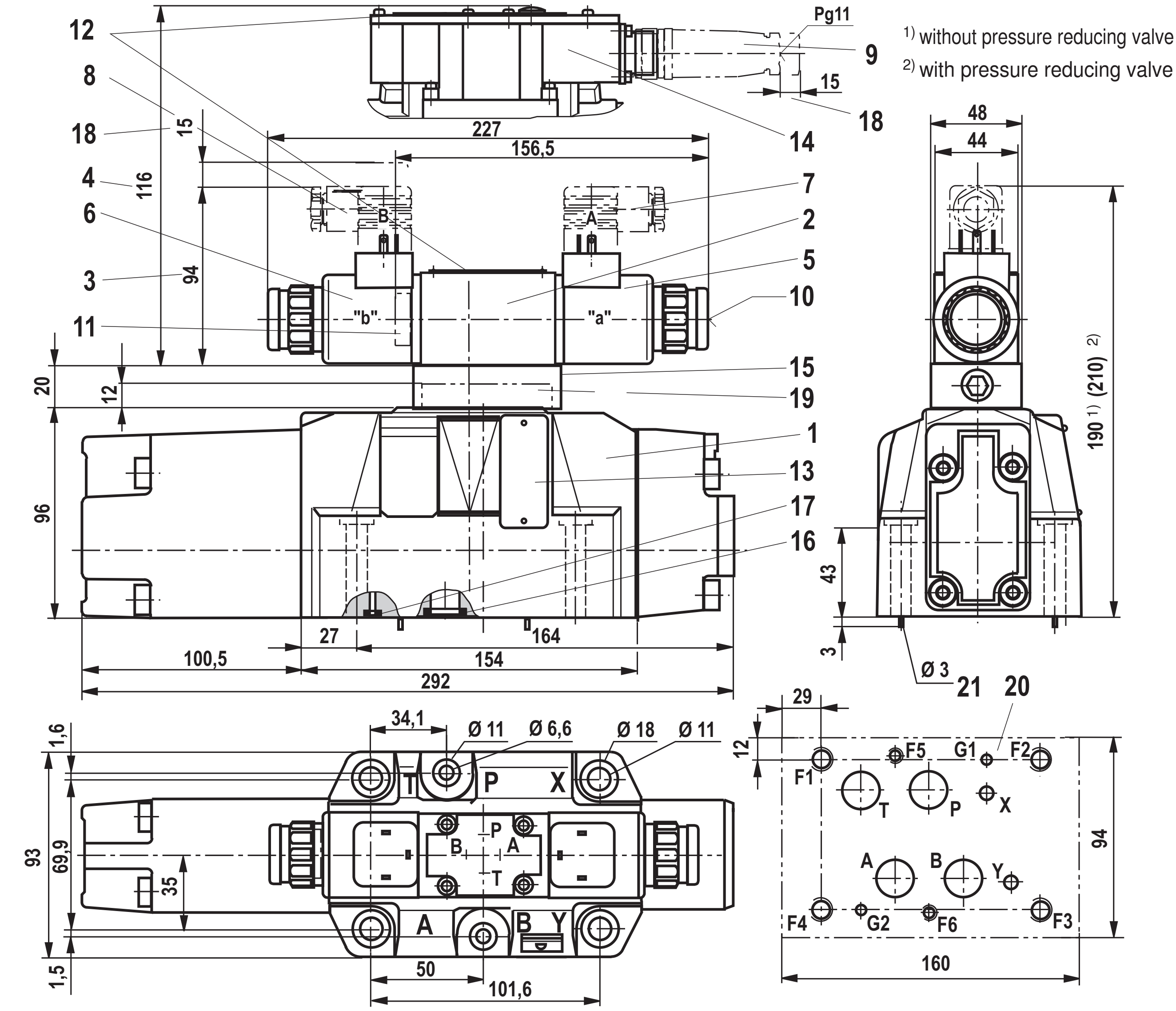


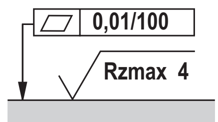
Required surface quality of the valve contact surface

- **1** Main valve
- **2** Pilot control valve
- **3** Dimension for version "4WRZ..." (**not** seawater-resistant)
- **4** Dimension for version "4WRZE..."
- **5** Proportional solenoid "a"
- **6** Proportional solenoid "b"
- **7** Mating connector "A", separate order, see page 27
- **8** Mating connector "B", separate order, see page 27
- **9** Mating connector, separate order, see page 27
- **10** Concealed manual override "N9"
- **11** Plug screw for valves with one solenoid
- **12** Name plate for pilot control valve
- **13** Name plate for main valve
- **14** Integrated electronics (OBE)
- **15** Pressure reducing valve "D3"
- **16** Identical seal rings for ports A, B, P, T, and T1
- **17** Identical seal rings for ports X and Y
- **18** Space required to remove the mating connector
- **19** Diversion plate (type 4WRH...)
- **20** Machined installation surface, porting pattern according to ISO 4401-05-05-0-05, ports X and Y as required

For subplates and valve mounting screws, see page 27

Dimensions: Size 16 (dimensions in mm)



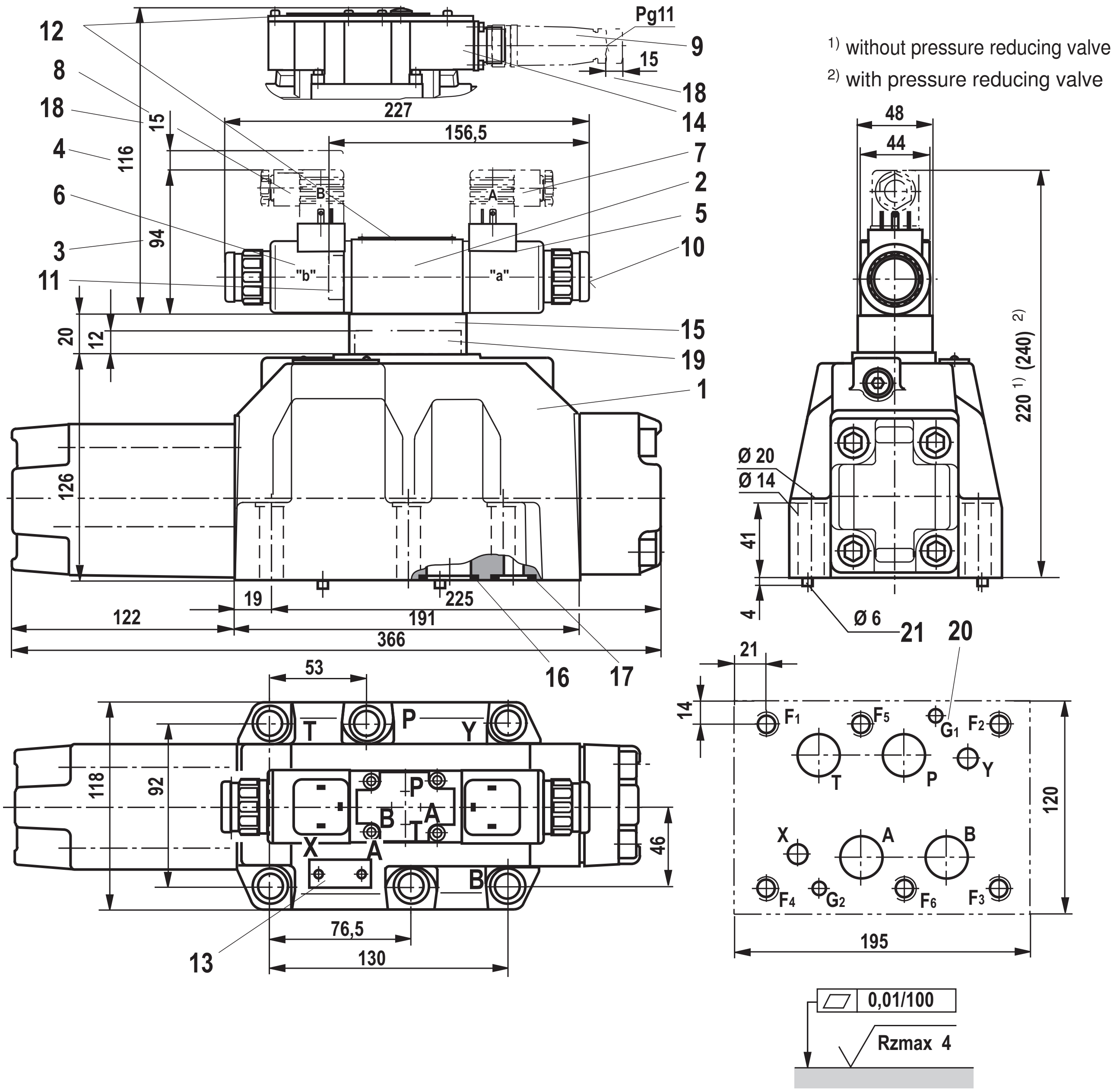


Required surface quality of the valve contact surface

1 Main valve
2 Pilot control valve
3 Dimension for version "4WRZ..." (**not** seawater-resistant)
4 Dimension for version "4WRZE..."
5 Proportional solenoid "a"
6 Proportional solenoid "b"
7 Mating connector "A", separate order, see page 27
8 Mating connector "B", separate order, see page 27
9 Mating connector, separate order, see page 27
10 Concealed manual override "N9"
11 Plug screw for valves with one solenoid
12 Name plate for pilot control valve
13 Name plate for main valve
14 Integrated electronics (OBE)
15 Pressure reducing valve "D3"
16 Identical seal rings for ports A, B, P, and T
17 Identical seal rings for ports X and Y
18 Space required to remove the mating connector
19 Diversion plate (type 4WRH...)
20 Machined installation surface, porting pattern according to ISO 4401-07-07-0-05, ports X and Y as required deviating from the standard: Ports A, B, P, T Ø20 mm.
21 Locking pin

For subplates and valve mounting screws, see page 27

Dimensions: Size 25 (dimensions in mm)

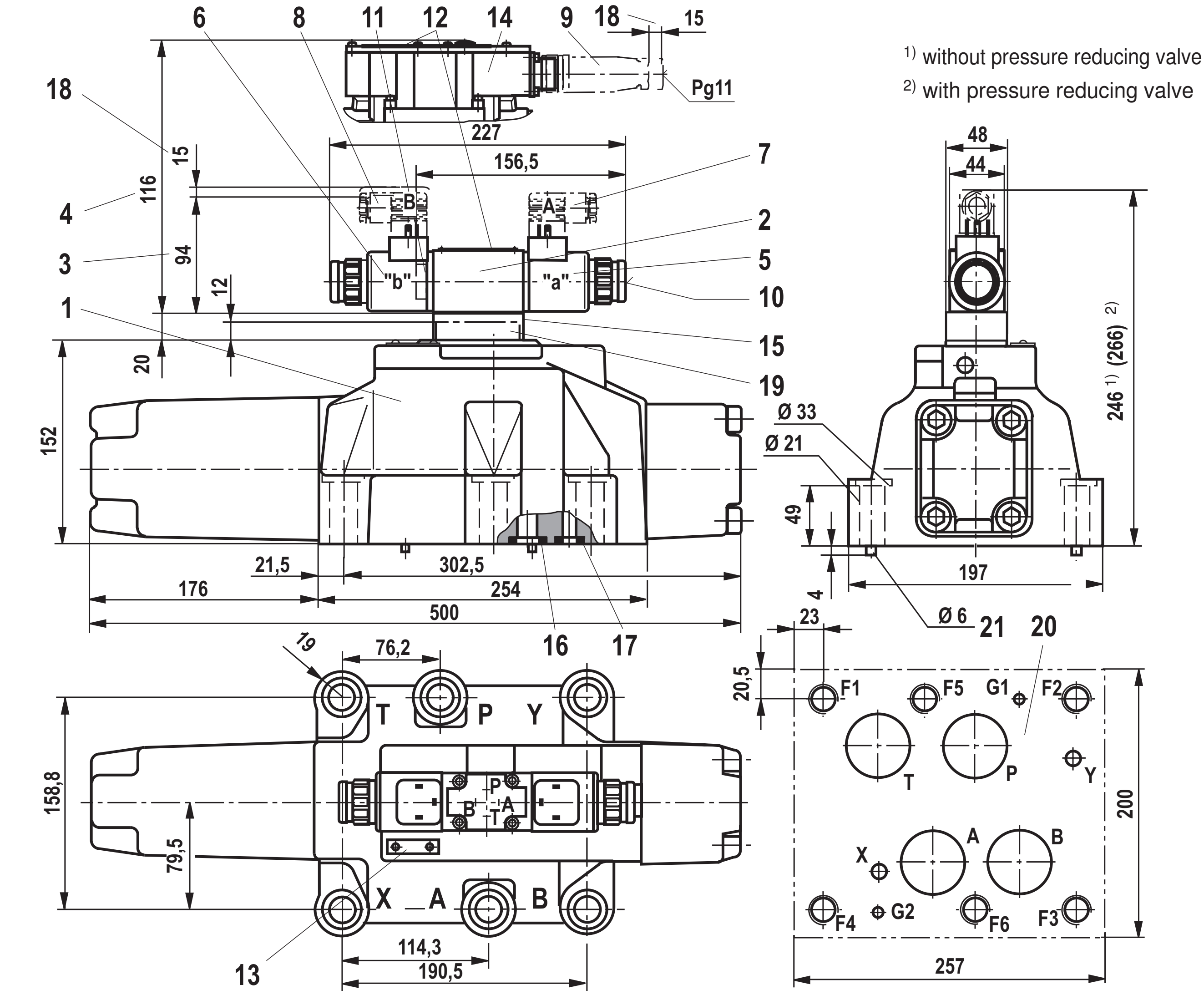


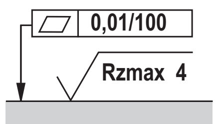
Required surface quality of the valve contact surface

- **1** Main valve
- **2** Pilot control valve
- **3** Dimension for version "4WRZ..." (**not** seawater-resistant)
- **4** Dimension for version "4WRZE..."
- **5** Proportional solenoid "a"
- **6** Proportional solenoid "b"
- **7** Mating connector "A", separate order, see page 27
- **8** Mating connector "B", separate order, see page 27
- **9** Mating connector, separate order, see page 27
- **10** Concealed manual override "N9"
- **11** Plug screw for valves with one solenoid
- **12** Name plate for pilot control valve
- **13** Name plate for main valve
- **14** Integrated electronics (OBE)
- **15** Pressure reducing valve "D3"
- **16** Identical seal rings for ports A, B, P, and T
- **17** Identical seal rings for ports X and Y
- **18** Space required for removing the mating connector
- **19** Diversion plate (type 4WRH...)
- **20** Machined installation surface, porting pattern according to ISO 4401-08-08-0-05, ports X and Y as required
- **21** Locking pin

For subplates and valve mounting screws, see page 27

Dimensions: Size 32 (dimensions in mm)



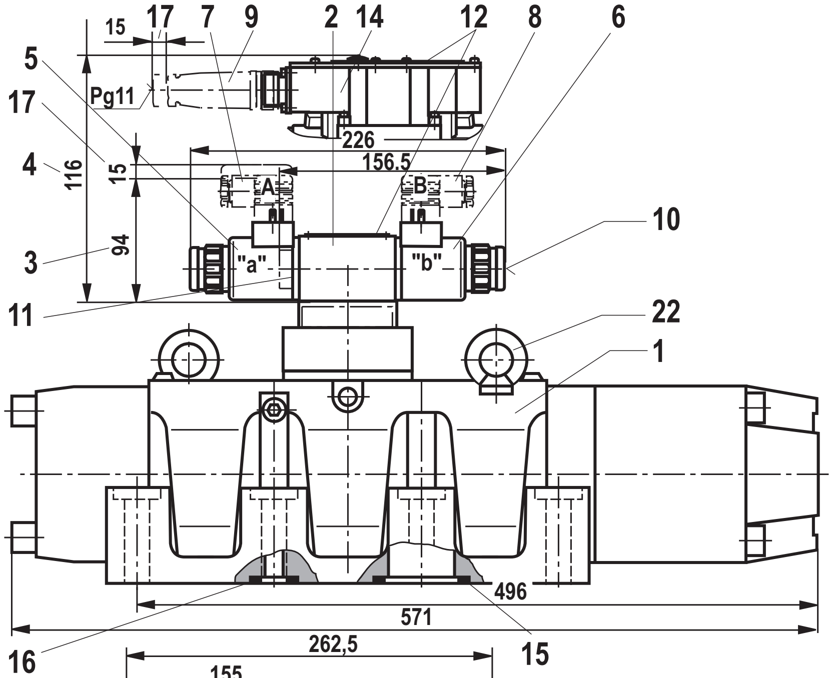


Required surface quality of the valve contact surface

1 Main valve
2 Pilot control valve
3 Dimension for version "4WRZ..." (**not** seawater-resistant)
4 Dimension for version "4WRZE..."
5 Proportional solenoid "a"
6 Proportional solenoid "b"
7 Mating connector "A", separate order, see page 27
8 Mating connector "B", separate order, see page 27
9 Mating connector, separate order, see page 27
10 Concealed manual override "N9"
11 Plug screw for valves with one solenoid
12 Name plate for pilot control valve
13 Name plate for main valve
14 Integrated electronics (OBE)
15 Pressure reducing valve "D3"
16 Identical seal rings for ports A, B, P, and T
17 Identical seal rings for ports X and Y
18 Space required for removing the mating connector
19 Diversion plate (type 4WRH...)
20 Machined installation surface, porting pattern according to ISO 4401-10-09-0-05, ports X and Y as required deviating from the standard:
– Ports A, B, T and P Ø38 mm.
21 Locking pin

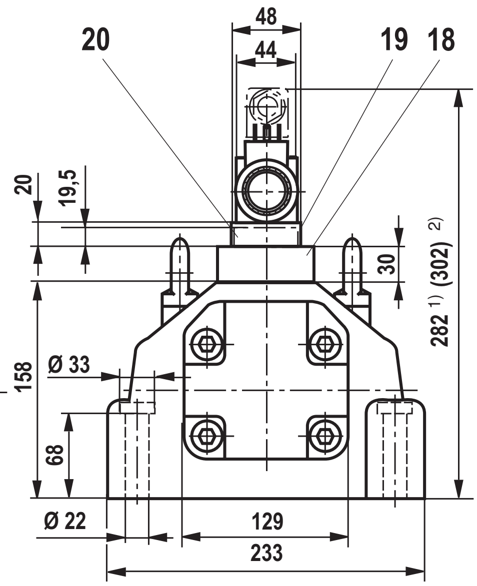
For subplates and valve mounting screws, see page 27

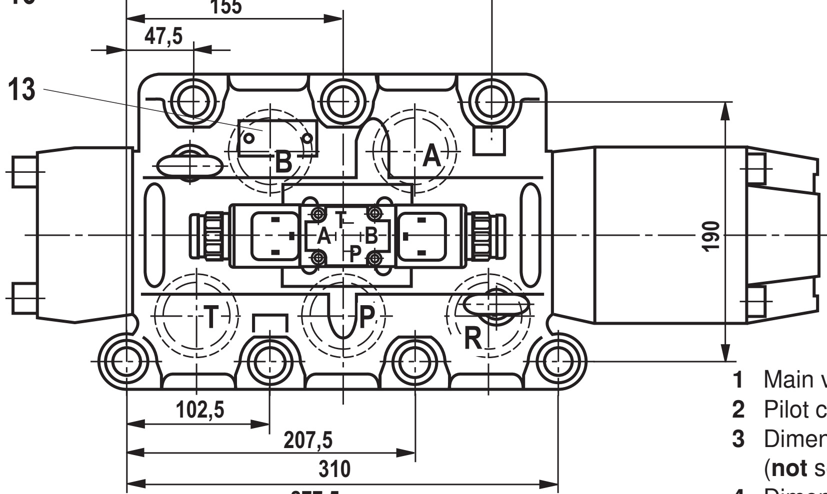
Dimensions: Subplate mounting size 52 (dimensions in mm)

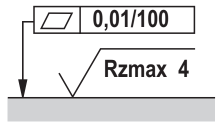


1) without pressure reducing valve

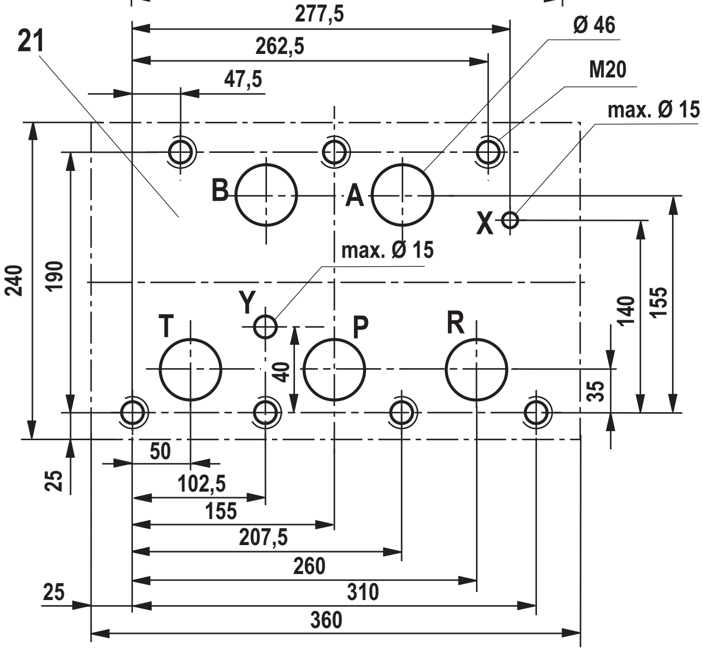
2) with pressure reducing valve







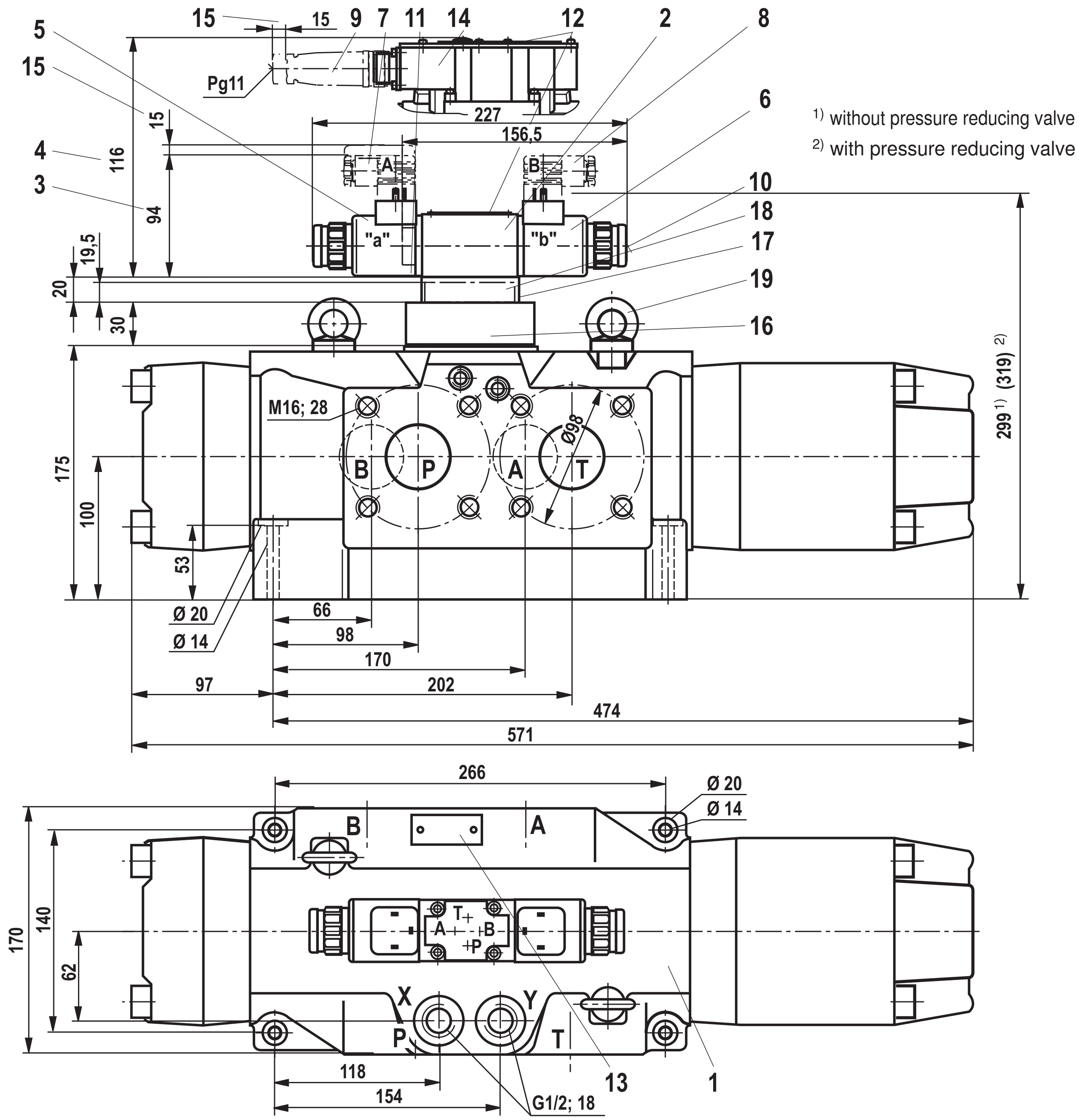
Required surface quality of the valve contact surface



1 Main valve
2 Pilot control valve
3 Dimension for version "4WRZ..." (**not** seawater-resistant)
4 Dimension for version "4WRZE..."
5 Proportional solenoid "a"
6 Proportional solenoid "b"
7 Mating connector "A"
8 Mating connector "B"
9 Mating connector, separate order, see page 27
10 Concealed manual override "N9"
11 Plug screw for valves with one solenoid
12 Name plate for pilot control valve
13 Name plate for main valve
14 Integrated electronics (OBE)
15 Identical seal rings for ports A, B, P, T, and R
16 Identical seal rings for ports X, Y, and L
17 Space required to remove the mating connector
18 Adapter plate
19 Pressure reducing valve "D3"
20 Diversion plate (type 4WRH...)
21 Machined installation surface, porting pattern, ports X and Y as required
22 Transport aid

For subplates and valve mounting screws, see page 27

Dimensions: Flange connection size 52 (dimensions in mm)



1 Main valve
2 Pilot control valve
3 Dimension for version "4WRZ..." (**not** seawater-resistant)
4 Dimension for version "4WRZE..."
5 Proportional solenoid "a"
6 Proportional solenoid "b"
7 Mating connector "A", separate order, see page 27
8 Mating connector "B", separate order, see page 27
9 Mating connector, separate order, see page 27
10 Concealed manual override "N9"
11 Plug screw for valves with one solenoid
12 Name plate for pilot control valve
13 Name plate for main valve
14 Integrated electronics (OBE)
15 Space required to remove the mating connector
16 Adapter plate
17 Pressure reducing valve "D3"
18 Diversion plate (type 4WRH...)
19 Transport aid

For subplates and valve mounting screws, see page 27

Accessories (not included in the scope of delivery)

Mating connectors			**Material number**
Mating connector for 4WRZ	DIN EN 175301-803	Solenoid "a", grey	R901017010
		Solenoid "b", black	R901017011
Mating connector for 4WRZE and 4WRZE...J...	DIN EN 175201-804		e.g. R900021267 (plastic)
			e.g. R900223890 (metal)

Hexagon socket head cap screws		**Material number**
Size 10	4x ISO 4762 - M6 x 45 - 10.9-flZn-240h-L Tightening torque M_A = 13.5 Nm ±10% or 4x ISO 4762 - M6 x 45 - 10.9 Tightening torque M_A = 15.5 Nm ±10%	R913000258
Size 16	2x ISO 4762 - M6 x 60 - 10.9-flZn-240h-L Tightening torque M_A = 12.2 Nm ±10% 4x ISO 4762 - M10 x 60 - 10.9-flZn-240h-L Tightening torque M_A = 58 Nm ±20% or 2x ISO 4762 - M6 x 60 - 10.9 Tightening torque M_A = 15.5 Nm ±10% 4x ISO 4762 - M10 x 60 - 10.9 Tightening torque M_A = 75 Nm ±20%	R913000115 R913000116
Size 25	6x ISO 4762 - M12 x 60 - 10.9-flZn-240h-L Tightening torque M_A = 100 Nm ±20% or 6x ISO 4762 - M12 x 60 - 10.9 Tightening torque M_A = 130 Nm ±20%	R913000121
Size 32	6x ISO 4762 - M20 x 80 - 10.9-flZn-240h-L Tightening torque M_A = 340 Nm ±20% or 6x ISO 4762 - M20 x 80 - 10.9 Tightening torque M_A = 430 Nm ±20%	R901035246
Size 52 (5WRZ52)	With a steel installation surface: 7x ISO 4762 - M20 x 90 - 10.9-flZn-240h-L Tightening torque M_A = 465 Nm ±20% With a cast iron installation surface: 7x ISO 4762 - M20 x 100 - 10.9-flZn-240h-L Tightening torque M_A = 465 Nm ±20% or With a steel installation surface: 7x ISO 4762 - M20 x 90 - 10.9 Tightening torque M_A = 610 Nm ±20% With a cast iron installation surface: 7x ISO 4762 - M20 x 100 - 10.9 Tightening torque M_A = 610 Nm ±20%	R913000397 R913000386
Size 52 (4WRZ52)	4x ISO 4762 - M12 x 70 - 10.9-flZn-240h-L Tightening torque M_A = 100 Nm ±20% or 4x ISO 4762 - M12 x 70 - 10.9 Tightening torque M_A = 130 Nm ±20%	R913000515

Subplates/connection flanges	**Data sheet**
Size 10	45054
Size 16	45056
Size 25	45058
Size 32	45060
Size 52	45501

When using type 4WRZ..., use the following throttle inserts in channel A and B of the pilot control valve:

Throttle insert	**Ø in mm**	**Material number**
Size 10	1.8	R900158510
Size 16	2.0	R900158547
Size 25	2.8	R900157948
Size 32	-	-
Size 52	-	-

RE 29 115-M/07.00

engineering
mannesmann
Rexroth

4/2 and 4/3 way proportional directional valve, pilot operated, without electrical feedback, seawater resistant Types 4WRZ…J and 4WRH…J

When compared to the standard version the following modifications have been carried out:

– The external metal components have been zinc galvanised (solenoid, housing) and aluminium nickal plated (component plug). The electronic's housing is made from plastic.

– Seawater resistance is identified by the code „J" in the ordering code

Note:

The valve fixing screws must be separately ordered:

Nom. size 10:	4 off M6 x 45 DIN 912-10.9 NEL [1];	M_A = 15.5 Nm,	Material No. 00230417
Nom. size 16:	4 off M10 x 60 DIN 912-10.9 NEL [1];	M_A = 75 Nm,	Material No. 00011397
	2 off M6 x 60 DIN 912-10.9 NEL [1];	M_A = 15.5 Nm,	Material No. 00230418
Nom. size 25:	6 off M12 x 60 DIN 912-10.9 NEL [1];	M_A = 130 Nm,	Material No. 00011399
Nom. size 32:	6 off M20 x 80 DIN 912-10.9 A3C oder NEL [1];	M_A = 430 Nm,	Material No. 00011429

[1] The code NEL stands for non-electrolytically applied zinc coatings which contain a lubrication additive for the reduction of friction in accordance with ISO/WD 10683, colour silver.

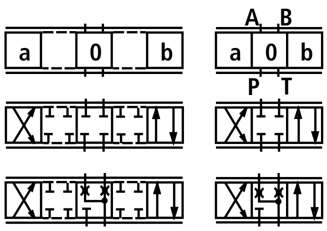
Further information can be obtained from the standard documentation RE 29 115.

Ordering details

4WR _				–7X	/			J		/			*

Nominal sizes 10 to 32

Symbols



= E

= W6-

Nominal flow in L/min bei at a valve pressure differential Δp = 10 bar

For nominal size 10	**= 25**	**= 50**	**= 85**
For nominal size 16		**= 100**	**= 150**
For nominal size 25		**= 220**	**= 325**
For nominal size 32		**= 360**	**= 520**

No code = Without hand override
N9 = With protected hand override

J = Seawater resistant

No code = Without pressure reducing valve

M = NBR seals suitable for mineral oil (HL, HLP) to DIN 51 524
V = FKM seals

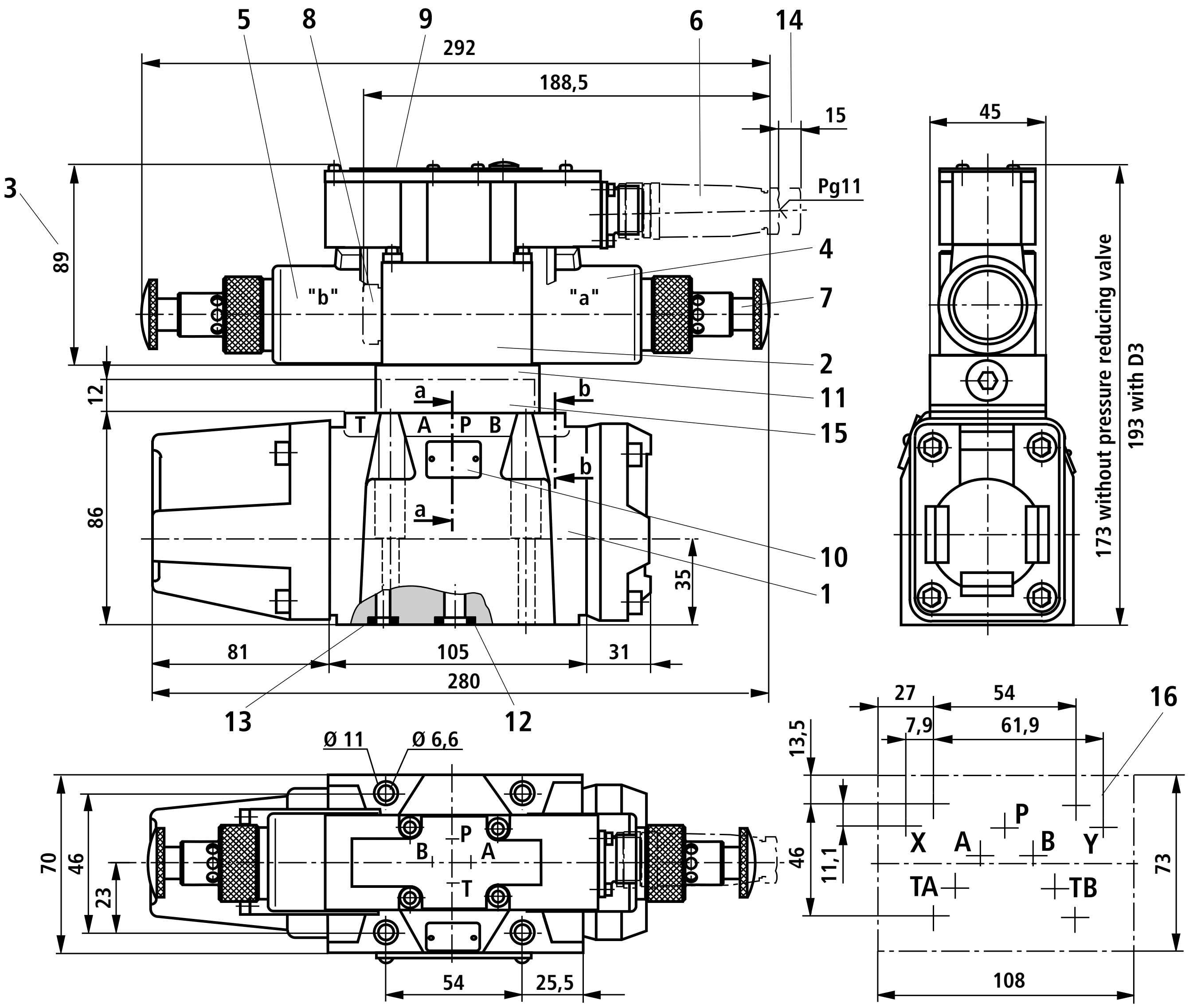
Rexroth Hydraulics

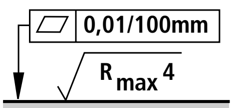
Preferred types

Type	Material No.
4WRZ 10 W6-85-7X/6EG24NJETK31/M	00970567
4WRZ 25 W6-325-7X/6EG24NJETK31/D3M	00959201
4WRZ 25 W6-325-7X/6EG24NJETK31/D3V	00966151
4WRZ 32 W6-520-7X/6EG24NJETK31/D3M	00970568
4WRZ 32 W6-520-7X/6EG24NJK31/V	00961666

Type	Material No.
4WRH 10 W6-50-7X/J/V	00953349
4WRH 10 W6-85-7X/J/M	00964459
4WRH 16 E100-7X/J/V	00952488
4WRH 16 W6-150-7X/J/M	00967471
4WRH 25 W6-325-7X/J/V	00963762

Unit dimensions: (Dimensions in mm) NS 10

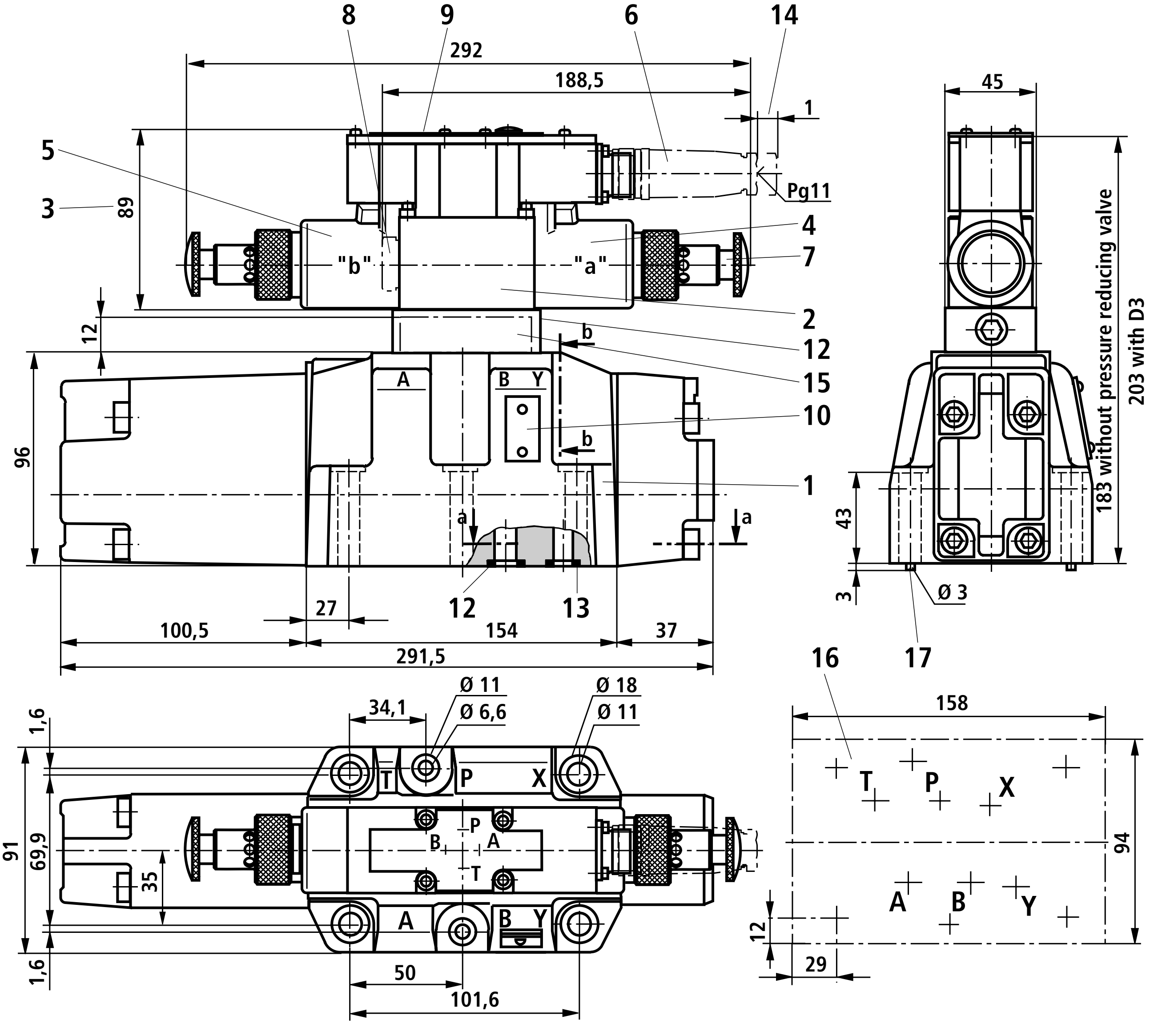




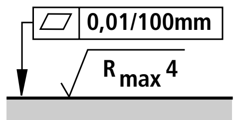
Required surface finish of mating piece

1 Main valve
2 Pilot control valve
3 Dimension for version „4WRZ…J“
4 Proportional solenoid „a“
5 Proportional solenoid „b“
6 Plug-in connector to E-DIN 43 563, separate order
7 Hand override
8 Cover for valves with one solenoid
9 Pilot control valve name plate
10 Main valve name plate
11 Pressure reducing valve
12 R-ring 13 x 1.6 x 2; ports A, B, P, T
13 R-ring 11.18 x 1.6 x 1.78; ports X, Y
14 Space required to remove the plug-in connector
15 Conversion plate (type 4WRH…)
16 Machined valve mounting surface, port locations to DIN 24 340 form A, ISO 4401 and CETOP-RP121H (X, Y on request)

Unit dimensions: (Dimensions in mm) NS 16



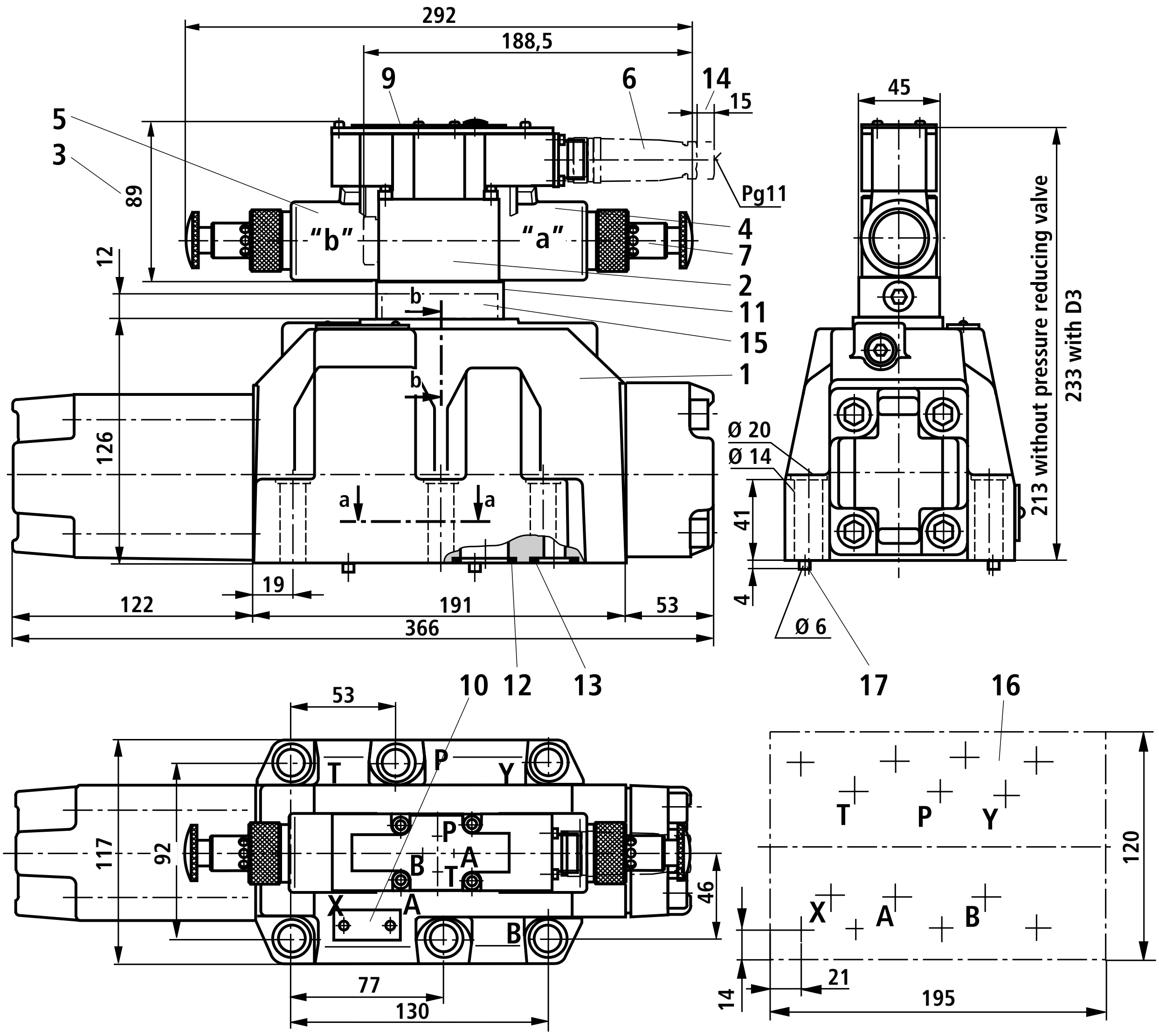
1 Main valve
2 Pilot control valve
3 Dimension for version „4WRZE…J“
4 Proportional solenoid „a“
5 Proportional solenoid „b“
6 Plug-in connector to E-DIN 43 563, separate order
7 Hand override
8 Cover for valves with one solenoid
9 Pilot control valve name plate
10 Main valve name plate
11 Pressure reducing valve
12 R-ring 22.53 x 2.3 x 2.62; ports A, B, P, T

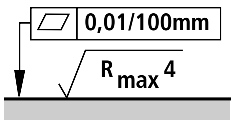


Required surface finish of mating piece

13 R-ring 10 x 2 x 2; ports X, Y
14 Space required to remove the plug-in connector
15 Conversion plate (type 4WRH…)
16 Machined valve mounting surface, port locations to DIN 24 340 form A, ISO 4401 and CETOP-RP121H
17 Locating pin

Unit dimensions: (Dimensions in mm) NS 25

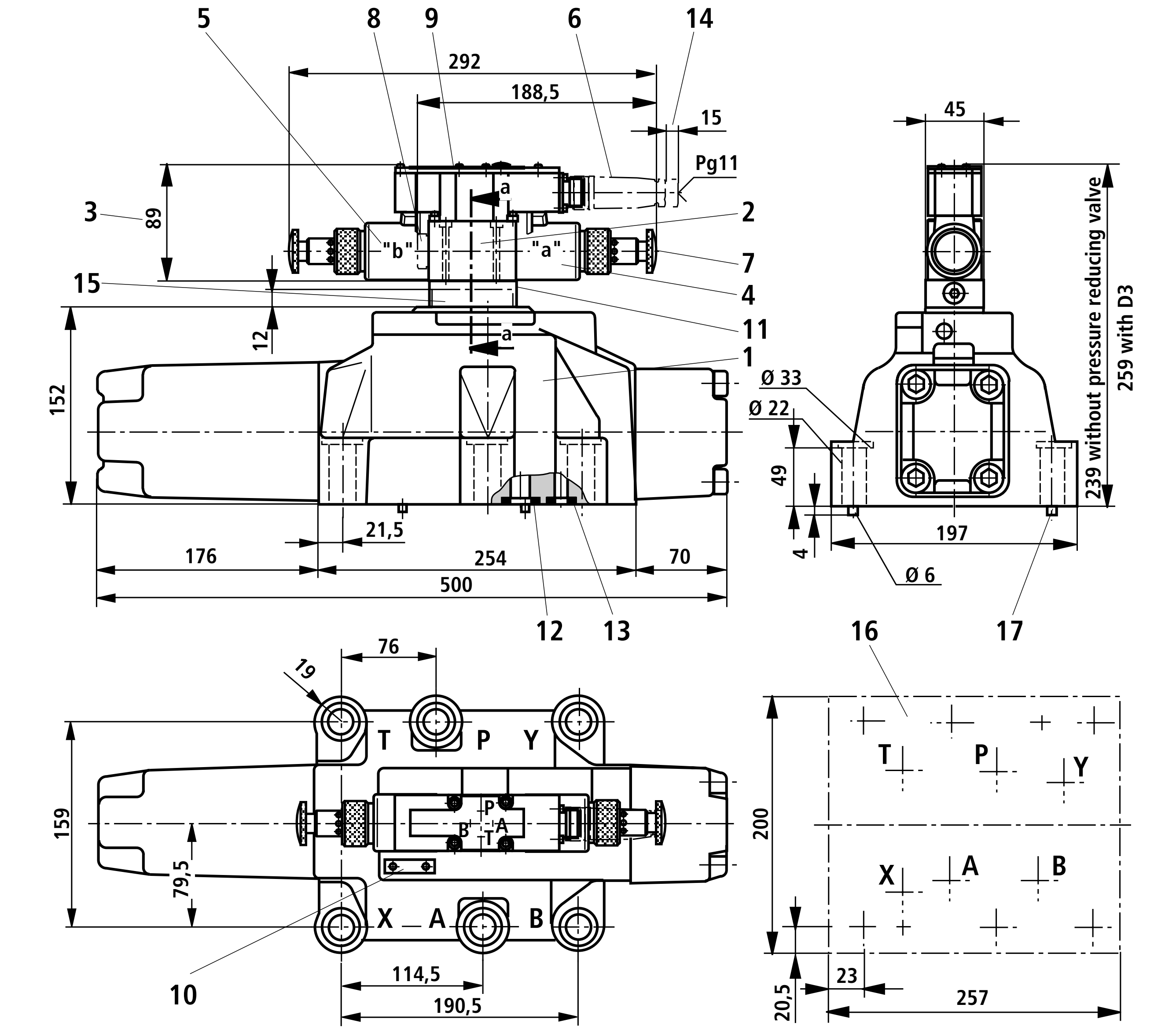


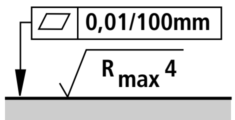


Required surface finish of mating piece

1 Main valve
2 Pilot control valve
3 Dimension for version „4WRZE…J“
4 Proportional solenoid „a“
5 Proportional solenoid „b“
6 Plug-in connector to E-DIN 43 563, separate order
7 Hand override
8 Cover for valves with one solenoid
9 Pilot control valve name plate
10 Main valve name plate
11 Pressure reducing valve
12 R-ring 27.8 x 2.6 x 3; ports A, B, P, T
13 R-ring 19 x 3 x 3; ports X, Y
14 Space required to remove the plug-in connector
15 Conversion plate (type 4WRH…)
16 Machined valve mounting surface, port locations to DIN 24 340 form A, ISO 4401 and CETOP-RP121H
17 Locating pin

Unit dimensions: (Dimensions in mm) **NS 32**





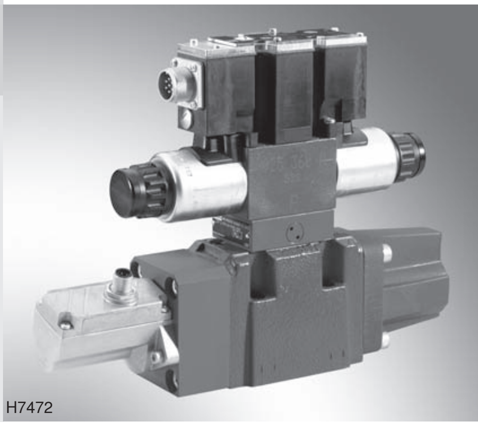
Required surface finish of mating piece

1 Main valve
2 Pilot control valve
3 Dimension for version „4WRZE…J"
4 Proportional solenoid „a"
5 Proportional solenoid „b"
6 Plug-in connector to E-DIN 43 563, separate order
7 Hand override
8 Cover for valves with one solenoid
9 Pilot control valve name plate
10 Main valve name plate
11 Pressure reducing valve
12 R-ring 42.5 x 3 x 3; ports A, B, P, T
13 R-ring 19 x 3 x 3; ports X, Y
14 Space required to remove the plug-in connector
15 Conversion plate (type 4WRH…)
16 Machined valve mounting surface, port locations to DIN 24 340 form A, ISO 4401 and CETOP-RP121H
17 Locating pin

4/2, 4/3 proportional directional valve, pilot operated, w/o electric position feedback without/with integrated electronics (OBE), with spool position indicator

RE 29117/08.13
Replaces: 06.08

Types 4WRZ(E)M and 4WRHM



H7472

Sizes 10 to 25
Component series 1X
Maximum operating pressure 350 bar
Maximum flow 870 l/min

Table of contents

Features

– Pilot operated, 2-stage proportional directional valves with integrated electronics (OBE) with type 4WRZE
– Spool position indicator
– In combination with a contact shut-off, the valve complies with the requirements for safety-related components of a control according to category 1, EN ISO 13849-1:2006
– Suitable for use in safety-related parts of controls according to category 4, EN ISO 13849-1:2006
– Control of flow direction and size
– Operation by means of proportional solenoids with central thread and detachable coil
– Subplate mounting, porting pattern according to ISO 4401
– Manual override, optional
– Spring-centered control spool

Ordering codes

4WR			M			–1X/					/			*

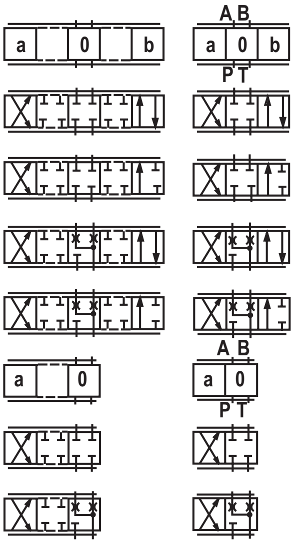
Hydraulic actuation = **H**
Electro-hydraulic actuation = **Z**

Only with WRZ:
With external electronics = **no code**
With integrated electronics = **E**

Monitoring the switching position = **M**

Size 10 = **10**
Size 16 = **16**
Size 25 = **25**
Size 32, see data sheet 29118

Control spool symbols



= **E**
E1-
= **E3-**
= **W6-**
W8-
= **W9-**
= **EA** [1)]
= **W6A** [1)]

With symbols E1- and W8-:
P → A: q_V B → T: $q_V/2$
P → B: $q_V/2$ A → T: q_V

With symbols E3- and W9-:
P → A: q_V B → T: Blocked
P → B: $q_V/2$ A → T: q_V
(differential circuit, piston top at port A)

Notice:
With spools W6-, W8-, W9-, W6A, there is a connection from A → T and B → T with less than 2% of the respective nominal cross-section in switching position "0".

For further details, see the plain text

M = NBR seals
V = FKM seals

no code = Without pressure reducing valve
D3 [1)] **=** With pressure reducing valve ZDR 6 DP0-4X/40YM-W80 (not adjustable)

Electronics interface for 4WRZEM:
A1 = Command value input ±10 V
F1 = Command value input 4 to 20 mA
no code = For WRZM and WRHM

Electrical connection for WRZM:
K4 = Without mating connector with connector according to DIN EN 175301-803
Mating connector – separate order, see page 19
for WRZEM:
K31 = Without mating connector with connector according to DIN EN 175201 804
Mating connector – separate order, see page 19

Pilot oil supply and return
no code = External pilot oil supply, external pilot oil return
E [1)] **=** Internal pilot oil supply, external pilot oil return
ET [1)] **=** Internal pilot oil supply, internal pilot oil return
T [1)] **=** External pilot oil supply, internal pilot oil return

no code = Without manual override
N9 [1)] **=** With concealed manual override

Supply voltage of the electronics
G24 [1)] **=** 24 V direct voltage (standard version)

6E [1)] **=** Pilot control valve size 6, proportional solenoid with detachable coil

1X = Component series 10 to 19
(10 to 19: Unchanged installation and connection dimensions)

Rated flow in l/min at valve pressure differential Δp = 10 bar

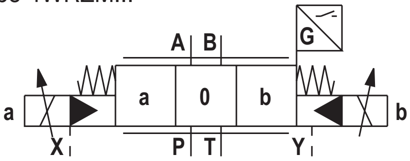
25 =	**50 =**	**85 =**		Size 10
100 =	**125 =**	**150 =**	**180 =**	Size 16
220 =	**325 =**			Size 25

[1)] Not applicable to 4WRH

Symbols (simplified)

With electro-hydraulic actuation and for external electronics

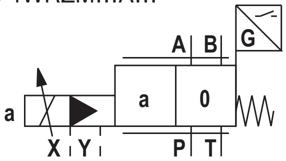
Type 4WRZM...



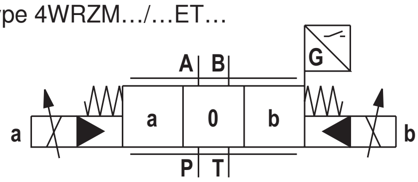
Pilot oil supply

X = external
Y = external

Type 4WRZM…A…

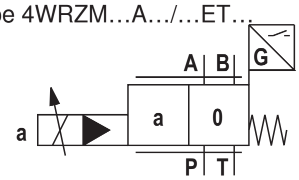


Type 4WRZM…/…ET…



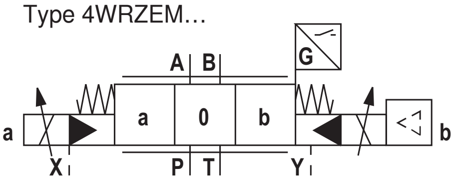
X = internal
Y = internal

Type 4WRZM…A…/…ET…



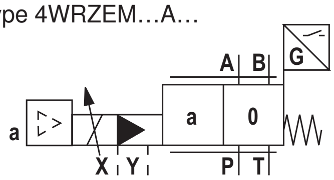
With electro-hydraulic actuation and integrated electronics

Type 4WRZEM…

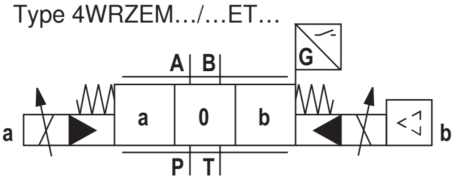


X = external
Y = external

Type 4WRZEM…A…

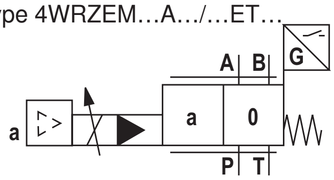


Type 4WRZEM…/…ET…



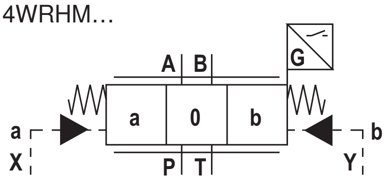
X = internal
Y = internal

Type 4WRZEM…A…/…ET…

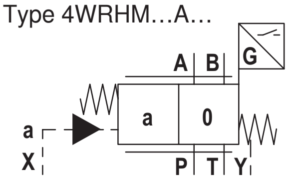


With hydraulic actuation

Type 4WRHM…



Type 4WRHM…A…



Pilot oil supply

Type 4WRZ(E)M… and type 4WRHM… — **Extern pilot oil supply** **External pilot oil return**

With this version, the pilot oil is supplied from a separate pilot circuit (externally).

The pilot oil return is not conducted into the T channel of the main valve, but is directed separately to the tank via port Y (externally).

Type 4WRZ(E)M…E… — **Internal pilot oil supply** **External pilot oil return**

With this version, the pilot oil is supplied from the P channel of the main valve (internally).

The pilot oil return is not conducted into the T channel of the main valve, but is directed separately to the tank via port Y (externally). Close port X in the subplate.

Type 4WRZ(E)M…ET… — **Internal pilot oil supply** **Internal pilot oil return**

With this version, the pilot oil is supplied from the P channel of the main valve (internally).

The pilot oil is returned directly to the T channel of the main valve (internally).

Close ports X and Y in the subplate.

Type 4WRZ(E)M…T… — **External pilot oil supply** **Internal pilot oil return**

With this version, the pilot oil is supplied from a separate pilot circuit (externally).

The pilot oil is returned directly to the T channel of the main valve (internally).

Close port Y in the subplate.

Function, section

Pilot control valve for 4WRZ(E)M… (type 3DREP(E)6…)

The pilot control valve is a 3-way pressure reducing valve that is actuated by a proportional solenoid. It converts an electrical input signal into a proportional pressure output signal.

The proportional solenoids are controllable, wet-pin DC solenoids with a central thread and a detachable coil. The solenoids can either be controlled by external electronics (type 4WRZM...) or by integrated electronics (type 4WRZEM...).

Set-up:

The pilot control valve basically consists of:

– Housing (1)

– Control spool (2) with pressure measuring spool (3 and 4)

– Solenoids (5 and 6) with central thread

– Optionally with Integrated electronics (7)

Function:

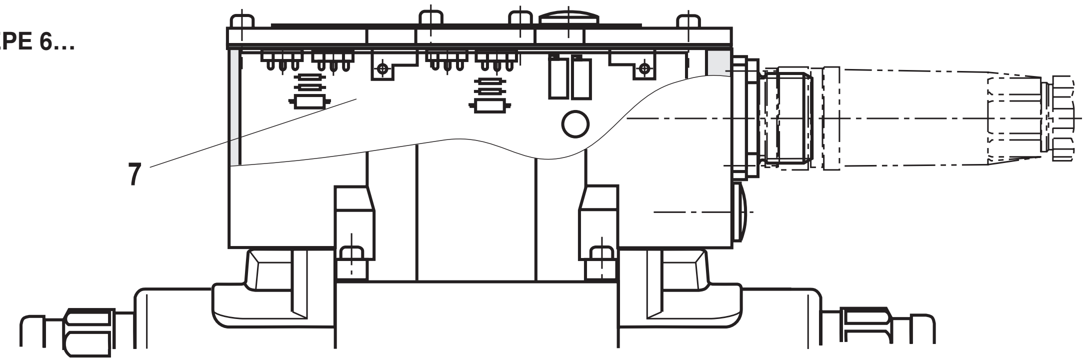
The pressure in A or B is set by means of the proportional solenoids. The amount of the pressure depends on the current.

With de-energized solenoids (5, 6), the control spool (2) is held in the central position by means of the pressure springs (8). Ports A and B are connected with T so that the hydraulic fluid can flow to the tank without obstructions.

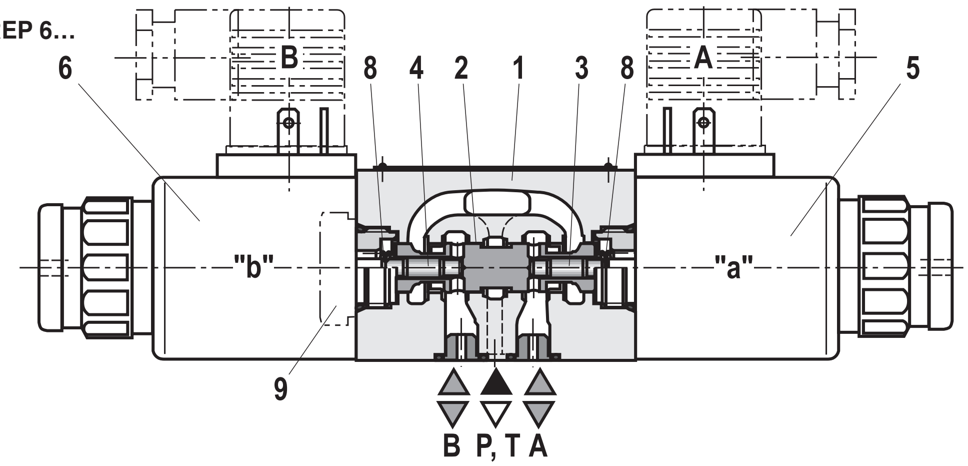
By energizing a proportional solenoid, e.g. solenoid "a" (5), the pressure measuring spool (3) and with it the control spool (2) are moved to the right. This opens the connection from P to B and A to T via orifice-type cross-sections with progressive flow characteristic. With the surface of the pressure measuring spool (4) the pressure that builds up in channel B acts on the control spool and against the solenoid force. The pressure measuring spool (4) is supported by solenoid "b". If the pressure exceeds the value set at solenoid "a", the control spool (2) is pushed back against the solenoid force and connects B with T until the set pressure is reached again. The pressure is proportional to the solenoid current.

When the solenoid is switched off, the control spool (2) is returned into the central position by the compression springs (8).

Type 3DREPE 6…



Type 3DREP 6…



Pilot control valve for 4WRZ(E)M…A… with two switching positions (type 3DREP(E)6…B…)

The operation of this valve version basically corresponds to the valve with 3 switching positions. However, this 2 spool position valve is only equipped with solenoid "a" (5).

In the place of the second proportional solenoid there is a plug screw (9).

Function, section

Electro-hydraulically actuated proportional directional valves Type 4WRZ(E)M…

Valves of type 4WRZ(E)M… are pilot operated proportional directional valves with spool position indicator.

They control the flow direction and size.

They are actuated by the proportional solenoids of the pilot control valve (see description on page 4).

Set-up:

The valve basically consists of:

- Pilot control valve (10) with proportional solenoids (5) and (6)
- Main valve (11) with main control spool (12), valve spring (13) and position indicator (14)

Function:

- With de-energized solenoids (5) and (6), the main control spool (12) is held in the central position by the valve spring (13).
- By energizing a proportional solenoid, e.g. solenoid "b" (6) the control spool (2) is moved to the right. Pilot oil enters the pressure chamber (15). The generated pressure moves the main control spool (12) proportionally to the electric input signal against the valve spring (13). This opens the connection from P to A and B to T via orifice-type cross-sections with progressive flow characteristic.
- Depending on the type, pilot oil is internally supplied to the pilot control valve via port P or externally via port X.
- When the solenoid (6) is switched off, the control spool (2) is returned into the central position by the compression springs (8). This unloads the pressure chamber (15) towards the tank and the main control spool (12) is returned to the central position by the valve spring (13).
- Depending on the type, the pilot oil is returned internally from the pilot control valve to the tank via port T or externally via port Y.
- An optional manual override (16 and 17) allows the control spool (2) and with it the main control spool (12) to be moved. **Inadvertent activation of the manual override may result in uncontrollable machine movements!**

Notice:

The tank line must not be allowed to run empty. If this is possible due to the installation conditions, install a preload valve (with a preload pressure of approx. 2 bar).

Spool position indicator:

The switching positions of the main control spool are detected by the inductive position switch (14) and displayed via two switching outputs with a preset logic. If the preset switching points are exceeded, the deviation from the zero position is displayed within the control spool overlap (see page 12).

The switching signals can be used in a superior control for monitoring purposes.

The electrical connection is implemented separately via a 4-pole connector M12x1 with two pins for signal output and two pins for voltage supply.

Area of application:

The valve may be used in machines with high safety requirements, e.g. hydraulic press control systems.

In combination with a contact shut-off, the valve complies with the requirements for safety-related components of a control according to category 1, EN ISO 13849-1:2006. The "emergency stop" command or an error detected by the machine control has to result in cutting the valve supply voltage.

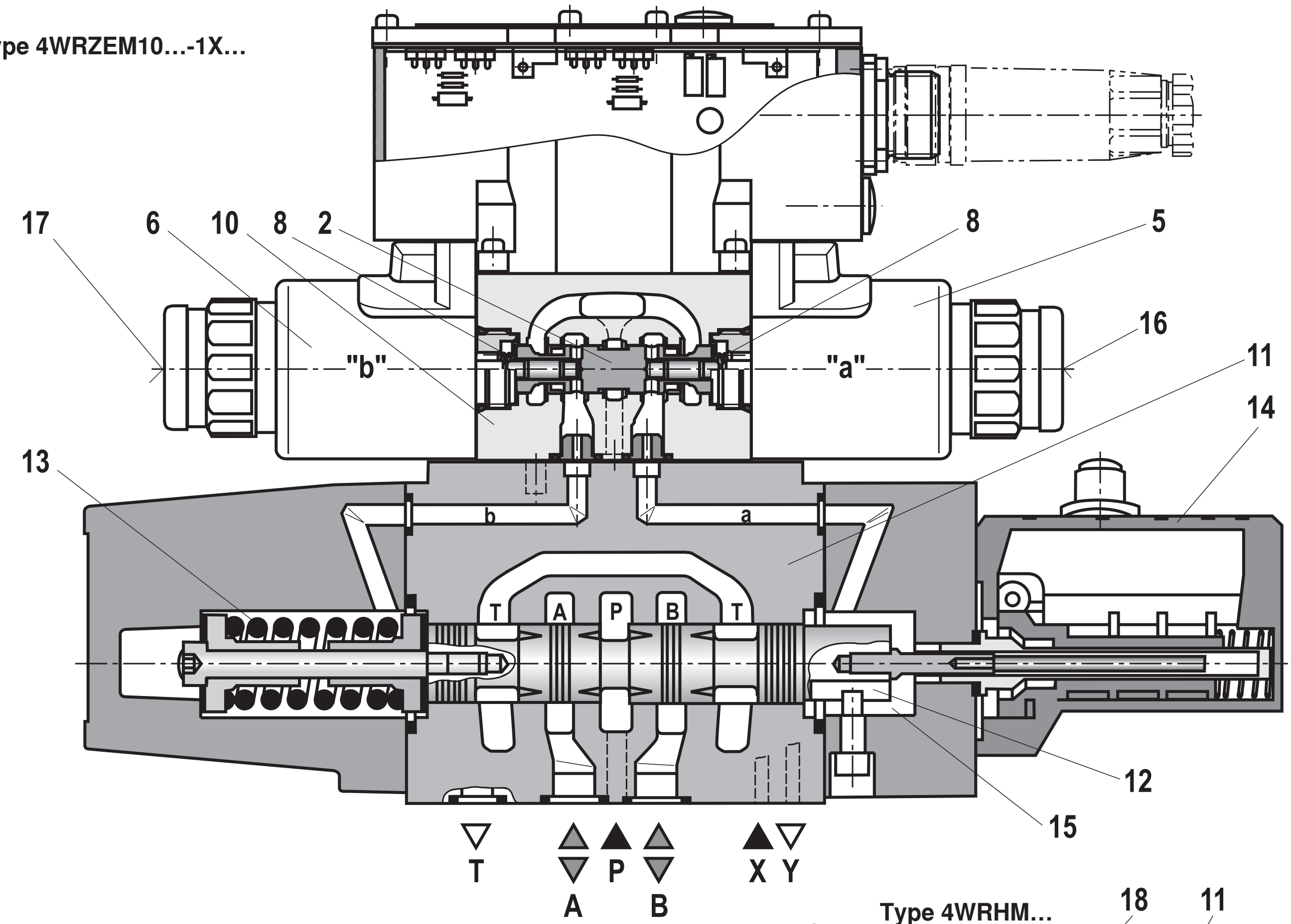
For the valve design the basic and well-tried safety principles according to ISO 13849-2:2003, tables C1 and C2 were used.

The valves are suitable for use in safety-related parts of controls according to category 4, EN ISO 13849-1:2006. This requires the entire control to meet the requirements of category 4, EN ISO 13849-1:2006 as well as the respective requirements of the applicable standards.

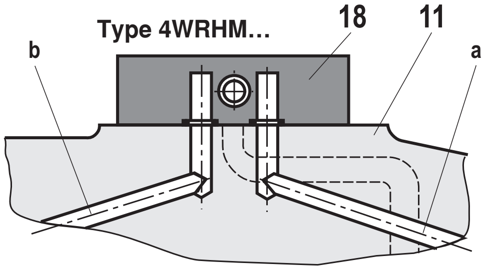
Please note chapter "Safety instructions" on page 20!

Function, section (continued)

Type 4WRZEM10…-1X…



Type 4WRHM…



Hydraulically actuated proportional directional valves

Type 4WRHM…

Valves of type 4WRHM… are pilot operated proportional directional valves with spool position indicator. They control the flow direction and size. Actuation is carried out hydraulically via external pressure control valves.

Set-up:

The valve basically consists of:

– Main valve (11) with main control spool (12), valve spring (13) and position switch (14)

– Diversion plate (18)

Function:

– The diversion plate (18) connects control channel (a) that leads to the pressure chamber (15) with port Y and control channel (b) with port X.

– When ports X and Y are pressurized, the main control spool (12) can be moved proportionally in both directions.

– At a pressure of approx. 5 bar the connection from P-A/ B-T and/or P-B/A-T is opened. At 25 bar the maximum opening cross-section is reached.

The pilot pressure at X and Y must not exceed 25 bar.

Area of application:

The valve may be used in machines with high safety requirements, e.g. hydraulic press control systems.

The valve corresponds to the requirements for safety-related control parts according to category 1, EN ISO 13849-1:2006. The "emergency stop" command or an error detected by the machine control has to result in unloading the control ports X and Y.

For the valve design the basic and well-tried safety principles according to ISO 13849-2:2003, tables C1 and C2 were used.

The valves are suitable for use in safety-related parts of controls according to category 4, EN ISO 13849-1:2006. This requires the entire control to meet the requirements of category 4, EN ISO 13849-1:2006 as well as the respective requirements of the applicable standards.

Please note chapter "Safety instructions" on page 20!

Technical data (for applications outside these parameters, please consult us!)

general

Valve type			4WRZM	4WRZEM	4WRHM
Installation position			Any, preferably horizontal (for commissioning information, see data sheet 07800)		
Storage temperature range		°C	–20 to +80		
Ambient temperature range	Size 10/16/25	°C	–20 to +50	–20 to +50	
Weight	Size 10	kg	8.2	9.0	6.5
	Size 16	kg	13.0	13.7	10.1
	Size 25	kg	20.2	20.9	18.4
	With "D3"	kg	+0.5 in addition		
Sine test according to DIN EN 60068-2-6:2008			10 cycles, 10...2000...10 Hz with logarithmic frequency changing speed of 1 oct./min., 5 to 57 Hz, amplitude 1.5 mm (p-p), 57 to 2000 Hz, amplitude 10 g, 3 axes		
Random test according to DIN EN 60068-2-64:2009			20…2000 Hz, amplitude 0.05 g^2/Hz (10 g_{RMS}) 3 axes, 30 min testing time per axis		
Shock test according to DIN EN 60068-2-27:2010			Half sine 15 g/11 ms, 3 times in positive/3 times in negative direction per axis, 3 axes		
Humid heat, cyclic according to DIN EN 60068-2-30:2006			Variant 2 +25 °C to +55 °C, 90% to 97% relative humidity, 2 cycles at 24 hours		

hydraulic

Size		Size	10	16	25
Operating pressure					
Pilot control valve WRZ(E)	– External pilot oil supply	bar	30 to 100		
	– Internal pilot oil supply	bar	100 to 315 only with "D3"	100 to 350 only with "D3"	
Control WRH	– Ports X and Y	bar	25 maximum (cracking pressure approx. 5 bar)		
Main valve	– Ports P, A, B	bar	Up to 315	Up to 350	Up to 350
Return flow pressure	– Port T (external pilot oil return)	bar	Up to 315	Up to 250	Up to 250
	– Port T (internal pilot oil return)	bar	Up to 30	Up to 30	Up to 30
	– Port Y	bar	Up to 30	Up to 30	Up to 30
Flow of the main valve		l/min	Up to 170	Up to 460	Up to 870
Pilot flow at ports X and Y with stepped input signal 0 → 100%		l/min	3.5	5.5	7
Pilot volume for switching process 0 → 100%		cm^3	1.7	4.6	10
Hydraulic fluid			See table on page 8		
Hydraulic fluid temperature range		°C	–20 to +80 (preferably +40 to +50)		
Viscosity range		mm^2/s	20 to 380 (preferably 30 to 46)		
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)					
	– Pilot control valve		Class 18/16/13 [1)]		
	– Main valve		Class 20/18/15 [1)]		
Hysteresis		%	≤ 6		

[1)] The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the life cycle of the components.

Technical data (for applications outside these parameters, please consult us!)

Hydraulic fluid		Classification	Suitable sealing materials	Standards
Mineral oils and related hydrocarbons		HL, HLP	NBR, FKM	DIN 51524
Flame-resistant	– containing water	HFC (Fuchs HYDROTHERM 46M, Petrofer Ultra Safe 620)	NBR	ISO 12922

Important information on hydraulic fluids!
- For more information and data on the use of other hydraulic fluids, refer to data sheet 90220 or contact us.
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.)!
- The flash point of the process and operating medium used must be 40 K greater than the maximum solenoid surface temperature.
- **Flame-resistant – containing water**: The maximum pressure differential per control edge is 175 bar. Pressure pre-loading at the tank port >20% of the pressure differential; otherwise, increased cavitation.
- Life cycle as compared to operation with mineral oil HL, HLP 50% to 100%

electric

Valve type			**4WRZM** 1)	**4WRZEM**
Voltage type			Direct voltage	
Command value overlap		%	20	
Maximum solenoid current		A	1.5	2.5
Solenoid coil resistance	Cold value at 20 °C	Ω	4.8	2
	Maximum hot value	Ω	7.2	3
Duty cycle		%	100	
Maximum coil temperature 3)		°C	150	
Electrical connection			With connector according to DIN EN 175301-803 Mating connector according to DIN EN 175301-803 2), see page 19	With connector according to DIN EN 175201-804 Mating connector according to DIN EN 175201-804 2), see page 19
Protection class of the valve according to EN 60529			IP65 with mating connectors mounted and locked	

1) With Rexroth control electronics

2) Separate order

3) Due to the temperatures occurring at the surfaces of the solenoid coils, the European standards ISO 13732-1 and DIN EN 982 need to be adhered to.

Technical data (for applications outside these parameters, please consult us!)

Control electronics

Integrated electronics (OBE) with type 4WRZEM			–	Integrated in the valve, see page 10
Current consumption	I_{max}	A	–	1.8
	– Impulse current	A	–	3.0
Command value signal	– Voltage input "A1"	V	–	±10
	– Current input "F1"	mA	–	4 to 20
Suitable command value preparation for type WRZEM				
Analog command value card [1]			VT-SWKA-1-1X/… according to data sheet RE 30255	
Digital command value card [1]			VT-HACD-1-1X/… according to data sheet RE 30143	
Analog command value modules [1]			VT-SWMA-1-1X/… according to data sheet RE 29902	
			VT-SWMAK-1-1X/… according to data sheet RE 29903	
External electronics for type 4WRZM				
Analog amplifier in Euro-card format [1]	with 1 ramp time		VT- VSPA2-1-2X/V0/T1 according to data sheet RE 30110	
	with 5 ramp times		VT- VSPA2-1-2X/V0/T5 according to data sheet RE 30110	
Digital amplifier in Euro-card format [1]			VT-VSPD-1-2X/… according to data sheet RE 30523	
Analog amplifier in modular design [1]			VT 11118-1X/… according to data sheet RE 30218	

[1] Separate order

electric, spool position indicator (see page 11)

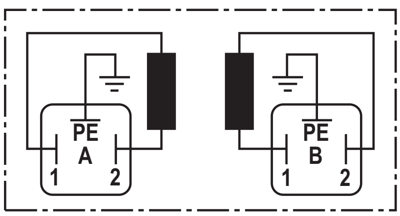
Principle		Inductive position switch
Switching point		Within positive valve overlap
Supply voltage	VDC	24 ± 4.8
Residual ripple		< 10%
Current consumption, without load current	mA	≤ 40
Reverse polarity protection		Installed, max. 300 V
Outputs		Reverse polarity protected, positive switching and short-circuit-proof
Protection class		IP 65 according to EN 60529 with installed connectors
Duty cycle		100%
Electrical connection		M12x1, 4-pole; assignment according to DIN EN 60947-5-2; mating connector, see page 19 (separate order)

Electrical connection (dimensions in mm)

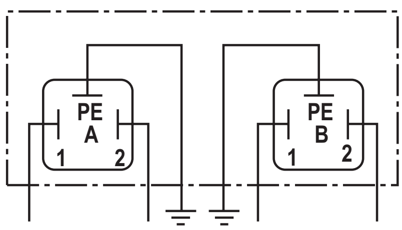
Type 4WRZM… for external electronics

For mating connectors, see page 19

Connector pin assignment



Mating connector pin assignment



Electrical connection (dimensions in mm)

Type 4WRZEM…, with integrated electronics (OBE)

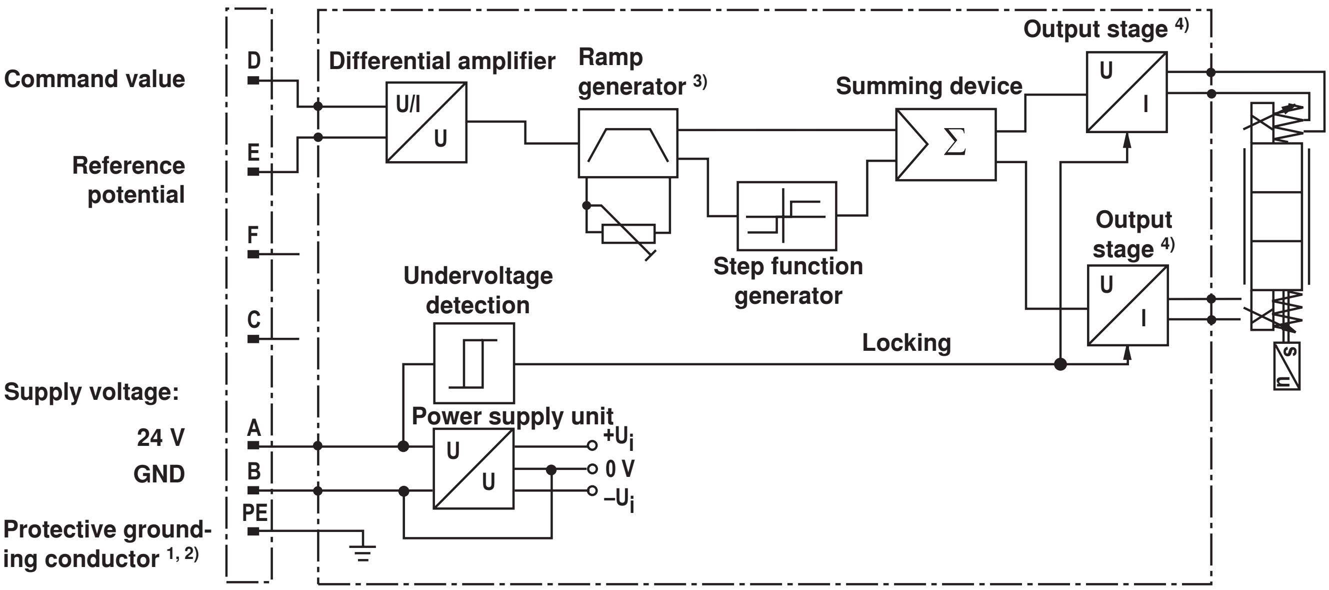
For mating connectors, see page 19

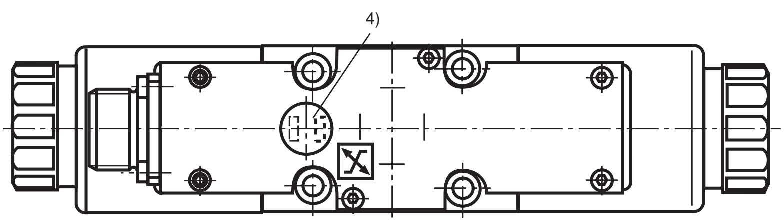
Connector pin assignment	Contact	Signal with A1	Signal at F1
Supply voltage	A	24 VDC (u(t) = 19.4 to 35 V); I_{max} = 2 A	
	B	0 V	
Reference (actual value)	C	Cannot be used [1]	
Differential amplifier input	D	±10 V; R_e > 50 kΩ	4 to 20 mA; R_e > 100 Ω
(Command value)	E	Command value reference potential	
	F	Cannot be used [1]	
Protective grounding conductor	PE	Connected to cooling element and valve housing	

[1] Contacts C and F must not be connected!

Mode of operation: A positive command value (0 to 10 V or 12 to 20 mA) at D and a reference potential at E result in a flow from P to A and B to T.
A negative command value (0 to –10 V or 12 to 4 mA) at D and a reference potential at E result in a flow from P to B and A to T.
If the valve and the solenoid are on side a (control spool variants **EA** and **W6A**), a reference potential at E and a positive command value at D (0 to 10 V or 4 to 20 mA) result in flow from P to B and A to T.

Block diagram of the integrated electronics





[1] Port PE is connected to the cooling element and the valve housing

[2] The protective grounding conductor is connected to the valve housing and cover

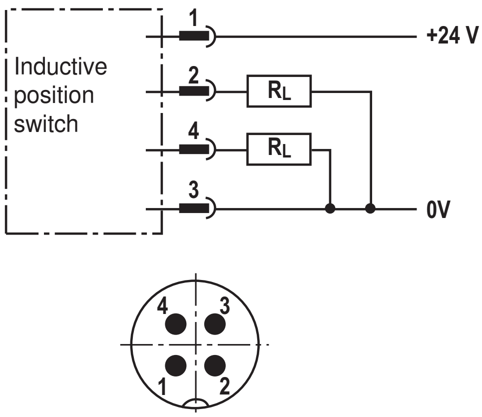
[3] Ramp can be set from 0 to 2.5 s from the outside, identical for T_{up} and T_{down}

[4] The output stages are current-controlled

Electrical connection (dimensions in mm)

Type 4WRZM… , 4WRZEM…, spool position indicator

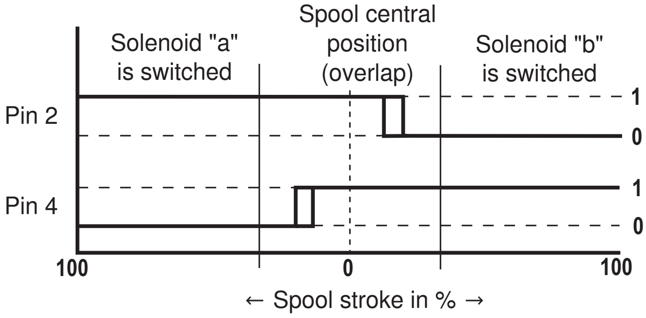
Connector pin assignment



	Pin	Signal	Mating connector wire color
Supply voltage	1	U_B = +24 V ± 4.8 V	Brown
Switching output 1	2	Switching status 0 (open): < 1.8 VDC Switching status 1 (closed): > U_B – 2.5 V (Limit load I_{max} = 250 mA)	White
Weight	3	0 V	Blue
Switching output 2	4	Switching status 0 (open): < 1.8 V DC Switching status 1 (closed): > U_B – 2.5 V (Limit load I_{max} = 250 mA)	Black

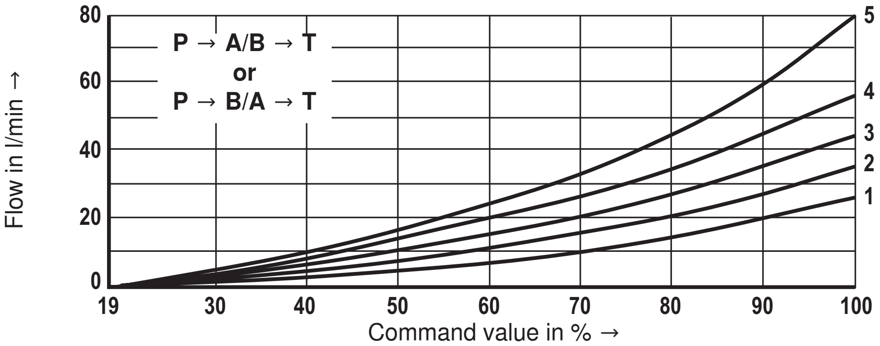
Notice: The position switch has no ground contact. Therefore, the use of protective extra-low voltage sources according to PELV (IEC64) is mandatory.

Switching logic



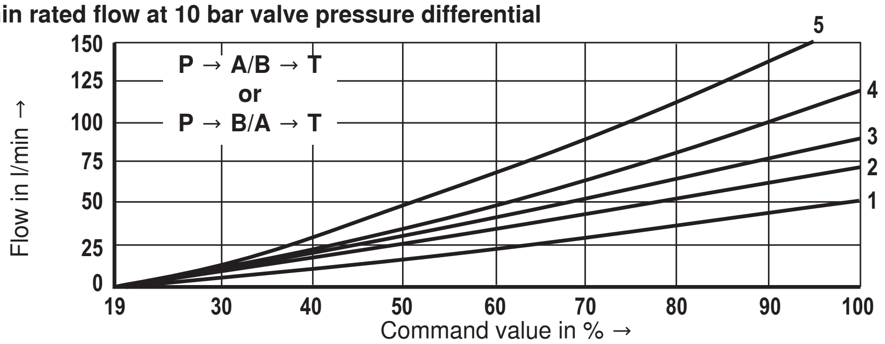
Characteristic curves size 10 (control spool "E, W6-, EA, W6A" as well as HLP46, ϑ_{oil} = 40 °C ±5 °C and p = 100 bar)

25 l/min rated flow at 10 bar valve pressure differential



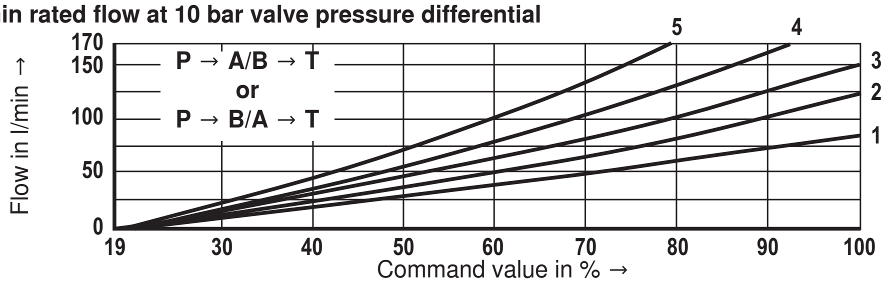
1 **Δp** = 10 bar, constant
2 **Δp** = 20 bar, constant
3 **Δp** = 30 bar, constant
4 **Δp** = 50 bar, constant
5 **Δp** = 100 bar, constant

50 l/min rated flow at 10 bar valve pressure differential



1 **Δp** = 10 bar, constant
2 **Δp** = 20 bar, constant
3 **Δp** = 30 bar, constant
4 **Δp** = 50 bar, constant
5 **Δp** = 100 bar, constant

85 l/min rated flow at 10 bar valve pressure differential

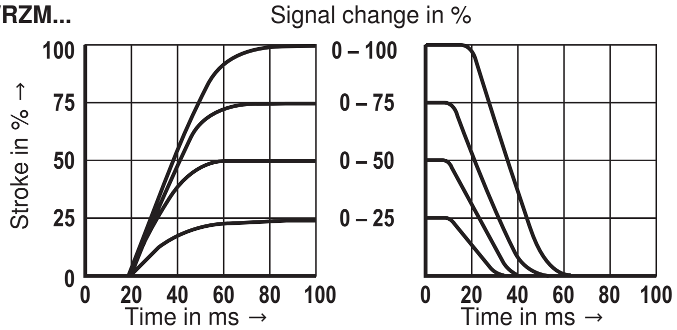


1 **Δp** = 10 bar, constant
2 **Δp** = 20 bar, constant
3 **Δp** = 30 bar, constant
4 **Δp** = 50 bar, constant
5 **Δp** = 100 bar, constant

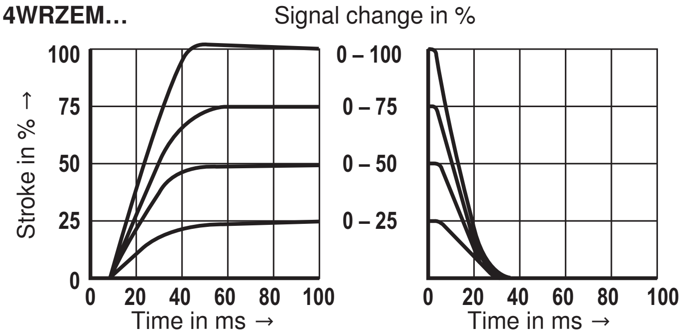
Δp = valve pressure differential according to DIN 24311 (inlet pressure $\boldsymbol{p}_P$ minus load pressure $\boldsymbol{p}_L$ minus return flow pressure $\boldsymbol{p}_T$)

Transition functions with stepped, electric input signals, measured at p_{St} = 50 bar

Type 4WRZM...

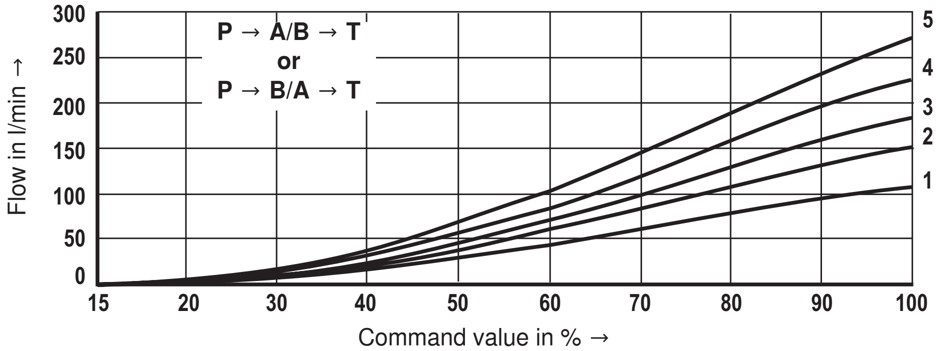


Type 4WRZEM…



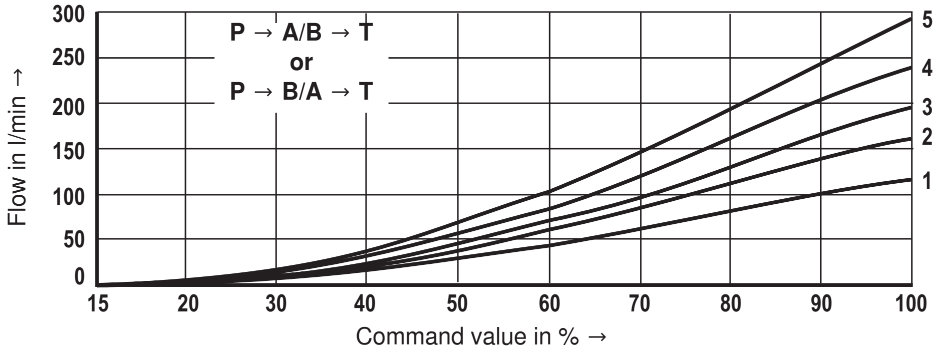
Characteristic curves size 16 (control spool "E, W6-, EA, W6A" as well as HLP46, ϑ_{oil} = 40 °C ±5 °C and p = 100 bar)

100 l/min rated flow at 10 bar valve pressure differential



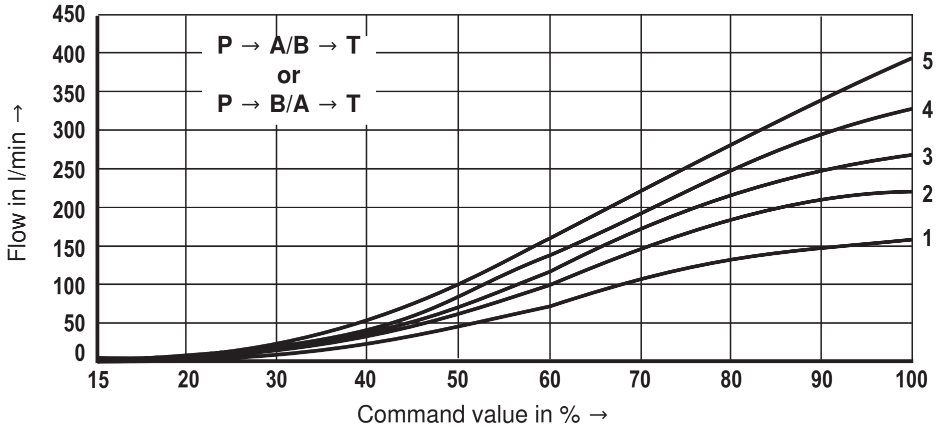
1 **Δp** = 10 bar, constant
2 **Δp** = 20 bar, constant
3 **Δp** = 30 bar, constant
4 **Δp** = 50 bar, constant
5 **Δp** = 100 bar, constant

125 l/min rated flow at 10 bar valve pressure differential



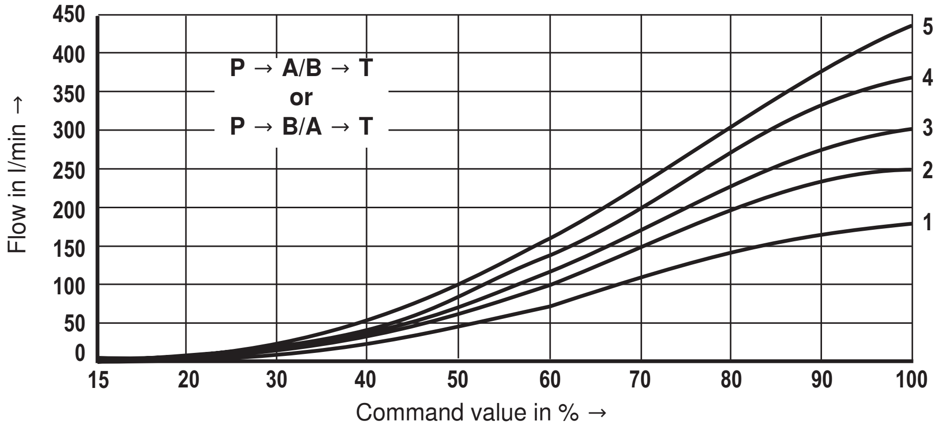
1 **Δp** = 10 bar, constant
2 **Δp** = 20 bar, constant
3 **Δp** = 30 bar, constant
4 **Δp** = 50 bar, constant
5 **Δp** = 100 bar, constant

150 l/min rated flow at 10 bar valve pressure differential



1 **Δp** = 10 bar, constant
2 **Δp** = 20 bar, constant
3 **Δp** = 30 bar, constant
4 **Δp** = 50 bar, constant
5 **Δp** = 100 bar, constant

180 l/min rated flow at 10 bar valve pressure differential



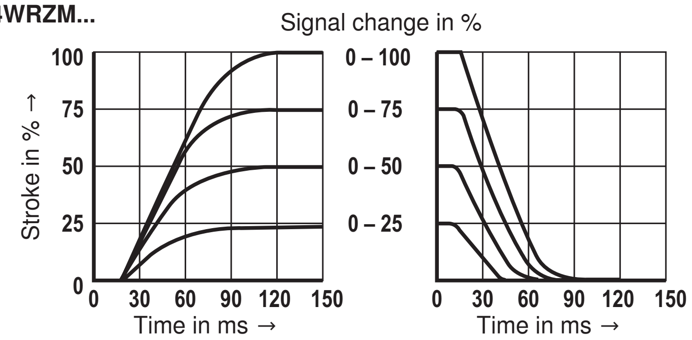
1 **Δp** = 10 bar, constant
2 **Δp** = 20 bar, constant
3 **Δp** = 30 bar, constant
4 **Δp** = 50 bar, constant
5 **Δp** = 100 bar, constant

Δp = valve pressure differential according to DIN 24311 (inlet pressure p_P minus load pressure p_L minus return flow pressure p_T)

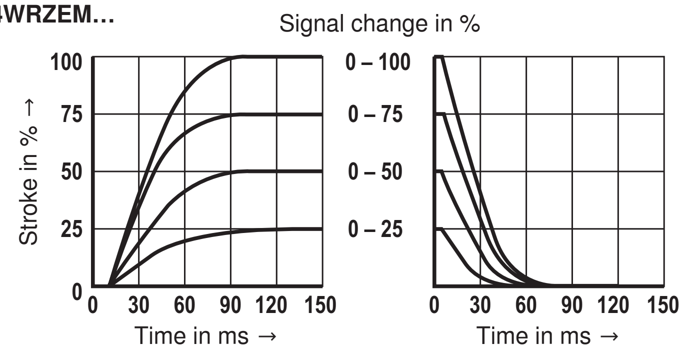
Characteristic curves size 16 (control spool "E, W6-, EA, W6A" as well as HLP46, ϑ_{oil} = 40 °C ±5 °C and p = 100 bar)

Transition functions with stepped, electric input signals, measured at p_{St} = 50 bar

Type 4WRZM...

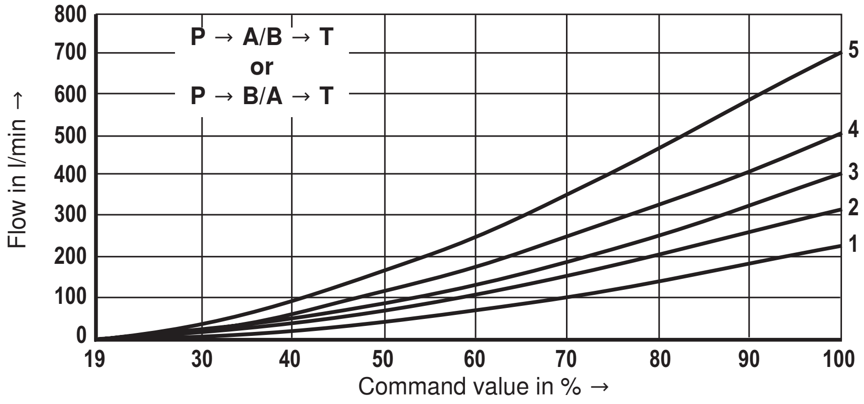


Type 4WRZEM…



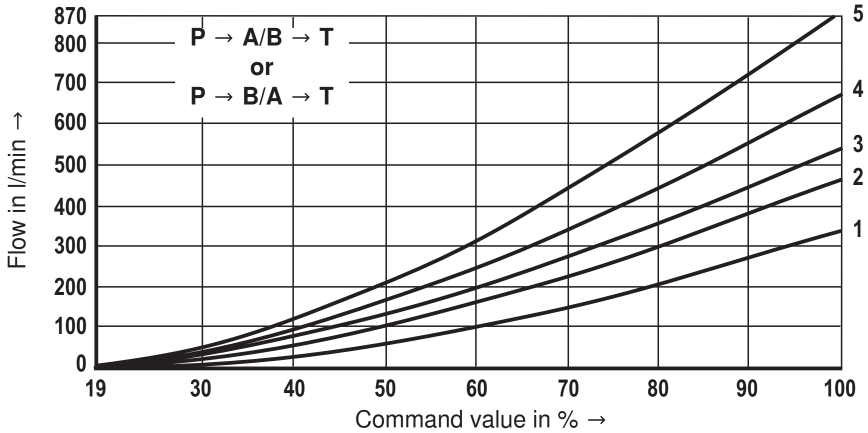
Characteristic curves size 25 (control spools "E, W6-, EA, W6A" as well as HLP46, ϑ_{oil} = 40 °C ±5 °C and p = 100 bar)

220 l/min rated flow at 10 bar valve pressure differential



1 **Δp** = 10 bar, constant
2 **Δp** = 20 bar, constant
3 **Δp** = 30 bar, constant
4 **Δp** = 50 bar, constant
5 **Δp** = 100 bar, constant

325 l/min rated flow at 10 bar valve pressure differential

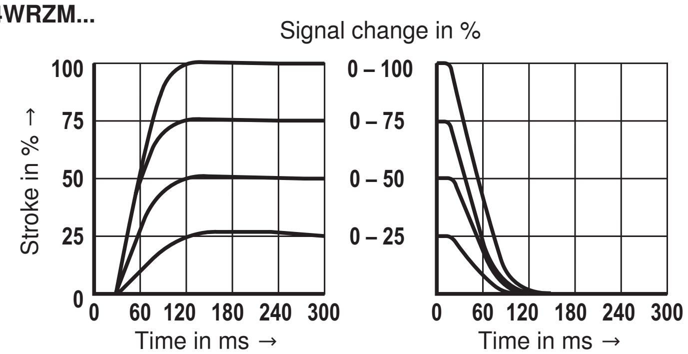


1 **Δp** = 10 bar, constant
2 **Δp** = 20 bar, constant
3 **Δp** = 30 bar, constant
4 **Δp** = 50 bar, constant
5 **Δp** = 100 bar, constant

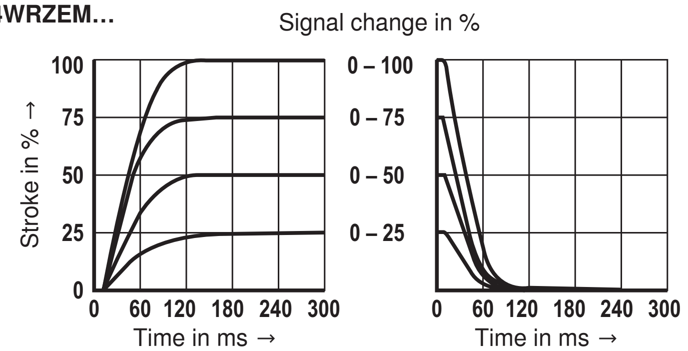
Δp = valve pressure differential according to DIN 24311 (inlet pressure p_P minus load pressure p_L minus return flow pressure p_T)

Transition functions with stepped, electric input signals, measured at p_{St} = 50 bar

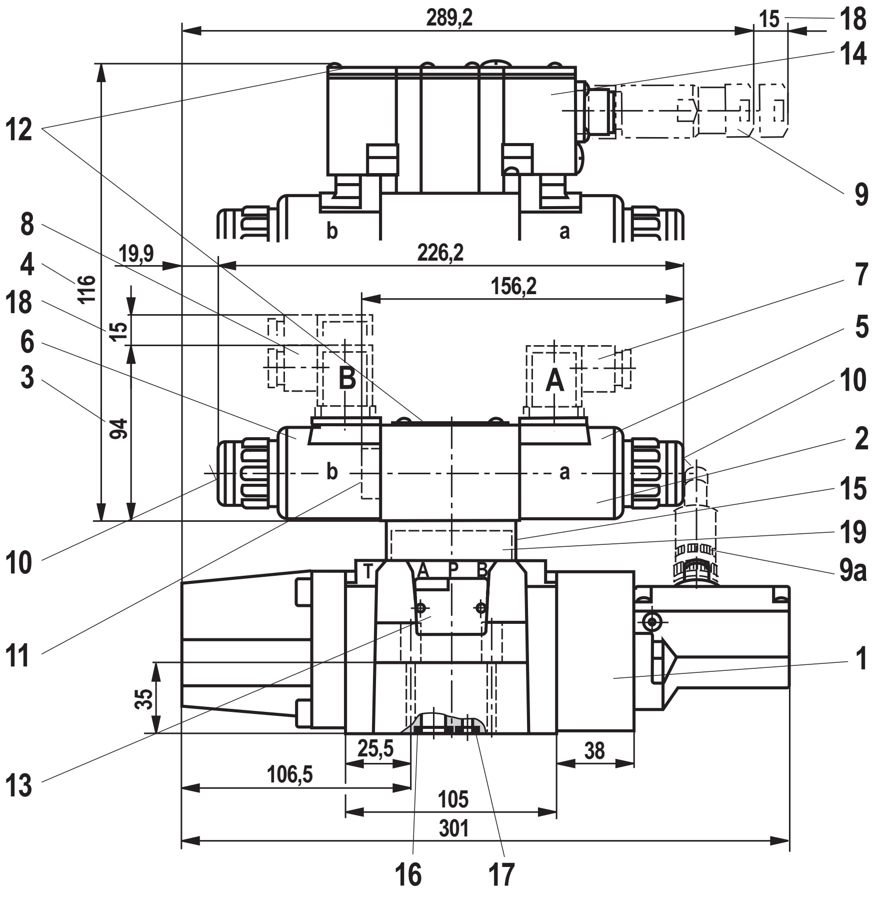
Type 4WRZM...



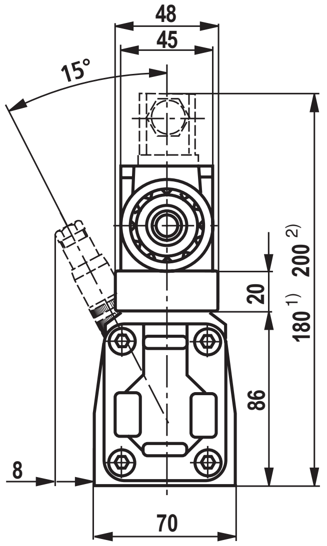
Type 4WRZEM…

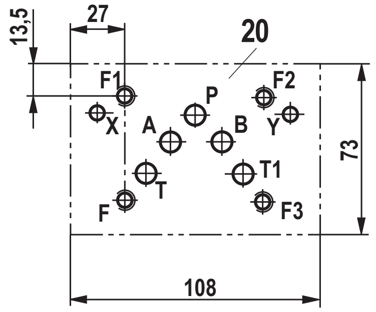


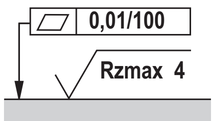
Dimensions: Size 10 (dimensions in mm)



[1)] without pressure reducing valve
[2)] with pressure reducing valve





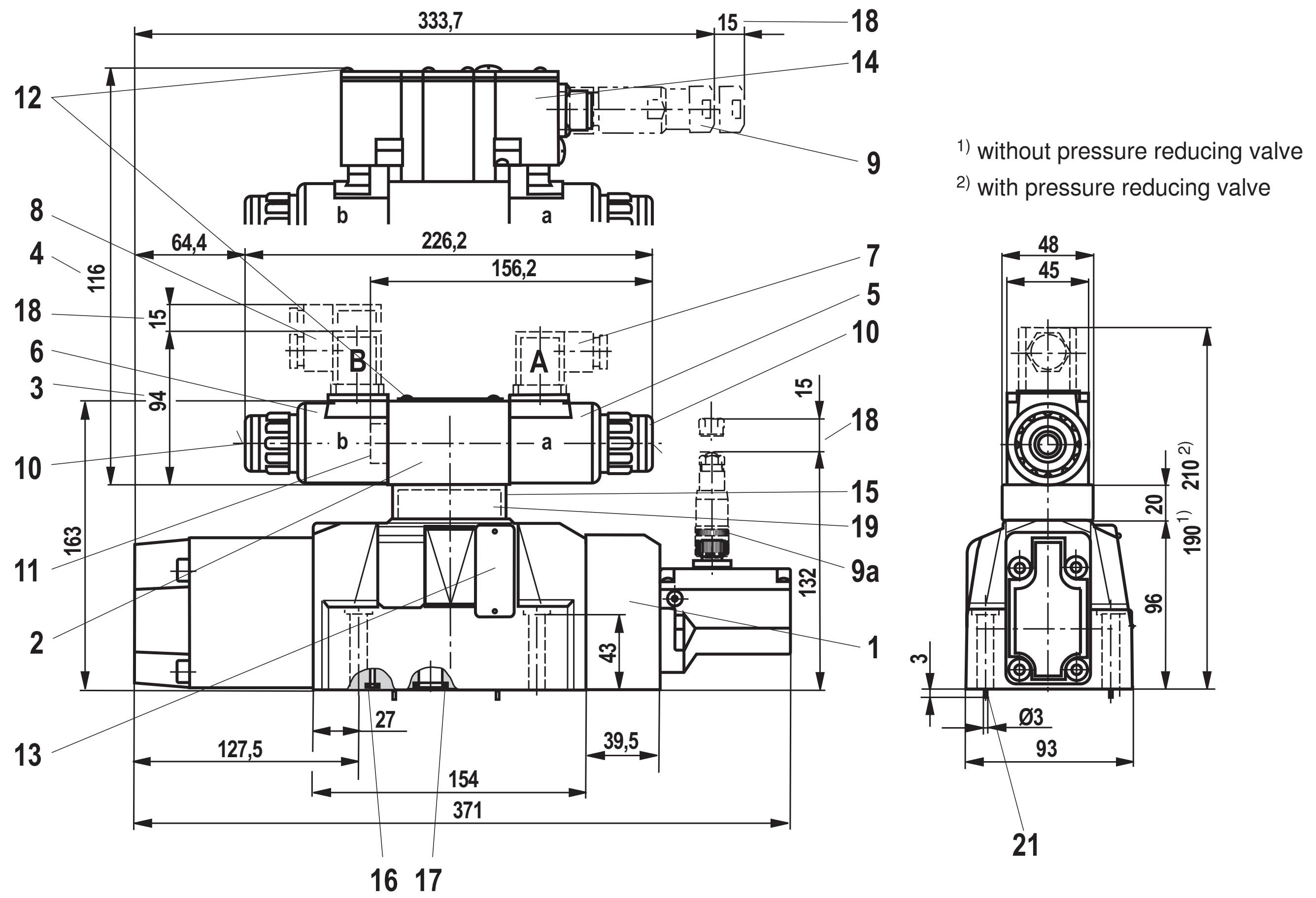


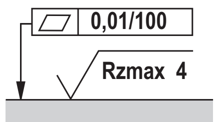
Required surface quality of the valve contact surface

1	Main valve
2	Pilot control valve
3	Dimension for version "4WRZM..."
4	Dimension for version "4WRZEM..."
5	Proportional solenoid "a"
6	Proportional solenoid "b"
7	Mating connector "A", separate order, see page 19
8	Mating connector "B", separate order, see page 19
9	Mating connector, separate order, see page 19
9a	Mating connector, separate order, see page 19
10	Concealed manual override "N9"
11	Plug screw for valves with one solenoid
12	Name plate for pilot control valve
13	Name plate for main valve
14	Integrated electronics (OBE)
15	Pressure reducing valve "D3"
16	Identical seal rings for ports A, B, P, T, and T1
17	Identical seal rings for ports X and Y
18	Space required for removing the mating connector
19	Diversion plate (type 4WRHM...)
20	Machined installation surface, porting pattern according to ISO 4401-05-05-0-05, ports X and Y as required

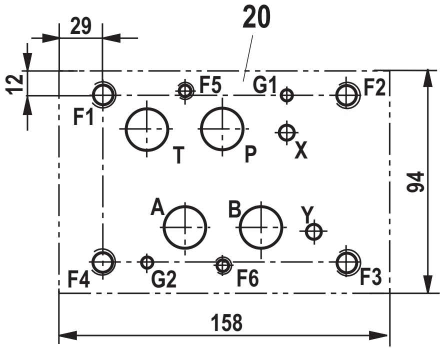
For subplates and valve mounting screws, see page 19

Dimensions: Size 16 (dimensions in mm)





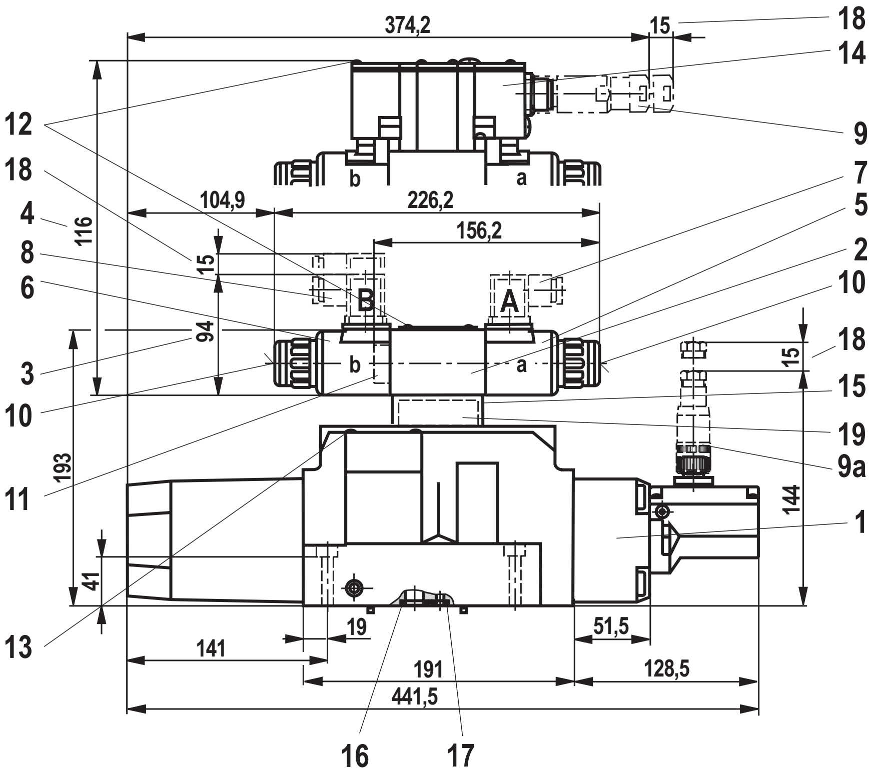
Required surface quality of the valve contact surface



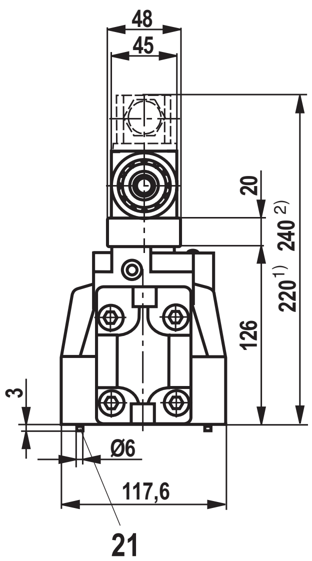
1 Main valve
2 Pilot control valve
3 Dimension for version "4WRZM..."
4 Dimension for version "4WRZEM..."
5 Proportional solenoid "a"
6 Proportional solenoid "b"
7 Mating connector "A", separate order, see page 19
8 Mating connector "B", separate order, see page 19
9 Mating connector, separate order, see page 19
9a Mating connector, separate order, see page 19
10 Concealed manual override "N9"
11 Plug screw for valves with one solenoid
12 Name plate for pilot control valve
13 Name plate for main valve
14 Integrated electronics (OBE)
15 Pressure reducing valve "D3"
16 Identical seal rings for ports A, B, P, and T
17 Identical seal rings for ports X and Y
18 Space required for removing the mating connector
19 Diversion plate (type 4WRHM...)
20 Machined installation surface, porting pattern according to ISO 4401-07-07-0-05,
ports X and Y as required
Deviating from the standard: Ports A, B, P, and T = Ø20 mm
21 Locking pin

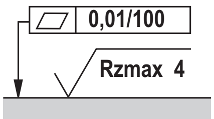
For subplates and valve mounting screws, see page 19

Dimensions: Size 25 (dimensions in mm)

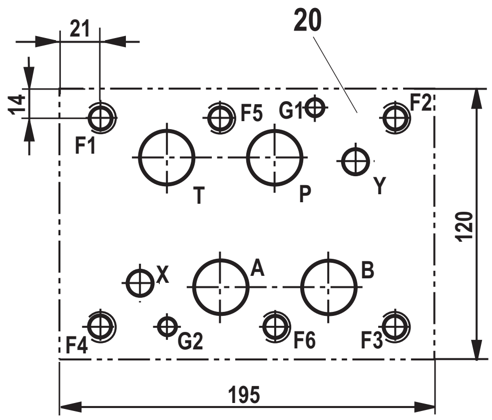


1) without pressure reducing valve
2) with pressure reducing valve





Required surface quality of
the valve contact surface



1 Main valve
2 Pilot control valve
3 Dimension for version "4WRZM..."
4 Dimension for version "4WRZEM..."
5 Proportional solenoid "a"
6 Proportional solenoid "b"
7 Mating connector "A", separate order, see page 19
8 Mating connector "B", separate order, see page 19
9 Mating connector, separate order, see page 19
9a Mating connector, separate order, see page 19
10 Concealed manual override "N9"
11 Plug screw for valves with one solenoid
12 Name plate for pilot control valve
13 Name plate for main valve
14 Integrated electronics (OBE)
15 Pressure reducing valve "D3"
16 Identical seal rings for ports A, B, P, and T
17 Identical seal rings for ports X and Y
18 Space required for removing the mating connector
19 Diversion plate (type 4WRHM...)
20 Machined installation surface, porting pattern according to ISO 4401-08-08-0-05
21 Locking pin

For subplates and valve mounting screws, see page 19

Dimensions

Hexagon socket head cap screws		Material number
Size 10	4x ISO 4762 - M6 x 45 - 10.9-flZn-240h-L Tightening torque M_A = 13.5 Nm ±10% or 4x ISO 4762 - M6 x 45 - 10.9 Tightening torque M_A = 15.5 Nm ±10%	R913000258
Size 16	2x ISO 4762 - M6 x 60 - 10.9-flZn-240h-L Tightening torque M_A = 12.2 Nm ±10% 4x ISO 4762 - M10 x 60 - 10.9-flZn-240h-L Tightening torque M_A = 58 Nm ±20% or 2x ISO 4762 - M6 x 60 - 10.9 Tightening torque M_A = 15.5 Nm ±10% 4x ISO 4762 - M10 x 60 - 10.9 Tightening torque M_A = 75 Nm ±20%	R913000115 R913000116
Size 25	6x ISO 4762 - M12 x 60 - 10.9-flZn-240h-L Tightening torque M_A = 100 Nm ±20% or 6x ISO 4762 - M12 x 60 - 10.9 Tightening torque M_A = 130 Nm ±20%	R913000121

Notice: The tightening torque of the hexagon socket head cap screws refers to maximum operating pressure.

Subplates	Data sheet
Size 10	45054
Size 16	45056
Size 25	45058

Accessories (not included in the scope of delivery)

Mating connectors		Material number
Mating connector for 4WRZM	DIN EN 175201-803, see data sheet 08006	Solenoid a, gray, R901017010
		Solenoid b, black, R901017011
Mating connector for 4WRZEM	DIN EN 175201-804, see data sheet 08006	e.g. R900021267 (plastic)
		e.g. R900223890 (metal)
Mating connector for spool position indicator	IEC 60947-5-2, see data sheet 08006	e.g. R900031155 (M12x1 with screw connection)
		e.g. R900082899 (M12x1 with screw connection, angled, rotatable 4x90°)

Safety instructions

Instructions on project planning, installation and commissioning

- When implementing safety-related controls comply with the applicable industry-specific standards and regulations.
- Due to the flexible use of valves in systems, the user has to check and ensure that the product characteristics comply with all functional and safety requirements of the overall system.
- Make sure that there are no switching shocks and that the valve spool does not vibrate.
- Valves with spool position indicators may only be installed, adjusted, commissioned and maintained by specialists trained in hydraulics and electronics.
  Improper work at safety-related parts of controls may result in personal injury and damage to property!

The following applies to all work carried out at the valve:

- Valves with spool position indicators must not be disassembled.
- Parts of the valves must not be exchanged.
- Integrated throttles must not be removed or modified.
- The spool position indicator may only be adjusted by the valve manufacturer.

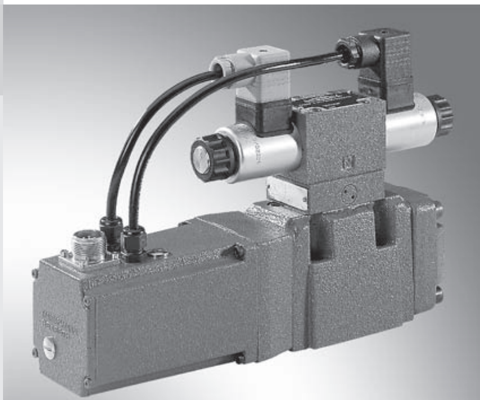
Rexroth
Bosch Group

Proportional directional valves, pilot operated, with electrical position feedback and integrated electronics (OBE)

RE 29075/08.13
Replaces: 08.04

Type 4WRKE

Size 10 to 35
Component series 3X
Maximum operating pressure 350 bar
Maximum flow 3,000 l/min



H/A/D 6512

Table of contents

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Features

- Pilot operated 2-stage proportional directional valve with electrical position feedback of the main control spool and integrated electronics (OBE)
- Control of flow direction and size of a flow
- Operation by means of proportional solenoids
- Subplate mounting:
  Porting pattern according to ISO 4401
- Electrical position feedback
- Spring-centered main control spool
- Pilot control valve:
  Single-stage proportional directional valve
- Main stage with position control

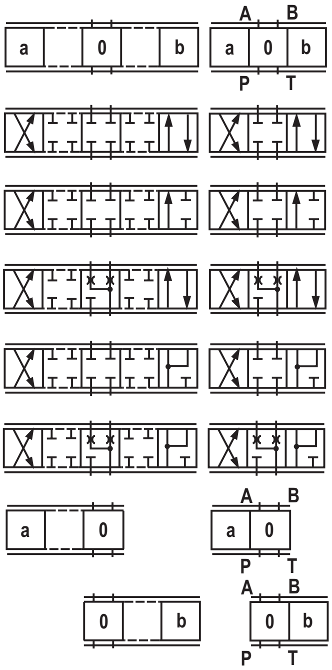
Ordering code

4WRKE				–3X / 6E	G24		K31 /		D3		*

Electrically operated 2-stage proportional directional valve in 4-way version with integrated electronics

Size 10	**= 10**
Size 16	**= 16**
Size 25	**= 25**
Size 27	**= 27**
Size 32	**= 32**
Size 35	**= 35**

Symbols



= E
= E1-
= E3-
= W6-
= W8-
= R
= R3-
= EA [1]
= W6A
= EB [1]
= W6B

With symbol E1-, W8-:

P → A : q_V B → T: $q_V/2$
P → B: $q_V/2$ A → T: q_V

With symbol R; R3:

P → A : q_V B → P: $q_V/2$
P → B : $q_V/2$ A → T: q_V

Notice:

In the zero position, spools W6-, W8- and R3- have a connection from A to T and B to T with approx. 2% of the relevant nominal cross-section.

Rated flow

25 = [2] or **50 =** [3] or **100 =**	Size 10
125 = [3] or **150 =** [3] or **200 =** or **220 =**	Size 16
220 = [3] or **350 =**	Size 25
500 =	Size 27
400 = or **600 =**	Size 32
1000 =	Size 35

Characteristic curve form

L = Linear
P = Linear with fine control range

3X = Component series 30 to 39 (30 to 39: Unchanged installation and connection dimensions)

6E = Proportional solenoid with detachable coil

Supply voltage

G24 = Direct voltage 24 V

Pilot oil supply and drain

no code = Pilot oil supply external, pilot oil drain external
E = Pilot oil supply internal, pilot oil drain external
ET = Pilot oil supply internal, pilot oil drain internal
T = Pilot oil supply external, pilot oil drain internal

Electrical connection

K31 = **Without** mating connector with connector according to DIN EN 175201-804
Mating connector – separate order see page 21

Electronics interface

C1 = Command value/ actual value ±10 mA
A1 = [4] Command value/ actual value ±10 V
F1 = Command value/ actual value 4 to 20 mA

D3 = With pressure reducing valve ZDR 6 DP0-4X/40YM-W80 (non-adjustable)

M = NBR seals
V = FKM seals

Further details in the plain text

[1] **Examples:** Spool with spool position "a" (P → B) ordering code ..**EA**.. or **W6A**
Spool with spool position "b" (P → A) ordering code ..**EB**.. or **W6B**

[2] Only E and W6- available with characteristic curve form **L** (linear)

[3] Only E1- and W8- available with characteristic curve form **L** (linear)

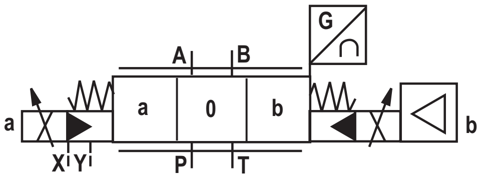
[4] When replacing the component series 2X with component series 3X the electronics interface is to be defined with **A5** (enable signal at pin C)

Symbols

Simplified

Example:

Pilot oil supply external
Pilot oil drain external

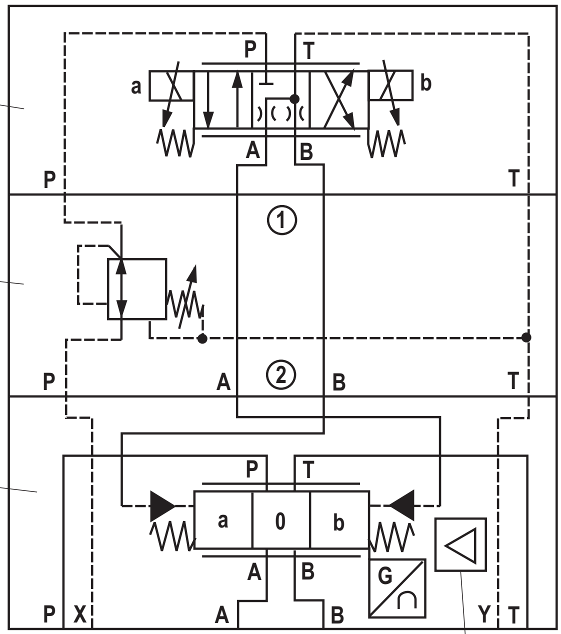


Detailed

1

3

2



4

Example:

1 Pilot control valve type 4WRAP 6…

2 Main valve

3 Pressure reducing valve
type ZDR 6 DP0-4X/40YM-W80

4 Integrated electronics (OBE)

Function, section

Pilot control valve type 4WRAP 6 W7.3X/G24… (1st stage)

The pilot control valve is a direct operated proportional valve. The control edge dimensions have been optimized for use as a pilot control valve for proportional directional valves type 4WRKE.

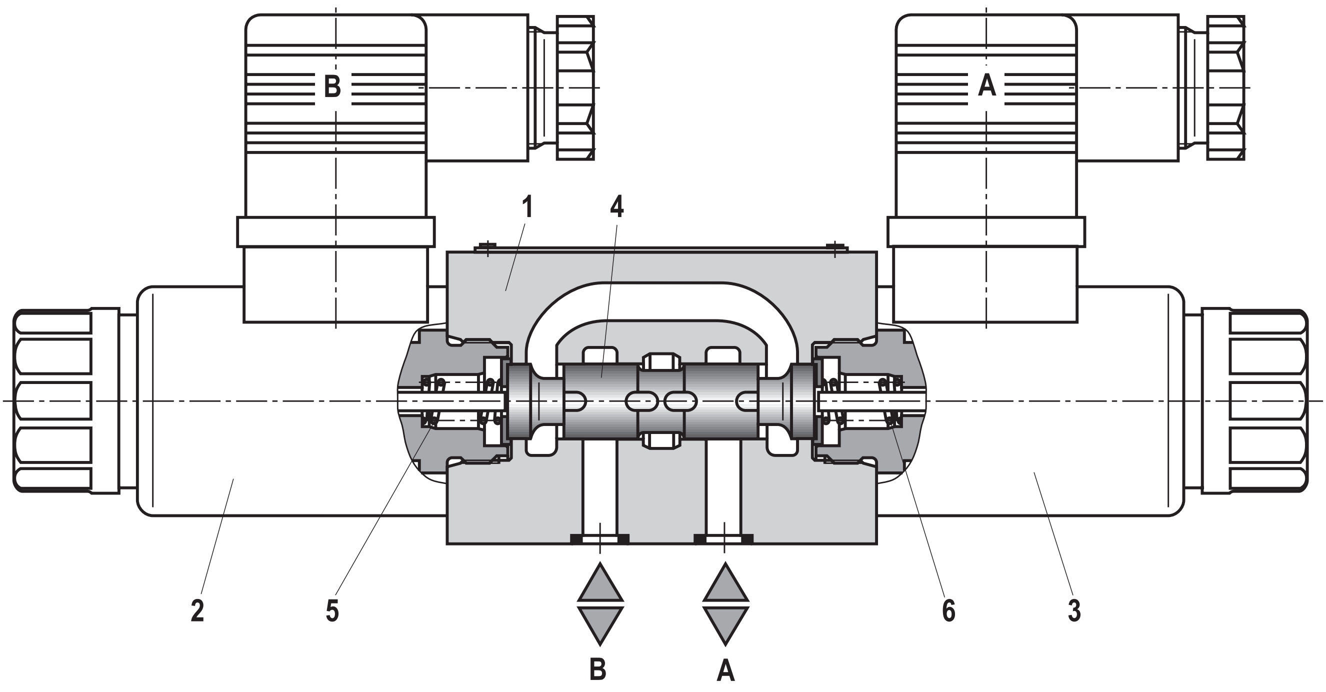
The proportional solenoids are pressure-tight, wet-pin AC solenoids with detachable coils. They transfer electric current proportionally into mechanical force. An increase of the current strength results in a correspondingly higher magnetic force. The set magnetic force remains the same during the total control stroke.

The pilot control valve mainly consists of the housing (1), the proportional solenoid (2 and 3), the valve control spool (4) and springs (5 and 6).

In a non-actuated state both actuators are connected to the tank. If one of the two solenoids (2 or 3) is excited, the magnetic force will move the valve control spool (4) towards the spring (5 or 6).

After having overcome the overlap area, the connection of one of the two actuators is blocked and the connection to the pressroom is made. There is a flow from P to the control chamber of the main stage.

Type 4WRAP 6 W7.3X/G24…



Function, section, valve particularities

Valves of type 4WRKE are 2-stage proportional directional valves.

They control the of flow direction and size.

The main stage is position-controlled so that the control spool position is independent from flow forces also in the case of bigger flows.

The valves mainly consist of the pilot control valve (1), the housing (8), the main control spool (7), the covers (5 and 6), the centering spring (4), the inductive position transducer (9) and the pressure reducing valve (3).

If there is no input signal, the main control spool (7) will be kept in the central position by the centering spring (4). Both control chambers in the covers (5 and 6) are connected to the tank via the valve control spool (2).

The main control spool (7) is connected to suitable control electronics via the inductive position transducer (9). Both the change of position of the main control spool (7) and the change of the command value at the junction summing of the amplifier create a differential voltage.

During the comparison of command and actual value a possible control deviation is determined via the electronics and the proportional solenoid of the pilot control valve (1) is supplied with current.

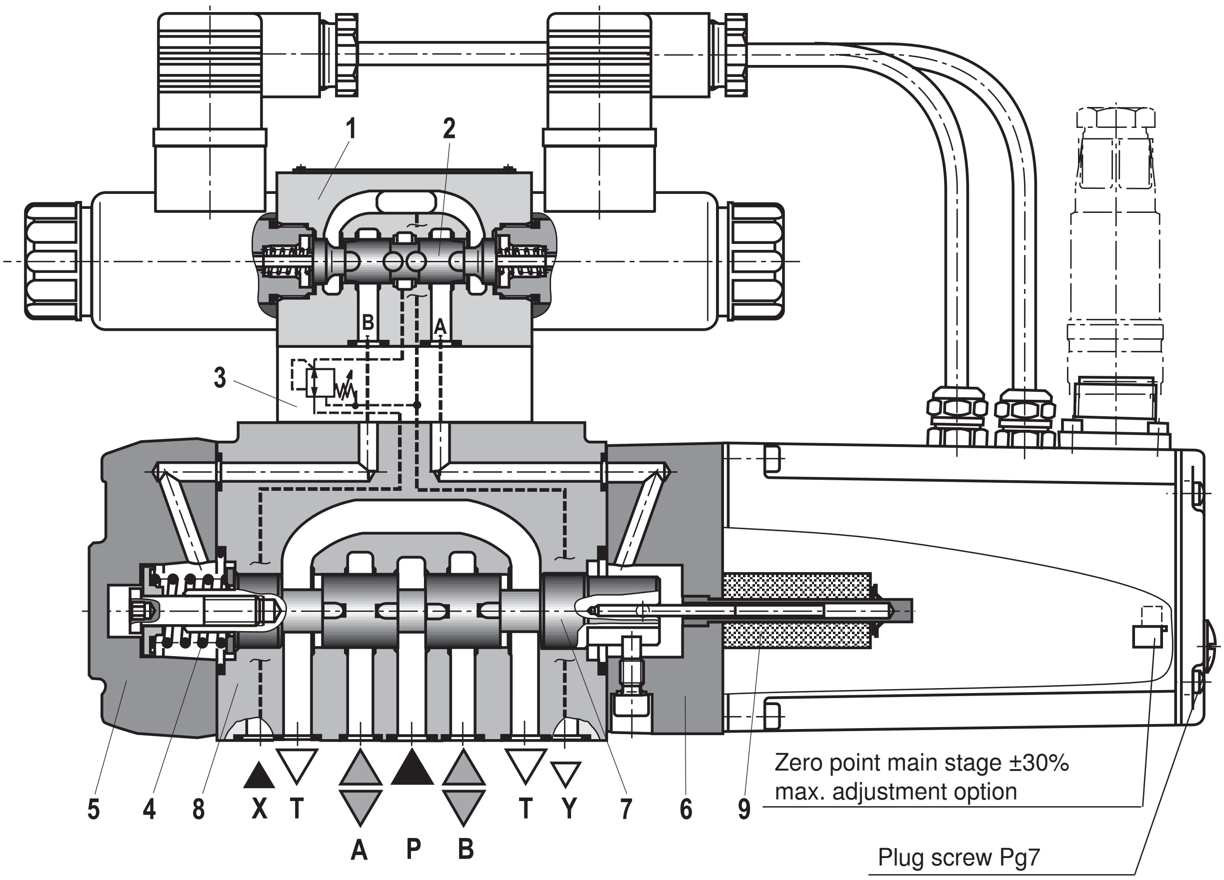
The current induces a force in the solenoid which operates the control spool via a plunger in a row. The flow which has been released via the control cross sections causes an adjustment of the main control spool.

The main control spool (7) with the core of the inductive position transducer (9) attached to it is displaced until the actual value corresponds to the command value. In a controlled state the main control spool (7) is balanced and kept in this control position.

The control spool stroke and the control opening change proportionally to the command value.

The control electronics are integrated in the valve. By adjusting valve and electronics, the deviation in series production of the devices is kept low.

The tank lines must not be allowed to run empty; a preload valve is to be installed in the case of a corresponding installation condition (counterbalance pressure approx. 2 bar).



Valve particularities

– The 2nd stage is mainly built up from components of our proportional valves.

– The zero point adjustment at **"zero point main stage"** is made at the factory and can be adjusted in a range of ±30% of the nominal stroke via a potentiometer in the control electronics. Access in the integrated control electronics by removing a plug screw on the front side of the cover housing.

– When the pilot control valve or the control electronics are exchanged, they are to be re-adjusted. All adjustments may be implemented by instructed experts only.

☞ **Notice!**

Changes in the zero point may result in damage to the system and may only be implemented by instructed specialists!

Technical data (for applications outside these parameters, please consult us!)

general

Sizes	Size	10	16	25	27	32	35
Installation position and commissioning information		Preferably horizontal, see RE 07800					
Storage temperature range	°C	–20 to +80					
Ambient temperature range	°C	–20 to +50					
Weight	kg	8.7	11.2	16.8	17	31.5	34
Sine test according to DIN EN 60068-2-6:2008 [1]		10 cycles, 10...2,000..10 Hz with logarithmic frequency changing speed of 1 oct./min, 5 to 57 Hz, amplitude 1.5 mm (p-p), 57 to 2,000 Hz, amplitude 10 g, 3 axes					
Random test according to DIN EN 60068-2-64:2009 [1]		20…2,000 Hz, amplitude 0.05 g^2/Hz (10 g_{RMS}) 3 axes, testing time 30 min per axis					
Shock test according to DIN EN 60068-2-27:2010 [1]		Half sine 15 g / 11 ms, 3 times in positive and 3 times in negative direction per axis, 3 axes					
Humid heat, cyclic according to DIN EN 60068-2-30:2006		Variant 2 +25 °C to +55 °C, 90% to 97% relative humidity, 2 cycles with 24 hours each					

1) The information on mechanical load applies to the fastening level of the integrated valve electronics.

hydraulic (measured at p = 100 bar with HLP46 at 40 °C ± 5 °C)

				10	16	25	27	32	35
Operating pressure	Pilot control valve	Pilot oil supply	bar	25 to 315					
	Main valve, connection P, A, B		bar	Up to 315	Up to 350	Up to 350	Up to 210	Up to 350	Up to 350
Return flow pressure	Connection T	Pilot oil drain, internal	bar	Static < 10 (pilot control valve)					
		Pilot oil drain, external	bar	Up to 315	Up to 250	Up to 250	Up to 210	Up to 250	Up to 250
	Connection Y		bar	Static < 10 (pilot control valve)					
Rated flow q_{Vnom} ±10% with Δp = 10 bar; Δp = valve pressure differential			l/min	– 25 50 100	125 150 200 220	– – 220 350	– – – 500	– – 400 600	– – – 1000
Recommended maximum flow			l/min	170	460	870	1000	1600	3000
Pilot oil flow at port X and/or Y with stepped input signal from 0 to 100% (315 bar)			l/min	4.1	8.5	11.7	11.7	13.0	13.0
Hydraulic fluid				See table page 7					
Maximum admissible degree of contamination of the hydraulic fluid - cleanliness class according to ISO 4406 (c)				Pilot control valve: Class 17/15/12 [1] Main stage: Class 20/18/15 [1]					
Hydraulic fluid temperature range			°C	–20 to +80, preferably +40 to +50					
Viscosity range			mm^2/s	20 to 380, preferably 30 to 45					
Hysteresis			%	≤ 1					
Response sensitivity			%	≤ 0.5					

1) The cleanliness classes stated for the components need to be maintained in hydraulic systems. Effective filtration prevents faults and simultaneously increases the life cycle of the components.

Technical data (for applications outside these parameters, please consult us!))

Hydraulic fluid		Classification	Suitable sealing materials	Standards
Mineral oils and related hydrocarbons		HL, HLP	NBR, FKM	DIN 51524
Flame-resistant	– containing water	HFC (Fuchs HYDROTHERM 46M, Petrofer Ultra Safe 620)	NBR	ISO 12922
Phosphoric acid ester		HFD-R	FKM	

Important information on hydraulic fluids!

- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.)!
- The flash point of the process and operating medium used must be 40 K greater than the maximum solenoid surface temperature.
- **Flame-resistant – containing water**: Maximum pressure differential per control edge 175 bar. Pressure pre-loading at the tank port > 20% of the pressure differential; otherwise, increased cavitation.
- Life cycle as compared to operation with mineral oil HL, HLP 50% to 100%

electrical

Voltage type		Direct voltage
Signal type		Analog
Maximum power	W	72 (average = 24 W)
Electrical connection		Mating connector according to DIN EN 175201-804
Protection class of the valve according to EN 60529		IP65 with mating connector mounted and locked
Control electronics		Integrated in the valve, see page 8

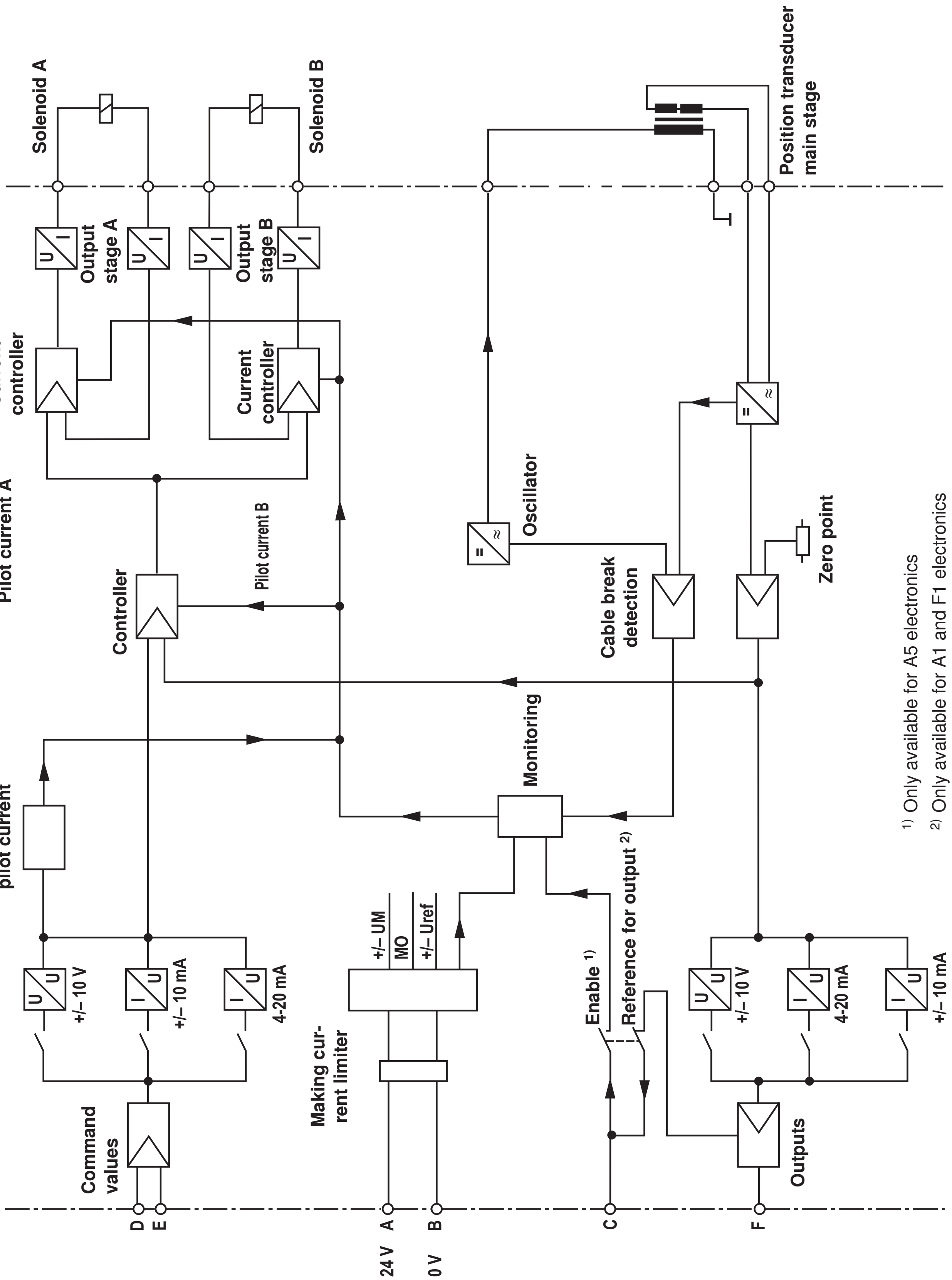
Connector pin assignment	Contact	Signal with A1	Signal with F1	Signal with A5
Supply voltage	A	24 VDC (18 to 35 VDC); I_{max} = 1.5 A; impulse load ≤ 3 A		
	B	0 V		
Reference (actual value)	C	Reference potential for actual value (contact "F")		Enable 4 to 24 V
Differential amplifier input	D	±10 V	4 to 20 mA	±10 V
(Command value)	E	0 V reference potential to pin D		0 V reference potential for pin D and F
Measuring output (actual value)	F	±10 V	4 to 20 mA	±10 V
	PE	Connected to cooling element and valve housing		

Command value: Reference potential at E and positive command value at D result in flow from P → A and B → T.
Reference potential at E and negative command value at D result in flow from P → B and A → T.

Connection cable: Recommendation: – Up to 25 m line length: Type LiYCY 7 x 0.75 mm²
– Up to 50 m line length: Type LiYCY 7 x 1.0 mm²
Only connect the shield to PE on the supply side.

Notice: **Electric signals taken out via valve electronics (e.g. actual value) must not be used for switching off safety-relevant machine functions!**

Block diagram of the integrated electronics (OBE)



1) Only available for A5 electronics

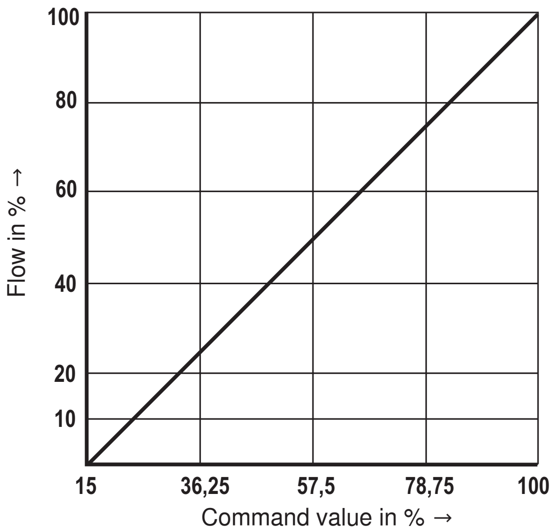
2) Only available for A1 and F1 electronics

Characteristic curves (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)

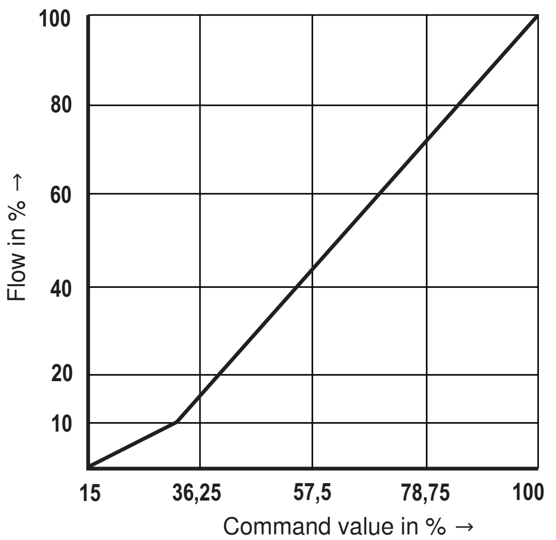
Flow command value function with e.g.
P → A / B → T 10 bar valve pressure differential or
P → A or A → T 5 bar per control edge

Control spool E, W, and R

Control spool with characteristic curve **L**

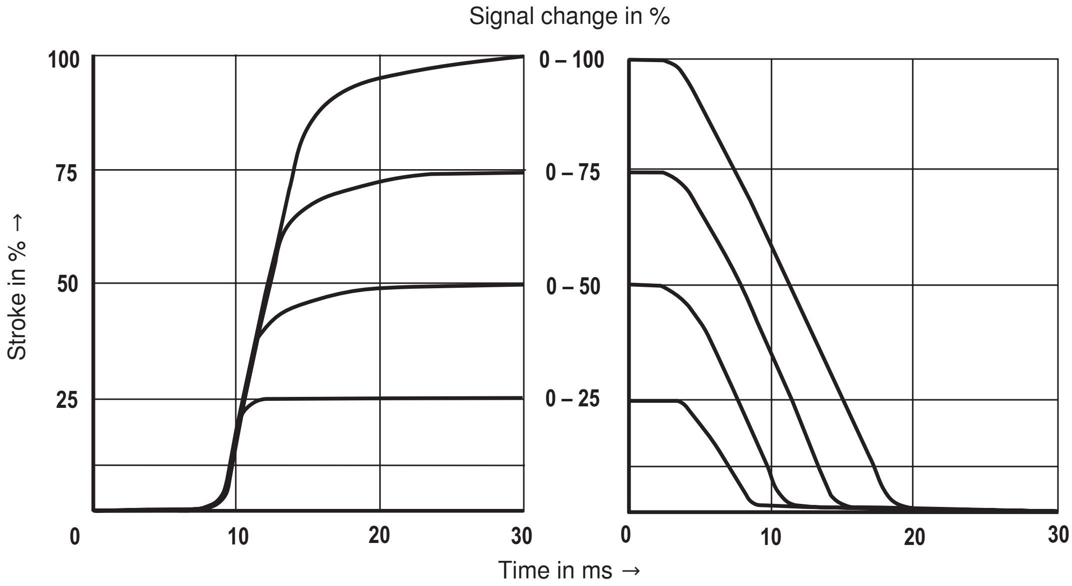


Control spool with characteristic curve **P**



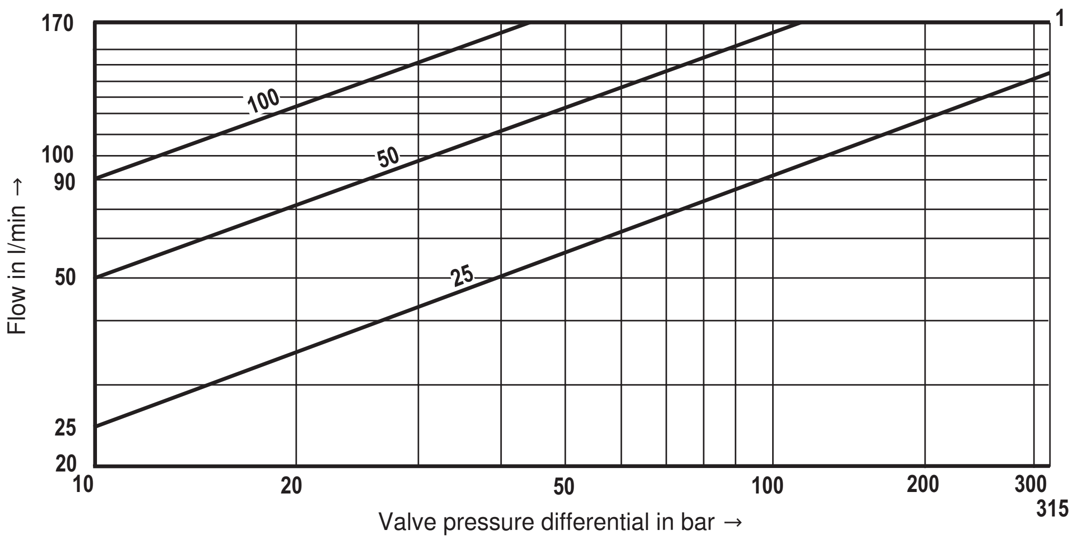
Characteristic curves: Size 10 (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)

Transition function with stepped electric input signals



Measured with
p_S = 100 bar

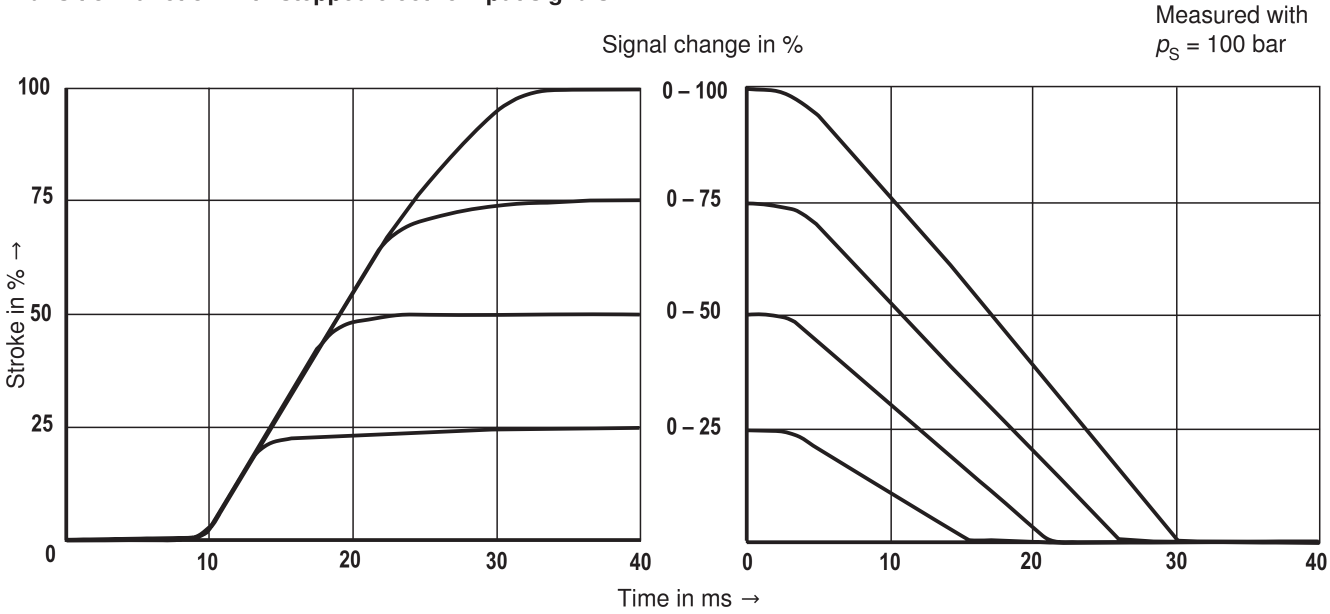
Flow/load function with maximum valve opening
(tolerance ±10%)



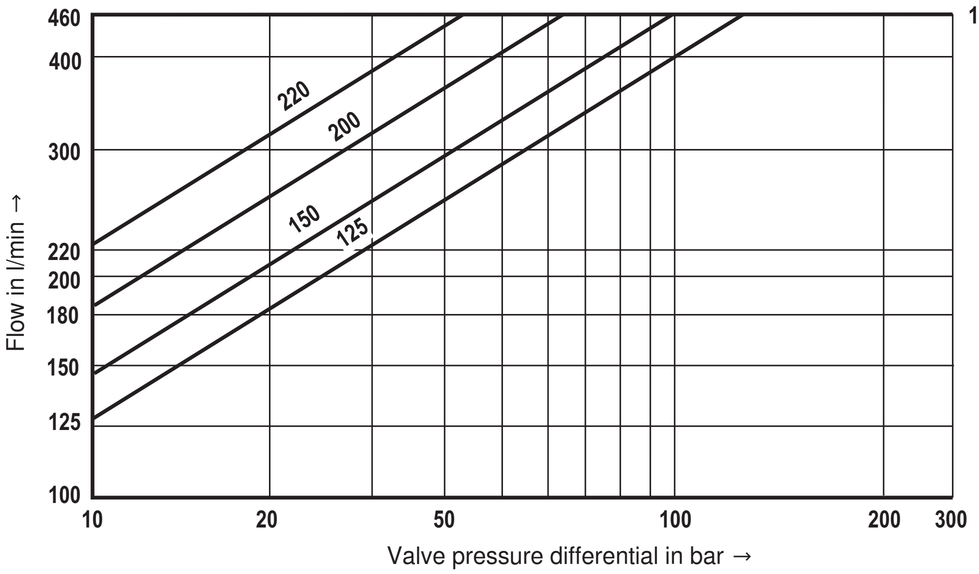
1 = Recommended flow limitation (flow velocity 30 m/s) in the valve connection bores

Characteristic curves: Size 16 (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)

Transition function with stepped electric input signals



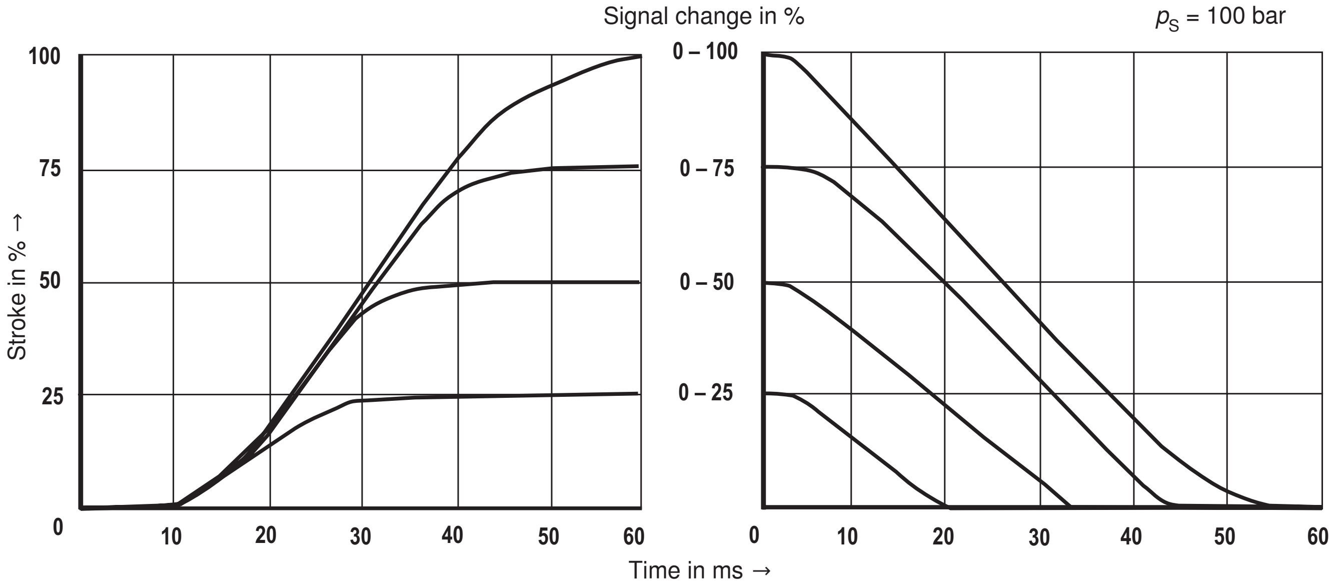
Flow/load function with maximum valve opening
(tolerance ±10%)



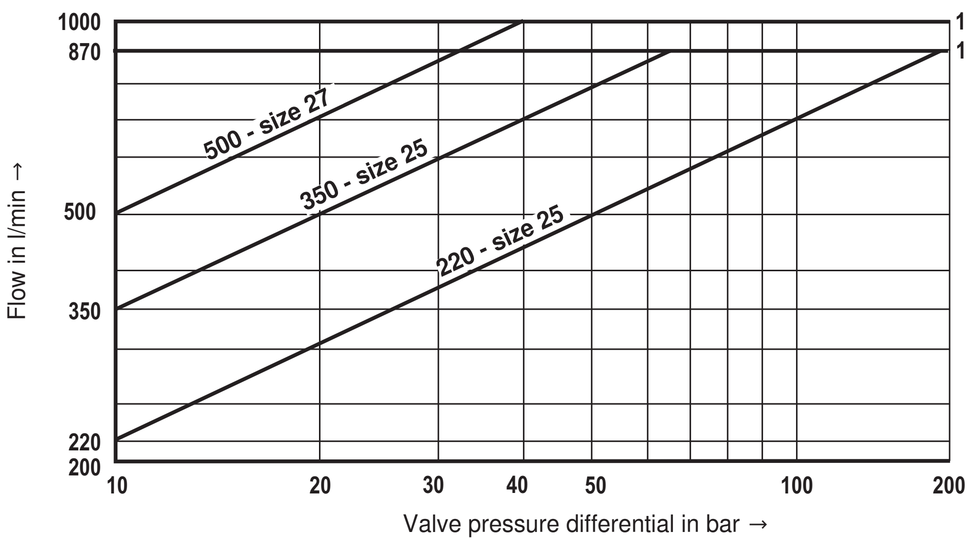
1 = Recommended flow limitation (flow velocity 30 m/s) in the valve connection bores

Characteristic curves: Size 25 and 27 (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)

Transition function with stepped electric input signals



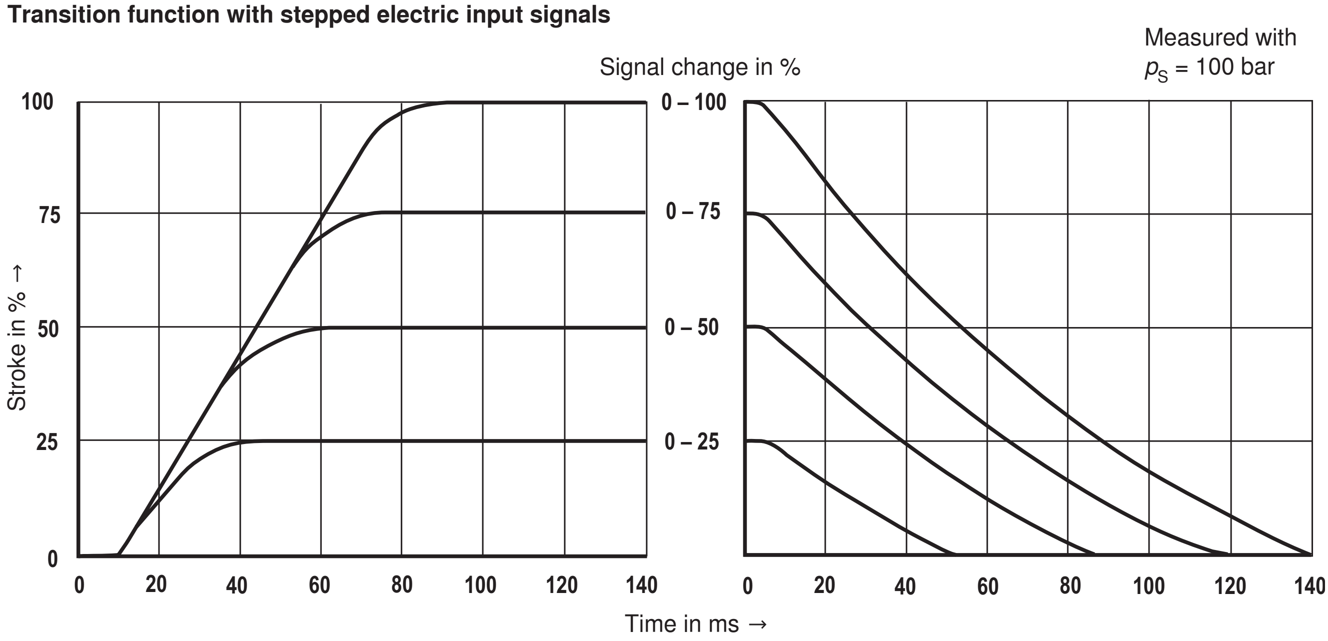
Flow/load function with maximum valve opening
(tolerance ±10%)



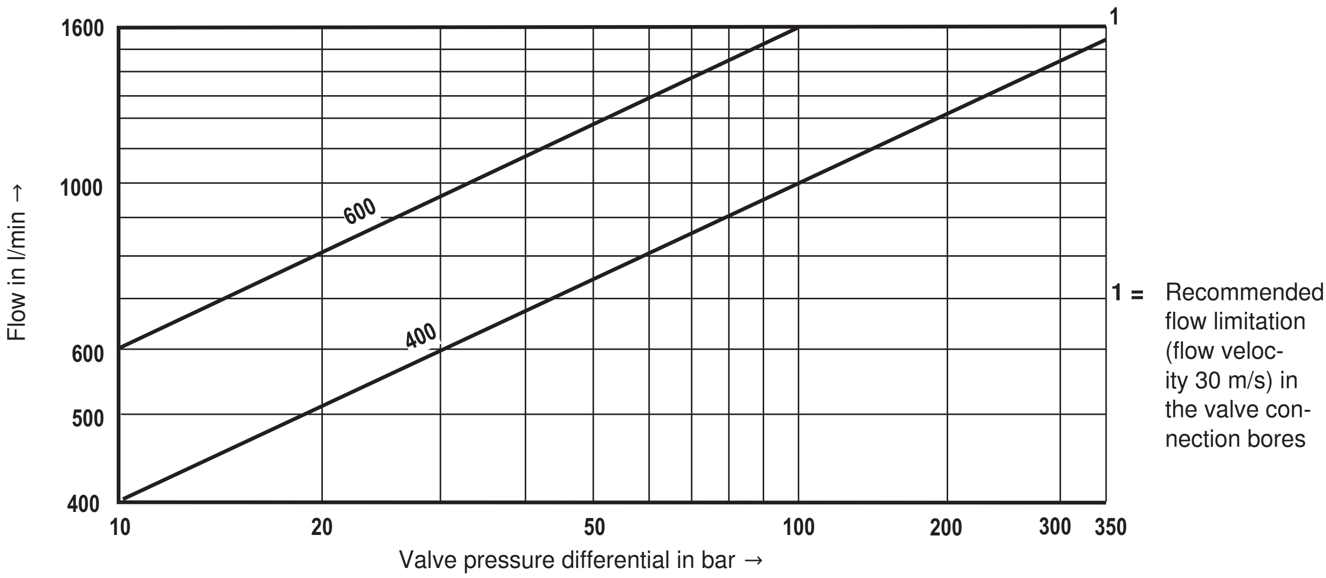
1 = Recommended flow limitation (flow velocity 30 m/s) in the valve connection bores

Characteristic curves: Size 32 (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)

Transition function with stepped electric input signals

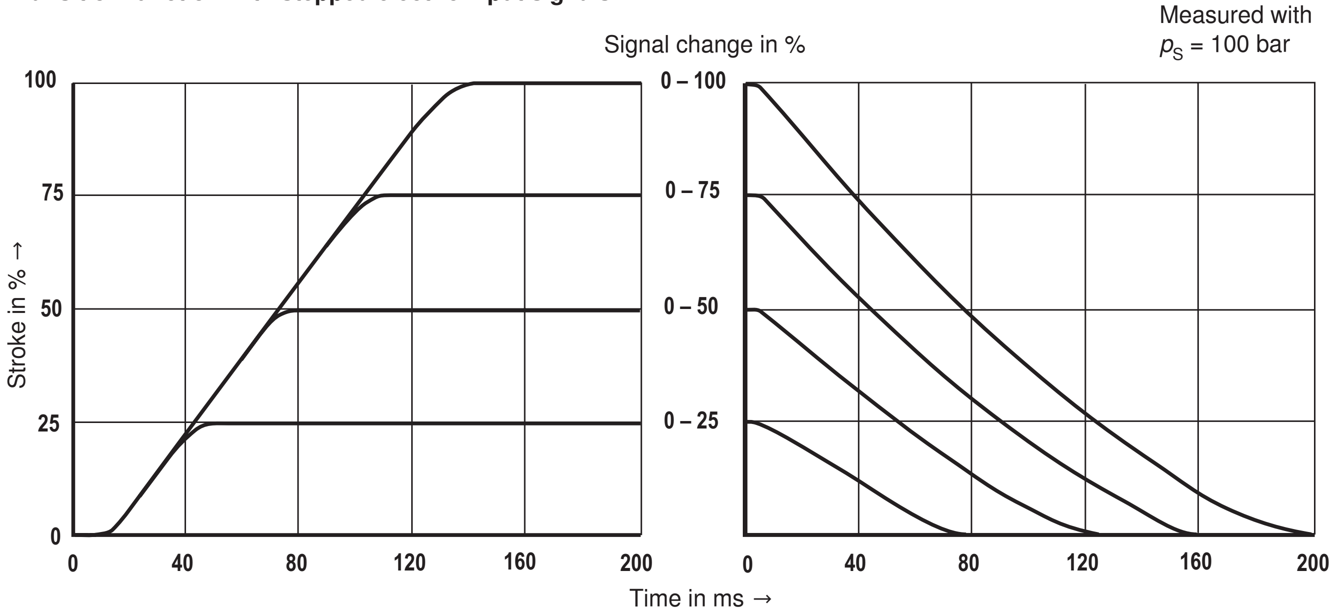


Flow/load function with maximum valve opening
(tolerance ±10%)

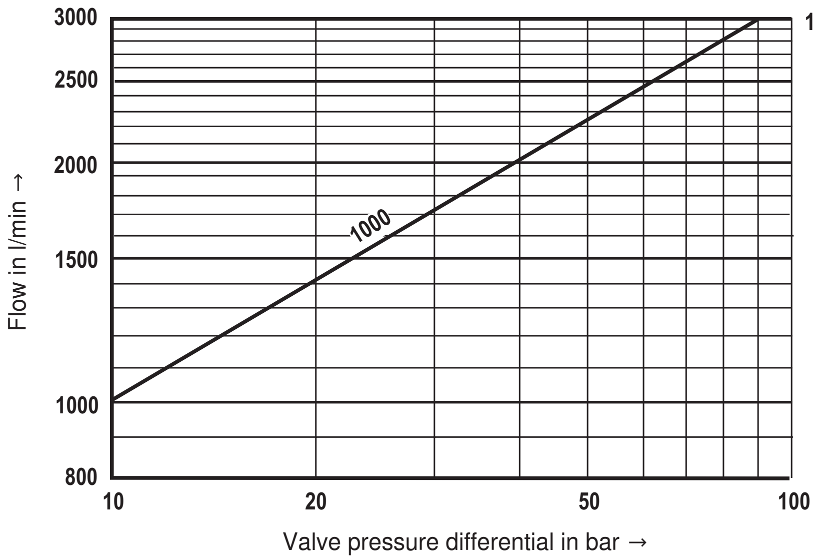


Characteristic curves: Size 35 (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)

Transition function with stepped electric input signals

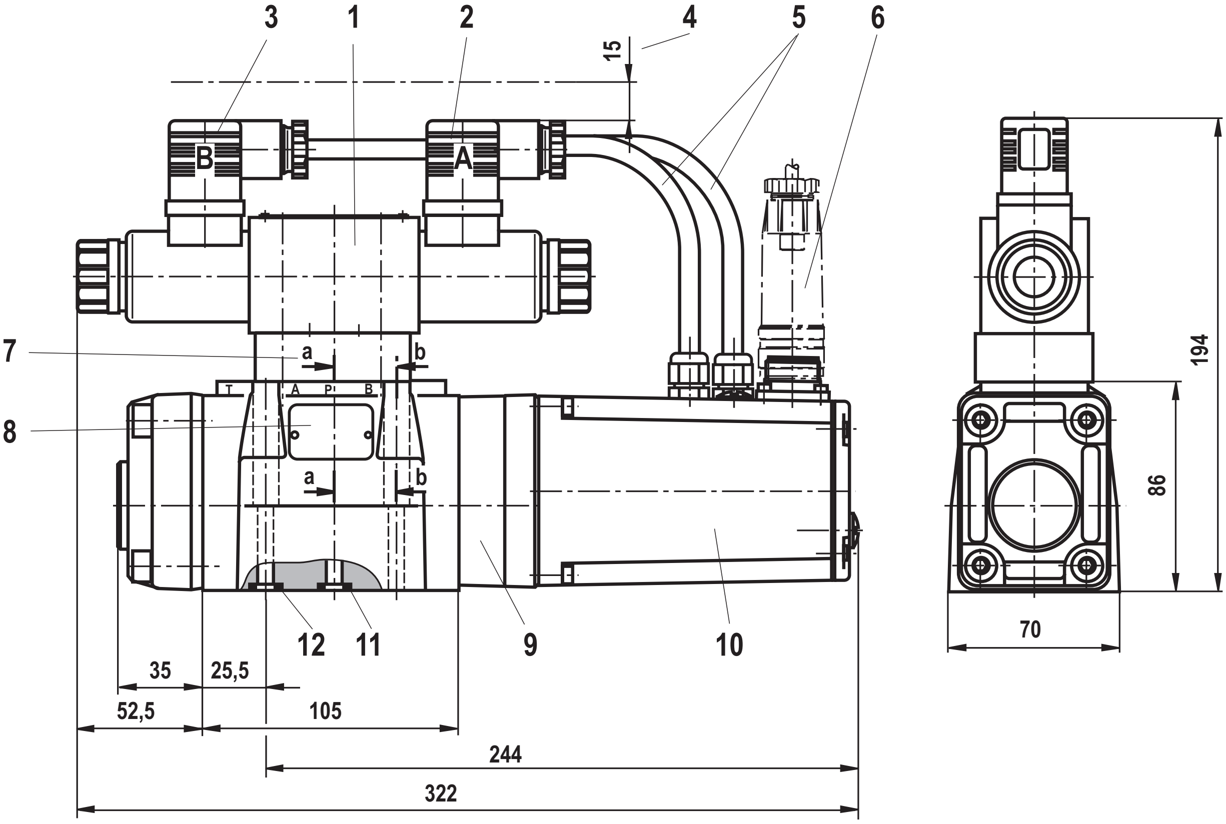


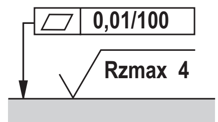
Flow/load function with maximum valve opening
(tolerance ±10%)



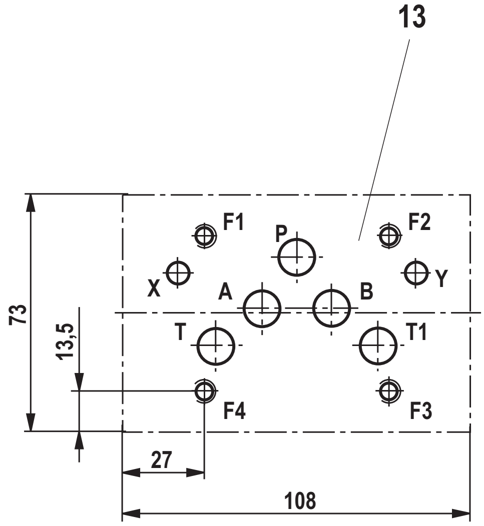
1 = Recommended flow limitation (flow velocity 30 m/s) in the valve connection bores

Dimensions: Size 10 (dimensions in mm)





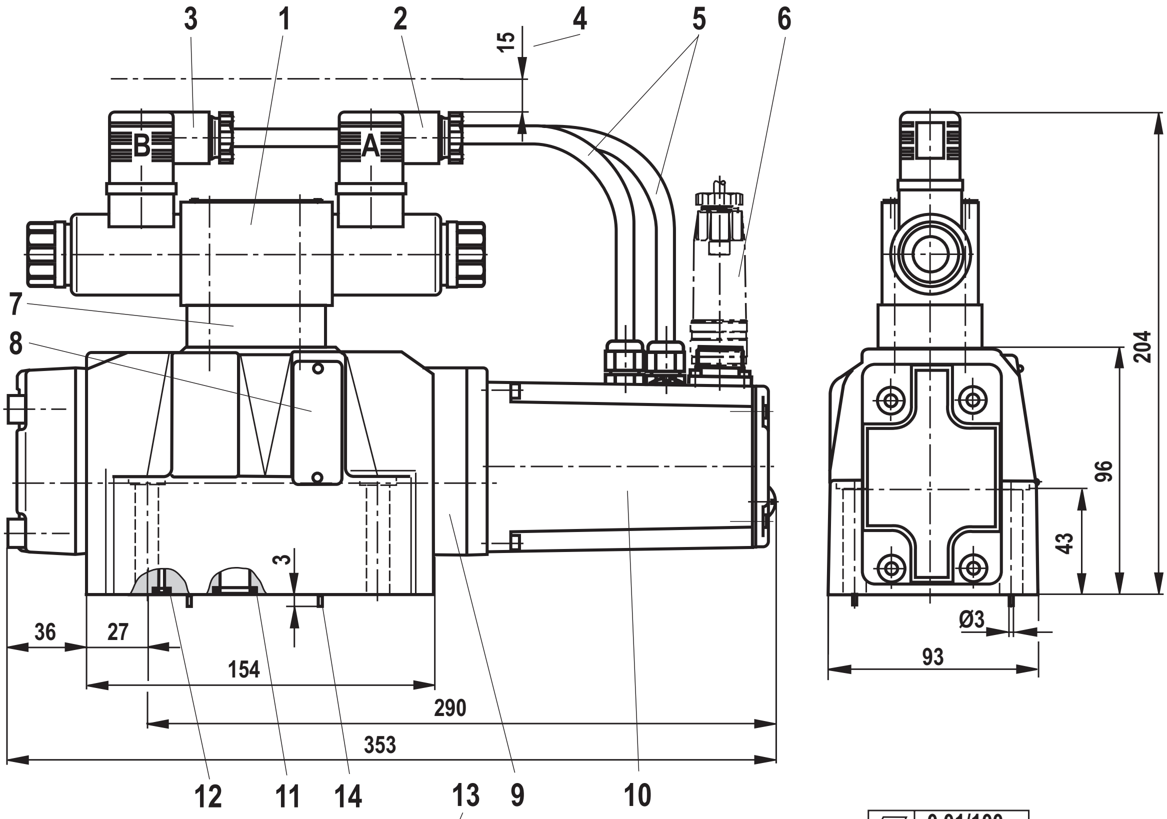
Required surface quality of the valve contact surface

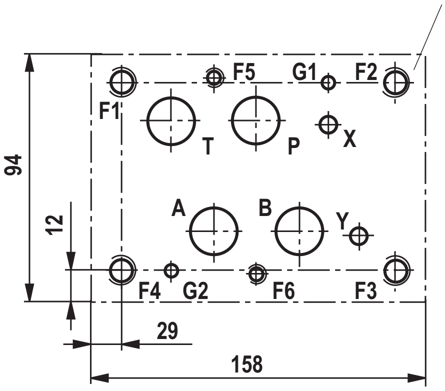


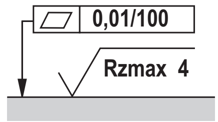
1 Pilot control valve
2 Mating connector "A", color gray
3 Mating connector "B", color black
4 Space required for connection cable and to remove the mating connector
5 Wiring
6 Mating connector, separate order, see page 21
7 Pressure reducing valve
8 Name plate
9 Main valve
10 Integrated electronics (OBE)
11 Identical seal rings for connection A, B, P, T
12 Identical seal rings for connection X, Y
13 Processed valve contact surface, porting pattern according to ISO 4401-05-05-0-05 (connection X, Y, as required)

Subplates and valve mounting screws see page 21

Dimensions: Size 16 (dimensions in mm)







Required surface quality of the valve contact surface

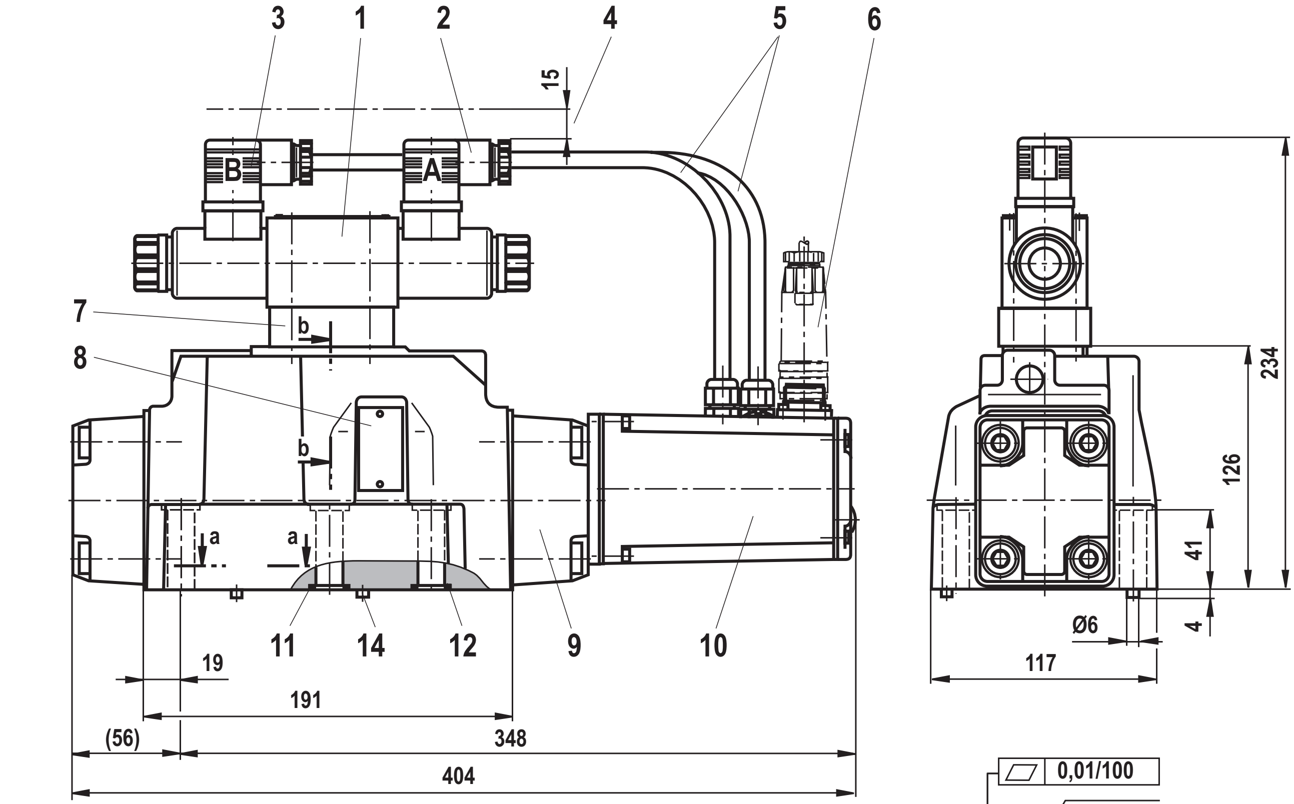
1 Pilot control valve
2 Mating connector "A", color gray
3 Mating connector "B", color black
4 Space required for connection cable and to remove the mating connector
5 Wiring
6 Mating connector, separate order, see page 21
7 Pressure reducing valve
8 Name plate
9 Main valve

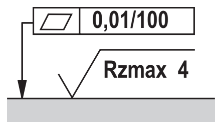
10 Integrated electronics (OBE)
11 Identical seal rings for connection A, B, P, T
12 Identical seal rings for connection X, Y
13 Processed valve contact surface, porting pattern according to ISO 4401-07-07-0-05 (connection X, Y as required) deviating from the standard:
- Connection A, B, T and P Ø 20mm

14 Locking pin

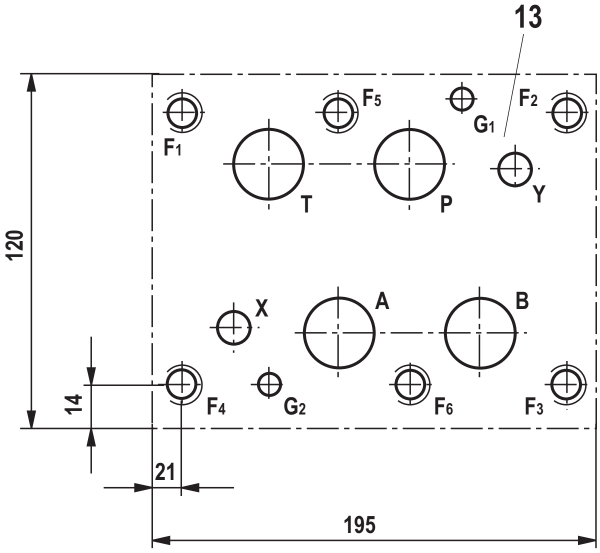
Subplates and valve mounting screws see page 21

Dimensions: Size 25 (dimensions in mm)





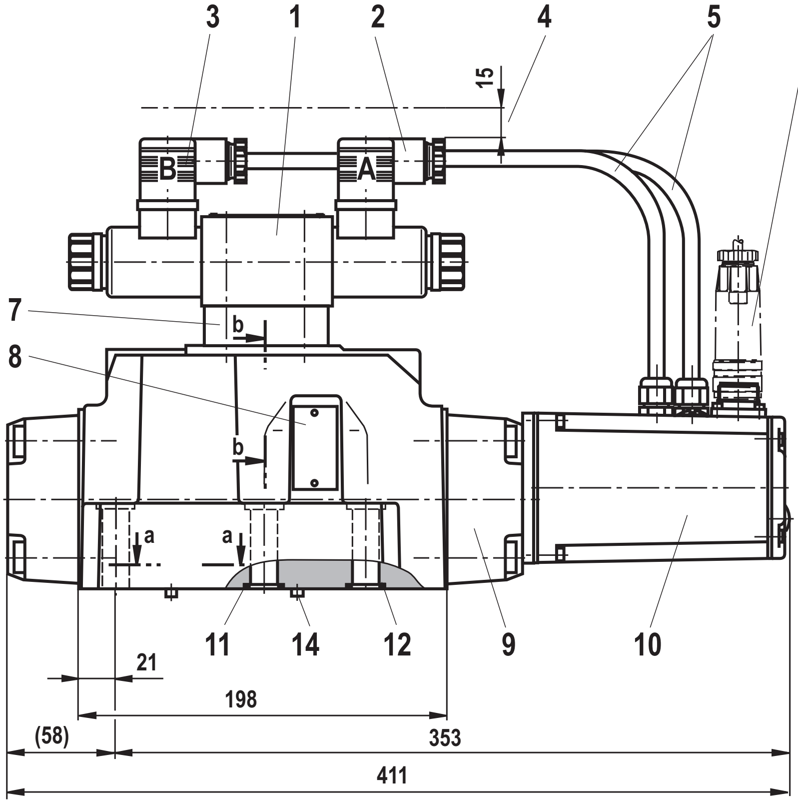
Required surface quality of the valve contact surface

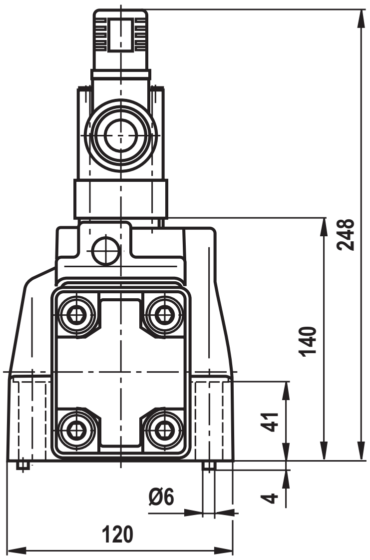


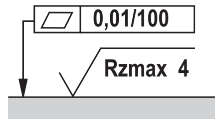
- **1** Pilot control valve
- **2** Mating connector "A", color gray
- **3** Mating connector "B", color black
- **4** Space required for connection cable and to remove the mating connector
- **5** Wiring
- **6** Mating connector, separate order, see page 21
- **7** Pressure reducing valve
- **8** Name plate
- **9** Main valve
- **10** Integrated electronics (OBE)
- **11** Identical seal rings for connection A, B, P, T
- **12** Identical seal rings for connection X, Y
- **13** Processed valve contact surface, porting pattern according to ISO 4401-08-08-0-05 (connection X, Y, as required)
- **14** Locking pin

Subplates and valve mounting screws see page 21

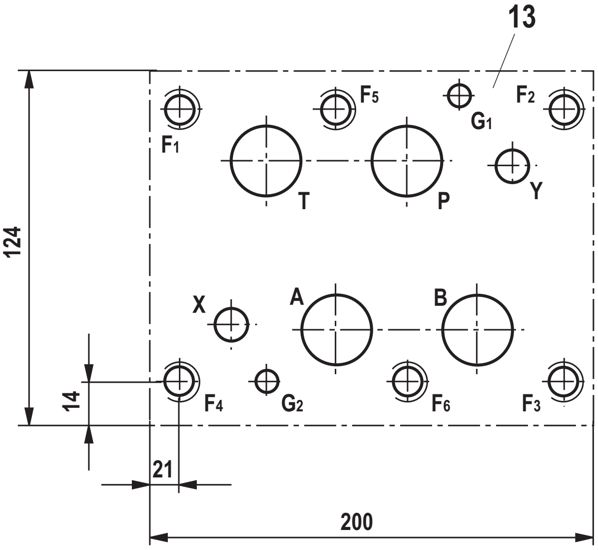
Dimensions: Size 27 (dimensions in mm)







Required surface quality of the valve contact surface

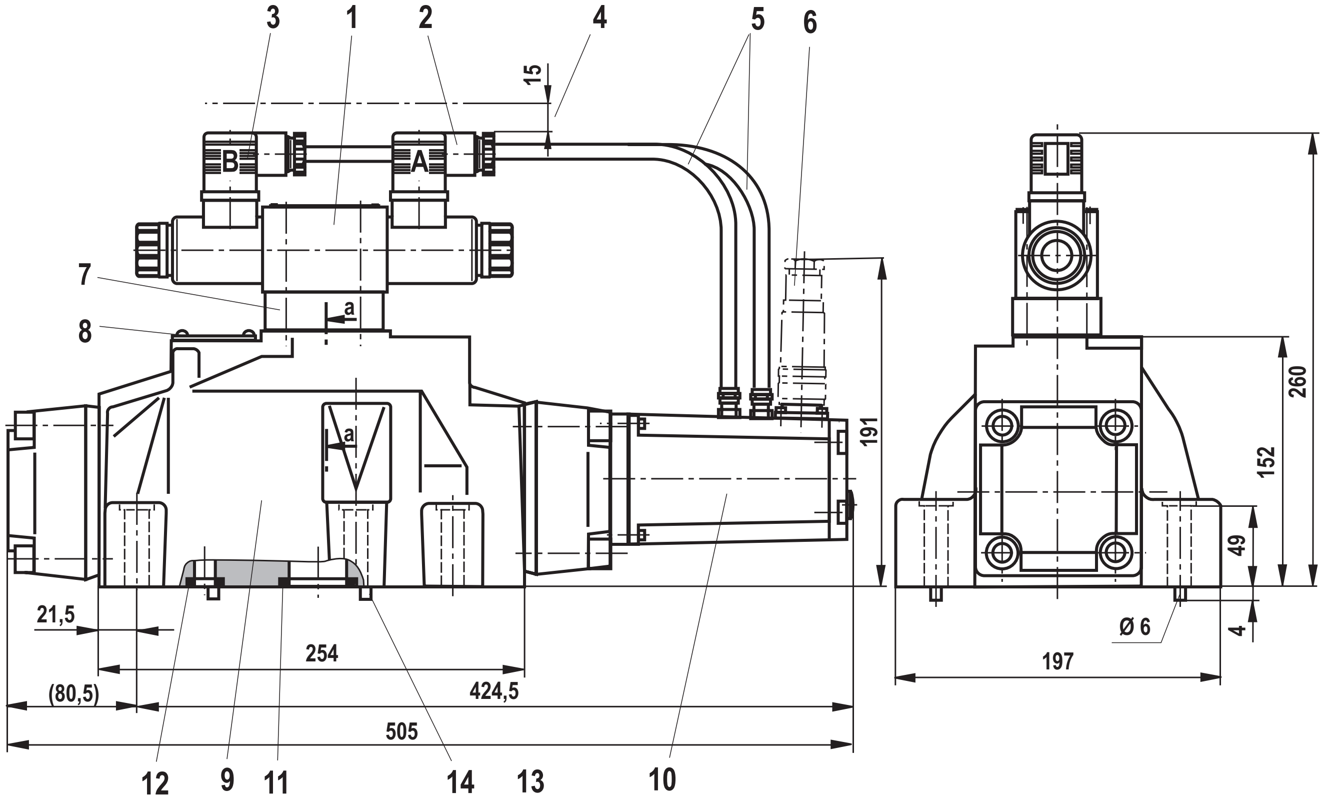


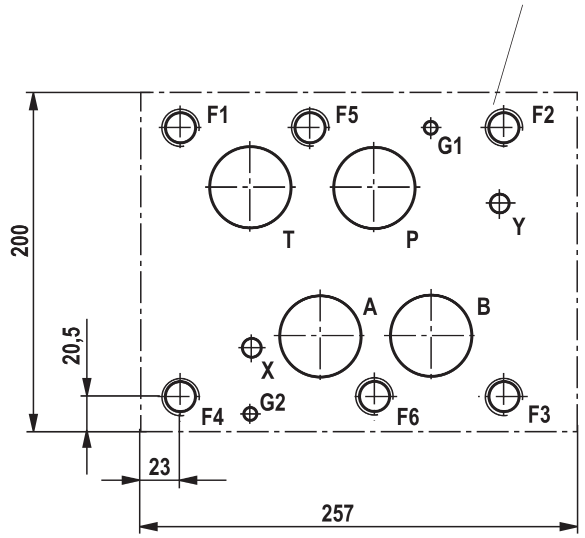
1 Pilot control valve
2 Mating connector "A", color gray
3 Mating connector "B", color black
4 Space required for connection cable and to remove the mating connector
5 Wiring
6 Mating connector, separate order, see page 21
7 Pressure reducing valve
8 Name plate
9 Main valve
10 Integrated electronics (OBE)
11 Identical seal rings for connection A, B, P, T
12 Identical seal rings for connection X, Y
13 Processed valve contact surface, porting pattern according to ISO 4401-08-08-0-05 (connection X, Y as required) deviating from the standard:
- Connection A, B, T and P Ø 32 mm

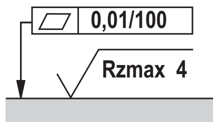
14 Locking pin

Subplates and valve mounting screws see page 21

Dimensions: Size 32 (dimensions in mm)







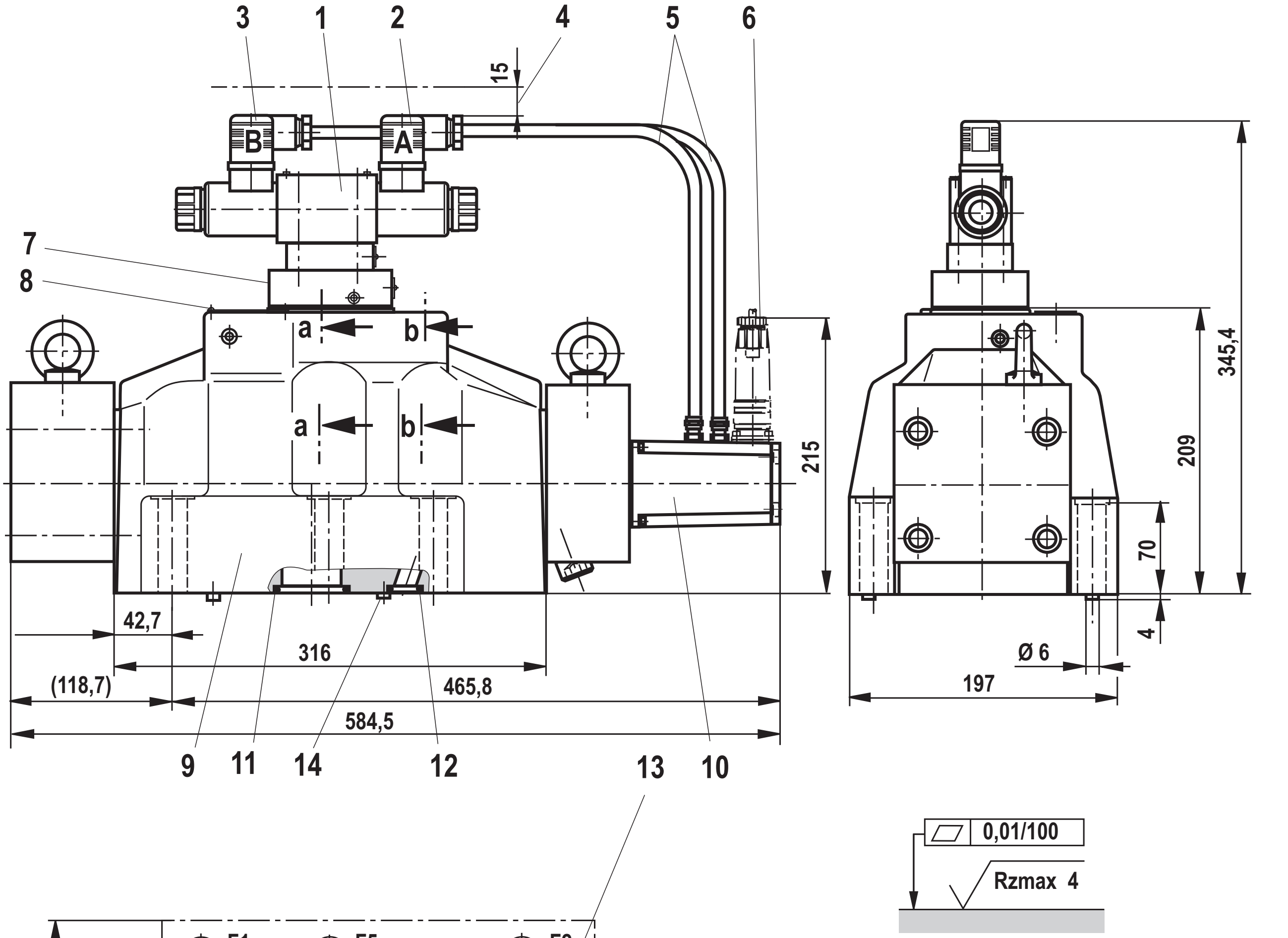
Required surface quality of the valve contact surface

1 Pilot control valve
2 Mating connector "A", color gray
3 Mating connector "B", color black
4 Space required for connection cable and to remove the mating connector
5 Wiring
6 Mating connector, separate order, see page 21
7 Pressure reducing valve
8 Name plate
9 Main valve
10 Integrated electronics (OBE)
11 Identical seal rings for connection A, B, P, T
12 Identical seal rings for connection X, Y
13 Processed valve contact surface, porting pattern according to ISO 4401-10-09-0-05 (connection X, Y as required) deviating from the standard:
- Connection, B, T and P Ø 38 mm

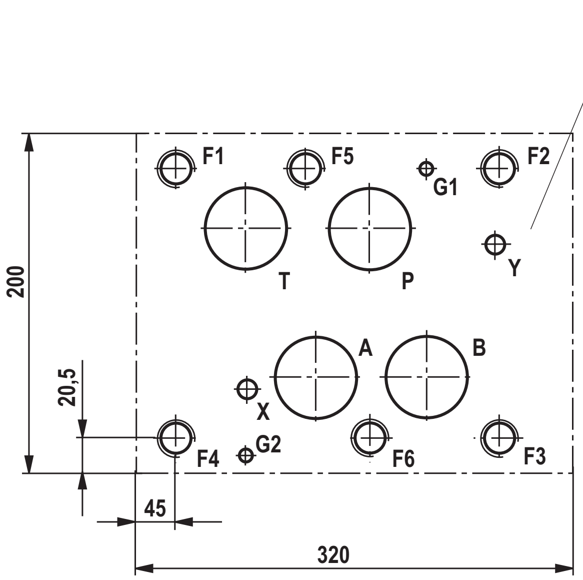
14 Locking pin

Subplates and valve mounting screws see page 21

Dimensions: Size 35 (dimensions in mm)



Required surface quality of the valve contact surface



1 Pilot control valve
2 Mating connector "A", color gray
3 Mating connector "B", color black
4 Space required for connection cable and to remove the mating connector
5 Wiring
6 Mating connector, separate order, see page 21
7 Pressure reducing valve
8 Name plate
9 Main valve
10 Integrated electronics (OBE)
11 Identical seal rings for connection A, B, P, T
12 Identical seal rings for connection X, Y
13 Processed valve contact surface, porting pattern according to ISO 4401-10-09-0-05 (connection X, Y as required) deviating from the standard:
- Connection A, B, T and P Ø 50 mm
14 Locating pins

Subplates and valve mounting screws see page 21

Dimensions

Hexagon socket head cap screws		Material number
Size 10	4x ISO 4762 - M6 x 45 - 10.9-flZn-240h-L Tightening torque M_A = 13.5 Nm ±10% or 4x ISO 4762 - M6 x 45 - 10.9 Tightening torque M_A = 15.5 Nm ±10%	R913000258
Size 16	2x ISO 4762 - M6 x 60 - 10.9-flZn-240h-L Tightening torque M_A = 12.2 Nm ±10% 4x ISO 4762 - M10 x 60 - 10.9-flZn-240h-L Tightening torque M_A = 58 Nm ±20% or 2x ISO 4762 - M6 x 60 - 10.9 Tightening torque M_A = 15.5 Nm ±10% 4x ISO 4762 - M10 x 60 - 10.9 Tightening torque M_A = 75 Nm ±20%	R913000115 R913000116
Sizes 25 and 27	6x ISO 4762 - M12 x 60 - 10.9-flZn-240h-L Tightening torque M_A = 100 Nm ±20% or 6x ISO 4762 - M12 x 60 - 10.9 Tightening torque M_A = 130 Nm ±20%	R913000121
Size 32	6x ISO 4762 - M20 x 80 - 10.9-flZn-240h-L Tightening torque M_A = 340 Nm ±20% or 6x ISO 4762 - M20 x 80 - 10.9 Tightening torque M_A = 430 Nm ±20%	R901035246
Size 35	6x ISO 4762 - M20 x 100 - 10.9-flZn-240h-L Tightening torque M_A = 465 Nm ±20% or 6x ISO 4762 - M20 x 100 - 10.9 Tightening torque M_A = 610 Nm ±20%	R913000386

Notice: The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure!

Subplates	Data sheet
Size 10	45054
Size 16	45056
Sizes 25 and 27	45058
Sizes 32 and 35	45060

Accessories (not included in the scope of delivery)

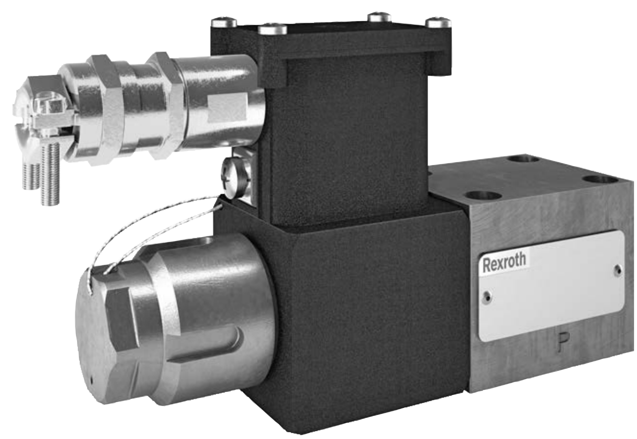
Mating connectors		Material number
Mating connector for high-response valve	DIN EN 175201-804, see data sheet 08006	e.g. R900021267 (plastic)
		e.g. R900223890 (metal)

RE 29162-XE
Edition: 2020-12
Replaces: 2019-09
RA78491255_AB

rexroth
A Bosch Company

Proportional pressure relief valve, direct operated

Type DBET…XE



H8119

- Size 6
- Component series 6X
- Maximum operating pressure 420 bar
- Maximum flow 2 l/min

CE

ATEX units
For potentially explosive atmospheres

Information on explosion protection:
- Area of application in accordance with the Explosion Protection Directive 2014/34/EU: **II 2G, II 2D**
- Type of protection valve:
  - Ex h IIC T4 Gb X according to EN 80079-36
  - Ex h IIIC T130°C Db X according to EN 80079-36
- Type of protection valve solenoid:
  - Gas: eb (EN 60079-7), mb (EN 60079-18)
  - Dust: tb (EN 60079-31)
- IECEx certificate of conformity of the valve solenoid

Features

- For intended use in potentially explosive atmospheres
- For subplate mounting
- Porting pattern according to ISO 4401-03-02-0-05
- Wet-pin DC solenoid
- Electrical connection as individual connection with cable gland
- The external metal parts are galvanized to protect them against corrosion (seawater-resistant)

Contents

☞ **Notice:** The documentation version with which the product was supplied is valid.

Ordering code

01		02		03		04	05	06	07	08	09
DBET	**–**		**–**	**6X**	**/**			**G24**	**XE**	**J**	**V**

01	Proportional pressure relief valve	**DBET**

Solenoid position (facing the cable gland)

02	Position up	**1**
	Position to the right	**2**
	Position down	**3**
	Position to the left	**4**

03	Component series 60 … 69 (60 … 69: unchanged installation and connection dimensions)	**6X**

Maximum pressure rating

04	50 bar	**50**
	100 bar	**100**
	200 bar	**200**
	315 bar	**315**
	350 bar	**350**
	420 bar	**420**

05	Internal pilot oil return	**no code**
	External pilot oil return (Y internally connected to T)	**Y**

06	Direct voltage 24 V	**G24**

Explosion protection

07	"Increased safety"	**XE**
	For details, see information on explosion protection, page 5	

Surface protection

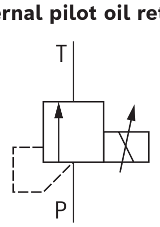
08	Seawater-resistant	**J**

Seal material (observe compatibility of seals with hydraulic fluid used, see page 4)

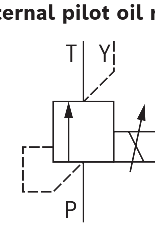
09	FKM seals	**V**

Symbols

Internal pilot oil return



External pilot oil return



Function, section

General information

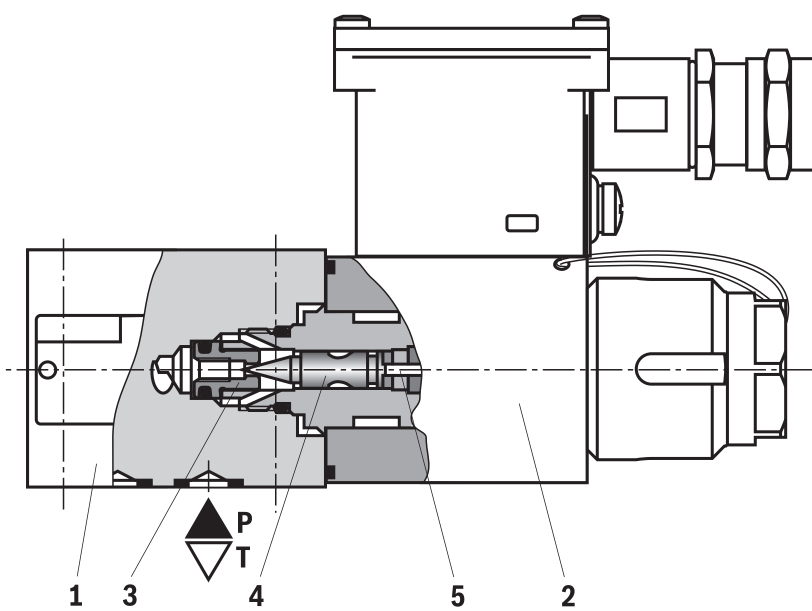
Proportional pressure relief valves of type DBET...XE are remote control valves in seat design and are intended for restricting the system pressure. Operation is effected by means of a proportional solenoid. The interior of the solenoid is connected to port T or Y and is filled with hydraulic fluid. Dependent on the electric command value, these valves can be used to steplessly set the system pressure to be limited.
The solenoid is controlled by an external amplifier of the type VT-MSPA2...1A0 (data sheet 30232-01). The maximum current at the solenoid must not exceed 1.0 A. In order to achieve this prescribed safety when operating the valve in the potentially explosive atmospheres, the solenoid current must be monitored and limited. This is to be ensured by means of the VT-MUXA2 safety module (data sheet 30290).

Set-up

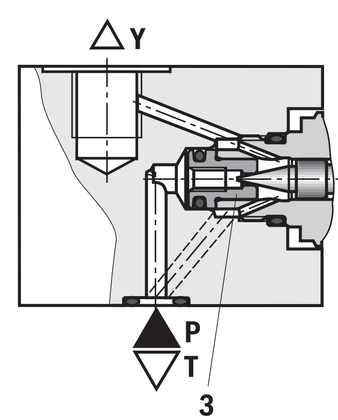
The valve basically consists of:
- Housing with connection surface (1)
- Proportional solenoid (2)
- Valve seat (3)
- Valve poppet (4)
- Armature plunger (5)

Basic principle

For setting system pressure, a command value is specified at the control electronics. Dependent on the command value, the electronics actuate the solenoid coil with electric current. The proportional solenoid converts the electric current into mechanical force that acts on the valve poppet (4) via the armature plunger (5). The valve poppet (4) presses on the valve seat (3) and interrupts the connection between port P and T or Y. If the hydraulic force on the valve poppet (4) equals the solenoid force, the valve controls the set pressure by lifting the valve poppet (4) off the valve seat (3) and thus enabling hydraulic fluid to flow from port P to T or Y. With a command value of zero, only the minimum control current is applied to the proportional solenoid (2) and the minimum set pressure is set.



Type DBET...XE



Type DBET.../...Y...XE

Technical data
(for applications outside these values, please consult us!)

General			
Installation position			any, preferably horizontal
Storage temperature range		°C	5 ... +40
Ambient temperature range		°C	−20 ... +70
Weight		kg	2,7

Hydraulic			
Maximum operating pressure	▶ Port P	bar	420
Maximum set pressure at a command value of 10 V	▶ Pressure rating 50 bar	bar	52.5
	▶ Pressure rating 100 bar	bar	105
	▶ Pressure rating 200 bar	bar	210
	▶ Pressure rating 315 bar	bar	330
	▶ Pressure rating 350 bar	bar	370
	▶ Pressure rating 420 bar	bar	420
Minimum set pressure at a command value of 0		bar	see characteristic curves page 6
Return flow pressure	▶ Port T, Y	bar	0 (separate return line to tank)
Maximum operating pressure	▶ Blind counterbore A, B	bar	350
Maximum flow		l/min	see characteristic curves page 7 [1]
Hydraulic fluid			see table below
Hydraulic fluid temperature range		°C	−15 ... +80 (preferably +40 ... +50)
Viscosity range		mm^2/s	20 ... 380 (preferably 30 ... 46)
Maximum admissible degree of contamination of the hydraulic fluid Cleanliness class according to ISO 4406 (c)			Class 20/18/15 [2]
Hysteresis		%	< 8 [3]
Range of inversion		%	< 0.5 [3]
Response sensitivity		%	< 0.5 [3]
Linearity		%	see characteristic curves page 7
Manufacturing tolerance of the command value pressure characteristic curve, related to 0.8 l/min; pressure increasing	▶ Command value 20%	%	< ±1.5 [3; 4]
	▶ Command value 100%	%	< ±5 [3; 5]
Step response ($\boldsymbol{T}_u$ + $\boldsymbol{T}_g$) 0 → 100% and/or 100% → 0 Line volume < 20 cm^3; $\boldsymbol{q}_V$ = 0.8 l/min		ms	100 (depending on the system)

Hydraulic fluid	Classification	Suitable sealing materials	Standards	Data sheet
Mineral oils	HL, HLP	FKM	DIN 51524	90220

Important notice on hydraulic fluids:
- For further information and data on the use of other hydraulic fluids, please refer to the data sheets above or contact us.
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.).
- The ignition temperature of the hydraulic fluid used must be 50 K higher than the maximum surface temperature.

1) If the maximum flow of the pressure rating is exceeded, a back pressure which exceeds the maximum nominal pressure of the valve may built up in port P.
2) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and simultaneously increases the life cycle of the components.
3) Of the maximum set pressure
4) Zero point calibration at the factory
5) Comparison at amplifier possible

Technical data
(for applications outside these values, please consult us!)

Electric			
Voltage type			Direct voltage; PWM signal 100 ... 500 Hz
Type of signal			analog
Maximum current		A	1.0
Limiting power		W	13.5
Solenoid coil resistance	▶ Cold value at 20 °C	Ω	8.3
	▶ Maximum hot value	Ω	12.56
Duty cycle		%	100
Maximum coil temperature		°C	130

Information on explosion protection			
Area of application according to Directive 2014/34/EU			II 2G, II 2D
Type of protection of valve according to EN 80079-36 [6]	▶ Gas		Ex h IIC T4 Gb X
	▶ Dust		Ex h IIIC T130°C Db X
Maximum surface temperature [7]		°C	130
Temperature class			T4
Type of protection of solenoid	▶ According to EN 60079-7; 60079-18		II 2G Ex eb mb IIC T4 Gb
	▶ According to EN 60079-31		II 2D Ex tb IIIC T130°C Db
Type examination certificate Solenoid			IBExU 16 ATEX 1143 X
"IECEx Certificate of Conformity" solenoid			IECEx IBE 16.0023X

☞ **Special application conditions for safe application:**
- In the event of bank assembly, only one solenoid of all valves may be energized at a time.
- Maximum admissible dust layer thickness ≤5 mm

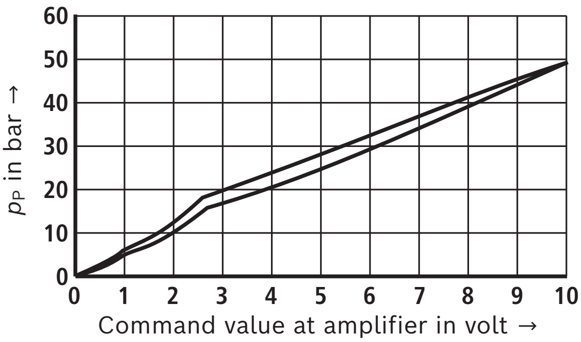
Control electronics	
Amplifier in modular design [8]	VT-MSPA2...1A0... (data sheet 30232-01)
Safety module [8]	VT-MUXA2-2 (data sheet 30290)

[6] Ex h: structural safety c according to EN 80079-37.
[7] Surface temperature > 50 °C, provide contact protection.
[8] For the electric circuit of valve, amplifier and safety module refer to data sheet 30290 and 30232-01

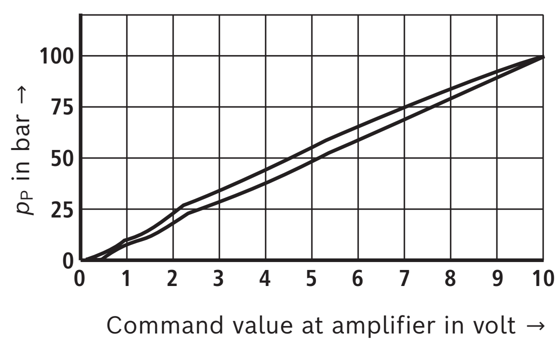
Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Pressure in port P (p_P) dependent on the command value
(measured with a volume flow of 0.8 l/min and the amplifier VT-MSPA2...1A0 with the safety module VT-MUXA2-2)

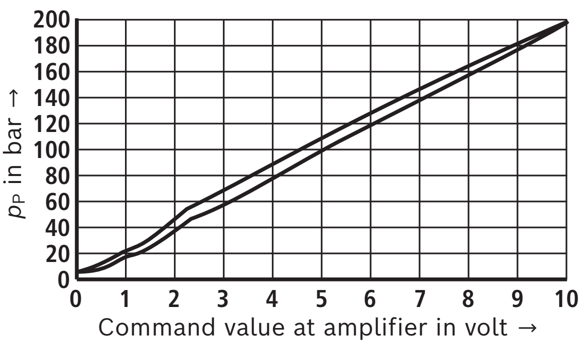
Pressure rating 50 bar



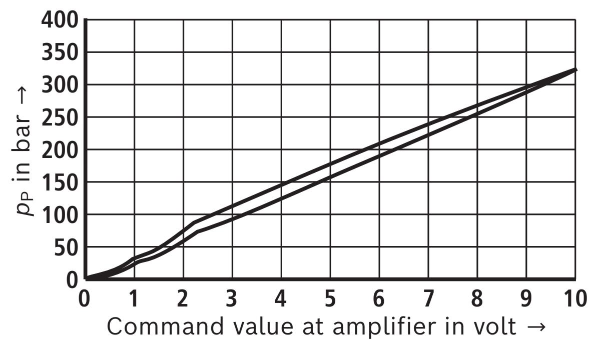
Pressure rating 100 bar



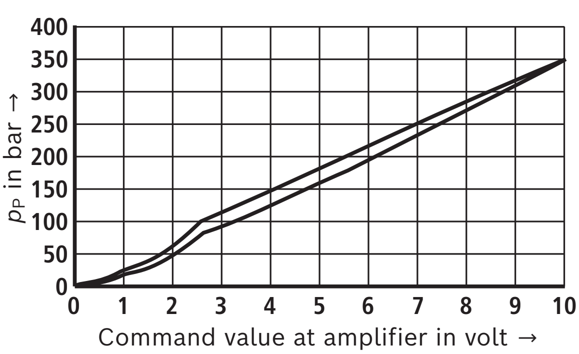
Pressure rating 200 bar



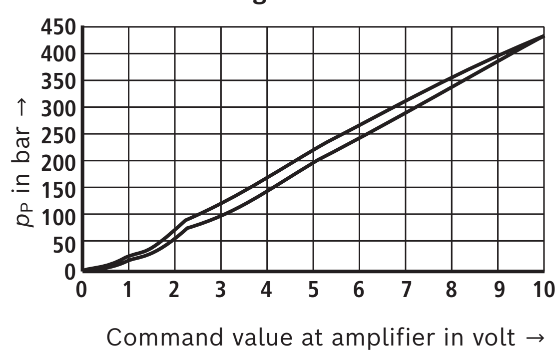
Pressure rating 315 bar



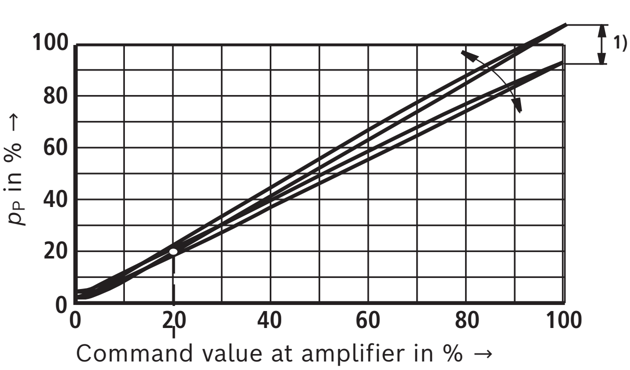
Pressure rating 350 bar



Pressure rating 420 bar



Comparison of the manufacturing tolerance



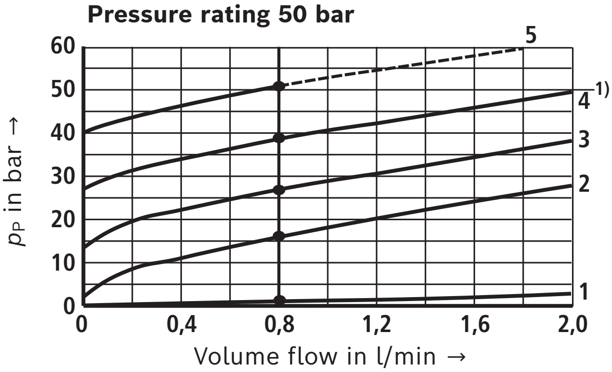
[1] The manufacturing tolerance can be compensated at the Gw potentiometer of the upstream VT-MSPA2...1A0 amplifier.

Notice:
Zero point calibration at the factory at 20%

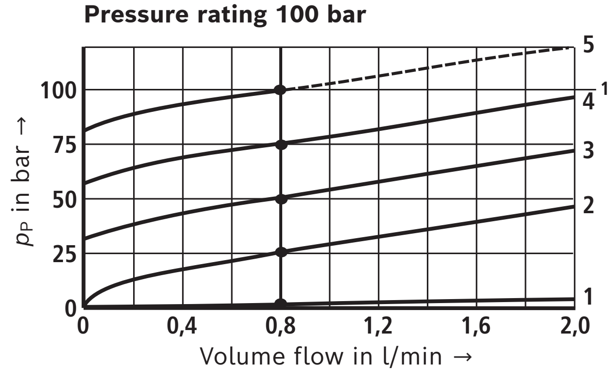
Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Pressure in port P (p_P) dependent on the volume flow
(Amplifier VT-MSPA2…1A0… with safety module VT-MUXA2-2)

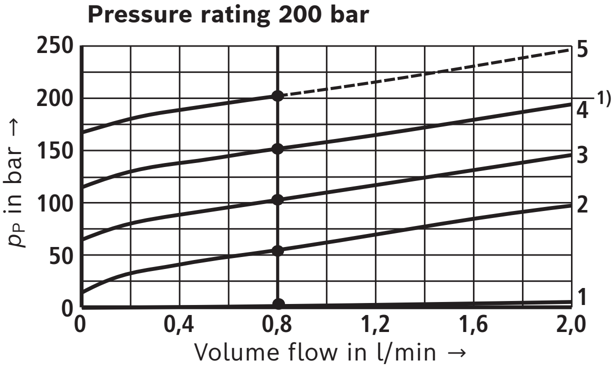
Pressure rating 50 bar



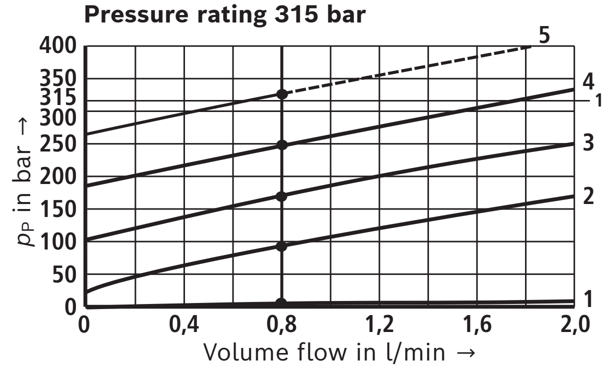
Pressure rating 100 bar



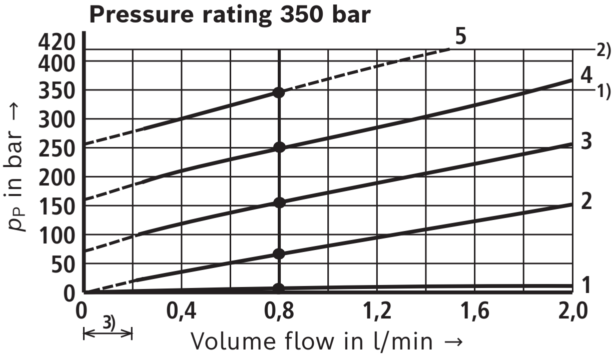
Pressure rating 200 bar



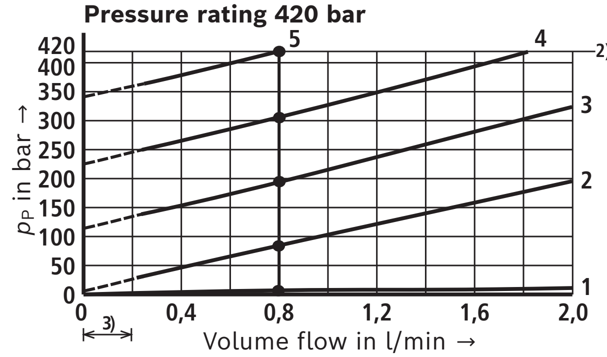
Pressure rating 315 bar



Pressure rating 350 bar



Pressure rating 420 bar

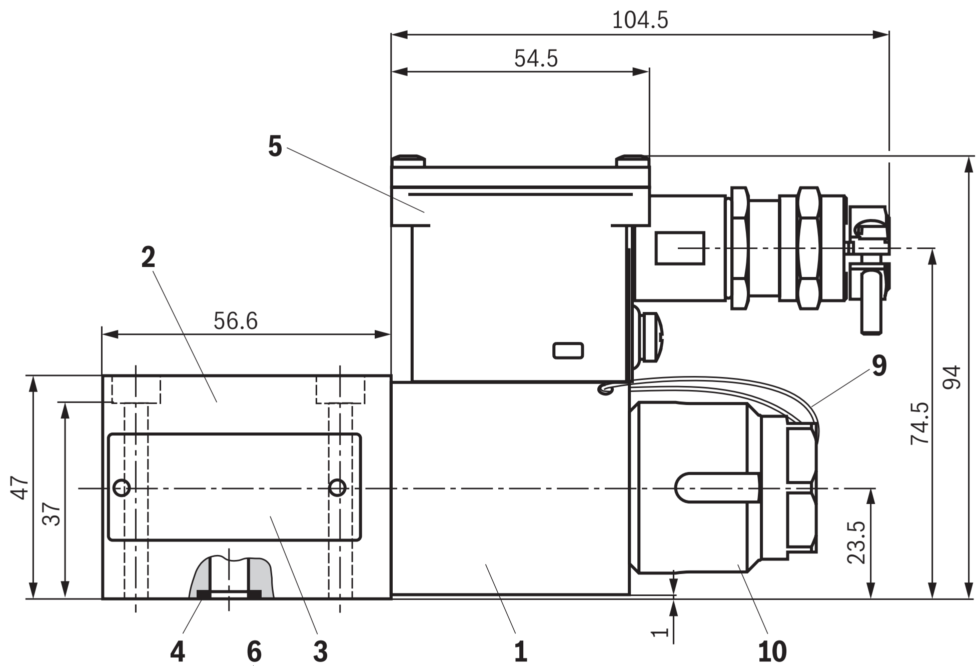


1) Flow limit of the pressure rating
2) Flow limit and maximum pressure
3) Theoretical characteristic curve at a flow < 0.2 l/min

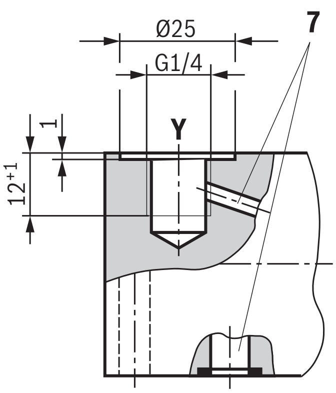
Applies to all pressure ratings:
- **1** 0% command value
- **2** 25% command value
- **3** 50% command value
- **4** 75% command value
- **5** 100% command value

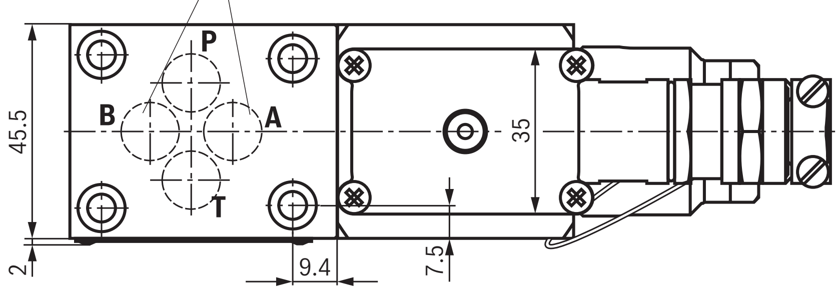
Notice:
The characteristic curves were measured without counter pressure in port T (p_T = 0 bar).

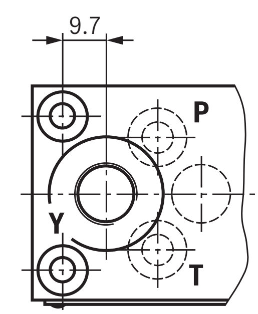
Dimensions
(dimensions in mm)

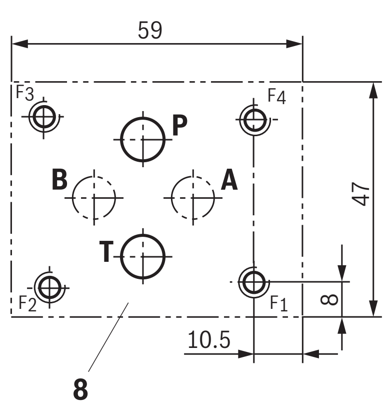


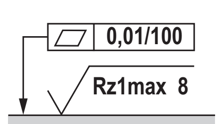
Version "Y"











Required surface quality of the valve contact surface

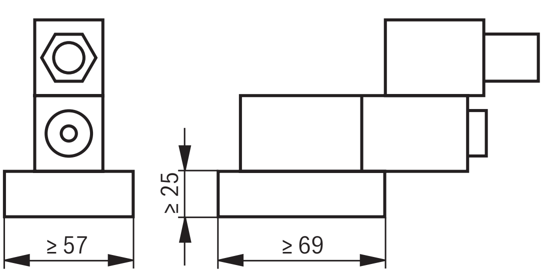
1 Proportional solenoid
2 Valve housing
3 Name plate
4 Identical seal rings for ports P, A, B and T
5 Terminal box
6 Blind counterbores A and B
7 With version ..Y.. (external pilot oil return), port Y is internally connected to port T; port T is **not** blocked
8 Machined valve contact surface;
Porting pattern according to ISO 4401-03-02-0-05
Deviating from the standard:
▶ Locating pin not available
▶ Channel A and B **not** bored
9 Securing of the factory setting by locking wire
10 Mounting nut for solenoid

Valve mounting screws (separate order)
Only use valve mounting screws with the subsequently listed thread diameters and strength properties. Observe the screw-in depth.
4 hexagon socket head cap screws ISO 4762 - M5 x 45 - 10.9
(friction coefficient μ_{total} = 0.09 ... 0.14);
Material no. **R913048087**

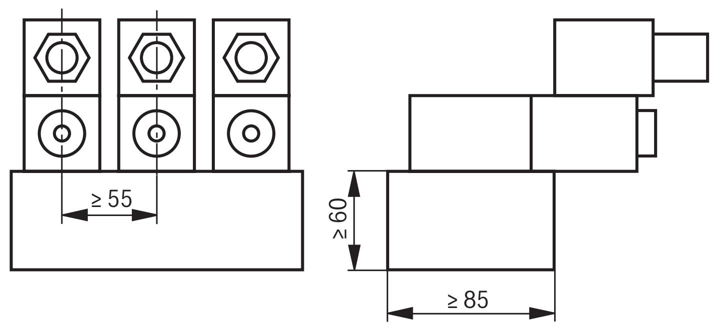
Installation conditions
(dimensions in mm)

	Individual assembly	Bank assembly
Subplate dimensions	Minimum dimensions Length ≥ 69, width ≥ 57, height ≥ 25	Minimum cross-section Height ≥ 60, width ≥ 85
Thermal conductivity of the subplate (referred to 300 °C)	≥ 32.5 W/mK	
Minimum distance between the longitudinal valve axes	≥ 55	

Individual assembly



Bank assembly

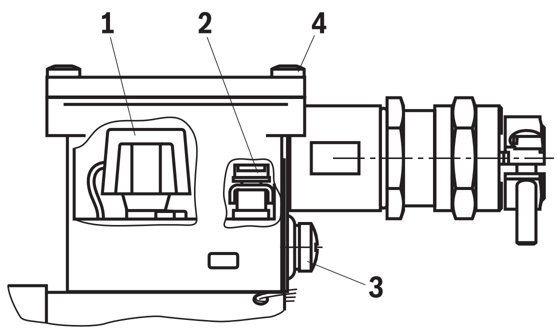


☞ **Notice:**
Observe the "Special application conditions for safe application" on page 5.

Electrical connection

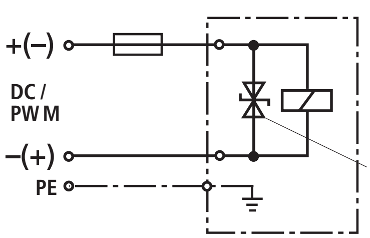
The type-examination tested actuation solenoid of the valve is equipped with a terminal box and a type-tested cable gland.
The connection is polarity-independent.

Notice:
A fuse which is appropriate for the rated current of the valve solenoid (max. 3 x I_N according to IEC/EN 60127-2) must be installed as short-circuit protection upstream of the valve solenoid. The shut-off threshold of the fuse must match or exceed the short-circuit current of the supply source.



Properties of the connection terminals and mounting elements

Position	Function	Connectable line cross-section
1	Operating voltage connection	single-wire 0.75 ... 2.5 mm²
		multi-wire 0.75 ... 1.5 mm²
2	Connection for protective grounding conductor	single-wire up to 2.5 mm²
		multi-wire up to 1.5 mm²
3	Connection for potential equalization conductor	single-wire up to 4 mm²
		multi-wire up to 4 mm²
4	Screws for cover	–



Notice:
Only use finely stranded conductors if they have pressed-on wire end ferrules.

Cable gland

Threaded connection		M20 x 1.5
Line diameter	mm	7 ... 12 (three-wire with protective grounding conductor)
Temperature rating	°C	–20 ... +130
Protection class according to EN 60529+A1		IP67 in mounted state
Seal material		FKM
Line type		Cable and lines without shielding and reinforcement
Required temperature rating quantities of the connection cable	°C	≥ 115

Notice:
The connection line must be fixed after a minimum of 150 mm to a fixed point.

Over-current fuse and switch-off voltage peaks

Voltage data in the valve type code	Nominal voltage, valve solenoid	Rated current, valve solenoid	Rated current, external miniature fuse: Medium time-lag (M) according to DIN 41571 and EN/IEC 60127	Rated voltage, external miniature fuse: Medium time-lag (M) according to DIN 41571 and EN/IEC 60127	Maximum voltage value when switching off	Interference protection circuit
G24	24 VDC	0.936 ADC	1000 mA	250 V	200 V	Suppressor diode Bi-directional

☞ **Notice:**
A fuse which corresponds to the rated current according to DIN 41571 and EN / IEC 60127 has to be connected upstream of every valve solenoid (max. 3 x I_{rated}).
The shut-off threshold of the fuse has to match the prospective short-circuit current of the supply source.
The prospective short-circuit current of the supply source may amount to a maximum of 1500 A.
This fuse may only be installed outside the potentially explosive atmospheres or must be of an explosion-proof design.
When inductivities are switched off, voltage peaks result which may cause faults in the connected control electronics.

Further information

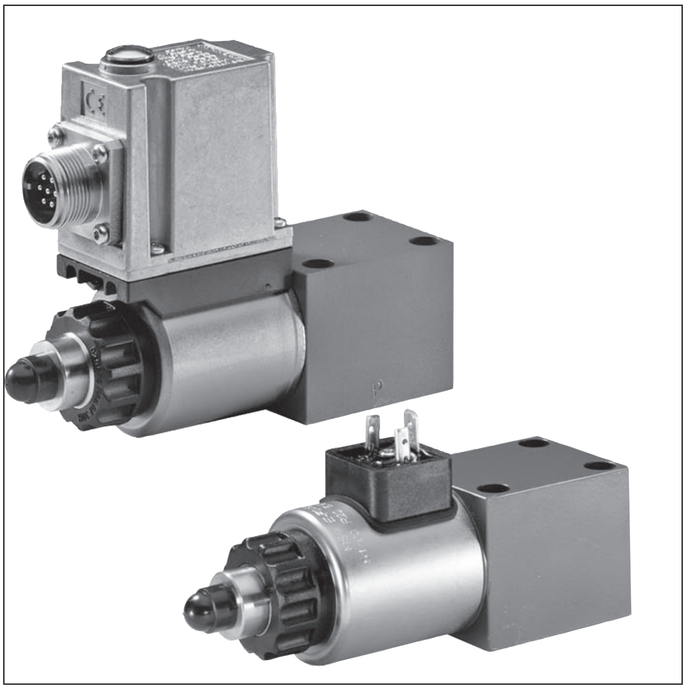
- Valve amplifier for proportional valves without electrical position feedback Maximum current limitation 1 A — Data sheet 30232-01
- Module for monitoring and limiting the solenoid currents with proportional valves — Data sheet 30290
- Subplates — Data sheet 45100
- Hydraulic fluids on mineral oil basis — Data sheet 90220
- Hydraulic valves for industrial applications — Operating instructions 07600-B
- Selection of filters
- Information on available spare parts

The Drive & Control Company

Proportional pressure relief valve, directly operated, without/with integrated electronics (OBE)

Type DBET and DBETE

RE 29162
Edition: 2013-06
Replaces: 04.13



- Size 6
- Component series 6X
- Maximum operating pressure 420 bar
- Maximum flow: 2 l/min

Features

- Directly operated valves for limiting a system pressure
- Operation by means of proportional solenoid
- Proportional solenoid with central thread and detachable coil
- For subplate mounting:
  Porting pattern according to ISO 4401
- Integrated electronics (OBE) with type DBETE:
  Little manufacturing tolerance of the command value pressure characteristic curve
- External control electronics with type DBET:
  Amplifier with modular design, Euro-card format and as plug-in amplifier, individually adjustable upwards and downwards ramp, fine adjustment of the command value pressure characteristic curve is possible

Contents

Ordering code

01	02		03		04	05	06	07	08	09	10	11
DBET		**–**	**6X**	**/**			**G24**					*****

01	Proportional pressure relief valve	**DBET**
02	For external control electronics	**no code**
	With integrated electronics	**E**
03	Component series 60 to 69 (60 to 69: Unchanged installation and connection dimensions)	**6X**
Maximum pressure rating		
04	Up to 50 bar	**50**
	Up to 100 bar	**100**
	Up to 200 bar	**200**
	Up to 315 bar	**315**
	Up to 350 bar	**350**
	Up to 420 bar	**420**
05	Pilot oil return internal	**no code**
	Pilot oil return, external	**Y**
Supply voltage of the integrated electronics (OBE)		
06	24 V DC voltage	**G24**
07	1600 mA coil	**no code**
	800 mA coil (only possible for DBET-6X (external control electronics))	**–8** [1]
Electrical connection		
08	**For type DBET:**	
	Without mating connector; connector DIN EN 175301-803	**K4** [2]
	For type DBETE:	
	Without mating connector; connector DIN EN 175201-804	**K31** [2]
Electronics interface		
09	Command value 0 to 10 V	**A1**
	Command value 4 to 20 mA	**F1**
	with DBET	**no code**
Seal material		
10	NBR seals	**M**
	FKM seals	**V**
	Attention: Observe compatibility of seals with hydraulic fluid used! (Other seals upon request)	
11	Further details in the plain text	

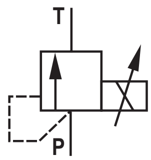
[1] Replacement for series 5X (for comparison, see characteristic curve on page 9). All hydraulic characteristics specified in the data sheet refer to the version with a 1600 mA coil.

[2] Mating connectors, separate order, see pages 7 and 14.

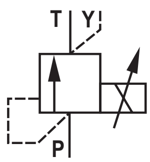
Symbols

For external control electronics (type DBET)

Pilot oil return internal

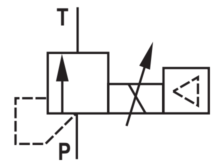


Pilot oil return, external (Y)

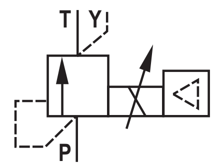


With integrated electronics (type DBETE)

Pilot oil return internal



Pilot oil return, external (Y)



Function, section

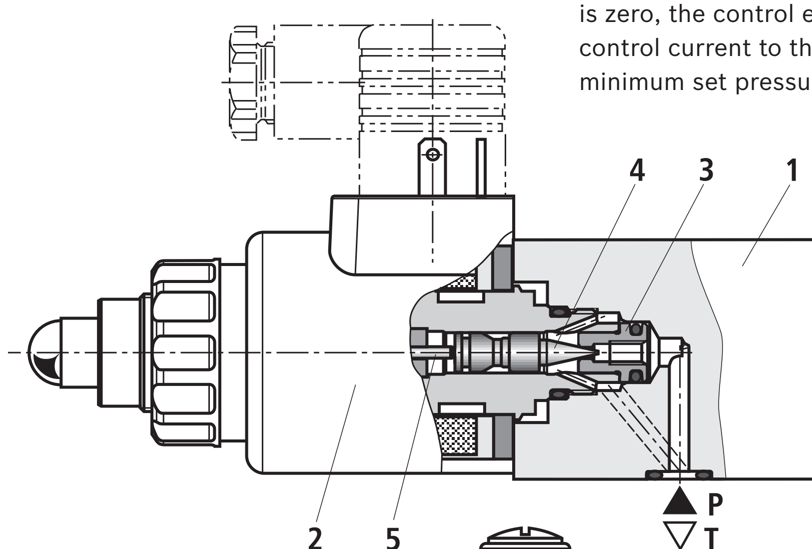
General information

Type DBET proportional pressure relief valves are remote control valves with seat design and are used to limit a system pressure. Operation by means of a proportional solenoid with central thread and detachable coil. The interior of the solenoid is connected to port T or Y and is filled with the hydraulic fluid. Depending on the electric command value, these valves can be used to smoothly set the system pressure to be limited.
The valves mainly consist of the housing (1), the proportional solenoid (2), the valve seat (3) and the valve poppet (4).

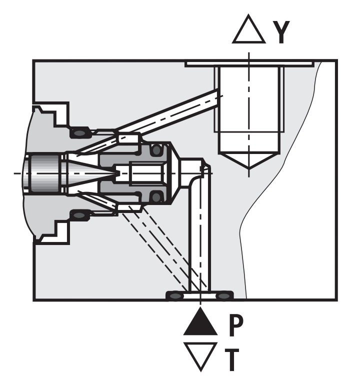
Basic principle

For the setting of the system pressure, a command value is specified at the control electronics. Depending on the command value, the electronics actuate the solenoid with electric current. The proportional solenoid converts the electric current into mechanical force that acts on the valve poppet (4) via the armature plunger (5). The valve poppet (4) presses on the valve seat (3) and interrupts the connection between port P and T or Y. If the hydraulic force on the valve poppet (4) equals the solenoid force, the valve controls the set pressure by lifting the valve poppet (4) off the valve seat (3) and thus enabling hydraulic fluid to flow from port P to T or Y. If the command value is zero, the control electronics only applies the minimum control current to the proportional solenoid (2) and the minimum set pressure is applied.

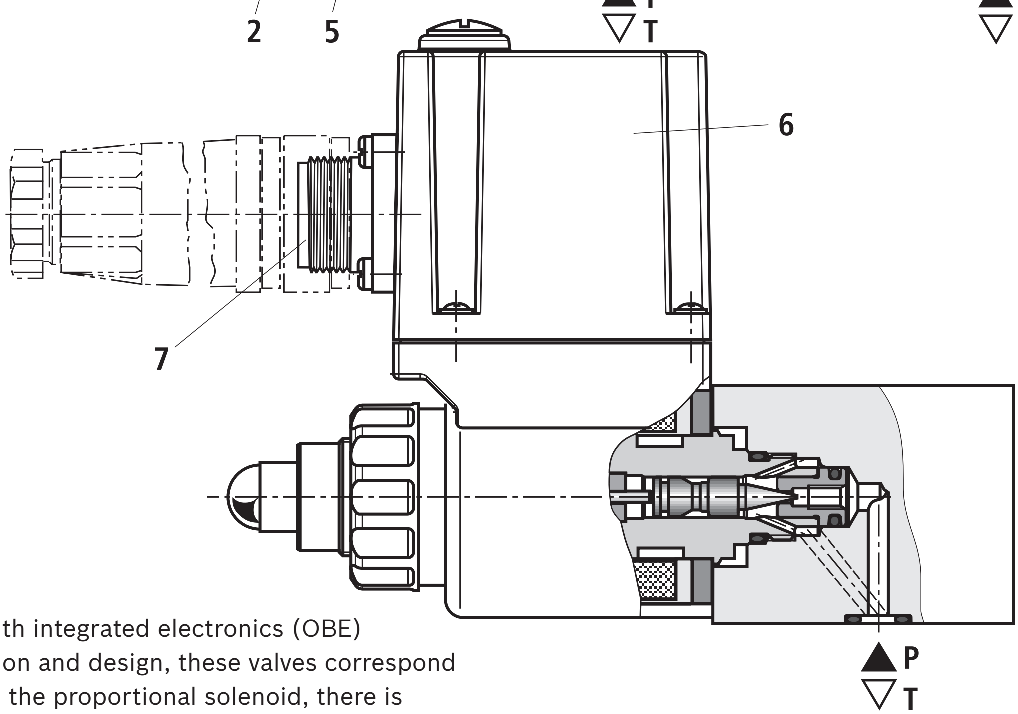
Type DBET



Type DBET...Y
Pilot oil return, external



Type DBETE



Type DBETE – with integrated electronics (OBE)
In terms of function and design, these valves correspond to type DBET. On the proportional solenoid, there is a housing (6) with the control electronics.
Supply and command value voltage are applied at the connector (7). At the factory, the command value pressure characteristic curve is adjusted with little manufacturing tolerance.

For more information on the control electronics, see page 8.

Technical data
(for applications outside these parameters, please consult us.)

general			
Weight	– Type DBET	kg	2.0
	– Type DBETE	kg	2.15
Mounting orientation			Any
Ambient temperature range		°C	–20 to +70 (DBET) –20 to +50 (DBETE)

hydraulic			
Maximum operating pressure	– Port P	bar	420
Maximum set pressure	– Pressure rating 50 bar	bar	50
	– Pressure rating 100 bar	bar	100
	– Pressure rating 200 bar	bar	200
	– Pressure rating 315 bar	bar	315
	– Pressure rating 350 bar	bar	350
	– Pressure rating 420 bar	bar	420
Minimum set pressure (at command value 0 V or 4 mA)		bar	See characteristic curves on page 11
Return flow pressure	Port T and/or Y	bar	Separately at zero pressure to the tank
Maximum flow		l/min	2 [1]
Hydraulic fluid [1]			See table on page 6
Hydraulic fluid temperature range		°C	–20 to +80
Viscosity range		mm^2/s	20 to 380, preferably 30 to 46
Maximum permitted degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)			Class 20/18/15 [2]
Hysteresis		%	< 4 of the maximum set pressure
Range of inversion		%	< 0.5 of the maximum set pressure
Response sensitivity		%	< 0.5 of the maximum set pressure
Linearity (flow 0.8 l/min)		%	±3 of the maximum set pressure
Manufacturing tolerance of the command value pressure characteristic curve, related to 0.8 l/min; pressure increasing	at command value 20 %	%	< ±1.5 of the maximum set pressure [3]
	at command value 100 %	%	< ±5 of the maximum set pressure (type DBET) [4] < ±1.5 of the maximum set pressure (type DBETE)
Step response (Tu + Tg) 0 → 100 % or 100 % → 0 line volume < 20 cm^3; $\boldsymbol{Q}$ = 0.8 l/min		ms	80 (depending on the system)

[1] Observe flow limitation for pressure ratings 315, 350 and 420 bar (page 10).

[2] The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the life cycle of the components.

[3] Zero point calibration at the factory.

[4] Possible comparison of the external control electronics.

Technical data
(for applications outside these parameters, please consult us.)

Hydraulic fluid		Classification	Suitable sealing materials	Standards
Mineral oils		HL, HLP	NBR, FKM	DIN 51524
Bio-degradable	– Insoluble in water	HEES	FKM	VDMA 24568
Flame-resistant	– Water-free	HFDU	FKM	ISO 12922
	– Containing water	HFC (Fuchs Hydrotherm 46M, Petrofer Ultra Safe 620)	NBR	ISO 12922

Important information on hydraulic fluids!
- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.)!
- The flash point of the hydraulic fluid used must be 40 K higher than the maximum solenoid surface temperature.
- **Flame-resistant – containing water:**
  - The maximum pressure differential per control edge is 210 bar. Otherwise, there is increased cavitation erosion.
  - Life cycle as compared to operation with mineral oil HLP 30 to 100 %
  - Maximum fluid temperature 60 °C
- **Bio-degradable:** When using bio-degradable hydraulic fluids that are zinc-solving, zinc may accumulate in the fluid (700 mg zinc per pole tube).

electric			**G24**	**G24-8**
Minimum solenoid current		mA	≤ 100	≤ 100
Maximum solenoid current		mA	1600 ± 10 %	800 ± 5 %
Solenoid coil resistance	– Cold value at 20 °C	Ω	5,5	20,6
	– Maximum hot value	Ω	8,05	33
Switch-on duration		%	100	100

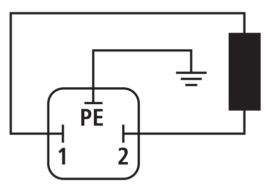
electric, integrated electronics (OBE)			
Supply voltage	– Nominal voltage	VDC	24
	– Lower limit value	VDC	21
	– Upper limit value	VDC	35
Current consumption		A	≤ 1,5
Required fuse protection		A	2, slow-blowing
Inputs	– Voltage	V	0 to 10
	– Current	mA	4 to 20
Output	– Actual current value	mV	1 mV ≙ 1 mA
Protection class of the valve according to EN 60529			IP 65 with mating connector mounted and locked

Notice!
Information on the environment simulation testing for the areas EMC (electromagnetic compatibility), climate and mechanical load, see data sheet 29162-U (declaration on environmental compatibility).

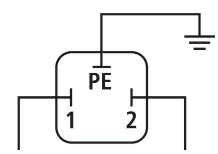
Electrical connection (dimensions in mm)

Type DBET

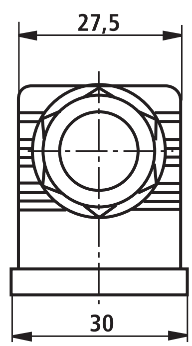
Connection at the connector

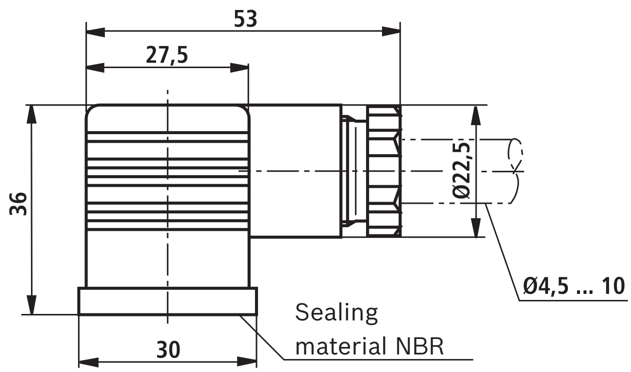


Connection at mating connector



Mating connector (black) according to DIN EN 175301-803, material no. **R901017011** (separate order)



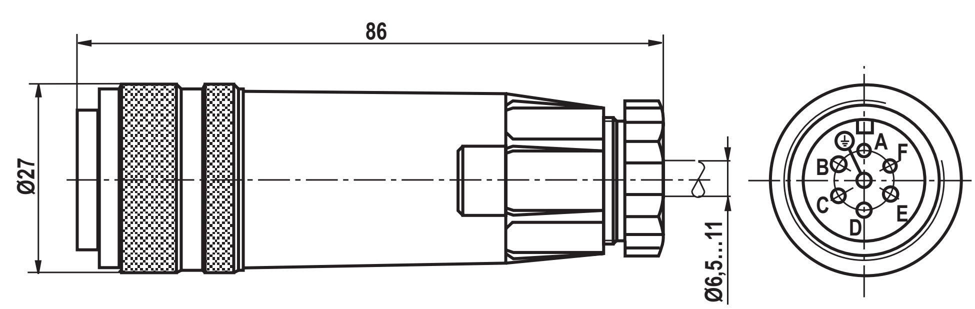


Type DBETE

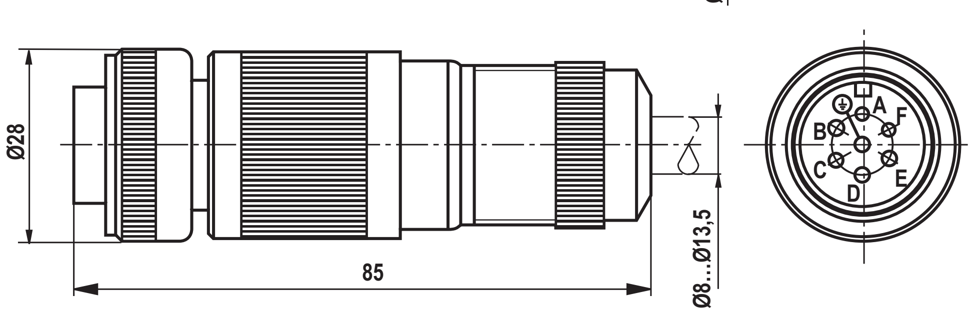
Connector pin assignment	Contact	Allocation interface "A1"	Allocation interface "F1"
Supply voltage	A	24 VDC (u(t) = 21 V to 35 V); I_{max} ≤ 1.5 A	
	B	0 V	
Reference potential actual value	C	Reference contact F; 0 V	Reference contact F; 0 V
Differential amplifier input	D	0 to 10 V; R_E = 100 kΩ	4 to 20 mA; R_E = 100 Ω
	E	Reference potential command value	
Measuring output (actual value)	F	0 to 1.6 V actual value (1 mV ≙ 1 mA) Load resistance > 10 kΩ	
Protective ground	PE	Connected to solenoid and valve housing	

Mating connectors according to DIN EN 175201-804, solder contacts for line cross-section 0.5 to 1.5 mm²

Plastic version, material no. **R900021267** (separate order)



Metal version, material no. **R900223890** (separate order)

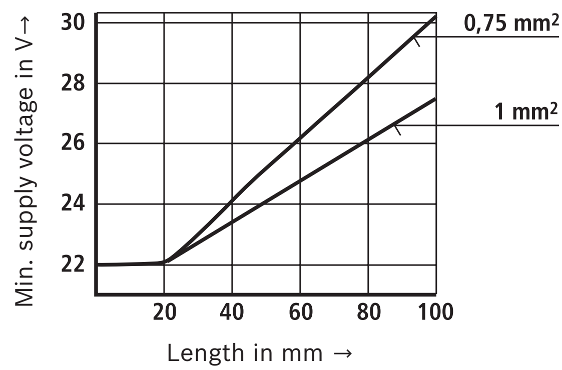


Electrical connection

Connection cable for type DBETE

– Recommendation 6-wire, 0.75 or 1 mm² plus protective grounding conductor and screening
– Only connect the screening to PE on the supply side
– Maximum admissible length = 100 m

The minimum supply voltage at the power supply unit depends on the length of the supply line (see diagram).



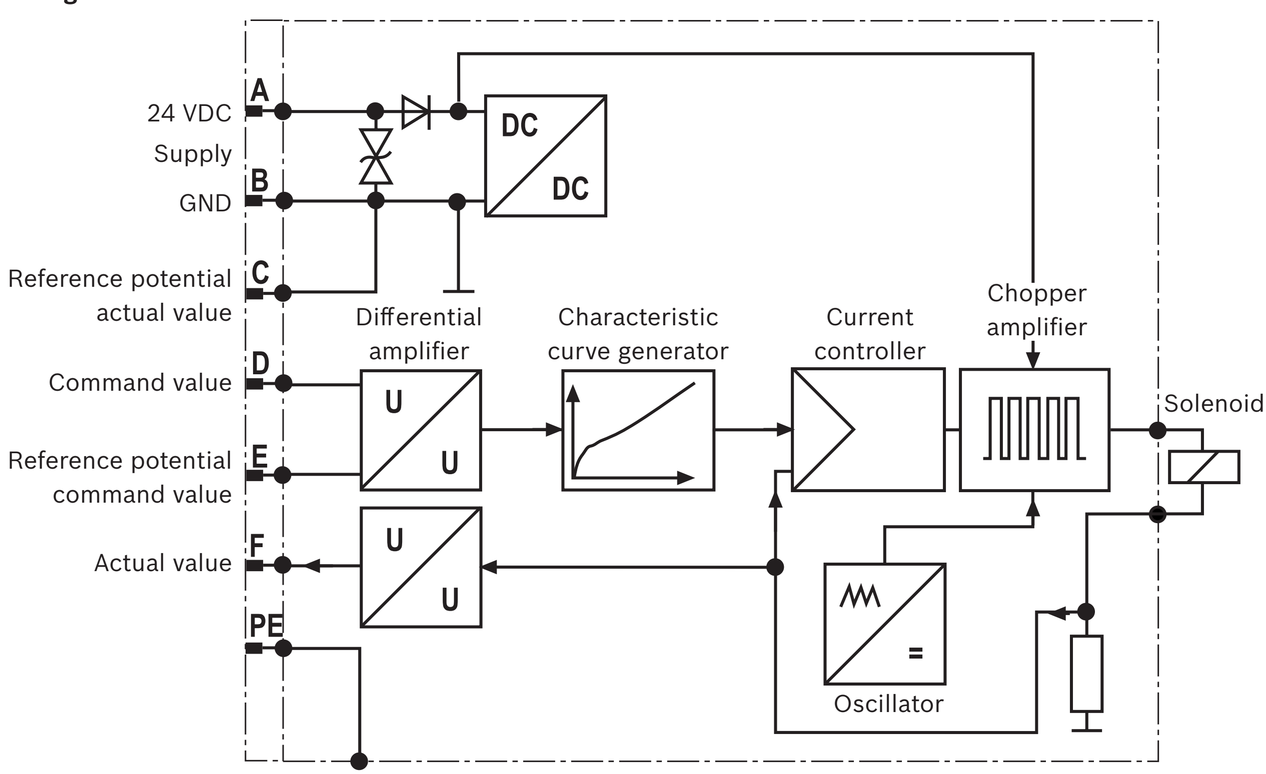
Integrated integrated (OBE) with type DBETE

Function

The electronics are supplied with voltage via ports A and B. The command value is applied to the differential amplifier ports D and E.
Via the characteristic curve generator, the command value solenoid current characteristic curve is adjusted to the valve so that non-linearities in the hydraulic system are compensated and thus, a linear command value pressure characteristic curve is created.
The current controller controls the solenoid current independently of the solenoid coil resistance.

The power stage of the electronics for controlling the proportional solenoid is a chopper amplifier with a cycle frequency of approx. 180 Hz to 400 Hz. The output signal is pulse-width modulated (PWM).
In order to check the solenoid current, a voltage can be measured at the connector between pin F(+) and pin C(–) that is proportional to the solenoid current. **1 mV** corresponds to **1 mA** solenoid current.

Block diagram

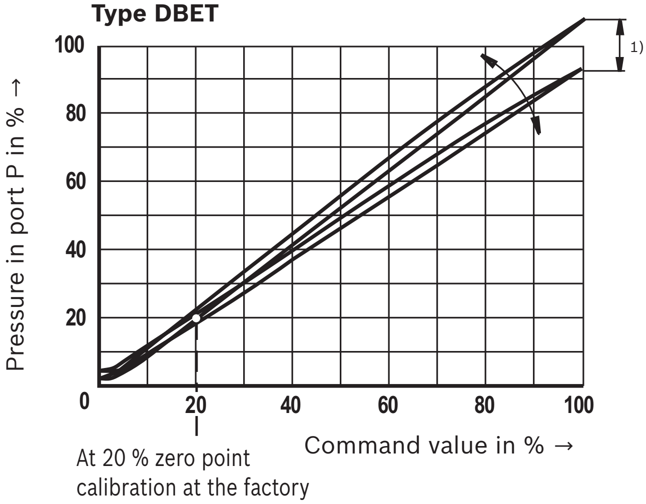


Characteristic curves

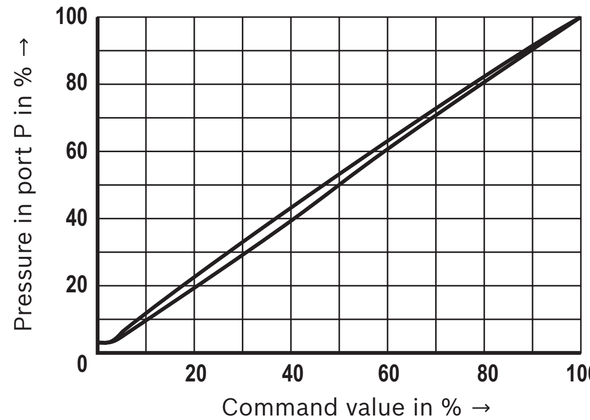
(measured with HLP46, ϑ_{Oil} = 40 ±5 °C)

Pressure in port P depending on the command value (flow = 0.8 l/min)

Type DBET



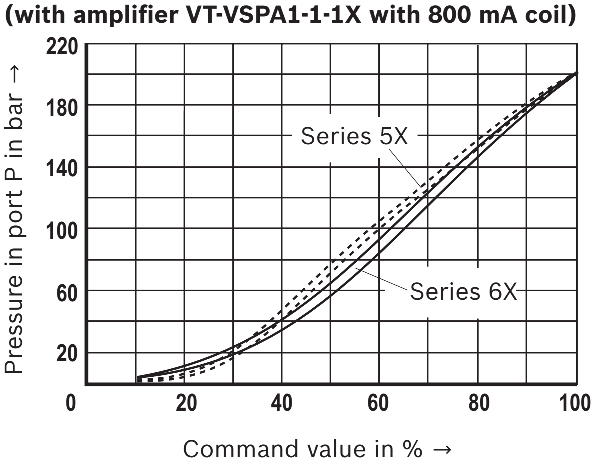
Type DBETE



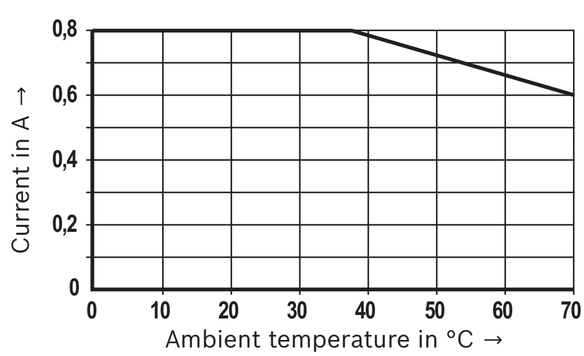
1) With valve type DBET, the manufacturing tolerance at the **external amplifier** (type and data sheet, see page 14) can be changed using the command value attenuator potentiometer "**Gw**". The digital amplifier is set using the parameter "Limit".
In this context, the control current according to the technical data must not be exceeded.
In order that several valves can be adjusted to the same characteristic curve, do not set the pressure higher than the maximum set pressure of the pressure rating with command value 100 %.

Pressure in port P depending on the command value

Comparison DBET series 5X-6X / pressure rating 200 bar (with amplifier VT-VSPA1-1-1X with 800 mA coil)



Current drop as ambient temperature rises, 24 V and 100 % duty cycle

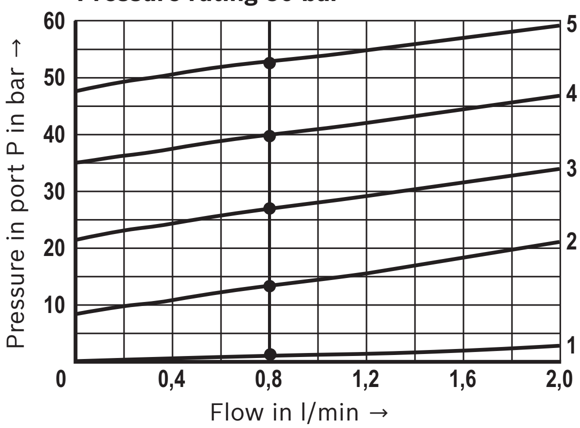


☞ **Note!**
At increased temperature, the solenoid current drops, which results in a corresponding deviation of the set pressure.

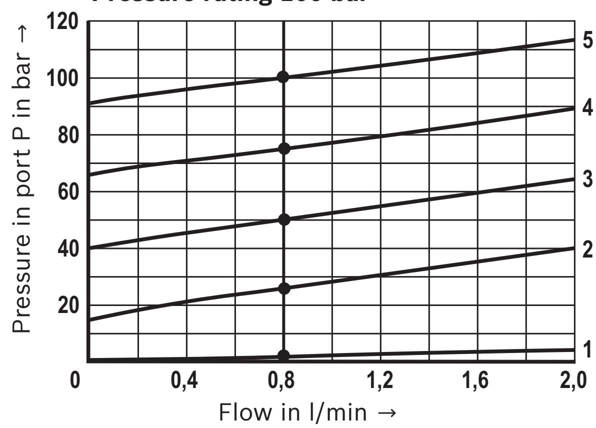
Characteristic curves
(measured with HLP46, ϑ_{Oil} = 40 ±5 °C)

Pressure in port P depending on the flow

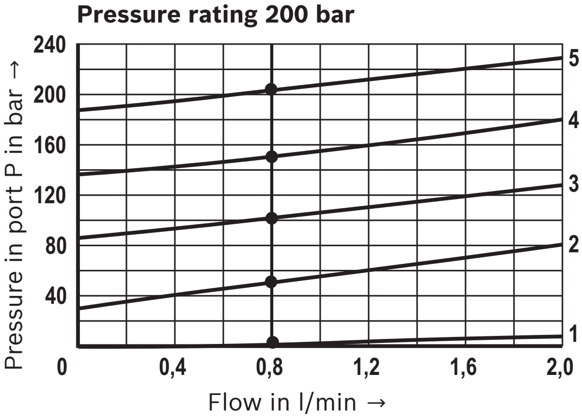
Pressure rating 50 bar



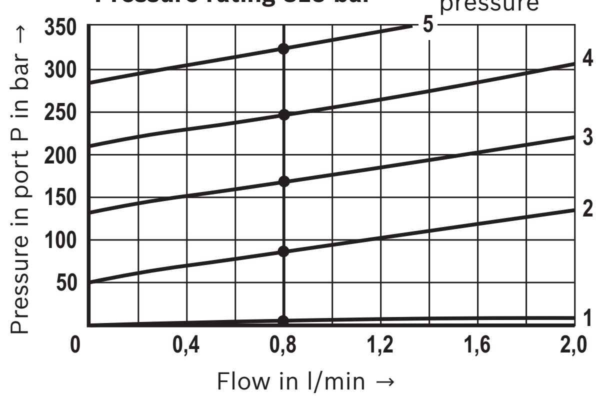
Pressure rating 100 bar



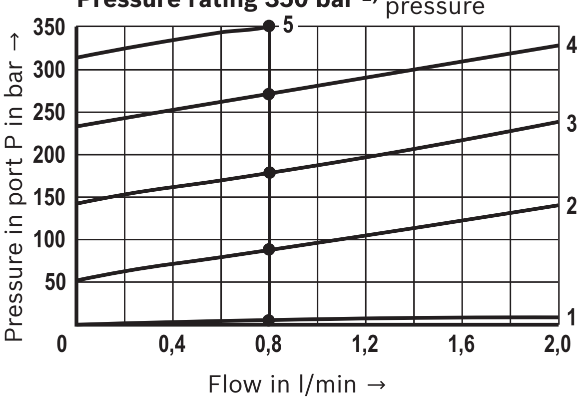
Pressure rating 200 bar



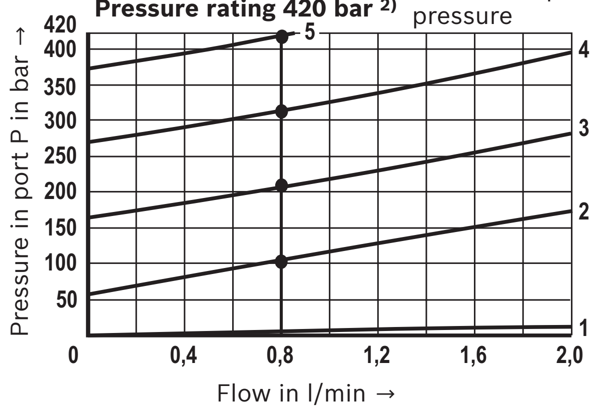
Pressure rating 315 bar [1)]



Pressure rating 350 bar [2)]



Pressure rating 420 bar [2)]



Applicable for all pressure ratings:
Curve **1** at 0 % of the command value
Curve **2** at 25 % of the command value
Curve **3** at 50 % of the command value
Curve **4** at 75 % of the command value
Curve **5** at 100 % of the command value [1; 2)]
The characteristic curves were measured without counter pressure in port T. ($\boldsymbol{p}_T$ = 0 bar)

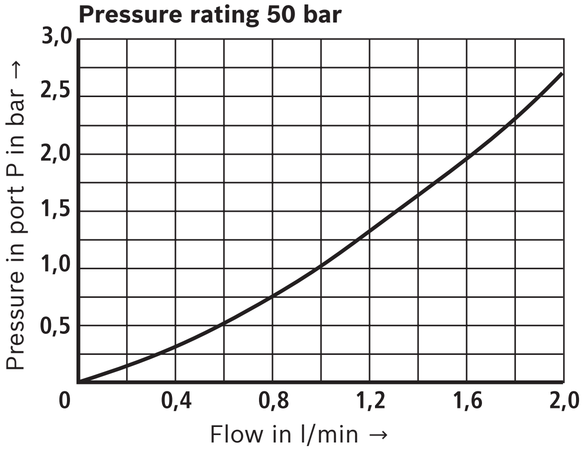
1) In the case of characteristic curve 5, the command value may not exceed the maximum flow of 1.4 l/min

2) In the case of characteristic curve 5, the command value may not exceed the maximum flow of 0.8 l/min

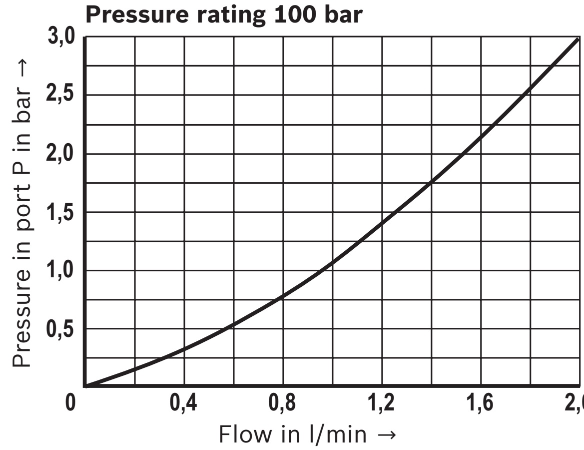
Characteristic curves
(measured with HLP46, ϑ_{Oil} = 40 ±5 °C)

Minimum set pressure in port P with command value 0 V and/or 4 mA depending on the flow

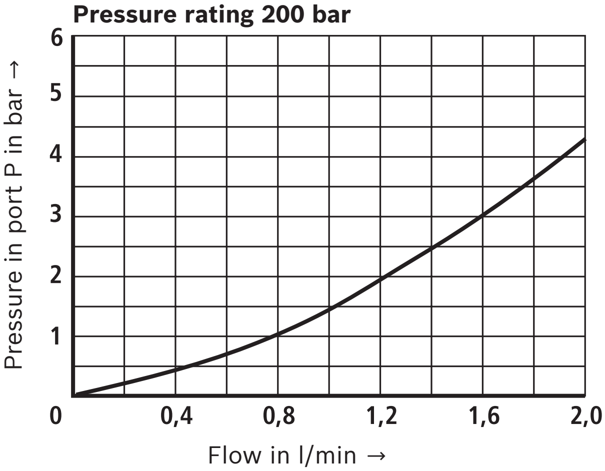
Pressure rating 50 bar



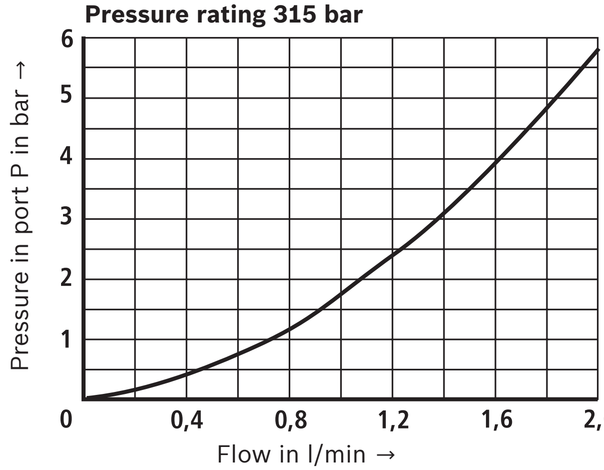
Pressure rating 100 bar



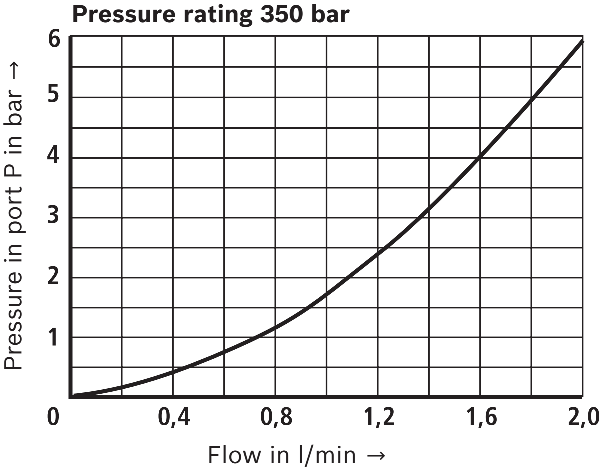
Pressure rating 200 bar



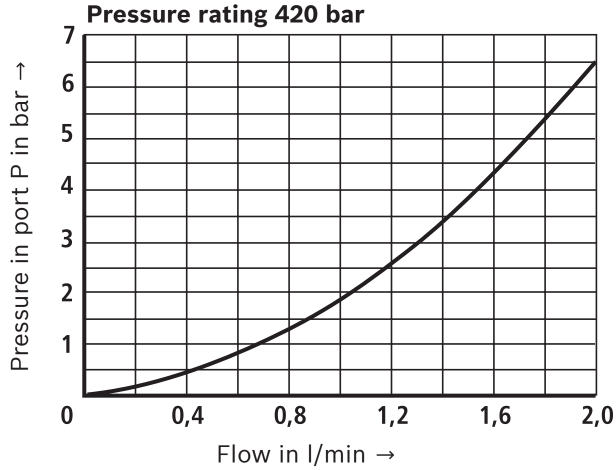
Pressure rating 315 bar



Pressure rating 350 bar



Pressure rating 420 bar



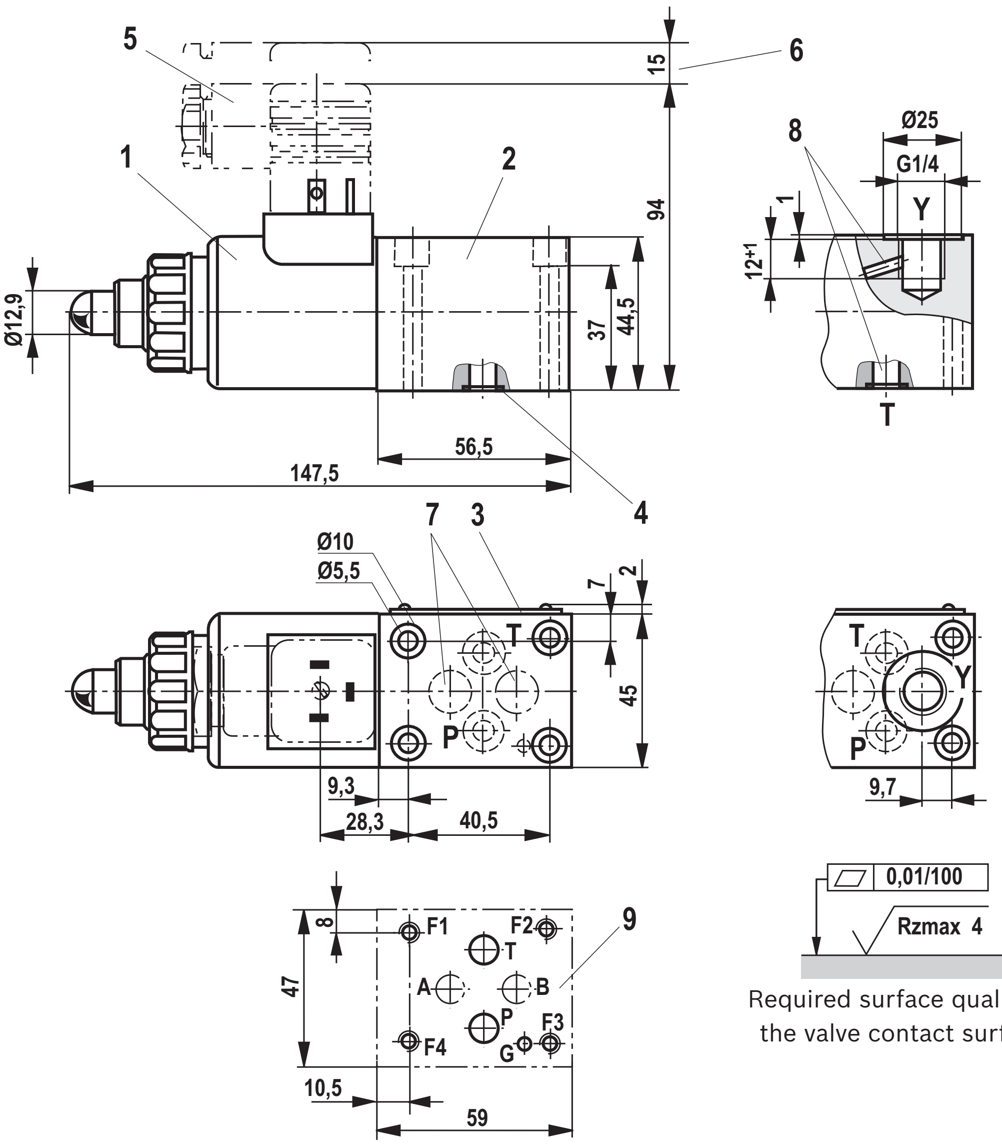
Notice

The characteristic curves were measured without counter pressure in port T. ($\boldsymbol{p}_T$ = 0 bar)

Minimum control current ≤ 100 mA

(This current is reached with a command value of 0 V and/or 4 mA.)

Dimensions: Type DBET
(dimensions in mm)

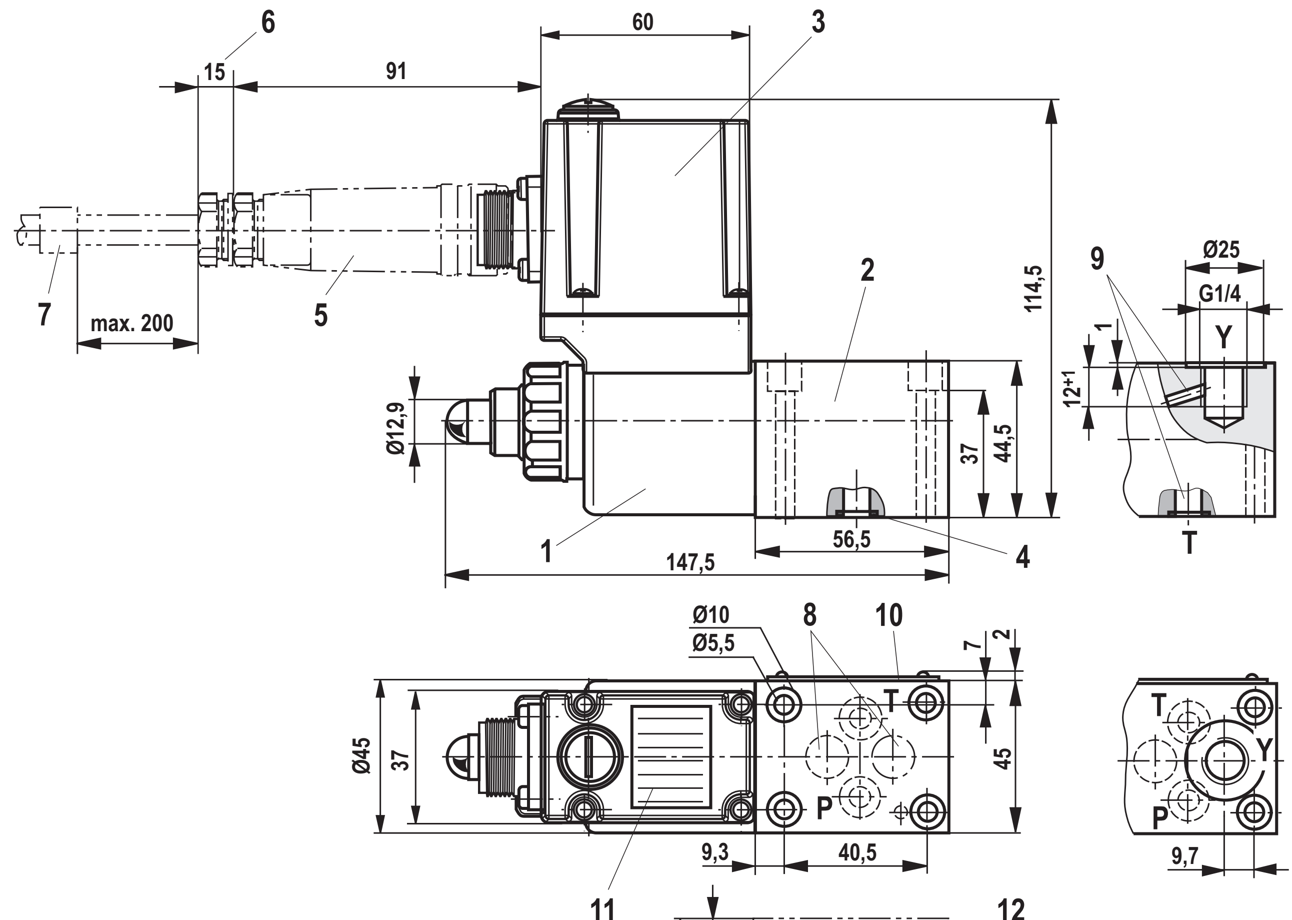


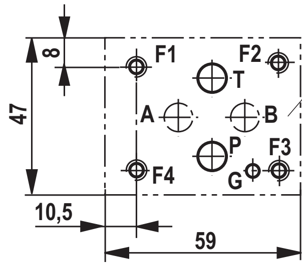
Required surface quality of the valve contact surface

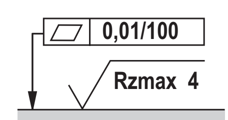
1 Proportional solenoid
2 Valve housing
3 Name plate
4 Identical seal rings for ports P, T, A and B
5 Mating connector according to DIN EN 175301-803
6 Space required for removing the mating connector
7 Blind counterbores A and B
8 With version ..Y.. (external pilot oil return) port Y is internally connected to port T. Port T is not plugged.
9 Machined valve contact surface, porting pattern according to ISO 4401-03-02-0-05 Deviating from the standard: "A" and "B" channels not drilled locating pin not included in the scope of delivery

For valve mounting screws and **subplates,** see page 14.

Dimensions: Type DBETE
(dimensions in mm)







Required surface quality of the valve contact surface

1 Proportional solenoid
2 Valve housing
3 Integrated electronics (OBE)
4 Identical seal rings for ports P, T, A and B
5 Mating connectors according to DIN EN 175301-804
6 Space required for removing the mating connector
7 Cable fastening
8 Blind counterbores A and B
9 With version ..Y.. (external pilot oil return) port Y is internally connected to port T. Port T is not plugged.
10 Name plate
11 Block diagram of the integrated electronics (OBE)
12 Machined valve contact surface, porting pattern according to ISO 4401-03-02-0-05 Deviating from the standard: "A" and "B" channels not drilled locating pin not included in the scope of delivery

For valve mounting screws and **subplates,** see page 14.

Dimensions

Hexagon socket head cap screws		Material number
Size 6	4x ISO 4762 - M5 x 45 - 10.9-flZn-240h-L Tightening torque M_A = 7 Nm ± 10 %	R913000140

Notice: The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure!

Subplates	Data sheet	Material number
G 341/01 (G1/4) G 341/60 (G3/8)	45052 45052	R900424447 R901027119

Accessories (not included in the scope of delivery)

External control for type DBET	Data sheet	Material number
VT-MSPA1-1-1X/V0/... in modular design (analog) VT-VSPD-1-2X/V0/.-0-1 in euro-card format (digital) VT-VSPA1-2-1X/V0/...in euro-card format (analog) VT-SSPA1-1-1X/V0/0-24 as a plug-in amplifier (analog) Limitations: No linearization of the command value pressure characteristic curve, higher hysteresis and range of inversion	30223 30523 30115 30265	

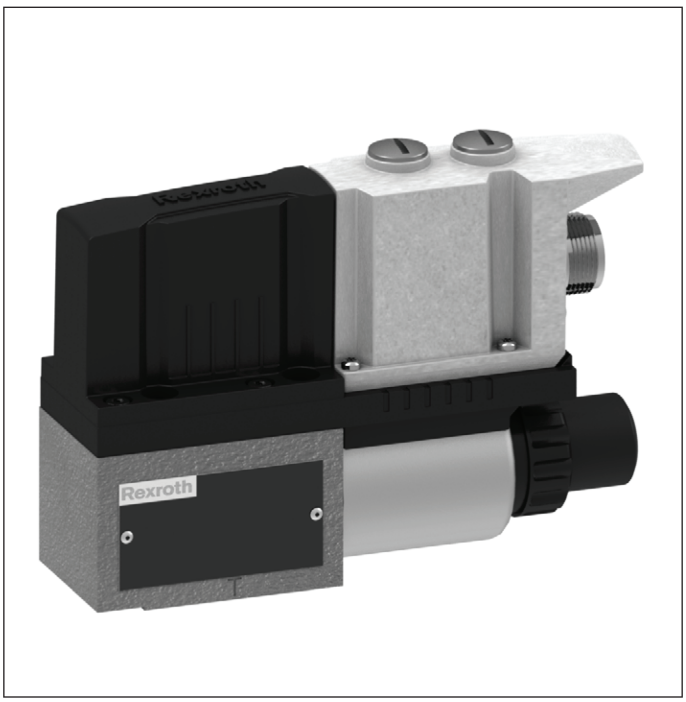
External control for type DBET ...G24-8...	Data sheet	Material number
VT-2000-5X/... in euro-card format VT-MSPA1-1-30 with modular design	29904 30224	

Mating connectors (details see page 7)	Data sheet	Material number
For type DBET: Mating connectors according to DIN EN 175301-803 For type DBETE: Mating connectors according to DIN EN 175201-804	08006 08006	R901017011 R900021267 (plastic) R900223890 (metal)

Pressure-controlled directly operated proportional pressure relief valve with integrated electronics (OBE)

Type DBETA

RE 29262
Edition: 2014-02
Replaces: 04.13



- Size 6
- Component series 6X
- Maximum operating pressure 500 bar
- Maximum flow: 5 l/min

Features

- Pressure-controlled, directly operated proportional valve for pressure relief (pilot valve)
- For subplate mounting: Porting pattern according to ISO 4401
- Integrated pressure sensor
- Actual pressure value can be read via analog output
- Pressure controller can be adjusted to different applications (easy setting via DIL switch)
- Linear command value pressure characteristic curve
- Virtually flow-independent pressure control
- CE conformity according to EMC Directive 2004/108/EC

Contents

Ordering code

01		02		03	04	05	06	07	08	09
DBETA	**–**	**6X**	**/**	**P**		**G24**	**K31**			*****

01	Proportional pressure relief valve, pressure-controlled with integrated electronics (OBE)	**DBETA**
02	Component series 60 to 69 (60 to 69: Unchanged installation and connection dimensions)	**6X**
03	Pressure measurement in channel P	**P**

Maximum set pressure

04	Up to 50 bar	**50**
	Up to 100 bar	**100**
	Up to 200 bar	**200**
	Up to 350 bar	**350**
	Up to 500 bar (only possible in version “M”)	**500**

Supply voltage of the integrated electronics (OBE)

05	24 V DC voltage	**G24**

Electrical connection

06	Connector DIN EN 175201-804	**K31**

Electronics interface

07	Command value 0 to 10 V	**A1**
	Command value 4 to 20 mA	**F1**

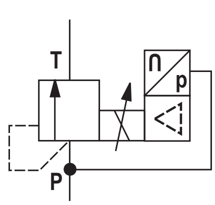
Seal material

08	NBR seals	**M**
	FKM seals	**V**
	Attention: Observe compatibility of seals with hydraulic fluid used! (Other seals upon request)	

09	Further details in the plain text	

Symbols

Version P



Function, section

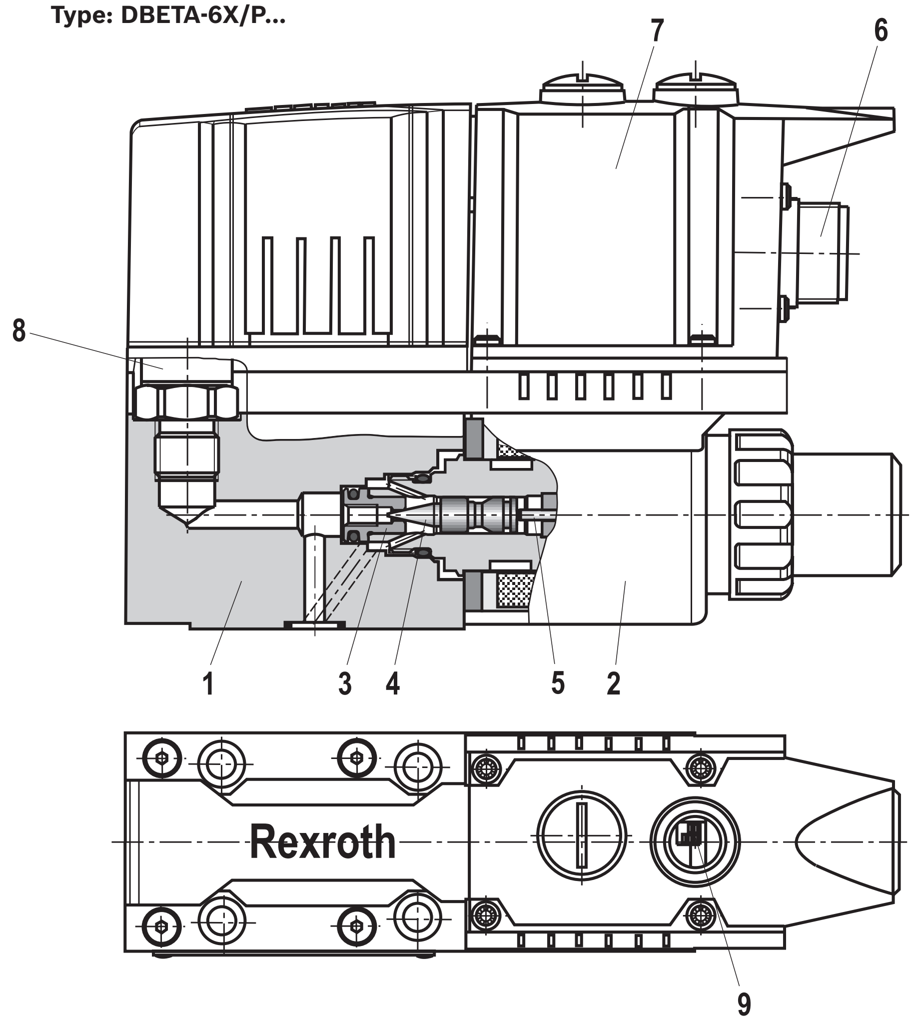
General information

DBETA proportional pressure relief valves are used for pressure relief. Operation is effected by means of a proportional solenoid. The pressure is regulated by the pressure sensor and the valve electronics. By means of these valves, the system pressure to be limited can be continuously adjusted and controlled depending on the electric command value.
The valves mainly consist of the housing (1), the valve seat (3), the valve poppet (4), the proportional solenoid (2), the integrated electronics (7) and the pressure sensor (8).

Basic principle

The supply voltage and the command value are applied to the connector (6). Depending on the command value the electronics converts the input signal into current. The proportional solenoid converts the electric current into mechanical force that acts directly on the valve poppet (4) via the armature plunger (5). The valve poppet (4) counteracts the hydraulic force in channel P. When the hydraulic force at the valve poppet (4) equals the solenoid force, the set pressure is reached. By increasing/reducing cross-section P to T, the pressure is maintained at the set level.
The pressure sensor (8) captures the pressure in channel P and/or B and the integrated electronics (7) controls the pressure independently of the flow.
Connector (6) provides the pressure in channel P and/or B as an analog actual value (0 to 10 V and/or 4 to 20 mA). If the command value is zero, the control electronics only applies the minimum control current to the proportional solenoid (2) and the minimum set pressure is applied.
With the DIL switch (9) the integrated pressure controller can be adjusted to different applications (see table on page 7).

Type: DBETA-6X/P...



Technical data
(for applications outside these parameters, please consult us!)

general			
Weight		kg	1.9
Mounting orientation			Any
Ambient temperature range		°C	–20 ... +60
Sine test according to DIN EN 60068-2-6			10...2000...10 Hz / maximum of 10 g / 10 cycles
Noise test according to DIN EN 60068-2-64			20...2000 Hz / 10 g_{RMS} / 30 g peak / 24h
Transport shock according to DIN EN 60068-2-27			15 g / 11ms
Maximum relative moisture at 25 to 55 °C		%	97

hydraulic			
Maximum operating pressure for pressure rating 200, 350 and 500 bar [1)	– Port P, A, B	bar	500
Maximum operating pressure for pressure rating 100 bar [1)	– Port P	bar	300
Maximum operating pressure for pressure rating 50 bar [1)	– Port P	bar	125
Return flow pressure	– Port T	bar	Ideally at zero pressure to the tank [2)
Maximum set pressure	– Pressure rating 50 bar	bar	50
	– Pressure rating 100 bar	bar	100
	– Pressure rating 200 bar	bar	200
	– Pressure rating 350 bar	bar	350
	– Pressure rating 500 bar	bar	500
Minimum set pressure (at command value 0 V and/or 4 mA)		bar	See characteristic curves page 8
Maximum flow [3)		l/min	5
Minimum line volume		ml	20
Hydraulic fluid			See table page 5
Hydraulic fluid temperature range		°C	–15 ... +80 (FKM seals) –20 ... +80 (NBR seals)
Viscosity range		mm^2/s	20 ... 380, preferably 30 to 46
Maximum permitted degree of contamination of the hydraulic fluid Cleanliness class according to ISO 4406 (c)			Class 20/18/15 [4)
Hysteresis		%	< 1 of the maximum set pressure [5)
Range of inversion		%	< 0,25 of the maximum set pressure [5)
Response sensitivity		%	< 0,25 of the maximum set pressure [5)
Linearity		%	±1 of the maximum set pressure [5)
Step response (Tu + Tg) Line volume ~20 cm^3; ***q*** = 0.8 l/min	10 % → 90 %	ms	165 (depending on the system)
	90 % → 10 %	ms	88 (depending on the system)

1) The summated pressure of all ports must not exceed 1030 bar, e.g. port P 500 bar + port B 500 bar + port T 30 bar + port A 0 bar = 1030 bar

2) Tank preloading of 30 bar in addition.
Attention: The tank preloading is added to the min. set pressure.
A short-time static pressure of 300 bar is admissible.

3) Recommended operation range ***q*** > 0,5 l/min.

4) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the life cycle of the components.

5) Accuracies apply for flow > 0.2 l/min and command value > 10%.

Technical data
(for applications outside these parameters, please consult us!)

Hydraulic fluid		Classification	Suitable sealing materials	Standards
Mineral oils		HL, HLP	NBR, FKM	DIN 51524
Bio-degradable	– insoluble in water	HEES	FKM	VDMA 24568
Flame-resistant	– water-free	HFDU	FKM	ISO 12922
	– containing water	HFC (Fuchs Hydrotherm 46M, Petrofer Ultra Safe 620)	NBR	ISO 12922

Important information on hydraulic fluids!
- For more information and data on the use of other hydraulic fluids refer to data sheet 90220, 90221, 90222 respectively 90223 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.)!
- The flash point of the hydraulic fluid used must be 40 K higher than the maximum solenoid surface temperature.
- **Flame-resistant – containing water**:
  - The maximum pressure differential per control edge is 210 bar, otherwise, increased cavitation erosion.
  - Life cycle as compared to operation with mineral oil HLP 30 % to 100 %.
  - Maximum fluid temperature 60 °C.
- **Bio-degradable:** When using bio-degradable hydraulic fluids that are simultaneously zinc-solving, zinc may accumulate in the fluid (700 mg zinc per pole tube).

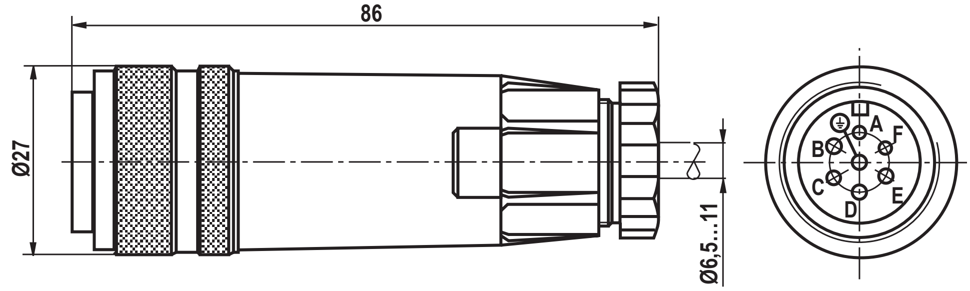
electric			
Minimum solenoid current		mA	≤ 100
Maximum solenoid current		mA	1600 ±10 %
Switch-on duration		%	100
Supply voltage	– Nominal voltage	VDC	24
	– Lower limit value	VDC	18
	– Upper limit value	VDC	36
Current consumption		A	≤ 1.5 (I_{max} 2 A is possible)
Required fuse protection		A	2, time-lag
Inputs Pressure command value	– Voltage	V	0 to 10
	– Current	mA	4 to 20
Outputs Actual pressure value	– Voltage	V	0 to 10 ≙ 0 to 100 % of nominal pressure
	– Current	mA	4 to 20 ≙ 0 to 100 % of nominal pressure
Protection class of the valve according to EN 60529			IP 65 with mating connector mounted and locked
Conformity			CE according to EMC Directive 2004/108/EC Tested according to EN 61000-6-2 and EN 61000-6-3

Electrical connection (dimensions in mm)

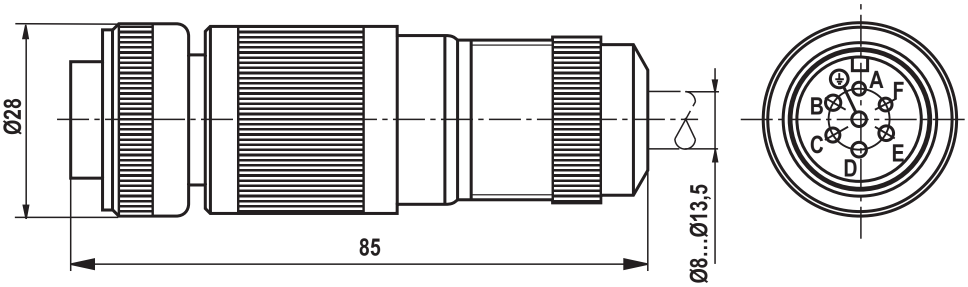
Connector pin assignment	Contact	Allocation interface "A1"	Allocation interface "F1"
Supply voltage	A	24 VDC (u(t) = 18 V to 36 V); $I_{max} \le 2.0$ A	24 VDC (u(t) = 18 V to 36 V); $I_{max} \le 2.0$ A
	B	0 V	0 V
Reference potential actual value	C	Reference potential for contact F; at R_i (drain) < 50 kΩ connect (star-like) to ground ⊥ on the control side	Reference contact F
Differential amplifier input	D	0 to 10 V; R_E > 100 kΩ	4 to 20 mA; R_E = 100 Ω
	E	Reference potential command value	Reference potential command value
Actual pressure value	F	0 to +10 V actual value; I_{max} = 5 mA	4 to 20 mA; maximum load resistance 600 Ω
Protective ground	PE	Connected to solenoid and valve housing	Connected to solenoid and valve housing

Mating connectors according to DIN EN 175201-804, solder contacts for line cross-section 0.5 to 1.5 mm²

Plastic version,
material no. **R900021267**
(separate order)

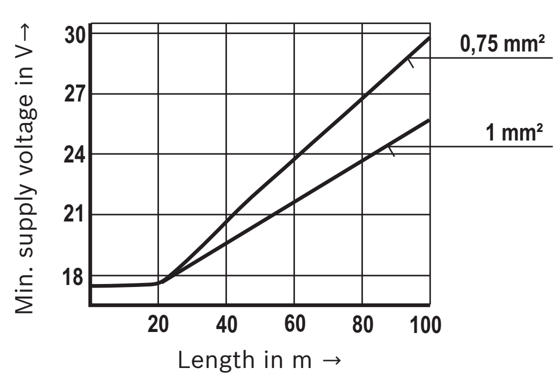


Metal version,
material no. **R900223890**
(separate order)



Connection cable 1)
– Recommendation 6-wire, 0.75 or 1 mm² plus protective grounding conductor and screening
– Only connect the screening to PE on the supply side
– Maximum admissible length = 100 m

The minimum supply voltage at the power supply unit depends on the length of the supply line (see diagram).



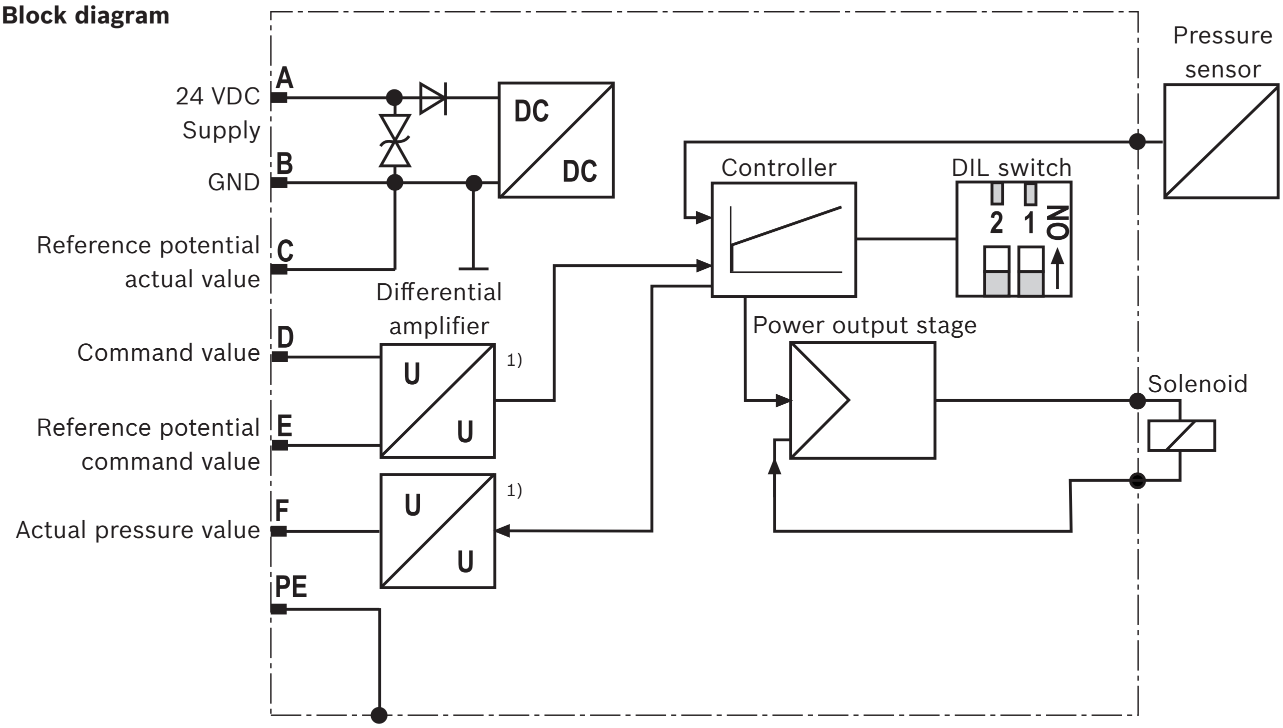
1) To comply with the provisions of EMC directive 2004/108/EC the metal version mating connector (R900223890) and a screened cable are required.

Integrated electronics (OBE)

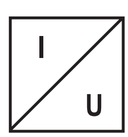
Function

The electronics are supplied with voltage via ports A and B. The command value is applied to the differential amplifier ports D and E.
The actual pressure value is captured by the integrated pressure sensor. The pressure command value is processed in the controller and compared to the actual pressure value. The power output stage processes the control output of the controller and controls the solenoid current.
The actual pressure value is reported at port F (reference port C).
With the DIL switch, the controller characteristics can be adjusted to certain applications (see table "DIL switch position").
For the system analysis, the pressure controller can be deactivated using the DIL switches. This corresponds to the function of a force-controlled pressure relief valve (DBETE).

Block diagram



1) For variant "F1":



Notice! If the pressure sensor fails, the valve switches to controlled operation. Port PIN F reports 0 V and/or 4 mA.

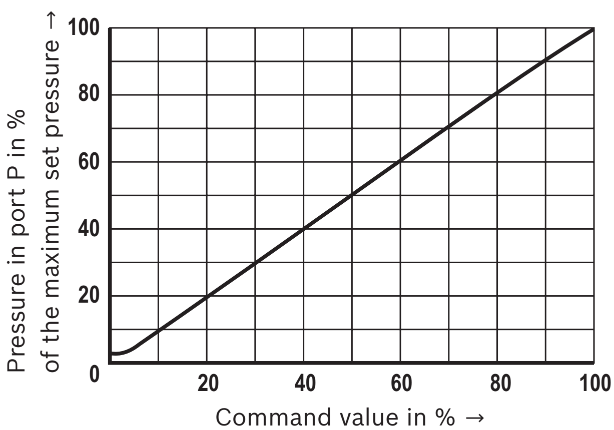
Notice! If the flow changes, the pressure controller is automatically adjusted to these operating conditions. In the first cycles, this may lead to changes in the transition behavior.

DIL switch position

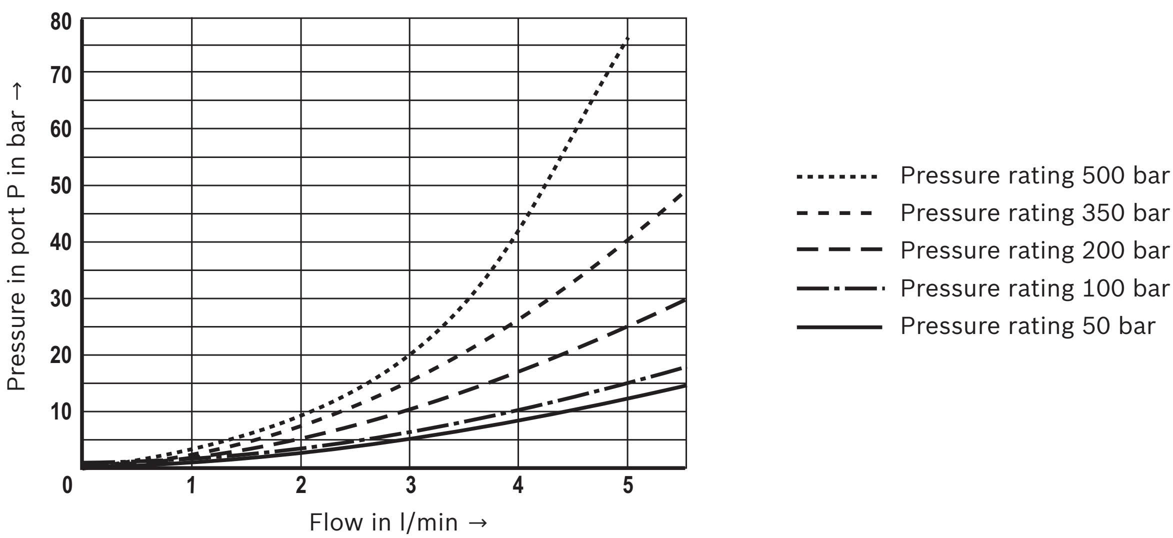
Switch (position)		Function	Examples of application
2	1		
off	off	open loop pressure, without sensor	Commissioning / system analysis
off	on	smallest dead volume (from 20 cm³)	Systems with little damping
on	off	pilot operated, large dead volume	Pilot valve for logic e.g. LC40
on	on	pilot operated, small dead volume	Pilot valve for logic e.g. LC16, LC25 Remote pump control DRG control
Adjust the switch position of the application before the commissioning. Default setting: both switches to on (pilot operated, small dead volume)			

Characteristic curves
(measured with HLP46, ϑ_{Oil} = 40 ±5 °C)

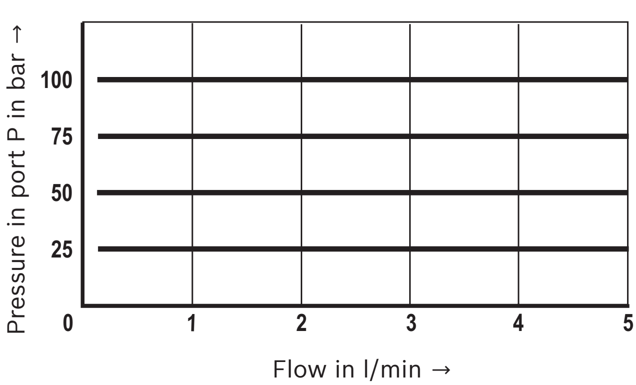
Pressure in port P depending on the command value (flow = 0.8 l/min)



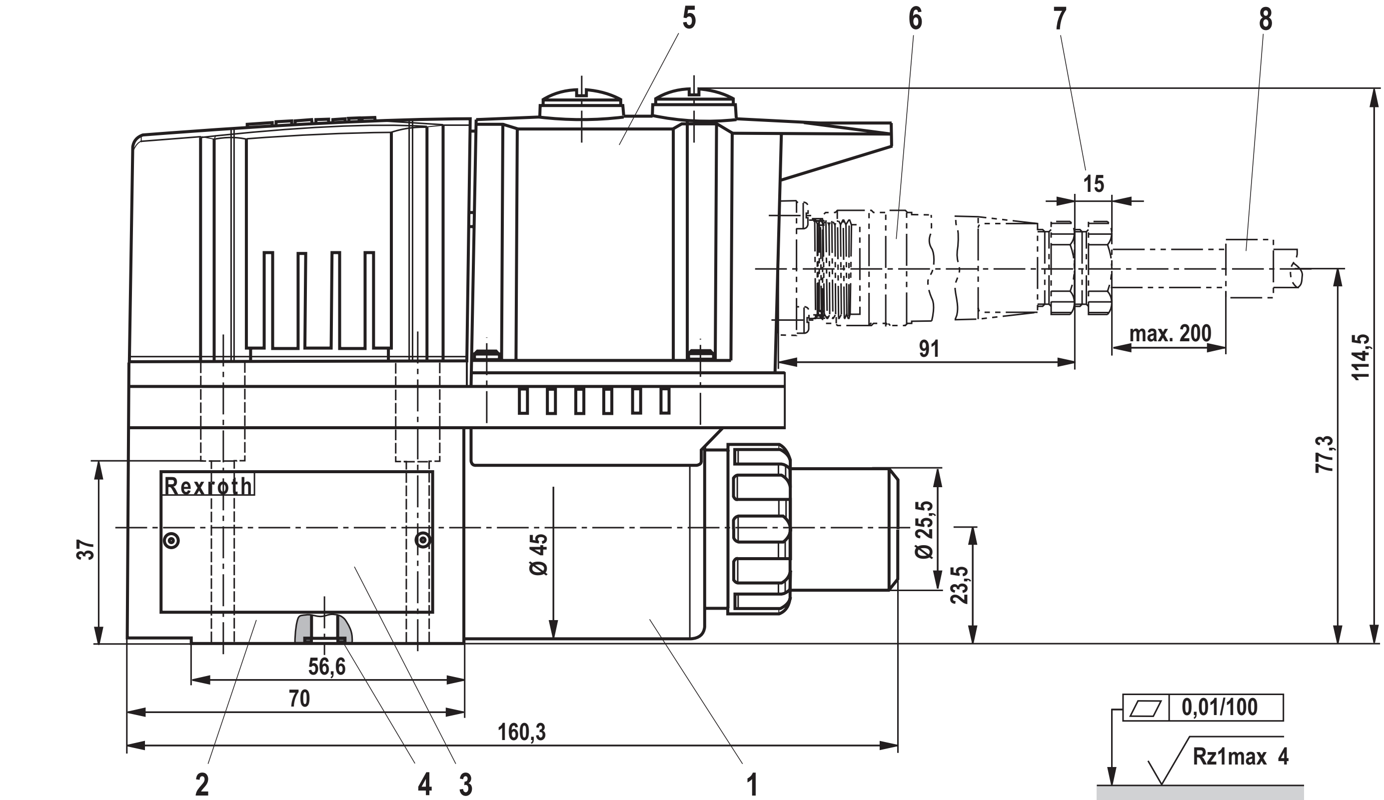
Minimum set pressure in port P with command value 0 V and/or 4 mA depending on the flow
(return flow pressure = 0 bar)



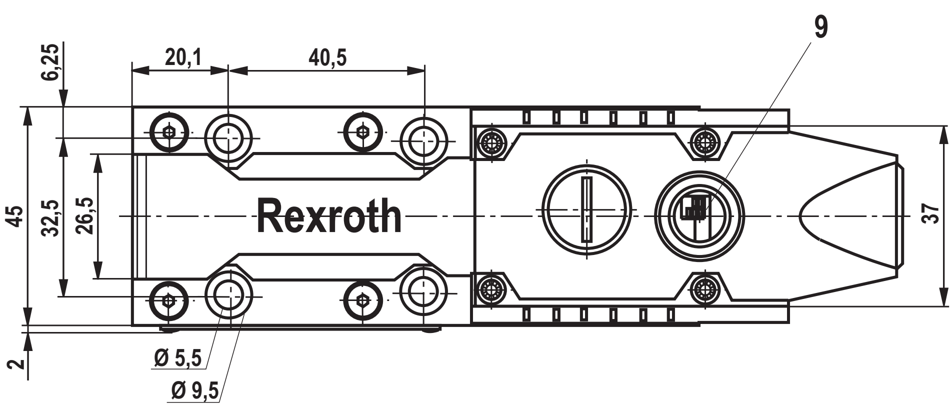
Pressure in port P depending on the flow (applies to all pressure ratings)

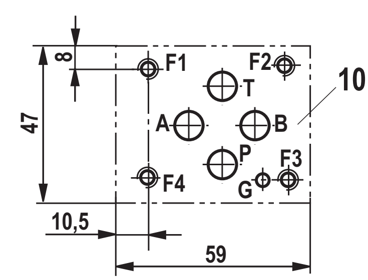


Dimensions:
(dimensions in mm)



Required surface quality of the valve connection surface





1 Proportional solenoid
2 Valve housing
3 Name plate
4 Identical seal rings for ports P, T, A and B
5 Integrated electronics (OBE)
6 Mating connector
7 Space required for removing the mating connector
8 Cable fastening
9 DIL switch for adjustment to various line volumes (see page 7)
10 Valve connection surface,
porting pattern according to ISO 4401-03-02-0-05
Deviating from the standard:
"A" channel not drilled, blind counterbore with sealing
"B" channel not drilled, blind counterbore with sealing (with version "P")
Locating pin not included in the scope of delivery

Notice!
The dimensions are nominal dimensions which are subject to tolerances.

For valve mounting screws and **subplates,** see page 10.

Dimensions

Hexagon socket head cap screws		Material number
Size 6	4x ISO 4762 - M5 x 45 - 10.9-flZn-240h-L Tightening torque M_A = 6 Nm ±10 %	R913000140

Notice: The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure!

Subplates (only admissible up to 350 bar)	**Data sheet**	**Material number**
G 341/01 (G1/4) G 341/60 (G3/8)	45052 45052	R900424447 R901027119

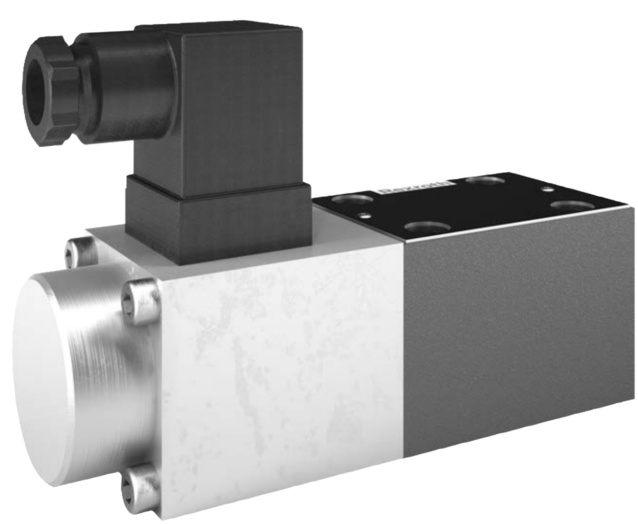
Accessories (not included in the scope of delivery)

Mating connectors (details see page 6)	**Data sheet**	**Material number**
Mating connectors according to DIN EN 175201-804	08006	R900021267 (plastic) R900223890 (metal)

Proportional pressure relief valve, direct-operated

Type DBETX

RE 29161
Edition: 2019-03
Replaces: 07.05



H8143

- Size 6
- Component series 1X
- Maximum operating pressure 315 bar
- Maximum flow 1.5 l/min

Features

- Subplate mounting
- Porting pattern according to ISO 4401-03-02-0-05 (however, without locating hole)
- Adjustable by solenoid current
- Solenoid variants $\boldsymbol{I}_{max}$ = 0.8 A or $\boldsymbol{I}_{max}$ = 2.5 A
- Maximum pressure limitation, even with defective electronics
- External control electronics with ramp and valve calibration

Contents

Ordering code

01	02		03			04	05		06	07	08	09	10
DBET	**X**	**–**	**1X**	**/**			**G24**	**–**		**N**	**Z4**	**M**	*****

01	Proportional pressure relief valve	**DBET**
02	Porting pattern according to ISO 4401-03-02-0-05	**X**
03	Component series 10 ... 19 (10 ... 19: unchanged installation and connection dimensions)	**1X**

Maximum pressure rating

04	50 bar	**50**
	80 bar	**80**
	180 bar	**180**
	250 bar	**250**
	315 bar	**315**

Supply voltage of the control electronics

05	24 V DC voltage	**G24**

Maximum solenoid current

06	0.8 A	**8**
	2.5 A	**25**
07	**With** manual override	**N**

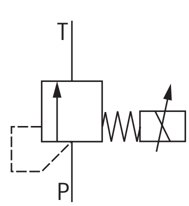
Electrical connection

08	Connector 3-pole (2 + PE) according to DIN EN 175301-803, mating connector included in the scope of delivery	**Z4**

Seal material

09	NBR seals	**M**
	Observe compatibility of seals with hydraulic fluid used. (Other seals upon request)	
10	Further details in the plain text	

Symbols



Function, section

General information

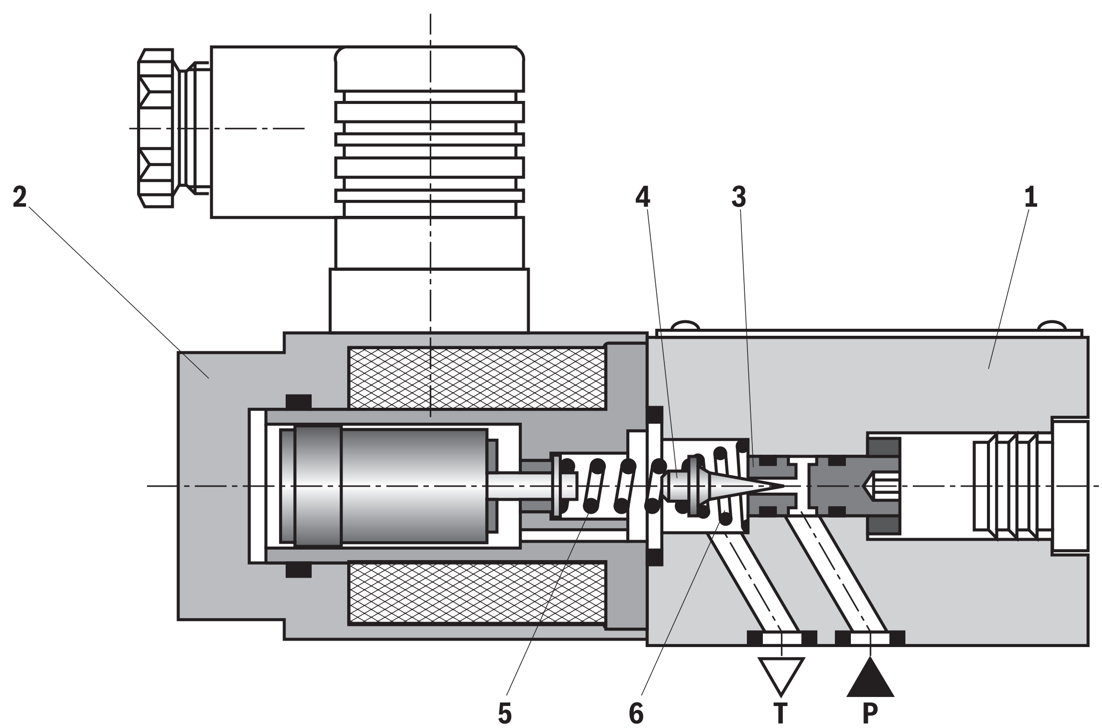
Proportional pressure relief valves type DBETX are remote control valves (pilot control valves) in poppet seat design. They are used for limiting a system pressure.
Operation is effected by means of a proportional solenoid. The interior of the solenoid is connected to port T and is filled with the hydraulic fluid.
These valves enable stepless adjustment of the system pressure to be limited by means of control electronics dependent on the solenoid current and at a flow ≤ l/min remaining as constant as possible.
The valves mainly consist of the housing (1), a proportional solenoid (2), the valve seat (3) and the valve poppet (4).

Basic principle

For the setting of the system pressure, a command value is specified at the control electronics.
Dependent on the command value, the solenoid coil is actuated by the electronics by means of a regulated PWM current (pulse width modulation). The proportional solenoid (2) converts the current into mechanical force that acts on the main spring (5) via the armature plunger.
The compression spring (6) between poppet (4) and valve seat (3) supports stability and minimum residual pressure.
The spring force at the poppet (4) and the pressure in the valve seat (3) are balanced at constant oil flow (0.7 ... 1 l/min). The maximum pressure rating is defined by the configuration of the poppet/seat bore.

Maximum pressure limitation

In case of failure or defect of control electronics and uncontrolled exceeding of the solenoid current (I_{max}), the maximum spring force remains decisive for pressure limitation.



Technical data
(for applications outside these values, please consult us!)

General			
Installation position			any
Ambient temperature range		°C	−20 ... +50
Weight		kg	1.9
Vibration resistance, test condition			max. 25 g, room vibration test in all directions (24 h)

Hydraulic							
Maximum operating pressure [1]	▶ Port P	bar	315 [2]				
	▶ Port T		250				
Maximum set pressure [1]		bar	50	80	180	250	315
Maximum pressure limitation, mechanical (e. g. at solenoid current $\boldsymbol{I} > \boldsymbol{I}_{max}$)		bar	< 55	< 85	< 186	< 258	< 325
Minimum set pressure [1]		bar	see characteristic curves on page 6				
Rated flow		l/min	1				
Maximum flow		l/min	1.5				
Hydraulic fluid			see table on page 5				
Hydraulic fluid temperature range		°C	−20 ... +80				
Viscosity range	▶ Recommended	mm^2/s	20 ... 100				
	▶ Maximum admissible	mm^2/s	10 ... 800				
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)			Class 18/16/13 [3]				

1) At rated flow 1 l/min

2) 350 bar upon request

3) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and simultaneously increases the life cycle of the components.

Technical data
(for applications outside these values, please consult us!)

Hydraulic fluid		**Classification**	**Suitable sealing materials**	**Standards**	**Data sheet**
Mineral oils		HL, HLP	NBR, FKM	DIN 51524	90220
Bio-degradable	▶ Insoluble in water	HETG	FKM	ISO 15380	90221
		HEES	FKM		
	▶ Soluble in water	HEPG	FKM	ISO 15380	
Flame-resistant	▶ Water-free	HFDU (glycol base)	FKM	ISO 12922	90222
		HFDU (ester base)	FKM		
		HFDR	FKM		
	▶ Containing water	HFC (Fuchs: Hydrotherm 46M, Renosafe 500; Petrofer: Ultra Safe 620; Houghton: Safe 620; Union: Carbide HP5046)	NBR	ISO 12922	90223

Important information on hydraulic fluids:
- For further information and data on the use of other hydraulic fluids, please refer to the data sheets above or contact us.
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.).
- The ignition temperature of the hydraulic fluid used must be 50 K higher than the maximum surface temperature.
- **Bio-degradable and flame-resistant – containing water:** If components with galvanic zinc coating (e.g. version "J3" or "J5") or parts containing zinc are used, small amounts of dissolved zinc may get into the hydraulic system and cause accelerated aging of the hydraulic fluid. Zinc soap may form as a chemical reaction product, which may clog filters, nozzles and solenoid valves - particularly in connection with local heat input.
- **Flame-resistant – containing water:**
  - Due to increased cavitation tendency with HFC hydraulic fluids, the life cycle of the component may be reduced by up to 30% as compared to the use with mineral oil HLP. In order to reduce the cavitation effect, it is recommended - if possible specific to the installation - to back up the return flow pressure in ports T to approx. 20% of the pressure differential at the component.
  - Dependent on the hydraulic fluid used, the maximum ambient and hydraulic fluid temperature must not exceed 50 °C. In order to reduce the heat input into the component, the command value profile is to be adjusted for proportional and high-response valves.

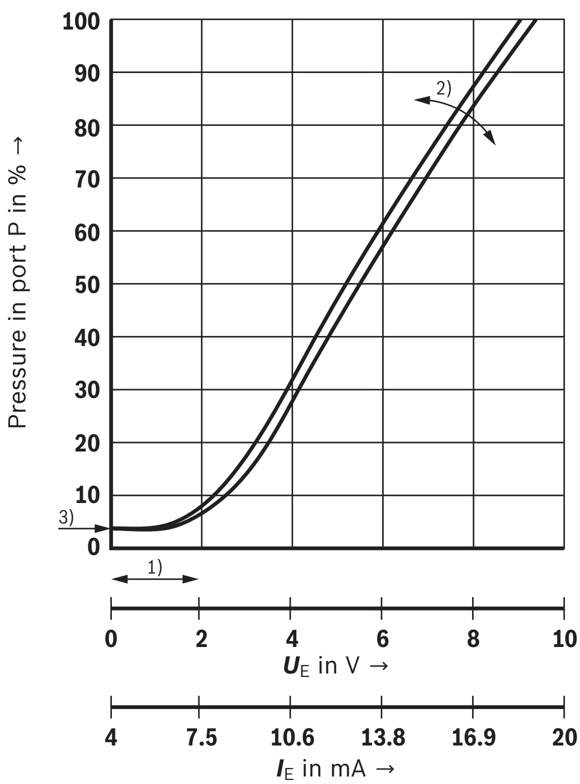
Electric			
Relative duty cycle	%	100 ED	
Maximum solenoid current I_{max}	A	0.8	2.5
Coil resistance R_{20}	Ω	22	3
Maximum power consumption (at 100% load and operating temperature)	VA	25	30
Protection class according to DIN EN 60529		IP65 (with mating connector mounted and locked)	

Static/dynamic			
Hysteresis		%	≤ 4
Range of inversion		%	≤ 3
Manufacturing tolerance		%	≤ 10
Actuating time (100% signal step)	▶ ON	ms	60
	▶ OFF	ms	70

Control electronics	
Analog amplifier in Europe format	VT-VSPA1 (data sheet 30109)
Analog connector amplifier	VT-SSPA1 (data sheet 30264)
Modular design	VT-MSPA1-2X (data sheet 30232)

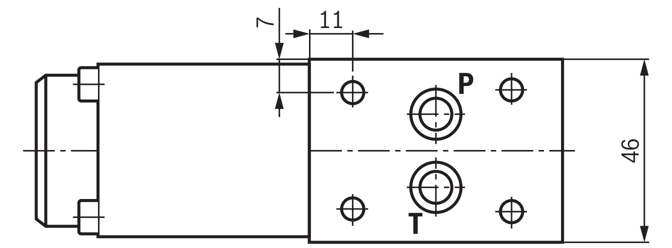
Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

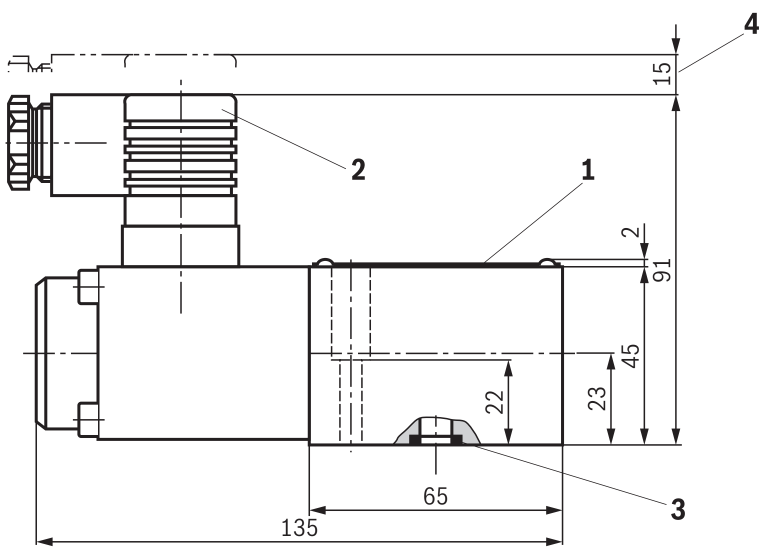
Pressure in port P dependent on the command value (rated flow 1 l/min)

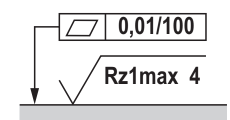


1) Zero point adjustment
2) Sensitivity adjustment
3) p_{min} ≤ 3% p_{max}

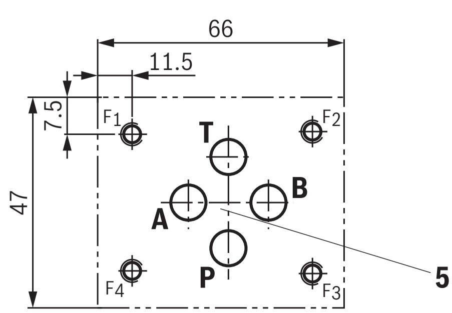
Dimensions
(dimensions in mm)







Required surface quality
of the valve contact surface



1 Name plate
2 Mating connectors 2-pole + PE, for connector "K4" (included within the scope of delivery)
3 Identical seal rings for ports A, B, P, T
4 Space required for removing the mating connector
5 Porting pattern according to ISO 4401-03-02-0-05 (however, without locating hole)
   - Deviating from the standard:
     – Ports P, A, B and T Ø8mm;
   - Minimum screw-in depth:
     – Ferrous metal 1.5 x Ø
     – Non-ferrous 2 x Ø

Valve mounting screws (separate order)

Size	Quantity	Hexagon socket head cap screws	Material number
6	4	**ISO 4762 - M5 x 30 - 10.9-CM-Fe-Zn-5-An-T0-H-B** Friction coefficient $\boldsymbol{\mu}_{\text{total}}$ = 0.09 ... 0.14; tightening torque $\boldsymbol{M}_{\text{A}}$ = 7 Nm ±10%	**R913022141**

Subplates (separate order) with porting pattern according to ISO 4401, see data sheet 45100.

Further information

▶ Electric amplifiers	Data sheet 30109
▶ Plug-in amplifier	Data sheet 30264
▶ Valve amplifier for proportional valves without electrical position feedback	Data sheet 30232
▶ Subplates	Data sheet 45100
▶ Hydraulic fluids on mineral oil basis	Data sheet 90220
▶ Environmentally compatible hydraulic fluids	Data sheet 90221
▶ Flame-resistant, water-free hydraulic fluids	Data sheet 90222
▶ Flame-resistant hydraulic fluids - containing water (HFAE, HFAS, HFB, HFC)	Data sheet 90223
▶ Mating connectors and cable sets for valves and sensors	Data sheet 08006
▶ Hydraulic valves for industrial applications	Operating instructions 07600-B
▶ Selection of filters	
▶ Information on available spare parts	

Proportional pressure relief valve with position feedback (Lvdt AC/AC)

Type DBETBX

Nominal size 6
Unit series 1X
Maximum working pressure P 315 bar, T 2 bar
Nominal flow rate Q_{nom} 1 l/min

List of contents

Contents	Page

Features

– Directly operated valves with position feedback for limiting system pressure
– Adjustable through the position of the armature against the compression spring
– Position-controlled at a high magnetic force, minimal hysteresis $<0.3\,\%$, see Technical data and Characteristic curve
– Pressure limitation to a safe level even with faulty electronics (solenoid current $I > I_{max}$)
– For subplate attachment, mounting hole configuration to ISO 4401-03-02-0-94
Subplates as per catalog sheet RE 45053 (order separately)
– Plug-in connector for solenoid to DIN 43650-AM2 and plug-in connector for position transducer, included in scope of delivery
– Data for the external trigger electronics
  • $U_B = 24\ V_{nom}$ DC
  • Adjustment of valve curve Np and gain
  • With and without ramp generator
  • Europe card format, setpoint 0...+10 V (order separately)

Ordering data

DBETB	X	– 1X /		G24 – 37	Z4	M	*

Proportional pressure relief valve with position control and inductive position transducer on the cone

Mounting hole configuration to ISO 4401-03-02-0-94 **= X**

Unit series 10 to 19 (10 to 19: installation and connection dimensions unchanged) **= 1X**

Max. pressure stage

up to 28 bar	**= 28**
up to 80 bar	**= 80**
up to 180 bar	**= 180**
up to 250 bar	**= 250**
up to 315 bar	**= 315**

Voltage supply of trigger electronics 24 V DC **= G24**

Further information in plain text

2 = Sealed seat adjustment[1)]

M = NBR seals, suitable for mineral oils (HL, HLP) to DIN 51524

Z4 = **Electrical connection**
Unit plug to DIN 43650-AM2
Plug-in connector included in scope of delivery

Solenoid type (current)

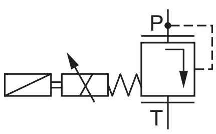
37 = Solenoid current 3.7 A max.

Preferred types

Type	Material Number
DBETBX–1X/28G24–37Z4M	0 811 402 013
DBETBX–1X/80G24–37Z4M2[1)]	0 811 402 007
DBETBX–1X/180G24–37Z4M	0 811 402 003
DBETBX–1X/250G24–37Z4M2[1)]	0 811 402 001
DBETBX–1X/315G24–37Z4M	0 811 402 004

Symbol

For external trigger electronics



Function, sectional diagram

General

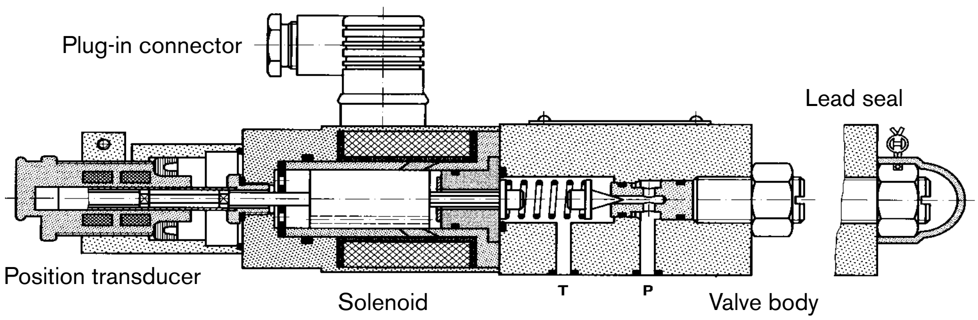
Type DBETBX proportional pressure relief valves are remote-controlled (pilot) valves in conical seat design. They are used to limit system pressure.
The valves are actuated by means of a position-controlled proportional solenoid.
With these valves, the system pressure that needs to be limited can be infinitely adjusted in relation to the position of the solenoid by means of external trigger electronics.

Basic principle

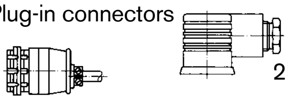
To adjust the system pressure, a setpoint is set in the trigger electronics. Based on this setpoint, the electronics control the position of the armature on the compression spring by means of the signal from the position transducer.
The position control ensures extremely low hysteresis: the position is maintained even in the event of external disturbances.
An "additional" spring between the cone and the seat contributes to stability and a minimal residual pressure.
The spring force acting on the cone and the pressure in the valve seat balance one another at a constant oil flow (0.7...1 l/min).
The "p_{max}" pressure stage is determined by the cone and seating bore configuration.

Pressure limitation for maximum safety

If a fault occurs in the electronics, so that the solenoid current (I_{max}) would exceed its specified level in an uncontrolled manner, the pressure cannot rise above the level determined by the maximum spring force.



Accessories

Type			Material Number
(4 x) ISO 4762-M5x50-10.9	Cheese-head bolts		2 910 151 174
Europe card 	VT-VRPA1-537-10/V0/PV	RE 30052	0 811 405 097
Europe card 	VT-VRPA1-537-10/V0/PV-RTP	RE 30054	0 811 405 102
Europe card 	VT-VRPA1-537-10/V0/PV-RTS	RE 30056	0 811 405 179
Plug-in connectors  2P+PE	Plug-in connector 2P+PE (M16x1.5) for the solenoid and plug-in connector for the position transducer, included in scope of delivery, see also RE 08008.		

Testing and service equipment

Test box type VT-PE-TB1, see RE 30063
Test adapter for Europe cards type VT-PA-3, see RE 30070

Technical data

General						
Construction		Poppet valve				
Actuation		Proportional solenoid with position control, external amplifier				
Connection type		Subplate, mounting hole configuration NG6 (ISO 4401-03-02-0-94)				
Mounting position		Horizontal, vertical with solenoid at top				
Ambient temperature range	°C	–20...+50				
Weight	kg	4.5				
Vibration resistance, test condition		Max. 25 g, shaken in 3 dimensions (24 h)				

Hydraulic (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)						
Pressure fluid		Hydraulic oil to DIN 51524...535, other fluids after prior consultation				
Viscosity range recommended	mm^2/s	20...100				
Viscosity range max. permitted	mm^2/s	10...800				
Pressure fluid temperature range	°C	–20...+80				
Maximum permitted degree of contamination of pressure fluid Purity class to ISO 4406 (c)		Class 18/16/13 [1]				
Direction of flow		See symbol				
Max. set pressure (at $Q = 1$ l/min)	bar	28	80	180	250	315
Minimum pressure (at $Q = 1$ l/min)	bar	1.5	3	4	5	6
		Note: At $Q_{max} = 3$ l/min the pressure levels stated here increase				
Max. mechanical pressure limitation level, e.g. when solenoid current $I > I_{max}$	bar	<29	<85	<186	<258	<325
Max. working pressure (at $Q = 1$ l/min)	bar	Port P: 315				
Max. pressure	bar	Port T: $\leqq 2$				

Electrical		
Cyclic duration factor	%	100
Degree of protection		IP 65 to DIN 40050 and IEC 14434/5
Solenoid connection		Unit plug DIN 43650/ISO 4400, M16 x 1.5 (2P+PE)
Position transducer connection		Special plug
Max. solenoid current	I_{max}	3.7
Coil resistance R_{20}	Ω	2.5
Max. power consumption at 100 % load and operating temperature	VA	60

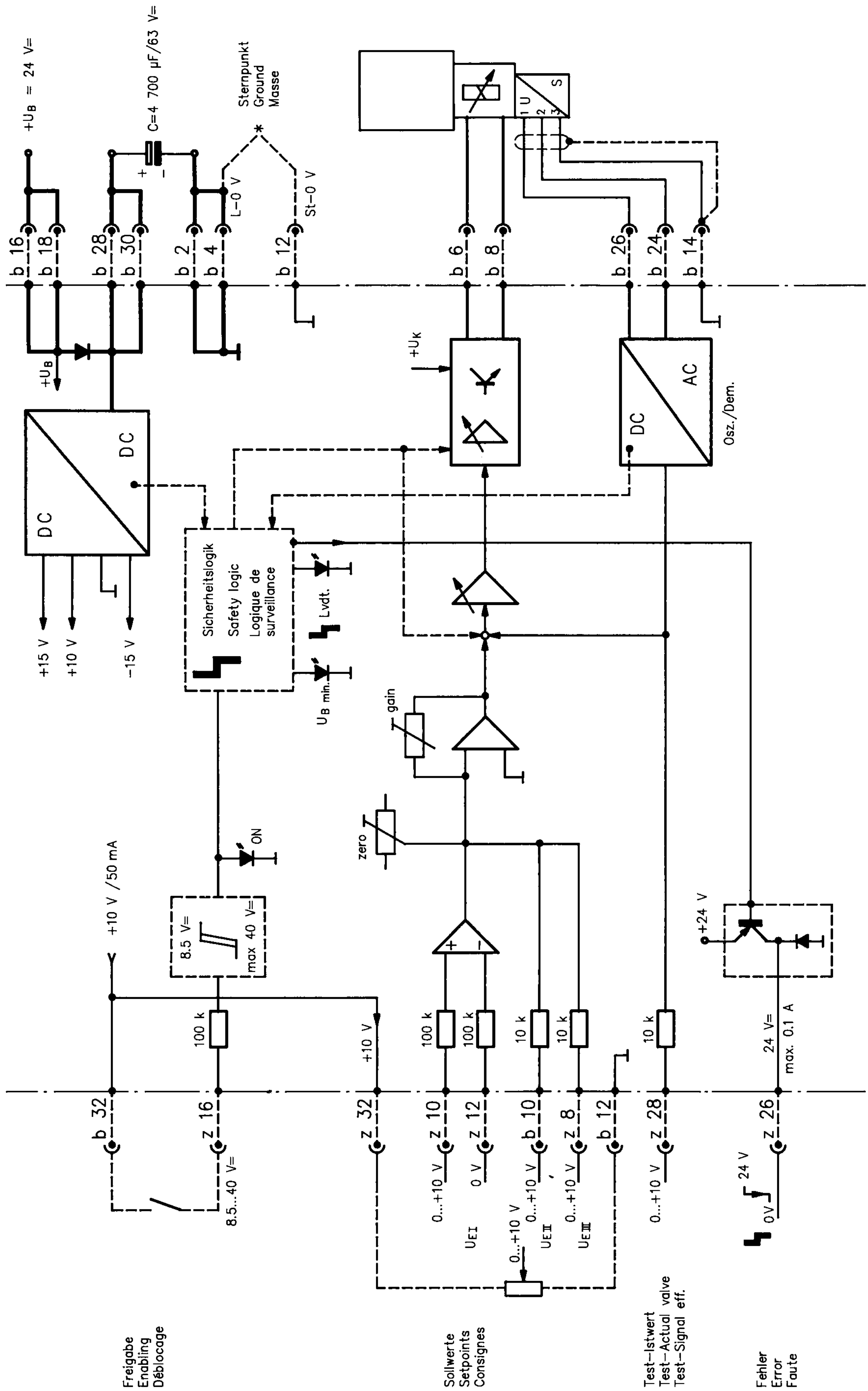
Static/Dynamic [2]		
Hysteresis	%	≤ 0.3
Range of inversion	%	≤ 0.2
Manufacturing tolerance for Q_{max}	%	≈ 6
Response time 100 % signal change	ms	On <45 / Off <25

[1] The purity classes stated for the components must be complied with in hydraulic systems. Effective filtration prevents problems and also extends the service life of components.
For a selection of filters, see catalog sheets RE 50070, RE 50076 and RE 50081.

[2] All characteristic values ascertained using amplifier 0 811 405 097 for the position-controlled 3.7 A solenoid.

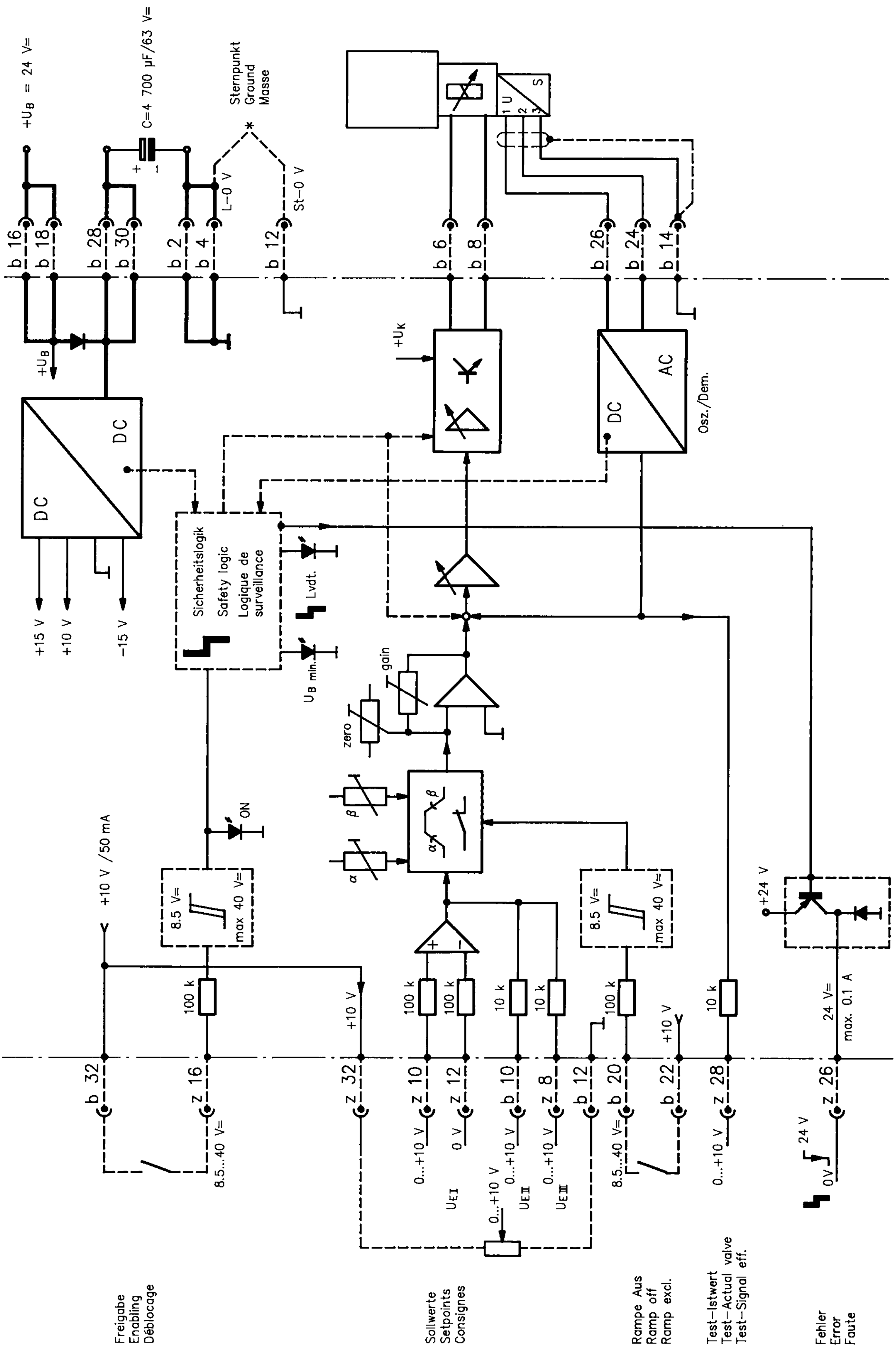
Valve with external trigger electronics (europe card without ramp, RE 30052)

Circuit diagram/pin assignment



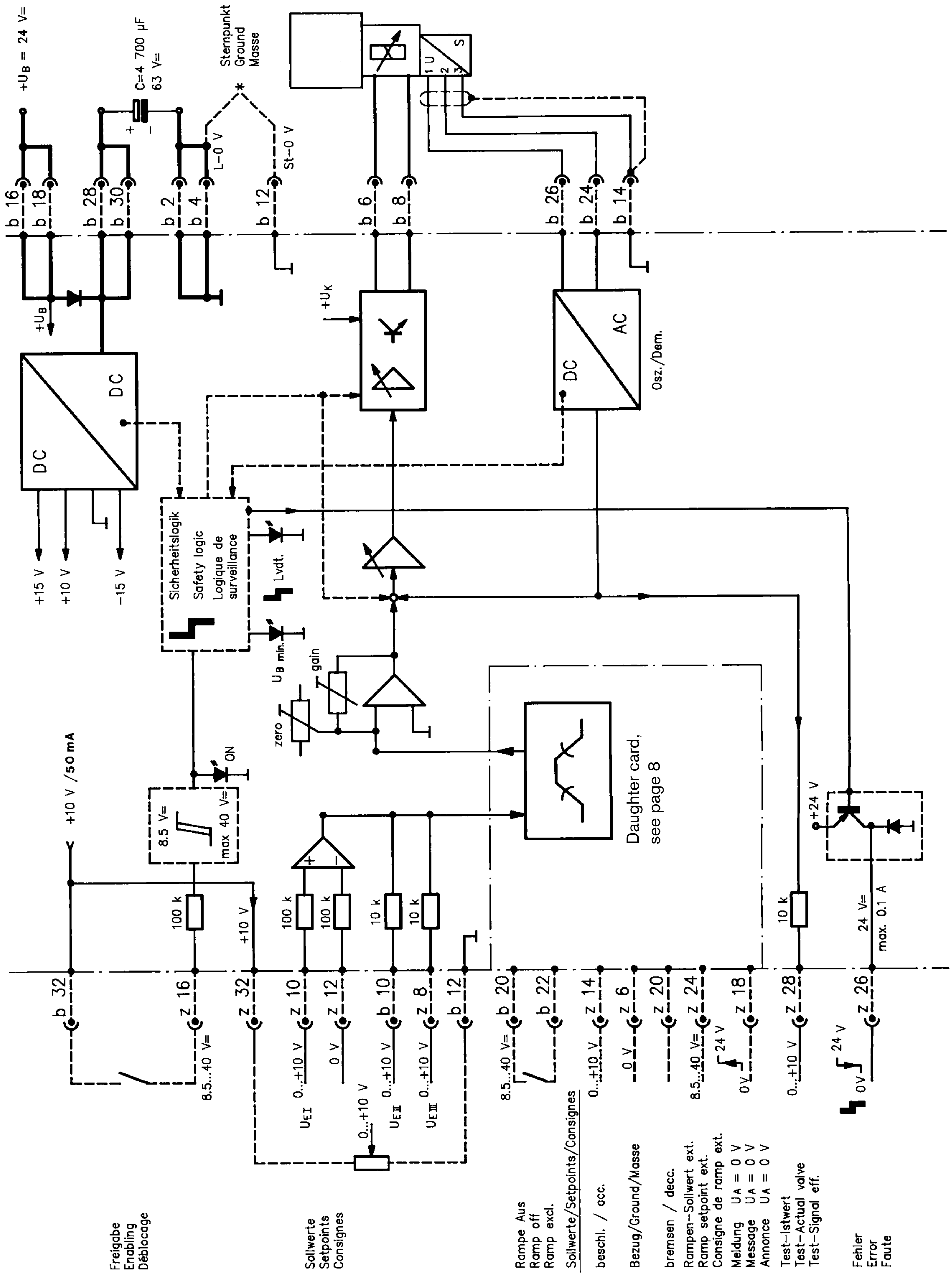
Valve with external trigger electronics (europe card with ramp, RE 30054)

Circuit diagram/pin assignment



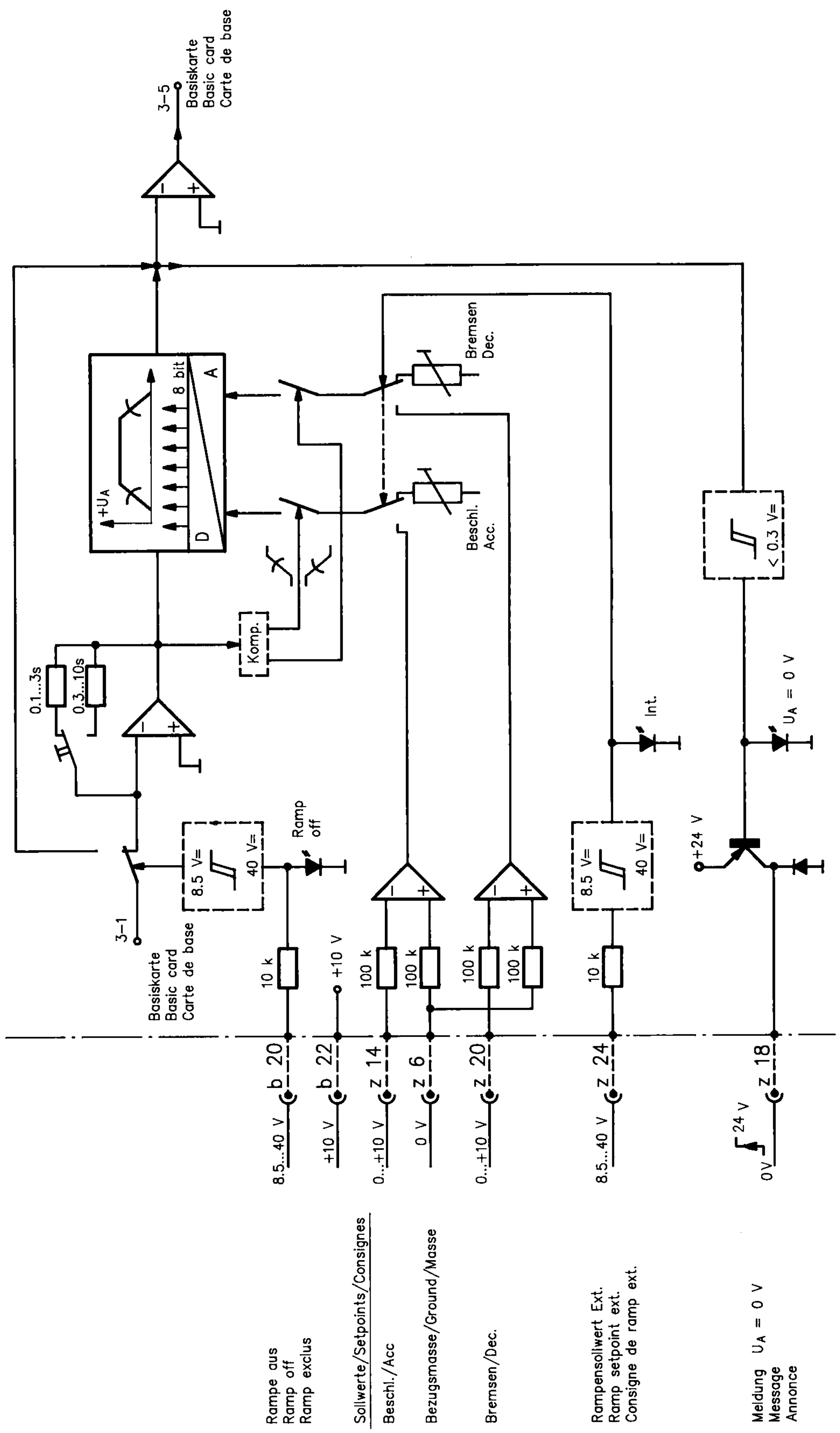
Valve with external trigger electronics (europe card with ramp, RE 30056)

Circuit diagram/pin assignment



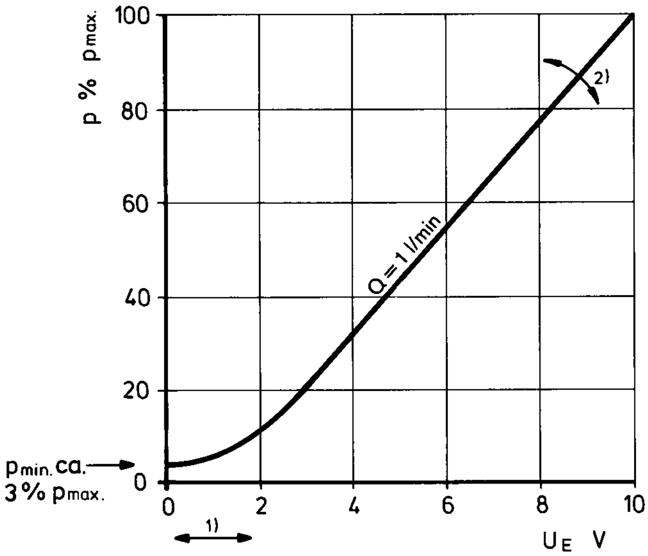
Valve with external trigger electronics (europe card with ramp, RE 30056)

Circuit diagram/pin assignment **Daughter card**



Characteristic curve (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

Pressure in port P as a function of the setpoint
Nominal flow rate = 1 l/min

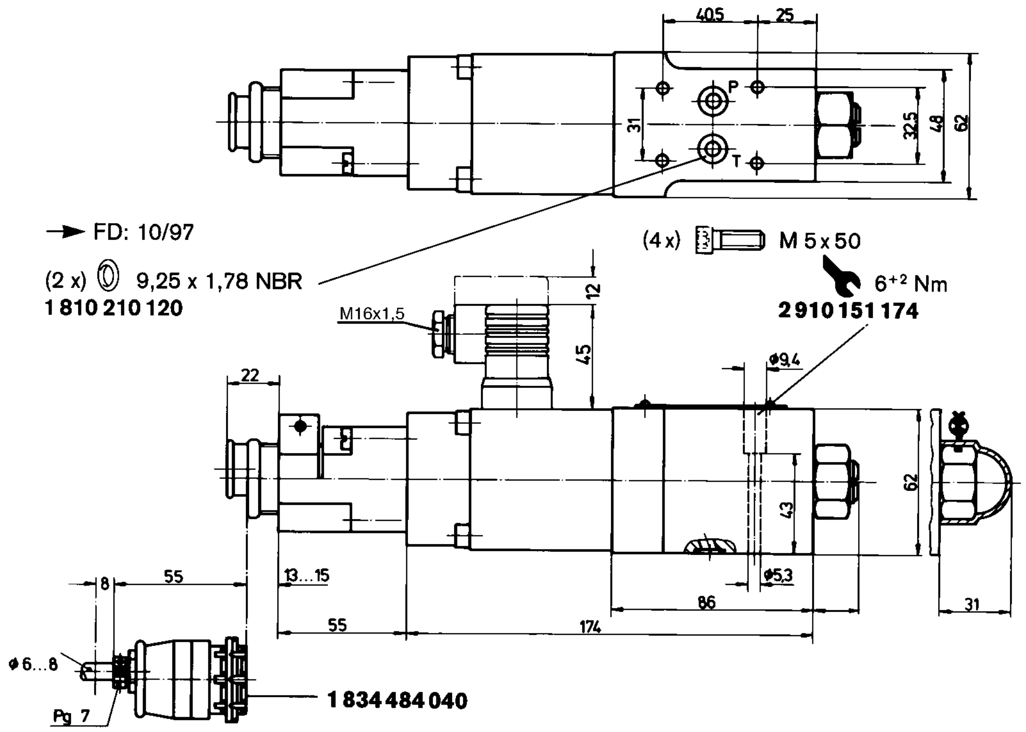


Valve amplifier

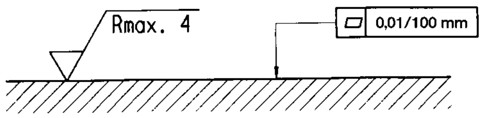
1) Zero adjustment

2) Sensitivity adjustment

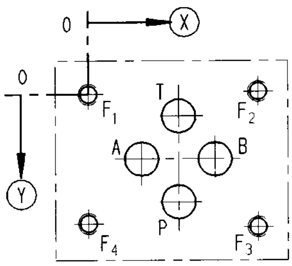
Unit dimensions (nominal dimensions in mm)



Required surface quality of mating component



Mounting hole configuration: NG6 (ISO 4401-03-02-0-94)
For subplates, see catalog sheet RE 45053



1) Deviates from standard
2) Thread depth:
Ferrous metal 1.5 x Ø
Non-ferrous 2 x Ø

	P	A	T	B	F_1	F_2	F_3	F_4
X	21.5	12.5	21.5	30.2	0	40.5	40.5	0
Y	25.9	15.5	5.1	15.5	0	–0.75	31.75	31
∅	8 1)	8 1)	8 1)	8 1)	M5 2)	M5 2)	M5 2)	M5 2)

Proportional pressure relief valve with on-board electronics (OBE) and position feedback

Type DBETBEX

Nominal size 6
Unit series 1X
Maximum working pressure P 315 bar, T 250 bar
Nominal flow rate Q_{nom} 1l/min

List of contents

Features

– Directly operated valves with position feedback and on-board electronics for limiting system pressure
– Adjustable through the position of the armature against the compression spring
– Position-controlled, minimal hysteresis $< 0.2\,\%$, rapid response times, see Technical data
– Pressure limitation to a safe level even with faulty electronics (solenoid current $I > I_{max}$)
– For subplate attachment, mounting hole configuration to ISO 4401-03-02-0-94. Subplates as per catalog sheet RE 45053 (order separately)
– Plug-in connector to DIN 43563-AM6, see catalog sheet RE 08008 (order separately)
– Data for the on-board trigger electronics
  • Complies with CE, EMC directives EN 61000-6-2: 2002-08 and EN 61000-6-3: 2002-08
  • $U_B = 24\ V_{nom}$ DC
  • Electrical connection 6P+PE
  • Signal actuation
    – Standard 0...+10 V (A1)
    – Version 4...20 mA (F1)
  • Valve curve calibrated at the factory

Ordering data

DBETB	E	X	–	1X	/		G24	K31		M	*

Proportional pressure relief valve with inductive position transducer on the cone

With on-board electronics **= E**

Mounting hole configuration to ISO 4401-03-02-0-94 **= X**

Unit series 10 to 19 **= 1X**
(10 to 19: installation and connection dimensions unchanged)

Max. pressure stage
up to 80 bar **= 80**
up to 180 bar **= 180**
up to 250 bar **= 250**
up to 315 bar **= 315**

Voltage supply of trigger electronics 24 V DC **= G24**

Further information in plain text

M = NBR seals, suitable for mineral oils (HL, HLP) to DIN 51524

Interface for trigger electronics
A1 = Setpoint input 0...+10 V
F1 = Setpoint input 4...20 mA

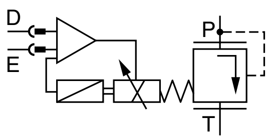
K31 = **Electrical connection**
without plug-in connector, with unit plug to DIN 43563-AM6
Order plug-in connector separately

Preferred types

Type ....A1 (0...+10 V)	Material Number	Type ....F1 (4...20 mA)	Material Number
DBETBEX–1X/80G24K31A1M	0 811 402 072	DBETBEX–1X/80G24K31F1M	0 811 402 140
DBETBEX–1X/180G24K31A1M	0 811 402 071	DBETBEX–1X/180G24K31F1M	0 811 402 075
DBETBEX–1X/250G24K31A1M	0 811 402 073	DBETBEX–1X/315G24K31F1M	0 811 402 141
DBETBEX–1X/315G24K31A1M	0 811 402 070		

Symbol

For on-board electronics



Function, sectional diagram

General

Type DBETBEX proportional pressure relief valves are remote-controlled (pilot) valves in conical seat design. They are used to limit system pressure.
The valves are actuated by means of a proportional solenoid with on-board electronics.
With these valves, rapid response times with low hysteresis can be achieved.

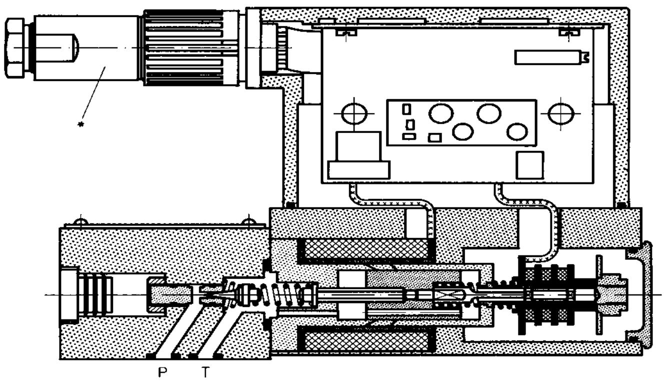
Basic principle

To adjust the system pressure, a setpoint is set in the trigger electronics. Based on this setpoint, the electronics control the position of the armature on the conical seat and on the compression spring.
The position control ensures extremely low hysteresis. The magnetic force determines the spring force until a new position is reached.

Pressure limitation for maximum safety

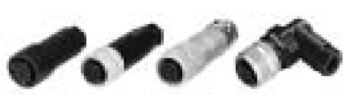
If a fault occurs in the electronics, so that the solenoid current (I_{max}) would exceed its specified level in an uncontrolled manner, the pressure cannot rise above the level determined by the maximum spring force.

CE EN 61000-6-2: 2002-08
EN 61000-6-3: 2002-08



Valve body Proportional solenoid with position transducer

Accessories

Type			Material Number
(4 x) ISO 4762-M5x30-10.9	Cheese-head bolts		2 910 151 166
* 	Plug-in connectors 2P+PE, see also RE 08008.	KS	1 834 482 022
		KS	1 834 482 026
		MS	1 834 482 023
		MS	1 834 482 024
		KS 90°	1 834 484 252

Testing and service equipment

Test box type VT-PE-TB3, see RE 30065
Measuring adapter 6P+PE type VT-PA-2, see RE 30068

Technical data

General		
Construction		Poppet valve
Actuation		Proportional solenoid with position control and OBE
Connection type		Subplate, mounting hole configuration NG6 (ISO 4401-03-02-0-94)
Mounting position		Optional
Ambient temperature range	°C	–20...+50
Weight	kg	2.7
Vibration resistance, test condition		Max. 25 g, shaken in 3 dimensions (24 h)

Hydraulic (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)						
Pressure fluid			Hydraulic oil to DIN 51524...535, other fluids after prior consultation			
Viscosity range	recommended	mm^2/s	20...100			
	max. permitted	mm^2/s	10...800			
Pressure fluid temperature range		°C	–20...+70			
Maximum permitted degree of contamination of pressure fluid Purity class to ISO 4406 (c)			Class 18/16/13 [1)]			
Direction of flow			See symbol			
Max. set pressure (at $Q = 1$ l/min)		bar	80	180	250	315
Minimum pressure (at $Q = 1$ l/min)		bar	3	4	5	8
			Note: At $Q_{max} = 1.5$ l/min the pressure levels stated here increase			
Max. mechanical pressure limitation level, e.g. when solenoid current $I > I_{max}$		bar	<85	<186	<258	<325
Max. working pressure (at $Q = 1$ l/min)		bar	Port P: 315			
Max. pressure		bar	Port T: 250			

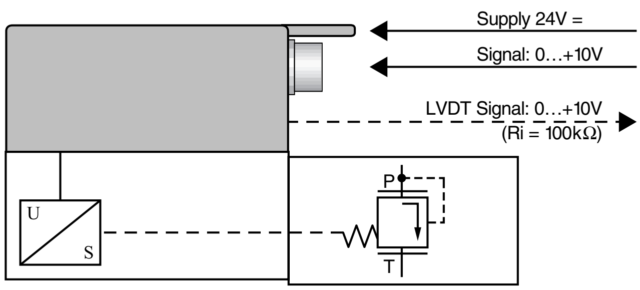
Static/Dynamic			
Hysteresis		%	$\leqq 0.2$
Range of inversion		%	$\leqq 0.1$
Manufacturing tolerance		%	$\leqq \pm 5$
Response time	100 % signal change	ms	30
	10 % signal change	ms	10
Thermal drift			<1 % at $\Delta T = 40\,°C$
Conformity			CE EN 61000-6-2: 2002-08 EN 61000-6-3: 2002-08

[1)] The purity classes stated for the components must be complied with in hydraulic systems.
Effective filtration prevents problems and also extends the service life of components.
For a selection of filters, see catalog sheets RE 50070, RE 50076 and RE 50081.

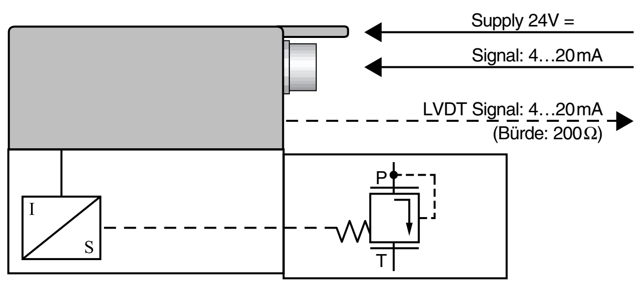
Technical data

Electrical, trigger electronics integrated in valve	
Cyclic duration factor %	100
Degree of protection	IP 65 to DIN 40050 and IEC 14434/5
Connection	Plug-in connector 6P+PE, DIN 43563
Supply voltage Terminal A: Terminal B: 0 V	24 V DC Min. 21 V DC/max. 40 V DC Ripple max. 2 V DC
Power consumption	Solenoid ⧄ 45 mm = 40 VA max.
External fuse	2.5 A_F
Input, "standard" version A1 Terminal D: U_E Terminal E:	Differential amplifier, R_i = 100 kΩ 0...+10 V 0 V
Input, "mA signal" version F1 Terminal D: I_{D-E} Terminal E: I_{D-E}	Burden, R_{sh} = 200 Ω 4...20 mA Current loop I_{D-E} feedback
Max. voltage to differential inputs over 0 V	D → B, E → B } max. 18 V DC
Test signal, "standard" version A1 Terminal F: U_{Test} Terminal C:	LVDT 0...+10 V Reference 0 V
Test signal, "mA signal" version F1 Terminal F: I_{F-C} Terminal C: I_{F-C}	LVDT signal 4...20 mA at external load 200...500 Ω max. 4...20 mA output Current loop I_{F-C} feedback
Safety earth conductor and shield	See pin assignment (installation in conformity with CE)
Recommended cable	See pin assignment up to 20 m 7 x 0.75 mm^2 up to 40 m 7 x 1 mm^2
Calibration	Calibrated at the factory, see valve curve

Version A1: Standard

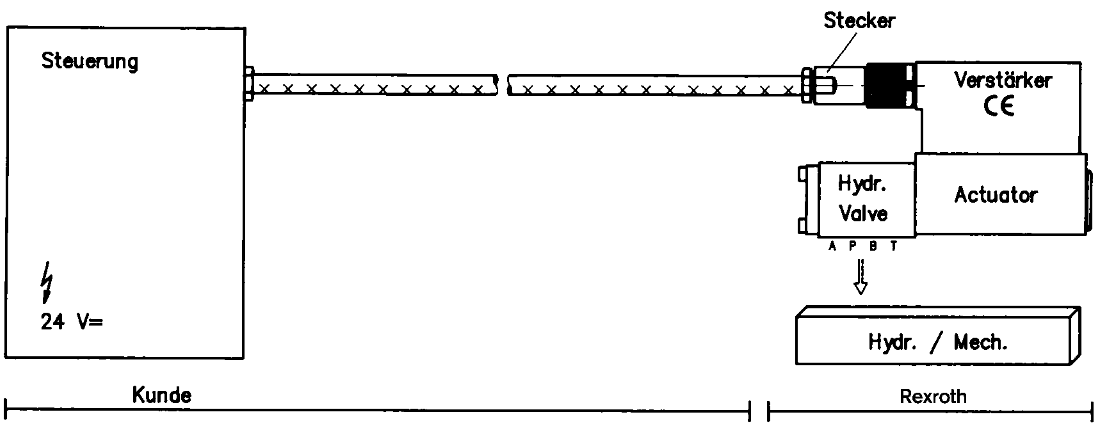


Version F1: mA signal



Connection

For electrical data, see page 5
and Operating Instructions **1 819 929 083**



Technical notes for the cable

Version:
- Multi-wire cable
- Extra-finely stranded wire to VDE 0295, Class 6
- Safety earth conductor, green/yellow
- Cu-braided shield

Type:
- e.g. Ölflex-FD 855 CP (from Lappkabel company)

No. of wires:
- Determined by type of valve, plug type and signal assignment

Cable Ø:
- 0.75 mm^2 up to 20 m long
- 1.0 mm^2 up to 40 m long

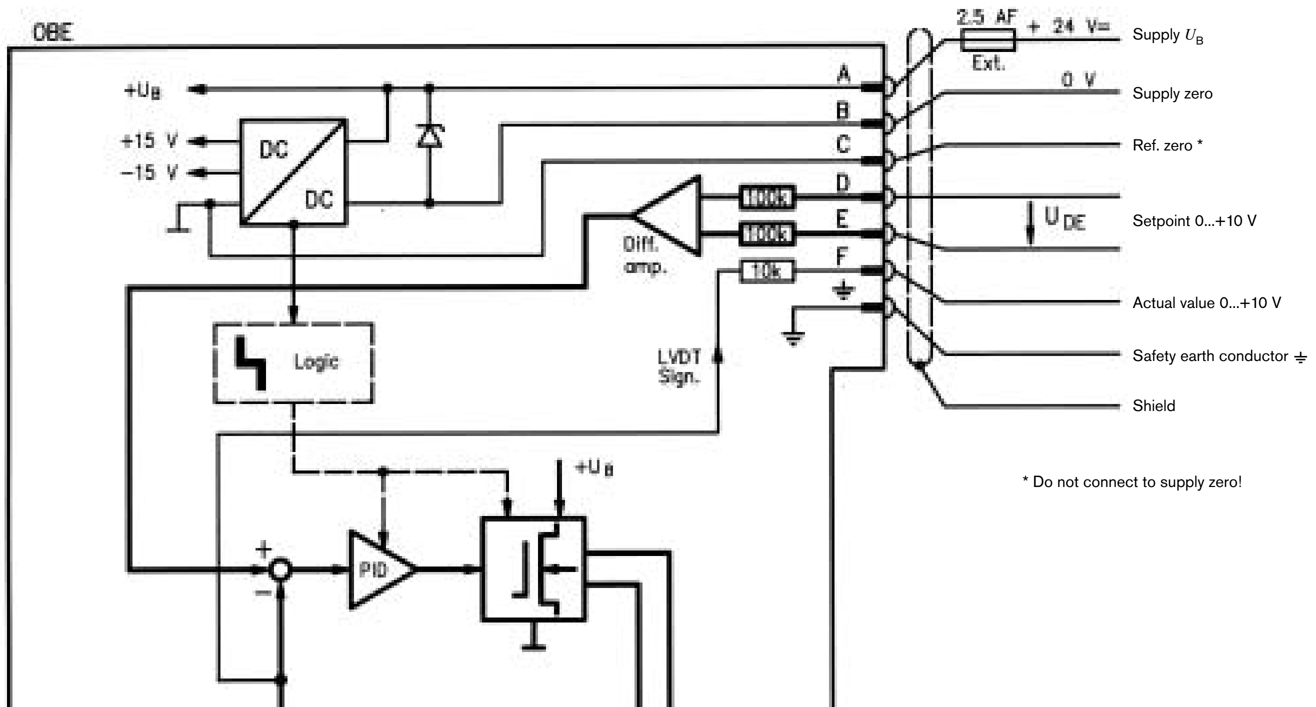
Outside Ø:
- 9.4...11.8 mm – Pg11
- 12.7...13.5 mm – Pg16

Important

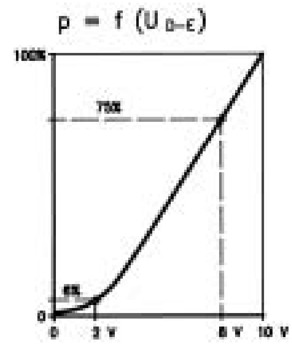
Voltage supply 24 V DC nom,
if voltage drops below 18 V DC, rapid shutdown resembling "Enable OFF" takes place internally.
In addition, with the "mA signal" version:
$I_{D-E} \geqq 3$ mA – valve is active
$I_{D-E} \leqq 2$ mA – valve is deactivated.
Electrical signals emitted via the trigger electronics (e.g. actual values) must not be used to shut down safety-relevant machine functions!
(See also European Standard, "Technical Safety Requirements for Fluid-Powered Systems and Components – Hydraulics", EN 982.)

On-board trigger electronics

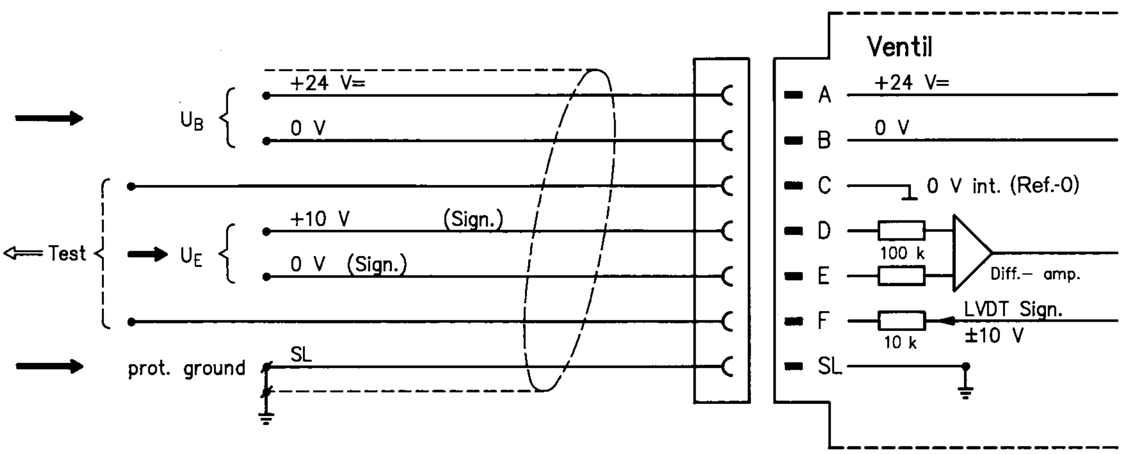
Circuit diagram/pin assignment
Version A1: U_{D-E} 0...+10 V



* Do not connect to supply zero!



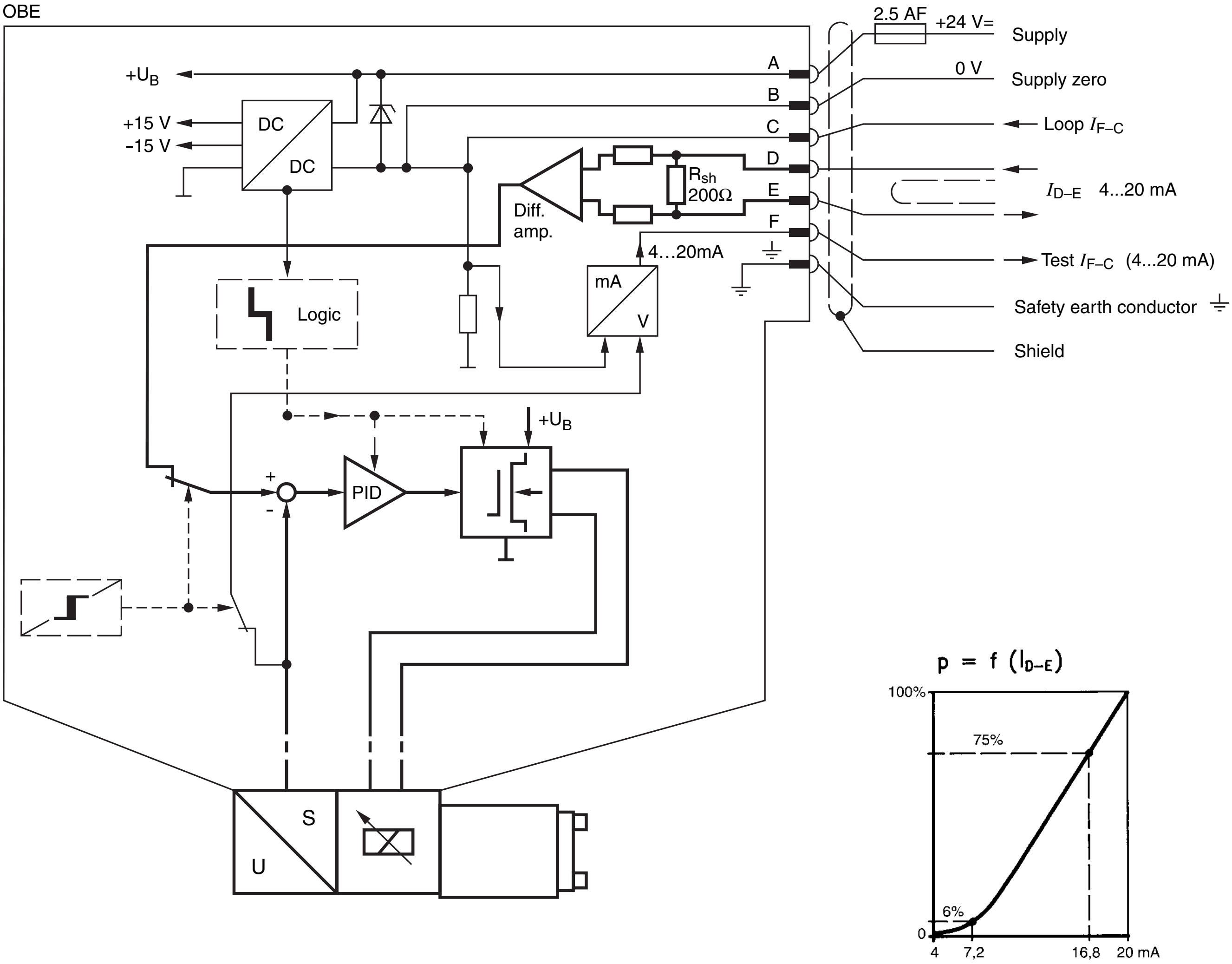
Pin assignment
Version A1: U_{D-E} 0...+10 V
(R_i = 100 kΩ)



On-board trigger electronics

Circuit diagram/pin assignment

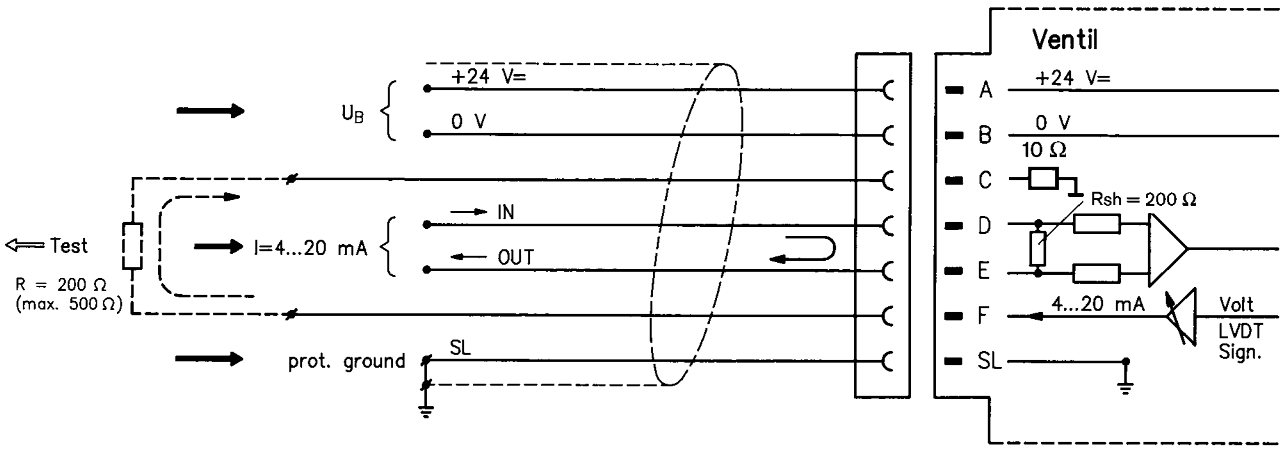
Version F1: I_{D-E} 4...20 mA



Pin assignment

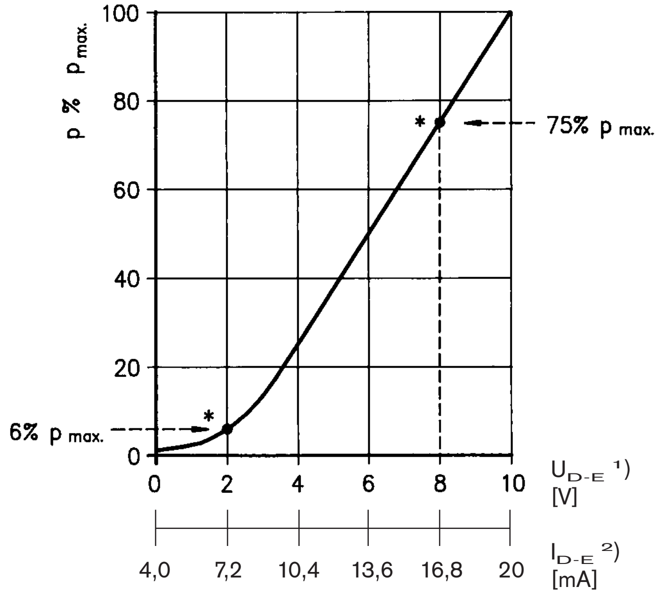
Version F1: I_{D-E} 4...20 mA

(R_{sh} = 200 kΩ)



Characteristic curve (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

Pressure in port P as a function of the setpoint
Nominal flow rate = 1 l/min

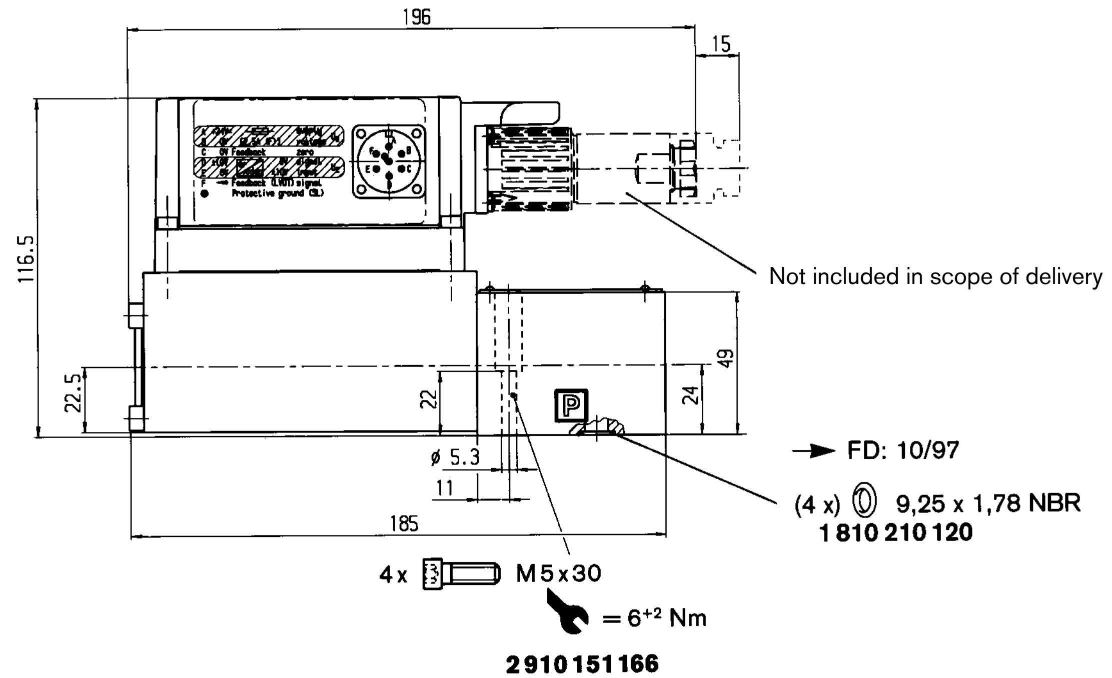


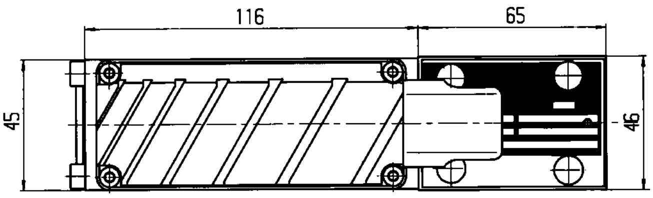
* Factory setting at $Q = 1$ l/min
±2 % manufacturing tolerance

1) Version: $U_{D-E} = 0...+10$ V

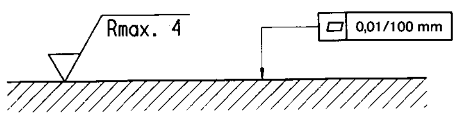
2) Version: $I_{D-E} = 4...20$ mA

Unit dimensions (nominal dimensions in mm)

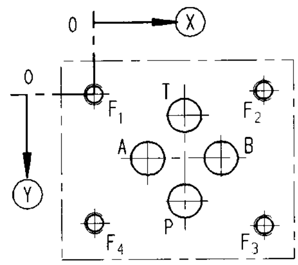




Required surface quality
of mating component



Mounting hole configuration: NG6 (ISO 4401-03-02-0-94)
For subplates, see catalog sheet RE 45053



1) Deviates from standard

2) Thread depth:
Ferrous metal 1.5 x Ø
Non-ferrous 2 x Ø

	P	A	T	B	F_1	F_2	F_3	F_4
Ⓧ	21.5	12.5	21.5	30.2	0	40.5	40.5	0
Ⓨ	25.9	15.5	5.1	15.5	0	–0.75	31.75	31
∅	8 1)	8 1)	8 1)	8 1)	M5 2)	M5 2)	M5 2)	M5 2)

Pressure relief valve, direct operated, with DC motor actuation

Type DBGT

RE 29143
Edition: 2014-02

- Size 6
- Component series 2X
- Maximum operating pressure: 700 bar
- Maximum flow: 12 l/min

Features

- Operation via DC motor with speed reduction transmission
- For subplate mounting:
  Porting pattern according to ISO 6264 with M6 tapped holes
- With actual value potentiometer
- Self-locking in the event of power failure
- Direct operated valve for system pressure limitation
- For high pressure applications with a system pressure of up to 700 bar
  – Suitable as pilot control valve for LCT / LFT high pressure logic valves

Contents

Ordering code

01		02		03	04	05	06	07
DBGT	–	2X	/	700		V	P2	*

01	Pressure relief valve, direct operated with DC motor actuation	**DBGT**
02	Component series 20 to 29 (20 to 29: Unchanged installation and connection dimensions)	**2X**

Pressure rating

03	Set pressure up to 700 bar	**700**

Pilot oil flow

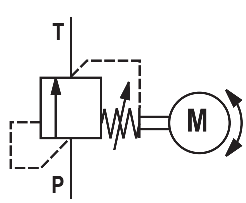
04	Pilot oil return, internal	**no code**
	Pilot oil return, external	**Y**

Seal material

05	FKM seals	**V**
06	Actual value potentiometer	**P2**
07	Further details in the plain text	

Symbol

Type DBGT-2X/...



Function, section

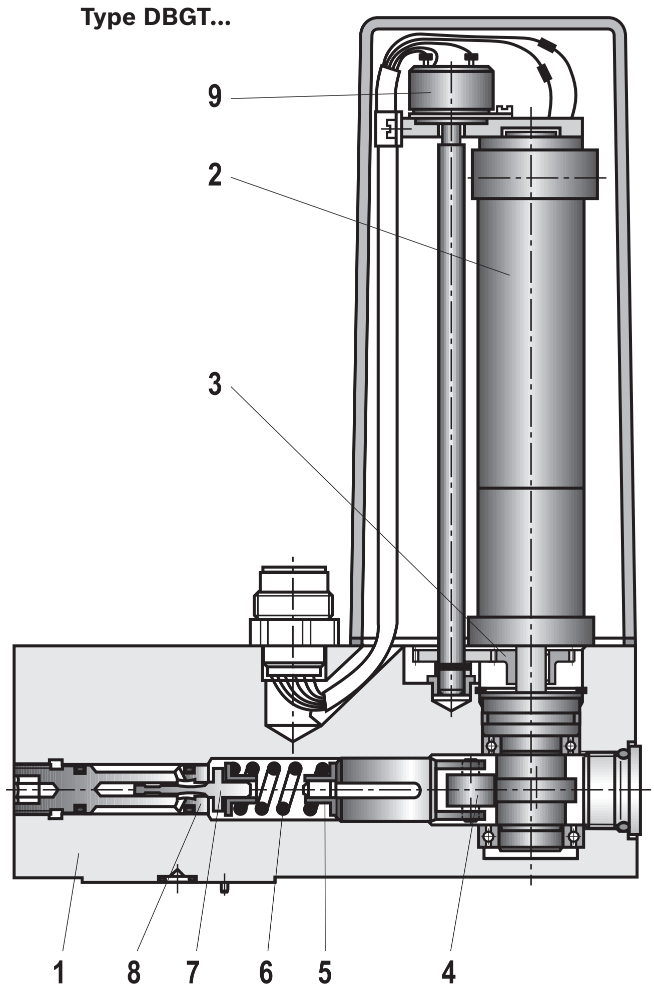
General information

Proportional pressure relief valves type DBGT can be controlled remotely and serve for variable setting and limitation of system pressures up to 700 bar.
The system pressure is set by means of a DC motor with self-locking speed reduction transmission. This way, the set pressure is maintained in the event of a voltage failure.
Pressure relief valves of this series include a main valve (1) and electric motor (2) with transmission (3) as pressure adjustment element.

Functional description

The system pressure is set by means of a DC motor (2) with speed reduction transmission (3). The output shaft of the speed reduction transmission turns the cam (4) that adjusts the preload of the spring (6) via the spring plate (5) to cause a pressure change.
The pressure applied to channel P acts on the valve poppet (7).
If the hydraulic force on the valve poppet exceeds the spring force, the valve regulates the set pressure by lifting the valve poppet from the valve seat (8) to enable the flow of hydraulic fluid from connection P to T.
The cam position (4) and the spring preload are reported back by the actual value potentiometer (9).
The integrated amplifier type VT-VRM1-1 enables program control.
If the power supply is interrupted (cable break, fuse defect, short circuit, etc.), the pressure set at the valve remains unchanged.

Type DBGT...



Technical data
(For applications outside these parameters, please consult us!)

general			
Size			6
Weight		kg	7.2
Installation position			Any
Ambient temperature range		°C	−20 to +50

hydraulic (measured with HLP46, ϑ_{Oil} = 40 ±5 °C)			
Maximum operating pressure	– Port P	bar	700
	– Port T	bar	10
Maximum set pressure		bar	700
Minimum set pressure		bar	q_{Vnom}- conditional (see characteristic curves page 6)
Maximum admissible flow		l/min	12
Hydraulic fluid			See table below
Hydraulic fluid temperature range		°C	−20 to +70
Viscosity range		mm^2/s	2.8 to 380
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)			Class 20/18/15 [1]
Hysteresis		%	< 6 % of the maximum set pressure
Repetition accuracy		mm^2/s	< 1 % of the maximum set pressure [2]

[1] The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the life cycle of the components.

[2] Determined at Q = 3 l/min and a command value of 50 %

Hydraulic fluid		Classification	Suitable sealing materials	Standards
Mineral oils and related hydrocarbons		HL, HLP	NBR, FKM	DIN 51524
Bio-degradable	– insoluble in water	HEES	FKM	VDMA 24568
Flame-resistant	– water-free	HFDU	FKM	ISO 12922
	– containing water	HFC	NBR	ISO 12922

Important information on hydraulic fluids!
- ▶ For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- ▶ There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.)!
- ▶ The flash point of the hydraulic fluid used must be 40 K higher than the maximum solenoid surface temperature.
- ▶ **Flame-resistant – containing water:** The maximum pressure differential per control edge is 210 bar. Otherwise, there is increased cavitation erosion. Life cycle as compared to HLP 30 to 100 %. Fluid temperature maximum 60 °C.
- ▶ **Bio-degradable:** When using bio-degradable hydraulic fluids that are also zinc-solving, zinc may accumulate in the fluid (700 mg zinc per pole tube).

Technical data

(For applications outside these parameters, please consult us!)

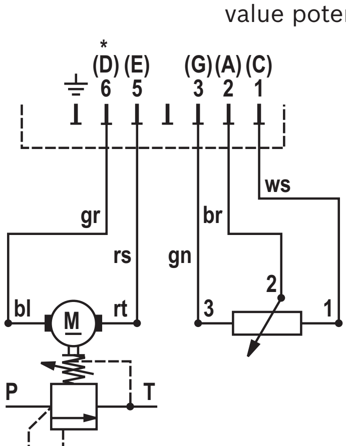
electric, drive motor			
Voltage type			Direct voltage
Supply voltage		VDC	24
Nominal power		W	24
Protection class of the valve according to EN 60529			IP 65 with mating connector mounted and locked

Adjustment with actual value potentiometer for cam position feedback: Ordering code "P2"			
Mechanical adjustment time, $\boldsymbol{p}_{\text{min}}$ to $\boldsymbol{p}_{\text{max}}$		s	1.1
Potentiometer	– Resistance	kΩ	5
	– Power	W	1.75

recommended amplifier	
Electric amplifier	VT-VRM1-1, component series 1X (see data sheet 30405-D)

Electrical connection

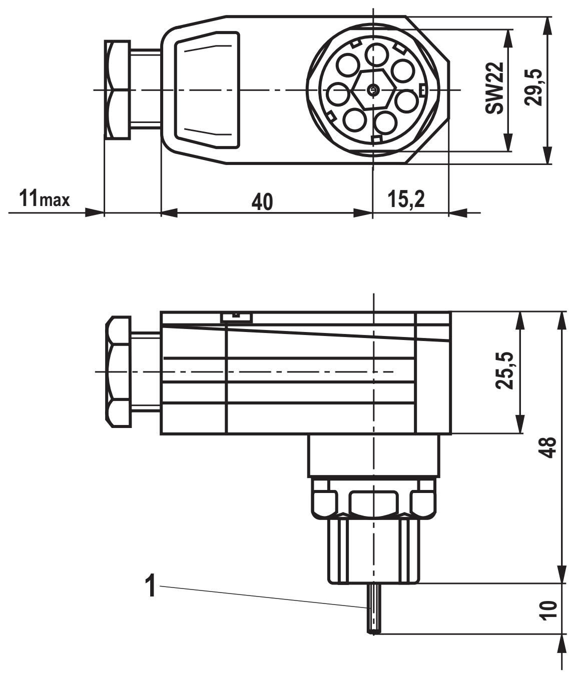
Connector connection at DBGT valve with actual value potentiometer

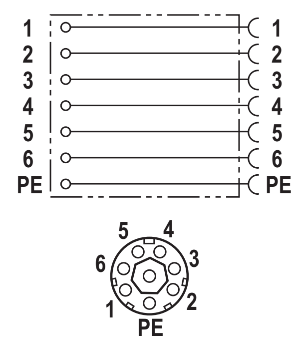


Observe the direction of rotation of the motor for connection no. 5 and 6.
* Pressure increasing no. 6 "+"

Electrical connection (dimensions in mm)

Mating connector (gray), material no. R900002803 (separate order)



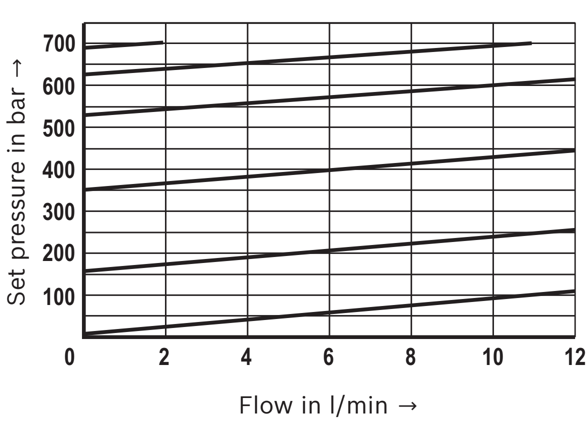


1 Mounting screw M3,
tightening torque M_A = 0.5 Nm

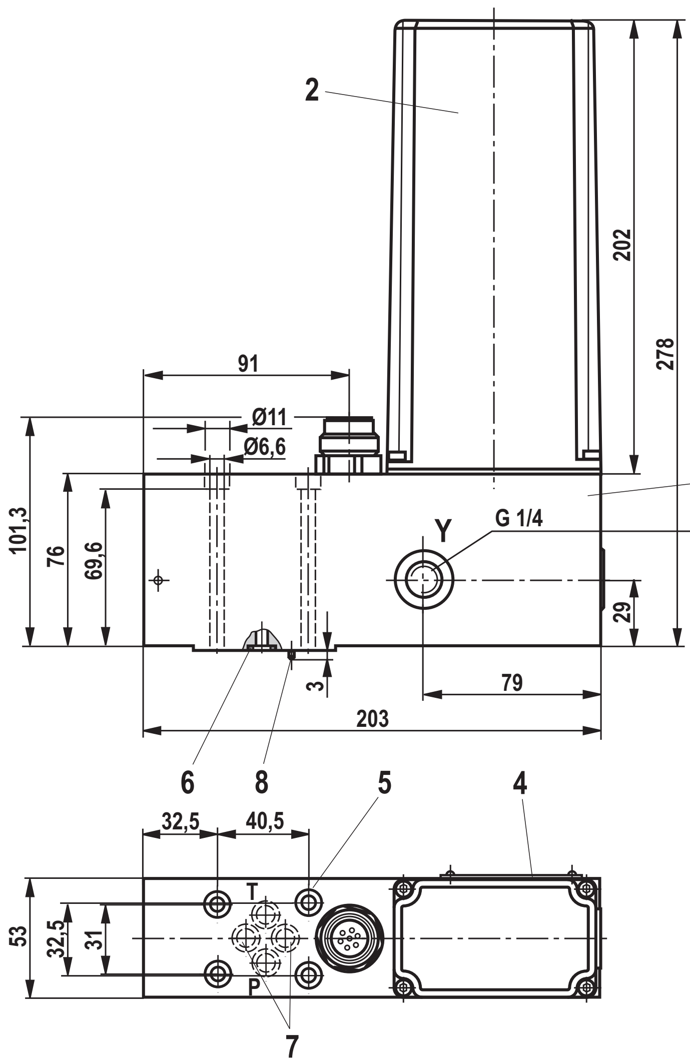
Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

The characteristic curves were measured without counter pressure in port T. (pT = 0 bar)

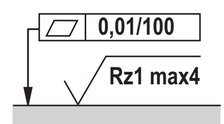
DBGT-2X/700



Dimensions
(dimensions in mm)



1 Valve housing
2 DC motor
3 "Y" port for "external" pilot oil return
4 Name plate
5 Valve mounting bores
6 Identical seal rings for ports P, T, A and B
7 Blind counterbores A and B
8 Locking pin ISO8752 - - 3x8 - St



Required surface quality of the valve contact surface

Notice!
The dimensions are nominal dimensions which are subject to tolerances.

Accessories
(not included in the scope of delivery)

Hexagon socket head cap screws (separate order)		**Material number**
DBGT	4x ISO 4762 - M6 x 80 - 10.9-flZn-240h-L Friction coefficient μ_{total} = 0.09 ... 0,14 Tightening torque $\boldsymbol{M_A}$ = 12.5 Nm ±10 %	R913000512

Notice: For reasons of stability, exclusively these valve mounting screws may be used. The tightening torque of the hexagon socket head cap screws refers to maximum operating pressure!

External control (separate order)	**Data sheet**	**Material number**
VT-VRM1-1-1X	30405-D	R913000512

Mating connector (separate order)	**Data sheet**	**Material number**
Mating connector 7P Z6 N6RFFK	08006	R900002803

Rexroth
Bosch Group

Proportional pressure relief valve, direct operated, increasing characteristic curve

RE 18139-04/06.12 1/14
Replaces: 11.11

Type KBPS.8A (High Performance)

H7071

Component size 8
Component series A
Maximum operating pressure 420 bar
Maximum flow 2 l/min

Table of contents

Features

– Cartridge valve
– Mounting cavity R/T-8A
– Direct operated proportional valve for limiting a system pressure
– Suitable for mobile and industrial applications
– Operation by means of proportional solenoid with central thread and detachable coil
– Fine adjustment of the command value pressure characteristic curve possible from the outside at the control electronics
– In case of power failure, minimum set pressure

– Control electronics:	Data sheet
• Plug-in proportional amplifier type VT-SSPA1…	30116
• Analog amplifier type RA…	95230
• BODAS controller type RC…	95200

Ordering code

KBPS		8	A	A / H	C			V		*

Proportional pressure relief valve, direct operated (pilot control valve)

Pressure rating

- up to 30 bar **= B**
- up to 50 bar **= C**
- up to 100 bar **= F**
- up to 150 bar **= H**
- up to 210 bar **= L**
- up to 250 bar **= N**
- up to 315 bar **= P**
- up to 350 bar **= R**
- up to 420 bar **= T**

Component size 8 **= 8**

Minimum pressure with command value = 0 **= A**

Component series **= A**

High Performance and mounting cavity R/T-8A (see page 13) **= H**

Proportional solenoid, wet-pin **= C**

Supply voltage

- **G12 =** Control electronics 12 V DC
- **G24 =** Control electronics 24 V DC

Electrical connection [1)]

- **K4 =** Without mating connector, with connector according to DIN EN 175301-803
- **K40 =** Without mating connector, with connector DT 04-2PA (Deutsch plug)
- **C4 =** Without mating connector, with connector AMP Junior-Timer

Seal material

- **V =** FKM seals
  Attention! Observe compatibility of the seals with the hydraulic fluid used!

- **no code =** Standard
- **-8 =** Coil 800 mA (see page 5)

Further details in the plain text

[1)] Mating connectors, separate order, see data sheet 08006.

Preferred types

Type	Material number
KBPSC8AA/HCG24K4V	R901049804
KBPSF8AA/HCG24K4V	R901049817
KBPSL8AA/HCG24K4V	R901027408
KBPSN8AA/HCG24K4V	R901049877
KBPSP8AA/HCG24K4V	R901047007
KBPSR8AA/HCG24K4V	R901049860
KBPST8AA/HCG24K40V	R901045871
KBPSL8AA/HCG24K4V-8	R901053398
KBPSP8AA/HCG24C4V-8	R901132980
KBPSR8AA/HCG24C4V-8	R901128882

Function, section, symbol

General

Valves of type KBPS.8A are direct operated proportional pressure relief valves (pilot control valves) in seat design and are used to limit a system pressure. They basically comprise of the pule tube (3), the solenoid coil (4), the valve seat (5) and the valve poppet (6).

With command value 0 or in case of power failure, the minimum pressure is set. Operation by means of a proportional solenoid with central thread and detachable coil. The solenoid's interior is connected to the main port ② and filled with hydraulic fluid. Depending on the electric command value, these valves can be used to continuously set the system pressure to be limited.

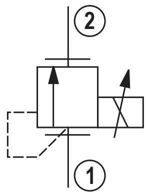
Basic principle

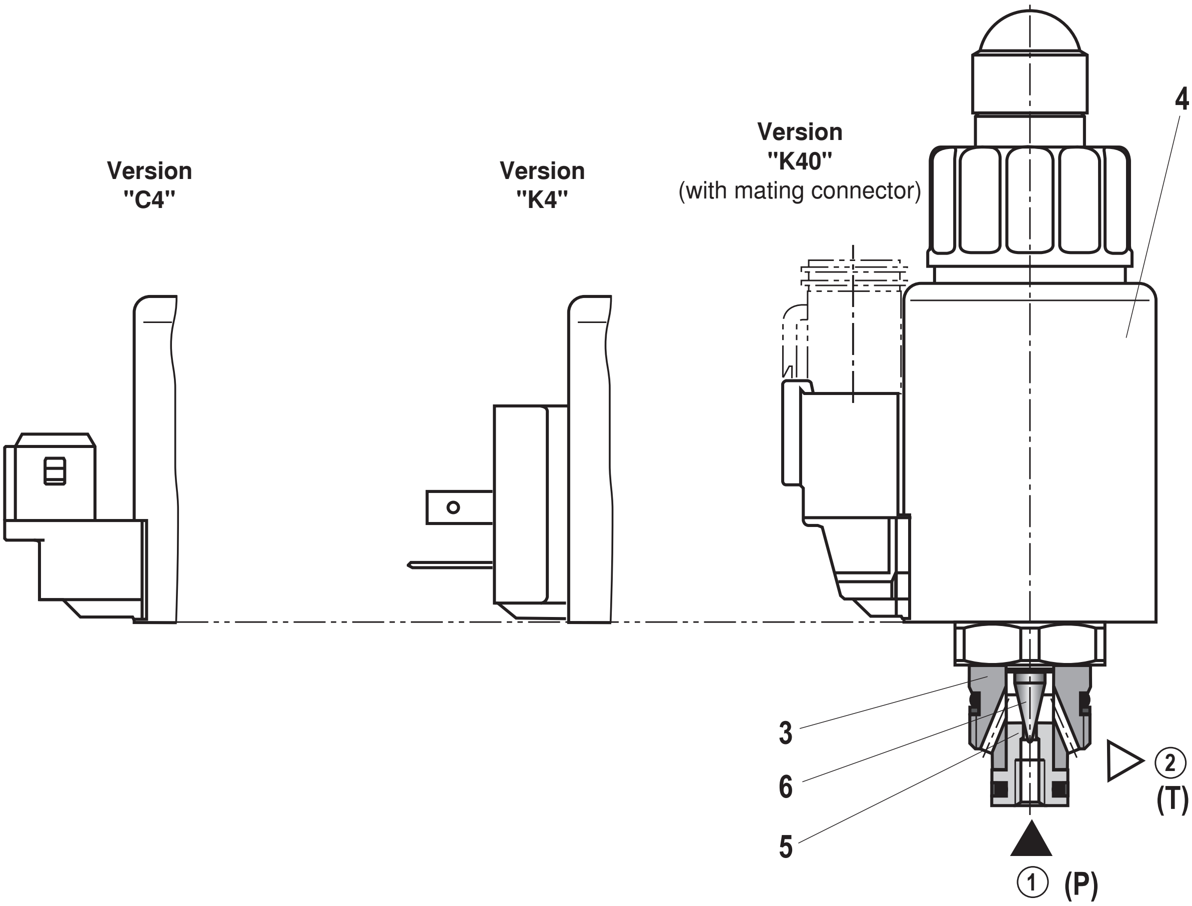
For the setting of the system pressure, a command value is specified at the control electronics. Depending on the command value, the electronics necessary for operation actuate the solenoid with electric current. The proportional solenoid converts the electric current into mechanical force that acts on the valve poppet (6) via the armature plunger. The valve poppet (6) pushes onto the valve seat (5) and blocks the connection between main port ① and ②. If the hydraulic force on the valve poppet (6) corresponds to the solenoid force, the valve controls the set pressure by lifting the valve poppet (6) off the valve seat (5) and thus enabling hydraulic fluid flow from main port ① to ②. If the command value is zero, the minimum pressure is set.

☞ **Notice!**

Occurring tank pressures (main port ②) are added up to the set values in the main port ①.

Symbol





Technical data (For applications outside these parameters, please consult us!)

general

Weight	kg	0.45
Installation position		Any - if it is ensured that no air can collect upstream the valve. Otherwise, we recommend suspended installation of the valve.
Ambient temperature range	°C	–20 to +120
Storage temperature range	°C	–20 to +80

Environmental audits:

Vibration test according to DIN EN 60068-2 / IEC 60068-2 /2 axes (X/Z)		
DIN EN 60068-2-6: 05/96	Vibrations, sine-shaped	10 cycles (5 Hz to 2000 Hz back to 5 Hz) with logarithmic frequency changing speed of 1 octave/min, 5 to 57 Hz, amplitude 1.5 mm (p-p), 57 to 2000 Hz, amplitude 10 g
IEC 60068-2-64: 05/93	Vibrations (random) and broadband noise	20 to 2000 Hz, amplitude 0.05 g^2/Hz (10 g RMS/30 g peak), testing time 30 min
DIN EN 60068-2-27: 03/95	Shocking	Half sine 15 g / 11 ms, 3 x in positive, 3 x in negative direction (a total of 6 individual shocks)
DIN EN 60068-2-29: 03/95	Bump test	Half sine 25 g / 6 ms, 1000 x in positive, 1000 x in negative direction (a total of 2000 individual shocks)
Indication per axis		
Climatic test according to EN 60068-2 / IEC 60068-2 (environmental test):		
DIN EN 60068-2-1: 03/95	Storage temperature	–40 °C, duration 16 h
DIN EN 60068-2-2: 08/94		+110 °C, duration 16 h
DIN EN 60068-2-1: 03/95	Cold test	2 cycles –25 °C, duration 2 h
DIN EN 60068-2-2: 08/94	Dry heating test	2 cycles +120 °C, duration 2 h
IEC 60068-2-30: 1985	Humid heat, cyclic	Variant 2/ +25 °C to +55 °C 93 % to 97 % relative humidity, 2 cycles à 24 h
Salt spray test: 720 h according to DIN 50021		
→ Coating generally not necessary. If paint is applied nevertheless, the reduced heat dissipation capacity is to be observed.		

hydraulic

Maximum operating pressure [1] (Main port ①)	bar	420
Maximum admissible return flow pressure (main port ②)	bar	210
Maximum set pressure [2]		See command value pressure characteristic curves page 6
Minimum set pressure with command value 0		See characteristic curves page 8 and 9
Maximum flow	l/min	2 (see characteristic curves page 6 and 7)
Hydraulic fluid		See page 5
Hydraulic fluid temperature range	°C	–20 to +80
Viscosity range	mm^2/s	15 to 380
Maximum permitted degree of contamination of the hydraulic fluid - cleanliness class according to ISO 4406 (c)		Class 20/18/15 [3]

[1] **Attention!** The maximum operating pressure is the total of set pressure and return flow pressure!

[2] If the valve is installed in a mounting cavity made of non-magnetically conductive material, the maximum set pressure is < 3 % lower.
Attention! The valves are set in the factory. In case of subsequent adjustment, the warranty will become invalid!

[3] The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the service life of the components.

Technical data (For applications outside these parameters, please consult us!)

hydraulic

Hysteresis 4)			< 5 % of the max. set pressure
Range of inversion 4)			< 0.5 % of the max. set pressure
Response sensitivity 4)			< 0.5 % of the max. set pressure
Manufacturing tolerance of the command value pressure characteristic curve	– Command value 100 %		< 5 % of the max. set pressure
	– Command value 0		< 2 % of the max. set pressure
Step response (T_u + T_g) 0 → 100 % and/or 100 % → 0		ms	70 (depending on the system)

Hydraulic fluid		Classification	Suitable sealing materials	Standards
Mineral oils and related hydrocarbons		HL, HLP, HLPD, HVLP, HVLPD	FKM	DIN 51524
Environmentally compatible	– Insoluble in water	HEES	FKM	ISO 15380
		HEPR	FKM	
	– Soluble in water	HEPG	FKM	ISO 15380
Flame-resistant	– Water-free	HFDU, HFDR	FKM	ISO 12922
	– Water-containing	HFAS	FKM	ISO 12922

Important information on hydraulic fluids!

- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, service life, maintenance intervals, etc.)!
- The flash point of the process and operating medium used must be 40 K higher than the maximum solenoid surface temperature.
- **Flame-resistant - containing water**: Maximum pressure differential per control edge 175 bar, otherwise, increased cavitation erosion!
  Tank pre-loading < 1 bar or > 20 % of the pressure differential. The pressure peaks should not exceed the maximum operating pressures!
- **Environmentally compatible:** When using environmentally compatible hydraulic fluids that are simultaneously zinc-solving, zinc may accumulate in the medium (700 mg zinc per pole tube).

electric

Supply voltage		V	12 DC	24 DC	"-8" / 24 DC
Maximum control current		mA	1760	1200	800
Coil resistance	– Cold value at 20 °C	Ω	2.3	4.8	11.5
	– max. hot value	Ω	3.8	7.9	18.9
Switch-on duration		%	100 5)		
Maximum coil temperature 6)		°C	150		
Protection class according to DIN EN 60529	– Version "K4"		IP 65 with mating connector mounted and locked		
	– Version "K40"		IP 69K with mating connector mounted and locked		
	– Version "C4"		IP 66 with mating connector mounted and locked		
			IP 69K with Rexroth mating connector (Material no. R901022127)		
Control electronics (separate order)			– Plug-in proportional amplifier type VT-SSPA1…, see data sheet 30116 – Analog amplifier type RA…, see data sheet 95230 – BODAS controller type RC…, see data sheet 95200		
Design according to VDE 0580					

4) Measured with analog amplifier type RA2-1/10, see data sheet 95230

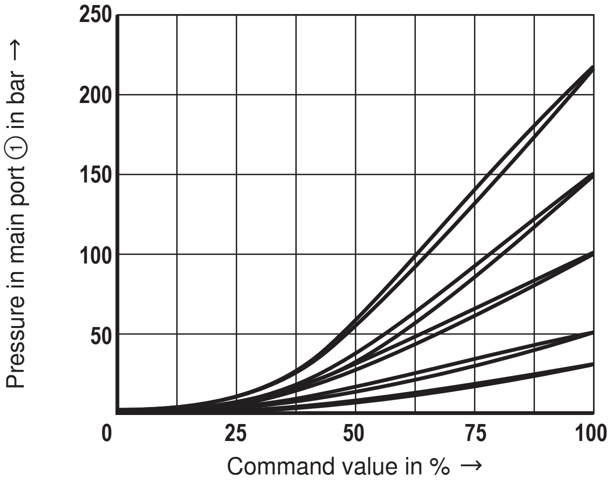
5) In case of use more than 2000 m a.s.l., please consult us.

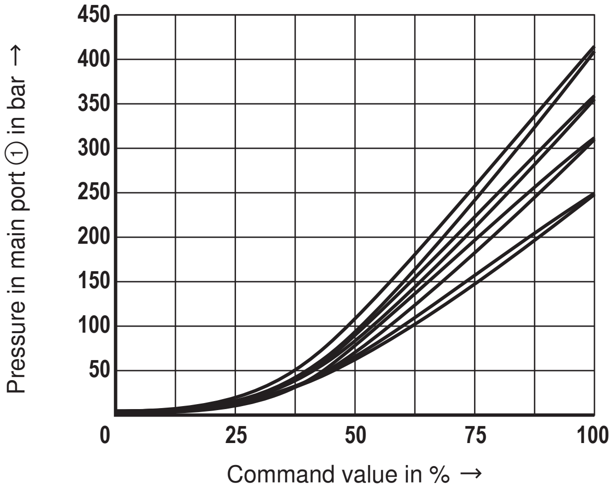
6) Due to the surface temperatures of the solenoid coils, the standards ISO 13732-1 and EN 982 need to be adhered to!

In the electrical connection, the protective earthing conductor (PE ⏚) must be connectedproperly.

Characteristic curves (measured with HLP46, ϑ_{Oil} = 40 °C ± 5 °C and 24 V coil)

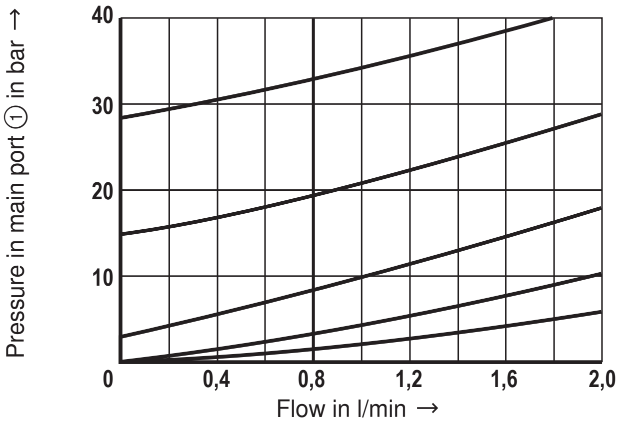
Pressure in the main port ① depending on the command value. Flow = 0.8 l/min



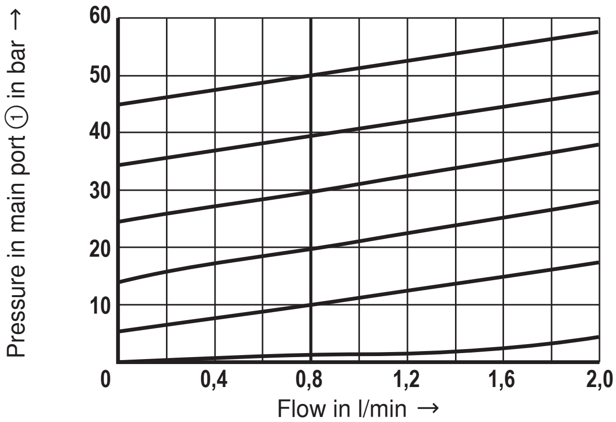


Pressure in the main port ① depending on the flow.
(The characteristic curve was measure without counter pressure in main port ②.)

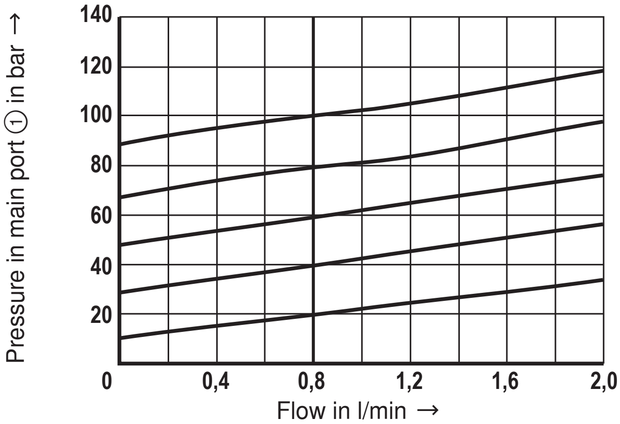
Pressure rating 30 bar



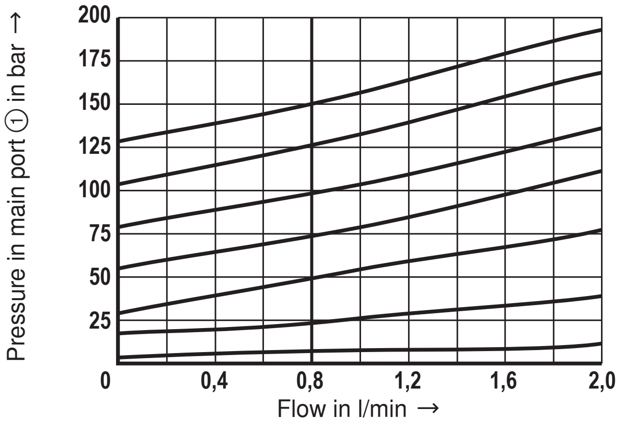
Pressure rating 50 bar



Pressure rating 100 bar

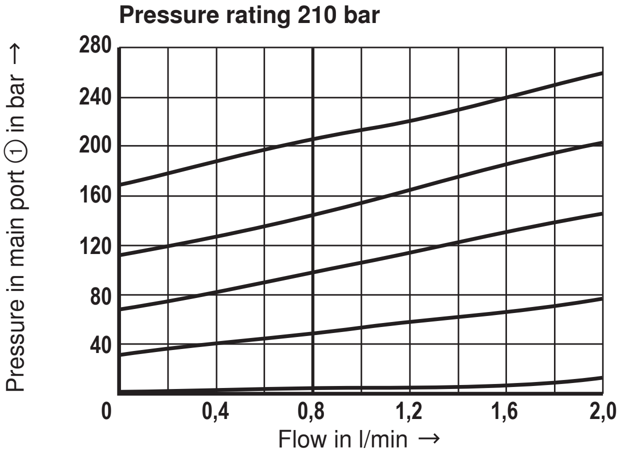


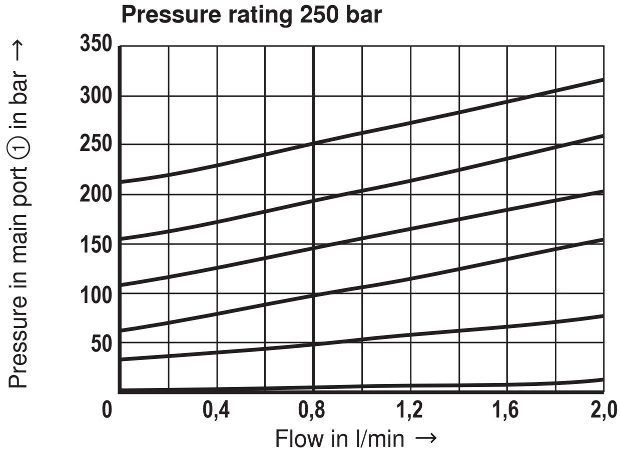
Pressure rating 150 bar

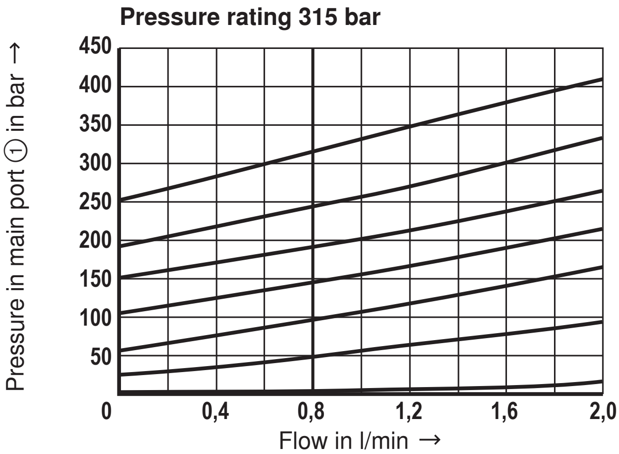


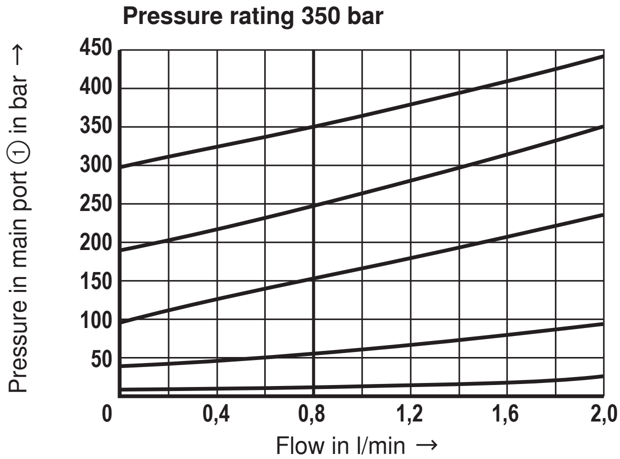
Characteristic curves (measures with HLP46, ϑ_{Oil} = 40 °C ± 5 °C and 24 V coil)

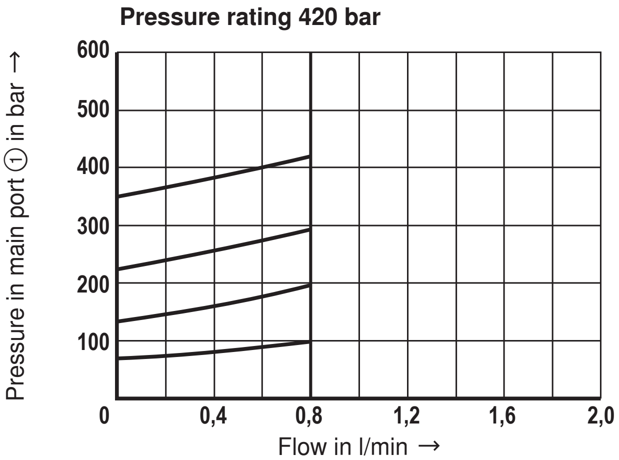
Pressure in the main port ① depending on the flow.
(The characteristic curve was measure without counter pressure in main port ②.)







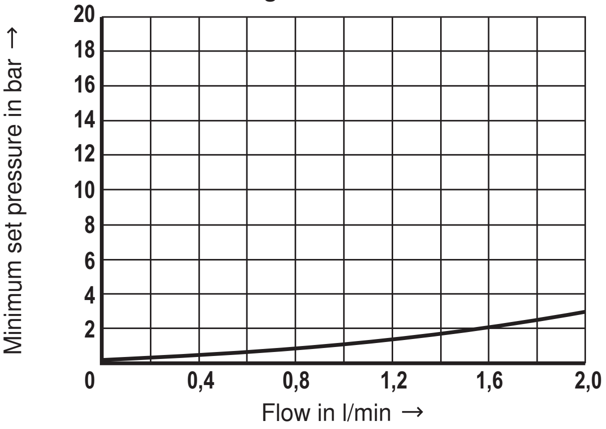




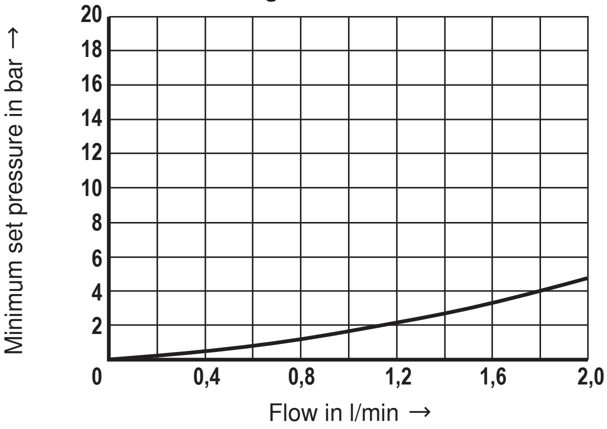
Characteristic curves (measured with HLP46, ϑ_{Oil} = 40 °C ± 5 °C and 24 V coil)

Minimum set pressure in main port ① with command value 0.
(The characteristic curve was measure without counter pressure in main port ②.)

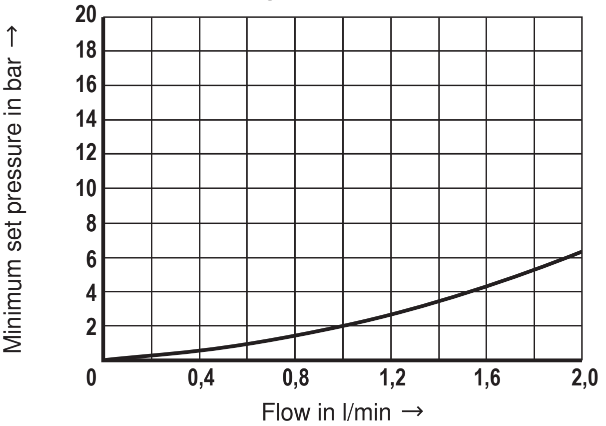
Pressure rating 30 bar



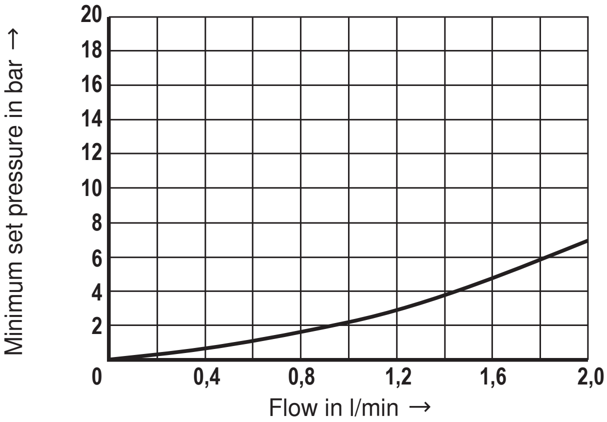
Pressure rating 50 bar



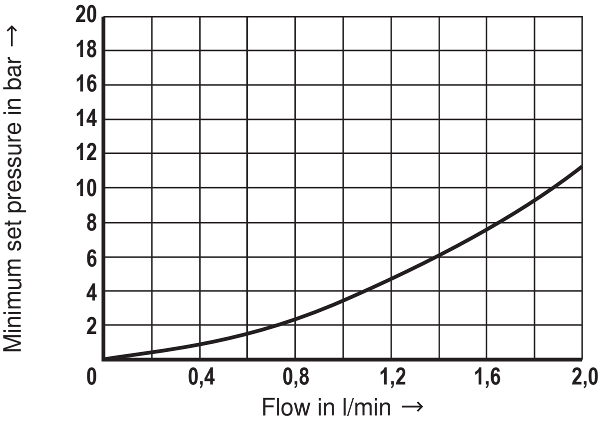
Pressure rating 100 bar



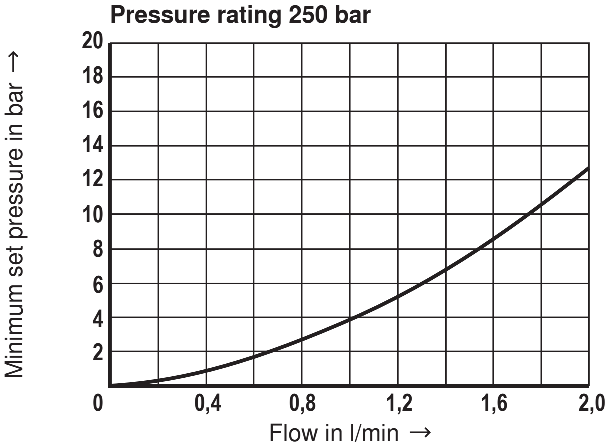
Pressure rating 150 bar



Pressure rating 210 bar

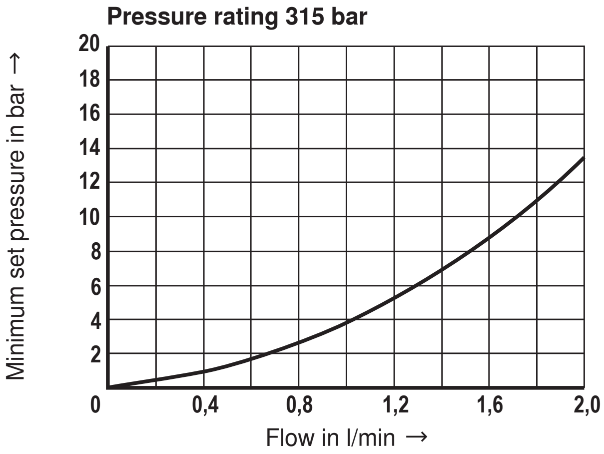


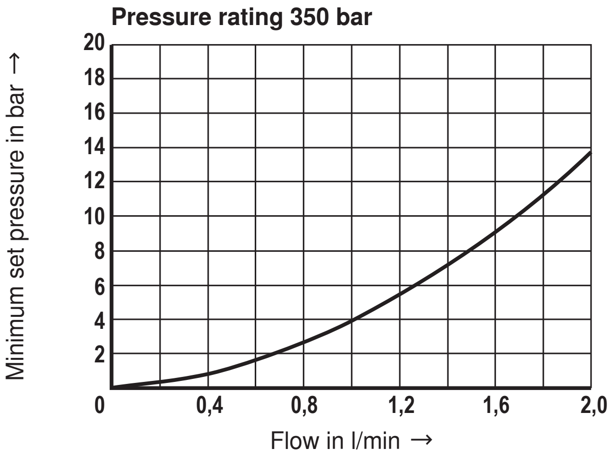
Pressure rating 250 bar

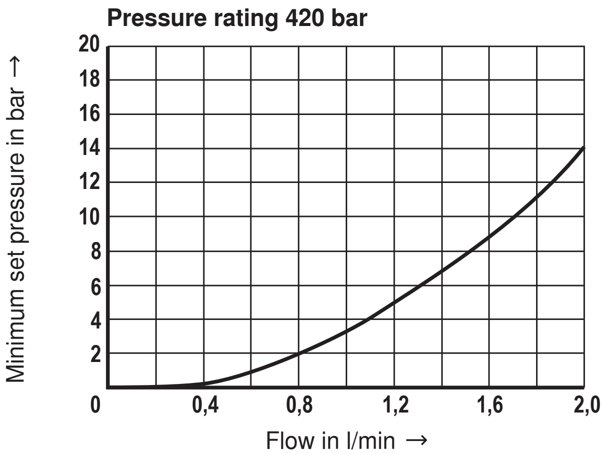


Characteristic curves (measured with HLP46, ϑ_{Oil} = 40 °C ± 5 °C and 24 V coil)

Minimum set pressure in main port ① with command value 0.
(The characteristic curve was measure without counter pressure in main port ②.)



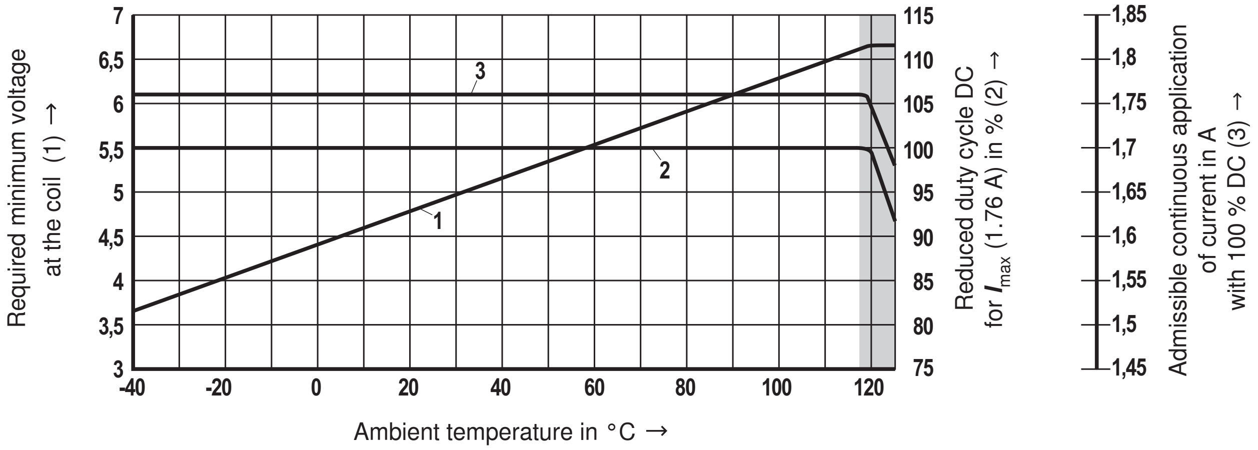




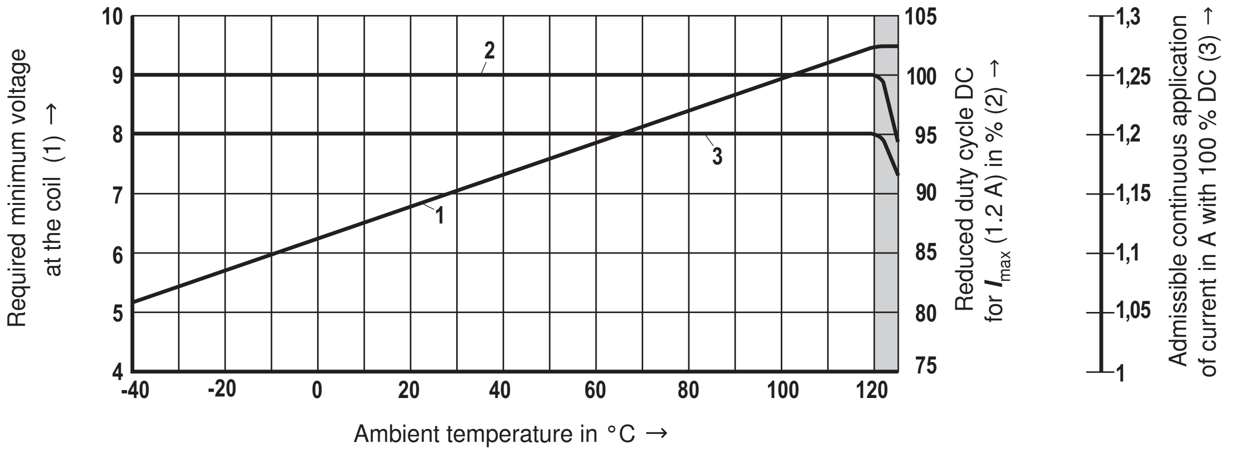
Minimum terminal voltage at the coil and relative duty cycle

Admissible working range against the ambient temperature

– **Version "G12"**



– **Version "G24"**



Limited valve performance

☞ **Notice!**

The characteristic curves have been determined for coils with valve with medium test block size (80 x 80 x 80 mm), without flow in calm air.

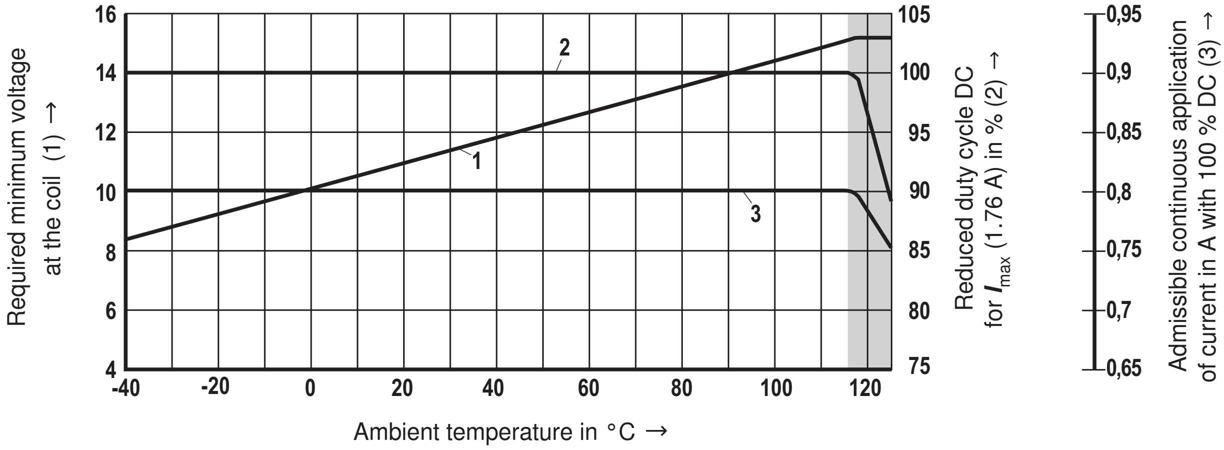
Depending on the installation conditions (block size, flow, air circulation, etc.) there may be a better heat dissipation. Thus, the area of application is broadened.

In single cases, more unfavorable conditions may lead to limitations of the area of application.

Minimum terminal voltage at the coil and relative duty cycle

Admissible working range against the ambient temperature

– Version "G24...-8"



Limited valve performance

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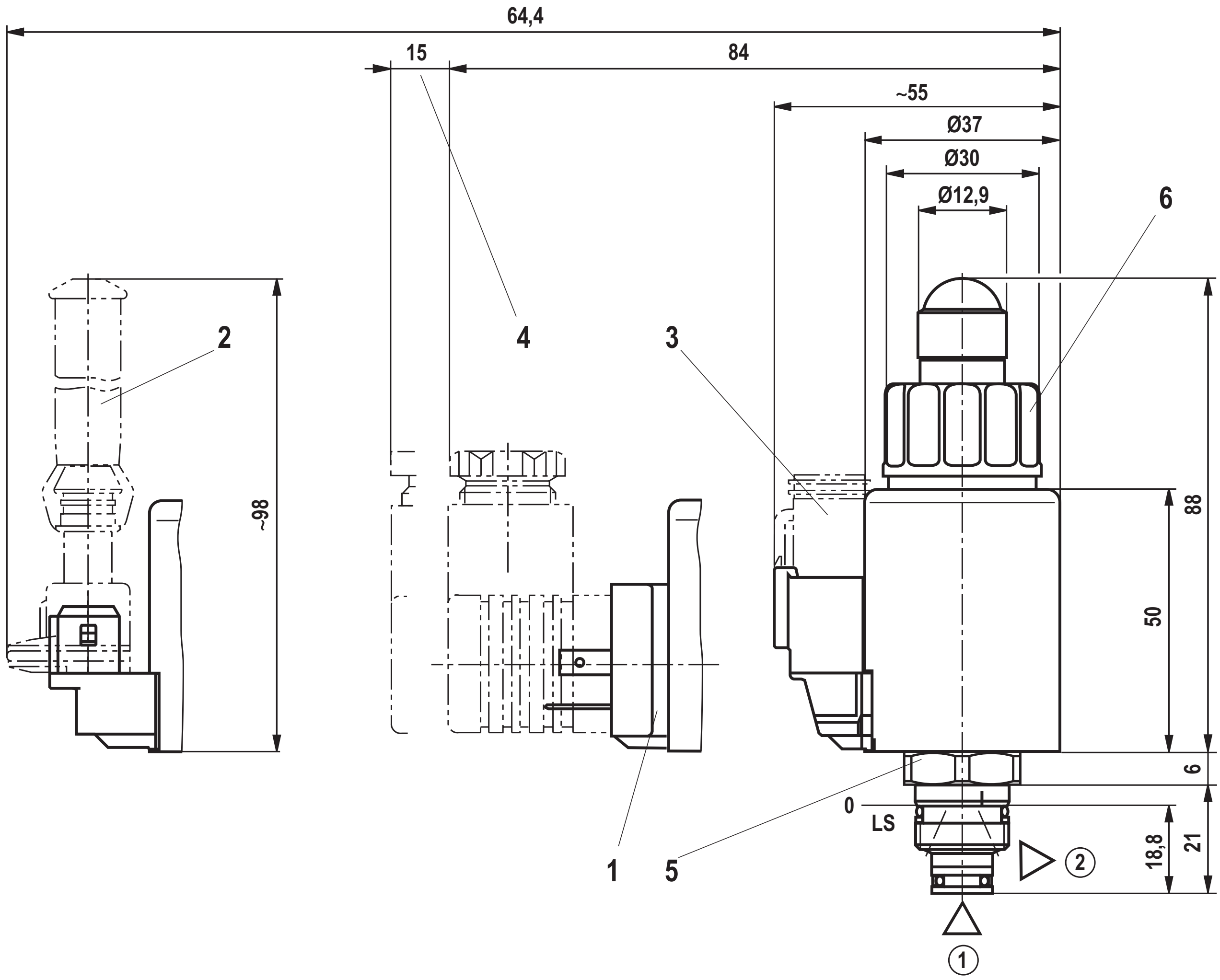
In single cases, more unfavorable conditions may lead to limitations of the area of application.

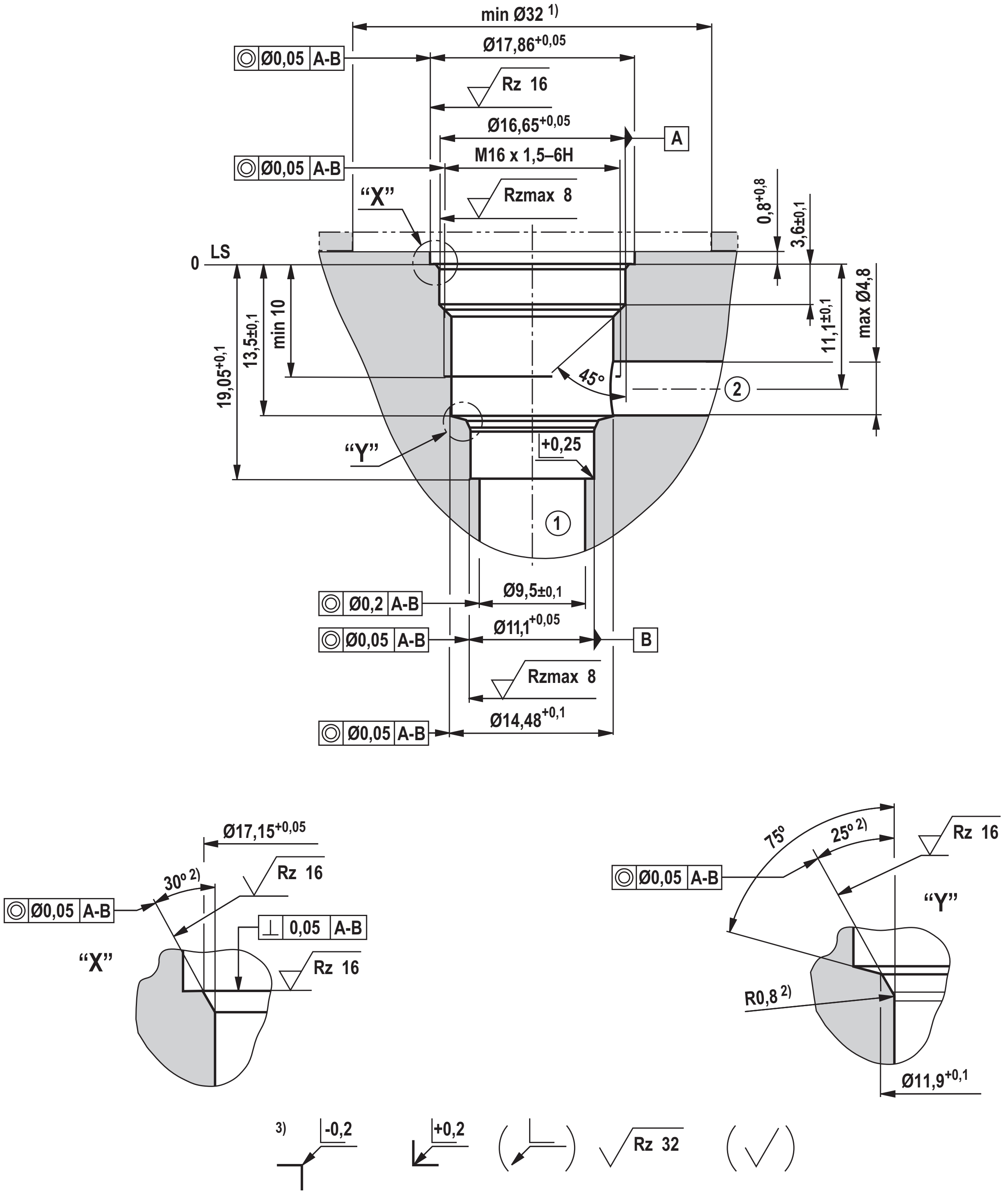
Unit dimensions (dimensions in mm)



① = Main port 1
② = Main port 2
LS = Location Shoulder

1. Mating connector for connector "K4" (separate order, see data sheet 08006)
2. Mating connector for connector "C4" (separate order, see data sheet 08006)
3. Mating connector for connector "K40" (separate order, see data sheet 08006)
4. Space required to remove the mating connector
5. Hexagon SW22 for screwing in the pole tube; tightening torque $M_A = 40^{+6}$ Nm
6. Solenoid nut, tightening torque $M_A = 5^{+1}$ Nm

Mounting cavity R/T-8A; 2 main ports; thread M16 x 1.5-6H (dimensions in mm)



1) With counterbore, deviating from T-8A

2) All seal ring insertion faces are rounded and free of burrs

3) Deviating from T-8A

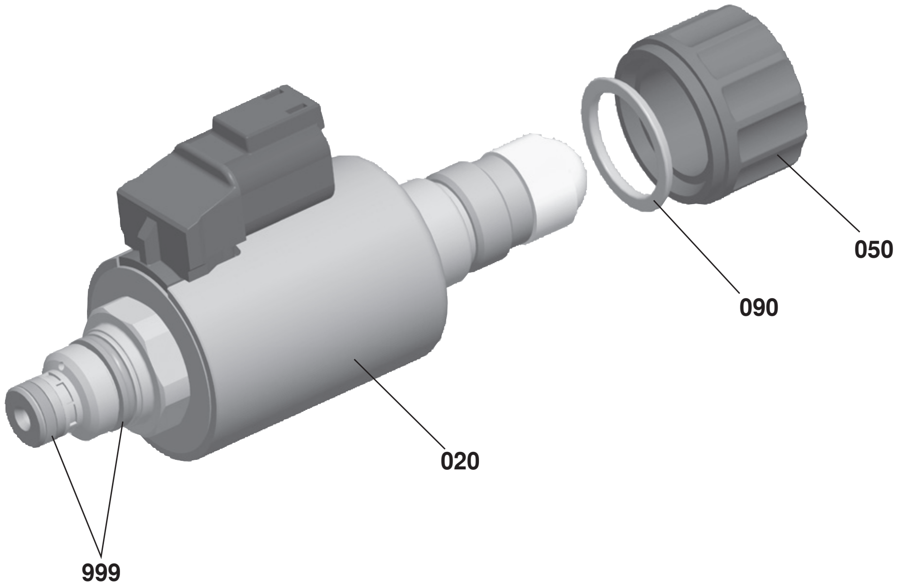
① = Main port 1

② = Main port 2

LS = Location Shoulder

Tolerance for all angles ±0.5°

Available individual components



Item	Denomination		Direct voltage	Material no.
020	Coil for individual connection [1]	Version "K4"	12 V	R901002932
			24 V	R901002319
			24 V / 800 mA	R901049962
		Version "K40"	12 V	R901003055
			24 V	R901003053
			24 V / 800 mA	R901050010
		Version "C4"	12 V	R901003044
			24 V	R901003026
			24 V / 800 mA	R901049963
050	Nut			R900992146
090	Seal ring for pole tube			R900007769
998	Seal kit of the valve			R961000376

[1] ☞ **Notice!**
After exchange of the solenoid coil, the pressure set in the factory may change by ±5 %.

Rexroth
Bosch Group

Proportional pressure relief valve, direct operated, decreasing characteristic curve

RE 18139-05/07.12 1/14
Replaces: 11.11

Type KBPS.8B (High Performance)

Component size 8
Component series A
Maximum operating pressure 420 bar
Maximum flow 2 l/min

H7071

Table of contents

Features

- Cartridge valve
- Mounting cavity R/T-8A
- Direct operated proportional valve for limiting a system pressure
- Suitable for mobile and industrial applications
- Operation by means of proportional solenoid with central thread and detachable coil
- Fine adjustment of the command value pressure characteristic curve possible from the outside at the control electronics
- Set to the maximum pressure via the adjustment screw
- In case of power failure, maximum set pressure

– Control electronics:	Data sheet
• Plug-in proportional amplifier type VT-SSPA1…	30116
• Analog amplifier type RA…	95230
• BODAS control unit type RC…	95200

Ordering code

KBPS		8	B	A /	H	C			V		*

Proportional pressure relief valve, direct operated (pilot control valve)

Pressure rating

up to 30 bar	**= B**
up to 50 bar	**= C**
up to 100 bar	**= F**
up to 150 bar	**= H**
up to 210 bar	**= L**
up to 250 bar	**= N**
up to 315 bar	**= P**
up to 350 bar	**= R**
up to 420 bar	**= T**

Component size 8 **= 8**

Maximum pressure with command value = 0 **= B**

Component series **= A**

High Performance and mounting cavity R/T-8A (see page 13) **= H**

Proportional solenoid, wet-pin **= C**

Supply voltage

G12 = Control electronics 12 V DC
G24 = Control electronics 24 V DC

Electrical connection [1)]

K4 = Without mating connector, with connector according to DIN EN 175301-803
K40 = Without mating connector, with connector DT 04-2PA (Deutsch plug)
C4 = Without mating connector, with connector AMP Junior-Timer

Seal material

V = FKM seals
Attention!
Observe compatibility of the seals with the hydraulic fluid used!

no code = Standard
-8 = Coil 800 mA (see page 5)

* Further details in the plain text

1) Mating connectors, separate order, see data sheet 08006.

Preferred types

Type	Material number
KBPSB8BA/HCG24C4V-8	R901144800
KBPSL8BA/HCG24C4V-8	R901120007
KBPSR8BA/HCG24C4V	R901018607
KBPSL8BA/HCG12C4V	R901056361
KBPSL8BA/HCG24C4V	R901018602
KBPSL8BA/HCG12K40V	R901064385
KBPSN8BA/HCG24K40V	R901016229
KBPSP8BA/HCG24K40V	R901026207
KBPSR8BA/HCG24K40V	R901188705
KBPSP8BA/HCG24K4V	R901018593

Function, section, symbol

General

Valves of type KBPS.8B are direct operated proportional pressure relief valves (pilot control valves) in seat design and are used to limit a system pressure. They basically comprise of the pole tube (3), the solenoid coil (4), the valve seat (5) and the valve poppet (6).

With command value 0 or in case of power failure, the maximum pressure is set. Operation by means of a proportional solenoid with central thread and detachable coil. The solenoid's interior is connected to the main port ② and filled with hydraulic fluid. Depending on the electric command value, these valves can be used to continuously set the system pressure to be limited.

Basic principle

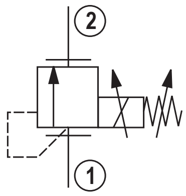
In the factory, the valves are mechanically set to the maximum pressure. For the proportional reduction of the system pressure, a command value is specified at the control electronics. Depending on the command value, the electronics actuate the solenoid with electric current.

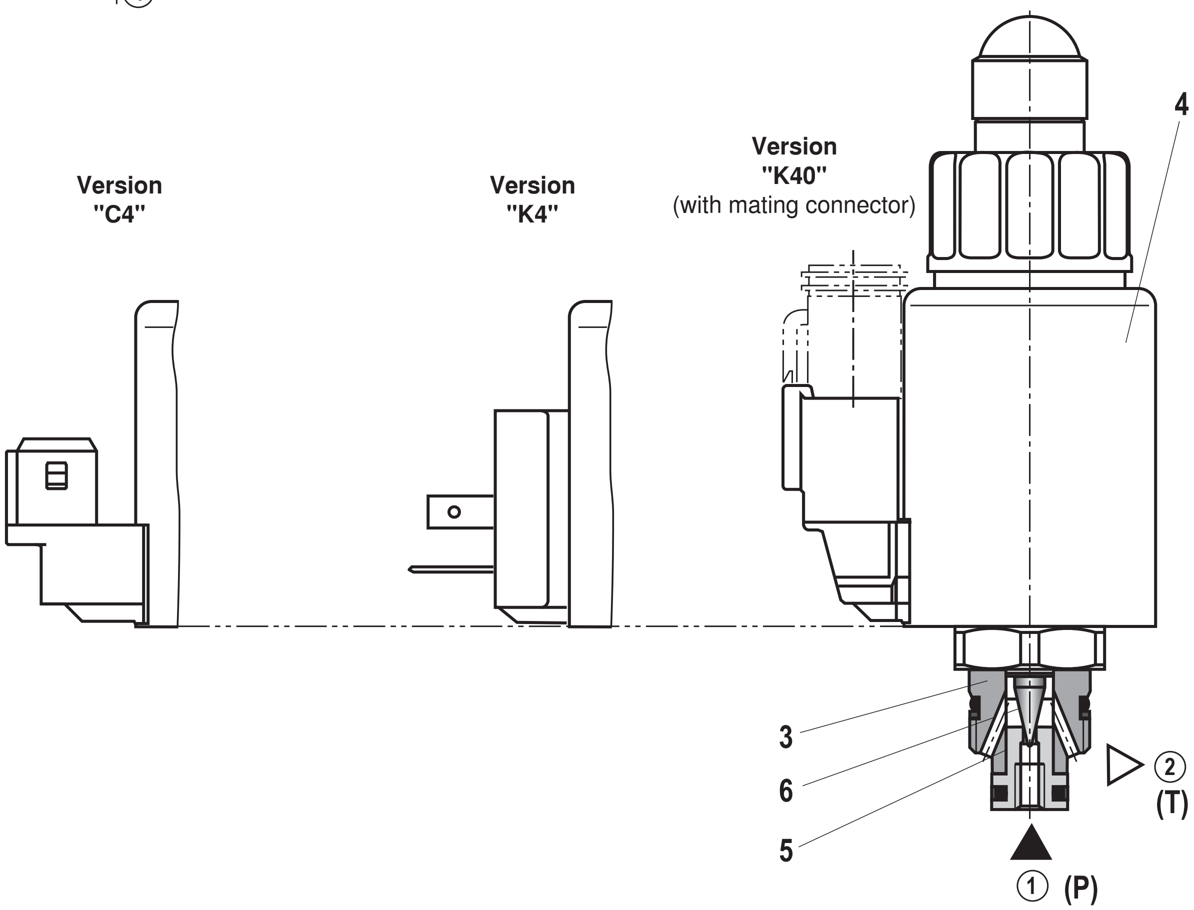
The proportional solenoid converts the electric current into mechanical force that acts against the setting spring via the armature and thus reduces the force on the valve poppet (6). The valve poppet (6) pushes onto the valve seat (5) and blocks the connection between main port ① and ②. If the hydraulic force on the valve poppet (6) corresponds to the force difference between setting spring and solenoid force, the valve controls the set pressure by lifting the valve poppet (6) off the valve seat and thus enabling hydraulic fluid flow from main port ① to ②. If the command value is zero, the maximum pressure is set.

Notice!

Occurring tank pressures (main port ②) are added up to the set values in the main port ①.

Symbol





Technical data (For applications outside these parameters, please consult us!)

general

Weight	kg	0.45
Installation position		Any - if it is ensured that no air can collect upstream the valve. Otherwise, we recommend suspended installation of the valve.
Ambient temperature range	°C	–20 to +120
Storage temperature range	°C	–20 to +80

Environmental audits:

Vibration test according to DIN EN 60068-2 / IEC 60068-2 /2 axes (X/Z)		
DIN EN 60068-2-6: 05/96	Vibrations, sine-shaped	10 cycles (5 Hz to 2000 Hz back to 5 Hz) with logarithmic frequency changing speed of 1 octave/min, 5 to 57 Hz, amplitude 1.5 mm (p-p), 57 to 2000 Hz, amplitude 10 g
IEC 60068-2-64: 05/93	Vibrations (random) and broadband noise	20 to 2000 Hz, amplitude 0.05 g^2/Hz (10 g RMS/30 g peak), testing time 30 min
DIN EN 60068-2-27: 03/95	Shocking	Half sine 15 g / 11 ms, 3 x in positive, 3 x in negative direction (a total of 6 individual shocks)
DIN EN 60068-2-29: 03/95	Bump test	Half sine 25 g / 6 ms, 1000 x in positive, 1000 x in negative direction (a total of 2000 individual shocks)
Indication per axis		
Climatic test according to EN 60068-2 / IEC 60068-2 (environmental test):		
DIN EN 60068-2-1: 03/95	Storage temperature	–40 °C, duration 16 h
DIN EN 60068-2-2: 08/94		+110 °C, duration 16 h
DIN EN 60068-2-1: 03/95	Cold test	2 cycles –25 °C, duration 2 h
DIN EN 60068-2-2: 08/94	Dry heating test	2 cycles +120 °C, duration 2 h
IEC 60068-2-30: 1985	Humid heat, cyclic	Variant 2/ +25 °C to +55 °C 93 % to 97 % relative humidity, 2 cycles à 24 h
Salt spray test: 720 h according to DIN 50021		
→ Coating generally not necessary. If paint is applied nevertheless, the reduced heat dissipation capacity is to be observed.		

hydraulic

Maximum operating pressure [1] (main port ①)	bar	420
Maximum admissible return flow pressure (main port ②)	bar	210
Maximum set pressure [2]		See command value pressure characteristic curves page 6
Minimum set pressure with command value max [3]		See characteristic curves page 8 and 9
Maximum flow	l/min	2 (see characteristic curves page 6 and 7)
Hydraulic fluid		See page 5
Hydraulic fluid temperature range	°C	–20 to +80
Viscosity range	mm^2/s	15 to 380
Maximum permitted degree of contamination of the hydraulic fluid - cleanliness class according to ISO 4406 (c)		Class 20/18/15 [4]

[1] **Attention!** The maximum operating pressure is the total of set pressure and return flow pressure!

[2] **Attention!** The valves are set in the factory. In case of subsequent adjustment, the warranty will become invalid!

[3] If the valve is installed in a mounting cavity made of non-magnetically conductive material, the minimum set pressure is slightly higher.

[4] The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the service life of the components.

Technical data (For applications outside these parameters, please consult us!)

hydraulic

Hysteresis [5]			< 4 % of the max. set pressure
Range of inversion [5]			< 0.5 % of the max. set pressure
Response sensitivity [5]			< 0.5 % of the max. set pressure
Manufacturing tolerance of the command value pressure characteristic curve	– Command value 100 %		< 2 % of the max. set pressure
	– Command value 0		< 5 % of the max. set pressure
Step response (T_u + T_g) 0 → 100 % and/or 100 % → 0		ms	70 (depending on the system)

Hydraulic fluid		Classification	Suitable sealing materials	Standards
Mineral oils		HL, HLP	FKM	DIN 51524
Bio-degradable	– Insoluble in water	HEES	FKM	VDMA 24568
	– Soluble in water	HEPG	FKM	

Important information on hydraulic fluids!
- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, service life, maintenance intervals, etc.)!
- The flash point of the hydraulic fluids used must be 40 K higher than the maximum solenoid surface temperature.
- **Bio-degradable:** When using bio-degradable hydraulic fluids that are simultaneously zinc-solving, zinc may accumulate in the fluid.

electric

Supply voltage		V	12 DC	24 DC	"-8" / 24 DC
Maximum control current		mA	1760	1200	800
Coil resistance	– Cold value at 20 °C	Ω	2.3	4.8	11.5
	– max. hot value	Ω	3.8	7.9	18.9
Switch-on duration		%	100 [6]		
Maximum coil temperature [7]		°C	150		
Protection class according to DIN EN 60529	– Version "K4"		IP 65 with mating connector mounted and locked		
	– Version "K40"		IP 69K with mating connector mounted and locked		
	– Version "C4"		IP 66 with mating connector mounted and locked		
			IP 69K with Rexroth mating connector (material no. R901022127)		
Control electronics (separate order)			– Plug-in proportional amplifier type VT-SSPA1…, see data sheet 30116 – Analog amplifier type RA…, see data sheet 95230 – BODAS control unit type RC…, see data sheet 95200		
Design according to VDE 0580					

[5] Measured with analog amplifier type RA1-1/10, see data sheet 95230

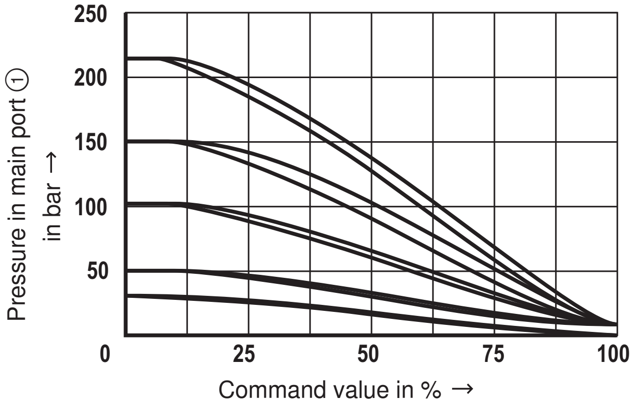
[6] In case of use more than 2000 m a.s.l., please consult us.

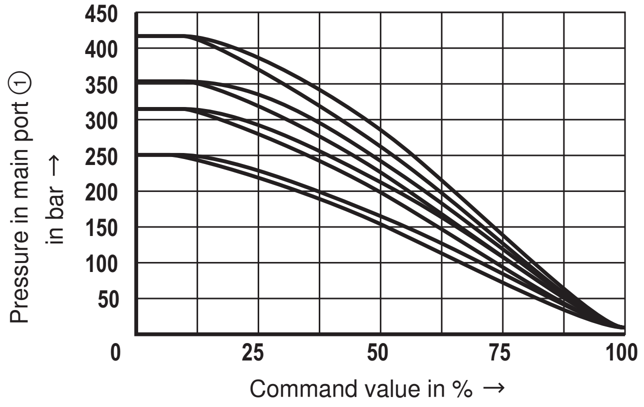
[7] Due to the surface temperatures of the solenoid coils, the standards ISO 13732-1 and EN 982 need to be adhered to!

In the electrical connection, the protective earthing conductor (PE ⏚) must be connected properly.

Characteristic curves (measured with HLP46, ϑ_{Oil} = 40 °C ± 5 °C and 24 V coil)

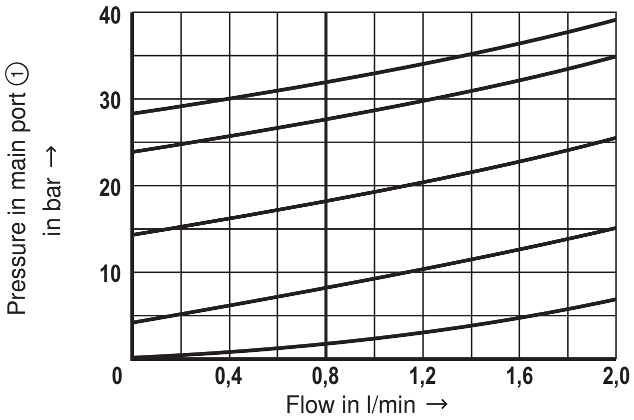
Pressure in main port ① depending on the command value. Flow = 0.8 l/min



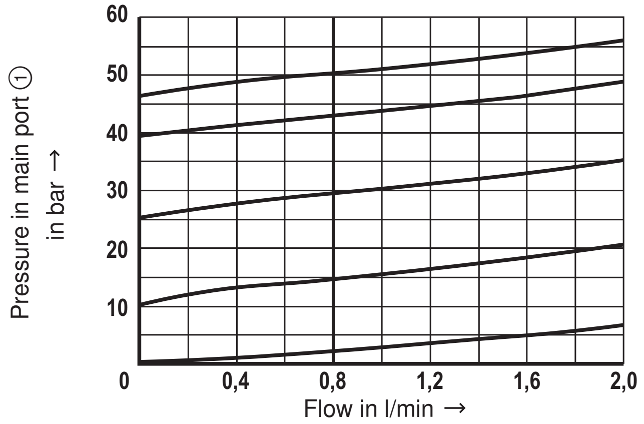


Pressure in main port ① depending on the flow.
(The characteristic curve was measure without counter pressure in main port ②.)

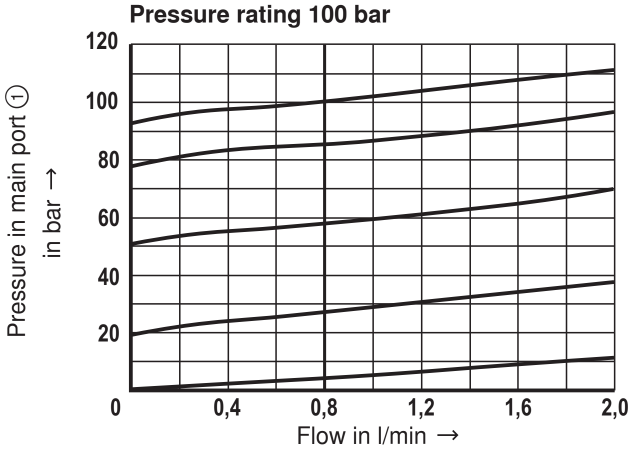
Pressure rating 30 bar



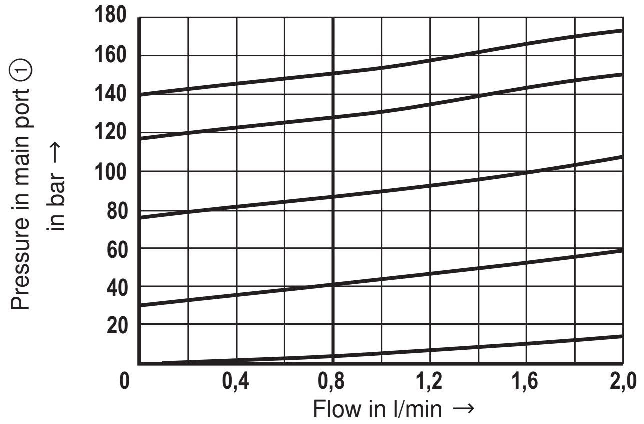
Pressure rating 50 bar



Pressure rating 100 bar



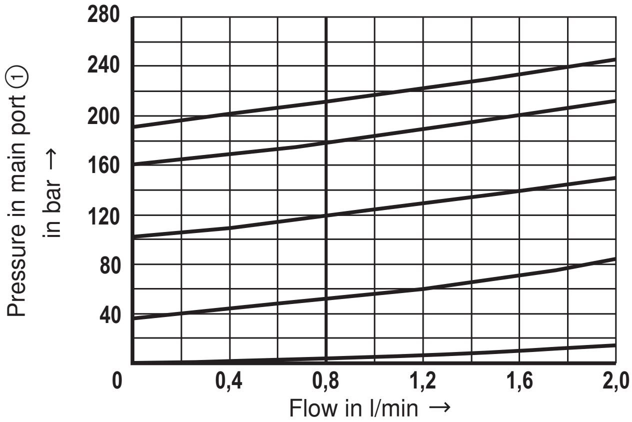
Pressure rating 150 bar



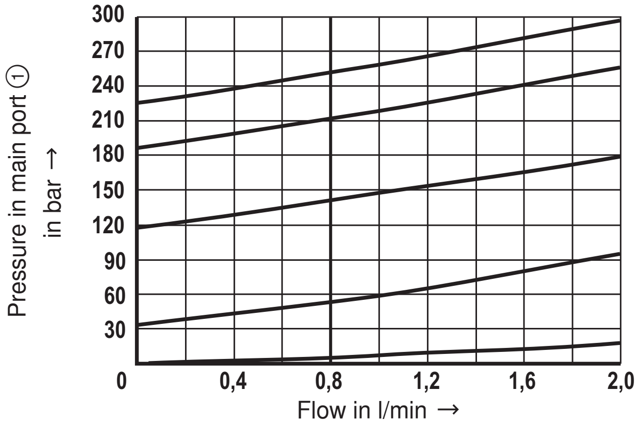
Characteristic curves (measured with HLP46, ϑ_{Oil} = 40 °C ± 5 °C and 24 V coil)

Pressure in main port ① depending on the flow.
(The characteristic curve was measure without counter pressure in main port ②.)

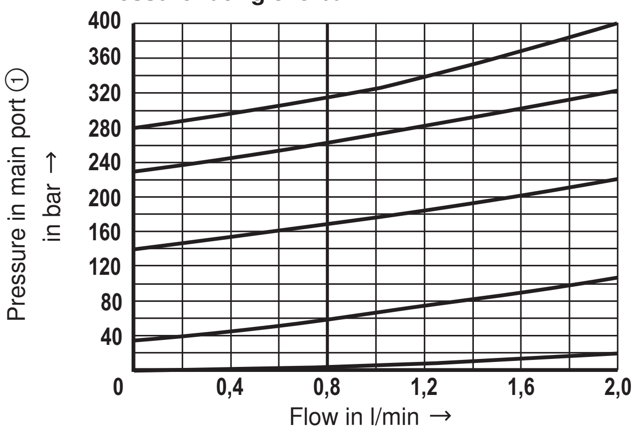
Pressure rating 210 bar



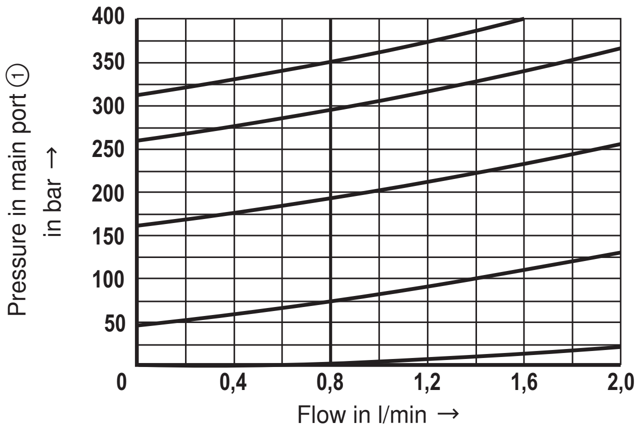
Pressure rating 250 bar



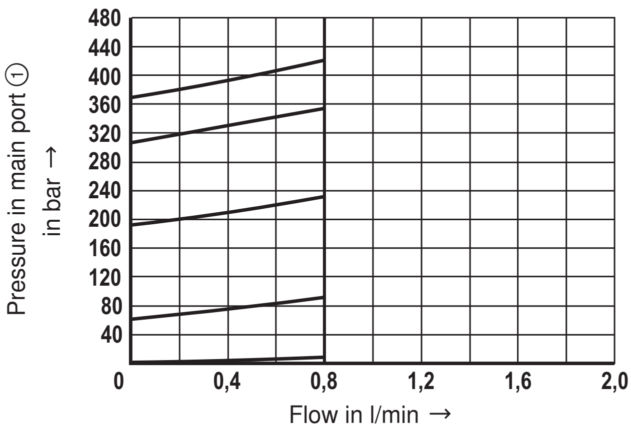
Pressure rating 315 bar



Pressure rating 350 bar

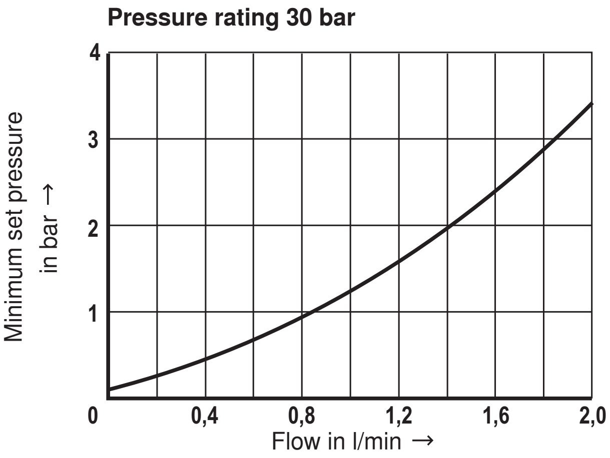


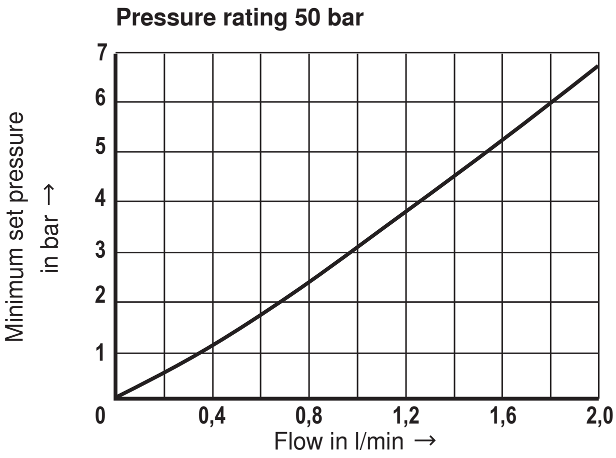
Pressure rating 420 bar

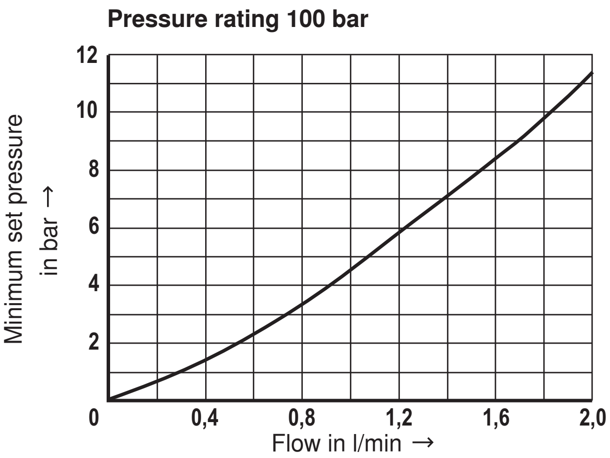


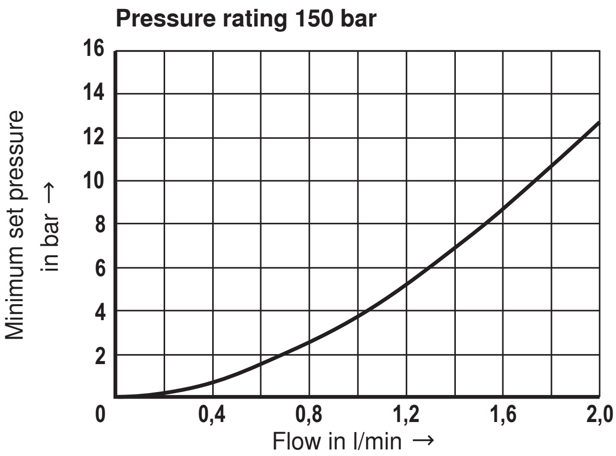
Characteristic curves (measured with HLP46, ϑ_{Oil} = 40 °C ± 5 °C and 24 V coil)

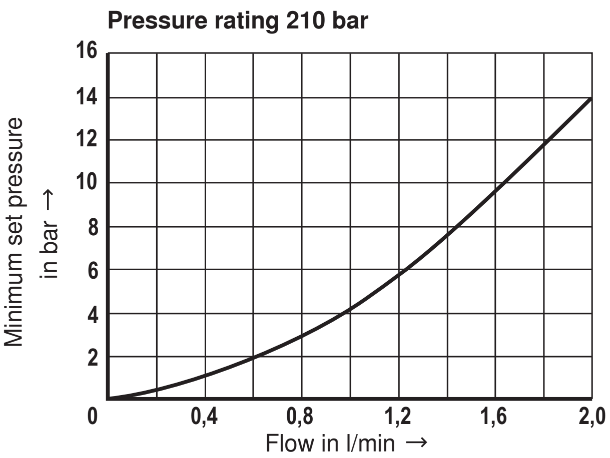
Minimum set pressure in main port ① with command value 100 %.
(The characteristic curve was measure without counter pressure in main port ②.)

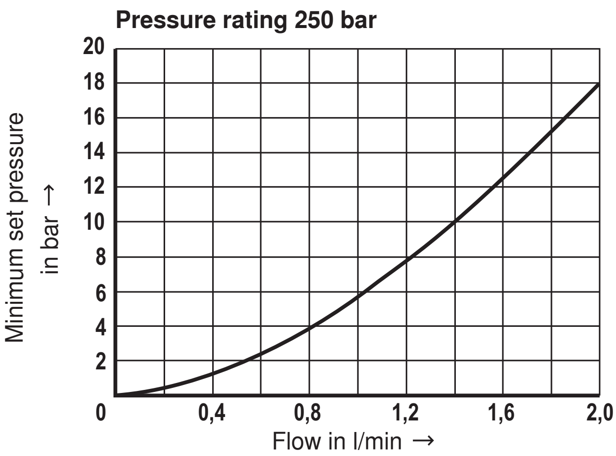






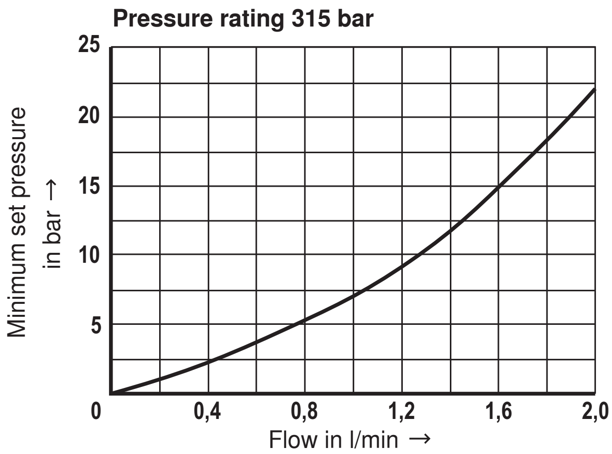


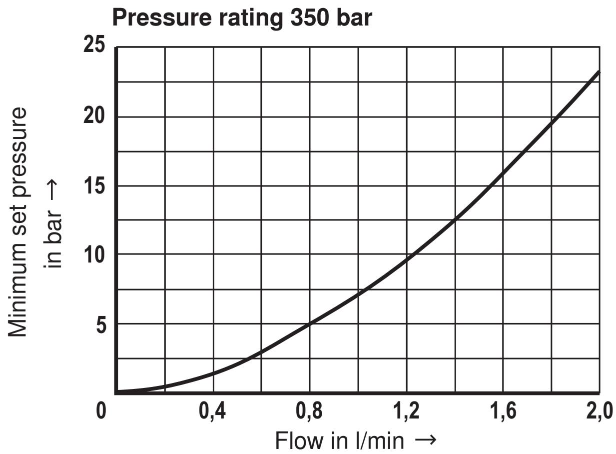


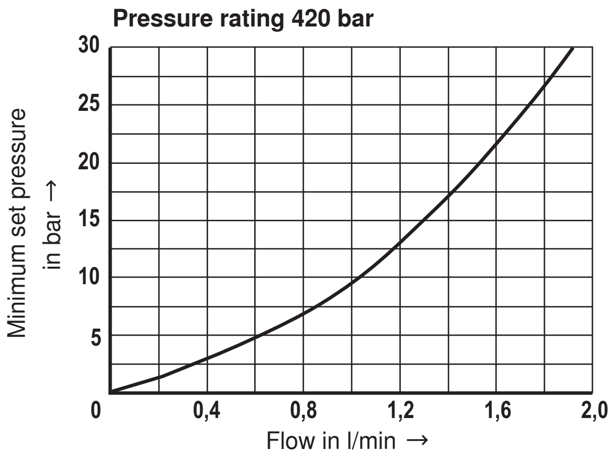


Characteristic curves (measured with HLP46, ϑ_{Oil} = 40 °C ± 5 °C and 24 V coil)

Minimum set pressure in main port ① with command value 100 %.
(The characteristic curve was measure without counter pressure in main port ②.)



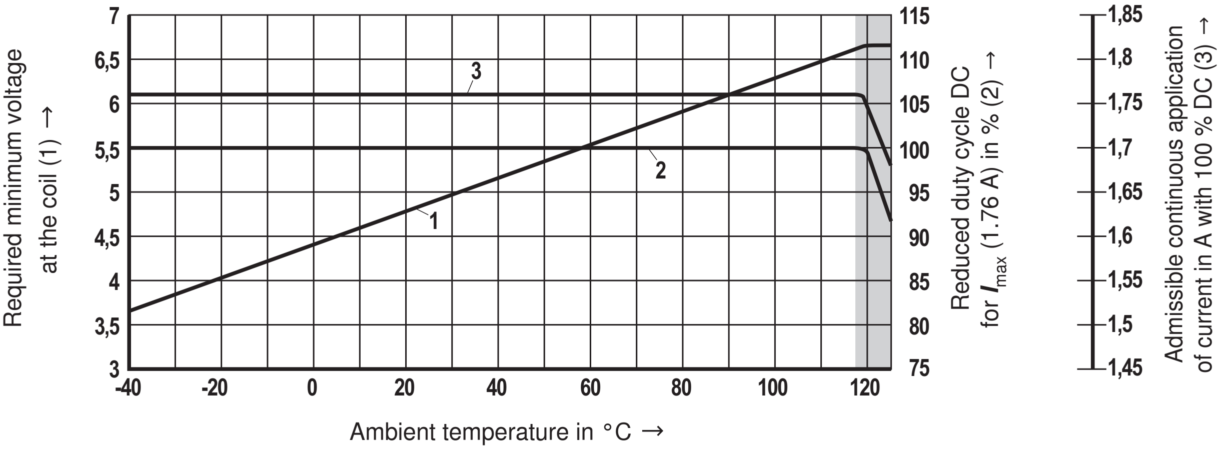




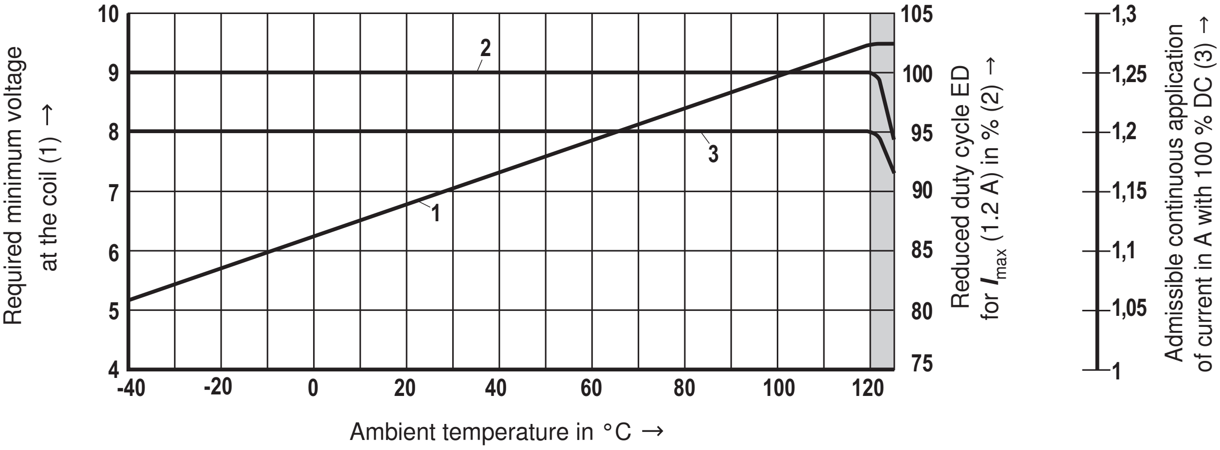
Minimum terminal voltage at the coil and relative duty cycle

Admissible working range against the ambient temperature

– Version "G12"



– Version "G24"



Limited valve performance

☞ **Notice!**

The characteristic curves have been determined for coils with valve with medium test block size (80 x 80 x 80 mm), without flow in calm air.

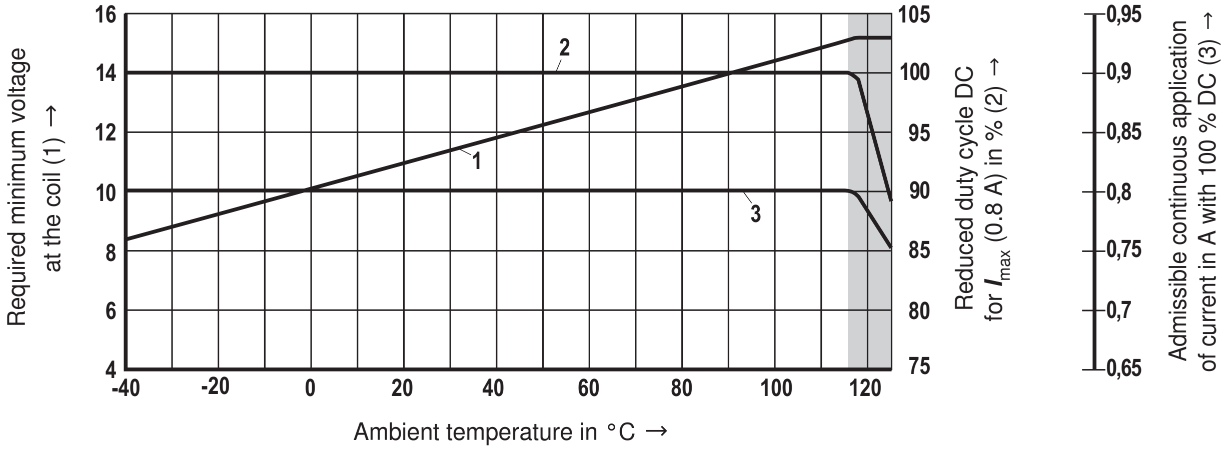
Depending on the installation conditions (block size, flow, air circulation, etc.) there may be a better heat dissipation. Thus, the area of application is broadened.

In single cases, more unfavorable conditions may lead to limitations of the area of application.

Minimum terminal voltage at the coil and relative duty cycle

Admissible working range against the ambient temperature

– Version "G24...-8"



Limited valve performance

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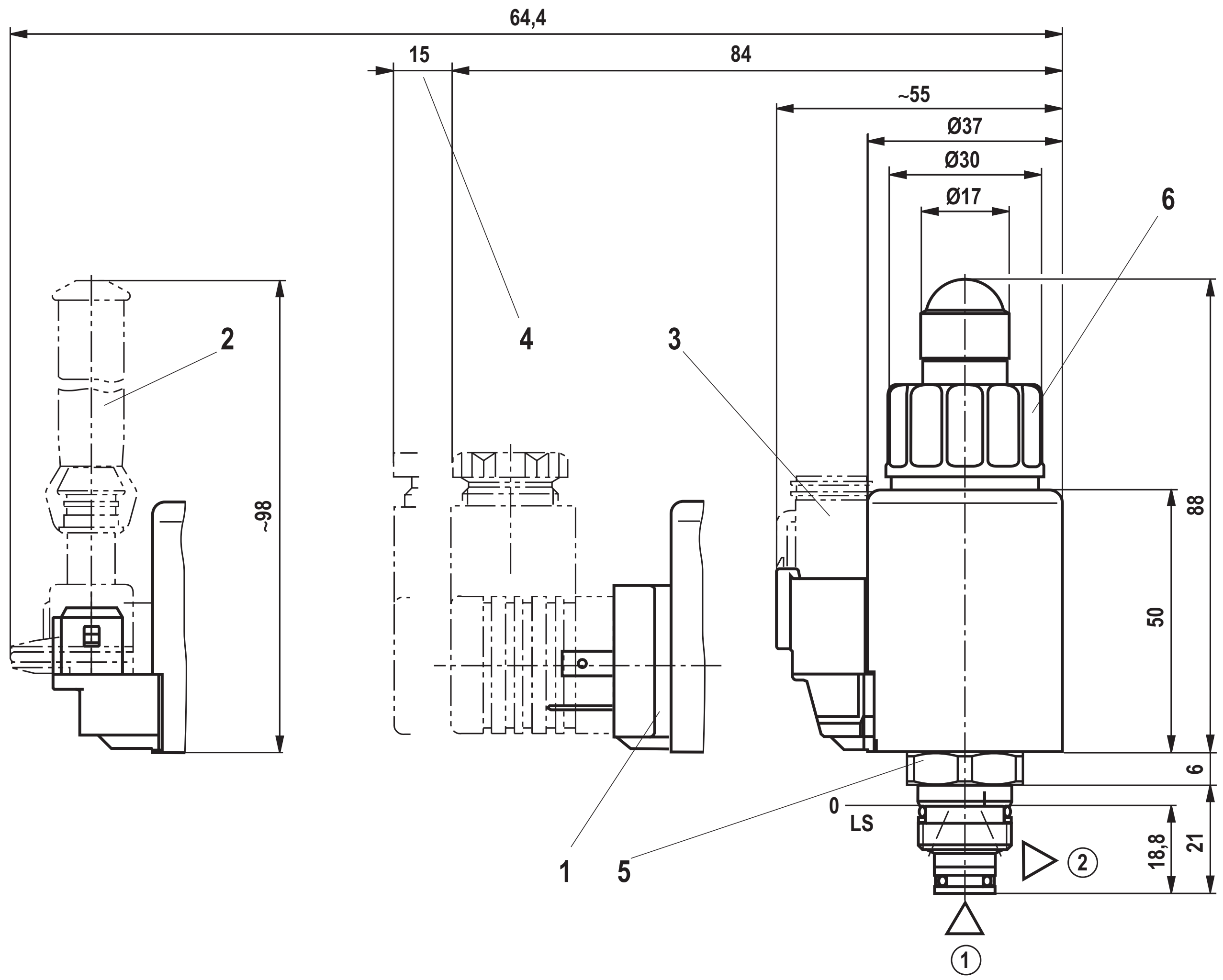
The characteristic curves have been determined for coils with valve with medium test block size (80 x 80 x 80 mm), without flow in calm air.

Depending on the installation conditions (block size, flow, air circulation, etc.) there may be a better heat dissipation. Thus, the area of application is broadened.

In single cases, more unfavorable conditions may lead to limitations of the area of application.

Unit dimensions (dimensions in mm)



① = main port 1

② = main port 2

LS = Location Shoulder

1 Mating connector for connector "K4" (separate order, see data sheet 08006)

2 Mating connector for connector "C4" (separate order, see data sheet 08006)

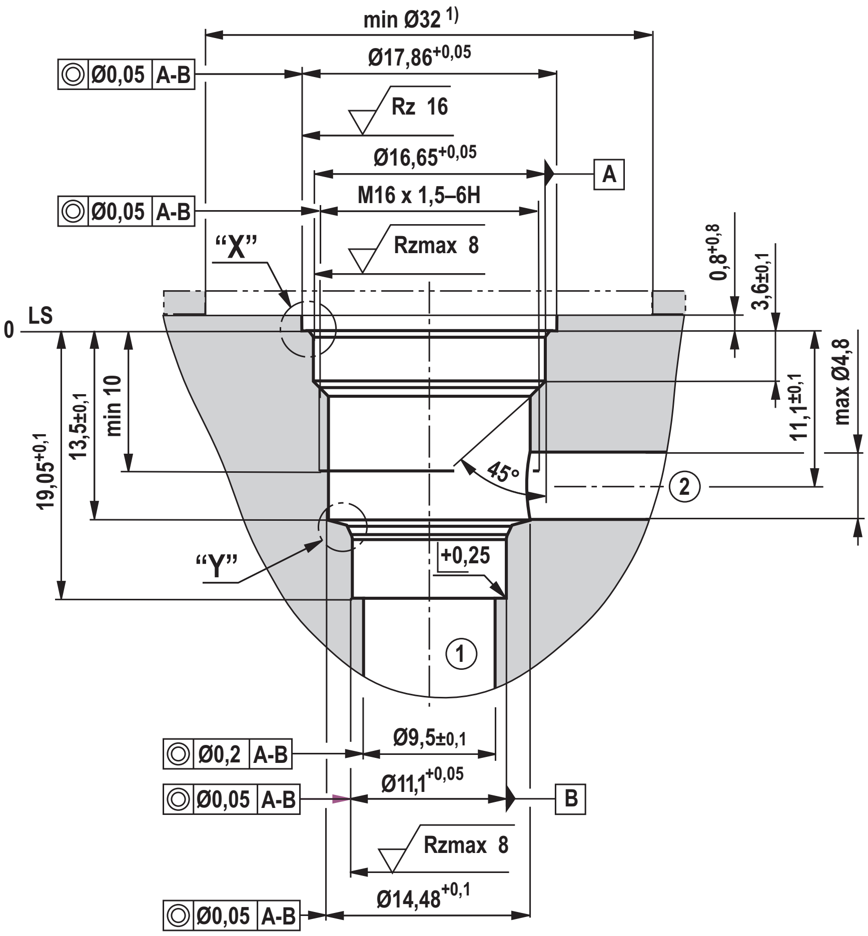
3 Mating connector for connector "K40" (separate order, see data sheet 08006)

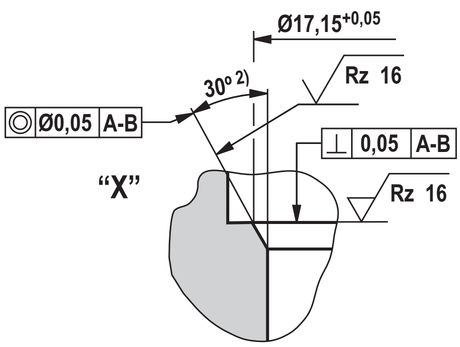
4 Space required to remove the mating connector

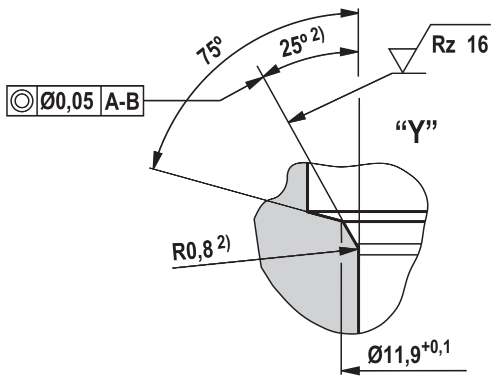
5 Hexagon SW22 for screwing in the pole tube; tightening torque $M_A = 40^{+6}$ Nm

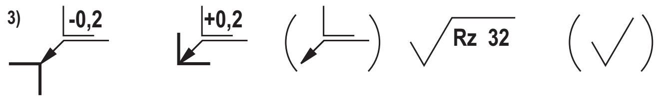
6 Solenoid nut, tightening torque $M_A = 5^{+1}$ Nm

Mounting cavity R/T-8A; 2 main ports; thread M16 x 1.5-6H (dimensions in mm)









1) With counterbore, deviating from T-8A

2) All seal ring insertion faces are rounded and free of burrs

3) Deviating from T-8A

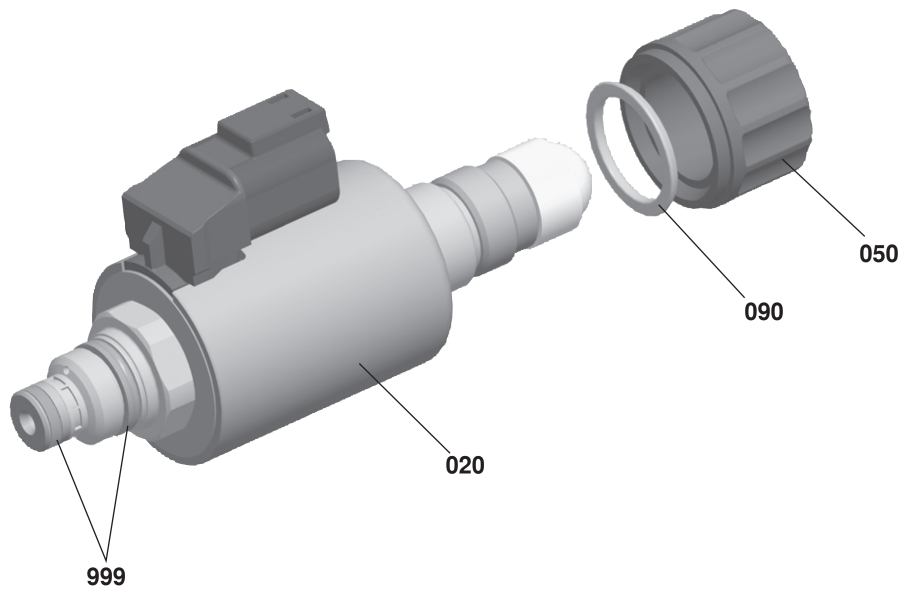
① = main port 1

② = main port 2

LS = Location Shoulder

Tolerance for all angles ±0.5°

Available individual components



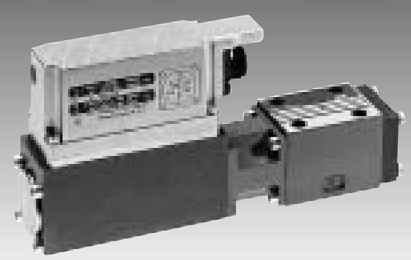
Item	Denomination		Direct voltage	Material no.
020	Coil for individual connection [1]	Version "K4"	12 V	R901002932
			24 V	R901002319
			24 V / 800 mA	R901049962
		Version "K40"	12 V	R901003055
			24 V	R901003053
			24 V / 800 mA	R901050010
		Version "C4"	12 V	R901003044
			24 V	R901003026
			24 V / 800 mA	R901049963
050	Nut			R900992146
090	Seal ring for pole tube			R900007769
998	Seal kit of the valve			R961000376

[1] ☞ **Notice!**
After exchange of the solenoid coil, the pressure set in the factory may change by ±5 %.

Rexroth
Bosch Group

Proportional pressure relief valve, pilot operated, with on-board electronics (OBE) and position feedback

Type DBEBE6X



Nominal size 6
Unit series 1X
Maximum working pressure P 315 bar, T 250 bar
Maximum flow rate 40 l/min

List of Contents

Contents	Page

Features

– Pilot operated valves with position feedback and on-board electronics for limiting system pressure (pilot oil internal only)
– Adjustable through the position of the armature against the compression spring
– Position-controlled, minimal hysteresis <1%, rapid response times, see Technical Data
– Pressure limitation to a safe level even with faulty electronics (solenoid current $I > I_{max}$)
– For subplate attachment, mounting hole configuration to ISO 4401-03-02-0-94. Subplates as per catalog sheet RE 45053 (order separately)
– Plug-in connector to DIN 43563-AM6, see catalog sheet RE 08008 (order separately)
– Data for the on-board trigger electronics
  • Complies with CE, EMC directives EN 61000-6-2: 2002-08 and EN 61000-6-3: 2002-08
  • U_B = 24 V_{nom}DC
  • Electrical connection 6P+PE
  • Signal actuation
    – Standard 0...+10 V (A1)
    – Version 4...20 mA (F1)
  • Valve curve calibrated at the factory

Ordering data

DBEB	E	6	X	–1X	/	G24	K31		M	*

Proportional pressure relief valve with inductive position transducer on the cone

With on-board electronics **= E**

Nominal size **= 6**

Mounting hole configuration to ISO 4401-03-02-0-94 **= X**

Unit series 10 to 19 **= 1X**
(10 to 19: installation and connection dimensions unchanged)

Max. pressure stage
up to 80 bar **= 80**
up to 180 bar **= 180**
up to 315 bar **= 315**

Voltage supply of trigger electronics 24 V DC **= G24**

K31 = **Electrical connection**
without plug-in connector,
with unit plug to DIN 43563-AM6
Order plug-in connector separately

Interface for trigger electronics
A1 = Setpoint input 0...+10 V
F1 = Setpoint input 4...20 mA

M = NBR seals, suitable for mineral oils (HL, HLP) to DIN 51524

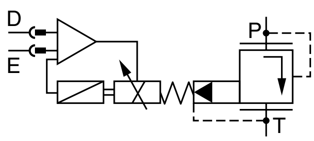
Further information in plain text

Preferred types

Type ....A1 (0...+10 V)	Material Number	Type ....F1 (4...20 mA)	Material Number
DBEBE6X–1X/80G24K31A1M	0 811 402 078	DBEBE6X–1X/80G24K31F1M	0 811 402 084
DBEBE6X–1X/180G24K31A1M	0 811 402 077	DBEBE6X–1X/180G24K31F1M	0 811 402 079
DBEBE6X–1X/315G24K31A1M	0 811 402 076		

Symbol

For on-board electronics



Function, sectional diagram

General

Type DBEBE6X proportional pressure relief valves are pilot valves that are used to limit system pressure. The valves are actuated by means of a position-controlled proportional solenoid with on-board electronics.
With these valves, rapid response times with low hysteresis can be achieved.

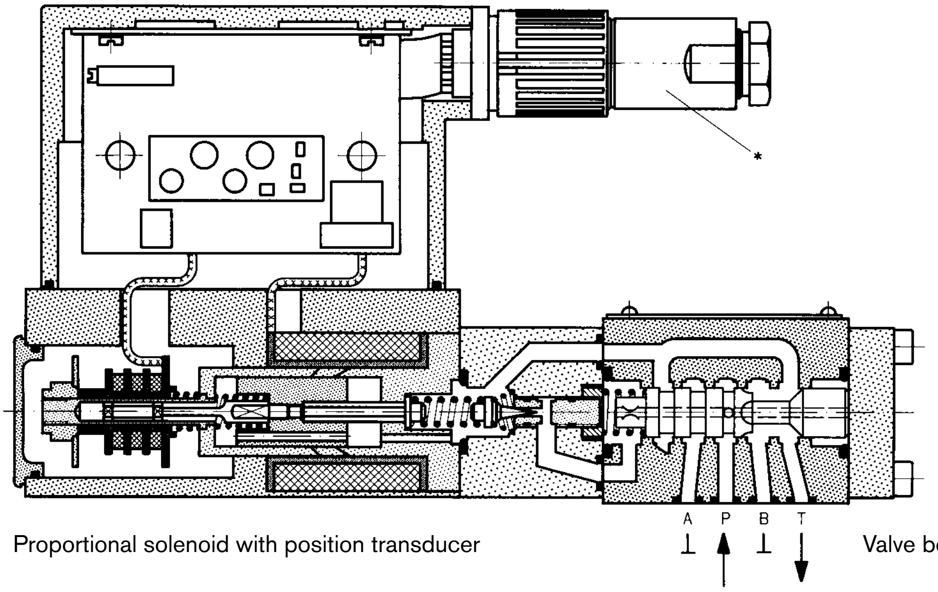
CE EN 61000-6-2: 2002-08
EN 61000-6-3: 2002-08

Basic principle

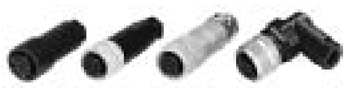
To adjust the system pressure, a setpoint is set in the trigger electronics. Based on this setpoint, the electronics control the position-controlled solenoid.
The proportional solenoid maintains its position against a spring force, which is proportionate to the system pressure.
The pilot stage is supplied with pilot oil through a bore hole at <0.6 l/min. The "p_{max}" pressure stage is determined by the cone and seating bore configuration.

Pressure limitation for maximum safety

If a fault occurs in the electronics, so that the solenoid current (I_{max}) would exceed its specified level in an uncontrolled manner, the pressure cannot rise above the level determined by the maximum spring force.



Accessories

Type			Material Number
(4 x) ISO 4762-M5x30-10.9	Cheese-head bolts		2 910 151 166
* 	Plug-in connectors 6P+PE, see also RE 08008	KS	1 834 482 022
		KS	1 834 482 026
		MS	1 834 482 023
		MS	1 834 482 024
		KS 90°	1 834 484 252

Testing and service equipment

Test box type VT-PE-TB3, see RE 30065
Measuring adapter 6P+PE type VT-PA-2, see RE 30068

Technical data

General

Construction	Pilot stage	Poppet valve
	Main stage	Spool valve
Actuation		Proportional solenoid with position control and OBE
Connection type		Subplate, mounting hole configuration NG6 (ISO 4401-03-02-0-94)
Mounting position		Optional
Ambient temperature range	°C	–20...+50
Weight	kg	3.4
Vibration resistance, test condition		Max. 25 g, shaken in 3 dimensions (24 h)

Hydraulic (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

Pressure fluid		Hydraulic oil to DIN 51524...535, other fluids after prior consultation		
Viscosity range recommended	mm²/s	20...100		
max. permitted	mm²/s	10...800		
Pressure fluid temperature range	°C	–20...+70		
Maximum permitted degree of contamination of pressure fluid Purity class to ISO 4406 (c)		Class 18/16/13 [1)]		
Direction of flow		See symbol		
Max. set pressure (at $Q = 1$ l/min)	bar	80	180	315
Minimum pressure (at $Q = 1$ l/min)	bar	7	8	10
Max. mechanical pressure limitation level, e.g. when solenoid current $I > I_{max}$	bar	<90	<190	<325
Max. working pressure	bar	Port P: 315		
Max. pressure	bar	Port T: 250		
Pilot oil flow	l/min	approx. 0.6		
Max. flow	l/min	40		

Static/Dynamic

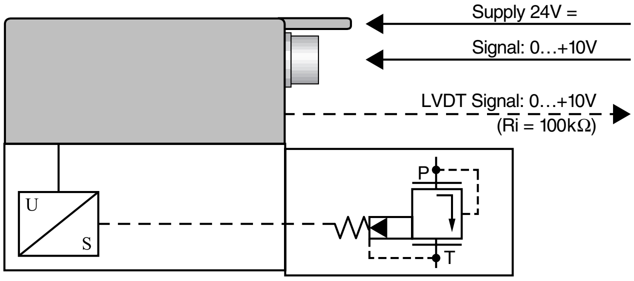
Hysteresis	%	≦ 1	
Manufacturing tolerance	%	≦ ±5	
Response time 100 % signal change	ms	70	Response time at: $Q = 10$ l/min (values depend on the dead volume)
10 % signal change	ms	15	
Thermal drift		<1 % at $\Delta T = 40\,°C$	
Conformity		CE EN 61000-6-2: 2002-08 EN 61000-6-3: 2002-08	

[1)] The purity classes stated for the components must be complied with in hydraulic systems.
Effective filtration prevents problems and also extends the service life of components.
For a selection of filters, see catalog sheets RE 50070, RE 50076 and RE 50081.

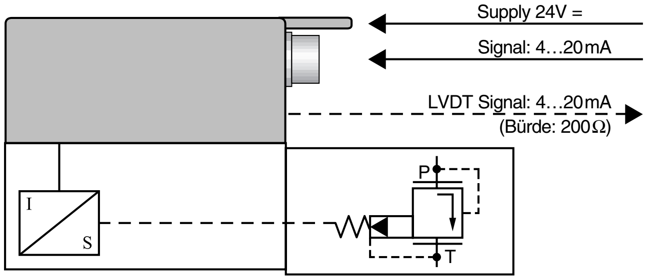
Technical data

Electrical, trigger electronics integrated in valve		
Cyclic duration factor	%	100
Degree of protection		IP 65 to DIN 40050 and IEC 14434/5
Connection		Plug-in connector 6P+PE, DIN 43563
Supply voltage Terminal A: Terminal B: 0 V		24 V DC_{nom} Min. 21 V DC/max. 40 V DC Ripple max. 2 V DC
Power consumption		Solenoid ⧄ 45 mm = 40 VA max.
External fuse		2.5 A_F
Input, “standard” version Terminal D: U_E Terminal E:	A1	Differential amplifier, R_i = 100 kΩ 0...+10 V 0 V
Input, “mA signal” version Terminal D: I_{D-E} Terminal E: I_{D-E}	F1	Burden, R_{sh} = 200 Ω 4...20 mA Current loop I_{D-E} feedback
Max. voltage to differential inputs over 0 V		$\left.\begin{array}{l} D \to B \\ E \to B \end{array}\right\}$ max. 18 V DC
Test signal, “standard” version Terminal F: U_{Test} Terminal C:	A1	LVDT 0...+10 V Reference 0 V
Test signal, “mA signal” version Terminal F: I_{F-C} Terminal C: I_{F-C}	F1	LVDT signal 4...20 mA at external load 200...500 Ω max. 4...20 mA output Current loop I_{F-C} feedback
Safety earth conductor and shield		See pin assignment (installation in conformity with CE)
Recommended cable		See pin assignment up to 20 m 7 x 0.75 mm^2 up to 40 m 7 x 1 mm^2
Calibration		Calibrated at the factory, see valve curve

Version A1: Standard

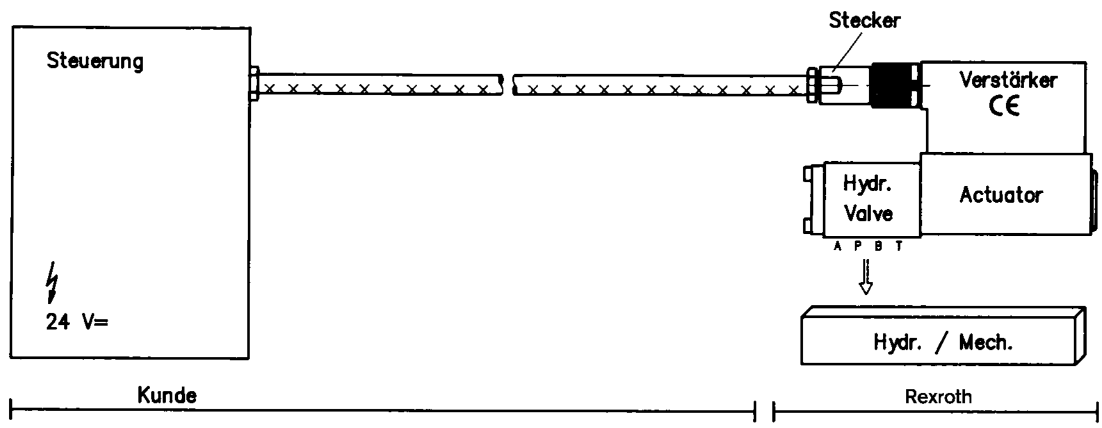


Version F1: mA signal



Connection

For electrical data, see page 5 and
Operating Instructions **1 819 929 083**



Technical notes for the cable

Version: – Multi-wire cable
– Extra-finely stranded wire to VDE 0295, Class 6
– Safety earth conductor, green/yellow
– Cu braided shield

Type: – e.g. Ölflex-FD 855 CP (from Lappkabel company)

No. of wires: – Determined by type of valve, plug type and signal assignment

Cable Ø: – 0.75 mm^2 up to 20 m long
– 1.0 mm^2 up to 40 m long

Outside Ø: – 9.4...11.8 mm – Pg11
– 12.7...13.5 mm – Pg16

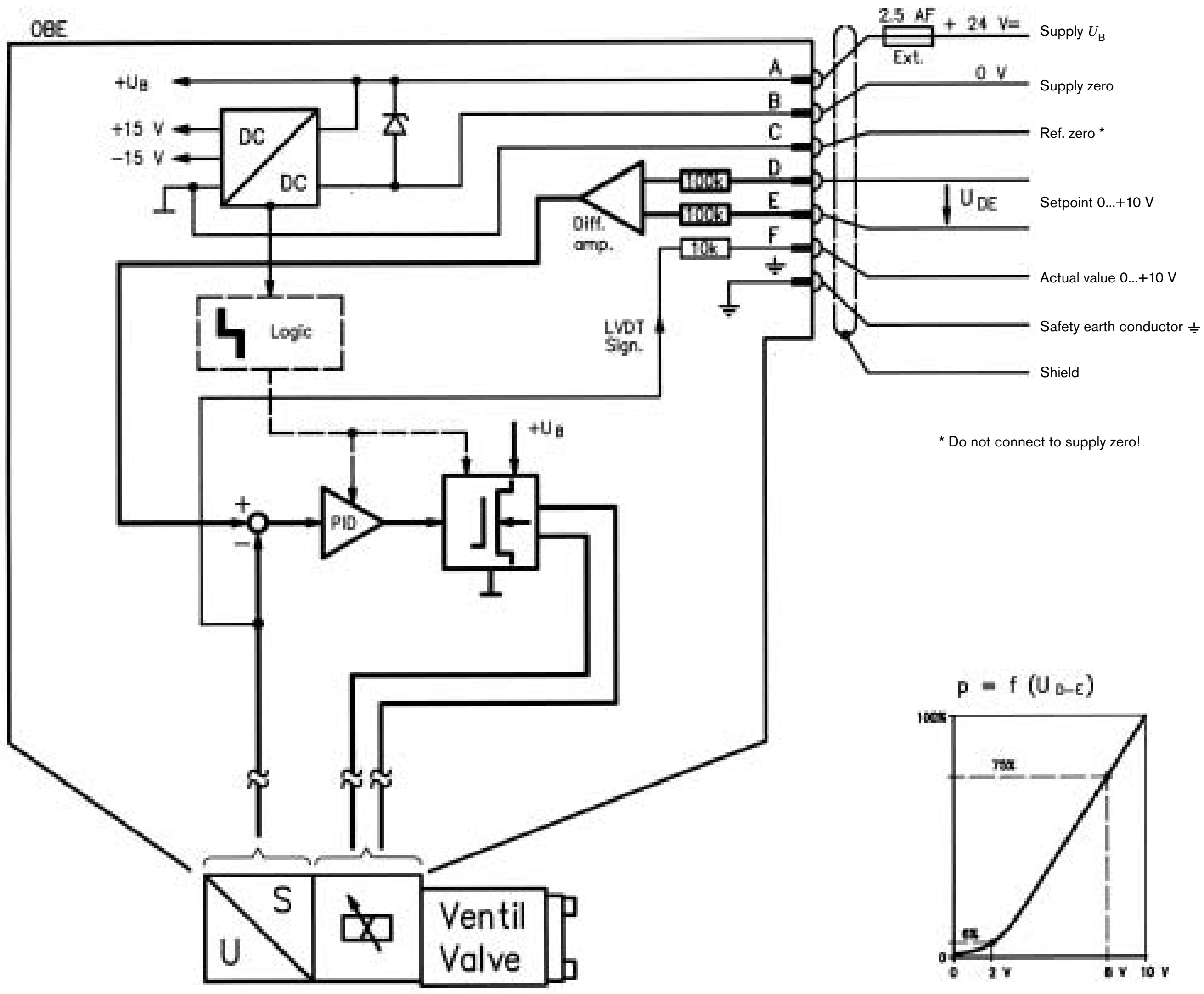
Important

Power supply 24 V DC nom,
if voltage drops below 18 V DC, rapid shutdown resembling "Enable OFF" takes place internally.
In addition, with the "mA signal" version:
$I_{D-E} \geqq 3$ mA – valve is active
$I_{D-E} \leqq 2$ mA – valve is deactivated.
Electrical signals emitted via the trigger electronics (e.g. actual values) must not be used to shut down safety-relevant machine functions!
(See also European Standard, "Technical Safety Requirements for Fluid-Powered Systems and Components – Hydraulics", EN 982).

On-board trigger electronics

Circuit diagram/pin assignment

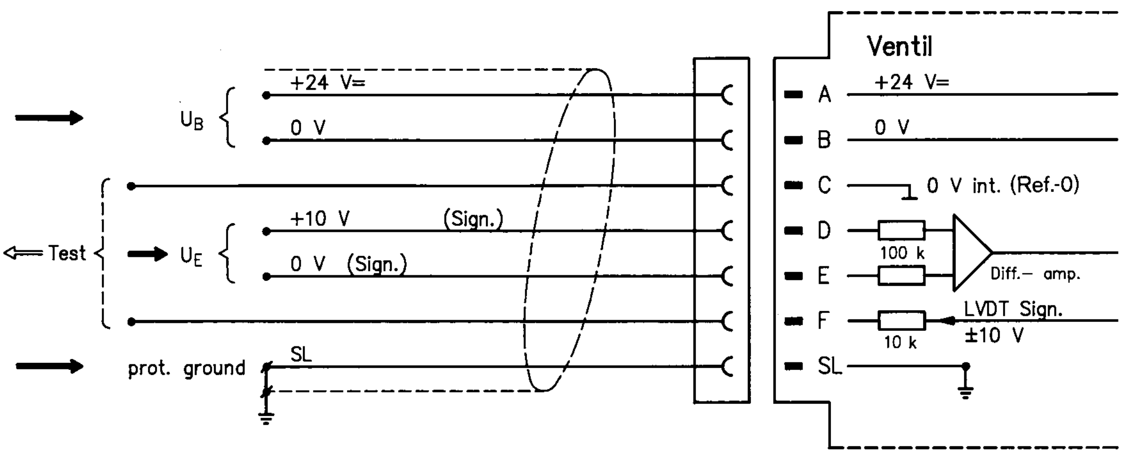
Version A1: U_{D-E} 0...+10 V



Pin assignment

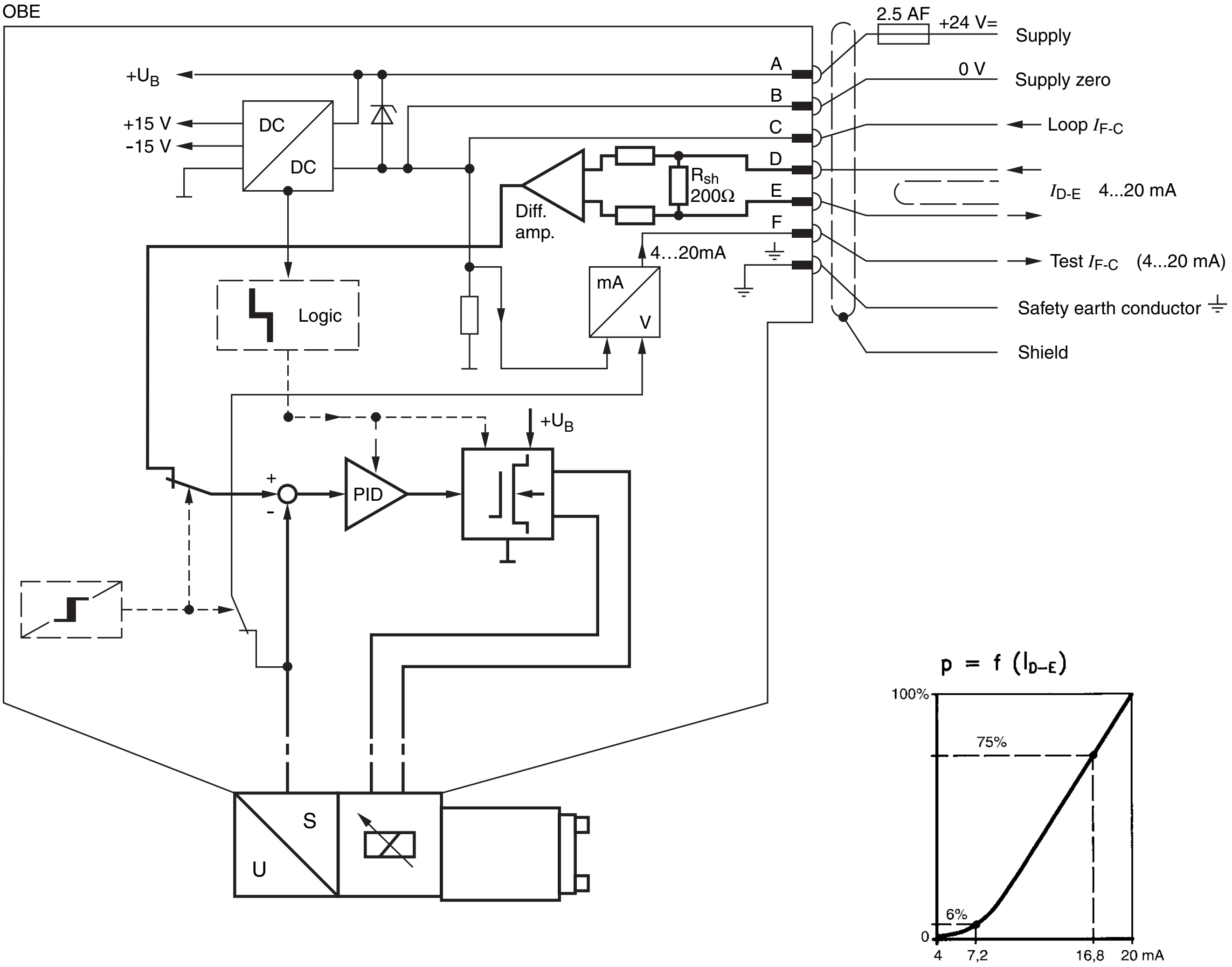
Version A1: U_{D-E} 0...+10 V

(R_i = 100 kΩ)

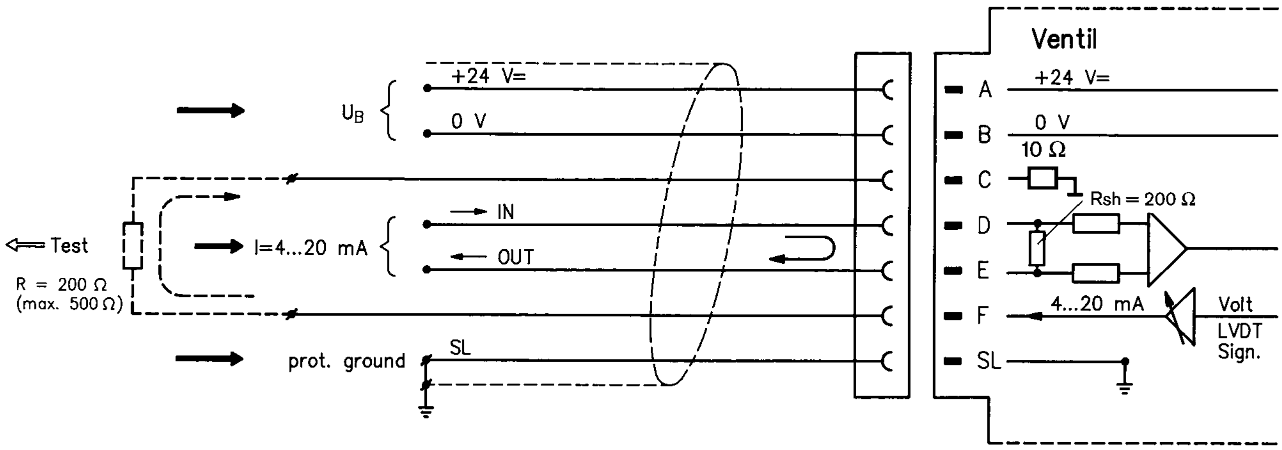


On-board trigger electronics

Circuit diagram/pin assignment
Version F1: I_{D-E} 4...20 mA

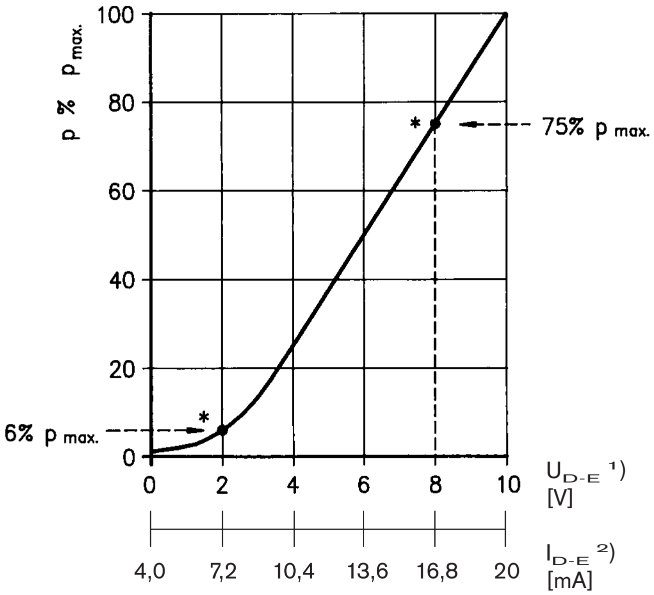


Pin assignment 6P+PE
Version F1: I_{D-E} 4...20 mA
(R_{sh} = 200 kΩ)



Characteristic curves (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

Pressure in port P as a function of the setpoint

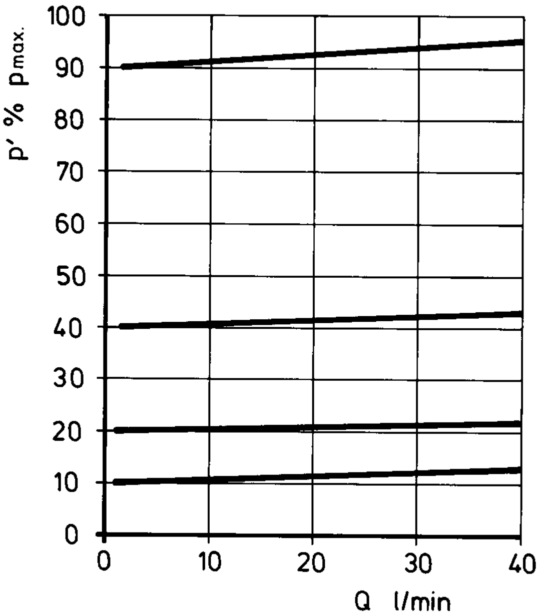


* Factory setting at $Q = 1$ l/min ±5 % manufacturing tolerance

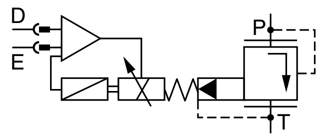
1) Version: $U_{D-E} = 0...+10$ V

2) Version: $I_{D-E} = 4...20$ mA

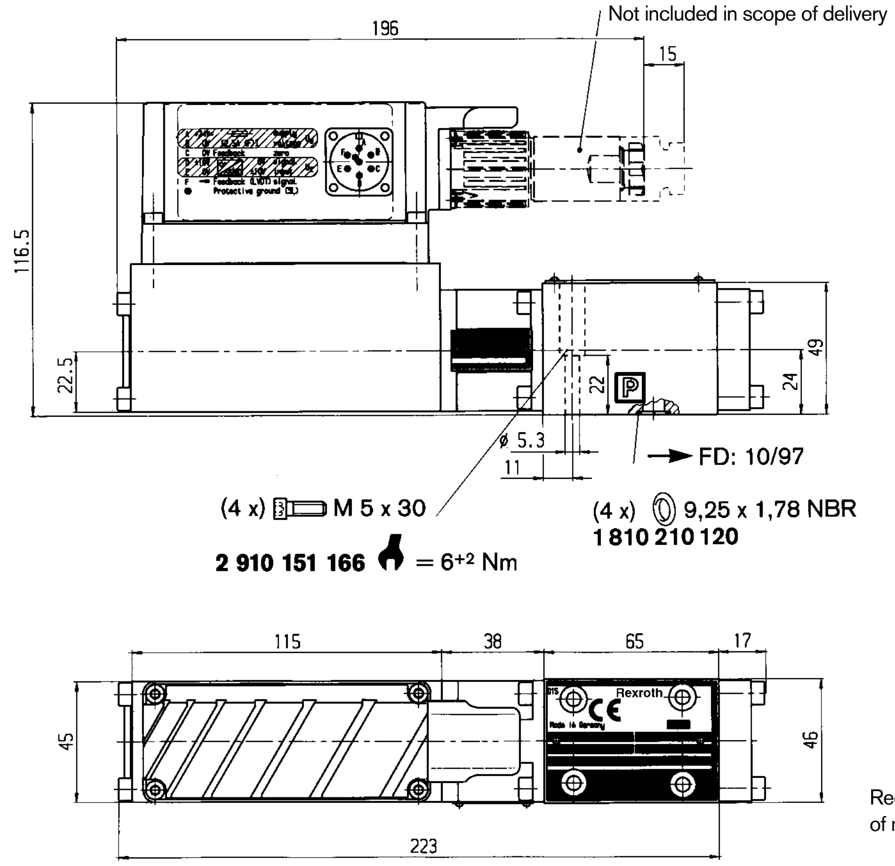
Pressure in port P proportionate to the maximum flow rate of the main stage



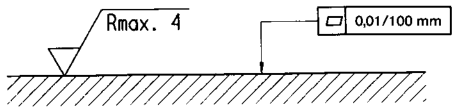
Set pressure
$p' = f\,(Q_{P-T})$



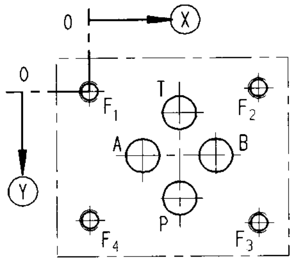
Unit dimensions (nominal dimensions in mm)



Required surface quality
of mating component



Mounting hole configuration: NG6 (ISO 4401-03-02-0-94)
For subplates see catalog sheet RE 45053



1) Deviates from standard
2) Thread depth:
Ferrous metal 1.5 x Ø
Non-ferrous 2 x Ø

	P	A	T	B	F_1	F_2	F_3	F_4
X	21.5	12.5	21.5	30.2	0	40.5	40.5	0
Y	25.9	15.5	5.1	15.5	0	–0.75	31.75	31
Ø	8 1)	8 1)	8 1)	8 1)	M5 2)	M5 2)	M5 2)	M5 2)

Proportional pressure relief valve, pilot operated, with on-board electronics (OBE) and position feedback

Type DBEBE10Z

Nominal size 10
Unit series 1X
Maximum working pressure A, B, X 315 bar, Y 2 bar
Maximum flow rate Q_{nom} 120 l/min

List of Contents

Features

- Pilot operated valves with position feedback and on-board electronics for limiting system pressure (pilot oil internal only)
- Adjustable through the position of the armature against the compression spring
- With position control, minimal hysteresis $<$1 %, rapid response times, see Technical Data
- Pressure limitation to a safe level even with faulty electronics (solenoid current $I > I_{max}$)
- For subplate attachment, mounting hole configuration to ISO 5781-AG-06-2-A
  Subplates as per catalog sheet RE 45055
  (order separately)
- Plug-in connector to DIN 43563-AM6, see catalog sheet RE 08008 (order separately)
- Data for the on-board trigger electronics
  Complies with CE, EMC directives EN 61000-6-2: 2002-08 and EN 61000-6-3: 2002-08
  • U_B = 24 V_{nom} DC
  • Electrical connection 6P+PE
  • Signal actuation
    – Standard 0...+10 V (A1)
    – Version 4...20 mA (F1)
  • Valve curve calibrated at the factory

Ordering data

DBEB	E	10	Z –1X/		XY	G24	K31	A1	M	*

Proportional pressure relief valve with inductive position transducer on the cone

With on-board electronics **= E**

Nominal size **= 10**

Mounting hole configuration to ISO 5781-AG-06-2-A **= Z**

Unit series 10 to 19 (10 to 19: installation and connection dimensions unchanged) **= 1X**

Max. pressure stage

up to 180 bar **= 180**

up to 315 bar **= 315**

Relief port X
Pilot oil port Y **= XY**

G24 = Voltage supply of trigger electronics 24 V DC

K31 = **Electrical connection without** plug-in connector, with unit plug to DIN 43563-AM6 Order plug-in connector separately

Interface for trigger electronics*

A1 = Setpoint input 0...+10 V

M = NBR seals, suitable for mineral oils (HL, HLP) to DIN 51524

Further information in plain text

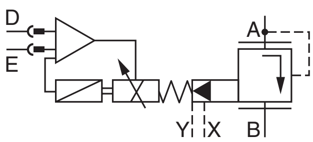
* Variant "F1" (4...20 mA version) available on request

Preferred types

Type....A1 (0... +10 V)	Material Number
DBEBE10Z–1X/180XYG24K31A1M	0 811 402 115
DBEBE10Z–1X/315XYG24K31A1M	0 811 402 116

Symbol

For on-board electronics



Function, sectional diagram

General

Type DBEBE10Z proportional pressure relief valves are pilot operated and are used to limit system pressure.
They are actuated by means of a position-controlled proportional solenoid with on-board electronics.
The valve body contains a logic element (poppet valve) of the "normally closed" type. This is pilot operated and is in conical seat design.

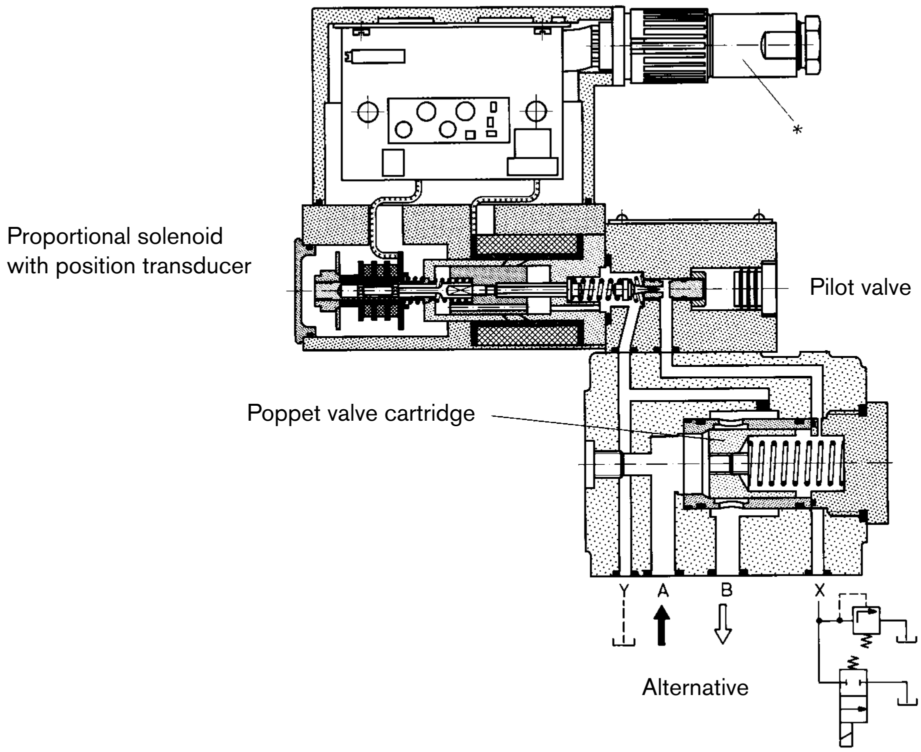
EN 61000-6-2: 2002-08
EN 61000-6-3: 2002-08

Basic principle

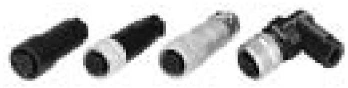
To adjust the system pressure, a setpoint is set in the trigger electronics. Based on this setpoint, the electronics control the position-controlled solenoid.
The proportional solenoid maintains its position against a spring force, which is proportionate to the system pressure.
The pilot stage is supplied with pilot oil at a flow rate of <0.8 l/min through a bore. The "p_{max}" pressure stage is determined by the cone and seating bore configuration.

Pressure limitation for maximum safety

If a fault occurs in the electronics, so that the solenoid current (I_{max}) would exceed its specified level in an uncontrolled manner, the pressure cannot rise above the level determined by the maximum spring force.



Accessories

Type			Material Number
(4 x) ISO 4762-M10x80-10.9	Cheese-head bolts		2 910 151 309
* 	Plug-in connectors 6P+PE, see also RE 08008	KS	1 834 482 022
		KS	1 834 482 026
		MS	1 834 482 023
		MS	1 834 482 024
		KS 90°	1 834 484 252

Testing and service equipment

Test box type VT-PE-TB3, see RE 30065
Measuring adapter 6P+PE type VT-PA-2, see RE 30068

Technical data

General			
Construction	Pilot stage	Poppet valve	
	Main stage	Pressure relief valve	
	Valve cartridge	Poppet valve, normally closed, with pilot oil bore	
Actuation		Proportional solenoid with position control and OBE	
Connection type		Subplate, mounting hole configuration NG10 (ISO 5781-AG-06-2-A)	
Mounting position		Optional	
Ambient temperature range	°C	–20...+50	
Weight	kg	7.8	
Vibration resistance, test condition		Max. 25 g, shaken in 3 dimensions (24 h)	

Hydraulic (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)			
Pressure fluid		Hydraulic oil to DIN 51524...535, other fluids after prior consultation	
Viscosity range, recommended	mm^2/s	20...100	
max. permitted	mm^2/s	10...800	
Pressure fluid temperature range	°C	–20...+70	
Maximum permitted degree of contamination of pressure fluid Purity class to ISO 4406 (c)		Class 18/16/13 [1)]	
Direction of flow		See symbol	
Max. set pressure (at Q_{min} = 1 l/min)	bar	180	315
Minimum pressure (at Q_{min} = 1 l/min)	bar	6	8
Max. mechanical pressure limitation level, e.g. when solenoid current $I > I_{max}$	bar	<190	<325
Max. working pressure	bar	Port A, B: 315	
		Port Y: ≤ 2 external pilot oil drain	
		Port X: 315 relief port	
Internal pilot oil flow	l/min	≤ 0.8	
Max. flow	l/min	120 for Q_{max}, see Characteristic Curves	

Static/Dynamic		
Hysteresis	%	≦ 1
Manufacturing tolerance for p_{max}	%	≦ ±5, see Characteristic Curves
Response time 100 % signal change	ms	≈ 80 dependent on dead volume or system volume
Thermal drift		<1 % at ΔT = 40 °C
Conformity		CE EN 61000-6-2: 2002-08 EN 61000-6-3: 2002-08

[1)] The purity classes stated for the components must be complied with in hydraulic systems.
Effective filtration prevents problems and also extends the service life of components.
For a selection of filters, see catalog sheets RE 50070, RE 50076 and RE 50081.

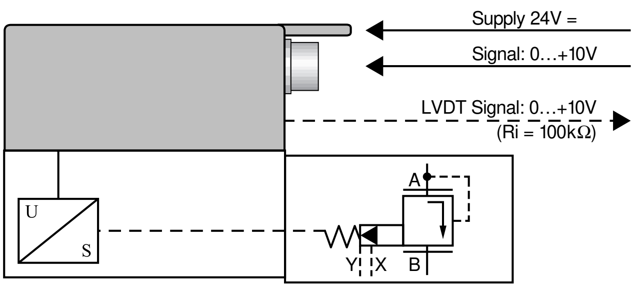
Technical data

Electrical, trigger electronics integrated in valve

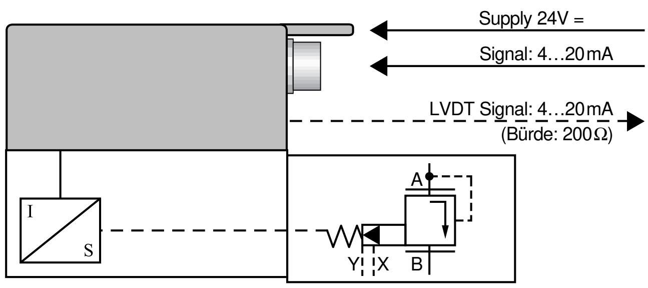
Cyclic duration factor	%	100 %
Degree of protection		IP 65 to DIN 40050 and IEC 14434/5
Connection		Plug-in connector 6P+PE, DIN 43563
Supply voltage Terminal A: Terminal B: 0 V		24 V DC_{nom} Min. 21 V DC/max. 40 V DC Ripple max. 2 V DC
Power consumption		Solenoid ⧄ 45 mm = 40 VA max.
External fuse		2.5 A_F
Input, “standard” version Terminal D: U_E Terminal E:	A1	Differential amplifier, R_i = 100 kΩ 0...+10 V 0 V
Input, “mA signal” version Terminal D: I_{D-E} Terminal E: I_{D-E}	F1*	Burden, R_{sh} = 200 Ω 4...20 mA Current loop I_{D-E} feedback
Max. voltage to differential inputs over 0 V		$\left.\begin{array}{l}D \rightarrow B\\E \rightarrow B\end{array}\right\}$ max. 18 V DC
Test signal, “standard” version Terminal F: U_{Test} Terminal C:	A1	LVDT 0...+10 V Reference 0 V
Test signal, “mA signal” version Terminal F: I_{F-C} Terminal C: I_{F-C}	F1*	LVDT signal 4...20 mA at external load 200...500 Ω max. 4...20 mA output Current loop I_{F-C} feedback
Safety earth conductor and shield		See pin assignment (installation in conformity with CE)
Recommended cable		See pin assignment up to 20 m 7 x 0.75 mm^2 up to 40 m 7 x 1 mm^2
Calibration		Calibrated at the factory, see valve curve

* Variant “F1” (4...20 mA version) available on request

Version A1: Standard

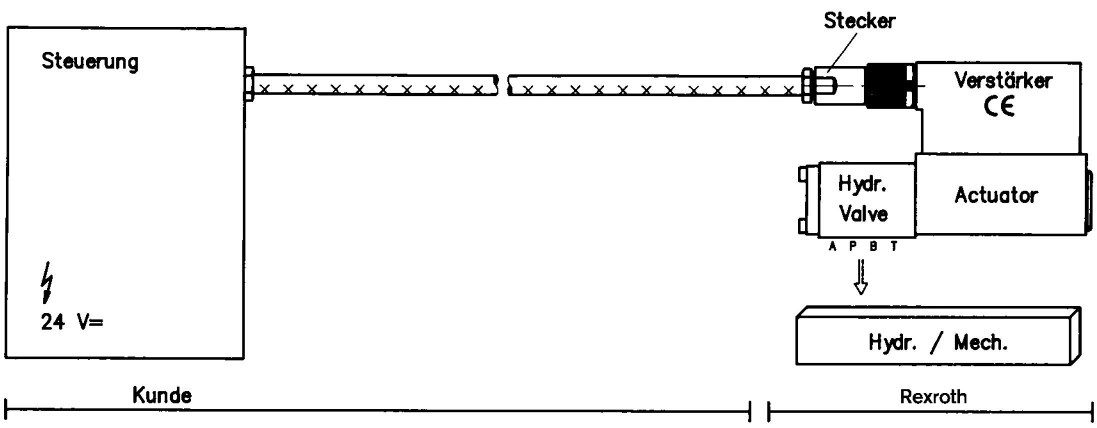


* Version F1: mA signal



Connection

For electrical data, see page 5 and
Operating Instructions **1 819 929 083**



Technical notes for the cable

Version:
- Multi-wire cable
- Extra-finely stranded wire to VDE 0295, Class 6
- Safety earth conductor, green/yellow
- Cu braided shield

Type:
- e.g. Ölflex-FD 855 CP (from Lappkabel company)

No. of wires:
- Determined by type of valve, plug type and signal assignment

Cable Ø:
- 0.75 mm² up to 20 m long
- 1.0 mm² up to 40 m long

Outside Ø:
- 9.4...11.8 mm – Pg11
- 12.7...13.5 mm – Pg16

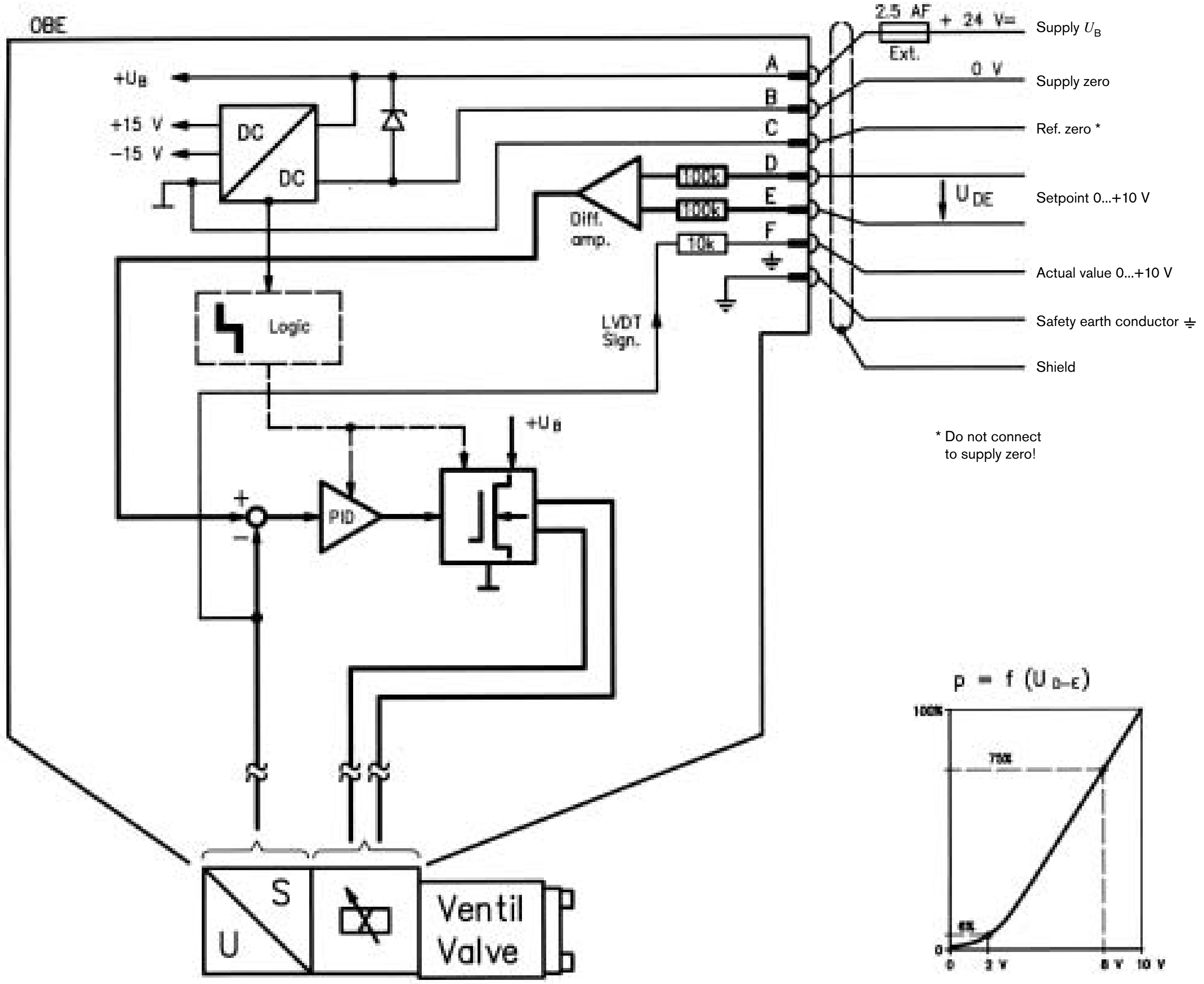
Important

Power supply 24 V DC nom.,
if voltage drops below 18 V DC, rapid shutdown resembling “Enable OFF” takes place internally.
In addition, with the “mA signal” version:
$I_{D-E} \geqq 3$ mA – valve is active
$I_{D-E} \leqq 2$ mA – valve is deactivated.
Electrical signals emitted via the trigger electronics (e.g. actual values) must not be used to shut down safety-relevant machine functions!
(See also European Standard, “Technical Safety Requirements for Fluid-Powered Systems and Components – Hydraulics”, EN 982.

On-board trigger electronics

Circuit diagram/pin assignment

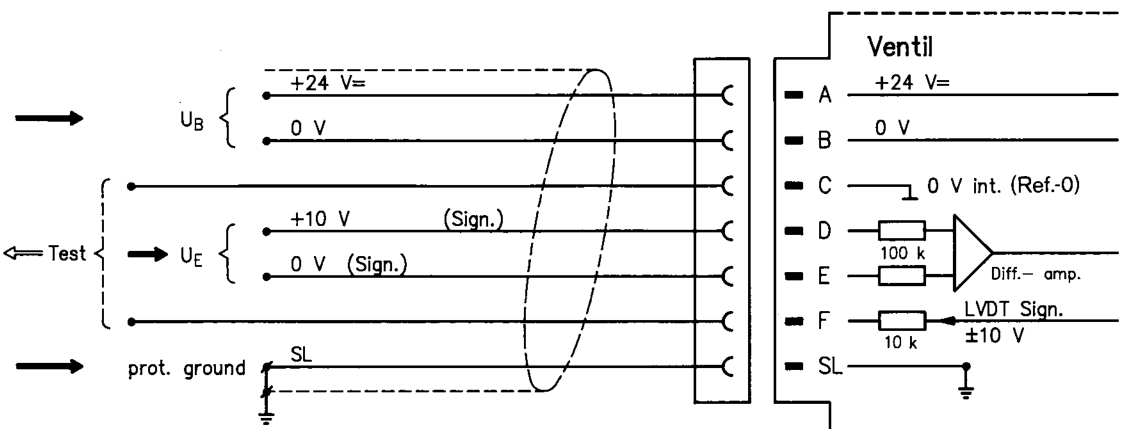
Version A1: U_{D-E} 0...+10 V



Pin assignment

Version A1: U_{D-E} 0...+10 V

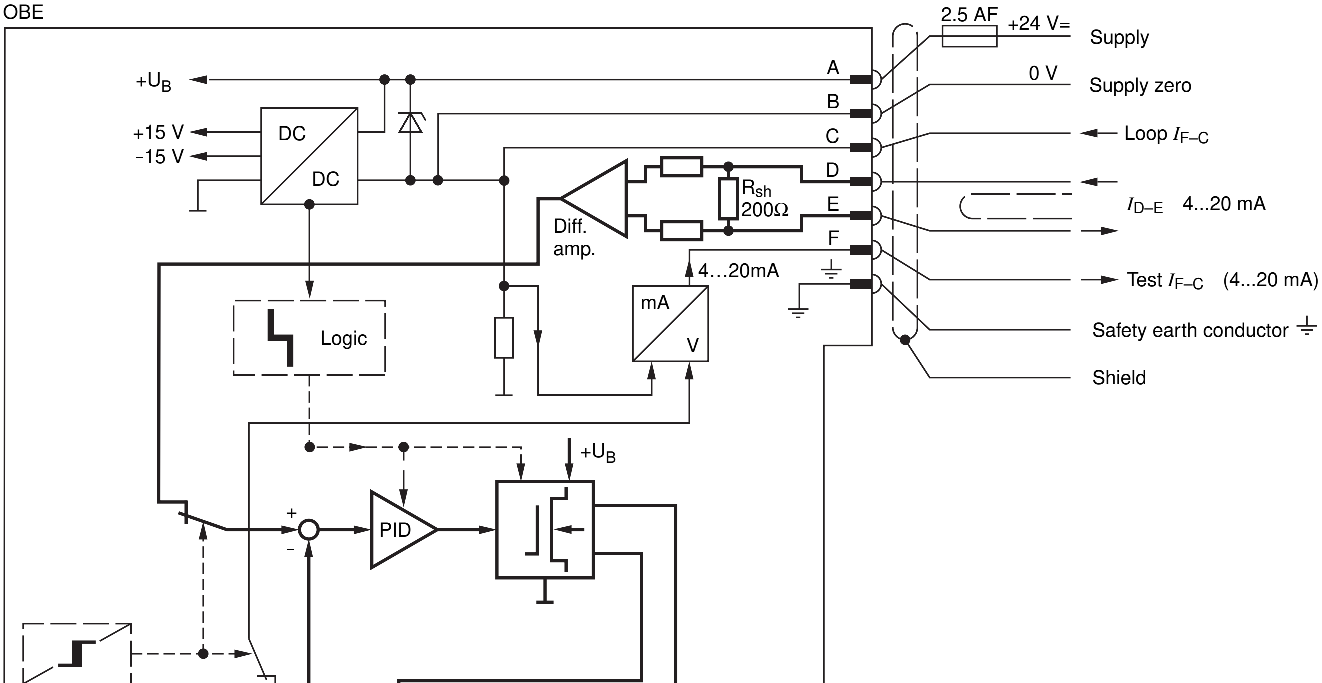
($R_i = 100$ kΩ)

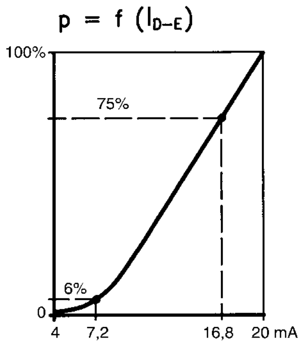


On-board trigger electronics

Circuit diagram/pin assignment

Version F1: I_{D-E} 4...20 mA

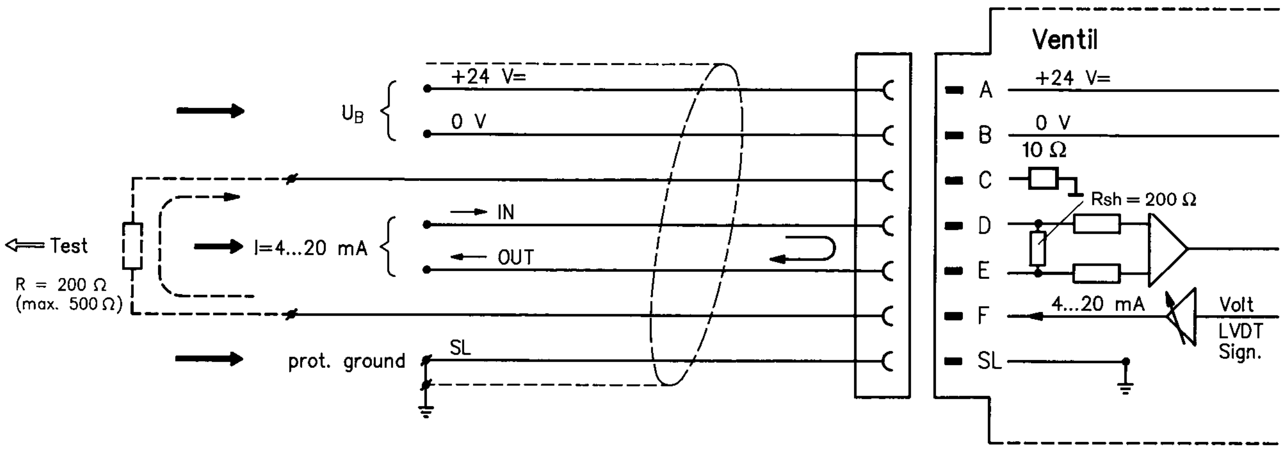




Pin assignment 6P+PE

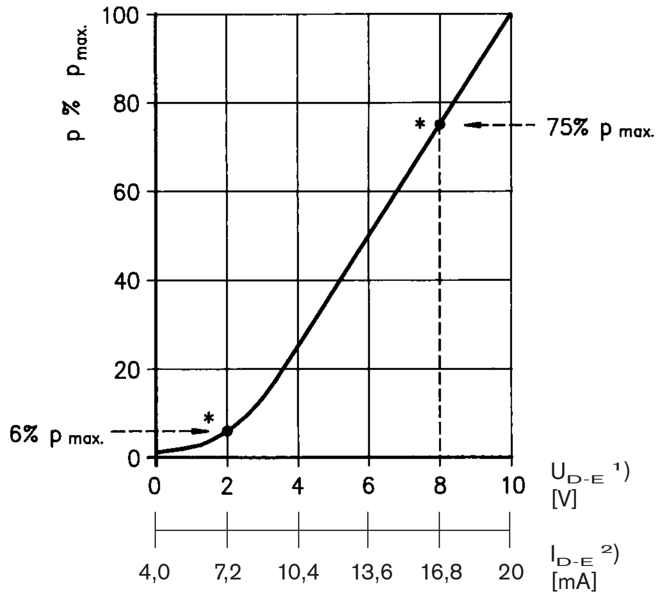
Version F1: I_{D-E} 4...20 mA

(R_{sh} = 200 kΩ)



Characteristic curves (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

Pressure in port A as a function of the setpoint



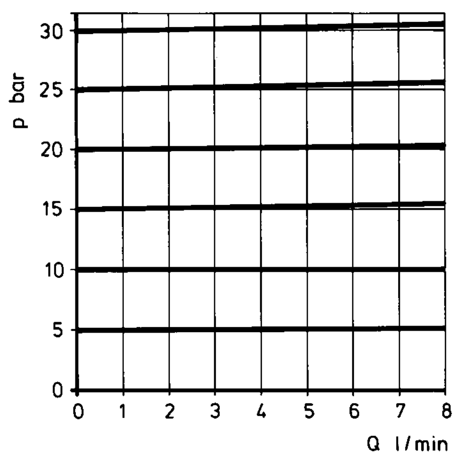
* Factory setting at $Q = 1$ l/min
±5 % manufacturing tolerance

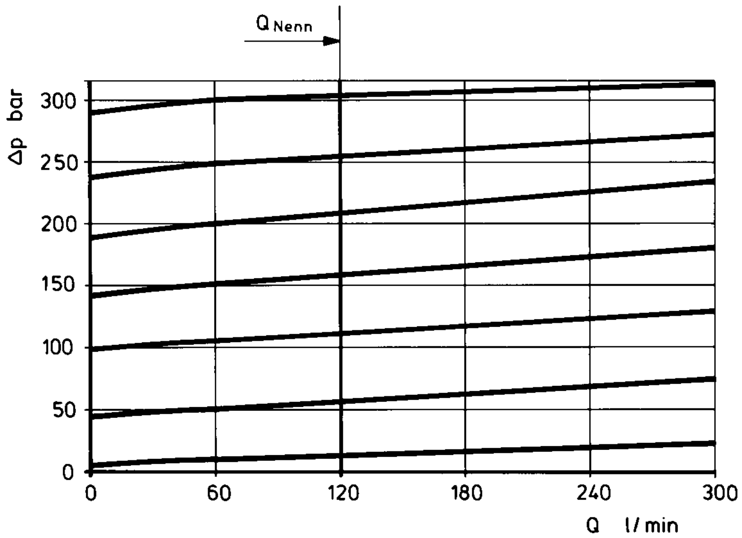
1) Version: $U_{D-E} = 0...+10$ V

2) Version: $I_{D-E} = 4...20$ mA

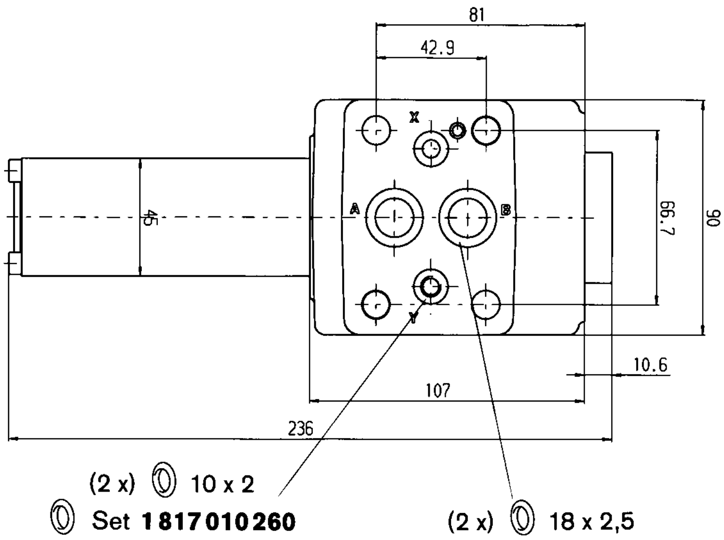
Pressure in port A as a function
of the main stage nominal flow rate

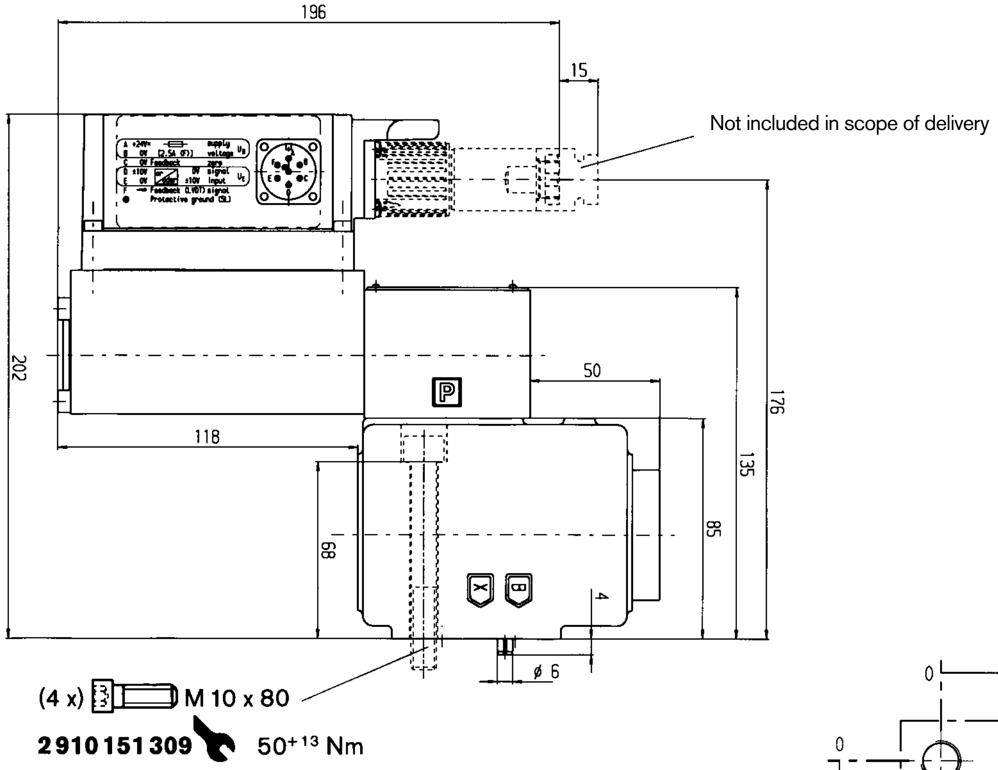
$p = f(Q)$

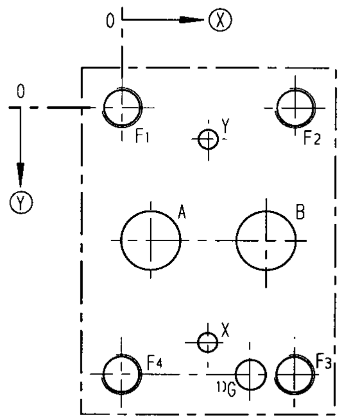




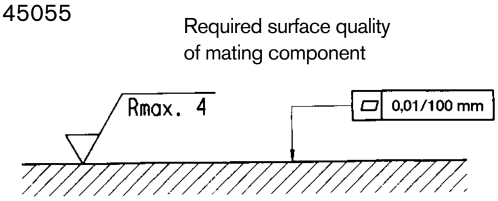
Unit dimensions (nominal dimensions in mm)







Mounting hole configuration: NG10 (ISO 5781-AG-06-2-A)
For subplates see catalog sheet RE 45055



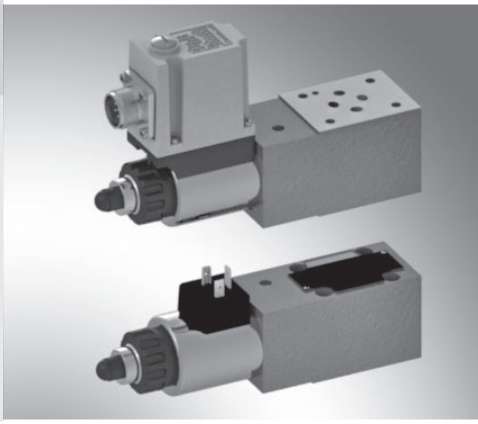
1) Deviates from standard
2) Thread depth:
Ferrous metal 1.5 x Ø*
Non-ferrous 2 x Ø
* NG10 min.10.5 mm

	A	B	X	Y	G	F_1	F_2	F_3	F_4
X	7.2	35.8	21.4	21.4	31.8	0	42.9	42.9	0
Y	33.35	33.35	58.7	7,9	66.7	0	0	66.7	66.7
∅	14.7	14.7	4.8	4,8	7.5	M10 2)	M10 2)	M10 2)	M10 2)

Proportional pressure relief valve, pilot operated

RE 29258/11.11
Replaces: RE 29158

Types (Z)DBE and (Z)DBEE



Size 6
Component series 2X
Maximum operating pressure 350 bar
Maximum flow 30 l/min

Table of contents

Features

- Pilot operated valve for limiting a system pressure
- Operation by means of proportional solenoids
- Proportional solenoid with rotatable and detachable coil
- For subplate mounting or sandwich plate design:
  Porting pattern according to ISO 4401-03-02-0-05
  and DIN 24340
- Valve and control electronics from a single source
- External control electronics for types DBE and ZDBE
- Linear command value pressure characteristic curve
- Types DBEE and ZDBEE with integrated electronics (OBE):
  - Low manufacturing tolerance of the command value pressure characteristic curve

Ordering code

	DBE		6		2	–2X/			G24				*

Subplate mounting = **no code**
Sandwich plate = **Z**

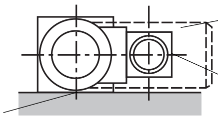
Proportional pressure relief valve

for external control electronics = **no code**
with integrated electronics (OBE) = **E**

Size 6 = **6**

Subplate mounting = **no code**
Pressure limitation in channel P = **VP**

Preferred position of mating connector = **2**



1)

The mating connector can be brought to the desired position after the nut was loosened (see page 17, 18).

[1] Valve mounting face (seal ring recesses in the housing)

Component series 20 to 29 = **2X**
(20 to 29: Unchanged installation and connection dimensions)

Maximum setting pressure

Pressure rating 25 bar	**= 25**
Pressure rating 50 bar	**= 50**
Pressure rating 100 bar	**= 100**
Pressure rating 200 bar	**= 200**
Pressure rating 315 bar	**= 315**
Pressure rating 350 bar	**= 350**

no code = Pilot oil return, internal (recommendation: Subplate mounting up to Q_{Vmax} =15 l/min)
Y = Pilot oil return, external (only possible with subplate mounting)

Supply voltage
G24 = +24 V direct voltage

Electrical connection
for DBE; ZDBE:
K4 = **without** mating connector, with connector according to DIN EN 175301-803
Mating connector – separate order see page 8
for DBEE; ZDBEE:
K31 = **without** mating connector, with connector according to DIN EN 175201-804
Mating connector – separate order see page 8

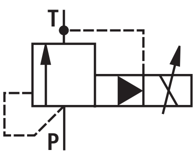
Interface electronics
A1 = Command value 0 to 10 V
F1 = Command value 4 to 20 mA
no code = for (Z)DBE

Seal material
M = NBR seals
V = FKM seals

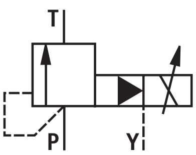
Further details in plain text

Symbols (for sandwich plate symbol: 1 = component side, 2 = plate side)

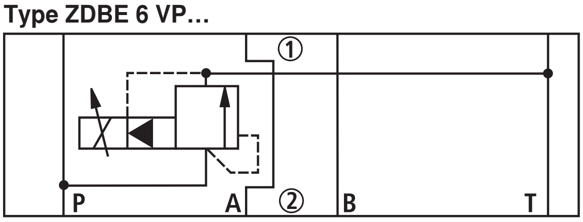
Type DBE 6…



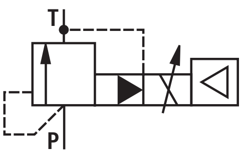
Type DBE 6…Y..



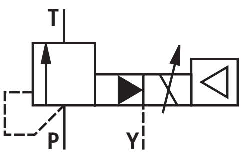
Type ZDBE 6 VP…



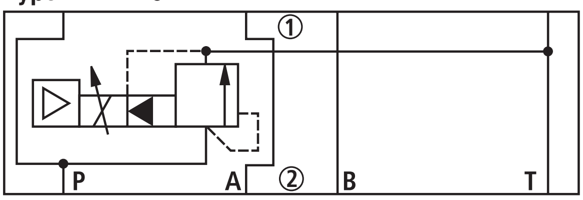
Type DBEE 6…



Type DBEE 6…Y..



Type ZDBEE 6 VP…



Function, cross-section

Types DBE and ZDBE

The pilot operated proportional pressure relief valves of the types DBE and ZDBE are operated by means of a proportional solenoid. These valves are used to limit a system pressure. With these valves it is possible to steplessly adjust the system pressure to be limited depending on the electrical command value.

These valves basically consist of a pilot control stage and a main stage.

The pilot control stage consists of a proportional solenoid (1), the poppet (2) and the valve seat (3). The main stage consists of a housing (4) and the main spool cartridge assembly (5). The proportional solenoid proportionally converts the electrical current into a mechanical force. An increase in the current intensity causes a corresponding rise in the magnetic force. The system pressure is adjusted by means of the proportional solenoid (1) depending on the command value. Pressure applied by the system in port P acts on the right hand side of the main spool cartridge assembly (5). At the same time, the system pressure acts via the pilot line (7), which is provided with an nozzle (6), on the spring-loaded side of the spool.

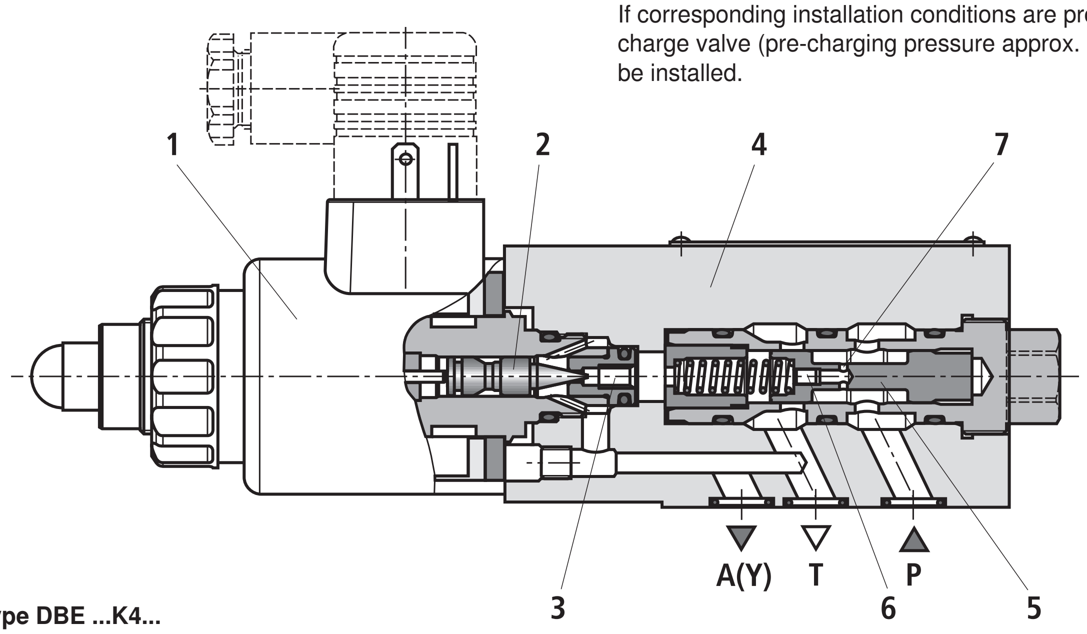
Via the valve seat in the pilot line (3), the pressure at the poppet (2) in the spring chamber acts against the force of the proportional solenoid (1).

Once the pressure has reached the pre-set value, the poppet (3) is lifted from the seat. The pilot oil can now (depending on the model) drain externally via port A (Y) or internally into the tank, which results in a limitation of the pressure on the spring-loaded side of the main spool (5). If the system pressure continues to rise slightly, the higher pressure on the right hand side of the spool will push the spool to the left into the control position P to T.

At a minimum control current (corresponds to a command value of zero), the minimum setting pressure will be set.

Notice!

– The tank lines should be prevented from running empty. If corresponding installation conditions are provided, a precharge valve (pre-charging pressure approx. 1 bar) is to be installed.



Type DBE ...K4...

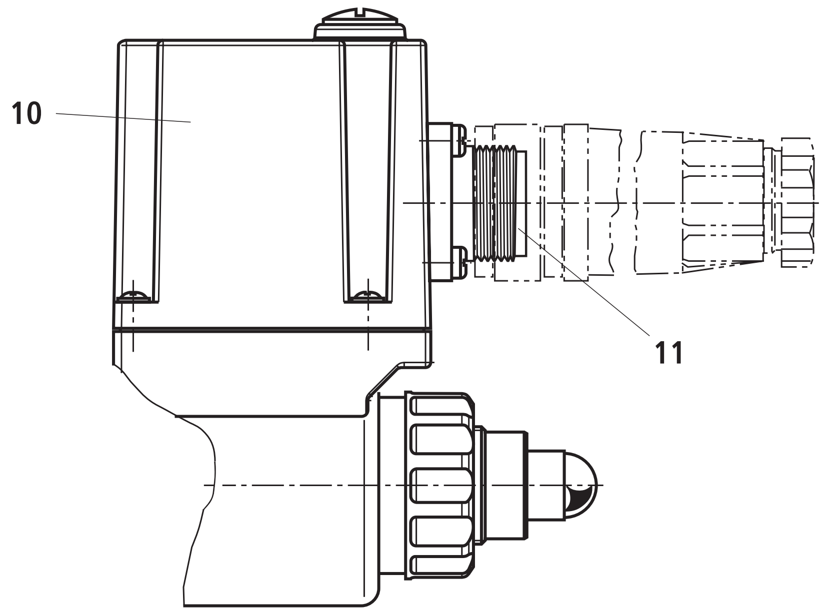
Function, cross-section

Type (Z)DBEE – with integrated electronics (OBE)

In terms of function and design, these valves correspond to type (Z)DBE. An additional housing (10) is fitted on the proportional solenoid which accommodates the control electronics.

Supply and command value voltage are applied at the connector (11).
In the factory, the command value pressure characteristic curve is adjusted with little manufacturing tolerance.

For more information on the control electronics, see page 9.



Type (Z)DBEE…-2X/…YG24K31...

Technical data (For applications outside these parameters, please consult us!)

general

Weight	– DBE and ZDBE	kg	2.4
	– DBEE and ZDBEE	kg	2.5
Installation position			Any
Storage temperature range		°C	–20 to +80
Ambient temperature range	– DBE and ZDBE	°C	–20 to +70
	– DBEE and ZDBEE	°C	–20 to +50

hydraulic (measured with HLP 46; ϑ_{oil} = 40 °C ± 5 °C)

Maximum operating pressure	– Port P; P1 – P2 A1 – A2; B1 – B2	bar	350
	– Port T	bar	50
Maximum setting pressure	– Pressure rating 25 bar	bar	25
	– Pressure rating 50 bar	bar	50
	– Pressure rating 100 bar	bar	100
	– Pressure rating 200 bar	bar	200
	– Pressure rating 315 bar	bar	315
	– Pressure rating 350 bar	bar	350
Minimum setting pressure at command value 0		bar	See characteristic curves on page 14 and 15
Return flow pressure in port A; with external pilot oil return (Y)			Separately at zero pressure to the tank
Pilot flow		l/min	0.6 to 1.2
Maximum flow		l/min	30
Hydraulic fluid			See table page 6
Hydraulic fluid temperature range		°C	–20 to +80
Viscosity range		mm^2/s	15 to 380
Maximum admissible degree of contamination of the hydraulic fluid cleanliness class according to ISO 4406 (c)			Class 20/18/15 [1)]
Hysteresis		%	±3 of the maximum setting pressure
Repeatability		%	< ±2 of the maximum setting pressure
Linearity		%	±3.5 of the maximum setting pressure
Manufacturing tolerance of the command value pressure characteristic curve, related to the hysteresis characteristic curve, pressure increasing	– DBE and ZDBE	%	±5 of the maximum setting pressure
	– DBEE and ZDBEE	%	±1.5 of the maximum setting pressure
Step response $T_u + T_g$ at Q_V = 5 l/min	10 % → 90 %	ms	130 — Depending on system
	90 % → 10 %	ms	110 — Depending on system

[1)] The cleanliness classes specified for the components must be complied with in hydraulic systems. An effective filtration prevents faults and at the same time increases the service life of the components.

Technical data (For applications outside these parameters, please consult us!)

hydraulic

Hydraulic fluid		Classification	Suitable sealing materials	Standards
Mineral oils and related hydrocarbons		HL, HLP	NBR, FKM	DIN 51524
Environmentally compatible	– Insoluble in water	HEES	FKM	ISO 15380
		HEPR	FKM	
	– Soluble in water	HEPG	FKM	ISO 15380
Flame-resistant	– Water-free	HFDU, HFDR	FKM	ISO 12922
	– Water-containing	HFC Fuchs Hydrotherm 46M Petrofer Ultra Safe 620	NBR	ISO 12922

☞ **Important information on hydraulic fluids!**

- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- The flash point of the process and operating medium used must be 40 K higher than the maximum solenoid surface temperature.
- **Flame-resistant – water-containing**:
  Maximum pressure differential 210 bar, otherwise increased cavitation erosion! The pressure peaks should not exceed the maximum operating pressures!
  Service life as compared to HLP 30 - 100 %
  Maximum fluid temperature 60 °C

electric

Minimum solenoid current		mA	≤ 100
Maximum solenoid current		mA	1600 ± 10 %
Solenoid coil resistance	Cold value at 20 °C	Ω	5.5
	Maximum hot value	Ω	8.05
Duty cycle		%	100

electrical, integrated electronics (OBE)

Supply voltage	Nominal voltage	VDC	24
	Lower limit value	VDC	21
	Upper limit value	VDC	35
Current consumption		A	≤ 1.5
Required fuse protection		A	2, time-lag
Inputs	Voltage	V	0 to 10
	Current	mA	4 to 20
Output	Actual current value	mV	1 mV ≙ 1 mA
Protection class of the valve according to EN 60529			IP 65 with mating connector mounted and locked

Accessories (not included in scope of delivery)

Proportional amplifier for type (Z)DBE		**Material number**
VT-MSPA1-11-1X/ in modular design	according to data sheet 30223	
VT-VSPD-2 in eurocard format	according to data sheet 30523	
VT-MSPA1-11-1X/ in eurocard format	according to data sheet 30100	
VT-SSPA1-1-1X plug-in amplifier	according to data sheet 30116	

Mating connector for type (Z)DBE		**Material number**
Mating connector (black)	according to DIN EN 175301-803	R901017011

Mating connector for type (Z)DBEE		**Material number**
Mating connector	according to DIN EN 175201-804	e.g. R900021267 (plastic)
		e.g. R900223890 (metal)

Hexagon socket head cap screws		**Material number**
Type DBE(E)	4x ISO 4762 - M5 x 50 - 10.9-flZn-240h-L (friction coefficient μ_{total} = 0.09 to 0.14) Tightening torque M_A = 7 Nm ±10 %	
Type ZDBE(E)	4x ISO 4762 - M5 - 10.9-flZn-240h-L (friction coefficient μ_{total} = 0.09 to 0.14) Tightening torque M_A = 7 Nm ±10 %	

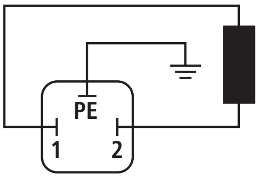
Notice: The tightening torque of the hexagon head cap screws refers to the maximum admissible operating pressure!

Subplates	**Data sheet**
Size 6	45052

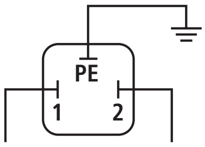
Electrical connection (dimensions in mm)

(Z)DBE

Connection to connector

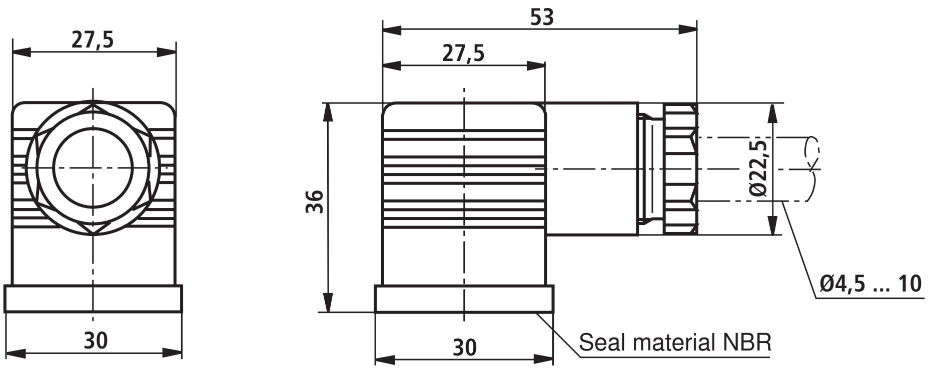


Connection to mating connector



to the amplifier

Mating connector (black)
according to DIN EN 175301-803
Material no. **R901017011**
(separate order)

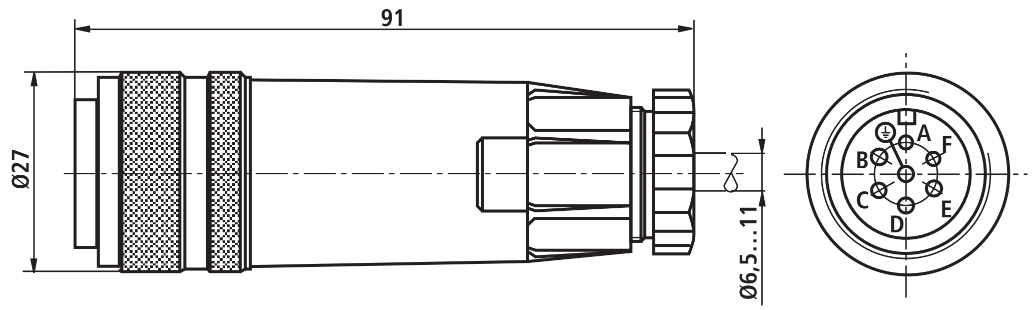


(Z)DBEE

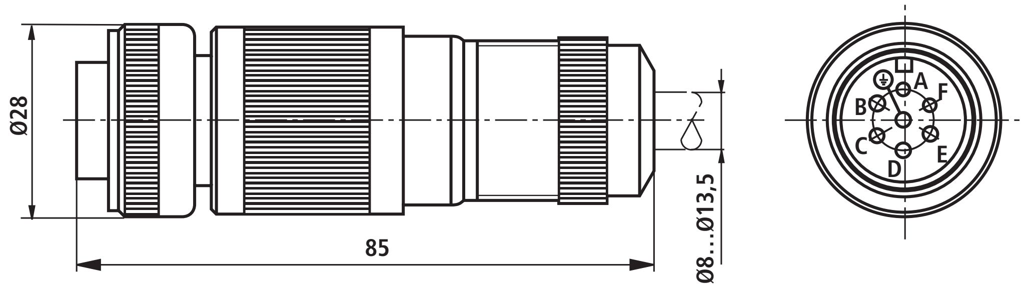
Device connector allocation	Contact	Assignment interface "A1"	Assignment interface "F1"
Supply voltage	A	24 VDC (u(t) = 21 V to 35 V); $I_{max} \leq$ 1.5 A	
	B	0 V	
Reference potential actual value	C	Reference contact F; 0 V	Reference contact F; 0 V
Differential amplifier input	D	0 to 10 V; R_E = 100 kΩ	4 to 20 mA; R_E = 100 Ω
	E	Reference potential command value	
Measuring output (actual value)	F	0 to 1.6 V actual value (1 mV ≙ 1 mA) Load resistance > 10 kΩ	
	PE	Connected to solenoid and valve housing	

Mating connectors according to DIN EN 175201-804, solder contacts for line cross-section 0.5 to 1.5 mm^2

Plastic version,
material no. **R900021267,**
(separate order)



Metal version,
material no. **R900223890,**
(separate order)

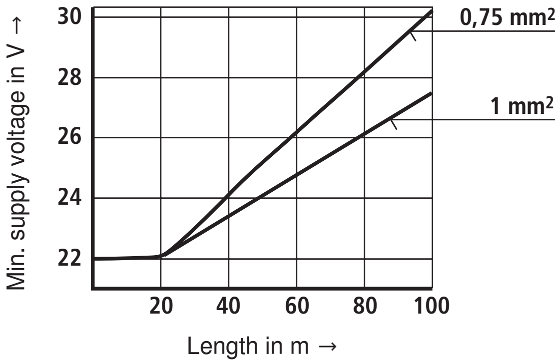


Electrical connection

Connection cable for (Z)DBEE

- Recommendation: 6-wire, 0.75 or 1 mm^2 plus protective earthing conductor and screening
- Only connect the screening to PE on the supply side
- Max. admissible length 100 m

The minimum supply voltage at the power supply unit depends on the length of the supply line (see diagram).



Integrated electronics (OBE) for type (Z)DBEE

Function

The electronics are supplied with voltage via ports A and B. The command value is applied to the differential amplifier ports D and E.

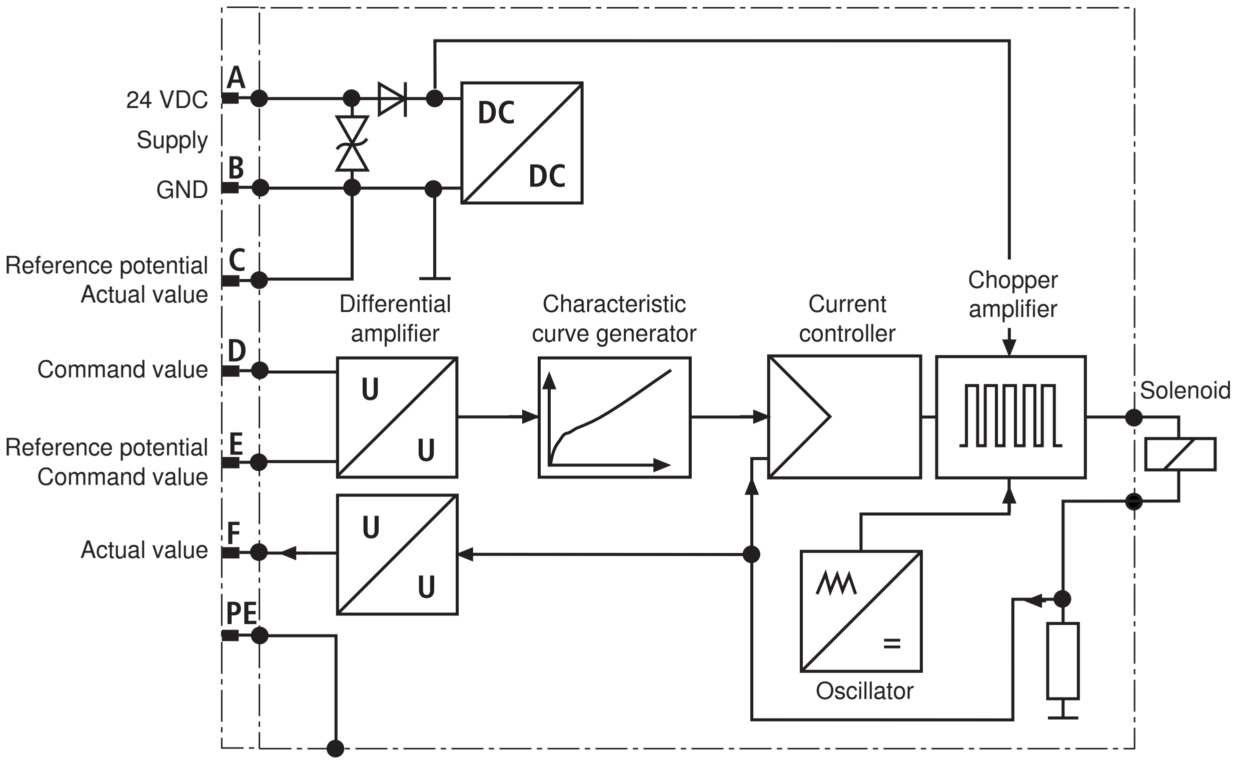
Via the characteristic curve generator, the command value solenoid current characteristic curve is adjusted to the valve so that non-linearities in the hydraulic system are compensated for and a linear command value pressure characteristic curve is created.

The current controller controls the solenoid current independent of the solenoid coil resistance.

The power section of the electronics for controlling the proportional solenoid is a chopper amplifier with a cycle frequency of approx. 180 Hz to 400 Hz. The output signal is pulse-width modulated (PWM).

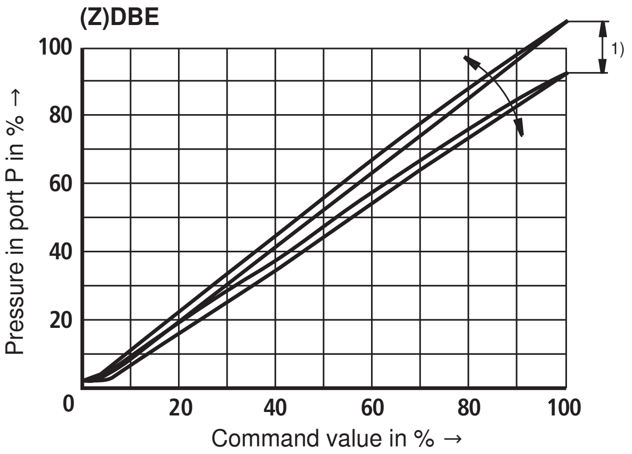
For checking the solenoid current, a voltage can be measured between pin F(+) and pin C(–) that is proportional to the solenoid current. **1 mV** corresponds to a solenoid current of **1 mA**.

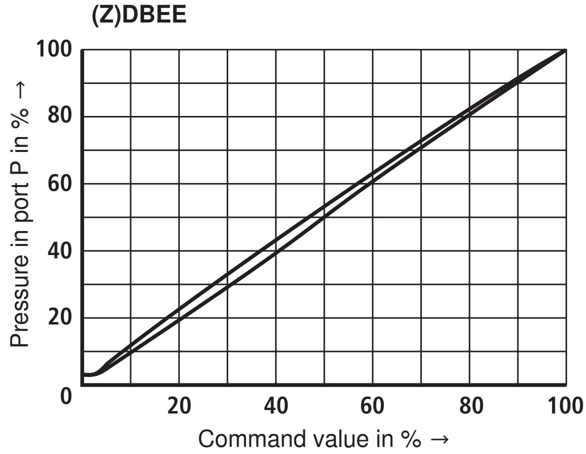
Block diagram



Characteristic curves (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C)

Pressure in port P depending on the command value (Q_V = 5 l/min)

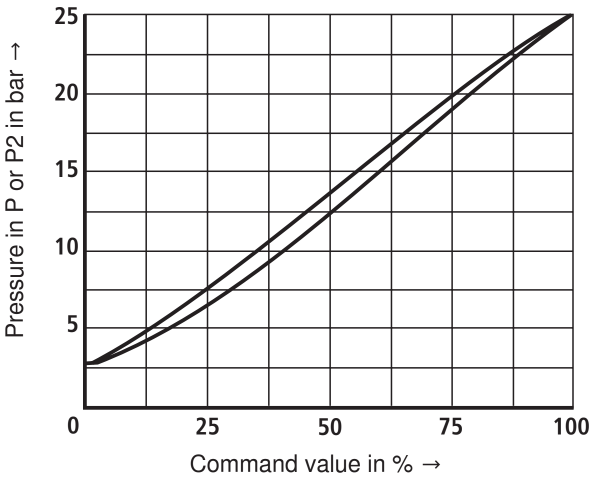




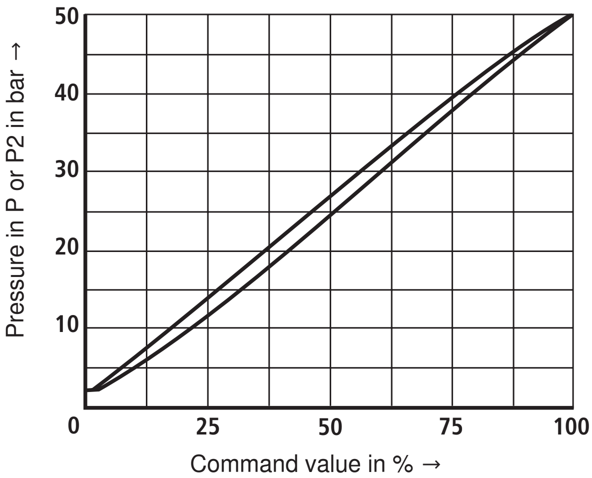
[1)] On valve DRE(M), the manufacturing tolerance can be adjusted at the **external analog amplifier** (for type and data sheet see page 7) using the command value attenuator potentiometer **"Gw"**. The digital amplifier can be set by means of the parameter "limit".
Here, the control current according to the technical data must not be exceeded.
In order to match several valves to the same characteristic curve, at a command value of 100 %, the pressure must not exceed the maximum setting pressure of the relevant pressure rating at no valve.

Pressure in port P or P2 depending on the command value (Q_V = 5 l/min)

Pressure rating 25 bar ("y" external and internal)

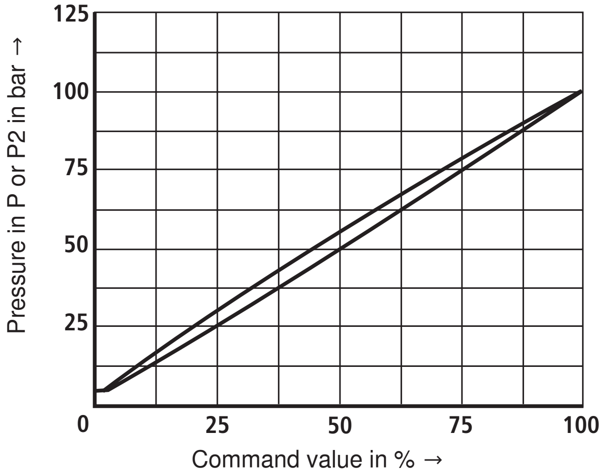


Pressure rating 50 bar ("y" external and internal)

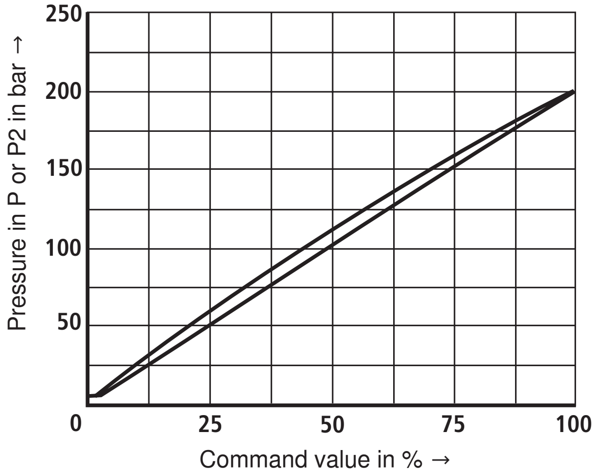


Characteristic curves (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C)

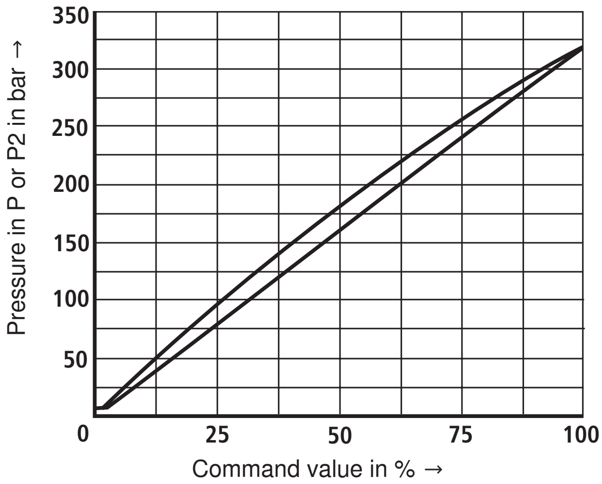
Pressure rating 100 bar ("y" external and internal)



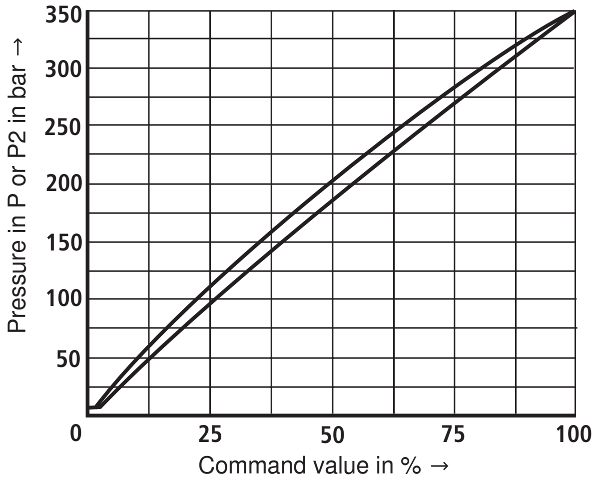
Pressure rating 200 bar ("y" external and internal)



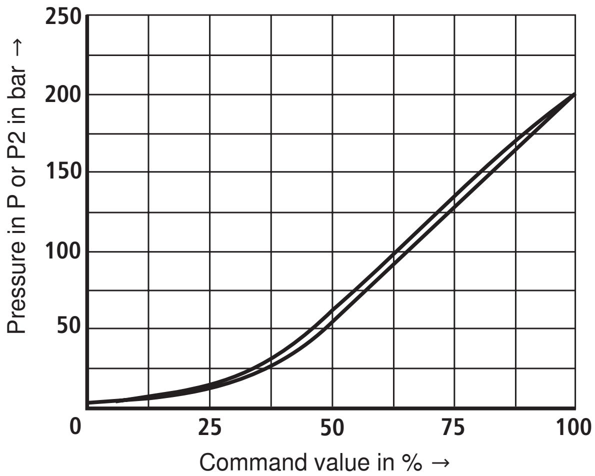
Pressure rating 315 bar ("y" external and internal)



Pressure rating 350 bar ("y" external and internal)

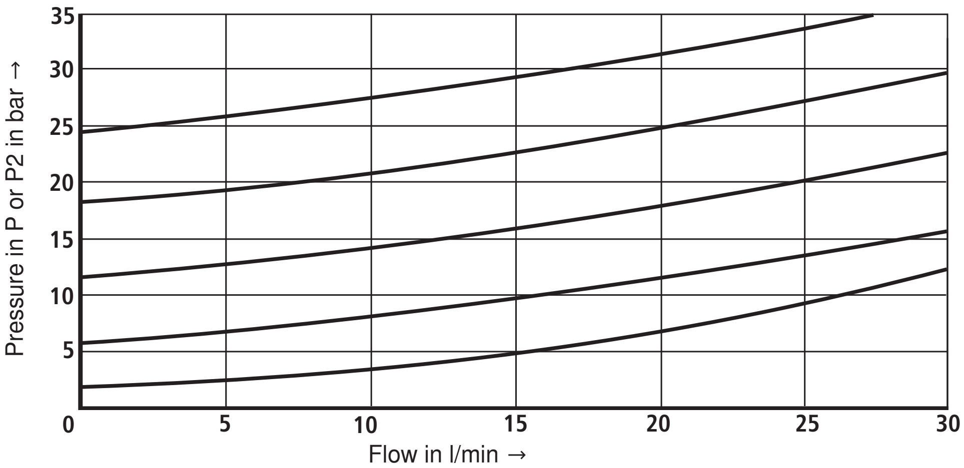


Pressure rating 200 bar (with VT-SSPA1) plug-in amplifier

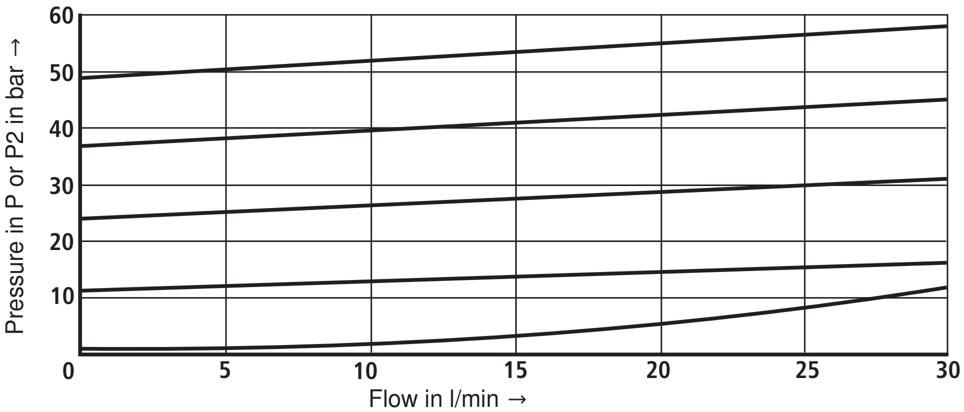


Characteristic curves (measured with HLP 46; ϑ_{oil} = 40 °C ± 5 °C)

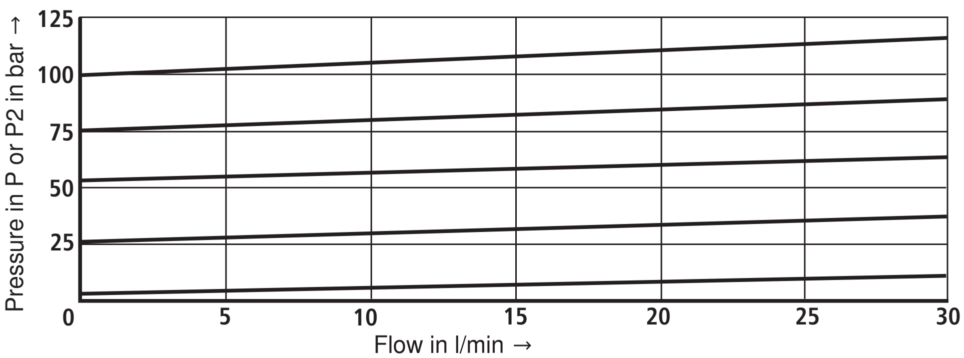
Pressure in channel P or P2 depending on the flow Q_v
Pressure rating 25 bar



Pressure rating 50 bar

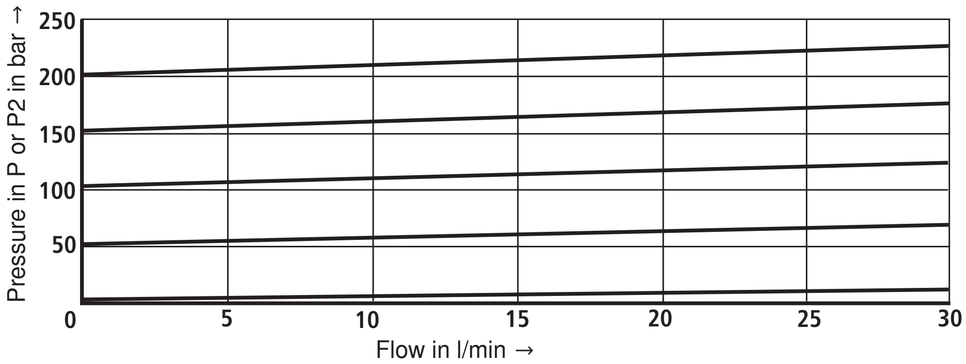


Pressure rating 100 bar

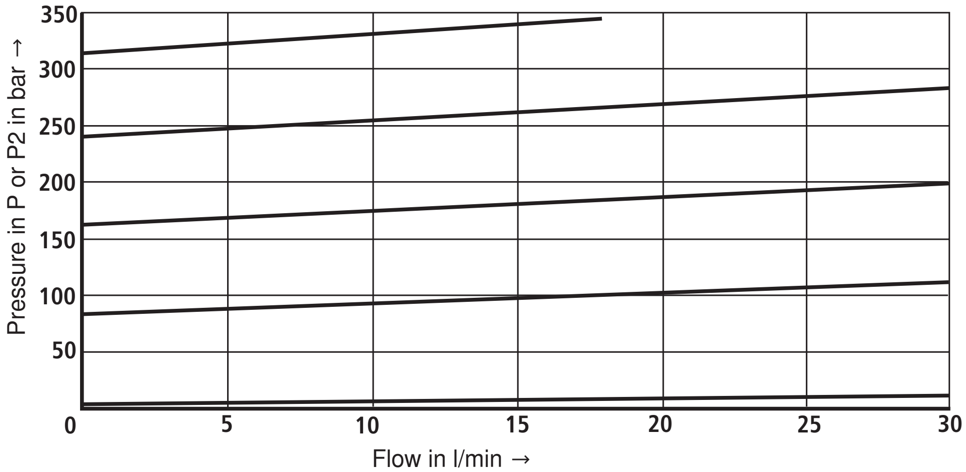


Characteristic curves (measured with HLP 46; ϑ_{oil} = 40 °C ± 5 °C)

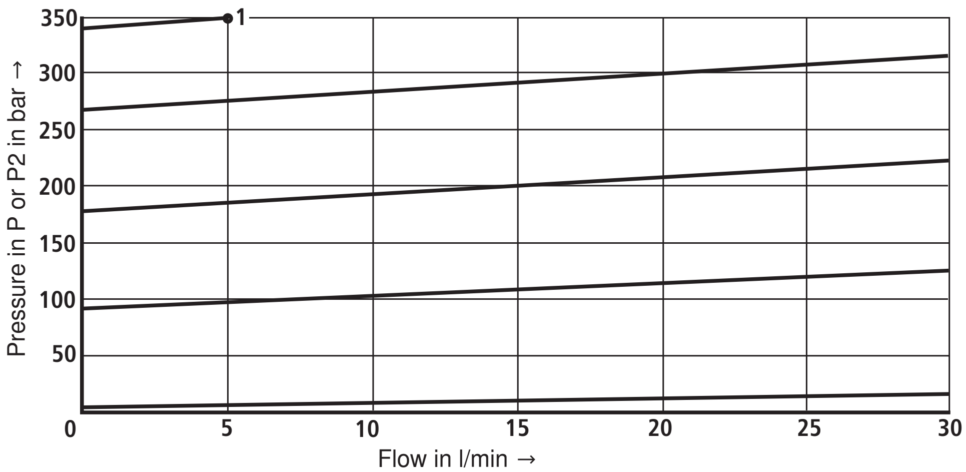
Pressure rating 200 bar



Pressure rating 315 bar



Pressure rating 350 bar [1)]



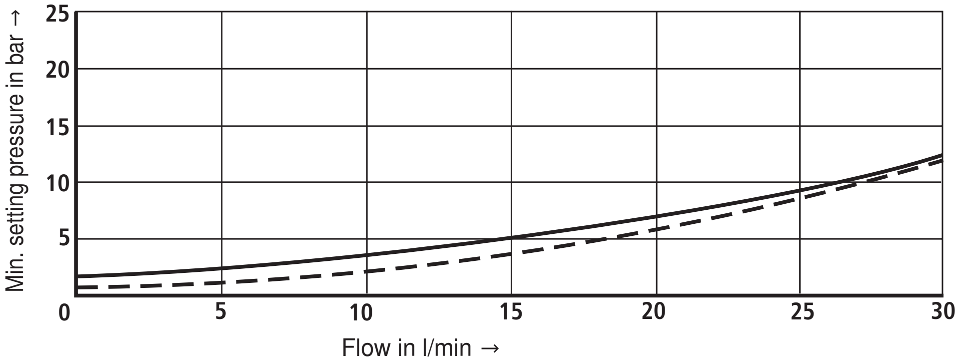
[1)] In case of characteristic curve 1, the command value may not exceed the maximum flow of 5 l/min

The characteristic curves were measured without counter pressure in port A (external pilot oil return) and T (internal pilot oil return). With internal pilot oil return, the pressure in P or P2 increases by the output pressure present in port T.

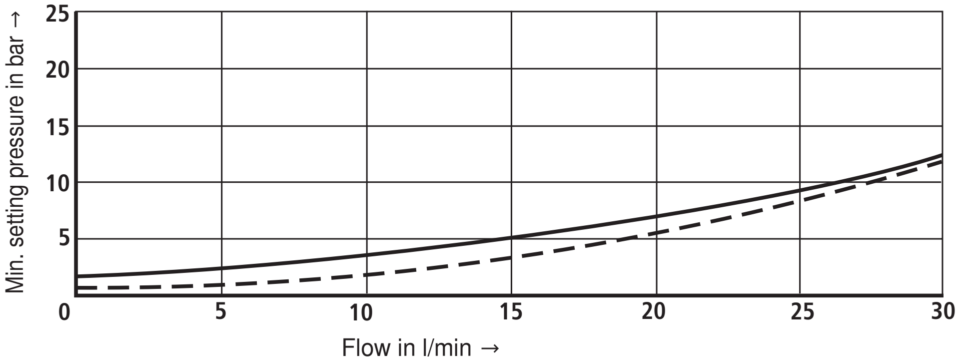
Characteristic curves (measured with HLP 46; ϑ_{oil} = 40 °C ± 5 °C)

Min. setting pressure in port P or P2 or at command value 0.

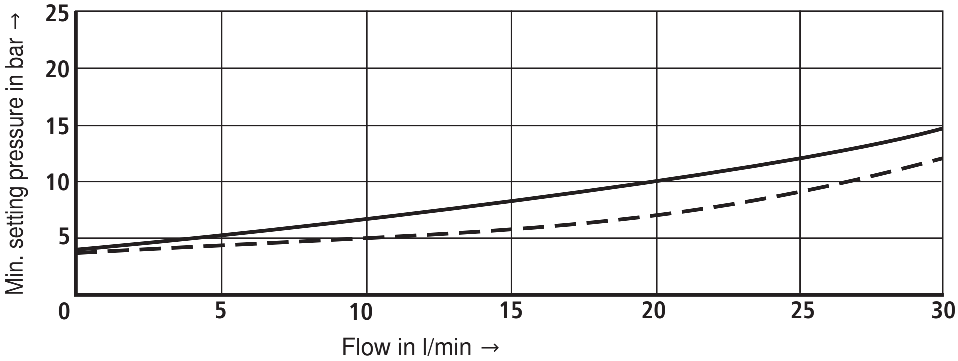
Pressure rating 25 bar



Pressure rating 50 bar



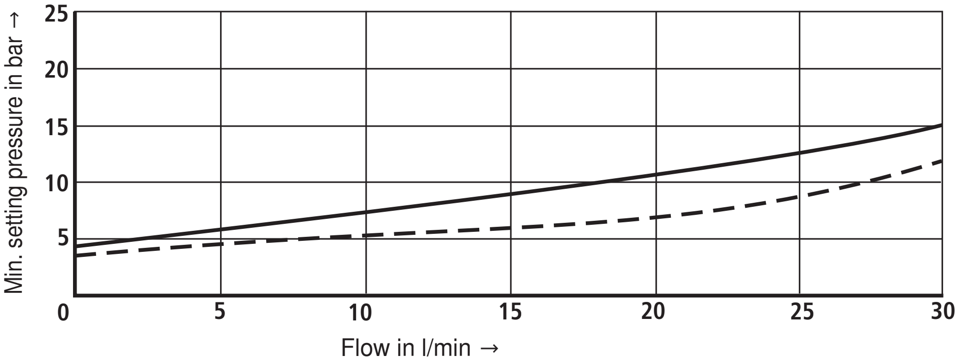
Pressure rating 100 bar



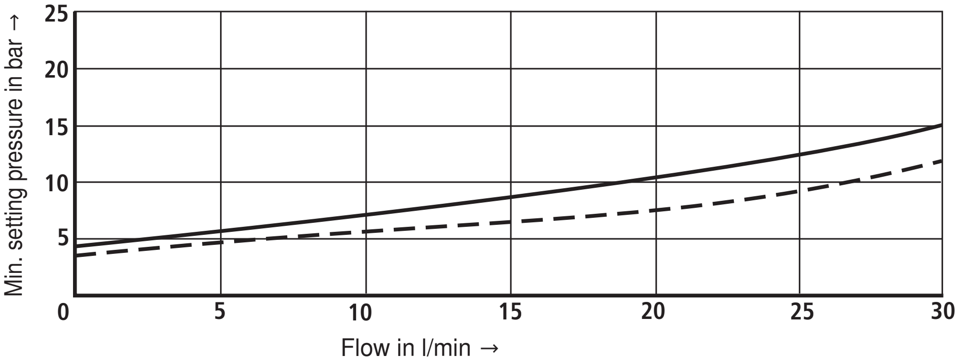
Pilot oil return ——— Internal – – – External

Characteristic curves (measured with HLP 46; ϑ_{oil} = 40 °C ± 5 °C)

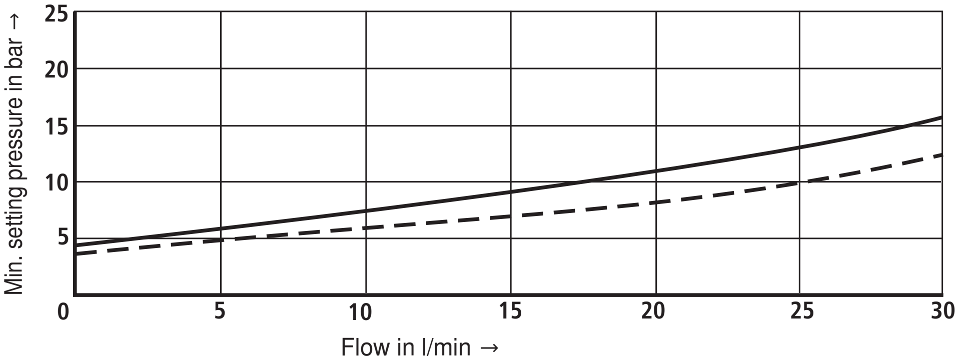
Pressure rating 200 bar



Pressure rating 315 bar



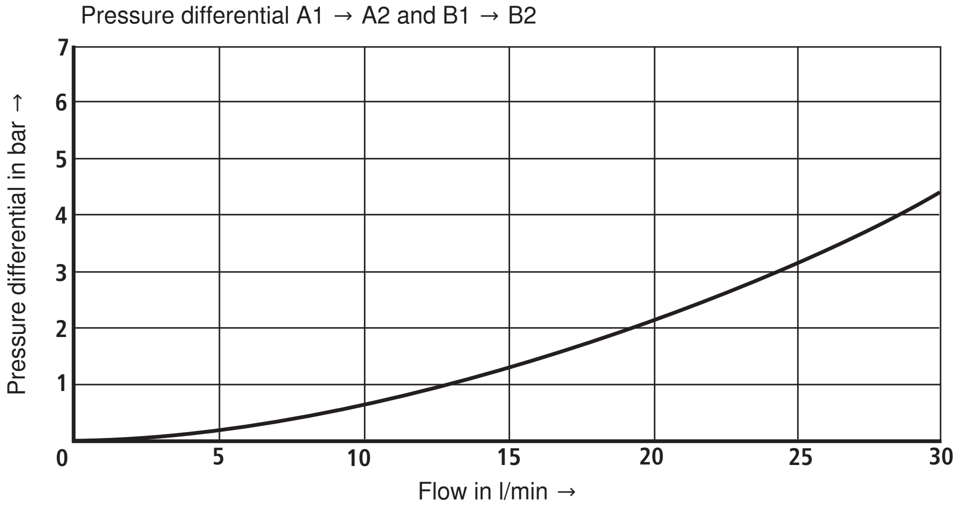
Pressure rating 350 bar

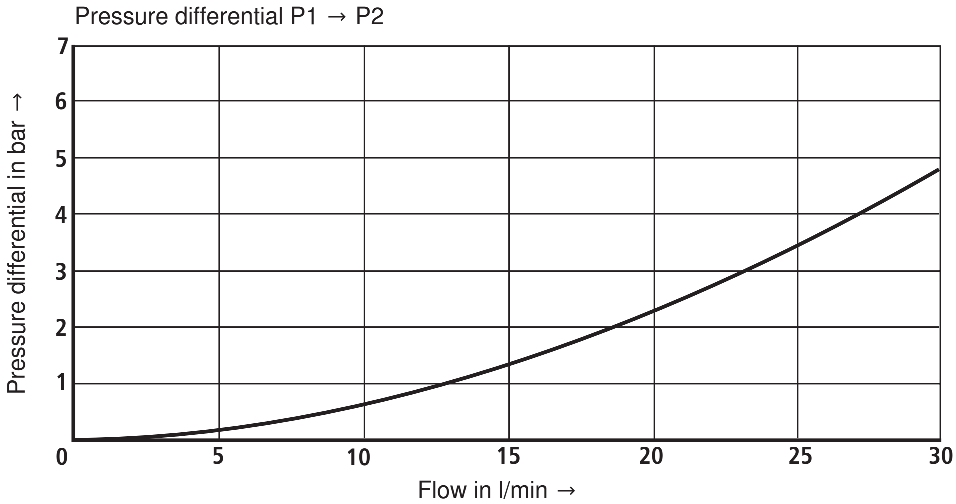


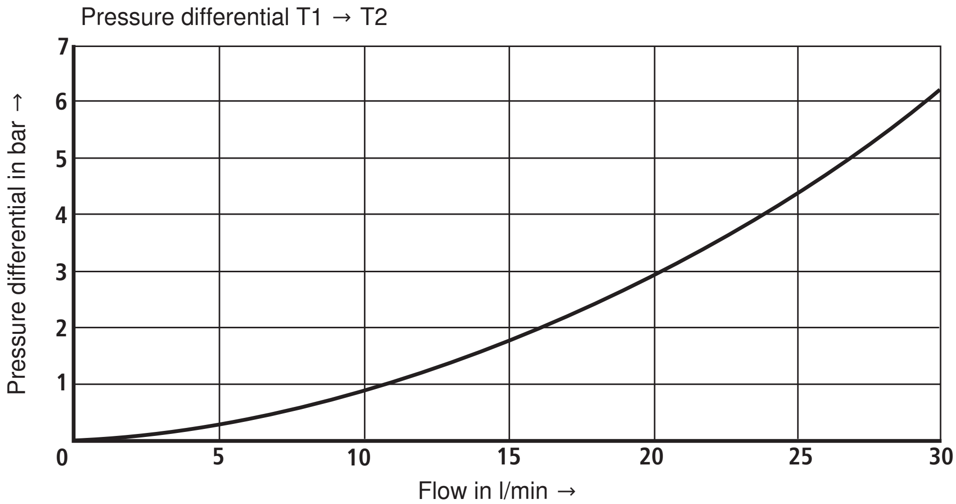
Pilot oil return ——— Internal – – – External

The characteristic curves were measured without counter pressure in port A (external pilot oil return) and T (internal pilot oil return). With internal pilot oil return, the pressure in P or P2 increases by the output pressure present in port T.

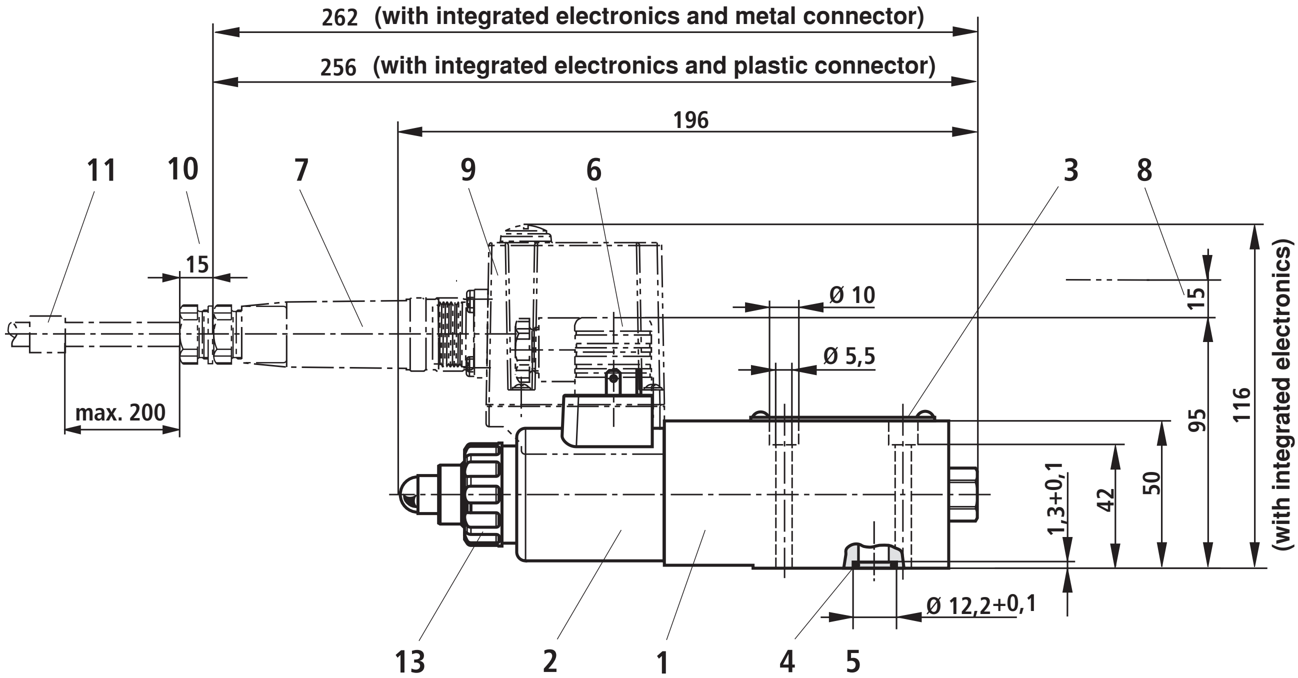
Characteristic curves (measured with HLP 46; ϑ_{oil} = 40 °C ± 5 °C)

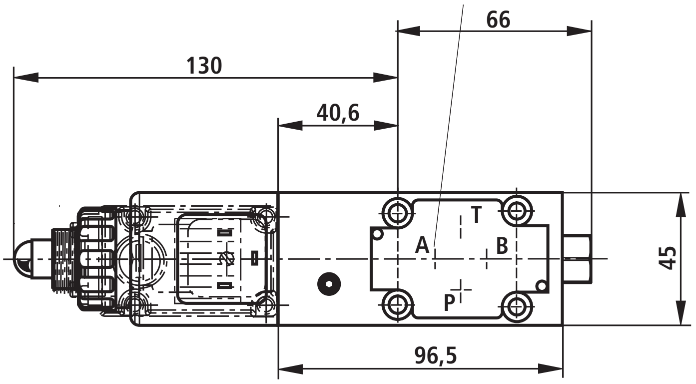


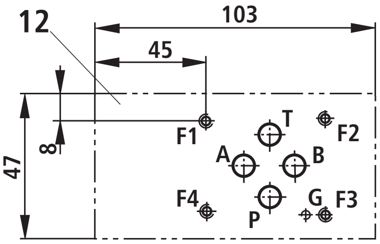


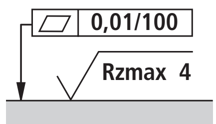


Unit dimensions: Types DBE and DBEE (dimensions in mm)









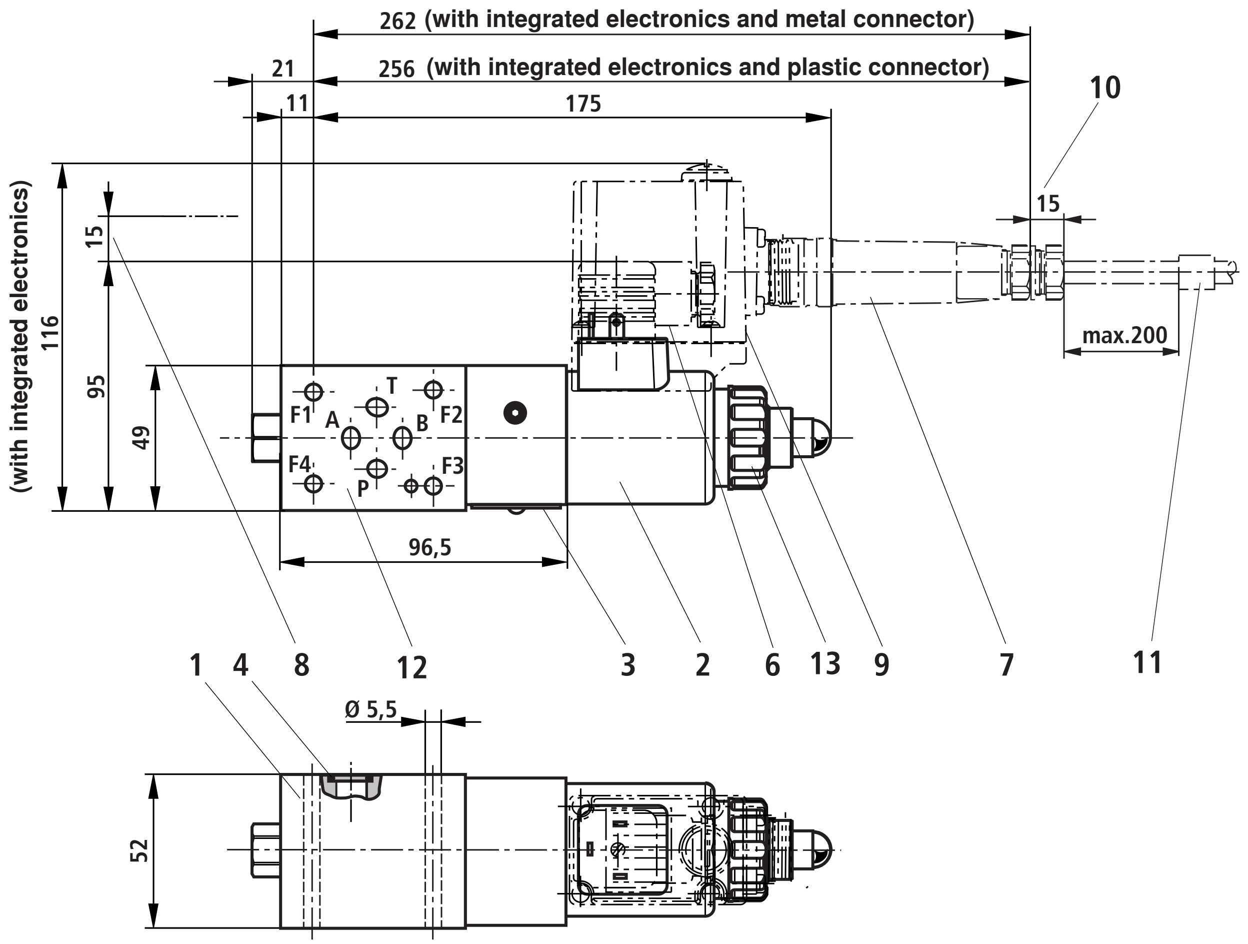
Required surface quality of the valve contact surface

1. **1** Valve housing
2. **2** Proportional solenoid
3. **3** Name plate
4. **4** Identical seal rings for ports A, B, P, and T
5. **5** With version Y, pilot oil return external via port A (Y)
6. **6** Mating connector according to DIN EN 175301-803
7. **7** Mating connector according to DIN EN 175201-804
8. **8** Space required for removing the mating connector
9. **9** Integrated electronics (OBE)
10. **10** Space required for removing the mating connector
11. **11** Cable fastening
12. **12** Machined installation surface, porting pattern according to DIN 24340 (**without** locating hole) and ISO 4401-03-02-0-05 (**with** locating hole)
13. **13** O-ring and plastic nut SW 32 for coil fixation
The nut can be loosened by rotating it anticlockwise (1 turn). The solenoid coil can then be rotated to the required position before fixing it again by tightening the nut.
Tightening torque: 4+1 Nm.

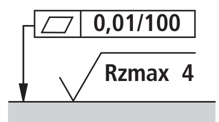
Tolerances according to:
- General tolerances ISO 2768-mK
- Tolerancing principle ISO 8015

Subplates and valve mounting screws see page 7

Unit dimensions: Types ZDBE and ZDBEE (dimensions in mm)



- **1** Valve housing
- **2** Proportional solenoid
- **3** Name plate
- **4** Identical seal rings for ports A, B, P, and T
- **6** Mating connector for type ZDBE (separate order, see page 6)
- **7** Mating connector for type ZDBEE (separate order see page 6)
- **8** Space required for removing the mating connector
- **9** Integrated electronics (OBE)
- **10** Space required for removing the mating connector
- **11** Cable fastening
- **12** Machined installation surface, porting pattern according to DIN 24340 (**without** locating hole) and ISO 4401-03-02-0-05 (**with** locating hole)
- **13** O-ring and plastic nut SW 32 for coil fixation
  The nut can be loosened by rotating it anticlockwise (1 turn). The solenoid coil can then be rotated to the required position before fixing it again by tightening the nut.
  Tightening torque: 4+1 Nm.



Required surface quality of the valve contact surface

Tolerances according to: – General tolerances ISO 2768-mK
– Tolerancing principle ISO 8015

Subplates and valve mounting screws see page 7

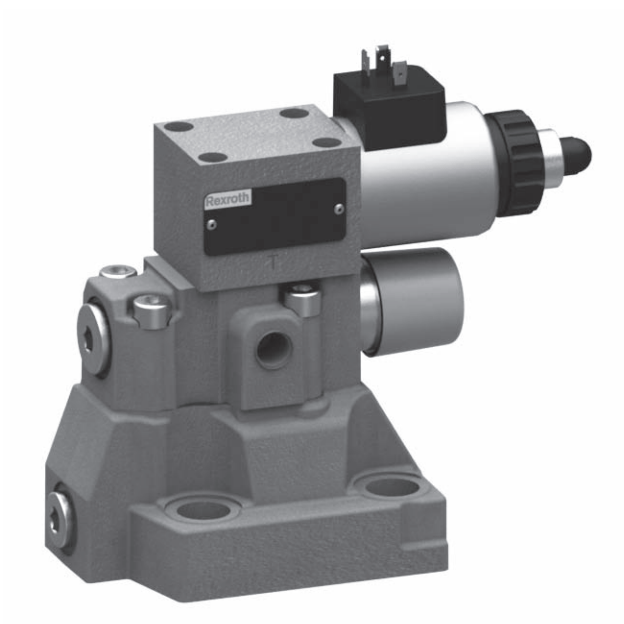
The Drive & Control Company

Rexroth
Bosch Group

Proportional pressure relief valve, pilot operated

Type DBEM and DBEME

RE 29361
Edition: 2013-07
Replaces: 2012-12



Similar figure

- Size 10 to 32
- Component series 7X
- Maximum operating pressure 350 bar
- Maximum flow: 700 l/min

Features

- Pilot operated valves for limiting a system pressure
- Operation by means of proportional solenoid
- For subplate mounting and threaded connection: Porting pattern according to ISO 6264
- Maximum pressure limitation
- Valve and control electronics from a single source
- Integrated electronics (OBE) with type DBEME: Little manufacturing tolerance of the command value pressure characteristic curve
- External control electronics with type DBEM (separate order)

Contents

Ordering code

01	02	03	04	05		06		07	08	09	10	11	12	13	14	15
DBE	M				–	7X	/			G24						*

01	Proportional pressure relief valve	**DBE**

02	**With** maximum pressure limitation	**M** 1)

03	For external control electronics	**no code**
	With integrated electronics (OBE)	**E**

Size

04	Size 10	**10**
	Size 25	**20**
	Size 32	**30**

05	Subplate mounting	**no code**
	Threaded connection	**G**

06	Component series 70 to 79 (70 to 79: Unchanged installation and connection dimensions)	**7X**

Pressure rating 2)

07	Up to 50 bar	**50**
	Up to 100 bar	**100**
	Up to 200 bar	**200**
	Up to 315 bar	**315**
	Up to 350 bar	**350**

08	Pilot oil return external	**Y**
	Unloading port X, pilot oil return external	**XY**

Supply voltage

09	24 V DC voltage	**G24**

10	1600 mA coil	**no code**
	800 mA coil	**–8** 3)

1) The maximum pressure limitation only serves as protection against overpressure in case of an error in the pilot valve (e.g. in case of contamination or overcurrent).

2) Special version DBEME-SO699 in size 10 and 20 available up to pressure rating 500 bar.

3) Replacement for series 3X and series 5X SO1 (comparison see characteristic curve page 12). All characteristics (hydraulic and electric) specified in the data sheet refer to the version with 1600 mA coil.

Ordering code

01	02	03	04	05		06		07	08	09	10	11	12	13	14	15
DBE	**M**				**–**	**7X**	**/**			**G24**						*****

Electrical connection

11	**For type DBEM:**	
	Without mating connector; connector DIN EN 175301-803	**K4** 4)
	For type DBEME:	
	Without mating connector; connector DIN EN 175201-804	**K31** 4)

Electronics interface

12	Command value 0 to 10 V	**A1**
	Command value 4 to 20 mA	**F1**
	With DBEM	**no code**

Seal material

13	NBR seals	**M**
	FKM seals	**V**
	Attention: Observe compatibility of seals with hydraulic fluid used!	

14	Pipe thread to DIN ISO228-1	**no code** 5)
	UNF-thread to ASME B1.1	**/12** 5)

15	Further details in the plain text	

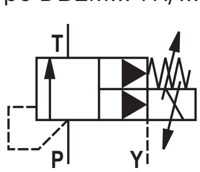
4) Mating connectors, separate order, see page 8 and 19

5) possible only for version G

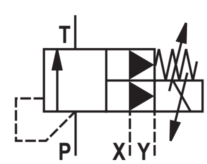
Symbols

For external control electronics:

Type DBEM...-7X/...Y...

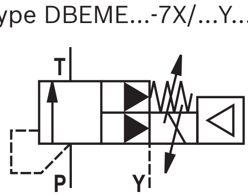


Type DBEM...-7X/...XY...

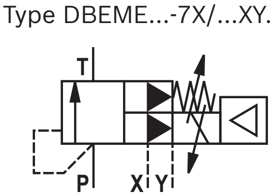


With integrated electronics:

Type DBEME...-7X/...Y...



Type DBEME...-7X/...XY...

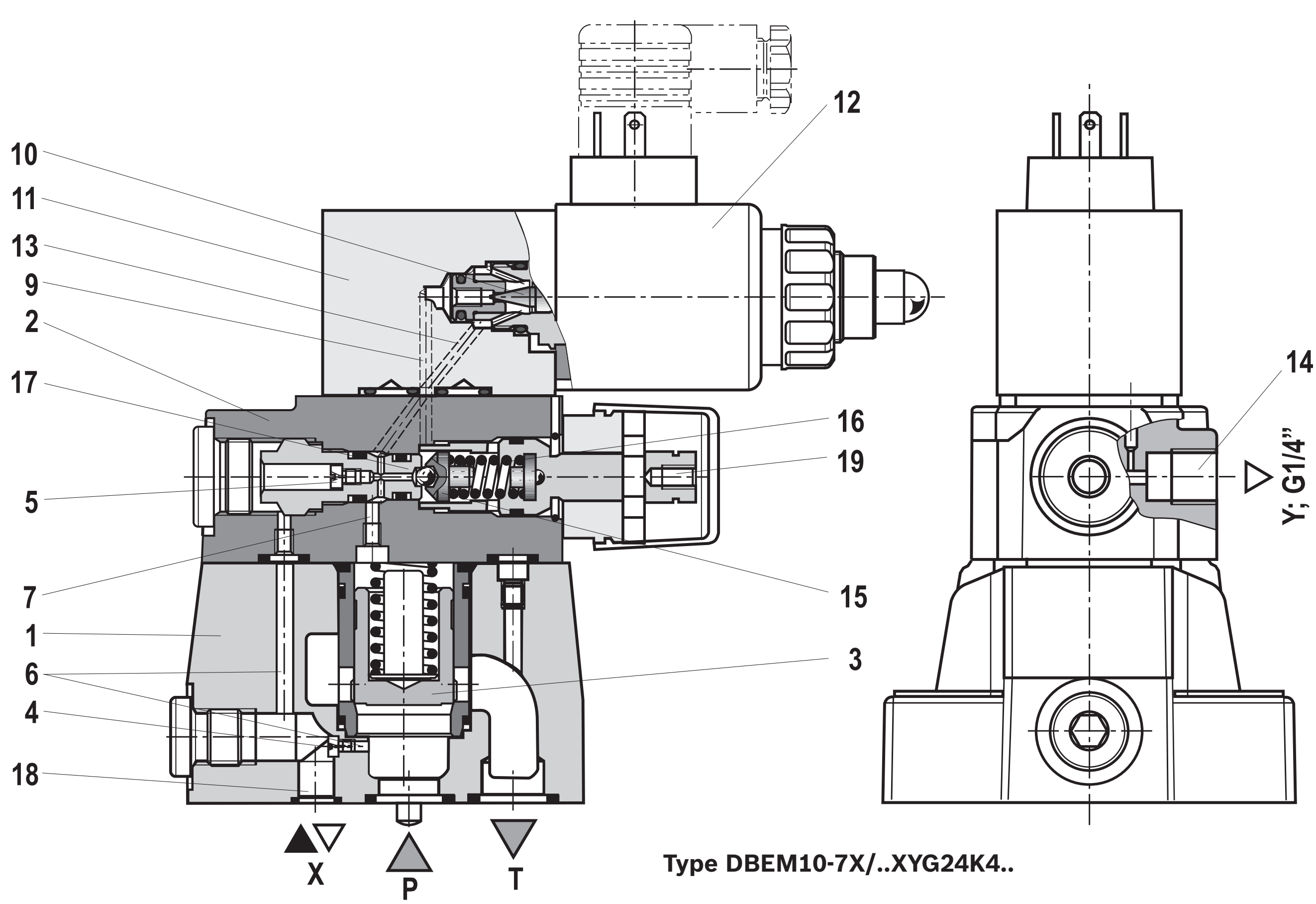


Function, section

Valves of type DBEM are pilot operated pressure relief valves. They are used to limit the operating pressure in hydraulic systems. By means of these valves, the pressure to be limited can be continuously adjusted depending on the electric command value.
These valves basically consist of the housing (1) with main spool insert (3), the sandwich plate valve with maximum pressure limitation (2) and the proportional pilot control valve (11).

Type DBEM...

The pressure applied to channel P acts on the main spool (3). At the same time, the pressure at port P is applied to the spring loaded side of the main spool (3) via the control lines (6, 7) provided with nozzles (4, 5). Via the connection bore (9), the pressure is simultaneously applied to the poppet (10) of the proportional pilot control valve (11). The hydraulic force at the pilot poppet (10) acts against the command value-dependent force of the proportional solenoid (12).
If the hydraulic force exceeds the solenoid force, the pilot poppet is opened (10). The pilot oil can now flow via the control line (13) into port Y (14) and to the tank; thus, a pressure drop results at the main spool (3) over the control lines (6, 7). The connection from port P to T is released. The main spool (3) controls the set operating pressure at port P.
As hydraulic protection against inadmissibly high pressures, a spring-loaded pressure relief valve (2) has been integrated. This maximum pressure limitation is pre-set to the relevant pressure rating (see table page 6). In the operating range of the valve, the poppet (15) is held on the valve seat (17) by the spring (16) and is thus closed. If the pressure in the spring chamber of the main spool (3) exceeds the maximum admissible set pressure of the valve, the poppet (15) is pressed against the compression spring (16) and the connection into the spring chamber is opened. Via port Y (14), the pilot oil flows into the tank. Due to the control lines (6, 7), a pressure drop occurs at the main spool (3). The connection from port P to T is released. The main spool (3) controls the set maximum operating pressure in port P. Via the adjustment element (19), the pre-set pressure can be reduced, if necessary. Port Y (14) must be externally piped to the tank. The connection to the tank should be pressureless. Via port X (18), the valve may be unloaded or the maximum pressure may be limited.



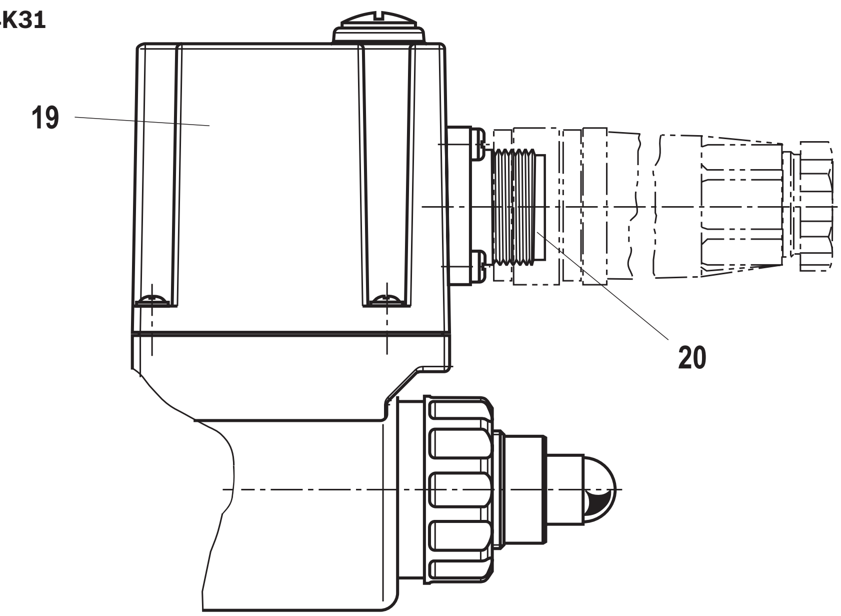
Type DBEM10-7X/..XYG24K4..

Function, section

Type DBEME – with integrated electronics (OBE)
In terms of function and design, these valves correspond to type DBEM. On the proportional solenoid, there is moreover a housing (19) with the control electronics.
Supply and command value voltage are applied to the connector (20).
In the factory, the command value pressure characteristic curve is adjusted with little manufacturing tolerance.

For more information on the control electronics, see page 9.

Type DBEME...-7X/...YG24K31



Technical data
(For applications outside these parameters, please consult us!)

general			**Size 10**	**Size 25**	**Size 32**
Weight	– Type DBEM	kg	4.5	5.3	6.4
	– Type DBEME	kg	4.7	5.5	6.6
	– Type DBEMG	kg	7	6,74	6.4
	– Type DBEMEG	kg	7,2	6,94	6.6
Installation position			Any		
Storage temperature range		°C	–20 to +80		
Ambient temperature range	– Type DBEM	°C	–20 to +70		
	– Type DBEME	°C	–20 to +50		

hydraulic (measured with HLP46, ϑ_{Oil} = 40 ±5 °C)			**Size 10**	**Size 25**	**Size 32**
Maximum operating pressure	– Port P and X	bar	350		
	– Port T	bar	315		
	– Port Y	bar	Separately and to the tank at zero pressure		
Maximum set pressure	– Pressure rating 50 bar	bar	50		
	– Pressure rating 100 bar	bar	100		
	– Pressure rating 200 bar	bar	200		
	– Pressure rating 315 bar	bar	315		
	– Pressure rating 350 bar	bar	350		
Minimum set pressure with command value zero		bar	See characteristic curve page 10		
Maximum pressure limitation, set upon delivery			If necessary, the value may be reduced		
	– Pressure rating 50 bar	bar	to 75 bar		
	– Pressure rating 100 bar	bar	to 135 bar		
	– Pressure rating 200 bar	bar	to 240 bar		
	– Pressure rating 315 bar	bar	to 350 bar		
	– Pressure rating 350 bar	bar	to 390 bar		
Maximum flow		l/min	275 [1]	550	700
Pilot flow		l/min	0.4 to 1	0.4 to 1.5	0.4 to 1.5
Hydraulic fluid			See table page 7		
Hydraulic fluid temperature range		°C	–20 to +80		
Viscosity range		mm²/s	15 to 380		
Maximum permitted degree of contamination of the hydraulic fluid - cleanliness class according to ISO 4406 (c)			Class 20/18/15 [2]		
Hysteresis (see command value pressure characteristic curve)		%	≤ 5 of the maximum set pressure		
Linearity		%	±3.5 of the maximum set pressure		
Manufacturing tolerance of the command value pressure characteristic curve, related to the hysteresis characteristic curve; pressure increasing	– Type DBEM	%	±5 of the maximum set pressure		
	– Type DBEME	%	±1.5 of the maximum set pressure		
Step response T_u + T_g	10 % → 90 %	ms	~100	Measured with standing hydraulic fluid column, 0.2 liters at port A	
	90 % → 10 %	ms	~100		
Step response T_u + T_g	10 % → 90 %	ms	~200	Measured with standing hydraulic fluid column, 5 liters at port A	
	90 % → 10 %	ms	~200		

1) Version G to 200 l/min

2) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the life cycle of the components.

Technical data

(For applications outside these parameters, please consult us!)

Hydraulic fluid		**Classification**	**Suitable sealing materials**	**Standards**
Mineral oils and related hydrocarbons		HL, HLP	NBR, FKM	DIN 51524
Bio-degradable	– Insoluble in water	HETG	NBR, FKM	VDMA 24568
		HEES	FKM	
	– Soluble in water	HEPG	FKM	VDMA 24568
Flame-resistant	– Water-free	HFDU, HFDR	FKM	ISO 12922
	– Containing water	HFC	NBR	ISO 12922

Important information on hydraulic fluids!

- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.)!
- The flash point of the hydraulic fluid used must be 40 K higher than the maximum solenoid surface temperature.
- **Flame-resistant – containing water**: Maximum pressure differential per control edge 210 bar, otherwise, increased cavitation erosion. Life cycle as compared to HLP 30 to 100 %
  Fluid temperature maximum 60 °C
- **Bio-degradable:** When using bio-degradable hydraulic fluids that are simultaneously zinc-solving, zinc may accumulate in the fluid (per pole tube 700 mg zinc).

electric			**G24**	**G24-8**
Minimum solenoid current		mA	≤ 100	≤ 100
Maximum solenoid current		mA	1600 ± 10 %	800 ± 5 %
Solenoid coil resistance	– Cold value at 20 °C	Ω	5.5	20.6
	– Maximum hot value	Ω	8.05	33
Duty cycle		%	100	100

electrical, integrated electronics (OBE)			
Supply voltage	– Nominal voltage	VDC	24
	– Lower limit	VDC	21
	– Upper limit	VDC	35
Current consumption		A	≤ 1.5
Required fuse protection		A	2, time-lag
Inputs	– Voltage	V	0 to 10
	– Current	mA	4 to 20
Output	– Actual current value	mV	1 mV ≙ 1 mA
Protection class of the valve according to EN 60529			IP 65 with mating connector mounted and locked

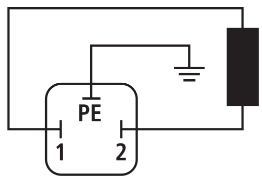
Caution!
At an ambient temperature of 70 °C and a duty cycle of 100 % with max. current, the coil reaches temperatures of up to 170 °C. Contact with the coil may lead to burns.

Notice!
Information on the environment simulation testing for the areas EMC (electromagnetic compatibility), see declaration on environmental compatibility data sheet 29162-U.

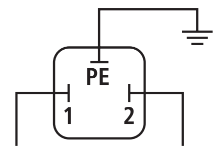
Electrical connection
(dimensions in mm)

Type DBEM

Connection at the connector

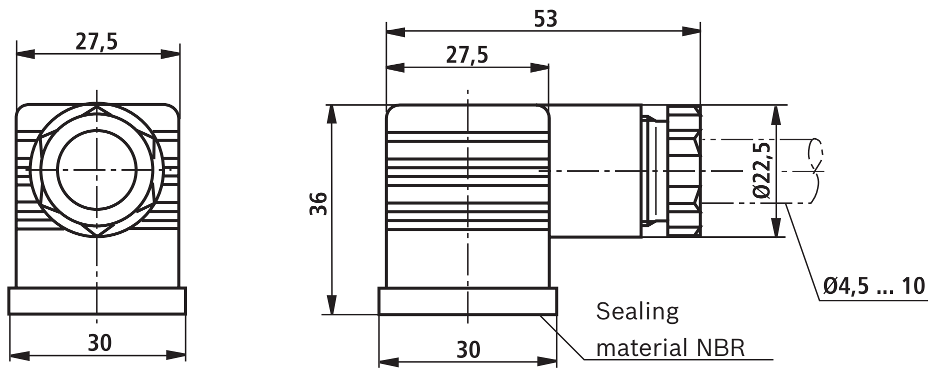


Connection at mating connector



to the amplifier

Mating connector (black) according to DIN EN 175301-803
Material no. **R901017011**
(separate order)

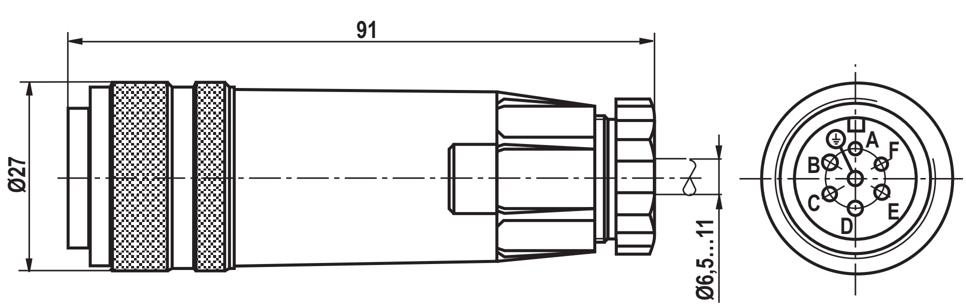


Type DBEME

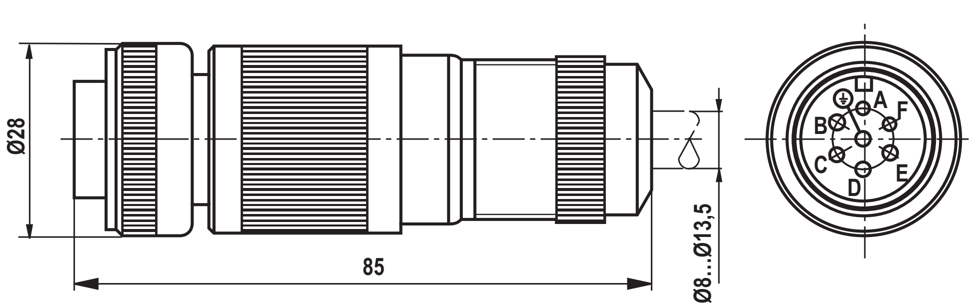
Device connector allocation	Contact	Allocation interface "A1"	Allocation interface "F1"
Supply voltage	A	24 VDC (u(t) = 21 V to 35 V); I_{max} ≤ 1.5 A	
	B	0 V	
Reference potential actual value	C	Reference contact F; 0 V	Reference contact F; 0 V
Differential amplifier input	D	0 to 10 V; R_E = 100 kΩ	4 to 20 mA; R_E = 100 Ω
	E	Reference potential command value	
Measuring output (actual value)	F	0 to 1.6 V actual value (1 mV ≙ 1 mA) load resistance > 10 kΩ	
Protective earth	PE	Connected to solenoid and valve housing	

Mating connectors according to DIN EN 175201-804, solder contacts for line cross-section 0.5 to 1.5 mm²

Plastic version,
material no. **R900021267**
(separate order)



Metal version,
material no. **R900223890**
(separate order)

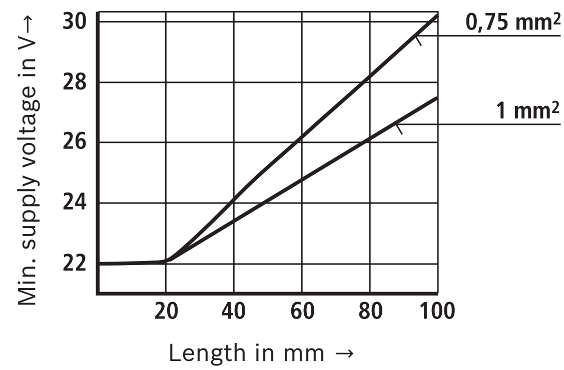


Electrical connection

Connection cable for type DBEME

– Recommendation 6-wire, 0.75 or 1 mm² plus protective earthing conductor and screening
– Only connect the screening to PE on the supply side
– Maximum admissible length 100 m

The minimum supply voltage at the power supply unit depends on the length of the supply line (see diagram).



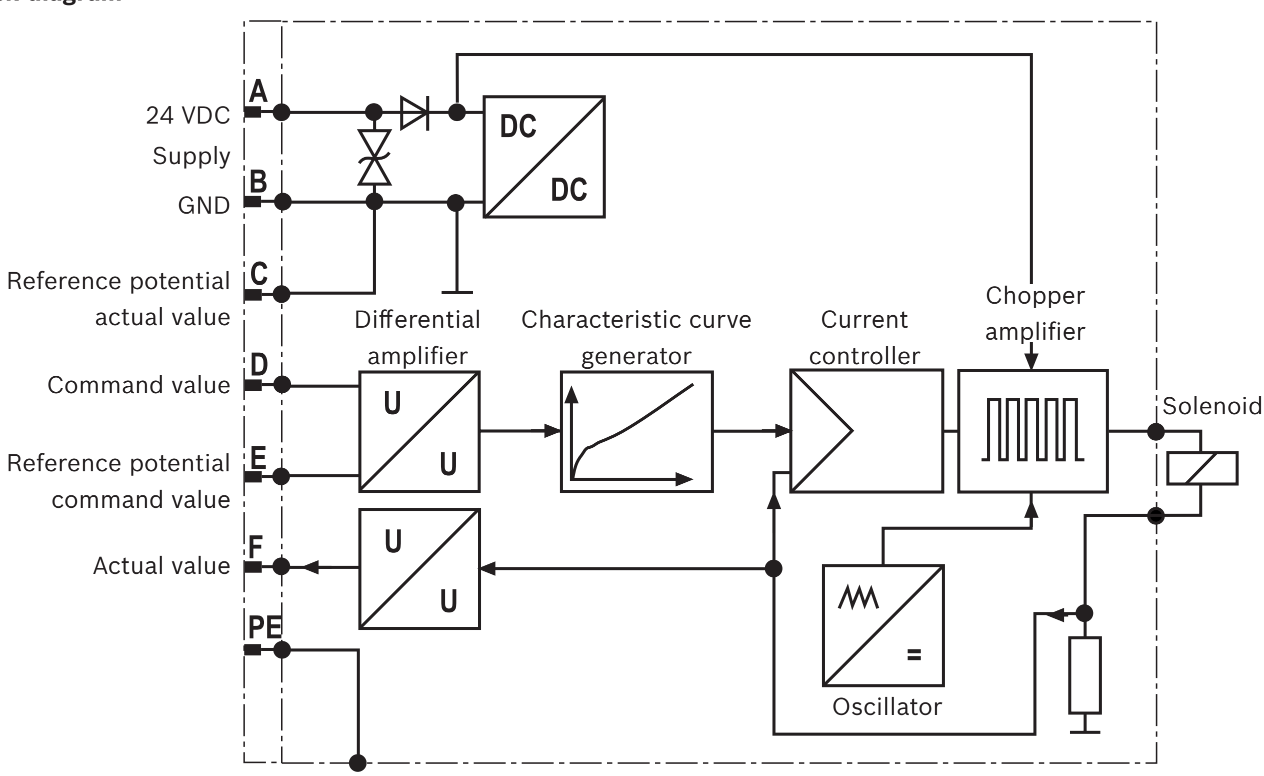
Integrated electronics (OBE) for type DBEME

Function

The electronics are supplied with voltage via ports A and B. The command value is applied to the differential amplifier ports D and E.
Via the characteristic curve generator, the command value solenoid current characteristic curve is adjusted to the valve so that non-linearities in the hydraulic system are compensated for and a linear command value pressure characteristic curve is created.
The current controller controls the solenoid current independent of the solenoid coil resistance.

The power stage of the electronics for controlling the proportional solenoid is a chopper amplifier with a cycle frequency of approx. 180 Hz to 400 Hz. The output signal is pulse-width modulated (PWM).
For checking the solenoid current, a voltage can be measured at the connector between pin F(+) and pin C(–) that is proportional to the solenoid current. **1 mV** corresponds to **1 mA** solenoid current

Block diagram

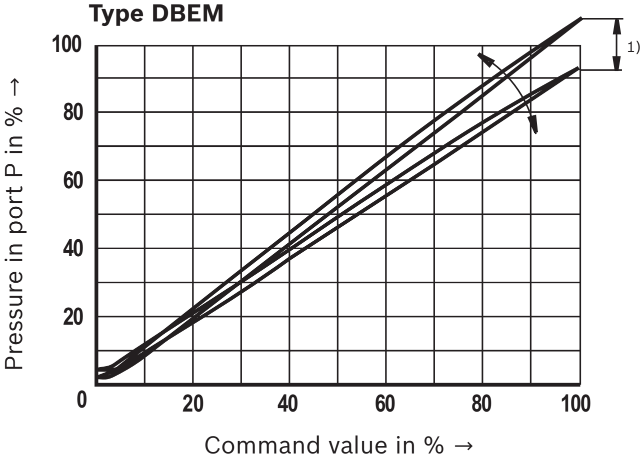


Characteristic curves

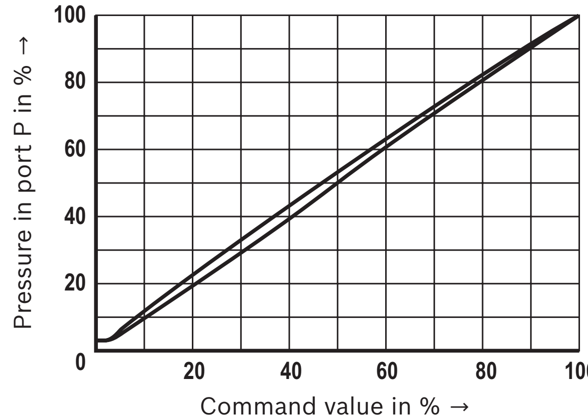
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Pressure in port P depending on the command value (flow = 24 l/min)

Type DBEM

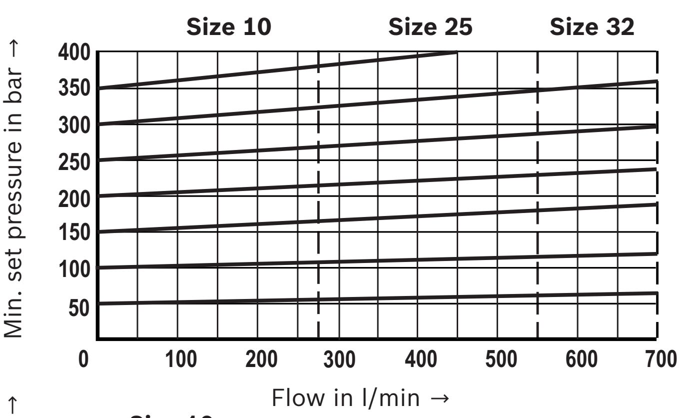


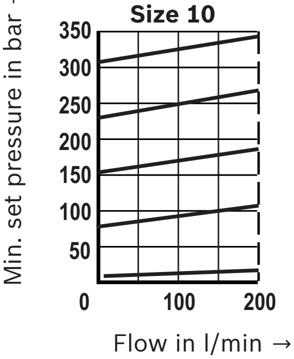
Type DBEME



1) With valve type DBEM, the manufacturing tolerance at the **external amplifier** (type and data sheet see page 16) can be changed using the command value attenuator potentiometer "**Gw**". The digital amplifier is set using the parameter "Limit".
In this connection, the control current according to the technical data must not be exceeded.
In order to be able to adjust several valves to the same characteristic curve, don't set the pressure higher than the maximum set pressure of the pressure rating with command value 100 %.

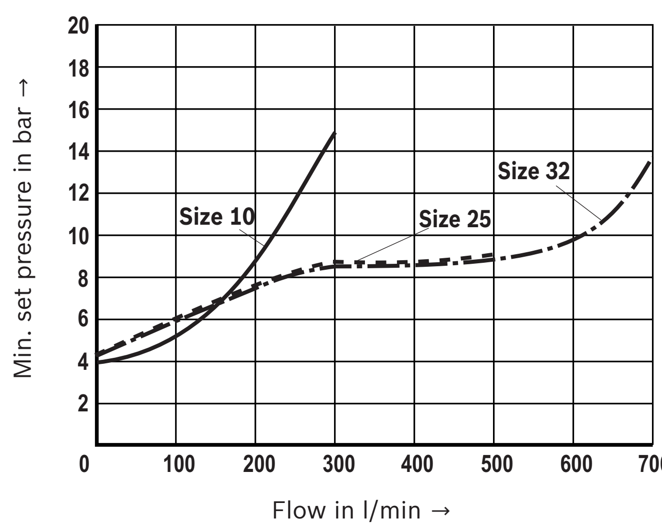
Set pressure depending on the flow





Version G
(Characteristic curves for size 25 and size 30 identical to version „subplate mounting")

Min. set pressure with command value 0

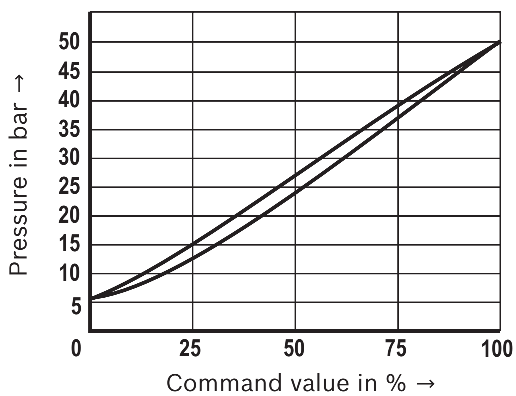


The characteristic curves apply to output pressure in T or Y = 0 bar in the total flow range.
Notice: So that the minimum set pressure is achieved, the pilot current must not exceed 100 mA.

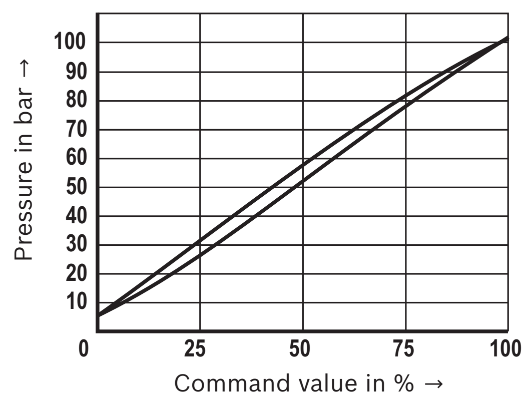
Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Command value pressure characteristic curves (measured with a flow of 24 l/min and with amplifier VT-MSPA1-1)

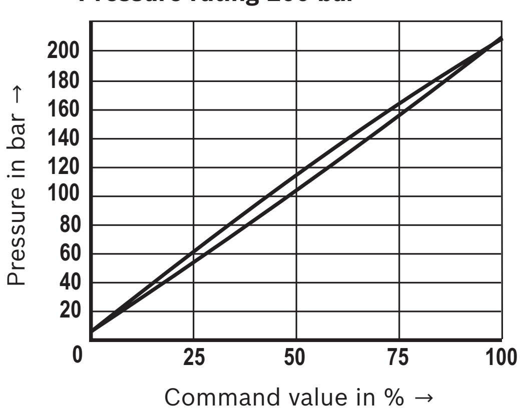
Pressure rating 50 bar



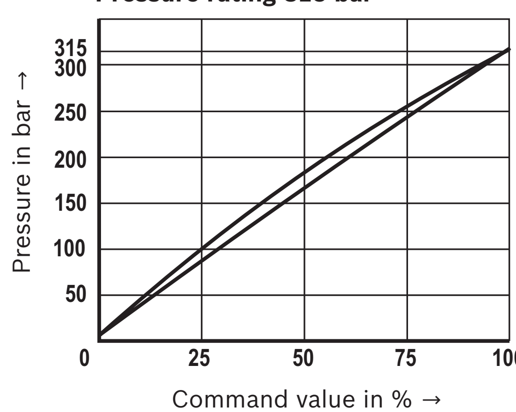
Pressure rating 100 bar



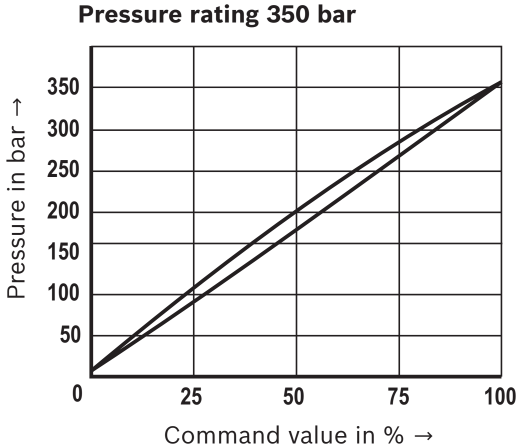
Pressure rating 200 bar



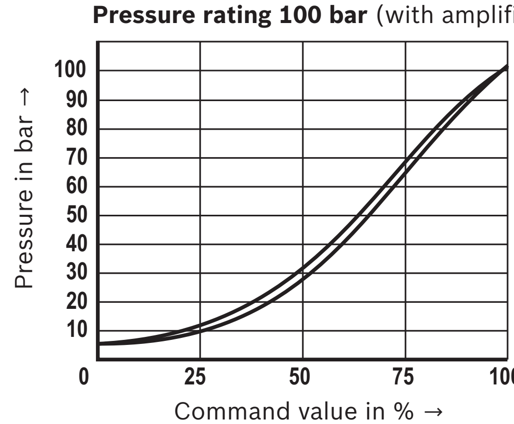
Pressure rating 315 bar



Pressure rating 350 bar

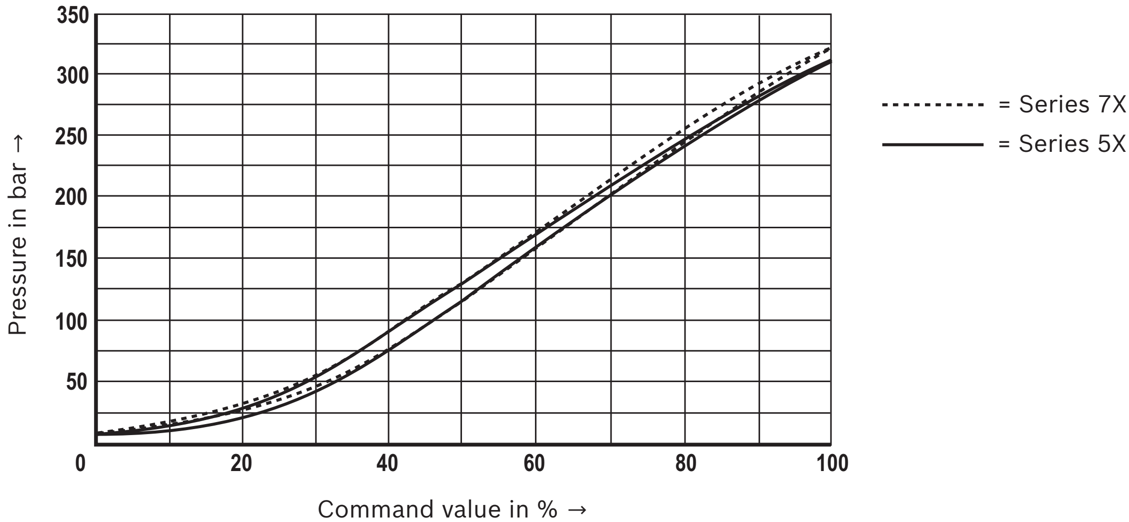


Pressure rating 100 bar (with amplifier VT-VSPA1-1)

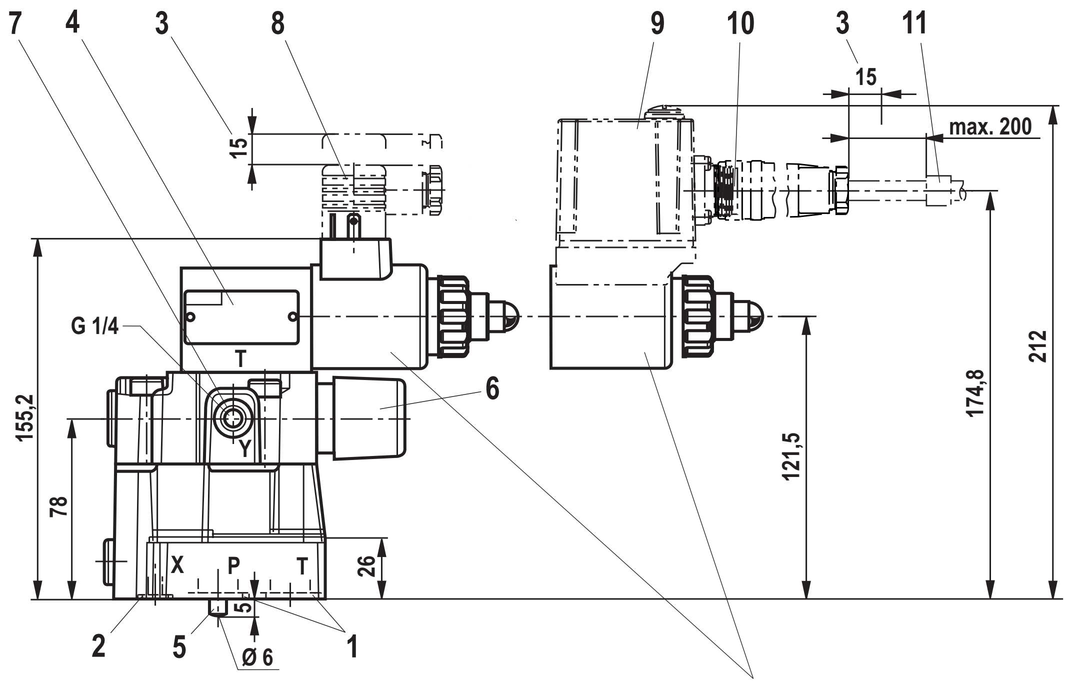


Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Comparison series 5X and 7X using the pressure rating 315 bar as example (with amplifier VT-SSPA1-1-1X with 800 mA coil)

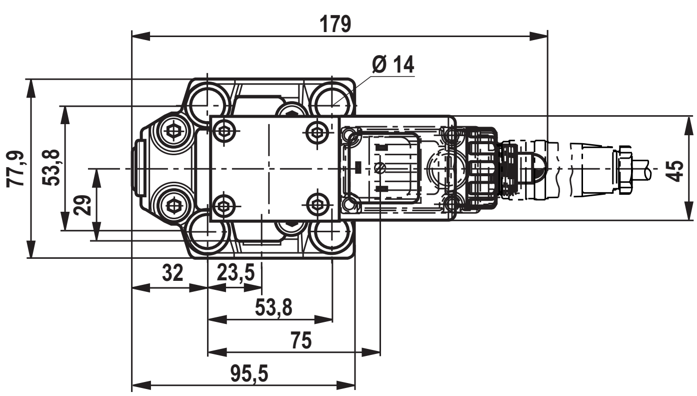


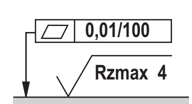
Dimensions: Type DBEM(E) 10
(dimensions in mm)



Coil and electronics freely rotatable!

O-ring and plastic nut for coil fixation. The nut can be loosened by rotating it counterclockwise (1 turn). Afterwards, the solenoid coil can be rotated in any desired position. Subsequent fixation applying 5±1 Nm.





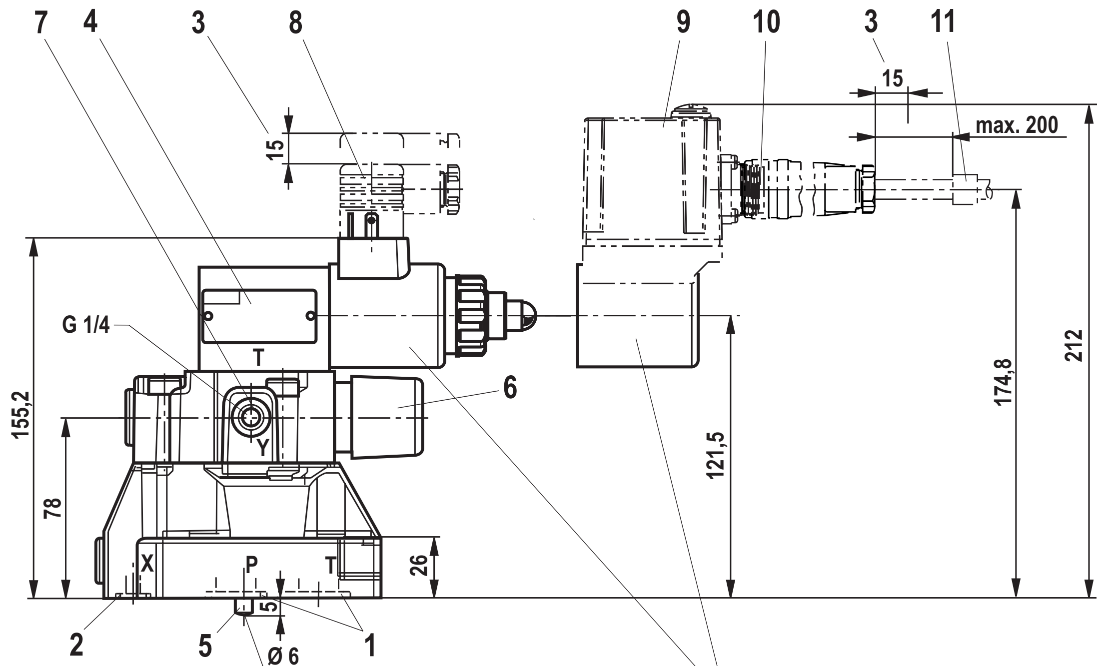
Required surface quality of the valve contact surface

1 Seal rings for ports P and T
2 Seal ring for ports X
3 Space required to remove the mating connector
4 Name plate
5 Locating pin
6 Maximum pressure limitation
7 External pilot oil return, separately and to the tank at zero pressure
8 Mating connector for type DBEM
9 Integrated electronics (OBE)
10 Mating connector for type DBEME
11 Cable fastening

Notice!
The dimensions are nominal dimensions which are subject to tolerances.

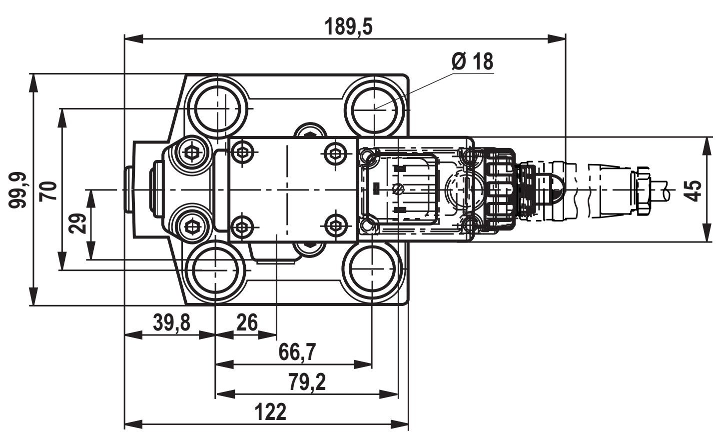
Valve mounting screws and **subplates** see page 19.

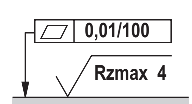
Dimensions: Type DBEM(E) 25
(dimensions in mm)



Coil and electronics freely rotatable!

O-ring and plastic nut for coil fixation. The nut can be loosened by rotating it counterclockwise (1 turn). Afterwards, the solenoid coil can be rotated in any desired position. Subsequent fixation applying 5±1 Nm.





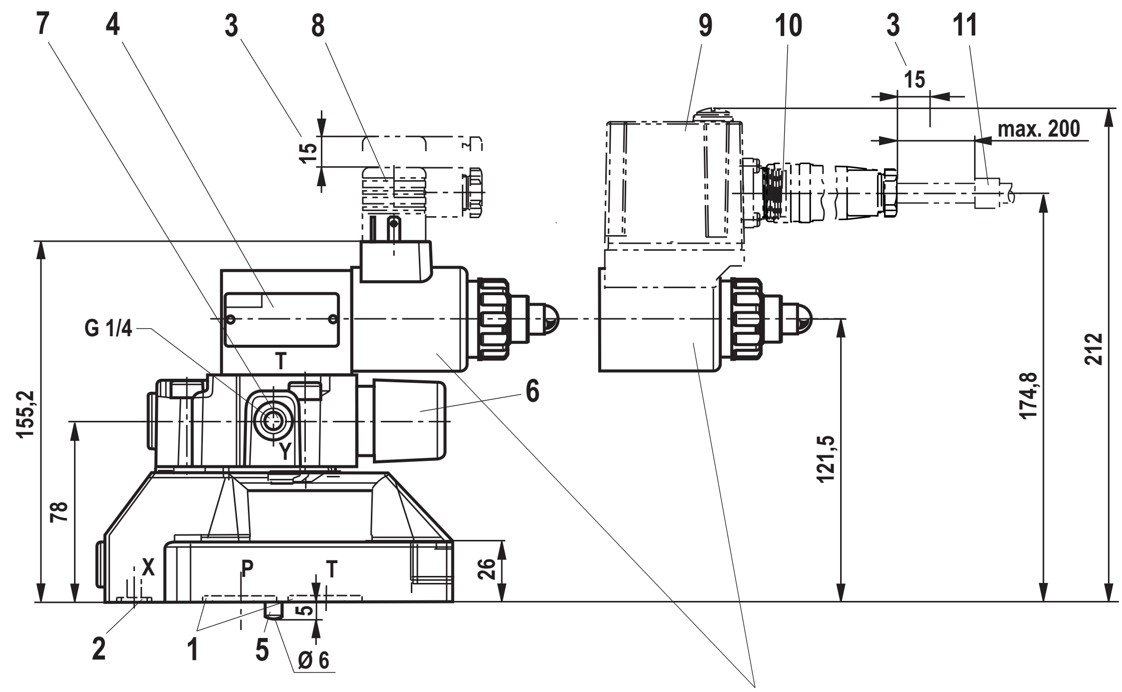
Required surface quality of the valve contact surface

1 Seal rings for ports P and T
2 Seal ring for ports X
3 Space required to remove the mating connector
4 Name plate
5 Locating pin
6 Maximum pressure limitation
7 External pilot oil return, separately and to the tank at zero pressure
8 Mating connector for type DBEM
9 Integrated electronics (OBE)
10 Mating connector for type DBEME
11 Cable fastening

Notice!
The dimensions are nominal dimensions which are subject to tolerances.

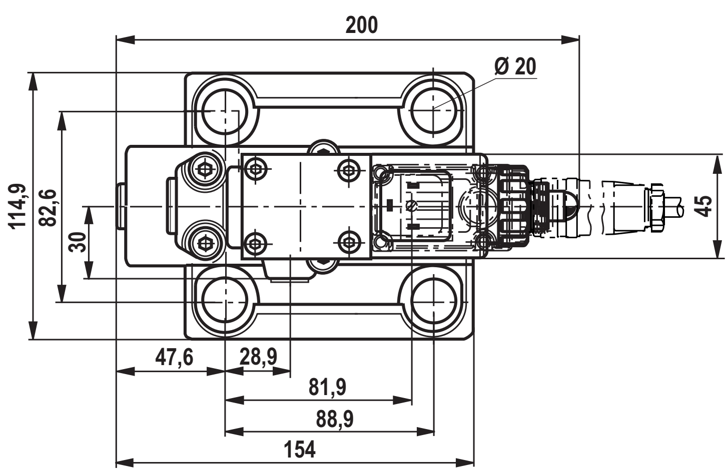
Valve mounting screws and **subplates** see page 19.

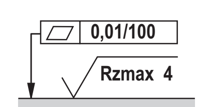
Dimensions: Type DBEM(E) 32
(dimensions in mm)



Coil and electronics freely rotatable!

O-ring and plastic nut for coil fixation. The nut can be loosened by rotating it counterclockwise (1 turn). Afterwards, the solenoid coil can be rotated in any desired position. Subsequent fixation applying 5±1 Nm.





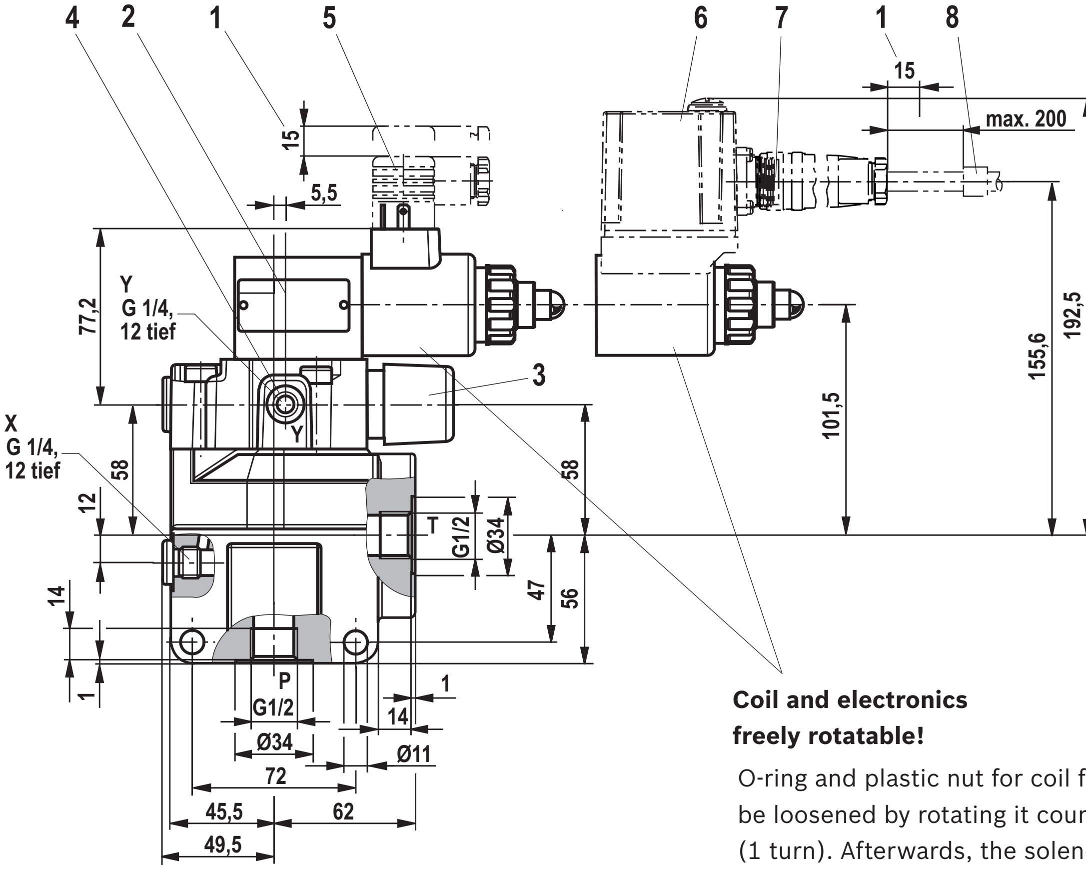
Required surface quality of the valve contact surface

1 Seal rings for ports P and T
2 Seal ring for ports X
3 Space required to remove the mating connector
4 Name plate
5 Locating pin
6 Maximum pressure limitation
7 External pilot oil return, separately and to the tank at zero pressure
8 Mating connector for type DBEM
9 Integrated electronics (OBE)
10 Mating connector for type DBEME
11 Cable fastening

Notice!
The dimensions are nominal dimensions which are subject to tolerances.

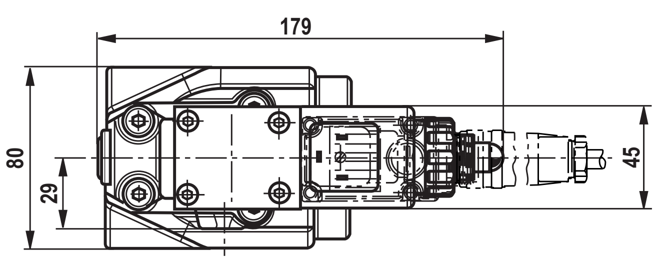
Valve mounting screws and **subplates** see page 19.

Dimensions: Type DBEM(E) 10G
(dimensions in mm)



Coil and electronics freely rotatable!

O-ring and plastic nut for coil fixation. The nut can be loosened by rotating it counterclockwise (1 turn). Afterwards, the solenoid coil can be rotated in any desired position. Subsequent fixation applying 5±1 Nm.

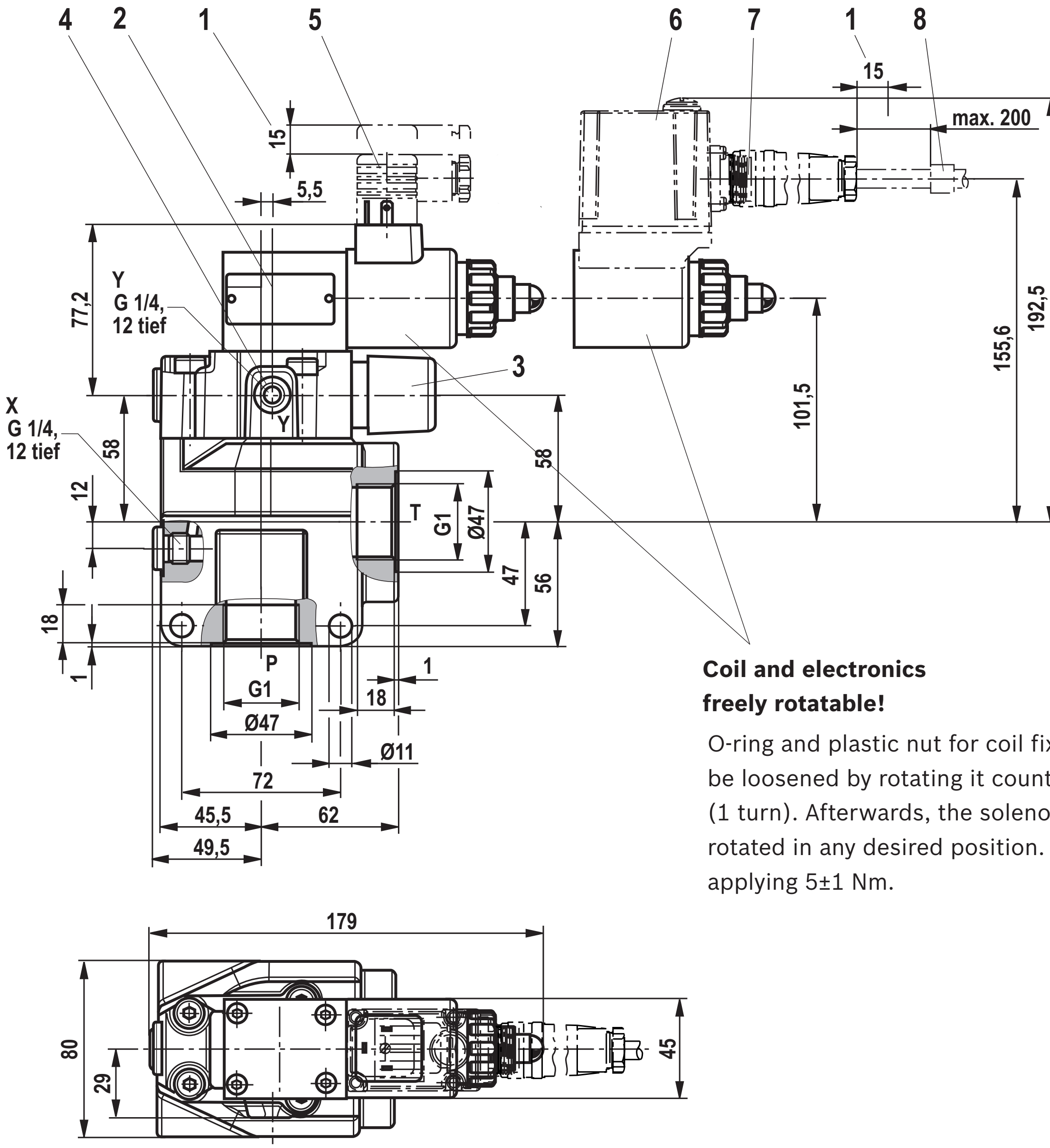


1 Space required to remove the mating connector
2 Name plate
3 Maximum pressure limitation
4 External pilot oil return,
separately and to the tank at zero pressure
5 Mating connector for type DBEM
6 Integrated electronics (OBE)
7 Mating connector for type DBEME
8 Cable fastening

Notice!
The dimensions are nominal dimensions which are subject to tolerances.

Valve mounting screws and **subplates** see page 19.

Dimensions: Type DBEM(E) 25G
(dimensions in mm)



Coil and electronics freely rotatable!

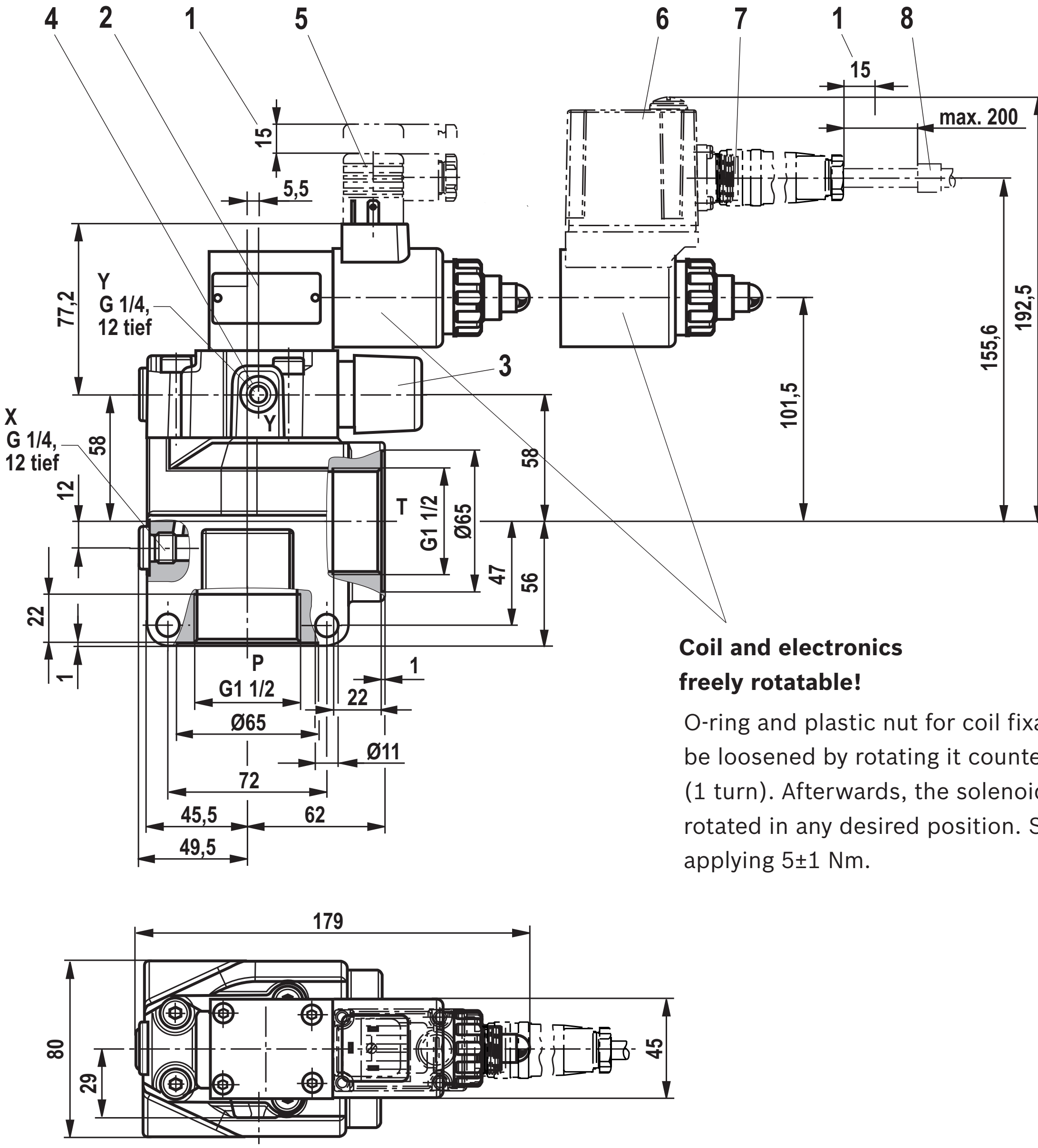
O-ring and plastic nut for coil fixation. The nut can be loosened by rotating it counterclockwise (1 turn). Afterwards, the solenoid coil can be rotated in any desired position. Subsequent fixation applying 5±1 Nm.

1 Space required to remove the mating connector
2 Name plate
3 Maximum pressure limitation
4 External pilot oil return,
separately and to the tank at zero pressure
5 Mating connector for type DBEM
6 Integrated electronics (OBE)
7 Mating connector for type DBEME
8 Cable fastening

Notice!
The dimensions are nominal dimensions which are subject to tolerances.

Valve mounting screws and **subplates** see page 19.

Dimensions: Type DBEM(E) 32G
(dimensions in mm)



Coil and electronics freely rotatable!

O-ring and plastic nut for coil fixation. The nut can be loosened by rotating it counterclockwise (1 turn). Afterwards, the solenoid coil can be rotated in any desired position. Subsequent fixation applying 5±1 Nm.

1 Space required to remove the mating connector
2 Name plate
3 Maximum pressure limitation
4 External pilot oil return,
separately and to the tank at zero pressure
5 Mating connector for type DBEM
6 Integrated electronics (OBE)
7 Mating connector for type DBEME
8 Cable fastening

Notice!
The dimensions are nominal dimensions which are subject to tolerances.

Valve mounting screws and **subplates** see page 19.

Dimensions

Hexagon socket head cap screws (separate order)		**Material number**
Size 10	4x ISO 4762 - M12 x 50 - 10.9-flZn-240h-L Friction coefficient μ_{total} = 0.09 to 0.14; Tightening torque M_A = 75 Nm ±10 %	R913000283
Size 25	4x ISO 4762 - M16 x 50 - 10.9-flZn-240h-L Friction coefficient μ_{total} = 0.09 to 0.14; Tightening torque M_A = 185 Nm ±10 %	R913000378
Size 32	4x hexagon socket head cap screw DIN 912 - M18 x 50 - 10.9-flZnnc-240h-L Friction coefficient μ_{total} = 0.09 to 0.14; Tightening torque M_A = 248 Nm ±10 %	R913031952

Notice: For reasons of stability, exclusively these valve mounting screws may be used. The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure!

Subplates	**Data sheet**	**Material number**
Size 10, 25, 32	45064	

Accessories
(not included in the delivery)

External control for type DBEM (only standard version G24)	**Data sheet**	**Material number**
VT-MSPA1-1-1X/V0/... in modular design (analog) VT-VSPD-1-2X/V0/.-0-1 in Euro-card format (digital) VT-VSPA1-2-1X/V0/...in Euro-card format (analog) VT-SSPA1-1-1X/V0/0-24 as plug-in amplifier	30223 30523 30115 30116	

Additionally (800 mA version G24-8)	**Data sheet**	**Material number**
VT-2000-5X/X/V0/... in Euro-card format VT-MSPA1-30 in modular design (analog)	29904 30224	

Mating connectors (details see page 7)	**Data sheet**	**Material number**
For type DBEM: Mating connectors according to DIN EN 175301-803 For type DBEME: Mating connectors according to DIN EN 175201-804	08006 08006	R901017011 R900021267 (plastic) R900223890 (metal)

Pressure relief valve with DC motor operation, pilot operated

RE 29139/06.07
Replaces: 01.00

Type DBG

Size 8 to 32
Component series 1X
Maximum operating pressure 315 bar
Maximum flow 600 l/min

tb0094

Table of contents

Features

– Operation by DC motor with reducing gear
– For subplate mounting:
  Porting pattern to ISO 6264-AR-06-2-A (size 10),
  ISO 6264-AS-08-2-A (size 25),
  ISO 6264-AT-10-2-A (size 32)
– For threaded connection
– For block installation
– 5 pressure ratings
– With actual value potentiometer or limit switch
– Self-locking in the event of a power failure
  (system pressure constant on variant with limit switch)

Further information:
Subplates according to RE 45064

Ordering code

DBG			–1X/				*

Pressure relief valve
with DC motor operation

Pilot operated valve (complete)	**= No code**
Pilot valve **without** main spool insert (do **not** enter valve size)	**= C**
Pilot valve **with** main spool insert (enter valve size 30)	**= C**
Separate pilot valve as remote control valve (do **not** enter valve size)	**= T**

Size	Ordering code	
	Subplate mounting "No code"	Threaded connection "G"
8	–	= **8** (G3/8)
10	= **10**	= **10** (G1/2)
16	–	= **15** (G3/4)
20	–	= **20** (G1)
25	= **20**	= **25** (G1 1/4)
32	= **30**	= **30** (G1 1/2)

For subplate mounting and block installation	**= No code**
For threaded connection	**= G**

1X =	Component series 10 to 19 (10 to 19: unchanged installation and connection dimensions)

Pressure rating, max

50 =	Set pressure up to 50 bar
100 =	Set pressure up to 100 bar
200 =	Set pressure up to 200 bar
315 =	Set pressure up to 315 bar
400 = (DBGT only)	Set pressure up to 400 bar

Pilot oil flow

No code =	Internal pilot oil supply / drain
X =	External pilot oil supply Internal pilot oil drain
Y =	Internal pilot oil supply External pilot oil drain
XY =	External pilot oil supply / drain

Seal material

No code =	NBR seals
V =	FKM seals

(other seals on request)

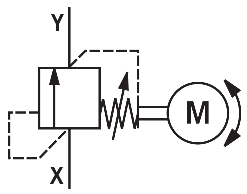
⚠ **Attention!**
Observe compatibility of seals with hydraulic fluid used!

E1 =	Limit switch
P2 =	Actual value potentiometer

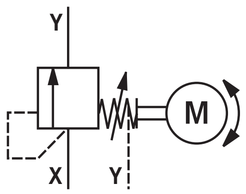
Further details in clear text

Symbols

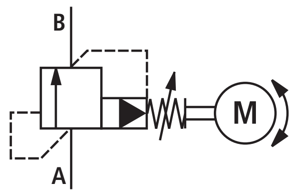
DBG $\genfrac{}{}{0pt}{}{C}{T}$–1X/..



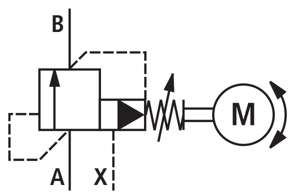
DBGC–1X/..Y..



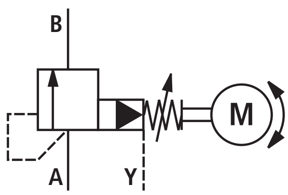
DBG..–1X/..
DBG..G–1X/..



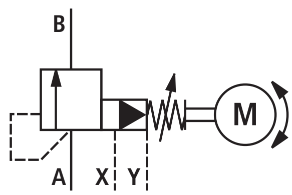
DBG..–1X/..X..
DBG..G–1X/..X..



DBG..–1X/..Y..
DBGC 30–1X/..
DBG..G–1X/..Y..



DBG..–1X/..XY..
DBG..G–1X/..XY..



Function, section

Pressure control valves of type DBG are pilot operated pressure relief valves.

They are used to limit a system pressure.

The pressure relief valves of this series basically consist of a pilot valve with electric motor as pressure adjustment element and a main valve with main spool insert.

The system pressure is adjusted by means of a DC motor (16) with reducing gear (17). The output shaft of reducing gear (17) rotates cam (14), which changes the tension of spring (8) via spring plate (15) and thus causes a change in pressure.

The pressure present in channel A acts on main spool (1.1). At the same time, the pressure is applied via pilot ports (4) and (5), which are fitted with orifices (2.1, 2.2) and (3), to the spring-loaded side of main spool (1.1) and to pilot poppet (6) in pilot valve (7).

When the system pressure rises above the value set on spring (8), pilot poppet (6) opens. The signal required for this is provided internally – on type DBG..–1X/.. via pilot lines (12) and (4) from channel A; or externally – on type DBG..–1X/..X (XY) via port (13) and pilot line (4). Pilot oil now flows through orifice (2.1), pilot line (4), orifice (2.2) and pilot poppet (6) into the spring chamber, from which it is fed to the tank either internally – on type DBG..–1X/.. via pilot line (10), or externally – on type DBG..–1X/..Y (XY) via pilot line (11)

In the closing direction, compression spring (1.2) acts on main spool (1.1), i.e. a pressure differential occurs between the '"A" side and the spring-loaded side of main spool (1.1). The pilot oil flow is determined by the cross-section of orifices (2.1, 2.2) and the pressure differential across main spool (1.1). When the pressure in "A" has risen by the pressure differential across main spool (1.1) when compared with the cracking pressure of pilot poppet (6), main spool (1.1) opens the connection from "A" to "B".

The oil now flows from channel "A" to channel "B" while maintaining the set operating pressure.

Actual value potentiometer (18) feeds back the position of cam (14).

Optionally, electrical limit switches can be installed instead of actual value potentiometer (18) for limiting the min. and max. pressure.

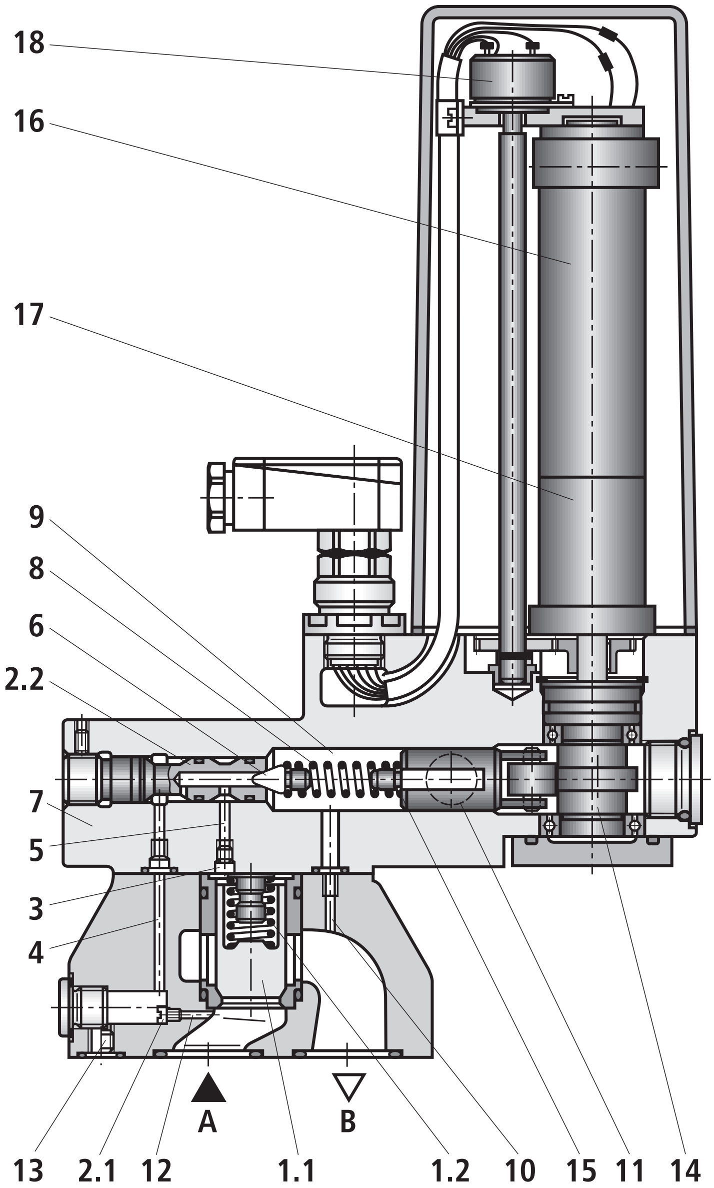
For the variant with limit switch, the min. adjustment time for the pressure range from p_{min} to p_{max} is 12 seconds. The adjustment time of 12 seconds allows gradual reaching of the required pressure in the inching mode.

For the variant with actual value potentiometer the min. adjustment time for the pressure range from p_{min} to p_{max} is 0.65 seconds.

In conjunction with the associated amplifier type VT-VRM1-1 a program control can be realised.

With the help of 2 additional pressure switches, the min. and max. pressures can be limited.

With the variant with limit switch, the pressure setting on the valve is maintained in the event of a power failure (cable break, fuse failure, short-circuit, etc.).



Technical data (for applications outside these parameters, please consult us!)

General

Size			Size	8	10	16	20	25	32
Weight	– Subplate mounting	DBG...	kg	–	7.4	–	–	8.1	9.4
	– Threaded connection	DBG..G	kg	8.5	8.5	8.5	8.3	9.8	9.5
	– Block installation	DBGC 30..	kg	5.4					
	– Pilot valve without main spool insert	DBGC...	kg	5.1					
	– Remote control valve	DBGT	kg	5.1					
Installation position				Optional					
Ambient temperature range			°C	–20 to +50					

Hydraulic

Maximum operating pressure	– Ports A, X		bar	315					
	– Port B		bar	10 (with internal pilot oil drain)					
				315 (with external pilot oil drain)					
Max. backpressure	– Port Y		bar	10					
Max. set pressure			bar	50; 100; 200; 315; 400 [1]					
Min. set pressure				Depending on q_V (see Characteristic curves on pages 6 and 7)					
Maximum flow	– Subplate mounting		l/min	–	200	–	–	400	600
	– Threaded connection		l/min	100	200	200	400	400	600
	– DBGT		l/min	12					
Pilot oil flow			l/min	1					
Hydraulic fluid				Mineral oil (HL, HLP) to DIN 51524 [2]; fast bio-degradable hydraulic fluids to VDMT 24568 (see also RE 90221); HETG (rape seed oil) [2]; HEPG (polyglycols) [3]; HEES (synthetic esters) [3]; other hydraulic fluids on request					
Hydraulic fluid temperature range			°C	–20 to +70					
Viscosity range			mm^2/s	2.8 to 380					
Permissible max. degree of contamination of the hydraulic fluid - cleanliness class to ISO 4406 (c)				Class 20/18/15 [4]					

Electrical, drive motor

Type of voltage			DC voltage
Supply voltage		V–	24
Rated power	– With limit switch	W	18
	– With actual value potentiometer	W	24
Electrical connection			Mating connector DIN 43651, 6-pin + PE
Type of protection to EN 60529			IP 65 with mating connector mounted and locked

[1] Pressure rating of 400 bar only with variant DBGT

[2] Suitable for NBR **and** FKM seals

[3] Suitable **only** for FKM seals

[4] The cleanliness classes specified for components must be adhered to in hydraulic systems.

Effective filtration prevents malfunction and, at the same time, prolongs the service life of components.
For the selection of filters, see data sheets RE 50070, RE 50076, RE 50081, RE 50086 and RE 50088.

Technical data (for applications outside these parameters, please consult us!)

Adjustment with limit switch in the inching mode: Ordering code “E1“

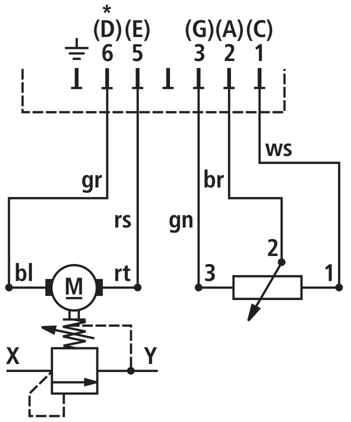
Adjustment time, p_{min} to p_{max}		s	12				
Limit switch variant:	– Micro-switch		30 V; 2 A DC				
	– Electric load		250 V; 5 A AC				
Pressure lag:	– Pressure rating	bar	50	100	200	315	400
	– Without short-circuit bridge	bar	1	2.5	5	7.5	10
	– With short-circuit bridge	bar	0.5	1	1.5	2	2.5

Adjustment with actual value potentiometer for cam position feedback function: Ordering code “P2“

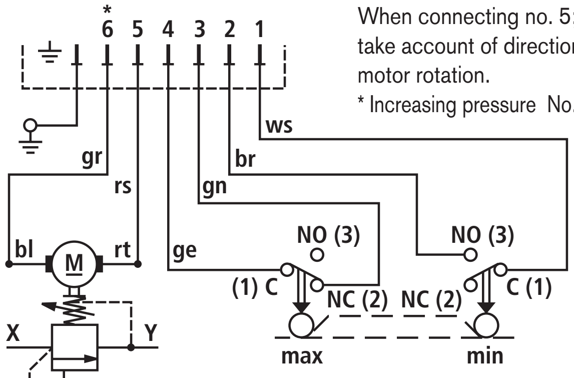
Adjustment time, p_{min} to p_{max}		s	0.65				
Potentiometer	– Resistance	kΩ	5				
	– Power	W	1.75				
Adjustment hysteresis: Start-up pressure – deviation > 10 bar from nominal pressure							
	– Pressure rating	bar	50	100	200	315	400
	– Hysteresis	bar	< 0.5	< 1	< 2.5	< 4	< 5
Adjustment hysteresis: Start-up pressure – deviation > 20 bar from nominal pressure							
	– Pressure rating	bar	50	100	200	315	400
	– Hysteresis	bar	< 0.3	< 0.5	< 1	< 1.5	< 2
Repeatability		bar	< 0.5	< 1	< 1.3	< 1.7	< 2
Amplifier							
Electrical amplifier			VT-VRM1-1, component series 1X – see RE 30405-D				

Electrical connection

Plug connection on DBG valve with actual value potentiometer	Plug connection on DBG valve with limit switch



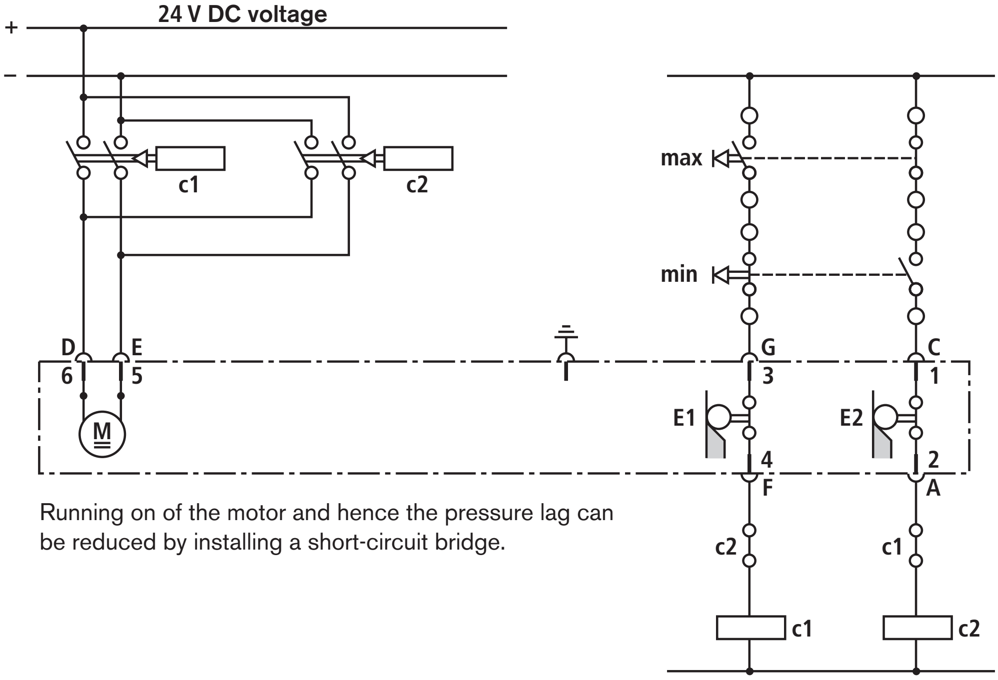
When connecting no. 5; 6 take account of direction of motor rotation.
* Increasing pressure No. 6 "+"



When connecting no. 5; 6 take account of direction of motor rotation.
* Increasing pressure No. 6 "+"

Initial position: Minimum position

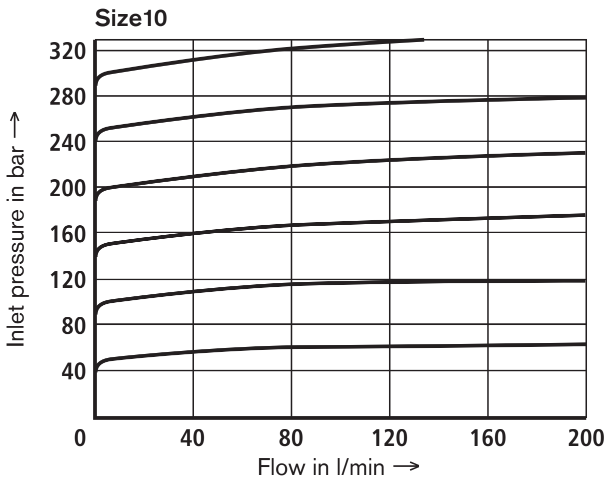
Circuit example: DBG valve with limit switch

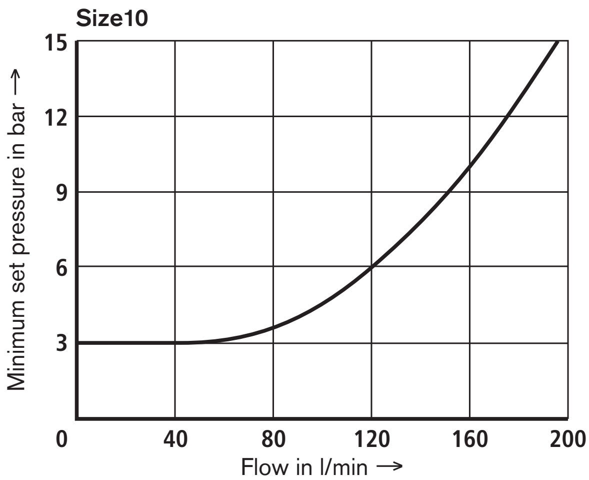


Running on of the motor and hence the pressure lag can be reduced by installing a short-circuit bridge.

Characteristic curves (measured at $\nu = 36$ mm²/s and $\vartheta_{oil} = 50$ °C)

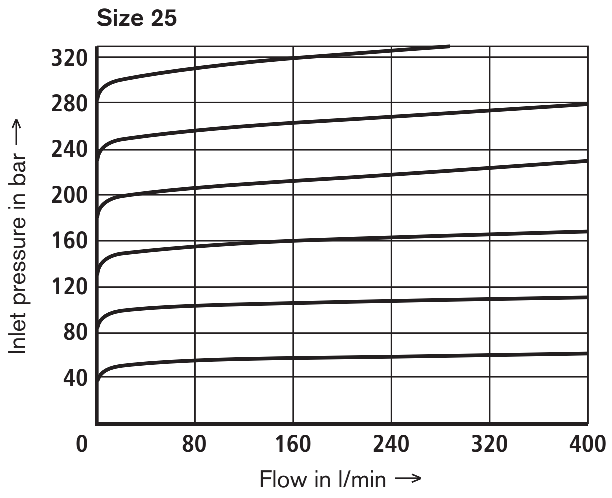
The characteristic curves were measured with external, pressureless pilot oil drain. With internal pilot oil drain, the inlet pressure increases by the output pressure present in port B.

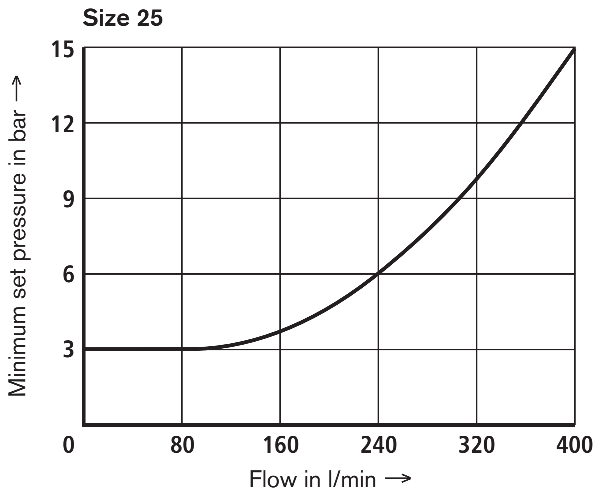


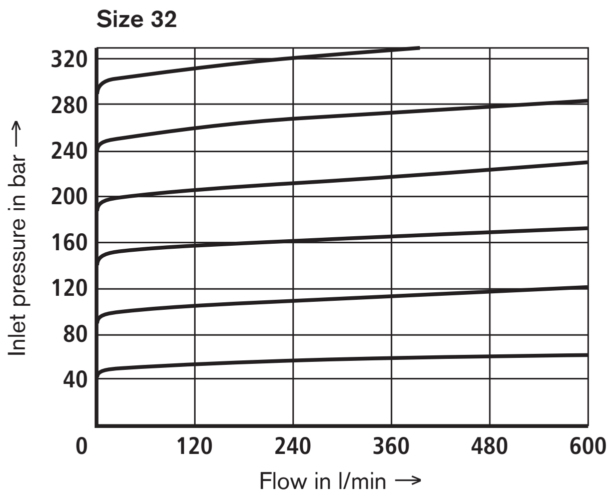


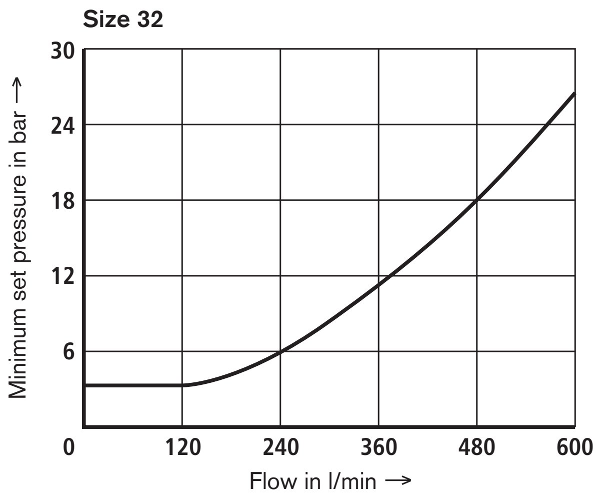
Characteristic curves (measured at $\nu = 36\ mm^2/s$ and $\vartheta_{oil} = 50\ °C$)

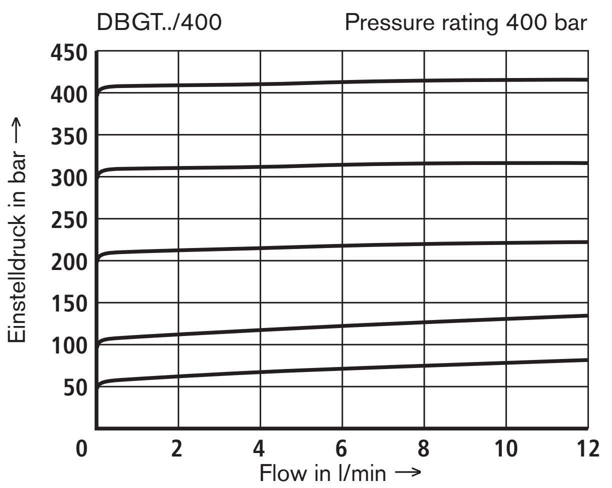
The characteristic curves were measured with external, pressureless pilot oil drain. With internal pilot oil drain, the inlet pressure increases by the outlet pressure present in port B.

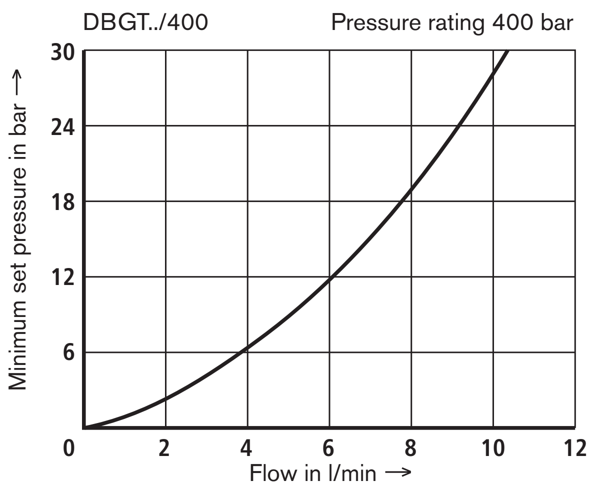




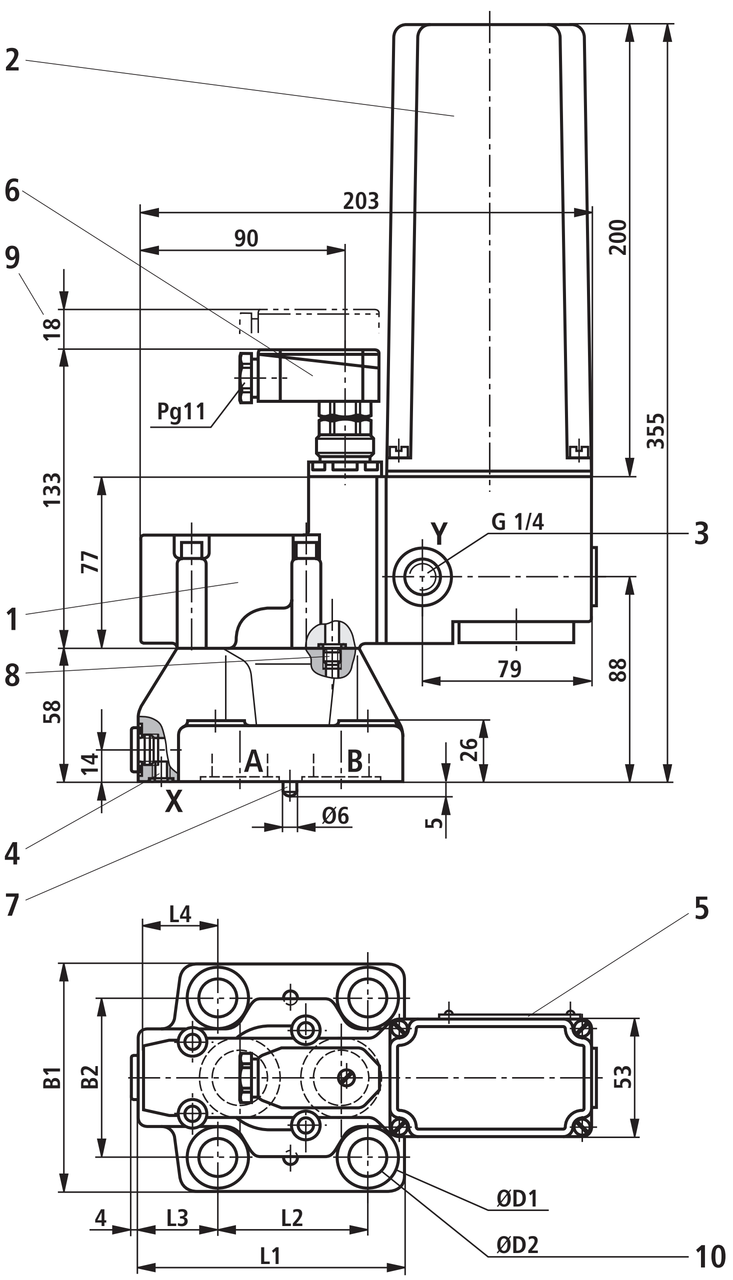








Unit dimensions: Subplate mounting (dimensions in mm)



1 Pilot valve
2 DC motor
3 Port “Y“
for external pilot oil drain
4 Port “X“
for external pilot oil supply
5 Nameplate
6 Mating connector (included in scope of supply)
7 Locating pin
8 Not required with internal pilot oil drain
9 Space required to remove mating connector
10 Valve mounting bore

Subplates to data sheet RE 45064
(separate order)

– Size 10	G 545/01	(G3/8)
	G 546/01	(G1/2)
– Size 25	G 408/01	(G3/4)
	G 409/01	(G1)
– Size 32	G 410/01	(G1 1/4)
	G 411/01	(G1 1/2)

Valve fixing screws (separate order)

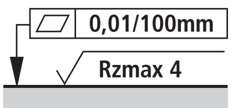
For strength reasons, only the following valve fixing screws may be used:

– Size 10
4 hexagon socket head cap screws ISO 4762 - M12 x 50 - 10.9-flZn-240h-L to VDA 235-101
Friction coefficient μ_{total} = 0.09 to 0.14,
tightening torque M_T = 75 Nm ± 10%,
Material no. **R913000283**

– Size 25
4 hexagon socket head cap screws ISO 4762 - M16 x 50 - 10.9-flZn-240h-L to VDA 235-101
Friction coefficient μ_{total} = 0.09 to 0.14,
tightening torque M_T = 185 Nm ± 10%,
Material no. **R913000378**

– Size 32
4 hexagon socket head cap screws ISO 4762 - M18 x 50 - 10.9-flZn-240h-L to VDA 235-101
Friction coefficient μ_{total} = 0.09 to 0.14,
tightening torque M_T = 248 Nm ± 10%,
Material no. **R900002245**

The tightening torques given are guidelines when screws of the specificied friction coefficients and a torque wrench (tolerance ±10 %) are used.

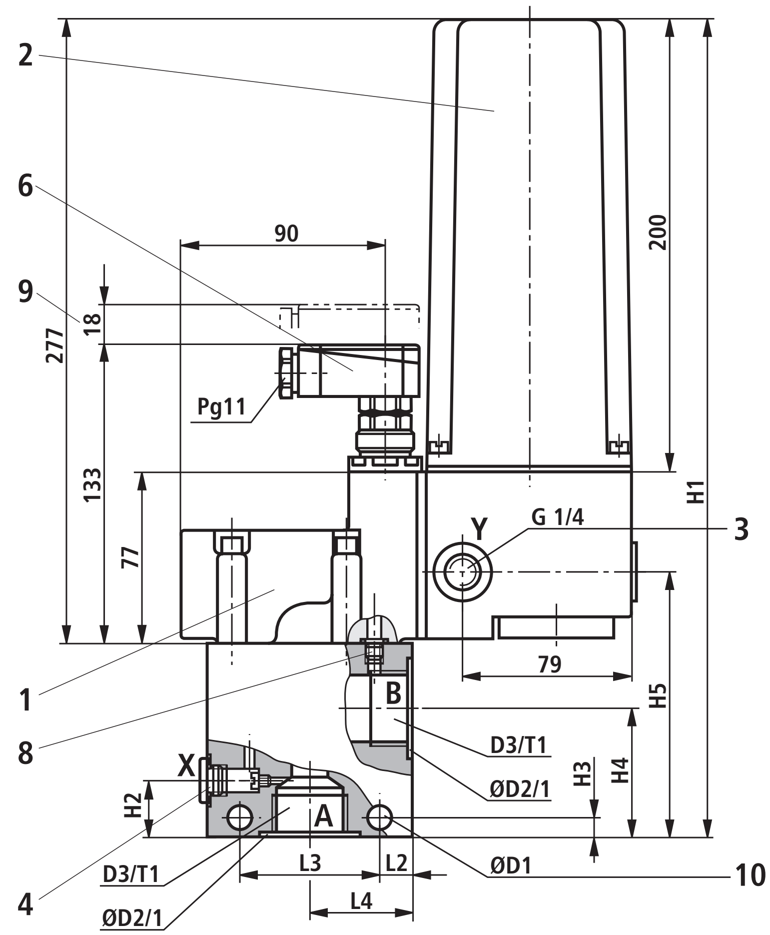


Required surface quality of valve mounting face

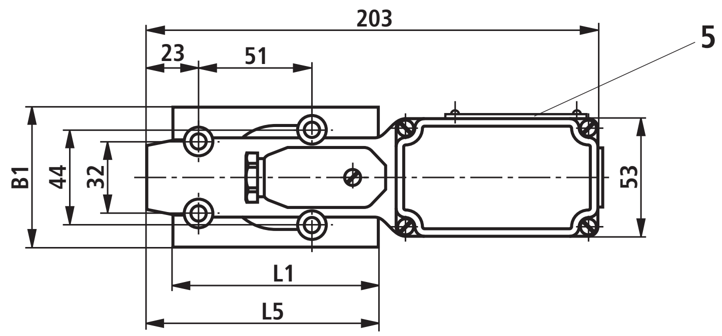
Tolerances according to:
– General tolerances ISO 2768-mK

Size	B1	B2	ØD1	ØD2	L1	L2	L3	L4	O-ring - port X	O-ring - ports A, B
10	78	54	20	14	90	54	23.5	37	9.25 x 1.78	17.12 x 2.62
25	100	69.8	26	18	117	66.7	34	34	9.25 x 1.78	28.17 x 3.53
32	115	82.5	30	20	148	89	41.5	31.5	9.25 x 1.78	34.52 x 3.53

Unit dimensions: Threaded connection (dimensions in mm)



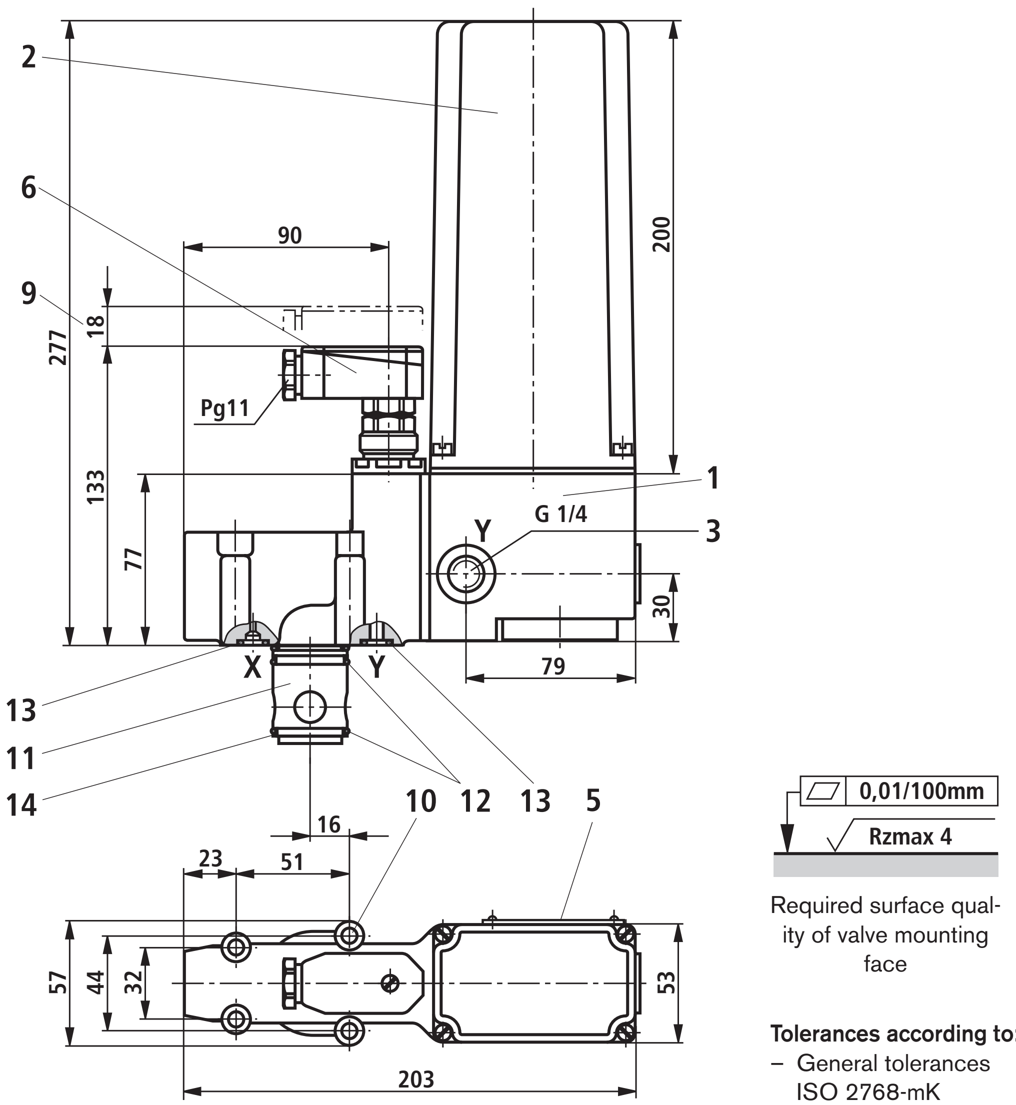
1 Pilot valve
2 DC motor
3 Port "Y" for external pilot oil drain
4 Port "X" for remote control
5 Nameplate
6 Mating connector (included in scope of supply)
8 Not required with internal pilot oil drain
9 Space required to remove mating connector
10 Valve mounting bore



Tolerances according to:
– General tolerances ISO 2768-mK

Size	B1	ØD1	ØD2	D3	H1	H2	H3	H4	H5	L1	L2	L3	L4	L5	T1
8	63	9	28	G3/8	362	27	10	62	115	85	14	62	45	100	12
10			34	G1/2											14
16			42	G3/4											16
20			47	G1				57							18
25	70	11	56	G1 1/4	375	42	13	66	128	100	18	72	54	109	20
32			61	G1 1/2											22

Unit dimensions: Block installation (dimensions in mm)



Required surface quality of valve mounting face

Tolerances according to:
- General tolerances ISO 2768-mK

1 Pilot valve
2 DC motor
3 Port "Y" for external pilot oil drain
5 Nameplate
6 Mating connector (included in scope of supply)
9 Space required to remove mating connector
10 Valve mounting bores
11 Main spool insert
12 O-ring 27.3 x 2.4
13 O-ring 9.25 x 1.78
14 Back-up ring 32/28.4 x 0.8

Valve fixing screws (separate order)

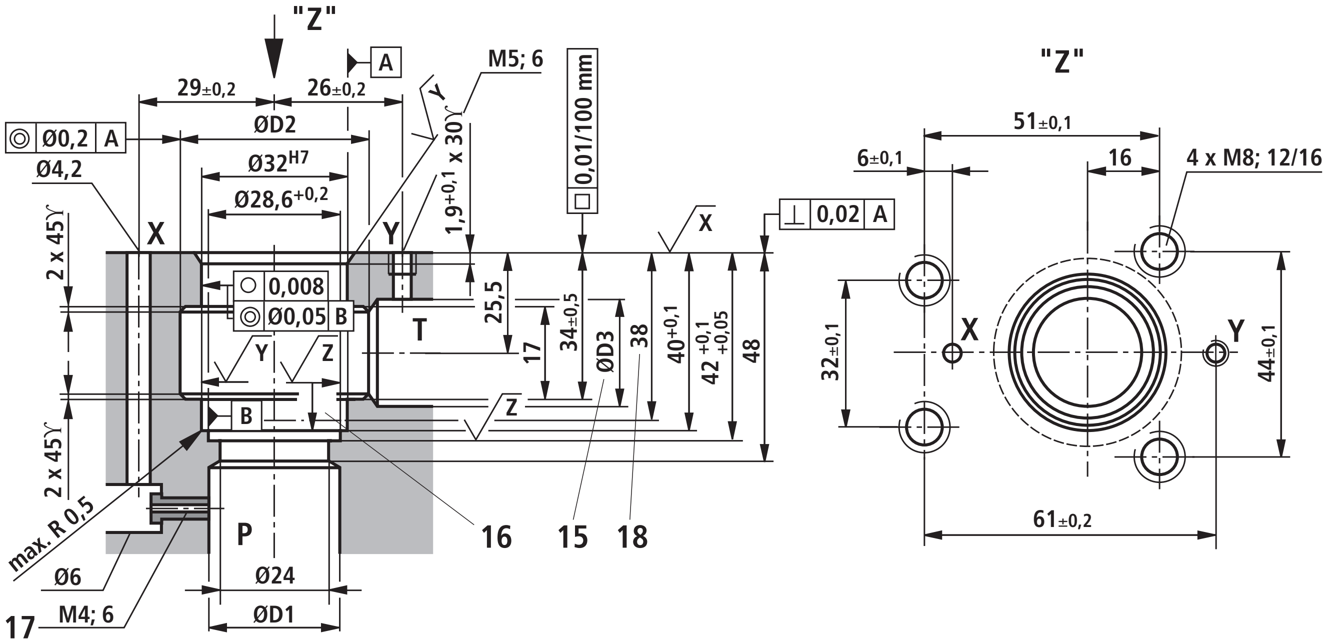
For strength reasons, only the following valve fixing screws may be used:

– Size10, 32
  4 hexagon socket head cap screws ISO 4762 - M8 x 50 - 10.9-flZn-240h-L to VDA 235-101
  Friction coefficient μ_{total} = 0.09 to 0.14,
  tightening torque M_T = 31 Nm ± 10%,
  Material no. **R913000543**

The tightening torques given are guidelines when screws of the specificied friction coefficients and a torque wrench (tolerance ±10 %) are used.

Unit dimensions: Block installation (dimensions in mm)

Mounting cavity



Tolerances according to:
– General tolerances ISO 2768-mK

√X = √Rzmax 4 √Y = √Rzmax 8 √Z = √Rz 16

Size	ØD1	ØD2	ØD3
10	10	40	10
32	32	45	32

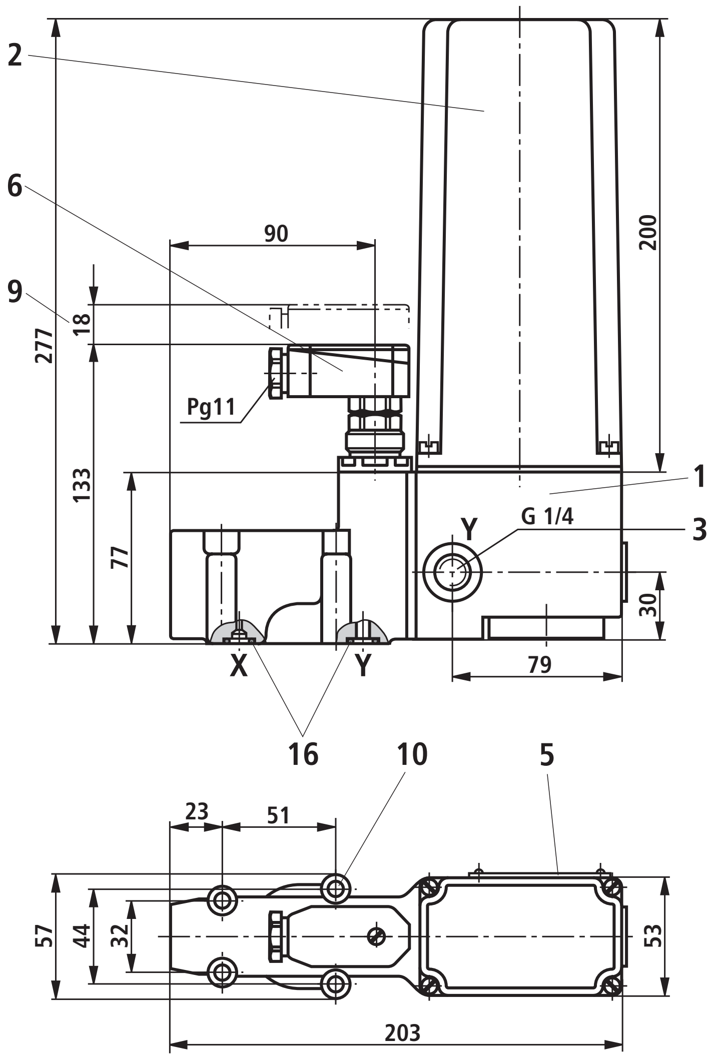
15 Bore ØD3 can intersect ØD2 at any point. However, care must be taken that connection bore X and the mounting bore are not damaged.

16 The back-up ring and the O-ring must be inserted in this bore before the main spool is installed.

17 Mounting kit includes orifice and main spool insert

18 Depth of fit

Unit dimensions: As remote control valve type DBGT (dimensions in mm)



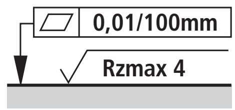
1 Pilot valve
2 DC motor
3 Port "Y" for external pilot oil drain
5 Nameplate
6 Mating connector (included in scope of supply)
9 Space required to remove mating connector
10 Valve mounting bores
16 O-ring 9.25 x 1,78

Subplates to data sheet RE 45064
(separate order)
G 51/01 (G1/4)

Valve fixing screws
(separate order)
For strength reasons, only the following valve fixing screws may be used:

4 hexagon socket head cap screws ISO 4762
- M8 x 50 - 10.9-flZn-240h-L to VDA 235-101
Friction coefficient μ_{total} = 0.09 to 0.14,
Tightening torque M_T = 31 Nm ± 10%,
Material no. **R913000543**

The tightening torques given are guidelines when screws of the specificied friction coefficients and a torque wrench (tolerance ±10 %) are used.



Required surface quality of
valve mounting face

Tolerances according to:
– General tolerances ISO 2768-mK

The Drive & Control Company

Rexroth
Bosch Group

Proportional pressure relief valve, pilot operated, increasing characteristic curve Type KBVS.1A

RE 18160
Edition: 12.2016
Replaces: 05.2012


H7893

- Component size 1
- Component series A
- Maximum operating pressure 420 bar
- Maximum flow 80 l/min

Features

- Cartridge valve
- Mounting cavity R/UNF10-01-0-06
- Pilot operated proportional valve for system pressure limitation
- Suitable for mobile and industrial applications
- Operation by means of proportional solenoid with central thread and detachable coil
- Rotatable solenoid coil
- Via an adjustment screw, the valve is set to maximum pressure
- In case of power failure, the minimum pressure is set
- Fine adjustment of the command value pressure characteristic curve possible from the outside at the control electronics

Contents

Ordering code

01	02	03	04	05		06	07	08	09	10	11	12
KBVS		**1**	**A**	**A**	**/**	**F**	**C**			**V**		*****

01	Proportional pressure relief valve, pilot operated	**KBVS**

Pressure rating

02	Up to 50 bar	**C**
	Up to 100 bar	**F**
	Up to 150 bar	**H**
	Up to 210 bar	**L**
	Up to 250 bar	**N**
	Up to 315 bar	**P**
	Up to 350 bar	**R**
	Up to 420 bar	**T**

03	Component size 1	**1**
04	With a command value = 0, the minimum pressure is set	**A**
05	Component series	**A**
06	High Performance and mounting cavity R/UNF-10-01-0-06 (see page 11)	**F**
07	Proportional solenoid, wet-pin	**C**

Supply voltage

08	Control electronics 12 V DC	**G12**
	Control electronics 24 V DC	**G24**

Electrical connection

09	**Without** mating connector, with connector according to DIN EN 175301-803	**K4**
	Without mating connector, with connector DT 04-2PA (Deutsch connector)	**K40**
	Without mating connector, with connector AMP Junior-Timer	**C4**

Seal material

10	FKM seals	**V**
	(other seals upon request) Attention! Observe compatibility of seals with hydraulic fluid used!	

11	Standard version	**no code**
	Coil 800 mA (see page 6)	**-8**
12	Further details in the plain text	*****

[1] Mating connectors, separate order, see data sheet 08006.

Valve types

Type	Material no.	Type	Material no.
KBVSC1AA/FCG24K40V	R901290550	KBVSN1AA/FCG24K40V	R901290569
KBVSF1AA/FCG24K40V	R901290561	KBVSP1AA/FCG24K40V	R901290570
KBVSH1AA/FCG24K40V	R901290562	KBVSR1AA/FCG24K40V	R901290580
KBVSL1AA/FCG24K40V	R901290567	KBVST1AA/FCG24K40V	R901290585

Function, symbol

General

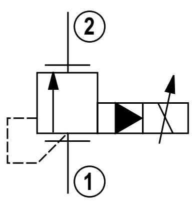
Valves of type KBVS are pilot operated proportional pressure relief valves in spool design and are used to limit the pressure in hydraulic systems. They mainly consist of the screwed-in proportional pilot control valve (1) and the main valve (2).
These valves can be used for infinitely adjusting the pressure to be limited depending on the command value. With command value 0 or in case of power failure, the minimum pressure is set.

Function

For the proportional increase in the system pressure, a command value is specified at the control electronics. The electronics control the solenoid coil with electric current depending on the command value, which via the pilot control valve (1) and the main valve (2) causes the actual pressure adjustment in main port ①.
(p_{max} = command value max; p_{min} = command value 0)

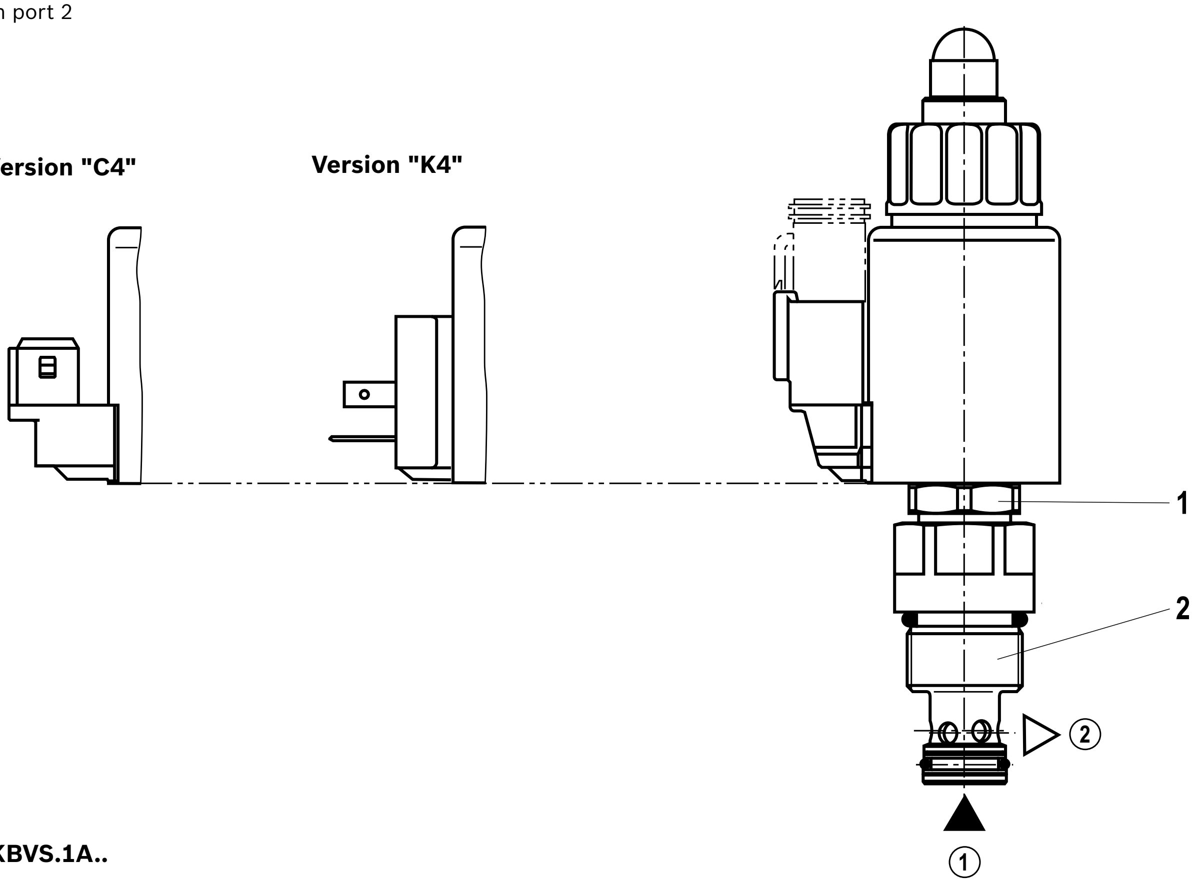
> **Notice**
> Occurring tank pressures (main port ②) are added up to the set values in main port ①.

Symbol



① = Main port 1
② = Main port 2

Version "C4" **Version "K4"** **Version "K40"**
(with mating connector)



Type KBVS.1A..

Technical data

(For applications outside these parameters, please consult us!)

general		
Weight	kg	0.75
Installation position		Any - if it is ensured that no air can collect upstream the valve. Otherwise, we recommend suspended installation of the valve.
Ambient temperature range	°C	−40 to +120 (see page 8 and 9)
Storage temperature	°C	−20 to +80

Environmental audits

Vibration test according to DIN EN 60068-2 / IEC 60068-2 /2 axes (X/Y)		
DIN EN 60068-2-6: 05/96	Vibrations, sine-shaped	10 cycles (5 Hz to 2000 Hz back to 5 Hz) with logarithmic frequency changing speed of 1 octave/min, 5 to 57 Hz, amplitude 1.6 mm (p-p), 57 to 2000 Hz, amplitude 10 g
IEC 60068-2-64: 05/93	Vibrations (random) and broad-band noise	20 to 2000 Hz, amplitude 0.1 g²/Hz (14 g RMS/30 g peak), testing time 24 h
DIN EN 60068-2-27: 03/95	Shocking	Half-sine 15 g / 11 ms; 3 x in positive, 3 x in negative direction (a total of 6 single shocks)
DIN EN 60068-2-29: 03/95	Bump test	Half-sine 15 g / 11 ms; 1000 x in positive, 1000 x in negative direction (a total of 2000 single shocks)
Indication per axis		
Climatic test according to EN 60068-2 / IEC 60068-2 (environmental audit)		
DIN EN 60068-2-1: 03/95	Storage temperature	−40 °C, duration 16 h
DIN EN 60068-2-2: 08/94		+110 °C, duration 16 h
DIN EN 60068-2-1: 03/95	Cold test	2 cycles −25 °C, duration 2 h
DIN EN 60068-2-2: 08/94	Dry heating test	2 cycles +120 °C, duration 2 h
IEC 60068-2-30: 1985	Humid heat, cyclic	Variant 2/ +25 °C to +55 °C 93 % to 97 % relative humidity, 2 cycles à 24 h
Salt spray test according to DIN 50021	**h**	**720**
→ Coating generally not necessary. If paint is applied nevertheless, the reduced heat dissipation capacity is to be observed.		

hydraulic			
Maximum operating pressure [1)	– Main port ①	bar	420
Maximum admissibler return flow pressure	– Main port ②	bar	210
Maximum set pressure [2)			See command value pressure characteristic curves page 7
Maximum set pressure with command value 0			See characteristic curves page 7
Maximum flow		l/min	80
Pilot oil		l/min	< 0.8
Leakage		ml/min	< 200 (with Δp = 250 bar; closed pilot control valve and HLP46, ϑ_{oil} = 40 °C)
Hydraulic fluid			See table below
Hydraulic fluid temperature range		°C	–40 to +80
Viscosity range		mm²/s	5 to 400 (preferably 10 to 100)
Maximum permitted degree of contamination of the hydraulic fluid - cleanliness class according to ISO 4406 (c)			Class 20/18/15 [3)
Load cycles			10 million
Hysteresis [4)			< 4 % of the max. set pressure
Turnover voltage [4)			< 0.5 % of the max. set pressure
Response sensitivity [4)			< 0.5 % of the max. set pressure
Manufacturing tolerance of the command value pressure characteristic curve	– Command value 100 %		< 5 % of the max. set pressure
	– Command value 0		< 2 % of the max. set pressure
Step response (T_u + T_g) 0 → 100 % and/or 100 % → 0		ms	100 (depending on the system)

Hydraulic fluid		Classification	Suitable sealing materials	Standards
Mineral oils		HL, HLP	FKM	DIN 51524
Bio-degradable	– Insoluble in water	HEES	FKM	VDMA 24568
	– Soluble in water	HEPG	FKM	

Important information on hydraulic fluids!

- ▶ For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- ▶ There may be limitations regarding the technical valve data (temperature, pressure range, service life, maintenance intervals, etc.)!
- ▶ The flash point of the hydraulic fluids used must be 40 K higher than the maximum solenoid surface temperature.
- ▶ **Bio-degradable:** When using bio-degradable hydraulic fluids that are simultaneously zinc-solving, zinc may accumulate in the fluid.

1) The maximum operating pressure is added up from the set pressure and the return flow pressure!

2) The valves are factory-set. In case of subsequent adjustment, the warranty will become invalid!

3) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the service life of the components.

4) Measured with analog amplifier type RA2-1/10, see data sheet 95230 (PWM = 300 Hz).

electric					
Voltage type			Direct voltage		
Supply voltages		V	**12 DC**	**24 DC**	**"-8" / 24 DC**
Maximum solenoid current		mA	1760	1200	800
Coil resistance	– Cold value at 20 °C	Ω	2.3	4.8	11.5
	– Max. hot value	Ω	3.8	7.9	18.9
Duty cycle		%	See characteristic curve page 8 and 9 [5)]		
Maximum coil temperature [6)]		°C	150		
Protection class according to VDE 0470-1 (DIN EN 60529) DIN 40050-9	– Version "K4"		IP 65 with mating connector mounted and locked		
	– Version "C4"		IP 66 with mating connector mounted and locked		
			IP 69K with Rexroth mating connector (material no. R901022127)		
	– Version "K40"		IP 69K with mating connector mounted and locked		
Control electronics (separate order)			Plug-in proportional amplifier type VT-SSPA1...	Data sheet 30116	
			Analog amplifier type RA...	Data sheet 95230	
			BODAS control unit type RC...	Data sheet 95200	
Recommended dither frequency (PMW)	Hz		300		
Design according to VDE 0580					

5) In case of use in altitudes > 2000 m a.s.l., we recommend consulting the manufacturer.

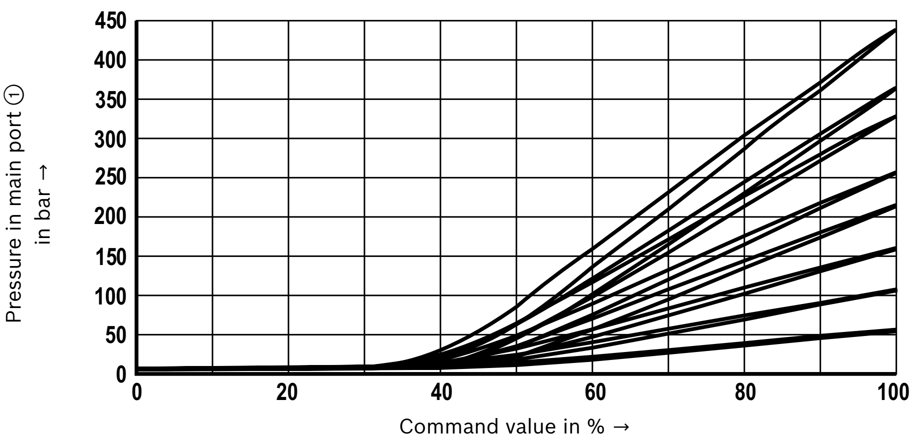
6) Due to the surface temperatures of the solenoid coils, the standards ISO 13732-1 and ISO 4413 need to be adhered to!

When establishing the electrical connection, the protective earthing conductor (PE ⏚) has to be connected properly.

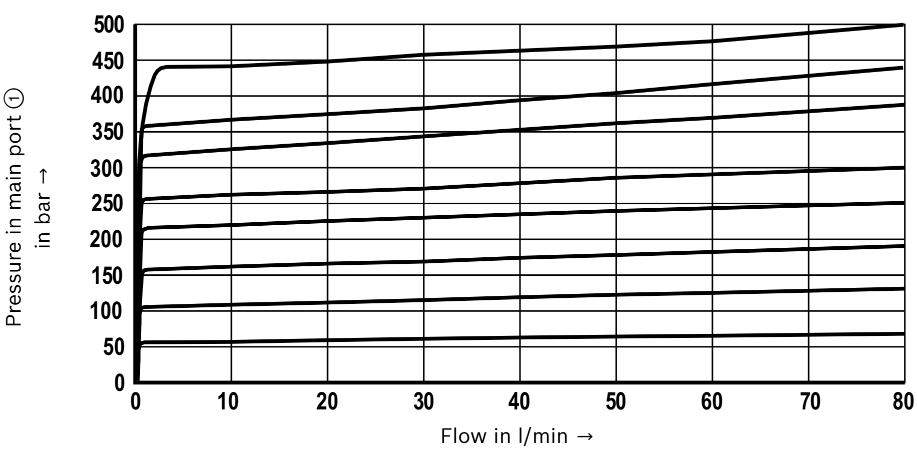
Characteristic curves

(measured with HLP46, ϑ_{oil} = $40^{\pm5}$ °C and 24 V coil)

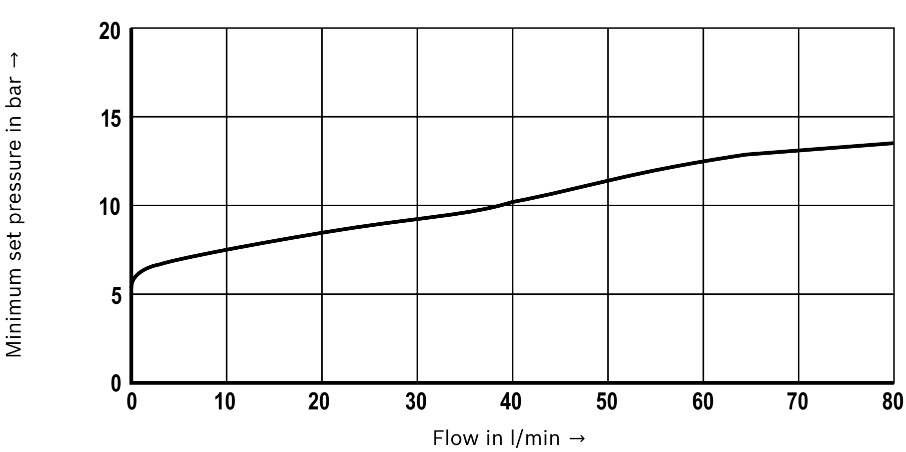
▼ **Pressure in main port ① depending on the command value; flow = 10 l/min**



▼ **Pressure in main port ① depending on the flow.**
(The characteristic curves were measured without back pressure in main port ②)



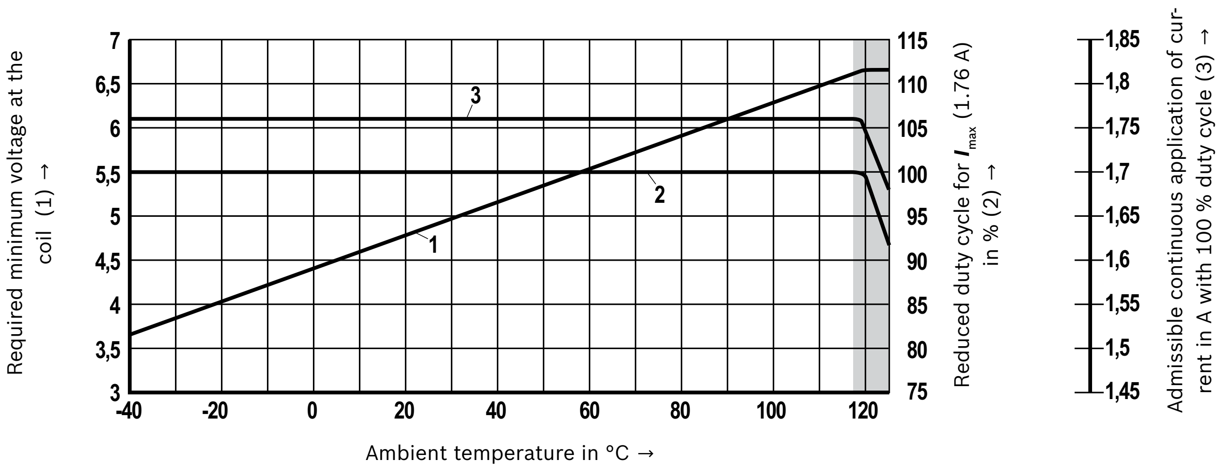
▼ **Minimum set pressure in the main port ① depending on the flow.**
(The characteristic curves were measured without back pressure in main port ②)



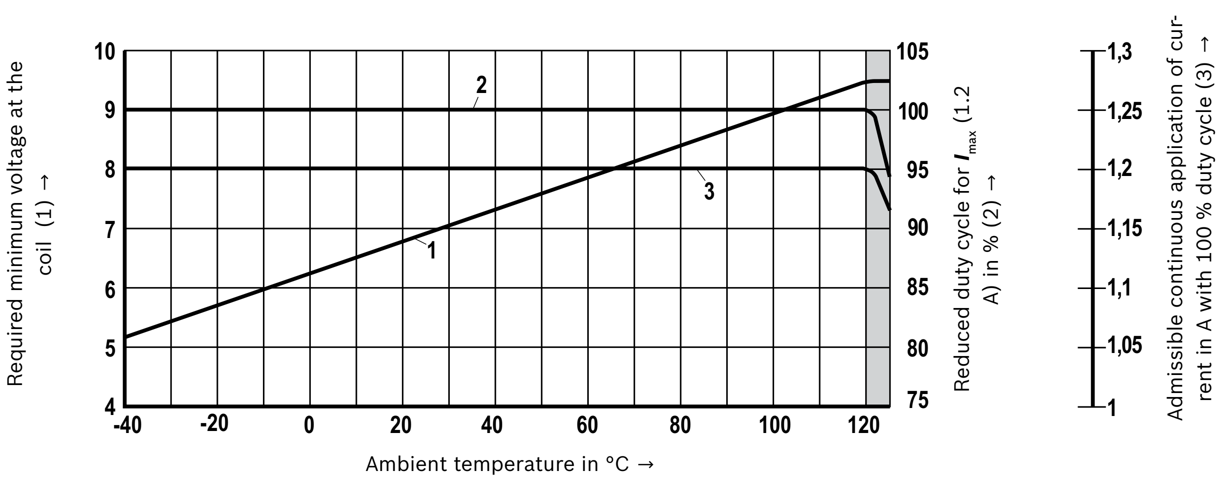
Minimum terminal voltage at the coil and relative duty cycle

Admissible working range depending on the ambient temperature

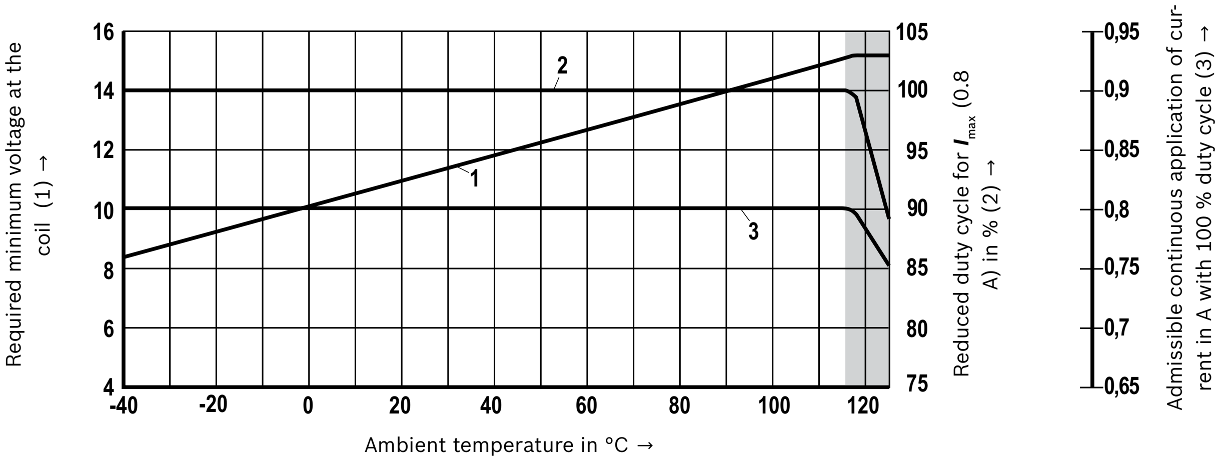
▼ **Version "G12"**



▼ **Version "G24"**



▼ **Version "G24..-8"**

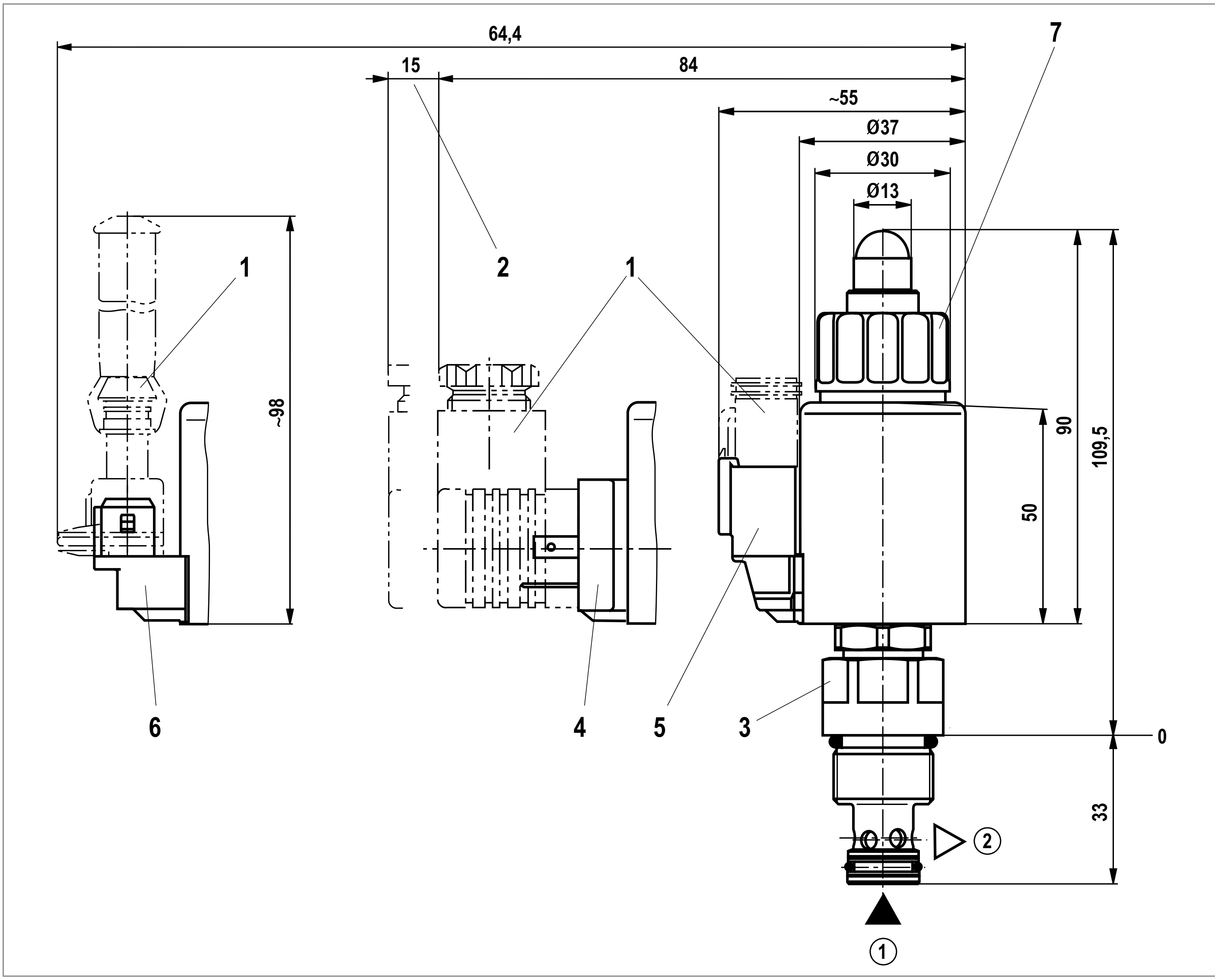


Limited valve performance

Notice
The characteristic curves have been determined for coils with valve with medium test block size (80 x 80 x 80 mm), without flow in calm air.
Depending on the installation conditions (block size, flow, air circulation, etc.) there may be a better heat dissipation. Thus, the area of application is broadened.
In single cases, more unfavorable conditions may lead to limitations of the area of application.

Dimensions

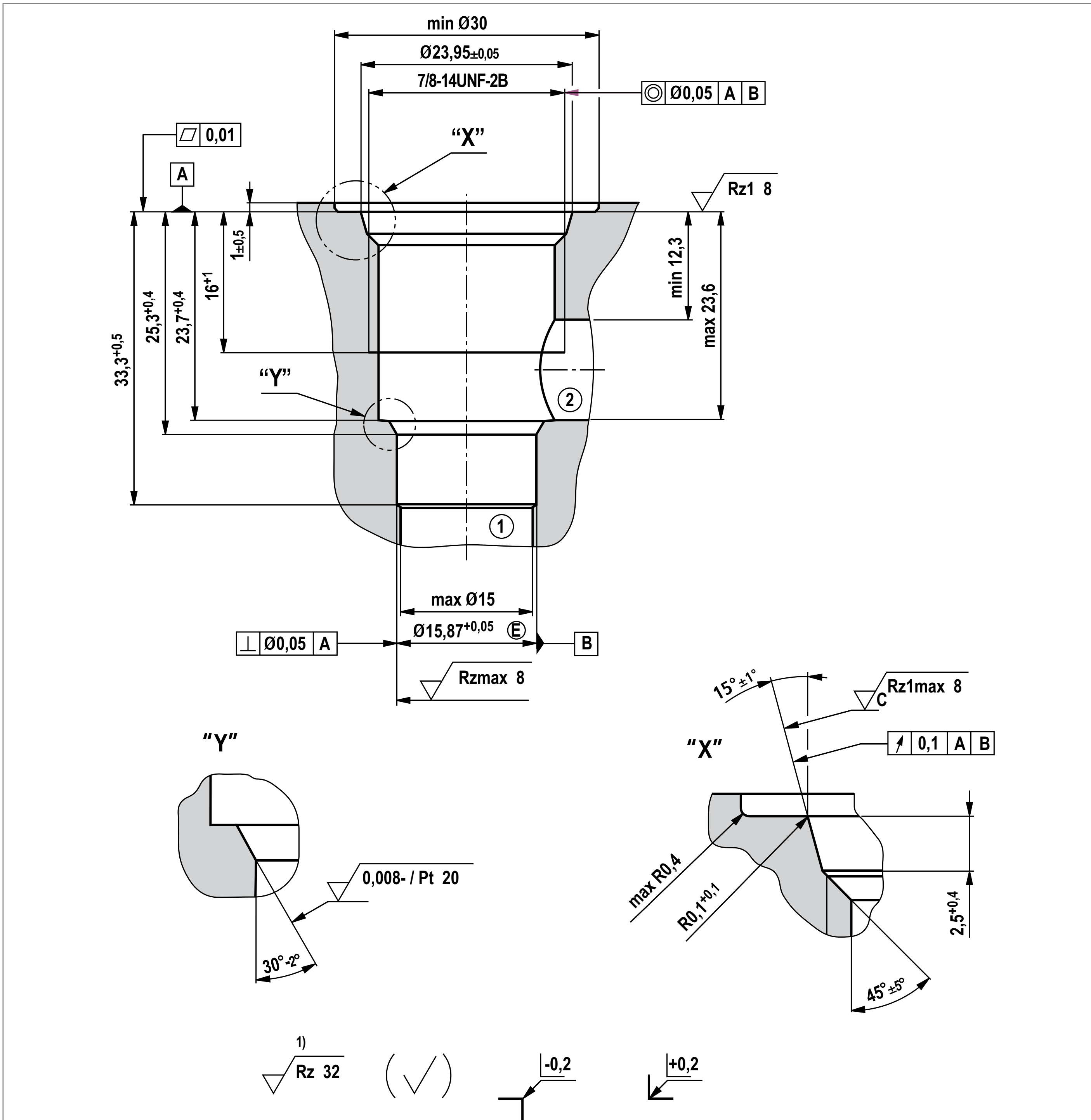
▼ **KBVS.1A**



1 Mating connectors, separate order, see data sheet 08006
2 Space required to remove the mating connector
3 SW24, tightening torque M_A = 55^{+5} Nm
4 Version "K4"
5 Version "K40"
6 Version "C4"
7 Nut, tightening torque M_A = 5^{+1} Nm

① = Main port 1
② = Main port 2

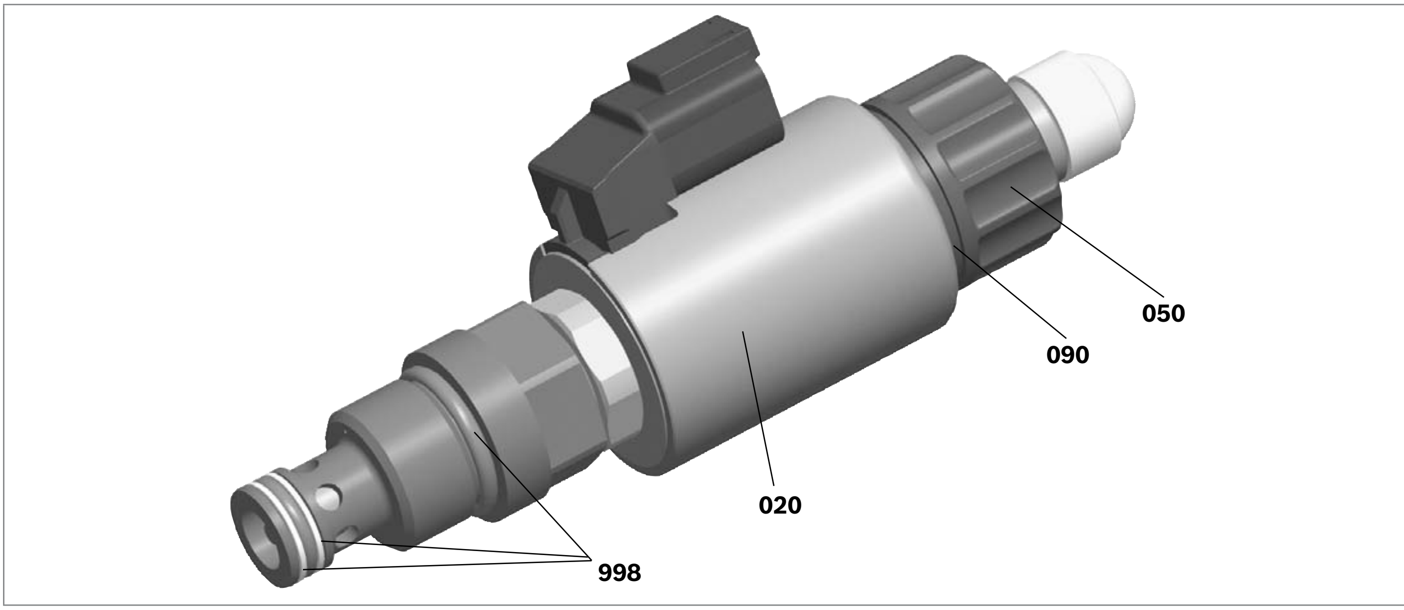
▼ **Mounting cavity R/UNF-10-01-0-06; 2 main ports; thread 7/8-14UNF-2B**



1) Visual inspection

① = Main port 1
② = Main port 2

Available individual components



Item	Denomination		Direct voltage	Material no.
020	Coil for individual connection 1)	K4	12 V	R901002932
			24 V / 1200 mA	R901002319
			24 V / 800 mA	R901049962
		K40	12 V	R901003055
			24 V / 1200 mA	R901003053
			24 V / 800 mA	R901050010
		C4	12 V	R901003044
			24 V / 1200 mA	R901003026
			24 V / 800 mA	R901049963
050	Nut			R900992146
090	Seal ring for pole tube			R900007769
998	Seal kit of the valve			R961006735

1) After exchange of the solenoid coil, the pressure set in the factory may change by ±5 %.

Related documents

- Control electronics:
  - Plug-in proportional amplifier type VT-SSPA1... Data sheet 30116
  - Analog amplifier type RA... Data sheet 95230
  - BODAS control unit type RC... Data sheet 95200
- Selection of the filters

The Drive & Control Company

Rexroth
Bosch Group

Proportional pressure relief valve, pilot operated, decreasing characteristic curve
Type KBVS.1B

RE 18152
Edition: 12.2016
Replaces: 07.2012

H7893

- Component size 1
- Component series A
- Maximum operating pressure 420 bar
- Maximum flow 80 l/min

Features

- Cartridge valve
- Mounting cavity R/UNF10-01-0-06
- Pilot operated proportional valve for system pressure limitation
- Suitable for mobile and industrial applications
- Operation by means of proportional solenoid with central thread and detachable coil
- Rotatable solenoid coil
- Via an adjustment screw, the valve is set to maximum pressure
- In case of power failure, the maximum pressure set results
- Fine adjustment of the command value pressure characteristic curve possible from the outside at the control electronics

Contents

Ordering code (valve without coil) [1)]

01	02	03	04	05		06	07	08	09	10	11	12
KBVS		**1**	**B**	**A**	**/**	**F**	**C**			**V**		*****

01	Proportional pressure relief valve, pilot operated	**KBVS**

Pressure rating

02	Up to 50 bar	**C**
	Up to 100 bar	**F**
	Up to 150 bar	**H**
	Up to 210 bar	**L**
	Up to 250 bar	**N**
	Up to 315 bar	**P**
	Up to 350 bar	**R**
	Up to 420 bar	**T**

03	Component size 1	**1**
04	With a command value = 0, the maximum pressure is set	**B**
05	Component series	**A**
06	High Performance and mounting cavity R/UNF-10-01-0-06 (see page 11)	**F**

Seal material

10	FKM seals	**V**
	(other seals upon request) Attention! Observe compatibility of seals with hydraulic fluid used!	

12	Further details in the plain text	*****

Valve types (without coil) [1)]

Type	Material no.	Type	Material no.
KBVSC1BA/FV	R901325098	KBVSN1BA/FV	R901325107
KBVSF1BA/FV	R901325099	KBVSP1BA/FV	R901325109
KBVSH1BA/FV	R901325102	KBVSR1BA/FV	R901325111
KBVSL1BA/FV	R901325105	KBVST1BA/FV	R901325112

Available coils (separate order) [1)]

	Material no. for coil with connector [2)]		
Direct voltage DC [3)]	**"K4"** 03pol (2+PE) DIN EN 175301-803	**"K40"** 02pol K40 DT 04-2PA, make Deutsch	**"C4"** 02pol C4/Z30 AMP Junior-Timer
12 V	R901002932	R901003055	R901003044
24 V / 1200 mA	R901002319	R901003053	R901003026
24 V / 800 mA	R901049962	R901050010	R901049963

1) Complete valves with mounted coil upon request
2) Mating connectors, separate order, see data sheet 08006.
3) Other voltages upon request.

Function, symbol

General

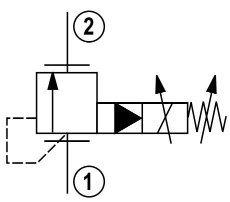
Valves of type KBVS are pilot operated proportional pressure relief valves in spool design and are used to limit the pressure in hydraulic systems. They mainly consist of the screwed-in proportional pilot control valve (1) and the main valve (2).
These valves can be used for infinitely adjusting the pressure to be limited depending on the command value. With command value 0 or in case of power failure, the maximum pressure is set (fail-safe characteristics).

Function

In the factory, the valves are mechanically set to the maximum pressure. For the proportional reduction of the system pressure, a command value is specified at the control electronics. The electronics control the solenoid coil with electric current depending on the command value, which via the pilot control valve (1) and the main valve (2) causes the actual pressure adjustment in main port ①.
(p_{max} = command value 0; p_{min} = command value max)

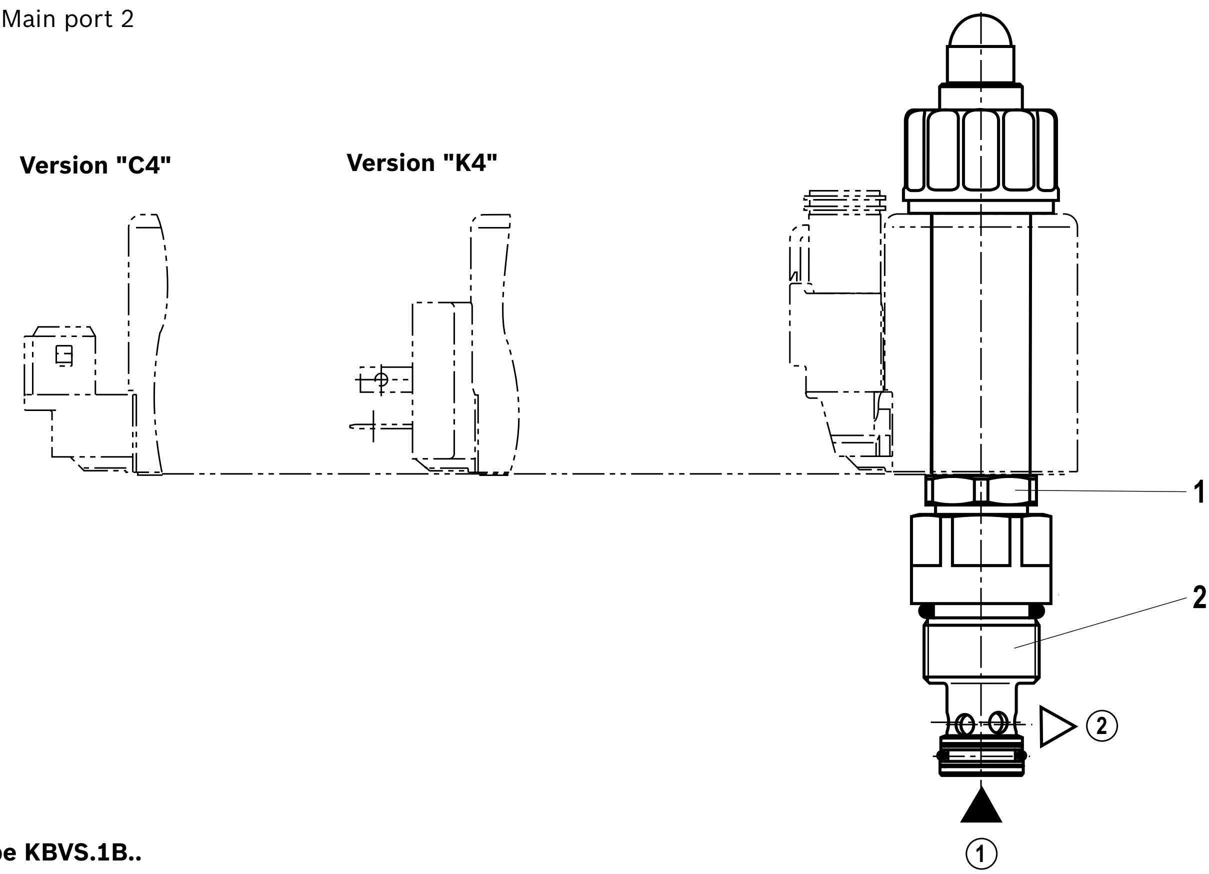
> **Notice**
> Occurring tank pressures (main port ②) are added up to the set values in main port ①.

Symbol



① = Main port 1
② = Main port 2

Version "C4" **Version "K4"** **Version "K40"**
(with mating connector)



Type KBVS.1B..

Technical data

(For applications outside these parameters, please consult us!)

general		
Weight	kg	0.75
Installation position		Any - if it is ensured that no air can collect upstream the valve. Otherwise, we recommend suspended installation of the valve.
Ambient temperature range	°C	–40 to +120 (see page 8 and 9)
Storage temperature	°C	–20 to +80

Environmental audits

Vibration test according to DIN EN 60068-2 / IEC 60068-2 /2 axes (X/Y)		
DIN EN 60068-2-6: 05/96	Vibrations, sine-shaped	10 cycles (5 Hz to 2000 Hz back to 5 Hz) with logarithmic frequency changing speed of 1 octave/min, 5 to 57 Hz, amplitude 1.6 mm (p-p), 57 to 2000 Hz, amplitude 10 g
IEC 60068-2-64: 05/93	Vibrations (random) and broad-band noise	20 to 2000 Hz, amplitude 0.1 g^2/Hz (14 g RMS/30 g peak), testing time 24 h
DIN EN 60068-2-27: 03/95	Shocking	Half-sine 15 g / 11 ms; 3 x in positive, 3 x in negative direction (a total of 6 single shocks)
DIN EN 60068-2-29: 03/95	Bump test	Half-sine 15 g / 11 ms; 1000 x in positive, 1000 x in negative direction (a total of 2000 single shocks)
Indication per axis		
Climatic test according to EN 60068-2 / IEC 60068-2 (environmental audit)		
DIN EN 60068-2-1: 03/95	Storage temperature	–40 °C, duration 16 h
DIN EN 60068-2-2: 08/94		+110 °C, duration 16 h
DIN EN 60068-2-1: 03/95	Cold test	2 cycles –25 °C, duration 2 h
DIN EN 60068-2-2: 08/94	Dry heating test	2 cycles +120 °C, duration 2 h
IEC 60068-2-30: 1985	Humid heat, cyclic	Variant 2/ +25 °C to +55 °C 93 % to 97 % relative humidity, 2 cycles à 24 h
Salt spray test according to DIN 50021	**h**	**720**
→ Coating generally not necessary. If paint is applied nevertheless, the reduced heat dissipation capacity is to be observed.		

hydraulic			
Maximum operating pressure [1]	– Main port ①	bar	420
Maximum admissible return flow pressure	– Main port ②	bar	210
Maximum set pressure [2]			See command value pressure characteristic curves page 7
Maximum set pressure with command value 0			See characteristic curves page 7
Maximum flow		l/min	80
Pilot oil		l/min	< 0.8
Leakage		ml/min	< 200 (with Δp = 250 bar; closed pilot control valve and HLP46, ϑ_{oil} = 40 °C)
Hydraulic fluid			See table below
Hydraulic fluid temperature range		°C	–40 to +80
Viscosity range		mm²/s	5 to 400 (preferably 10 to 100)
Maximum permitted degree of contamination of the hydraulic fluid - cleanliness class according to ISO 4406 (c)			Class 20/18/15 [3]
Load cycles			10 million
Hysteresis [4]			< 4 % of the max. set pressure
Turnover voltage [4]			< 0.5 % of the max. set pressure
Response sensitivity [4]			< 0.5 % of the max. set pressure
Manufacturing tolerance of the command value pressure characteristic curve	– Command value 100 %		< 2 % of the max. set pressure
	– Command value 0		< 5 % of the max. set pressure
Step response ($T_u + T_g$) 0 → 100 % and/or 100 % → 0		ms	100 (depending on the system)

Hydraulic fluid		**Classification**	**Suitable sealing materials**	**Standards**
Mineral oils		HL, HLP	FKM	DIN 51524
Bio-degradable	– Insoluble in water	HEES	FKM	VDMA 24568
	– Soluble in water	HEPG	FKM	

Important information on hydraulic fluids!

- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, service life, maintenance intervals, etc.)!
- The flash point of the hydraulic fluids used must be 40 K higher than the maximum solenoid surface temperature.
- **Bio-degradable:** When using bio-degradable hydraulic fluids that are simultaneously zinc-solving, zinc may accumulate in the fluid.

[1] The maximum operating pressure is added up from the set pressure and the return flow pressure!

[2] The valves are factory-set. In case of subsequent adjustment, the warranty will become invalid!

[3] The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the service life of the components.

[4] Measured with analog amplifier type RA2-1/10, see data sheet 95230 (PWM = 300 Hz).

electric					
Voltage type			Direct voltage		
Supply voltages		V	**12 DC**	**24 DC**	**"-8" / 24 DC**
Maximum solenoid current		mA	1760	1200	800
Coil resistance	– Cold value at 20 °C	Ω	2.3	4.8	11.5
	– Max. hot value	Ω	3.8	7.9	18.9
Duty cycle		%	See characteristic curve page 8 and 9 [5]		
Maximum coil temperature [6]		°C	150		
Protection class according to VDE 0470-1 (DIN EN 60529) DIN 40050-9	– Version "K4"		IP 65 with mating connector mounted and locked		
	– Version "C4"		IP 66 with mating connector mounted and locked		
			IP 69K with Rexroth mating connector (material no. R901022127)		
	– Version "K40"		IP 69K with mating connector mounted and locked		
Control electronics (separate order)			Plug-in proportional amplifier type VT-SSPA1...	Data sheet 30116	
			Analog amplifier type RA...	Data sheet 95230	
			BODAS control unit type RC...	Data sheet 95200	
Recommended dither frequency (PMW)		Hz	300		
Design according to VDE 0580					

[5] In case of use in altitudes > 2000 m a.s.l., we recommend consulting the manufacturer.

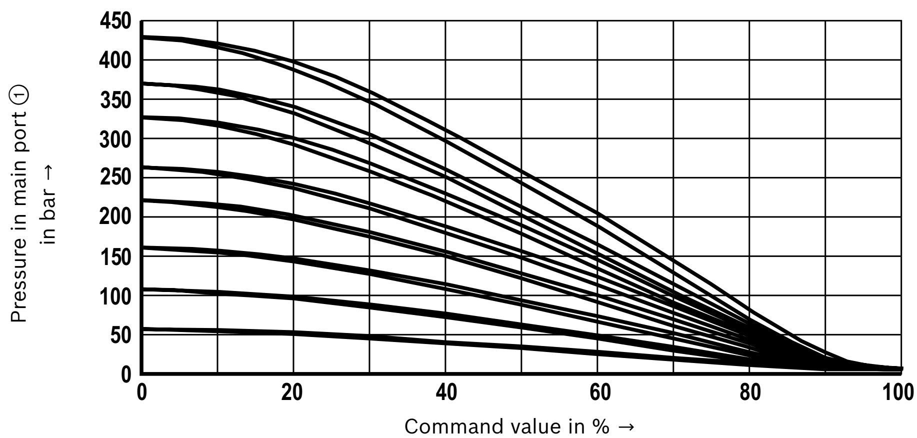
[6] Due to the surface temperatures of the solenoid coils, the standards ISO 13732-1 and ISO 4413 need to be adhered to!

When establishing the electrical connection, the protective earthing conductor (PE ⏚) has to be connected properly.

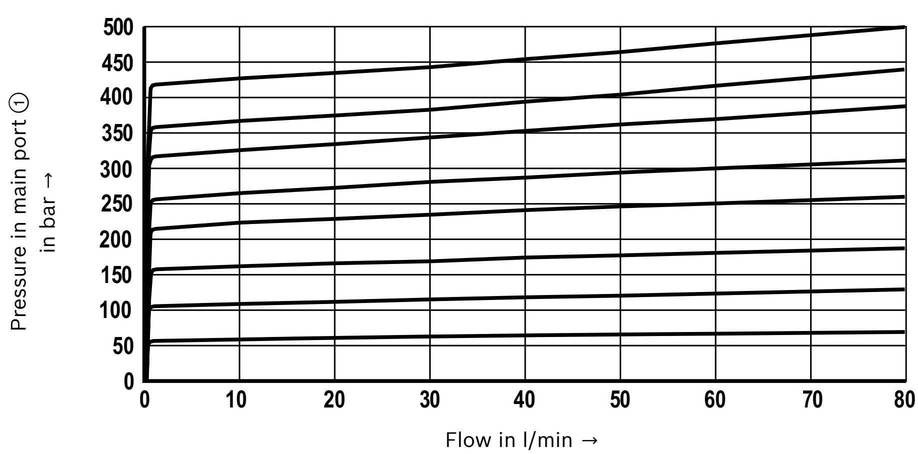
Characteristic curves

(measured with HLP46, ϑ_{oil} = $40^{\pm5}$ °C and 24 V coil)

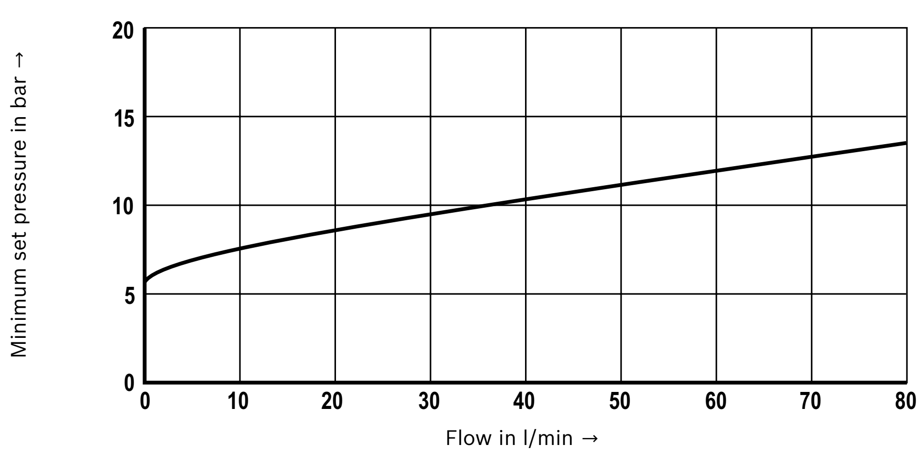
▼ **Pressure in main port ① depending on the command value; flow = 10 l/min**



▼ **Pressure in main port ① depending on the flow.**
(The characteristic curves were measured without back pressure in main port ②)



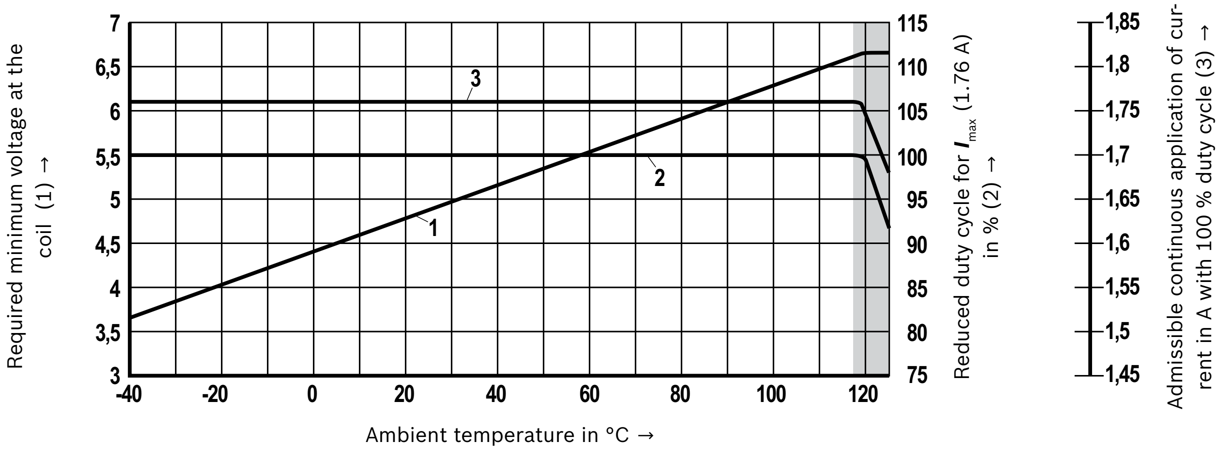
▼ **Minimum set pressure in the main port ① depending on the flow.**
(The characteristic curves were measured without back pressure in main port ②)



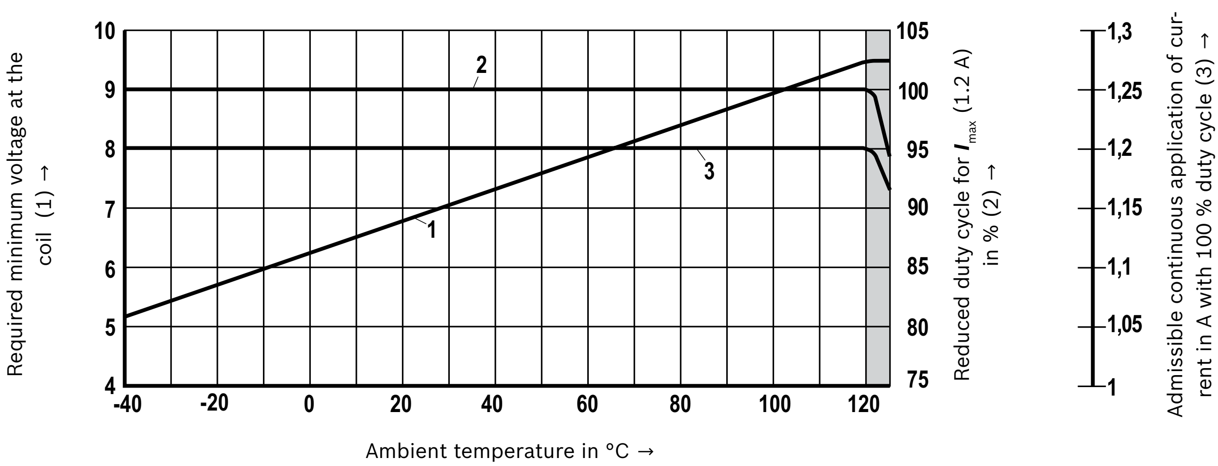
Minimum terminal voltage at the coil and relative duty cycle

Admissible working range depending on the ambient temperature

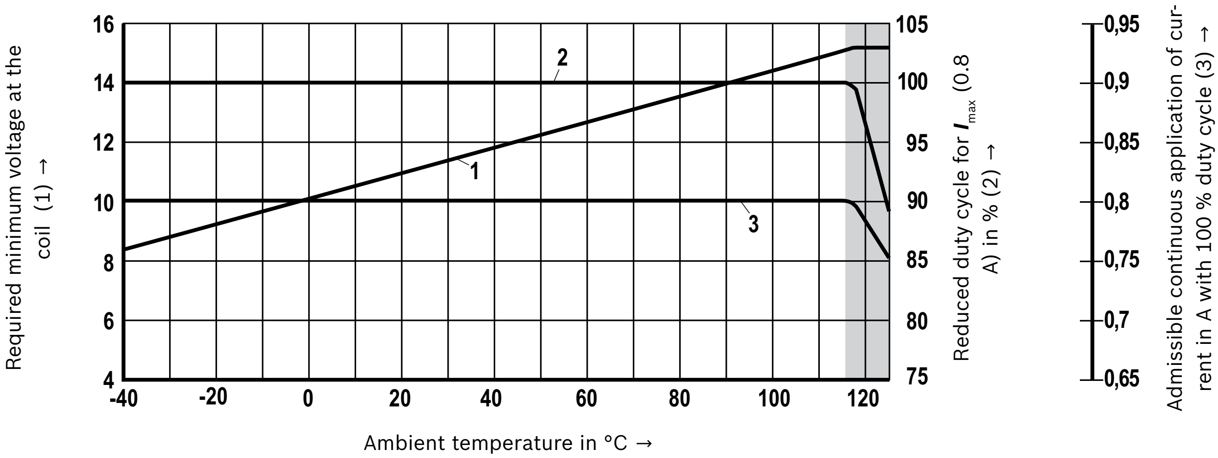
▼ **Version "G12"**



▼ **Version "G24"**



▼ **Version "G24..-8"**



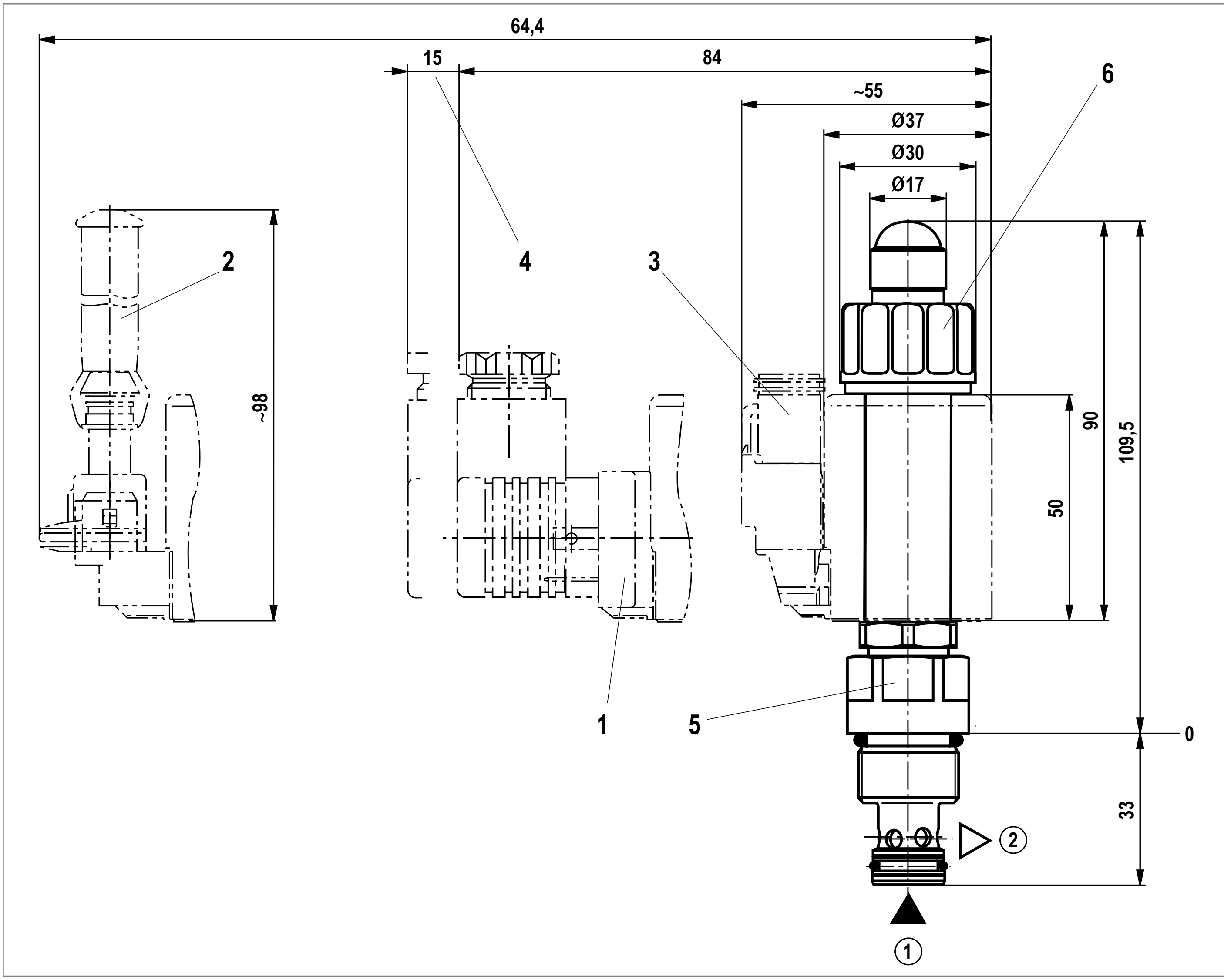
Limited valve performance

Notice

The characteristic curves have been determined for coils with valve with medium test block size (80 x 80 x 80 mm), without flow in calm air.
Depending on the installation conditions (block size, flow, air circulation, etc.) there may be a better heat dissipation. Thus, the area of application is broadened. In single cases, more unfavorable conditions may lead to limitations of the area of application.

Dimensions

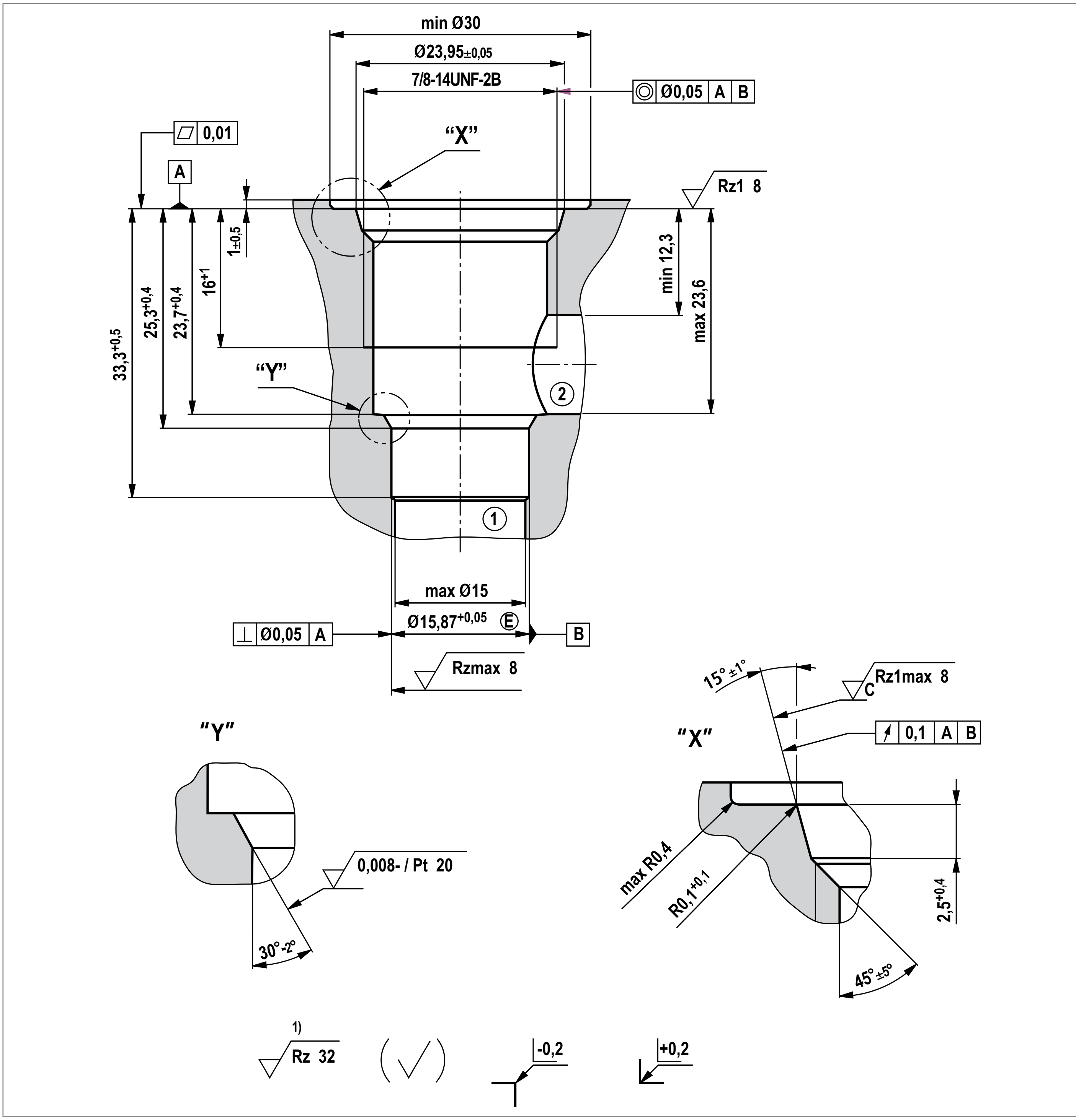
▼ **KBVS.1B**



1 Mating connectors, separate order, see data sheet 08006
2 Space required to remove the mating connector
3 SW24, tightening torque M_A = 55^{+5} Nm
4 Version "K4"
5 Version "K40"
6 Version "C4"
7 Nut, tightening torque M_A = 5^{+1} Nm

① = Main port 1
② = Main port 2

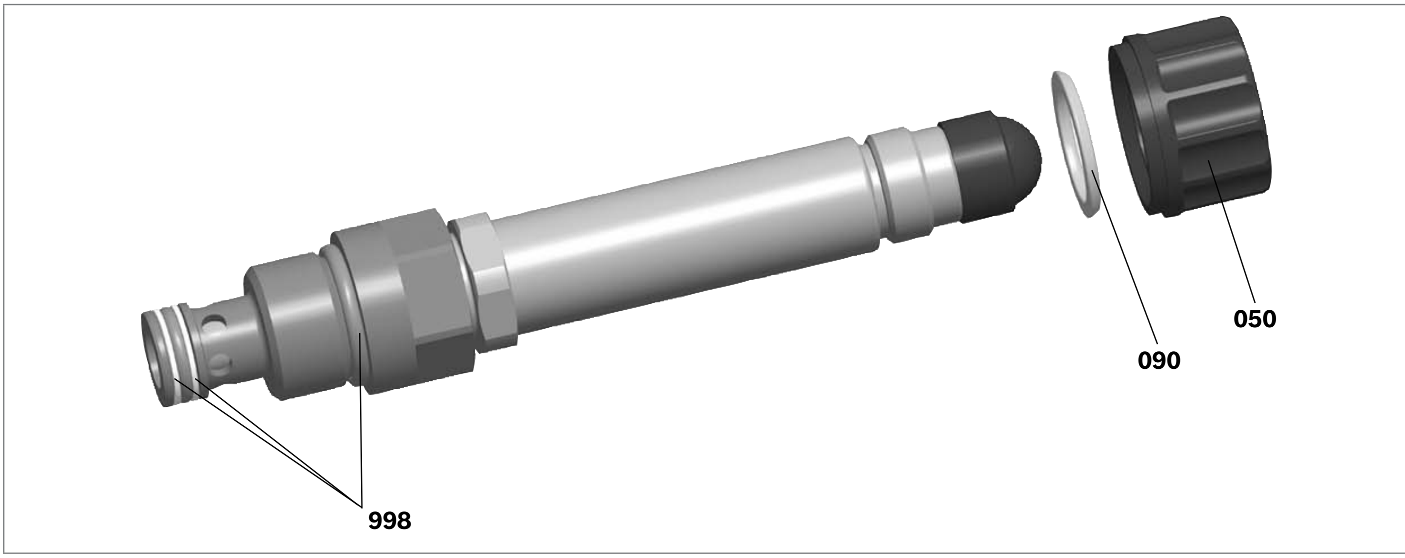
▼ **Mounting cavity R/UNF-10-01-0-06; 2 main ports; thread 7/8-14UNF-2B**



[1] Visual inspection

① = Main port 1
② = Main port 2

Available individual components



Item	Denomination	Material no.
050	Nut	R900992146
090	Seal ring for pole tube	R900007769
998	Seal kit of the valve	R961006735

Coils, separate order, see page 2

More information

- Control electronics:
  - Plug-in proportional amplifier type VT-SSPA1... Data sheet 30116
  - Analog amplifier type RA... Data sheet 95230
  - BODAS control unit type RC... Data sheet 95200
- Selection of the filters

Rexroth
Bosch Group

Proportional pressure relief valve, pilot operated, falling characteristic curve

RE 18375/04.12
Replaces: 08.11

Type KBVS (High Performance)

Size 2
Component series A
Maximum operating pressure 420 bar
Maximum flow 250 l/min

H7683

Table of contents

Features

- Cartridge valve
- Mounting cavity R/FD
- Pilot operated proportional valve for the limitation of a system pressure
- Suitable for mobile and industrial applications
- Operation by means of proportional solenoid with central thread and detachable coil
- Rotatable solenoid coil
- Fine balancing of the command value/pressure characteristic curves possible externally on the control electronics
- Valves are adjusted to maximum pressure by means of an adjustment screw
- In the event of a power failure, maximum set pressure becomes effective

– Control electronics:	Data sheet
• Plug-in proportional amplifier Type VT-SSPA1…	30116
• Analog amplifier Type RA…	95230
• BODAS control unit Type RC…	95200

Ordering code

KBVS		2	B	A /	DD	C			Y	V		*

Proportional pressure relief valve, pilot operated

Pressure rating
up to 315 bar **= P**
up to 420 bar **= T**
Other pressure stages upon request

Size 2 **= 2**

Maximum pressure at command value = 0 **= B**

Component series **= A**

High-performance and mounting cavity R/FD (see page 10) **= DD**

Proportional solenoid, wet-pin **= C**

Supply voltage
Control electronics 12 V DC **= G12**
Control electronics 24 V DC **= G24**

Electrical connection [1)]
K4 = without mating connector, with connector according to DIN EN 175301-803
K40 = without mating connector, with connector DT 04-2PA (Deutsch plug)
C4 = without mating connector, with connector AMP Junior-Timer

Y = Pilot oil supply internal, pilot oil return external

Seal material
V = FKM seals
Attention!
Observe compatibility of seals with hydraulic fluid used!

No code = Standard
-8 = Coil 800 mA (see page 5)

Further details in the plain text

[1)] Mating connectors, separate order, see data sheet 08006.

Preferred types

Type	Material number
KBVSP 2 BA/DDCG24K4YV	R901138473
KBVST 2 BA/DDCG24K40YV-8	R901233649

Function, symbol

General

Type KBVS valves are pilot operated proportional pressure relief valves of poppet design and are used for limiting the pressure in hydraulic systems. They basically consist of the screwed in proportional pilot control valve (1) and the main valve (2).

These valves can be used for infinitely adjusting the pressure to be limited in dependence upon the command value. At command value 0 or in the event of a power failure, the maximum pressure is set (fail-safe characteristics).

Basic principle

The mechanics of the valve are factory-set to the maximum pressure. A command value for the proportional reduction of the system pressure is selected on the control electronics. The electronics control the solenoid coil with electric current in dependence upon the command value, which causes the actual pressure adjustment in main port ① via the pilot control valve (1) and the main valve (2).

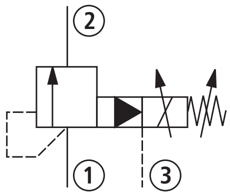
($\boldsymbol{p}_{max}$ = command value 0; $\boldsymbol{p}_{min}$ = command value max.)

The pilot oil return is effected externally via main port ③.

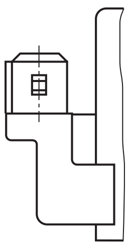
Notice!

Any occurring tank pressure (main port ②) is added up to the set values in main port ①.

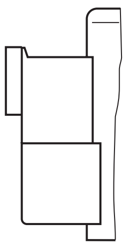
Symbol



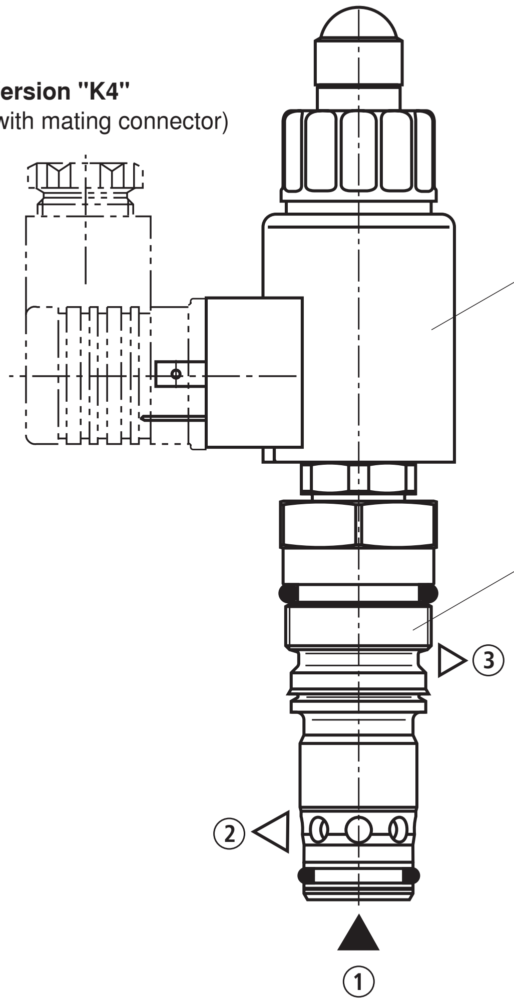
Version "C4"



Version "K40"



Version "K4"
(with mating connector)



① = main port 1 (P)
② = main port 2 (T)
③ = main port 3 (Y)

Technical data (For applications outside these parameters, please consult us!)

general

Weight	kg	0.66
Installation position		Any - if it is ensured that no air can collect upstream the valve. Otherwise, a suspended installation is recommended.
Ambient temperature range	°C	–20 to +120
Storage temperature range	°C	–20 to +80

Environmental audits:

Vibration test according to DIN EN 60068-2 / IEC 60068-2 /3 axes (X/Y/Z)		
DIN EN 60068-2-6: 05/96	Vibrations, sinusoidal	10 cycles, 5 to 2000 to 5 Hz with logarithmic frequency changing speed of 1 octave/min, 5 to 57 Hz, amplitude 1.6 mm (p-p), 57 to 2000 Hz, amplitude 10 g
IEC 60068-2-64: 05/93	Vibrations (random) and broadband noise	20 to 2000 Hz, amplitude 0.1 g^2/Hz (14 g RMS / 30 g peak), testing time 24 h
DIN EN 60068-2-27: 03/95	Shock test	Half sine 15 g / 11 ms, 3 x in positive, 3 x in negative direction (a total of 6 individual shocks)
DIN EN 60068-2-29: 03/95	Bump test	Half sine 15 g / 11 ms, 1000 x in positive, 1000 x in negative direction (a total of 2000 individual shocks)
Details per axis:		
Climatic test according to DIN EN 60068-2 / IEC 60068-2 (environmental test):		
DIN EN 60068-2-1: 03/95	Storage temperature	–40 °C, duration 16 h
DIN EN 60068-2-2: 08/94		+110 °C, duration 16 h
DIN EN 60068-2-1: 03/95	Cold test	2 cycles, –25 °C, duration 2 h
DIN EN 60068-2-2: 08/94	Dry heating test	2 cycles, +120 °C, duration 2 h
IEC 60068-2-30: 1985	Humid heat, cyclic	Variant 2/ +25 °C to +55 °C, 93 % to 97 % relative humidity, 2 cycles, 24 h each
Salt spray test: 720 h according to DIN 50021		
→ Finish painting generally not required. Should you nevertheless wish to apply a finish coat, observe the reduced heat dissipation capacity.		

hydraulic

Maximum operating pressure [1] (main port ①)	bar	420
Maximum permissible return flow pressure (main port ② and ③)	bar	30
Maximum set pressure [2]		See command value/pressure characteristic curves on page 6
Minimum set pressure at max. command value		See characteristic curves on page 6
Maximum flow	l/min	250
Hydraulic fluid		See page 5
Hydraulic fluid temperature range	°C	–20 to +80
Viscosity range	mm^2/s	15 to 380
Max. permissible degree of contamination of the hydraulic fluid - cleanliness class according to ISO 4406 (c)		Class 20/18/15 [3]

1) **Attention!** The maximum operating pressure is added up from the set pressure and the return flow pressure!

2) **Attention!** The valves are factory-set. In the case of subsequent re-adjustment, the warranty will become void!

3) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the service life of the components.

Technical data (For applications outside these parameters, please consult us!)

hydraulic

Hysteresis [4]		< 4 % of the maximum set pressure
Range of inversion [4]		< 0.5 % of the maximum set pressure
Response sensitivity [4]		< 0.5 % of the maximum set pressure
Manufacturing tolerance of the command value/pressure characteristic curve	– Command value 100 %	< 2 % of the maximum set pressure
	– Command value 0	< 5 % of the maximum set pressure
Step response (T_u + T_g) 0 → 100 % and/or 100 % → 0	ms	100 (depending on the system)

Hydraulic fluid		Classification	Suitable sealing materials	Standards
Mineral oils and related hydrocarbons		HL, HLP, HLPD, HVLP, HVLPD	FKM	DIN 51524
Environmentally compatible	– Insoluble in water	HEES	FKM	ISO 15380
		HEPR	FKM	
	– Soluble in water	HEPG	FKM	ISO 15380
Flame-resistant	– Water-free	HFDU, HFDR	FKM	ISO 12922
	– Water-containing	HFAS	FKM	ISO 12922

☞ **Important information on hydraulic fluids!**

- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, service life, maintenance intervals, etc.)!
- The flash point of the process and operating medium used must be 40 K higher than the maximum solenoid surface temperature.
- **Flame-resistant – water-containing:** Maximum pressure differential per control edge 175 bar; otherwise, increased cavitation erosion!
  Tank pre-loading < 1 bar or > 20 % of the pressure differential. The pressure peaks should not exceed the maximum operating pressures!
- **Environmentally compatible:** When using environmentally compatible hydraulic fluids that are simultaneously zinc-solving, zinc may accumulate in the medium (700 mg zinc per pole tube).

electric

Supply voltage		V	12 DC	24 DC	"-8" / 24 DC
Maximum control current		mA	1760	1200	800
Coil resistance	– Cold value at 20 °C	Ω	2.3	4.8	11.5
	– Max. hot value	Ω	3.8	7.9	18.9
Duty cycle		%	100 [5]		
Maximum coil temperature [6]		°C	150		
Protection class according to DIN EN 60529	– Version "K4"		IP 65 with mating connector mounted and locked		
	– Version "K40"		IP 69K with mating connector mounted and locked		
	– Version "C4"		IP 66 with mating connector mounted and locked		
			IP 69K with Rexroth mating connector (Material no. R901022127)		
Control electronics (separate order)			– Plug-in proportional amplifier Type VT-SSPA1…, see data sheet 30116 – Analog amplifier Type RA…, see data sheet 95230 – BODAS control unit Type RC…, see data sheet 95200		
Design according to VDE 0580					

4) Measured with analog amplifier type RA2-1/10, see data sheet 95230

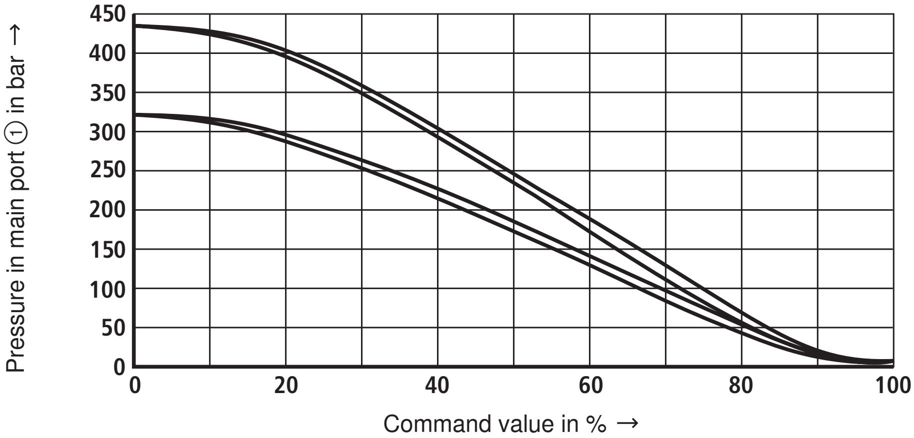
5) In the case of use at heights > 2000 m above MSL, please consult us.

6) Due to the temperatures occurring at the surfaces of the solenoid coils, the standards ISO 13732-1 and EN 982 need to be adhered to!

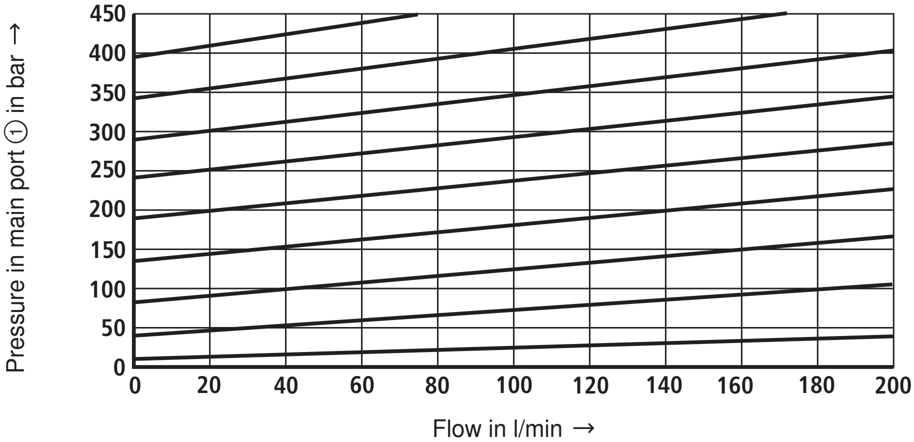
In the electrical connection, the protective earthing conductor (PE ⏚) is to be connected properly.

Characteristic curves (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C and 24 V coil)

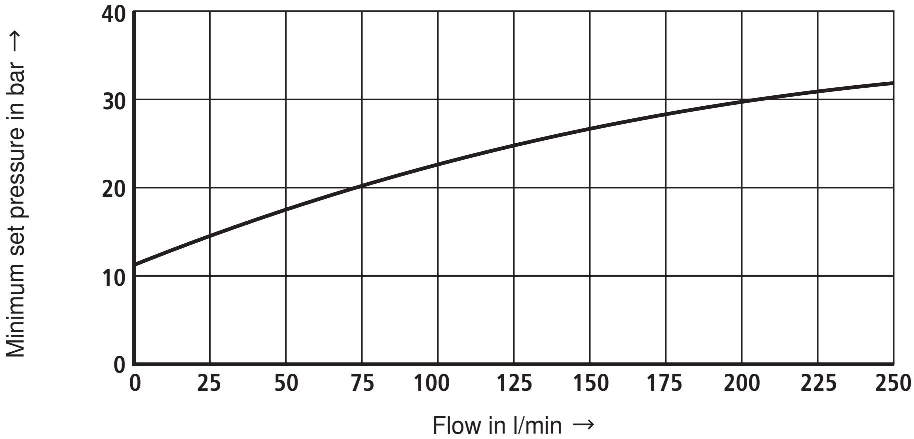
Pressure in main port ① in dependence on command value; flow = 20 l/min



Pressure in main port ① in dependence on flow.
(The characteristic curves were measured without backpressure in main port ②)



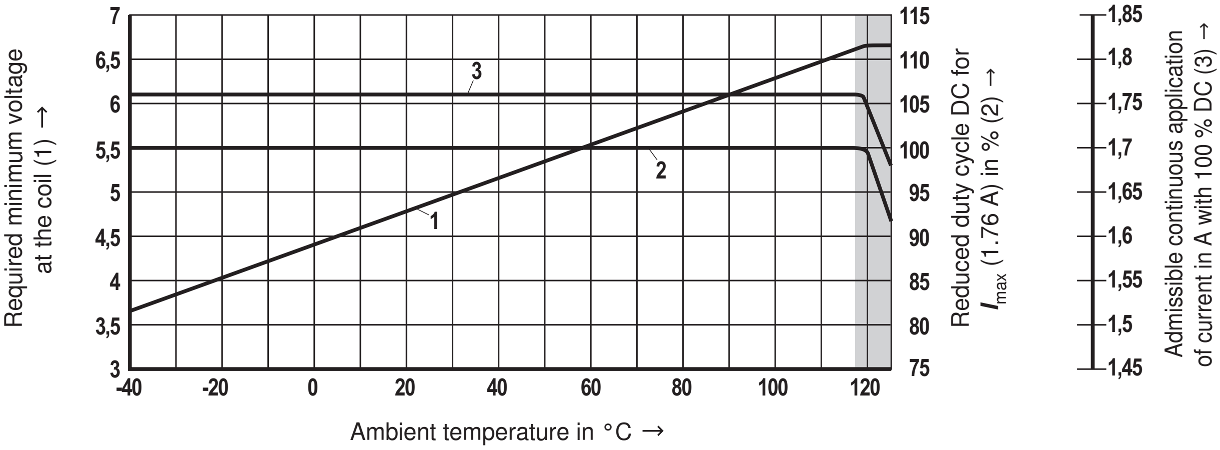
Minimum set pressure in main port ① in dependence on flow.
(The characteristic curves were measured without backpressure in main port ②)



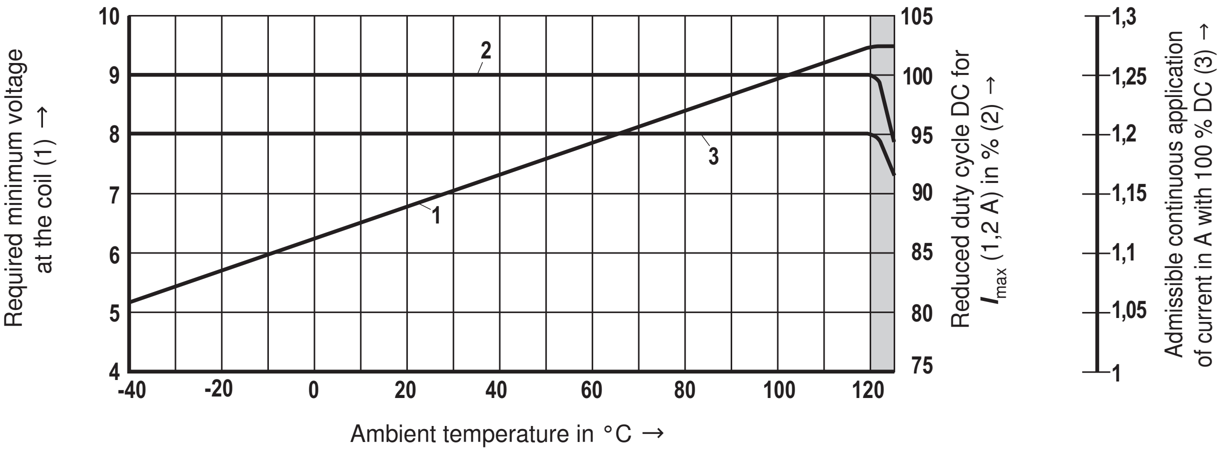
Minimum terminal voltage at the coil and relative duty cycle

Admissible working range against the ambient temperature

– Version "G12"



– Version "G24"



Limited valve performance

Notice!

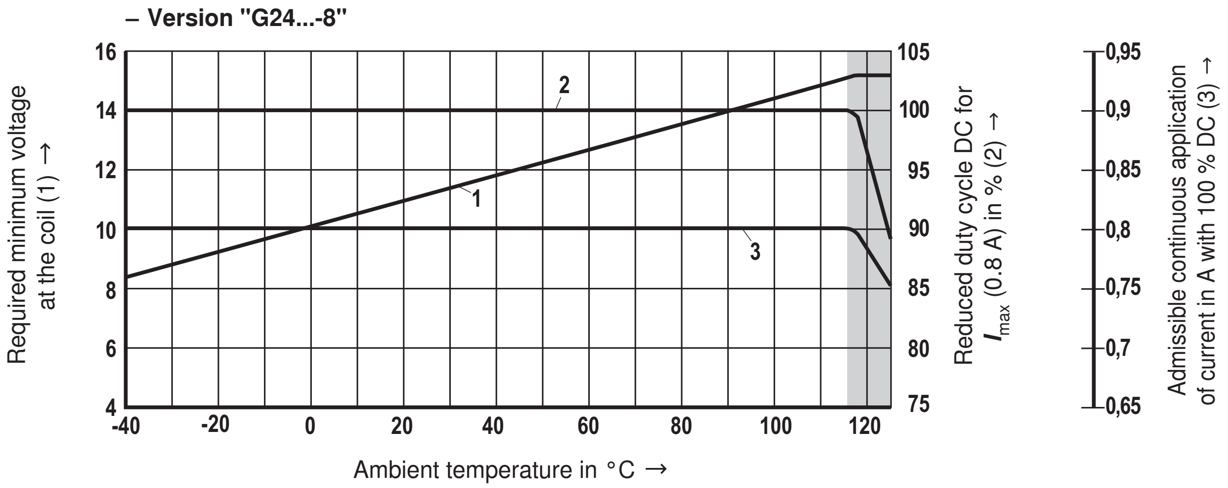
The characteristic curves have been determined for coils with valve with medium test block size (80 x 80 x 80 mm), without flow in calm air.

Depending on the installation conditions (block size, flow, air circulation, etc.) there may be a better heat dissipation. Thus, the range of application is broadened.

In single cases, more unfavorable conditions may lead to limitations of the range of application.

Minimum terminal voltage at the coil and relative duty cycle

Admissible working range against the ambient temperature



Limited valve performance

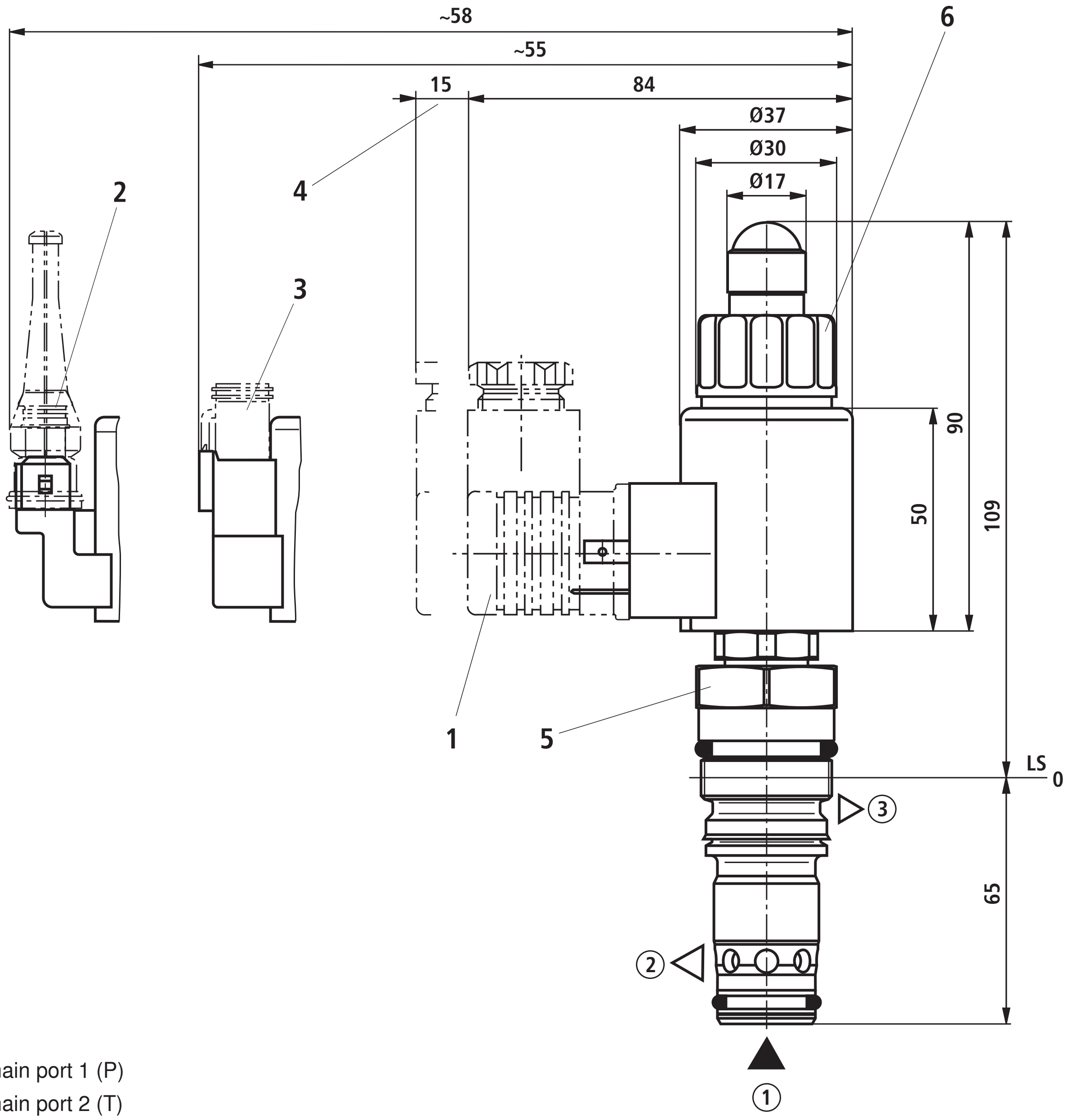
Notice!

The characteristic curves have been determined for coils with valve with medium test block size (80 x 80 x 80 mm), without flow in calm air.

Depending on the installation conditions (block size, flow, air circulation, etc.) there may be a better heat dissipation. Thus, the range of application is broadened.

In single cases, more unfavorable conditions may lead to limitations of the range of application.

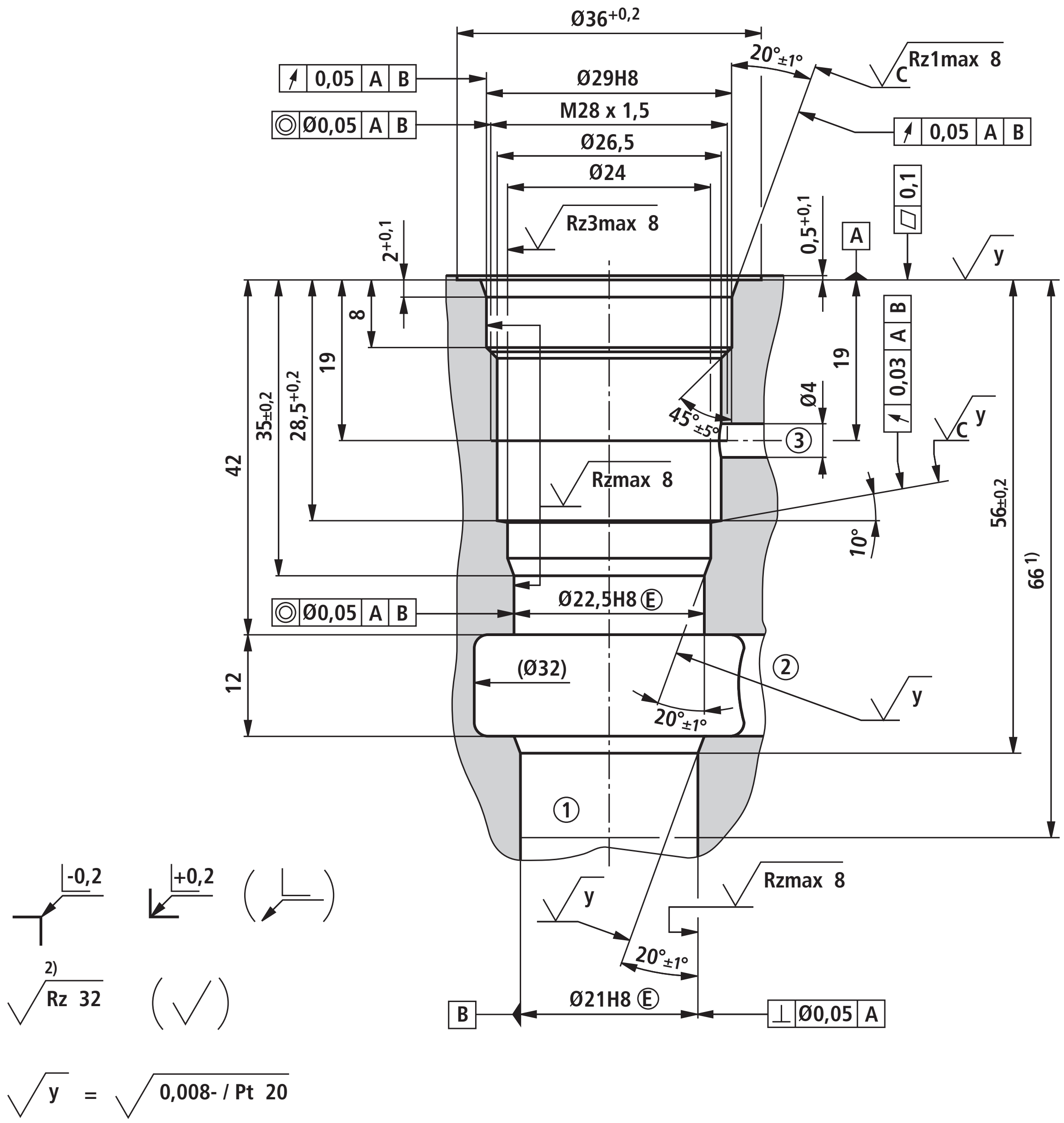
Unit dimensions (dimensions in mm)



① = main port 1 (P)
② = main port 2 (T)
③ = main port 3 (Y)
LS = Location Shoulder

- **1** Mating connector for connector "K4" (separate order, see data sheet 08006)
- **2** Mating connector for connector "C4" (separate order, see data sheet 08006)
- **3** Mating connector for connector "K40" (separate order, see data sheet 08006)
- **4** Space required to remove cable socket
- **5** Hexagon SW30; tightening torque $M_A = 92^{+10}$ Nm
- **6** Solenoid nut, tightening torque $M_A = 5^{+1}$ Nm

Mounting cavity R/FD; 3 main ports; thread M28 x 1.5 (dimensions in mm)



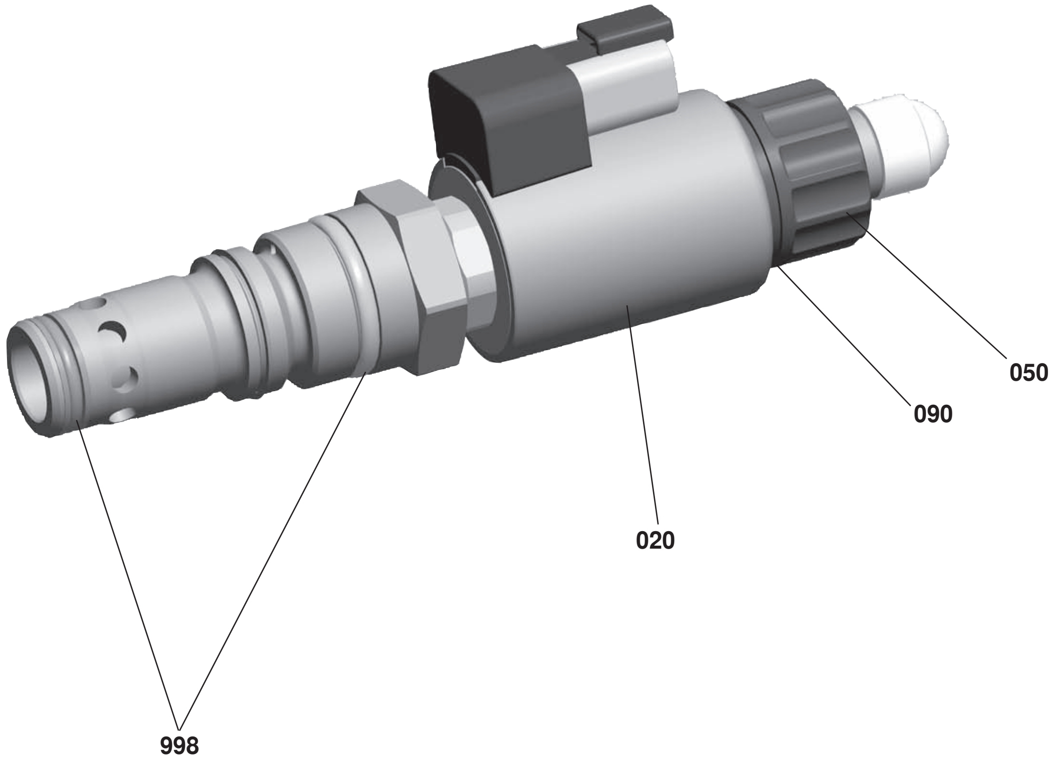
① = main port 1 (P)
② = main port 2 (T)
③ = main port 3 (Y)
LS = Location Shoulder

Standards:

Workpiece edges	DIN ISO 13715
Form and position tolerance	DIN EN ISO 1101
General tolerance for metal-cutting procedures	DIN ISO 2768-mK
Tolerance	DIN ISO 8015
Surface condition	DIN EN ISO 1302

[1] Depth of fit
[2] Visual inspection

Available individual components



Item	Denomination		Direct voltage	Material no.
020	Coil for individual connection [1]	Version "K4"	12 V	R901002932
			24 V	R901002319
			24 V / 800 mA	R901049962
		Version "K40"	12 V	R901003055
			24 V	R901003053
			24 V / 800 mA	R901050010
		Version "C4"	12 V	R901003044
			24 V	R901003026
			24 V / 800 mA	R901049963
050	Nut			R900992146
090	Seal ring for pressure tube			R900007769
998	Pilot control valve seal kit			R901138335

[1] ☞ **Notice!**
After the solenoid coil has been replaced, the factory-set pressure may change by ±5 %.

Suitable housing for threaded connection, see data sheet 25818.

Proportional pressure relief valve, pilot-operated, rising characteristic curve

RE 18139-08/07.12 1/12
Replaces: 09.07

Type KBVS.3A (High-Performance)

Component size 3
Component series A
Maximum operating pressure 350 bar
Maximum flow 200 l/min

H7139

Overview of contents

Contents **Page**

Features

- Mounting cavity R/ISO 7789-33-01-0-98
- Pilot-operated valve for limiting a system pressure
- Suitable for mobile and industrial applications
- Operation by proportional solenoid
- Proportional solenoid with central thread and detachable coil
- Cartridge valve
- Control electronics: plug-in amplifier VT-SSPA1...
- Fine balancing of the command value/pressure characteristic curves possible externally on the control electronics
- In the event of a power failure, the minimum pressure becomes effective

Ordering code

KBVS		3	A	A / L	C			V		*

Pilot-operated proportional pressure relief valve

Pressure stage

up to 50 bar **= C**
up to 100 bar **= F**
up to 150 bar **= H**
up to 210 bar **= L**
up to 250 bar **= N**
up to 315 bar **= P**
up to 350 bar **= R**

Component size 3 **= 3**

At command value = 0 the pressure is set **= A**

Component series **= A**

L = High-Performance and mounting cavity R/ISO 7789 [2]

C = Proportional solenoid, wet pin

Supply voltage

G12 = Control electronics 12 V DC
G24 = Control electronics 24 V DC

Electrical connection [1]

K4 = Component plug 03-pin (2+PE) K4, DIN EN 175301-803
K40 = Component plug 02-pin K40 DT 04-2PA, make: Deutsch
C4 = Cable plug 02-pin C4/Z30 type: Junior-Timer

Seal material

V = FKM seals
⚠ Caution! Observe compatibility of seals with the hydraulic fluid used!

no code = Standard
-8 = Coil 800 mA (see page 5)

Further details in clear text

[1] Cable sockets (separate order), see RE 08006

[2] See page 10

Preferred types

Type	Material number
KBVSC3AA/LCG24K4V	R901061858
KBVSF3AA/LCG24K4V	R901061859
KBVSH3AA/LCG24K4V	R901061869
KBVSL3AA/LCG24K4V	R901061873
KBVSN3AA/LCG24K4V	R901061874
KBVSP3AA/LCG24K4V	R901061875
KBVSR3AA/LCG24K4V	R901061877

Function, Symbol

General

Valves of the KBVS type are pilot-operated proportional pressure relief valves of poppet design and used for limiting the pressure in hydraulic systems. They basically consist of a screwed-in proportional pilot valve (1) and the main valve (2).

These valves can be used for infinitely adusting the pressure to be limited in dependence upon the command value. At command value 0 or in the event of a power failure, the minimum pressure is set.

Basic principle

For the proportional increase in the system pressure, a command value is selected on the control electronics. The electronics controls the solenoid coil with electric current in dependence upon the command value, which causes the actual pressure adjustment in main port 1 via pilot valve (1) and main valve (2).

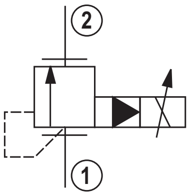
($\boldsymbol{p}_{max}$ = command value max; $\boldsymbol{p}_{min}$ = command value 0)

Internal pilot oil supply and drain.

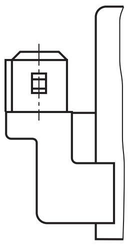
Note!

Any tank pressures (main port 2) add to the set value in main port 1.

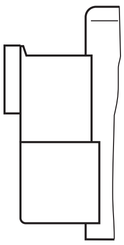
Symbol



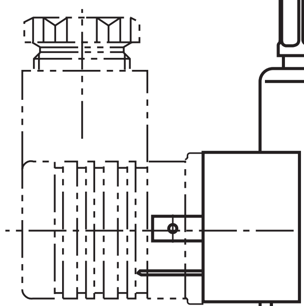
Version "C4"

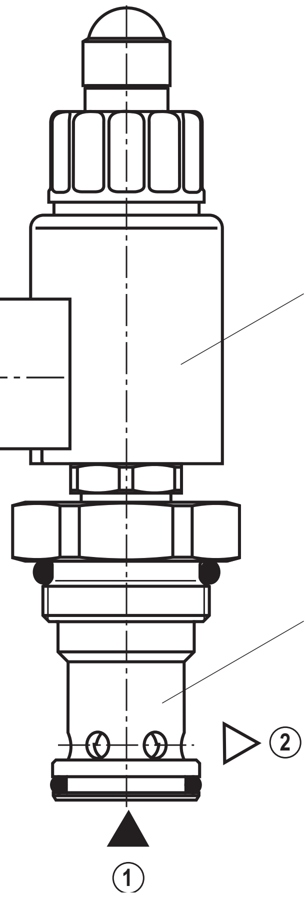


Version "K40"



Version "K4"





Technical data (for applications outside these parameters, please consult us!)

general

Weight	kg	0,7
Installation orientation		Optional, if it can be ensured that no air can collect up-stream of the valve. Otherwise, we recommend that the valve be mounted in a suspended position.
Ambient temperature range	°C	–20 to +120
Storage temperature range	°C	–20 to +80

Environmental tests:

Vibration test according to DIN EN 60068-2 / IEC 60068-2 /2 axes (X/Z)		
DIN EN 60068-2-6: 05/96	Vibration, sinusoidal	10 cycles at 5 to 2000 to 5 Hz with a logarithmic frequency change rate of 1 Oct./min, 5 to 57 Hz, amplitude 1.5 mm (p-p), 57 to 2000 Hz, amplitude 10 g
IEC 60068-2-64: 05/93	Vibration (random) and broadband noise	20 to 2000 Hz, amplitude 0.05 g^2/Hz (10 g RMS/30 g peak), testing time 30 min
DIN EN 60068-2-27: 03/95	Shock test	Half sine 15 g / 11 ms; 3 x in pos., 3 x in neg. direction (6 individual shocks in total)
DIN EN 60068-2-29: 03/95	Bump test	Half sine 25 g / 6 ms; 1000 x in pos., 1000 x in neg. direction (2000 individual shocks in total)
Details per axis		
Climatic test according to DIN EN 60068-2 / IEC 60068-2 (environmental testing):		
DIN EN 60068-2-1: 03/95	Storage temperature	–40 °C, dwell time 16 h
DIN EN 60068-2-2: 08/94		+110 °C, dwell time 16 h
DIN EN 60068-2-1: 03/95	Cold test	2 cycles at –25 °C, dwell time 2 h
DIN EN 60068-2-2: 08/94	Dry heat test	2 cycles at +120 °C, dwell time 2 h
IEC 60068-2-30: 1985	Damp heat, cyclical	Variant 2/ +25 °C to +55 °C 93 % to 97 % relative humidity, 2 cycles, 24 h each
Salt spray test: 720 h according to DIN 50021		

→ Finish painting generally not required. Should you nevertheless wish to apply a finish coat, observe the reduced heat dissipation capacity.

hydraulic

Max. operating pressure [1] (main port 1)	bar	350
Max. permissible return flow pressure (main port 2)	bar	210
Maximum set pressure [2]		See command value/pressure characteristic curves on page 6
Minimum set pressure at command value 0		See charateristic curves on page 6
Maximum flow	l/min	200 (with pressure stage 350 bar max. 100 l/min)
Hydraulic fluid		see page 5
Hydraulic fluid temperature range	°C	–20 to +80
Viscosity range	mm^2/s	15 to 380
Max. permissible degree of contamination of the hydraulic fluid - cleanliness class acc. to ISO 4406 (c)		Class 20/18/15 [3]

1) ⚠ **Caution!** The maximum operating pressure is added up from the set pressure and the return flow pressure!

2) ⚠ **Caution!** The valves are factory-set. In the case of subsequent re-adjustment, the warranty will become void!

3) The cleanliness class stated for the components must be adhered to in hydraulic systems. Effective filtration prevents malfunction and, at the same time, increases the service life of components.

Technical data (for applications outside these parameters, please consult us!)

hydraulic

Hysteresis			< 6 % of max. set pressure
Range of inversion			< 0,5 % of max. set pressure
Response sensitivity			< 0,5 % of max. set pressure
Tolerance of the command value/pressure characteristic curve	– Command value 100 %		< 5 % of max. set pressure
	– Command value 0		< 2 % of max. set pressure
Step response (T_u + T_g) 0 → 100 % or 100 % → 0		ms	100 (depends on system)

Hydraulic fluid		Classification	Suitable sealing materials	Standards
Mineral oils		HL, HLP	FKM	DIN 51524
Bio-degradable	– Insoluble in water	HEES	FKM	VDMA 24568
	– Soluble in water	HEPG	FKM	

Important information on hydraulic fluids!

- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, service life, maintenance intervals, etc.)!
- The flash point of the hydraulic fluids used must be 40 K higher than the maximum solenoid surface temperature.
- **Bio-degradable:** When using bio-degradable hydraulic fluids that are simultaneously zinc-solving, zinc may accumulate in the fluid.

electrical

Supply voltage		V	12 DC	24 DC	“-8” / 24 DC
Maximum control current		mA	max. nominal current 1760 mA	max. nominal current 1200 mA	max. nominal current 800 mA
Coil resistance	– Cold value at 20 °C	Ω	2,3	4,8	11,5
	– Max. hot value	Ω	3,8	7,9	18,9
Duty cycle		%	100 [4]		
Maximum coil temperature [5]		°C	150		
Type of protection acc. to VDE 0470-1 (DIN EN 60529), DIN 40050-9	– Version "K4"		IP 65 with cable socket mounted and locked		
	– Version "C4"		IP 66 with cable socket mounted and locked		
			IP 69K with Rexroth cable socket (material no. R901022127)		
	– Version “K40“		IP 69K with cable socket mounted and locked		
Control electronics [6]			Plug-in amplifier VT-SSPA1 (300 Hz)		
Rating according to VDE 0580					

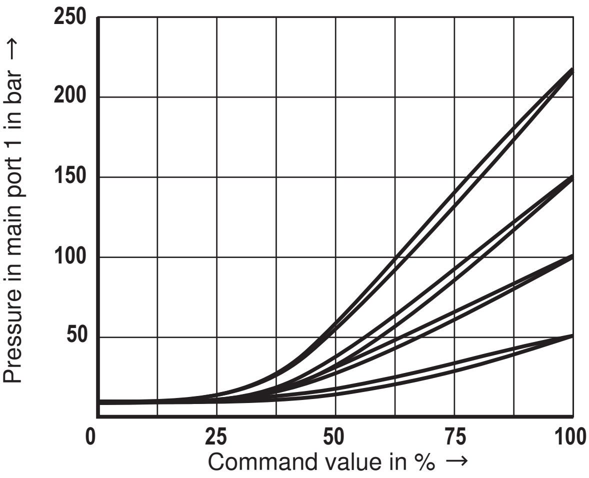
[4] In the case of use at heights > 2000 m above MSL we recommend that you consult the manufacturer.

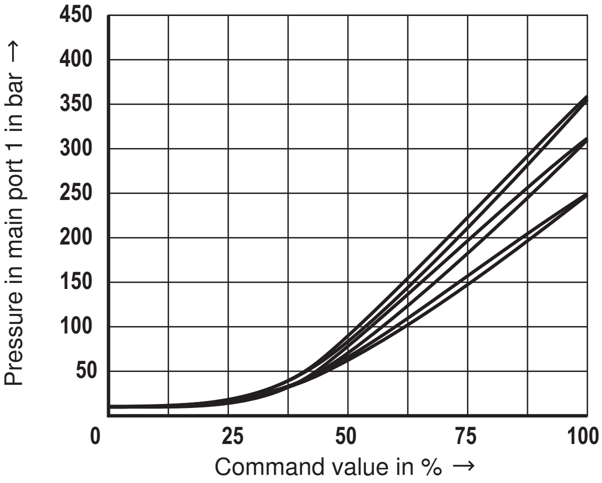
[5] Due to the surface temperatures occurring on solenoid coils, the European standards ISO 13732-1 and EN 982 must be observed!

[6] Separate order, see RE 30116

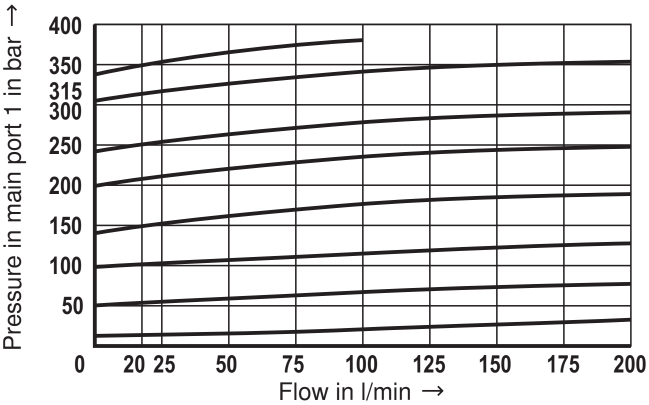
Characteristic curves (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C and 24 V coil)

Pressure in main port 1 in dependence on command value. Flow = 20 l/min



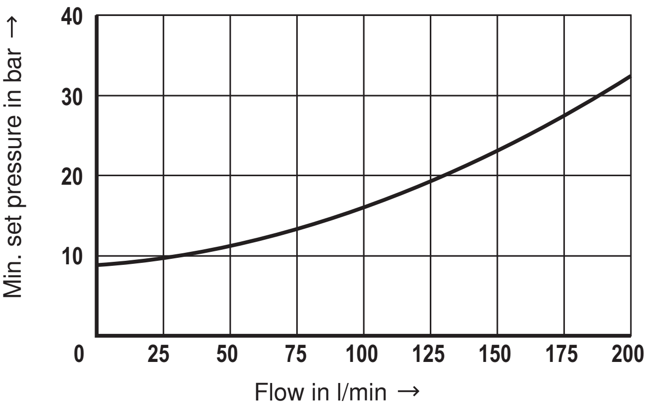


Pressure in main port 1 in dependence on flow.
(The characteristic curves were measured without backpressure in main port 2.)

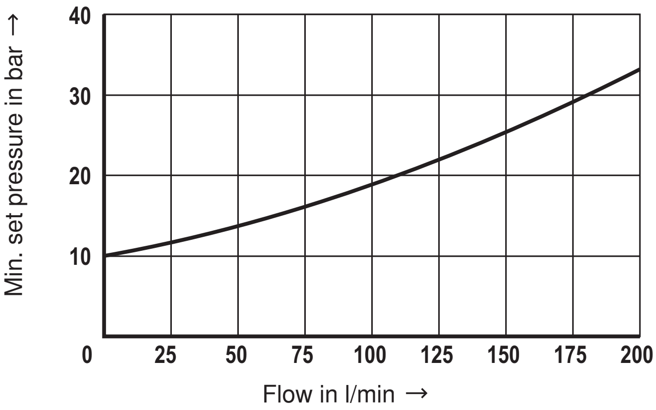


Minimum set pressure in main port 1 at command value 0.
(The characteristic curves were measured without backpressure in main port 2.)

Pressure stage 50 to 250 bar



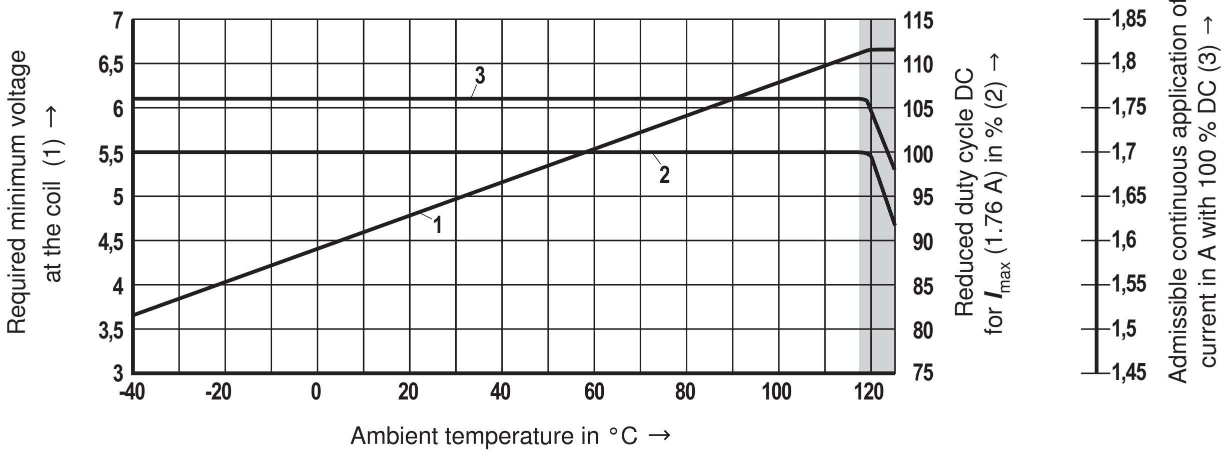
Pressure stage 315 to 350 bar



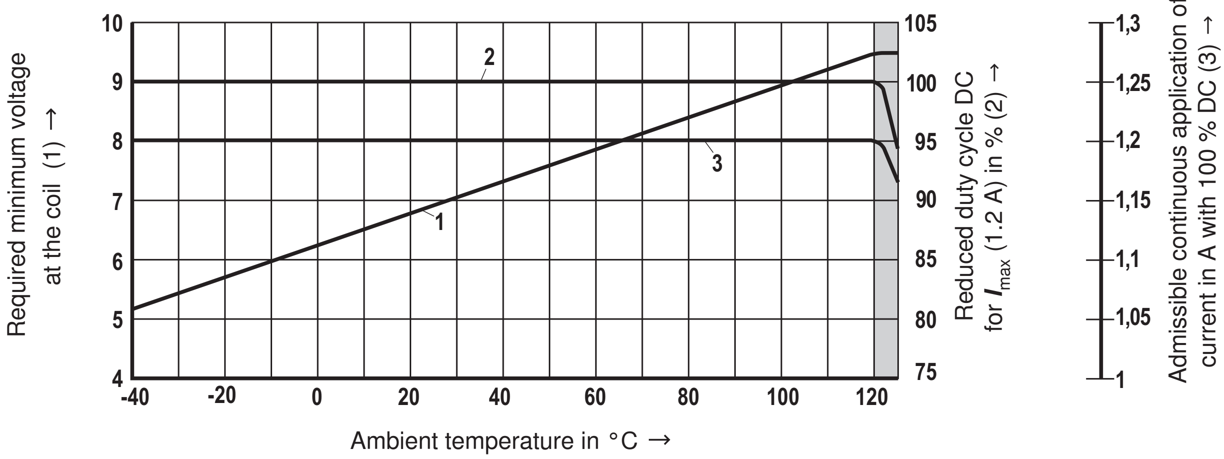
Minimum terminal voltage at the coil and relative duty cycle

Admissible working range against the ambient temperature

– Version "G12"



– Version "G24"



Limited valve performance

Notice!

The characteristic curves have been determined for coils with valve with medium test block size (80 x 80 x 80 mm), without flow in calm air.

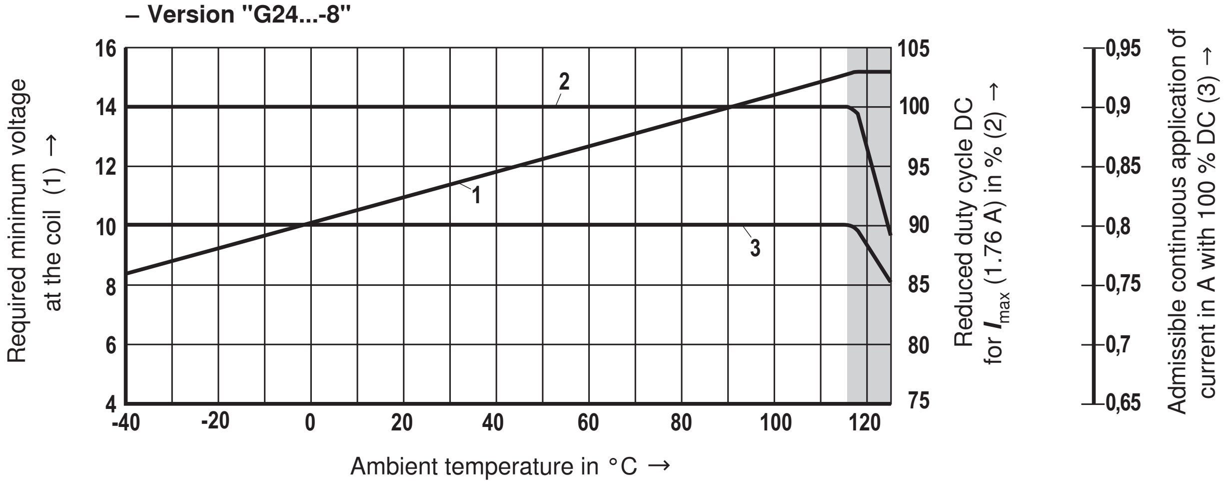
Depending on the installation conditions (block size, flow, air circulation, etc.) there may be a better heat dissipation. Thus, the area of application is broadened.

In single cases, more unfavorable conditions may lead to limitations of the area of application.

Minimum terminal voltage at the coil and relative duty cycle

Admissible working range against the ambient temperature

– **Version "G24...-8"**



Limited valve performance

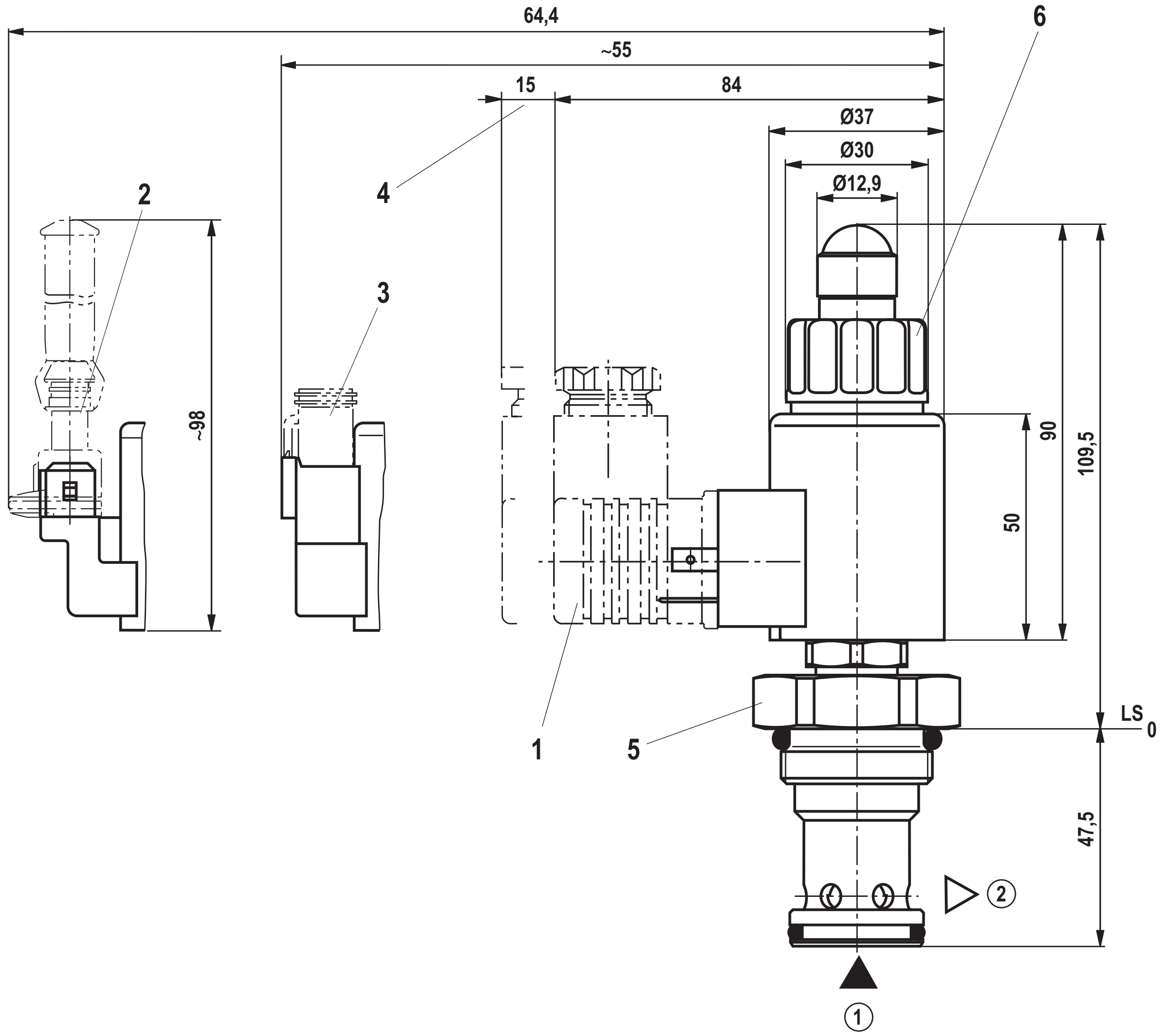
Notice!

The characteristic curves have been determined for coils with valve with medium test block size (80 x 80 x 80 mm), without flow in calm air.

Depending on the installation conditions (block size, flow, air circulation, etc.) there may be a better heat dissipation. Thus, the area of application is broadened.

In single cases, more unfavorable conditions may lead to limitations of the area of application.

Unit dimensions (dimensions in mm)



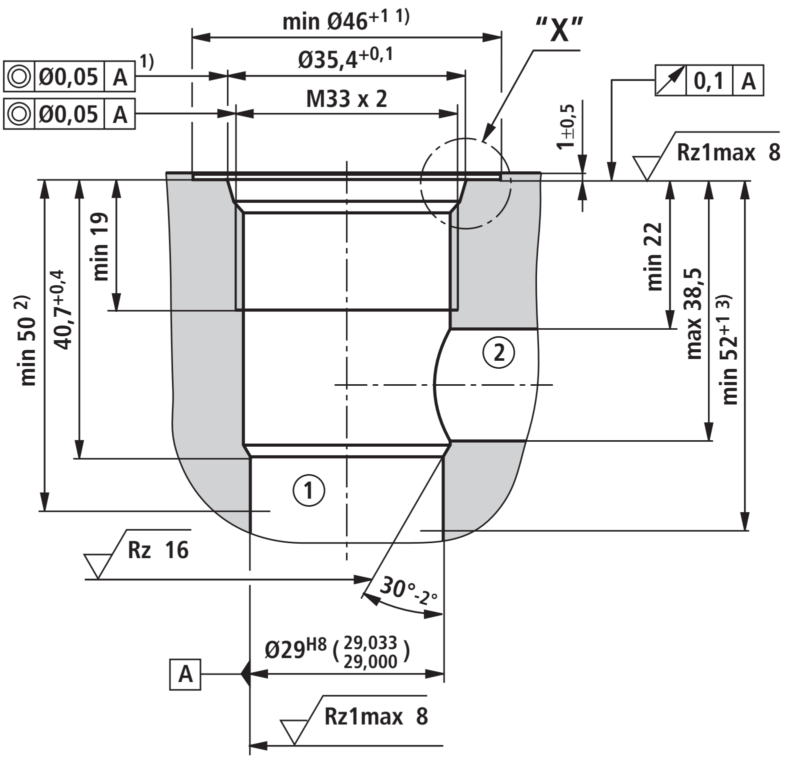
① = Main port 1

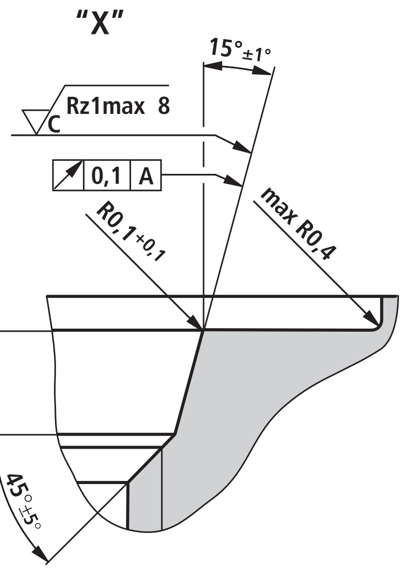
② = Main port 2

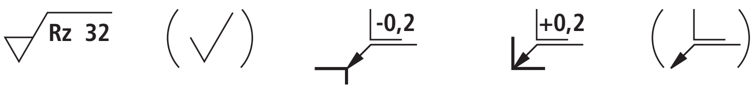
LS = Location shoulder

1. **1** Cable socket for component plug "K4" (separate order, see RE 08006)
2. **2** Cable socket for component plug "C4" (separate order, see RE 08006)
3. **3** Cable socket for component plug "K40" (separate order, see RE 08006)
4. **4** Space required to remove the plug-in connector
5. **5** Hexagon SW41;
   – Tightening torque M_A = 100^{+20} Nm (< 250 bar)
   – Tightening torque M_A = 120^{+20} Nm (> 250 bar)
6. **6** Solenoid nut, tightening torque M_A = 5^{+1} Nm

Mounting cavity R/ISO 7789-33-01-0-98; 2 main ports; thread M33 x 2
(dimensions in mm)



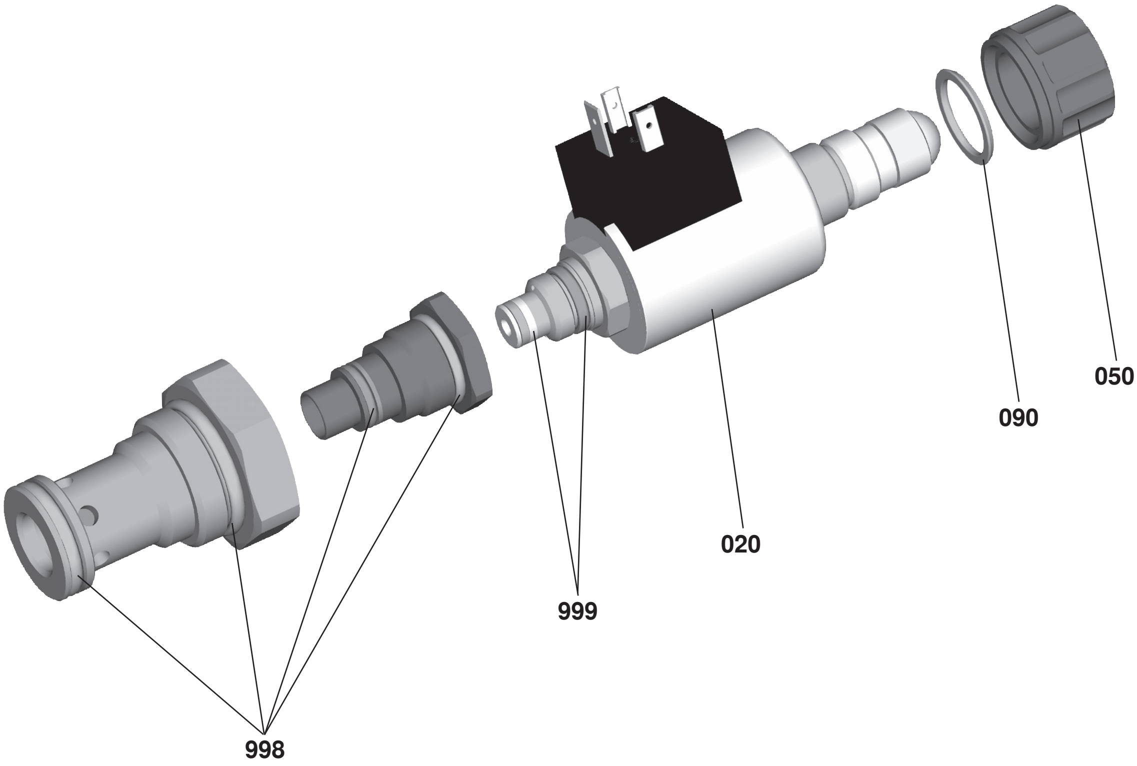




[1] Different from ISO 7789-33-01-0-98
[2] Depth of fit
[3] Optional

① = Main port 1
② = Main port 2
LS = Location shoulder

Available individual components



Item	Designation		DC	Material no.
020	Coil for individual connection [1]	Version K4	12 V 24 V 24 V / 800 mA	R901002932 R901002319 R901049962
		Version K40	12 V 24 V 24 V / 800 mA	R901003055 R901003053 R901050010
		Version C4	12 V 24 V 24 V / 800 mA	R901003044 R901003026 R901049963
050	Nut			R900992146
090	Seal ring for pressure tube			R900007769
998	Main stage seal kit			R961001025
999	Pilot valve seal kit			R961000376

[1] **Note!**
After the solenoid coil was replaced, the factory-set pressure may change by ±5 %.

Proportional pressure relief valve, pilot-operated, falling characteristic curve

RE 18139-07/07.12 1/12
Replaces: 06.08

Type KBVS.3B (High-Performance)

Component size 3
Component series A
Maximum operating pressure 350 bar
Maximum flow 200 l/min

H7139

Overview of contents

Features

– Mounting cavity R/ISO 7789-33-01-0-98
– Pilot-operated valve for limiting a system pressure
– Suitable for mobile and industrial applications
– Operation by proportional solenoid
– Proportional solenoid with central thread and detachable coil
– Cartridge valve
– Control electronics: plug-in amplifier VT-SSPA1..
– Fine balancing of the command value/pressure characteristic curves possible externally on the control electronics
– Valves are adjusted to max. pressure by means of an adjustment screw
– In the event of a power failure, the maximum set pressure becomes effective

Ordering code

KBVS		3	B	A /	L	C			V		*

Pilot-operated proportional pressure relief valve

Pressure stage

up to 50 bar **= C**
up to 100 bar **= F**
up to 150 bar **= H**
up to 210 bar **= L**
up to 250 bar **= N**
up to 315 bar **= P**
up to 350 bar **= R**

Component size 3 **= 3**

At command value = 0 the maximum pressure is set **= B**

Component series **= A**

L = High-Performance and mounting cavity R/ISO 7789 [2]

C = Proportional solenoid, wet pin

Supply voltage

G12 = Control electronics 12 V DC
G24 = Control electronics 24 V DC

Electrical connection [1]

K4 = Component plug 03-pin (2+PE) K4, DIN EN 175301-803
K40 = Component plug 02-pin K40 DT 04-2PA, make: Deutsch
C4 = Cable plug 02-pin C4/Z30 type: Junior-Timer

Seal material

V = FKM seals
⚠ Caution!
Observie compatibility of seals with the hydraulic fluid used!

no code = Standard
-8 = Coil 800 mA (see page 5)

Further details in clear text

[1] Cable sockets (separate order), see RE 08006
[2] See page 10

Preferred types

Type	Material number
KBVSC3BA/LCG24K4V	R901042645
KBVSF3BA/LCG24K4V	R901042649
KBVSH3BA/LCG24K4V	R901047841
KBVSL3BA/LCG24K4V	R901032852
KBVSN3BA/LCG24K4V	R901041058
KBVSP3BA/LCG24K4V	R901042652
KBVSR3BA/LCG24K4V	R901022444

Function, Symbol

General

Valves of the KBVS type are pilot-operated proportional pressure relief valves of poppet design and used for limiting the pressure in hydraulic systems. They basically consist of a screwed-in proportional pilot valve (1) and the main valve (2).

These valves can be used for infinitely adusting the pressure to be limited in dependence upon the command value. At command value 0 or in the event of a power failure, the maximum pressure is set (fail-safe characteristics).

Basic principle

The mechanics of the valve is factory-set to the maximum pressure. A command value for the proportional reduction of the system pressure is selected on the control electronics. The electronics controls the solenoid coil with electric current in dependence upon the command value, which causes the actual pressure adjustment in main port ① via pilot valve (1) and main valve (2).

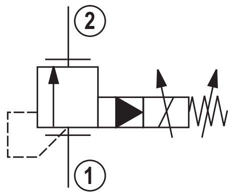
($\boldsymbol{p}_{max}$ = command value 0; $\boldsymbol{p}_{min}$ = command value max.)

Internal pilot oil supply and drain.

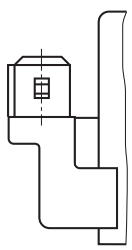
☞ **Note!**

Any tank pressures (main port ②) add to the set value in main port ①.

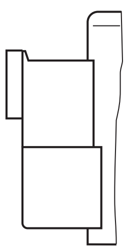
Symbol



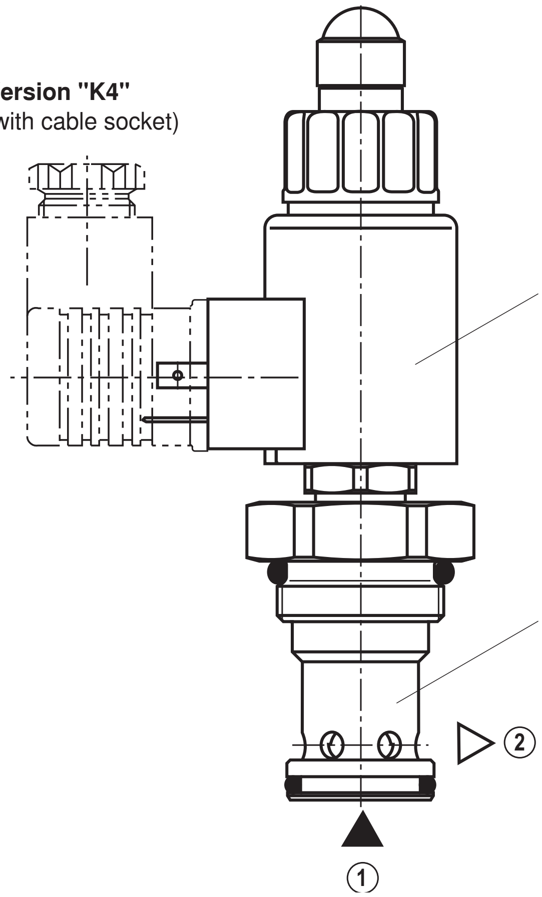
Version "C4"



Version "K40"



Version "K4"
(with cable socket)



Technical data (for applications outside these parameters, please consult us!)

general

Weight	kg	0,7
Installation orientation		Optional, if it can be ensured that no air can collect up-stream of the valve. Otherwise, we recommend that the valve be mounted in a suspended position.
Ambient temperature range	°C	–20 to +120 (–40 to +110 for fan drives)
Storage temperature range	°C	–20 to +80

Environmental tests:

Vibration test according to DIN EN 60068-2 / IEC 60068-2 /2 axes (X/Z)		
DIN EN 60068-2-6: 05/96	Vibration, sinusoidal	10 cycles at 5 to 2000 to 5 Hz with a logarithmic frequency change rate of 1 Oct./min, 5 to 57 Hz, amplitude 1.5 mm (p-p), 57 to 2000 Hz, amplitude 10 g
IEC 60068-2-64: 05/93	Vibration (random) and broadband noise	20 to 2000 Hz, amplitude 0.05 g^2/Hz (10 g RMS/30 g peak), testing time 30 min
DIN EN 60068-2-27: 03/95	Shock test	Half sine 15 g / 11 ms; 3 x in pos., 3 x in neg. direction (6 individual shocks in total)
DIN EN 60068-2-29: 03/95	Bump test	Half sine 25 g / 6 ms; 1000 x in pos., 1000 x in neg. direction (2000 individual shocks in total)
Details per axis		
Climatic test according to DIN EN 60068-2 / IEC 60068-2 (environmental testing):		
DIN EN 60068-2-1: 03/95	Storage temperature	–40 °C, dwell time 16 h
DIN EN 60068-2-2: 08/94		+110 °C, dwell time 16 h
DIN EN 60068-2-1: 03/95	Cold test	2 cycles at –25 °C, dwell time 2 h
DIN EN 60068-2-2: 08/94	Dry heat test	2 cycles at +120 °C, dwell time 2 h
IEC 60068-2-30: 1985	Damp heat, cyclical	Variant 2/ +25 °C to +55 °C 93 % to 97 % relative humidity, 2 cycles, 24 h each
Salt spray test: 720 h according to DIN 50021		

→ Finish painting generally not required. Should you nevertheless wish to apply a finish coat, observe the reduced heat dissipation capacity.

hydraulic

Max. operating pressure 1) (main port ①)	bar	350
Max. permissible return flow pressure (main port ②)	bar	210
Maximum set pressure 2)		See command value/pressure characteristic curves on page 6
Minimum set pressure at max. command value		See charateristic curves on page 6
Maximum flow	l/min	200 (with pressure stage 350 bar max. 100 l/min)
Hydraulic fluid		See page 5
Hydraulic fluid temperature range	°C	–20 to +80 (–20 to +110 for fan drives)
Viscosity range	mm^2/s	12 to 800
Max. permissible degree of contamination of the hydraulic fluid - cleanliness class acc. to ISO 4406 (c)		Class 20/18/15 3)

1) ⚠ **Caution!** The maximum operating pressure is added up from the set pressure and the return flow pressure!

2) ⚠ **Caution!** The valves are factory-set. In the case of subsequent re-adjustment, the warranty will become void!

3) The cleanliness class stated for the components must be adhered to in hydraulic systems. Effective filtration prevents malfunction and, at the same time, increases the service life of components.

F

Technical data (for applications outside these parameters, please consult us!)

hydraulic

Hysteresis			< 4 % of max. set pressure
Range of inversion			< 0.5 % of max. set pressure
Response sensitivity			< 0.5 % of max. set pressure
Tolerance of the command value/pressure characteristic curve	– Command value 100 %		< 2 % of max. set pressure
	– Command value 0		< 5 % of max. set pressure
Step response (T_u + T_g) 0 → 100 % or 100 % → 0		ms	100 (depends on system)

Hydraulic fluid		Classification	Suitable sealing materials	Standards
Mineral oils		HL, HLP	FKM	DIN 51524
Bio-degradable	– Insoluble in water	HEES	FKM	VDMA 24568
	– Soluble in water	HEPG	FKM	

Important information on hydraulic fluids!
- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, service life, maintenance intervals, etc.)!
- The flash point of the hydraulic fluids used must be 40 K higher than the maximum solenoid surface temperature.
- **Bio-degradable:** When using bio-degradable hydraulic fluids that are simultaneously zinc-solving, zinc may accumulate in the fluid.

electrical

Supply voltage		V	12 DC	24 DC	"-8" / 24 DC
Maximum control current		mA	max. nominal current 1760 mA	max. nominal current 1200 mA	max. nominal current 800 mA
Coil resistance	– Cold value at 20 °C	Ω	2,3	4,8	11,5
	– Max. hot value	Ω	3,8	7,9	18,9
Duty cycle		%	100 [4]		
Maximum coil temperature [5]		°C	150		
Type of protection acc. to VDE 0470-1 (DIN EN 60529), DIN 40050-9	– Version "K4"		IP 65 with cable socket mounted and locked		
	– Version "C4"		IP 66 with cable socket mounted and locked		
			IP 69K with Rexroth cable socket (material no. R901022127)		
	– Version "K40"		IP 69K with cable socket mounted and locked		
Control electronics [6]			Plug-in amplifier VT-SSPA1		
Rating according to VDE 0580					

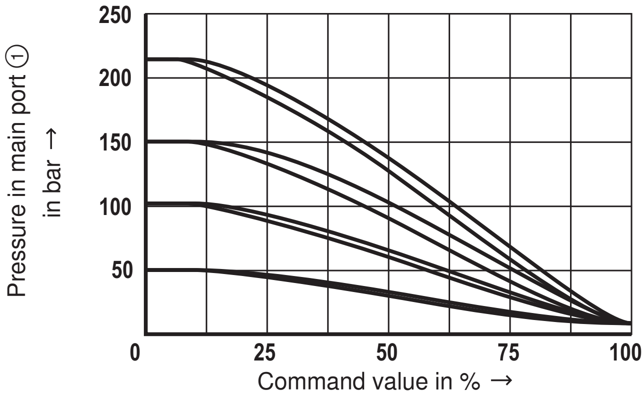
[4] In the case of use at heights > 2000 m above MSL we recommend that you consult the manufacturer.

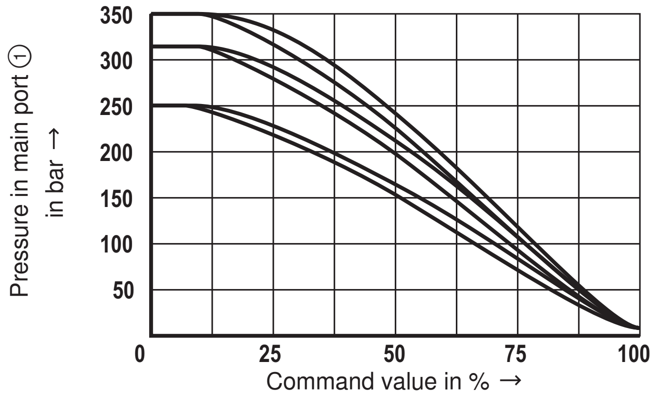
[5] Due to the surface temperatures occurring on solenoid coils, the European standards ISO 13732-1 and EN 982 must be observed!

[6] Separate order, see RE 30116

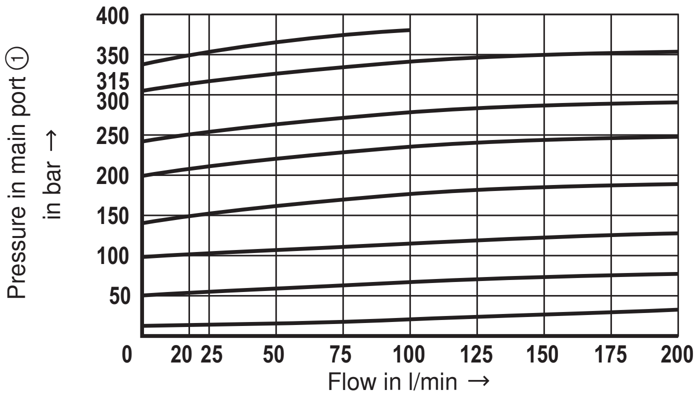
Characteristic curves (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C and 24 V coil)

Pressure in main port ① in dependence on command value. Flow = 20 l/min



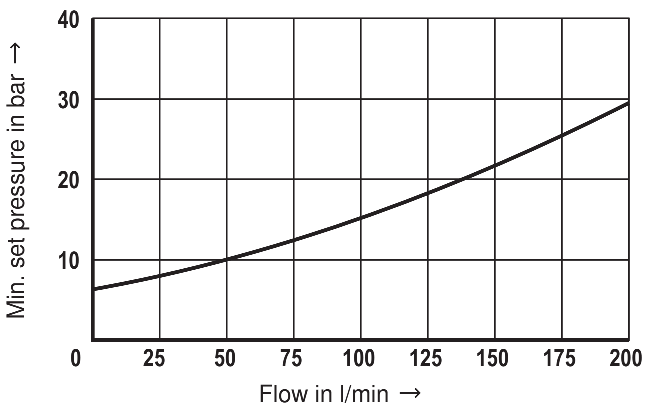


Pressure in main port ① in dependence on flow.
(The characteristic curves were measured without backpressure in main port ②.)

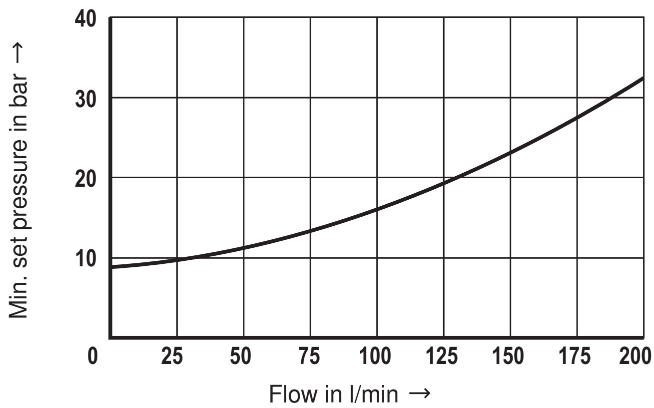


Minimum set pressure in main port ① at command value 100 %.
(The characteristic curves were measured without backpressure in main port ②.)

Pressure stage 50 to 250 bar



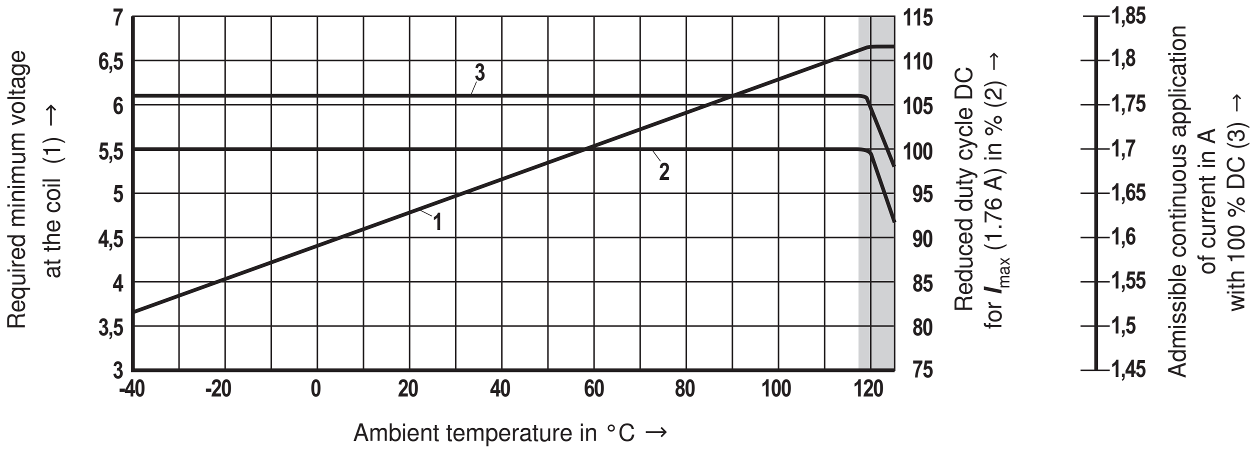
Pressure stage 315 and 350 bar



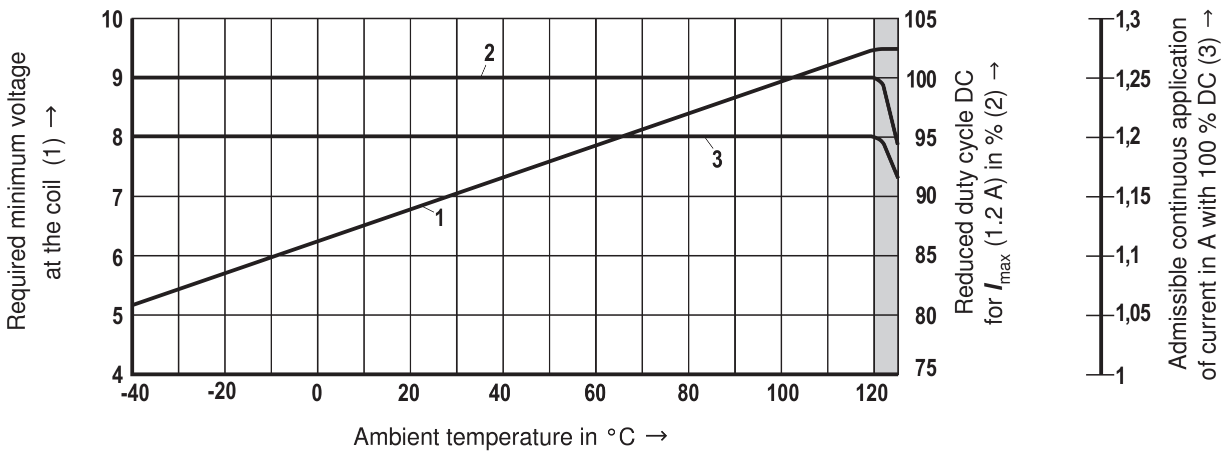
Minimum terminal voltage at the coil and relative duty cycle

Admissible working range against the ambient temperature

– Version "G12"



– Version "G24"



Limited valve performance

Notice!

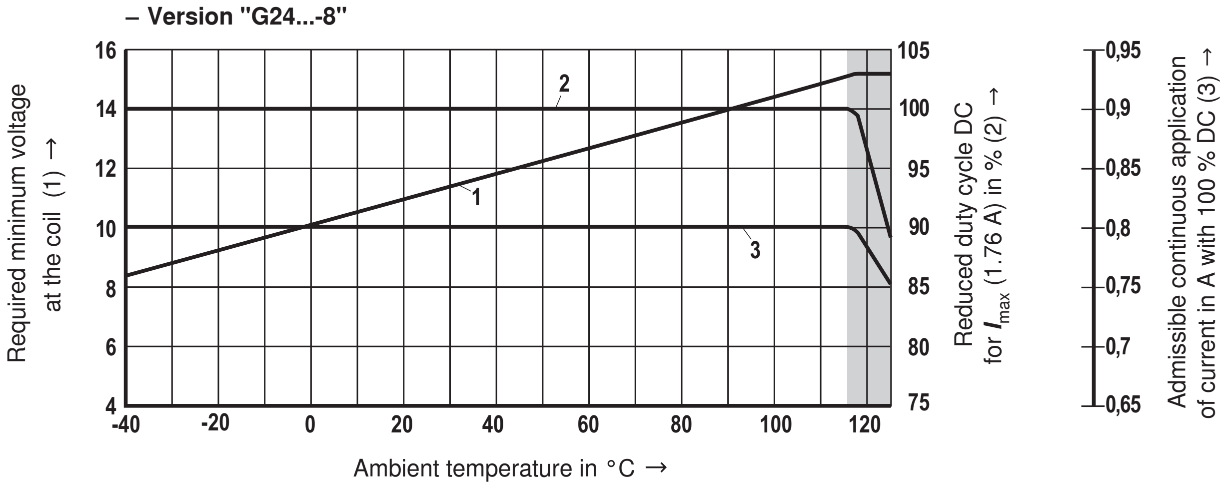
The characteristic curves have been determined for coils with valve with medium test block size (80 x 80 x 80 mm), without flow in calm air.

Depending on the installation conditions (block size, flow, air circulation, etc.) there may be a better heat dissipation. Thus, the area of application is broadened.

In single cases, more unfavorable conditions may lead to limitations of the area of application.

Minimum terminal voltage at the coil and relative duty cycle

Admissible working range against the ambient temperature



Limited valve performance

Notice!

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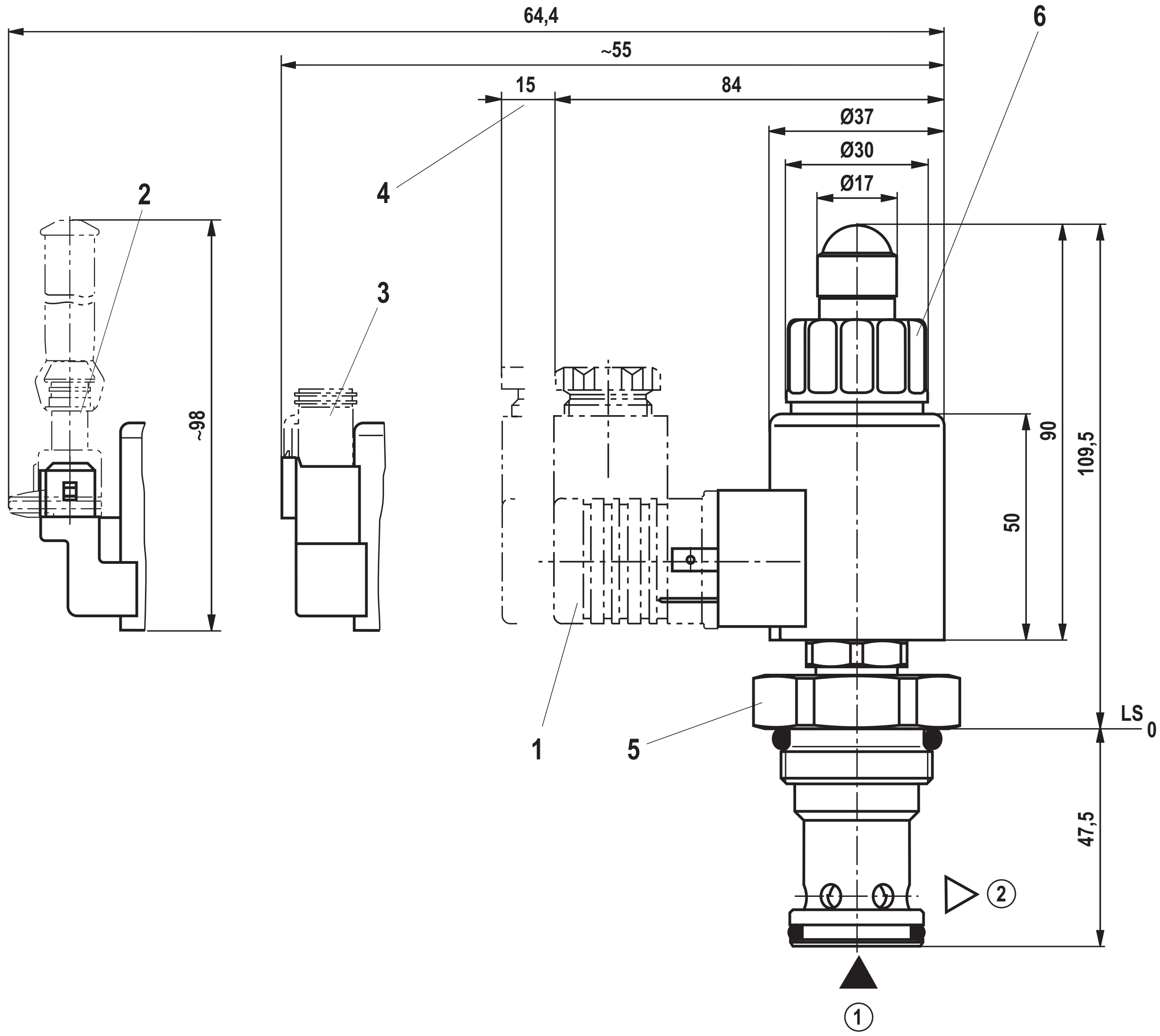
Depending on the installation conditions (block size, flow, air circulation, etc.) there may be a better heat dissipation. Thus, the area of application is broadened.

In single cases, more unfavorable conditions may lead to limitations of the area of application.

Unit dimensions (dimensions in mm)



① = Main port 1

② = Main port 2

LS = Location shoulder

1 Cable socket for component plug "K4" (separate order, see RE 08006)

2 Cable socket for component plug "C4" (separate order, see RE 08006)

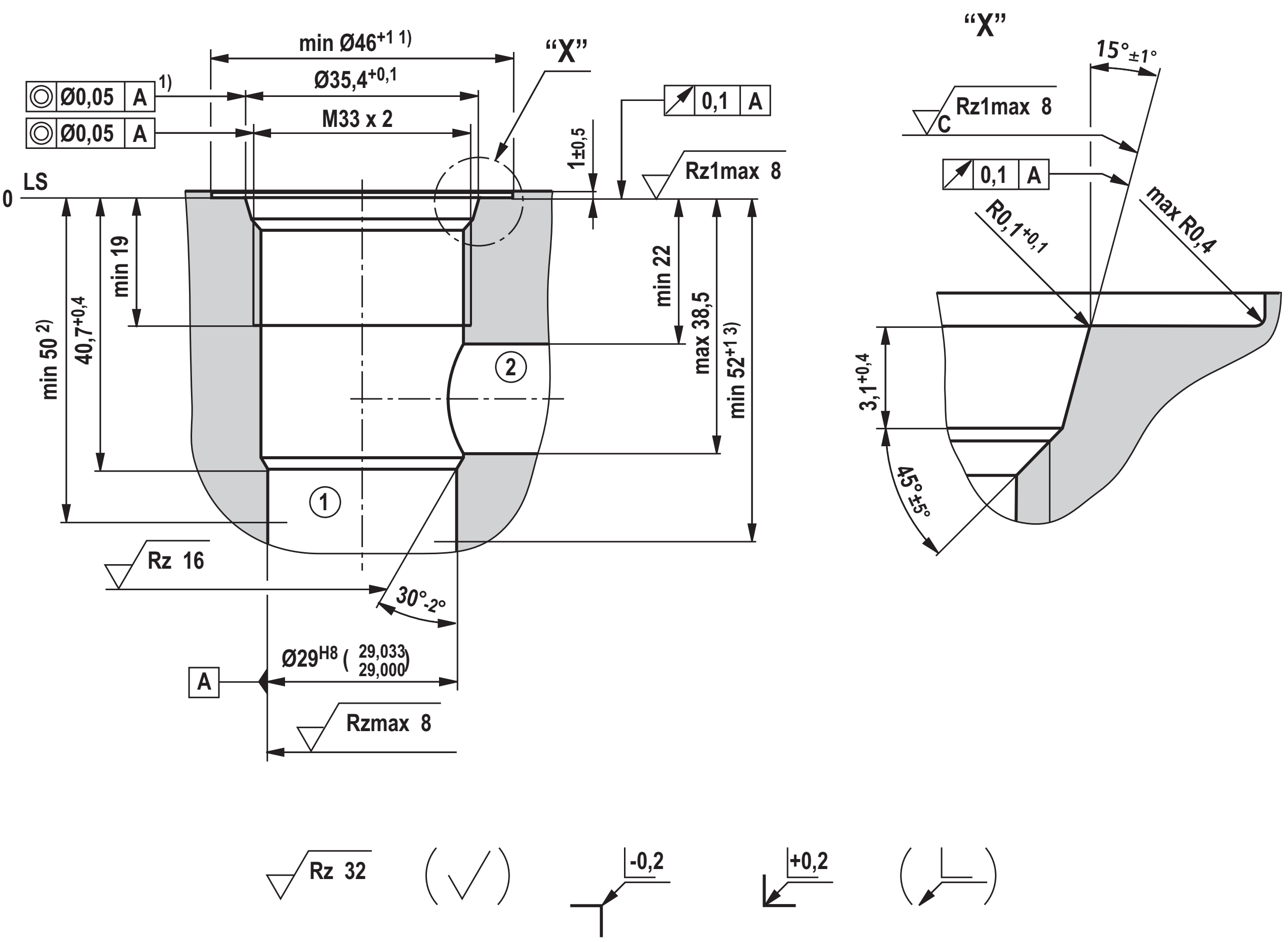
3 Cable socket for component plug "K40" (separate order, see RE 08006)

4 Space required to remove the plug-in connector

5 Hexagon SW41;
– Tightening torque M_A = 100^{+20} Nm (< 250 bar)
– Tightening torque M_A = 120^{+20} Nm (> 250 bar)

6 Solenoid nut, tightening torque M_A = 5^{+1} Nm

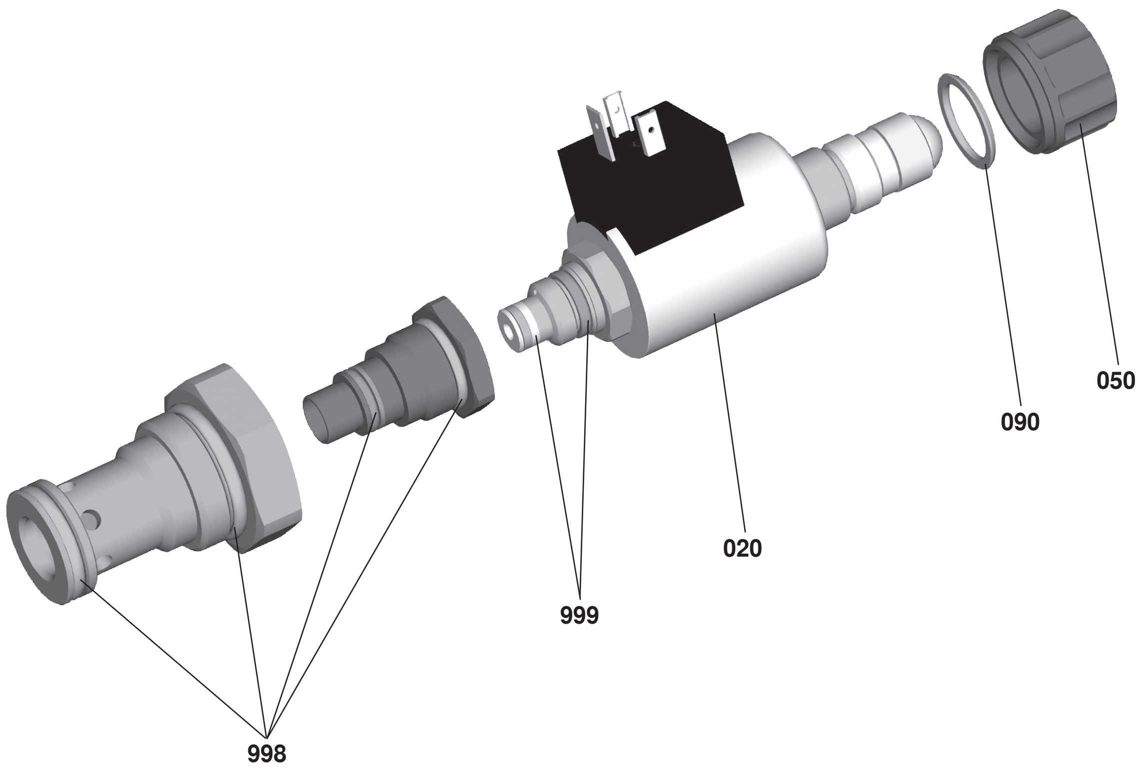
Mounting cavity R/ISO 7789-33-01-0-98; 2 main ports; thread M33 x 2
(dimensions in mm)



[1] Different from ISO 7789-33-01-0-98
[2] Depth of fit
[3] Optional

① = Main port 1
② = Main port 2
LS = Location shoulder

Available individual components



Item	Designation		DC	Material no.
020	Coil for individual connection 1)	Version K4	12 V 24 V 24 V / 800 mA	R901002932 R901002319 R901049962
		Version K40	12 V 24 V 24 V / 800 mA	R901003055 R901003053 R901050010
		Version C4	12 V 24 V 24 V / 800 mA	R901003044 R901003026 R901049963
050	Nut			R900992146
090	Seal ring for pressure tube			R900007769
998	Main stage seal kit			R961001025
999	Pilot valve seal kit			R961000376

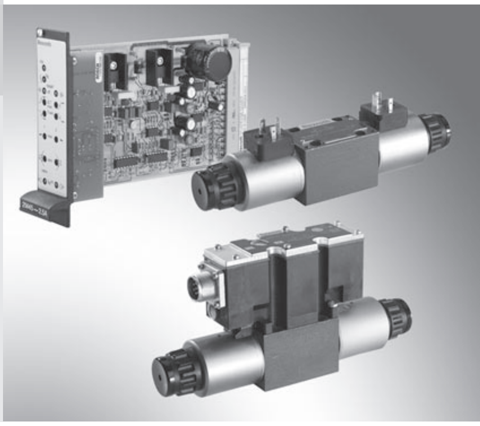
1) ☞ **Note!**
After the solenoid coil was replaced, the factory-set pressure may change by ±5 %.

Rexroth
Bosch Group

Proportional pressure reducing valve, in 3-way version

RE 29184/06.11
Replaces: 12.02

Type 3DREP and 3DREPE



Size 6
Component series 2X

Maximum operating pressure	100 bar
Maximum flow	15 l/min

Table of contents

Features

- Direct operated proportional valves for controlling a pressure and the direction of a flow
- Operation by means of proportional solenoids with central thread and detachable coil
- Subplate mounting:
  Porting pattern according to ISO 4401
- Manual override, optional
- Spring-centered control spool
- Type 3DREPE with integrated control electronics
- External control electronics for type 3DREP:
  - Analog amplifiers type VT-VSPA2-1-2X/… in Eurocard format (separate order), see page 5
  - Digital amplifier type VT-VSPD-1-1X/… in Eurocard format (separate order), see page 5
  - Electric amplifier type VT 11118 in modular design (separate order), see page 5

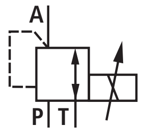
Ordering code

3DREP		6	–2X/		E	G24			/		*

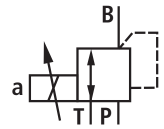
For **external** control electronics = **No code**
With **integrated** control electronics = **E**

Size
Size 6 = **6**

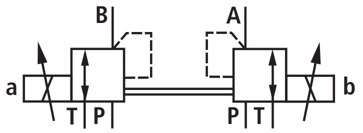
Symbols (simplified)



= **A**



= **B**



= **C**

Component series 20 to 29 = **2X**
(20 to 29: Unchanged installation and connection dimensions)

Pressure rating
16 bar = **16**
25 bar = **25**
45 bar = **45**

E = Proportional solenoid with detachable coil

Supply voltage
G24 = +24 V direct voltage

No code = Without manual override
N9 = [3] With concealed manual override

No code = Without special type of protection
J = [2] Sea water-resistant

Electrical connection for DREP
K4 = [1] **Without** mating connectors, with connector according to DIN EN 175 301-803
Mating connectors - separate order see page 7

For DREPE
K31 = [1] **Without** mating connectors, with connector according to DIN EN 175 301-804
Mating connectors - separate order see page 7

No code = For DREP
For DREPE
A1 = Command value/ actual value ±10 V
F1 = Command value/ actual value 4 to 20 mA

Seal material
M = NBR seals
V = FKM seals

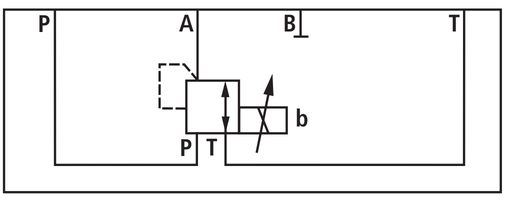
Further details in the plain text

[1] With version "J" = sea water-resistant only specify "K31"
[2] Only with version 3DREP6
[3] With version "J" = "N" instead of "N9"

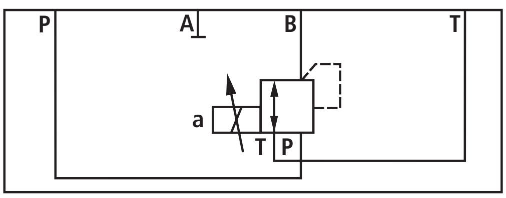
Electric special types of protection on request!

Symbols

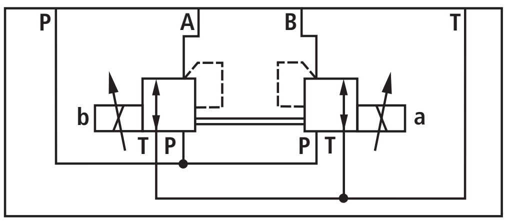
Type 3DREP..6 **A** 2X/..E (detailed)



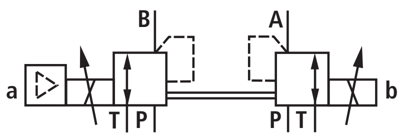
Type 3DREP..6 **B** 2X/..E (detailed)



Type 3DREP..6 **C** 2X/..E (detailed)



Example of valve with integrated control electronics
Type 3DREP**E**..6 **C** 2X/..E (simplified)



Function, section

The 3-way pressure reducing valve type 3 DREP 6.. is direct operated by proportional solenoids. It is used to convert an electric input signal into a proportional pressure output signal. The proportional solenoids are controllable wet-pin DC solenoids with central thread and detachable coil. The solenoids are optionally actuated by external control electronics (type 3DREP) or by the internal control electronics (type 3DREPE).

Set-up:

The valve basically consists of:

– Housing (1) with connection surface
– Control spool (2) with pressure measuring spool (3, 4)
– Solenoids (5, 6) with central thread
– Optionally integrated control electronics (7)

Function:

The pressure in A or B is set by means of the proportional solenoids. The amount of the pressure depends on the current. With de-energized solenoids (5, 6), the control spool (2) is held in the central position by means of the pressure springs (8). Ports A and B are connected with T so that the hydraulic fluid can flow off to the tank without obstructions.

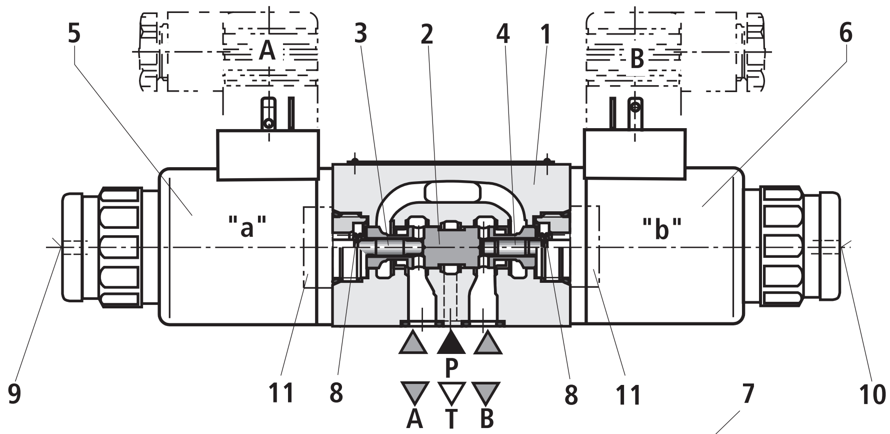
By energizing a proportional solenoid e.g. solenoid "a" (5), the pressure measuring spool (3) and with it the control spool (2) are moved to the right. This opens the connection from P to B and A to T via orifice-type cross-sections with progressive flow characteristic. The pressure that builds up in channel B acts with the surface of the pressure measuring spool (4) on the control spool and against the solenoid force. The pressure measuring spool (4) is supported by the solenoid "b". If the pressure exceeds the value set at solenoid "a", the control spool (2) is pushed back against the solenoid force and connects B with T until the set pressure is achieved again. The pressure is proportional to the solenoid current.

After shut-down of the solenoid, the control spool (2) is returned into the central position by the compression springs (8). An optional hand override (9, 10) allows for the displacement of the control spool (2) without solenoid energization.

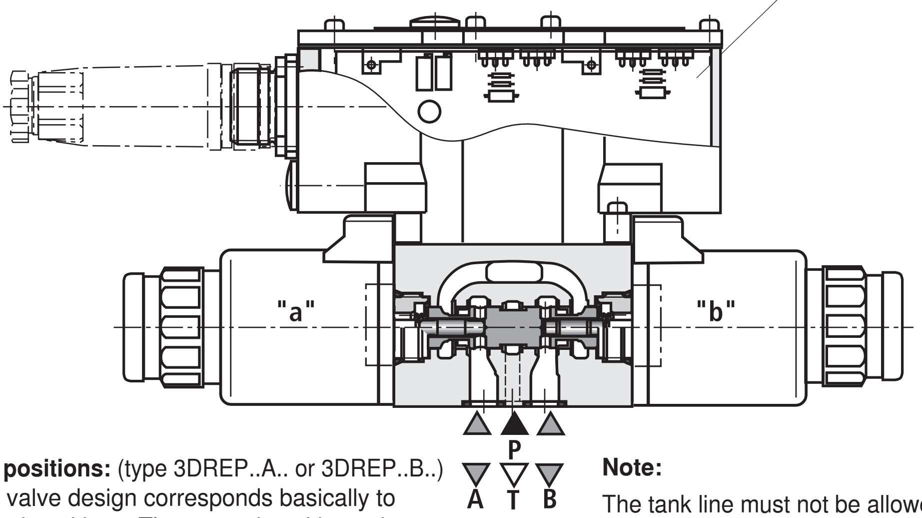
☞ **Note:**

The unwanted activation of the hand override may lead to uncontrolled machine movements!

Type 3DREP 6..



Type 3DREPE 6..



Valve with 2 spool positions: (type 3DREP..A.. or 3DREP..B..)
The function of this valve design corresponds basically to the valve with 3 spool positions. The 2 spool position valves are, however, only equipped with solenoid "a" (5) or solenoid "b" (6). Instead of the 2nd proportional solenoid, there is a plug screw (11).

Note:

The tank line must not be allowed to run empty. With corresponding installation conditions, a precharge valve (pre-charging pressure approx. 2 bar) must be installed.

Technical data (For applications outside these parameters, please consult us!)

general

Valve type		3DREP	3DREPE
Weight	kg	2.0	2.2
Installation position		Any, preferably horizontal	
Storage temperature range	°C	–20 to +80	
Ambient temperature range	°C	–20 to +70	–20 to +50

hydraulic (measured with HLP 32, ϑ_{oil} = 40 °C ± 5 °C)

Operating pressure range	Port P	bar	20 to 100 for pressure rating 16
		bar	30 to 100 for pressure rating 25
		bar	50 to 100 for pressure rating 45
	Port T	bar	0 to 30
Maximum flow		l/min	15 (Δp = 50 bar)
Hydraulic fluid			See table below
Hydraulic fluid temperature range (at the valve working ports)		°C	–20 to +80, preferably +40 to +50
Viscosity range		mm^2/s	20 to 380, preferably 30 to 46
Maximum admissible degree of contamination of the hydraulic fluid cleanliness class according to ISO 4406 (c)			Class 17/15/12 [1)]
Hysteresis		%	≤ 5
Repeatability		%	≤ 1
Response sensitivity		%	≤ 0.5
Range of inversion		%	≤ 1

[1)] The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the service life of the components.

Hydraulic fluid		Classification	Suitable sealing materials	Standards
Mineral oils and related hydrocarbons		HL, HLP	NBR, FKM	DIN 51524
Flame-resistant	– Water-containing	HFC	NBR	ISO 12922

☞ **Important information on hydraulic fluids!**

- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, service life, maintenance intervals, etc.)!
- The flash point of the process and operating medium used must be 40 K higher than the maximum solenoid surface temperature.
- **Flame-resistant – water-containing**: Maximum pressure differential per control edge 175 bar, otherwise, increased cavitation erosion!
  Tank pre-loading < 1 bar or > 20 % of the pressure differential. The pressure peaks should not exceed the maximum operating pressures!

Technical data (For applications outside these parameters, please consult us!)

electric

Valve type			3DREP	3DREPE
Voltage type			Direct voltage	
Type of signal			Analog	
Command value signal	Voltage input "A1"	V	-	±10
	Current input "F1"	mA		4 to 20
Maximum current per solenoid		A	1.5	2.5
Solenoid coil resistance	Cold value at 20 °C	Ω	5.2	2.15
	Maximum hot value	Ω	7.6	3.3
Duty cycle		%	100	
Maximum coil temperature [1]		°C	up to 150	
Protection class according DIN EN 60529/VDE 0470 part 1			IP 65 with mating connector mounted and locked	

[1] Due to the temperatures occurring at the surfaces of the solenoid coils, the European standards ISO 13732-1 and EN 982 need to be adhered to!

Control electronics

For 3DREP	Digital amplifier in Eurocard format [1]		VT-VSPD-1-2X/... according to data sheet 30523
	Analog amplifier in Eurocard format [1]		VT-VSPA2-1-2X/… according to data sheet 30110
	Analog module amplifier [1]		VT11118-1X/... according to data sheet 30218
For 3DREPE			Integrated in the valve, see page 8
	Analog command value module		VT- SWMA-1-1X/... according to data sheet 29902
	Analog command value module		VT-SWMKA-1-1X/... according to data sheet 29903
	Digital command value card		VT-HACD-1-1X/… according to data sheet 30143
	Analog command value card		VT-SWKA-1-1X/... according to data sheet 30255
Supply voltage 3DREPE, 3DREP [2]	Nominal voltage	VDC	24
	Lower limit value	V	19
	Upper limit value	V	35
Current consumption of the amplifier	I_{max}	A	1.8
	Maximum impulse current	A	3

[1] Separate order

[2] With Bosch Rexroth AG control electronics

☞ **Note:** Information on the **environment simulation testing** for the areas EMC (electromagnetic compatibility), climate and mechanical load see RE 29055-U (declaration on environmental compatibility).

Block diagram of the integrated electronics (OBE) for type 3DREPE

Device connector allocation	Contact	Signal with A1	Signal with F1
Supply voltage	A	24 VDC (u(t) = 19.4 to 35 V); I_{max} = 2 A	
	B	0 V	
Reference (actual value)	C	Cannot be used [1]	
Differential amplifier input	D	±10 V; R_e > 50 kΩ	4 to 20 mA; R_e > 100 Ω
(command value)	E	Reference potential command value	
	F	Cannot be used [1]	
	PE	Connected to cooling element and valve housing	

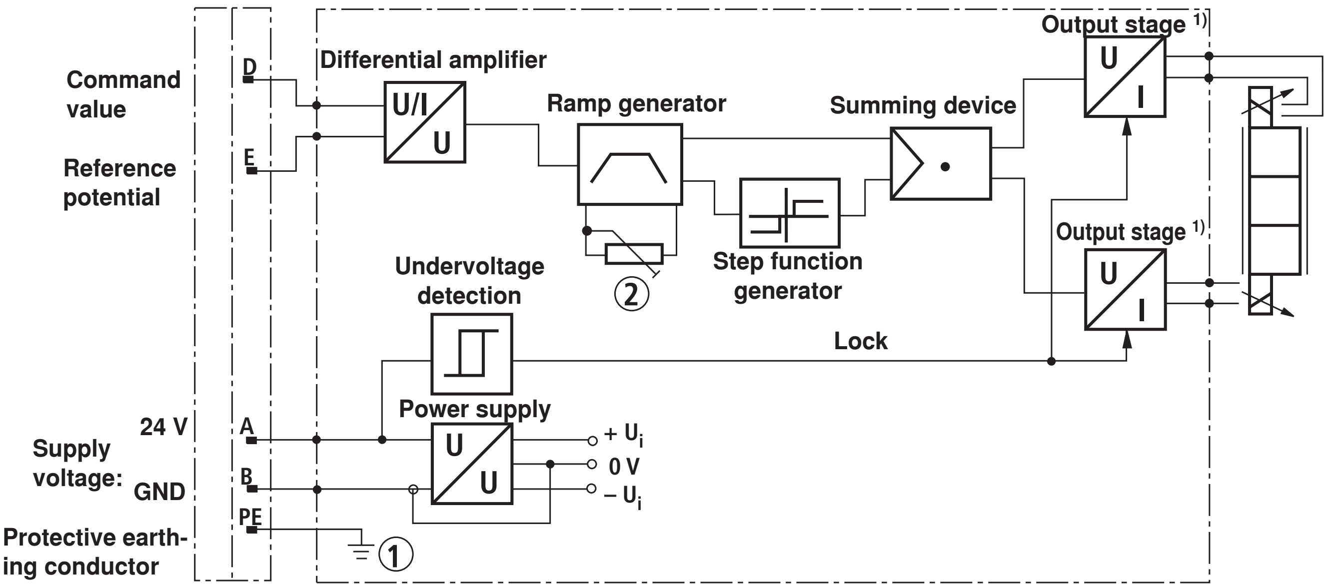
[1] Slots C and F must not be connected!

Command value: Reference potential at E and positive command value (or 12 to 20 mA) at D result in pressure in A.
Reference potential at E and negative command value (or 12 to 4 mA) at D result in pressure in B.
With valves with 1 solenoid on side b (design A):
Reference potential at E and positive command value at D (4 to 20 mA) result in pressure in A.
With valves with 1 solenoid on side a (design B):
Reference potential at E and positive command value at D (4 to 20 mA) result in pressure in B.

Connection cable: Recommendation:
– Up to 25 m line length: Type LiYCY 5 x 0.75 mm²
– Up to 50 m line length: Type LiYCY 5 x 1.0 mm²

External diameter 6.5 to 11 mm
Connect shield on PE only on the supply side.

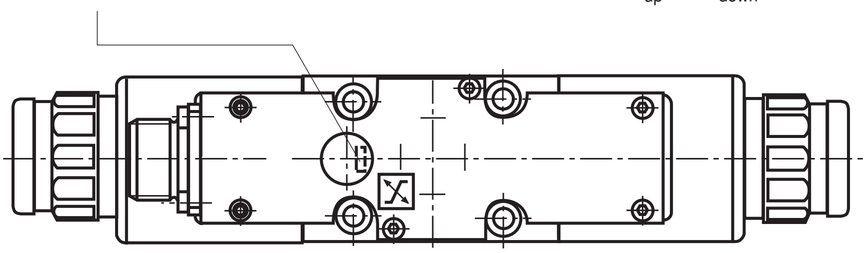
Interface	Integrated control electronics	Valve



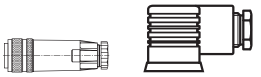
[1] Output stages current-controlled

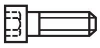
1 Protective earthing conductor screwed to valve housing and cover

2 Ramp can be set from 0 to 5 s from the outside ($T_{up} \triangleq T_{down}$)



Accessories (not included in scope of delivery)

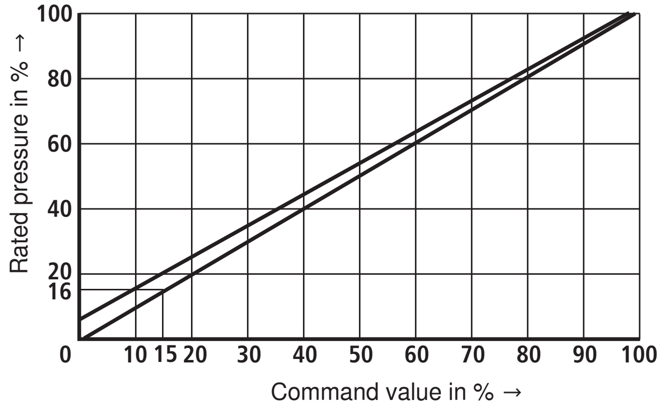
Mating connectors			**Material number**
Mating connector for **3DREP**	DIN EN 175301-803	Solenoid **a**, color gray	R900074683
		Solenoid **b**, color black	R900074684
Mating connector for **3DREPE** and **3DREPE...J...**	DIN EN 175201-804		e.g. R900021267 (plastic)
			e.g. R900223890 (metal)
			e.g. R900217845 (plastic 90°)
Mating connector for **3DREP...J...**	DIN EN 175201-804		R900021267 (plastic)

Hexagon socket head cap screws		**Material number**
Size 6	4 x ISO 4762 - M5 x 50 - 10.9 Tightening torque $\boldsymbol{M}_A$ = 8.9 Nm ±10 %	

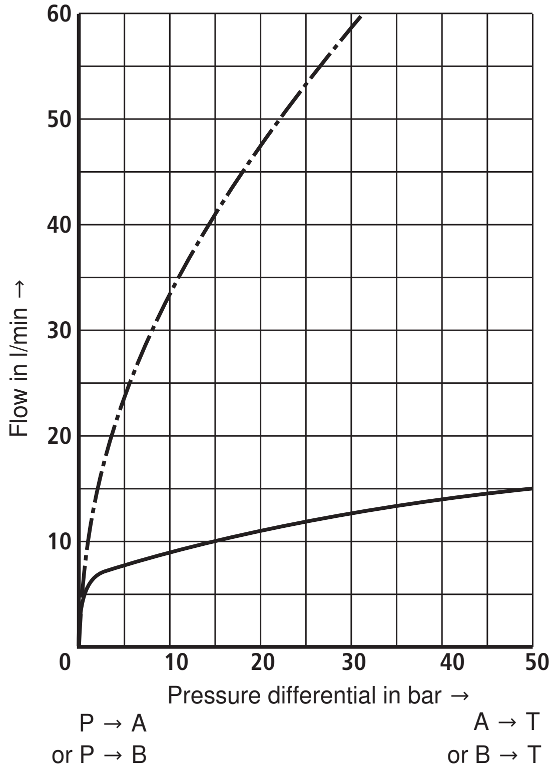
Subplates	**Data sheet**
Size 6	45052

Characteristic curves (measured with HLP 46, ϑ_{oil} = 40 °C ± 5 °C and p = 100 bar)

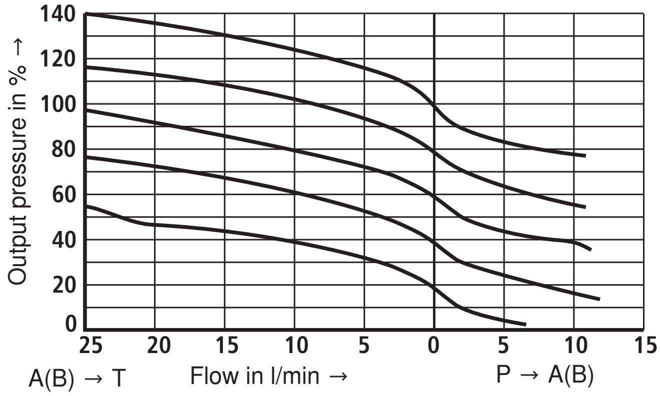
Pressure rating 16, 25 and 45 bar



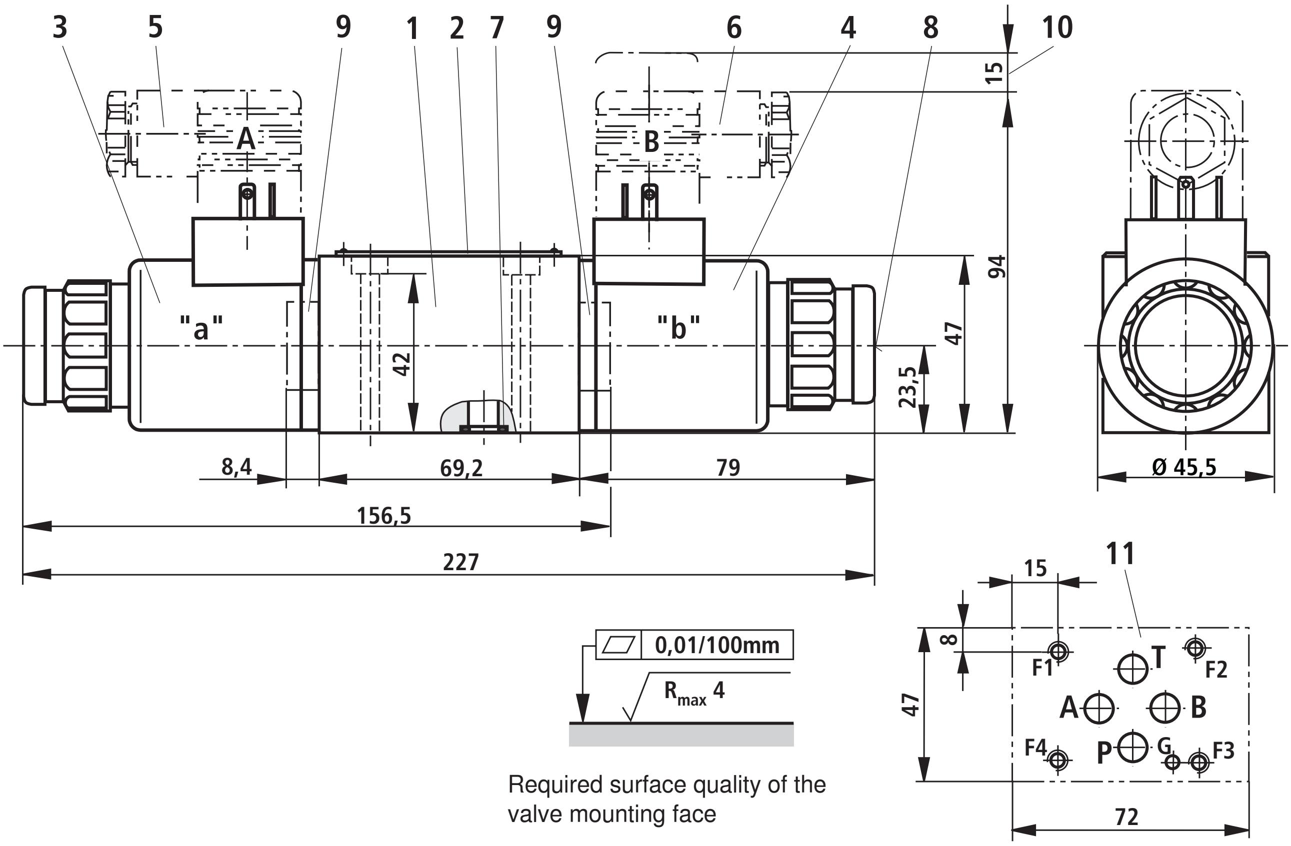
Pressure rating 16, 25 and 45 bar



Pressure/flow dependency



Unit dimensions: Type 3DREP (dimensions in mm)



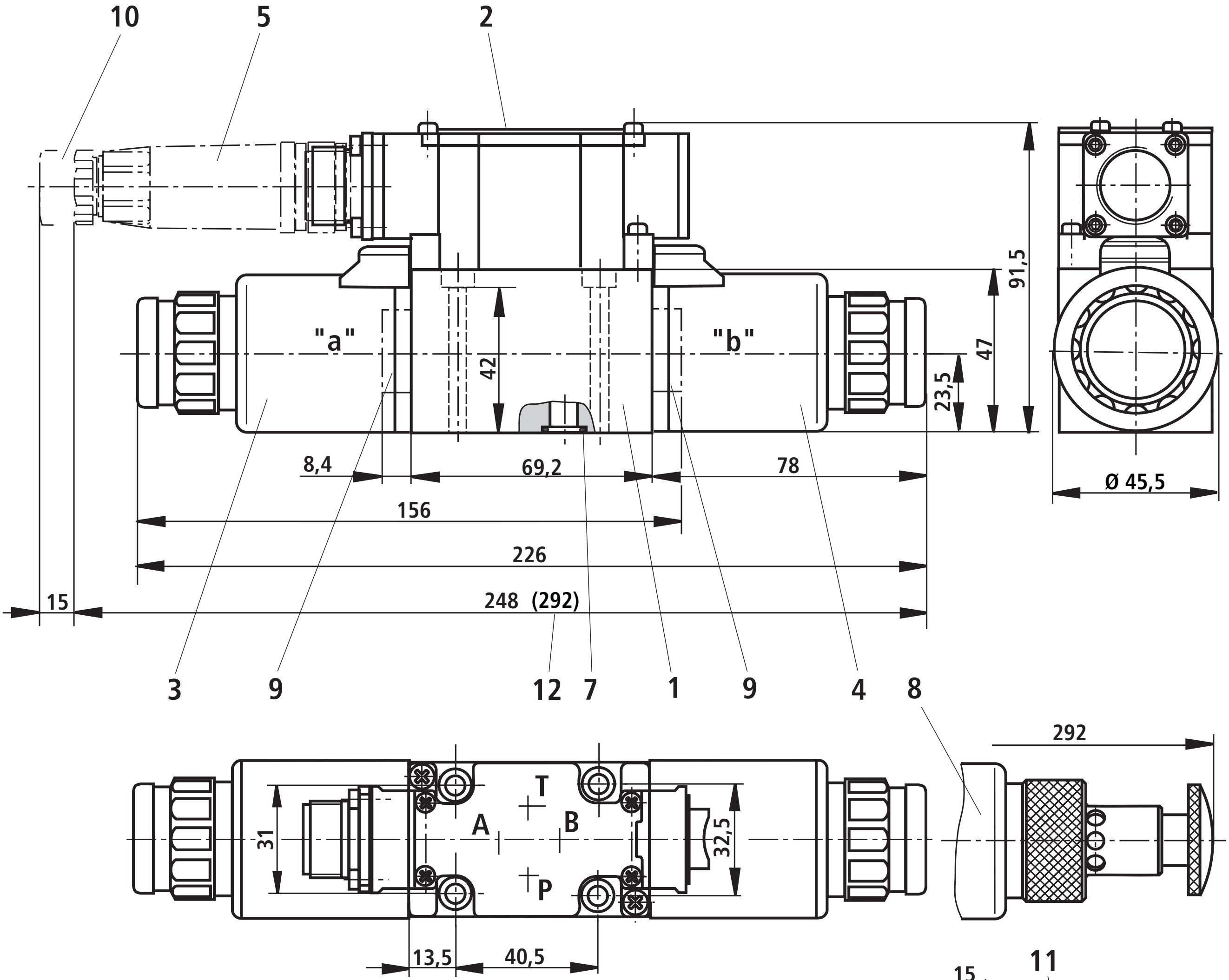
Required surface quality of the valve mounting face

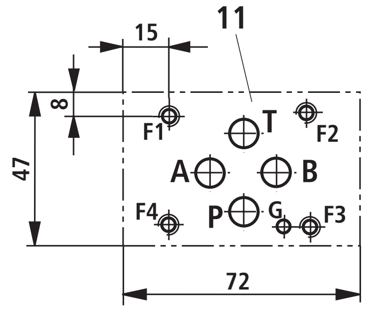
General tolerances according to ISO 2768-mK

1 Valve housing
2 Name plate
3 Proportional solenoid "a"
4 Proportional solenoid "b"
5 Mating connector "A", color gray (order separately, see page 5)
6 Mating connector "B", color black (order separately, see page 5)
7 Identical seal rings for ports A, B, P, and T
8 Concealed manual override "N9"
9 Plug screw for valves with 1 solenoid (version "A" or "B")
10 Space required for removing the mating connector
11 Machined valve mounting face, porting pattern according to ISO 4401-03-02-0-05

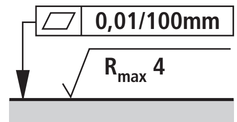
Subplates and valve mounting screws see page 7.

Unit dimensions: Type 3DREP...J - sea water-resistant (dimensions in mm)





1 Valve housing
2 Name plate
3 Proportional solenoid "a"
4 Proportional solenoid "b"
5 Mating connector (order separately, see page 5)
7 Identical seal rings for ports A, B, P, and T
8 Concealed manual override "N"
9 Plug screw for valves with 1 solenoid (version "A" or "B")
10 Space required for removing the mating connector
11 Machined valve mounting face, porting pattern according to ISO 4401-03-02-0-05
12 Dimension for version "N"

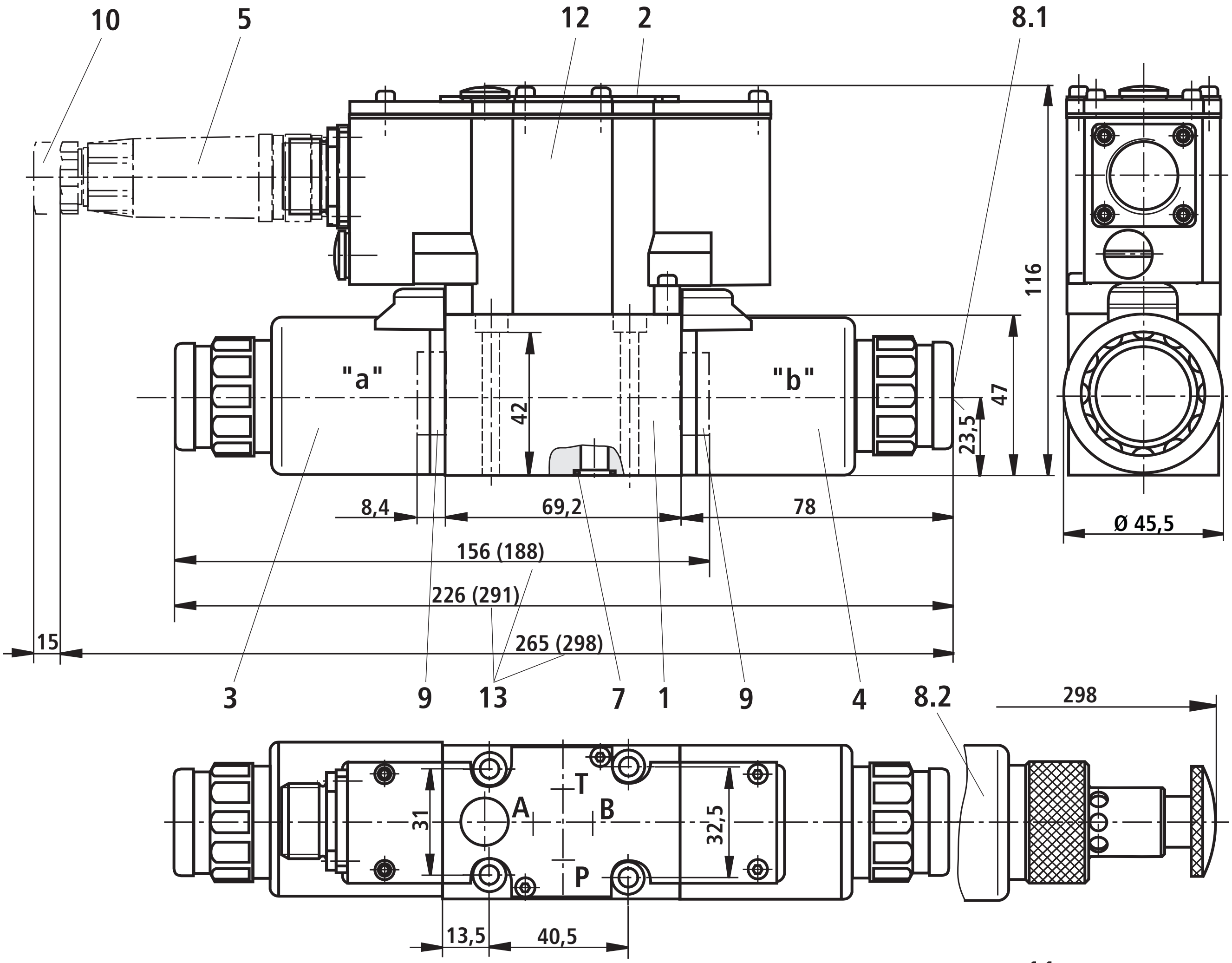


Required surface quality of the valve mounting face

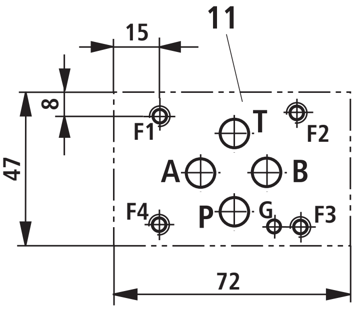
Subplates and valve mounting screws see page 7

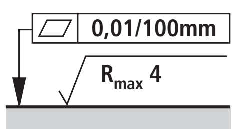
General tolerances according to ISO 2768-mK

Unit dimensions: Type 3DREPE and 3DREPE...J - sea water-resistant (dimensions in mm)



1 Valve housing
2 Name plate
3 Proportional solenoid "a"
4 Proportional solenoid "b"
5 Mating connector (order separately, see page 5)
7 Identical seal rings for ports A, B, P, and T
8.1 Concealed manual override "N9"
8.2 Manual override "N" for sea water-resistant version "J"
9 Plug screw for valves with 1 solenoid (version "A" or "B")
10 Space required for removing the mating connector
11 Machined valve mounting face, porting pattern according to ISO 4401-03-02-0-05
12 Integrated control electronics
13 Dimension ( ) for sea water-resistant version "J"





Required surface quality of the valve mounting face

General tolerances according to ISO 2768-mK

Subplates and valve mounting screws see page 7

Throttle insert

When using a proportional directional valve type 4WRZ..., the following throttle inserts are to be used in channel A and B:

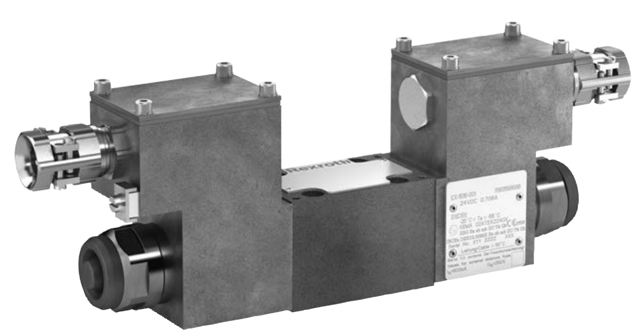
Size	**10**	**16**	**25**	**32**	**52**
Ø in mm	1.8	2.0	2.8	–	–
Material no.	R900158510	R900158547	R900158548	–	–

RE 29184-XE
Edition: 2021-02
Replaces: 2019-09
RA78492794_AB

rexroth
A Bosch Company

Proportional pressure reducing valve, direct operated

Type 3DREP ...XE


H8089

- Size 6
- Component series 2X
- Maximum operating pressure 100 bar
- Maximum flow 15 l/min

ATEX units
For potentially explosive atmospheres

Information on explosion protection:
- Area of application in accordance with the Explosion Protection Directive 2014/34/EU: **II 2G; II 2D**
- Type of protection valve:
  - Ex h IIC T4 Gb X according to EN 80079-36
  - Ex h IIIC T115°C Db X according to EN 80079-36
- Type of protection, solenoid coil:
  - Ex eb mb IIC T4 Gb according to EN 60079-7 / EN 60079-18
  - Ex tb IIIC T115°C Db according to EN 60079-31
- Solenoid coil certified according to IECEx

Features

- 3-way version
- For intended use in potentially explosive atmosphere
- For pressure control in ports A and B
- For subplate mounting
- Porting pattern according to ISO 4401-03-02-0-05 (however, without locating hole)
- Solenoid coil is rotatable by 90°
- Electrical connection as individual connection with cable gland

Contents

☞ **Notice:** The documentation version with which the product was supplied is valid.

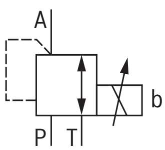
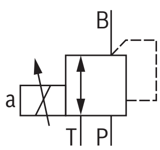
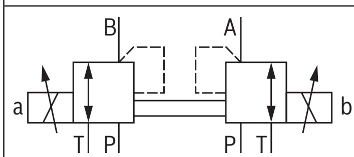
Ordering code

01	02	03		04		05	06	07	08	09		10
3DREP	**6**		**–**	**2X**	**/**		**E**	**G24**	**XE**	**J**	**/**	

01	Proportional pressure reducing valve, direct operated	**3DREP**

02	Size 6	**6**

Symbols (simplified)

03		**A**
		**B**
		**C**

04	Component series 20 … 29 (20 … 29: unchanged installation and connection dimensions)	**2X**

05	Pressure rating 16 bar	**16**
	Pressure rating 25 bar	**25**
	Pressure rating 45 bar	**45**

06	Proportional solenoid	**E**

Supply voltage of the control electronics

07	Direct voltage 24 V	**G24**

Explosion protection

08	"Increased safety"	**XE**
	For details, see information on the explosion protection page 7	

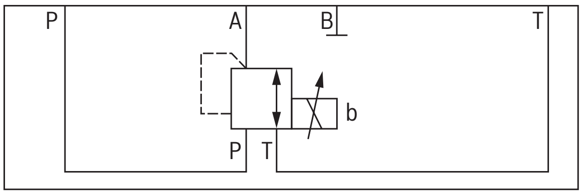
09	Surface protection seawater-resistant, galvanized	**J**

Seal material (observe compatibility of seals with hydraulic fluid used, see page 6)

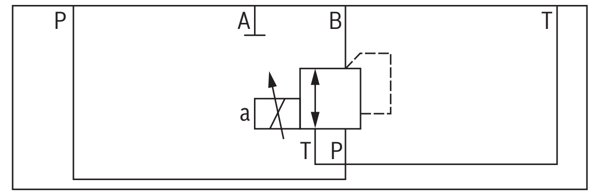
10	NBR seals	**M**
	FKM seals	**V**

Symbols (detailed)

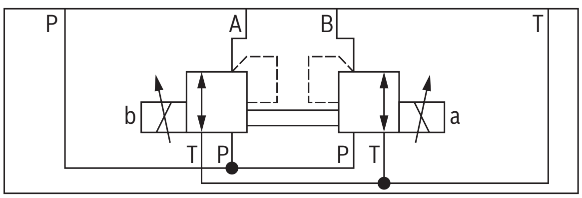
Version **"A"**



Version **"B"**



Version **"C"**



☞ **Notice:**
Representation according to DIN ISO 1219-1.

Function, section

Valves of type 3DREP are direct operated 3-way pressure reducing valves with proportional solenoids. They convert an electrical input signal into a proportional pressure output signal.
The proportional solenoids are controllable wet-pin DC solenoids. The solenoids are actuated by external control electronics.

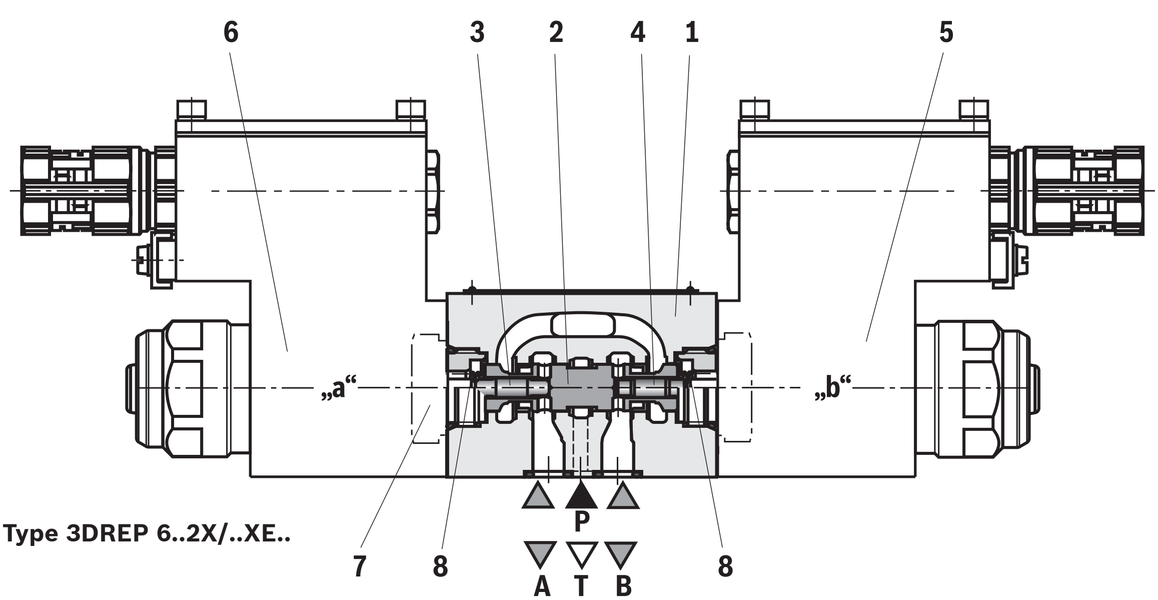
Set-up
The valve basically consists of:
- Housing (1) with connection surface
- Control spool (2) with pressure measuring pins (3 and 4)
- Solenoids (5 and 6) with central thread

Function
The pressure in A or B is set by means of the proportional solenoids. The amount of the pressure depends on the current.
With de-energized solenoids (5, 6), the control spool (2) is held in the central position by means of the compression springs (8). Ports A and B are connected with T so that the hydraulic fluid can flow off to the tank without obstructions. When one proportional solenoid is actuated, e.g. solenoid "b" (5), the pressure measuring pin and the control spool (2) are moved to the left. This opens the connection from P to A and B to T via orifice-type cross-sections with progressive flow characteristic. With the surface of the pressure measuring pin (3), the pressure that builds up in channel A acts on the control spool (2) and against the solenoid force. The pressure measuring pin (3) is supported by the solenoid "a". If the pressure exceeds the value set at solenoid "b", the control spool (2) is pushed back against the solenoid force and connects A to T until the set pressure is achieved again. The pressure is proportional to the solenoid current.
When the solenoid is switched off, the control spool (2) is returned into the central position by the compression springs (8).

Notice:
Regarding valves of the version "3DREP 6 **C**", only one solenoid may be actuated at a time.

Valve with two spool positions (Version "A" and "B")
The function of this valve version basically corresponds to the valve with three spool positions. This 2-spool position valve is, however, only equipped with solenoid "a" (6) or solenoid "b" (5). Instead of the second proportional solenoid, there is a plug screw (7).

Notice:
The tank line must not be allowed to run empty. With corresponding installation conditions, a preload valve (preload pressure approx. 2 bar) must be installed.



Type 3DREP 6..2X/..XE..

Technical data
(for applications outside these values, please consult us!)

General			
Installation position			any; preferably horizontal
Storage temperature range		°C	+5 ... +40
Maximum storage time		Years	1
Ambient temperature range		°C	–20 ... +60
Weight	▶ Version "A", "B"	kg	2.7
	▶ Version "C"	kg	4.4
Surface protection			galvanized
Maximum surface temperature		°C	See information on explosion protection, page 7

Hydraulic			
Operating pressure range	▶ Port P		
	– Version "16"	bar	20 ... 100
	– Version "25"	bar	30 ... 100
	– Version "45"	bar	50 ... 100
	▶ Port T	bar	0 ... 30
Maximum flow P → A or P → B		l/min	15 (***Δp*** = 50 bar) see characteristic curves page 8
Hydraulic fluid			See table page 6
Hydraulic fluid temperature range		°C	–20 ... +80 (NBR seals) –15 ... +80 (FKM seals)
Viscosity range		mm^2/s	20 ... 380 (preferably 30 ... 46)
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)			Class 17/15/12 [1]
Hysteresis		%	≤ 6
Repetition accuracy		%	≤ 2
Response sensitivity		%	≤ 1
Range of inversion		%	≤ 2

[1] The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and simultaneously increases the life cycle of the components.

Technical data
(for applications outside these values, please consult us!)

Hydraulic fluid		Classification	Suitable sealing materials	Standards	Data sheet
Mineral oils		HL, HLP, HLPD, HVLP, HVLPD	NBR, FKM	DIN 51524	90220
Bio-degradable	▶ Insoluble in water	HETG	FKM	ISO 15380	90221
		HEES	FKM		
	▶ Soluble in water	HEPG	FKM	ISO 15380	
Flame-resistant	▶ Water-free	HFDU (glycol base)	FKM	ISO 12922	90222
		HFDU (ester base)	FKM		
		HFDR	FKM		
	▶ Containing water	HFC (Fuchs: Hydrotherm 46M, Renosafe 500; Petrofer: Ultra Safe 620; Houghton: Safe 620; Union: Carbide HP5046)	NBR	ISO 12922	90223

Important information on hydraulic fluids:

- For further information and data on the use of other hydraulic fluids, please refer to the data sheets above or contact us.
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.).
- The ignition temperature of the hydraulic fluid used must be 50 K higher than the maximum surface temperature.
- **Bio-degradable and flame-resistant – containing water:** If components with galvanic zinc coating (e.g. version "J3" or "J5") or parts containing zinc are used, small amounts of dissolved zinc may get into the hydraulic system and cause accelerated aging of the hydraulic fluid. Zinc soap may form as a chemical reaction product, which may clog filters, nozzles and solenoid valves – particularly in connection with local heat input.
- **Flame-resistant – containing water:**
  - Due to increased cavitation tendency with HFC hydraulic fluids, the life cycle of the component may be reduced by up to 30% as compared to the use with mineral oil HLP. In order to reduce the cavitation effect, it is recommended – if possible specific to the installation – to back up the return flow pressure in ports T to approx. 20% of the pressure differential at the component.
  - Dependent on the hydraulic fluid used, the maximum ambient and hydraulic fluid temperature must not exceed 50 °C. In order to reduce the heat input into the component, the command value profile is to be adjusted for proportional and high-response valves.

Technical data
(for applications outside these values, please consult us!)

electric		
Voltage type		Direct current or pulse-width modulated signal with a pulse voltage ≤ 28 V and a frequency ≥ 160 Hz up to max. 500 Hz
Type of signal		analog
Maximum solenoid current	A	1.03
Duty cycle	%	100

Control electronics [2]	
Valve amplifier for proportional valves without electrical position feedback; maximum current limitation 1 A	VT-MSPA2-2X/A5/1A0/000 according to data sheet 30232-01
Module for monitoring and limiting the solenoid currents with proportional valves	VT-MUXA2-2-1X/V0/1A according to data sheet 30290

Information on explosion protection			
Area of application according to Directive 2014/34/EU		II 2G	II 2D
Type of protection of valve according to EN 80079-36 [3]		Ex h IIC T4 Gb X	Ex h IIIC T115°C Db X
Maximum surface temperature [4]	°C	115	
Temperature class		T4	–
Type of protection, solenoid coil according to EN 60079-7 / EN 60079-18 / EN 60079-31		Ex eb mb IIC T4 Gb	Ex tb IIIC T115°C Db
Type examination certificate, solenoid coil		BVS 20 ATEX E 009 X	
"IECEx Certificate of Conformity" for solenoid coil		IECEx BVS 20.0007X	

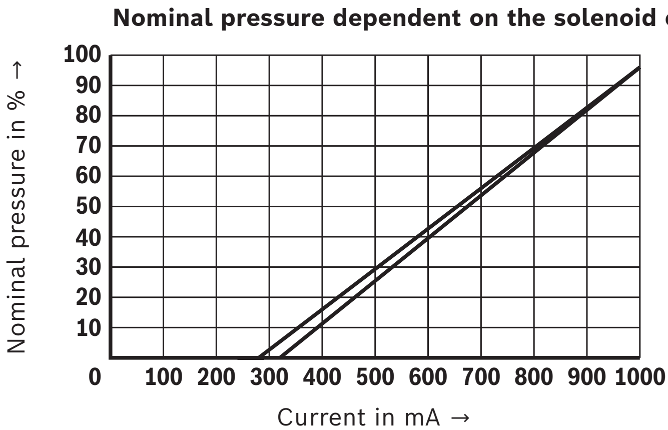
2) A monitoring circuit is to be provided for the monitoring of the solenoid current. We recommend operating the valves with the assemblies described herein. The valve amplifier and the monitoring module may only be installed outside the potentially explosive atmosphere.

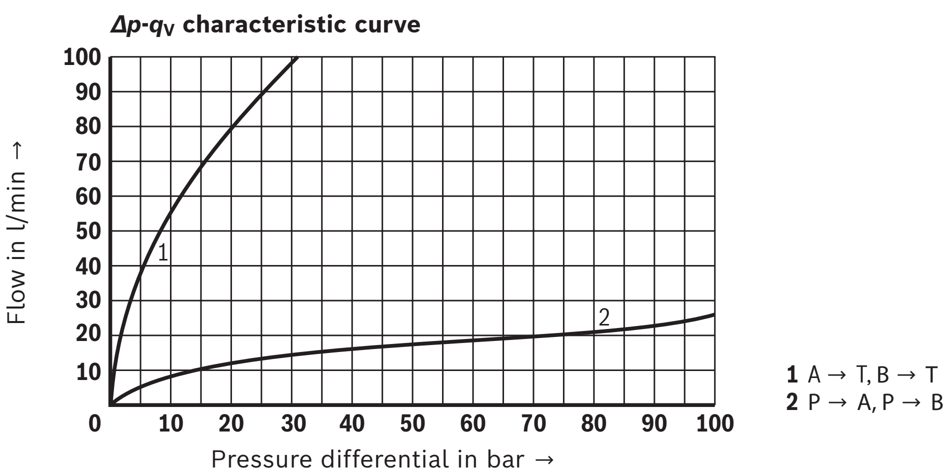
3) Ex h: structural safety c according to EN 80079-37.

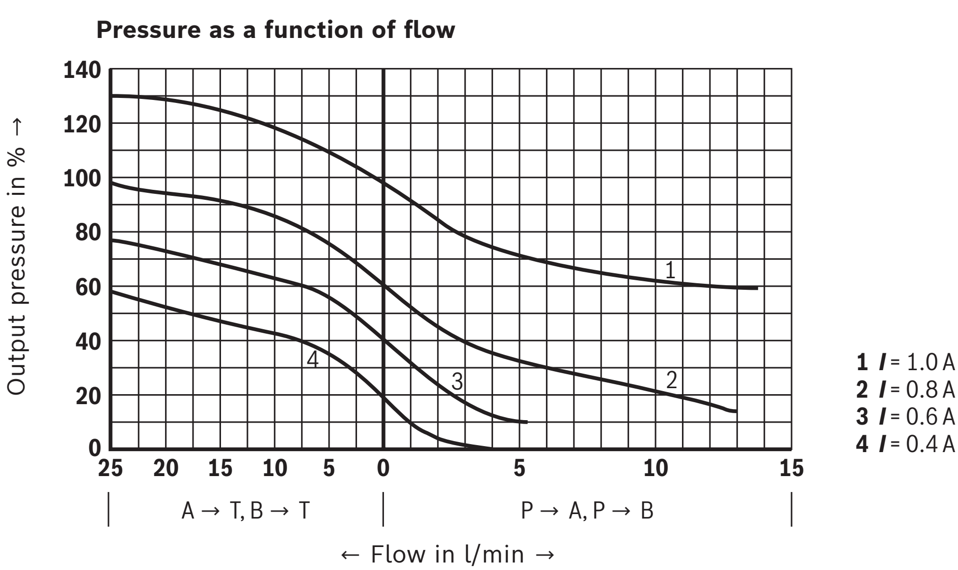
4) Surface temperature > 50 °C, provide contact protection.

Special application conditions for safe application:
- In case of bank assembly, only one solenoid of all valves may be energized at a time.
- In case of valves with two solenoids, maximally one of the solenoids may be energized at a time.
- Only direct current or a pulse-width modulated signal with a pulse voltage ≤ 28 V and a frequency ≥ 160 Hz ... max. 500 Hz may be used for operation.
- Connection lines must be passed in a strain-relieved way. The first mounting point must be within 150 mm of the cable and line entry.
- The maximum temperature of the surface of the valve jacket is 115 °C. This has to be considered when selecting the connection cable and/or contact of the connection cable with the surface of the jacket is to be prevented.

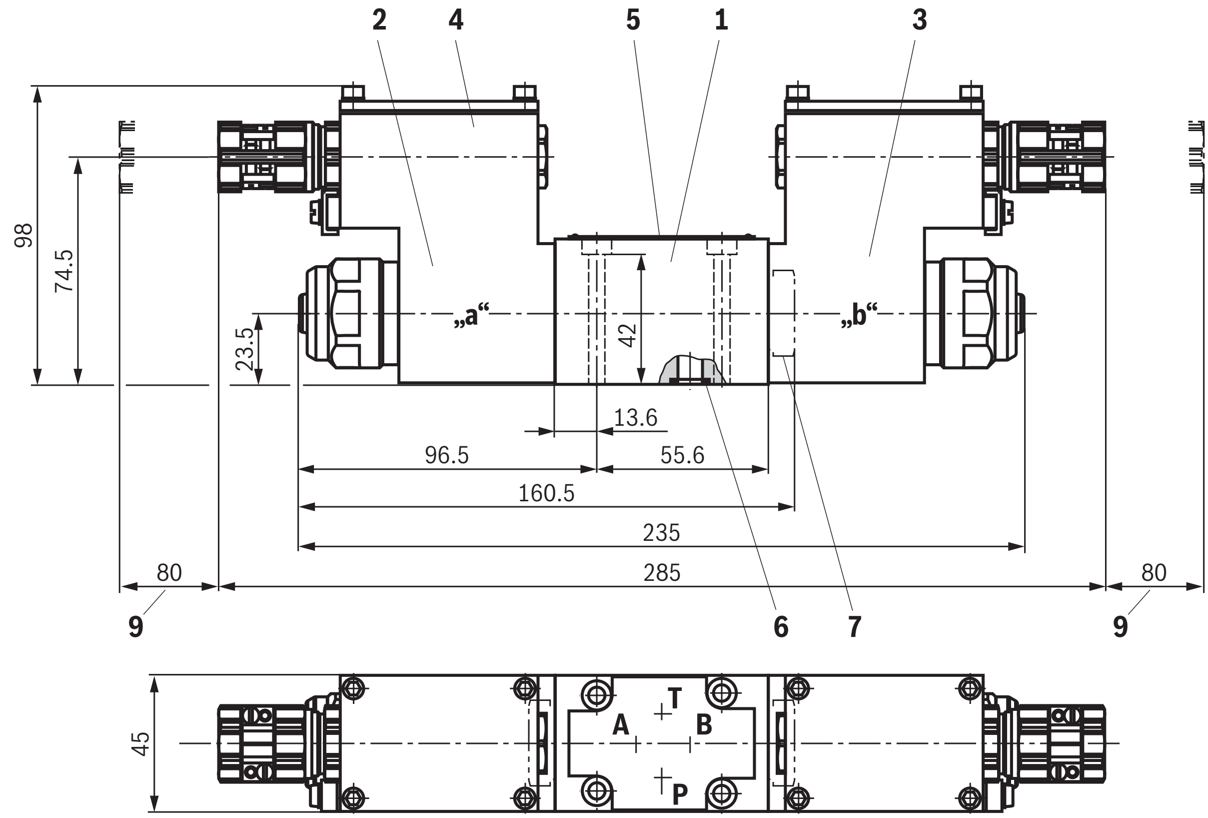
Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ±5 °C and p = 100 bar)

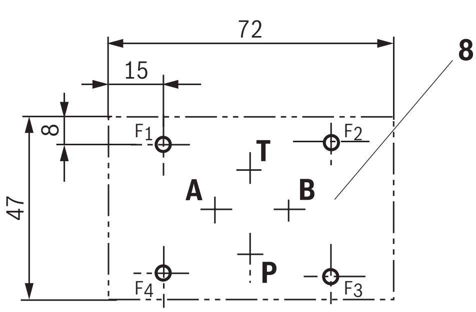


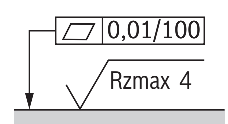




Dimensions
(dimensions in mm)







Required surface quality
of the valve contact surface

1 Valve housing
2 Proportional solenoid "a"
3 Proportional solenoid "b"
4 Terminal box
5 Name plate
6 identical seal rings for A, B, P and T
7 Plug screw for valve with one solenoid
(2 spool positions, version A or B)
8 Porting pattern according to ISO 4401-03-02-0-05
(however, without locating hole)
9 Space required to remove the solenoid coil

Notice:
The dimensions are nominal dimensions which are subject to tolerances.

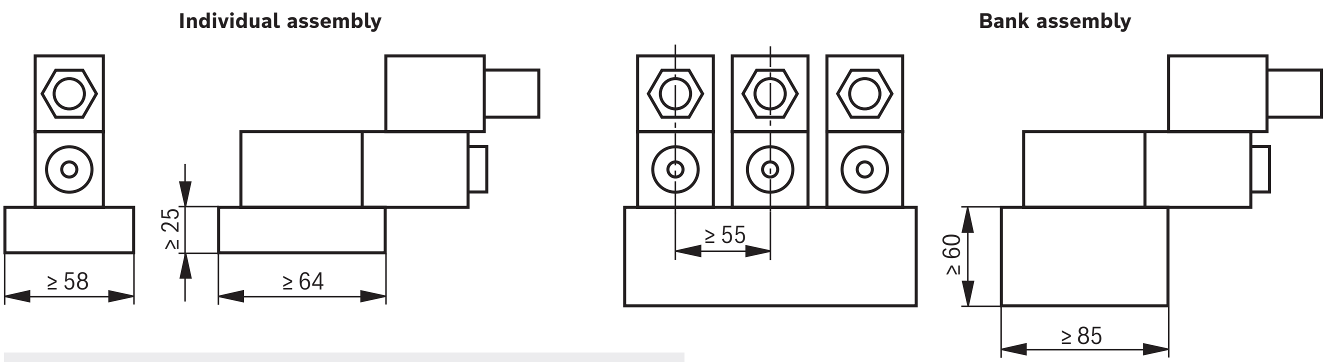
Subplates (separate order) with porting pattern according to ISO 4401-03-02-0-05, see data sheet 45100.

Valve mounting screws (separate order)
Only use valve mounting screws with the subsequently listed thread diameters and strength properties:
4 hexagon socket head cap screws
ISO 4762 - M5 x 50 - 10.9
(Friction coefficient μ_{total} = 0.09 ... 0.14)
Tightening torque M_A = 7 Nm ±10%,
Material no. **R913043758**

Notice:
Subplates are no components in the sense of Directive 2014/34/EU and can be used after the manufacturer of the overall system has conducted an assessment of the risk of ignition.
The "G...J3" versions are free from aluminum and/or free from magnesium and galvanized.

Installation conditions
(dimensions in mm)

	Individual assembly	Bank assembly
Subplate dimensions	Minimum dimensions Length ≥ 64, width ≥ 58, height ≥ 25	Minimum cross-section height ≥ 60, width ≥ 85
Thermal conductivity of the subplate	≥ 36.2 W/mK	
Minimum distance between the longitudinal valve axes	≥ 55	

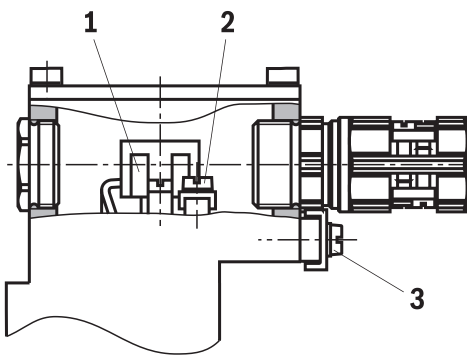


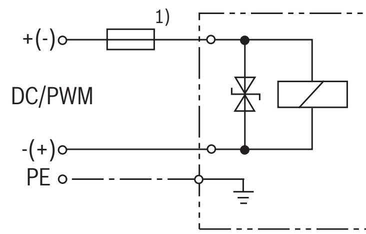
Notice:
Observe the "Special application conditions for safe application" on page 7.

Electrical connection

The type-examination tested solenoid coil of the valve is equipped with a terminal box, a type-examination tested cable entry and a type-examination tested blind plug. The connection is polarity-independent.

Notice:
When establishing the electrical connection, the protective grounding conductor (PE ⏚) has to be connected properly.





1) Recommended pre-fuse characteristics medium time-lag according to DIN 41571, 1.25 A.

Properties of the connection terminals and mounting elements

Position	Function	Connectable line cross-section
1	Operating voltage connection	single-wire 0.75 ... 2.5 mm^2 finely stranded 0.75 ... 1.5 mm^2
2	Connection for protective grounding conductor	single-wire max. 2.5 mm^2 finely stranded max. 1.5 mm^2
3	Connection for potential equalization conductor	single-wire max. 6 mm^2 finely stranded max. 4 mm^2

Connection line		
Line type		non-armored and non-shielded connection lines
Temperature rating	°C	≤–20 ... ≥+110
Line diameter	mm	7 ... 10.5

Notice:
Only use finely stranded conductors if they have pressed-on wire end ferrules.

Over-current fuse and switch-off voltage peaks

Voltage data in the valve type code	Nominal voltage of solenoid coil	Rated current Solenoid coil	Rated current external miniature fuse: Medium time-lag (M) according to DIN 41571 and EN/IEC 60127	Rated voltage, external miniature fuse: Medium time-lag (M) according to DIN 41571 and EN/IEC 60127	Maximum voltage value when switching off	Interference protection circuit
G24	24 VDC	1.03 ADC	1.25 A	250 V	–70 V	Suppressor diode bi-directional

☞ **Notice:**
A fuse which corresponds to the rated current according to DIN 41571 and EN/IEC 60127 has to be connected upstream of every solenoid coil (max. 3 x I_{rated}).
The shut-off threshold of the fuse has to match the prospective short-circuit current of the supply source.
The prospective short-circuit current of the supply source may amount to a maximum of 1500 A.
This fuse may only be installed outside the potentially explosive atmospheres or must be of an explosion-proof design.
When inductivities are switched off, voltage peaks result which may cause faults in the connected control electronics. For this reason, the solenoid coils comprise an interference protection circuit which dampens this voltage peak to the voltage value shown in the table.

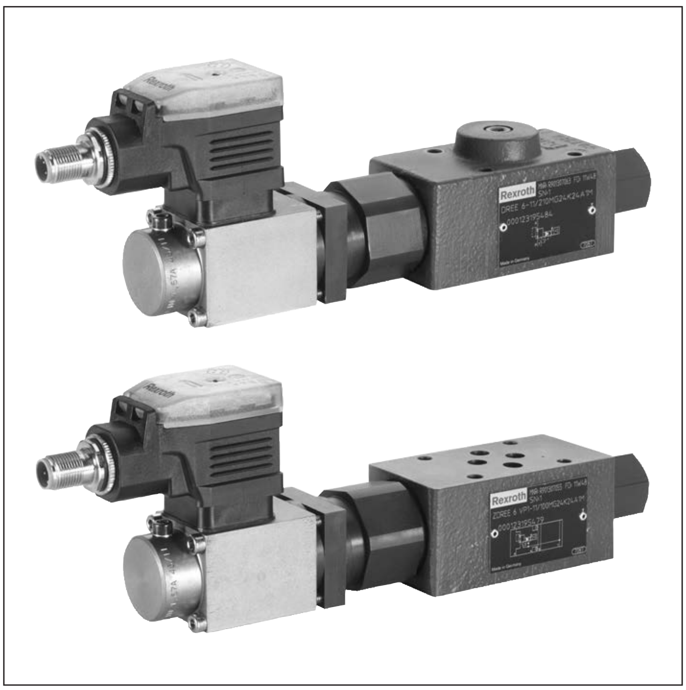
Further information

- Subplates — Data sheet 45100
- Hydraulic fluids on mineral oil basis — Data sheet 90220
- Environmentally compatible hydraulic fluids — Data sheet 90221
- Flame-resistant, water-free hydraulic fluids — Data sheet 90222
- Flame-resistant hydraulic fluids - containing water (HFAE, HFAS, HFB, HFC) — Data sheet 90223
- Use of non-electrical hydraulic components in an explosive environment (ATEX) — Data sheet 07011
- Selection of filters
- Information on available spare parts

RE 29175
Edition: 2021-11
Replaces: 2013-06

Proportional pressure reducing valve, pilot-operated

Type DRE(E) and ZDRE(E)



- Size 6
- Component series 1X
- Maximum operating pressure: 210 bar (DRE)
  315 bar (ZDRE)
- Maximum flow 30 l/min

Features

- For pressure reduction in ports A and P① with pressure limitation
- Operation by means of proportional solenoids
- For subplate mounting or sandwich plate design
- Porting pattern according to ISO 4401-03-02-0-05
- Low manufacturing tolerance of the command value pressure characteristic curve due to electrical adjustment for the operation with external control electronics
- Minimum set pressure in ports A or P①
- With integrated electronics (OBE), optional
- CE conformity according to EMC Directive 2014/30/EU

Contents

Ordering code

01	02	03	04	05	06		07		08	09	10	11	12	13	14	15
	DRE		**6**			**–**	**1X**	**/**		**M**	**G24**					*****

01	Subplate mounting	**no code**
	Sandwich plate design	**Z**

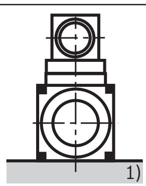
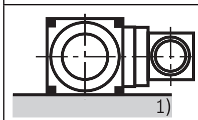
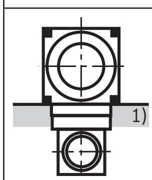
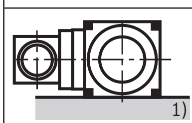
02	Proportional pressure reducing valve	**DRE**

03	For external control electronics	**no code**
	With integrated electronics (OBE)	**E**

04	Size 6	**6**

05	Pressure reduction in channel A (subplate mounting)	**no code**
	Pressure reduction in channel P① (sandwich plate design)	**VP**

Position of the mating connector (only sandwich plate design)

06		**1**
		**2**
		**3**
		**4**

07	Component series 10 ... 19 (10 ... 19: unchanged installation and connection dimensions)	**1X**

Pressure rating

08	50 bar	**50**
	100 bar	**100**
	210 bar	**210**
	315 bar	**315** [2)]

09	Without check valve	**M**

Supply voltage

10	Direct voltage 24 V	**G24**

11	With manual override	**N9**
	Without manual override	**no code**

Ordering code

01	02	03	04	05	06		07		08	09	10	11	12	13	14	15
	DRE		**6**			**–**	**1X**	**/**		**M**	**G24**					*****

Electrical connection

12	**– Type DRE and ZDRE**	
	Without mating connector; connector DIN EN 175301-803	**K4** 3)
	– Type DREE and ZDREE	
	Without mating connector; connector M12	**K24** 3)

Electronics interface

13	External control electronics	**no code**
	Command value 0 ... 10 V	**A1**
	Command value 4 ... 20 mA	**F1**

Seal material (observe compatibility of seals with hydraulic fluid used, see page 7)

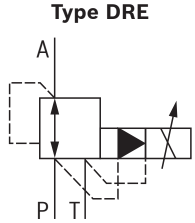
14	NBR seals	**M**
	FKM seals	**V**

09	Further details in the plain text	

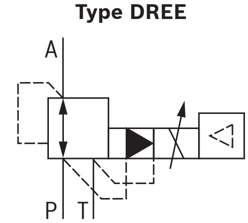
1) Valve contact surface (seal ring recesses in the housing)
2) Only available for "Z" version
3) Mating connectors and cable sets, separate order, see page 18 and data sheet 08006.

Symbols (① = component side, ② = plate side)

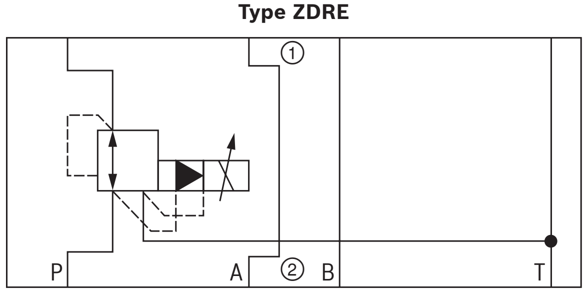
Type DRE



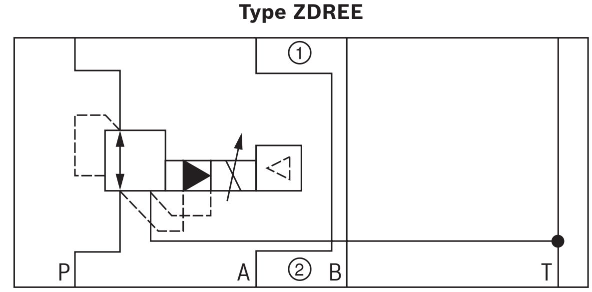
Type DREE



Type ZDRE



Type ZDREE



Function, section: Type (Z)DRE

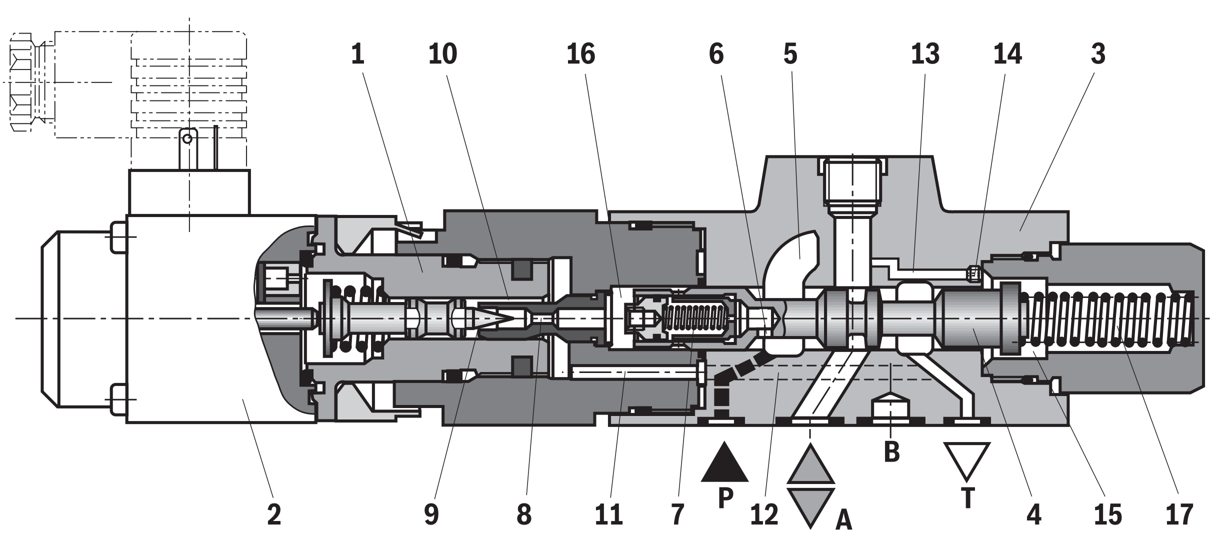
The valve types DRE and ZDRE are electrically pilot-operated 3-way pressure reducing valves with pressure limitation of the actuator. They are used for reducing a system pressure.
The valve basically consists of a pilot control valve (1), proportional solenoid (2), main valve (3) with main control spool (4).

Type DRE

- Command value-dependent setting of the pressure to be reduced in channel A via the proportional solenoid (2).
- In the depressurized port P, the spring (17) holds the main control spool (4) in the initial position.
- Thus, opening the connection from A to T and blocking of the connection from P to A.
- Pressure connection from port P to the ring channel (5).
- Pilot oil flows from the bore (6) to port T, via the flow controller (7), the nozzle (8) to the pilot control valve (1), the throttle gap (9) to the longitudinal groove (10) and the bores (11, 12).
- Pressure reduction
  - Build-up of the pilot pressure in the control chamber (16) as function of the command value.
  - Movement of the main control spool (4) to the right, hydraulic fluid flows from P to A.
  - Actuator pressure pending in port A to the spring chamber (15) via channel (13) and nozzle (14).
  - Increase in the pressure in port A to the set pressure of the pilot control valve (1) leads to the movement of the main control spool (4) to the left. Pressure in port A is almost identical with the set pressure at the pilot control valve (1).
- Pressure limitation
  - If the pressure in port A exceeds the set pressure of the pilot control valve (1), the main control spool (4) will be moved further to the left.
  - Thus, opening of the connection from A to T and limitation of the pressure pending in port A to the set command value.

Type ZDRE

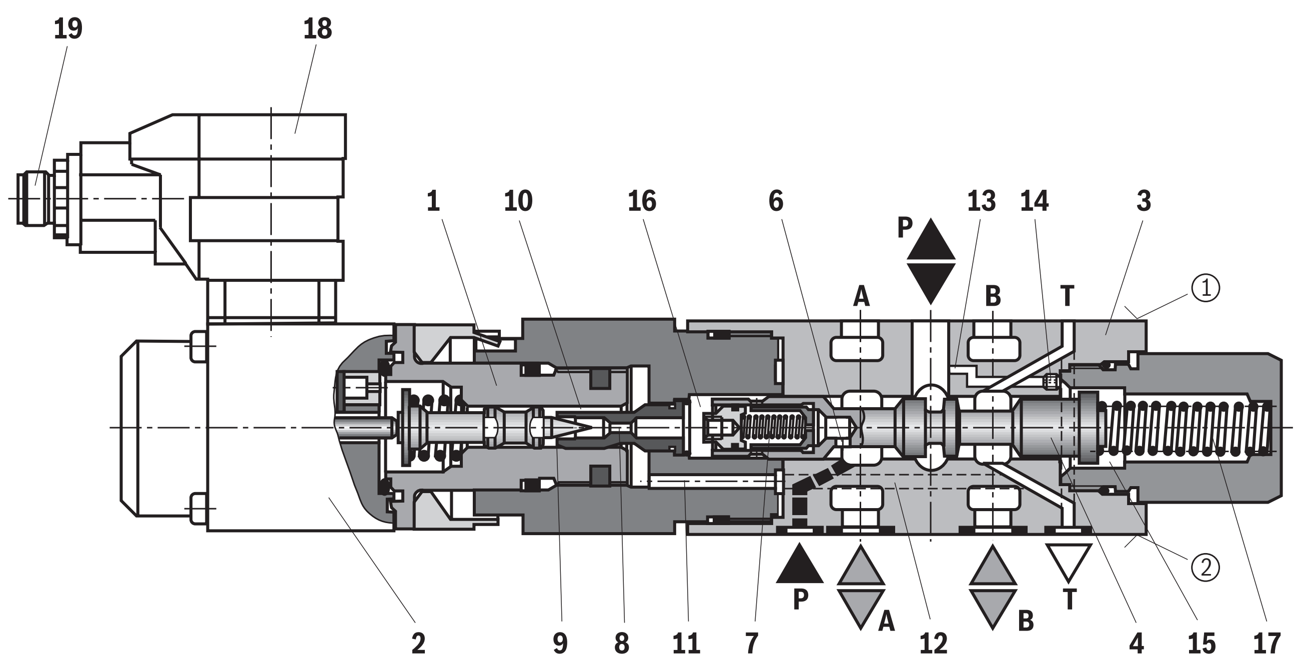
In principle, the function of this valve version corresponds to the function of type DRE.
However, the pressure is reduced in channel P①.



Type DRE ...

Function, section: Type (Z)DREE

Type (Z)DREE – with integrated electronics (OBE)
With regard to function and design, these valves correspond to type (Z)DRE. On the proportional solenoid (2), there is moreover a housing (18) with the control electronics.
Supply and command value voltage or command value current
are applied to the connector (19).
In the factory, the command value pressure characteristic curve is adjusted with little manufacturing tolerance.



Type ZDREE ...

① = component side
② = plate side

Technical data
(For applications outside these values, please consult us!)

General			
Weight	▶ Type (Z)DRE	kg	2.0
	▶ Type (Z)DREE	kg	2.1
Installation position			any
Storage temperature range		°C	−20 ... +80
Ambient temperature range		°C	−20 ... +70
Protection class according to EN 60529			IP65 (if suitable and correctly mounted mating connectors are used)
Conformity	▶ CE according to EMC directive 2014/30/EU, tested according to		EN 61000-6-2 and EN 61000-6-3

Hydraulic			
Maximum operating pressure	▶ Port P or P②	bar	315
	▶ Port P①, A and B	bar	210
	▶ Port T	bar	separate and depressurized to the tank
Maximum set pressure in channels P① and A	▶ Pressure rating 50 bar	bar	50
	▶ Pressure rating 100 bar	bar	100
	▶ Pressure rating 210 bar	bar	210
	▶ Pressure rating 315 bar	bar	315 [1)]
Minimum set pressure with command value 0 in port A or P①		bar	see characteristic curves page 11
Pilot flow		l/min	0.65
Maximum flow		l/min	30
Hydraulic fluid			see table page 7
Hydraulic fluid temperature range		°C	−20 ... +80
Viscosity range		mm^2/s	15 ... 380
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)			Class 20/18/15 [2)]

1) Only available for "Z" version.

2) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the life cycle of the components.

Static/dynamic			
Hysteresis		%	±2.5 [3)]
Repetition accuracy		%	< ±2 [3)]
Linearity	▶ Type (Z)DRE	%	±3.5 [3)]
Manufacturing tolerance of the command value pressure characteristic curve, related to the hysteresis characteristic curve, pressure increasing	▶ Type (Z)DRE	%	±2 [3)]
	▶ Type (Z)DREE	%	±3 [3)]
Step response $\boldsymbol{T}_u$ + $\boldsymbol{T}_g$ [4)]	▶ 10% → 90%	ms	~150
	▶ 90% → 10%	ms	~150

3) Of the maximum set pressure

4) Measured with 1 liter standing hydraulic fluid column

Technical data
(For applications outside these values, please consult us!)

Hydraulic fluid		Classification	Suitable sealing materials	Standards	Data sheet
Mineral oils		HL, HLP	NBR, FKM	DIN 51524	90220
Bio-degradable	▶ Insoluble in water	HETG	FKM	ISO 15380	90221
		HEES	FKM		
	▶ Soluble in water	HEPG	FKM	ISO 15380	
Flame-resistant	▶ Water-free	HFDU (glycol base)	FKM	ISO 12922	90222
		HFDU (ester base)	FKM		
		HFDR	FKM		
	▶ Containing water	HFC (Fuchs: Hydrotherm 46M, Renosafe 500; Petrofer: Ultra Safe 620; Houghton: Safe 620; Union: Carbide HP5046)	NBR	ISO 12922	90223

Important information on hydraulic fluids:
- For further information and data on the use of other hydraulic fluids, please refer to the data sheets above or contact us.
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.).
- The ignition temperature of the hydraulic fluid used must be 50 K higher than the maximum surface temperature.
- **Bio-degradable and flame-resistant – containing water:** If components with galvanic zinc coating (e.g. version "J3" or "J5") or parts containing zinc are used, small amounts of dissolved zinc may get into the hydraulic system and cause accelerated aging of the hydraulic fluid. Zinc soap may form as a chemical reaction product, which may clog filters, nozzles and solenoid valves – particularly in connection with local heat input.
- **Flame-resistant – containing water:**
  - Due to the increased cavitation tendency with HFC hydraulic fluids, the life cycle of the component may be reduced by up to 30% as compared to the use with mineral oil HLP.
  - Dependent on the hydraulic fluid used, the maximum environment and hydraulic fluid temperature must not exceed 50 °C. In order to reduce the heat input into the component, the command value profile is to be adjusted for proportional and high-response valves.

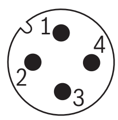
Electrical			
Supply voltage		VDC	24
Minimum control current		mA	100
Maximum control current		mA	1600
Solenoid coil resistance	▶ Cold value at 20 °C	Ω	5
	▶ Maximum hot value	Ω	7.5
Switch-on duration		%	100

Electrical, integrated electronics (OBE)			
Supply voltage	▶ Nominal value	VDC	24
	▶ Minimum	VDC	18
	▶ Maximum	VDC	35
Current consumption		A	≤ 1.5
Fuse protection, external		A	2.0 time-lag
Inputs	▶ Voltage	V	0 ... 10
	▶ Current	mA	4 ... 20

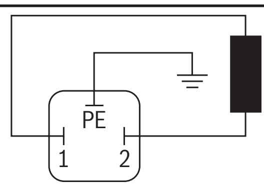
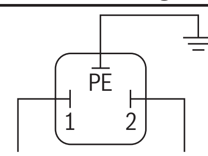
Electrical connections and assignment

Connector pin assignment "A1" and "F1"

Contact	Interface	
	"A1" (6 + PE)	**"F1"** (6 + PE)
1	24 VDC supply voltage (u(t) = 21 ... 35 V); I_{max} ≤1,5 A	
2	Command value 0 ... 10 V (***Re*** > 20 kΩ)	Command value 4 ... 20 mA (***Re*** = 100 Ω)
3	0 V (ground)	
4	Reference potential command value	

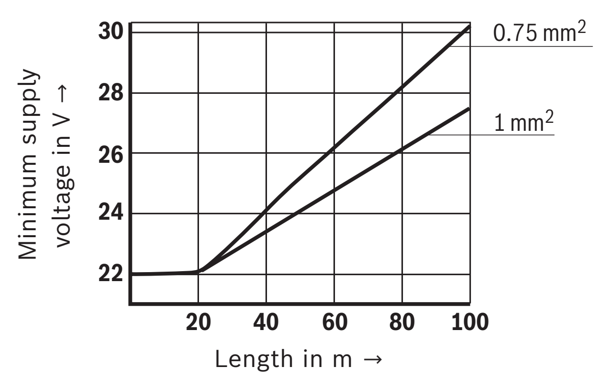


Type (Z)DRE

Connection at the connector	Connection at mating connector
	

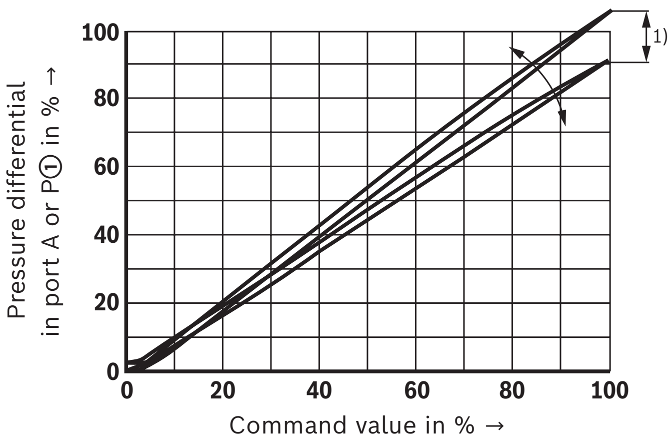
Connection cable (recommendation):
- 6-wire, 0.75 or 1 mm² plus protective grounding conductor and screening
- Only connect the screening to PE on the supply side
- Maximum admissible length = 100 m

The minimum supply voltage at the power supply unit depends on the length of the supply line (see diagram).



Characteristic curves: Type (Z)DRE
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

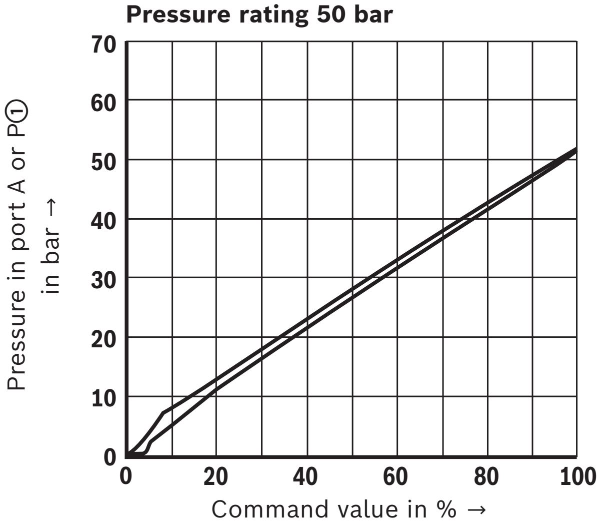
Reduced pressure in port A or P① of the command value (manufacturing tolerance)



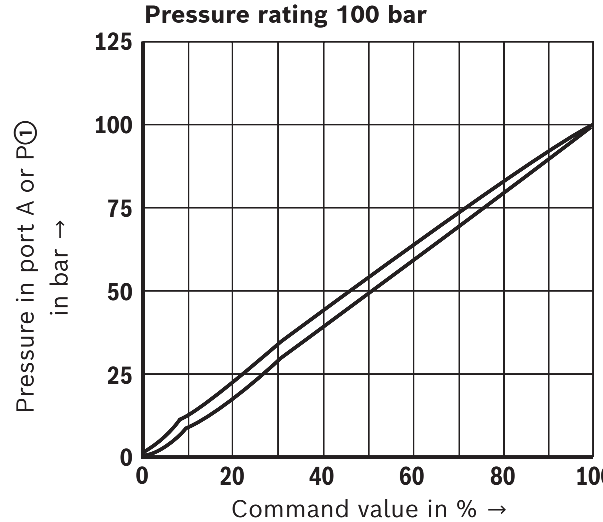
[1] In order to be able to adjust several valves to the same characteristic curve, the manufacturing tolerance can - with version "(Z)DRE" - be changed at the external amplifier (see page 18) using the command value attenuator "G". In this connection, do not set the pressure higher than the maximum set pressure of the pressure rating with command value 100%.

Pressure in port A or P① dependent on the command value

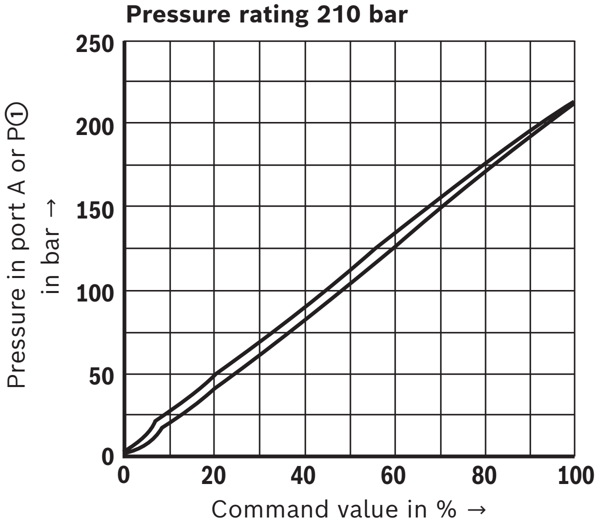
Pressure rating 50 bar



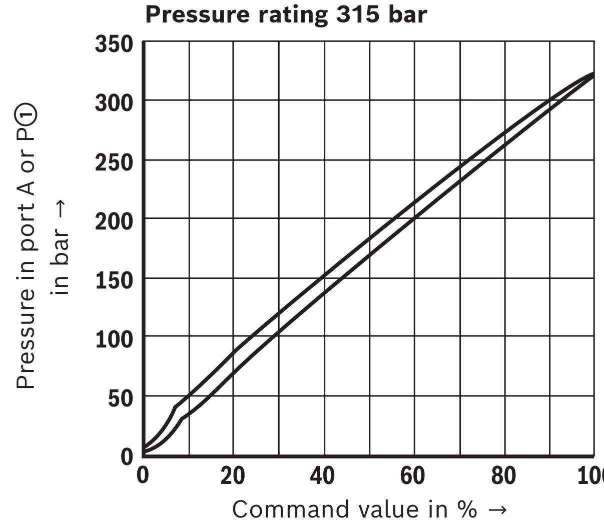
Pressure rating 100 bar



Pressure rating 210 bar



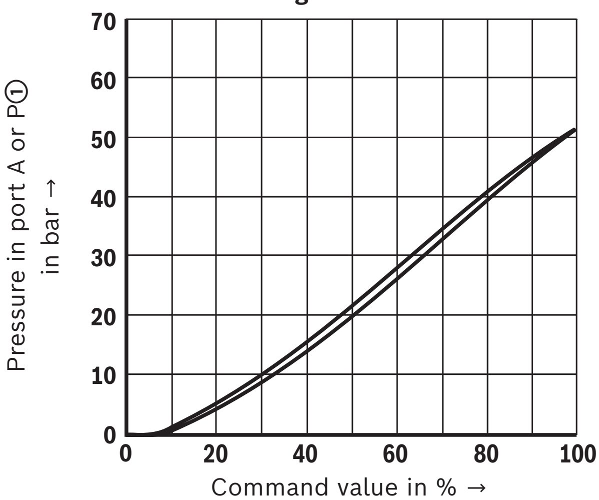
Pressure rating 315 bar



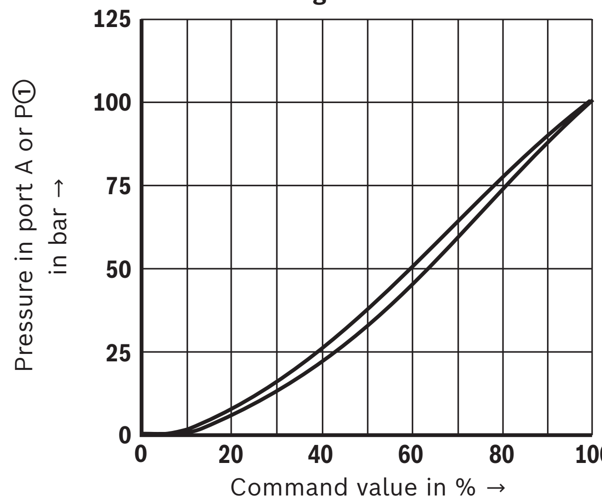
Characteristic curves: Type (Z)DREE
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Pressure in port A or P① dependent on the command value

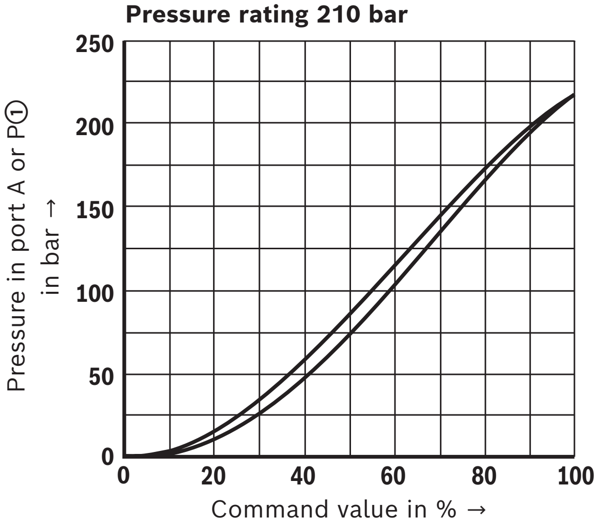
Pressure rating 50 bar



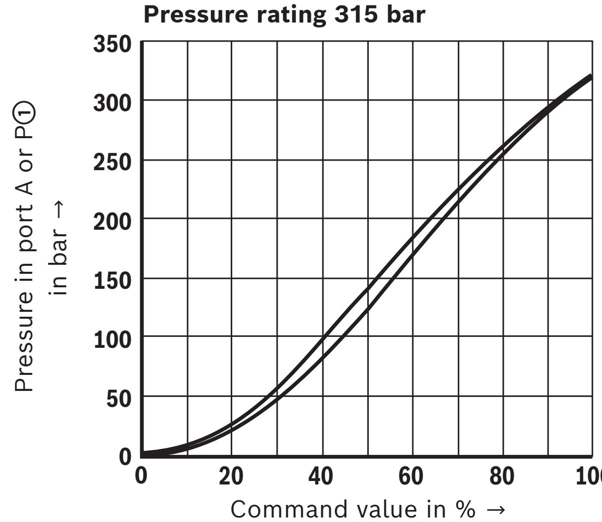
Pressure rating 100 bar



Pressure rating 210 bar



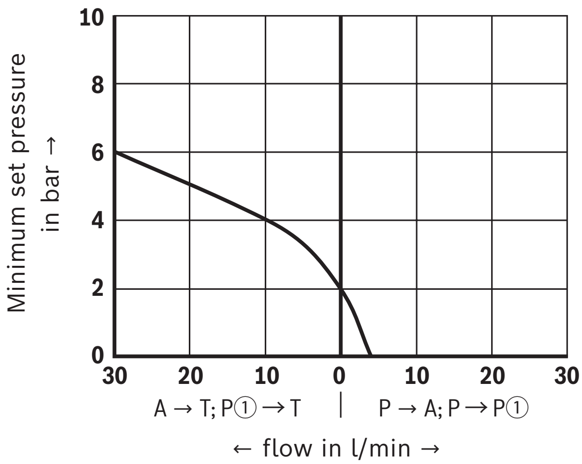
Pressure rating 315 bar



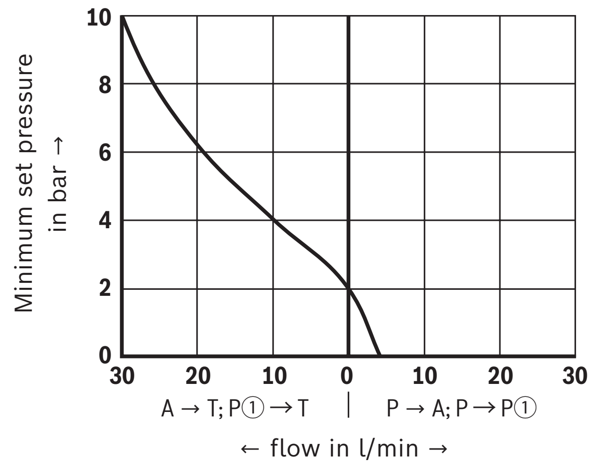
Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Minimum set pressure in port A or P① with command value 0 V (without counter pressure in channel T)

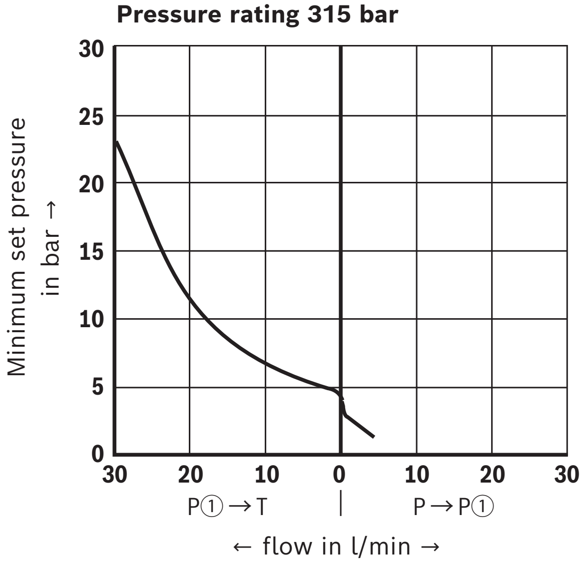
Pressure rating 50 bar



Pressure rating 100 bar and 210 bar



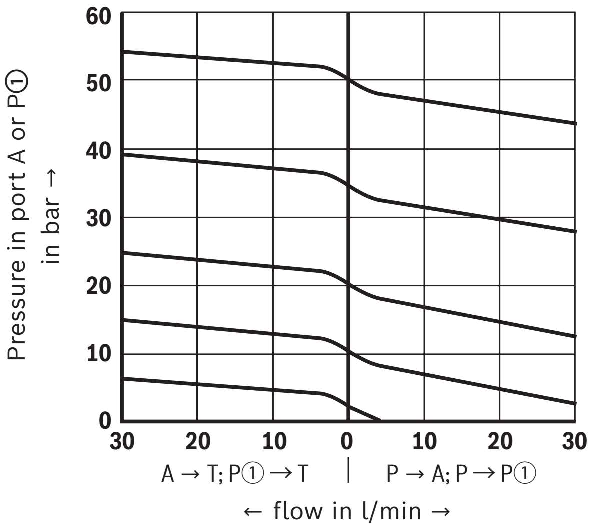
Pressure rating 315 bar



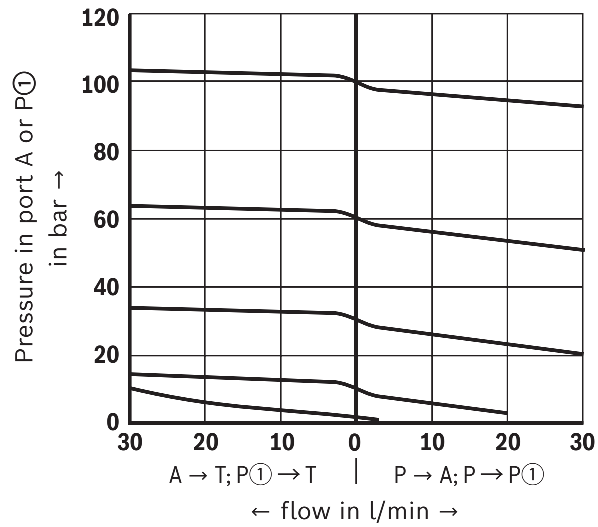
Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Pressure in port A or P① dependent on the flow

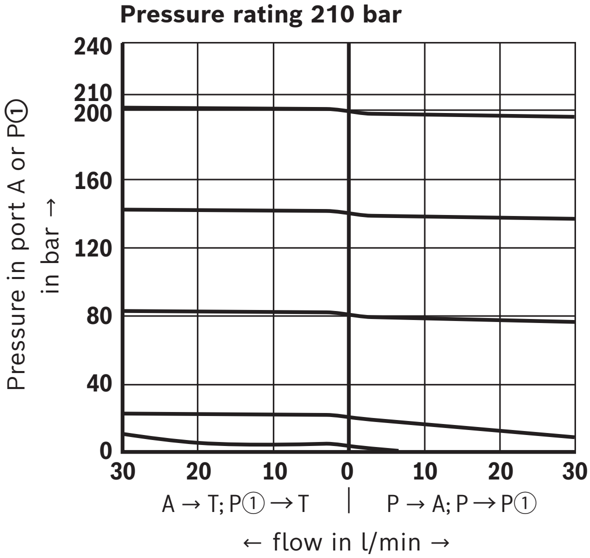
Pressure rating 50 bar



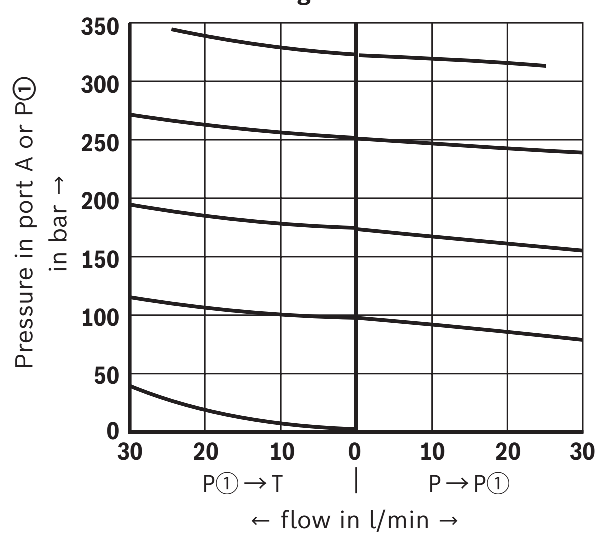
Pressure rating 100 bar



Pressure rating 210 bar

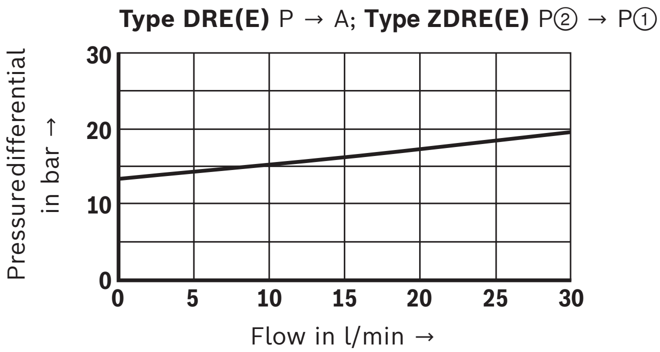


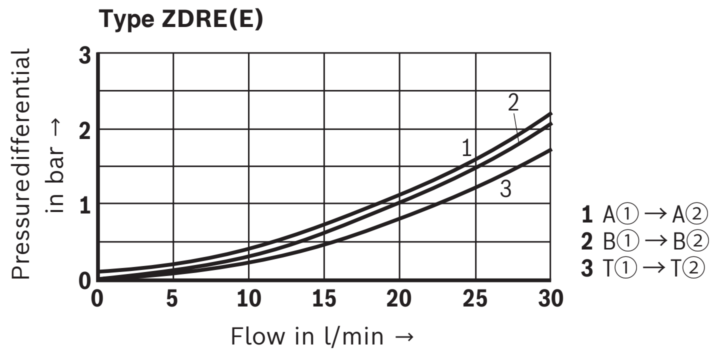
Pressure rating 315 bar



Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

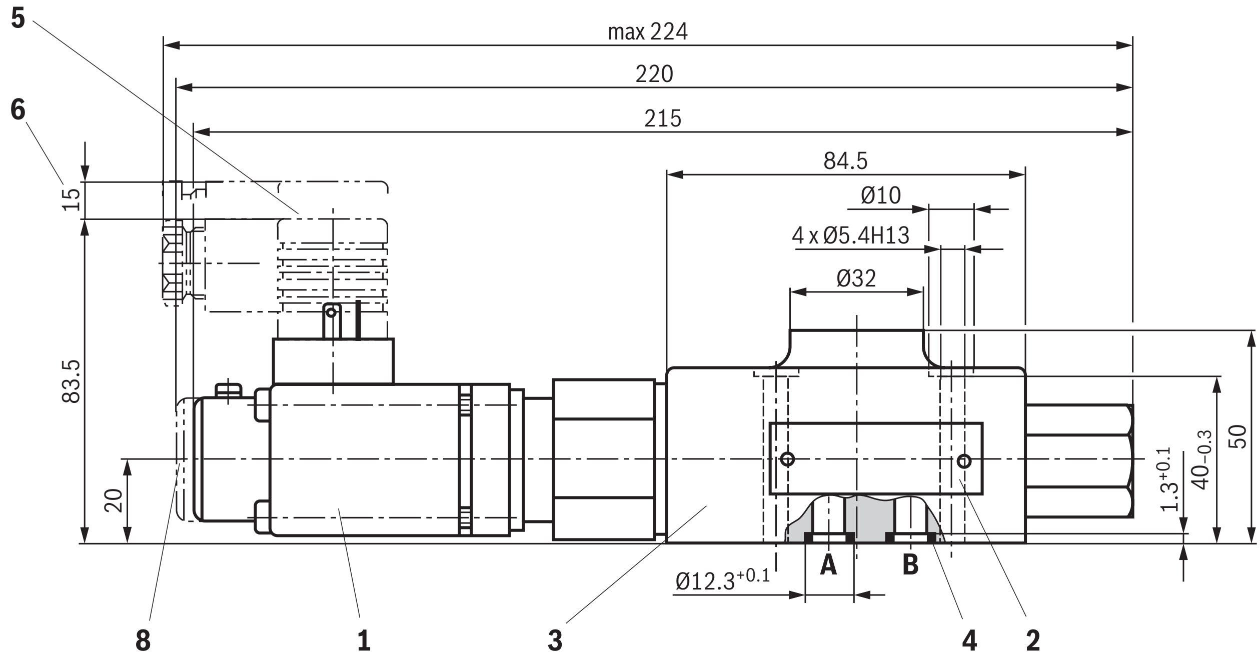
Δp-q_V characteristic curves

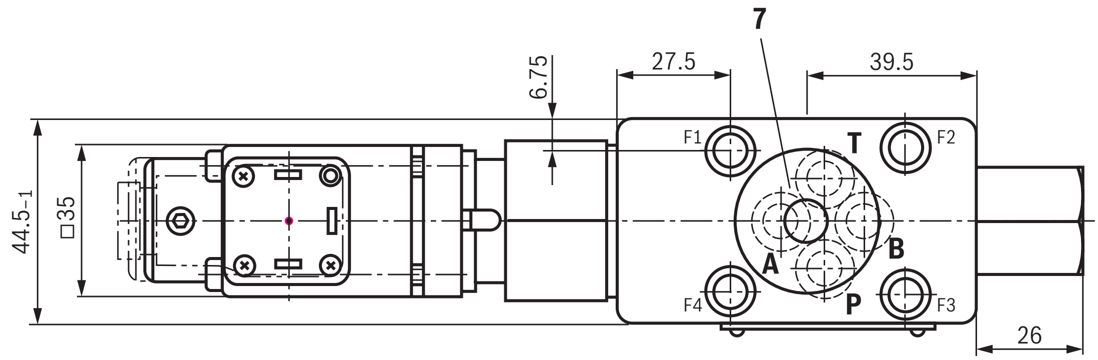




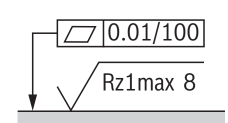
Notice:
The specified pressure differential corresponds to the minimum pressure available in port P (P②) minus the maximum pressure to be controlled in port A (P①).

Dimensions: Type DRE
(dimensions in mm)





1 Proportional solenoid without manual override
2 Name plate
3 Valve housing
4 Identical seal rings for ports A, B, P and T
5 Mating connector, separate order, see page 18
6 Space required for removing the mating connector
7 Porting pattern according to ISO 4401-03-02-0-05
8 Proportional solenoid with manual override

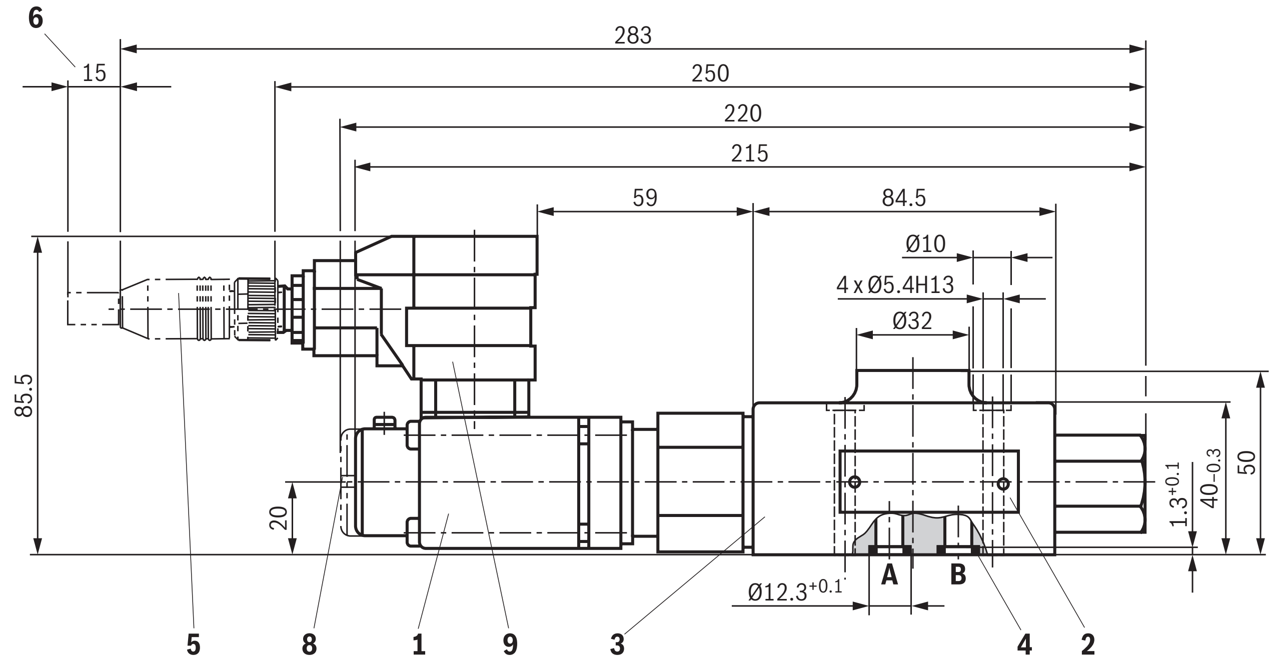


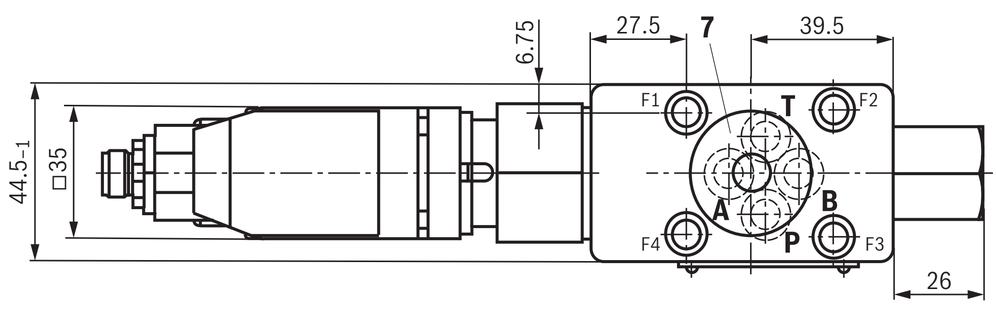
Required surface quality of the valve contact surface

Valve mounting screws and **subplates,** see page 18.

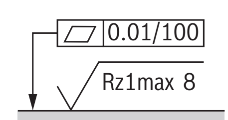
Notice:
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions: Type DREE
(dimensions in mm)





- **1** Proportional solenoid without manual override
- **2** Name plate
- **3** Valve housing
- **4** Identical seal rings for ports A, B, P and T
- **5** Mating connector, separate order, see page 18
- **6** Space required for removing the mating connector
- **7** Porting pattern according to ISO 4401-03-02-0-05
- **8** Proportional solenoid with manual override
- **9** Integrated electronics (OBE)

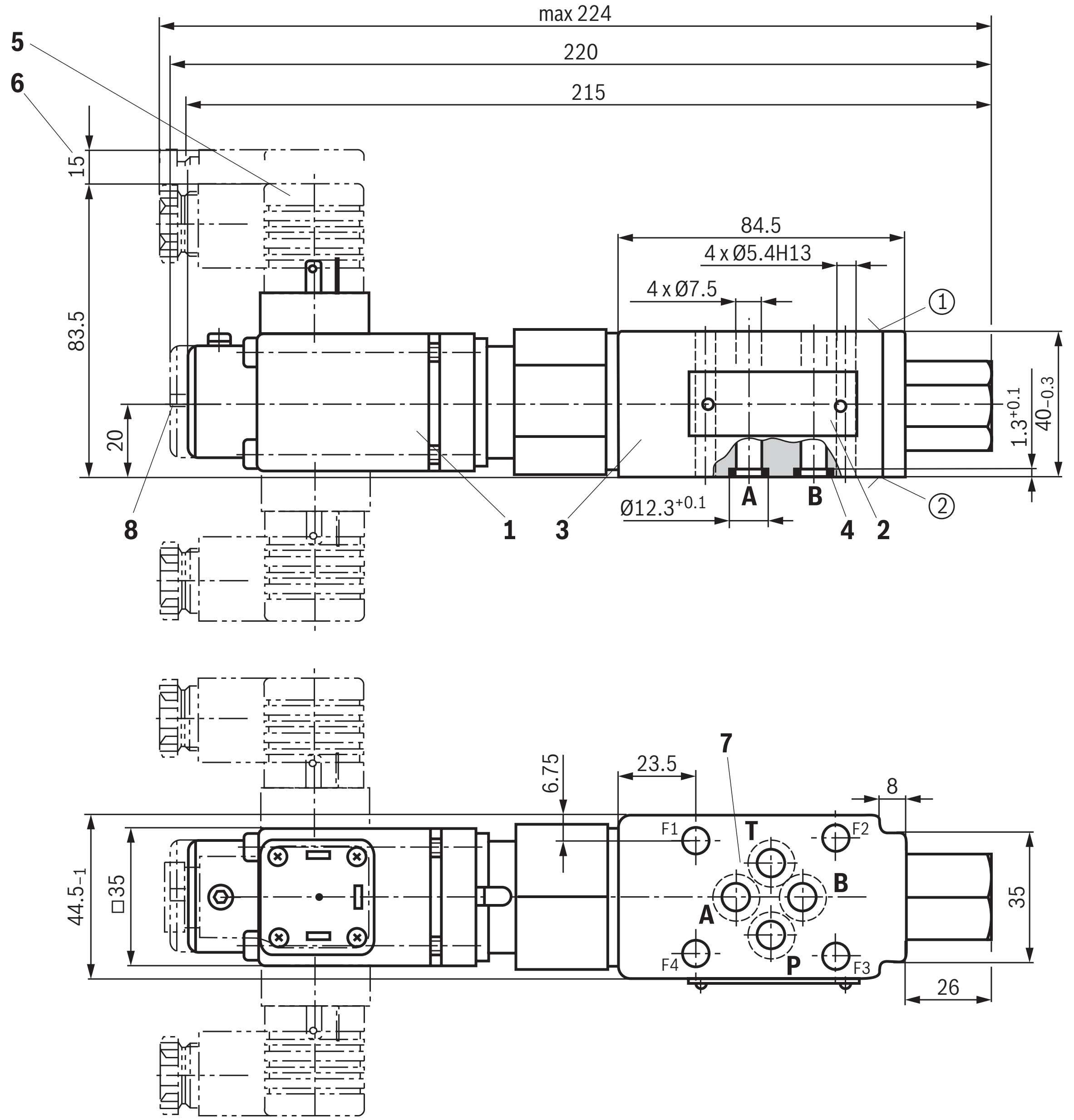


Required surface quality of the valve contact surface

Valve mounting screws and **subplates,** see page 18.

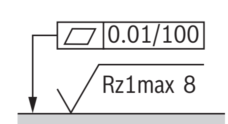
Notice:
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions: Type ZDRE
(dimensions in mm)



① component side
② plate side

1 Proportional solenoid without manual override
2 Name plate
3 Valve housing
4 Identical seal rings for ports A, B, P and T
5 Mating connector, separate order, see page 18
6 Space required for removing the mating connector
7 Porting pattern according to ISO 4401-03-02-0-05
8 Proportional solenoid with manual override

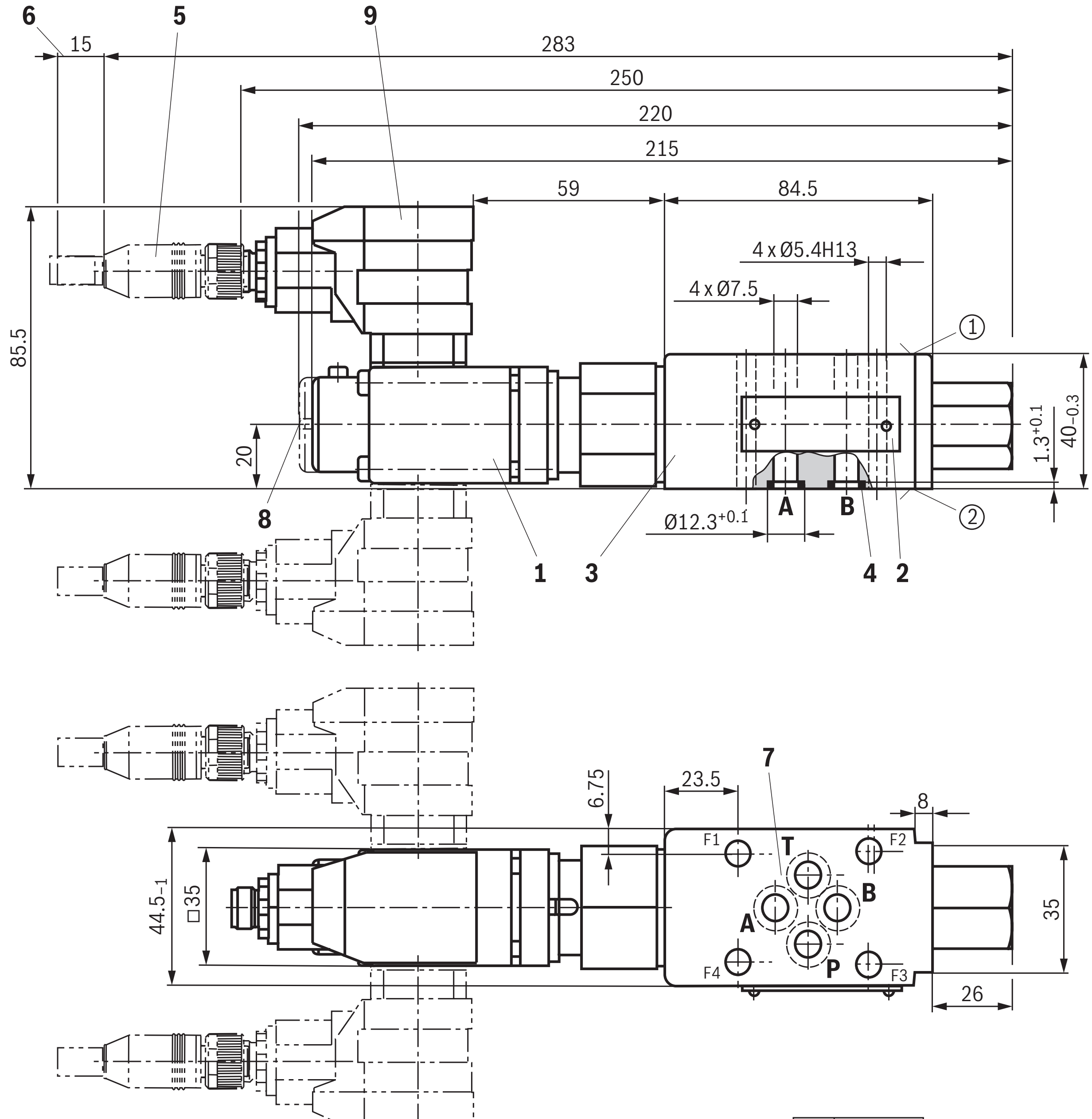


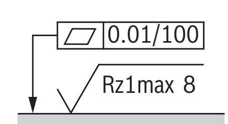
Required surface quality of the valve contact surface

Valve mounting screws and **subplates**, see page 18.

Notice:
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions: Type ZDREE
(dimensions in mm)





Required surface quality of the valve contact surface

① component side
② plate side

- **1** Proportional solenoid without manual override
- **2** Name plate
- **3** Valve housing
- **4** Identical seal rings for ports A, B, P and T
- **5** Mating connector, separate order, see page 18
- **6** Space required for removing the mating connector
- **7** Porting pattern according to ISO 4401-03-02-0-05
- **8** Proportional solenoid with manual override
- **9** Integrated electronics (OBE)

Valve mounting screws and **subplates,** see page 18.

Notice:
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions

Valve mounting screws (separate order)

Type	Quantity	Hexagon socket head cap screws	Material number
DRE(E) ...	4	**ISO 4762 - M5 x 50 - 10.9-flZn-240h-L** Friction coefficient μ_{total} = 0.09 ... 0.14; tightening torque M_A = 7 Nm ±10%	**R913043758**
ZDRE(E) ...	4	**ISO 4762 - M5 - 10.9-flZn-240h-L** Friction coefficient μ_{total} = 0.09 ... 0.14; tightening torque M_A = 7 Nm ±10%	–

☞ **Notice:**
The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure.

Subplates (separate order) with porting pattern according to ISO 4401-03-02-0-05 see data sheet 45100.

Accessories (separate order)

External control electronics

	Type	Data sheet
Modular design	VT-MSPA1-2X	30232

Mating connectors and cable sets

Type	Designation	Version	Short designation	Material number	Data sheet
(Z)DRE ...	Mating connector; for valves with "K4" connector, 2-pole + PE, design A	Without circuitry, M16 x 1.5, 12 ... 240 V, "b"	Z4	**R901017011**	**08006**
(Z)DREE ...	Cable sets for valves with "K24", "K35" and "K72" connectors, 4-pole	M12 x 1, straight	VT-SSPA1-1X/M12/1/V00	**R901241656**	
		M12 x 1, angled	T-SSPA1-1X/M12/2/V00	**R901241651**	

Proportional pressure reducing valve, pilot-operated

Type Z3DRE and Z3DREE

RE 29282
Edition: 2019-02
Replaces: 2018-11

H8127

- Size 10
- Component series 1X
- Maximum operating pressure 350 bar
- Maximum flow 120 l/min

Features

- Operation by rotatable proportional solenoid
- Sandwich plate design
- Porting pattern according to ISO 4401-05-05-0-05
- 4 pressure ratings
- Valve and control electronics from a single source
- External control electronics for type Z3DRE
- Linear command value pressure characteristic curve
- Integrated electronics (OBE) with type Z3DREE with little manufacturing tolerance of the command value pressure characteristic curve

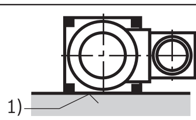
Contents

Ordering code

01	02	03	04	05	06	07	08		09		10	11	12	13	14	15	16	17
Z	**3**	**DRE**		**10**	**V**	**P**	**2**	**–**	**1X**	**/**				**G24**				*****

01	Sandwich plate valve	**Z**
02	3-way version	**3**
03	Proportional pressure reducing valve	**DRE**
04	External control electronics	**no code**
	Integrated electronics (OBE)	**E**
05	Size 10	**10**
06	Pilot-operated	**V**
07	Pressure reduction in channel P①	**P**

Preferred position of the proportional solenoid



08	The mating connector can be brought to the desired position when the nut was loosened, see "Dimensions" page 14 and 15	**2**
09	Component series 10 ... 19 (10 ... 19: unchanged installation and connection dimensions)	**1X**

Pressure rating

10	Set pressure up to 50 bar	**50**
	Set pressure up to 100 bar	**100**
	Set pressure up to 200 bar	**200**
	Set pressure up to 315 bar	**315**

Pilot oil flow

11	Pilot oil supply for the directional valve from port P②, pilot oil return external for directional valve and Z3DRE(E)	**Y**
	Pilot oil supply external for directional valve, pilot oil return external for directional valve and Z3DRE(E)	**XY**
	Pilot oil supply for the directional valve from port P②, pilot oil return internal for directional valve and external for Z3DRE(E)	**L**
	Pilot oil supply external for directional valve, pilot oil return internal for directional valve and external for Z3DRE(E); Directional valve without pilot oil supply	**XL**
	Further information see page 6	

Pressure measuring port G1/4

12	Without pressure measuring port	**no code**
	With pressure measuring port (secondary pressure)	**MS**
13	Direct voltage 24 V	**G24**

Electrical connection

14	**External** control electronics: connector DIN EN 175301-803	**K4** [2]
	Integrated electronics: connector DIN EN 175301-804	**K31** [2]

Control electronics interface

15	**External** control electronics	**no code**
	– Integrated electronics	
	Command value input 0 ... 10 V	**A1**
	Command value input 4 ... 20 mA	**F1**

1) Valve contact surface (seal ring recess in the housing)

2) Mating connectors, separate order, see page 16 and data sheet 08006.

Ordering code

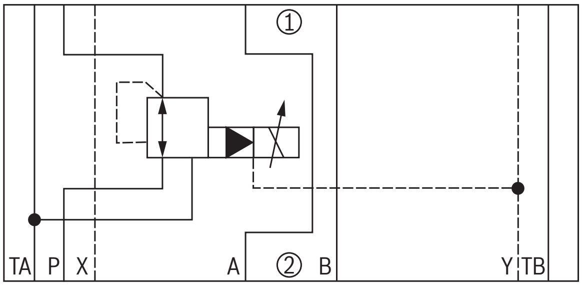
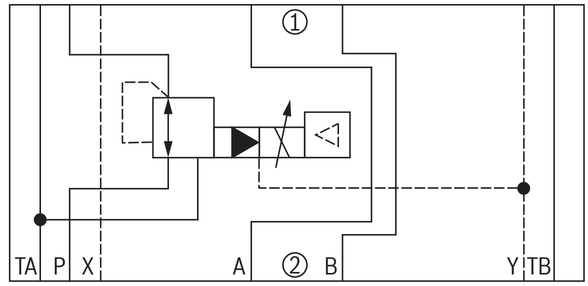
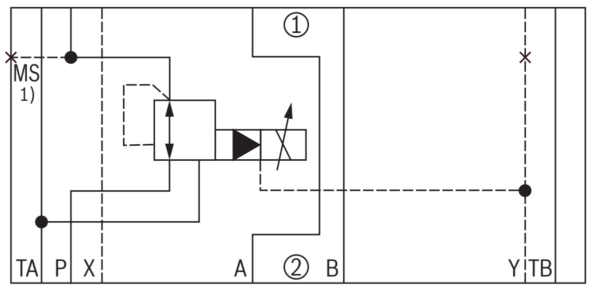
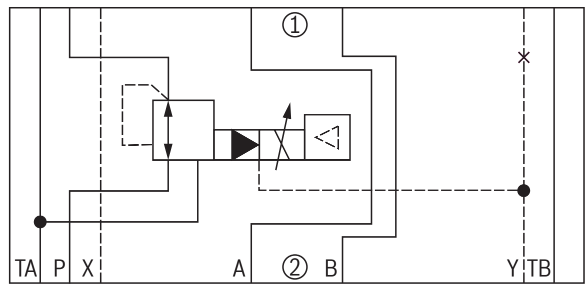
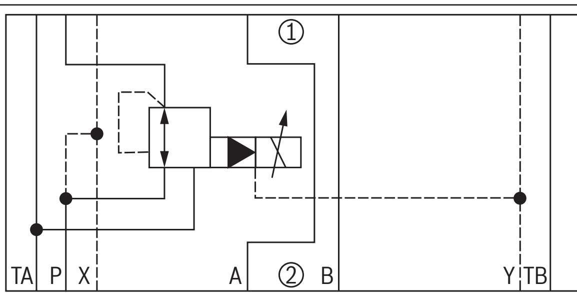
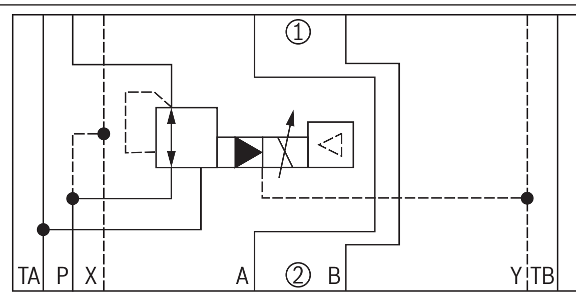
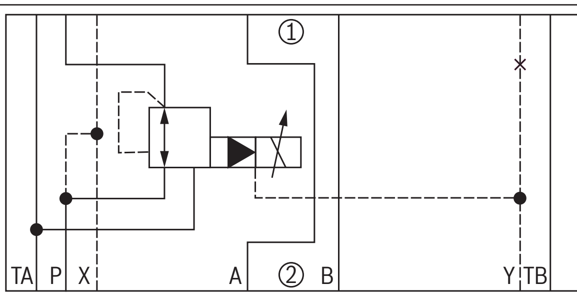
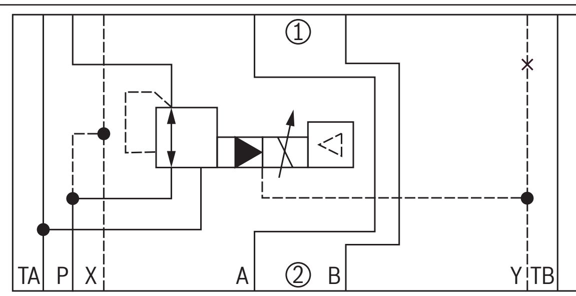
01	02	03	04	05	06	07	08		09		10	11	12	13	14	15	16	17
Z	**3**	**DRE**		**10**	**V**	**P**	**2**	**–**	**1X**	**/**				**G24**				*****

Seal material (observe compatibility of seals with hydraulic fluid used, see page 8)

16	NBR seals	**M**
	FKM seals	**V**

17	Further details in the plain text	

Symbols (① = component side, ② = plate side)

	External control electronics "Z3DRE"	Integrated electronics "Z3DREE"
Version "XY"		
Version "XL"		
Version "Y"		
Version "L"		

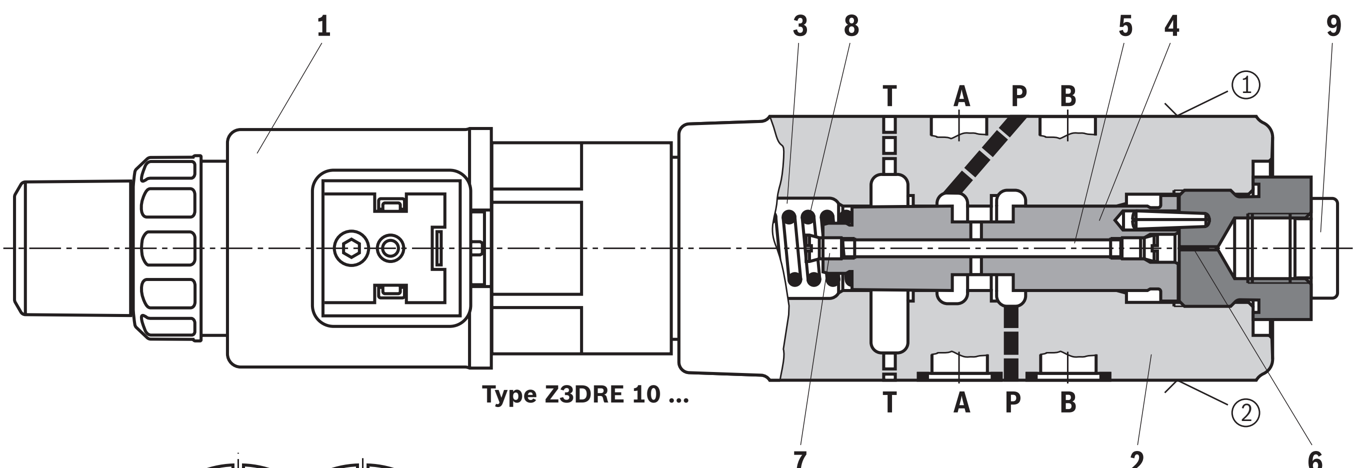
1) Pressure measuring port "MS" as example for all types

Notes:
- Representation according to DIN ISO 1219-1.
- Deviating from ISO 4401, port T is in this data sheet called TA, port T1 is called TB.

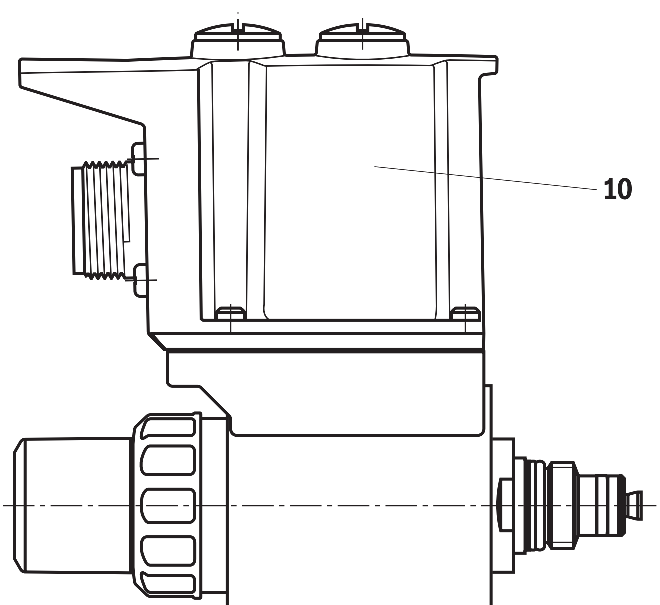
Function, section

Valves of type Z3DRE... are pilot-operated pressure reducing valves in sandwich plate design and 3-way version, i. e. with pressure limitation of the actuator pressure. They are used for reducing a system pressure.
The valves basically consist of a proportional pilot control valve (1), main valve (2) and control spool (4).
The pressure in channel P① is set in a command value-dependent form via the pilot control valve (1).

External control electronics "Z3DRE"
In rest position, i. e. without pressure in channel P②, the control spool (4) opens the connection from channel P② to P①.
The pressure in channel P① acts on the spool face (6) via the bore (5). The pilot oil for the pilot control valve (1) is taken from channel P① and flows via the bore (5) and the nozzle (7) into the spring chamber (3).
The pressure required in channel P① is preset at the related amplifier. The proportional pilot control valve (1) increases the pressure in the spring chamber (3).
In this way, the two chambers (6) and (3) are pressure-compensated and the compression spring (8) moves the control spool (4) to the right in opening direction P② to P①. As soon as the actuator pressure P① has increased to the value set at the pilot control valve (1), the valve poppet (11) opens and limits the pressure in the spring chamber (3). The control spool (4) now moves to the left into control position. If the actuator pressure P① exceeds the value set at the pilot control valve (1), the control spool (4) is moved further to the left. It blocks the flow from P② to P① and opens the connection from P① to the tank until the pressure has dropped again to the set value.
Version "MS" enables measurement and monitoring of the set secondary pressure via a pressure load cell at the measuring port (9).



Type Z3DRE 10 ...

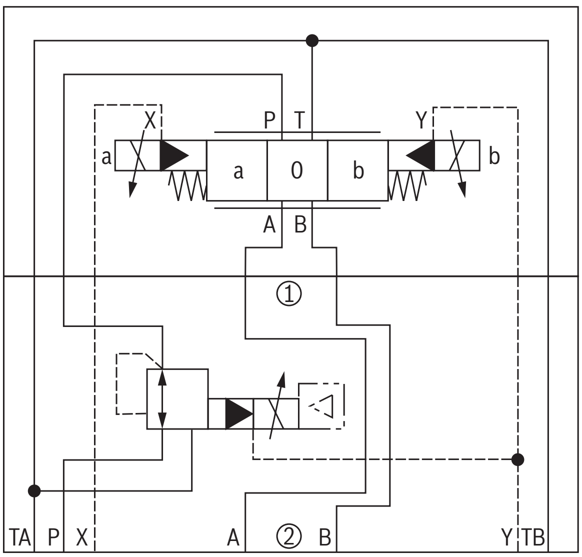


Type Z3DREE 10 ...

Integrated electronics "Z3DREE"
With regard to function and set-up, these valves correspond to type Z3DRE - except for the integrated electronics (OBE). The electronics (OBE) in the housing (10) maintain the supply and command value voltage via the mating connector.
At the factory, the command value pressure characteristic curve is adjusted with little manufacturing tolerance.
For further details on the integrated electronics (OBE) refer to page 9 and 10.

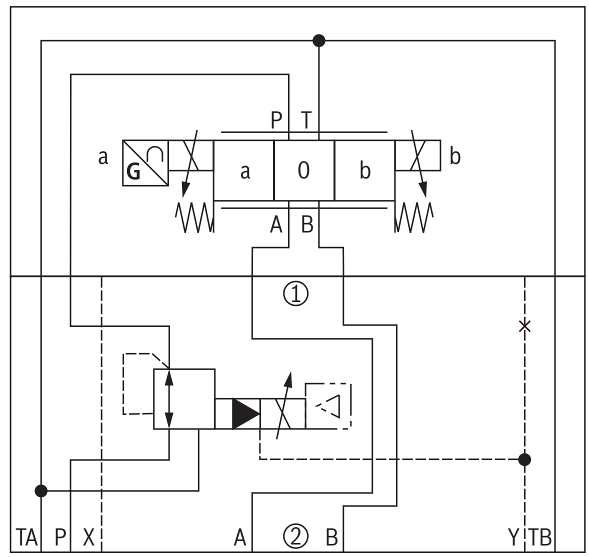
Pilot oil supply (for the attached directional valve)

Version "XY"
(e.g. with proportional directional valve, pilot-operated, type 4WRZ)



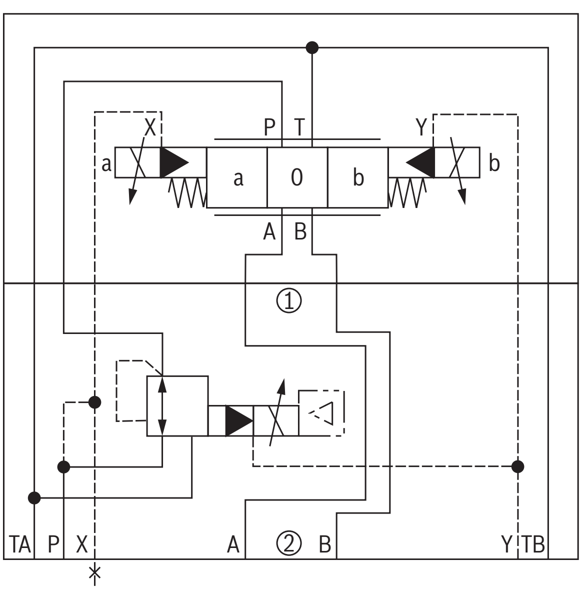
No connection between P② and X

Version "XL"
(e.g. with proportional directional valve, direct operated, type 4WRE)



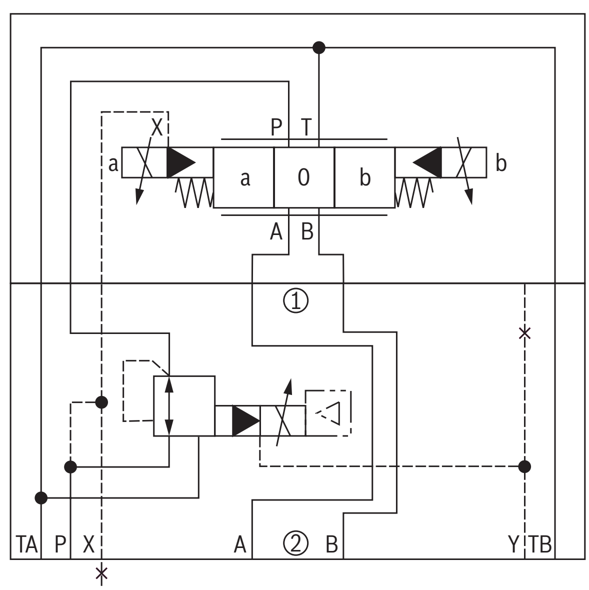
No connection between P② and X

Version "Y"
(e.g. with proportional directional valve, pilot-operated, type 4WRZ)



Port X in the subplate must be closed

Version "L"
(e.g. with proportional directional valve, pilot-operated, type 4WRZ)



Port X in the subplate must be closed

Notes:
- With **direct operated** directional valves, the seals for ports X and Y are missing in the connection surface of the housing. To ensure that no hydraulic fluid leaks, the pilot oil supply from P② to X and the pilot oil return between directional valve and Z3DRE(E) has to be closed (version "XL").
- A **pilot-operated** proportional directional valve in connection with Z3DRE(E) has to have an **external pilot oil supply**.

Notes:
- Representation according to DIN ISO 1219-1.
- Deviating from ISO 4401, port T is in this data sheet called TA, port T1 is called TB.

Technical data
(for applications outside these values, please consult us!)

general			
Weight	▶ "Z3DRE"	kg	3.3
	▶ "Z3DREE"	kg	3.4
Installation position			preferred position of the proportional solenoid downward or horizontal
Storage temperature range		°C	–20 ... +80
Ambient temperature range	▶ "Z3DRE"	°C	–20 ... +70
	▶ "Z3DREE"	°C	–20 ... +50
Sine test according to DIN EN 60068-2-6			10 ... 2000 ... 10 Hz / maximum 10 g / 10 cycles
Noise test according to DIN EN 60068-2-64			20 ... 2000 Hz / 10 g_{RMS} / 24 h
Transport shock according to DIN EN 60068-2-27			15 g / 11 ms
$MTTF_D$ values according to EN ISO 13849		Years	150 [1] (for more information see data sheet 08012)

hydraulic			
Maximum operating pressure [2]	▶ Port P①	bar	350
	▶ Ports P②, A, B, X	bar	350
	▶ Port T	bar	250
	▶ Port Y, L		Line separate and to the tank at zero pressure
Maximum set pressure at port P①	▶ Pressure rating 50 bar	bar	50
	▶ Pressure rating 100 bar	bar	100
	▶ Pressure rating 200 bar	bar	200
	▶ Pressure rating 315 bar	bar	315
Minimum set pressure in channel P① with command value zero		bar	12
Maximum flow		l/min	120
Pilot flow		l/min	0.4 ... 0.9
Hydraulic fluid			see table page 8
Hydraulic fluid temperature range		°C	–20 ... +80
Viscosity range		mm²/s	15 ... 380
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)			Class 20/18/15 [3]
Hysteresis		%	< 6 of the maximum set pressure
Repetition accuracy		%	< ±2 of the maximum set pressure
Linearity		%	±3.5 of the maximum set pressure
Manufacturing tolerance of the command value pressure characteristic curve, related to the hysteresis characteristic curve	▶ "Z3DRE" [4]	%	±5 of the maximum set pressure
	▶ "Z3DREE" [5]	%	±1.5 of the maximum set pressure
Step response $T_u + T_g$ [6]	▶ 10 ... 90%	msec	~140
	▶ 90 ... 10%	msec	~140

1) Switch off "OBE" voltage supply.
2) The pressure at port P② must be approx. 20 bar higher than the required set pressure that is to be achieved at port P①.
3) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and simultaneously increases the life cycle of the components.

4) Details see page 11
5) Comparison at the factory
6) Measured with 5 liters standing hydraulic fluid column at port P①

Technical data
(for applications outside these values, please consult us!)

Hydraulic fluid		Classification	Suitable Sealing materials	Standards	Data sheet
Mineral oils		HL, HLP	NBR, FKM	DIN 51524	90220
Bio-degradable	▶ Insoluble in water	HETG	FKM	ISO 15380	90221
		HEES	FKM		
	▶ Soluble in water	HEPG	FKM	ISO 15380	
Flame-resistant	▶ Water-free	HFDU (glycol base)	FKM	ISO 12922	90222
		HFDU (ester base)	FKM		
		HFDR	FKM		
	▶ Containing water	HFC (Fuchs: Hydrotherm 46M, Renosafe 500; Petrofer: Ultra Safe 620; Houghton: Safe 620; Union: Carbide HP5046)	NBR	ISO 12922	90223

Important information on hydraulic fluids:
- For further information and data on the use of other hydraulic fluids, please refer to the data sheets above or contact us.
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.).
- The ignition temperature of the hydraulic fluid used must be 50 K higher than the maximum surface temperature.
- **Bio-degradable and flame-resistant – containing water:** If components with galvanic zinc coating (e.g. version "J3" or "J5") or parts containing zinc are used, small amounts of dissolved zinc may get into the hydraulic system and cause accelerated aging of the hydraulic fluid. Zinc soap may form as a chemical reaction product, which may clog filters, nozzles and solenoid valves - particularly in connection with local heat input.
- **Flame-resistant – containing water:**
  – Due to increased cavitation tendency with HFC hydraulic fluids, the life cycle of the component may be reduced by up to 30% as compared to the use with mineral oil HLP. In order to reduce the cavitation effect, it is recommended - if possible specific to the installation - to back up the return flow pressure in ports T to approx. 20% of the pressure differential at the component.
  – Dependent on the hydraulic fluid used, the maximum ambient and hydraulic fluid temperature must not exceed 50 °C. In order to reduce the heat input into the component, the command value profile is to be adjusted for proportional and high-response valves.

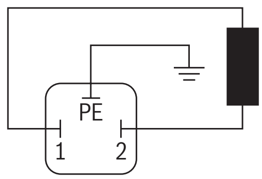
electric			
Minimum solenoid current		mA	100
Maximum solenoid current		mA	1600 ±10%
Solenoid coil resistance	▶ Cold value at 20 °C	Ω	5.5
	▶ Maximum hot value	Ω	8.05
Duty cycle		%	100

electrical, integrated electronics (OBE)			
Supply voltage	▶ Nominal voltage	VDC	24
	▶ Lower limit value	VDC	21
	▶ Upper limit value	VDC	35
Current consumption		A	≤ 1.5
Fuse protection		A	2 (time-lag)
Inputs	▶ Voltage	V	0 ... 10
	▶ Current	mA	4 ... 20
Output	▶ Actual current value	mV	1 mV corresponds to 1 mA
Protection class of the valve according to EN 60529			IP 65 (with mating connector mounted and locked)

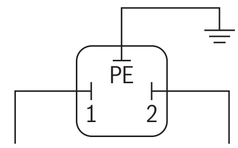
External control electronics	
Modular design	Type VT-MSPA1-2X according to data sheet 30232

Electrical connection: External control electronics "Z3DRE"

Connection at connector



Connection at mating connector



to the amplifier

> **Notice:**
> Mating connectors, separate order, see page 16 and data sheet 08006.

Electrical connection: Integrated electronics "Z3DREE"

Connector pin assignment

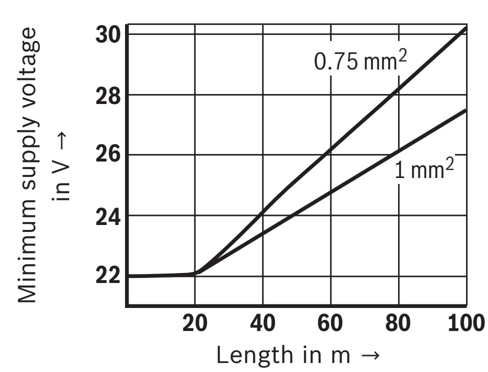
Pin	Signal	Assignment interface A1	Assignment interface F1
A	Supply voltage	24 VDC (u(t) = 21 V ... 35 V); $I_{max} \leq$ 1.5 A	
B		0 V	
C	Reference potential actual value	Reference potential actual value - pin F; 0 V	
D	Differential amplifier input	0 ... 10 V; R_E = 100 kΩ	4 ... 20 mA; R_E = 100 Ω
E		Reference potential command value	
F	Measuring output (actual value)	0 ... 1.6 V actual value (1 mV corresponds to 1 mA); load resistance > 10 kΩ	
PE		Functional ground (directly connected to solenoid and valve housing)	

> **Notice:**
> Mating connectors, separate order, see page 16 and data sheet 08006.

Connection cable (recommendation)**:**

- Recommendation 6-wire, 0.75 or 1 mm² plus protective grounding conductor and screening
- Only connect the screening to PE on the supply side.
- Maximum length 100 m

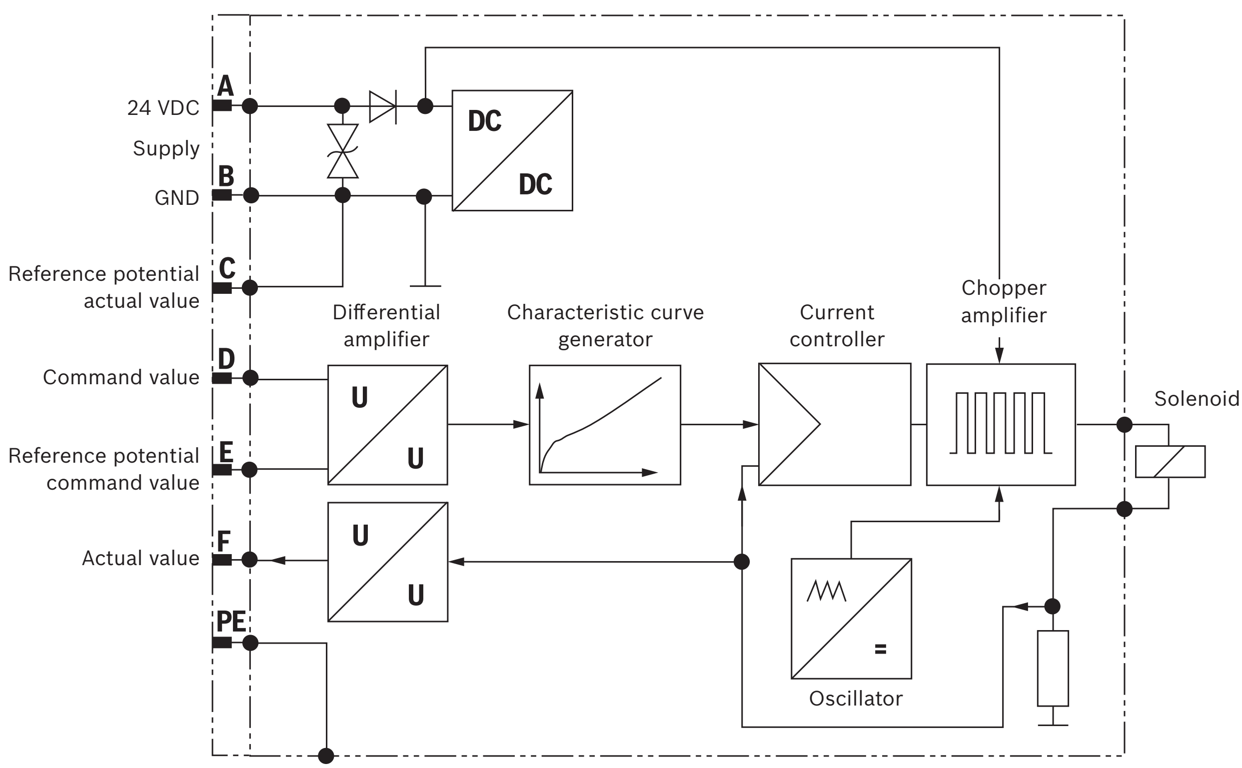
The minimum supply voltage at the power supply unit depends on the length of the supply line (see diagram).



Block diagram/controller function block: Integrated electronics "Z3DREE"

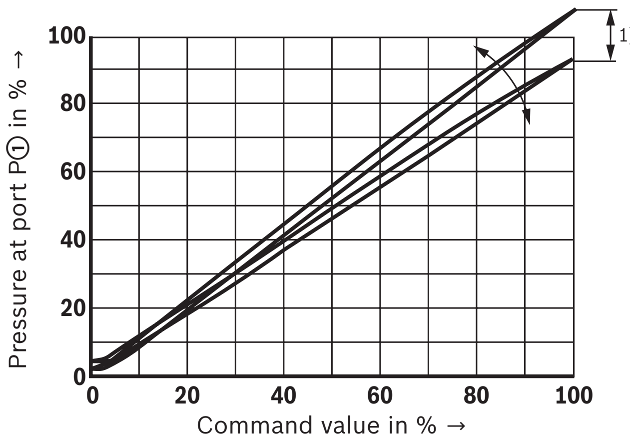
The electronics are supplied with voltage via ports A and B. The command value is applied to the differential amplifier ports D and E.
Via the characteristic curve generator, the command value solenoid current characteristic curve is adjusted to the valve so that non-linearities in the hydraulic system are compensated and thus, a linear command value pressure characteristic curve is created.
The current controller controls the solenoid current independently of the solenoid coil resistance.

The power stage of the electronics for controlling the proportional solenoid is a chopper amplifier with a clock frequency of approx. 180 Hz to 400 Hz. The output signal is pulse-width modulated (PWM).
For checking the solenoid current, a voltage can be measured at the connector between pin F(+) and pin C(−) that is proportional to the solenoid current. **1 mV** corresponds to **1 mA** solenoid current.



Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

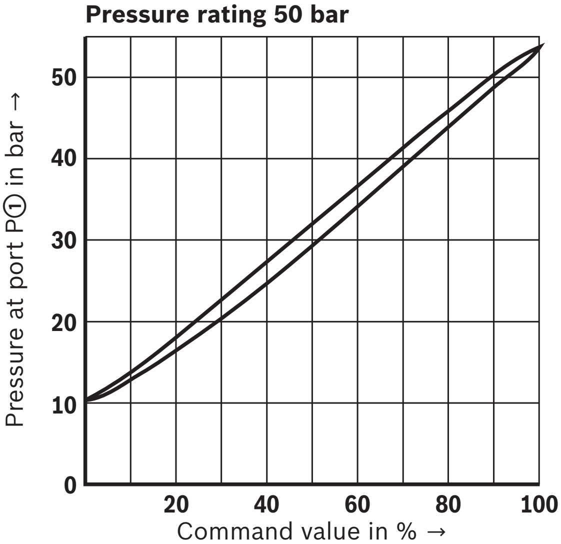
Reduced pressure at port P① dependent on the command value (manufacturing tolerance)



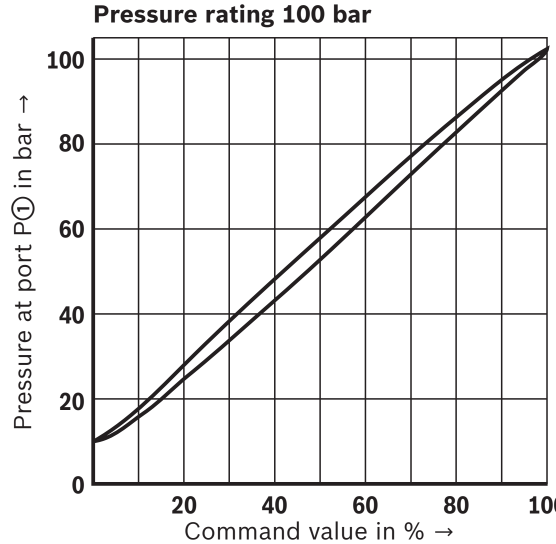
1) In order to be able to adjust several valves to the same characteristic curve, the manufacturing tolerance can - with version "Z3DRE" - be changed at the **external amplifier** (type and data sheet see page 8) using the command value attenuator "**G**". In this connection, do not set the pressure higher than the maximum set pressure of the pressure rating with command value 100%.

Pressure at port P① dependent on the command value (with a flow of 0 l/min)

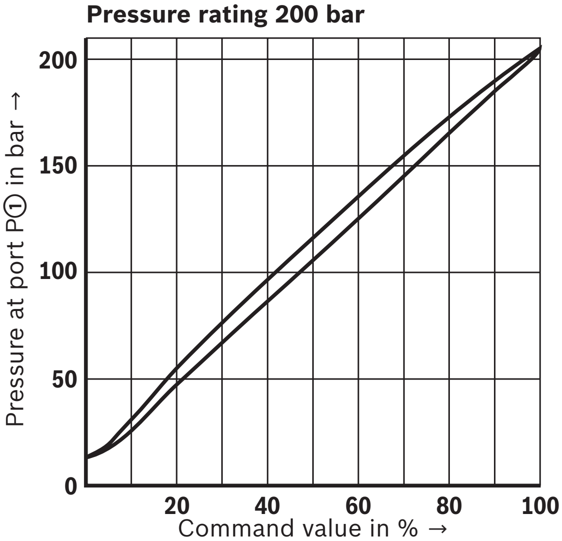
Pressure rating 50 bar



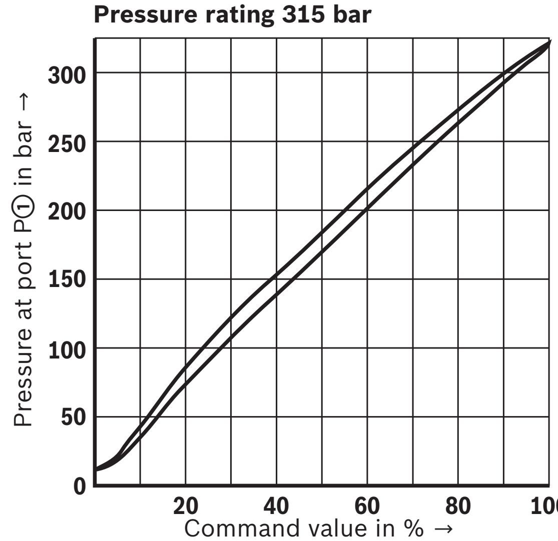
Pressure rating 100 bar



Pressure rating 200 bar



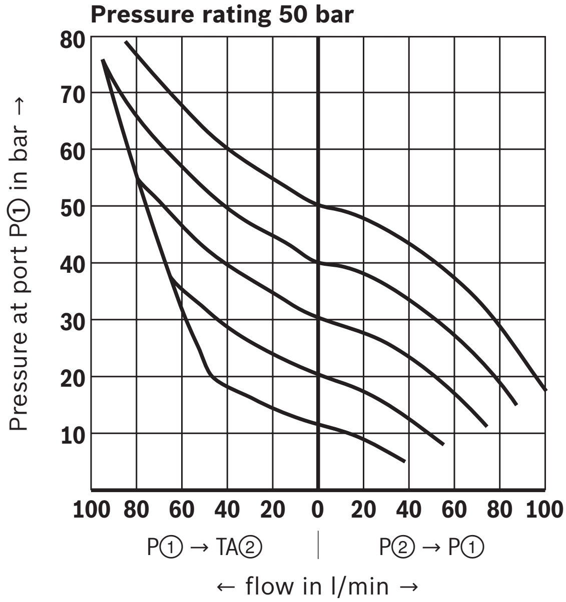
Pressure rating 315 bar



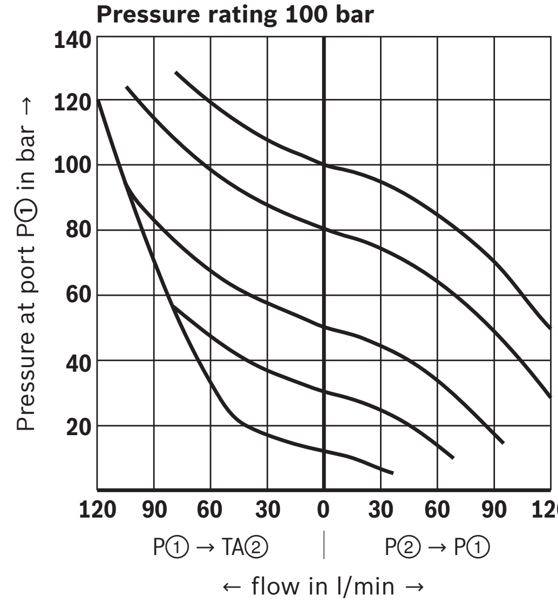
Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Pressure at port P① dependent on the flow

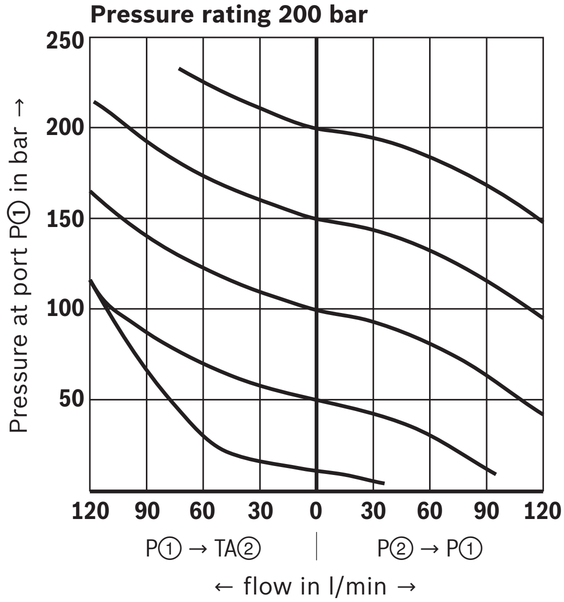
Pressure rating 50 bar



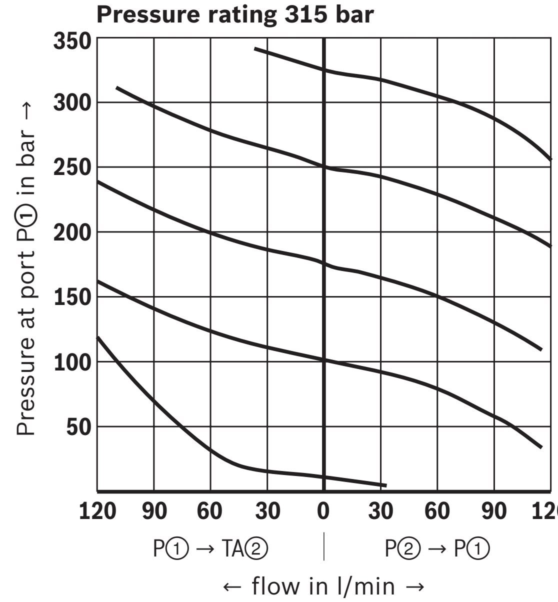
Pressure rating 100 bar



Pressure rating 200 bar

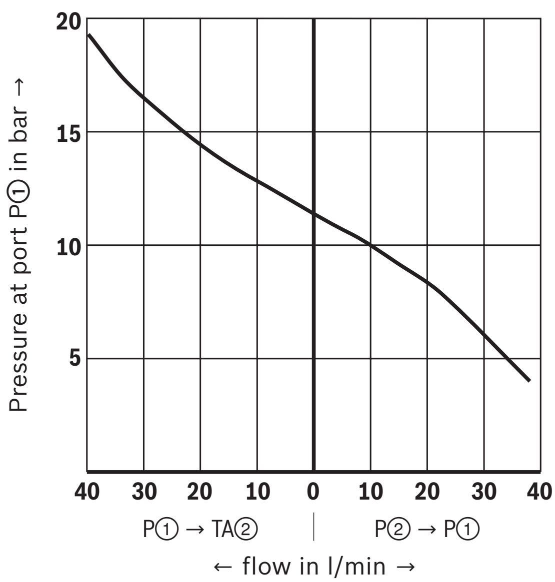


Pressure rating 315 bar

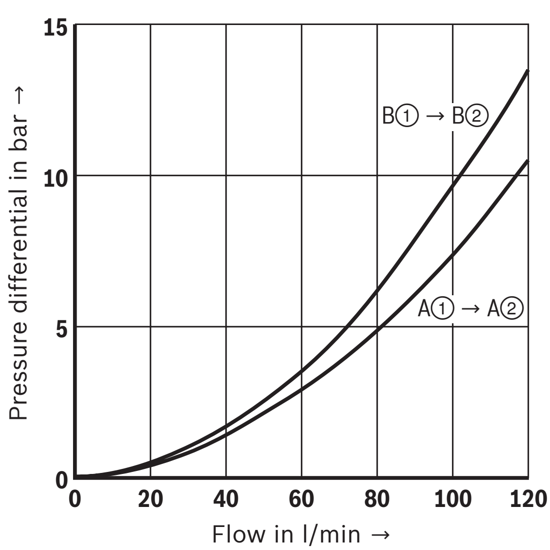


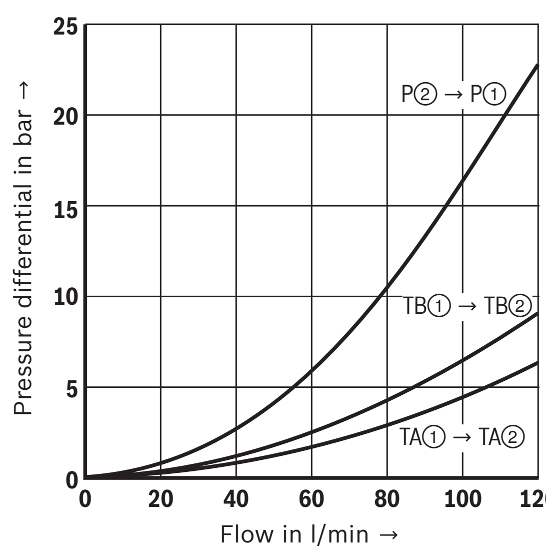
Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Minimum set pressure dependent on the flow with command value zero

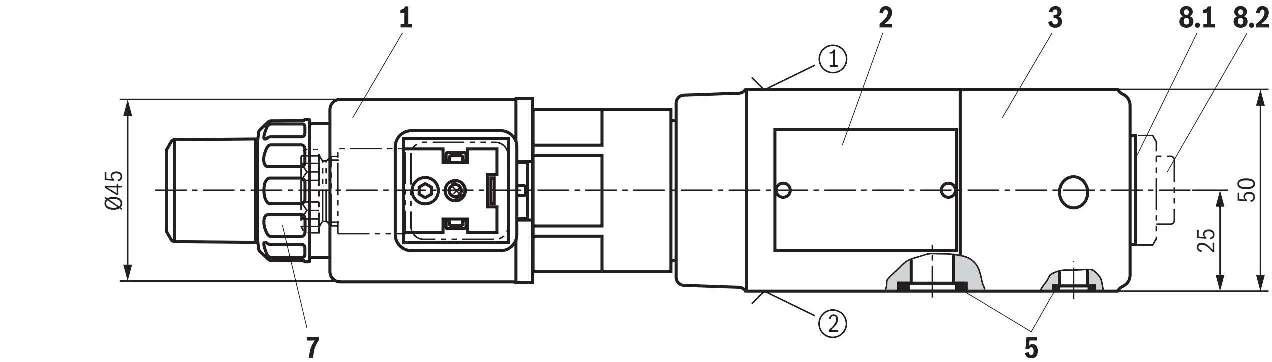


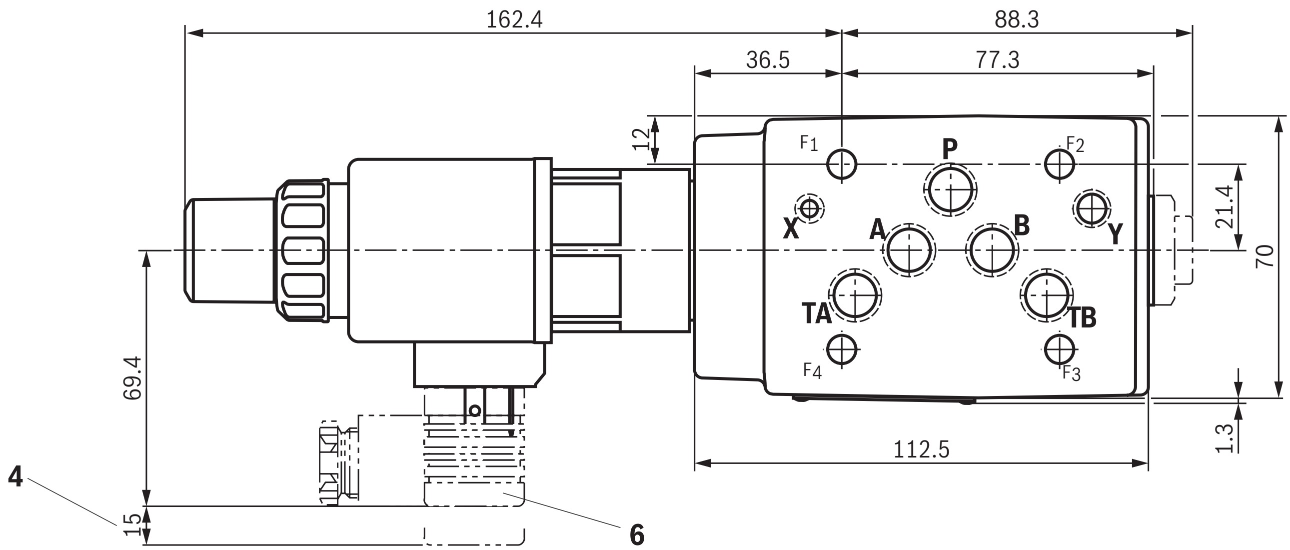
Pressure differential dependent on the flow

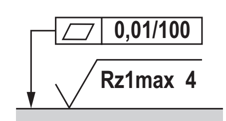




Dimensions: External control electronics "Z3DRE" (dimensions in mm)







Required surface quality of the valve contact surface

① component side – porting pattern according to ISO 4401-05-05-0-05

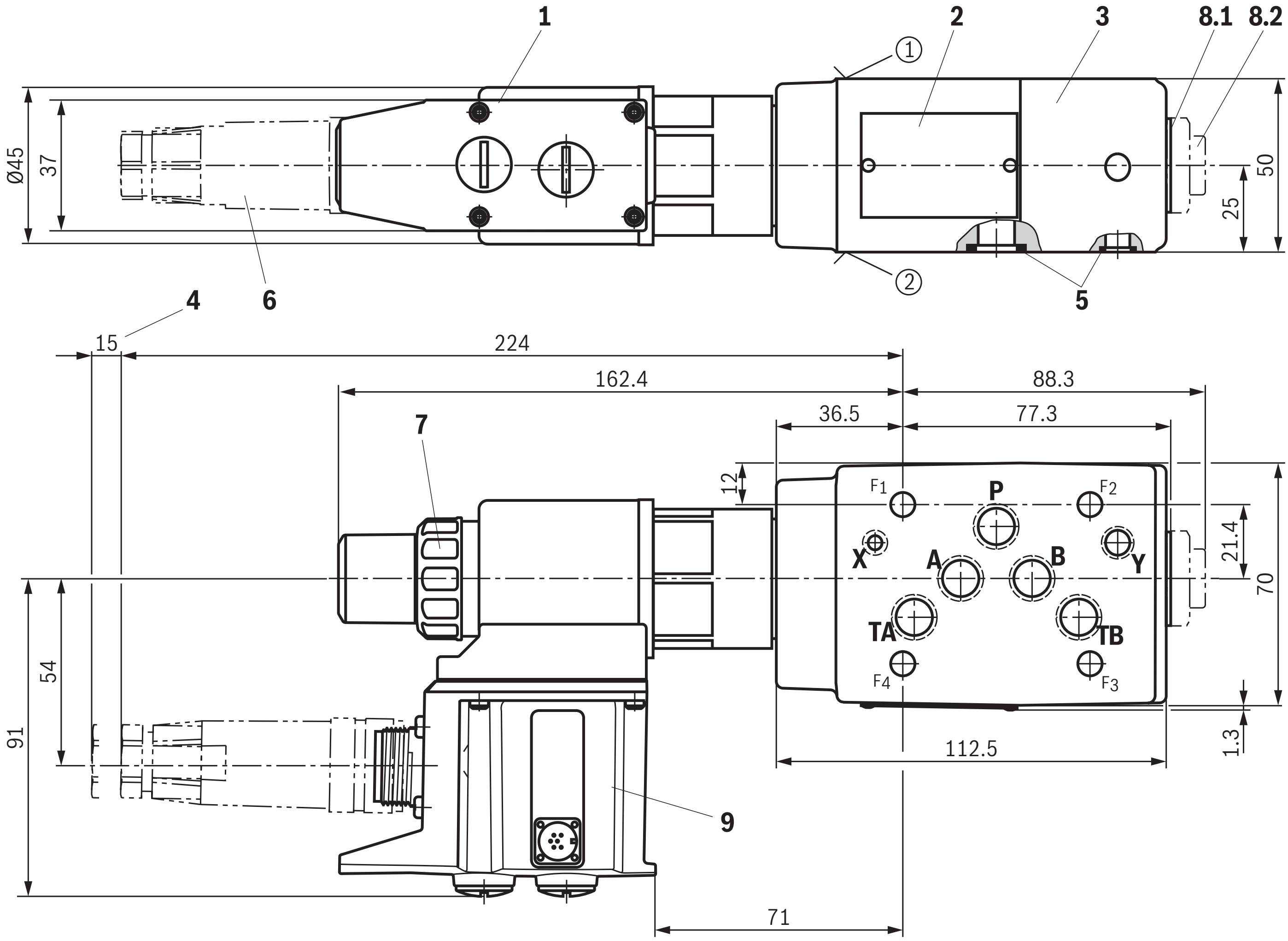
② plate side – porting pattern according to ISO 4401-05-05-0-05

- **1** Solenoid coil
- **2** Name plate
- **3** Valve housing
- **4** Space required for removing the mating connector
- **5** Identical seal rings for ports A, B, P, T (plate side)
  Identical seal rings for ports X and Y (plate side)
- **6** Mating connector, separate order, see page 16
- **7** O-ring and plastic nut SW32 for coil fixation.
  The nut can be loosened by rotating it counterclockwise (1 turn). The solenoid coil can then be rotated to the required position before fixing it again by tightening the nut (tightening torque 4^{+1} Nm)
- **8.1** Without pressure measuring port (standard)
- **8.2** Pressure measuring port (version "MS"); when loosening the plug screw (internal hexagon SW6, tightening torque $\boldsymbol{M}_A$ = 20 Nm ±10%), hold the reducing piece SW24

Valve mounting screws (separate order)
4 hexagon socket head cap screws ISO 4762 - M6 - 10.9

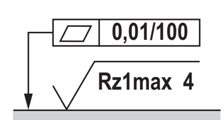
Notes:
- Length and tightening torque of the valve mounting screws must be calculated according to the components mounted under and over the sandwich plate valve.
- Deviating from ISO 4401, port T is called TA and port T1 is called TB in this data sheet.
- The dimensions are nominal dimensions which are subject to tolerances.

Dimensions: Integrated electronics "Z3DREE" (dimensions in mm)



① component side – porting pattern according to ISO 401-05-05-0-05

② plate side – porting pattern according to ISO 4401-05-05-0-05



Required surface quality of the valve contact surface

- **1** Solenoid coil
- **2** Name plate
- **3** Valve housing
- **4** Space required for removing the mating connector
- **5** Identical seal rings for ports A, B, P, T (plate side)
  Identical seal rings for ports X and Y (plate side)
- **6** Mating connector, separate order, see page 16
- **7** O-ring and plastic nut SW32 for coil fixation.
  The nut can be loosened by rotating it counterclockwise (1 turn). The solenoid coil can then be rotated to the required position before fixing it again by tightening the nut (tightening torque 4^{+1} Nm)
- **8.1** Without pressure measuring port (standard)
- **8.2** Pressure measuring port (version "MS"); when loosening the plug screw (internal hexagon SW6, tightening torque M_A = 20 Nm ±10%), hold the reducing piece SW24
- **9** Integrated electronics with connector

Valve mounting screws (separate order)
4 hexagon socket head cap screws ISO 4762 - M6 - 10.9

Notes:
- Length and tightening torque of the valve mounting screws must be calculated according to the components mounted under and over the sandwich plate valve.
- Deviating from ISO 4401, port T is called TA and port T1 is called TB in this data sheet.
- The dimensions are nominal dimensions which are subject to tolerances.

Accessories (separate order)

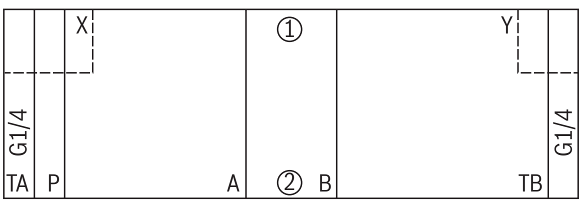
Valves with external control electronics

Mating connectors 2-pole + PE	Design	Material number	Data sheet
For valves with "K4" connector, 2+PE, design A (large cubic connector) 12 ... 240 V, 16 A, black, M16 x 1.5	Plastic	**R901017011**	08006

Valves with integrated electronics

Mating connectors 6-pole + PE	Structural shape	Design	Material number	Data sheet
For the connection of valves with integrated electronics, round connector 6+PE, line cross-section 0.5 ... 1.5 mm²	straight	Metal	**R900223890**	08006
	straight	Plastic	**R900021267**	08006

Sandwich plate type HSZ



Sandwich plate type HSZ 10 B097-3X/M01

Dimensions (length x width x height)	100 x 70 x 30 mm
Weight	2.5 kg
Size of ports X and Y	G1/4
Material no.	**R900320785**
Data sheet	48052

Subplates (separate order) with porting pattern according to ISO 4401-05-05-0-05, see data sheet 45100.

Further information

- Valve amplifier for proportional valves without electrical position feedback — Data sheet 30232
- Subplates — Data sheet 45100
- Hydraulic fluids on mineral oil basis — Data sheet 90220
- Environmentally compatible hydraulic fluids — Data sheet 90221
- Flame-resistant, water-free hydraulic fluids — Data sheet 90222
- Flame-resistant hydraulic fluids - containing water (HFAE, HFAS, HFB, HFC) — Data sheet 90223
- Reliability characteristics according to EN ISO 13849 — Data sheet 08012
- Mating connectors and cable sets for valves and sensors — Data sheet 08006
- Hydraulic valves for industrial applications — Operating instructions 07600-B
- Selection of filters
- Information on available spare parts

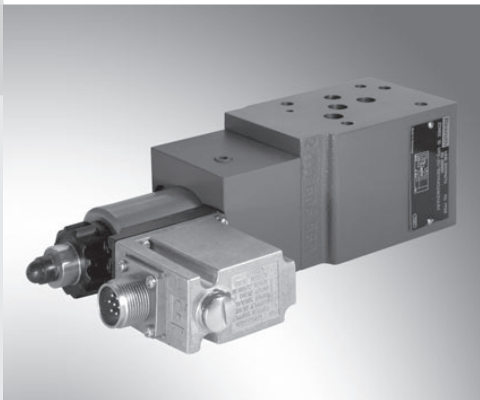
Rexroth
Bosch Group

Proportional pressure reducing valve, pilot operated

RE 29279/12.10
Replaces: 01.09

Types ZDRE; ZDREE

Size 10
Component series 2X
Maximum pressure setting 315 bar
Maximum flow 80 l/min



TB0220

Table of contents

Features

- Pilot operated valve for reducing a system pressure
- Actuation by proportional solenoid, which can be rotated
- Sandwich plate design
- Porting pattern to DIN 24340-A and ISO 4401
- 4 pressure ratings
- Valve and control electronics from a single source
- External control electronics for type ZDRE
- Linear command value/pressure characteristic curve
- Integrated electronics (OBE) with type ZDREE, with low manufacturing tolerance of the command value/pressure characteristic curve

Ordering code

Z	DRE		10	VP	2	–2X /		M	G24				*

Sandwich plate = **Z**

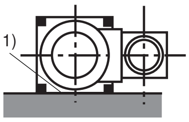
Proportional pressure reducing valve = **DRE**

For external electronics = **No code**
With integrated electronics = **E**

Size 10 = **10**

Pressure reduction in channel P1 = **VP**

Preferred position of mating connector = 2



The mating connector can be brought to the desired position after the nut was loosened (see page 13)

[1] Valve contact face (O-ring recesses in the housing)

Component series 20 to 29 = **2X**
(20 to 29: unchanged installation and connection dimensions)

Pressure rating
Up to 50 bar = **50**
Up to 100 bar = **100**
Up to 200 bar = **200**
Up to 315 bar = **315**

Pilot oil supply/drain
Y = Pilot oil supply for directional valve from port P2, external pilot oil drain for directional valve and ZDRE
XY = External pilot oil supply for directional valve, external pilot oil drain for directional valve and ZDRE
L = Pilot oil supply for directional valve from P2, internal pilot oil drain for directional valve and external for ZDRE
XL = Pilot oil supply from P2 to X is plugged (direct operated directional valve needs **no** pilot oil), pilot oil drain of directional valve is plugged (direct operated directional valve needs **no** pilot oil drain), external pilot oil drain for ZDRE

Note: If no pilot oil supply is provided on the subplate, use sandwich plate HSZ 10 B097-3X/M01 for the supply.

M = Without check valve

Supply voltage of control electronics
G24 = DC voltage 24 V

Electrical connection
for ZDRE
K4 = **Without** mating connector, with component plug to DIN EN 175301-803
for ZDREE
K31 = **Without** mating connector, with component plug to DIN EN 175201-804

Electronics interface
A1 = Command value 0 to 10 V
F1 = Command value 4 to 20 mA
No code = For ZDRE

Seal material
M = NBR seals,
V = FKM seals

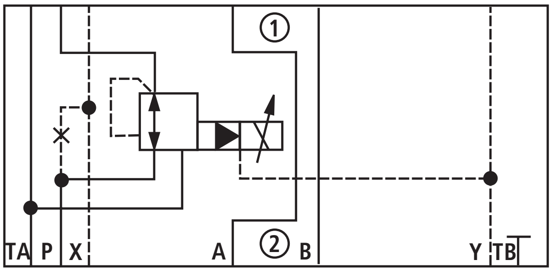
Further details in clear text

Accessories (not included in scope of supply)

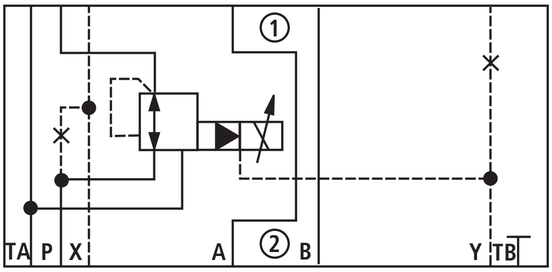
- Sandwich plate with X and Y port (for details, see page 3)
  Type HSZ 10 B097-3X/M01
  Material no.: **R900320785**
- Subplates to data sheet RE 45054
  - G 535/01 (G3/4), Material no. **R900476061**
  - G 536/01 (G1), Material no. **R900476059**
- External control for type ZDRE:
  - Analog amplifier VT-MSPA1-11-1X/V0 of modular design to data sheet RE 30223
  - Digital amplifier VT-VSPD-1-2X/V0/.-0-1 of Euro-card format to data sheet RE 30523
  - Analog amplifier VT-VSPA1-11-1X/V0/0 of Euro-card format to data sheet RE 30100
- Mating connectors (for details, see page 8)
  - For ZDRE: to DIN EN 175301-803, Material no. **R901017011**
  - For ZDREE: to DIN EN 175201-804, Material no. **R900021267** or **R900223890**

Symbols (① = component side, ② = plate side)

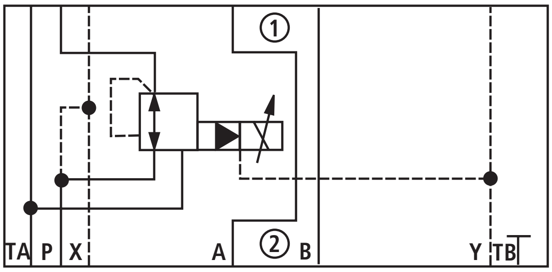
Type ZDRE



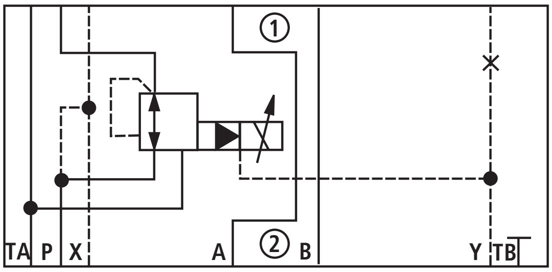
Type ZDRE10VP…**XY**



Type ZDRE10VP…**XL**

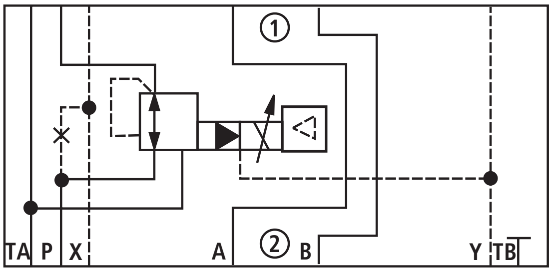


Type ZDRE10VP…**Y**

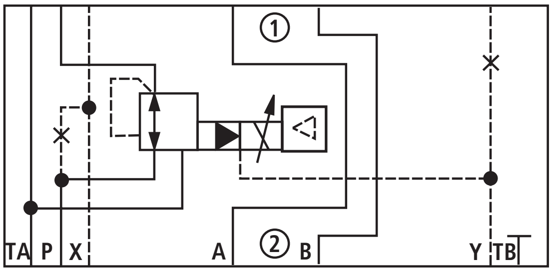


Type ZDRE10VP…**L**

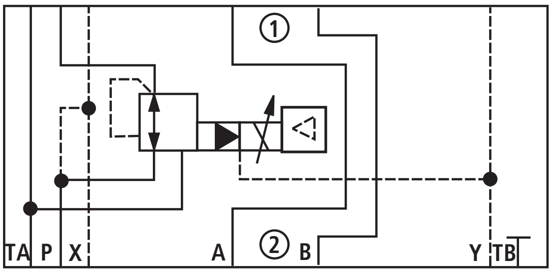
Type ZDREE



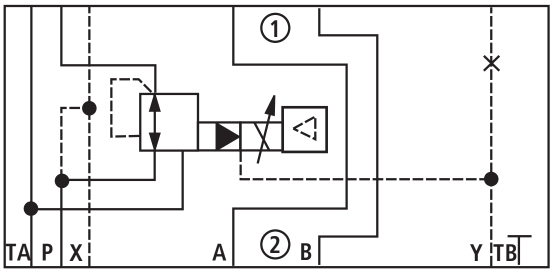
Type ZDREE10VP…**XY**



Type ZDREE10VP…**XL**

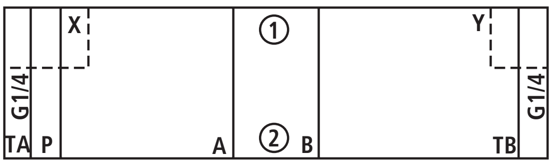


Type ZDREE10VP…**Y**



Type ZDREE10VP…**L**

Type sandwich plate HSZ



Sandwich plate HSZ 10 B097-3X/M01

- Dimensions (length x width x height): 100 x 70 x 30 mm
- Weight: 2.5 kg
- Size of ports X and Y: G1/4
- Dimensional sheet no.: R900262648

Function, section

Type ZDRE

Valves of type ZDRE... are pilot operated pressure reducing valves of sandwich plate design in 3-way variant, i.e. with pressure limitation of the actuator pressure.

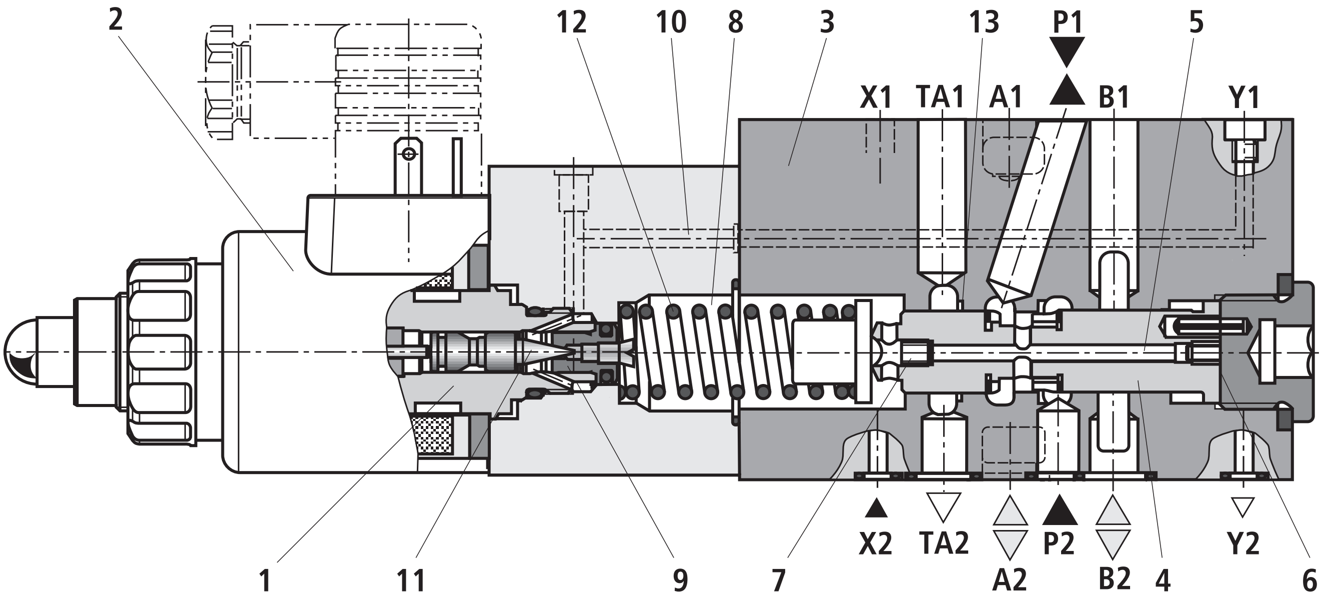
They are used for reducing a system pressure.

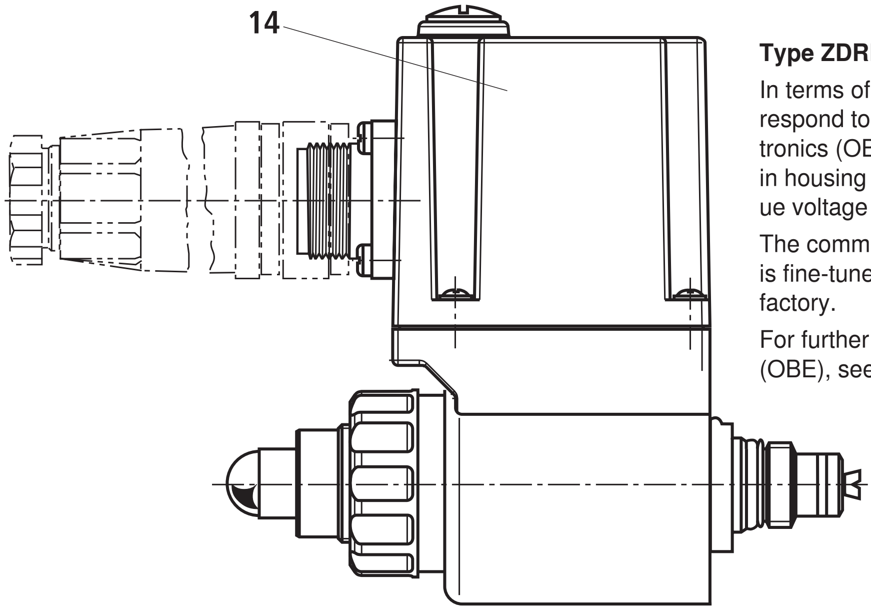
They basically consist of pilot part (1) with proportional solenoid (2), main valve (3) and control spool (4). The pressure in channel P1 is adjusted in dependence on the command value via proportional solenoid (2).

In the rest position, i.e. when no pressure is present in channel P2, control spool (4) opens the connection from channel P2 to P1.

The pressure in channel P1 acts via bore (5) onto spool area (6). The pilot oil for the pilot valve is taken from channel P1 and flows via bore (5), orifice (7), to spring chamber (8). From there, it is fed via valve seat (9), bore (10) and Y-line back to the tank.

The pressure required in channel P1 is pre-selected on the associated amplifier. The proportional solenoid moves valve poppet (11) towards valve seat (9) and increases the pressure in spring chamber (8). Thus, the pressure in both chambers (6) and (8) is balanced, and compression spring (12) pushes spool (4) to the right in the opening direction P2 to P1. As soon as actuator pressure P1 has increased to the value set on the pilot valve, valve poppet (11) opens and limits the pressure in spring chamber (8). Control spool (4) now moves to the left to the control position. When actuator pressure P1 exceeds the value set on the pilot valve, the control spool is pushed further to the left. It closes the connection from P2 to P1 and opens the connection P1 to tank TA1 at control land (13) until this pressure falls again to the set value.





Type ZDREE – with integrated electronics (OBE)

In terms of function and structure, these valves correspond to type ZDRE, except for the integrated electronics (OBE). The electronics (OBE) accommodated in housing (14) receives its supply and command value voltage via the mating connector.

The command value/pressure characteristic curve is fine-tuned with low manufacturing tolerance in the factory.

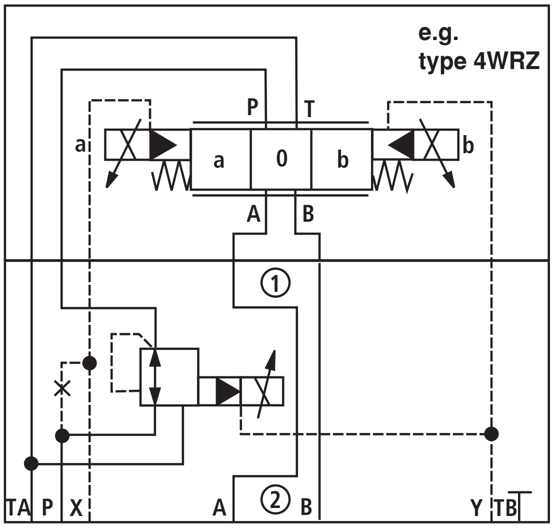
For further details on the integrated electronics (OBE), see page 9.

Pilot oil supply for directional valve mounted above

Notes

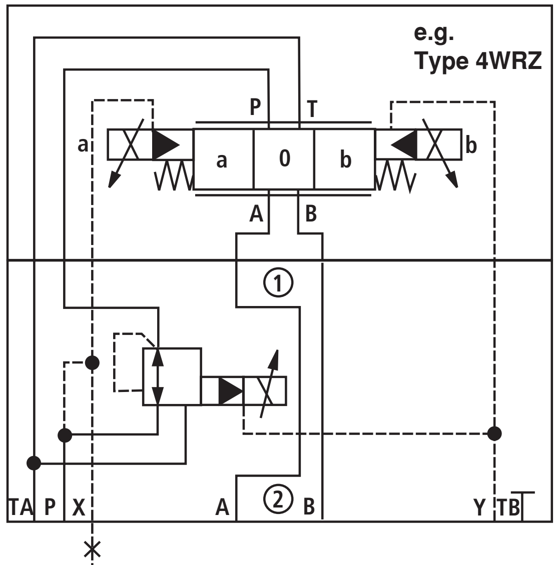
- On the **direct operated** directional valve, the seals for ports X and Y are missing on the connection faces of the housing. To prevent hydraulic fluid from flowing out, the pilot oil supply from P2 to X and the pilot oil drain between the directional valve and the ZDRE(E) must be plugged (variant XL).
- Leakage through the spool clearance from P to B can result in pressure building up in channel B!
- A **pilot operated** proportional directional valve in conjunction with the ZDRE(E) must have an **external pilot oil supply**.

On variants XY and XL the connection between P2 and X is plugged.

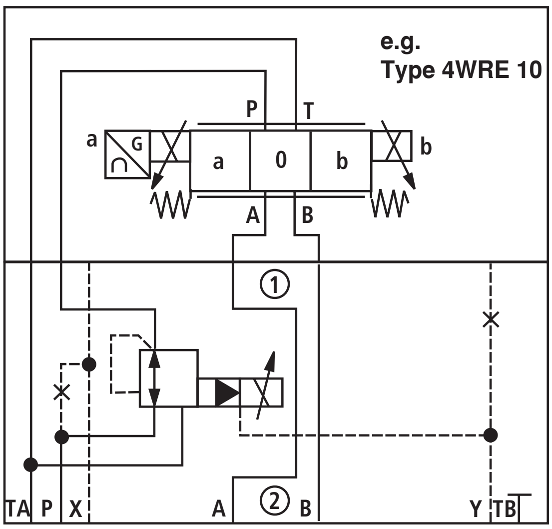


Type ZDRE(E) 10…2X/…**XY**

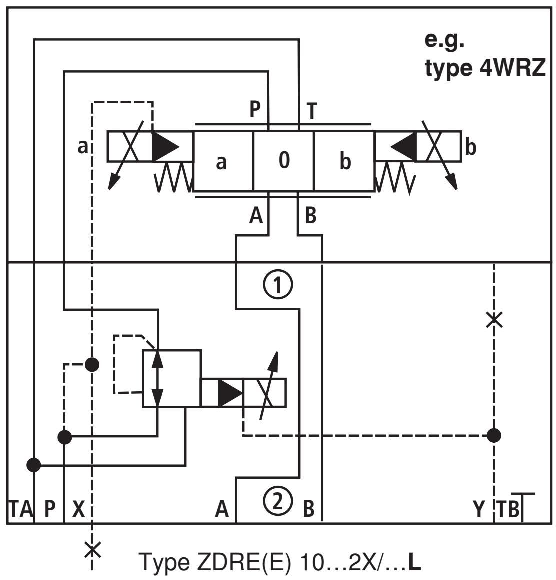
On variants Y and L port X must be plugged on the subplate.



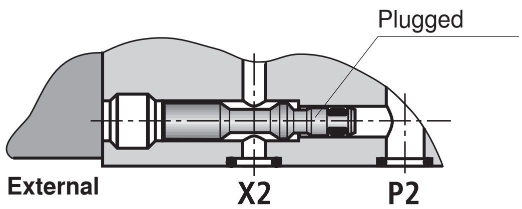
Type ZDRE(E) 10…2X/…**Y**

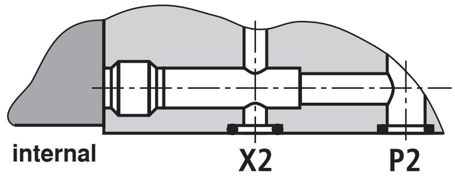


Type ZDRE(E) 10…2X/…**XL**



Type ZDRE(E) 10…2X/…**L**





Technical data (for applications outside these parameters, please consult us!)

General

Weight	ZDRE	kg	5.1
	ZDREE	kg	5.2
Installation orientation			Preferred orientation of the proportional solenoid: pointing downwards or horizontal
Storage temperature range		°C	–20 to +80
Ambient temperature range	ZDRE	°C	–20 to +70
	ZDREE	°C	–20 to +50

Hydraulic (measured with HLP 46; ϑ_{oil} = 40 °C ± 5 °C)

Maximum operating pressure	Port P1	bar	315	The pressure in an P2 must be about 20 bar higher than the required set pressure, which is to be achieved in P1.
	Ports P2; A; B; X	bar	350	
	Port T	bar	250	
	Port Y or L		Line separately and at zero pressure to tank	
Maximum set pressure in port P1	Pressure rating 50 bar	bar	50	
	Pressure rating 100 bar	bar	100	
	Pressure rating 200 bar	bar	200	
	Pressure rating 315 bar	bar	315	
Min. set pressure in channel P1 with zero command value		bar	See $p_{E\ min}$-q_v characteristic curve on page 12	
Permissible max. flow		l/min	80	
Pilot flow		l/min	0.6 to 0.9	
Hydraulic fluid			Mineral oil (HL, HLP) to DIN 51524, further hydraulic fluids on request	
Hydraulic fluid temperature range		°C	–20 to +80	
Viscosity range		mm²/s	15 to 380	
Permissible max. degree of contamination of the hydraulic fluid - cleanliness class to ISO 4406 (c)			Class 20/18/15 [1)]	
Hysteresis		%	±3 of maximum set pressure	
Repeatability		%	< ±2 of maximum set pressure	
Linearity		%	±3.5 of maximum set pressure	
Manufacturing tolerance of command value/pressure characteristic curve, referred to hysteresis characteristic curve	ZDRE [2)]	%	±5 of set max. pressure	
	ZDREE [3)]	%	±1.5 of set max. pressure	
Step response $T_u + T_g$	10 → 90%	ms	~160	Measured with 5 liters of a standing hydraulic fluid column in port P1
	90 → 10%	ms	~160	

[1)] The cleanliness classes specified for components must be adhered to in hydraulic systems. Effective filtration prevents malfunction and, at the same time, prolongs the service life of components.
For the selection of filters, see data sheets RE 50070, RE 50076, RE 50081, RE 50086 and RE 50088.

[2)] For details, see page 10

[3)] Adjustment in the factory

Technical data (for applications outside these parameters, please consult us!)

Electrical

Minimum solenoid current		mA	100
Maximum solenoid current		mA	1600 ± 10 %
Solenoid coil resistance	Cold value at 20 °C	Ω	5.5
	Max. warm value	Ω	8.05
Duty cycle		%	100

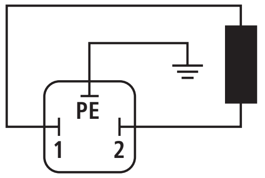
Electrical, integrated electronics (OBE)

Supply voltage	Nominal voltage	VDC	24
	Lower limit value	VDC	21
	Upper limit value	VDC	35
Current consumption		A	≤ 1.5
Required fuses		A	2, slow-blowing
Inputs	Voltage	V	0 to 10
	Current	mA	4 to 20
Output	Actual current value	mV	1 mV ≙ 1mA
Type of protection of the valve to EN 60529			IP 65 with mating connector mounted and locked

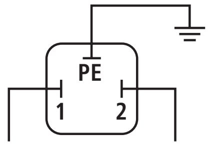
Electrical connection (dimensions in mm)

ZDRE

Connection to component plug

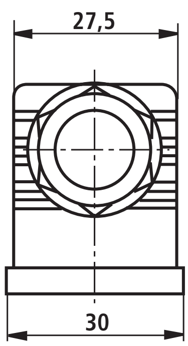


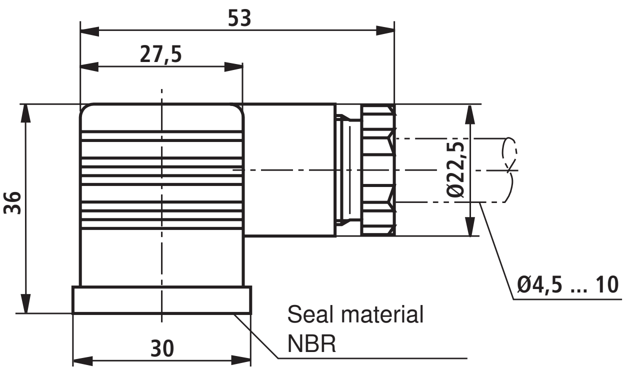
Connection to mating connector



to amplifier

Mating connector (black) to
DIN EN 175301-803
Material no. **R901017011**
(separate order)



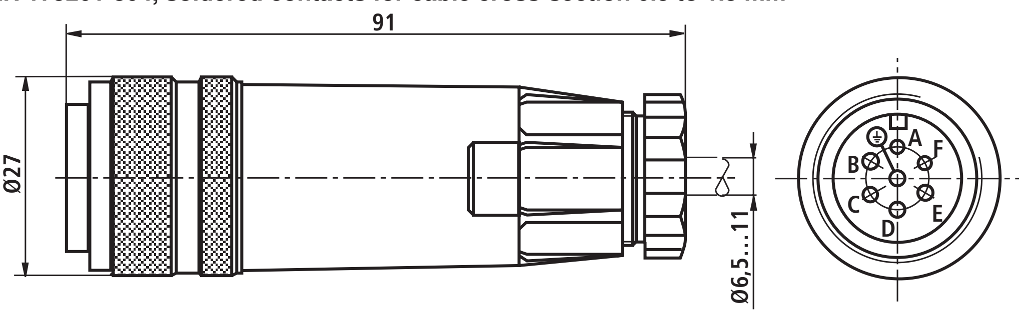


ZDREE

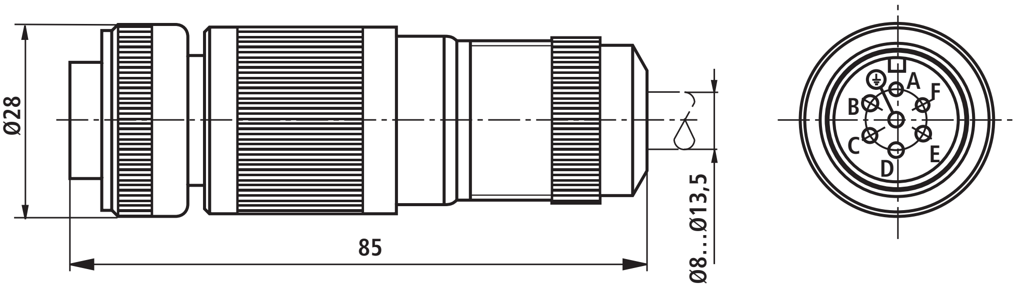
Component plug pinout	Contact	Pinout of interface “A1“	Pinout of interface “F1“
Supply voltage	A	24 VDC (u(t) = 21 V to 35 V); $I_{max} \leq$ 1.5 A	
	B	0 V	
Actual value reference potential	C	Reference contact F; 0 V	Reference contact F; 0 V
Differential amplifier input	D	0 to 10 V; R_i = 100 kΩ	4 to 20 mA; R_i = 100 Ω
	E	Command value reference potential	
Measurement output (actual value)	F	0 to 1.6 V actual value (1 mV ≙ 1 mA) Load resistance > 10 kΩ	
	PE	Connected to solenoid and valve housing	

Mating connectors to DIN EN 175201-804, soldered contacts for cable cross-section 0.5 to 1.5 mm²

Plastic variant,
Material no. **R900021267,**
(separate order)



Metal variant,
Material no. **R900223890**
separate order

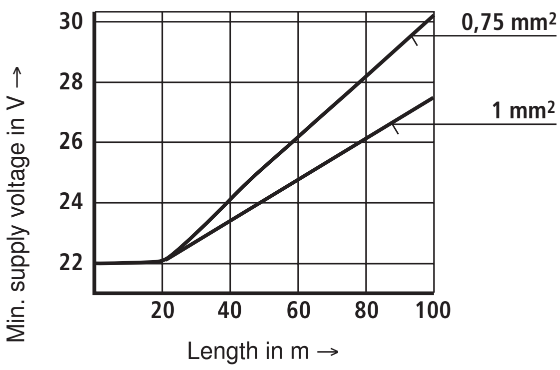


Electrical connection

Connection cable for ZDREE

– Recommendation: 6-wire, 0.75 or 1 mm² plus protective earth conductor and shield
– Connect shield only on the supply side to PE
– Permissible max. length 100 m

The minimum supply voltage on the power supply unit depends on the length of the supply cable (see diagram).



Integrated electronics (OBE) of type ZDREE

Function

Power supply to electronics via connections A and B. The command value is applied to differential amplifier connections D and E.

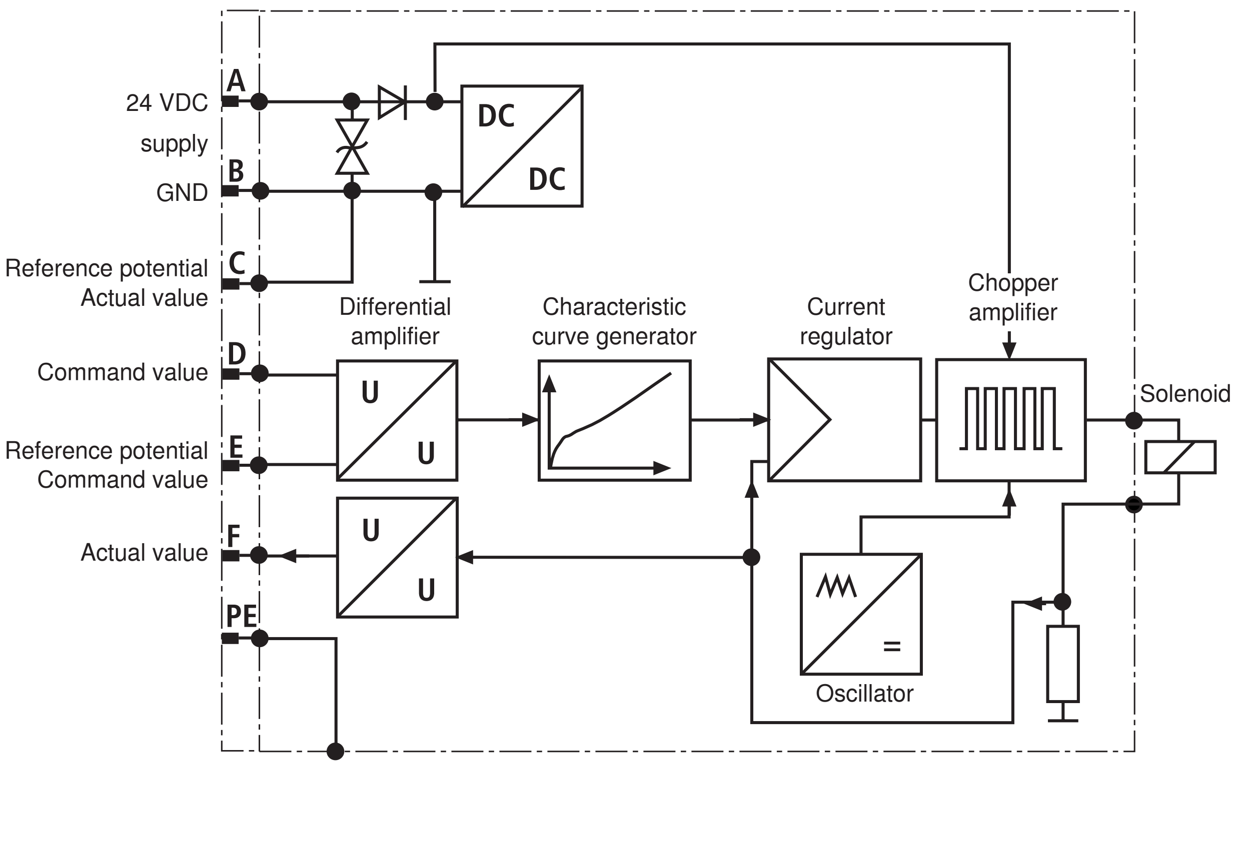
The characteristic curve generator adapts the command value/solenoid current characteristic curve to the valve so that non-linearities in the hydraulics are compensated for and a linear command value/pressure characteristic curve is obtained.

The current regulator regulates the solenoid current independently of the solenoid coil resistance.

A chopper amplifier with a clock frequency of ca. 180 Hz to 400 Hz forms the power output stage of the electronics for controlling the proportional solenoid. The output signal is pulse-width-modulated (PWM).

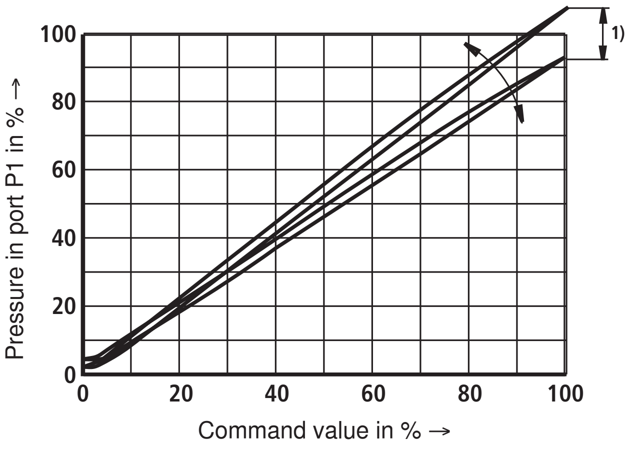
For testing the solenoid current, a voltage, which is proportional to the solenoid current, can be measured between pin F(+) and pin C(–) on the plug-in connector. **1 mV** corresponds to a solenoid current of **1 mA**.

Block circuit diagram



Characteristic curves (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C)

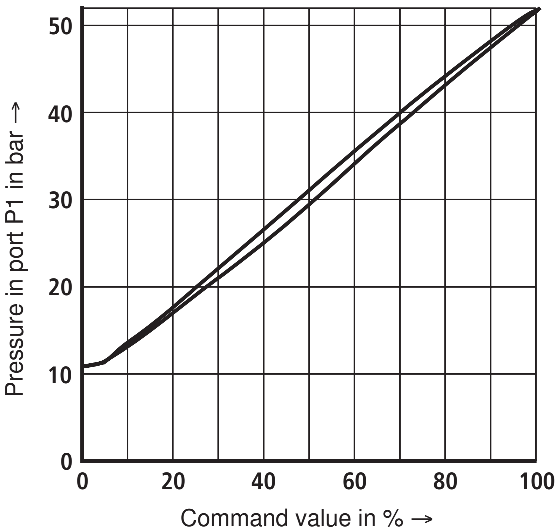
Reduced pressure in port P1 in dependence upon the command value (manufacturing tolerance)



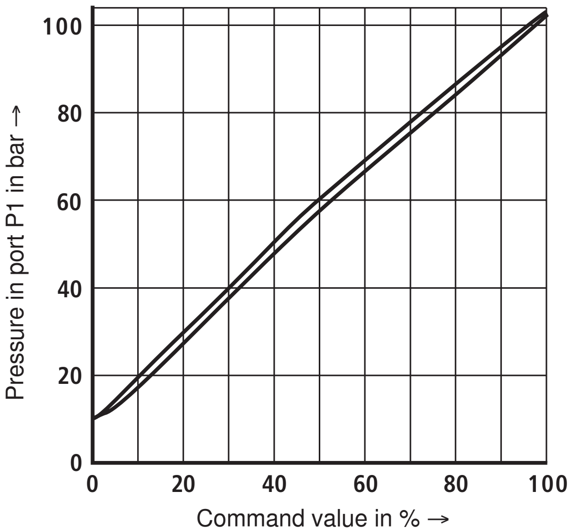
[1)] For valve ZDRE the tolerance can be modified on the **external amplifier** (for type and data sheet, see page 2) using command value attenuator potentiometer "**Gw**" . The digital amplifier can be adjusted by means of parameter "Limit".
Here, the control current specified in the technical data must not be exceeded.
In order that several valves can be matched to the same characteristic curves, the pressure at a command value of 100 % must not be set higher than the maximum pressure setting of the pressure rating.

Pressure in port P1 in dependence upon the command value (at flow 0 l/min)

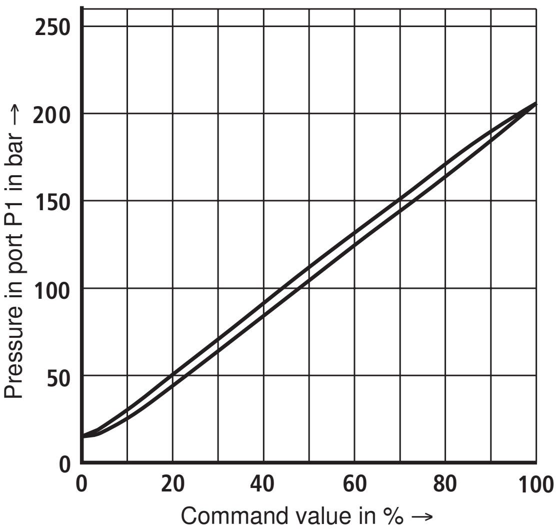
Pressure rating 50 bar



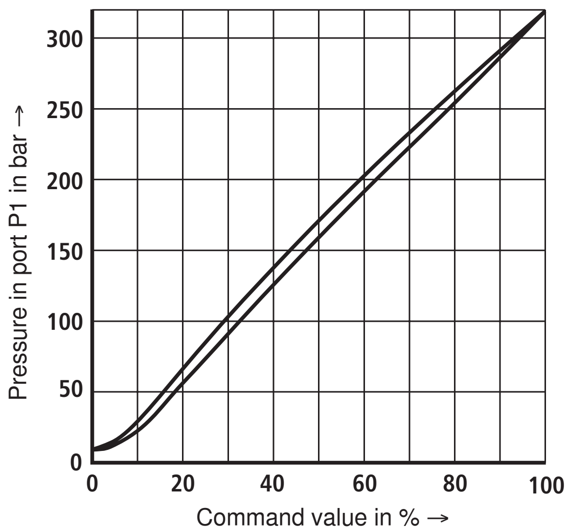
Pressure rating 100 bar



Pressure rating 200 bar

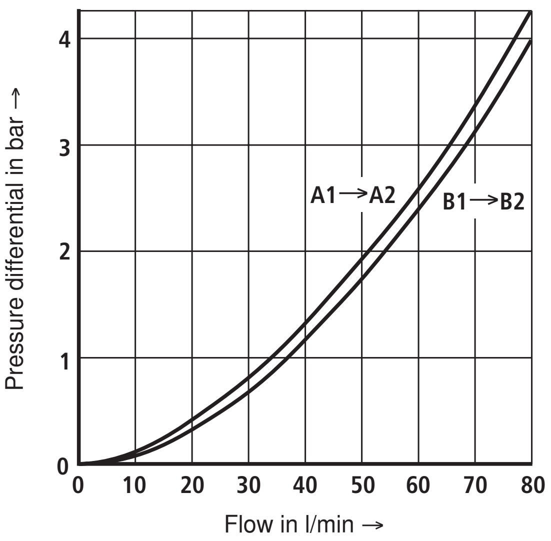


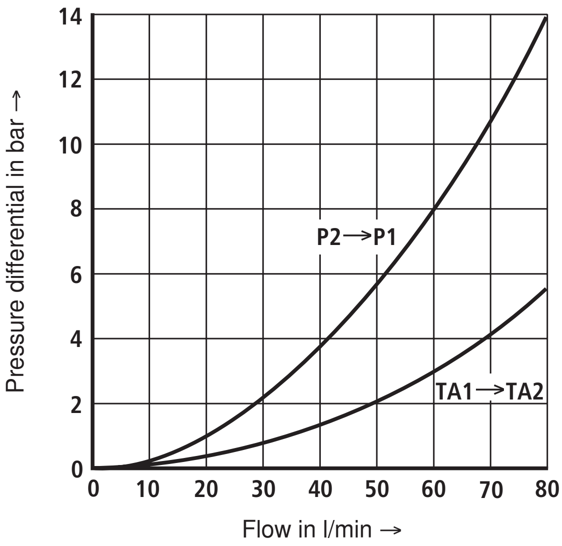
Pressure rating 315 bar



Characteristic curves (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C)

Pressure differential in dependence upon the flow

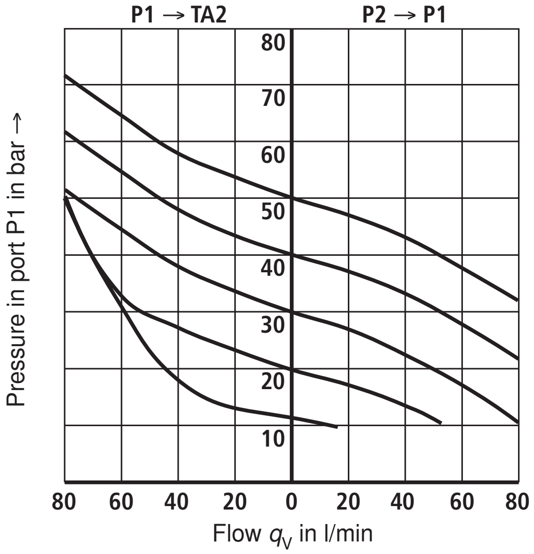




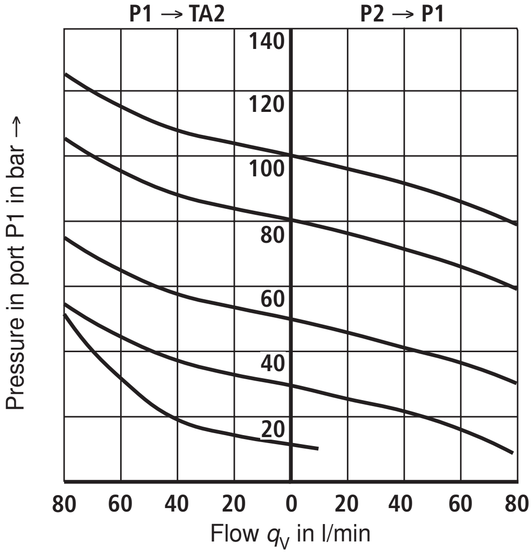
Characteristic curves (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C)

Pressure in port P1 in dependence upon the flow

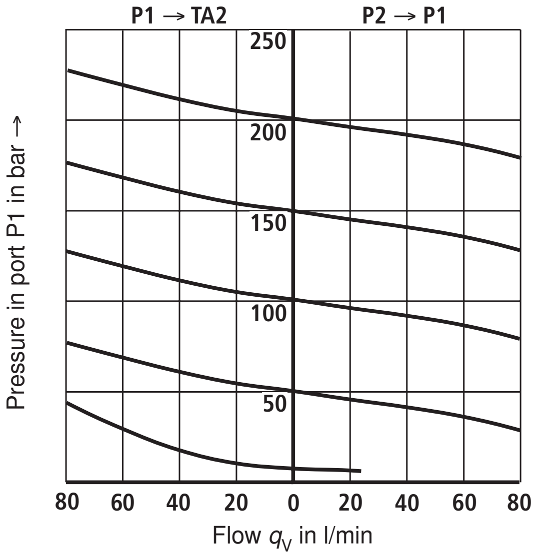
Pressure rating 50 bar



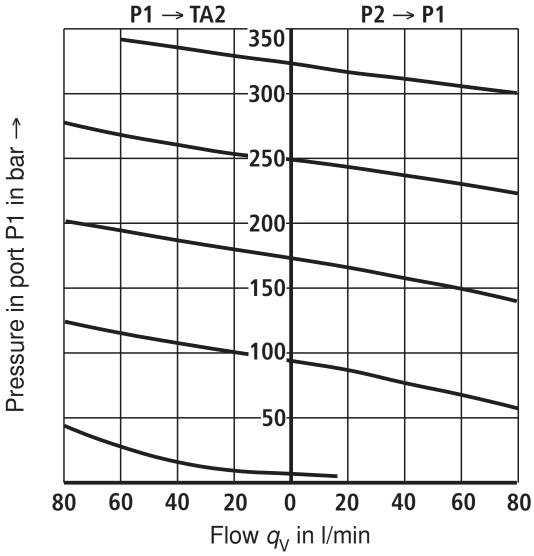
Pressure rating 100 bar



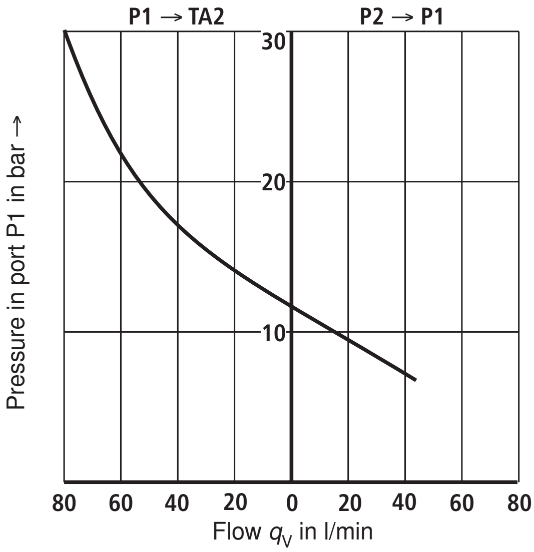
Pressure rating 200 bar



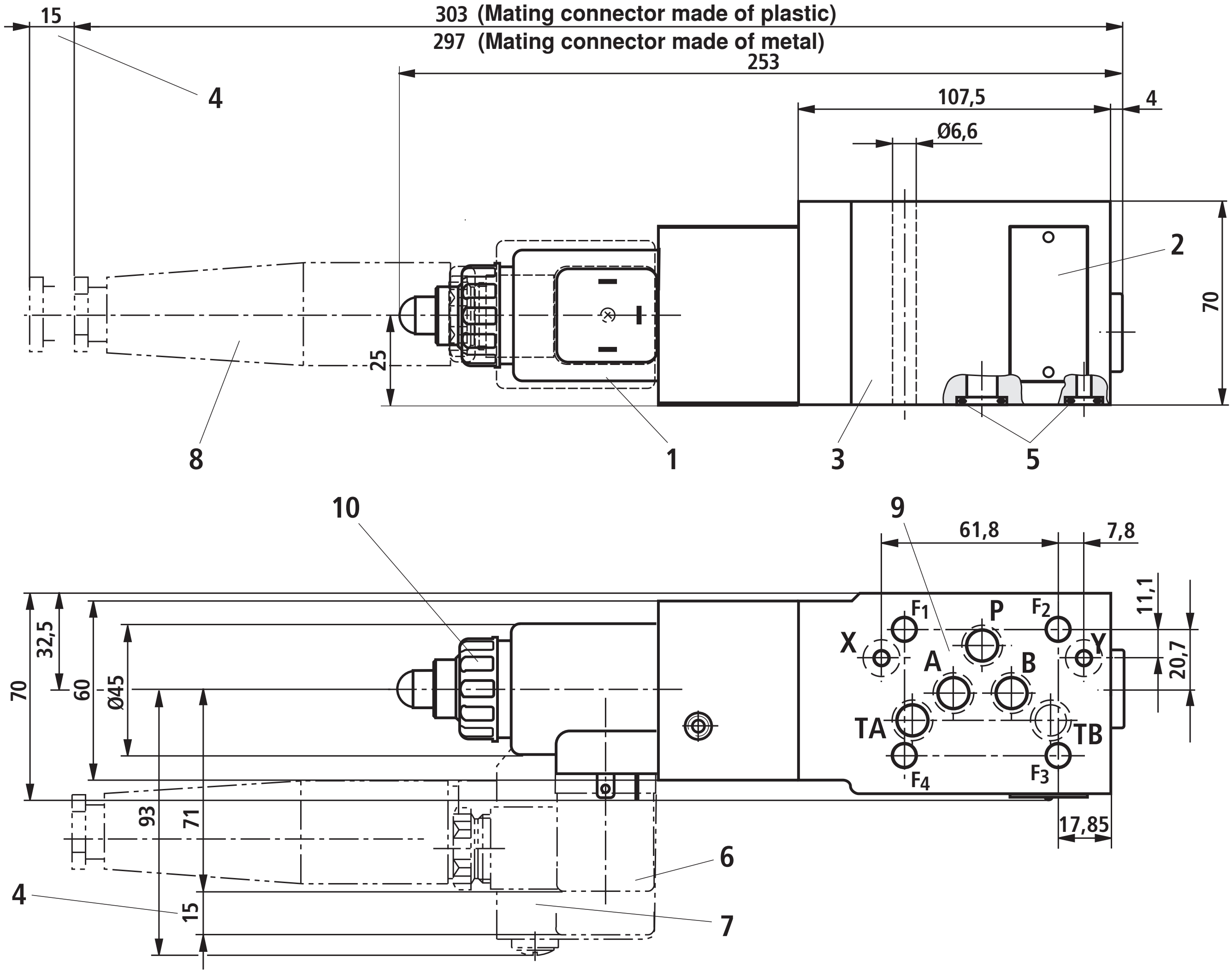
Pressure rating 315 bar

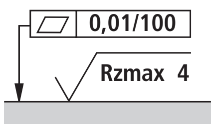


Min. set pressure in dependence upon the flow at zero command value



Unit dimensions (dimensions in mm)





Required surface quality of valve mounting face

1 Solenoid coil
2 Nameplate
3 Valve housing
4 Space required to remove mating connector
5 Identical seal rings for ports A2, B2, P2, TA2, TB2
Identical seal rings for ports X2, Y2
6 Mating connector for type ZDRE
(separate order)
7 Integrated electronics (type ZDREE) with component plug
8 Mating connector for type ZDREE,
plastic or metal variant,
(separate order)
9 Porting pattern to DIN 24340-A10
and ISO 4401-05-05-0-05 (X, Y as required)
10 O-ring and plastic nut A/F 32 for coil mounting
The nut can be loosened by turning it counter-clockwise (1 turn). The solenoid coil can then be rotated to the desired position and fixed by tightening the nut.
Tightening torque: 4+1 Nm

Valve mounting screws

4 hexagon socket head cap screws ISO 4762-M6-10.9-flZn-240h-L
(Friction coefficient μ_{total} = 0.09 to 0.14);
tightening torque M_T = 12.5 Nm ± 10 %

or

4 hexagon socket head cap screws ISO 4762-M6-10.9
(Friction coefficient μ_{total} = 0.12 to 0.17);
tightening torque M_T = 15.5 Nm ± 10 %

Screw length as required

RE 29283
Edition: 2021-04
Replaces: 2020-11

rexroth
A Bosch Company

Proportional pressure reducing valve, pilot-operated, with or without integrated digital electronics (OBED)

Type 3DRE(E)(A) and Z3DRE(E)(A)

H8172+8173

- Size 6
- Component series 2X
- Maximum operating pressure 350 bar
- Maximum flow 60 l/min

CE

IO-Link

Features

- Pressure-controlled, optional
- Pressure reduction in ports A and P① with pressure limitation
- For subplate mounting or sandwich plate design
- With integrated digital electronics (OBED), optional
- CE conformity according to EMC Directive 2014/30/EU
- Linear command value pressure characteristic curve
- With integrated and external pressure sensor, optional
- Pressure sensor adjustable for various applications
- Digital (IO-Link, Bluetooth®) and analoge interfaces, optional
- Optional via Bluetooth®, fast and easy analysis and structural adjustment by means of app function

Contents

Ordering code

01	02	03	04	05	06	07		08		09	10	11	12	13	14	15	16	17
	3	**DRE**		**6**			**–**	**2X**	**/**			**G24**						*****

01	Subplate mounting	**no code**
	Sandwich plate	**Z**

02	3-way version	**3**

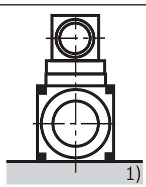
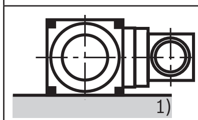
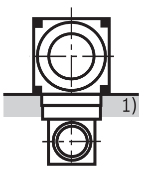
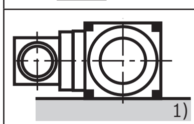
03	Proportional pressure reducing valve	**DRE**

04	For external control electronics	**no code**
	With integrated electronics (OBED)	**E**
	With integrated electronics (OBED), pressure-controlled	**A**

05	Size 6	**6**

06	Pressure reduction in channel A (subplate mounting)	**no code**
	Pressure reduction in channel P① (sandwich plate)	**VP**

Position of the mating connector (only sandwich plate design)

07		**1**
		**2**
		**3**
		**4**

08	Component series 20 ... 29 (20 ... 29: unchanged installation and connection dimensions)	**2X**

Pressure rating

09	50 bar	**50**
	100 bar	**100**
	200 bar	**200**
	315 bar	**315**

Pressure sensor

10	Internal	**no code**
	External (only with integrated electronics "A", pressure-controlled)	**A** 2)

Supply voltage

11	Direct voltage 24 V	**G24**

Coil

12	1600 mA	**no code**
	800 mA (only with external control electronics)	**-8**

Ordering code

01	02	03	04	05	06	07		08		09	10	11	12	13	14	15	16	17
	3	**DRE**		**6**			**–**	**2X**	**/**			**G24**						*****

Electrical connection

13	**– Type (Z)3DRE**	
	Without mating connector; connector DIN EN 175301-803	**K4** [3]
	– Type (Z)3DREE and (Z)3DREA – Version "A1", "F1"	
	Without mating connector; connector DIN EN 175201-804	**K31** [3]
	– Type (Z)3DREE and (Z)3DREA – Version "L1"	
	Without mating connector; connector cable sets M12, 4-pole	**K24** [3]

Electronics interface

14	External control electronics	**no code**
	Command value input and actual value output 0 ... 10 V [4]	**A1**
	Command value input and actual value output 4 ... 20 mA [4]	**F1**
	IO-Link interface (only with integrated electronics "E" and "A"; for class B) [5]	**L1**

Accessories, service interface

15	Without Bluetooth® interface	**no code**
	With Bluetooth® interface (only with integrated electronics "E" and "A")	**B**

Seal material (observe compatibility of seals with hydraulic fluid used, see page 8)

16	NBR seals	**M**
	FKM seals	**V**

17	Further details in the plain text	*****

1) Valve contact surface (seal ring recesses in the housing)

2) Pressure sensor adjustment via "easy2connect app" (for electrical connections and assignment, see page 11; pressure sensor, separate order, see page 26)

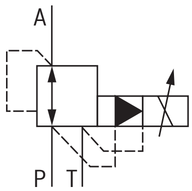
3) Mating connectors and cable sets, separate order, see page 26 and data sheet 08006.

4) Command value input switchable via Bluetooth® interface "B" ("A1" ↔ "F1")

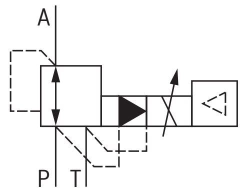
5) Only for use in the industrial area according to IO-Link specification and EN 61131-9. When used in the household / small business area, additional EMC measures are required for the I/O-Link system.

Symbols (① = component side, ② = plate side)

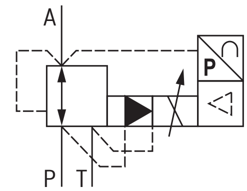
Type 3DRE



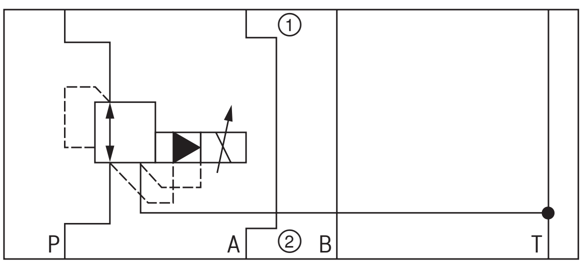
Type 3DREE; 3DREA ...A



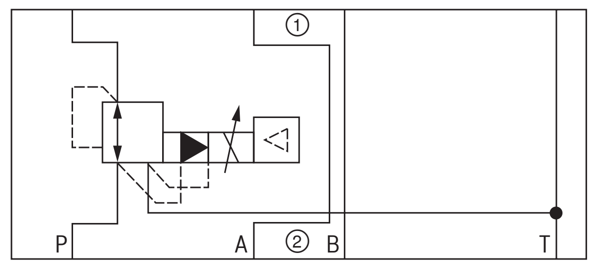
Type 3DREA



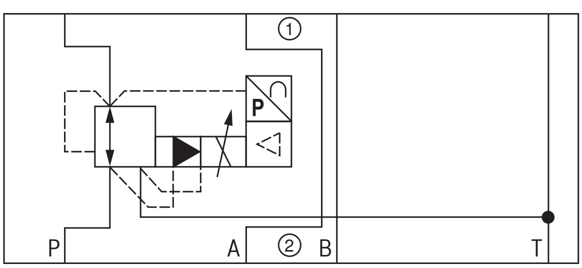
Type Z3DRE



Type Z3DREE, Z3DREA ...A



Type Z3DREA



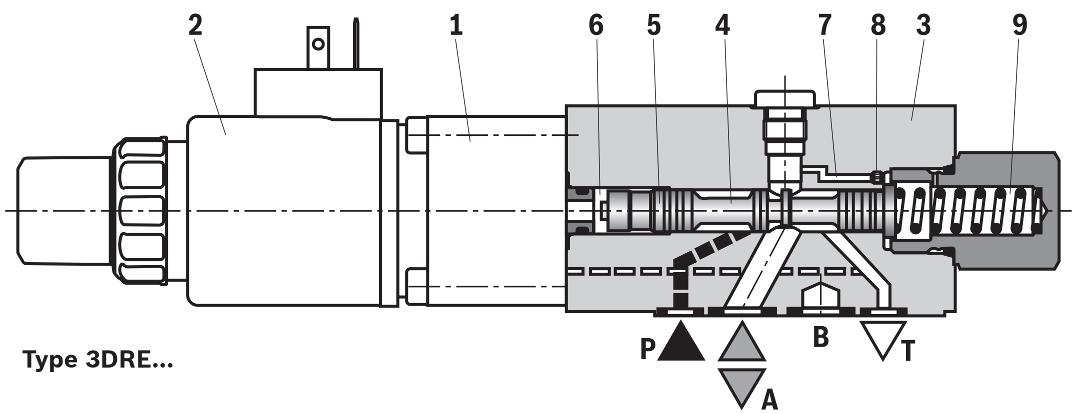
Function, section: Type (Z)3DRE

Valves of type 3DRE and Z3DRE are electrically pilot-operated 3-way pressure reducing valves with pressure limitation of the actuator. They are used for reducing a system pressure.
The valve basically consists of a pilot control valve (1), proportional solenoid (2), main valve (3) with main control spool (4).

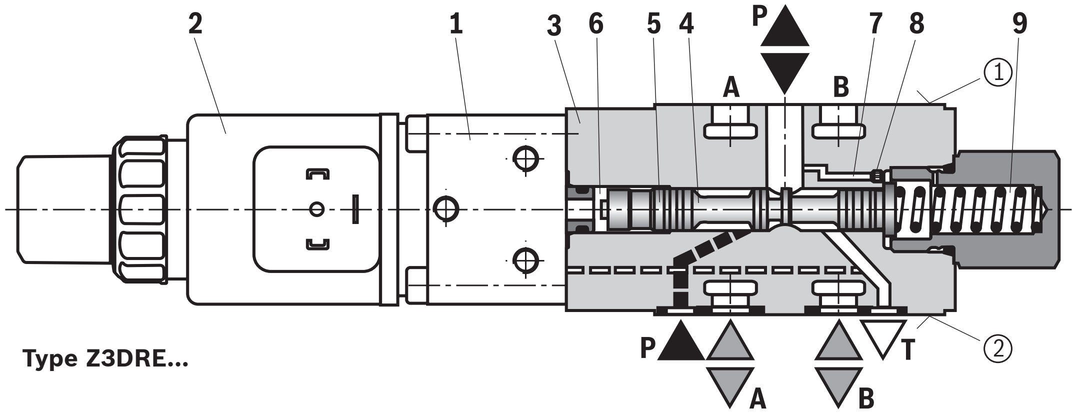
General
In rest position, i. e. without pressure in channel P, the spring holds the main control spool in initial position. This opens the connection from A (P①) to T and blocks the connection from P to A (P①).
With pressure connection from port P, pilot oil flows via flow controller (5) and nozzle and throttle gap to the pilot control valve (1) and afterwards flows off to channel T.
The command value-dependent setting of the pressure to be reduced in channel A (P①) is effected using the proportional solenoid.

Type 3DRE
The pilot pressure builds up in the control chamber (6) as function of the command value. This moves the main control spool (4) to the right, hydraulic fluid flows from P to A.
The actuator pressure in channel A is applied to the spring chamber (9) via the channel (7) and the nozzle (8). If the pressure in port A increases to the set pressure of the pilot control valve, this leads to the movement of the main control spool (4) to the left. The pressure in port A is almost identical with the set pressure at the pilot control valve.
If, however, the pressure in port A exceeds the set pressure of the pilot control valve, the main control spool (4) is moved further to the left so that the connection from A to T is opened. In this way, the pending pressure in port A is limited to the set command value.

Type Z3DRE
In principle, the function of this valve version corresponds to the function of type 3DRE.
The pressure reduction is, however, effected in channel P①.



Type 3DRE...



Type Z3DRE...

Function: Type (Z)3DREE and (Z)3DREA

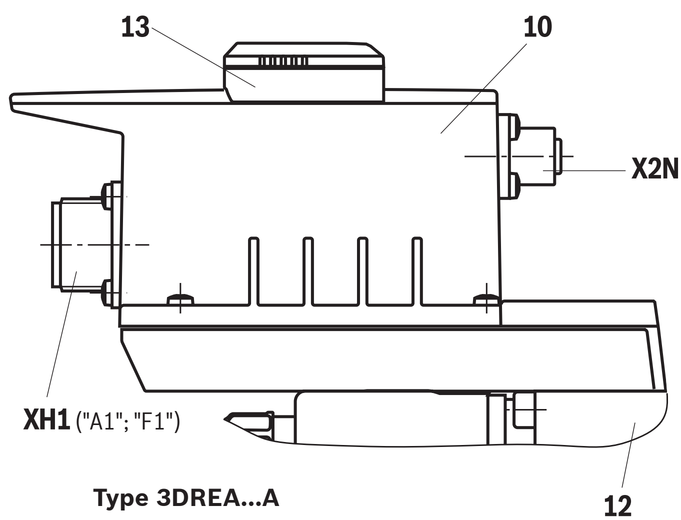
Type (Z)3DREE – with integrated digital electronics (OBED)
With regard to function and set-up, they correspond to valve type (Z)3DRE.
On the proportional solenoid, there is the digital on-board electronics (OBED) (10). It may be equipped with different electric interfaces:

- Analog interface (XH1)
  - Interface "A1" (command value 0 ... 10 V)
  - Interface "F1" (command value 4 ... 20 mA)
- Digital interface (XH5)
  - IO-Link "L1"

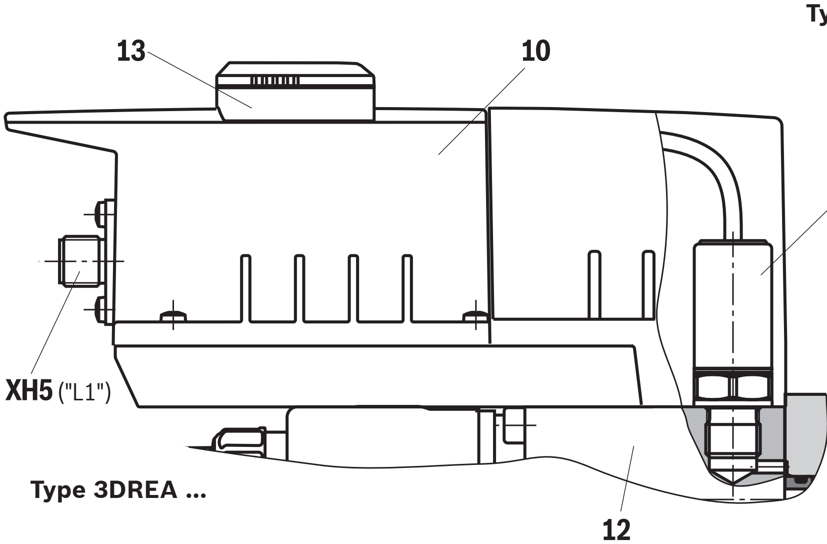
Type (Z)3DREA – with integrated digital electronics (OBED) and pressure control
With regard to function and set-up, they correspond to valve type (Z)3DREE.
This valve version moreover has a pressure transducer (11). The latter is either directly attached on the carrier (12) or may be externally integrated in the system via the interface (X2N).
The pressure in channel P is captured by means of the pressure transducer (11) and regulated independently of the flow via the integrated electronics (10).
The pressure in channel A (P①) is made available via the connector (XH1, XH5) as analog or digital actual value (0 ...10 V or 4 ... 20 mA or in the unit [bar]).
If the command value is zero, the integrated electronics only applies the minimum control current to the proportional solenoid and the minimum set pressure is applied.

Bluetooth® function
The digital on-board electronics (OBED) provides the user with a digital diagnosis interface via a Bluetooth® dongle (Bluetooth® Low Energy). It may also be ordered as accessory and retrofitted. The Bluetooth® dongle may only be attached when the valve is de-energized.
By means of the "easy2connect app", the valve status can be displayed and configurations at the valve can be carried out via the Bluetooth® dongle (13).

Notice:
- The "easy2connect app" can be downloaded in the App Store (iOS) or Google Play Store (Android).
- Further information on the Bluetooth® dongle VT-ZBT-1-1X (R901505294) as well as set-up and installation of the app is available in data sheet 30581 and operating instructions 30581-B.



Type 3DREA...A



Type 3DREA ...

Technical data
(For applications outside these values, please consult us!)

General			
Weight	▶ Type (Z)3DRE	kg	2.6
	▶ Type (Z)3DREE	kg	3.1
	▶ Type (Z)3DREA	kg	3.5
Installation position			any (preferably horizontal)
Storage temperature range		°C	−20 ... +80
Ambient temperature range	▶ without "OBED"	°C	−20 ... +80
	▶ with "OBED"	°C	−20 ... +60
Maximum storage time		Years	1 (if the storage conditions are observed; refer to the operating instructions 07600-B)
Sine test according to DIN EN 60068-2-6			10 ... 2000 Hz / maximum of 10 g / 10 cycles / 3 axes
Noise test according to DIN EN 60068-2-64			20 ... 2000 Hz / 10 g_{RMS} / 30 g peak / 30 min. / 3 axes
Transport shock according to DIN EN 60068-2-27			15 g / 11 ms / 3 shocks / 3 axes
Maximum relative humidity (no condensation)		%	97
$MTTF_d$ value according to EN ISO 13849		Years	150 (for further details see data sheet 08012) [1]

Hydraulic			
Maximum operating pressure	▶ Port P, P②	bar	350
	▶ Port P①, A, B	bar	315
	▶ Port T	bar	separately and to the tank at zero pressure
Maximum set pressure	▶ Port P①, A	bar	50; 100; 200; 315
Minimum set pressure with command value 0	▶ Port P①, A	bar	see characteristic curves page 14
Maximum flow		l/min	60
Pilot flow		l/min	0.5
Hydraulic fluid			see table page 8
Hydraulic fluid temperature range		°C	−20 ... +80
Viscosity range	▶ recommended	mm²/s	10 ... 100
	▶ maximum admissible	mm²/s	10 ... 380
Maximum admissible degree of contamination of the hydraulic fluid; cleanliness class according to ISO 4406 (c)			Class 20/18/15 [2]

1) "OBED" voltage supply switched off.

2) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and simultaneously increases the life cycle of the components.

Technical data
(For applications outside these values, please consult us!)

Hydraulic fluid		Classification	Suitable sealing materials	Standards	Data sheet
Mineral oils		HL, HLP, HLPD, HVLP, HVLPD	NBR, FKM	DIN 51524	90220
Bio-degradable	▶ Insoluble in water	HETG	FKM	ISO 15380	90221
		HEES	FKM		
	▶ Soluble in water	HEPG	FKM	ISO 15380	
Flame-resistant	▶ Water-free	HFDU (glycol base)	FKM	ISO 12922	90222
		HFDU (ester base)	FKM		
		HFDR	FKM		
	▶ Containing water	HFC (Fuchs: Hydrotherm 46M, Renosafe 500; Petrofer: Ultra Safe 620; Houghton: Safe 620; Union: Carbide HP5046)	NBR	ISO 12922	90223

Important notices on hydraulic fluids:

- For further information and data on the use of other hydraulic fluids, please refer to the data sheets above or contact us.
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.).
- The ignition temperature of the hydraulic fluid used must be 50 K higher than the maximum surface temperature.
- **Bio-degradable and flame-resistant – containing water:** If components with galvanic zinc coating (e.g. version "J3" or "J5") or parts containing zinc are used, small amounts of dissolved zinc may get into the hydraulic system and cause accelerated aging of the hydraulic fluid. Zinc soap may form as a chemical reaction product, which may clog filters, nozzles and solenoid valves – particularly in connection with local heat input.
- **Flame-resistant – containing water:**
  - Due to the increased cavitation tendency with HFC hydraulic fluids, the life cycle of the component may be reduced by up to 30% as compared to the use with mineral oil HLP.
  - Dependent on the hydraulic fluid used, the maximum environment and hydraulic fluid temperature must not exceed 50 °C. In order to reduce the heat input into the component, the command value profile is to be adjusted for proportional and high-response valves.

Static / dynamic						
Type			(Z)3DRE		(Z)3DREE	(Z)3DREA
			1600 mA	800 mA		
Hysteresis [3]		%	<6	<8	<6	<2
Range of inversion [3]		%	<0.5	<0.5	<0.5	< 0.25
Response sensitivity [3]		%	<0.5	<0.5	<0.5	< 0.25
Manufacturing tolerance [3]		%	6	6	2	1
Temperature drift	▶ Electronics	%/10K	–	–	<0.3	<0.3
	▶ Pressure sensor					
	– Pressure rating "50"	%/10K	–	–	–	<0.4
	– Pressure rating "100"	%/10K	–	–	–	<0.2
	– Pressure rating "200"	%/10K	–	–	–	<0.1
	– Pressure rating "315"	%/10K	–	–	–	<0.1
Repetition accuracy [3]		%	±1	±1	±1	±0.5
Linearity [3]		%	±2	±2	±2	±1
Step response $\boldsymbol{T}_u + \boldsymbol{T}_g$ [4]	▶ 10% → 90%	ms	150	250	85 [5]	85 [5]
	▶ 90% → 10%	ms	150	250	85 [5]	85 [5]

3) Of the maximum set pressure

4) Line volume <20 cm³, $\boldsymbol{q}_V$ = 0 l/min

5) Adjustment possible up to 70 ms

Technical data
(For applications outside these values, please consult us!)

Electrical				
Version			"G24"	"G24-8"
Supply voltage		VDC	24	
Minimum control current		mA	<100	
Maximum control current		mA	1600 ±10%	800 ±5%
Solenoid coil resistance	▶ Cold value at 20 °C	Ω	5.5	20.6
	▶ Maximum hot value	Ω	8.05	33
Relative duty cycle		%	100 (continuous operation)	
Conformity			▶ RoHS Directive 2011/65/EU	

Electrical, integrated electronics (OBE) – Interface "A1" and "F1"			
Protection class according to EN 60529			IP65 (If suitable and correctly mounted mating connectors are used)
Supply voltage	▶ Nominal voltage	VDC	24
	▶ Lower limit value	VDC	18
	▶ Upper limit value	VDC	30
Current consumption		A	≤1.6 (impulse current 3 A)
Fuse protection, external		A_T	2.5 (time-lag)
Input (pressure command value)	Version "A1"	VDC	0 ... +10
	Version "F1"	mA	4 ... 20
Output (actual pressure value)	Version "A1"	VDC	0 ... 10 (0 ... 100% nominal pressure)
	Version "F1"	mA	4 ... 20 (0 ... 100% nominal pressure)
Conformity			▶ CE according to EMC Directive 2014/30/EU, tested according to EN 61000-6-2 and EN 61000-6-3 ▶ RoHS Directive 2011/65/EU

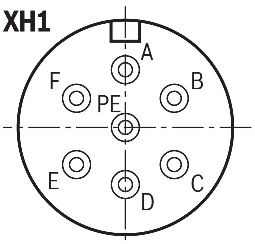
Electrical, integrated electronics (OBED) – Interface "L1"			
Relative duty cycle		%	100 (continuous operation)
Protection class according to EN 60529			IP65 (If suitable and correctly mounted mating connectors are used)
Supply voltage	▶ Valve amplifier	VDC	24
	– Pin 2	VDC	min. 18 / max. 30
	– Pin 5	VDC	0
	▶ IO-Link interface	VDC	24
	– Pin 1	VDC	min. 18 / max. 30
	– Pin 3	VDC	0
Maximum current consumption	▶ Valve amplifier	A	1.6 (impulse current 3 A)
	▶ IO-Link interface	mA	50
Maximum residual ripple		Vpp	1.3
Minimum process cycle time		ms	
Bit rate COM3		kBaud (kbit/s)	230.4
Required master port class			IO-Link class B
Resolution	▶ A/D transformer	Bit	12
Functional ground			Provide via valve block
Directive			IO-Link Interface and System Specification Version 1.1.2
Conformity			▶ CE according to EMC Directive 2014/30/EU, tested according to EN 61000-6-2 and EN 61000-6-3 ▶ RoHS Directive 2011/65/EU

Electrical connections and assignment

Connector pin assignment "A1" and "F1"

<table>
<tr><th rowspan="2">Contact</th><th colspan="2">Interface</th></tr>
<tr><th>"A1" (6 + PE)</th><th>"F1" (6 + PE)</th></tr>
<tr><td>A</td><td colspan="2">24 VDC supply voltage (u(t) = 18 ... 30 V); I_{max} ≤ 2 A</td></tr>
<tr><td>B</td><td colspan="2">0 V (ground)</td></tr>
<tr><td>C</td><td colspan="2">Reference potential actual value to F (connect to ground on the control side)</td></tr>
<tr><td>D</td><td>Command value 0 ... 10 V (Re > 100 kΩ)</td><td>Command value 4 ... 20 mA (Re = 100 Ω + 2 V diode distance)</td></tr>
<tr><td>E</td><td colspan="2">Reference potential command value to D (connect to ground on the control side)</td></tr>
<tr><td>F</td><td>Actual value 0 ... 10 V; I_{max} = 5 mA</td><td>Actual value 4 ... 20 mA (load max. 475 Ω)</td></tr>
<tr><td>FE</td><td colspan="2">Functional ground (directly connected to the valve housing)</td></tr>
</table>

XH1

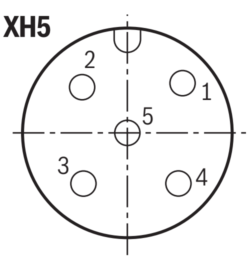


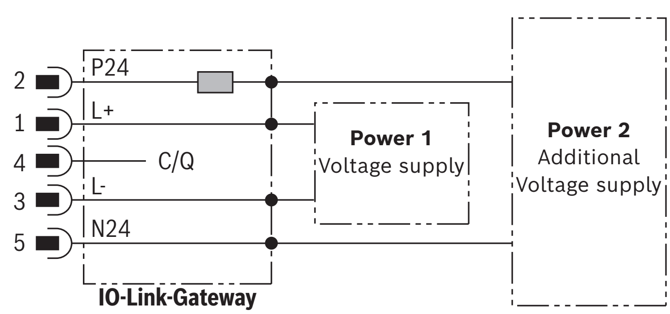
Connection cable:	▶ Up to 20 m cable length type LiYCY 7 x 0.75 mm²
	▶ Up to 40 m cable length type LiYCY 7 x 1.0 mm²
	▶ EMC-compliant installation: – Apply screening to both line ends – Use metal mating connector (see page 26)

Notices:
- Configurable via Bluetooth® interface.
- Mating connectors, separate order, see page 26 and data sheet 08006.

Connector pin assignment "L1" (M12-5, A-coded; pins, class B)

XH5





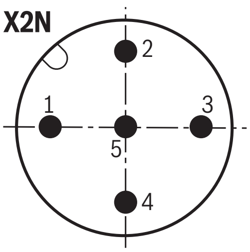
Notices:
- M12 sensor/actuator connection line, 5-pole; M12 connector/bush, A-coded, without shield, maximum cable length 20 m. Observe the voltage drop over the cable. Wire cross-section at least 0.34 mm².
- Mating connectors, separate order, see page 26 and data sheet 08006.
- Communication and parameter description see data sheet 29283-FK

Pin	Signal	Interface "L1"
1	L+	Voltage supply IO-Link
2	P24	24 V voltage supply for valve electronics, pressure sensor, Bluetooth® dongle (incl. LEDs etc.) and power section of max. 1.6 A continuous current and up to 2 A as making current. Potential is galvanically separated from supply L+ and L-.
3	L-	Reference potential pin 1
4	C/Q	Data line IO-Link (SDCI)
5	N24	Reference potential pin (galvanically separated from supply L+ and L-)

Electrical connections and assignment

Connector pin assignment "Analogously configurable pressure sensor interface" (M12-5, A-coded, bush)

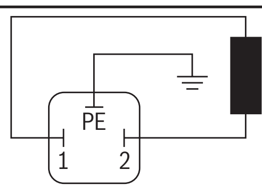
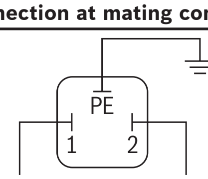
X2N



Pin	Signal	Interface
1	$\boldsymbol{U}_{\mathrm{S}}$	Voltage supply for pressure sensor from the valve supply +$\boldsymbol{U}_{\mathrm{B}}$ or P24, max. 50 mA (short-circuit-proof). Observe the voltage range of the pressure sensor.
2	$\boldsymbol{I}_{\mathrm{Meas}}$	Current input 4 ... 20 mA, connected to GND via 100 Ω load resistance +2 V diode connector. Measuring input configurable via Bluetooth® or IO-Link.
3	GND	Reference potential; do not connect with two-wire system (current input).
4	$\boldsymbol{U}_{\mathrm{Meas}}$	Voltage input 0 ... 10 V ($\boldsymbol{Re}_{\mathrm{min}}$ = 50 kΩ)
5	n.c.	No connection; insulated bore in the socket.
Thread	Shield (functional ground)	Connected to the housing via the thread.

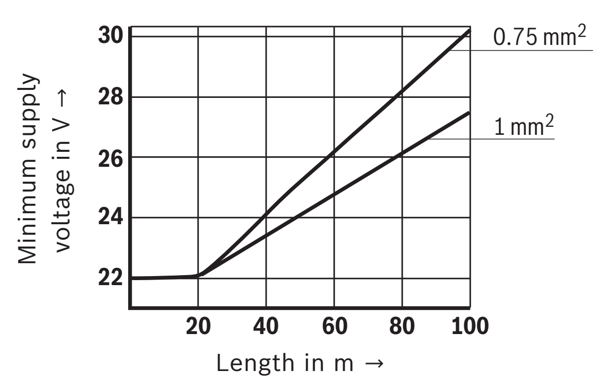
☞ **Notices:**
- ▶ In the condition as supplied, the actual value input PIN 4 0.1 ... 10 V of the pressure sensor interface is configured.
- ▶ At the factory, the interface is set for a 400 bar pressure sensor (0.1 ... 10 V).
- ▶ Connection cable up to 10 m cable length with screening connected to both line ends.
- ▶ The pressure sensor signal interface is always configured to voltage signal.
- ▶ The pressure sensor signal can be independently changed via IO-Link or via the Bluetooth® interface by means of "easy2connect app".

Type (Z)3DRE

Connection at the connector	Connection at mating connector
	

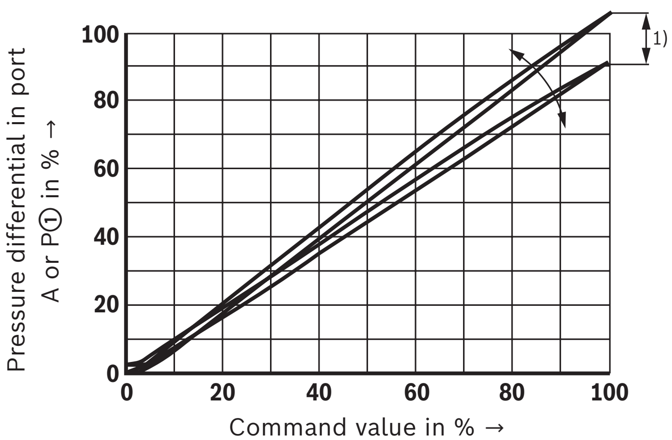
Connection cable (recommendation):
- ▶ 2-wire, 0.75 or 1 mm² plus protective grounding conductor and screening
- ▶ Only connect the screening to PE on the supply side
- ▶ Maximum admissible length = 100 m

The minimum supply voltage at the power supply unit depends on the length of the supply line (see diagram).



Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

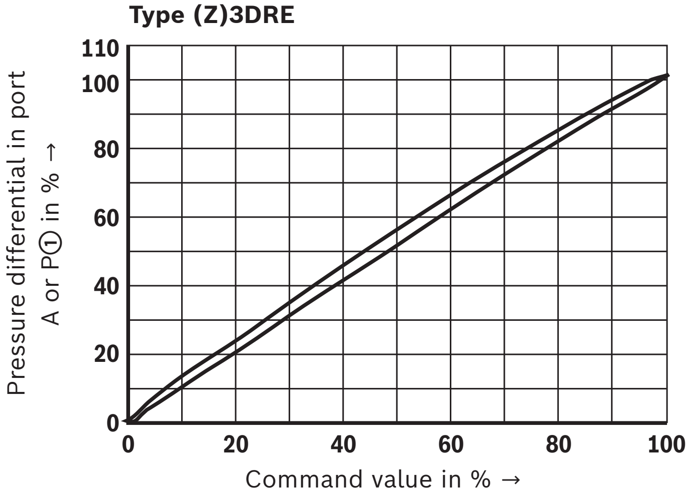
Reduced pressure in port A or P① of the command value (manufacturing tolerance)



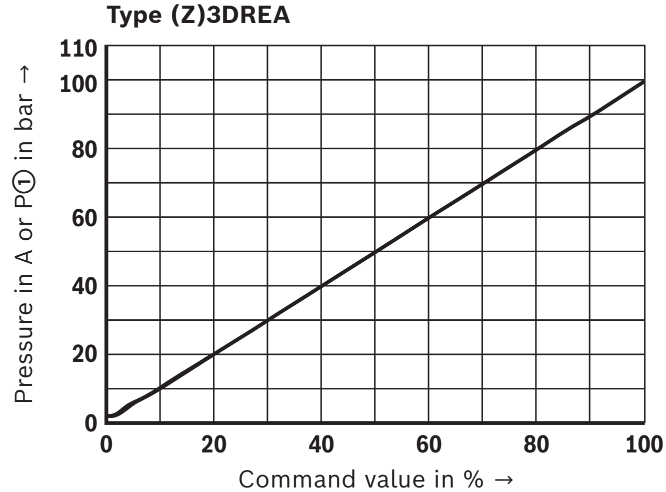
1) In order to be able to adjust several valves to the same characteristic curve, the manufacturing tolerance can - with version "(Z)3DRE" - be changed at the external amplifier (see page 26) using the command value attenuator "G". In this connection, do not set the pressure higher than the maximum set pressure of the pressure rating with command value 100%.

Pressure in port A or P① dependent on the command value (flow 0 l/min)
Pressure rating 100 bar (exemplary of all pressure ratings)

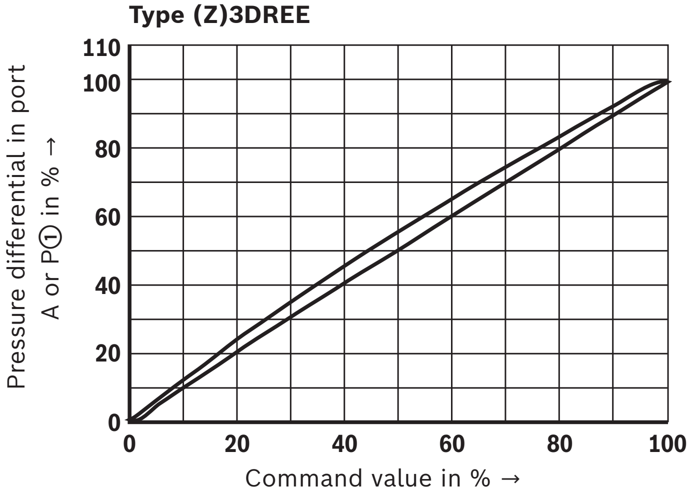
Type (Z)3DRE



Type (Z)3DREA



Type (Z)3DREE

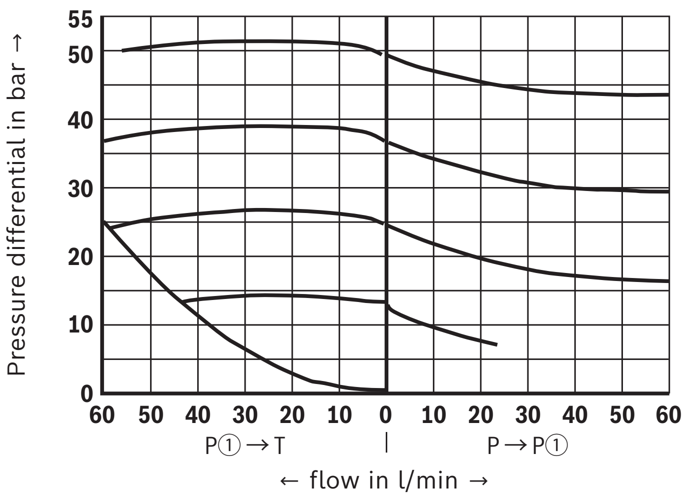


Notices:
- The characteristic curves apply for output pressure p_T = 0 bar in the entire flow range.
- System pressure = nominal pressure + 50 bar (minor dead volume).

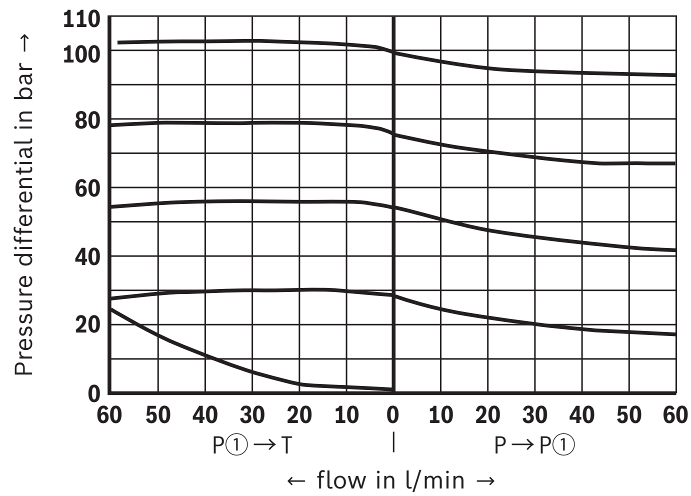
Characteristic curves: Type Z3DRE and Z3DREE (measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Δp-q_V characteristic curves

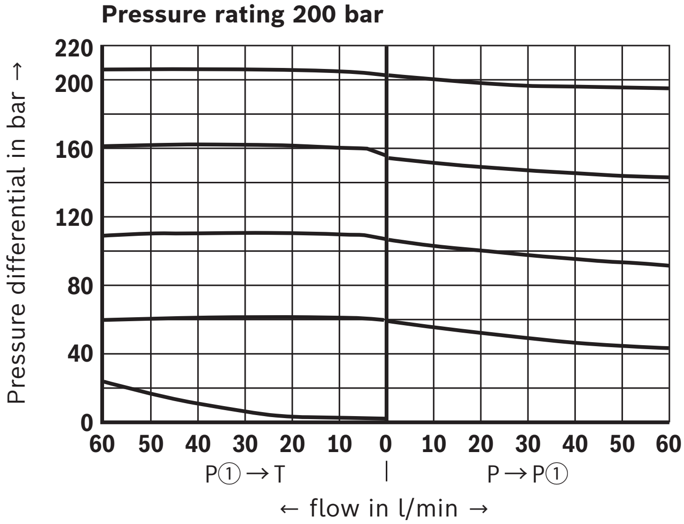
Pressure rating 50 bar



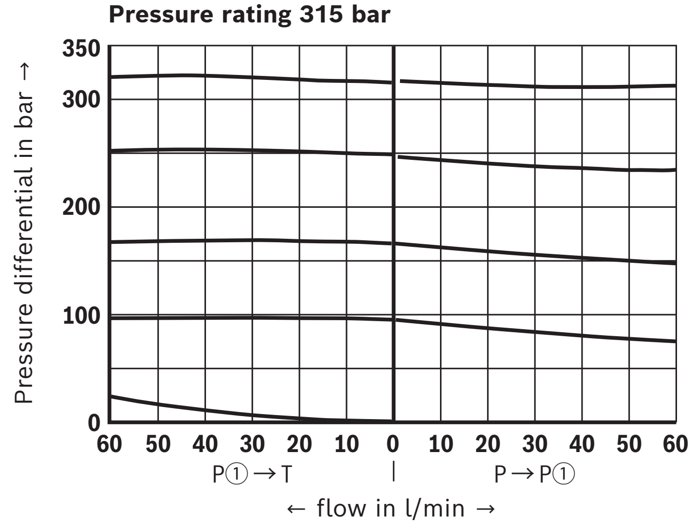
Pressure rating 100 bar



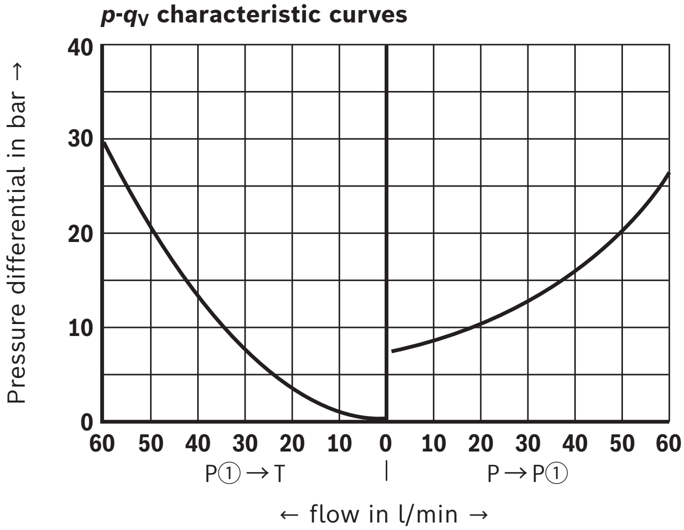
Pressure rating 200 bar



Pressure rating 315 bar



p-q_V characteristic curves

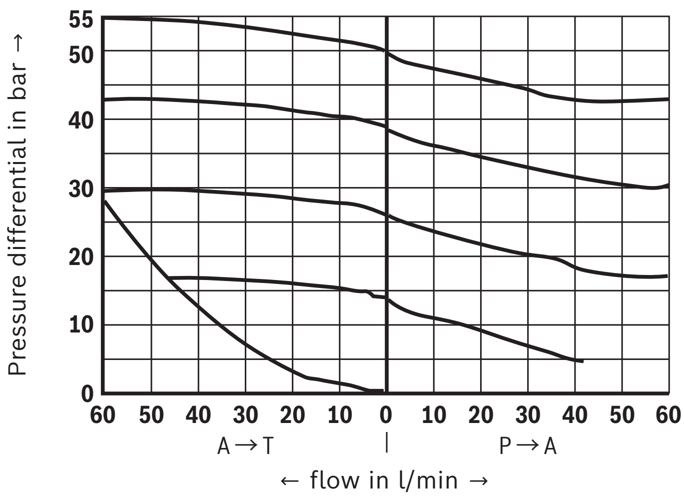


Notices:
- The characteristic curves apply for output pressure p_T = 0 bar in the entire flow range.
- System pressure = nominal pressure + 50 bar (minor dead volume).

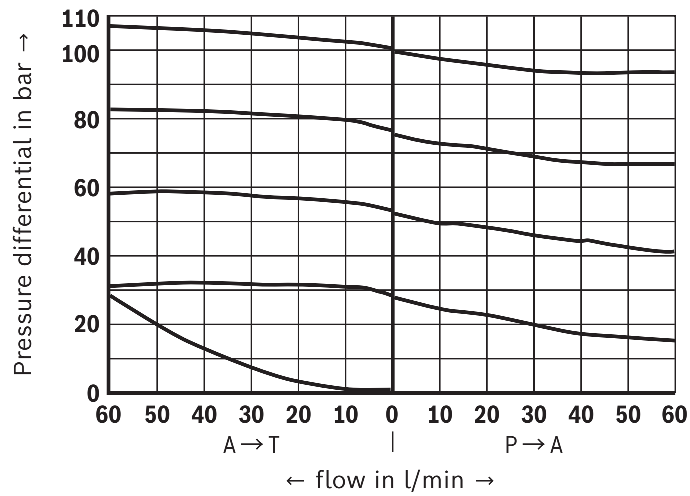
Characteristic curves: Type 3DRE and 3DREE (measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Δp-q_V characteristic curves

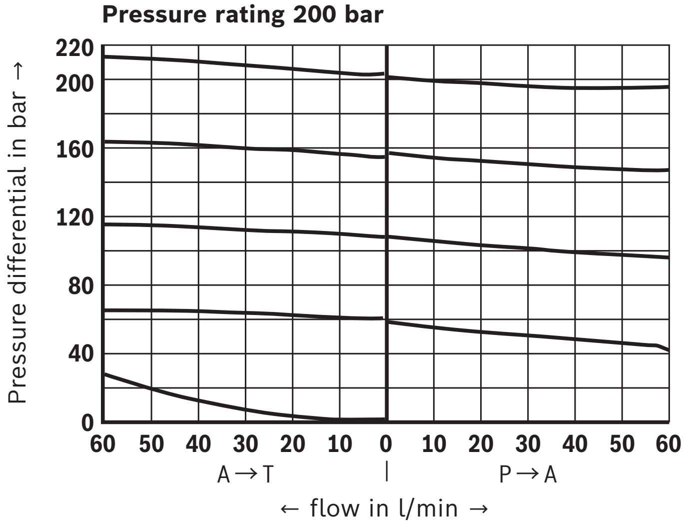
Pressure rating 50 bar



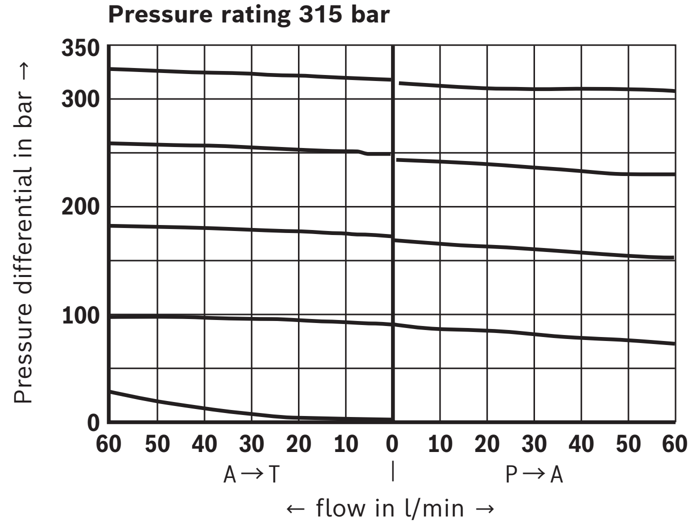
Pressure rating 100 bar



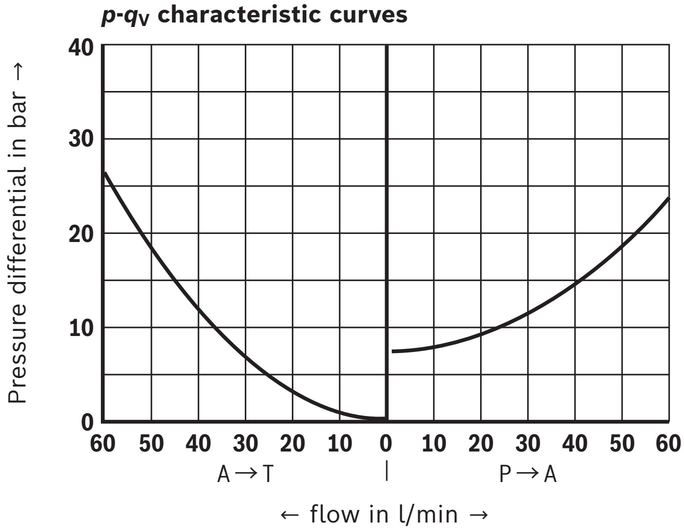
Pressure rating 200 bar



Pressure rating 315 bar



p-q_V characteristic curves

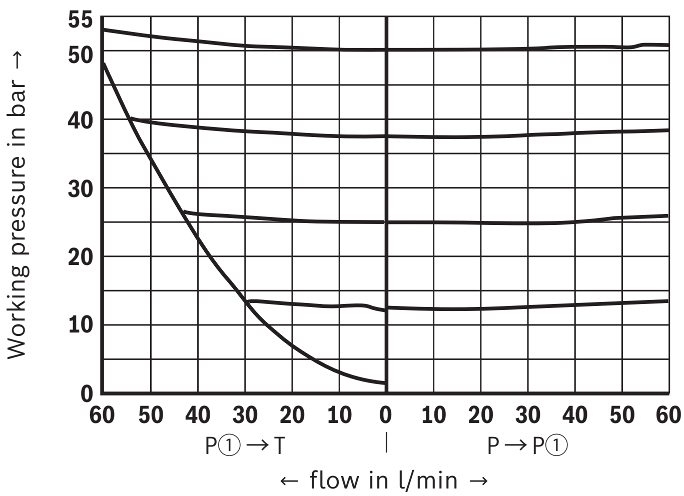


Notices:
- The characteristic curves apply for output pressure p_T = 0 bar in the entire flow range.
- System pressure = nominal pressure + 50 bar (minor dead volume).

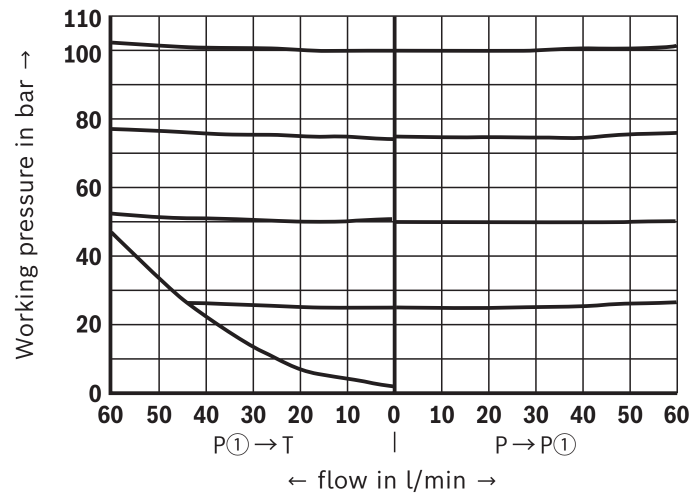
Characteristic curves: Type Z3DREA (measured with HLP46, ϑ_{oil} = 40 ±5 °C)

***p*-q_V characteristic curves**

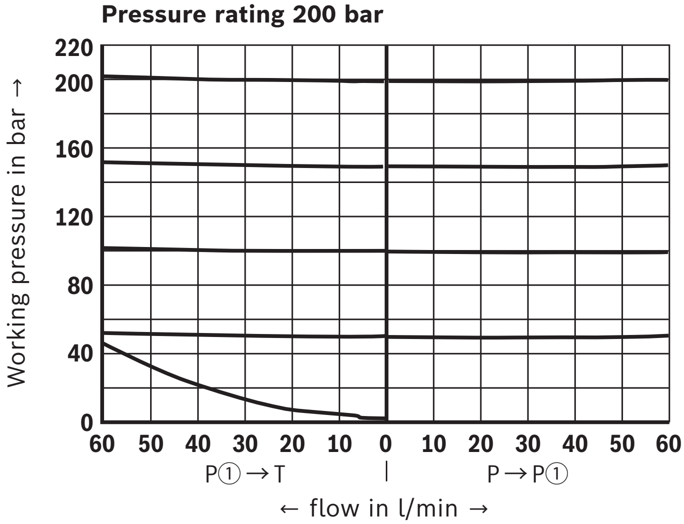
Pressure rating 50 bar



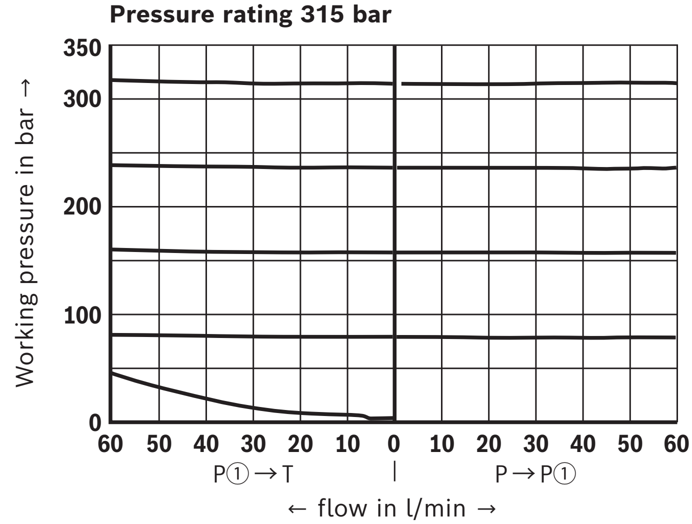
Pressure rating 100 bar



Pressure rating 200 bar



Pressure rating 315 bar

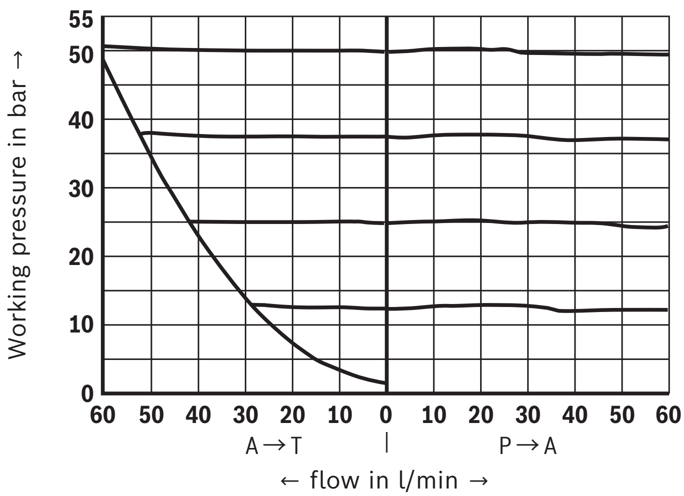


Notices:
- The characteristic curves apply for output pressure p_T = 0 bar in the entire flow range.
- System pressure = nominal pressure + 50 bar (minor dead volume).

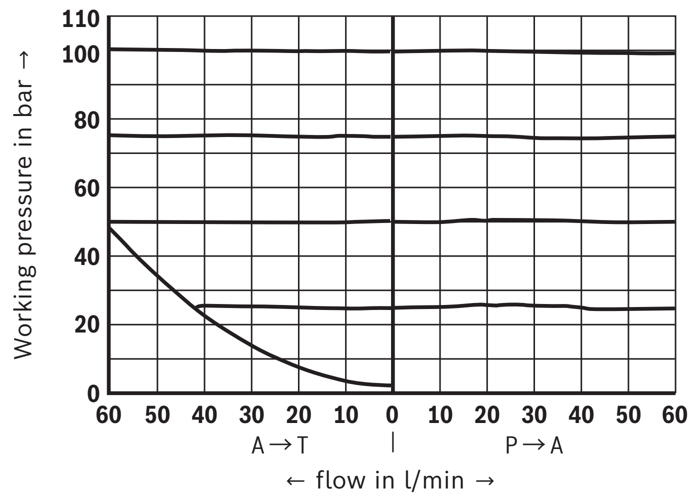
Characteristic curves: Type 3DREA
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

***p*-*q*$_V$ characteristic curves**

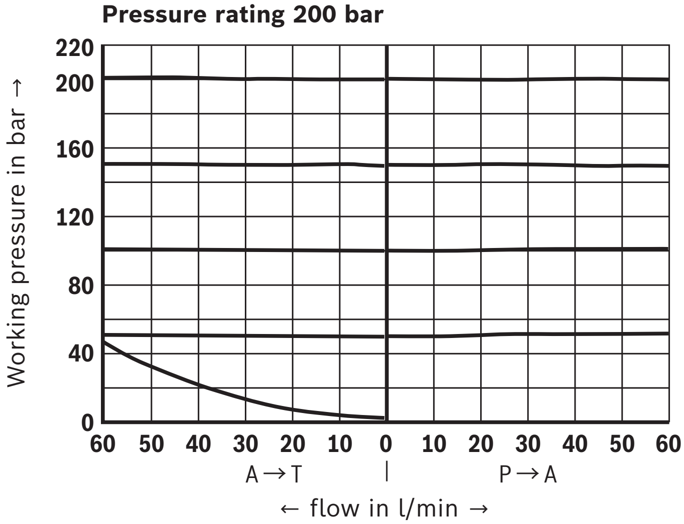
Pressure rating 50 bar



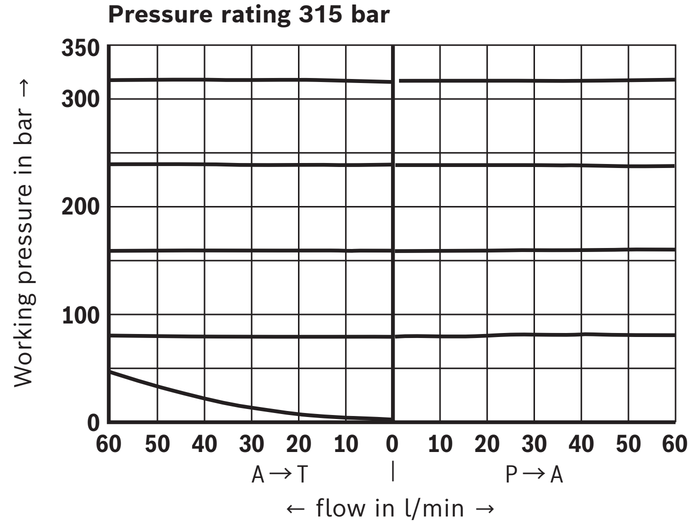
Pressure rating 100 bar



Pressure rating 200 bar

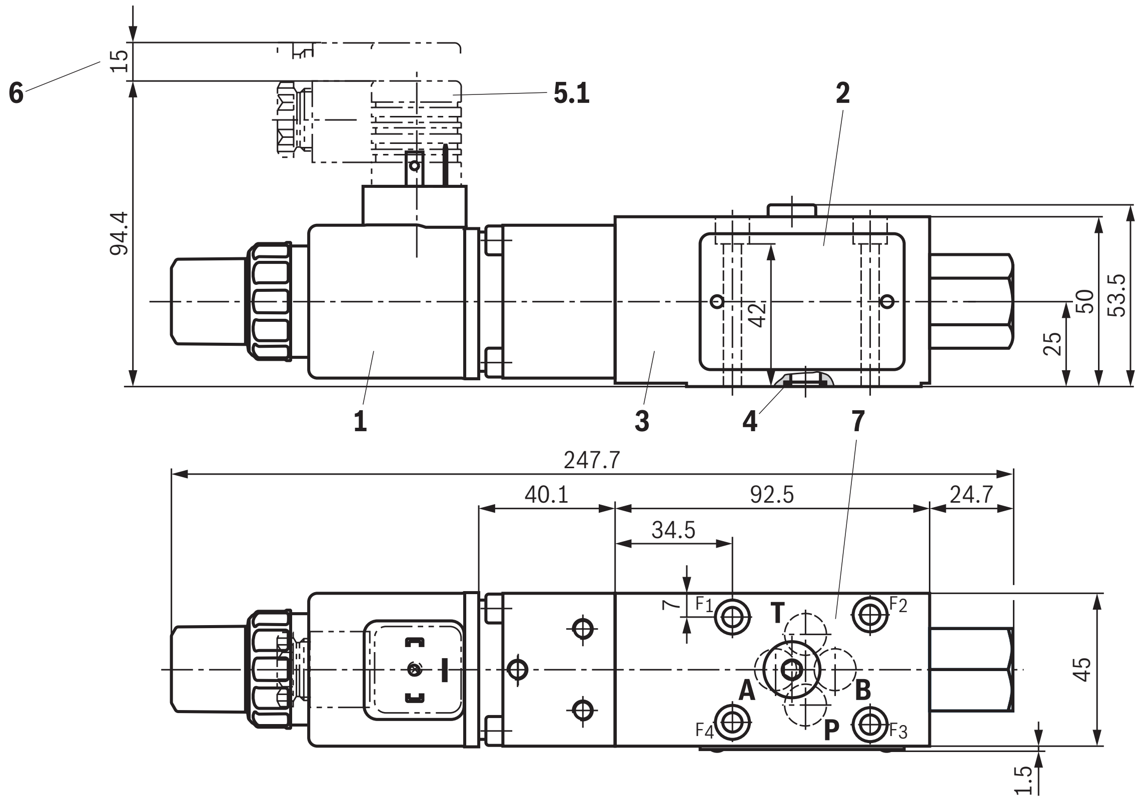


Pressure rating 315 bar

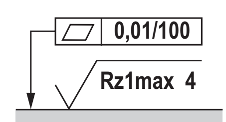


Notices:
- The characteristic curves apply for output pressure p_T = 0 bar in the entire flow range.
- System pressure = nominal pressure + 50 bar (minor dead volume).

Dimensions: Type 3DRE
(dimensions in mm)



1 Proportional solenoid
2 Name plate
3 Valve housing
4 Identical seal rings for ports A, B, P and T
5.1 Mating connector **without** circuitry for connector "K4" (separate order, see page 26 and data sheet 08006)
6 Space required for removing the mating connector
7 Porting pattern according to ISO 4401-03-02-0-05

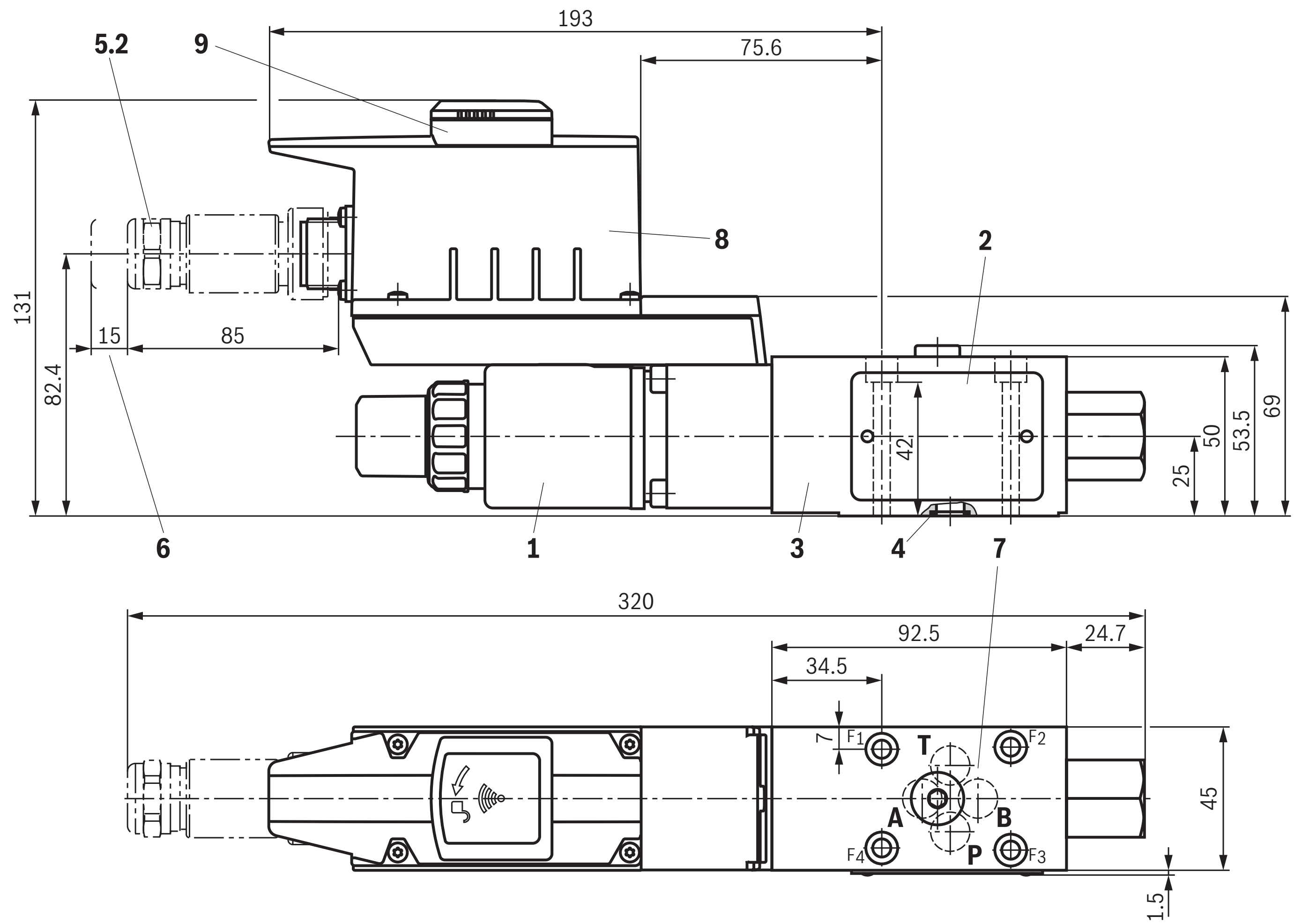


Required surface quality of the valve contact surface

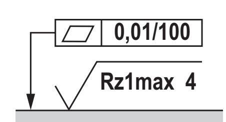
Valve mounting screws and **subplates**, see page 25.

Notice:
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions: Type 3DREE
(dimensions in mm)



- **1** Proportional solenoid
- **2** Name plate
- **3** Valve housing
- **4** Identical seal rings for ports A, B, P and T
- **5.2** Mating connectors with version "A1" and "F1" (separate order, see page 26 data sheet 08006)
- **6** Space required for removing the mating connector
- **7** Porting pattern according to ISO 4401-03-02-0-05
- **8** Digital on-board electronics (OBED)
- **9** Bluetooth® dongle (separate order, see page 26)

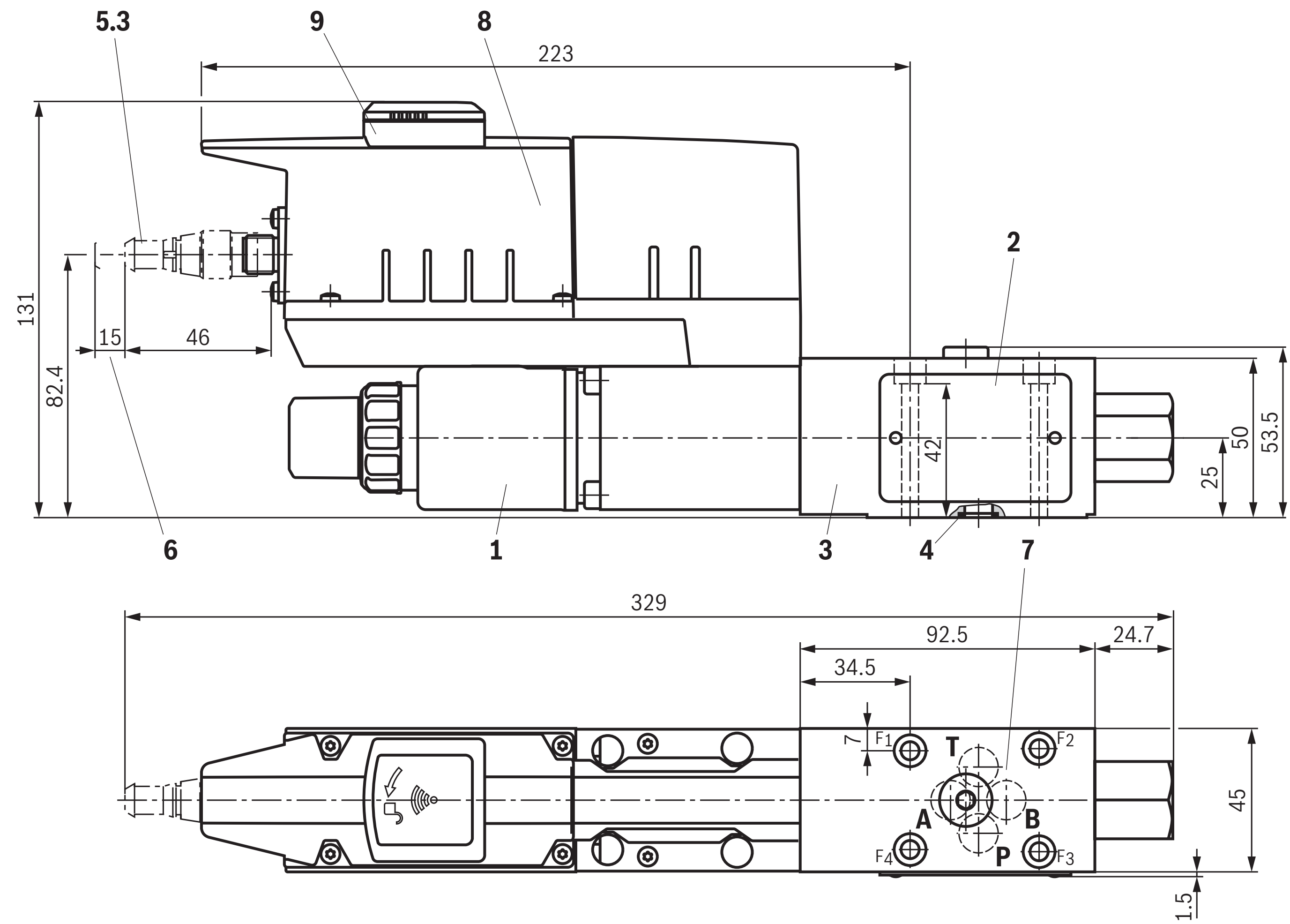


Required surface quality of the valve contact surface

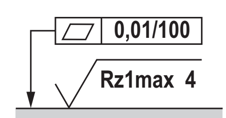
Valve mounting screws and **subplates**, see page 25.

Notice:
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions: Type 3DREA
(dimensions in mm)



- **1** Proportional solenoid
- **2** Name plate
- **3** Valve housing
- **4** Identical seal rings for ports A, B, P and T
- **5.3** Mating connectors with version "L1" (separate order, see page 26 data sheet 08006)
- **6** Space required for removing the mating connector
- **7** Porting pattern according to ISO 4401-03-02-0-05
- **8** Digital on-board electronics (OBED)
- **9** Bluetooth® dongle (separate order, see page 26)

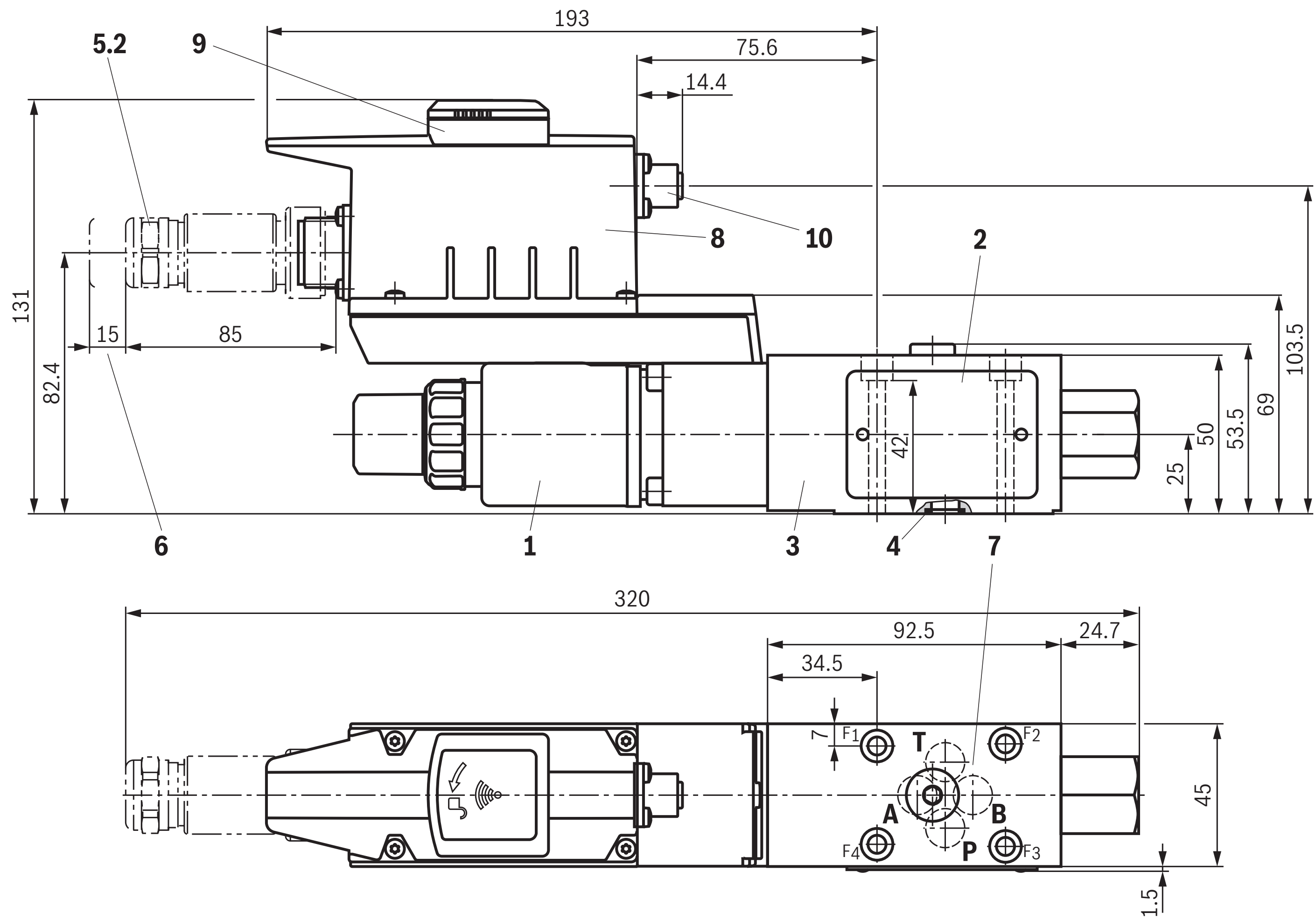


Required surface quality of the valve contact surface

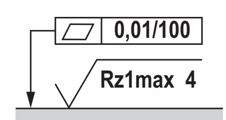
Valve mounting screws and **subplates,** see page 25.

Notice:
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions: Type 3DREA ...A
(dimensions in mm)



- **1** Proportional solenoid
- **2** Name plate
- **3** Valve housing
- **4** Identical seal rings for ports A, B, P and T
- **5.2** Mating connectors with version "A1" and "F1" (separate order, see page 26 data sheet 08006)
- **6** Space required for removing the mating connector
- **7** Porting pattern according to ISO 4401-03-02-0-05
- **8** Digital on-board electronics (OBED)
- **9** Bluetooth® dongle (separate order, see page 26)
- **10** External connection for pressure sensor (pressure sensor, separate order, see page 26)

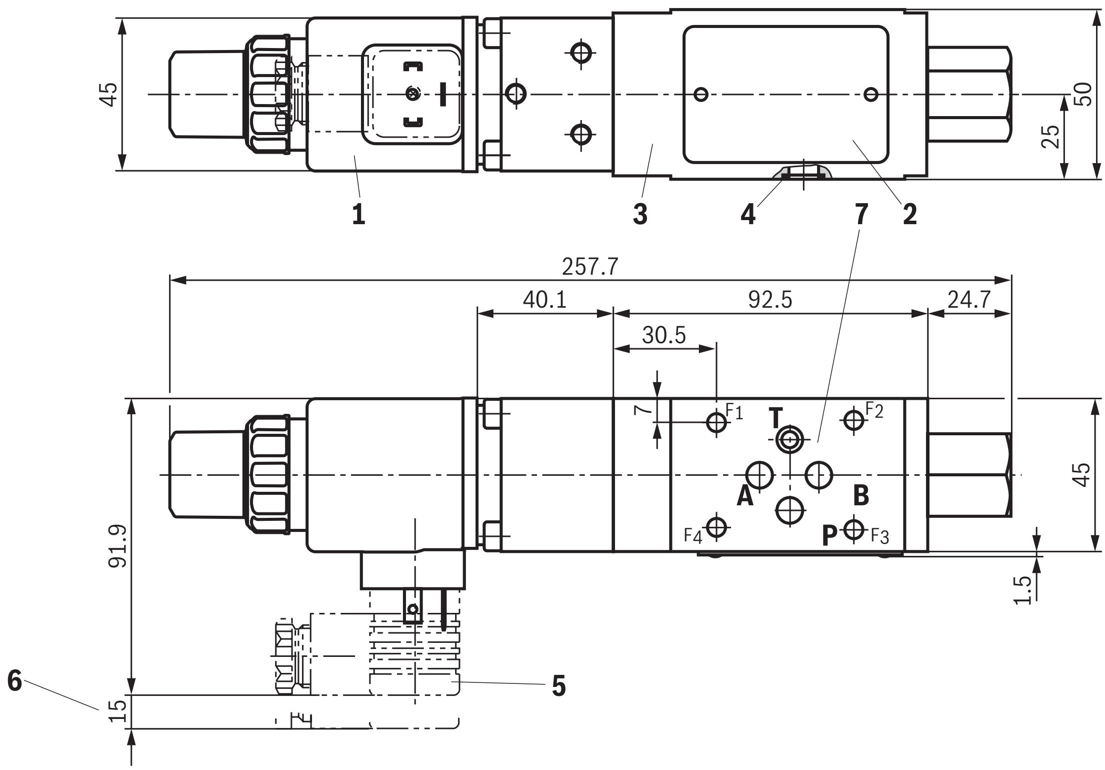


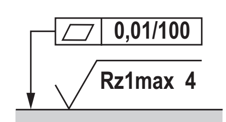
Required surface quality of the valve contact surface

Valve mounting screws and **subplates**, see page 25.

Notice:
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions: Type Z3DRE
(dimensions in mm)





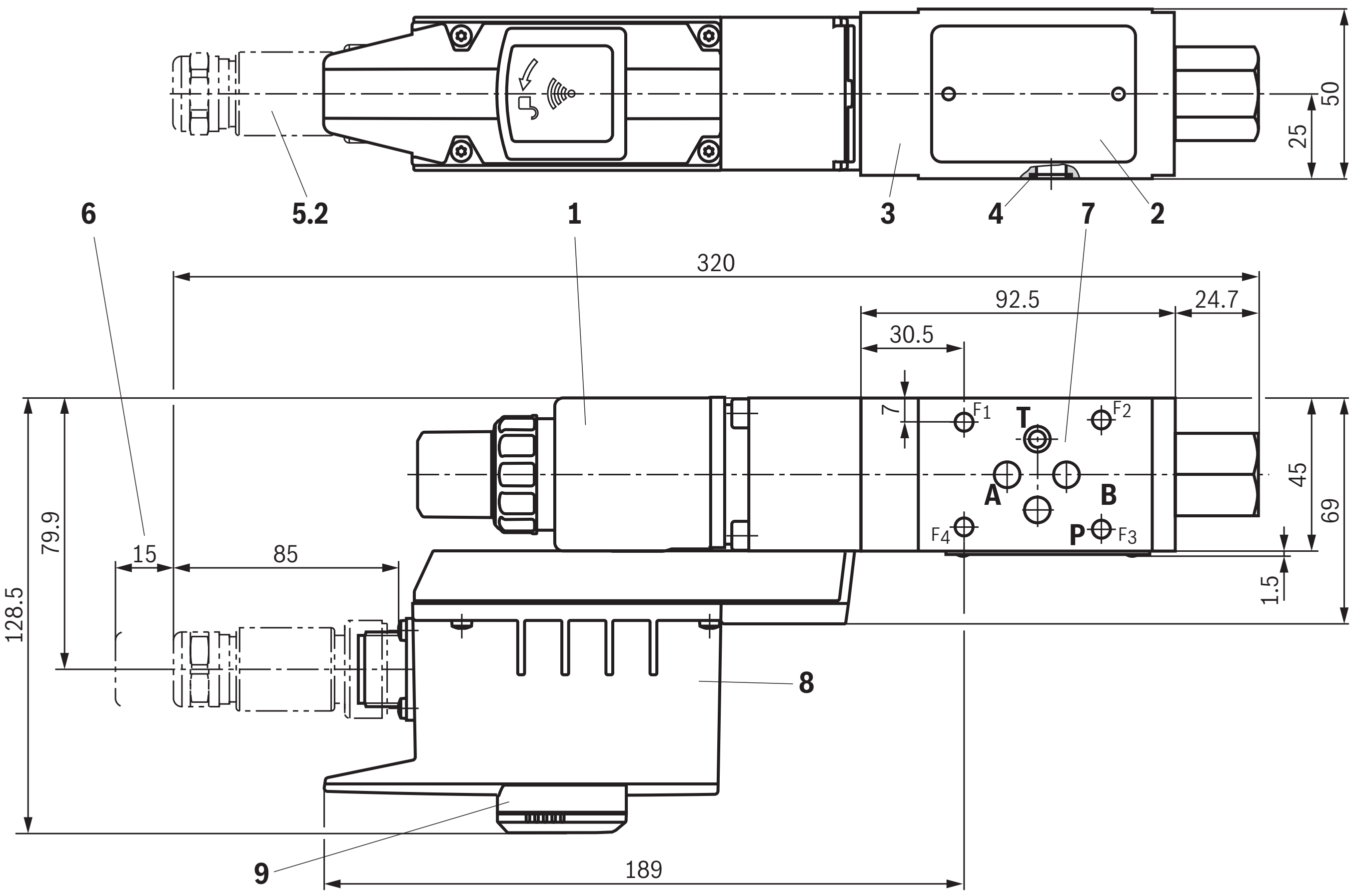
Required surface quality of the valve contact surface

1 Proportional solenoid
2 Name plate
3 Valve housing
4 Identical seal rings for ports A, B, P and T
5.1 Mating connector **without** circuitry for connector "K4" (separate order, see page 26 and data sheet 08006)
6 Space required for removing the mating connector
7 Porting pattern according to ISO 4401-03-02-0-05

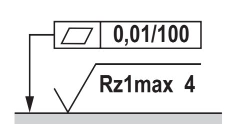
Valve mounting screws and **subplates**, see page 25.

Notice:
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions: Type Z3DREE
(dimensions in mm)



1 Proportional solenoid
2 Name plate
3 Valve housing
4 Identical seal rings for ports A, B, P and T
5.2 Mating connectors with version "A1" and "F1" (separate order, see page 26 data sheet 08006)
6 Space required for removing the mating connector
7 Porting pattern according to ISO 4401-03-02-0-05
8 Digital on-board electronics (OBED)
9 Bluetooth® dongle (separate order, see page 26)

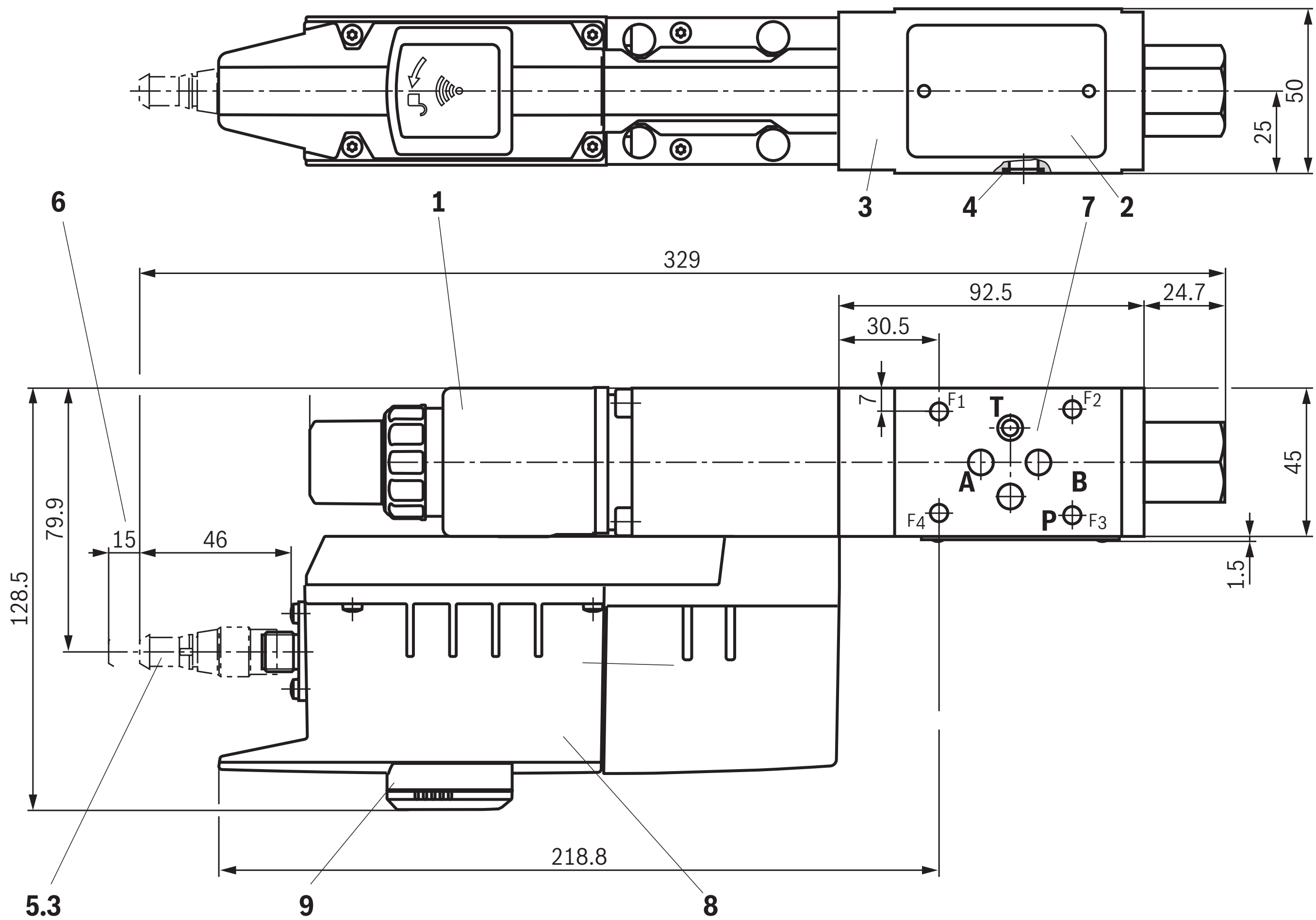


Required surface quality of the valve contact surface

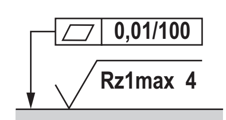
Valve mounting screws and **subplates**, see page 25.

Notice:
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions: Type Z3DREA
(dimensions in mm)



1 Proportional solenoid
2 Name plate
3 Valve housing
4 Identical seal rings for ports A, B, P and T
5.3 Mating connectors with version "L1" (separate order, see page 26 data sheet 08006)
6 Space required for removing the mating connector
7 Porting pattern according to ISO 4401-03-02-0-05
8 Digital on-board electronics (OBED)
9 Bluetooth® dongle (separate order, see page 26)

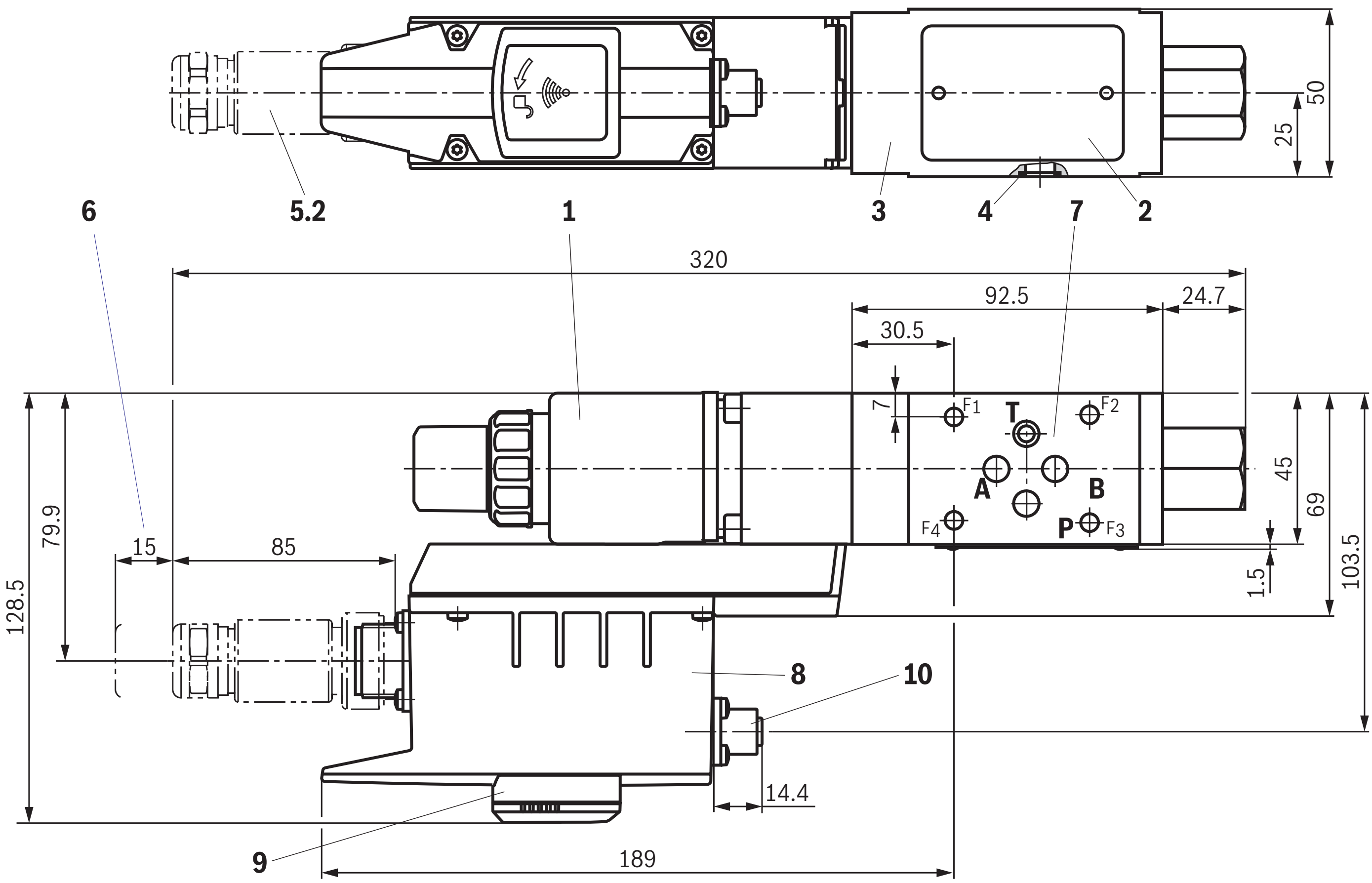


Required surface quality of the valve contact surface

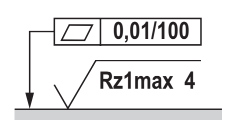
Valve mounting screws and **subplates,** see page 25.

Notice:
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions: Type Z3DREA ...A
(dimensions in mm)



1 Proportional solenoid
2 Name plate
3 Valve housing
4 Identical seal rings for ports A, B, P and T
5.2 Mating connectors with version "A1" and "F1" (separate order, see page 26 data sheet 08006)
6 Space required for removing the mating connector
7 Porting pattern according to ISO 4401-03-02-0-05
8 Digital on-board electronics (OBED)
9 Bluetooth® dongle (separate order, see page 26)
10 External connection for pressure sensor (pressure sensor, separate order, see page 26)



Required surface quality of the valve contact surface

Valve mounting screws and **subplates**, see page 25.

☞ **Notice:**
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions

Valve mounting screws (separate order)

Type	Quantity	Hexagon socket head cap screws	Material number
3DRE ...	4	**ISO 4762 - M5 x 50 - 10.9-CM-Fe-ZnNi-5-Cn-T0-H-B** Friction coefficient μ_{total} = 0.09 ... 0.14; tightening torque M_A = 7 Nm ±10%	**R913043758**
Z3DRE ...	4	**ISO 4762 - M5 - 10.9-CM-Fe-ZnNi-5-Cn-T0-H-B** Friction coefficient μ_{total} = 0.09 ... 0.14; tightening torque M_A = 7 Nm ±10%	–

☞ **Notice:**
The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure.

Subplates (separate order) with porting pattern according to ISO 4401-03-02-0-05 see data sheet 45100.

Accessories (separate order)

Pressure sensor for external connection of pressure sensor

Type	Material number	Data sheet
HM 20-2X/400-H-C19-0,16-N	**R901518764**	–

Bluetooth® dongle

	Material number	Data sheet
Bluetooth® dongle	**R901505294**	30581-B
Empty cover (for valves without Bluetooth® dongle)	**R901521063**	–

Valves with integrated electronics

Mating connectors 6-pole + PE	Design	Version	Material number	Data sheet
For the connection of valves with integrated electronics, round connector 6+PE, line cross-section 0.5 ... 1.5 mm²	Straight	Metal	**R900223890**	08006
		Metal with mechanical locking	**R901044595**	–

Cable set (analog sensors)	**Length** in m	Material number	Data sheet
Cable set for connection of the Rexroth pressure sensors type HM20, shielded, 5-pole, A-coding, PUR/PVC, straight connector M12, on straight socket M12, line cross-section 0.34 mm²	0.6	**R901111709**	–
	1.0	**R901111712**	–
	2.0	**R901111713**	–

External control electronics

	Type	Data sheet
Modular design	VT-MSPA1-2X	30232

Test and service devices

	Material number	Data sheet
Service case with test device for proportional servo valves with integrated electronics (OBE)	**R901049737**	29685

IO-Link gateways

Designation	Description	Material number
S67E-PN-IOL8-DI4-M12-6P	IndraControl S67E PROFINET device in the plastic housing 8 IO-Link ports (4 x class A and 4 x class B), 4 digital inputs, 24 VDC, M12 quick connection technology	**R911174436**
S67E-S3-IOL8-DI4-M12-6P	IndraControl S67E Sercos device in the plastic housing 8 IO-Link ports (4 x class A and 4 x class B), 4 digital inputs, 24 VDC, M12 quick connection technology	**R911174437**

Safety instructions

IT security
The operation of installations, systems and machines basically requires the implementation of a holistic IT security concept which is state-of-the-art in terms of technology.
Accordingly, Bosch Rexroth products and their properties must be considered as components of installations, systems and machines for their holistic IT security concept.

Unless otherwise documented, Bosch Rexroth products are designed for operation in local, physically and logically secured networks with access restrictions for authorized persons, and they are not classified according to IEC 62443-4-2.

Certification

Title	Document number
EU declaration of conformity	DCTC-31000-175
China certificate	DCTC-31000-181
India certificate	DCTC-31000-182
South Korea certificate	DCTC-31000-183
US certificate	DCTC-31000-184

☞ **Notice:**
The Bluetooth® dongle is certified for the regions and/or economic areas included in the table.

Further information

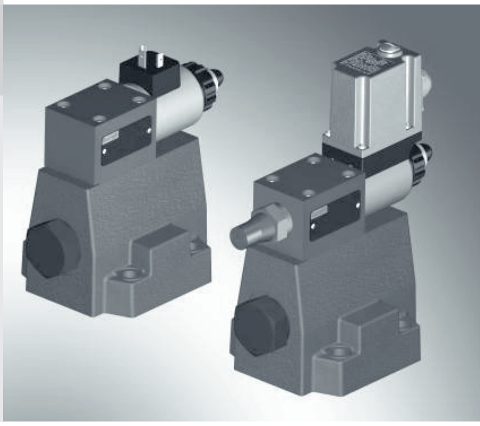
- Hydraulic valves for industrial applications — Operating instructions 07600-B
- Subplates — Data sheet 45100
- Hydraulic fluids on mineral oil basis — Data sheet 90220
- Environmentally compatible hydraulic fluids — Data sheet 90221
- Flame-resistant, water-free hydraulic fluids — Data sheet 90222
- Flame-resistant hydraulic fluids - containing water (HFAE, HFAS, HFB, HFC) — Data sheet 90223
- Bluetooth® dongle — Data sheet 30581
- Reliability characteristics according to EN ISO 13849 — Data sheet 08012
- Hexagon socket head cap screw, metric/UNC — Data sheet 08936
- Assembly, commissioning and maintenance of hydraulic systems — Data sheet 07900
- Proportional pressure reducing valve — Functional description 29283-FK
- Bluetooth® dongle — Operating instructions 30581-B
- Selection of filters
- Information on available spare parts

Rexroth
Bosch Group

Proportional pressure reducing valve, pilot operated

RE 29276/03.11
Replaces: 01.10

Type DRE(M) and DRE(M)E



Sizes 10 and 25 [1)]
Component series 6X
Maximum operating pressure 315 bar
Maximum flow 300 l/min

Table of contents

Features

- Valve for reducing an operating pressure
- Operation by means of proportional solenoids
- Proportional solenoid with rotatable and detachable coil
- For subplate mounting:
  Porting pattern according to ISO 5781,
  Subplates according to data sheet RE 45062
  (separate order), see page 11
- Third path A to Y (Ø 7.5 mm)
- Minimum setting pressure 2 bar with command value zero
- Linearized command value-pressure characteristic curve
- Good transient response
- Optional check valve between A and B
- Maximum pressure limitation optional
- Type DRE(M)E with integrated electronics (OBE):
  • Little manufacturing tolerance of the command value-pressure characteristic curve

1) Size 32 see data sheet RE 29278

Ordering code

DRE			–6X/	Y		G24					*

without maximum pressure limitation **= no code**
with maximum pressure limitation [1)] **= M**

For external control electronics **= no code**
with integrated electronics (OBE) **= E**

Size 10 **= 10**
Size 25 **= 20**

Component series 60 to 69 **= 6X**
(60 to 69: Unchanged installation and connection dimensions)

Pressure rating
50 bar **= 50**
100 bar **= 100**
200 bar **= 200**
315 bar **= 315**

Pilot oil return always external separately and at zero pressure to the tank **= Y**

with check valve between A and B **= no code**
without check valve **= M**

Further details in the plain text

Seal material
M = NBR seals
V = FKM seals

Interface electronics
A1 = Command value 0 to 10 V
F1 = Command value 4 to 20 mA
no code = with DRE

Electrical connection
for DRE(M):
K4 = **without** mating connector, with connector according to DIN EN 175301-803
Mating connector - separate order see page 8
for DRE(M)E:
K31 = **without** mating connector, with connector according to DIN EN 175201-804
Mating connector - separate order see page 8

no code = 1600 mA design
- 8 = 800 mA design [2)]

Supply voltage of the control electronics
G24 = Direct voltage 24 V

Accessories (not included in scope of delivery)

– External control for type DRE (only standard version G24 (1.6 A solenoid)):
  - Analog amplifier VT-MSPA1-11-1X/ in modular design according to data sheet RE 30223
  - Digital amplifier VT-VSPD-2 in Eurocard format according to data sheet RE 30523
  - Analog amplifier VT-VSPA1-11-1X/ in Eurocard format according to data sheet RE 30100
  - Proportional plug-in amplifier VT-SSPA1-1-1X plug-in amplifier according to data sheet RE 30116 connection M12 - 4-pole

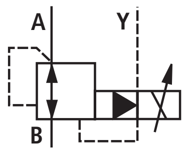
– Mating connectors (details, see page 8)
  - For DRE(M): According to DIN EN 175301-803, Material no. **R901017011**
  - For DRE(M)E: According to DIN EN 175201-804, Material no. **R900021267** or **R900223890**

[1)] In case of an error (e.g. in case of contamination or overcurrent), the maximum pressure limitation prevents an inadmissibly high overpressure at the valve.

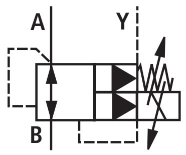
[2)] Replacement series 5X (Attention! External amplifiers only suitable for G24 = 1.6 A solenoid), see accessories.

Symbols

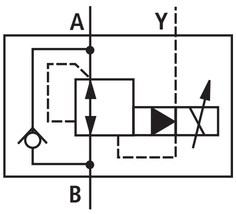
DRE -6X/...**YM**…



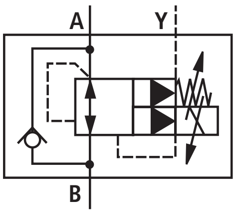
DREM -6X/...**YM**…



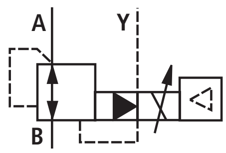
DRE -6X/...**Y**…



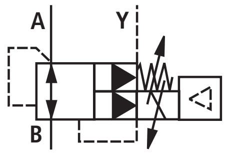
DREM -6X/...**Y**…



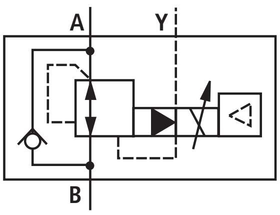
DREE -6X/...**YM**…



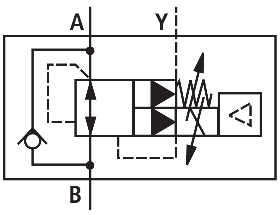
DREME -6X/...**YM**…



DREE -6X/...**Y**…



DREME -6X/...**Y**…



Function, section

Valves of type DRE(M) are pilot controlled pressure reducing valves. They are used for reducing an operating pressure.

These valves basically comprise of a pilot control valve (1) with proportional solenoid (2), main valve (3) with main spool insert (4), as well as an optional check valve (5).

Type DRE...

The pressure in channel A is set in a command value-dependent form via the proportional solenoid (2).

In rest position - no pressure in channel B -, the spring (17) holds the main spool (4) in its initial position. The connection from channel B to A is closed. A start-up jump is thus suppressed.

Via the bore (6), the pressure in channel A acts on the surface (7) of the main spool. The pilot oil is taken from channel B and flows via the bore (8) to the constant flow controller (9) keeping the pilot flow constant, independent of the pressure drop between channel A and B. From the constant flow controller (9), the pilot flow flows into the spring chamber (10), through the bores (11) and (12) via the valve seat (13) into the Y channel (14, 15, 16) and from there to the return.

The pressure required in channel A is preset at the related amplifier. The proportional solenoid moves the valve poppet (20) in the direction of the valve seat (13) and limits the pressure in the spring chamber (10) to the set value. If the pressure in channel A is lower than the specified command value, the higher pressure in the spring chamber (10) pushes the main spool to the right. The connection from B to A is opened.

If the set pressure in A is achieved, the forces at the main spool are balanced - the main spool is in control position.

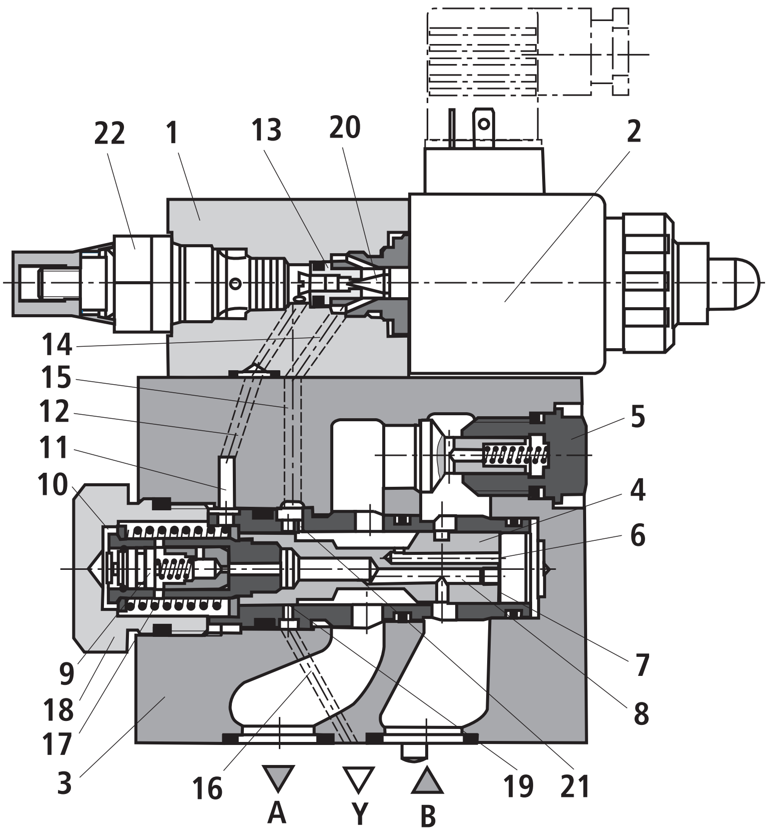
Pressure in channel A • Spool face (7) =
Pressure in the spring chamber (10) • Spool face – Spring force (17)

If in a standing hydraulic fluid column (e.g. cylinder piston to stop), the pressure in A is to be reduced, a lower command value is (e.g.) specified at the control electronics and thus, a lower pressure is pre-selected that is immediately applied to the spring chamber (10). The higher pressure in A at the face (7) of the main spool pushes the main spool against the plug screw (18) to stop. The connection A to B is blocked and A to Y is open. The force of spring (17) now acts against the hydraulic force at the face (7) of the main spool. In this main spool position, the hydraulic fluid can flow from channel A via the control edge (19) to Y into the return.

If the pressure in A has been reduced to the pressure in the spring chamber (10) plus Δp from spring (17), the main spool at the control edge A to Y closes the large control bores in the socket.

The remaining differential pressure of approx. 10 bar to the new command value pressure in A is only discharged via the fine control bore (21). This results in a good transient response without pressure undershoots.

For the free return flow from channel A to B, a check valve (5) can optionally be installed. A part of this flow from channel A simultaneously flows via the open control edge (19) of the main spool from A to Y into the return.



Type DREM…-6X/…YG24K4... (**with** check valve)

Type DREM...

For hydraulic protection against an inadmissibly high electric control current at the proportional solenoid, which imperatively results in increased pressures in port A, you can optionally install a spring-loaded pressure relief valve as maximum pressure limitation (22). The maximum pressure limitation is pre-set referred to the relevant pressure rating (table page 6).

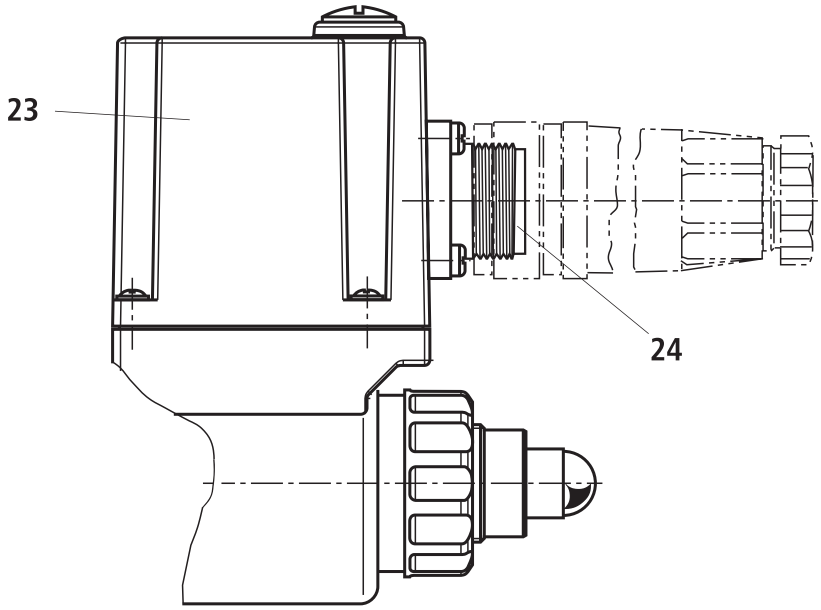
Function, section

Type DRE(M) – with integrated electronics (OBE)

With regard to function and structure, these types correspond to type DRE. On the proportional solenoid, there is moreover a housing (23) with the control electronics.

Supply and command value voltage are applied at the connector (24).
In the factory, the command value pressure characteristic curve is adjusted with little manufacturing tolerance.

For more information on the control electronics see page 8.



Type DRE(M)E…-6X/…YG24K31...

Technical Data (For applications outside these parameters, please consult us!)

general

Size		Size	10	25
Weight	– DRE and DREM	kg	4.7	6.0
	– DREE and DREME	kg	4.8	6.1
Installation position			Any	
Storage temperature range		°C	–20 to +80	
Ambient temperature range	– DRE(M)	°C	–20 to +70	
	– DRE(M)E	°C	–20 to +50	

hydraulic (measured with HLP 46, ϑ_{oil} = 40 °C ± 5 °C)

Size		Size	10	25
Max. operating pressure	– Port A and B	bar	315	
	– Port Y		Separately and to the tank at zero pressure (internal pipe Ø ≥ 5 mm; pipe length < 2500 mm)	
Max. setting pressure in channel A	– Pressure rating 50 bar	bar	50	
	– Pressure rating 100 bar	bar	100	
	– Pressure rating 200 bar	bar	200	
	– Pressure rating 315 bar	bar	315	
Min. setting pressure in channel A with command value zero		bar	2	
Maximum pressure limitation (fixedly set)			Set in the factory:	
	– Pressure rating 50 bar	bar	To 70 bar	
	– Pressure rating 100 bar	bar	To 130 bar	
	– Pressure rating 200 bar	bar	To 230 bar	
	– Pressure rating 315 bar	bar	To 350 bar	
Max. flow of the main valve		l/min	200	300
Pilot flow		l/min	0.8	
Hydraulic fluid			On mineral oil basis and related hydrocarbons (HL, HLP, HLPD, HLPP) according to DIN 51524 [1)] Flame-resistant – water-free (HFDU(G), HFDU(E), HFDR) according to ISO12922 [2), 4)] Flame-resistant – containing water (HFC: Fuchs Hydrotherm 46M, Petrofer Ultra Safe 620) according to ISO12922 [3), 4)]	
Hydraulic fluid temperature range		°C	–20 to +80	
Viscosity range		mm^2/s	15 to 380	
Max. admissible degree of contamination of the hydraulic fluid Cleanliness class according to ISO 4406 (c)			Class 20/18/15 [5)]	
Hysteresis		%	±3.5 of the max. setting pressure [6)]	
Repeatability		%	< ±2 of the max. setting pressure [6)]	
Linearity		%	±2 of the max. setting pressure [6)]	
Manufacturing tolerance of the command value pressure characteristic curve, related to the hysteresis characteristic curve, pressure increasing	– DRE(M)	%	±3.5 of the max. setting pressure [6)]	
	– DRE(M)E	%	±1.5 of the max. setting pressure [6)]	
Step response $T_u + T_g$	10 → 90 %	ms	~130	Measured with standing hydraulic fluid column, 1 liter at port A
	90 → 10 %	ms	~160	
Step response $T_u + T_g$	10 → 90 %	ms	~150	Measured with standing hydraulic fluid column, 5 liters at port A
	90 → 10 %	ms	~150	

Foot notes see next page

Technical Data (For applications outside these parameters, please consult us!)

1) Suitable with NBR **and** FKM seals

2) Suitable **only** with FKM seals

3) Suitable **only** with NBR seals

4) When using flame-resistant hydraulic fluids HFC, the following limitations are to be observed:
- Max. operating pressure 210 bar
- Max. hydraulic fluid temperature 60 °C
- Expected service life 30...100 % as compared to HLP

5) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the service life of the components.

6) Does not apply to types "G24 - 8"

electric			"G24"	"G24-8"
Minimum solenoid current		mA	≤ 100	≤ 100
Maximum solenoid current		mA	1600 ± 10 %	800 ± 5 %
Solenoid coil resistance	Cold value at 20 °C	Ω	5.5	20.6
	Max. hot value	Ω	8	33
Duty cycle		%	100	100

electrical, integrated electronics (OBE)

Supply voltage	Nominal voltage	VDC	24
	Lower limit value	VDC	21
	Upper limit value	VDC	35
Current consumption		A	≤ 1.5
Required fuse protection		A	2, time-lag
Inputs	Voltage	V	0 to 10
	Current	mA	4 to 20
Output	Actual current value	mV	1 mV ≙ 1 mA
Protection class of the valve according to EN 60529			IP 65 with mating connector mounted and locked

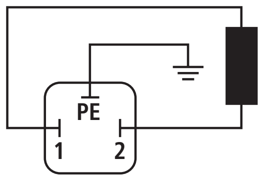
Caution!

With an ambient temperature of 70 °C and a duty cycle of 100 % with max. current, the coil of the 800 mA solenoid reaches temperatures of up to 170 °C. In case of contact with the coil, this may lead to burns.

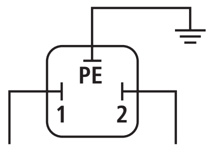
Electrical connection (dimensions in mm)

DRE(M)

Connection at connector

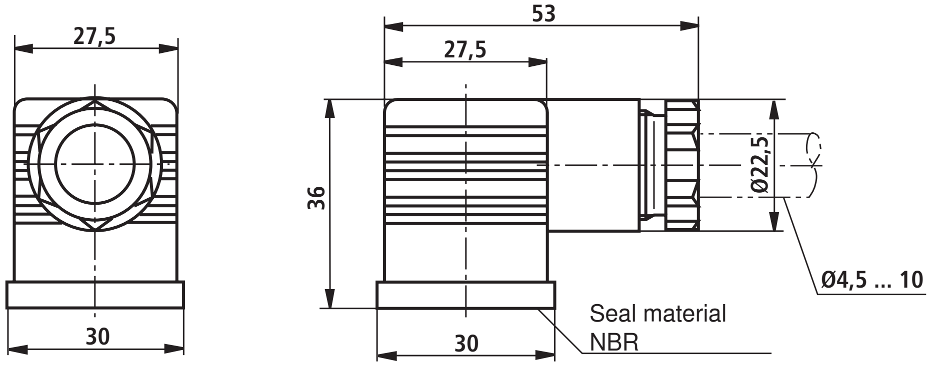


Connection at mating connector



To the amplifier

Mating connector (black) according to DIN EN 175301-803
Material no. **R901017011**
(separate order)

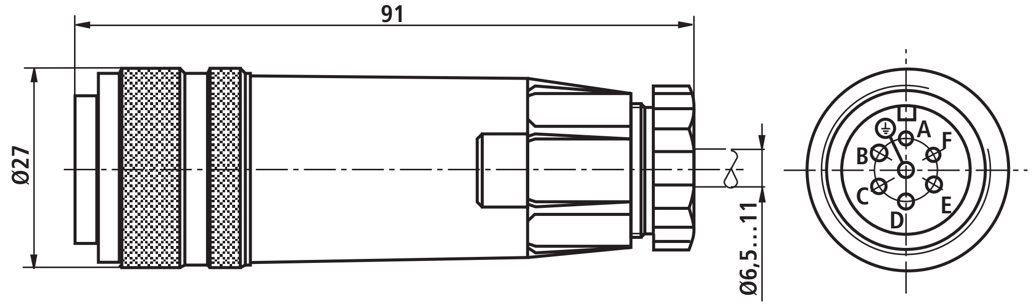


DRE(M)E

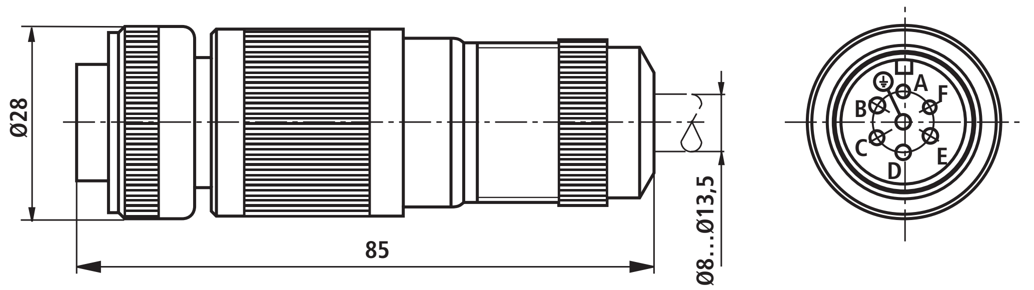
Device connector allocation	Contact	Allocation interface "A1"	Allocation interface "F1"
Supply voltage	A	24 VDC (u(t) = 21 V to 35 V); $I_{max} \leq 1.5$ A	
	B	0 V	
Reference potential actual value	C	Reference contact F; 0 V	Reference contact F; 0 V
Differential amplifier input	D	0 to 10 V; R_E = 100 kΩ	4 to 20 mA; R_E = 100 kΩ
	E	Reference potential command value	
Measuring output (actual value)	F	0 to 1.6 V actual value (1 mV ≙ 1 mA) Load resistance > 10 kΩ	
	PE	Connected to solenoid and valve housing	

Mating connectors according to DIN EN 175201-804, solder contacts for line cross-section 0.5 to 1.5 mm^2

Plastic version,
material no. **R900021267,**
(separate order)



Metal version,
material no. **R900223890**
(separate order)

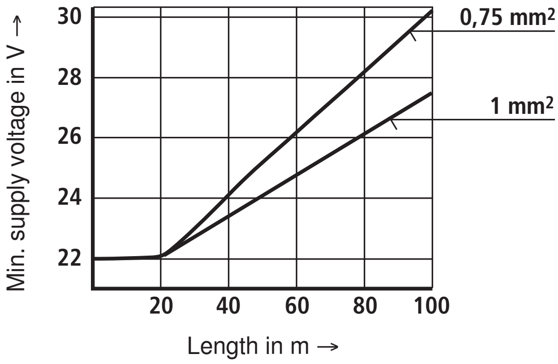


Electrical connection

Connection cable for DRE(M)E

– Recommendation 6-wire, 0.75 or 1 mm² plus protective earthing conductor and screening
– Only connect the screening to PE on the supply side
– Max. admissible length 100 m

The minimum supply voltage at the mains adapter depends on the length of the supply line (see diagram).



Integrated electronics (OBE) with type DRE(M)E

Function

The electronics are supplied with voltage via ports A and B. The command value is applied to the differential amplifier ports D and E.

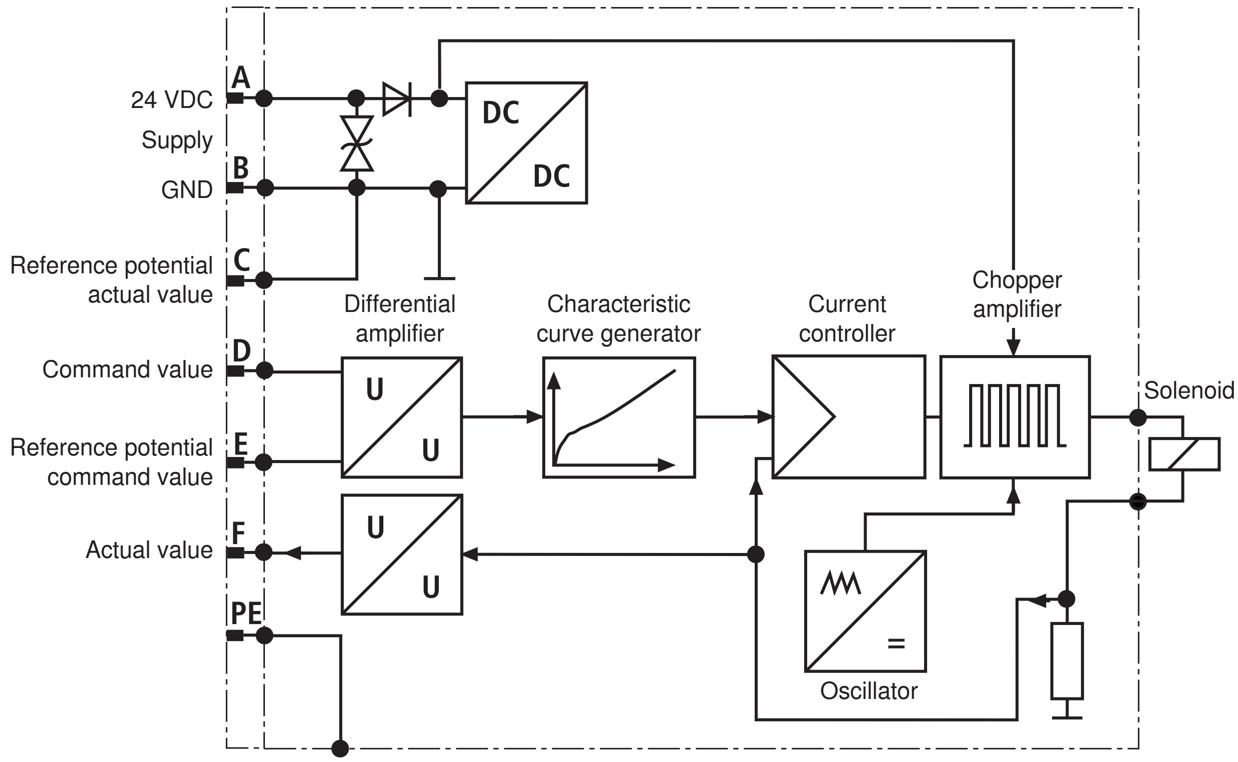
Via the characteristic curve generator, the command value solenoid current characteristic curve is adjusted to the valve so that non-linearities in the hydraulic system are compensated and thus, a linear command value pressure characteristic curve is created.

The current controller controls the solenoid current independent of the solenoid coil resistance.

The power section of the electronics for controlling the proportional solenoid is a chopper amplifier with a cycle frequence of approx. 180 Hz to 400 Hz. The output signal is pulse-width modulated (PWM).

For checking the solenoid current, a voltage can be measured between pin F(+) and pin C(–) that is proportional to the solenoid current. **1 mV** corresponds to **1 mA** solenoid current.

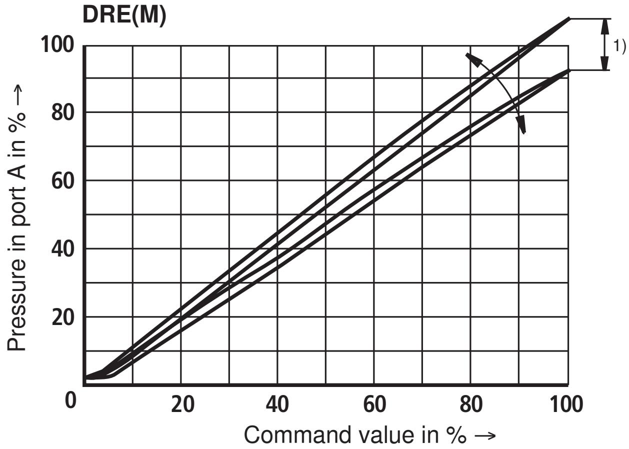
Block diagram



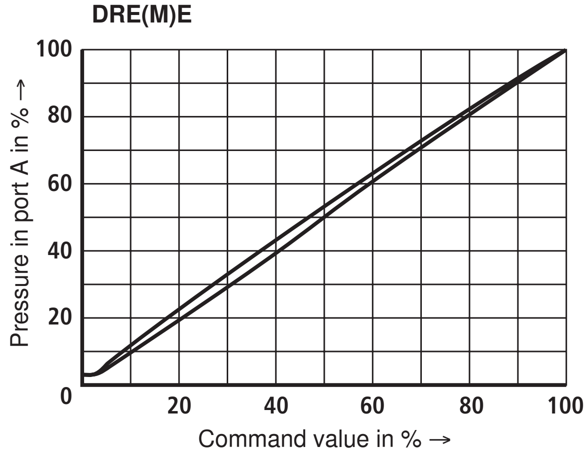
Characteristic curves (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C)

Pressure in port A depending on the command value (flow = 0.8 l/min)

DRE(M)



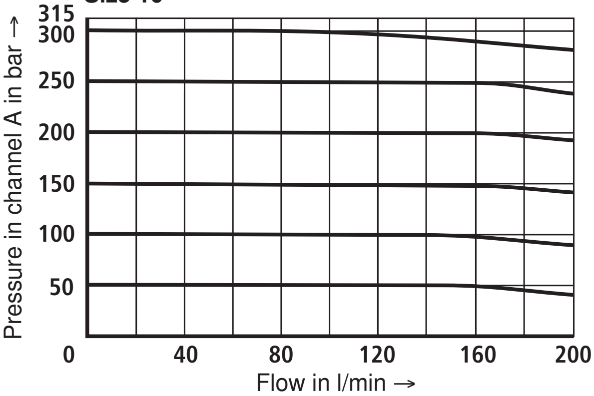
DRE(M)E



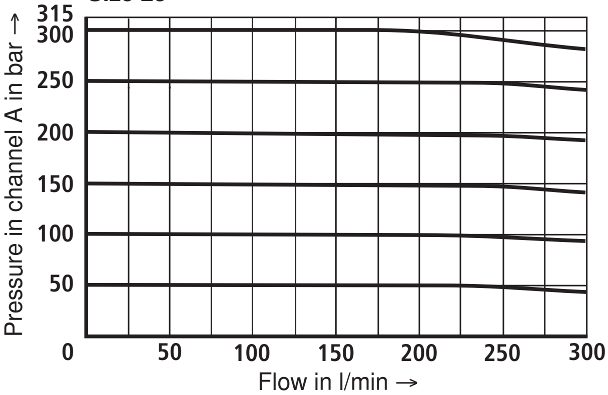
1) With valve DRE(M), the manufacturing tolerance at the **external amplifier** (type and data sheet see page 2) can be changed using the command value attenuator potentiometer "**Gw**". With the digital amplifier, the setting is made using the "Limit" parameter.
In this connection, the control current according to the technical data must not be exceeded.
In order to be able to adjust several valves to the same characteristic curve, the pressure must - with a command value of 100 % - at no valve not exceed the maximum setting pressure of the relevant pressure rating.

Pressure in channel A dependent on the flow q_v (characteristic curve with constant Δp)

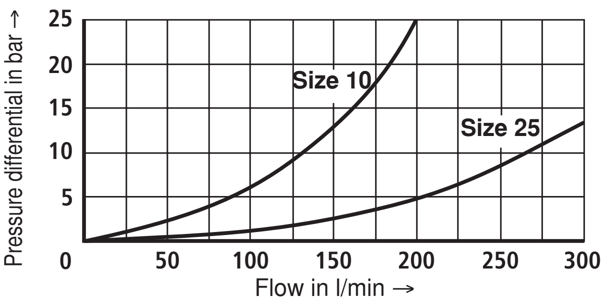
Size 10



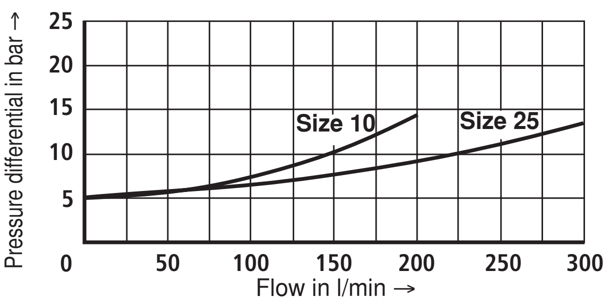
Size 25



Pressure differential via the check valve from A to B



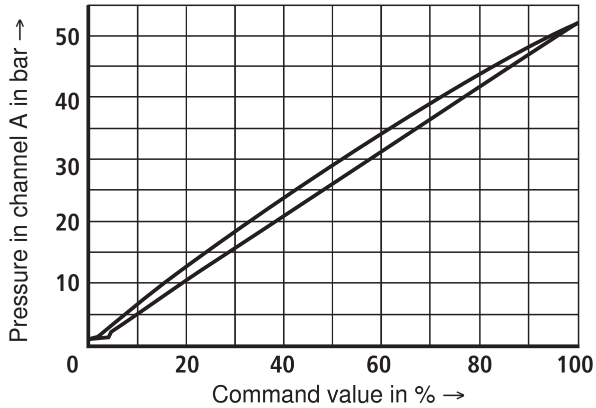
Pressure differential from B to A



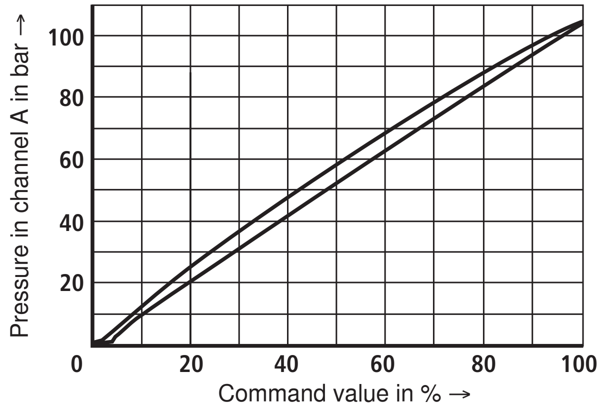
Characteristic curves (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C and amplifier VT VSPA1-11-1X, 1600 mA coil...)

Pressure in channel A depending on the command value

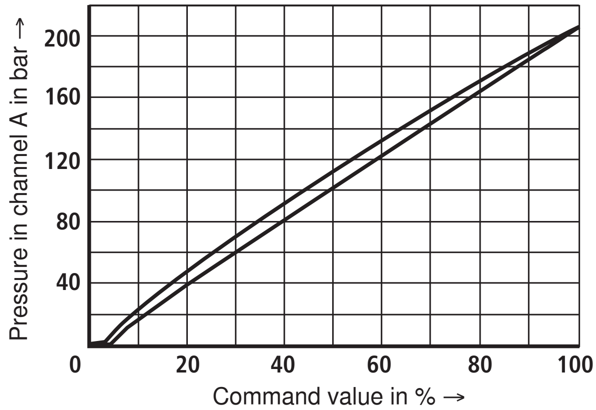
Pressure rating 50 bar



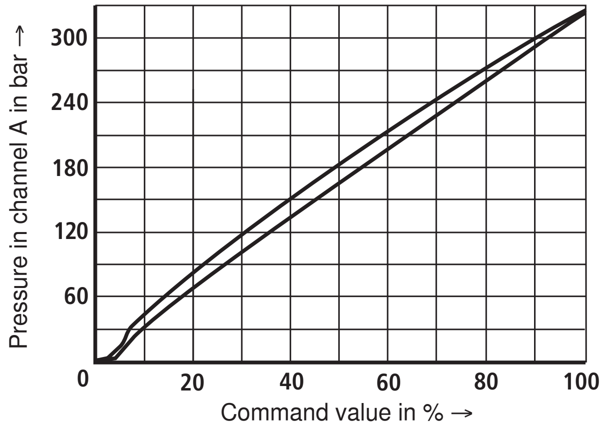
Pressure rating 100 bar



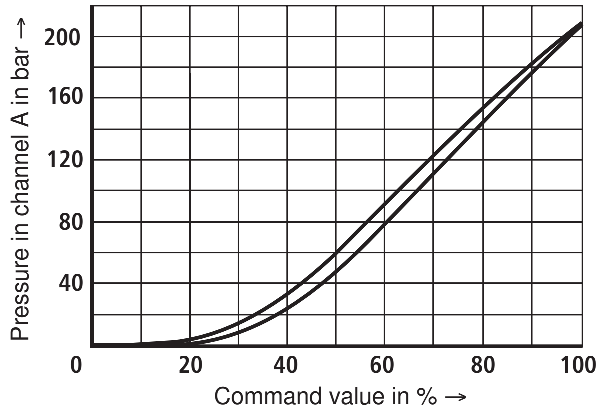
Pressure rating 200 bar



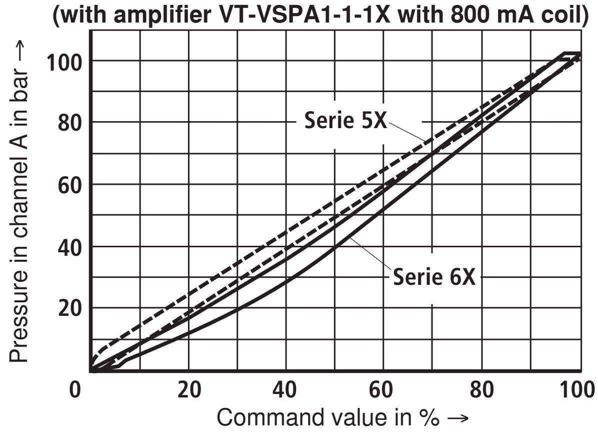
Pressure rating 315 bar



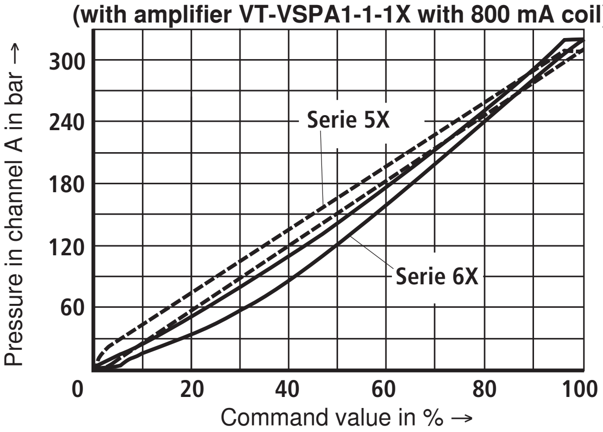
Pressure rating 200 bar (with VT-SSPA1)



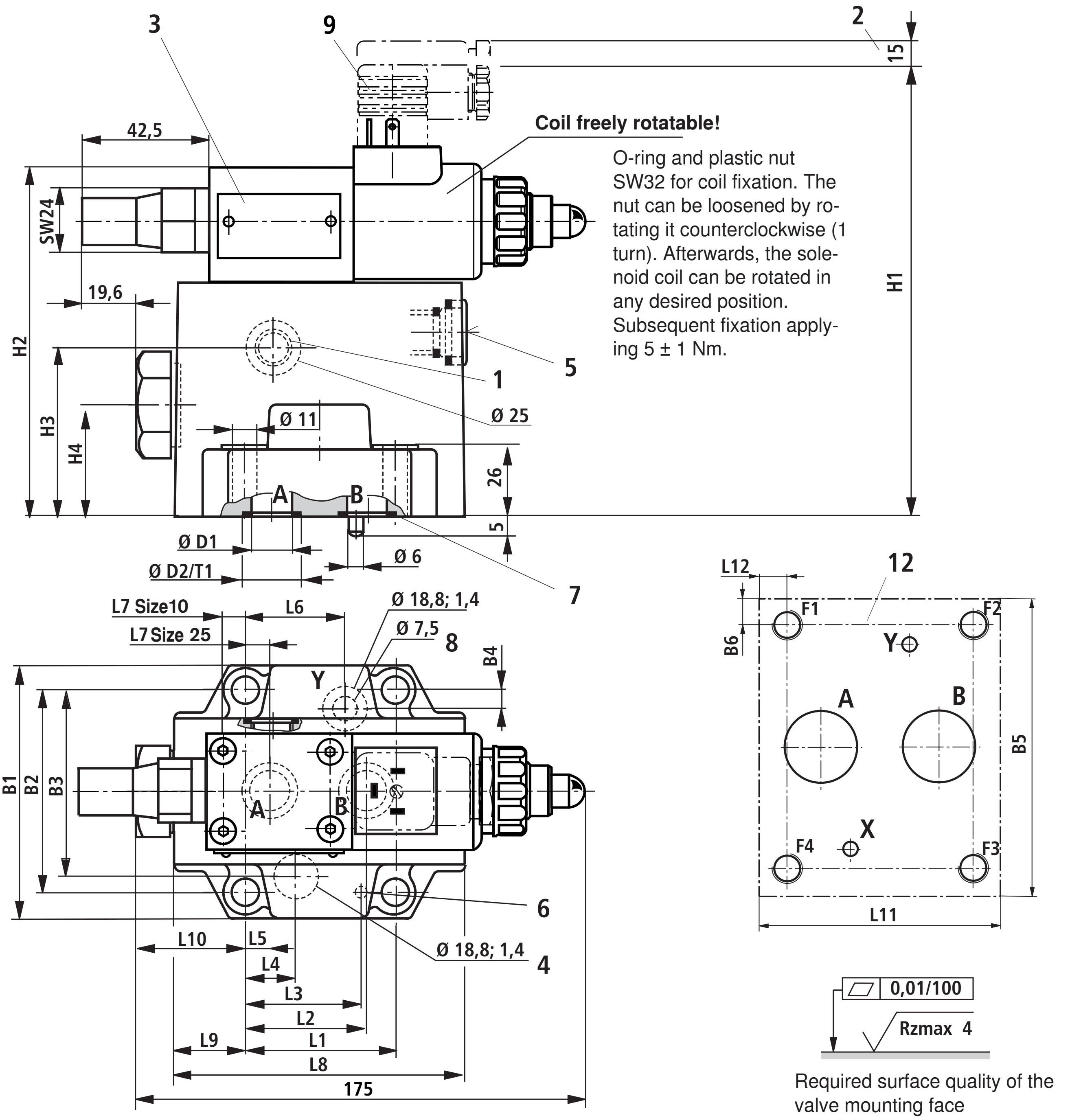
Comparison series 5X-6X / pressure rating 100 bar (with amplifier VT-VSPA1-1-1X with 800 mA coil)



Comparison series 5X-6X / pressure rating 315 bar (with amplifier VT-VSPA1-1-1X with 800 mA coil)



Unit dimensions type DRE(M) (dimensions in mm)



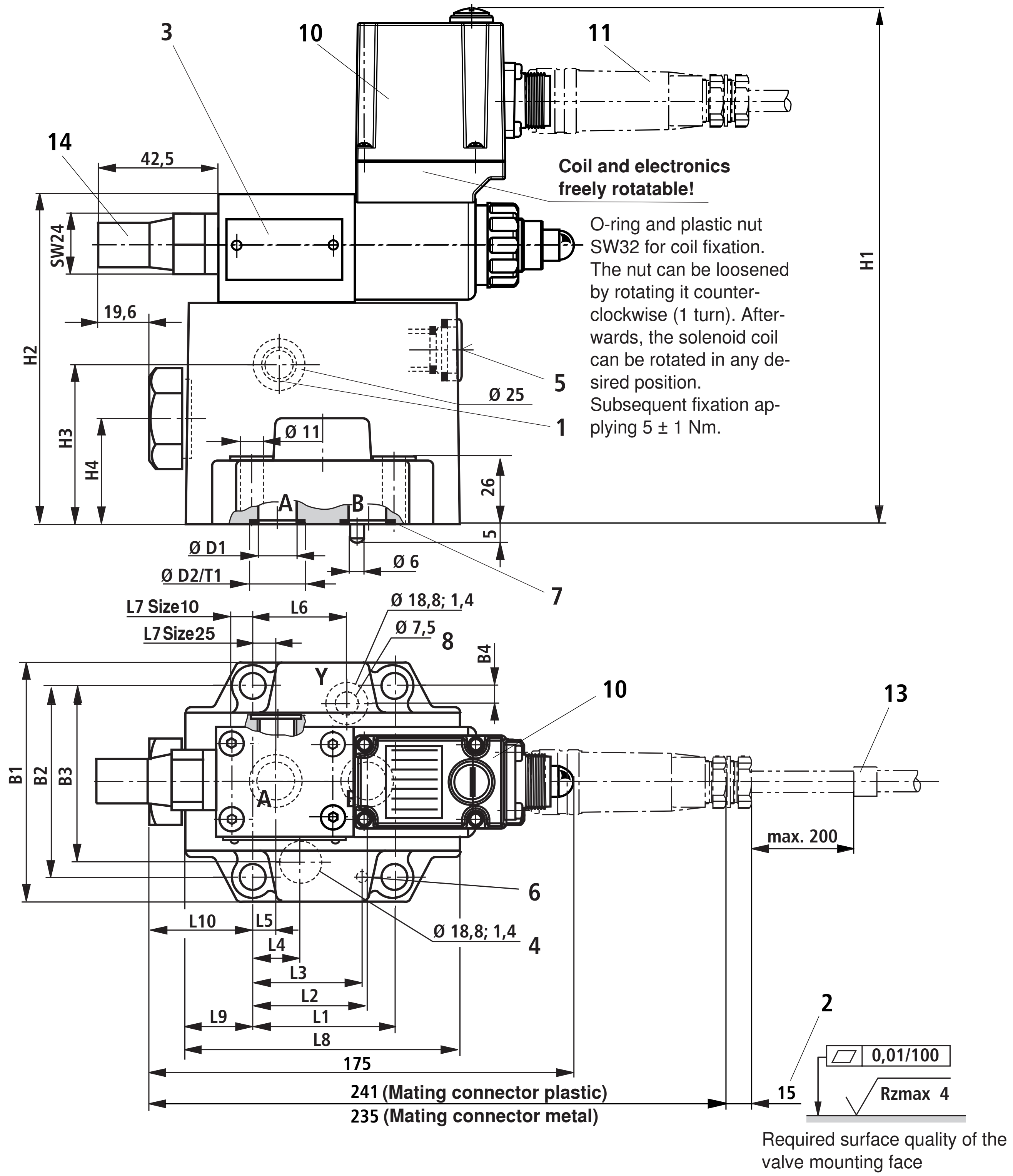
Required surface quality of the valve mounting face

Size	B1	B2	B3	B4	ØD1	ØD2[H11]	H1	H2	H3	H4
10	85	66.7	58.8	7.9	15	21.8	171	123	58	36
25	102	79.4	73	6.4	25	34.8	185	137	64	44

Size	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	T1
10	42.9	35.8	31.8	21.5	7.2	21.5	5	116	44.5	59.5	2.0
25	60.3	49.2	44.5	20.6	11.1	39.7	12.2	116	27.3	42	2.9

Size	B5	B6	L11	L12
10	84	8.65	61	9.05
25	97	8.8	78	8.85

Unit dimensions type DRE(M)E (dimensions in mm)



Required surface quality of the valve mounting face

Size	B1	B2	B3	B4	ØD1	ØD2 H11	H1	H2	H3	H4
10	85	66.7	58.8	7.9	15	21.8	192	123	58	36
25	102	79.4	73	6.4	25	34.8	206	137	64	44

Size	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	T1
10	42.9	35.8	31.8	21.5	7.2	21.5	5	116	44.5	59.5	2.0
25	60.3	49.2	44.5	20.6	11.1	39.7	12.2	116	27.3	42	2.9

Unit dimensions (continued)

1 Upon delivery, this port (G1/4) is closed. After removal of the blanking plug, an external and separate pilot oil return at zero pressure to the tank is, however, also possible here.

2 Space required for removing the mating connector

3 Name plate

4 Blind counterbore

5 Check valve, optional

6 Locating pin

7 Identical seal rings for ports A and B
Identical seal rings for port Y and blind counterbore (item 4)

8 Pilot oil return always external and separately at zero pressure to the tank, or optionally at item 1

9 Mating connector according to DIN EN 175301-803

10 Integrated electronics (OBE), type DRE(M)E with connector "K31"

11 Mating connector according to DIN EN 175201-804

12 Processed installation surface, porting pattern according to
ISO 5781-06-07-0-00 (size 10)
ISO 5781-08-10-0-00 (size 25)

13 Cable fastening

14 Maximum pressure limitation with version DREM and DREME

Subplates according to data sheet RE 45062 and valve mounting screws must be ordered separately.

Subplates:

Size 10: G 460/01 (G 3/8)
G 461/01 (G 1/2)

Size 25: G 412/01 (G 3/4)
G 413/01 (G 1)

Valve mounting screws:
4 hexagon socket head cap screws
ISO 4762-M10x45-10.9-flZn-240h-L
(friction coefficient μ_{total} = 0.09 to 0.14,
Tightening torque $\boldsymbol{M}_A$ = 59 Nm ± 10 %

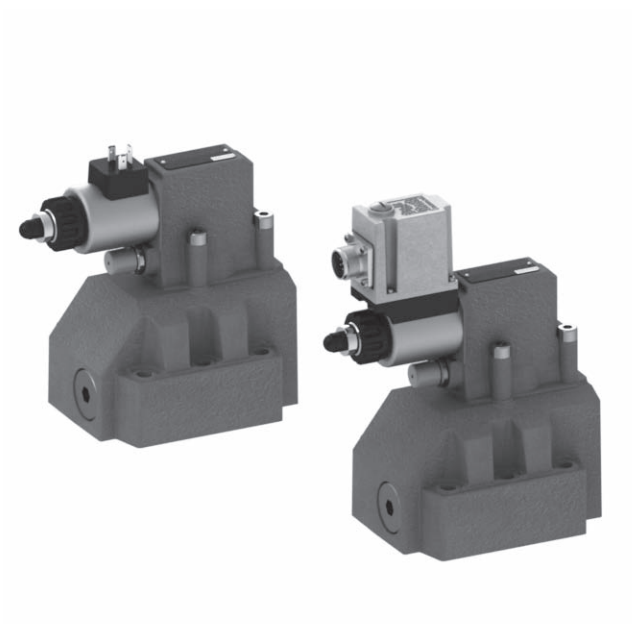
or

4 hexagon socket head cap screws ISO 4762-M10x45-10.9
(friction coefficient μ_{total} = 0.12 to 0.17)
Tightening torque $\boldsymbol{M}_A$ = 75 Nm ± 10 %

Proportional pressure reducing valve, pilot operated

Type DRE(M) and DRE(M)E

RE 29278
Edition: 2012-12
Replaces: 11.11



- Size 32
- Component series 6X
- Maximum operating pressure 315 bar
- Maximum flow: 300 l/min

Features

- Valve for reducing an operating pressure
- Operation by means of proportional solenoid
- Proportional solenoid with rotatable and detachable coil
- For subplate mounting:
  Porting pattern according to ISO 5781
- Optional check valve between A and B
- Maximum pressure limitation optional
- Valve and control electronics from a single source
- Integrated electronics (OBE) with type DREME:
  Little manufacturing tolerance of the command value pressure characteristic curve
- External control electronics with type DRE and DREM (separate order)

Contents

Ordering code

01	02	03	04		05		06	07	08	09	10	11	12	13	14
DRE			**30**	**–**	**6X**	**/**		**Y**		**G24**					*****

01	Proportional pressure reducing valve	**DRE**
02	**Without** maximum pressure limitation	**no code**
	With maximum pressure limitation	**M** [1)]
03	For external control electronics	**no code**
	With integrated electronics (OBE)	**E**

Size

04	Size 32	**30**
05	Component series 60 to 69 (60 to 69: Unchanged installation and connection dimensions)	**6X**

Pressure rating

06	Up to 50 bar	**50**
	Up to 100 bar	**100**
	Up to 200 bar	**200**
	Up to 315 bar	**315**
07	Pilot oil return always external, separately and at zero pressure to the tank	**Y**
08	**With** check valve between A and B	**no code**
	Without check valve	**M**

Supply voltage

09	24 V DC voltage	**G24**
10	1600 mA coil	**no code**
	800 mA coil	**–8** [2)]

1) The maximum pressure limitation only serves as protection against overpressure in case of an error in the pilot valve (e.g. in case of contamination or over-current).

2) Replacement for series 4X (Attention! External amplifiers only suitable for G24 = 1.6 A solenoid), see accessories.

Ordering code

01	02	03	04		05		06	07	08	09	10	11	12	13	14
DRE			**30**	**–**	**6X**	**/**		**Y**		**G24**					*****

Electrical connection

11	**For type DBEM:**	
	Without mating connector; connector DIN EN 175301-803	**K4** 3)
	For type DBEME:	
	Without mating connector; connector DIN EN 175201-804	**K31** 3)

Electronics interface

12	Command value 0 to 10 V	**A1**
	Command value 4 to 20 mA	**F1**
	With DBEM	**no code**

Seal material

13	NBR seals	**M**
	FKM seals	**V**
	Attention: Observe compatibility of seals with hydraulic fluid used!	

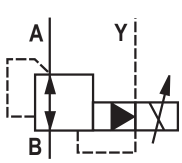
14	Further details in the plain text	

3) Mating connectors, separate order, see page 8 and 16

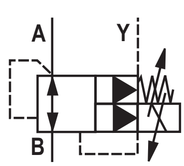
Symbols

For external control electronics:

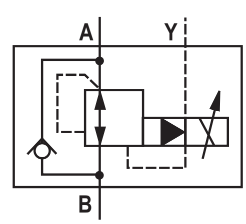
DRE 30-6X/…**YM**…



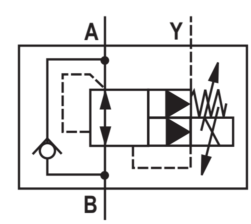
DREM 30-6X/…**YM**…



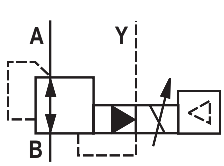
DRE 30-6X/…**Y**…



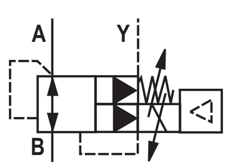
DREM 30-6X/…**Y**…



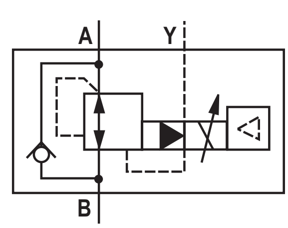
With integrated electronics:



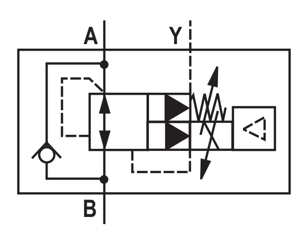
DREE 30-6X/…**YM**…



DREME 30-6X/…**YM**…



DREE 30-6X/…**Y**…



DREME 30-6X/…**Y**…

Function, section

Valves of type DRE(M) are pilot operated pressure reducing valves. They are used to reduce an operating pressure. These valves basically consist of a pilot control valve (1) with proportional solenoid (2), a main valve (3) with main spool insert (4), as well as an optional check valve (5).

Type DRE...

The pressure in channel A is set in a command value-dependent form via the proportional solenoid (2).

In rest position – no pressure in channel B –, the spring (11) holds the main spool (4) in its initial position. The connection from channel B to A is open.

The pressure in channel A acts on the bottom side of the main spool in closing direction and the pressure of the pilot control valve on the spring side of the main spool in the opening direction from channel B to A.

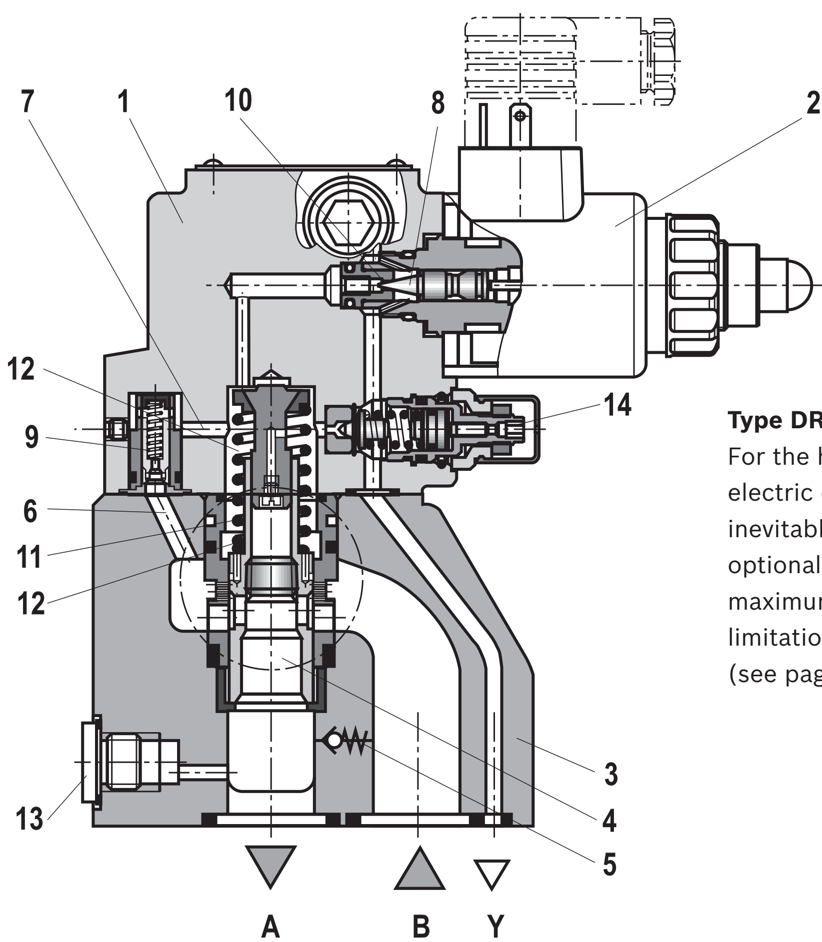
The pilot oil is taken from channel B and flows via the bore (6) to the fixed flow control (9) keeping the pilot flow constant, independent of the pressure drop between channel A and B. From the fixed flow control (9), the pilot flow flows through the bores (7) via the valve seat (10) by the valve poppet (8) into the Y channel to the tank.

The pressure required in channel A is preset at the related amplifier. The proportional solenoid pushes the valve poppet (8) in the direction of the valve seat (10) and limits the pressure in the spring chamber (12) to the set value. In the control position of the main spool (4), the hydraulic fluid flows from channel B to A and generates the pressure in channel A (setting of the pilot control valve plus spring (11)). If the set pressure in A is achieved, the forces at the main spool are balanced.

When the actuator connected to port A is not moving (e.g. cylinder piston at stop), and a lower pressure is set in channel A via the proportional solenoid (2), the main spool (4) closes the connection from B to A and at the same time opens the connection from channel A to the spring chamber (12) of the main spool (4). In this position, the compression volume in channel A can expand via the pilot control valve (1) and port Y.

For the free flow back from channel A to B, a check valve (5) can optionally be installed.

A pressure gauge connection (13) allows for the control of the reduced pressure in channel A.



Type DREM.30-4X/.YG24K4... (with check valve)

Type DREM...

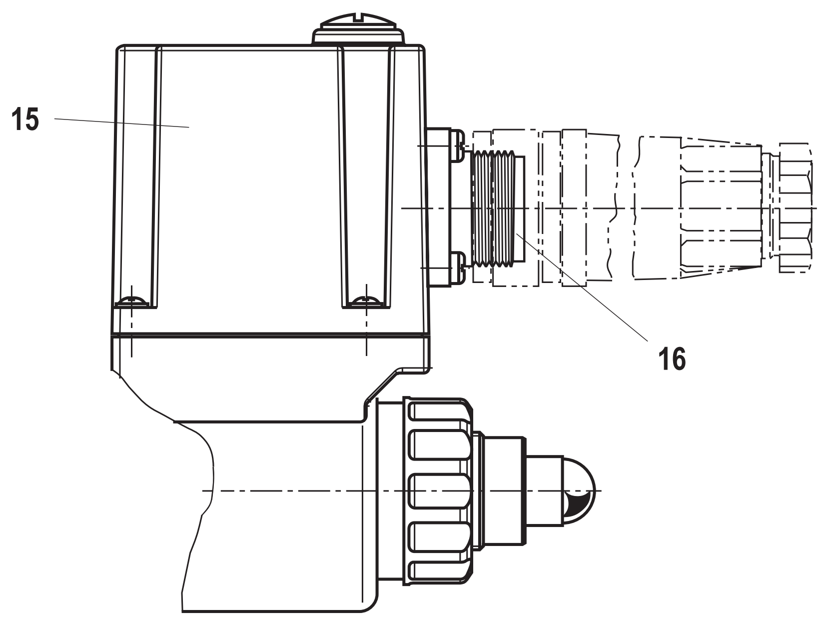
For the hydraulic protection against an inadmissible high electric control current at the proportional solenoid which inevitably results in excessive pressures in port A, you can optionally install a spring-loaded pressure relief valve as maximum pressure limitation (14). The maximum pressure limitation is pre-set, referred to the relevant pressure rating (see page 6).

Function, section

Type DRE(M)E – with integrated electronics (OBE)
With regard to function and set-up, these types correspond to type DRE. On the proportional solenoid, there is moreover a housing (15) with the control electronics.
Supply and command value voltage are applied to the connector (16).
In the factory, the command value pressure characteristic curve is adjusted with little manufacturing tolerance.

For more information on the control electronics, see page 9.

Type DRE(M)E...-6X/...YG24K31...



Technical data
(For applications outside these parameters, please consult us!)

general			
Weight	– Type DRE and DREM	kg	8.6
	– Type DREE and DREME	kg	8.7
Installation position			Any
Storage temperature range		°C	–20 to +80
Ambient temperature range	– Type DRE and DREM	°C	–20 to +70
	– Type DREE and DREME	°C	–20 to +50

hydraulic (measured with HLP46, ϑ_{oil} = 40 ± 5 °C)				
Maximum operating pressure	– Port A and B	bar	315	
	– Port Y	bar	Separately and to the tank at zero pressure	
Maximum set pressure in channel A	– Pressure rating 50 bar	bar	50	
	– Pressure rating 100 bar	bar	100	
	– Pressure rating 200 bar	bar	200	
	– Pressure rating 315 bar	bar	315	
Minimum set pressure in channel A with command value zero		bar	See characteristic curve page 14	
Maximum pressure limitation, fixedly set:			Set in the factory:	
	– Pressure rating 50 bar	bar	To 75 bar	
	– Pressure rating 100 bar	bar	To 130 bar	
	– Pressure rating 200 bar	bar	To 230 bar	
	– Pressure rating 315 bar	bar	To 350 bar	
Maximum flow of the main valve		l/min	300	
Pilot flow		l/min	1.0	
Hydraulic fluid			See table page 7	
Hydraulic fluid temperature range		°C	–20 to +70	
Viscosity range		mm^2/s	15 to 380	
Maximum admissible degree of contamination of the hydraulic fluid - cleanliness class according to ISO 4406 (c)			Class 20/18/15 [1]	
Hysteresis		%	±3 of the maximum set pressure [2]	
Repetition accuracy		%	< ±2 of the maximum set pressure [2]	
Linearity		%	±3.5 of the maximum set pressure [2]	
Manufacturing tolerance of the command value pressure characteristic curve, related to the hysteresis characteristic curve; pressure increasing	– Type DRE(M)	%	±5 of the maximum set pressure [2]	
	– Type DRE(M)E	%	±1.5 of the maximum set pressure	
Step response T_u + T_g	10 % → 90 %	ms	~160	Measured with standing hydraulic fluid column, 1 liter at port A
	90 % → 10 %	ms	~250	
Step response T_u + T_g	10 % → 90 %	ms	~250	Measured with standing hydraulic fluid column, 5 liters at port A
	90 % → 10 %	ms	~450	

[1] The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the life cycle of the components.

[2] Does not apply to types "G24-8"

Technical data

(For applications outside these parameters, please consult us!)

Hydraulic fluid		Classification	Suitable sealing materials	Standards
Mineral oils and related hydrocarbons		HL, HLP, HLPD, HLPP	NBR, FKM	DIN 51524
Flame-resistant	– water-free	HFDU, HFDR	FKM	ISO 12922
	– containing water	HFC Fuchs Hydrotherm 46M Petrofer Ultra Safe 620	NBR	ISO 12922

Important information on hydraulic fluids!

- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- The flash point of the hydraulic fluid used must be 40 K higher than the maximum solenoid surface temperature.
- **Flame-resistant – containing water**: Maximum pressure differential 210 bar, otherwise, increased cavitation erosion. The pressure peaks should not exceed the maximum operating pressures!
  Life cycle as compared to HLP 30 to 100 %
  Fluid temperature maximum 60 °C

electric			G24	G24-8
Minimum solenoid current		mA	≤ 100	≤ 100
Maximum solenoid current		mA	1600 ±10 %	800 ±5 %
Solenoid coil resistance	– Cold value at 20 °C	Ω	5.5	20.6
	– Maximum hot value	Ω	8.05	33
Duty cycle		%	100	100

electrical, integrated electronics (OBE)			
Supply voltage	– Nominal voltage	VDC	24
	– Lower limit	VDC	21
	– Upper limit	VDC	35
Current consumption		A	≤ 1.5
Required fuse protection		A	2, time-lag
Inputs	– Voltage	V	0 to 10
	– Current	mA	4 to 20
Output	– Actual current value	mV	1 mV ≙ 1 mA
Protection class of the valve according to EN 60529			IP 65 with mating connector mounted and locked

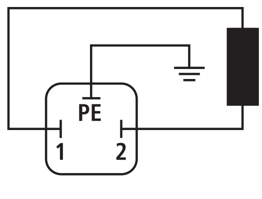
Caution!

At an ambient temperature of 70 °C and a duty cycle of 100 % with max. current, the coil of the 800 mA solenoid reaches temperatures of up to 170 °C. Contact with the coil may lead to burns.

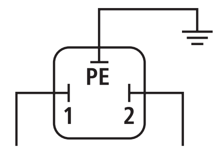
Electrical connection
(dimensions in mm)

Type DRE(M)

Connection at the connector

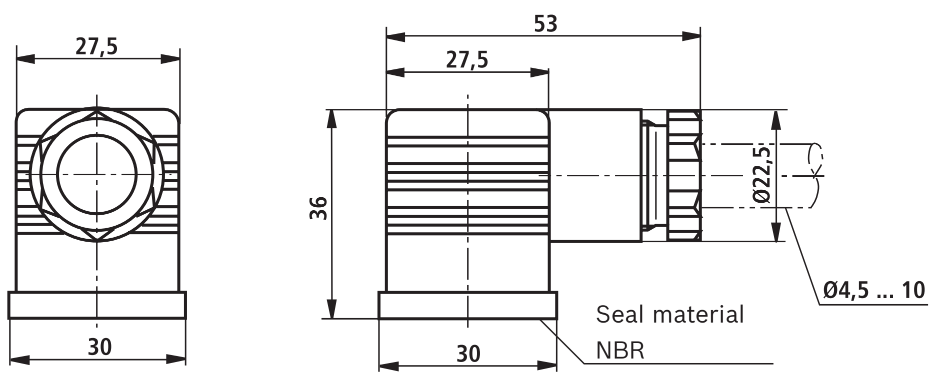


Connection at mating connector



to the amplifier

Mating connector (black)
according to DIN EN 175301-803
Material no. **R901017011**
(separate order)

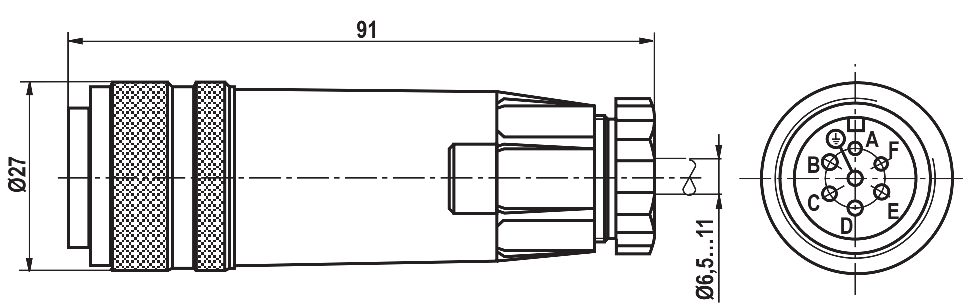


Type DRE(M)E

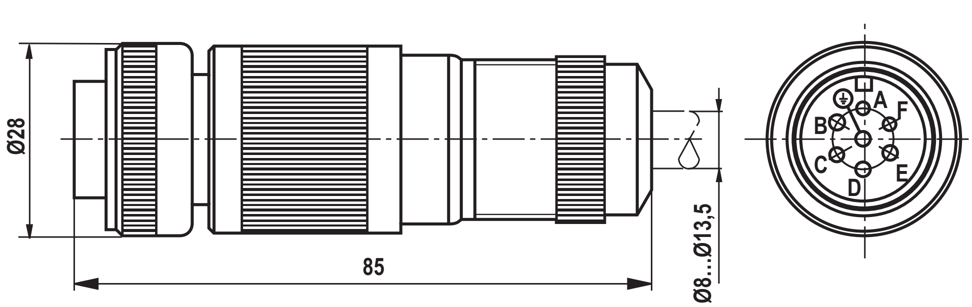
Device connector allocation	Contact	Allocation interface "A1"	Allocation interface "F1"
Supply voltage	A	24 VDC (u(t) = 21 V to 35 V); I_{max} ≤ 1.5 A	
	B	0 V	
Reference potential actual value	C	Reference contact F; 0 V	Reference contact F; 0 V
Differential amplifier input	D	0 to 10 V; R_E = 100 kΩ	4 to 20 mA; R_E = 100 Ω
	E	Reference potential command value	
Measuring output (actual value)	F	0 to 1.6 V actual value (1 mV ≙ 1 mA) Load resistance > 10 kΩ	
Protective earth	PE	Connected to solenoid and valve housing	

Mating connectors according to DIN EN 175201-804, solder contacts for line cross-section 0.5 to 1.5 mm²

Plastic version,
material no. **R900021267**
(separate order)



Metal version,
material no. **R900223890**
(separate order)

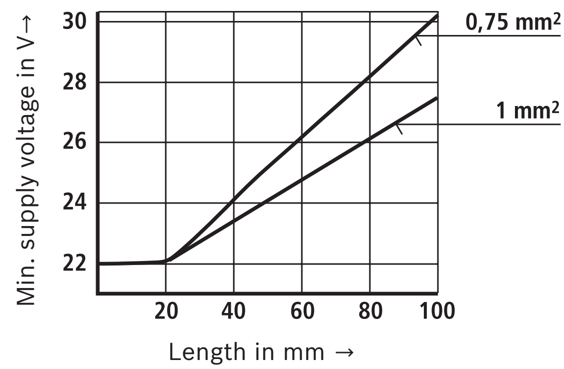


Electrical connection

Connection cable for type DRE(M)E

– Recommendation 6-wire, 0.75 or 1 mm² plus protective earthing conductor and screening
– Only connect the screening to PE on the supply side
– Maximum admissible length 100 m

The minimum supply voltage at the mains adapter depends on the length of the supply line (see diagram).

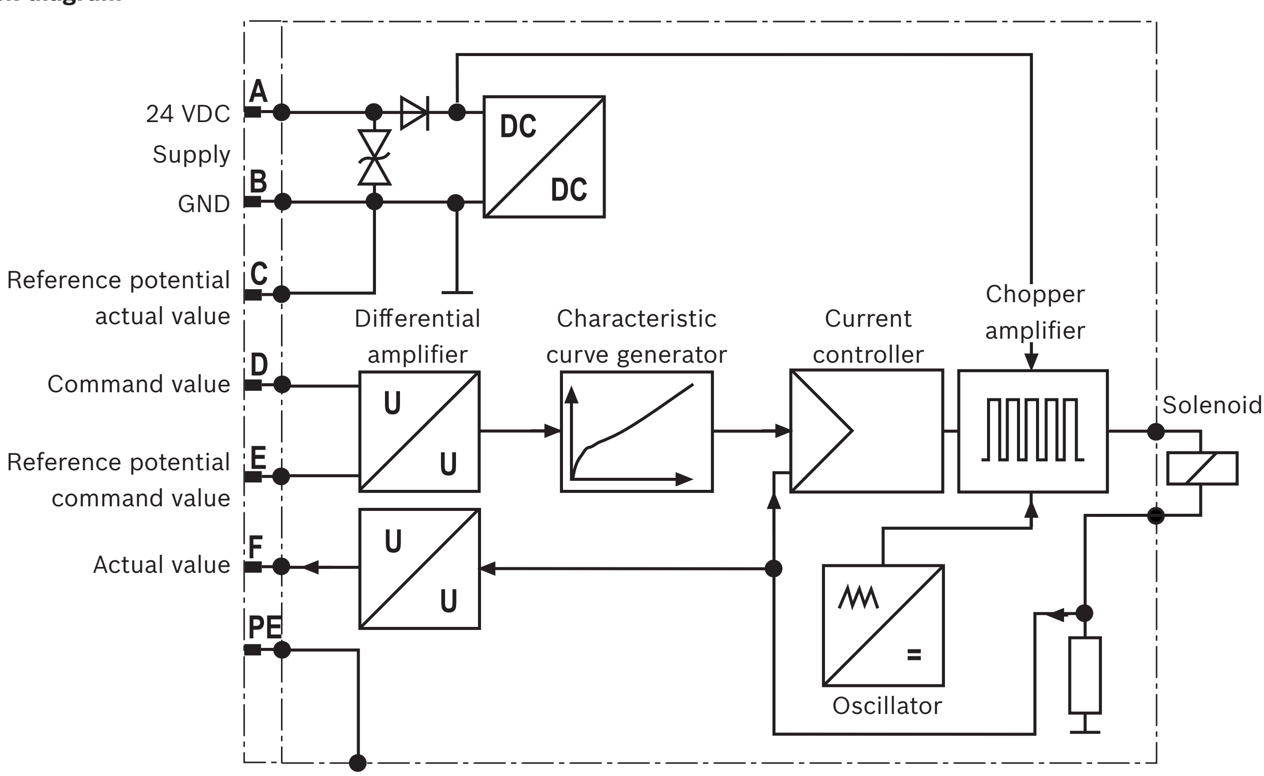


Integrated electronics (OBE) with type DRE(M)E

Function

The electronics are supplied with voltage via ports A and B. The command value is applied to the differential amplifier ports D and E.
Via the characteristic curve generator, the command value solenoid current characteristic curve is adjusted to the valve so that non-linearities in the hydraulics are compensated for and a linear command value pressure characteristic curve is created.
The current controller controls the solenoid current independent of the solenoid coil resistance.
The power stage of the electronics for controlling the proportional solenoid is a chopper amplifier with a cycle frequency of approx. 180 Hz to 400 Hz. The output signal is pulse-width modulated (PWM).
For checking the solenoid current, a voltage can be measured at the connector between pin F(+) and pin C(–) that is proportional to the solenoid current. **1 mV** corresponds to **1 mA** solenoid current.

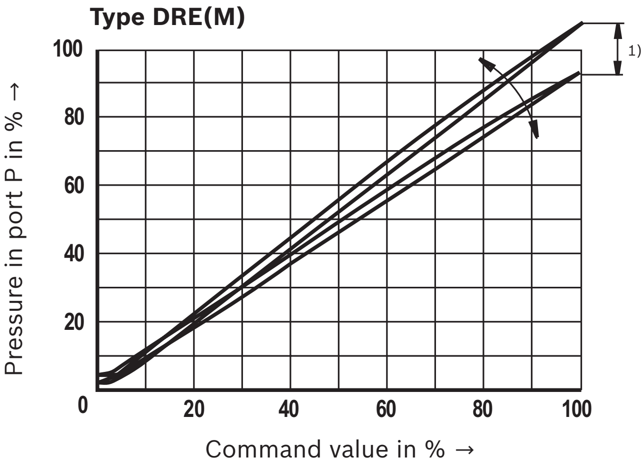
Block diagram

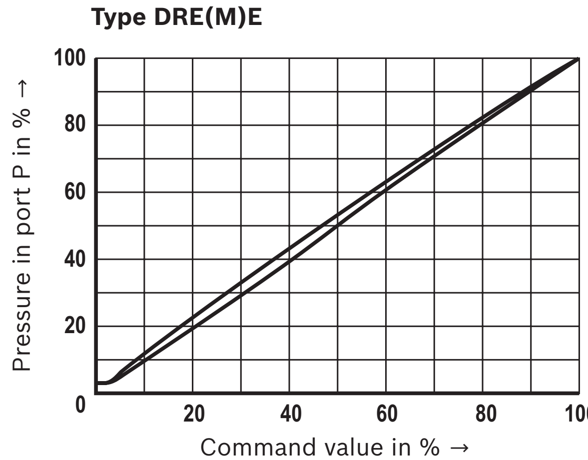


Characteristic curves

(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

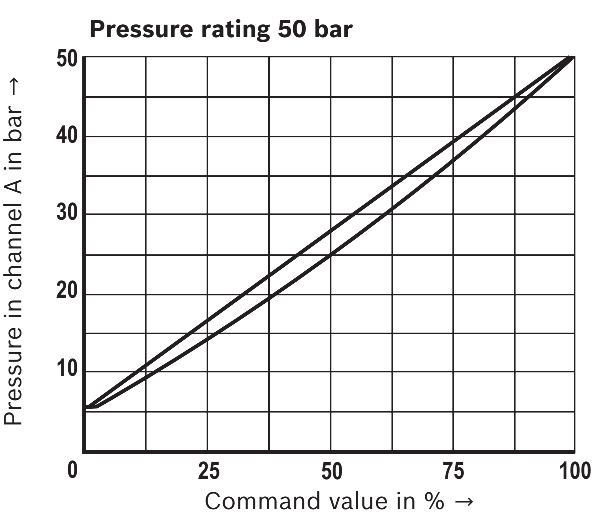
Pressure in port P depending on the command value (flow = 0.8 l/min)

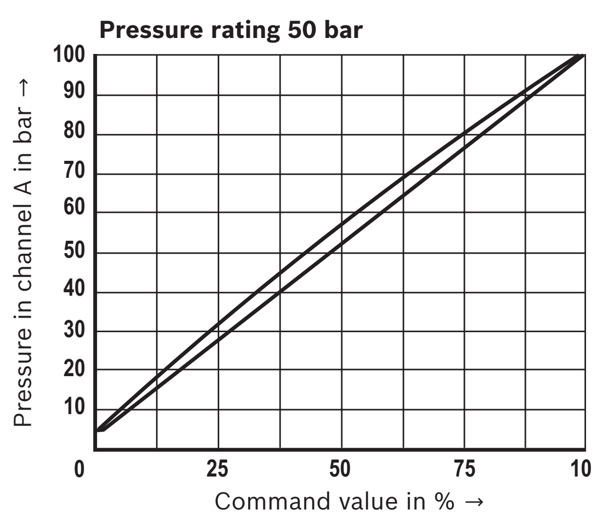




1) With valve type DRE(M), the manufacturing tolerance at the **external amplifier** (type and data sheet see page 16) can be changed using the command value attenuator potentiometer "**Gw**". The digital amplifier is set using the "Limit" parameter.
In this connection, the control current according to the technical data must not be exceeded.
In order to be able to adjust several valves to the same characteristic curve, do not set the pressure higher than the maximum set pressure of the pressure rating with command value 100 %.

Pressure in channel A depending on command value (measured with a flow of 0 l/min from B to A as well as related control electronics)

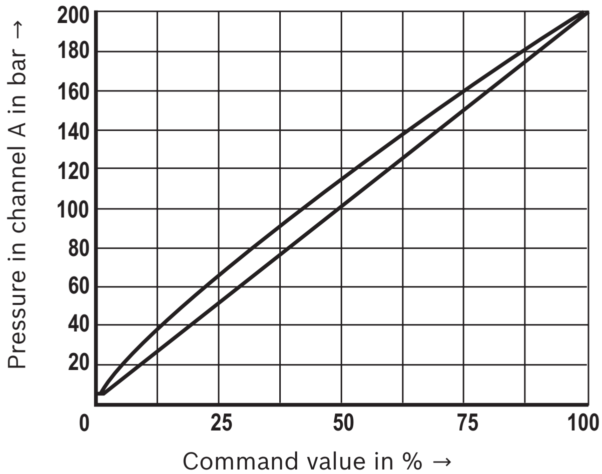




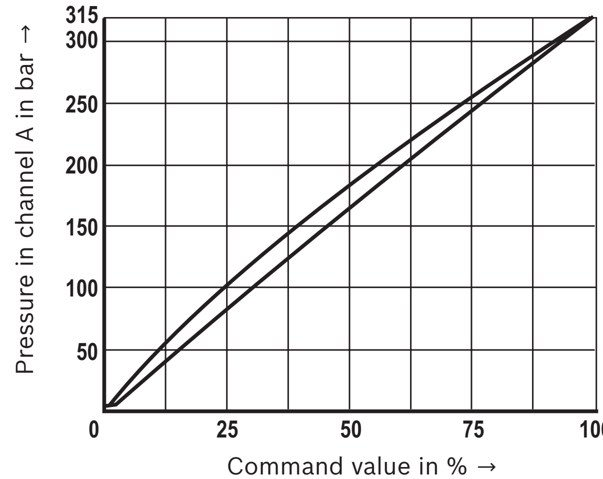
Characteristic curves

(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

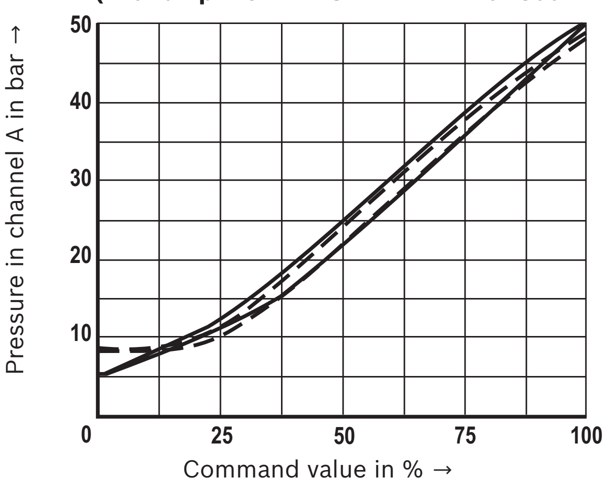
Pressure rating 200 bar



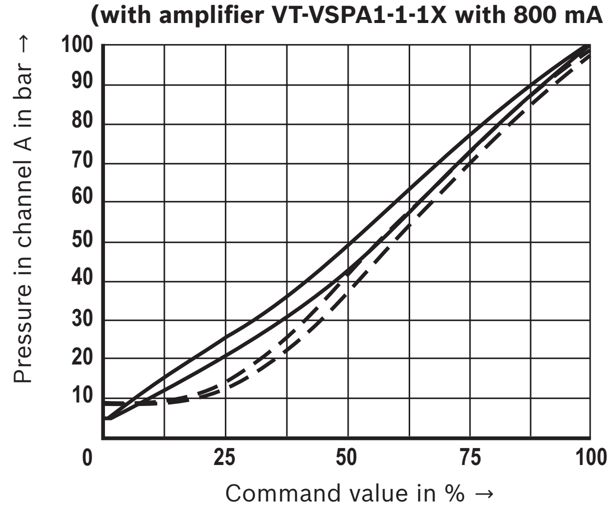
Pressure rating 315 bar



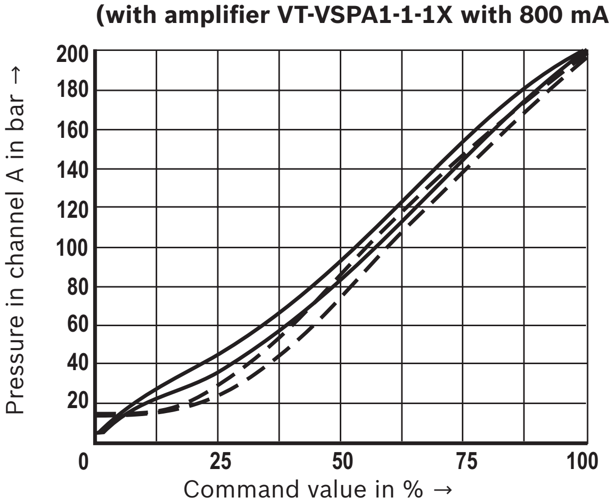
Comparison series 4X-6X / pressure rating 50 bar (with amplifier VT-VSPA1-1-1X with 800 mA coil)



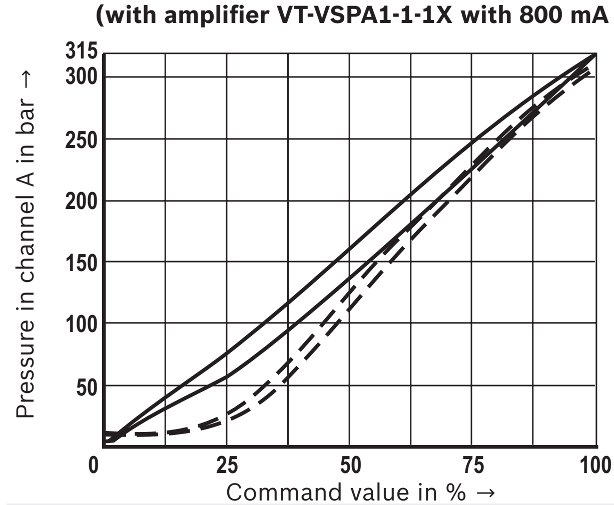
Comparison series 4X-6X / pressure rating 100 bar (with amplifier VT-VSPA1-1-1X with 800 mA coil)



Comparison series 4X-6X / pressure rating 200 bar (with amplifier VT-VSPA1-1-1X with 800 mA coil)



Comparison series 4X-6X / pressure rating 315 bar (with amplifier VT-VSPA1-1-1X with 800 mA coil)



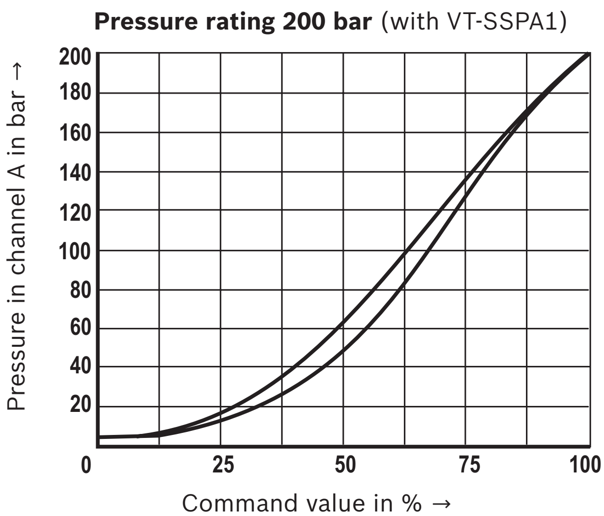
– – Series 4X

—— Series 6X 800 mA

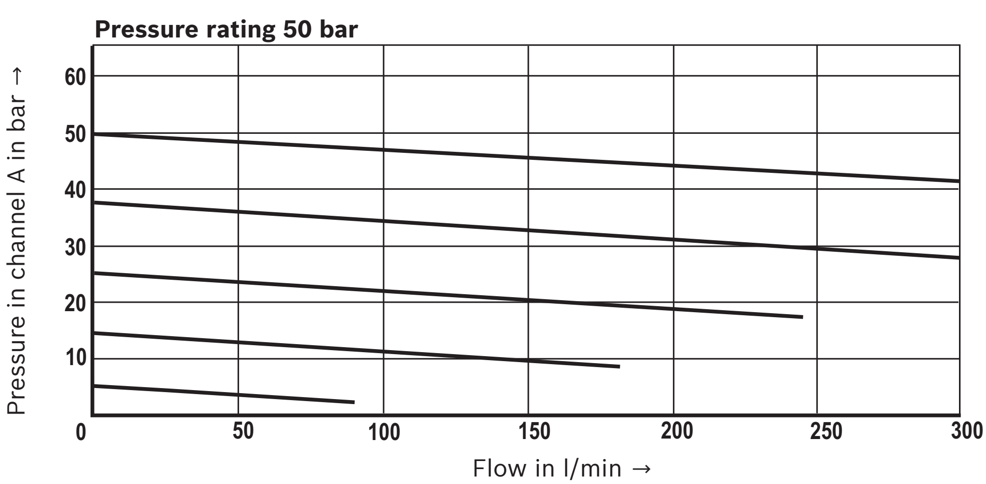
Notice!
In order to achieve the lowest settable pressure, the pilot current must not exceed 100 mA.

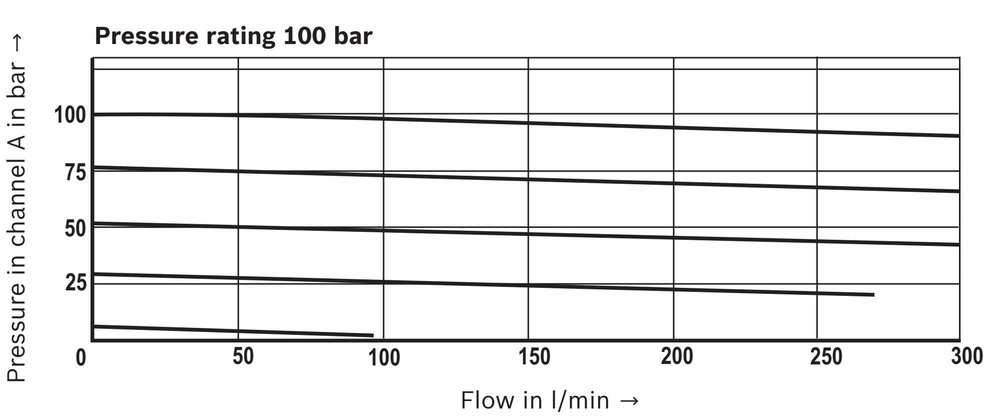
Characteristic curves

(measured with HLP46, ϑ_{oil} = 40 ±5 °C)



Pressure in channel A dependent on the flow Q_v

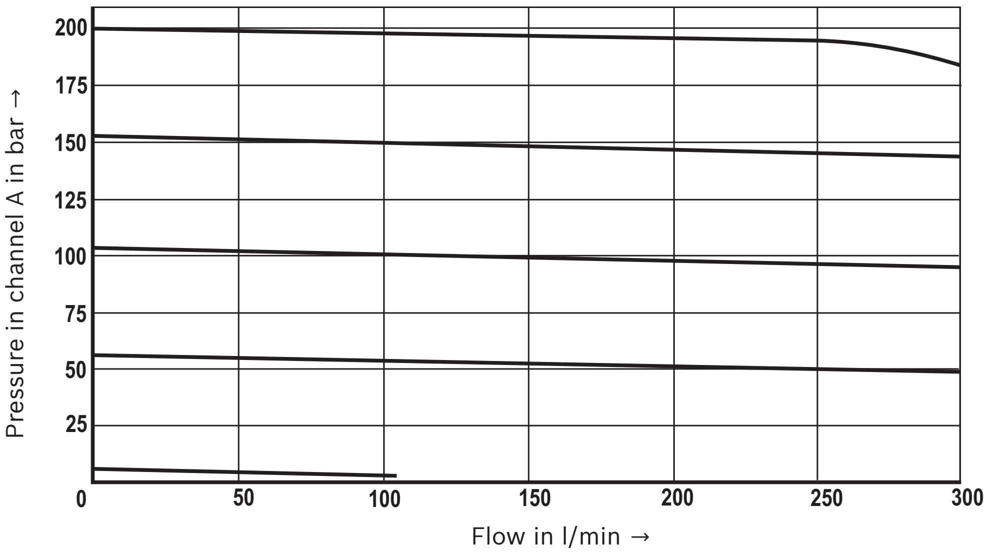




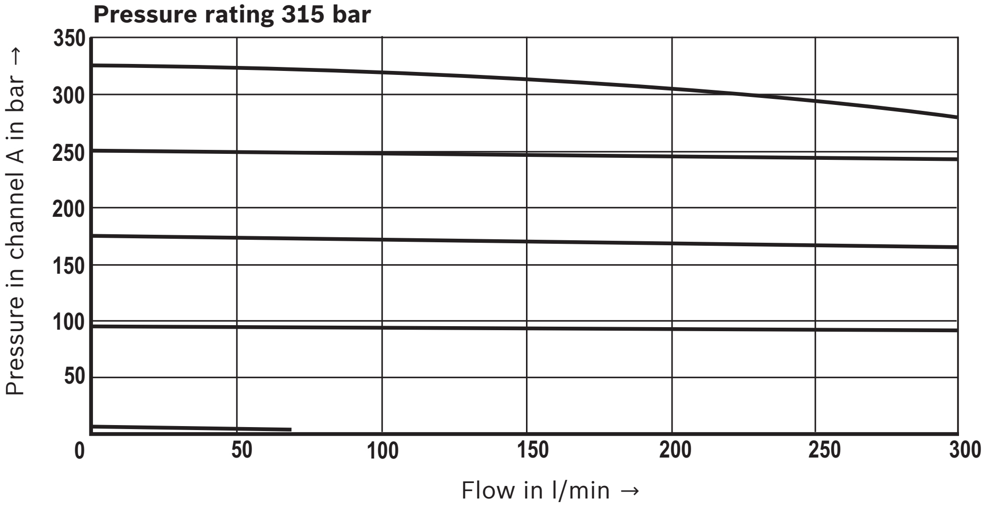
Characteristic curves

(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Pressure rating 200 bar

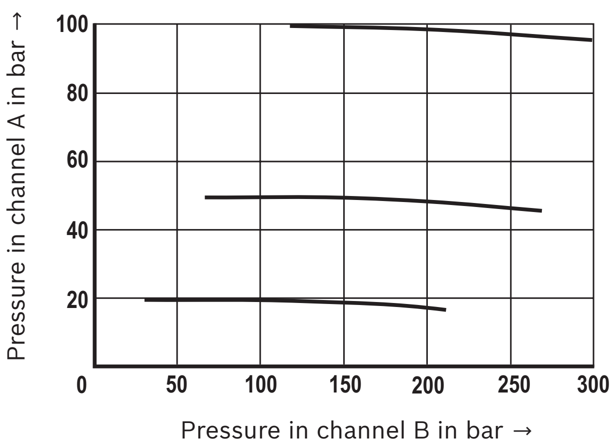


Pressure rating 315 bar

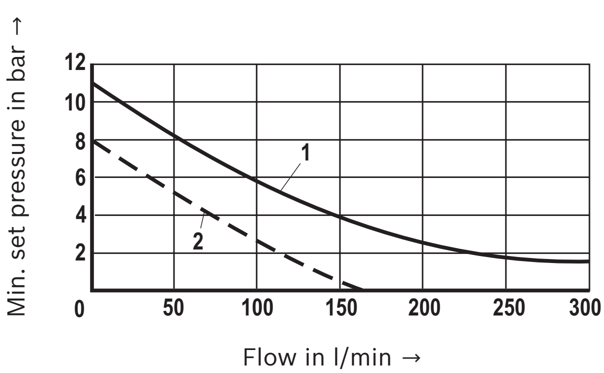


Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

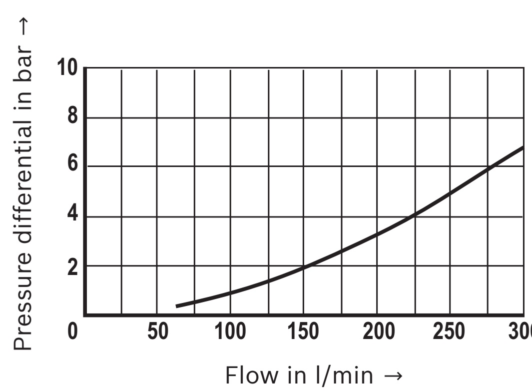
Pressure in channel A depending on pressure in channel B



p_{min}-Q_v characteristic curve



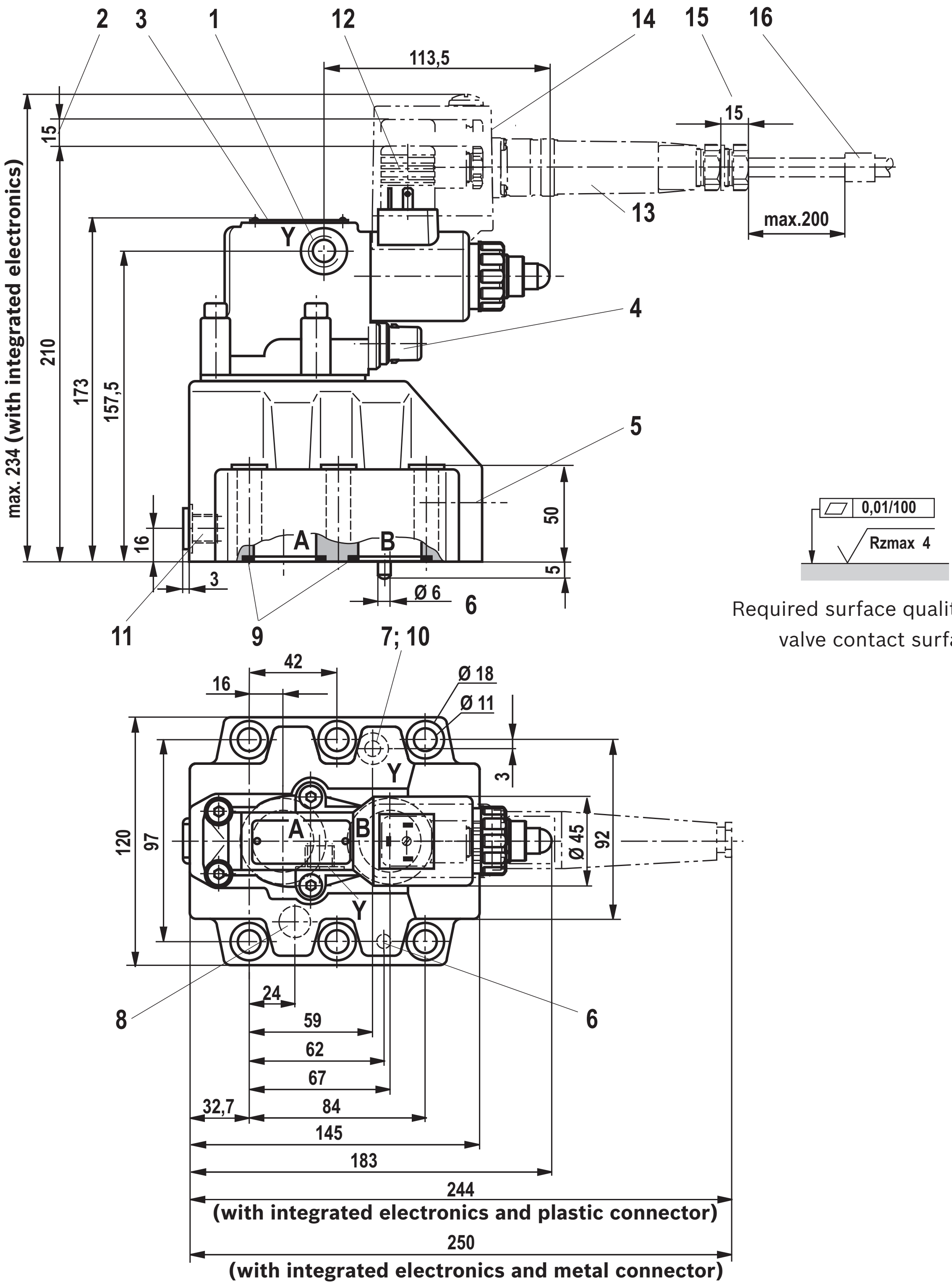
Pressure differential from A to B via the check valve



Characteristic curve 1: Same behavior of series 4X and 6X with p_{min} = 11 bar

Characteristic curve 2: Series 6X improved p_{min} = 8 bar, resulting in lower flow at p_{min}

Device dimensions
(dimensions in mm)



Required surface quality of the valve contact surface

Notice!
The dimensions are nominal dimensions which are subject to tolerances.

Item explanations, valve mounting screws and **subplates** see page 16.

Device dimensions

1 Upon delivery, this port (G 1/4) is closed. After removal of the blanking plug, an external and separate pilot oil return at zero pressure to the tank is, however, also possible here.
2 Space required to remove the mating connector
3 Name plate
4 Maximum pressure limitation with version DREM and DREME
5 Check valve, optional
6 Locating pin
7 Pilot oil return to the tank always external and at zero pressure
8 Blind counterbore
9 Identical seal rings for ports A and B
10 Identical seal rings for port Y and blind counterbore (item 8)
11 Pressure gauge connection G 1/4; 12 deep
12 Mating connector according to DIN EN 175301-803
13 Mating connector according to DIN EN 175201-804
14 Integrated electronics (OBE)
15 Space required to remove the mating connector
16 Cable fastening

Hexagon socket head cap screws (separate order)		**Material number**
Size 32	6x ISO 4762 - M10 x 70 - 10.9-flZn-240h-L Friction coefficient μ_{total} = 0.09 to 0.14; tightening torque $\boldsymbol{M_A}$ = 60 Nm ±10 % or 6x ISO 4762 - M10 x 70 - 10.9 Friction coefficient μ_{total} = 0.12 to 0.17; tightening torque $\boldsymbol{M_A}$ = 75 Nm ±10 %	R900002245

Notice: For reasons of stability, exclusively these valve mounting screws may be used. The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure!

Subplates	**Data sheet**	**Material number**
Size 32	45062	

Accessories
(not included in the scope of delivery)

External control for type DREM	**Data sheet**	**Material number**
VT-MSPA1-11-1X/ in modular design	30223	
VT-VSPD-2 in Euro-card format	30523	
VT-VSPA1-11-1X/ in Euro-card format	30100	
VT-SSPA1-1-1X/ as plug-in amplifier	30116	

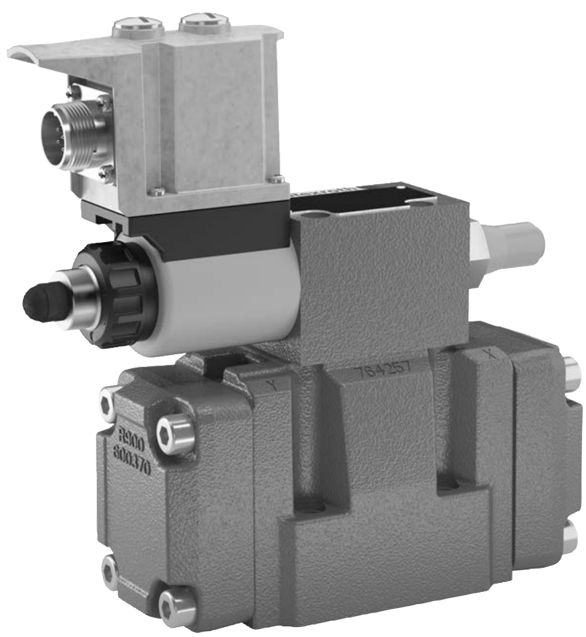
Mating connectors (details see page 8)	**Data sheet**	**Material number**
For type DRE(M): Mating connectors according to DIN EN 175301-803	08006	R901017011
For type DRE(M)E: Mating connectors according to DIN EN 175201-804	08006	R900021267 (plastic) R900223890 (metal)

RE 29286
Edition: 2020-01
Replaces: 2014-02

A Bosch Company

Proportional pressure reducing valve, pilot-operated

Type 3DRE(M) and 3DRE(M)E


H8145

- Sizes 10 and 16
- Component series 7X
- Maximum set pressure 315 bar
- Maximum flow 300 l/min

Features

- 3-way version
- Operation by means of proportional solenoid with rotatable coil
- For subplate mounting
- Porting pattern according to ISO 4401
- Maximum pressure limitation, optional
- Valve and control electronics from a single source
- Integrated electronics (OBE) (type 3DRE(M)E):
  - Little manufacturing tolerance of the command value pressure characteristic curve
- External control electronics (type 3DRE(M)
- Linear command value pressure characteristic curve

Contents

Ordering code

01	02	03	04	05		06		07	08	09	10	11	12	13	14
3DRE				P	–	7X	/			G24					*

01	Proportional pressure reducing valve in 3-way version	**3DRE**

02	**Without** maximum pressure limitation	**no code**
	With maximum pressure limitation	**M**

03	For external control electronics	**no code**
	With integrated electronics (OBE)	**E**

Size

04	Size 10	**10**
	Size 16	**16**

05	Subplate mounting	**P**

06	Component series 70 ... 79 (70 ... 79: unchanged installation and mounting dimensions)	**7X**

Pressure rating

07	Up to 50 bar	**50**
	Up to 100 bar	**100**
	Up to 200 bar	**200**
	Up to 250 bar (only size 16)	**250**
	Up to 315 bar (only size 10)	**315**

08	Internal pilot oil supply, external pilot oil return	**Y**
	External pilot oil supply, external pilot oil return	**XY**

Supply voltage

09	24 VDC voltage	**G24**

Coil

10	1600 mA	**no code**
	800 mA (only for external control electronics)	**-8**

Electrical connection

11	**– Type 3DRE(M)**	
	Without mating connector; connector DIN EN 175301-803	**K4**
	– Type DBE(M)E	
	Without mating connector; connector DIN EN 175201-804	**K31**

Interfaces of the control electronics

12	Command value input 0 ... 10 V	**A1**
	Command value input 4 ... 20 mA	**F1**
	External control electronics	**no code**

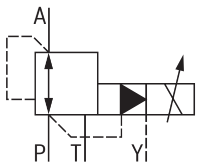
Seal material (observe compatibility of seals with hydraulic fluid used, see page 7)

13	FKM seals	**V**
	NBR seals	**M**

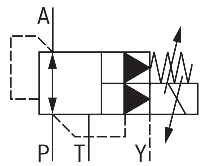
14	Further details in the plain text	

Symbols

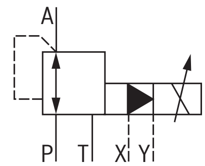
"3DRE....**Y**..."



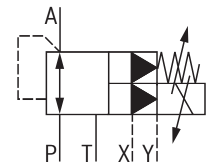
"3DREM....**Y**..."



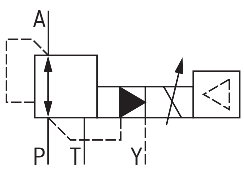
"3DRE....**XY**..."



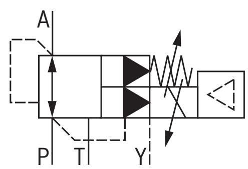
"3DREM....**XY**..."



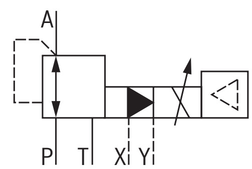
"3DREE....**Y**..."



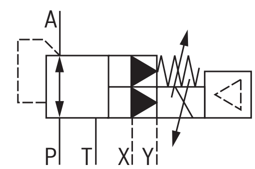
"3DREME....**Y**..."



"3DREE....**XY**..."



"3DREME....**XY**..."



Function, section

The valve types 3DRE(M) and 3DRE(M)E are electrically pilot-operated 3-way pressure reducing valves with pressure limitation of the actuator.
They are used for reduction (P to A) and limitation (A to T) of a system pressure.

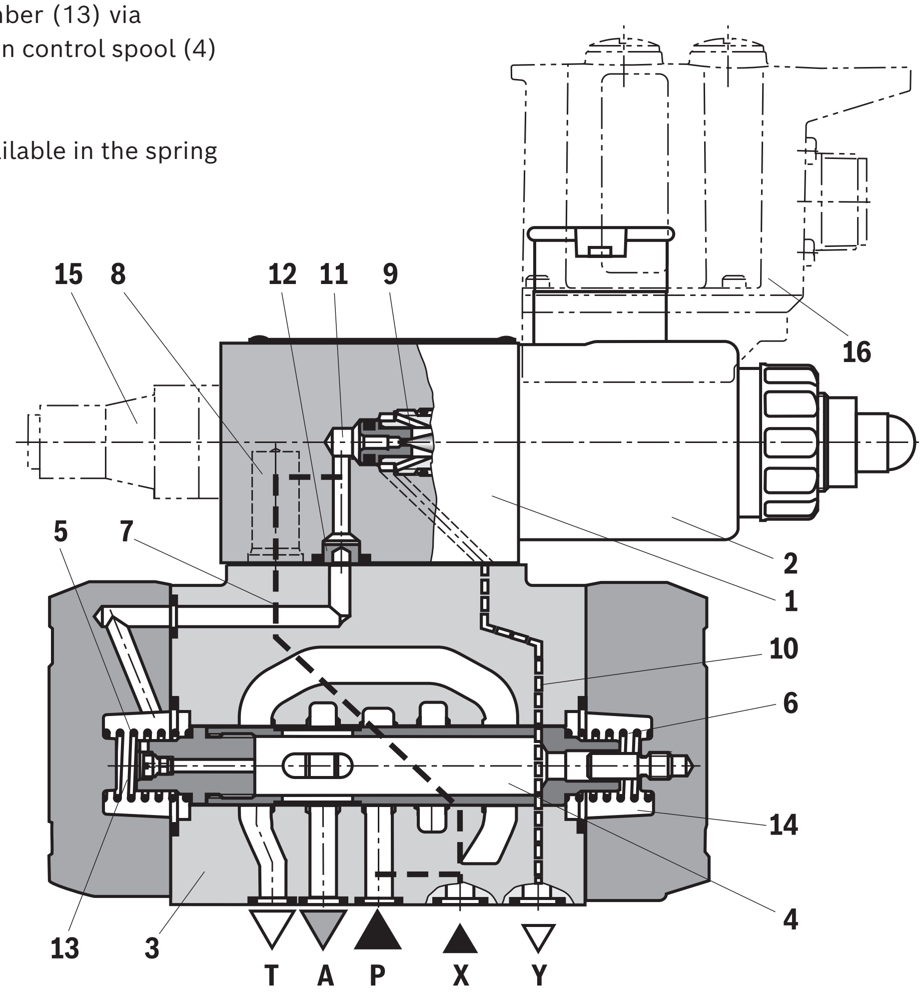
Set-up
The valves consist of two main assemblies:
- Pilot control valve (1) with proportional solenoid (2), optionally with maximum pressure limitation (15)
- Main valve (3) with main control spool (4)

Function
- Command value-dependent setting of the pressure to be reduced in port A via the pilot control valve (1).
- With depressurized port P, the springs (5) and (6) hold the main control spool (4) in its central position. In this way, a start-up jump at the actuator is prevented.
- Pilot fluid flows from bore (7) via the flow controller (8), via the control chamber (11) to the throttle gap (9), via line (10) to port Y. This connection is to be led into the tank at zero pressure.

Pressure reduction
- Build-up of the pilot pressure in the control chamber (11) as a function of the command value.
- Pressure build-up in the spring chamber (13) via nozzle (12) and movement of the main control spool (4) to the right. Hydraulic fluid flows from P to A.
- The actuator pressure in port A is available in the spring chamber (14).
- Increase in the pressure in port A to the set pressure of the pilot control valve (1) leads to the movement of the main spool (4) to the left. Pressure in port A is almost identical with the set pressure at the pilot control valve (1).

Pressure limitation
- If the pressure in port A exceeds the set pressure of the pilot control valve (1), the main control spool (4) is moved further to the left.
- This opens the connection from A to T and limits the pressure pending in port A to the set command value.

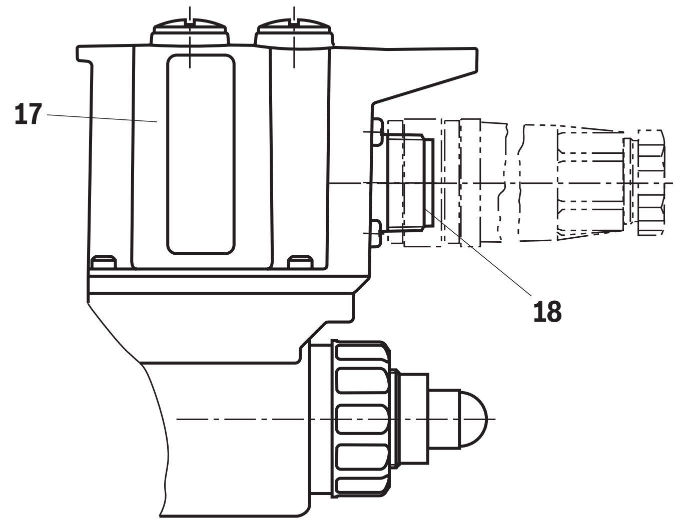
Type 3DREM
For hydraulic protection against an inadmissibly high electric control current at the proportional solenoid, which imperatively results in increased pressures in port A, you can optionally install a spring-loaded pressure relief valve as maximum pressure limitation (15).
The maximum pressure limitation is pre-set, referred to the relevant pressure rating (see page 6).



Function, section

Type 3DREE and 3DREME (with integrated electronics (OBE))
With regard to function and set-up, these valves correspond to types 3DRE and 3DREM. At the pilot control valve, there is moreover a housing (17) with the control electronics.
Supply and command value voltage are applied to the connector (18).
At the factory, the command value pressure characteristic curve is adjusted with little manufacturing tolerance.

For more information, see page 9.



Type 3DRE(M)E...YG24K31

Pilot oil supply

Type 3DRE...XY
External pilot oil supply, external pilot oil return
The pilot oil is supplied externally from a separate pilot circuit.
The pilot oil return is implemented externally via port Y into the tank.

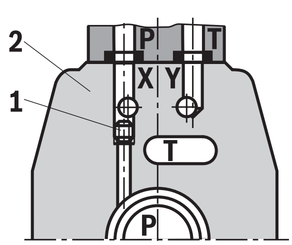
Type 3DRE...Y
Internal pilot oil supply, external pilot oil return
The pilot oil supply is implemented internally from channel P of the main valve.
The pilot oil return is implemented externally via port Y into the tank.
In the subplate, port X is closed.

1 Plug screw M6 according to DIN 906, wrench size 3 – pilot oil return
2 Main valve
3 Cover

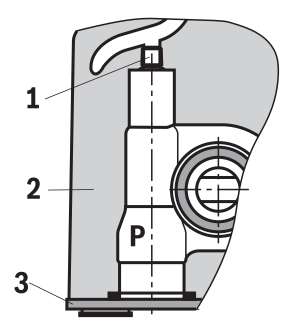
Pilot oil supply
External: **1** closed
Internal: **1** open

Pilot oil return
external

Size 10



Size 16



Technical data
(For applications outside these values, please consult us!)

General				
Size		NG	10	16
Weight	▶ Type 3DRE and 3DREM	kg	7.5	10.3
	▶ Type 3DREE and 3DREME	kg	7.6	10.4
Installation position			any, preferably horizontal	
Storage temperature range		°C	–20 ... +80	
Ambient temperature range	▶ Type 3DRE and 3DREM	°C	–20 ... +70	
	▶ Type 3DREE and 3DREME	°C	–20 ... +50	

Hydraulic				
Maximum operating pressure	▶ Port P and X	bar	350	315
	▶ Port A and T	bar	315	250
	▶ Port Y	bar	separate and depressurized to the tank	
Maximum set pressure in channel A	▶ Pressure rating 50 bar	bar	50	50
	▶ Pressure rating 100 bar	bar	100	100
	▶ Pressure rating 200 bar	bar	200	200
	▶ Pressure rating 250 bar	bar	–	250
	▶ Pressure rating 315 bar	bar	315	–
Minimum set pressure in channel A with flow, with command value zero, see characteristic curves page 8		bar	< 5	< 4
Maximum pressure limitation (continuously adjustable, set at the factory)	▶ Pressure rating 50 bar	bar	70	
	▶ Pressure rating 100 bar	bar	130	
	▶ Pressure rating 200 bar	bar	230	
	▶ Pressure rating 250 bar (size 16)	bar	270	
	▶ Pressure rating 315 bar (size 10)	bar	350	
Maximum flow		l/min	125	300
Pilot flow		l/min	1.1	
Hydraulic fluid			see table page 7	
Hydraulic fluid temperature range		°C	–20 ... +80	
Viscosity range		mm^2/s	15 ... 380	
Maximum admissible degree of contamination of the hydraulic fluid; cleanliness class according to ISO 4406 (c)			class 20/18/15 [1)]	
Hysteresis		%	±3 [2)]	
Repetition accuracy		%	< ±2 [2)]	
Linearity		%	±3.5 [2)]	
Manufacturing tolerance of the command value pressure characteristic curve, related to the hysteresis characteristic curve; pressure increasing	▶ Type 3DRE(M) [4)]	%	< ±1.5 [2; 5)]	
	▶ Type 3DRE(M)E [3)]		< ±1.5 [2; 5)]	
	▶ Type 3DRE(M) [4)]	%	< ±5 [2; 6)]	
	▶ Type 3DRE(M)E [3)]	%	< ±1.5 [2; 6)]	
Step response $\boldsymbol{T}_u + \boldsymbol{T}_g$	Command value 10 % → 90 %	ms	< 140 [7)]	

1) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and simultaneously increases the life cycle of the components.

2) Of the maximum set pressure
3) Comparison at the factory
4) Details see page 10
5) At 20 % of the command value
6) At 100 % of the command value
7) Measured with standing hydraulic fluid column, 1.0 liter at port A

Technical data
(For applications outside these values, please consult us!)

Hydraulic fluid		Classification	Suitable sealing materials	Standards	Data sheet
Mineral oils		HL, HLP, HLPD, HVLP, HVLPD	NBR, FKM	DIN 51524	90220
Bio-degradable	▶ Insoluble in water	HETG	FKM	ISO 15380	90221
		HEES	FKM		
	▶ Soluble in water	HEPG	FKM	ISO 15380	
Flame-resistant	▶ Water-free	HFDU (glycol base)	FKM	ISO 12922	90222
		HFDU (ester base)	FKM		
		HFDR	FKM		
	▶ Containing water	HFC (Fuchs: Hydrotherm 46M, Renosafe 500; Petrofer: Ultra Safe 620; Houghton: Safe 620; Union: Carbide HP5046)	NBR	ISO 12922	90223

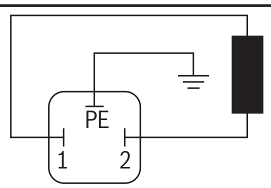
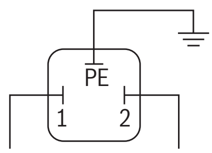
Important information on hydraulic fluids:
- For further information and data on the use of other hydraulic fluids, please refer to the data sheets above or contact us.
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.).
- The ignition temperature of the hydraulic fluid used must be 50 K higher than the maximum surface temperature.
- **Bio-degradable and flame-resistant – containing water:** If components with galvanic zinc coating (e.g. version "J3" or "J5") or parts containing zinc are used, small amounts of dissolved zinc may get into the hydraulic system and cause accelerated aging of the hydraulic fluid. Zinc soap may form as a chemical reaction product, which may clog filters, nozzles and solenoid valves – particularly in connection with local heat input.
- **Flame-resistant – containing water:**
  - Due to increased cavitation tendency with HFC hydraulic fluids, the life cycle of the component may be reduced by up to 30 % as compared to the use with mineral oil HLP. In order to reduce the cavitation effect, it is recommended – if possible specific to the installation – to back up the return flow pressure in ports T to approx. 20 % of the pressure differential at the component.
  - Dependent on the hydraulic fluid used, the maximum environment and hydraulic fluid temperature must not exceed 50 °C. In order to reduce the heat input into the component, the command value profile is to be adjusted for proportional and high-response valves.

Electric				
Version			"G24"	"G24-8"
Minimum solenoid current		mA	≤ 100	≤ 100
Maximum solenoid current		mA	1600 ±10 %	800 ±5 %
Solenoid coil resistance	▶ Cold value at 20 °C	Ω	5.5	20.6
	▶ Maximum hot value	Ω	8.05	33
Duty cycle		%	100	100

Electrical, integrated electronics (OBE)			
Supply voltage	▶ Nominal voltage	VDC	24
	▶ Lower limit value	VDC	21
	▶ Upper limit value	VDC	35
Current consumption		A	≤ 1.5
Fuse protection		A	2 (time-lag)
Inputs	▶ Voltage	V	0 ... 10
	▶ Current	mA	4 ... 20
Output	▶ Actual current value	mV / mA	1
Protection class of the valve according to EN 60529			IP65 (with correctly installed electrical connection)

Electrical connections and assignment

▶ Type 3DRE and 3DREM

Connection to	
Connector	**Mating connector**
	 to the amplifier

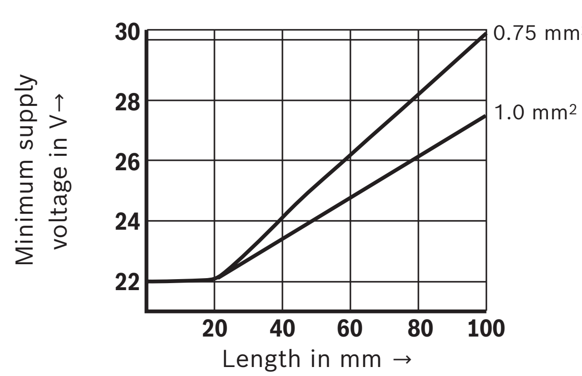
▶ Type 3DREE and 3DREME

Connector pin assignment	Contact	Interface assignment "A1"	Interface assignment "F1"
Supply voltage	A	24 VDC (u(t) = 21 V ... 35 V); I_{max} ≤ 1.5 A	
	B	0 V	
Reference potential actual value	C	reference contact F; 0 V	reference contact F; 0 V
Differential amplifier input	D	0 ... 10 V; R_E = 100 kΩ	4 ... 20 mA; R_E = 100 Ω
	E	reference potential command value	
Measuring output (actual value)	F	0 ... 1.6 V actual value (1 mV ≙ 1 mA) load resistance > 10 kΩ	
Protective ground	PE	functional ground (directly connected to the valve housing)	

☞ **Notice:**
Mating connectors, separate order, see page 18 and data sheet 08006.

Connection cable for type 3DRE(M)E
- Recommendation 6-wire, 0.75 or 1 mm² plus protective grounding conductor and screening
- Only connect the screening to PE on the supply side
- Maximum admissible length = 100 m

The minimum supply voltage at the power supply unit depends on the length of the supply line (see diagram).



Block diagram: Integrated electronics (OBE)

Function

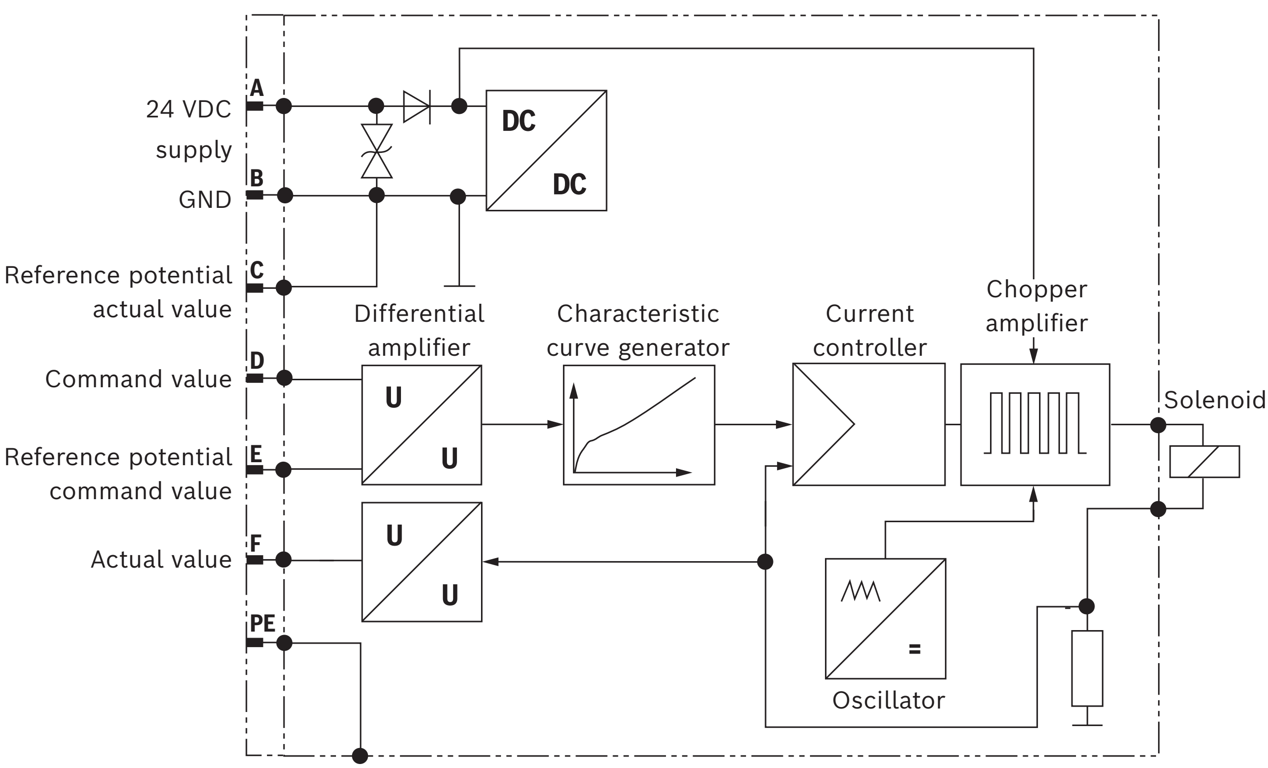
The electronics are supplied with voltage via ports A and B. The command value is applied to the differential amplifier ports D and E.

Via the characteristic curve generator, the command value solenoid current characteristic curve is adjusted to the valve so that non-linearities in the hydraulics are compensated for and a linear command value pressure characteristic curve is created.

The current controller controls the solenoid current independently of the solenoid coil resistance.

The power stage of the electronics for controlling the proportional solenoid is a chopper amplifier with a clock frequency of approx. 180 Hz to 400 Hz. The output signal is pulse-width modulated (PWM).

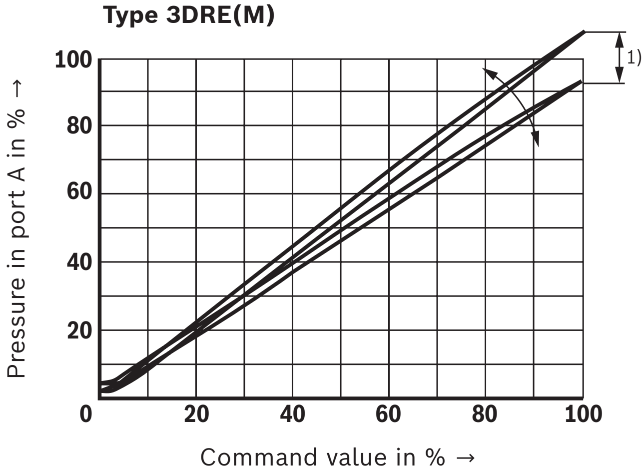
For checking the solenoid current, a voltage can be measured at the connector between pin F(+) and pin C(−) that is proportional to the solenoid current. 1 mV corresponds to 1 mA solenoid current.



Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Pressure in port A depending on the command value (manufacturing tolerance) – Without flow

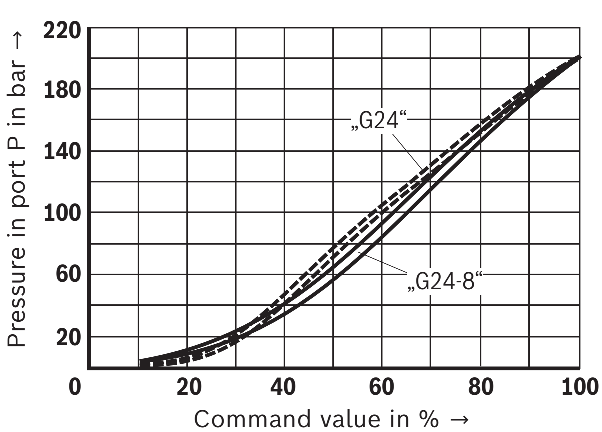
Type 3DRE(M)



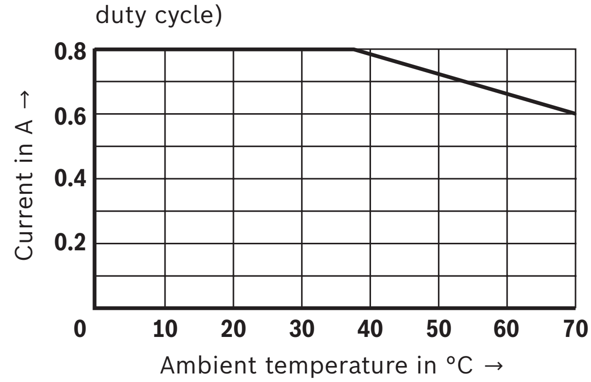
[1] In order to be able to adjust several valves to the same characteristic curve, the manufacturing tolerance can - with version 3DRE(M) - be changed at the external amplifier (see page 18) using the command value attenuator "G". In this connection, do not set the pressure higher than the maximum set pressure of the pressure rating with command value 100 %.

Pressure in port P depending on the command value

Comparison "G24" and "G24-8", pressure rating 200 bar
(with amplifier VT-VSPA1-1-1X, 800 mA coil)



Current drop with version "G24-8"
(increasing ambient temperature, 24 V, 100 % duty cycle)

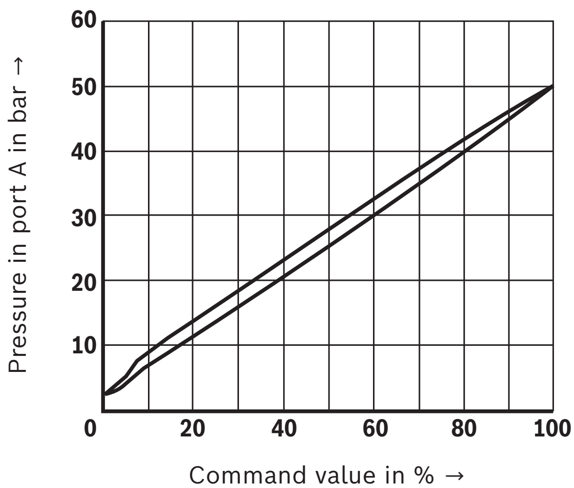


Notice:
- Valve body and hydraulic fluid temperature-compensated. Large temperature differences may lead to differing characteristic curves/values.
- With version "G24-8", the solenoid current drops in case of increased temperature. Thus, the set pressure differs accordingly.

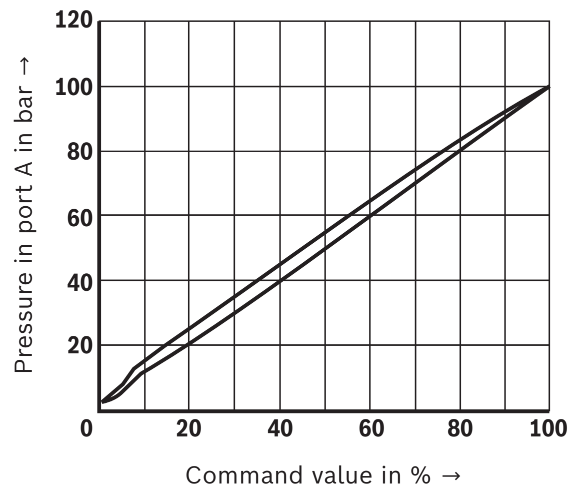
Characteristic curves: Size 10
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Pressure in port A depending on the command value – flow 0 l/min

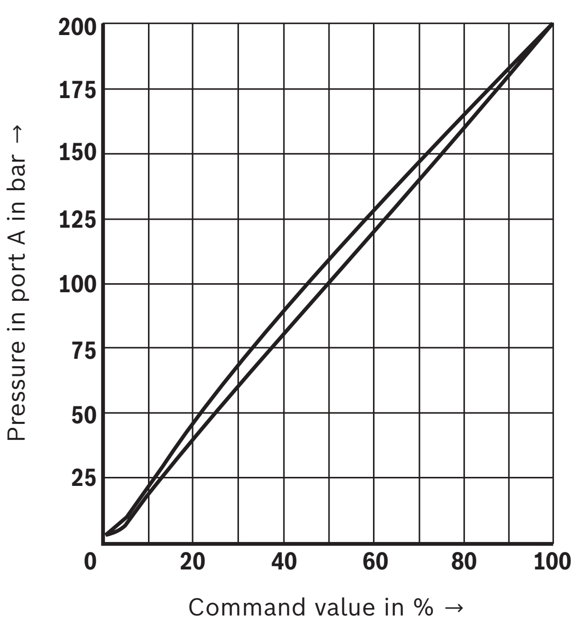
Pressure rating 50 bar



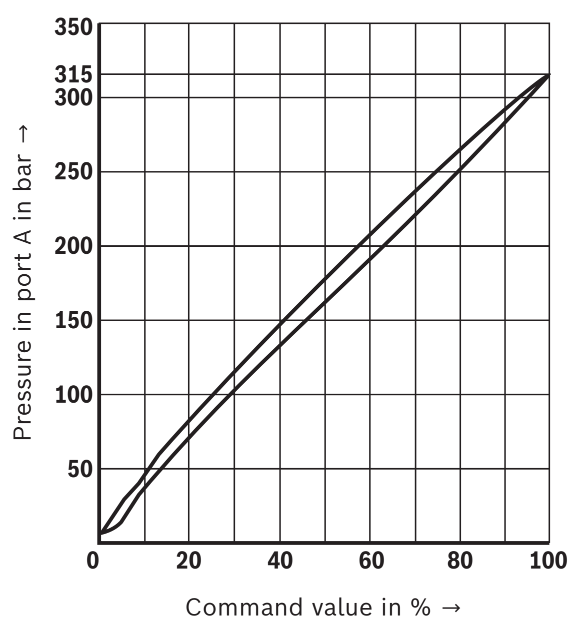
Pressure rating 100 bar



Pressure rating 200 bar



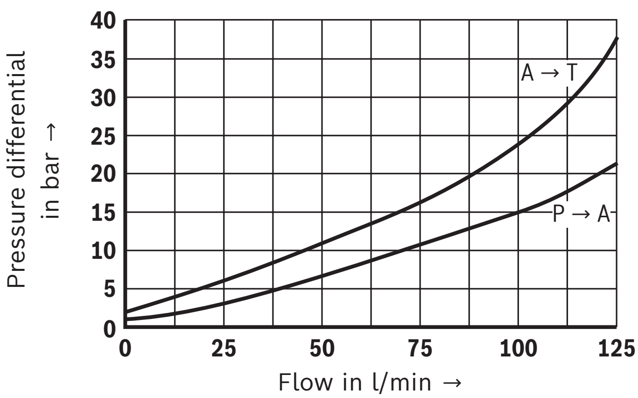
Pressure rating 315 bar



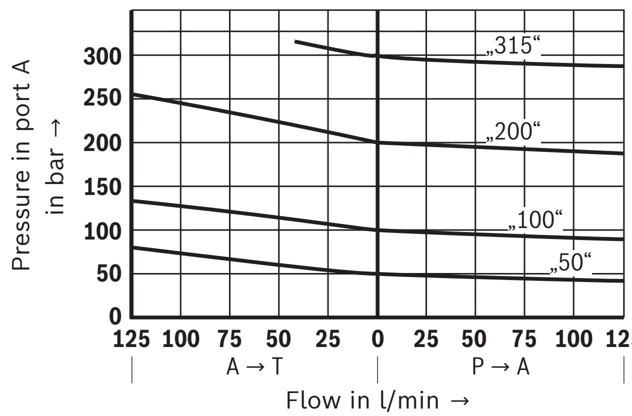
Notice:
Valve body and hydraulic fluid temperature-compensated.
Large temperature differences may lead to differing characteristic curves/values.

Characteristic curves: Size 10
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

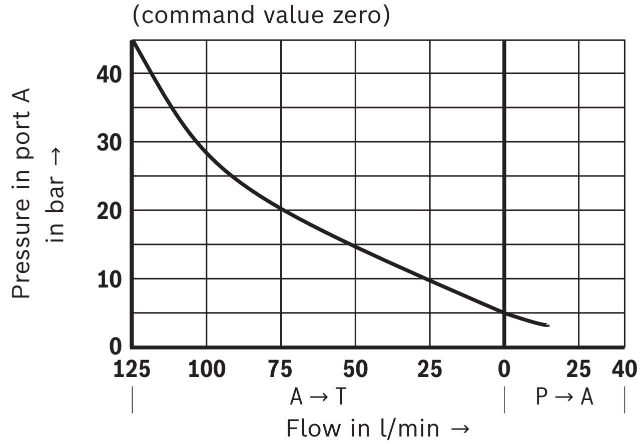
***Δp-q*$_V$ characteristic curves**



Pressure in port A depending on the flow



Minimum set pressure depending on the flow
(command value zero)

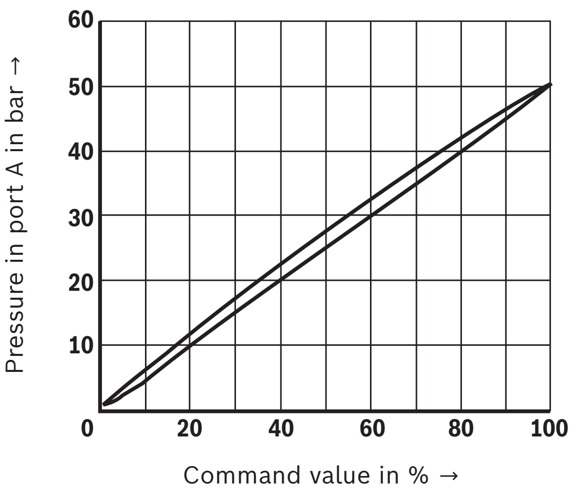


Notice:
Valve body and hydraulic fluid temperature-compensated.
Large temperature differences may lead to differing characteristic curves/values.

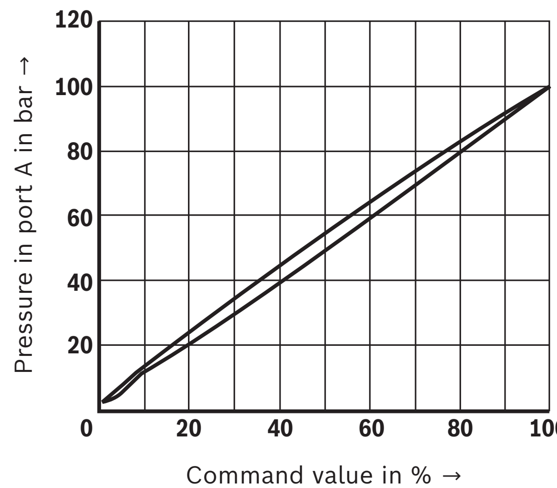
Characteristic curves: Size 16
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Pressure in port A depending on the command value – flow 0 l/min

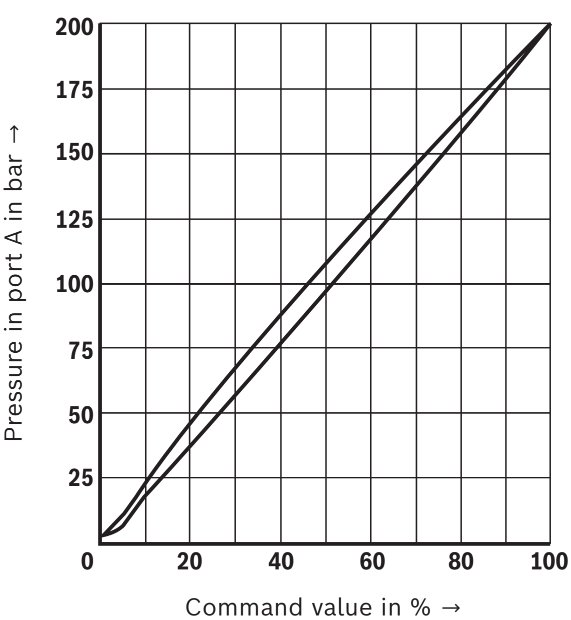
Pressure rating 50 bar



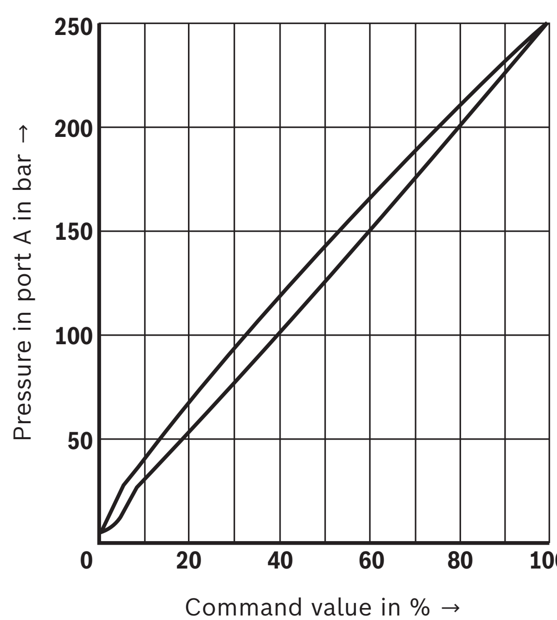
Pressure rating 100 bar



Pressure rating 200 bar



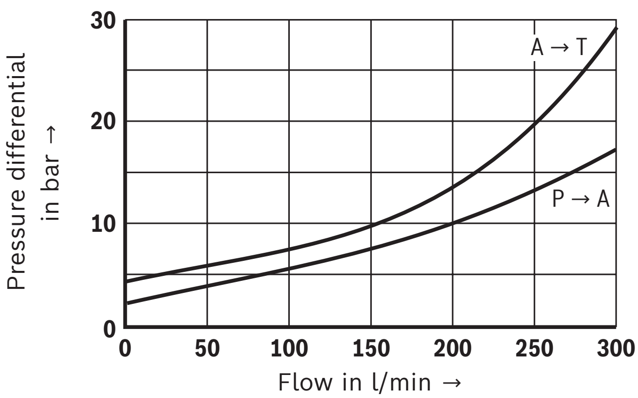
Pressure rating 250 bar



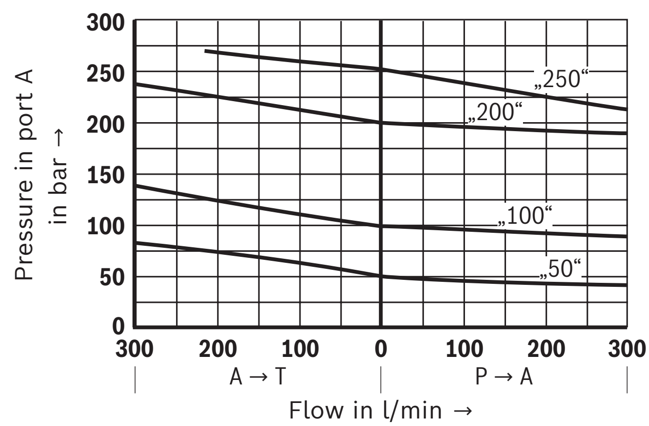
Notice:
Valve body and hydraulic fluid temperature-compensated.
Large temperature differences may lead to differing characteristic curves/values.

Characteristic curves: Size 16
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

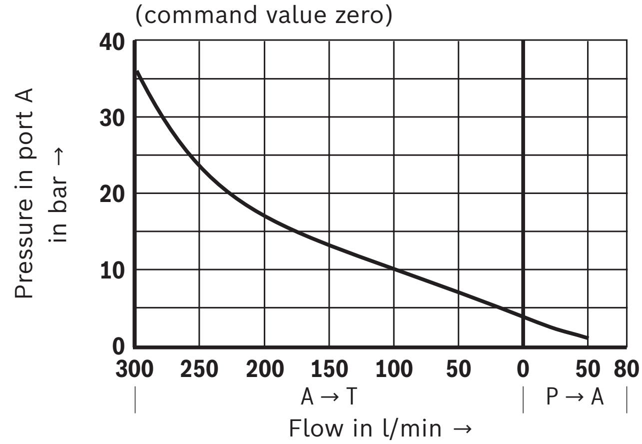
Δp-q_V characteristic curves



Pressure in port A depending on the flow

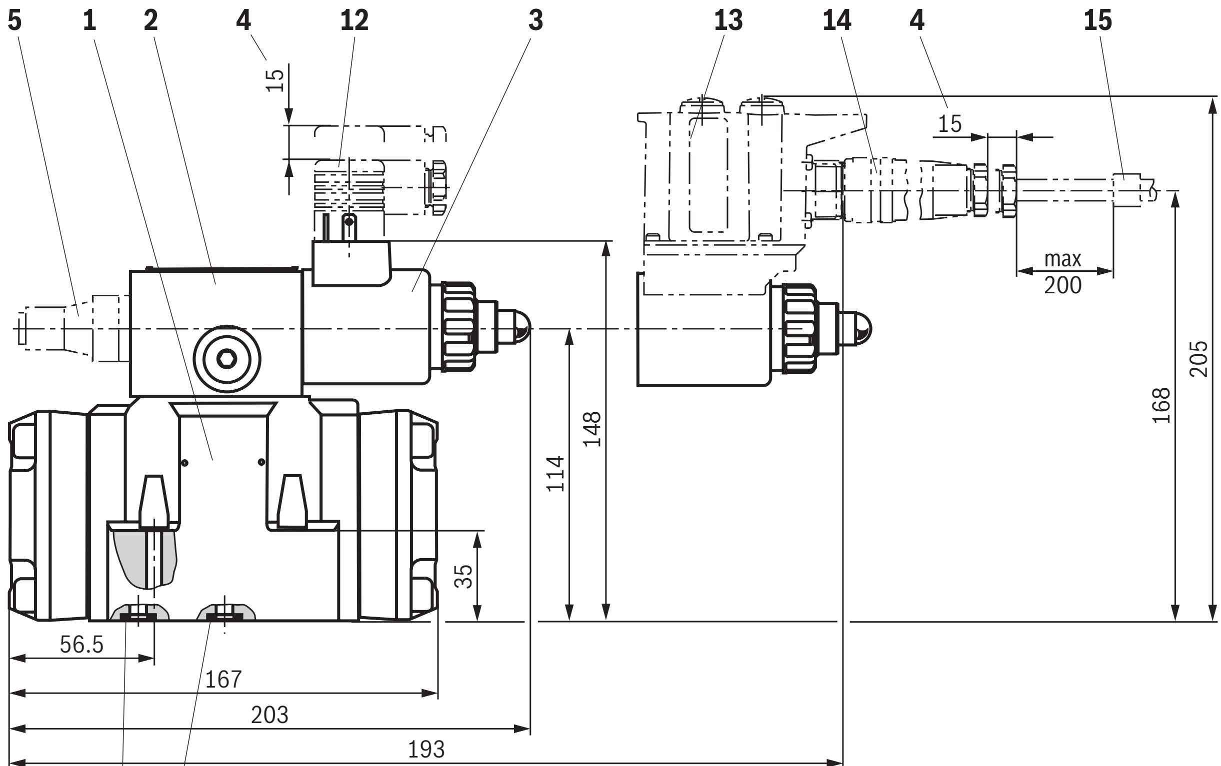


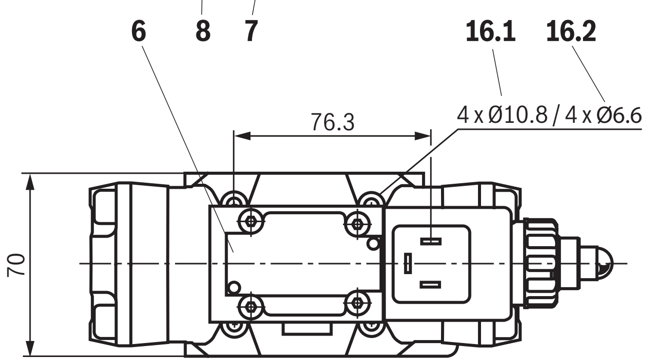
Minimum set pressure depending on the flow
(command value zero)

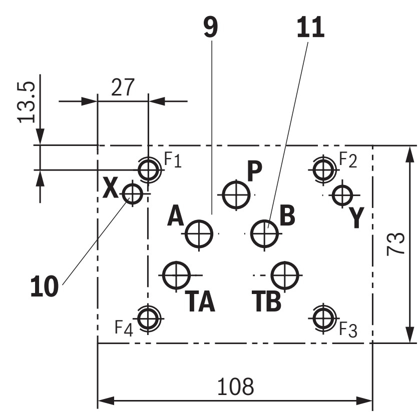


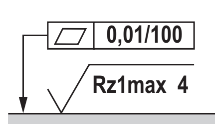
Notice:
Valve body and hydraulic fluid temperature-compensated.
Large temperature differences may lead to differing characteristic curves/values.

Dimensions: Size 10
(dimensions in mm)







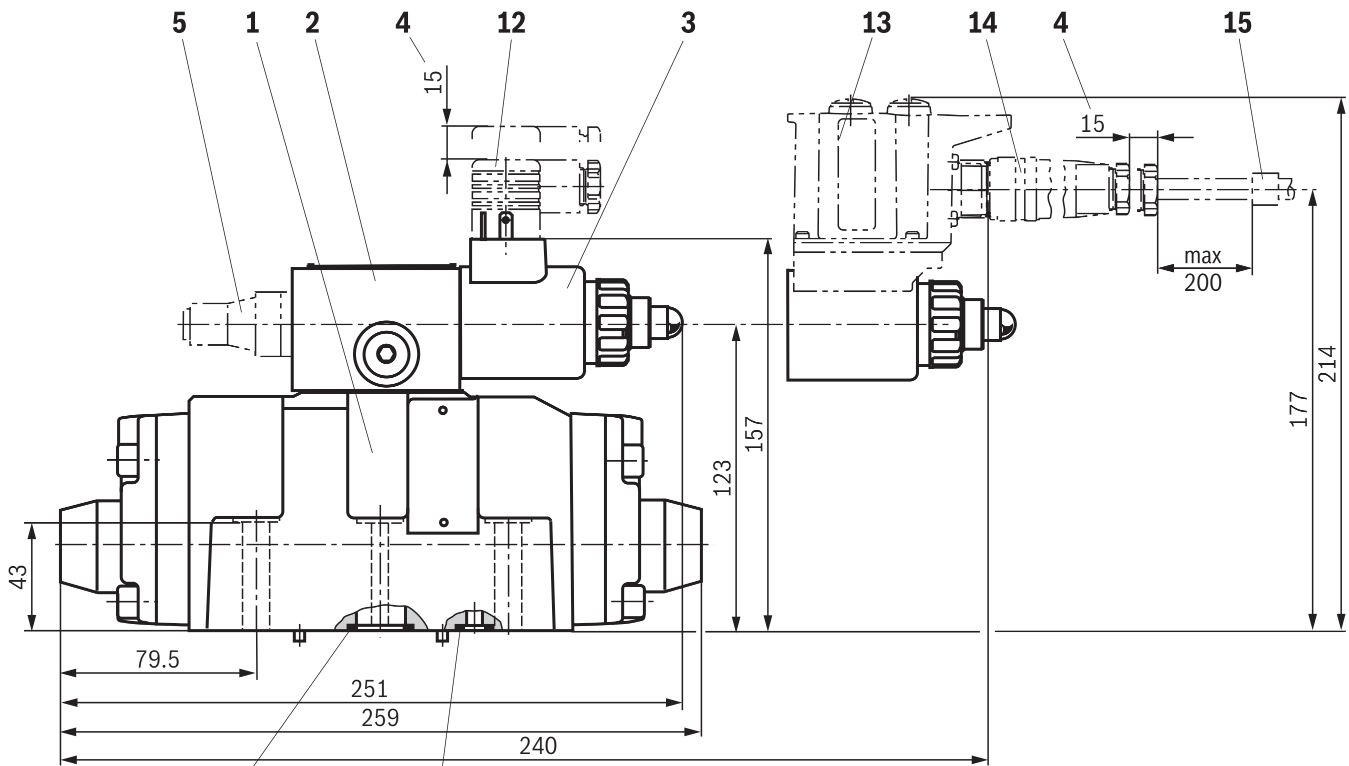


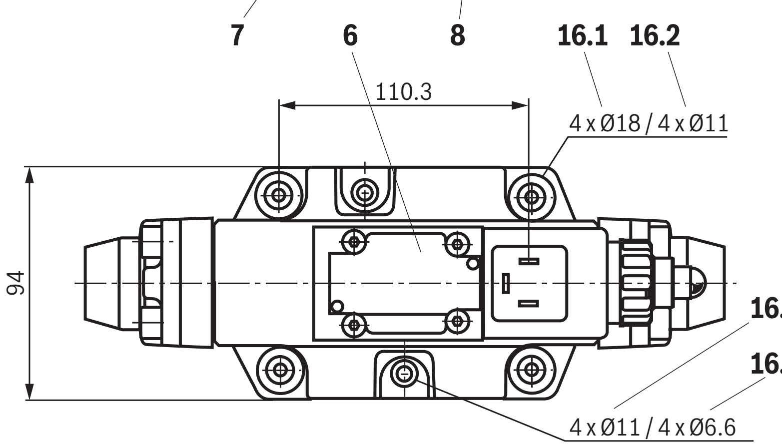
Required surface quality of the valve contact surface

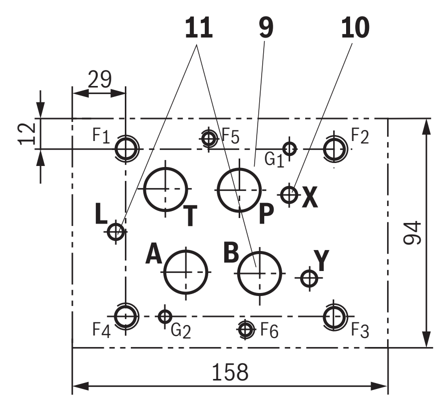
For item explanations, valve mounting screws and **subplates,** see page 17.

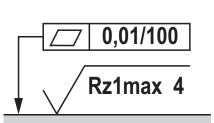
Notice:
- Deviating from ISO 4401, port T is called TA and port T1 is called TB in this data sheet.
- The dimensions are nominal dimensions which are subject to tolerances.

Dimensions: Size 16
(dimensions in mm)









Required surface quality of the
valve contact surface

For item explanations, valve mounting screws and **subplates,** see page 17.

Notice:
- Deviating from ISO 4401, port T is called TA and port T1 is called TB in this data sheet.
- The dimensions are nominal dimensions which are subject to tolerances.

Dimensions

1 Main valve
2 Pilot valve
3 Proportional solenoid
4 Space required to remove the mating connector
5 Maximum pressure limitation (type 3DREM...)
6 Name plate
7 Identical seal rings for port A, B, P, TA and TB
8 Identical seal rings for ports X and Y
9 Machined valve contact surface; porting pattern according to ISO 4401-05-05-0-05
10 With "internal" pilot oil supply (version "Y"), port X in the subplate must be closed.
11 Port B must be closed in the subplate
12 Mating connector for type 3DRE(M) (separate order, see page 18 and data sheet 08006)
13 Integrated electronics (type 3DREE, 3DREME) with connector
14 Mating connector for type 3DRE(M)E, plastic or metal version (separate order, see page 18 and data sheet 08006)
15 Cable fastening
16.1 Recess
16.2 Bore

Valve mounting screws (separate order)

Size	Quantity	Hexagon socket head cap screws	Material number
10	4	**ISO 4762 - M6 x 45 - 10.9** Friction coefficient μ_{total} = 0.09 ... 0.14; tightening torque M_A = 12.5 Nm ±10 %	**R913043777**
	or		
	4	**ISO 4762 - M6 x 45 - 10.9** Friction coefficient μ_{total} = 0.12 ... 0.17; tightening torque M_A = 15.5 Nm ±10 %	Not included in the Rexroth delivery range
16	2	**ISO 4762 - M6 x 60 - 10.9** Friction coefficient μ_{total} = 0.09 ... 0.14; tightening torque M_A = 12.2 Nm ±10 %	**R913043410**
	4	**ISO 4762 - M10 x 60 - 10.9** Friction coefficient μ_{total} = 0.09 ... 0.14; tightening torque M_A = 59 Nm ±20 %	**R913014770**
	or		
	2	**ISO 4762 - M6 x 60 - 10.9** Friction coefficient μ_{total} = 0.12 ... 0.17; tightening torque M_A = 15.5 Nm ±10 %	Not included in the Rexroth delivery range
	4	**ISO 4762 - M10 x 60 - 10.9** Friction coefficient μ_{total} = 0.12 ... 0.17; tightening torque M_A = 75 Nm ±10 %	Not included in the Rexroth delivery range

Notice:
- For reasons of stability, exclusively these valve mounting screws may be used.
- The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure.

Subplates (separate order) with porting pattern according to ISO 4401, see data sheet 45100.

Accessories (separate order)

Mating connectors and cable sets

Item [1)]	Designation	Version	Short designation	Material number	Data sheet
12	Mating connector; for valves with round connector, 6-pole + PE	straight, metal	7PZ31...M	**R900223890**	08006
		straight, plastic	7PZ31...K	**R900021267**	
14	Mating connector; for valves with "K4" connector, 2-pole + PE, design A	without circuitry, M16 x 1.5, 12 ... 240 V, "b"		**R901017011**	

1) See dimensions on page 15 and 16.

External control electronics

Designation	Data sheet
Valve amplifier for proportional valves without electrical position feedback; type VT-MSPA.2X	30232

Further information

- Valve amplifier for proportional valves without electrical position feedback — Data sheet 30232
- Subplates — Data sheet 45100
- Hydraulic fluids on mineral oil basis — Data sheet 90220
- Environmentally compatible hydraulic fluids — Data sheet 90221
- Flame-resistant, water-free hydraulic fluids — Data sheet 90222
- Flame-resistant hydraulic fluids - containing water (HFAE, HFAS, HFB, HFC) — Data sheet 90223
- Mating connectors and cable sets for valves and sensors — Data sheet 08006
- Hydraulic valves for industrial applications — Operating instructions 07600-B
- Selection of the filters
- Information on available spare parts

The Drive & Control Company

Rexroth
Bosch Group

Proportional pressure reducing valve, pilot operated, with DC motor operation

Type DRS and ZDRS

RE 29173
Edition: 2015-10
Replaces: 2014-10

H7121

- Size 6
- Component series 1X
- Maximum operating pressure 210 bar
- Maximum flow 30 l/min

Features

- Pressure reduction at ports A or P① with pressure limitation
- For subplate mounting
- Porting pattern according to ISO 4401-03-02-0-05
- As a sandwich plate valve
- Self-locking DC motor → on failure of the supply voltage or error message from the control electronics, the pressure setting is retained
- Position feedback
- Built-in pressure monitoring, optional

Contents

Ordering codes

01	02	03		04	05		06	07	08	09	10	11	12	13
	DRS	**6**		**–**	**1X**	**/**			**M**	**G24**	**K32**		**G**	*****

01	Subplate mounting	**no code**
	Sandwich plate	**Z**

02	Pressure reducing valve with DC motor actuation	**DRS**

03	Size 6	**6**

Pressure reduction

04	In channel A (subplate mounting)	**no code**
	In channel P① (sandwich plate valve)	**VP**

05	Component series 10 ... 19 (10 ... 19: unchanged installation and connection dimensions)	**1X**

Pressure rating

06	50 bar	**50**
	100 bar	**100**
	210 bar	**210**

07	**Without** pressure transducer on device	**A**
	With pressure transducer on device (only version "100")	**S**

08	**Without** check valve	**M**

Supply voltage of the control electronics

09	Direct voltage 24 V	**G24**

Electrical connection

10	**Without** mating connector; connector type GO51FAVM	**K32** [1]

Seal material

11	NBR seals	**M**
	FKM seals	**V**
	Observe compatibility of seals with hydraulic fluid used! (Other seals on request)	

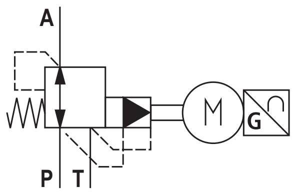
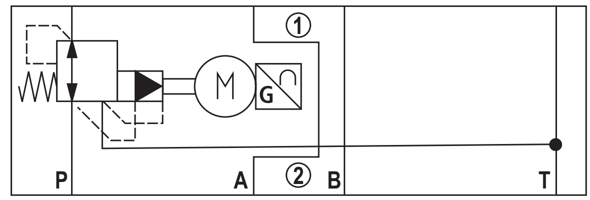
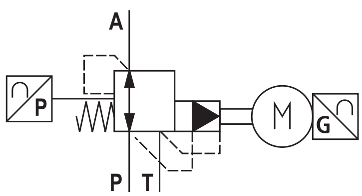
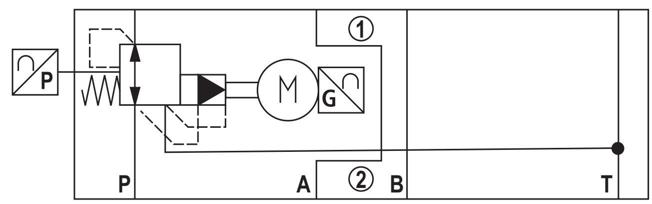
12	**With** position feedback	**G**

13	Further details in the plain text	*****

[1] For mating connectors, separate order, see page 14.

☞ **Notice:** Preferred types and standard units are contained in the EPS (standard price list).

Symbols (① = component side, ② = plate side)

Type DRS	Type ZDRS
Version "A"(without pressure transducer)	**Version "A"**(without pressure transducer)
	
Version "S" (with pressure transducer)	**Version "S"** (with pressure transducer)
	

Function, section: Type DRS

Valves of type DRS are pilot operated 3-way pressure reducing valves with pressure limitation of the actuator. They are used for reducing a system pressure.

Set-up

The valves consist of three main assemblies:

- ▶ Pilot control valve (1)
- ▶ DC motor (2) with position feedback
- ▶ Main valve (3) with main spool (4)
- ▶ With or without pressure transducer, optional (18)

Function

- ▶ Setting of the pressure to be reduced in channel A based on the command value via the DC motor (2).
- ▶ If port P is depressurized, spring (17) holds the main spool (4) in the starting position → connection from port A to T open, port P to A blocked.
- ▶ Pressure connection from port P to the ring channel (5). Pilot oil flows through bore (6) via the flow controller (7) into the pilot control chamber (16), via the nozzle (8), the throttle gap (9) into the chamber (10) and through the bores (11, 12) to port T

Pressure reduction

- ▶ Build-up of the pilot pressure in the pilot control chamber (16) as function of the command value.
- ▶ Movement of the main spool (4) to the right, hydraulic fluid flows from P to A
- ▶ Actuator pressure pending in port A to the spring chamber (15) via channel (13) and nozzle (14).
- ▶ Increase in the pressure in port A to the command pressure set leads to the movement of the main spool (4) to the left into the control position. The pressure in port A is almost identical with the set pressure at pilot control valve (1).

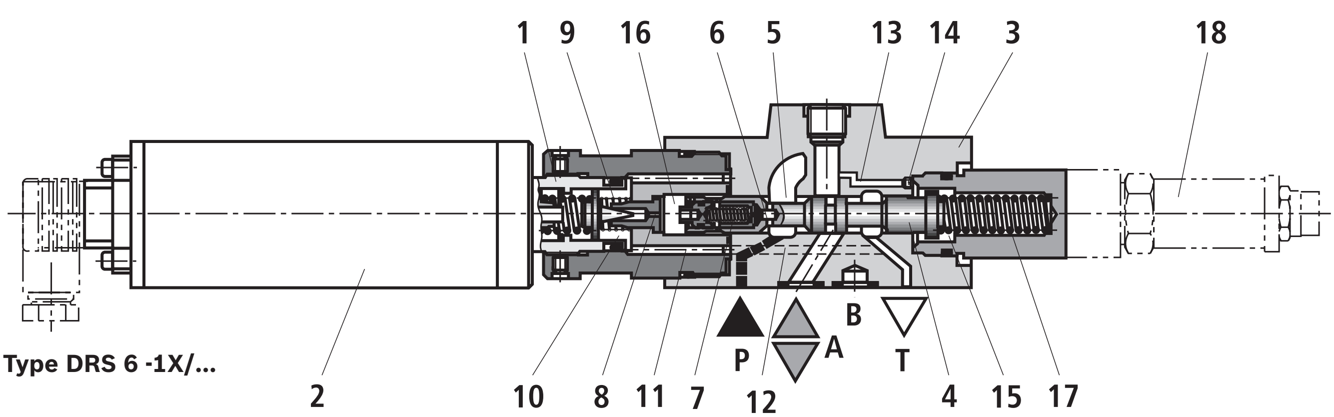
Pressure limitation does not work if contaminated.

- ▶ If the pressure in port A exceeds the command pressure set, the main spool (4) is moved further to the left.
- ▶ This closes the connection from P to A, opens the connection from P to T and limits the pressure pending in port A in accordance with the command value set.

Pressure monitoring

For valves with built-in pressure transducers, this is connected to the electronics system and used for recording and monitoring the pressure set. Another alternative is a valve without a built-in pressure transducer, but with a pressure measurement sandwich plate. (For example applications, see data sheet 62003)

> ☞ **Notice:**
> If the voltage supply to the control electronics is switched off or fails, the DC motor stays in its current position and therefore the last pressure set is also retained if the hydraulic supply is in place.



Type DRS 6 -1X/...

Function, section: Type ZDRS

Valves of type ZDRS are pilot operated 3-way pressure reducing valves with pressure limitation of the actuator. They are used for reducing a system pressure.

Set-up

The valves consist of three main assemblies:

- Pilot control valve (1)
- DC motor (2) with position feedback
- Main valve (3) with main spool (4)
- With or without pressure transducer, optional (18)

Function

- Setting of the pressure to be reduced in channel A based on the command value via the DC motor (2).
- If port P is depressurized, spring (17) holds the main spool (4) in the starting position → connection from port A to T is open, port P to A blocked
- Pressure connection from port P to the ring channel (5). Pilot oil flows through bore (6) via the flow controller (7) into the pilot control chamber (16), via the nozzle (8) and the throttle gap (9) into the chamber (10) and through the bores (11, 12) to port T

Pressure reduction

- Build-up of the pilot pressure in the pilot control chamber (16) as function of the command value.
- Movement of the main spool (4) to the right, hydraulic fluid flows from P to A
- Actuator pressure pending in port A to the spring chamber (15) via channel (13) and nozzle (14).
- Increase in the pressure in port A to the command pressure set leads to the movement of the main spool (4) to the left into the control position. The pressure in port A is almost identical with the set pressure at pilot control valve (1).

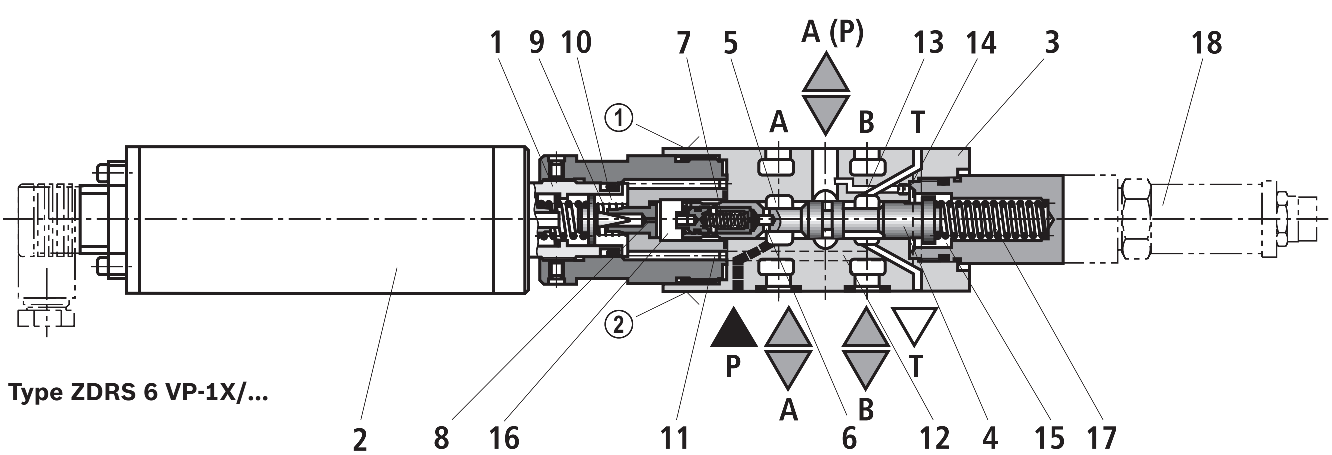
Pressure limitation does not work if contaminated.

- If the pressure in port A (P①) exceeds the command pressure set, the main spool (4) is moved further to the left.
- This closes the connection from P to A (P①) , opens the connection from P① to T and limits the pressure pending in port A (P①) in accordance with the command value set.

Pressure monitoring

For valves with built-in pressure transducers, this is connected to the electronics system and used to record and monitor the pressure set in channel P①. Another alternative is a valve without a built-in pressure transducer, but with a pressure measurement sandwich plate. (For example applications, see data sheet 62003)

> **Notice:**
> If the voltage supply to the control electronics is switched off or fails, the DC motor stays in its current position and therefore the last pressure set is also retained if the hydraulic supply is in place.



Type ZDRS 6 VP-1X/...

Technical data
(For applications outside these parameters, please consult us!)

General			
Installation position			Any (preferably horizontal)
Weight	▶ Type DRS	kg	1.6
	▶ Type ZDRS	kg	1.5
Storage temperature range		°C	-20 ... +80
Ambient temperature range		°C	-20 ... +60

Hydraulic			
Maximum operating pressure	▶ Port P, P②	bar	250
	▶ Port P①, A, B	bar	210
	▶ Port T	bar	separately to tank[1] at zero pressure (volume flow 30 l/min possible)
Maximum set pressure in channel P① and A	▶ Pressure rating 50 bar	bar	50
	▶ Pressure rating 100 bar	bar	100
	▶ Pressure rating 210 bar	bar	210
Minimum pressure in channel P or P②		bar	Set pressure in channel A or channel P① plus 20 bar
Minimum set pressure with command value 0 in channel A or P①		bar	see characteristic curves page 10 (maximum 3 bar)
Maximum flow		l/min	30
Pilot flow		l/min	0.65
Hydraulic fluid			see table on page 7
Maximum permissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)			Class 20/18/15 [2]
Hydraulic fluid temperature range		°C	-20 ... +80
Viscosity range		mm^2/s	15 ... 280
Hysteresis		%	< 2 of the maximum pressure which can be set
Repetition accuracy		%	< ± 1 of the maximum pressure which can be set
Linearity		%	< 2 of the maximum pressure which can be set
Response sensitivity		%	< 0.5 of the maximum pressure which can be set
Valve manufacturing tolerance of the command value pressure characteristic curve,		%	< ± 6 of the maximum pressure which can be set [3]
Step response $T_u + T_g$ [4]	▶ 0 % → 100 %, 100 % → 0 %	ms	< 500

1) Pressures > 10 can destroy the motor.

2) The cleanliness classes stated for the components need to be maintained in hydraulic systems. Effective filtration prevents faults and at the same time increases the service life of the components.

3) By adjusting the zero point and the range in the electronics system, type VT-MRMA1-1-1X/V0/0, the manufacturing tolerance of the complete unit (valve + electronics) can be reduced.

4) T_u + T_g measured with standing hydraulic fluid column < 5 liters

Notice:
The technical data were determined at a viscosity of 46 mm^2/s (HLP46; 40 °C).

Technical data
(For applications outside these parameters, please consult us!)

Hydraulic fluid		Classification	Suitable sealing materials	Standards	Data sheet
Mineral oils		HL, HLP	NBR, FKM	DIN 51524	90220
Bio-degradable	▶ Insoluble in water	HEES	FKM	ISO 15380	90221
	▶ soluble in water	HEPG	FKM	ISO 15380	
Flame-resistant	▶ water-free	HFDU	FKM	ISO 12922	90222
	▶ containing water	HFC (Fuchs Hydrotherm 46M, Petrofer Ultra Safe 620)	NBR	ISO 12922	90223

Important Information on hydraulic fluids:
- For more information and data on the use of other hydraulic fluids, please refer to the above data sheets or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.)!
- The flash point of the hydraulic fluid used must be 40 K higher than the maximum solenoid surface temperature.
- **Flame-resistant – containing water**:
  - Maximum pressure differential 210 bar, otherwise, increased cavitation.
  - Pressure pre-loading at the tank port >20 % of the pressure differential, otherwise increased cavitation
  - Life cycle as compared to operation with mineral oil HL, HLP 30 to 100 %
- **Bio-degradable and flame resistant:** When using these hydraulic fluids that are simultaneously zinc-solvent, zinc may accumulate (700 mg zinc per pole tube).

Electrical: Valve		
Nominal voltage	V	18
Rated current	A	0.5 ± 20%
Maximum continuous current	A	0.5
Connection resistance	Ω	9.9
Winding temperature	°C	approx. 20
	K	100
Protection class of the valve according to EN 60529		IP 65 (with mating connector mounted and locked)
Electrical: Control electronics		
Control electronics		Amplifier type VT-MSPA1-11-1X/V0/0 in modular design (separate order) based on data sheet 30214

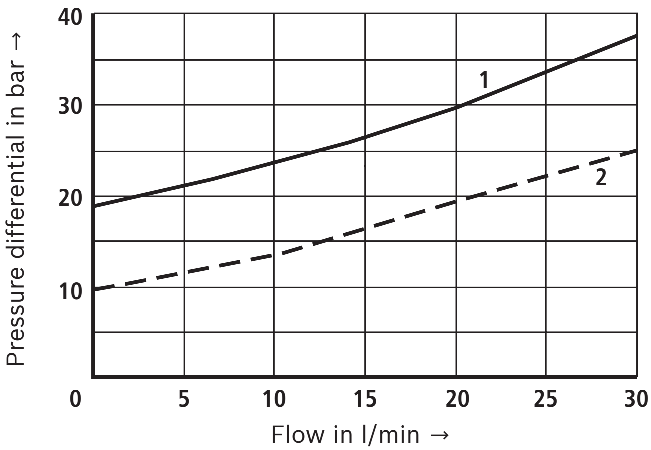
Notices:
The valves must not be used for **safety-related machine functions** as only the electrical area is secured, not the hydraulic one. This means that if the hydraulic pressure in P falls to 0 bar, the actuator pressure (A) or secondary pressure (P①) is also 0.

When establishing the electrical connection, the protective earthing conductor (PE ⏚) has to be connected correctly.

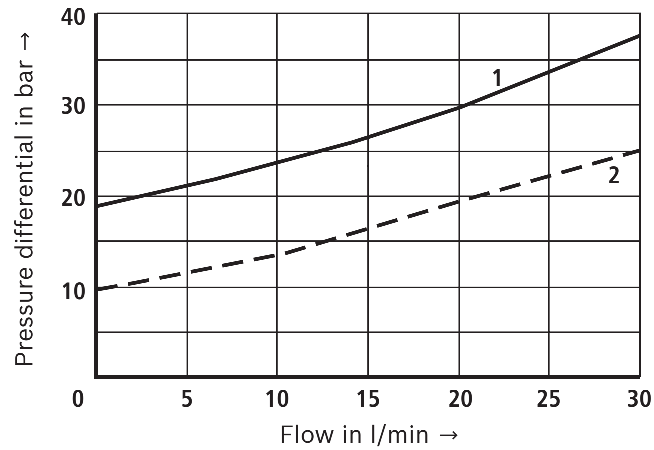
Characteristic curves
(measured with HLP46, ϑ_{oil}= 40 ±5 °C)

Δ*p*-*q*$_V$ characteristic curves

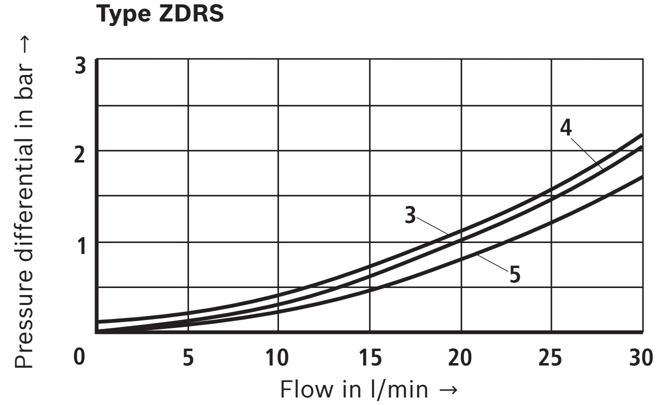
Type DRS (P → A)



Type ZDRS (P② → P①)



Type ZDRS

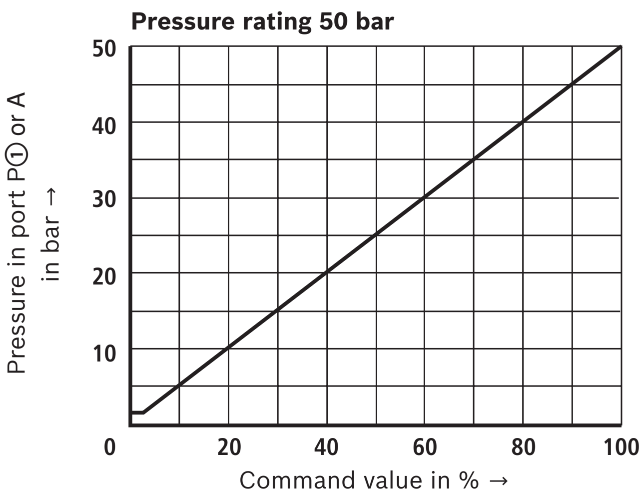


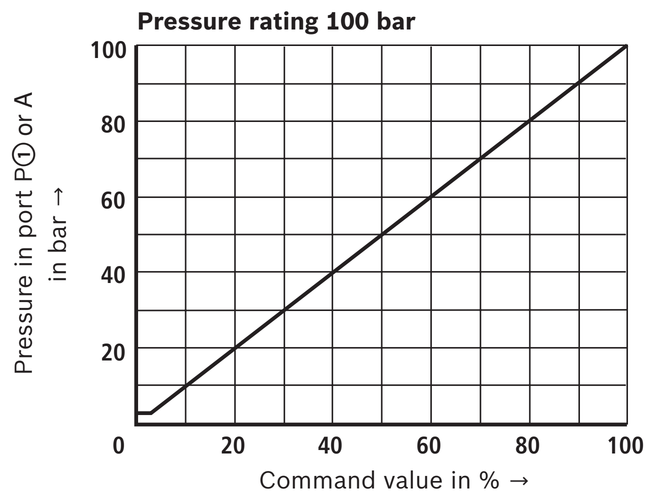
☞ **Notice:**
The pressure differential shown corresponds to the minimum pressure available in port P (P②) minus the maximum pressure to be controlled in port A (P①).

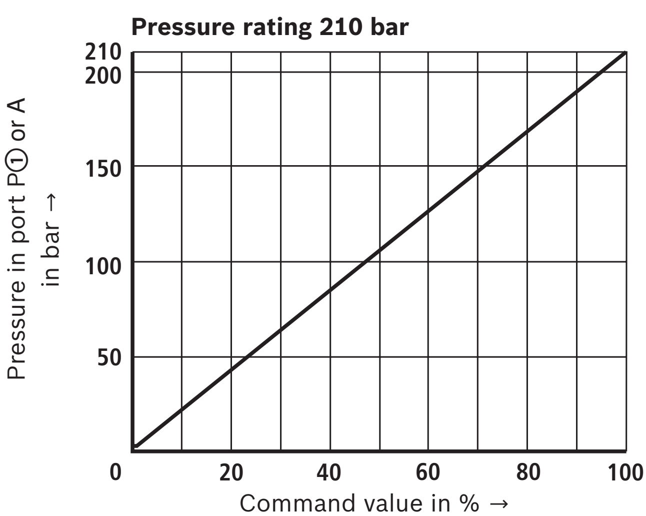
1 100/210 bar
2 50 bar
3 A① →A②
4 B① →B②
5 T① →T②

Characteristic curves
(measured with HLP46, ϑ_{oil}= 40 ±5 °C)

Pressure in port P① or A depending on the command value

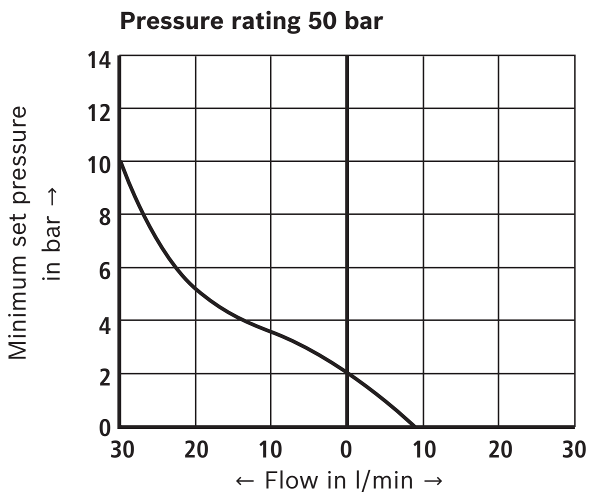




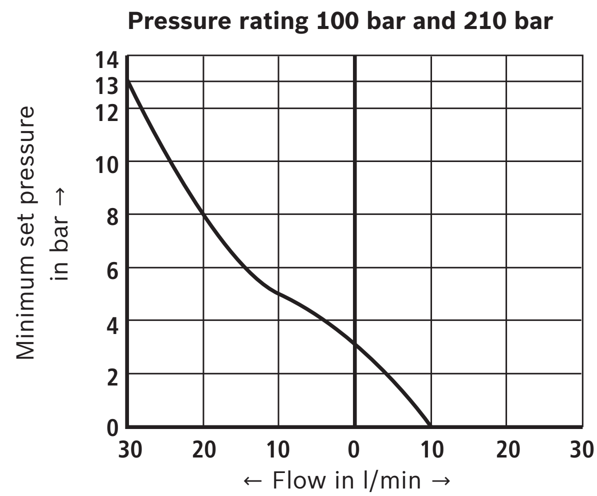


Characteristic curves
(measured with HLP46, ϑ_{oil}= 40 ±5 °C)

Minimum set pressure in port P① or A with command value 0 V **(without counter pressure in channel T or T①)**



Type DRS	A → T	P → A
Type ZDRS	P① → T②	P② → P①

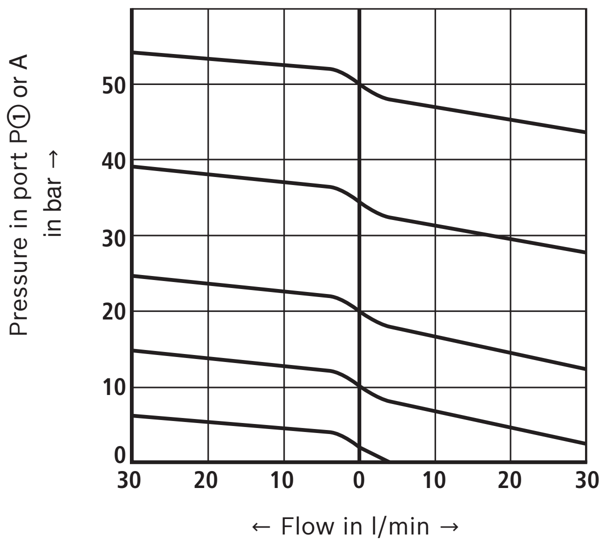


Type DRS	A → T	P → A
Type ZDRS	P① → T②	P② → P①

Characteristic curves
(measured with HLP46, ϑ_{oil}= 40 ±5 °C)

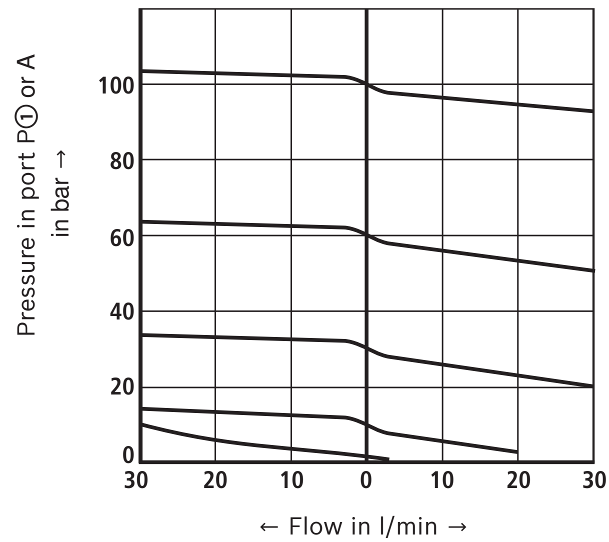
Pressure in port P① or A depending on the flow

Pressure rating 50 bar



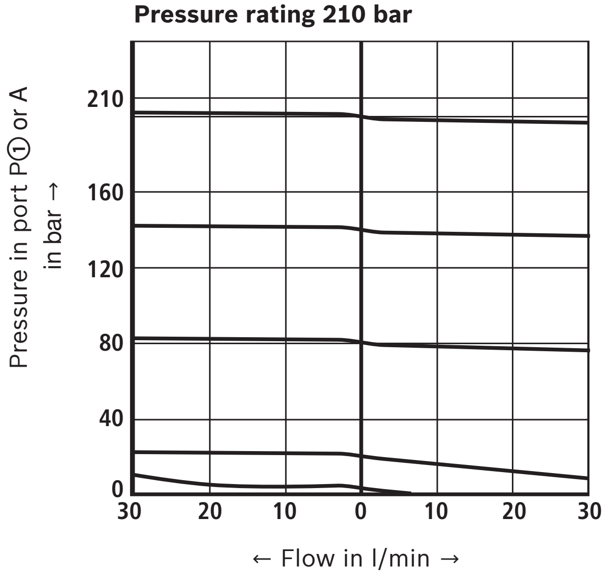
Type DRS	A → T	P → A
Type ZDRS	P① → T②	P② → P①

Pressure rating 100 bar



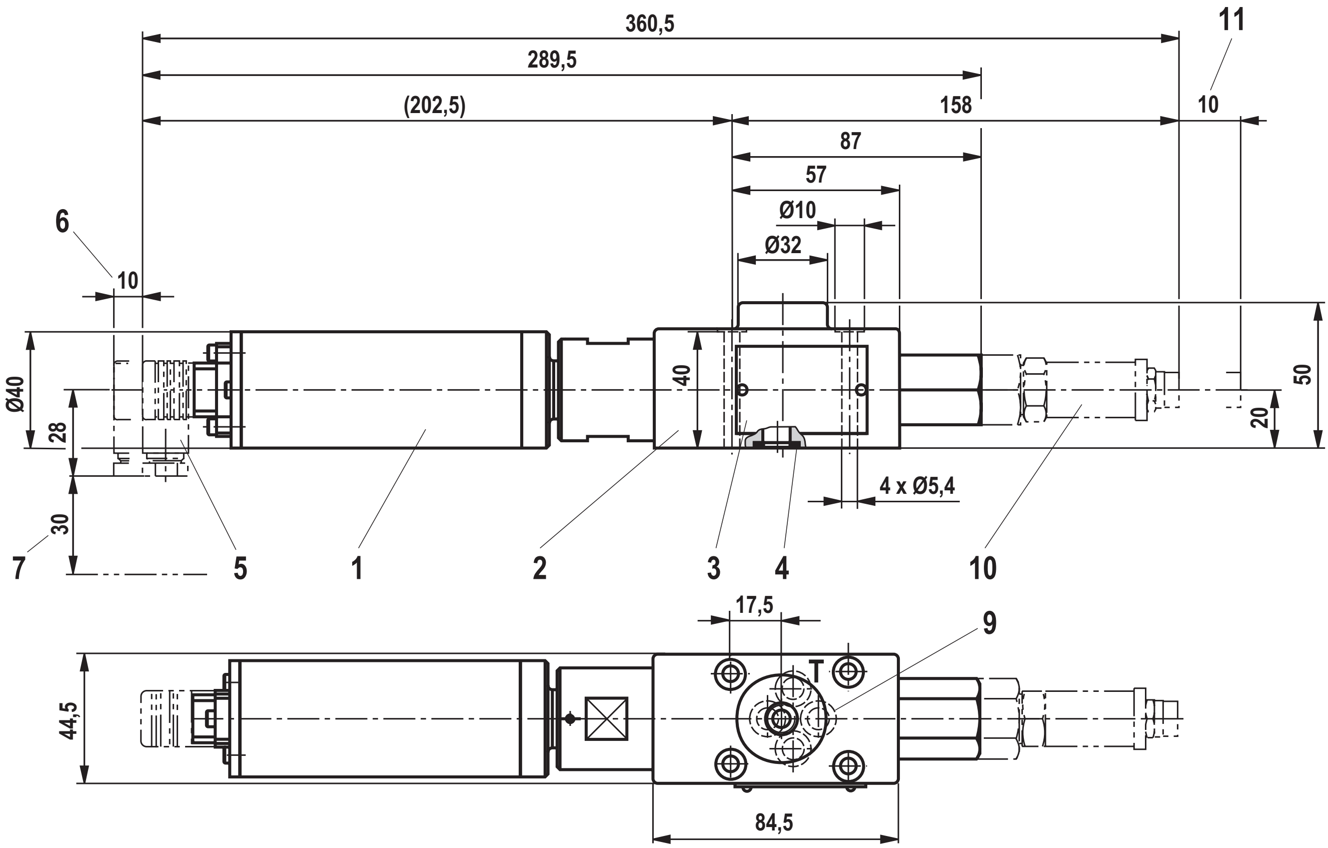
Type DRS	A → T	P → A
Type ZDRS	P① → T②	P② → P①

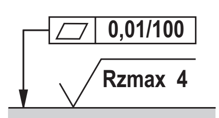
Pressure rating 210 bar



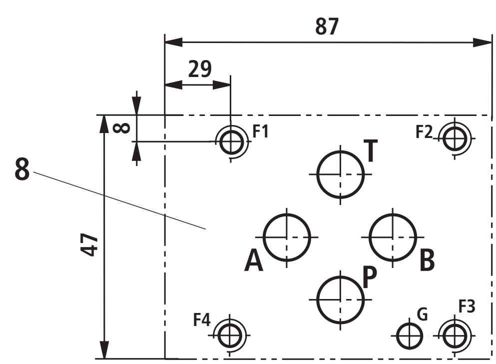
Type DRS	A → T	P → A
Type ZDRS	P① → T②	P② → P①

Dimensions: Type DRS
(dimensions in mm)





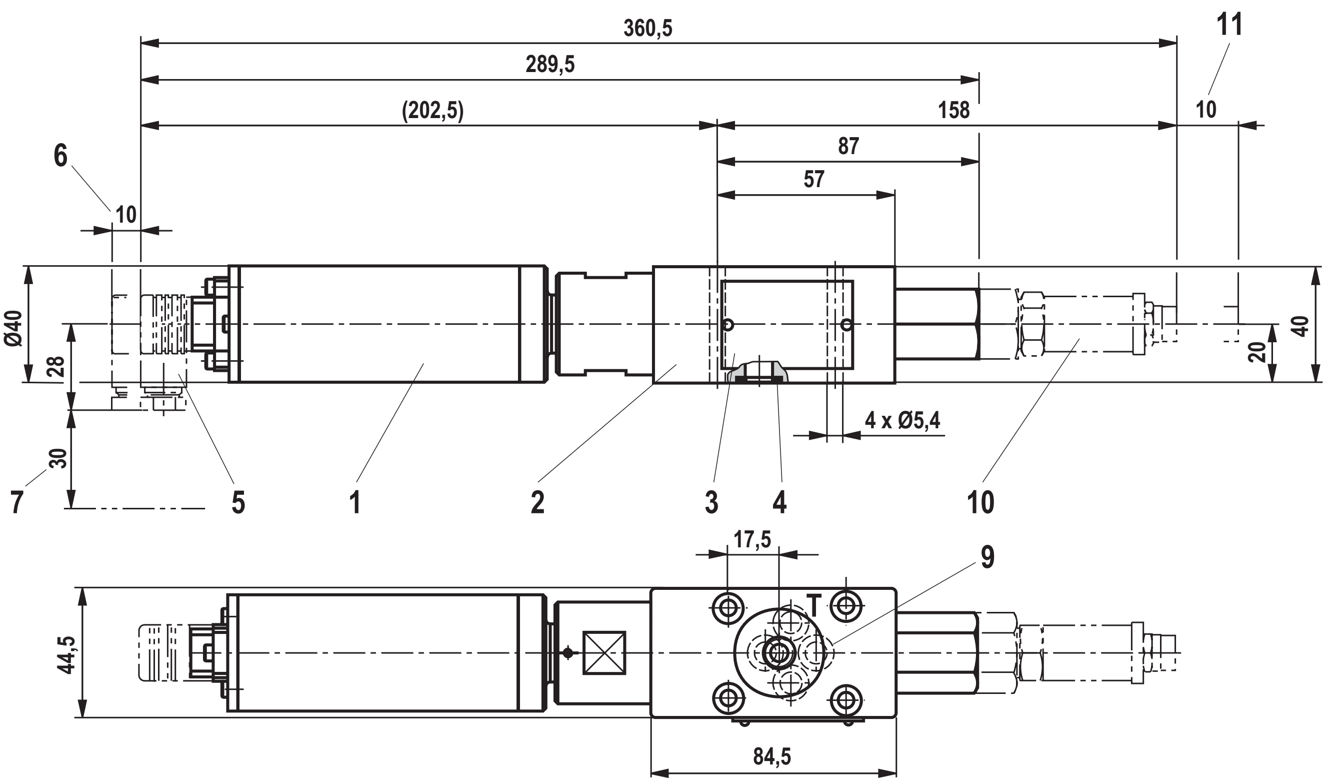
Required surface quality of the valve contact surface

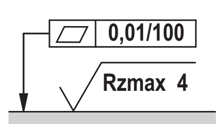


1 DC motor
2 valve housing
3 Name plate
4 Identical seal rings for ports A, P, T and blind counterbore B
5 Mating connector, separate order, see page 14.
6 Space required to remove the mating connector
7 Space required for connecting cable
Note: The mating connector can be fitted offset by 4 x 90°.
8 Porting pattern according to ISO 4401-03-02-0-05 (Deviating from the standard, without locating pin)
9 Blind bore hole (port B)
10 Pressure transducer for version “S”
11 Space required to remove the mating connector

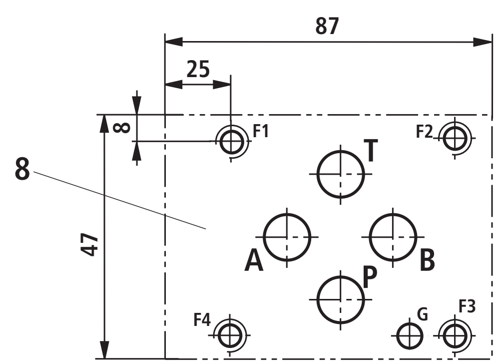
For valve mounting screws and **subplates,** see page 14.

Dimensions: Type ZDRS (dimensions in mm)





Required surface quality of the valve contact surface



1 DC motor

2 valve housing

3 Name plate

4 Identical seal rings for ports A, P, T and blind counterbore B

5 Mating connector, separate order, see page 14.

6 Space required to remove the mating connector

7 Space required for connecting cable
Note: The mating connector can be fitted offset by 4 x 90°.

8 Porting pattern according to ISO 4401-03-02-0-05 (Deviating from the standard, without locating pin)

9 Blind bore hole (port B)

10 Pressure transducer for version “S”

11 Space required to remove the mating connector

For valve mounting screws and **subplates,** see page 14.

Dimensions

Valve mounting screws (separate order)

Type	Quantity	Hex socket head cap screws	Material number
DRS	4	**ISO 4762 - M5 x 50 - 10.9-flZn-240h-L** (friction coefficient μ_{total} = 0.09 ... 0.14); tightening torque M_A = 7 Nm ±10 %	**R913000064**
	or		
	4	**4 hexagon socket head cap screws ISO 4762 - M5 x 50 - 10.9** (friction coefficient μ_{total} = 0.12 ... 0.17); tightening torque M_A = 8.1 Nm ±10 %	Not included in the Rexroth delivery range
ZDRS	4	**ISO 4762 - M5 - 10.9-flZn-240h-L** (friction coefficient μ_{total} = 0.09 ... 0.14); tightening torque M_A = 7 Nm ±10 %,	See notes
	or		
	4	**ISO 4762 - M5 - 10.9** (friction coefficient μ_{total} = 0.12 ... 0.17); tightening torque M_A = 8.1 Nm ±10 %	Not included in the Rexroth delivery range

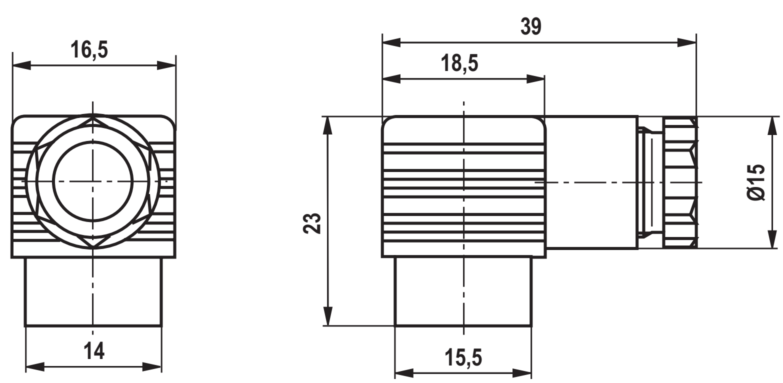
Notices:
- The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure.
- Type ZDRS: Length and tightening torque of the valve mounting screws must be calculated according to the components mounted under and over the sandwich plate valve.

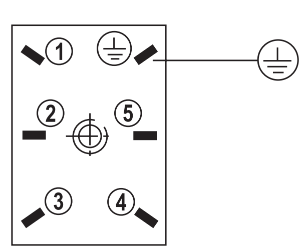
Subplates(separate order)

Size	Data sheet	Material number
6	45052	–

Electrical connection
(dimensions in mm)

Mating connector (separate order)
Material no. **R900021448**
(Plastic version)

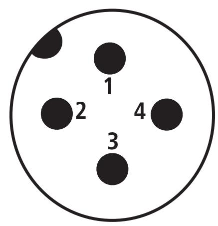




1 Position feedback +
2 Position feedback output
3 Position feedback -
4 Motor +
5 Motor –
⏚ PE = GND

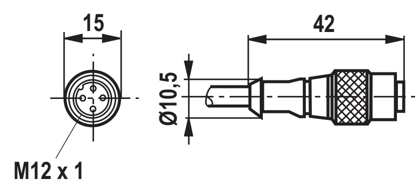
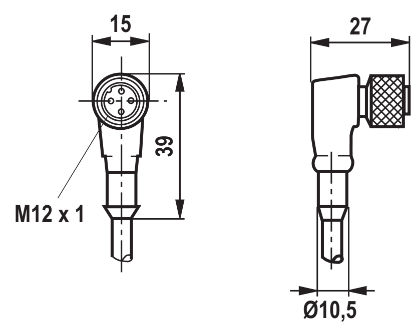
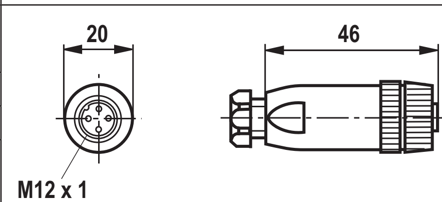
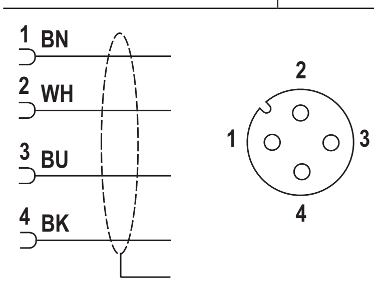
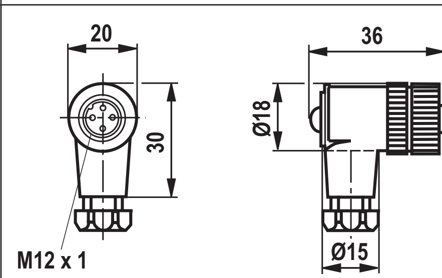
Electrical connection
(dimensions in mm)

Pressure transducer on device, Version “S”
(4-pole M12 connector, view of contact side)



Voltage	**Current** (two-wire system)
1 → auxiliary energy + (+ U_B)	**1** → auxiliary energy + (+ U_B)
2 → n.c.	**2** → n.c.
3 → auxiliary energy – (0 V)	**3** → auxiliary energy – (0 V)
4 → output signal	**4** → n.c.

Mating connectors for pressure transducer

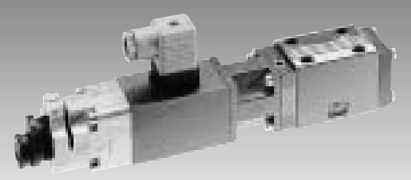
Technical data			**Designation**	**Material no.**
Current carrying capacity	4 A		04 POL (with 2 m cable)	**R900773031**
Temperature range	–25 ... 90 °C		04 POL (with 5 m cable)	**R900779498**
Protection class	IP 67			
Contacts	CuZn			
Contact surface	gold-plated		04 POL (with 2 m cable)	**R900779504**
Housing	TPU		04 POL (with 5 m cable)	**R900779503**
Seal material	FKM			
Fitting	CuZn/Ni			
Wire cross-section	4 x 0.34 mm			
Jacket material	PUR			
Screening	on connector side not applied		04 POL (without cable), protection class IP 68	**R900773042**
Sleeve diameter	Ø 5.0 mm			
Sleeve color	black			
Bending radius for dynamic use	min. 50 mm			
			04 POL (without cable), protection class IP 68	**R900779509**

More information

▶ Subplates	Data sheet 45052
▶ Analog amplifier module type VT-MRMA1-1-1X/V0/0	Data sheet 30214
▶ Compact power supply units VT-NE30	Data sheet 29929
▶ Pressure transducer with integrated electronics, type HM 17	Data sheet 30269
▶ Application example: Analog pressure adjustment system with pressure monitoring	Data sheet 62003
▶ Mineral oil-based hydraulic fluids	Data sheet 90220
▶ Environmentally compatible hydraulic fluids	Data sheet 90221
▶ Flame-resistant, water-free hydraulic fluids	Data sheet 90222
▶ Hydraulic valves for industrial applications	Data sheet 07600-B
▶ General product information on hydraulic products	Data sheet 07008
▶ Assembly, commissioning and maintenance of industrial valves	Data sheet 07300
▶ Filter range	

Proportional pressure reducing valve, pilot operated, with inductive position transducer

Type DREB6X



Nominal size 6
Unit series 1X
Maximum working pressure P 315 bar, T 250 bar
Maximum flow rate 40 l/min

List of Contents

Features

- Pilot operated valves for reducing system pressure at the consumer (pilot oil internal only)
- 3-way version (P–A / A–T), $p_{min} = p_T$
- Adjustable through the position of the armature against the compression spring
- Position-controlled, minimal hysteresis < 1 %, rapid response times, see Technical data
- Pressure limitation to a safe level even with faulty electronics (solenoid current $I > I_{max}$)
- For subplate attachment, mounting hole configuration to ISO 4401-03-02-0-94
  Subplates as per catalog sheet RE 45053 (order separately)
- Plug-in connector to DIN 43650-AM2 for the solenoid and plug-in connector for the position transducer, included in scope of delivery
- Data for the external trigger electronics
  - U_B = 24 V_{nom} DC
  - Adjustment of valve curve Np and gain with and without ramp generator
  - Europe card format, setpoint 0...+10 V (order separately)

Ordering data

DREB6	X –	1X /		M	G24 –	25	Z4	M	*

Proportional 3-way pressure reducing valve with inductive position transducer, NG6, pilot operated

Mounting hole configuration to ISO 4401-03-02-0-94 **= X**

Unit series 10 to 19 (10 to 19: installation and connection dimensions unchanged) **= 1X**

Max. pressure stage
up to 75 bar **= 75**
up to 175 bar **= 175**
up to 310 bar **= 310**

Without non-return valve **= M**

Voltage supply of trigger electronics 24 V DC **= G24**

25 = **Solenoid type (current)**
Solenoid current 2.5 A max.

Z4 = **Electrical connection**
Unit plug to DIN 43650-AM2
Plug-in connector included in scope of delivery

M = NBR seals, suitable for mineral oils (HL, HLP) to DIN 51524

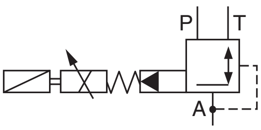
Further information in plain text

Preferred types

Solenoid 2.5 A	
Type	**Material Number**
DREB6X–1X/75MG24–25Z4M	0 811 402 050
DREB6X–1X/175MG24–25Z4M	0 811 402 051
DREB6X–1X/310MG24–25Z4M	0 811 402 052

Symbol

For external trigger electronics



Function, sectional diagram

General

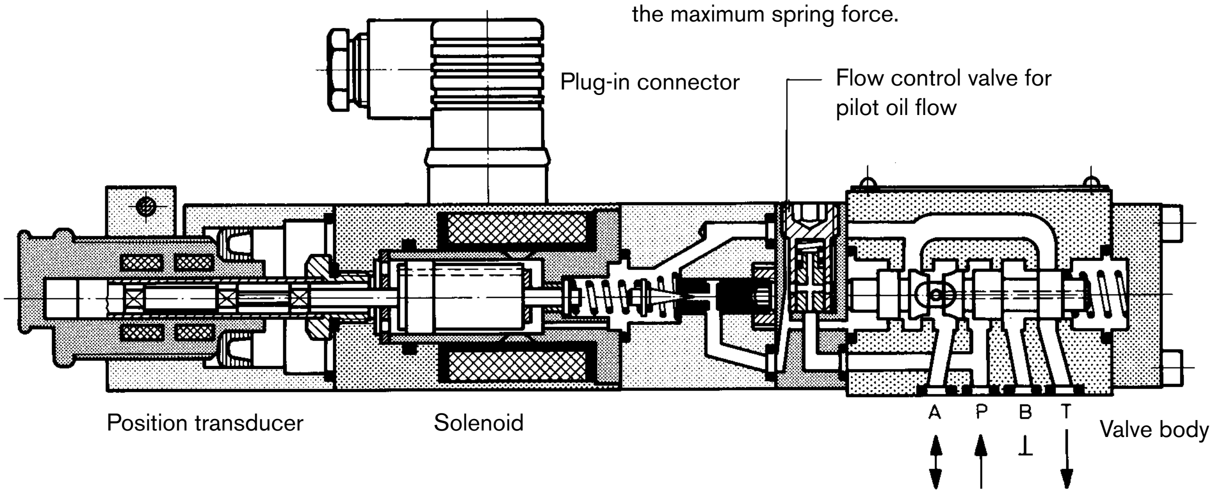
Type DREB6X proportional pressure reducing valves are pilot operated, with a 3-way main stage.
The pilot valve (pressure relief valve pilot stage) is supplied internally with a controlled flow of pilot oil via P.
The valves are actuated by a proportional solenoid, which is position-controlled against a spring. This ensures rapid response times and minimal hysteresis.
With these valves, the pressure in A (consumer) can be infinitely adjusted and reduced in relation to the solenoid current.

Basic principle

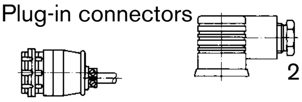
To adjust the system pressure in A, a setpoint is set in the trigger electronics. Based on this setpoint, the electronics control the solenoid coil with regulated PWM (pulse-width-modulated) current.
The proportional solenoid is positioned precisely on the spring characteristic curve. The pilot stage is supplied with oil from P at a flow rate of < 0.6 l/min via a flow control valve. The pilot pressure is compared with the consumer pressure (plus spring) in A and regulated (P–A/A–T).
The spring results in $p_{\mathrm{Amin}} = p$ in T.

Pressure limitation for maximum safety

If a fault occurs in the electronics, so that the solenoid current (I_{max}) would exceed its specified level in an uncontrolled manner, the pressure cannot rise above the level determined by the maximum spring force.



Accessories

Type				Material Number
(4 x) ISO 4762-M5x30-10.9		Cheese-head bolts		2 910 151 166
Europe card 		VT-VRPA1-527-10/V0/PV	RE 30052	0 811 405 096
Europe card 		VT-VRPA1-527-10/V0/PV-RTP	RE 30054	0 811 405 101
Europe card 		VT-VRPA1-527-10/V0/PV-RTS	RE 30056	0 811 405 176
Plug-in connectors  2P+PE		Plug-in connector 2P+PE (M16x1 .5) for the solenoid and plug-in connector for the position transducer, included in scope of delivery, see also RE 08008		

Testing and service equipment

Test box type VT-PE-TB1, see RE 30063
Test adapter for Europe cards type VT-PA-3, see RE 30070

Technical data

General

Construction	Pilot stage		Poppet valve
	Main stage		Spool valve
Actuation			Proportional solenoid with position control, external amplifier
Connection type			Subplate, mounting hole configuration NG6 (ISO 4401-03-02-0-94)
Mounting position			Optional
Ambient temperature range		°C	–20...+50
Weight		kg	2.4
Vibration resistance, test condition			max. 25 g, shaken in 3 dimensions (24 h)

Hydraulic (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

Pressure fluid			Hydraulic oil to DIN 51524...535, other fluids after prior consultation		
Viscosity range	recommended	mm^2/s	20...100		
	max. permitted	mm^2/s	10...800		
Pressure fluid temperature range		°C	–20...+80		
Maximum permitted degree of contamination of pressure fluid Purity class to ISO 4406 (c)			Class 18/16/13 [1]		
Direction of flow			See symbol		
Max. set pressure in A (at $Q_{min} = 1$ l/min)		bar	75	175	310
Minimum pressure in A		bar	0 (relative) or pressure in T		
Min. inlet pressure in P		bar	$p_P = p_A + \geq 5$		
Max. working pressure		bar	Port P: 315		
Max. pressure		bar	Port T: 250 (B sealed)		
Internal pilot oil flow		l/min	approx. 0.6 (with closed-loop control)		
Max. flow		l/min	40		

Electrical

Cyclic duration factor	%	100
Degree of protection		IP 65 to DIN 40050 and IEC 14434/5
Solenoid connection		Unit plug DIN 43650/ISO 4400, M16 x 1.5 (2P+PE)
Position transducer connection		Special plug
Max. solenoid current	I_{max}	2.5 A
Coil resistance R_{20}	Ω	3
Max. power consumption at 100% load and operating temperature	VA	30

Static/Dynamic [2]

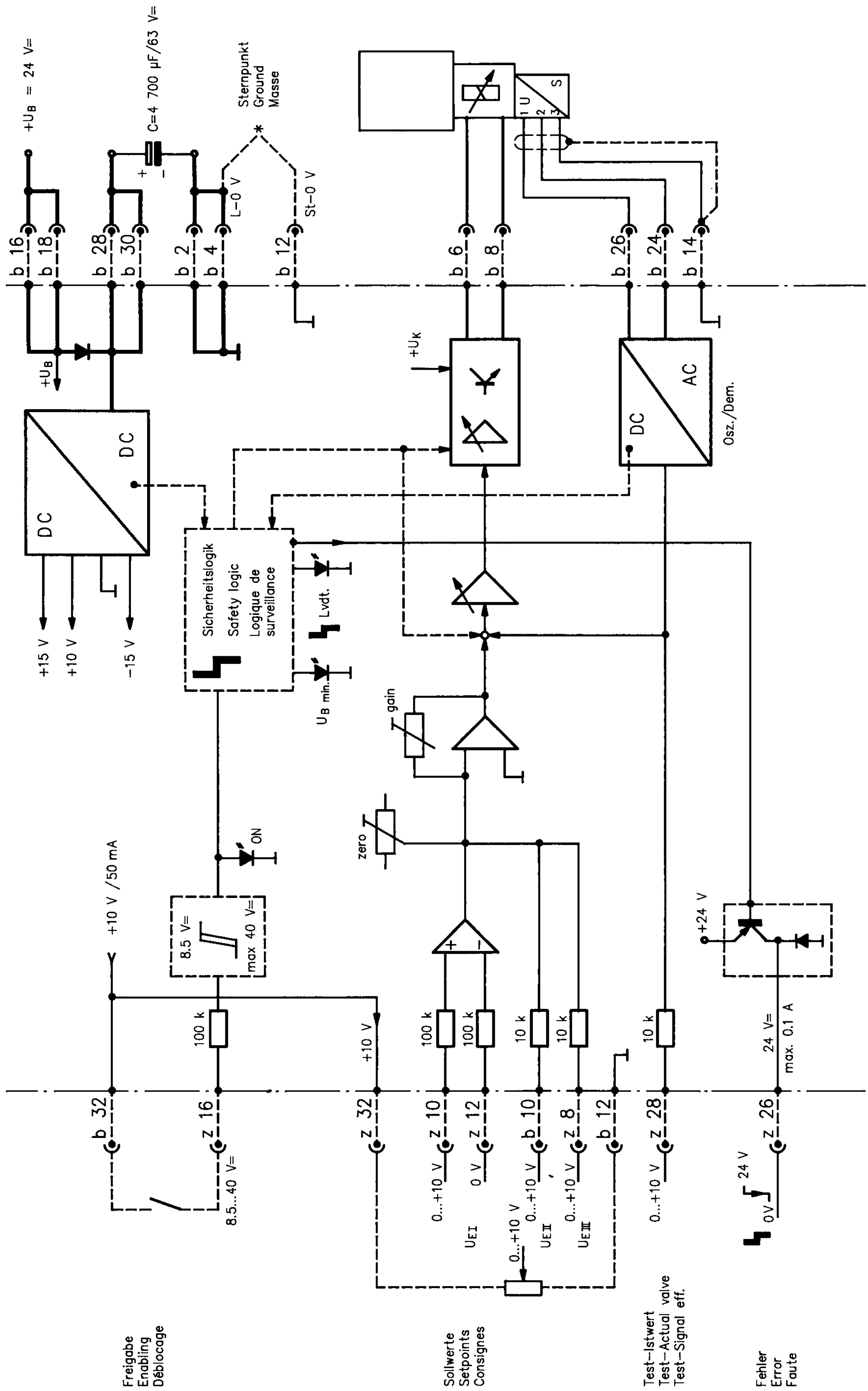
Hysteresis	%	≤ 1	
Manufacturing tolerance for p_{max}	%	≤ 10	
Response time 100 % signal change	ms	On <50	Response time at: $Q = 10$ l/min (values depend on the dead volume)
		Off <20	

[1] The purity classes stated for the components must be complied with in hydraulic systems. Effective filtration prevents problems and also extends the service life of components. For a selection of filters, see catalog sheets RE 50070, RE 50076 and RE 50081.

[2] All characteristic values ascertained using amplifier 0 811 405 096 (without ramp).

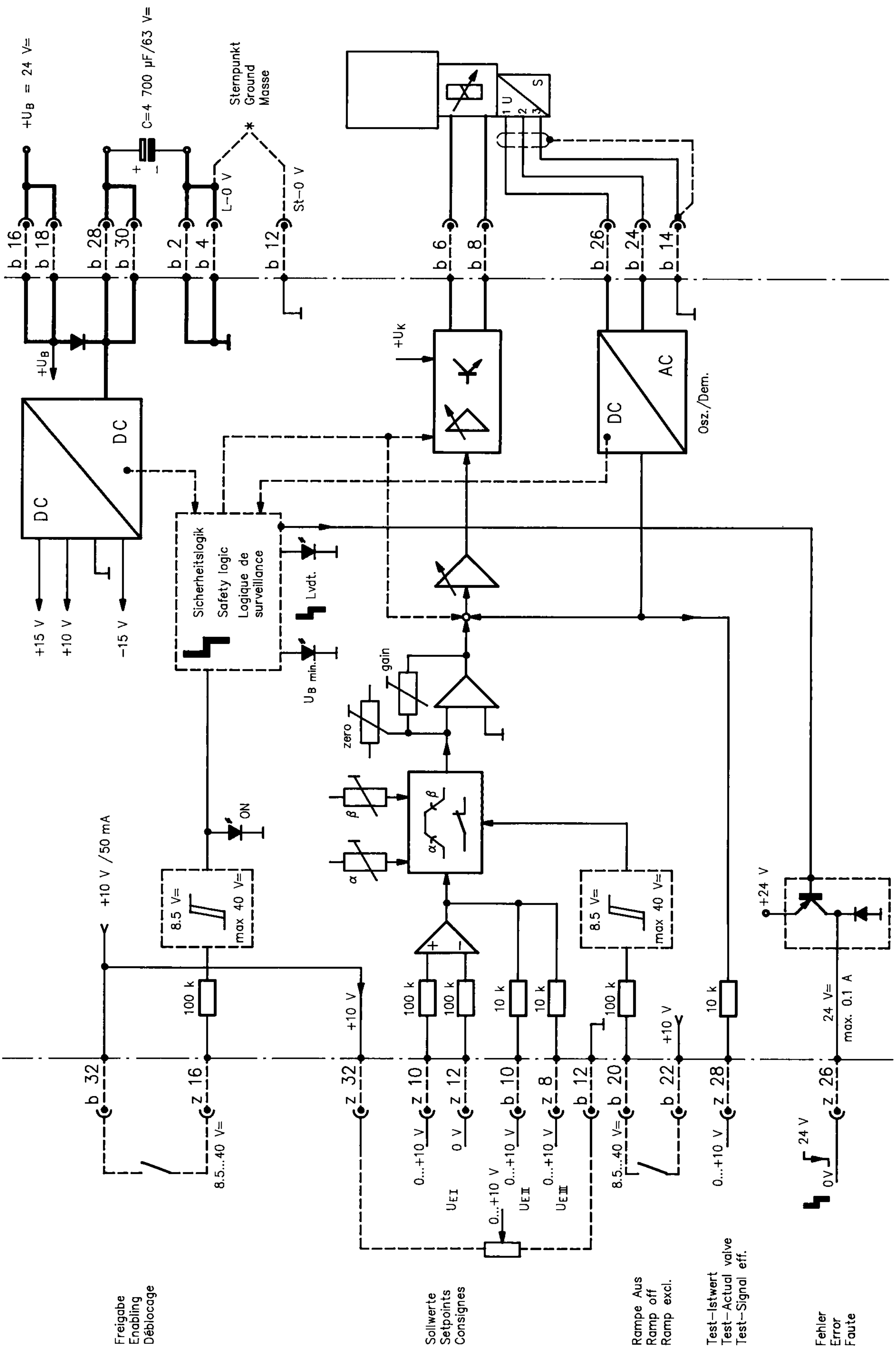
Valve with external trigger electronics (europe card without ramp, RE 30052)

Circuit diagram/pin assignment



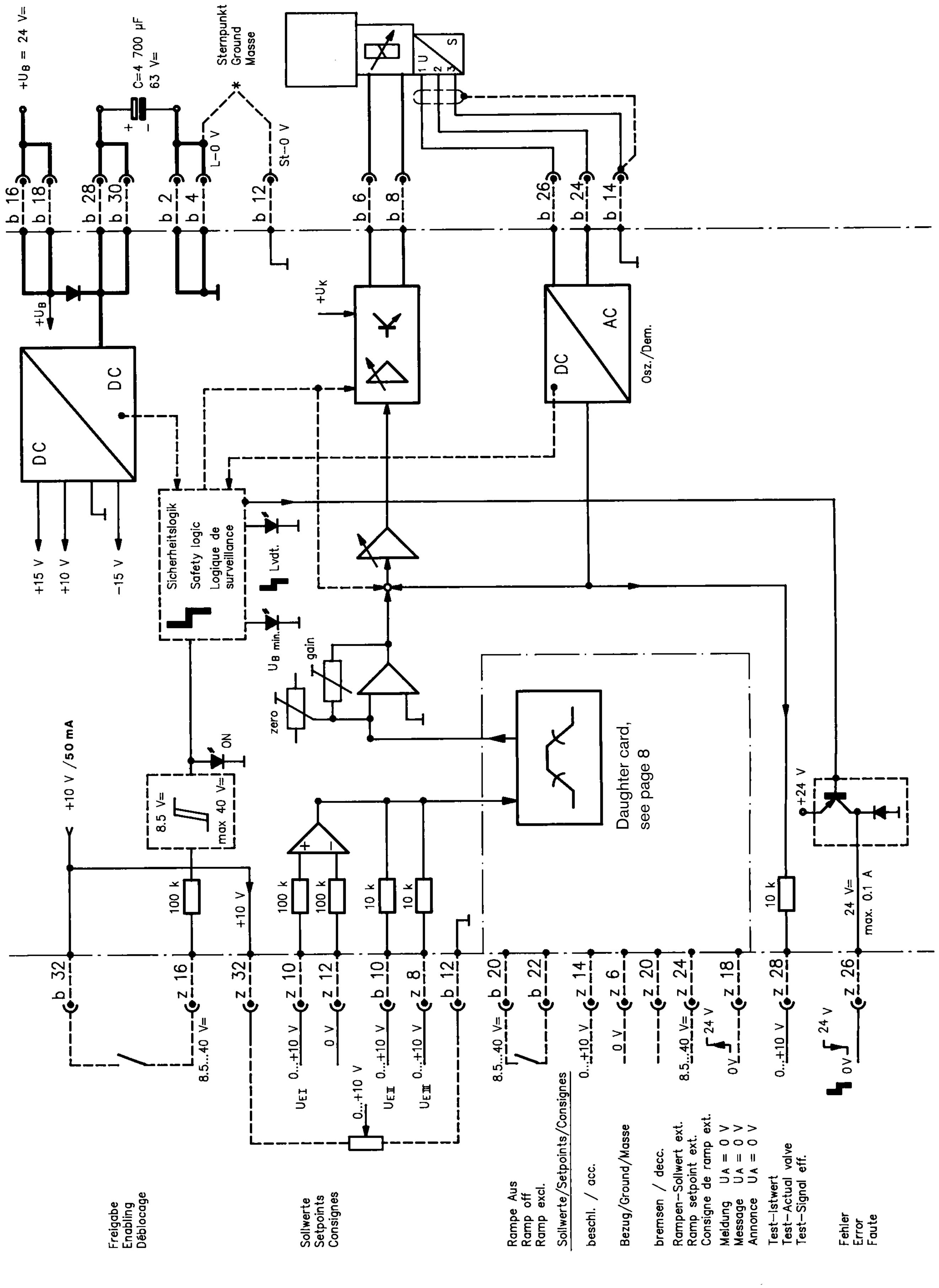
Valve with external trigger electronics (europe card without ramp, RE 30054)

Circuit diagram/pin assignment



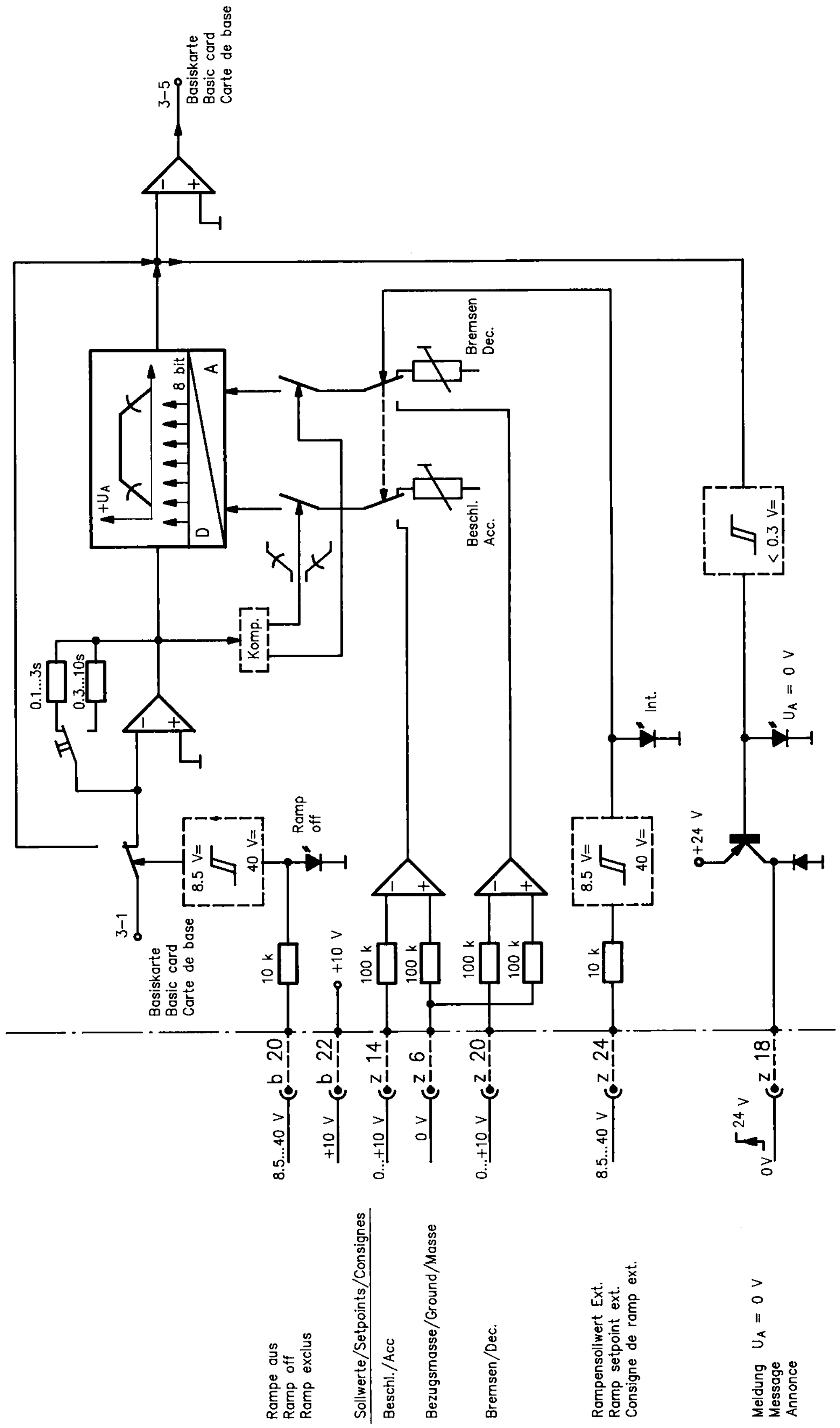
Valve with external trigger electronics (europe card without ramp, RE 30056)

Circuit diagram/pin assignment



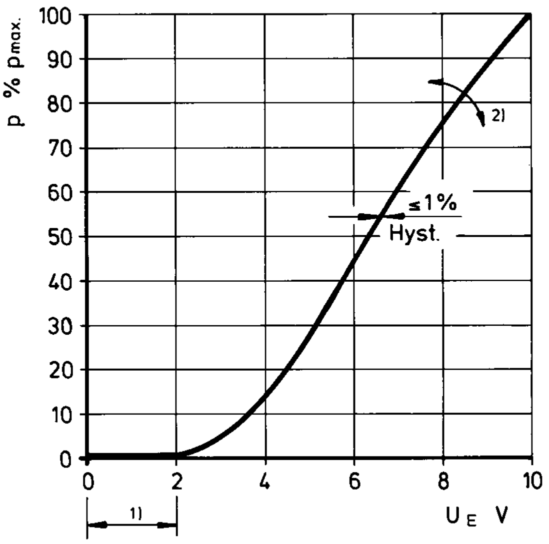
Valve with external trigger electronics (europe card without ramp, RE 30056)

Circuit diagram/pin assignment **Daughter card**



Characteristic curves (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

Pressure in port A as a function of the setpoint

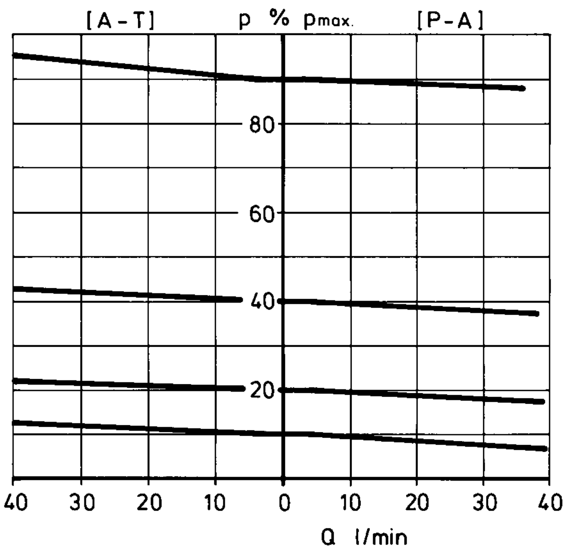


Valve amplifier

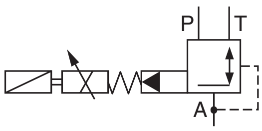
1) Zero adjustment

2) Sensitivity adjustment

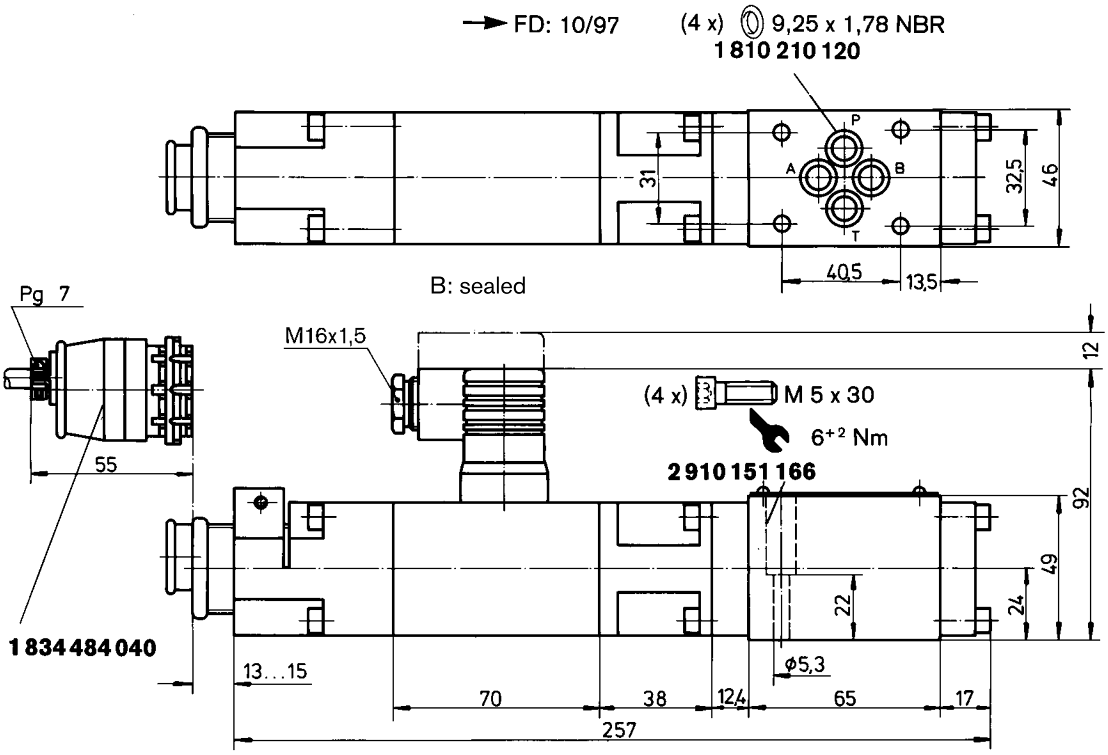
Pressure in port A proportionate to the maximum flow rate of the main stage



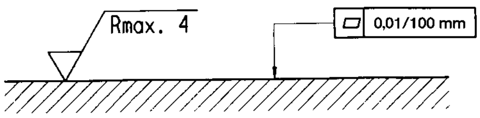
Set pressure
$p\,\%\,p_{max} = f\,(Q_{P-A}/Q_{A-T})$



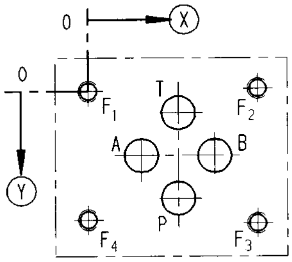
Unit dimensions (nominal dimensions in mm)



Required surface quality of mating component



Mounting hole configuration: NG6 (ISO 4401-03-02-0-94)
For subplates, see catalog sheet RE 45053



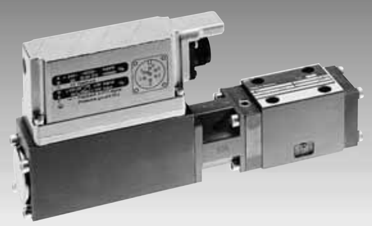
1) Deviates from standard
2) Thread depth:
Ferrous metal 1.5 x Ø
Non-ferrous 2 x Ø

	P	A	T	B	F_1	F_2	F_3	F_4
X	21.5	12.5	21.5	30.2	0	40.5	40.5	0
Y	25.9	15.5	5.1	15.5	0	–0.75	31.75	31
∅	8 1)	8 1)	8 1)	8 1)	M5 2)	M5 2)	M5 2)	M5 2)

Proportional pressure reducing valve, pilot operated, with on-board electronics (OBE) and position feedback

RE 29195/05.06
Replaces: 07.05

Type DREBE6X



Nominal size (NG) 6
Unit series 1X
Maximum working pressure P 315 bar, T 250 bar
Maximum flow rate 40 l/min

List of Contents

Features

– Pilot operated valves with position feedback and on-board electronics for reducing system pressure in the consumer (pilot oil internal only)
– 3-way version (P–A/A–T), $p_{min} = p_T$
– Adjustable through the position of the armature against the compression spring
– Position-controlled, minimal hysteresis < 1 %, rapid response times, see Technical data
– Pressure limitation to a safe level even with faulty electronics (solenoid current $I > I_{max}$)
– For subplate attachment, mounting hole configuration to ISO 4401-03-02-0-05. Subplates as per catalog sheet RE 45053 (order separately)
– Plug-in connector to DIN 43563-AM6, see catalog sheet RE 08008 (order separately)
– Data for the on-board trigger electronics
  • Complies with CE, EMC directives EN 61000-6-2: 2002-08 and EN 61000-6-3: 2002-08
  • $U_B = 24\ V_{nom}$ DC
  • Electrical connection 6P+PE
  • Signal actuation
    – Standard 0...+ 10 V (A1)
    – Version 4...20 mA (F1)
  • Valve curve calibrated at the factory

Ordering data

DREB	E	6	X	–	1X	/		M	G24	K31		M	*

Proportional 3-way pressure reducing valve with inductive position transducer, pilot operated

With on-board electronics **= E**

Nominal size **= 6**

Mounting hole configuration to ISO 4401-03-02-0-05 **= X**

Unit series 10 to 19 **= 1X**
(10 to 19: installation and connection dimensions unchanged)

Max. pressure stage
up to 75 bar **= 75**
up to 175 bar **= 175**
up to 310 bar **= 310**

Without non-return valve **= M**

Voltage supply of trigger electronics 24 V DC **= G24**

K31 = **Electrical connection**
without plug-in connector, with unit plug to DIN 43563-AM6
Order plug-in connector separately

Interface for trigger electronics
A1 = Setpoint input 0...+10 V
F1 = Setpoint input 4...20 mA

M = NBR seals, suitable for mineral oils (HL, HLP) to DIN 51524

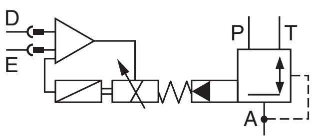
Further information in plain text

Preferred types

Type....A1 (0...+10 V)	Material Number	Type....F1 (4...20 mA)	Material Number
DREBE6X–1X/75MG24K31A1M	0 811 402 082	DREBE6X–1X/175MG24K31F1M	0 811 402 083
DREBE6X–1X/175MG24K31A1M	0 811 402 080	DREBE6X–1X/310MG24K31F1M	0 811 402 085
DREBE6X–1X/310MG24K31A1M	0 811 402 081		

Symbol

For on-board electronics



Function, sectional diagram

General

Type DREBE6X proportional pressure reducing valves are pilot operated with a 3-way main stage.
The pilot valve (pressure relief valve pilot stage) is supplied internally with a controlled flow of pilot oil via P.
The valves are actuated by means of a position-controlled proportional solenoid with on-board electronics.
With these valves, the pressure in A (consumer) can be infinitely adjusted and reduced in relation to the setpoint.

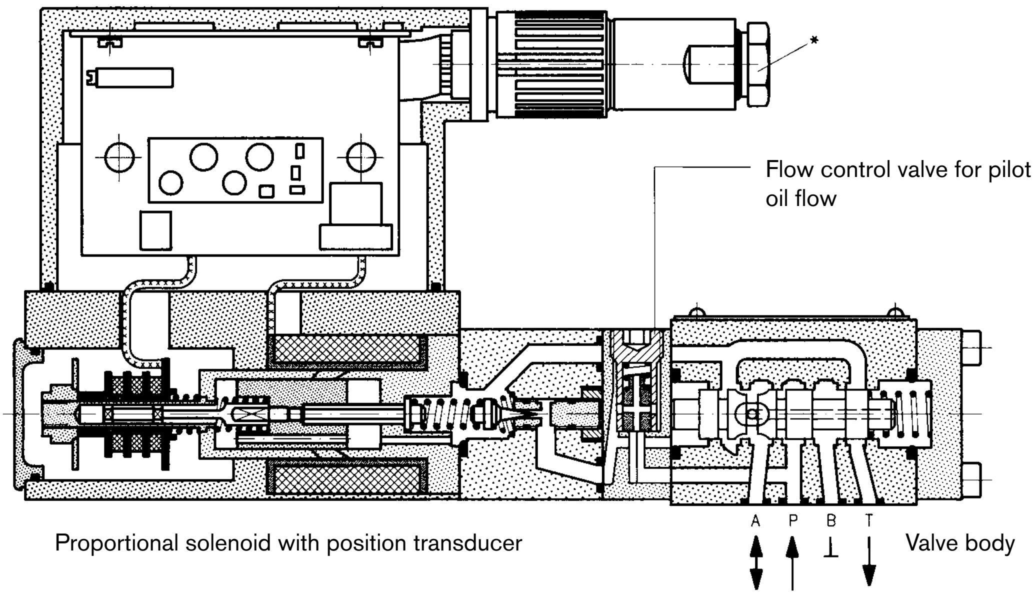
CE EN 61000-6-2: 2002-08
EN 61000-6-3: 2002-08

Basic principle

To adjust the system pressure in A, a setpoint is set in the trigger electronics. Based on this setpoint, the electronics control the position of the solenoid against the spring force. The proportional solenoid is positioned precisely on the spring characteristic curve. The pilot stage is supplied with oil from P at a flow rate of < 0.6 l/min via a flow control valve. The pilot pressure is compared with the consumer pressure (plus spring) in A and regulated.
The spring results in $p_{Amin} = p$ in T.

Pressure limitation for maximum safety

If a fault occurs in the electronics, so that the solenoid current (I_{max}) would exceed its specified level in an uncontrolled manner, the pressure cannot rise above the level determined by the maximum spring force.



Accessories

Type			Material Number
(4 x) ISO 4762-M5x30-10.9	Cheese-head bolts		2 910 151 166
* 	Plug-in connectors 6P+PE, see also RE 08008	KS	1 834 482 022
		KS	1 834 482 026
		MS	1 834 482 023
		MS	1 834 482 024
		KS 90°	1 834 484 252

Testing and service equipment

Test box type VT-PE-TB3, see RE 30065
Measuring adapter 6P+PE type VT-PA-2, see RE 30068

Technical data

General				
Construction	Pilot stage	Poppet valve		
	Main stage	Spool valve		
Actuation		Proportional solenoid with position control and OBE		
Connection type		Subplate, mounting hole configuration NG6 (ISO 4401-03-02-0-05)		
Mounting position		Optional		
Ambient temperature range	°C	–20...+50		
Weight	kg	3.3		
Vibration resistance, test condition		Max. 25 g, shaken in 3 dimensions (24 h)		

Hydraulic (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)				
Pressure fluid		Hydraulic oil to DIN 51524...535, other fluids after prior consultation		
Viscosity range	recommended mm^2/s	20...100		
	max. permitted mm^2/s	10...800		
Pressure fluid temperature range	°C	–20...+70		
Maximum permitted degree of contamination of pressure fluid Purity class to ISO 4406 (c)		Class 18/16/13 [1)]		
Direction of flow		See symbol		
Max. set pressure in A (at $Q_{min} = 1$ l/min)	bar	75	175	310
Minimum pressure in A	bar	0 (relative) or pressure in T		
Min. inlet pressure in P	bar	$p_P = p_A + \geq 5$		
Max. working pressure	bar	Port P: 315		
Max. pressure	bar	Port T: 250 (B sealed)		
Internal pilot oil flow	l/min	approx. 0.6 (with closed-loop control)		
Max. flow	l/min	40		

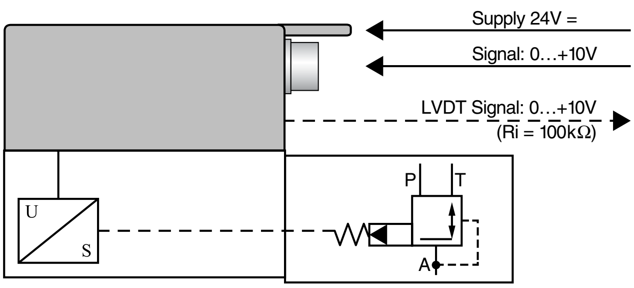
Static/Dynamic			
Hysteresis		%	≦ 1 of max. set pressure
Manufacturing tolerance		%	≦ ±5 of max. set pressure
Response time	100 % signal change	ms	50
	10 % signal change	ms	20
Thermal drift			<1% at $\Delta T = 40\,°C$
Conformity			CE EN 61000-6-2: 2002-08 EN 61000-6-3: 2002-08

1) The purity classes stated for the components must be complied with in hydraulic systems.
Effective filtration prevents problems and also extends the service life of components.
For a selection of filters, see catalog sheets RE 50070, RE 50076 and RE 50081.

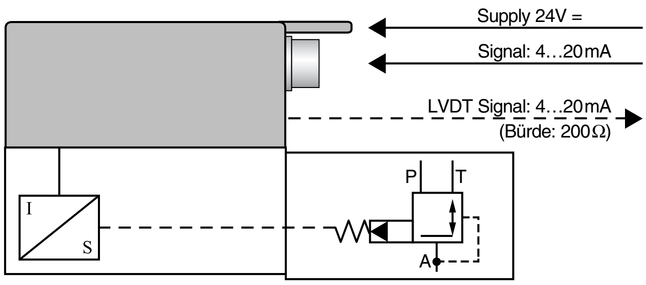
Technical data

Electrical, trigger electronics integrated in valve		
Cyclic duration factor	%	100
Degree of protection		IP 65 to DIN 40050 and IEC 14434/5
Connection		Plug-in connector 6P+PE, DIN 43563
Supply voltage Terminal A: Terminal B: 0 V		24 V DC_{nom} Min. 21 V DC/max. 40 V DC Ripple max. 2 V DC
Power consumption		Solenoid ⍁ 45 mm = 40 VA max.
External fuse		2.5 A_F
Input, “standard” version Terminal D: U_E Terminal E:	A1	Differential amplifier, $R_i = 100$ kΩ 0...+10 V 0 V
Input, “mA signal” version Terminal D: I_{D-E} Terminal E: I_{D-E}	F1	Burden, $R_{sh} = 200$ Ω 4...20 mA Current loop I_{D-E} feedback
Max. voltage to differential inputs over 0 V		D → B, E → B } max. 18 V DC
Test signal, “standard” version Terminal F: U_{Test} Terminal C:	A1	LVDT 0...+10 V Reference 0 V
Test signal, “mA signal” version Terminal F: I_{F-C} Terminal C: I_{F-C}	F1	LVDT signal 4...20 mA at external load 200...500 Ω max. 4...20 mA output Current loop I_{F-C} feedback
Safety earth conductor and shield		See pin assignment (installation in conformity with CE)
Recommended cable		See pin assignment up to 20 m 7 x 0.75 mm^2 up to 40 m 7 x 1 mm^2
Calibration		Calibrated at the factory, see valve curve

Version A1: Standard

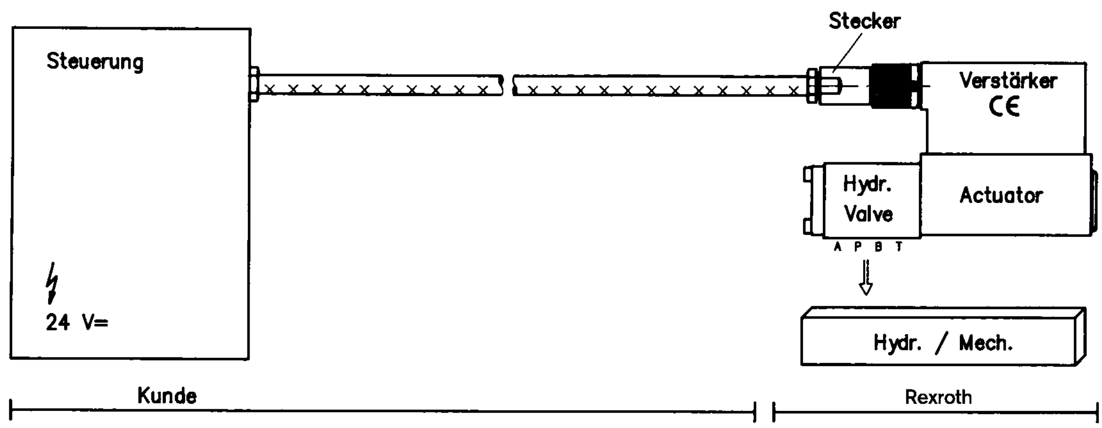


Version F1: mA signal



Connection

For electrical data, see page 5 and
Operating Instructions **1 819 929 083**



Technical notes for the cable

Version: – Multi-wire cable
– Extra-finely stranded wire to VDE 0295, Class 6
– Safety earth conductor, green/yellow
– Cu braided shield

Type: – e.g. Ölflex-FD 855 CP (from Lappkabel company)

No. of wires: – Determined by type of valve, plug type and signal assignment

Cable Ø: – 0.75 mm^2 up to 20 m long
– 1.0 mm^2 up to 40 m long

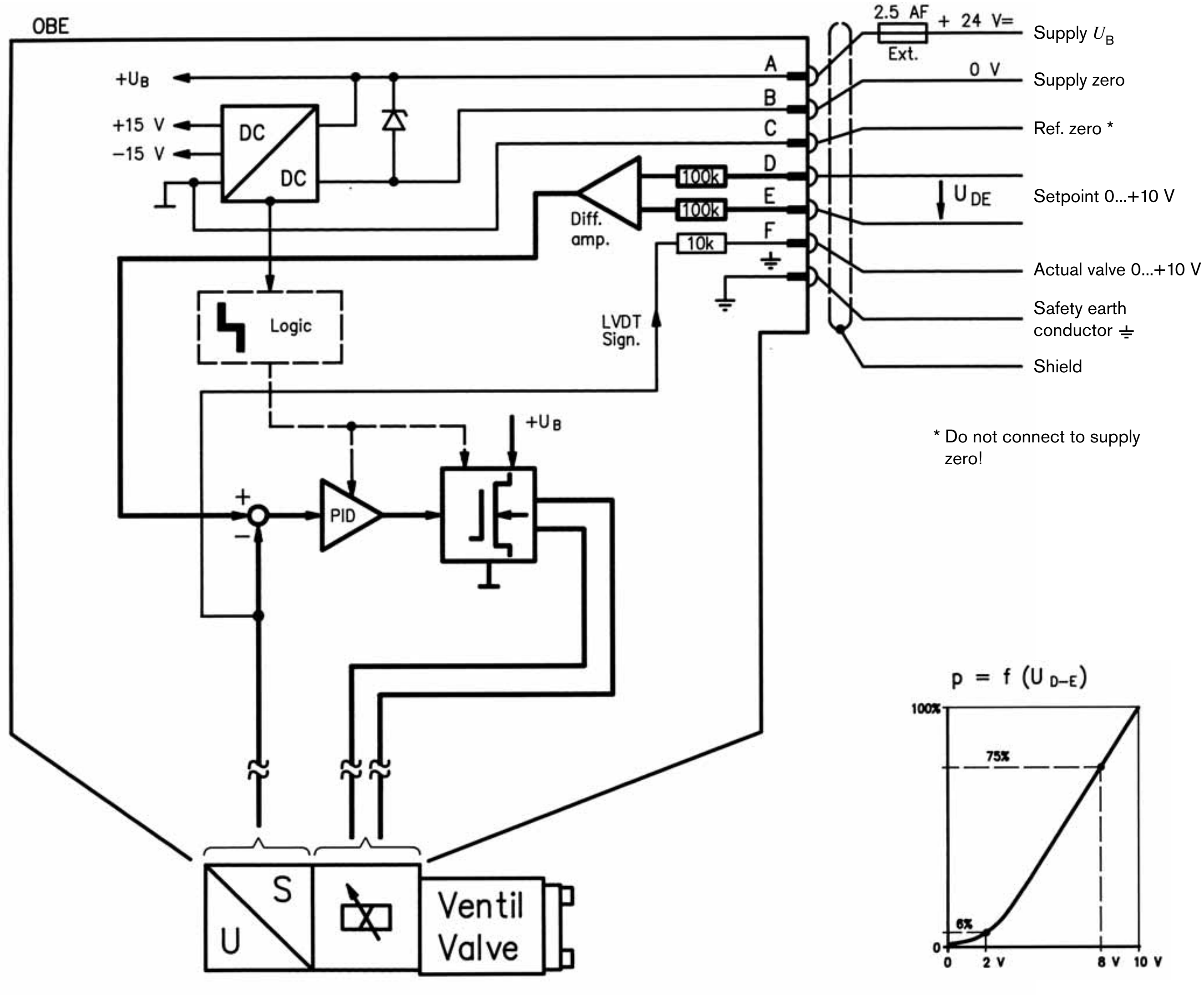
Outside Ø: – 9.4...11.8 mm – Pg 11
– 12.7...13.5 mm – Pg 16

Important

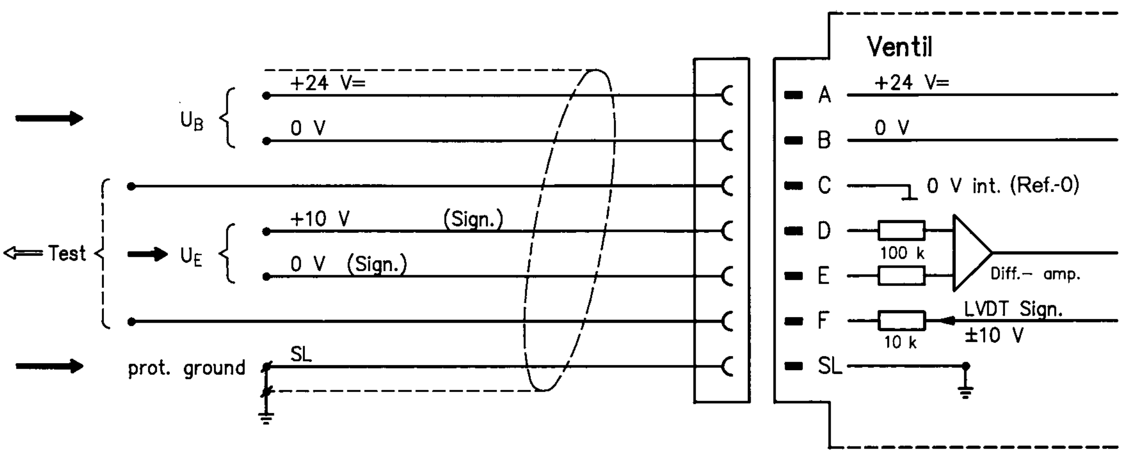
Voltage supply 24 V DC nom.,
if voltage drops below 18 V DC, rapid shutdown resembling "Enable OFF" takes place internally.
In addition, with the "mA signal" version:
$I_{D-E} \geqq 3$ mA – valve is active
$I_{D-E} \leqq 2$ mA – valve is deactivated.
Electrical signals emitted via the trigger electronics (e.g. actual values) must not be used to shut down safety-relevant machine functions!
(See also European Standard, "Technical Safety Requirements for Fluid-Powered Systems and Components – Hydraulics", EN 982.)

On-board trigger electronics

Circuit diagram/pin assignment
Version A1: U_{D-E} 0...+10 V

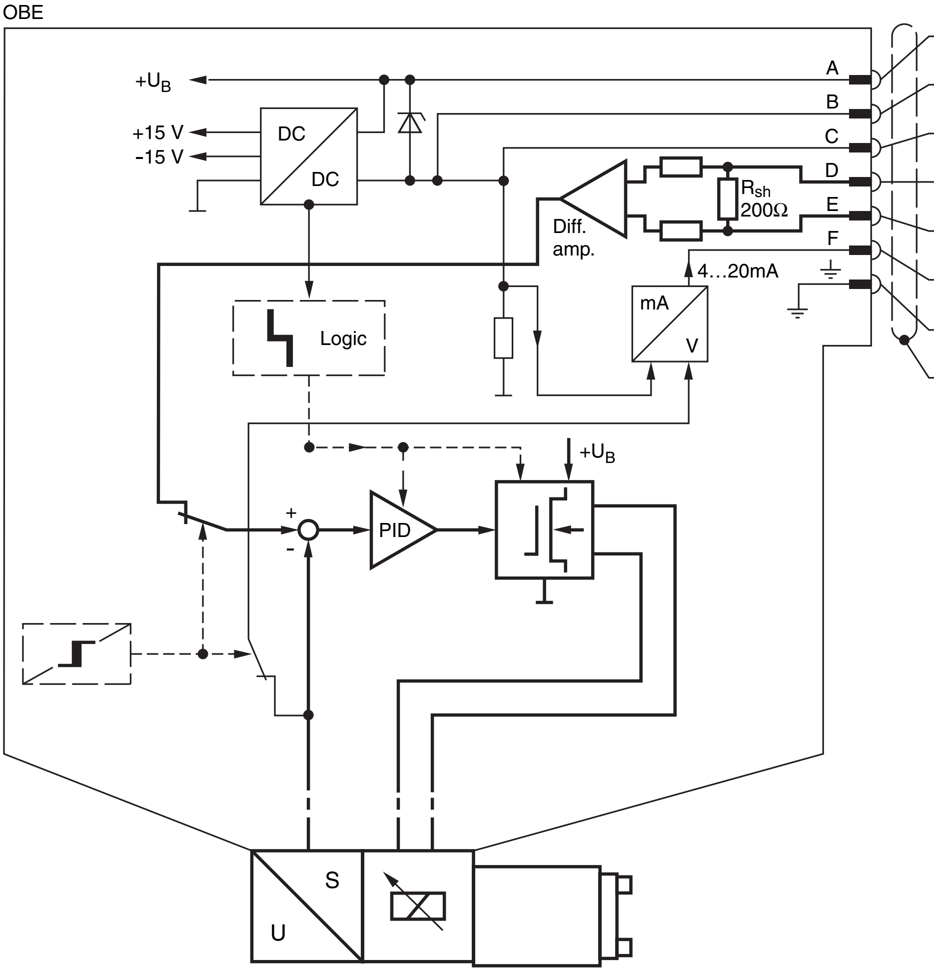


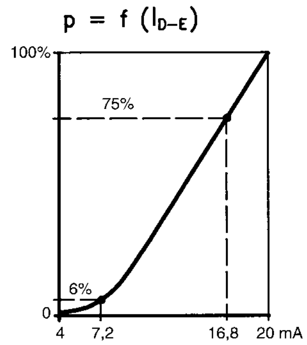
Pin assignment
Version A1: U_{D-E} 0...+10 V
(R_i = 100 kΩ)



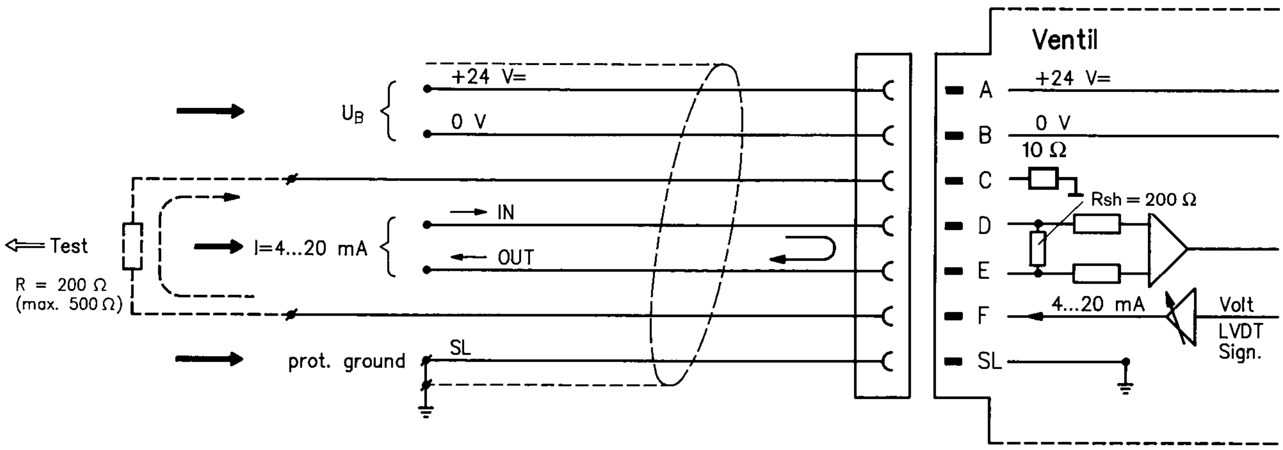
On-board trigger electronics

Circuit diagram/pin assignment
Version F1: I_{D-E} 4...20 mA



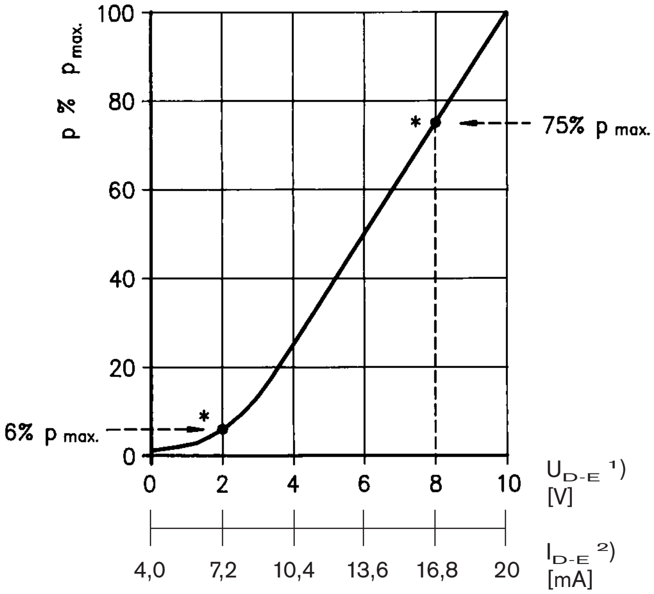


Pin assignment 6P+PE
Version F1: I_{D-E} 4...20 mA
(R_{sh} = 200 kΩ)



Characteristic curves (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

Pressure in port A as a function of the setpoint

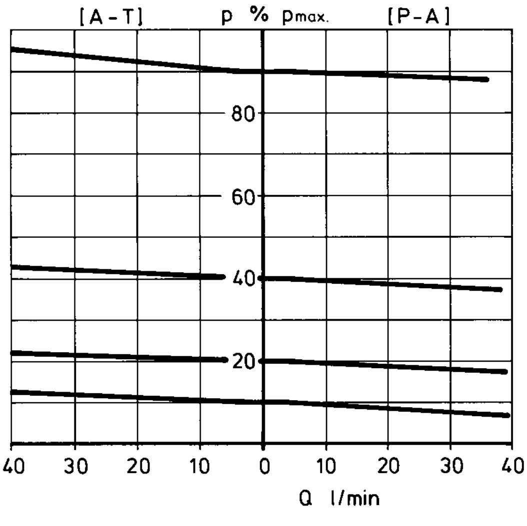


* Factory setting at $Q = 1$ l/min
+5 % manufacturing tolerance
(of max. set pressure)

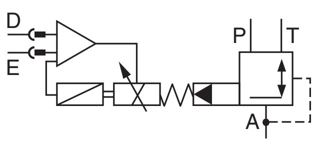
1) Version: $U_{D-E} = 0...+10$ V

2) Version: $I_{D-E} = 4...20$ mA

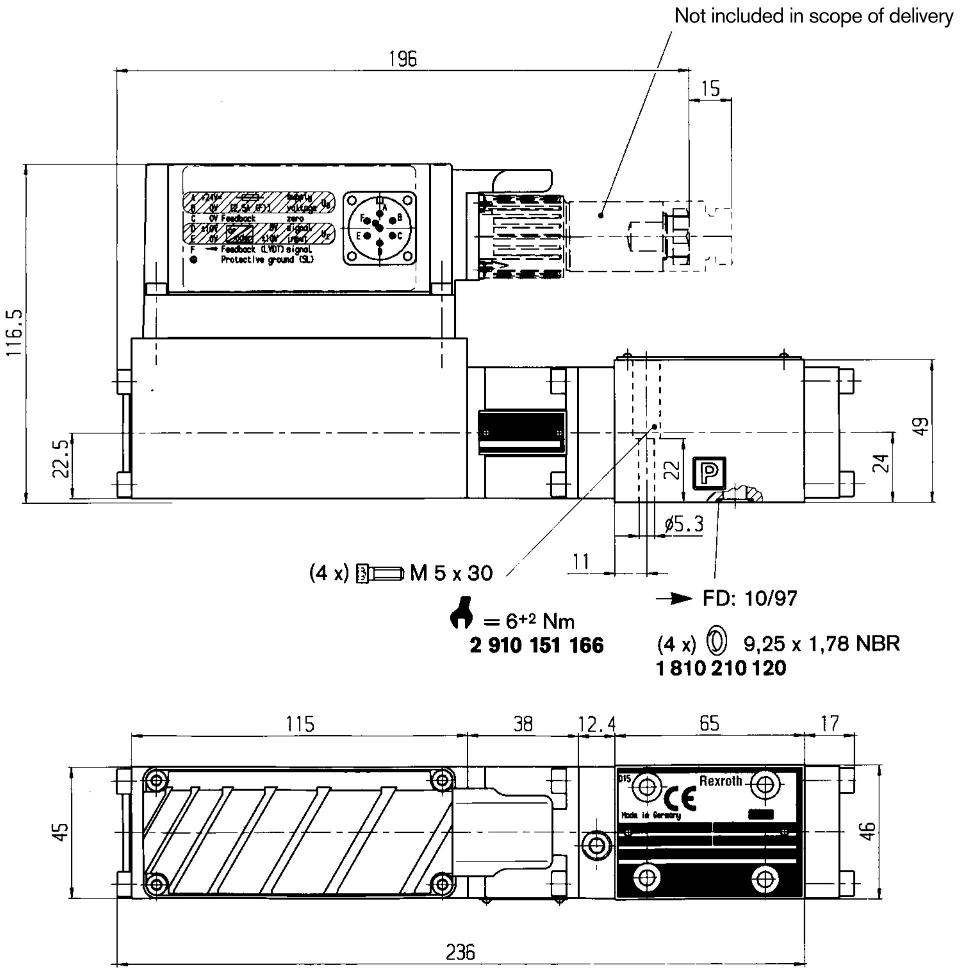
Pressure in port A proportionate to the maximum flow rate of the main stage



Set pressure
$p\ \%\ p_{max} = f\ (Q_{P-A}/Q_{A-T})$

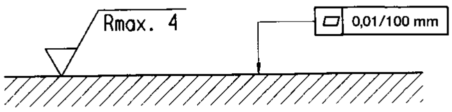


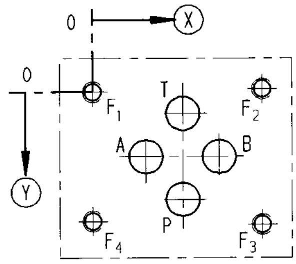
Unit dimensions (nominal dimensions in mm)



Mounting hole configuration: NG6
(ISO 4401-03-02-0-05)
For subplates, see catalog sheet RE 45053

Required surface quality of mating component





1) Deviates from standard
2) Thread depth:
Ferrous metal 1.5 x Ø
Non-ferrous 2 x Ø

	P	A	T	B	F_1	F_2	F_3	F_4
X	21.5	12.5	21.5	30.2	0	40.5	40.5	0
Y	25.9	15.5	5.1	15.5	0	–0.75	31.75	31
Ø	8 1)	8 1)	8 1)	8 1)	M5 2)	M5 2)	M5 2)	M5 2)

Proportional pressure reducing valve, pilot operated, with on-board electronics (OBE) and position feedback

Type DREBE10Z

Nominal size 10
Unit series 1X
Maximum working pressure A, B, X 315 bar, Y 2 bar
Maximum flow rate Q_{nom} 120 l/min

List of contents

Contents	Page

Features

- Pilot operated valves with position feedback and on-board electronics for reducing system pressure (pilot oil internal only, with relief port X)
- Adjustable through the position of the armature against the compression spring
- With position control, minimal hysteresis <1%, rapid response times, see Technical Data
- Pressure limitation to a safe level even with faulty electronics (solenoid current $I > I_{max}$)
- For subplate attachment, mounting hole configuration to ISO 5781-AG-06-2-A
  Subplates as per catalog sheet RE 45055
  (order separately)
- Plug-in connector to DIN 43563-AM6, see catalog sheet RE 08008 (order separately)
- Data for the on-board trigger electronics
  - Complies with CE, EMC directives EN 61000-6-2: 2002-08 and EN 61000-6-3: 2002-08
  - U_B = 24 V_{nom} DC
  - Electrical connection 6P+PE
  - Signal actuation
    – Standard 0...+10 V (A1)
  - Valve curve calibrated at the factory

Ordering data

DREB	E	10	Z	–1X/		XY	M	G24	K31	A1	M	*

Proportional pressure reducing valve with inductive position transducer on the cone

With on-board electronics = **E**

Nominal size = **10**

Mounting hole configuration to ISO 5781-AG-06-2-A = **Z**

Unit series 10 to 19 (10 to 19: installation and connection dimensions unchanged) = **1X**

Max. pressure stage
up to 180 bar = **180**
up to 315 bar = **315**

Relief port X
Pilot oil port Y = **XY**

* Variant "F1" (4...20 mA version) available on request

Further information in plain text

M = NBR seals, suitable for mineral oils (HL, HLP) to DIN 51524

Interface for trigger electronics*
A1 = Setpoint input 0...+10 V

K31 = **Electrical connection**
without plug-in connector, with unit plug to DIN 43563-AM6
Order plug-in connector separately

G24 = Voltage supply of trigger electronics 24 V DC

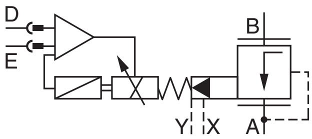
M = Without non-return valve

Preferred types

Type ....A1 (0...+10 V)	Material Number
DREBE10Z–1X/180XYMG24K31A1M	0 811 402 155
DREBE10Z–1X/315XYMG24K31A1M	0 811 402 152

Symbol

For on-board electronics



Function, sectional diagram

General

Type DREBE10Z proportional pressure reducing valves are pilot operated and are used to reduce system pressure.
They are actuated by means of a position-controlled proportional solenoid with on-board electronics.
The valve body contains a logic element (spool valve) of the "normally open" type. This is pilot operated and is in conical seat design.

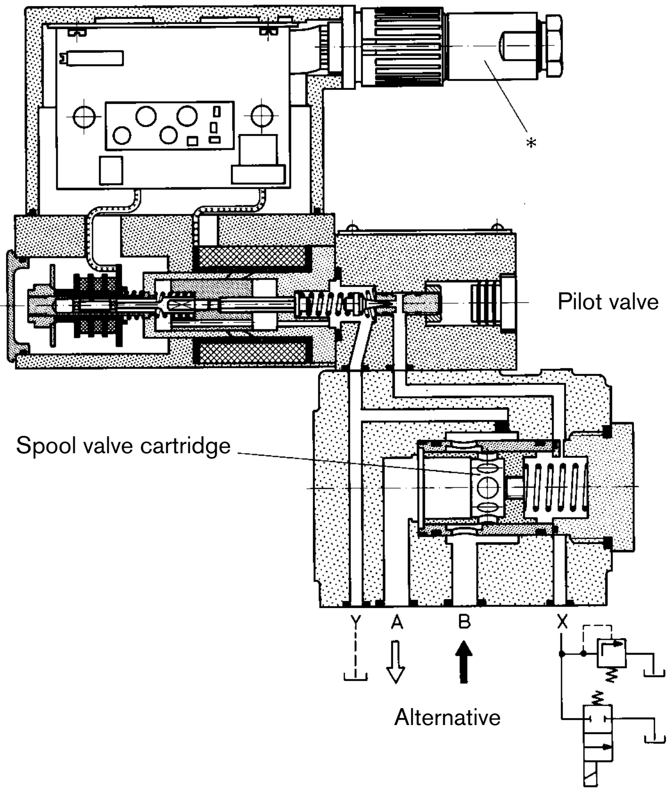
Basic principle

To adjust the system pressure, a setpoint is set in the trigger electronics. Based on this setpoint, the electronics control the position-controlled solenoid.
The proportional solenoid maintains its position against a spring force, which is proportionate to the system pressure.
The pilot stage is supplied with pilot oil at a flow rate of < 0.8 l/min through a bore. The "p_{max}" pressure stage is determined by the cone and seating bore configuration.

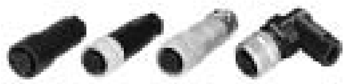
Pressure limitation for maximum safety

If a fault occurs in the electronics, so that the solenoid current (I_{max}) would exceed its specified level in an uncontrolled manner, the pressure cannot rise above the level determined by the maximum spring force.

CE EN 61000-6-2: 2002-08
EN 61000-6-3: 2002-08



Accessories

Type			Material Number
(4 x) ISO 4762-M10x80-10.9	Cheese-head bolts		2 910 151 309
* 	Plug-in connectors 6P+PE, see also RE 08008	KS	1 834 482 022
		KS	1 834 482 026
		MS	1 834 482 023
		MS	1 834 482 024
		KS 90°	1 834 484 252

Testing and service equipment

Test box type VT-PE-TB3, see RE 30065
Measuring adapter 6P+PE type VT-PA-2, see RE 30068

Technical data

General

Construction	Pilot stage		Poppet valve
	Main stage		Pressure reducing valve
	Valve cartridge		Spool valve, normally open
Actuation			Proportional solenoid with position control and OBE
Connection type			Subplate, mounting hole configuration NG10 (ISO 5781-AG-06-2-A)
Mounting position			Optional
Ambient temperature range		°C	–20...+50
Weight		kg	7.8
Vibration resistance, test condition			Max. 25 g, shaken in 3 dimensions (24 h)

Hydraulic (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

Pressure fluid			Hydraulic oil to DIN 51524...535, other fluids after prior consultation	
Viscosity range	recommended	mm^2/s	20...100	
	max. permitted	mm^2/s	10...800	
Pressure fluid temperature range		°C	–20...+70	
Maximum permitted degree of contamination of pressure fluid Purity class to ISO 4406 (c)			Class 18/16/13 [1)]	
Direction of flow			See symbol	
Max. set pressure (at $Q_{min} = 1$ l/min)		bar	180	315
Minimum pressure (at $Q_{min} = 1$ l/min)		bar	6	8
Max. mechanical pressure limitation level, e.g. when solenoid current $I > I_{max}$		bar	< 190	< 325
Max. working pressure		bar	Port A, B: 315	
			Port Y: ≤ 2 external pilot oil drain	
			Port X: 315 relief port	
Internal pilot oil flow		l/min	≤ 0.8	
Max. flow		l/min	120 for Q_{max}, see Characteristic Curves	

Static/Dynamic

Hysteresis	%	≦ 1
Manufacturing tolerance for p_{max}	%	≦ ±5, see Characteristic Curves
Response time 100 % signal change	ms	≈ 80 dependent on dead volume or system volume
Thermal drift		< 1% at $\Delta T = 40\,°C$
Conformity		CE EN 61000-6-2: 2002-08 EN 61000-6-3: 2002-08

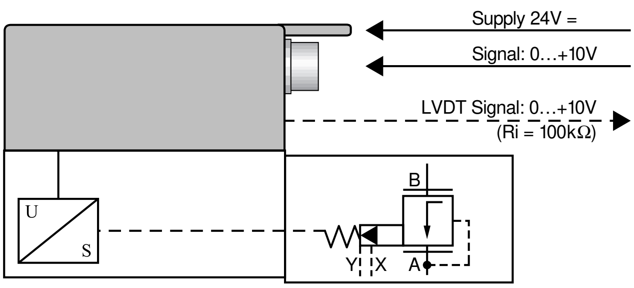
[1)] The purity classes stated for the components must be complied with in hydraulic systems.
Effective filtration prevents problems and also extends the service life of components.
For a selection of filters, see catalog sheets RE 50070, RE 50076 and RE 50081.

Technical data

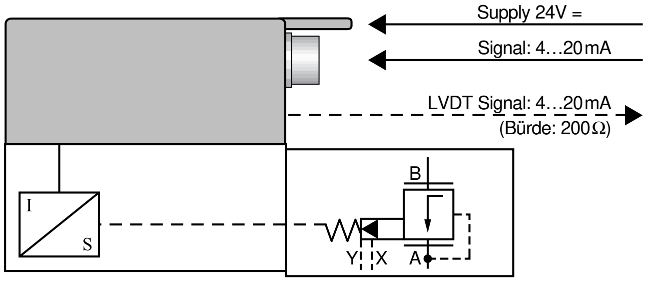
Electrical, trigger electronics integrated in valve		
Cyclic duration factor	%	100 %
Degree of protection		IP 65 to DIN 40050 and IEC 14434/5
Connection		Plug-in connector 6P+PE, DIN 43563
Supply voltage Terminal A: Terminal B: 0 V		24 V DC_{nom} Min. 21 V DC/max. 40 V DC Ripple max. 2 V DC
Power consumption		Solenoid ⌀ 45 mm = 40 VA max.
External fuse		2.5 A_F
Input, "standard" version Terminal D: U_E Terminal E:	A1	Differential amplifier, R_i = 100 kΩ 0...+10 V 0 V
Input, "mA signal" version Terminal D: I_{D-E} Terminal E: I_{D-E}	F1*	Burden, R_{sh} = 200 Ω 4...20 mA Current loop I_{D-E} feedback
Max. voltage to differential inputs over 0 V		$\left.\begin{array}{l} D \rightarrow B \\ E \rightarrow B \end{array}\right\}$ max. 18 V=
Test signal, "standard" version Terminal F: U_{Test} Terminal C:	A1	LVDT 0...+10 V Reference 0 V
Test signal, "mA signal" version Terminal F: I_{F-C} Terminal C: I_{F-C}	F1*	LVDT signal 4...20 mA at external load 200...500 Ω max. 4...20 mA output Current loop I_{F-C} feedback
Safety earth conductor and shield		See pin assignment (installation in conformity with CE)
Recommended cable		See pin assignment up to 20 m 7 x 0.75 mm² up to 40 m 7 x 1 mm²
Calibration		Calibrated at the factory, see valve curve

* Variant "F1" (4...20 mA version) available on request

Version A1: Standard

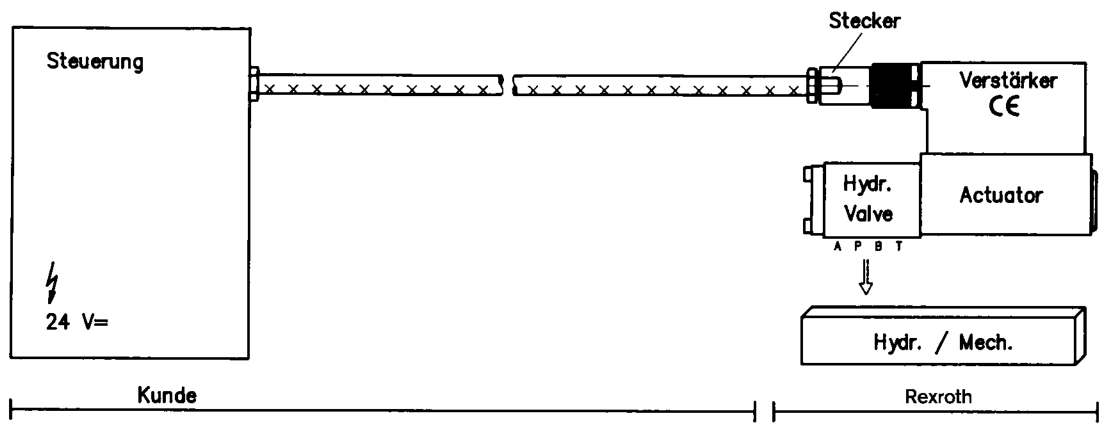


* Version F1: mA signal



Connection

For electrical data, see page 5 and
Operating Instructions **1 819 929 083**



Technical notes for the cable

Version:
- Multi-wire cable
- Extra-finely stranded wire to VDE 0295, Class 6
- Safety earth conductor, green/yellow
- Cu braided shield

Type:
- e.g. Ölflex-FD 855 CP (from Lappkabel company)

No. of wires:
- Determined by type of valve, plug type and signal assignment

Cable Ø:
- 0.75 mm^2 up to 20 m long
- 1.0 mm^2 up to 40 m long

Outside Ø:
- 9.4...11.8 mm – Pg 11
- 12.7...13.5 mm – Pg 16

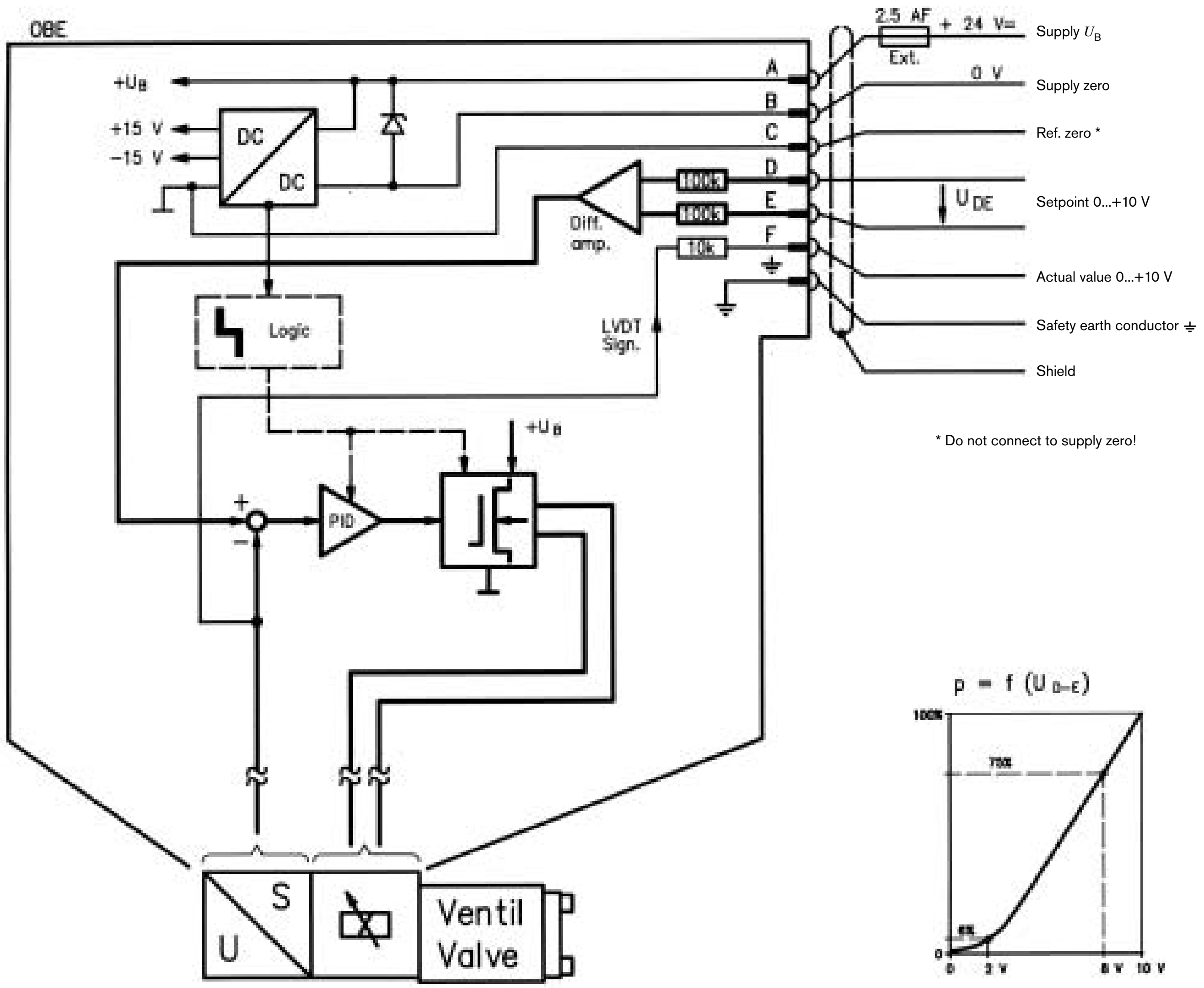
Important

Power supply 24 V DC nom.,
if voltage drops below 18 V DC, rapid shutdown resembling "Enable OFF" takes place internally.
In addition, with the "mA signal" version:
$I_{D-E} \geqq 3$ mA – valve is active
$I_{D-E} \leqq 2$ mA – valve is deactivated.
Electrical signals emitted via the trigger electronics (e.g. actual values) must not be used to shut down safety-relevant machine functions!
(See also European Standard, "Technical Safety Requirements for Fluid-Powered Systems and Components – Hydraulics", EN 982).

On-board trigger electronics

Circuit diagram/pin assignment

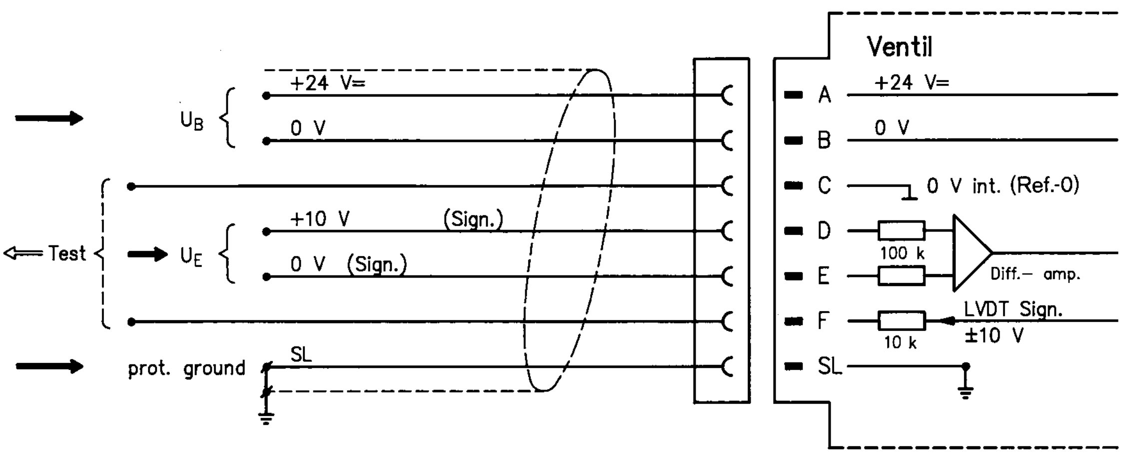
Version A1: U_{D-E} 0...+10 V



* Do not connect to supply zero!

Pin assignment

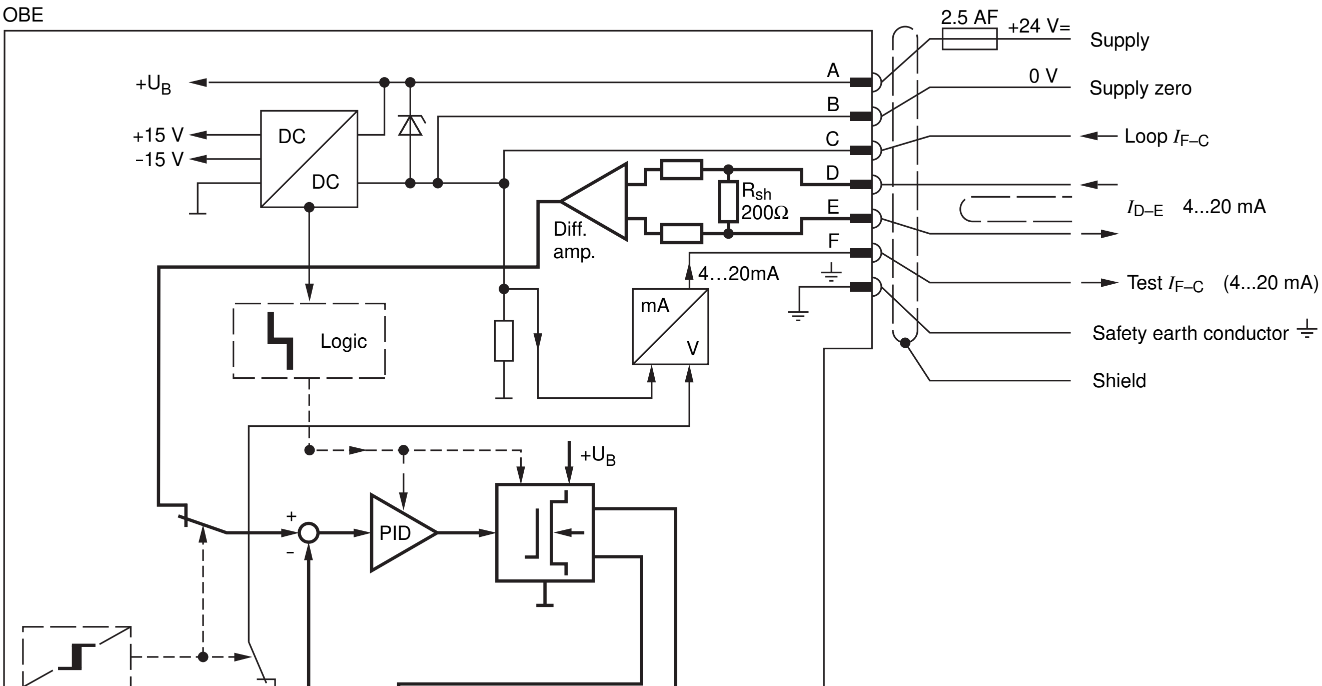
Version A1: U_{D-E} 0...+10 V
(R_i = 100 kΩ)

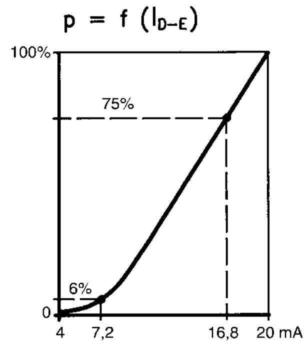


On-board trigger electronics

Circuit diagram/pin assignment

Version F1: I_{D-E} 4...20 mA

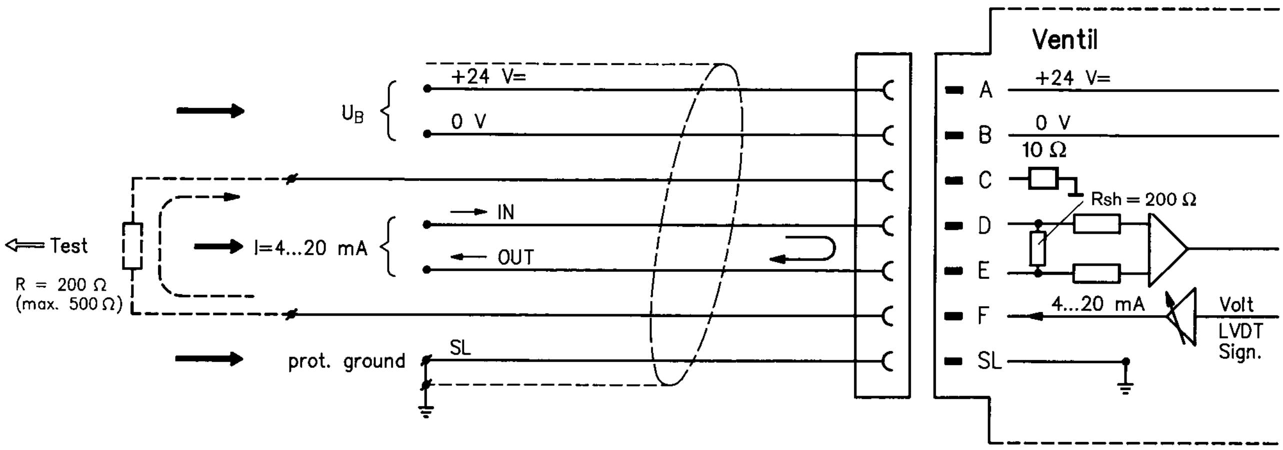




Pin assignment 6P+PE

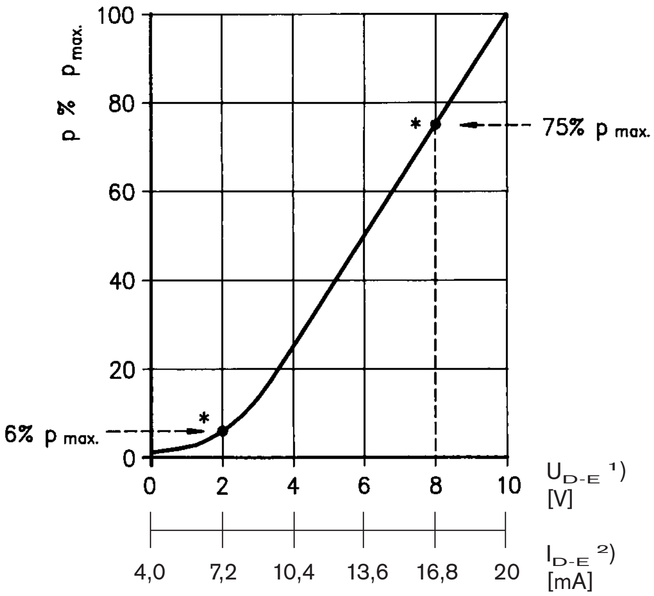
Version F1: I_{D-E} 4...20 mA

(R_{sh} = 200 kΩ)



Characteristic curves (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

Pressure in port A as a function of the setpoint



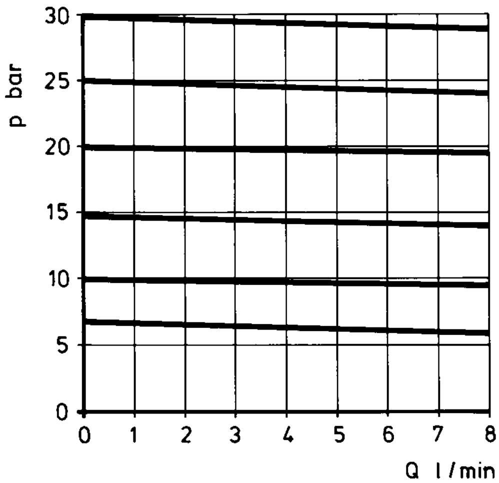
* Factory setting at $Q = 1$ l/min ±5 % manufacturing tolerance

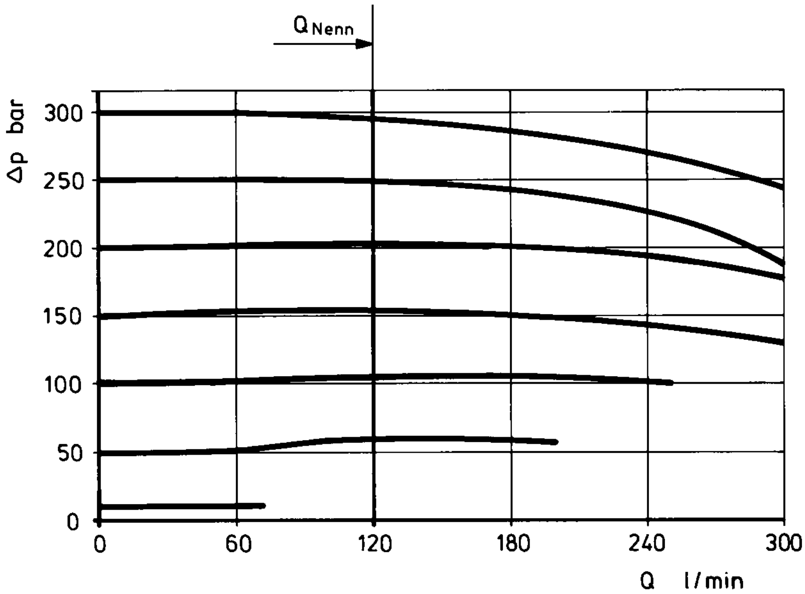
1) Version: $U_{D-E} = 0...+10$ V

2) Version: $I_{D-E} = 4...20$ mA

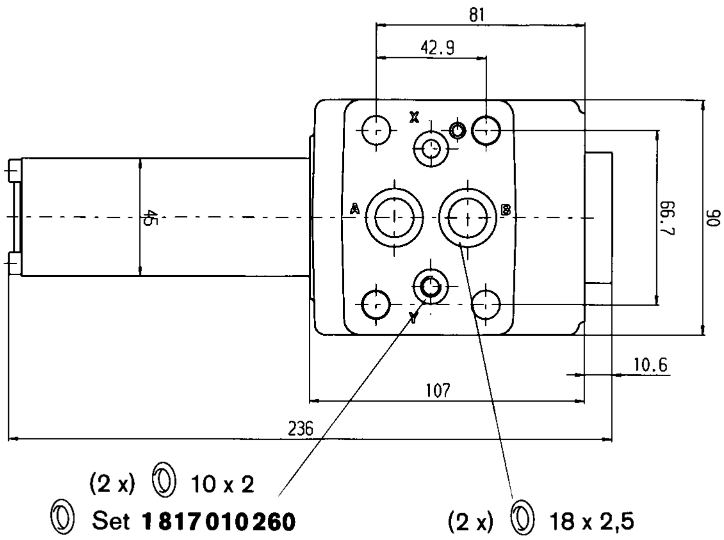
Pressure in port A as a function of the main stage nominal flow rate

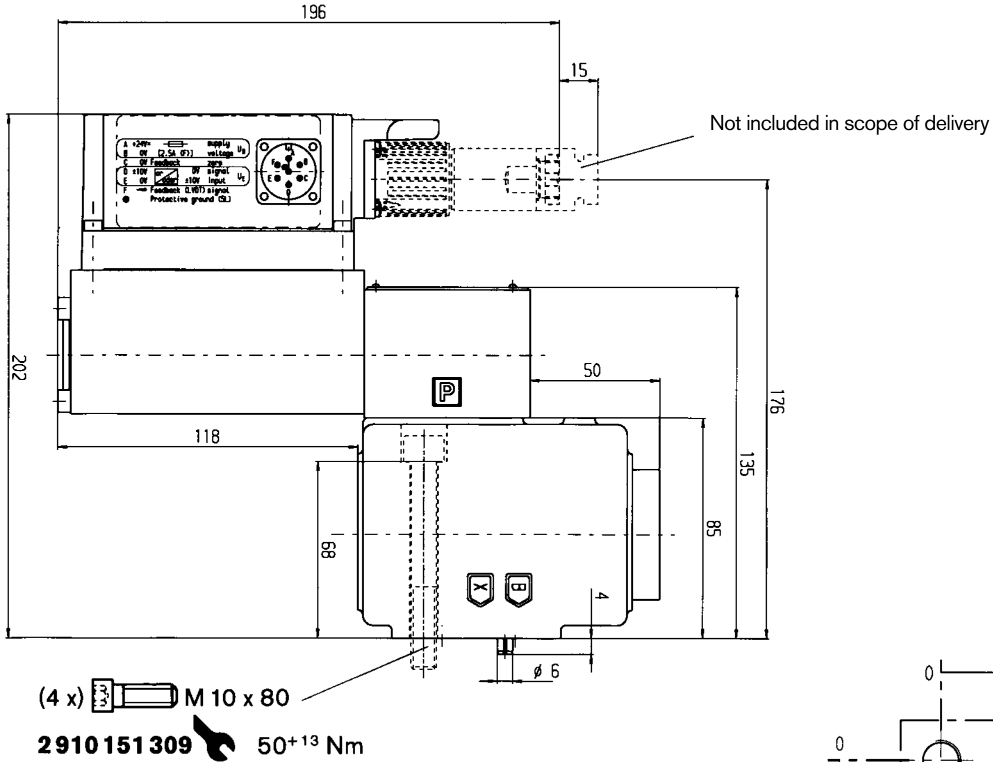
$p = f(Q)$

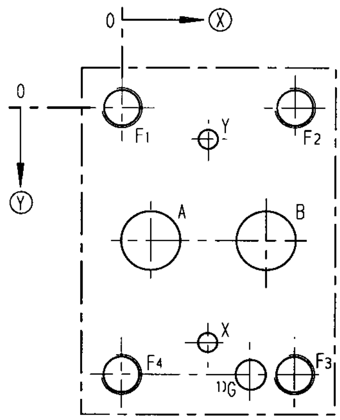




Unit dimensions (nominal dimensions in mm)

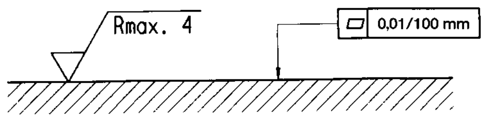






Mounting hole configuration: NG10 (ISO 5781-AG-06-2-A)
For subplates see catalog sheet RE 45055

Required surface quality
of mating component



1) Deviates from standard
2) Thread depth:
Ferrous metal 1.5 x Ø*
Non-ferrous 2 x Ø
* NG10 min. 10.5 mm

	A	B	X	Y	G	F_1	F_2	F_3	F_4
X	7,2	35,8	21,4	21,4	31,8	0	42,9	42,9	0
Y	33,35	33,35	58,7	7,9	66,7	0	0	66,7	66,7
∅	14,7	14,7	4,8	4,8	7,5	M10 2)	M10 2)	M10 2)	M10 2)

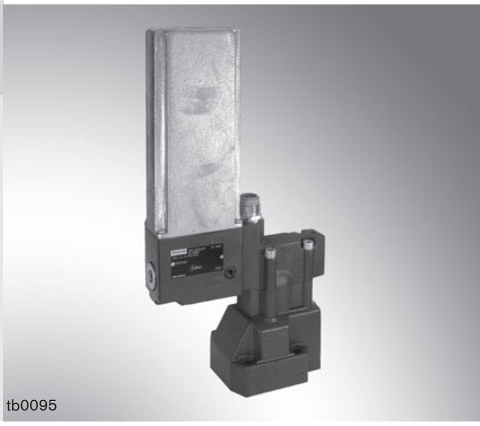
Rexroth
Bosch Group

Pressure reducing valve with DC motor operation, pilot operated

RE 29145/06.07
Replaces: 01.00

Type DRG

Size 8 to 32
Component series 1X
Maximum operating pressure 315 bar
Maximum flow 300 l/min



tb0095

Table of contents

Features

- Actuation by a DC motor with reducing gear
- For subplate mounting:
  Porting pattern to DIN 24340 Form D and ISO 5781
- For threaded connection
- For block installation
- 4 pressure ratings
- With actual value potentiometer or limit switch
- Check valve, optional
- Self-locking in the event of a power failure
  (with variant with position switch, system pressure remains constant)

Further information:

Subplates to RE 45062

Ordering code

DRG			–1X /		Y				*

Pressure reducing valve with DC motor operation

Pilot operated valve **= No code**
Pilot valve **without** main spool insert (do **not** enter size) **= C**
Pilot valve **with** main spool insert (enter size **10** or **32**) **= C**

Size	Ordering code	
	Subplate mounting “No code“	Threaded connection “G“
8	–	**= 8** (G3/8)
10	**= 10**	**= 10** (G1/2)
16	–	**= 15** (G3/4)
20	–	**= 20** (G1)
25	**= 20**	**= 25** (G1 1/4)
32	**= 30**	**= 30** (G1 1/2)

For subplate mounting and block installation **= No code**
For threaded connection **= G**

1X = Component series 10 to 19
(10 to 19: unchanged installation and connection dimensions)

Pressure rating, max.
50 = Set pressure up to 50 bar
100 = Set pressure up to 100 bar
200 = Set pressure up to 200 bar
315 = Set pressure up to 315 bar

Pilot oil flow
Y = Pilot oil supply/drain see Symbols below

No code = **With** check valve
M = **Without** check valve

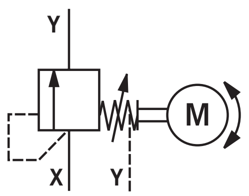
Seal material
No code = NBR seals
V = FKM seals
(other seals on request)
⚠ **Attention!**
Observe compatibility of seals with hydraulic fluid used!

E1 = Limit switch
P2 = Actual value potentiometer

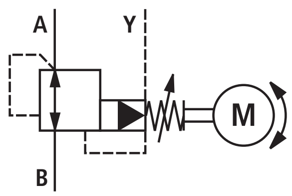
Further details in clear text

Symbols

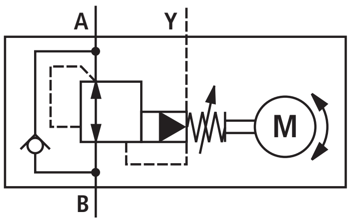
DRGC–1X/..Y



DRG..–1X/..Y..M
DRG..G–1X/..Y..
DRGC 10–1X/..Y.. and
DRGC 30–1X/..Y..



DRG..–1X/..Y



Function, section

Pressure control valves of type DRG are pilot operated pressure reducing valves.

They are used to reduce a system pressure.

Pressure reducing valves of this series basically consist of a pilot valve with electric motor with electric motor as pressure adjustment element, a main valve with main spool insert and an optional check valve.

The reduced pressure in A is adjusted by means of DC motor (16) with reducing gear (17). The output shaft of reducing gear (17) rotates cam (15), which changes the tension of spring (5) via spring plate (9) and thus causes a change in pressure.

The reduced pressure is present in port A, the inlet pressure in port B. The main fluid flow flows from B to A.

Actual value potentiometer (18) feeds back the position of cam (15).

Optionally, electrical limit switches can be installed instead of actual value potentiometer (18) for limiting the min. and max. pressure.

For the variant with limit switch, the min. adjustment time for the pressure range from p_{min} to p_{max} is 18 seconds.

The adjustment time of 18 seconds allows gradual reaching of the required pressure in the inching mode.

For the variant with actual value potentiometer the min. adjustment time for the pressure range from p_{min} to p_{max} is 1.3 seconds.

In conjunction with the associated amplifier type VT-VRM1-1 a program control can be realised.

With the help of 2 additional pressure switches, the min. and max. pressures can be limited.

With the variant with limit switch, the pressure setting on the valve is maintained in the event of a power failure (cable break, fuse failure, short-circuit, etc.).

Type DRG Sizes 8 and 10

The reduced pressure in A is applied simultaneously to the spring-loaded side of main spool (1) via orifice (2.1), pilot line (4), orifice (2.2) and orifice (3).

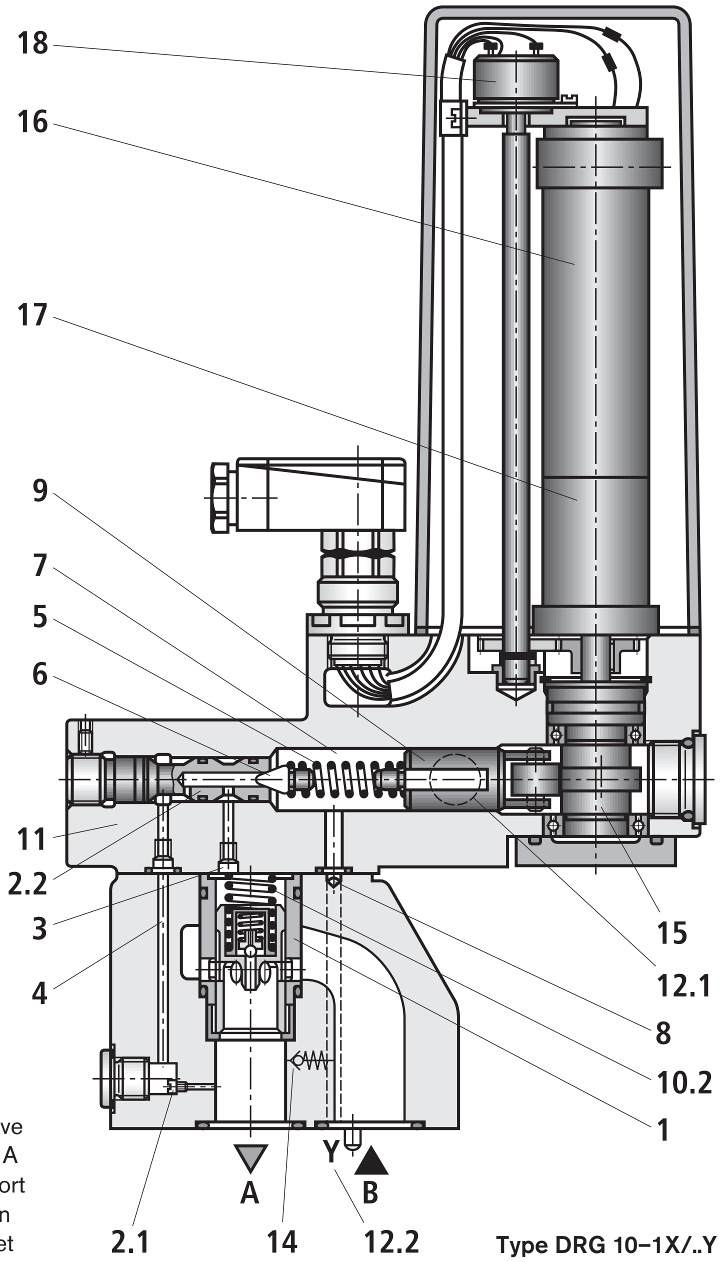
The pressure on the spring-loaded side of main spool (1) is by the pressure differential of compression spring (10.2) lower than the pressure in A. In the opening direction, compression spring (10.2) acts on main spool (1). According to the

opening cross-section of orifices (2.1; 2.2) and the pressure differential of compression spring (10.2), pilot oil flows through orifice (2.1), pilot line (4), orifice (2.2), poppet (6) into spring chamber (7) and further to the tank via Y (12.2) on the variant with subplate mounting or via (12.1) with the variant with threaded connection.

When the pressure in A rises above the value set on pilot valve (11), main spool (1) reduces the flow cross-section from B to A until the pressure set on pilot valve (11) is reached again in port A. Conversely, main spool (1) increases the flow cross-section from B to A, when the pressure in A is lower than the value set on pilot valve (11).

With a static oil column between A and the actuator, only the pilot oil flows via the main spool from B to A.
If, in this position, a lower pressure is set on pilot valve (11), main spool (1) interrupts the pilot oil supply from B to A until the oil volume isolated between A and the actuator has expanded to the lower pressure on pilot valve (11) via orifice (2.1), pilot line (4), orifice (2.2), poppet (6) and port Y.

A check valve (14) can optionally be installed to allow a free return flow from A to B.



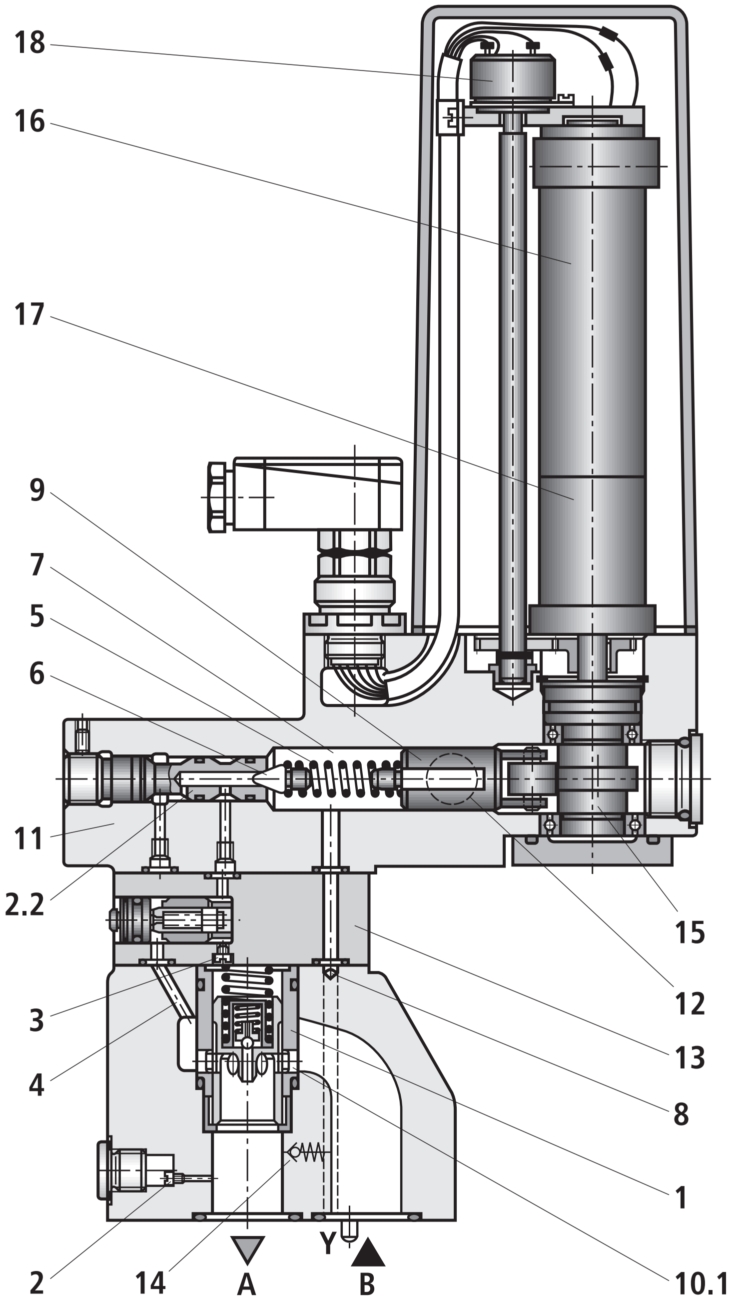
Type DRG 10–1X/..Y

Function, section

Type DRG sizes 16 to 32

Unlike with DRG 8 and DRG 10, with these valves, the pilot oil is taken from inlet pressure channel B. The flow regulator (13) holds the pilot oil flow constant.

If, with a static oil column between A and the actuator, a lower pressure is set on pilot valve (11), the oil column is unloaded via check valve (10.1), pilot line (4), poppet (6) and port Y.



Type DRG 20–1X/..Y

Technical data (for applications outside these parameters, please consult us!)

General

Size			Size	8	10	16	20	25	32
Weight	– Subplate mounting	DRG...	kg	–	7.8	–	–	10.0	12.8
	– Threaded connection	DRG..G	kg	8.4	8.4	9.5	9.5	10.4	10.4
	– Block installation	DRGC 10..	kg	5.5	–	–	–	–	6.1
		DRGC 30..	kg	5.5	–	–	–	–	6.1
	– Pilot valve without main spool insert	DRGC	kg	5.2	–	–	–	–	5.8
Installation position				Optional					
Ambient temperature range			°C	–20 to +50					

Hydraulic

Inlet pressure	– Port B	bar	up to 315						
Pressure rating		bar	50	100	200	315	400		
Outlet pressure, can be regulated	– Port A	bar	up to 50	up to 100	up to 200	up to 315	up to 400		
Minimum set pressure		bar	Depending on q_V (see Characteristic curves on page 8)						
Backpressure	– Port Y	bar	up to 10						
Size		Size	8	10	16	20	25	32	
Maximum flow	– Subplate mounting	l/min	–	80	–	–	200	300	
	– Threaded connection	l/min	80	80	200	200	200	300	
Pilot oil flow		l/min	0.5		1.3				
Hydraulic fluid			Mineral oil (HL, HLP) to DIN 51524 [1]; fast bio-degradable hydraulic fluids to VDMT 24568 (see also RE 90221); HETG (rape seed oil) [1]; HEPG (polyglycols) [2]; HEES (synthetic esters) [2]; other hydraulic fluids on request						
Hydraulic fluid temperature range		°C	–20 to +70						
Viscosity range		mm^2/s	2.8 to 380						
Permissible max. degree of contamination of the hydraulic fluid - cleanliness class to ISO 4406 (c)			Class 20/18/15 [3]						

Electrical, drive motor

Type of voltage			DC voltage
Supply voltage		V–	24
Rated power	– With limit switch	W	18
	– With actual value potentiometer	W	24
Electrical connection			Mating connector DIN 43651, 6-pin + PE
Type of protection to EN 60529			IP 65 with mating connector mounted and locked

[1] Suitable for NBR **and** FKM seals

[2] Suitable **only** for FKM seals

[3] The cleanliness classes specified for components must be adhered to in hydraulic systems.

Effective filtration prevents malfunction and, at the same time, prolongs the service life of components.
For the selection of filters, see data sheets RE 50070, RE 50076, RE 50081, RE 50086 and RE 50088.

Technical data (for applications outside these parameters, please consult us!)

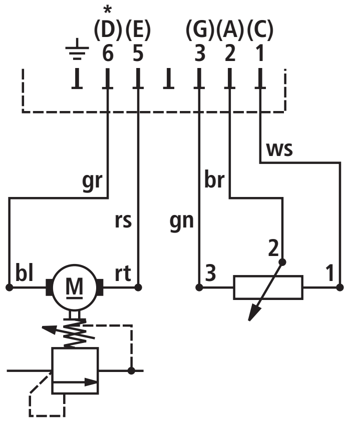
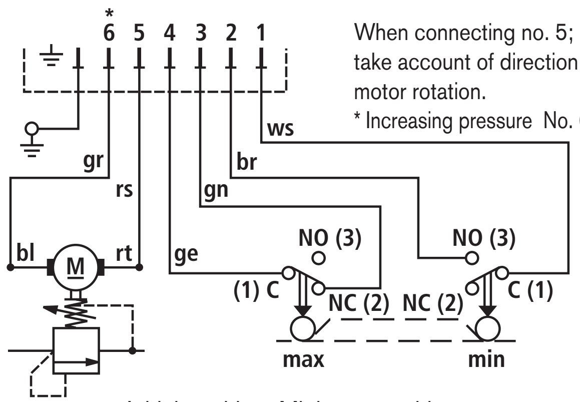
Adjustment with limit switch in inching mode: Ordering code “E1“

Adjustment time, p_{min} to p_{max}		s	18				
Position switch variant:	– Micro-switch		20 V; 2 A DC				
	– Electric load		250 V; 5 A AC				
Pressure lag:	– Pressure rating	bar	50	100	200	315	400
	– Without short-circuit bridge	bar	1	2.5	5	7.5	10
	– With short-circuit bridge	bar	0.5	1	1.5	2	2.5

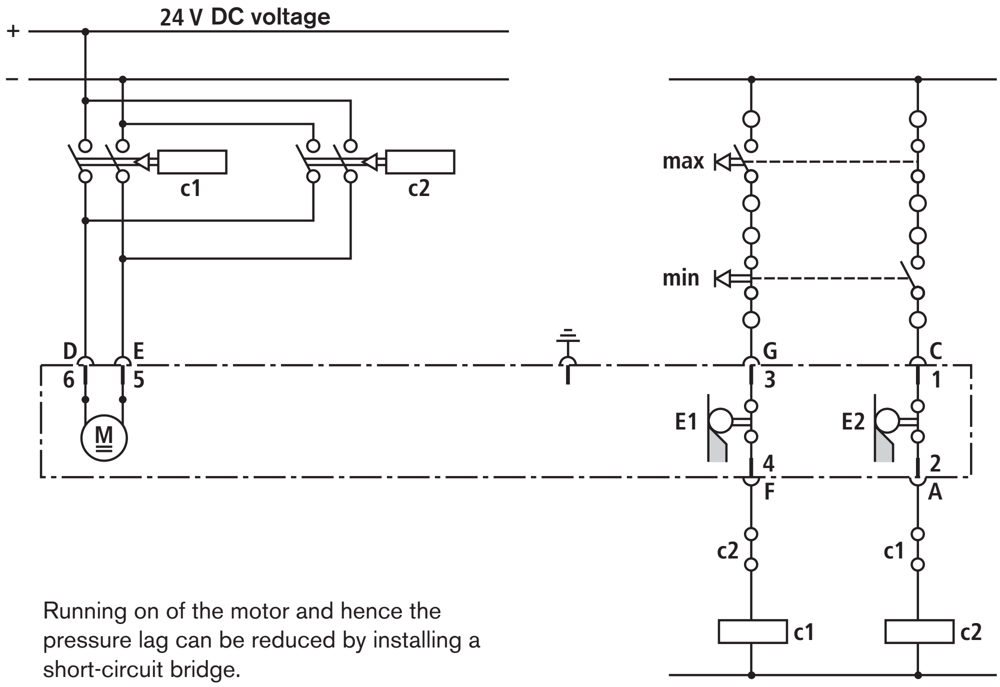
Adjustment with actual value potentiometer for cam position feedback function: Ordering code “P2“

Adjustment time, p_{min} to p_{max}		s	1.3				
Potentiometer	– Resistance	kΩ	5				
	– Power	W	1.75				
Adjustment hysteresis: Start-up pressure – deviation > 10 bar from nominal pressure							
	– Pressure rating	bar	50	100	200	315	400
	– Hysteresis	bar	< 0.5	< 1	< 2.5	< 4	< 5
Adjustment hysteresis: Start-up pressure – deviation > 20 bar from nominal pressure							
	– Pressure rating	bar	50	100	200	315	400
	– Hysteresis	bar	< 0.3	< 0.5	< 1	< 1.5	< 2
Repeatability		bar	< 0.5	< 1	< 1.3	< 1.7	< 2
Amplifier							
Electrical amplifier			VT-VRM1-1, component series 1X – see RE 30405-D				

Electrical connection

Plug connection on DRG valve with actual value potentiometer	Plug connection on DRG valve with limit switch
 When connecting no. 5; 6 take account of direction of motor rotation. * Increasing pressure No. 6 “+“	 When connecting no. 5; 6 take account of direction of motor rotation. * Increasing pressure No. 6 “+“ Initial position: Minimum position

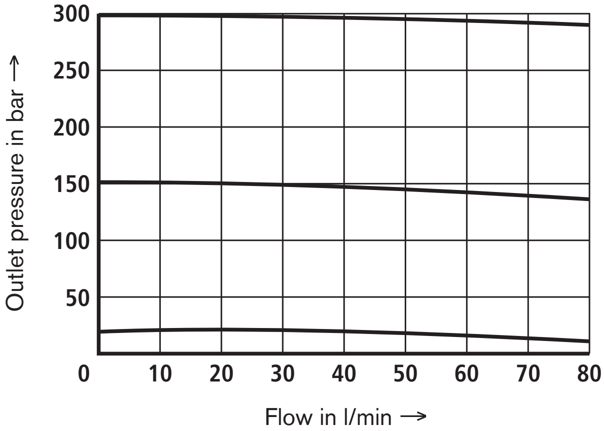
Circuit example: DRG valve with limit switch



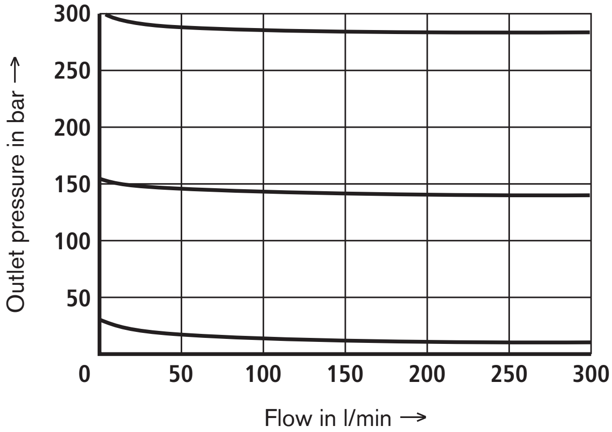
Running on of the motor and hence the pressure lag can be reduced by installing a short-circuit bridge.

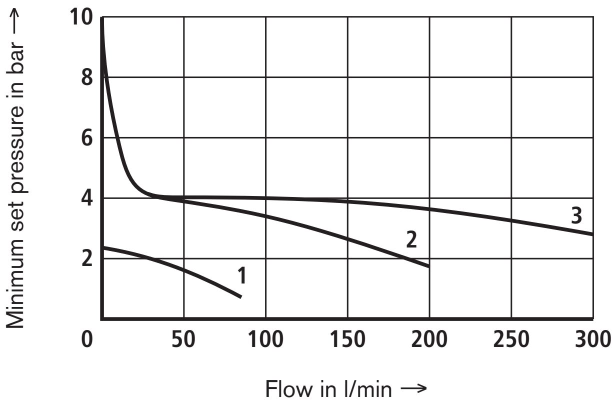
Characteristic curves (measured at $\nu = 41\ mm^2/s$ and $\vartheta_{oil} = 50\ °C$)

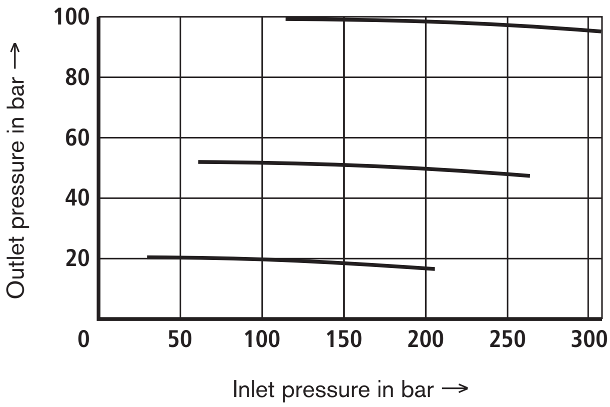
Sizes 8 and 10



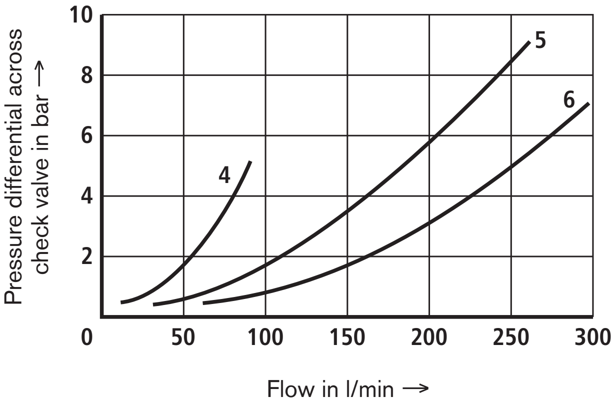
Sizes 16 to 32





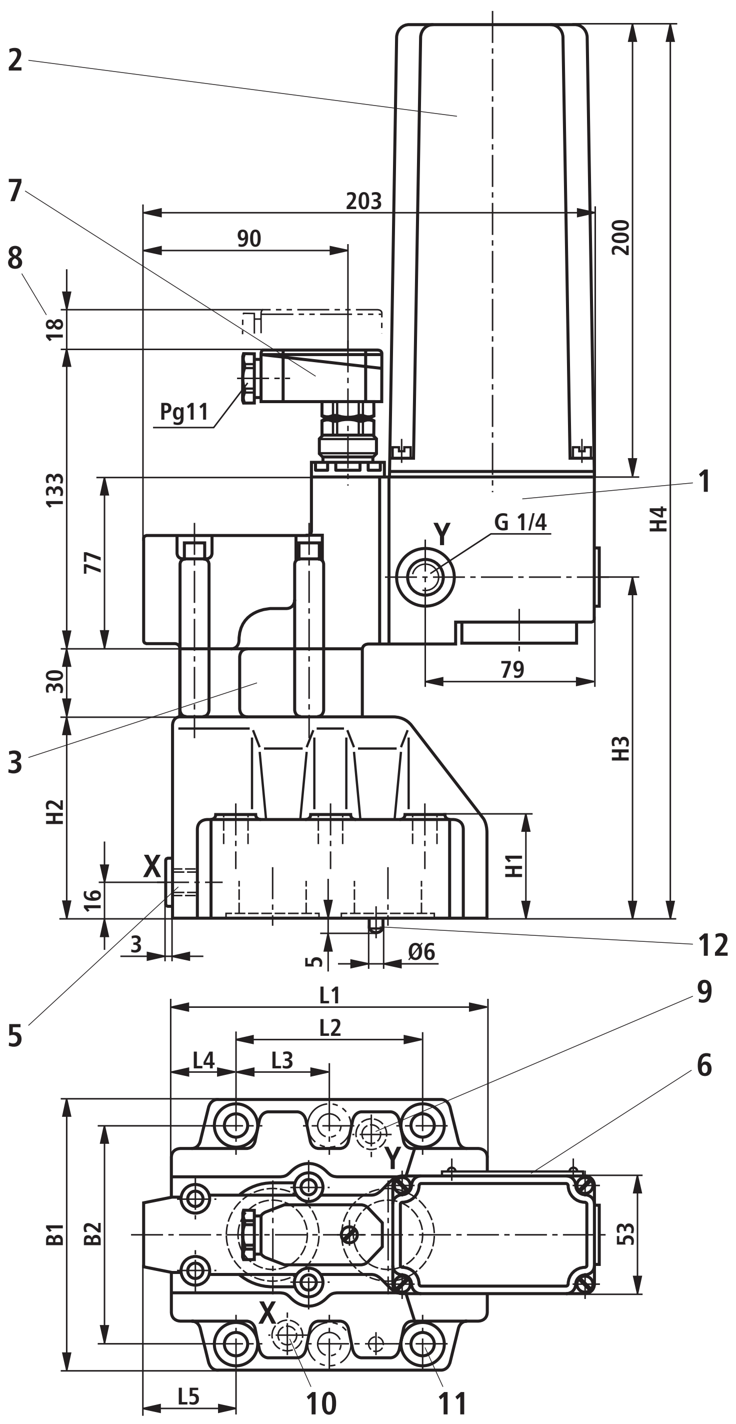


1 = DRG 8 and 10
2 = DRG 16 to 25
3 = DRG 30



4 = DRG 10
5 = DRG 20
6 = DRG 30

Unit dimensions: Subplate mounting (dimensions in mm)



1 Pilot valve

2 DC motor

3 Constant flow regulator (only with sizes 25 and 32)

5 Port “X“ for remote control on size 10
Port M for pressure gauge on sizes 25 and 32

6 Nameplate

7 Mating connector (included in scope of supply)

8 Space required to remove mating connector

9 Port “Y“

10 Port “X“ without function (blind hole)

11 4 valve mounting bores for sizes 10 and 25
6 valve mounting bores for size 32

12 Locating pin

Subplates to data sheet RE 45062 (separate order)

– Size 10 G 460/01 (G3/8)
G 461/01 (G1/2)

– Size 25 G 412/01 (G3/4)
G 413/01 (G1)

– Size 32 G 414/01 (G1 1/4)
G 415/01 (G1 1/2)

Valve fixing screws (separate order)

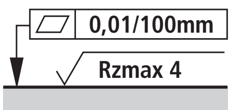
For strength reasons, only the following valve fixing screws may be used:

– Size 10
4 hexagon socket head cap screws ISO4762 - M10x50 - 10.9-flZn-240h-L to VDA 235-101
Friction coefficient μ_{total} = 0.09 to 0.14,
tightening torque M_T = 59 Nm ± 10%,
Material no. **R913000471**

– Size 25
4 hexagon socket head cap screws ISO4762 - M10x60 - 10.9-flZn-240h-L to VDA 235-101
Friction coefficient μ_{total} = 0.09 to 0.14,
tightening torque M_T = 59 Nm ± 10%,
Material no. **R913000116**

– Size 32
6 hexagon socket head cap screws ISO4762 - M10x70 - 10.9-flZn-240h-L to VDA 235-101
Friction coefficient μ_{total} = 0.09 to 0.14,
tightening torque M_T = 59 Nm ± 10%,
Material no. **R913000126**

The tightening torques given are guidelines when screws of the specificied friction coefficients and a torque wrench (tolerance ±10 %) are used.

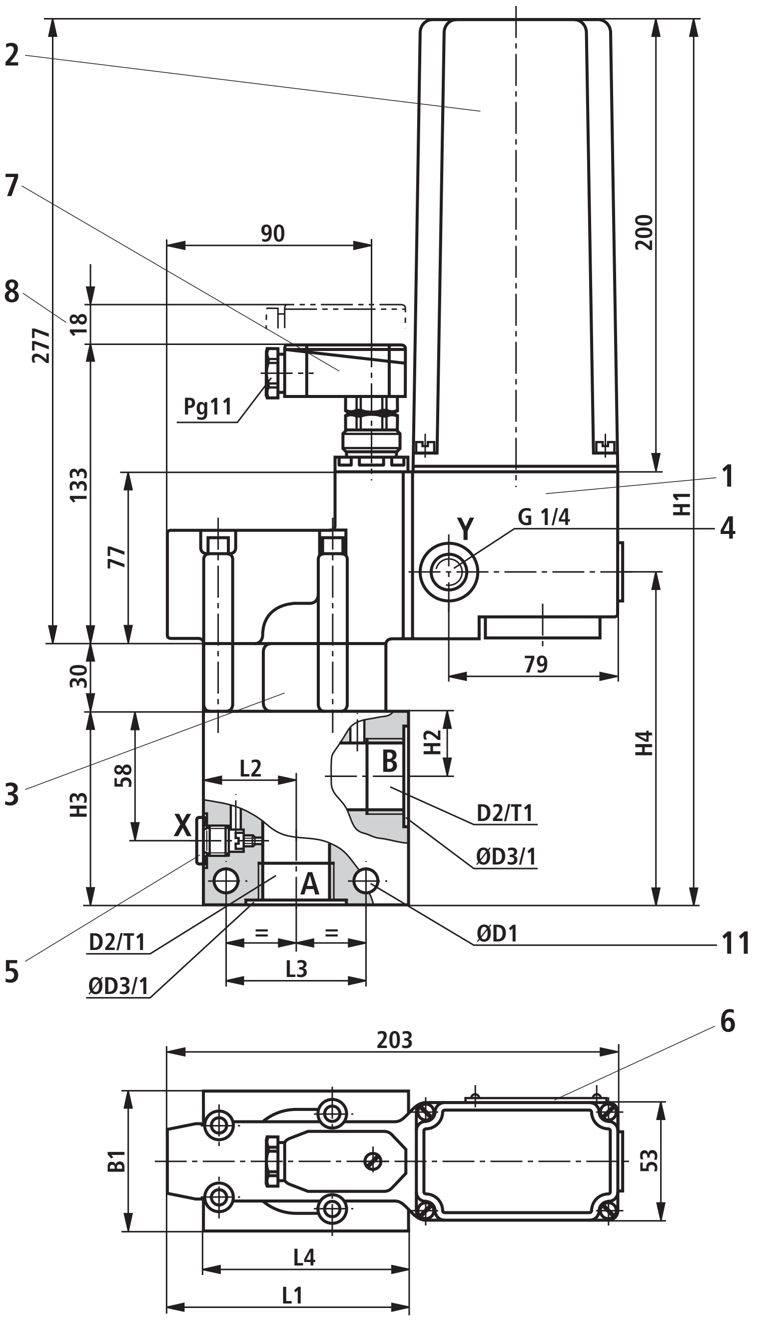


Required surface quality of valve mounting face

Tolerances according to:
– General tolerances ISO 2768-mK

Size	B1	B2	H1	H2	H3	H4	L1	L2	L3	L4	L5	O-ring Port Y	O-ring Port A, B
10	85	66.7	28	72	102	349	90	42.9	–	35.5	44.5	9.25 x 1.78	17.12 x 2.62
25	102	79.4	38	82	142	389	112	60.3	–	33.5	46.5	9.25 x 1.78	28.17 x 3.53
32	120	96.8	46	90	150	397	140	84.2	42.1	28	41.5	9.25 x 1.78	34.52 x 3.53

Unit dimensions: Threaded connection (dimensions in mm)



1 Pilot valve
2 DC motor
3 Constant flow regulator (only on sizes 16 to 32)
4 Port “Y“ for external pilot oil drain
5 Port “X“ for remote control on sizes 8 and 10
Port M for pressure gauge on sizes 16 to 32
6 Nameplate
7 Mating connector (included in scope of supply)
8 Space required to remove mating connector
11 Valve mounting bore

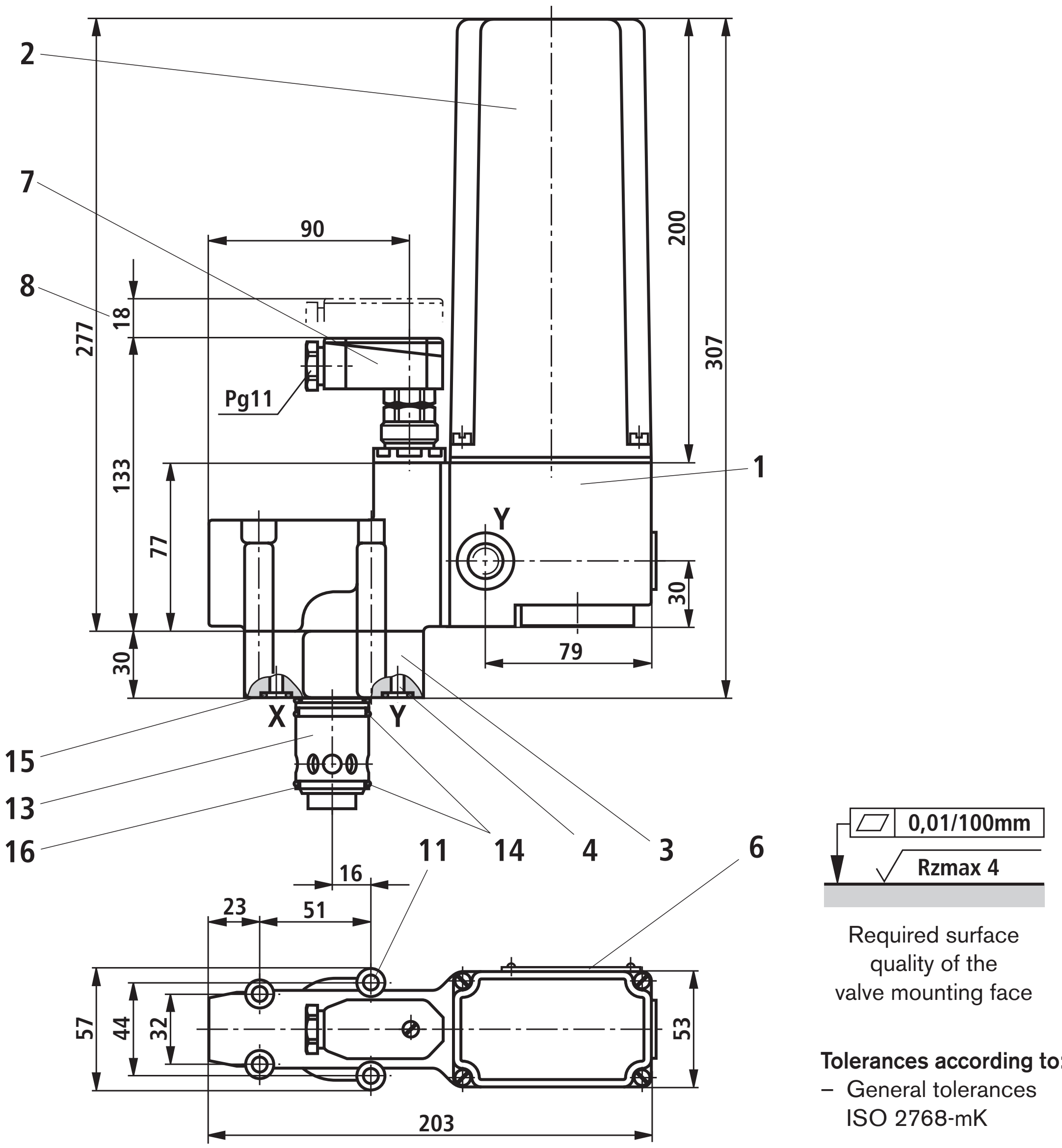
Note!

On this valve variant, no check valve is integrated in the valve to allow a free return flow from A to B.

Tolerances according to:
– General tolerances ISO 2768-mK

<table>
<tr><th>Size</th><th>B1</th><th>ØD1</th><th>D2</th><th>ØD3</th><th>H1</th><th>H2</th><th>H3</th><th>H4</th><th>L1</th><th>L2</th><th>L3</th><th>L4</th><th>T1</th></tr>
<tr><td>8</td><td rowspan="4">63</td><td rowspan="4">9</td><td>G3/8</td><td>28</td><td rowspan="2">362</td><td rowspan="3">23</td><td rowspan="4">75</td><td rowspan="2">115</td><td rowspan="4">108</td><td rowspan="4">40</td><td rowspan="4">62</td><td rowspan="4">90</td><td>12</td></tr>
<tr><td>10</td><td>G1/2</td><td>34</td><td>14</td></tr>
<tr><td>16</td><td>G3/4</td><td>42</td><td rowspan="2">392</td><td rowspan="2">145</td><td>16</td></tr>
<tr><td>20</td><td>G1</td><td>47</td><td>28</td><td>18</td></tr>
<tr><td>25</td><td rowspan="2">70</td><td rowspan="2">11</td><td>G1 1/4</td><td>56</td><td rowspan="2">405</td><td rowspan="2">34</td><td rowspan="2">85</td><td rowspan="2">158</td><td rowspan="2">111</td><td rowspan="2">46</td><td rowspan="2">72</td><td rowspan="2">99</td><td>20</td></tr>
<tr><td>32</td><td>G1 1/2</td><td>61</td><td>22</td></tr>
</table>

Unit dimensions: Block installation (dimensions in mm)



Required surface quality of the valve mounting face

Tolerances according to:
- General tolerances ISO 2768-mK

1 Pilot valve
2 DC motor
3 Constant flow regulator (only on size 32)
4 Port "Y" for pilot oil drain
6 Nameplate
7 Mating connector (included in scope of supply)
8 Space required to remove mating connector
11 Valve mounting bores
13 Main spool insert
14 O-ring 27.3 x 2.4
15 O-ring 9.25 x 1.78
16 Back-up ring 32/28.4 x 0.8

Valve fixing screws (separate order)

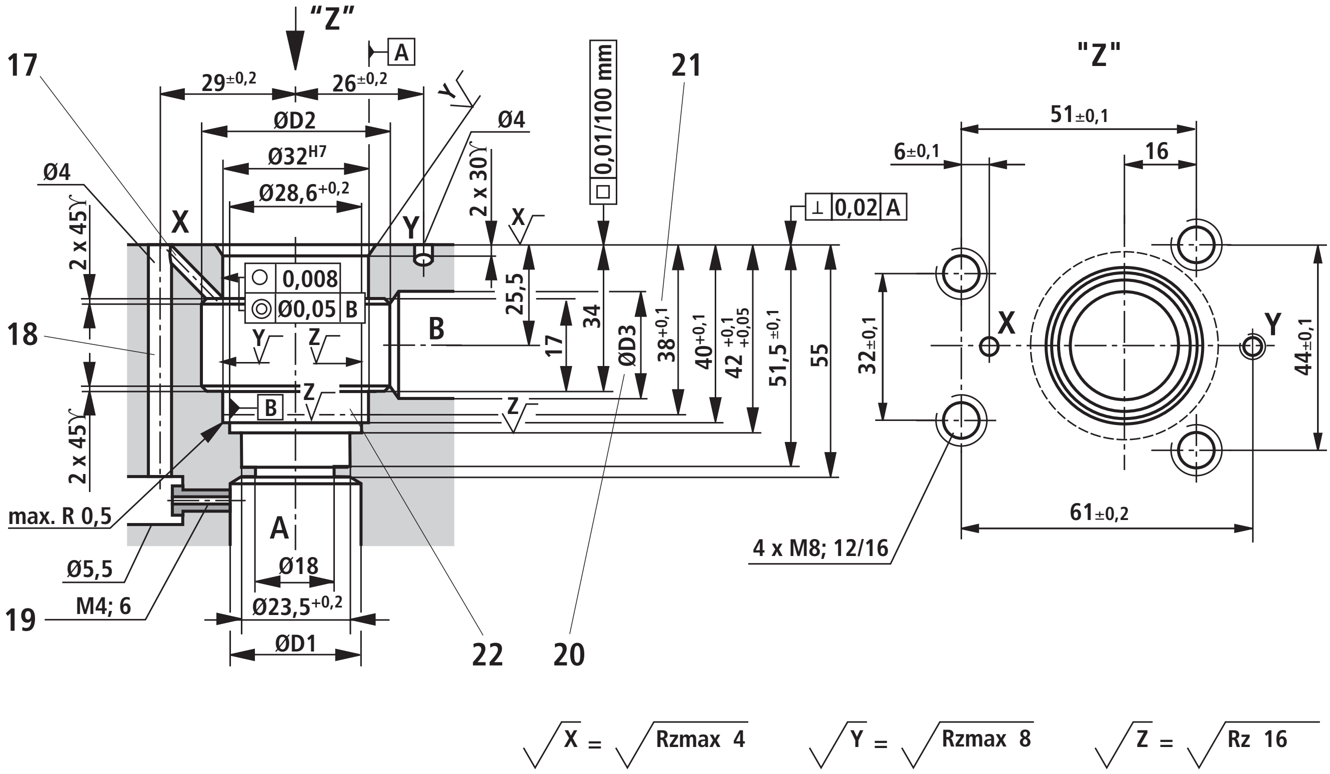
For strength reasons, only the following valve fixing screws may be used:

– Size10
  4 hexagon socket head cap screws ISO4762 - M8x50 - 10.9-flZn-240h-L to VDA 235-101
  Friction coefficient μ_{total} = 0.09 to 0.14,
  tightening torque M_T = 31 Nm ± 10%,
  Material no. **R913000543**

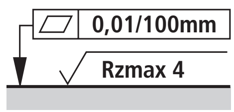
– Size 32
  4 hexagon socket head cap screws ISO4762 - M8x80 - 10.9-flZn-240h-L to VDA 235-101
  Friction coefficient μ_{total} = 0.09 to 0.14,
  tightening torque M_T = 31 Nm ± 10%,
  Material no. **R913000276**

The tightening torques given are guidelines when screws of the specificied friction coefficients and a torque wrench (tolerance ±10 %) are used.

Mounting cavity for block installation (dimensions in mm)



Size	ØD1	ØD2	Ø D3
10	10	40	10
32	32	45	32



Required surface quality of valve mounting face

17 Pilot oil tapping on size 32

18 Pilot oil tapping on size10

19 Pilot oil tapping nozzle on size 10

20 Bore ØD3 can intersect ØD2 at any point. However, care must be taken that connection bore X and the fixing screws are not damaged.

21 Depth of fit

22 The back-up ring and the O-ring must be inserted in this bore before the main spool is installed

Tolerances according to:

– General tolerances ISO 2768-mK

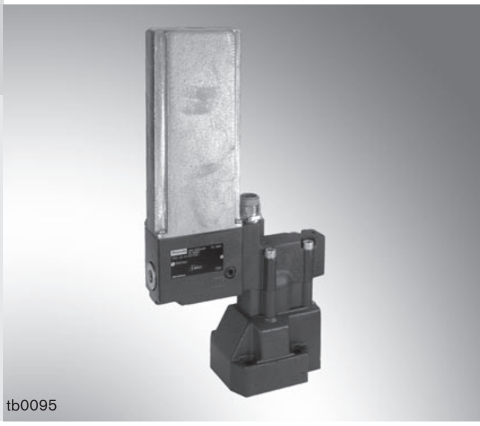
Rexroth
Bosch Group

Pressure reducing valve with DC motor operation, pilot operated

RE 29145/06.07
Replaces: 01 .00

Type DRG

Size 8 to 32
Component series 1X
Maximum operating pressure 315 bar
Maximum flow 300 l/min



tb0095

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Features

- Actuation by a DC motor with reducing gear
- For subplate mounting:
  Porting pattern to DIN 24340 Form D and ISO 5781
- For threaded connection
- For block installation
- 4 pressure ratings
- With actual value potentiometer or limit switch
- Check valve, optional
- Self-locking in the event of a power failure
  (with variant with position switch, system pressure remains constant)

Further information:

Subplates to RE 45062

Ordering code

DRG			–1X/		Y				*

Pressure reducing valve with DC motor operation

Pilot operated valve = **No code**
Pilot valve **without** main spool insert (do **not** enter size) = **C**
Pilot valve **with** main spool insert (enter size **10** or **32**) = **C**

Size	Ordering code	
	Subplate mounting "No code"	Threaded connection "G"
8	–	= **8** (G3/8)
10	= **10**	= **10** (G1/2)
16	–	= **15** (G3/4)
20	–	= **20** (G1)
25	= **20**	= **25** (G1 1/4)
32	= **30**	= **30** (G1 1/2)

For subplate mounting and block installation = **No code**
For threaded connection = **G**

1X = Component series 10 to 19
(10 to 19: unchanged installation and connection dimensions)

Pressure rating, max.
50 = Set pressure up to 50 bar
100 = Set pressure up to 100 bar
200 = Set pressure up to 200 bar
315 = Set pressure up to 315 bar

Pilot oil flow
Y = Pilot oil supply/drain see Symbols below

No code = **With** check valve
M = **Without** check valve

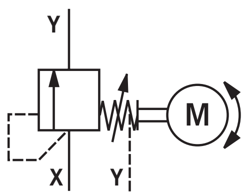
Seal material
No code = NBR seals
V = FKM seals
(other seals on request)
⚠ **Attention!**
Observe compatibility of seals with hydraulic fluid used!

E1 = Limit switch
P2 = Actual value potentiometer

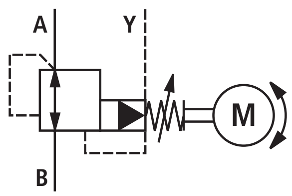
Further details in clear text

Symbols

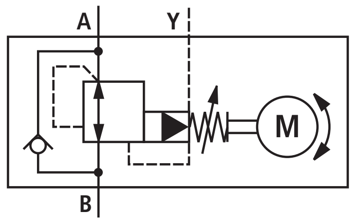
DRGC–1X/..Y



DRG..–1X/..Y..M
DRG..G–1X/..Y..
DRGC 10–1X/..Y.. and
DRGC 30–1X/..Y..



DRG..–1X/..Y



Function, section

Pressure control valves of type DRG are pilot operated pressure reducing valves.

They are used to reduce a system pressure.

Pressure reducing valves of this series basically consist of a pilot valve with electric motor with electric motor as pressure adjustment element, a main valve with main spool insert and an optional check valve.

The reduced pressure in A is adjusted by means of DC motor (16) with reducing gear (17). The output shaft of reducing gear (17) rotates cam (15), which changes the tension of spring (5) via spring plate (9) and thus causes a change in pressure.

The reduced pressure is present in port A, the inlet pressure in port B. The main fluid flow flows from B to A.

Actual value potentiometer (18) feeds back the position of cam (15).

Optionally, electrical limit switches can be installed instead of actual value potentiometer (18) for limiting the min. and max. pressure.

For the variant with limit switch, the min. adjustment time for the pressure range from p_{min} to p_{max} is 18 seconds.

The adjustment time of 18 seconds allows gradual reaching of the required pressure in the inching mode.

For the variant with actual value potentiometer the min. adjustment time for the pressure range from p_{min} to p_{max} is 1.3 seconds.

In conjunction with the associated amplifier type VT-VRM1-1 a program control can be realised.

With the help of 2 additional pressure switches, the min. and max. pressures can be limited.

With the variant with limit switch, the pressure setting on the valve is maintained in the event of a power failure (cable break, fuse failure, short-circuit, etc.).

Type DRG Sizes 8 and 10

The reduced pressure in A is applied simultaneously to the spring-loaded side of main spool (1) via orifice (2.1), pilot line (4), orifice (2.2) and orifice (3).

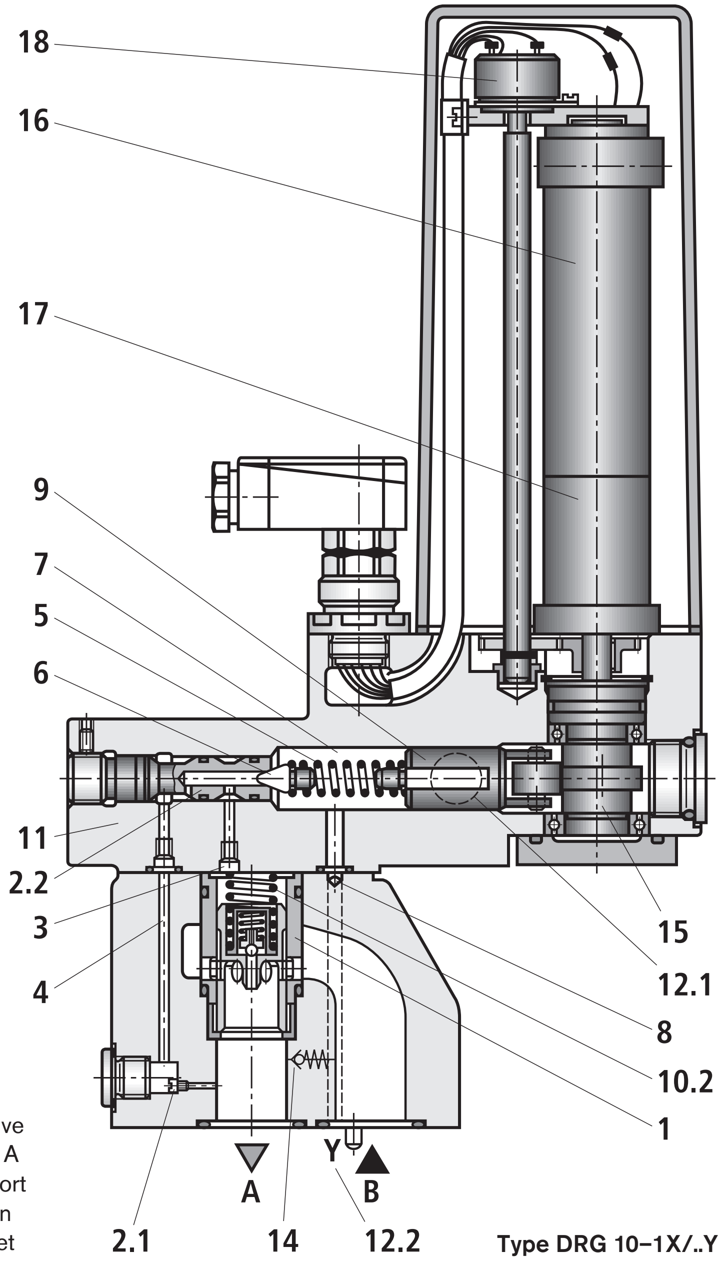
The pressure on the spring-loaded side of main spool (1) is by the pressure differential of compression spring (10.2) lower than the pressure in A. In the opening direction, compression spring (10.2) acts on main spool (1). According to the

opening cross-section of orifices (2.1; 2.2) and the pressure differential of compression spring (10.2), pilot oil flows through orifice (2.1), pilot line (4), orifice (2.2), poppet (6) into spring chamber (7) and further to the tank via Y (12.2) on the variant with subplate mounting or via (12.1) with the variant with threaded connection.

When the pressure in A rises above the value set on pilot valve (11), main spool (1) reduces the flow cross-section from B to A until the pressure set on pilot valve (11) is reached again in port A. Conversely, main spool (1) increases the flow cross-section from B to A, when the pressure in A is lower than the value set on pilot valve (11).

With a static oil column between A and the actuator, only the pilot oil flows via the main spool from B to A.
If, in this position, a lower pressure is set on pilot valve (11), main spool (1) interrupts the pilot oil supply from B to A until the oil volume isolated between A and the actuator has expanded to the lower pressure on pilot valve (11) via orifice (2.1), pilot line (4), orifice (2.2), poppet (6) and port Y.

A check valve (14) can optionally be installed to allow a free return flow from A to B.



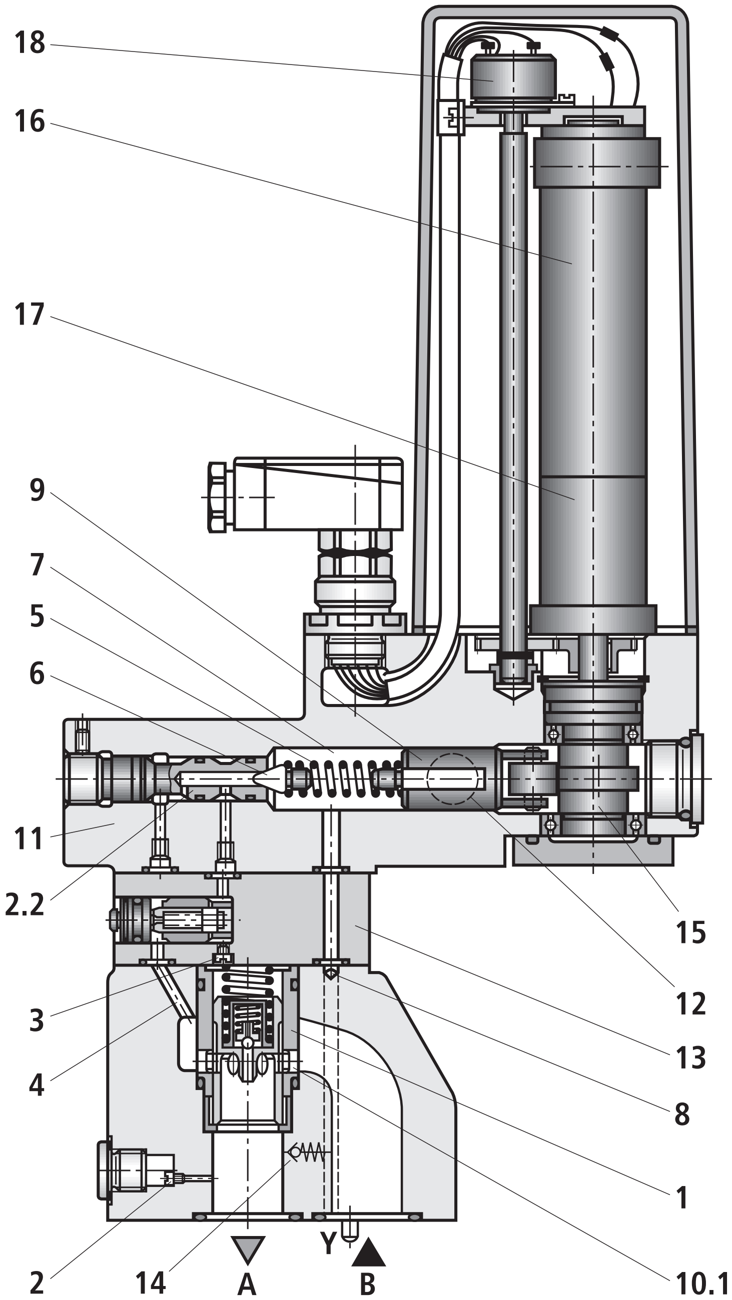
Type DRG 10–1X/..Y

Function, section

Type DRG sizes 16 to 32

Unlike with DRG 8 and DRG 10, with these valves, the pilot oil is taken from inlet pressure channel B. The flow regulator (13) holds the pilot oil flow constant.

If, with a static oil column between A and the actuator, a lower pressure is set on pilot valve (11), the oil column is unloaded via check valve (10.1), pilot line (4), poppet (6) and port Y.



Type DRG 20–1X/..Y

Technical data (for applications outside these parameters, please consult us!)

General

Size			Size	8	10	16	20	25	32
Weight	– Subplate mounting	DRG...	kg	–	7.8	–	–	10.0	12.8
	– Threaded connection	DRG..G	kg	8.4	8.4	9.5	9.5	10.4	10.4
	– Block installation	DRGC 10..	kg	5.5	–	–	–	–	6.1
		DRGC 30..	kg	5.5	–	–	–	–	6.1
	– Pilot valve without main spool insert	DRGC	kg	5.2	–	–	–	–	5.8
Installation position				Optional					
Ambient temperature range			°C	–20 to +50					

Hydraulic

Inlet pressure	– Port B	bar	up to 315				
Pressure rating		bar	50	100	200	315	400
Outlet pressure, can be regulated	– Port A	bar	up to 50	up to 100	up to 200	up to 315	up to 400
Minimum set pressure		bar	Depending on q_V (see Characteristic curves on page 8)				
Backpressure	– Port Y	bar	up to 10				

Size		Size	8	10	16	20	25	32
Maximum flow	– Subplate mounting	l/min	–	80	–	–	200	300
	– Threaded connection	l/min	80	80	200	200	200	300
Pilot oil flow		l/min	0.5		1.3			

Hydraulic fluid		Mineral oil (HL, HLP) to DIN 51524 [1]; fast bio-degradable hydraulic fluids to VDMT 24568 (see also RE 90221); HETG (rape seed oil) [1]; HEPG (polyglycols) [2]; HEES (synthetic esters) [2]; other hydraulic fluids on request
Hydraulic fluid temperature range	°C	–20 to +70
Viscosity range	mm^2/s	2.8 to 380
Permissible max. degree of contamination of the hydraulic fluid - cleanliness class to ISO 4406 (c)		Class 20/18/15 [3]

Electrical, drive motor

Type of voltage			DC voltage
Supply voltage		V–	24
Rated power	– With limit switch	W	18
	– With actual value potentiometer	W	24
Electrical connection			Mating connector DIN 43651, 6-pin + PE
Type of protection to EN 60529			IP 65 with mating connector mounted and locked

1) Suitable for NBR **and** FKM seals

2) Suitable **only** for FKM seals

3) The cleanliness classes specified for components must be adhered to in hydraulic systems.

Effective filtration prevents malfunction and, at the same time, prolongs the service life of components.
For the selection of filters, see data sheets RE 50070, RE 50076, RE 50081, RE 50086 and RE 50088.

Technical data (for applications outside these parameters, please consult us!)

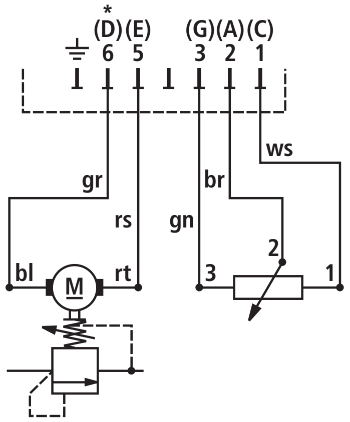
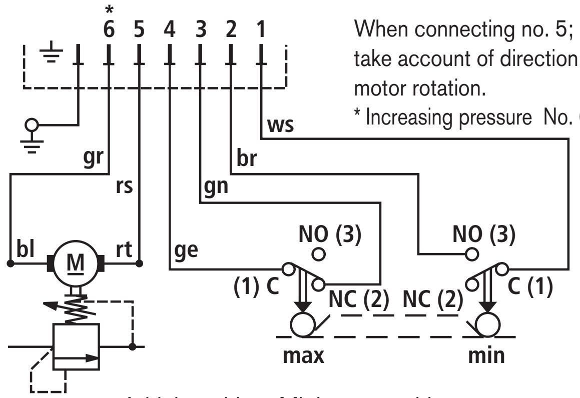
Adjustment with limit switch in inching mode: Ordering code “E1“

Adjustment time, p_{min} to p_{max}		s	18				
Position switch variant:	– Micro-switch		20 V; 2 A DC				
	– Electric load		250 V; 5 A AC				
Pressure lag:	– Pressure rating	bar	50	100	200	315	400
	– Without short-circuit bridge	bar	1	2.5	5	7.5	10
	– With short-circuit bridge	bar	0.5	1	1.5	2	2.5

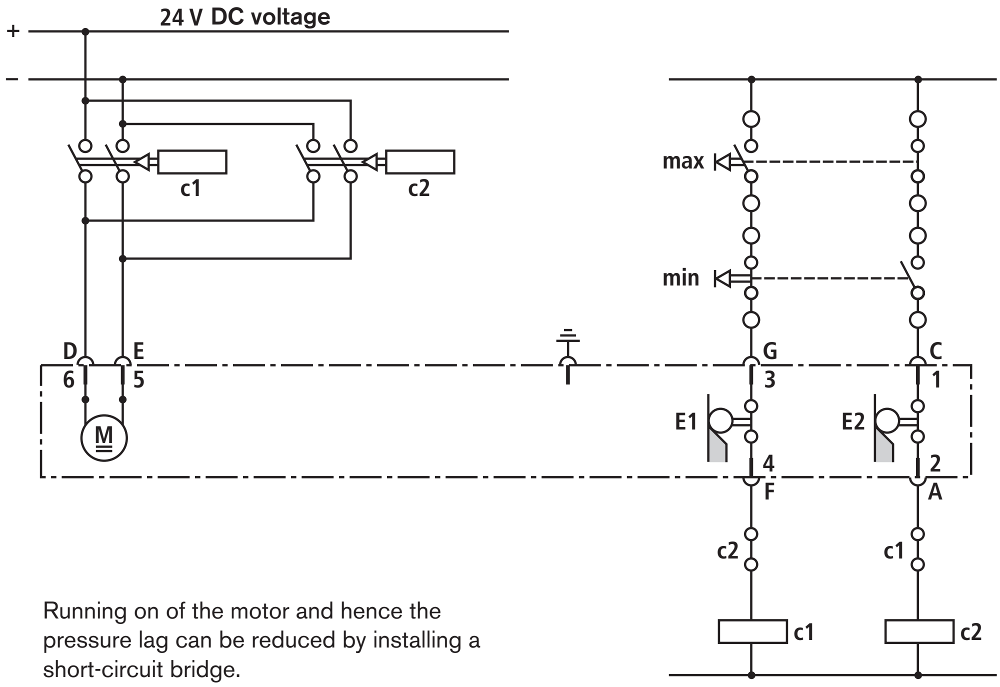
Adjustment with actual value potentiometer for cam position feedback function: Ordering code “P2“

Adjustment time, p_{min} to p_{max}		s	1.3				
Potentiometer	– Resistance	kΩ	5				
	– Power	W	1.75				
Adjustment hysteresis: Start-up pressure – deviation > 10 bar from nominal pressure							
	– Pressure rating	bar	50	100	200	315	400
	– Hysteresis	bar	< 0.5	< 1	< 2.5	< 4	< 5
Adjustment hysteresis: Start-up pressure – deviation > 20 bar from nominal pressure							
	– Pressure rating	bar	50	100	200	315	400
	– Hysteresis	bar	< 0.3	< 0.5	< 1	< 1.5	< 2
Repeatability		bar	< 0.5	< 1	< 1.3	< 1.7	< 2
Amplifier							
Electrical amplifier			VT-VRM1-1, component series 1X – see RE 30405-D				

Electrical connection

Plug connection on DRG valve with actual value potentiometer	Plug connection on DRG valve with limit switch
 When connecting no. 5; 6 take account of direction of motor rotation. * Increasing pressure No. 6 "+"	 When connecting no. 5; 6 take account of direction of motor rotation. * Increasing pressure No. 6 "+" Initial position: Minimum position

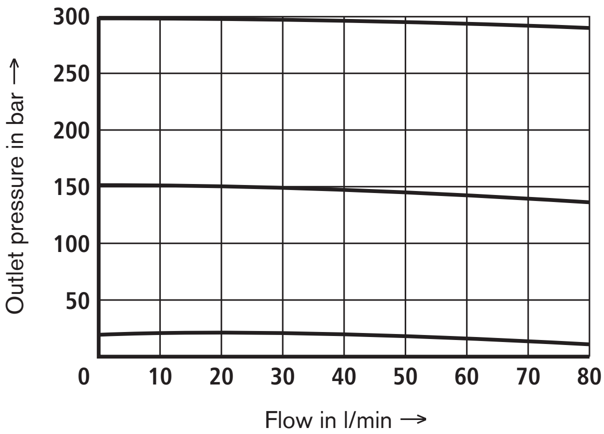
Circuit example: DRG valve with limit switch



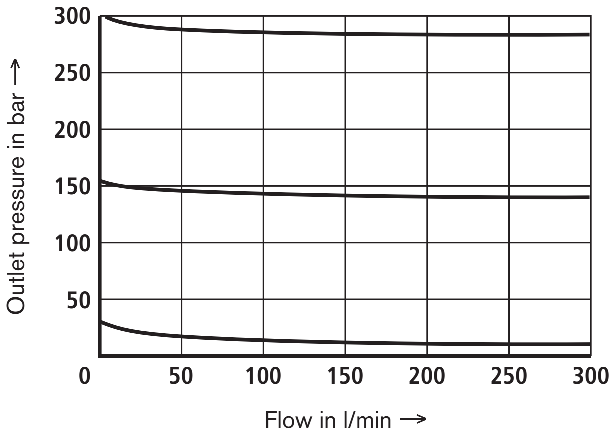
Running on of the motor and hence the pressure lag can be reduced by installing a short-circuit bridge.

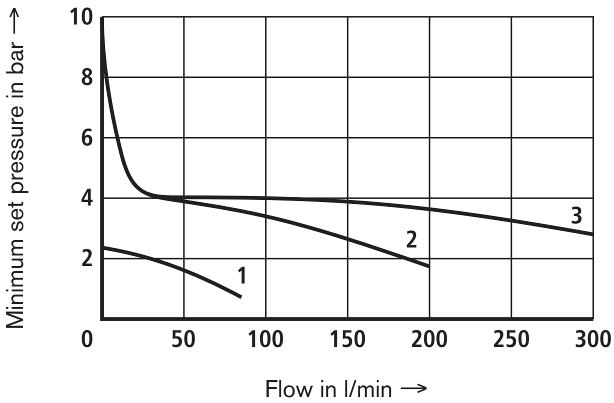
Characteristic curves (measured at $\nu = 41\ \mathrm{mm^2/s}$ and $\vartheta_{oil} = 50\ °C$)

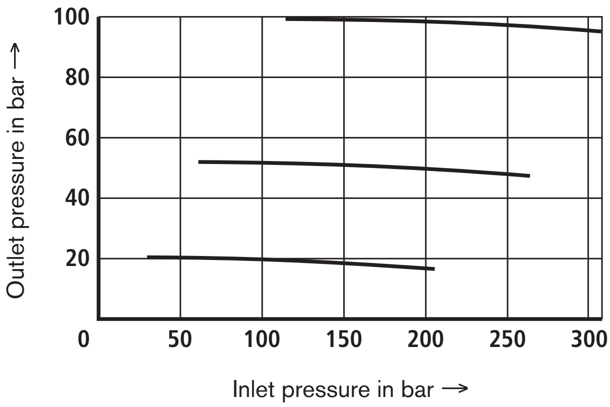
Sizes 8 and 10



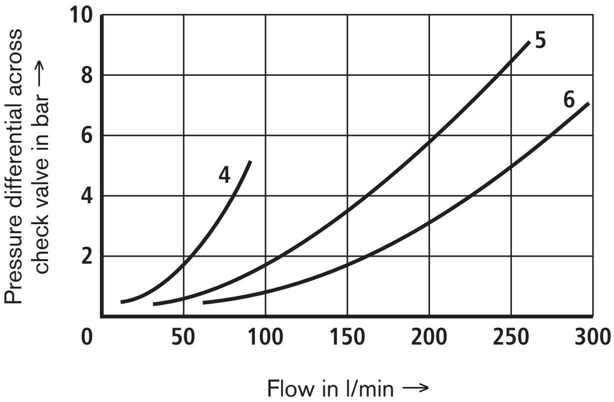
Sizes 16 to 32





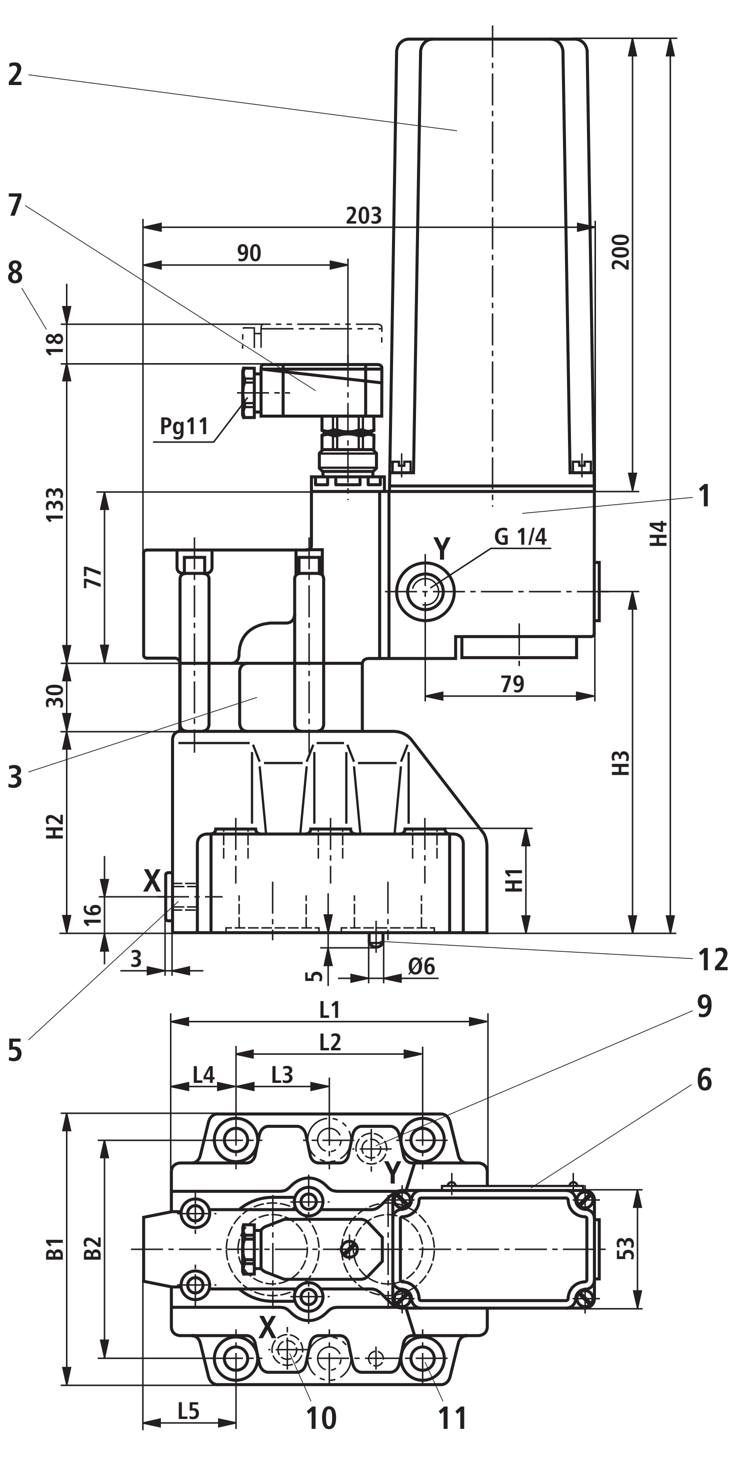


1 = DRG 8 and 10
2 = DRG 16 to 25
3 = DRG 30



4 = DRG 10
5 = DRG 20
6 = DRG 30

Unit dimensions: Subplate mounting (dimensions in mm)



1 Pilot valve

2 DC motor

3 Constant flow regulator (only with sizes 25 and 32)

5 Port “X“ for remote control on size 10
Port M for pressure gauge on sizes 25 and 32

6 Nameplate

7 Mating connector (included in scope of supply)

8 Space required to remove mating connector

9 Port “Y“

10 Port “X“ without function (blind hole)

11 4 valve mounting bores for sizes 10 and 25
6 valve mounting bores for size 32

12 Locating pin

Subplates to data sheet RE 45062
(separate order)

– Size 10	G 460/01	(G3/8)
	G 461/01	(G1/2)
– Size 25	G 412/01	(G3/4)
	G 413/01	(G1)
– Size 32	G 414/01	(G1 1/4)
	G 415/01	(G1 1/2)

Valve fixing screws (separate order)

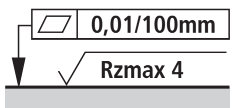
For strength reasons, only the following valve fixing screws may be used:

– Size 10
4 hexagon socket head cap screws ISO4762 - M10x50 - 10.9-flZn-240h-L to VDA 235-101
Friction coefficient μ_{total} = 0.09 to 0.14,
tightening torque M_T = 59 Nm ± 10%,
Material no. **R913000471**

– Size 25
4 hexagon socket head cap screws ISO4762 - M10x60 - 10.9-flZn-240h-L to VDA 235-101
Friction coefficient μ_{total} = 0.09 to 0.14,
tightening torque M_T = 59 Nm ± 10%,
Material no. **R913000116**

– Size 32
6 hexagon socket head cap screws ISO4762 - M10x70 - 10.9-flZn-240h-L to VDA 235-101
Friction coefficient μ_{total} = 0.09 to 0.14,
tightening torque M_T = 59 Nm ± 10%,
Material no. **R913000126**

The tightening torques given are guidelines when screws of the specificied friction coefficients and a torque wrench (tolerance ±10 %) are used.

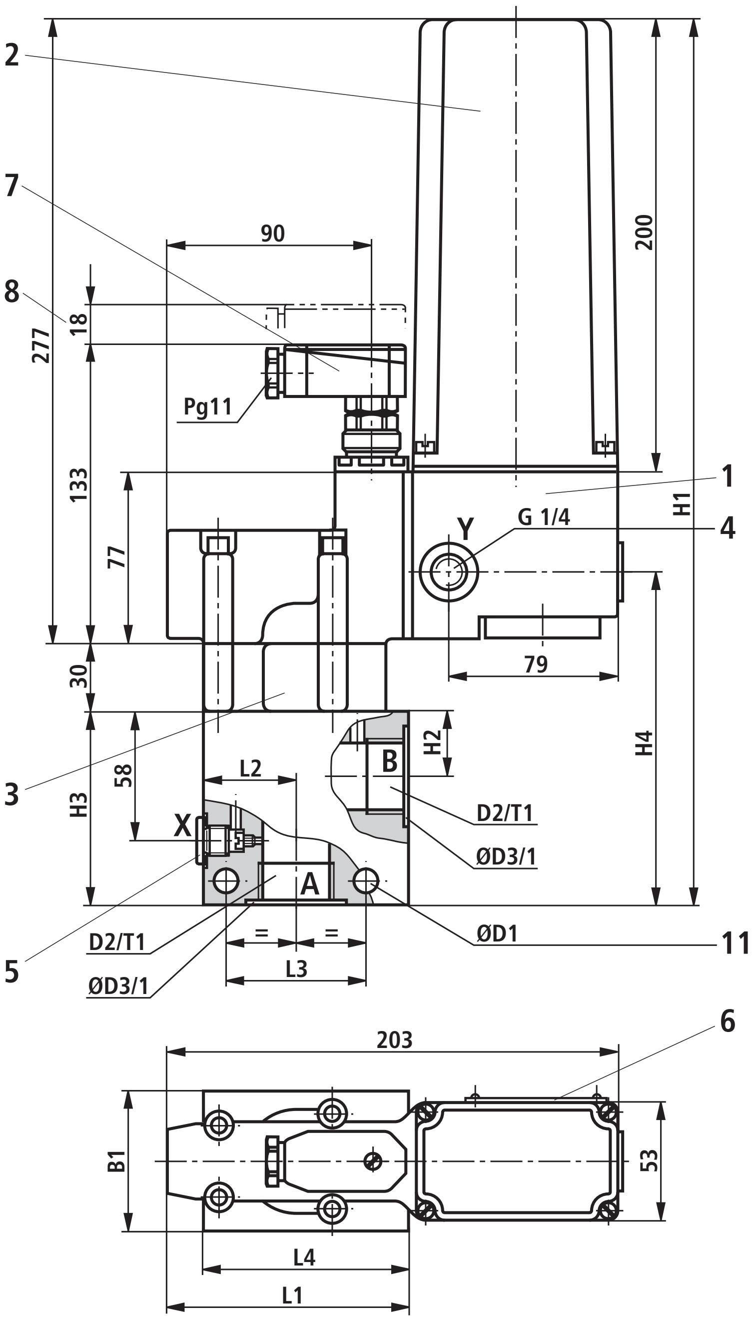


Required surface quality of valve mounting face

Tolerances according to:
– General tolerances ISO 2768-mK

Size	B1	B2	H1	H2	H3	H4	L1	L2	L3	L4	L5	O-ring Port Y	O-ring Port A, B
10	85	66.7	28	72	102	349	90	42.9	–	35.5	44.5	9.25 x 1.78	17.12 x 2.62
25	102	79.4	38	82	142	389	112	60.3	–	33.5	46.5	9.25 x 1.78	28.17 x 3.53
32	120	96.8	46	90	150	397	140	84.2	42.1	28	41.5	9.25 x 1.78	34.52 x 3.53

Unit dimensions: Threaded connection (dimensions in mm)



1 Pilot valve
2 DC motor
3 Constant flow regulator (only on sizes 16 to 32)
4 Port “Y“ for external pilot oil drain
5 Port “X“ for remote control on sizes 8 and 10
Port M for pressure gauge on sizes 16 to 32
6 Nameplate
7 Mating connector (included in scope of supply)
8 Space required to remove mating connector
11 Valve mounting bore

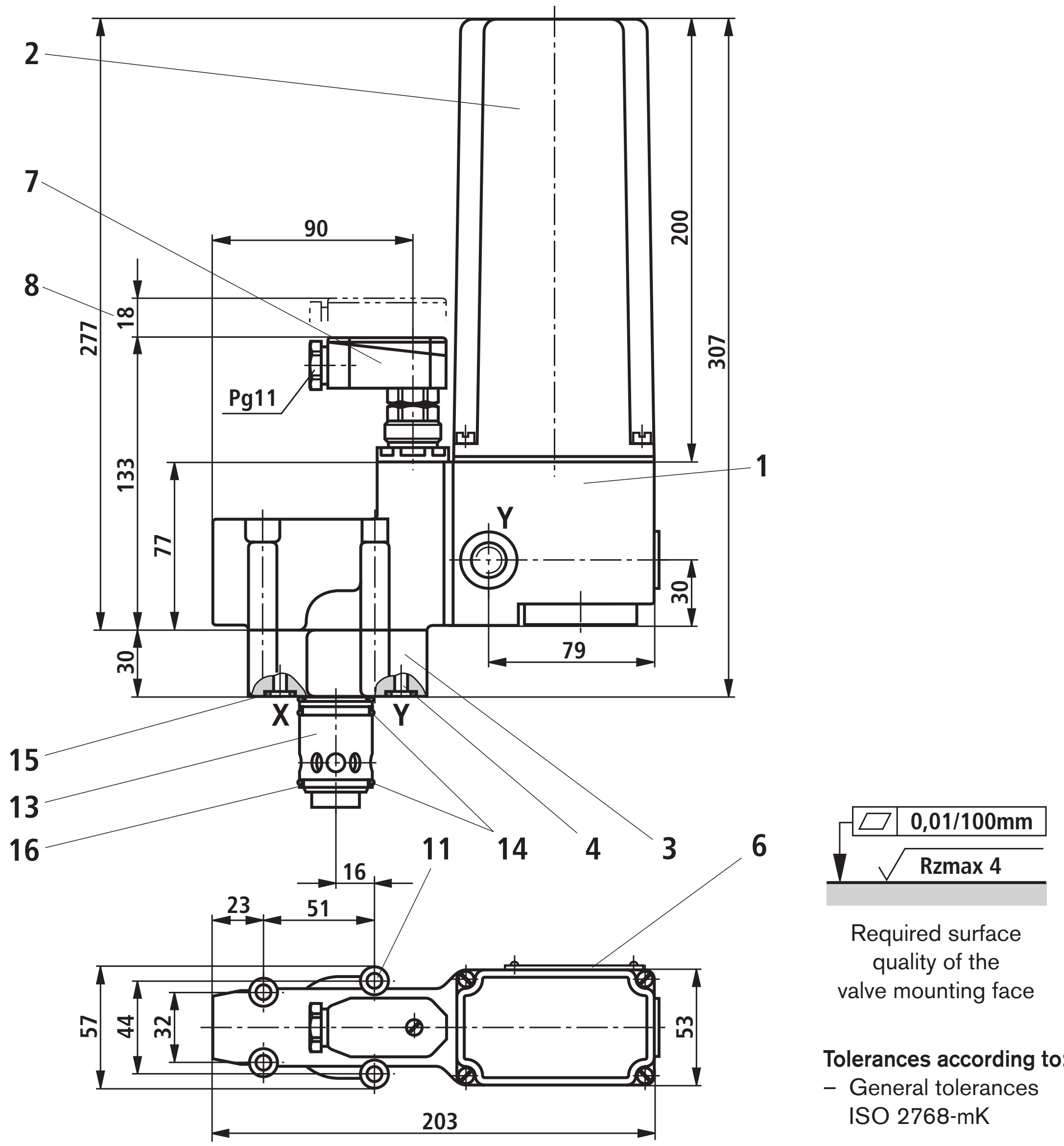
Note!

On this valve variant, no check valve is integrated in the valve to allow a free return flow from A to B.

Tolerances according to:
– General tolerances ISO 2768-mK

Size	B1	ØD1	D2	ØD3	H1	H2	H3	H4	L1	L2	L3	L4	T1
8	63	9	G3/8	28	362	23	75	115	108	40	62	90	12
10			G1/2	34									14
16			G3/4	42	392			145					16
20			G1	47		28							18
25	70	11	G1 1/4	56	405	34	85	158	111	46	72	99	20
32			G1 1/2	61									22

Unit dimensions: Block installation (dimensions in mm)



Required surface quality of the valve mounting face

Tolerances according to:
– General tolerances ISO 2768-mK

1 Pilot valve
2 DC motor
3 Constant flow regulator (only on size 32)
4 Port “Y“ for pilot oil drain
6 Nameplate
7 Mating connector (included in scope of supply)
8 Space required to remove mating connector
11 Valve mounting bores
13 Main spool insert
14 O-ring 27.3 x 2.4
15 O-ring 9.25 x 1.78
16 Back-up ring 32/28.4 x 0.8

Valve fixing screws (separate order)

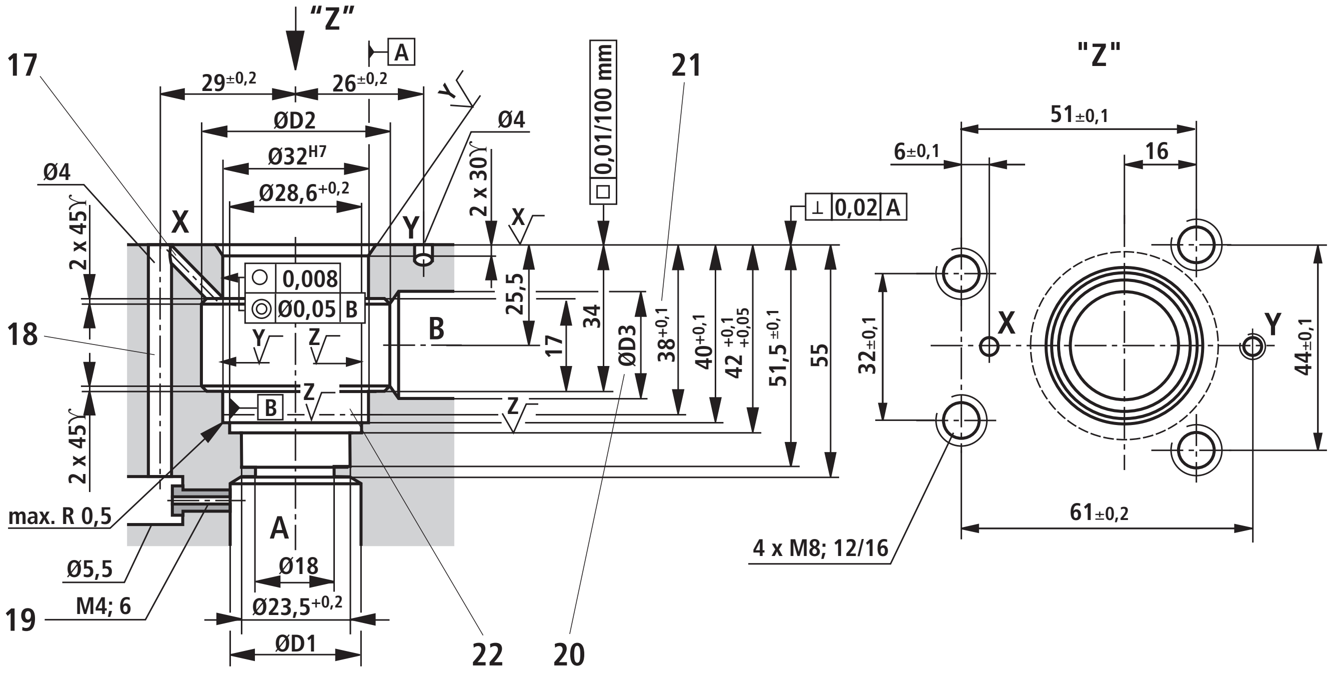
For strength reasons, only the following valve fixing screws may be used:

– Size10
4 hexagon socket head cap screws ISO4762 - M8x50 - 10.9-flZn-240h-L to VDA 235-101
Friction coefficient μ_{total} = 0.09 to 0.14,
tightening torque M_T = 31 Nm ± 10%,
Material no. **R913000543**

– Size 32
4 hexagon socket head cap screws ISO4762 - M8x80 - 10.9-flZn-240h-L to VDA 235-101
Friction coefficient μ_{total} = 0.09 to 0.14,
tightening torque M_T = 31 Nm ± 10%,
Material no. **R913000276**

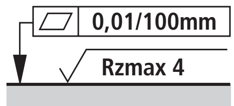
The tightening torques given are guidelines when screws of the specificied friction coefficients and a torque wrench (tolerance ±10 %) are used.

Mounting cavity for block installation (dimensions in mm)



X = Rzmax 4   Y = Rzmax 8   Z = Rz 16

Size	ØD1	ØD2	Ø D3
10	10	40	10
32	32	45	32



Required surface quality of valve mounting face

17 Pilot oil tapping on size 32

18 Pilot oil tapping on size10

19 Pilot oil tapping nozzle on size 10

20 Bore ØD3 can intersect ØD2 at any point. However, care must be taken that connection bore X and the fixing screws are not damaged.

21 Depth of fit

22 The back-up ring and the O-ring must be inserted in this bore before the main spool is installed

Tolerances according to:

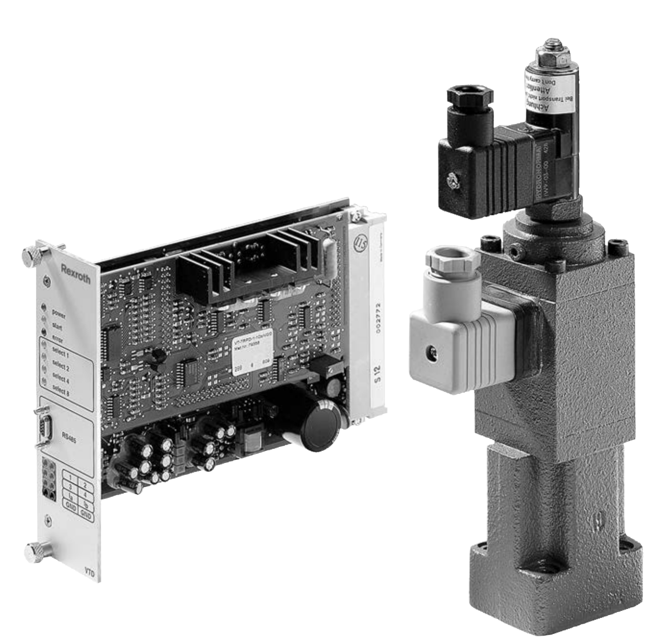
– General tolerances ISO 2768-mK

The Drive & Control Company

Proportional flow control valve

Type 2FRE

RE 29188
Edition: 2016-05
Replaces: 02.07



H6139

- Size 6
- Component series 2X
- Maximum operating pressure 210 bar
- Maximum flow 25 l/min

Features

- 2-way version
- Valve with pressure compensator for pressure-compensated flow control
- Actuation via proportional solenoid
- For subplate mounting
- Porting pattern according to ISO 4401-03-02-0-05
- With electrical position control for the metering orifice
- Axially movable position transducer coil, therefore an easy zero point calibration of the metering orifice is possible without having to interfere with the control electronics (electrical-hydraulic)
- Low manufacturing tolerance of the valve and electric amplifier VT-VRPA1-150-1X (analog) and amplifier module VT-MRPA1-150-1X (analog), optional
- Flow control in both directions by means of rectifier sandwich plate

Contents

Ordering code: Proportional flow control valve

01	02	03		04		05	06	07	08	09
2FRE	**6**		**–**	**2X**	**/**		**K4**		**V**	*****

01	Proportional flow control valve, 2-way version	**2FRE**

02	Size 6	**6**

03	**With** external closing of the pressure compensator (suppression of the start-up jump)	**A**
	Without external closing of the pressure compensator	**B**

04	Component series 20 ... 29 (20 ... 29: unchanged installation and connection dimensions)	**2X**

Rated flow A → B / flow characteristic

05	**– Linear**	
	Up to 1 l/min	**1L**
	Up to 2 l/min	**2L**
	Up to 8 l/min	**8L**
	– Progressive	
	Up to 3 l/min	**3Q**
	Up to 6 l/min	**6Q**
	Up to 10 l/min	**10Q**
	Up to 16 l/min	**16Q**
	Up to 25 l/min	**25Q**
	– Progressive with rapid traverse	
	Fine control range up to 2 l/min	**2QE**

Electrical connection

06	**Individual connection**	
	Without mating connector; connector DIN EN 175301-803-A (proportional solenoid) and GSA20 (position transducer)	**K4** [1)]

07	**With** check valve	**R**
	Without check valve	**M**

Seal material

08	FKM seals	**V**
	Observe compatibility of seals with hydraulic fluid used. (Other seals upon request)	

09	Further details in the plain text	

1) Mating connectors, separate order, see page 12 and data sheet 08006.

☞ **Notice:** Preferred types and standard units are contained in the EPS (standard price list).

Ordering code: Rectifier sandwich plate

01	02		03		04	05
Z4S	**6**	**–**	**1X**	**/**	**V**	*****

Material no. **R900489356**

01	Rectifier sandwich plate	**Z4S**
02	Size 6	**6**
03	Component series 10 ... 19 (10 ... 19: unchanged installation and connection dimensions)	**1X**

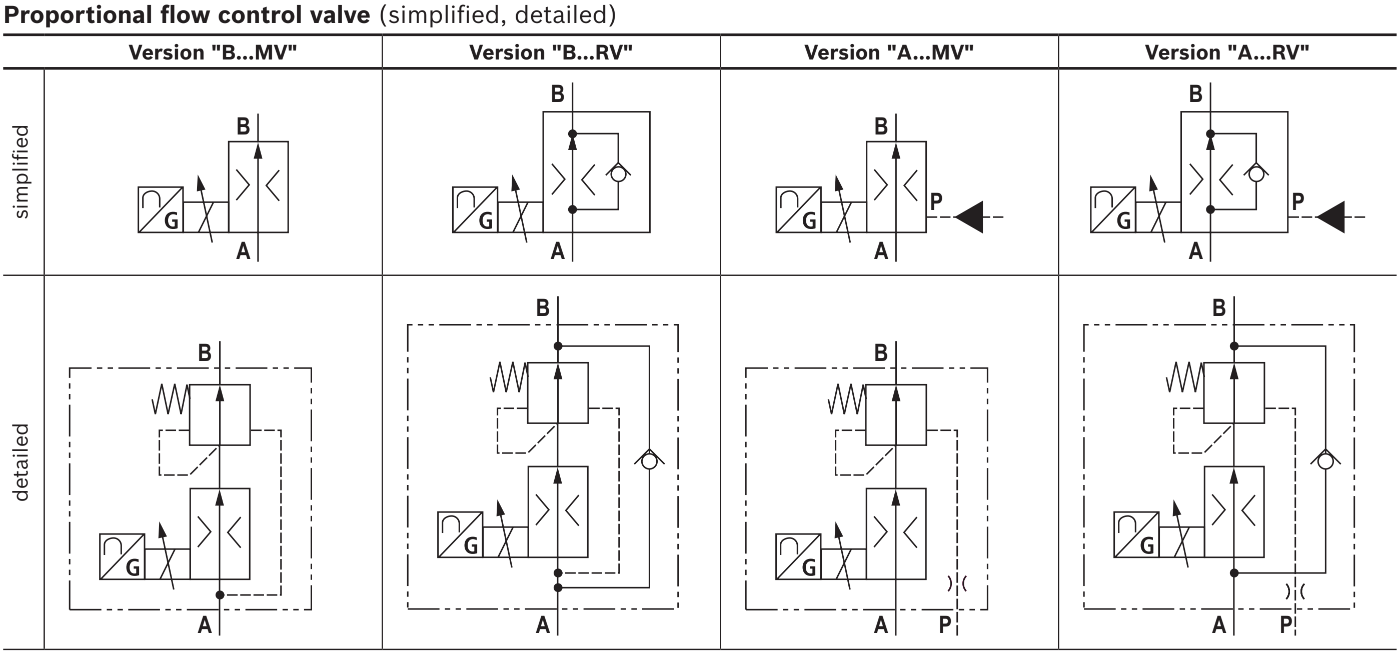
Seal material

08	FKM seals	**V**
	Observe compatibility of seals with hydraulic fluid used. (Other seals upon request)	
09	Further details in the plain text	

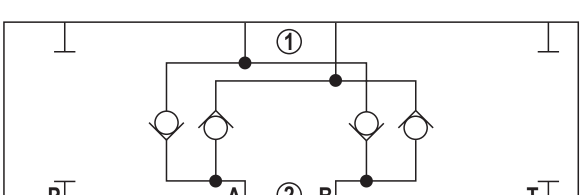
☞ **Notice:**
Rectifier sandwich plate **impossible** with proportional flow control valve, version "A" (with external closing of the pressure compensator).

Symbols (① = component side, ② = plate side)

Proportional flow control valve (simplified, detailed)



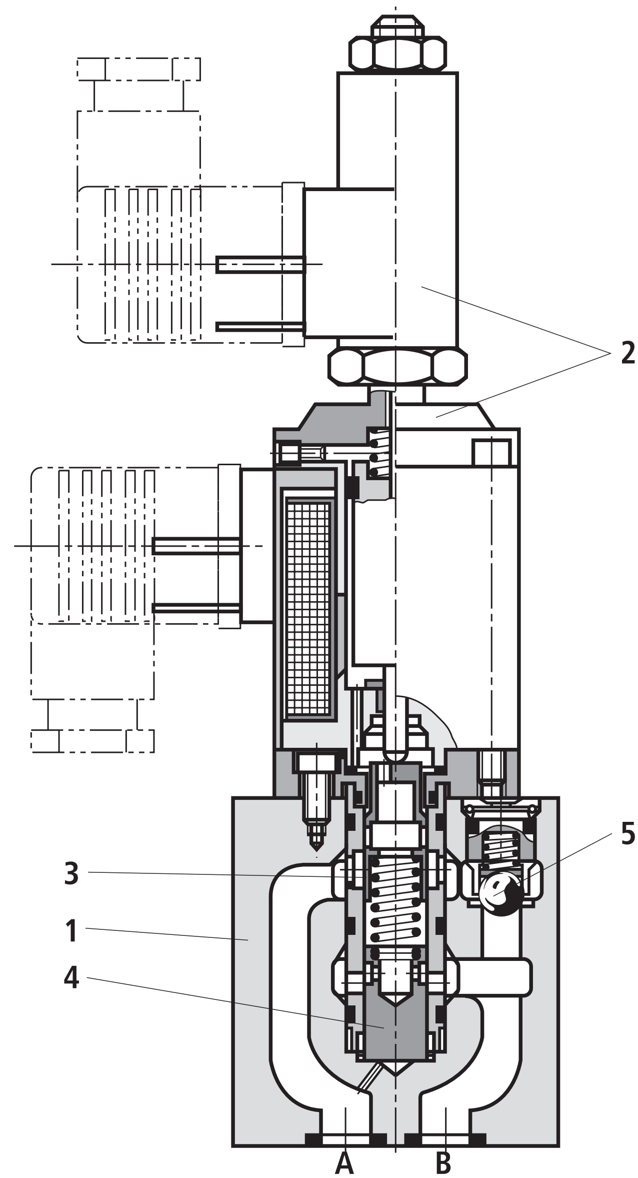
Rectifier sandwich plate



Function, section

Proportional flow control valves of the 2FRE ... type comprise a 2-way function. They are capable of controlling a flow indicated by the electrical command value in a pressure- and temperature-compensated manner.
The set-up basically consists of a housing (1), proportional solenoid with inductive position transducer (2), metering orifice (3), pressure compensator (4) as well as check valve (5), optional.

Proportional flow control valve, version "B...RV" (**without** external closing, **with** check valve)
The flow setting is determined by the indication (0 ... 100%) at the command value potentiometer. Via the amplifier as well as the proportional solenoid, the indicated command value has an effect on the adjustment of the metering orifice (3). The position of the metering orifice (3) is recorded by the inductive position transducer. Any existing variations from the command value are corrected by the position control.
The pressure compensator (4) keeps the pressure drop at the metering orifice (3) at a constant value at all times. Thus, the flow is load-compensated. The low temperature drift is the result of the favorable design of the metering orifice.
With a command value of 0%, the metering orifice is closed. In the event of a power failure or cable break at the inductive position transducer, the metering orifice closes.
From the command value 0%, a smooth start-up is possible. Via two ramps in the electric amplifier, the metering orifice can be opened and closed with delay.
Via the check valve (5), a free return flow from B to A is possible.
With an additional rectifier sandwich plate of the Z4S 6 type under the proportional flow control valve, the supply and return flow from the actuator can be regulated.

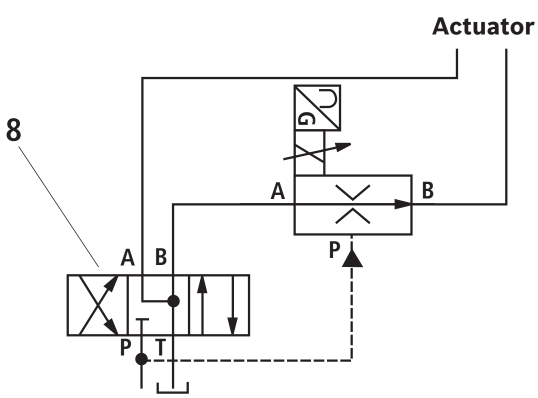


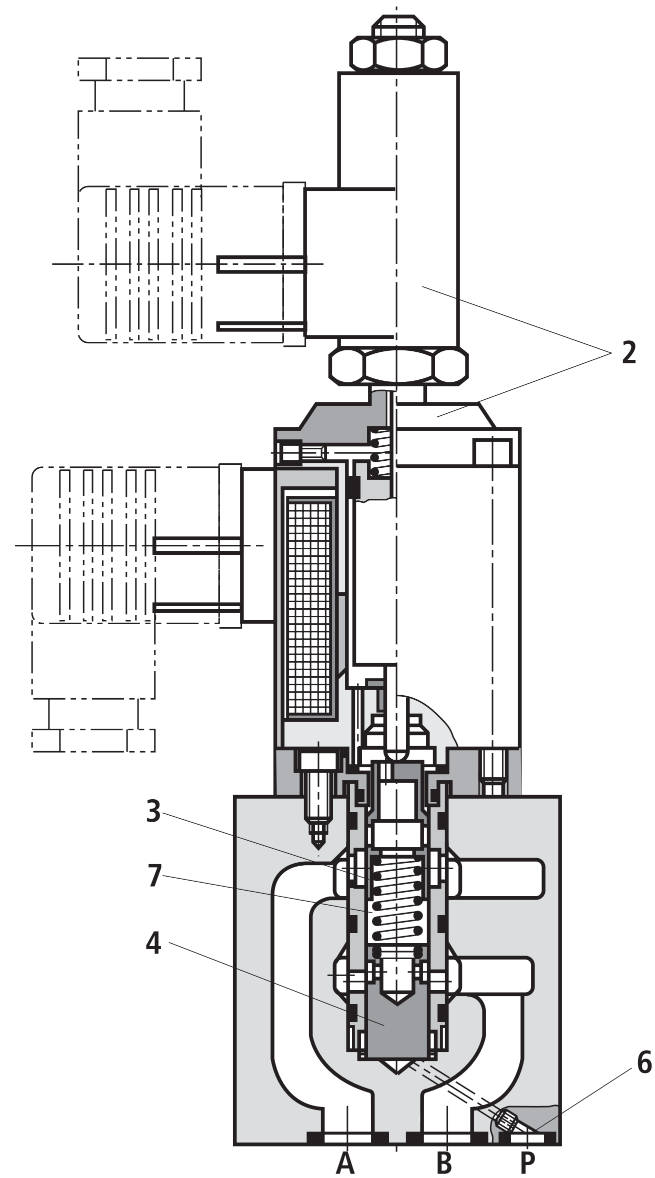
Type 2FRE 6 B-2X/.K4RV

Nozzle

Function, section

Proportional flow control valve, version "A...MV"
(**with** external closing, **without** check valve)
In principle, the function of this valve corresponds to the function of version "B...RV".
For the start-up jump suppression with open metering orifice (3) (command value > 0%), a closing of the pressure compensator (4) is provided via port P (6). The internal connection between port A and the pressure compensator (4) is abandoned. Via the external port P (6), the pressure in P upstream to the directional valve (8) has an impact on the pressure compensator (4) and keeps the latter in its closed position against the spring force (7).
If the directional valve (8) is switched from P to B, the pressure compensator (4) moves from the closed position into the control position and the start-up jump is thus prevented.





Type 2FRE 6 A-2X/.K4MV

Technical data
(For applications outside these values, please consult us!)

general												
Weight	▶ Proportional flow control valve	kg	1.8									
	▶ Rectifier sandwich plate	kg	0.9									
Installation position			Any									
Storage temperature range		°C	−20 ... +80									
Ambient temperature range		°C	−20 ... +50									

hydraulic – Proportional flow control valve [1]												
Maximum operating pressure	▶ Port A	bar	210									
Version			**1L**	**2L**	**8L**	**3Q**	**6Q**	**10Q**	**16Q**	**25Q**	**2QE**
Maximum flow volume		l/min	1	2	8	3	6	10	16	25	25
Minimum flow	▶ 100 bar	cm^3/min	25	25	50	15	25	50	70	100	15
	▶ 210 bar	cm^3/min	25	25	50	25	25	50	70	100	25
Maximum leakage flow, $\Delta p_{A \to B}$ with a command value of 0% [2]	▶ 50 bar	cm^3/min	4	4	6	4	4	6	7	10	4
	▶ 100 bar	cm^3/min	5	5	8	5	5	8	10	15	5
	▶ 210 bar	cm^3/min	7	7	12	7	7	12	15	22	7
Minimum pressure differential		bar	6 ... 10								
Pressure differential with free return flow B → A			See characteristic curve, page 9								
Pressure/flow-dependence of input/output pressure			See characteristic curve, page 9								
Temperature dependence Temperature drift, hydraulic and electric			See characteristic curve, page 9								
Hydraulic fluid			See table, page 7								
Maximum admissible degree of contamination of the hydraulic fluid Cleanliness class according to ISO 4406 (c)			Class 20/18/15 [3]								
Hydraulic fluid temperature range		°C	−20 ... +80								
Viscosity range		mm^2/s	15 ... 380								
Hysteresis		%	< ±1 of q_{Vmax}								
Repetition accuracy		%	< 1 of q_{Vmax}								
Manufacturing tolerance	▶ Valve, type 2FRE 6		≤ ±3% with command value 33% ≤ ±5% with command value 100%								
	▶ Amplifier VT-VRPA1-150 (analog)		The amplifier is to be adapted to the valve [4]								
	▶ Amplifier module VT-MRPA1-150 (analog)		The amplifier is to be adapted to the valve [4]								
Hydraulic – Rectifier sandwich plate											
Maximum operating pressure		bar	210								
Cracking pressure		bar	0.7								
Rated flow		l/min	25								

1) Measured with HLP46 and with ϑ_{oil} = 40°C ±5°C
2) Measured with ν = 41 mm^2/s and ϑ = 50°C
3) The cleanliness classes stated for the components need to be maintained in hydraulic systems. Effective filtration prevents faults and simultaneously increases the life cycle of the components.

4) Due to tolerances of the oscillator frequency (supply of the position transducer), amplifiers comprise manufacturing tolerances.
In new systems or when replacing the amplifier, an adaptation of the amplifier setting may be necessary.

Technical data
(For applications outside these values, please consult us!)

Hydraulic fluid		Classification	Suitable sealing materials	Standards	Data sheet
Mineral oils		HL, HLP	FKM	DIN 51524	90220
Flame-resistant	▶ Water-free	HFDU (glycol base)	FKM	ISO 12922	90222

Important notices on hydraulic fluids:
- For more information and data on the use of other hydraulic fluids, please refer to the data sheets above or contact us.
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.).
- The ignition temperature of the hydraulic fluid used must be 50 K higher than the maximum solenoid surface temperature.

electrical – Proportional solenoid					
Voltage type			Direct voltage		
Coil resistance	▶ Cold value at 20°C	Ω	5.4		
	▶ Maximum hot value	Ω	8.2		
Duty cycle		%	100		
Maximum current per solenoid		A	1.5		
Electrical connection			Connector according to DIN EN 175301-803-A [5]		
Protection class according to EN 60529 [6]			IP 65 with mating connector mounted and locked		
electrical – Inductive position transducer					
Coil resistance (total resistance of the coils between PIN) at 20°C (see page 11)			1 and 2	2 and earthing	Earthing and 1
			31.5	45.5	31.5
Electrical connection			Connector GSA20 [5]		
Protection class according to EN 60529 [6]			IP 65 with mating connector mounted and locked		
Inductivity		mH	6 ... 8		
Oscillator frequency		kHz	2.5		
Electrical position measurement system			Differential throttle		
Nominal stroke		mm	3.5		

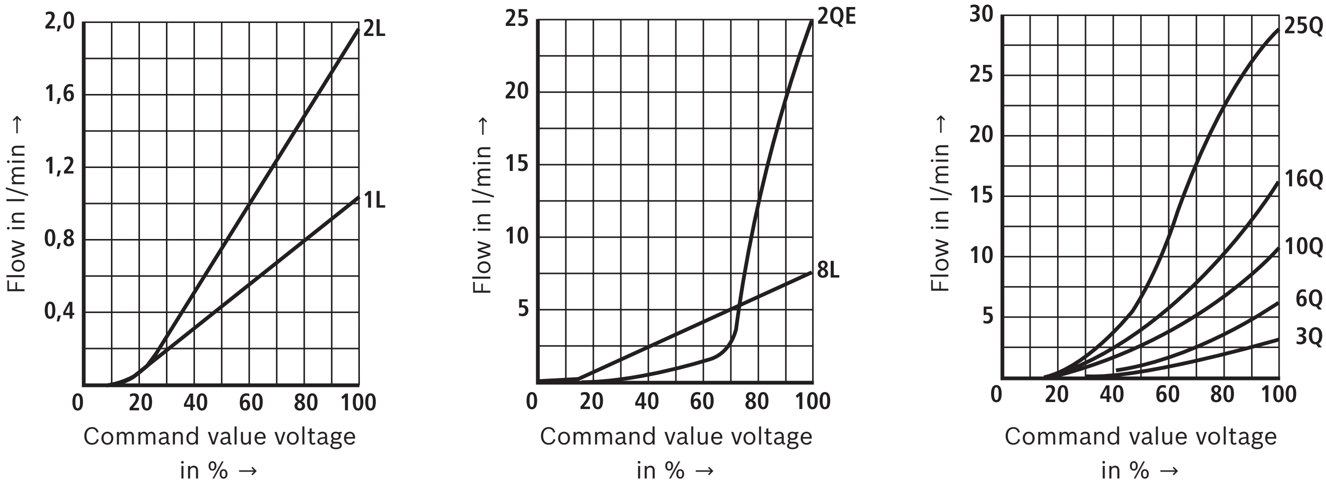
Control electronics (separate order)	
Related amplifier in euro-card format	Type VT-VRPA1-150-1X (analog) according to data sheet 30118
Related amplifier module	Type VT-MRPA1-150-1X (analog) according to data sheet 30221

5) Mating connector, separate order, see page 12.

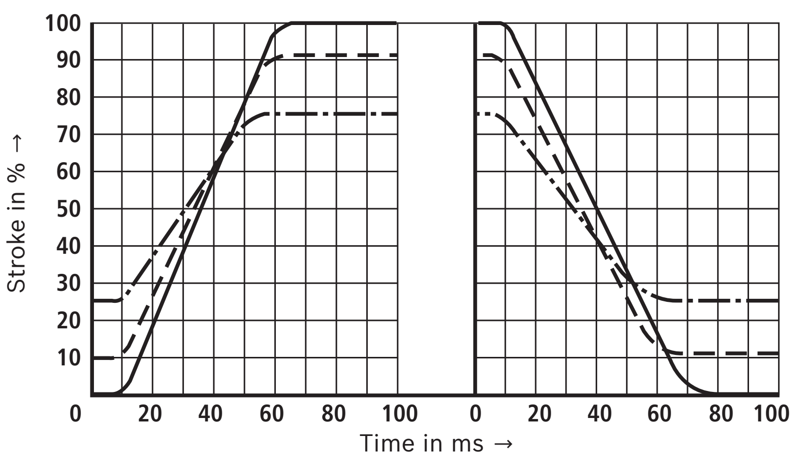
6) Due to the arising surface temperatures of the solenoid coils, the standards ISO 13732-1 and ISO 4413 are to be observed.

Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ± 5°C)

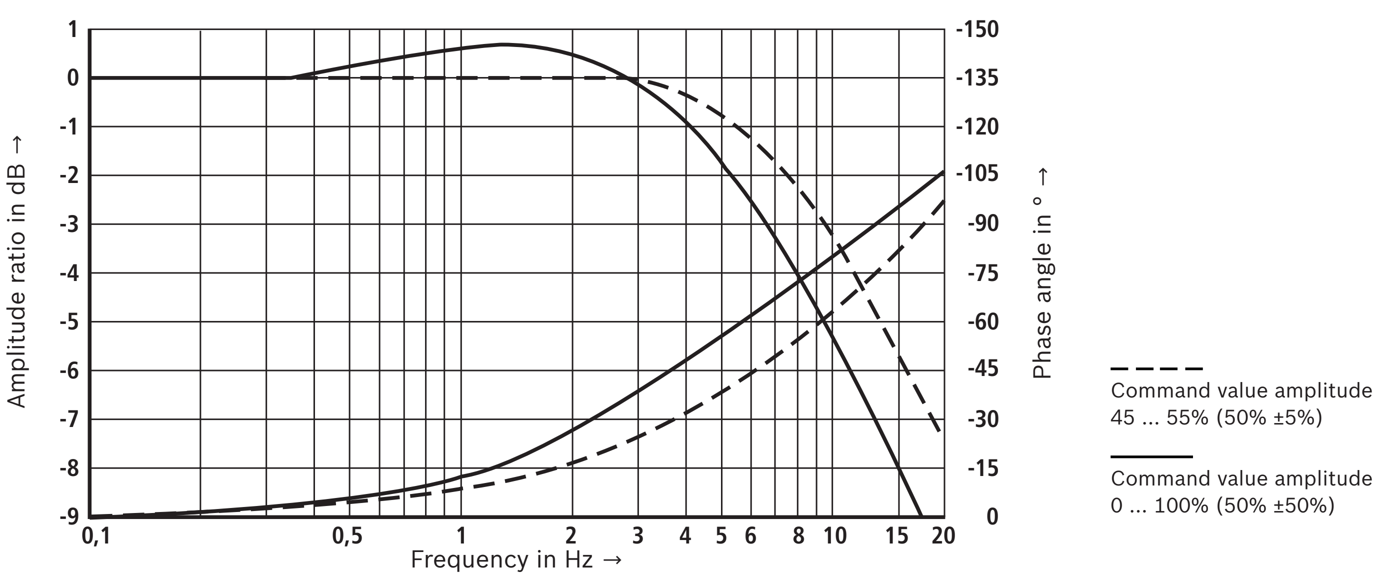
Dependency of the flow from the command value voltage
(Flow control of A → B); p_{nom} = 50 bar



Transition function with stepped command value modification; p_{nom} = 100 bar; version "25Q"



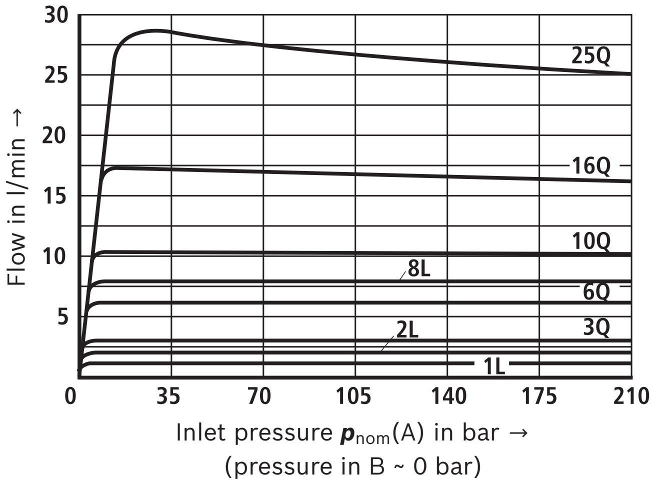
Frequency response characteristic curves; p_{nom} = 100 bar; version "25Q"

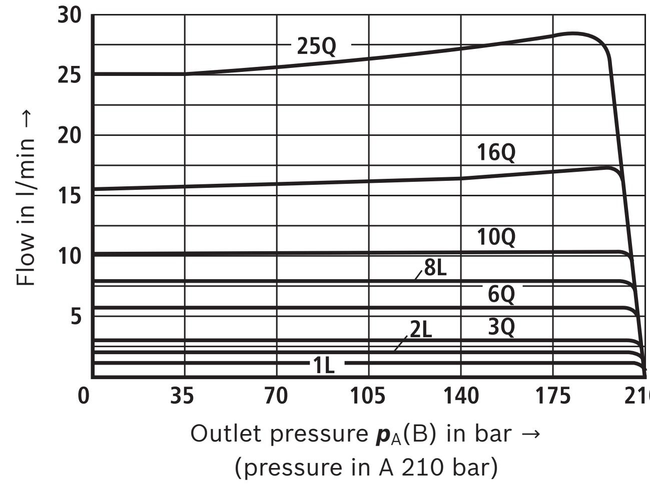


Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ± 5°C)

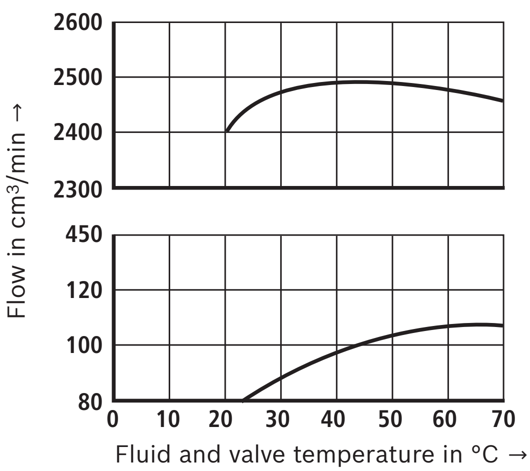
Proportional flow control valve

Flow-dependent pressure

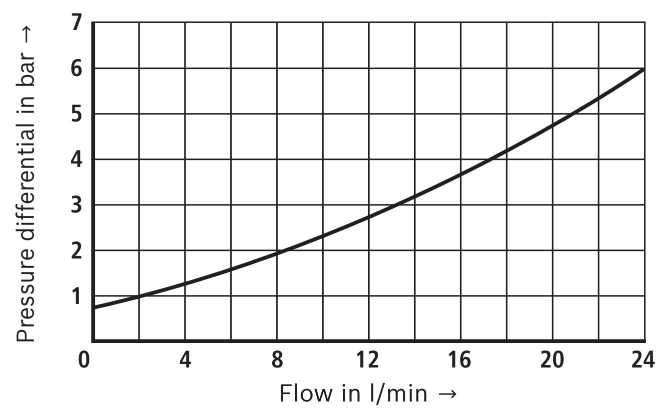




Temperature dependence (version "25Q" – greatest variation) at Δp = 30 bar

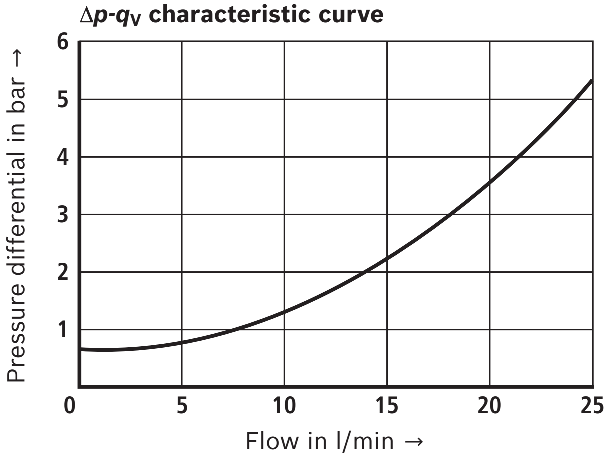


Pressure differential via check valve B → A orifice closed

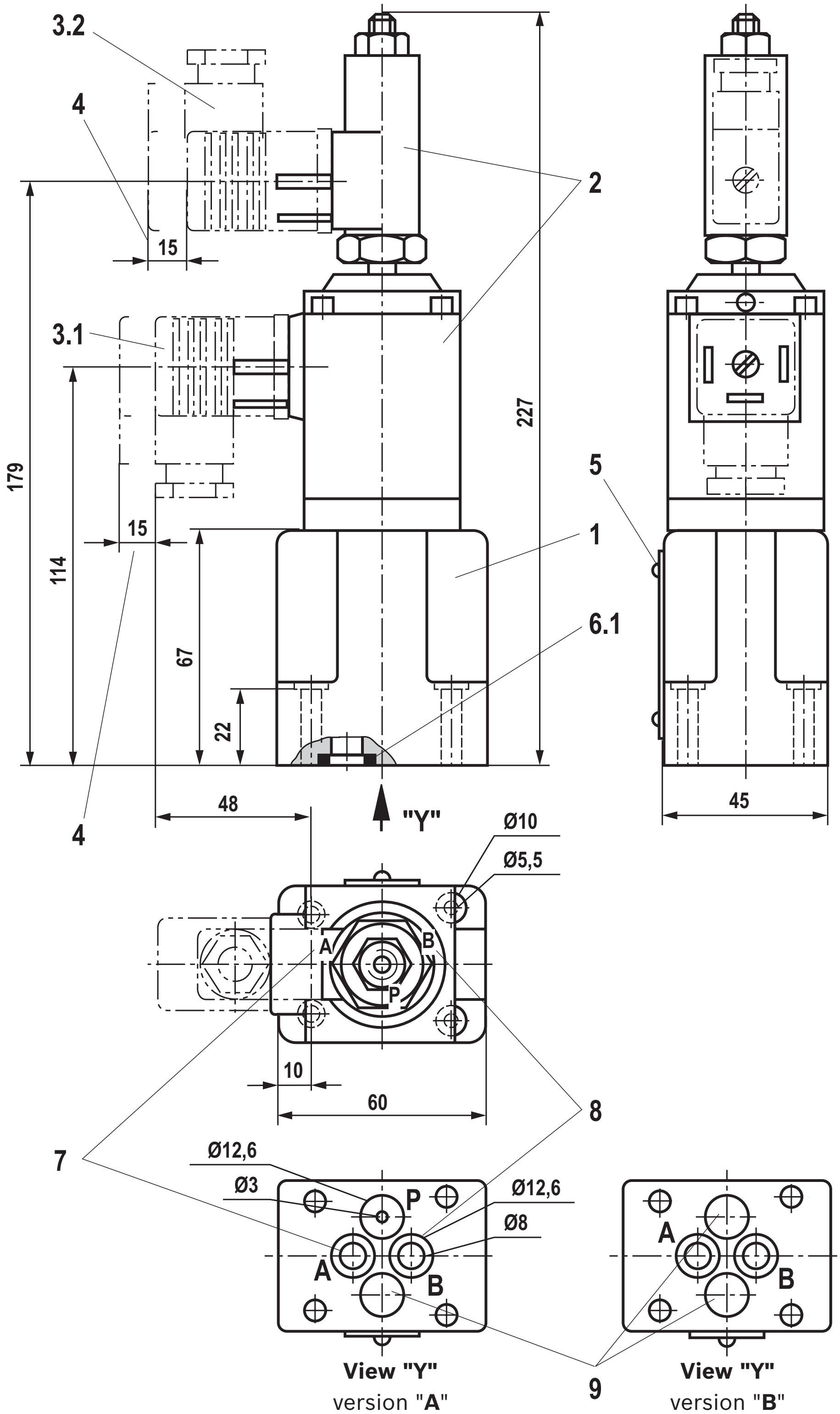


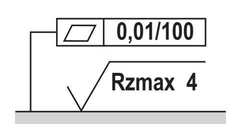
Rectifier sandwich plate

Δp-q_V characteristic curve

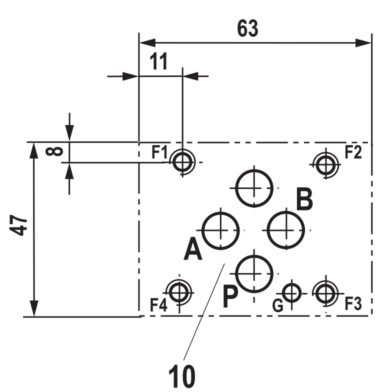


Dimensions: Proportional flow control valve (dimensions in mm)





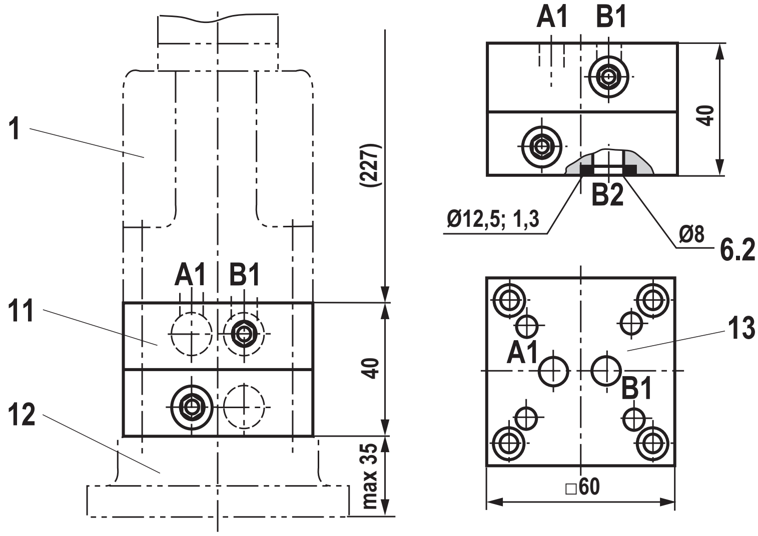
Required surface quality of the valve contact surface

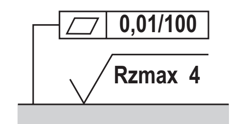


For item explanations, valve mounting screws and **subplates,** see page 11.

☞ **Notice:**
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions: Rectifier sandwich plate (dimensions in mm)





Required surface quality of the valve contact surface

1 Valve housing
2 Proportional solenoid with inductive position transducer
3.1 Mating connector for proportional solenoid, separate order, see page 12
3.2 Mating connector for position transducer, separate order, see page 12
4 Space required for removing the mating connector
5 Name plate
6.1 Same seal rings for ports A, B, P and blind counterbore
6.2 Same seal rings for ports A2 and B2
7 Port A
8 Port B
9 Blind counterbore Ø12.6 mm
10 Machined valve contact surface, porting pattern according to ISO 4401-03-02-0-05
11 Rectifier sandwich plate
12 Subplate
13 Valve contact surface for proportional flow control valve, type 2FRE 6...

Subplates (separate order) with porting pattern according to ISO 4401-03-02-0-05, see data sheet 45100.

Valve mounting screws (separate order)
The following valve mounting screws are recommended:

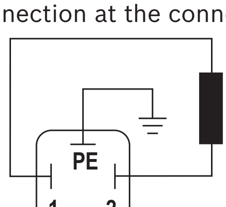
- **Proportional flow control valve**
  - **4 hexagon socket head cap screws ISO 4762 - M5 x 30 - 10.9-flZn240h-L**
    (friction coefficient 0.09 ... 0.14 according to VDA 235-101)
    tightening torque M_A = 7 Nm ±10%,
    material no. **R913048086**
  - **4 hexagon socket head cap screws ISO 4762 - M5 x 30 - 10.9**
    (friction coefficient 0.08 ... 0.16 according to VDI 2230 – black)
    tightening torque M_A = 8.1 Nm ±10%,
    material no. **2910150205**

- **Rectifier sandwich plate**
  - **4 tie rods M5 x 70**
    material no. **R901318602**
  - **4 hexagon nuts ISO 4032 - M5 - 10-CM-FE-ZN-5-AN-T0-H-B**
    (friction coefficient 0.08 ... 0.16 according to VDI 2230 – black)
    tightening torque M_A = 8.1 Nm ±10%,
    material no. **R913016628**

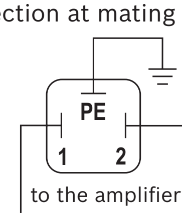
Notices:
- Rectifier sandwich plate **impossible** with proportional flow control valve, version "A" (with external closing of the pressure compensator).
- The dimensions are nominal dimensions which are subject to tolerances.

Electrical connections and assignment

Connection at the connector

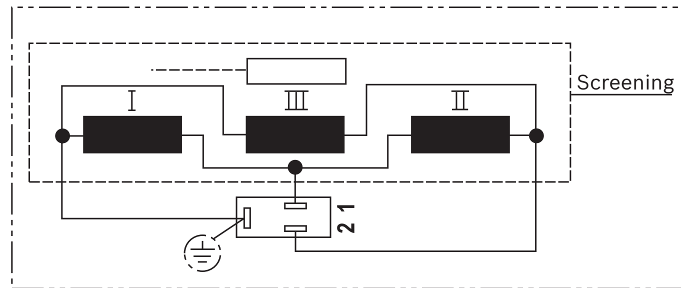


Connection at mating connector

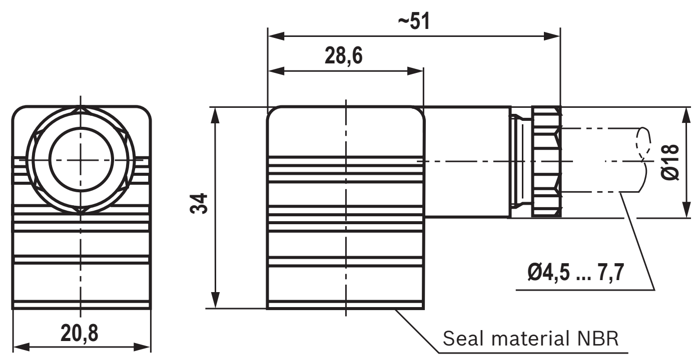


Mating connectors (separate order)

Mating connector according to DIN EN 175301-803-A,
material no. **R901017011** (plastic version),
see data sheet 08006



Mating connector GM209N (Pg 9),
material no. **R900013674** (plastic version)



Further information

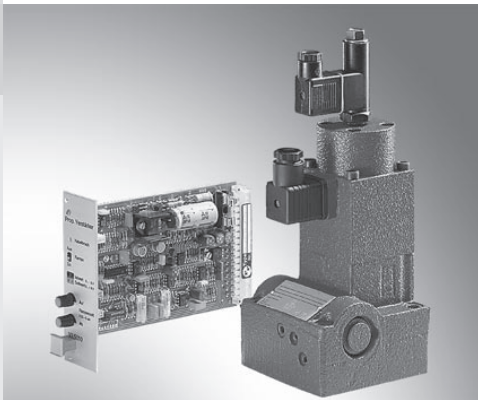
▶ Analog amplifiers	Data sheet 30118
▶ Valve amplifier for proportional valves with electrical position feedback	Data sheet 30221
▶ Subplates	Data sheet 45100
▶ Hydraulic fluids on mineral oil basis	Data sheet 90220
▶ Flame-resistant, water-free hydraulic fluids	Data sheet 90222
▶ Hydraulic valves for industrial applications	Operating instructions 07600-B
▶ Selection of the filters	
▶ Information on available spare parts	

Proportional flow control valve, 2-way version

RE 29190/02.07
Replaces: 02.06

Type 2FRE

Sizes 10 and 16
Component series 4X
Maximum operating pressure 315 bar
Maximum flow 160 l/min



H5570_d

Table of contents

Contents	Page

Features

- Valve with pressure compensator for the pressure-compensated control of a flow
- Actuation by means of proportional solenoid
- For subplate mounting:
  Porting pattern to ISO 6263, see page 10
  Subplates according to data sheet RE 45066 (separate order), see page 10
- With electrical closed-loop position control of the metering orifice
- The position transducer coil can be axially shifted, which simplifies zero point balancing of the metering orifice (electrical-hydraulic) without the need for intervening into the control electronics
- Low manufacturing tolerances of the valve and the electrical amplifier types VT-VRPA1-151-1X (analogue) and amplifier module Typ VT-MRPA1-151-1X (analogue), separate order, see page 5
- Flow control in both directions due to rectifier sandwich plate

Ordering code: Proportional flow control valve

2FRE		–4X/		B	K4		*

Size 10 = 10
Size 16 = 16

Component series 40 to 49 = 4X
(40 to 49: unchanged installation and connection dimensions)

Further details in clear text

M = NBR seals, suitable for mineral oil (HL, HLP) to DIN 51524
V = FKM seals

Electrical connection
K4 = **Without** cable socket, with component plug to DIN EN 175301-803-A for proportional solenoid and GSA20 for position transducer
Cable sockets – separate order see page 6

B = With pressure compensator stroke limiter

Nominal flow A → B / flow characteristics					
Size 10				Size 16	
Linear		Progressive with rapid speed (fine control rnge)		Linear	
Up to 10 l/min	= 10L	With rapid speed	= 5QE	Up to 80 l/min	= 80L
Up to 16 l/min	= 16L		= 5Q	Up to 100 l/min	= 100L
Up to 25 l/min	= 25L		= 10Q	Up to 125 l/min	= 125L
Up to 50 l/min	= 50L		= 16Q	Up to 160 l/min	= 160L
Up to 60 l/min	= 60L		= 25Q		

Standard types

Size 10

Type	material number
2FRE 10-4X/10LBK4M	R900915817
2FRE 10-4X/16LBK4M	R900915825
2FRE 10-4X/25LBK4M	R900915820
2FRE 10-4X/50LBK4M	R900915815

Size 16

Type	material number
2FRE 16-4X/100LBK4M	R900915819
2FRE 16-4X/160LBK4M	R900915814

Ordering code: Rectifier sandwich plate

Z4S		–2X/		*

Size 10 = 10
Size 16 = 16

Component series 20 to 29 = 2X
(20 to 29: unchanged installation and connection dimensions)

Further details in clear text

No code = NBR seals, suitable for mineral oil (HL, HLP) to DIN 51524
V = FKM seals

Size 10

Type	material number
Z4S 10-2X/	R900413377
Z4S 10-2X/V	R900413379

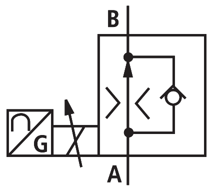
Size 16

Type	material number
Z4S 16-2X/	R900425901
Z4S 16-2X/V	R900427362

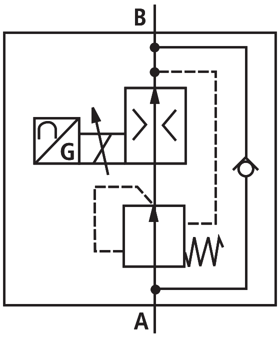
Symbols

Proportional flow control valve

Simplified

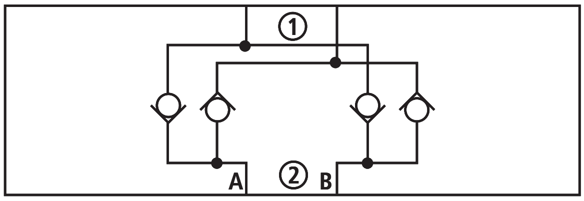


Detailed



Rectifier sandwich plate

① = component side, ② = plate side



Function, section

Proportional flow control valves of type 2FRE … feature a 2-way function. They can control a flow, which is determined by an electrical command value, in a pressure- and largely temperature-compensated way.

They basically consist of housing (1), proportional solenoid with inductive position transducer (2), metering orifice (3), pressure compensator (4), stroke limiter (5) and check valve (6).

The setting of the flow is determined by the setting (0 to 100 %) on the command value potentiometer. The selected command value causes metering orifice (3) to be adjusted via the amplifier and the proportional solenoid. The inductive position transducer senses the position of metering orifice (3). Any deviations from the command value are corrected by the closed-loop position control.

Pressure compensator (4) keeps the pressure differential across metering orifice (3) always at a constant value. This ensures pressure compensation of the flow.

If the current regulator is used only within a range, which is significantly smaller than the maximum nominal flow provided from the valve, the response time of pressure compensator (4) can be shortened by limiting the pressure compensator stroke. Thus, undesirable start-up jumps can be reduced.
If the grub screw of stroke limiter (5) is at the left-hand limit stop (turned out), the pressure compensator stroke is not limited.

The low temperature drift is a result of the favourable design of the metering orifice.

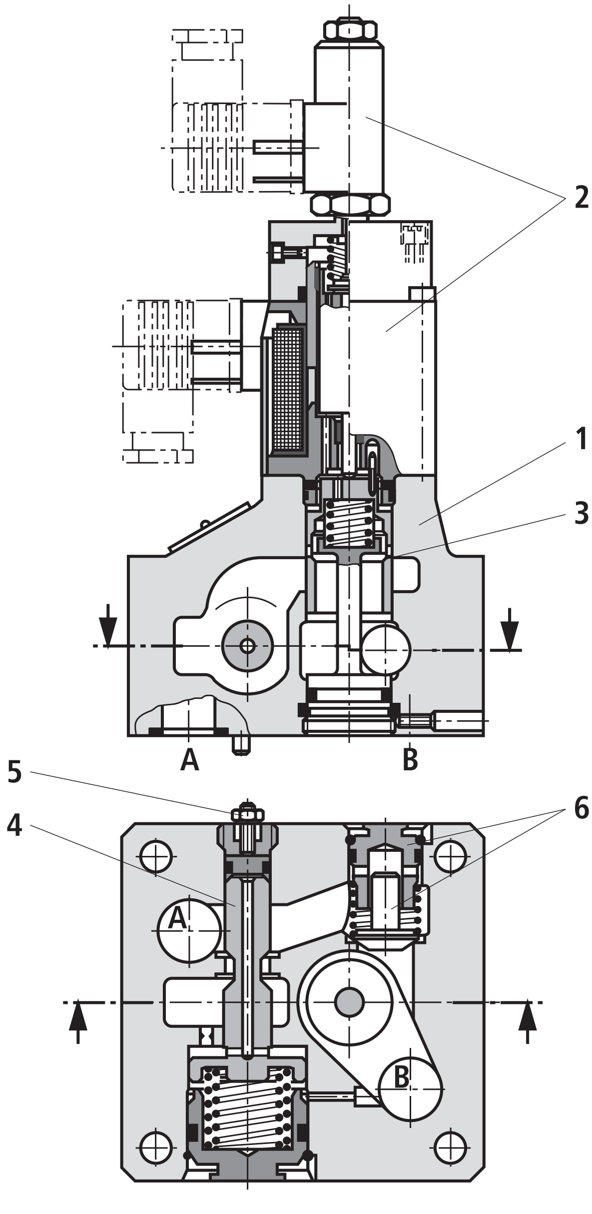
At a command value of 0 % the metering orifice is closed.

In the event of a power failure or cable break on the inductive position transducer, the metering orifice closes.

Starting from a 0 % command value, a jump-free start-up is possible. The metering orifice can be opened and closed with a delay provided by two ramps in the electrical amplifier.

Check valve (6) allows the free return flow from B to A.

The supply and return flow to and from the actuator can be controlled with the help of an additional rectifier sandwich plate of type Z4S… under the proportional flow control valve.



Technical data (for applications outside these parametes, please consult us!)

General

Size		Size	**10**					**16**			
Weight	– Proportional flow control valve	kg	6.1					8.5			
	– Rectifier sandwich plate	kg	3.2					9.3			
Installation orientation			Optional								
Storage temperature range		°C	– 20 to + 80								
Ambient temperature range		°C	– 20 to + 70								

Hydraulic – proportional flow control valve (measured with HLP46 and at ϑ_{oil} = 40 °C ± 5 °C)

Size		Size	**10**					**16**			
Max. operating pressure	in port A	bar	Up to 315								
Max. flow	– Linear	l/min	10	16	25	50	60	80	100	125	160
	– Progressive with rapid speed	l/min	40					–			
Minimum pressure differential		bar	3 to 8					6 to 10			
Δp with free flow B → A		bar	see diagram on page 9								
Flow control											
Temperature drift	– Hydraulic + electrical Δq_V /°C	%	0.1 of q_{Vmax}								
	– Pressure-compensated (up to Δp = 315 bar)	%	± 2 of q_{Vmax}								
Hydraulic fluid			Mineral oil (HL, HLP) to DIN 51524 Further hydraulic fluids on enquiry!								
Hydraulic fluid temperature range		°C	– 20 to + 80								
Viscosity range		mm^2/s	15 to 380								
Max. permissible degree of contamination of the hydraulic fluid - cleanliness class to ISO 4406 (c)			Class 20/18/15 [1)]								
Hysteresis		%	< ± 1 of q_{Vmax}								
Repeatability		%	< 1 of q_{Vmax}								
Manufacturing tolerance	Valve	%	≤ ± 2 at 33 % command value ≤ ± 5 at 100 % command value								
	– Amplifier VT-VRPA1-151 (analogue)	%	Amplifier must be matched to valve [2)]								
	– Amplifier module VT-MRPA1-151 (analogue)	%	Amplifier must be matched to valve [2)]								

Hydraulic – rectifier sandwich plate

Size	Size	**10**	**16**
Operating pressure	bar	Up to 315	
Cracking pressure	bar	1.5	
Nominal flow	l/min	60	160

[1)] The cleanliness classes specified for components must be adhered to in hydraulic systems. Effective filtration prevents malfunction and, at the same time, prolongs the service life of components.

For the selection of filters, see data sheets RE 50070, RE 50076, RE 50081, RE 0086 and RE 50088.

[2)] Due to tolerances of the oscillator frequency (position transducer supply), amplifiers are subject to tolerances.
When installing new systems or replacing an amplifier, the amplifier settings may have to be adjusted.

Technical data (for applications outside these parametes, please consult us!)

Electrical – proportional solenoid

Type of voltage			DC
Coil resistance	– Cold value at 20 °C	Ω	10
	– Max. hot value	Ω	13.9
Duty cycle		%	100
Max. current per solenoid		A	1.51
Electrical connection			With component plug to DIN EN 175301-803-A
			Cable socket to DIN EN 175301-803-A [1]
Type of protection to EN 60529			IP 65 [2], with cable socket mounted and locked

Electrical – inductive position transducer

Coil resistance	Total resistance of coils between		1 and 2	2 and ⏚	⏚ and 1
at 20 °C (see page 6)		Ω	31.5	45.5	31.5
Electrical connection			With component plug GSA20		
			Cable socket GM209N (Pg 9) [1]		
Inductance		mH	6 to 8		
Oscillator frequency		kHz	2.5		
Electrical position measuring system			Differential throttle		
Nominal stroke		mm	4		
Type of protection to EN 60529			IP 65 [2], with cable socket mounted and locked		

Control electronics (separate order)

Associated amplifier in Euro-card format	Type VT-VRPA1-151-1X (analogue) to data sheet RE 30118
Associated amplifier module	Type VT-MRPA1-151-1X (analogue) to data sheet RE 30221

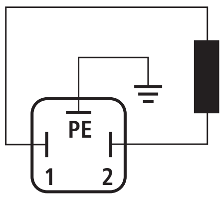
[1] Separate order, see page 6

[2] Due to the surface temperatures of solenoid coils, observe European standards DIN EN563 and DIN EN982!

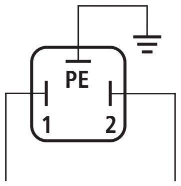
Electrical connection, cable sockets (nominal dimensions in mm)

Proportional solenoid

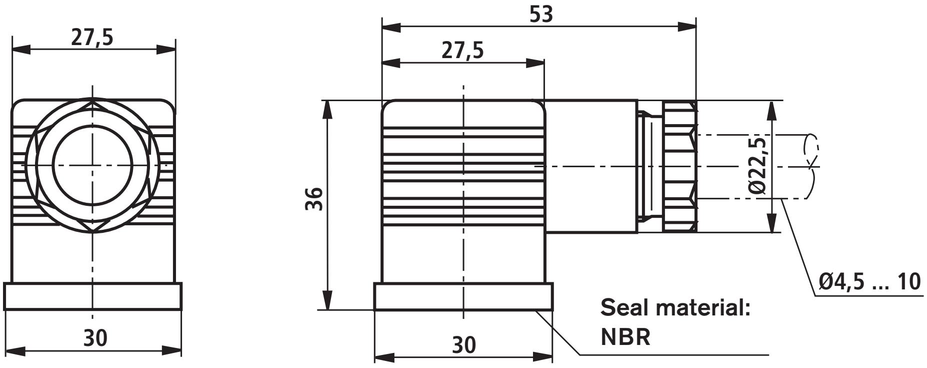
Connection to component plug



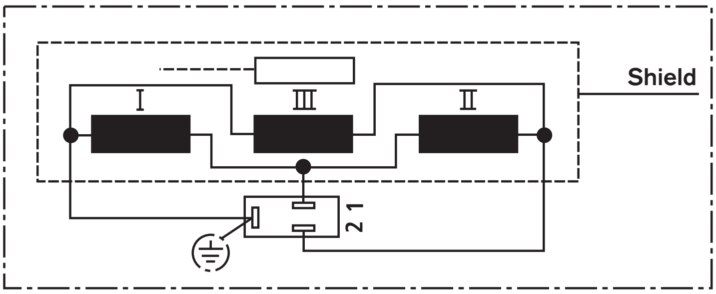
Connection to cable socket



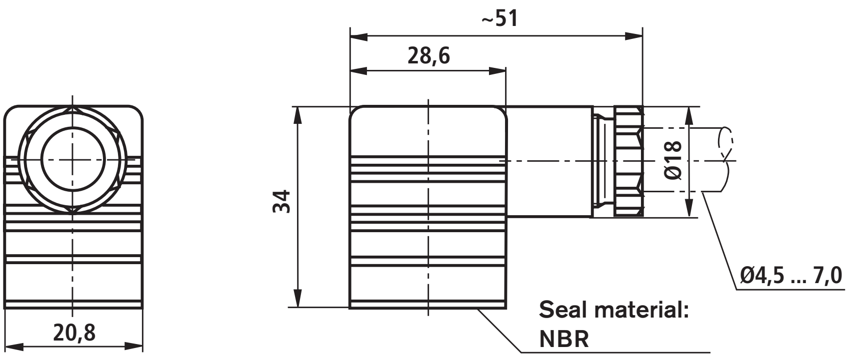
Cable socket to DIN EN 175301-803-A
Separate order stating material no. **R901017011**
(plastic version)



Inductive position transducer

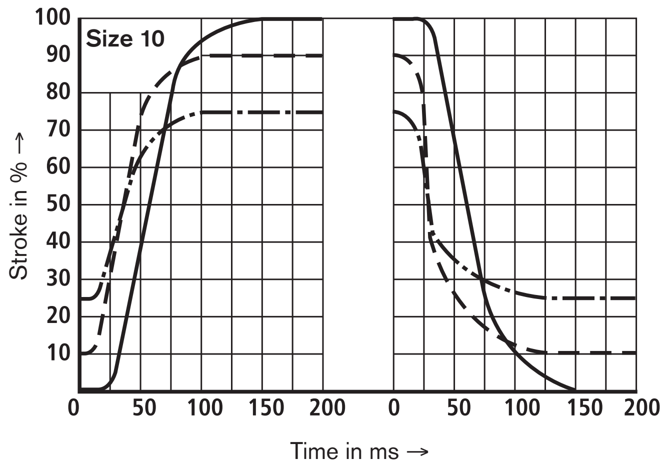


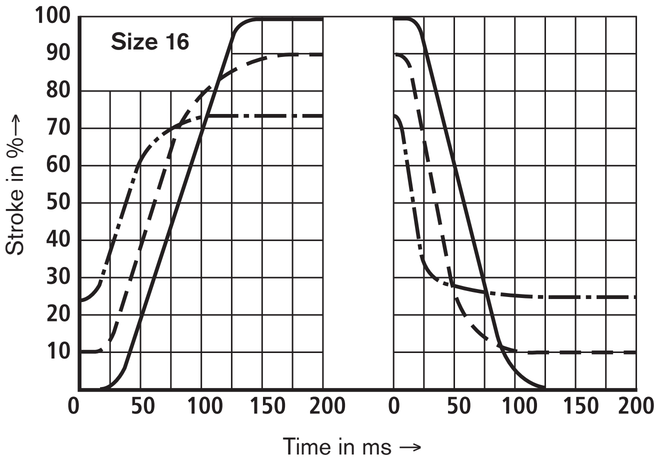
Cable socket Pg 9
Separate order stating material no. **R900013674**
(plastic version)



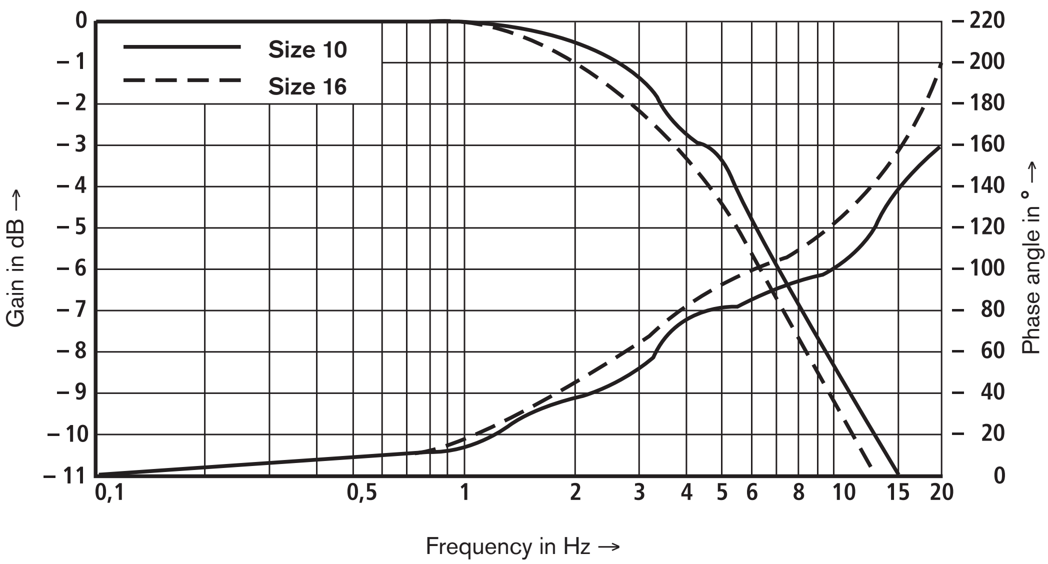
Characteristic curves (measured at $\nu = 41$ mm²/s and $\vartheta = 50$ °C; $p_{nom} = 50$ bar; Amplitude 0 → 100 %; size 10 type 60L / size 16 type 160L)

Transient function at stepped command value change



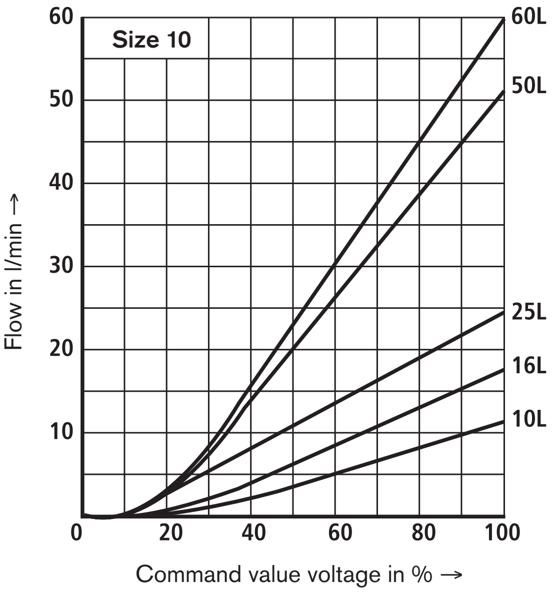


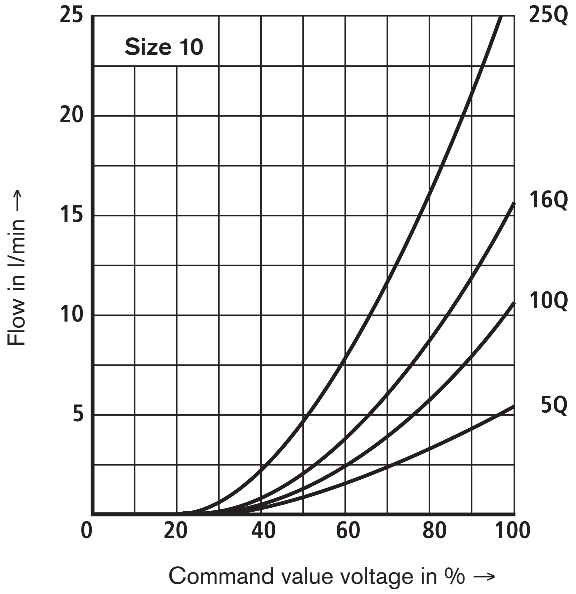
Frequency response characteristic curves

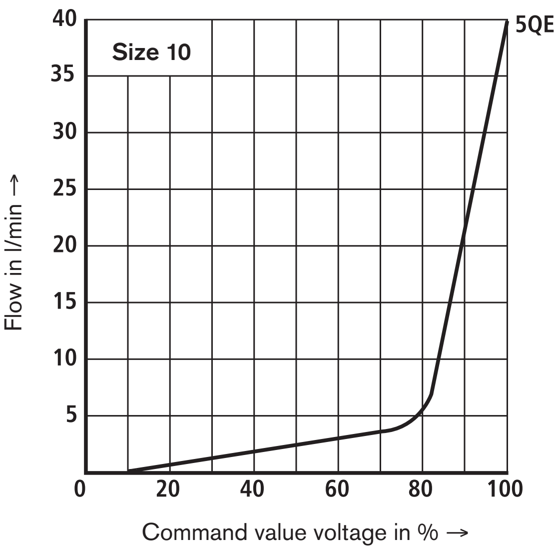


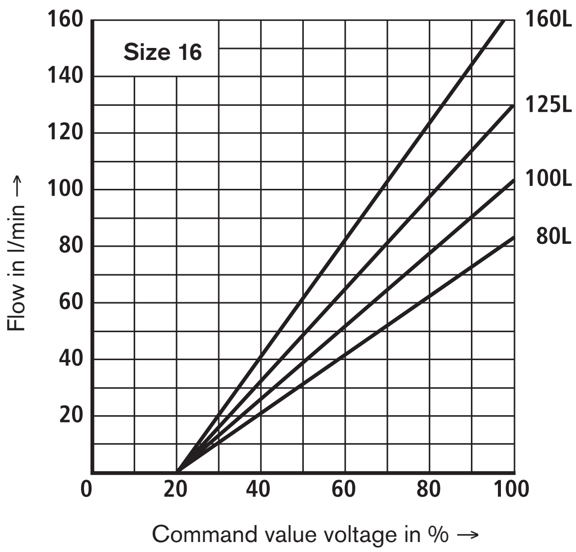
Characteristic curves (measured at $\nu = 41$ mm^2/s and $\vartheta = 50$ °C)

Dependence of flow on command value voltage (flow control from A → B)



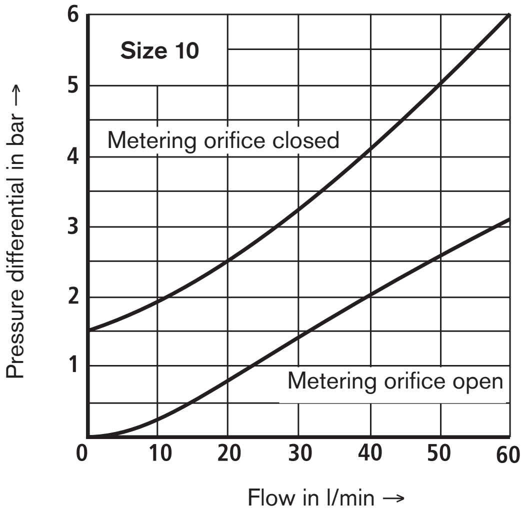


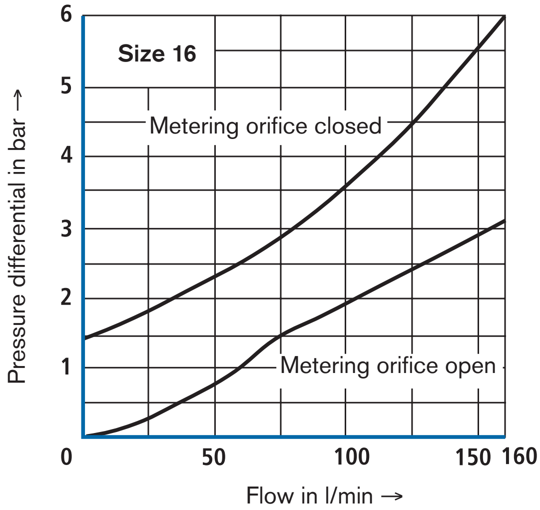




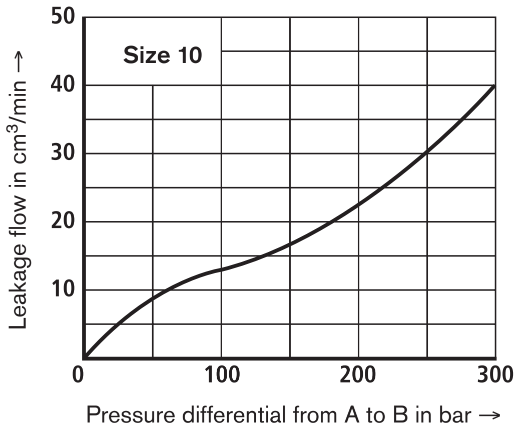
Characteristic curves (measured at $\nu = 41\ mm^2/s$ and $\vartheta = 50\ °C$)

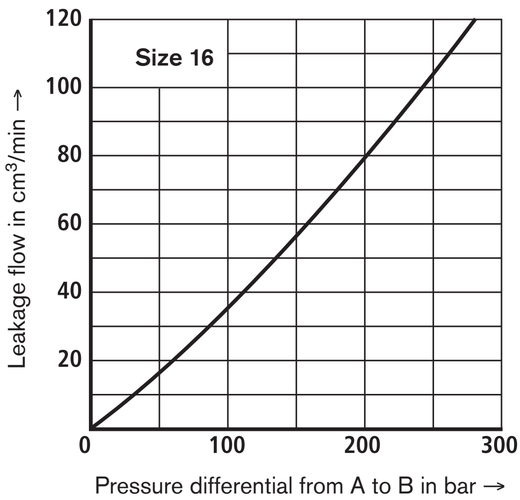
Pressure differential across check valve B → A





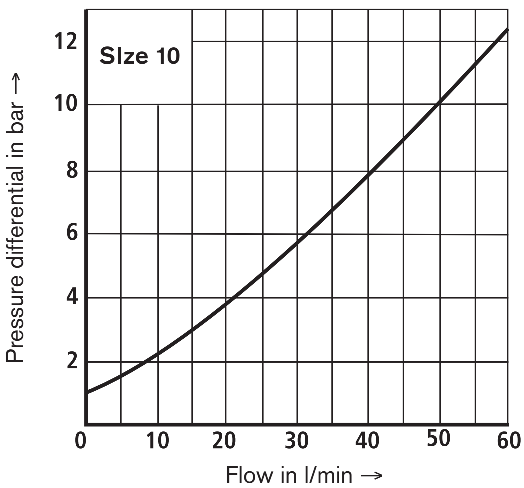
Leakage flow from A → B

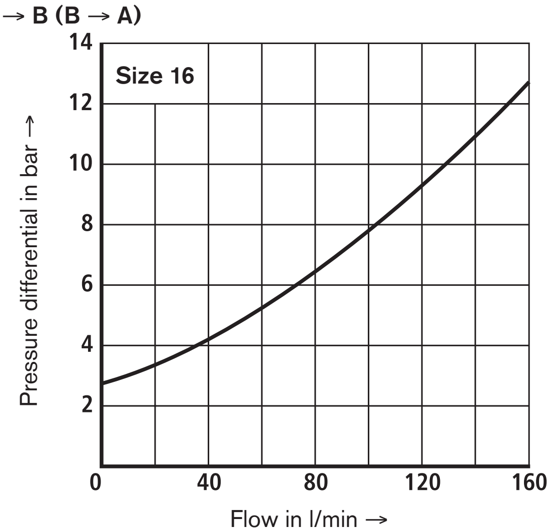




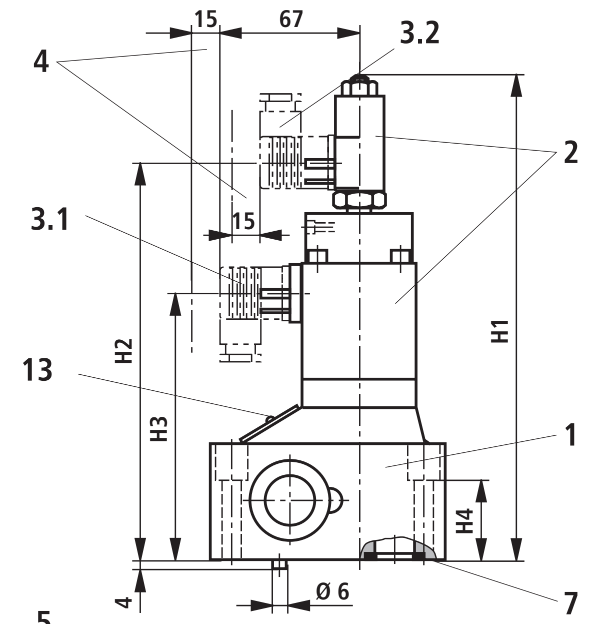
Rectifier sandwich plate

Pressure differential identical in both directions of flow
Flow from A → B (B → A)



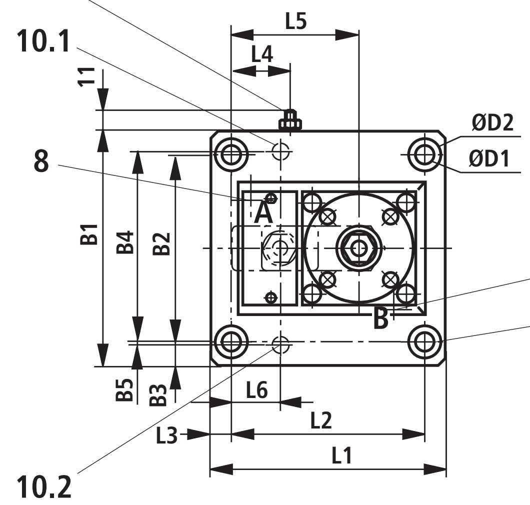


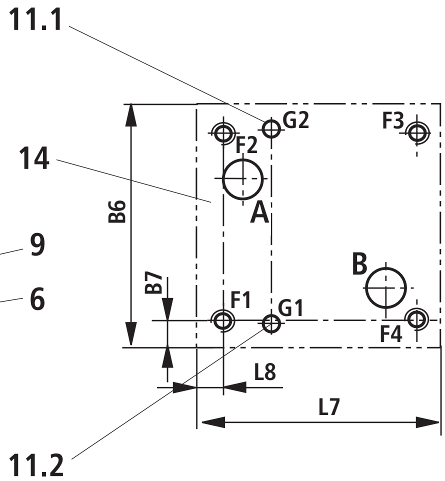
Unit dimensions: Proportional flow control valve (nominal dimensions in mm)



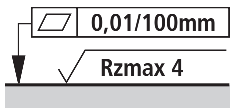
Size	10	16
B1	95	123.5
B2	76	101.5
B3	9.5	11
B4	79.4	102.4
B5	–	0.8
B6	97	126
B7	10.5	12
ØD1	9	11
ØD2	15	18
H1	245	255.5
H2	200	210
H3	210	140
H4	48	51

Size	10	16
L1	102.5	123.5
L2	82.5	101.5
L3	10	11
L4	24	31
L5	62.5	72.5
L6	23.8	28.6
L7	105	126
L8	11	12





Required surface quality of the valve contact face



1 Valve housing

2 Proportional solenoid with inductive position transducer

3.1 Cable socket for proportional solenoid; separate order, see page 6

3.2 Cable socket for position transducer (separate order, see page 6)

4 Space required to remove cable socket

5 Setscrew of pressure compensator limiter, hexagon socket A/F 3, lock nut A/F 10

6 Valve fixing screws (separate order, see page 11)

7 Identical seal rings for ports A and B

8 Port A

9 Port B

10.1 Locating pin for sizes 10 and 16

10.2 Locating pin for size 16

Tolerances to: – General tolerances ISO 2768-mK

11.1 Locating bore for locating pin for sizes 10 and 16

11.2 Locating bore for locating pin for size 16

13 Nameplate

14 Machined valve mounting face,
Size 10 - position of ports to ISO 6263-06-05-0-97
Size 16 - position of ports to ISO 6263-09-05-0-97

Subplates to data sheet RE 45066 and valve fixing screws must be ordered separately.

Subplates:	**Size 10**	**Size 16**
	G279/01 (G1/2)	G281/01 (G1)
	G280/01 (G3/4)	G282/01 (G1 1/4)

Unit dimensions: Valve fixing screws (separate order)

Without rectifier sandwich plate

Size 10
The following valve fixing screws are recommended:

4 socket head cap screws to ISO 4762 - M8 x 60 - 10.9-flZn-240h-L
(Friction coefficient 0.09 to 0.14 to VDA 235-101);
tightening torque M_T = 30 Nm ± 10%,
material no. **R913000217**

or

4 socket head cap screws to ISO 4762 - M8 x 60 - 10.9
(Friction coefficient 0.08 to 0.6 to VDI2230,
tempering, black);
tightening torque M_T = 34 Nm ± 10%

Size 16
The following valve fixing screws are recommended:

4 socket head cap screws to ISO 4762 - M10 x 70 - 10.9-flZn-240h-L
(Friction coefficient 0.09 to 0.14 to VDA 235-101);
tightening torque M_T = 64 Nm ± 10%,
material no. **R913000126**

or

4 socket head cap screws to ISO 4762 - M10 x 70 - 10.9
(Friction coefficient 0.08 to 0.16 to VDI 2230,
tempering, black);
tightening torque M_T = 75 Nm ± 10%,

With rectifier sandwich plate

Size 10
The following valve fixing screws are recommended:

4 socket head cap screws to ISO 4762 - M8 x 120 - 10.9-flZn-240h-L
(Friction coefficient 0.09 to 0.14 to VDA 235-101);
tightening torque M_T = 30 Nm ± 10%,
material no. **R913000423**

or

4 socket head cap screws to ISO 4762 - M8 x 120 - 10.9
(Friction coefficient 0.08 to 0.16 to VDI2230,
tempering, black);
tightening torque M_T = 34 Nm ± 10%

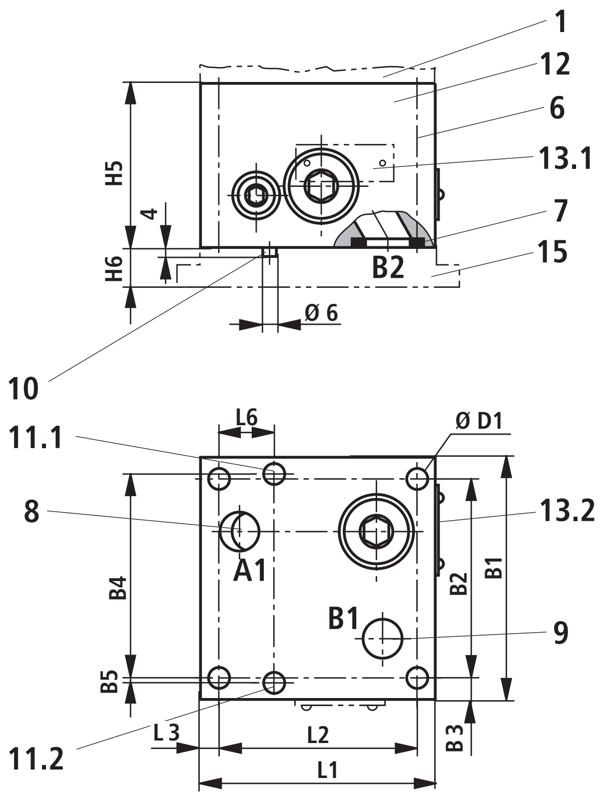
Size 16
The following valve fixing screws are recommended:

4 socket head cap screws to ISO 4762 - M10 x 160 - 10.9-flZn-240h-L
(Friction coefficient 0.09 to 0.14 to VDA 235-101);
tightening torque M_T = 64 Nm ± 10%,
material no. **R913000072**

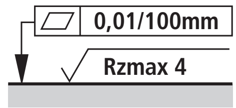
or

4 socket head cap screws to ISO 4762 - M10 x 160 - 10.9
(Friction coefficient 0.08 to 0.6 to VDI 2230,
tempering, black);
tightening torque M_T = 75 Nm ± 10%,

Unit dimensions: Rectifier sandwich plate (nominal dimensions in mm)



Size	10	16
B1	95	123.5
B2	76	101.5
B3	9.5	11
B4	79.4	102.4
B5	–	0.8
ØD1	9	11
H5	60	85
H6	30	40
L1	102.5	123.5
L2	82.5	101.5
L3	10	11
L6	23.8	28.6



Required surface quality of valve contact face

Tolerances to:
– General tolerances ISO 2768-mK

1 Valve housing
6 Valve fixing screws (separate order, see page 11)
7 Identical seal rings for A and B
8 Port A1 (A2)
9 Port B1 (B2)
10 Locating pin (position like items 11.1 and 11.2)
11.1 Locating bore for locating pin for sizes 10 and 16
11.2 Locating bore for locating pin for size 6
12 Rectifier sandwich plate
13.1 Nameplate (rectifier sandwich plate size 10)
13.2 Nameplate (rectifier sandwich plate size 16)
15 Subplate (separate order)

Subplates to data sheet RE 45066 and valve fixing screws must be ordered separately.

Subplates:	**Size 10**	**Size 16**
	G279/01 (G1/2)	G281/01 (G1)
	G280/01 (G3/4)	G282/01 (G1 1/4)

Rexroth
Bosch Group

Proportional flow control valve, without position control

RE 29219/04.07
Replaces: 08.05

Type 3(2)FREX

Nominal size (NG) 6, 10
Unit series 1X
Maximum working pressure 250 bar
Nominal flow rate Q_{nom} 7.5...60 l/min

List of contents

Features

- Directly controlled flow control valves NG6 and NG10
- 2- or 3-way function is determined by how the hydraulic ports are assigned (residual flow runs through port P, 3rd way). Symbol “NO” (normally open) can only be implemented as a 2-way function
- Adjustable by means of the solenoid current, see Characteristic Curve, Technical Data and the selected valve electronics
- Solenoid version $I_{max} = 2.5$ A
- For subplate attachment, mounting hole configuration NG6 to ISO 4401-03-02-0-05, NG10 to ISO 4401-05-04-0-05
- Subplates as per catalog sheet, RE 45053 for NG6, RE 45055 for NG10 (order separately)
- Plug-in connector to DIN 43650-AM2 included in scope of delivery
- External trigger electronics with ramps and valve calibration in the following versions/designs (order separately)
  - Plug, setpoint 0...+10 V or 4...20 mA, RE 30264
  - Module, setpoint 0...+10 V, RE 30222
  - Europe card format, setpoint 0...+10 V, RE 30109

Ordering data

	FRE	X		B –1X/		L		G24–25		Z4	M	M

3-way **= 3**
2-way **= 2**

Proportional flow control valve, without position control

Without inductive position transducer **= X**

NG6 **= 6**
NG10 **= 10**

Without external closing fixture for pressure compensator **= B**

Unit series 10 to 19 **= 1X**
(10 to 19: installation and connection dimensions unchanged)

Nominal flow rate
7.5 l/min at NG6 **= 7.5**
15 l/min at NG6 **= 15**
35 l/min at NG6 **= 35**
60 l/min at NG10 **= 60**
70 l/min at NG10 **= 70**

Flow characteristic (L = linear) **= L**

Setpoint input +10 V, Q_{min} (NO) **= 1**
Setpoint input +10 V, Q_{max} (NC) **= 2**

M = NBR seals, suitable for mineral oils (HL, HLP) to DIN 51524

M = Without non-return valve

Z4 = **Electrical connection**
Unit plug to DIN 43650-AM2
Plug-in connector included in scope of delivery

N9 = Covered manual auxiliary override
N12 = Manual auxiliary override, screwable with counter nut

Solenoid type (current)
25 = Solenoid current 2.5 A

G24 = Voltage supply of trigger electronics 24 V DC

Preferred types

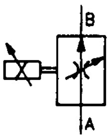
NG6 Solenoid 2.5 A		**NG10 Solenoid 2.5 A**	
Type	**Material Number**	**Type**	**Material Number**
FREX6B–1X/15L1G24–25N9Z4MM	0 811 403 123	FREX10B–1X/70L1G24–25N9Z4MM	0 811 403 013
FREX6B–1X/7,5L2G24–25N9Z4MM	0 811 403 112	FREX10B–1X/60L2G24–25N9Z4MM	0 811 403 010
FREX6B–1X/35L2G24–25N9Z4MM	0 811 403 113	FREX10B–1X/60L2G24–25N12Z4MM	0 811 403 011

Symbols

For external trigger electronics

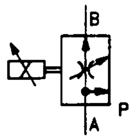
2-way, normally open

NO



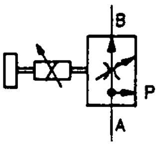
3-way, normally closed

NC



3-way, normally closed
with manual auxiliary override

NC

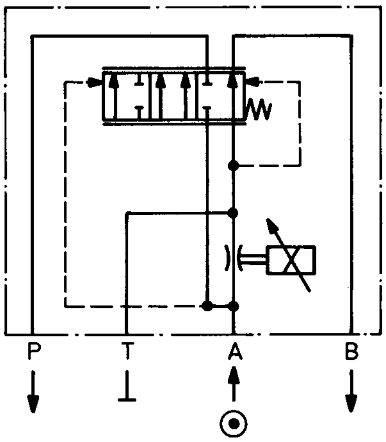


General
Flow control valves are directly actuated throttle valves with integrated pressure compensator.

Direction of flow
"3-way design" proportional flow control valves that are normally closed may be employed either as 2-way or 3-way flow control valves.

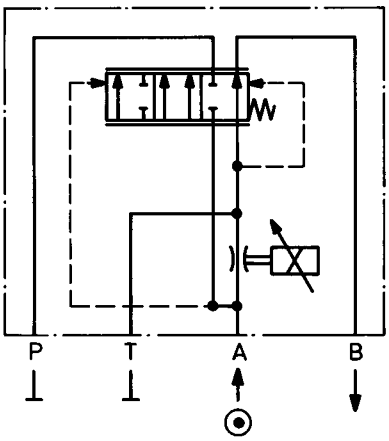
3-way flow control valve

A: Supply
B: Discharge
P: Residual flow, capacity up to 250 bar, or tank
T: Closed



2-way flow control valve

A: Supply
B: Discharge
P: } Closed
T: }



Note
Flow control valves with a normally open basic position may only be used as 2-way valves.

Function, sectional diagram

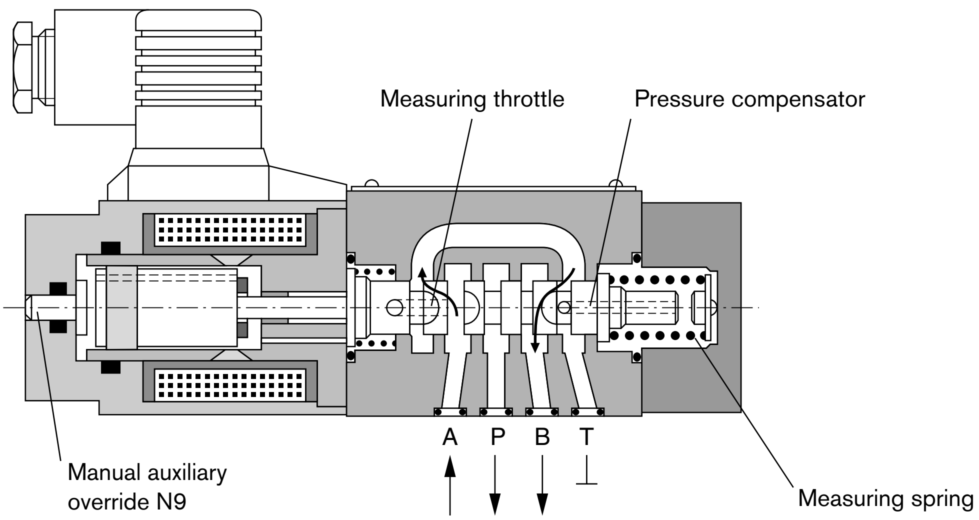
General

Type 3(2)FREX proportional flow control valves without position control are available in nominal sizes 6 and 10. They are actuated by means of a proportional solenoid. Hysteresis is < 5 %, the valve amplifier electronics are available in various designs.
The symbol “NO”, normally open, can only be used as a 2-way flow control valve (type 2FREX).
The symbol “NC”, normally closed, can be used as a 3 or a 2-way flow control valve.
The design of the valve body is such that, in the 3-way version, the residual flow runs through port P.
In the 2-way version, the flow runs from A to B (P and T are closed).

Basic principle

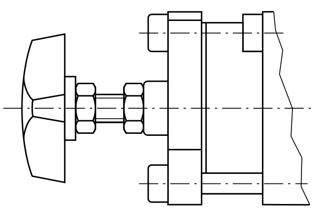
To adjust the oil flow rate, a setpoint is set in the trigger electronics. Based on this setpoint, the electronics control the solenoid coil with regulated PWM (pulse-width-modulated) current. The current is modulated with a dither, ensuring low hysteresis. The proportional solenoid converts the current to a mechanical force, with which an armature plunger acts on a spool to push against the spring. This then achieves a position that conforms to the characteristic curve of the spring. The valve opening is determined by the metering edges on the spool, and the integrated pressure compensator compares the pressure drop by means of a 4- or 8-bar measuring spring.
The pressure compensator with measuring spring regulates the pressure before the throttling edge according to the simplified formula:
“Load pressure plus force of measuring spring”.
In this way, the pressure drop over the metering edge is maintained at a constant level.

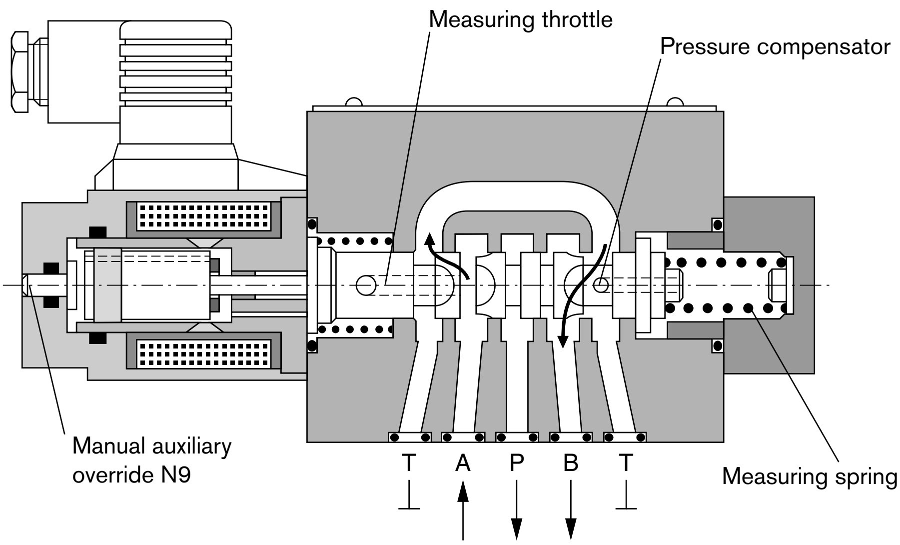
NG6



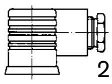
NG10

Manual auxiliary override N12





Accessories

Type				Material Number
(4x) ISO 4762-M5x30-10.9	Cheese-head bolts NG6			2 910 151 166
(4x) ISO 4762-M6x35-10.9	Cheese-head bolts NG10			2 910 151 207
Plug 	VT-SSPA1-525-20/V0	(2.5 A)	RE 30264	0 811 405 143
	VT-SSPA1-525-20/V0/I	(2.5 A)		0 811 405 145
Module 	VT-MSPA1-525-10/V0	(2.5 A)	RE 30222	0 811 405 127
Europe card 	VT-VSPA1-525-10/V0/RTP	(2.5 A)	RE 30109	0 811 405 079
Plug-in connector  2P+PE	Plug-in connector 2P+PE (M16x1.5) included in scope of delivery, see also RE 08008			

Testing and service equipment

Test box type VT-PE-TB1, see RE 30063
Current measuring adapter type VT-PA-5, see RE 30073

Technical data

General

Construction		Spool-type valve with integrated pressure compensator
Actuation		Proportional solenoid without position control, manual auxiliary override, external amplifier
Connection type		Subplate, mounting hole configuration NG6 (ISO 4401-03-02-0-05), NG10 (ISO 4401-05-04-0-05)
Mounting position		Optional
Ambient temperature range	°C	–20...+50
Weight	NG6 kg	2.0 (2.2 with manual auxiliary override)
	NG10 kg	5.8 (6.0 with manual auxiliary override)
Vibration resistance, test condition		Max. 25 g, shaken in 3 dimensions (24 h)

Hydraulic (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

Pressure fluid		Hydraulic oil to DIN 51524...535, other fluids after prior consultation				
Viscosity range	recommended mm²/s	20...100				
	max. permitted mm²/s	10...800				
Pressure fluid temperature range	°C	–20...+80				
Maximum permitted degree of contamination of pressure fluid Purity class to ISO 4406 (c)		Class 18/16/13 [1)]				
Direction of flow, see symbol		**NG6**			**NG10**	
Nominal flow rate Q_B with closed-loop control	l/min	7.5	15	35	60	70
Supply flow rate $Q_{A\,max}$	l/min	30	(NO)	40	65	(NO)
Minimum pressure drop $p_A > p_B$	bar	10	10	22	22	22
Max. working pressure	bar	Port A, B: 250 Port T: Closed Port P: Closed or residual flow 250 bar				

Electrical

Cyclic duration factor	%	100
Degree of protection		IP 65 to DIN 40050 and IEC 14434/5
Solenoid connection		Unit plug DIN 43650/ISO 4400, M16x1.5 (2P+PE)
Valve with solenoid type	A	2.5
Max. solenoid current I_{max}	A	2.5
Coil resistance R_{20}	Ω	3
Max. power consumption at 100 % load and operating temperature	VA	30

Static/Dynamic [2)]

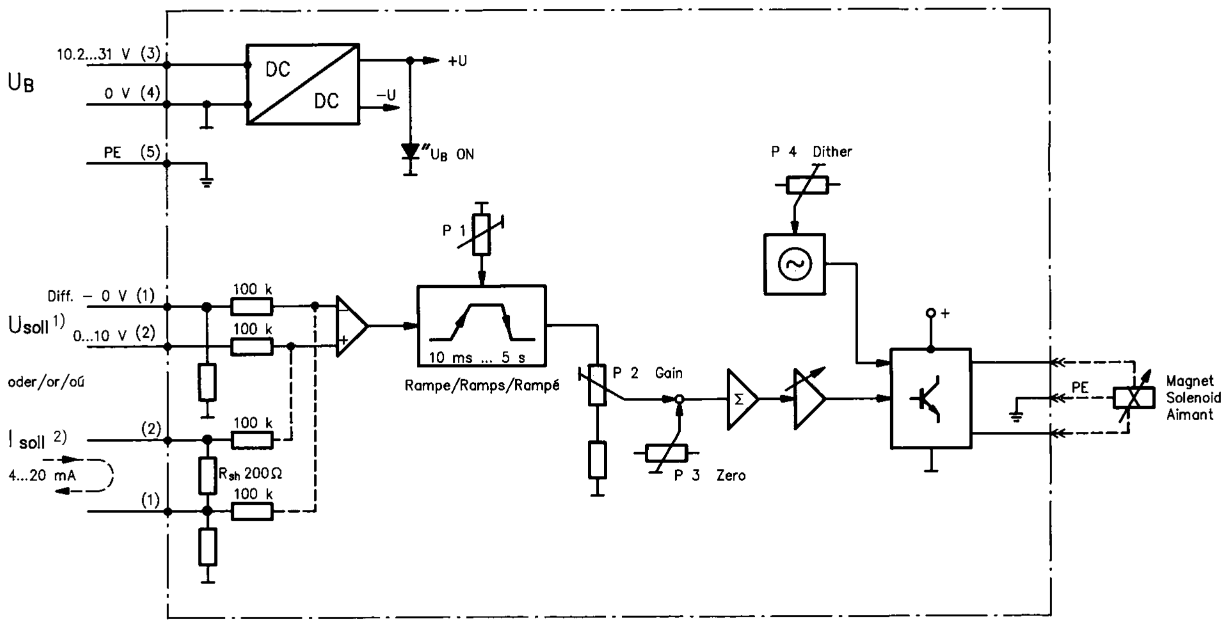
Hysteresis	%	≤ 5 from qv_{max}
Range of inversion	%	≤ 3 from qv_{max}
Manufacturing tolerance	%	≤ 20 from qv_{max}
Response time 100 % signal change	ms	On < 70
Correction time on max. load change (pressure compensator)		NG6 ≤ 30 NG10 ≤ 45

1) The purity classes stated for the components must be complied with in hydraulic systems. Effective filtration prevents problems and also extends the service life of components. For a selection of filters, see catalog sheets RE 50070, RE 50076 and RE 50081.

2) All characteristic values ascertained using amplifier 0 811 405 079 for the 2.5 A solenoid.

Valve with external trigger electronics (plug, RE 30264)

Circuit diagram/pin assignment



1) Version with 0...+10 V signal

2) Version with 4...20 mA signal

Connection/calibration

P1 – Ramp time

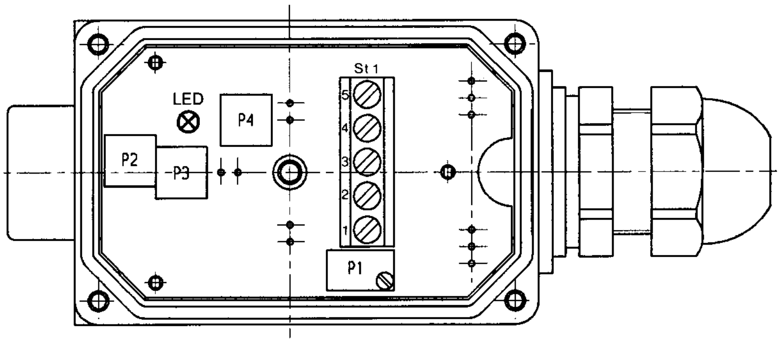
P2 – Sensitivity

P3 – Zero

P4 – Dither frequency

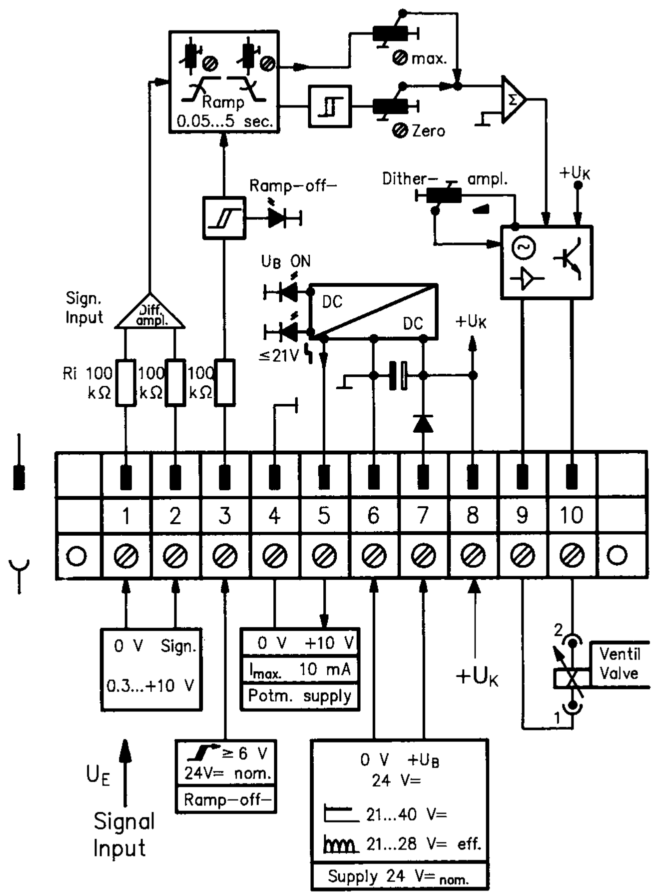
St1 – Terminal

LED – U_B display

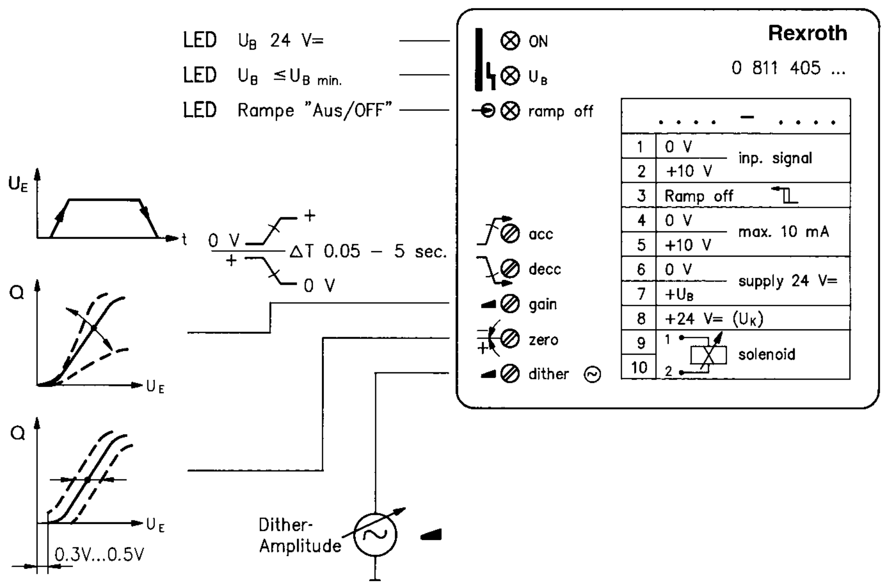


Valve with external trigger electronics (module, RE 30222)

Circuit diagram/pin assignment

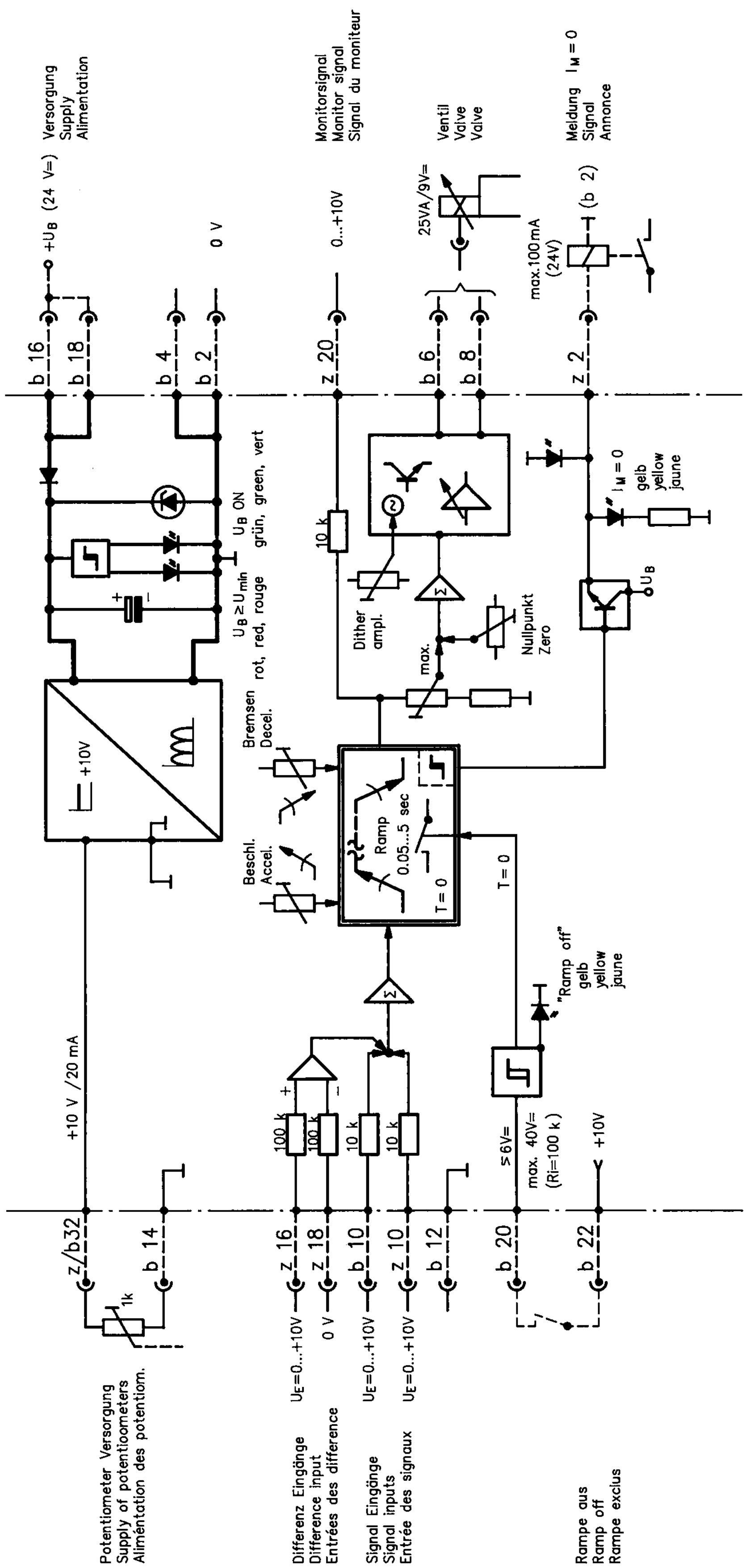


Front view/calibration



Valve with external trigger electronics (europe card, RE 30109)

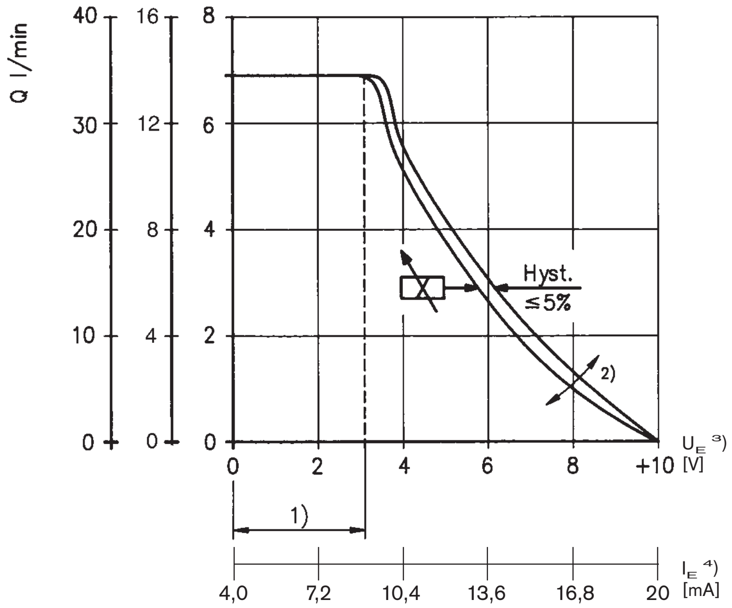
Circuit diagram/pin assignment



Characteristic curves NG6 (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

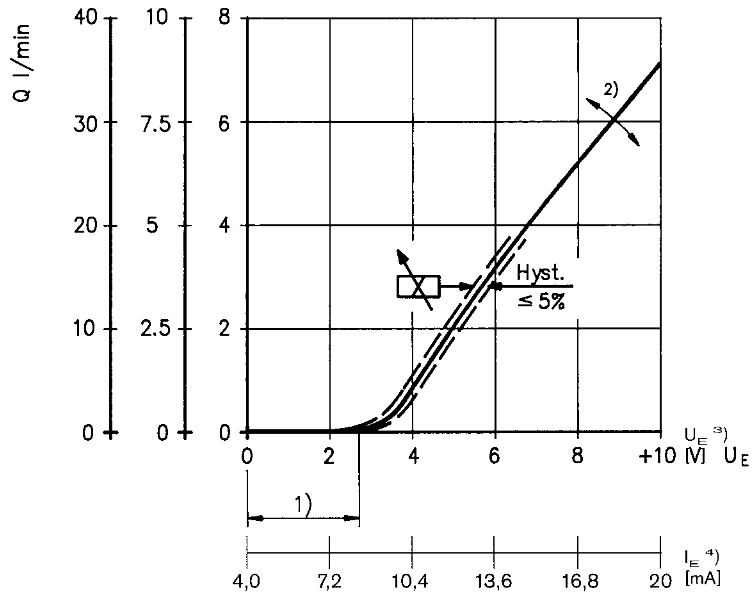
Q_{nom} = 7.5/15/35 l/min

Basic position open “NO”
(2-way version)



Q_{nom} = 7.5/15/35 l/min

Basic position closed “NC”
(3- or 2-way version)



Valve amplifier

1) Zero adjustment

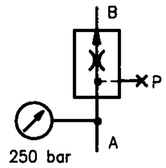
2) Sensitivity adjustment

3) Version: U_E = 0...+10 V

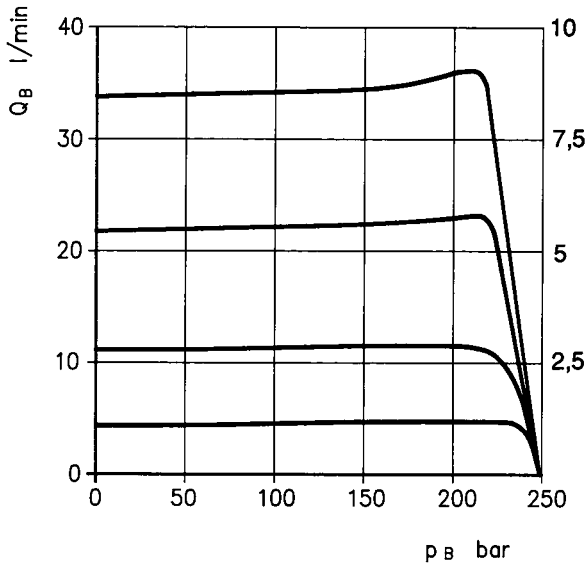
4) Version: I_E = 4...20 mA

Characteristic curves NG6 (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

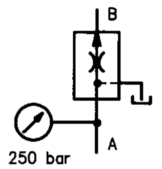
2-way version



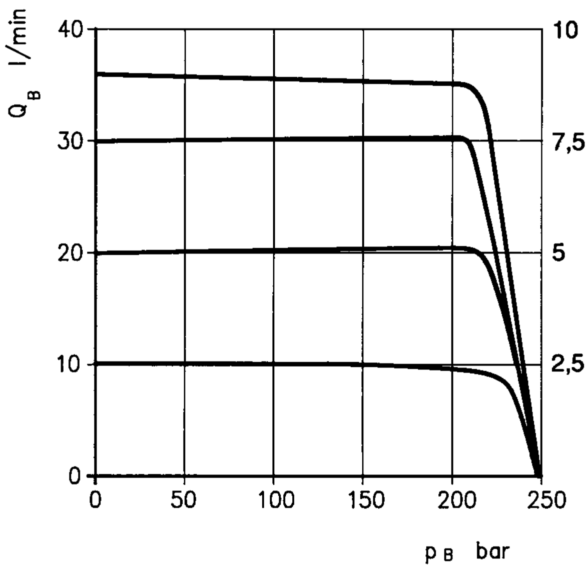
Q_{nom} = 7.5/15/35 l/min



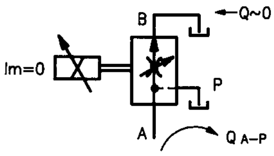
3-way version

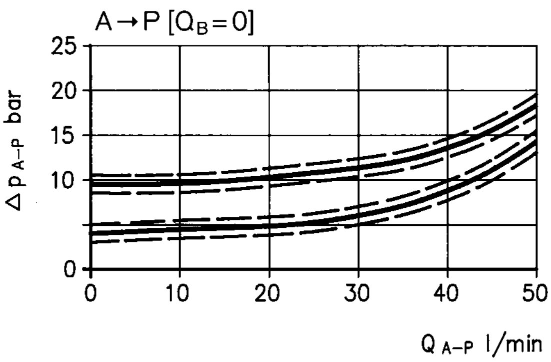


Q_{nom} = 7.5/15/35 l/min



Residual flow "A–P"
(pressure drop)

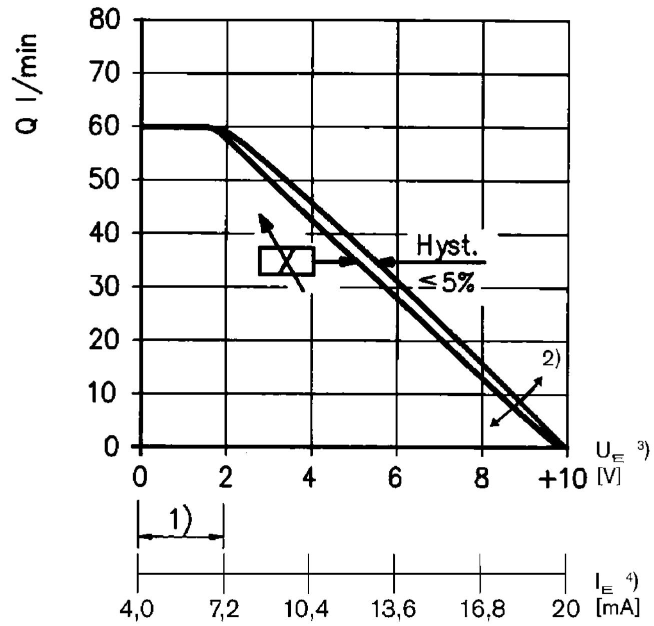




Characteristic curves NG10 (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

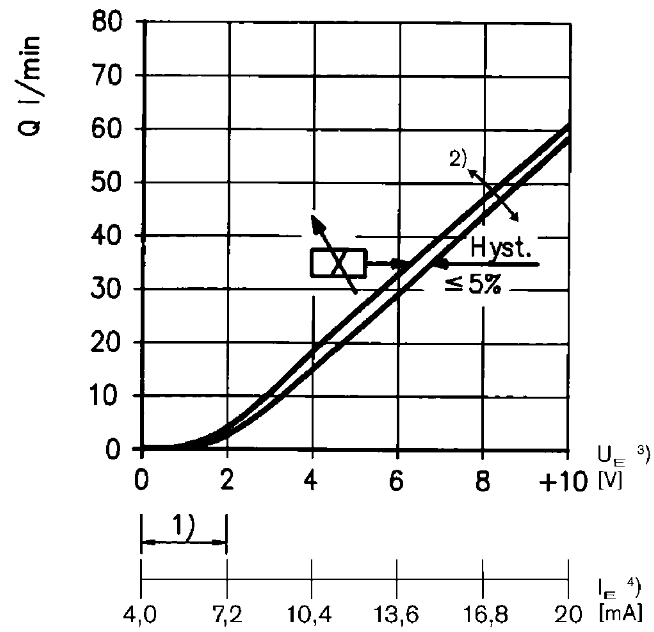
Q_{nom} = 60 (70) l/min

Basic position open "NO"
(2-way version)



Q_{nom} = 60 l/min

Basic position closed "NC"
(3- or 2-way version)



Valve amplifier

[1] Zero adjustment

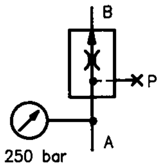
[2] Sensitivity adjustment

[3] Version: U_E = 0...+10 V

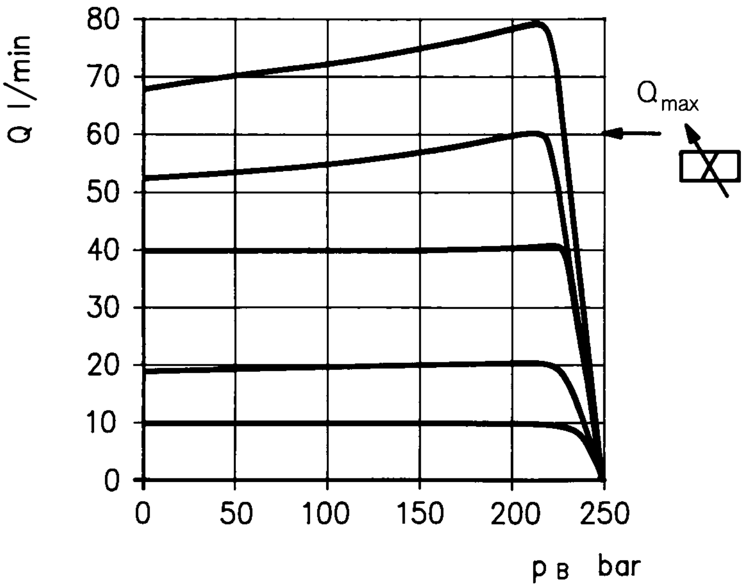
[4] Version: I_E = 4...20 mA

Characteristic curves NG10 (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

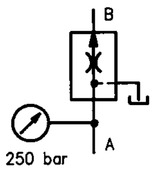
2-way version



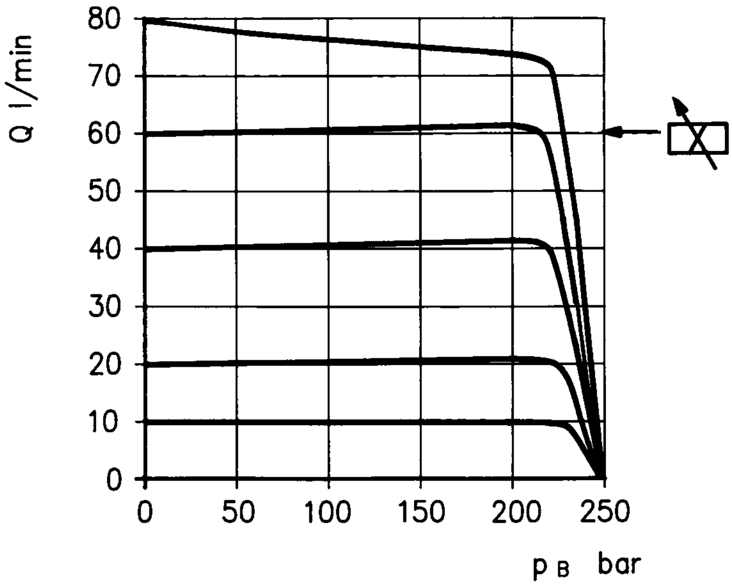
Q_{nom} = 60 (70) l/min



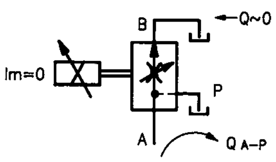
3-way version

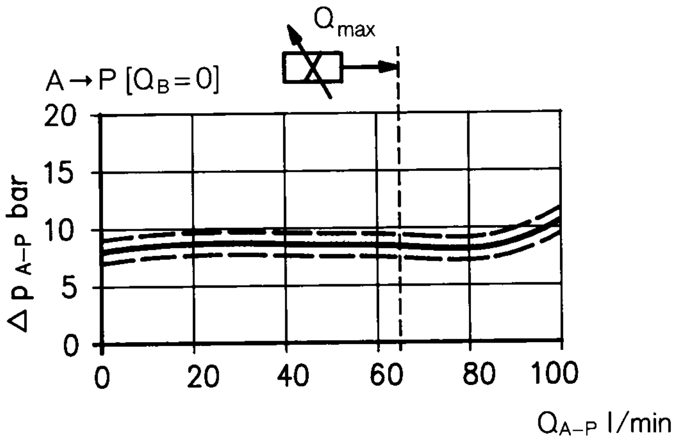


Q_{nom} = 60 l/min

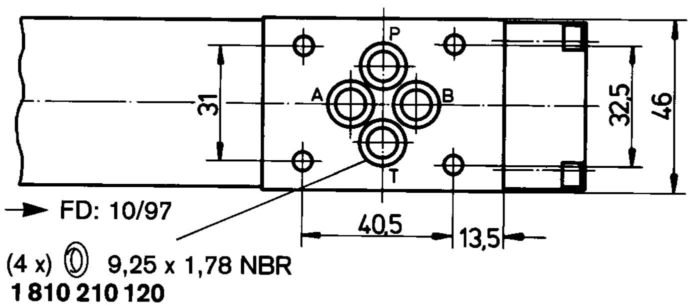


Residual flow "A–P"
(pressure drop)

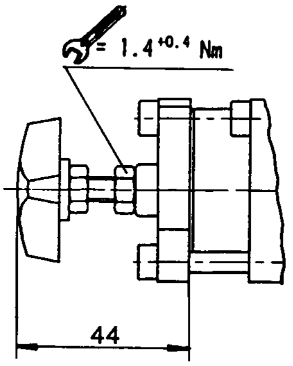


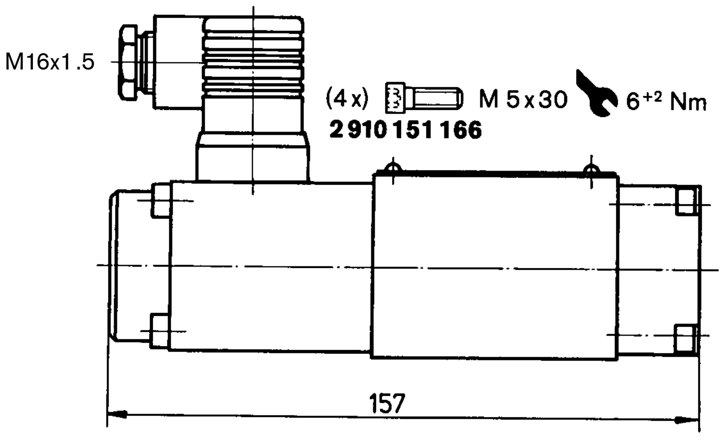


Unit dimensions NG6 (nominal dimensions in mm)

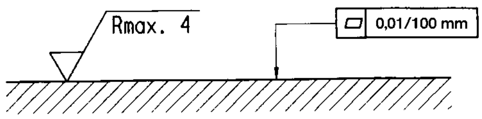


Manual auxiliary override N12



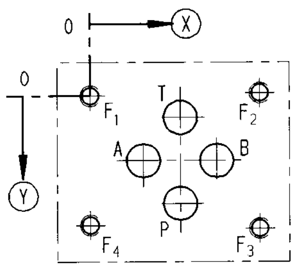


Required surface quality
of mating component



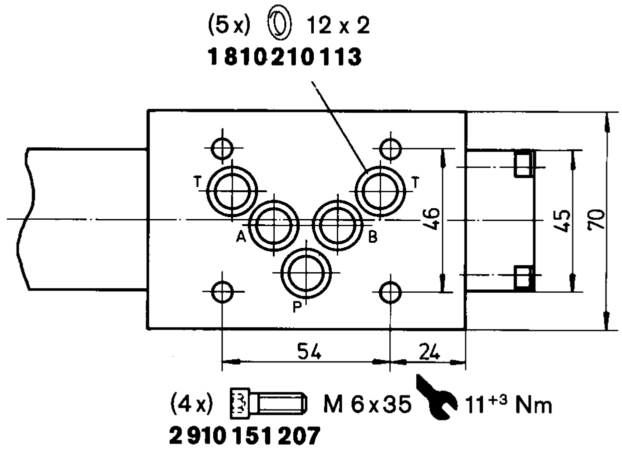
Mounting hole configuration: NG6 (ISO 4401-03-02-0-05)
For subplates, see catalog sheet RE 45053

[1] Deviates from standard
[2] Thread depth:
Ferrous metal 1.5 x Ø
Non-ferrous 2 x Ø

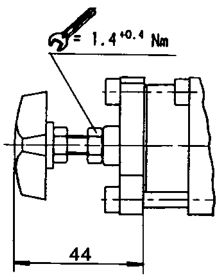


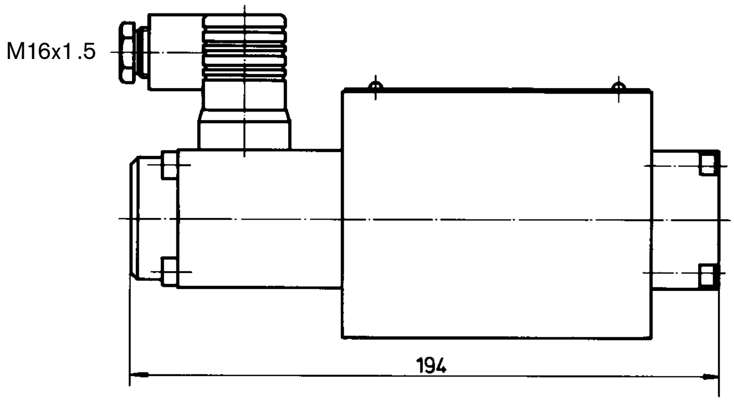
	P	A	T	B	F_1	F_2	F_3	F_4
X	21.5	12.5	21.5	30.2	0	40.5	40.5	0
Y	25.9	15.5	5.1	15.5	0	–0.75	31.75	31
Ø	8 [1]	8 [1]	8 [1]	8 [1]	M5 [2]	M5 [2]	M5 [2]	M5 [2]

Unit dimensions NG10 (nominal dimensions in mm)

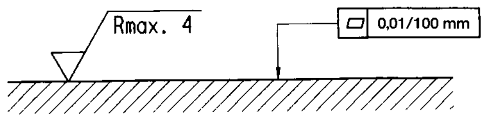


Manual auxiliary override N12

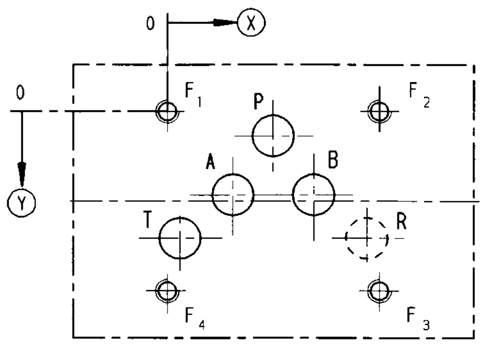




Required surface quality
of mating component



Mounting hole configuration: NG10 (ISO 4401-05-04-0-05)
For subplates, see catalog sheet RE 45055



1) Deviates from standard
2) Thread depth:
Ferrous metal 1.5 x Ø*
Non-ferrous 2 x Ø

* NG10 min. 10.5 mm

	P	A	T	B	F_1	F_2	F_3	F_4	R
X	27	16.7	3.2	37.3	0	54	54	0	50.8
Y	6.3	21.4	32.5	21.4	0	0	46	46	32.5
∅	10.5 1)	10.5 1)	10.5 1)	10.5 1)	M6 2)	M6 2)	M6 2)	M6 2)	10.5 1)

Rexroth
Bosch Group

Proportional flow control valve, with inductive position transducer

Type 3FREZ

Nominal size 6, 10
Unit series 1X
Maximum working pressure 250 bar
Nominal flow rate Q_{nom} 2.6...80 l/min

Overview of Contents

Features

– Directly controlled flow control valves NG6 and NG10
– With position control, minimal hysteresis < 1 %, see Technical Data
– The 3-way function is determined by how the hydraulic ports are assigned (residual flow runs through port P, 3rd way).
– Adjustable by means of the controlled solenoid position, the position transducer and the external valve electronics
– Solenoid version $I_{max} = 2.7$ A
– For subplate attachment, mounting hole configuration NG6 to ISO 4401-03-02-0-94, NG10 to ISO 4401-05-04-0-94
– Subplates as per catalog sheet, RE 45053 for NG6, RE 45055 for NG10 (order separately)
– Plug-in connector to DIN 43650-AM2 for the solenoid and plug-in connector for the position transducer, included in scope of delivery
– Data for the external trigger electronics
  • $U_B = 24$ V_{nom} DC
  • Adjustment of valve curve Np and gain with and without ramp generator
  • Europe card format, setpoint 0...+10 V (order separately)

Ordering data

3	FRE	Z		B – 1X /		L	2	G24 – 27	Z4	M	M	*

3-way **= 3**

Proportional flow control valve, with position control

With inductive position transducer **= Z**

NG6 **= 6**
NG10 **= 10**

Without external closing fixture for pressure compensator **= B**

Unit series 10 to 19 **= 1X**
(10 to 19: installation and connection dimensions unchanged)

Nennvolumenstrom
2.6 l/min ($\Delta p = 4$ bar pressure drop) **= 2.6**[1)]
10 l/min ($\Delta p = 8$ bar pressure drop) **= 10**
35 l/min ($\Delta p = 8$ bar pressure drop) **= 35**
80 l/min ($\Delta p = 8$ bar pressure drop) **= 80**

Flow characteristic (L = linear) **= L**

Setpoint input +10 V, $Q = 0$ l/min (NC) **= 2**

[1)] Recommended: p_{max} 100 bar

Further information in plain text

M = NBR seals, suitable for mineral oils (HL, HLP) to DIN 51524

M = Without non-return valve

Z4 = **Electrical connection**
Unit plug to DIN 43650-AM2
Plug-in connector included in scope of delivery

Solenoid type (current)
27 = Solenoid current max. 2.7 A

G24 = Voltage supply of trigger electronics 24 V DC

Preferred types

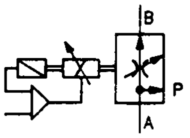
NG6 **Solenoid 2.7 A**		**NG10** **Solenoid 2.7 A**	
Type	**Material Number**	**Type**	**Material Number**
3FREZ6B–1X/2.6L2G24–27Z4MZ	0 811 403 121	3FREZ10B–1X/80L2G24–27Z4MM	0 811 403 012
3FREZ6B–1X/10L2G24–27Z4MM	0 811 403 117		
3FREZ6B–1X/35L2G24–27Z4MM	0 811 403 114		

Symbols

For external trigger electronics

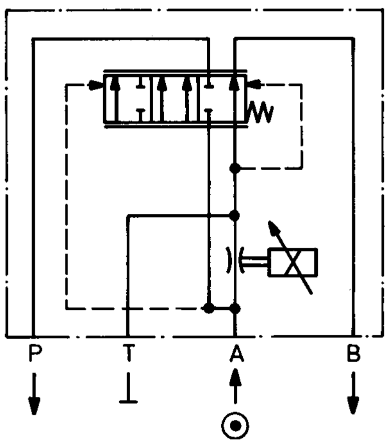
3-way, normally closed

NC



General
Flow control valves are directly actuated throttle valves with integrated pressure compensator.

3-way flow control valve
A: Supply
B: Discharge
P: Residual flow, capacity up to 250 bar, or tank
T: Closed



Function, sectional diagram

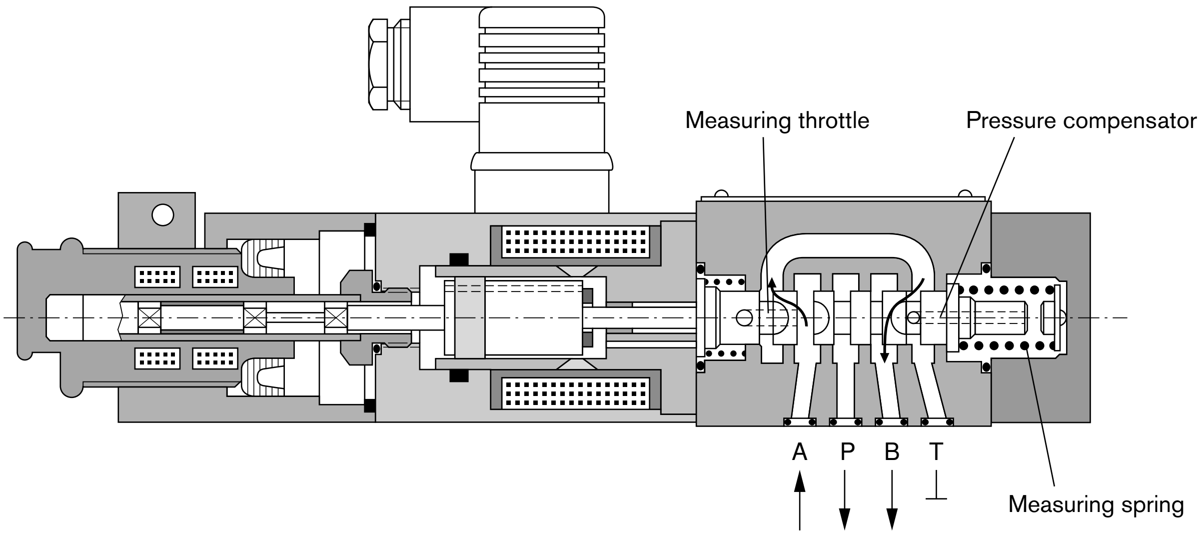
General

Type 3FREZ proportional flow control valves with position control are available in nominal sizes 6 and 10.
They are actuated by means of a proportional solenoid with inductive position transducer. Hysteresis is < 1 %. The valve amplifier electronics are available in the form of a Europe card. The design of the valve body is such that the residual flow runs through port P.

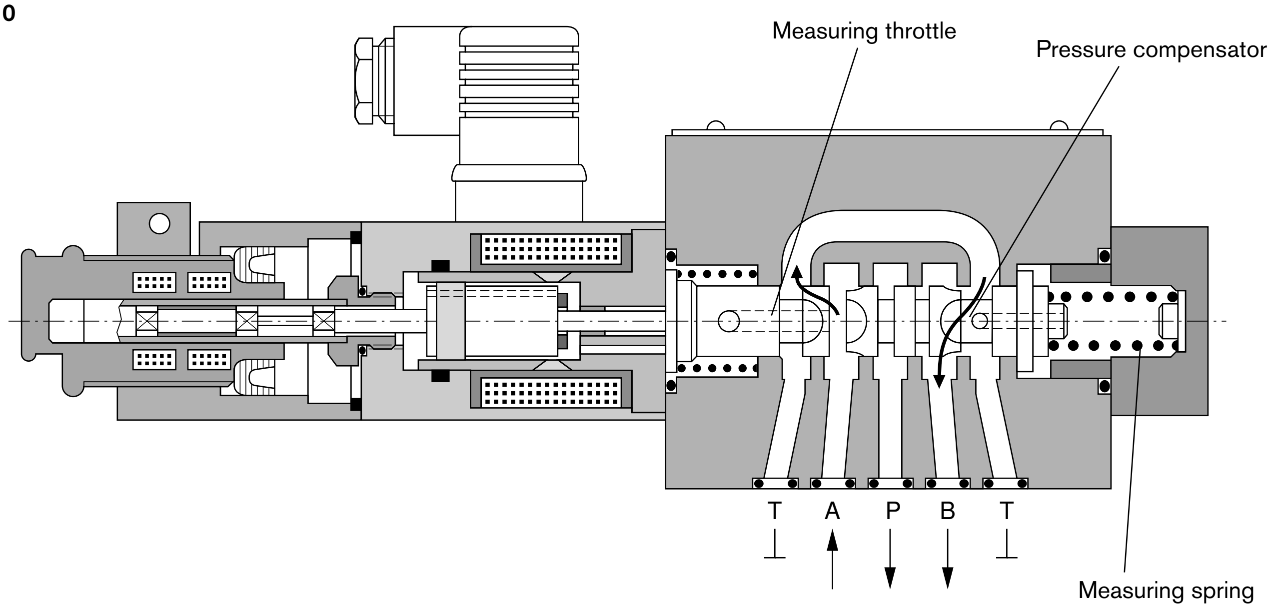
Basic principle

To adjust the oil flow rate from B, a setpoint is set in the trigger electronics. Based on this setpoint, the electronics control the solenoid coil as a function of the signal from the position transducer. The position control ensures very low hysteresis. The valve opening is determined by the metering edges on the spool, and the integrated pressure compensator compares the pressure drop by means of a 4 or 8-bar measuring spring. The pressure compensator with measuring spring regulates the pressure before the throttling edge according to the simplified formula: "Load pressure plus force of measuring spring". In this way, the pressure drop over the metering edge is maintained at a constant level.

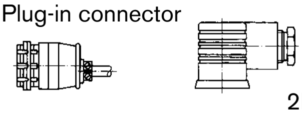
NG6



NG10



Accessories

Type			Material Number
(4x) ISO 4762-M5x30-10.9	Cheese-head bolts NG6		2 910 151 166
(4x) ISO 4762-M6x35-10.9	Cheese-head bolts NG10		2 910 151 207
Europe card 	VT-VRPA1-527-10/V0/QV	RE 30052	0 811 405 098
Europe card 	VT-VRPA1-527-10/V0/QV-RTP	RE 30054	0 811 405 103
Europe card 	VT-VRPA1-527-10/V0/QV-RTS	RE 30056	0 811 405 177
Plug-in connector  2P+PE	Plug-in connector 2P+PE (M16x1.5) for the solenoid and plug-in connector for the position transducer, included in scope of delivery, see also RE 08008.		

Testing and service equipment

Test box type VT-PE-TB1, see RE 30063
Test adapter for Europe cards type VT-PA-5, see RE 30070

Technical data

General

Construction			Spool-type valve with integrated pressure compensator
Actuation			Proportional solenoid with position control, external amplifier
Connection type			Subplate, mounting hole configuration NG6 (ISO 4401-03-02-0-94), NG10 (ISO 4401-05-04-0-94)
Mounting position			Optional
Ambient temperature range		°C	–20...+50
Weight	NG6	kg	2.2
	NG10	kg	6.0
Vibration resistance, test condition			Max. 25 g, shaken in 3 dimensions (24 h)

Hydraulic (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

Pressure fluid			Hydraulic oil to DIN 51524...535, other fluids after prior consultation			
Viscosity range,	recommended	mm^2/s	20...100			
	max. permitted	mm^2/s	10...800			
Pressure fluid temperature range		°C	–20...+80			
Maximum permitted degree of contamination of pressure fluid Purity class to ISO 4406 (c)			Class 18/16/13 [1]			
Direction of flow, see symbol			NG6			NG10
Nominal flow rate Q_B with closed-loop control		l/min	2.6	10	35	80
Pressure drop Δp		bar	4	8	8	8
Supply flow rate $Q_{A\,max}$		l/min	2.6	50	50	100
Minimum pressure drop $p_A > p_B$		bar	6	14	14	14
Max. working pressure		bar	Port A, B: 250 Port T: Closed Port P: Closed or residual flow 250 bar			

Electrical

Cyclic duration factor	%	100
Degree of protection		IP 65 to DIN 40050 and IEC 14434/5
Solenoid connection		Unit plug DIN 43650/ISO 4400, M16x1.5 (2P+PE)
Position transducer connection		Special plug
Valve with solenoid type	A	2.7
Max. solenoid current I_{max}	A	2.7
Coil resistance R_{20}	Ω	2.7
Max. power consumption at 100 % load and operating temperature	VA	40

Static/Dynamic [2]

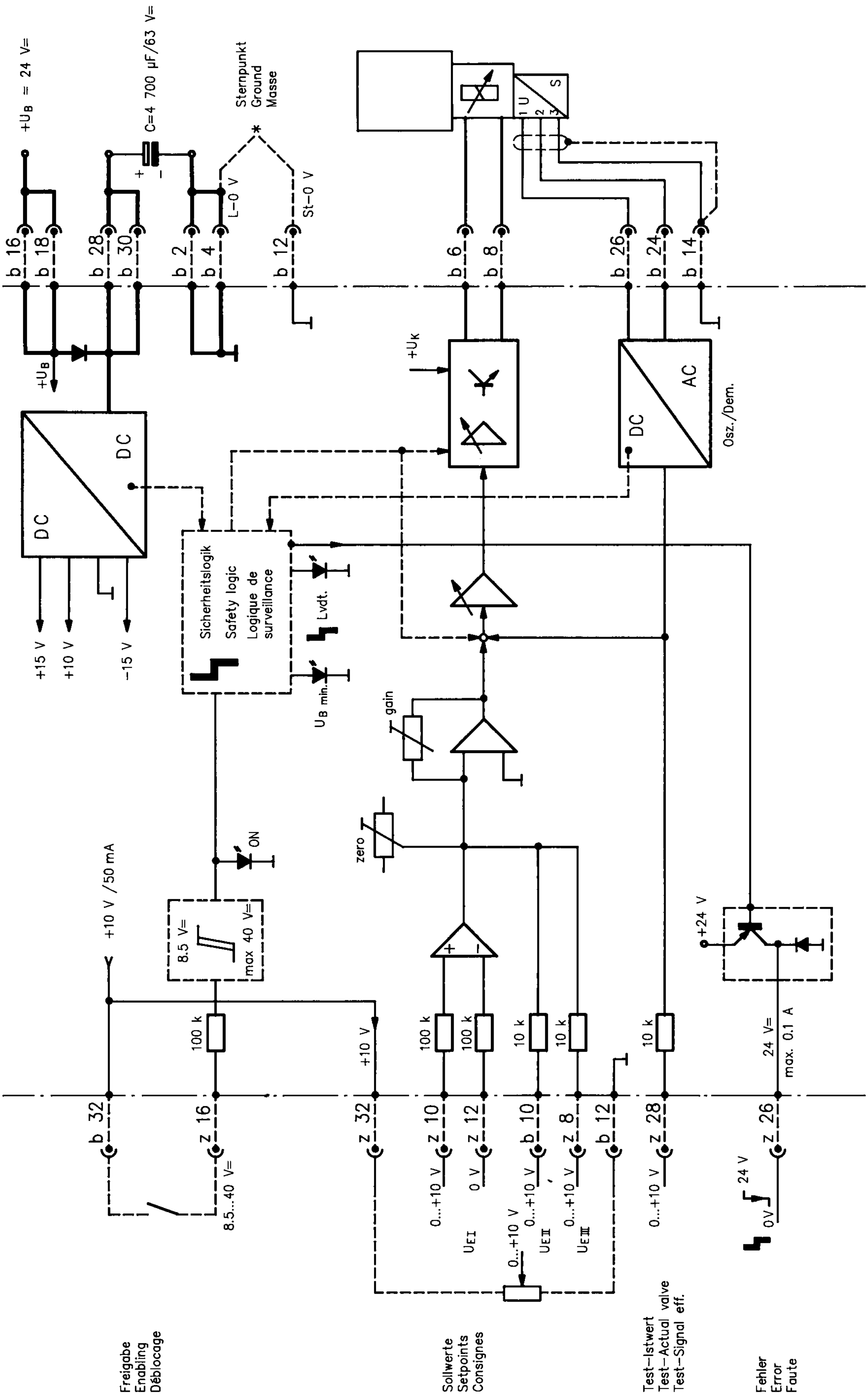
Hysteresis	%	≤ 1
Range of inversion	%	≤ 0.5
Manufacturing tolerance	%	≤ 5
Resp. time 100 %/signal change 10 %	ms	$\leq 35/25$
Correction time on max. load change (pressure compensator)	ms	NG6 ≤ 30 NG10 ≤ 45

[1] The purity classes stated for the components must be complied with in hydraulic systems. Effective filtration prevents problems and also extends the service life of components. For a selection of filters, see catalog sheets RE 50070, RE 50076 and RE 50081.

[2] All characteristic values ascertained using amplifier 0 811 405 098 for the 2.7 A solenoid.

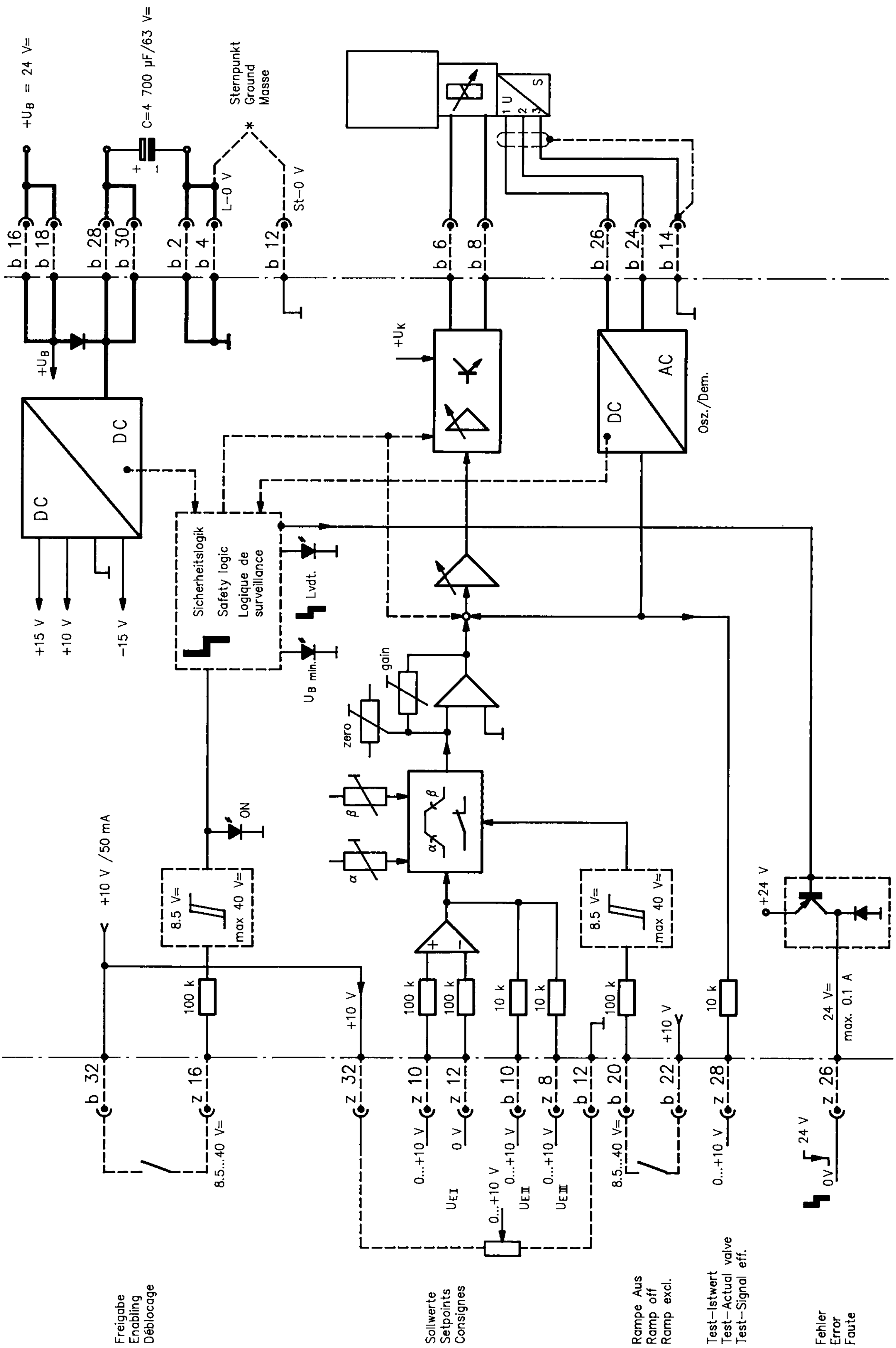
Valve with external trigger electronics (europe card without ramp, RE 30052)

Circuit diagram/pin assignment



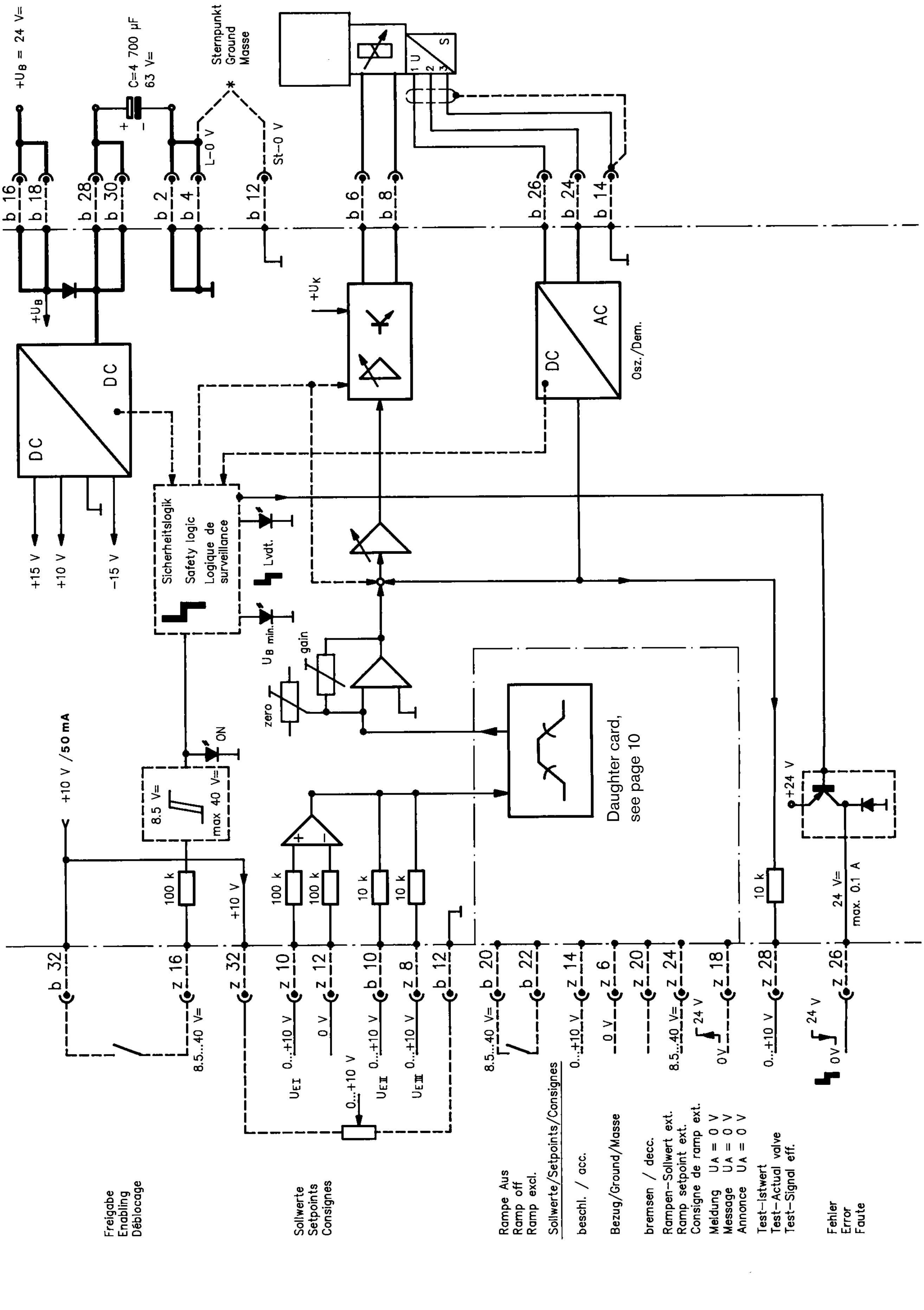
Valve with external trigger electronics (europe card with ramp, RE 30054)

Circuit diagram/pin assignment



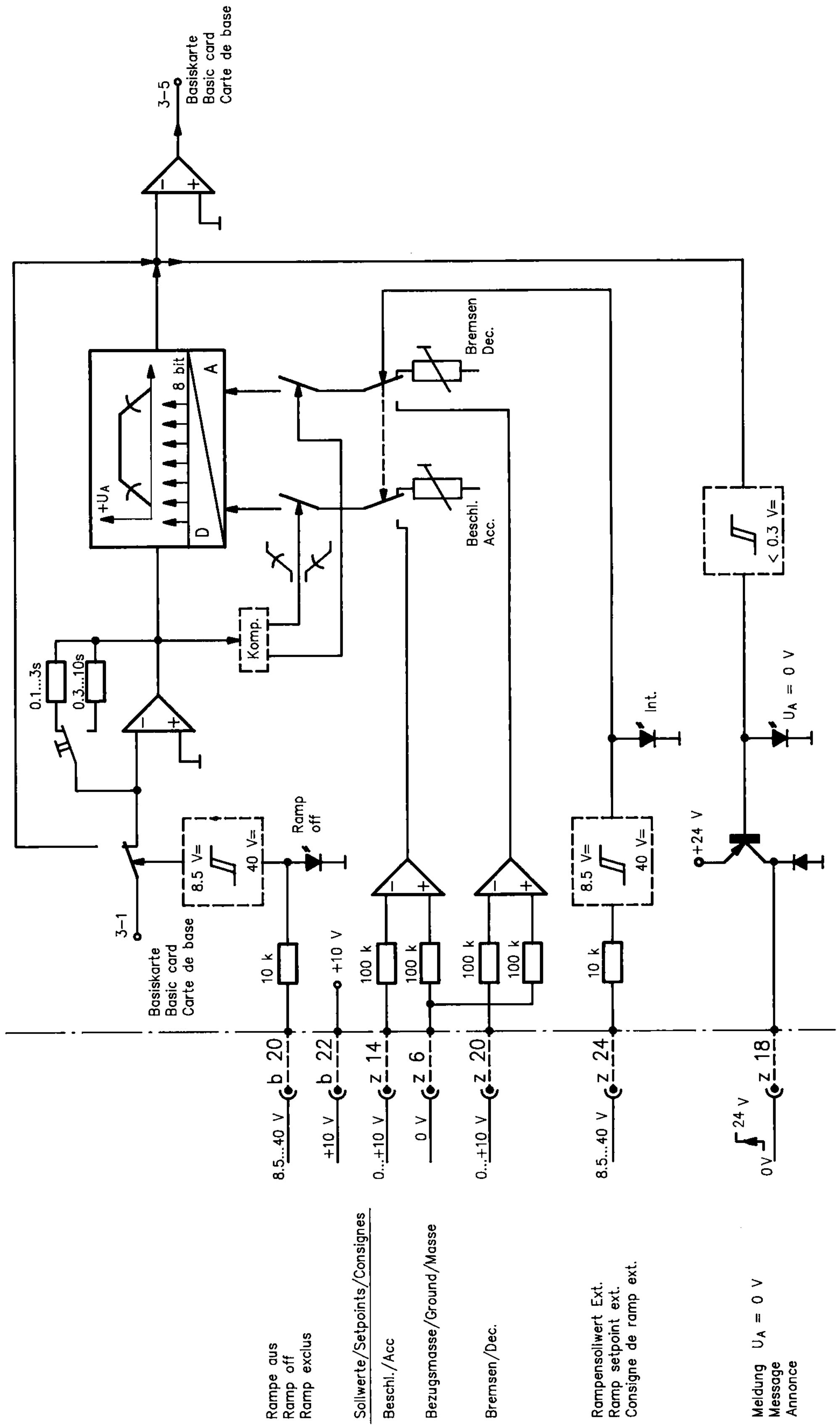
Valve with external trigger electronics (europe card with ramp, RE 30056)

Circuit diagram/pin assignment



Valve with external trigger electronics (europe card with ramp, RE 30056)

Circuit diagram/pin assignment **Daughter card**

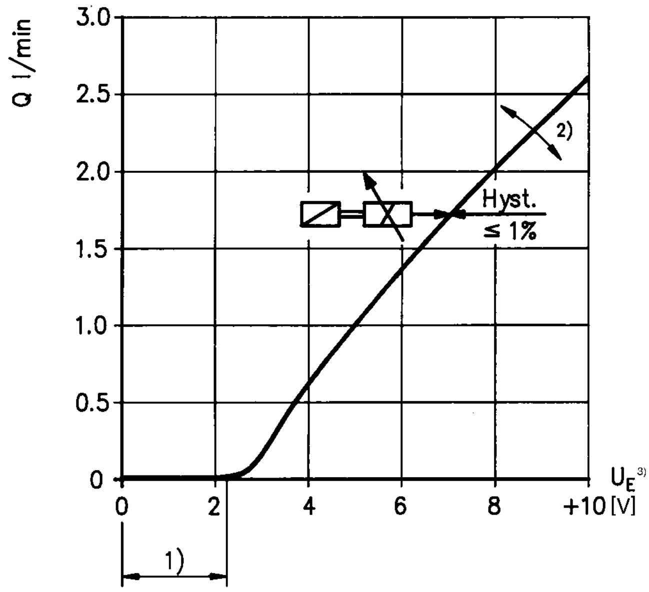


Characteristic curves NG6 (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

Q_{nom} = 2.6 l/min, p_{max} = 100 bar

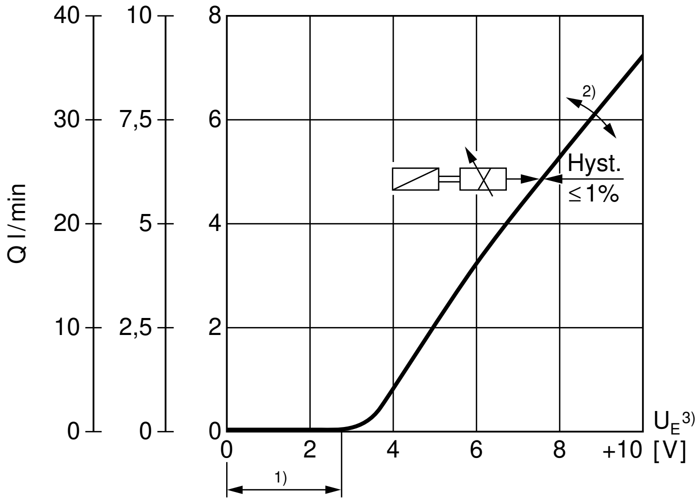
Special version for very low flow rates

Basic position closed "NC"



Q_{nom} = 10/35 l/min

Basic position closed "NC"



Valve amplifier

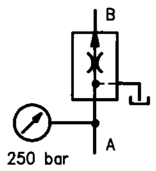
1) Zero adjustment

2) Sensitivity adjustment

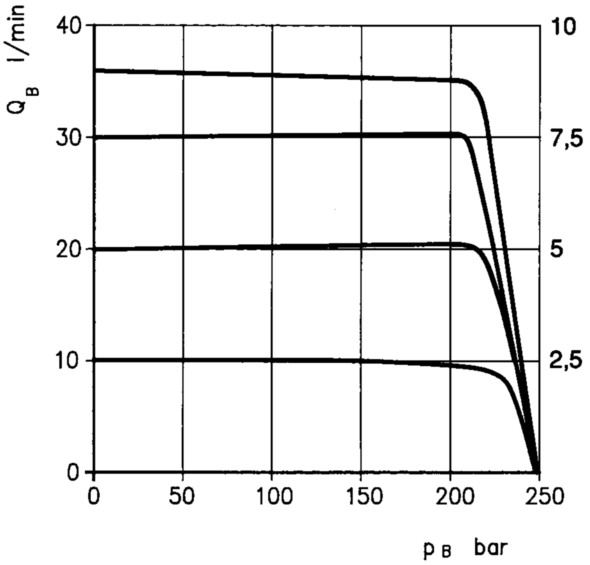
3) Version: U_E = 0...+10 V

Characteristic curves NG6 (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

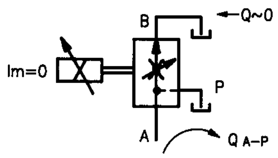
3-way version

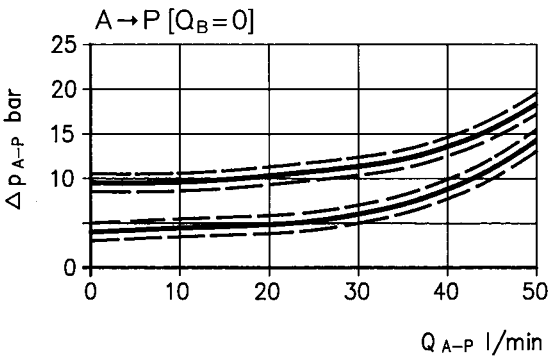


Q_{nom} **= 10/35 l/min**



Residual flow "A–P"
(pressure drop)

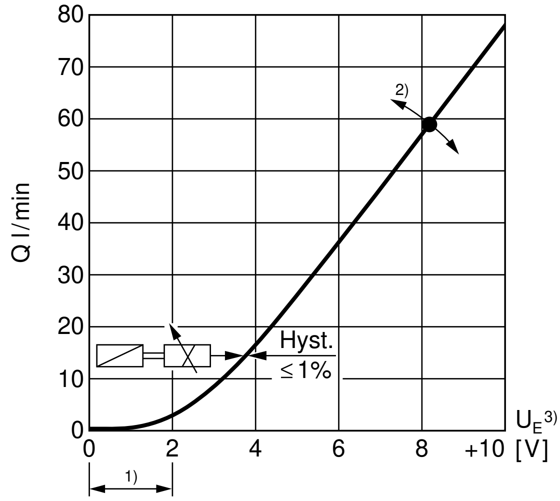




Characteristic curves NG10 (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

Q_{nom} = 80 l/min

Basic position closed “NC”



Valve amplifier

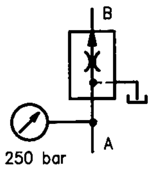
1) Zero adjustment

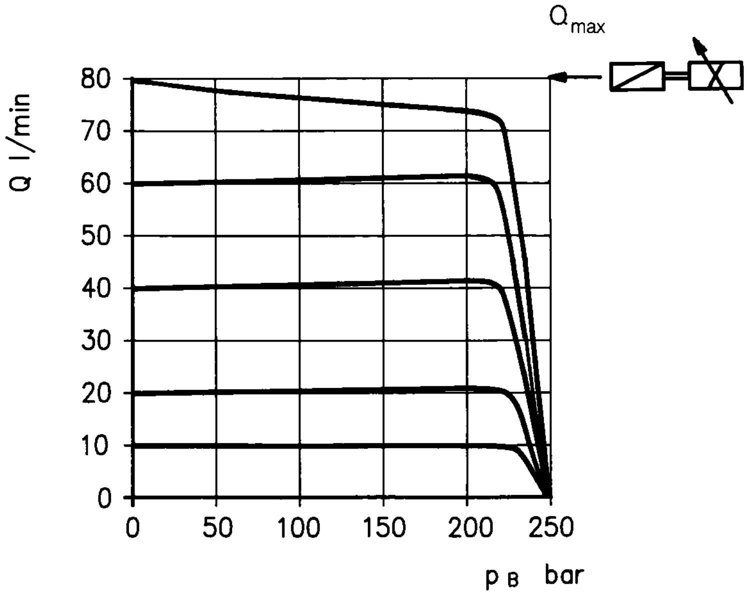
2) Sensitivity adjustment

3) Version: U_E = 0...+10 V

Characteristic curves NG10 (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

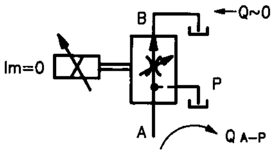
3-way version

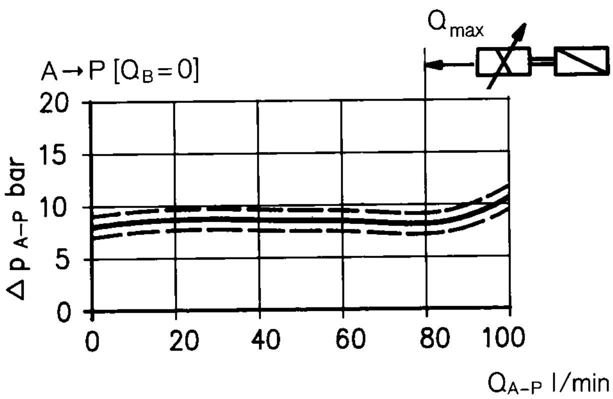




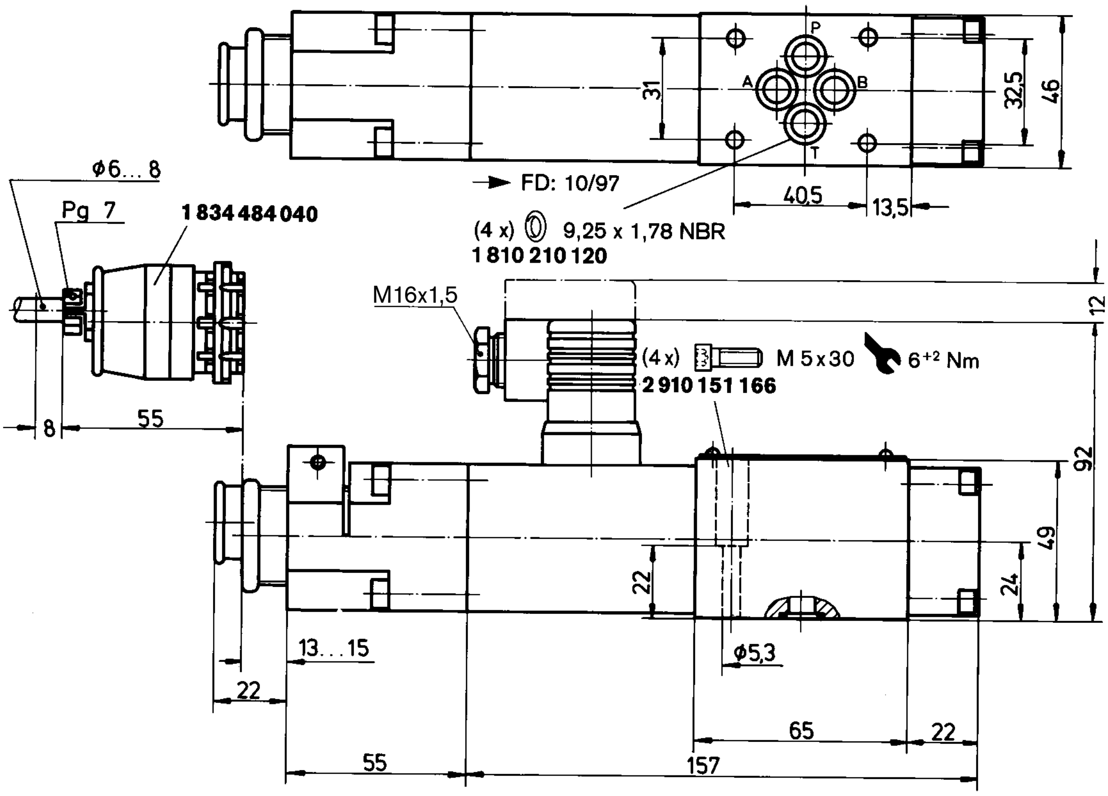
Q_{nom} **= 80 l/min**

Residual flow “A–P”
(pressure drop)

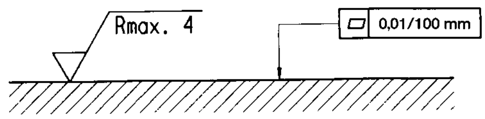




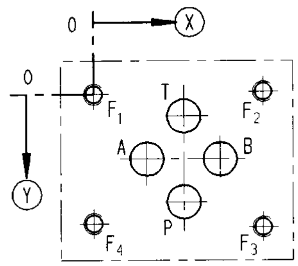
Unit dimensions NG6 (nominal dimensions in mm)



Required surface quality of mating component



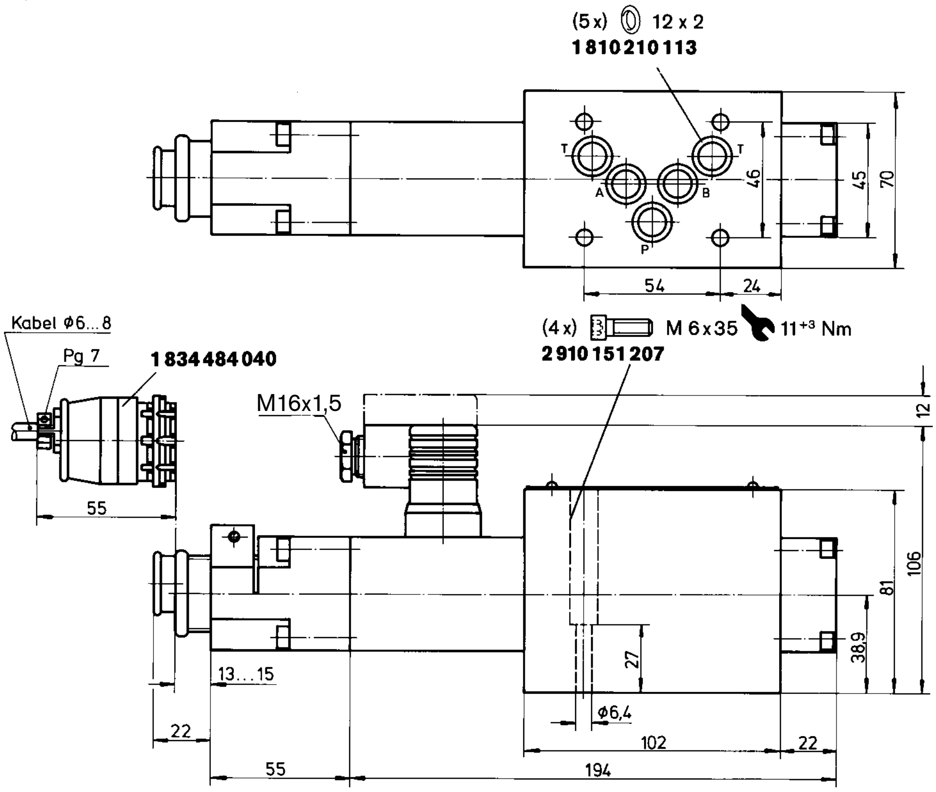
Mounting hole configuration: NG6 (ISO 4401-03-02-0-94)
For subplates see catalog sheet RE 45053



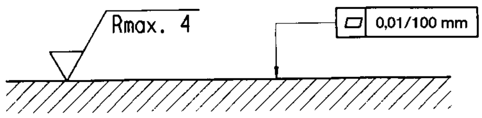
[1] Deviates from standard
[2] Thread depth:
Ferrous metal 1.5 x Ø
Non-ferrous 2 x Ø

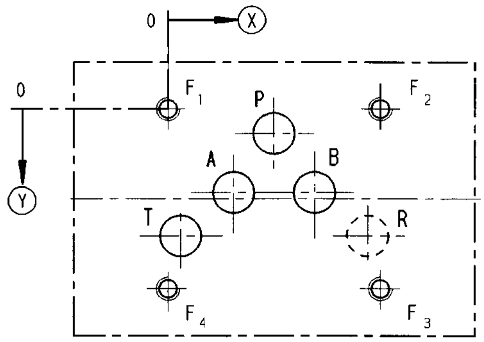
	P	A	T	B	F_1	F_2	F_3	F_4
X	21.5	12.5	21.5	30.2	0	40.5	40.5	0
Y	25.9	15.5	5.1	15.5	0	–0.75	31.75	31
∅	8 [1]	8 [1]	8 [1]	8 [1]	M5 [2]	M5 [2]	M5 [2]	M5 [2]

Unit dimensions NG10 (nominal dimensions in mm)



Required surface quality of mating component





Mounting hole configuration: NG10 (ISO 4401-05-04-0-94)
For subplates see catalog sheet RE 45055

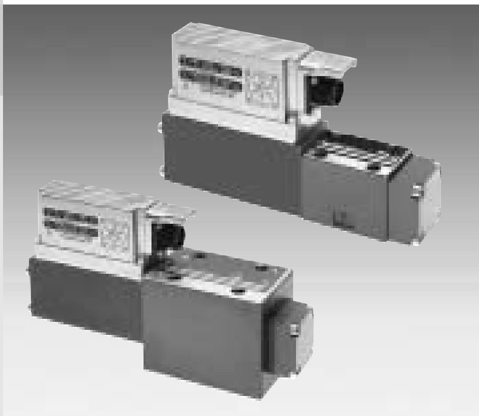
1) Deviates from standard
2) Thread depth:
Ferrous metal 1.5 x Ø*
Non-ferrous 2 x Ø

* NG10 min. 10.5 mm

	P	A	T	B	F_1	F_2	F_3	F_4	R
X	27	16.7	3.2	37.3	0	54	54	0	50.8
Y	6.3	21.4	32.5	21.4	0	0	46	46	32.5
∅	10.5 1)	10.5 1)	10.5 1)	10.5 1)	M6 2)	M6 2)	M6 2)	M6 2)	10.5 1)

Proportional flow control valve, with on-board electronics (OBE) and inductive position transducer

Type 3FREEZ



Nominal size 6, 10
Unit series 1X
Maximum working pressure 250 bar
Nominal flow rate Q_{nom} 10...70 l/min

Overview of Contents

Features

– Directly controlled flow control valves NG6 and NG10 with on-board electronics and inductive position transducer
– With position control, minimal hysteresis < 1 %, see Technical Data
– The 3-way function is determined by how the hydraulic ports are assigned (residual flow runs through port P, 3rd way)
– Adjustable by means of the controlled solenoid position, the position transducer and the on-board electronics
– For subplate attachment, mounting hole configuration NG6 to ISO 4401-03-02-0-94, NG10 to ISO 4401-05-04-0-94
– Subplates as per catalog sheet, RE 45053 for NG6, RE 45055 for NG10 (order separately)
– Plug-in connector to DIN 43563-AM6, see catalog sheet RE 08008 (order separately)
– Data for the on-board trigger electronics
  • Complies with CE, EMC directives EN 61000-6-2: 2002-08 and EN 61000-6-3: 2002-08
  • U_B = 24 V_{nom} DC
  • Electrical connection 6P+PE
  • Signal actuation
    – Standard 0...+10 V (A1)
  • Valve curve calibrated at the factory

Ordering data

3	FRE	E	Z		B – 1X /		L	2	G24 – K31	A1	M	M	*

3-way **= 3**

Proportional flow control valve, with position control

With on-board electronics **= E**

With inductive position transducer **= Z**

NG6 **= 6**
NG10 **= 10**

Without external closing fixture for pressure compensator **= B**

Unit series 10 to 19 **= 1X**
(10 to 19: installation and connection dimensions unchanged)

Nominal flow rate
10 l/min ($\Delta p = 8$ bar pressure drop) **= 10**
35 l/min ($\Delta p = 8$ bar pressure drop) **= 35**
70 l/min ($\Delta p = 8$ bar pressure drop) **= 70**

Flow characteristic (L = linear) **= L**

Setpoint input +10 V, $Q = 0$ l/min (NC) **= 2**

* Version “F1” (4...20 mA version) available on request

Further information in plain text

M = NBR seals, suitable for mineral oils (HL, HLP) to DIN 51524

M = Without non-return valve

Interface for trigger electronics*
A1 = Setpoint input 0...+10 V

K31 = **Electrical connection without** plug-in connector, with unit plug to DIN 43563-AM6
Order plug-in connector separately

G24 = Voltage supply of trigger electronics 24 V DC

Preferred types

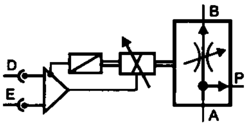
NG6		**NG10**	
Type	**Material Number**	**Type**	**Material Number**
3FREEZ6B–1X/10L2G24–K31A1MM	0 811 403 150	3FREEZ10B–1X/70L2G24–K31A1MM	0 811 403 019
3FREEZ6B–1X/35L2G24–K31A1MM	0 811 403 151		

Symbols

For on-board electronics

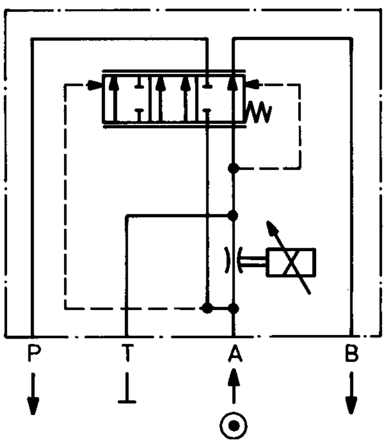
3-way, normally closed

NC



General
Flow control valves are directly actuated throttle valves with integrated pressure compensator.

3-way flow control valve
A: Supply
B: Discharge
P: Residual flow, capacity up to 250 bar, or tank
T: Closed



Function, sectional diagram

General

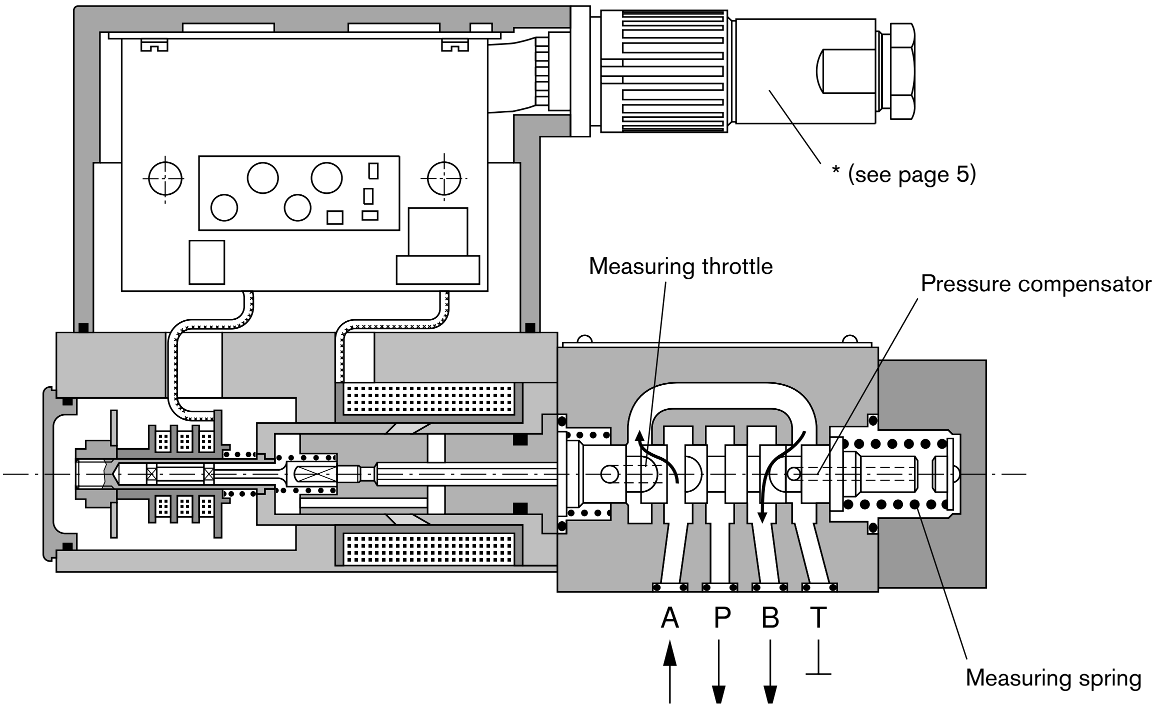
Type 3FREEZ proportional flow control valves with position control and on-board electronics are available in nominal sizes 6 and 10. They are actuated by means of a proportional solenoid with inductive position transducer. Hysteresis is < 1 %. The on-board electronics are calibrated at the factory and enable rapid response times. The design of the valve body is such that the residual flow runs through port P.

Basic principle

To adjust the oil flow rate from B, a setpoint is set in the trigger electronics. Based on this setpoint, the electronics control the solenoid coil as a function of the signal from the position transducer. The position control ensures very low hysteresis. The valve opening is determined by the metering edges on the spool, and the integrated pressure compensator compares the pressure drop by means of an 8-bar measuring spring. The pressure compensator with measuring spring regulates the pressure before the throttling edge according to the simplified formula: “Load pressure plus force of measuring spring”. In this way, the pressure drop over the metering edge is maintained at a constant level.

NG6

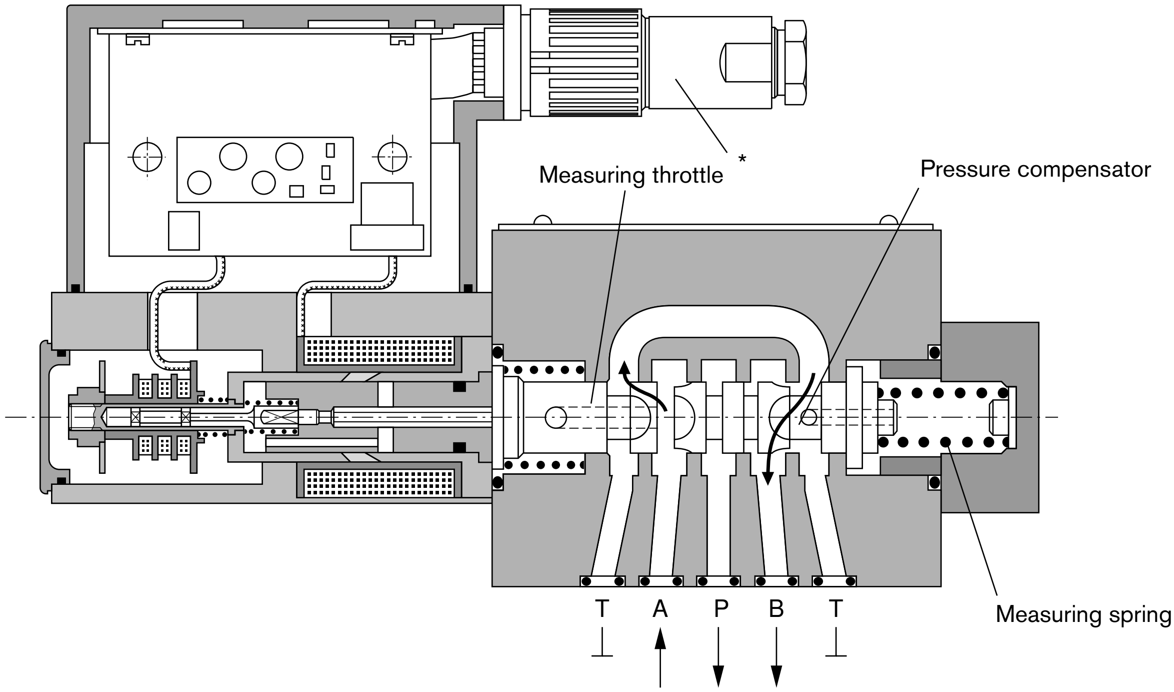
CE EN 61000-6-2: 2002-08
EN 61000-6-3: 2002-08



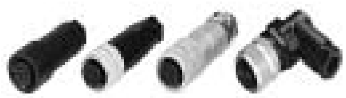
Function, sectional diagram

NG10

EN 61000-6-2: 2002-08
EN 61000-6-3: 2002-08



Accessories

Type			Material Number
(4x) ISO 4762-M5x30-10.9	Cheese-head bolts NG6		2 910 151 166
(4x) ISO 4762-M6x35-10.9	Cheese-head bolts NG10		2 910 151 207
* 	Plug-in connectors 6P+PE, see also RE 08008	KS	1 834 482 022
		KS	1 834 482 026
		MS	1 834 482 023
		MS	1 834 482 024
		KS 90°	1 834 484 252

Testing and service equipment

Test box type VT-PE-TB3, see RE 30065
Measuring adapter 6P+PE type VT-PA-2, see RE 30068

Technical data

General

Construction		Spool-type valve with integrated pressure compensator
Actuation		Proportional solenoid with position control and on-board electronics OBE
Connection type		Subplate, mounting hole configuration NG6 (ISO 4401-03-02-0-94), NG10 (ISO 4401-05-04-0-94)
Mounting position		Optional
Ambient temperature range	°C	–20...+50
Weight	NG6 kg	3.1
	NG10 kg	6.9
Vibration resistance, test condition		Max. 25 g, shaken in 3 dimensions (24 h)

Hydraulic (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

Pressure fluid		Hydraulic oil to DIN 51524...535, other fluids after prior consultation		
Viscosity range,	recommended mm²/s	20...100		
	max. permitted mm²/s	10...800		
Pressure fluid temperature range	°C	–20...+70		
Maximum permitted degree of contamination of pressure fluid Purity class to ISO 4406 (c)		Class 18/16/13 [1)]		
Direction of flow, see symbol		**NG6**		**NG10**
Nominal flow rate Q_B with closed-loop control	l/min	10	35	70
Pressure drop Δp	bar	8	8	8
Supply flow rate $Q_{A\,max}$	l/min	50	50	100
Minimum pressure drop $p_A > p_B$	bar	14	14	14
Max. working pressure	bar	Port A, B: 250 Port T: Closed Port P: Closed or residual flow 250 bar		

Static/Dynamic

Hysteresis	%	≤ 1	≤ 1
Range of inversion	%	≤ 0.5	≤ 0.5
Manufacturing tolerance	%	≤ 5	≤ 5
Resp. time 100 %/signal change 10 %	ms	25/25	35/25
Correction time on max. load change (pressure compensator)	ms	≤ 30	≤ 45
Conformity		CE EN 61000-6-2: 2002-08 EN 61000-6-3: 2002-08	

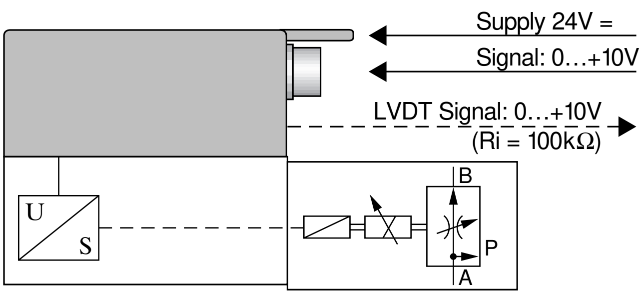
1) The purity classes stated for the components must be complied with in hydraulic systems.
Effective filtration prevents problems and also extends the service life of components.
For a selection of filters, see catalog sheets RE 50070, RE 50076 and RE 50081 .

Technical data

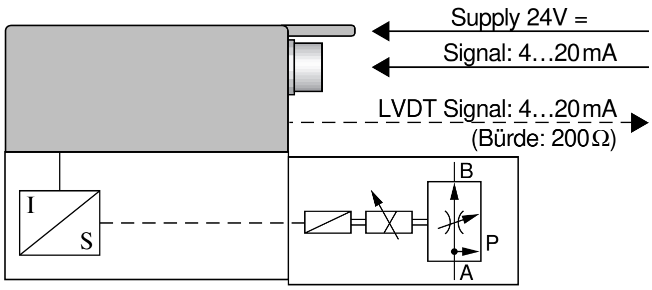
Electrical, trigger electronics integrated in valve		
Cyclic duration factor	%	100
Degree of protection		IP 65 to DIN 40050 and IEC 14434/5
Connection		Plug-in connector 6P+PE, DIN 43563
Supply voltage Terminal A: Terminal B: 0 V		24 V DC_{nom} Min. 21 V DC/max. 40 V DC Ripple max. 2 V DC
Power consumption		Solenoid ⧄ 45 mm = 40 VA max.
External fuse		2.5 A_F
Input, “standard” version Terminal D: U_E Terminal E:	A1	Differential amplifier, R_i = 100 kΩ 0...+10 V 0 V
Input, “mA signal” version Terminal D: I_{D-E} Terminal E: I_{D-E}	F1*	Burden, R_{sh} = 200 Ω 4...20 mA Current loop I_{D-E} feedback
Max. voltage to differential inputs over 0 V		$\left.\begin{matrix} D \rightarrow B \\ E \rightarrow B \end{matrix}\right\}$ max. 18 V DC
Test signal, “standard” version Terminal F: U_{Test} Terminal C:	A1	LVDT 0...+10 V Reference 0 V
Test signal, “mA signal” version Terminal F: I_{F-C} Terminal C: I_{F-C}	F1*	LVDT signal 4...20 mA at external load 200...500 Ω max. 4...20 mA output Current loop I_{F-C} feedback
Safety earth conductor and shield		See pin assignment (installation in conformity with CE)
Recommended cable		See pin assignment up to 20 m 7 x 0.75 mm^2 up to 40 m 7 x 1 mm^2
Calibration		Calibrated at the factory, see valve curve

* Version “F1” (4...20 mA version) available on request

Version A1:
Standard

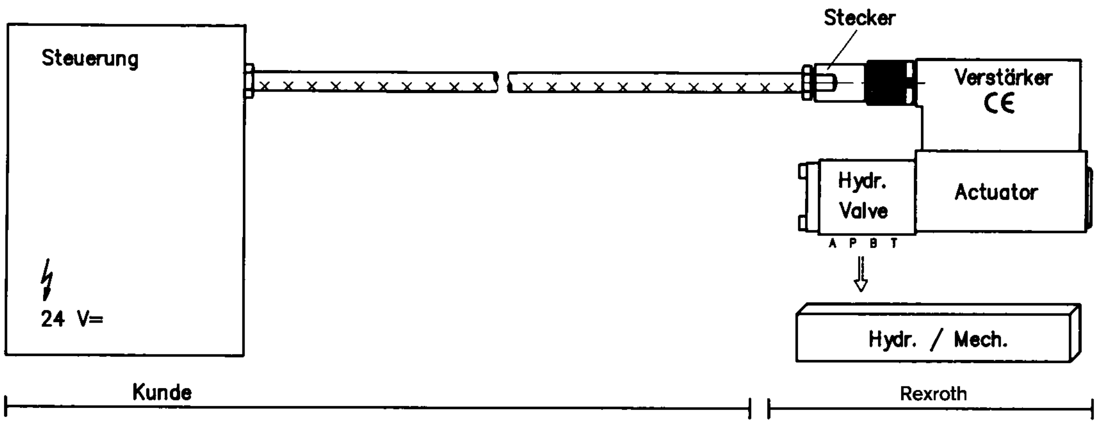


*** Version F1:**
mA Signal



Connection

For electrical data, see page 7 and
Operating Instructions **1 819 929 083**



Technical notes for the cable

Design:
- Multi-wire cable
- Extra-finely stranded wire to VDE 0295, Class 6
- Safety earth conductor, green/yellow
- Cu braided shield

Type:
- e.g. Ölflex-FD 855 CP (from Lappkabel company)

No. of wires:
- Determined by type of valve, plug type and signal assignment

Cable Ø:
- 0.75 mm² up to 20 m long
- 1.0 mm² up to 40 m long

Outside Ø:
- 9.4...11.8 mm – Pg 11
- 12.7...13.5 mm – Pg 16

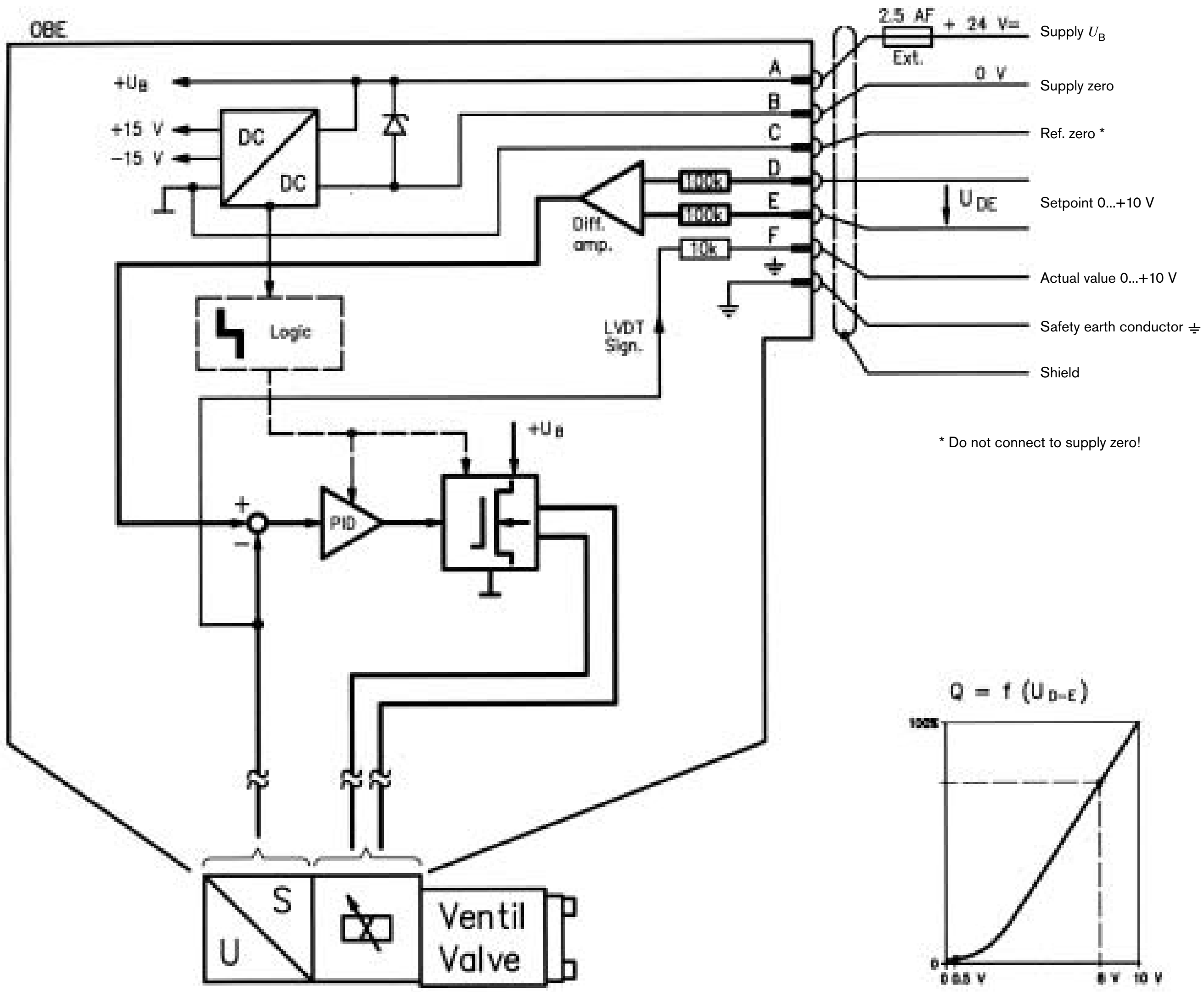
Important

Power supply 24 V DC nom.,
if voltage drops below 18 V DC, rapid shutdown resembling "Enable OFF" takes place internally.
In addition, with the "mA signal" version:
$I_{D\text{-}E} \geqq 3$ mA – valve is active
$I_{D\text{-}E} \leqq 2$ mA – valve is deactivated.
Electrical signals (e.g. actual values) emitted via the trigger electronics must not be used to shut down safety-relevant machine functions!
(Also see European Standard, "Technical Safety Requirements for Fluid-Powered Systems and Components – Hydraulics", EN 982).

On-board trigger electronics

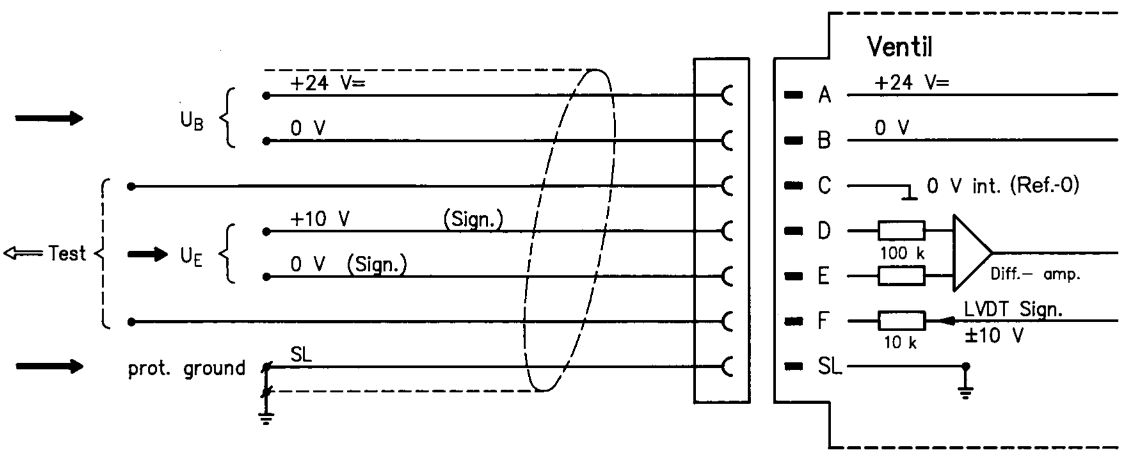
Circuit diagram/pin assignment

Version A1: $U_{D\text{-}E}$ 0...+10 V



Pin assignment

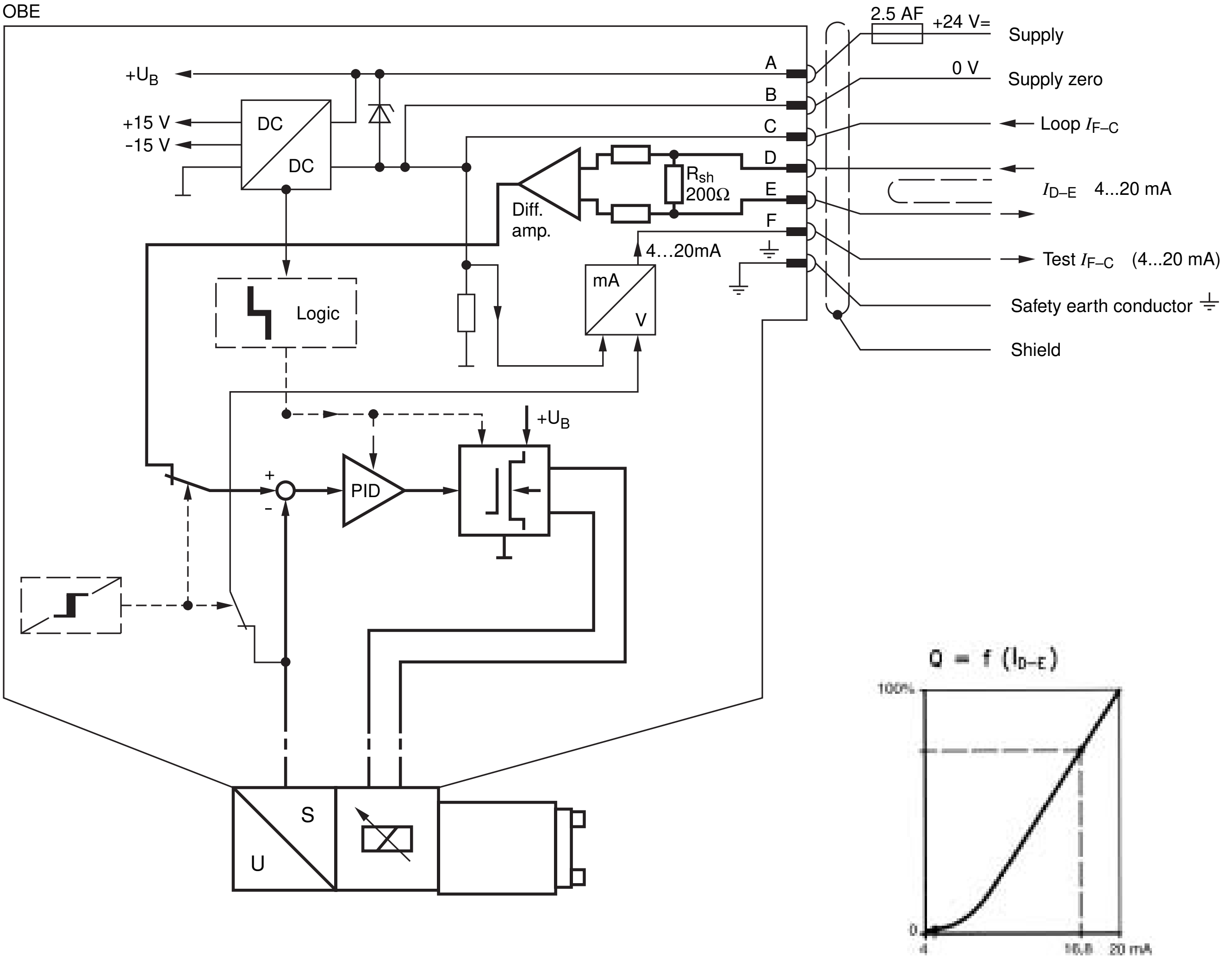
Version A1: $U_{D\text{-}E}$ 0...+10 V
(R_i = 100 kΩ)



On-board trigger electronics

Circuit diagram/pin assignment

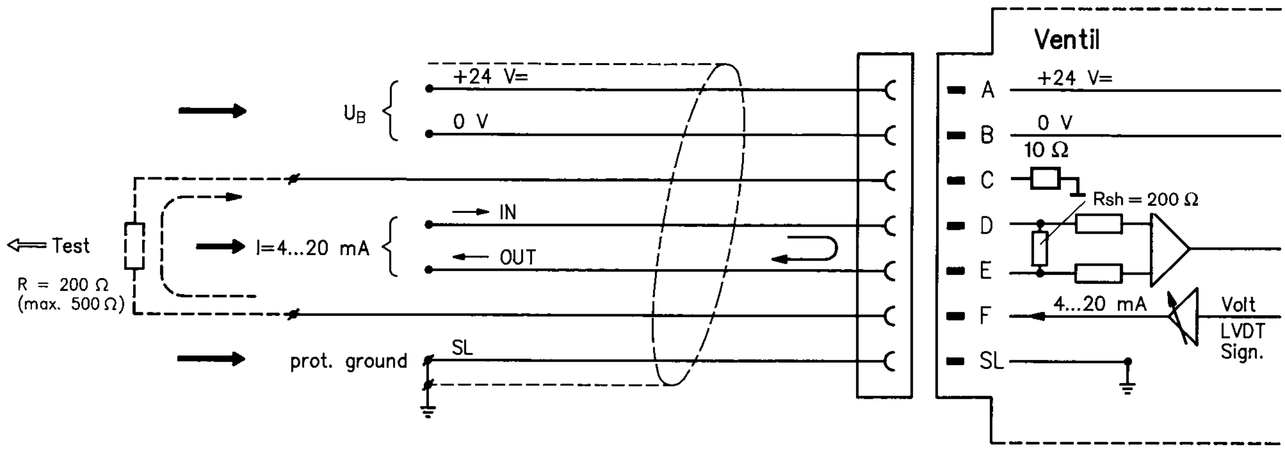
Version F1: $I_{D\text{-}E}$ 4...20 mA



Pin assignment 6P+PE

Version F1: $I_{D\text{-}E}$ 4...20 mA

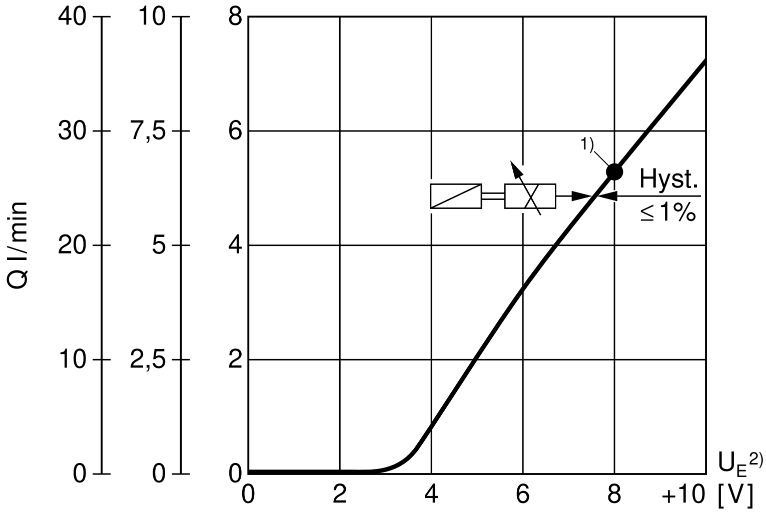
(R_{sh} = 200 kΩ)



Characteristic curves NG6 (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

Q_{nom} = 10/35 l/min

Basic position closed "NC"

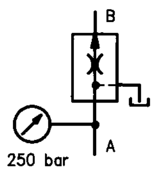


Valve amplifier

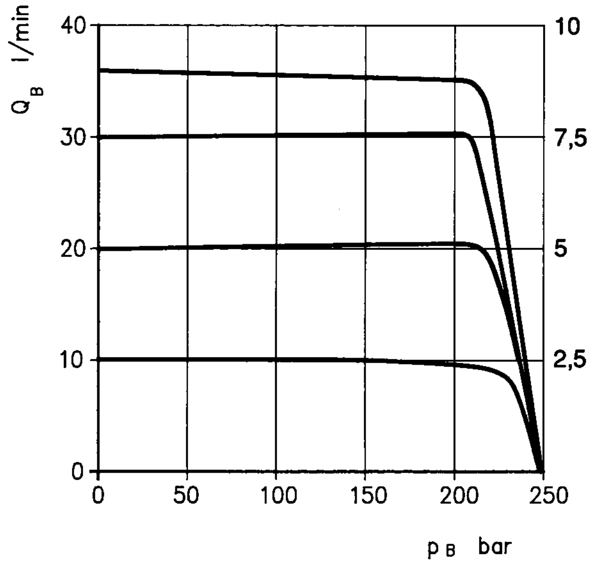
[1] Factory setting – OBE
±5% manufacturing tolerance

[2] Version: U_E = 0...+10 V

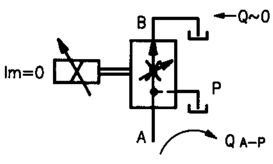
3-way version

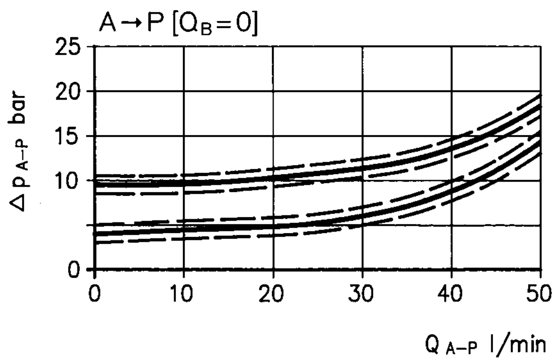


Q_{nom} = 10/35 l/min



Residual flow "A–P"
(pressure drop)

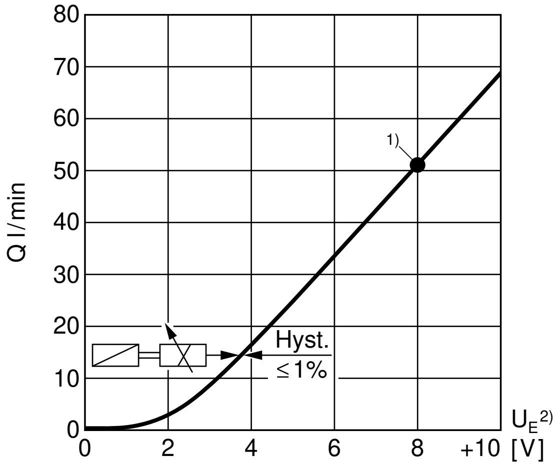




Characteristic curves NG10 (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

$Q_{nom.}$ = 70 l/min

Basic position closed “NC”

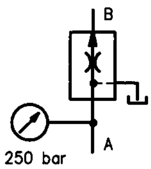


Valve amplifier

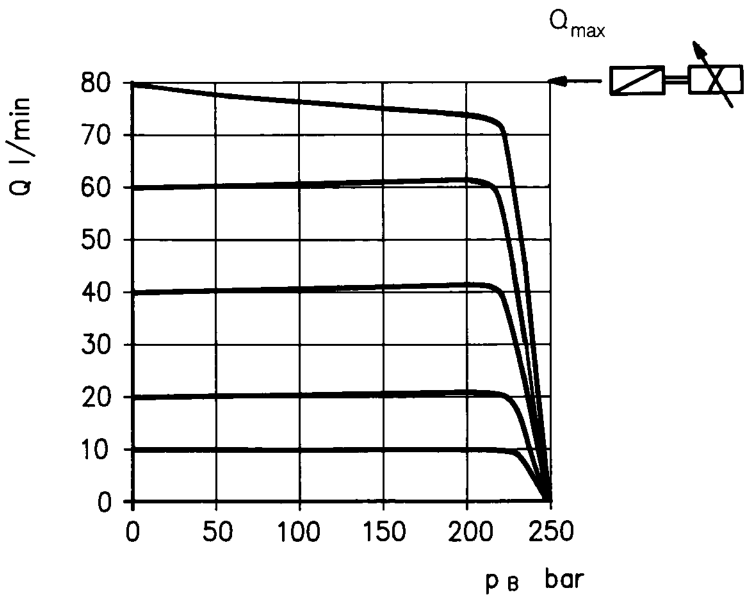
1) Factory setting – OBE
±5% manufacturing tolerance

2) Version: U_E = 0...+10 V

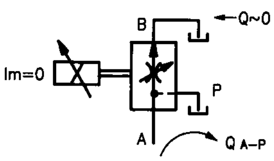
3-way version

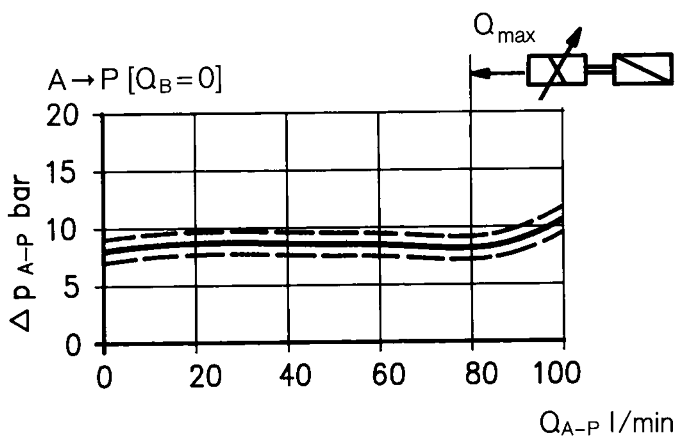


Q_{nom} = 70 l/min

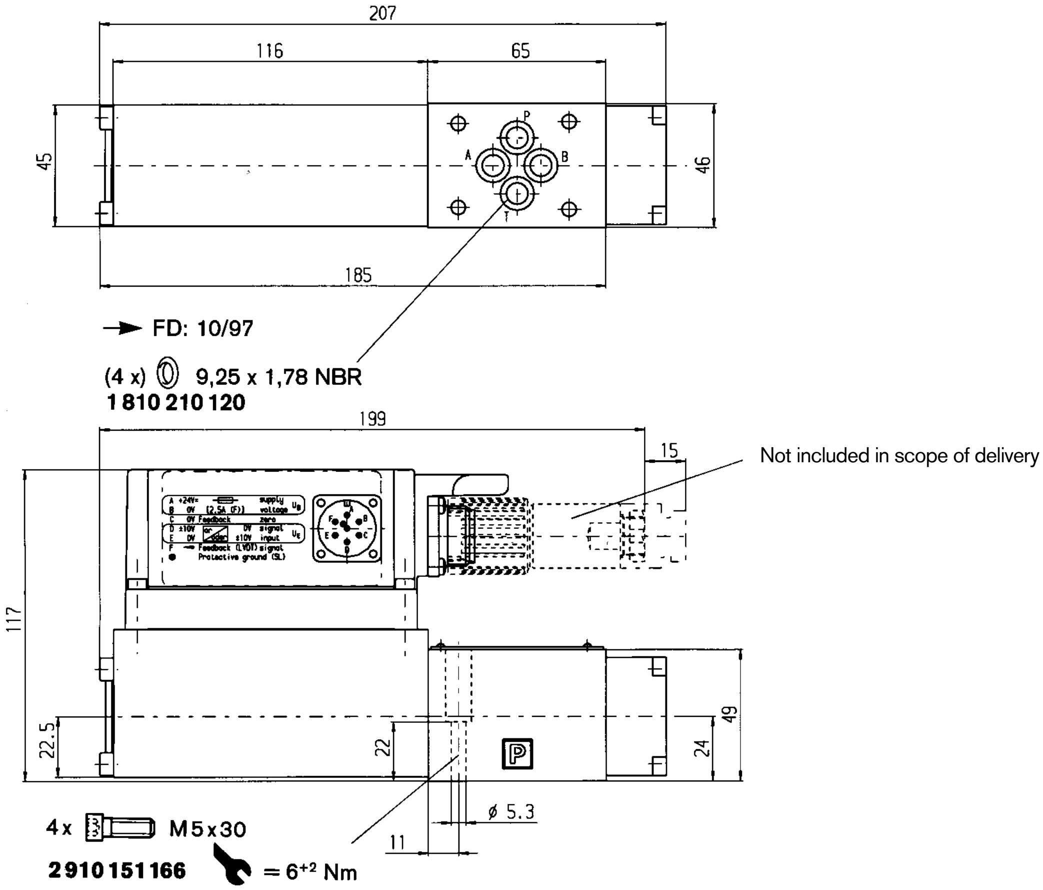


Residual flow “A-P”
(pressure drop)

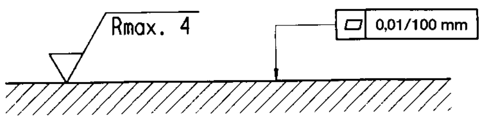




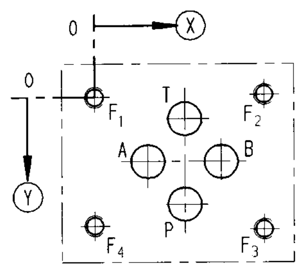
Unit dimensions NG6 (nominal dimensions in mm)



Required surface quality of mating component



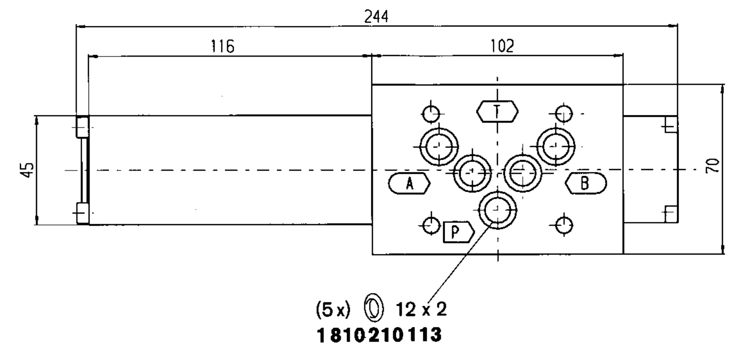
Mounting hole configuration: NG6 (ISO 4401-03-02-0-94)
For subplates see catalog sheet RE 45053

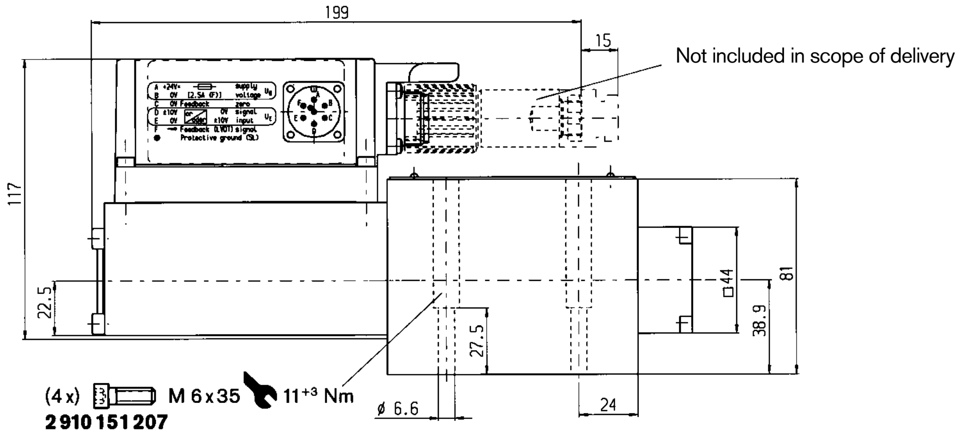


1) Deviates from standard
2) Thread depth:
Ferrous metal 1.5 x Ø
Non-ferrous 2 x Ø

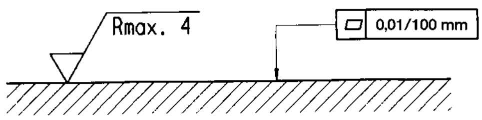
	P	A	T	B	F_1	F_2	F_3	F_4
X	21.5	12.5	21.5	30.2	0	40.5	40.5	0
Y	25.9	15.5	5.1	15.5	0	–0.75	31.75	31
Ø	8 1)	8 1)	8 1)	8 1)	M5 2)	M5 2)	M5 2)	M5 2)

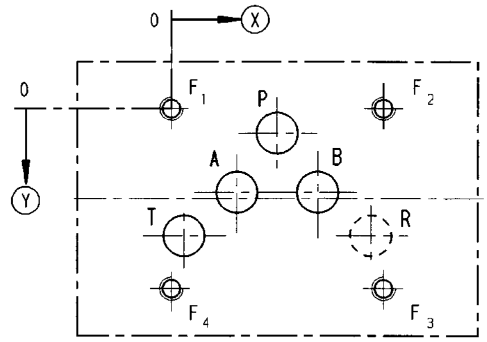
Unit dimensions NG10 (nominal dimensions in mm)





Required surface quality of mating component





Mounting hole configuration: NG10 (ISO 4401-05-04-0-94)
For subplates see catalog sheet RE 45055

1) Deviates from standard
2) Thread depth:
Ferrous metal 1.5 x Ø*
Non-ferrous 2 x Ø

* NG10 min. 10.5 mm

	P	A	T	B	F_1	F_2	F_3	F_4	R
X	27	16.7	3.2	37.3	0	54	54	0	50.8
Y	6.3	21.4	32.5	21.4	0	0	46	46	32.5
Ø	10.5 1)	10.5 1)	10.5 1)	10.5 1)	M6 2)	M6 2)	M6 2)	M6 2)	10.5 1)

Proportional flow control valve with integrated pressure compensator Type KUDSR

RE 18702
Edition: 12.2017
Replaces: 10.2016


H8125

- Size 3
- Component series B
- Maximum operating pressure 350 bar
- Maximum supply flow 120 l/min

Features
- Mounting cavity R/UNF-16-03-0-06
- Direct operated proportional valve for controlling the flow size
- Operation by means of proportional solenoid
- Detachable and rotatable solenoid coil (connector position freely selectable)
- With concealed manual override
- Screwable manual override with star handle, optional

Contents

Type code (valve without coil)[1)]

01	02	03	04	05		06	07	08	09
KUDS	**R**	**3**		**B**	**/**	**F**	**N9**	**V**	*****

Type

01	Proportional flow control valve with integrated pressure compensator, direct operated	**KUDS**

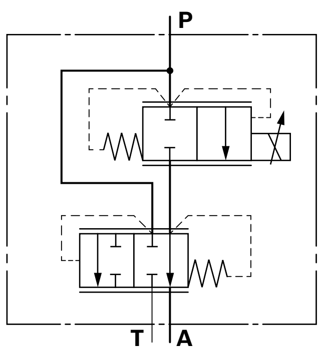
Maximum operating pressure

02	350 bar	**R**

Size

03	Size 3	**3**

Flow in port A

04	Symbol 	80 l/min	**C**
		60 l/min	**C1**
		40 l/min	**C2**

Component series

05	Component series B	**B**

Mounting cavity

06	High-Performance and mounting cavity R/UNF-16-03-0-06, see page 11	**F**

Manual override

07	With concealed manual override	**N9**
	Screwable manual override with star handle (separate order, material no. R913009058, see page 12)	**N14**

Sealing material

08	FKM (fluoroelastomer) (other seals on request)	**V**

09	Further details in the plain text	*****

Preferred types (valve without coil)[1)]

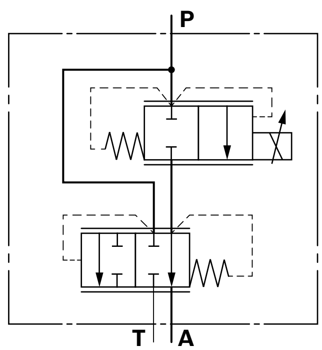
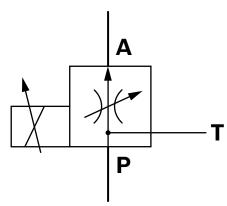
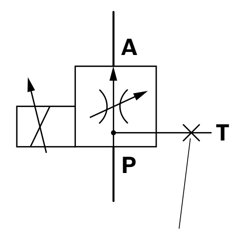
Type	Material no.
KUDSR3CB/FN9V	R901480558
KUDSR3C1B/FN9V	R901480554
KUDSR3C2B/FN9V	R901480557

1) Complete valves with mounted coil on request.

Available coils (separate order)

	Material no. for coil with connector[2]		
Direct voltage DC[3]	**"K4"** 03pol (2+PE) DIN EN 175301-803	**"K40"** 02pol K40 DT 04-2PA, co. Deutsch	**"C4"** 02pol C4/Z30 AMP Junior-Timer
12 V (1.8 A)	R901022180	R901272648	R901022680
24 V (1.2 A)	R901022174	R901272647	R901022683

Symbols

detailed	simplified	
		 By closing the tank port **T** the valve can also be operated as a 2-way flow control valve.

P = Pump port
T = Tank port
A = Control pressure port

2) Plug-in connectors separate order, see data sheet 08006.
3) Other voltages upon request.

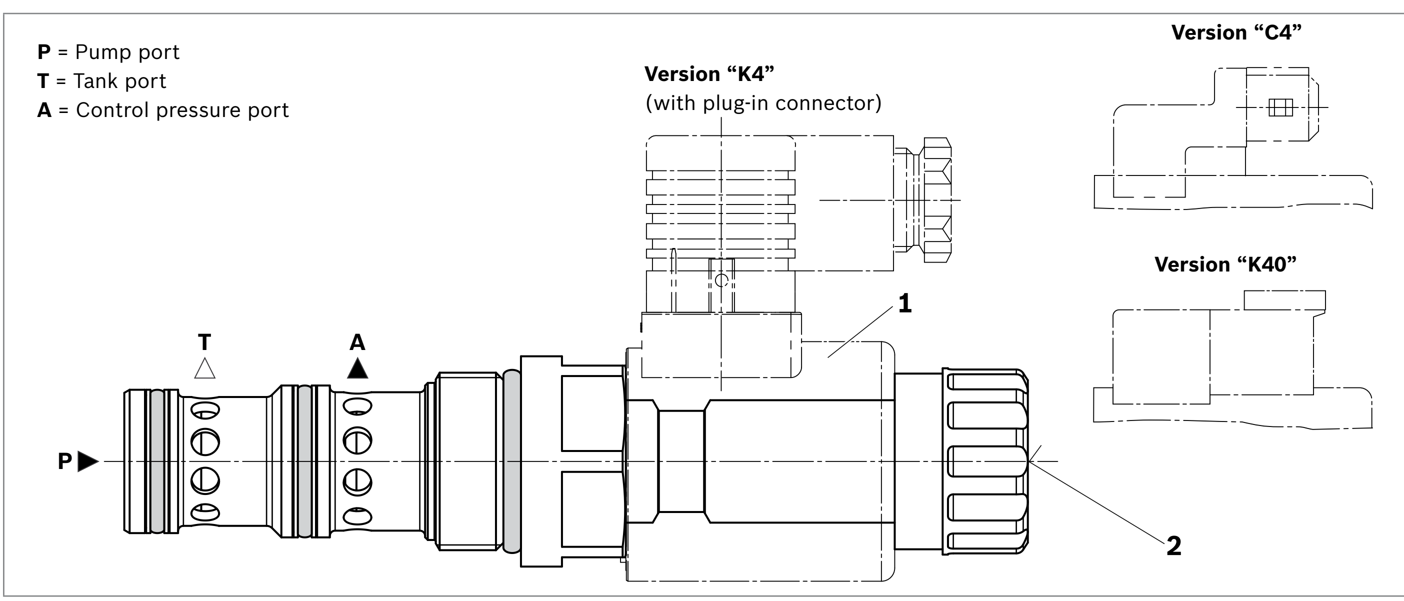
Functional description

General
The proportional flow control valve is a direct operated screw-in cartridge valve in spool design with integrated pressure compensator. It regulates the flow proportionally to the input signal in a stepless form from port **P** to **A**. Any excessive residual flow is led to the tank or to another actuator via port **T**.
The valve basically consists of housing, control spool, control spring, pressure compensator spool, orifice bush, pressure compensator spring as well as proportional solenoid (**1**) with central thread and detachable coil.

Function (2-way)
With de-energized proportional solenoid (**1**), the control spool that is always pressure-compensated to the actuating forces due to its structural design is held in the initial position by the control spring and blocks the flow between port **P** and **A**. By energizing the proportional solenoid (**1**), the control spool is adjusted directly proportional to the electrical input signal and, via orifice-type cross-sections (with progressive flow characteristics), adjusts and connects the ports **P** and **A**. Due to the integrated pressure compensator spool together with the pressure compensator spring, the pressure drop across the valve is kept constant, independent of the pressures at **P** and **A**. In case of de-excitation of the proportional solenoid (**1**), the control spring returns the control spool into its initial position. The entire flow must bedissipated via the upstream system pressure relief valve.
The manual override (**2**) allows for the adjustment of the valve without solenoid energization.

Function (3-way)
With de-energized proportional solenoid (**1**), the control spool that is always pressure-compensated to the actuating forces due to its structural design is held in the initial position by the control spring and blocks the flow between port **P** and **A**. By energizing the proportional solenoid (**1**), the control spool is adjusted directly proportional to the electrical input signal and, via orifice-type cross-sections (with progressive flow characteristics), adjusts and connects the ports **P** and **A**. Due to the integrated pressure compensator spool together with the pressure compensator spring, the pressure drop across the valve is kept constant, independent of the pressures at **P**, **T** and **A**. In case of excessive flow from **P**, the pressure compensator spool moves to the right and opens the connection **P** to **T**. In case of de-excitation of the proportional solenoid (**1**), the control spring returns the control spool into its initial position. The entire flow is now directly led from port **P** to port **T**.
The manual override (**2**) allows for the adjustment of the valve without solenoid energization.

▼ **Type KUDSR3...**



1 Proportional solenoid
2 Manual override

Technical data

General			
Weight		kg	0.97
Installation position			Any – if it is ensured that no air can collect upstream of the valve. Otherwise, we recommend suspended installation of the valve.
Ambient temperature range		°C	See characteristic curve on page 9
Storage temperature range		°C	–20 to +80
Environmental audits			
Salt spray test according to DIN 50021		h	720
Surface protection DC solenoids			Coating according to DIN 50962-Fe//ZnNi with thick film passivation

Hydraulic			
Maximum operating pressure	Port **P**	bar	350
Bypass pressure	Port **T**	bar	350 with q_{Vmax}
Priority pressure	Port **A**	bar	330 ... q_{Vmax}
Control pressure differential	**P** → **A**	bar	12 ... 15
Minimum pressure differential	**P** → **A**	bar	> 10
Maximum flow	Port **P**	l/min	120
Rated flow	**P** → **A**	l/min	80 (regulated)
Leakage		ml/min	< 100 (with Δp = 100 bar in **P**; HLP46, ϑ_{Oil} = 40°C)
Hydraulic fluid			See table on page 6
Hydraulic fluid temperature range		°C	−40 ... +100 (preferably +40 ... +50)
Viscosity range		mm^2/s	5 ... 400 (preferably 10 ... 100)
Maximum admissible degree of contamination of the hydraulic fluid Cleanliness class according to ISO 4406 (c)			Class 20/18/15 [1]
Load cycles		Million	10
Hysteresis[2]		%	≤ 5
Range of inversion[2]		%	≤ 2
Response sensitivity[2]		%	≤ 1

Notice
For applications outside these parameters, please consult us!

1) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and simultaneously increases the life cycle of the components.

2) Measured with analog amplifier type RA2-1/10 according to data sheet 95230 (PWM = 100 Hz).

Elektric				
Voltage type			Direct voltage	
Supply voltages[3]		V	12 DC	24 DC
Maximum solenoid current		A	1.8	1.2
Coil resistance	Cold value at 20°C	Ω	3.3	7.2
	Max. hot value	Ω	5.8	13.0
Duty cycle (ED)		%	see characteristic curve on page 9	
Maximum coil temperature[4]		°C	150	
Protection class according to VDE 0470-1 (DIN EN 60529) DIN 40050-9	Version “K4”		IP 65 with plug-in connector mounted and locked	
	Version “C4”		IP 66 with plug-in connector mounted and locked	
			IP 69K with Rexroth plug-in connector (Material no. **R901022127**)	
	Version “K40”		IP 69K with plug-in connector mounted and locked	
PWM signal (recommendation)		Hz	100 (Analog amplifier type RA... Data sheet 95230)	
Control electronics (separate order)			Analog amplifier module type VT-MSPA1...	Data sheet 30223
			Plug-in proportional amplifier type VT-SSPA1...	Data sheet 30116
			Analog amplifier type RA...	Data sheet 95230
			BODAS control unit type RC...	Data sheet 95200
Design according to VDE 0580				

Notice
When establishing the electrical connection, the protective earthing conductor (PE ⏚) must be connected correctly.

3) Other voltages on request
4) Due to the surface temperatures of the solenoid coils, the standards ISO 13732-1 and ISO 4413 need to be adhered to!

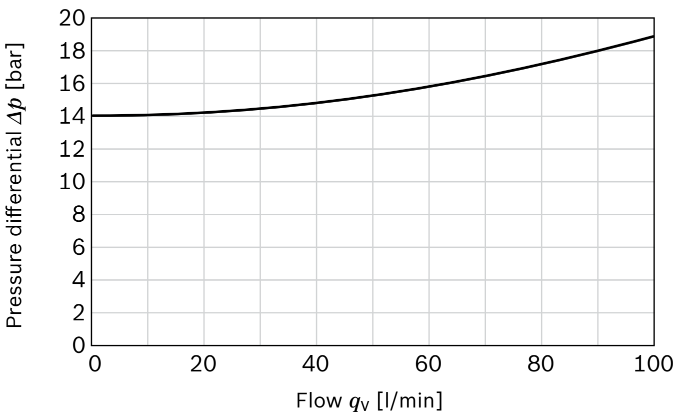
Hydraulic fluid

Hydraulic fluid		Classification	Suitable sealing material	Standards	Data sheet
Mineral oils		HL, HLP	FKM	DIN 51524	90220
Bio-degradable	Insoluble in water	HEES	FKM	ISO 15380	90221
	Soluble in water	HEPG	FKM	ISO 15380	90221

Notice
- Further information and details on using other hydraulic fluids are available in the above data sheets or on request!
- Restrictions are possible with the technical valve data (temperature, pressure range, service life, maintenance intervals, etc.).
- The flash point of the hydraulic fluids used must be 40 K above the maximum solenoid surface temperature.
- **Bio-degradable:** When using biodegradable hydraulic fluids that are also zinc-solving, zinc may accumulate in the fluid.

Characteristic curves

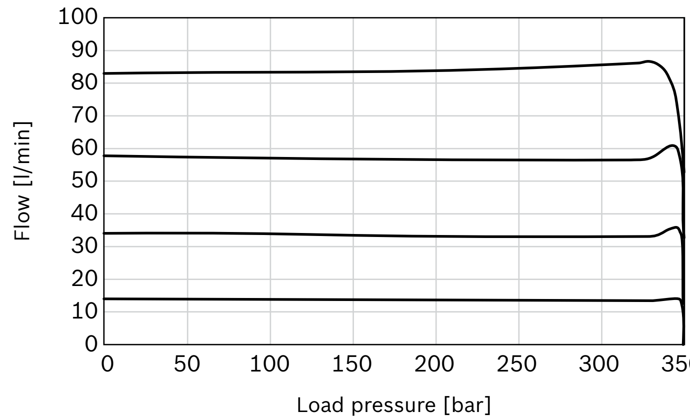
▼ **Δp–qV-characteristic curve – port P → T**
(**A** open, orifice closed)



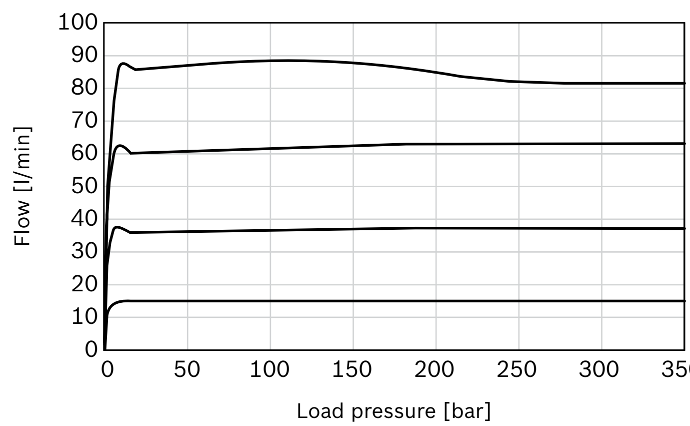
Notice
Characteristic curves measured with HLP46, ϑ_{Oil} = $40^{\pm 5}$°C and 24 V coil.

Version "C" (q_V **P** = 80 l/min)

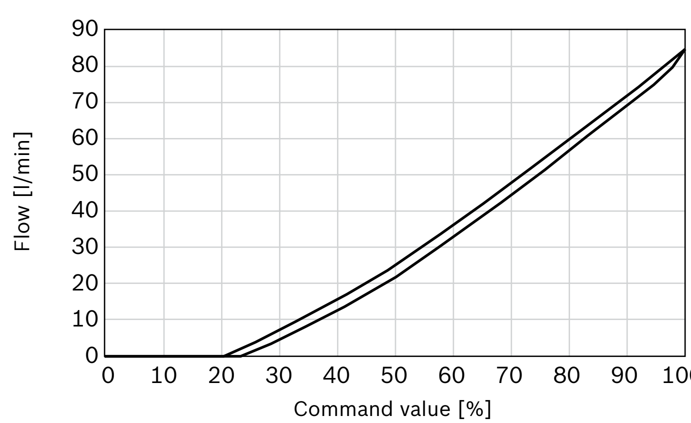
▼ **Regulated flow at port A as a function of the load pressure**
3-way function (port **T** open to the tank)



▼ **Regulated flow at port A as a function of the load pressure**
2-way function (port **T** closed)

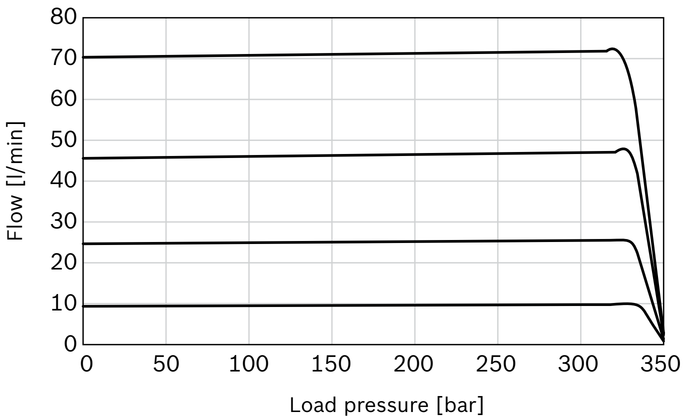


▼ **Regulated flow at port A as a function of the command value**

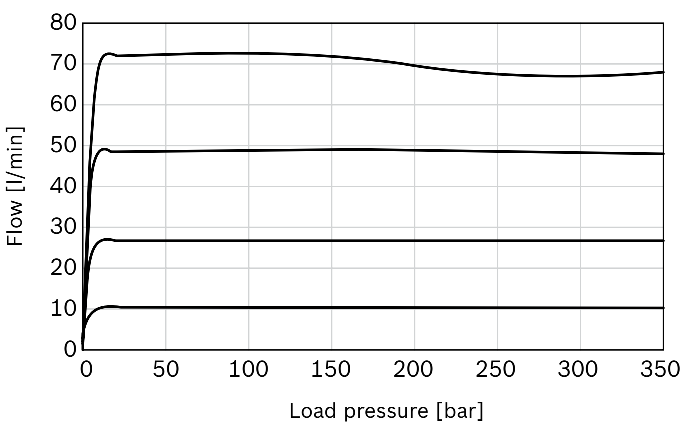


Version "C1" (q_V **P** = 60 l/min)

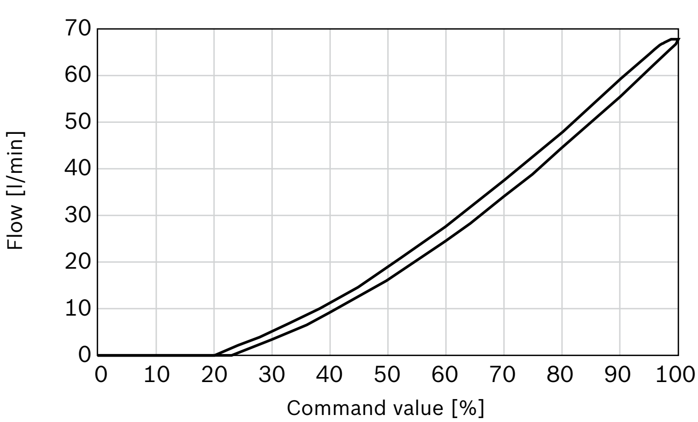
▼ **Regulated flow at port A as a function of the load pressure**
3-way function (port **T** open to the tank)



▼ **Regulated flow at port A as a function of the load pressure**
2-way function (port **T** closed)

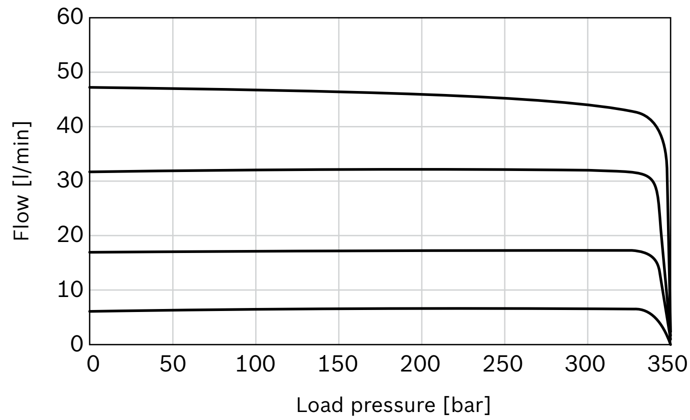


▼ **Regulated flow at port A as a function of the command value**

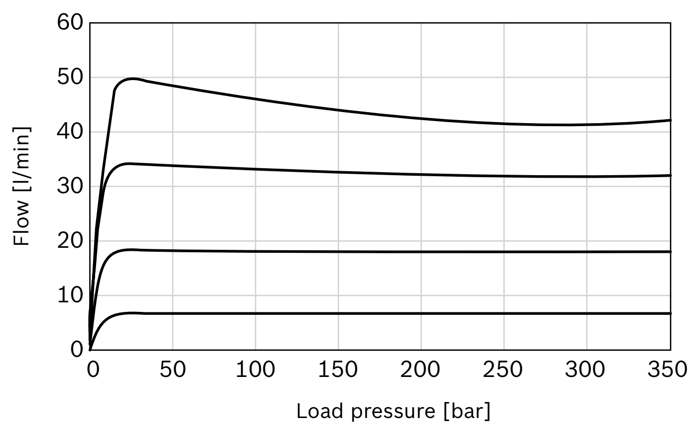


Version "C2" (q_V **P** = 40 l/min)

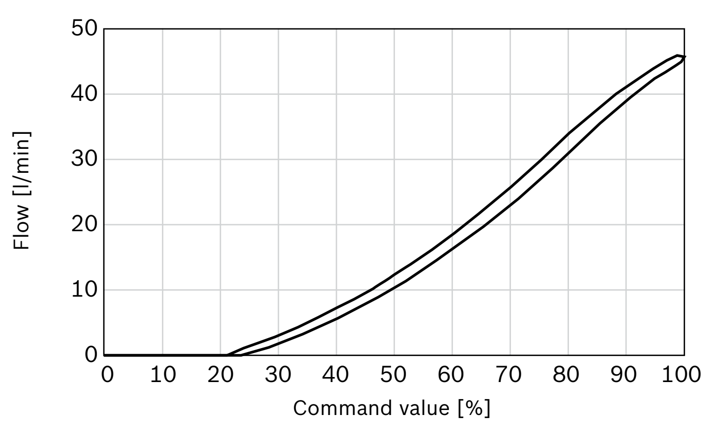
▼ **Regulated flow at port A as a function of the load pressure**
3-way function (port **T** open to the tank)



▼ **Regulated flow at port A as a function of the load pressure**
2-way function (port **T** closed)



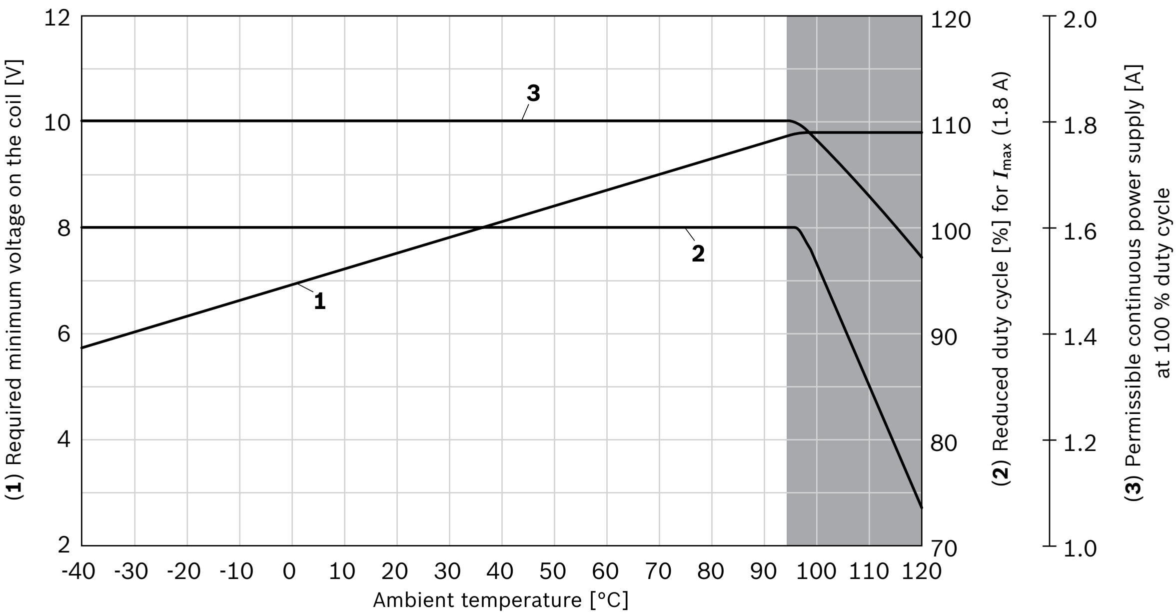
▼ **Regulated flow at port A as a function of the command value**



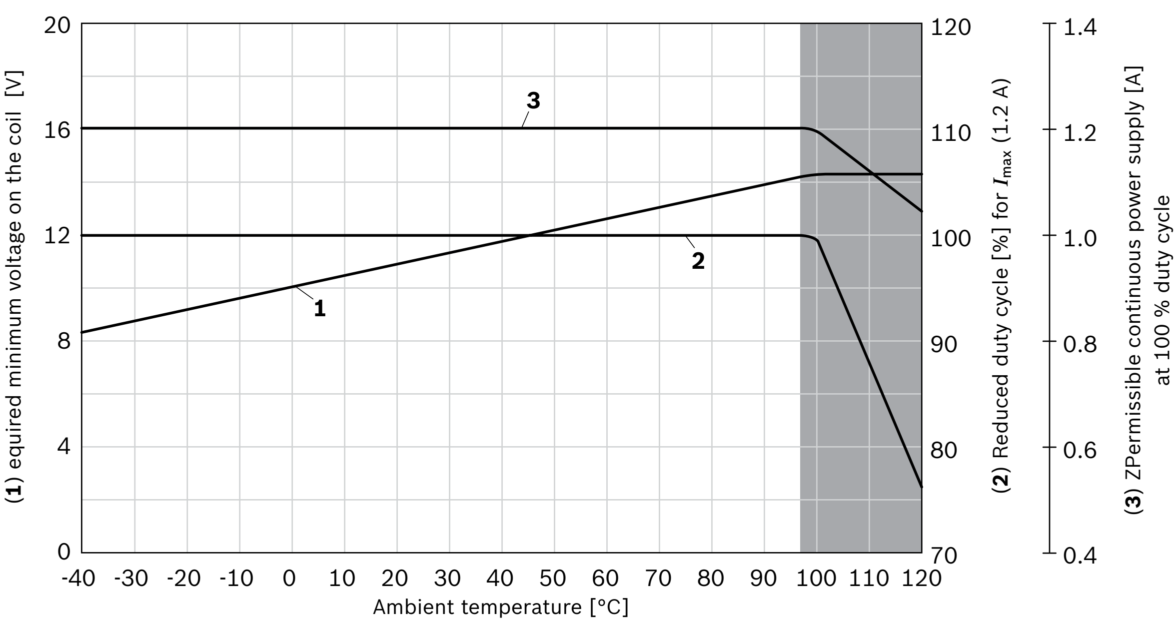
Permissible working range

Minimum terminal voltage at the coil, relative duty cycle and permissible working range depending on the ambient temperature

▼ **Version “G12”**



▼ **Version “G24”**

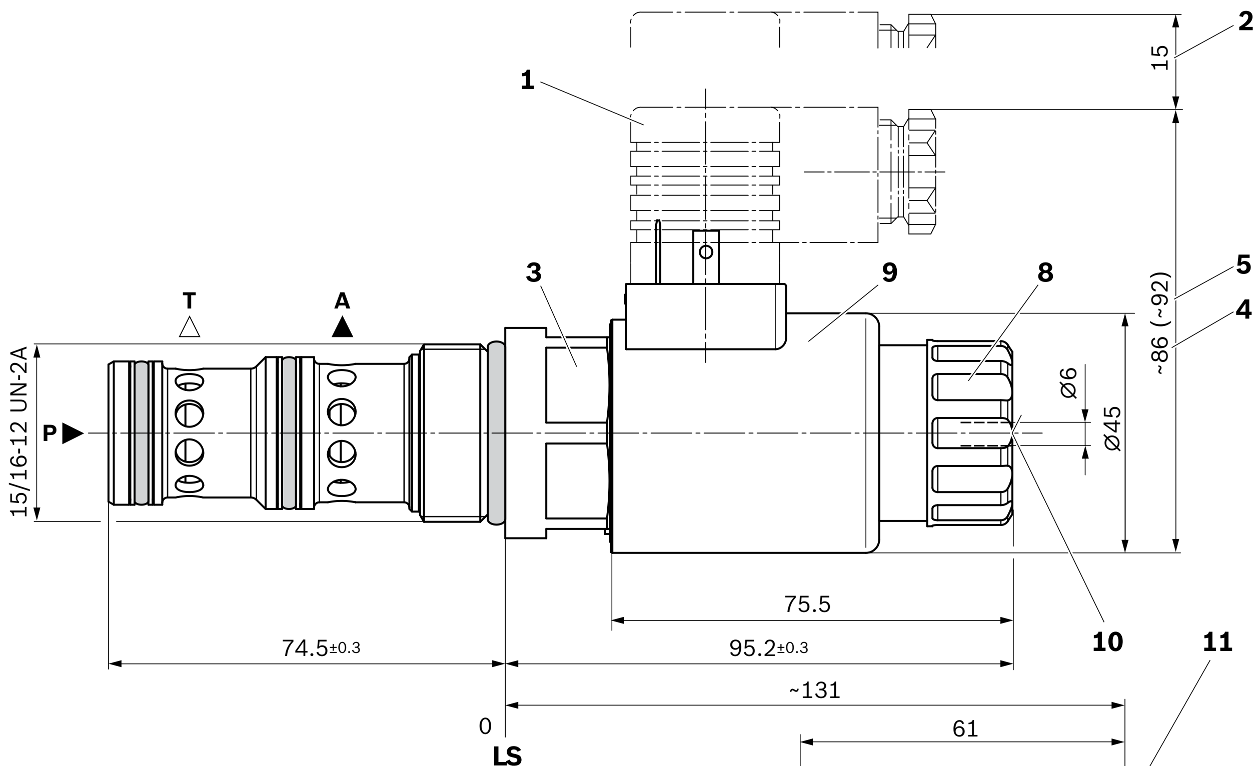


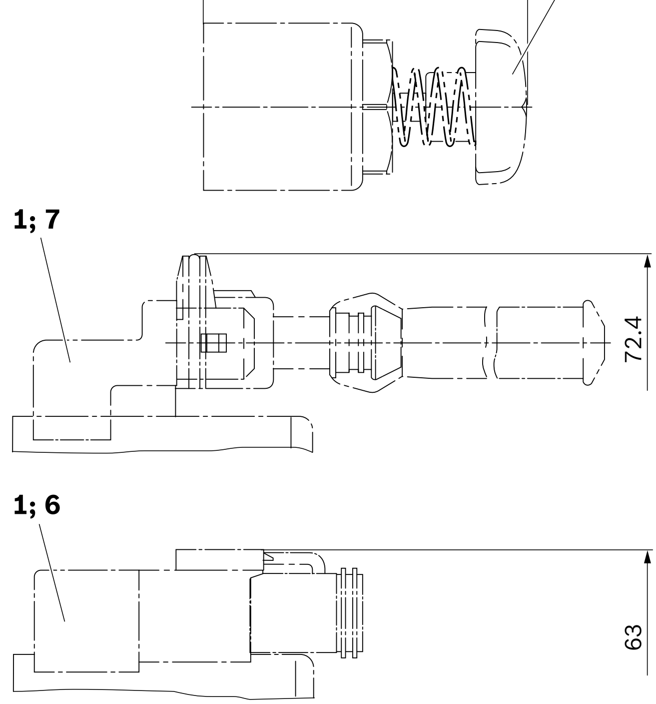
Notice
The characteristic curves have been determined for coils with valve with medium test block size (80 × 80 × 80 mm), without flow in calm air.
Depending on the installation conditions (block size, flow, air circulation, etc.) there may be a better heat dissipation. Thus, the area of application is broadened.

In individual cases, more unfavorable conditions may lead to limitations of the area of application.

= Limited valve performance

Dimensions





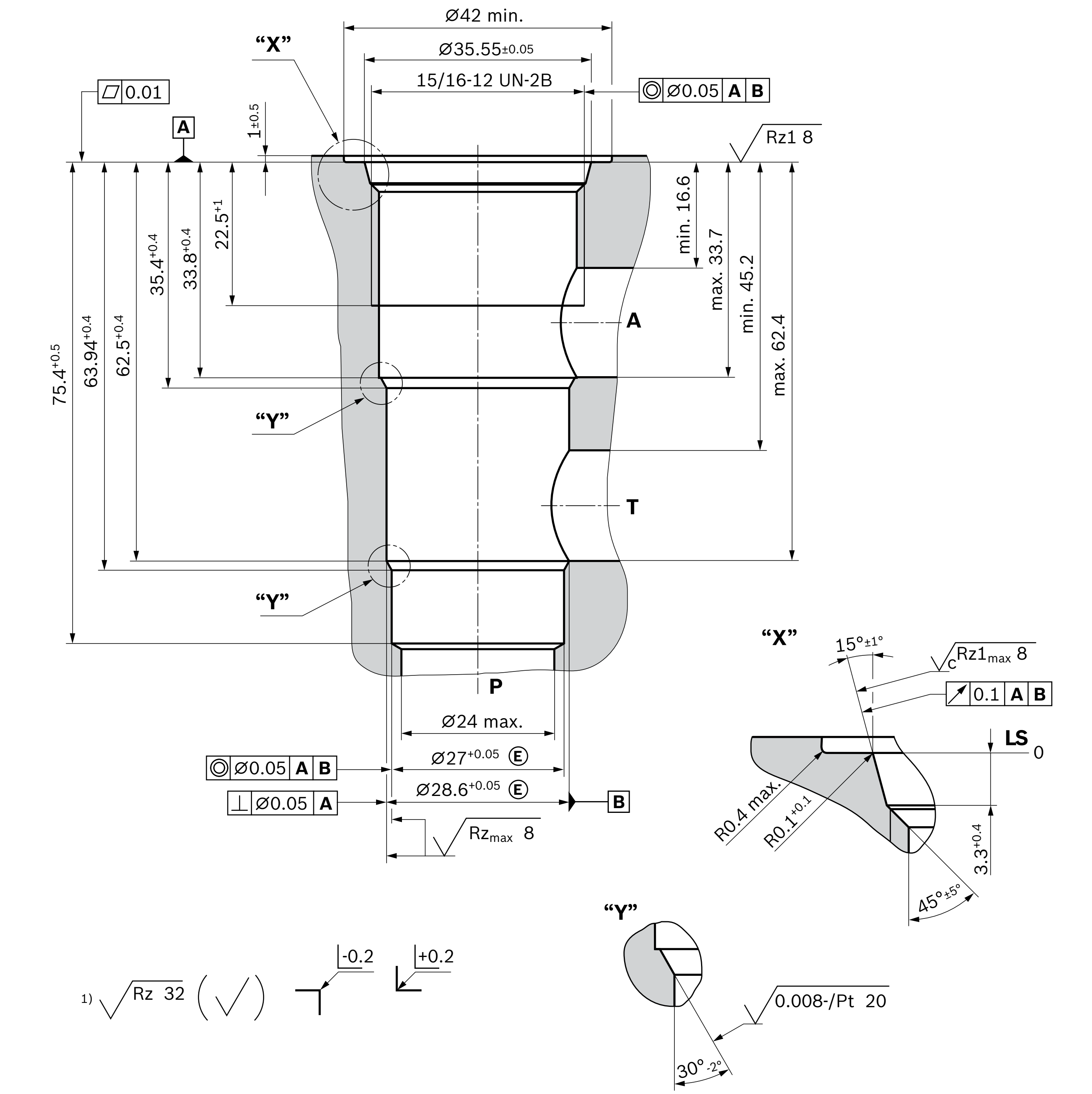
1 Plug-in connector without circuitry for connector “K4” (separate order, see data sheet 08006)
2 Space required to remove the plug-in connector
3 SW36, tightening torque M_A = 165^{+15} Nm
4 Dimension for “K4” plug-in connector, without circuitry
5 Dimension () for “K4” plug-in connector, with circuitry
6 Plug-in connector for connector “K40” (separate order, see data sheet 08006)
7 Plug-in connector for connector “C4” (separate order, see data sheet 08006)
8 Nut, tightening torque M_A = 5^{+2} Nm
9 Coil (separate order, see page 3)
10 Concealed manual override “N9”
11 Screwable manual override with star handle “N14” (separate order, see page 12)

P = Pump port
T = Tank port
A = Control pressure port

LS = Location Shoulder

Mounting cavity

▼ **R/UNF16-03-0-06; 3 main ports; thread 1 5/16-12 UN-2B**



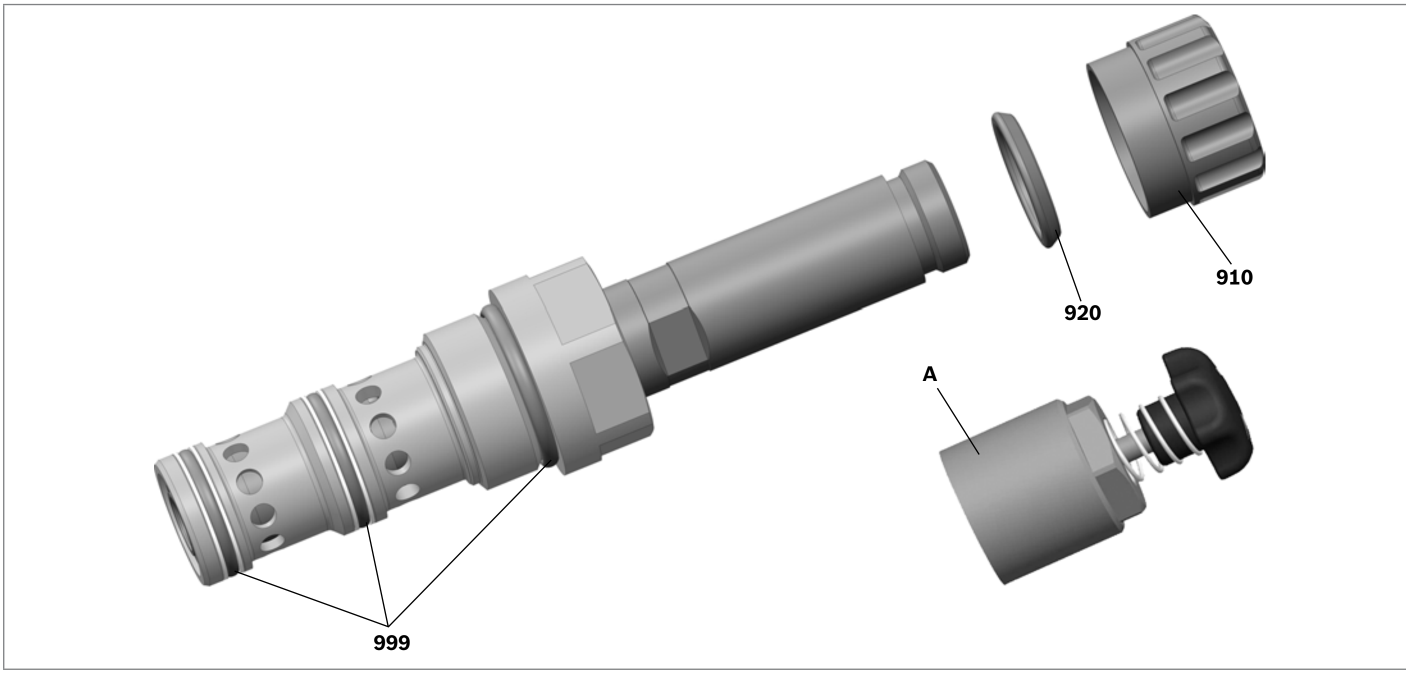
P = Pump port
T = Tank port
A = Control pressure port

LS = Location Shoulder

All seal ring insertion faces are rounded and free of burrs.

1) Visual inspection

Available individual components



Item	Denomination	Material no.
910	Nut	R900029574
920	Seal ring for pole tube	R900002507
999	Seal kit of the valve	R961005887
A	Manual override “N14”	R913009058

Coils separate order, see page 3.

Related documents

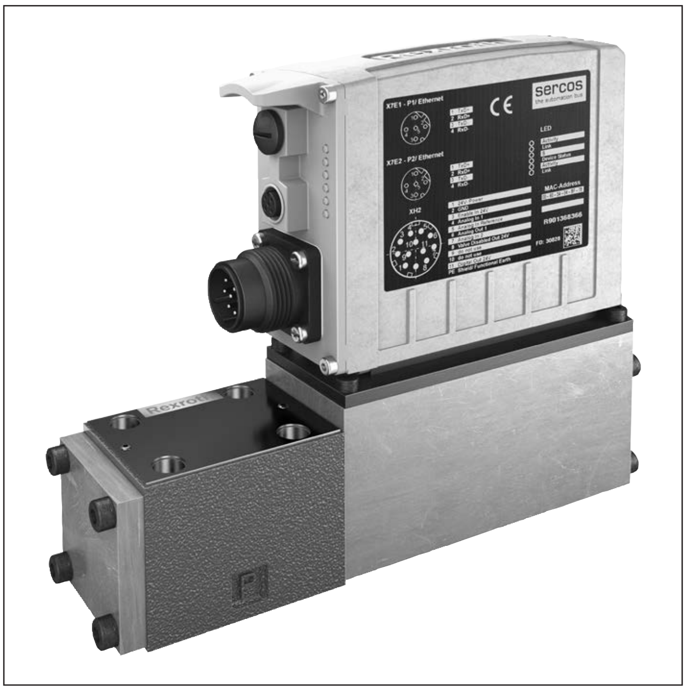
- Control electronics:
  - Analog amplifier module — Type VT-MSPA1... — Data sheet 30223
  - Plug-in proportional amplifier — Type VT-SSPA1... — Data sheet 30116
  - Analog amplifier — Type RA... — Data sheet 95230
  - BODAS control unit — Type RC... — Data sheet 95200
- Selection of the filters

RE 29391
Edition: 2021-05
Replaces: 2016-02

rexroth
A Bosch Company

Directional control valve, direct operated, with integrated digital axis controller (IAC-Multi-Ethernet)

Type 4WRPDH



- Sizes 6 and 10
- Component series 2X
- Maximum operating pressure 350 bar
- Maximum flow 100 l/min (***Δp*** = 70 bar)

Features

- Open
  - Integrated digital axis control functionality (IAC Multi Ethernet)
  - Bus connection/service interface (sercos, EtherCAT, EtherNet/IP, PROFINET RT, POWERLINK, VARAN)
- Scalable
  - 2 configurable analog sensor inputs
  - 1 input for linear position measurement system (SSI, 1Vpp or EnDat 2.2)
- Safe
  - Internal safety function (can be used up to category 4/PL e according to EN 13849-1)
  - CE conformity according to EMC Directive 2004/108/EC
- Precise
  - Best-in-class hydraulic controller
  - High response sensitivity and low hysteresis

Contents

Ordering code

01	02	03	04	05	06	07	08	09		10		11		12	13	14	15	16
4	**WRP**	**D**	**H**			**B**			**–**	**2X**	**/**		**/**	**24**		**D6**		

01	4 main ports	**4**
02	Directional control valve	**WRP**
03	With integrated digital axis controller	**D**
04	Control spool/sleeve	**H**
05	Size 6	**6**
	Size 10	**10**
06	Symbols; possible version see page 3	
07	Installation side of the inductive position transducer	**B**

Rated flow at 70 bar pressure differential (35 bar/control edge)

08		Flow characteristic			
		"L"	**"P"** (inflection 40%)	**"P"** (inflection 60%)	
	– Size 6				
	2 l/min	✓	–	–	**02**
	4 l/min	✓	✓	–	**04**
	12 l/min	✓	–	–	**12**
	15 l/min	–	–	✓	**15**
	24 l/min	✓	–	–	**24**
	25 l/min	–	–	✓	**25**
	40 l/min	✓	✓	–	**40**
	– Size 10				
	50 l/min	✓	✓	–	**50**
	100 l/min	✓	✓	–	**100**

Flow characteristic

09	Linear	**L**
	Inflected characteristic curve (inflection 60% for NG6 with rated flows "**15**" and "**25**", otherwise inflection 40%)	**P**
10	Component series 20 ... 29 (20 ... 29: unchanged installation and connection dimensions)	**2X**

Seal material (observe compatibility of seals with hydraulic fluid used, see page 7)

11	NBR seals	**M**
	FKM seals	**V**
12	Supply voltage 24 V	**24**

Ethernet interface

13	EtherNET/IP	**E**
	PROFINET RT	**N**
	Sercos	**S**
	EtherCAT (CANopen profile)	**T**
	POWERLINK (CANopen profile)	**W**
	VARAN	**V**

Electrical interface

14	±10 VDC or 4 ... 20 mA	**D6**

Ordering code

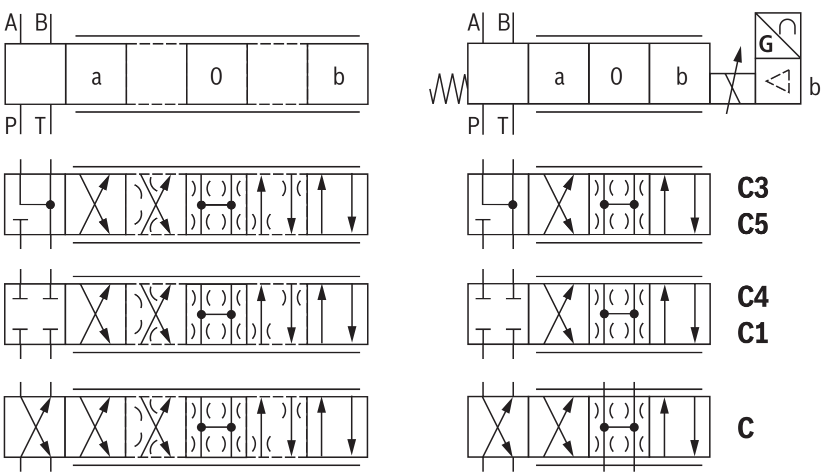
01	02	03	04	05	06	07	08	09		10		11		12	13	14	15	16
4	**WRP**	**D**	**H**			**B**			**–**	**2X**	**/**		**/**	**24**		**D6**		

Sensor interfaces

15	0 ... 10 V/4 ... 20 mA/EnDat 2.2	**S**
	0 ... 10 V/4 ... 20 mA/SSI	**T**
	0 ... 10 V/4 ... 20 mA/1Vpp	**U**

16	Further details in the plain text	*****

Symbols

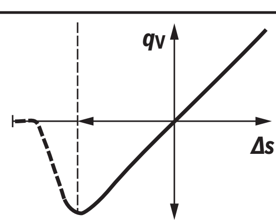
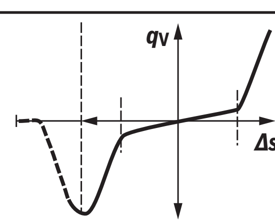
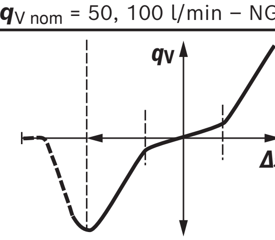
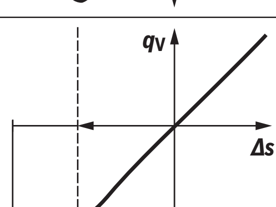


With symbols C5 and C1: [1]
P → A: $q_{V\ nom}$ B → T: $q_{V\ nom}/2$
P → B: $q_{V\ nom}/2$ A → T: $q_{V\ nom}$

[1] Standard = 1:1, , $q_{V\ nom}$ 2:1 from rated flow = 40 l/min (version "40")

Notice:
Representation according to DIN ISO 1219-1.
Hydraulic interim positions are shown by dashes.

Flow characteristic

Symbol	**Linear characteristic curve** (version "L")	**Inflected characteristic curve** (version "P") Inflection 60% ($q_{V\ nom}$ = 15, 25 l/min)	Inflection 40% ($q_{V\ nom}$ = 4, 40 l/min – NG6) ($q_{V\ nom}$ = 50, 100 l/min – NG10)
C3, C5 **C4, C1**			
C		–	–

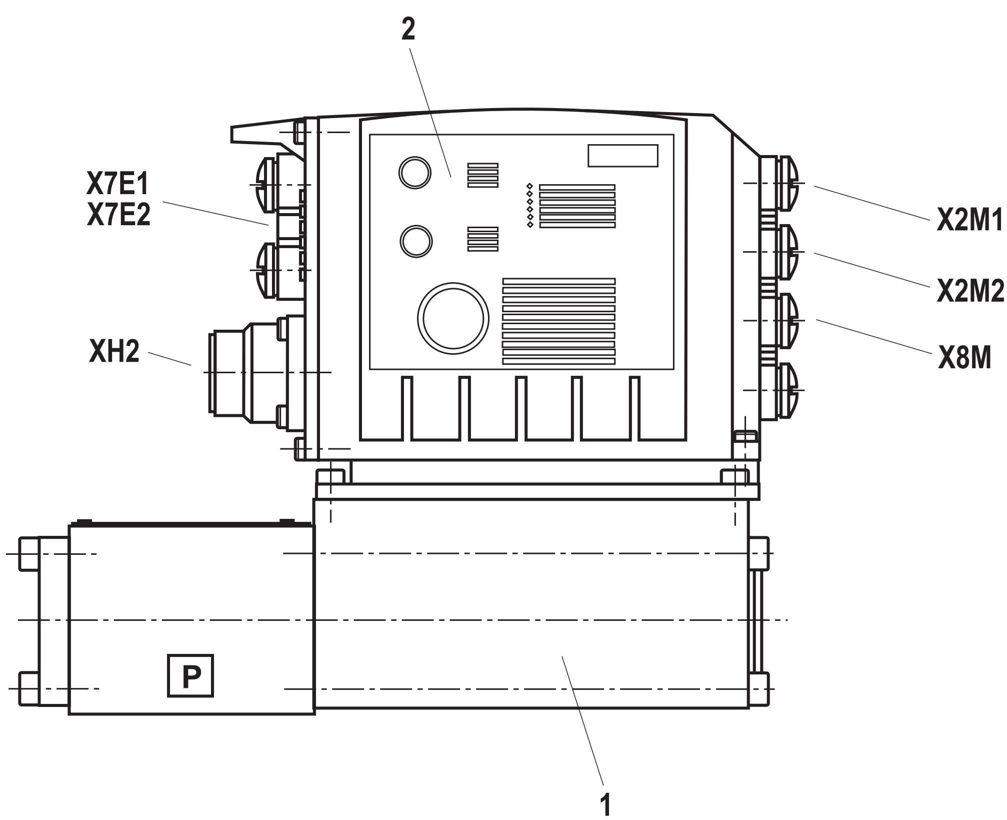
Function, section

Set-up

The directional control valve with IAC-Multi-Ethernet electronics mainly consists of:

- Direct operated directional control valve (1) with control spool and sleeve in servo quality
- Integrated digital axis controller (2) with:
  - analog/digital interface (XH2)
  - Ethernet interfaces (X7E1, X7E2)
  - analog sensor interfaces (X2M1, X2M2)
  - digital sensor interface (X8M)

Directional control valve with integrated axis controller, analog interfaces (X2M1, X2M2), digital interfaces (XH2, X8M) and Ethernet interfaces (X7E1, X7E2)



Function, section

Functional description

The **IAC-Multi-Ethernet** valve (**I**ntegrated **A**xis **C**ontroller based on directional control valves) is a digital directional control valve with integrated axis controller and the following functionalities:

- Position control
- Pressure/force control
- Closed-loop speed control
- Substitutional closed-loop control (position - pressure/force)
- Substitutional control (flow - pressure/force)
- pQ function (flow-controlled)

This enables, amongst others, the following operating modes:

- Valve direct control
- Drive-controlled position control
- Drive-controlled positioning
- Positioning block operation

- The command values are preset via the Ethernet interface (X7E1 or X7E2) or, alternatively, via the analog/digital interface (XH2)
- The feedback information of the actual value signals to the superior control system is provided optionally either via the Ethernet interface (X7E1 or X7E2) or the analog/digital interface (XH2)
- The controller parameters are set via the Ethernet interface (X7E1 or X7E2)

Monitoring

The digital control electronics enable comprehensive monitoring functions/error detection including:

- Undervoltage
- Communication error
- Cable break for analog sensor inputs and digital position measurement system
- Short-circuit monitoring for analog/digital outputs
- Monitoring of the microcontroller (watchdog)
- Temperature of the integrated electronics

IndraWorks DS PC program

To implement the project planning task and to parameterize the IAC-Multi-Ethernet valves, the user may use the IndraWorks DS engineering tool (see accessories):

- Project planning
- Parameterization
- Commissioning
- Diagnosis
- Comfortable administration of all data on a PC
- PC operating systems: Windows XP (SP3), Windows 7

Safety function

The integrated control electronics of the valve enables the additional shut-off of a channel according to EN 13849-1 in the direction P to A (depending on the application, the fail-safe position must be adhered to).
For this purpose, a suitable control system must be provided to perform the plausibility check between the direction-dependent valve signals "enable input" and "enable acknowledgement" (signal fed back by the valve).
It is not possible to switch off direction P to B in a safety-relevant manner according to EN 13849-1 (depending on valve type).

Technical data
(For applications outside these values, please consult us!)

General				
Size		NG	6	10
Type of connection			Plate connection, porting pattern according to ISO 4401	
Weight		kg	3.2	7.2
Installation position			any	
Ambient temperature range		°C	–20 ... +60	
Storage temperature range		°C	+5 ... +40	
Maximum solenoid surface temperature		°C	150	
$MTTF_d$ value according to EN ISO 13849	▶ Hydraulic (category 1)	Years	150 (for further details, see operating instructions 29391-B)	
Vibration resistance	▶ Sine test according to DIN EN 60068-2-6		10 ... 2000 Hz / maximum of 10 g / 10 cycles / 3 axes	
	▶ Noise test according to DIN EN 60068-2-64		20 ... 2000 Hz / 10 g_{RMS} / 30 g peak / 30 min / 3 axes	
	▶ Transport shock according to DIN EN 60068-2-27		15 g / 11 ms / 3 axes	
Maximum relative humidity (no condensation)		%	95	

Hydraulic										
Maximum operating pressure	▶ Ports A, B, P	bar	350						315	
	▶ Port T	bar	250							
Hydraulic fluid			see table page 7							
Hydraulic fluid temperature range (flown-through)		°C	–20 ... +60							
Viscosity range	▶ Recommended	mm²/s	20 ... 100							
	▶ Maximum admissible	mm²/s	10 ... 800							
Maximum admissible degree of contamination of the hydraulic fluid; cleanliness class according to ISO 4406 (c)			Class 18/16/13 [2)]							
Rated flow (***Δp*** = 35 bar per edge [1)])		l/min	2	4	12	15	24/25	40	50	100
Leakage flow (at 100 bar)	▶ Linear characteristic curve "L"	cm³/min	< 150	< 180	< 300	–	< 500	< 900	< 1200	< 1500
	▶ Inflected characteristic curve "P"	cm³/min	–	–	–	< 180	< 300	< 450	< 600 (1:1) < 500 (2:1)	< 600
Limitation of use (transition in fail safe position)	▶ Symbol C3, C5	bar	350	350	350	350	350	160	315	160
	▶ Symbols C4, C1	bar	350	350	350	280	250	100	250	100

1) Flow for deviating ***Δp***:

$$q_x = q_{Vnom} \times \sqrt{\frac{\Delta p_x}{35}}$$

2) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and simultaneously increases the life cycle of the components.

Technical data
(For applications outside these values, please consult us!)

Hydraulic fluid		**Classification**	**Suitable sealing materials**	**Standards**	**Data sheet**
Mineral oils		HL, HLP, HLPD, HVLP, HVLPD	NBR, FKM	DIN 51524	90220
Bio-degradable	▶ Insoluble in water	HETG	FKM	ISO 15380	90221
		HEES	FKM		
	▶ Soluble in water	HEPG	FKM	ISO 15380	
Flame-resistant	▶ Water-free	HFDU (glycol base)	FKM	ISO 12922	90222
		HFDU (ester base)	FKM		
		HFDR	FKM		
	▶ Containing water	HFC (Fuchs: Hydrotherm 46M, Renosafe 500; Petrofer: Ultra Safe 620; Houghton: Safe 620; Union: Carbide HP5046)	NBR	ISO 12922	90223

Important information on hydraulic fluids:
- For further information and data on the use of other hydraulic fluids, please refer to the data sheets above or contact us.
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.).
- The ignition temperature of the hydraulic fluid used must be 50 K higher than the maximum surface temperature.
- **Bio-degradable and flame-resistant – containing water:** If components with galvanic zinc coating (e.g. version "J3" or "J5") or parts containing zinc are used, small amounts of dissolved zinc may get into the hydraulic system and cause accelerated aging of the hydraulic fluid. Zinc soap may form as a chemical reaction product, which may clog filters, nozzles and solenoid valves – particularly in connection with local heat input.
- **Flame-resistant – containing water:**
  - Due to the increased cavitation tendency with HFC hydraulic fluids, the life cycle of the component may be reduced by up to 30% as compared to the use with mineral oil HLP. In order to reduce the cavitation effect, it is recommended – if possible specific to the installation – backing up the return flow pressure in ports T to approx. 20% of the pressure differential at the component.
  - Dependent on the hydraulic fluid used, the maximum environment and hydraulic fluid temperature must not exceed 50 °C. In order to reduce the heat input into the component, the command value profile is to be adjusted for proportional and high-response valves.

Static/dynamic		
Hysteresis	%	≤ 0.2
Manufacturing tolerance q_{Vmax}	%	≤ 10
Temperature drift	%/10 K	Zero shift < 0.25
Pressure drift	%/100 bar	Zero shift < 0.15
Zero compensation		ex plant ±1%

Technical data
(For applications outside these values, please consult us!)

Electrical, integrated electronics (OBE)				
Size		NG	6	10
Supply voltage [3; 4]	▶ Nominal voltage	VDC	24	
	▶ Lower limit value	VDC	18	
	▶ Upper limit value	VDC	36	
Maximum admissible residual ripple		Vpp	2.5 (comply with absolute supply voltage limit values)	
Current consumption	▶ Maximum [5]	A	2.5	
	▶ Impulse current	A	4	
Maximum power consumption		W	40	60
Relative duty cycle		%	100 (continuous operation)	
Protection class according to EN 60529			IP 65 with mounted and locked plug-in connectors	
Required fuse protection, external		A	4, time-lag	
Protective grounding conductor and screening			see connector pin assignment (CE-compliant installation) page 12 and 13	
Adjustment			calibrated in the plant, see characteristic curves page 15 ... 18	
Booting time		s	< 15	
Scan time pressure and force controller (minimum)		ms	0.5	
Scan time position controller (minimum)		ms	1	
AD/DA resolution	▶ Analog inputs	Bit	12	
	▶ Analog output	Bit	10	
Parameterization interface			Ethernet	
Conformity			CE according to EMC directive 2004/108/EC tested according to EN 61000-6-2 and EN 61000-6-3	

3) Supply voltage is used directly for sensor connections X2M1, X2M2 and X8M (no internal voltage limitation)

4) Voltage limit values must be observed directly at the connector of the valve (observe line length and cable cross-section!)

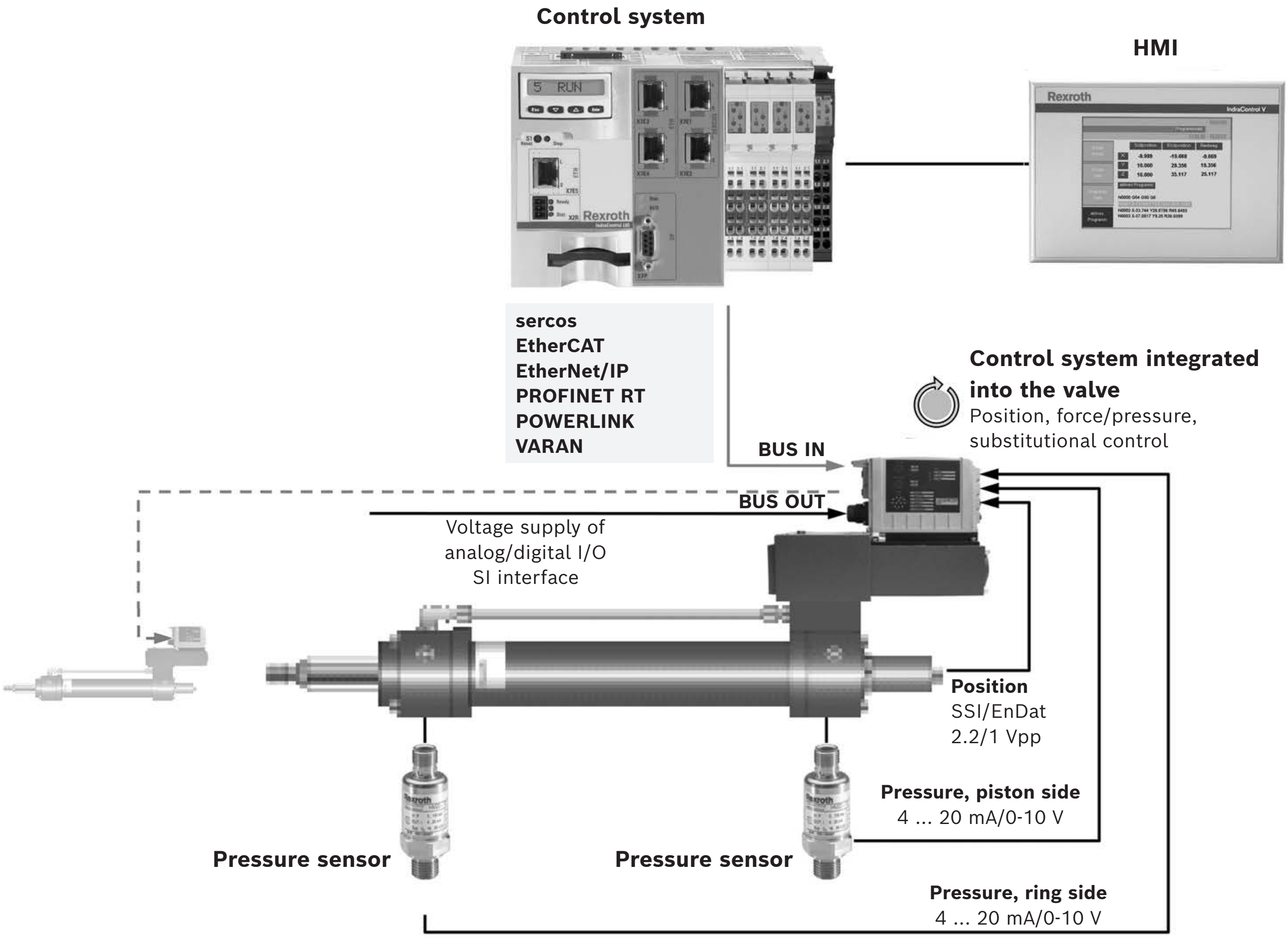
5) When using the sensor inputs or the switching output, the maximum current consumption will increase according to the external load

Electrical, integrated electronics (OBE)			
Digital inputs XH2	▶ Quantity		optionally up to 2, configurable (analog inputs are omitted)
	▶ Low level	V	–3 ... 5
	▶ High level	V	15 ... $\boldsymbol{U}_B$
	▶ Current consumption at high level	mA	< 1
	▶ Reference potential		Pin 5
Digital outputs XH2	▶ Quantity		1
	▶ Low level	V	0 ... 3
	▶ High level	V	15 ... $\boldsymbol{U}_B$
	▶ Current carrying capacity	A	1.5 (short-circuit-proof)
	▶ Signal delay time	msec	< 2 (depending on set scan time)
	▶ Reference potential		GND

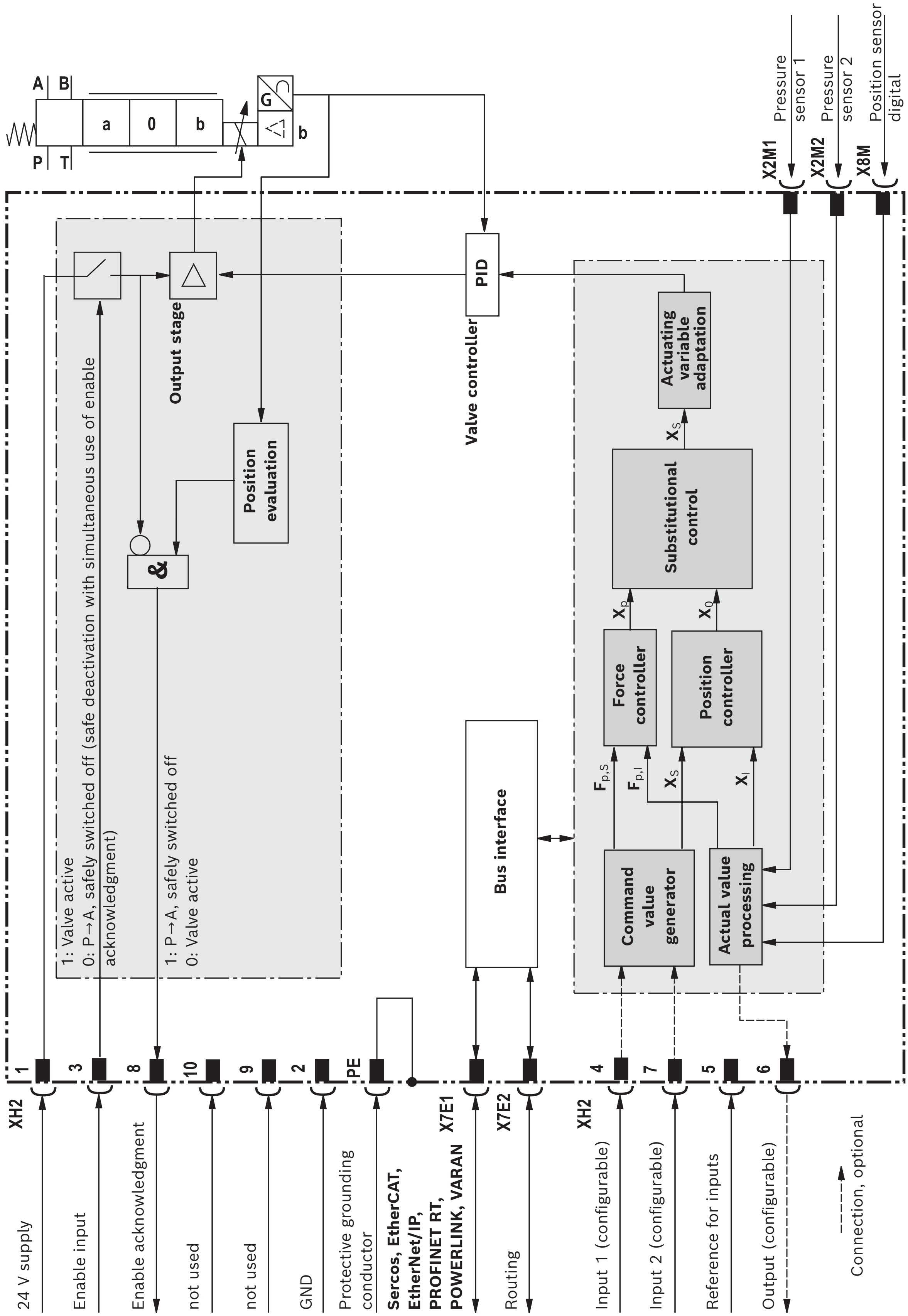
Technical data
(For applications outside these values, please consult us!)

Analog inputs XH2	▶ Number (current and voltage input parameterizable)		optionally up to 2, configurable (digital inputs are no longer required)
	▶ AD resolution	bit	12
	▶ Voltage inputs (differential inputs)		
	– Measurement range	V	–10 … +10
	– Input resistance	kΩ	80 +10%
	– Temperature drift		< 14 mV / 10 K
	▶ Current inputs (reference to AGND)		
	– Input current		4 … 20 (0 … 20 physically)
	– Input resistance	Ω	200, measuring resistance plus FET
	– Temperature drift		< 25 µA / 10 K
Analog outputs XH2	▶ Number (current and voltage input parameterizable)		1
	▶ DA resolution	bit	14
	▶ Voltage outputs		
	– Output range	V	–10 … +10 (0 … 10 by software)
	– Minimum load impedance	kΩ	10
	– Temperature drift		< 5 mV / 10 K
	▶ Current outputs		
	– Output range	mA	0 … 20 (4 … 20 by software)
	– Maximum load	Ω	200
Analog sensors X2M1, X2M2	▶ Number (current and voltage input configurable)		1 per connector
	▶ Supply voltage	V	24 (corresponding to supply voltage applied to XH2)
	▶ Maximum supply current	mA	350 (sum X2M1, X2M2 and X8M)
	▶ AD resolution	bit	12
	▶ Voltage inputs		
	– Measurement range	V	0 … 10
	– Input resistance	kΩ	80 +10%
	– Temperature drift		< 15 mV / 10 K
	▶ Current inputs (reference to AGND)		
	– Input current		4…20 (0…20 physically)
	– Input resistance	Ω	200, measuring resistance plus PTC
	– Temperature drift		< 10 µA / 10 K
Digital sensor X8M	▶ Supply voltage		24 V or 5 V
	▶ Maximum supply current – 24 V	mA	350 (sum X2M1, X2M2 and X8M)
	– 5 V	mA	250
	▶ SSI transducer		
	– Coding		Gray
	– Data width		12 … 28 bit
	– Transfer frequency		80 kHz … 1 MHz
	– Line receiver / driver		RS485
	▶ Endat encoder		2.2
	– Line receiver / driver		RS485
	– Resolution		minimum 10 nm and multiple
	▶ 1Vpp-encoder		
	– Transfer frequency	kHz	250

Representation of the axis controller in the system network



Block diagram/controller function block



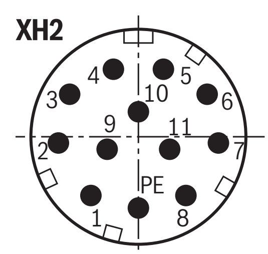
Detailed description of the safety function:
After the signal at the enable input has been removed, the output stage, and thus the solenoid of the valve, are internally separated from the available supply voltage. The enable acknowledgment will only be activated after the safe valve spool position has been achieved. For a detailed description of the safety function, refer to the operating instructions 29391-B.

Electrical connections, assignment

Connector pin assignment XH2, 11-pole + PE according to EN 175201-804

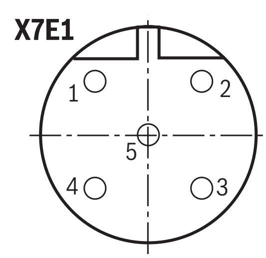
	Core marking		
Pin	Cable, one-part [1)]	Cable, split [2)]	**Interface D6 assignment**
1	1	1	24 V DC supply voltage
2	2	2	GND
3	3	white	Enable input 24 V DC (high ≥ 15 V; low < 2 V)
4	4	yellow	Command values 1 (4 ... 20 mA/±10 V) [3)]
5	5	green	Reference for command values
6	6	violet	Actual value (4 ... 20 mA/±10 V) [3; 4)]
7	7	pink	Command value 2 (4 ... 20 mA/±10 V) [3)]
8	8	red	Enable acknowledgment 24 V DC (I_{max} 50 mA) [5)]
9	9	brown	not used
10	10	black	not used
11	11	blue	Switching output 24 V, configurable (fault-free operation (24 V)/error (0V) or power circuit signal), maximum 1.5 A [3; 5)]
PE	green-yellow	green-yellow	Functional ground (connected directly to metal housing)

1) Core marking of the connection lines for mating connector with cable set (see accessories, page 22, material numbers R901268000, R901272854, R901272852)
2) Core marking of the connection lines for mating connector with cable set (see accessories, page 22, material numbers R900884671, R900032356, R900860399)
3) Selection via commissioning software
4) For diagnostic purposes, precise actual value response via Ethernet interface
5) A load increases the current consumption on pin 1



Connector pin assignment for Ethernet interfaces "X7E1" and "X7E2" (coding D), M12, 4-pole, socket

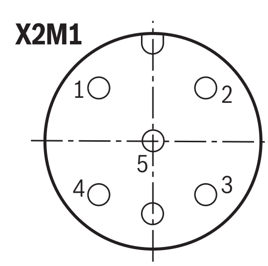
Pin	Assignment
1	TxD +
2	RxD +
3	TxD –
4	RxD –
5	not used



Analog configurable sensor interfaces, connections "X2M1", "X2M2" (coding A), M12, 5-pole, socket

Pin	Assignment
1	+24 V voltage output (sensor supply) [1; 2)]
2	Sensor signal input current (4 ... 20 mA) [3)]
3	GND
4	Sensor signal input voltage (0 ... 10 V) [3)]
5	Negative differential amplifier input to pin 4 (optional)

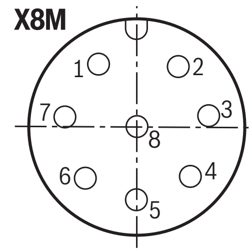
1) Voltage output same as voltage supply connected to input XH2. (Maximum load capacity see page 13)
2) A load increases the current consumption of the valve (pin 1 on the connector XH2)
3) Only one signal input per interface, configurable



Electrical connections, assignment

Digital sensor interface SSI, EnDat 2.2 or 1Vpp measurement system "X8M", M12, 8-pole, socket

Pin	SSI pin assignment 1)	EnDat 2.2 pin assignment 1; 2)	1Vpp pin assignment
1	GND	GND	GND
2	+24 V 3)	+5 V 3)	+5 V 3)
3	Data +	Data +	A +
4	Data –	Data –	A –
5	GND	GND	B +
6	Clock –	Clock –	B –
7	Clock +	Clock +	R +
8	+24 V 3)	+5 V 3)	R –

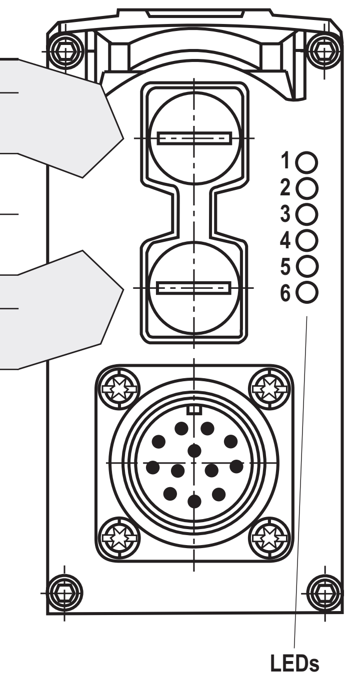


1) Pins 2, 8 and 1, 5 have the same assignment each
2) Supported resolution ≥ 10 nm
3) A load increases the current consumption of the valve (pin 1 on the connector XH2)

Notices:
- Reference potential for all signals: GND
- We recommend connecting the shields on both sides via the metal housings of the plug-in connectors.
  Using connector pins will affect the shielding effect! Internal screens are not required.

LED displays

LED	Interface	Sercos	EtherNET/IP	EtherCAT	PROFINET RT	POWERLINK	VARAN
1	**X7E1**	Activity	Activity	not used	Activity	not used	Active
2		Link	Link	Link/activity	Link	Link/data activity	Link
3	**Electronics module**	S	Network status	Network status	Network status	Status/error	Network status
4		Module status	Module status	Module status	Module status	Module status	Module status
5	**X7E2**	Activity	Activity	not used	Activity	not used	not used
6		Link	Link	Link/activity	Link	Link/data activity	not used



Displays of the status LEDs

Module status LED (LED 4)	Display status
Aus	No voltage supply
Green-red, flashing	Initialization
Green, flashing	Drive ready for operation
Green	Drive active
Orange, flashing	Warning
Red, flashing	Error

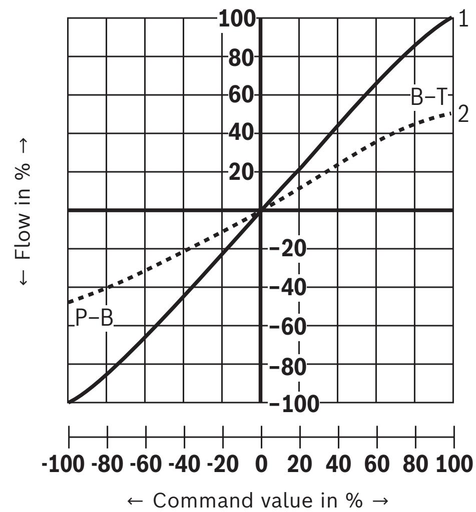
Network status LED (LED 3)	Display status
Aus	No voltage supply
Green	Operation

☞ **Notices:**
- LEDs 1, 2, 5 and 6 relate to interfaces "X7E1" and "X7E2"
  - Link: Cable plugged in, connection established (permanently lit)
  - Activity: Data sent/received (flashing)
- Module status LEDs 3 and 4 relate to the electronics module
- For a detailed description of the diagnosis LEDs, please refer to the functional description Rexroth HydraulicDrive HDx.

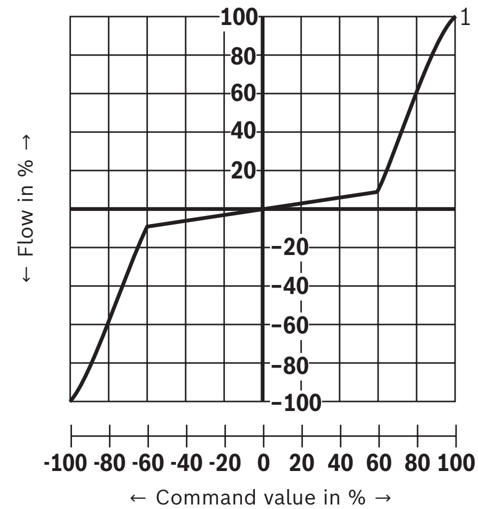
Characteristic curves: Size 6 – Flow characteristic (measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/signal function

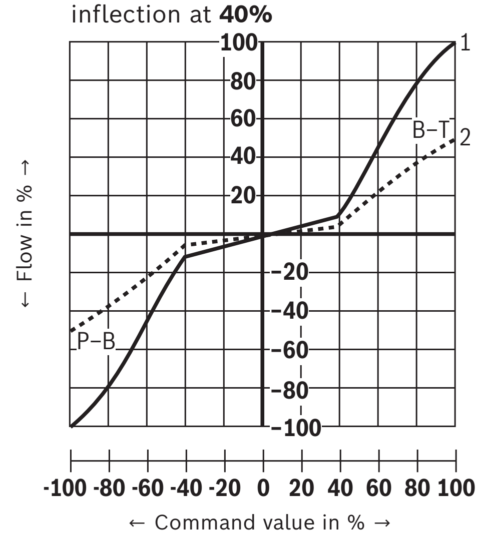
Linear characteristic curve "L"



Inflected characteristic curve "P", inflection at **60%**

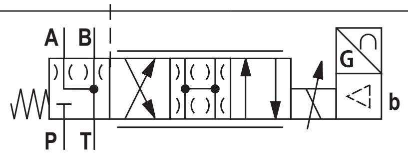
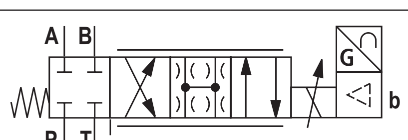


Inflected characteristic curve "P", inflection at **40%**



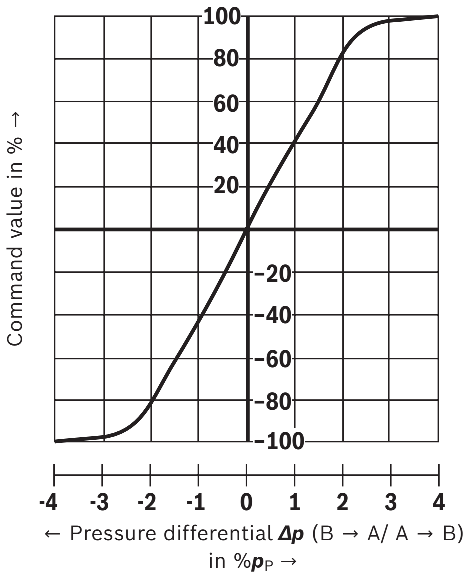
1 $q_{vA} : q_{vB}$ = 1:1
2 $q_{vA} : q_{vB}$ = 2:1

Fail-safe position

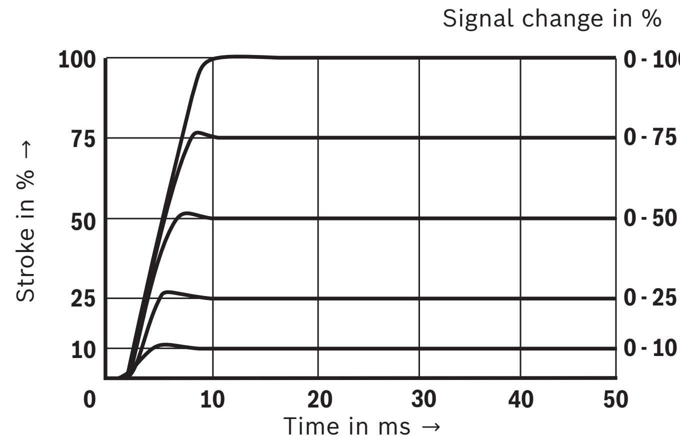
	Leakage flow at 100 bar	P→A P→B	50 cm³/min 70 cm³/min
	Flow at Δp = 35 bar	A→T B→T	10 ... 20 l/min 7 ... 20 l/min
	Leakage flow at 100 bar	P→A P→B	50 cm³/min 70 cm³/min
		A→T B→T	70 cm³/min 50 cm³/min
Fail-safe	***p*** = 0 bar → 7 ms ***p*** = 100 bar → 10 ms	Enable "off" or internal shut-off if an error has occurred U_B ≤ 18 V or ***I*** ≤ 2 mA (with 4 ... 20 mA signal, cable break detection: current threshold configurable)	

Characteristic curves: Size 6
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

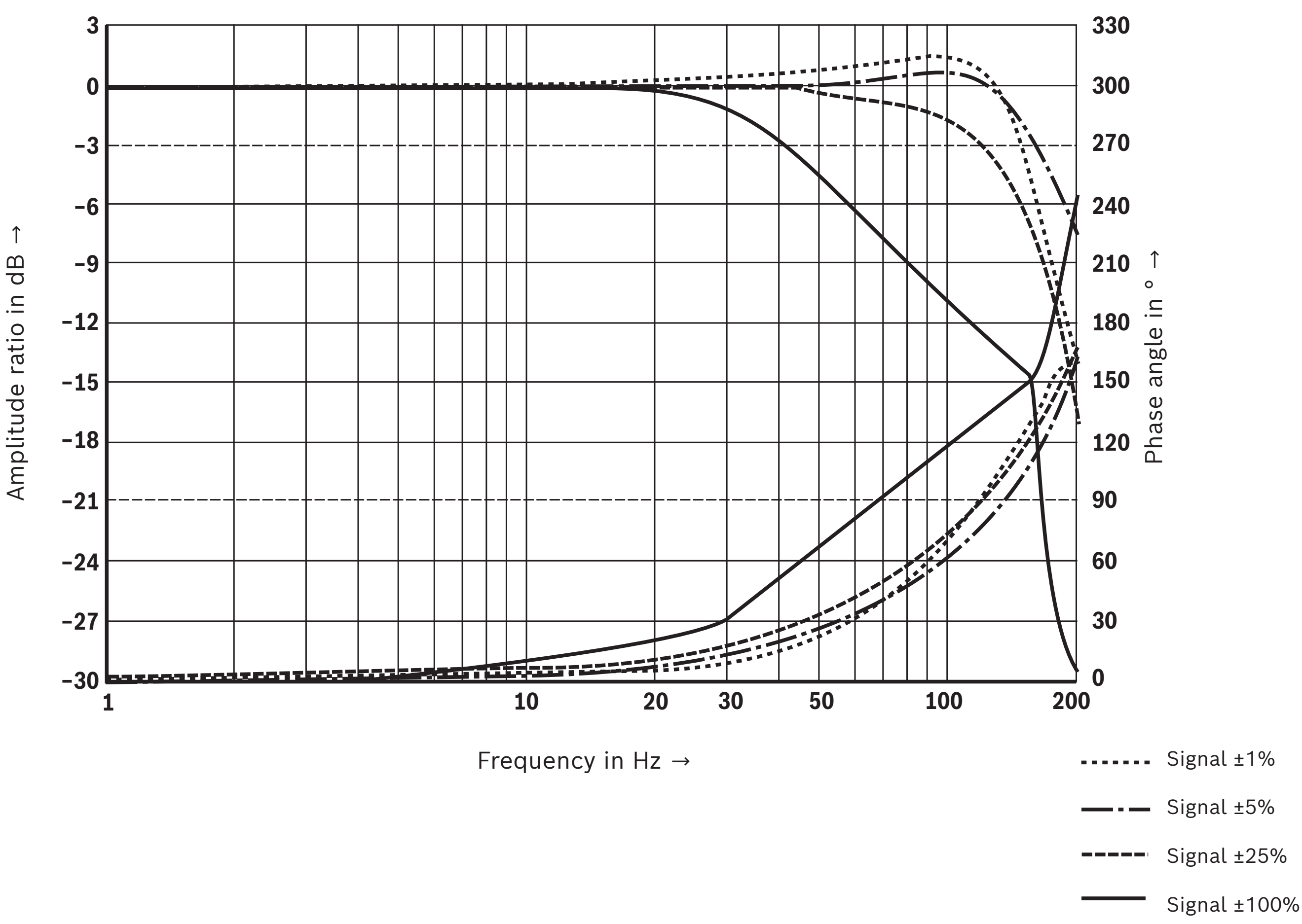
Pressure/signal characteristic curve



Transition function with stepped electric input signals



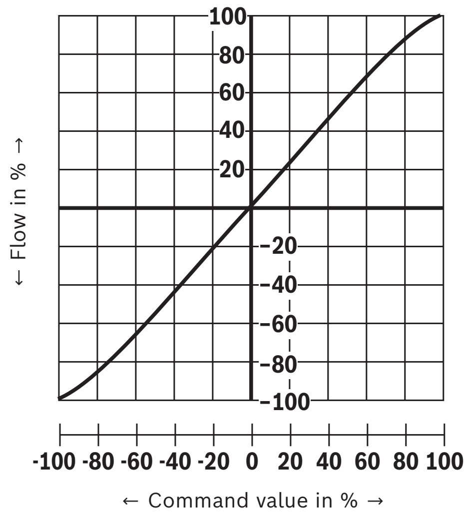
Frequency response



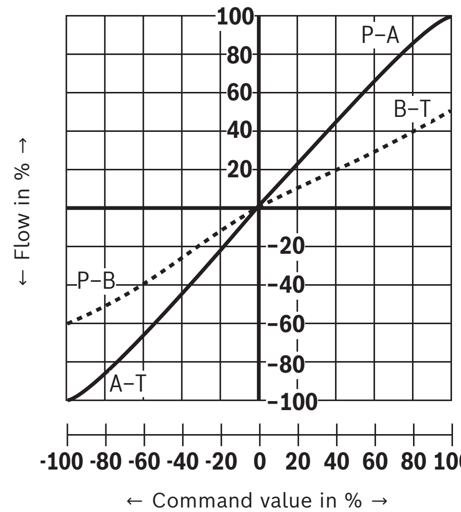
Characteristic curves: Size 10 – Flow characteristic (measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/signal function

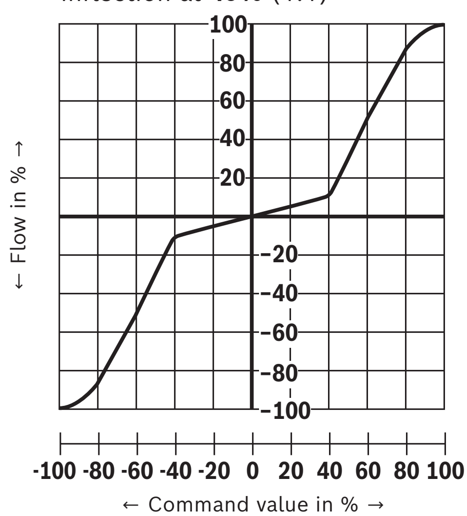
Linear characteristic curve "L" (1:1)



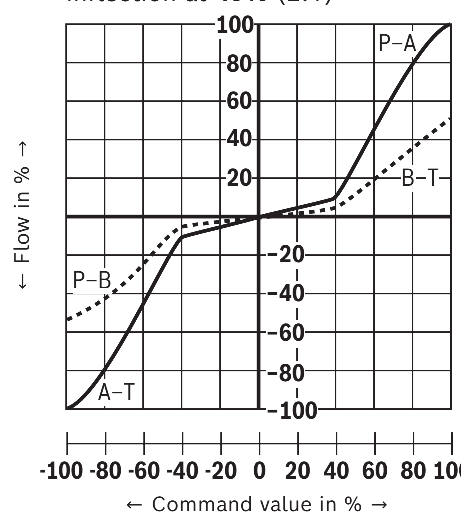
Linear characteristic curve "L" (2:1)



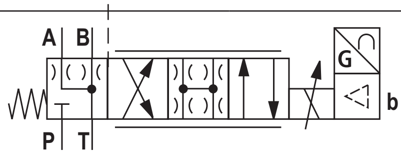
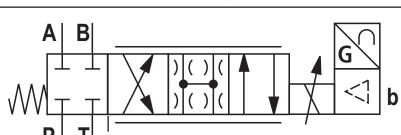
Inflected characteristic curve "P", inflection at **40%** (1:1)



Inflected characteristic curve "P", inflection at **40%** (2:1)

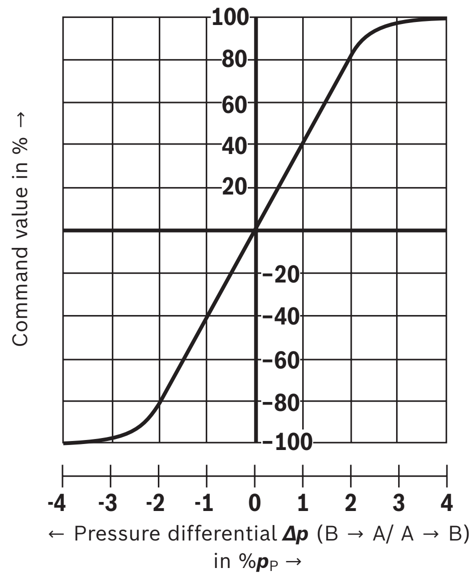


Fail-safe position

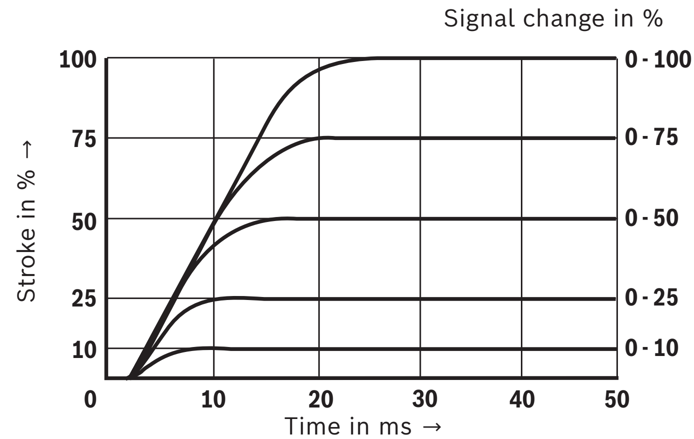
	Leakage flow at 100 bar	P→A P→B	50 cm^3/min 70 cm^3/min
	Flow at ***Δp*** = 35 bar	A→T B→T	100 ... 110 l/min 10 ... 25 l/min
	Leakage flow at 100 bar	P→A P→B	50 cm^3/min 70 cm^3/min
		A→T B→T	70 cm^3/min 50 cm^3/min
Fail-safe	***p*** = 0 bar → 12 ms ***p*** = 100 bar → 16 ms	Enable "off" or internal shut-off if an error has occurred U_B ≤ 18 V or ***I*** ≤ 2 mA (with 4 ... 20 mA signal, cable break detection: current threshold configurable)	

Characteristic curves: Size 10
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

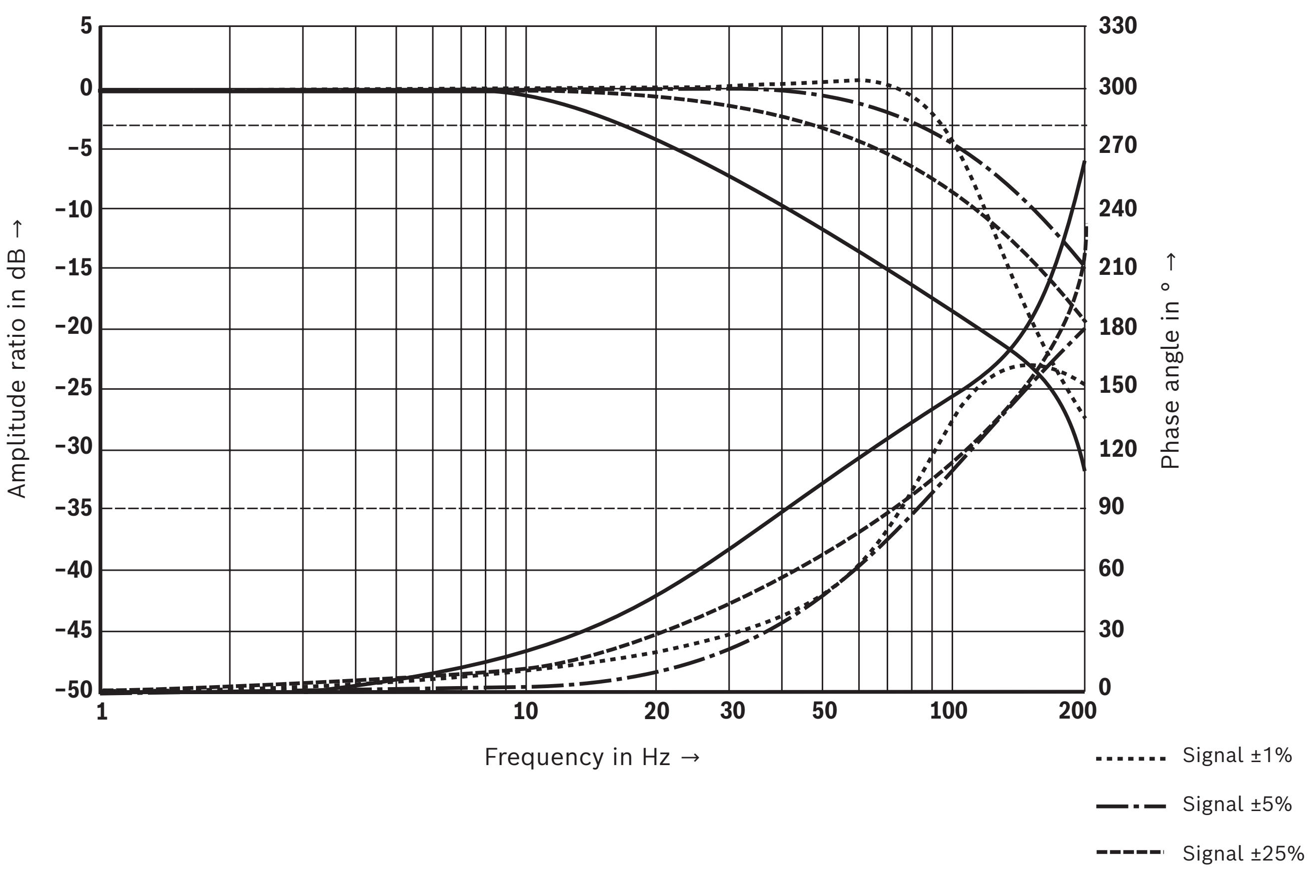
Pressure/signal characteristic curve



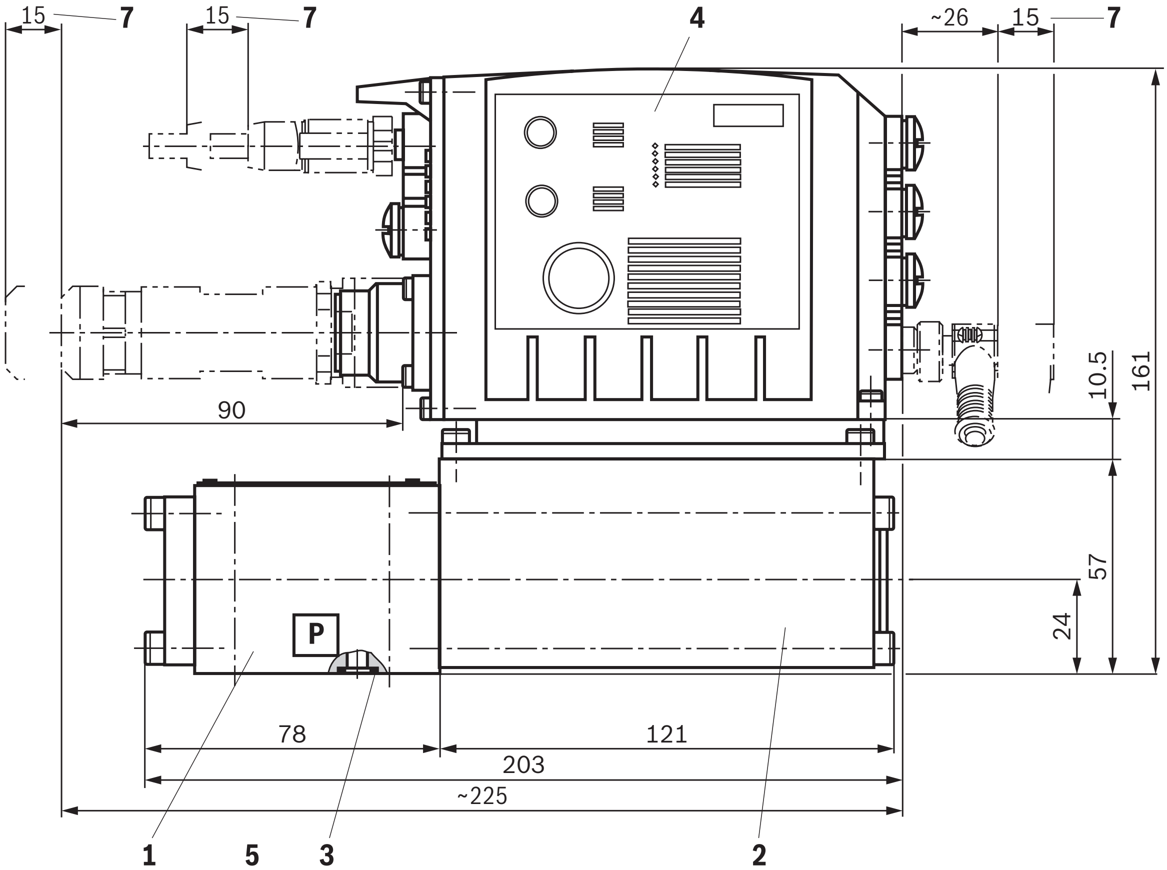
Transition function with stepped electric input signals

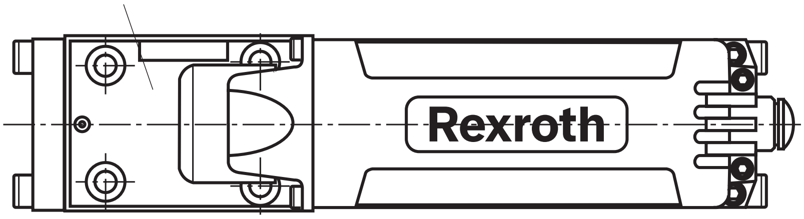


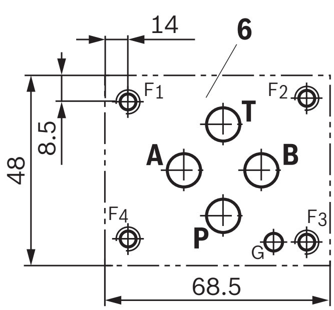
Frequency response

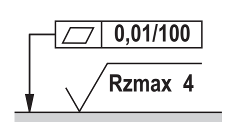


Dimensions: Size 6
(dimensions in mm)









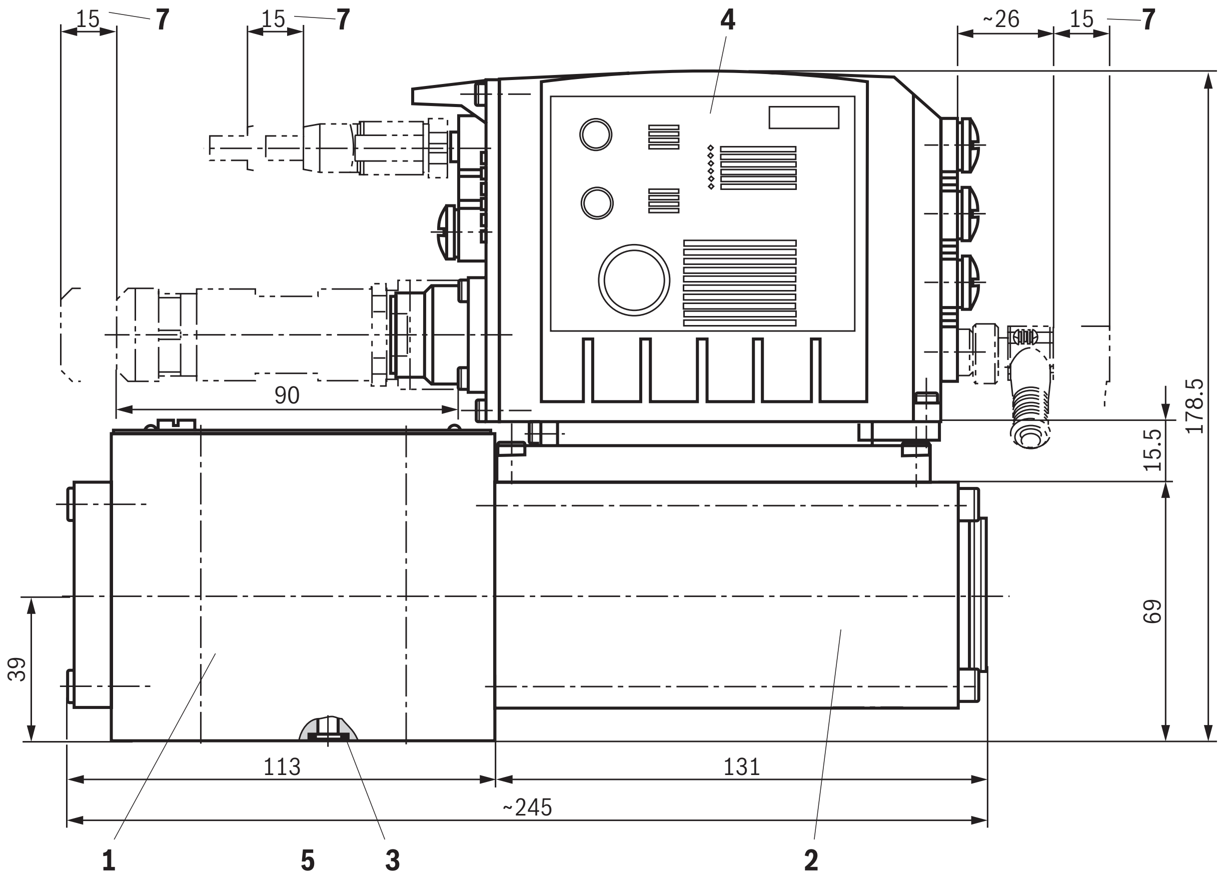
Required surface quality of the valve contact surface

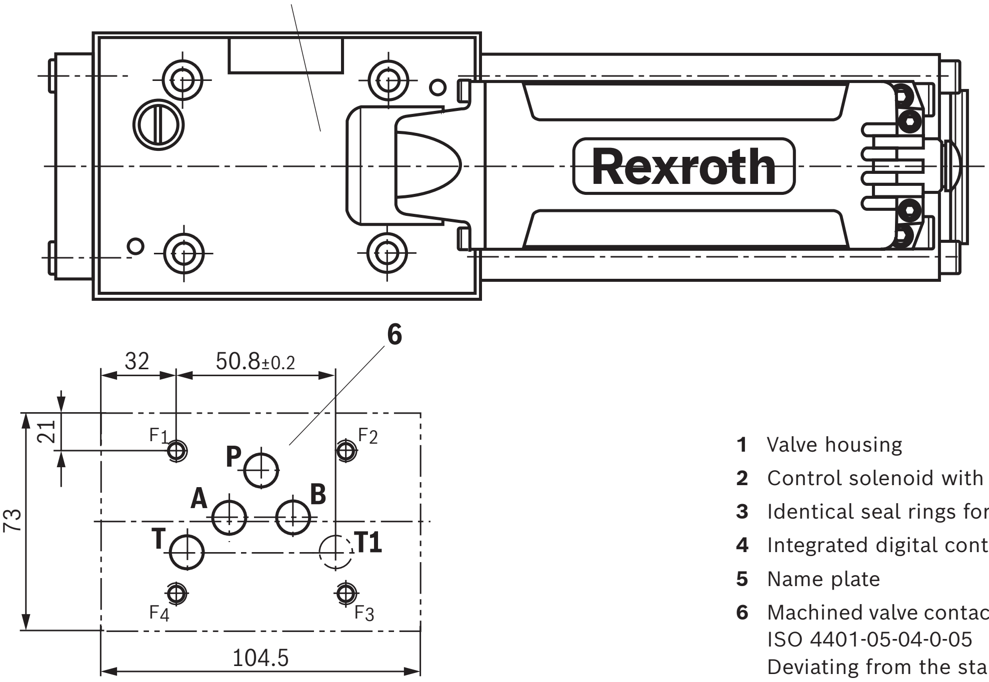
- **1** Valve housing
- **2** Control solenoid with position transducer
- **3** Identical seal rings for ports A, B, P, T
- **4** Integrated digital control electronics
- **5** Name plate
- **6** Machined valve contact surface, porting pattern according to ISO 4401-03-02-0-05
- **7** Space required to remove the mating connectors

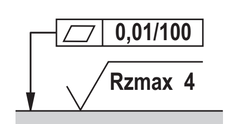
Notices:
The dimensions are nominal dimensions which are subject to tolerances.

Valve mounting screws see page 21.

Dimensions: Size 10
(dimensions in mm)







Required surface quality of the valve contact surface

1 Valve housing
2 Control solenoid with position transducer
3 Identical seal rings for ports A, B, P, T, T1
4 Integrated digital control electronics
5 Name plate
6 Machined valve contact surface, porting pattern according to ISO 4401-05-04-0-05
Deviating from the standard:
Port T1 exists additionally
7 Space required to remove the mating connectors

☞ **Notices:**
The dimensions are nominal dimensions which are subject to tolerances.

Valve mounting screws see page 21.

Dimensions

Valve mounting screws (separate order)

Size	Hexagon socket head cap screws	Material number
6	**4 hexagon socket head cap screws ISO 4762 - M5 x 30 - 10.9-N67F 821 70** (galvanized according to Bosch standard N67F821 70) Tightening torque $\boldsymbol{M}_A$ = 6^{+2} Nm	**2910151166**
10	**4 hexagon socket head cap screws ISO 4762 - M6 x 40 - 10.9-N67F 821 70** (galvanized according to Bosch standard N67F821 70) Tightening torque $\boldsymbol{M}_A$ = 11^{+3} Nm	**2910151209**

☞ **Notice:**
The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure.

Accessories (separate order)

Mating connectors and cable sets

Port	Designation	Version	Short designation	Material number	Data sheet
XH2	Mating connector; for valves with round connector, 11-pole + PE	Metal, shielded	12PN11... EMC	**R901268000**	08006
		Plastic, two cable outlets	12PN11...2XD8	**R900884671**	
	Cable sets; for valves with round connector, 11-pole + PE	Metal, shielded, 5 m	12PN11REFS EMV...BG	**R901272854**	
		Metal, shielded, 20 m		**R901272852**	
		Plastic, shielded, 5 m	12PN11REFF 2X...	**R900032356**	
		Plastic, shielded, 20 m		**R900860399**	
X7E1, X7E2	Cable set; shielded, 4-pole, D coding	Straight connector M12, on straight connector M12, line cross-section 0.25 mm², CAT 5e, length freely selectable (= xx.x)	–	**R911172111** 1)	–
	Cable set; shielded, 4-pole	Straight connector M12, on straight connector RJ45, line cross-section 0.25 mm², CAT 5e, length freely selectable (= xx.x)	–	**R911172135** 2)	–
X2M1, X2M2	Cable set; shielded, 5-pole, for connecting Rexroth pressure sensors, type HM20, A coding	PUR/PVC, straight connector M12, on straight socket M12, line cross-section 0.34 mm², 0.6 m	–	**R901111709**	–
		PUR/PVC, straight connector M12, on straight socket M12, line cross-section 0.34 mm², 1.0 m	–	**R901111712**	–
		PUR/PVC, straight connector M12, on straight socket M12, line cross-section 0.34 mm², 2.0 m	–	**R901111713**	–
	Cable set; shielded, 5-pole, A coding	Straight connector M12, on free line end, line cross-section 0.34 mm², 1.5 m	–	**R901111752**	–
		Straight connector M12, on free line end, line cross-section 0.34 mm², 3.0 m	–	**R901111754**	–
		Straight connector M12, on free line end, line cross-section 0.34 mm², 5.0 m	–	**R901111756**	–
		Straight connector M12, on free line end, line cross-section 0.34 mm², 10.0 m	–	**R913005147**	–
	Plug-in connector; 5-pole, M12 x 1, pins, A-coding	Metal (cable diameter 4 ... 6 mm2)	–	**R901075542**	–
X8M	Cable set; Shielded, 8-pole, A-coding (only SSI, 1Vss) 3)	Straight connector M12, on free line end, line cross-section 0.25 mm², 10 m	–	**R913002641**	–

1) Additional indication of type designation RKB0040/xx.x

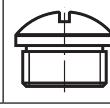
2) Additional indication of type designation RKB0044/xx.x

3) **Recommendation:** If an EnDat 2.2 sensor is used, please refer to the sensor manufacturer Heidenhain with respect to a cable set.

Notices:
- Tighten the M12 connector with a manual torque wrench by 1 Nm.
- Self-locking M12 cables must be used.
- It must be ensured that cables are secured without radial forces.
- All cables connected to XH1, X7E1 and X7E2 must be bundled in a wire harness after 20cm the latest. The wire harness must be fixed after further 20 ... 30cm. Make sure that there is no relative motion between the fixation and the valve.
- Before the fixation point, there must not be any cable loops.
- In general, the information on installation provided by the cable manufacturers must be observed.
- Respectively, the cables of X2M1, X2M2 and X8M, if used, are also fixed as described above.
- For further information, see operating instructions 29391-B

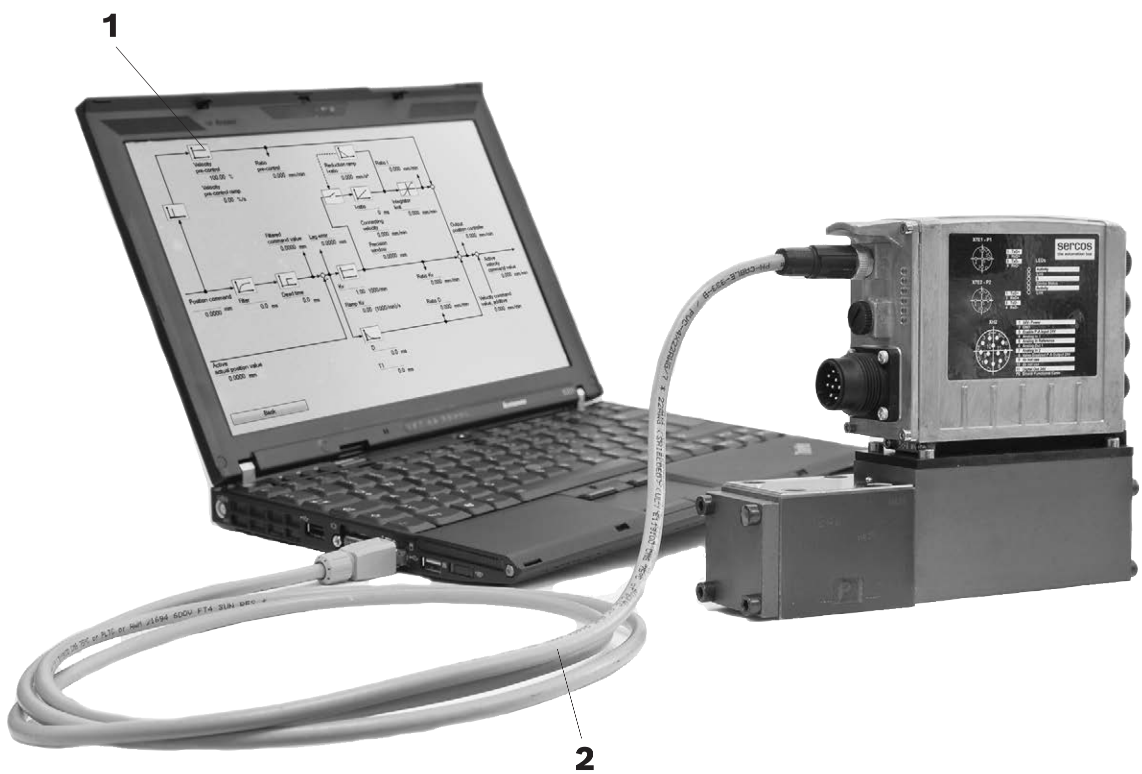
Accessories (separate order)

Protective cap

Protective cap M12	**Version**	**Material number**
		**R901075563**

Parameterization

The following is required for the parameterization with PC		**Material number/download**
1 Commissioning software	IndraWorks, Indraworks D, Indraworks DS	
2 Connection cable, 3 m	Shielded, M12 on RJ45, length can be freely selected (= xx.x)	**R911172135** (additional indication of type designation RKB0044/xx.x)



Project planning and maintenance instructions

- The supply voltage must be permanently connected; otherwise, bus communication is not possible.
- If electro-magnetic interference is to be expected, take appropriate measures to ensure the function (depending on the application, e.g. shielding, filtration).
- The devices have been tested in the plant and are supplied with default settings.
- Only complete devices can be repaired. Repaired devices are returned with default settings. User-specific settings will not be applied. The machine end-user will have to retransfer the corresponding user parameters.

Further information

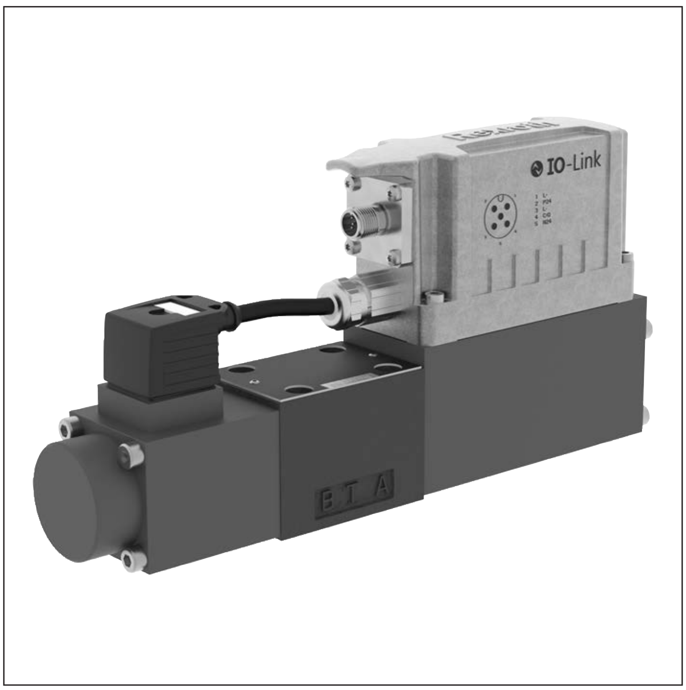
▶ Directional control valves, direct operated, with electrical position feedback and integrated electronics (OBE)	Data sheet 29035 and 29037
▶ Directional control valve with integrated digital axis controller (IAC-R) and field bus interface	Data sheet 29191
▶ Directional control valve with integrated digital axis controller (IAC-R) and clock synchronized PROFIBUS DP/V2 (PROFIdrive profile)	Data sheet 29291
▶ Directional control valve with integrated digital axis controller	Operating instructions 29391-B
▶ CE Declaration of Conformity	Upon request
▶ Subplates	Data sheet 45100
▶ Hydraulic fluids on mineral oil basis	Data sheet 90220
▶ Environmentally compatible hydraulic fluids	Data sheet 90221
▶ Flame-resistant, water-free hydraulic fluids	Data sheet 90222
▶ Hydraulic valves for industrial applications	Operating instructions 07600-B
▶ General product information on hydraulic products	Data sheet 07008
▶ Installation, commissioning and maintenance of servo valves and high-response valves	Data sheet 07700
▶ Assembly, commissioning and maintenance of hydraulic systems	Data sheet 07900
▶ Operation IAC-Multi-Ethernet electronics (xx = software version): – Functional description Rexroth HydraulicDrive HDx-xx – Parameter description Rexroth HydraulicDrive HDx-xx – Description of diagnosis Rexroth HydraulicDrive HDx-xx	
▶ Commissioning software and documentation on the Internet	
▶ Selection of filters	
▶ Information on available spare parts	

RE 29118
Edition: 2021-07

rexroth
A Bosch Company

Directional control valves, direct operated with electrical position feedback and integrated electronics (OBE)

Type 4WRPE



- Size 6
- Component series 3X
- Maximum operating pressure 350 bar
- Rated flow 8, 18, 32 l/min
- Digital interface, IO link for I4.0

CE

IO-Link

Features

- Reliable – proven and robust design
- Energy-efficient – no pilot oil demand, high flows with low pressure differential
- Flexible – suitable for position and velocity control
- Precise – high response sensitivity and little hysteresis
- IO-Link interface

Contents

Ordering code

01	02	03	04	05	06	07	08		09		10		11	12	13	14	15
4	**WRP**	**E**	**6**			**S**		**–**	**3X**	**/**		**/**		**24**			*****

01	4 main ports	**4**

02	Directional control valve, direct operated	**WRP**

03	With integrated electronics	**E**

04	Size 6	**6**

05	Symbols; possible version see page 3	

Rated flow (***Δp*** = 5 bar/control edge)

06	8 l/min	**8**
	18 l/min	**18**
	32 l/min	**32**

Flow characteristic

07	Progressive	**S**

08	Without overlap jump	**no code**
	With overlap jump (opening point 5% command value with symbols E, E1-, W and W1-)	**J**

09	Component series 30 … 39 (30 … 39: unchanged installation and connection dimensions)	**3X**

Seal material (observe compatibility of seals with hydraulic fluid used, see page 6)

10	NBR seals	**M**
	FKM seals	**V**

11	Without damping plate	**no code**
	With damping plate	**D**

12	Supply voltage 24 V	**24**

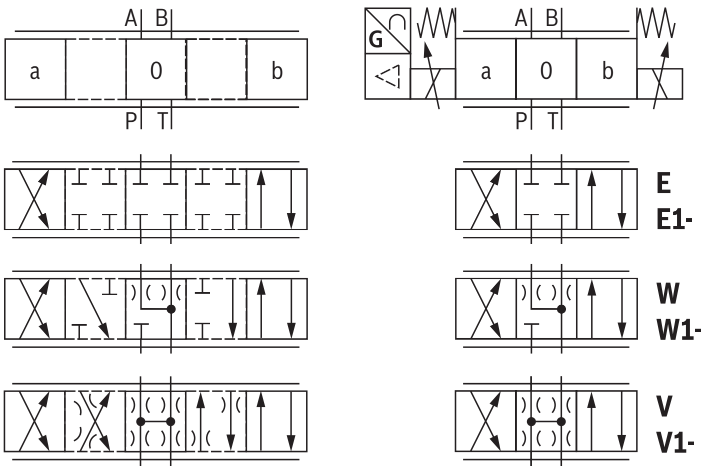
Interfaces of the control electronics

13	IO-Link interface	**L1**

14	Without electronics protection membrane	**no code**
	With electronics protection membrane	**-967**

15	Further details in the plain text	

Symbols



With symbol E1-, V1- and W1-:

P → A: $q_{V\ max}$ B → T: $q_V/2$
P → B: $q_V/2$ A → T: $q_{V\ max}$

Notices:

- Representation according to DIN ISO 1219-1.
  Hydraulic interim positions are shown by dashes.
- Only symbols E, E1-, W and W1- are suitable for applications according to EN 13849-1.
  Further measures must be taken according to EN 13849-1 and operating instructions 29118-B must be observed.

Function, section

The valve type 4WRPE is a direct operated directional control valve with electric position feedback and integrated electronics (OBE).

Set-up

The valve basically consists of:

- Valve housing (1)
- Control spool (2) with compression springs (3.1 and 3.2)
- Control solenoid with position transducer (4) (optional with electronics protection membrane (8))
- Stroke solenoid (7)
- On-board electronics (OBE) (5) with IO-Link interface (optionally with damping plate (9))

Function

The integrated electronics (OBE) compares the specified command value to the position actual value. In case of control deviations, the relevant solenoid will be activated. Due to the changed magnetic force, the control spool (2) is adjusted against the corresponding spring. The stroke/control spool cross-section is regulated proportionally to the command value. In case of a command value presetting of 0 V, the electronics adjust the control spool (2) to central position.

Error detection

In the following cases of error, the electronics will de-energize the control solenoids:

- Falling below the minimum supply voltage ≤15 V (restarting ≥17.5 V).
- Interface "L1":
  - Enable inactive, communication interruption (watchdog)
  - In case of internal IO-Link error

The control spool (2) is kept in the mechanical central position by the compression springs (3.1 and 3.2) (with symbol V, this does not correspond to the hydraulic central position).

Safe shut-off with IO-Link

With symbols E, E1-, W and W1-, the valve can be used as shut-off element in applications of categories 1, 2 or 3 with up to PL d in compliance with EN 13849-1.
Depending on the category or application, additional safety measures must be taken according to EN 13849-1 and operating instructions 29118-B must be observed.
In every safety-relevant application, a safe shut-off of the IO-Link-B voltage (pin 2 and 5) must be ensured according to EN 13849-1.
The safe shut-off is not part of the IO-Link valve and must be taken into account for the safe design of the machinery.

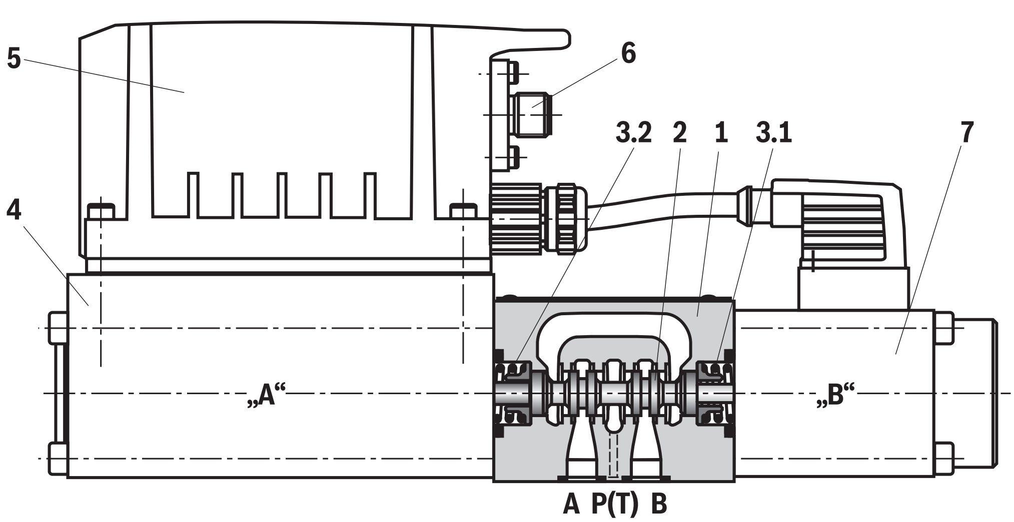
Damping plate "D"

The damping plate (9) reduces the acceleration amplitudes on the on-board electronics (frequencies >300 Hz).

> ☞ **Notice:**
> Using the damping plate is not recommended for applications with mainly low-frequency excitation <300 Hz.

Electronics protection membrane "-967"

To prevent condensate formation in the housing of the integrated electronics (OBE), an electronics protection membrane (8) can be used.
Recommended for use outside industry-standard conditions with high ambient air humidity and significant cyclic temperature changes (e.g. outdoors).



> ☞ **Notice:**
> With version "V32", the control spool may rotate in case of single-sided flow through the supply flow edges (P–A or P–B) causing damage to or failure of the valve. This can be solved by reducing the pressure differential over the supply flow edge to a maximum of 80 bar or by simultaneously using both control edges (P–A/B–T or P–B/A–T).

Technical data
(For applications outside these values, please consult us!)

General			
Weight		kg	7.6
Installation position			any
Ambient temperature range		°C	−20 ... +60
Storage temperature range with UV protection		°C	+10 ... +40
Transport temperature		°C	−30 ... +80
Maximum storage time		Years	1 (if the storage conditions are observed, refer to the operating instructions 07600-B)
Sine test according to DIN EN 60068-2-6	▶ Without damping plate		10 ... 2000 Hz / maximum of 10 g / 10 cycles / 3 axes
	▶ With damping plate [1]		10 ... 2000 Hz / maximum of 10 g / 10 cycles / 3 axes
Noise test according to DIN EN 60068-2-64	▶ Without damping plate		20 ... 2000 Hz / 10 g_{RMS} / 30 g peak / 24 h / 3 axes
	▶ With damping plate [1]		20 ... 2000 Hz / 10 g_{RMS} / 30 g peak / 24 h / 3 axes
Transport shock according to DIN EN 60068-2-27	▶ Without damping plate		15 g / 11 ms / 3 shocks / 3 axes
	▶ With damping plate [1]		15 g / 11 ms / 3 shocks / 3 axes
Shock according to DIN EN 60068-2-27	▶ With damping plate [1]		35 g / 6 ms / 1000 shocks / 3 axes
Maximum relative humidity (no condensation)		%	95
Maximum solenoid surface temperature		°C	150 (individual operation)
$MTTF_d$ value according to EN ISO 13849		Years	150 (for further details see data sheet 08012)
Conformity	▶ CE according to EMC directive 2014/30/EU, tested according to		EN 61000-6-2 and EN 61000-6-3
	▶ RoHS directive		2011/65/EU [2]

Hydraulic					
Maximum operating pressure	▶ Ports A, B, P	bar	350		
	▶ Port T	bar	200		
Maximum flow [3]		l/min	80		
Rated flow (Δp = 5 bar/control edge [4])		l/min	8	18	32
Zero flow (Δp ≥ 5 bar/control edge)	▶ Symbol W-; A - T	l/min	0.8	1.2	1.2
	▶ Symbol W-; B - T	l/min	0.8	1.2	1.2
	▶ Symbol W1-; A - T	l/min	–	1.2	1.2
	▶ Symbol W1-; B - T	l/min	–	0.8	1.2
Hydraulic fluid			see table on page 6		
Viscosity range	▶ recommended	mm²/s	20 ... 100		
	▶ maximum admissible	mm²/s	10 ... 800		
Hydraulic fluid temperature range (flown-through)		°C	−20 ... +70		
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)			Class 18/16/13 [5]		

[1] Not recommended for applications with mainly low-frequency excitation < 300 Hz

[2] The product fulfills the substance requirements of the RoHS directive 2011/65/EU.

[3] Recommended (flow velocity 30 m/s)

[4] Flow with deviating Δp (control edge):

$$q_x = q_{Vnom} \cdot \sqrt{\frac{\Delta p_x}{5}}$$

[5] The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the life cycle of the components.

Notice:
The specified technical data were measured with HLP46 and ϑ_{oil} = 40 ±5 °C.

Technical data
(For applications outside these values, please consult us!)

Hydraulic fluid		Classification	Suitable sealing materials	Standards	Data sheet
Mineral oils		HL, HLP, HLPD, HVLP, HVLPD	NBR, FKM	DIN 51524	90220
Bio-degradable	▶ Insoluble in water	HETG	FKM	ISO 15380	90221
		HEES	FKM		
	▶ Soluble in water	HEPG	FKM	ISO 15380	
Flame-resistant	▶ Water-free	HFDU (glycol base)	FKM	ISO 12922	90222
		HFDU (ester base)	FKM		
		HFDR	FKM		
	▶ Containing water	HFC (Fuchs: Hydrotherm 46M, Renosafe 500; Petrofer: Ultra Safe 620; Houghton: Safe 620; Union: Carbide HP5046)	NBR	ISO 12922	90223

Important information on hydraulic fluids:
- For further information and data on the use of other hydraulic fluids, please refer to the data sheets above or contact us.
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.).
- The ignition temperature of the hydraulic fluid used must be 50 K higher than the maximum surface temperature.
- **Bio-degradable and flame-resistant – containing water:** If components with galvanic zinc coating (e.g. version "J3" or "J5") or parts containing zinc are used, small amounts of dissolved zinc may get into the hydraulic system and cause accelerated aging of the hydraulic fluid. Zinc soap may form as a chemical reaction product, which may clog filters, nozzles and solenoid valves – particularly in connection with local heat input.
- **Flame-resistant – containing water:**
  - Due to the increased cavitation tendency with HFC hydraulic fluids, the life cycle of the component may be reduced by up to 30% as compared to the use with mineral oil HLP. In order to reduce the cavitation effect, it is recommended – if possible specific to the installation – backing up the return flow pressure in ports T to approx. 20% of the pressure differential at the component.
  - Dependent on the hydraulic fluid used, the maximum ambient and hydraulic fluid temperature must not exceed 50 °C. In order to reduce the heat input into the component, the command value profile is to be adjusted for proportional and high-response valves.

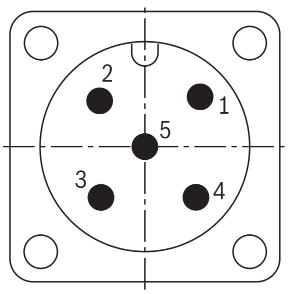
Static/dynamic		
Hysteresis	%	< 0.25
Range of inversion	%	< 0.1
Response sensitivity	%	< 0.1
Manufacturing tolerance q_{Vmax}	%	< 10
Temperature drift (temperature range 20 °C ... 80 °C)	%/10 K	Zero shift < 0.2
Pressure drift	%/100 bar	Zero shift < 0.2
Zero compensation		ex plant ±1%

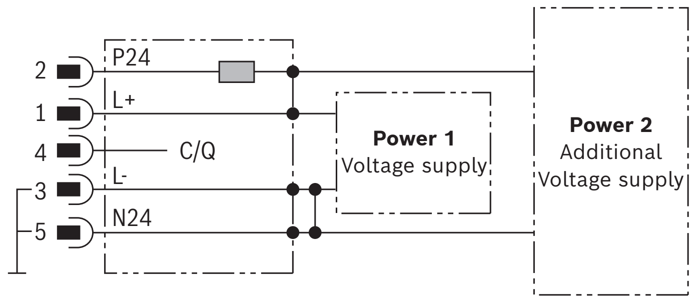
Technical data
(For applications outside these values, please consult us!)

Electrical, Integrated Electronics (OBE) – Interface "L1"			
Relative duty cycle		%	100 (continuous operation)
Protection class according to EN 60529			IP 65 with mounted and locked plug-in connectors
Supply voltage	▶ Valve amplifier	VDC	24
	– Pin 2	VDC	min. 18 / max. 30
	– Pin 5	VDC	0
	▶ IO-Link interface	VDC	24
	– Pin 1	VDC	min. 18 / max. 30
	– Pin 3	VDC	0
Maximum current consumption	▶ Valve amplifier	A	2
	▶ IO-Link interface	mA	50
Maximum residual ripple		Vpp	1.3
Maximum current consumption		mA	50
Minimum process cycle time		ms	0.6
Bit rate COM3		kBaud (kbit/s)	230.4
Required master port class			Class B
Resolution	▶ A/D transformer	bit	12 (110% valve opening)
	▶ D/A transformer	bit	12 (110% valve opening)
Functional ground			Provide via valve block
Adjustment			Calibrated in the plant
Directive			IO-Link Interface and System Specification Version 1.1.2

Electrical connections and assignment

Connector pin assignment "L1" (M12-5, A-coded, class B)



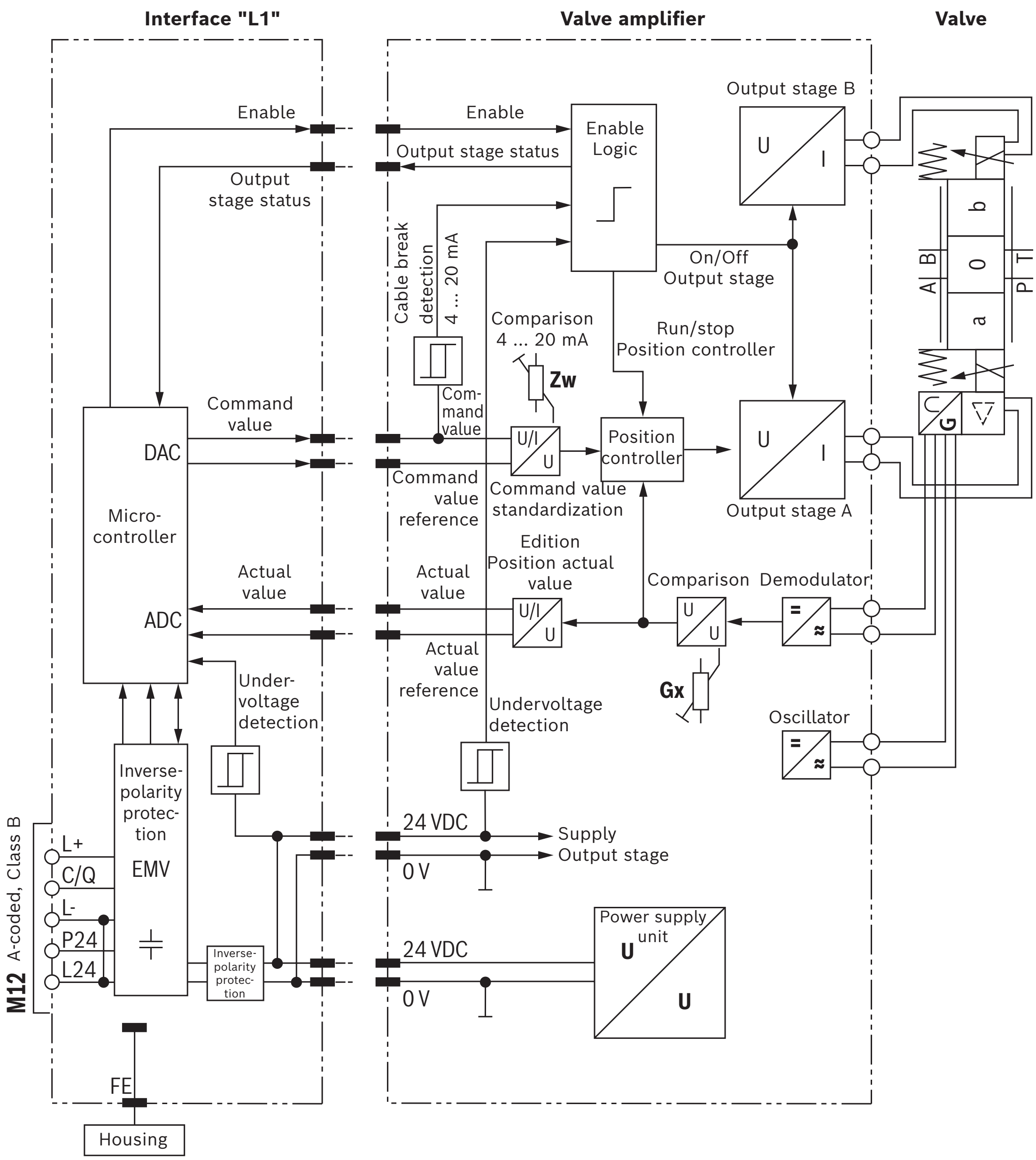


☞ **Notices:**
- M12 sensor/actuator connection line, 5-pole;
  M12 connector/bush, A-coded, without shield, maximum cable length 20 m. Observe the voltage drop over the cable.
  Line cross-section at least 0.34 mm².
- Mating connectors, separate order, see page 22.
- For the communication and parameter description see data sheet 29400-PA
- With a line cross-section of 0.34 mm² (standard line), a maximum cable length of 10 m is possible. For a maximum cable length of 20 m, the cross-section must be doubled.

Pin	Signal	Allocation interface L1
1	L+	Voltage supply IO-Link
2	P24	Voltage supply valve electronics and power part (current consumption 3 A)
3	L-	Reference potential pin 1 [1)]
4	C/Q	Data line IO-Link (SDCI)
5	N24	Reference potential pin 2 [1)]

1) Pin 3 and 5 are linked with each other in the valve electronics. The reference potentials L- and N24 of the two supply voltages must also be linked with each other on the power supply unit side.

Block diagram/controller function block

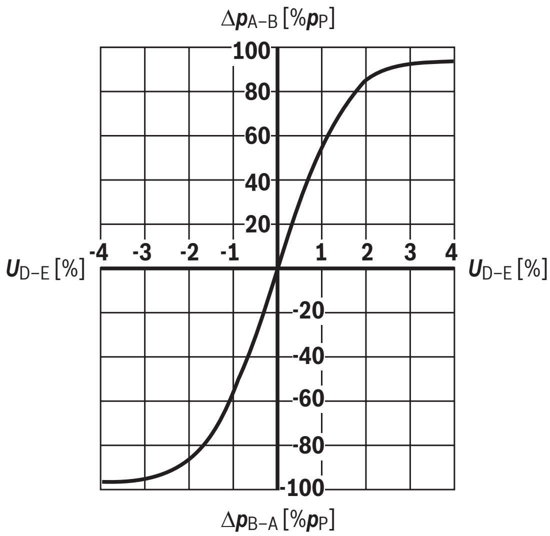


Notices:

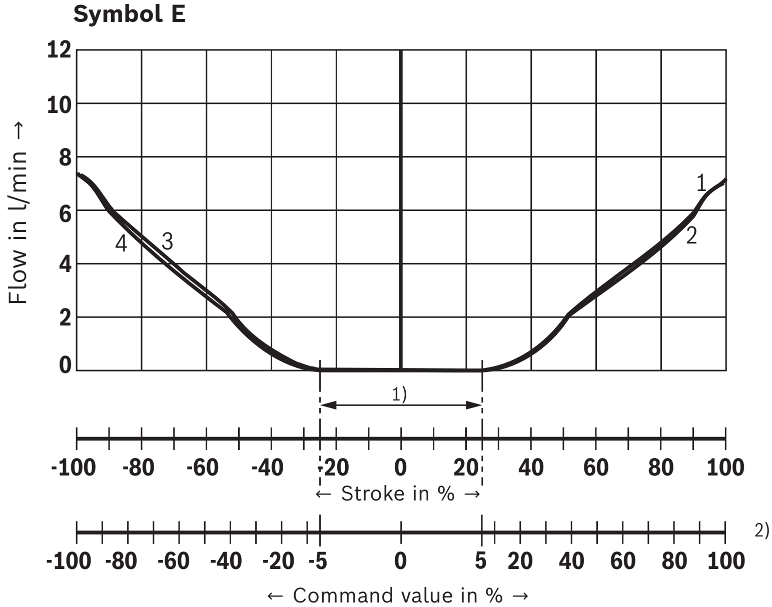
- Electrical signals provided via control electronics (e.g. actual value) must not be used for switching off safety-relevant machine functions.
- The setting of the potentiometer at the factory must not be changed.

Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Pressure/signal characteristic curve (symbol V)



Flow/signal function (rated flow 8 l/min with Δp = 5 bar/control edge)



1 P–A
2 B–T
3 P–B
4 A–T

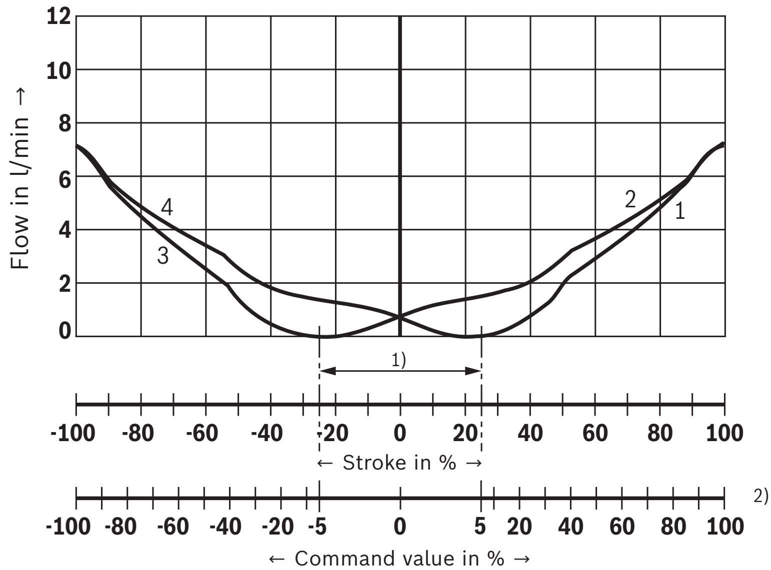
1) Step compensation
2) Version "J"

Notice:
Typical characteristic curves which are subject to tolerance variations.

Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/signal function (rated flow 8 l/min with Δp = 5 bar/control edge)

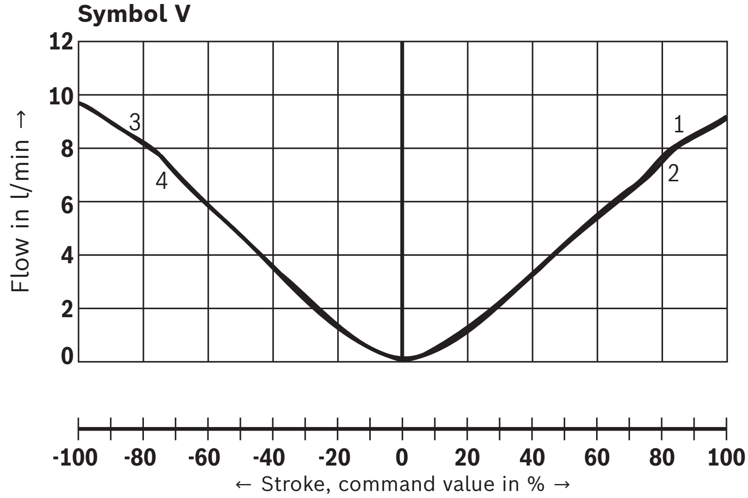
Symbol W



1 P–A
2 B–T
3 P–B
4 A–T

1) Step compensation
2) Version "J"

Symbol V



1 P–A
2 B–T
3 P–B
4 A–T

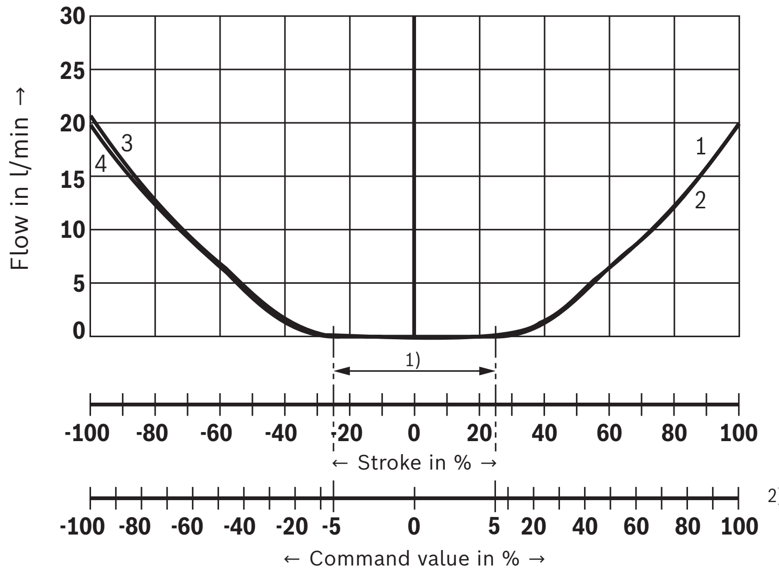
Notice:
Typical characteristic curves which are subject to tolerance variations.

Characteristic curves

(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/signal function (rated flow 18 l/min with Δp = 5 bar/control edge)

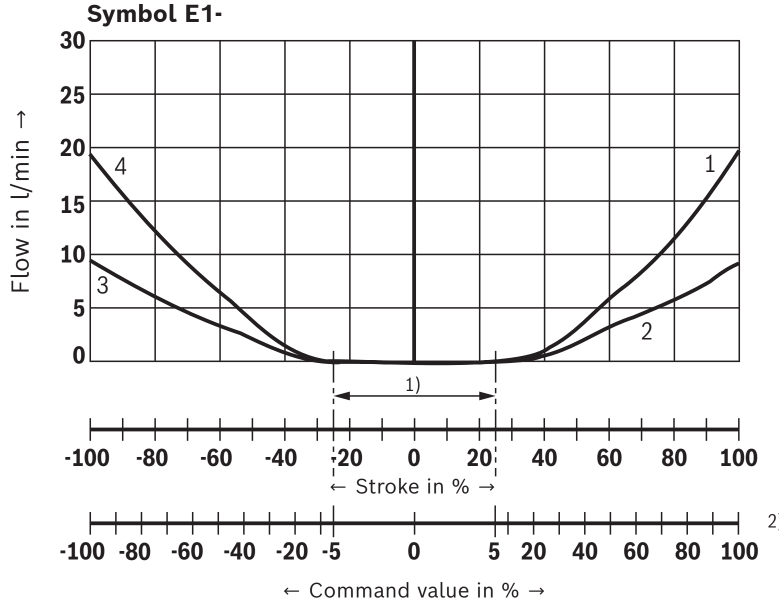
Symbol E



1 P–A
2 B–T
3 P–B
4 A–T

1) Step compensation
2) Version "J"

Symbol E1-



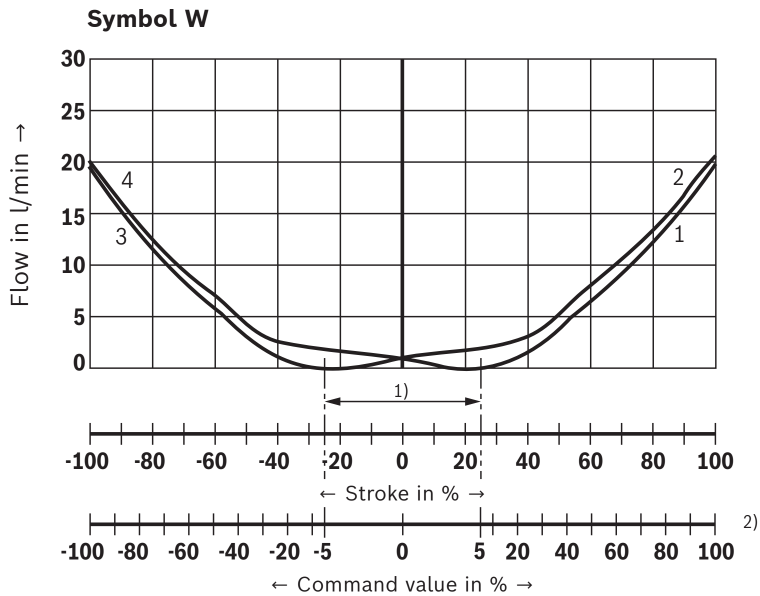
1 P–A
2 B–T
3 P–B
4 A–T

1) Step compensation
2) Version "J"

Notice:
Typical characteristic curves which are subject to tolerance variations.

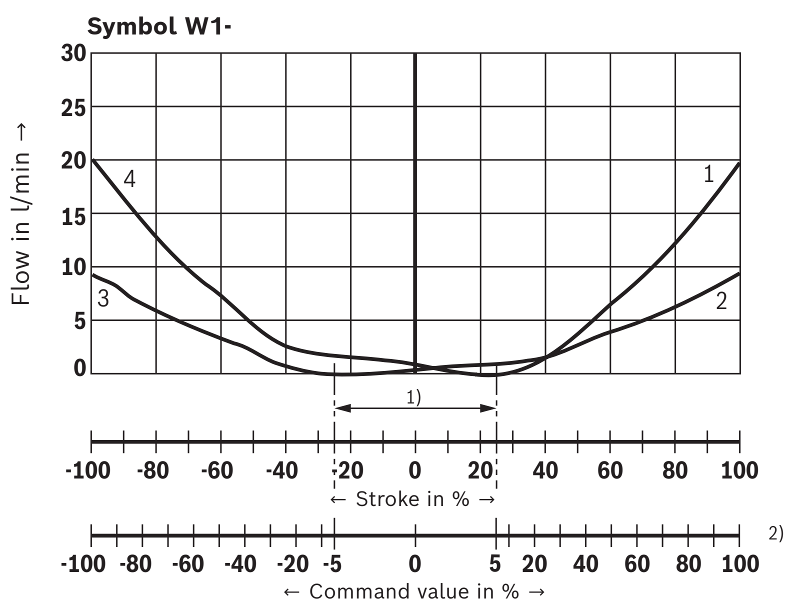
Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/signal function (rated flow 18 l/min with Δp = 5 bar/control edge)



1 P–A
2 B–T
3 P–B
4 A–T

1) Step compensation
2) Version "J"



1 P–A
2 B–T
3 P–B
4 A–T

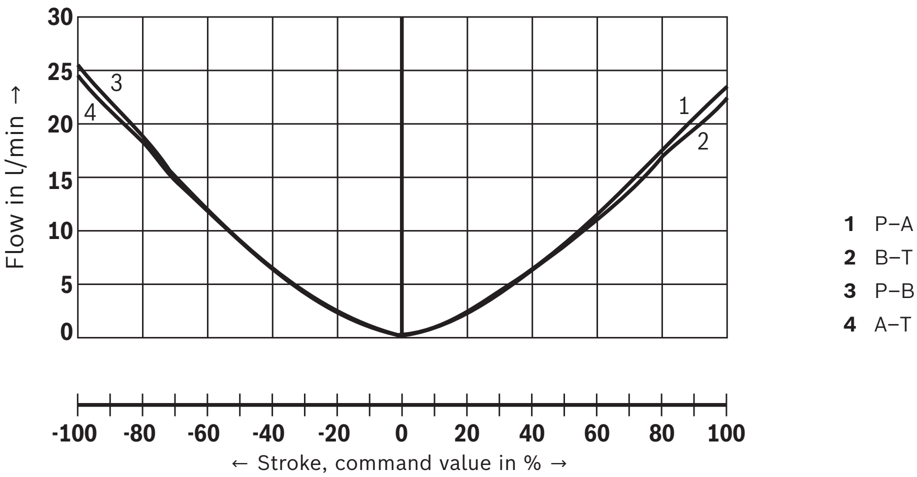
1) Step compensation
2) Version "J"

Notice:
Typical characteristic curves which are subject to tolerance variations.

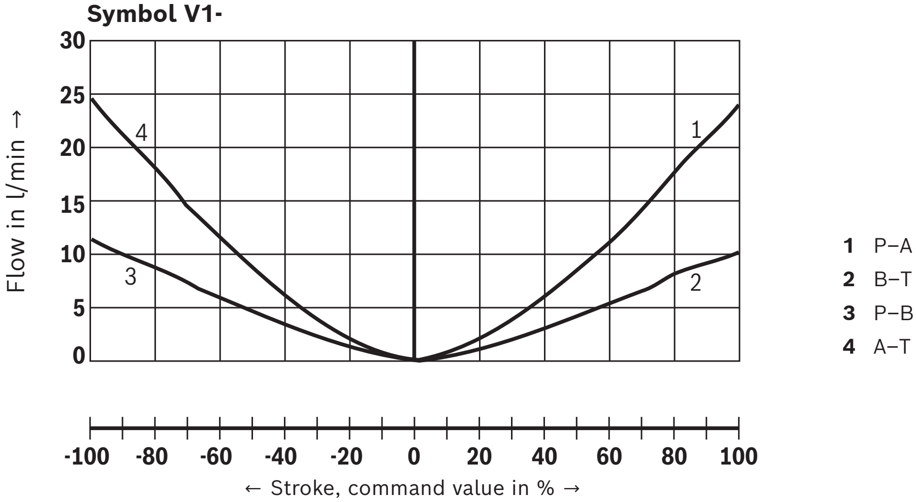
Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/signal function (rated flow 18 l/min with Δp = 5 bar/control edge)

Symbol V



Symbol V1-

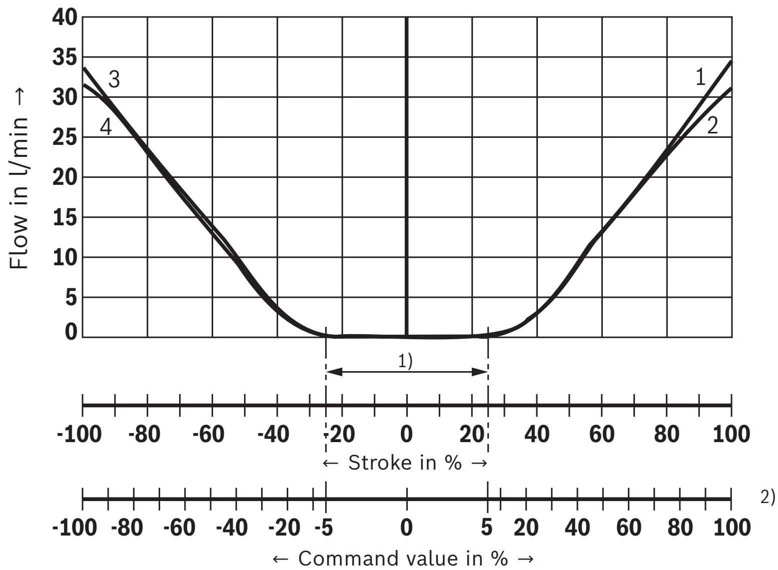


Notice:
Typical characteristic curves which are subject to tolerance variations.

Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/signal function (rated flow 32 l/min with ***Δp*** = 5 bar/control edge)

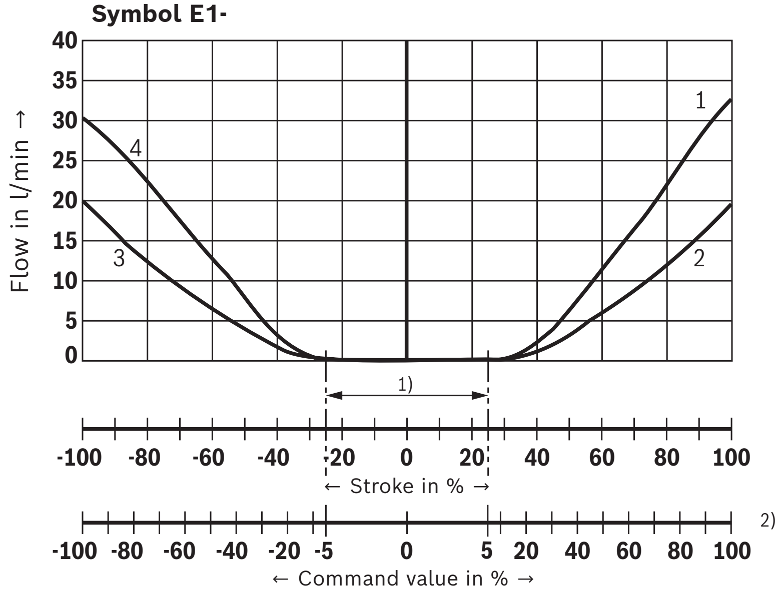
Symbol E



1 P–A
2 B–T
3 P–B
4 A–T

1) Step compensation
2) Version "J"

Symbol E1-



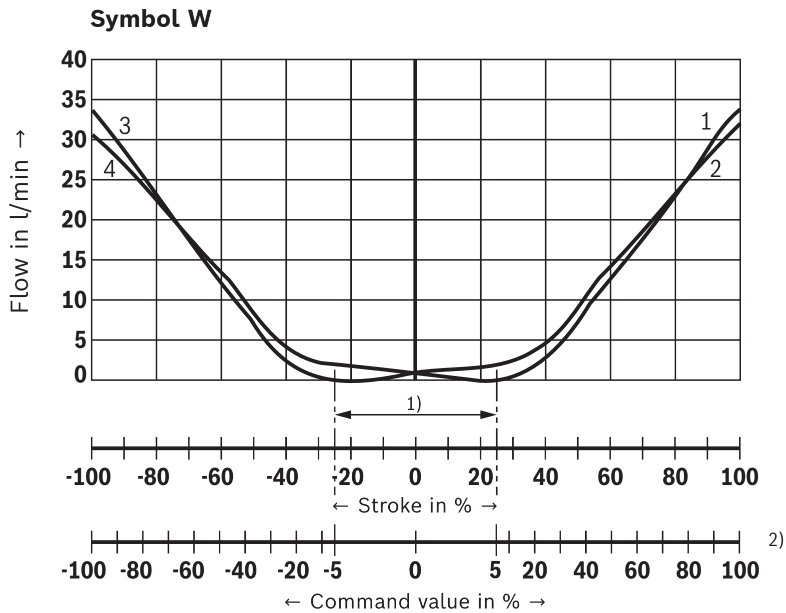
1 P–A
2 B–T
3 P–B
4 A–T

1) Step compensation
2) Version "J"

☞ **Notice:**
Typical characteristic curves which are subject to tolerance variations.

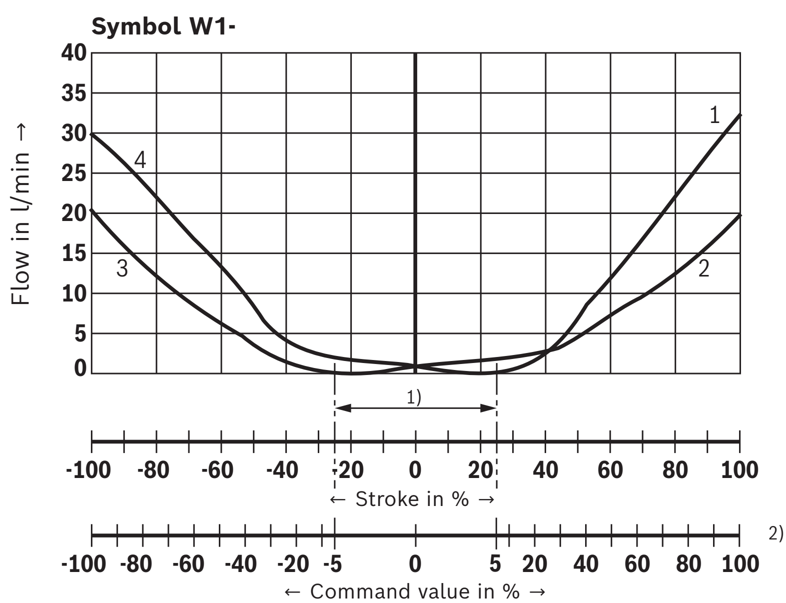
Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/signal function (rated flow 32 l/min with Δp = 5 bar/control edge)



1 P–A
2 B–T
3 P–B
4 A–T

1) Step compensation
2) Version "J"



1 P–A
2 B–T
3 P–B
4 A–T

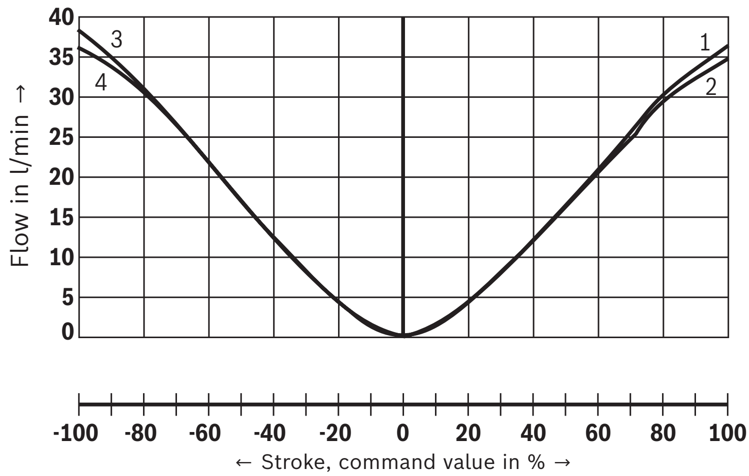
1) Step compensation
2) Version "J"

Notice:
Typical characteristic curves which are subject to tolerance variations.

Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

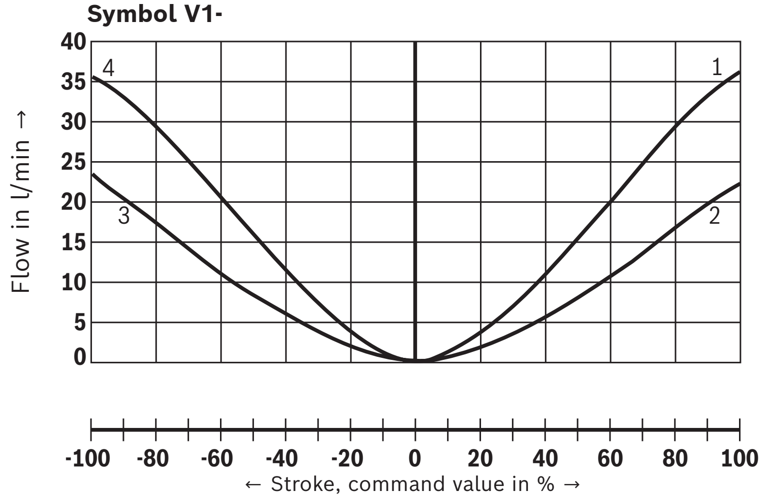
Flow/signal function (rated flow 32 l/min with Δp = 5 bar/control edge)

Symbol V



1 P–A
2 B–T
3 P–B
4 A–T

Symbol V1-

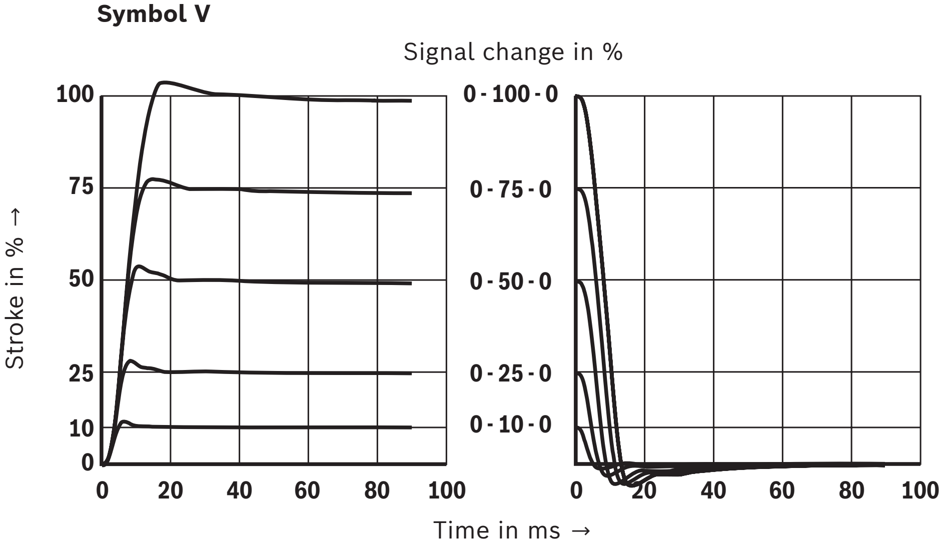


1 P–A
2 B–T
3 P–B
4 A–T

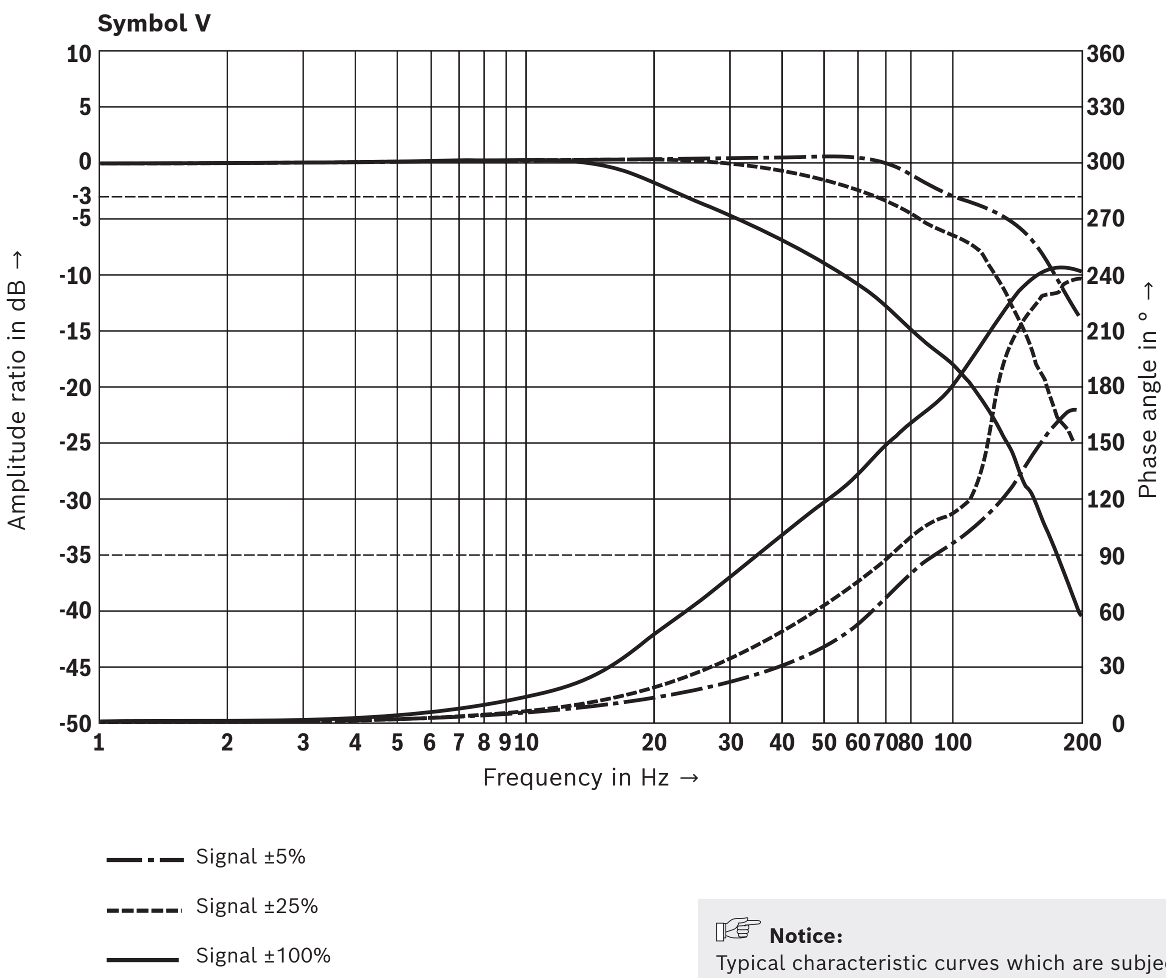
Notice:
Typical characteristic curves which are subject to tolerance variations.

Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Transition function with stepped electric input signals



Frequency response

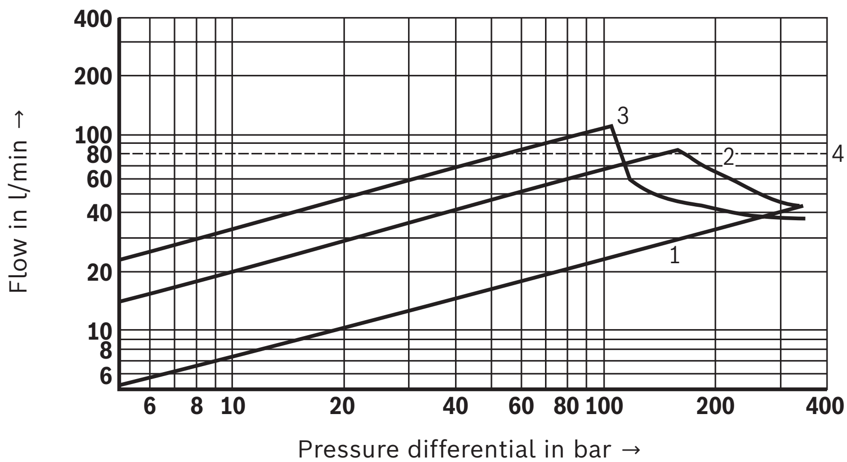


> **Notice:**
> Typical characteristic curves which are subject to tolerance variations.

Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

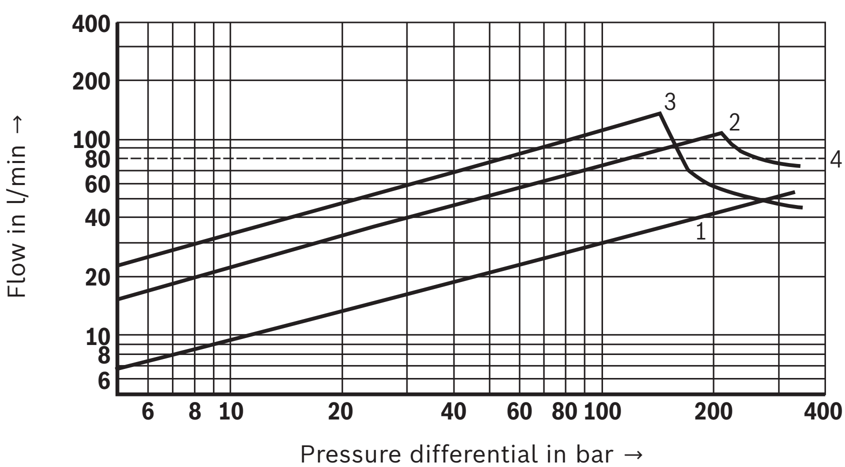
Flow load function with maximum valve opening (tolerance ±10%)

Symbol E



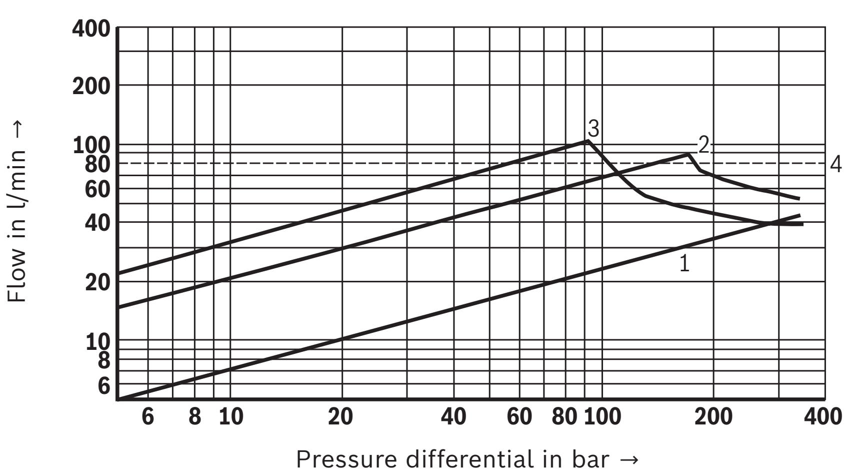
1 8 l/min (summated edge)
2 18 l/min (summated edge)
3 32 l/min (summated edge)
4 Recommended flow (flow velocity 30 m/s)

Symbol V



1 8 l/min (summated edge)
2 18 l/min (summated edge)
3 32 l/min (summated edge)
4 Recommended flow (flow velocity 30 m/s)

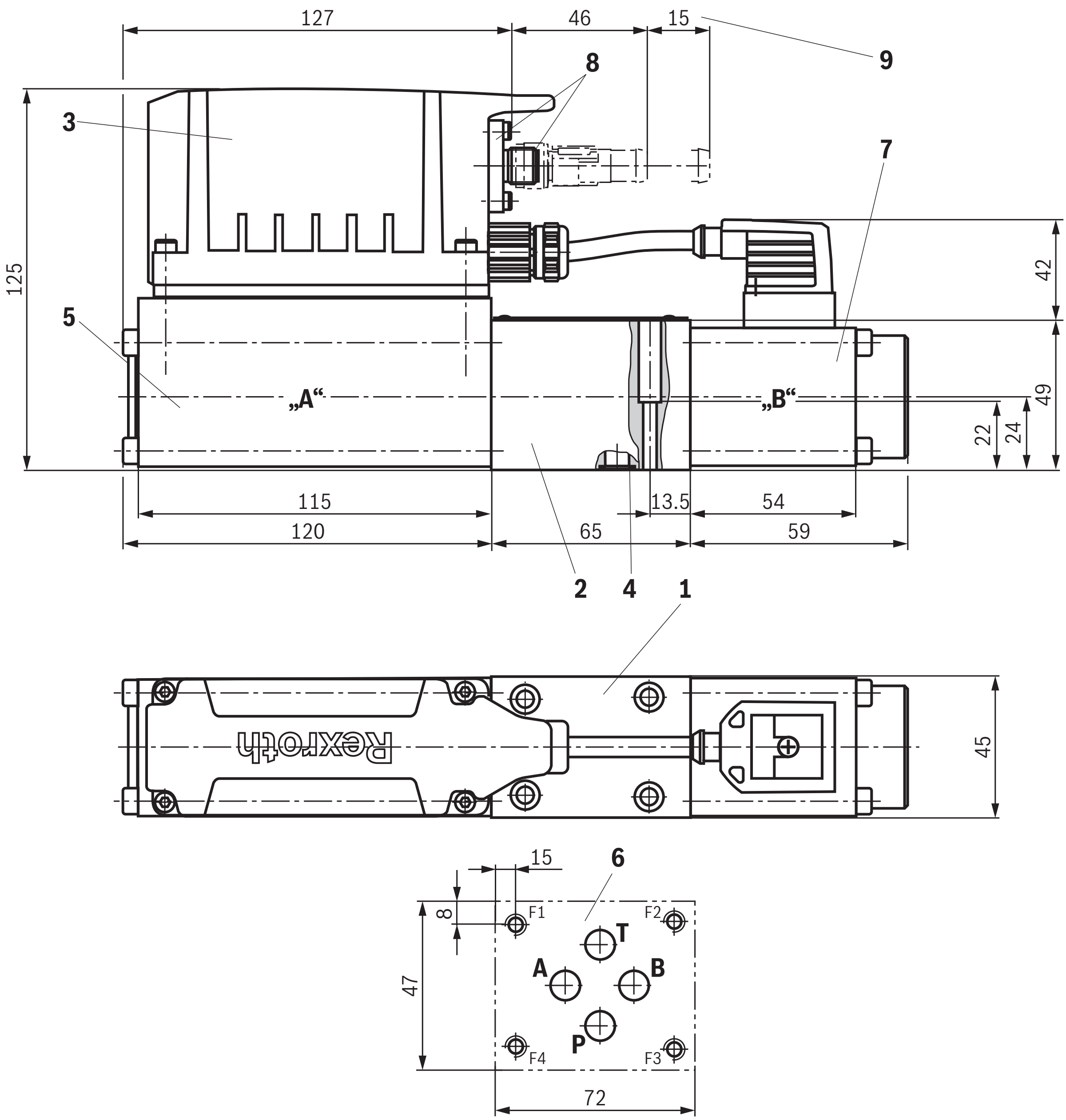
Symbol W

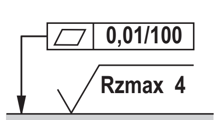


1 8 l/min (summated edge)
2 18 l/min (summated edge)
3 32 l/min (summated edge)
4 Recommended flow (flow velocity 30 m/s)

Notice:
Typical characteristic curves which are subject to tolerance variations.

Dimensions
(dimensions in mm)





Required surface quality of the valve contact surface

Notices:
- The dimensions are nominal dimensions which are subject to tolerances.
- Mating connectors, separate order, see page 22.

For item explanations, valve mounting screws and **subplates,** see page 21.

Dimensions

1 Name plate
2 Valve housing
3 Integrated electronics (OBE)
4 Identical seal rings for ports A, B, P, T, T1
5 Control solenoid with position transducer
6 Machined valve contact surface, porting pattern according to ISO 4401-03-02-0-05
7 Stroke solenoid
8 Mating connectors for version "L1", separate order, see page 22.
9 Space required for removing the mating connector

Valve mounting screws (separate order)

Size	Quantity	Hexagon socket head cap screws	Material number
6	4	**ISO 4762 - M5 x 30 - 10.9-CM-Fe-ZnNi-5-Cn-T0-H-B** (Friction coefficient μ_{total} = 0.09 … 0.14) Tightening torque M_A = 7 Nm ±10%	**R913048086**
	or		
	4	**ISO 4762 - M5 x 30 - 10.9** Tightening torque M_A = 8.9 Nm ±10%	Not included in the Rexroth delivery range

☞ **Notice:**
The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure.

Subplates (separate order) with porting pattern according to ISO 4401-03-02-0-05 see data sheet 45100.

Accessories (separate order)

Valves with integrated electronics and IO-Link interface

Cable sets for IO-Link	**Length** in m	**Material number**	**Data sheet**
For the connection of valves with IO-Link interface, M12-5, A-coded, unshielded, line cross-section 5 x 0.34 mm^2	1.5	**R901508849**	–
	3.0	**R901554223**	–
	5.0	**R901415747**	–
	7.5	**R901481016**	–
	10.0	**R901554225**	–

Further information

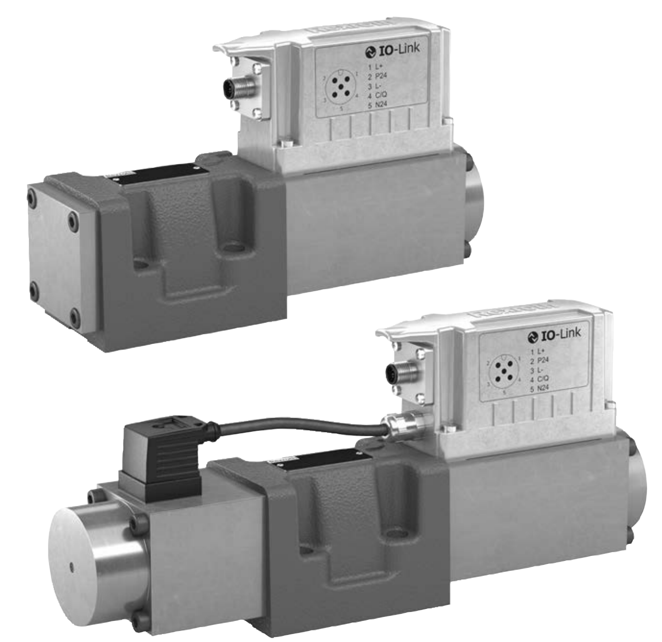
- Subplates — Data sheet 45100
- Hydraulic fluids on mineral oil basis — Data sheet 90220
- Environmentally compatible hydraulic fluids — Data sheet 90221
- Flame-resistant, water-free hydraulic fluids — Data sheet 90222
- Flame-resistant hydraulic fluids - containing water (HFAE, HFAS, HFB, HFC) — Data sheet 90223
- Reliability characteristics according to EN ISO 13849 — Data sheet 08012
- Hexagon socket head cap screw, metric/UNC — Data sheet 08936
- Installation, commissioning and maintenance of servo valves and high-response valves — Data sheet 07700
- General product information on hydraulic products — Data sheet 07008
- Hydraulic valves for industrial applications — Operating instructions 07600-B
- Assembly, commissioning and maintenance of hydraulic systems — Data sheet 07900
- Directional control valves, direct operated, with electrical position feedback and IO link interface — Data sheet 29400-PA
- Directional control and proportional directional valves with IO-Link interface
- Information on available spare parts
- Connecting hydraulic systems via IO-Link

RE 29122
Edition: 2019-07
Replaces: 2017-05

rexroth
A Bosch Company

Directional control valves, direct operated, with electrical position feedback and integrated electronics (OBE)

Type 4WRPE



H8154+8155

- Size 10
- Component series 3X
- Maximum operating pressure 350 bar
- Rated flow 50, 80 l/min
- Digital interface, IO link for I4.0

Features

- Reliable – proven and robust design
- Energy-efficient – no pilot oil demand, high flows with low pressure differential
- Flexible – suitable for position and velocity control
- Precise – high response sensitivity and little hysteresis
- Safe – shut-off of the second solenoid by means of ISA adapter possible
- IO-Link interface, optional

Contents

Ordering code

01	02	03	04	05	06	07	08		09		10		11	12		13	14	15
4	WRP	E	10			S	J	–	3X	/		/		24	/			*

01	4 main ports	**4**
02	Directional control valve, direct operated	**WRP**
03	With integrated electronics	**E**
04	Size 10	**10**
05	Symbols e.g. E, E1, W6 etc.; possible version see page 3	

Rated flow (***Δp*** = 5 bar/control edge)

06	50 l/min (only with symbols E, E1-, V and W6-)	**50**
	80 l/min	**80**

Flow characteristic

07	Progressive	**S**
08	Overlap jump (opening point 5 command value with symbols E, E1-, EA, W6- and W8-)	**J**
09	Component series 30 ... 39 (30 ... 39: unchanged installation and connection dimensions)	**3X**

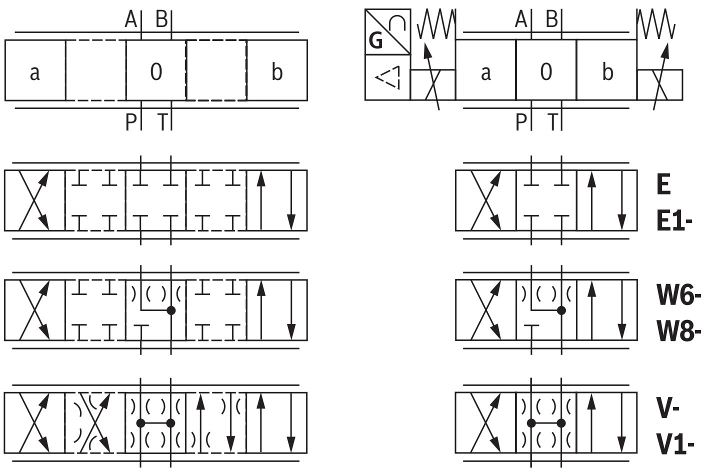
Seal material (observe compatibility of seals with hydraulic fluid used, see page 7)

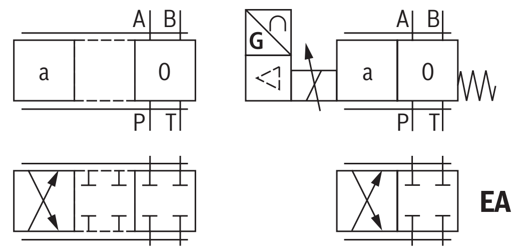
10	NBR seals	**M**
	FKM seals	**V**
11	**Without** damping plate	**without designation**
	With damping plate	**D**
12	Supply voltage 24 V	**24**

Interfaces of the control electronics

13	Command value input ±10 V	**A1**
	Command value input 4 ... 20 mA	**F1**
	IO-Link interface	**L1**
	Command value ±10 mA, actual value 4 ... 20 mA, release (connector 6+PE)	**C6**
14	**Without** electronics protection membrane	**without designation**
	With electronics protection membrane	**-967**
15	For further details, see the plain text	

Symbols





With symbol E1–, V1– and W8–:

P → A: $\boldsymbol{q}_{\text{V max}}$ B → T: $\boldsymbol{q}_{\text{V}}/2$

P → B: $\boldsymbol{q}_{\text{V}}/2$ A → T: $\boldsymbol{q}_{\text{V max}}$

Notice:
Representation according to DIN ISO 1219-1.
Hydraulic interim positions are shown by dashes.

Function, section (4/3 directional valve)

The valve type 4WRPE is a direct operated directional control valve with electric position feedback and integrated electronics (OBE).

Set-up

The valve basically consists of:

- Valve housing (1)
- Control spool (2) with compression springs (3.1 and 3.2)
- Control solenoid with position transducer (4) (optional with electronics protection membrane (8))
- Stroke solenoid (7)
- On-board electronics (OBE) (5) with analog (6) or IO-Link interface (optionally with damping plate (9))

Function

The integrated electronics (OBE) compares the specified command value to the position actual value. In case of control deviations, the relevant solenoid will be activated. Due to the changed magnetic force, the control spool (2) is adjusted against the corresponding spring. The stroke/control spool cross-section is regulated proportionally to the command value. In case of a command value presetting of 0 V, the electronics adjust the control spool (2) to central position.

Error detection

In the following cases of error, the electronics will de-energize the control solenoids:

- Falling below the minimum supply voltage ≤ 15 V (restarting ≥ 17.5 V).
- Only at interface “F1”:
  - Falling below the minimum current command value of 2 mA (includes cable break of the command value line (current loop)).
- Only at interface “L1”:
  - Enable inactive, communication interruption (watchdog)
  - In case of internal IO-Link error
- Only at interface “C6”:
  - Additionally, release inactive

The control spool (2) is kept in the mechanical central position by the compression springs (3.1 and 3.2) (with symbol V, this does not correspond to the hydraulic central position).

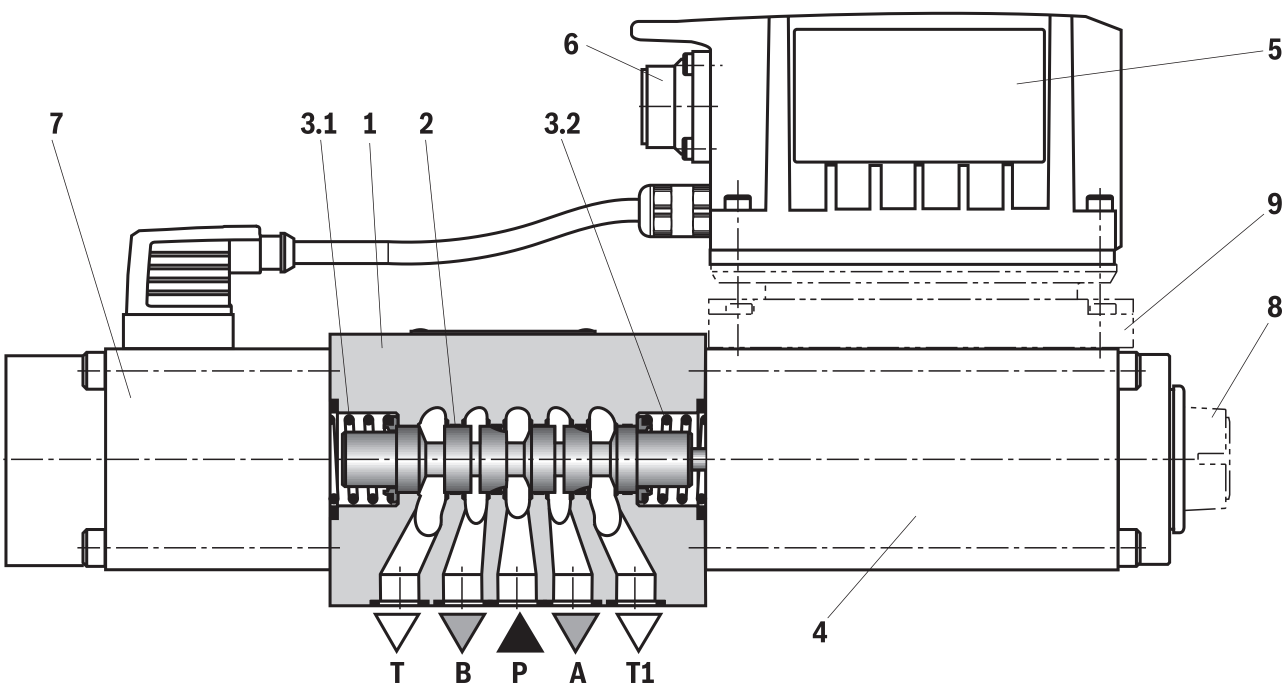
Damping plate "D"

The damping plate (9) reduces the acceleration amplitudes on the on-board electronics (frequencies >300 Hz).

> ☞ **Notice:**
> Using the damping plate is not recommended for applications with mainly low-frequency excitation <300 Hz.

Electronics protection membrane "-967"

To prevent condensate formation in the housing of the integrated electronics (OBE), an electronics protection membrane (8) can be used.
Recommended for use outside industry-standard conditions with high ambient air humidity and significant cyclic temperature changes (e.g. outdoors).



Function, section (4/2 directional valve)

The valve type 4WRPE is a direct operated directional control valve with electric position feedback and integrated electronics (OBE).

Set-up

The valve basically consists of:

- Valve housing (1)
- Control spool (2) with compression springs (3)
- Control solenoid with position transducer (4) (optional with electronics protection membrane (8))
- On-board electronics (OBE) (5) with analog (6) or IO-Link interface (optionally with damping plate (9))

Function

The integrated electronics (OBE) compares the specified command value to the position actual value. In case of control deviations, the control solenoid will be activated. Due to the changed magnetic force, the control spool (2) is adjusted against the control spring. The stroke/control spool cross-section is regulated proportionally to the command value. With a positive command value presetting, the valve opens from P to B or A to T. Negative command values lead to no change in the control spool position.

Error detection

In the following cases of error, the electronics will de-energize the control solenoid:

- Falling below the minimum supply voltage ≤ 15 V (restarting ≥ 17.5 V).
- Only at interface “F1”:
  - Falling below the minimum current command value of 2 mA (includes cable break of the command value line (current loop)).
- Only at interface “L1”:
  - Enable inactive, communication interruption (watchdog)
  - In case of internal IO-Link error
- Only at interface “C6”:
  - Additionally, release inactive

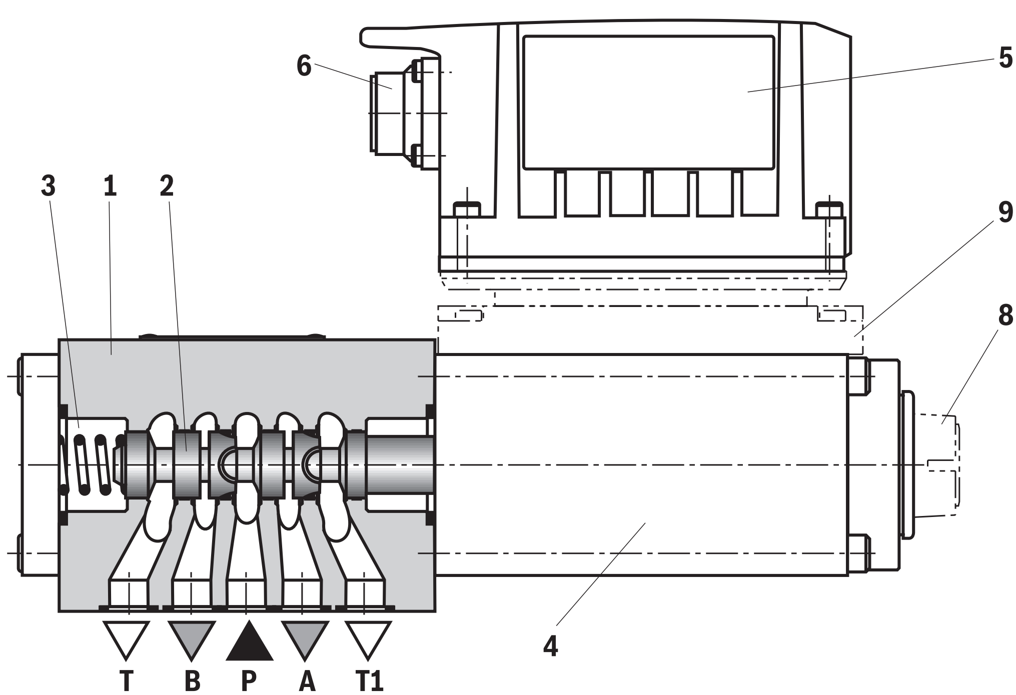
Damping plate "D"

The damping plate (9) reduces the acceleration amplitudes on the on-board electronics (frequencies >300 Hz).

☞ **Notice:**
Using the damping plate is not recommended for applications with mainly low-frequency excitation <300 Hz.

Electronics protection membrane "-967"

To prevent condensate formation in the housing of the integrated electronics (OBE), an electronics protection membrane (8) can be used.
Recommended for use outside industry-standard conditions with high ambient air humidity and significant cyclic temperature changes (e.g. outdoors).



Technical data
(For applications outside these values, please consult us!)

General			
Installation position			Any
Ambient temperature range		°C	-20 ... +60
Storage temperature range with UV protection		°C	+10 ... +40
Transport temperature		°C	-30 ... +80
Maximum storage time		years	1 (if the storage conditions are observed; refer to the operating instructions 07600-B)
Sine test according to DIN EN 60068-2-6	▶ Without damping plate		10 ... 2000 Hz / maximum of 10 g / 10 cycles / 3 axes
	▶ With damping plate 1)		10 ... 2000 Hz / maximum of 10 g / 10 cycles / 3 axes
Noise test according to DIN EN 60068-2-64	▶ Without damping plate		20 ... 2000 Hz / 10 g_{RMS} / 30 g peak / 30 min. / 3 axes
	▶ With damping plate 1)		20 ... 2000 Hz / 10 g_{RMS} / 30 g peak / 24 h / 3 axes
Transport shock according to DIN EN 60068-2-27	▶ Without damping plate		15 g / 11 ms / 3 shocks / 3 axes
	▶ With damping plate 1)		15 g / 11 ms / 3 shocks / 3 axes
Shock according to DIN EN 60068-2-27	▶ With damping plate 1)		35 g / 6 ms / 1000 shocks / 3 axes
Weight	▶ 4/3-way version	kg	7.6
	▶ 4/2-way version	kg	6.0
Maximum relative humidity (no condensation)		%	95
Maximum solenoid surface temperature		°C	150 (individual operation)
$MTTF_d$ value according to EN ISO 13849		years	150 (for further details see data sheet 08012)
Conformity			▶ CE according to EMC directive 2014/30/EU, tested according to EN 61000-6-2 and EN 61000-6-3 ▶ RoHS directive 2015/65/EU ▶ REACH ordinance (EC) no. 1907/2006

Hydraulic						
Maximum operating pressure	▶ Ports A, B, P	bar	350			
	▶ Port T	bar	200			
Rated flow (**Δp** = 5 bar/control edge 2))		l/min	50		80	
Flow unloading central position (**Δp** = 5 bar/ control edge)			A – T	B – T	A – T	B – T
	▶ Symbol W6-	l/min	0.7	0.7	0.7	0.7
	▶ Symbol W8-	l/min	–	–	0.7	0.7
Hydraulic fluid			See table page 7			
Viscosity range	▶ Recommended	mm²/s	20 ... 100			
	▶ Maximum admissible	mm²/s	10 ... 800			
Hydraulic fluid temperature range (flown-through)		°C	-20 ... +70			
Maximum admissible degree of contamination of the hydraulic fluid; cleanliness class according to ISO 4406 (c)			Class 18/16/13 3)			

1) Not recommended for applications with mainly low-frequency excitation < 300 Hz

2) Flow for deviating **Δp** (control edge):

$$\boxed{q_x = q_{Vnom} \cdot \sqrt{\frac{\Delta p_x}{5}}}$$

3) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and simultaneously increases the life cycle of the components.

Notice:
The specified technical data were measured with HLP46 and ϑ_{oil} = 40 ±5 °C.

Technical data
(For applications outside these values, please consult us!)

Hydraulic fluid		Classification	Suitable sealing materials	Standards	Data sheet
Mineral oils		HL, HLP, HLPD, HVLP, HVLPD	NBR, FKM	DIN 51524	90220
Bio-degradable	▶ Insoluble in water	HETG	FKM	ISO 15380	90221
		HEES	FKM		
	▶ Soluble in water	HEPG	FKM	ISO 15380	
Flame-resistant	▶ Water-free	HFDU (glycol base)	FKM	ISO 12922	90222
		HFDU (ester base)	FKM		
		HFDR	FKM		
	▶ Containing water	HFC (Fuchs: Hydrotherm 46M, Renosafe 500; Petrofer: Ultra Safe 620; Hough-ton: Safe 620; Union: Carbide HP5046)	NBR	ISO 12922	90223

Important notices on hydraulic fluids:

- For further information and data on the use of other hydraulic fluids, please refer to the data sheets above or contact us.
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.).
- The ignition temperature of the hydraulic fluid used must be 50 K higher than the maximum surface temperature.
- **Bio-degradable and flame-resistant – containing water:** If components with galvanic zinc coating (e.g. version "J3" or "J5") or parts containing zinc are used, small amounts of dissolved zinc may get into the hydraulic system and cause accelerated aging of the hydraulic fluid. Zinc soap may form as a chemical reaction product, which may clog filters, nozzles and solenoid valves - particularly in connection with local heat input.
- **Flame-resistant – containing water**:
  - Due to the increased cavitation tendency with HFC hydraulic fluids, the life cycle of the component may be reduced by up to 30 % as compared to the use with mineral oil HLP. In order to reduce the cavitation effect, it is recommended - if possible specific to the installation - to back up the return flow pressure in ports T to approx. 20 % of the pressure differential at the component.
  - Dependent on the hydraulic fluid used, the maximum ambient and hydraulic fluid temperature must not exceed 50 °C. In order to reduce the heat input into the component, the command value profile is to be adjusted for proportional and high-response valves.

Static/dynamic		
Hysteresis	%	< 0.25
Range of inversion	%	< 0.05
Response sensitivity	%	< 0.05
Manufacturing tolerance q_{Vmax}	%	< 10
Temperature drift (temperature range 20 °C ... 80 °C)		Zero shift < 0.2
Pressure drift	%/100 bar	Zero shift < 0.2
Zero compensation		ex plant ±1 %

Technical data
(For applications outside these values, please consult us!)

Electrical, integrated electronics (OBE) – Interface “A1” and “F1”		
Relative duty cycle	%	100 (continuous operation)
Protection class according to EN 60529		IP 65 with mounted and locked plug-in connectors
Supply voltage	VDC	24
▶ Terminal A	VDC	min. 19 / max. 36
▶ Terminal B	VDC	0
Maximum admissible residual ripple	Vpp	2.5
Maximum power consumption	VA	60
Fuse protection, external	A_T	3.15 (time-lag)
Input, version "A1"		Differential amplifier, $\boldsymbol{R}_i$ = 100 kΩ
▶ Terminal D ($\boldsymbol{U}_E$)	VDC	0 ... ±10 (4/3-way version) 0 ... +10 (4/2-way version)
▶ Terminal E	VDC	0
Input, version "F1"		Load, $\boldsymbol{R}_{sh}$ = 200 Ω
▶ Terminal D ($\boldsymbol{I}_{D-E}$)	mA	4 ... (12) ... 20 (4/3-way version) 4 ... 20 (4/2-way version)
▶ Terminal E ($\boldsymbol{I}_{D-E}$)		Current loop $\boldsymbol{I}_{D-E}$ feedback
Maximum voltage of the differential inputs against 0 V		D → B; E → B (max. 18 V)
Test signal, version "A1"		LVDT
▶ Terminal F ($\boldsymbol{U}_{Test}$)	V	0 ... ±10 (4/3-way version) 0 ... +10 (4/2-way version)
▶ Terminal C		Reference 0 V
Test signal, version "F1"		LVDT signal 4 ... 20 mA on external load 200 ... 500 Ω maximum
▶ Terminal F ($\boldsymbol{I}_{F-C}$)	mA	4 ... (12) ... 20 (4/3-way version) 4 ... 20 (4/2-way version)
▶ Terminal C ($\boldsymbol{I}_{F-C}$)		Current loop $\boldsymbol{I}_{F-C}$ feedback
Functional ground and screening		See page 10 (CE-compliant installation)
Adjustment		Calibrated in the plant, see valve characteristic curves page 13 ... 21
Conformity		CE according to EMC Directive 2014/30/EU tested according toEN 61000-6-2 and EN 61000-6-3

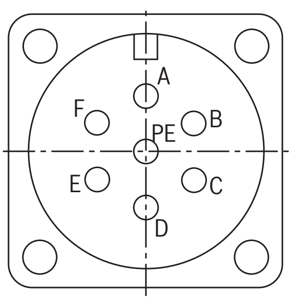
Electrical, integrated electronics (OBE) – Interface “L1”			
Relative duty cycle		%	100 (continuous operation)
Protection class according to EN 60529			IP 65 with mounted and locked plug-in connectors
Supply voltage	▶ Valve amplifier	VDC	24
	– Pin 2	VDC	min. 18 / max. 30
	– Pin 5	VDC	0
	▶ IO-Link interface	VDC	24
	– Pin 1	VDC	min. 18 / max. 30
	– Pin 3	VDC	0
Maximum current consumption	▶ Valve amplifier	A	3
	▶ IO-Link interface	mA	50
Maximum residual ripple		Vpp	1.3
Maximum current consumption		mA	50
Minimum process cycle time		ms	0.6
Bit rate COM3		kBaud (kbit/s)	230.4
Required master port class			Class B
Resolution	▶ A/D transformer	bit	12 (110% valve opening)
	▶ D/A transformer	bit	12 (110% valve opening)
Functional ground			Provide via valve block
Adjustment			Calibrated in the plant
Directive			IO-Link Interface and System Specification Version 1.1.2

Technical data
(For applications outside these values, please consult us!)

Electrical, integrated control electronics (OBE) – Interface "C6"		
Relative duty cycle	%	100 (continuous operation)
Protection class according to EN 60529		IP 65 with mounted and locked plug-in connectors
Supply voltage	VDC	24
▶ Terminal A	VDC	min. 19 / max. 36
▶ Terminal B	VDC	0
Maximum admissible residual ripple	Vpp	2.5
Maximum power consumption	VA	60
Fuse protection, external	A_T	3.15 (time-lag)
Input		Load, R_{sh} = 200 Ω
▶ Terminal D (I_{D-E})	mA	0 ... ±10
▶ Terminal E (I_{D-E})		Current loop I_{D-E} feedback
Test signal		LVDT signal 4 ... 20 mA on external load 200 ... 500 Ω maximum
▶ Terminal F (I_{F-B})	mA	4 ... 20
▶ Terminal B (I_{F-B})		Current loop I_{F-B} feedback
Functional ground and screening		See page 10 (EMC-compliant installation)
Adjustment		Calibrated in the plant, see valve characteristic curves page 13 ... 21

Electrical connections and assignment

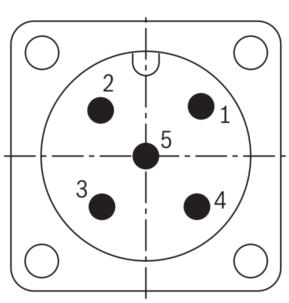
Contact	Interface assignment		
	"A1" (6 + PE)	**"F1"** (6 + PE)	**"C6"** (6 + PE)
A	24 VDC supply voltage		
B	GND		GND, reference potential actual value/enable
C	Reference potential actual value	Reference potential actual value	Enable input 24 VDC (high ≥ 11 V, low ≤ 5 V)
D	Command value ±10 V (***Re*** > 100 kΩ)	Command value 4 ... 20 mA (***Re*** = 200 Ω)	Command value ±10 mA (***Re*** = 200 Ω)
E	Reference potential command value	Reference potential command value	Reference potential command value
F	Actual value ±10 V (***Ri*** ≈ 1 kΩ)	Actual value 4 ... 20 mA (Load max. 500 Ω)	Actual value 4 ... 20 mA (Load max. 500 Ω)
FE	Functional ground (directly connected to the valve housing)		

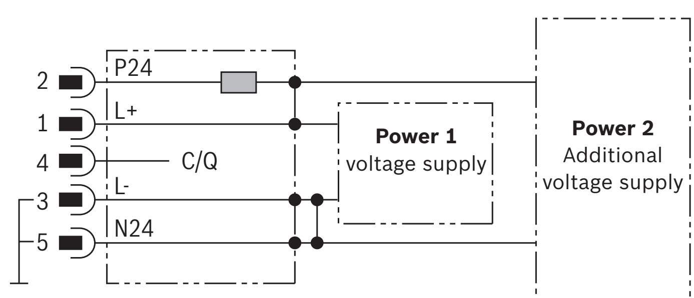


Command value:	▶ Positive command value (0 ... 10 V or 12 ... 20 mA) at D and reference potential at E cause flow from P → A and B → T.
	▶ Negative command value (0 ... –10 V or 12 ... 4 mA) at D and reference potential at E cause flow from P → B and A → T.
Connection cable:	▶ Up to 20 m cable length type LiYCY 7 x 0.75 mm²
	▶ Up to 40 m cable length type LiYCY 7 x 1.0 mm²
	▶ EMC-compliant installation: – Apply screening to both line ends – Use metal mating connector (see page 25) ▶ Alternatively up to 30 m cable length admissible – Apply screening on supply side – Plastic mating connector (see page 25) can be used

Notice:
Mating connectors, separate order, see page 25 and data sheet 08006.

Connector pin assignment "L1" (M12-5, A-coded, class B)



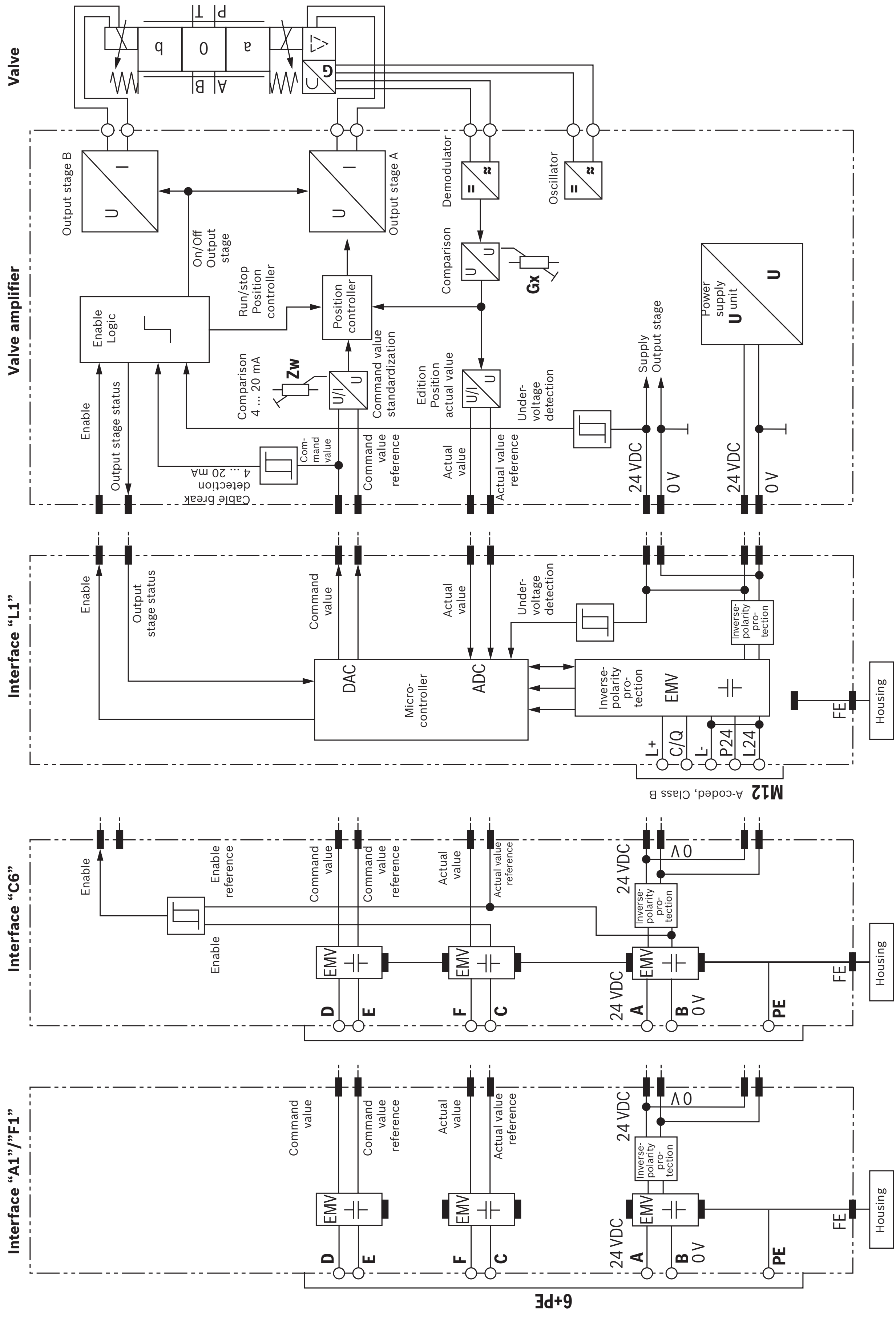


Notices:
- ▶ M12 sensor/actuator connection line, 5-pole; M12 connector/bush, A-coded, without shield, maximum cable length 20 m. Observe the voltage drop over the cable. Wire cross-section at least 0.34 mm².
- ▶ Mating connectors, separate order, see page 25 and data sheet 08006.
- ▶ Communication and parameter description see data sheet 29400-PA
- ▶ With a wire cross-section of 0.34 mm² (standard line), a maximum cable length of 10 m is possible. For a maximum cable length of 20 m, the cross-section must be doubled.

Pin	Signal	Allocation interface L1
1	L+	Voltage supply IO-Link
2	P24	Voltage supply valve electronics and power part (current consumption 3 A)
3	L-	Reference potential pin 1 [1)]
4	C/Q	Data line IO-Link (SDCI)
5	N24	Reference potential pin 2 [1)]

[1)] Pin 3 and 5 are linked with each other in the valve electronics. The reference potentials L- and N24 of the two supply voltages must also be linked with each other on the power supply unit side.

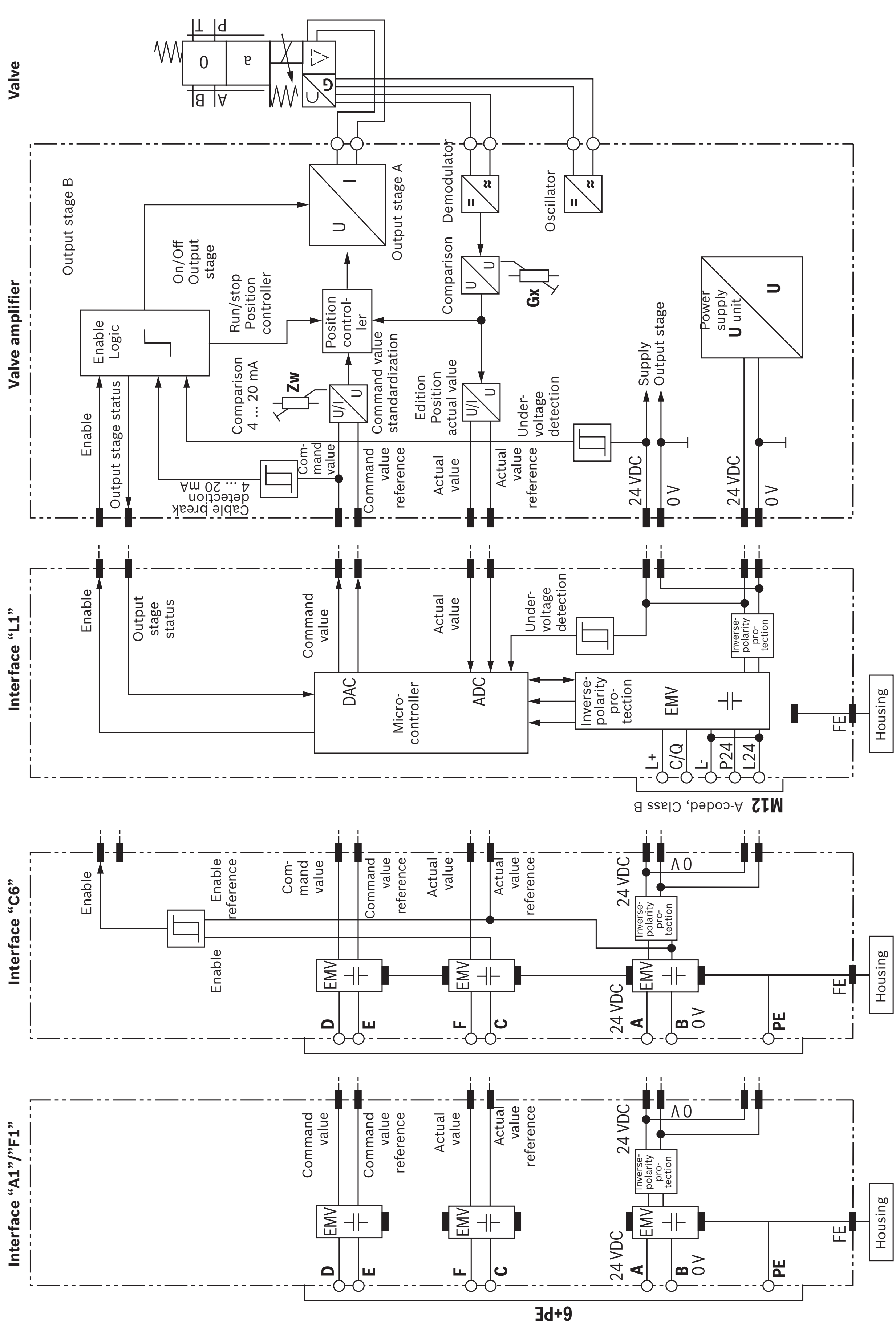
Block diagram/controller function block (4/3-way version)



Notices:

- Electrical signals provided via control electronics (e.g. actual value) must not be used for switching off safety-relevant machine functions.
- The setting of the potentiometer at the factory must not be changed.

Block diagram/controller function block (4/2-way version)

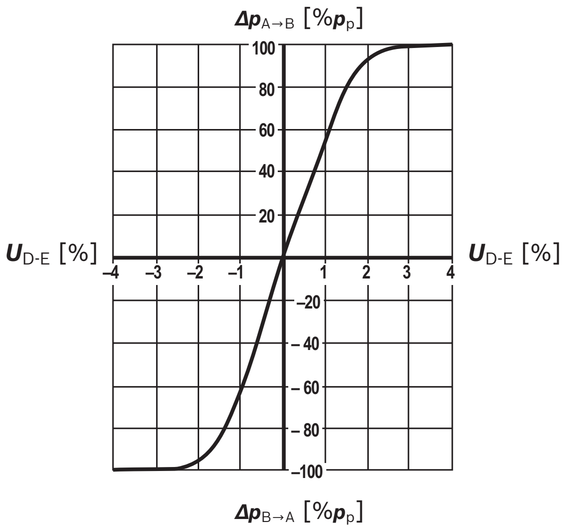


☞ **Notices:**

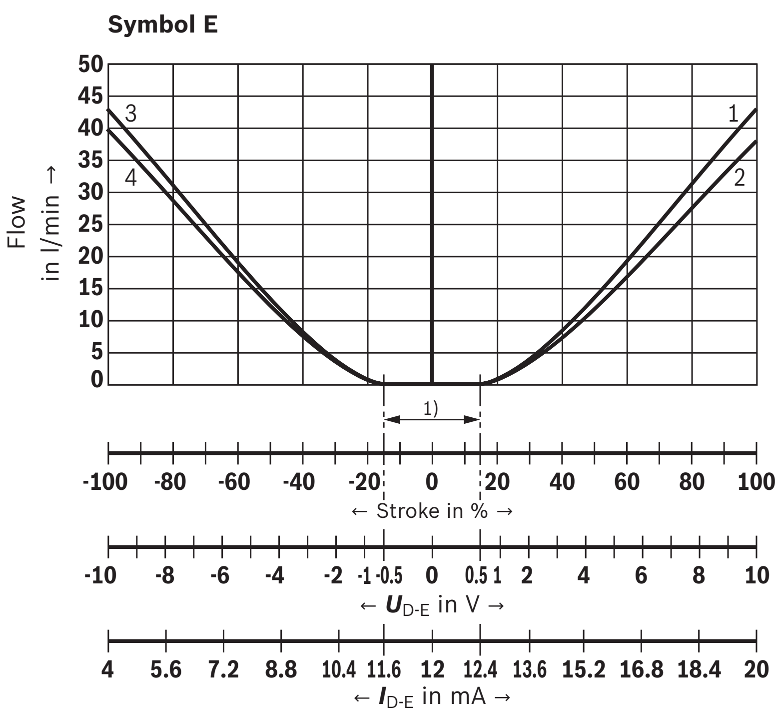
- Electrical signals provided via control electronics (e.g. actual value) must not be used for switching off safety-relevant machine functions.
- The setting of the potentiometer at the factory must not be changed.

Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Pressure/signal characteristic curve (symbol V)



Flow/signal function (rated flow 50 l/min with Δp = 5 bar/control edge)



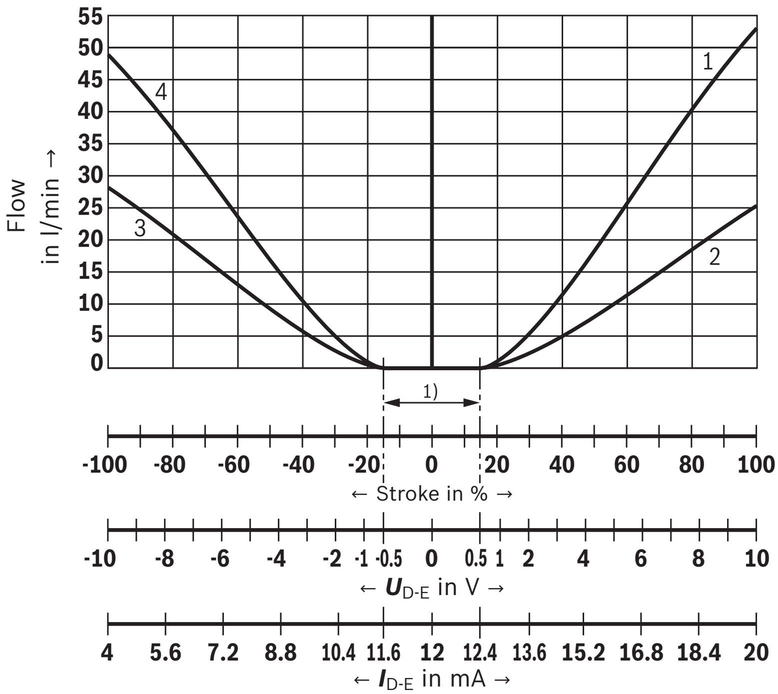
1) Step compensation

1 P–A
2 B–T
3 P–B
4 A–T

Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/signal function (rated flow 50 l/min with Δp = 5 bar/control edge)

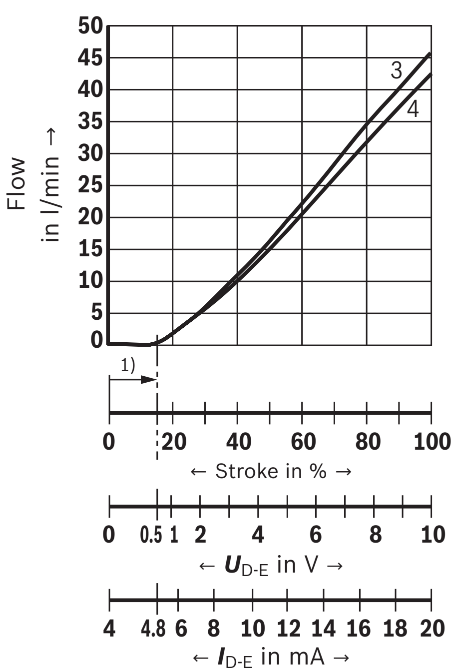
Symbol E1-



1) Step compensation

1 P–A
2 B–T
3 P–B
4 A–T

Symbol EA



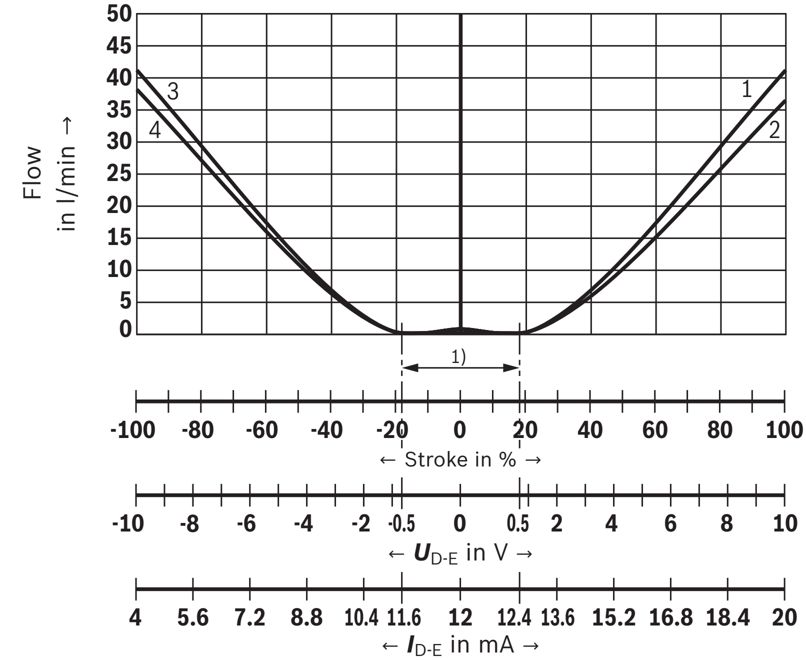
1) Step compensation

3 P–B
4 A–T

Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/signal function (rated flow 50 l/min with ***Δp*** = 5 bar/control edge)

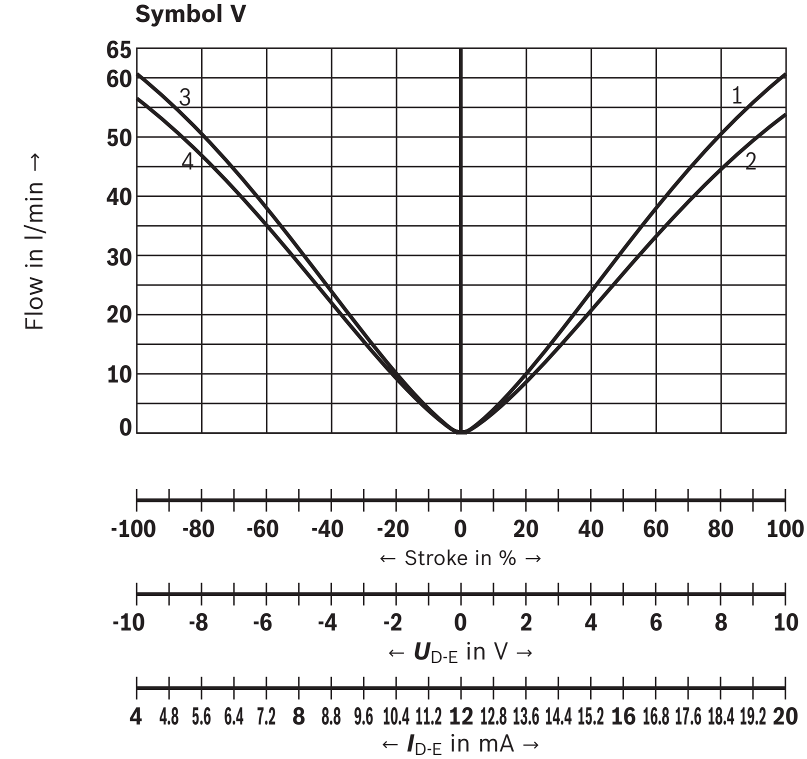
Symbol W6-



1) Step compensation

1 P–A
2 B–T
3 P–B
4 A–T

Symbol V



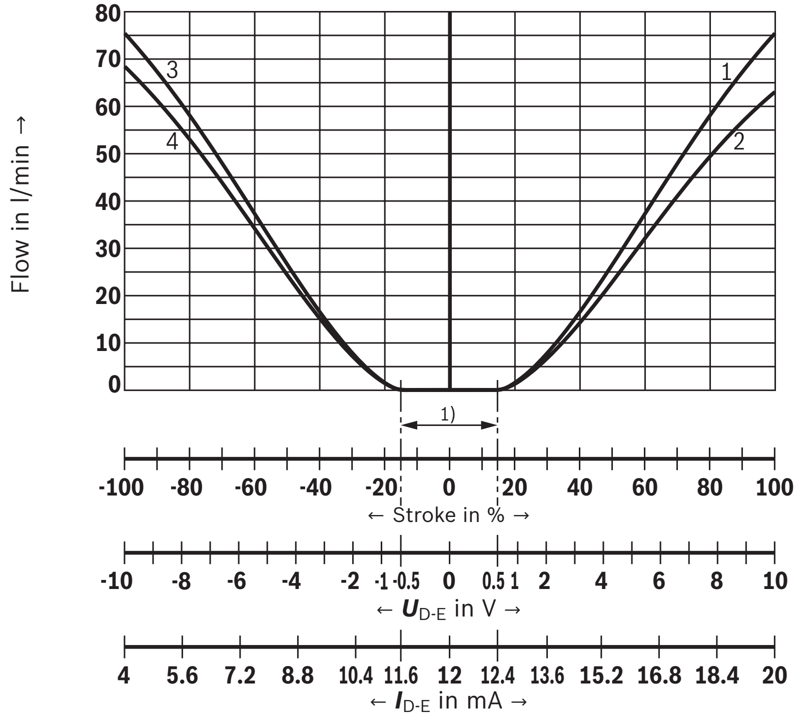
1 P–A
2 B–T
3 P–B
4 A–T

Characteristic curves

(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/signal function (rated flow 80 l/min with Δp = 5 bar/control edge)

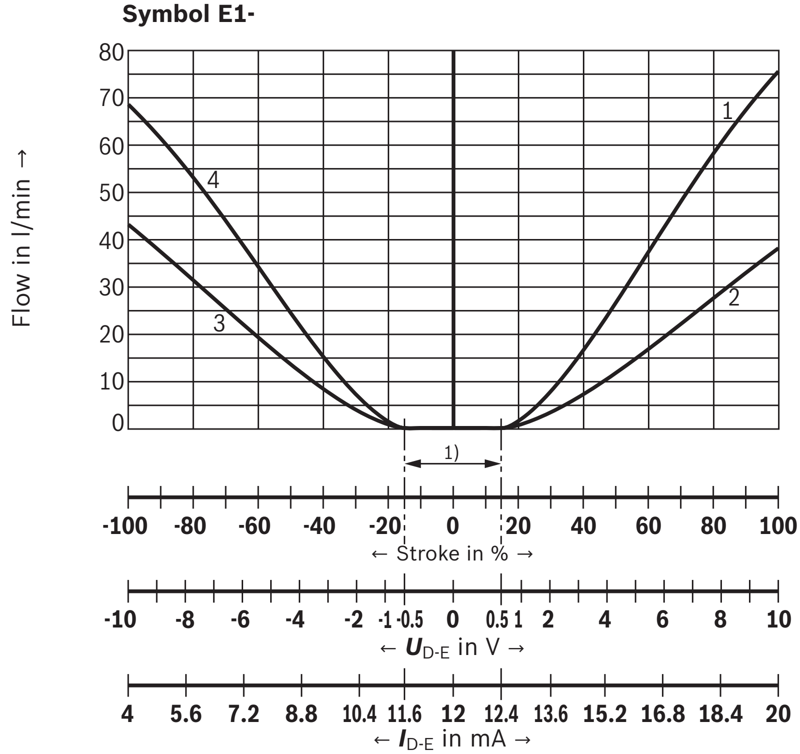
Symbol E



1) Step compensation

1 P–A
2 B–T
3 P–B
4 A–T

Symbol E1-

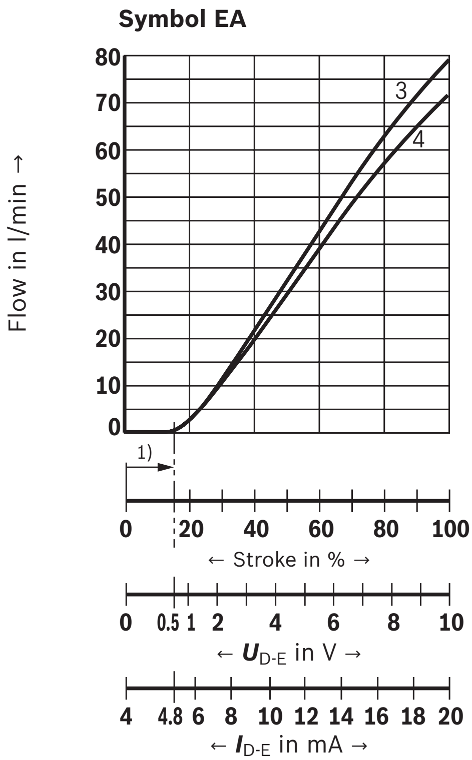


1) Step compensation

1 P–A
2 B–T
3 P–B
4 A–T

Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/signal function (rated flow 80 l/min with Δp = 5 bar/control edge)



1) Step compensation

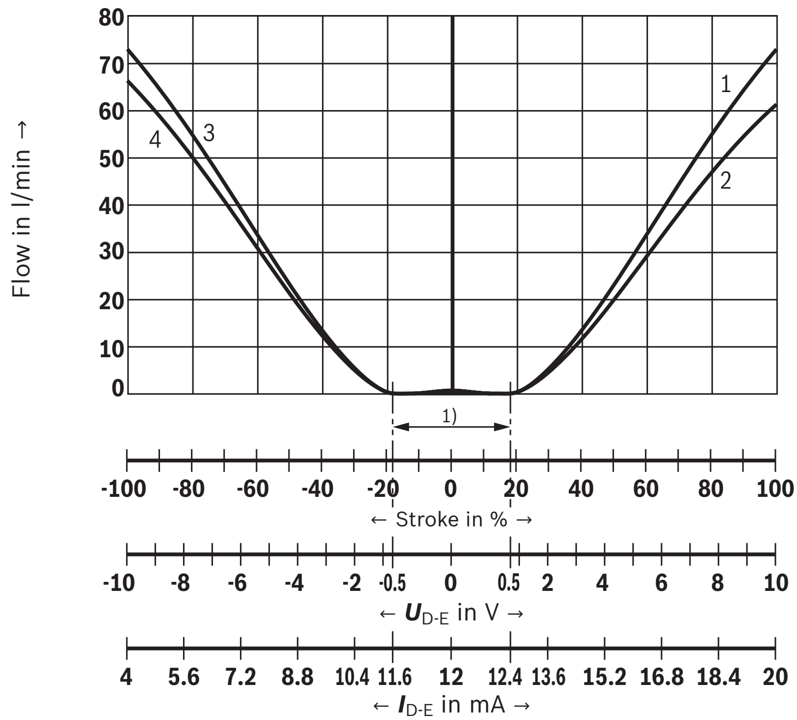
3 P–B

4 A–T

Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/signal function (rated flow 80 l/min with Δp = 5 bar/control edge)

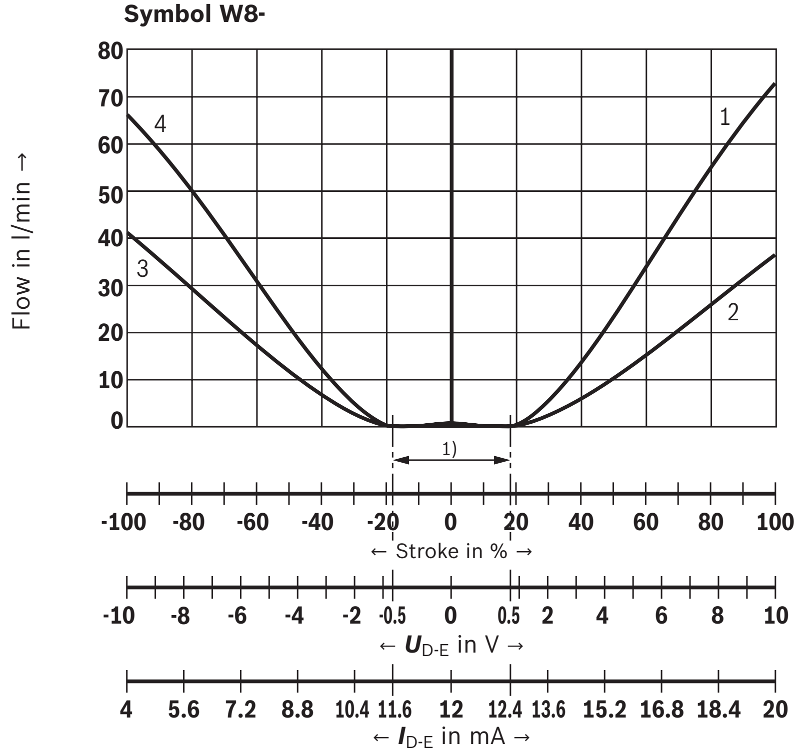
Symbol W6-



1) Step compensation

1 P–A
2 B–T
3 P–B
4 A–T

Symbol W8-



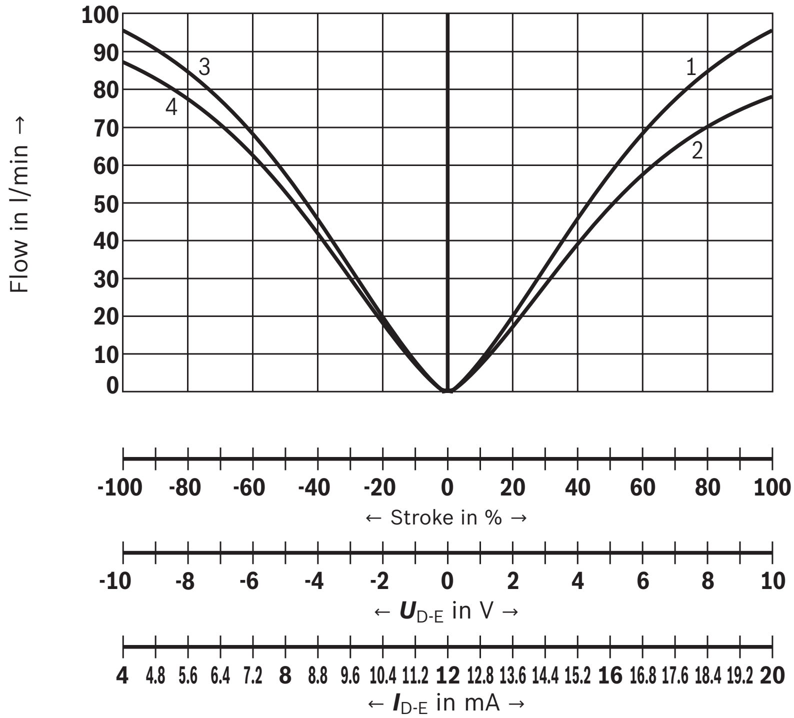
1) Step compensation

1 P–A
2 B–T
3 P–B
4 A–T

Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

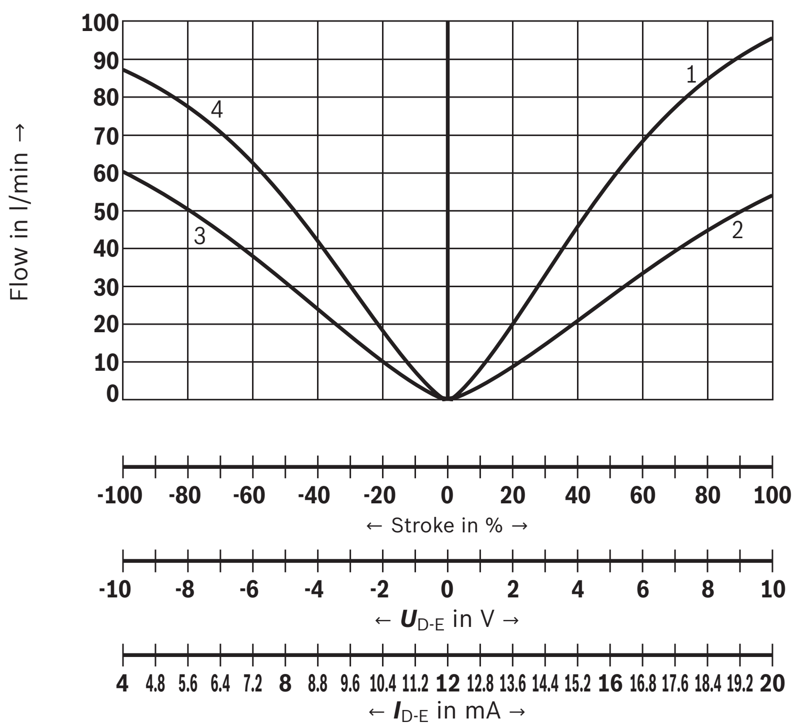
Flow/signal function (rated flow 80 l/min with Δp = 5 bar/control edge)

Symbol V



1 P–A
2 B–T
3 P–B
4 A–T

Symbol V1-

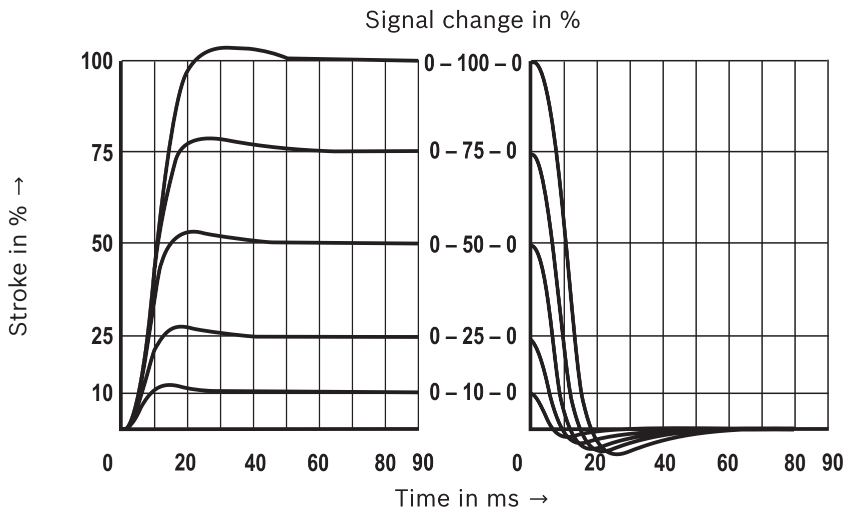


1 P–A
2 B–T
3 P–B
4 A–T

Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

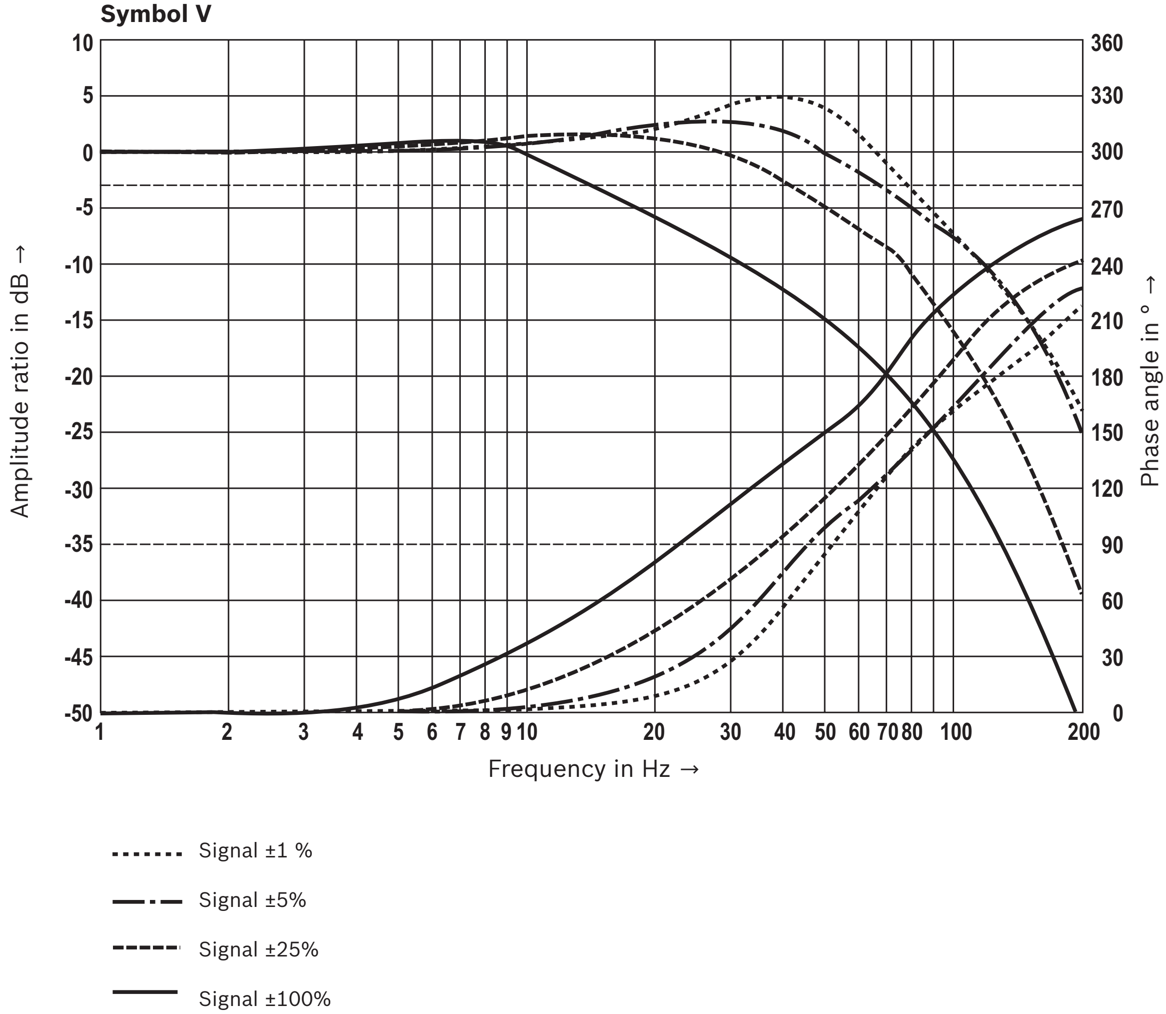
Transition function with stepped electric input signals (4/3-way version)

Symbol V



Frequency response characteristic curves

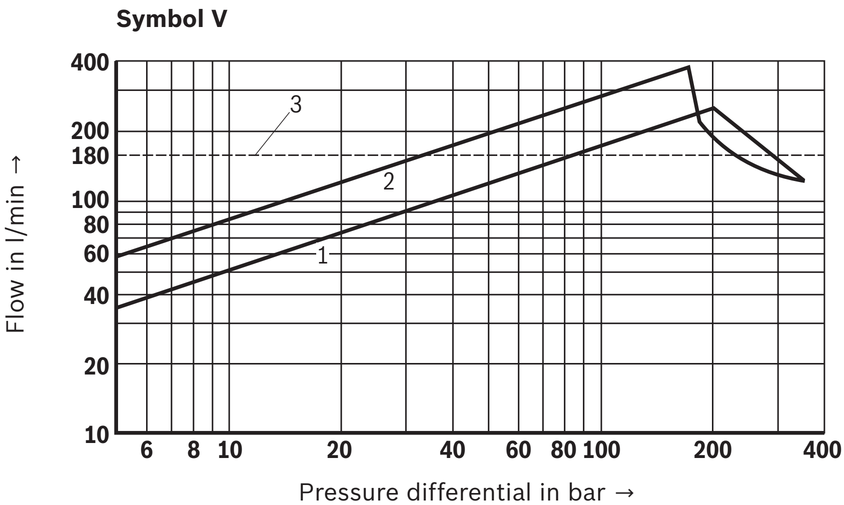
Symbol V



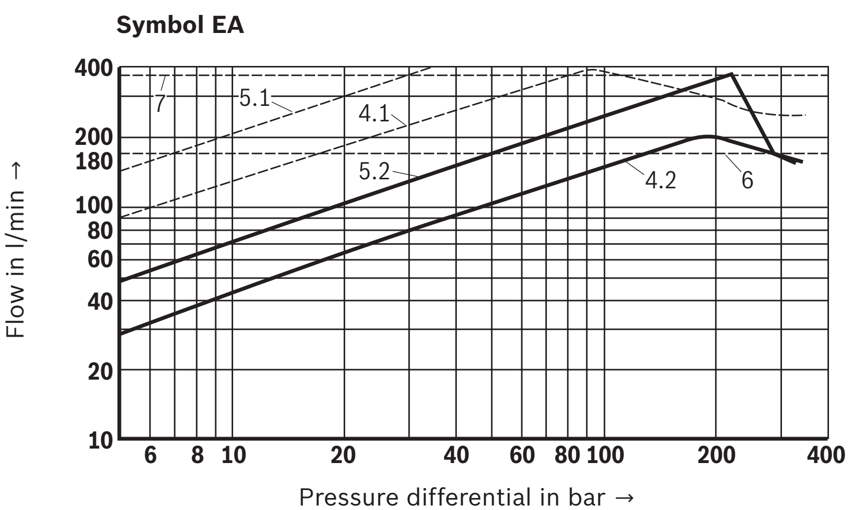
Characteristic curves

(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/load function with maximum valve opening (tolerance ±10 %) (4/3-way version)

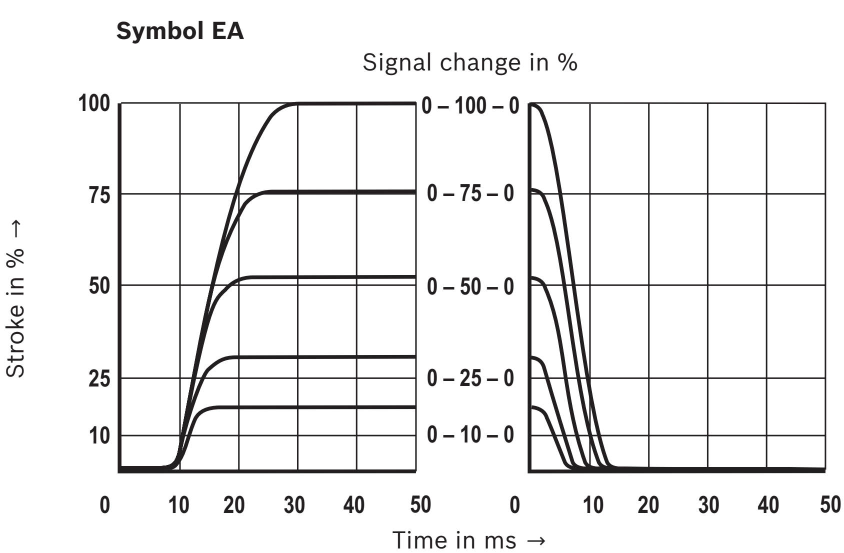


1 50 l/min (summated edge)
2 80 l/min (summated edge)
3 Recommended flow limitation

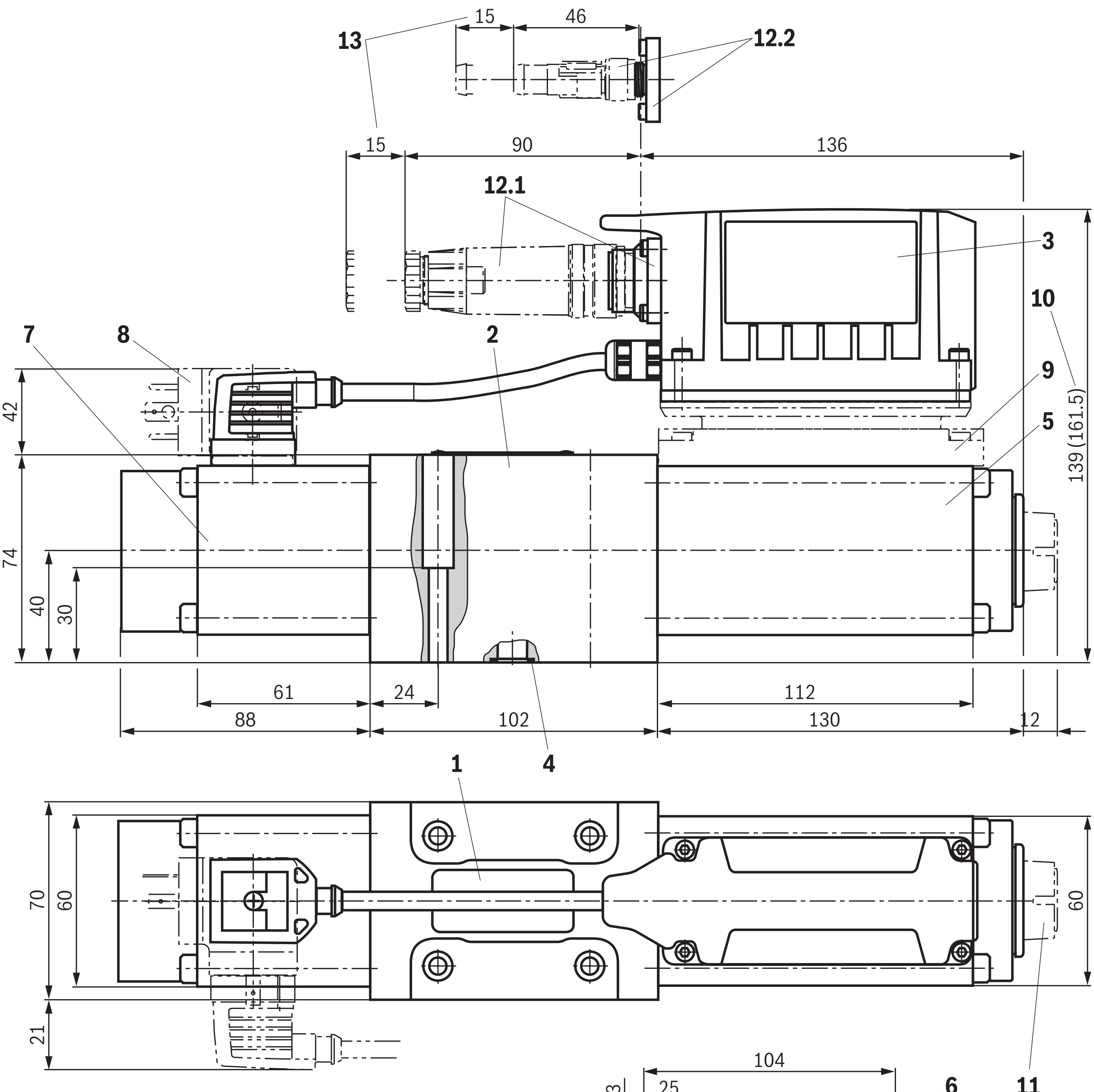


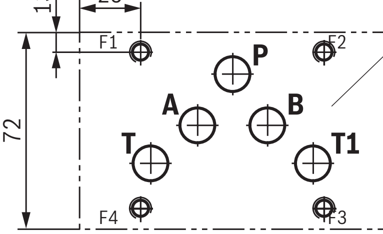
4.1 50 l/min, with double flow (summated edge)
4.2 50 l/min (summated edge)
5.1 80 l/min, with double flow (summated edge)
5.2 80 l/min (summated edge)
6 Recommended flow limitation with individual flow (180 l/min)
7 Recommended flow limitation with double flow (360 l/min)

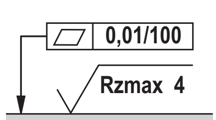
Transition function with stepped electric input signals (4/2-way version)



Dimensions (4/3-way version)
(dimensions in mm)







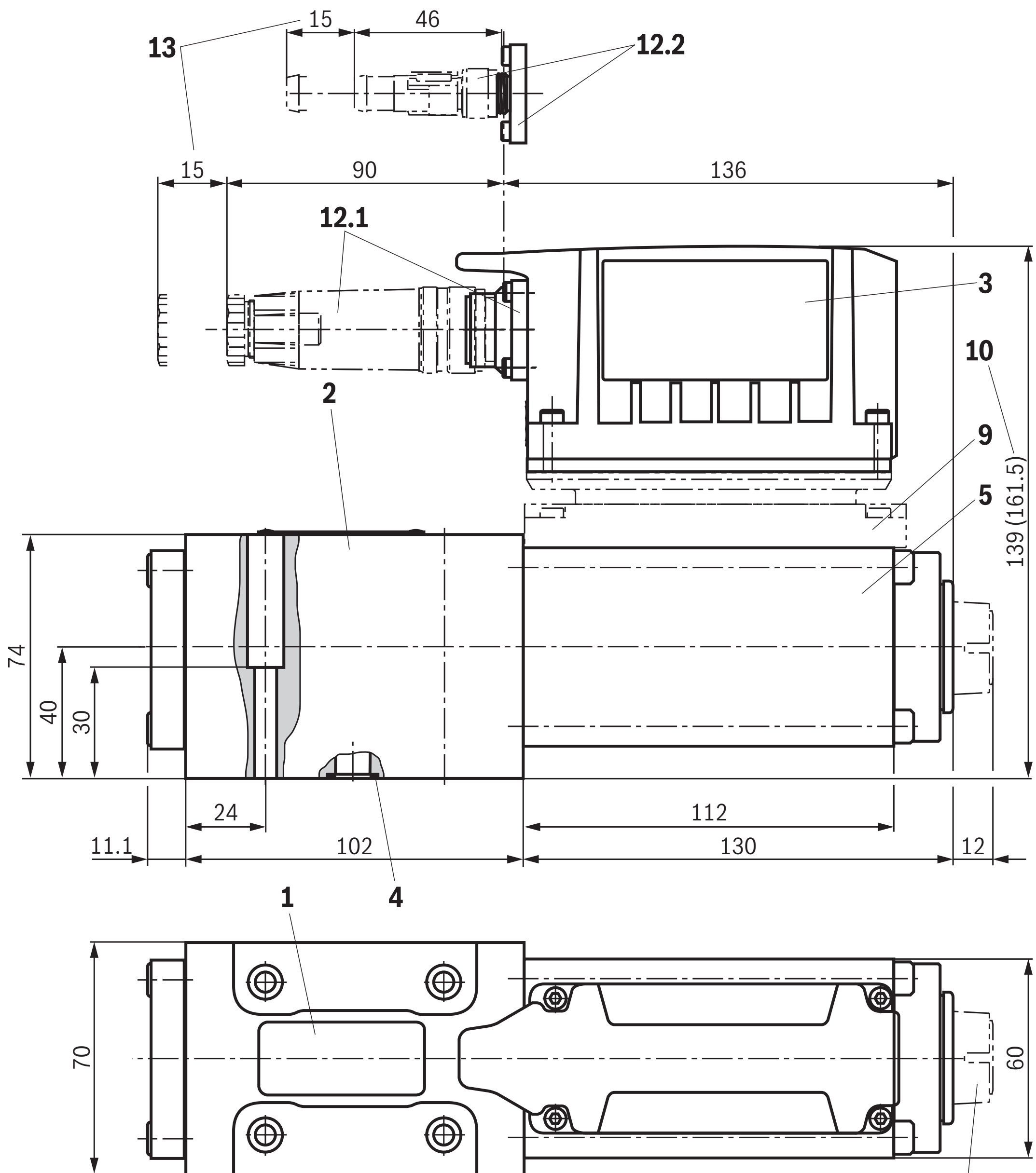
Required surface quality
of the valve contact surface

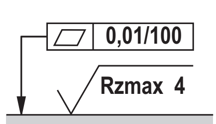
☞ **Notices:**

- The dimensions are nominal dimensions which are subject to tolerances.
- Mating connectors, separate order, see page 25 and data sheet 08006.

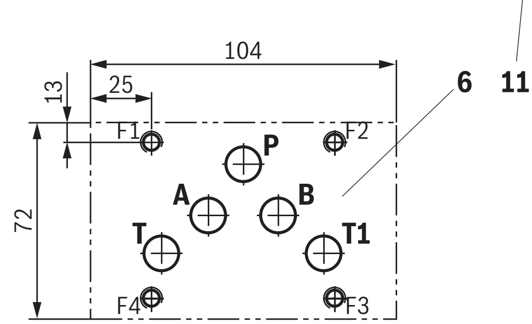
For item explanations, valve mounting screws and **subplates,** see page 24.

Dimensions (4/2-way version)
(dimensions in mm)





Required surface quality
of the valve contact surface



Notices:
- The dimensions are nominal dimensions which are subject to tolerances.
- Mating connectors, separate order, see page 25 and data sheet 08006.

For **item explanations, valve mounting screws** and **subplates,** see page 24.

Dimensions

1 Name plate
2 Valve housing
3 Integrated electronics (OBE)
4 Identical seal rings for ports A, B, P, T, T1
5 Control solenoid with position transducer
6 Machined valve contact surface, porting pattern according to ISO 4401-05-04-0-05
7 Stroke solenoid
8 ISA adapter, separate order, see page 25
9 Damping plate "D"
10 Dimension in () for version with damping plate "D"
11 Electronics protection membrane "-967"
12.1 Mating connectors for version “A1”, “F1” and “C6”, separate order, see page 25 and data sheet 08006.
12.2 Mating connectors for version “L1”, separate order, see page 25 and data sheet 08006.
13 Space required for removing the mating connector

Valve mounting screws (separate order)

Size	Quantity	Hexagon socket head cap screws	Material number
10	4	**ISO 4762 - M6 x 40 - 10.9-CM-Fe-ZnNi-5-Cn-T0-H-B** (Friction coefficient μ_{total} = 0.09 … 0.14) Tightening torque M_A = 12.5 Nm ±10 %	**R913051533**
	or		
	4	**ISO 4762 - M6 x 40 - 10.9** Tightening torque M_A = 15.5 Nm ±10%	Not included in the Rexroth delivery range
	or		
	4	**ASME B18.3 - 1/4-20 UNC x 1 3/4“ - ASTM-A574** Tightening torque M_A = 15 Nm *[11 ft-lbs]* ±10 %	Not included in the Rexroth delivery range

Notice:
The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure.

Subplates (separate order) with porting pattern according to ISO 4401-05-04-0-05 see data sheet 45100.

Accessories (separate order)

Valves with integrated electronics

Mating connectors 6-pole + PE	**Design**	**Version**	**Material number**	**Data sheet**
For the connection of valves with integrated electronics, round connector 6+PE, line cross-section 0.5 ... 1.5 mm²	Straight	Metal	**R900223890**	08006
	Straight	Plastic	**R900021267**	08006
	Angled	Plastic	**R900217845**	–

Cable sets 6-pole + PE	**Length** in m	**Material number**	**Data sheet**
For the connection of valves with integrated electronics, round connector 6+PE, straight connector, shielded, potted-in mating connector, line cross-section 0.75 mm²	3.0	**R901420483**	08006
	5.0	**R901420491**	08006
	10.0	**R901420496**	08006
	20.0	**R901448068**	–

Test and service devices

	Material number	**Data sheet**
Service case with test device for proportional servo valves with integrated electronics (OBE)	**R901049737**	29685

		Material number	**Data sheet**
ISA adapter	ISA adapter for external shut-off of the second solenoid (tightening torque M_A = $0.5^{+0.1}$ Nm)	**1834484245**	**–**

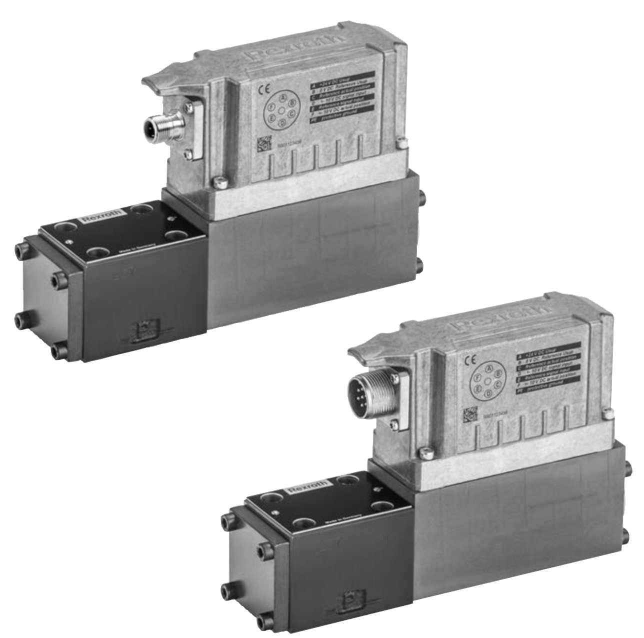
Further information

▶ Subplates	Data sheet 45100
▶ Hydraulic fluids on mineral oil basis	Data sheet 90220
▶ Environmentally compatible hydraulic fluids	Data sheet 90221
▶ Flame-resistant, water-free hydraulic fluids	Data sheet 90222
▶ Flame-resistant hydraulic fluids - containing water (HFAE, HFAS, HFB, HFC)	Data sheet 90223
▶ Reliability characteristics according to EN ISO 13849	Data sheet 08012
▶ Hexagon socket head cap screw, metric/UNC	Data sheet 08936
▶ Installation, commissioning and maintenance of servo valves and high-response valves	Data sheet 07700
▶ General product information on hydraulic products	Data sheet 07008
▶ Hydraulic valves for industrial applications	Data sheet 07600-B
▶ Assembly, commissioning and maintenance of hydraulic systems	Data sheet 07900
▶ Directional control valves, direct operated, with electrical position feedback and IO-Link interface	Data sheet 29400-PA
▶ Selection of filters	
▶ Information on available spare parts	
▶ Link hydraulics via IO-Link	

Directional control valves, direct operated, with electrical position feedback and integrated electronics (OBE)

Type 4WRPEH

RE 29121
Edition: 2019-02
Replaces: 2018-01



25090 m

- Size 6
- Component series 3X
- Maximum operating pressure 350 bar
- Rated flow 4 ... 40 l/min

Features

- Reliable - proven and robust design
- Safe - fail-safe position of the control spool in switched-off condition
- Energy-efficient - no pilot oil demand
- High quality - control spool and sleeve in servo quality
- Flexible - suitable for position, velocity and pressure control
- Precise - high response sensitivity and little hysteresis
- IO-Link interface, optional

Contents

Ordering code

01	02	03	04	05	06	07	08	09		10		11		12	13	14	15	16
4	WRP	E	H	6		B			–	3X	/		/		24			*

01	4 main ports	**4**
02	Directional control valve, direct operated	**WRP**
03	With integrated electronics	**E**
04	Control spool/sleeve	**H**
05	Size 6	**6**
06	Symbols e.g. C, C1, C5 etc.; for possible design, see page 3	
07	Installation side of the inductive position transducer	**B**

Rated flow (***Δp*** = 35 bar/control edge)

08		Flow characteristic		
		"L"	**"P"**	
	4 l/min	✓	✓ (Inflection at 20%)	**04**
	12 l/min	✓	–	**12**
	15 l/min	–	✓ (Inflection at 60%)	**15**
	24 l/min	✓	–	**24**
	25 l/min	–	✓ (Inflection at 60%)	**25**
	40 l/min	✓	✓ (Inflection at 40%)	**40**

Flow characteristic

09	Linear	**L**
	Inflected characteristic curve, linear	**P**
10	Component series 30 ... 39 (30 ... 39: unchanged installation and connection dimensions)	**3X**

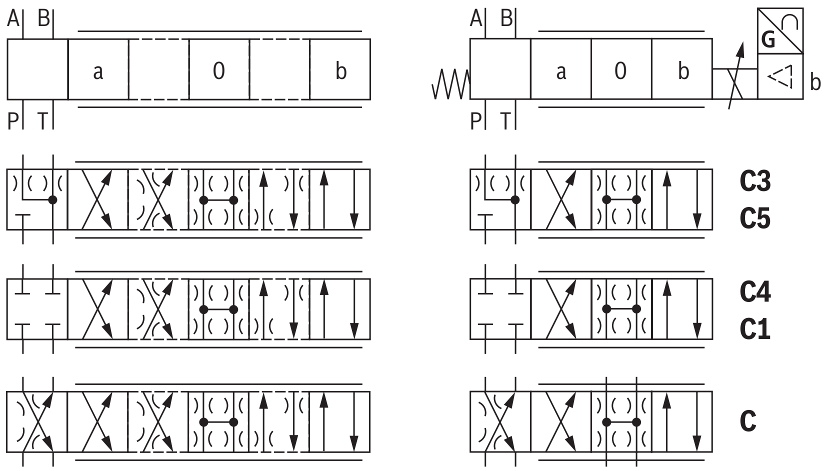
Seal material (observe compatibility of seals with hydraulic fluid used, see page 6)

11	NBR seals	**M**
	FKM seals	**V**
12	**Without** damping plate	**no code**
	With damping plate	**D**
13	Supply voltage of the integrated electronics: 24VDC	**24**

Interfaces of the control electronics

14	Command value input ±10 V	**A1**
	Command value input 4 ... 20 mA	**F1**
	IO-Link interface	**L1**
	Command value ±10 mA, actual value 4 ... 20 mA, release (connector 6+PE)	**C6**
15	**Without** electronics protection membrane	**no code**
	With electronics protection membrane	**-967**
16	Further details in the plain text	

Symbols



With symbols C5 and C1: [1)]

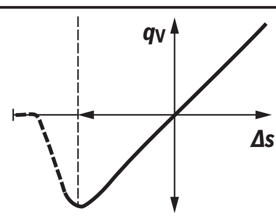
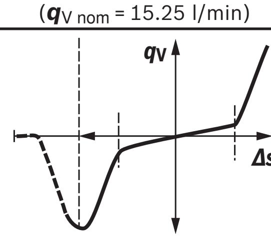
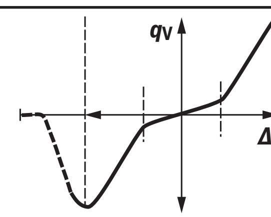
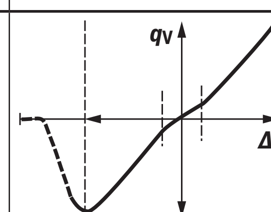
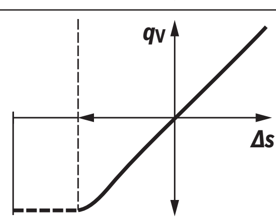
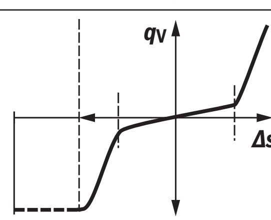
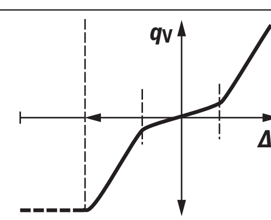
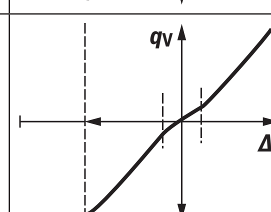
P → A: $q_{V\,nom}$ B → T: $q_{V\,nom}/2$

P → B: $q_{V\,nom}/2$ A → T: $q_{V\,nom}$

> 👉 **Notice:**
> Representation according to DIN ISO 1219-1.
> Hydraulic interim positions are shown by dashes.

[1)] $q_{V\,nom}$ 2:1 in connection with flow characteristic "P" only for rated flow 40 l/min (version "40")

Flow characteristic

Symbol	**Linear characteristic curve** (Version "L")	**Inflected characteristic curve** (version "P")		
		Inflection 60% ($q_{V\,nom}$ = 15.25 l/min)	Inflection 40%	Inflection 20%
C3, C5 **C4, C1**				
C				

Function, section

Valves of type 4WRPEH are direct operated directional control valves with electrical position feedback and integrated electronics (OBE).

Set-up

The 4WRPEH high-response valve mainly consists of:

- Valve housing with control spool and sleeve in servo quality (1)
- Control solenoid with position transducer (2) (optionally with electronics protection membrane (5))
- On-board electronics (OBE) (3) with analog or IO-Link interface (4) (optionally with damping plate (6))

Function

The integrated electronics (OBE) compares the specified command value to the position actual value. In case of control deviations, the stroke solenoid will be activated. Due to the changed solenoid force, the control spool is adjusted against the spring. Stroke/control spool cross-section is controlled proportionally to the command value. In case of a command value presetting of 0, the electronics adjusts the control spool against the spring to central position. In deactivated condition, the spring is untensioned to a maximum and the valve is in fail-safe position.

Control solenoid shut-off

In case of the following errors, the control solenoids are de-energized by the integrated electronics (OBE) and the control spool is set to fail-safe position:

- Falling below the minimum supply voltage
- Only at interface "F1":
  - Falling below the minimum current command value of 2 mA (includes cable break of the command value line (current loop))
- Only at interface "L1":
  - Enable inactive, communication interruption (watchdog)
  - In case of internal IO-Link error
- Only at interface "C6":
  - Additionally release inactive

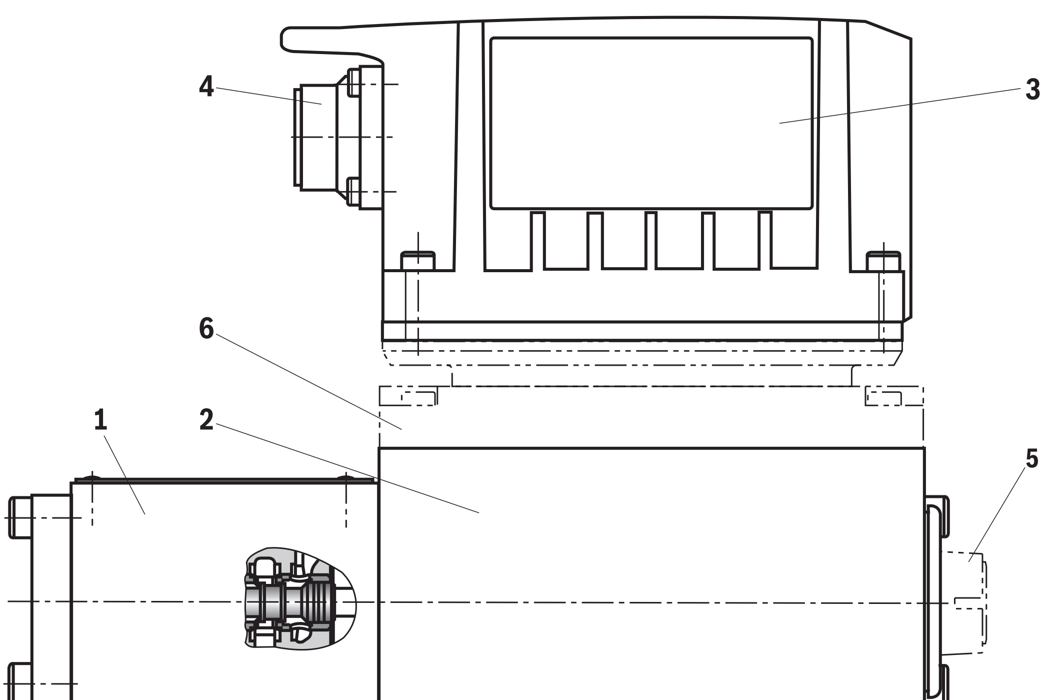
Damping plate "D"

The damping plate reduces the acceleration amplitudes on the on-board electronics (frequencies >300 Hz).

> **Notice:**
> Use of the damping plate is not recommended for applications with mainly low-frequency excitation <300 Hz

Electronics protection membrane "-967"

To prevent condensate formation in the housing of the integrated electronics (OBE), an electronics protection membrane (5) can be used.
Recommended for use outside industry-standard conditions with high ambient air humidity and significant cyclic temperature changes (e.g. outdoors).



Technical data
(for applications outside these values, please consult us!)

General			
Design			Spool valve, direct operated, with steel sleeve
Actuation			Proportional solenoid with position control, OBE
Type of connection			Subplate mounting, porting pattern according to ISO 4401
Installation position			any
Ambient temperature range		°C	−20 ... +60
Transport temperature		°C	−30 ... +80
Maximum storage time		Years	1 (if the storage conditions are observed; refer to the operating instructions 07600-B)
Sine test according to DIN EN 60068-2-6	▶ Without damping plate		10 ... 2000 Hz / maximum of 10 g / 10 cycles / 3 axes
	▶ With damping plate [1]		10 ... 2000 Hz / maximum of 10 g / 10 cycles / 3 axes
Noise test according to DIN EN 60068-2-64	▶ Without damping plate		20 ... 2000 Hz / 10 g_{RMS} / 30 g peak / 30 min. / 3 axes
	▶ With damping plate [1]		20 ... 2000 Hz / 10 g_{RMS} / 30 g peak / 24 h / 3 axes
Transport shock according to DIN EN 60068-2-27	▶ Without damping plate		15 g / 11 ms / 3 shocks / 3 axes
	▶ With damping plate [1]		15 g / 11 ms / 3 shocks / 3 axes
Shock according to DIN EN 60068-2-27	▶ With damping plate [1]		35 g / 6 ms / 1000 shocks / 3 axes
Weight		kg	2.9
Maximum relative humidity (no condensation)		%	95
Maximum solenoid surface temperature		°C	150
$MTTF_d$ value according to EN ISO 13849		Years	150 (for further details see data sheet 08012)
Conformity			▶ CE according to EMC directive 2014/30/EU, tested according to EN 61000-6-2 and EN 61000-6-3 ▶ RoHS directive 2015/65/EU ▶ REACH ordinance (EC) no. 1907/2006

Hydraulic							
Maximum operating pressure	▶ Port A, B, P	bar	350				
	▶ Port T	bar	250				
Rated flow at Δp = 35 bar/control edge [2]		l/min	4	12	15	24/25	40
Hydraulic fluid			see table page 6				
Viscosity range	▶ Recommended	mm²/s	20 ... 100				
	▶ Maximum admissible	mm²/s	10 ... 800				
Hydraulic fluid temperature range (flown-through)		°C	−20 ... +70				
Maximum admissible degree of contamination of the hydraulic fluid cleanliness class according to ISO 4406 (c)			Class 18/16/13 [3]				
Limitation of use (Δp) with regard to the transition to fail-safe (values apply to summated edge)	▶ Symbols C3, C5, C	bar	350	350	350	350	160
	▶ Symbols C1, C4	bar	350	350	280	250	100
Leakage flow at 100 bar	▶ Linear characteristic curve "L"	cm³/min	< 180	< 300	–	< 500	< 900
	▶ Inflected characteristic curve "P"	cm³/min	< 150	–	< 180	< 300	< 450

1) Not recommended for applications with mainly low-frequency excitation < 300 Hz

2) Flow for deviating Δp (control edge):

$$\boxed{q_x = q_{Vnom} \cdot \sqrt{\frac{\Delta p_x}{35}}}$$

3) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and simultaneously increases the life cycle of the components.

Technical data
(for applications outside these values, please consult us!)

Hydraulic fluid		Classification	Suitable sealing materials	Standards	Data sheet
Mineral oils		HL, HLP, HLPD, HVLP, HVLPD	NBR, FKM	DIN 51524	90220
Bio-degradable	▶ Insoluble in water	HETG	FKM	ISO 15380	90221
		HEES	FKM		
	▶ Soluble in water	HEPG	FKM	ISO 15380	
Flame-resistant	▶ Water-free	HFDU (glycol base)	FKM	ISO 12922	90222
		HFDU (ester base)	FKM		
		HFDR	FKM		
	▶ Containing water	HFC (Fuchs: Hydrotherm 46M, Renosafe 500; Petrofer: Ultra Safe 620; Houghton: Safe 620; Union: Carbide HP5046)	NBR	ISO 12922	90223

Important information on hydraulic fluids:
- For further information and data on the use of other hydraulic fluids, please refer to the data sheets above or contact us.
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.).
- The ignition temperature of the hydraulic fluid used must be 50 K higher than the maximum surface temperature.
- **Bio-degradable and flame-resistant – containing water:** If components with galvanic zinc coating (e.g. version "J3" or "J5") or parts containing zinc are used, small amounts of dissolved zinc may get into the hydraulic system and cause accelerated aging of the hydraulic fluid. Zinc soap may form as a chemical reaction product, which may clog filters, nozzles and solenoid valves - particularly in connection with local heat input.
- **Flame-resistant – containing water:**
  - Due to increased cavitation tendency with HFC hydraulic fluids, the life cycle of the component may be reduced by up to 30% as compared to the use with mineral oil HLP. In order to reduce the cavitation effect, it is recommended - if possible specific to the installation - to back up the return flow pressure in ports T to approx. 20% of the pressure differential at the component.
  - Dependent on the hydraulic fluid used, the maximum ambient and hydraulic fluid temperature must not exceed 50 °C. In order to reduce the heat input into the component, the command value profile is to be adjusted for proportional and high-response valves.

Static /dynamic		
Hysteresis	%	< 0.1
Range of inversion	%	< 0.05
Response sensitivity	%	< 0.05
Manufacturing tolerance q_{Vmax}	%	< 10
Temperature drift (temperature range 20 °C ... 80 °C)		Zero shift < 0.25% with $\Delta\vartheta$ = 10 K
Pressure drift	%/100 bar	Zero shift < 0.15
Zero compensation		ex plant ±1%

Technical data
(for applications outside these values, please consult us!)

Electrical, integrated electronics (OBE) – Interface "A1" and "F1"		
Relative duty cycle	%	100 (continuous operation)
Protection class according to EN 60529		IP 65 with mounted and locked plug-in connectors
Supply voltage	VDC	24
▶ Terminal A	VDC	min. 19 / max. 36
▶ Terminal B	VDC	0
Maximum admissible residual ripple	Vpp	2.5
Maximum power consumption	VA	40
Fuse protection, external	A_T	2.5 (time-lag)
Input, version "A1"		Differential amplifier, $\boldsymbol{R}_i$ = 100 kΩ
▶ Terminal D ($\boldsymbol{U}_E$)	VDC	0 ... ±10
▶ Terminal E	VDC	0
Input, version "F1"		Load, $\boldsymbol{R}_{sh}$ = 200 Ω
▶ Terminal D ($\boldsymbol{I}_{D-E}$)	mA	4 ... 20
▶ Terminal E ($\boldsymbol{I}_{D-E}$)		Current loop $\boldsymbol{I}_{D-E}$ feedback
Maximum voltage of the differential inputs against 0 V		D → B; E → B (max. 18 V)
Test signal, version "A1"		LVDT
▶ Terminal F ($\boldsymbol{U}_{Test}$)	VDC	0 ... ±10
▶ Terminal C		Reference 0 V
Test signal, version "F1"	mA	LVDT signal 4 ... 20 at external load 200 ... 500 Ω maximum
▶ Terminal F ($\boldsymbol{I}_{F-C}$)	mA	4 ... 20 output
▶ Terminal C ($\boldsymbol{I}_{F-C}$)		Current loop $\boldsymbol{I}_{F-C}$ feedback
Functional ground and screening		see pin assignment on page 9 (CE-compliant installation)
Adjustment		Calibrated in the plant, see valve characteristic curves page 11 ... 19

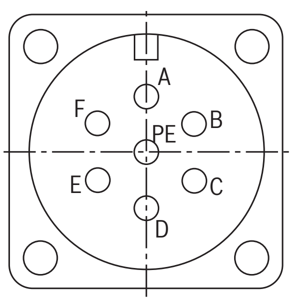
Electrical, integrated electronics (OBE) – Interface "L1"			
Relative duty cycle		%	100 (continuous operation)
Protection class according to EN 60529			IP 65 with mounted and locked plug-in connectors
Supply voltage	▶ Valve amplifier	VDC	24
	– Pin 2	VDC	min. 18 / max. 30
	– Pin 5	VDC	0
	▶ IO-Link interface	VDC	24
	– Pin 1	VDC	min. 18 / max. 30
	– Pin 3	VDC	0
Maximum current consumption	▶ Valve amplifier	A	2
	▶ IO-Link interface	mA	50
Maximum residual ripple		Vpp	1.3
Maximum current consumption		mA	50
Minimum process cycle time		ms	0.6
Bit rate COM3		kBaud (kbit/s)	230.4
Required master port class			Class B
Resolution	▶ A/D transformer	bit	12 (110% valve opening)
	▶ D/A transformer	bit	12 (110% valve opening)
Functional ground			provide via valve block
Adjustment			calibrated in the plant
Directive			IO-Link Interface and System Specification Version 1.1.2

Technical data
(for applications outside these values, please consult us!)

Electrical, integrated control electronics (OBE) – Interface "C6"		
Relative duty cycle	%	100 (continuous operation)
Protection class according to EN 60529		IP 65 with mounted and locked plug-in connectors
Supply voltage	VDC	24
▶ Terminal A	VDC	min. 19 / max. 36
▶ Terminal B	VDC	0
Maximum admissible residual ripple	Vpp	2.5
Maximum power consumption	VA	40
Fuse protection, external	A_T	2.5 (time-lag)
Input		Load, $\boldsymbol{R}_{sh}$ = 200 Ω
▶ Terminal D ($\boldsymbol{I}_{D-E}$)	mA	0 ... ±10
▶ Terminal E ($\boldsymbol{I}_{D-E}$)		Current loop $\boldsymbol{I}_{D-E}$ feedback
Test signal		LVDT signal 4 ... 20 mA on external load 200 ... 500 Ω maximum
▶ Terminal F ($\boldsymbol{I}_{F-C}$)	mA	4 ... 20
▶ Terminal B ($\boldsymbol{I}_{F-C}$)		Current loop $\boldsymbol{I}_{F-C}$ feedback
Functional ground and screening		see page 9 (EMC-compliant installation)
Adjustment		Calibrated in the plant, see valve characteristic curves page 11 ... 19

Electrical connections and assignment

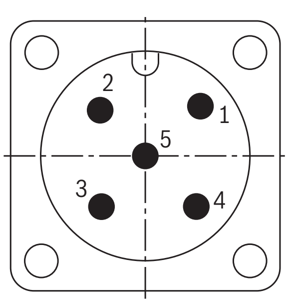
Contact	Interface assignment		
	"A1" (6 + PE)	**"F1"** (6 + PE)	**"C6"** (6 + PE)
A	24 VDC supply voltage		
B	GND		GND, reference potential actual value/enable
C	Reference potential actual value	Reference potential actual value	Reference potential actual value/ command value Enable input 24 VDC (high ≥ 11 V, low ≤ 5 V)
D	Command value ± 10 V (***Re*** > 100 kΩ)	Command value 4 ... 20 mA (***Re*** = 200 Ω)	Command value ± 10 mA (***Re*** = 200 Ω)
E	Reference potential command value	Reference potential command value	Reference potential command value
F	Actual value ± 10 V (***Ri*** ≈ 1 kΩ)	Actual value 4 ... 20 mA (Load max. 500 Ω)	Actual value 4 ... 20 mA (Load max. 500 Ω)
FE	Functional ground (directly connected to the valve housing)		

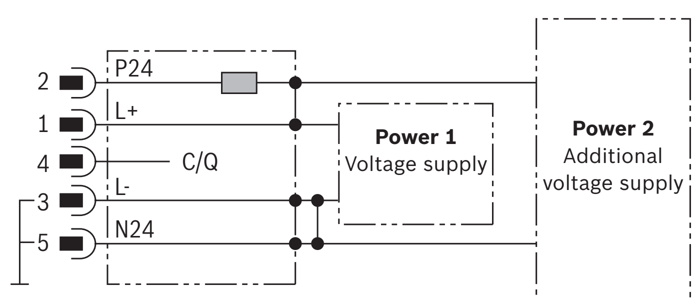


Command value	▶ Positive command value (0 ... 10 V or 12 ... 20 mA) at D and reference potential at E cause flow from P → A and B → T.
	▶ Negative command value (0 ... –10 V or 12 ... 4 mA) at D and reference potential at E cause flow from P → B and A → T.
Connection cable	▶ Up to 20 m cable length type LiYCY 7 x 0.75 mm²
	▶ Up to 40 m cable length type LiYCY 7 x 1.0 mm²
	▶ EMC-compliant installation: – Apply screening to both line ends – Use metal mating connector (see page 21) ▶ Alternatively up to 30 m cable length admissible – Apply screening on supply side – Plastic mating connector (see page 21) can be used

Notice:
Mating connectors, separate order, see page 21 and data sheet 08006.

Connector pin assignment "L1" (M12-5, A-coded, class B)



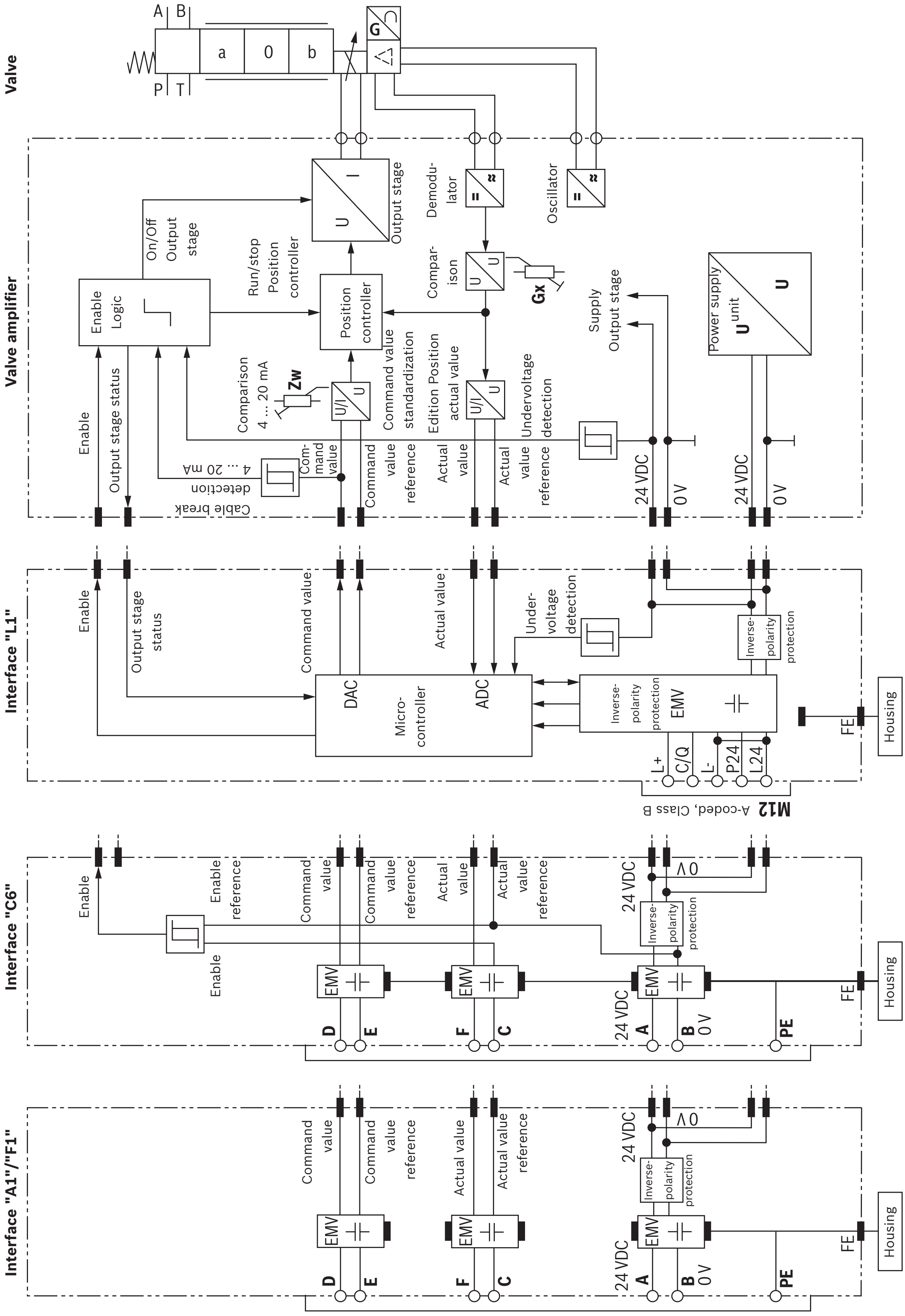


Notice:
- ▶ M12 sensor/actuator connection line, 5-pole; M12 connector/ bush, A-coded, without shield, maximum cable length 20 m. Observe the voltage drop over the cable. Wire cross-section at least 0.34 mm².
- ▶ Mating connectors, separate order, see page 21 and data sheet 08006.
- ▶ Communication and parameter description see data sheet 29400-PA

Pin	Signal	Allocation interface L1
1	L+	Voltage supply IO-Link
2	P24	Voltage supply valve electronics and power part (current consumption 2 A)
3	L-	Reference potential pin 1 [1)]
4	C/Q	Data line IO-Link (SDCI)
5	N24	Reference potential pin 2 [1)]

[1)] Pin 3 and 5 are linked with each other in the valve electronics. The reference potentials L- and N24 of the two supply voltages must also be linked with each other on the power supply unit side.

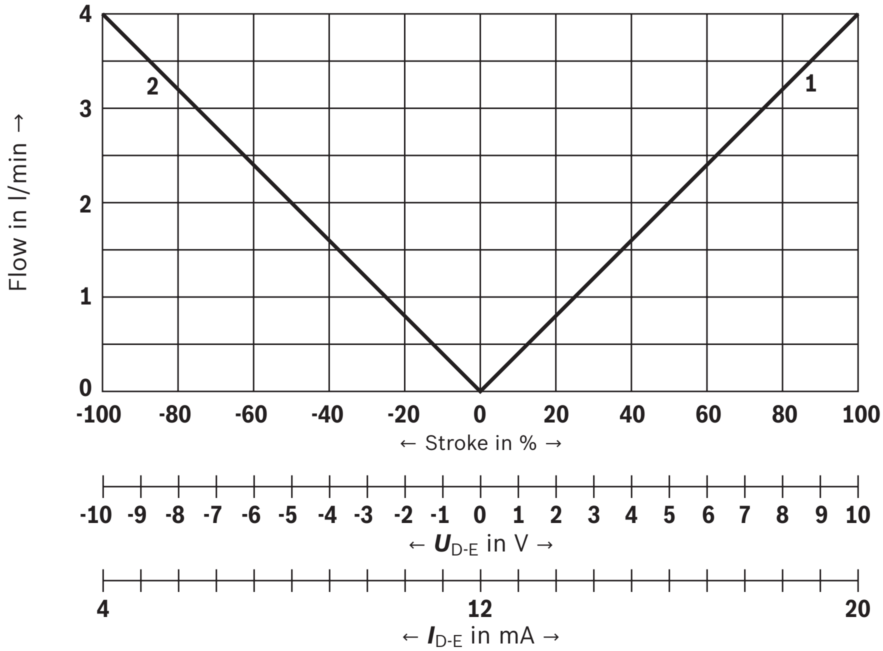
Block diagram/controller function block



Characteristic curves: Flow characteristic "L"
(measured with HLP46, ϑ_{oil} = 40 ±5 °C; Δp = 35 bar/control edge)

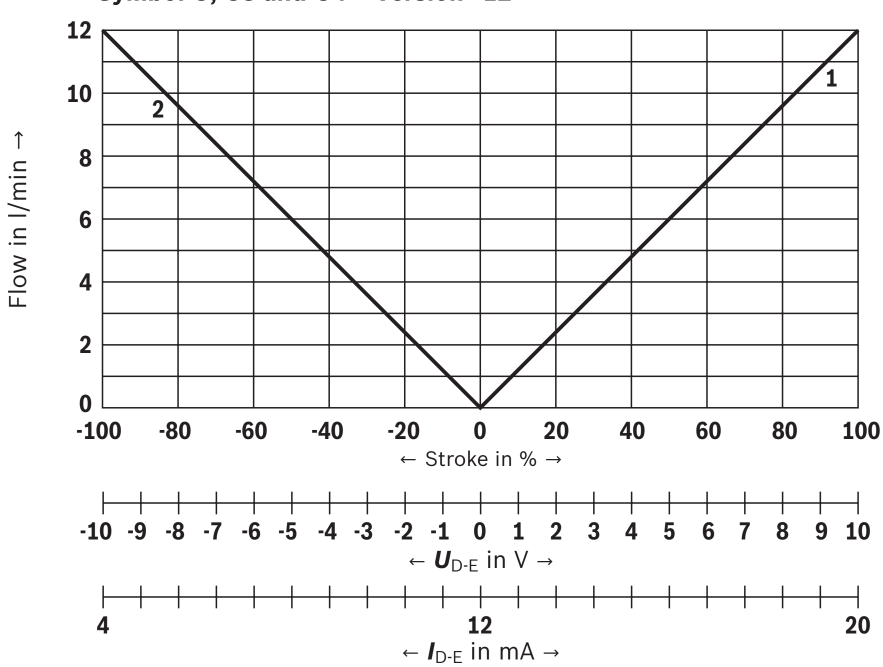
Flow/signal function

Symbol C, C3 and C4 – Version "04"



1 P–A; B–T
2 P–B; A–T

Symbol C, C3 and C4 – Version "12"

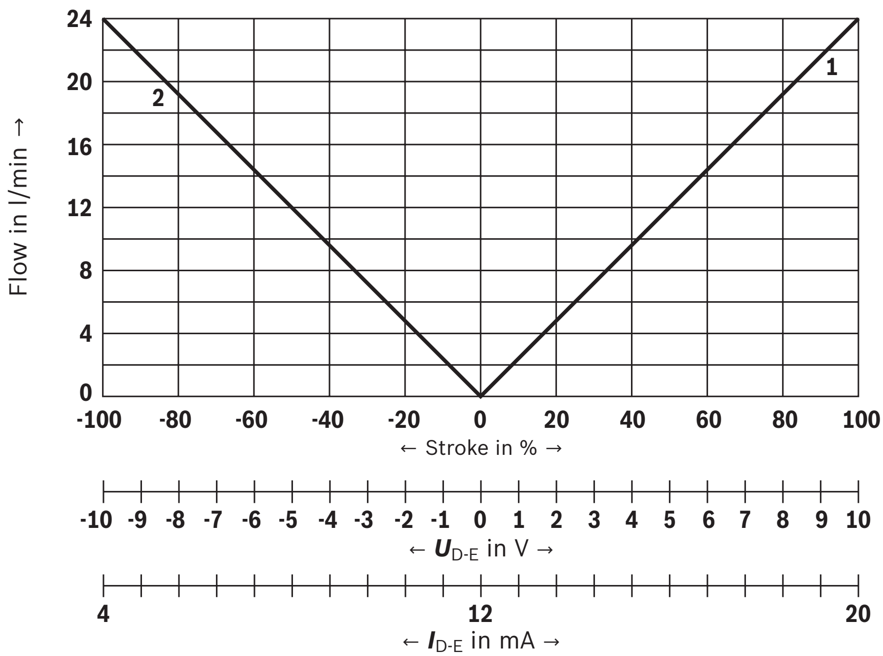


1 P–A; B–T
2 P–B; A–T

Characteristic curves: Flow characteristic "L"
(measured with HLP46, ϑ_{oil} = 40 ±5 °C; Δp = 35 bar/control edge)

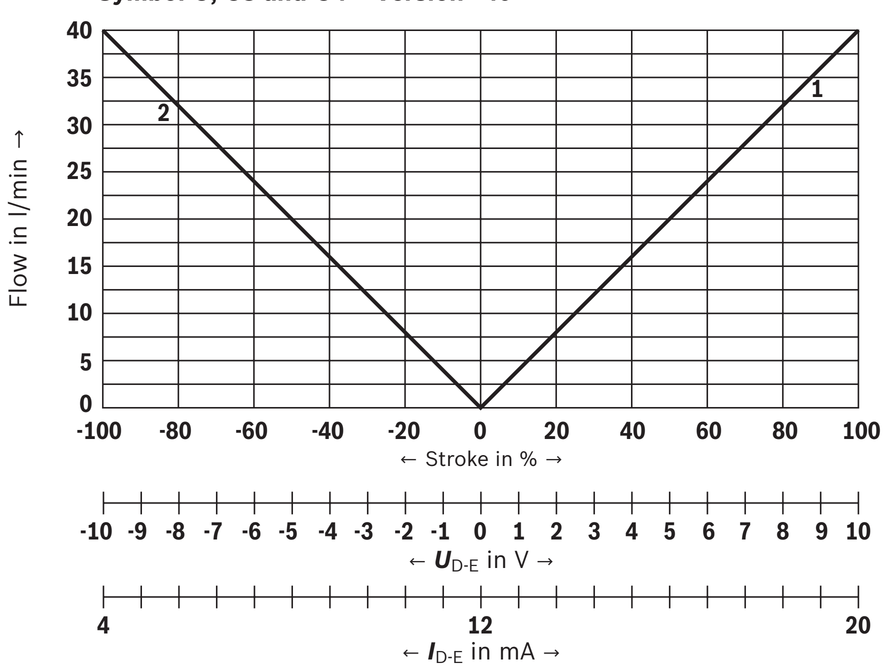
Flow/signal function

Symbol C, C3 and C4 – Version "24"



1 P–A; B–T
2 P–B; A–T

Symbol C, C3 and C4 – Version "40"

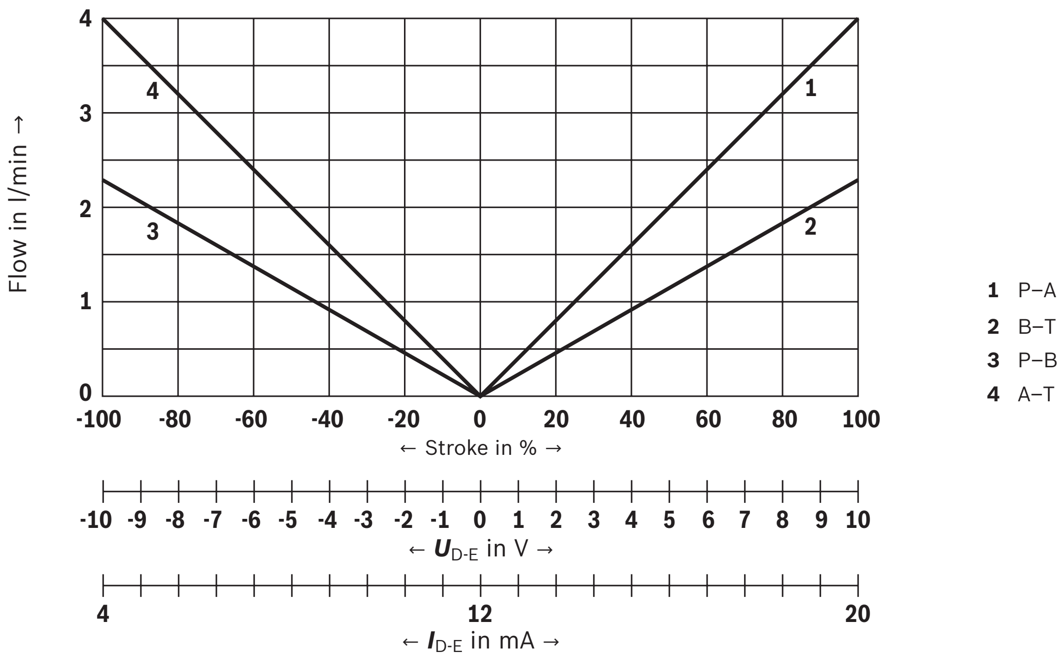


1 P–A; B–T
2 P–B; A–T

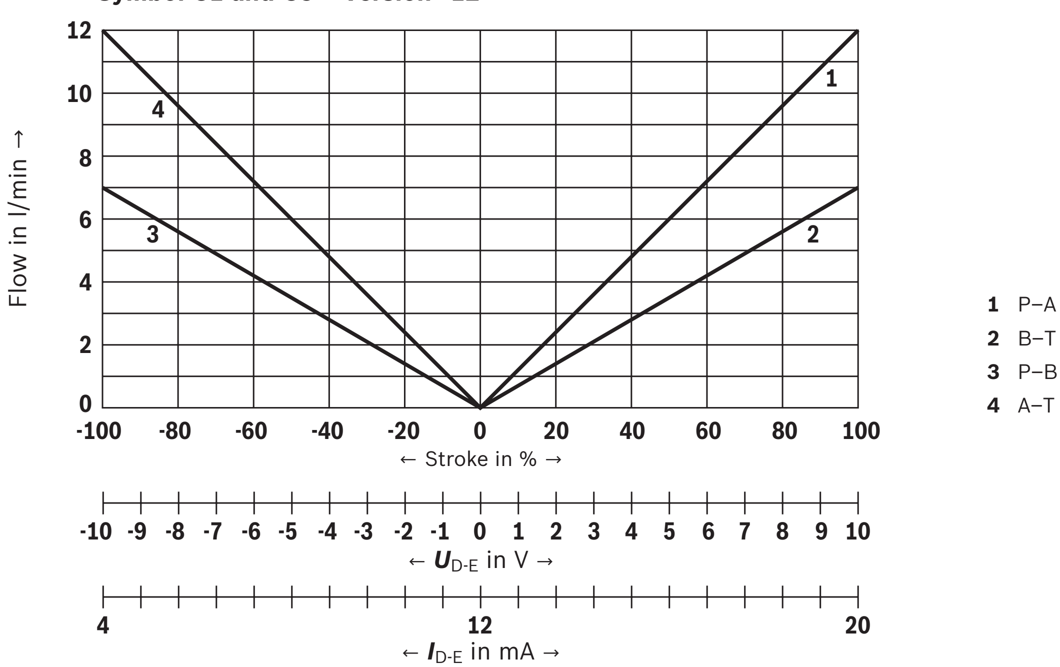
Characteristic curves: Flow characteristic "L"
(measured with HLP46, ϑ_{oil} = 40 ±5 °C; Δp = 35 bar/control edge)

Flow/signal function

Symbol C1 and C5 – Version "04"



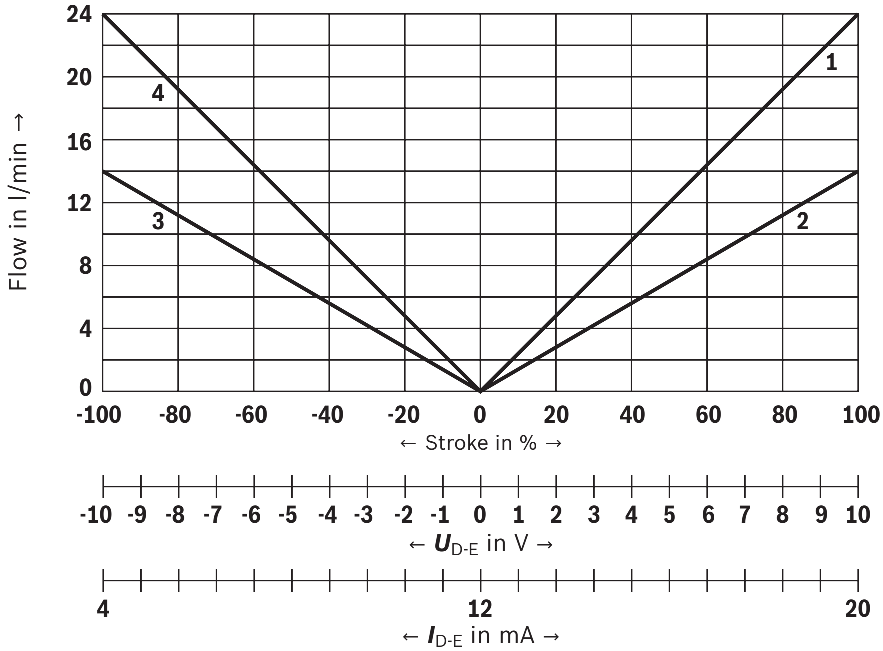
Symbol C1 and C5 – Version "12"



Characteristic curves: Flow characteristic "L"
(measured with HLP46, ϑ_{oil} = 40 ±5 °C; Δp = 35 bar/control edge)

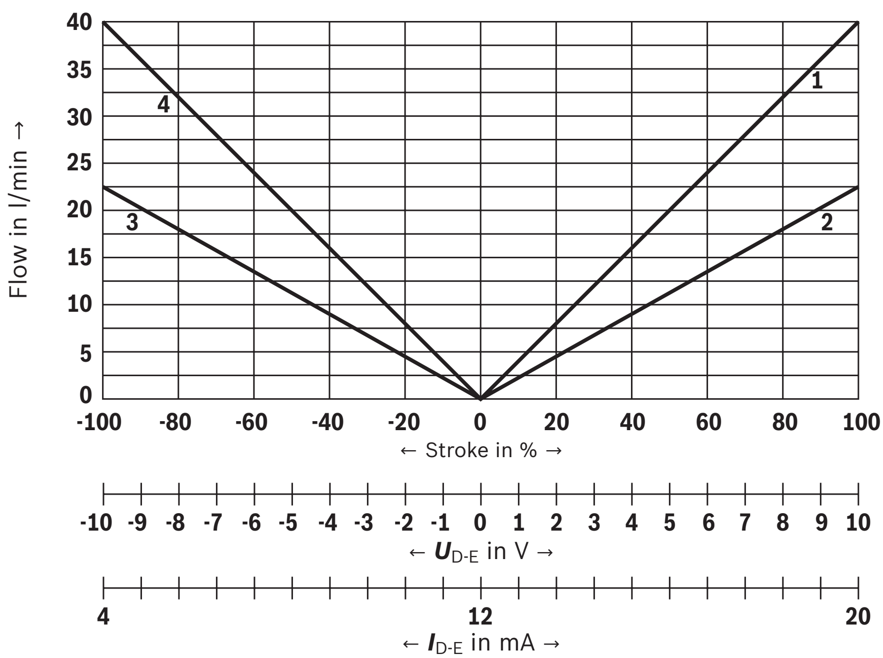
Flow/signal function

Symbol C1 and C5 – Version "24"



1 P–A
2 B–T
3 P–B
4 A–T

Symbol C1 and C5 – Version "40"

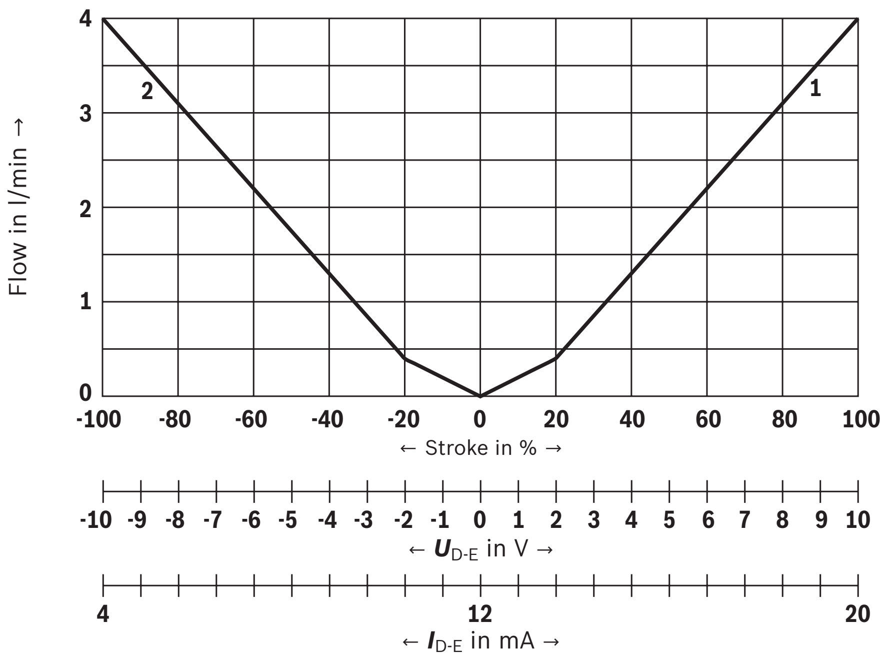


1 P–A
2 B–T
3 P–B
4 A–T

Characteristic curves: Flow characteristic "P"
(measured with HLP46, ϑ_{oil} = 40 ±5 °C; Δp = 35 bar/control edge)

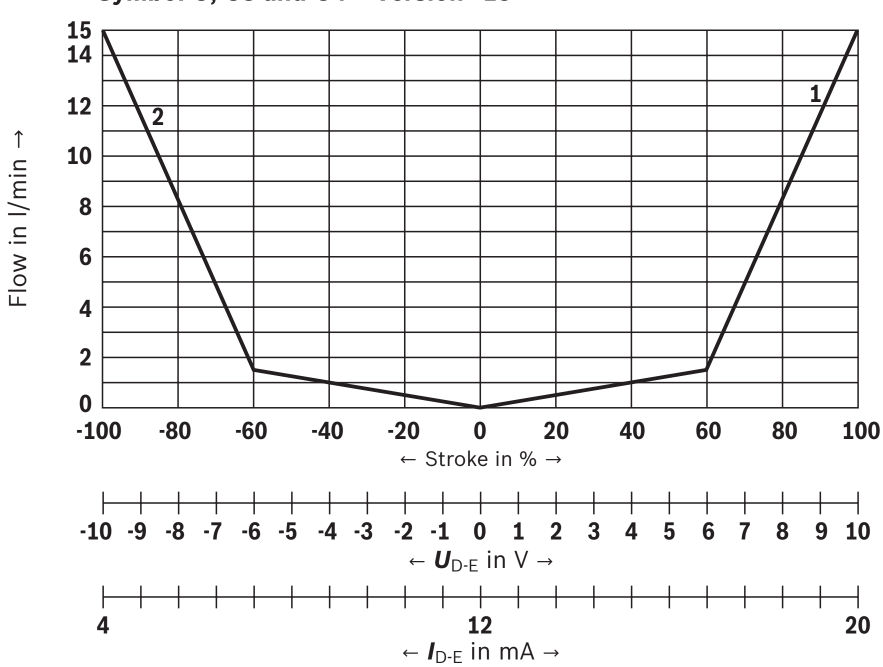
Flow/signal function

Symbol C, C3 and C4 – Version "04"



1 P–A; B–T
2 P–B; A–T

Symbol C, C3 and C4 – Version "15"

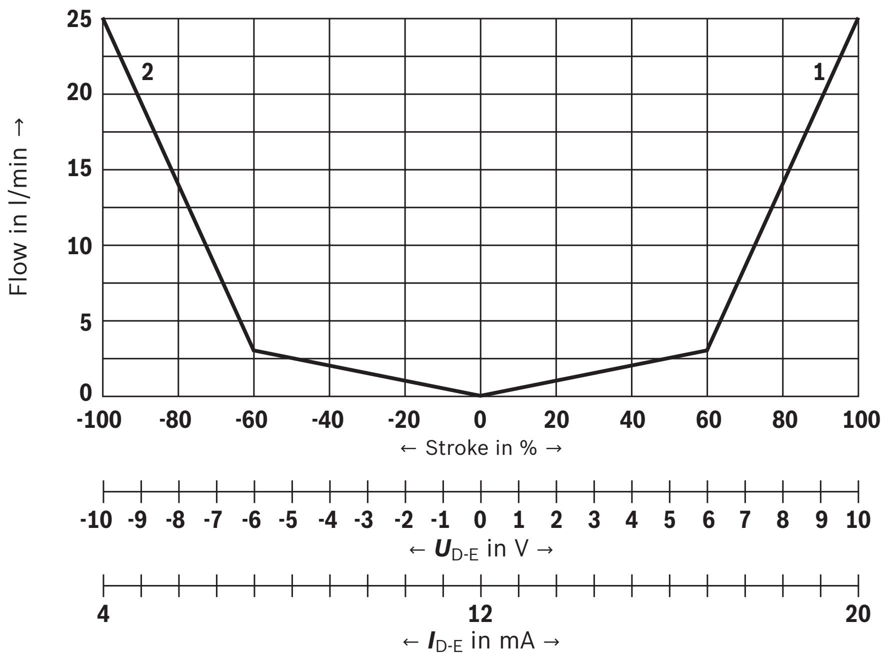


1 P–A; B–T
2 P–B; A–T

Characteristic curves: Flow characteristic "P"
(measured with HLP46, ϑ_{oil} = 40 ±5 °C; Δp = 35 bar/control edge)

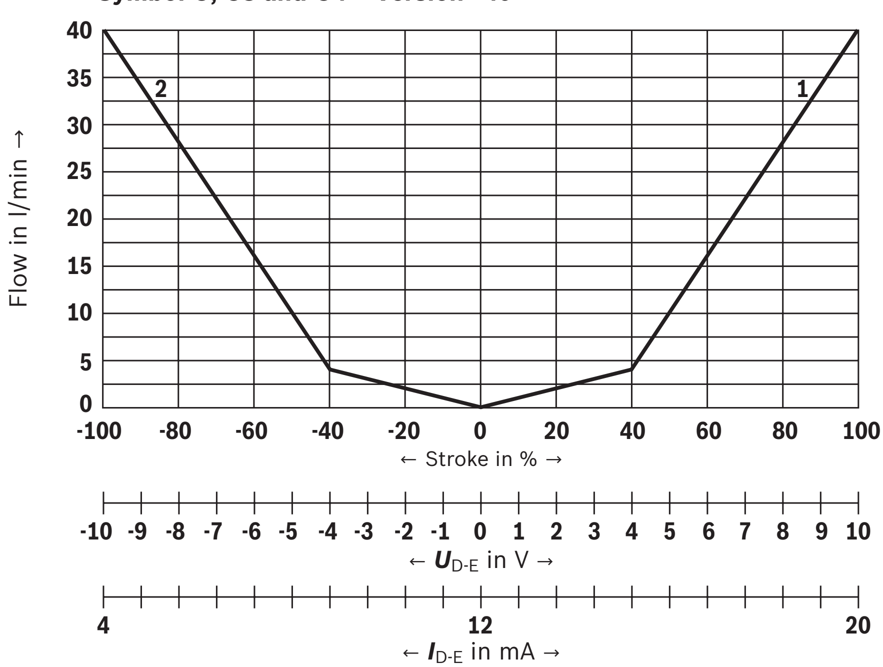
Flow/signal function

Symbol C, C3 and C4 – Version "25"



1 P–A; B–T
2 P–B; A–T

Symbol C, C3 and C4 – Version "40"

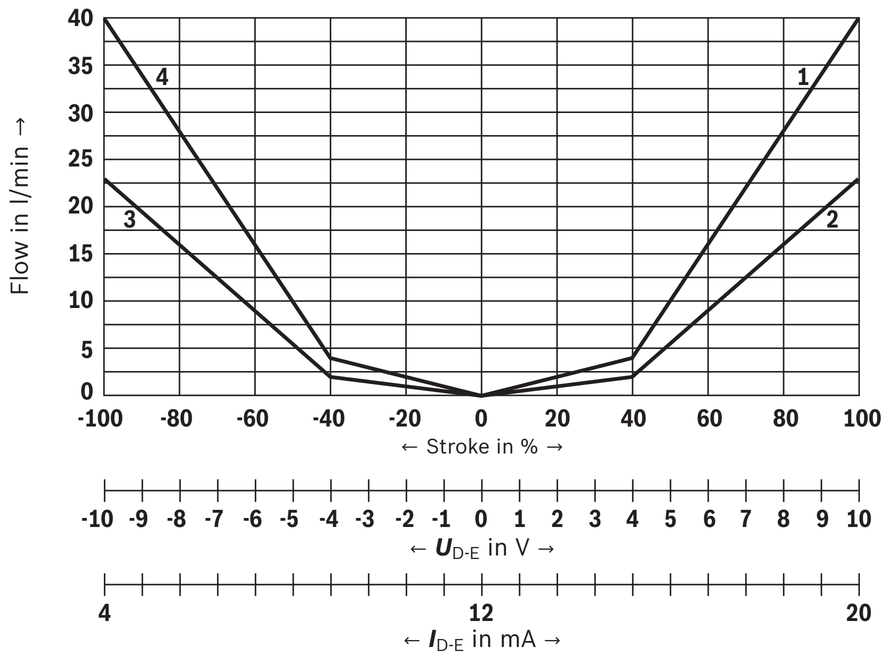


1 P–A; B–T
2 P–B; A–T

Characteristic curves: Flow characteristic "P"
(measured with HLP46, ϑ_{oil} = 40 ±5 °C; Δp = 35 bar/control edge)

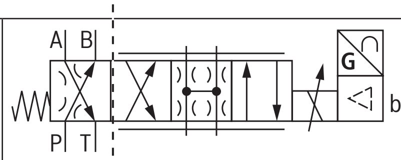
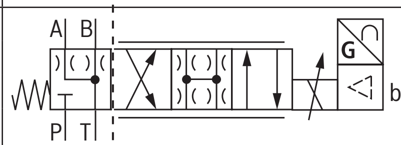
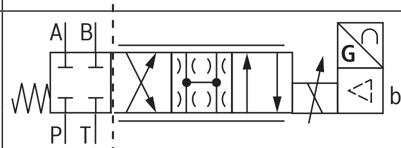
Flow/signal function

Symbol C1 and C5 – Version "40"



1 P–A
2 B–T
3 P–B
4 A–T

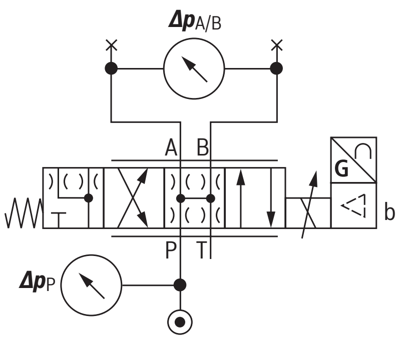
Fail-safe position: Flow/leakage flow

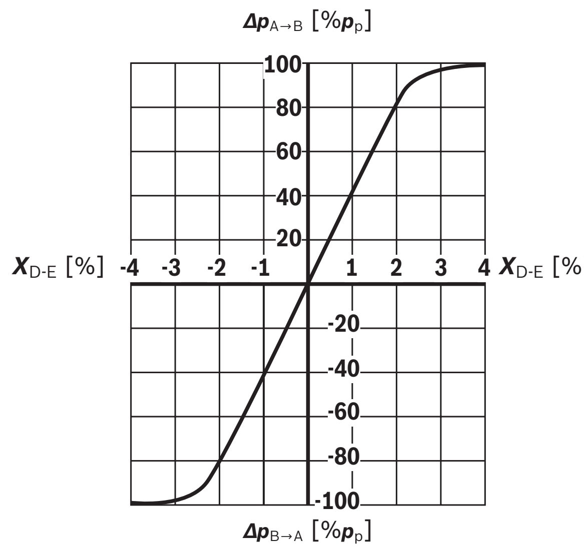
	Fail-safe position	Rated flow at Δp = 35 bar/control edge		l/min	4	12	15	24/25	40
C		Flow at Δp = 35 bar/control edge		l/min	4	10	13	18	20
C3, C5		Leakage flow at 100 bar	P→A	cm^3/min	50				
			P→B	cm^3/min	70				
		Flow at Δp = 35 bar	A→T	l/min	10 ... 20				
			B→T	l/min	7 ... 20				
C4, C1		Leakage flow at 100 bar	P→A	cm^3/min	50				
			P→B	cm^3/min	70				
			A→T	cm^3/min	70				
			B→T	cm^3/min	50				

Fail-safe	p = 0 bar ⇒ 7 ms	Internal shut-off in case of the following errors: ▶ Drop of supply voltage U_B ≤15 V and restarting at U_B ≥17.5 V. ▶ Only at interface "F1": – Falling below the minimum current command value of 2 mA (includes cable break of the command value line (current loop)) ▶ Only at interface "L1": – Enable inactive, communication interruption (watchdog) – In case of internal IO-Link error
	p = 100 bar ⇒ 10 ms	

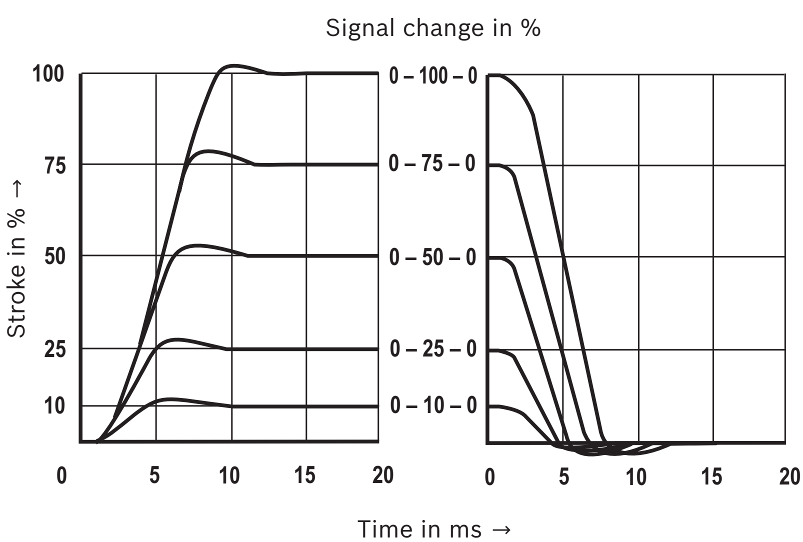
Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Pressure/signal characteristic curve



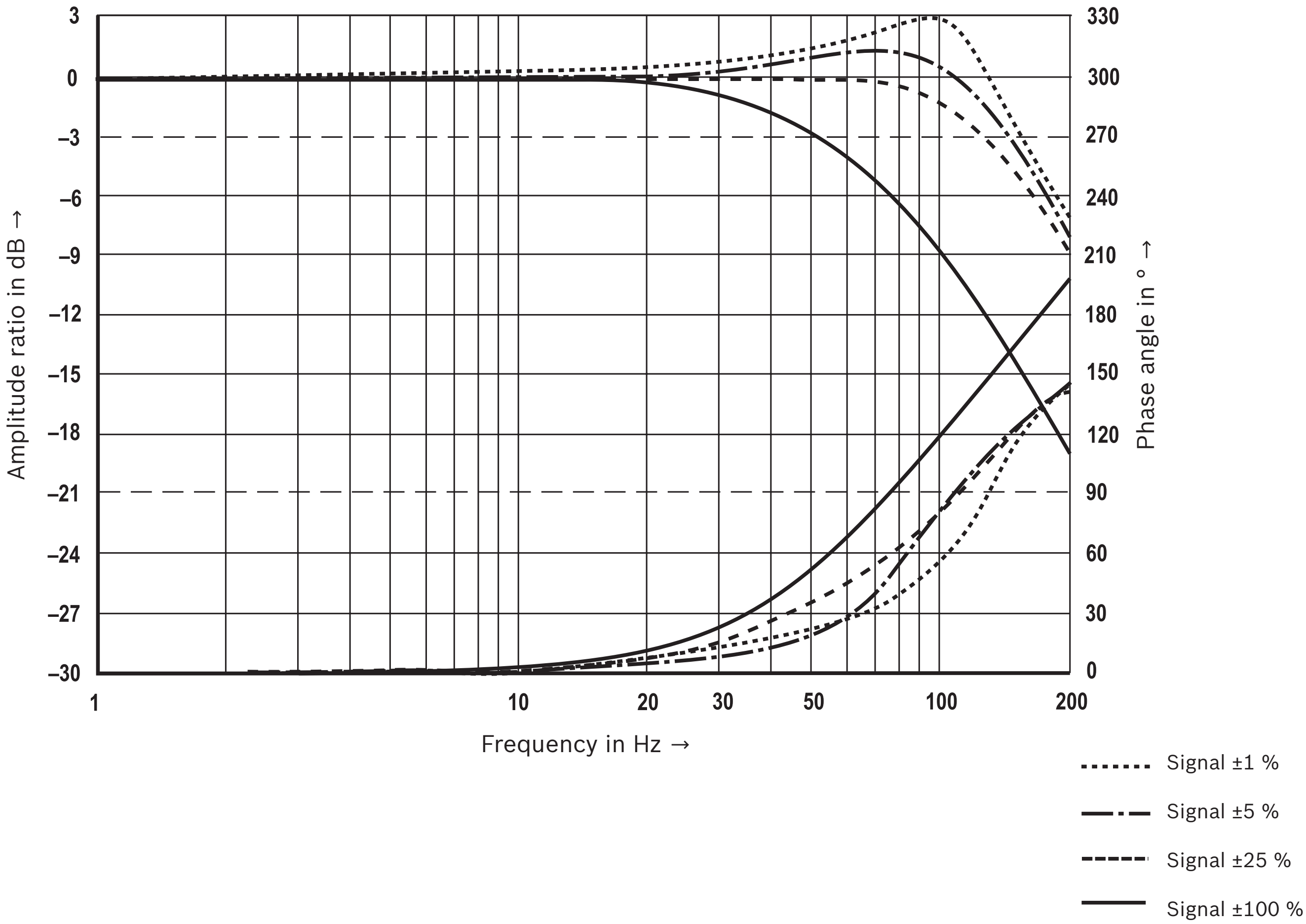


Transition function with stepped electric input signals

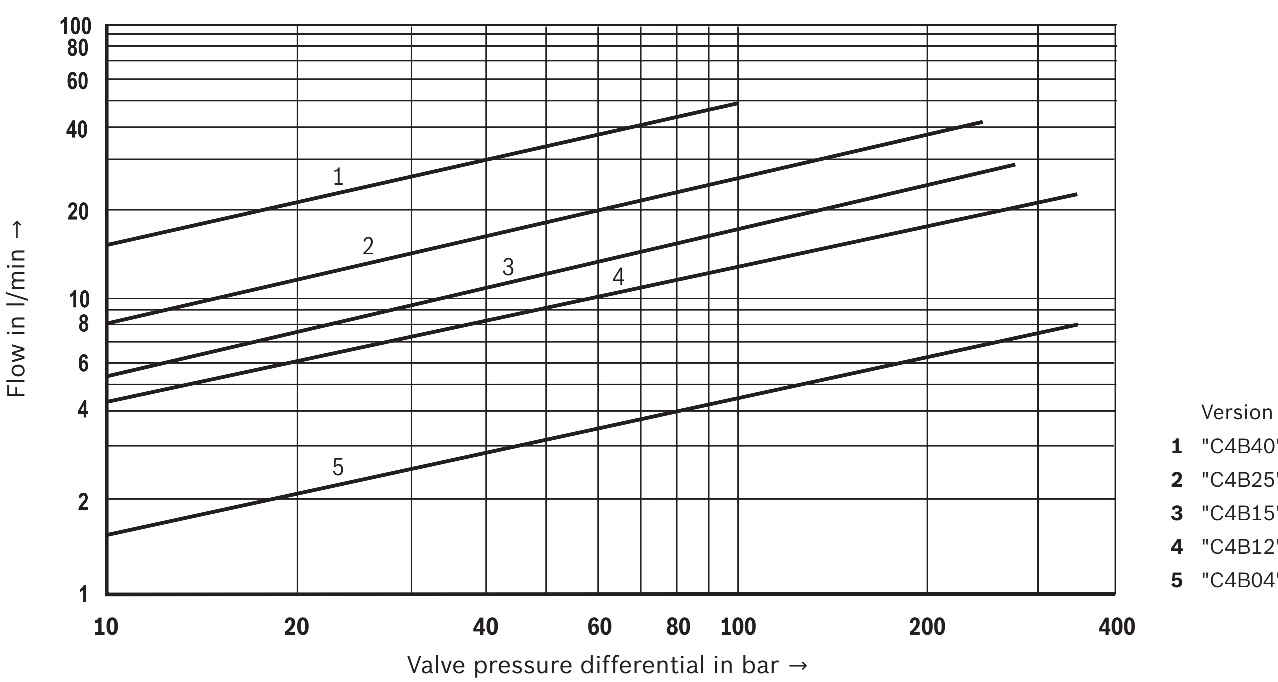


Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

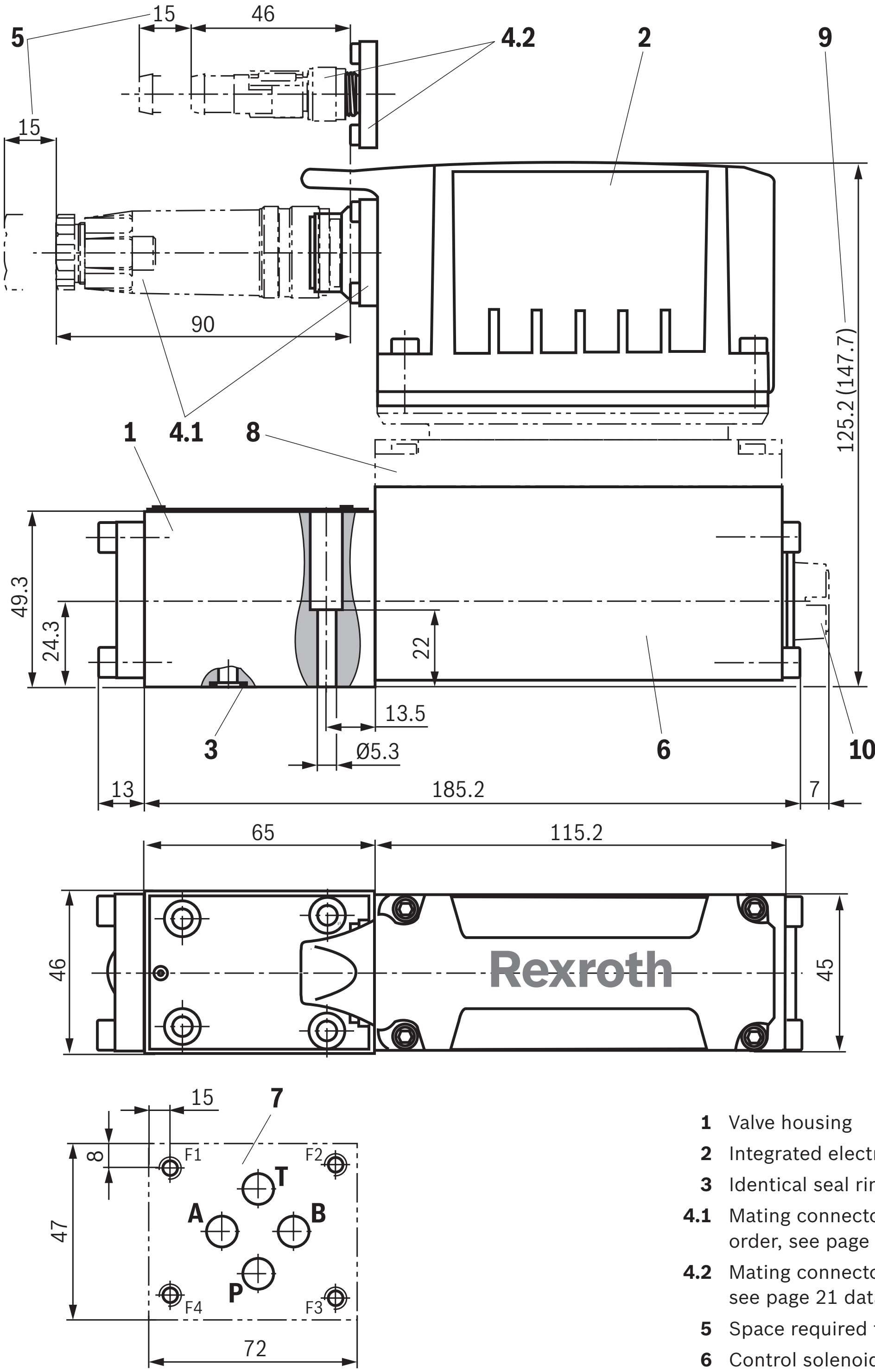
Frequency response characteristic curves

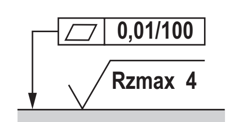


Flow/load function with maximum valve opening



Dimensions
(dimensions in mm)





Required surface quality
of the valve contact surface

- **1** Valve housing
- **2** Integrated electronics
- **3** Identical seal rings for ports P, A, B, T
- **4.1** Mating connectors with version "A1", "F1" and "C6", separate order, see page 21 data sheet 08006
- **4.2** Mating connectors with version "L1", separate order, see page 21 data sheet 08006
- **5** Space required to remove the mating connector
- **6** Control solenoid with position transducer
- **7** Machined valve contact surface, porting pattern according to ISO 4401-03-02-0-05
  Deviating from the standard: Ports P, A, B, T Ø8 mm
  Minimum screw-in depth:
  - Ferrous metal 1.5 x Ø
  - Non-ferrous 2 x Ø
- **8** Damping plate "D"
- **9** Dimension in () for version with damping plate "D"
- **10** Electronics protection membrane "-967"

Notice:
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions

Valve mounting screws (separate order)

4 hexagon socket head cap screws	Material number
ISO 4762 - M5 x 30 - 10.9-CM-Fe-ZnNi-5-Cn-T0-H-B Tightening torque M_A = 7 Nm ±10 %	**R913048086**
or	
ISO 4762 - M5 x 30 - 10.9 Tightening torque M_A = 8.9 Nm ±10 %	Not included in the Rexroth delivery range
or	
ASME B18.3 - 10-24 UNC x 1 1/4“ - ASTM-A574 Tightening torque M_A = 8.0 Nm *[5.9 ft-lbs]* ±10 %	Not included in the Rexroth delivery range

☞ **Notice:**
The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure.

Subplates (separate order) with porting pattern according to ISO 4401-03-02-0-05 see data sheet 45100.

Accessories (separate order)

Valves with integrated electronics

Mating connectors 6-pole + PE	Design	Version	Material number	Data sheet
For the connection of valves with integrated electronics, round connector 6+PE, line cross-section 0.5 ... 1.5 mm²	straight	Metal	**R900223890**	08006
	straight	Plastic	**R900021267**	08006
	angled	Plastic	**R900217845**	–

Cable sets 6-pole + PE	**Length** in m	Material number	Data sheet
For the connection of valves with integrated electronics, round connector 6+PE, straight connector, shielded, potted-in mating connector, line cross-section 0.75 mm²	3.0	**R901420483**	08006
	5.0	**R901420491**	08006
	10.0	**R901420496**	08006
	20.0	**R901448068**	–

Test and service devices

	Material number	Data sheet
Service case with test device for proportional servo valves with integrated electronics (OBE)	**R901049737**	29685

IO-Link gateways

Designation	Description	Material number
S67E-PN-IOL8-DI4-M12-6P	IndraControl S67E PROFINET device in the plastic housing 8 IO-Link ports (4 x class A and 4 x class B), 4 digital inputs, 24 VDC, M12 quick connection technology	**R911174436**
S67E-S3-IOL8-DI4-M12-6P	IndraControl S67E Sercos device in the plastic housing 8 IO-Link ports (4 x class A and 4 x class B), 4 digital inputs, 24 VDC, M12 quick connection technology	**R911174437**

Further information

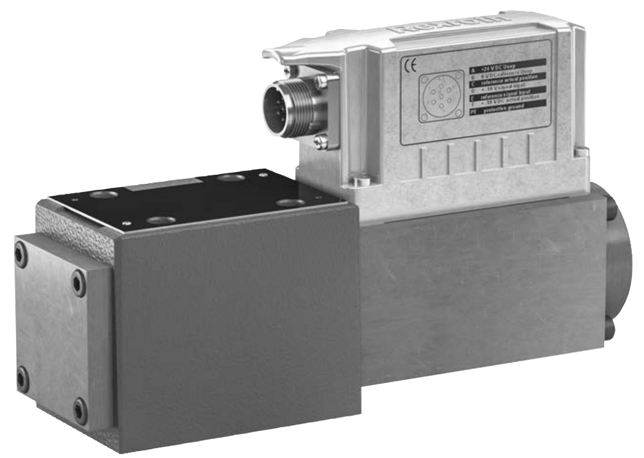
▶ Hydraulic valves for industrial applications	Data sheet 07600-B
▶ Subplates	Data sheet 45100
▶ Hydraulic fluids on mineral oil basis	Data sheet 90220
▶ Environmentally compatible hydraulic fluids	Data sheet 90221
▶ Flame-resistant, water-free hydraulic fluids	Data sheet 90222
▶ Flame-resistant hydraulic fluids - containing water (HFAE, HFAS, HFB, HFC)	Data sheet 90223
▶ Reliability characteristics according to EN ISO 13849	Data sheet 08012
▶ Hexagon socket head cap screw, metric/UNC	Data sheet 08936
▶ Installation, commissioning and maintenance of servo valves and high-response valves	Data sheet 07700
▶ Assembly, commissioning and maintenance of hydraulic systems	Data sheet 07900
▶ Directional control valves, direct operated, with electrical position feedback and IO-Link interface	Data sheet 29400-PA
▶ Selection of filters	
▶ Information on available spare parts	

RE 29038
Edition: 2019-12
Replaces: 2019-09

rexroth
A Bosch Company

Directional control valves, direct operated with electrical position feedback and integrated electronics (OBE)

Type 4WRPEH



H8160

- Size 10
- Component series 3X
- Maximum operating pressure 350 bar
- Rated flow 50 ... 100 ml/min
- Digital interface, IO link for I4.0

CE

IO-Link

Features

- Reliable - proven and robust design
- Safe - fail-safe position of the control spool in switched-off condition
- Energy-efficient - no pilot oil demand
- High quality - control spool and sleeve in servo quality
- Flexible - suitable for position, velocity and pressure control
- Precise - high response sensitivity and little hysteresis
- IO-Link interface, optional

Contents

Ordering code

01	02	03	04	05	06	07	08	09		10		11		12	13	14	15	16
4	**WRP**	**E**	**H**	**10**		**B**			**–**	**3X**	**/**		**/**		**24**			*****

01	4 main ports	**4**
02	Directional control valve, direct operated	**WRP**
03	With integrated electronics	**E**
04	Control spool/sleeve	**H**
05	Size 10	**10**

06	Symbols e.g. C, C1, C5 etc.; for possible design, see page 3	
07	Installation side of the inductive position transducer	**B**

Rated flow (*Δp* = 35 bar/control edge)

08	50 l/min	**50**
	100 l/min	**100**

Flow characteristic

09	Linear	**L**
	Inflected characteristic curve, linear	**P**
10	Component series 30 ... 39 (30 ... 39: unchanged installation and connection dimensions)	**3X**

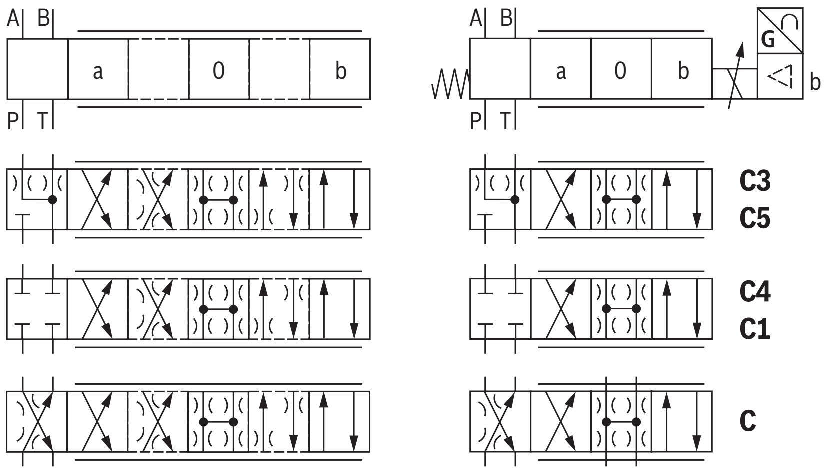
Seal material(observe compatibility of seals with hydraulic fluid used, see page 6)

11	NBR seals	**M**
	FKM seals	**V**
12	**Without** damping plate	**no code**
	With damping plate	**D**
13	Supply voltage of the integrated electronics 24 VDC	**24**

Interfaces of the control electronics

14	Command value input ±10 V	**A1**
	Command value input 4 ... 20 mA	**F1**
	IO-Link interface	**L1**
	Command value ±10 mA, actual value 4 ... 20 mA, release (connector 6+PE)	**C6**
15	**Without** electronics protection membrane	**no code**
	With electronics protection membrane	**-967**
16	Further details in the plain text	

Symbols

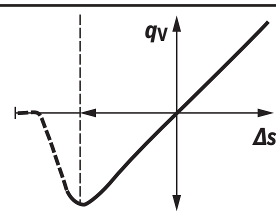
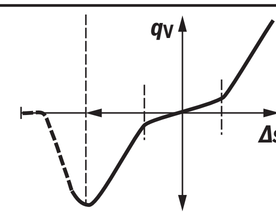
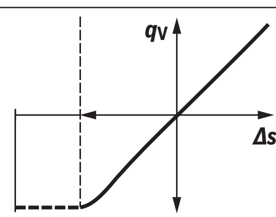
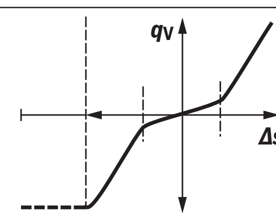


With symbols C5 and C1:

P → A: $q_{V\ nom}$ B → T: $q_{V\ nom}/2$
P → B: $q_{V\ nom}/2$ A → T: $q_{V\ nom}$

Notice:
Representation according to DIN ISO 1219-1.
Hydraulic interim positions are shown by dashes.

Flow characteristic

Symbol	**Linear characteristic curve** (model "L")	**Inflected characteristic curve** (version "P") Inflection 40%
C3, C5 C4, C1		
C		

Function, section

Valves of type 4WRPEH are direct operated directional control valves with electrical position feedback and integrated electronics (OBE).

Set-up

The 4WRPEH high-response valve mainly consists of:

- Valve housing with control spool and sleeve in servo quality (1)
- Control solenoid with position transducer (2) (optionally with electronics protection membrane (6))
- On-board electronics (OBE) (3) with analog or IO-Link interface (4) (optionally with damping plate (5))

Function

The integrated electronics (OBE) compares the specified command value to the position actual value. In case of control deviations, the stroke solenoid will be activated. Due to the changed solenoid force, the control spool is adjusted against the spring. Stroke/control spool cross-section is controlled proportionally to the command value. In case of a command value presetting of 0, the electronics adjusts the control spool against the spring to central position. In deactivated condition, the spring is untensioned to a maximum and the valve is in fail-safe position.

Control solenoid shut-off

In case of the following errors, the control solenoids are de-energized by the integrated electronics (OBE) and the control spool is set to fail-safe position:

- Falling below the minimum supply voltage
- Only at interface "F1":
  - Falling below the minimum current command value of 2 mA (includes cable break of the command value line (current loop))
- Only at interface "L1":
  - Enable inactive, communication interruption (watchdog)
  - In case of internal IO-Link error
- Only at interface "C6":
  - Additionally, release inactive

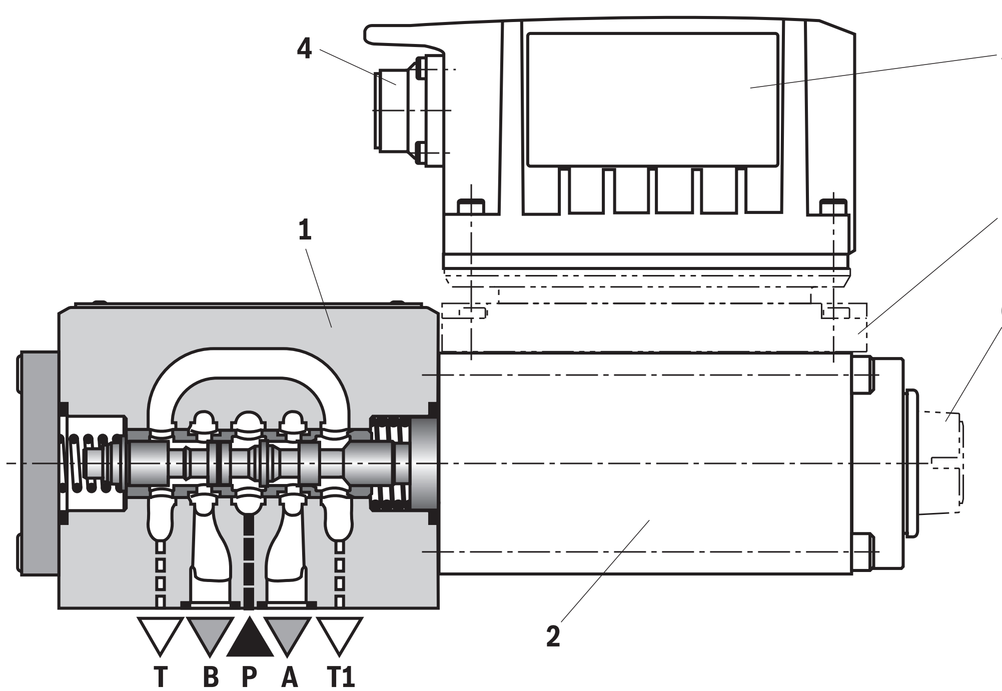
Damping plate "D"

The damping plate (5) reduces the acceleration amplitudes on the on-board electronics (frequencies >300 Hz).

Notice:
Using the damping plate is not recommended for applications with mainly low-frequency excitation <300 Hz.

Electronics protection membrane "-967"

- To prevent condensate formation in the housing of the integrated electronics (OBE), an electronics protection membrane (6) can be used. Recommended for use outside industry-standard conditions with high ambient air humidity and significant cyclic temperature changes (e.g. outdoors).



Type 4WRPEH 10 CB..-3X...

Technical data

(For applications outside these values, please consult us!)

General		
Type of connection		Subplate mounting, porting pattern according to ISO 4401-05-04-0-05
Installation position		Any
Ambient temperature range	°C	–20 ... +60
Transport temperature	°C	-30 ... +80
Maximum storage time	years	1 (if the storage conditions are observed; refer to the operating instructions 07600-B)
Sine test according to DIN EN 60068-2-6		10 ... 2000 Hz / maximum of 10 g / 10 cycles / 3 axes
Noise test according to DIN EN 60068-2-64		20 ... 2000 Hz / 10 g_{RMS} / 30 g peak / 30 min. / 3 axes
Transport shock according to DIN EN 60068-2-27		15 g / 11 ms / 3 shocks / 3 axes
Shock according to DIN EN 60068-2-27		35 g / 6 ms / 1000 shocks / 3 axes
Weight	kg	7.1
Maximum relative humidity (no condensation)	%	95
Maximum solenoid surface temperature	°C	150
$MTTF_d$ value according to EN ISO 13849	years	150 (for further details see data sheet 08012)
Conformity		▶ CE according to EMC directive 2014/30/EU, tested according to EN 61000-6-2 and EN 61000-6-3 ▶ RoHS directive 2011/65/EU ▶ REACH ordinance (EC) no. 1907/2006

<table>
<tr><th colspan="7">Hydraulic</th></tr>
<tr><td rowspan="2">Maximum operating pressure</td><td>▶ Ports A, B, P</td><td>bar</td><td colspan="4">350</td></tr>
<tr><td>▶ Port T</td><td>bar</td><td colspan="4">250</td></tr>
<tr><td colspan="2">Rated flow at Δp = 35 bar/control edge [1]</td><td>l/min</td><td colspan="2">50</td><td colspan="2">100</td></tr>
<tr><td colspan="3">Hydraulic fluid</td><td colspan="4">See table page 6</td></tr>
<tr><td rowspan="2">Viscosity range</td><td>▶ Recommended</td><td>mm²/s</td><td colspan="4">20 ... 100</td></tr>
<tr><td>▶ Maximum</td><td>mm²/s</td><td colspan="4">10 ... 800</td></tr>
<tr><td colspan="2">Hydraulic fluid temperature range (flown-through)</td><td>°C</td><td colspan="4">-20 ... +70</td></tr>
<tr><td colspan="3">Maximum admissible degree of contamination of the hydraulic fluid; cleanliness class according to ISO 4406 (c)</td><td colspan="4">Class 18/16/13 [2]</td></tr>
<tr><td rowspan="2">Limitation of use (Δp) with regard to the transition to failsafe (values apply to summated edge)</td><td>▶ Symbols C3, C5, C</td><td>bar</td><td colspan="2">350</td><td colspan="2">140</td></tr>
<tr><td>▶ Symbols C1, C4</td><td>bar</td><td colspan="2">250</td><td colspan="2">100</td></tr>
<tr><td rowspan="2">Leakage flow at 100 bar</td><td>▶ Linear characteristic curve "L"</td><td>cm³/min</td><td colspan="2">< 1200</td><td>< 1500 (1:1)</td><td>< 1000 (2:1)</td></tr>
<tr><td>▶ Inflected characteristic curve "P"</td><td>cm³/min</td><td>< 600 (1:1)</td><td>< 500 (2:1)</td><td colspan="2">< 600</td></tr>
</table>

[1] Flow for deviating Δp (control edge):

$$\boxed{q_x = q_{Vnom} \cdot \sqrt{\frac{\Delta p_x}{35}}}$$

[2] The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and simultaneously increases the life cycle of the components.

Technical data
(For applications outside these values, please consult us!)

Hydraulic fluid		Classification	Suitable sealing materials	Standards	Data sheet
Mineral oils		HL, HLP, HLPD, HVLP, HVLPD	NBR, FKM	DIN 51524	90220
Bio-degradable	▶ Insoluble in water	HETG	FKM	ISO 15380	90221
		HEES	FKM		
	▶ Soluble in water	HEPG	FKM	ISO 15380	
Flame-resistant	▶ Water-free	HFDU (glycol base)	FKM	ISO 12922	90222
		HFDU (ester base)	FKM		
		HFDR	FKM		
	▶ Containing water	HFC (Fuchs: Hydrotherm 46M, Renosafe 500; Petrofer: Ultra Safe 620; Houghton: Safe 620; Union: Carbide HP5046)	NBR	ISO 12922	90223

Important information on hydraulic fluids:
- For further information and data on the use of other hydraulic fluids, please refer to the data sheets above or contact us.
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.).
- The ignition temperature of the hydraulic fluid used must be 50 K higher than the maximum surface temperature.
- **Bio-degradable and flame-resistant – containing water:** If components with galvanic zinc coating (e.g. version "J3" or "J5") or parts containing zinc are used, small amounts of dissolved zinc may get into the hydraulic system and cause accelerated aging of the hydraulic fluid. Zinc soap may form as a chemical reaction product, which may clog filters, nozzles and solenoid valves – particularly in connection with local heat input.
- **Flame-resistant – containing water**:
  - Due to increased cavitation tendency with HFC hydraulic fluids, the life cycle of the component may be reduced by up to 30% as compared to the use with mineral oil HLP. In order to reduce the cavitation effect, it is recommended – if possible specific to the installation – to back up the return flow pressure in ports T to approx. 20% of the pressure differential at the component.
  - Dependent on the hydraulic fluid used, the maximum ambient and hydraulic fluid temperature must not exceed 50 °C. In order to reduce the heat input into the component, the command value profile is to be adjusted for proportional and high-response valves.

Static/dynamic		
Hysteresis	%	≤ 0.2
Manufacturing tolerance q_{Vmax}	%	< 10
Temperature drift (temperature range 20 °C ... 80 °C)		Zero shift < 1% with $\Delta\vartheta$ = 40°C
Command value step	ms	see characteristic curves page 15
Zero compensation		ex plant ±1%

Technical data
(For applications outside these values, please consult us!)

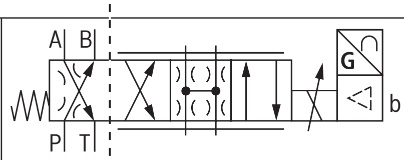
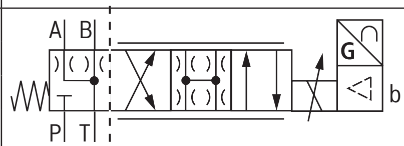
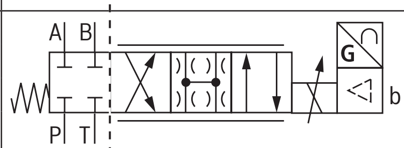
electrical, integrated electronics (OBE) – Interface "A1" and "F1"			
Relative duty cycle		%	100 (continuous operation)
Protection class according to EN 60529			IP65(If suitable and correctly mounted mating connectors are used)
Supply voltage		VDC	24
	▶ Terminal A	VDC	min. 19 / max. 36
	▶ Terminal B	VDC	0
Maximum admissible residual ripple		Vpp	2.5
Maximum power consumption		VA	60
Fuse protection, external		A_T	3.15 (time-lag)
Input, version "A1"			Differential amplifier, $\boldsymbol{R}_i$ = 100 kΩ
	▶ Terminal D ($\boldsymbol{U}_E$)	VDC	0 ... ±10
	▶ Terminal E	VDC	0
Input, version "F1"			Load, $\boldsymbol{R}_{sh}$ = 200 Ω
	▶ Terminal D ($\boldsymbol{I}_{D-E}$)	mA	4 ... 20
	▶ Terminal E ($\boldsymbol{I}_{D-E}$)		Current loop $\boldsymbol{I}_{D-E}$ feedback
Maximum voltage of the differential inputs against 0 V			D → B; E → B (max. 18 V)
Test signal, version "A1"			LVDT
	▶ Terminal F ($\boldsymbol{U}_{Test}$)	VDC	0 ... ±10
	▶ Terminal C		Reference 0 V
Test signal, version "F1"		mA	LVDT signal 4 ... 20 at external load 200 ... 500 Ω maximum
	▶ Terminal F ($\boldsymbol{I}_{F-C}$)	mA	4 ... 20 output
	▶ Terminal C ($\boldsymbol{I}_{F-C}$)		Current loop $\boldsymbol{I}_{F-C}$ feedback
Functional ground and screening			see pin assignment on page 10 (CE-compliant installation)
Adjustment			Calibrated in the plant, see valve characteristic curves page 11 ... 16

electrical, integrated electronics (OBE) – Interface "L1"				
Relative duty cycle			%	100 (continuous operation)
Protection class according to EN 60529				IP65(If suitable and correctly mounted mating connectors are used)
Supply voltage	▶ Valve amplifier		VDC	24
		– Pin 2	VDC	min. 18 / max. 30
		– Pin 5	VDC	0
	▶ IO-Link interface		VDC	24
		– Pin 1	VDC	min. 18 / max. 30
		– Pin 3	VDC	0
Maximum current consumption	▶ Valve amplifier		A	3
	▶ IO-Link interface		mA	50
Maximum residual ripple			Vpp	1.3
Maximum current consumption			mA	50
Minimum process cycle time			ms	0.6
Bit rate COM3			kBaud (kbit/s)	230.4
Required master port class				Class B
Resolution	▶ A/D transformer		bit	12 (110% valve opening)
	▶ D/A transformer		bit	12 (110% valve opening)
Functional ground				Provide via valve block
Adjustment				Calibrated in the plant
Directive				IO-Link Interface and System Specification Version 1.1.2, July 2013

Technical data
(For applications outside these values, please consult us!)

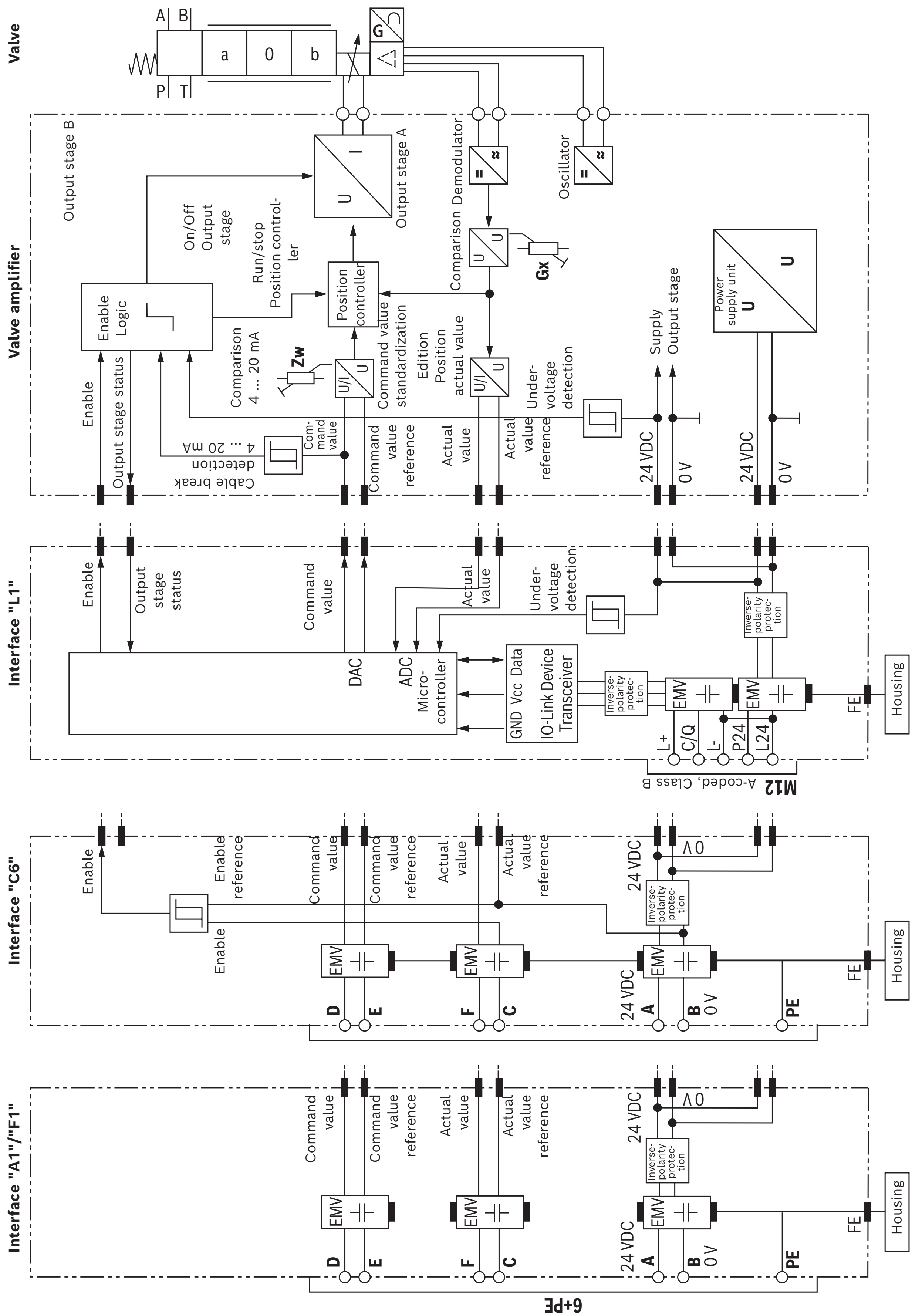
Electrical, integrated control electronics (OBE) – Interface "C6"		
Relative duty cycle	%	100 (continuous operation)
Protection class according to EN 60529		IP65(If suitable and correctly mounted mating connectors are used)
Supply voltage	VDC	24
▶ Terminal A	VDC	min. 19 / max. 36
▶ Terminal B	VDC	0
Maximum admissible residual ripple	Vpp	2.5
Maximum power consumption	VA	60
Fuse protection, external	A_T	3.15 (time-lag)
Input		Load, R_{sh} = 200 Ω
▶ Terminal D (I_{D-E})	mA	0 ... ±10
▶ Terminal E (I_{D-E})		Current loop I_{D-E} feedback
Test signal		LVDT signal 4 ... 20 mA on external load 200 ... 500 Ω maximum
▶ Terminal F (I_{F-C})	mA	4 ... 20
▶ Terminal B (I_{F-C})		Current loop I_{F-C} feedback
Functional ground and screening		See page 10 (EMC-compliant installation)
Adjustment		Calibrated in the plant, see characteristic curves page 11 ... 16

Fail-safe position: Flow/leakage flow

	Fail-safe position	Rated flow at Δp = 35 bar/control edge		l/min	50	100
C		Flow at Δp = 35 bar/control edge		l/min	50	100
C3, C5		Leakage flow at 100 bar	P→A	cm³/min	50	
			P→B	cm³/min	70	
		Flow at Δp = 35 bar	A→T	l/min	10 ... 100	
			B→T	l/min	10 ... 25	
C4, C1		Leakage flow at 100 bar	P→A	cm³/min	50	
			P→B	cm³/min	70	
			A→T	cm³/min	70	
			B→T	cm³/min	50	

Fail-safe	p = 0 bar ⇒ 13 ms	Internal shut-off in case of the following errors: ▶ Drop of supply voltage U_B ≤15 V and restarting at U_B ≥17.5 V. ▶ Only at interface "F1": – Falling below the minimum current command value of 2 mA (includes cable break of the command value line (current loop)) ▶ Only at interface "L1": – Enable inactive, communication interruption (watchdog) – In case of internal IO-Link error
	p = 100 bar ⇒ 17 ms	

Block diagram/controller function block



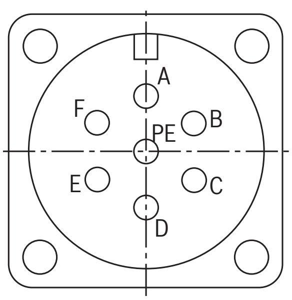
Notice:

▶ Electrical signals provided via control electronics (e.g. actual value) must not be used for switching off safety-relevant machine functions.

▶ The setting of the potentiometer at the factory must not be changed.

Electrical connections and assignment

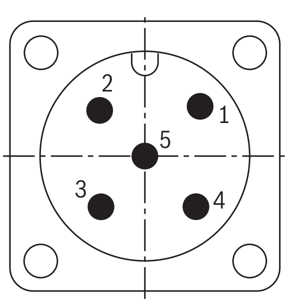
Contact	Interface assignment		
	"A1" (6 + PE)	**"F1"** (6 + PE)	**"C6"** (6 + PE)
A	24 VDC supply voltage		
B	GND		GND, reference potential actual value/enable
C	Reference potential actual value	Reference potential actual value	Enable input 24 VDC (high ≥ 11 V, low ≤ 5 V)
D	Command value ±10 V (***Re*** > 100 kΩ)	Command value 4 ... 20 mA (***Re*** = 200 Ω)	Command value ±10 mA (***Re*** = 200 Ω)
E	Reference potential command value	Reference potential command value	Reference potential command value
F	Actual value ±10 V (***Ri*** ≈ 1 kΩ)	Actual value 4 ... 20 mA (Load max. 500 Ω)	Actual value 4 ... 20 mA (Load max. 500 Ω)
FE	Functional ground (directly connected to the valve housing)		

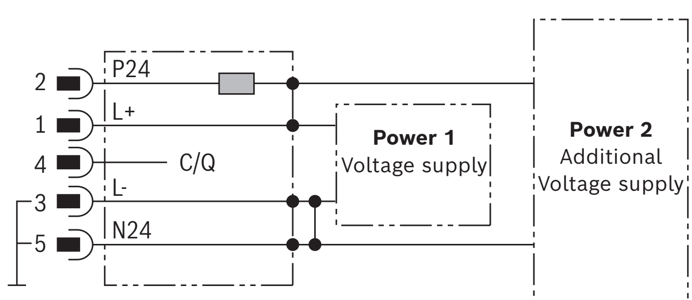


Command value:	▶ Positive command value (0 ... 10 V or 12 ... 20 mA) at D and reference potential at E cause flow from P → A and B → T.
	▶ Negative command value (0 ... –10 V or 12 ... 4 mA) at D and reference potential at E cause flow from P → B and A → T.
Connection cable:	▶ Up to 20 m cable length type LiYCY 7 x 0.75 mm²
	▶ Up to 40 m cable length type LiYCY 7 x 1.0 mm²
	▶ EMC-compliant installation: – Apply screening to both line ends – Use metal mating connector (see page 18) ▶ Alternatively up to 30 m cable length admissible – Apply screening on supply side – Plastic mating connector (see page 18) can be used

Notice:
Mating connectors, separate order, see page 18 and data sheet 08006.

Connector pin assignment "L1" (M12-5, A-coded, class B)





Notice:
- ▶ M12 sensor/actuator connection line, 5-pole; M12 connector/bush, A-coded, without shield, maximum cable length 20 m. Observe the voltage drop over the cable. Wire cross-section at least 0.34 mm².
- ▶ Mating connectors, separate order, see page 18 and data sheet 08006.
- ▶ Communication and parameter description see data sheet 29400-PA
- ▶ With a wire cross-section of 0.34 mm² (standard line), a maximum cable length of 10 m is possible. For a maximum cable length of 20 m, the cross-section must be doubled.

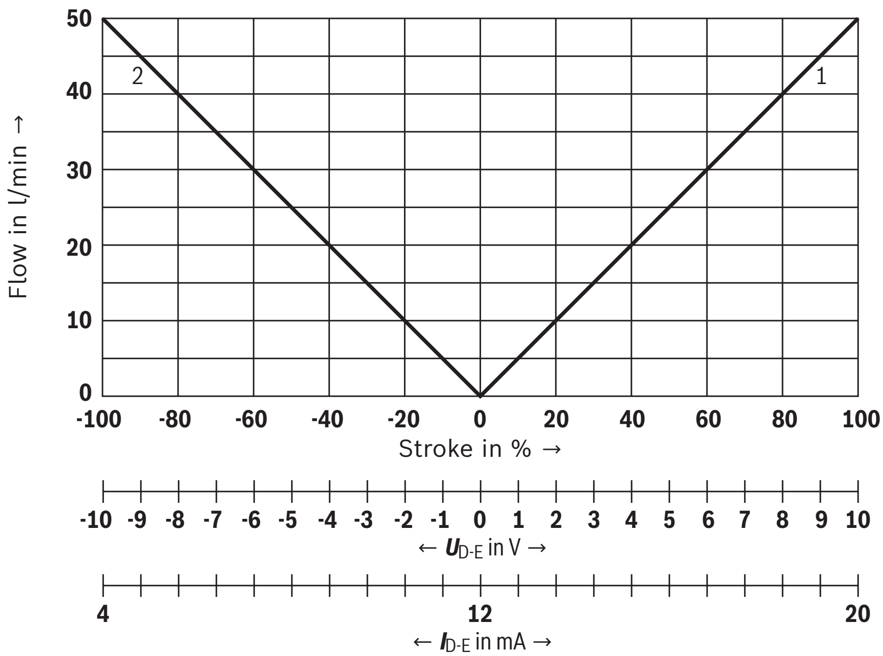
Pin	Signal	Allocation interface L1
1	L+	Voltage supply IO-Link
2	P24	Voltage supply valve electronics and power part (current consumption 3 A)
3	L-	Reference potential pin 1 [1)]
4	C/Q	Data line IO-Link (SDCI)
5	N24	Reference potential pin 2 [1)]

1) Pin 3 and 5 are linked with each other in the valve electronics. The reference potentials L- and N24 of the two supply voltages must also be linked with each other on the power supply unit side.

Characteristic curves: Flow characteristic "L"
(measured with HLP46, ϑ_{oil} = 40 ±5 °C; Δp = 35 bar/control edge)

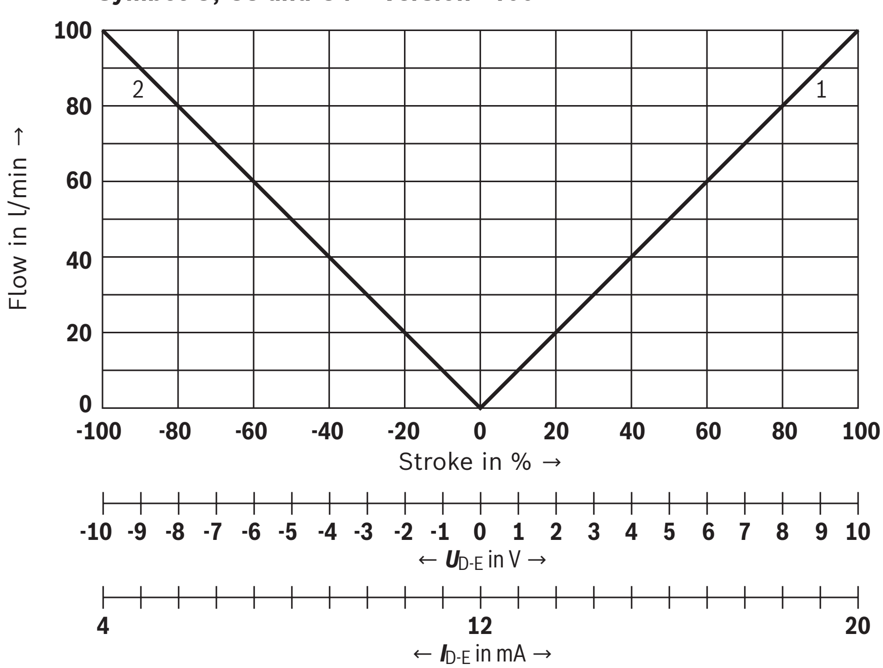
Flow/signal function

Symbol C, C3 and C4 – Version "50"



1 P–A; B–T
2 P–B; A–T

Symbol C, C3 and C4 – Version "100"

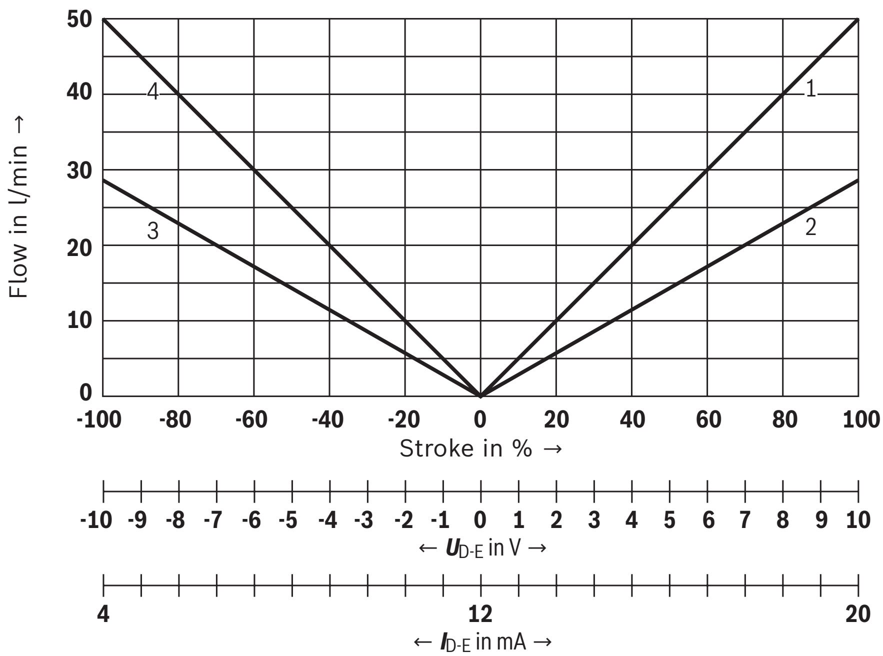


1 P–A; B–T
2 P–B; A–T

Characteristic curves: Flow characteristic "L"
(measured with HLP46, ϑ_{oil} = 40 ±5 °C; Δp = 35 bar/control edge)

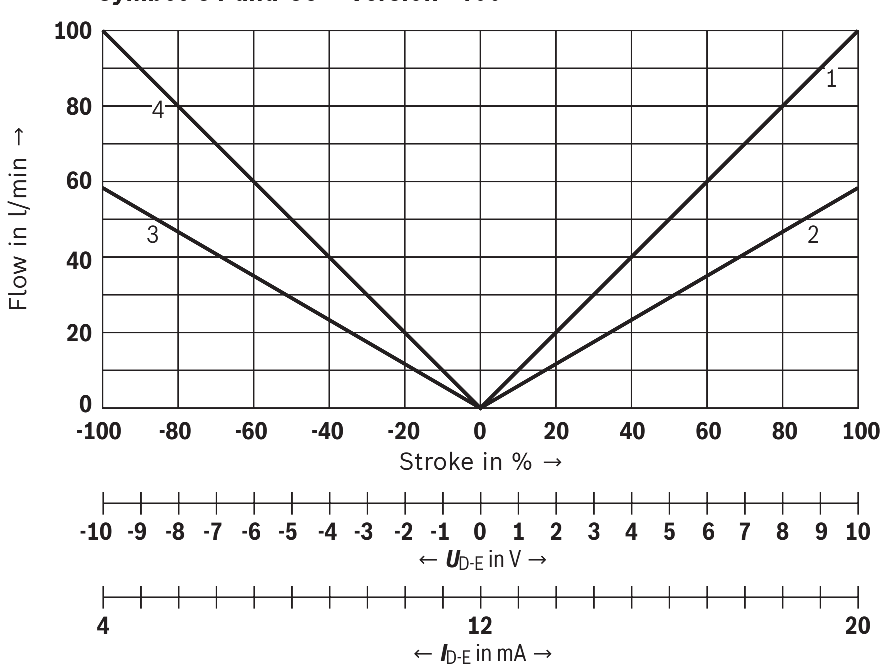
Flow/signal function

Symbol C1 and C5 – Version "50"



1 P–A
2 B–T
3 P–B
4 A–T

Symbol C1 and C5 – Version "100"

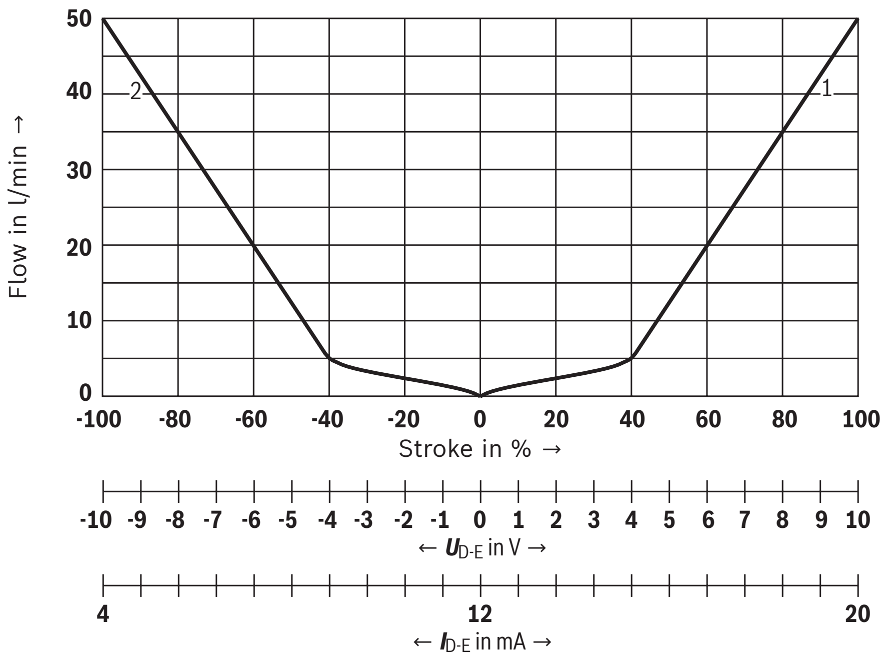


1 P–A
2 B–T
3 P–B
4 A–T

Characteristic curves: Flow characteristic "P"
(measured with HLP46, ϑ_{oil} = 40 ±5 °C; Δp = 35 bar/control edge)

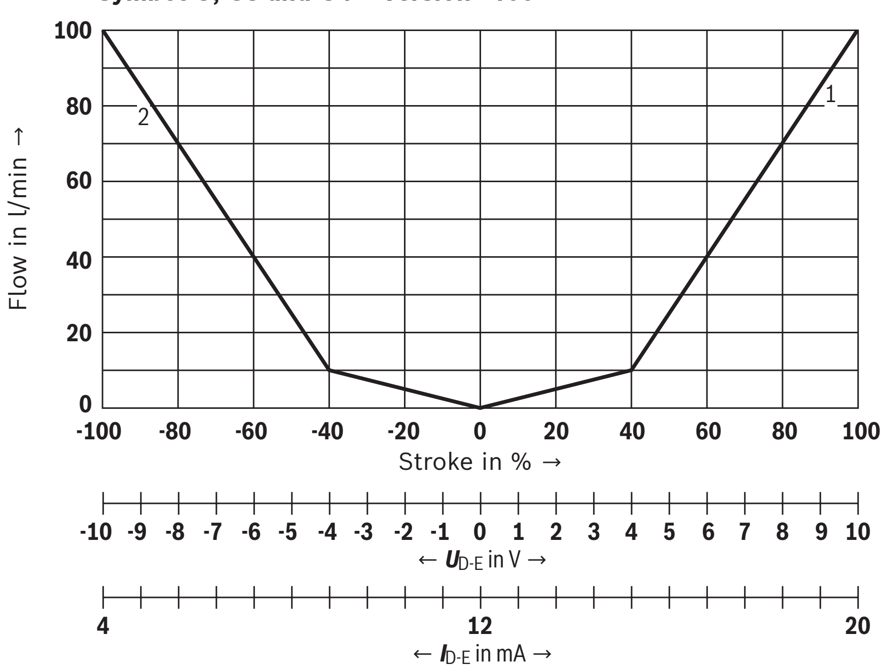
Flow/signal function

Symbol C, C3 and C4 – Version "50"



1 P–A; B–T
2 P–B; A–T

Symbol C, C3 and C4 – Version "100"

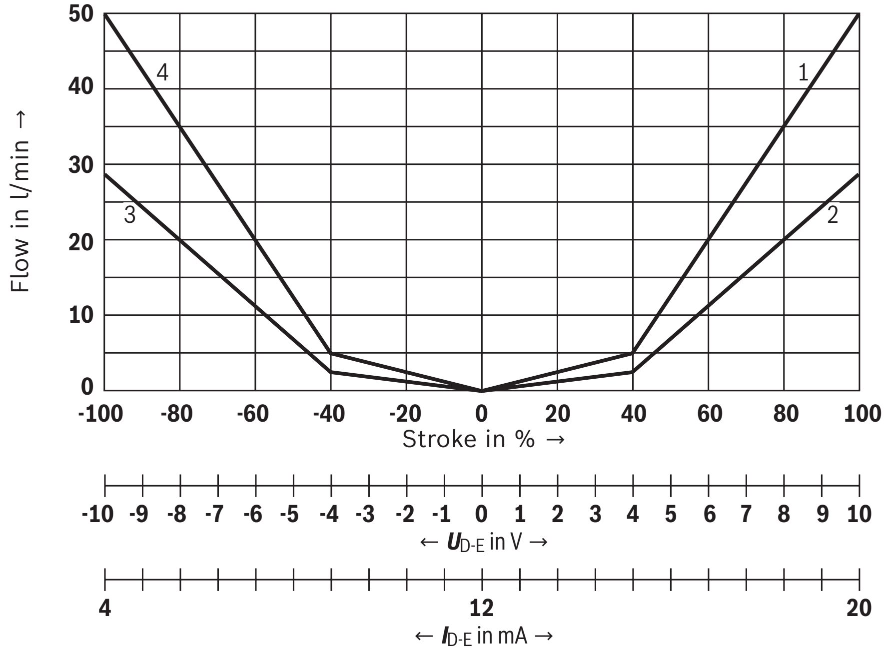


1 P–A; B–T
2 P–B; A–T

Characteristic curves: Flow characteristic "P"
(measured with HLP46, ϑ_{oil} = 40 ±5 °C; Δp = 35 bar/control edge)

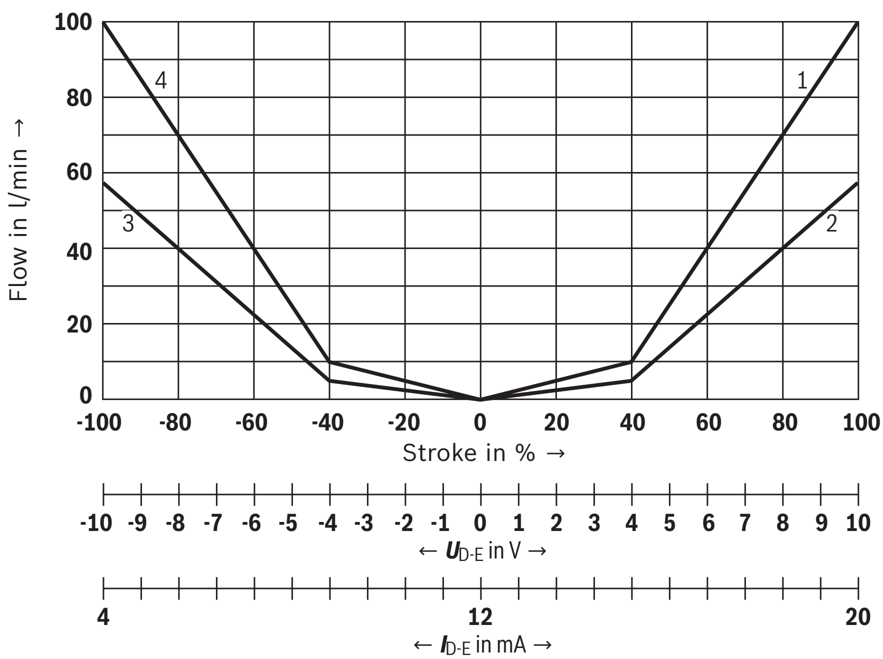
Flow/signal function

Symbol C1 and C5 – Version "50"



1 P–A
2 B–T
3 P–B
4 A–T

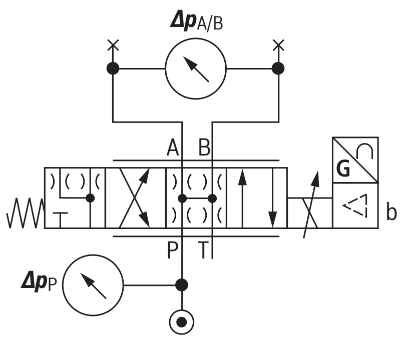
Symbol C1 and C5 – Version "100"

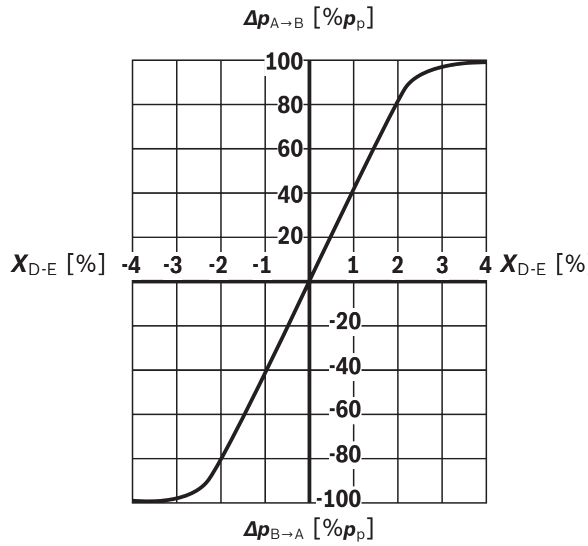


1 P–A
2 B–T
3 P–B
4 A–T

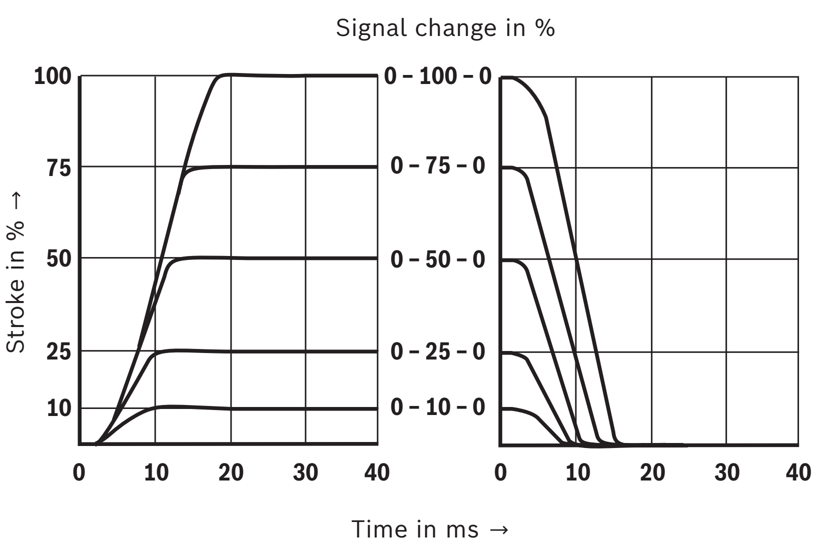
Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Pressure/signal characteristic curve





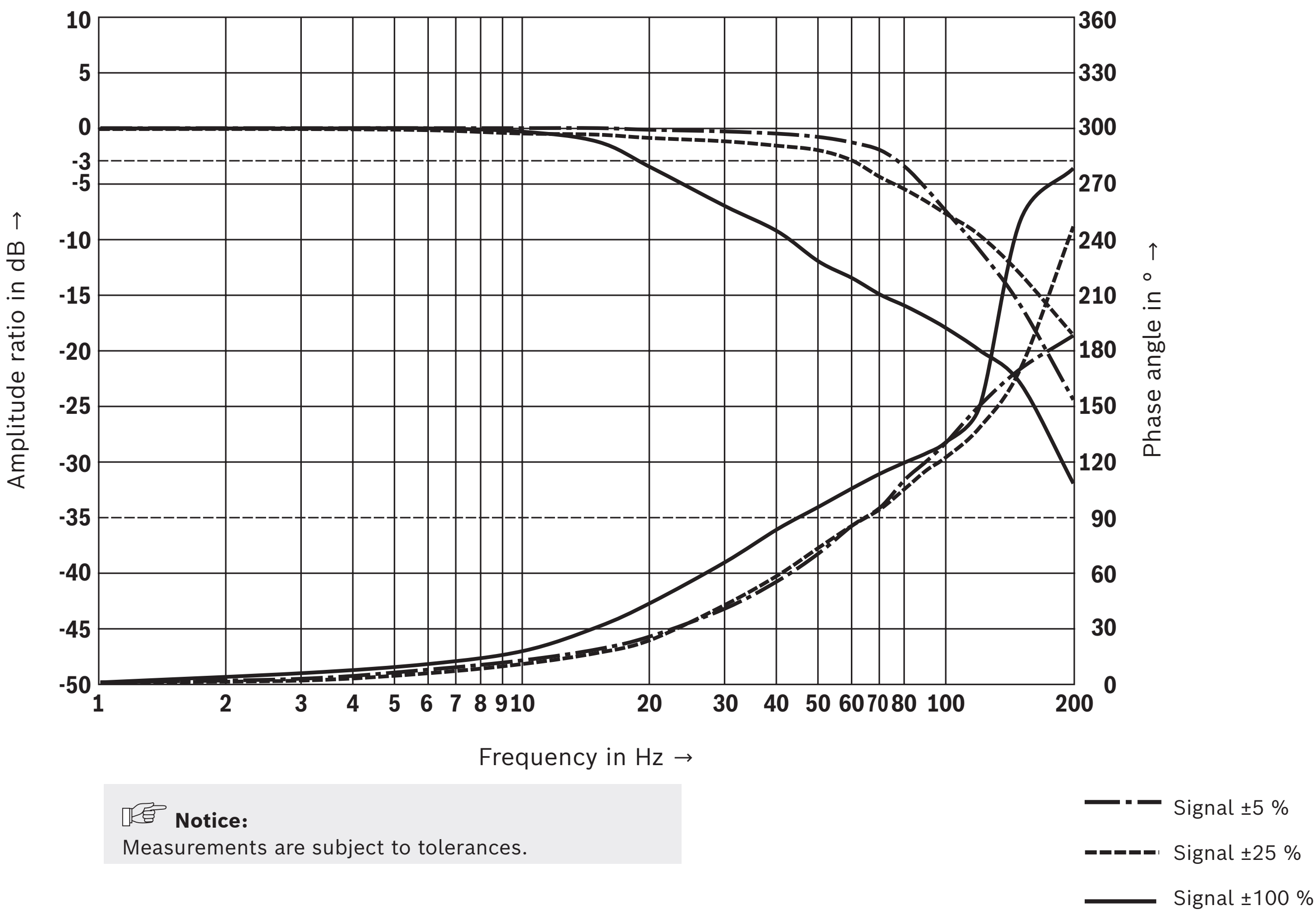
Transition function with stepped electric input signals



Characteristic curves

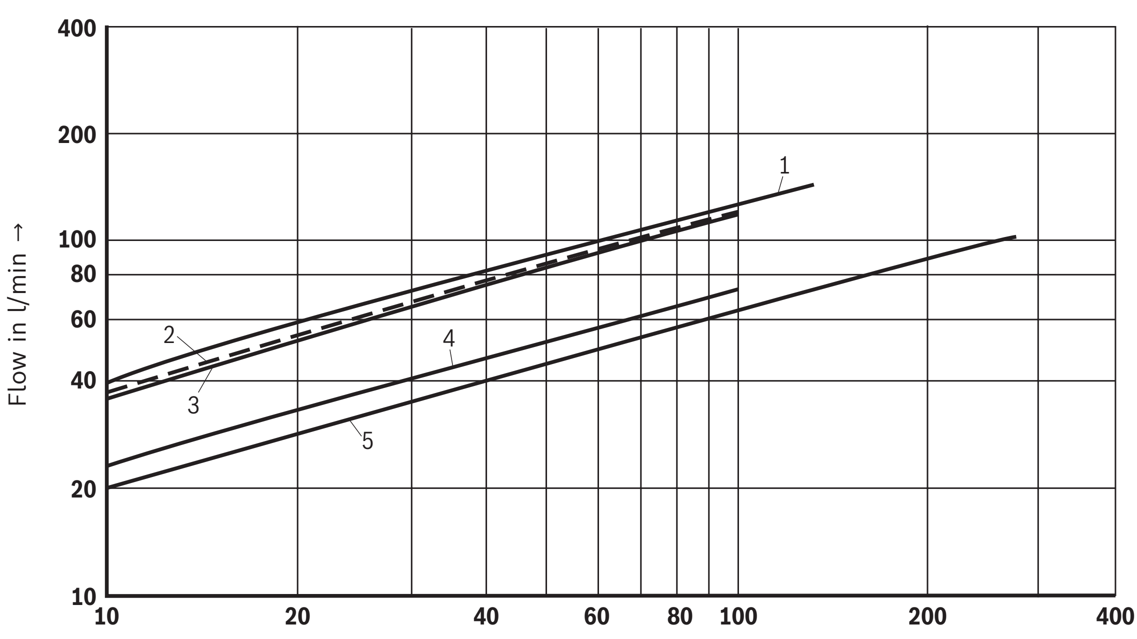
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Frequency response characteristic curves



Notice:
Measurements are subject to tolerances.

Flow/load function with maximum valve opening



Version

1 "C3B100L"

2 "C4B100P"

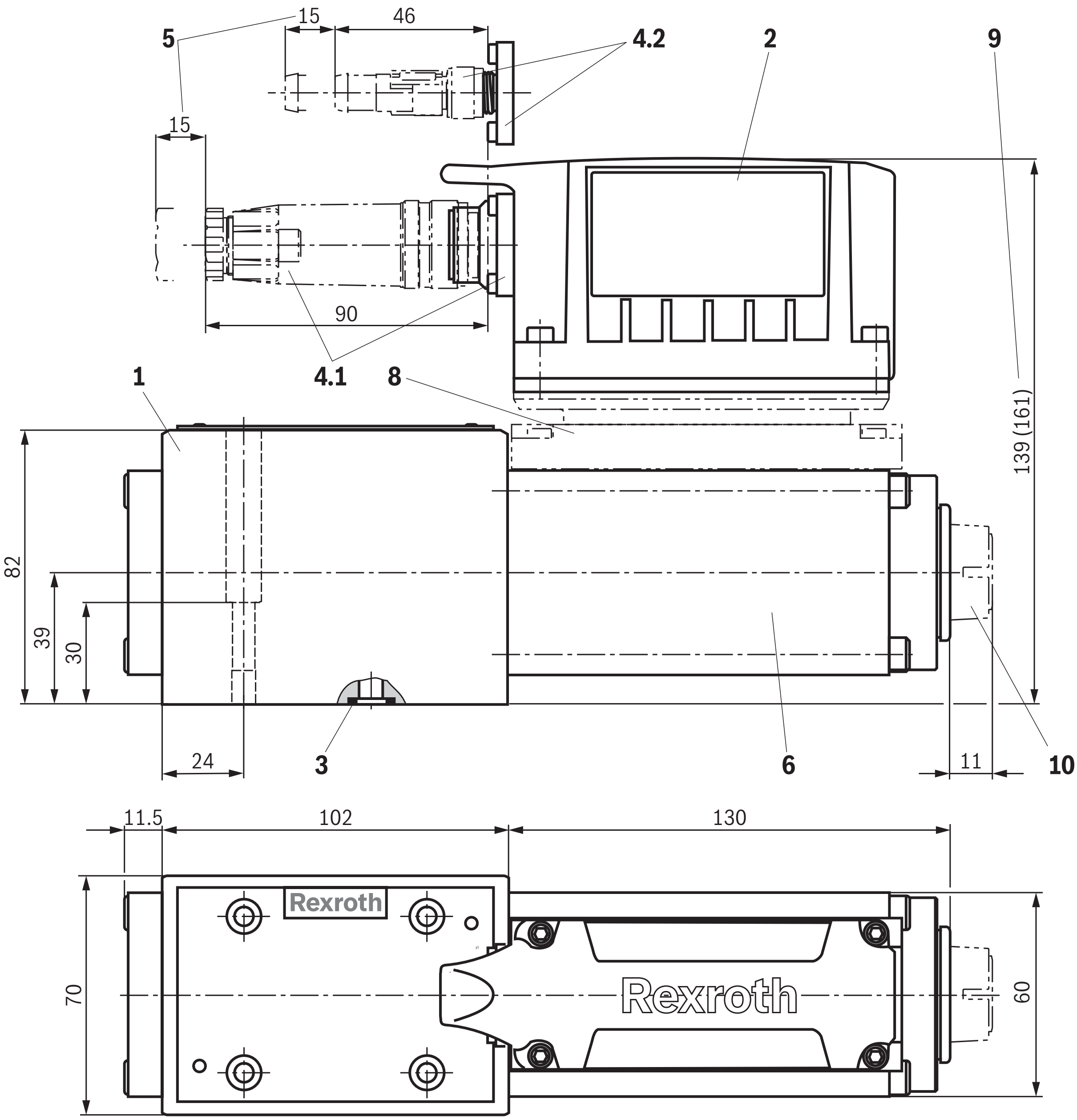
3 "C4B100L"

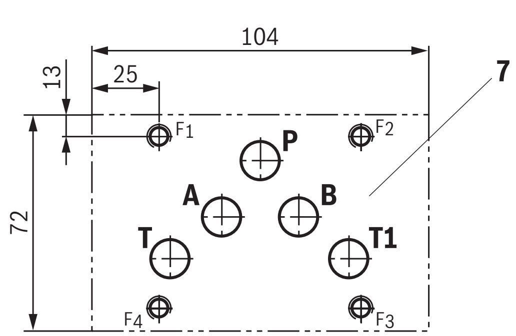
4 "C1B100L"

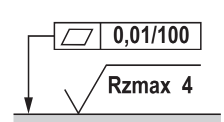
5 "C4B50L"

Dimensions

(dimensions in mm)







Required surface quality of the valve contact surface

Notice:
The dimensions are nominal dimensions which are subject to tolerances.

For item explanations, valve mounting screws and **subplates,** see page 18.

Dimensions

- **1** Valve housing
- **2** Integrated electronics
- **3** Identical seal rings for ports P, A, B, T, T1
- **4.1** Mating connectors with version "A1" and "F1", separate order, see page 18 data sheet 08006
- **4.2** Mating connectors with version "L1", separate order, see page 18 data sheet 08006
- **5** Space required to remove the mating connector
- **6** Control solenoid with position transducer
- **7** Machined valve contact surface, porting pattern according to ISO 4401-05-04-0-05 Deviating from the standard: Ports P, A, B, T, T1 Ø10.5 mm
- **8** Damping plate "D"
- **9** Dimension in () for version with damping plate "D"
- **10** Electronics protection membrane "-967"

Valve mounting screws (separate order)

Size	Quantity	Hexagon socket head cap screws	Material number
10	4	**ISO 4762 - M6 x 40 - 10.9-CM-Fe-ZnNi-5-Cn-T0-H-B** (Friction coefficient μ_{total} = 0.09 … 0.14) Tightening torque M_A = 12.5 Nm ±10%	**R913051533**
	or		
	4	**ISO 4762 - M6 x 40 - 10.9** Tightening torque M_A = 15.5 Nm ±10%	Not included in the Rexroth delivery range
	or		
	4	**ASME B18.3 - 1/4-20 UNC x 1 3/4" - ASTM-A574** Tightening torque M_A = 15 Nm *[11 ft-lbs]* ±10%	Not included in the Rexroth delivery range

Notice:
The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure.

Subplates (separate order) with porting pattern according to ISO 4401-05-04-0-05 see data sheet 45100.

Accessories (separate order)

Valves with integrated electronics

Mating connectors 6-pole + PE	Design	Version	Material number	Data sheet
For the connection of valves with integrated electronics, round connector 6+PE, line cross-section 0.5 … 1.5 mm²	Straight	Metal	**R900223890**	08006
	Straight	Plastic	**R900021267**	08006
	Angled	Plastic	**R900217845**	–

Cable sets 6-pole + PE	**Length** in m	Material number	Data sheet
For the connection of valves with integrated electronics, round connector 6+PE, straight connector, shielded, potted-in mating connector, line cross-section 0.75 mm²	3.0	**R901420483**	08006
	5.0	**R901420491**	08006
	10.0	**R901420496**	08006
	20.0	**R901448068**	–

Test and service devices

	Material number	Data sheet
Service case with test device for proportional servo valves with integrated electronics (OBE)	**R901049737**	29685
Measuring adapter (6P+PE)	–	30068

RE 29131
Edition: 2021-03
Replaces: 2019-11

rexroth
A Bosch Company

Directional control valves, direct operated, with electrical position feedback and integrated field bus (IFB Multi-Ethernet)

Type 4WRPF

H8162+8164

- Sizes 6 and 10
- Component series 3X
- Maximum operating pressure 350 bar
- Rated flow 8, 18, 32, 50, 80 l/min (Δp = 10 bar)

CE

Features

- Open
  - Integrated fieldbus (IFB Multi-Ethernet)
  - Bus connection/service interface (Sercos, Ether-CAT, EtherNet/IP, PROFINET RT, VARAN)
- Scalable
  - External (input 0 ... 10 V) or integrated pressure sensors
- Safe
  - Internal safety function (can be used up to category 4/PL e according to EN 13849-1)
  - CE conformity according to EMC Directive 2014/30/EU

Contents

Ordering code

01	02	03	04	05	06	07	08		09		10		11	12	13		14	15	16	17
4	**WRP**	**F**				**S**		**–**	**3X**	**/**		**/**			**24**	**/**		**D9**		*****

01	4 main ports	**4**

02	Directional control valve, direct operated	**WRP**

03	With integrated fieldbus	**F**

04	Size 6	**6**
	Size 10	**10**

05	Symbols; possible version see page 3	

Rated flow (***Δp*** = 5 bar/control edge)

06	**– Size 6**	
	8 l/min (only symbols E, V- and W-)	**8**
	18 l/min (only symbols E, E1-, V-, V1-, W- and W1-)	**18**
	32 l/min	**32**
	– Size 10	
	50 l/min (only symbols E, E1-, V- and W6-)	**50**
	80 l/min	**80**

Flow characteristic

07	Progressive	**S**

Overlap jump

08	Without	**no code**
	With (opening point 5% command value with symbols E, E1-, W-, W1-, W6- and W8-)	**J**

09	Component series 30 ... 39 (30 ... 39: unchanged installation and connection dimensions)	**3X**

Seal material (observe compatibility of seals with hydraulic fluid used, see page 7)

10	NBR seals	**M**
	FKM seals	**V**

Pressure sensor (pressure rating)

11	Without pressure rating	**0**
	Pressure rating 280 bar	**G**

Internal pressure sensor (position)

12	Without internal pressure sensors	**0**
	In port A	**A**
	In port B	**B**
	In ports A and B	**C**

13	Supply voltage 24 V	**24**

Ethernet interface

14	EtherNET/IP	**E**
	PROFINET RT	**N**
	Sercos	**S**
	EtherCAT (CANopen profile)	**T**
	VARAN	**V**

Ordering code

01	02	03	04	05	06	07	08		09		10		11	12	13		14	15	16	17
4	WRP	F				S		–	3X	/		/			24	/		D9		*

Connector

15	Voltage supply, enable acknowledgment	**D9**

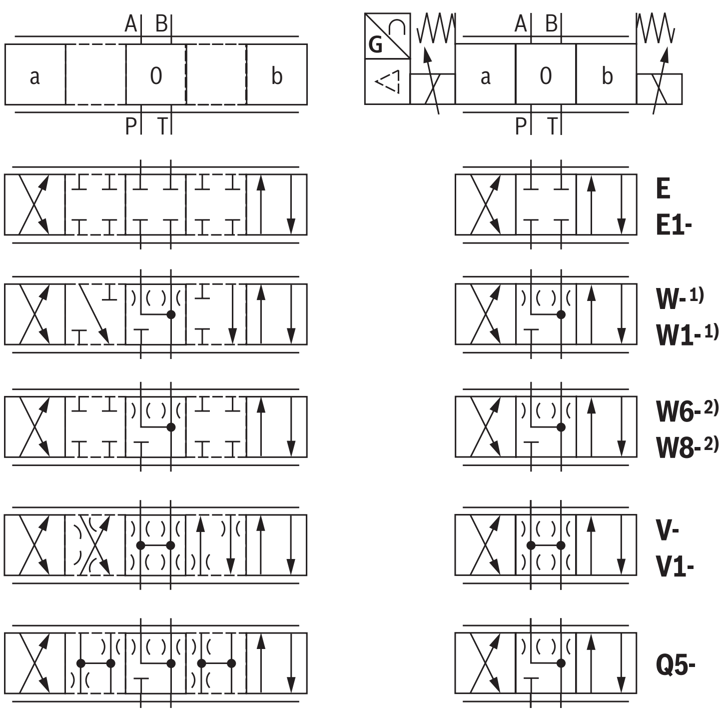
Pressure sensor interface

16	Without interface	**0**
	Analog, a maximum of 3 external pressure sensors (0 ... 10 VDC)	**5** [1]

17	Further details in the plain text	*

[1] Only with version "0" at positions 11 and 12

Symbols



With symbols E1-, V1-, W1- and W8-:

P → A: $q_{V\ max}$ B → T: $q_V/2$

P → B: $q_V/2$ A → T: $q_{V\ max}$

[1] Only size 6

[2] Only size 10

Notice:
Representation according to DIN ISO 1219-1.
Hydraulic interim positions are shown by dashes.

Function

General information

The **IFB Multi-Ethernet** valve (**I**ntegrated **F**ield**b**bus) is a digital directional control valve with integrated fieldbus.

The following operating modes are possible:

- Standard:
  - Valve direct control
  - Flow control
- With external (version "00..D95") or internal pressure sensors:
  - Pressure/force control
  - Active damping
  - Substitutional control (flow – pressure/force); pQ function (flow-controlled)

Communication is done via the digital Multi-Ethernet interface (X7E1 or X7E2) only. The following data may be exchanged:

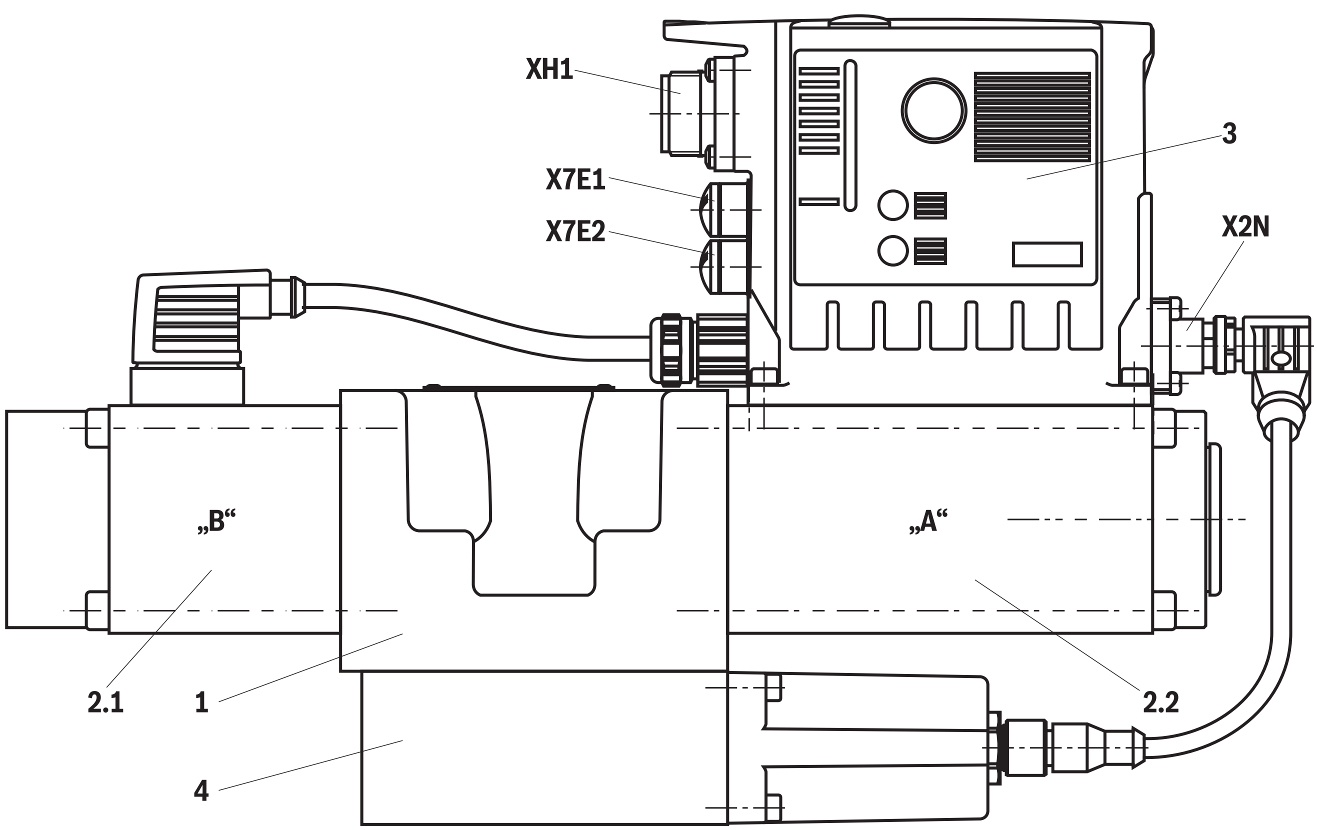
- Command values
- Actual values
- Configuration and setting of the system control parameters
- Status messages, faults or warnings

Set-up

The directional control valve with IFB Multi-Ethernet electronics
mainly consists of:

- Main housing with control spool (1)
- Control electronics with integrated fieldbus (3)
  - Connector, voltage supply, safety shut-down (XH1)
  - Ethernet interfaces (X7E1, X7E2)
  - Analog sensor interfaces (X2N), optional
- Pressure sensor sandwich plate (4), optional
- Stroke solenoid (2.1)
- Control solenoid with electrical position feedback (2.2)

☞ **Notice:**
With version "V32", the control spool may rotate in case of single-sided flow through the supply flow edges (P–A or P–B) causing damage or failure of the valve. This can be solved by reduction of the pressure differential over the supply flow edge to a maximum of 80 bar or by simultaneous use of both control edges (P–A/B–T or P–B/A–T).



Function

The integrated electronics (OBE) compares the specified command value to the position actual value. In case of control deviations, the relevant solenoid (2) will be activated and will compensate the COMMAND/ACTUAL difference by changing the solenoid force. Stroke/control spool cross-section is regulated proportionally to the command value. In case of a command value presetting of "0", the electronics adjust the control spool (1) to central position (zero flow).

Safety function
Thanks to the two control solenoids (enable pin D and E, low signal) at the connector (XH1), direction-dependent shut-off is enabled. The control spool of the valve is in spring-centered central position for this purpose (fail-safe position).
Enable acknowledgment pin C for solenoid A and pin F for solenoid B are "high". By connecting both control solenoids (enable pin D and E, high signal), the valve can be controlled by a command value presetting (command value positive, solenoid B or command value negative, solenoid A).
Enable acknowledgment pin C for solenoid A and pin F for solenoid B are "low".
Separate shut-off of solenoid A or solenoid B will moreover allow for the direction-dependent activation or shut-off of the drive.

Notice for safe shut-off according to EN 13849-1
Enable acknowledgment
The enable acknowledgment is not set (pin C and F):
- For failure of supply voltage.
- In case of a cable break (the integrated electronics (OBE) will de-energize both control solenoids and the control spool will move to the spring-centered central position).
- If the control spool is not in a hydraulically safe position (insufficient safety overlap of the control spool or safe position is not reached).

Safety function
The integrated electronics (OBE) of the valve enables the additional shut-off of a channel according to EN 13849-1 in both directions (depending on the symbol, the valve can be considered as safely shut-off).
When using symbol V, the valve cannot be used in a safety-relevant manner according to EN 13849-1.

Monitoring
The digital control electronics enable comprehensive monitoring functions/error detection including:
- Undervoltage
- Communication error
- Cable break for analog sensor inputs
- Monitoring of the microcontroller (watchdog)
- Temperature of the integrated electronics

IndraWorks DS PC program
To implement the project planning task and to parameterize the valve, the user may use the IndraWorks DS engineering tool (see accessories):
- Project planning
- Parameterization
- Commissioning
- Diagnosis
- Comfortable administration of all data on a PC
- PC operating systems: Windows 7-10

Notes:
- When using symbol V, V1, the enable inputs (enable pin D and E) may only be activated and deactivated together.
- For all other symbols, a unilateral shut-off will cause reduced performance data.
- 4/3 directional control valves do not have a leakage-free basic locking when deactivated. Leakage must be considered when designing the drive.
- Valve type 4WRPF can be used as shut-off element cat. 3 or 4 (up to PL e according to EN 13849-1). For both categories, an additional shut-off element is required to achieve a two-channel shut-off.
  For further information on the safety application, see operating instructions 29391-B.

Technical data
(For applications outside these values, please consult us!)

General				
Size		NG	6	10
Installation position			any	
Ambient temperature range		°C	−20 ... +60	
Storage temperature range		°C	+5 ... +40	
Maximum storage time		Years	1 (if the storage conditions are observed; refer to the operating instructions 07600-B)	
Vibration resistance	▶ Sine test according to DIN EN 60068-2-6		10 ... 2000 Hz/maximum of 10 g/10 cycles/3 axes	
	▶ Noise test according to DIN EN 60068-2-64		20 ... 2000 Hz / 10 g_{RMS} / 30 g peak / 30 min. / 3 axes	
	▶ Transport shock according to DIN EN 60068-2-27		15 g / 11 ms / 3 shocks / 3 axes	
Weight	▶ Without pressure sensor sandwich plate	kg	3.9	7.6
	▶ With pressure sensor sandwich plate	kg	4.7	9.8
Maximum relative humidity (no condensation)		%	95	
Maximum solenoid surface temperature		°C	150 (individual operation)	
$MTTF_d$ value according to EN ISO 13849		Years	150 (for further details see data sheet 08012)	
Conformity			▶ CE according to EMC Directive 2014/30/EU, tested according to EN 61000-6-2 and EN 61000-6-3 ▶ RoHS Directive 2011/65/EU ▶ REACH ordinance (EC) no. 1907/2006	

Hydraulic							
Maximum operating pressure	▶ Ports A, B, P	bar	350				
	▶ Port T	bar	200				
Rated flow (***Δp*** = 5 bar/control edge [1])		l/min	8	18	32	50	80
Flow unloading central position (***Δp*** = 5 bar/control edge)	▶ Symbol W-; A - T	l/min	0.8	1.2	1.2	–	–
	▶ Symbol W-; B - T	l/min	0.8	1.2	1.2	–	–
	▶ Symbol W1-; A - T	l/min	–	1.2	1.2	–	–
	▶ Symbol W1-; B - T	l/min	–	0.8	1.2	–	–
	▶ Symbol W6-; A - T	l/min	–	–	–	0.7	0.7
	▶ Symbol W6-; B - T	l/min	–	–	–	0.7	0.7
	▶ Symbol W8-; A - T	l/min	–	–	–	–	0.7
	▶ Symbol W8-; B - T	l/min	–	–	–	–	0.7
Hydraulic fluid			See table page 7				
Viscosity range	▶ recommended	mm²/s	20 ... 100				
	▶ maximum admissible	mm²/s	10 ... 800				
Hydraulic fluid temperature range (flown-through)		°C	−20 ... +70				
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)			Class 18/16/13 [2]				

[1] Flow for deviating ***Δp*** (control edge):

$$q_x = q_{Vnom} \cdot \sqrt{\frac{\Delta p_x}{5}}$$

[2] The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and simultaneously increases the life cycle of the components.

Notice:
The specified technical data were measured with HLP46 and ϑ_{oil} = 40 ±5 °C.

Technical data
(For applications outside these values, please consult us!)

Hydraulic fluid		Classification	Suitable sealing materials	Standards	Data sheet
Mineral oils		HL, HLP, HLPD, HVLP, HVLPD	NBR, FKM	DIN 51524	90220
Bio-degradable	▶ Insoluble in water	HETG	FKM	ISO 15380	90221
		HEES	FKM		
	▶ Soluble in water	HEPG	FKM	ISO 15380	
Flame-resistant	▶ Water-free	HFDU (glycol base)	FKM	ISO 12922	90222
		HFDU (ester base)	FKM		
		HFDR	FKM		
	▶ Containing water	HFC (Fuchs: Hydrotherm 46M, Renosafe 500; Petrofer: Ultra Safe 620; Houghton: Safe 620; Union: Carbide HP5046)	NBR	ISO 12922	90223

Important information on hydraulic fluids:
- For further information and data on the use of other hydraulic fluids, please refer to the data sheets above or contact us.
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.).
- The ignition temperature of the hydraulic fluid used must be 50 K higher than the maximum surface temperature.
- **Bio-degradable and flame-resistant – containing water:** If components with galvanic zinc coating (e.g. version "J3" or "J5") or parts containing zinc are used, small amounts of dissolved zinc may get into the hydraulic system and cause accelerated aging of the hydraulic fluid. Zinc soap may form as a chemical reaction product, which may clog filters, nozzles and solenoid valves – particularly in connection with local heat input.
- **Flame-resistant – containing water:**
  - Due to the increased cavitation tendency with HFC hydraulic fluids, the life cycle of the component may be reduced by up to 30% as compared to the use with mineral oil HLP. In order to reduce the cavitation effect, it is recommended – if possible specific to the installation – backing up the return flow pressure in ports T to approx. 20% of the pressure differential at the component.
  - Dependent on the hydraulic fluid used, the maximum environment and hydraulic fluid temperature must not exceed 50 °C. In order to reduce the heat input into the component, the command value profile is to be adjusted for proportional and high-response valves.

Static / dynamic		
Hysteresis	%	< 0.25
Range of inversion	%	< 0.05
Response sensitivity	%	< 0.05
Manufacturing tolerance q_{Vmax}	%	< 10
Temperature drift (temperature range 20 °C ... 80 °C)	%/10 K	Zero shift < 0.25
Pressure drift	%/100 bar	Zero shift < 0.2
Zero compensation		Ex plant ±1%

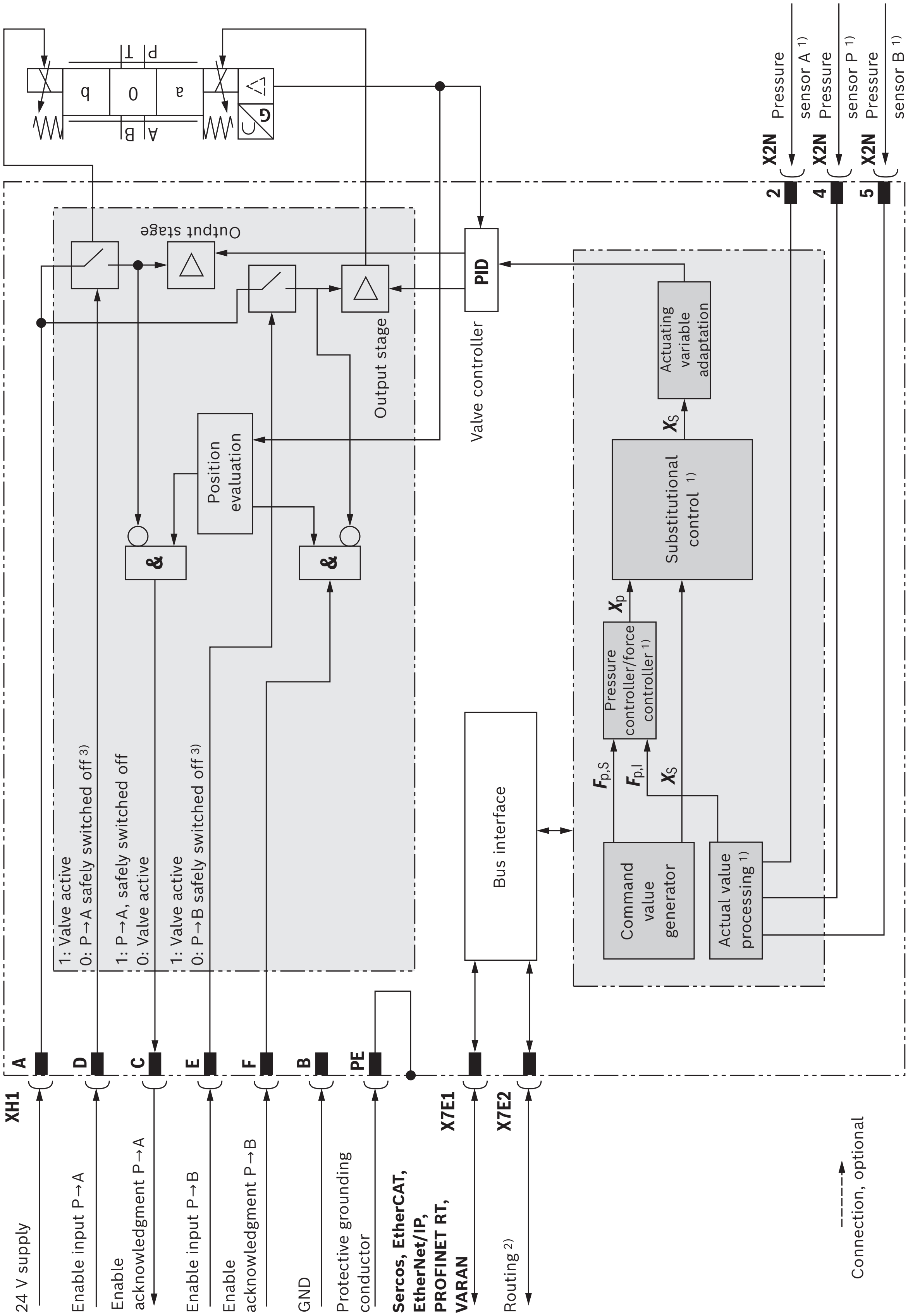
Technical data
(For applications outside these values, please consult us!)

Electrical, integrated electronics (OBE)				
Size		NG	6	10
Relative duty cycle		%	100 (continuous operation)	
Protection class according to EN 60529			IP65 (if suitable and correctly mounted mating connectors are used)	
Supply voltage [3]	▶ Nominal voltage	VDC	24	
	▶ Lower limit value	VDC	18	
	▶ Upper limit value	VDC	36	
	▶ Maximum admissible residual ripple	Vpp	2.5 (comply with absolute supply voltage limit values)	
Current consumption (at nominal voltage)	▶ Maximum [4]	A	2.5	2.8
	▶ Impulse current	A	4	
Maximum power consumption		W	40	65
AD/DA resolution	▶ Analog inputs		12 bit	
Protective grounding conductor and screening			See connector pin assignment (CE-compliant installation) page 10	
Required fuse protection, external		A	4, time-lag	
Adjustment			Calibrated in the plant	
Conformity			CE according to EMC Directive 2014/30/EU tested according to EN 61000-6-2 and EN 61000-6-3	
Parameterization interface			Ethernet	
Scan time pressure and force controller (minimum)		ms	0.5	
Booting time		s	< 15	
Switching input Enable XH1	▶ Quantity		1	
	▶ Low level	V	–3 ... 5	
	▶ High level	V	15 ... U_B	
	▶ Current consumption at high level	mA	< 1	
	▶ Reference potential		Pin 5	
Switching output Enable acknowledgment XH1	▶ Quantity		1	
	▶ Low level	V	0 ... 3	
	▶ High level	V	15 ... U_B	
	▶ Current carrying capacity	mA	50 (short-circuit-proof)	
	▶ Signal delay time	ms	See operating instructions 29391-B	
	▶ Reference potential		GND	
Analog sensors X2N	▶ Quantity of voltage inputs		3 (version "5")	
	▶ Supply voltage	V	24	
	▶ Maximum supply current	mA	50	
	▶ AD resolution	bit	12	
	▶ Voltage inputs			
	– Measurement range	V	0 ... 10	
	– Input resistance	kΩ	100 +10%	
	– Temperature drift		< 15 mV/10 K	

[3] Voltage limit values must be observed directly at the connector of the valve (observe line length and cable cross-section!)

[4] When using the sensor inputs or the switching output, the maximum current consumption will increase according to the external load

Block diagram/controller function block



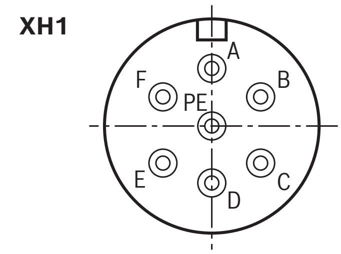
Detailed description of the safety function:
After both enable signals have been removed, both output stages, and thus the solenoid A and B of the valve, are internally separated from the available supply voltage.
The enable acknowledgment will only be activated for shut-off of A and B separately after the safe valve spool position has been achieved.
For a detailed description of the safety function, refer to the operating instructions 29391-B.

1) Only with version "5"
2) Not with "VARAN"
3) Safe deactivation with simultaneous use of enable acknowledgment

Electrical connections, assignment

Connector pin assignment XH1, 6-pole + PE according to DIN 43563

Pin	Assignment of interface D9
A	24 VDC supply voltage [1]
B	GND
C	Enable acknowledgment 24 VDC (I_{max} = 50 mA) [2] (high ≥15 V; low <2 V); Flow from P→A
D	Enable input 24 VDC (high ≥15 V; low <2 V); Flow from P→A
E	Enable input 24 VDC (high ≥15 V; low <2 V); Flow from P→B
F	Enable acknowledgment 24 VDC (I_{max} = 50 mA) [2] (high >15 V; low <2 V); Flow from P→B
PE	Functional ground (connected directly to metal housing)

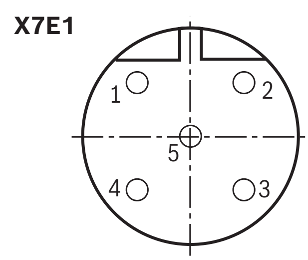


[1] A load increases the current consumption on pin A

[2] Enable acknowledgment is issued only if the valve has safely switched off according to EN 13849-1, see operating instructions 29391-B.

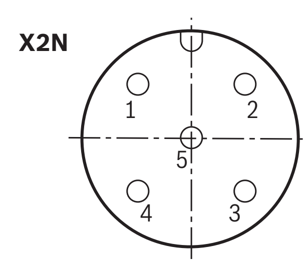
Connector pin assignment for Ethernet interfaces "X7E1" and "X7E2" (coding D), M12, 4-pole, socket

Pin	Assignment
1	TxD +
2	RxD +
3	TxD –
4	RxD –
5	Not used



Analog configurable sensor interface, port "X2N" (coding A), M12, 5-pole, socket

Pin	Assignment
1	+24 V voltage output
2	Analog sensor input 2 (0 ... 10 V)
3	GND
4	Analog sensor input 4 (0 ... 10 V)
5	Analog sensor input 3 (0 ... 10 V)

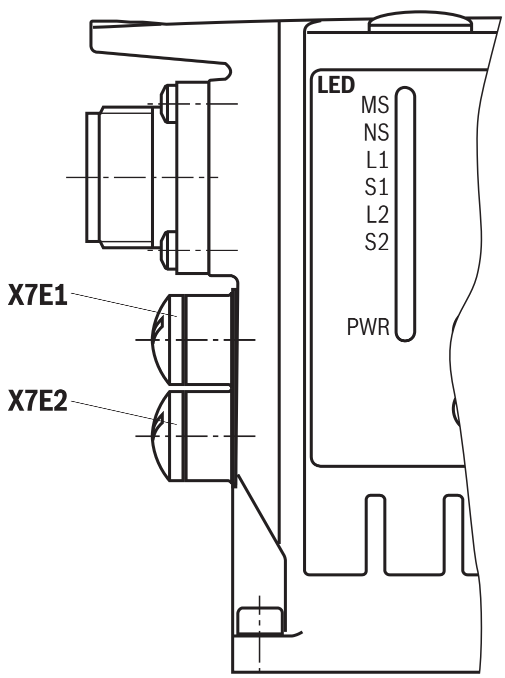


Only with version "5"

Notes:
- Reference potential for all signals: GND
- We recommend connecting the shields on both sides via the metal housings of the plug-in connectors.

LED displays

LED	Interface	Sercos	EtherNET/IP	EtherCAT	PROFINET RT	VARAN
MS	**Electronics module**	Module Status	Module Status	Module Status	Module Status	Module Status
NS		S	Network status and others	Network status and others	Network status and others	Network status and others
L1	**X7E1**	Link and others	Link and others	Link/Activity	Link and others	Link and others
S1		Activity and others	Activity and others	not used	Activity and others	Active and others
L2	**X7E2**	Link and others	Link and others	Link/Activity	Link and others	not used
S2		Activity and others	Activity and others	not used	Activity and others	not used
PWR	**XH1**	Power	Power	Power	Power	Power



Displays of the status LEDs

Power LED (LED PWR)	Display status
Off	No voltage supply
Green	Operation

Module status LED (LED MS)	Display status
Off	No voltage supply
Green-red, flashing	Initialization
Green, flashing	Drive ready for operation
Green	Drive active
Orange, flashing	Warning
Red, flashing	Error
Green, rapidly flashing	Firmware must be loaded

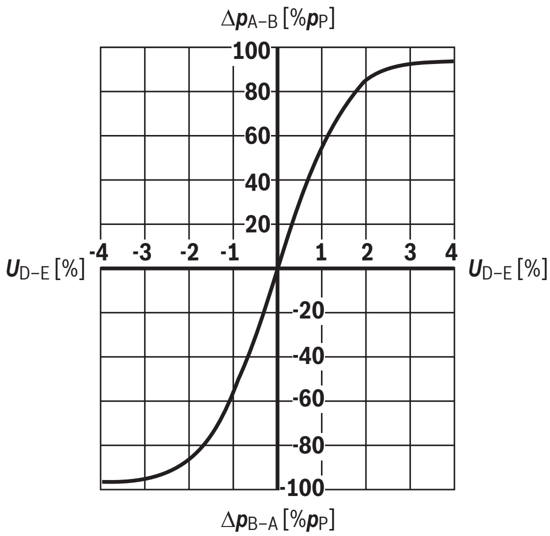
Link LED (LED L1)	Display status
Permanently lit	Cable plugged in, connection established

Activity LED (LED S1)	Display status
Flashing	Data sent/received

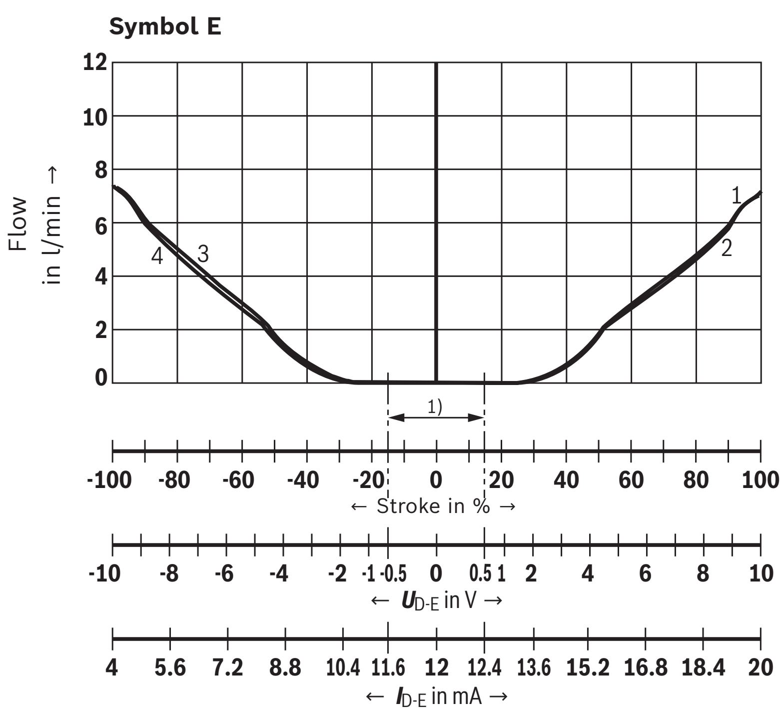
Notes:
- For the connection to the M12 sockets, we recommend using self-locking mating connectors
- Module status LED MS relates to the electronics module
- The network status LED NS indicates the status of the control communication, see application description 30338-FK
- LEDs L1, S1, L2 and S2 relate to interfaces "X7E1" and "X7E2"
- For a detailed description of the diagnosis LEDs, please refer to the functional description Rexroth HydraulicDrive HDx.
- Function is only available after start-up of the electronics.

Characteristic curves: Size 6
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Pressure/signal characteristic curve (symbol V)



Flow/signal function (rated flow 8 l/min with Δp = 5 bar/control edge)



1) Step compensation

1 P–A

2 B–T

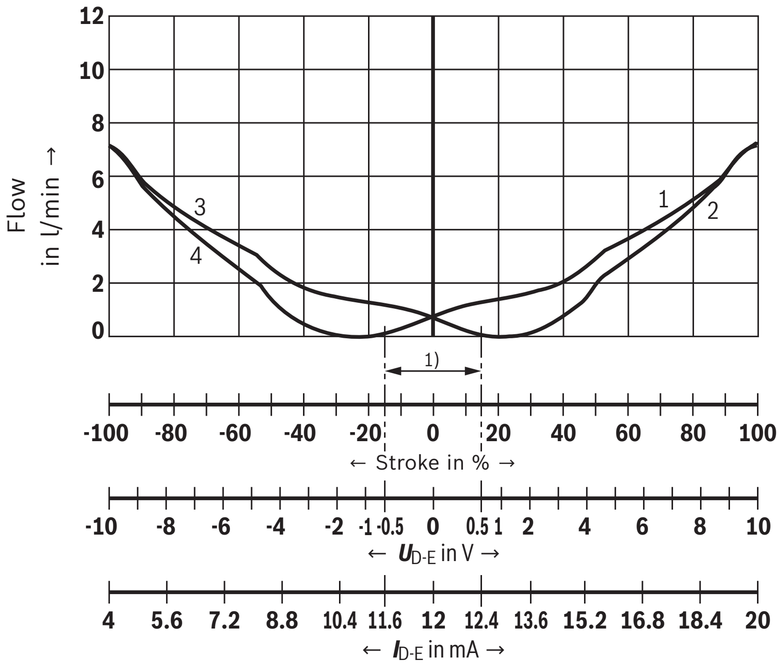
3 P–B

4 A–T

Characteristic curves: Size 6
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/signal function (rated flow 8 l/min with Δp = 5 bar/control edge)

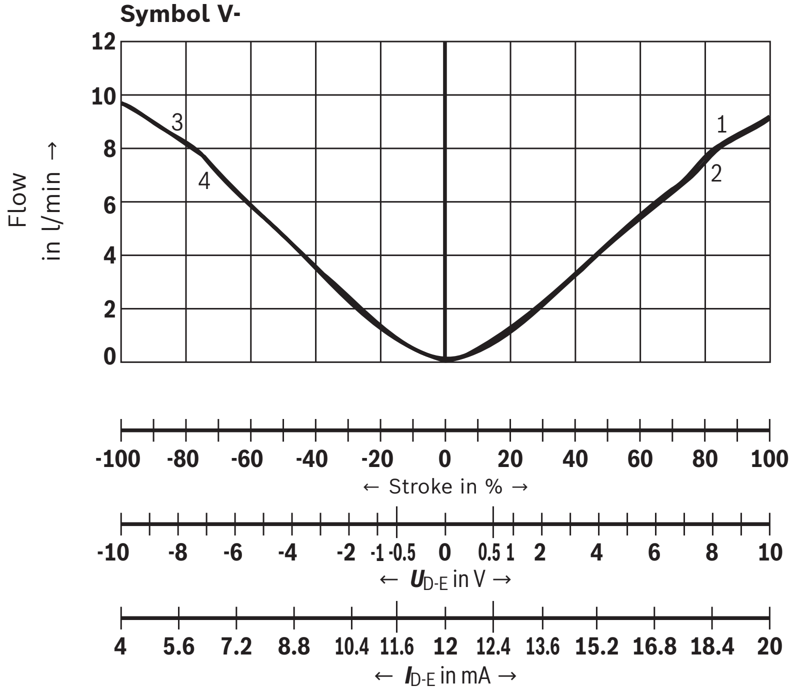
Symbol W-



[1] Step compensation

1 P–A
2 B–T
3 P–B
4 A–T

Symbol V-

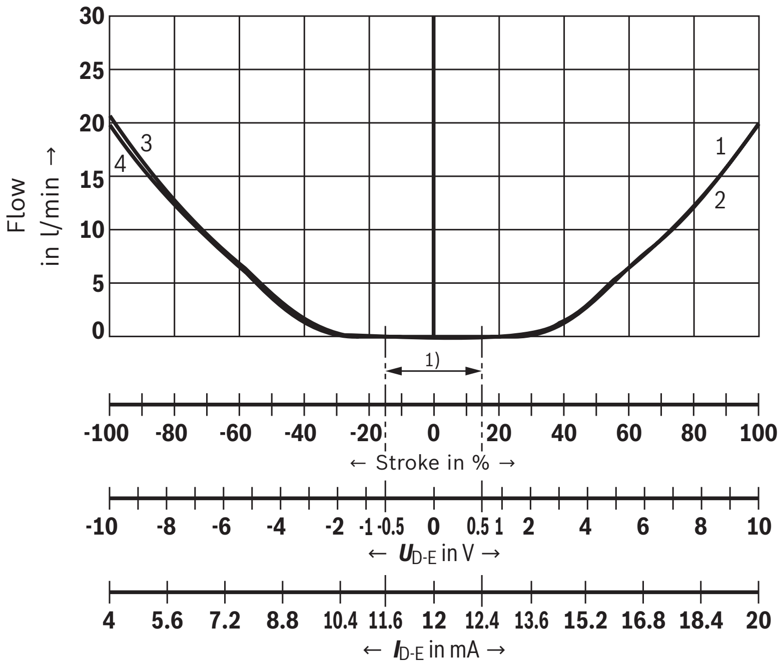


1 P–A
2 B–T
3 P–B
4 A–T

Characteristic curves: Size 6
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/signal function (rated flow 18 l/min with Δp = 5 bar/control edge)

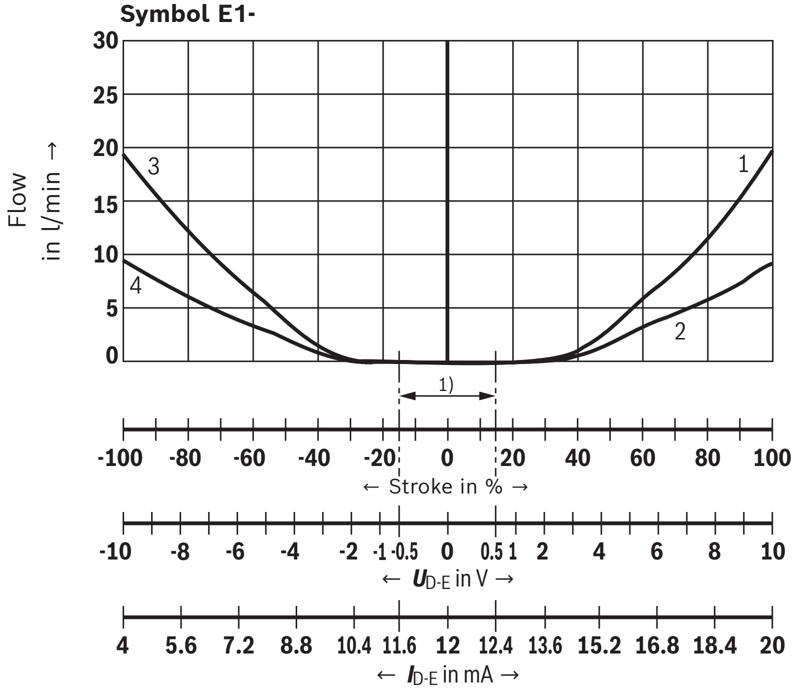
Symbol E



1) Step compensation

1 P–A
2 B–T
3 P–B
4 A–T

Symbol E1-



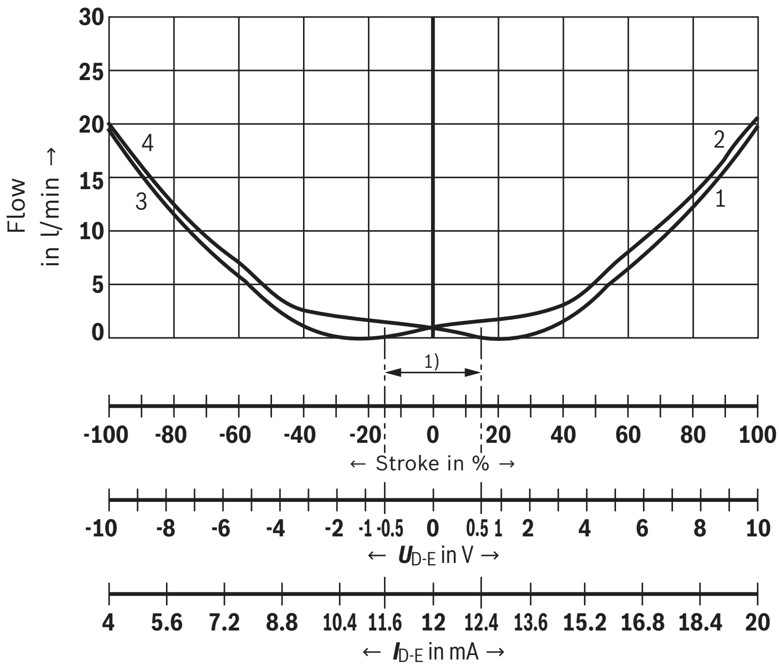
1) Step compensation

1 P–A
2 B–T
3 P–B
4 A–T

Characteristic curves: Size 6
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/signal function (rated flow 18 l/min with Δp = 5 bar/control edge)

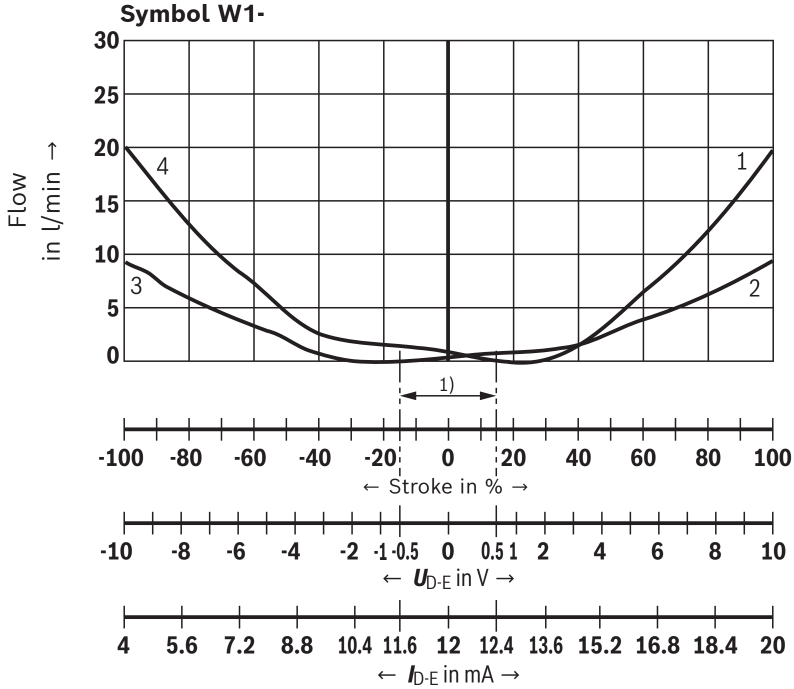
Symbol W-



[1] Step compensation

1 P–A
2 B–T
3 P–B
4 A–T

Symbol W1-



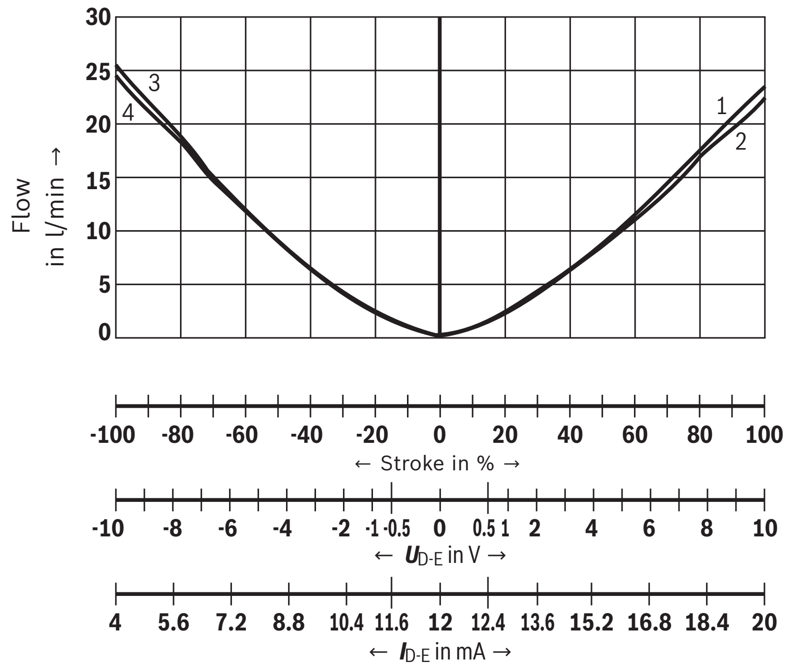
[1] Step compensation

1 P–A
2 B–T
3 P–B
4 A–T

Characteristic curves: Size 6
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

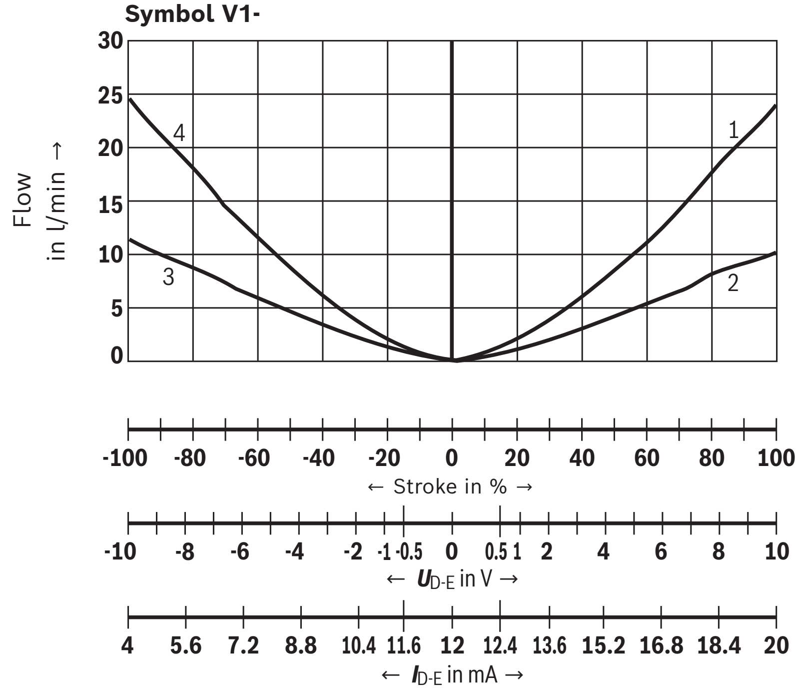
Flow/signal function (rated flow 18 l/min with Δp = 5 bar/control edge)

Symbol V-



1 P–A
2 B–T
3 P–B
4 A–T

Symbol V1-

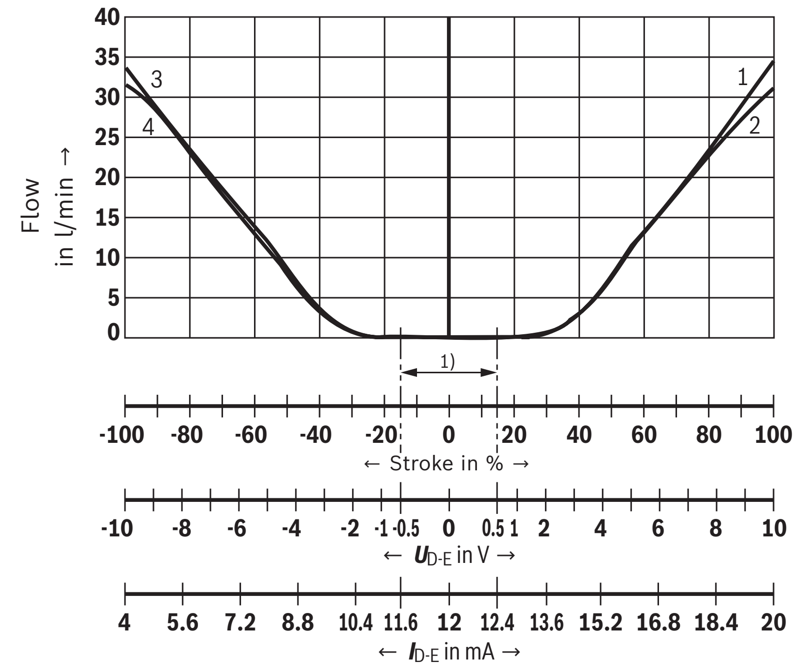


1 P–A
2 B–T
3 P–B
4 A–T

Characteristic curves: Size 6
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/signal function (rated flow 32 l/min with Δp = 5 bar/control edge)

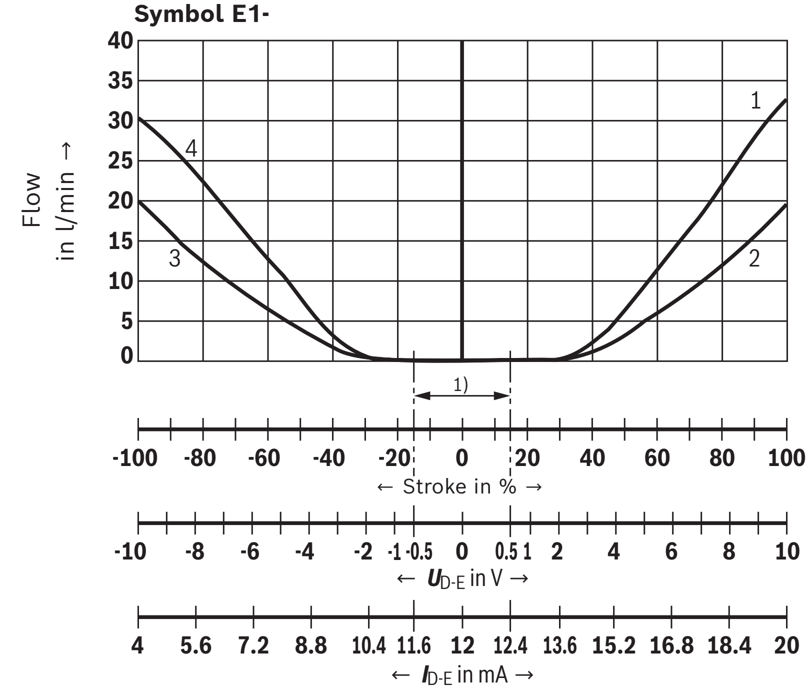
Symbol E



1) Step compensation

1 P–A
2 B–T
3 P–B
4 A–T

Symbol E1-



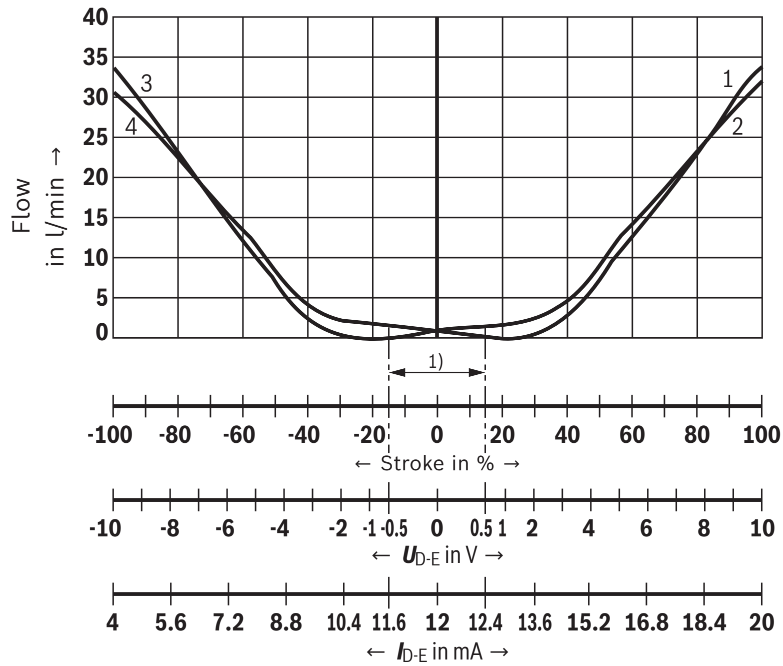
1) Step compensation

1 P–A
2 B–T
3 P–B
4 A–T

Characteristic curves: Size 6
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/signal function (rated flow 32 l/min with ***Δp*** = 5 bar/control edge)

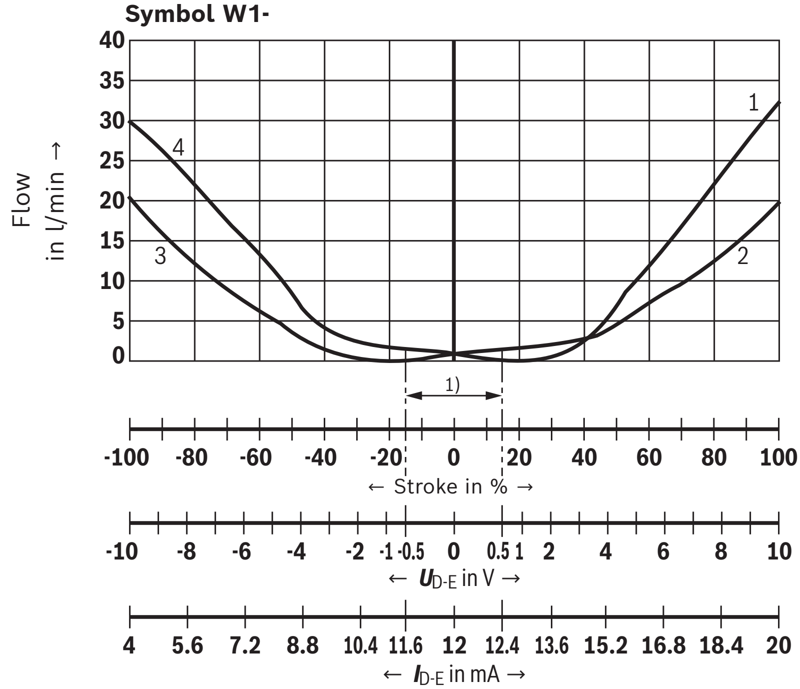
Symbol W-



[1] Step compensation

1 P–A
2 B–T
3 P–B
4 A–T

Symbol W1-



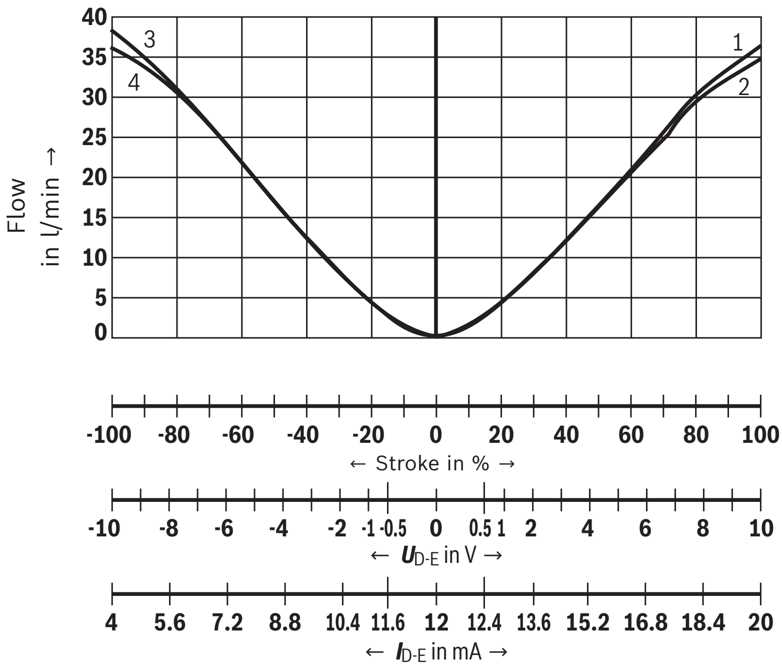
[1] Step compensation

1 P–A
2 B–T
3 P–B
4 A–T

Characteristic curves: Size 6
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/signal function (rated flow 32 l/min with Δp = 5 bar/control edge)

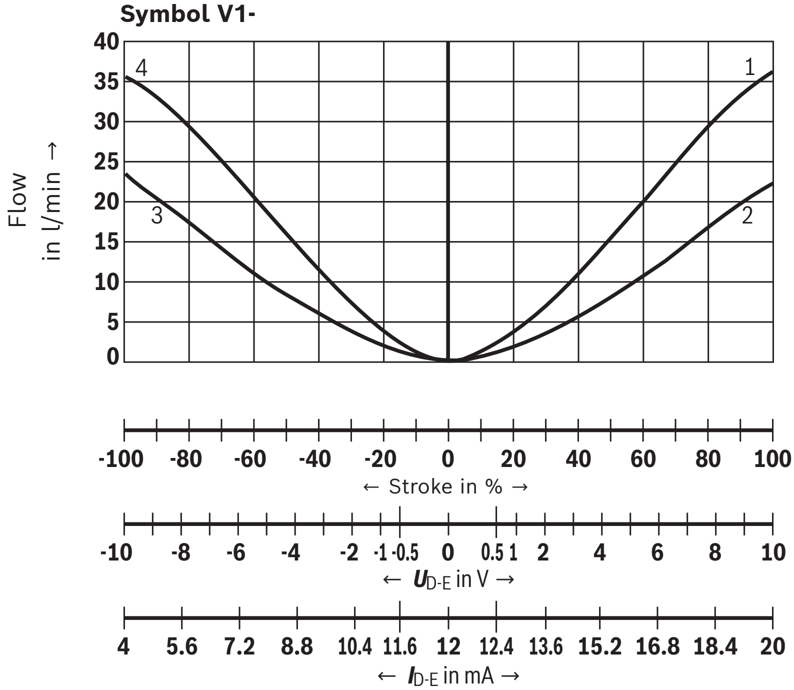
Symbol V-



1) Step compensation

1 P–A
2 B–T
3 P–B
4 A–T

Symbol V1-

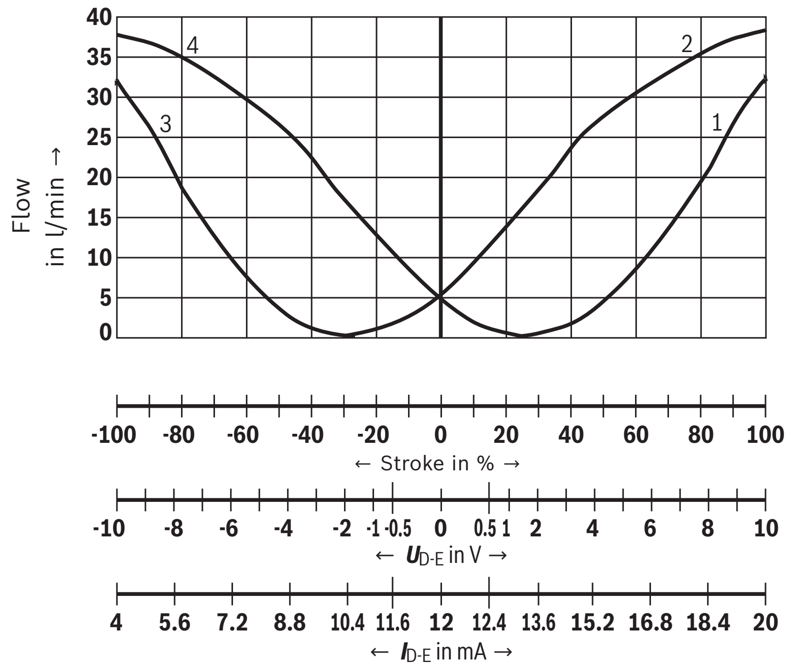


1 P–A
2 B–T
3 P–B
4 A–T

Characteristic curves: Size 6
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/signal function (rated flow 32 l/min with Δp = 5 bar/control edge)

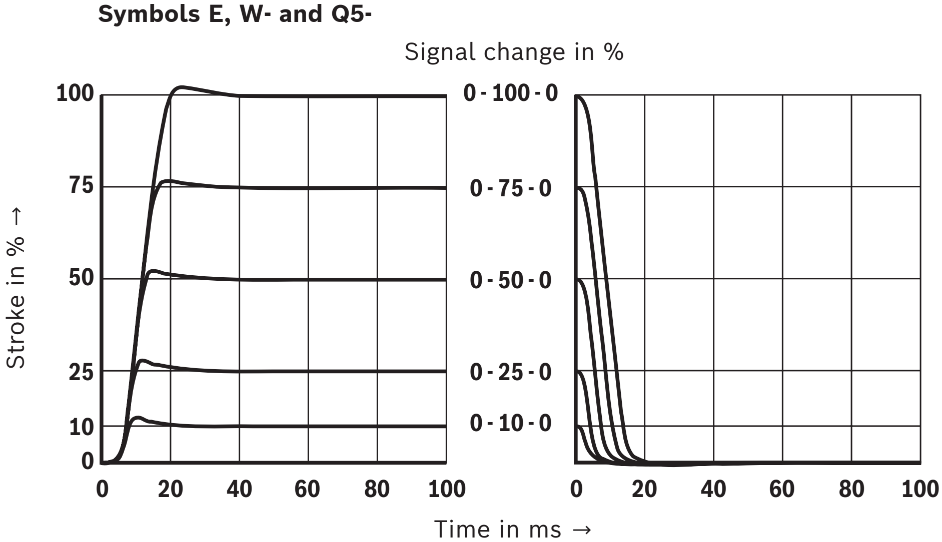
Symbol Q5-



1 P–A
2 B–T
3 P–B
4 A–T

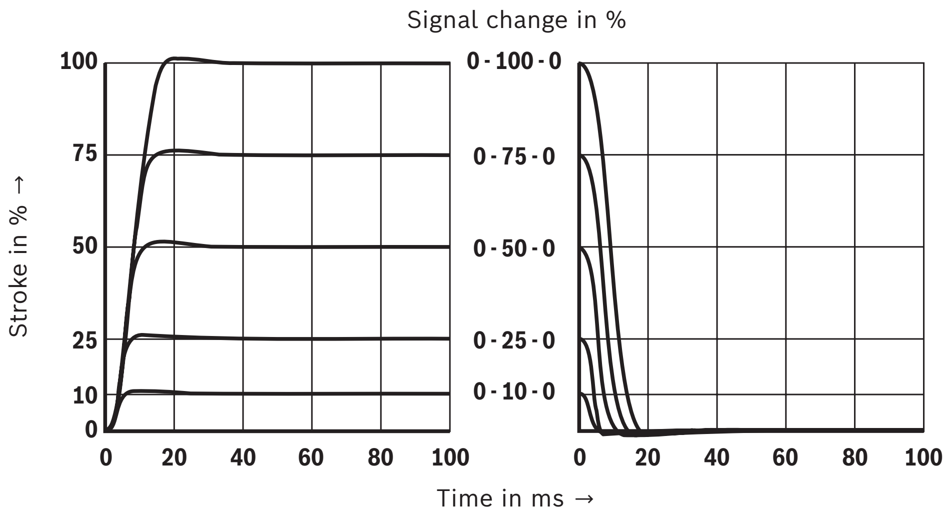
Transition function with stepped electric input signals

Symbols E, W- and Q5-

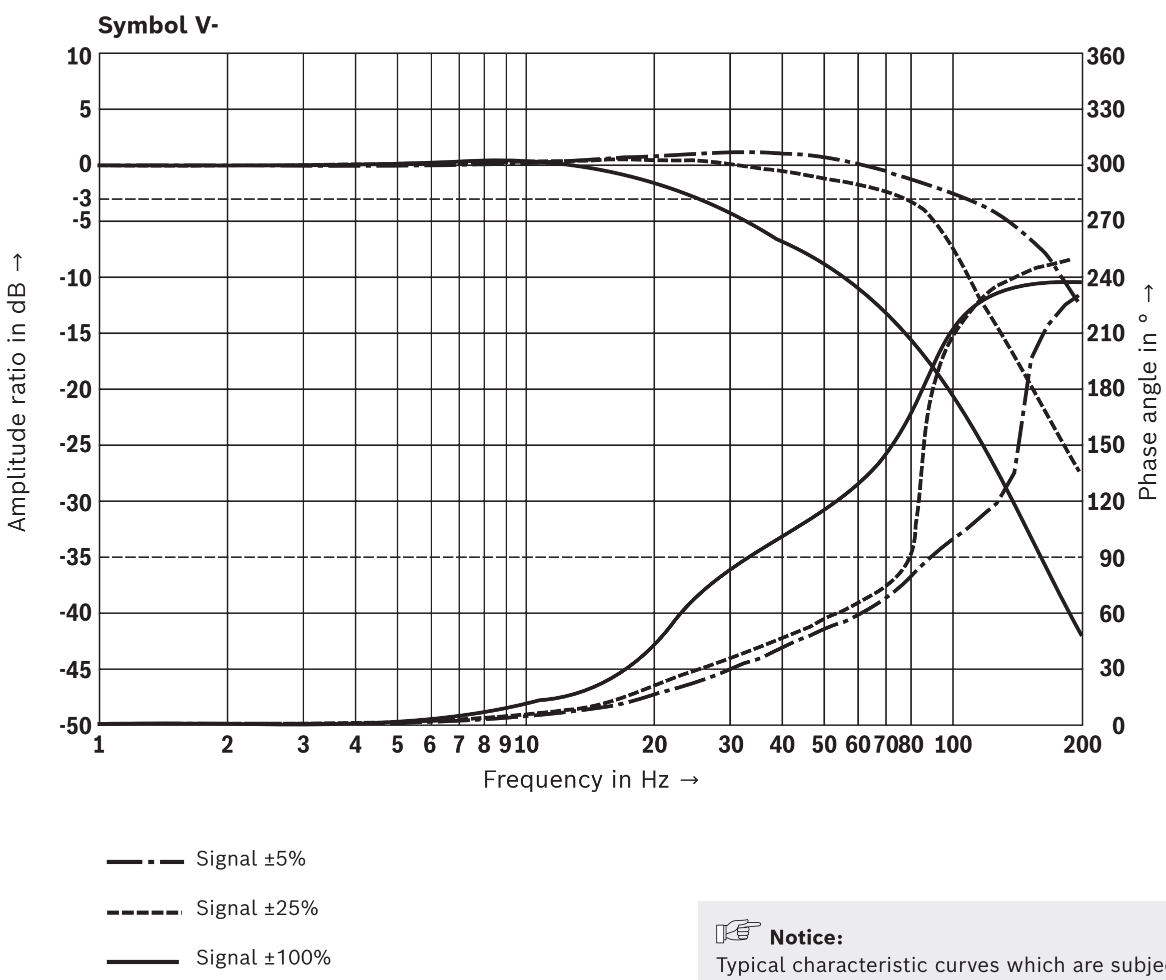


Characteristic curves: Size 6
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Transition function with stepped electric input signals



Frequency response

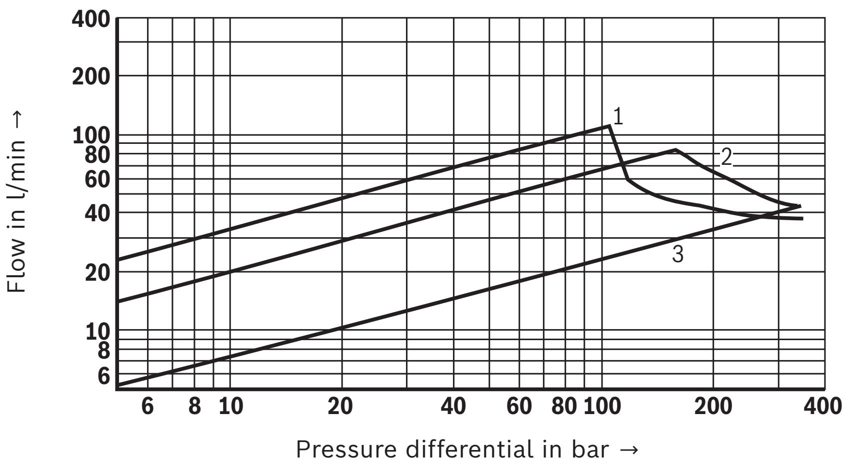


> **Notice:**
> Typical characteristic curves which are subject to tolerance variation.

Characteristic curves: Size 6
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

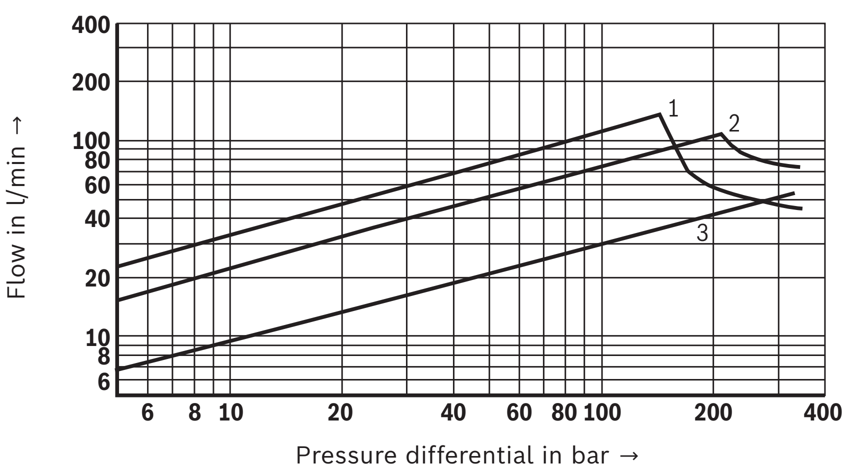
Flow/load function with maximum valve opening (tolerance ±10%) (4/3-way version)

Symbol E



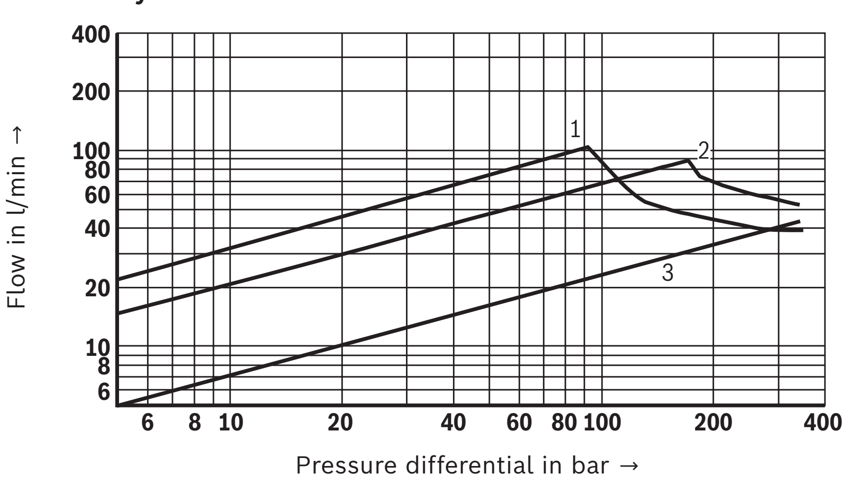
1 8 l/min (summated edge)
2 18 l/min (summated edge)
3 32 l/min (summated edge)

Symbol V-



1 8 l/min (summated edge)
2 18 l/min (summated edge)
3 32 l/min (summated edge)

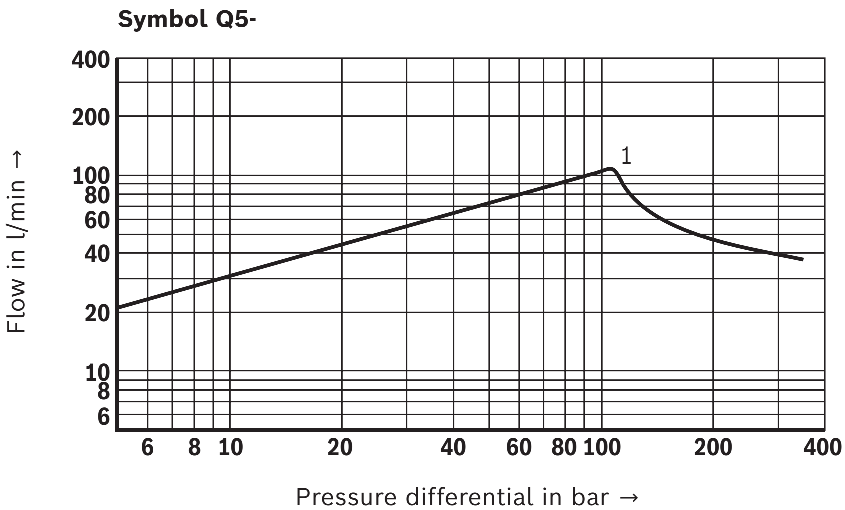
Symbol W-



1 8 l/min (summated edge)
2 18 l/min (summated edge)
3 32 l/min (summated edge)

Characteristic curves: Size 6
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

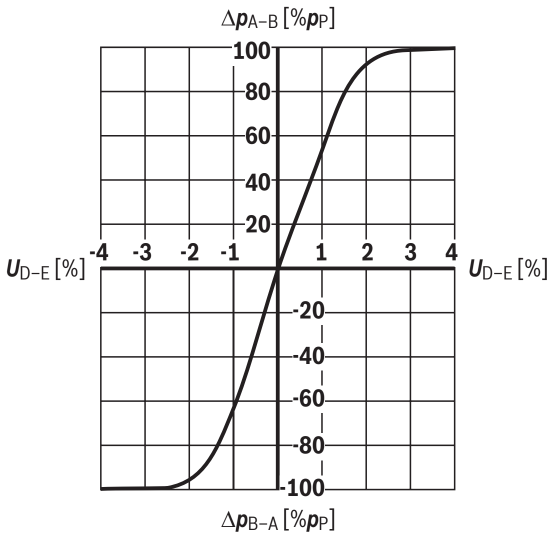
Flow/load function with maximum valve opening (tolerance ±10%) (4/3-way version)



1 32 l/min (summated edge)

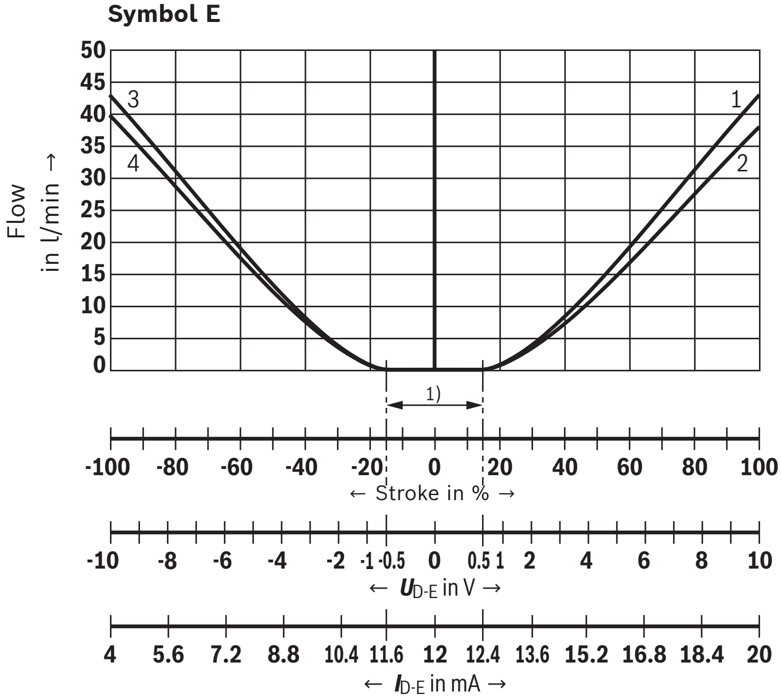
Characteristic curves: Size 10
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Pressure/signal characteristic curve (symbol V)



Flow/signal function (rated flow 50 l/min with Δp = 5 bar/control edge)

Symbol E



[1] Step compensation

1 P–A

2 B–T

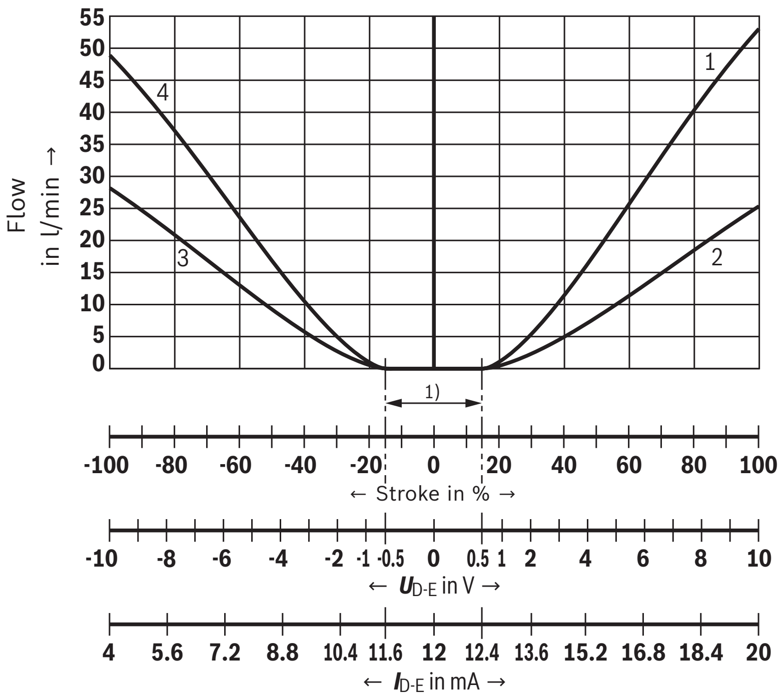
3 P–B

4 A–T

Characteristic curves: Size 10
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/signal function (rated flow 50 l/min with Δp = 5 bar/control edge)

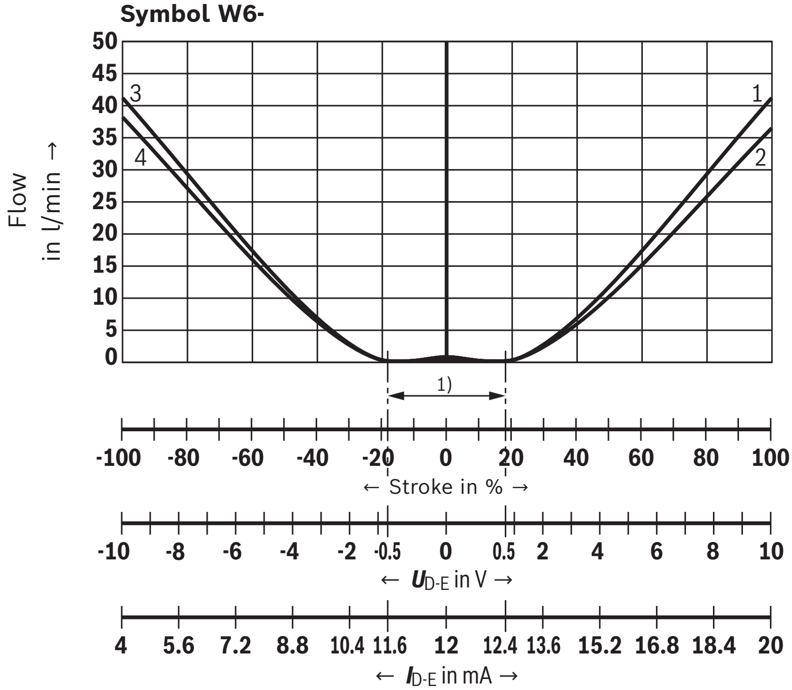
Symbol E1-



1) Step compensation

1 P–A
2 B–T
3 P–B
4 A–T

Symbol W6-

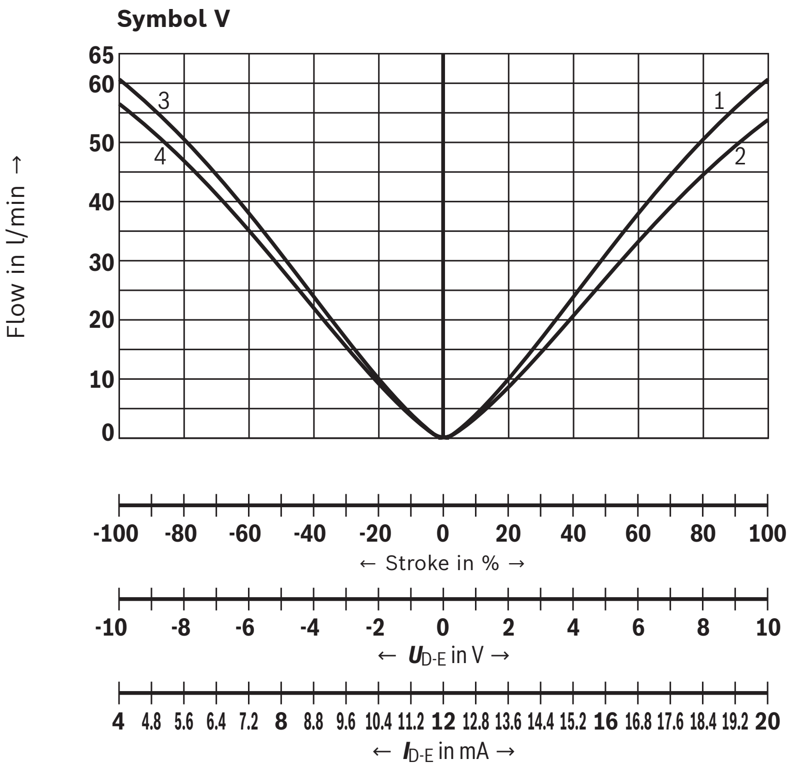


1) Step compensation

1 P–A
2 B–T
3 P–B
4 A–T

Characteristic curves: Size 10
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/signal function (rated flow 50 l/min with Δp = 5 bar/control edge)

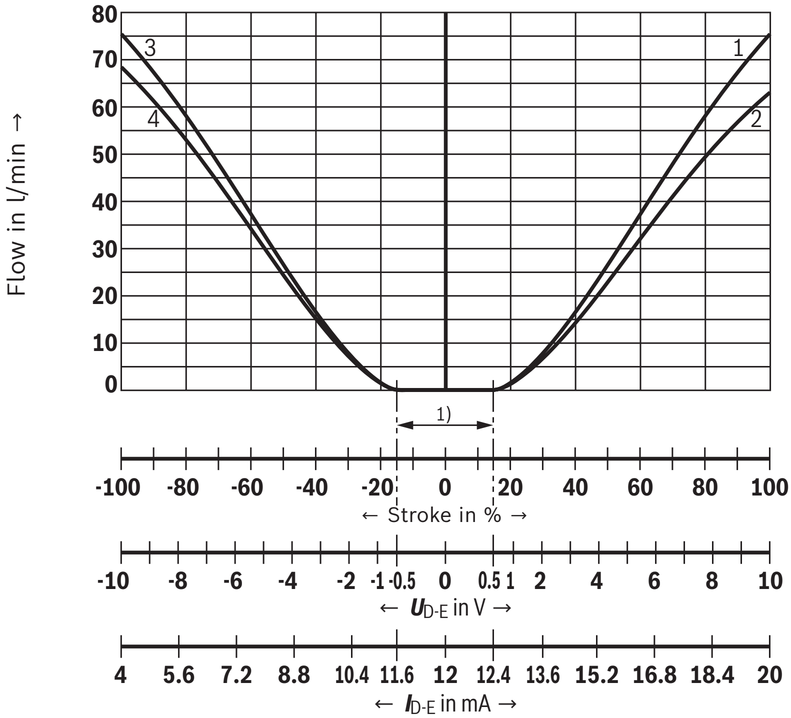


1 P–A
2 B–T
3 P–B
4 A–T

Characteristic curves: Size 10
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/signal function (rated flow 80 l/min with Δp = 5 bar/control edge)

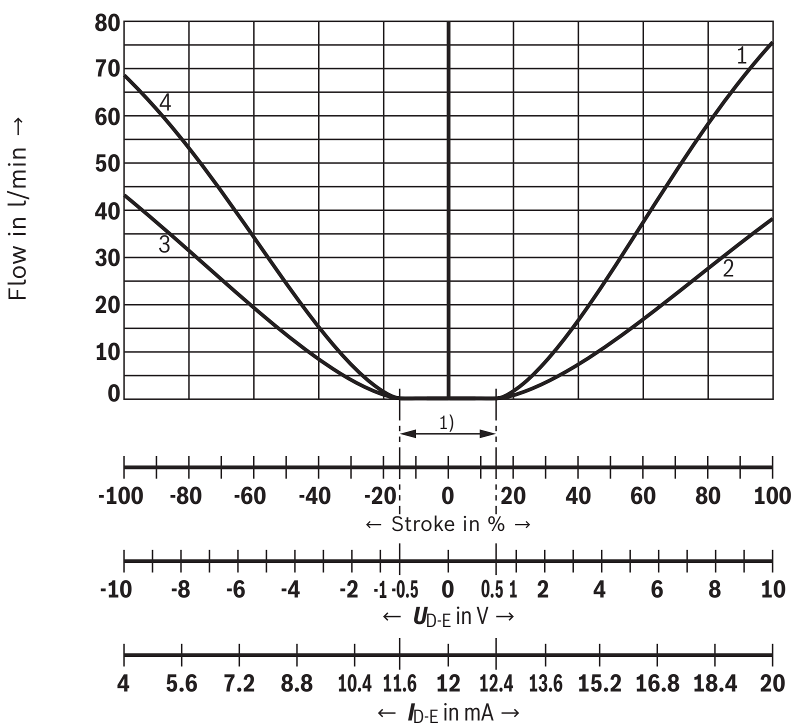
Symbol E



1) Step compensation

1 P–A
2 B–T
3 P–B
4 A–T

Symbol E1-



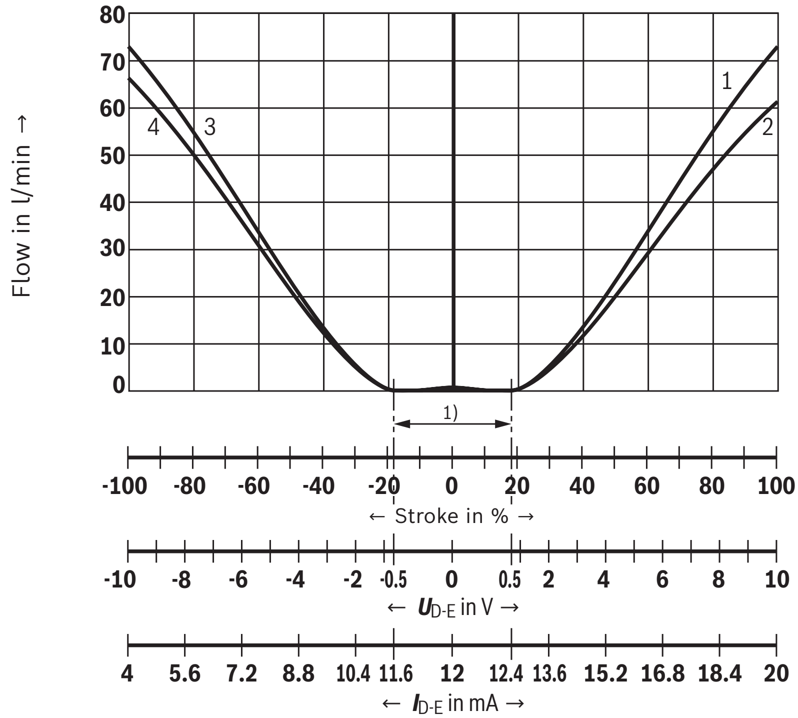
1) Step compensation

1 P–A
2 B–T
3 P–B
4 A–T

Characteristic curves: Size 10
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/signal function (rated flow 80 l/min with Δp = 5 bar/control edge)

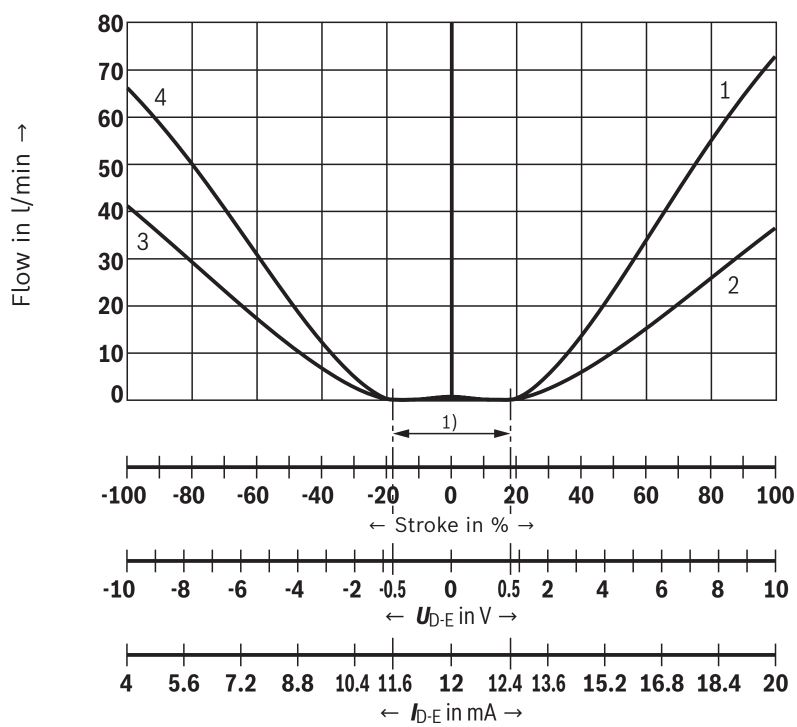
Symbol W6-



1) Step compensation

1 P–A
2 B–T
3 P–B
4 A–T

Symbol W8-



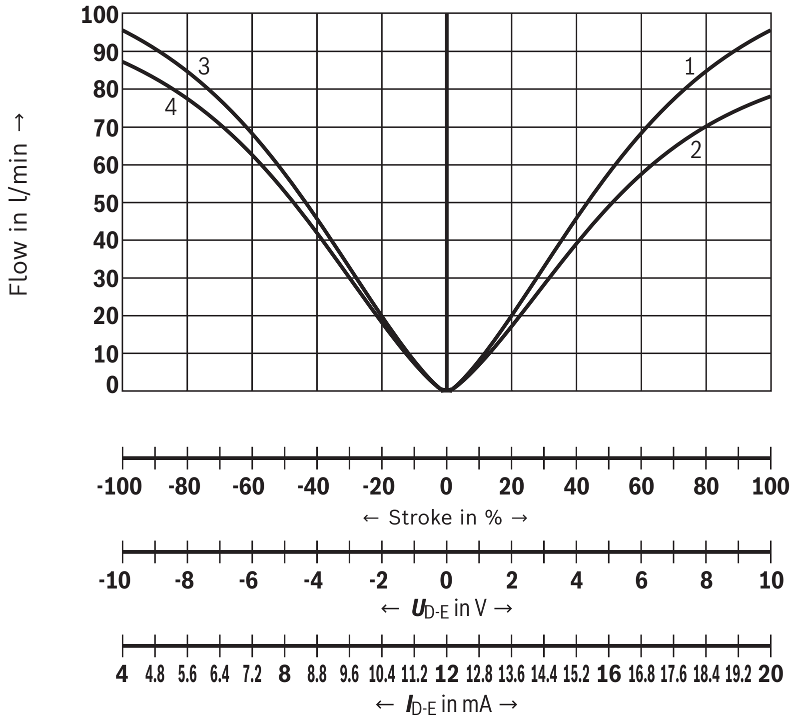
1) Step compensation

1 P–A
2 B–T
3 P–B
4 A–T

Characteristic curves: Size 10
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

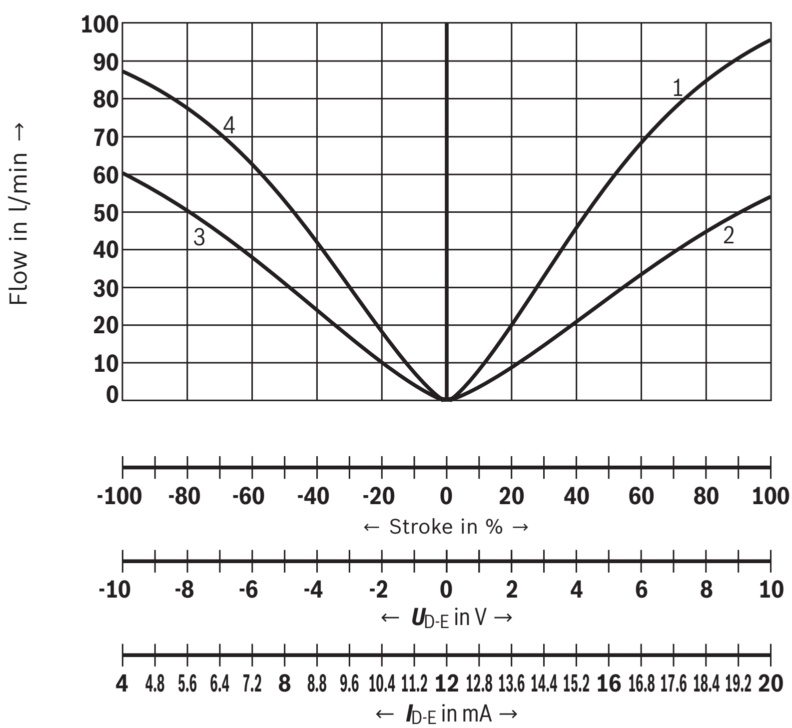
Flow/signal function (rated flow 80 l/min with Δp = 5 bar/control edge)

Symbol V



1 P–A
2 B–T
3 P–B
4 A–T

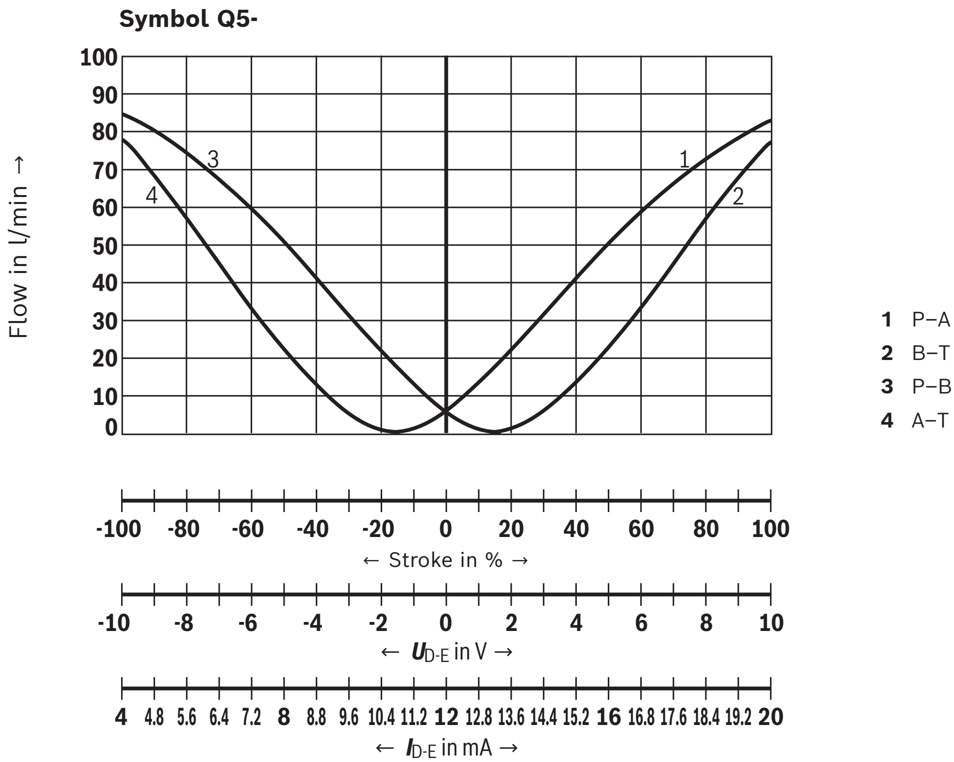
Symbol V1-



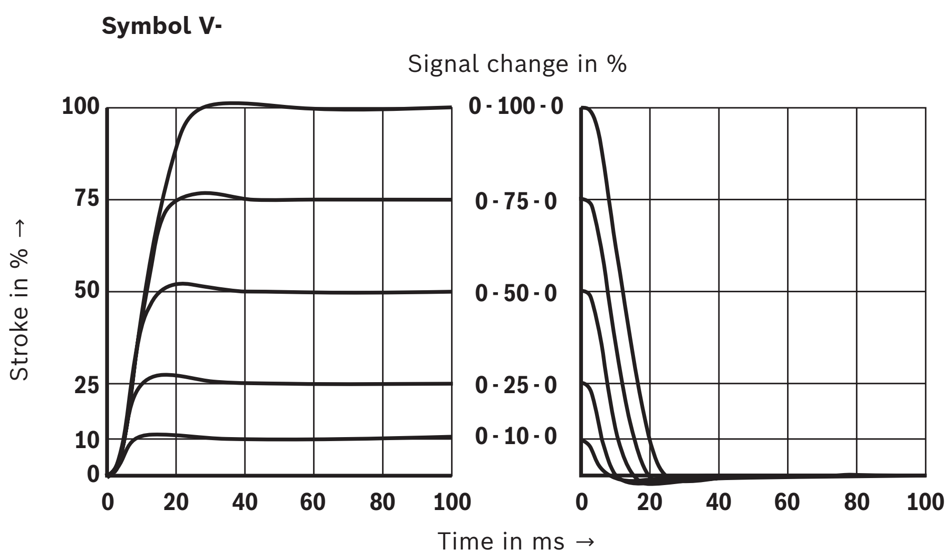
1 P–A
2 B–T
3 P–B
4 A–T

Characteristic curves: Size 10
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/signal function (rated flow 80 l/min with Δp = 5 bar/control edge)

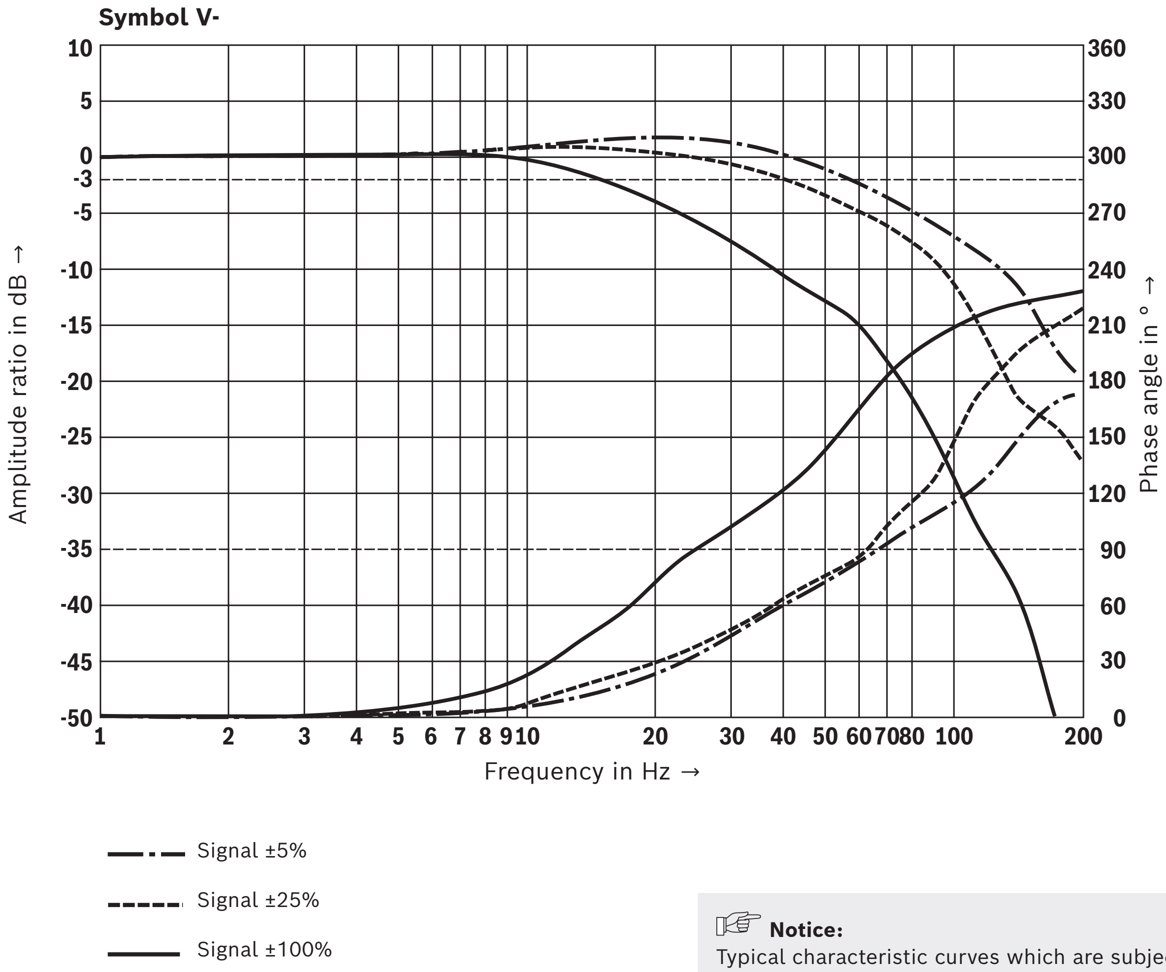


Transition function with stepped electric input signals



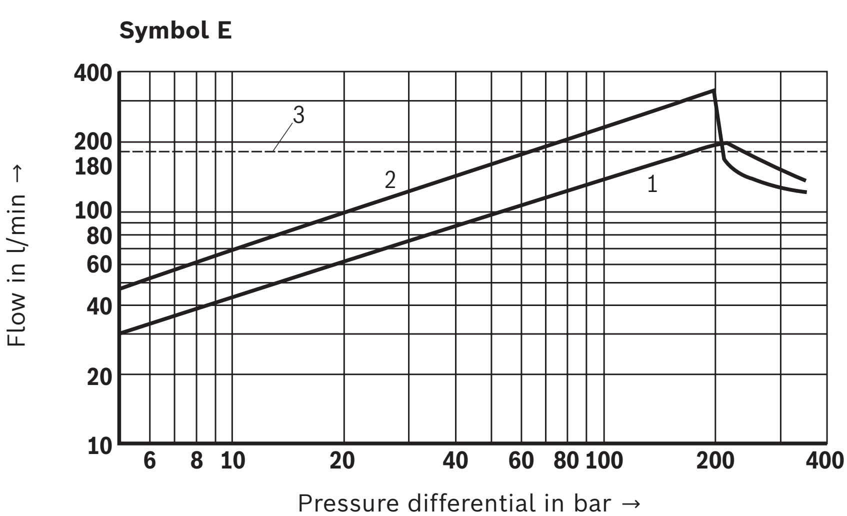
Characteristic curves: Size 10
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Frequency response characteristic curves



Notice:
Typical characteristic curves which are subject to tolerance variation.

Flow/load function with maximum valve opening (tolerance ±10%) (4/3-way version)

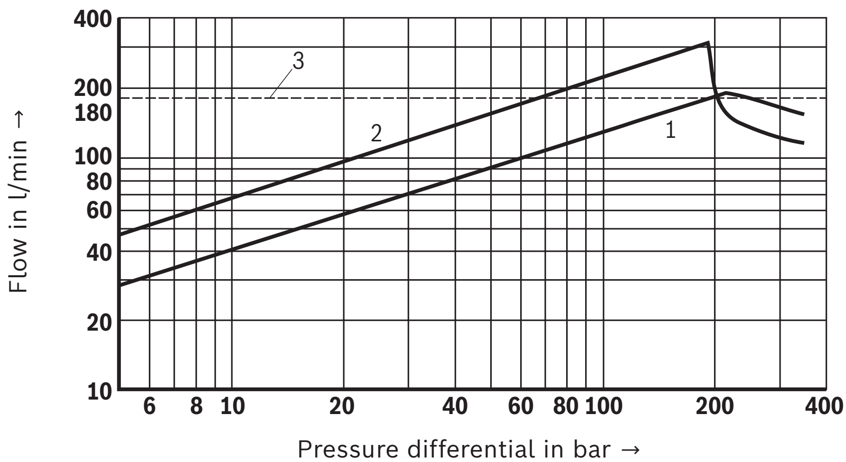


1 50 l/min (summated edge)
2 80 l/min (summated edge)
3 Recommended flow limitation

Characteristic curves: Size 10
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

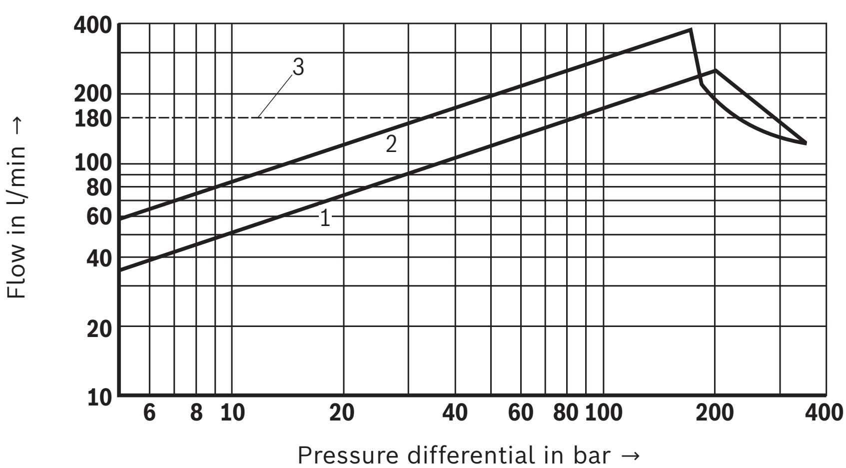
Flow/load function with maximum valve opening (tolerance ±10%) (4/3-way version)

Symbol W6-



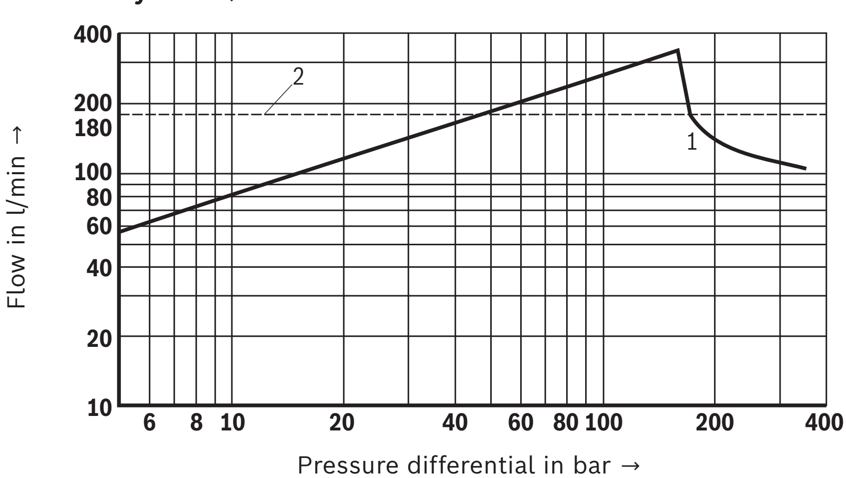
1 50 l/min (summated edge)
2 80 l/min (summated edge)
3 Recommended flow limitation

Symbol V-



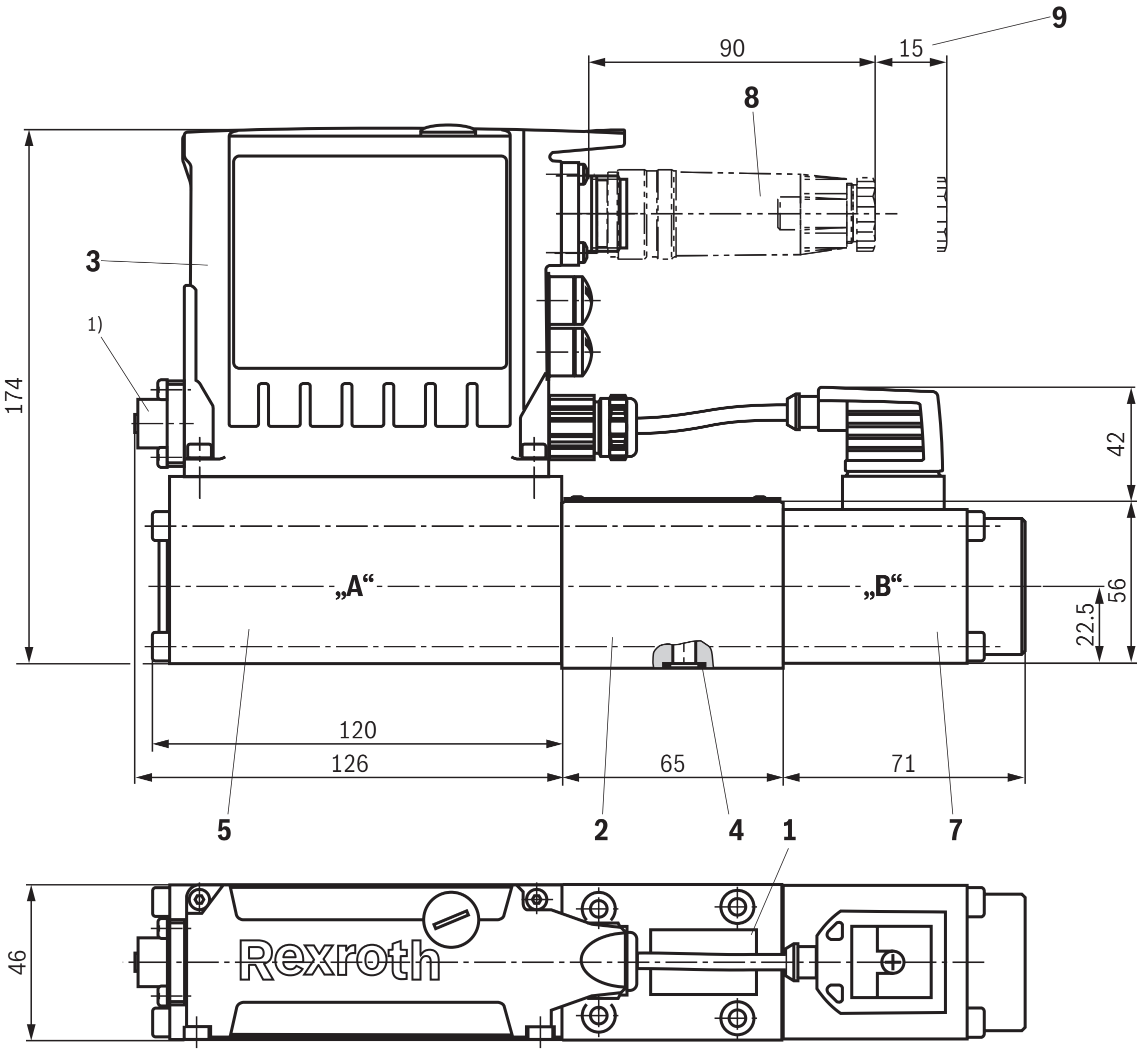
1 50 l/min (summated edge)
2 80 l/min (summated edge)
3 Recommended flow limitation

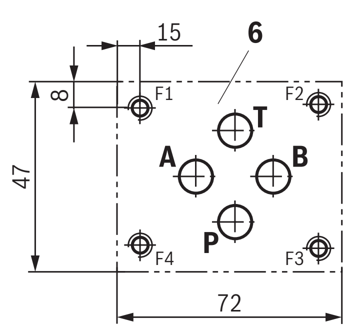
Symbol Q5-

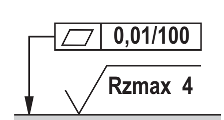


1 80 l/min (summated edge)
2 Recommended flow limitation

Dimensions: Size 6 – versions "00..D90" and "00..D95" (dimensions in mm)







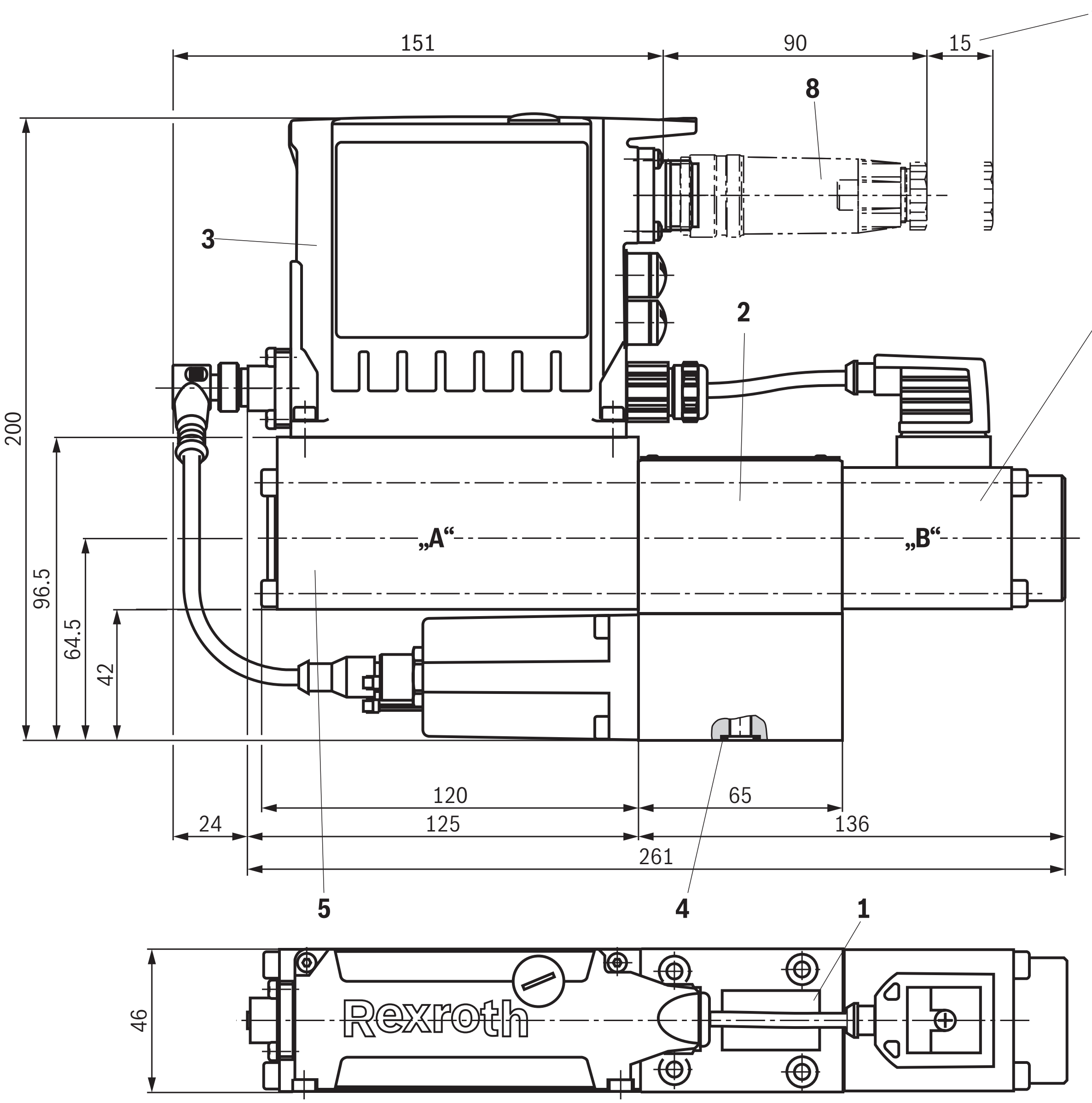
Required surface quality of the valve contact surface

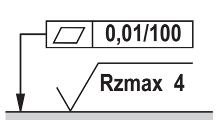
Notes:
- The dimensions are nominal dimensions which are subject to tolerances.
- Mating connectors, separate order, see page 38 and data sheet 08006.

For item explanations, valve mounting screws and **subplates,** see page 37.

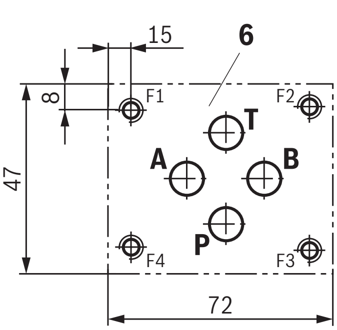
1) Version "00..D95" only

Dimensions: Size 6 – versions "GA..D90", "GB..D90" and "GC..D90" (dimensions in mm)





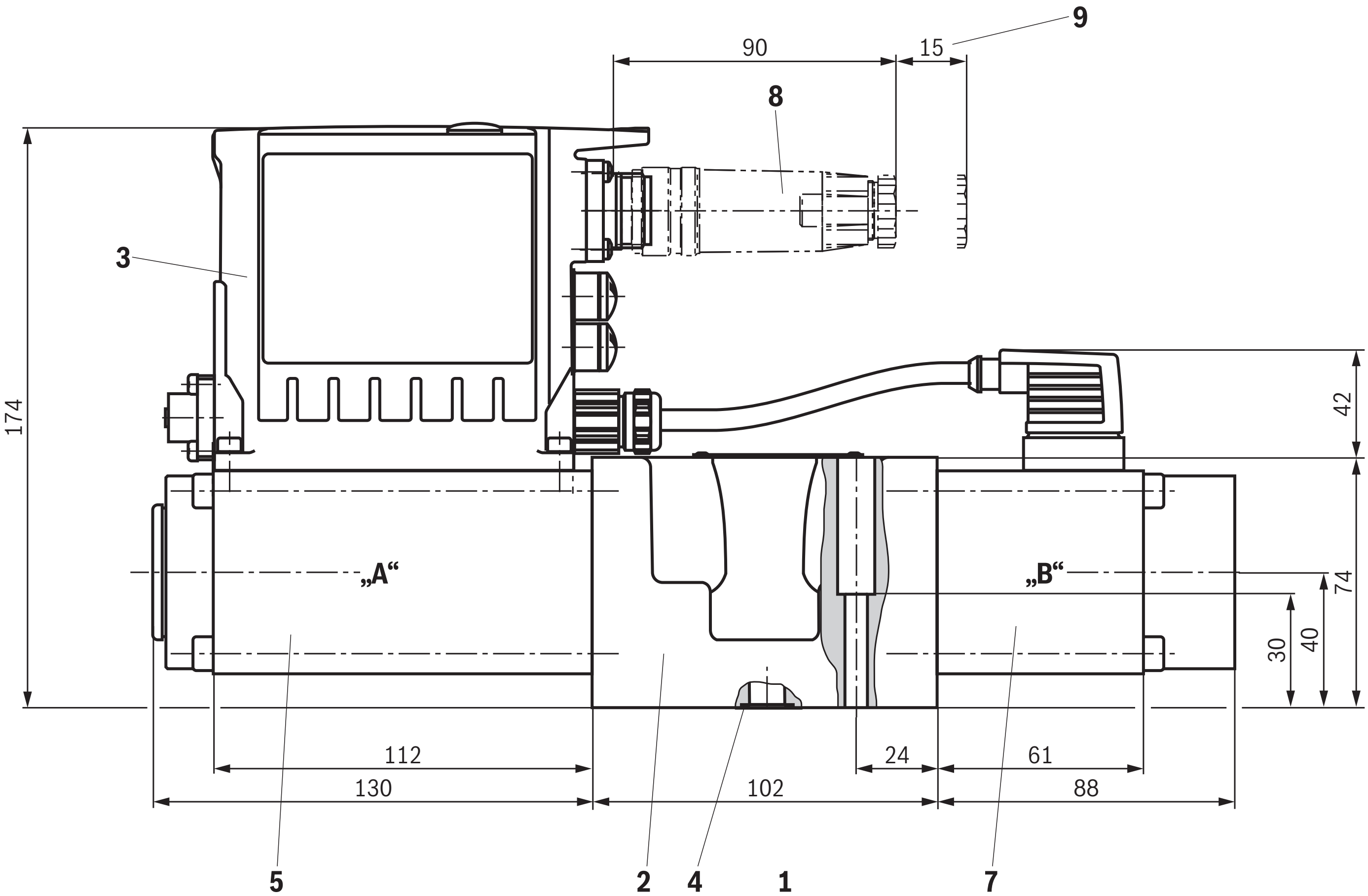
Required surface quality of the valve contact surface

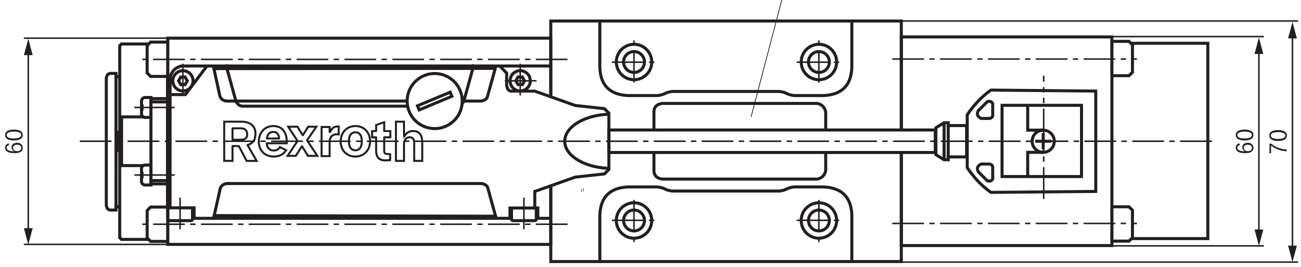


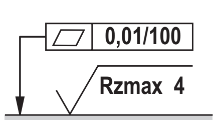
Notes:
- The dimensions are nominal dimensions which are subject to tolerances.
- Mating connectors, separate order, see page 38 and data sheet 08006.

For item explanations, valve mounting screws and **subplates,** see page 37.

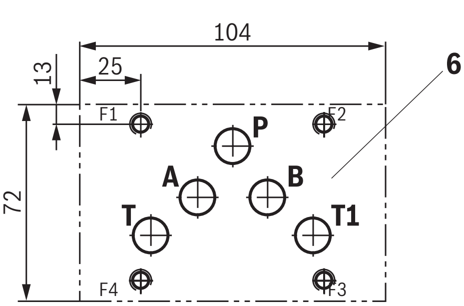
Dimensions: Size 10 – versions "00..D90" and "00..D95" (dimensions in mm)







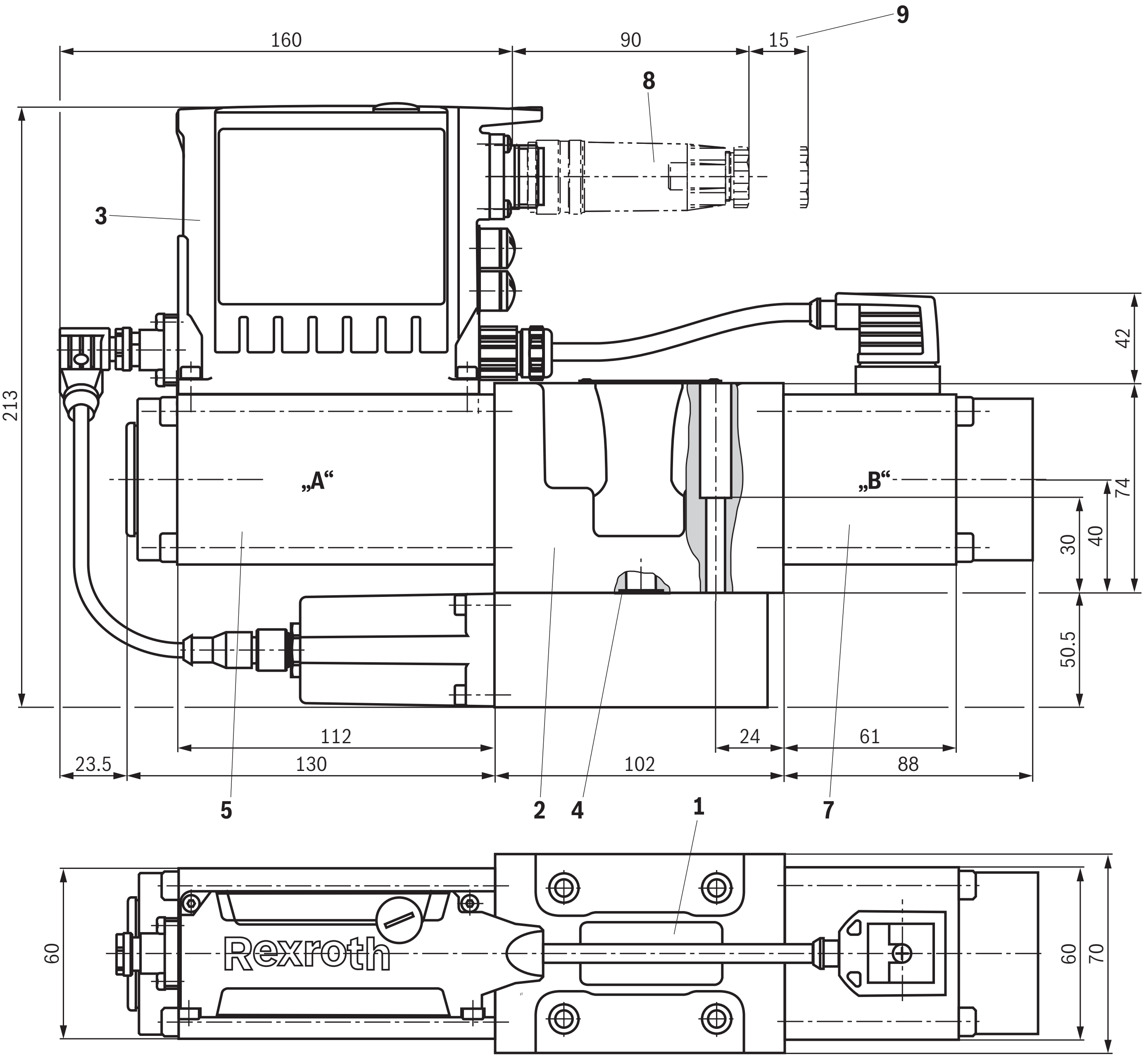
Required surface quality of the valve contact surface

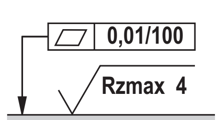


☞ **Notes:**
- The dimensions are nominal dimensions which are subject to tolerances.
- Mating connectors, separate order, see page 38 and data sheet 08006.

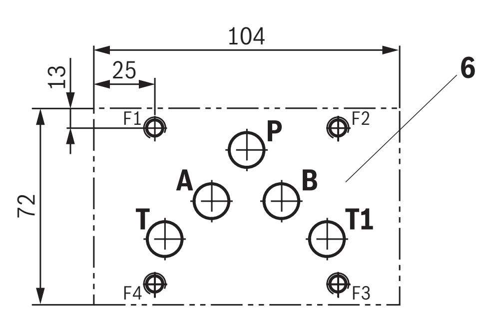
For item explanations, valve mounting screws and **subplates,** see page 37.

Dimensions: Size 10 – versions "GA..D90", "GB..D90" and "GC..D90" (dimensions in mm)





Required surface quality of the valve contact surface



☞ **Notes:**
- The dimensions are nominal dimensions which are subject to tolerances.
- Mating connectors, separate order, see page 38 and data sheet 08006.

For item explanations, valve mounting screws and **subplates,** see page 37.

Dimensions

1 Name plate
2 Valve housing
3 Integrated digital control electronics
4 Identical seal rings for ports A, B, P, T, T1
5 Control solenoid with position transducer
6 Machined valve contact surface, porting pattern according to ISO 4401-03-02-0-05 (NG6) and ISO 4401-05-04-0-05 (NG10)
7 Stroke solenoid
8 Mating connectors, separate order, see page 38 and data sheet 08006.
9 Space required for removing the mating connector

Valve mounting screws (separate order)

Size	Version	Quantity	Hexagon socket head cap screws	Material number
6	"00..D90", "00..D95"	4	**ISO 4762 - M5 x 30 - 10.9-CM-Fe-ZnNi-5-Cn-T0-H-B** Friction coefficient μ_{total} = 0.09 … 0.14; tightening torque M_A = 7 Nm ±10%	**R913048086**
		or		
		4	**ISO 4762 - M5 x 30 - 10.9** Tightening torque M_A = 8.9 Nm ±10%	Not included in the Rexroth delivery range
	"GA..D90", "GB..D90", "GC..D90"	4	**ISO 4762 - M5 x 70 - 10.9-CM-Fe-ZnNi-5-Cn-T0-H-B** Friction coefficient μ_{total} = 0.09 … 0.14; tightening torque M_A = 8.9 Nm ±10%	**R913043762**
		or		
		4	**ISO 4762 - M5 x 70 - 10.9** Tightening torque M_A = 8.9 Nm ±10%	Not included in the Rexroth delivery range
10	"00..D90", "00..D95"	4	**ISO 4762 - M6 x 40 - 10.9-CM-Fe-ZnNi-5-Cn-T0-H-B** Friction coefficient μ_{total} = 0.09 … 0.14; tightening torque M_A = 12.5 Nm ±10%	**R913051533**
		or		
		4	**ISO 4762 - M6 x 40 - 10.9** Tightening torque M_A = 15.5 Nm ±10%	Not included in the Rexroth delivery range
	"GA..D90", "GB..D90", "GC..D90"	4	**ISO 4762 - M6 x 80 - 10.9-CM-Fe-ZnNi-5-Cn-T0-H-B** Friction coefficientμ_{total} = 0.09 … 0.14; tightening torque M_A = 13 Nm ±10%	**R913049927**
		or		
		4	**ISO 4762 - M6 x 80 - 10.9** Tightening torque M_A = 13 Nm ±10%	Not included in the Rexroth delivery range

☞ **Notice:**
The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure.

Subplates (separate order) with porting pattern according to ISO 4401, see data sheet 45100.

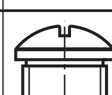
Accessories (separate order)

Mating connectors and cable sets

Port	Designation	Version	Short designation	Material number	Data sheet
XH1	Mating connector; for valves with round connector, 6-pole + PE	Straight, metal	7PZ31...M	**R900223890**	08006
		Straight, plastic	7PZ31...K	**R900021267**	
		Angled, plastic	–	**R900217845**	–
	Cable sets; for valves with round connector, 6-pole + PE	Plastic, 3.0 m	7P Z31 BF6	**R901420483**	08006
		Plastic, 5.0 m		**R901420491**	
		Plastic, 10.0 m		**R901420496**	
		Plastic, 20.0 m	–	**R901448068**	–
X7E1, X7E2	Cable set; shielded, 4-pole, D coding	Straight connector M12, on straight connector M12, line cross-section 0.25 mm^2, CAT 5e, length freely selectable (= xx.x)	–	**R911172111** [1]	–
	Cable set; shielded, 4-pole	Straight connector M12, on straight connector RJ45, line cross-section 0.25 mm^2, CAT 5e, length freely selectable (= xx.x)	–	**R911172135** [2]	–
X2N [3]	Cable set; shielded, 5-pole, for connecting Rexroth pressure sensors, type HM20, A coding	PUR/PVC, straight connector M12, on straight socket M12, line cross-section 0.34 mm^2, 0.6 m	–	**R901111709**	–
		PUR/PVC, straight connector M12, on straight socket M12, line cross-section 0.34 mm^2, 1.0 m	–	**R901111712**	–
		PUR/PVC, straight connector M12, on straight socket M12, line cross-section 0.34 mm^2, 2.0 m	–	**R901111713**	–
	Cable set; shielded, 5-pole, A coding	Straight connector M12, on free line end, line cross-section 0.34 mm^2, 1.5 m	–	**R901111752**	–
		Straight connector M12, on free line end, line cross-section 0.34 mm^2, 3.0 m	–	**R901111754**	–
		Straight connector M12, on free line end, line cross-section 0.34 mm^2, 5.0 m	–	**R901111756**	–
		Straight connector M12, on free line end, line cross-section 0.34 mm^2, 10.0 m	–	**R913005147**	–

1) Additional indication of type designation RKB0040/xx.x
2) Additional indication of type designation RKB0044/xx.x
3) Only with connection of an external sensor, type HM20

Protective cap

Protective cap M12	**Version**	**Material number**
		**R901075563**

Parameterization

The following is required for the parameterization with PC		**Material number/download**
1 Commissioning software	IndraWorks, Indraworks D, Indraworks DS	
2 Connection cable, 3 m	Shielded, M12 on RJ45, length can be freely selected (= xx.x)	**R911172135** (additional indication of type designation RKB0044/xx.x)

Project planning and maintenance instructions

- The supply voltage must be permanently connected; otherwise, bus communication is not possible.
- If electro-magnetic interference is to be expected, take appropriate measures to ensure the function (depending on the application, e.g. shielding, filtration).
- The devices have been tested in the plant and are supplied with default settings.
- Only complete devices can be repaired. Repaired devices are returned with default settings. User-specific settings will not be applied. The machine end-user will have to retransfer the corresponding user parameters.

Further information

▶ Subplates	Data sheet 45100
▶ Hydraulic fluids on mineral oil basis	Data sheet 90220
▶ Environmentally compatible hydraulic fluids	Data sheet 90221
▶ Flame-resistant, water-free hydraulic fluids	Data sheet 90222
▶ Flame-resistant hydraulic fluids - containing water (HFAE, HFAS, HFB, HFC)	Data sheet 90223
▶ Reliability characteristics according to EN ISO 13849	Data sheet 08012
▶ Hexagon socket head cap screw, metric/UNC	Data sheet 08936
▶ Installation, commissioning and maintenance of servo valves and high-response valves	Data sheet 07700
▶ General product information on hydraulic products	Data sheet 07008
▶ High-response/proportional valve with Multi-Ethernet interface	Data sheet 29391-B
▶ Hydraulic valves for industrial applications	Data sheet 07600-B
▶ Assembly, commissioning and maintenance of hydraulic systems	Data sheet 07900
▶ Operation fieldbus electronics (xx = software version):	
– Functional description Rexroth HydraulicDrive HDx-20	30338-FK
– Parameter description Rexroth HydraulicDrive HDS-16, HDx-17 ... 20	30330-PA
– Description of diagnosis Rexroth HydraulicDrive HDS-16, HDx-17 ... 20	30330-WA
▶ Selection of filters	
▶ Information on available spare parts	
▶ "IFB" hydraulic field bus valves	

The Drive & Control Company

Rexroth
Bosch Group

Directional control valve, direct operated, with integrated fieldbus (IFB Multi-Ethernet)

Type 4WRPFH

RE 29395
Edition: 2019-07

H8148+8149+8150

- Size 6
- Component series 3X
- Maximum operating pressure 350 bar
- Rated flow 40 l/min (***Δp*** = 70 bar)

Features

- Open
  - Integrated fieldbus (IFB Multi-Ethernet)
  - Bus connection/service interface (Sercos, EtherCAT, EtherNet/IP, PROFINET RT, POWERLINK, VARAN)
- Scalable
  - 2 configurable analog pressure sensor inputs
- Safe
  - Internal safety function (can be used up to category 4/PL e according to EN 13849-1)
  - CE conformity according to EMC Directive 2014/30/EU
- Precise
  - Integrated pressure/force control, optional
  - High response sensitivity and low hysteresis

Contents

Ordering code

01	02	03	04	05	06	07	08	09		10		11	12	13		14	15	16	17	18
4	**WRP**	**F**	**H**	**6**		**B**			**–**	**3X**	**/**				**/**	**24**		**D9**		

01	4 main ports	**4**

02	Directional control valve	**WRP**

03	With integrated fieldbus	**F**

04	Control spool/sleeve	**H**

05	Size 6	**6**

06	Symbols e.g. C, C1 etc.; for possible version, see page 3	

07	Installation side of the inductive position transducer	**B**

Rated flow at 70 bar pressure differential (35 bar/control edge)

08		Flow characteristic			
		"L"	**"P"** (inflection 40 %)	**"P"** (inflection 60 %)	
	2 l/min	✓	–	–	**02**
	4 l/min	✓	✓	–	**04**
	12 l/min	✓	–	–	**12**
	15 l/min	–	–	✓	**15**
	24 l/min	✓	–	–	**24**
	25 l/min	–	–	✓	**25**
	40 l/min	✓	✓	–	**40**

Flow characteristic

09	Linear	**L**
	Inflected characteristic curve (inflection 60 % for size 6 with rated flows **"15"** and **"25"**, otherwise inflection 40 %)	**P**

10	Component series 30 … 39 (30 … 39: unchanged installation and connection dimensions)	**3X**

Seal material (observe compatibility of seals with hydraulic fluid used, see page 8)

11	NBR seals	**M**
	FKM seals	**V**

Pressure sensor (pressure rating)

12	Without pressure rating	**0**
	Pressure rating 280 bar	**G**

Internal pressure sensor (position)

13	Without internal pressure sensors	**0**
	In port A	**A**
	In port B	**B**
	In ports A and B	**C**

14	Supply voltage 24 V	**24**

Ethernet interface

15	EtherNET/IP	**E**
	PROFINET RT	**N**
	Sercos	**S**
	EtherCAT (CANopen profile)	**T**
	POWERLINK (CANopen profile)	**W**
	VARAN	**V**

Ordering code

01	02	03	04	05	06	07	08	09		10		11	12	13		14	15	16	17	18
4	**WRP**	**F**	**H**	**6**		**B**			**–**	**3X**	**/**				**/**	**24**		**D9**		

Connector

16	Voltage supply, enable acknowledgment	**D9**

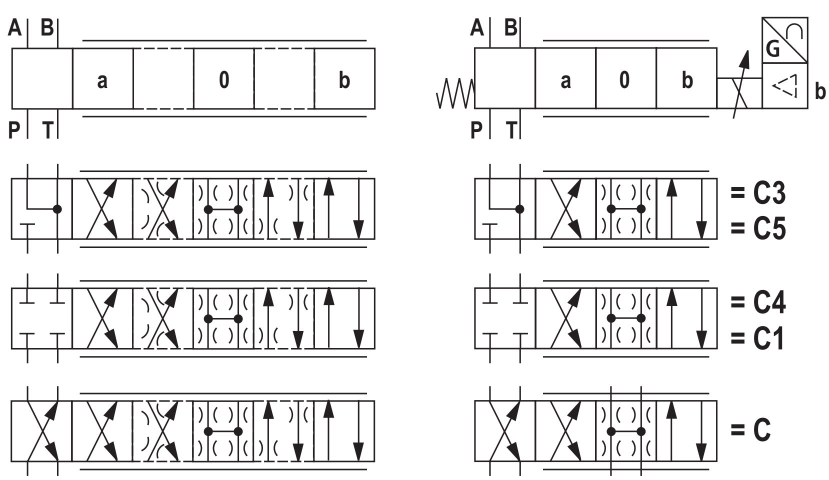
Pressure sensor interface

17	Without interface	**0**
	Analog, a maximum of 3 external pressure sensors (0 ... 10 VDC)	**5** [1]

18	For further details, see the plain text	*

[1] Only with version "0" at positions 12 and 13 ("4WRPFH 6 .B..-3X/.**00**/24.D95")

Symbols



With symbols C5 and C1: [1]

P → A: $q_{V\,nom}$ B → T: $q_{V\,nom}/2$

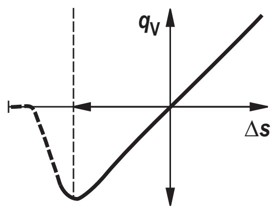
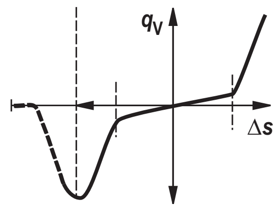
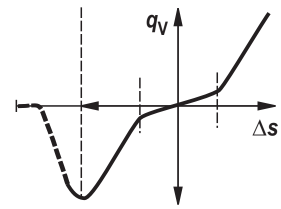
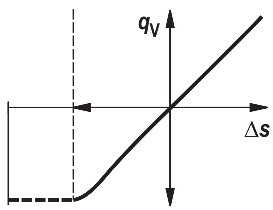
P → B: $q_{V\,nom}/2$ A → T: $q_{V\,nom}$

[1] Standard = 1:1, $q_{V\,nom}$ 2:1 from rated flow = 40 l/min (version "40")

Notice:
Representation according to DIN ISO 1219-1.
Hydraulic interim positions are shown by dashes.

Symbols

Flow characteristic

Symbol	**Linear characteristic curve** (version "L")	**Inflected characteristic curve** (version "P")	
		Inflection 60 % ($q_{V\ nom}$ = 15, 25 l/min)	Inflection 40 % ($q_{V\ nom}$ = 4, 40 l/min – size 6) ($q_{V\ nom}$ = 50, 100 l/min – size 10)
C3, C5 **C4, C1**			
C		–	–

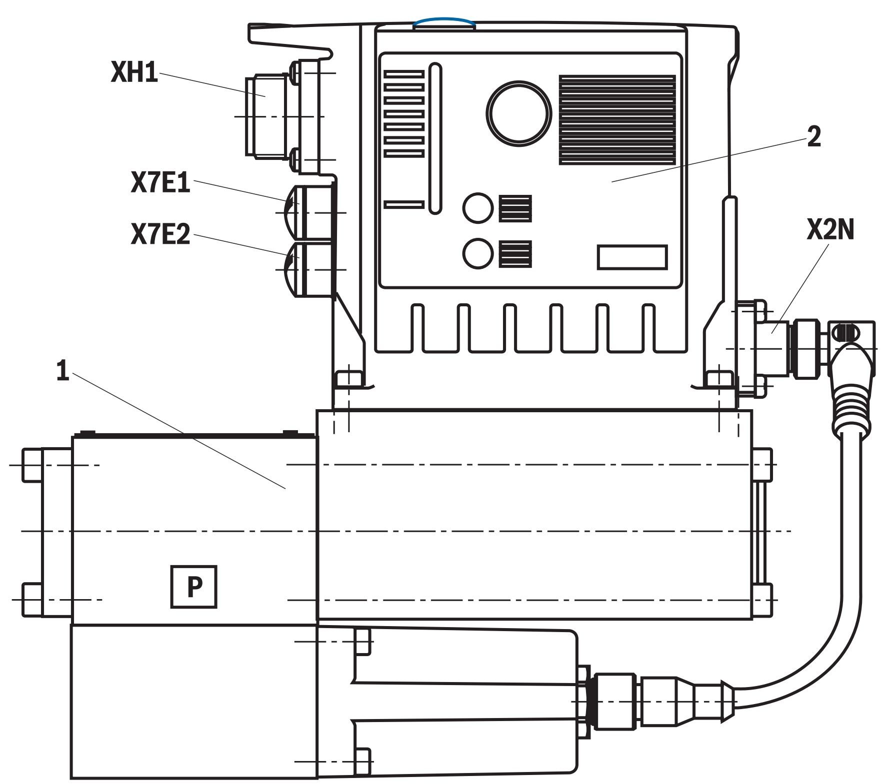
Function

General information
The **IFB Multi-Ethernet** valve (**I**ntegrated **F**ield**b**us) is a digital directional control valve with integrated fieldbus.

The following operating modes are possible:
- ▶ Standard:
  - – Valve direct control
  - – Flow control
- ▶ Version "5" or with internal pressure sensors:
  - – Pressure/force control
  - – Active damping
  - – Substitutional control (flow – pressure/force); pQ function (flow-controlled)

- ▶ Command value presetting is done purely digitally via the Ethernet interface (X7E1 or X7E2)
- ▶ The feedback information of the actual value signals to the superior control system is provided via the Ethernet interface (X7E1 or X7E2)
- ▶ The controller parameters are set via the Ethernet interface (X7E1 or X7E2)

Set-up
The directional control valve with IFB Multi-Ethernet electronics mainly consists of:
- ▶ Direct operated directional control valve (1) with control spool and sleeve in servo quality
- ▶ Integrated fieldbus (3) with:
  - – connector, voltage supply, safety shut-down (XH1)
  - – Ethernet interfaces (X7E1, X7E2)
  - – Analog sensor interfaces (X2N, optional)



Type 4WRPFH 6 ...G..D90

Function

Function

When the control solenoid of the valve is switched off (enable pin D, low signal), the spring-operated control spool is in the fail-safe position.
When the control solenoid is activated (enable pin D, high signal), the digital electronics (OBE) compares the specified command value to the position actual value.
In case of control deviations, the control of the solenoid is changed so as to be compensated. Due to the change in magnetic force, the control spool is adjusted against the spring. Stroke/control spool cross-section is regulated proportionally to the command value. In case of a command value presetting of 0, the electronics adjusts the control spool against the spring to central position. In deactivated condition, the spring is untensioned to a maximum and the valve is in fail-safe position.

Notice for safe shut-off according to EN 13849-1

(enable acknowledgment)
The enable acknowledgment is not set (pin C). If the supply voltage fails or in case of cable break, the integrated electronics (OBE) will de-energize the control solenoid and the control spool will move to the fail-safe position.
The enable acknowledgment is also not set if the control spool is not in a hydraulically safe position (insufficient safety overlap of the control spool).

Safety function

The integrated control electronics of the valve enables the additional shut-off of a channel according to EN 13849-1 in the direction P to A (depending on the application, the fail-safe position must be adhered to).
For this purpose, a suitable control system must be provided to perform the plausibility check between the direction-dependent valve signals "enable input" and "enable acknowledgment" (signal fed back by the valve).
It is not possible to switch off direction P→B in a safety-relevant manner according to EN 13849-1 (depending on valve type).

Monitoring

The digital control electronics enable comprehensive monitoring functions/error detection including:
- Undervoltage
- Communication error
- Cable break for analog sensor inputs
- Monitoring of the microcontroller (watchdog)
- Temperature of the integrated electronics

IndraWorks DS PC program

To implement the project planning task and to parameterize the valve, the user may use the IndraWorks DS engineering tool (see accessories):
- Project planning
- Parameterization
- Commissioning
- Diagnosis
- Comfortable administration of all data on a PC
- PC operating systems: Windows 7-10

☞ **Notice:**
4/3 directional control valves are only functional in the active control loop and do not have a leakage-free basic position when deactivated. Consequently, "external isolator valves" are required in many applications and must be taken into account regarding the switch-on/switch-off order.
While the electrical supply voltage is being switched off, the drive may be accelerated for a short time in functional direction P→B.

Technical data
(For applications outside these values, please consult us!)

General			
Installation position			Any
Ambient temperature range		°C	−20 ... +60
Storage temperature range		°C	+5 ... +40
Maximum storage time		years	1 (if the storage conditions are observed; refer to the operating instructions 07600-B)
Vibration resistance	▶ Sine test according to DIN EN 60068-2-6		10 ... 2000 Hz/maximum of 10 g/10 cycles/3 axes
	▶ Noise test according to DIN EN 60068-2-64		20 ... 200 0Hz/10 g_{RMS}/30 g peak/30 min./3 axes
	▶ Transport shock according to DIN EN 60068-2-27		15 g/11 ms/3 axes
Weight	▶ Versions "00..D90" and "00..D95"	kg	3.5
	▶ Versions "GA..D90", "GB..D90" and "GC..D90"	kg	4.8
Maximum relative humidity (no condensation)		%	95
Maximum surface temperature		°C	150
$MTTF_d$ value according to EN ISO 13849		years	150 (for further details, see operating instructions 29391-B)

Hydraulic								
Maximum operating pressure	▶ Ports A, B, P	bar	350					
	▶ Port T	bar	250					
Rated flow (***Δp*** = 35 bar per edge [1]))		l/min	2	4	12	15	24/25	40
Limitation of use (transition to fail-safe position)	▶ Symbols C3, C5	bar	350	350	350	350	350	160
	▶ Symbols C4, C1	bar	350	350	350	280	250	100
Leakage flow (at 100 bar)	▶ Linear characteristic curve "L"	cm³/min	< 150	< 180	< 300	–	< 500	< 900
	▶ Inflected characteristic curve "P"	cm³/min	–	–	–	< 180	< 300	< 450
Hydraulic fluid			See table page 8					
Viscosity range	▶ Recommended	mm²/s	20 ... 100					
	▶ Maximum admissible	mm²/s	10 ... 800					
Hydraulic fluid temperature range (flown-through)		°C	−20 ... +60					
Maximum admissible degree of contamination of the hydraulic fluid cleanliness class according to ISO 4406 (c)			Class 18/16/13 [2])					

1) Flow for deviating ***Δp***:

$$\boldsymbol{q}_x = \boldsymbol{q}_{Vnom} \times \sqrt{\frac{\Delta p_x}{35}}$$

2) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and simultaneously increases the life cycle of the components.

Technical data
(For applications outside these values, please consult us!)

Hydraulic fluid		**Classification**	**Suitable sealing materials**	**Standards**	**Data sheet**
Mineral oils		HL, HLP, HLPD, HVLP, HVLPD	NBR, FKM	DIN 51524	90220
Bio-degradable	▶ Insoluble in water	HETG	FKM	ISO 15380	90221
		HEES	FKM		
	▶ Soluble in water	HEPG	FKM	ISO 15380	
Flame-resistant	▶ Water-free	HFDU (glycol base)	FKM	ISO 12922	90222
		HFDU (ester base)	FKM		
		HFDR	FKM		
	▶ Containing water	HFC (Fuchs: Hydrotherm 46M, Renosafe 500; Petrofer: Ultra Safe 620; Houghton: Safe 620; Union: Carbide HP5046)	NBR	ISO 12922	90223

Important information on hydraulic fluids:
- For further information and data on the use of other hydraulic fluids, please refer to the data sheets above or contact us.
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.).
- The ignition temperature of the hydraulic fluid used must be 50 K higher than the maximum surface temperature.
- **Bio-degradable and flame-resistant – containing water:**
  If components with galvanic zinc coating (e.g. version "J3" or "J5") or parts containing zinc are used, small amounts of dissolved zinc may get into the hydraulic system and cause accelerated aging of the hydraulic fluid. Zinc soap may form as a chemical reaction product, which may clog filters, nozzles and solenoid valves - particularly in connection with local heat input.
- **Flame-resistant – containing water:**
  - Due to increased cavitation tendency with HFC hydraulic fluids, the life cycle of the component may be reduced by up to 30 % as compared to the use with mineral oil HLP. In order to reduce the cavitation effect, it is recommended – if possible specific to the installation – to back up the return flow pressure in ports T to approx. 20 % of the pressure differential at the component.
  - Dependent on the hydraulic fluid used, the maximum ambient and hydraulic fluid temperature must not exceed 50 °C.
    In order to reduce the heat input into the component, the command value profile is to be adjusted for proportional and high-response valves.

Static/dynamic		
Hysteresis	%	≤ 0.2
Manufacturing tolerance q_{Vmax}	%	≤ 10
Temperature drift	%/10 K	Zero shift < 0.25
Pressure drift	%/100 bar	Zero shift < 0.15
Zero compensation		Ex plant ±1 %

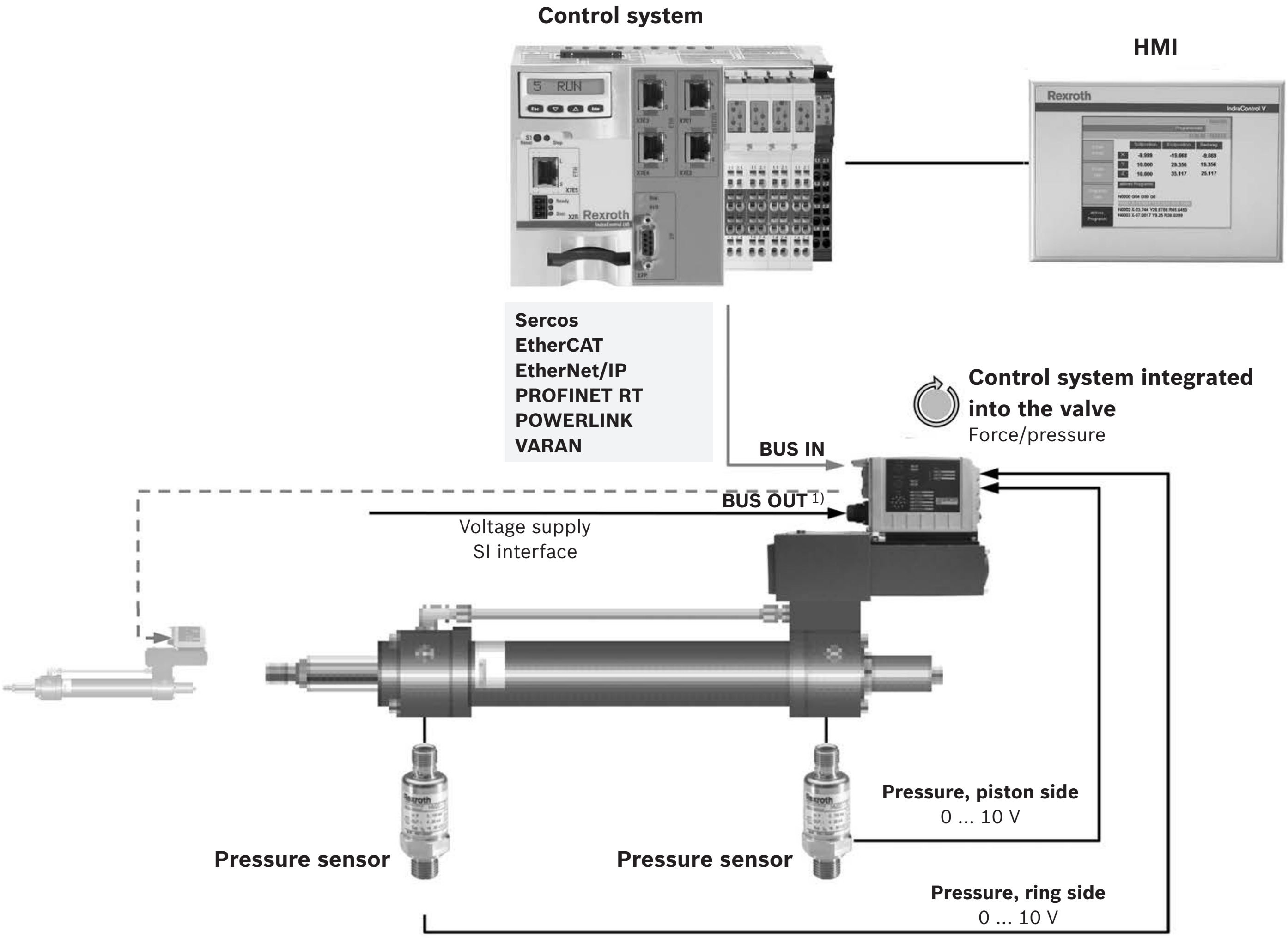
Technical data
(For applications outside these values, please consult us!)

Electrical, integrated electronics (OBE)				
Relative duty cycle			%	100 (continuous operation)
Protection class according to EN 60529				IP65 (If suitable and correctly mounted mating connectors are used)
Supply voltage [3]	▶ Nominal voltage		VDC	24
	▶ Lower limit value		VDC	18
	▶ Upper limit value		VDC	36
	▶ Maximum admissible residual ripple		Vpp	2.5 (comply with absolute supply voltage limit values)
Current consumption	▶ Maximum [4]		A	2.5
	▶ Impulse current		A	4
Maximum power consumption			W	40
AD/DA resolution	▶ Analog inputs			12 bit
Protective grounding conductor and screening				See connector pin assignment (CE-compliant installation) page 12
Required fuse protection, external			A	4, time-lag
Adjustment				Calibrated in the plant, see characteristic curves page 14 ... 15
Conformity				CE according to EMC Directive 2014/30/EU tested according to EN 61000-6-2 and EN 61000-6-3
Parameterization interface				Ethernet
Scan time pressure and force controller (minimum)			ms	0.5
Booting time			s	< 15
Switching input Enable XH1	▶ Quantity			1
	▶ Low level		V	−3 ... 5
	▶ High level		V	15 ... U_B
	▶ Current consumption at high level		mA	< 1
	▶ Reference potential			Pin 5
Switching output Enable acknowledgment XH1	▶ Quantity			1
	▶ Low level		V	0 ... 3
	▶ High level		V	15 ... U_B
	▶ Current carrying capacity		mA	50 (short-circuit-proof)
	▶ Signal delay time		ms	see operating instructions 29391-B
	▶ Reference potential			GND
Analog sensors X2N	▶ Quantity of voltage inputs			3 (version "5")
	▶ Supply voltage		V	24
	▶ Maximum supply current		mA	50
	▶ AD resolution		bit	12
	▶ Voltage inputs			
		– Measurement range	V	0 ... 10
		– Input resistance	kΩ	100 +10 %
		– Temperature drift		< 15 mV/10 K

3) Voltage limit values must be observed directly at the connector of the valve (observe line length and cable cross-section!)

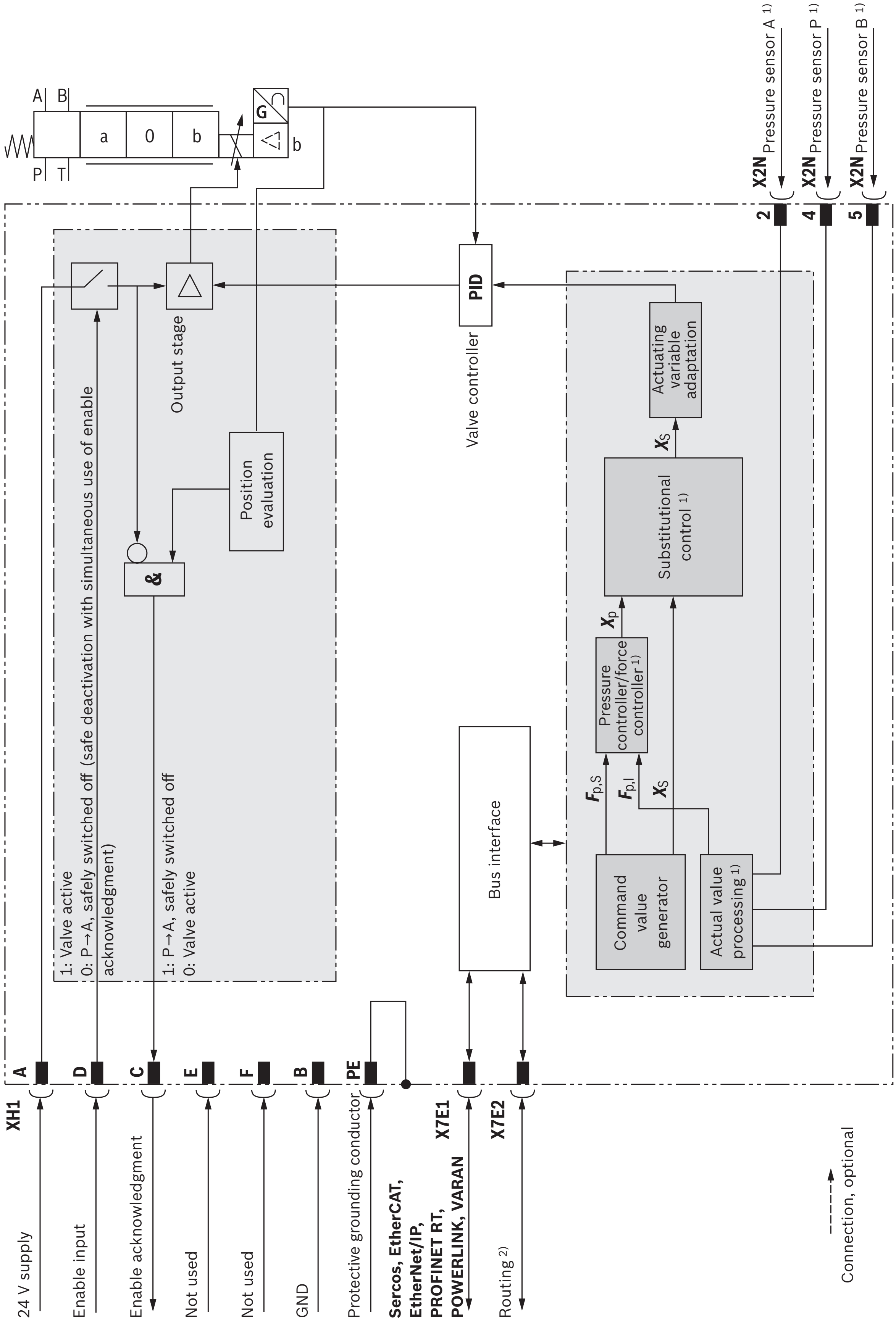
4) When using the sensor inputs or the switching output, the maximum current consumption will increase according to the external load

Representation of the IFB valve in the system network (version "5")



1) Not with "VARAN"

Block diagram/controller function block



1) Only with version "5"

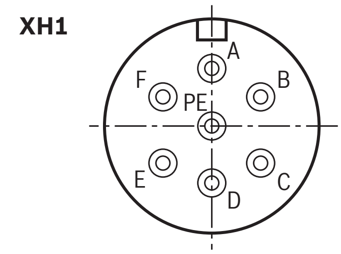
2) Not with "VARAN"

Detailed description of the safety function:
After the signal at the enable input has been removed, the output stage, and thus the solenoid of the valve, are internally separated from the available supply voltage. The enable acknowledgment will only be activated after the safe valve spool position has been achieved. For a detailed description of the safety function, refer to the operating instructions 29391-B.

Electrical connections, assignment

Connector pin assignment XH1, 6-pole + PE according to DIN 43563

Pin	Assignment of interface D9
A	24 VDC supply voltage [1]
B	GND
C	Enable acknowledgment 24 VDC (I_{max} 50 mA) [2] (high ≥ 15 V; low < 2 V)
D	Enable input 24 VDC (high ≥ 15 V; low < 2 V)
E	Not used
F	Not used
PE	Functional ground (connected directly to metal housing)

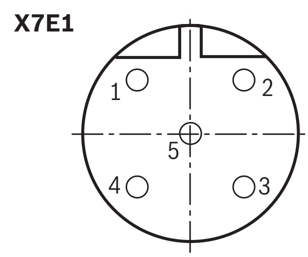


[1] A load increases the current consumption on pin A

[2] Enable acknowledgment is issued only if the valve has safely switched off according to EN 13849-1, see operating instructions 29391-B.

Connector pin assignment for Ethernet interfaces "X7E1" and "X7E2" (coding D), M12, 4-pole, socket

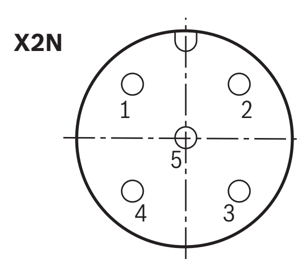
Pin	Assignment
1	TxD +
2	RxD +
3	TxD –
4	RxD –
5	Not used



Analog configurable sensor interface, port "X2N" (coding A), M12, 5-pole, socket

Pin	Assignment
1	+24 V voltage output
2	Analog sensor input 2 (0 ... 10 V)
3	GND
4	Analog sensor input 4 (0 ... 10 V)
5	Analog sensor input 3 (0 ... 10 V)

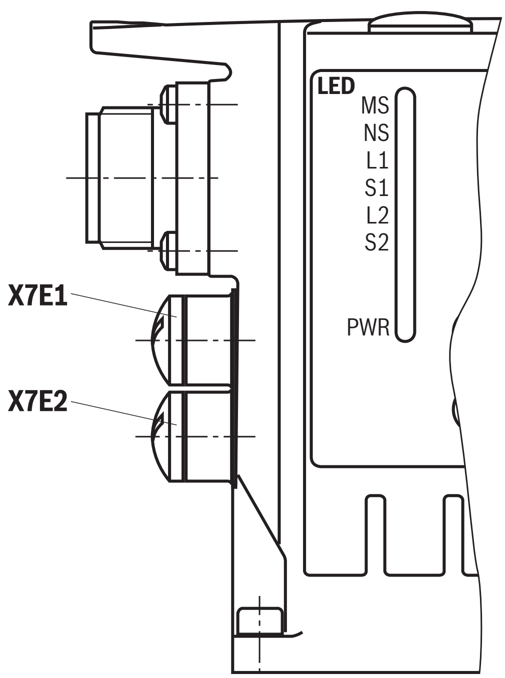
Only with version "5"



Notice:
- Reference potential for all signals: GND
- We recommend connecting the shields on both sides via the metal housings of the plug-in connectors.

LED displays

LED	Interface	Sercos	EtherNET/IP	EtherCAT	PROFINET RT	POWERLINK	VARAN
MS	**Electronics module**	Module status	Module status	Module status	Module status	Module status	Module status
NS		S	Network status and others	Network status and others	Network status and others	Status/error	Network status and others
L1	**X7E1**	Link and others	Link and others	Link/activity	Link and others	Link/data activity	Link and others
S1		Activity and others	Activity and others	Not used	Activity and others	Not used	Active and others
L2	**X7E2**	Link and others	Link and others	Link/activity	Link and others	Link/data activity	Not used
S2		Activity and others	Activity and others	Not used	Activity and others	Not used	Not used
PWR	**XH1**	Power	Power	Power	Power	Power	Power



Displays of the status LEDs

Power LED (LED PWR)	Display status
Off	No voltage supply
Green	Operation

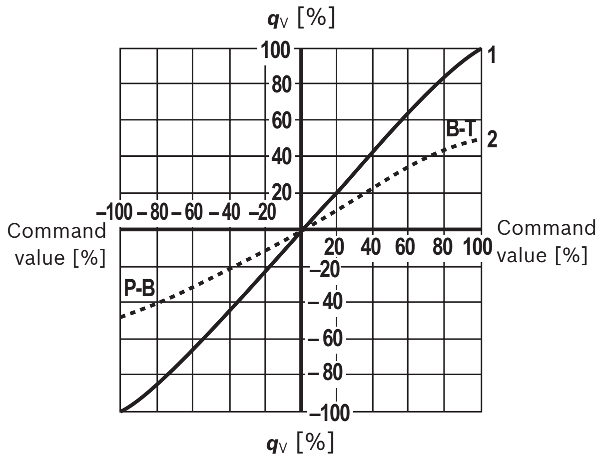
Module status LED (LED MS)	Display status
Off	No voltage supply
Green-red, flashing	Initialization
Green, flashing	Drive ready for operation
Green	Drive active
Orange, flashing	Warning
Red, flashing	Error
Green, rapidly flashing	Firmware must be loaded

Notice:
- For the connection to the M12 sockets, we recommend using self-locking mating connectors
- Module status LED MS relates to the electronics module
- The network status LED NS indicates the status of the control communication, see application description 30338-FK
- LEDs L1, S1, L2 and S2 relate to interfaces "X7E1" and "X7E2"
  - Link: Cable plugged in, connection established (permanently lit)
  - Activity: Data sent/received (flashing)
- For a detailed description of the diagnosis LEDs, please refer to the functional description Rexroth HydraulicDrive HDx.

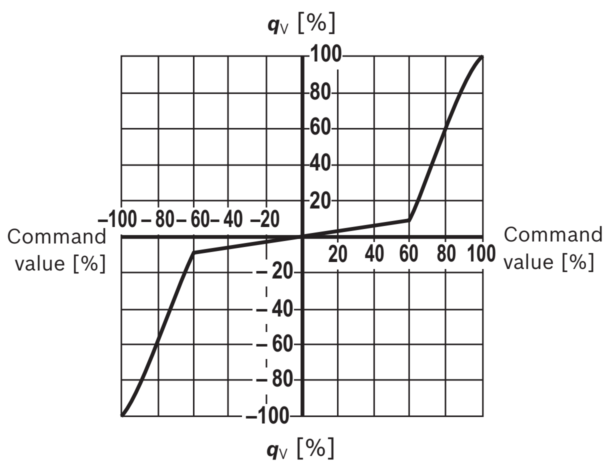
Characteristic curves: Flow characteristic (measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/signal function

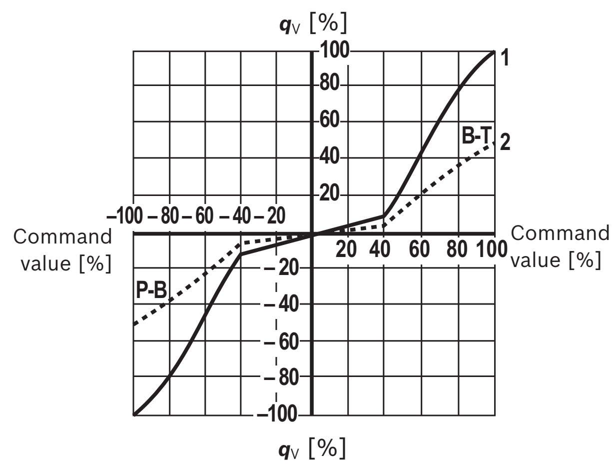
Linear characteristic curve "L"



Inflected characteristic curve "P", inflection at **60 %**

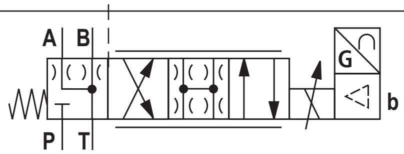
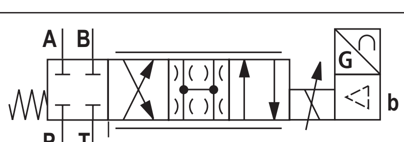


Inflected characteristic curve "P", inflection at **40 %**



1 $q_{vA} : q_{vB}$ = 1:1
2 $q_{vA} : q_{vB}$ = 2:1

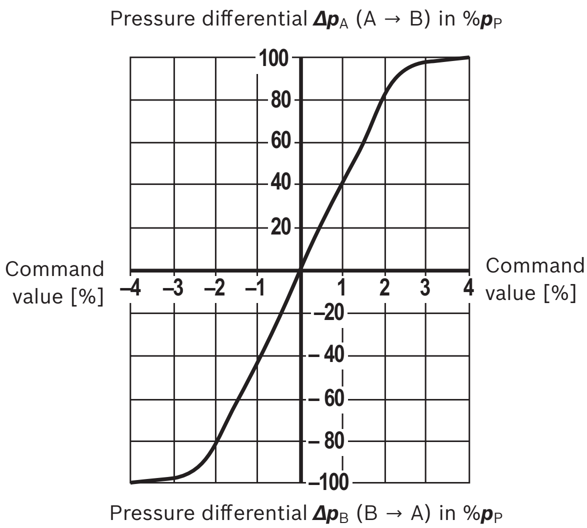
Fail-safe position

	Leakage flow at 100 bar	P→A P→B	50 cm³/min 70 cm³/min
	Flow at Δp = 35 bar	A→T B→T	10 ... 20 l/min 7 ... 20 l/min
	Leakage flow at 100 bar	P→A P→B	50 cm³/min 70 cm³/min
		A→T B→T	70 cm³/min 50 cm³/min
Fail-safe ←	p = 0 bar → 7 ms p = 100 bar → 10 ms	Enable "off" or internal shut-off if an error has occurred U_B ≤ 18 V or I ≤ 2 mA (with 4 ... 20 mA signal, cable break detection: current threshold configurable)	

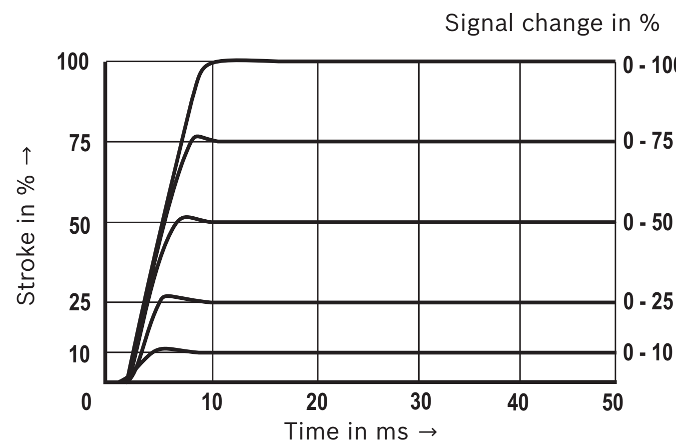
Characteristic curves

(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

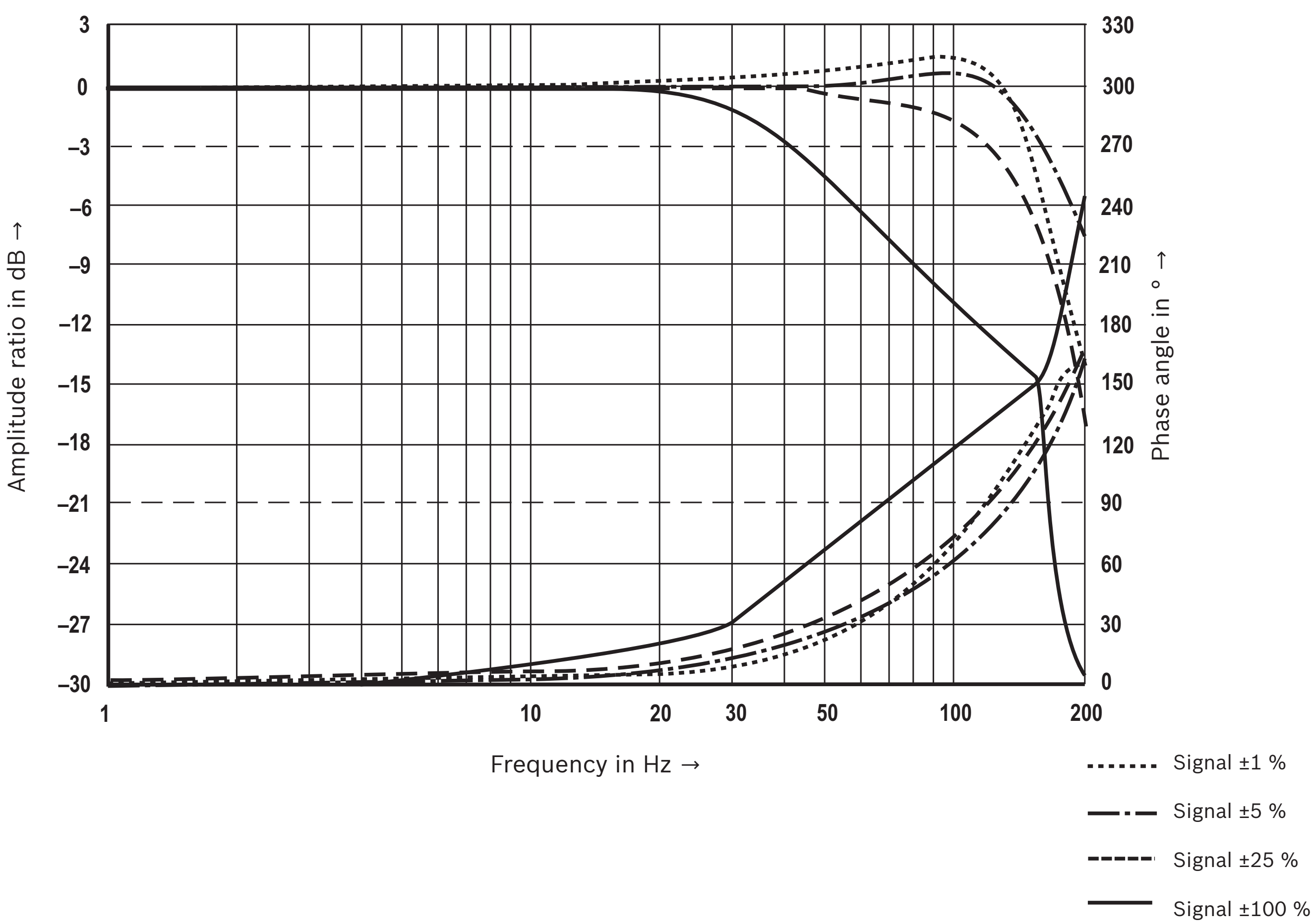
Pressure/signal characteristic curve



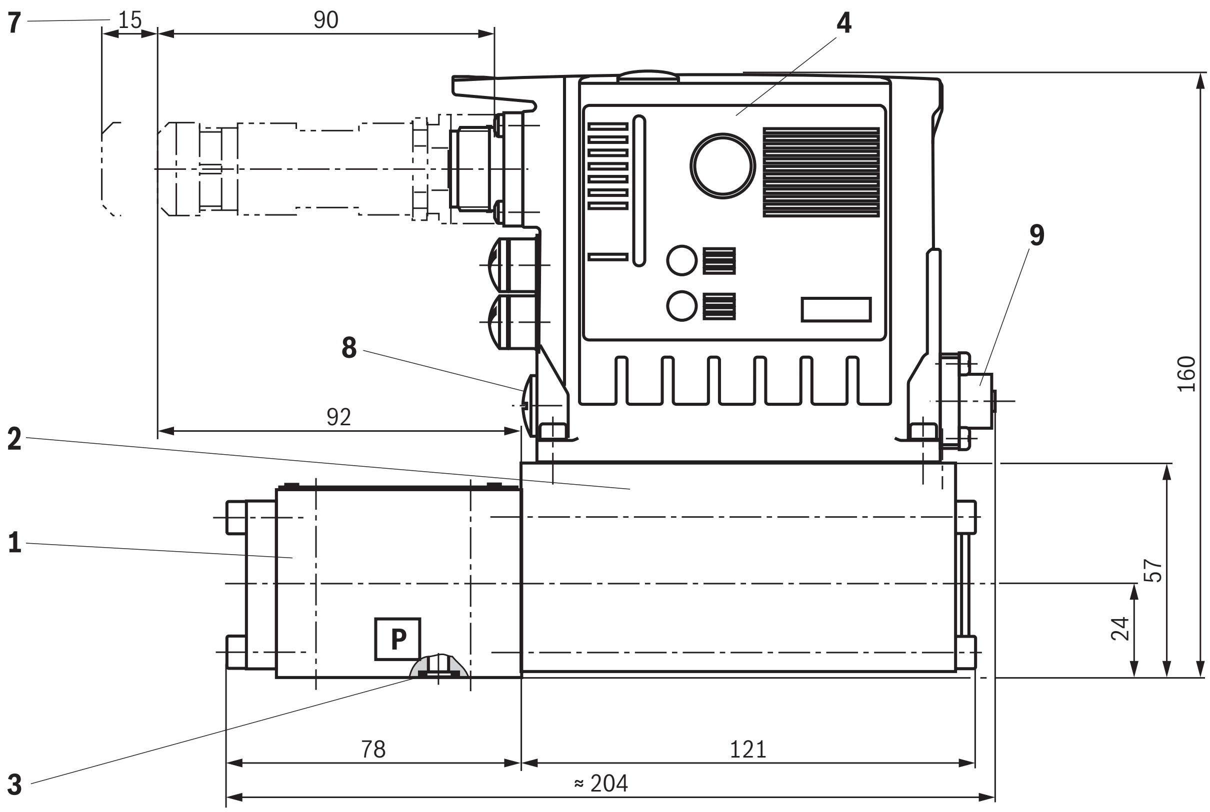
Transition function with stepped electric input signals

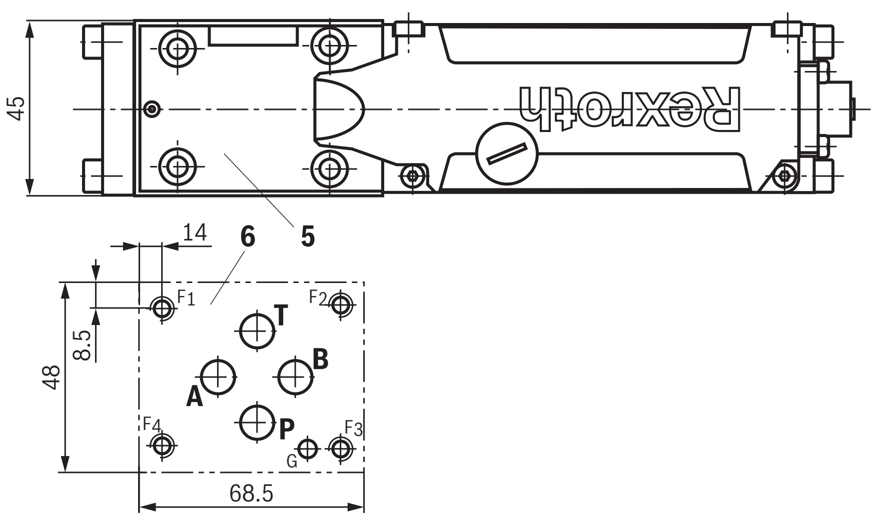


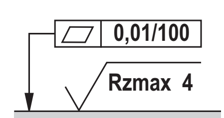
Frequency response characteristic curves



Dimensions: Versions "00..D90" and "00..D95" (dimensions in mm)







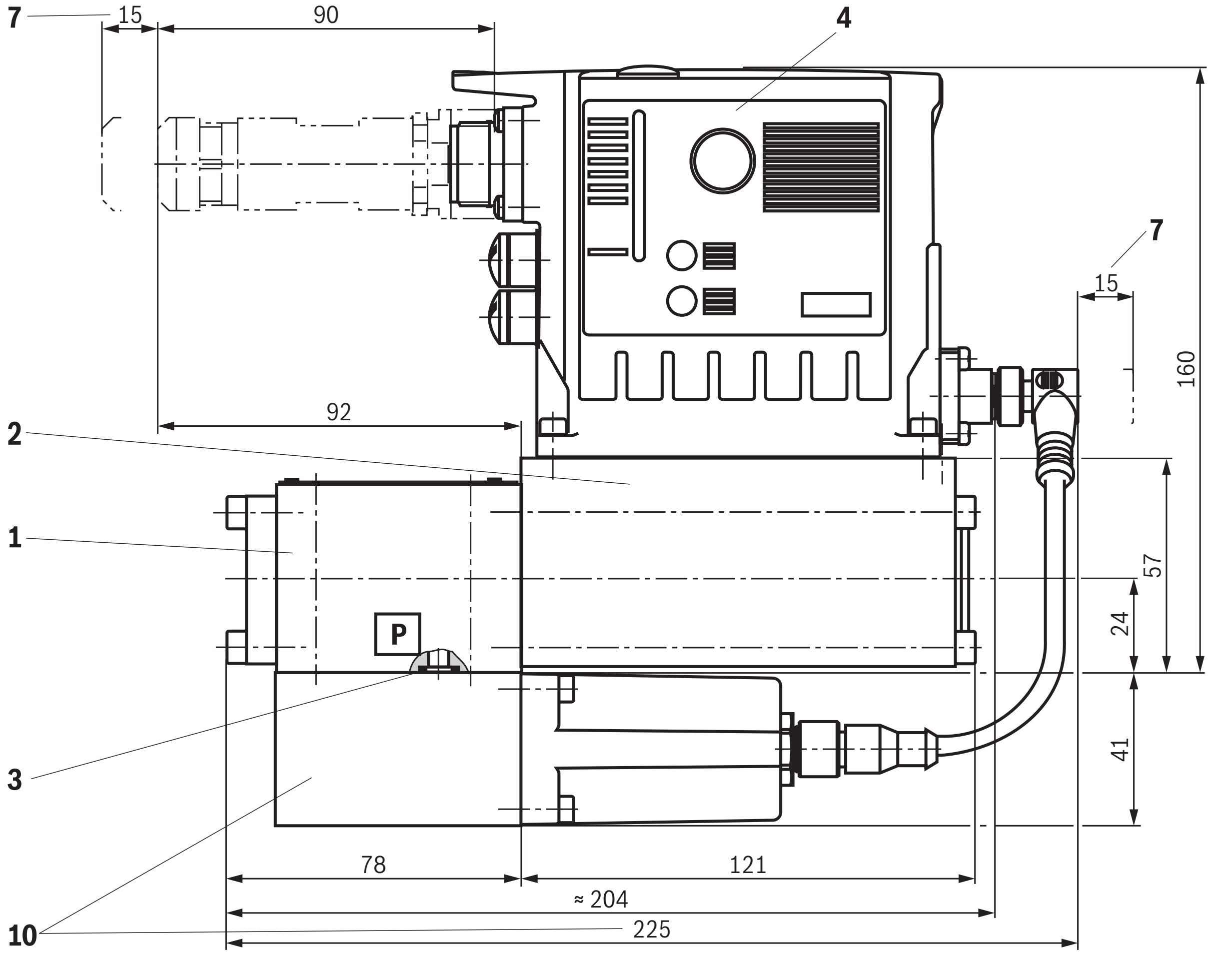
Required surface quality
of the valve contact surface

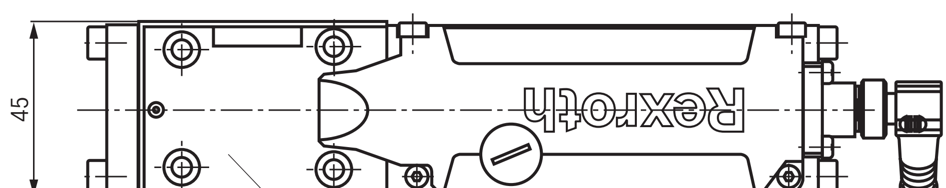
1 Valve housing
2 Control solenoid with position transducer
3 Identical seal rings for ports A, B, P, T
4 Integrated digital control electronics
5 Name plate
6 Machined valve contact surface, porting pattern according to ISO 4401-03-02-0-05
7 Space required to remove the mating connectors
8 Plug screw PG, version "00..D90" only
9 Version "00..D95" only

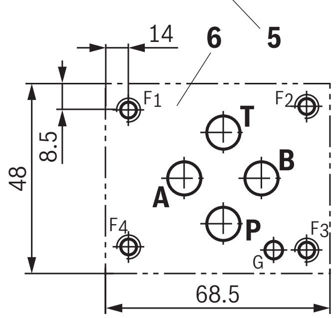
Valve mounting screws see page 18.

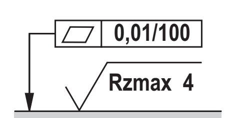
Notice:
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions: Versions "GA..D90", "GB..D90" and "GC..D90"
(dimensions in mm)









Required surface quality
of the valve contact surface

1 Valve housing
2 Control solenoid with position transducer
3 Identical seal rings for ports A, B, P, T
4 Integrated digital control electronics
5 Name plate
6 Machined valve contact surface, porting pattern according to ISO 4401-03-02-0-05
7 Space required to remove the mating connectors
10 Integrated pressure sensor

Valve mounting screws see page 18.

☞ **Notice:**
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions

Valve mounting screws (separate order)

Version	Hexagon socket head cap screws	Material number
"00..D90", "00..D95"	**4 hexagon socket head cap screws ISO 4762 - M5 x 30 - 10.9-CM-Fe-ZnNi-5-Cn-T0-H-B** Friction coefficient μ_{total} = 0.09 ... 0.14; tightening torque M_A = 6^{+2} Nm	**R913048086**
"GA..D90", "GB..D90", "GC..D90"	**4 hexagon socket head cap screws ISO 4762 - M5 x 70 - 10.9-CM-Fe-ZnNi-5-Cn-T0-H-B** Friction coefficient μ_{total} = 0.09 ... 0.14; tightening torque M_A = 8.9 Nm ±10 %	**R913043762**

Notice:
The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure.

Accessories (separate order)

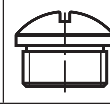
Mating connectors and cable sets

Port	Designation	Version	Short designation	Material number	Data sheet
XH1	Mating connector; for valves with round connector, 6-pole + PE	Straight, metal	7PZ31...M	**R900223890**	08006
		Straight, plastic	7PZ31...K	**R900021267**	
		Angled, plastic	–	**R900217845**	–
	Cable sets; for valves with round connector, 6-pole + PE	Plastic, 3.0 m	7P Z31 BF6	**R901420483**	08006
		Plastic, 5.0 m		**R901420491**	
		Plastic, 10.0 m		**R901420496**	
		Plastic, 20.0 m	–	**R901448068**	–
X7E1, X7E2	Cable set; shielded, 4-pole, D coding	Straight connector M12, on straight connector M12, line cross-section 0.25 mm², CAT 5e, length freely selectable (= xx.x)	–	**R911172111** 1)	–
	Cable set; shielded, 4-pole	Straight connector M12, on straight connector RJ45, line cross-section 0.25 mm², CAT 5e, length freely selectable (= xx.x)	–	**R911172135** 2)	–
X2N 3)	Cable set; shielded, 5-pole, for connecting Rexroth pressure sensors, type HM20, A coding	PUR/PVC, straight connector M12, on straight socket M12, line cross-section 0.34 mm², 0.6 m	–	**R901111709**	–
		PUR/PVC, straight connector M12, on straight socket M12, line cross-section 0.34 mm², 1.0 m	–	**R901111712**	–
		PUR/PVC, straight connector M12, on straight socket M12, line cross-section 0.34 mm², 2.0 m	–	**R901111713**	–
	Cable set; shielded, 5-pole, A coding	Straight connector M12, on free line end, line cross-section 0.34 mm², 1.5 m	–	**R901111752**	–
		Straight connector M12, on free line end, line cross-section 0.34 mm², 3.0 m	–	**R901111754**	–
		Straight connector M12, on free line end, line cross-section 0.34 mm², 5.0 m	–	**R901111756**	–
		Straight connector M12, on free line end, line cross-section 0.34 mm², 10.0 m	–	**R913005147**	–

1) Additionally indication of type designation RKB0040/xx.x
2) Additionally indication of type designation RKB0044/xx.x
3) Only with connection of an external sensor, type HM20

Accessories (separate order)

Protective cap

Protective cap M12	Version	Material number
		**R901075563**

Parameterization

The following is required for the parameterization with a PC		Material number/download
1 Commissioning software	IndraWorks, Indraworks D, Indraworks DS	
2 Connection cable, 3 m	Shielded, M12 on RJ45, length can be freely selected (= xx.x)	**R911172135** (additionally indication of type designation RKB0044/xx.x)

Project planning and maintenance instructions

- The supply voltage must be permanently connected; otherwise, bus communication is not possible.
- If electro-magnetic interference is to be expected, take appropriate measures to ensure the function (depending on the application, e.g. shielding, filtration).
- The devices have been tested in the plant and are supplied with default settings.
- Only complete devices can be repaired. Repaired devices are returned with default settings. User-specific settings will not be applied. The machine end-user will have to retransfer the corresponding user parameters.

Further information

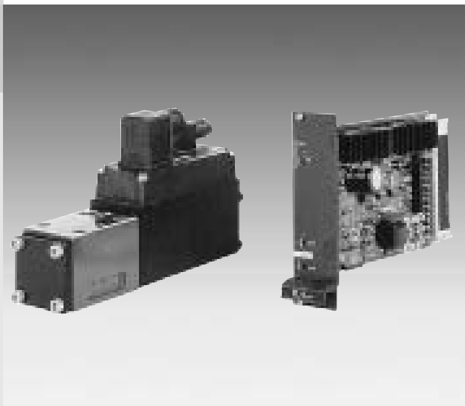
- Directional control valves, direct operated, with electrical position feedback and integrated electronics (OBE) — Data sheet 29035
- Directional control valve with integrated digital axis controller (IAC-R) and field bus interface — Data sheet 29191
- Directional control valve with integrated digital axis controller (IAC-R) and clock-synchronized PROFIBUS DP/V2 (PROFIdrive profile) — Data sheet 29291
- High-response/proportional valve with Multi-Ethernet interface — Operating instructions 29391-B
- CE Declaration of Conformity — Upon request
- Subplates — Data sheet 45100
- Hydraulic fluids on mineral oil basis — Data sheet 90220
- Environmentally compatible hydraulic fluids — Data sheet 90221
- Flame-resistant, water-free hydraulic fluids — Data sheet 90222
- Hexagon socket head cap screws, metric/UNC — Data sheet 08936
- Hydraulic valves for industrial applications — Operating instructions 07600-B
- General product information on hydraulic products — Data sheet 07008
- Installation, commissioning and maintenance of servo valves and high-response valves — Data sheet 07700
- Assembly, commissioning and maintenance of hydraulic systems — Data sheet 07900
- Operation fieldbus electronics (xx = software version):
  - Functional description Rexroth HydraulicDrive HDx-20 — 30338-FK
  - Parameter description Rexroth HydraulicDrive HDS-16, HDx-17 ...HDx-20 — 30330-PA
  - Description of diagnosis Rexroth HydraulicDrive HDS-16, HDx-17 ...HDx-20 — 30330-WA
- Commissioning software and documentation on the Internet
- Selection of the filters
- Information on available spare parts

Rexroth
Bosch Group

Servo solenoid valves with electrical position feedback (Lvdt DC/DC ±10 V)

RE 29028/01.05
Replaces: 09.03

Type 4WRPH 6



Size 6
Unit series 2X
Maximum working pressure P, A, B 315 bar, T 250 bar
Nominal flow rate 2...40 l/min (Δp 70 bar)

List of contents

Features

- Directly operated servo solenoid valve NG6, with control piston and sleeve in servo quality
- Actuated on one side, 4/4 fail-safe position when switched off
- Control solenoid with integral position feedback and electronics for position transducer (Lvdt DC/DC)
- Suitable for electrohydraulic controllers in production and testing systems
- For subplate attachment, mounting hole configuration to ISO 4401-03-02-0-94
- Subplates as per catalogue section RE 45053 (order separately)
- Line sockets to DIN 43560-AM2
  Solenoid 2P+PE/M16 x 1.5, position transducer 4P/Pg7 in scope of delivery, see catalogue section RE 08008
- External trigger electronics (order separately)
  - Electric amplifier for standard curve “L” 0 811 405 060, see catalogue section RE 30041
  - Electric amplifier for non-linear curve “P” 40 % – 0 811 405 065 and 60 % – 0 811 405 066, see catalogue section RE 30040

Variants on request

- For standard applications
- Special symbols for plastic machines
- Sturdy “ruggedized” version for applications up to 40 g, valve with metal cap and central plug (7P).

Ordering data and scope of delivery

4WRP		H	6		B		–2X/G24	Z4/ M	*

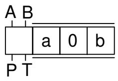
For **external** trigger eletronics **= no desig.**

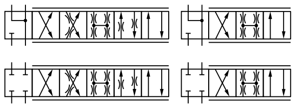
Control piston/sleeve **= H**

Size 6 **= 6**

Symbols

4/4-way version





= C3, C5

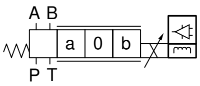
= C4, C1

With symbols C5 and C1:[3]

P → A: q_v B → T: $q_v/2$

P → B: $q_v/2$ A → T: q_v

Side of inductive position tranducer



(Standard) **= B**

Further information in plain text

M = NBR seals, suitable for mineral oils (HL, HLP) to DIN 51524

Electronical connection

Z4 = with line socket, with plug to DIN 43560-AM2

Line socket in scope of delivery

Voltage supply of trigger electronics

G24 = +24 V DC

2X = Unit series 20 to 29 (installation and connection dimensions unchanged)

Flow characteristic

L = Linear

P = Non-linear curve[2]

Nominal flow rate at 70 bar valve pressure difference (35 bar /metering notch)

Size 6

02 = 2 l/min
04 = 4 l/min
12 = 12 l/min
15[1] = 15 l/min
24 = 24 l/min
25[1] = 25 l/min
40[3] = 40 l/min

[1] Only in connection with flow characteristic “p”

[2] Kink 60 % for NG6 with nominal flow rate “15” and “25”, otherwise kink 40 %

[3] q_v 2:1 only with nominal flow rate = 40 l/min

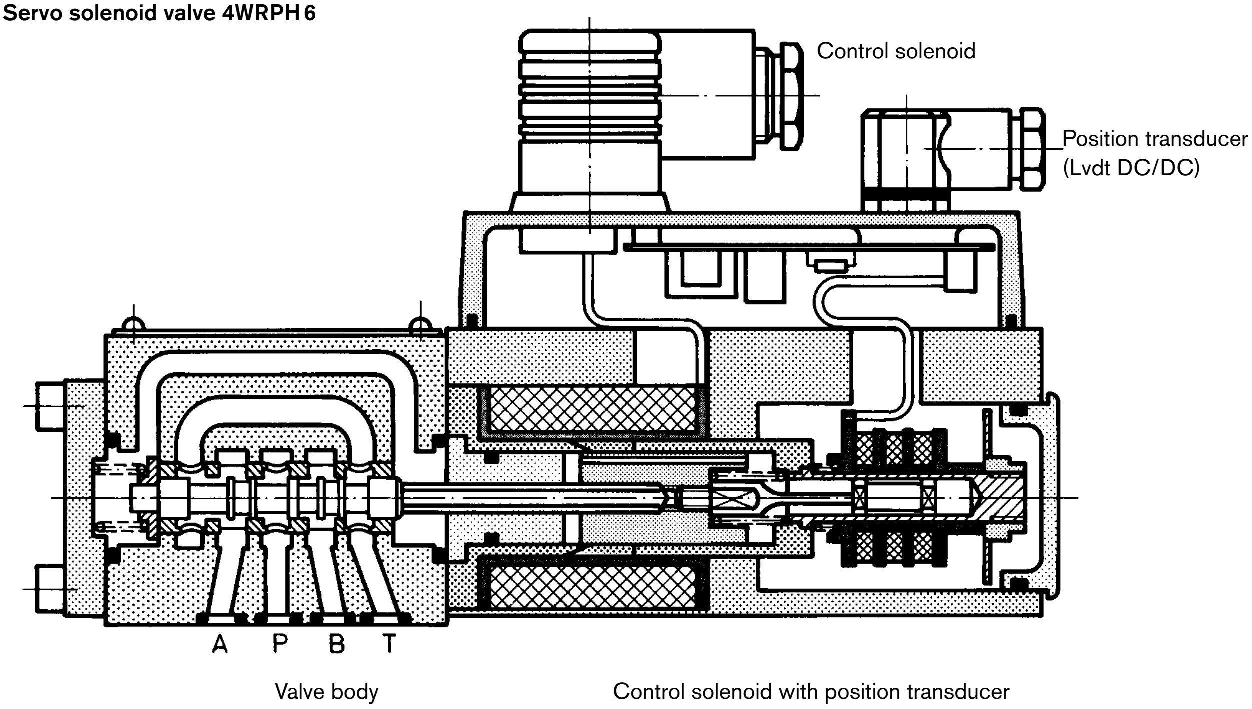
Preferred types (available at short notice)

Type 4WRPH 6	Material no.
C3/C5	
4WRPH 6 C3B02L –2X/G24Z4 /M	**0 811 404 041**
4WRPH 6 C3B04L –2X/G24Z4 /M	**0 811 404 033**
4WRPH 6 C3B12L –2X/G24Z4 /M	**0 811 404 034**
4WRPH 6 C3B24L –2X/G24Z4 /M	**0 811 404 035**
4WRPH 6 C3B40L –2X/G24Z4 /M	**0 811 404 036**
4WRPH 6 C5B40L –2X/G24Z4 /M	**0 811 404 510**
4WRPH 6 C3B15P –2X/G24Z4 /M	**0 811 404 047**
4WRPH 6 C3B25P –2X/G24Z4 /M	**0 811 404 043**
4WRPH 6 C3B40P –2X/G24Z4 /M	**0 811 404 044**
4WRPH 6 C5B40P –2X/G24Z4 /M	**0 811 404 511**

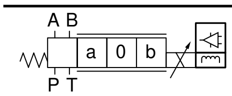
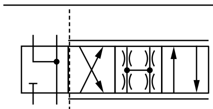
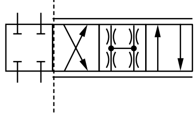
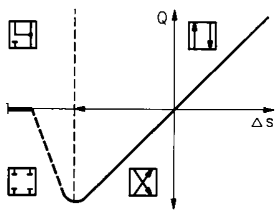
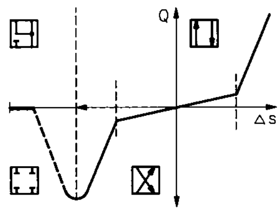
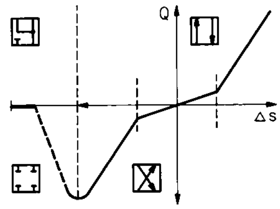
Type 4WRPH 6	Material no.
C1/C4	
4WRPH 6 C4B02L –2X/G24Z4 /M	**0 811 404 512**
4WRPH 6 C4B04L –2X/G24Z4 /M	**0 811 404 160**
4WRPH 6 C4B12L –2X/G24Z4 /M	**0 811 404 037**
4WRPH 6 C4B24L –2X/G24Z4 /M	**0 811 404 038**
4WRPH 6 C4B40L –2X/G24Z4 /M	**0 811 404 039**
4WRPH 6 C1B40L –2X/G24Z4 /M	**0 811 404 513**
4WRPH 6 C4B15P –2X/G24Z4 /M	**0 811 404 048**
4WRPH 6 C4B25P –2X/G24Z4 /M	**0 811 404 045**
4WRPH 6 C4B40P –2X/G24Z4 /M	**0 811 404 046**
4WRPH 6 C1B40P –2X/G24Z4 /M	**0 811 404 162**

Function, sectional diagram

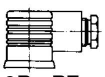
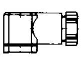
Servo solenoid valve 4WRPH 6



Symbols

	Linear	p: kink 60 % [q_n 15,25 l/min]	p: kink 40 % [q_n 40 l/min]
 **C3, C5**  **C4, C1**			
	C3, C5, C4, C1		
	Standard = 1:1, from q_n 40 l/min also 2:1		

Accessories, not included in scope of delivery

(4 x) M5 x 30 DIN 912–10.9	Fastening screws	**2 910 151 166**
 	VT-VRRA1-527-20 / V0, see RE 30041	**0 811 405 060**
	VT-VRRA1-527-20 / V0 / K60-AGC, see RE 30040	**0 811 405 066**
	VT-VRRA1-527-20 / V0 / K40-AGC, see RE 30040	**0 811 405 065**
 2P + PE  4P	2P + PE (M16 x 1.5) and 4P (Pg7) included in scope of delivery, see also RE 08008	

Application

– Valve amplifier with pressure compensator (p/Q), see RE 30058.

Testing and service equipment

– Test box type VT-PE-TB2, see RE 30064.
– Test adapter type VT-PA-3, see RE 30070.

Technical Data

General

Construction		Spool type valve, operated directly, with steel sleeve
Actuation		Proportional solenoid with position control, external amplifier
Type of mounting		Subplate, mounting hole configuration NG6 (ISO 4401-03-02-0-94)
Installation position		Optional
Ambient temperature range	°C	−20 … +50
Weight	kg	2.3
Vibration resistance, test condition		Max. 25 g, shaken in 3 dimensions (24 h)

Hydraulic (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

Pressure fluid			Hydraulic oil to DIN 51524 … 535, other fluids after prior consultation					
Viscosity range	recommended	mm^2/s	20 … 100					
	max. permitted	mm^2/s	10 … 800					
Pressure fluid temperature range		°C	−20 … +80					
Maximum permissible degree of contamination of pressure fluid Purity class to ISO 4406 (c)			Class 18/16/13[1)]					
Flow direction			See symbol					
Nominal flow at $\Delta p = 35$ bar per notch[2)]		l/min	2	4	12	15	24	40
Max. working pressure		bar	Port P, A, B: 315					
Max. pressure		bar	Port T: 250					
Operating limits at Δp Pressure drop at valve $q_{Vnom}: > q_N$ valves		bar	315	315	315	315	315	160
		bar	315	315	315	280	250	100
Leakage at 100 bar		cm^3/min	< 150	< 180	< 300	–	< 500	< 900
		cm^3/min	–	–	–	< 180	< 300	< 450

Electrical

Cyclic duration factor	%	100 ED
Power supply		24 V_{nom} (external amplifier)
Degree of protection		IP 65 to DIN 40050
Solenoid connector		Connector DIN 43650/ISO 4400 M16 x 1.5 (2P + PE)
Position transducer connector		Special Connector Pg7 (4P)
Max. solenoid current	A	2.7
Coil restistance R_{20}	Ω	2.5
Max. power consumption at 100 % load and operational temperature	VA	40
Position transducer DC/DC technology		Supply: +15 V/35 mA −15 V/35 mA — Signal: 0...±10 V ($R_L \geqq 10$ kΩ)

Static/Dynamic

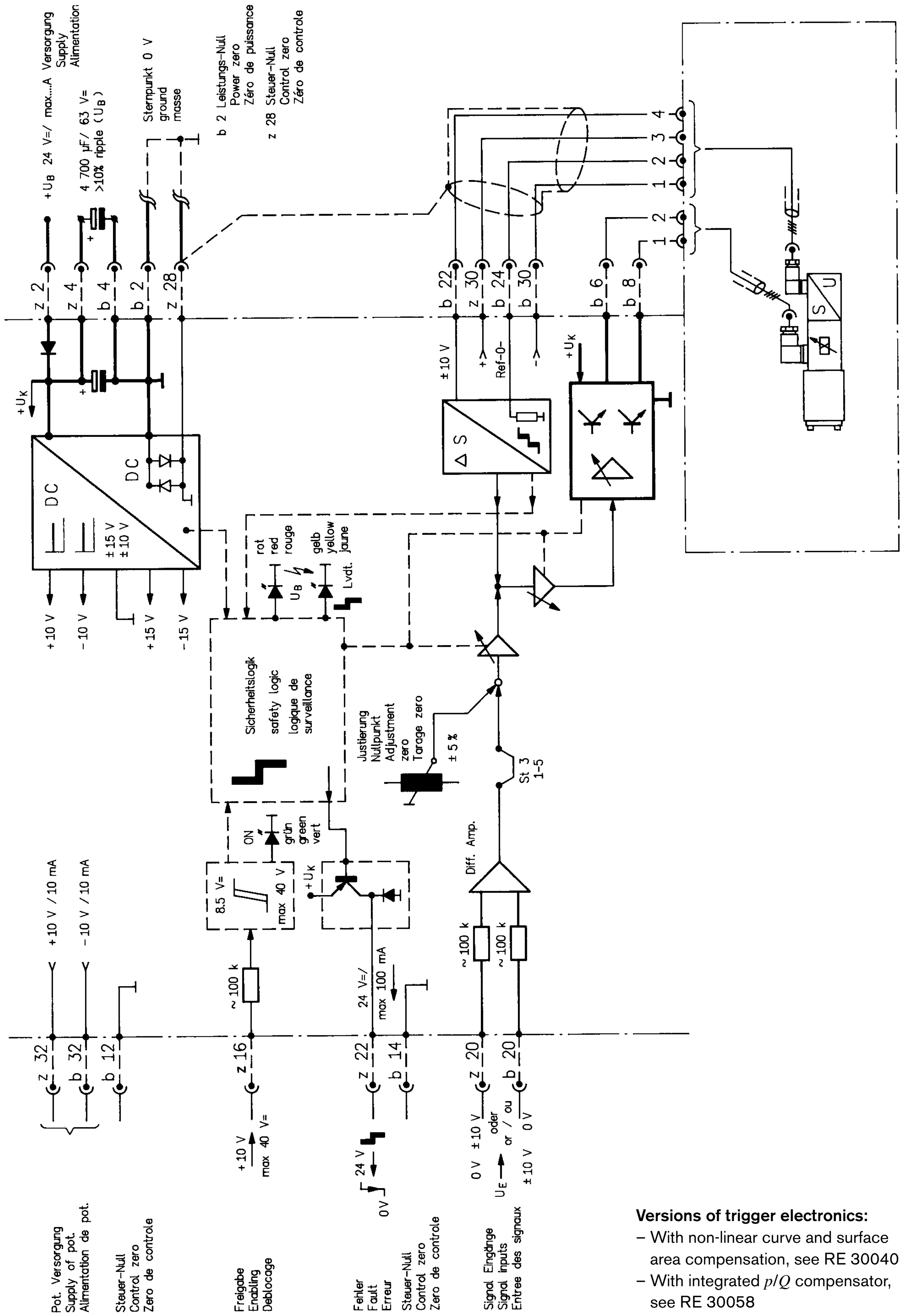
Hysteresis	%	$\leqq 0.2$
Manufacturing tolerance for $q_{max.}$	%	< 10
Response time for signal change 0 … 100 %	ms	< 10
Thermal drift		Zero point displacement < 1 % at $\Delta T = 40\,°C$

1) The purity classes stated for the components must be complied with in hydraulic systems. Effective filtration prevents problems and also extends the service life of components. For a selection of filters, see catalogue sections RE 50070, RE 50076 and RE 50081.

2) Flow rate at a different Δp $\quad q_x = q_{nom} \cdot \sqrt{\dfrac{\Delta p_x}{35}}$

Valve with external trigger electronics (standard linear curve: L)

Block diagram/pin assignment

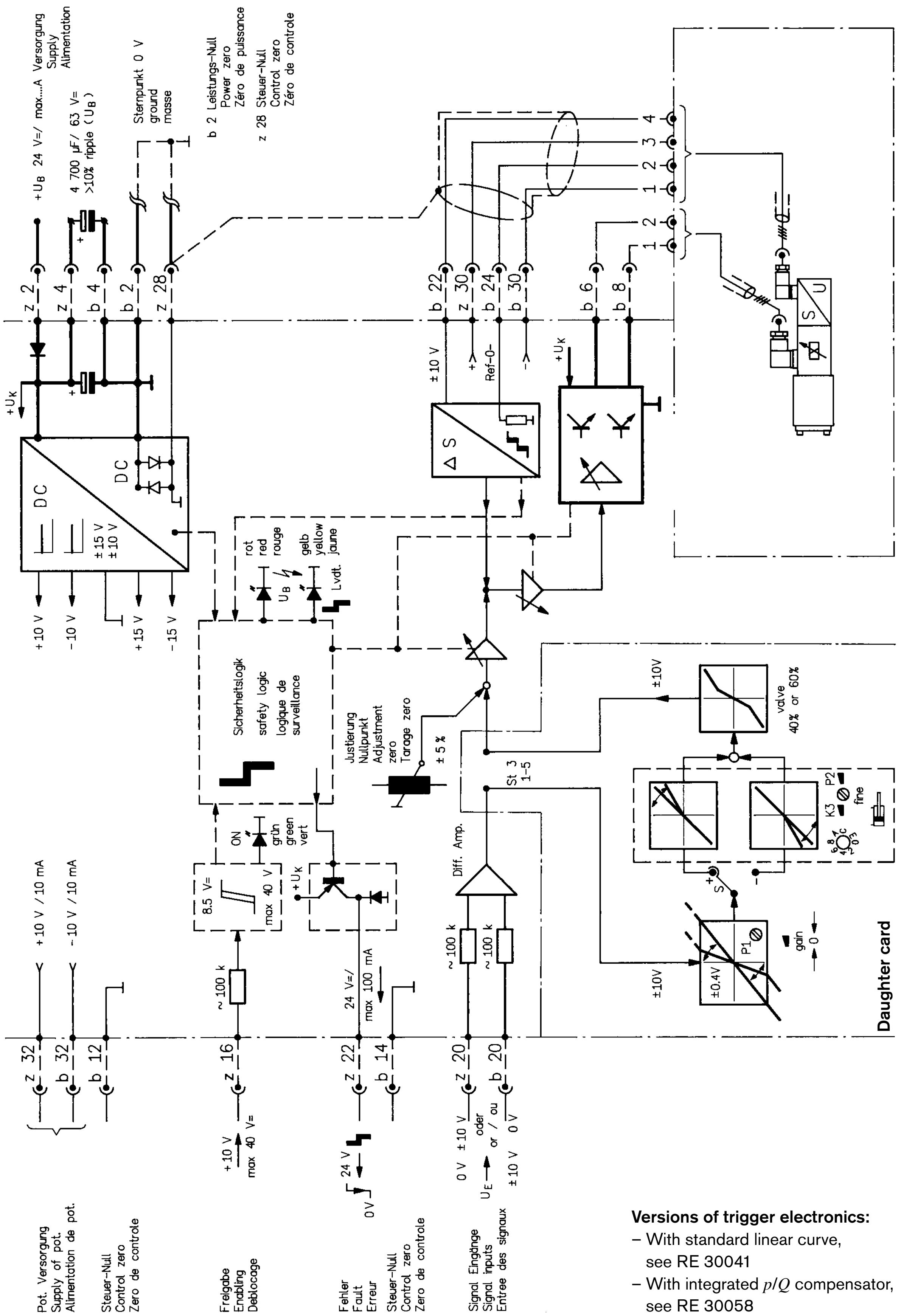


Versions of trigger electronics:

- With non-linear curve and surface area compensation, see RE 30040
- With integrated p/Q compensator, see RE 30058

Valve with external trigger electronics (non-linear curve: P)

Block diagram/pin assignment

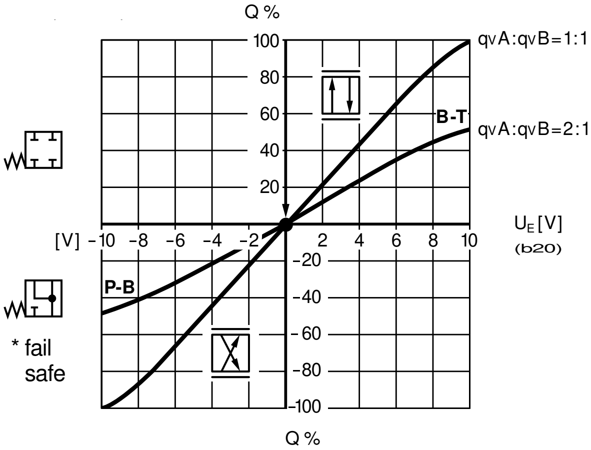


Versions of trigger electronics:
- With standard linear curve, see RE 30041
- With integrated p/Q compensator, see RE 30058

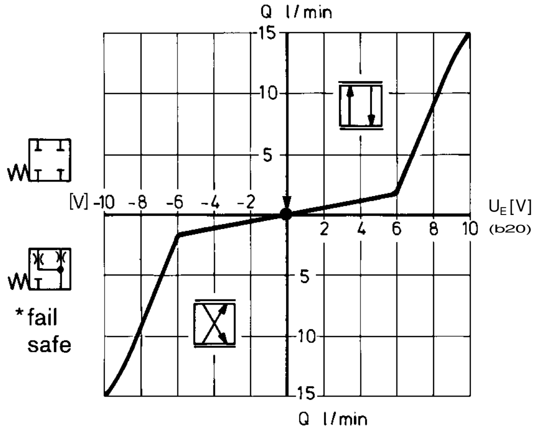
Performance curves (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

Flow rate/Signal function $Q = f\,(U_E)$

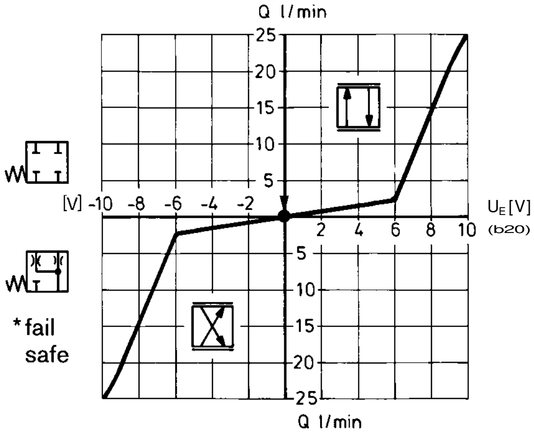
L: Linear



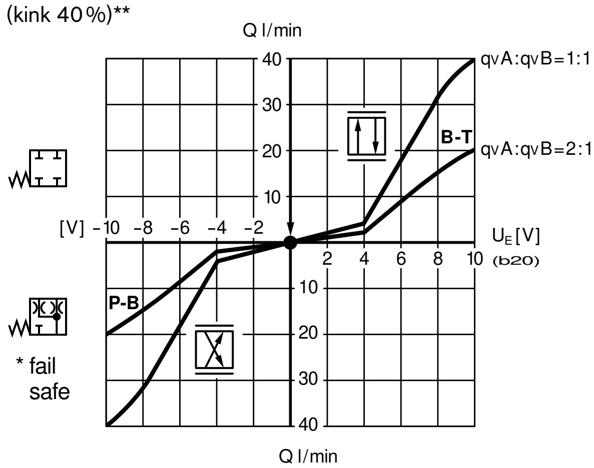
P: (kink 60 %)**



P: (kink 60 %)

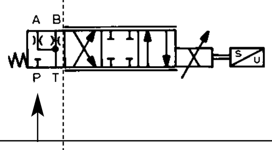
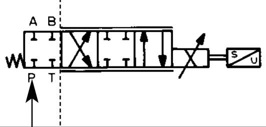


P: (kink 40 %)**



*Fail-safe when enabling is not released.
**Q-kink = 10 % Q_N.

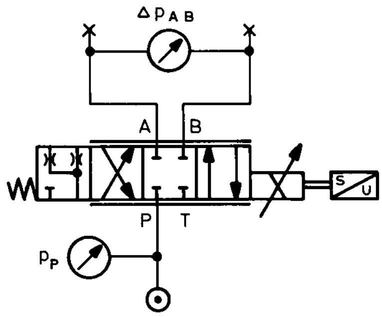
Fail-safe position

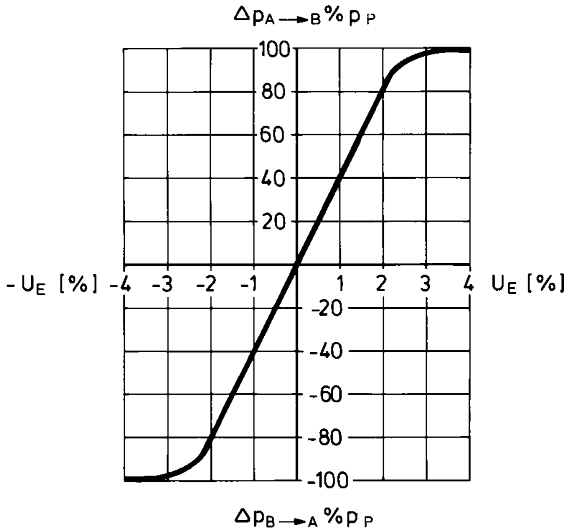
	Leakage at	100 bar	P–A P–B	50 cm³/min 70 cm³/min
	Flow rate at	$\Delta p = 35$ bar	A–T B–T	10 … 20 l/min 7 … 20 l/min
	Leakage at	100 bar	P–A P–B A–T B–T	50 cm³/min 70 cm³/min 70 cm³/min 50 cm³/min

Fail-safe	$p =$ 0 bar → 7 ms $p =$ 100 bar → 10 ms	Enable off

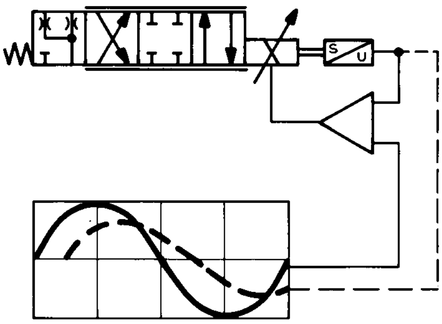
Performance curves (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

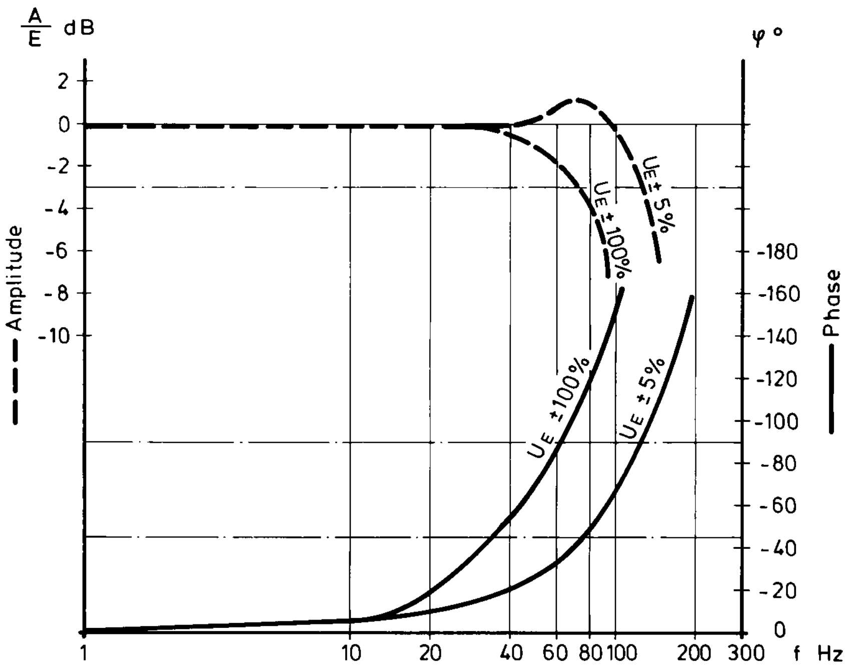
Pressure gain



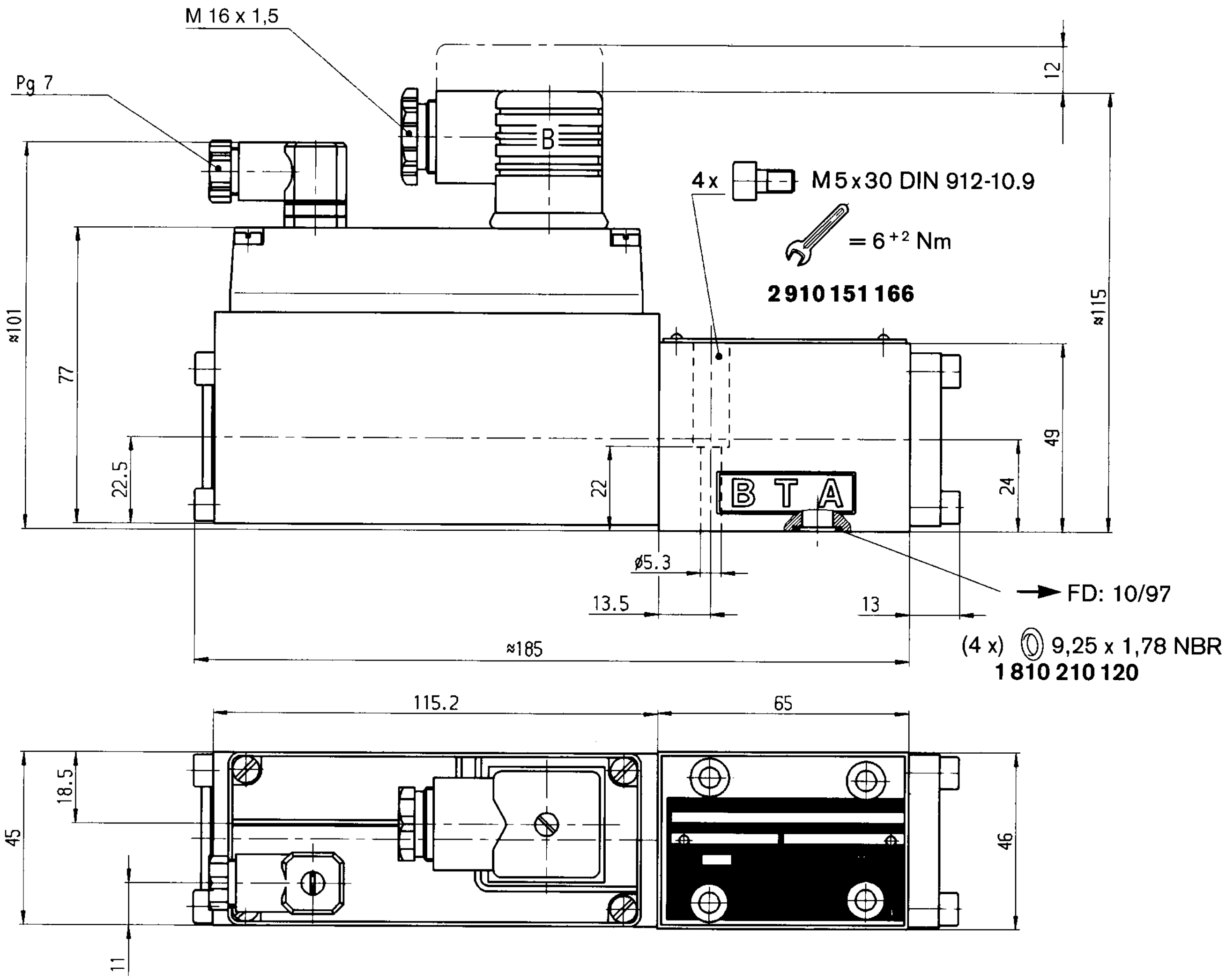


Bode diagram

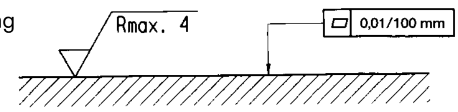


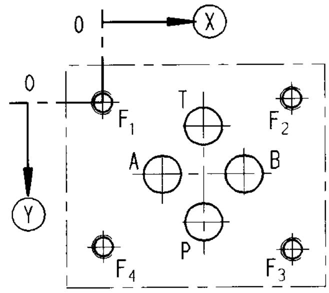


Unit dimensions (nominal dimensions in mm)



Required surface quality of mating component





Mounting hole configuration: NG6 (ISO 4401-03-02-0-94)
For subplates, see catalogue section
RE 45053

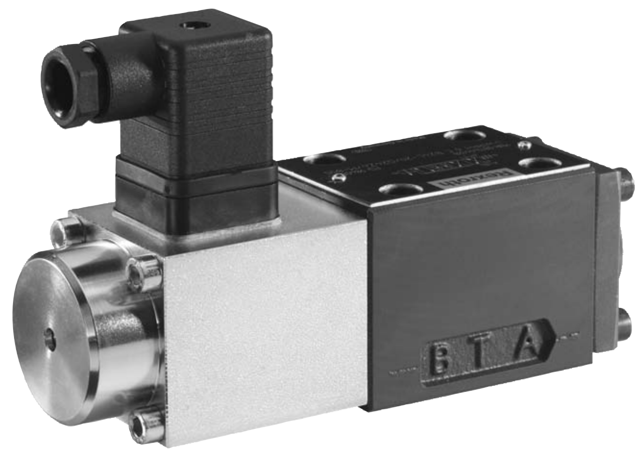
1) Deviates from standard
2) Thread depth:
Ferrous metal 1.5 x Ø
Non-ferrous 2 x Ø

	P	A	T	B	F_1	F_2	F_3	F_4
Ⓧ	21.5	12.5	21.5	30.2	0	40.5	40.5	0
Ⓨ	25.9	15.5	5.1	15.5	0	–0.75	31.75	31
∅	8 1)	8 1)	8 1)	8 1)	M5 2)	M5 2)	M5 2)	M5 2)

Directional control valves, direct operated, without electrical position feedback

Type 4WRPH

RE 29027
Edition: 2016-01
Replaces: 09.08



H7651

- Size 6
- Component series 2X
- Maximum operating pressure 350 bar
- Rated flow 24 and 40 l/min ($\boldsymbol{\Delta p}$ = 70 bar)

Features

- Subplate mounting
- Porting pattern according to ISO 4401-03-02-0-05
- Pilot control valve for axial piston variable displacement pump, type A4VS with HS5 adjustment
- Control spool and sleeve in servo quality
- Actuated on one side, preferred position when switched off or if not released
- Control solenoid without position feedback
- Use for electro-hydraulic controls in production and test systems
- External control electronics via amplifier card or amplifier module

Contents

Ordering codes

01	02	03	04	05	06	07	08	09		10		11	12		13		14
4	WRP		H	6	C			L	–	2X	/	G24	Z4	/		–	855

01	4 main ports	**4**
02	Directional control valve, direct operated	**WRP**
03	For external control electronics	**no code**
04	Sleeve	**H**
05	Size 6	**6**

Symbol

06	see page 3	**C**

Installation side control solenoid

07	Valve side A	**A** [1]
	Valve side B	**B**

Rated flow at 70 bar valve pressure differential (35 bar/control edge)

08	24 l/min	**24**
	40 l/min	**40**

Flow characteristic

09	Linear	**L**
10	Component series 20 ... 29 (20 ... 29: unchanged installation and connection dimensions)	**2X**
11	Supply voltage of the control electronics 24 V	**G24**

Electrical connection

12	**Individual connection**	
	With mating connector; connector DIN EN 175301-803 (see data sheet 08006)	**Z4**

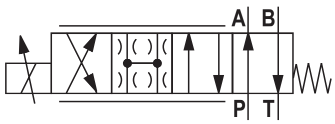
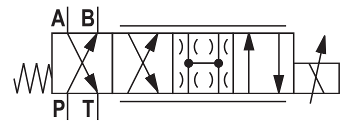
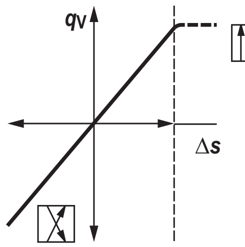
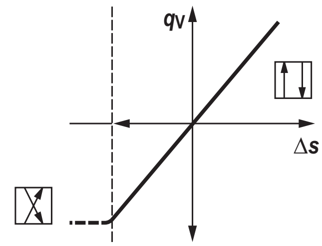
Seal material

13	NBR seals	**M**
	FKM seals	**V**
	Observe compatibility of seals with hydraulic fluid used.	
14	Control solenoid without position control; control spool without overcompensation of flow forces	**855**

[1] When using as pilot control valve for axial piston variable displacement pump, type A4VS with HS5 adjustment

Symbols

Flow characteristic

Design "A"	Design "B"
	
	

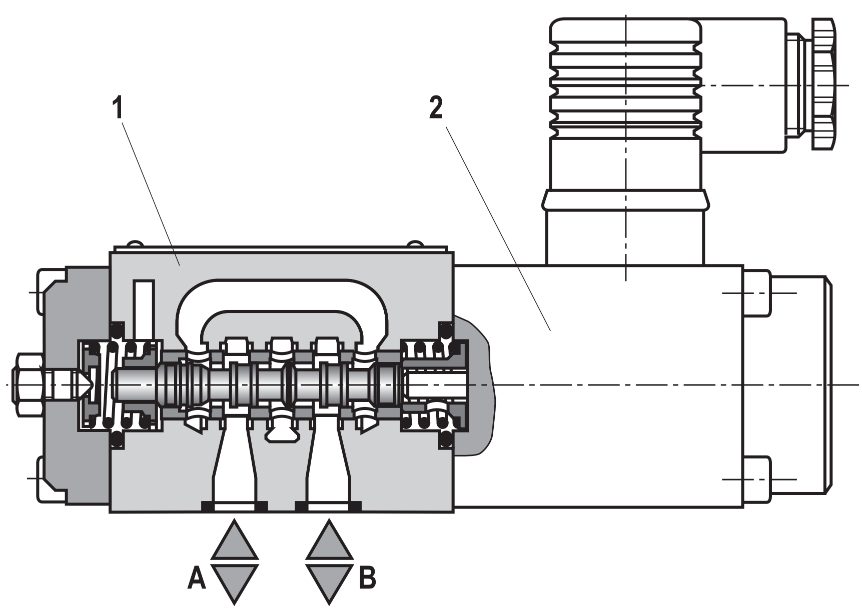
Function, section

The valve type 4WRPH is a direct operated directional control valve without electrical position feedback.

Set-up

The valve basically consists of 2 main assemblies:

- Valve housing with control spool and sleeve in servo quality (1)
- Control solenoid with position transducer (2)



Technical data
(For application outside these parameters, please consult us!)

general			
Weight		kg	2.1
Installation position			Any
Ambient temperature range		°C	−20 ... +70
Maximum storage time		Years	1 (if the storage conditions are observed; refer to the operating instructions 07600-B)
Maximum vibration resistance (test condition: room vibration test in all directions 24 h)		g	25
Maximum relative humidity (no condensation)		%	95

hydraulic				
Maximum operating pressure	▶ Port A, B, P	bar	350	
	▶ Port T	bar	250	
Rated flow [1)]		l/min	24	40
Limitations of use (pressure drop Δp on valve $q_{Vnom} > q_N$)		bar	315	160
Leakage oil (at 100 bar)		cm^3/min	< 500	< 900
Hydraulic fluid			See table below	
Viscosity range	▶ recommended	mm^2/s	20 ... 100	
	▶ maximum admissible	mm^2/s	10 ... 800	
Hydraulic fluid temperature range (flown-through)		°C	−20 ... +80	
Maximum admissible degree of contamination of the hydraulic fluid; Cleanliness class according to ISO 4406 (c)			Class 18/16/13 [2)]	

Hydraulic fluid		Classification	Suitable sealing materials	Standards	Data sheet
Mineral oils		HL, HLP, HLPD, HVLP, HVLPD	NBR, FKM	DIN 51524	90220
Bio-degradable	▶ insoluble in water	HETG	NBR, FKM	ISO 15380	90221
		HEES	FKM		
	▶ soluble in water	HEPG	FKM	ISO 15380	
Flame-resistant	▶ water-free	HFDU, HFDR	FKM	ISO 12922	90222
	▶ containing water	HFC (Fuchs Hydrotherm 46M, Petrofer Ultra Safe 620)	NBR	ISO 12922	90223

Important information on hydraulic fluids:
- For more information and data on the use of other hydraulic fluids, please refer to the data sheets above or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.)!
- The flash point of the hydraulic fluid used must be 40 K higher than the maximum solenoid surface temperature.

- **Flame-resistant – containing water:**
  - Maximum pressure differential per control edge 175 bar
  - Pressure pre-loading at the tank port > 20 % of the pressure differential, otherwise increased cavitation
  - Life cycle as compared to operation with mineral oil HL, HLP 50 to 100 %

1) Rated flow at 70 bar valve pressure differential (35 bar/control edge).
For deviating valve pressure differential (Δp):

$$\boxed{q_x = q_{V\,nom} \times \sqrt{\frac{\Delta p_x}{35}}}$$

2) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and simultaneously increases the life cycle of the components.

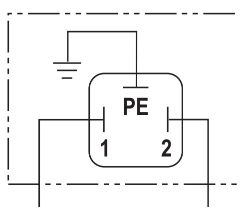
Technical data
(For application outside these parameters, please consult us!)

static / dynamic			
Hysteresis		%	< 7
Response sensitivity		%	< 1
Actuating time for signal step	▶ 0 ... 100 %	ms	< 30

electric		
Relative duty cycle	%	100 (continuous operation)
Protection class according to EN 60529		IP 65 (with mating connector mounted and locked)
Supply voltage	VDC	24 (external electric amplifier or module)
Maximum solenoid current	A	2.7
Coil resistance $\boldsymbol{R}_{20}$	Ω	2.5
Maximum power consumption	VA	40 (at 100 % load and operating temperature)
Control electronics		Valve amplifiers type VT-MSRA1-1; see data sheet 30227

Electrical connection

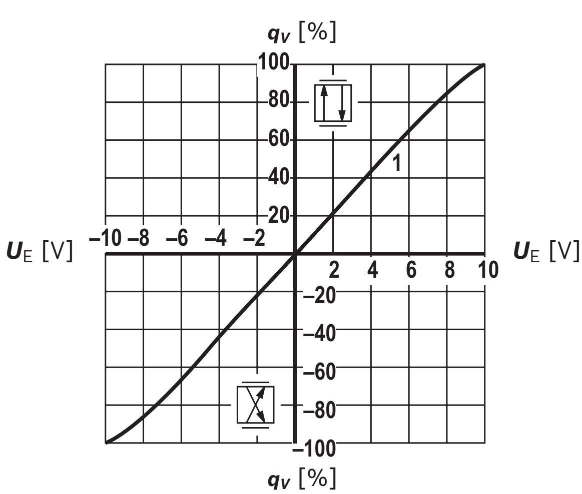
Connection at mating connector



To the amplifier

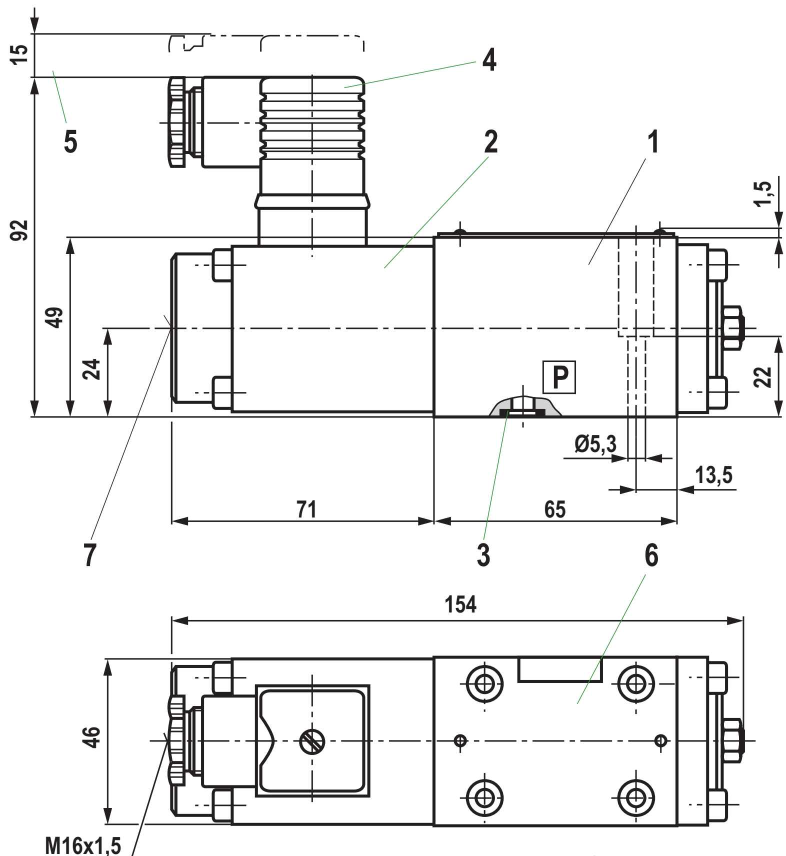
Characteristic curves
(measured with HLP46, ϑ_{Oil} = 40 ± 5 °C)

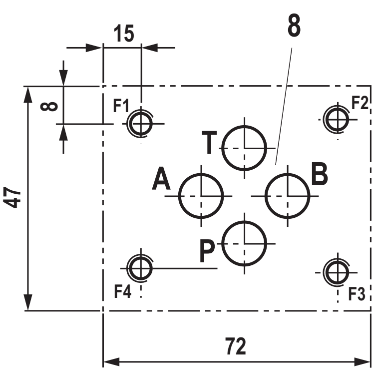
Flow/signal function

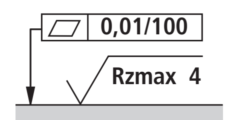


1 $q_{V\,A} : q_{V\,B}$ (1:1)

Dimensions: Version "A" (dimensions in mm)







Required surface quality of the valve contact surface

1. Valve housing
2. Control solenoid
3. Identical seal rings for ports P, A, B, T
4. Mating connectors, included within the scope of delivery, see data sheet 08006.
5. Space required to remove the mating connector
6. Name plate
7. Manual override
8. Machined valve contact surface, porting pattern according to ISO 4401-03-02-0-05 Minimum screw-in depth: Ferrous metal: 1.5 x Ø

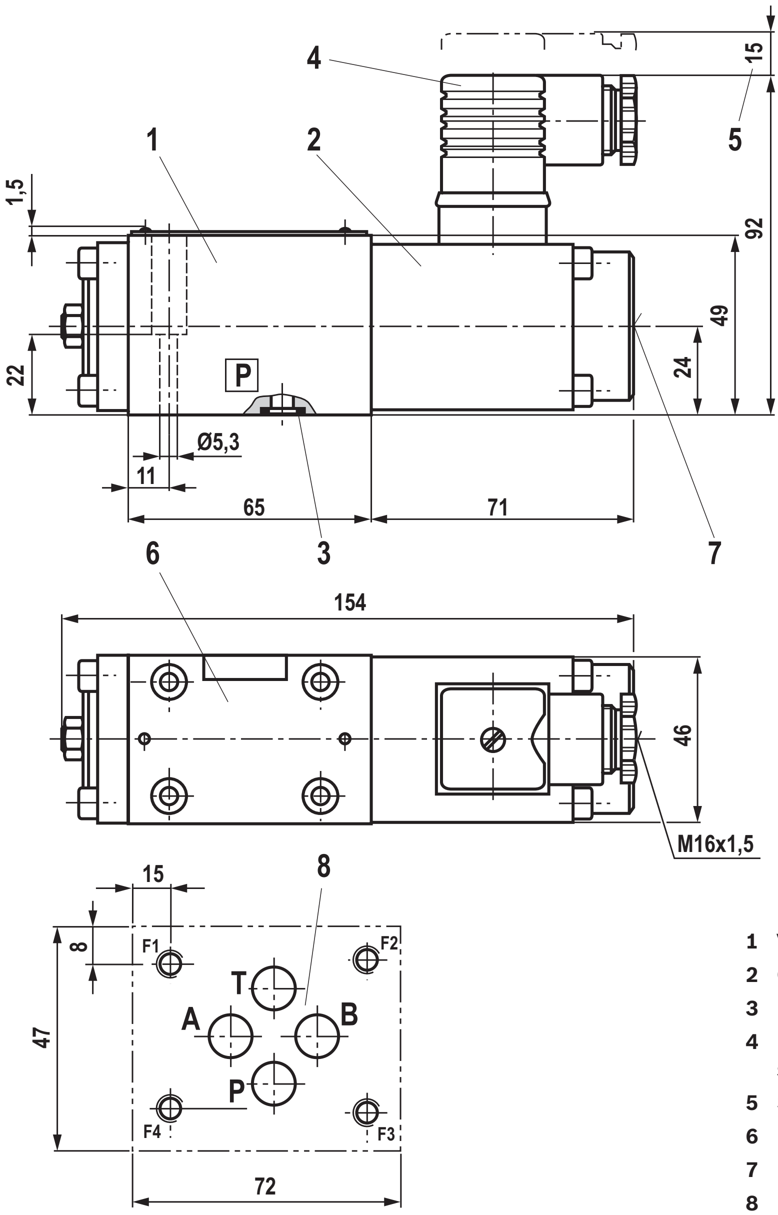
> **Notices:**
> The dimensions are nominal dimensions which are subject to tolerances.

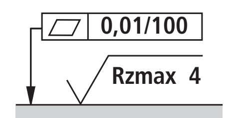
Valve mounting screws (separate order)

Quantity	Hexagon socket head cap screws	Material number
4	**ISO 4762 - M5 x 30 - 10.9-flZn-240h-L** Tightening torque M_A = 7 Nm ±10 %	**R913000316**
or		
4	**ISO 4762 - M5 x 30 - 10.9** Tightening torque M_A = 8.9 Nm ±10 %	Not included in the Rexroth delivery range

Subplates according to data sheet 45052 (separate order)

Dimensions: Version "B"
(dimensions in mm)





Required surface quality of the valve contact surface

1 Valve housing
2 Control solenoid
3 Identical seal rings for ports P, A, B, T
4 Mating connectors, included within the scope of delivery, see data sheet 08006.
5 Space required to remove the mating connector
6 Name plate
7 Manual override
8 Machined valve contact surface,
porting pattern according to ISO 4401-03-02-0-05
Minimum screw-in depth: Ferrous metal: 1.5 x Ø

Notices:
The dimensions are nominal dimensions which are subject to tolerances.

Valve mounting screws (separate order)

Quantity	Hexagon socket head cap screws	Material number
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or		
4	**ISO 4762 - M5 x 30 - 10.9** Tightening torque M_A = 8.9 Nm ±10 %	Not included in the Rexroth delivery range

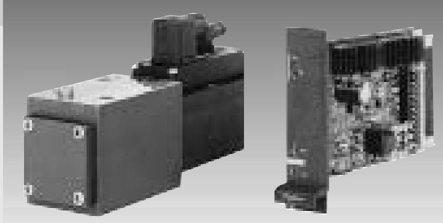
Subplates according to data sheet 45052 (separate order)

Rexroth
Bosch Group

Servo solenoid valves with electrical position feedback (Lvdt DC/DC ±10 V)

RE 29032/01.05
Replaces: 09.03

Type 4WRPH 10



Size 10
Unit series 2X
Maximum working pressure P, A, B 315 bar, T 250 bar
Nominal flow rate 50...100 l/min (Δp 70 bar)

List of contents

Features

- Directly operated servo solenoid valve NG10, with control piston and sleeve in servo quality
- Actuated on one side, 4/4 fail-safe position when switched off
- Control solenoid with integral position feedback and electronics for position transducer (Lvdt DC/DC)
- Suitable for electrohydraulic controllers in production and testing systems
- For subplate attachment, mounting hole configuration to ISO 4401-05-04-0-94
- Subplates as per catalogue section RE 45055 (order separately)
- Line sockets to DIN 43560-AM2
  Solenoid 2P+PE/M16 x 1.5, position transducer 4P/Pg7 in scope of delivery, see catalogue section RE 08008
- External trigger electronics (order separately)
  - Electric amplifier for standard curve “L”
    0 811 405 061, see catalogue section RE 30041
  - Electric amplifier for non-linear curve “P”
    40 % – 0 811 405 067, see catalogue section RE 30040

Variants on request

- For standard applications
- Special symbols for plastic injection-moulding machines
- Sturdy “ruggedized” version for applications up to 40 g, valve with metal cap and central plug (7P).

Ordering data and scope of delivery

4WRP		H	10		B		– 2X	/ G24	Z4 /	M	*

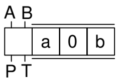
For **external** trigger electronics **= no desig.**

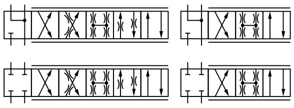
Control piston/sleeve **= H**

Size 10 **= 10**

Symbols

4/4-way version





= C3, C5

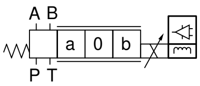
= C4, C1

With symbols C5 and C1:

P → A: q_v B → T: $q_v/2$

P → B: $q_v/2$ A → T: q_v

Side of inductive position transducer



(Standard) **= B**

Nominal flow rate at 70 bar valve pressure difference (35 bar/metering notch)

Size 10

50 = 50 l/min

100 = 100 l/min

Flow characteristic

L = Linear

P = Non-linear curve

2X = Unit series 20 to 29 (installation and connection dimensions unchanged)

Voltage supply of trigger electronics

G24 = +24 V DC

Electrical connection

Z4 = with line socket, with plug to DIN 43560-AM2

Line socket included in scope of delivery

M = NBR seals, suitable for mineral oils (HL, HLP) to DIN 51524

Further information in plain text

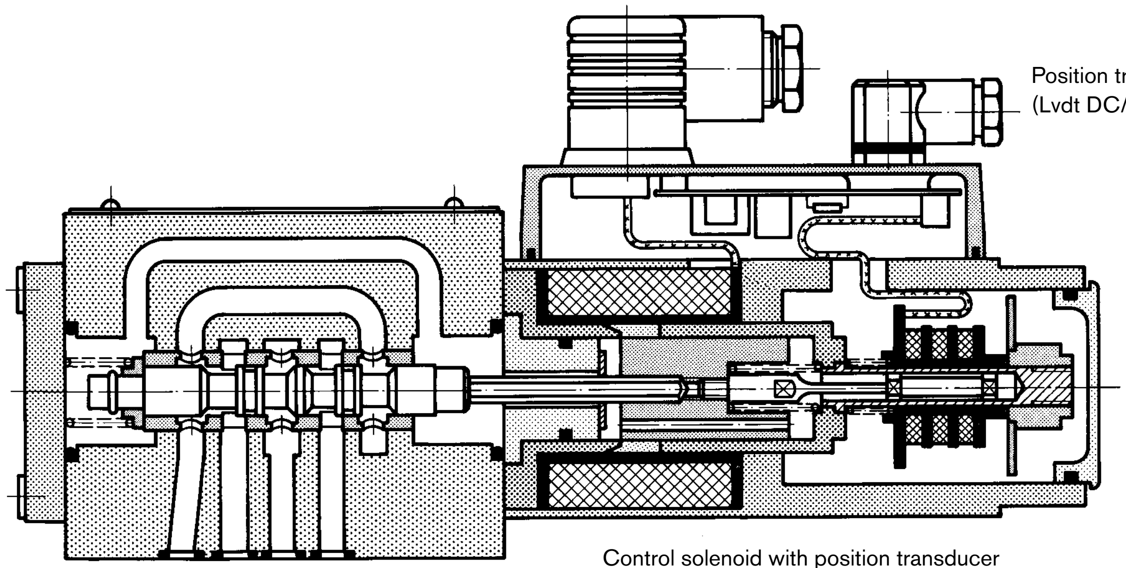
Preferred types (available at short notice)

Type 4WRPH 10	Material No.
C3/C5	
4WRPH 10 C3B50L –2X/G24Z4 /M	**0 811 404 058**
4WRPH 10 C3B100L –2X/G24Z4 /M	**0 811 404 059**
4WRPH 10 C5B100L –2X/G24Z4 /M	**0 811 404 077**
4WRPH 10 C3B50P –2X/G24Z4 /M	**0 811 404 062**
4WRPH 10 C3B100P –2X/G24Z4 /M	**0 811 404 063**
4WRPH 10 C5B100P –2X/G24Z4 /M	**0 811 404 079**

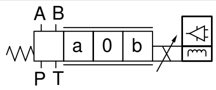
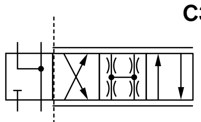
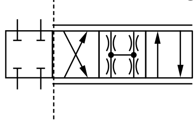
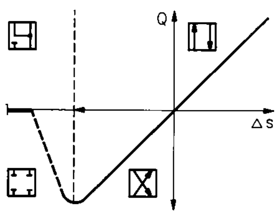
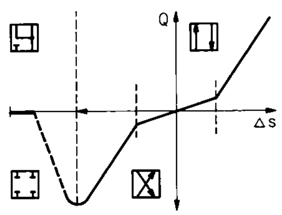
Type 4WRPH 10	Material No.
C1/C4	
4WRPH 10 C4B50L –2X/G24Z4 /M	**0 811 404 060**
4WRPH 10 C4B100L –2X/G24Z4 /M	**0 811 404 061**
4WRPH 10 C1B100L –2X/G24Z4 /M	**0 811 404 076**
4WRPH 10 C4B50P –2X/G24Z4 /M	**0 811 404 064**
4WRPH 10 C4B100P –2X/G24Z4 /M	**0 811 404 065**
4WRPH 10 C1B50P –2X/G24Z4 /M	**0 811 404 067**
4WRPH 10 C1B100P –2X/G24Z4 /M	**0 811 404 078**

Function, sectional diagram

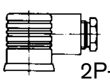
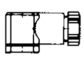
Servo solenoid valve 4WRPH 10



Symbols

	Linear	p: kink 40 %
C3, C5  **C4, C1** 		
	C3, C4, C5, C1	

Accessories, not included in scope of delivery

(4 x) M6 x 40 DIN 912–10.9	Fastening screws	**2 910 151 209**
	VT-VRRA1-537-20/V0, see RE 30041	**0 811 405 061**
	VT-VRRA1-537-20/V0/K40-AGC, see RE 30040	**0 811 405 067**
 2P+PE  4P	Line sockets 2P+PE (M16 x 1.5) and 4P (Pg7) included in scope of delivery, see also RE 08008	

Application

– Valve amplifier with pressure compensator (p/Q), see RE 30058.

Testing and service equipment

– Test box type VT-PE-TB2, see RE 30064.
– Test adapter type VT-PA-3, see RE 30070.

Technical data

General

Construction		Spool type valve, operated directly, with steel sleeve
Actuation		Proportional solenoid with position control, external amplifier
Type of mounting		Subplate, mounting hole configuration NG10 (ISO 4401-05-04-0-94)
Installation position		Optional
Ambient temperature range	°C	–20 … +50
Weight	kg	6.8
Vibration resistance, test condition		Max. 25 g, shaken in 3 dimensions (24 h)

Hydraulic (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

Pressure fluid			Hydraulic oil to DIN 51524 … 535, other fluids after prior consultation			
Viscosity range	recommended	mm²/s	20 … 100			
	max. permitted	mm²/s	10 … 800			
Pressure fluid temperature range		°C	–20 … +80			
Maximum permissible degree of contamination of pressure fluid Purity class to ISO 4406 (c)			Class 18/16/13 [1)]			
Flow direction			See symbol			
Nominal flow at $\Delta p = 35$ bar per notch [2)]		l/min	50 (1:1)	50 (2:1)	100 (1:1)	100 (2:1)
Max. working pressure		bar	Port P, A, B: 315			
Max. pressure		bar	Port T: 250			
Operating limits at Δp Pressure drop at valve		bar	315	315	160	160
q_{Vnom}: > q_N valves		bar	250	250	100	100
Leakage at 100 bar		cm³/min	< 1200	< 1200	< 1500	< 1000
		cm³/min	< 600	< 500	< 600	< 600

Electrical

Cyclic duration factor	%	100	
Power supply		24 V_{nom} (external amplifier)	
Degree of protection		IP 65 to DIN 40050	
Solenoid connector		Connector DIN 43650/ISO 4400 M16 x 1.5 (2P+PE)	
Position transducer connector		Connector Pg7 (4P)	
Max. solenoid current	A	3.7	
Coil resistance R_{20}	Ω	2.4	
Max. power consumption at 100 % load and operational temperature	VA	60	
Position transducer DC/DC technology		Supply: +15 V/35 mA –15 V/25 mA	Signal: 0...±10 V ($R_L \geqq 10$ kΩ)

Static/Dynamic

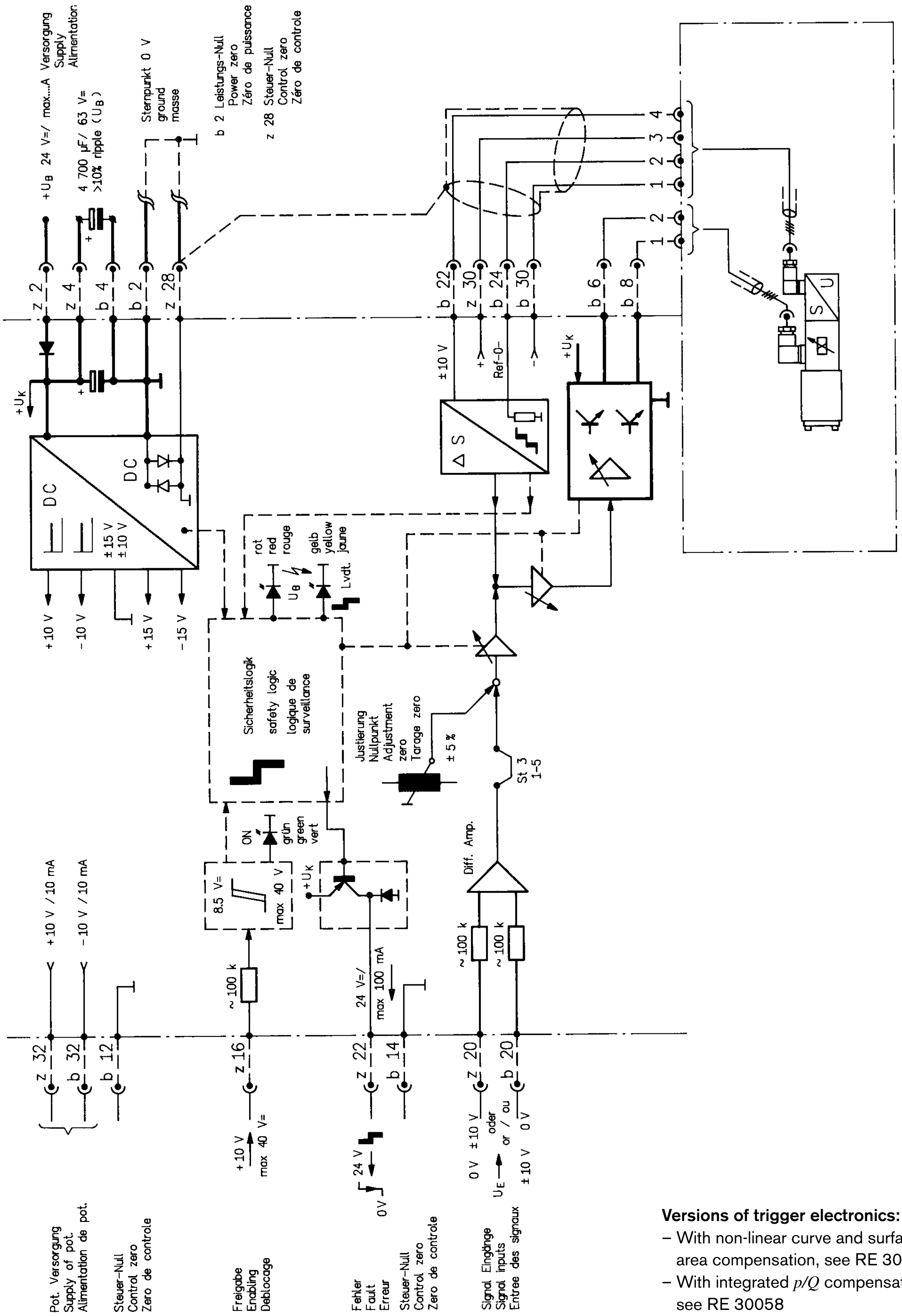
Hysteresis	%	$\leqq 0.2$
Manufacturing tolerance for $q_{max.}$	%	< 10
Response time for signal change 0 … 100 %	ms	< 25
Thermal drift		Zero point displacement < 1 % at $\Delta T = 40\,°C$

1) The purity classes stated for the components must be complied with in hydraulic systems. Effective filtration prevents problems and also extends the service life of components. For a selection of filters, see catalogue sections RE 50070, RE 50076 and RE 50081.

2) Flow rate at a different Δp $\quad q_x = q_{nom} \cdot \sqrt{\dfrac{\Delta p_x}{35}}$

Valve with external trigger electronics (standard linear curve: L)

Block diagram/pin assignment

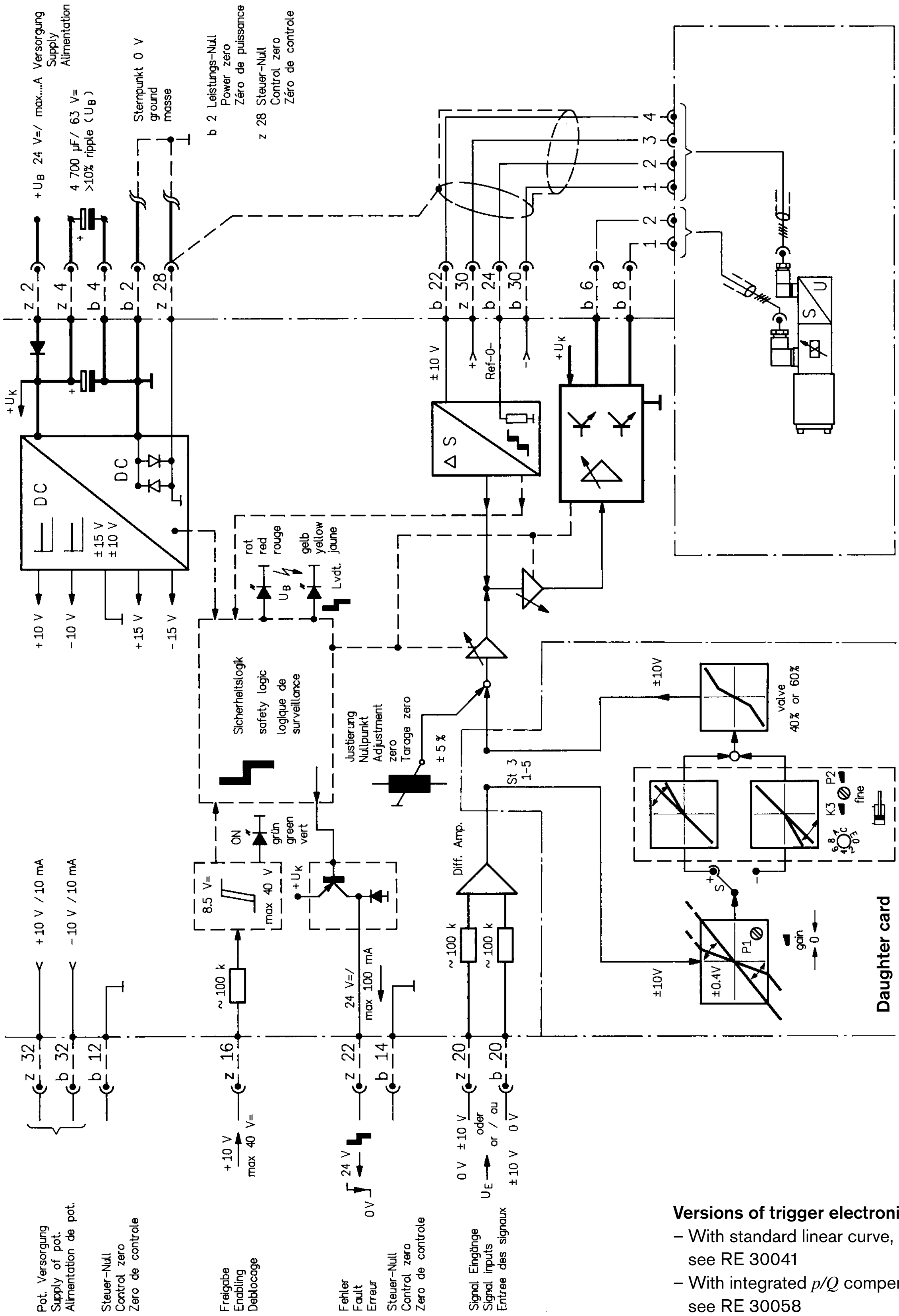


Versions of trigger electronics:

- With non-linear curve and surface area compensation, see RE 30040
- With integrated *p/Q* compensator, see RE 30058

Valve with external trigger electronics (standard non-linear curve: P)

Block diagram/pin assignment

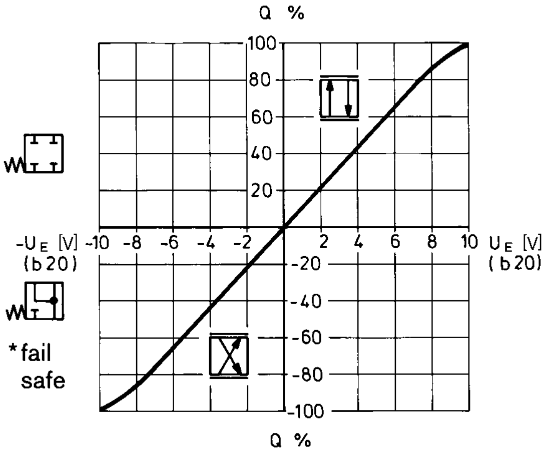


Versions of trigger electronics:
- With standard linear curve, see RE 30041
- With integrated *p/Q* compensator, see RE 30058

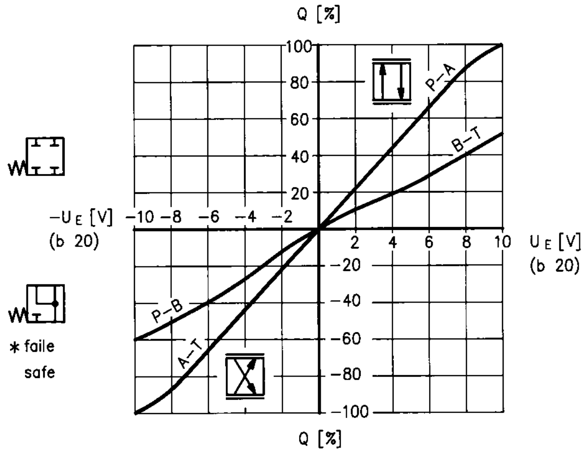
Performance curves (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

Flow rate/Signal function $Q = f\ (U_E)$

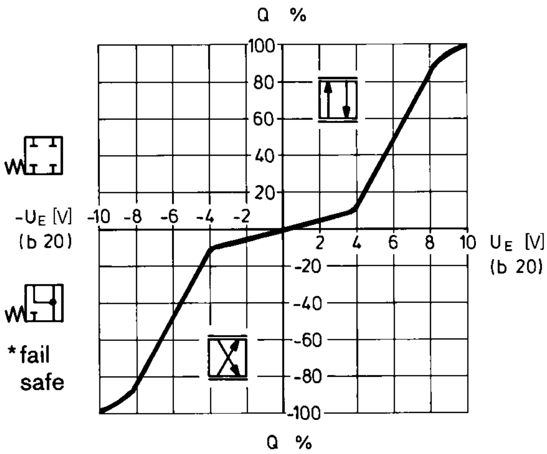
L: Linear



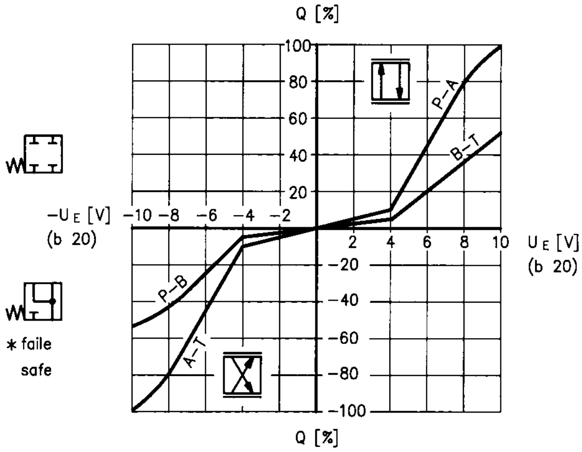
L: (linear) 2:1



P: (kink 40 %)**

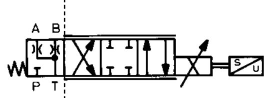


P: (kink 40 %) 2:1**

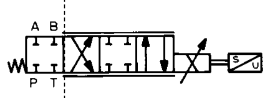


*Fail-safe when enabling is not released.
**Q_N-kink = 10 % Q_N.

Fail-safe position



Leakage at	100 bar	P–A P–B	50 cm³/min 70 cm³/min
Flow at	Δp = 35 bar q_N 50/100 l/min	A–T B–T	10 … 100 l/min 10 … 25 l/min

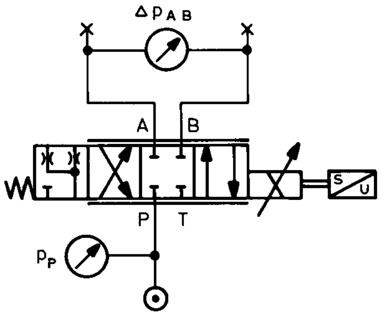


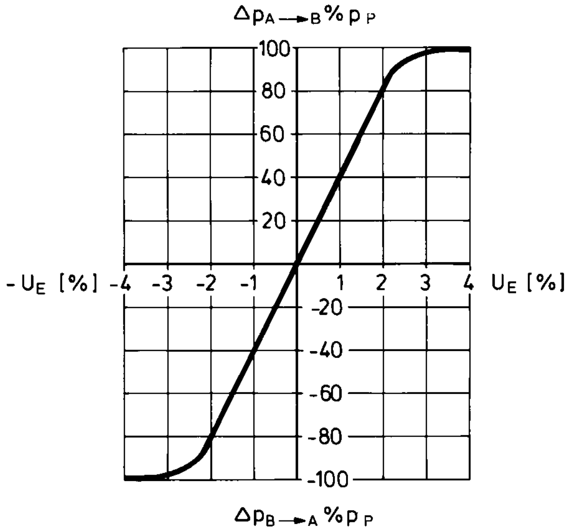
Leakage at	100 bar	P–A P–B A–T B–T	50 cm³/min 70 cm³/min 70 cm³/min 50 cm³/min

Fail-safe	p = 0 bar → 12 ms p = 100 bar → 16 ms	Enable off

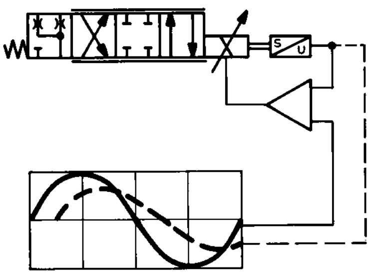
Performance curves (measured with HLP46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

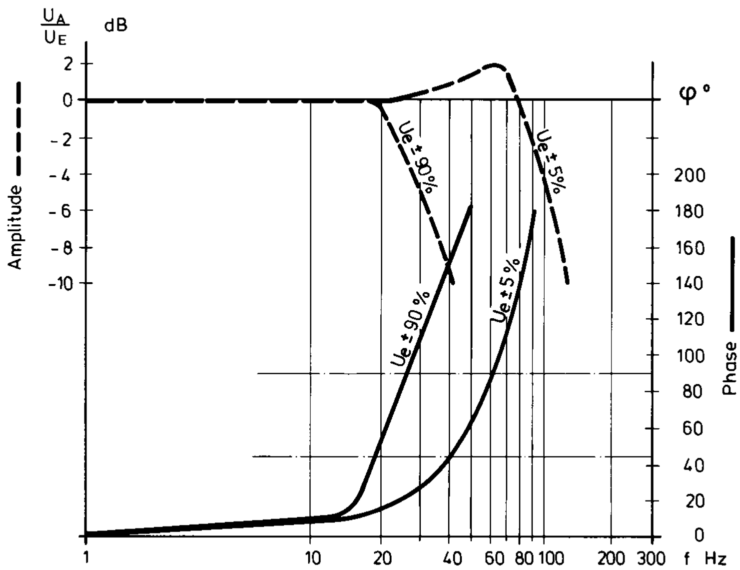
Pressure gain



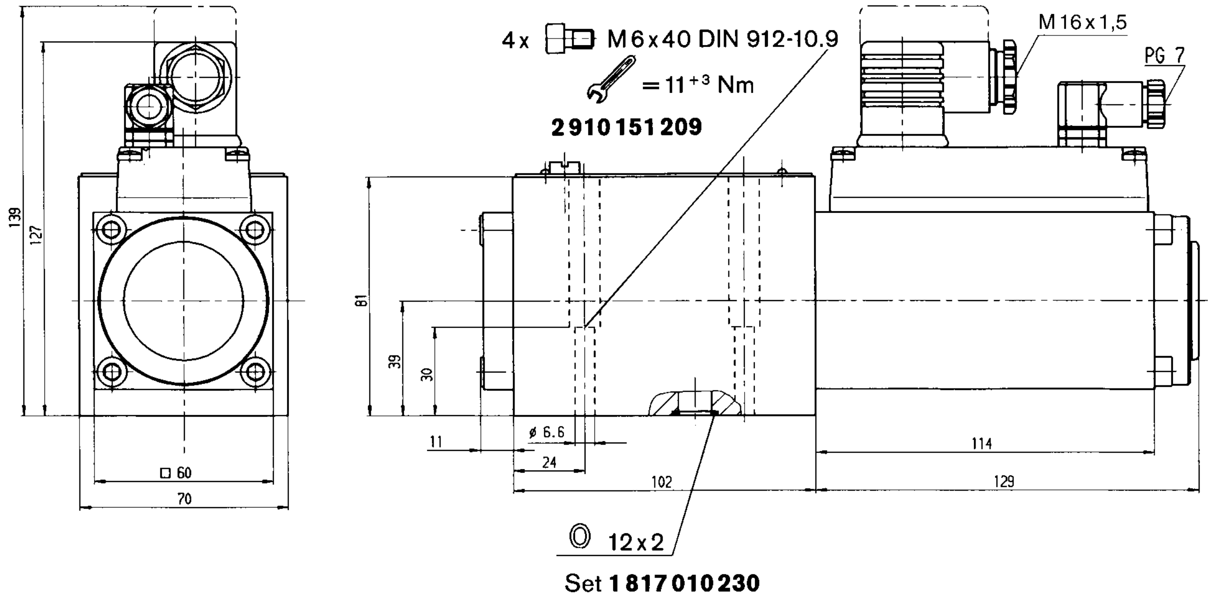


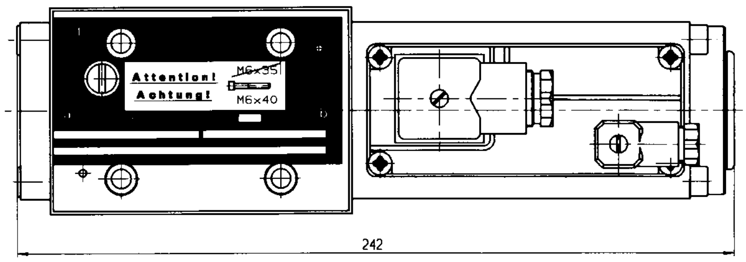
Bode diagram



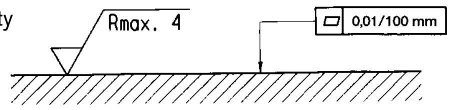


Unit dimensions (nominal dimensions in mm)

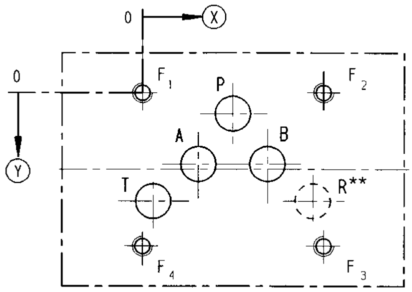




Required surface quality
of mating component



Mounting hole configuration: NG10
(ISO 4401-05-04-0-94)
For subplates, see catalogue section
RE 45055



1) Deviates from standard
2) Thread depth:
Ferrous metal 1.5 x Ø*
Non-ferrous 2 x Ø
* (NG10 min. 10.5 mm)

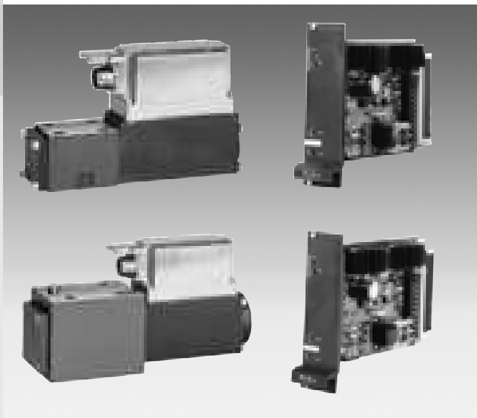
** 5/3 – NG10
$R = P_2$

	P	A	T	B	F_1	F_2	F_3	F_4	R
Ⓧ	27	16.7	3.2	37.3	0	54	54	0	50.8
Ⓨ	6.3	21.4	32.5	21.4	0	0	46	46	32.5
Ø	10.5 [1]	10.5 [1]	10.5 [1]	10.5 [1]	M6 [2]	M6 [2]	M6 [2]	M6 [2]	10.5 [1]

Servo solenoid valves with electrical position feedback (Lvdt DC/DC) (ruggedized design)

RE 29026/07.08
Replaces: 01.05

Type 4WRPH



Nominal size (NG) 6, 10
Unit series 2X
Maximum working pressure P, A, B 315 bar, T 250 bar
Nominal flow rate 12...40 l/min (NG6), 50...100 l/min (NG10)

List of contents

Features

– Directly operated servo solenoid valve NG6, NG10, with control piston and sleeve in servo quality and sturdy design
– Actuated on one side, 4/4 fail-safe position when switched off
– “Ruggedized” design 40 *g* with central plug
– Suitable for the wood industry and in systems with difficult ambient conditions
– For subplate attachment, mounting hole configuration NG6 to ISO 4401-03-02-0-05 and NG10 to ISO 4401-05-04-0-05
– Subplates as per catalogue section NG6 RE 45053 and NG10 RE 45055 (order separately)

Ordering data

4WRP		H			B		–2X/G24	K0/	M – 750

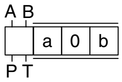
For **external** trigger electronics **= no design.**

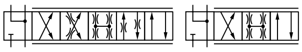
Control piston/sleeve **= H**

Nominal size 6 **= 6**
Nominal size 10 **= 10**

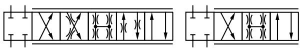
Symbols

4/4-way version





= C3, C5

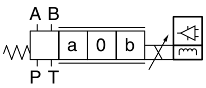


= C4, C1

With symbols C5 and C1: [3]

P → A: q_v B → T: $q_v/2$
P → B: $q_v/2$ A → T: q_v

Side of inductive position transducer



(Standard) **= B**

Nominal flow rate at 70 bar valve pressure difference

Nominal Size 6	**Nominal Size 10**
12 = 12 l/min	**50 =** 50 l/min
15[1] = 15 l/min	**100 =** 100 l/min
24 = 24 l/min	
25[1] = 25 l/min	
40 = 40 l/min	

Flow characteristic
L = Linear
P = Non-linear curve [2]

2X = Unit series 20 to 29 (installation and connection dimensions unchanged)

Voltage supply of trigger electronics
G24 = +24 V DC

Electrical connection
K0 = without line socket, with plug to DIN 43563-AM6
Order line socket separately

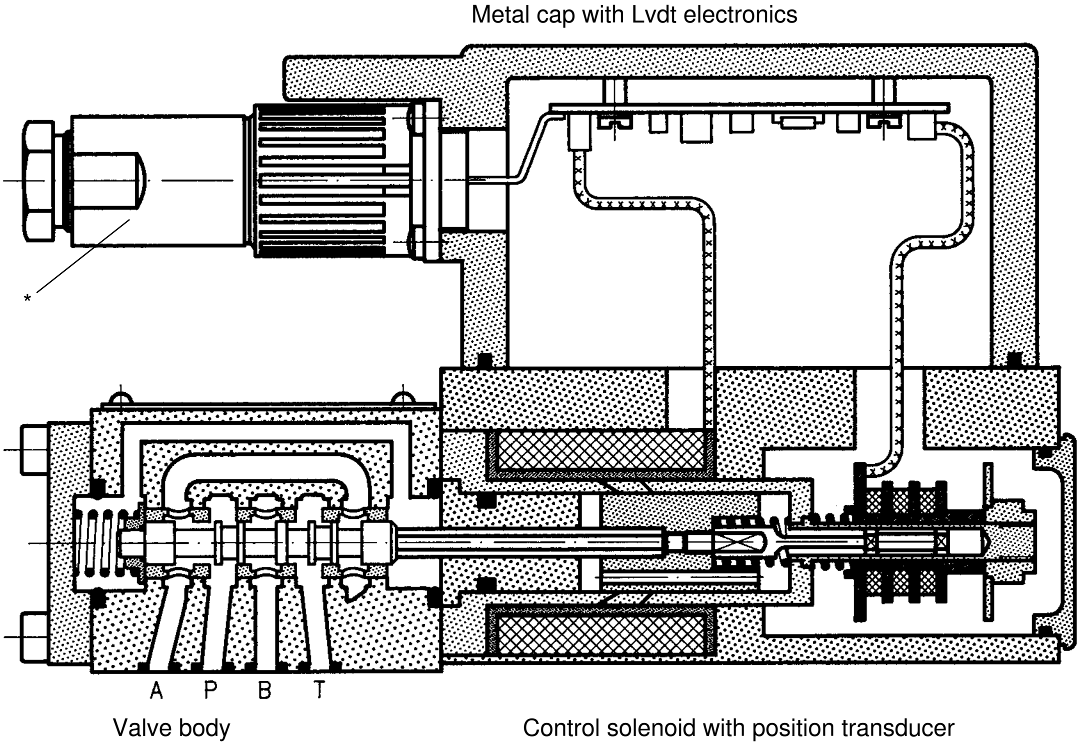
M = NBR seals, suitable for mineral oils (HL, HLP) to DIN 51524

750 = Ruggedized design

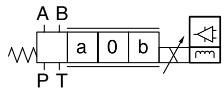
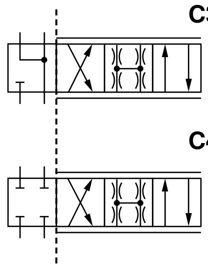
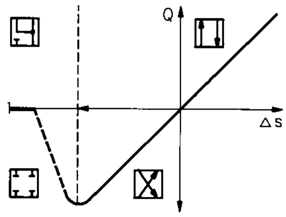
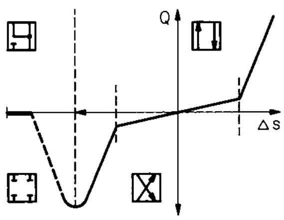
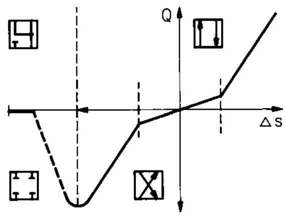
[1] Only in connection with flow characteristic “p”
[2] Kink 60% for NG6 with nominal flow rate “15” and “25”, otherwise kink 40%
[3] q_v 2:1 only with nominal flow rate ≧ 40 l/min

Function, Sectional diagram

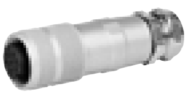
Servo solenoid valve 4WRPH6...–750



Symbols

	Linear	p: kink 60 %	p: kink 40 %
C3, C5  **C4, C1**			
	C3, C4	C5, C1	C5, C1

Accessories

(4 x) M5 x 30 DIN 912–10.9	Fastening screws	**2 910 151 166**
 	VT-VRRA1-527-20/V0, see RE 30041	**0 811 405 060**
	VT-VRRA1-527-20/V0/K60-AGC, see RE 30040	**0 811 405 066**
	VT-VRRA1-527-20/V0/K40-AGC, see RE 30040	**0 811 405 065**
*  6P + PE (Pg16)	Line socket not included in scope of delivery, see also RE 08008	**1 834 482 024**

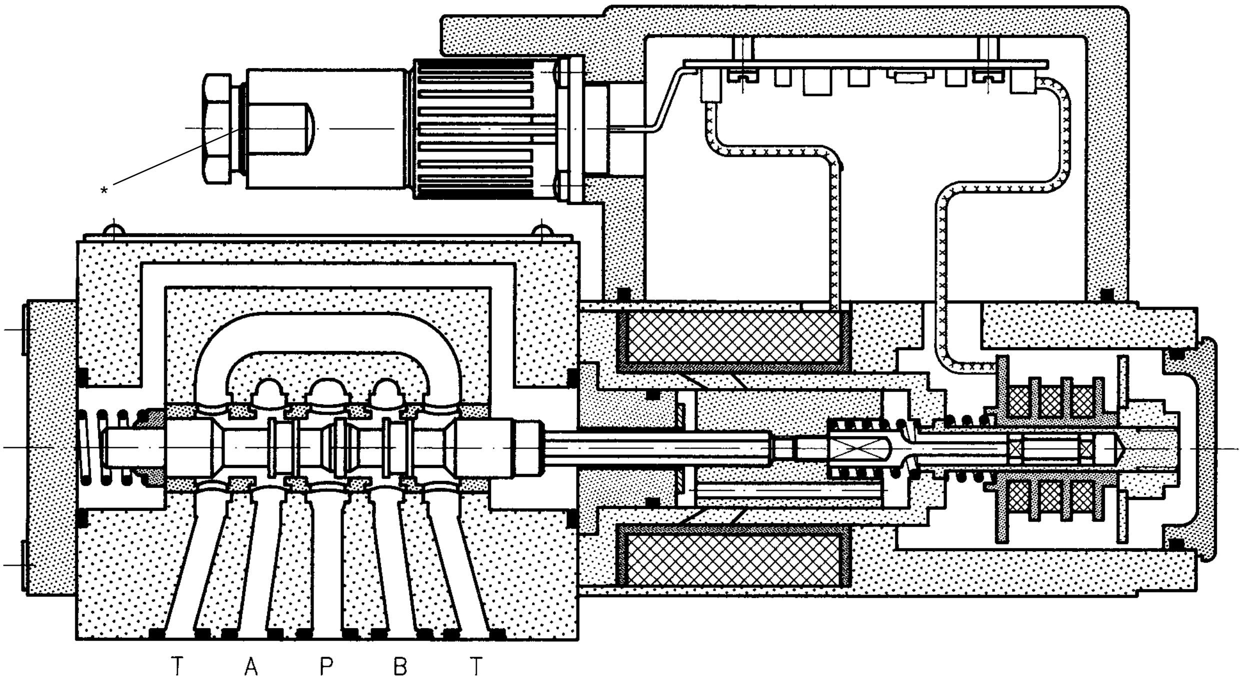
Testing and service equipment

– Test box type VT-PE-TB2, see RE 30064.

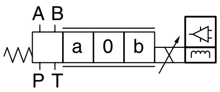
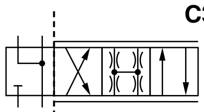
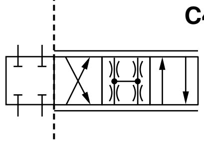
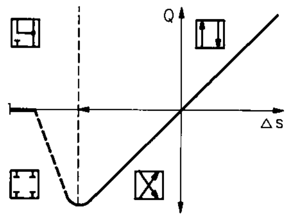
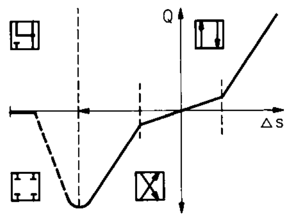
– Test adapter type VT-PA-3, see RE 30070.

Function, Sectional diagram

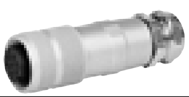
Servo solenoid valve 4WRPH 10...–750



Symbols

	Linear	p: kink 40%
C3, C5  **C4, C1** 		
	C3, C4	C5, C1

Accessories

(4 x) M6 x 40 DIN 912–10.9 	Fastening screws	**2 910 151 209**
	VT-VRRA1-537-20/V0, see RE 30041	**0 811 405 061**
	VT-VRRA1-537-20/V0/K40-AGC, see RE 30040	**0 811 405 067**
*  6P + PE (Pg16)	Line socket not includes in scope of delivery, see also RE 08008	**1 834 482 024**

Testing and service equipment

– Test box type VT-PE-TB2, see RE 30064.

– Test adapter type VT-PA-3, see RE 30070.

Technical data (Type 4WRPH 6)

General

Construction		Spool type valve, operated directly, with steel sleeve
Actuation		Proportional solenoid with position control, external amplifier
Type of mounting		Subplate, mounting hole configuration NG6 (ISO 4401-03-02-0-05)
Installation position		Optional
Ambient temperature range	°C	–20...+60
Weight	kg	2.5
Vibration resistance, test condition		Max. 40 g, shaken in 3 dimensions (24 h)

Hydraulic (measured with HLP 46, ϑ_{oil} = 40 °C ±5 °C)

Pressure fluid			Hydraulic oil to DIN 51524...535, other fluids after prior consultation			
Viscosity range	recommende	mm^2/s	20...100			
	max. permitted	mm^2/s	10...800			
Pressure fluid temperature range		°C	–20...+70			
Maximum permissible degree of contamination of pressure fluid Purity class to ISO 4406 (c)			Class 18/16/13 [1]			
Flow direction			See symbol			
Nominal flow at Δp = 35 bar per notch [2]		l/min	12	15	24	40
Max. working pressure		bar	Port P, A, B: 315			
Max. pressure		bar	Port T: 250			
Operating limits at Δp Pressure drop at valve Q_{Vnom}: > Q_N valves		bar	315	315	315	160
		bar	315	280	250	100
Leakage at 100 bar		cm^3/min	< 300	–	< 500	< 900
		cm^3/min	–	< 180	< 300	< 450

Electrical

Cyclic duration factor	%	100	
Power supply		24 V_{nom} (external amplifier)	
Degree of protection		IP 66 to DIN 40050, line socket 1 834 482 024, mounted	
Connectors for solenoid and position transducer		To DIN 43563-AM6 (line socket 1 834 482 024) Pg16 For pin assignment see block diagram on pages 7 and 8	
Max. solenoid current	A	2.7	
Coil resistance R_{20}	Ω	2.5	
Max. power consumption at 100 % load and operational temperature	VA	40	
Position transducer DC/DC technology		Supply: +15 V/35 mA –15 V/25 mA	Signal: 0...±10 V (R_L ≧ 10 kΩ)

Static/Dynamic

Hysteresis	%	≦ 0.2
Manufacturing tolerance for Q_{max}	%	< 10
Response time for signal change 0...100 %	ms	< 10
Thermal drift		Zero point displacement <1 % at ΔT = 40 °C

[1] The purity classes stated for the components must be complied with in hydraulic systems.
Effective filtration prevents problems and also extends the service life of components.
For a selection of filters, see catalogue sections RE 50070, RE 50076 and RE 50081.

[2] Flow rate at a different Δp $\quad Q_x = Q_{nom} \cdot \sqrt{\frac{\Delta p_x}{35}}$

Technical data (Type 4WRPH 10)

General

Construction		Spool type valve, operated directly, with steel sleeve
Actuation		Proportional solenoid with position control, external amplifier
Type of mounting		Subplate, mounting hole configuration NG10 (ISO 4401-05-04-0-05)
Installation position		Optional
Ambient temperature range	°C	–20...+60
Weight	kg	7.0
Vibration resistance, test condition		Max. 40 g, shaken in 3 dimensions (24 h)

Hydraulic (measured with HLP 46, ϑ_{oil} = 40 °C ± 5 °C)

Pressure fluid		Hydraulic oil to DIN 51524...535, other fluids after prior consultation			
Viscosity range recommended	mm^2/s	20...100			
Viscosity range max. permitted	mm^2/s	10...800			
Pressure fluid temperature range	°C	–20...+70			
Maximum permissible degree of contamination of pressure fluid Purity class to ISO 4406 (c)		Class 18/16/13 [1)]			
Flow direction		See symbol			
Nominal flow at Δp = 35 bar per notch [2)]	l/min	50 (1:1)	50 (2:1)	100 (1:1)	100 (2:1)
Max. working pressure	bar	Port P, A, B: 315			
Max. pressure	bar	Port T: 250			
Operating limits at Δp Pressure drop at valve Q_{Vnom}: > Q_N Ventile	bar	315	315	160	160
	bar	250	250	100	100
Leakage at 100 bar	cm^3/min	< 1,200	< 1,200	< 1,500	< 1,000
	cm^3/min	< 600	< 500	< 600	< 600

Electrical

Cyclic duration factor	%	100	
Power supply		24 V_{nom} (external amplifier)	
Degree of protection		IP 66 to DIN 40050, line socket 1 834 482 024, mounted	
Connectors for solenoid and position transducer		To DIN 43563-AM6 (line socket 1 834 482 024) Pg16 For pin assignment see block diagram on pages 7 and 8	
Max. solenoid current	A	3.7	
Coil resistance R_{20}	Ω	2.4	
Max. power consumption at 100 % load and operational temperature	VA	60	
Position transducer DC/DC technology		Supply: +15 V/35 mA –15 V/25 mA	Signal: 0...±10 V ($R_L \geqq$ 10 kΩ)

Static/Dynamic

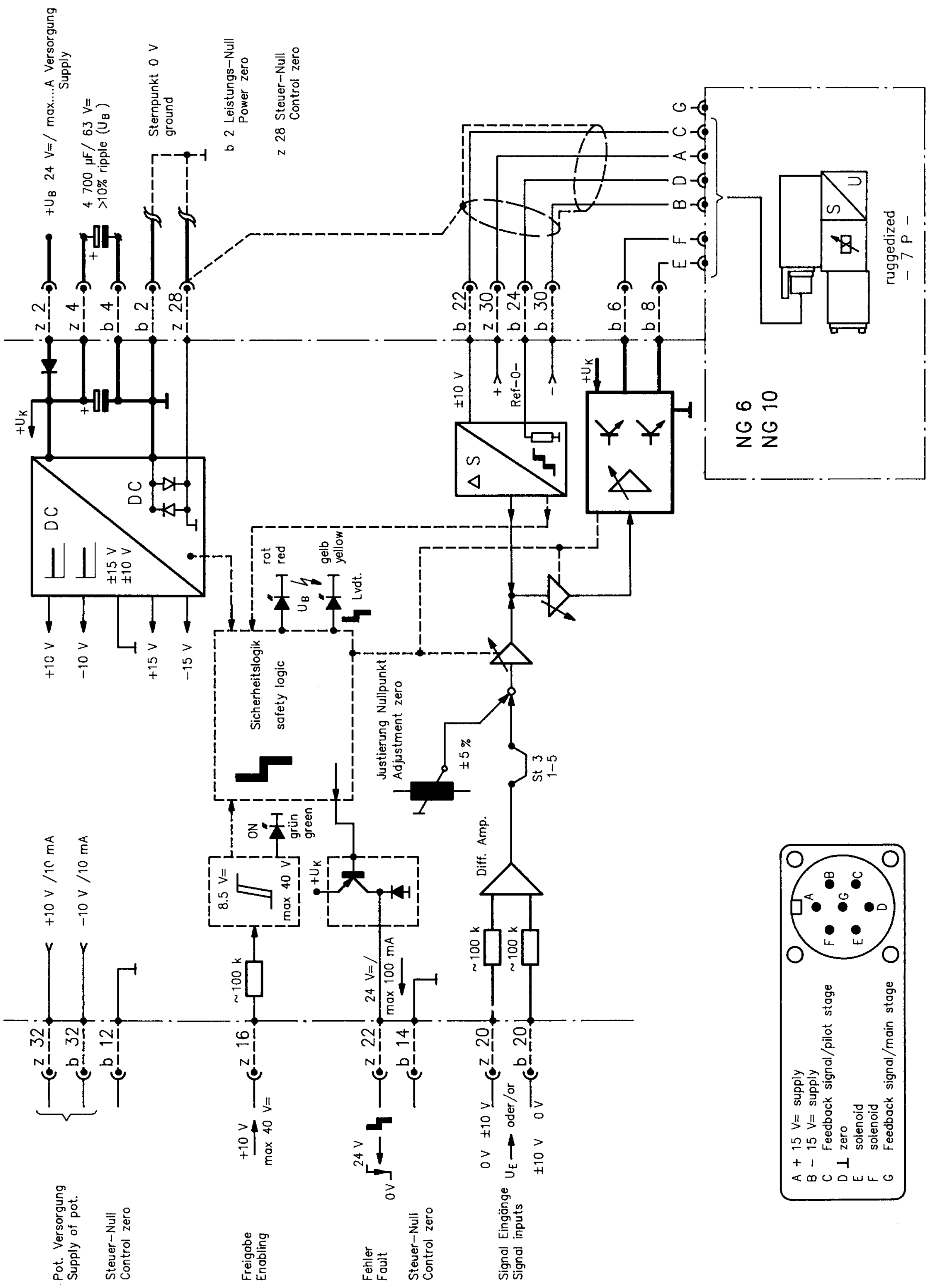
Hysteresis	%	$\leqq$ 0.2
Manufacturing tolerance for Q_{max}	%	< 10
Response time for signal change 0...100 %	ms	$\leqq$ 25
Thermal drift		Zero point displacement <1 % at ΔT = 40 °C

1) The purity classes stated for the components must be complied with in hydraulic systems. Effective filtration prevents problems and also extends the service life of components. For a selection of filters, see catalogue sections RE 50070, RE 50076 and RE 50081.

2) Flow rate at a different Δp $\qquad Q_x = Q_{nom} \cdot \sqrt{\frac{\Delta p_x}{35}}$

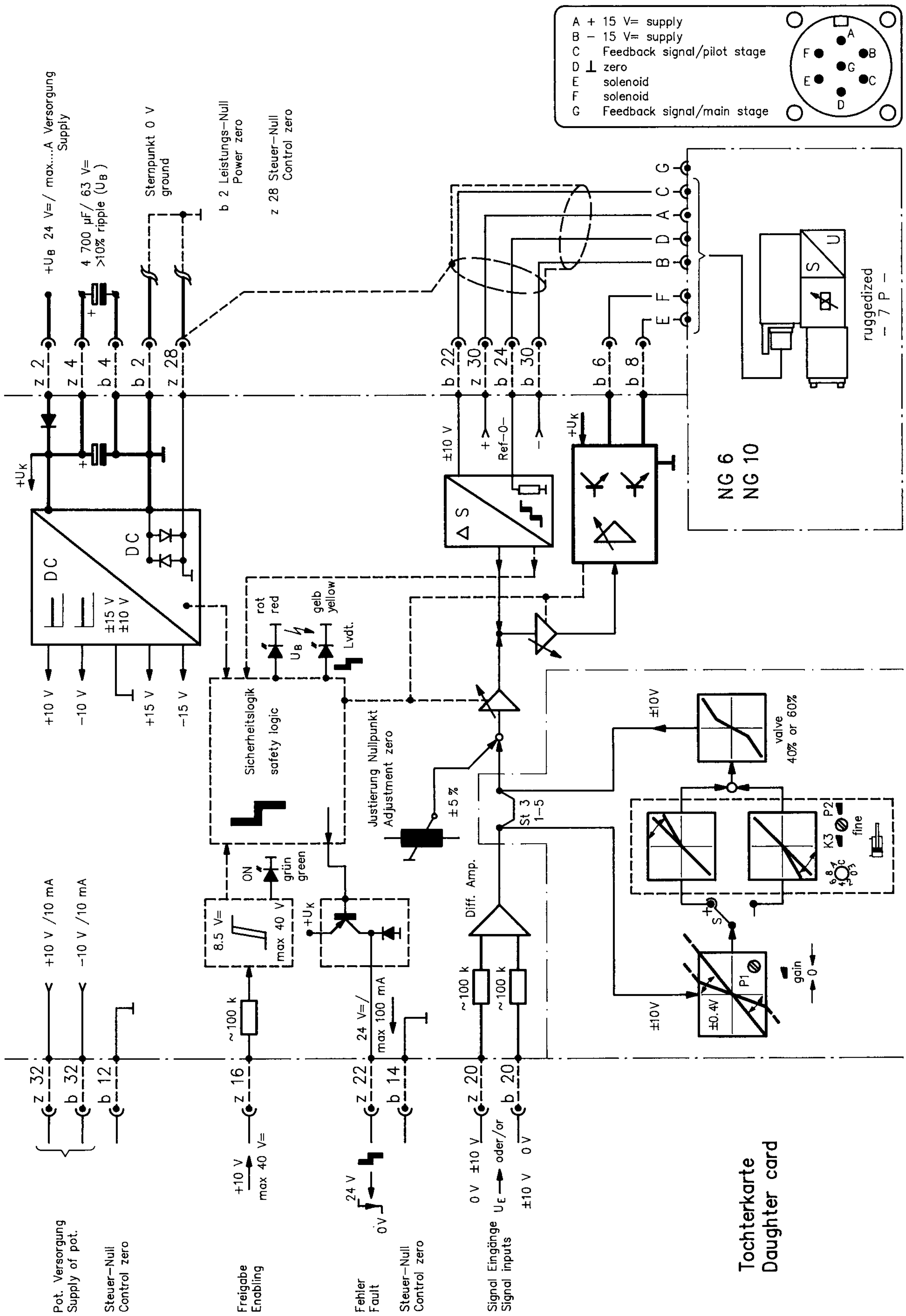
Valve with external trigger electronics (standard linear curve: L)

Block diagram/pin assignment



Valve with external trigger electronics (standard non-linear curve: P)

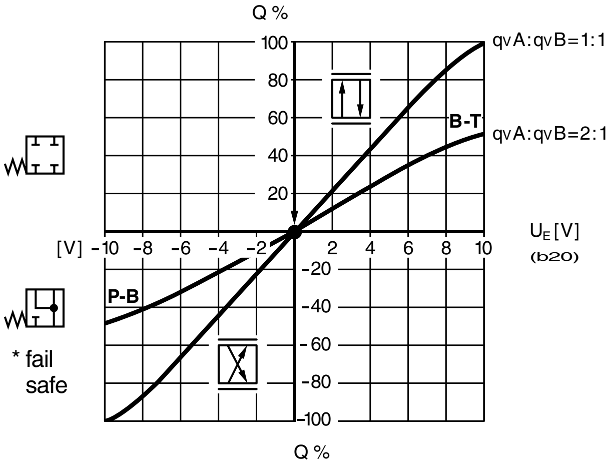
Block diagram/pin assignment



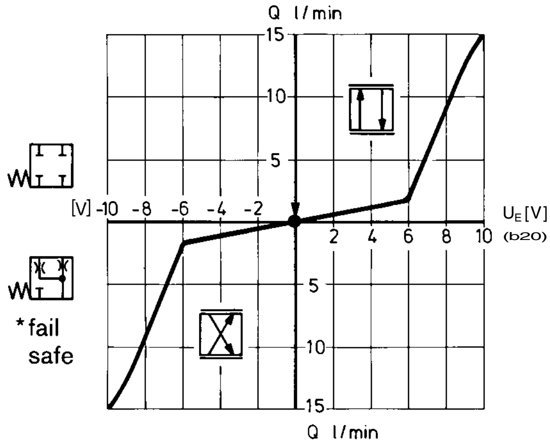
Performance curves (measured with HLP 46, ϑ_{oil} = 40 °C ±5 °C)

Flow rate/Signal function (with 70 bar pressure drop at valve)

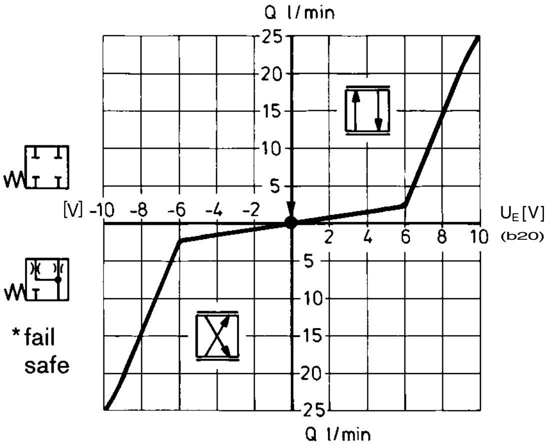
NG6, NG10
L: Linear 1:1 and 2:1



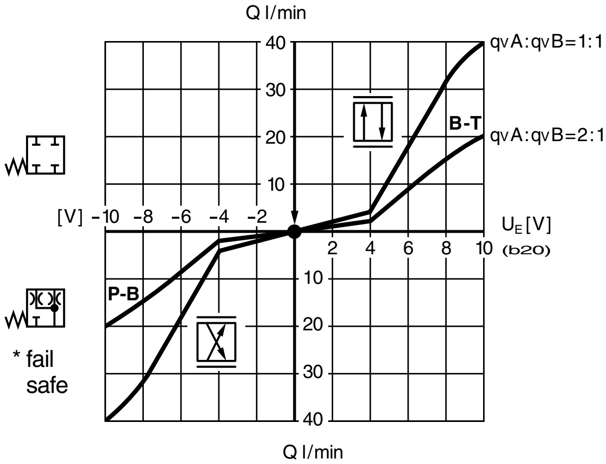
NG6
P: (kink 60 %)**



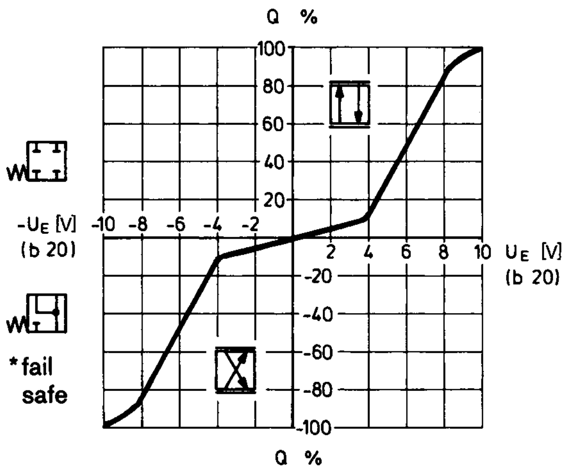
NG6
P: (kink 60 %)**



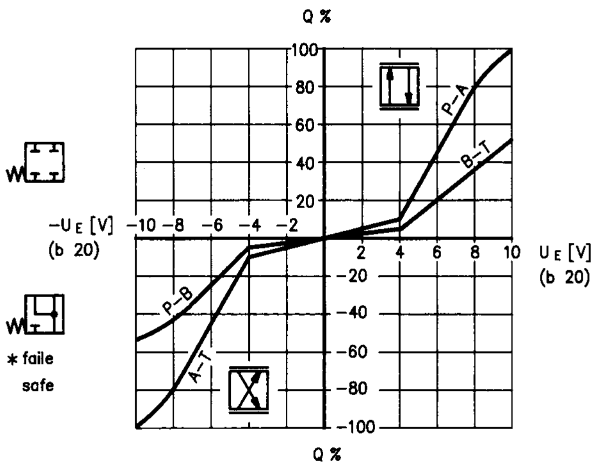
NG6
P: (kink 40 %) 1:1 and 2:1**



NG10
P: (kink 40 %)**



NG10
P: (kink 40 %) 1:1 and 2:1**

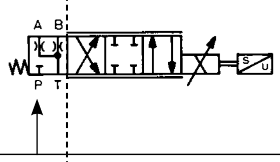
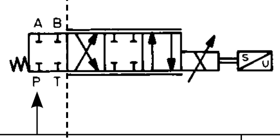


*Fail-safe, when enabling is not released.
**Q-kink = 10 % Q_N.

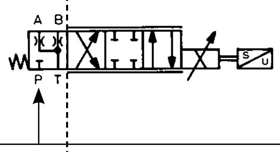
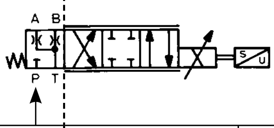
Performance curves (measured with HLP 46, ϑ_{oil} = 40 °C ±5 °C)

Fail-safe position

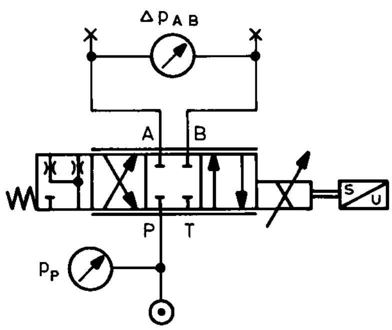
NG6 ← **Fail-safe position**

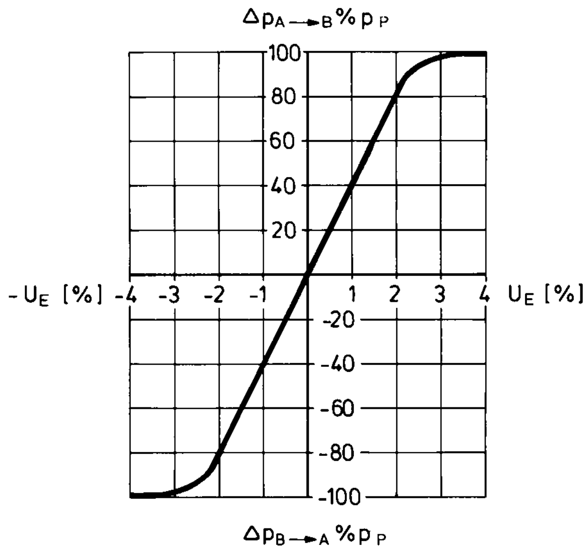
	Leakage at	100 bar	P–A P–B	50 cm³/min 70 cm³/min
	Flow at	Δp = 35 bar	A–T B–T	10...20 l/min 7...20 l/min
	Leakage at	100 bar	P–A P–B A–T B–T	50 cm³/min 70 cm³/min 70 cm³/min 50 cm³/min
Fail-safe	p = 0 bar → 7 ms p = 100 bar → 10 ms	Enable off		

NG10 ← **Fail-safe position**

	Leakage at	100 bar	P–A P–B	50 cm³/min 70 cm³/min
	Flow at	Δp = 35 bar Q_N 50/100 l/min	A–T B–T	10...100 l/min 10... 25 l/min
	Leakage at	100 bar	P–A P–B A–T B–T	50 cm³/min 70 cm³/min 70 cm³/min 50 cm³/min
Fail-safe	p = 0 bar → 12 ms p = 100 bar → 16 ms	Enable off		

Pressure gain

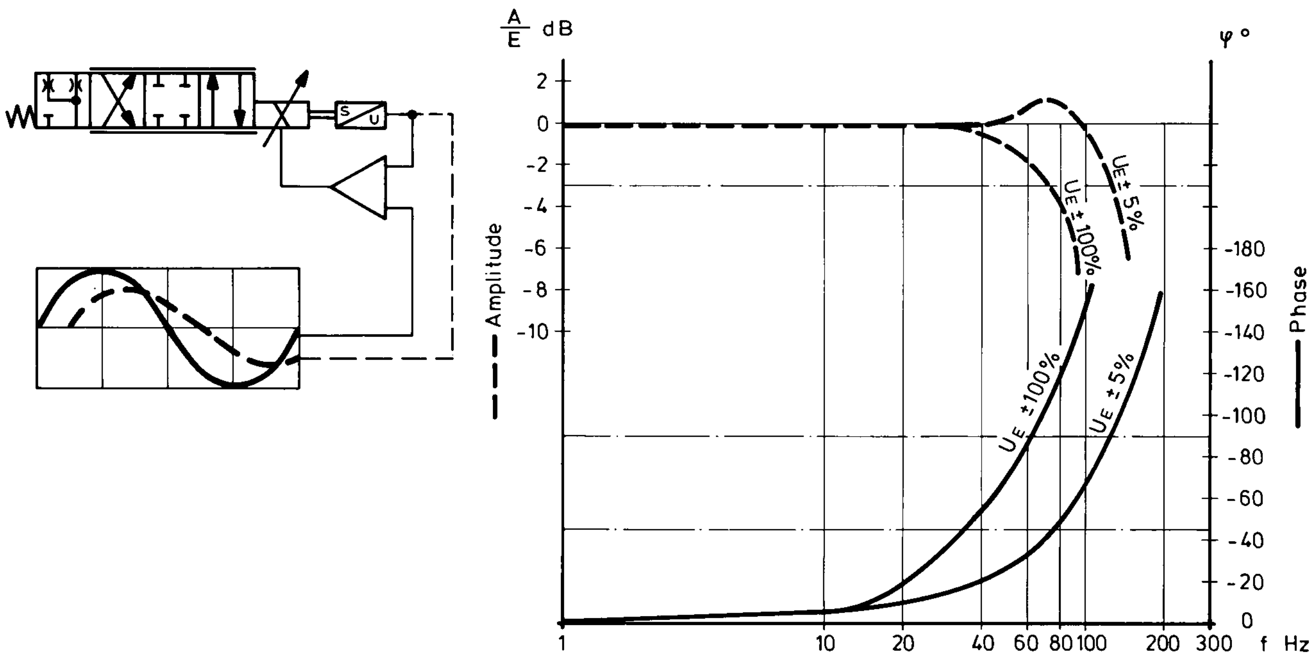




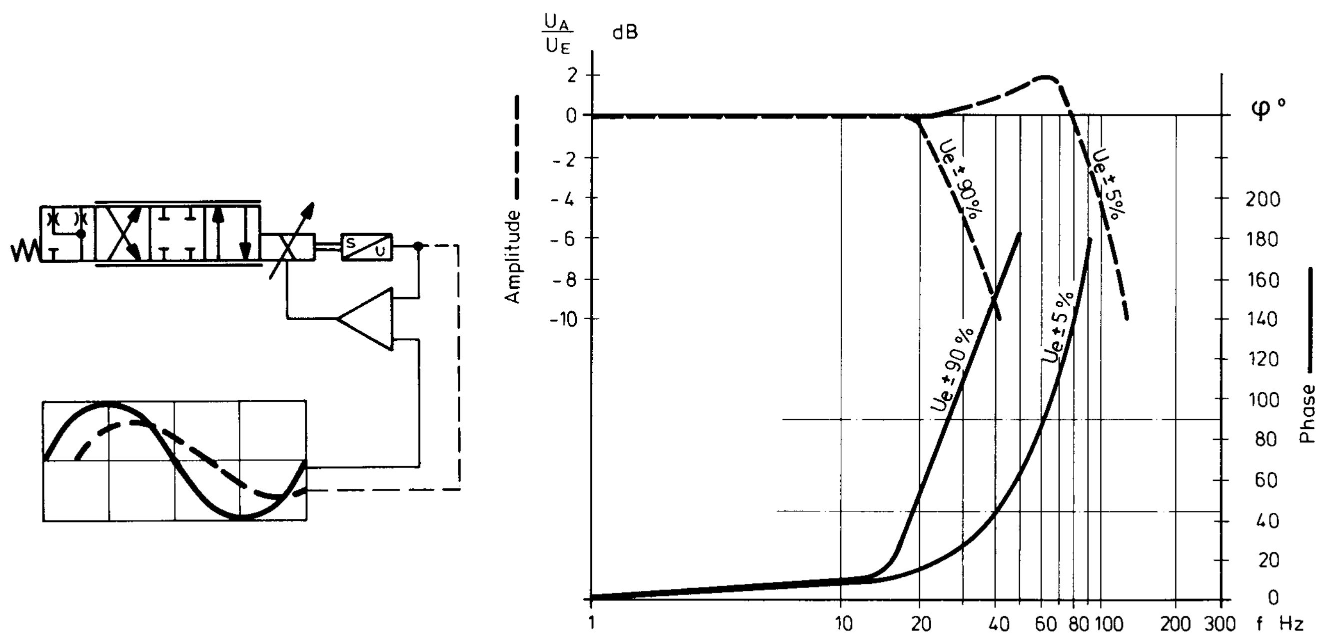
Performance curves (measured with HLP 46, ϑ_{oil} = 40 °C ±5 °C)

Bode diagram

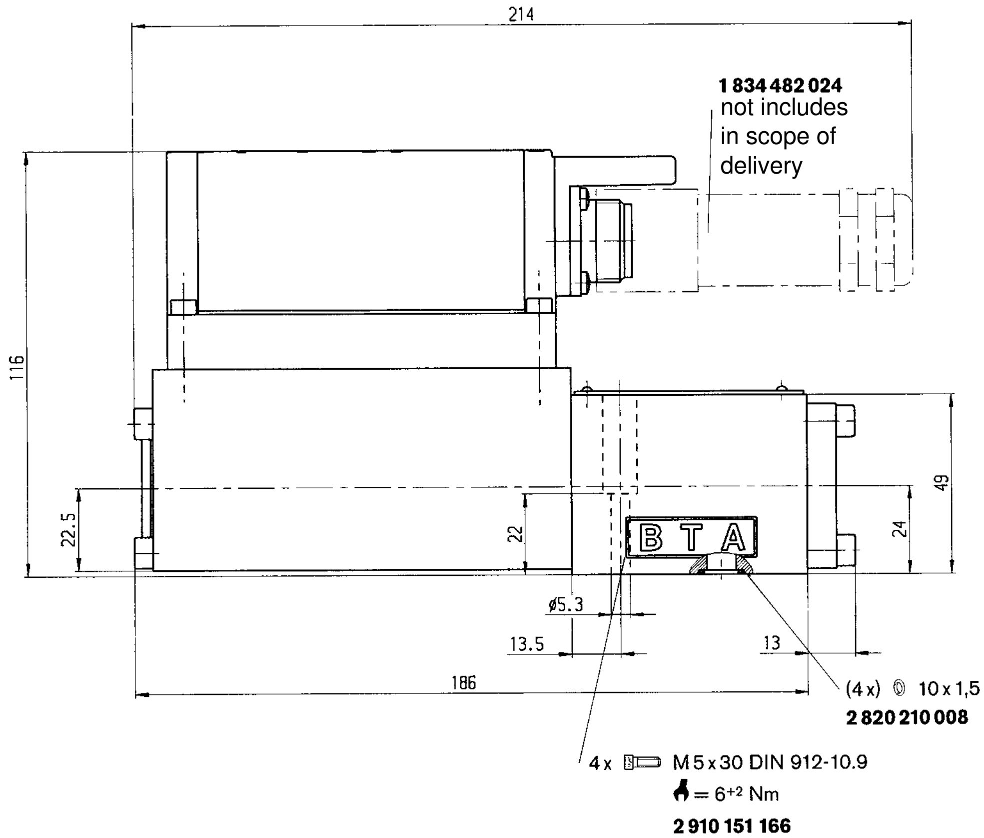
NG6

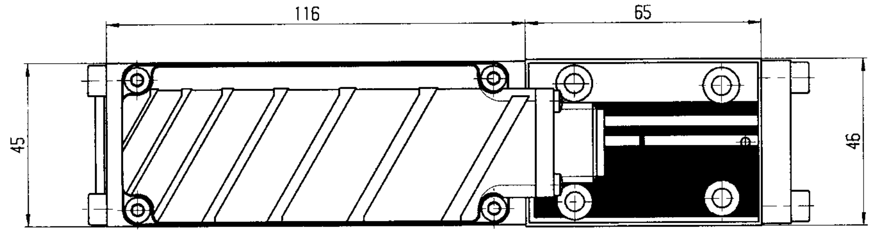


NG10

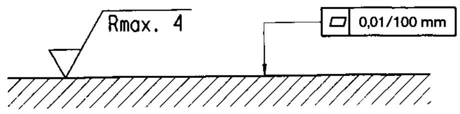


Unit dimensions for NG6 (in mm)

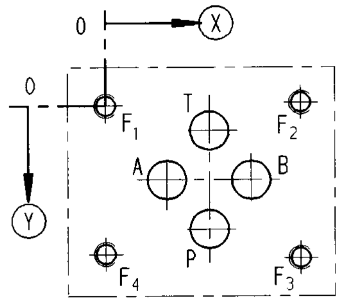




Required surface quality
of valve contact surface



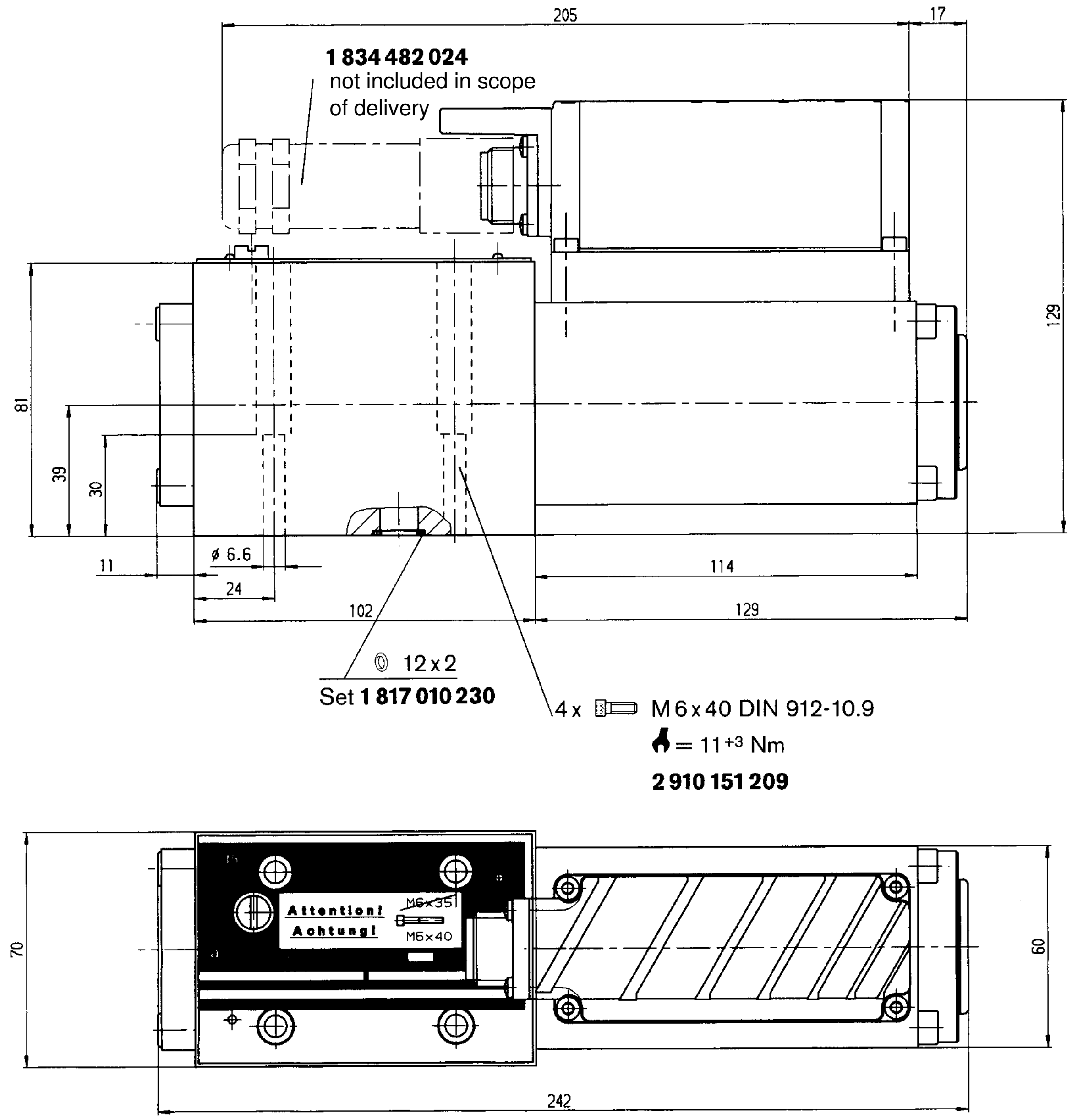
Mounting hole configuration: NG6 (ISO 4401-03-02-0-05)
For subplates, see catalogue section RE 45053



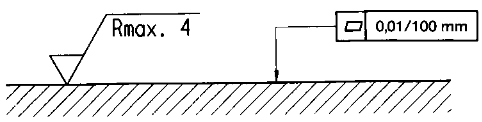
1) Deviates from standard
2) Thread depth:
Ferrous metal 1.5 x Ø
Non-ferrous 2 x Ø

	P	A	T	B	F_1	F_2	F_3	F_4
Ⓧ	21.5	12.5	21.5	30.2	0	40.5	40.5	0
Ⓨ	25.9	15.5	5.1	15.5	0	–0.75	31.75	31
∅	8 1)	8 1)	8 1)	8 1)	M5 2)	M5 2)	M5 2)	M5 2)

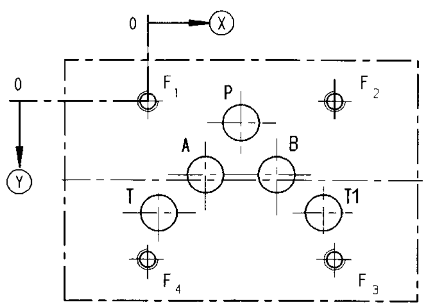
Unit dimensions for NG10 (in mm)



Required surface quality
of valve contact surface



Mounting hole configuration: NG10 (ISO 4401-05-04-0-05)
For subplates, see catalogue section RE 45055



[1] Deviates from standard
[2] Thread depth:
Ferrous metal 1.5 x Ø*
Non-ferrous 2 x Ø
* (NG10 min. 10.5 mm)

	P	A	T	T1	B	F_1	F_2	F_3	F_4
X	27	16.7	3.2	50.8	37.3	0	54	54	0
Y	6.3	21.4	32.5	32.5	21.4	0	0	46	46
Ø	10.5 [1]	10.5 [1]	10.5 [1]	10.5 [1]	10.5 [1]	M6 [2]	M6 [2]	M6 [2]	M6 [2]

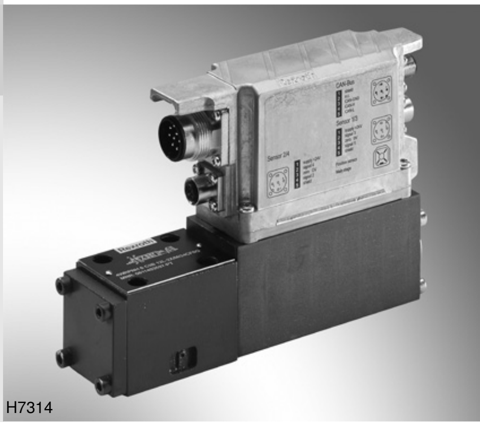
Rexroth
Bosch Group

High-response valve with integrated digital axis controller (IAC-R) and field bus interface

RE 29191/09.10
Replaces: 06.05

Type 4WRPNH.../24C...
Type 4WRPNH.../24P...

Size 6 and 10
Component series 2X
Maximum operating pressure 315 bar
Maximum flow 100 l/min (Δp = 70 bar)



H7314

Table of contents

Features

- Direct operated high-response valves size 6 and size 10 with control spool and sleeve in servo quality
- Single-side operated, 4/4 fail-safe position in deactivated state
- Integrated digital axis control functionality (IAC-R) for:
  - Flow control
  - Position control
  - Pressure control
  - p/Q function
  - Substitutional position/pressure and position/force control
  - NC functionality (stand-alone operation possible)
- Analog and digital interfaces for command and actual values
  - 4 x analog sensors (+/–10 V or 4..20 mA) or
  - 1 x length measurement system (1Vss or SSI) and 2 analog sensors
- Command value provision/actual value response analog (current or voltage) or via field bus
- Analog/digital inputs/outputs configurable
- Field bus connection
  - CAN bus with CANopen protocol DS408
  - Profibus-DP V0/V1
- Quick commissioning via PC and commissioning software

Ordering code

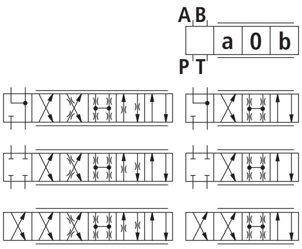
4WRP	N	H			B			– 2X /	M /	24				*

with integrated digital axis controller and NC functionality **= N**

Control spools / sleeve **= H**

Size 6 **= 6**
Size 10 **= 10**

Spool symbols
4/4-directional design



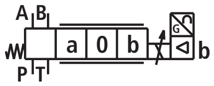
= C3, C5

= C4, C1

= C

With symbols C5 and C1:
P → A: q_v B → T: $q_v/2$
P → B: $q_v/2$ A → T: q_v

Mounting side of the inductive position transducer



(standard) **= B**

Rated flow at 70 bar valve pressure differential (35 bar / control edge)

Size 6

2 l/min	**= 02**
4 l/min	**= 04**
12 l/min [8]	**= 12**
15 l/min [1]	**= 15**
24 l/min [8]	**= 24**
25 l/min [1]	**= 25**
40 l/min [2]	**= 40**

Size 10

50 l/min	**= 50**
100 l/min	**= 100**

Flow characteristics
Linear **= L**
Inflected characteristic curve [3] **= P**

Further details in the plain text

Sensor interfaces [4]
A = X4, M12-5, ±10 V; X7, M12-5, ±10 V
B = X4, M12-5, ±10 V; X7, M23-12, SSI [5]
C = X4, M12-5, ±10 V; X7, M23-12, 1 Vss [6]
G = X4, M12-5, 4...20 mA; X7, M12-5, 4...20 mA
H = X4, M12-5, 4...20 mA; X7, M23-12, SSI [5]

Command value inputs
A6 = ±10 VDC
F6 = 4...20 mA

Field bus interface
C = CANopen [7]
P = Profibus DP V0/V1

24 = Supply voltage 24 V

Seal material
M = NBR seals suitable for mineral oils (HL; HLP) according to DIN 51524

2X = Component series 20 to 29 (20 to 29: Identical installation and connection dimensions)

1) Only in connection with flow characteristics **"P"**
2) q_v 2:1 only with rated flow = 40 l/min
3) Inflection 60 % at size 6 with rated flow **"15"** and **"25"**, otherwise inflection 40 %
4) For sensor interfaces **"A"**, **"B"** or **"C"** only command value input **"A6"** is possible.
For sensor interface **"G"** and **"H"** only command value input **"F6"** is possible.
5) Gray code or binary
6) Adjustable interpolation
7) Field bus interface CANopen with sensor interface **"B"**, **"C"**, **"G"** or **"H"** only upon request
8) Only in connection with flow characteristics **"L"**

Note:
Ordering codes for and technical information on the control valve with integrated digital axis controller (IAC-R) and clock-synchronized PROFIBUS DP/V2 (PROFIdrive profile) can be seen on data sheet 29291.

Standard types

Size 6 with CANopen

Material no.	Type
R901124262	4WRPNH 6 C4 B40P-2X/M/24CA6A
R901131590	4WRPNH 6 C4 B15P-2X/M/24CA6A
0811403540	4WRPNH 6 C3 B24L-2X/M/24CF6G
0811403548	4WRPNH 6 C4 B40L-2X/M/24CA6A
0811403541	4WRPNH 6 C3 B04L-2X/M/24CA6A

Size 10 with CANopen

Material no.	Type
R901125645	4WRPNH 10 C3 B100P-2X/M/24CA6A
0811403361	4WRPNH 10 C3 B100L-2X/M/24CA6A
R901243764	4WRPNH 10 C3 B100L-2X/M/24CA6B
R901243769	4WRPNH 10 C3 B100P-2X/M/24CA6B

Size 6 with Profibus DP

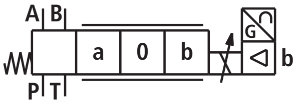
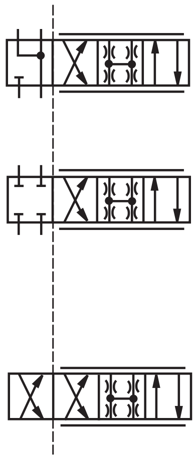
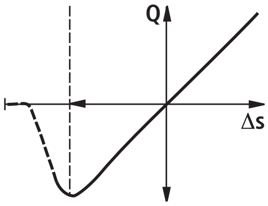
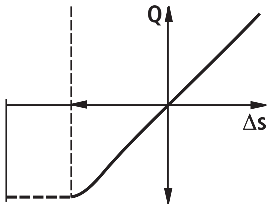
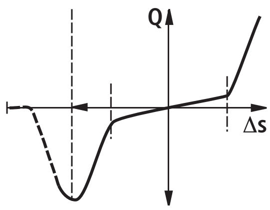
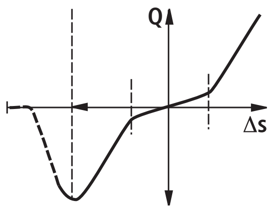
Material no.	Type
0811403552	4WRPNH 6 C3 B04L-2X/M/24PA6A
0811403575	4WRPNH 6 C3 B40L-2X/M/24PA6B
0811403550	4WRPNH 6 C3 B40L-2X/M/24PA6A
0811403573	4WRPNH 6 C3 B25P-2X/M/24PA6B
0811403559	4WRPNH 6 C3 B04L-2X/M/24PF6G
0811403531	4WRPNH 6 C3 B40L-2X/M/24PF6G
R901224758	4WRPNH 6 C1 B24L-2X/M/24PF6G

Size 10 with Profibus DP

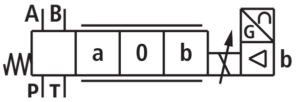
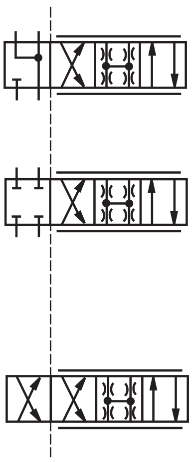
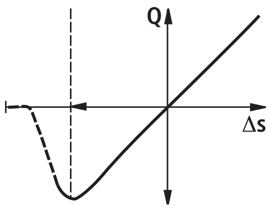
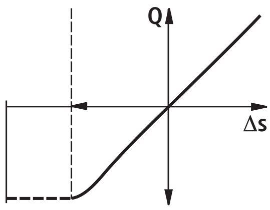
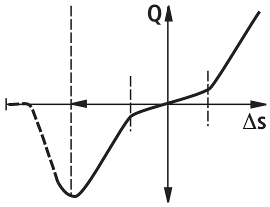
Material no.	Type
0811403358	4WRPNH 10 C3 B100L-2X/M/24PF6G
0811403359	4WRPNH 10 C4 B100L-2X/M/24PF6G
R901232766	4WRPNH 10 C4 B100P-2X/M/24PF6G

Symbols

Size 6

	Linear	*p*: Inflection 60 % [q_n 15.25 l/min]	*p*: Inflection 40 % [q_n 40 l/min]
 C3, C5 / C4, C1 / C	 C3, C5, C4, C1  C		
		C3, C5, C4, C1	
	Standard = 1:1, from q_n = 40 l/min also 2:1		

Size 10

	Linear	*p*: Inflection 40 %
 C3, C5 / C4, C1 / C	 C3, C5, C4, C1  C	 C3, C5, C4, C1

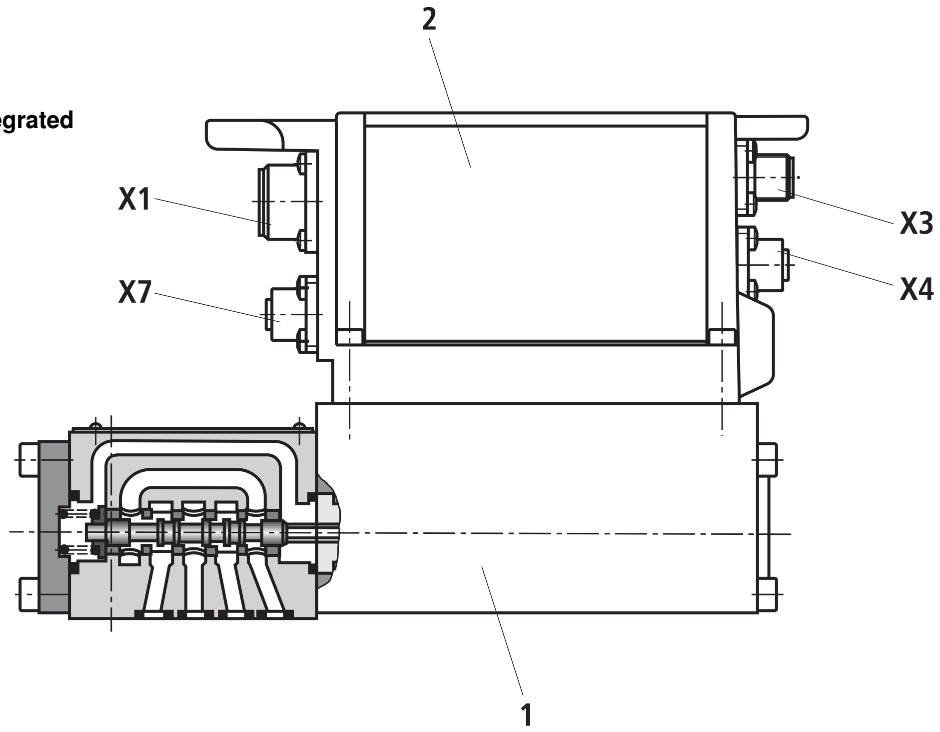
Function, section

Structure

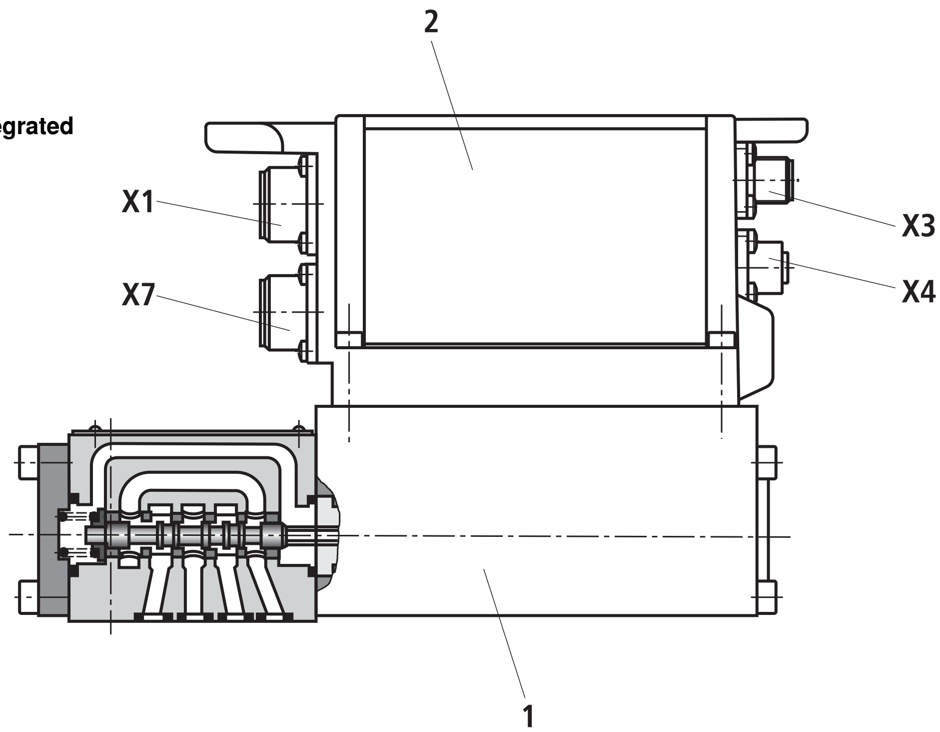
The IAC-R valve mainly consists of:

– Direct operated high-response valve (1) with control spool in servo quality
– Integrated digital axis controller (2) with analog and digital sensor interfaces and field bus connection (X3)

High-response valve with integrated axis controller with analog interfaces (X1, X4, X7)



High-response valve with integrated axis controller with analog interfaces (X1, X4) and digital sensor interface (X7)



Function, section

Functional description

The **IAC-**R valve (**I**ntegrated **A**xis **C**ontroller on the basis of high-response valves) is a digital high-response valve with integrated axis controller with the following functionalities:

- Flow control
- Position control
- Pressure control
- p/Q function
- Substitutional position/pressure and position/ force control
- NC functionality

- The command value can alternatively be provided via an analog interface (X1) or via the field bus interface (X3)
- The actual value signals are provided via an analog interface (X1) and can additionally be read out via the field bus (X3).
- The controller parameters are set via the field bus.
- Separate supply voltage for bus/controller and power part (output stage) for safety reasons

PC program WinHPT

To implement the project planning task and to parameterize the IAC-R valves, the user may use the commissioning software WinHPT (see accessories).

- Parameterization
- Programming of NC functionality
- Diagnosis
- Comfortable data management on a PC
- PC operating systems: Windows 2000 or Windows XP

The digital integrated control electronics enables the following fault detection:

- Cable break sensors
- Undervoltage
- Temperature of the integrated electronics
- Communication errors
- Watchdog

The following additional functions are available:

- Ramp generator
- Internal command value profile
- Release function analog/digital
- Error output 24 V (e.g. as switching signal to PLC/logic and further valves), max. 1.8 A
- Control output adjustment
  - Deadband compensation
  - Zero point correction
  - Valve inflection compensation
  - Friction compensation
  - Direction-dependent gain

Technical Data (For applications outside these parameters, please consult us!)

general		Size 6	Size 10
Type		Gate valve, directly operated, with steel sleeve	
Actuation		Proportional solenoid with position control, OBE	
Type of connection		Plate connection, porting pattern according to ISO 4401	
Installation position		Any	
Ambient temperature range	°C	–20 … +50	
Weight	kg	2.7	7.5

hydraulic (measured with HLP46, $\vartheta_{ÖL}$ = 40 °C ± 5 °C)

Hydraulic fluid			Hydraulic oil according to DIN 51524…535, other media upon request
Viscosity range	Recommended	mm^2/s	20 … 100
	Max admissible	mm^2/s	10 … 800
Hydraulic fluid temperature range		°C	–20 … +60
Maximum permitted degree of contamination of the hydraulic fluid cleanliness class according to ISO 4406 (c)			Class 18/16/13 [1)]
Direction of flow			According to symbol

hydraulic, size 6								
Rated flow at Δp = 35 bar per edge [2)]		l/min	2	4	12	15	24/25	40
Max. operating pressure	Ports P, A, B	bar	315					
	Port T	bar	250					
Limitation of use with regard to the transition to failsafe	Spool symbols C3, C5	bar	315	315	315	315	315	160
	Spool symbols C1, C4	bar	315	315	315	280	250	100
Leakage oil at 100 bar	Linear characteristic curve L	cm^3/min	< 150	< 180	< 300	-	< 500	< 900
	Inflected characteristic curve P	cm^3/min	-	-	-	< 180	< 300	< 450

hydraulic, size 10						
Rated flow at Δp = 35 bar per edge [2)]		l/min	50 (1:1)	50 (2:1)	100 (1:1)	100 (2:1)
Max. operating pressure	Ports P, A, B	bar	315			
	Port T	bar	250			
Limitation of use with regard to the transition to failsafe	Spool symbols C3, C5		315	315	160	160
	Spool symbols C1, C4		250	250	100	100
Leakage oil at 100 bar	Linear characteristic curve L	cm^3/min	< 1200	< 1200	< 1500	< 1500
	Inflected characteristic curve P	cm^3/min	< 600	< 500	< 600	< 600

static / **dynamic**		Size 6	Size 10
Hysteresis	%	≤ 0.2	
Manufacturing tolerance q_{max}	%	< 10	
Actuating time for signal step 0 … 100 %	ms	≤ 10	25
Temperature drift		Zero shift < 1 % at $\Delta\vartheta$ = 40 °C	
Zero compensation		ex factory ±1 %	
Conformity		CE according to EMC directive 2004/108/EC	

The footnotes are explained on the following page.

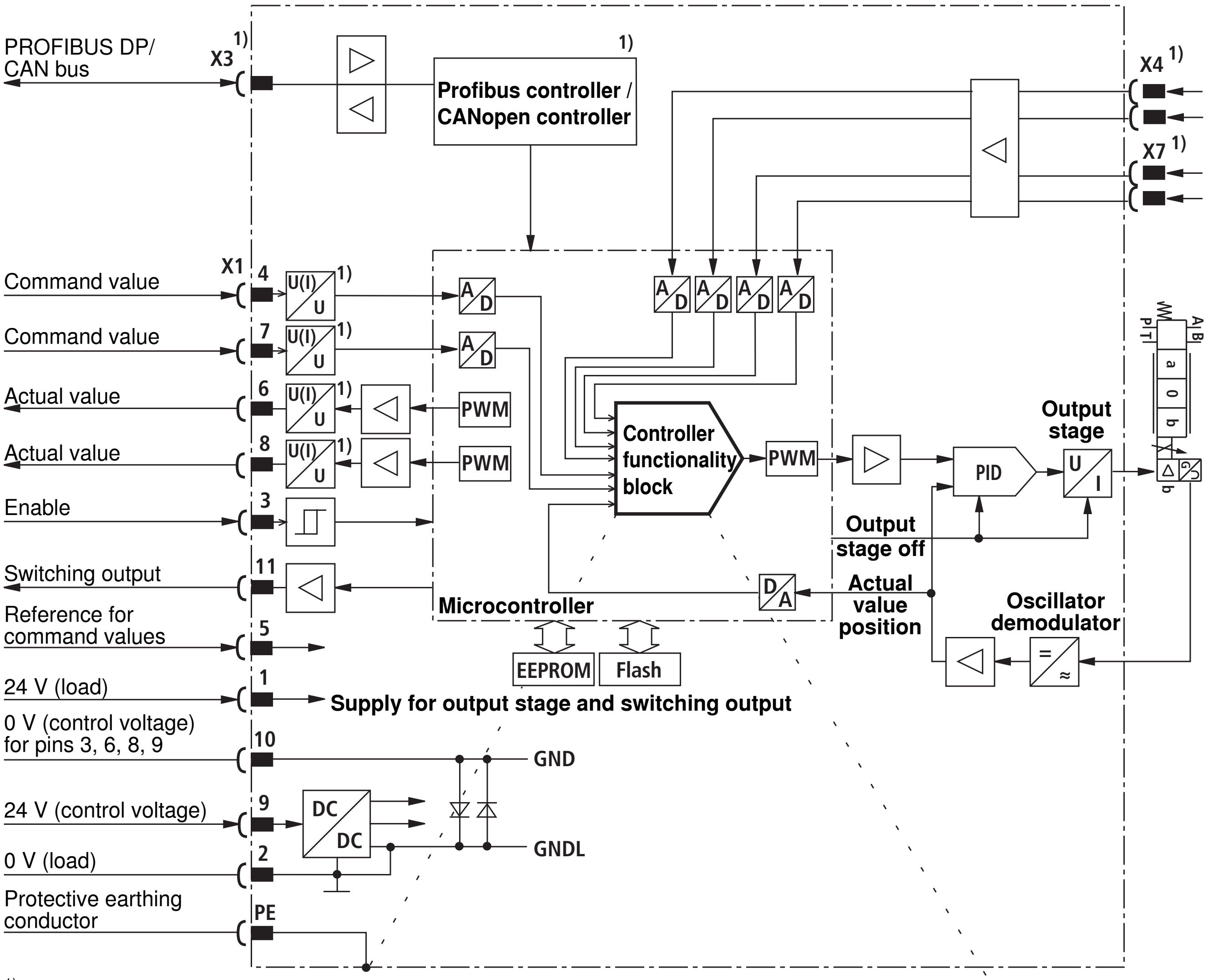
Technical Data (For applications outside these parameters, please consult us!)

electric				
Relative duty cycle			%	100 (continuous operation)
Protection class according to EN 60529				IP 65 with mounted and locked plug-in connectors
Supply voltage	Nominal voltage		VDC	24
	Lower limit value		VDC	21
	Upper limit value		VDC	36
	Max admissible residual ripple		Vss	2 (at supply voltage of 23 V … 34 V)
Power consumption		Size 6	W	Max. 40
		Size 10	W	Max. 60
AD/DA resolution			Analog inputs Analog outputs	12 bit 10 bit
Protective earthing conductor and shielding				See pin assignment (CE-compliant installation)
Adjustment				Calibrated ex factory, see valve characteristic curve

[1] The cleanliness classes specified for the components must be adhered to in hydraulic systems.
Effective filtration prevents faults and at the same time increases the service life of the components.

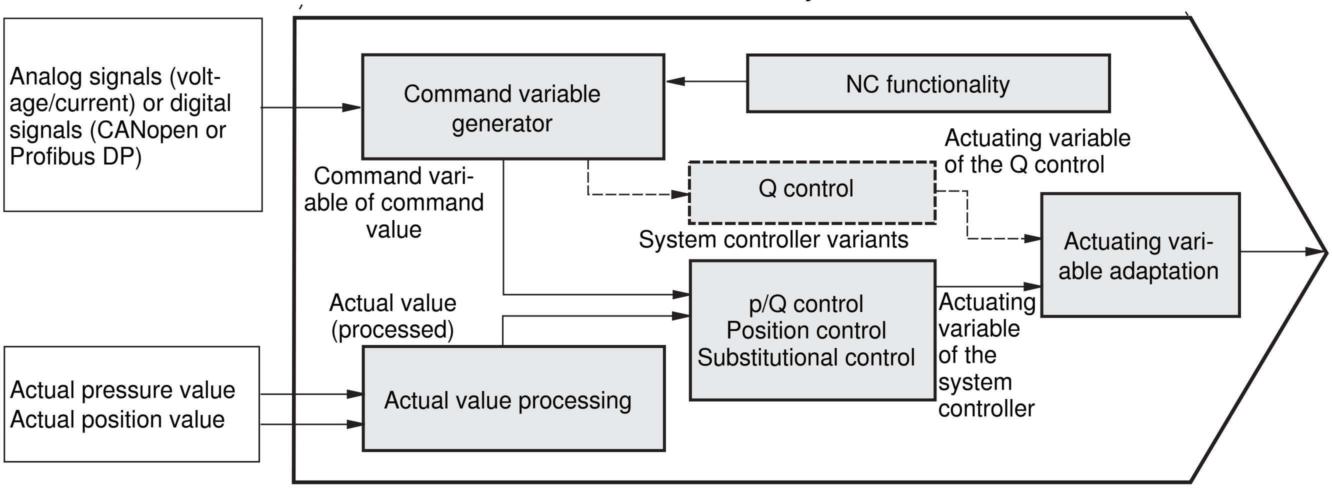
[2] Flow at different Δp: $q_x = q_{nom} \cdot \sqrt{\frac{\Delta p_x}{35}}$

Block diagram/controller functionality



1) According to ordering code

Controller functionality block



These variables must be parameterized.

Electrical connections, assignment

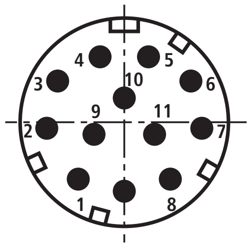
Unit connector pin assignment X1, 11-pole + PE according to EN 175201-804

Pin	Core marking [1]	Assignment of interface A6	Assignment of interface F6
1	1	24 VDC (supply for output stage and power switching signal)	
2	2	0 V ≙ load zero (for output stage)	
3	3	Release input 8.5 … 24 VDC = function, R_e ~10 kΩ	
4	4	Command value ±10 V; R_e ~130 kΩ or dig. Input (from PLC) [2]	4 … 20 mA command value; R_e = 200 Ω or dig. Input (from PLC) [2]
5	5	Reference for command values	
6	6	±10 V actual value or dig. Output (to PLC) [2]	4 … 20 mA actual value, load resistance ~330 Ω or dig. Output (to PLC) [2]
7	7	Command value ±10 V; R_e ~130 kΩ or dig. Input (from PLC) [2]	4 … 20 mA command value; R_e = 200 Ω or dig. Input (from PLC) [2]
8	8	±10 V actual value or dig. Output (to PLC) [2]	4 … 20 mA actual value, load resistance ~330 Ω or dig. Output (to PLC) [2]
9	9	24 VDC (control voltage for signal part and bus)	
10	10	0 V reference potential for pin 3, 6, 8 and 9	
11	11	Switching output 24 V (error signal or power switching signal) max 1.8 A	
PE	Green-yellow	Protective earthing conductor (connected directly to metal housing)	

[1] Core marking of the connection lines for line socket with cable set (see accessories)

[2] Selection via commissioning software

X1



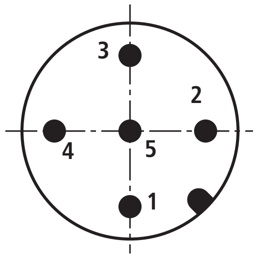
Unit connector pin assignment for CAN bus "X3" (code A), M12, 5-pole, pins

Pin	Assignment
1	n.c.
2	n.c.
3	CAN_GND
4	CAN_H
5	CAN_L

External screen on both sides of the metallic housing of the plug-in connection.

Internal screens are not required.

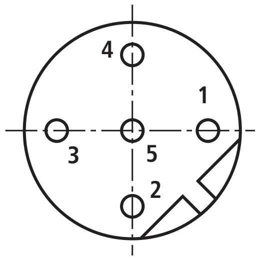
Transmission rate kbit/s	20 to 1000
Bus address	1 to 127



Unit connector pin assignment for Profibus DP "X3" (code B), M12, 5-pole, socket

Pin	Assignment
1	VP
2	RxD/TxD-N (A line)
3	D GND
4	RxD/TxD-P (B line)
5	Shield

Transmission rate	up to 12 MBaud
Bus address	1 to 126

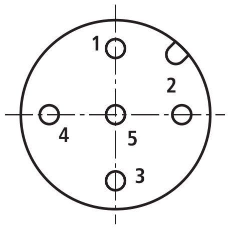


The galvanically separated voltage +5 V (pin 1 - VP) at the socket allows for passive termination of the profibus.

Electrical connections, assignment

Analog sensor interfaces, connection "X4" and "X7" (code A), M12, 5-pole, socket

Pin	Assignment of voltage interface	Assignment of current interface
1	Supply 24 VDC	Supply 24 VDC
2	Signal 3 (X4) / 4 (X7), (–10 … +10 V)	Signal 3 (X4) / 4 (X7), (4 … 20 mA)
3	Zero 0 V	Zero 0 V [1)]
4	Signal 1 (X4) / 2 (X7), (–10 … +10 V)	Signal 1 (X4) / 2 (X7), (4 … 20 mA)
5	Shield	Shield

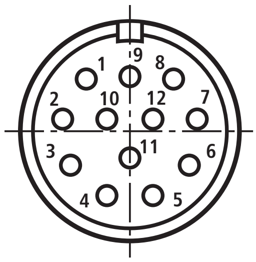


[1)] Do not connect to 2-wire pressure transducer

Attention: The analog sensor interfaces at the connections X4 and X7 are not coded.
Danger of confusing the same! The user has to ensure proper wiring!

Digital sensor interface 1Vss or SSI measurement system "X7", M23, 12-pole, socket

Pin	Assignment 1Vss	Assignment SSI
1	$\overline{\text{B}}$	0 V
2	Sense +5 V [1)]	Data
3	R	Clock
4	$\overline{\text{R}}$	n.c.
5	A	n.c.
6	$\overline{\text{A}}$	n.c.
7	n.c.	n.c.
8	B	n.c.
9	n.c.	24 V
10	0 V [1)]	$\overline{\text{Data}}$
11	Sense 0 V [1)]	$\overline{\text{Clock}}$
12	+5 V [1)]	n.c.



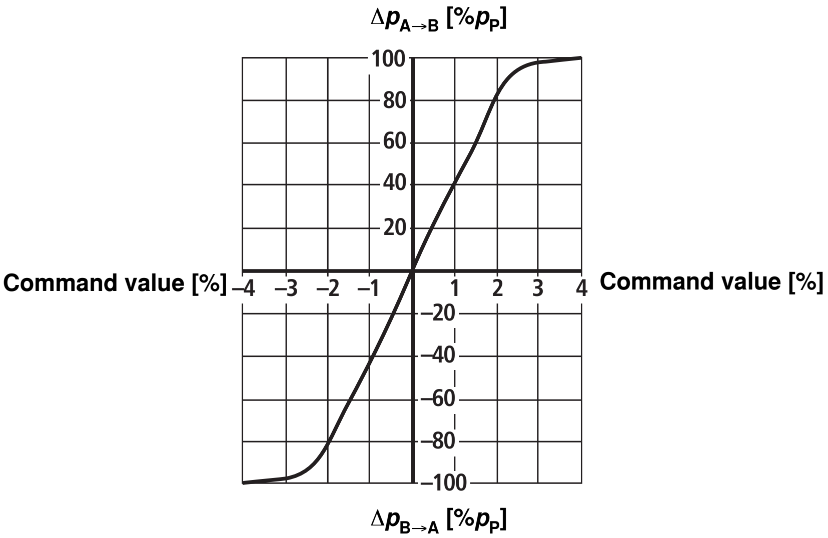
Note:
The sense signal is not analyzed.

[1)] **Recommendation**:
Connect the voltages +5 V (pin 12) and +5 V-Sense (pin 2), as well as 0 V (pin 10) and 0 V-Sense (pin 11) for transducer supply.

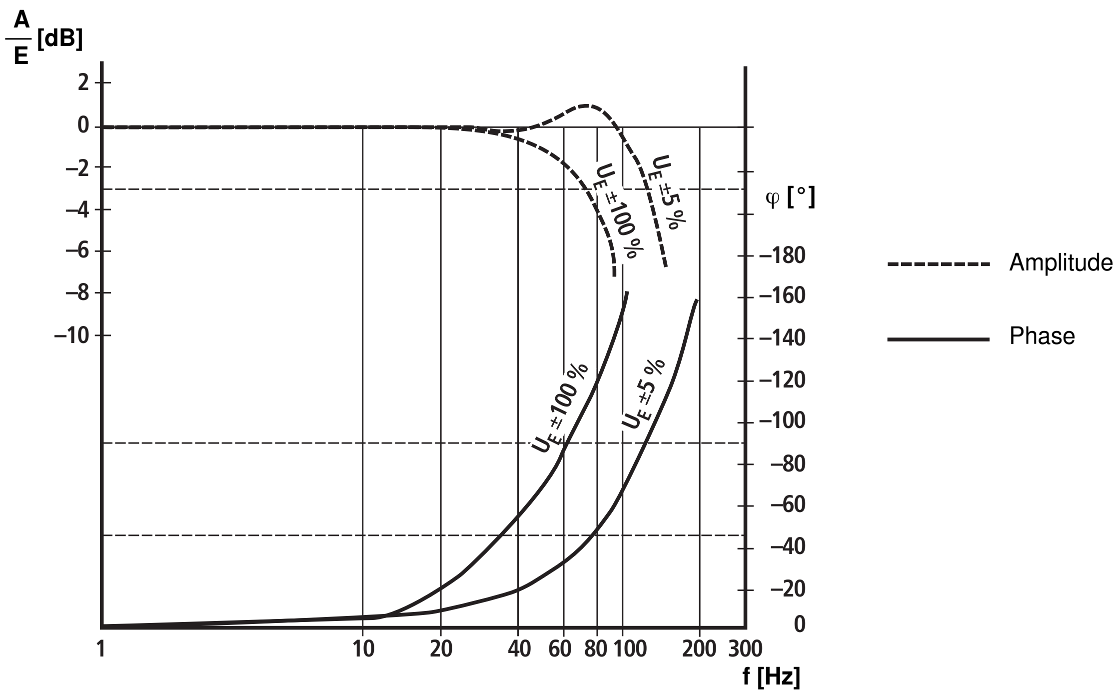
Note:
We recommend connecting the screens on both sides over the metallic housings of the plug-and-socket-connectors.
Using connector pins will affect the effectiveness of the screen!
Internal screens are not required.

Characteristic curves size 6 (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C)

Pressure gain



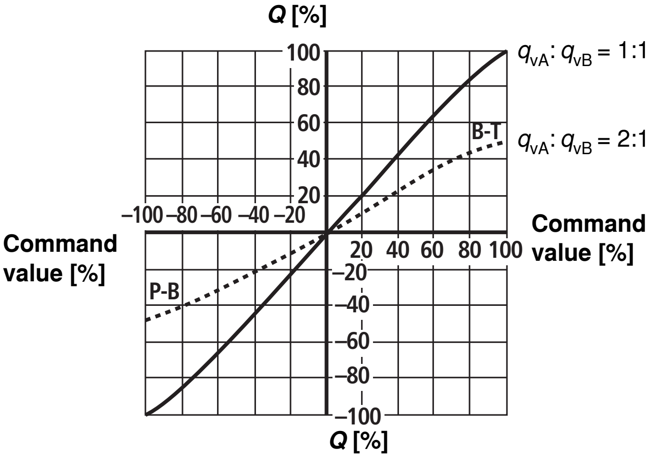
Bode diagram



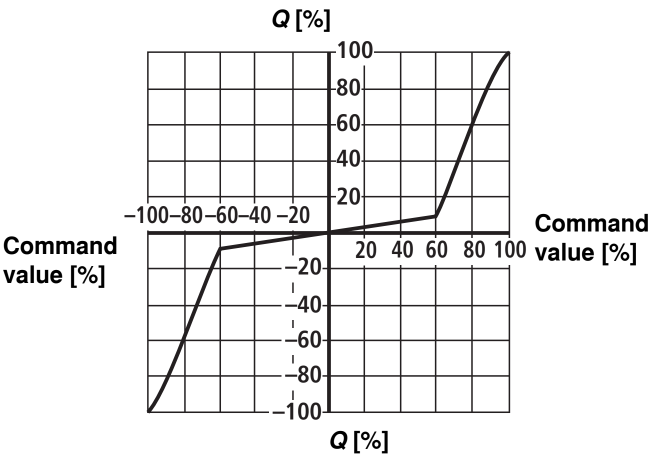
Characteristic curves size 6 (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C)

Flow - signal function

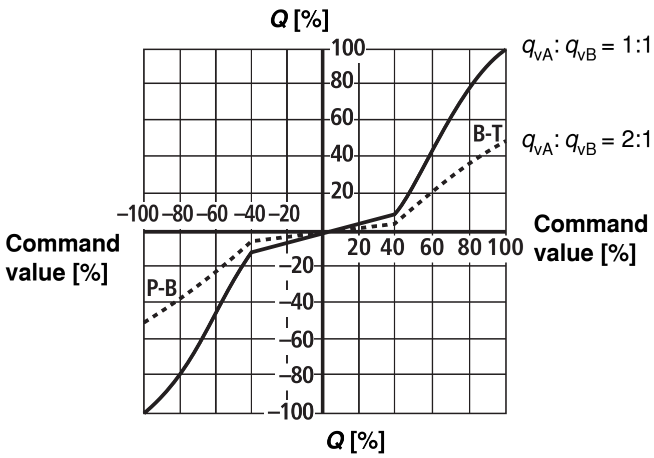
L: Linear



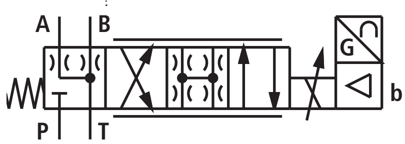
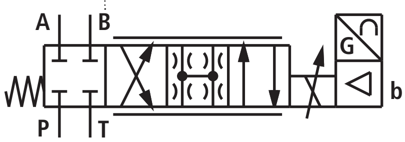
P: Inflection 60 %



P: Inflection 40 %



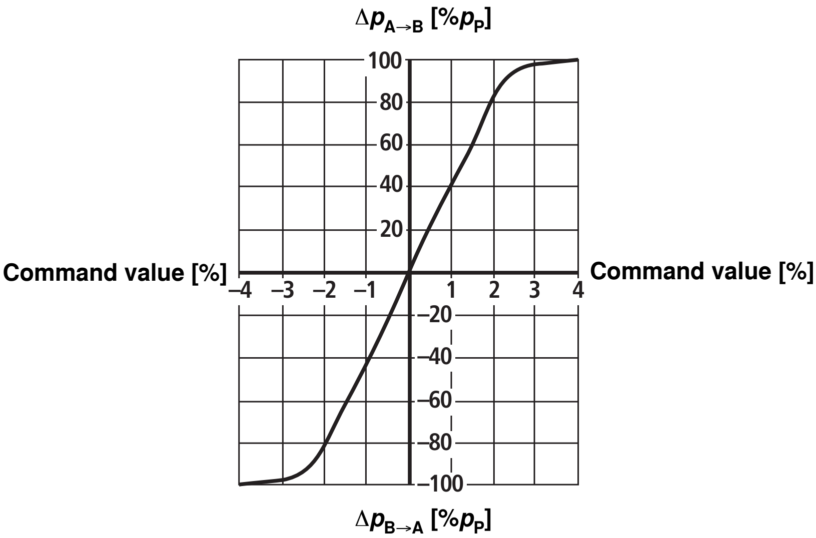
Fail-safe position

	Leakage oil at	100 bar	P → A	50 cm^3/min
			P → B	70 cm^3/min
	Flow at	Δp = 35 bar	A → T	10 ... 20 l/min
			B → T	7 ... 20 l/min
	Leakage oil at	100 bar	P → A	50 cm^3/min
			P → B	70 cm^3/min
			A → T	70 cm^3/min
			B → T	50 cm^3/min

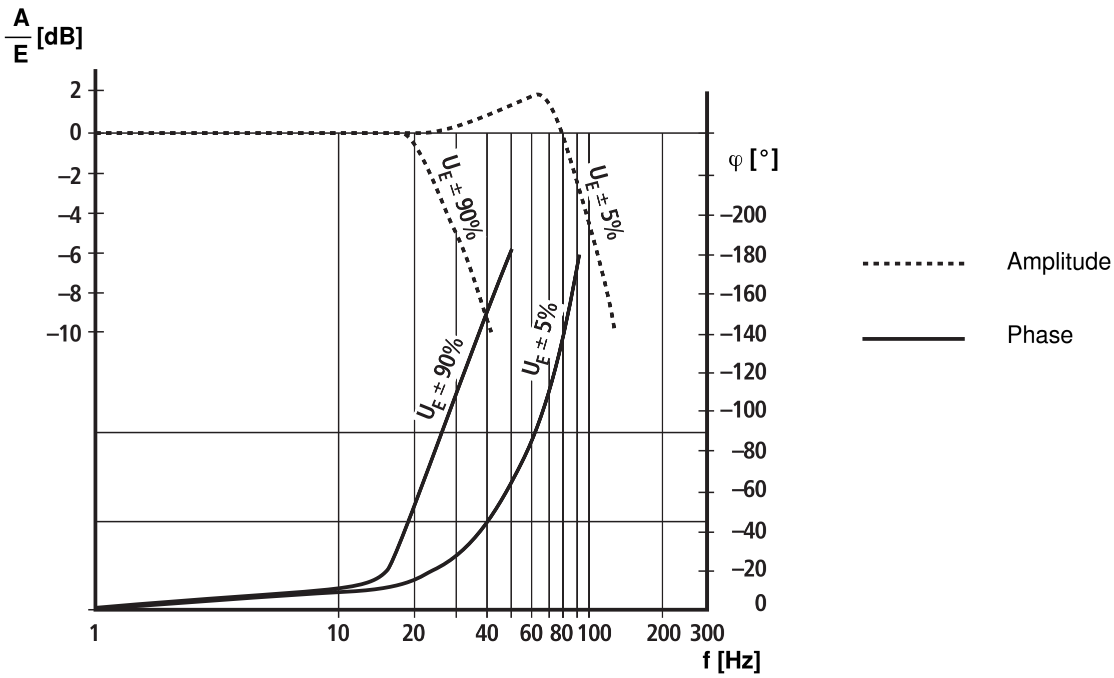
Fail-safe	p = 0 bar => 7 ms	Enable "off" or internal shut-off in case of error
	p = 100 bar => 10 ms	U_B ≤ 18 V or I ≤ 2 mA (at 4…20 mA signal)

Characteristic curves size 10 (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C)

Pressure gain



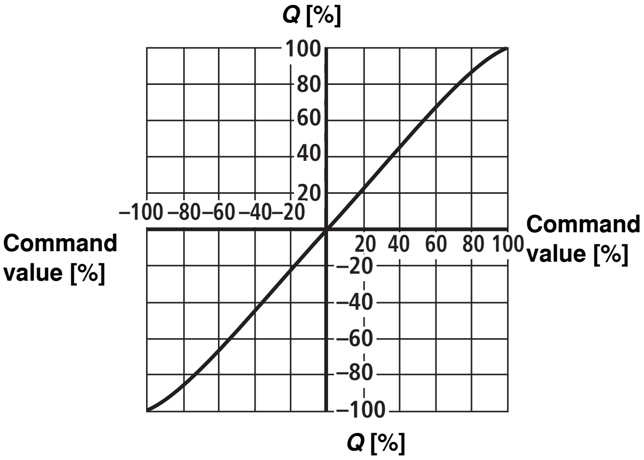
Bode diagram



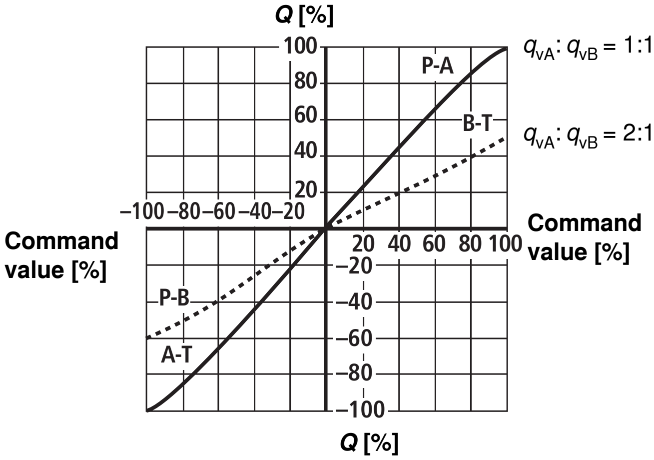
Characteristic curves size 10 (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C)

Flow - signal function

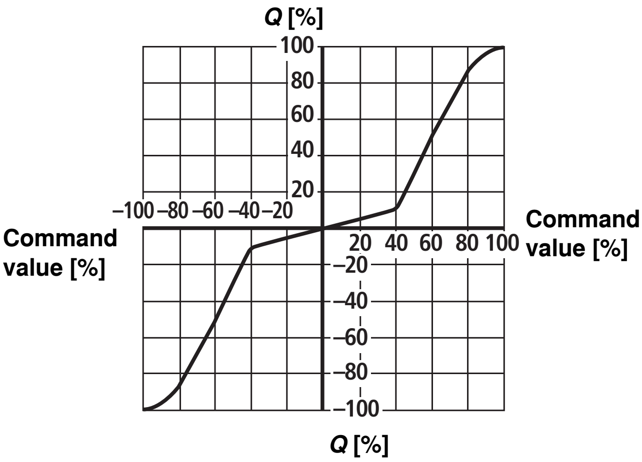
L: Linear 1:1



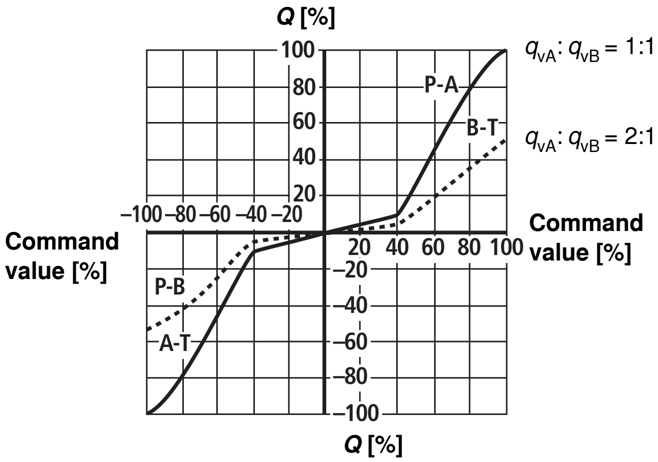
L: Linear 2:1



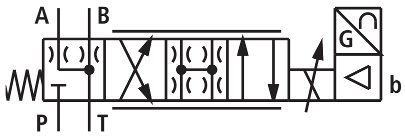
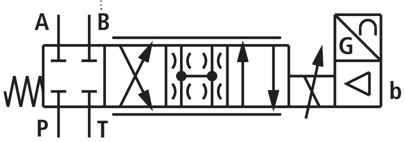
P: Inflection 40 % 1:1



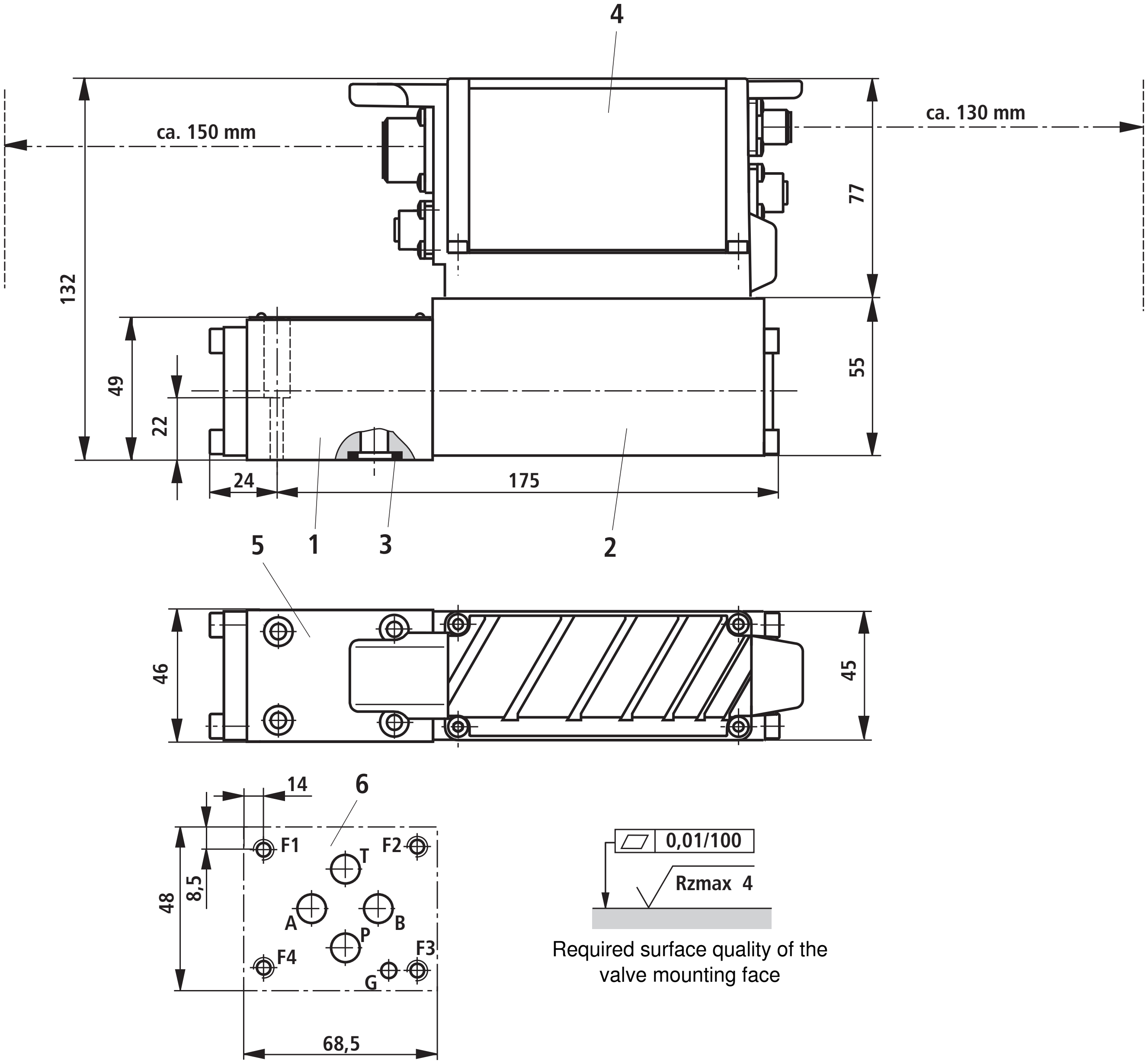
P: Inflection 40 % 2:1



Fail-safe position

	Leakage oil at	100 bar	P → A	50 cm^3/min
			P → B	70 cm^3/min
	Flow at	Δp = 35 bar	A → T	10 ... 20 l/min
		q_n = 50/100 l/min	B → T	7 ... 20 l/min
	Leakage oil at	100 bar	P → A	50 cm^3/min
			P → B	70 cm^3/min
			A → T	70 cm^3/min
			B → T	50 cm^3/min
Fail-safe	p = 0 bar => 12 ms	Enable "off" or internal shut-off in case of error		
	p = 100 bar => 16 ms	$U_B \leq$ 18 V or $I \leq$ 2 mA (at 4…20 mA signal)		

Unit dimensions size 6 (dimensions in mm)



Required surface quality of the valve mounting face

1 Valve housing

2 Control solenoid with position transducer

3 O-ring 9.25 x 1.78 (ports P, A, B, T)

4 Integrated digital control electronics

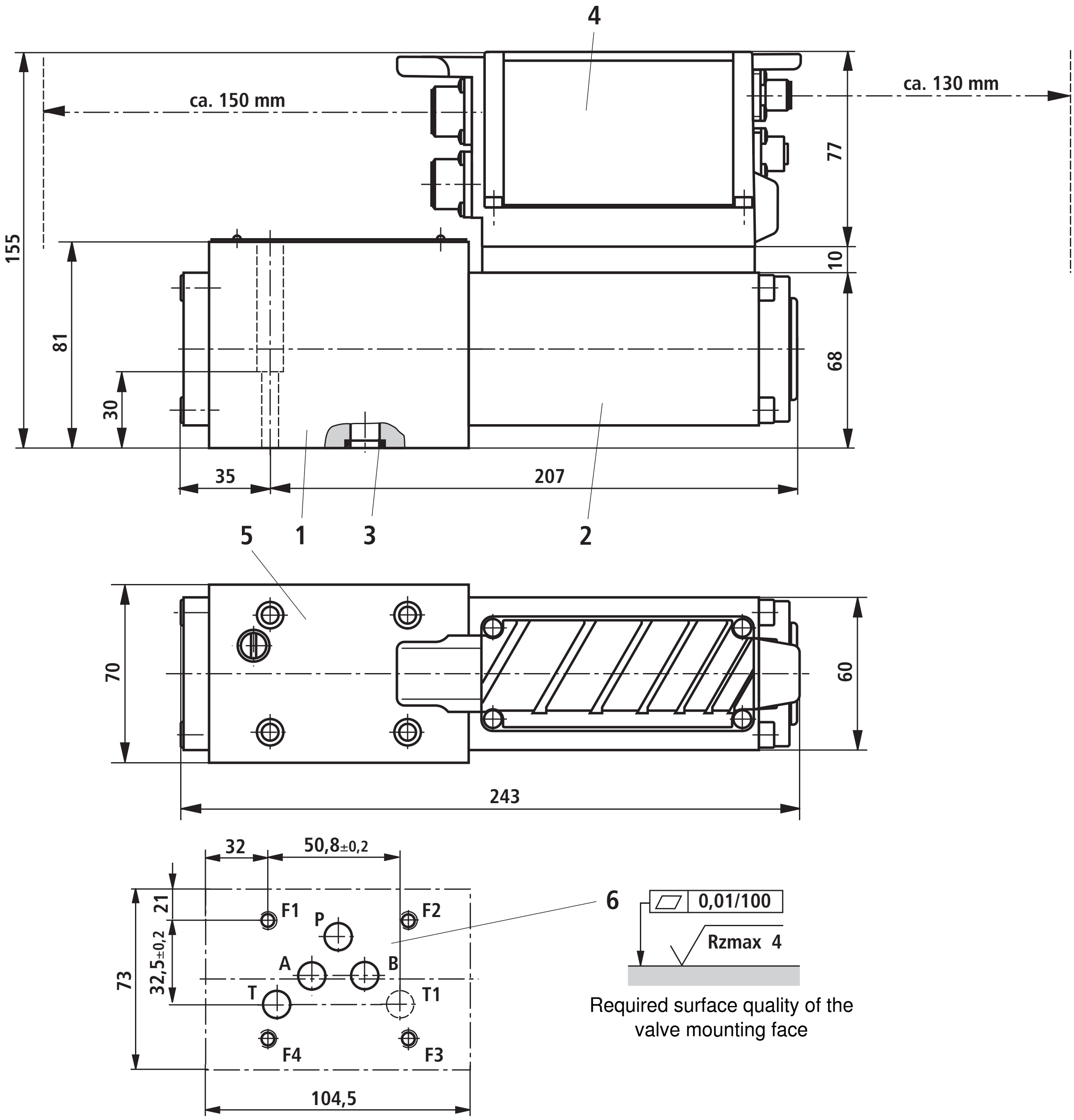
5 Name plate

6 Machined valve mounting face, porting pattern according to ISO 4401-03-02-0-05

Valve mounting screws
(not included in scope of delivery)
4 units of hexagon socket head cap screws according to ISO4762-M5x30-10.9-N67F 821 70
(galvanized according to Bosch standard N67F 821 70)
M_A = 6+2 Nm

Mat. no. **2910151166**

Unit dimensions size 10 (dimensions in mm)



Required surface quality of the valve mounting face

1 Valve housing

2 Control solenoid with position transducer

3 O-ring 12.0 x 2.0 (ports P, A, B, T, T1)

4 Integrated digital control electronics

5 Name plate

6 Machined valve mounting face, porting pattern according to ISO 4401-05-04-0-05

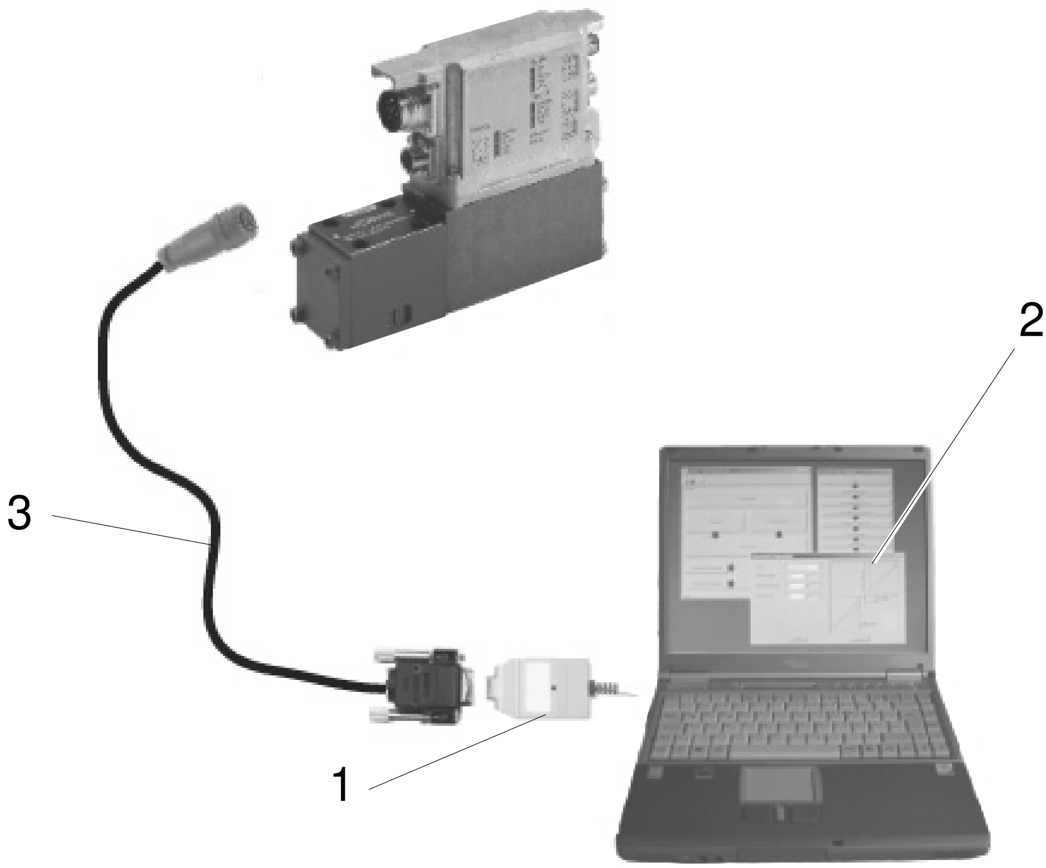
Deviating from the standard:
– Port T1 is provided additionally

Valve mounting screws
(not included in scope of delivery)
4 units of hexagon socket head cap screws according to ISO4762-M6x40-10.9-N67F 821 70
(galvanized according to Bosch standard N67F 821 70)
M_A = 11+3 Nm

Mat. no. **2910151209**

Accessories for parameterization (not included in scope of delivery)

The following is required for the parameterization with PC:	CANopen	Profibus DP
1 Interface converter (USB)	VT-ZKO-USB/CA-1-1X/V0/0 Mat. no. **R901071963**	VT-ZKO-USB/P-1-1X/V0/0 Mat. no. **R901071962**
2 Start-up software	WinHPT	
3 Connecting cable, 3 m	D-Sub / M12 (coding A), Mat. no. **R900751271**	D-Sub / M12 (coding B), Mat. no. **R901078053**

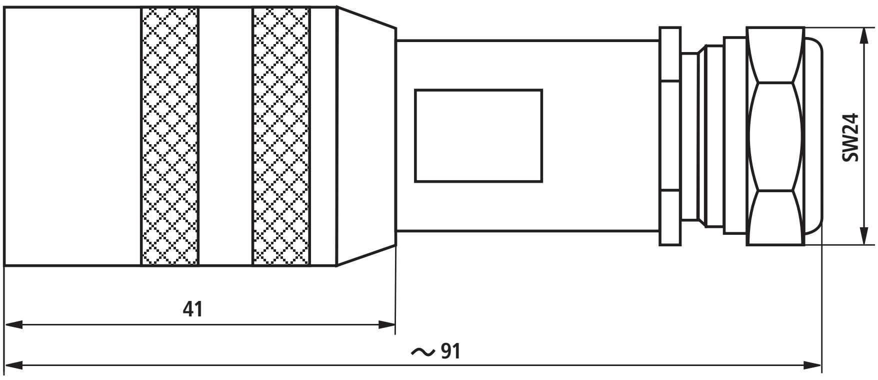


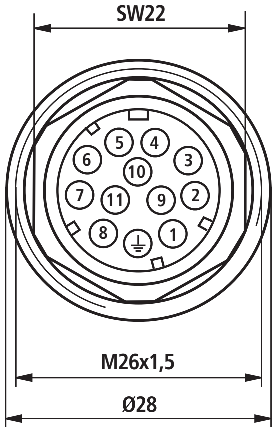
Accessories, port X1 (not included in scope of delivery)

Mating connector for X1

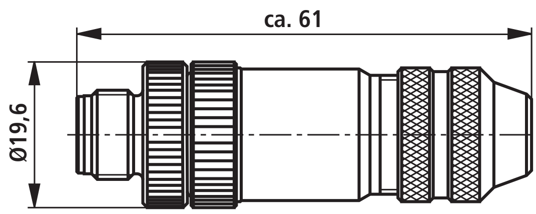
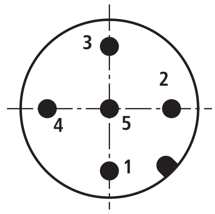
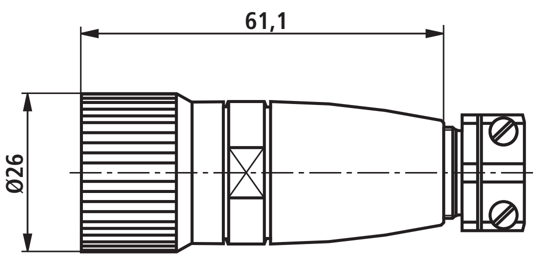
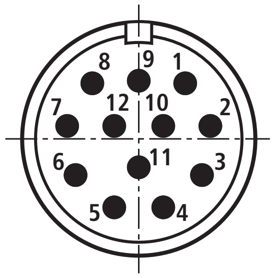
Mating connector according to EN 175201-804 (12-pole, metal design)

- Mating connector (construction set) for a cable diameter of 12-15 mm — Material no. **R901268000**
- Mating connector with 5 m cable, 12 x 0.75 mm^2 with cable shield, assembled — Material no. **R901272854**
- Mating connector with 20 m cable, 12 x 0.75 mm^2 with cable shield, assembled — Material no. **R901272852**

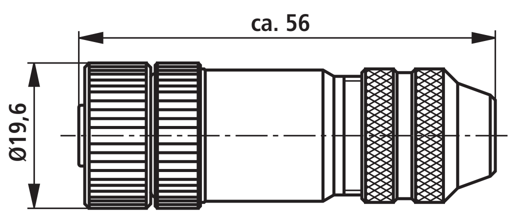
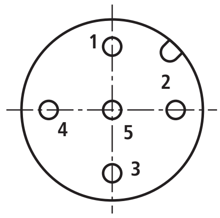
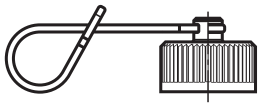




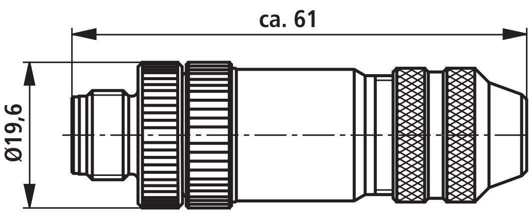
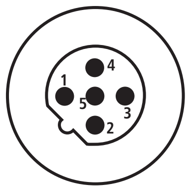
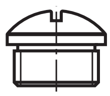
Accessories, sensor connections (not included in scope of delivery)

Description	View, dimensions	Pole image, order details
X4, X7 (analog sensors) Plug-in connector, 5-pole, M12 x 1, pins, A coding, metal design		 Mat. no.: **R901075542** (cable diameter 4 … 6 mm)
X7 (digital sensors, 1 Vss and SSI) Plug-in connector, 12-pole, M23, pins, soldered joint, metal design with cap nut		 Mat. no.: **R901076284** (cable diameter up to 10.5 mm)

Accessories, CAN bus (A coding) (not included in scope of delivery)

Description	View, Dimensions	Pole image, order details
X3 Round plug-in connector, processible, 5-pole, M12 x 1 Straight mating connector from metal.		 Mat. no.: **R901076910** (cable diameter 6-8 mm)
M12 cap Dust protection		Mat. no.: **R901075564**

Accessories, profibus (B code) (not included in scope of delivery)

Description	View, Dimensions	Pole image, order details
X3 Round plug-in connector, processible, 5-pole, M12 x 1 Straight line coupling plug from metal.		 Mat. no.: **R901075545** (cable diameter 6-8 mm)
Further profibus participants can be connected e.g. with a Y cable (can be ordered at HARTING, Mat. no. TB61042030039).		
M12 protective cap		Mat. no.: **R901075563**

Project Planning / Maintenance Instructions / Additional Information

Product documentation for IAC-R

- **Data sheet 29191** (this data sheet)
- **Declaration on environmental compatibility 29191-U**
- **Operator's manual**
  CANopen 29090-B-01
  Profibus 29090-B-02
- **General information on the maintenance and commissioning of hydraulic components**
  07800 / 07900

Maintenance instructions:

– The devices have been tested in the plant and are supplied with default settings.

– Only complete units can be repaired. Repaired devices are returned with default settings.
User-specific settings are not maintained. The operator will have to retransfer the corresponding user parameters.

Notes:

– Connect the valve to the supply voltage only when this is required for the functional processes of the machine.

– Electric signals taken out via control electronics (e.g. signal "ready for operation") may not be used for the actuation of safety-relevant machine functions! (See also the European standard "Safety requirements for fluid power systems and their components - Hydraulics", EN 982.)

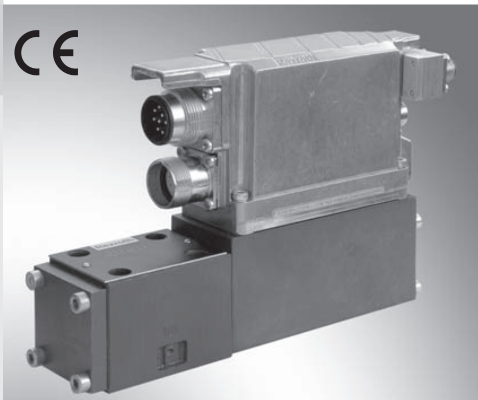
– If electromagnetic interference is to be anticipated, suitable measures must be taken to ensure the function (depending on the application, e.g. shielding, filtration)!

High-response valve with integrated digital axis controller (IAC-R) and clock-synchro-nized PROFIBUS DP/V2 (PROFIdrive profile)

RE 29291/06.13
Replaces: 02.11

Type 4WRPNH.../24F..

Size 6 and 10
Component series 2X
Maximum operating pressure 315 bar
Maximum flow 100 l/min (Δp = 70 bar)



TB0193
Type 4WRPNH 6 .../24F..

Table of contents

Features

– Direct operated high-response valves size 6 and size 10 with servo performance type control spool and sleeve
– Single-side operated, 4/4 fail-safe position in deactivated state
– Integrated digital axis control functionality (IAC-R) for:
  • position control with underlying velocity control
  • DSC functionality
– Analog sensor interfaces for
  • current and voltage
– Digital sensor interfaces for
  • 1 x length measurement system 1Vpp or
  • 1 x length measurement system SSI or
  • 1 x length measurement system EnDat 2.2
– Clock-synchronous command value provision according to PROFIdrive profile V4.0
  • telegram 5 or 105
– PROFIBUS DP/V1, DP/V2
– Quick commissioning via PC and commissioning software WinHPT from version 2.1

Ordering code

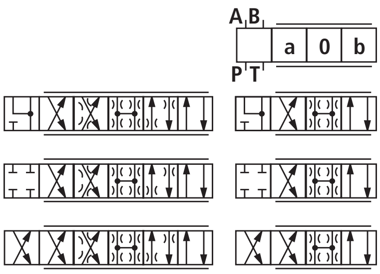
4WRP	N	H			B			–2X/	M/	24	F			*

With integrated digital axis controller for NC control systems **= N**

Control spool / sleeve **= H**

Size 6 **= 6**
Size 10 **= 10**

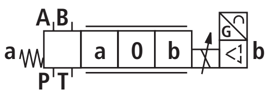
Spool symbols
4/4 directional design



= C3, C5
= C4, C1
= C

With symbols C5 and C1:
P → A: q_v B → T: q_v / 2
P → B: q_v / 2 A → T: q_v

Mounting side of the inductive position transducer



(standard) **= B**

Rated flow at 70 bar valve pressure differential (35 bar / control edge)

Size 6
2 l/min [1] **= 02**
4 l/min **= 04**
12 l/min [5] **= 12**
15 l/min [2] **= 15**
24 l/min [5] **= 24**
25 l/min [2] **= 25**
40 l/min [3] **= 40**

Size 10
50 l/min **= 50**
100 l/min **= 100**

Flow characteristics
Linear **= L**
Inflected characteristic curve [4] **= P**

Further details in clear text

Sensor interfaces
A = X4, M12-5, ±10 V
X7, M12-5, ±10 V
B = X4, M12-5, ±10 V
X7, M23-12, SSI
C = X4, M12-5, ±10 V
X7, M23-12, 1 Vpp
G = X4, M12-5, 4-20 mA
X7, M12-5, 4-20 mA
T = X4, M12-5, ±10V
X7, M12-8, EnDat 2.2

Electronics interface
A6 = ±10 VDC
F6 = 4 to 20 mA

Drive bus
F = PROFIBUS DP/V2
PROFIdrive profile

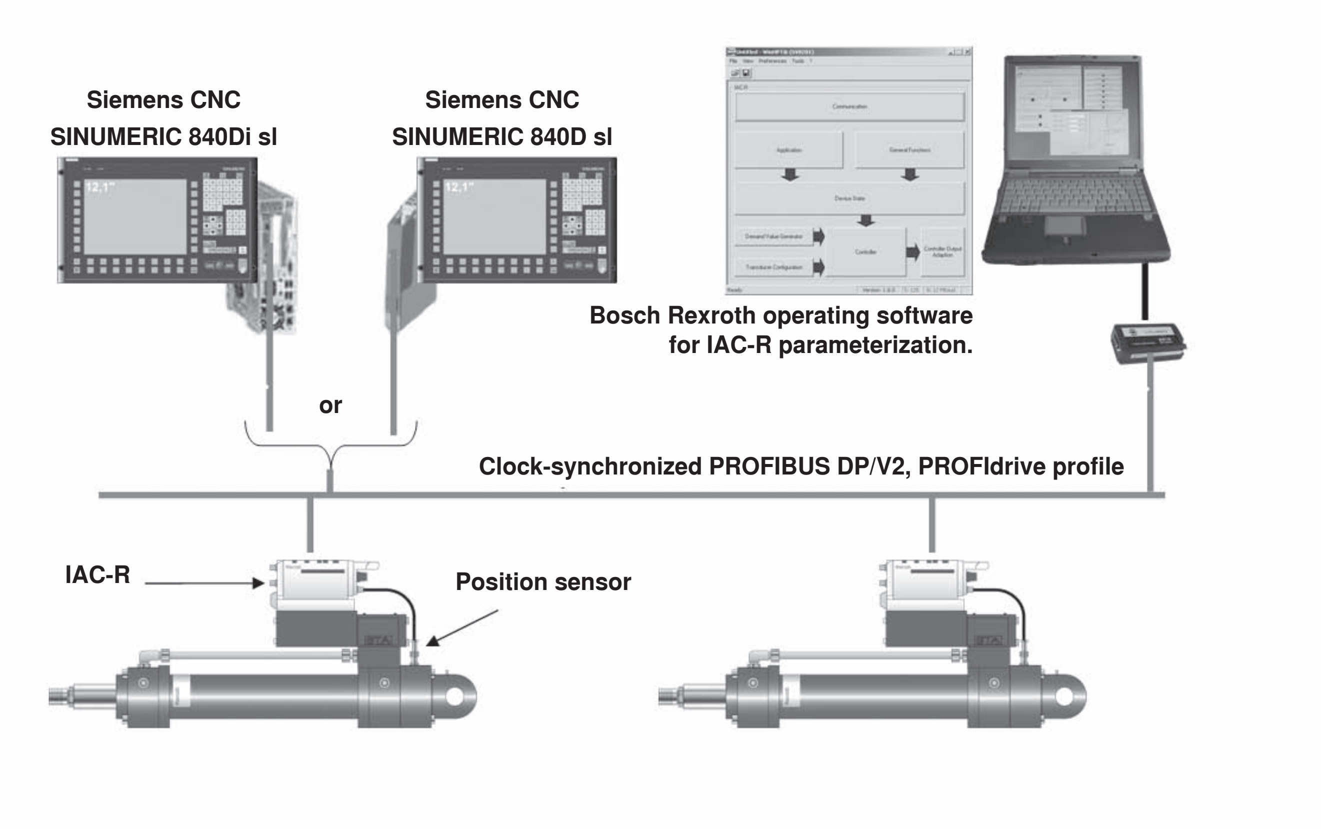
24 = Supply voltage 24 V

Seal material
M = NBR gaskets
suitable for mineral oils
(HL; HLP) according to DIN 51524

2X = Component series 20 to 29
(20 to 29: unchanged mounting and connection dimensions)

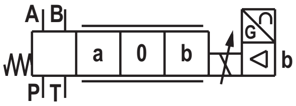
[1] Rated flow 2 l/min not with flow characteristics **"P"**
[2] Only in connection with flow characteristics **"P"**
[3] q_V 2:1 only with rated flow = 40 l/min
[4] Inflection 60% at size 6 with rated flow **"15"** and **"25"**, otherwise inflection 40%
[5] Only in connection with flow characteristics **"L"**

System overview



Symbols

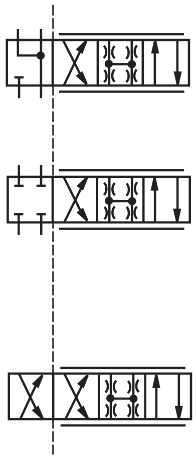
Size 6



Linear

p: Inflection 60 %
[q_n 15.25 l/min]

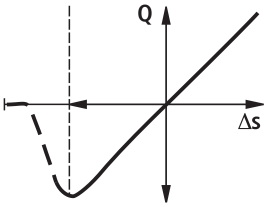
p: Inflection 40 %
[q_n 40 l/min]



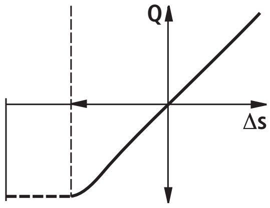
C3, C5

C4, C1

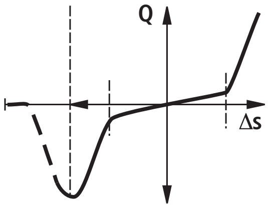
C

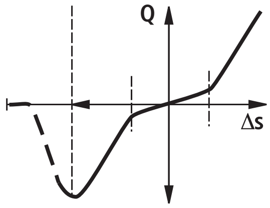


C3, C5, C4, C1



C

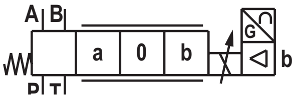




C3, C5, C4, C1

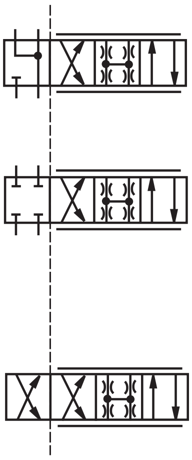
Standard = 1:1, from q_n = 40 l/min also 2:1

Size 10



Linear

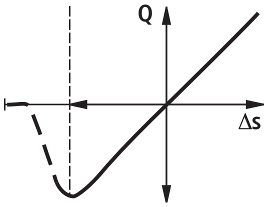
p: Inflection 40 %



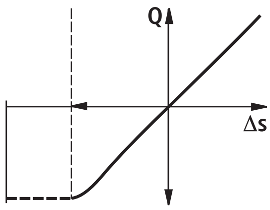
C3, C5

C4, C1

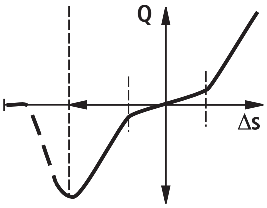
C



C3, C5, C4, C1



C



C3, C5, C4, C1

Function, section

Construction

The IAC-R valve mainly consists of:

- Direct operated high-response valve (1) with servo performance type control spool
- Integrated digital axis controller (2) with analog (X4/X7) or digital (X7) sensor interface
- PROFIBUS interface (X3) with functionality according to DP/V1 with clock synchronization according to DP/V2

Functional description

The IAC-R valve is a digital high-response valve with integrated axis controller with the following functionalities:

- Position control
- DSC functionality
- Analog (X4/X7) or digital (X7) sensor interface
- Clock-synchronous command value specification according to PROFIdrive profile V4.0
  • telegram 5 or 105
- The controller parameters are set via the PROFIdrive parameter protocol.
- Separate supply voltage for bus/controller and power part (output stage) for safety reasons.

PC program WinHPT

To implement the project planning task and to parameterize the IAC-R valves, the user may use the commissioning software WinHPT (see accessories).

- Parameterization
- Diagnosis
- Comfortable data management on a PC
- PC operating systems: Windows 2000 or Windows XP

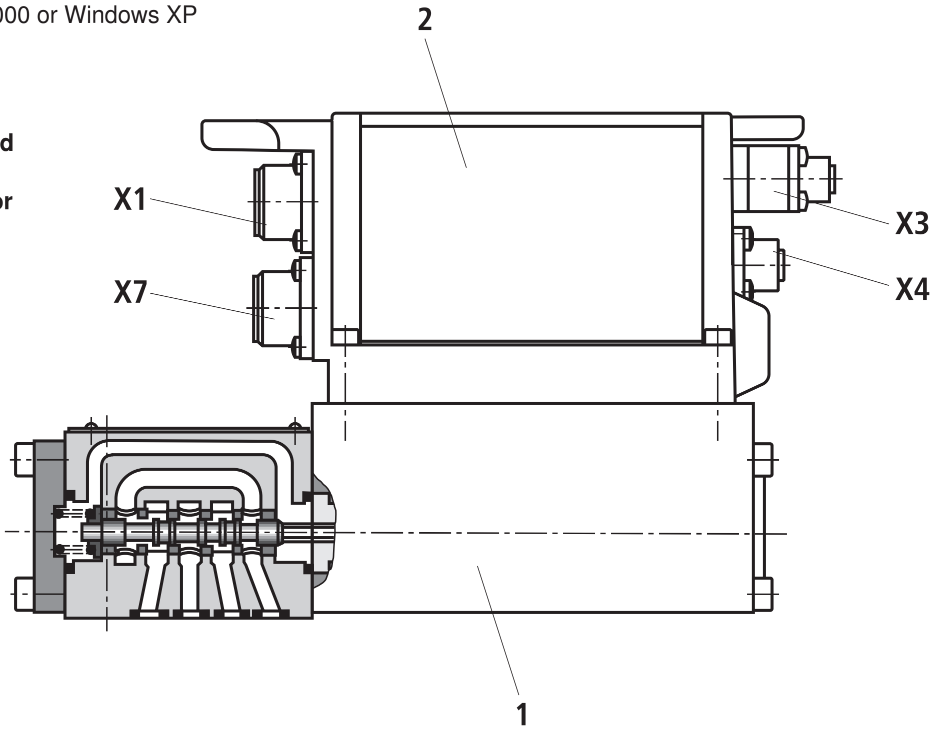
The digital integrated control electronics enables the following fault detection:

- Cable rupture of sensorics system
- Undervoltage
- Temperature of the integrated electronics
- Communication fault
- Watchdog
- Synchronous monitoring

The following additional functions are available:

- Fault output 24 V or control of an isolator valve
- Control output adjustment
  • deadband compensation
  • zero offset
  • valve inflection compensation
  • friction compensation
  • direction-dependent gain
- PIDT1 controller
- State controller
- Automatic/semi-automatic drive measurement for simple controller optimization

High-response valve with integrated axis controller and analog (X4/X7) or digital (X7) sensor interface



Technical data (For applications outside these parameters, please consult us!)

General			Size 6	Size 10
Type			Spool valve, directly operated, with steel sleeve	
Actuation			Proportional solenoid with position control, OBE	
Type of connection			Subplate mounting, porting pattern according to ISO 4401	
Installation position			any	
Ambient temperature range		°C	–20 … +50	
Weight		kg	2.7	7.5
hydraulic (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)				
Hydraulic fluid			Hydraulic oil according to DIN 51524…535, other media upon request	
Viscosity range	recommended	mm^2/s	20 … 100	
	max admissible	mm^2/s	10 … 800	
Hydraulic fluid temperature range		°C	–20 … +60	
Maximum admissible degree of contamination of the hydraulic fluid – cleanliness class according to ISO 4406 (c)			Class 18/16/13 1)	
Flow direction			according to symbol	

Hydraulic, size 6								
Rated flow at Δp = 35 bar per edge 2)		l/min	2	4	12	15	24/25	40
Max operating pressure	Ports P, A, B	bar	315					
	Port T	bar	250					
Limitations of use Δp pressure drop across valve q_{Vnom}: > $q_{N\ valves}$	Spool symbols C, C3, C5	bar	315	315	315	315	315	160
	Spool symbols C1, C4	bar	315	315	315	280	250	100
Leakage oil at 100 bar	linear characteristic curve L	cm^3/min	< 150	< 180	< 300	–	< 500	< 900
	inflected characteristic curve P	cm^3/min	–	–	–	< 180	< 300	< 450

Hydraulic, size 10						
Rated flow at Δp = 35 bar per edge 2)		l/min	50 (1:1)	50 (2:1)	100 (1:1)	100 (2:1)
Max. operating pressure	Ports P, A, B	bar	315			
	Port T	bar	250			
Limitations of use Δp pressure loss at valve q_{Vnom}: > $q_{N\ valves}$	Spool symbols C, C3, C5	bar	315	315	160	160
	Spool symbols C1, C4	bar	250	250	100	100
Leakage oil at 100 bar	linear characteristic curve L	cm^3/min	< 1200	< 1200	< 1500	< 1500
	inflected characteristic curve P	cm^3/min	< 600	< 500	< 600	< 600

Static / dynamic		Size 6	Size 10
Hysteresis	%	≤ 0.2	
Manufacturing tolerance	%	< 10	
Acutating time for signal step 0 … 100 %	ms	≤ 10	25
Temperature drift		Zero point drift < 1% at $\Delta\vartheta$ = 40 °C	
Zero point calibration		ex factory ±1 %	
Conformity		CE according to EMC directive 2004/108/EC	

The footnotes are explained on the following page.

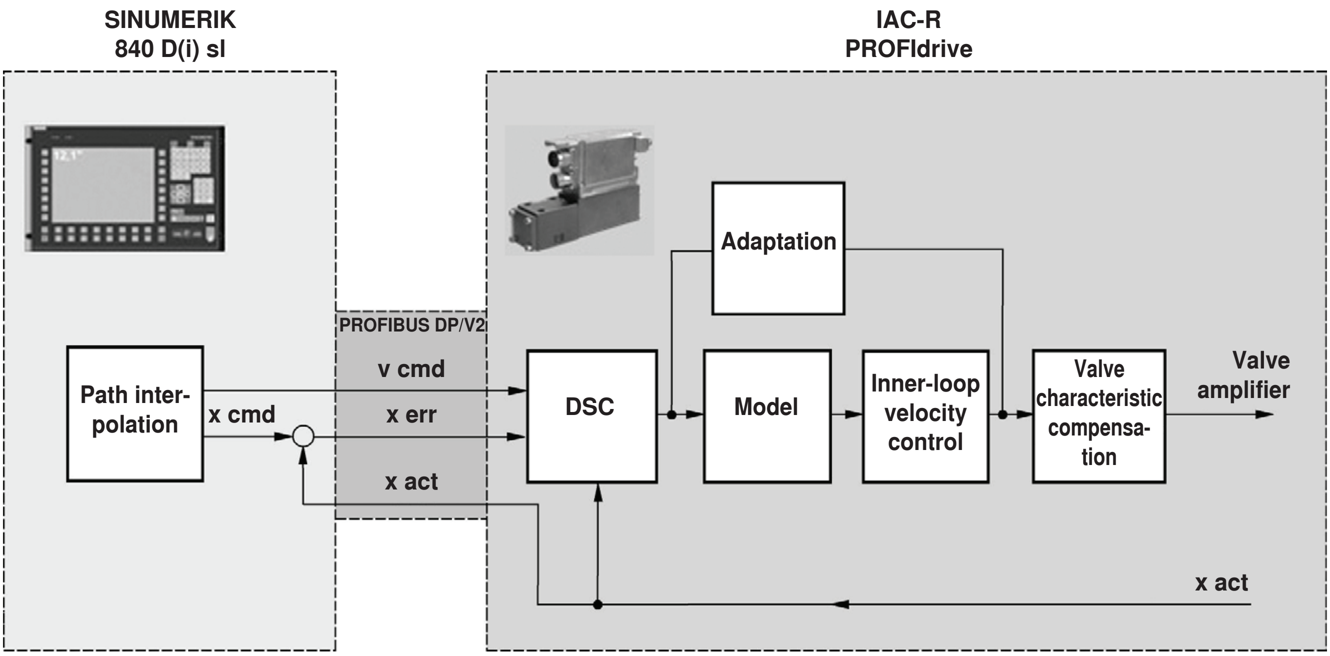
Technical data (For applications outside these parameters, please consult us!)

Electrical			
Relative duty cycle		%	100 (continuous operation)
Protection class			IP 65 according to EN 60529 with mounted and locked line connectors
Supply voltage	Nominal voltage	VDC	24
	Lower limit value	VDC	21
	Upper limit value	VDC	36
	Max. admissible residual ripple	Vpp	2 (at supply voltage of 23 V … 34 V)
Power consumption	Size 6	W	max. 40
	Size 10	W	max. 60
Protective earthing conductor and shielding			see pin assignment (CE-compliant installation)
Adjustment			Calibrated ex factory, see valve characteristic curve

1) The cleanliness classes stated for the components need to be maintained in hydraulic systems.
Effective filtration prevents faults and at the same time increases the service life of the components.

2) Flow at different Δp: $q_x = q_{nom} \cdot \sqrt{\frac{\Delta p_x}{35}}$

Block diagram of the controller functionality



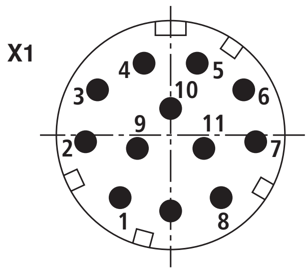
Electrical connections, assignment

Unit connector assignment X1, 11-pin + PE according to DIN EN 175201-804

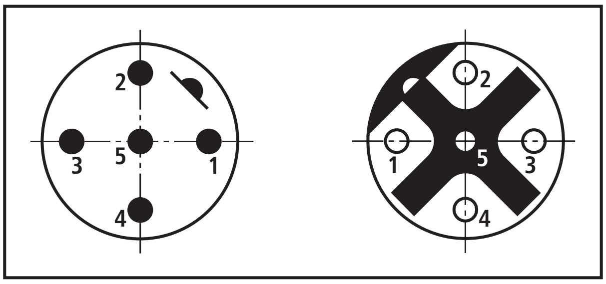
Pin	No. or Litz wire color[1)]	Assignment interface A6/F6
1	1	24 VDC (supply for output stage and power switching signal)
2	2	0 V ≙ load zero (for output stage)
3	white	reserved
4	yellow	reserved
5	green	reserved
6	purple	reserved
7	pink	reserved
8	red	reserved
9	brown	24 VDC (supply for signal part and bus)
10	black	0 V reference potential for pin 9 (supply for signal part and bus)
11	blue	Switching output 24 V (error signal or power switching signal) max 1.8 A
PE	green-yellow	Protective earthing conductor (connected directly to metal housing)

Connect shield on PE only on the supply side!

[1)] Litz wire colors of the connection lines for line socket (see accessories)



Unit connector assignment for PROFIBUS DP "X3" (code B), M12, 5-pin, socket / pins



Pin	Pinout of plug	Pinout of socket
1	n.c.	VP
2	RxD/TxD-N (A line)	RxD/TxD-N (A line)
3	DGND	DGND
4	RxD/TxD-P (B line)	RxD/TxD-P (B line)
5 [1)]	Shield	Shield

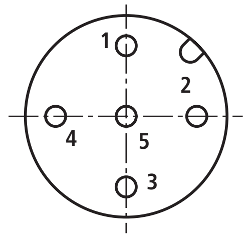
[1)] We recommend connecting the shield on both sides via the metallic housing of the plug-and-socket-connectors. Using pin 5 will have adverse effects on the effectiveness of the shield!

The unit socket and the unit plug are equivalent as PROFIBUS connections.
The electrically isolated voltage +5 V (pin 1 - VP) at the socket allows for passive termination of the PROFIBUS.

Electrical connections, assignment

Analog sensor interfaces, connection "X4" and "X7" (code A), M12, 5-pin, socket

Pin	Pinout Voltage interface	Pinout Current interface
1	Supply 24 VDC	Supply 24 VDC
2	Signal 3 (X4) / 4 (X7), (–10 … +10 V)	Signal 3 (X4) / 4 (X7), (4 … 20 mA)
3	Zero 0 V	Zero 0V
4	Signal 1 (X4) / 2 (X7), (–10 … +10 V)	Signal 1 (X4) / 2 (X7), (4 … 20 mA)
5	Shield	Shield

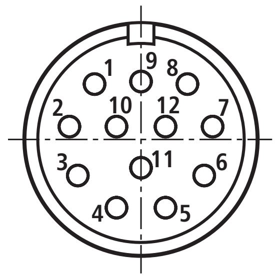


Note:

The analog sensor interfaces at the connections X4 and X7 are not coded. Danger of confusing the same! The user has to ensure proper wiring!

Digital sensor interface 1Vpp or SSI measurement system "X7", M23, 12-pin, socket

Pin	Pinout 1Vpp	Pinout SSI
1	$\overline{\text{B}}$	0 V
2	sense +5 V [1)]	Data
3	R	Clock
4	$\overline{\text{R}}$	n.c.
5	A	n.c.
6	$\overline{\text{A}}$	n.c.
7	n.c.	n.c.
8	B	n.c.
9	n.c.	24 V
10	0 V [1)]	$\overline{\text{Data}}$
11	Sense 0 V [1)]	$\overline{\text{Clock}}$
12	+5 V [1)]	n.c.

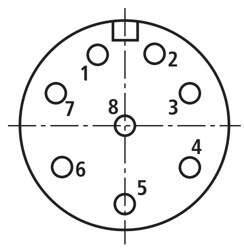


Note:

The sense signal is not evaluated.

Digitale Sensorschnittstelle EnDat 2.2 Messsystem „X7“, M12, 8-polig, Buchse

Pin	Belegung EnDat 2.2
1	0 V [2)]
2	+5 V [2)]
3	Data
4	$\overline{\text{Data}}$
5	0V [2)]
6	$\overline{\text{Clock}}$
7	Clock
8	supply +5 V [2)]



Note:

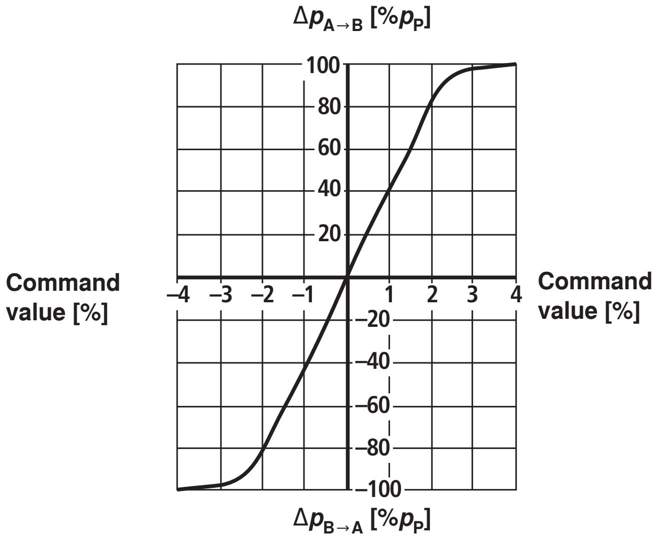
We recommend connecting the shields on both sides via the metallic housings of the plug-and-socket-connectors. Using connector pins will affect the effectiveness of the screen!
Internal shields are not required.

[1)] **Recommendation**: Connect the voltages +5 V (pin 12) and +5 V-Sense (pin 2), as well as 0 V (pin 10) and 0 V-Sense (pin 11) for transducer supply.

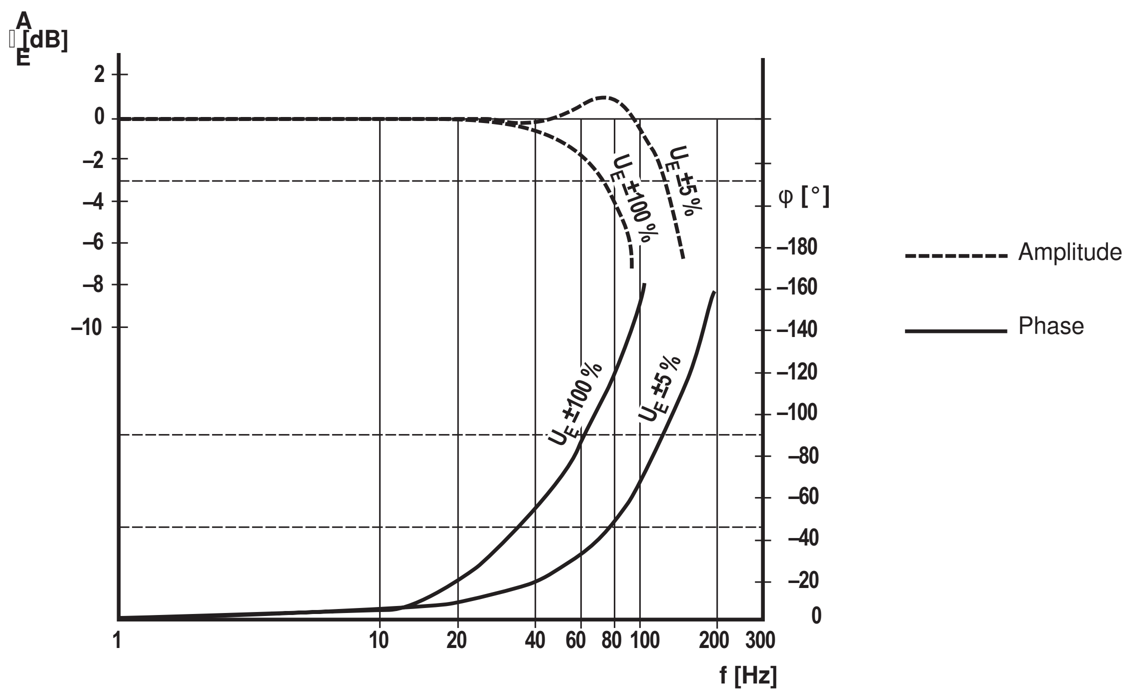
[2)] **Recommendation**: Connect the voltages +5 V (pin 2 and 8) as well as 0 V (pin 1 and 5) for transducer supply.

Characteristic curves size 6 (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)

Pressure gain



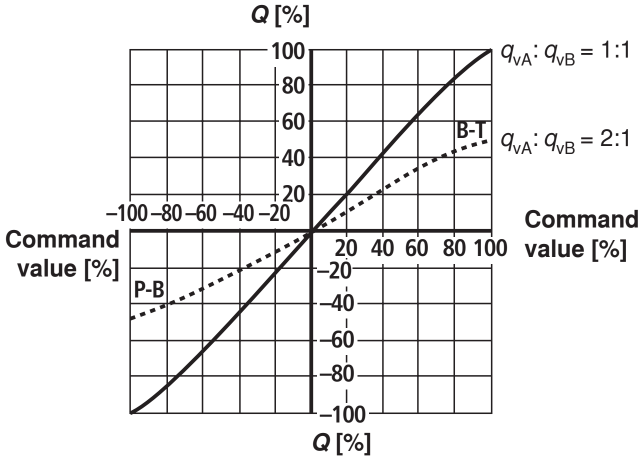
Bode diagram



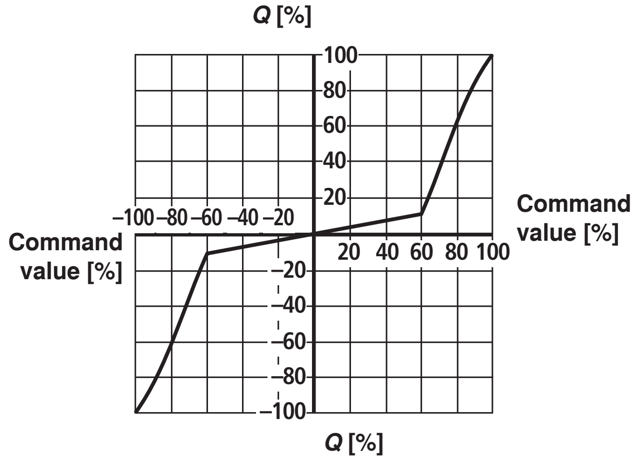
Characteristic curves size 6 (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)

Flow - signal function

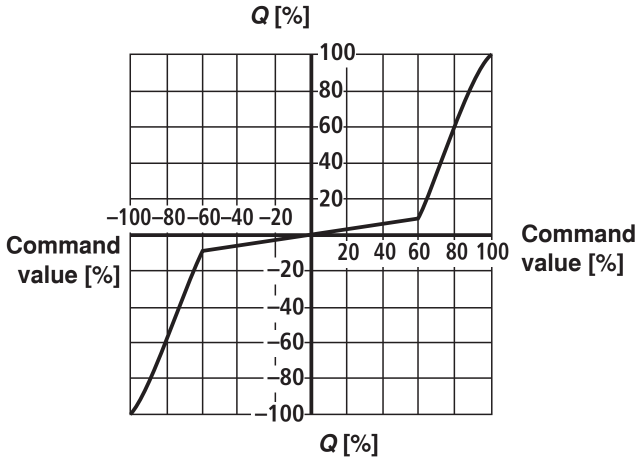
L: Linear



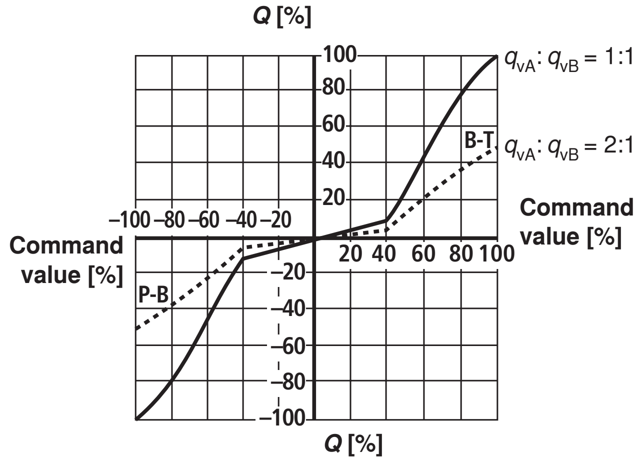
P: Inflection 60 %



P: Inflection 60 %



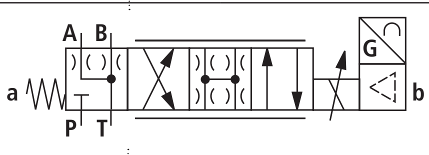
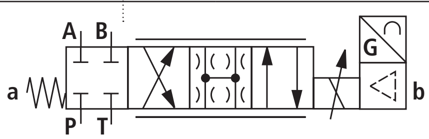
P: Inflection 40 %



Note:

Ex factory the inflection-compensation is activated at the valve electronics. In order that the P-characteristic curve appears linear.

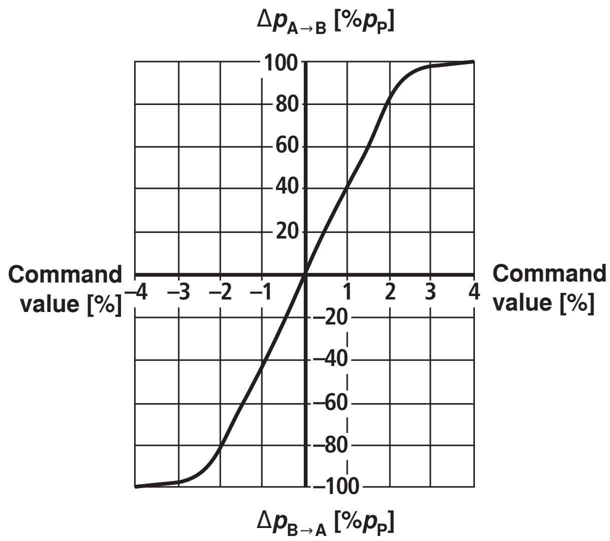
Fail-safe position

	Leakage oil at	100 bar	P → A	50 cm^3/min
			P → B	70 cm^3/min
	Flow at	Δp = 35 bar	A → T	10 ... 20 l/min
			B → T	7 ... 20 l/min
	Leakage oil at	100 bar	P → A	50 cm^3/min
			P → B	70 cm^3/min
			A → T	70 cm^3/min
			B → T	50 cm^3/min

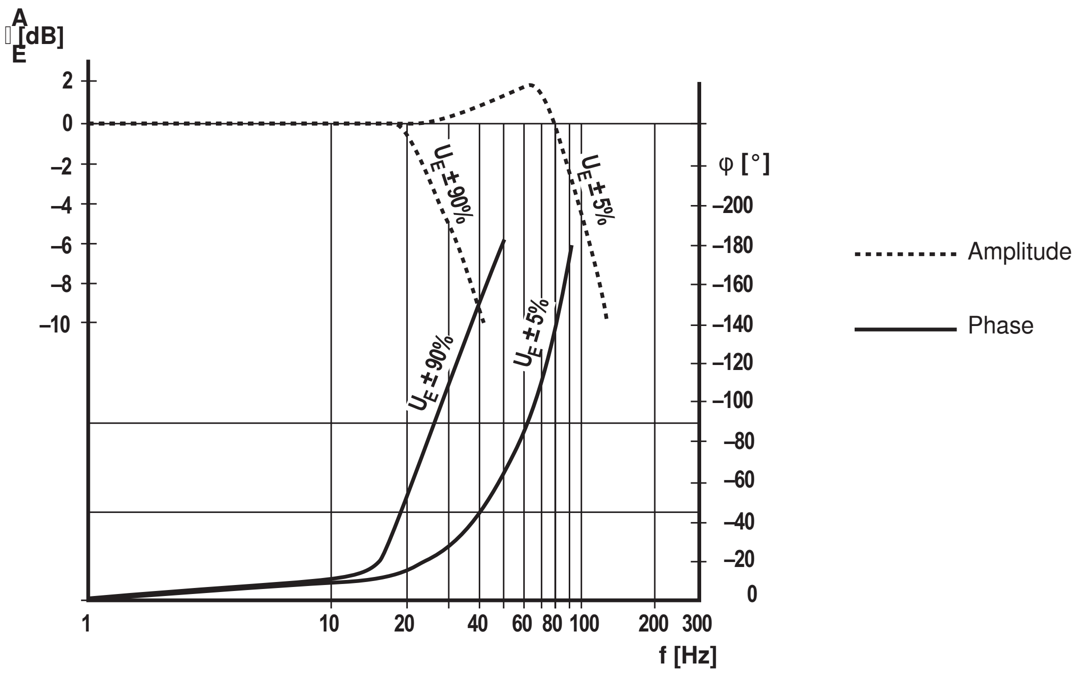
Fail-safe	p = 0 bar => 7 ms	Shut-down U_B (output stage) X1 / pin 1+2
	p = 100 bar => 10 ms	

Characteristic curves size 10 (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)

Pressure gain



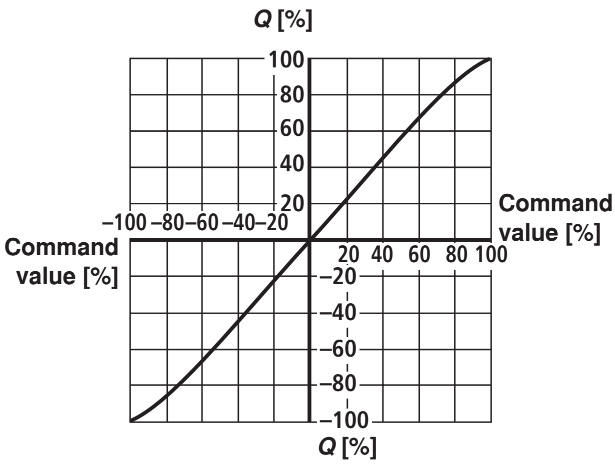
Bode diagram



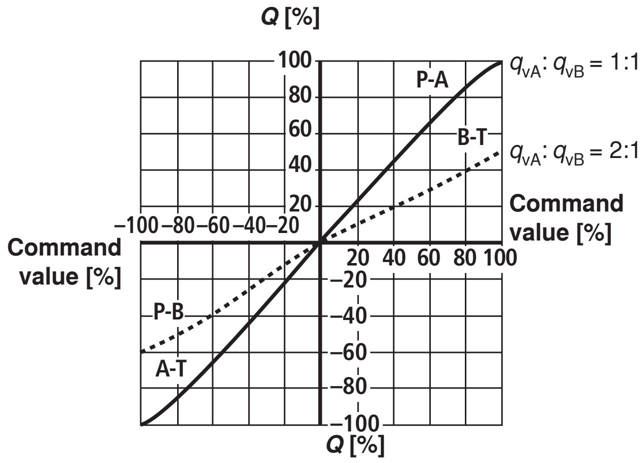
Characteristic curves size 10 (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)

Flow - signal function

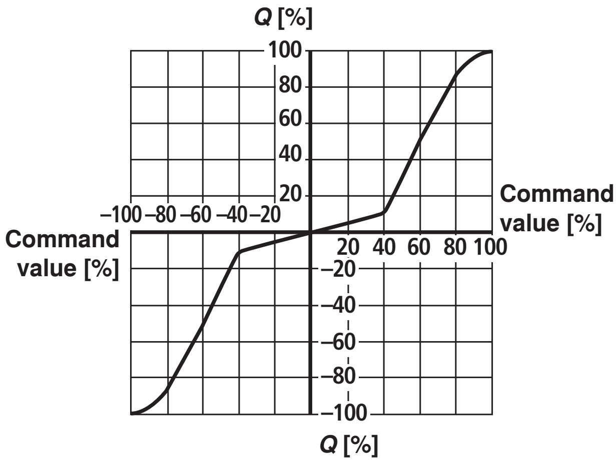
L: Linear 1:1



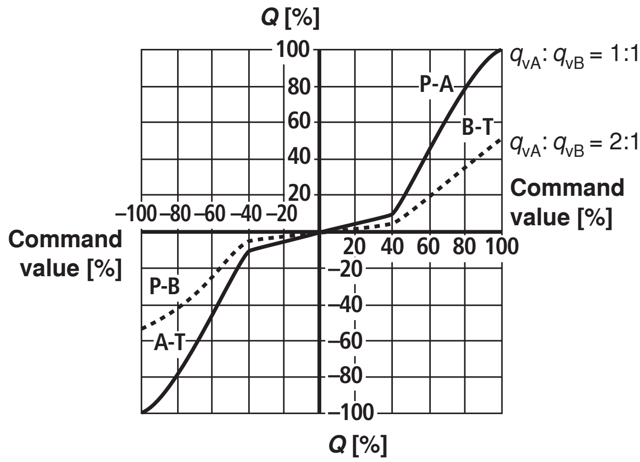
L: Linear 2:1



P: Inflection 40% 1:1



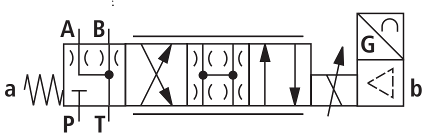
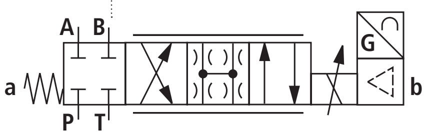
P: Inflection 40% 2:1



Note:

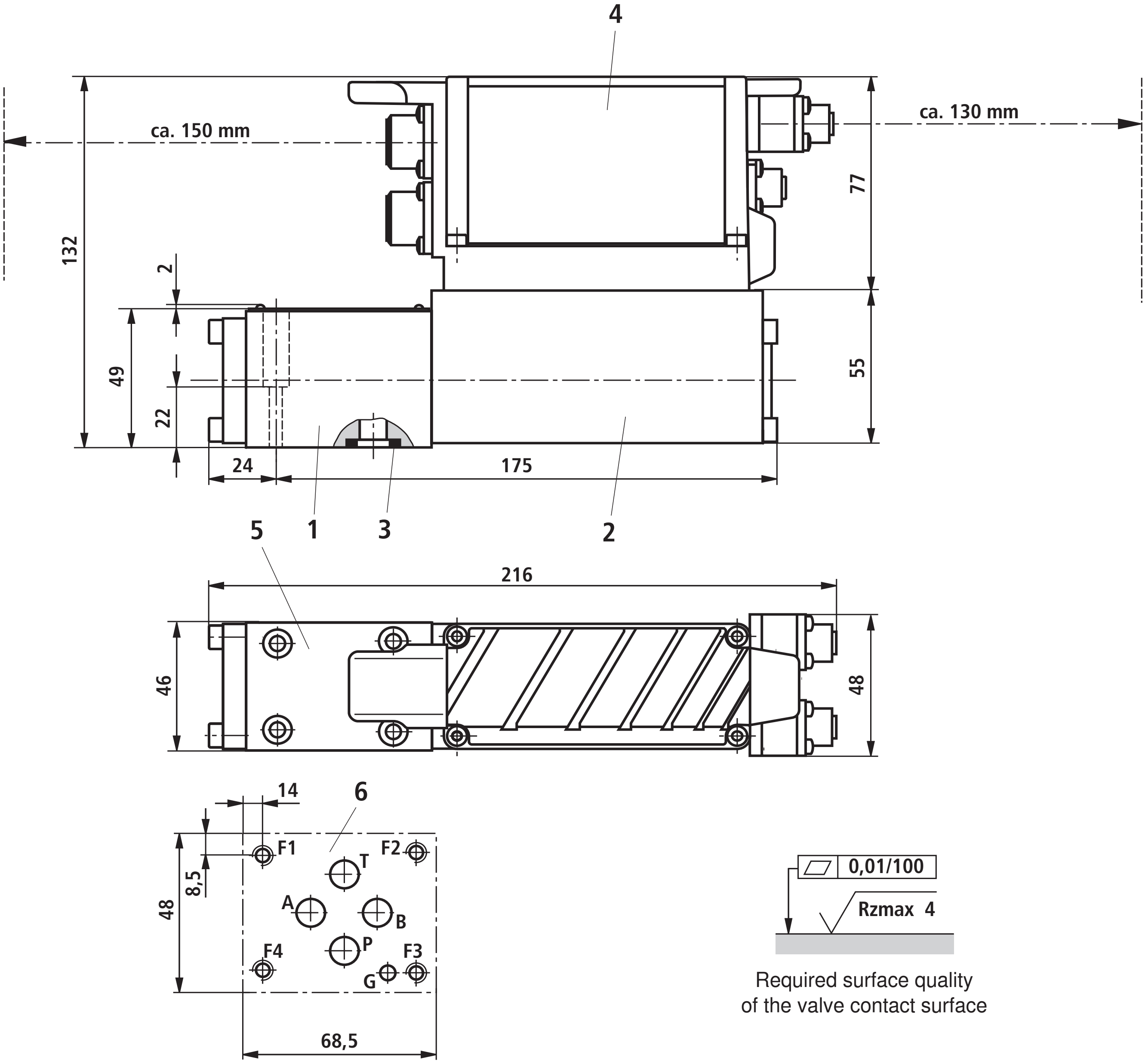
Ex factory the inflection-compensation is activated at the valve electronics. In order that the P-characteristic curve appears linear.

Fail-safe position

	Leakage oil at	100 bar	P → A	50 cm³/min
			P → B	70 cm³/min
	Flow at	Δp = 35 bar	A → T	10 ... 20 l/min
		q_n = 50/100 l/min	B → T	7 ... 20 l/min
	Leakage oil at	100 bar	P → A	50 cm³/min
			P → B	70 cm³/min
			A → T	70 cm³/min
			B → T	50 cm³/min

Fail-safe	p = 0 bar => 12 ms	Shut-down U_B (output stage) X1 / pin 1+2
	p = 100 bar => 16 ms	

Unit dimensions size 6 (dimensions in mm)

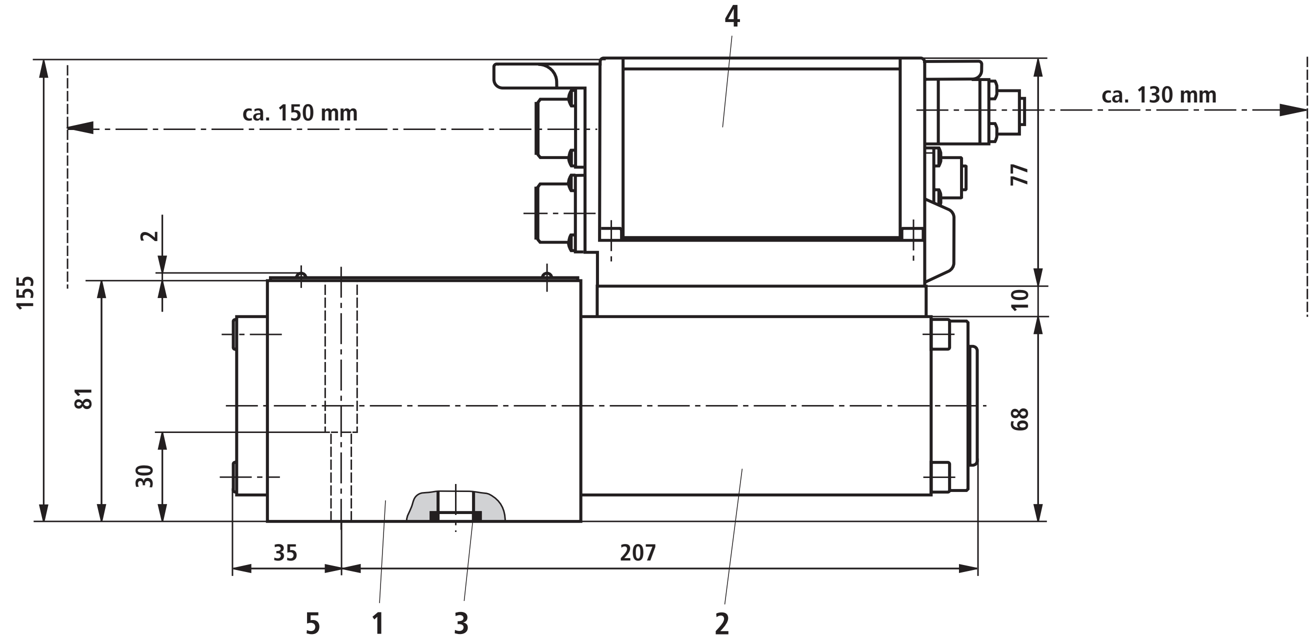


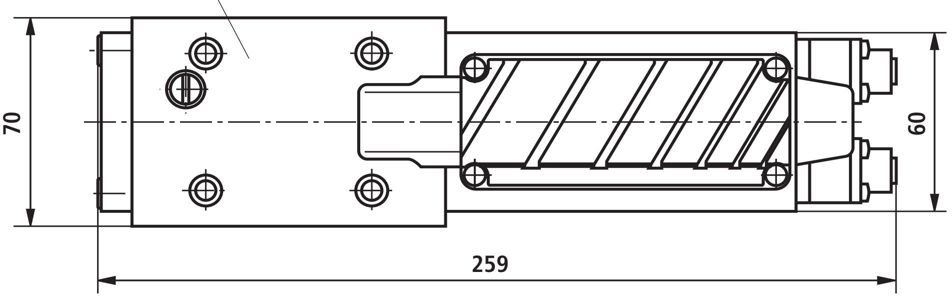
Required surface quality
of the valve contact surface

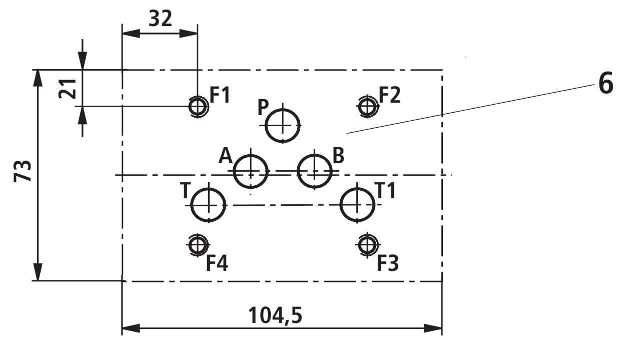
1 Valve housing
2 Control solenoid with position transducer
3 Identical seal rings for ports P, A, B, T
4 Integrated digital control electronics
5 Nameplate
6 Machined valve contact surface, position of the ports according to ISO 4401-03-02-0-05

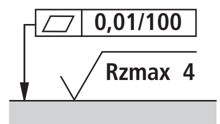
Valve mounting screws
(not included in scope of delivery):
4 units of hexagon socket head cap screws according to ISO4762-M5x30-10.9-N67F 821 70
(galvanized according to Bosch standard N67F 821 70)
M_T = 6 +2 Nm
material no. **2910151166**

Unit dimensions size 10 (dimensions in mm)









Required surface quality
of the valve contact surface

1 Valve housing

2 Control solenoid with position transducer

3 Identical seal rings for ports P, A, B, T, T1

4 Integrated digital control electronics

5 Nameplate

6 Machined valve contact surface, position of the ports according to ISO 4401-05-04-0-05

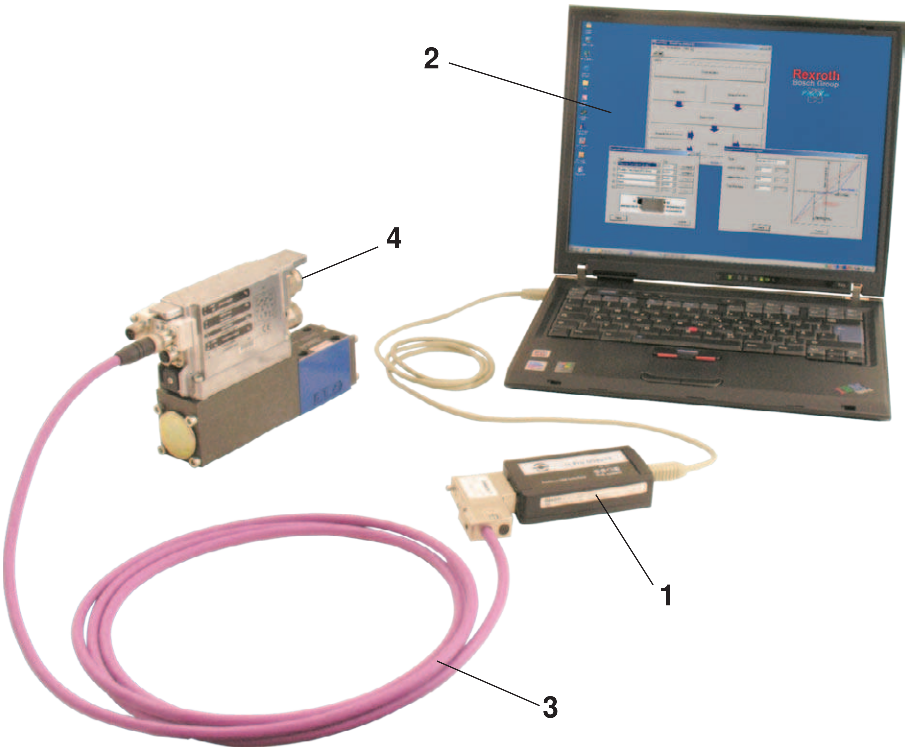
Deviating from the standard:
– port T1 exists additionally

Valve mounting screws
(not included in scope of delivery):

4 units of hexagon socket head cap screws according to ISO4762-M6x40-10.9-N67F 821 70
(galvanized according to Bosch standard N67F 821 70)
M_T = 11 +3 Nm
material no. **2910151209**

Accessories for parameterization (not included in scope of delivery)

For parameterization using the PC, the following is required:	PROFIBUS DP (code B)
1 Interface converter (USB-PROFIBUS DP)	VT-ZKO-USB/P-1-1X/V0/0 Mat.no. **R901071962**
2 Start-up software	WinHPT (from version 2.1)
3 Connecting cable, 3 m	D-Sub/M12, Mat.no. **R901078053**
4 24 V supply voltage	Mating connector for X1 (see below)

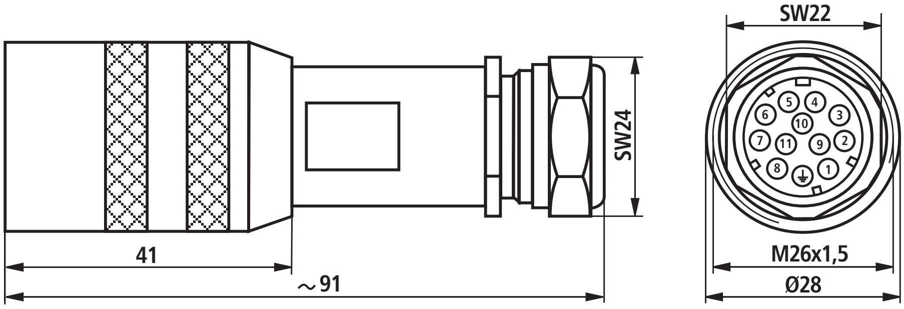


Accessories, port X1 (not included in the scope of delivery)

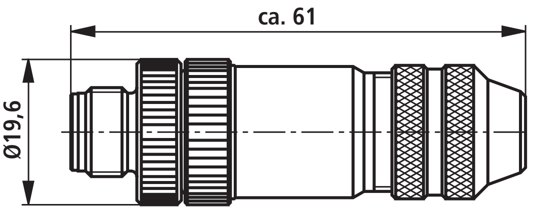
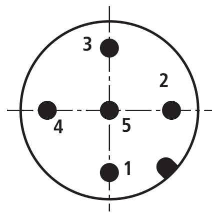
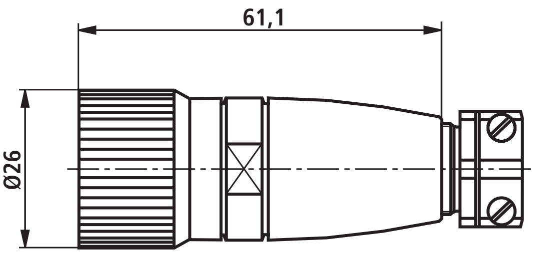
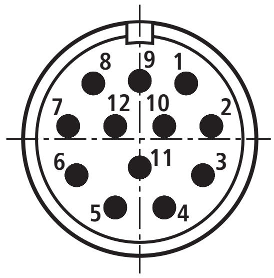
Mating connector for X1

Mating connector according to EN 175201-804 (12-pole, metal design)

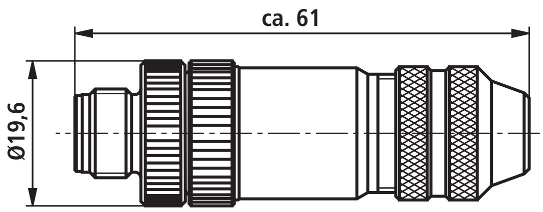
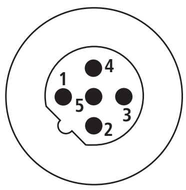
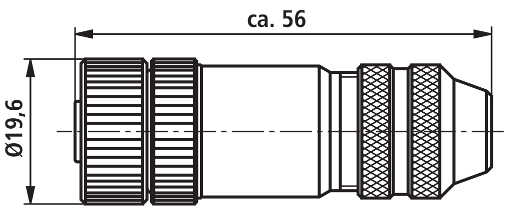
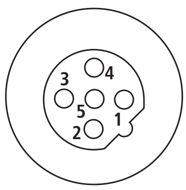
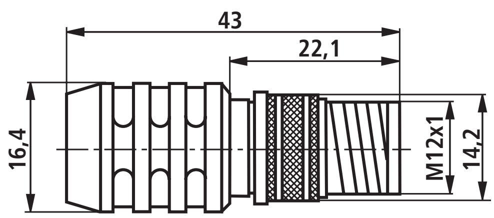
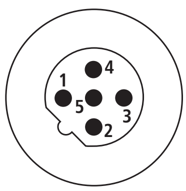
- Mating connector (construction set) for a cable diameter of 12-15 mm, Material no. **R901268000**
- Mating connector with 5 m cable, 12 x 0.75 mm² with cable shield, assembled, Material no. **R901272854**
- Mating connector with 20 m cable, 12 x 0.75 mm² with cable shield, assembled, Material no. **R901272852**



Accessories, sensor connections (not included in scope of delivery)

Description	View, dimensions	Pin pattern, order details
X4, X7 (analog sensors) Plug-in connector, 5-pole, M12 x 1, pins, A coding, metal design		 Mat. no.: **R901075542** (cable diameter 4 … 6 mm)
X7 (digital sensors, 1 Vpp and SSI) Plug-in connector, 12-pole, M23, pins, soldered joint, metal design with cap nut		 Mat. no.: **R901076284** (cable diameter up to 10.5 mm)

Accessories, PROFIBUS (B code) (not included in scope of delivery)

Description	Detail, dimensions	Pin pattern, order details
X3 Round connector, to be wired by user, 5-pin, M12 x 1 Straight line connector in metal design		 Material no.: **R901075545** (cable diameter 6 - 8 mm)
X3 Round connector, to be wired by user, 5-pin, M12 x 1 Straight mating connector from metal		 Material no.: **R901075550** (cable diameter 6 - 8 mm)
PROFIBUS terminating resistor Round plug-in connector, 5-pin, M12 x 1		 Material no.: **R901078086**

Project planning / maintenance instructions / additional information

Product documentation for IAC-R with clock-synchronized PROFIBUS DP/V2 (PROFIdrive profile)

- **Data sheet 29291** (this data sheet)
- **Declaration on environmental compatibility 29191-U**
- **Operating instructions 29291-B**
- **General Information on the Maintenance and Start-up of Hydraulic Components 07800 / 07900**

Mainenance notes:
- The devices have been tested in the factory and are supplied with default settings.
- Only complete units can be repaired. The repaired units will be supplied with default settings and current firmware. User-specific settings are not maintained. The operator will have to retransfer the corresponding user parameters.

Notes:
- Connect the valve to the supply voltage only when this is required for the functional processes of the machine.
- Electric signals brought out via control electronics (e.g. signal "ready for operation") may not be used for the actuation of safety-relevant machine functions! (see also the European standard "Safety requirements for fluid power systems and their components - Hydraulics", EN 982.)
- If electromagnetic interference must be expected, take appropriate measures to safeguard the function (depending on the application, e.g. shielding, filtering)!

RE 29133
Edition: 2020-08

rexroth
A Bosch Company

Directional control valves, direct operated, with electrical position feedback and integrated flow control (IFB Multi-Ethernet)

Type 4WRPQ

H8165+8166

- Sizes 6 and 10
- Component series 3X
- Maximum operating pressure 280 bar
- Rated flow 32, 80 l/min

CE

Features

- Open
  - Integrated, digital flow controller (IFB Multi-Ethernet)
  - Bus connection/service interface (Sercos, Ether-CAT, EtherNet/IP, PROFINET RT, POWERLINK, VARAN)
- Safe
  - Internal safety function (can be used up to category 4/PL e according to EN 13849-1)
  - CE conformity according to EMC Directive 2014/30/EU

Contents

Ordering code

01	02	03	04	05	06	07		08		09		10	11	12		13	14	15	16
4	WRP	Q				S	–	3X	/		/	G	F	24	/		D9	0	*

01	4 main ports	**4**
02	Directional control valve, direct operated	**WRP**
03	With integrated digital flow controller	**Q**
04	Size 6	**6**
	Size 10	**10**
05	Symbols; possible version see page 3	

Rated flow (***Δp*** = 5 bar/control edge)

06	32l/min (only NG6L)	**32**
	80l/min (only NG10)	**80**

Flow characteristic

07	Progressive	**S**
08	Component series 30 … 39 (30 … 39: unchanged installation and connection dimensions)	**3X**

Seal material(observe compatibility of seals with hydraulic fluid used, see page 7)

09	NBR seals	**M**
	FKM seals	**V**

Pressure sensor (pressure rating)

10	Pressure rating 280 bar	**G**

Internal pressure sensor (position)

11	In port A, B and P	**F**
12	Supply voltage 24 V	**24**

Ethernet interface

13	EtherNET/IP	**E**
	PROFINET RT	**N**
	Sercos	**S**
	EtherCAT (CANopen profile)	**T**
	POWERLINK (CANopen profile)	**W**
	VARAN	**V**

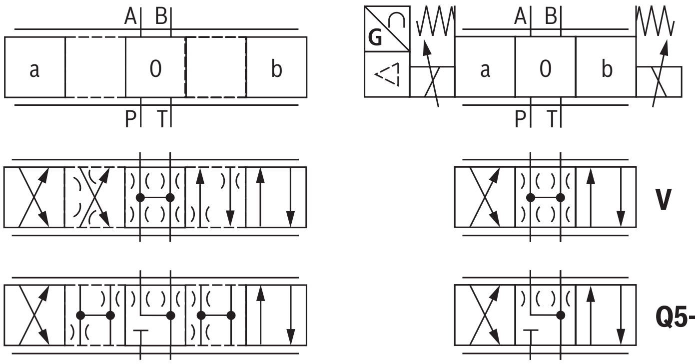
Connector

14	Voltage supply, enable acknowledgment	**D9**

Pressure sensor interface

15	Without interface	**0**
16	Further details in the plain text	*****

Symbols



☞ **Notice:**
Representation according to DIN ISO 1219-1.
Hydraulic interim positions are shown by dashes.

Function

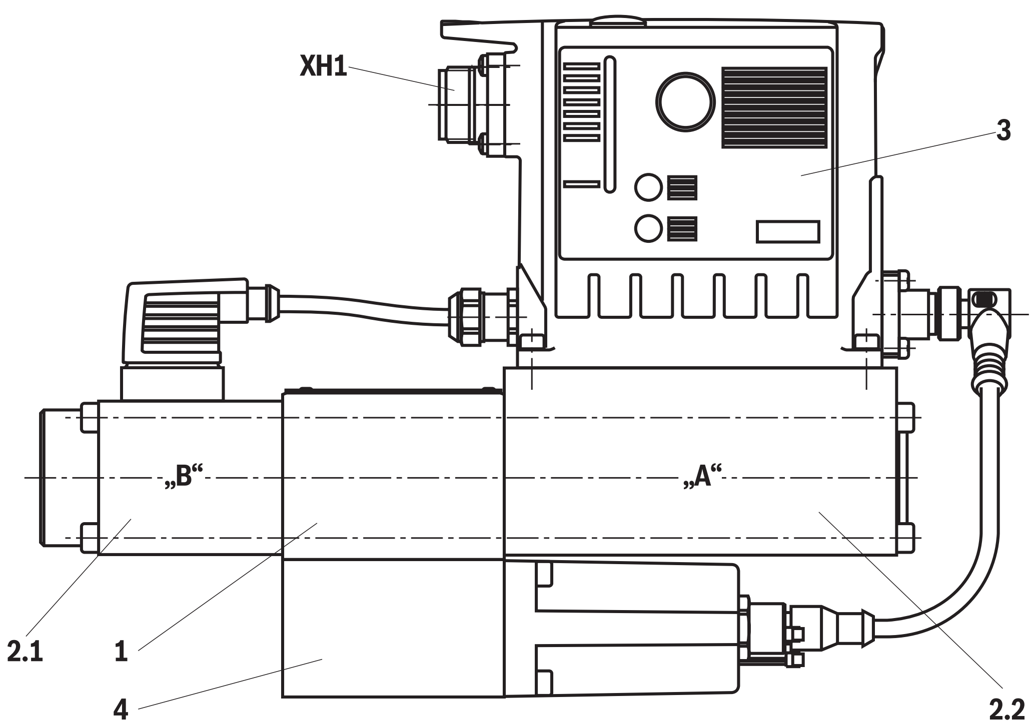
General information
The **IFB Multi-Ethernet** valve (**I**ntegrated **F**ield**b**us) is a digital directional control valve with integrated flow controller, load-independent.

The following operating modes are possible:
- Valve direct control
- Flow control
- Pressure/force control
- Pressure control/volume substitutional
- Torque/force control/flow
- Pressure control/valve direct control substitutional
- Substitutional control (flow – pressure/force); pQ function (flow-controlled)

Communication is done via the digital Multi-Ethernet interface (X7E1 or X7E2) only. The following data may be exchanged:
- Command values
- Actual values
- Configuration and setting of the system control parameters
- Status messages, faults or warnings

Set-up
The directional control valve with IFB Multi-Ethernet electronics mainly consists of:
- Main housing with control spool (1)
- Control electronics with integrated fieldbus (3)
  - Connector, voltage supply, safety shut-down (XH1)
  - Ethernet interfaces (X7E1, X7E2)
- Pressure sensor sandwich plate (4)
- Stroke solenoid (2.1)
- Control solenoid with electrical position feedback (2.2)

☞ **Notice:**
With version "V32", the control spool may rotate in case of single-sided flow through the supply flow edges (P–A or P–B) causing damage or failure of the valve. This can be solved by reduction of the pressure differential over the supply flow edge to a maximum of 80 bar or by simultaneous use of both control edges (P–A/B–T or P–B/A–T).



Function (flow control)

The integrated electronics (OBE) enables load-independent control of the flow at positive command value by means of the two integrated pressure sensors in ports P and A. At negative command value, the flow is controlled from P to B.

Safety function (only symbol Q5-)
The integrated electronics (OBE) of the valve enable additional shut-off of a channel according to EN 13849-1 in both directions (depending on the symbol, the valve can be considered as safely shut-off).
When using symbol V, the valve cannot be used in a safety-relevant manner according to EN 13849-1 while enable acknowledgment always remains 0.
Thanks to the two control solenoids (enable pin D and E, low signal) at the connector (XH1), direction-dependent shut-off is enabled. The control spool of the valve is in spring-centered central position for this purpose (fail-safe position).
Enable acknowledgment pin C for solenoid A and pin F for solenoid B are "high". By connecting both control solenoids (enable pin D and E, high signal), the valve can be controlled by a command value presetting (command value positive, solenoid B or command value negative, solenoid A).
Enable acknowledgment pin C for solenoid A and pin F for solenoid B are "low".
Separate shut-off of solenoid A or solenoid B will moreover allow for the direction-dependent activation or shut-off of the drive.

Notice for safe shut-off according to EN 13849-1
Enable acknowledgment
The enable acknowledgment is not set (pin C and F):

- Regular operation, enable active:
  Enable at pin D clears enable acknowledgment at pin C, enable at pin E clears enable acknowledgment at pin F.
- For failure of supply voltage.
- In case of a cable break (the integrated electronics (OBE) will de-energize both control solenoids and the control spool will move to the spring-centered central position).
- If the control spool is not in a hydraulically safe position (insufficient safety overlap of the control spool or safe position is not reached).

Monitoring
The digital control electronics enable comprehensive monitoring functions/error detection including:

- Undervoltage
- Communication error
- Cable break for analog sensor inputs
- Monitoring of the microcontroller (watchdog)
- Temperature of the integrated electronics

IndraWorks DS PC program
To implement the project planning task and to parameterize the valve, the user may use the IndraWorks DS engineering tool (see accessories):

- Project planning
- Parameterization
- Commissioning
- Diagnosis
- Comfortable administration of all data on a PC
- PC operating systems: Windows 10

☞ **Notices:**

- When using symbol V, the enable inputs (enable pin D and E) may only be activated and deactivated together.
- For all other symbols, a unilateral shut-off will cause reduced performance data.
- 4/3 directional control valves do not have a leakage-free basic locking when deactivated. Leakage must be considered when designing the drive.
- Valve type 4WRPQ (symbol Q5-) can be used as shut-off element cat. 3 or 4 (up to PL e according to EN 13849-1). For both categories, an additional shut-off element is required to achieve a two-channel shut-off. For further information on the safety application, see operating instructions 29391-B.
- At a flow command value of 0, the specified flow control tolerance also applies.

Technical data
(For applications outside these values, please consult us!)

General				
Size		NG	6	10
Installation position			any	
Ambient temperature range		°C	–20 ... +60	
Storage temperature range (with UV protection)		°C	+10 ... +40	
Transport temperature		°C	–30 ... +80	
Maximum storage time		Years	1 (if the storage conditions are observed; refer to the operating instructions 07600-B)	
Vibration resistance	▶ Sine test according to DIN EN 60068-2-6		10 ... 2000 Hz / maximum of 10 g / 10 cycles / 3 axes	
	▶ Noise test according to DIN EN 60068-2-64		20 ... 2000 Hz / 10 g_{RMS} / 30 g peak / 30 min. / 3 axes	
	▶ Transport shock according to DIN EN 60068-2-27		15 g / 11 ms / 3 shocks / 3 axes	
Weight		kg	4.7	9.8
Maximum relative humidity (no condensation)		%	95	
Maximum solenoid surface temperature		°C	150 (individual operation)	
$MTTF_d$ value according to EN ISO 13849		Years	150 (for further details see data sheet 08012)	
Conformity			▶ CE according to EMC Directive 2014/30/EU, tested according to EN 61000-6-2 and EN 61000-6-3 ▶ RoHS Directive 2011/65/EU ▶ REACH ordinance (EC) no. 1907/2006	

Hydraulic				
Maximum operating pressure	▶ Ports A, B, P	bar	280	
	▶ Port T	bar	200	
Rated flow (Δp = 5 bar/control edge [1])		l/min	32	80
Hydraulic fluid			See table page 7	
Viscosity range	▶ Recommended	mm²/s	20 ... 100	
	▶ Maximum admissible	mm²/s	10 ... 800	
Hydraulic fluid temperature range (flown-through)		°C	–20 ... +70	
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)			Class 18/16/13 [2]	

1) Flow for deviating Δp (control edge):

$$\boxed{q_x = q_{Vnom} \cdot \sqrt{\frac{\Delta p_x}{5}}}$$

2) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and simultaneously increases the life cycle of the components.

Notice:
The specified technical data were measured with HLP46 and ϑ_{oil} = 40 ±5 °C.

Technical data

(For applications outside these values, please consult us!)

Hydraulic fluid		Classification	Suitable sealing materials	Standards	Data sheet
Mineral oils		HL, HLP, HLPD, HVLP, HVLPD	NBR, FKM	DIN 51524	90220
Bio-degradable	▶ Insoluble in water	HETG	FKM	ISO 15380	90221
		HEES	FKM		
	▶ Soluble in water	HEPG	FKM	ISO 15380	
Flame-resistant	▶ Water-free	HFDU (glycol base)	FKM	ISO 12922	90222
		HFDU (ester base)	FKM		
		HFDR	FKM		
	▶ Containing water	HFC (Fuchs: Hydrotherm 46M, Renosafe 500; Petrofer: Ultra Safe 620; Houghton: Safe 620; Union: Carbide HP5046)	NBR	ISO 12922	90223

Important notices on hydraulic fluids:

- For further information and data on the use of other hydraulic fluids, please refer to the data sheets above or contact us.
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.).
- The ignition temperature of the hydraulic fluid used must be 50 K higher than the maximum surface temperature.
- **Bio-degradable and flame-resistant – containing water:** If components with galvanic zinc coating (e.g. version "J3" or "J5") or parts containing zinc are used, small amounts of dissolved zinc may get into the hydraulic system and cause accelerated aging of the hydraulic fluid. Zinc soap may form as a chemical reaction product, which may clog filters, nozzles and solenoid valves – particularly in connection with local heat input.
- **Flame-resistant – containing water:**
  - Due to the increased cavitation tendency with HFC hydraulic fluids, the life cycle of the component may be reduced by up to 30% as compared to the use with mineral oil HLP. In order to reduce the cavitation effect, it is recommended – if possible specific to the installation – backing up the return flow pressure in ports T to approx. 20% of the pressure differential at the component.
  - Dependent on the hydraulic fluid used, the maximum environment and hydraulic fluid temperature must not exceed 50 °C. In order to reduce the heat input into the component, the command value profile is to be adjusted for proportional and high-response valves.

Static /dynamic (valve direct control)		
Hysteresis	%	< 0.25
Range of inversion	%	< 0.05
Response sensitivity	%	< 0.05
Manufacturing tolerance $q_{V\max}$	%	< 10
Temperature drift (temperature range 20 °C ... 80 °C)	%/10 K	Zero shift < 0.25
Pressure drift	%/100 bar	Zero shift < 0.2
Zero compensation		ex plant ±1%

Static /dynamic (flow control)			
Size	NG	6	10
Flow accuracy [3]	l/min	80±4	180±9

[3] Accuracy tolerance of controlled flow/recommended maximum flow

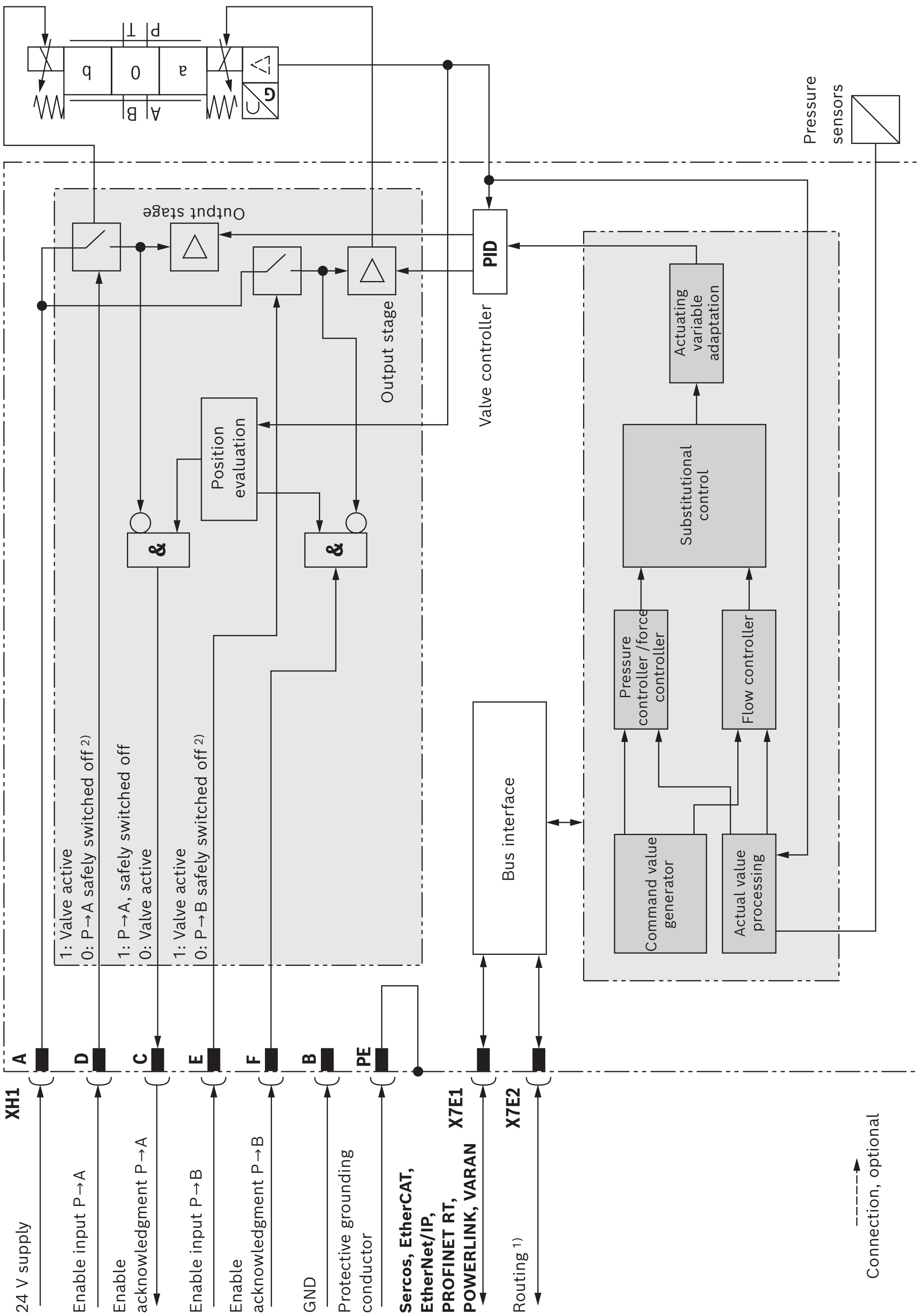
Technical data
(For applications outside these values, please consult us!)

Electrical, integrated electronics (OBE)			
Relative duty cycle		%	100 (continuous operation)
Protection class according to EN 60529			IP65 (If suitable and correctly mounted mating connectors are used)
Supply voltage [4]	▶ Nominal voltage	VDC	24
	▶ Lower limit value	VDC	18
	▶ Upper limit value	VDC	36
	▶ Maximum admissible residual ripple	Vpp	2.5 (comply with absolute supply voltage limit values)
Current consumption (at nominal voltage)	▶ Maximum [5]	A	2.8
	▶ Impulse current	A	4
Maximum power consumption		W	65
AD/DA resolution	▶ Analog inputs		12 bit
Protective grounding conductor and screening			See connector pin assignment (CE-compliant installation) page 10
Required fuse protection, external		A	4, time-lag
Adjustment			Calibrated in the plant
Conformity			CE according to EMC Directive 2014/30/EU tested according to EN 61000-6-2 and EN 61000-6-3
Parameterization interface			Ethernet
Scan time pressure and force controller (minimum)		ms	0.5
Booting time		s	< 15
Switching input Enable XH1	▶ Quantity		2
	▶ Low level	V	–3 ... 5
	▶ High level	V	15 ... $\boldsymbol{U}_B$
	▶ Current consumption at high level	mA	< 15
	▶ Reference potential GND		Pin B
Switching output Enable acknowledgment XH1	▶ Quantity		2
	▶ Low level	V	0 ... 3
	▶ High level	V	15 ... $\boldsymbol{U}_B$
	▶ Current carrying capacity	mA	50 (short-circuit-proof)
	▶ Signal delay time	ms	See operating instructions 29391-B
	▶ Reference potential GND		Pin B

[4] Voltage limit values must be observed directly at the connector of the valve (observe line length and cable cross-section!)

[5] When using the sensor inputs or the switching output, the maximum current consumption will increase according to the external load

Block diagram/controller function block



1) Not with "VARAN"

2) Safe deactivation with simultaneous use of enable acknowledgment

Detailed description of the safety function:
After both enable signals have been removed, both output stages, and thus the solenoid A and B of the valve, are internally separated from the available supply voltage. The enable acknowledgment will only be activated for shut-off of A and B separately after the safe valve spool position has been achieved.
For a detailed description of the safety function, refer to the operating instructions 29391-B.

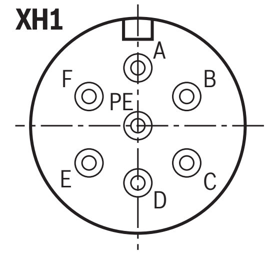
Electrical connections, assignment

Connector pin assignment XH1, 6-pole + PE according to DIN 43563

Pin	Assignment of interface D9
A	24 VDC supply voltage [1]
B	GND (reference for pin A, C, D, E, F)
C	Enable acknowledgment 24 VDC (I_{max} = 50 mA) [2] (high ≥15 V; low <2 V); Flow from P→A
D	Enable input 24 VDC (high ≥15 V; low <2 V); Flow from P→A
E	Enable input 24 VDC (high ≥15 V; low <2 V); Flow from P→B
F	Enable acknowledgment 24 VDC (I_{max} = 50 mA) [2] (high >15 V; low <2 V); Flow from P→B
PE	Functional ground (connected directly to metal housing)

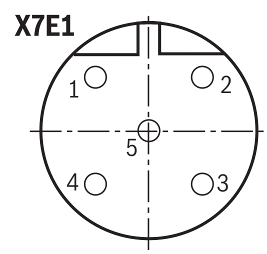
[1] A load increases the current consumption on pin A

[2] Enable acknowledgment is issued only if the valve has safely switched off according to EN 13849-1, see operating instructions 29391-B.



Connector pin assignment for Ethernet interfaces "X7E1" and "X7E2" (coding D), M12, 4-pole, socket

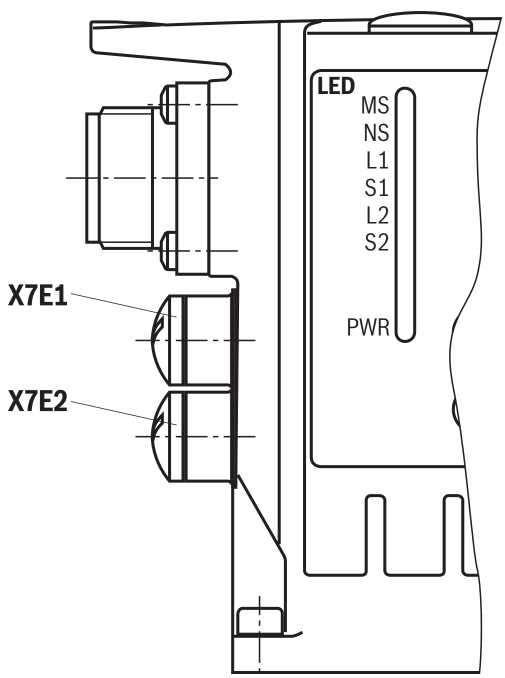
Pin	Assignment
1	TxD +
2	RxD +
3	TxD –
4	RxD –
5	not assigned



Notices:
- Reference potential for all signals: GND
- We recommend connecting the shields on both sides via the metal housings of the plug-in connectors.

LED displays

LED	Interface	Sercos	EtherNET/IP	EtherCAT	PROFINET RT	POWERLINK	VARAN
MS	**Electronics module**	Module status	Module status	Module status	Module status	Module status	Module status
NS		S	Network status and others	Network status and others	Network status and others	Status/error	Network status and others
L1	**X7E1**	Link and others	Link and others	Link/activity	Link and others	Link/data activity	Link and others
S1		Activity and others	Activity and others	Not used	Activity and others	Not used	Active and others
L2	**X7E2**	Link and others	Link and others	Link/activity	Link and others	Link/data activity	Not used
S2		Activity and others	Activity and others	Not used	Activity and others	Not used	Not used
PWR	**XH1**	Power	Power	Power	Power	Power	Power



Displays of the status LEDs

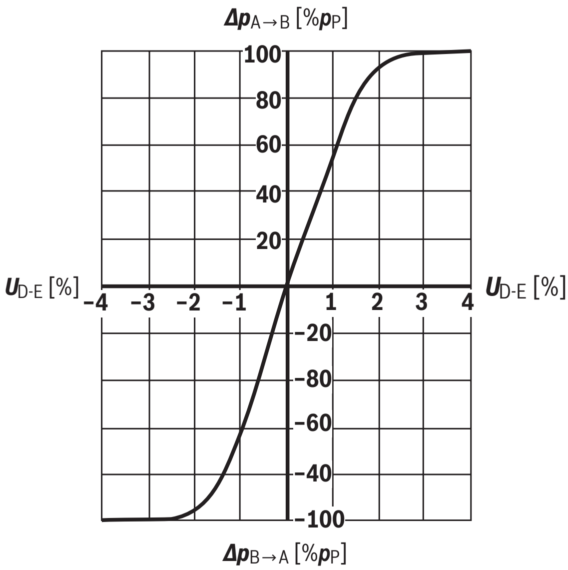
Power LED (LED PWR)	Display status
Off	No voltage supply
Green	Operation

Module status LED (LED MS)	Display status
Off	No voltage supply
Green-red, flashing	Initialization
Green, flashing	Drive ready for operation
Green	Drive active
Orange, flashing	Warning
Red, flashing	Error
Green, rapidly flashing	Firmware must be loaded

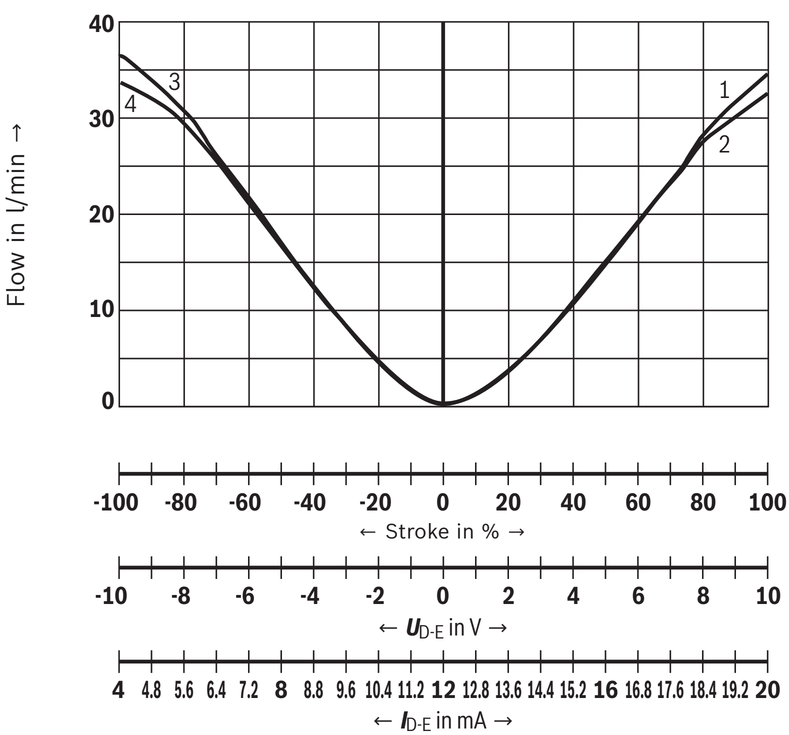
Notices:
- For the connection to the M12 sockets, we recommend using self-locking mating connectors
- Module status LED MS relates to the electronics module
- The network status LED NS indicates the status of the control communication, see application description 30338-FK
- LEDs L1, S1, L2 and S2 relate to interfaces "X7E1" and "X7E2"
  - Link: Cable plugged in, connection established (permanently lit)
  - Activity: Data sent/received (flashing)
- For a detailed description of the diagnosis LEDs, please refer to the functional description Rexroth HydraulicDrive HDx.

Characteristic curves: Size 6 – Valve direct control (measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Pressure/signal characteristic curve (symbol V)



Flow/signal function (rated flow 32 l/min with Δp = 5 bar/control edge)



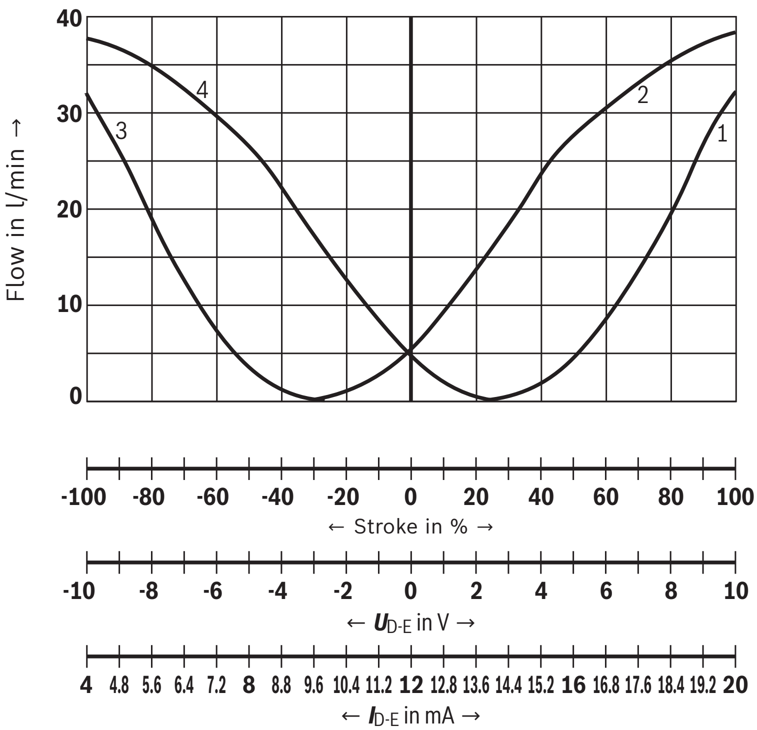
1 P–A
2 B–T
3 P–B
4 A–T

> **Notice:**
> Typical characteristic curves which are subject to tolerance variation.

Characteristic curves: Size 6 – Valve direct control (measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/signal function (rated flow 32 l/min with Δp = 5 bar/control edge)

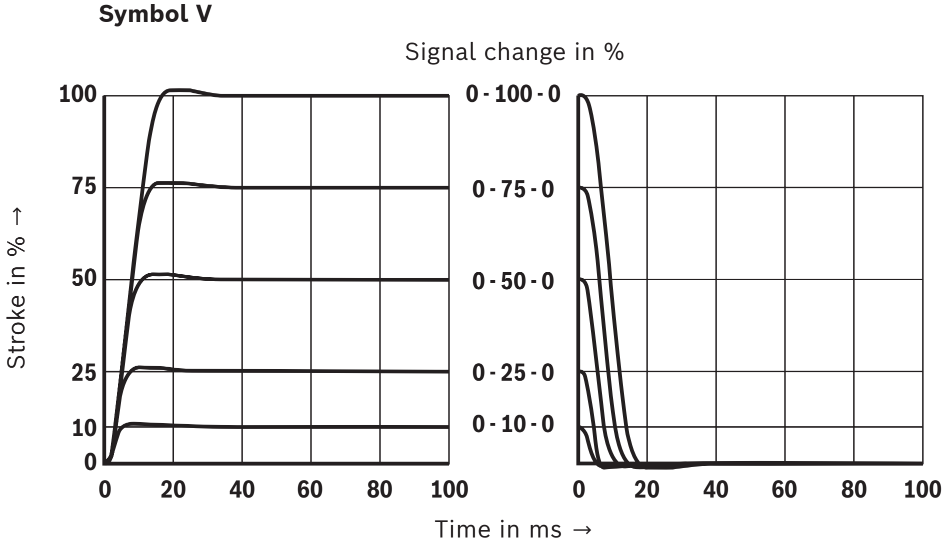
Symbol Q5-



1 P–A
2 B–T
3 P–B
4 A–T

Transition function with stepped electric input signals

Symbol V

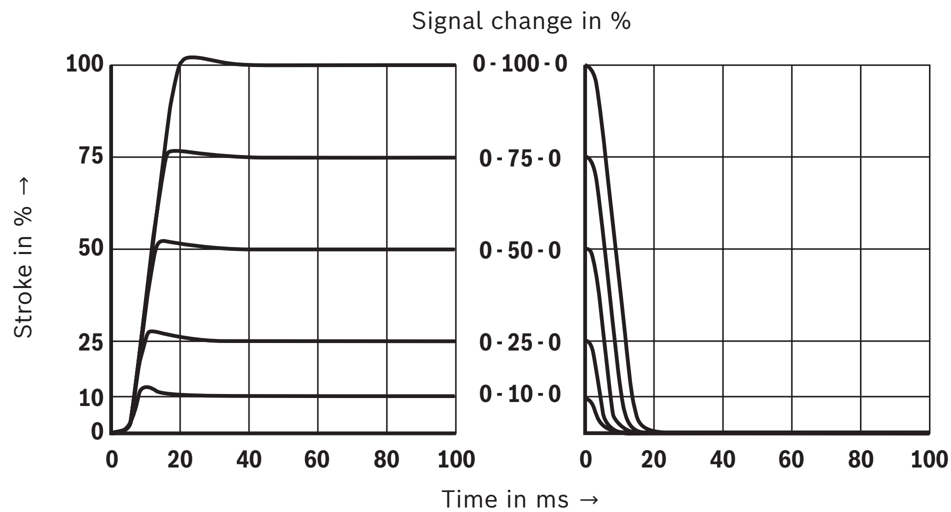


Notice:
Typical characteristic curves which are subject to tolerance variation.

Characteristic curves: Size 6 – Valve direct control (measured with HLP46, ϑ_{oil} = 40 ±5 °C)

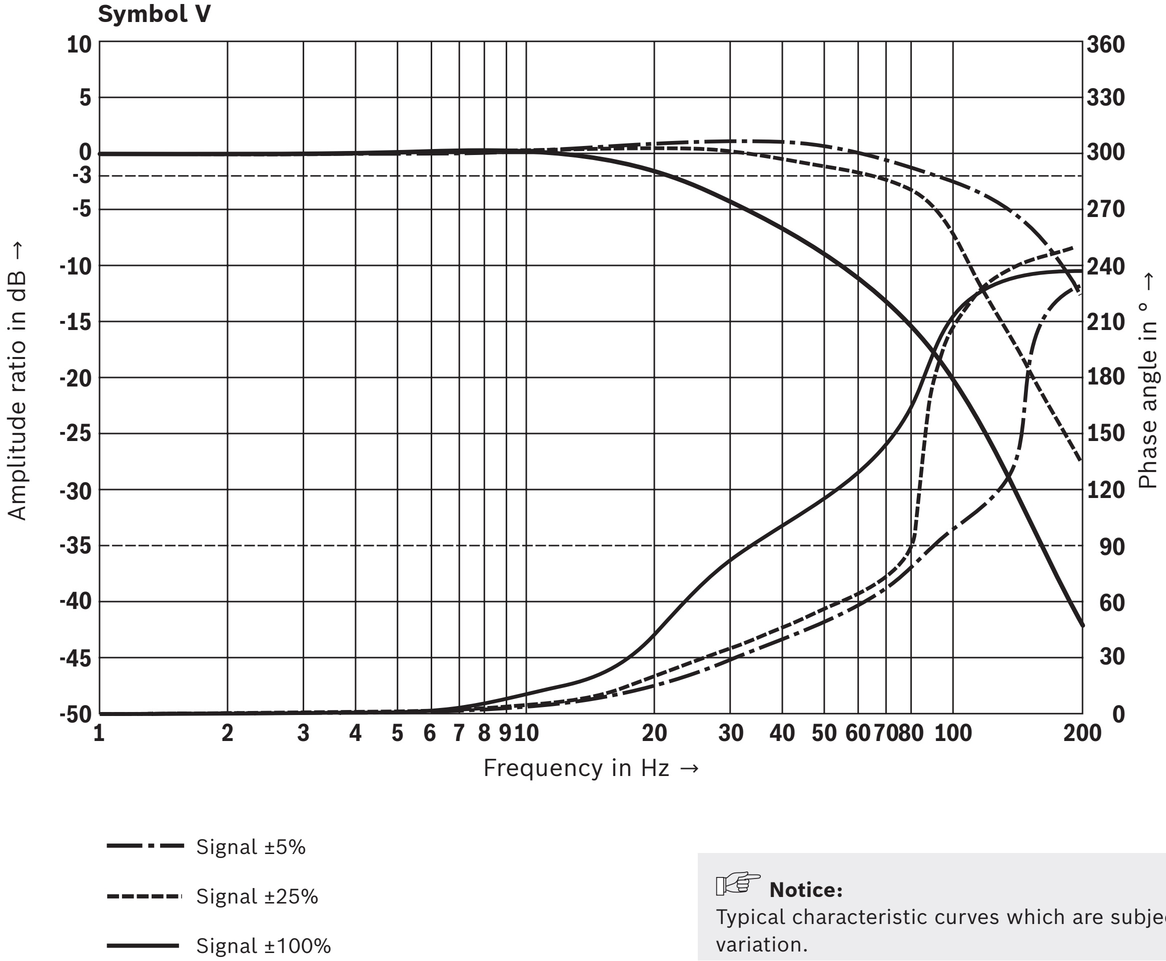
Transition function with stepped electric input signals

Symbol Q5-



Frequency response characteristic curves

Symbol V

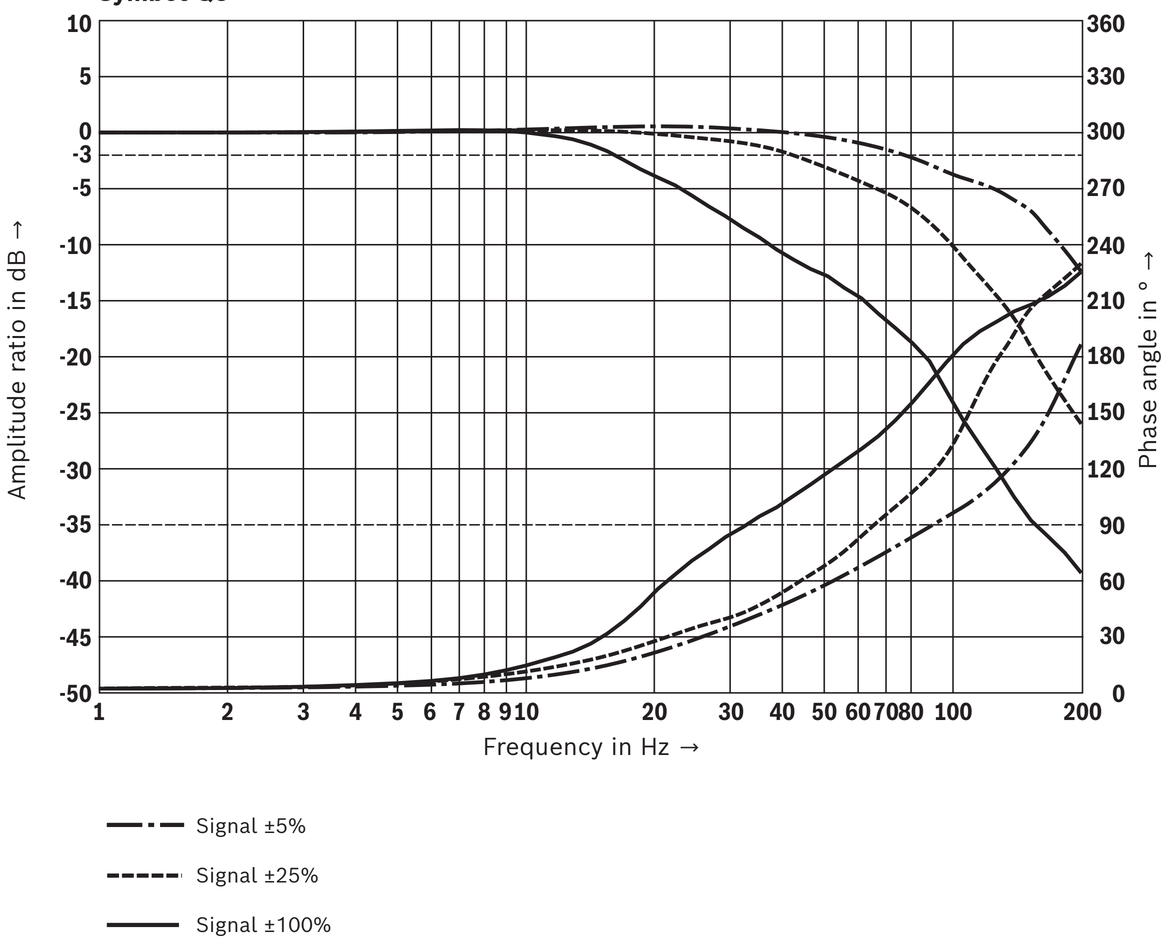


Notice:
Typical characteristic curves which are subject to tolerance variation.

Characteristic curves: Size 6 – Valve direct control (measured with HLP46, ϑ_{oil} = 40 ±5 °C)

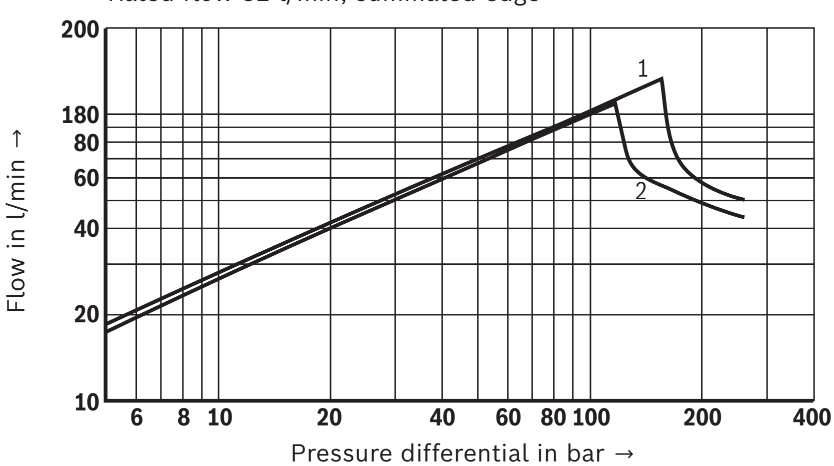
Frequency response characteristic curves

Symbol Q5-



Flow/load function with maximum valve opening (tolerance ±10%)

Rated flow 32 l/min, summated edge



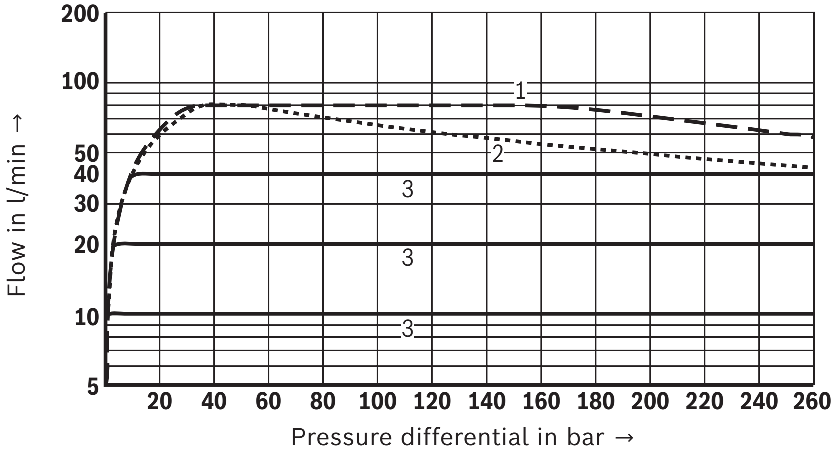
1 Symbol V

2 Symbol Q5-

Notice:
Typical characteristic curves which are subject to tolerance variation.

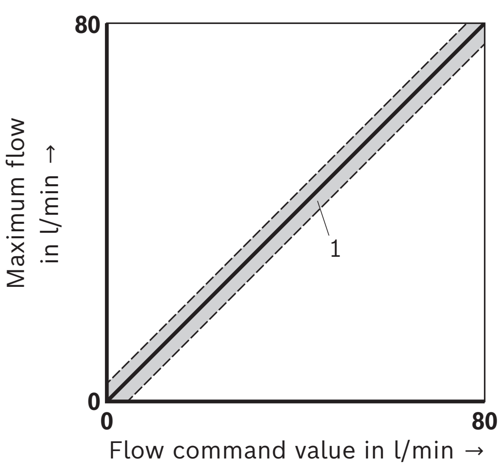
Characteristic curves: Size 6 – Flow control (measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Flow deviation (tolerance ±4 l/min)
Single edge (supply flow edge $q_{V\ command}$ = 80 l/min)



1 Symbol V
2 Symbol Q5-
3 Symbol V and Q5-

Tolerance of controlled flow / recommended maximum flow
(Default value 80 l/min)

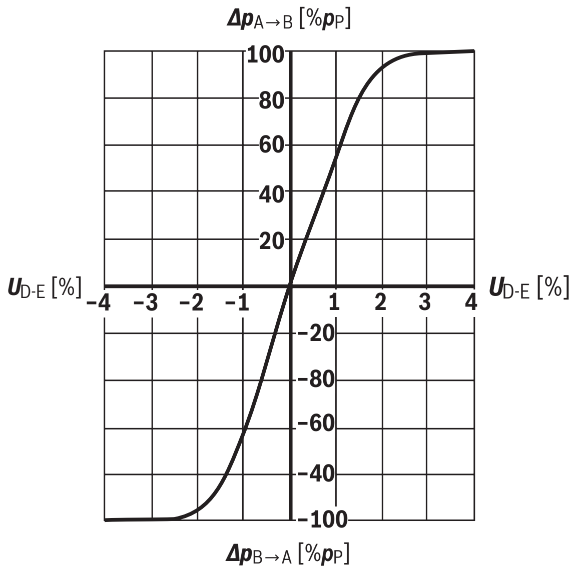


1 Tolerance ±4 l/min

Notice:
- The maximum possible flow is specified in parameter "maximum flow" (P-0-2875.0.3).
  The default value is defined by the performance data of the valve (see parameter description 30330-PA).
- Observe the limitations of use of the valve under "Flow/load function with maximum valve opening".

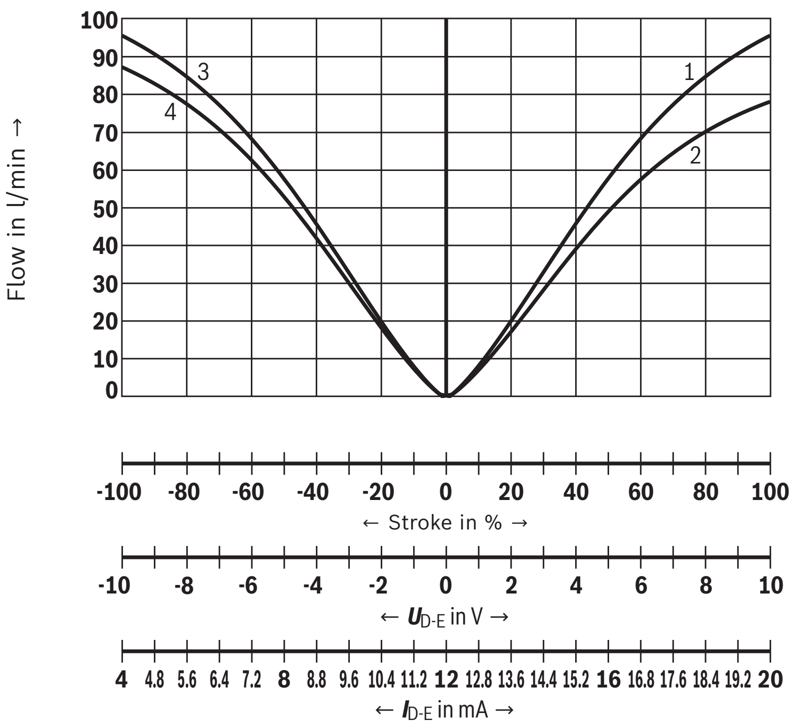
Characteristic curves: Size 10 – Valve direct control (measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Pressure/signal characteristic curve (symbol V)



Flow/signal function (rated flow 80 l/min with ***Δp*** = 5 bar/control edge)

Symbol V



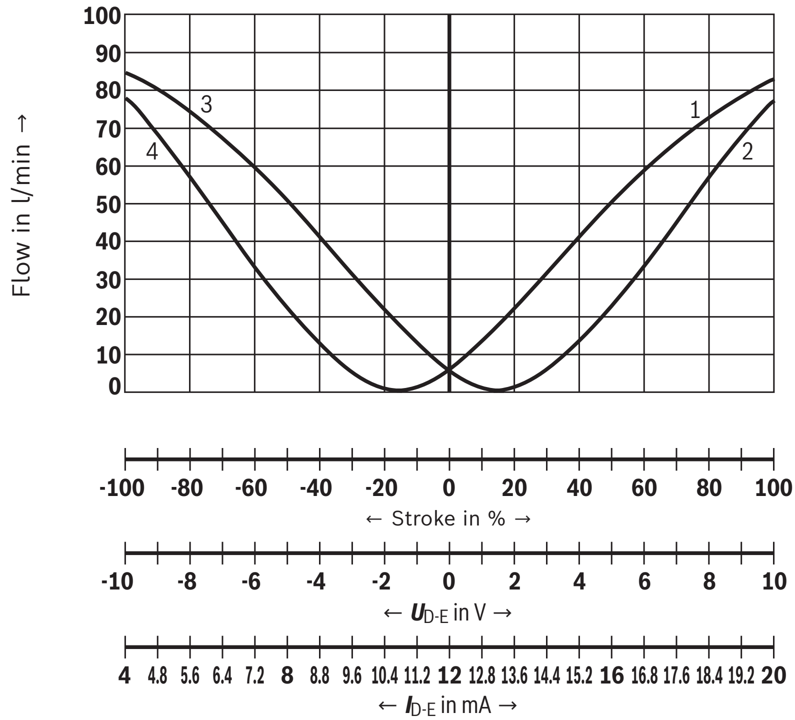
1 P–A
2 B–T
3 P–B
4 A–T

☞ **Notice:**
Typical characteristic curves which are subject to tolerance variation.

Characteristic curves: Size 10 – Valve direct control (measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/signal function (rated flow 80 l/min with Δp = 5 bar/control edge)

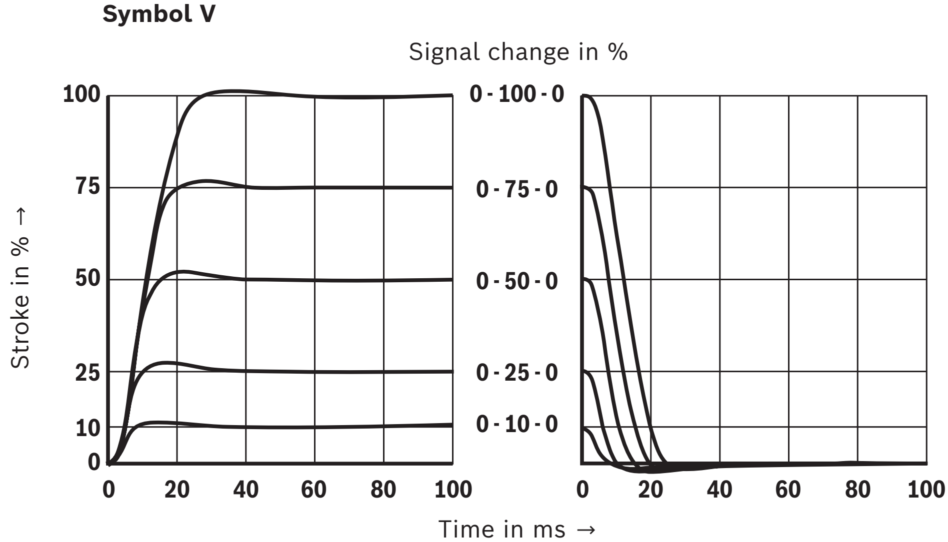
Symbol Q5-



1 P–A
2 B–T
3 P–B
4 A–T

Transition function with stepped electric input signals

Symbol V

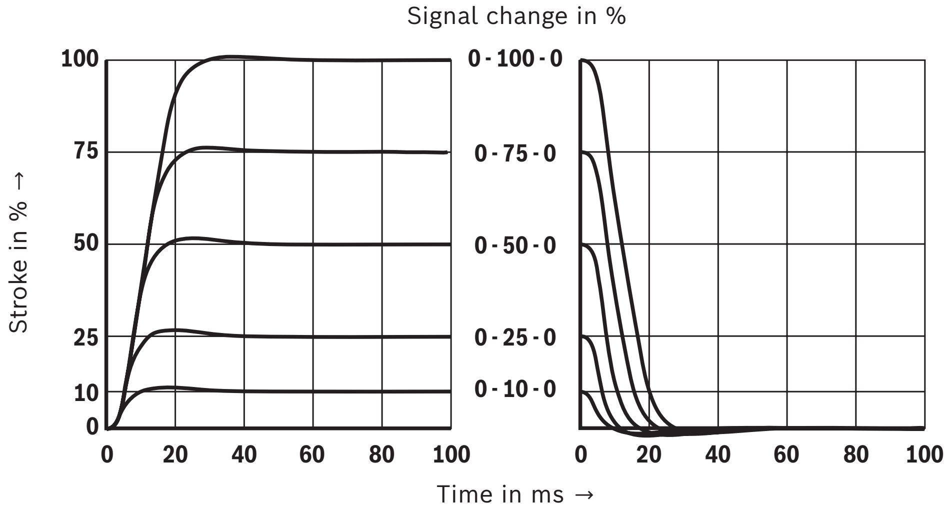


☞ **Notice:**
Typical characteristic curves which are subject to tolerance variation.

Characteristic curves: Size 10 – Valve direct control
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

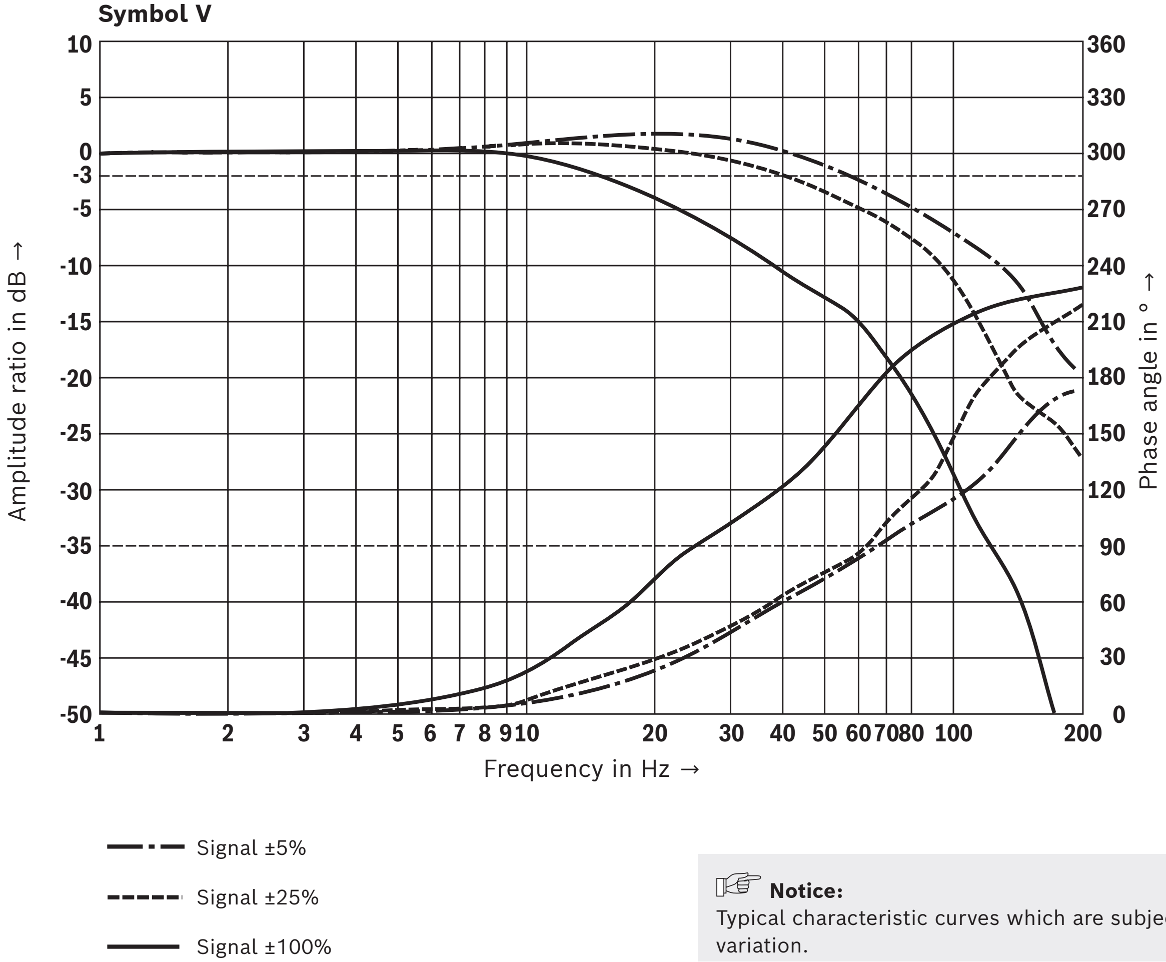
Transition function with stepped electric input signals

Symbol Q5-



Frequency response characteristic curves

Symbol V

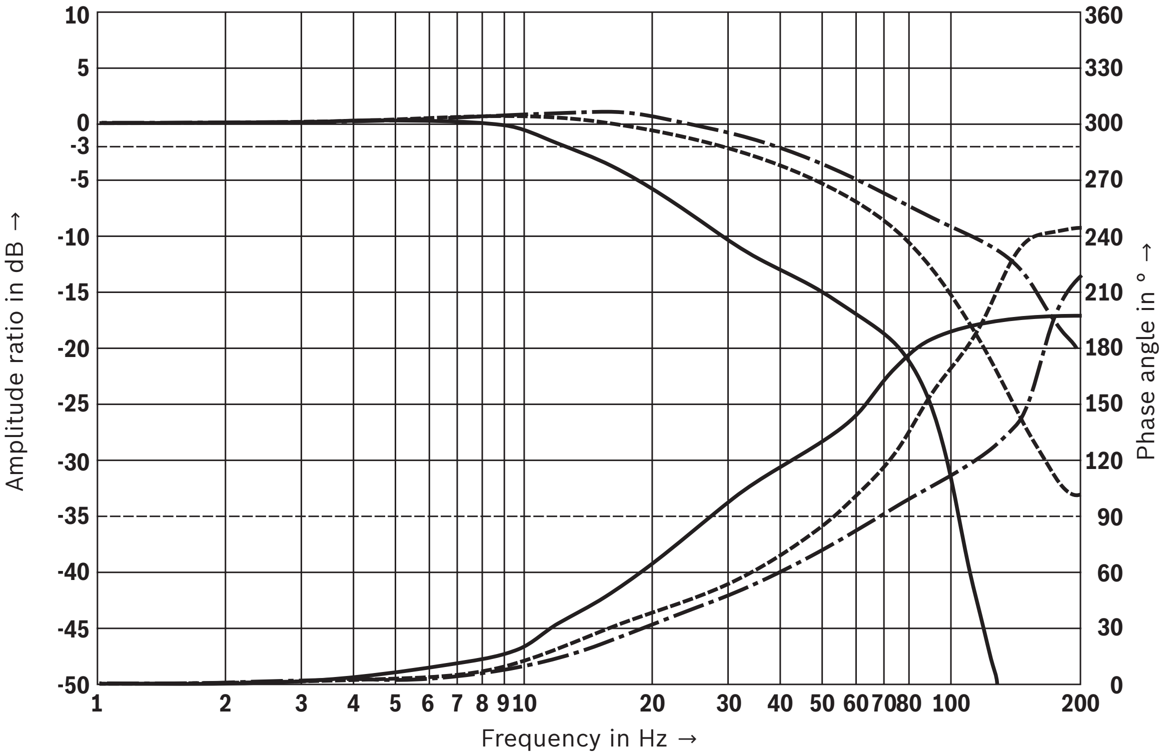


Notice:
Typical characteristic curves which are subject to tolerance variation.

Characteristic curves: Size 10 – Valve direct control (measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Frequency response characteristic curves

Symbol Q5-



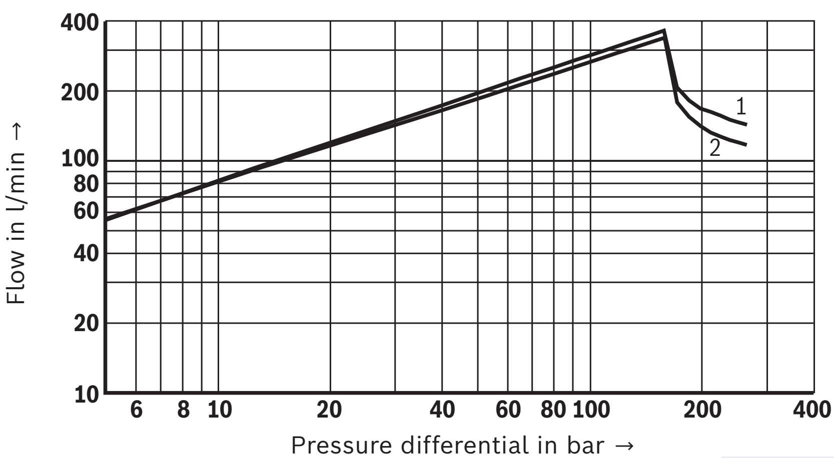
Signal ±5%

Signal ±25%

Signal ±100%

Flow/load function with maximum valve opening (tolerance ±10%)

Rated flow 80 l/min, summated edge



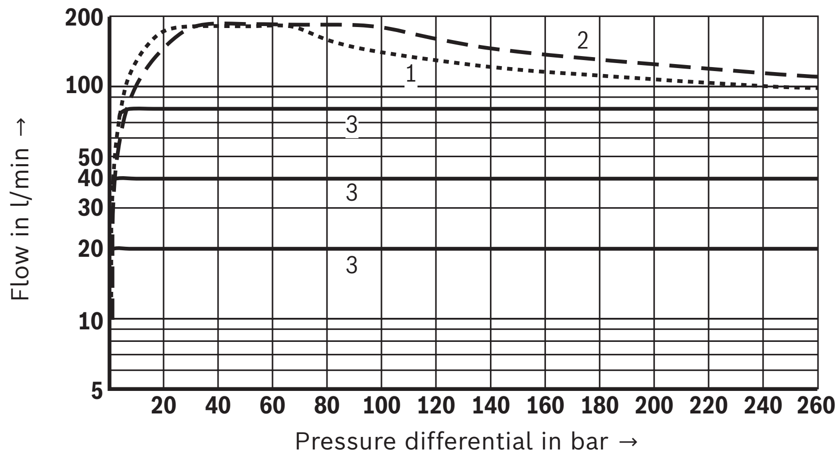
1 Symbol V

2 Symbol Q5-

> **Notice:**
> Typical characteristic curves which are subject to tolerance variation.

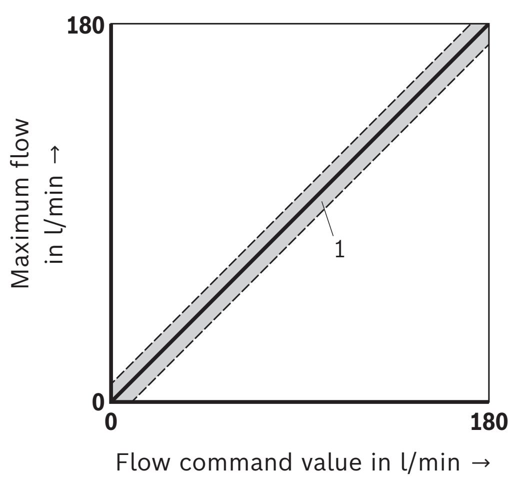
Characteristic curves: Size 10 – Flow control (measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Flow deviation (tolerance ±4 l/min)
Single edge (supply flow edge $q_{V\ command}$ = 180 l/min)



1 Symbol V
2 Symbol Q5-
3 Symbol V and Q5-

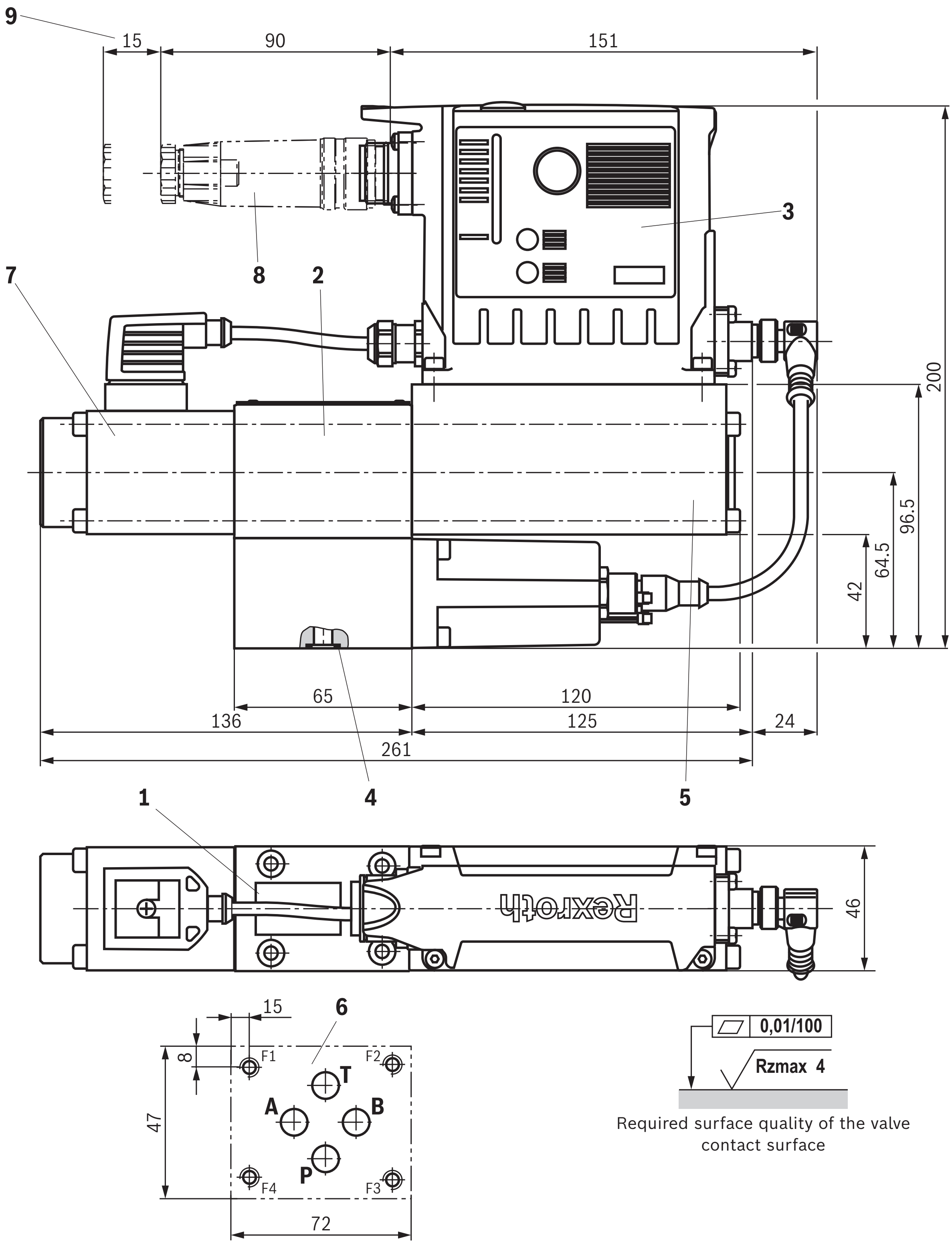
Tolerance of controlled flow / recommended maximum flow
(Default value 180 l/min)



1 Tolerance ±9 l/min

☞ **Notice:**
- The maximum possible flow is specified in parameter "maximum flow" (P-0-2875.0.3).
  The default value is defined by the performance data of the valve (see parameter description 30330-PA).
- Observe the limitations of use of the valve under "Flow/load function with maximum valve opening".

Dimensions: Size 6
(Dimensions in mm)

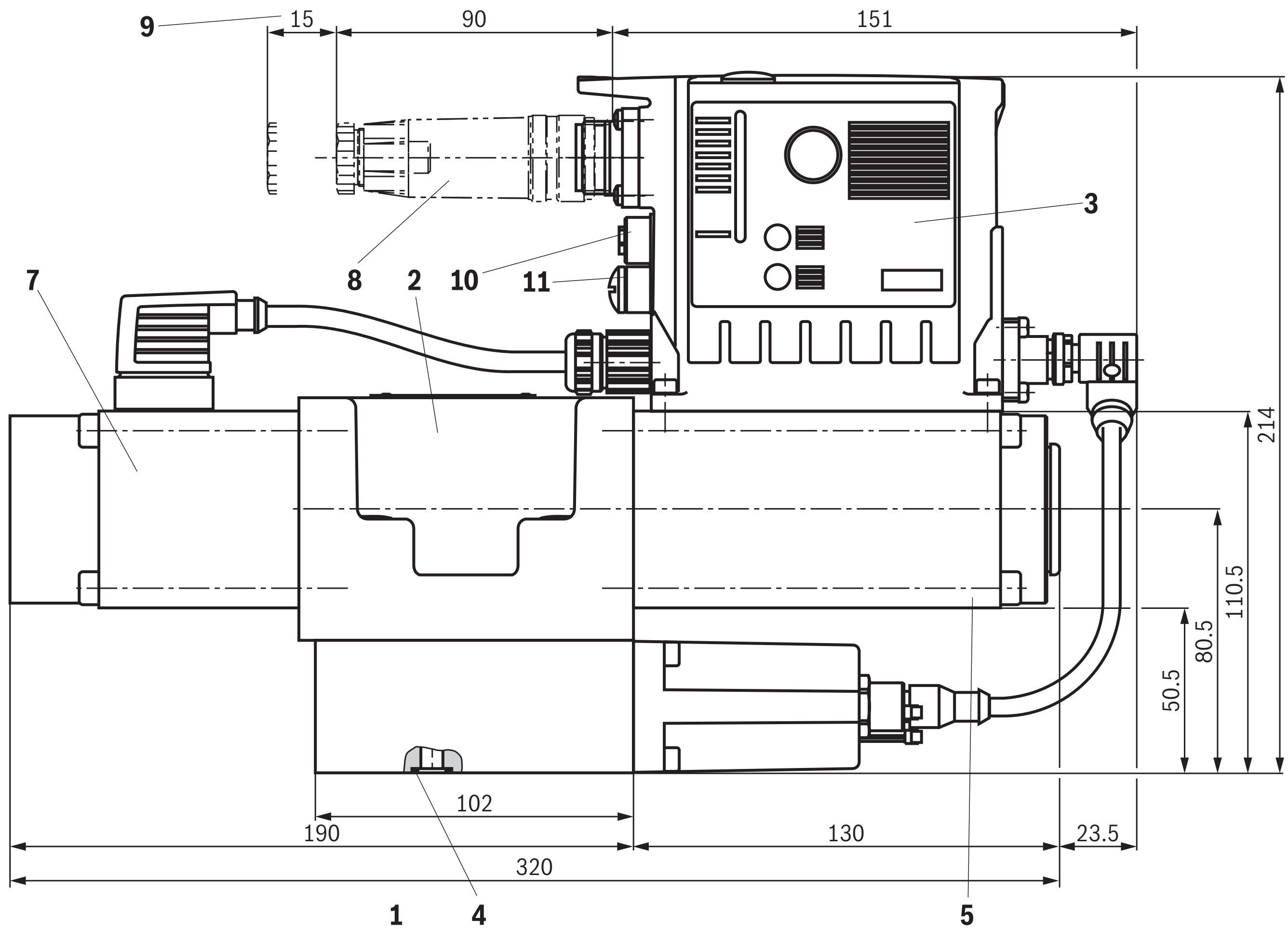


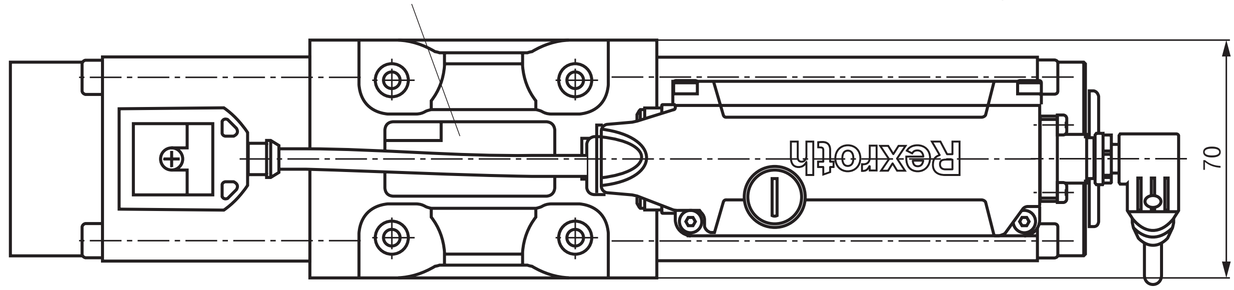
Required surface quality of the valve contact surface

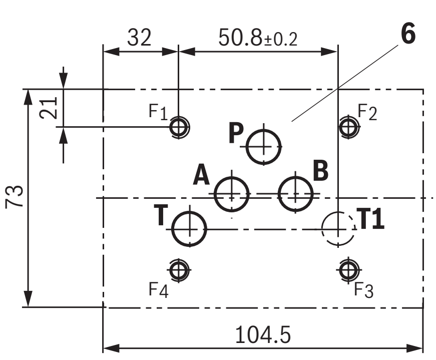
Notices:
The dimensions are nominal dimensions which are subject to tolerances.

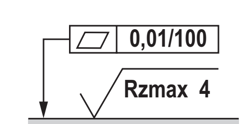
For item explanations, valve mounting screws and **subplates,** see page 24.

Dimensions: Size 10
(Dimensions in mm)









Required surface quality of the valve contact surface

For item explanations, valve mounting screws and **subplates,** see page 24.

Notices:
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions

1 Name plate
2 Valve housing
3 Integrated digital control electronics
4 Identical seal rings for ports A, B, P, T
5 Control solenoid with position transducer
6 Machined valve contact surface, porting pattern according to ISO 4401-03-02-0-05
7 Stroke solenoid
8 Mating connectors, separate order, see page 25 and data sheet 08006.
9 Space required for removing the mating connector
10 Multi Ethernet interface X7E1
11 Multi Ethernet interface X7E2

Valve mounting screws (separate order)

Size	Quantity	Hexagon socket head cap screws	Material number
6	4	**ISO 4762 - M5 x 70 - 10.9-CM-Fe-ZnNi-5-Cn-T0-H-B** Friction coefficient μ_{total} = 0.09 ... 0.14; tightening torque M_A = 8.9 Nm ±10%	**R913043762**
	or		
	4	**ISO 4762 - M5 x 70 - 10.9** Tightening torque M_A = 8.9 Nm ±10%	Not included in the Rexroth delivery range
10	4	**ISO 4762 - M6 x 80 - 10.9-CM-Fe-ZnNi-5-Cn-T0-H-B** Friction coefficient μ_{total} = 0.09 ... 0.14; tightening torque M_A = 13 Nm ±10%	**R913049927**
	or		
	4	**ISO 4762 - M6 x 80 - 10.9** Tightening torque M_A = 13 Nm ±10%	Not included in the Rexroth delivery range

☞ **Notice:**
The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure.

Subplates (separate order) with porting pattern according to ISO 4401, see data sheet 45100.

Accessories (separate order)

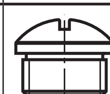
Mating connectors and cable sets

Port	Designation	Version	Short designation	Material number	Data sheet
XH1	Mating connector; for valves with round connector, 6-pole + PE	Straight, metal	7PZ31...M	**R900223890**	08006
		Straight, plastic	7PZ31...K	**R900021267**	
		Angled, plastic	–	**R900217845**	–
	Cable sets; for valves with round connector, 6-pole + PE	Plastic, 3.0 m	7P Z31 BF6	**R901420483**	08006
		Plastic, 5.0 m		**R901420491**	
		Plastic, 10.0 m		**R901420496**	
		Plastic, 20.0 m	–	**R901448068**	–
X7E1, X7E2	Cable set; shielded, 4-pole, D coding	Straight connector M12, on straight connector M12, line cross-section 0.25 mm², CAT 5e, length freely selectable (= xx.x)	–	**R911172111** 1)	–
	Cable set; shielded, 4-pole	Straight connector M12, on straight connector RJ45, line cross-section 0.25 mm², CAT 5e, length freely selectable (= xx.x)	–	**R911172135** 2)	–

1) Additional indication of type designation RKB0040/xx.x

2) Additional indication of type designation RKB0044/xx.x

Protective cap

Protective cap M12	Version	Material number
		**R901075563**

Parameterization

The following is required for the parameterization with PC		Material number/download
1 Commissioning software	IndraWorks, Indraworks D, Indraworks DS	
2 Connection cable, 3 m	Shielded, M12 on RJ45, length can be freely selected (= xx.x)	**R911172135** (additional indication of type designation RKB0044/xx.x)

Project planning and maintenance instructions

- The supply voltage must be permanently connected; otherwise, bus communication is not possible.
- If electro-magnetic interference is to be expected, take appropriate measures to ensure the function (depending on the application, e.g. shielding, filtration).
- The devices have been tested in the plant and are supplied with default settings.
- Only complete devices can be repaired. Repaired devices are returned with default settings. User-specific settings will not be applied. The machine end-user will have to retransfer the corresponding user parameters.

Further information

▶ Subplates	Data sheet 45100
▶ Hydraulic fluids on mineral oil basis	Data sheet 90220
▶ Environmentally compatible hydraulic fluids	Data sheet 90221
▶ Flame-resistant, water-free hydraulic fluids	Data sheet 90222
▶ Flame-resistant hydraulic fluids - containing water (HFAE, HFAS, HFB, HFC)	Data sheet 90223
▶ Reliability characteristics according to EN ISO 13849	Data sheet 08012
▶ Hexagon socket head cap screw, metric/UNC	Data sheet 08936
▶ Installation, commissioning and maintenance of servo valves and high-response valves	Data sheet 07700
▶ General product information on hydraulic products	Data sheet 07008
▶ High-response/proportional valve with Multi-Ethernet interface	Data sheet 29391-B
▶ Hydraulic valves for industrial applications	Data sheet 07600-B
▶ Assembly, commissioning and maintenance of hydraulic systems	Data sheet 07900
▶ Operation fieldbus electronics (xx = software version):	
– Functional description Rexroth HydraulicDrive HDx-20	30338-FK
– Parameter description Rexroth HydraulicDrive HDS-16, HDx-17 ... 20	30330-PA
– Description of diagnosis Rexroth HydraulicDrive HDS-16, HDx-17 ... 20	30330-WA
▶ Selection of filters	
▶ Information on available spare parts	
▶ "IFB" hydraulic field bus valves	

Rexroth
Bosch Group

4/3 directional high-response control valves, direct operated, with integrated control electronics (OBE)

RE 29067/11.05
Replaces: 02.03

Type 4WRSE

Type 4WRSE 6 -...-3X/... with integrated control electronics (OBE)

Type 4WRSE 10 -...-3X/... with integrated control electronics (OBE)

Sizes 6 and 10
Series 3X
Maximum operating pressure 315 bar
Maximum flow 180 l/min

Table of contents

Features

– Direct operated directional high-response control valve with integrated control electronics (OBE) for controlling the direction and magnitude of a flow
– Suitable for position and velocity control
– Actuation by control solenoids
– Electrical position feedback
– High response sensitivity and low hysteresis
– Integrated control electronics (OBE) with interface ±10 V or 4 … 20 mA
– For subplate mounting:
Porting pattern to DIN 24340 form A and ISO 4401
Subplates to data sheets RE 45052 and RE 45054 (separate order), see pages 12 and 13

Ordering code

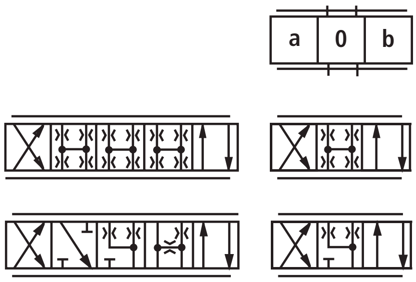
4WRS	E					–3X/G24	K0/		V	*

Integrated control electronics (OBE) = **E**

Without sleeve = **No code**

Size 6 = **6**
Size 10 = **10**

Spool symbols



= **V, V1-**

= **Q2-**

With symbol V1-:

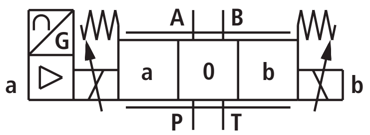
P → A: q_V B → T: $q_V/2$
P → B: $q_V/2$ A → T: q_V

With symbol Q2-:

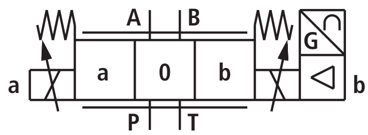
P → A: q_V B → T: q_V
P → B: $q_V/3$ A → T: q_V

Note:
Spools V and V1 have an overlap of –1.0 % … +1.0 %.

Side of inductive position transducer



= **No code** (standard)



= **C**

Further details in clear text

Seal material

V = FKM seals, suitable for mineral oils (HL, HLP) to DIN 51524 and phosphate ester (HFD-R)

Interface of control electronics

A1 = Command value input ±10 V
F1 = Command value input 4 … 20 mA

Electrical connection

K0 = With component plug to DIN EN 175201-804
Without cable socket
Cable socket – separate order, see page 5

Supply voltage of control electronics

G24 = 24 V DC

3X = Component series 30 … 39 (30 … 39: unchanged installation and connection dimensions)

Nominal flow at 10 bar valve pressure differential

Size 6

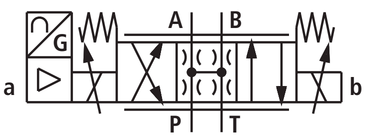
04 = 4 l/min (only with symbol V)
10 = 10 l/min
20 = 20 l/min
35 = 35 l/min

Size 10

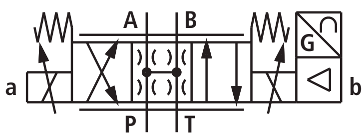
25 = 25 l/min
50 = 50 l/min
80 = 75 l/min

Symbols

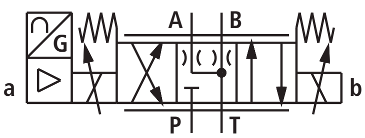
Type 4WRSE..**V** (standard)



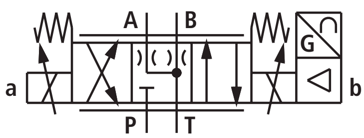
Type 4WRSE..**VC**



Type 4WRSE..**Q2** (standard)



Type 4WRSE..**Q2C**



Standard types

Size 6

Type	Material number
4WRSE 6 V04-3X/G24K0/A1V	R900938307
4WRSE 6 V1-10-3X/G24K0/A1V	R900909078
4WRSE 6 V1-20-3X/G24K0/A1V	R900906155
4WRSE 6 V1-35-3X/G24K0/A1V	R900904794
4WRSE 6 V10-3X/G24K0/A1V	R900558830
4WRSE 6 V20-3X/G24K0/A1V	R900576060
4WRSE 6 V35-3X/G24K0/A1V	R900579447

Size 10

Type	Material number
4WRSE 10 Q2-50-3X/G24K0/A1V	R900916872
4WRSE 10 V1-80-3X/G24K0/A1V	R900556812
4WRSE 10 V1-25-3X/G24K0/A1V	R900922997
4WRSE 10 V1-50-3X/G24K0/A1V	R900579140
4WRSE 10 V25-3X/G24K0/A1V	R900579637
4WRSE 10 V50-3X/G24K0/A1V	R900579943
4WRSE 10 V80-3X/G24K0/A1V	R900579286

Function, section

These 4/3 directional high-response valves are direct operated components of sandwich plate design. They are actuated by control solenoids. The solenoids are controlled by integrated control electronics (OBE).

Structure:

The valve basically consists of:

- Housing (1) with connection face
- Control spool (2) with compression springs (3 and 4)
- Solenoids (5 and 6)
- Position transducer (7)
- Integrated control electronics (OBE) (8)
- Zero point adjustment (9) accessible via Pg9 cover

Functional description:

- When solenoids (5 and 6) are de-energised, control spool (2) is held by compression springs (3 and 4) in the central position
- Direct operation of control spool (2) through energisation of the control solenoid

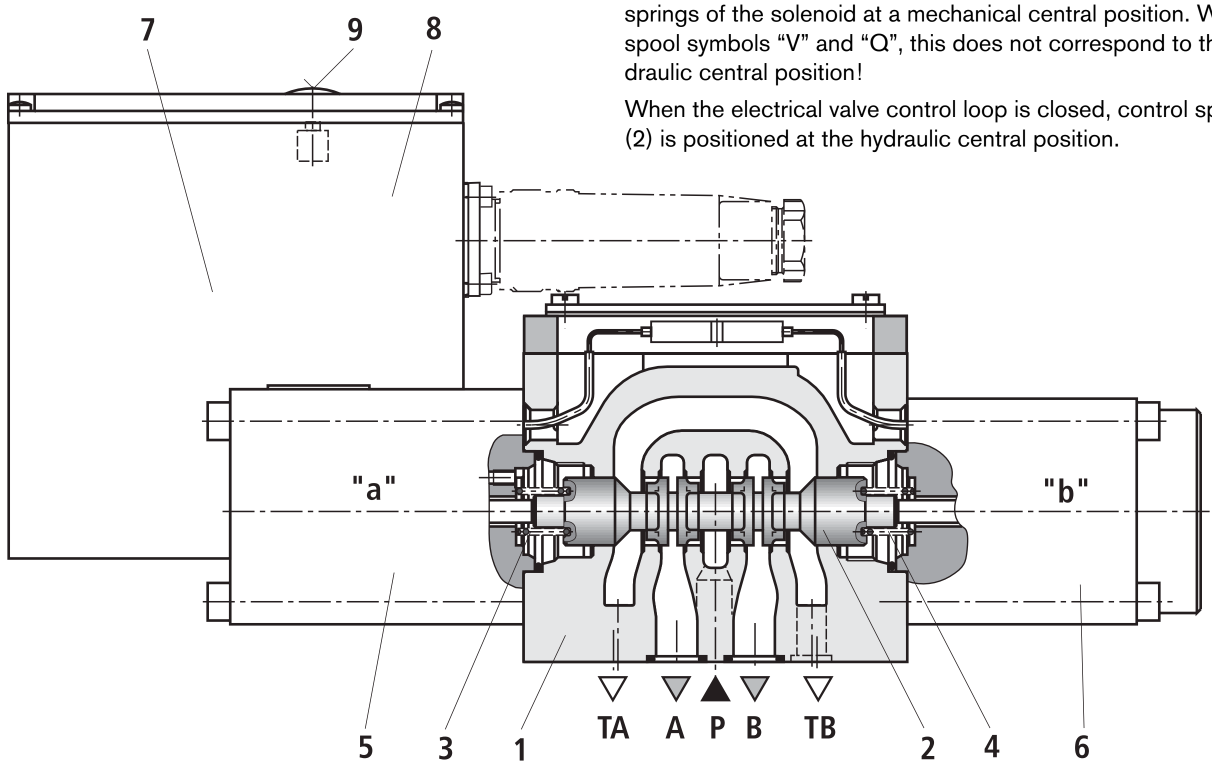
  e.g. controlling of solenoid "b" (6)

  - Control spool (2) is pushed to the left in proportion to the electrical input signal
  - Connection open from P → A and B → T via orifice-like cross-sections with linear flow characteristics
- De-energisation of solenoid (6)
  Control spool (2) is returned by compression spring (3) to the central position

In the de-energised state, control spool (2) is held by the return springs of the solenoid at a mechanical central position. With spool symbols "V" and "Q", this does not correspond to the hydraulic central position!

When the electrical valve control loop is closed, control spool (2) is positioned at the hydraulic central position.

Type 4WRSE 10 V…



Technical data (for applications outside these parameters, please consult us!)

General

Sizes		**Size 6**	**Size 10**
Weight	kg	3.0	7.3
Installation orientation		Optional, preferably horizontal	
Ambient temperature range	°C	−20 … +50	
Storage temperature range	°C	−20 … +80	

Hydraulic (measured with HLP46, $\vartheta_{oil} = 40$ °C ± 5 °C and $p = 100$ bar)

Operating pressure	Ports P, A, B	bar	up to 315	up to 315
	Port T	bar	up to 315	up to 315
Nominal flow $q_{V\ nom}$ ±10 % at $\Delta p = 10$ bar		l/min	4	25
			10	50
(Δp = valve pressure differential)			20	75
			35	–
Max. permissible flow		l/min	80	180
Hydraulic fluid			Mineral oil (HL, HLP) to DIN 51524 and phosphate ester (HFD-R), further hydraulic fluids on enquiry	
Hydraulic fluid temperature range		°C	−20 … +80	
Viscosity range		mm^2/s	20 … 380, preferably 30 … 46	
Max. permissible degree of contamination of the hydraulic fluid - cleanliness class to ISO 4406 (c)			Class 18/16/13 1)	
Hysteresis		%	≤ 0.05	
Range of inversion		%	≤ 0.03	
Response sensitivity		%	≤ 0.03	
Zero point balancing		%	≤ 1	
Zero point drift with change in:			**Size 6**	**Size 10**
	Hydraulic fluid temperature	%/10 K	< 0.1	< 0.1
	Operating pressure	%/100 bar	< 0.5	< 0.3

Electrical

Operating voltage	Nominal value (limits)	VDC	24	(19.4 … 35)
Current consumption	Size 6	A	max. 2	Impulse load: 4 A
	Size 10	A	max. 2.8	Impulse load: 4 A
Interface “A1“	Command value signal	V	±10	$R_i > 50$ kΩ
	Actual value signal	V	±10	$I_{max} = 2$ mA
Interface “F1“	Command value signal	mA	4 … 20	$R_e > 100$ Ω
	Actual value signal	mA	4 … 20	max. load resistance 500 Ω
Duty cycle		%	100	
Coil temperature 1)		°C	up to 150	
Type of protection of valve to EN 60529			IP 65 with cable socket correctly mounted and locked	

1) Due to the surface temperatures of solenoid coils, observe European standards EN 563 and EN 982!

Note: For details with regard to environment simulation testing in the fields of EMC (electromagnetic compatibility), climate and mechanical stress, see RE 29067-U (declaration on environmental compatibility).

Electrical connection

Component plug pin assignment	Contact	Signal	
		Interface A1	Interface F1
Supply voltage	A	24 VDC (19.4 … 35 VDC), I_{max} = 2 A (size 6), I_{max} = 2.8 A (size 10), impulse load: 4 A	
	B	0 V	
Actual value reference potential	C	Connect reference potential for contact F to ⊥ on the control side (star-shape)	Reference potential for contact F
Comand value signal	D	±10 V, R_i > 50 kΩ	4 … 20 mA, R_i > 100 Ω
	E	Reference potential for contact D	
Actual value	F	±10 V I_{max} = 2 mA	4 … 20 mA, max. load resistance 500 Ω
Protective conductor	PE	Connected to heat sink and valve body	

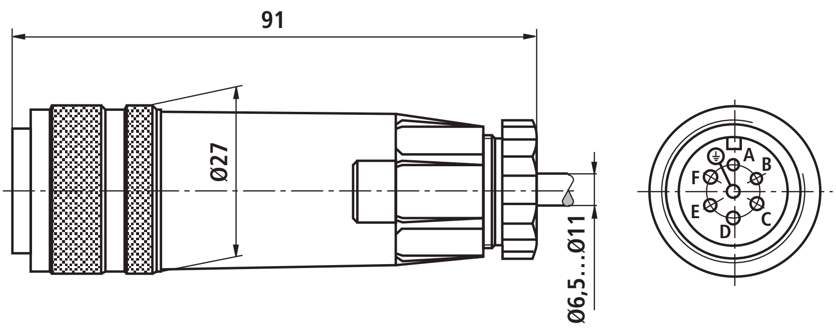
Command value: Positive command value at D (interface A1) or 12 ... 20 mA (interface F1) and reference potential at E causes a flow from P → A and B → T.
Negative command value at D (interface A1) or 12 ... 4 mA (interface F1) and reference potential at E causes a flow from P → B and A → T.

Actual value: Interface A1: Positive signal at F and reference potential at C means flow from P → A.
Interface F1: 12 ... 20 mA means flow from P → A.

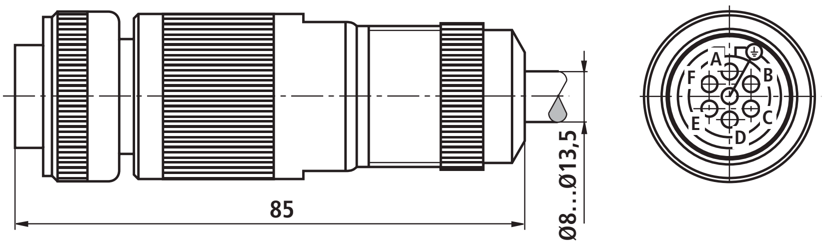
Connecting cable: Recommendation: – up to 25 m cable length: Type LiYCY 7 x 0.75 mm²
– up to 50 m cable length: Type LiYCY 7 x 1.0 mm²
Outer diameter 6.5 … 11 mm or 8 … 13.5 mm, respectively
Connect shield to ⊥ only on the supply side.

Cable sockets

Cable socket (plastic version)
to DIN EN 175201-804
Separate order,
material no. **R900021267**



Cable socket (metal version)
to DIN EN 175201-804
Separate order,
material no. **R900223890**

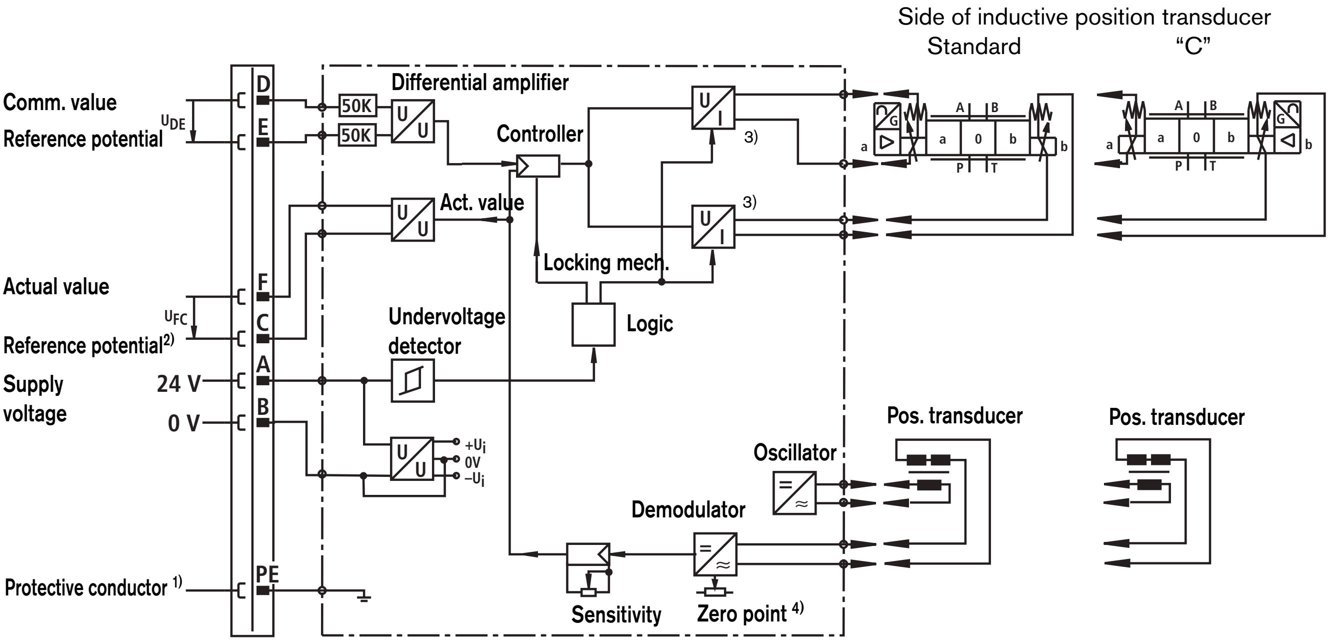


Integrated control electronics (OBE)

Block circuit diagram / pin assignment of integrated control electronics (OBE)

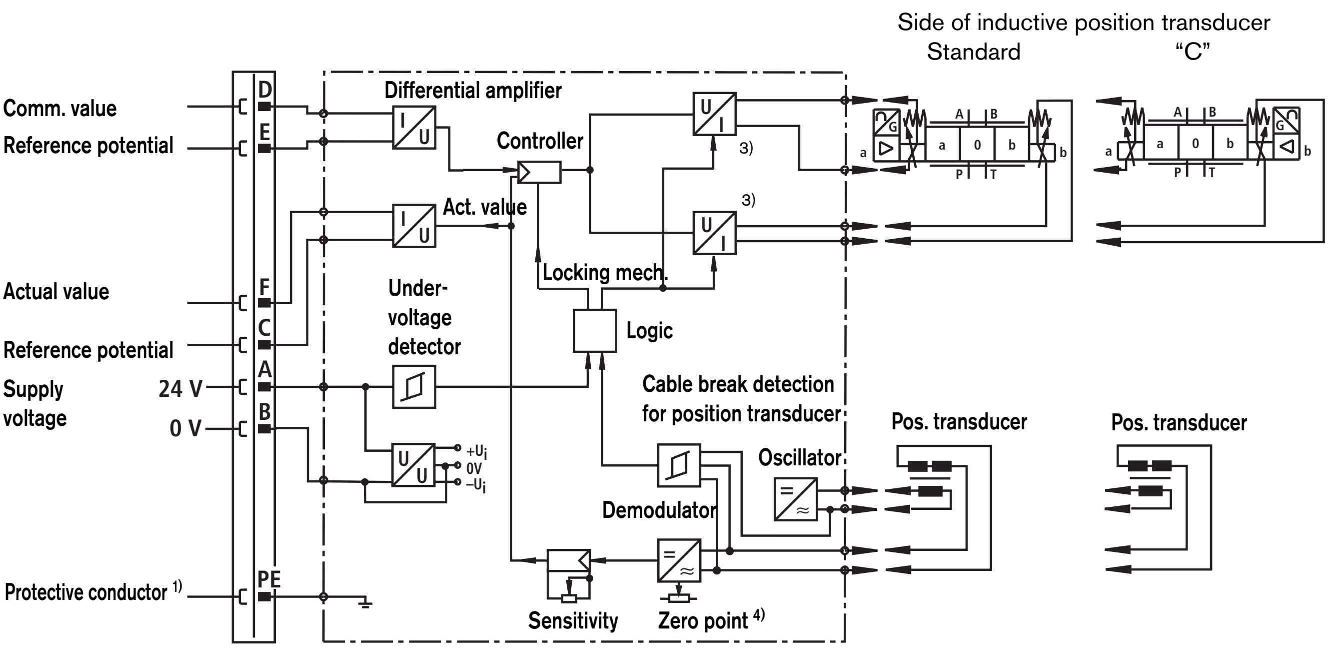
Interface A1

Interface	Integrated control electronics (OBE)	Valve



Interface F1

Interface	Integrated control electronics (OBE)	Valve



Note:

Electrical signals brought out via control electronics (e.g. actual value) must not be used for switching off safety-relevant machine functions! (See also European standard EN 982, "Safety requirements for fluid power systems and components - hydraulics")

1) PE connection connected to heat sink and valve body

2) Connect pin C to ⊥ on the control side

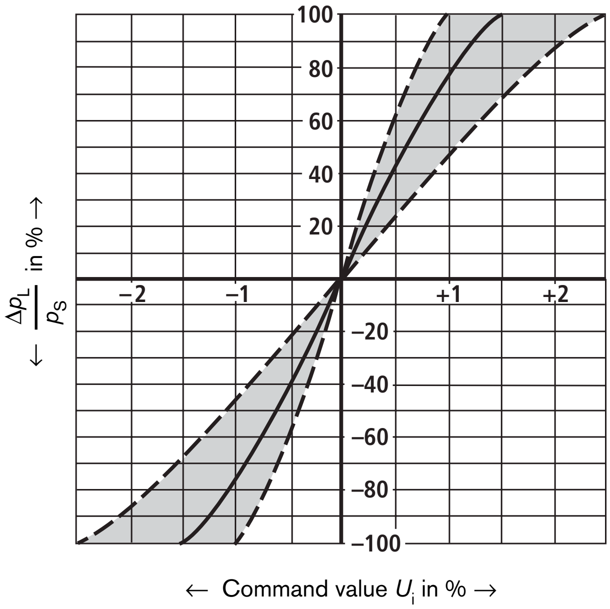
3) Output stage current regulated

4) Zero point externally adjustable

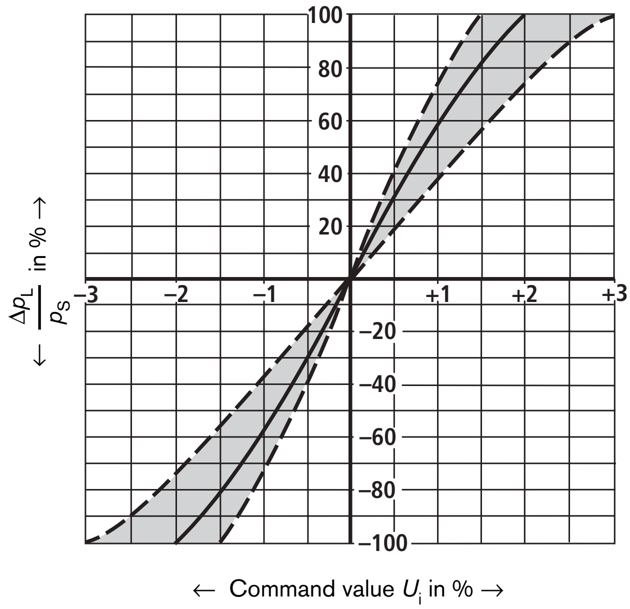
Characteristic curves (measured with HLP46, $\vartheta_{oil} = 40\ °C \pm 5\ °C$)

Pressure/signal characteristic curves (V spool) $p_S = 100$ bar

Size 6
Type 4WRSE 6 V…

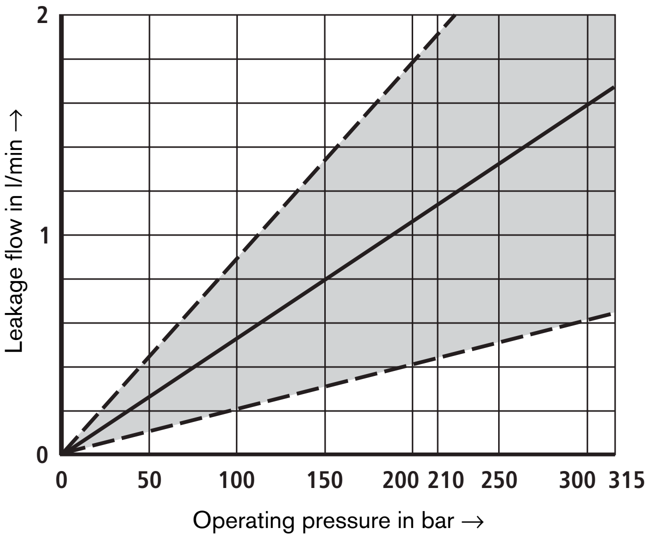


Size 10
Type 4WRSE 10 V…

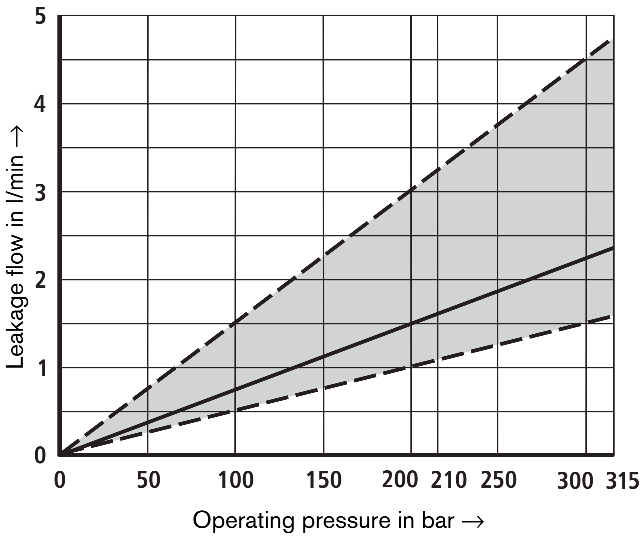


Typical leakage flow

Size 6
Type 4WRSE 6 V.35…



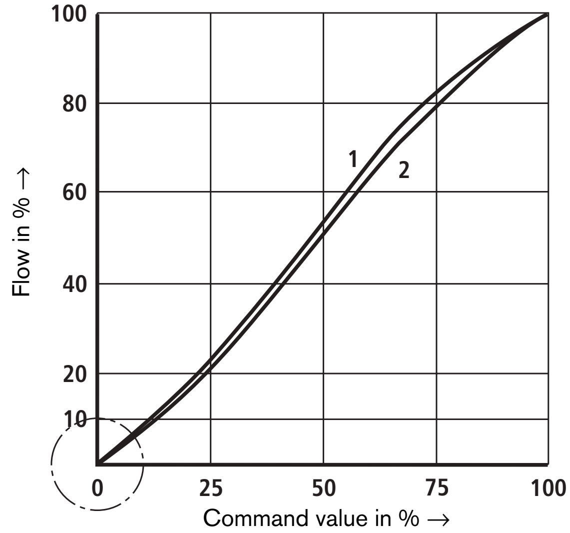
Size 10
Type 4WRSE 10 V.80…



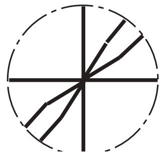
Characteristic curves of size 6 (measured with HLP46, $\vartheta_{oil} = 40\ °C \pm 5\ °C$)

Typical flow characteristic curve (V, V1 spool)

at 10 bar valve pressure differential or 5 bar per control land



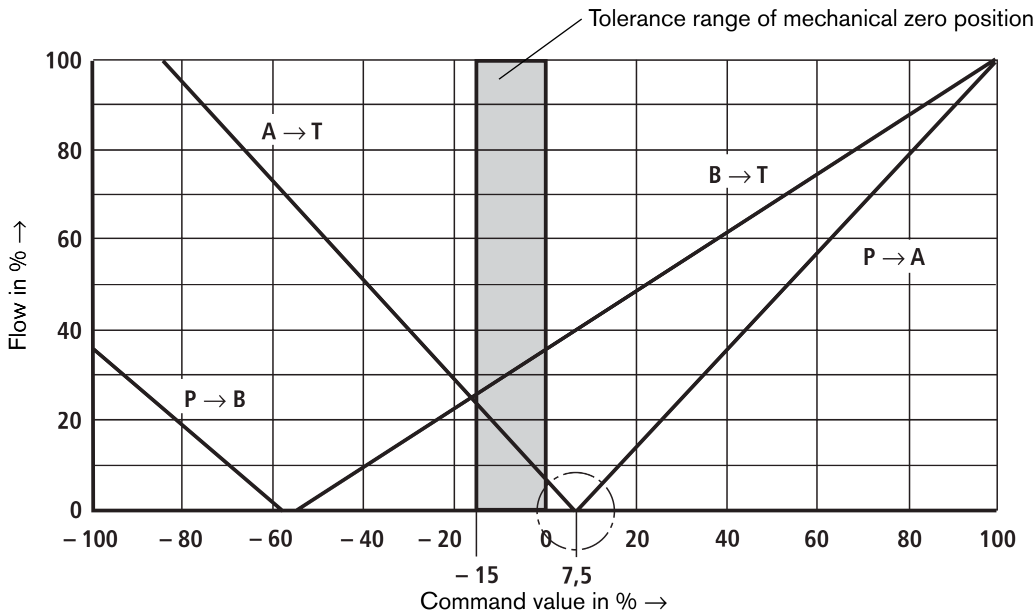
1 = Nominal flow 35 l/min
2 = Nominal flow 10 l/min
Spool … 20 between characteristic curves 1 and 2

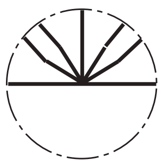


Zero point passage depending on manufacturing tolerance
Valve overlap −1 % … +1 %

Typical flow characteristic curve (Q2 spool)

at 10 bar valve pressure differential or 5 bar per control land

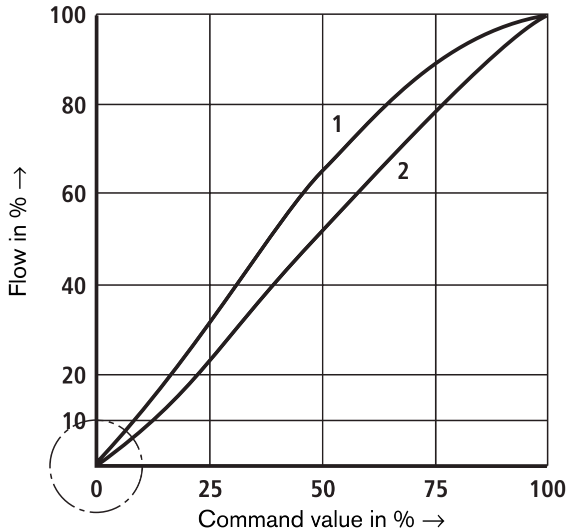




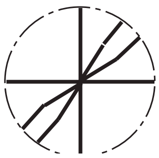
Characteristic curves of size 10 (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C)

Typical flow characteristic curve (V, V1 spool)

at 10 bar valve pressure differential or 5 bar per control land



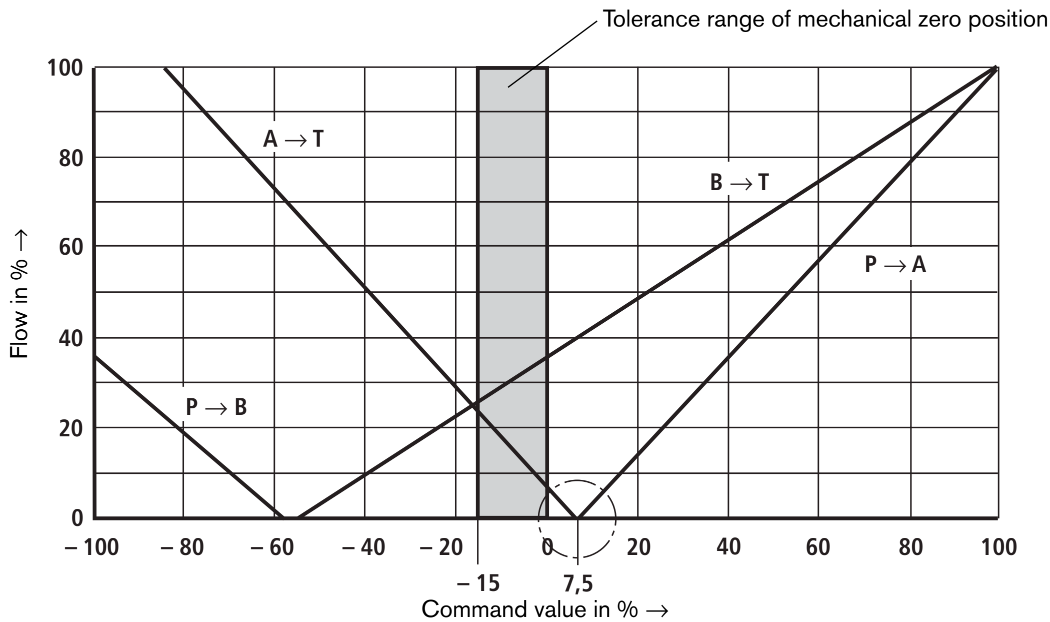
1 = Nominal flow 75 l/min
2 = Nominal flow 25 l/min
Spool … 50 between characteristic curves 1 and 2



Zero point passage depending on manufacturing tolerance
Valve overlap –1 % … +1 %

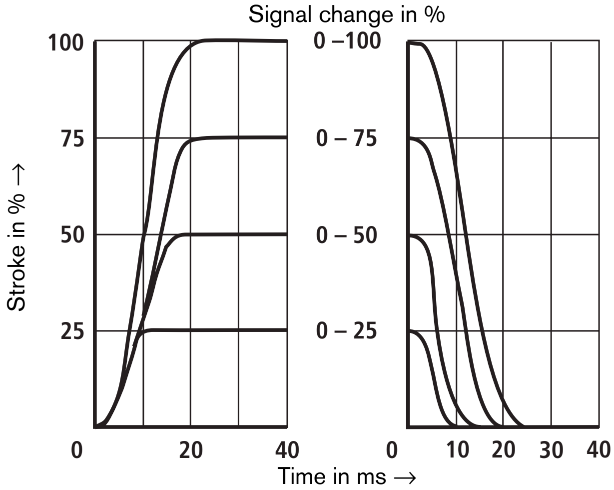
Typical flow characteristic curve (Q2 spool)

at 10 bar valve pressure differential or 5 bar per control land



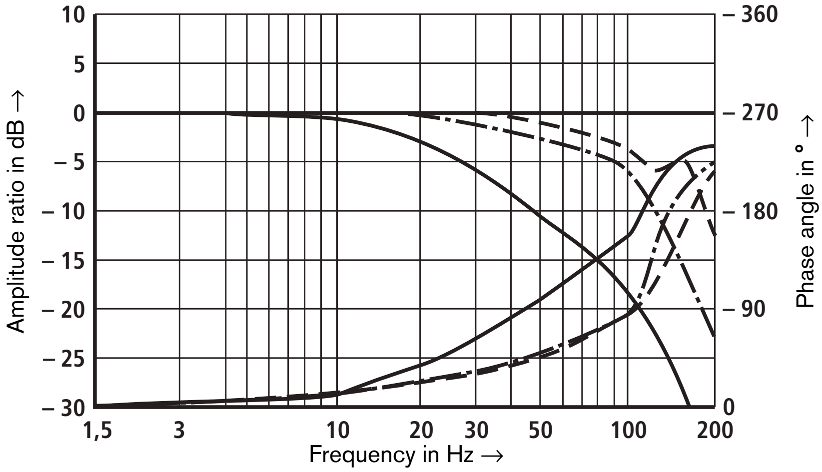
Characteristic curves of size 6 (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C)

Transient function with stepped electrical input signals



Measured at:
p_S = 10 bar
ν = 46 mm²/s
ϑ = 40 °C

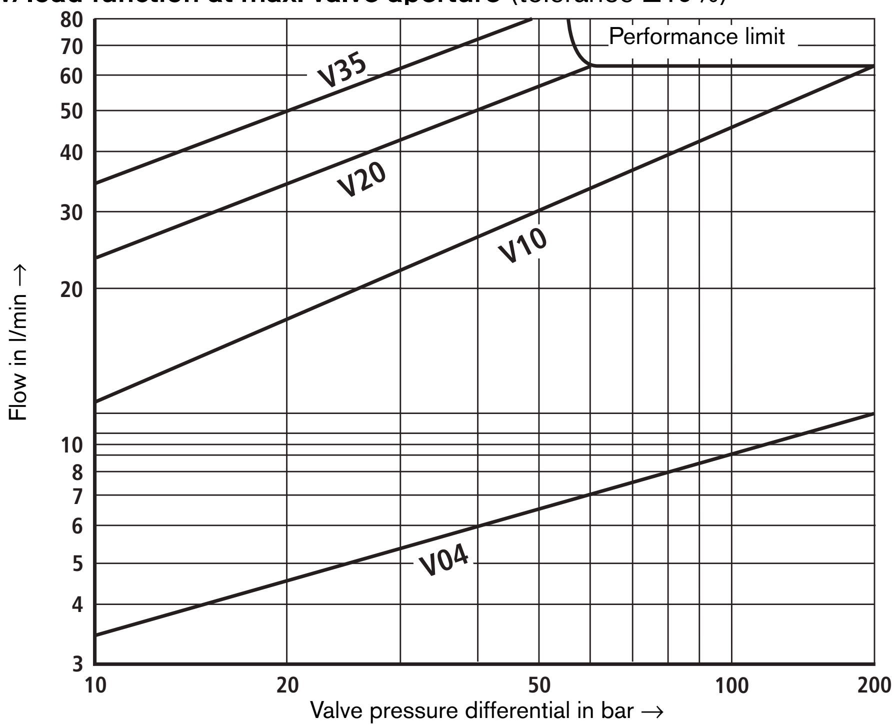
Frequency response characteristic curves



Measured at:
p_S = 10 bar
ν = 46 mm²/s
ϑ = 40 °C

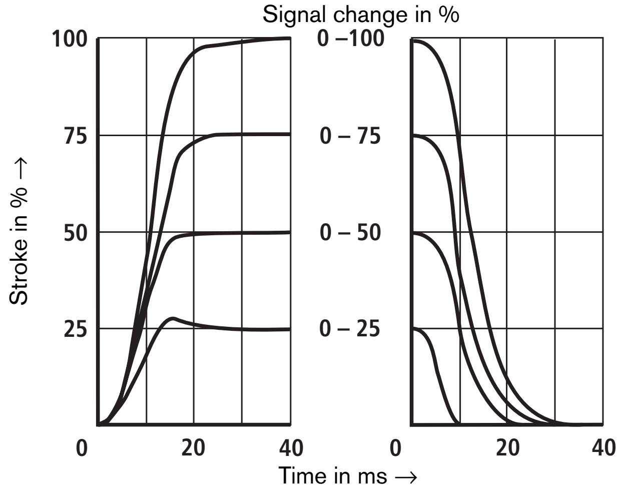
Signal ±10 %
Signal ±25 %
Signal ±100 %

Flow/load function at max. valve aperture (tolerance ±10%)



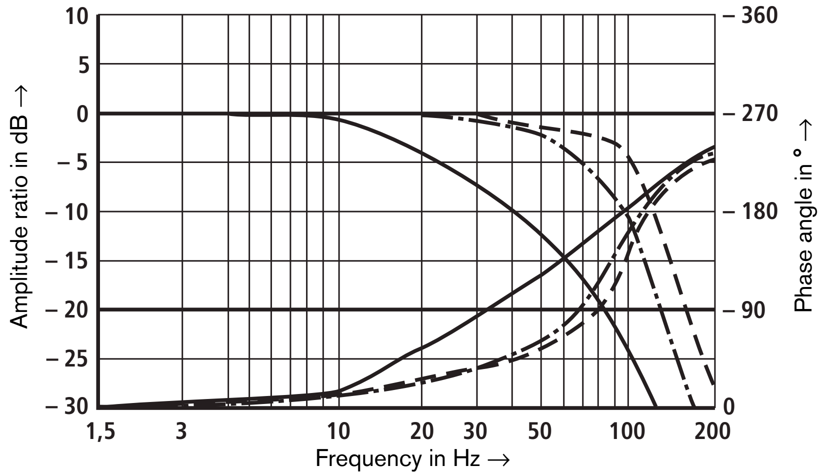
Characteristic curves of size 10 (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C)

Transient function with stepped electrical input signals



Measured at:
p_S = 10 bar
ν = 46 mm²/s
ϑ = 40 °C

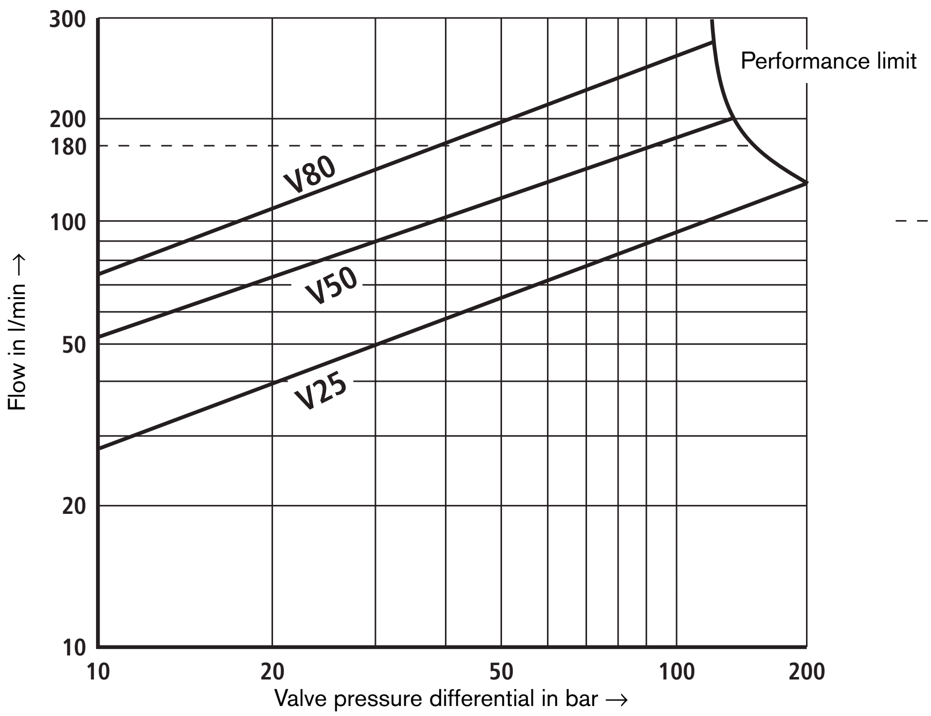
Frequency response characteristic curves



Measured at:
p_S = 10 bar
ν = 46 mm²/s
ϑ = 40 °C

Signal ±10 %
Signal ±25 %
Signal ± 100 %

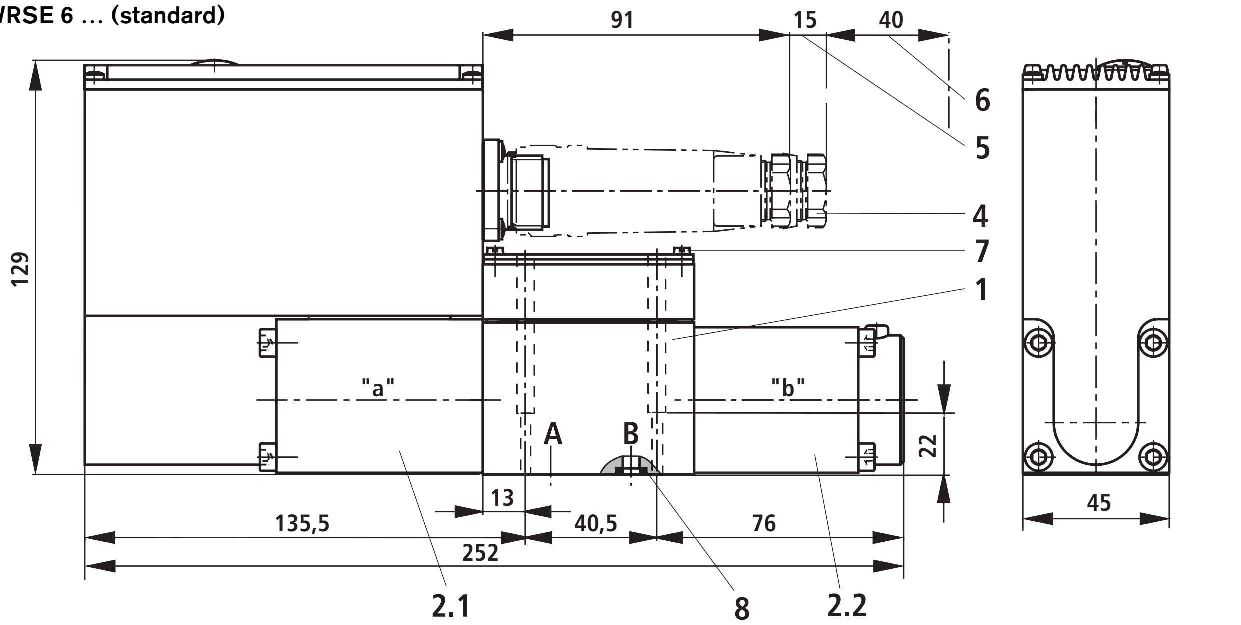
Flow/load function at max. valve aperture (tolerance ±10%)



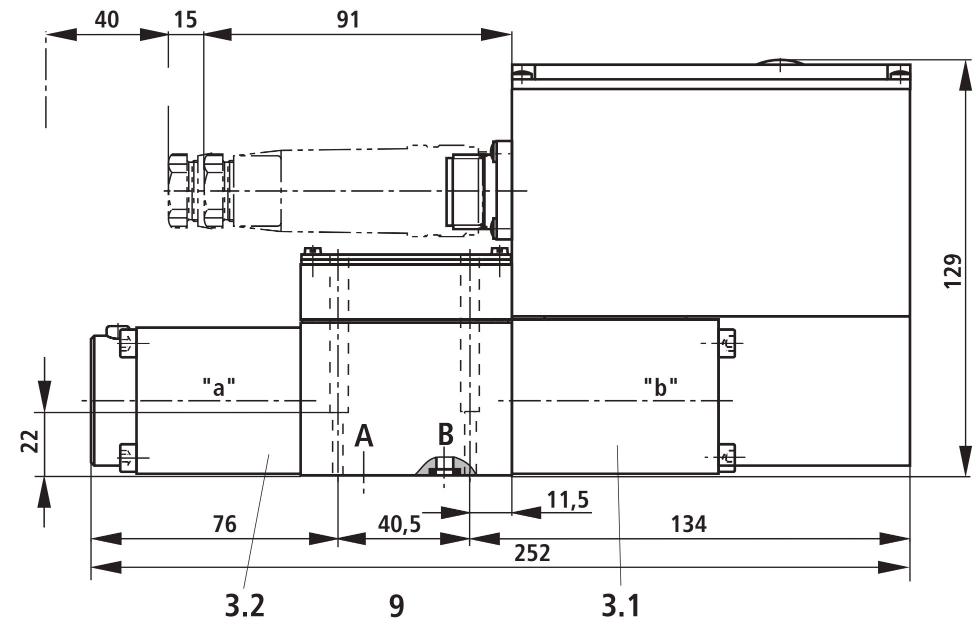
Recommended flow limitation
q_V = 180 l/min

Unit dimensions of size 6 (nominal dimensions in mm)

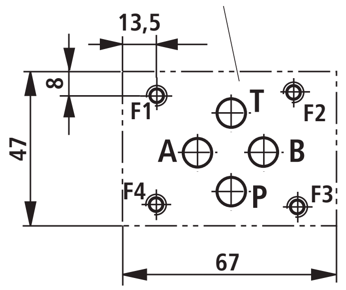
Type 4WRSE 6 … (standard)

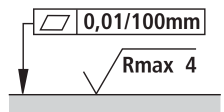


Type 4WRSE 6 C…



- **1** Valve housing
- **2.1** Control solenoid "a" with inductive position transducer
- **2.2** Control solenoid "b"
- **3.1** Control solenoid "b" with inductive position transducer
- **3.2** Control solenoid "a"
- **4** Cable socket to DIN EN 175201-804 (separate order, see page 5)
- **5** Space required to remove cable socket
- **6** Additional space required for bending radius of connecting cable
- **7** Nameplate
- **8** R-ring 9.81 x 1.5 x 1.78 (ports P, A, B, T)
- **9** Machined valve mounting face, position of ports to DIN 24340 form A6 and ISO 4401-03-02-0-94 without locating bore





Required surface quality of mating part

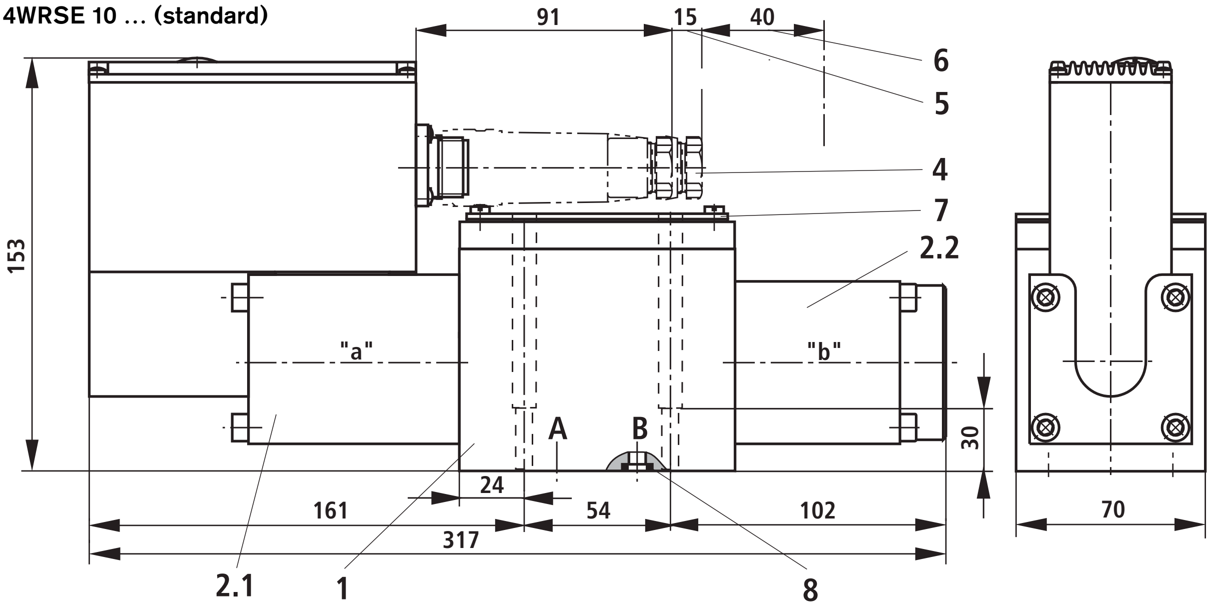
Subplates to data sheet RE 45052 and valve fixing screws must be ordered separately.

Subplates: G 341/01 (G1/4)
G 342/01 (G3/8)
G 502/01 (G1/2)

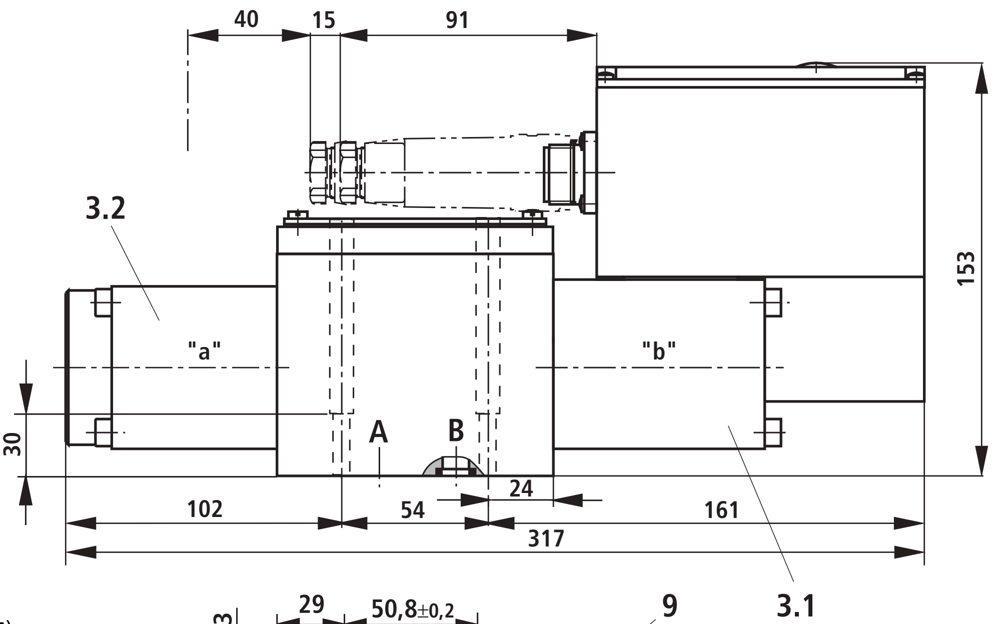
4 hexagon socket head cap screws
ISO 4762 – M5x30-10.9-flZn-240h-L
(friction coefficient total = 0.09 to 0.14)
Tightening torque M_T = 7 Nm ± 10%
material no. R913000316 (separate order)

Unit dimensions of size 10 (nominal dimensions in mm)

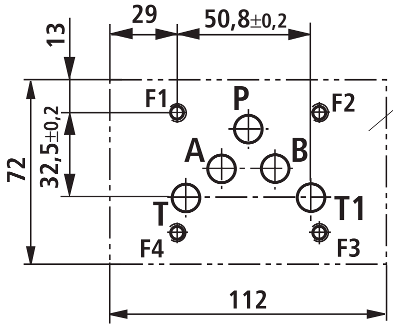
Type 4WRSE 10 … (standard)

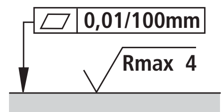


Type 4WRSE 10 C…



1 Valve housing
2.1 Control solenoid "a" with inductive position transducer
2.2 Control solenoid "b"
3.1 Control solenoid "b" with inductive position transducer
3.2 Control solenoid "a"
4 Cable socket to DIN EN 175201-804 (separate order, see page 5)
5 Space required to remove cable socket
6 Additional space required for bending radius of connecting cable
7 Nameplate
8 R-ring 13.0 x 1.6 x 2.0 (ports A, B, P, T)
9 Machined valve mounting face, position of ports to DIN 24340 form A10 and ISO 4401-05-04-0-94





Required surface quality of mating part

Subplates to data sheet RE 45054 and valve fixing screws must be ordered separately.

Subplates: G 66/01 (G3/8)
G 67/01 (G1/2)
G 534/01 (G3/4)

4 hexagon socket head cap screws
ISO 4762 – M6x40-10.9-flZn-240h-L
(friction coefficient total = 0.09 to 0.14)
Tightening torque M_T = 12.5 Nm ± 10%
material no. R913000058 (separate order)

RE 29 069/02.03

Replaces: 12.99

4/3 and 4/4 high response directional control valves, direct operated, with electrical position feedback Type 4WRSEH

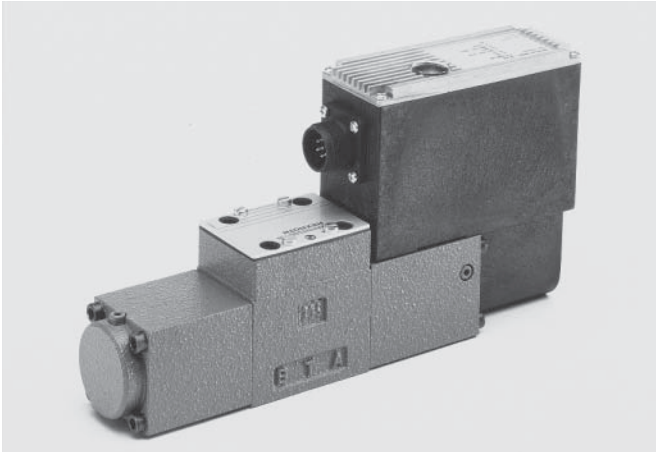
Nominal sizes 6 and 10

Series 3X

Maximum operating pressure 315 bar

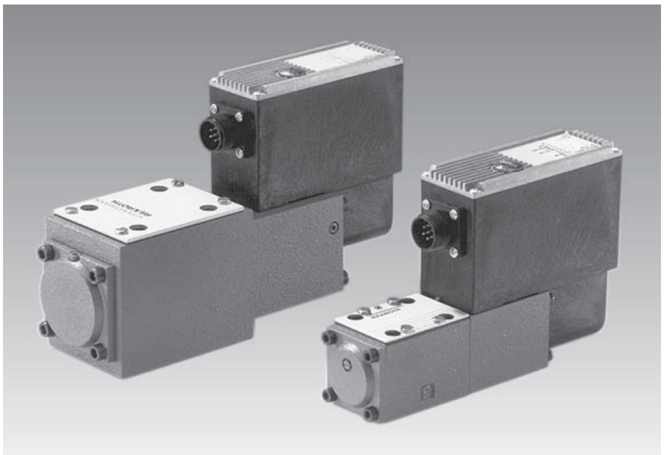
Maximum flow 80 L/min (NS 6)

Maximum flow 180 L/min (NS 10)



H/A 5276/95

Type 4WRSEH 6 **V**…D-3X/… (4/3 high response directional control valve)



H/A 5544/96

Types 4WRSEH 10 **C.B**…D-3X/… and 4WRSEH 6 **C.B**…D-3X/… (4/4 high response directional control valve)

Overview of contents

Features

– Direct operated high response directional control valve for the control of the size and direction of a flow
– Valve spool and bush are of servo quality
– Suitable for closed loop, position, speed and pressure control
– Operated via high response solenoids
– With fail-safe position for the 4/4 high response directional control valve
– Electrical position feedback
– High response sensitivity and low hysteresis
– Integrated control electronics with interface A1 or F1
– For subplate mounting:
  Porting pattern to DIN 24 340 form A, ISO 4401 and CETOP-RP 121 H
  Subplates to catalogue sheets RE 45 052 and RE 45 054 (separate order), see pages 14 to 17

Ordering details

4WRS	E	H						–3X /	G24	K0 /		V	*

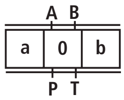
With **integrated** control electronics **= E**

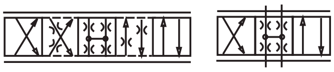
Control spool/bush **= H**

Nominal size 6 **= 6**
Nominal size 10 **= 10**

Symbols

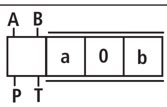
4/3-way version

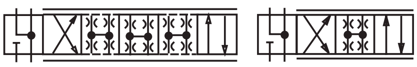




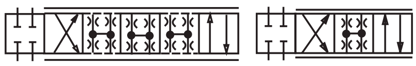
= V

4/4-way version



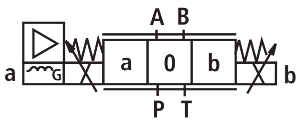


= C3

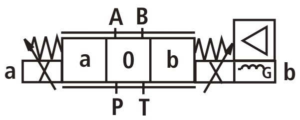


= C4

Inductive position transducer location with spool symbol „V“

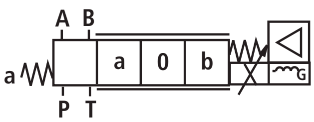


(Standard) **= No code**

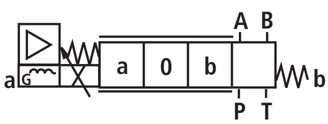


= C

Inductive position transducer location with spool symbols „C3“ and „C4“



(Standard) **= B**



= No code

Further details in clear text

V = FKM seals, suitable for mineral oils (HL, HLP) to DIN 51 524 and phosphate ester (HFD-R)

Control electronics interface

A1 = Command value input ± 10 V
F1 = Command value input 4 to 20 mA

Electrical connections

K0 = With component plug to E DIN 43 563-AM6
Without plug-in connector,
Plug-in connector – separate order,
see page 6

Control electronics power supply

G24 = + 24 V DC

3X = Series 30 to 39
(30 to 39: unchanged installation and connection dimensions)

Spool overlap [4)]

E = 0...0.5% negative
D = 0...0.5% positive

Flow characteristics

L = Linear
P = Inflected characteristic curve 40 %

Nominal flow at a 70 bar pressure differential

Nominal size 6

04 = [3)] 4 L/min
12 = 12 L/min
24 = 24 L/min
40 = [2)] 40 L/min
50 = [1)] 50 L/min

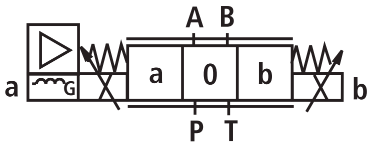
Nominal size 10

50 = 50 L/min
100 = 100 L/min

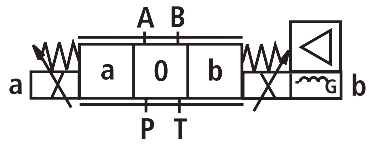
1) Only with „V“ in conjunction with flow characteristic „L“
2) Only with „C“ and „V“ in conjunction with flow characteristic „P“
3) Only in conjunction with flow characteristic „L“
4) The spool overlap in % relates to the nominal stroke of the control spool. We recommend, for closed loop applications, the D overlap. Further spool overlaps on request!

Symbols

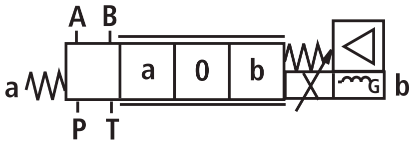
Type 4WRSEH.V…-3X…



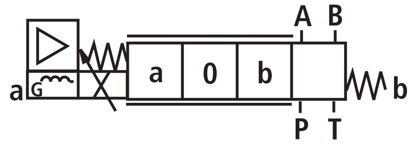
Type 4WRSEH.V**C**…-3X/…



Type 4WRSEH.C.**B**…-3X/…



Type 4WRSEH.C…-3X/…



Function, section

The 4/3 and 4/4 high response directional control valves are designed as direct operated units of subplate mounting design. They are operated by high response solenoids. The solenoids are controlled via the integrated control electronics.

Design:

The valve basically comprises of:

– Housing (1) with mounting surface
– Control spool (2) in bush (3) with compression springs (4 and 5)
– Solenoids (6 and 7)
– Position transducer (8)
– Integrated control electronics (9)
– Zero point adjustment accessible (10) via Pg9

Functional description:
4/3-way version

– With solenoids (6 and 7), de-energised the control spool (2) is held in its mechanical centre position by the compression springs (4 and 5)
– Direct operation of the control spool (2) by the energisation of one of the high response solenoids

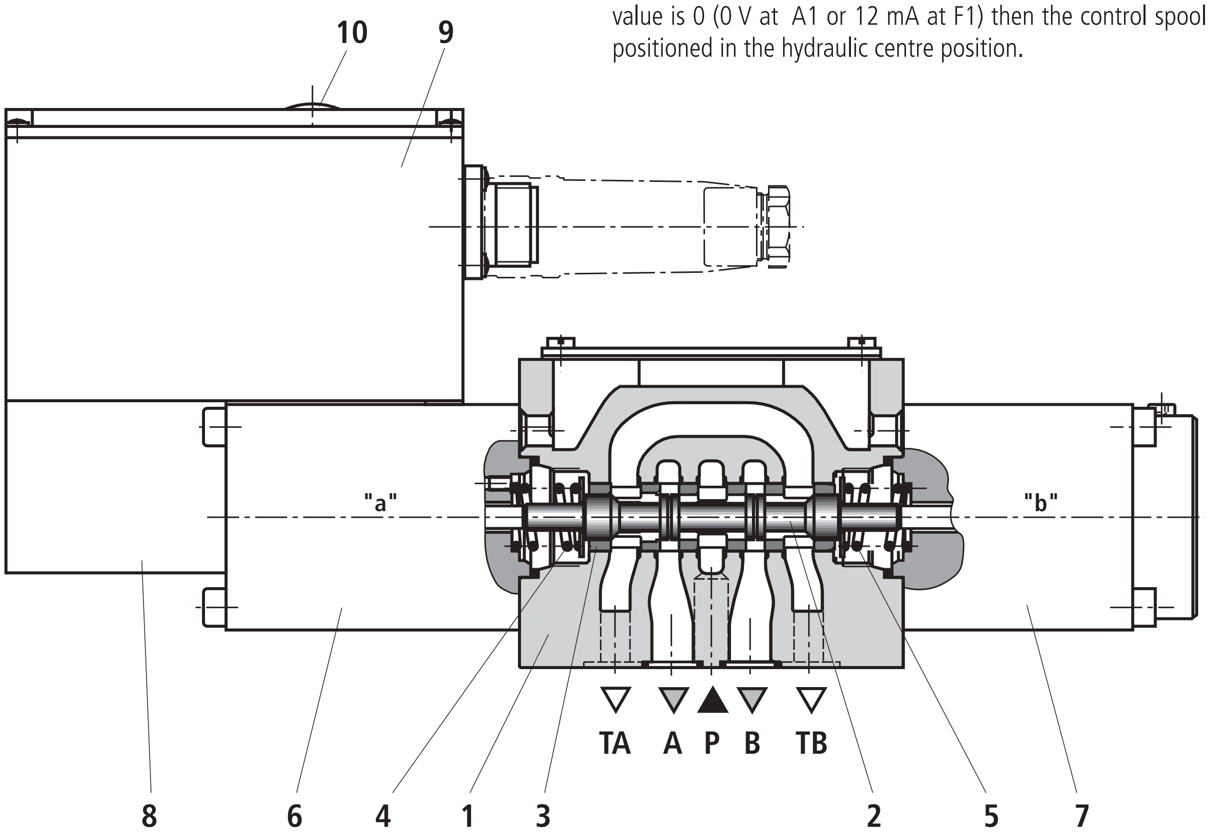
  E.g. control of solenoid "b" (7)

  → Moves the control spool (2) to the left in proportion to the electrical input signal

  → Connection from P to A and B to T via orifice type cross-sections with linear or inflected flow characteristics
– By de-energising the solenoid (7) → control spool (2) is returned to its centre position via the compression spring (4)

In the de-energised condition the control spool (2) is held in a mechanical centre position via the control springs. This does not relate to the hydraulic centre position!

By closing the electrical valve closed loop circuit and the command value is 0 (0 V at A1 or 12 mA at F1) then the control spool (2) is positioned in the hydraulic centre position.



Type 4WRSEH 10 V…–3X/…

4/4-way version

The function of these valves is basically the same as the 4/3-way version. However, when the solenoid is de-energised the control spool is moved into a fail-safe position via a compression spring.

The 4/4 high response directional control valves are designed as direct operated units of subplate mounting design. They are operated by high response solenoids. The solenoids are controlled via the integrated control electronics.

Design:

The valve basically comprises of:
- Housing (1) with mounting surface
- Control spool (2) in bush (3) with compression springs (4)
- Solenoid (5) and cover (6)
- Position transducer (7)
- Integrated control electronics (8)
- Zero point adjustment accessible (9) via the Pg9

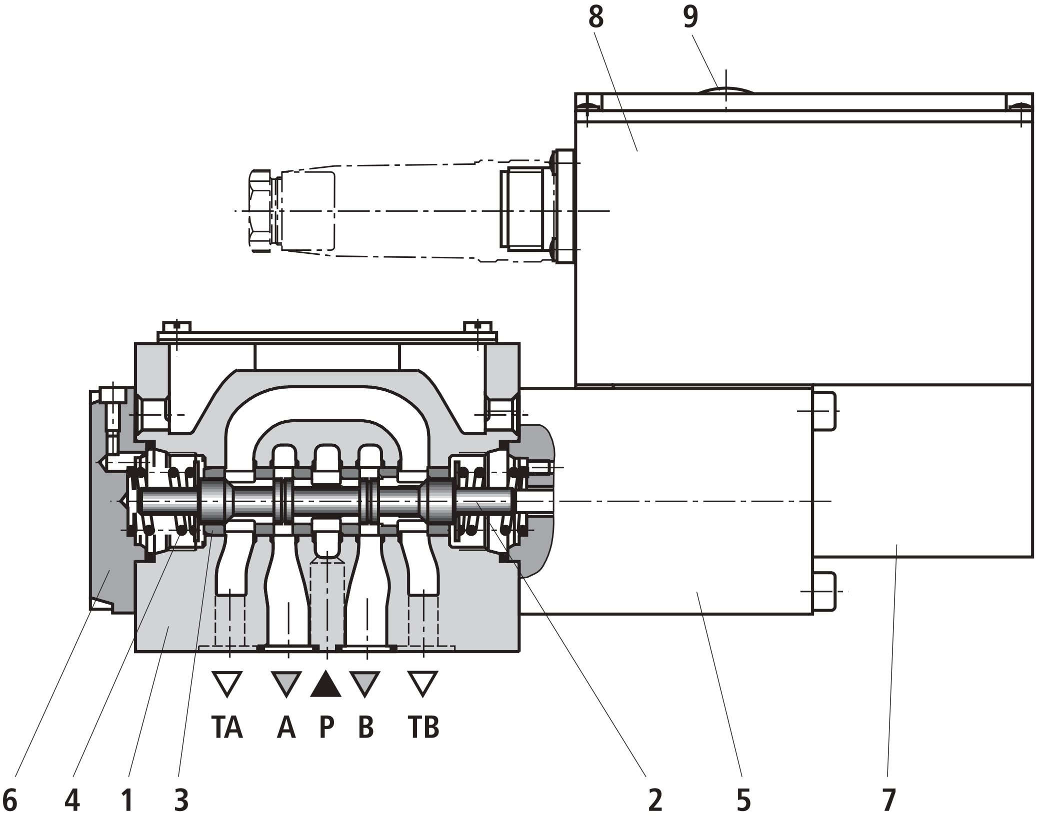
Functional description:

- With the solenoid (5) de-energised, a fail-safe position for the control spool (2) via compression spring (4) results
- Direct operation of the control spool (2) by the energisation of the high response solenoid (5)

  E.g. control of the solenoid

  → Moves the control spool (2) in proportion to the electrical input signal

  → Connection from P to A and B to T via orifice type cross-sections with linear or inflected flow characteristics
- By de-energising the solenoid (5) → the control spool (2) is moved back into the fail-safe condition via the compression spring (4)



Type 4WRSEH 10 VC…–3X/…

Technical data (for applications outside these applications, please consult us!)

General			**NS 6**	**NS 10**
Installation			Optional, preferably horizontal	
Storage temperature range		°C	– 20 to + 80	
Ambient temperature range		°C	– 20 to + 50	
Weight	Valve with 1 solenoid	kg	2.3	6.0
	Valve with 2 solenoids	kg	3.0	7.3

Hydrualic (measured at p = 100 bar, ν = 46 mm²/s and ϑ = 40 °C)

Operating pressure	Ports A, B, P	bar	up to 315				up to 315	
	Port T	bar	up to 315				up to 210	
Application limits C3, C4	Nominal flow	L/min	04	12	24	40	50	100
[1] The details for C4 are	Application limit Δp with symbol C3	bar	315	315	315	160	250	150
only preliminary details!	Application limit Δp with symbol C4 [1]	bar	315	315	200	100	150	100
Nominal flow $q_{V\ nom}$ ± 10 % at Δp = 70 bar		L/min	4				50	
Δp = valve pressure differential							12 100	
			24				–	
			50 (with V spool with flow „L“); 40 (with C and V spools with flow characteristic „P“)				–	
Max. permissble flow		L/min	80				180	
Pressure fluid			Mineral oil (HL, HLP) to DIN 51 524 and phosphate ester (HFD-R), further pressure fluids on request					
Degree of contamination			Maximum permissible degree of pressure fluid contamination to NAS 1638				A filter with a minimum retention rate of $\beta_x \geq 75$ is recommended	
			Class 7				x = 10	
Pressure fluid temperature range		°C	– 20 to + 80					
Viscosity range		mm²/s	20 to 380, preferably 30 to 46					
Hysteresis		%	< 0.05					
Reversal span		%	< 0.03					
Response sensitivity		%	< 0.03					

Electrical

Valve protection to DIN 40 050			IP 65	
Voltage type			DC	
Signal type			analogue	
Zero point alignment		%	≤ 1	
Zero point displacement with changes to:			**NS 6**	**NS 10**
	Pressure fluid temperature	%/10 K	< 0.15	< 0.1
	Operating pressure	%/100 bar	< 0.05	< 0.05
Electrical connection			With component plug to E DIN 43 563 AM6	
[2] separate order, see page 6			Plug-in connector to E DIN 43 563-BF6-3/Pg11 [2]	
Control electronics			VT 13070 (integrated into the valve, see page 7)	

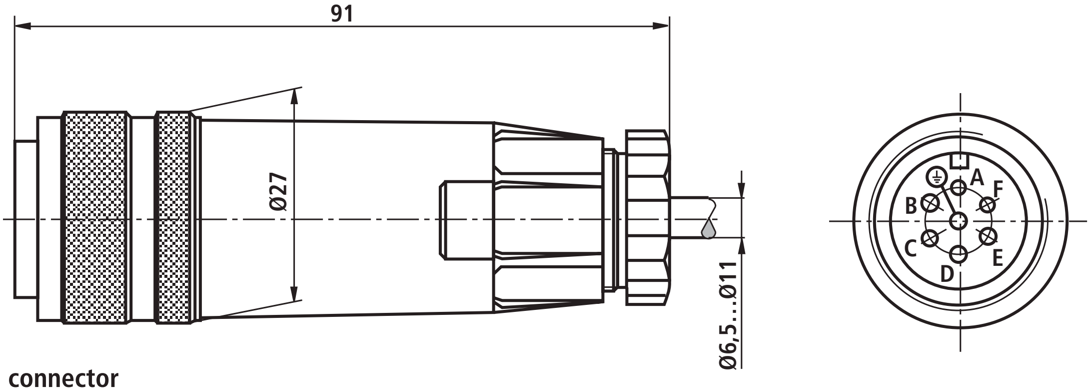
☞ **Note:** For details regarding the **environmental simulation test** covering EMC (electro-magnetic compatibility), climate and mechanical loading see RE 29 069-U (declaration regarding environmental compatibility).

Electrical connections, plug-in connector

Plug-in connector

Plug-in connector to E DIN 43 563-BF6-3/Pg11
Separate order under material No. **00021267** (plastic version)

For pin allocation see block circuit diagram on page 7

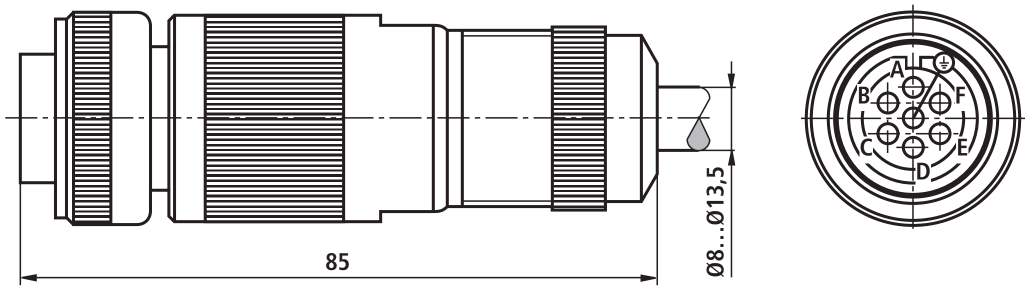


Plug-in connector

Plug-in connector to E DIN 43 563-BF6-3-Pg13.5

Separate order under material No. **000223890** (metal version)

For pin allocation see block circuit diagram on page 7



Component plug allocation

	Contact	Signal
Supply voltage	A	24 VDC (u(t) = 19.4 V to 35 V); I_{max} = 2 A (NS 6) I_{max} = 2.8 A (NS 10); impulse load= 4 A
	B	0 V
Ref. (actual value)	C	Ref. potential for actual value (contact F); A1: $R_e > 50$ kΩ F1: $R_e < 10$ Ω
Differential amplifier input	D	A1: ± 10 V command value, $R_e > 50$ kΩ or F1: 4...20 mA, $R_e > 100$ Ω
(command value)	E	0 V ref. potentional
Measurement output (act. value)	F	± 10 V actual value (limiting load 2 mA); or F1: 4...20 mA, max. load impedance 500 Ω
	PE	Connected with cooling body and valve housing

Actual value: Interface A1: A positive signal at F and the reference potential at C results in a flow from P to A.
Note for A1: Connect pin C on the control side (star form) with ⊥.
Interface F1: 12...20 mA results in a flow from P to A.

Command value: A positive command value at D (interface A1) or 12...20 mA (interface F1) and the reference potential at E results in a flow from P to A and B to T.
A negative command value at D (interface A1) or 12...4 mA (interface F1) and the reference potential at E results in a flow from P to B and A to T.

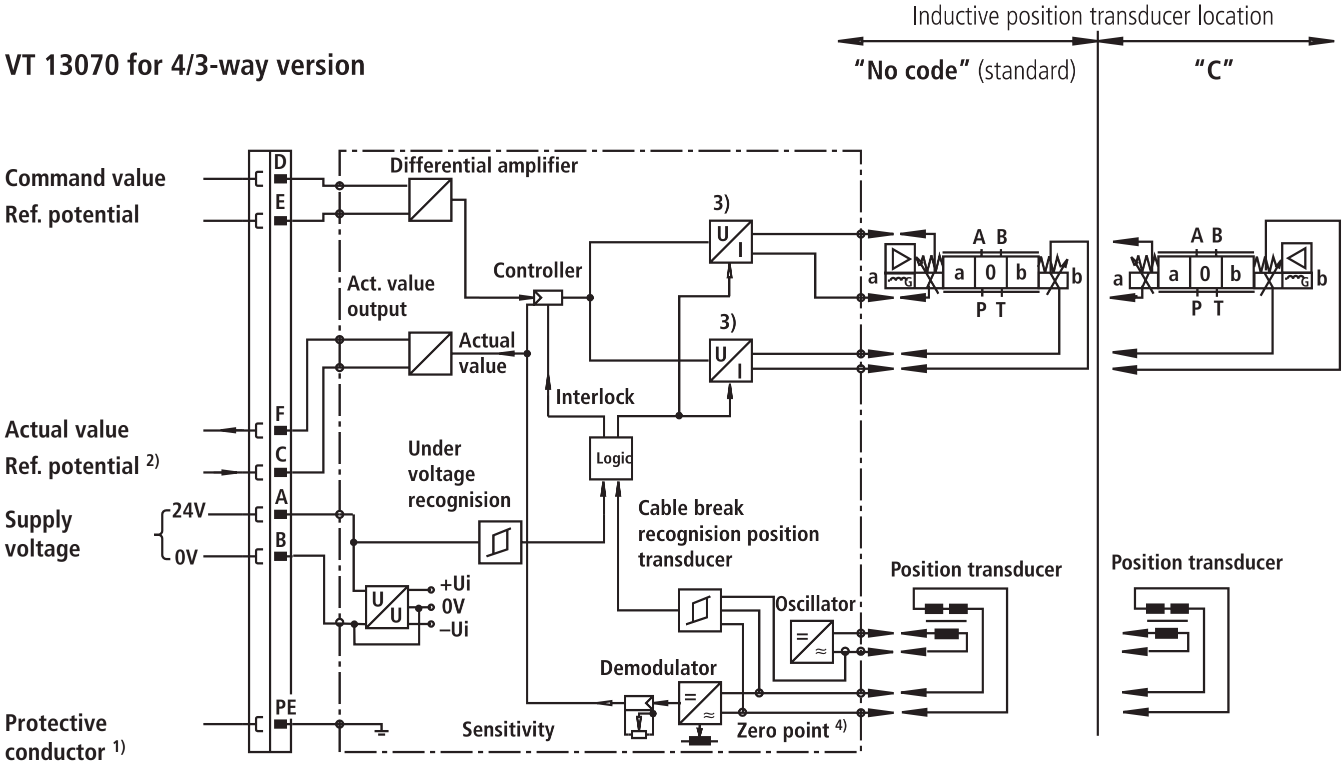
Connection cable: Recommended: – up to 25 m cable length type LiYCY 7 x 0.75 mm^2
– up to 50 m cable length type LiYCY 7 x 1.0 mm^2
Outside diameter 6.5 to 11 mm
Only connect the screen to ⊥ on the supply side.

Integrated control electronics VT 13070

Block circuit diagram / connection allocation for the integrated control electronics

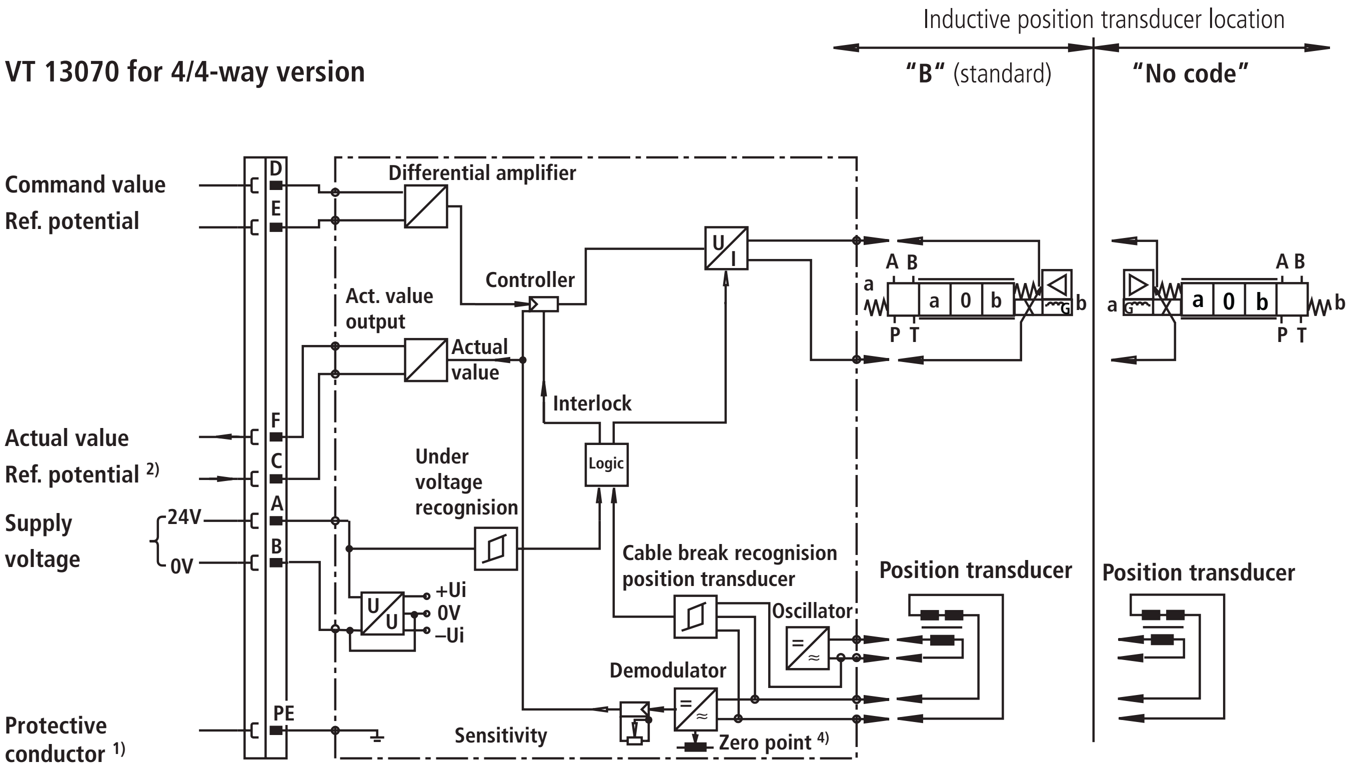
Interface	Integrated control electronics	Valve

VT 13070 for 4/3-way version



Interface	Integrated control electronics	Valve

VT 13070 for 4/4-way version



1) Connection PE is connected with the cooling body and the valve housing

2) **Note for A1:** Connect pin C on the control side to ⊥

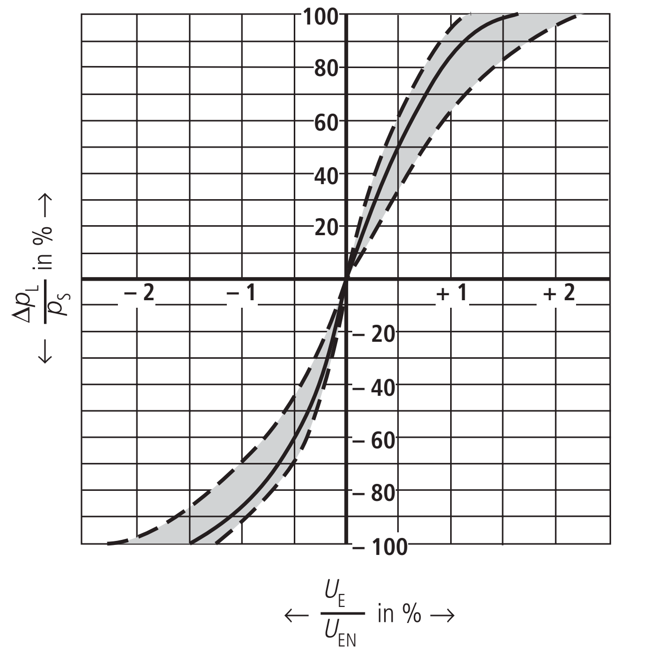
3) Output stage, current controller

4) Zero point externally adjustable

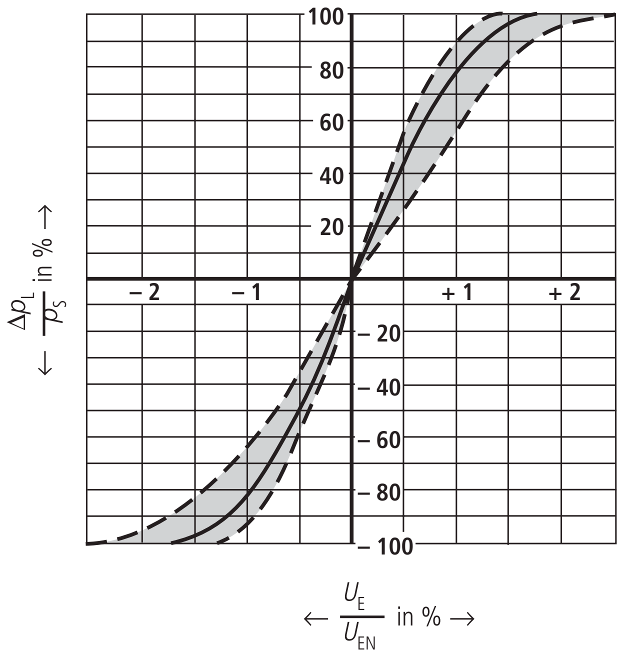
Note: Electrical signal (e.g. actual value) taken via valve electronics must not be used to switch off the machine safety functions!
(This is in accordance with the regulations to the European standard "Safety requirements of fluid technology systems and components – hydraulics", EN 982!)

Pressure-signal-characteristic curve p_S = 100 bar

NS 6 Type 4WRSEH 6 … L.-3X/…

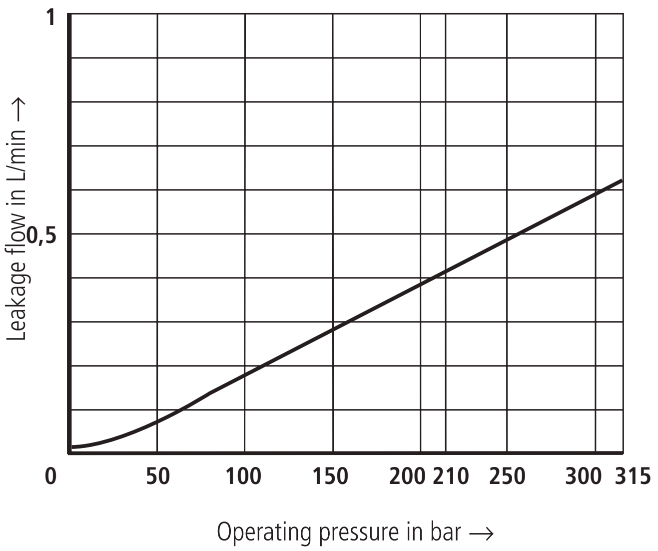


NS 10 Type 4WRSEH 10 … L.-3X/…

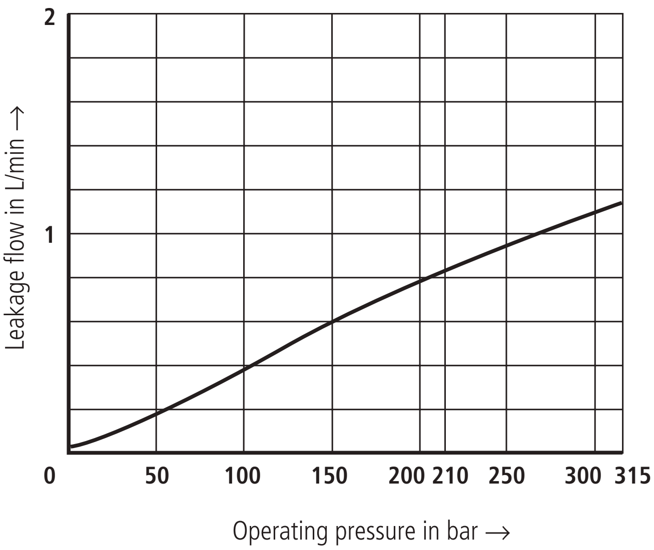


Leakage flow (typical)

NS 6 Type 4WRSEH 6 V50 L.-3X/…

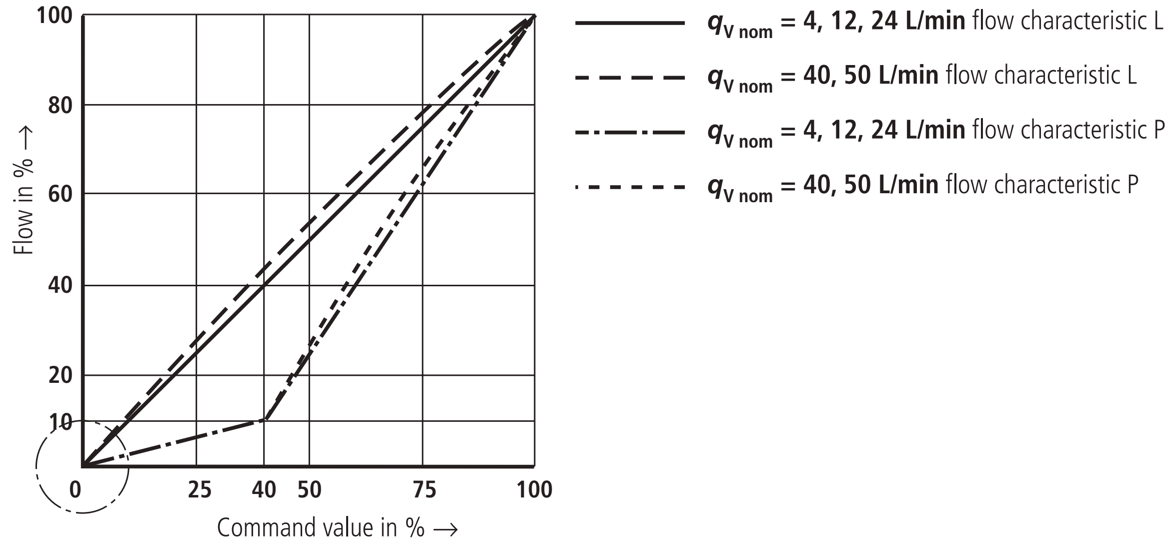


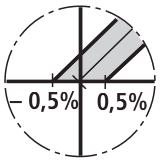
NS 10 Type 4WRSEH 10 V100 L.-3X/…



Characteristic curves (typical flow characteristic curve at 70 bar valve pressure differential or 35 bar per control land)

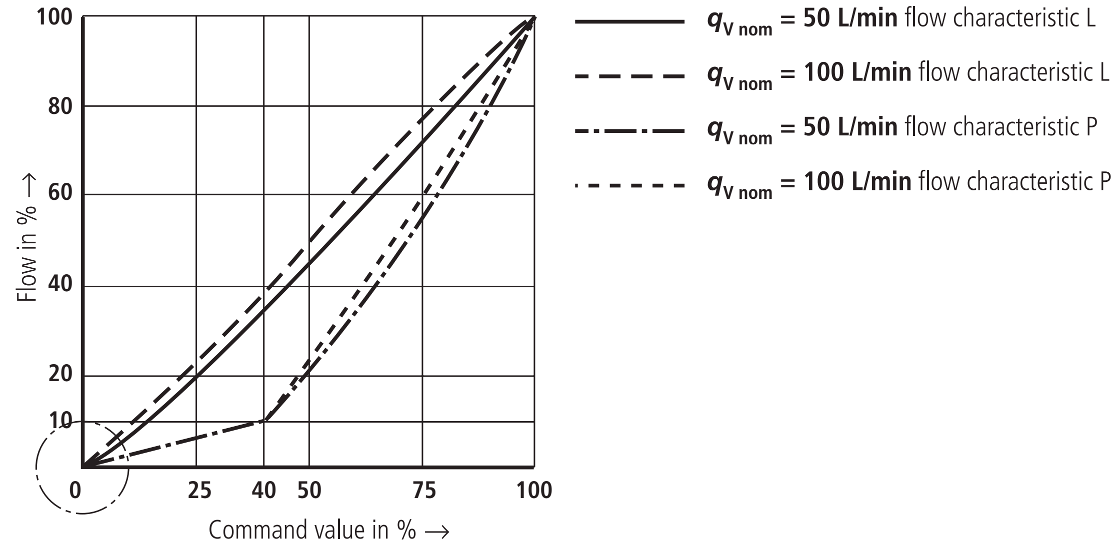
NS 6

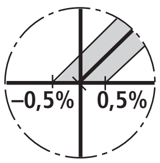




Zero travel dependent on series spread 0 % … 0.5 % for overlap „D“
Zero travel dependent on series spread – 0.5 % … 0 % for overlap „E“

NS 10

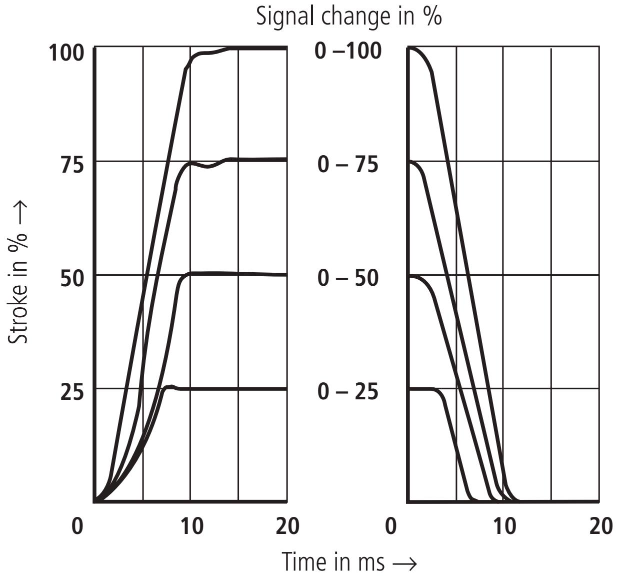




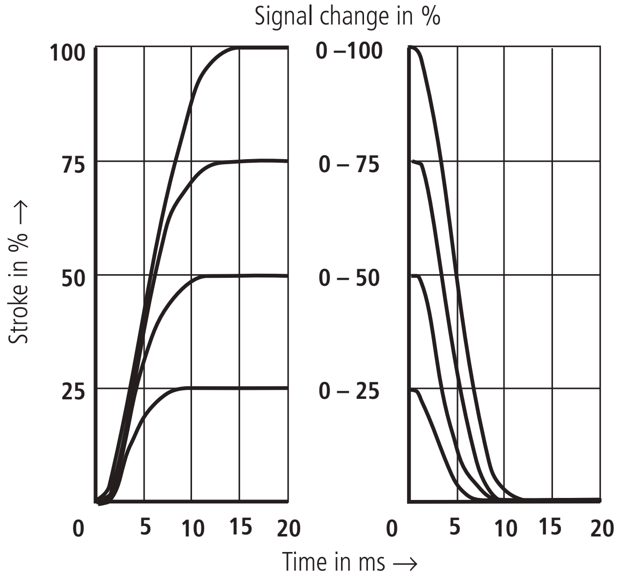
Zero travel dependent on series spread 0 % … 0.5 % for overlap „D“
Zero travel dependent on series spread – 0.5 % … 0 % for overlap „E“

Transient function with a jump form of electrical input signal

4/3-way version

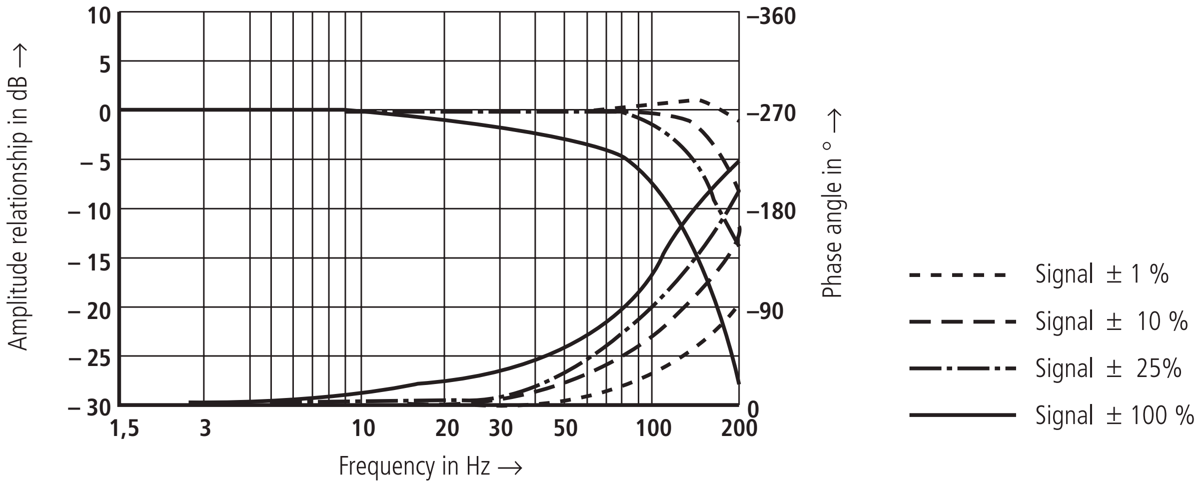


4/4-way version

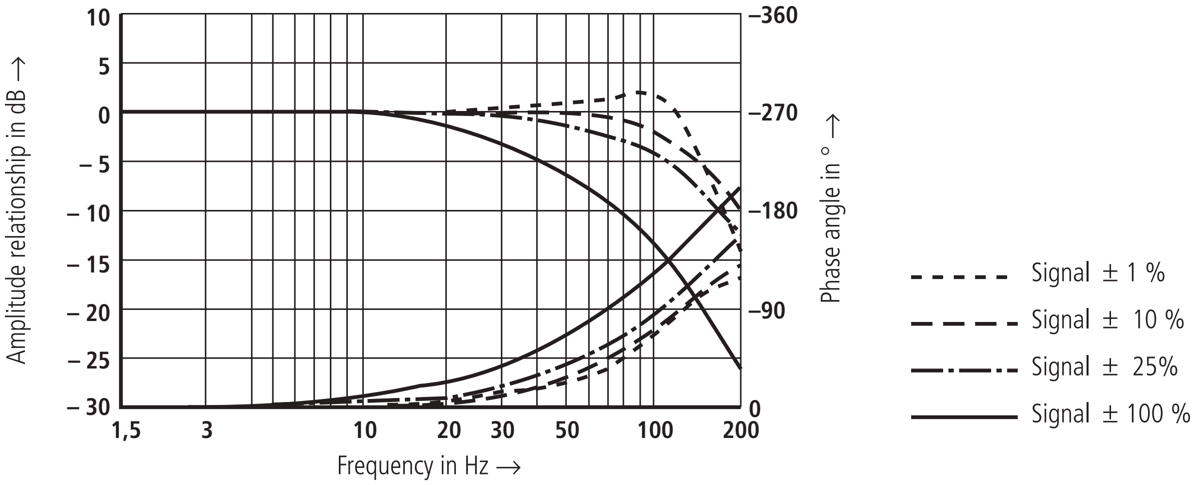


Frequency response characteristic curves

4/3-way version

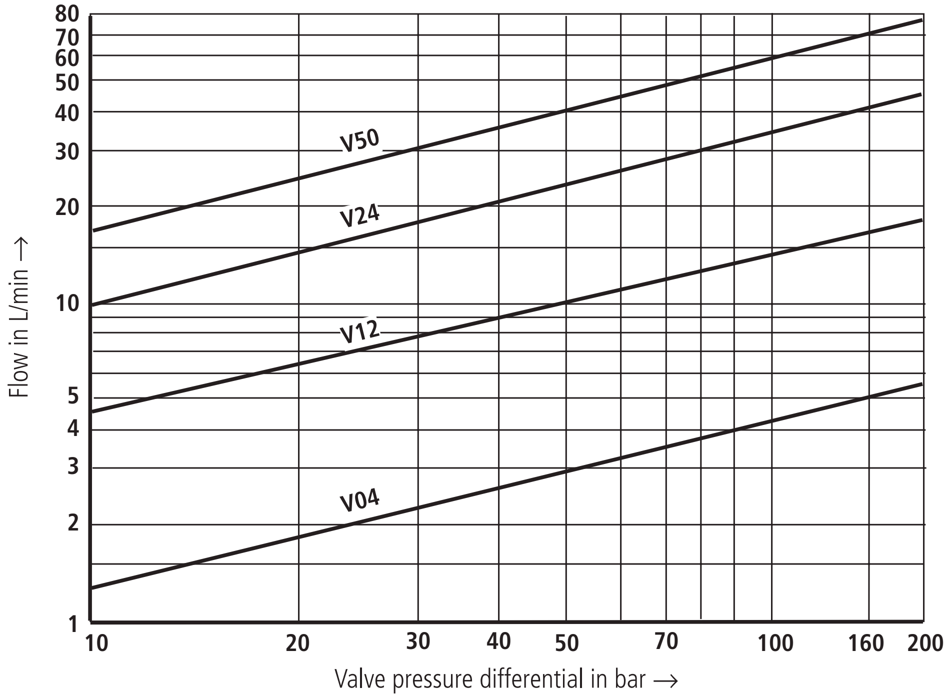


4/4-way version

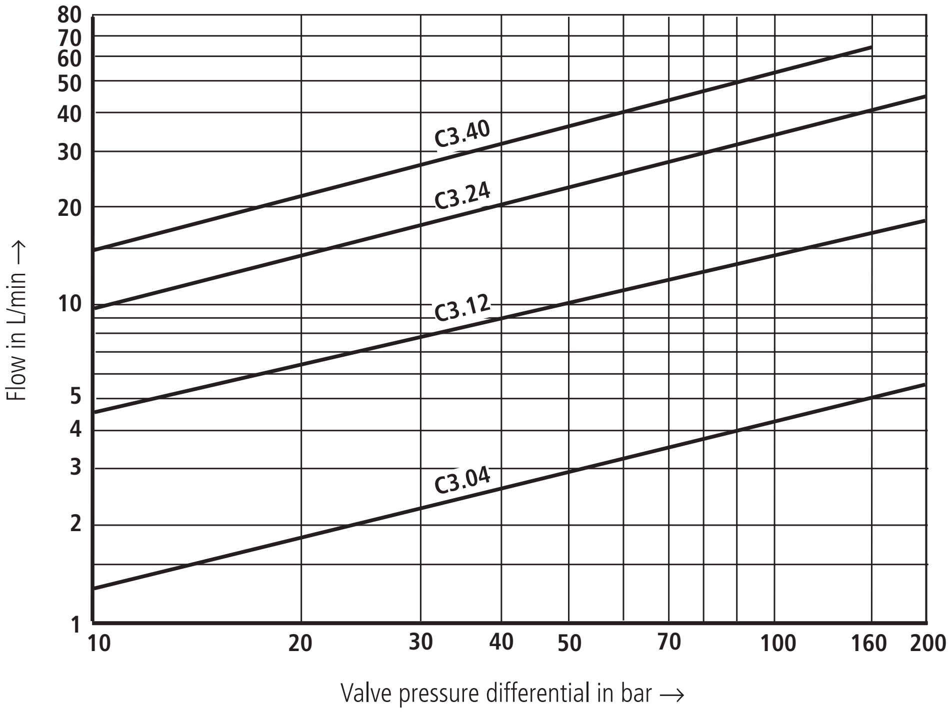


Flow-load function at the max. valve opening (tolerance ± 10%)

4/3-way version

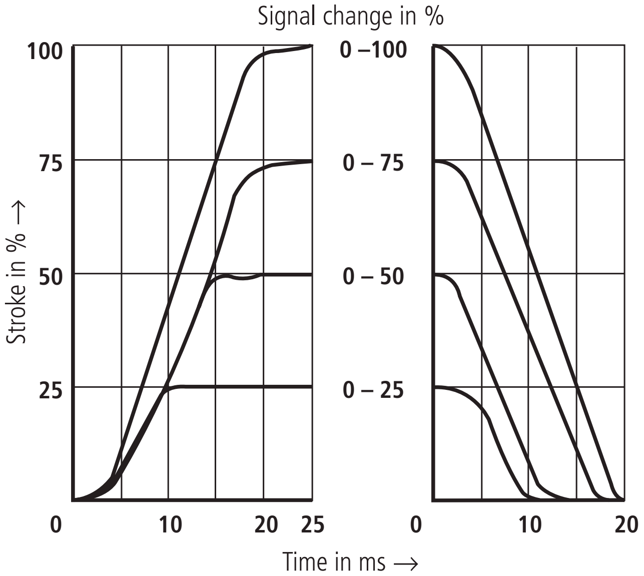


4/4-way version

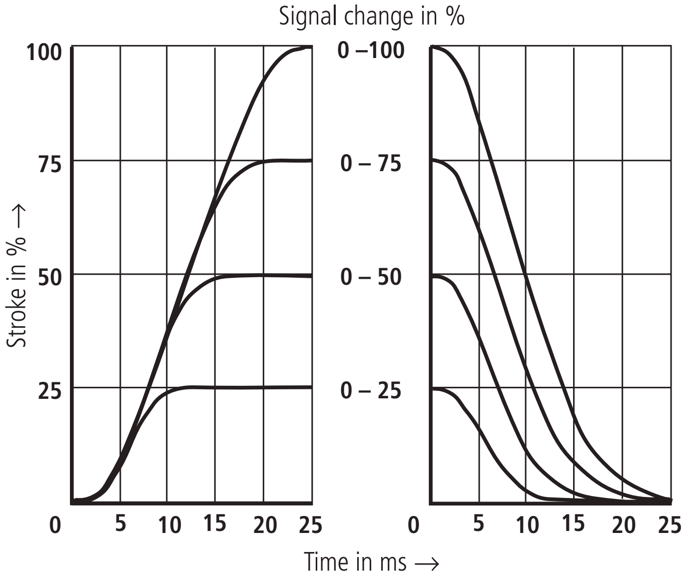


Transient function with a jump form of electrical input signal

4/3-way version

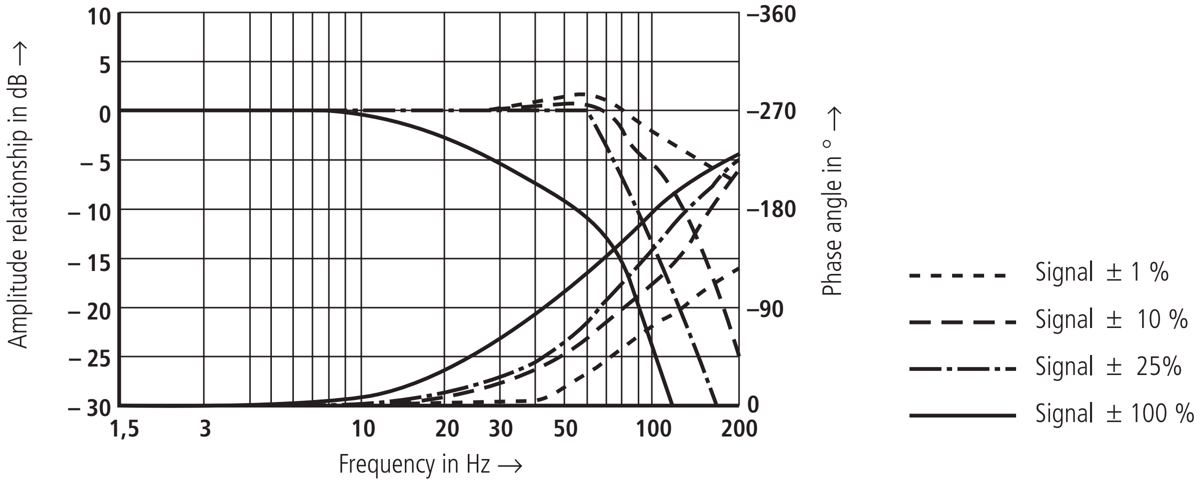


4/4-way version

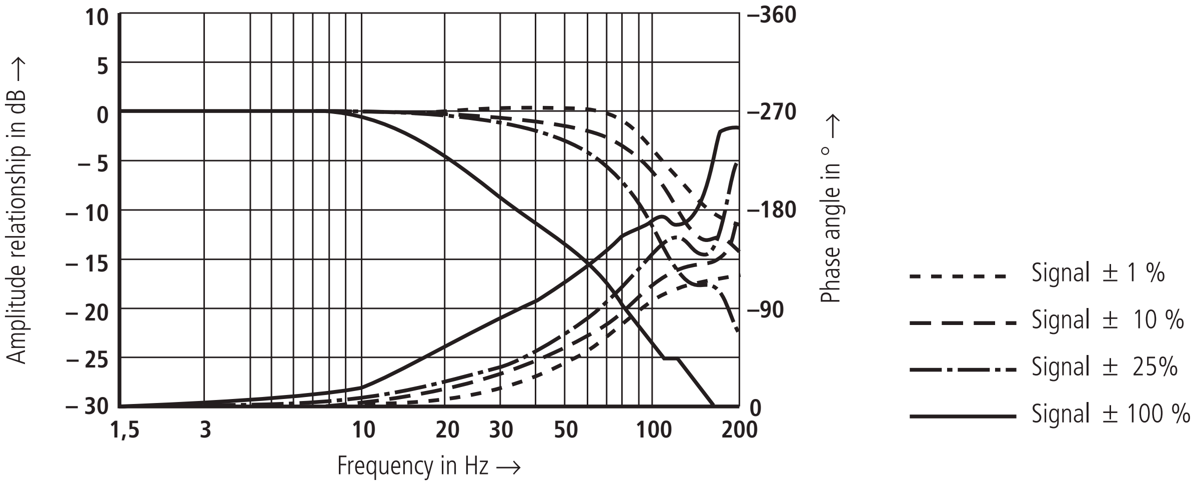


Frequency response characteristic curves

4/3-way version

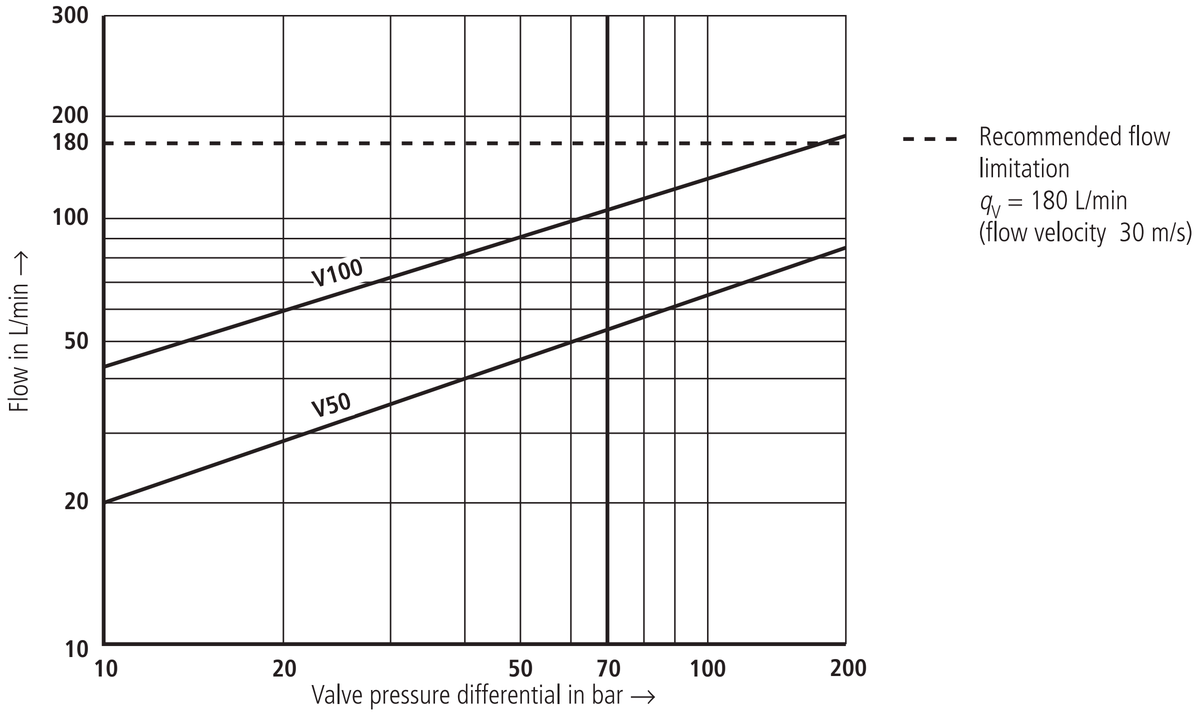


4/4-way version

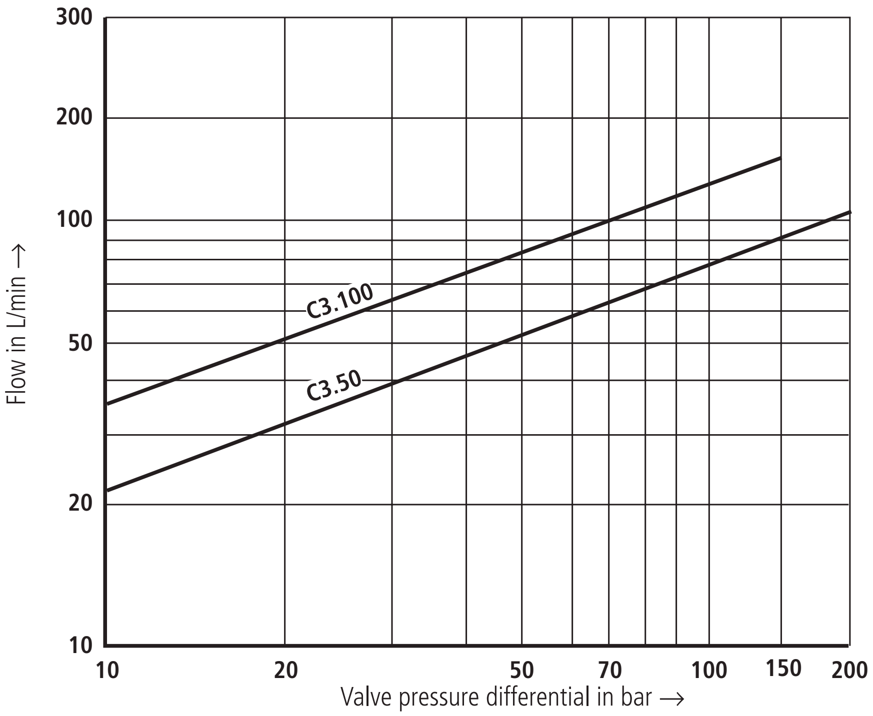


Flow-load function at the max. valve opening (tolerance ± 10%)

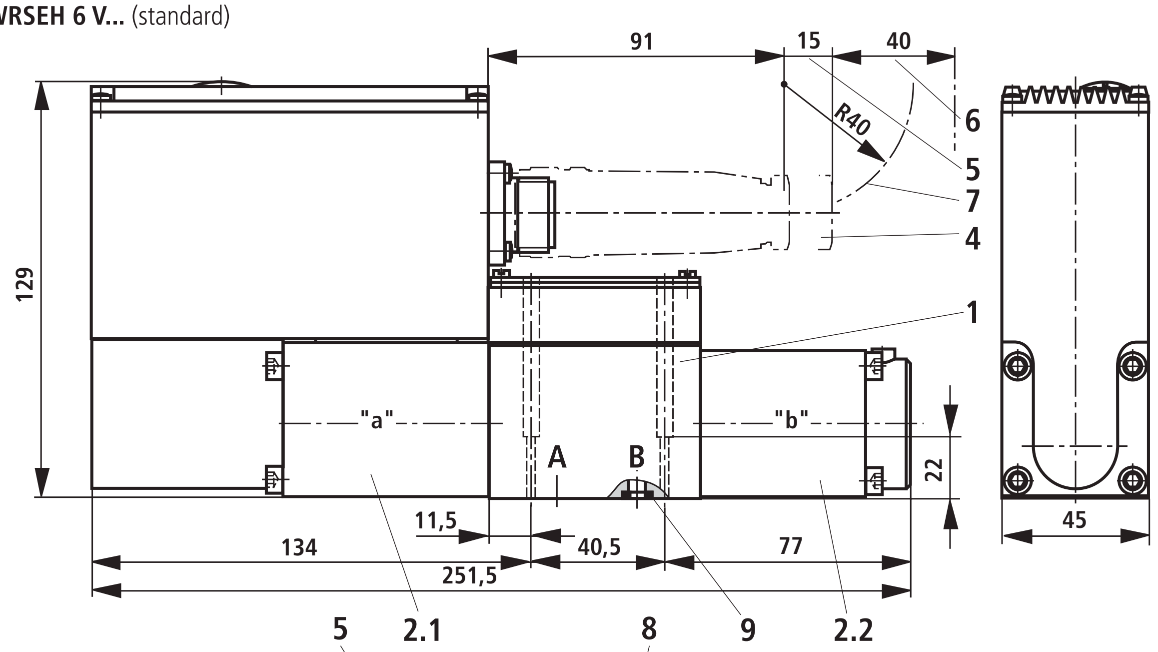
4/3-way version



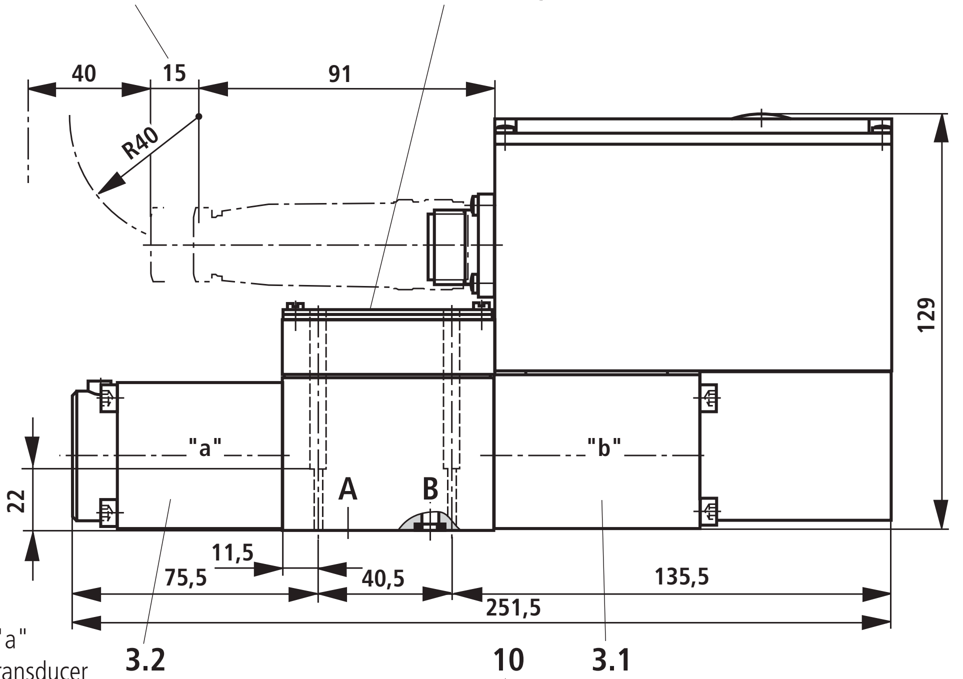
4/4-way version

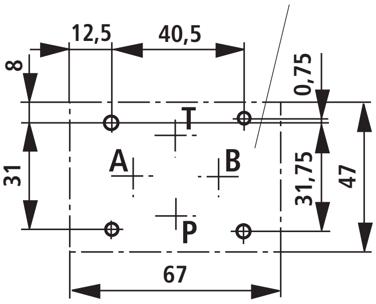


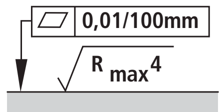
Type 4WRSEH 6 V... (standard)



Type 4WRSEH 6 VC..







Required surface finish of mating piece

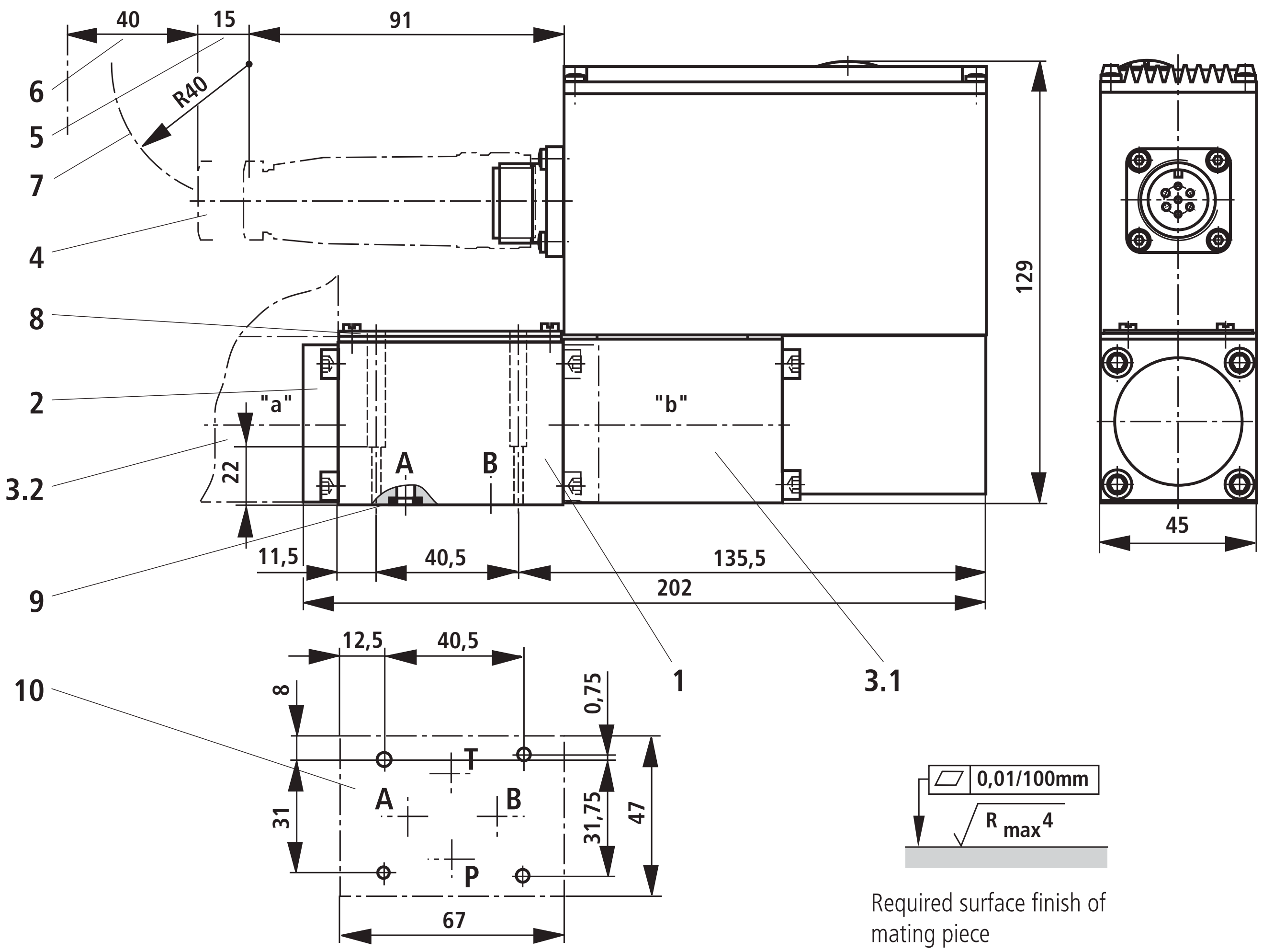
1 Valve housing
2.1 High response solenoid "a" with inductive position transducer
2.2 High response solenoid "b"
3.1 High response solenoid "b" with inductive position transducer
3.2 High response solenoid "a"
4 Plug-in connector to E DIN 43 563 BF6-3/Pg11 (separate order, see page 6)
5 Space required to remove the plug-in connector
6 Space requed for the cable bend radius when removing the plug-in connector
7 Cable bend radius
8 Name plate
9 R-ring 9.81 x 1.5 x 1.78 (ports A, B, P, T)
10 Machined valve mounting surface, position of ports to DIN 24 340 form A, ISO 4401 and CETOP-RP 121 H

Subplates to catalogue sheet RE 45 052 and valve fixing screws must be ordered separately.

Subplates: G 341/01 (G 1/4)
G 342/01 (G 3/8)
G 502/01 (G 1/2)

Valve fixing screws:
4 off M5 x 30 DIN 912-10.9; M_A = 7.1 Nm

Type 4WRSEH 6 C.B...



Required surface finish of mating piece

- **1** Valve housing
- **2** Cover
- **3.1** High response solenoid „b“ with inductive position transducer
- **3.2** High response solenoid „a“ with inductive position transducer
- **4** Plug-in connector to E DIN 43 563 BF6-3/Pg11 (separate order, see page 6)
- **5** Space required to remove the plug-in connector
- **6** Space required for the cable bend radius when removing the plug-in connector
- **7** Cable bend radius
- **8** Name plate
- **9** R-ring 9.81 x 1.5 x 1.78 (ports A, B, P, T)
- **10** Machined valve mounting surface, position of ports to DIN 24 340 form A, ISO 4401 and CETOP-RP 121 H

Subplates to catalogue sheet RE 45 052 and valve fixing screws must be ordered separately.

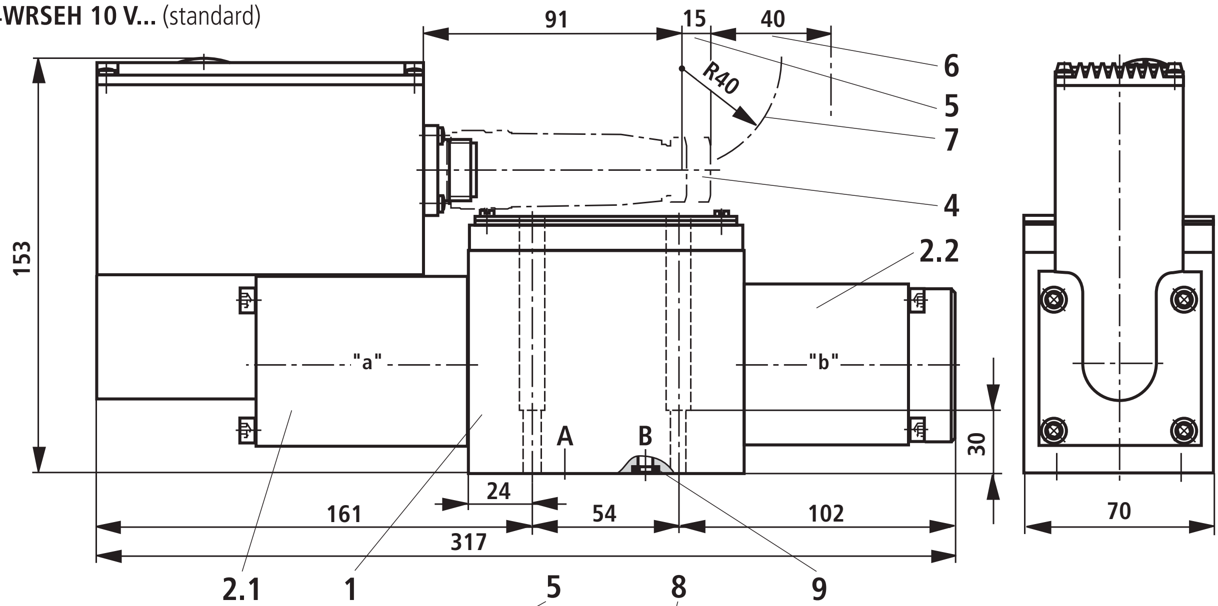
Subplates: G 341/01 (G 1/4)
G 342/01 (G 3/8)
G 502/01 (G 1/2)

Valve fixing screws:
4 off M5 x 30 DIN 912-10.9; M_A = 7.1 Nm

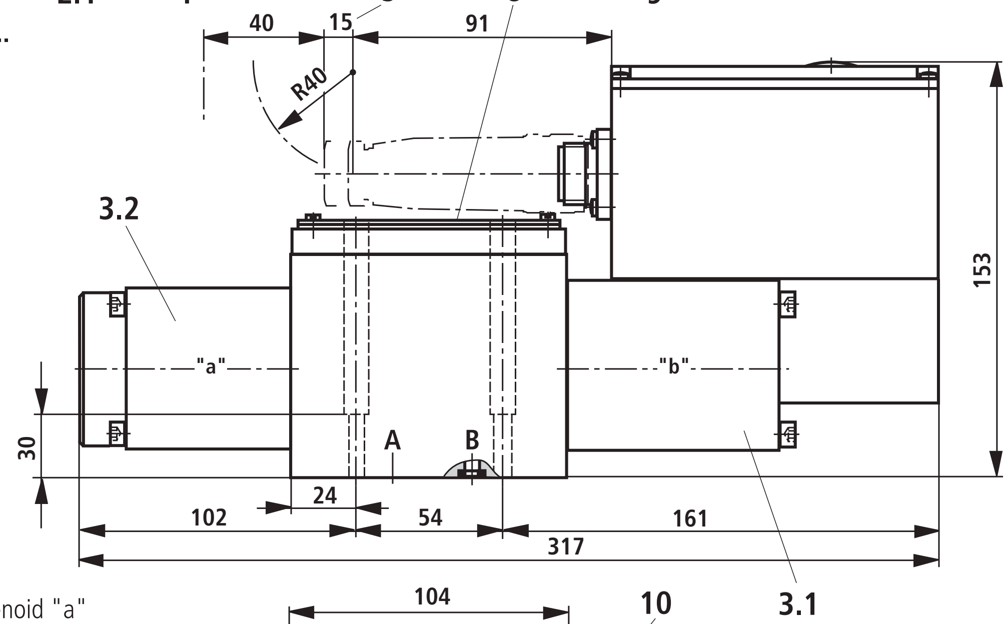
Unit dimensions: NS 10

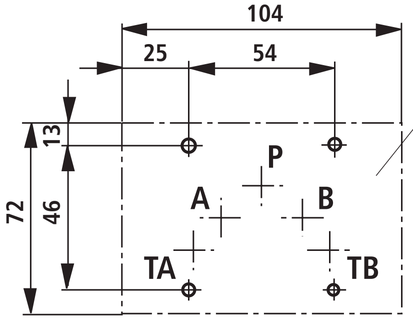
(Dimensions in mm)

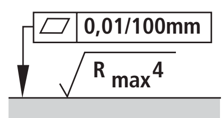
Type 4WRSEH 10 V... (standard)



Type 4WRSEH 10 .VC..







Required surface finish of mating piece

1 Valve housing

2.1 High response solenoid "a" with inductive position transducer

2.2 High response solenoid "b"

3.1 High response solenoid "b" with inductive position transducer

3.2 High response solenoid "a"

4 Plug-in connector to E DIN 43 563-BF6-3/Pg11 (separate order, see page 6)

5 Space required to remove the plug-in connector

6 Space required for the cable bend radius when removing the plug-in connector

7 Cable bend radius

8 Name plate

9 R-ring 13.0 x 1.6 x 2.0 (ports A, B, P, T)

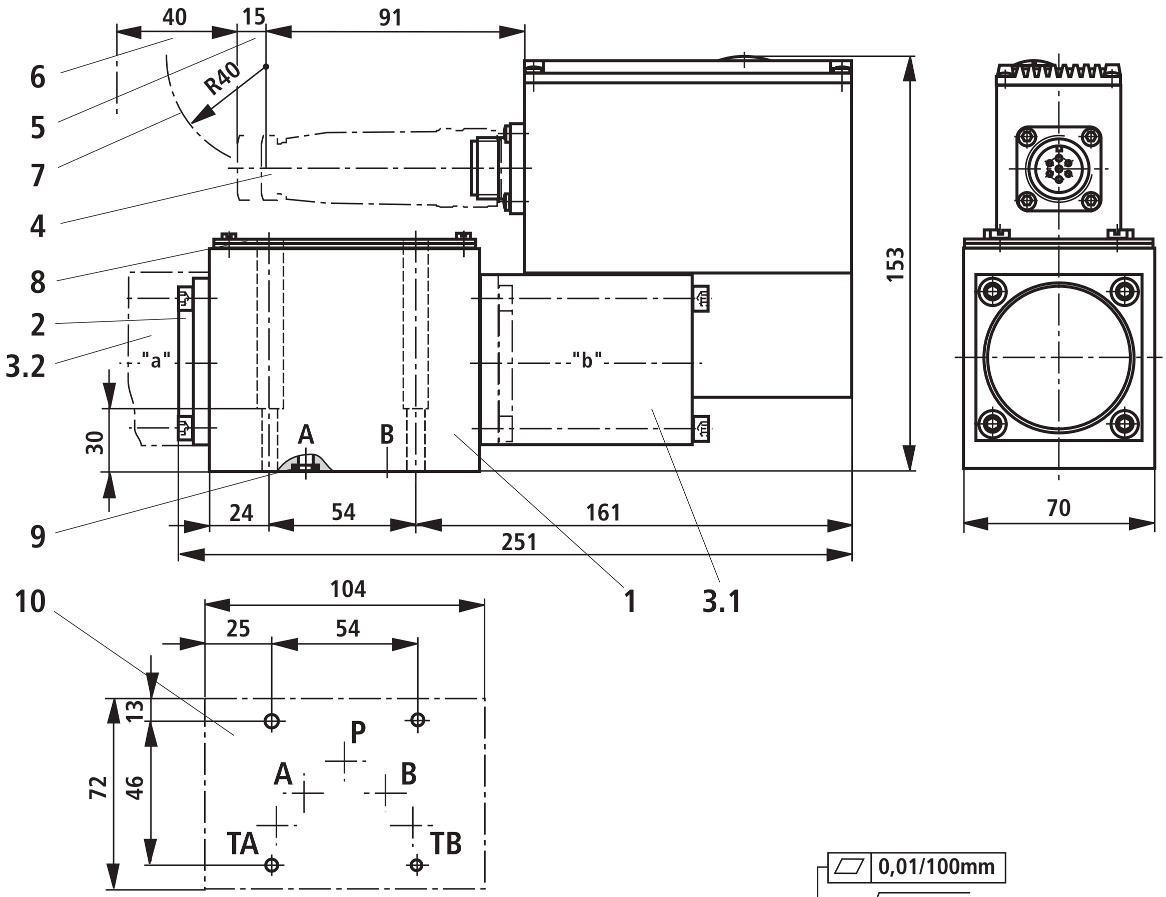
10 Machined valve mounting surface, position of ports to DIN 24 340 form A, ISO 4401 and CETOP-RP 121 H

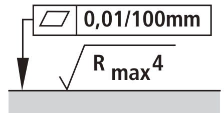
Subplates to catalogue sheet RE 45 054 and valve fixing screws must be ordered separately.

Subplates: G 66/01 (G 3/8); G 67/01 (G 1/2)
G 534/01 (G 3/4)

Valve fixing screws:
4 off M6 x 40 DIN 912-10.9; M_A = 12.2 Nm

Type 4WRSEH 10 C.B...





Required surface finish of mating piece

1 Valve housing
2 Cover
3.1 High response solenoid „b“ with inductive position transducer
3.2 High response solenoid „a“ with inductive position transducer
4 Plug-in connector to E DIN 43 563-BF6-3/Pg11 (separate order, see page 6)
5 Space required to remove the plug-in connector
6 Space required for the cable bend radius when removing the plug-in connector
7 Cable bend radius
8 Name plate
9 R-ring 13.0 x 1.6 x 2.0 (ports A, B, P, T)
10 Machined valve mounting surface, position of ports to DIN 24 340 form A, ISO 4401 and CETOP-RP 121 H

Subplates to catalogue sheet RE 45 054 and valve fixing screws must be ordered separately.

Subplates: G 66/01 (G 3/8); G 67/01 (G 1/2)
G 534/01 (G 3/4)

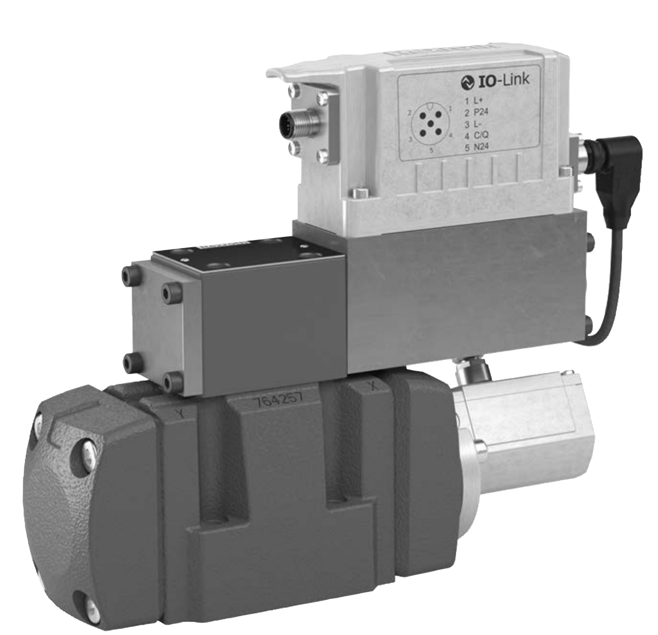
Valve fixing screws:
4 off M6 x 40 DIN 912-10.9; M_A = 12.2 Nm

RE 29123
Edition: 2019-07
Replaces: 2018-10

rexroth
A Bosch Company

Directional control valves, pilot-operated, with electrical position feedback and integrated electronics (OBE)

Type 4WRLE



H8153

- Size 10 ... 35
- Component series 4X
- Maximum operating pressure 350 bar
- Rated flow 60 ... 1500 l/min
- Digital interface, IO link for I4.0

Features

- Reliable – proven and robust design
- Safe
  - The control spool of the pilot control valve is in the "fail safe" position when the unit is switched off
  - The control spool of the main valve is in the spring-centered central position and/or in the offset position
- High quality – control spool and sleeve of the pilot control valve in servo quality
- Flexible – suitable for position, velocity and pressure control
- Precise – high response sensitivity and little hysteresis
- IO-Link interface, optional

Contents

Ordering code

01	02	03	04	05	06	07	08		09		10	11		12	13	14	15	16
4	**WRL**	**E**					**J**	**–**	**4X**	**/**			**/**		**24**			*****

01	4 main ports	**4**
02	Directional control valve, pilot-operated	**WRL**
03	With integrated electronics (OBE)	**E**
04	Size 10	**10**
	Size 16	**16**
	Size 25	**25**
	Size 27	**27**
	Size 35	**35**
05	Symbols e.g. E, E1-, W6- etc.; possible version see page 4	

Rated flow (**Δp** = 5 bar/control edge)

06	**– Size 10**	
	60 l/min (only symbol E, E1-, W6-, W8-, V, V1-)	**60**
	100 l/min	**100**
	– Size 16	
	200 l/min (only symbol W6- and W8-)	**200**
	250 l/min (only symbol E, E1-, V, V1- and Q3-)	**250**
	– Size 25	
	350 l/min (only symbol W6- and W8-)	**350**
	400 l/min (only symbol E, E1-, V, V1- and Q3-)	**400**
	– Size 27	
	430 l/min (only symbol W6- and W8-)	**430**
	600 l/min (only symbol E, E1-, V, V1- and Q3-)	**600**
	– Size 35	
	1000 l/min (only symbol E, E1-, V, V1-)	**1000**
	1200 l/min (only symbol W6- and W8-)	**1200**
	1500 l/min (only symbol E, E1-, V, V1- and Q3-)	**1500**

Flow characteristic

07	Linear	**L**
	Linear with fine control range (available for NG 10, other sizes on request)	**P**
	Progressive with linear fine control (only symbol Q3-)	**M**
08	Overlap jump (opening point 5% with covered valve; only symbols E, E1-, W6-, W8-)	**J**
09	Component series 40 ... 49 (40 ... 49: unchanged installation and mounting dimensions)	**4X**

Seal material (observe compatibility of seals with hydraulic fluid used, see page 10)

10	NBR seals	**M**
	FKM seals	**V**

Pilot oil flow

11	External pilot oil supply, external pilot oil return	**XY**
	Internal pilot oil supply, external pilot oil return	**PY**
	Internal pilot oil supply; internal pilot oil return	**PT**
	External pilot oil supply, internal pilot oil return	**XT**

Ordering code

01	02	03	04	05	06	07	08		09		10	11		12	13	14	15	16
4	**WRL**	**E**					**J**	**–**	**4X**	**/**			**/**		**24**			*****

12	**Without** damping plate	**without designation**
	With damping plate	**D**

13	Supply voltage 24 V	**24**

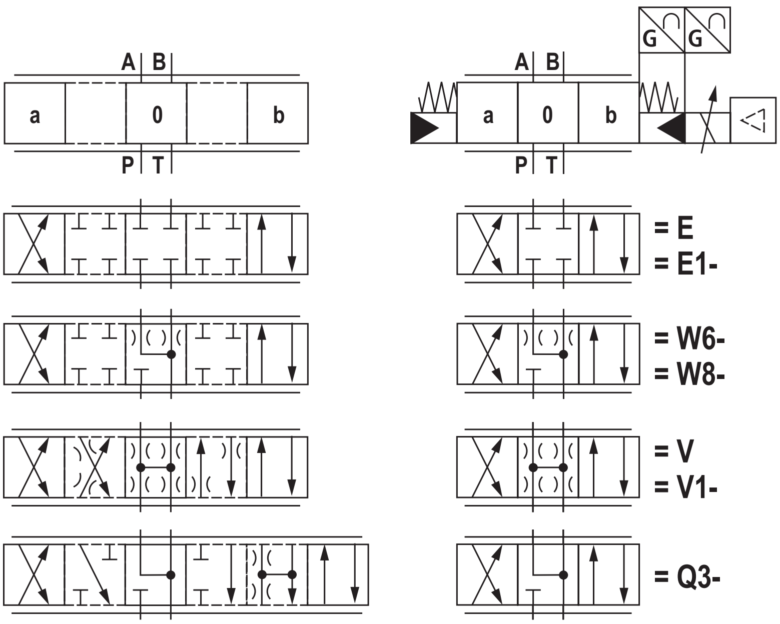
Interfaces of the control electronics

14	Command value input ±10 V	**A1**
	Command value input 4 ... 20 mA	**F1**
	IO-Link interface	**L1**
	Command value ±10 mA, actual value 4 ... 20 mA, release (connector 6+PE)	**C6**

15	**Without** electronics protection membrane	**without designation**
	With electronics protection membrane	**-967**

16	For further details, see the plain text	*****

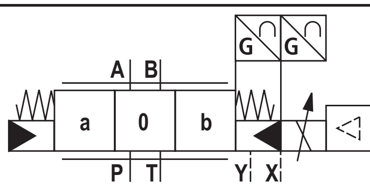
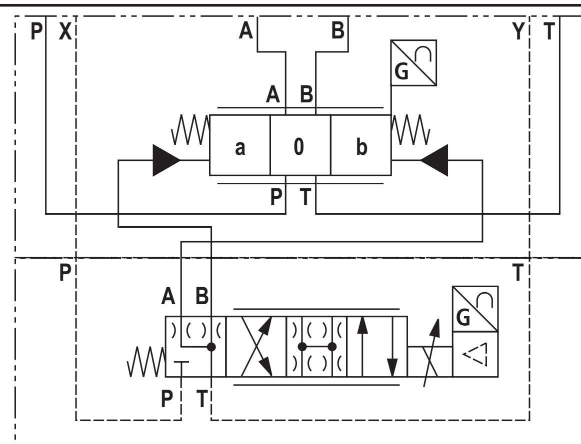
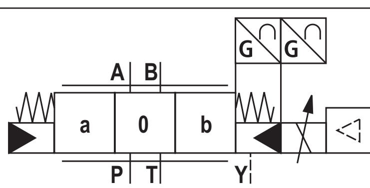
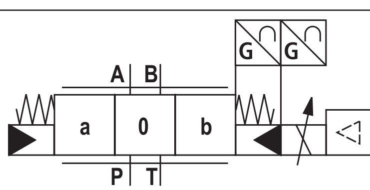
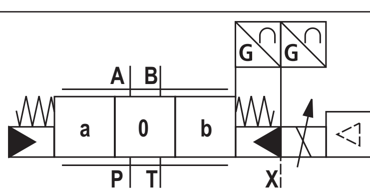
Symbols



With symbol E1–, V1– and W8–:

P → A: $q_{V\,max}$ B → T: $q_V/2$

P → B: $q_V/2$ A → T: $q_{V\,max}$

Version	simple	detailed
"XY"		
"PY"		
"PT"		
"XT"		

Notice:
- Representation according to DIN ISO 1219-1. Hydraulic interim positions are shown by dashes.
- For information on the "switch-off behavior", refer to the technical data on page 10.

Function, section: Symbol E. and W.

The valve type 4WRLE is a pilot-operated directional control valve with electrical position feedback and integrated electronics (OBE).

Set-up

The valve basically consists of 3 main assemblies:
- Pilot control valve (1) with control spool and sleeve, return spring, control solenoid and inductive position transducer (optionally with electronics protection membrane (5) and damping plate (4))
- Main valve (2) with centering spring and position feedback
- On-board electronics (OBE) (3) with analog (6) or IO-Link interface

Function

When the integrated electronics (OBE) are switched off or inactive, the control spool of the pilot control valve is spring-operated in the “fail-safe" position. The control spool of the main valve is in its spring-centered central position.

The integrated electronics (OBE) compare the specified command value to the position actual value of the main valve control spool. In case of control deviations, the control solenoid will be activated. Due to the changed magnetic force, the pilot control spool is adjusted against the spring.

The flow, which is activated via the control cross-sections, leads to an adjustment of the main control spool. The stroke/control cross-section of the main control spool is regulated proportionally to the command value.

The pilot oil supply in the pilot control valve is either internal via port P or external via port X. The feedback can be internal via port T or external via port Y to the tank.

Control solenoid shut-off

In case of the following errors, the control solenoids are de-energized by the integrated electronics (OBE), the pilot control spool is set to its “fail-safe” position and unloads the pilot oil chambers of the main valve. Operated by the spring, the main valve control spool will move to the central position.
- Falling below the minimum supply voltage
- Only at interface “F1”:
  - Falling below the minimum current command value of 2 mA (includes cable break of the command value line (current loop)).
- Only at interface “L1”:
  - Enable inactive, communication interruption (watchdog)
  - In case of internal IO-Link error
- Only at interface “C6”:
  - Additionally, release inactive

Damping plate "D"

The damping plate (4) reduces the acceleration amplitudes on the on-board electronics (frequencies >300 Hz).

> **Notice:**
> Using the damping plate is not recommended for applications with mainly low-frequency excitation <300 Hz.

Electronics protection membrane "-967"

To prevent condensate formation in the housing of the integrated electronics (OBE), an electronics protection membrane (5) can be used.

Recommended for use outside industry-standard conditions with high ambient air humidity and significant cyclic temperature changes (e.g. outdoors).

> **Notice:**
> Pilot-operated 4/3 directional control valves with positive overlap are functional in controlled or regulated axes. The overlap in the de-energized state is approx. 20% of the control spool stroke.
> While the electrical supply voltage is switching off, the drive may be accelerated for a short time in functional direction P to B.

For sectional drawing see page 6.

Function, section: Symbol V and V1-

The valve type 4WRLE is a pilot-operated directional control valve with electrical position feedback and integrated electronics (OBE).

Set-up

The valve basically consists of 3 main assemblies:

- Pilot control valve (1) with control spool and sleeve, return spring, control solenoid and inductive position transducer (optionally with electronics protection membrane (5) and damping plate (4))
- Main valve (2) with centering spring and position feedback
- On-board electronics (OBE) (3) with analog (6) or IO-Link interface

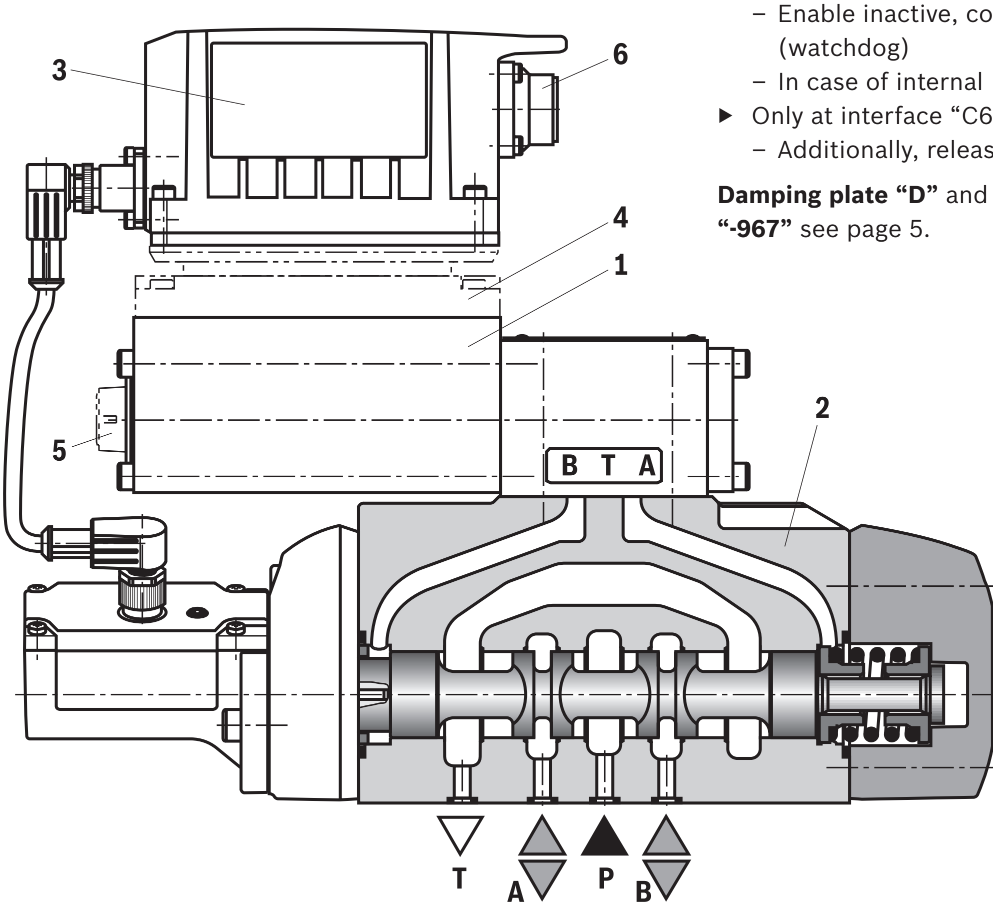
Function

When the integrated electronics (OBE) are switched off or inactive, the control spool of the pilot control valve is spring-operated in the “fail-safe" position. The control spool of the main valve is in its spring-centered offset position at approx. 6% of the stroke in direction P to B/A to T.

The integrated electronics (OBE) compare the specified command value to the position actual value of the main valve control spool. In case of control deviations, the control solenoid will be activated. Due to the changed magnetic force, the pilot control spool is adjusted against the spring.

The flow, which is activated via the control cross-sections, leads to an adjustment of the main control spool. The stroke/control cross-section of the main control spool is regulated proportionally to the command value. In case of a command value presetting of 0 V, the electronics adjust the control spool of the main valve to central position.

The pilot oil supply in the pilot control valve is either internal via port P or external via port X. The feedback can be internal via port T or external via port Y to the tank.



Control solenoid shut-off

In case of the following errors, the control solenoids are de-energized by the integrated electronics (OBE), the pilot control spool is set to its “fail-safe” position and unloads the pilot oil chambers of the main valve. Operated by the spring, the main valve control spool will move to the offset position (approx. 6% P → B/A → T).

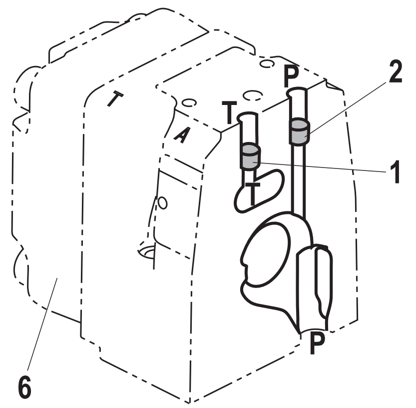
- Falling below the minimum supply voltage
- Only at interface “F1”:
  - Falling below the minimum current command value of 2 mA (includes cable break of the command value line (current loop)).
- Only at interface “L1”:
  - Enable inactive, communication interruption (watchdog)
  - In case of internal IO-Link error
- Only at interface “C6”:
  - Additionally, release inactive

Damping plate “D” and **electronics protection membrane “-967”** see page 5.

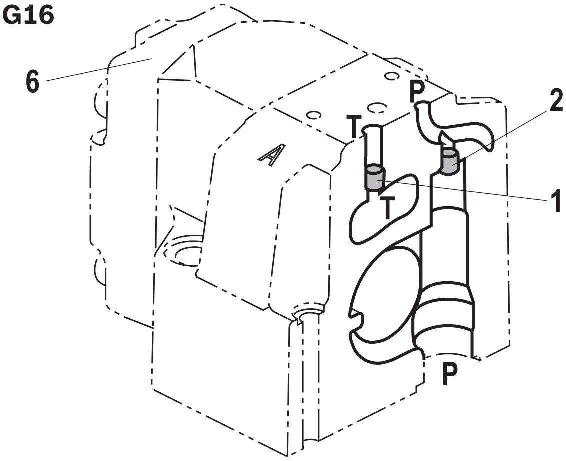
☞ **Notice:**
Pilot-operated 4/3 directional control valves are only functional in the active control loop and do not have a locking basic position when deactivated. Consequently "external isolator valves" are required in many applications and must be taken into account regarding the switch-on/switch-off order. While the electrical supply voltage is switching off, the drive may be accelerated for a short time in functional direction P to B.

Pilot oil supply (schematic illustration)

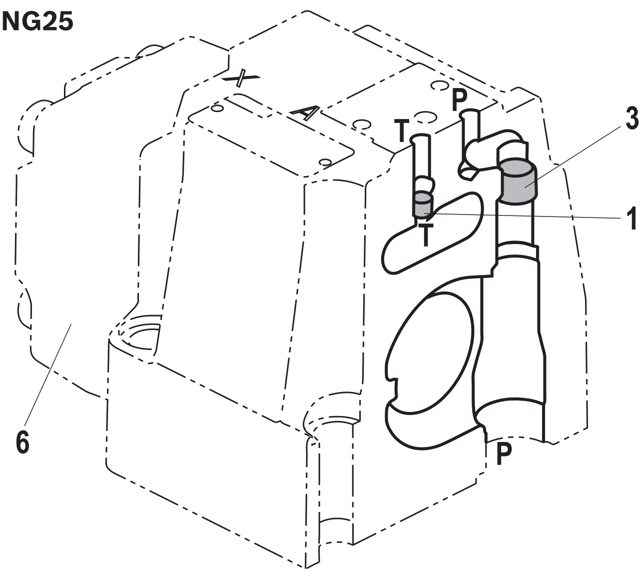
NG10



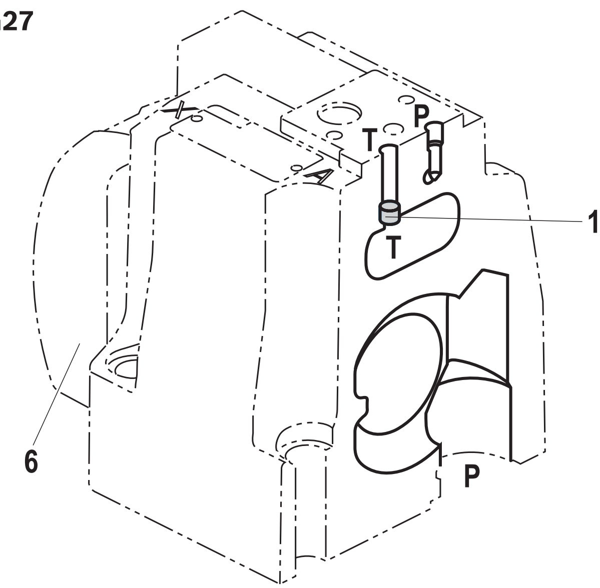
NG16



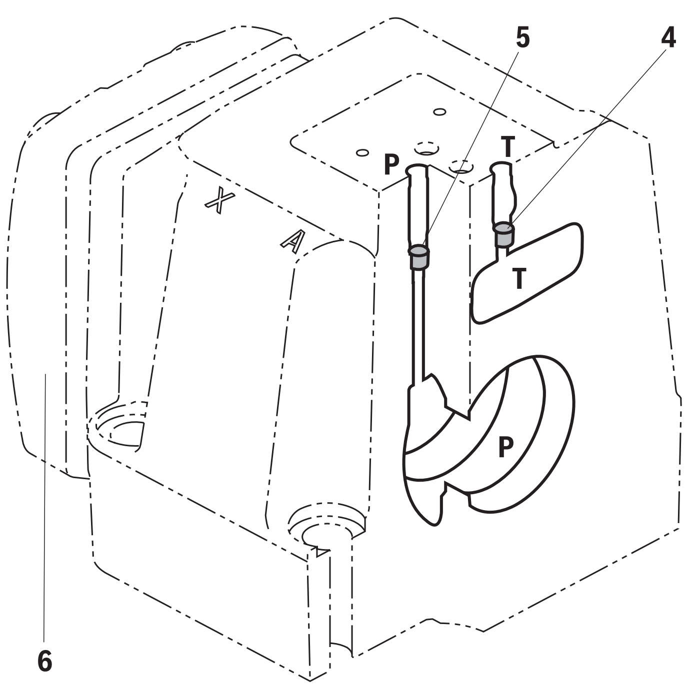
NG25



NG27



NG35



1 Plug screw M6 according to DIN 906, wrench size 3 – pilot oil return

2 Plug screw M6 according to DIN 906, wrench size 3 –pilot oil supply

3 Plug screw M12 x 1.5 according to DIN 906, wrench size 6 –pilot oil supply

4 Plug screw 1/16-27 NPTF, SW4 – pilot oil return

5 Plug screw 1/16-27 NPTF, SW4 –pilot oil supply

6 Housing cover main stage (position transducer side)

Pilot oil supply

External: **2, 3, 5** closed
Internal: **2, 3, 5** open

Pilot oil return

External: **1, 4** closed
Internal: **1, 4** open

Further explanations on page 8.

Pilot oil supply

Version "XY"
External pilot oil supply
External pilot oil return
In this version, the pilot oil is supplied from a separate control circuit (external).
The pilot oil return is not directed into channel T of the main valve but is separately directed to the tank via port Y (external).

Version "PY"
Internal pilot oil supply
External pilot oil return
With this version, the pilot oil is supplied from channel P of the main valve (internal).
The pilot oil return is not directed into channel T of the main valve but is separately directed to the tank via port Y (external).
In the subplate, port X is to be closed.

Version "PT"
Internal pilot oil supply
Internal pilot oil return
With this version, the pilot oil is supplied from channel P of the main valve (internal).
The pilot oil is directly returned to channel T of the main valve (internal).
In the subplate, ports X and Y are to be closed.

Version "XT"
External pilot oil supply
Internal pilot oil return
In this version, the pilot oil is supplied from a separate control circuit (external).
The pilot oil is directly returned to channel T of the main valve (internal).
In the subplate, port Y is to be closed.

☞ **Notice:**
The modification of the pilot oil supply may only be performed by authorized specialists or at the factory.
The maximum admissible operating parameters must be observed, see page 9.

Technical data
(For applications outside these values, please consult us!)

General							
Size		NG	10	16	25	27	35
Installation position			Any				
Ambient temperature range		°C	-20 ... +60				
Maximum storage time		years	1 (if the storage conditions are observed; refer to the operating instructions 07600-B)				
Sine test according to DIN EN 60068-2-6	▶ Without damping plate		10 ... 2000 Hz / maximum of 10 g / 10 cycles / 3 axes				
	▶ With damping plate [1]		10 ... 2000 Hz / maximum of 10 g / 10 cycles / 3 axes				
Noise test according to DIN EN 60068-2-64	▶ Without damping plate		20 ... 2000 Hz / 10 g_{RMS} / 30 g peak / 30 min. / 3 axes				
	▶ With damping plate [1]		20 ... 2000 Hz / 10 g_{RMS} / 30 g peak / 24 h / 3 axes				
Transport shock according to DIN EN 60068-2-27	▶ Without damping plate		15 g / 11 ms / 3 shocks / 3 axes				
	▶ With damping plate [1]		15 g / 11 ms / 3 shocks / 3 axes				
Shock according to DIN EN 60068-2-27	▶ With damping plate [1]		35 g / 6 ms / 1000 shocks / 3 axes				
Weight		kg	9	12	19	21	80
Maximum relative humidity (no condensation)		%	95				
Maximum solenoid surface temperature		°C	120 (individual operation)				
$MTTF_d$ value according to EN ISO 13849		years	75 (for further details see data sheet 08012)				
Conformity			▶ CE according to EMC directive 2014/30/EU, tested according to EN 61000-6-2 and EN 61000-6-3 ▶ RoHS directive 2015/65/EU ▶ REACH ordinance (EC) no. 1907/2006				

[1] Not recommended for applications with mainly low-frequency excitation < 300 Hz

Technical data
(For applications outside these values, please consult us!)

Hydraulic							
Size		NG	10	16	25	27	35
Maximum operating pressure	▶ Ports A, B, P						
	– External pilot oil supply	bar	350			270	350
	– Internal pilot oil supply	bar	280			270	280
	▶ Port X	bar	280			270	280
	▶ Ports T, Y	bar	250			210	250
Minimum pilot pressure (pilot control valve)		bar	10				
Maximum flow		l/min	300	800	1250	1850	4700
Rated flow (Δp = 5 bar/control edge) [2]		l/min	60/100	200/250	350/400	430/600	1000/1200/1500
Pilot oil flow [3]	▶ Symbol E, W	l/min	2.4	3.5	7.5		23
	▶ Symbol V, Q3-	l/min	4.5	11.5	22		29
Maximum leakage flow (inlet pressure 100 bar)	▶ Symbol E, E1-						
	– Main valve	l/min	0.06	0.13	0.17		0.61
	– Main valve + pilot control valve	l/min	0.14	0.28	0.42		1.01
	▶ Symbol W6-, W8-						
	– Main valve	l/min	0.12	0.26	0.35		1.23
	– Main valve + pilot control valve	l/min	0.2	0.41	0.6		1.63
Maximum zero flow (inlet pressure 100 bar)	▶ Symbol V, V1-						
	– Main valve	l/min	1.7	2.3	2.8	3.3	7.2
	– Main valve + pilot control valve	l/min	1.85	2.6	3.2	3.7	7.65
	▶ Symbol Q3-						
	– Main valve	l/min	0.4	1.6	1.8	2.2	1.6
	– Main valve + pilot control valve	l/min	0.55	1.9	2.2	2.6	2.05

Flow unloading central position Δp = 5 bar/control edge			A→T	B→T	A→T	B→T	A→T	B→T	A→T	B→T	A→T	B→T
	▶ Symbol W6-	l/min	2.8	2.8	4	4	6	6	6	6	25	25
	▶ Symbol W8-	l/min	2.8	1.4	4	2	6	3	6	3	25	12.5

Pilot oil volume	0 ... 100%	cm^3	1.3	2.9	6.8	6.8	33.2
Hydraulic fluid			See table page 10				
Viscosity range	▶ Recommended	mm^2/s	20 ... 100				
	▶ Maximum	mm^2/s	10 ... 800				
Hydraulic fluid temperature range (flown-through)		°C	-20 ... +70				
Maximum admissible degree of contamination of the hydraulic fluid; cleanliness class according to ISO 4406 (c)			Class 18/16/13 [4]				

[2] Flow for deviating Δp (control edge):

$$q_x = q_{Vnom} \times \sqrt{\frac{\Delta p_x}{5}}$$

[3] At port X and Y with stepped input signal from 0 ... 100% (pilot pressure 100 bar)

[4] The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and simultaneously increases the life cycle of the components.

Explanation of the footnotes see page 10.

Technical data
(For applications outside these values, please consult us!)

Hydraulic fluid		Classification	Suitable sealing materials	Standards	Data sheet
Mineral oils		HL, HLP	NBR, FKM	DIN 51524	90220
Bio-degradable	▶ Insoluble in water	HETG	FKM	ISO 15380	90221
		HEES	FKM		
	▶ Soluble in water	HEPG	FKM	ISO 15380	
Flame-resistant	▶ Water-free	HFDU (glycol base)	FKM	ISO 12922	90222
		HFDU (ester base)	FKM		
		HFDR	FKM		
	▶ Containing water	HFC (Fuchs: Hydrotherm 46M, Renosafe 500; Petrofer: Ultra Safe 620; Houghton: Safe 620; Union: Carbide HP5046)	NBR	ISO 12922	90223

Important notices on hydraulic fluids:
- For further information and data on the use of other hydraulic fluids, please refer to the data sheets above or contact us.
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.).
- The ignition temperature of the hydraulic fluid used must be 50 K higher than the maximum surface temperature.
- **Bio-degradable and flame-resistant – containing water:** If components with galvanic zinc coating (e.g. version "J3" or "J5") or parts containing zinc are used, small amounts of dissolved zinc may get into the hydraulic system and cause accelerated aging of the hydraulic fluid. Zinc soap may form as a chemical reaction product, which may clog filters, nozzles and solenoid valves - particularly in connection with local heat input.
- **Flame-resistant – containing water**:
  - Due to the increased cavitation tendency with HFC hydraulic fluids, the life cycle of the component may be reduced by up to 30 % as compared to the use with mineral oil HLP. In order to reduce the cavitation effect, it is recommended - if possible specific to the installation - to back up the return flow pressure in ports T to approx. 20 % of the pressure differential at the component.
  - Dependent on the hydraulic fluid used, the maximum ambient and hydraulic fluid temperature must not exceed 50 °C. In order to reduce the heat input into the component, the command value profile is to be adjusted for proportional and high-response valves.

Static/dynamic							
Size		NG	10	16	25	27	35
Hysteresis		%	< 0.1				
Response sensitivity		%	< 0.05				
Range of inversion		%	< 0.08				
Manufacturing tolerance q_{Vmax}		%	≤ 10				
Actuating time for 0 ... 100% at X=210 bar	▶ Symbols E, E1-, W6-, W8-	ms	25	37	36	36	55
Switch-off behavior (after electric shut-off)	▶ Symbols E, E1-, W6-, W8-		Pilot control valve in fail-safe position, main valve moves to overlapped spring-centered central position				
	▶ Symbol V, V1-		Pilot control valve in fail-safe position, main valve moves to spring-centered "offset position" (approx. 6%, P→B/A→T)				
	▶ Symbol Q3		Pilot control valve in fail-safe position, main valve moves to spring-centered "offset position" (P blocked, A/B to port T open)				
Temperature drift (temperature range 20 °C ... 80 °C)		%/10 °C	Zero shift < 0.25				
Zero compensation			Ex plant ±1%				

Technical data
(For applications outside these values, please consult us!)

Electrical, integrated electronics (OBE) – Interface “A1” and “F1”		
Relative duty cycle	%	100 (continuous operation)
Protection class according to EN 60529		IP 65 with mounted and locked plug-in connectors
Supply voltage	VDC	24
▶ Terminal A	VDC	min. 19 / max. 36
▶ Terminal B	VDC	0
Maximum admissible residual ripple	Vpp	2.5
Maximum power consumption	VA	40
Fuse protection, external	A_T	2.5 (time-lag)
Input, version "A1"		Differential amplifier, R_i = 100 kΩ
▶ Terminal D (U_E)	VDC	0 ... ±10
▶ Terminal E	VDC	0
Input, version "F1"		Load, R_{sh} = 200 Ω
▶ Terminal D (I_{D-E})	mA	4 ... 20
▶ Terminal E (I_{D-E})		Current loop I_{D-E} feedback
Maximum voltage of the differential inputs against 0 V		D → B; E → B (max. 18 V)
Test signal, version "A1"		LVDT
▶ Terminal F (U_{Test})	V	0 ... ±10
▶ Terminal C		Reference 0 V
Test signal, version "F1"		LVDT signal 4 ... 20 mA on external load 200 ... 500 Ω maximum
▶ Terminal F (I_{F-C})	mA	4 ... 20
▶ Terminal C (I_{F-C})		Current loop I_{F-C} feedback
Functional ground and screening		See page 13 (EMC-compliant installation)
Adjustment		Calibrated in the plant, see valve characteristic curves page 15 ... 32

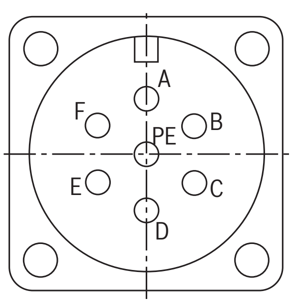
Electrical, integrated electronics (OBE) – Interface “L1”			
Relative duty cycle		%	100 (continuous operation)
Protection class according to EN 60529			IP 65 with mounted and locked plug-in connectors
Supply voltage	▶ Valve amplifier	VDC	24
	– Pin 2	VDC	min. 18 / max. 30
	– Pin 5	VDC	0
	▶ IO-Link interface	VDC	24
	– Pin 1	VDC	min. 18 / max. 30
	– Pin 3	VDC	0
Maximum current consumption	▶ Valve amplifier	A	2
	▶ IO-Link interface	mA	50
Maximum residual ripple		Vpp	1.3
Maximum current consumption		mA	50
Minimum process cycle time		ms	0.6
Bit rate COM3		kBaud (kbit/s)	230.4
Required master port class			Class B
Resolution	▶ A/D transformer	bit	12 (110% valve opening)
	▶ D/A transformer	bit	12 (110% valve opening)
Functional ground			Provide via valve block
Adjustment			Calibrated in the plant
Directive			IO-Link Interface and System Specification Version 1.1.2

Technical data
(For applications outside these values, please consult us!)

Electrical, integrated control electronics (OBE) – Interface “C6”		
Relative duty cycle	%	100 (continuous operation)
Protection class according to EN 60529		IP 65 with mounted and locked plug-in connectors
Supply voltage	VDC	24
▶ Terminal A	VDC	min. 19 / max. 36
▶ Terminal B	VDC	0
Maximum admissible residual ripple	Vpp	2.5
Maximum power consumption	VA	40
Fuse protection, external	A_T	2.5 (time-lag)
Input		Load, R_{sh} = 200 Ω
▶ Terminal D (I_{D-E})	mA	0 ... ±10
▶ Terminal E (I_{D-E})		Current loop I_{D-E} feedback
Test signal		LVDT signal 4 ... 20 mA on external load 200 ... 500 Ω maximum
▶ Terminal F (I_{F-B})	mA	4 ... 20
▶ Terminal B (I_{F-B})		Current loop I_{F-B} feedback
Functional ground and screening		See page 13 (EMC-compliant installation)
Adjustment		Calibrated in the plant, see valve characteristic curves page 15 ... 32

Electrical connections and assignment

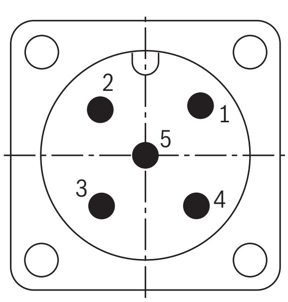
Contact	Interface assignment		
	"A1" (6 + PE)	**"F1"** (6 + PE)	**"C6"** (6 + PE)
A	24 VDC supply voltage		
B	GND		GND, reference potential actual value/enable
C	Reference potential actual value	Reference potential actual value	Enable input 24 VDC (high ≥ 11 V, low ≤ 5 V)
D	Command value ±10 V (***Re*** > 100 kΩ)	Command value 4 ... 20 mA (***Re*** = 200 Ω)	Command value ±10 mA (***Re*** = 200 Ω)
E	Reference potential command value	Reference potential command value	Reference potential command value
F	Actual value ±10 V (***Ri*** ≈ 1 kΩ)	Actual value 4 ... 20 mA (Load max. 500 Ω)	Actual value 4 ... 20 mA (Load max. 500 Ω)
FE	Functional ground (directly connected to the valve housing)		

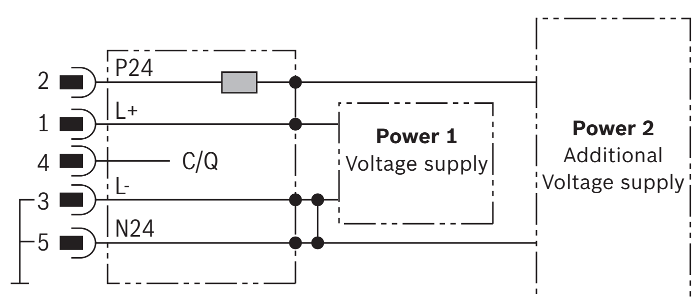


Command value:	▶ Positive command value (0 ... 10 V or 12 ... 20 mA) at D and reference potential at E cause flow from P → A and B → T.
	▶ Negative command value (0 ... –10 V or 12 ... 4 mA) at D and reference potential at E cause flow from P → B and A → T.
Connection cable:	▶ Up to 20 m cable length type LiYCY 7 x 0.75 mm²
	▶ Up to 40 m cable length type LiYCY 7 x 1.0 mm²
	▶ EMC-compliant installation: – Apply screening to both line ends – Use metal mating connector (see page 39) ▶ Alternatively up to 30 m cable length admissible – Apply screening on supply side – Plastic mating connector (see page 39) can be used

Notice:
Mating connectors, separate order, see page 39 and data sheet 08006.

Connector pin assignment "L1" (M12-5, A-coded, class B)



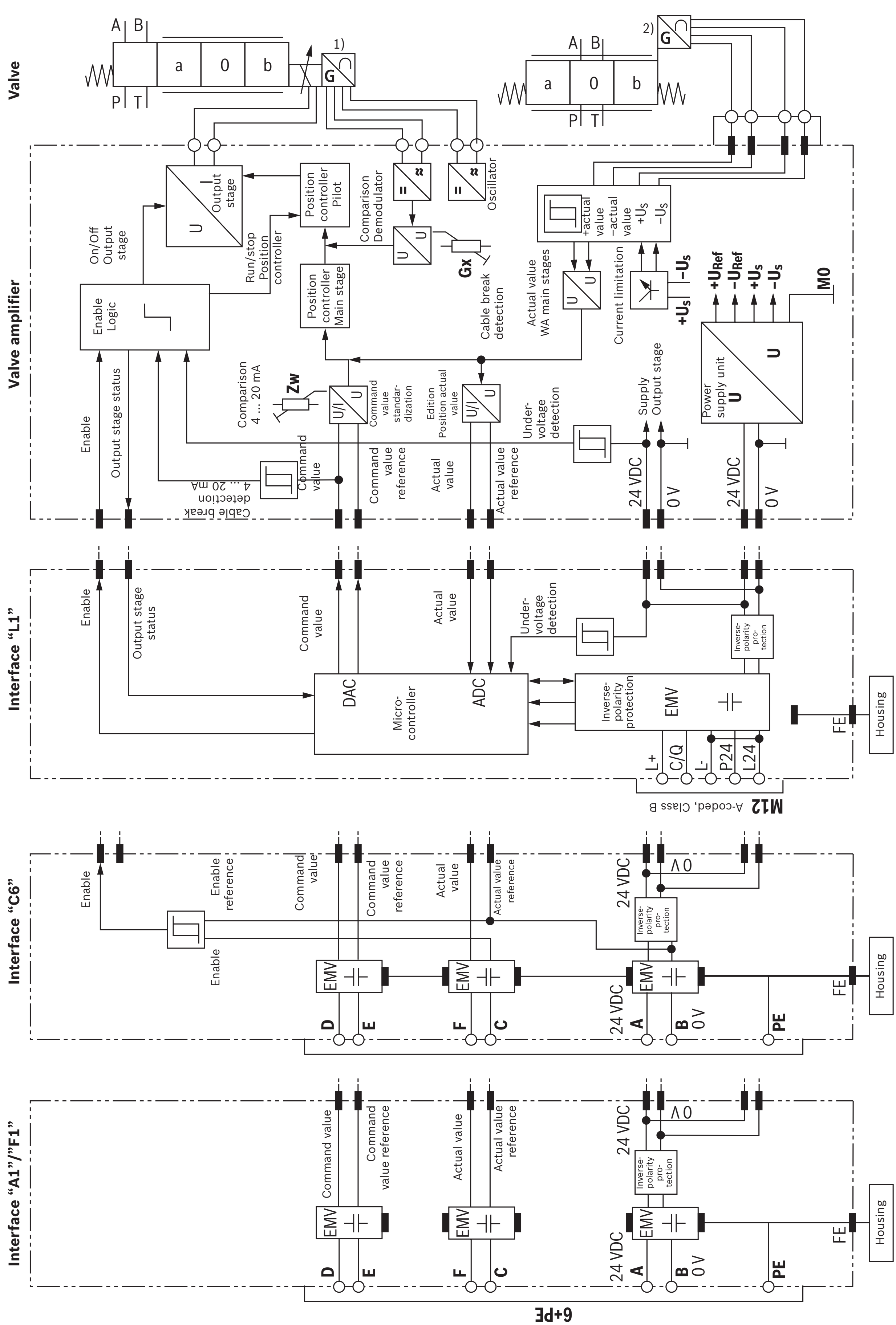


Notices:
- ▶ M12 sensor/actuator connection line, 5-pole; M12 connector/bush, A-coded, without shield, maximum cable length 20 m. Observe the voltage drop over the cable. Wire cross-section at least 0.34 mm².
- ▶ Mating connectors, separate order, see page 39 and data sheet 08006.
- ▶ Communication and parameter description see data sheet 29400-PA

Pin	Signal	Allocation interface L1
1	L+	Voltage supply IO-Link
2	P24	Voltage supply valve electronics and power part (current consumption 2 A)
3	L-	Reference potential pin 1 [1)]
4	C/Q	Data line IO-Link (SDCI)
5	N24	Reference potential pin 2 [1)]

[1)] Pin 3 and 5 are linked with each other in the valve electronics. The reference potentials L- and N24 of the two supply voltages must also be linked with each other on the power supply unit side.

Block diagram/controller function block



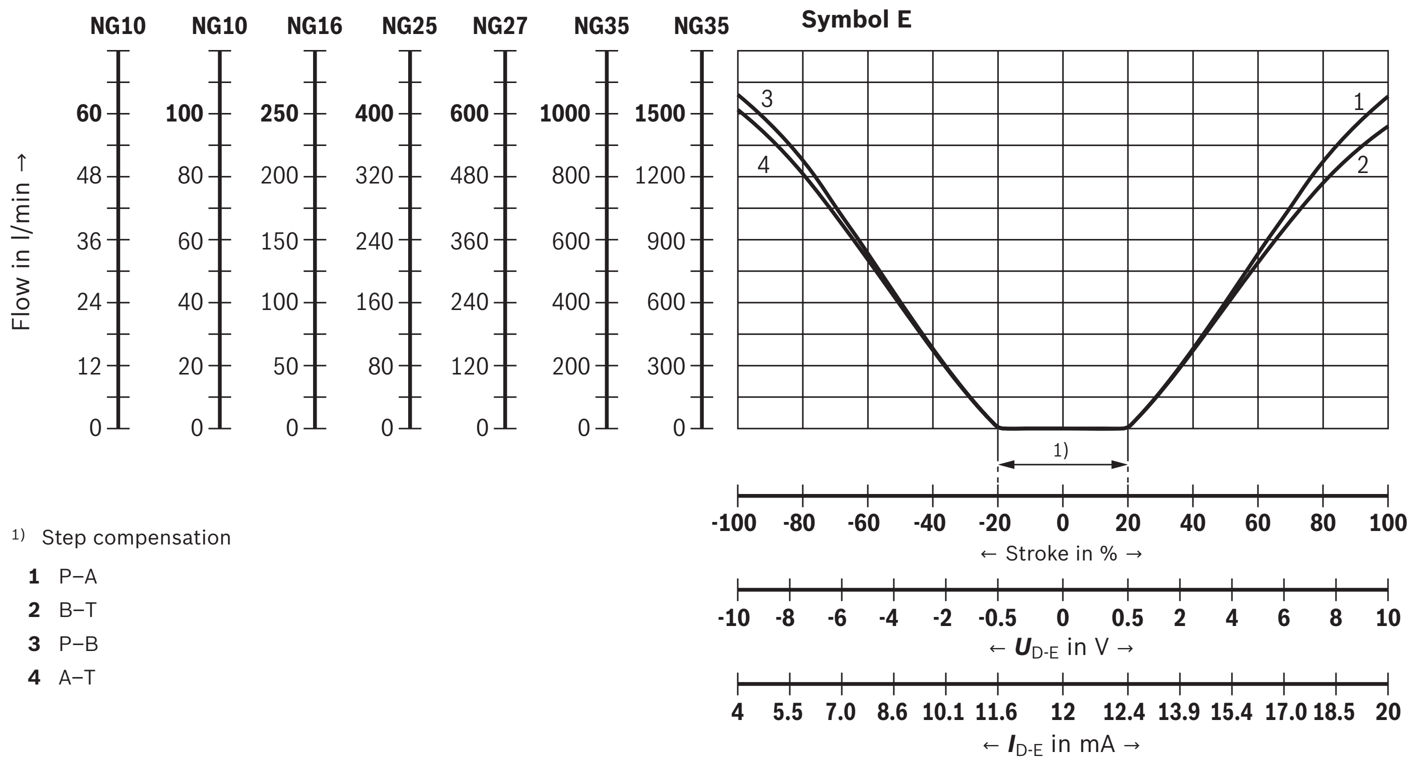
☞ **Notices:**

- Electrical signals provided via control electronics (e.g. actual value) must not be used for switching off safety-relevant machine functions.
- The setting of the potentiometer at the factory must not be changed.

1) Position transducer, pilot control valve
2) Position transducer, main valve

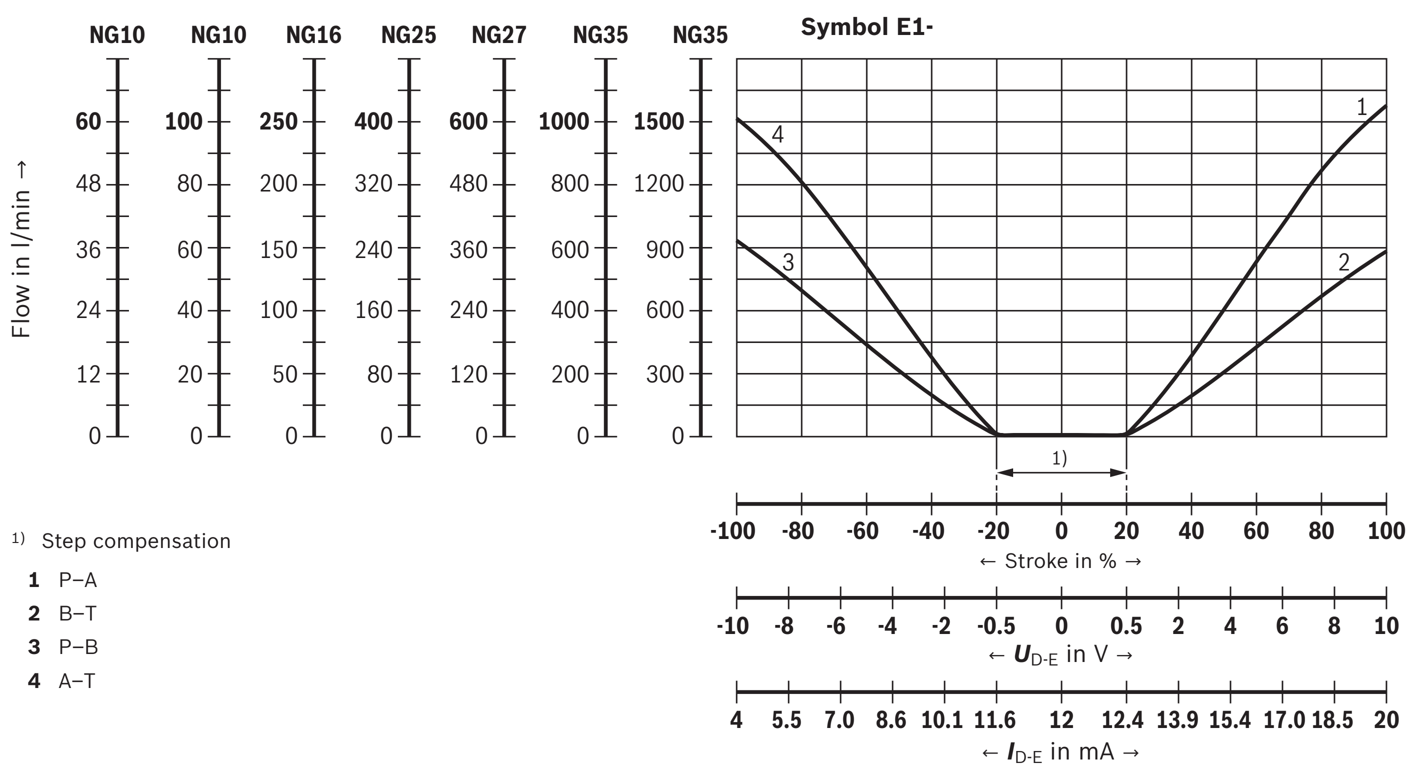
Characteristic curves: Flow characteristic “L”
(valid for HLP46, ϑ_{oil} = 40 ±5 °C; Δp = 5 bar/control edge)

Flow/signal function



[1] Step compensation

1 P–A
2 B–T
3 P–B
4 A–T

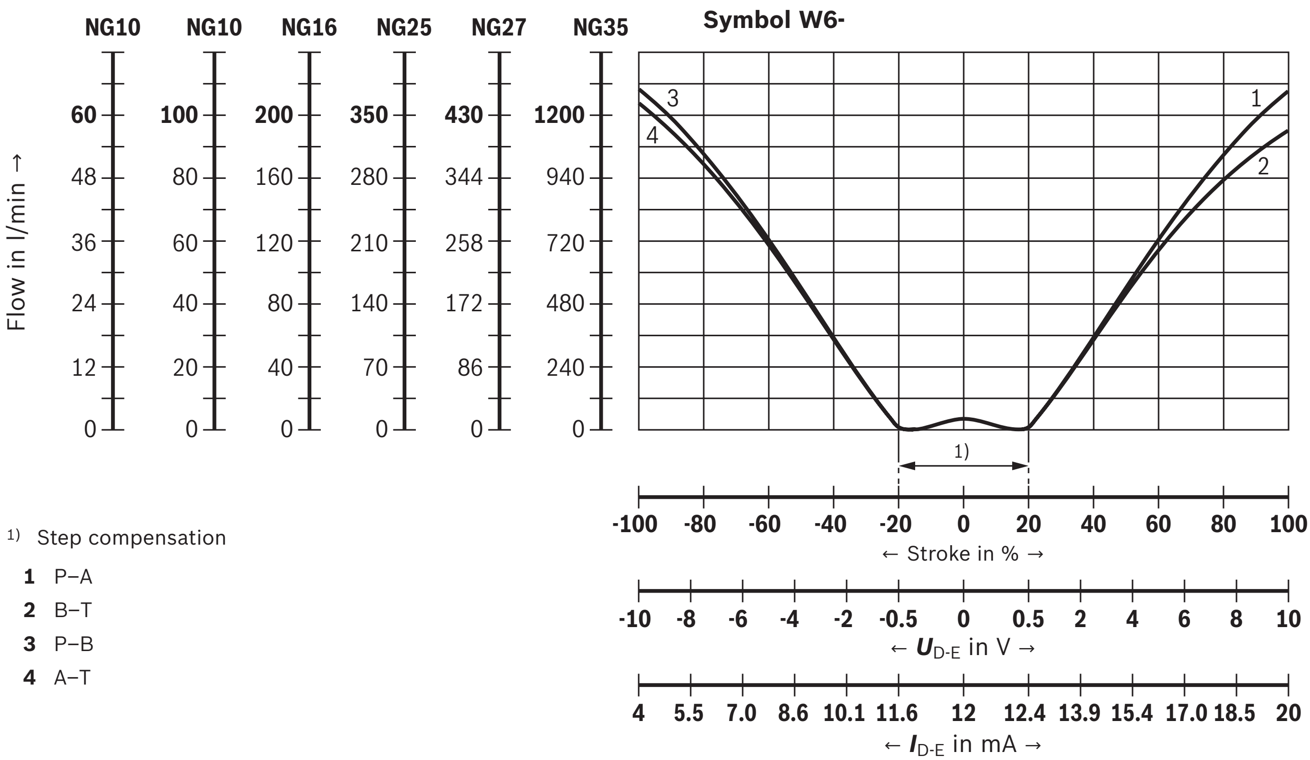


[1] Step compensation

1 P–A
2 B–T
3 P–B
4 A–T

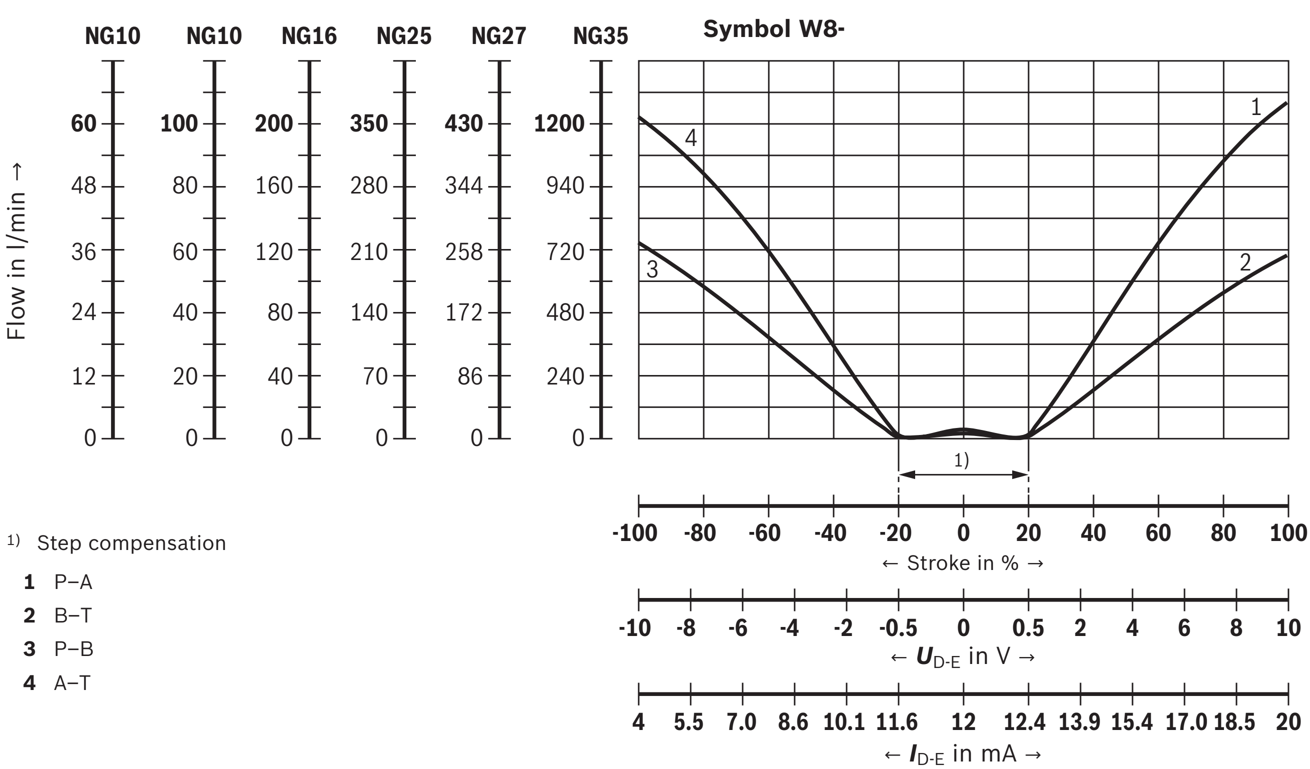
Characteristic curves: Flow characteristic “L”
(valid for HLP46, ϑ_{oil} = 40 ±5 °C; Δp = 5 bar/control edge)

Flow/signal function



1) Step compensation

- **1** P–A
- **2** B–T
- **3** P–B
- **4** A–T

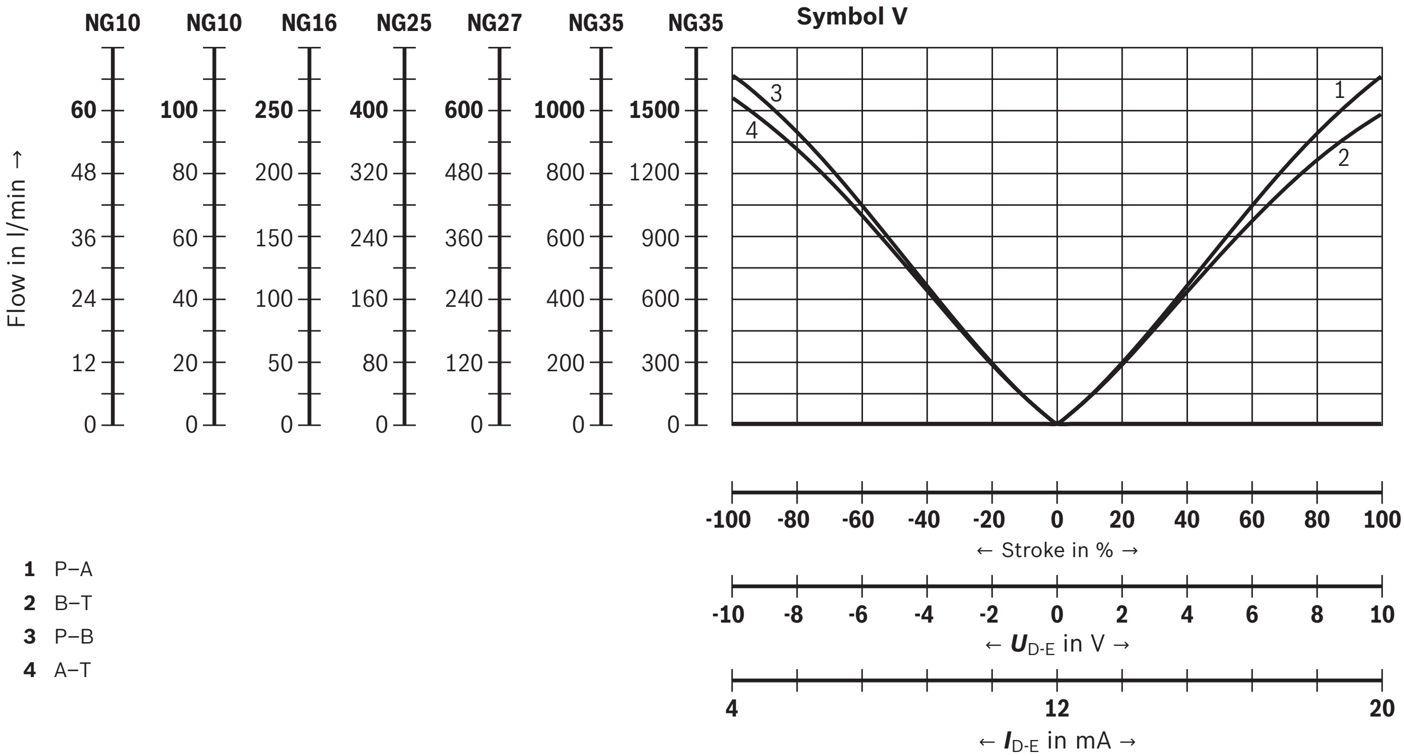


1) Step compensation

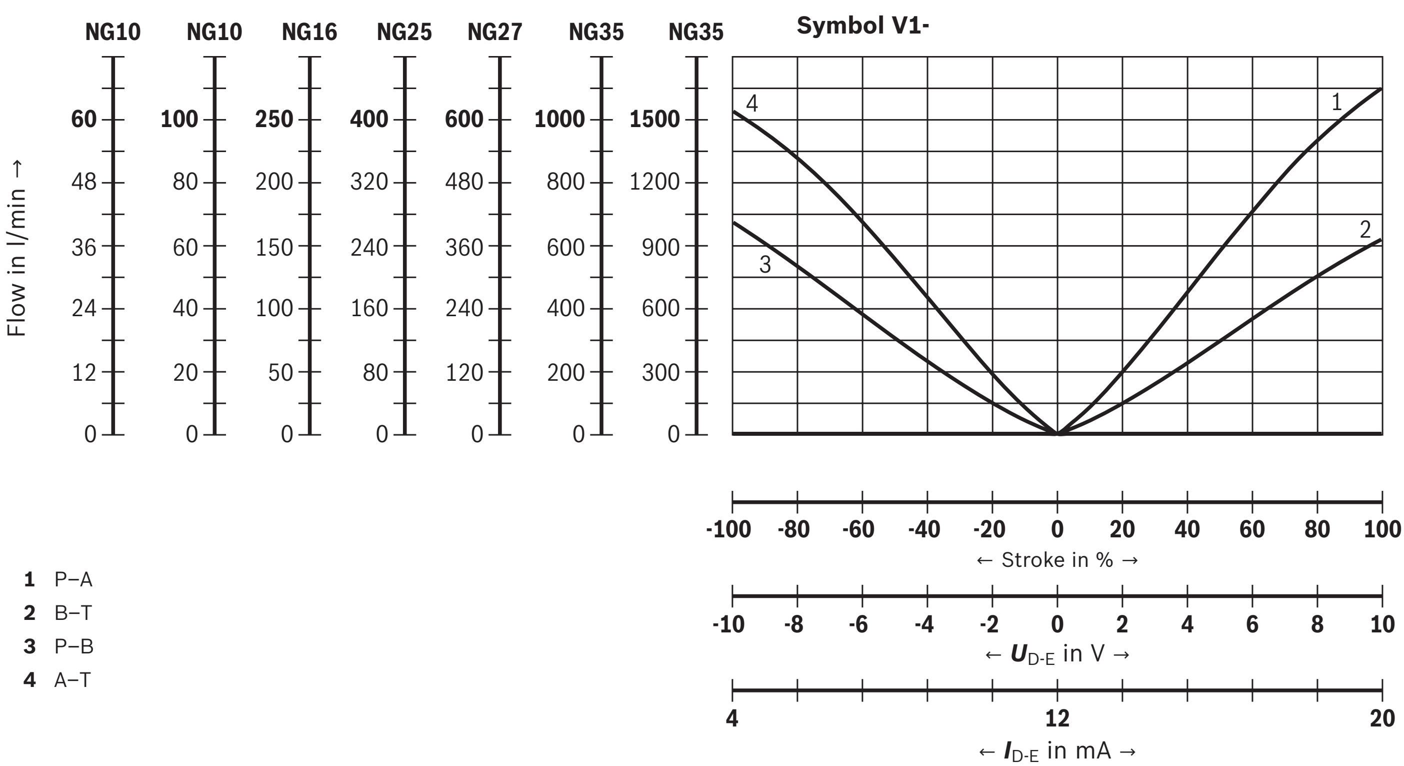
- **1** P–A
- **2** B–T
- **3** P–B
- **4** A–T

Characteristic curves: Flow characteristic "L"
(valid for HLP46, ϑ_{oil} = 40 ±5 °C; Δp = 5 bar/control edge)

Flow/signal function



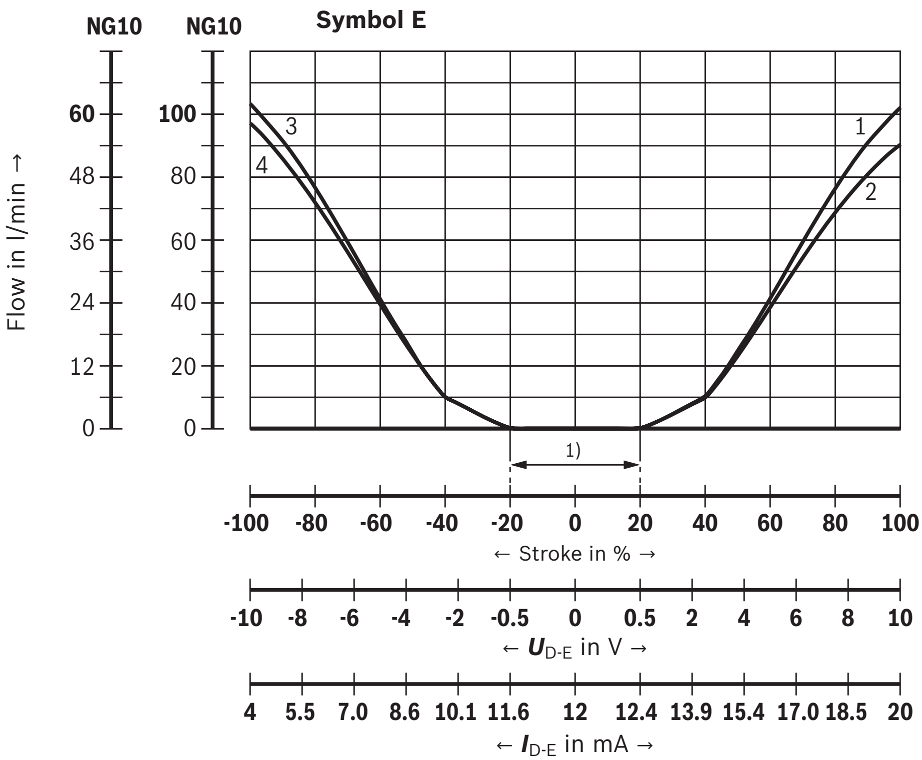
1 P–A
2 B–T
3 P–B
4 A–T



1 P–A
2 B–T
3 P–B
4 A–T

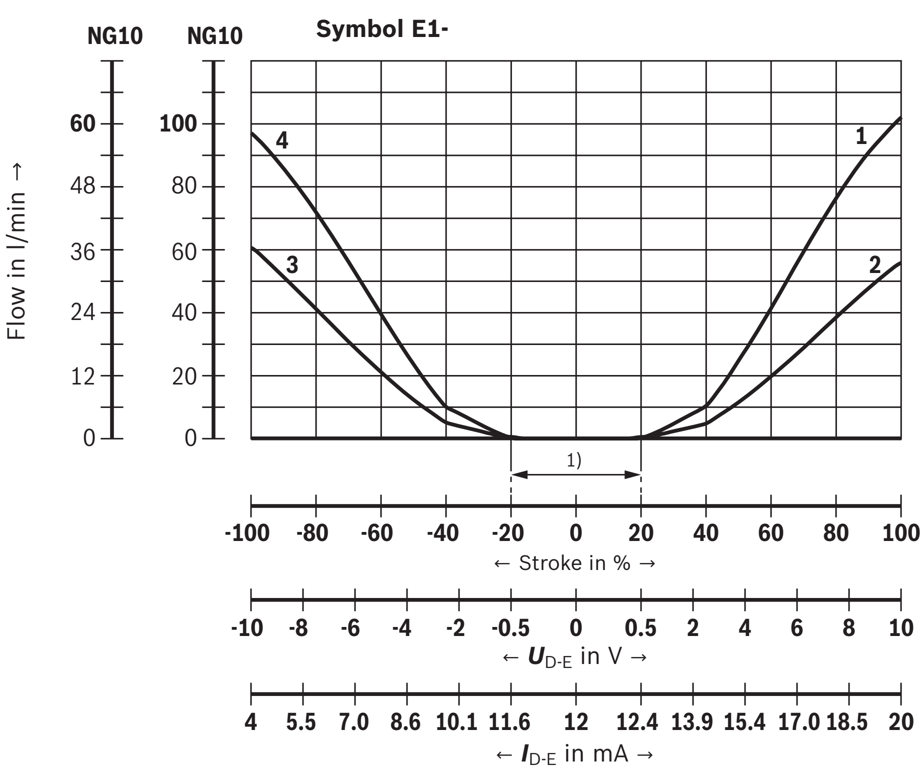
Characteristic curves: Flow characteristic "P"
(valid for HLP46, ϑ_{oil} = 40 ±5 °C; Δp = 5 bar/control edge)

Flow/signal function



1) Step compensation

1 P–A
2 B–T
3 P–B
4 A–T

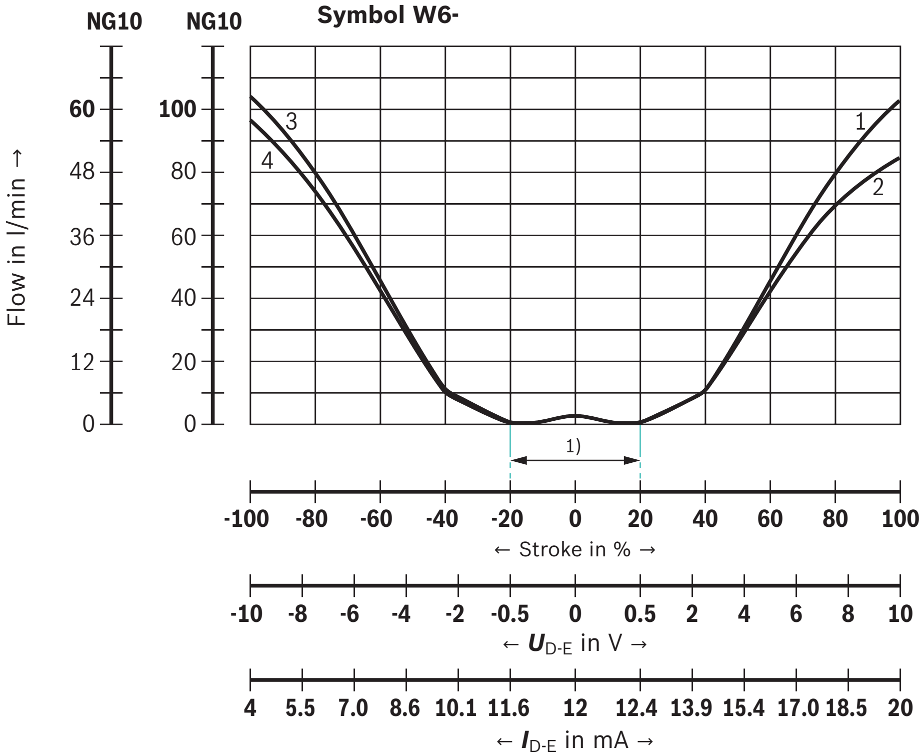


1) Step compensation

1 P–A
2 B–T
3 P–B
4 A–T

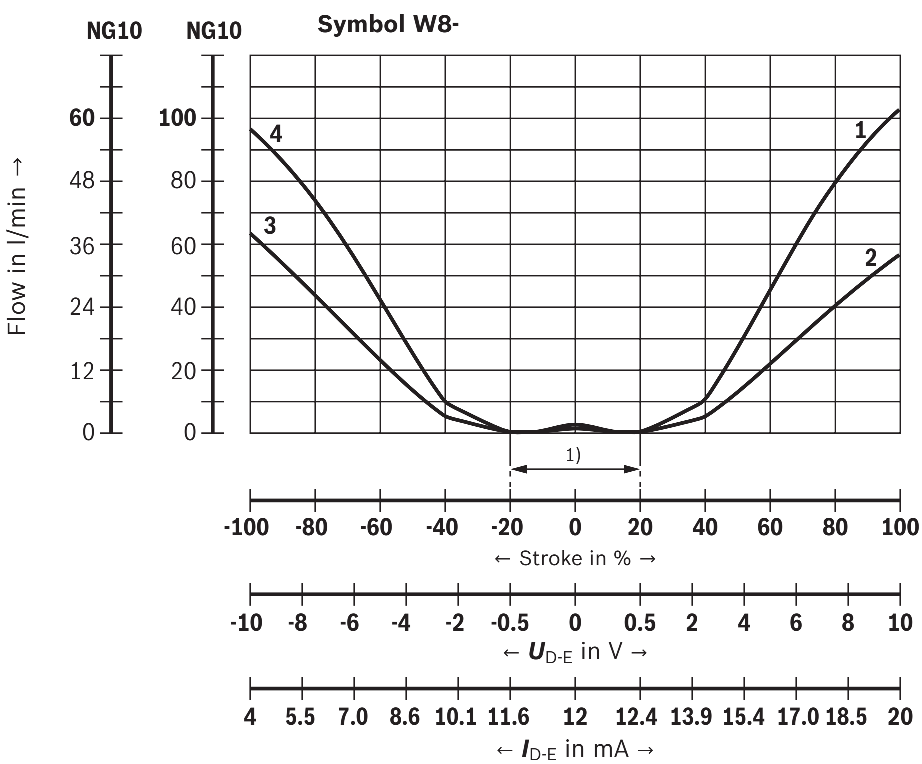
Characteristic curves: Flow characteristic “P”
(valid for HLP46, ϑ_{oil} = 40 ±5 °C; Δp = 5 bar/control edge)

Flow/signal function



1) Step compensation

1 P–A
2 B–T
3 P–B
4 A–T

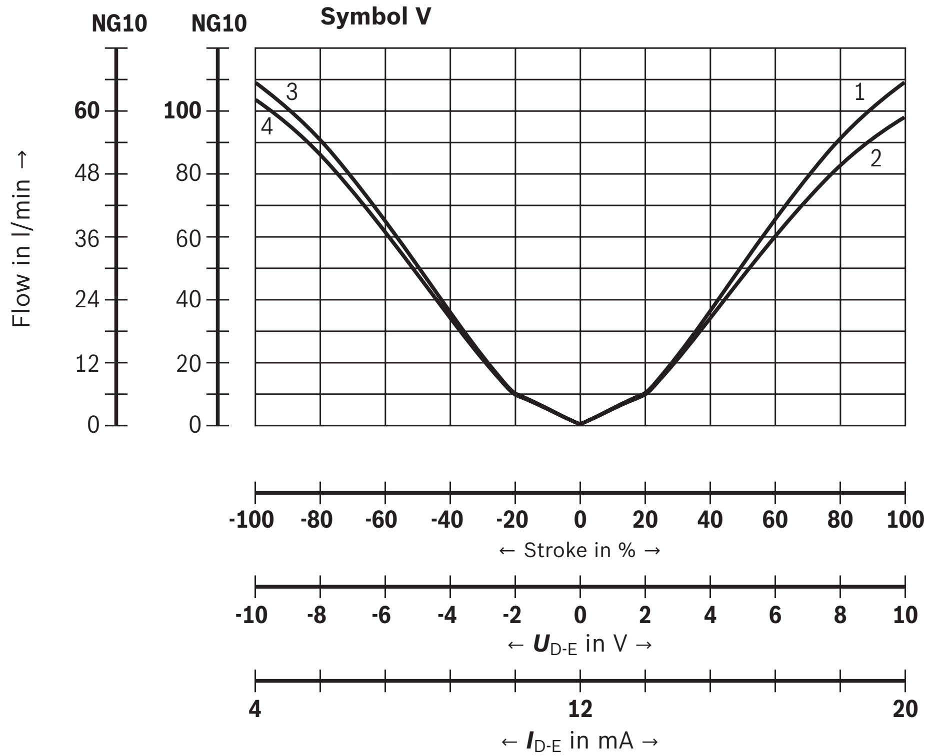


1) Step compensation

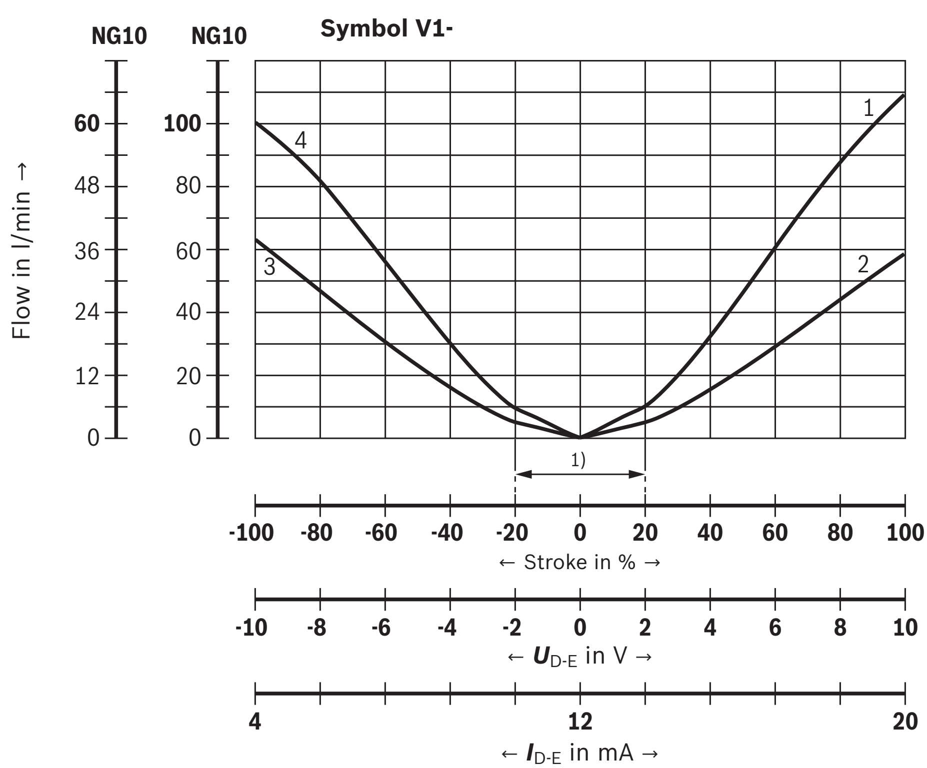
1 P–A
2 B–T
3 P–B
4 A–T

Characteristic curves: Flow characteristic “P”
(valid for HLP46, ϑ_{oil} = 40 ±5 °C; Δp = 5 bar/control edge)

Flow/signal function



1 P–A
2 B–T
3 P–B
4 A–T

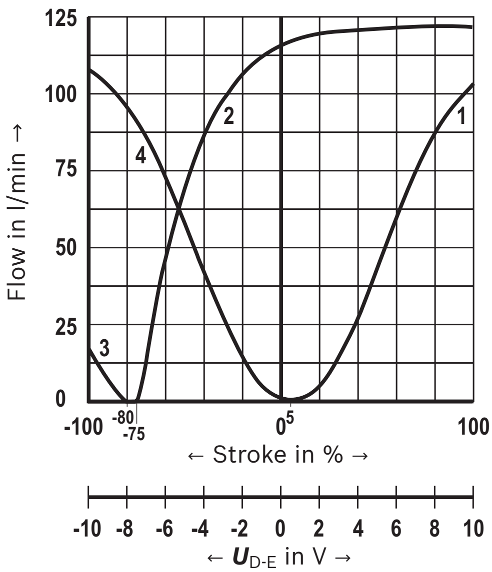


1 P–A
2 B–T
3 P–B
4 A–T

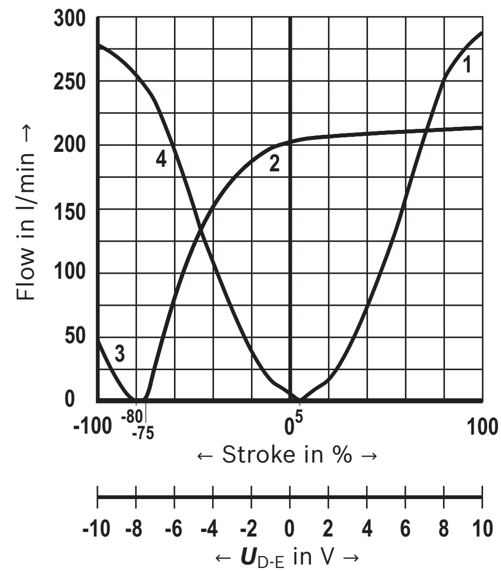
Characteristic curves: Flow characteristic "M"
(valid for HLP46, ϑ_{oil} = 40 ±5 °C; Δp = 5 bar/control edge)

Flow/signal function

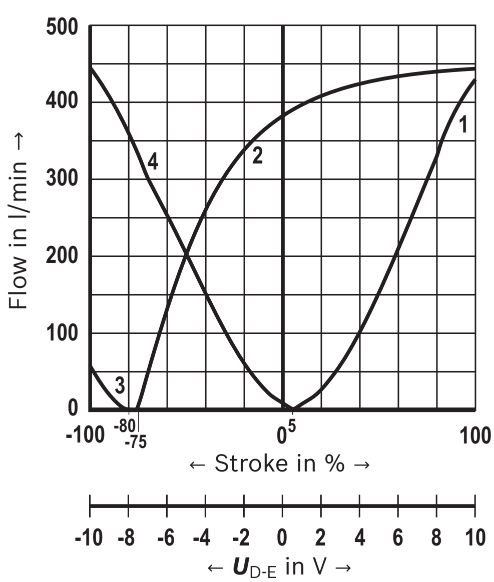
Symbol Q3, version "100"



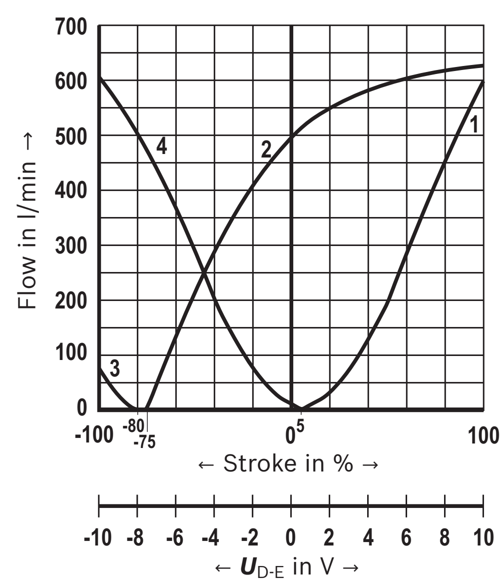
Symbol Q3, version "250"



Symbol Q3, version "400"



Symbol Q3, version "600"

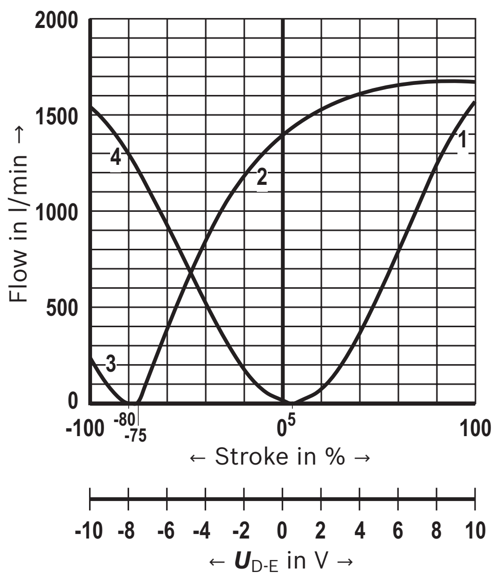


1 P–A
2 B–T
3 P–B
4 A–T

Characteristic curves: Flow characteristic "M"
(valid for HLP46, ϑ_{oil} = 40 ±5 °C; Δp = 5 bar/control edge)

Flow/signal function

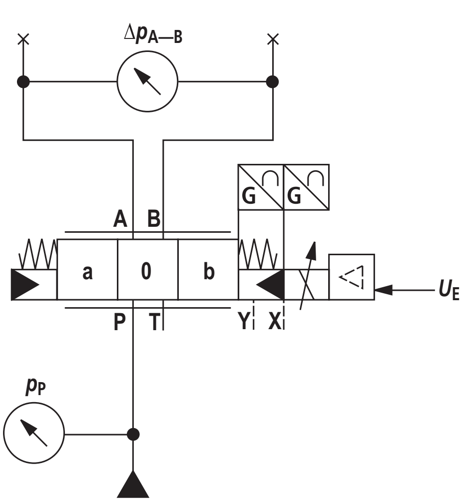
Symbol Q3, version "1500"

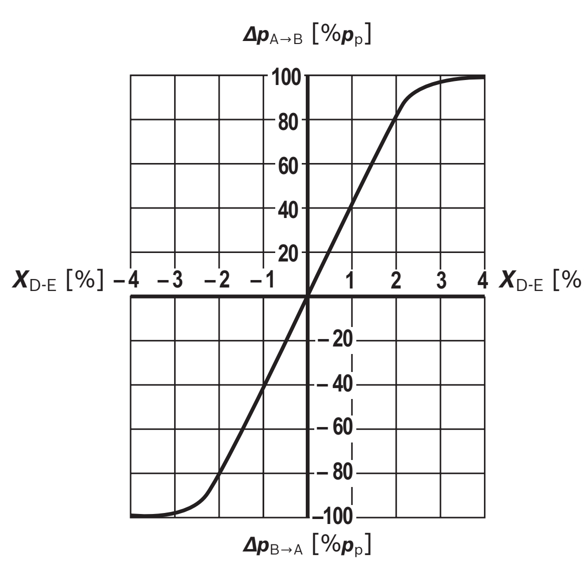


1 P–A
2 B–T
3 P–B
4 A–T

Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Pressure/signal characteristic curve

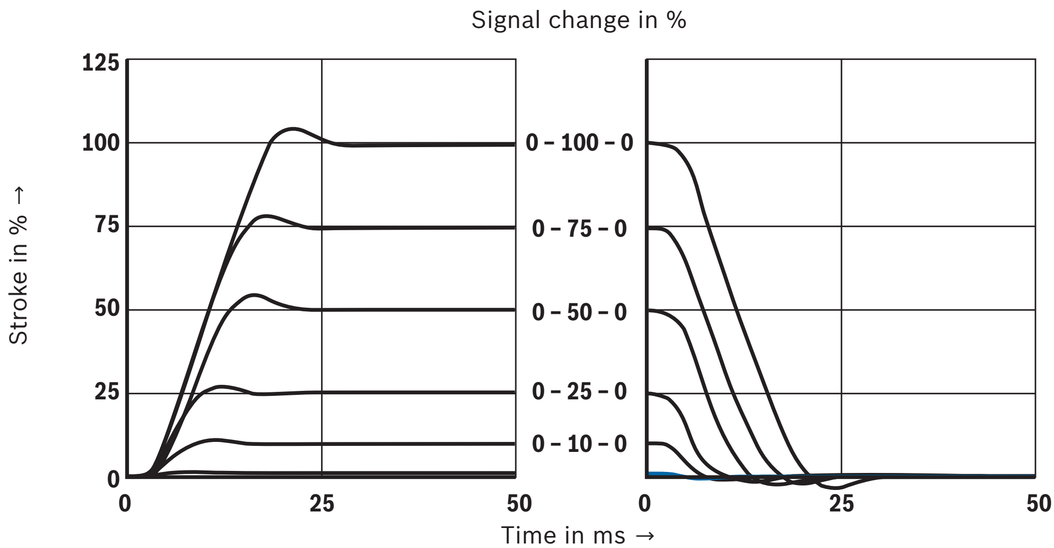




Characteristic curves: Size 10
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Transition function with stepped electric input signals

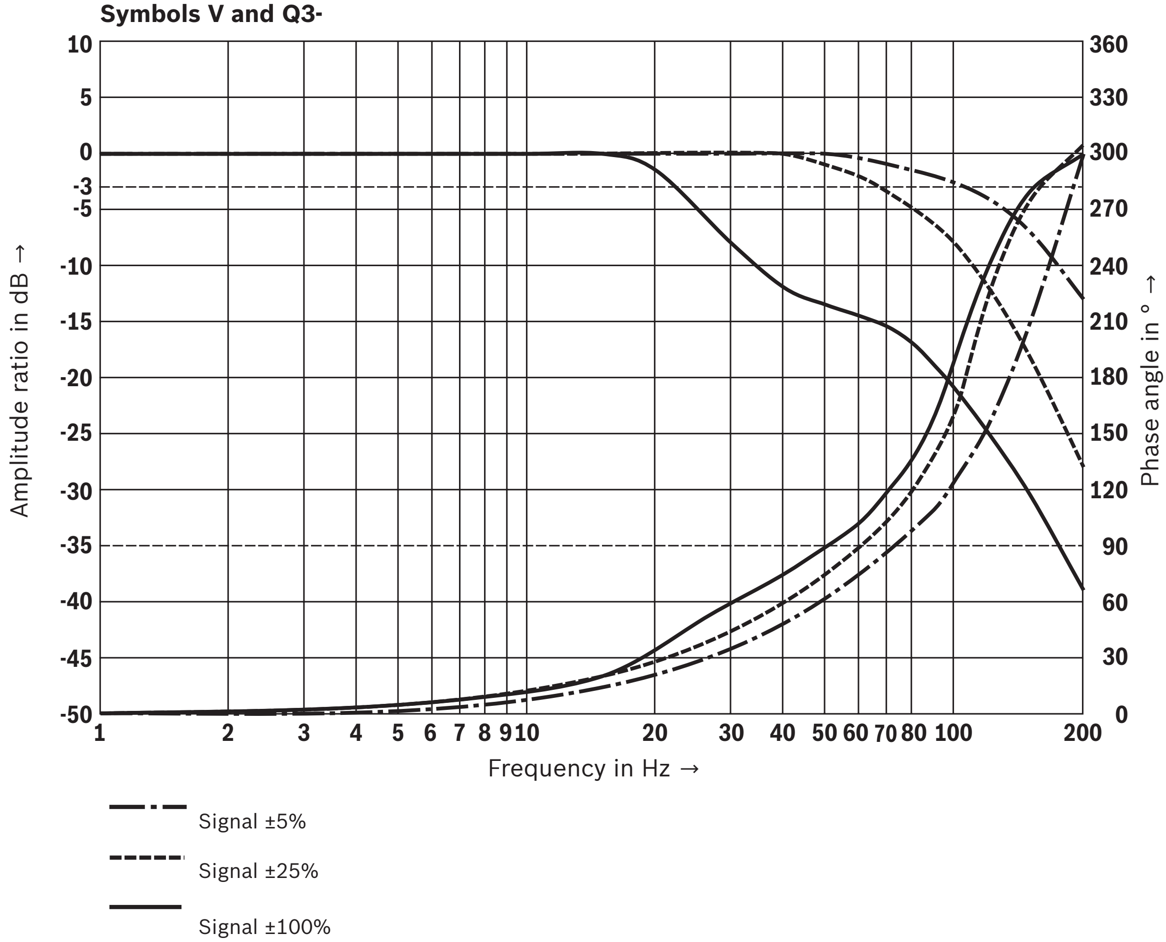
Symbols V and Q3-



- Main valve, port P = 10 bar
- Pilot control valve, port X = 210 bar

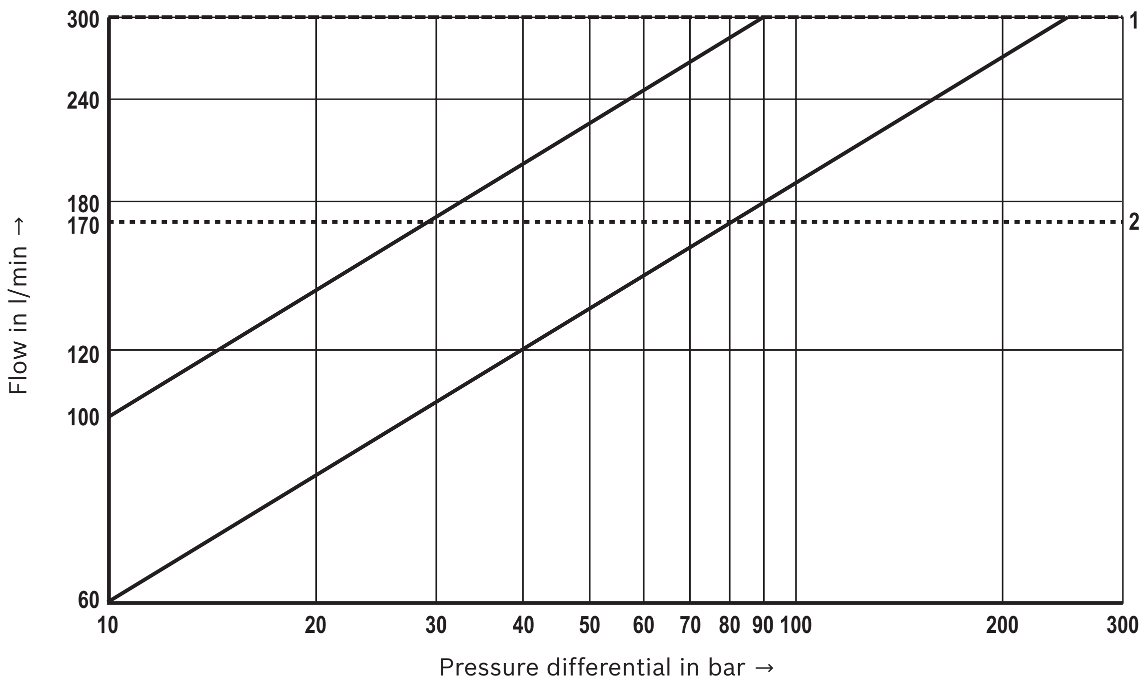
Frequency response characteristic curves

Symbols V and Q3-



Characteristic curves: Size 10
(valid for HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/load function (with maximum valve opening; tolerance ±10%)



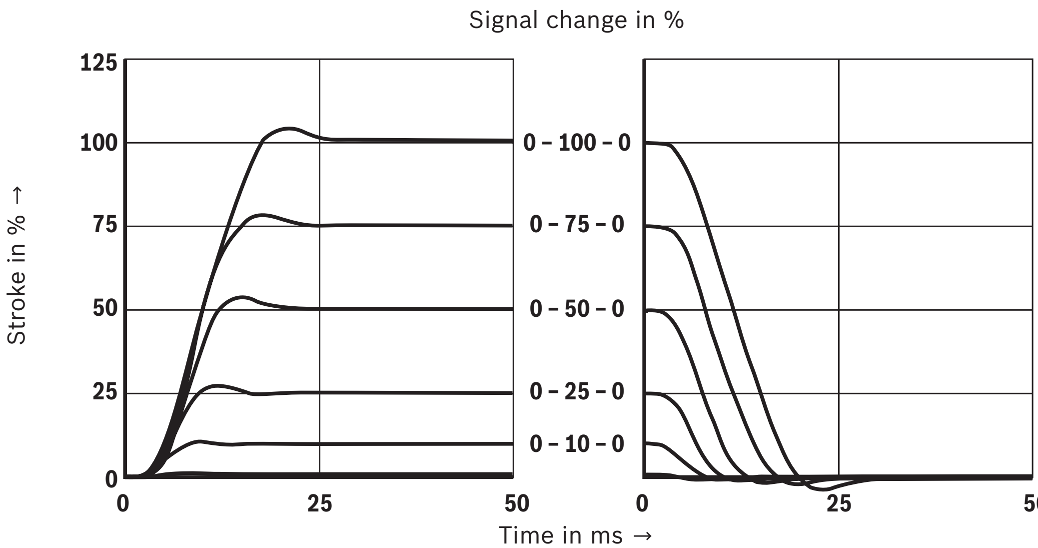
1 Maximum admissible flow

2 Recommended flow (flow velocity 30 m/s)

Characteristic curves: Size 16
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Transition function with stepped electric input signals

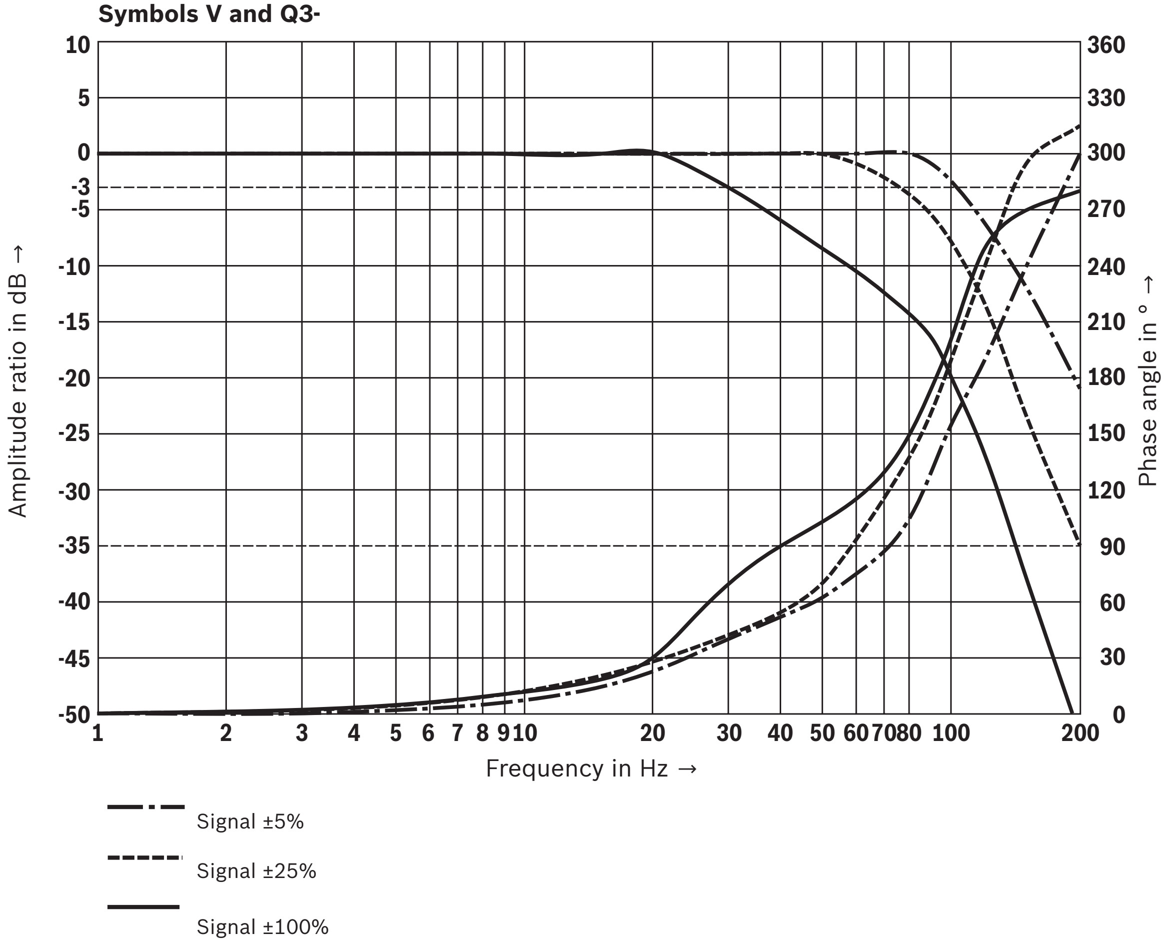
Symbols V and Q3-



- Main valve, port P = 10 bar
- Pilot control valve, port X = 210 bar

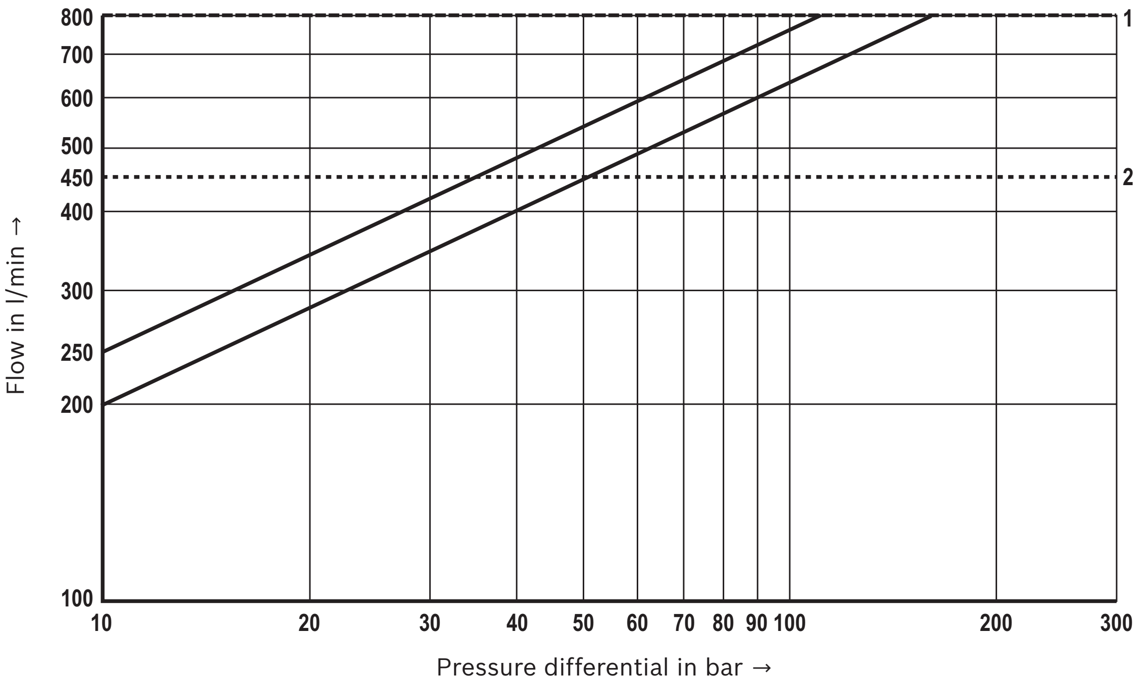
Frequency response characteristic curves

Symbols V and Q3-



Characteristic curves: Size 16
(valid for HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/load function (with maximum valve opening; tolerance ±10%)

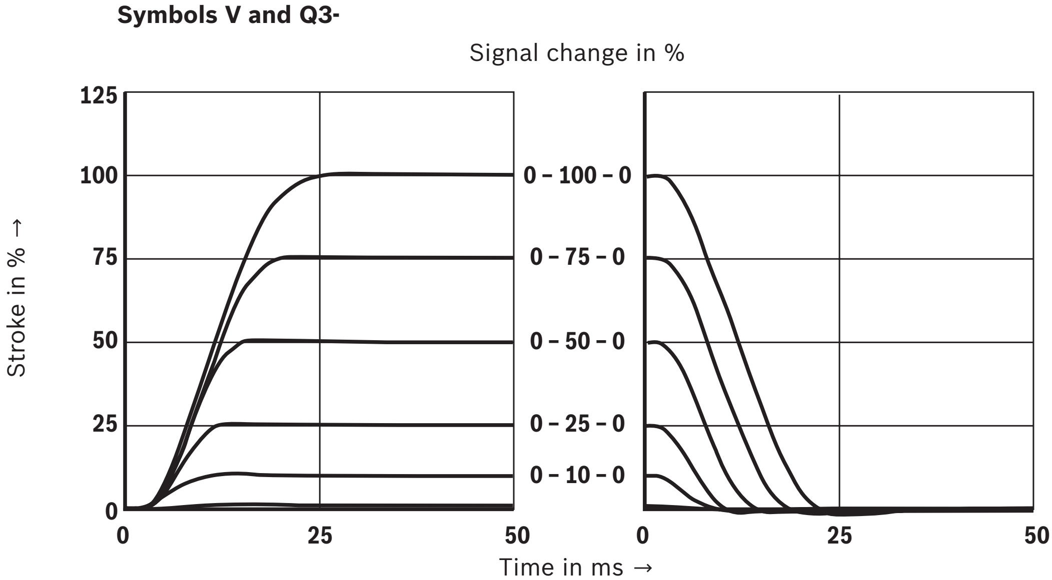


1 Maximum admissible flow

2 Recommended flow (flow velocity 30 m/s)

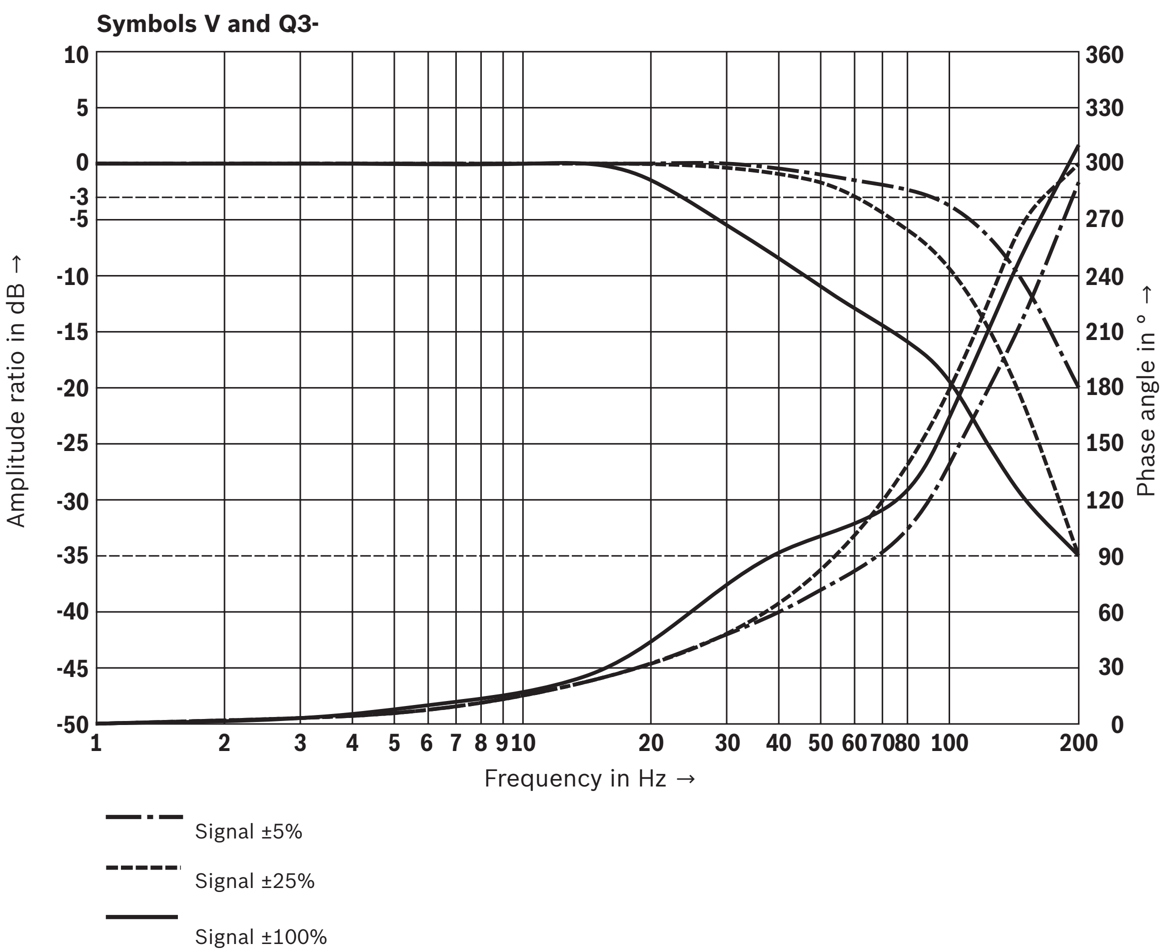
Characteristic curves: Size 25
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Transition function with stepped electric input signals



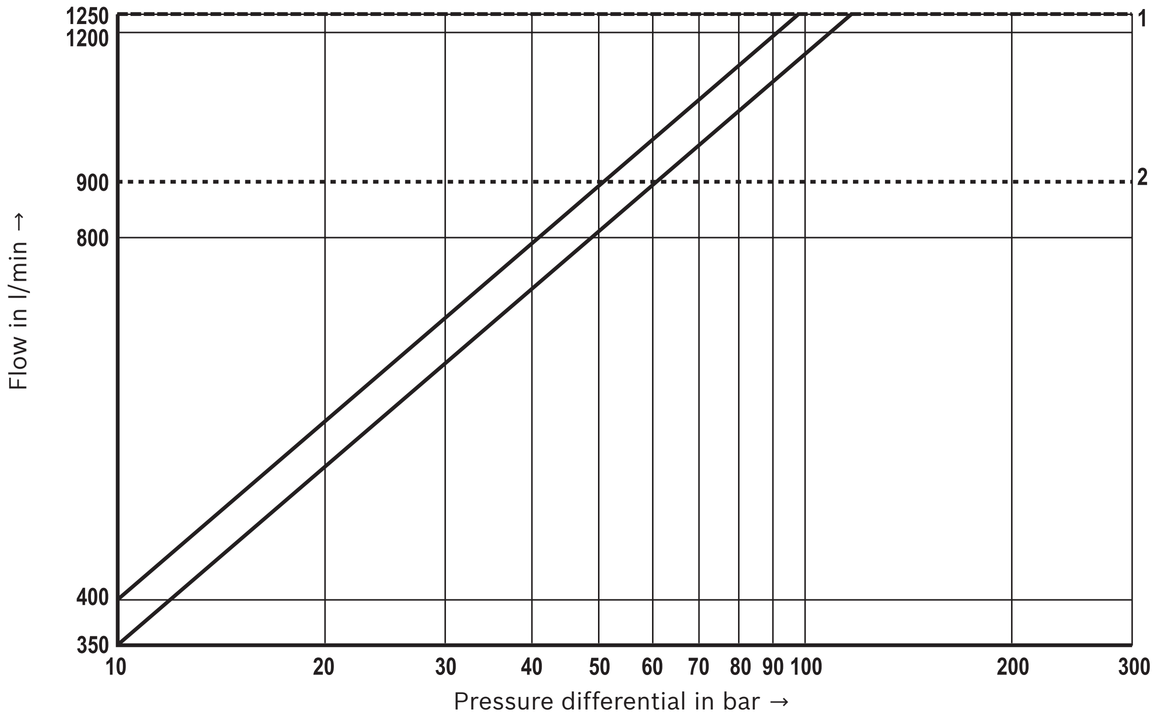
- Main valve, port P = 10 bar
- Pilot control valve, port X = 210 bar

Frequency response characteristic curves



Characteristic curves: Size 25
(valid for HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/load function (with maximum valve opening; tolerance ±10%)



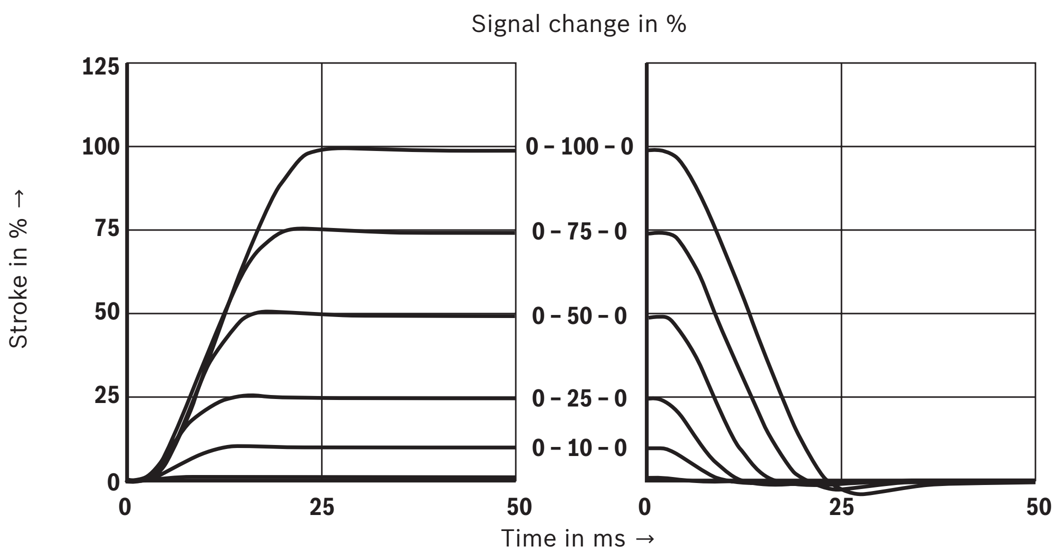
1 Maximum admissible flow

2 Recommended flow
(flow velocity 30 m/s)

Characteristic curves: Size 27
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Transition function with stepped electric input signals

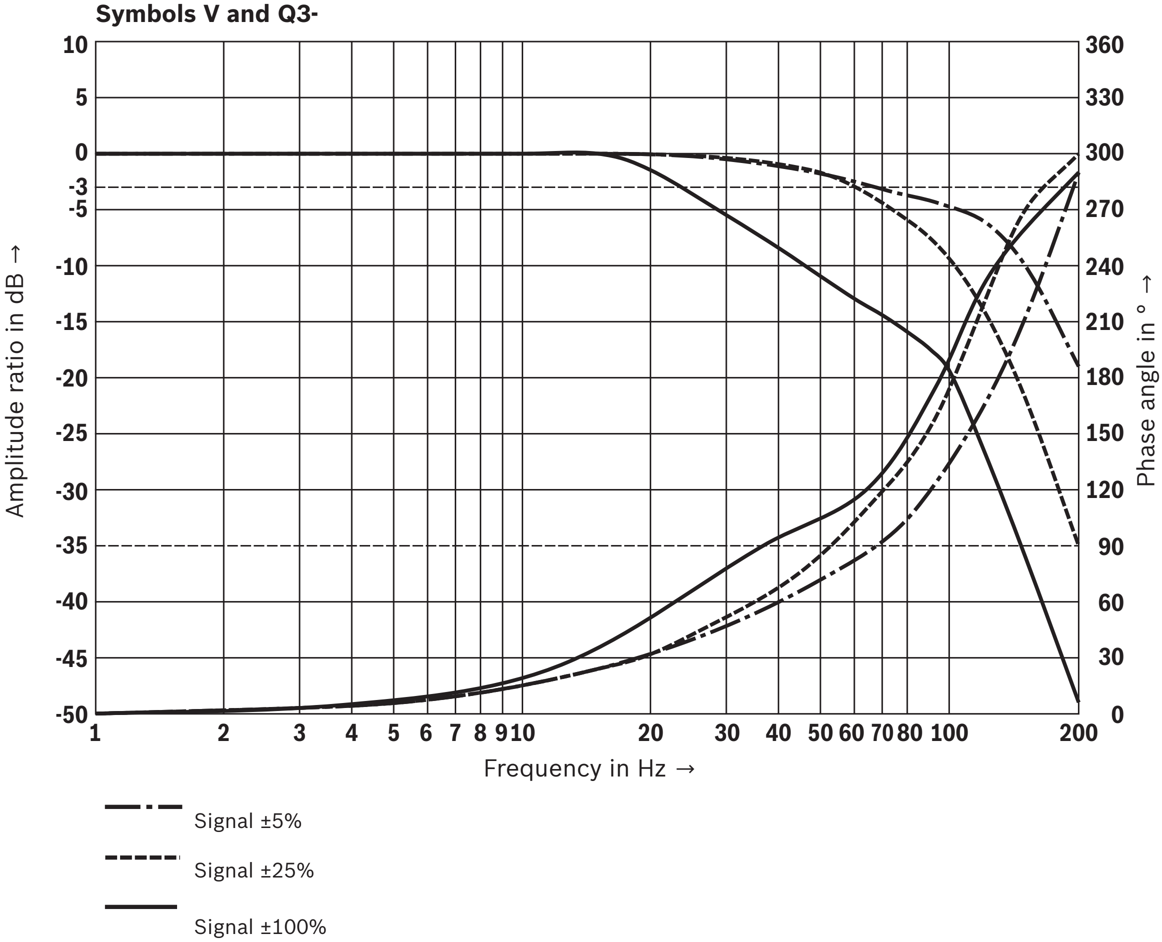
Symbols V and Q3-



- Main valve, port P = 10 bar
- Pilot control valve, port X = 210 bar

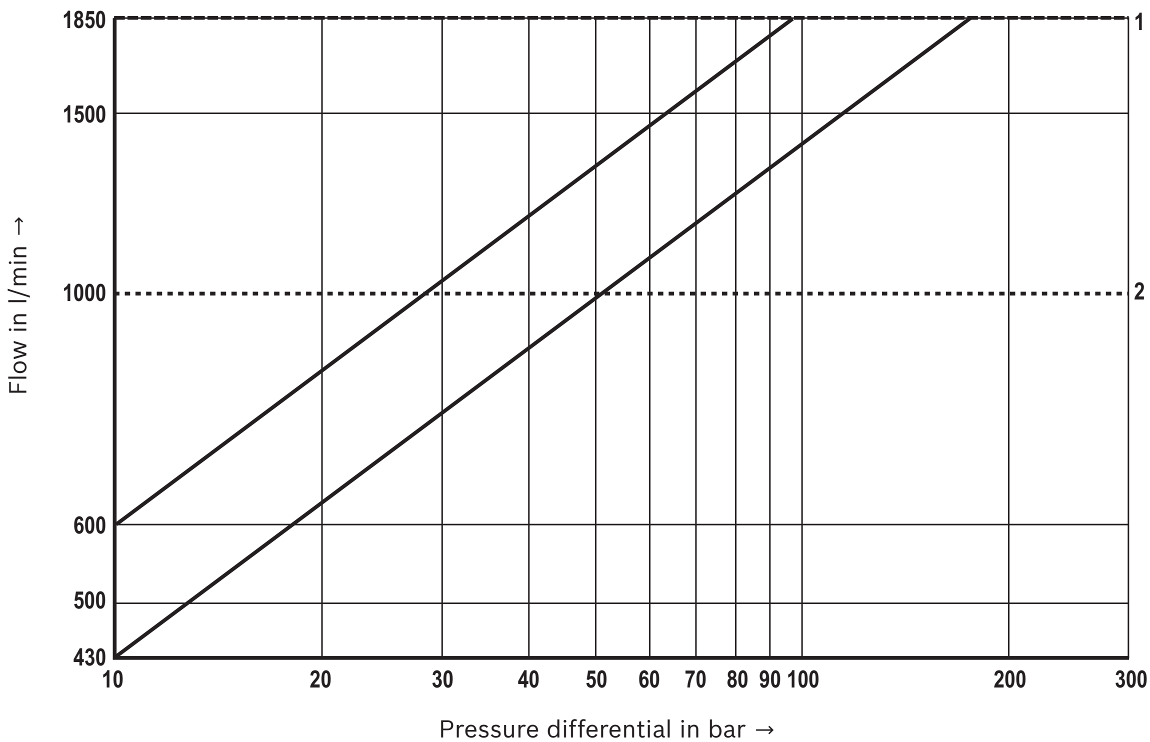
Frequency response characteristic curves

Symbols V and Q3-



Characteristic curves: Size 27
(valid for HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/load function (with maximum valve opening; tolerance ±10%)

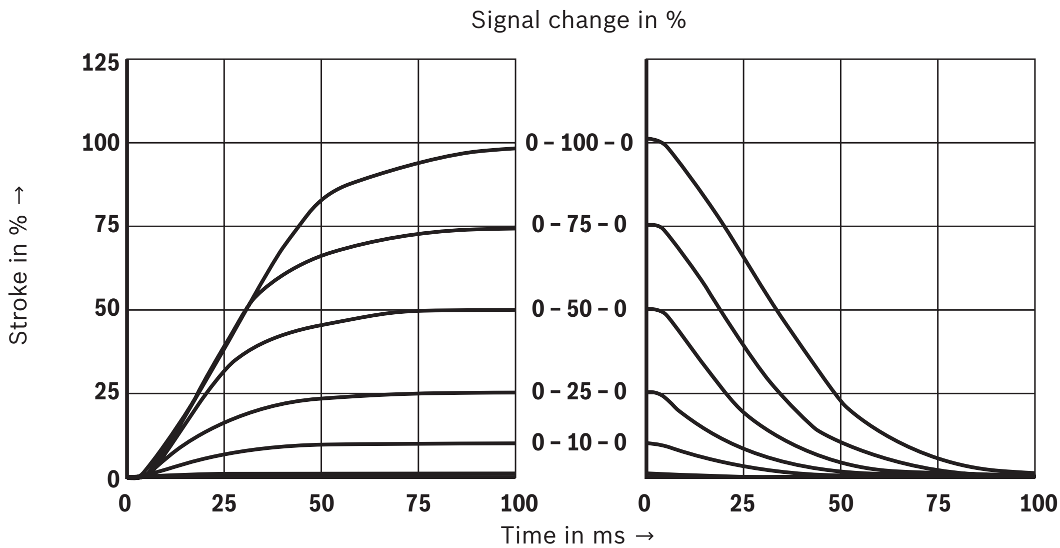


1 Maximum admissible flow
2 Recommended flow
(flow velocity 30 m/s)

Characteristic curves: Size 35
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Transition function with stepped electric input signals

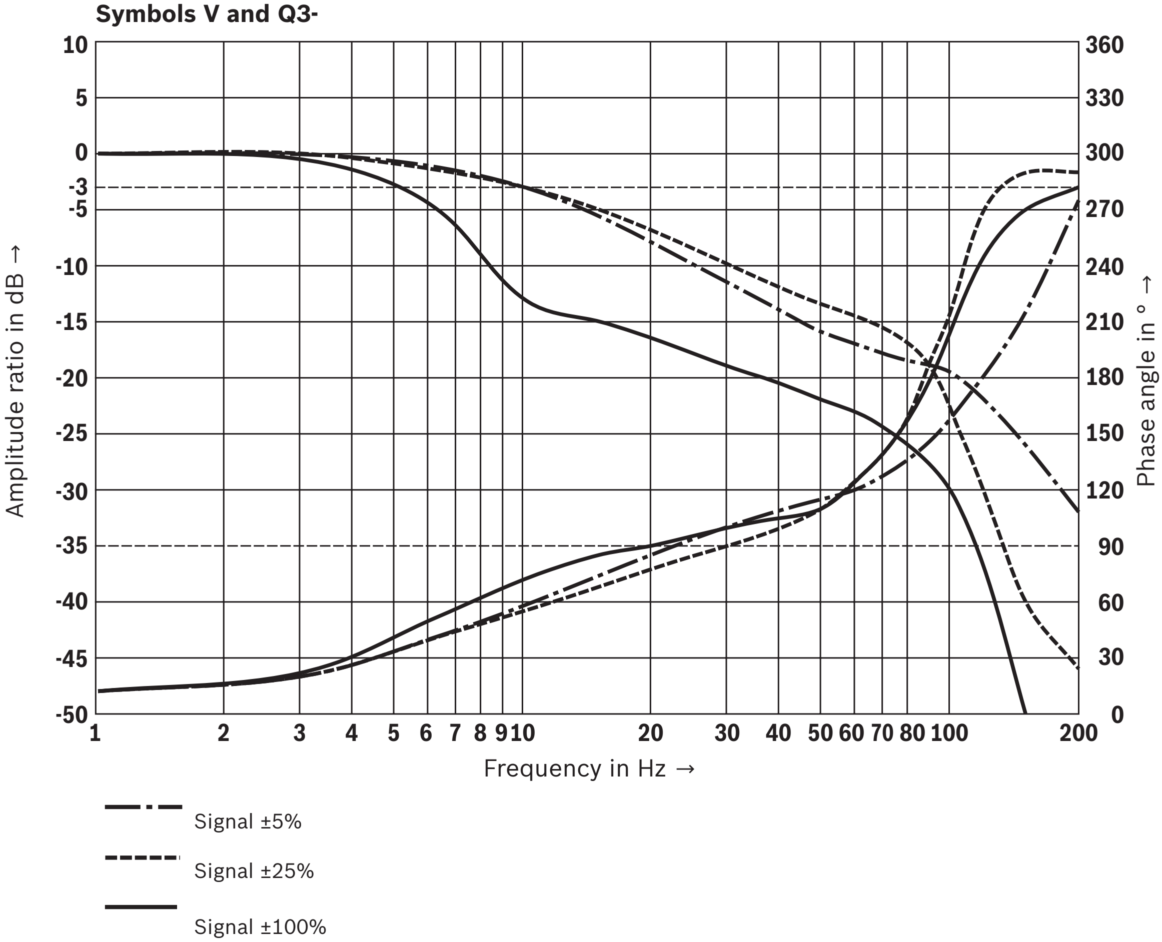
Symbols V and Q3-



- Main valve, port P = 10 bar
- Pilot control valve, port X = 210 bar

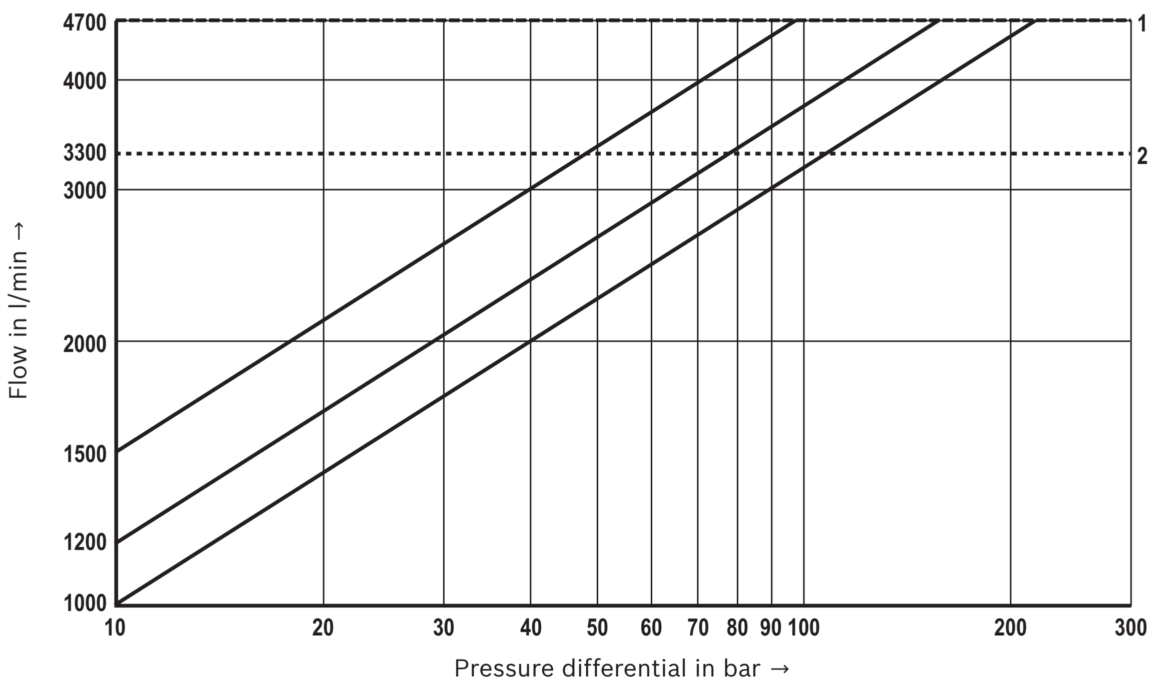
Frequency response characteristic curves

Symbols V and Q3-



Characteristic curves: Size 35
(valid for HLP46, ϑ_{oil} = 40 ±5 °C)

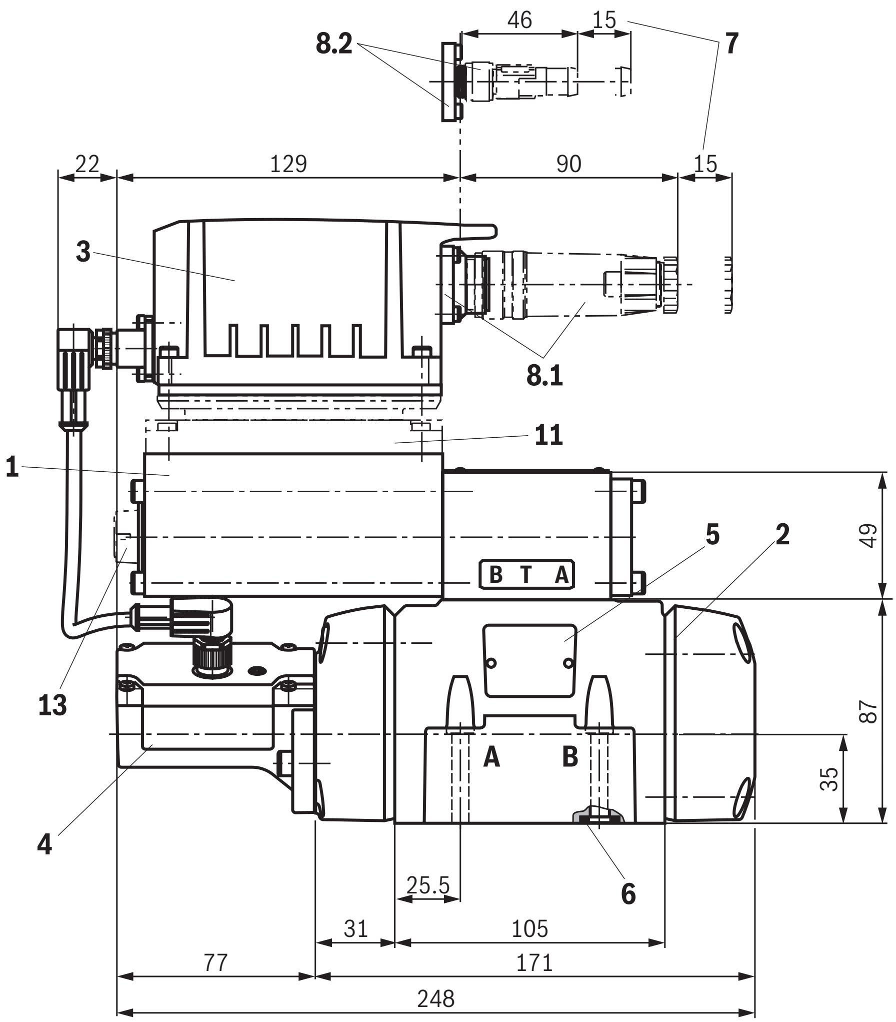
Flow/load function (with maximum valve opening; tolerance ±10%)

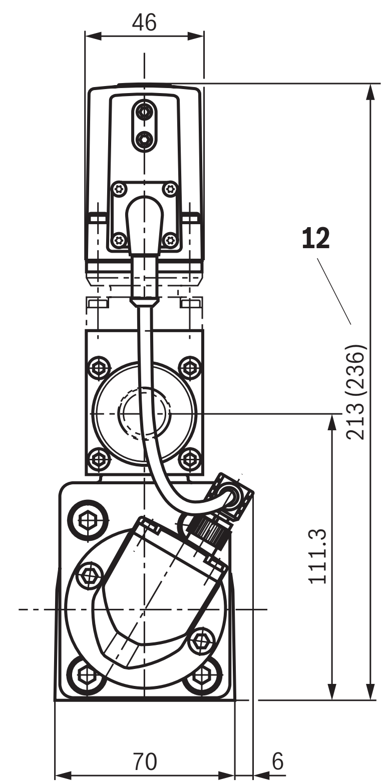


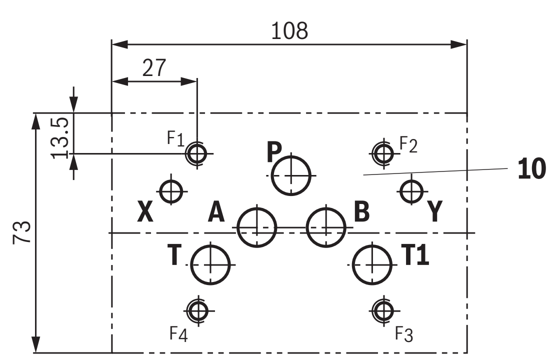
1 Maximum admissible flow

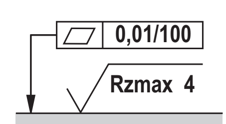
2 Recommended flow
(flow velocity 30 m/s)

Dimensions: Size 10
(dimensions in mm)







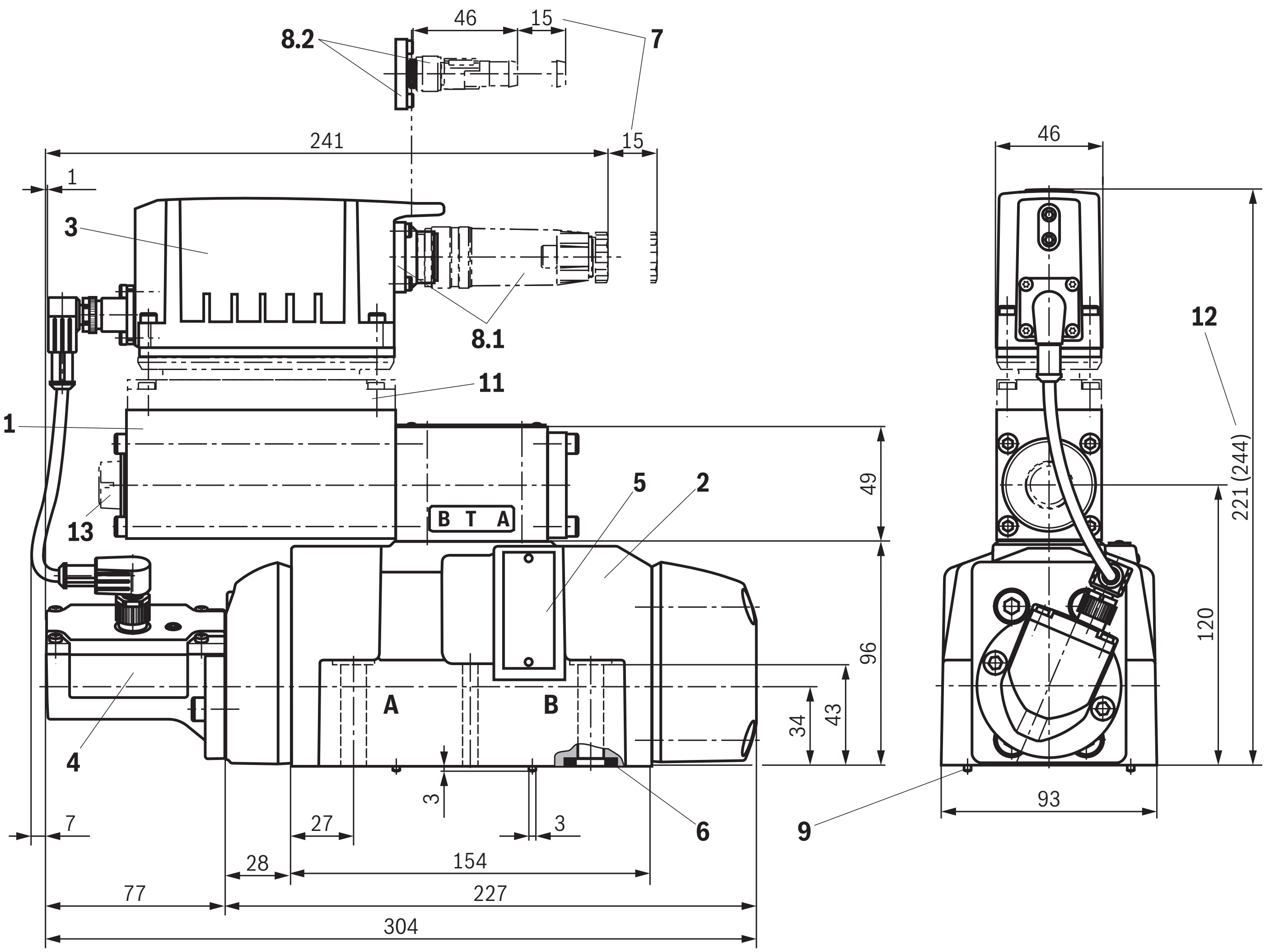


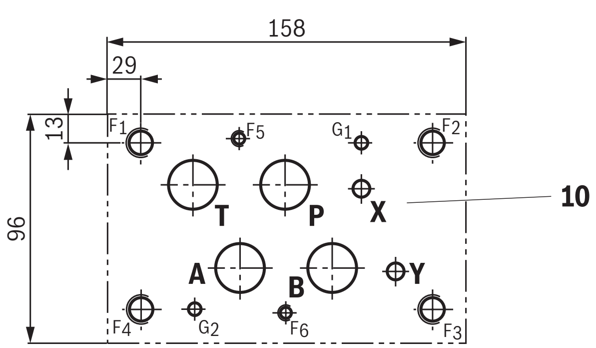
Required surface quality
of the valve contact surface

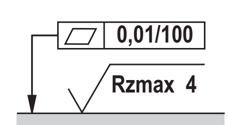
Item explanations can be found on page 37**.**
Valve mounting screws and **subplates,** see page 12.

Notices:
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions: Size 16
(dimensions in mm)





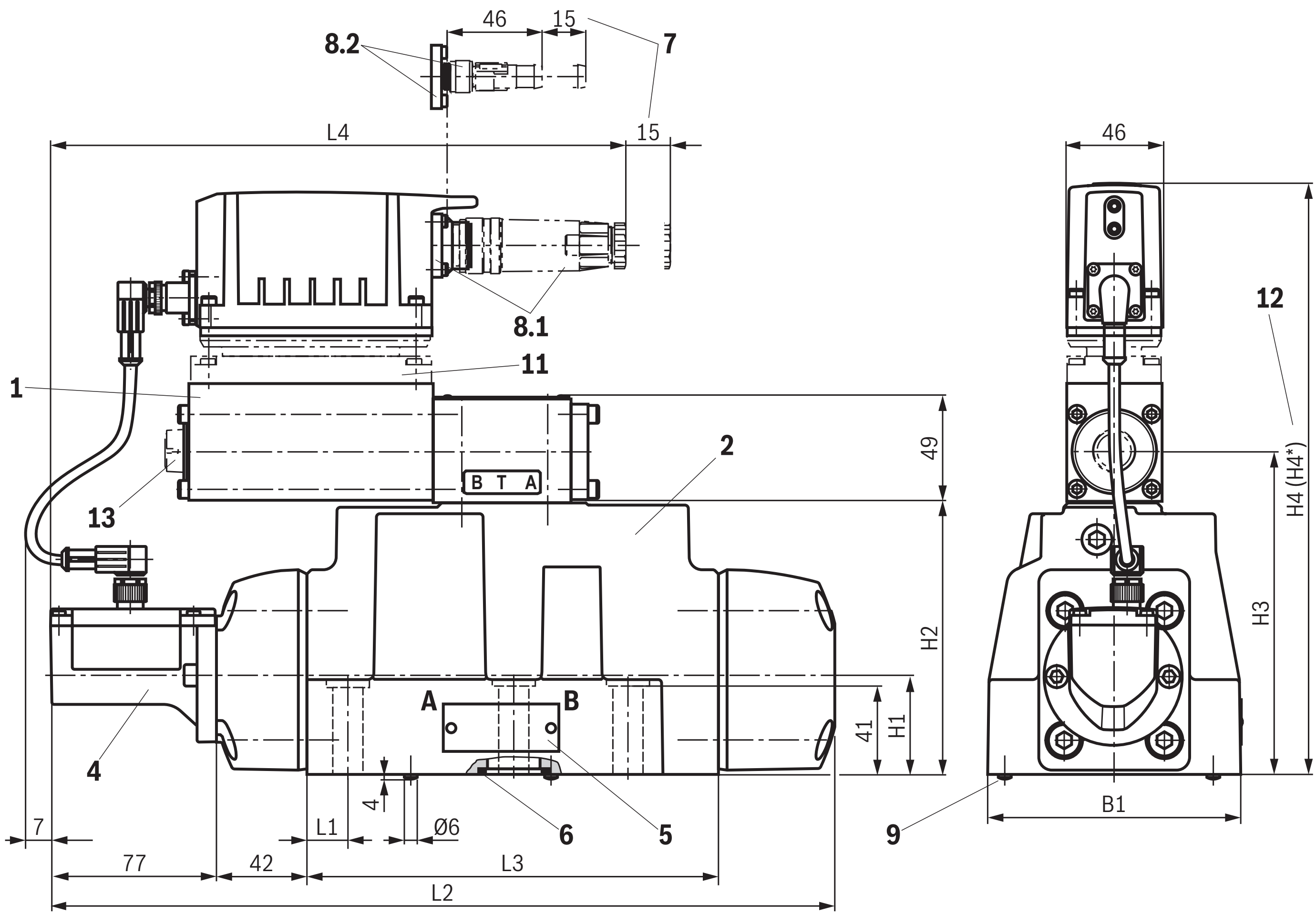


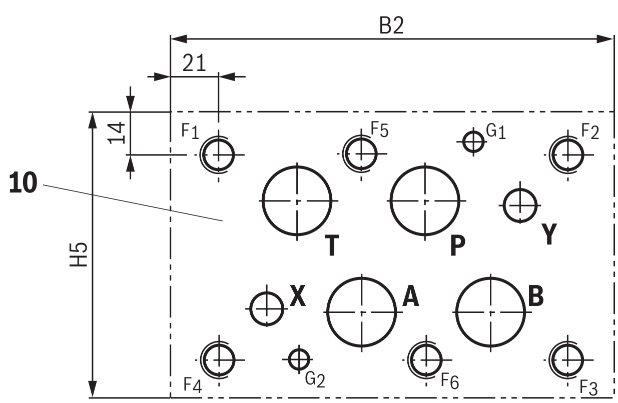
Required surface quality
of the valve contact surface

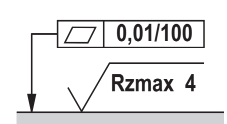
Item explanations can be found on page 37.
Valve mounting screws and **subplates,** see page 12.

☞ **Notices:**
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions: Sizes 25 and 27
(dimensions in mm)







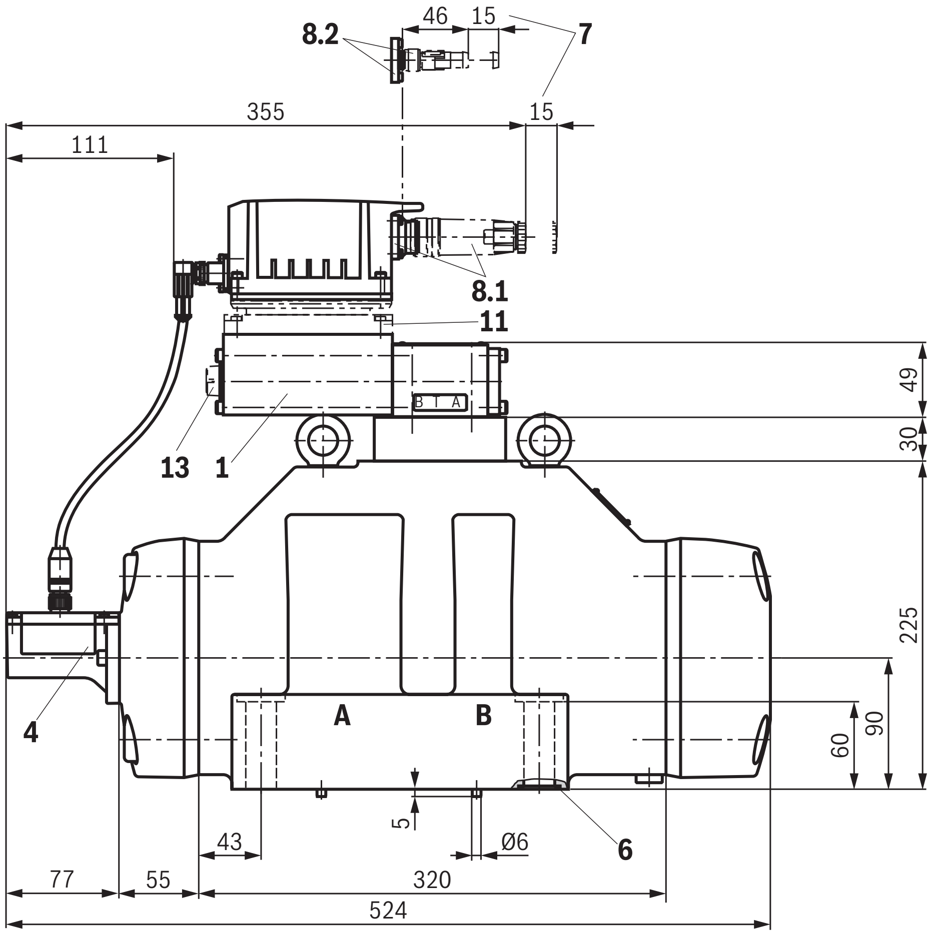
Required surface quality
of the valve contact surface

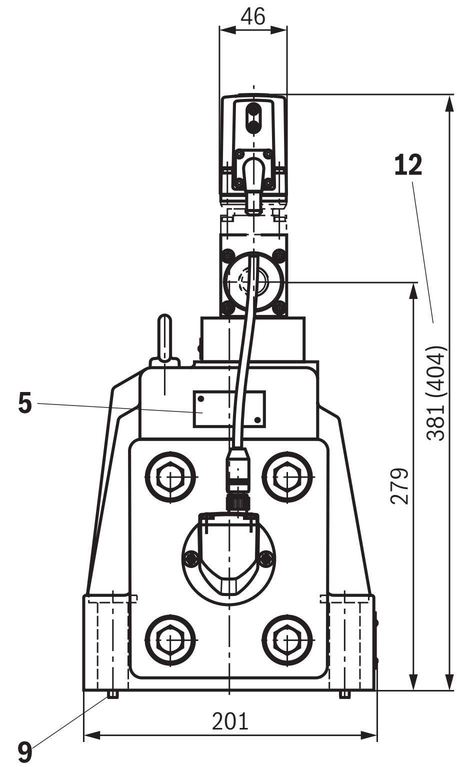
NG	L1	L2	L3	L4	H1	H2	H3	H4	H4*	H5	B1	B2
25	19	364	191	274	46	126	150	251	274	120	118	195
27	20.5	371	198	277	50	140	164	265	288	124	120	200

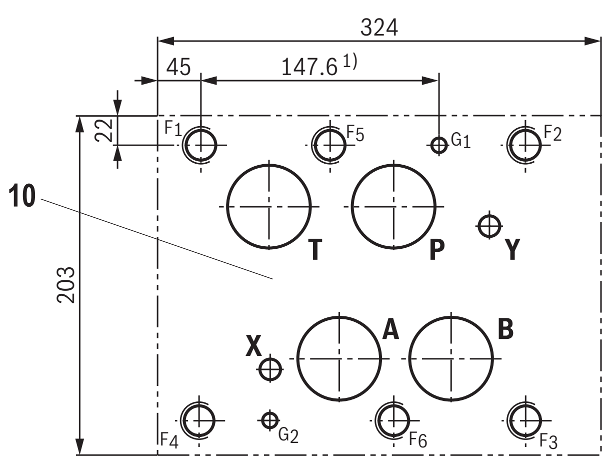
Item explanations can be found on page 37.
Valve mounting screws and **subplates,** see page 12.

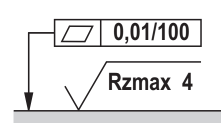
Notices:
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions: Size 35
(dimensions in mm)









Required surface quality
of the valve contact surface

Item explanations can be found on page 37**. Valve mounting screws** and **subplates,** see page 12.

☞ **Notices:**
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions

1 Pilot control valve

2 Main valve

3 Integrated electronics (OBE)

4 Inductive position transducer (main valve)

5 Name plate

6 Identical seal rings for ports P, A, B, T
Identical seal rings for ports X, Y

7 Space required for removing the mating connector

8.1 Mating connectors for version “A1”, “F1” and “C6”, separate order, see page 39 and data sheet 08006.

8.2 Mating connectors for version “L1”, separate order, see page 39 and data sheet 08006.

9 Locking pin

10 Machined valve contact surface
- Size 10:
  Porting pattern according to ISO 4401-05-05-0-05
- Size 16:
  Porting pattern according to ISO 4401-07-07-0-05
  Deviating from the standard:
  Ports P, A, B, T – Ø20 mm
- Size 25 and 27:
  Porting pattern according to ISO 4401-08-08-0-05
  Deviating from the standard:
  NG27: Ports P, A, B, T – Ø32 mm
- Size 35:
  Porting pattern according to ISO4401-10-09-0-05
  Deviating from the standard:
  Ports P, A, B, T – Ø50 mm
  [1)]Position G1 according to DIN 24340 Form A

11 Damping plate "D"

12 Dimension in () for version with damping plate "D"

13 Electronics protection membrane "-967"

Dimensions

Valve mounting screws (separate order)

Size	Quantity	Hexagon socket head cap screws	Material number
10	4	**ISO 4762 - M6 x 45 - 10.9-CM-Fe-ZnNi-5-Cn-T0-H-B** Tightening torque M_A = 13.5 Nm ±10%	**R913043777**
	or		
	4	**ISO 4762 - M6 x 45 - 10.9** Tightening torque M_A = 15.5 Nm ±10%	Not included in the Rexroth delivery range
	or		
	4	**ASME B18.3 - 1/4-20 UNC x 1 3/4“ - ASTM-A574** Tightening torque M_A = 15 Nm *[11 ft-lbs]* ±10 %	Not included in the Rexroth delivery range
16	2	**ISO 4762 - M6 x 60 - 10.9-CM-Fe-ZnNi-5-Cn-T0-H-B** Tightening torque M_A = 12.2 Nm ±10%	**R913043410**
	4	**ISO 4762 - M10 x 60 - 10.9-flZn/nc/480h/C** Tightening torque M_A = 58 Nm ±20%	**R913014770**
	or		
	2	**ISO 4762 - M6 x 60 - 10.9** Tightening torque M_A = 15.5 Nm ±10%	Not included in the Rexroth delivery range
	4	**ISO 4762 - M10 x 60 - 10.9** Tightening torque M_A = 75 Nm ±20%	
	or		
	2	**ASME B18.3 - 1/4-20 UNC x 2 1/4“ - ASTM-A574** Tightening torque M_A = 15 Nm *[11 ft-lbs]* ±10 %	Not included in the Rexroth delivery range
	4	**ASME B18.3 - 3/8-16 UNC x 2 1/4“ - ASTM-A574** Tightening torque M_A = 60 Nm *[44 ft-lbs]* ±10 %	
25, 27	6	**ISO 4762 - M12 x 60 - 10.9-flZn/nc/480h/C** Tightening torque M_A = 100 Nm ±20%	**R913015613**
	or		
	6	**ISO 4762 - M12 x 60** Tightening torque M_A = 130 Nm ±20%	Not included in the Rexroth delivery range
	or		
	6	**ASME B18.3 - 1/2-13 UNC x 2 1/4“ - ASTM-A574** Tightening torque M_A = 110 Nm *[81 ft-lbs]* ±10 %	Not included in the Rexroth delivery range
35	6	**ISO 4762 - M20 x 90 - 10.9-flZn/nc/480h/C** Tightening torque M_A = 465 Nm ±20%	**R913009160**
	or		
	6	**ISO 4762 - M20 x 90 - 10.9** Tightening torque M_A = 610 Nm ±20%	Not included in the Rexroth delivery range
	or		
	6	**ASME B18.3 - 3/4-10 UNC x 3 1/2“ - ASTM-A574** tightening torque M_A = 395 Nm *[291 ft-lbs]* ±10 %	Not included in the Rexroth delivery range

Notice:
- The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure.
- **When replacing component series 3X with 4X, only the valve mounting screws listed here may be used (for size 16, a minimum screw length of 55 mm is admissible, as well). Prior to assembly, check the existing mounting bore on the block for sufficient screw-in depth.**

Subplates (separate order) with porting pattern according to ISO 4401, see data sheet 45100.

Accessories (separate order)

Valves with integrated electronics

Interface	Mating connectors 6-pole + PE	Design	Version	Material number	Data sheet
„A1“, „F1“, „C6“	For the connection of valves with integrated electronics, round connector 6+PE, line cross-section 0.5 … 1.5 mm²	Straight	Metal	**R900223890**	08006
		Straight	Plastic	**R900021267**	08006
		Angled	Plastic	**R900217845**	–

Interface	Cable sets 6-pole + PE	**Length** in m	Material number	Data sheet
„A1“, „F1“, „C6“	For the connection of valves with integrated electronics, round connector 6+PE, straight connector, shielded, potted-in mating connector, line cross-section 0.75 mm²	3.0	**R901420483**	08006
		5.0	**R901420491**	08006
		10.0	**R901420496**	08006
		20.0	**R901448068**	–

Test and service devices

	Material number	Data sheet
Service case with test device for proportional servo valves with integrated electronics (OBE)	**R901049737**	29685

IO-Link gateways

Designation	Description	Material number
S67E-PN-IOL8-DI4-M12-6P	IndraControl S67E PROFINET device in the plastic housing 8 IO-Link ports (4 x class A and 4 x class B), 4 digital inputs, 24 VDC, M12 quick connection technology	**R911174436**
S67E-S3-IOL8-DI4-M12-6P	IndraControl S67E Sercos device in the plastic housing 8 IO-Link ports (4 x class A and 4 x class B), 4 digital inputs, 24 VDC, M12 quick connection technology	**R911174437**

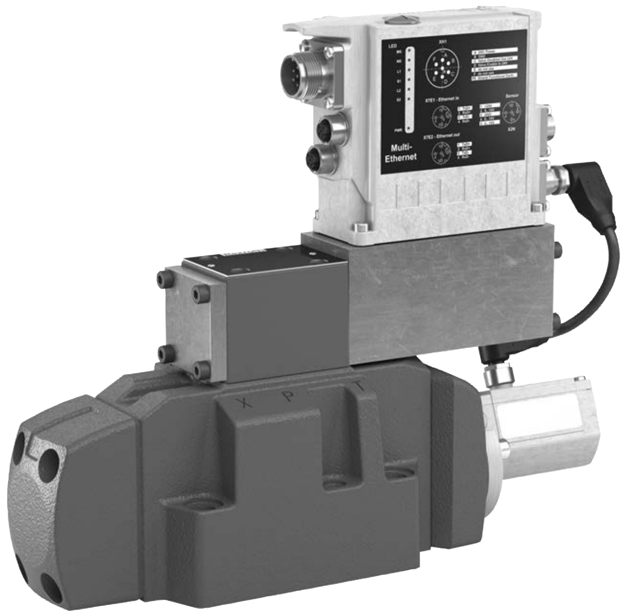
Further information

▶ Hydraulic valves for industrial applications	Data sheet 07600-B
▶ Subplates	Data sheet 45100
▶ Hydraulic fluids on mineral oil basis	Data sheet 90220
▶ Environmentally compatible hydraulic fluids	Data sheet 90221
▶ Flame-resistant, water-free hydraulic fluids	Data sheet 90222
▶ Flame-resistant hydraulic fluids - containing water (HFAE, HFAS, HFB, HFC)	Data sheet 90223
▶ Reliability characteristics according to EN ISO 13849	Data sheet 08012
▶ Hexagon socket head cap screw, metric/UNC	Data sheet 08936
▶ General product information on hydraulic products	Data sheet 07008
▶ Installation, commissioning and maintenance of servo valves and high-response valves	Data sheet 07700
▶ Assembly, commissioning and maintenance of hydraulic systems	Data sheet 07900
▶ Directional control valves, direct operated, with electrical position feedback and IO-Link interface	Data sheet 29400-PA
▶ Selection of filters	
▶ Information on available spare parts	
▶ Link hydraulics via IO-Link	

Directional control valve, pilot-operated, with integrated fieldbus (IFB-Multi Ethernet)

Type 4WRLF

RE 29293
Edition: 2019-06



H8152

- Sizes 10 ... 27
- Component series 4X
- Maximum operating pressure of 350 bar (ports P, A, B)
- Rated flow 600 l/min (***Δp*** = 10 bar)

Features

- Open
  - Integrated fieldbus (IFB Multi-Ethernet)
  - Bus connection/service interface (Sercos, EtherCAT, EtherNet/IP, PROFINET RT, POWERLINK, VARAN)
- Scalable
  - 2 configurable analog pressure sensor inputs
- Precise
  - Integrated pressure-force control
  - High response sensitivity and low hysteresis
- Safe
  - Internal safety function (can be used up to category 4/PL e according to EN 13849-1)
  - CE conformity according to EMC Directive 2014/30/EU

Contents

Ordering code

01	02	03	04	05	06	07	08		09		10	11	12	13		14	15	16	17	18
4	WRL	F						–	4X	/				00	/	24		D9		*

01	4 main ports	**4**

02	Directional control valve, pilot-operated	**WRL**

03	With integrated fieldbus	**F**

04	Size 10	**10**
	Size 16	**16**
	Size 25	**25**
	Size 27	**27**

Symbols

05	Possible versions see page 4	

Rated flow at 10 bar pressure differential (5 bar/control edge)

06	**– Size 10**	
	60 l/min (only symbol E, E1-, W6-, W8-, V and V1-)	**60**
	100 l/min	**100**
	– Size 16	
	200 l/min (only symbol W6- and W8-)	**200**
	250 l/min (only symbol E, E1-, V, V1- and Q3)	**250**
	– Size 25	
	350 l/min (only symbol W6- and W8-) [1]	**350**
	400 l/min (only symbol E, E1-, V, V1- and Q3)	**400**
	– Size 27	
	430 l/min (only symbol W6- and W8-) [1]	**430**
	600 l/min (only symbol E, E1-, V, V1- and Q3)	**600**

Flow characteristic

07	Linear	**L**
	Linear with fine control range (only NG10; other sizes on request)	**P**
	Progressive with linear fine control range (only symbols Q3-)	**M**

08	**Without** overlap jump (only symbols V, V1- and Q3)	**no code**
	With overlap jump (opening point 5% with covered valve; only symbols E, E1-, W6-, W8-)	**J**

09	Component series 40 ... 49 (40 ... 49: unchanged installation and mounting dimensions)	**4X**

Seal material (observe compatibility of seals with hydraulic fluid used, see page 10)

10	NBR seals	**M**
	FKM seals	**V**

Pilot oil flow

11	External pilot oil supply, external pilot oil return	**XY**
	Internal pilot oil supply, external pilot oil return	**PY**
	Internal pilot oil supply; internal pilot oil return	**PT**
	External pilot oil supply, internal pilot oil return	**XT**

Sandwich plate shut-off valve

12	**Without** shut-off valve	**no code**
	With shut-off valve (sandwich plate valve "Z4WE 6 E166-3X/EG24...", see data sheet 23193)	**WL**

13	Without internal pressure sensors	**00**

[1] Higher rated flow upon request

Ordering code

01	02	03	04	05	06	07	08		09		10	11	12	13		14	15	16	17	18
4	**WRL**	**F**						**–**	**4X**	**/**				**00**	**/**	**24**		**D9**		*****

14	Supply voltage 24 V	**24**

Ethernet interface

15	EtherNET/IP	**E**
	PROFINET RT	**N**
	Sercos	**S**
	EtherCAT (CANopen profile)	**T**
	POWERLINK (CANopen profile)	**W**
	VARAN	**V**

Connector

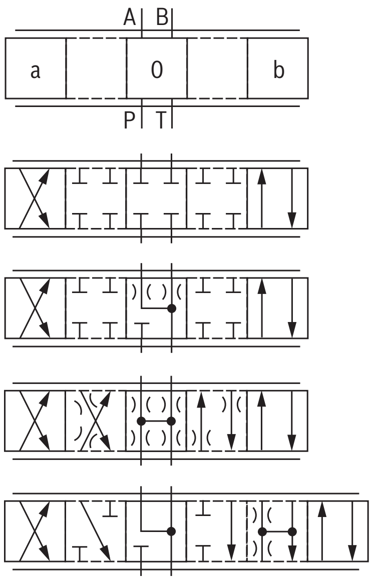
16	Voltage supply, enable acknowledgement	**D9**

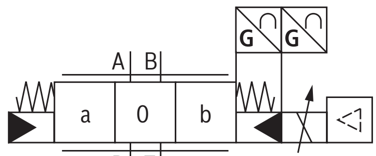
Pressure sensor interface

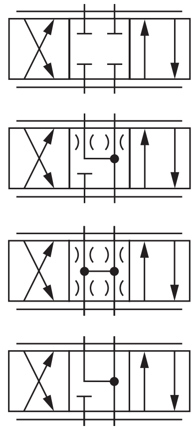
17	**Without** interface	**0**
	Analog interface for a maximum of 3 external pressure sensors (0 ... 10 V)	**5**

18	Further details in the plain text	*****

Symbols







E
E1-

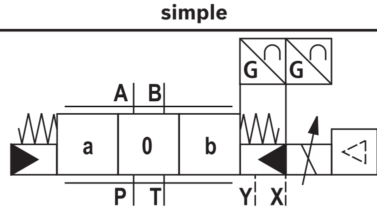
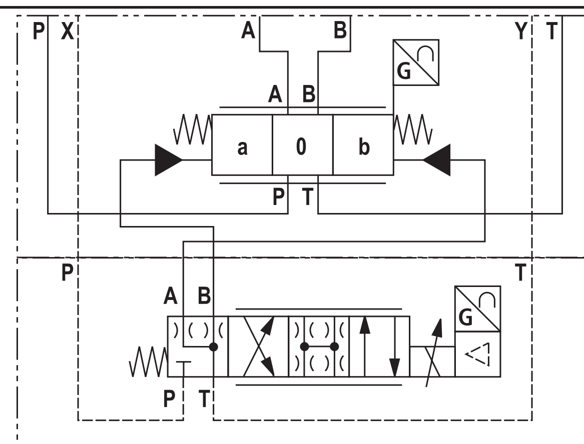
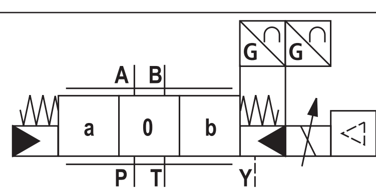
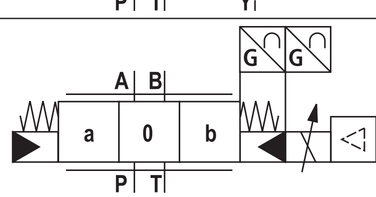
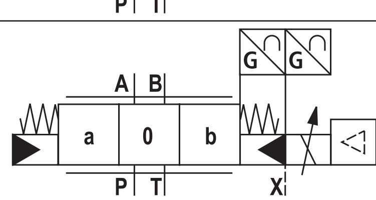
W6-
W8-

V
V1-

Q3-

With symbol E1–, V1– and W8–:

P → A: $q_{V\,max}$ B → T: $q_V/2$
P → B: $q_V/2$ A → T: $q_{V\,max}$

Version	simple	detailed
"XY"		
"PY"		
"PT"		
"XT"		

Notice:
- Representation according to DIN ISO 1219-1. Hydraulic interim positions are shown by dashes.
- For information on the "switch-off behavior", refer to the technical data on page 10.
- Symbols V and V1 are not suitable for use in safety applications (no overlap).

Function

General information

The pilot-operated **IFB Multi-Ethernet** valve (**I**ntegrated **F**ield**b**bus) is a digital directional control valve with integrated fieldbus:

The following operating modes are possible:

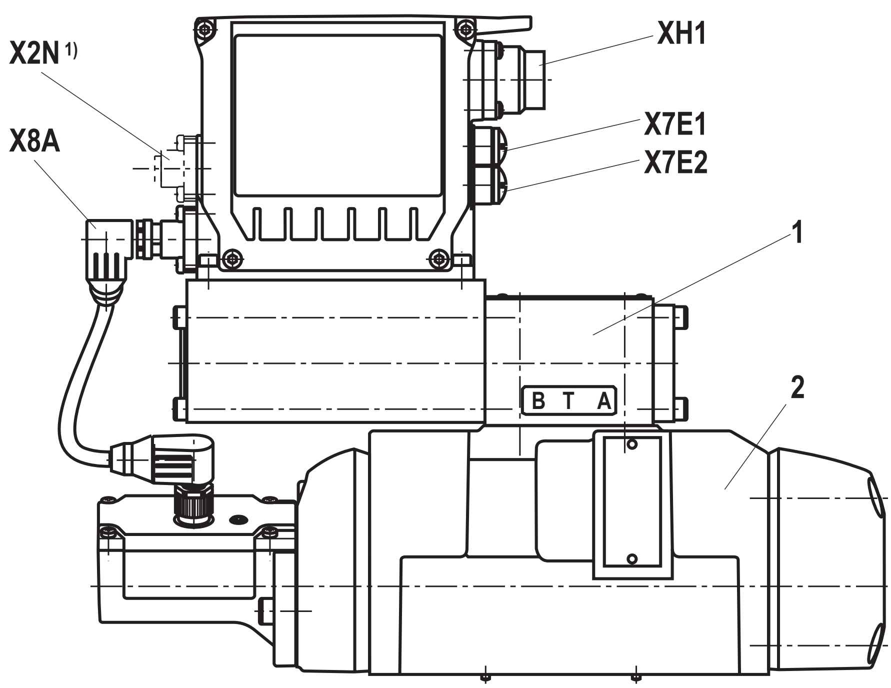
- Standard:
  - Valve direct control
  - Flow control
- Version "5" (with external pressure sensors):
  - Pressure/force control
  - Active damping
  - Substitutional control (flow - pressure/force); pQ function (flow-controlled)

- Command value presetting is done via the Ethernet interface (X7E1 or X7E2)
- The feedback information of the actual value signals to the superior control system is provided via the Ethernet interface (X7E1 or X7E2)
- The controller parameters are set via the Ethernet interface (X7E1 or X7E2)

Set-up

The directional control valve with IFB Multi-Ethernet electronics mainly consists of:

- Pilot control valve (1) with control spool and sleeve in servo quality
- Main stage (2) with centering springs and position feedback
- Integrated fieldbus (3) with:
  - connector, voltage supply, safety shut-down (XH1)
  - Ethernet interfaces (X7E1, X7E2)
  - analog sensor interfaces (X2N)
  - interface for the position transducer of the main stage (X8A)



[1] Only version "5"

Function

Function (symbol V, V1- and Q3-)
When the control solenoid of the pilot control valve is de-energized, its spring-operated control spool is in the "fail safe" position. The control spool of the main valve is in the spring-centered offset position at approx. 6% of the stroke in direction P→B/A→T.
The integrated electronics (OBE) compare the specified command value to the position actual value of the control spool of the main stage. In case of a control deviation, the control solenoid of the pilot control valve is activated and its control spool is adjusted.
The flow which is activated via the control cross-sections at the pilot control valve leads to an adjustment of the control spool of the main valve. The stroke/control cross-section of the main valve is regulated proportionally to the command value. In case of a command value presetting of 0%, the electronics adjust the control spool of the main valve to central position.
The pilot oil supply in the pilot control valve is either internal via port P or external via port X. The feedback can be internal via port T or external via port Y to the tank.

Switching off the release (symbol V and V1-)
The control spool of the main valve is not in a safe position after the release is switched off. The enable acknowledgement is not set (pin C). If the supply voltage fails or in case of cable break, the integrated electronics will de-energize the control solenoid, the pilot control spool will move to the fail-safe position and will unload the pilot oil chambers of the main valve. Operated by the spring, the control spool of the main valve will move to the offset position (approx. 6% P→B/A→T).

Function (symbol E. and W.)
When the control solenoid of the pilot control valve is de-energized, its spring-operated control spool is in the "fail safe" position. The control spool of the main valve is in spring-centered central position.
The integrated electronics (OBE) compare the specified command value to the position actual value of the control spool of the main stage. In case of a control deviation, the control solenoid of the pilot control valve is activated and its control spool is adjusted.
The flow which is activated via the control cross-sections at the pilot control valve leads to an adjustment of the control spool of the main valve. The stroke/control cross-section of the main valve is regulated proportionally to the command value.
The pilot oil supply in the pilot control valve is either internal via port P or external via port X. The feedback can be internal via port T or external via port Y to the tank.

Switching off the release (symbol E., W. and Q3-)
If the control spool of the main valve is in the safe position, the enable acknowledgement is set (pin C).
If the control spool of the main valve leaves the safe position or the release is set, the enable acknowledgement expires. If the supply voltage fails or in case of cable break, the integrated electronics will de-energize the control solenoid, the pilot control spool will move to the fail-safe position and will unload the pilot oil chambers of the main valve. Operated by the spring, the control spool of the main valve will move to the central position.

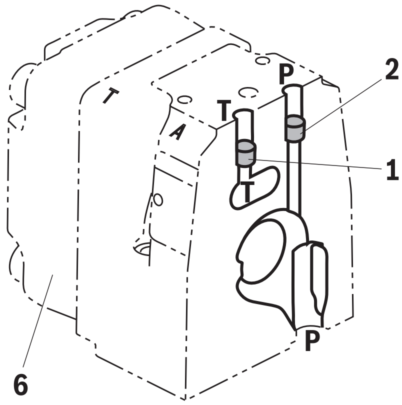
Monitoring
The digital control electronics enable comprehensive monitoring functions/error detection including:
- Undervoltage
- Communication error
- Cable break for analog sensor inputs
- Monitoring of the microcontroller (watchdog)
- Temperature of the integrated electronics

IndraWorks DS PC program
To implement the project planning task and to parameterize the valves, the user may use the IndraWorks DS engineering tool (see accessories):
- Project planning
- Parameterization
- Commissioning
- Diagnosis
- Comfortable administration of all data on a PC
- PC operating systems: Windows 7-10

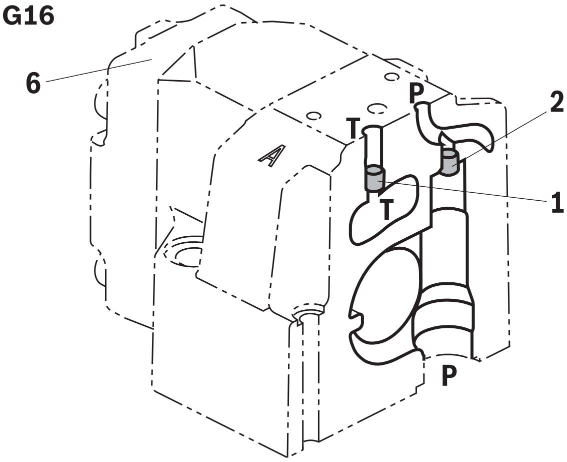
☞ **Notice:**
- Symbol V and V1-:
  Pilot-operated 4/3 directional control valves are only functional in the active control loop and do not have a locking basic position when deactivated.
  Consequently "external isolator valves" are required in many applications and must be taken into account regarding the switch-on/switch-off order.
  While the electrical supply voltage is being switched off, the drive may be accelerated for a short time in functional direction P → B.
- Symbol E. and W.:
  Pilot-operated 4/3 directional control valves with positive overlap are functional in controlled or regulated axes. The overlap in the de-energized state is approx. 20% of the control spool stroke.
  While the release is being switched off, the drive may be accelerated for a short time in functional direction P → B (see operating instructions 29391-B).

Pilot oil supply (schematic illustration)

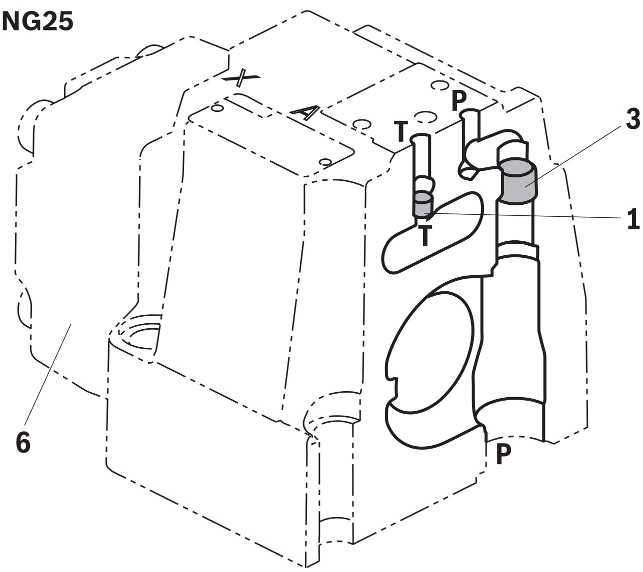
NG10



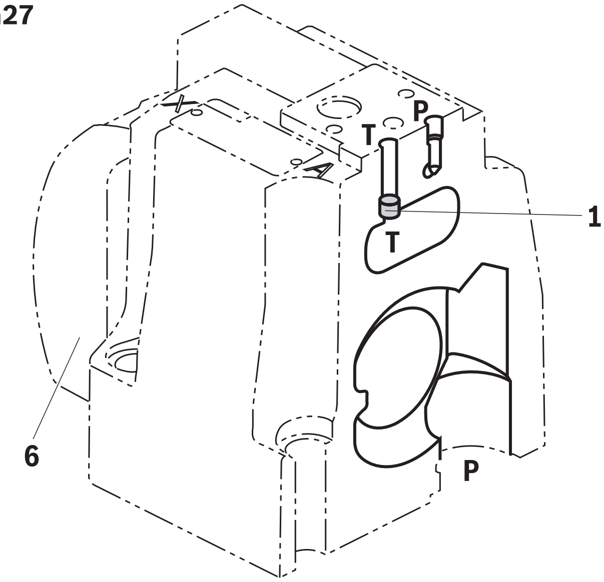
NG16



NG25



NG27



1 Plug screw M6 according to DIN 906, wrench size 3 – pilot oil return
2 Plug screw M6 according to DIN 906, wrench size 3 – pilot oil supply
3 Plug screw M12 x 1.5 according to DIN 906, wrench size 6 – pilot oil supply
6 Housing cover main stage (position transducer side)

Pilot oil supply
external: **2, 3** closed
internal: **2, 3** open

Pilot oil return
external: **1** closed
internal: **1** open

Further explanations on page 8.

Pilot oil supply

Version "XY"
External pilot oil supply
External pilot oil return
In this version, the pilot oil is supplied from a separate control circuit (external).
The pilot oil return is not directed into channel T of the main valve, but is separately directed to the tank via port Y (external).

Version "PY"
Internal pilot oil supply
External pilot oil return
With this version, the pilot oil is supplied from channel P of the main valve (internal).
The pilot oil return is not directed into channel T of the main valve, but is separately directed to the tank via port Y (external).
In the subplate, port X is to be closed.

Version "PT"
Internal pilot oil supply
Internal pilot oil return
With this version, the pilot oil is supplied from channel P of the main valve (internal).
The pilot oil is directly returned to channel T of the main valve (internal).
In the subplate, ports X and Y are to be closed.

Version "XT"
External pilot oil supply
Internal pilot oil return
In this version, the pilot oil is supplied from a separate control circuit (external).
The pilot oil is directly returned to channel T of the main valve (internal).
In the subplate, port Y is to be closed.

Technical data
(For applications outside these values, please consult us!)

General						
Size		NG	10	16	25	27
Installation position			Any			
Ambient temperature range		°C	–20 ... +60			
Storage temperature range		°C	+5 ... +40			
Maximum storage time		years	1 (if the storage conditions are observed; refer to the operating instructions 07600-B)			
Vibration resistance	▶ Sine test according to DIN EN 60068-2-6		10 ... 2000 Hz / maximum of 10 g / 10 cycles / 3 axes			
	▶ Noise test according to DIN EN 60068-2-64		20 ... 2000 Hz / 10 g_{RMS} / 30 g peak / 30 min. / 3 axes			
	▶ Transport shock according to DIN EN 60068-2-27		15 g / 11 ms / 3 axes			
Weight		kg	9	12	19	21
Maximum relative humidity (no condensation)		%	95			
Maximum solenoid surface temperature		°C	120 (individual operation)			
$MTTF_d$ value according to EN ISO 13849	▶ Hydraulic (category 1)	years	75 (for further details, see operating instructions 29391-B)			
	▶ Hydraulic and electric (category 3 and 4, without power supply unit)	years	70 (for further details, see operating instructions 29391-B)			

Technical data
(For applications outside these values, please consult us!)

<table>
<tr><th colspan="11">Hydraulic</th></tr>
<tr><td colspan="2">Size</td><td>NG</td><td colspan="2">10</td><td colspan="2">16</td><td colspan="2">25</td><td colspan="2">27</td></tr>
<tr><td rowspan="5">Maximum operating pressure</td><td>▶ Ports A, B, P</td><td></td><td colspan="8"></td></tr>
<tr><td>– External pilot oil supply</td><td>bar</td><td colspan="6">350</td><td colspan="2">270</td></tr>
<tr><td>– Internal pilot oil supply</td><td>bar</td><td colspan="6">280</td><td colspan="2">270</td></tr>
<tr><td>▶ Port X</td><td>bar</td><td colspan="6">280</td><td colspan="2">270</td></tr>
<tr><td>▶ Ports T, Y</td><td>bar</td><td colspan="6">250</td><td colspan="2">210</td></tr>
<tr><td colspan="2">Minimum pilot pressure (pilot control valve)</td><td>bar</td><td colspan="8">10</td></tr>
<tr><td colspan="2">Maximum flow</td><td>l/min</td><td colspan="2">300</td><td colspan="2">800</td><td colspan="2">1250</td><td colspan="2">1850</td></tr>
<tr><td colspan="2">Rated flow (Δp = 5 bar/control edge) 1)</td><td>l/min</td><td colspan="2">60/100</td><td colspan="2">200/250</td><td colspan="2">350/400</td><td colspan="2">430/600</td></tr>
<tr><td rowspan="2">Pilot oil flow 2)</td><td>▶ Symbol E, W</td><td>l/min</td><td colspan="2">2.4</td><td colspan="2">3.5</td><td colspan="4">7.5</td></tr>
<tr><td>▶ Symbol V, Q3-</td><td>l/min</td><td colspan="2">4.5</td><td colspan="2">11.5</td><td colspan="4">22</td></tr>
<tr><td rowspan="6">Maximum leakage flow (inlet pressure 100 bar)</td><td>▶ Symbol E, E1-</td><td></td><td colspan="2"></td><td colspan="2"></td><td colspan="4"></td></tr>
<tr><td>– Main valve</td><td>l/min</td><td colspan="2">0.06</td><td colspan="2">0.13</td><td colspan="4">0.17</td></tr>
<tr><td>– Main valve + pilot control valve</td><td>l/min</td><td colspan="2">0.14</td><td colspan="2">0.28</td><td colspan="4">0.42</td></tr>
<tr><td>▶ Symbol W6-, W8-</td><td></td><td colspan="2"></td><td colspan="2"></td><td colspan="4"></td></tr>
<tr><td>– Main valve</td><td>l/min</td><td colspan="2">0.12</td><td colspan="2">0.26</td><td colspan="4">0.35</td></tr>
<tr><td>– Main valve + pilot control valve</td><td>l/min</td><td colspan="2">0.2</td><td colspan="2">0.41</td><td colspan="4">0.6</td></tr>
<tr><td rowspan="6">Maximum zero flow (inlet pressure 100 bar)</td><td>▶ Symbol V, V1-</td><td></td><td colspan="2"></td><td colspan="2"></td><td colspan="4"></td></tr>
<tr><td>– Main valve</td><td>l/min</td><td colspan="2">1.7</td><td colspan="2">2.3</td><td colspan="2">2.8</td><td colspan="2">3.3</td></tr>
<tr><td>– Main valve + pilot control valve</td><td>l/min</td><td colspan="2">1.85</td><td colspan="2">2.6</td><td colspan="2">3.2</td><td colspan="2">3.7</td></tr>
<tr><td>▶ Symbol Q3-</td><td></td><td colspan="2"></td><td colspan="2"></td><td colspan="4"></td></tr>
<tr><td>– Main valve</td><td>l/min</td><td colspan="2">0.4</td><td colspan="2">1.6</td><td colspan="2">1.8</td><td colspan="2">2.2</td></tr>
<tr><td>– Main valve + pilot control valve</td><td>l/min</td><td colspan="2">0.55</td><td colspan="2">1.9</td><td colspan="2">2.2</td><td colspan="2">2.6</td></tr>
<tr><td colspan="3">Flow unloading central position Δp = 5 bar/control edge</td><td>A→T</td><td>B→T</td><td>A→T</td><td>B→T</td><td>A→T</td><td>B→T</td><td>A→T</td><td>B→T</td></tr>
<tr><td></td><td>▶ Symbol W6-</td><td>l/min</td><td>2.8</td><td>2.8</td><td>4</td><td>4</td><td>6</td><td>6</td><td>6</td><td>6</td></tr>
<tr><td></td><td>▶ Symbol W8-</td><td>l/min</td><td>2.8</td><td>1.4</td><td>4</td><td>2</td><td>6</td><td>3</td><td>6</td><td>3</td></tr>
<tr><td colspan="3">Hydraulic fluid</td><td colspan="8">See table page 10</td></tr>
<tr><td rowspan="2">Viscosity range</td><td>▶ Recommended</td><td>mm²/s</td><td colspan="8">30 ... 45</td></tr>
<tr><td>▶ Maximum admissible</td><td>mm²/s</td><td colspan="8">20 ... 380</td></tr>
<tr><td colspan="2">Hydraulic fluid temperature range (flown-through)</td><td>°C</td><td colspan="8">−20 ... +70</td></tr>
<tr><td colspan="3">Maximum admissible degree of contamination of the hydraulic fluid cleanliness class according to ISO 4406 (c)</td><td colspan="8">Class 18/16/13 3)</td></tr>
</table>

1) Flow for deviating Δp (valve pressure differential):

$$\boxed{q_x = q_{Vnom} \times \sqrt{\frac{\Delta p_x}{10}}}$$

2) At port X and Y with stepped input signal from 0 ... 100% (100 bar)

3) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and simultaneously increases the life cycle of the components.

Technical data
(For applications outside these values, please consult us!)

Hydraulic fluid		Classification	Suitable sealing materials	Standards	Data sheet
Mineral oils		HL, HLP, HLPD, HVLP, HVLPD	NBR, FKM	DIN 51524	90220
Bio-degradable	▶ Insoluble in water	HETG	FKM	ISO 15380	90221
		HEES	FKM		
	▶ Soluble in water	HEPG	FKM	ISO 15380	
Flame-resistant	▶ Water-free	HFDU (glycol base)	FKM	ISO 12922	90222
		HFDU (ester base)	FKM		
		HFDR	FKM		
	▶ Containing water	HFC (Fuchs: Hydrotherm 46M, Renosafe 500; Petrofer: Ultra Safe 620; Houghton: Safe 620; Union: Carbide HP5046)	NBR	ISO 12922	90223

Important information on hydraulic fluids:
- For further information and data on the use of other hydraulic fluids, please refer to the data sheets above or contact us.
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.).
- The ignition temperature of the hydraulic fluid used must be 50 K higher than the maximum surface temperature.
- **Bio-degradable and flame-resistant – containing water:** If components with galvanic zinc coating (e.g. version "J3" or "J5") or parts containing zinc are used, small amounts of dissolved zinc may get into the hydraulic system and cause accelerated aging of the hydraulic fluid. Zinc soap may form as a chemical reaction product, which may clog filters, nozzles and solenoid valves - particularly in connection with local heat input.
- **Flame-resistant – containing water:**
  - Due to increased cavitation tendency with HFC hydraulic fluids, the life cycle of the component may be reduced by up to 30% as compared to the use with mineral oil HLP. In order to reduce the cavitation effect, it is recommended - if possible specific to the installation - to back up the return flow pressure in ports T to approx. 20% of the pressure differential at the component.
  - Dependent on the hydraulic fluid used, the maximum ambient and hydraulic fluid temperature must not exceed 50 °C. In order to reduce the heat input into the component, the command value profile is to be adjusted for proportional and high-response valves.

Static /dynamic						
Size		NG	10	16	25	27
Hysteresis		%	< 0.1			
Response sensitivity		%	< 0.05			
Range of inversion		%	< 0.08			
Manufacturing tolerance q_{Vmax}		%	≤ 10			
Actuating time for 0 ... 100% at X=100 bar	▶ Symbols E, E1-, W6-, W8-	ms	40	60	60	60
Switch-off behavior (after electric shut-off)	▶ Symbols E, E1-, W6-, W8-		Pilot control valve in fail-safe position, main valve moves to overlapped spring-centered central position			
	▶ Symbol V, V1-		Pilot control valve in fail-safe position, main valve moves to spring-centered "offset position" (approx. 6%, P→B/A→T)			
	▶ Symbol Q3		Pilot control valve in fail-safe position, main valve moves to spring-centered "offset position" (P blocked, A/B to port T open)			
Temperature drift (temperature range 20 °C ... 80 °C)		%/10 °C	Zero shift < 0.25			
Zero compensation			Ex plant ±1%			

Technical data
(For applications outside these values, please consult us!)

Electrical, integrated electronics (OBE)			
Relative duty cycle		%	100 (continuous operation)
Protection class according to EN 60529			IP 65 with mounted and locked plug-in connectors
Supply voltage [4; 5]	▶ Nominal voltage	VDC	24
	▶ Lower limit value	VDC	18
	▶ Upper limit value	VDC	36
Maximum admissible residual ripple		Vpp	2.5 (comply with absolute supply voltage limit values)
Current consumption	▶ Maximum [6]	A	2.5
	▶ Impulse current	A	4

Electrical, integrated electronics (OBE)			
Maximum power consumption		W	40
AD/DA resolution	▶ Analog inputs [7]		12 bit
Protective grounding conductor and screening			see connector pin assignment (CE-compliant installation) page 14
Required fuse protection, external		A	4, time-lag
Adjustment			Calibrated in the plant, see characteristic curves page 16 ... 26
Conformity			CE according to EMC Directive 2014/30/EU tested according to EN 61000-6-2 and EN 61000-6-3
Parameterization interface			Ethernet
Scan time pressure and force controller (minimum) [7]		ms	0.5
Booting time		s	< 15
Switching input Enable XH1	▶ Quantity		1
	▶ Low level	V	–3 ... 5
	▶ High level	V	15 ... U_B
	▶ Current consumption at high level	mA	< 1
	▶ Reference potential		Pin 5
Switching output Enable acknowledgment XH1	▶ Quantity		1
	▶ Low level	V	0 ... 3
	▶ High level	V	15 ... U_B
	▶ Current carrying capacity	mA	50 (short-circuit-proof)
	▶ Signal delay time	ms	0.2 ... 210 [7]
	▶ Reference potential		GND
Analog sensor X2N	▶ Quantity (voltage inputs)		3 [8]
	▶ Supply voltage	V	24 (corresponding to supply voltage applied to XH2)
	▶ Maximum supply current	mA	50
	▶ AD resolution	bit	12
	▶ Voltage inputs		
	– Measurement range	V	0 ... 10
	– Input resistance	kΩ	100 +10%
	– Temperature drift		< 15 mV / 10 K

4) Supply voltage is used directly for sensor connection X8M (no internal voltage limitation)

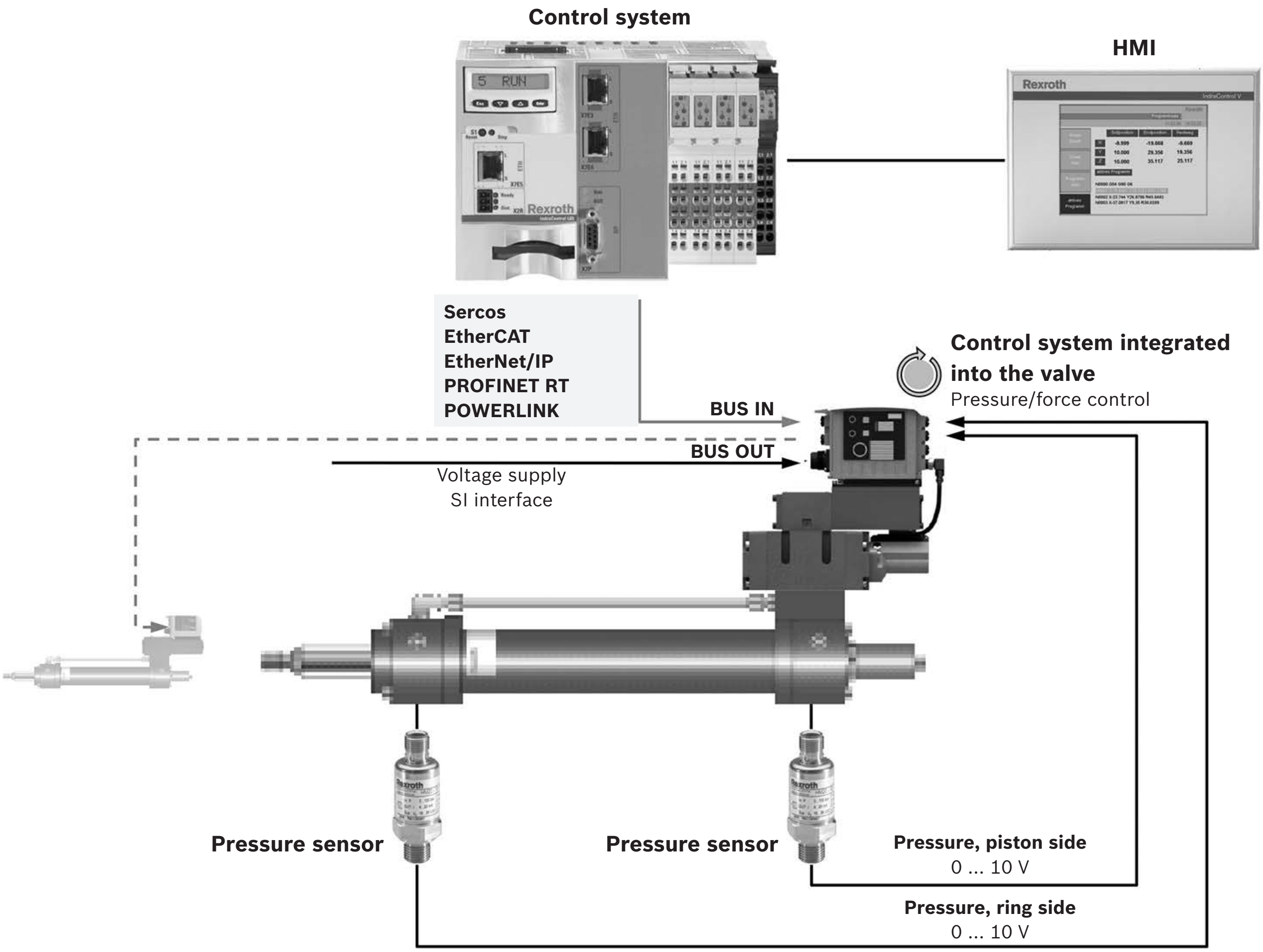
5) Voltage limit values must be observed directly at the connector of the valve (observe line length and cable cross-section!)

6) The maximum current consumption will increase when using the sensor inputs or the switching output according to the external load

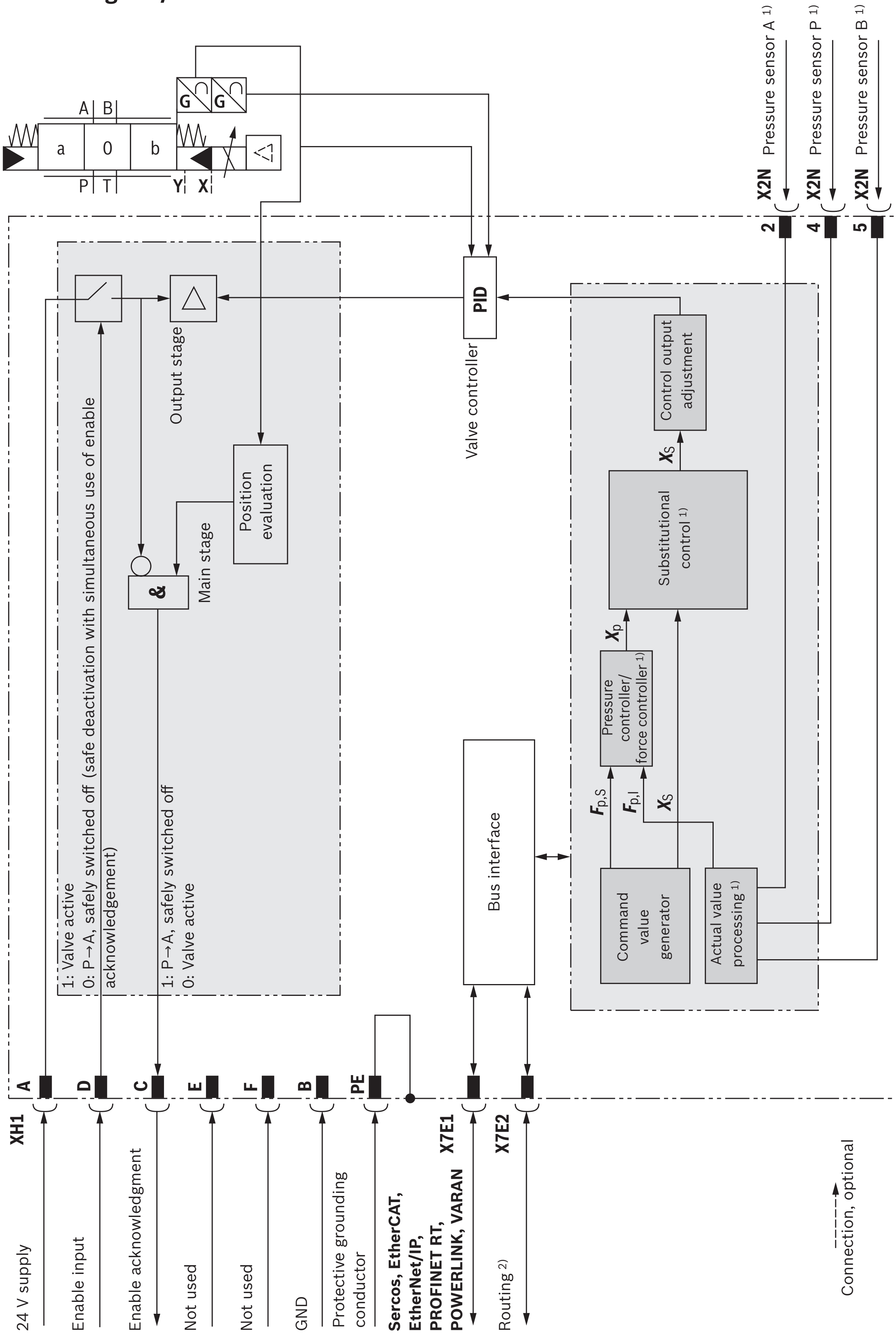
7) Depending on valve and operating condition, see operating instructions 29391-B

8) Only version "5"

Representation of the IFB valve in the system network (version "5")



Block diagram/controller function block



1) Only with version "5"

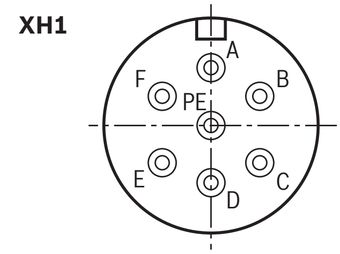
2) Not with "VARAN"

Detailed description of the safety function:
After the signal at the enable input has been removed, the output stage, and thus the solenoid of the valve, are internally separated from the available supply voltage. The enable acknowledgment will only be activated after the safe valve spool position has been achieved. For a detailed description of the safety function, refer to the operating instructions 29391-B.

Electrical connections, assignment

Connector pin assignment XH1, 6-pole + PE according to DIN 43563

Pin	Assignment of interface D9
A	24 V DC supply voltage [1]
B	GND
C	Enable acknowledgment 24 V DC (I_{max} 50 mA) [2] (high ≥ 15 V; low < 2 V)
D	Enable input 24 V DC (high ≥ 15 V; low < 2 V)
E	Not assigned
F	Not assigned
PE	Functional ground (connected directly to metal housing)

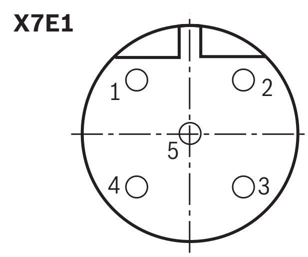


[1] A load increases the current consumption on pin A

[2] Enable acknowledgement is issued only if the valve has safely switched off according to EN 13849-1, see operating instructions 29391-B.

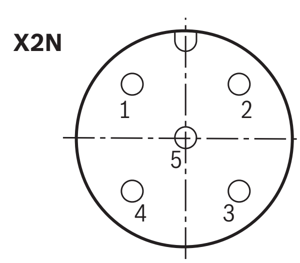
Connector pin assignment for Ethernet interface "X7E1" and "X7E2" (coding D), M12, 4-pole, socket

Pin	Assignment
1	TxD +
2	RxD +
3	TxD –
4	RxD –
5	Not assigned



Analog configurable sensor interface, port "X2N" (coding A), M12, 5-pole, socket

Pin	Assignment
1	+24 V voltage output
2	Analog sensor input 2 (0 ... 10 V)
3	GND
4	Analog sensor input 4 (0 ... 10 V)
5	Analog sensor input 3 (0 ... 10 V)

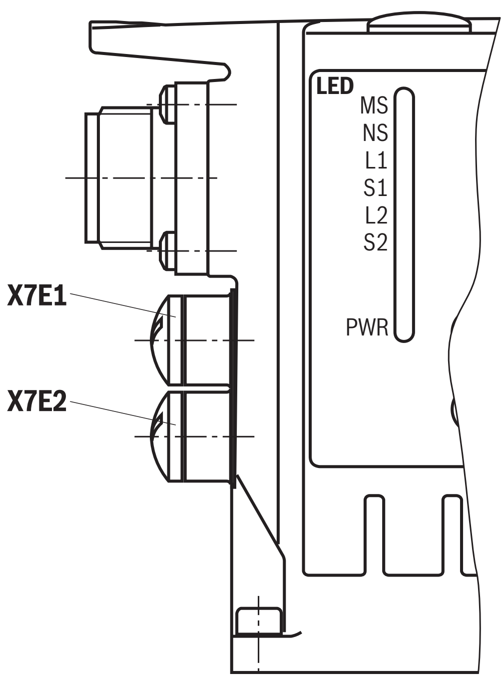


Only with version "5"

Notice:
- Reference potential for all signals: GND
- We recommend connecting the shields on both sides via the metal housings of the plug-in connectors.

LED displays

LED	Interface	Sercos	EtherNET/IP	EtherCAT	PROFINET RT	POWERLINK	VARAN
MS	**Electronics module**	Module status	Module status	Module status	Module status	Module status	Module status
NS		S	Network status and others	Network status and others	Network status and others	Status/error	Network status and others
L1	**X7E1**	Link and others	Link and others	Link/activity	Link and others	Link/data activity	Link and others
S1		Activity and others	Activity and others	Not used	Activity and others	Not used	Active and others
L2	**X7E2**	Link and others	Link and others	Link/activity	Link and others	Link/data activity	Not used
S2		Activity and others	Activity and others	Not used	Activity and others	Not used	Not used
PWR	**XH1**	Power	Power	Power	Power	Power	Power



Displays of the status LEDs

Power LED (LED PWR)	Display status
Off	No voltage supply
Green	Operation

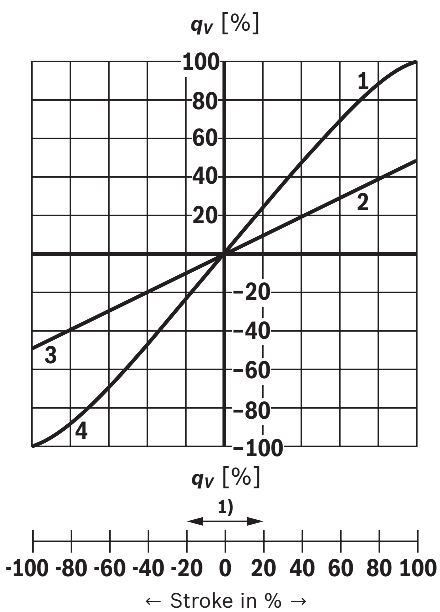
Module status LED (LED MS)	Display status
Off	No voltage supply
Green-red, flashing	Initialization
Green, flashing	Drive Ready for operation
Green	Drive active
Orange, flashing	Warning
Red, flashing	Error
Green, rapidly flashing	Firmware must be loaded

Notice:
- For the connection to the M12 sockets, we recommend using self-locking mating connectors
- Module status LED MS relates to the electronics module
- The network status LED NS indicates the status of the control communication, see application description 30338-FK
- LEDs L1, S1, L2 and S2 relate to interfaces "X7E1" and "X7E2"
  - Link: Cable plugged in, connection established (permanently lit)
  - Activity: Data sent/received (flashing)
- For a detailed description of the diagnosis LEDs, please refer to the functional description Rexroth HydraulicDrive HDx.

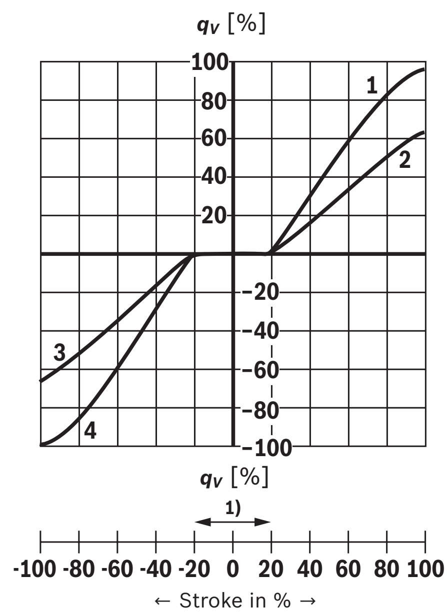
Characteristic curves: Flow characteristic "L" and "P" (measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/signal function – Version "L"

Symbol V, V1-

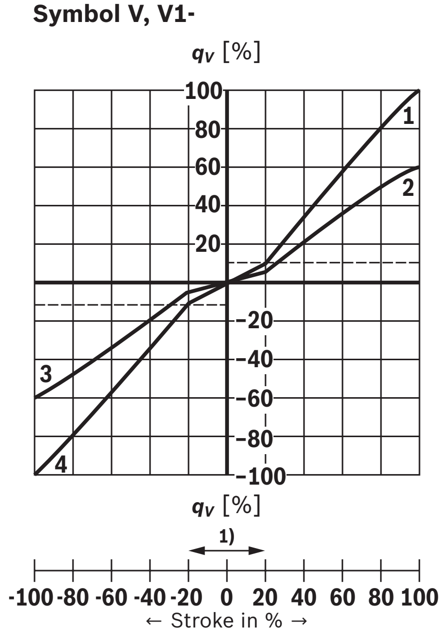


Symbols E, E1-, W6-, W8-

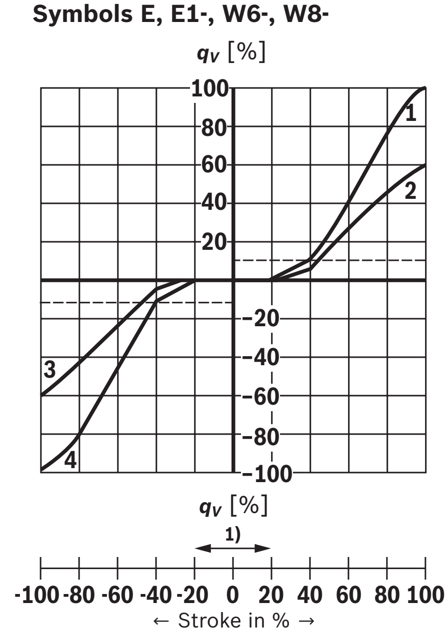


Flow/signal function – Version "P"

Symbol V, V1-



Symbols E, E1-, W6-, W8-

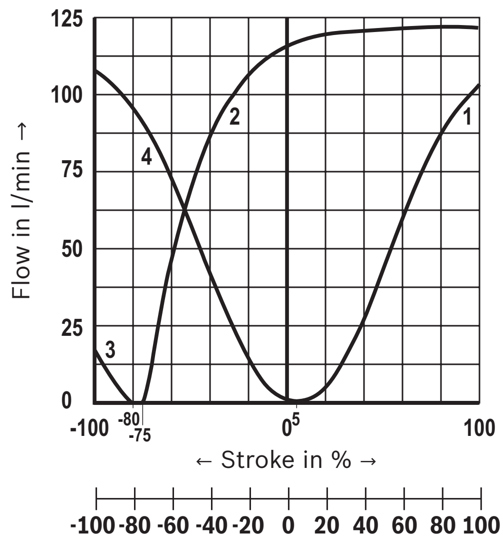


1 P–A; B–T (1:1)
2 B–T (2:1)
3 P–B (2:1)
4 P–B; A–T (1:1)
--- 10% q_V

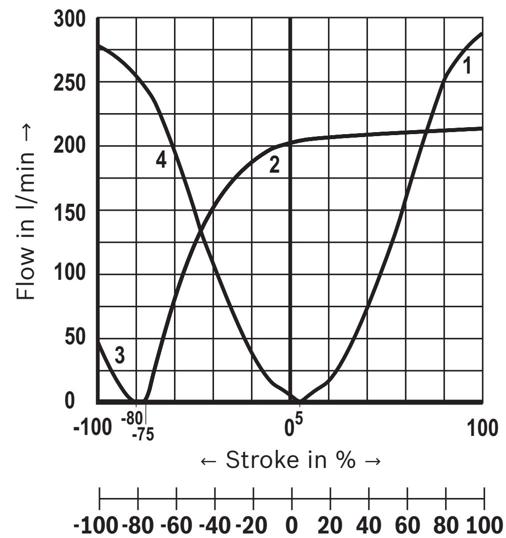
1) Step compensation (opening at 5%)

Characteristic curves: Flow characteristic "M"
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

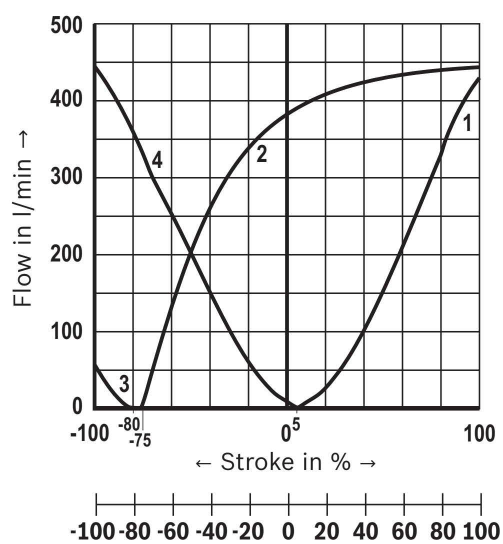
Symbol Q3, version "100"



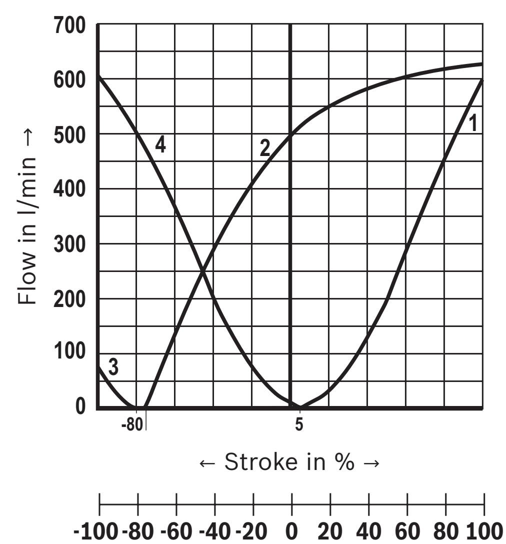
Symbol Q3, version "250"



Symbol Q3, version "400"



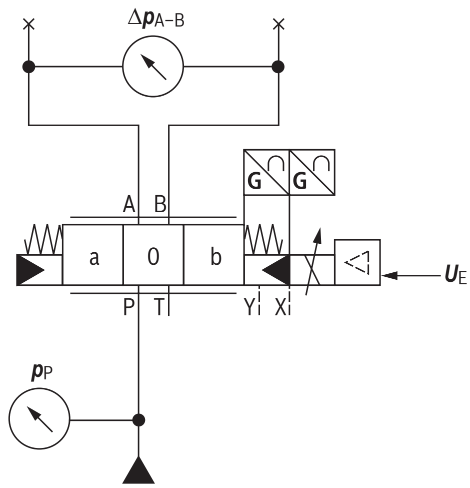
Symbol Q3, version "600"

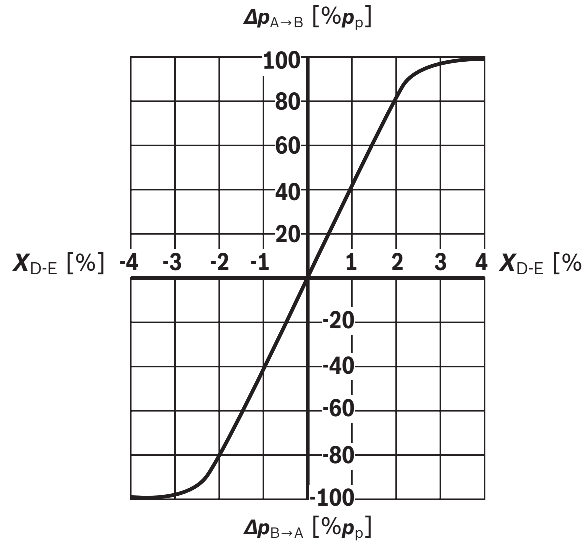


1 P–A
2 B–T
3 P–B
4 A–T

Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Pressure amplification

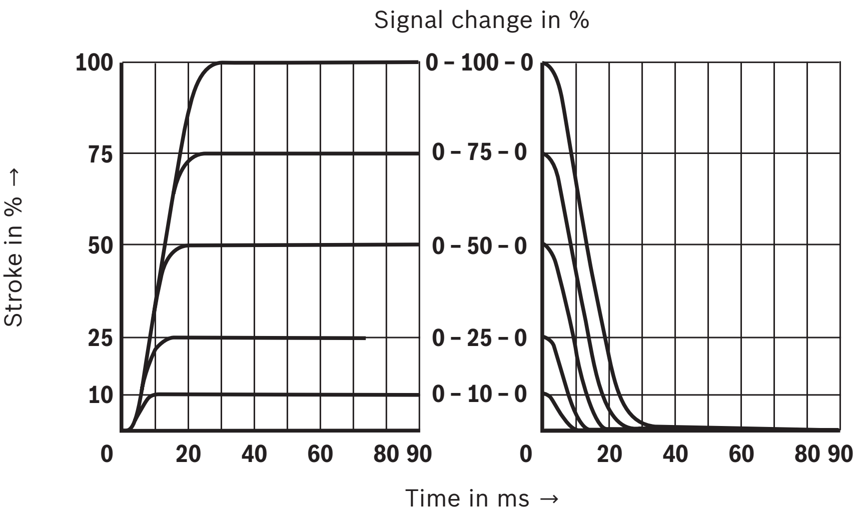




Characteristic curves: Size 10
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Transition function with stepped electric input signals

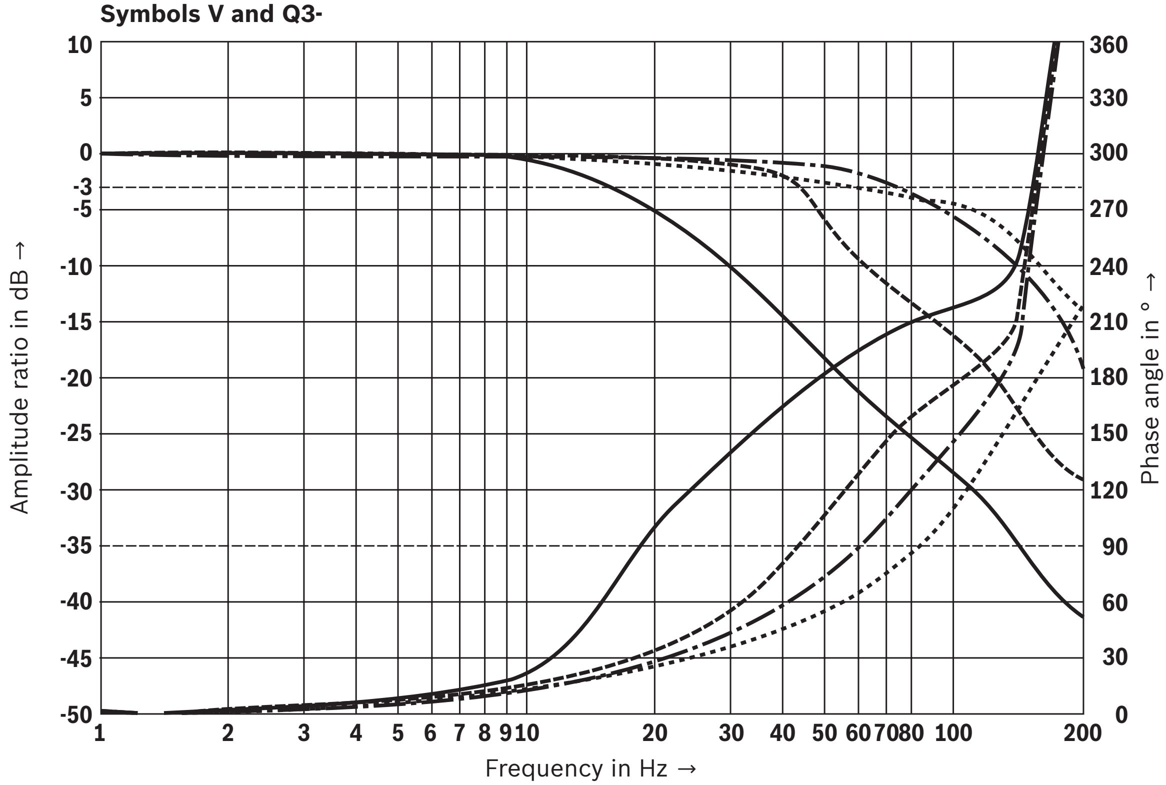
Symbols V and Q3-



- Pilot control valve, port X = 100 bar
- Main valve, port P = 10 bar

Frequency response characteristic curves

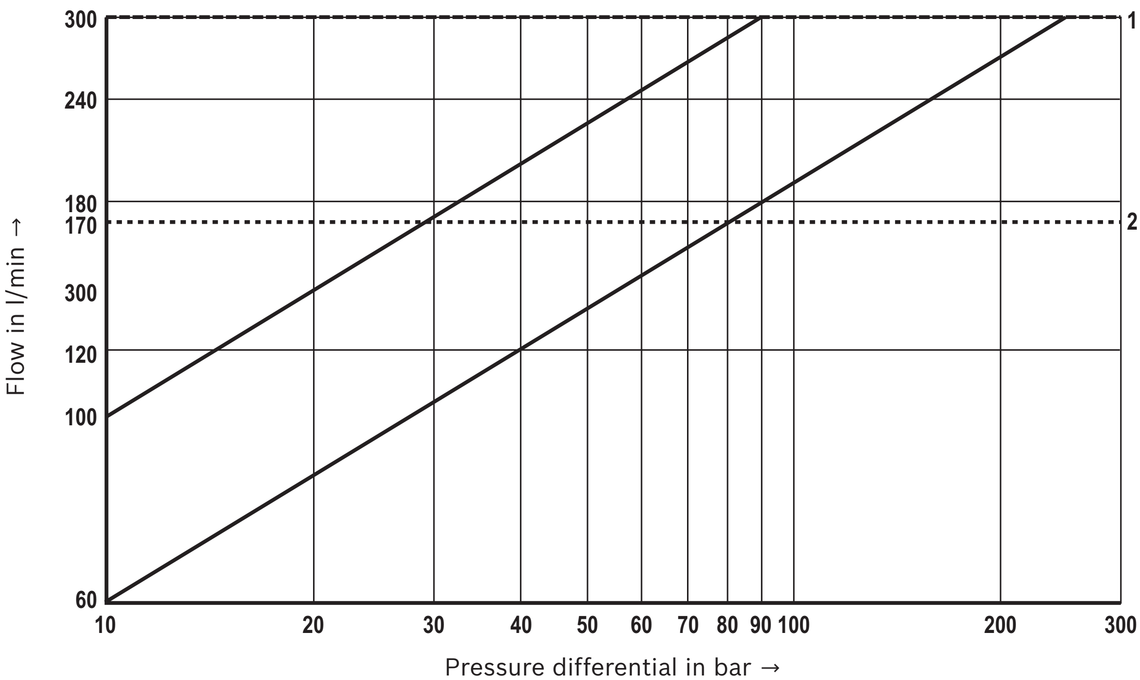
Symbols V and Q3-



- Signal ±1%
- Signal ±5%
- Signal ±25%
- Signal ±100%

Characteristic curves: Size 10
(valid for HLP46, ϑ_{oil} = 40 ±5 °C)

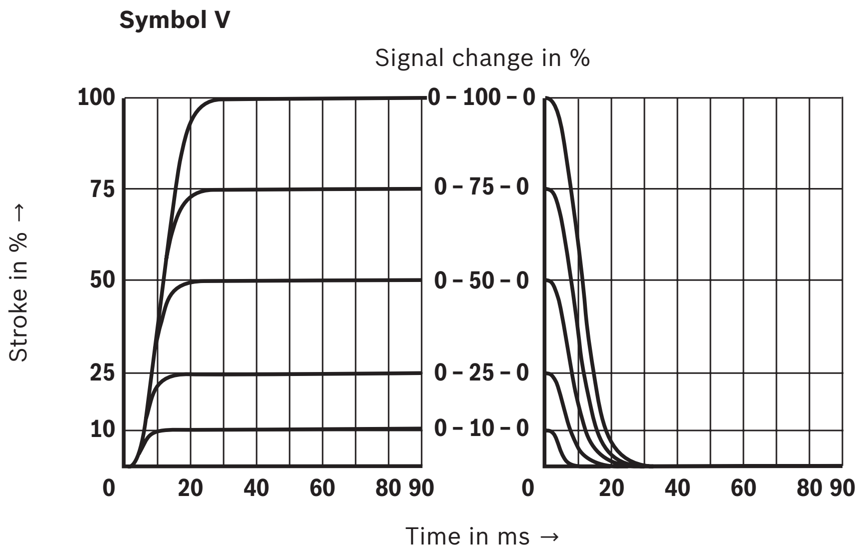
Flow/load function (with maximum valve opening; tolerance ± 10%)



1 Maximum admissible flow
2 Recommended flow
(flow velocity 30 m/s)

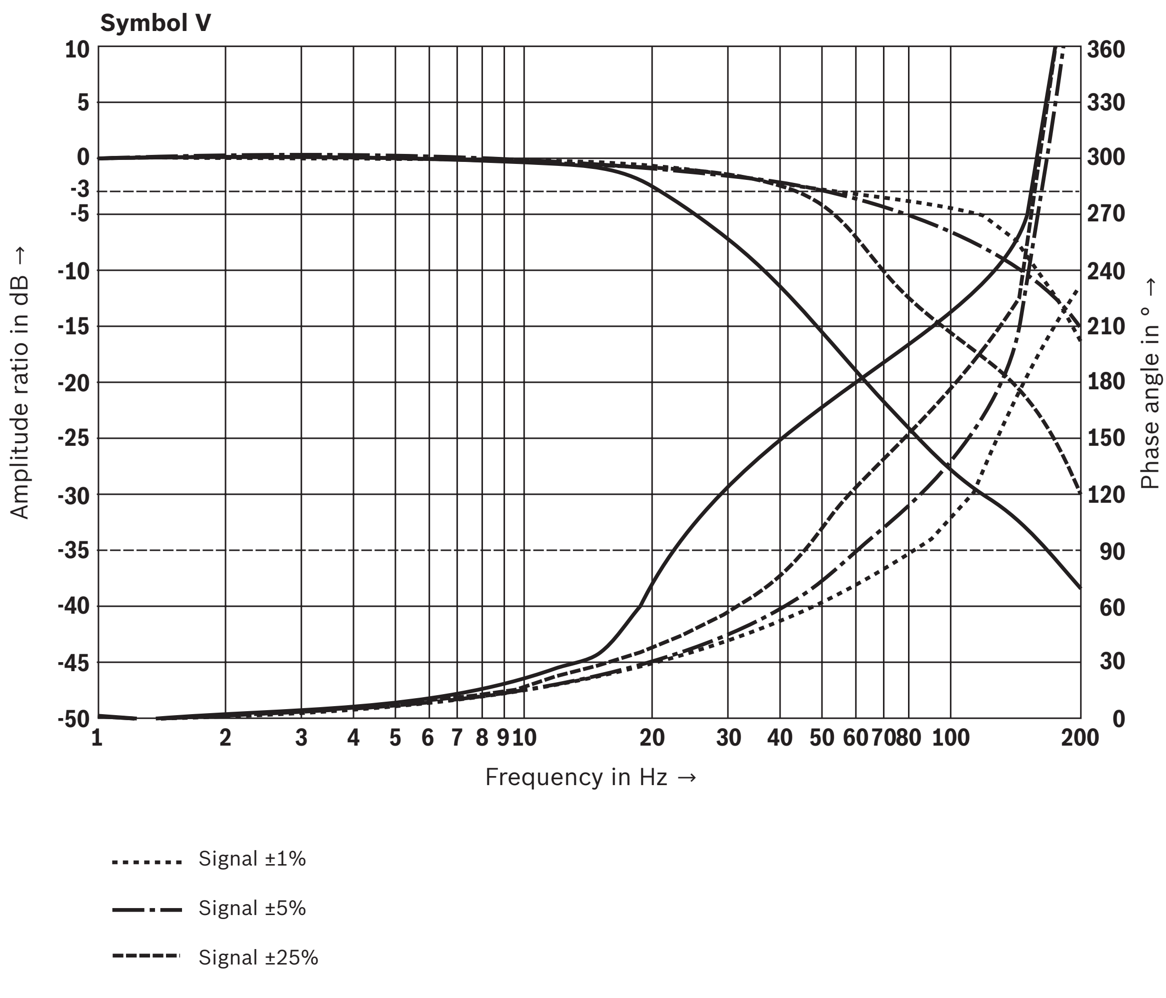
Characteristic curves: Size 16
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Transition function with stepped electric input signals



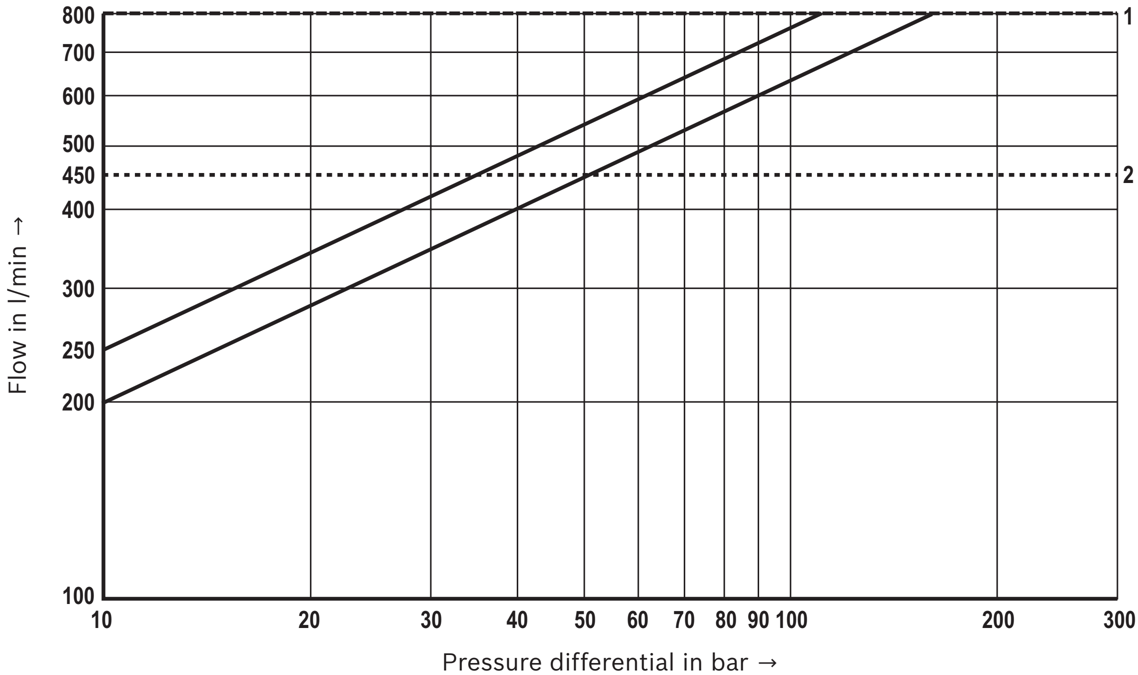
- Pilot control valve, port X = 100 bar
- Main valve, port P = 10 bar

Frequency response characteristic curves



Characteristic curves: Size 16
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/load function (with maximum valve opening; tolerance ± 10%)



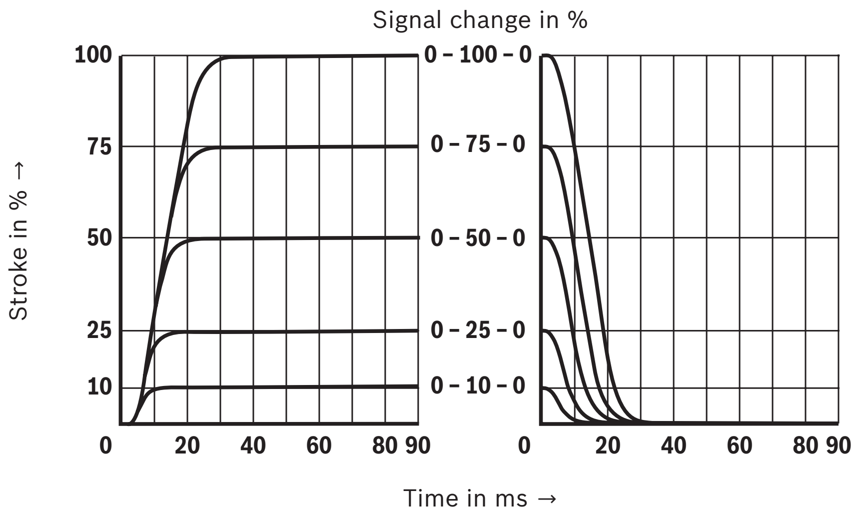
1 Maximum admissible flow

2 Recommended flow limitation
(flow velocity 30 m/s)

Characteristic curves: Size 25
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Transition function with stepped electric input signals

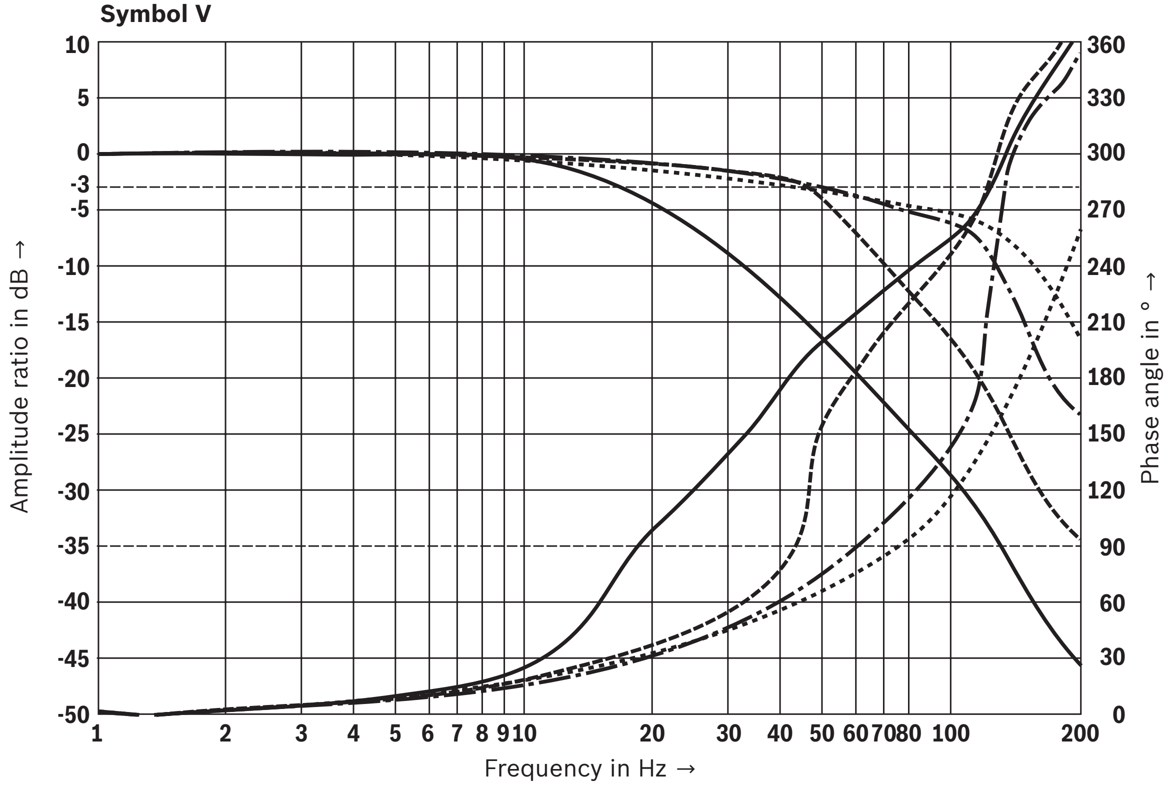
Symbol V



- Pilot control valve, port X = 100 bar
- Main valve, port P = 10 bar

Frequency response characteristic curves

Symbol V



Signal ±1%

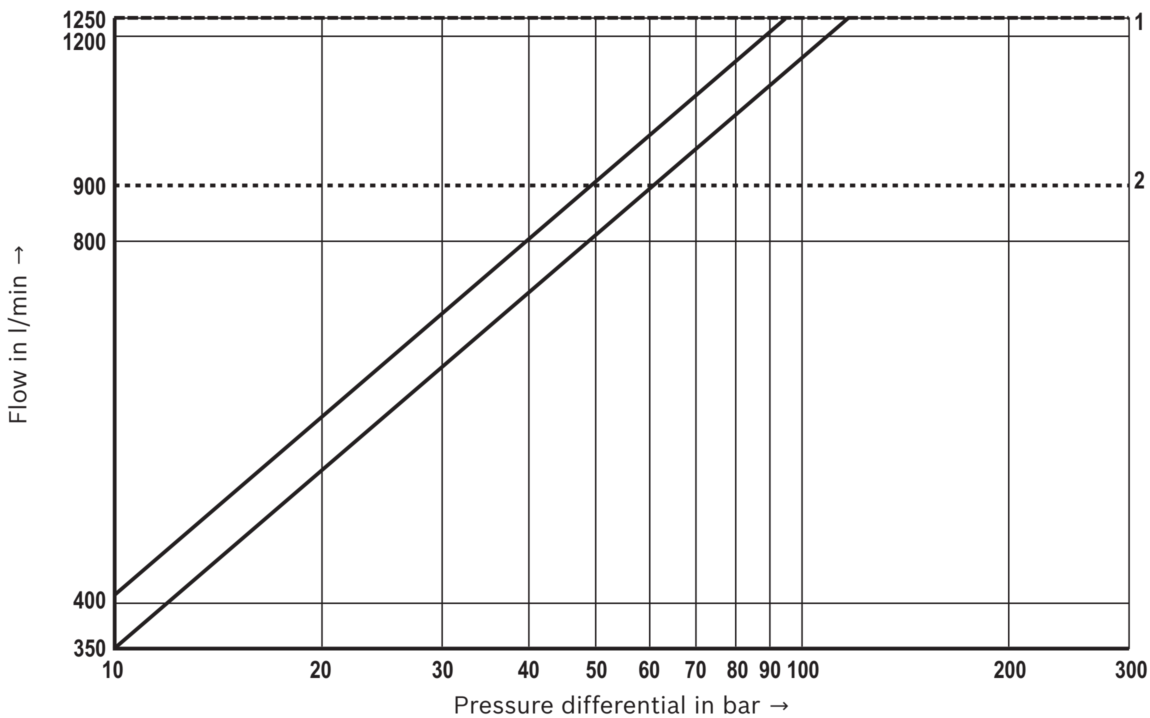
Signal ±5%

Signal ±25%

Signal ±100%

Characteristic curves: Size 25
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/load function (with maximum valve opening; tolerance ± 10%)



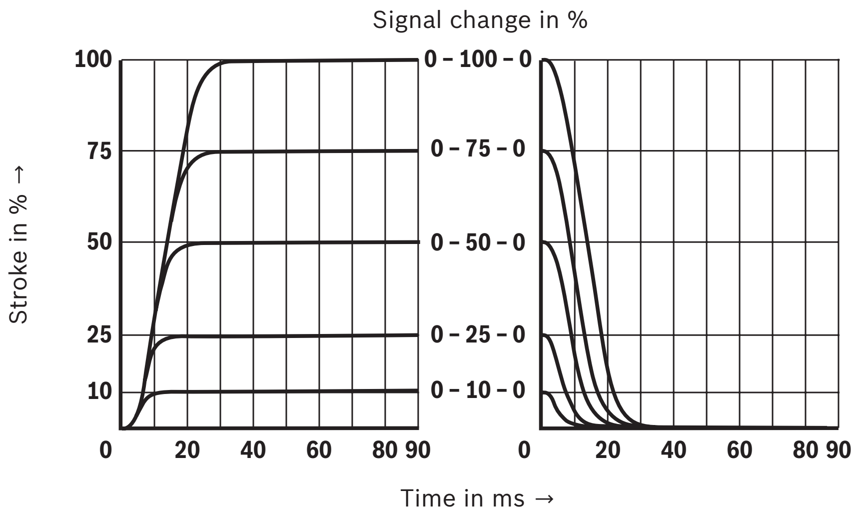
1 Maximum admissible flow

2 Recommended flow limitation (flow velocity 30 m/s)

Characteristic curves: Size 27
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Transition function with stepped electric input signals

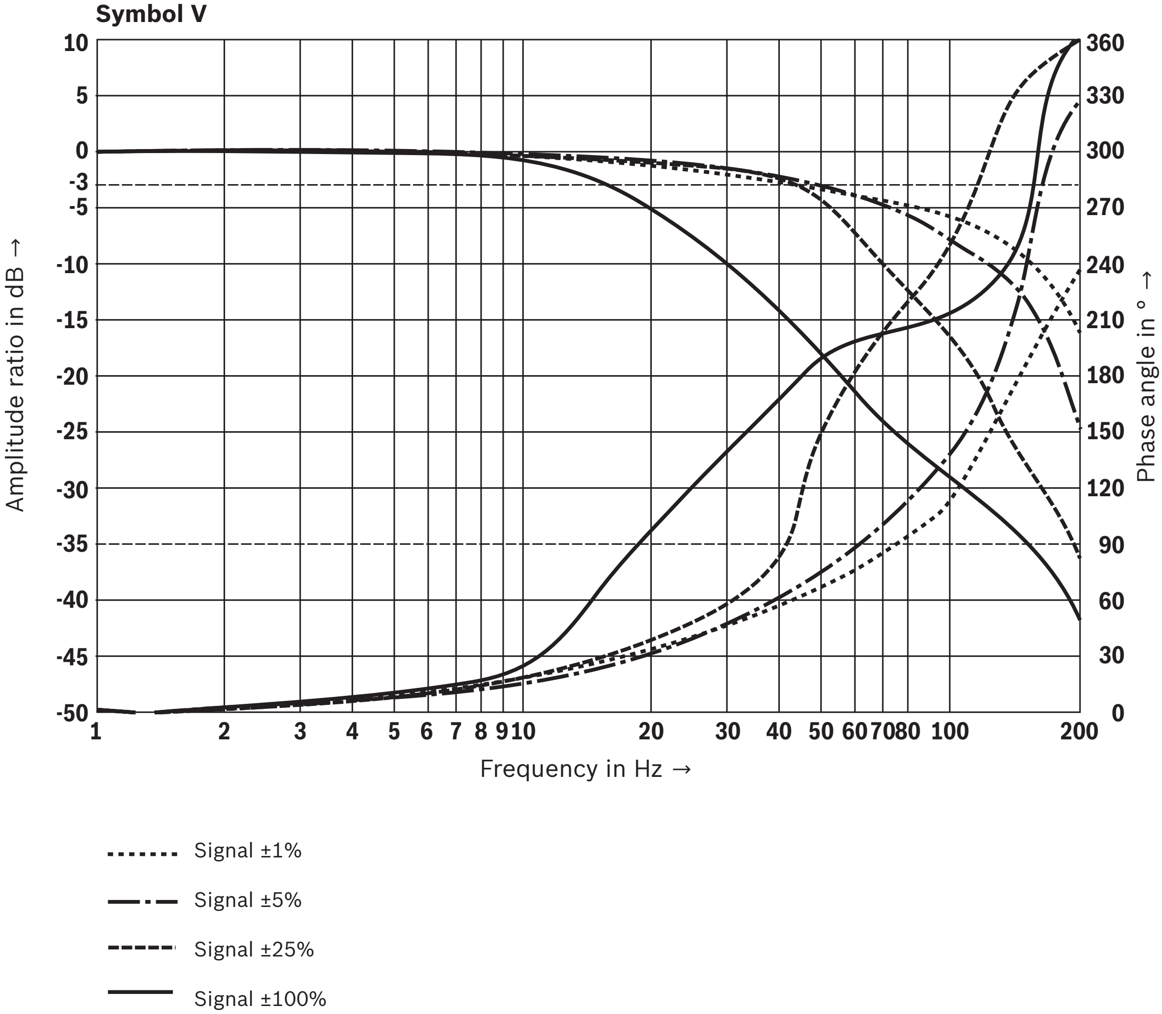
Symbol V



- Pilot control valve, port X = 100 bar
- Main valve, port P = 10 bar

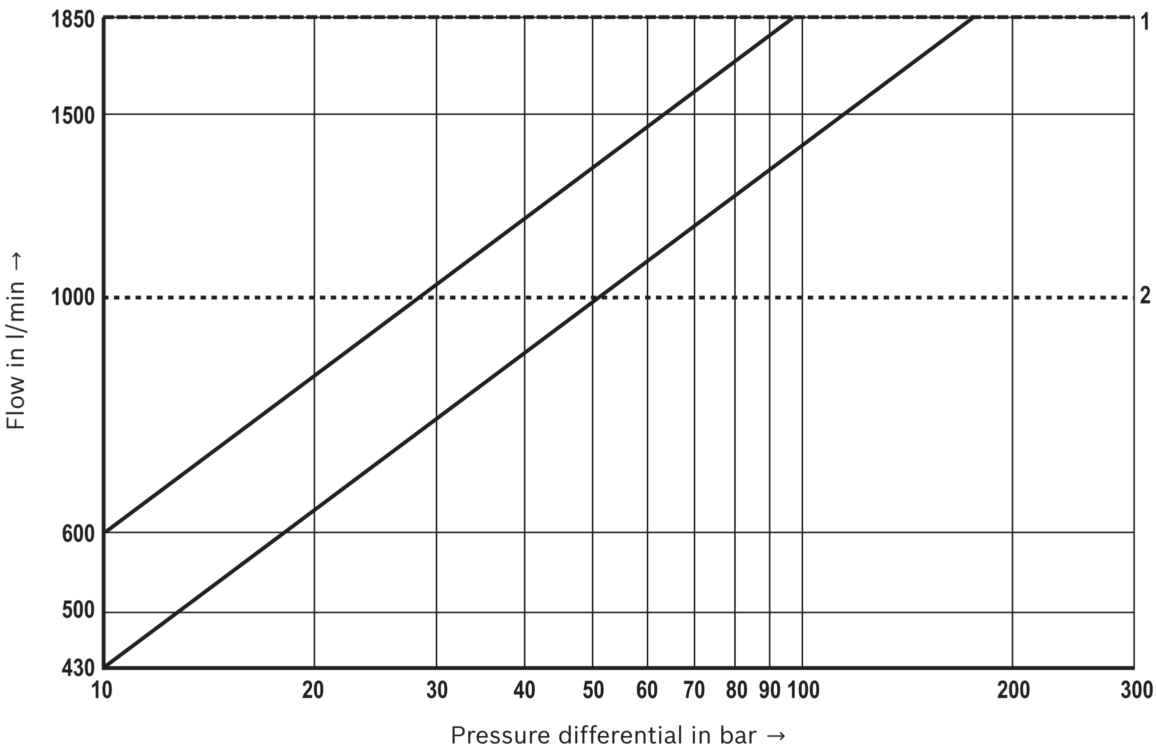
Frequency response characteristic curves

Symbol V



Characteristic curves: Size 27
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

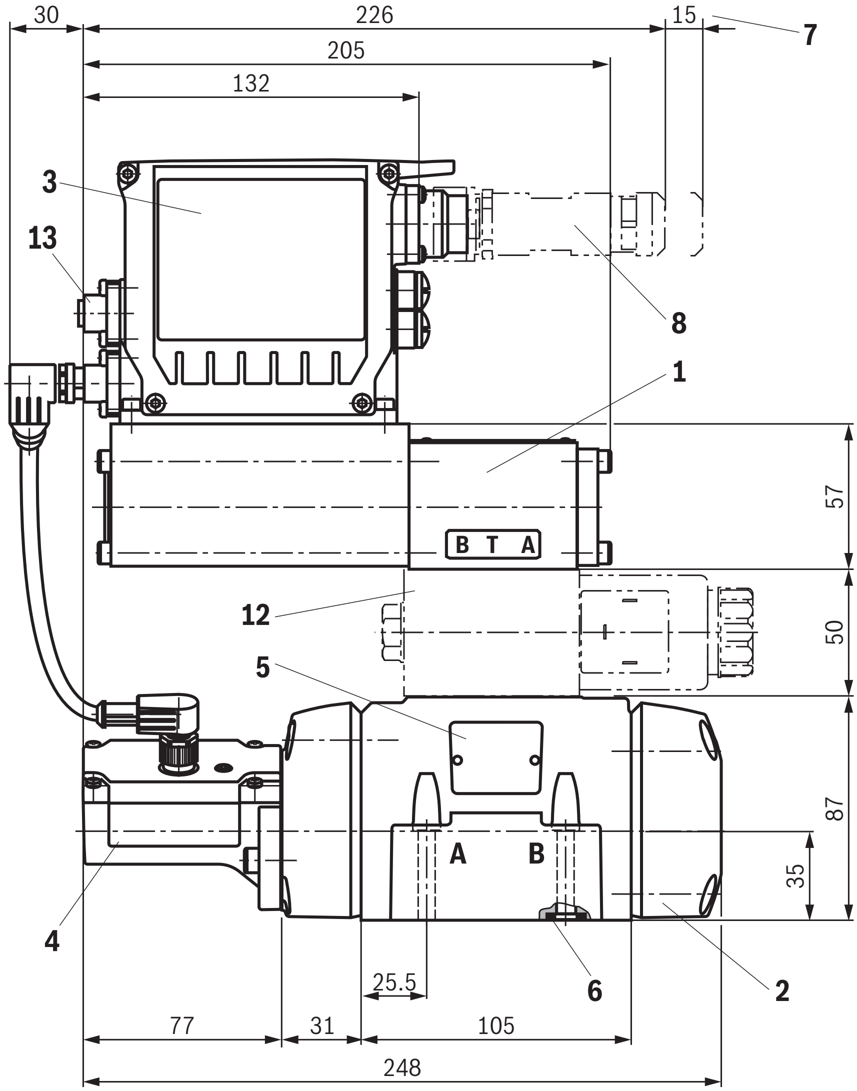
Flow/load function (with maximum valve opening; tolerance ± 10%)

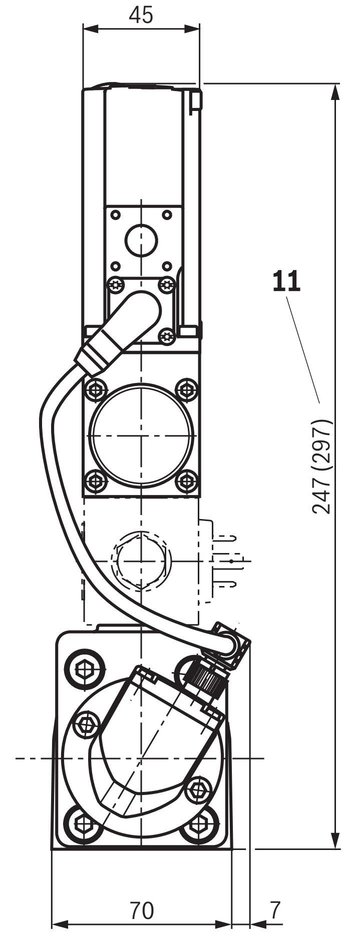


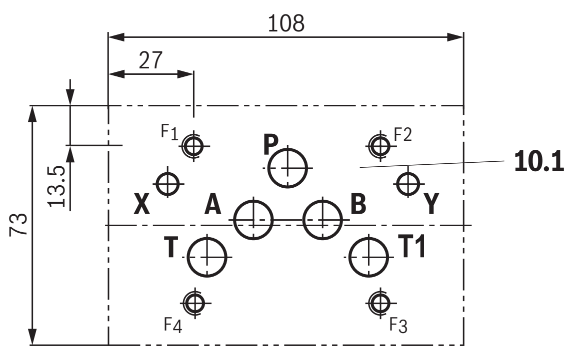
1 Maximum admissible flow

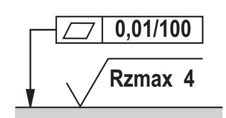
2 Recommended flow limitation
(flow velocity 30 m/s)

Dimensions: Size 10
(dimensions in mm)







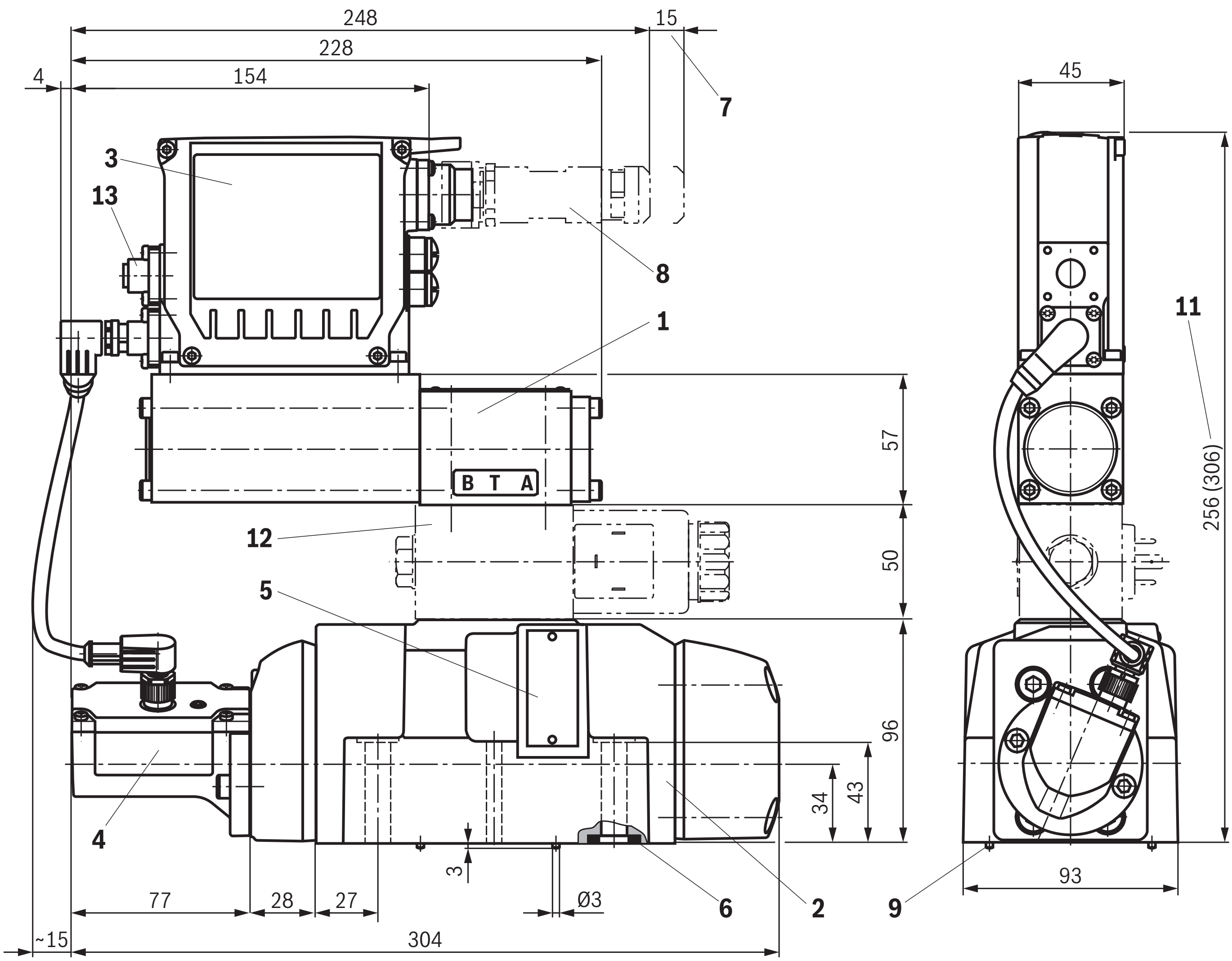


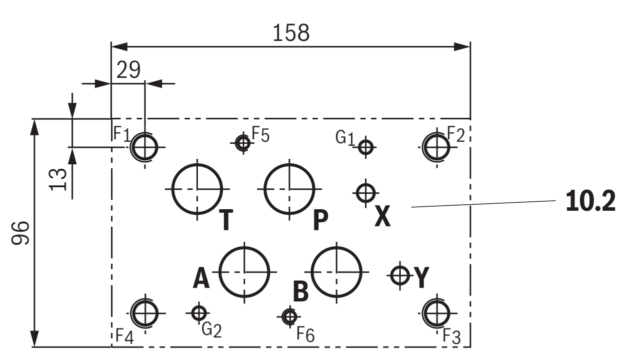
Required surface quality
of the valve contact surface

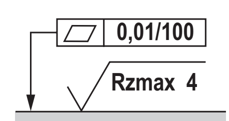
For **item explanations, valve mounting screws** and **subplates,** see page 30.

Notice:
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions: Size 16
(dimensions in mm)





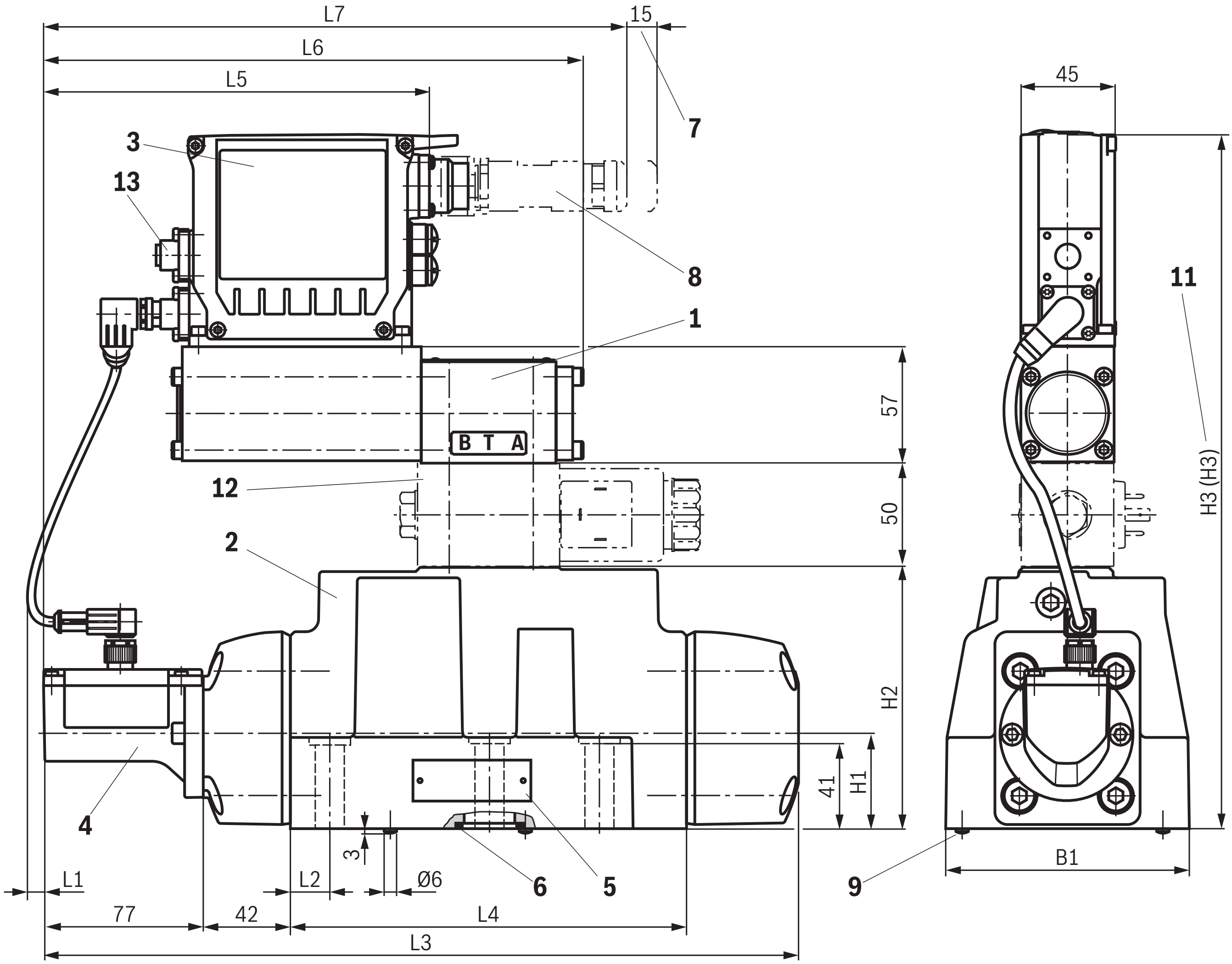


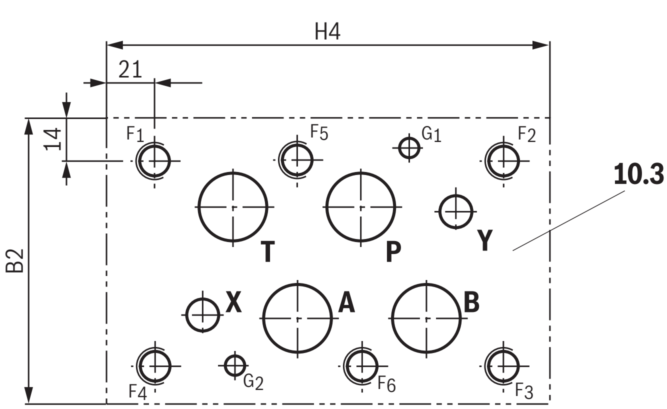
Required surface quality
of the valve contact surface

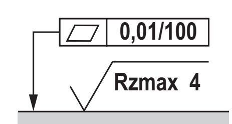
For **item explanations, valve mounting screws** and **subplates,** see page 30.

Notice:
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions: Sizes 25 and 27
(dimensions in mm)







Required surface quality
of the valve contact surface

NG	L1	L2	L3	L4	L5	L6	L7	H1	H2	H3	(H3)	H4	B1	B2
25	15	19	364	191	187	260	281	46	126	286	336	195	118	120
27	15	20.5	371	198	190	264	284	50	140	300	350	200	120	124

For **item explanations, valve mounting screws** and **subplates,** see page 30.

Notice:
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions

1 Pilot control valve

2 Main valve

3 Integrated electronics (OBE)

4 Inductive position transducer (main valve)

5 Name plate

6 Identical seal rings for ports P, A, B, T
Identical seal rings for ports X, Y

7 Space required for removing the mating connector

8 Mating connectors, separate order, see page 31 and data sheet 08006.

9 Locking pin

10.1 Machined valve contact surface,
porting pattern according to ISO 4401-05-05-0-05

10.2 Machined valve contact surface,
porting pattern according to ISO 4401-07-07-0-05
Deviating from the standard: ports P, A, B, T – Ø20 mm
Minimum screw-in depth:
- Ferrous metal: 1.5 x Ø
- Non-ferrous metal: 2.0 x Ø

10.3 Machined valve contact surface,
porting pattern according to ISO 4401-08-08-0-05
Deviating from the standard:
- NG25: Ports X, Y – Ø14 mm
- NG27: Ports P, A, B, T – Ø32 mm

Minimum screw-in depth:
- Ferrous metal: 1.5 x Ø
- Non-ferrous metal: 2.0 x Ø

11 Dimension () with version "WL"

12 Shut-off valve, optional (sandwich plate valve "Z4WE 6 E166-3X/EG24...", see data sheet 23193)

13 Port X2N (only version "5")

Valve mounting screws (separate order)

Size	Quantity	Hexagon socket head cap screws	Material number
10	4	**ISO 4762 - M6 x 45 - 10.9-CM-Fe-ZnNi-5-Cn-T0-H-B** Tightening torque M_A = 13.5 Nm ±10%	**R913043777**
	or		
	4	**ISO 4762 - M6 x 45 - 10.9** Tightening torque M_A = 15.5 Nm ±10%	Not included in the Rexroth delivery range
16	2	**ISO 4762 - M6 x 60 - 10.9-CM-Fe-ZnNi-5-Cn-T0-H-B** Tightening torque M_A = 12.2 Nm ±10%	**R913043410**
	4	**ISO 4762 - M10 x 60 - 10.9-CM-Fe-ZnNi-5-Cn-T0-H-B** Tightening torque M_A = 58 Nm ±20%	**R913014770**
	or		
	2	**ISO 4762 - M6 x 60 - 10.9** Tightening torque M_A = 15.5 Nm ±10%	Not included in the Rexroth delivery range
	4	**ISO 4762 - M10 x 60 - 10.9** Tightening torque M_A = 75 Nm ±20%	
25, 27	6	**ISO 4762 - M12 x 60 - 10.9-CM-Fe-ZnNi-5-Cn-T0-H-B** Tightening torque M_A = 100 Nm ±20%	**R913015613**
	or		
	6	**ISO 4762- M12 x 60 - 10.9** Tightening torque M_A = 130 Nm ±20%	Not included in the Rexroth delivery range

Notice:
The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure.

Subplates (separate order) with porting pattern according to ISO 4401, see data sheet 45100.

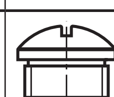
Accessories (separate order)

Mating connectors and cable sets

Port	Designation	Version	Short designation	Material number	Data sheet
XH1	Mating connector; for valves with round connector, 6-pole + PE	straight, metal	7PZ31...M	**R900223890**	08006
		straight, plastic	7PZ31...K	**R900021267**	
		angled, plastic	–	**R900217845**	–
	Cable sets; for valves with round connector, 6-pole + PE	Plastic, 3.0 m	7P Z31 BF6	**R901420483**	08006
		Plastic, 5.0 m		**R901420491**	
		Plastic, 10.0 m		**R901420496**	
		Plastic, 20.0 m	–	**R901448068**	–
X7E1, X7E2	Cable set; shielded, 4-pole, D coding	Straight connector M12, on straight connector M12, line cross-section 0.25 mm^2, CAT 5e, length freely selectable (= xx.x)	–	**R911172111** [1]	–
	Cable set; shielded, 4-pole	Straight connector M12, on straight connector RJ45, line cross-section 0.25 mm^2, CAT 5e, length freely selectable (= xx.x)	–	**R911172135** [2]	–
X2N	Cable set; shielded, 5-pole, for connecting Rexroth pressure sensors, type HM20, A coding	PUR/PVC, straight connector M12, on straight socket M12, line cross-section 0.34 mm^2, 0.6 m	–	**R901111709**	–
		PUR/PVC, straight connector M12, on straight socket M12, line cross-section 0.34 mm^2, 1.0 m	–	**R901111712**	–
		PUR/PVC, straight connector M12, on straight socket M12, line cross-section 0.34 mm^2, 2.0 m	–	**R901111713**	–
	Cable set; shielded, 5-pole, A coding	Straight connector M12, on free line end, line cross-section 0.34 mm^2, 1.5 m	–	**R901111752**	–
		Straight connector M12, on free line end, line cross-section 0.34 mm^2, 3.0 m	–	**R901111754**	–
		Straight connector M12, on free line end, line cross-section 0.34 mm^2, 5.0 m	–	**R901111756**	–
		Straight connector M12, on free line end, line cross-section 0.34 mm^2, 10.0 m	–	**R913005147**	–

1) Additionally indication of type designation RKB0040/xx.x
2) Additionally indication of type designation RKB0044/xx.x

Protective cap

Protective cap M12	Version	Material number
		**R901075563**

Parameterization

The following is required for the parameterization with PC		Material number/download
1 Commissioning software	IndraWorks, Indraworks D, Indraworks DS	
2 Connection cable, 3 m	Shielded, M12 on RJ45, length can be freely selected (= xx.x)	**R911172135** (additionally indication of type designation RKB0044/xx.x)

Project planning and maintenance instructions

- The supply voltage must be permanently connected; otherwise, bus communication is not possible.
- If electro-magnetic interference must be expected, take appropriate measures to ensure the function (depending on the application, e.g. shielding, filtration).
- The devices have been tested in the plant and are supplied with default settings.
- Only complete devices can be repaired. Repaired devices are returned with default settings. User-specific settings will not be applied. The machine end-user will have to retransfer the corresponding user parameters.

Further information

▶ High-response/proportional valve with Multi-Ethernet interface	Operating instructions 29391-B
▶ CE Declaration of Conformity	Upon request
▶ Subplates	Data sheet 45100
▶ Hydraulic fluids on mineral oil basis	Data sheet 90220
▶ Environmentally compatible hydraulic fluids	Data sheet 90221
▶ Flame-resistant, water-free hydraulic fluids	Data sheet 90222
▶ Hexagon socket head cap screws, metric/UNC	Data sheet 08936
▶ Hydraulic valves for industrial applications	Operating instructions 07600-B
▶ General product information on hydraulic products	Data sheet 07008
▶ Installation, commissioning and maintenance of servo valves and high-response valves	Data sheet 07700
▶ Assembly, commissioning and maintenance of hydraulic systems	Data sheet 07900
▶ Operation fieldbus electronics (xx = software version):	
– Functional description Rexroth HydraulicDrive HDx-20	– 30338-FK
– Parameter description Rexroth HydraulicDrive HDS-16, HDx-17 ...HDx-20	– 30330-PA
– Description of diagnosis Rexroth HydraulicDrive HDS-16, HDx-17 ...HDx-20	– 30330-WA
▶ Commissioning software and documentation on the Internet	
▶ Selection of filters	
▶ Information on available spare parts	

RE 29289
Edition: 2021-05
Replaces: 2017-09

rexroth
A Bosch Company

Directional control valve, pilot-operated, with integrated digital axis controller (IAC-Multi-Ethernet)

Type 4WRLD

H8073

- Sizes 10 ... 35
- Component series 4X
- Maximum operating pressure of 350 bar (ports P, A, B)
- Rated flow 60 ... 1500 l/min (***Δp*** = 10 bar)

CE

Features

- Open
  - Integrated digital axis control functionality (IAC-Multi-Ethernet)
  - Bus connection/service interface (Sercos, EtherCAT, EtherNet/IP, PROFINET RT, POWERLINK, VARAN)
- Scalable
  - 2 configurable analog sensor inputs
  - 1 input for linear position measurement system (SSI, 1Vpp or EnDat 2.2)
- Precise
  - Best-in-class hydraulic controller
  - High response sensitivity and low hysteresis
- Safe
  - Internal safety function (can be used up to category 4/PL e according to EN 13849-1)
  - CE conformity according to EMC Directive 2014/30/EU

Contents

Ordering code

01	02	03	04	05	06	07	08		09		10	11		12	13	14	15	16
4	WRL	D						–	4X	/			/	24		D6		*

01	4 main ports	**4**
02	Directional control valve, pilot-operated	**WRL**
03	With integrated digital axis controller	**D**
04	Size 10	**10**
	Size 16	**16**
	Size 25	**25**
	Size 27	**27**
	Size 35	**35**
05	Symbols; possible version see page 4	

Rated flow at 10 bar pressure differential (5 bar/control edge)

06	**– Size 10**	
	60 l/min (only symbol E, E1-, W6-, W8-, V and V1-)	**60**
	100 l/min	**100**
	– Size 16	
	200 l/min (only symbol W6- and W8-)	**200**
	250 l/min (only symbol E, E1-, V, V1- and Q3)	**250**
	– Size 25	
	350 l/min (only symbol W6- and W8-) [1)]	**350**
	400 l/min (only symbol E, E1-, V, V1- and Q3)	**400**
	– Size 27	
	430 l/min (only symbol W6- and W8-) [1)]	**430**
	600 l/min (only symbol E, E1-, V, V1- and Q3)	**600**
	– Size 35	
	1000 l/min (only symbol E, E1-, V and V1-)	**1000**
	1200 l/min (only symbol W6- and W8-) [1)]	**1200**
	1500 l/min (only symbol E, E1-, V, V1- and Q3-)	**1500**

Flow characteristic

07	Linear	**L**
	Linear with fine control range (only NG10; other sizes on request)	**P**
	Progressive with linear fine control range (only symbols Q3-)	**M**
08	**Without** overlap jump (only symbols V, V1- and Q3)	**no code**
	With overlap jump (opening point 5% with covered valve; only symbols E, E1-, W6-, W8-)	**J**
09	Component series 40 ... 49 (40 ... 49: unchanged installation and mounting dimensions)	**4X**

Seal material (observe compatibility of seals with hydraulic fluid used, see page 10)

10	NBR seals	**M**
	FKM seals	**V**

Pilot oil flow

11	External pilot oil supply, external pilot oil return	**XY**
	Internal pilot oil supply, external pilot oil return	**PY**
	Internal pilot oil supply; internal pilot oil return	**PT**
	External pilot oil supply, internal pilot oil return	**XT**
12	Supply voltage 24 V	**24**

1) Higher rated flow upon request

Ordering code

01	02	03	04	05	06	07	08		09		10	11		12	13	14	15	16
4	**WRL**	**D**						**–**	**4X**	**/**			**/**	**24**		**D6**		*

Ethernet interface

13	EtherNET/IP	**E**
	PROFINET RT	**N**
	Sercos	**S**
	EtherCAT (CANopen profile)	**T**
	POWERLINK (CANopen profile)	**W**
	VARAN	**V**

Electrical interface

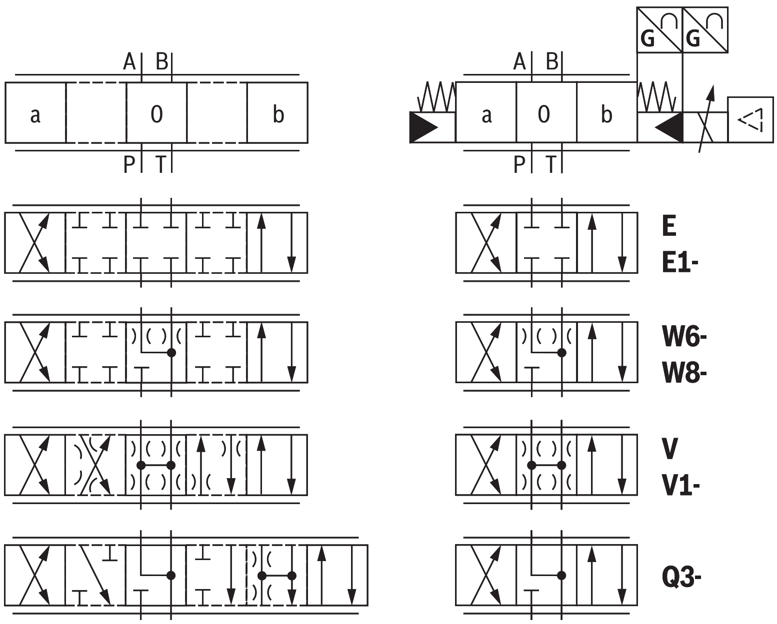
14	±10 VDC or 4 ... 20 mA	**D6**

Sensor interfaces

15	0 ... 10 V/4 ... 20 mA/EnDat 2.2	**S**
	0 ... 10 V/4 ... 20 mA/SSI	**T**
	0 ... 10 V/4 ... 20 mA/1Vpp	**U**

16	Further details in the plain text	*

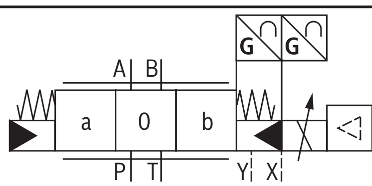
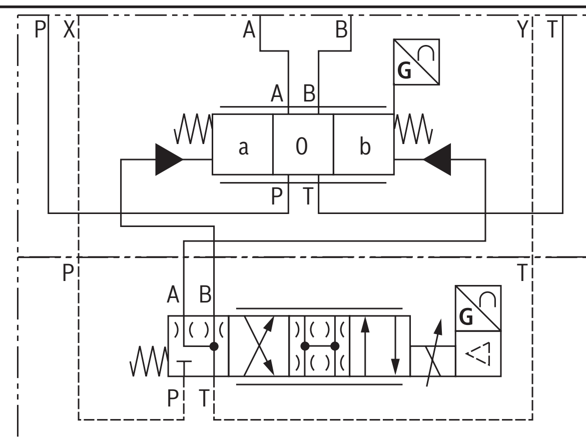
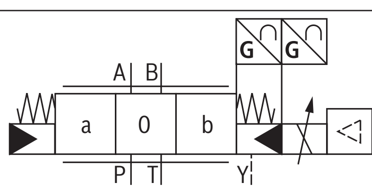
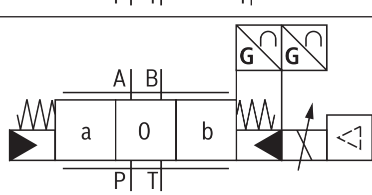
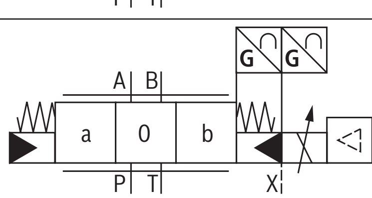
Symbols



With symbol E1–, V1– and W8–:

P → A: $q_{V\,max}$ B → T: $q_V/2$

P → B: $q_V/2$ A → T: $q_{V\,max}$

Version	simple	detailed
"XY"		
"PY"		
"PT"		
"XT"		

Notice:
- Representation according to DIN ISO 1219-1.Hydraulic interim positions are shown by dashes.
- For information on the "switch-off behavior", refer to "Technical data" on page 10.
- Symbols V and V1 are not suitable for use in safety applications (no overlap).

Function

General

The pilot-operated **IAC-Multi-Ethernet** valve (**I**ntegrated **A**xis **C**ontroller based on directional control valves) is a digital directional control valve with integrated axis controller and the following functionalities:

- Position control
- Pressure/force control
- Closed-loop speed control
- Substitutional closed-loop control (position - pressure/force)
- Substitutional control (flow - pressure/force)
- pQ function (flow-controlled)

Among others, the following operating modes are possible:

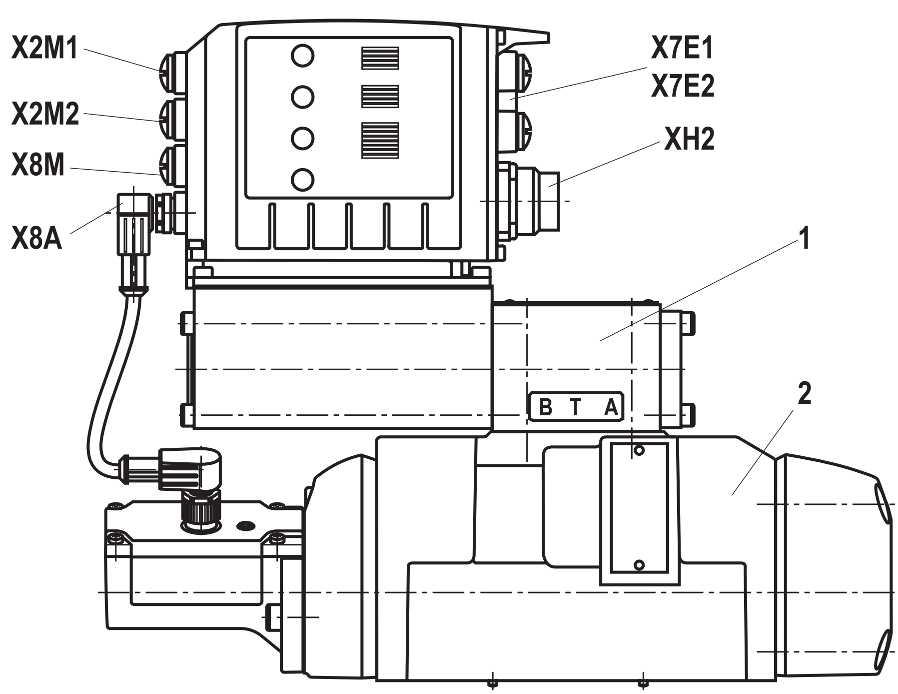
- Valve direct control
- Drive-controlled position control
- Drive-controlled positioning
- Positioning block operation

- The command values are preset via the Ethernet interface (X7E1 or X7E2) or, alternatively, via the analog/digital interface (XH2)
- The feedback information of the actual value signals to the superior control system is provided optionally either via the Ethernet interface (X7E1 or X7E2) or the analog/digital interface (XH2)
- The controller parameters are set via the Ethernet interface (X7E1 or X7E2)

Set-up

The directional control valve with IAC-Multi-Ethernet electronics mainly consists of:

- Pilot control valve (1) with control spool and sleeve in servo quality
- Main stage (2) with centering springs and position feedback
- Integrated digital axis controller (3) with:
  - analog/digital interface (XH2)
  - Ethernet interfaces (X7E1, X7E2)
  - analog sensor interfaces (X2M1, X2M2)
  - digital sensor interface (X8M)
  - interface for the position transducer of the main stage (X8A)



Function

Function (symbol V, V1- and Q3)
When the control solenoid of the pilot control valve is de-energized, its spring-operated control spool is in the "fail safe" position. The control spool of the main valve is in the spring-centered offset position at approx. 6% of the stroke in direction P→B/A→T.
The integrated electronics (OBE) compare the specified command value to the position actual value of the control spool of the main stage. In case of a control deviation, the control solenoid of the pilot control valve is activated and its control spool is adjusted.
The flow which is activated via the control cross-sections at the pilot control valve leads to an adjustment of the control spool of the main valve. The stroke/control cross-section of the main valve is regulated proportionally to the command value. In case of a command value presetting of 0%, the electronics adjust the control spool of the main valve to central position.
The pilot oil supply in the pilot control valve is either internal via port P or external via port X. The feedback can be internal via port T or external via port Y to the tank.

Switching off the release (symbol V and V1-)
If the supply voltage fails or in case of cable break, the integrated electronics will de-energize the control solenoid, the pilot control spool will move to the fail-safe position and will unload the pilot oil chambers of the main valve. Operated by the spring, the main valve control spool will move to the offset position (approx. 6% P→B/A→T).

Function (symbol E. and W.)
When the control solenoid of the pilot control valve is de-energized, its spring-operated control spool is in the "fail safe" position. The control spool of the main valve is in spring-centered central position.
The integrated electronics (OBE) compare the specified command value to the position actual value of the control spool of the main stage. In case of a control deviation, the control solenoid of the pilot control valve is activated and its control spool is adjusted.
The flow which is activated via the control cross-sections at the pilot control valve leads to an adjustment of the control spool of the main valve. The stroke/control cross-section of the main valve is regulated proportionally to the command value.
The pilot oil supply in the pilot control valve is either internal via port P or external via port X. The feedback can be internal via port T or external via port Y to the tank.

Switching off the release (symbol E. and W.)
If the supply voltage fails or in case of cable break, the integrated electronics will de-energize the control solenoid, the pilot control spool will move to the fail-safe position and will unload the pilot oil chambers of the main valve. Operated by the spring, the main valve control spool will move to the central position.

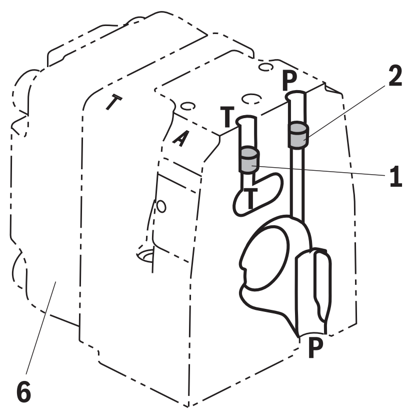
Monitoring
The digital control electronics enable comprehensive monitoring functions/error detection including:
- Undervoltage
- Communication error
- Cable break for analog sensor inputs and digital position measurement system
- Short-circuit monitoring for analog/digital outputs
- Monitoring of the microcontroller (watchdog)
- Temperature of the integrated electronics

IndraWorks DS PC program
To implement the project planning task and to parameterize the IAC-Multi-Ethernet valves, the user may use the IndraWorks DS engineering tool (see accessories):
- Project planning
- Parameterization
- Commissioning
- Diagnosis
- Comfortable administration of all data on a PC
- PC operating systems: Windows XP (SP3), Windows 7-10

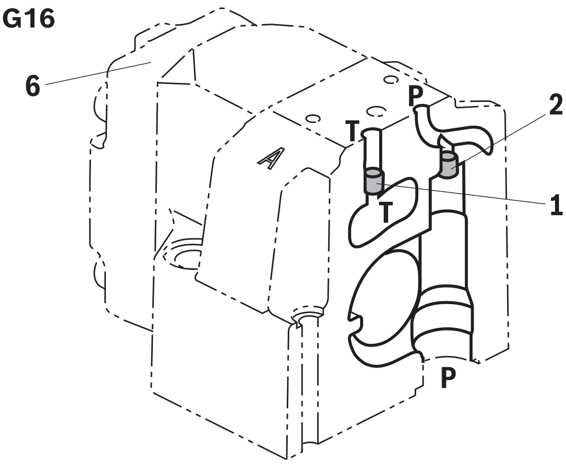
☞ **Notices:**
- Symbol V and V1-:
  Pilot-operated 4/3 directional control valves are only functional in the active control loop and do not have a locking basic position when deactivated.
  Consequently, "external isolator valves" are required in many applications and must be taken into account regarding the switch-on/switch-off order.
  While the electrical supply voltage is being switched off, the drive may be accelerated for a short time in functional direction P → B.
- Symbol E. and W.:
  Pilot-operated 4/3 directional control valves with positive overlap are functional in controlled or regulated axes. The overlap in the de-energized state is approx. 20% of the control spool stroke.
  While the release is being switched off, the drive may be accelerated for a short time in functional direction P → B. (For further details, please refer to operating instructions 29391-B)

Pilot oil supply (schematic illustration)

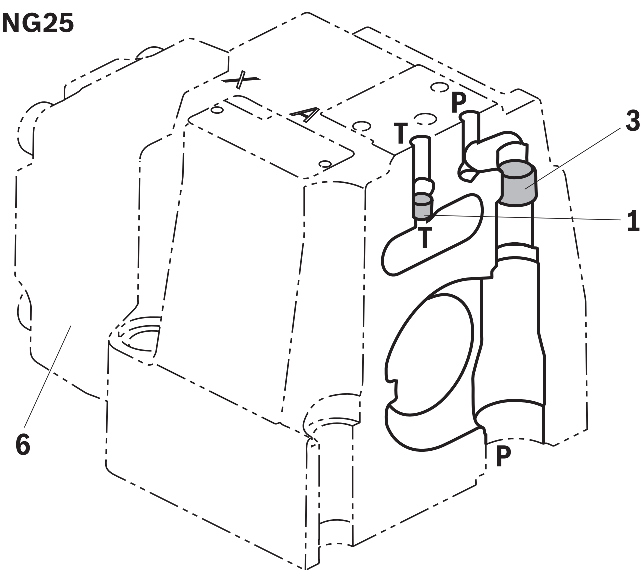
NG10



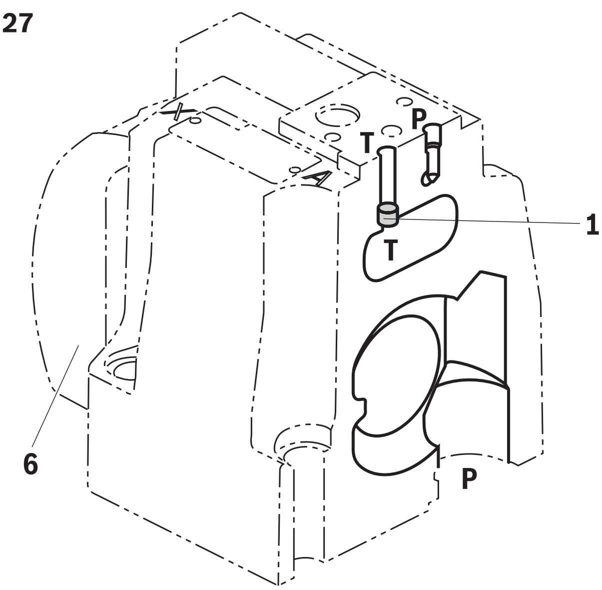
NG16



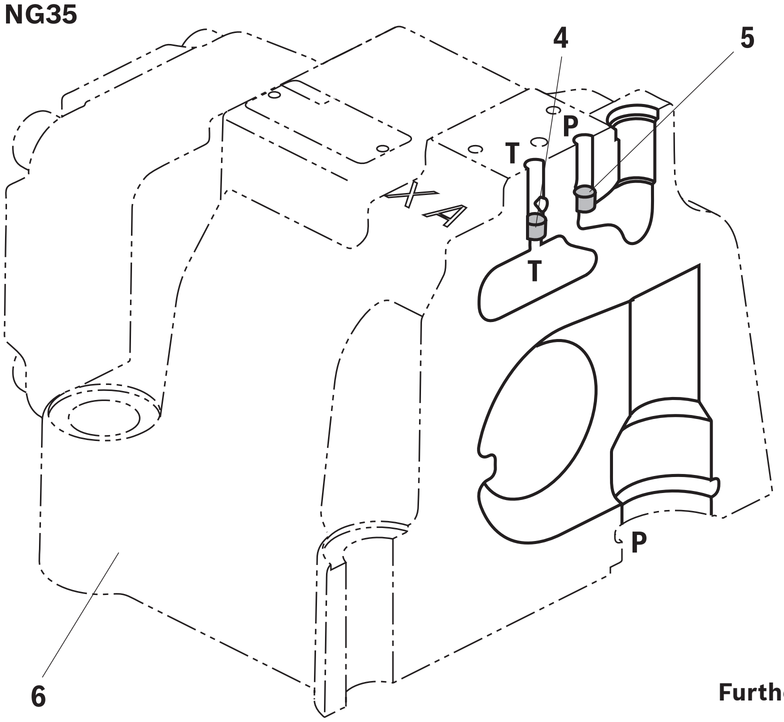
NG25



NG27



NG35



1 Plug screw M6 according to DIN 906, wrench size 3 – pilot oil return
2 Plug screw M6 according to DIN 906, wrench size 3 –pilot oil supply
3 Plug screw M12 x 1.5 according to DIN 906, wrench size 6 –pilot oil supply
4 Plug screw 1/16-27 NPTF, SW4 – pilot oil return
5 Plug screw 1/16-27 NPTF, SW4 –pilot oil supply
6 Housing cover main stage (position transducer side)

Pilot oil supply

External: **2, 3, 5** closed
Internal: **2, 3, 5** open

Pilot oil return

External: **1, 4** closed
Internal: **1, 4** open

Further explanations on page 8.

Pilot oil supply

Version "XY"
External pilot oil supply
External pilot oil return
In this version, the pilot oil is supplied from a separate control circuit (external).
The pilot oil return is not directed into channel T of the main valve but is separately directed to the tank via port Y (external).

Version "PY"
Internal pilot oil supply
External pilot oil return
With this version, the pilot oil is supplied from channel P of the main valve (internal).
The pilot oil return is not directed into channel T of the main valve but is separately directed to the tank via port Y (external).
In the subplate, port X is to be closed.

Version "PT"
Internal pilot oil supply
Internal pilot oil return
With this version, the pilot oil is supplied from channel P of the main valve (internal).
The pilot oil is directly returned to channel T of the main valve (internal).
In the subplate, ports X and Y are to be closed.

Version "XT"
External pilot oil supply
Internal pilot oil return
In this version, the pilot oil is supplied from a separate control circuit (external).
The pilot oil is directly returned to channel T of the main valve (internal).
In the subplate, port Y is to be closed.

Technical data
(For applications outside these values, please consult us!)

General							
Size		NG	10	16	25	27	35
Weight		kg	9	12	19	21	80
Installation position			any				
Ambient temperature range		°C	–20 ... +60				
Maximum solenoid surface temperature		°C	120 (individual operation)				
Maximum storage time		Years	1 (if the storage conditions are observed; refer to the operating instructions 07600-B)				
$MTTF_d$ value according to EN ISO 13849	▶ Hydraulic (category 1)	Years	75 (for further details, see operating instructions 29391-B)				
	▶ Hydraulic and electric (category 3 and 4, without power supply unit)	Years	70 (for further details, see operating instructions 29391-B)				
Vibration resistance	▶ Sine test according to DIN EN 60068-2-6		10 ... 2000 Hz/maximum of 10 g/10 cycles/3 axes				
	▶ Noise test according to DIN EN 60068-2-64		20 ... 2000 Hz / 10 g_{RMS} / 30 g peak / 30 min. / 3 axes				
	▶ Transport shock according to DIN EN 60068-2-27		15 g / 11 ms / 3 axes				
Maximum relative humidity (no condensation)		%	95				

Technical data

(For applications outside these values, please consult us!)

Hydraulic							
Size		NG	10	16	25	27	35
Maximum operating pressure	▶ Ports A, B, P						
	– External pilot oil supply	bar	350			270	350
	– Internal pilot oil supply	bar	280			270	280
	▶ Port X	bar	280			270	280
	▶ Ports T, Y	bar	250			210	250
Hydraulic fluid			see table page 10				
Hydraulic fluid temperature range (flown-through)		°C	−20 ... +70				
Viscosity range	▶ recommended	mm^2/s	30 ... 45				
	▶ maximum admissible	mm^2/s	20 ... 380				
Rated flow (Δp = 5 bar/control edge) [1]		l/min	60/100	200/250	350/400	430/600	1000/1200/1500
Maximum flow		l/min	300	800	1250	1850	4700
Maximum leakage flow (inlet pressure 100 bar)	▶ Symbol E, E1-						
	– Main valve	l/min	0.06	0.13	0.17		0.61
	– Main valve + pilot control valve	l/min	0.14	0.28	0.42		1.01
	▶ Symbol W6-, W8-						
	– Main valve	l/min	0.12	0.26	0.35		1.23
	– Main valve + pilot control valve	l/min	0.2	0.41	0.6		1.63
Maximum zero flow (inlet pressure 100 bar)	▶ Symbol V, V1-						
	– Main valve	l/min	1.7	2.3	2.8	3.3	7.2
	– Main valve + pilot control valve	l/min	1.85	2.6	3.2	3.7	7.65
	▶ Symbol Q3-						
	– Main valve	l/min	0.4	1.6	1.8	2.2	1.6
	– Main valve + pilot control valve	l/min	0.55	1.9	2.2	2.6	2.05
Minimum pilot pressure (pilot control valve)		bar	10				
Pilot flow [2]	▶ Symbol E, W	l/min	2.4	3.5	7.5		23
	▶ Symbol V, Q3-	l/min	4.5	11.5	22		29
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)			Class 18/16/13 [3]				

Flow unloading central position Δp = 5 bar/control edge			A→T	B→T	A→T	B→T	A→T	B→T	A→T	B→T	A→T	B→T
	▶ Symbol W6-	l/min	2.8	2.8	4	4	6	6	6	6	25	25
	▶ Symbol W8-	l/min	2.8	1.4	4	2	6	3	6	3	25	12.5

1) Flow for deviating Δp (valve pressure differential):

$$q_x = q_{Vnom} \times \sqrt{\frac{\Delta p_x}{10}}$$

2) At port X and Y with stepped input signal from 0 ... 100% (100 bar)

3) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and simultaneously increases the life cycle of the components.

Technical data

(For applications outside these values, please consult us!)

Hydraulic fluid		Classification	Suitable sealing materials	Standards	Data sheet
Mineral oils		HL, HLP, HLPD, HVLP, HVLPD	NBR, FKM	DIN 51524	90220
Bio-degradable	▶ Insoluble in water	HETG	FKM	ISO 15380	90221
		HEES	FKM		
	▶ Soluble in water	HEPG	FKM	ISO 15380	
Flame-resistant	▶ Water-free	HFDU (glycol base)	FKM	ISO 12922	90222
		HFDU (ester base)	FKM		
		HFDR	FKM		
	▶ Containing water	HFC (Fuchs: Hydrotherm 46M, Renosafe 500; Petrofer: Ultra Safe 620; Houghton: Safe 620; Union: Carbide HP5046)	NBR	ISO 12922	90223

☞ **Important information on hydraulic fluids:**

- For further information and data on the use of other hydraulic fluids, please refer to the data sheets above or contact us.
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.).
- The ignition temperature of the hydraulic fluid used must be 50 K higher than the maximum surface temperature.
- **Bio-degradable and flame-resistant – containing water:** If components with galvanic zinc coating (e.g. version "J3" or "J5") or parts containing zinc are used, small amounts of dissolved zinc may get into the hydraulic system and cause accelerated aging of the hydraulic fluid. Zinc soap may form as a chemical reaction product, which may clog filters, nozzles and solenoid valves – particularly in connection with local heat input.
- **Flame-resistant – containing water:**
  - Due to the increased cavitation tendency with HFC hydraulic fluids, the life cycle of the component may be reduced by up to 30% as compared to the use with mineral oil HLP. In order to reduce the cavitation effect, it is recommended – if possible specific to the installation – backing up the return flow pressure in ports T to approx. 20% of the pressure differential at the component.
  - Dependent on the hydraulic fluid used, the maximum environment and hydraulic fluid temperature must not exceed 50 °C. In order to reduce the heat input into the component, the command value profile is to be adjusted for proportional and high-response valves.

Static/dynamic							
Size		NG	10	16	25	27	35
Hysteresis		%	< 0.1				
Range of inversion		%	< 0.08				
Response sensitivity		%	< 0.05				
Manufacturing tolerance q_{Vmax}		%	≤ 10				
Temperature drift (temperature range 20 °C ... 80 °C)		%/10 °C	Zero shift < 0.25				
Zero compensation (ex plant)		%	±1				
Actuating time for 0 ... 100% at X=100 bar	▶ Symbols E, E1-, W6-, W8-	ms	40	60	60	60	90
Switch-off behavior (after electric shut-off)	▶ Symbols E, E1-, W6-, W8-		Pilot control valve in fail-safe position, main valve moves to overlapped spring-centered central position				
	▶ Symbol V, V1-		Pilot control valve in fail-safe position, main valve moves to spring-centered "offset position" (approx. 6%, P→B/A→T)				
	▶ Symbol Q3		Pilot control valve in fail-safe position, main valve moves to spring-centered "offset position" (P blocked, A/B to port T open)				

Technical data
(For applications outside these values, please consult us!)

Electrical, integrated electronics (OBE)			
Supply voltage [4; 5]	▶ Nominal voltage	VDC	24
	▶ Lower limit value	VDC	18
	▶ Upper limit value	VDC	36
Maximum admissible residual ripple		Vpp	2.5 (comply with absolute supply voltage limit values)
Current consumption	▶ Maximum [6]	A	2.5
	▶ Impulse current	A	4
Maximum power consumption		W	40
Relative duty cycle		%	100 (continuous operation)
Protection class according to EN 60529			IP 65 with mounted and locked plug-in connectors
Required fuse protection, external		A	4, time-lag
Protective grounding conductor and screening			see connector pin assignment (CE-compliant installation) page 15 and 16
Adjustment			calibrated in the plant, see characteristic curves page 18 ... 30
Booting time		s	< 15
Scan time pressure and force controller (minimum)		ms	0.5
Scan time position controller (minimum)		ms	1
AD/DA resolution	▶ Analog inputs	Bit	12
	▶ Analog output	Bit	12
Parameterization interface			Ethernet
Conformity			CE according to EMC directive 2004/108/EC tested according to EN 61000-6-2 and EN 61000-6-3
Digital inputs XH2	▶ Quantity		optionally up to 2, configurable (analog inputs are omitted)
	▶ Low level	V	–3 ... 5
	▶ High level	V	15 ... U_B
	▶ Current consumption at high level	mA	< 1
	▶ Reference potential		Pin 5
Digital outputs XH2	▶ Quantity		1
	▶ Low level	V	0 ... 3
	▶ High level	V	15 ... U_B
	▶ Current carrying capacity	A	1.5 (short-circuit-proof)
	▶ Signal delay time	ms	< 2 (depending on set scan time)
	▶ Reference potential		GND
Analog inputs XH2	▶ Number (current and voltage input parameterizable)		optionally up to 2, configurable (digital inputs are no longer required)
	▶ AD resolution	bit	12
	▶ Voltage inputs (differential inputs)		
	– Measurement range	V	–10 ... +10
	– Input resistance	kΩ	80 +10%
	– Temperature drift		< 14 mV / 10 K
	▶ Current inputs (reference to AGND)		
	– Input current		4 ... 20 (0 ... 20 physically)
	– Input resistance	Ω	200, measuring resistance plus FET
	– Temperature drift		< 25 µA / 10 K

4) Supply voltage is used directly for sensor connections X2M1, X2M2 and X8M (no internal voltage limitation)

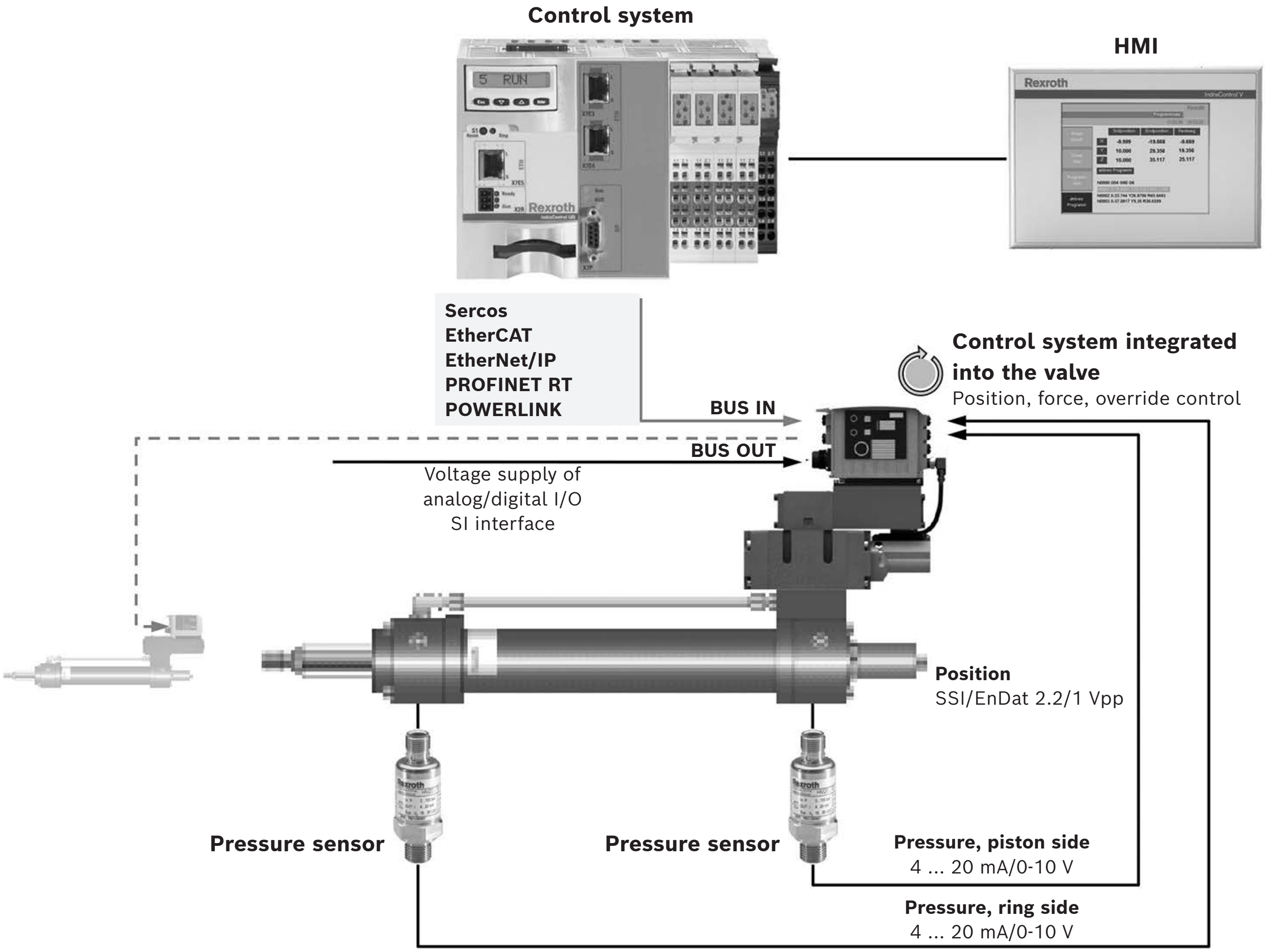
5) Voltage limit values must be observed directly at the connector of the valve (observe line length and cable cross-section!)

6) When using the sensor inputs or the switching output, the maximum current consumption will increase according to the external load

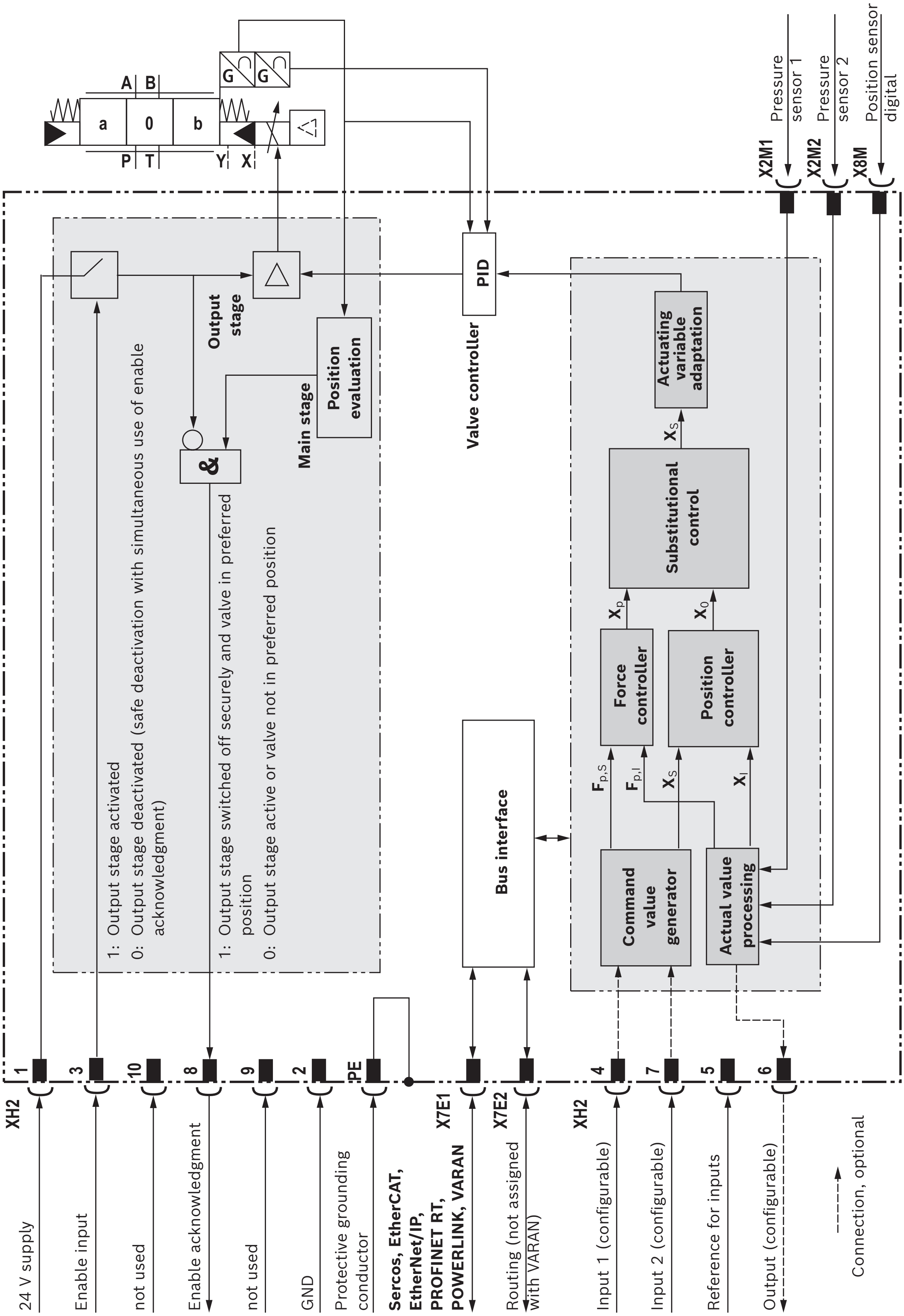
Technical data
(For applications outside these values, please consult us!)

Analog outputs XH2	▶ Number (current and voltage input parameterizable)			1
	▶ DA resolution		bit	12
	▶ Voltage outputs – Output range		V	–10 ... +10 (0 ... 10 by software)
	– Minimum load impedance		kΩ	10
	– Temperature drift			< 5 mV / 10 K
	▶ Current outputs – Output range		mA	0 ... 20 (4 ... 20 by software)
	– Maximum load		Ω	200
Analog sensors X2M1, X2M2	▶ Number (current and voltage input configurable)			1 per connector
	▶ Supply voltage		V	24 (corresponding to supply voltage applied to XH2)
	▶ Maximum supply current		mA	350 (sum X2M1, X2M2 and X8M)
	▶ AD resolution		bit	12
	▶ Voltage inputs – Measurement range		V	0 ... 10
	– Input resistance		kΩ	80 +10%
	– Temperature drift			< 15 mV / 10 K
	▶ Current inputs (reference to AGND) – Input current			4...20 (0...20 physically)
	– Input resistance		Ω	200, measuring resistance plus PTC
	– Temperature drift			< 10 µA / 10 K
Digital sensor X8M	▶ Supply voltage			24 V or 5 V
	▶ Maximum supply current	– 24 V	mA	350 (sum X2M1, X2M2 and X8M)
		– 5 V	mA	250
	▶ SSI transducer – Coding			Gray
	– Data width			12 ... 28 bit
	– Transfer frequency			80 kHz ... 1 MHz
	– Line receiver / driver			RS485
	▶ Endat encoder			2.2
	– Line receiver / driver			RS485
	– Resolution			minimum 10 nm and multiple
	▶ 1Vpp-encoder – Transfer frequency		kHz	250

Representation of the axis controller in the system network



Block diagram/controller function block



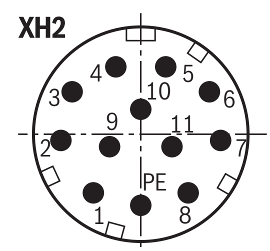
Detailed description of the safety function:
After the signal at the enable input has been removed, the output stage, and thus the solenoid of the valve, are internally separated from the available supply voltage. The enable acknowledgment will only be activated after the safe valve spool position has been achieved. For a detailed description of the safety function, refer to the operating instructions 29391-B.

Electrical connections, assignment

Connector pin assignment XH2, 11-pole + PE according to EN 175201-804

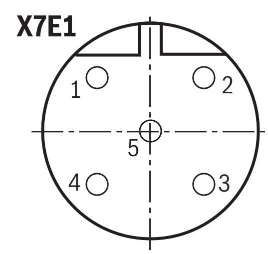
Pin	Core marking		Interface D6 assignment
	Cable, one-part [1]	Cable, split [2]	
1	1	1	24 V DC supply voltage
2	2	2	GND
3	3	white	Enable input 24 V DC (high ≥ 15 V; low < 2 V)
4	4	yellow	Command values 1 (4 ... 20 mA/±10 V) [3]
5	5	green	Reference for command values
6	6	violet	Actual value (4 ... 20 mA/±10 V) [3; 4]
7	7	pink	Command value 2 (4 ... 20 mA/±10 V) [3]
8	8	red	Enable acknowledgment 24 V DC (I_{max} 50 mA) [5]
9	9	brown	not used
10	10	black	not used
11	11	blue	Switching output 24 V, configurable (fault-free operation (24 V)/error (0V) or power circuit signal), maximum 1.5 A [3; 5]
PE	green-yellow	green-yellow	Functional ground (connected directly to metal housing)

1) Core marking of the connection lines for mating connector with cable set (see accessories, page 37, material numbers R901268000, R901272854, R901272852)
2) Core marking of the connection lines for mating connector with cable set (see accessories, page 37, material numbers R900884671, R900032356, R900860399)
3) Selection via commissioning software
4) For diagnostic purposes, precise actual value response via Ethernet interface
5) A load increases the current consumption on pin 1



Connector pin assignment for Ethernet interfaces "X7E1" and "X7E2" (coding D), M12, 4-pole, socket

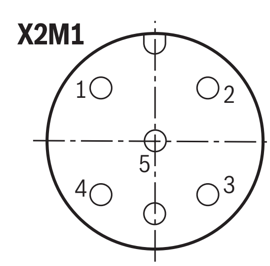
Pin	Assignment
1	TxD +
2	RxD +
3	TxD –
4	RxD –
5	not used



Analog configurable sensor interfaces, connections "X2M1", "X2M2" (coding A), M12, 5-pole, socket

Pin	Assignment
1	+24 V voltage output (sensor supply) [1; 2]
2	Sensor signal input current (4 ... 20 mA) [3]
3	GND
4	Sensor signal input voltage (0 ... 10 V) [3]
5	Negative differential amplifier input to pin 4 (optional)

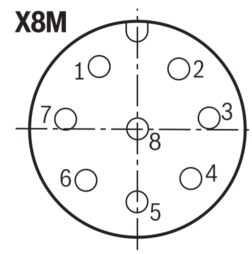
1) Voltage output same as voltage supply connected to input XH2. (Maximum load capacity see page 16)
2) A load increases the current consumption of the valve (pin 1 on the connector XH2)
3) Only one signal input per interface, configurable



Electrical connections, assignment

Digital sensor interface SSI, EnDat 2.2 or 1Vpp measurement system "X8M", M12, 8-pole, socket

Pin	SSI pin assignment [1]	EnDat 2.2 pin assignment [1; 2]	1Vpp pin assignment
1	GND	GND	GND
2	+24 V [3]	+5 V [3]	+5 V [3]
3	Data +	Data +	A +
4	Data –	Data –	A –
5	GND	GND	B +
6	Clock –	Clock –	B –
7	Clock +	Clock +	R +
8	+24 V [3]	+5 V [3]	R –

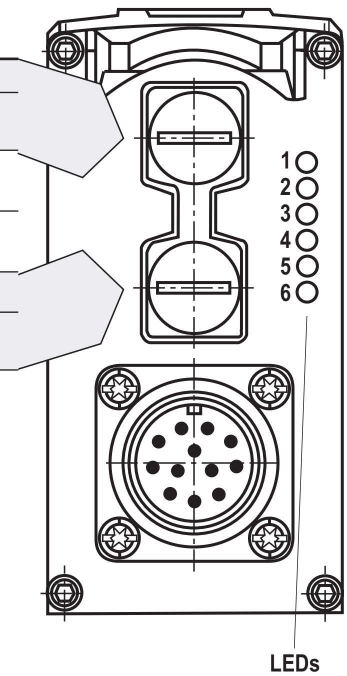


1) Pins 2, 8 and 1, 5 have the same assignment each
2) Supported resolution ≥ 10 nm
3) A load increases the current consumption of the valve (pin 1 on the connector XH2)

Notices:
- Reference potential for all signals: GND
- We recommend connecting the shields on both sides via the metal housings of the plug-in connectors.
  Using connector pins will affect the shielding effect!
  Internal screens are not required.

LED displays

LED	Interface	Sercos	EtherNET/IP	EtherCAT	PROFINET RT	POWERLINK	VARAN
1	**X7E1**	Activity	Activity	not used	Activity	not used	Active
2		Link	Link	Link/activity	Link	Link/data activity	Link
3	**Electronics module**	S	Network status	Network status	Network status	Status/error	Network status
4		Module status	Module status	Module status	Module status	Module status	Module status
5	**X7E2**	Activity	Activity	not used	Activity	not used	not used
6		Link	Link	Link/activity	Link	Link/data activity	not used



Displays of the status LEDs

Module status LED (LED 4)	Display status
Aus	No voltage supply
Green-red, flashing	Initialization
Green, flashing	Drive ready for operation
Green	Drive active
Orange, flashing	Warning
Red, flashing	Error

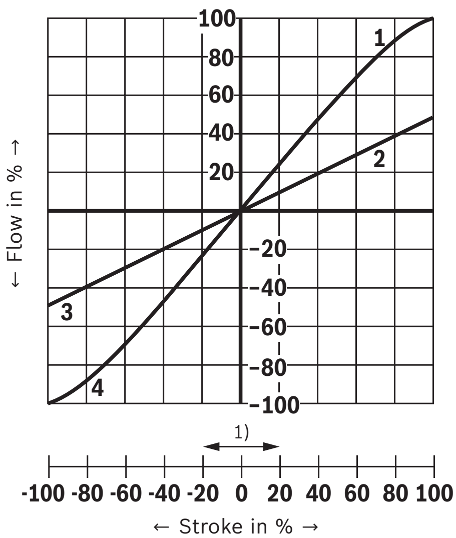
Network status LED (LED 3)	Display status
Aus	No voltage supply
Green	Operation

Notices:
- LEDs 1, 2, 5 and 6 relate to interfaces "X7E1" and "X7E2"
  - Link: Cable plugged in, connection established (permanently lit)
  - Activity: Data sent/received (flashing)
- Module status LEDs 3 and 4 relate to the electronics module
- For a detailed description of the diagnosis LEDs, please refer to the functional description Rexroth HydraulicDrive HDx.

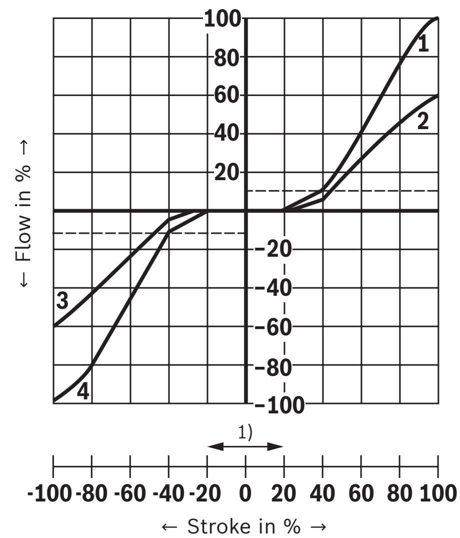
Characteristic curves: Flow characteristic "L" and "P" (measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/signal function – Version "L"

Symbol V, V1-

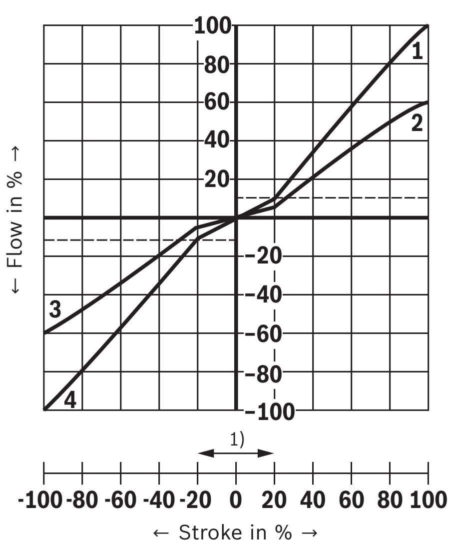


Symbols E, E1-, W6-, W8-

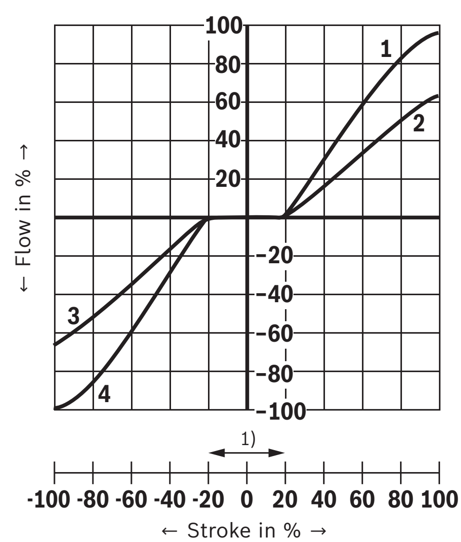


Flow/signal function – Version "P"

Symbol V, V1-



Symbols E, E1-, W6-, W8-

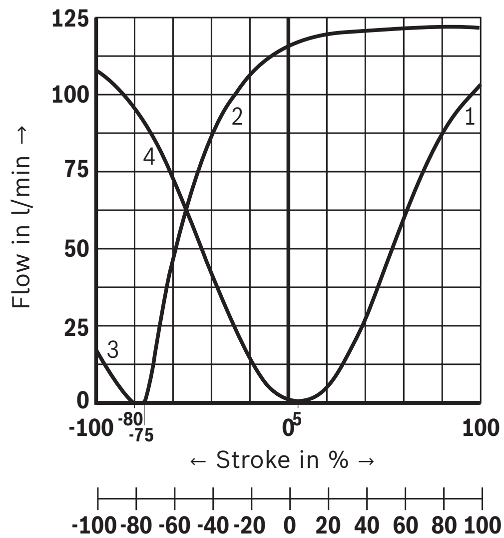


1 P–A; B–T (1:1)
2 B–T (2:1)
3 P–B (2:1)
4 P–B; A–T (1:1)
––– 10 % q_V

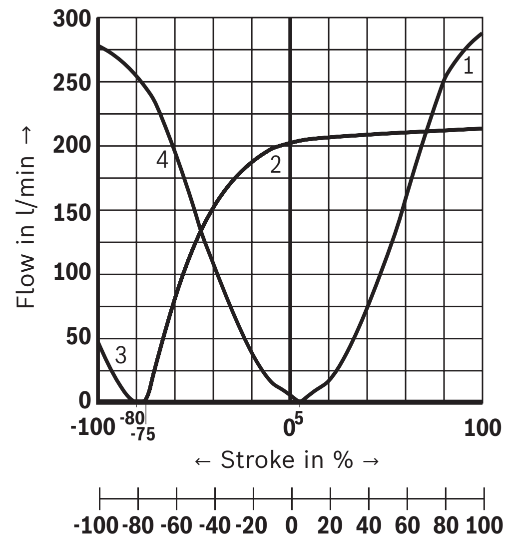
1) Step compensation (opening at 5%)

Characteristic curves: Flow characteristic "M"
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

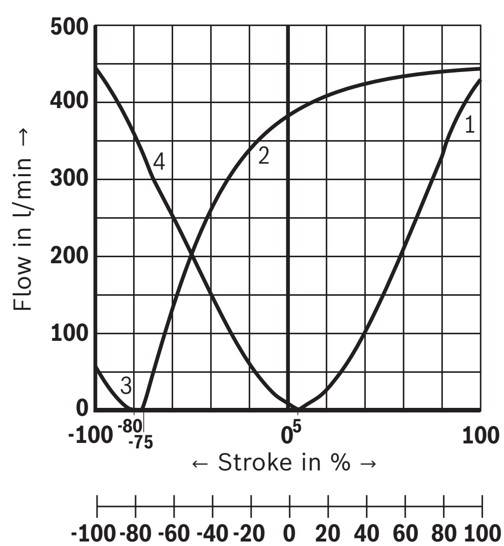
Symbol Q3, version "100"



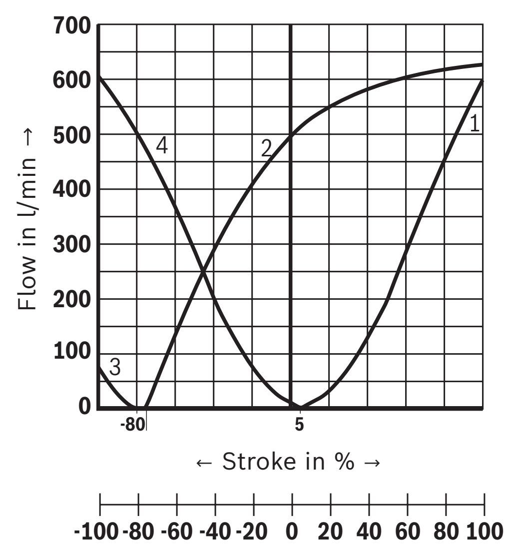
Symbol Q3, version "250"



Symbol Q3, version "400"



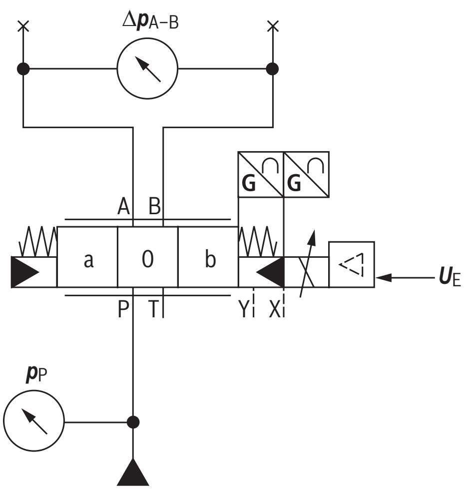
Symbol Q3, version "600"

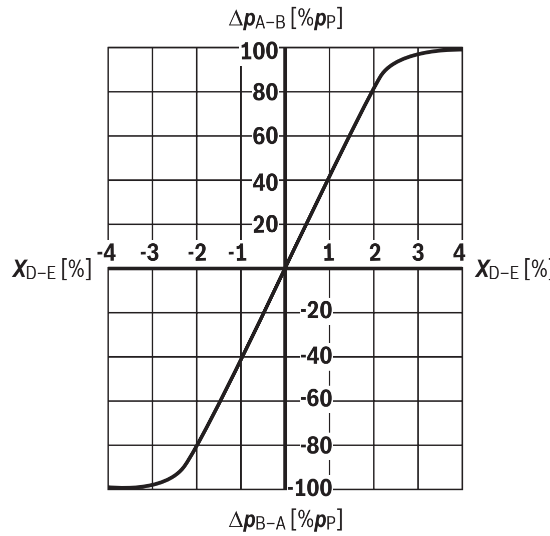


1 P–A
2 B–T
3 P–B
4 A–T

Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

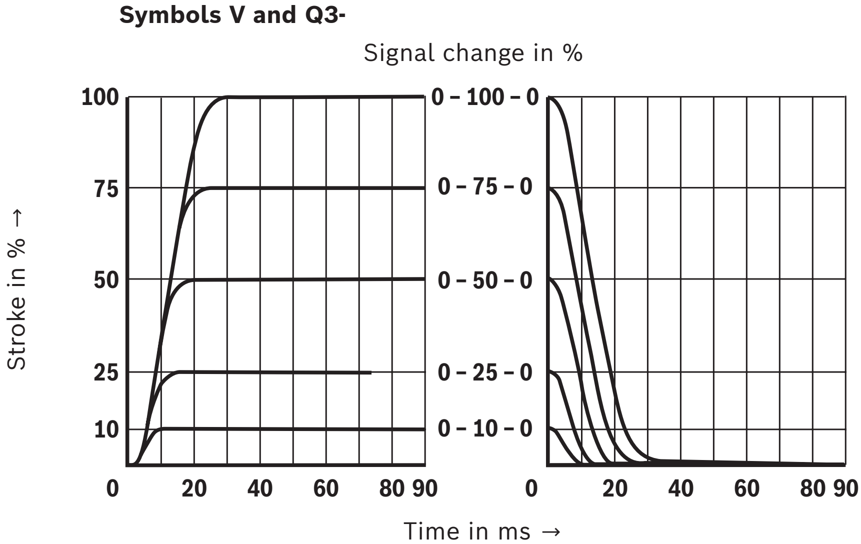
Pressure amplification





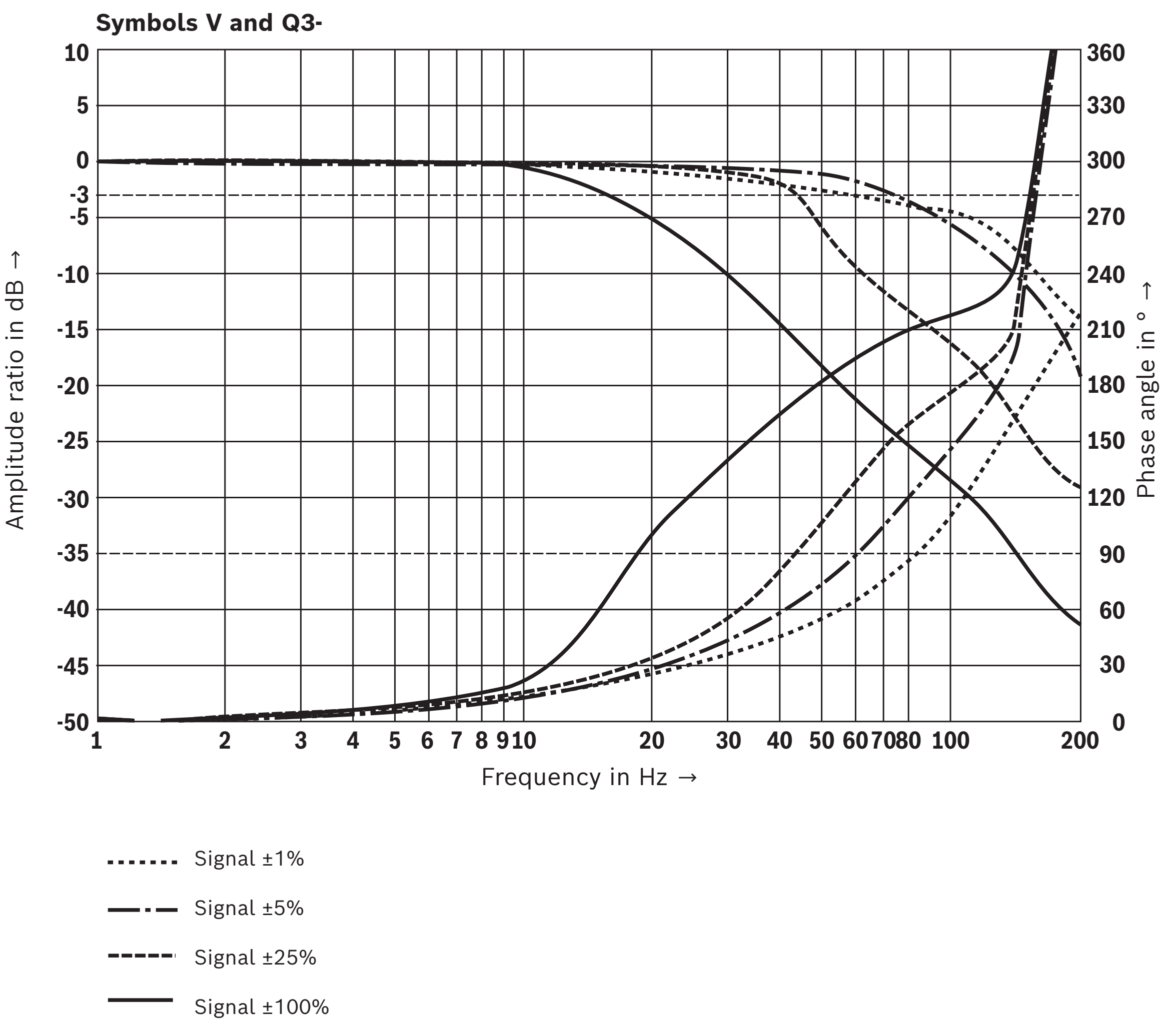
Characteristic curves: Size 10
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Transition function with stepped electric input signals



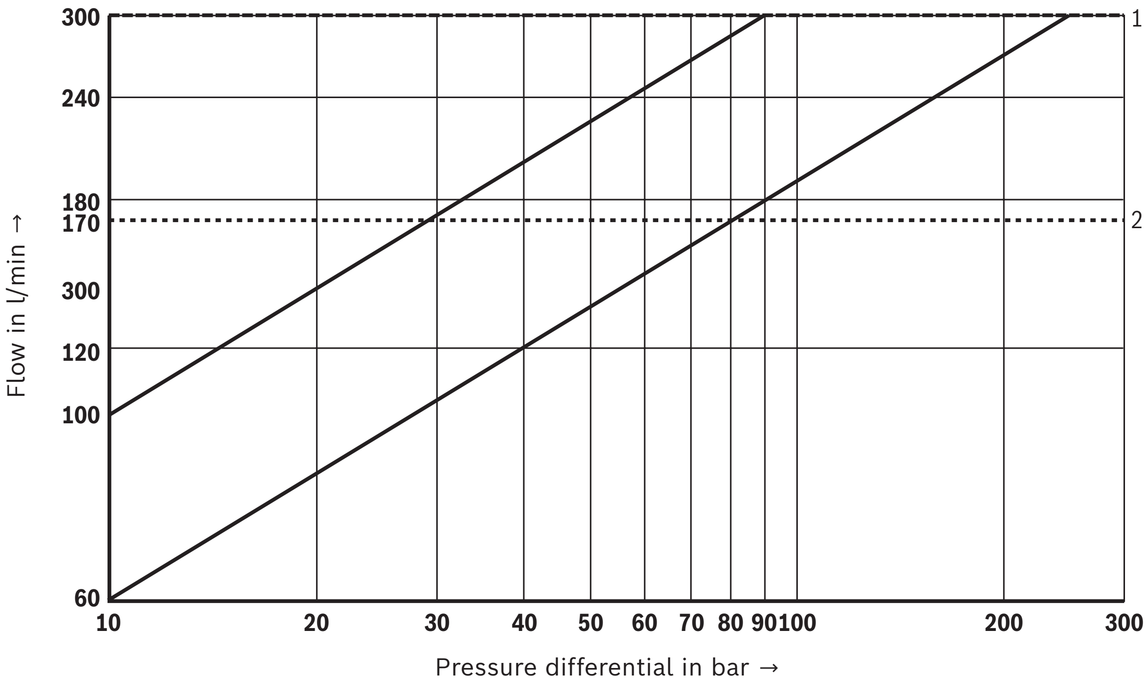
- Pilot control valve, port X = 100 bar
- Main valve, port P = 10 bar

Frequency response



Characteristic curves: Size 10
(valid for HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/load function (with maximum valve opening; tolerance ±10%)



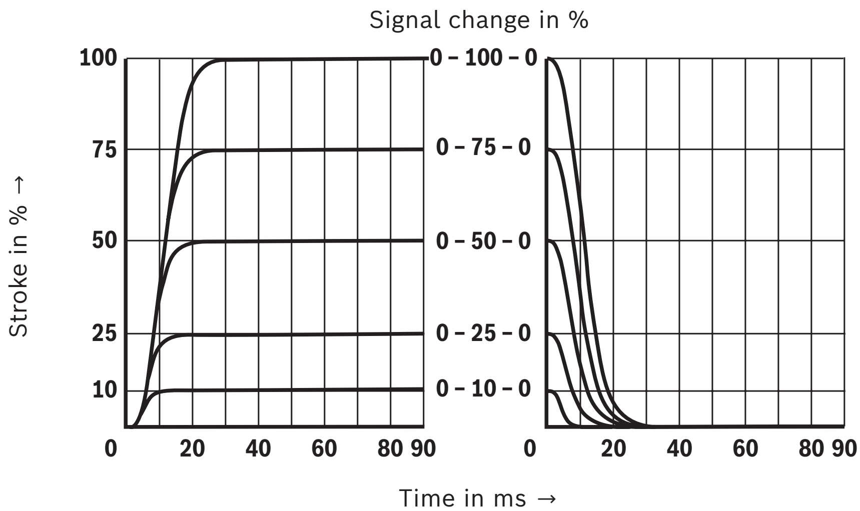
1 Maximum flow

2 Recommended flow
(flow velocity 30 m/s)

Characteristic curves: Size 16
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Transition function with stepped electric input signals

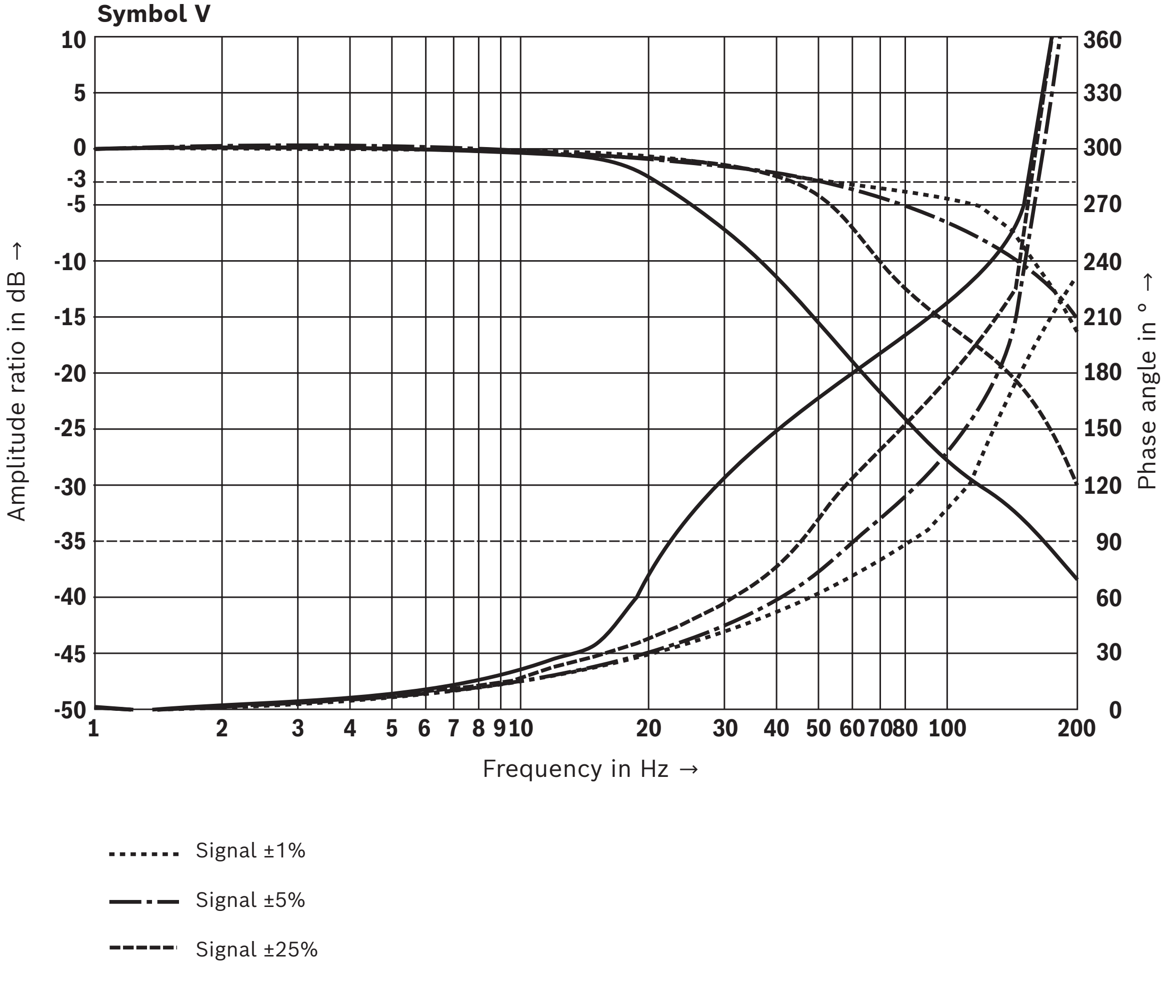
Symbol V



- ▶ Pilot control valve, port X = 100 bar
- ▶ Main valve, port P = 10 bar

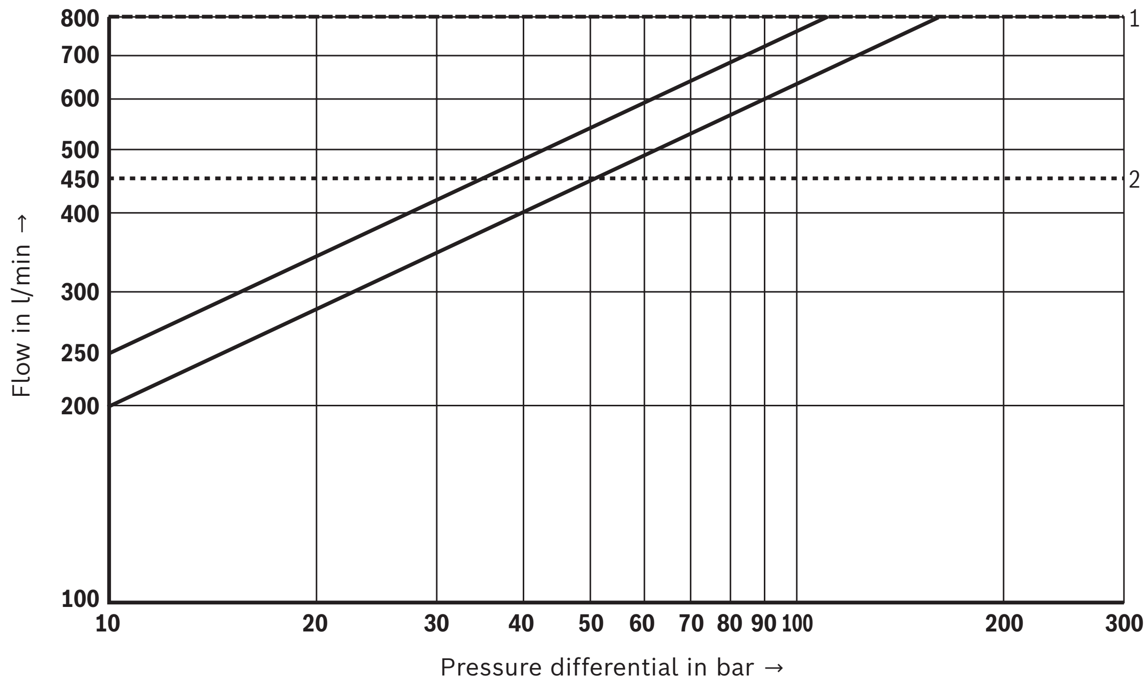
Frequency response

Symbol V



Characteristic curves: Size 16
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/load function (with maximum valve opening; tolerance ±10%)

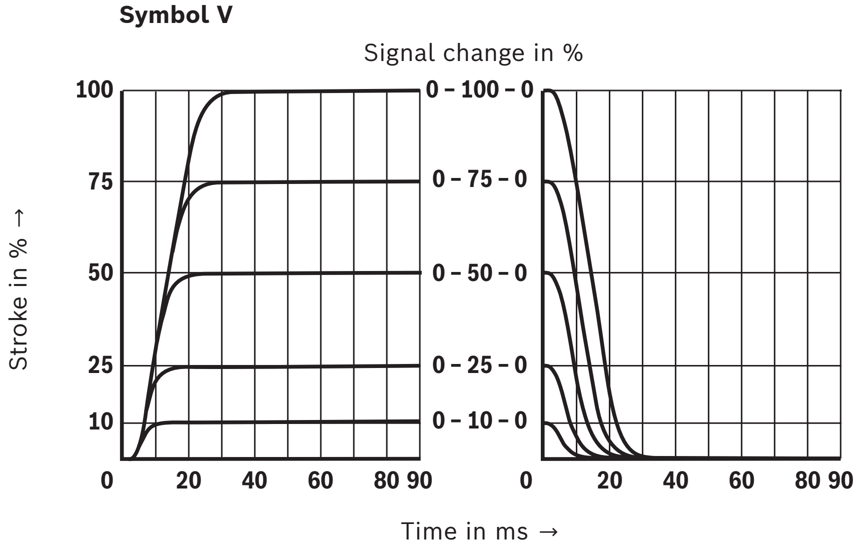


1 Maximum admissible flow

2 Recommended flow limitation (flow velocity 30 m/s)

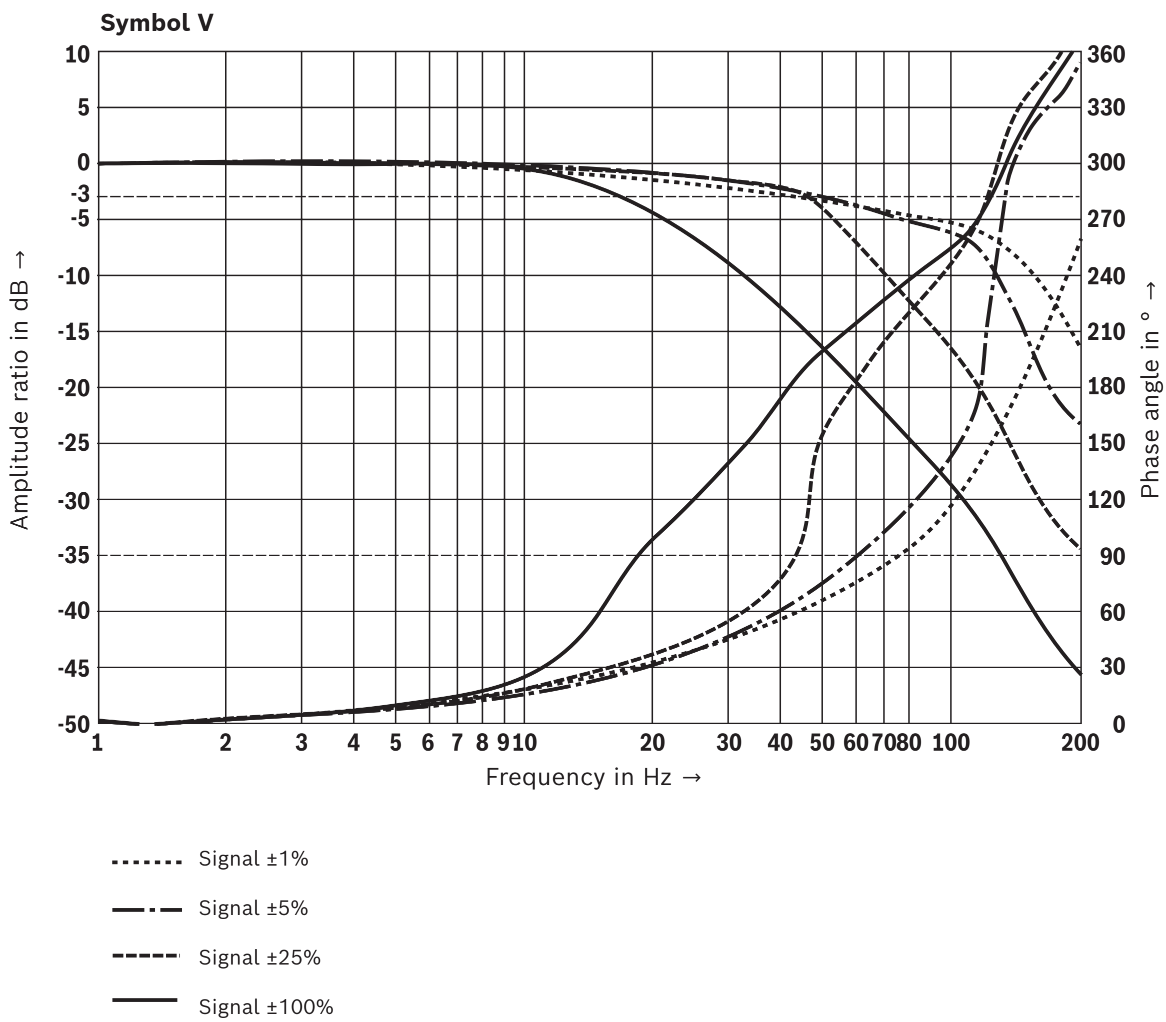
Characteristic curves: Size 25
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Transition function with stepped electric input signals



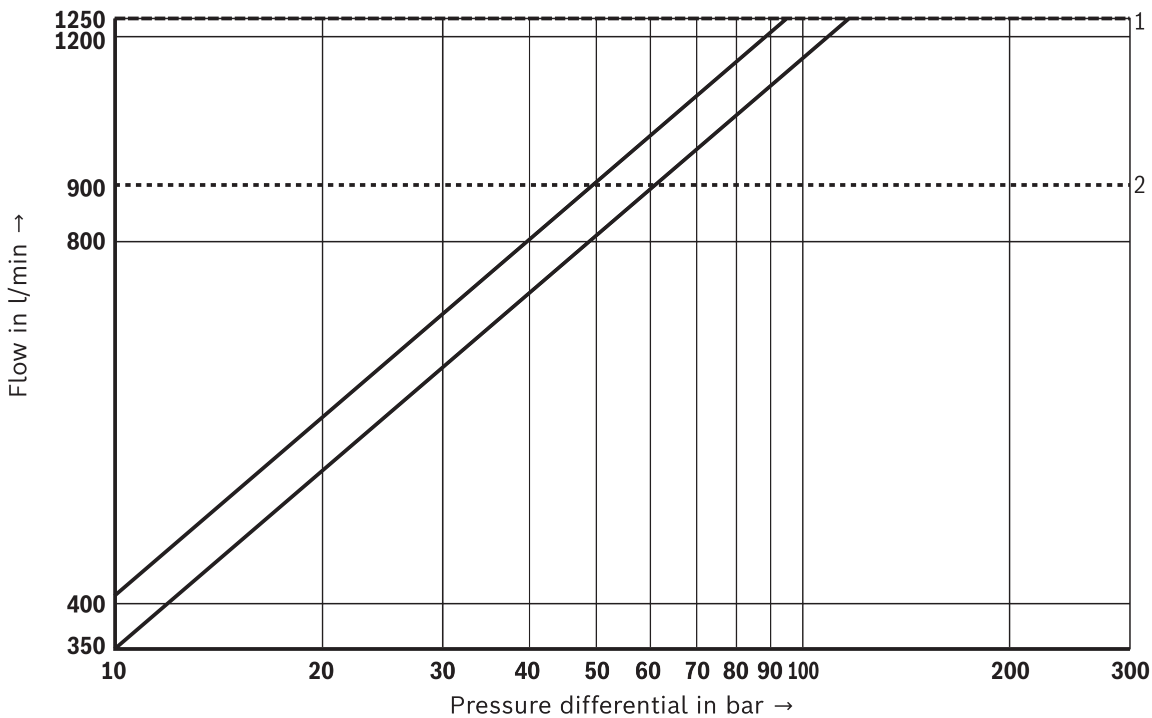
- Pilot control valve, port X = 100 bar
- Main valve, port P = 10 bar

Frequency response



Characteristic curves: Size 25
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/load function (with maximum valve opening; tolerance ±10%)



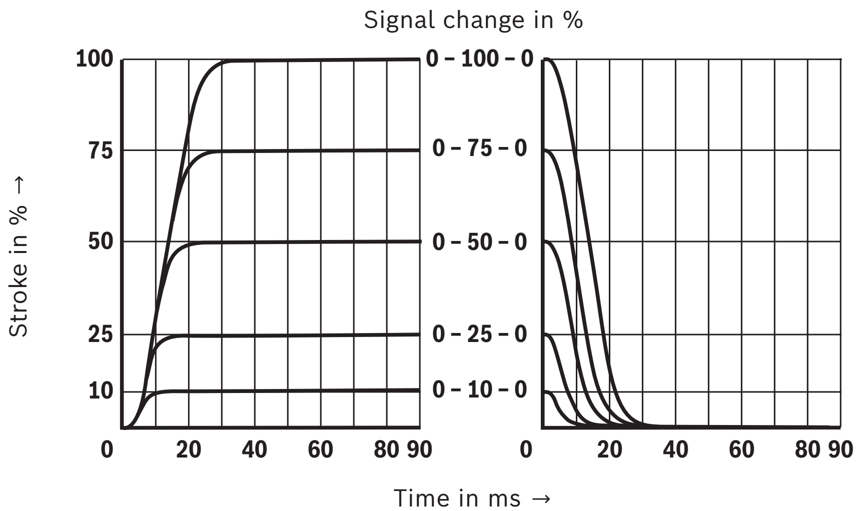
1 Maximum flow

2 Recommended flow limitation
(flow velocity 30 m/s)

Characteristic curves: Size 27
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Transition function with stepped electric input signals

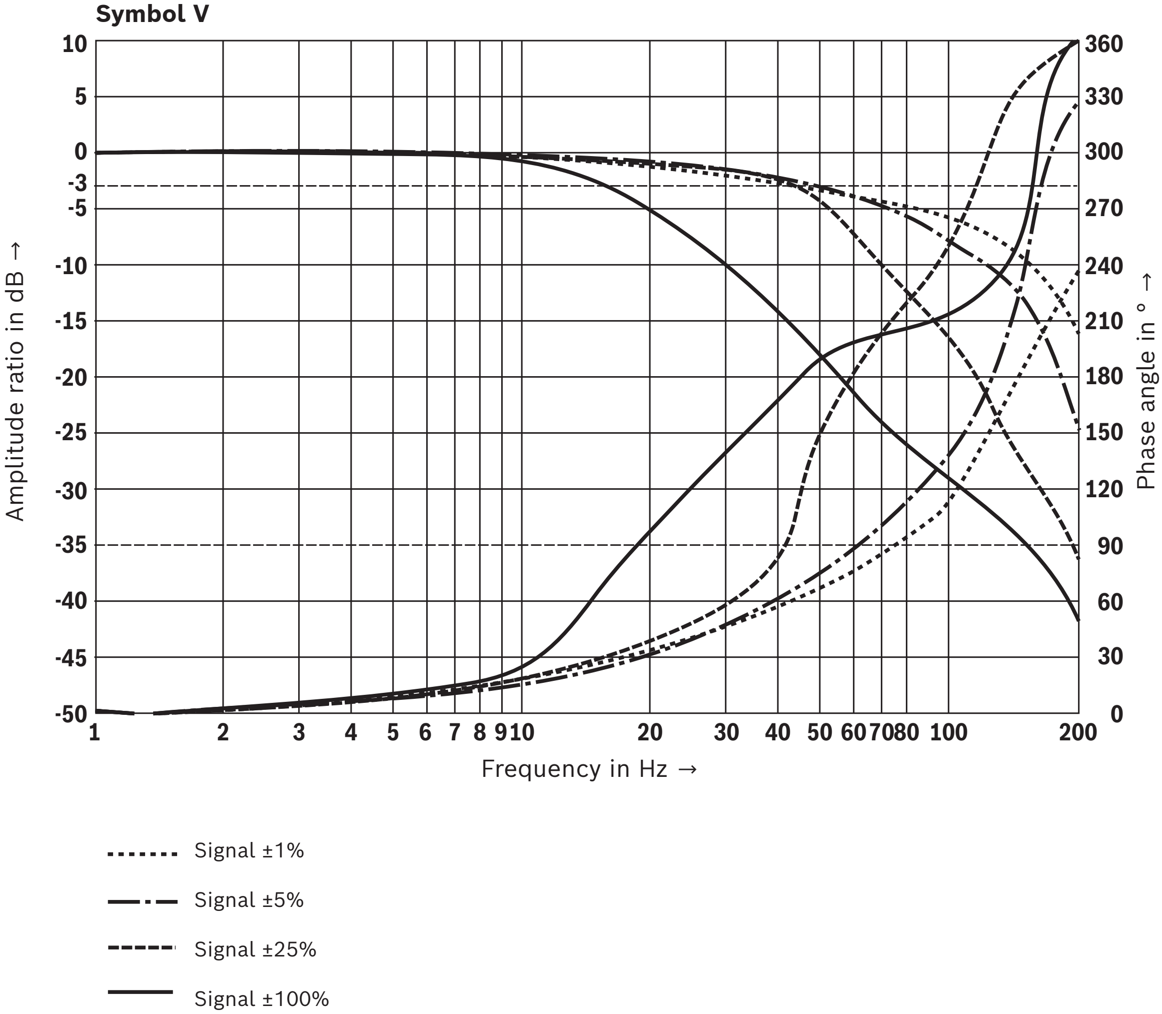
Symbol V



- Pilot control valve, port X = 100 bar
- Main valve, port P = 10 bar

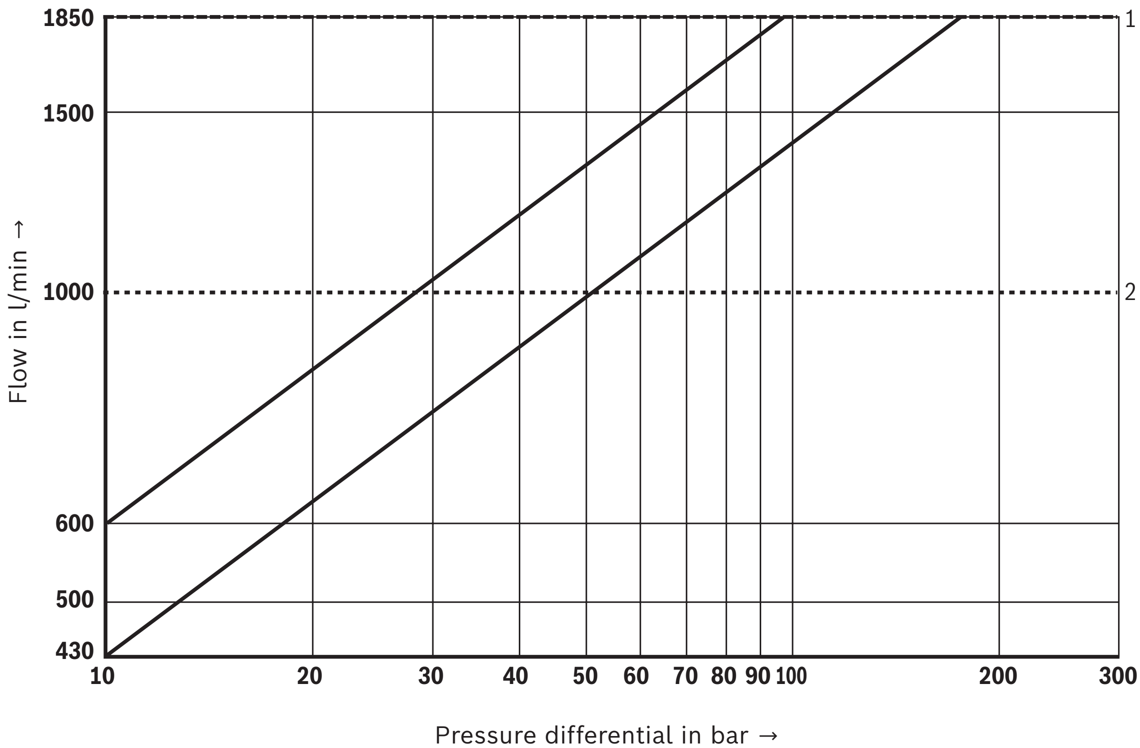
Frequency response

Symbol V



Characteristic curves: Size 27
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/load function (with maximum valve opening; tolerance ±10%)



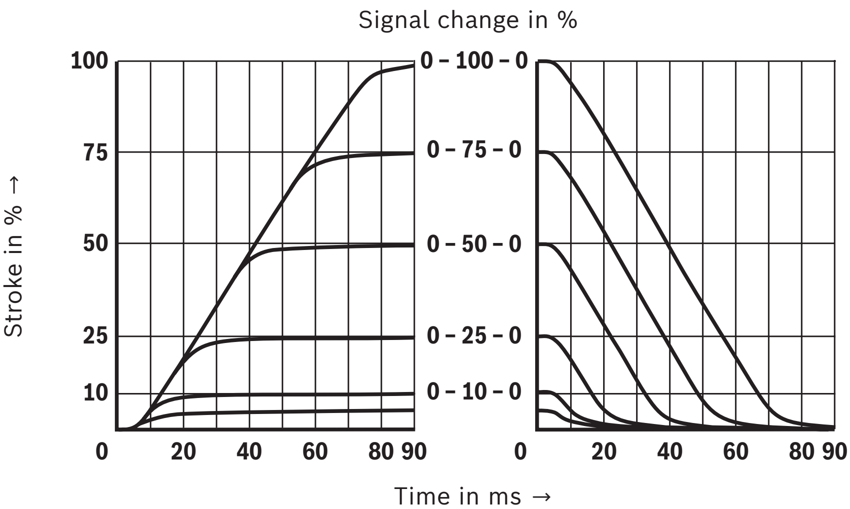
1 Maximum flow

2 Recommended flow limitation
(flow velocity 30 m/s)

Characteristic curves: Size 35
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Transition function with stepped electric input signals

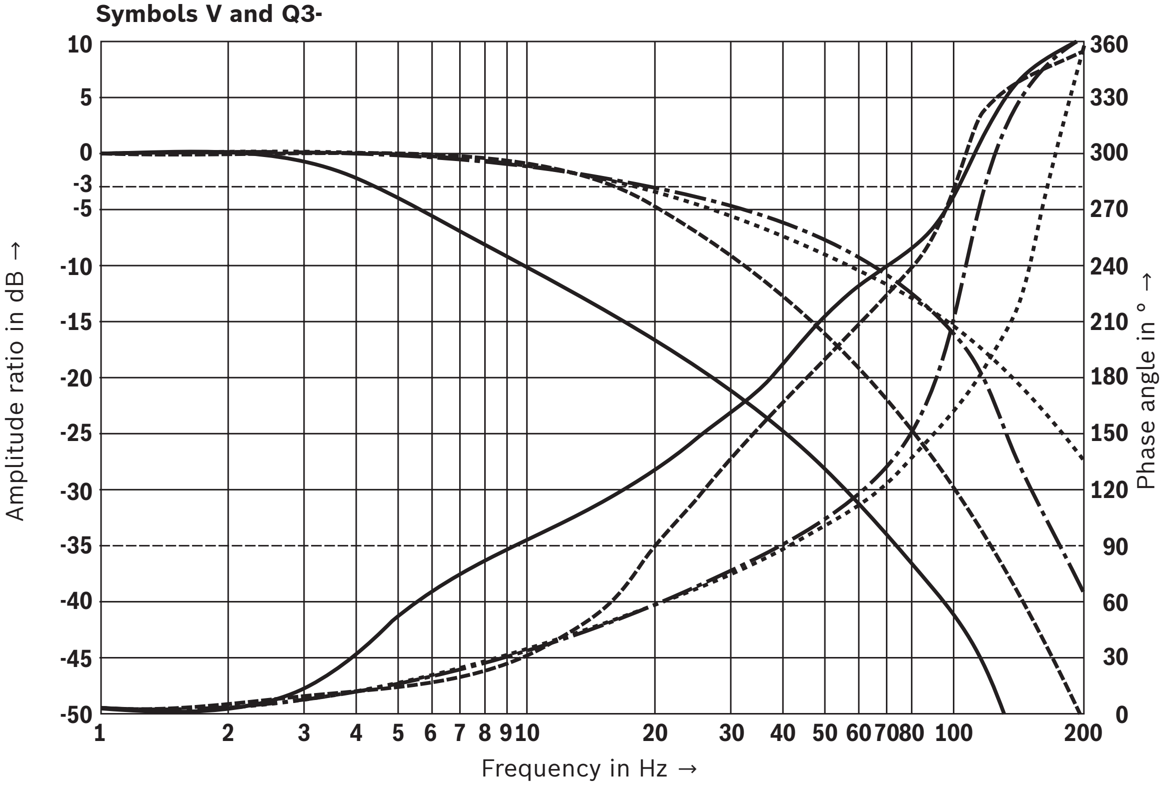
Symbols V and Q3-



- Pilot control valve, port X = 100 bar
- Main valve, port P = 10 bar

Frequency response characteristic curves

Symbols V and Q3-



Signal ±1%

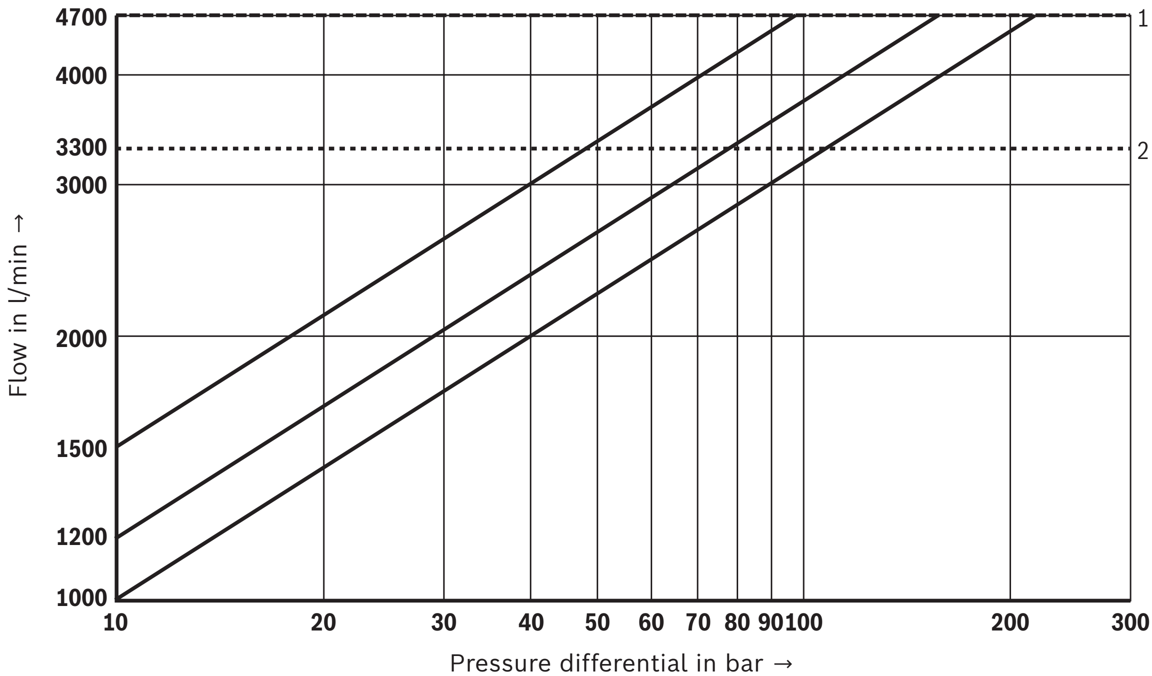
Signal ±5%

Signal ±25%

Signal ±100%

Characteristic curves: Size 35
(valid for HLP46, ϑ_{oil} = 40 ±5 °C)

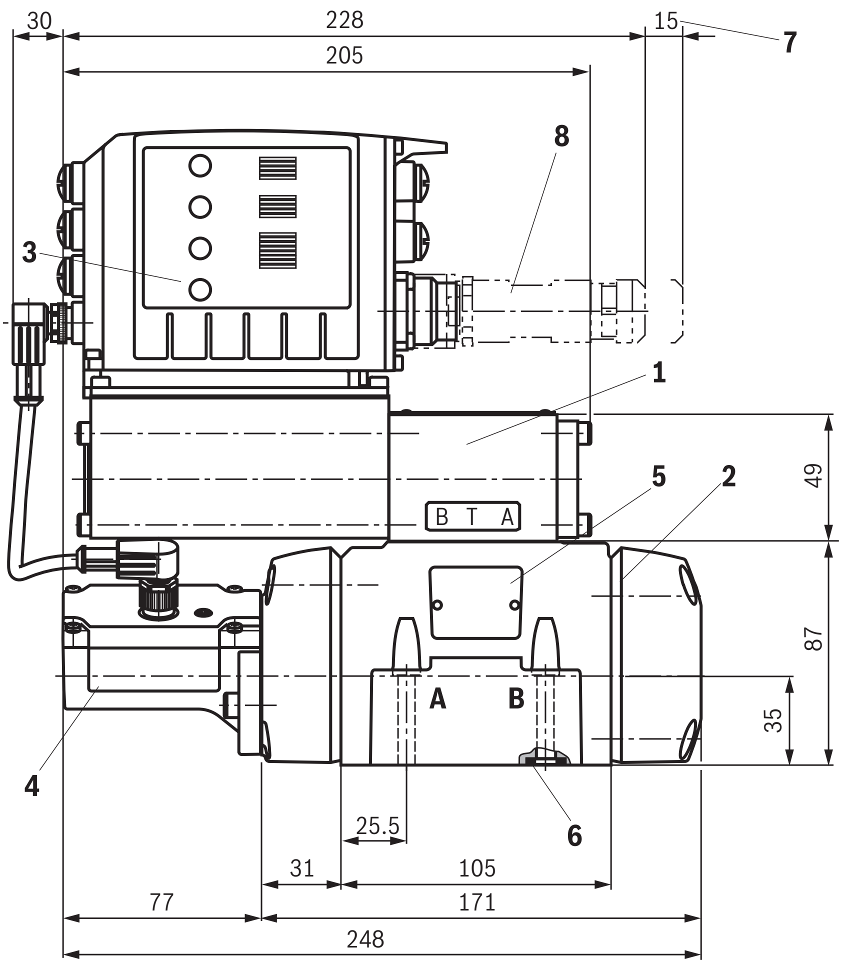
Flow/load function (with maximum valve opening; tolerance ±10%)

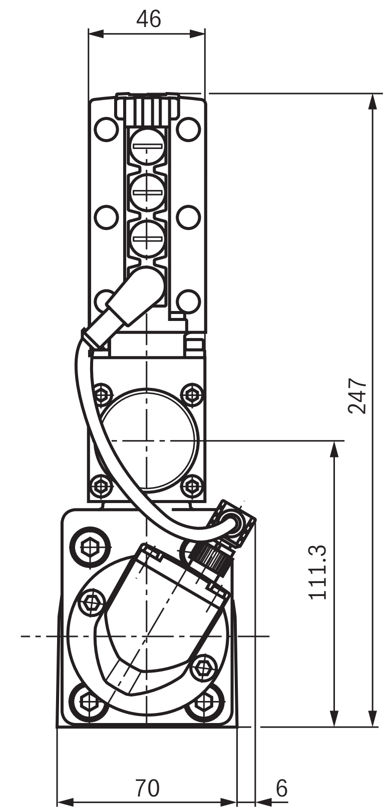


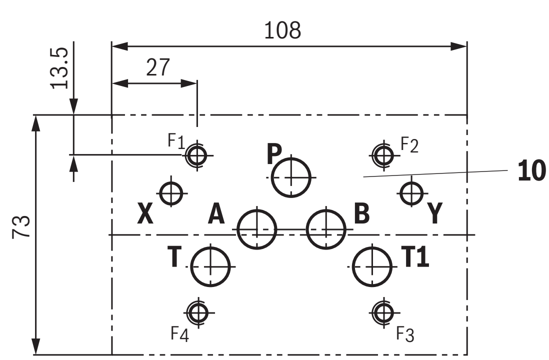
1 Maximum flow

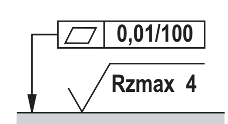
2 Recommended flow
(flow velocity 30 m/s)

Dimensions: Size 10
(dimensions in mm)









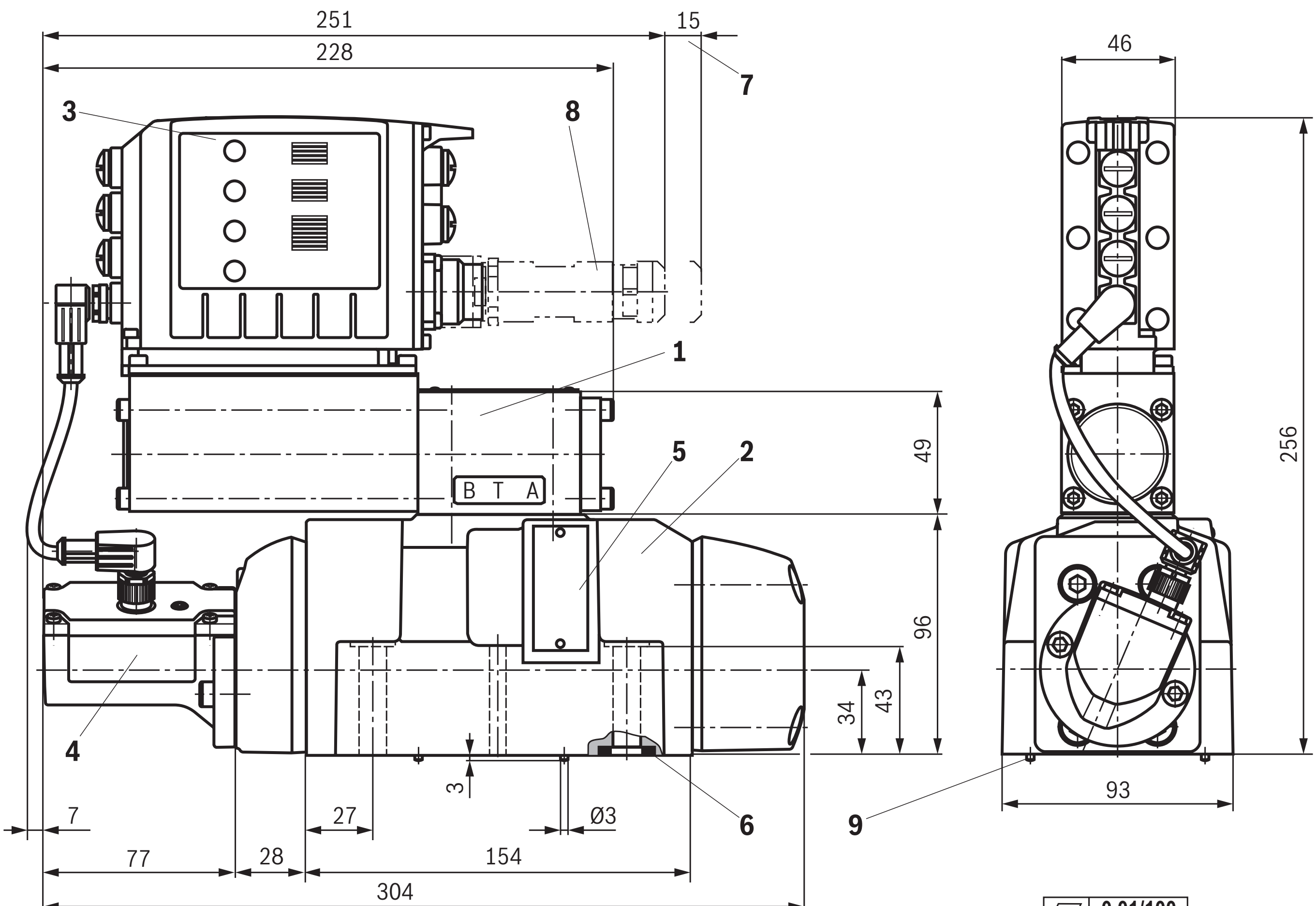
Required surface quality of the valve contact surface

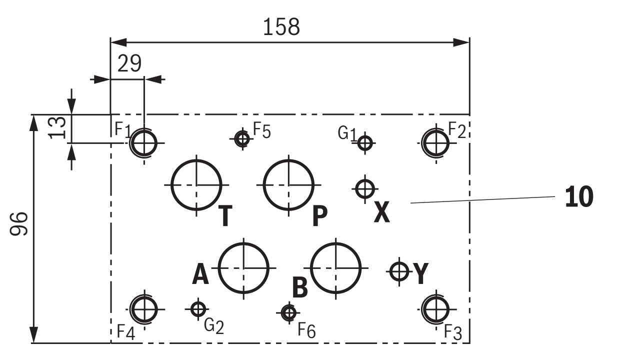
1 Pilot control valve
2 Main valve
3 Integrated electronics (OBE)
4 Inductive position transducer (main valve)
5 Name plate
6 Identical seal rings for ports P, A, B, T
Identical seal rings for ports X, Y
7 Space required for removing the mating connector
8 Mating connectors, separate order, see page 37 and data sheet 08006.
9 Locking pin
10 Machined valve contact surface,
Porting pattern according to ISO 4401-05-05-0-05

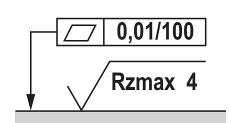
Valve mounting screws and **subplates,** see page 36.

☞ **Notice:**
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions: Size 16
(dimensions in mm)







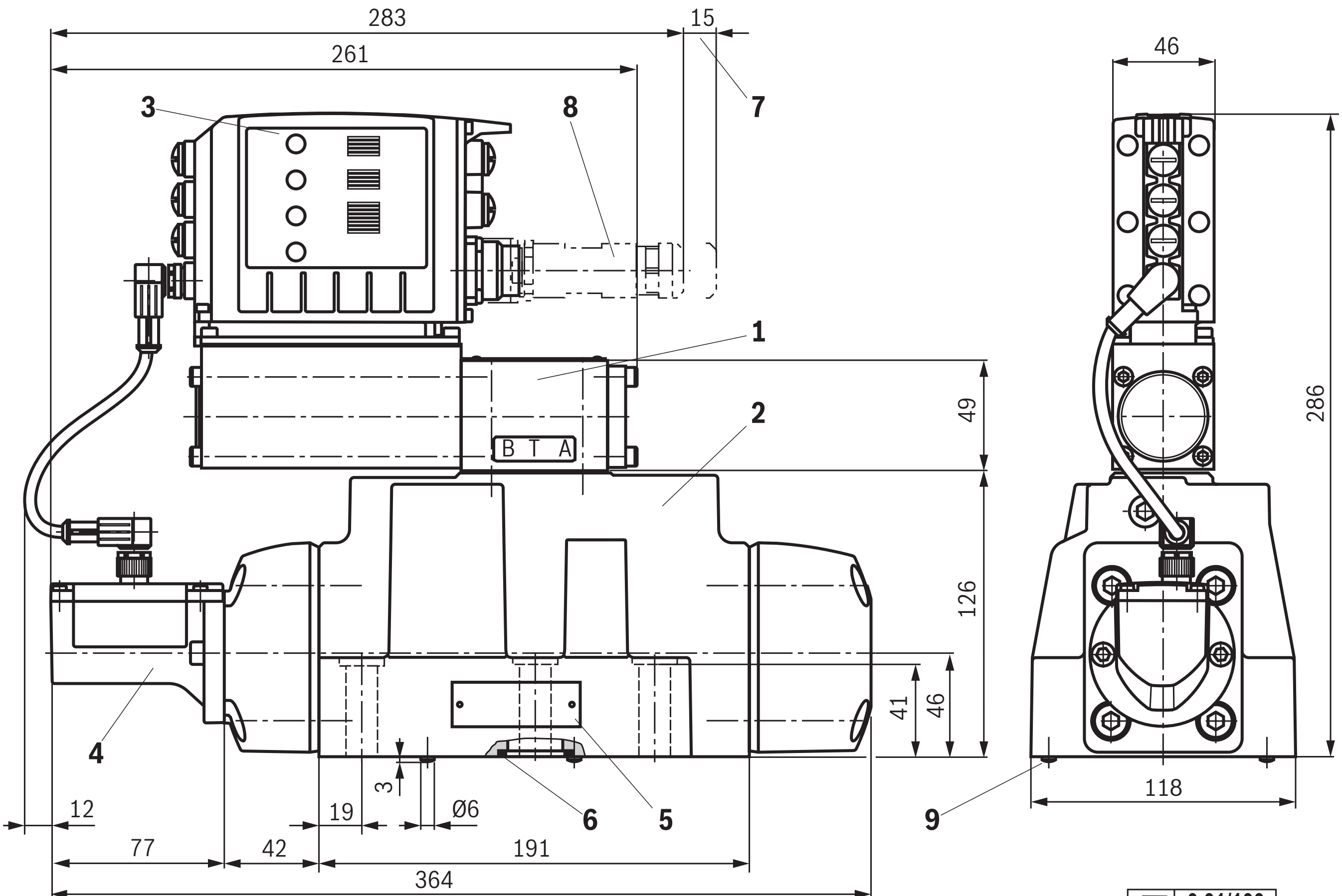
Required surface quality of the valve contact surface

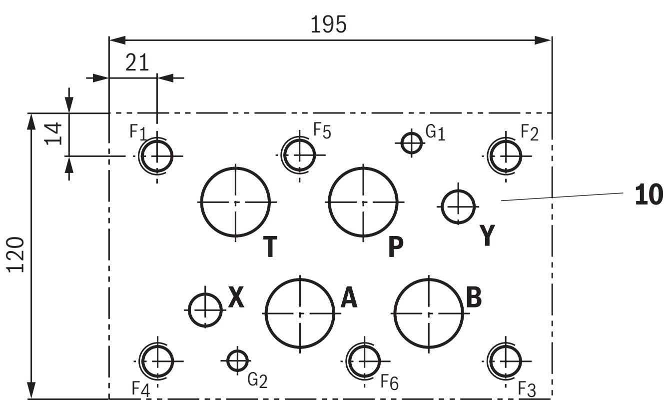
1 Pilot control valve
2 Main valve
3 Integrated electronics (OBE)
4 Inductive position transducer (main valve)
5 Name plate
6 Identical seal rings for ports P, A, B, T
Identical seal rings for ports X, Y
7 Space required for removing the mating connector
8 Mating connectors, separate order, see page 37 and data sheet 08006.
9 Locking pin
10 Machined valve contact surface,
porting pattern according to ISO 4401-07-07-0-05
Deviating from the standard: Ports P, A, B, T – Ø20 mm
Minimum screw-in depth:
- Ferrous metal: 1.5 x Ø
- Non-ferrous metal: 2.0 x Ø

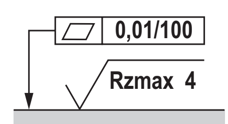
Valve mounting screws and **subplates,** see page 36.

☞ **Notice:**
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions: Size 25
(dimensions in mm)







Required surface quality of the valve contact surface

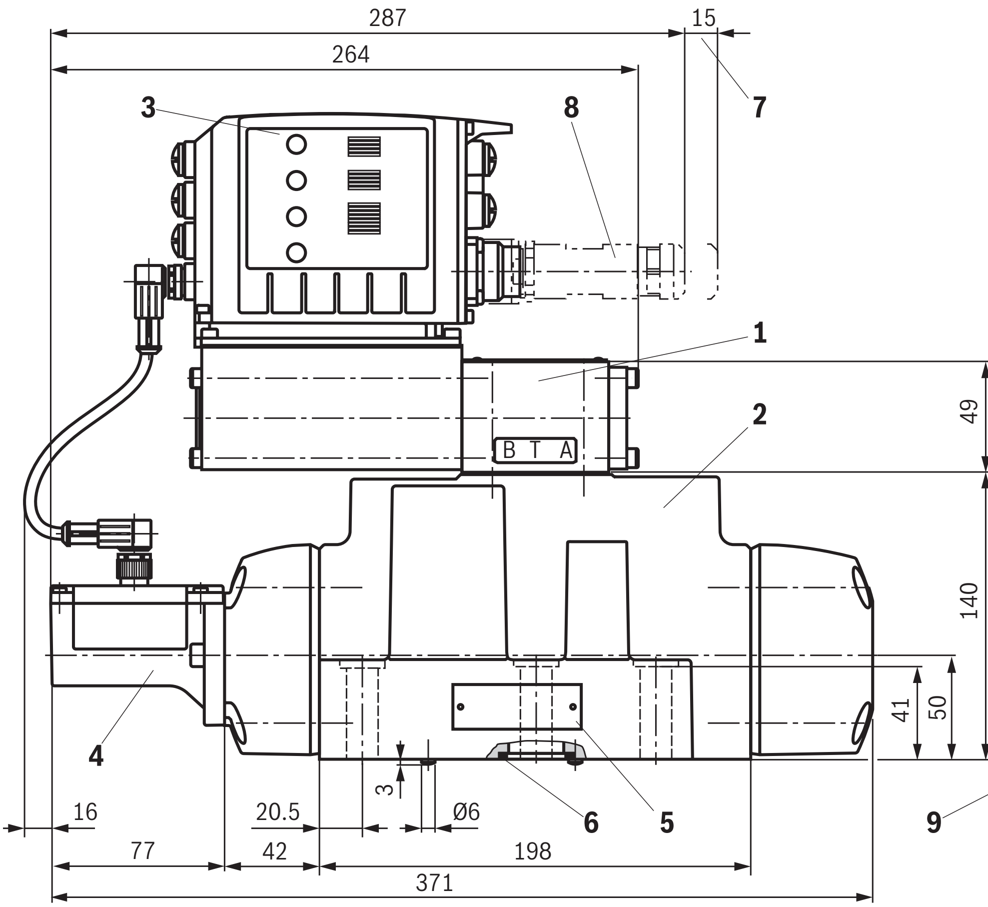
1 Pilot control valve
2 Main valve
3 Integrated electronics (OBE)
4 Inductive position transducer (main valve)
5 Name plate
6 Identical seal rings for ports P, A, B, T
Identical seal rings for ports X, Y
7 Space required for removing the mating connector
8 Mating connectors, separate order, see page 37 and data sheet 08006.
9 Locking pin
10 Machined valve contact surface,
Porting pattern according to ISO 4401-08-08-0-05
Deviating from the standard:
- Ports X, Y – Ø14 mm

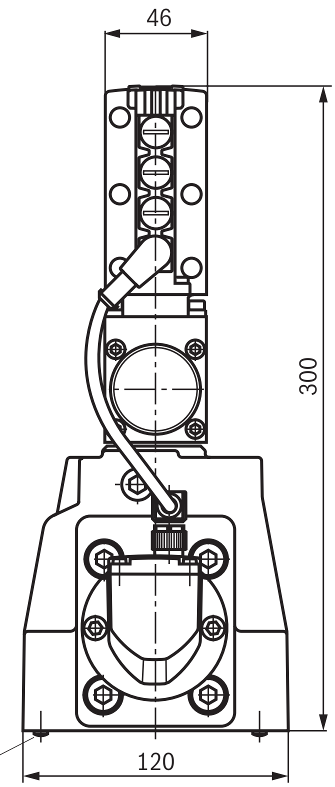
Minimum screw-in depth:
- Ferrous metal: 1.5 x Ø
- Non-ferrous metal: 2.0 x Ø

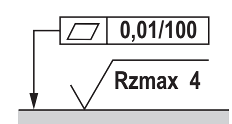
Valve mounting screws and **subplates,** see page 36.

☞ **Notice:**
The dimensions are nominal dimensions which are subject to tolerances.

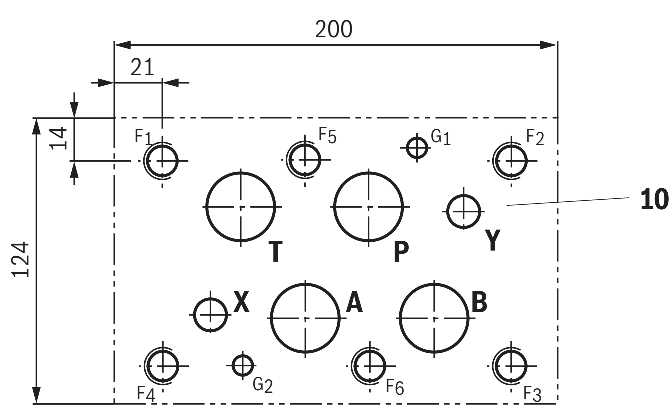
Dimensions: Size 27
(dimensions in mm)







Required surface quality of the valve contact surface



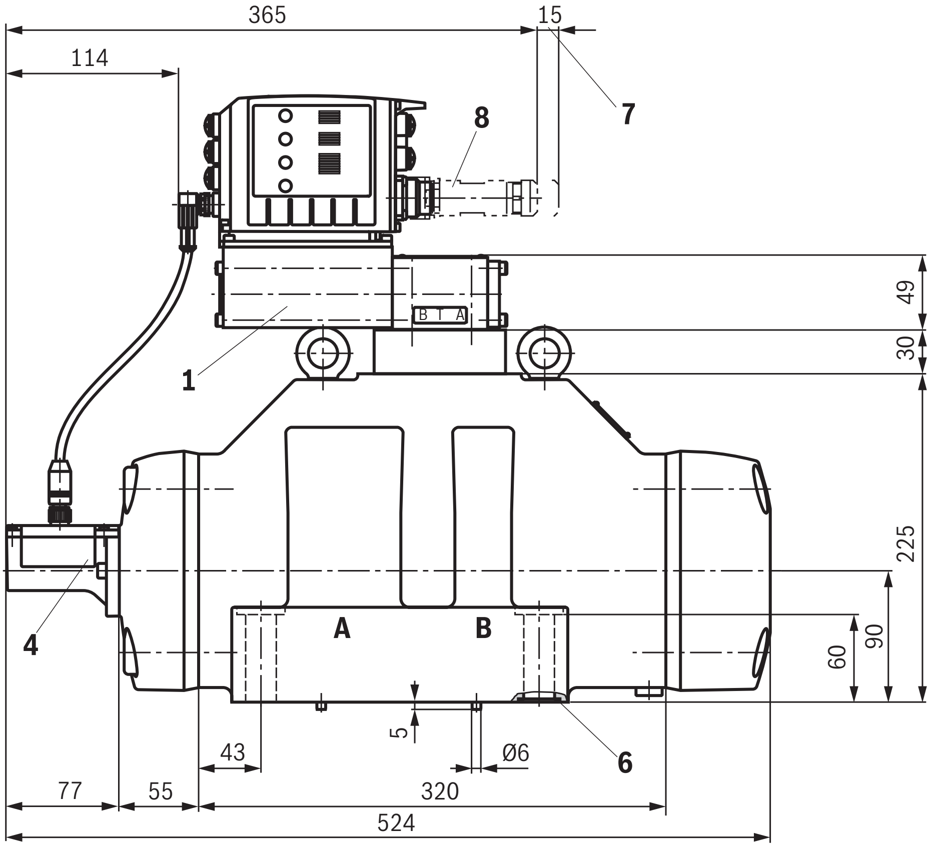
1 Pilot control valve
2 Main valve
3 Integrated electronics (OBE)
4 Inductive position transducer (main valve)
5 Name plate
6 Identical seal rings for ports P, A, B, T
Identical seal rings for ports X, Y
7 Space required for removing the mating connector
8 Mating connectors, separate order, see page 37 and data sheet 08006.
9 Locking pin
10 Machined valve contact surface,
Porting pattern according to ISO 4401-08-08-0-05
Deviating from the standard:
- Ports P, A, B, T – Ø32 mm

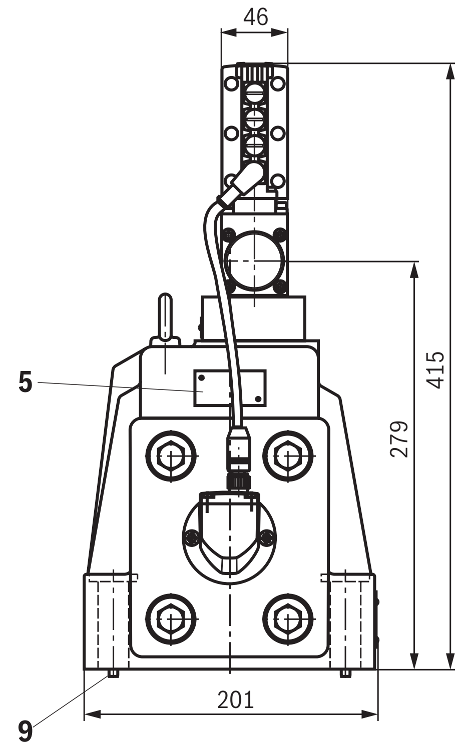
Minimum screw-in depth:
- Ferrous metal: 1.5 x Ø
- Non-ferrous metal: 2.0 x Ø

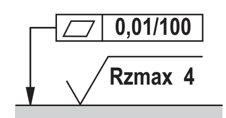
Valve mounting screws and **subplates,** see page 36.

Notice:
The dimensions are nominal dimensions which are subject to tolerances.

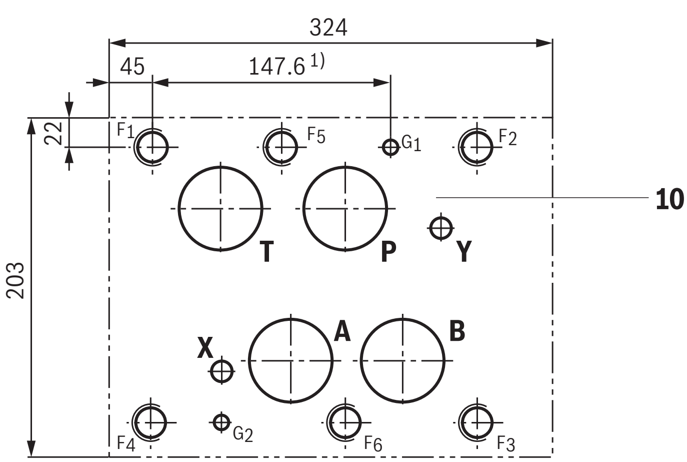
Dimensions: Size 35
(dimensions in mm)







Required surface quality of the valve contact surface



1 Pilot control valve
2 Main valve
3 Integrated electronics (OBE)
4 Inductive position transducer (main valve)
5 Name plate
6 Identical seal rings for ports P, A, B, T
  Identical seal rings for ports X, Y
7 Space required for removing the mating connector
8 Mating connectors, separate order, see page 37 and data sheet 08006.
9 Locking pin
10 Machined valve contact surface,
  Porting pattern according to ISO4401-10-09-0-05
  Deviating from the standard:
  Ports P, A, B, T – Ø50 mm

[1] Position G1 according to DIN 24340 Form A

Valve mounting screws and **subplates,** see page 36.

Notice:
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions

Valve mounting screws (separate order)

Size	Quantity	Hexagon socket head cap screws	Material number
10	4	**ISO 4762 - M6 x 45 - 10.9-CM-Fe-ZnNi-5-Cn-T0-H-B** Tightening torque M_A = 13.5 Nm ±10%	**R913043777**
	or		
	4	**ISO 4762 - M6 x 45 - 10.9** Tightening torque M_A = 15.5 Nm ±10%	Not included in the Rexroth delivery range
16	2	**ISO 4762 - M6 x 60 - 10.9-flZn-240h-L** Tightening torque M_A = 12.2 Nm ±10%	**R913000115**
	4	**ISO 4762 - M10 x 60 - 10.9-flZn-240h-L** Tightening torque M_A = 58 Nm ±20%	**R913000116**
	or		
	2	**ISO 4762 - M6 x 60 - 10.9** Tightening torque M_A = 15.5 Nm ±10%	Not included in the Rexroth delivery range
	4	**ISO 4762 - M10 x 60 - 10.9** Tightening torque M_A = 75 Nm ±20%	
25, 27	6	**ISO 4762 - M12 x 60 - 10.9-flZn-240h-L** Tightening torque M_A = 100 Nm ±20%	**R913000121**
	or		
	6	**ISO 4762- M12 x 60 - 10.9** Tightening torque M_A = 130 Nm ±20%	Not included in the Rexroth delivery range
35	6	**ISO 4762 - M20 x 90 - 10.9-flZn/nc/480h/C** Tightening torque M_A = 465 Nm ±20%	**R913009160**
	or		
	6	**ISO 4762 - M20 x 90 - 10.9** Tightening torque M_A = 610 Nm ±20%	Not included in the Rexroth delivery range

☞ **Notices:**
- The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure.
- **When replacing component series 3X with 4X, only the valve mounting screws listed here may be used. Prior to assembly, check the existing mounting bore on the block for sufficient screw-in depth.**

Subplates (separate order) with porting pattern according to ISO 4401, see data sheet 45100.

Accessories (separate order)

Mating connectors and cable sets

Port	Designation	Version	Short designation	Material number	Data sheet
XH2	Mating connector; for valves with round connector, 11-pole + PE	Metal, shielded	12PN11... EMC	**R901268000**	08006
		Plastic, two cable outlets	12PN11...2XD8	**R900884671**	
	Cable sets; for valves with round connector, 11-pole + PE	Metal, shielded, 5 m	12PN11REFS EMV...BG	**R901272854**	
		Metal, shielded, 20 m		**R901272852**	
		Plastic, shielded, 5 m	12PN11REFF 2X...	**R900032356**	
		Plastic, shielded, 20 m		**R900860399**	
X7E1, X7E2	Cable set; shielded, 4-pole, D coding	Straight connector M12, on straight connector M12, line cross-section 0.25 mm², CAT 5e, length freely selectable (= xx.x)	–	**R911172111** 1)	–
	Cable set; shielded, 4-pole	Straight connector M12, on straight connector RJ45, line cross-section 0.25 mm², CAT 5e, length freely selectable (= xx.x)	–	**R911172135** 2)	–
X2M1, X2M2	Cable set; shielded, 5-pole, for connecting Rexroth pressure sensors, type HM20, A coding	PUR/PVC, straight connector M12, on straight socket M12, line cross-section 0.34 mm², 0.6 m	–	**R901111709**	–
		PUR/PVC, straight connector M12, on straight socket M12, line cross-section 0.34 mm², 1.0 m	–	**R901111712**	–
		PUR/PVC, straight connector M12, on straight socket M12, line cross-section 0.34 mm², 2.0 m	–	**R901111713**	–
	Cable set; shielded, 5-pole, A coding	Straight connector M12, on free line end, line cross-section 0.34 mm², 1.5 m	–	**R901111752**	–
		Straight connector M12, on free line end, line cross-section 0.34 mm², 3.0 m	–	**R901111754**	–
		Straight connector M12, on free line end, line cross-section 0.34 mm², 5.0 m	–	**R901111756**	–
		Straight connector M12, on free line end, line cross-section 0.34 mm², 10.0 m	–	**R913005147**	–
	Plug-in connector; 5-pole, M12 x 1, pins, A-coding	Metal (cable diameter 4 ... 6 mm2)	–	**R901075542**	–
X8M	Cable set; Shielded, 8-pole, A coding (only SSI, 1Vss) 3)	Straight connector M12, on free line end, line cross-section 0.25 mm², 10 m	–	**R913002641**	–

1) Additional indication of type designation RKB0040/xx.x

2) Additional indication of type designation RKB0044/xx.x

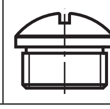
3) **Recommendation:** If an EnDat 2.2 sensor is used, please refer to the sensor manufacturer Heidenhain with respect to a cable set.

Notices:

- Tighten the M12 connector with a manual torque wrench by 1 Nm.
- Self-locking M12 cables must be used.
- It must be ensured that cables are secured without radial forces.
- All cables connected to XH1, X7E1 and X7E2 must be bundled in a wire harness after 20cm the latest. The wire harness must be fixed after further 20 ... 30cm. Make sure that there is no relative motion between the fixation and the valve.
- Before the fixation point, there must not be any cable loops.
- In general, the information on installation provided by the cable manufacturers must be observed.
- Respectively, the cables of X2M1, X2M2 and X8M, if used, are also fixed as described above.
- For further information, see operating instructions 29391-B

Accessories (separate order)

Protective cap

Protective cap M12	**Version**	**Material number**
		**R901075563**

Parameterization

The following is required for the parameterization with PC		**Material number/download**
1 Commissioning software	IndraWorks, Indraworks D, Indraworks DS	
2 Connection cable, 3 m	Shielded, M12 on RJ45, length can be freely selected (= xx.x)	**R911172135** (additional indication of type designation RKB0044/xx.x)

Project planning and maintenance instructions

- The supply voltage must be permanently connected; otherwise, bus communication is not possible.
- If electro-magnetic interference is to be expected, take appropriate measures to ensure the function (depending on the application, e.g. shielding, filtration).
- The devices have been tested in the plant and are supplied with default settings.
- Only complete devices can be repaired. Repaired devices are returned with default settings. User-specific settings will not be applied. The machine end-user will have to retransfer the corresponding user parameters.

Further information

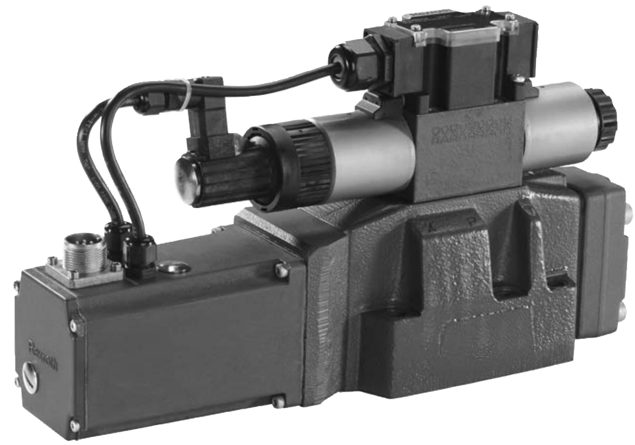
▶ Directional control valve with integrated digital axis controller (IAC-Multi-Ethernet, component series 2X)	Data sheet 29391 and 29391-B
▶ CE Declaration of Conformity	Upon request
▶ Subplates	Data sheet 45100
▶ Hydraulic fluids on mineral oil basis	Data sheet 90220
▶ Environmentally compatible hydraulic fluids	Data sheet 90221
▶ Flame-resistant, water-free hydraulic fluids	Data sheet 90222
▶ Flame-resistant hydraulic fluids - containing water (HFAE, HFAS, HFB, HFC)	Data sheet 90223
▶ Hexagon socket head cap screw, metric/UNC	Data sheet 08936
▶ Hydraulic valves for industrial applications	Data sheet 07600-B
▶ General product information on hydraulic products	Data sheet 07008
▶ Installation, commissioning and maintenance of servo valves and high-response valves	Data sheet 07700
▶ Assembly, commissioning and maintenance of hydraulic systems	Data sheet 07900
▶ Operation IAC-Multi-Ethernet electronics (xx = software version): – Functional description Rexroth HydraulicDrive HDx-xx – Parameter description Rexroth HydraulicDrive HDx-xx – Description of diagnosis Rexroth HydraulicDrive HDx-xx	
▶ Commissioning software and documentation on the Internet	
▶ Selection of filters	
▶ Information on available spare parts	

The Drive & Control Company **Rexroth Bosch Group**

Directional control valves, pilot-operated, with electrical position feedback and integrated electronics (OBE)

Type 4WRTE

RE 29083
Edition: 2017-03
Replaces: 08.13



H7809

- Size 10 ... 35
- Component series 4X
- Maximum operating pressure 350 bar
- Rated flow 25 ... 1000 l/min

Features

- Reliable – proven and robust design
- Safe
  - Automatic pressure compensation in the control chambers of the main stage by the pilot control valve
  - Control spool of the main stage in the spring-centered central position and/or in the offset position
  - Optionally with spool position monitoring
- Flexible – suitable for position, speed and pressure control
- Precise – high response sensitivity and little hysteresis

Contents

Ordering code

01	02	03	04	05	06	07	08		09		10	11	12	13		14	15	16	17
4	**WRT**	**E**						**–**	**4X**	**/**	**6E**	**G24**		**K31**	**/**				*

01	4 main ports	**4**
02	Directional control valve, pilot-operated	**WRT**
03	With integrated electronics	**E**
04	**Without** spool position monitoring	**no code**
	With spool position monitoring (NG16 ... NG35 only)	**M**
05	Size 10	**10**
	Size 16	**16**
	Size 25	**25**
	Size 27	**27**
	Size 32	**32**
	Size 35	**35**
06	Symbols e. g. E, E1-, W6- etc.; possible version see page 3	

Rated flow (***Δp*** = 5 bar/control edge)

07	**– Size 10**	
	25 l/min (symbol E, W6-, W8- and V only with flow characteristic "L")	**25**
	50 l/min (symbol E1-, W8- and V1 only with flow characteristic "L")	**50**
	90 l/min	**100**
	– Size 16	
	150 l/min (symbol V1 only with flow characteristic "L")	**150**
	220 l/min	**220**
	– Size 25	
	220 l/min	**220**
	350 l/min	**350**
	– Size 27	
	500 l/min	**500**
	– Size 32	
	400 l/min	**400**
	600 l/min	**600**
	– Size 35	
	1000 l/min	**1000**

Flow characteristic

08	Linear	**L**
	Linear with fine control range	**P**
09	Component series 40 ... 49 (40 ... 49: unchanged installation and mounting dimensions)	**4X**

Pilot control valve

10	Proportional solenoid with detachable coil (NG6)	**6E**
11	Direct voltage 24 V	**G24**

Pilot oil flow

12	External pilot oil supply, external pilot oil return	**no code**
	Internal pilot oil supply, external pilot oil return	**E**
	External pilot oil supply, internal pilot oil return	**T**
	Internal pilot oil supply, internal pilot oil return	**ET**

Electrical connection

13	**Without** mating connector; connector DIN EN 175201-804	**K31** [1)]

Ordering code

01	02	03	04	05	06	07	08		09		10	11	12	13		14	15	16	17
4	**WRT**	**E**						**–**	**4X**	**/**	**6E**	**G24**		**K31**	**/**				*****

Interfaces of the control electronics

14	Command value/actual value ± 10 V	**A1**
	Command value/actual value 4 ... 20 mA	**F1**
	Command value/actual value ± 10 V, enable signal (pin C)	**A5** 2)

Seal material

15	NBR seals	**M**
	FKM seals	**V**
	Observe compatibility of seals with hydraulic fluid used.	

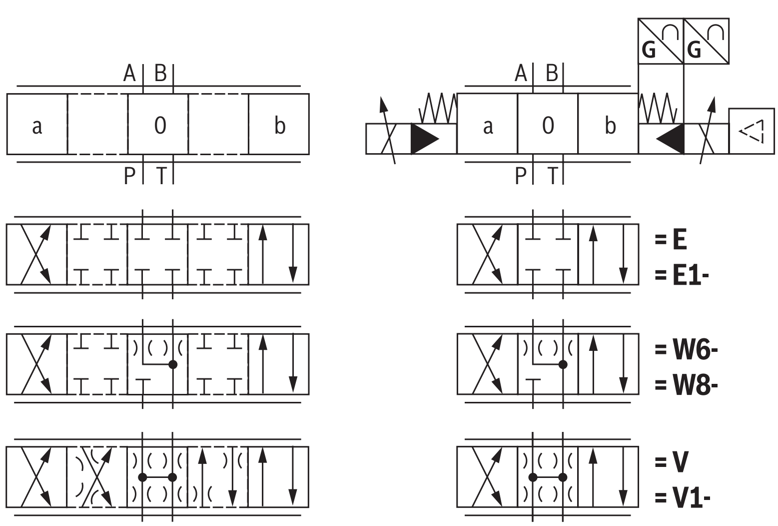
16	**Without** electronics protection membrane	**no code**
	With electronics protection membrane	**-967**

17	Further details in the plain text	*

1) Mating connectors, separate order, see page 28 and data sheet 08006.

2) When replacing the component series 3X by component series 4X, the electronics interface is to be defined with A5 (enable signal at pin C).

Symbols



With symbol E1–, V1– and W8–:

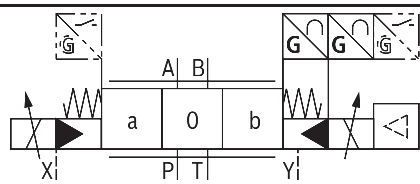
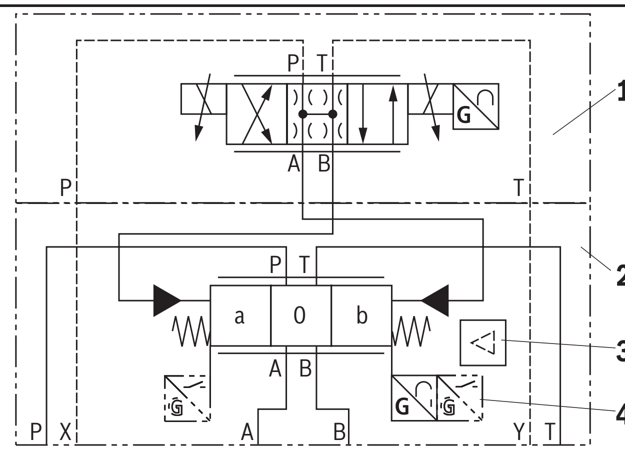
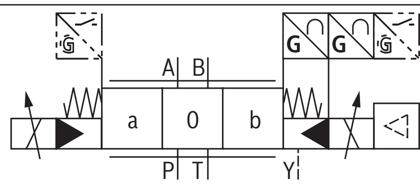
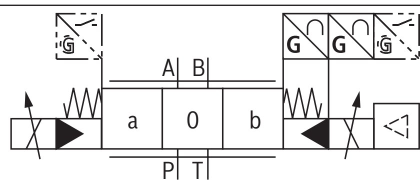
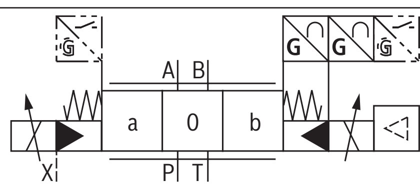
P → A: $q_{V\,max}$ B → T: $q_V/2$

P → B: $q_V/2$ A → T: $q_{V\,max}$

Notices:

- Representation according to DIN ISO 1219-1. Hydraulic interim positions are shown by dashes.

Symbols

Design	simple	detailed
"no code"		
"E"		
"ET"		
"T"		

1 Pilot control valve
2 Main valve
3 Integrated electronics (OBE)
4 Design with spool position monitoring "M"

Notice:
Representation according to DIN ISO 1219-1.

Function, section

Valves of type 4WRTE are pilot-operated directional control valves with electrical position feedback, integrated electronics (OBE) and optional spool position monitoring.

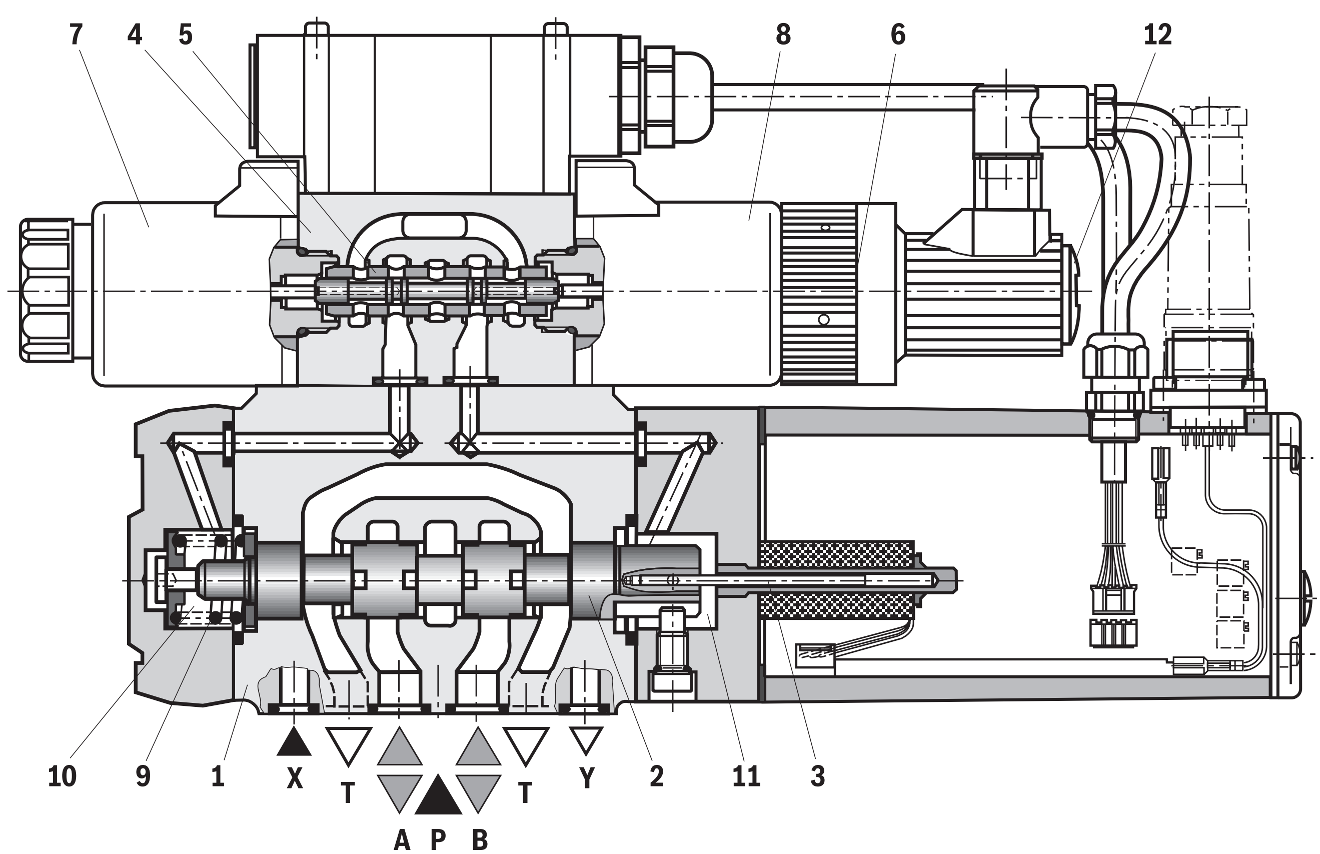
Set-up

The valve basically consists of 3 main assemblies:

- Housing (1) with main stage control spool (2) and optional spool position monitoring (13)
- Integrated electronics (optionally with electronics protection membrane (14)) with inductive position transducer (3) of the main stage
- Pilot control valve (4) with control spool/socket unit (5), inductive position transducer (6) and pressure feed back for central position of the main stage control spool (2)

Function

- With de-energized proportional solenoids (7; 8) central position of the main stage control spool (2) due to centering spring (9) and pressure feed back
- Control of the main stage control spool (2) via the pilot control valve (4) → the main stage control spool (2) is positioned in a regulated manner
- Controlling the control spool of the pilot control valve (4) by changing the solenoid force of the proportional solenoids (7; 8)
- Connection of the command and actual values in the integrated electronics
- Pilot oil supply to the pilot control valve internally via port P or externally via port X
  Pilot oil return internally via port T or externally via Y to the tank
- With a command value of 0 V, the electronics control the main stage control spool (2) in central position



Function, section

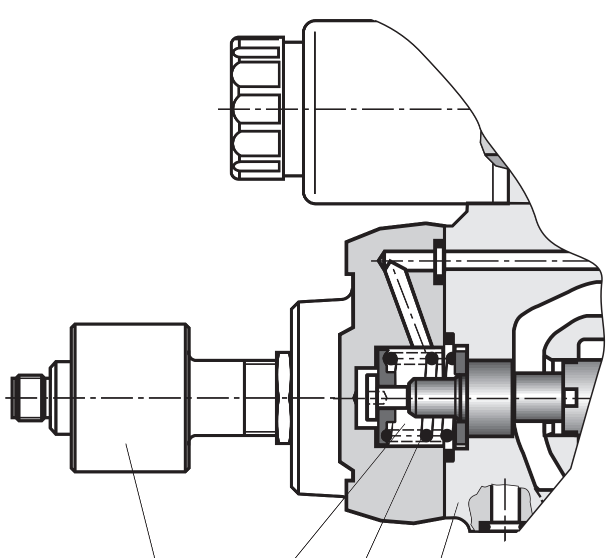
Spool position monitoring
The spool positions of the main stage control spool (2) are detected by the inductive position switch (13) and displayed via two switching outputs with a preset logic. If the fixedly set switching points are exceeded, the deviation from the zero position is monitored within the control spool overlap (see page 27).
The switching signals can be used in a superior control for monitoring functions. The electrical connection is implemented separately via a 4-pole connector M12x1 with two pins for signal output and two pins for voltage supply.

Area of application
The valve can be used in safety-related two-channel applications (category 3, PL d and category 4, PL e according to EN 13849-1) as switch-off element for one channel. The valve meets the requirements of a secure start inhibitor according to EN 60204, stop category 0.
If safety requirements are needed, the supply voltage of the valve must be safely disconnected based on the required safety level (category PL).
Depending on the application and the requirements of work equipment-specific standards according to EN 13849-1, the user must provide appropriate monitoring/plausibility checks which comply with the required diagnostic coverage DCavg using a superior control.

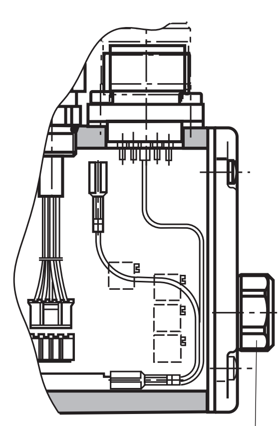
Electronics protection membrane "-967"
To prevent condensate formation in the housing of the integrated electronics (OBE), an electronics protection membrane (14) can be used.
Recommended for use outside industry-standard conditions with high ambient air humidity and significant cyclic temperature changes (e. g. outdoors).

Failure of supply voltage
- Integrated electronics de-energize the solenoid in case of supply voltage failure or cable break
- Automatic pressure control on the same level in the control chambers (10 and 11) by the pilot control valve
- In case of pressure supply failure, centering of the main stage control spool by centering spring (9)
- Central position of the main stage control spool (2)

Notices:
- Failure of the supply voltage will lead to an abrupt standstill of the control axis. The acceleration forces occurring in this connection may cause machine damage.
  With control spool symbols E, E1-, W6- and W8-, the centering spring (9) sets the main stage control spool (2) in central position, control spools V- and V1 are switched to the preferred direction P to B and A to T in a tolerance range of 1% to a maximum of 11% of the control spool stroke.
- The PG fitting (12) must not be opened. Mechanical adjustment of the adjustment nut located below is prohibited and damages the valve.
- The zero point has been adjusted at the factory. Changes in the zero point may result in damage to the system and may only be implemented by instructed specialists.
- If the pilot control valve or the electronics are exchanged, the zero point has to be adjusted once again by instructed specialists.



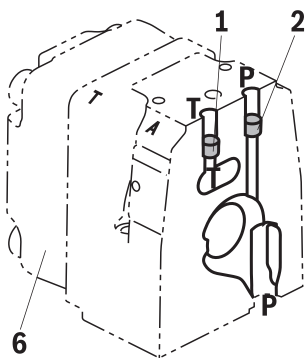
13 10 9 1



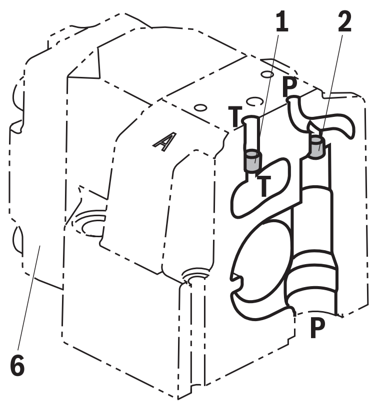
14

Pilot oil supply (schematic illustration)

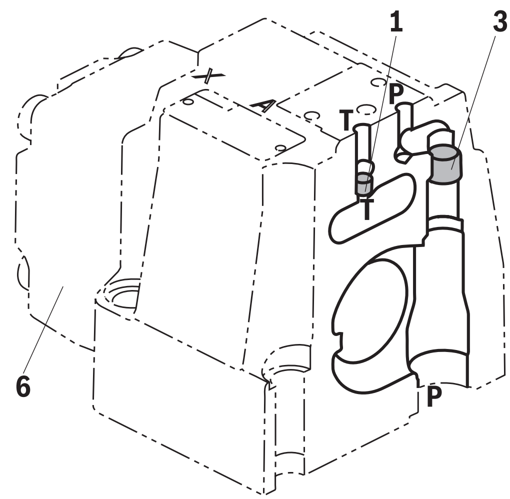
NG10



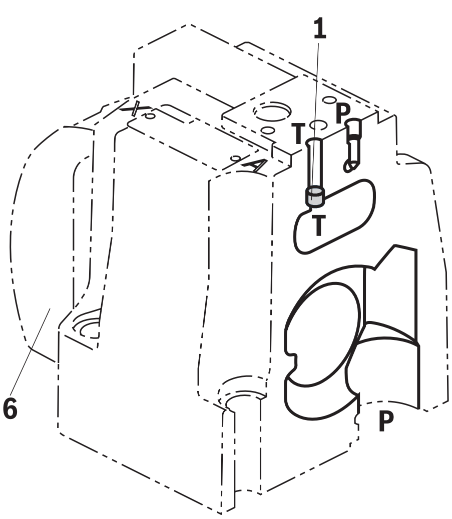
NG16



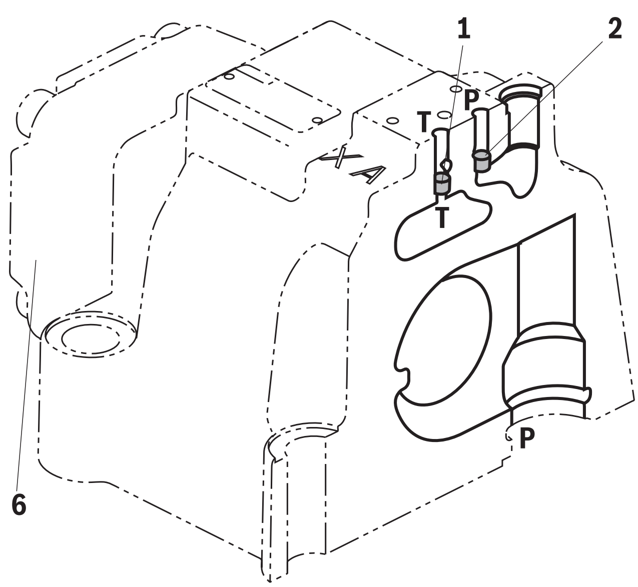
NG25



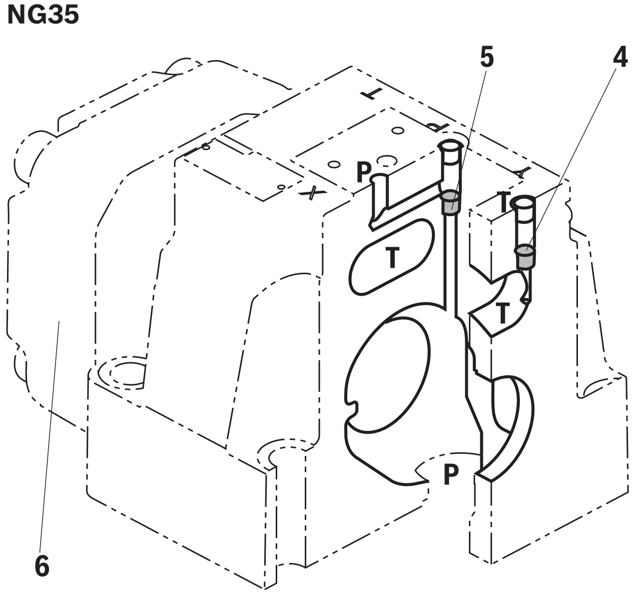
NG27



NG32



NG35



1 Plug screw M6 according to DIN 906, wrench size 3 – pilot oil return

2 Plug screw M6 according to DIN 906, wrench size 3 – pilot oil supply

3 Plug screw M12 x 1.5 according DIN 906, wrench size 6 – pilot oil supply

4 Plug screw M10 x 1 according to DIN 906, wrench size 5 – pilot oil return

5 Plug screw M10 x 1 according DIN 906, wrench size 5 – pilot oil supply

6 Main stage housing cover (opposite the OBE)

Pilot oil supply		Pilot oil return	
external	internal	external	internal
2, 3, 5 closed	**2, 3, 5** open	**1, 4** closed	**1, 4** open

Further explanations on page 8.

Pilot oil supply

"No code" version
External pilot oil supply
External pilot oil return
In this version, the pilot oil is supplied from a separate control circuit (external).
The pilot oil return is not directed into channel T of the main valve, but is separately directed to the tank via port Y (external).

Version "E"
Internal pilot oil supply
External pilot oil return
With this version, the pilot oil is supplied from channel P of the main valve (internally).
The pilot oil return is not directed into channel T of the main valve, but is separately directed to the tank via port Y (external).
In the subplate, port X is to be closed.

Version "ET"
Internal pilot oil supply
Internal pilot oil return
With this version, the pilot oil is supplied from channel P of the main valve (internally).
The pilot oil is directly returned to channel T of the main valve (internally).
In the subplate, ports X and Y are to be closed.

Version "T"
External pilot oil supply
Internal pilot oil return
In this version, the pilot oil is supplied from a separate control circuit (external).
The pilot oil is directly returned to channel T of the main valve (internally).
In the subplate, port Y is to be closed.

Technical data
(For applications outside these parameters, please consult us!)

general							
Sizes	NG	10	16	25	27	32	35
Weight	kg	8.7	11.2	16.8	17	31.5	34
Installation position and commissioning information		Preferably horizontal, see data sheet 07700					
Ambient temperature range	°C	–20 ... +50					
Maximum storage time	Years	1 (if the storage conditions are observed; refer to the operating instructions 07600-B)					
$MTTF_D$ values according to EN ISO 13849	Years	150 [1] (for more information see data sheet 08012)					
Sine test according to DIN EN 60068-2-6		10 ... 2000 Hz / maximum of 10 g / 10 cycles / 3 axes					
Noise test according to DIN EN 60068-2-64		20 ... 2000 Hz / 10 g_{RMS} / 30 g peak / 30 min. / 3 axes					
Transport shock according to DIN EN 60068-2-27		15 g / 11 ms / 3 shocks / 3 axes					
Damp heat, cyclic, according to DIN EN 60068-2-30		Variant 2 +25 °C ... +55 °C, 90% ... 97% relative humidity, 2 cycles of 24 hours					

[1] With symbol E, E1, W6 and W8: in longitudinal control spool direction, there is sufficient positive overlap without shock/vibration load; observe the installation orientation with regard to the main direction of acceleration.

Technical data
(For applications outside these parameters, please consult us!)

hydraulic										
Sizes			NG	10	16	25	27	32	35
Maximum operating pressure	▶ Pilot control valve	Pilot oil supply [2]	bar	25 ... 315					
	▶ Main valve	Port P, A, B	bar	350	350	350	270	350	350
Maximum return flow pressure	▶ Port T	Internal pilot oil return	bar	Static < 10					
		External pilot oil return	bar	315	250	250	210	250	250
	▶ Port Y		bar	Static < 10					
Rated flow $\boldsymbol{q}_{\text{Vnom}}$ ±10% [3] with $\boldsymbol{\Delta p}$ = 5 bar/control edge			l/min	25 50 100	150 – 220	– 220 350	– – 500	– 400 600	– – 1000
Maximum flow (recommended)			l/min	170	460	870	1000	1600	3000
Pilot oil flow at port X or Y with stepped input signal from 0 to 100% (315 bar)			l/min	7	14	20	20	27	29
Pilot oil volume 0 ... 100%			cm^3	1.1	2.9	6.8	6.8	17.7	33.9
Hydraulic fluid				See table below					
Hydraulic fluid temperature range (at the valve working ports)			°C	−20 ... +80; preferably +40 ... +80					
Viscosity range			mm^2/s	20 ... 380; preferably 30 ... 45					
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)				Class 18/16/13 [4]					
Hysteresis			%	≤ 0.1					
Response sensitivity			%	≤ 0.05					
Zero point calibration (ex works) [5]			%	≤ 1					
Temperature drift			%/10 °C	Zero shift < 0.3					

Hydraulic fluid		**Classification**	**Suitable sealing materials**	**Standards**	**Data sheet**
Mineral oils		HL, HLP, HLPD, HVLP, HVLPD	NBR, FKM	DIN 51524	90220
Bio-degradable	▶ Insoluble in water	HETG	NBR, FKM	ISO 15380	90221
		HEES	FKM		
	▶ Soluble in water	HEPG	FKM	ISO 15380	
Flame-resistant	▶ Water-free	HFDU, HFDR	FKM	ISO 12922	90222
	▶ Containing water	HFC (Fuchs Hydrotherm 46M, Petrofer Ultra Safe 620)	NBR	ISO 12922	90223

Important information on hydraulic fluids:
- For further information and data on the use of other hydraulic fluids, please refer to the data sheets above or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.)!
- The ignition temperature of the hydraulic fluid used must be 40 K higher than the maximum solenoid surface temperature.
- **Flame-resistant – containing water**:
  - Maximum operating pressure 210 bar
  - Maximum pressure differential per control edge 175 bar
  - Pressure pre-loading at the tank port >20% of the pressure differential, otherwise increased cavitation erosion
  - Life cycle as compared to operation with mineral oil HL, HLP 50 ... 100%
  - Maximum hydraulic fluid temperature 50 °C

[2] For perfect system behavior, we recommend an external pilot oil supply for pressures above 210 bar.

[3] Flow for deviating $\boldsymbol{\Delta p}$ (valve pressure differential):

$$\boxed{\boldsymbol{q}_x = \boldsymbol{q}_{\text{V nom}} \times \sqrt{\frac{\boldsymbol{\Delta p}_x}{5}}}$$

[4] The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and simultaneously increases the life cycle of the components.

[5] Related to the pressure-signal characteristic curve (symbol V)

Notice:
Technical data (hydraulic) measured with HLP46, ϑ_{Oil} = 40 °C ±5 °C

Technical data
(For applications outside these parameters, please consult us!)

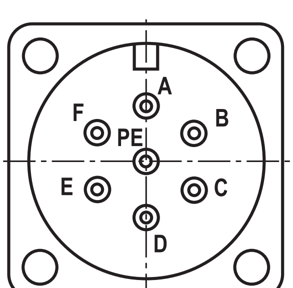
electrical, integrated electronics (OBE)			
Relative duty cycle		%	100 (continuous operation)
Protection class according to EN 60529			IP 65 with mounted and locked plug-in connectors
Supply voltage	▶ Nominal voltage	VDC	24
	▶ Lower limit value	VDC	18
	▶ Upper limit value	VDC	35
Maximum admissible residual ripple		Vpp	2.5 (Comply with absolute supply voltage limit value)
Current consumption	▶ Maximum	A	1.6
	▶ Impulse current	A	2.7
Maximum power consumption		VA	72 (average 24)
Required fuse protection, external		A_T	4 (time-lag)
Voltage input "A1" (differential input)	▶ Measurement range	VDC	−10 ... +10
	▶ Input resistance	kΩ	100
Current input "F1"	▶ Input current	mA	4 ... (12) ... 20
	▶ Input resistance	Ω	100
Enable input "A5"	▶ Low level	VDC	0 ... 2
	▶ High level	VDC	11 ... U_B
Maximum coil temperature 6)		°C	150

6) Due to the temperatures occurring at the surfaces of the solenoid coils, the European standards ISO 13732-1 and EN ISO 4413 need to be adhered to.

Electrical connections and assignment

Connector pin assignment

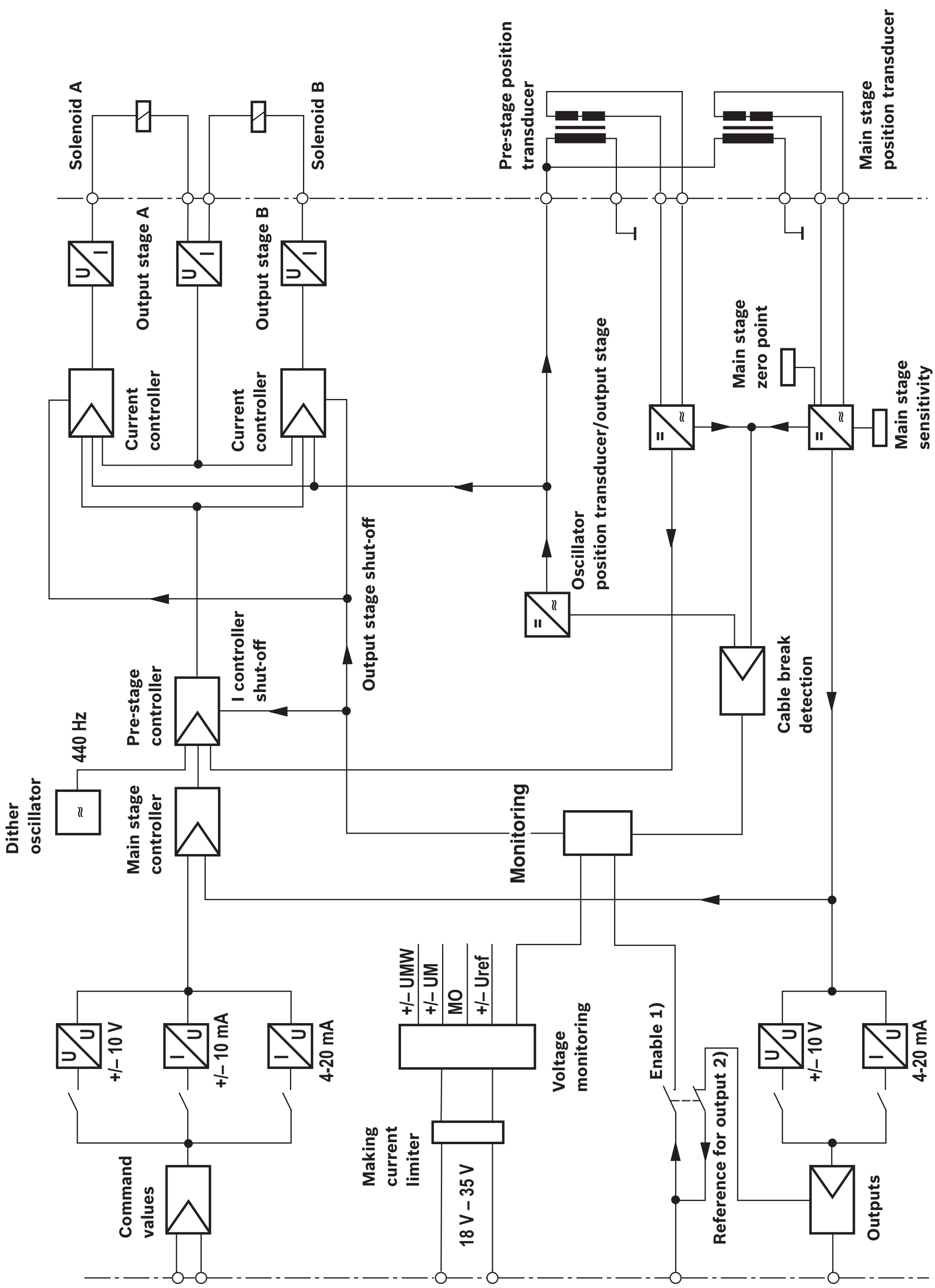
Pin	Signal	Interface A1	Interface F1	Interface A5
A	Supply voltage	24 V DC		
B		0 V		
C	Reference potential (actual value)/enable signal	Reference potential for actual value (pin F)		Enable signal 11 ... U_B V DC
D	Differential amplifier input (command value)	±10 V	4 ... 20 mA	±10 V
E		0 V reference potential (pin D)		0 V reference potential for pin D and F
F	Measuring output (actual value)	±10 V	4 ... 20 mA	±10 V
PE		Functional ground (directly connected to the valve housing)		



Command value:	▶ Reference potential at E and positive command value at D result in flow from P → A and B → T.
	▶ Reference potential at E and negative command value at D result in flow from P → B and A → T.
Connection cable (recommendation):	▶ Up to 25 m cable length type LiYCY 7 x 0.75 mm²
	▶ Up to 50 m cable length type LiYCY 7 x 1.0 mm²
	▶ Connect shield on PE only on the supply side

Notices:
- Electrical signals provided via valve electronics (e.g. actual value) must not be used to switch off safety-relevant machine functions.
- Mating connectors, separate order, see page 28 and data sheet 08006.

Block diagram: Integrated electronics (OBE)



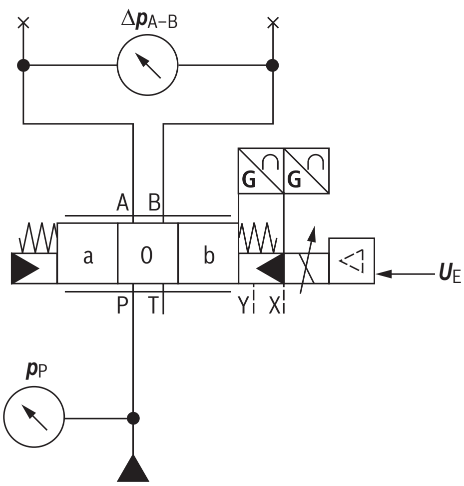
1) Only with electronics interface "A5"

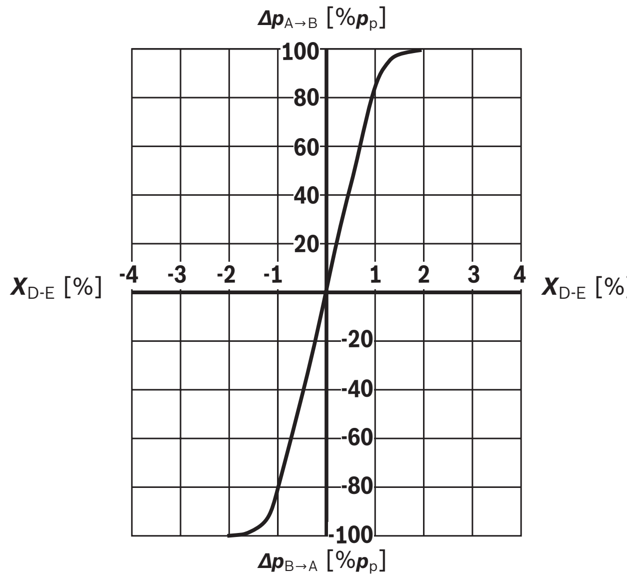
2) Only with electronics interfaces "A1" and "F1"

Characteristic curves

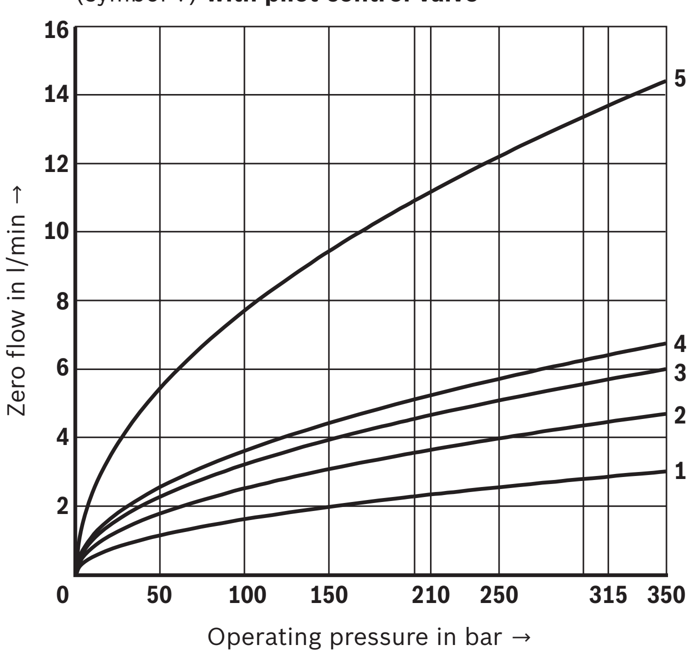
(measured with HLP46, ϑ_{Oil} = 40 °C ±5 °C and p = 100 bar)

Pressure amplification

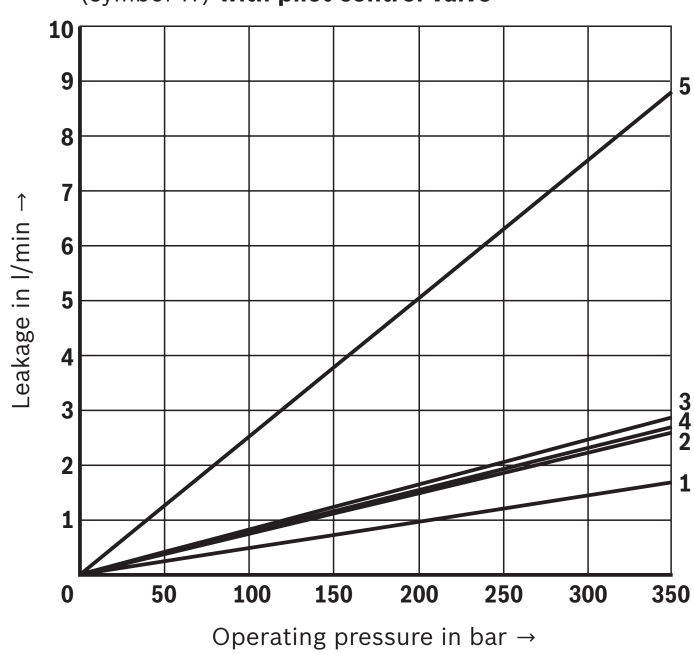




Maximum zero flow of the main stage
(symbol V) **with pilot control valve**



Maximum internal leakage of the main stage
(symbol W) **with pilot control valve**



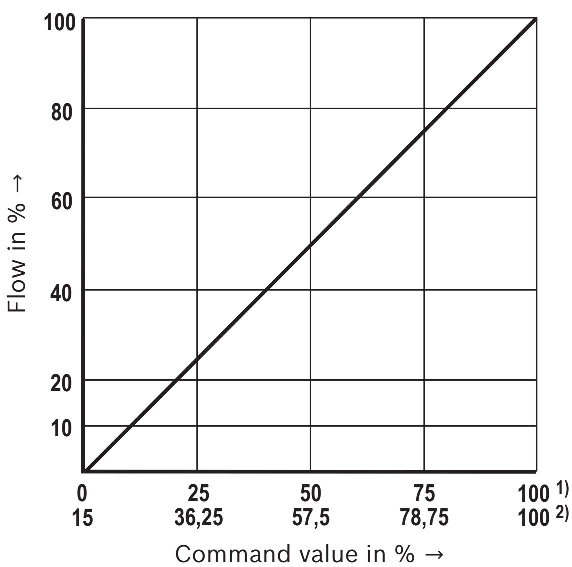
1 Size 10
2 Size 16
3 Sizes 25, 27
4 Size 32
5 Size 35

Characteristic curves
(measured with HLP46, ϑ_{Oil} = 40 °C ±5 °C)

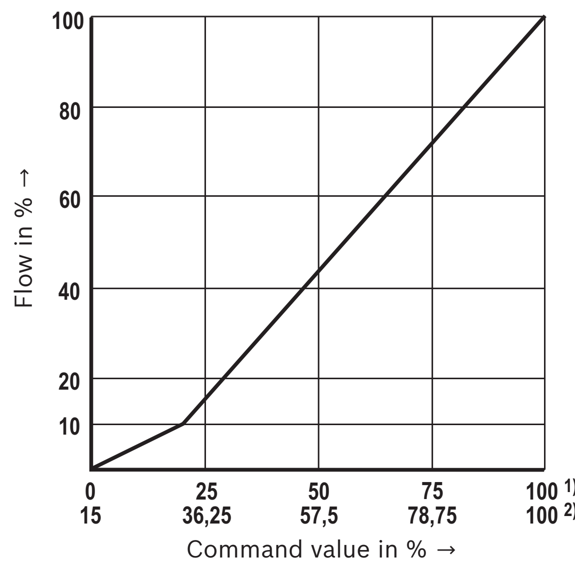
Flow command value function
(***Δp*** = 5 bar/control edge)

Symbol E, W, and V

Version "L"



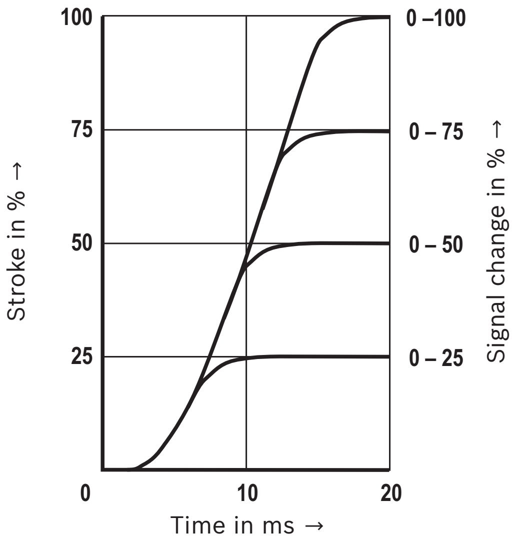
Version "P"



1) Positive overlap 0 ... 0.5% at symbol V
2) Positive overlap 15% at symbol E and W

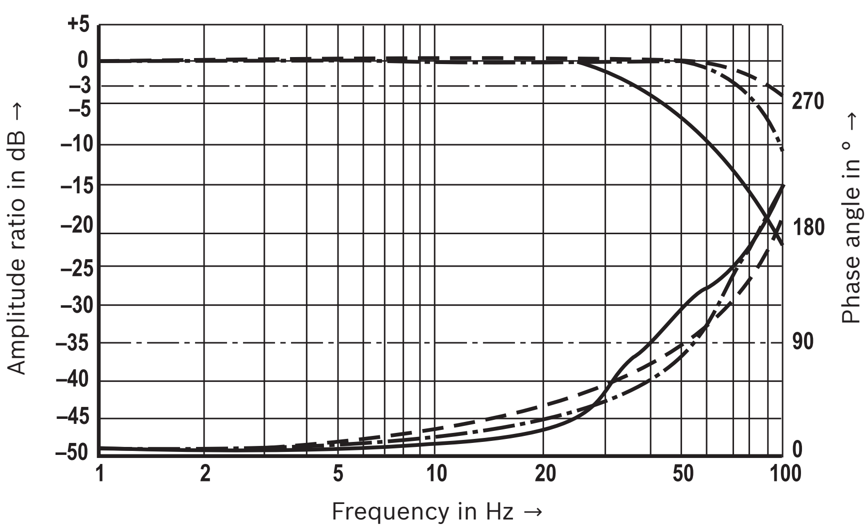
Characteristic curves: Size 10
(measured with HLP46, ϑ_{Oil} = 40 ±5 °C)

Transition function with stepped electric input signals



Measured with:
- Pilot control valve: Port X = 100 bar
- Main stage: Port P = 10 bar

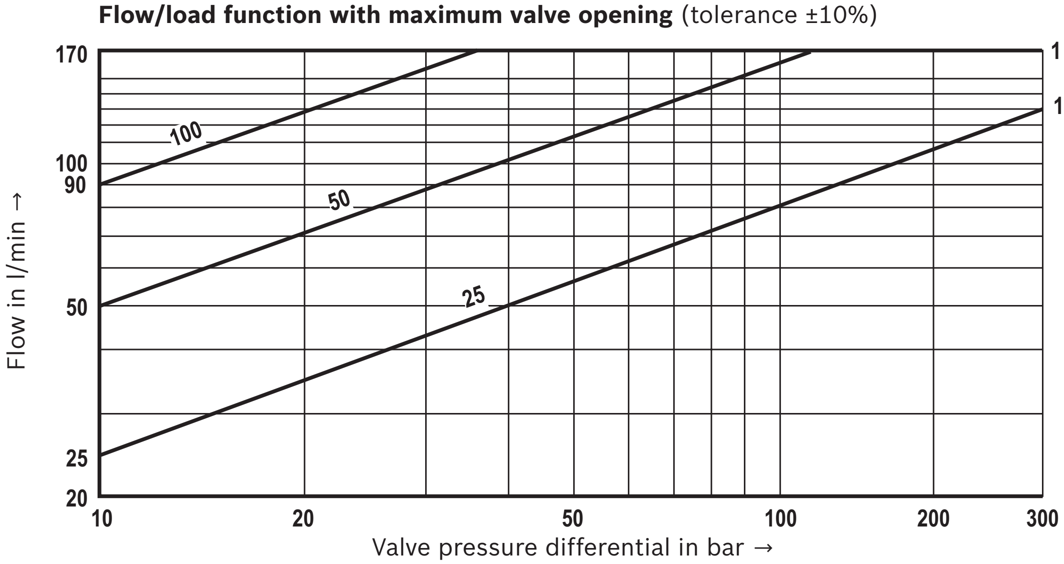
Frequency response characteristic curves



Measured with:
- Pilot control valve: Port X = 100 bar
- Main stage: Port P = 10 bar

Signal ±100%
Signal ±25%
Signal ±5%

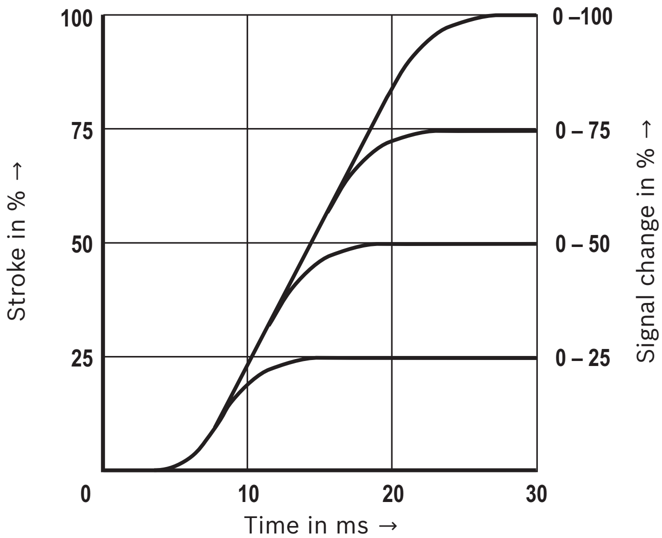
Flow/load function with maximum valve opening (tolerance ±10%)



1 Recommended flow limitation (flow velocity 30 m/s)

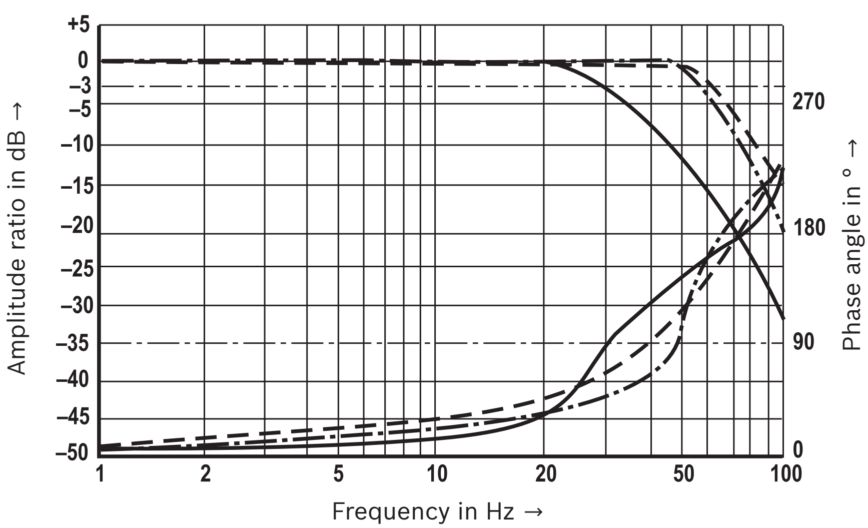
Characteristic curves: Size 16
(measured with HLP46, ϑ_{Oil} = 40 ±5 °C)

Transition function with stepped electric input signals



Measured with:
- Pilot control valve: Port X = 100 bar
- Main stage: Port P = 10 bar

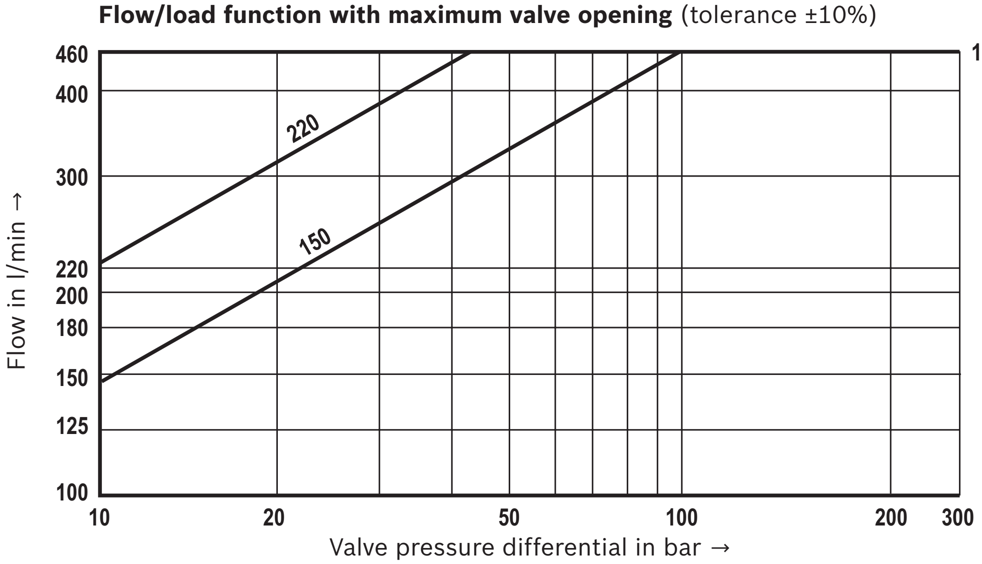
Frequency response characteristic curves



Measured with:
- Pilot control valve: Port X = 100 bar
- Main stage: Port P = 10 bar

Signal ±100% (solid line)
Signal ±25% (dash-dot line)
Signal ±5% (dashed line)

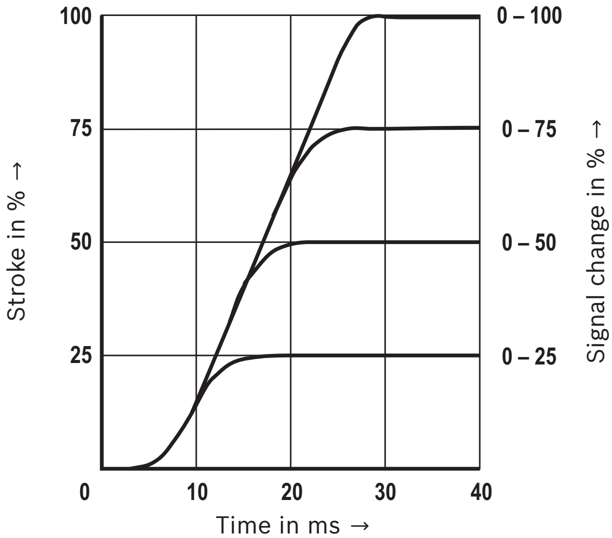
Flow/load function with maximum valve opening (tolerance ±10%)



1 Recommended flow limitation (flow velocity 30 m/s)

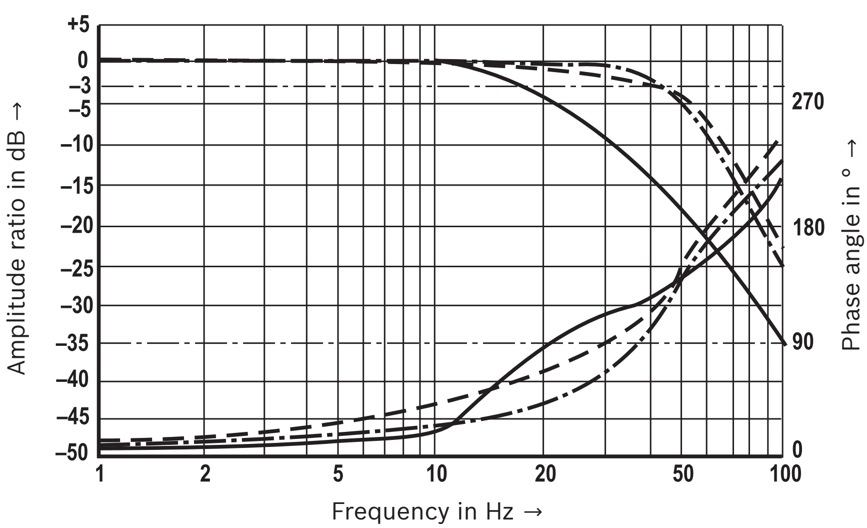
Characteristic curves: Size 25 and 27
(measured with HLP46, ϑ_{Oil} = 40 ±5 °C)

Transition function with stepped electric input signals



Measured with:
- Pilot control valve: Port X = 100 bar
- Main stage: Port P = 10 bar

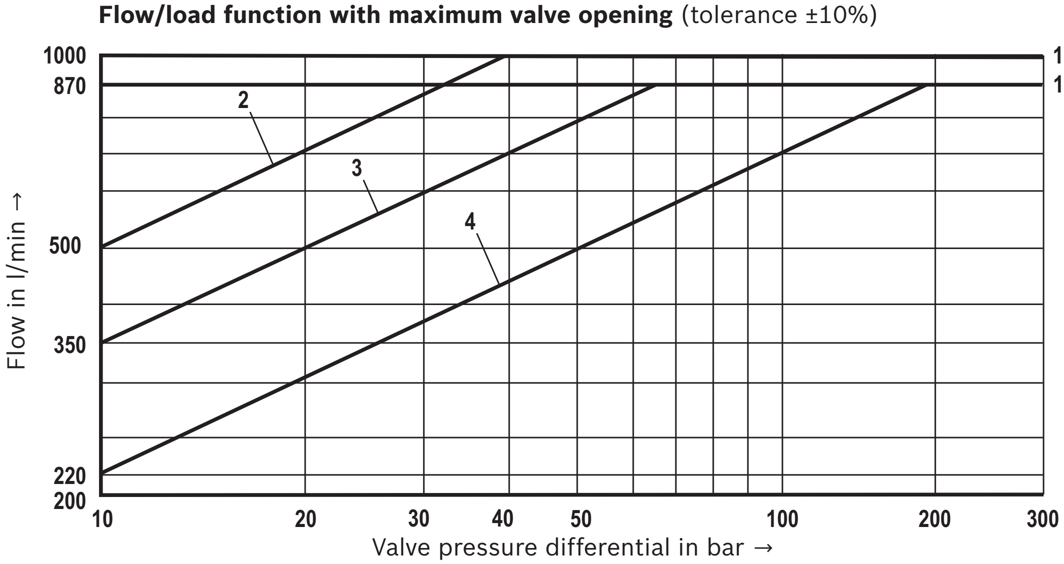
Frequency response characteristic curves



Measured with:
- Pilot control valve: Port X = 100 bar
- Main stage: Port P = 10 bar

Signal ±100%
Signal ±25%
Signal ±5%

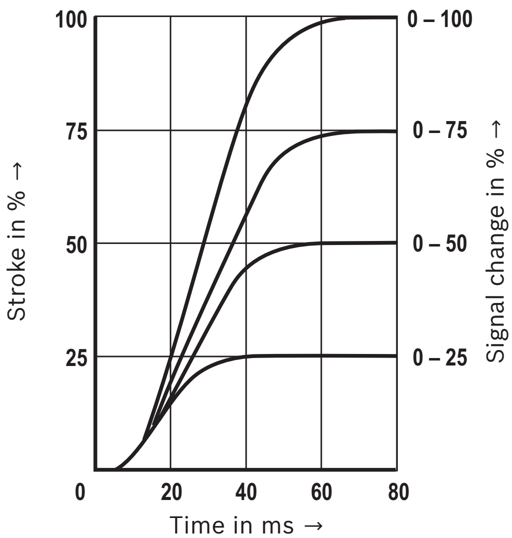
Flow/load function with maximum valve opening (tolerance ±10%)



1 Recommended flow limitation (flow velocity 30 m/s)
2 500 – NG27
3 350 – NG25
4 220 – NG25

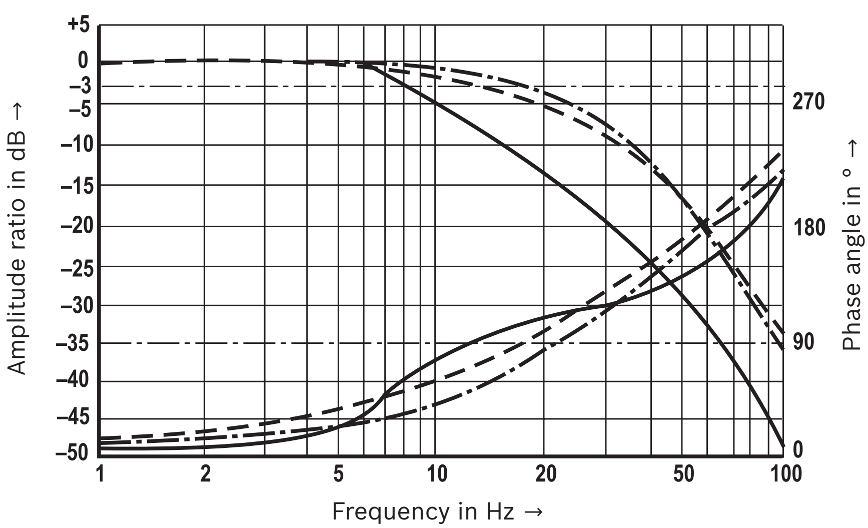
Characteristic curves: Size 32
(measured with HLP46, ϑ_{Oil} = 40 ±5 °C)

Transition function with stepped electric input signals



Measured with:
- Pilot control valve: Port X = 100 bar
- Main stage: Port P = 10 bar

Frequency response characteristic curves



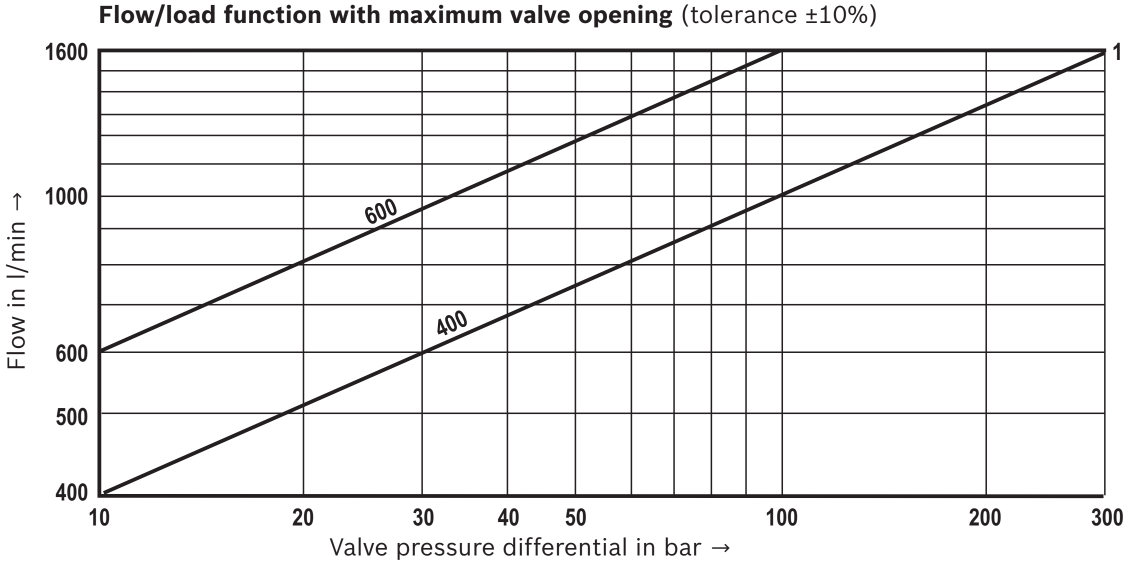
Measured with:
- Pilot control valve: Port X = 100 bar
- Main stage: Port P = 10 bar

Signal ±100%

Signal ±25%

Signal ±5%

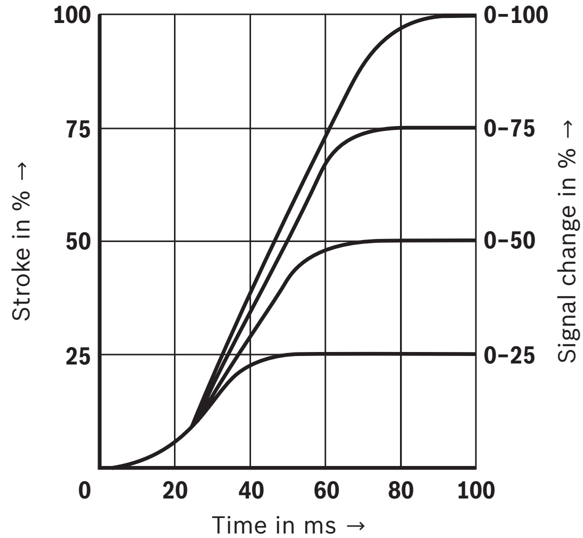
Flow/load function with maximum valve opening (tolerance ±10%)



1 Recommended flow limitation (flow velocity 30 m/s)

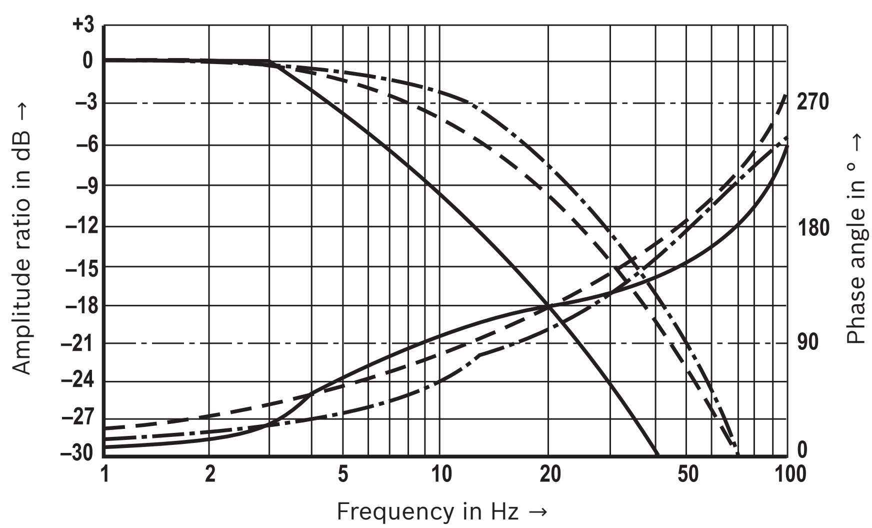
Characteristic curves: Size 35
(measured with HLP46, ϑ_{Oil} = 40 ±5 °C)

Transition function with stepped electric input signals



Measured with:
- Pilot control valve: Port X = 100 bar
- Main stage: Port P = 10 bar

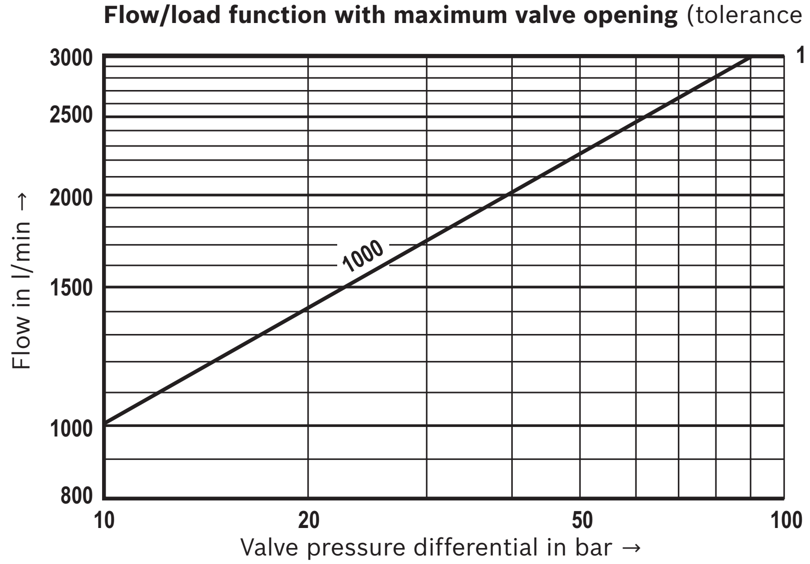
Frequency response characteristic curves



Measured with:
- Pilot control valve: Port X = 100 bar
- Main stage: Port P = 10 bar

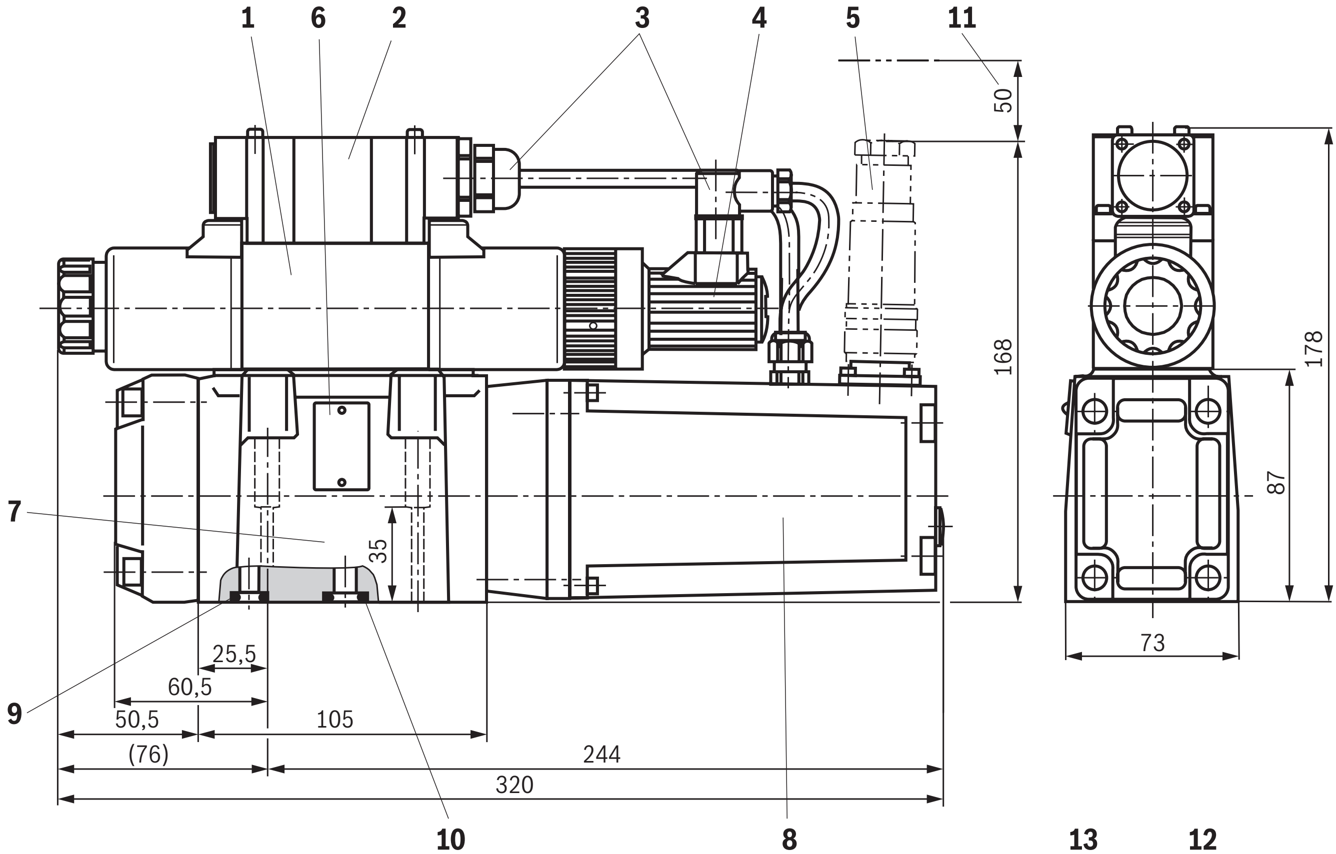
Signal ±100%
Signal ±25%
Signal ±5%

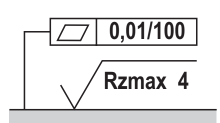
Flow/load function with maximum valve opening (tolerance ±10%)



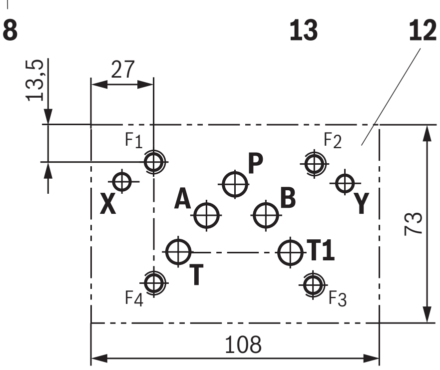
1 Recommended flow limitation (flow velocity 30 m/s)

Dimensions: Size 10
(dimensions in mm)





Required surface quality of
the valve contact surface



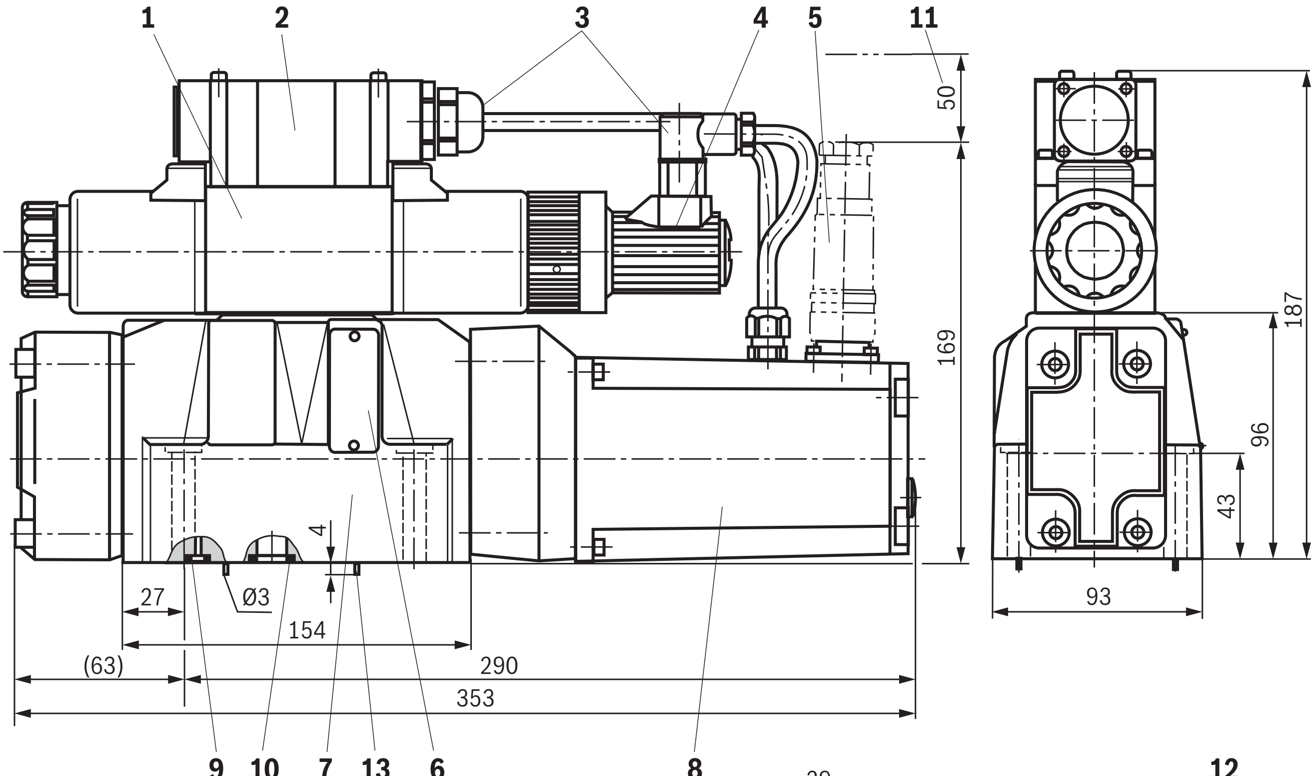
1 Pilot control valve
2 Electrical connection
3 Wiring and mating connector
4 Inductive position transducer (pilot control valve)
5 Mating connector 6-pole + PE (separate order, see page 28 and data sheet 08006)
6 Name plate
7 Main valve
8 Integrated electronics (OBE) and inductive position transducer (main valve)
9 Identical seal rings for ports X, Y
10 Identical seal rings for ports A, B, P, T, T1
11 Space required for connection cable and to remove the mating connector
12 Machined valve contact surface, porting pattern according to ISO 4401-05-05-0-05 (ports X, Y as required)

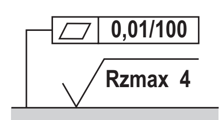
Subplates (separate order) with porting pattern according to ISO 4401-05-05-0-05 see data sheet 45100.

Notice:
The dimensions are nominal dimensions which are subject to tolerances.

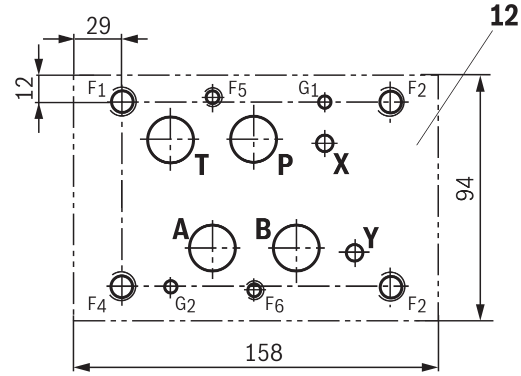
Dimensions for **electronics protection membrane "-967"** see page 25**.**
Valve mounting screws see page 26.

Dimensions: Size 16
(dimensions in mm)





Required surface quality of the valve contact surface



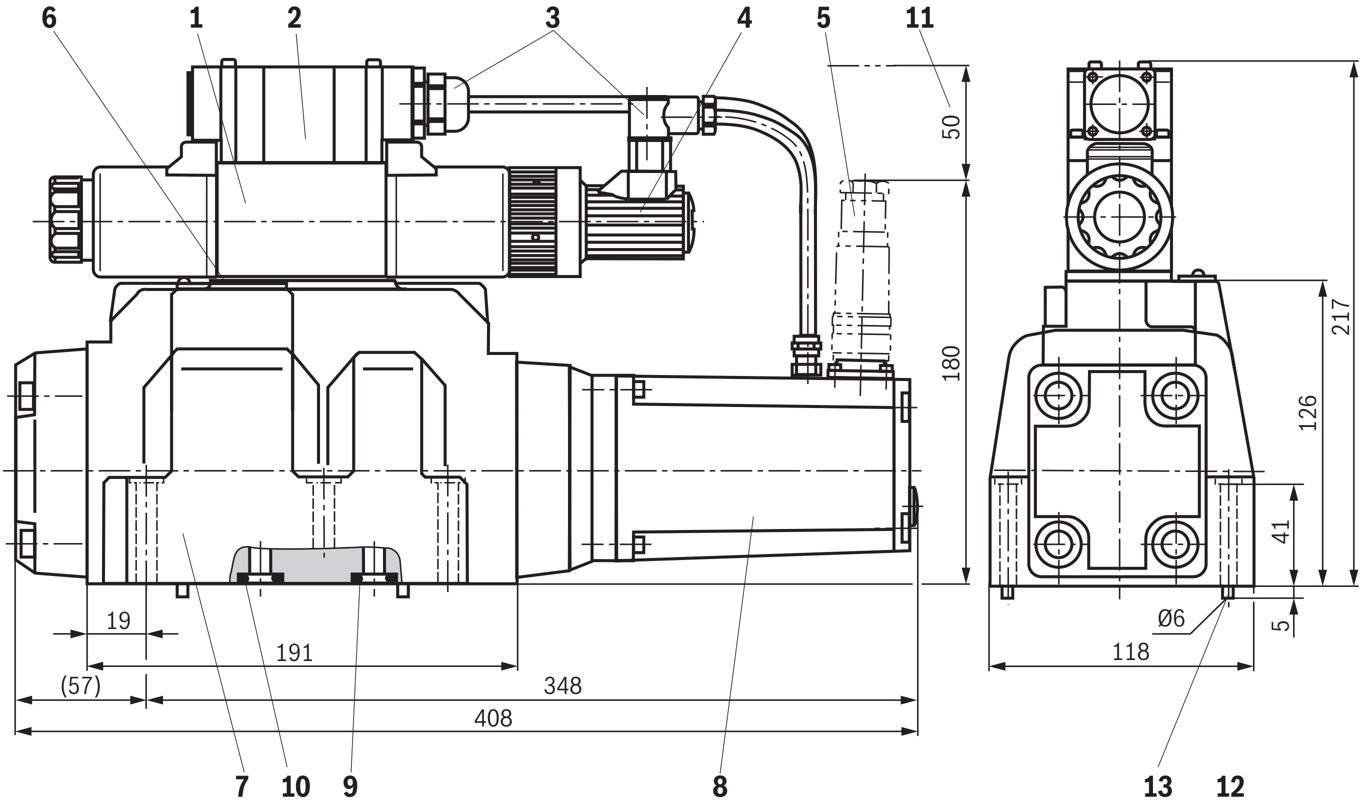
1. **1** Pilot control valve
2. **2** Electrical connection
3. **3** Wiring and mating connector
4. **4** Inductive position transducer (pilot control valve)
5. **5** Mating connector 6-pole + PE (separate order, see page 28 and data sheet 08006)
6. **6** Name plate
7. **7** Main valve
8. **8** Integrated electronics (OBE) and inductive position transducer (main valve)
9. **9** Identical seal rings for ports X, Y
10. **10** Identical seal rings for ports A, B, P, T
11. **11** Space required for connection cable and to remove the mating connector
12. **12** Machined valve contact surface, porting pattern according to ISO 4401-07-07-0-05 (ports X, Y as required)
    Deviating from the standard: ports A, B, P, T – Ø20 mm
13. **13** Locking pin

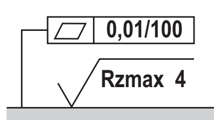
Subplates (separate order) with porting pattern according to ISO 4401-07-07-0-05 see data sheet 45100.

> **Notice:**
> The dimensions are nominal dimensions which are subject to tolerances.

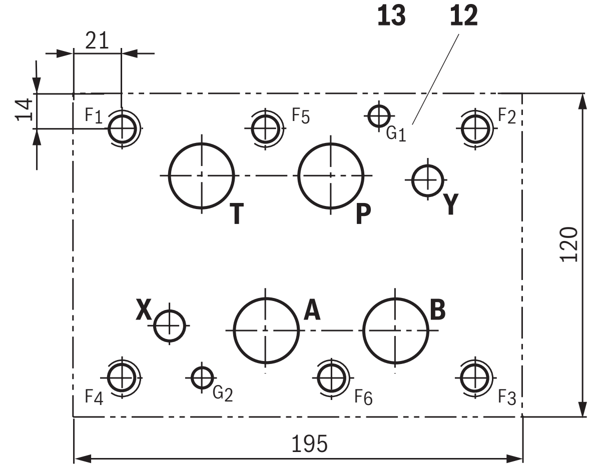
Dimensions for **electronics protection membrane "-967"** and **spool position monitoring "M"** see page 25**.**
Valve mounting screws see page 26.

Dimensions: Size 25
(dimensions in mm)





Required surface quality of
the valve contact surface



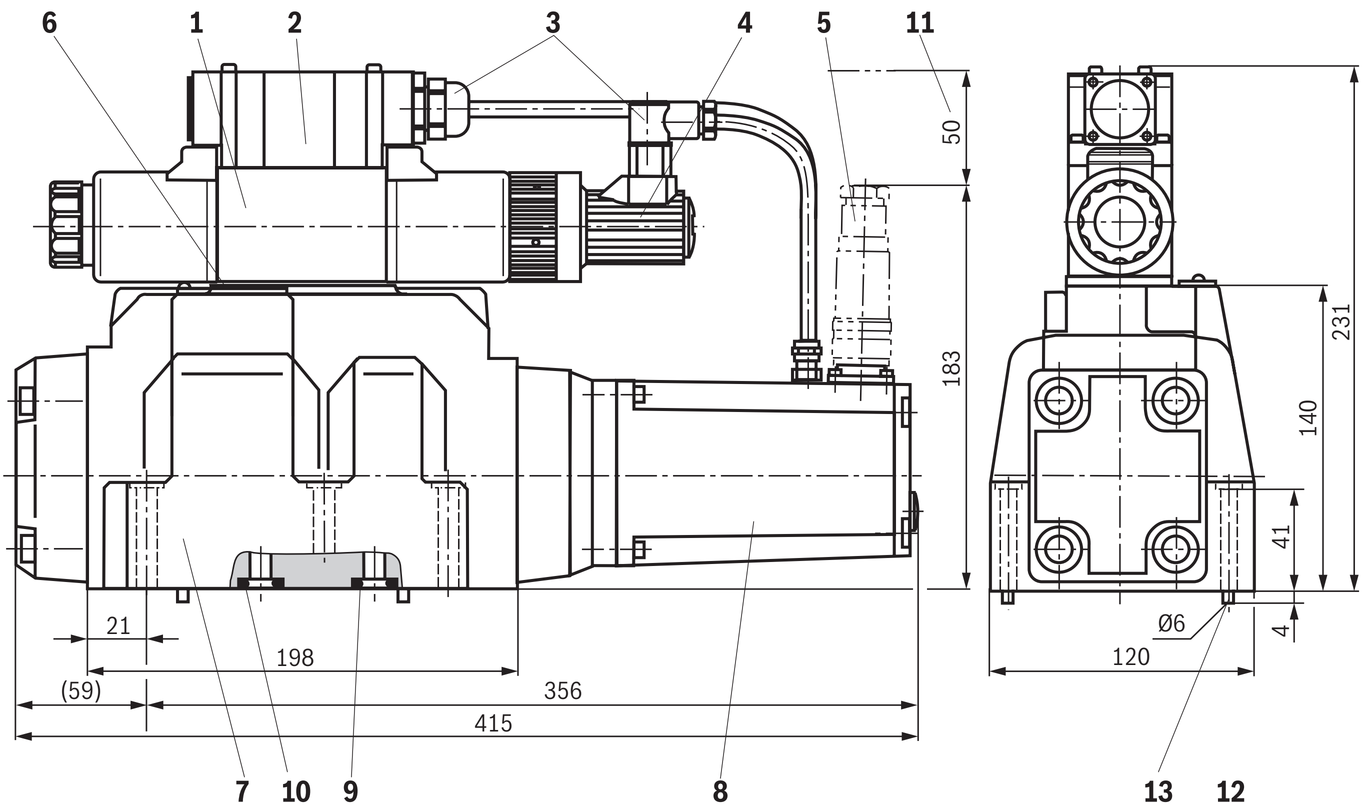
1 Pilot control valve
2 Electrical connection
3 Wiring and mating connector
4 Inductive position transducer (pilot control valve)
5 Mating connector 6-pole + PE (separate order, see page 28 and data sheet 08006)
6 Name plate
7 Main valve
8 Integrated electronics (OBE) and inductive position transducer (main valve)
9 Identical seal rings for ports X, Y
10 Identical seal rings for ports A, B, P, T
11 Space required for connection cable and to remove the mating connector
12 Machined valve contact surface; porting pattern according to ISO 4401-08-08-0-05 (ports X, Y as required)
13 Locking pin

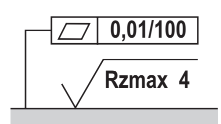
Subplates (separate order) with porting pattern according to ISO 4401-08-08-0-05 see data sheet 45100.

☞ **Notice:**
The dimensions are nominal dimensions which are subject to tolerances.

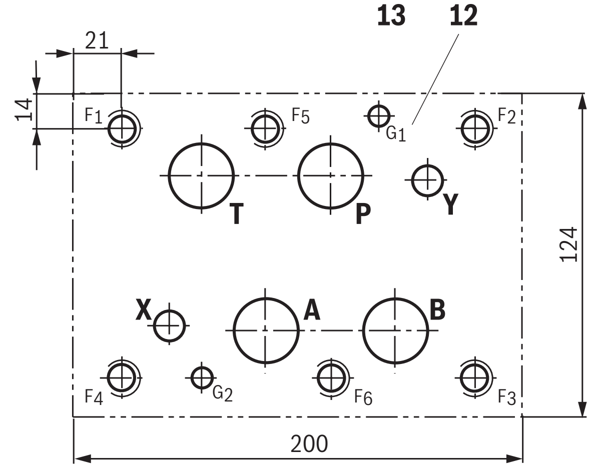
Dimensions for **electronics protection membrane "-967"** and **spool position monitoring "M"** see page 25**.**
Valve mounting screws see page 26.

Dimensions: Size 27
(dimensions in mm)





Required surface quality of
the valve contact surface



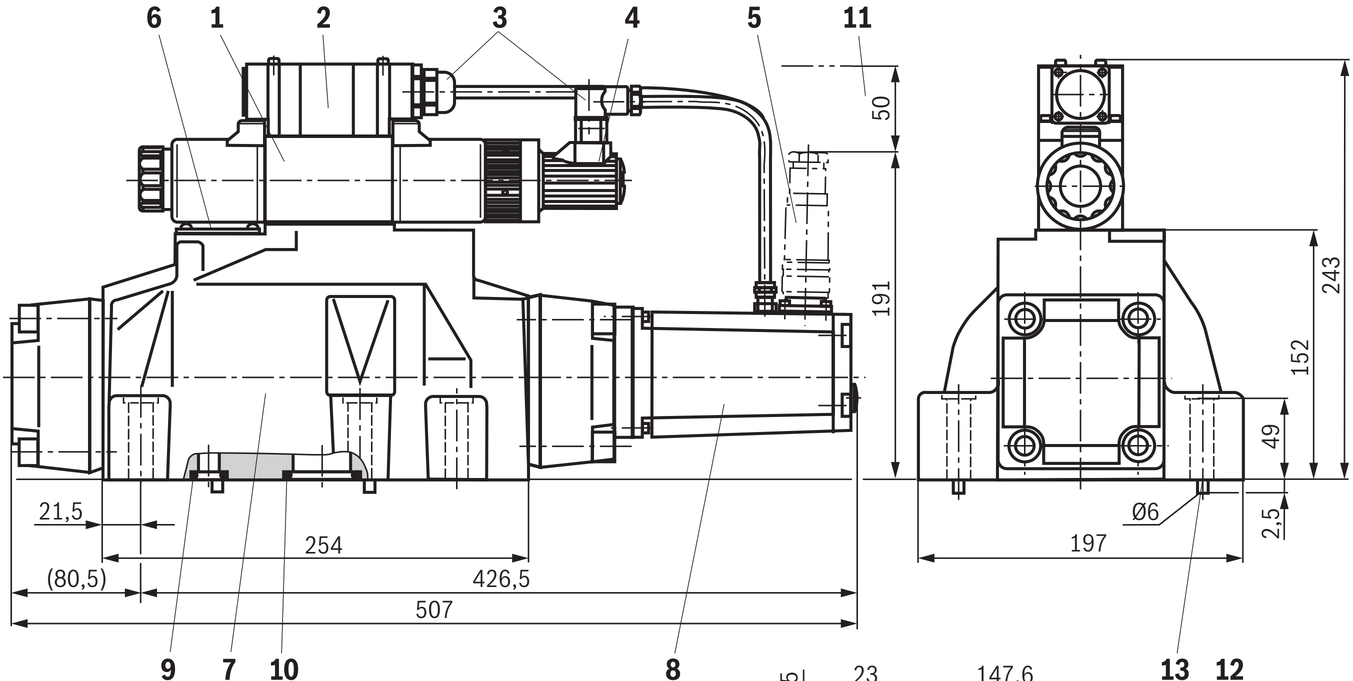
1. **1** Pilot control valve
2. **2** Electrical connection
3. **3** Wiring and mating connector
4. **4** Inductive position transducer (pilot control valve)
5. **5** Mating connector 6-pole + PE (separate order, see page 28 and data sheet 08006)
6. **6** Name plate
7. **7** Main valve
8. **8** Integrated electronics (OBE) and inductive position transducer (main valve)
9. **9** Identical seal rings for ports X, Y
10. **10** Identical seal rings for ports A, B, P, T
11. **11** Space required for connection cable and to remove the mating connector
12. **12** Machined valve contact surface; porting pattern according to ISO 4401-08-08-0-05 (ports X, Y as required)
    Deviating from the standard: ports A, B, P, T – Ø32 mm
13. **13** Locking pin

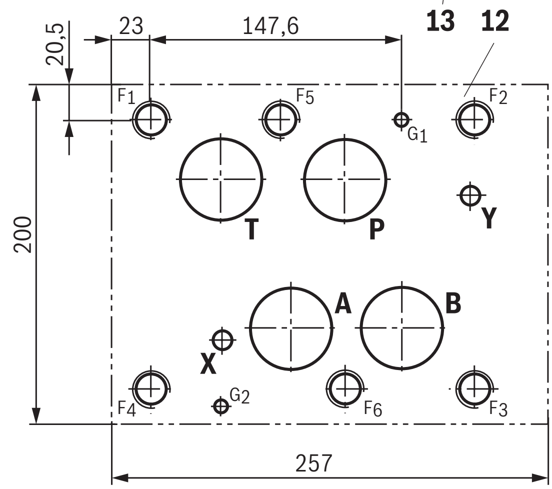
Subplates (separate order) with porting pattern according to ISO 4401-08-08-0-05 see data sheet 45100.

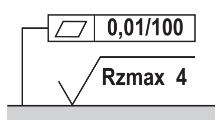
☞ **Notice:**
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions for **electronics protection membrane "-967"** and **spool position monitoring "M"** see page 25**.**
Valve mounting screws see page 26.

Dimensions: Size 32
(dimensions in mm)







Required surface quality of the valve contact surface

1 Pilot control valve
2 Electrical connection
3 Wiring and mating connector
4 Inductive position transducer (pilot control valve)
5 Mating connector 6-pole + PE (separate order, see page 28 and data sheet 08006)
6 Name plate
7 Main valve
8 Integrated electronics (OBE) and inductive position transducer (main valve)
9 Identical seal rings for ports X, Y
10 Identical seal rings for ports A, B, P, T
11 Space required for connection cable and to remove the mating connector
12 Machined valve contact surface; porting pattern according to ISO 4401-10-09-0-05 (ports X, Y as required)
Deviating from the standard:
- Ports A, B, P, T – Ø38 mm
- Dimension G_1 according to DIN 24340 Form A

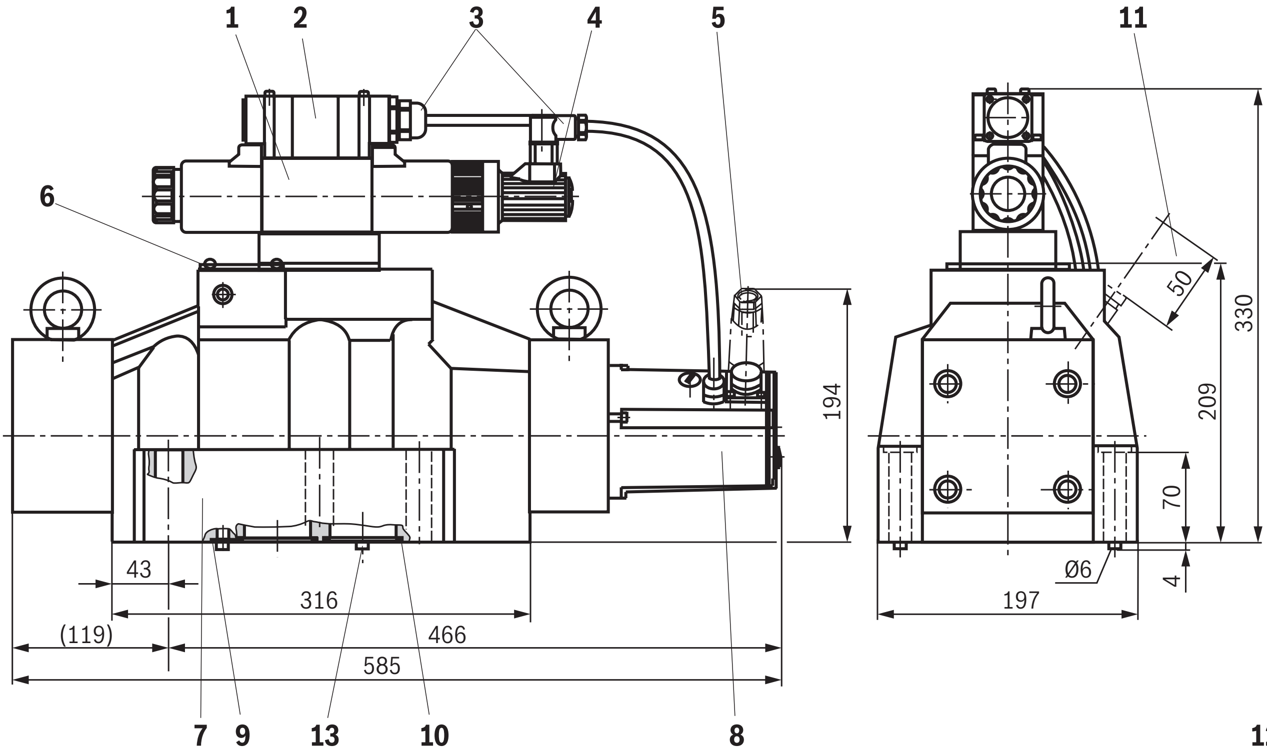
13 Locking pin

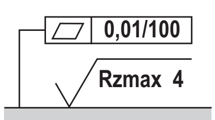
Subplates (separate order) with porting pattern according to ISO 4401-10-09-0-05 see data sheet 45100.

Notice:
The dimensions are nominal dimensions which are subject to tolerances.

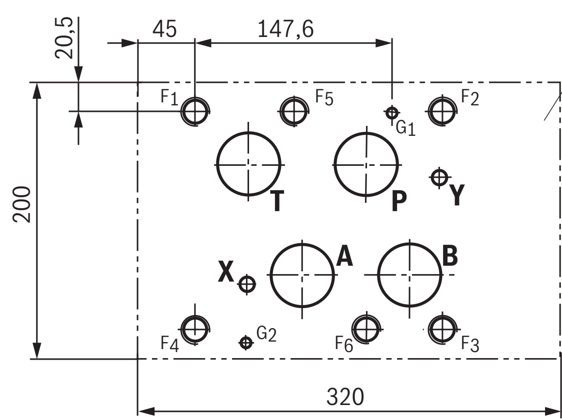
Dimensions for **electronics protection membrane "-967"** and **spool position monitoring "M"** see page 25.
Valve mounting screws see page 26.

Dimensions: Size 35
(dimensions in mm)





Required surface quality of the valve contact surface



1 Pilot control valve
2 Electrical connection
3 Wiring and mating connector
4 Inductive position transducer (pilot control valve)
5 Mating connector 6-pole + PE (separate order, see page 28 and data sheet 08006)
6 Name plate
7 Main valve
8 Integrated electronics (OBE) and inductive position transducer (main valve)
9 Identical seal rings for ports X, Y
10 Identical seal rings for ports A, B, P, T
11 Space required for connection cable and to remove the mating connector
12 Machined valve contact surface; porting pattern according to ISO 4401-10-09-0-05 (ports X, Y as required)
Deviating from the standard:
- Ports A, B, P, T – Ø50 mm
- [1)] Dimension G_1 according to DIN 24340 Form A

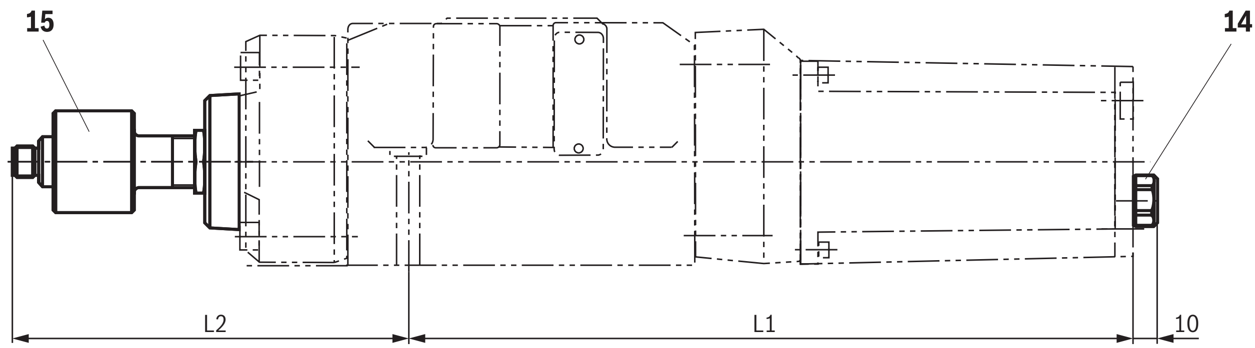
13 Locking pin

Subplates (separate order) with porting pattern according to ISO 4401-10-09-0-05 see data sheet 45100.

Notice:
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions for **electronics protection membrane "-967"** and **spool position monitoring "M"** see page 25.
Valve mounting screws see page 26.

Dimensions: Spool position monitoring "M" and electronics protection membrane "-967" (dimensions in mm)



NG	L1	L2
10	240	–
16	286	151
25	347	143
27	353	144
32	422	168
35	463	201

14 Electronics protection membrane "-967"

15 Spool position monitoring "M", optional

Notice:
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions

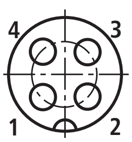
Valve mounting screws (separate order)

Size	Quantity	Hexagon socket head cap screws	Material number
10	4	**ISO 4762 - M6 x 45 - 10.9-CM-Fe-ZnNi-5-Cn-T0-H-B** tightening torque M_A = 13.5 Nm ±10%	**R913043777**
	or		
	4	**ISO 4762 - M6 x 45 - 10.9** tightening torque M_A = 15.5 Nm ±10%	Not included in the Rexroth delivery range
16	2	**ISO 4762 - M6 x 60 - 10.9-CM-Fe-ZnNi-5-Cn-T0-H-B** tightening torque M_A = 12.2 Nm ±10%	**R913043410**
	4	**ISO 4762 - M10 x 60 - 10.9-flZn/nc/480h/C** tightening torque M_A = 58 Nm ±20%	**R913014770**
	or		
	2	**ISO 4762 - M6 x 60 - 10.9** tightening torque M_A = 15.5 Nm ±10%	Not included in the Rexroth delivery range
	4	**ISO 4762 - M10 x 60 - 10.9** tightening torque M_A = 75 Nm ±20%	
25, 27	6	**ISO 4762 - M12 x 60 - 10.9-flZn/nc/480h/C** tightening torque M_A = 100 Nm ±20%	**R913015613**
	or		
	6	**ISO 4762 - M12 x 60** tightening torque M_A = 130 Nm ±20%	Not included in the Rexroth delivery range
32	6	**ISO 4762 - M20 x 80 - 10.9-flZn/nc/480h/C** tightening torque M_A = 340 Nm ±20%	**R913008472**
	or		
	6	**ISO 4762 - M20 x 80 - 10.9** tightening torque M_A = 430 Nm ±20%	Not included in the Rexroth delivery range
35	6	**ISO 4762 - M20 x 100 - 10.9-flZn/nc/480h/C** tightening torque M_A = 465 Nm ±20%	**R913015670**
	or		
	6	**ISO 4762 - M20 x 100 - 10.9** tightening torque M_A = 610 Nm ±20%	Not included in the Rexroth delivery range

Notice:
The tightening torque of the hexagon socket head cap screws refers to maximum operating pressure.

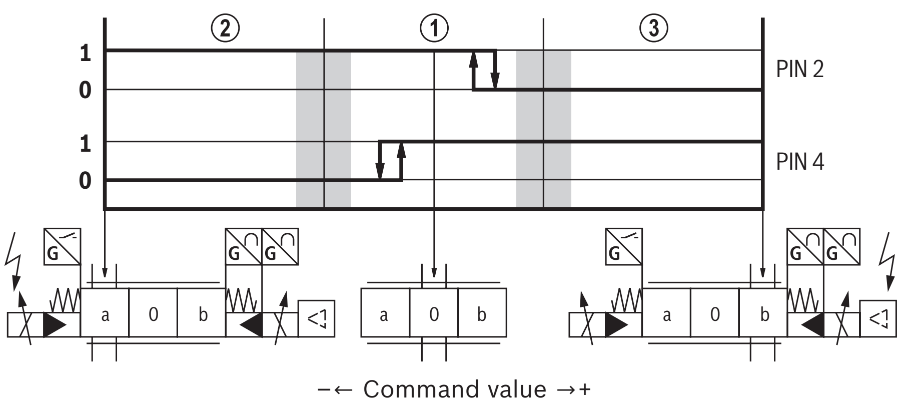
Inductive position switch: Electrical connection

The electrical connection is realized via a 4-pole mating connector (separate order, see page 28) with connection thread M12 x 1.

Switching point	Within positive valve overlap
Supply voltage	20...32 V DC
Admissible residual ripple	≤ 10%
Current consumption	approx. 25 mA (no load)
Outputs	2
Output function	PNP
Low level "0"	< 0.5 V DC
High level "1"	U_B–2 V DC
Current carrying capacity	≤ 400 mA
Signal delay time	≤ 15 ms (electrical, without switching time of valve)
Reference potential	GND
Pinout: 	**1** +24 V
	2 Switching output: 400 mA (valve opening P→A)
	3 0 V, GND
	4 Switching output: 400 mA (valve opening P→B)

Inductive position switch: Switching logics

Position switch on side A, monitored spool position "0"



① Central position (mechanical control spool overlap)
② Valve opening P→B
③ Valve opening P→A

Accessories: Mating connectors and cable sets (separate order)

Valve with integrated electronics

Mating connectors 6-pole + PE	**Design**	**Design**	**Material number**	**Data sheet**
For the connection of valves with integrated electronics, round connector 6+PE, line cross-section 0.5 ... 1.5 mm²	straight	Metal	**R900223890**	08006
	straight	Plastic	**R900021267**	08006
	angled	Plastic	**R900217845**	–

Cable sets 6-pole + PE	**Length** in m	**Material number**	**Data sheet**
For the connection of valves with integrated electronics, round connector 6+PE, straight connector, shielded, potted-in mating connector, line cross-section 0.75 mm²	3.0	**R901420483**	08006
	5.0	**R901420491**	08006
	10.0	**R901420496**	08006
	20.0	**R901448068**	–

Sensors

Mating connectors 4-pole	**Design**	**Line fitting**	**Material number**	**Data sheet**
For the connection of sensors with connector "K24", "K35" and "K72", line cross-section 0.75 mm²	straight	PG7	**R900773042**	08006
	straight	PG9	**R900031155**	08006
	angled	PG7	**R900779509**	08006
	angled	PG9	**R900082899**	08006

Cable sets 4-pole	**Design**	**Screening**	**Length** in m	**Material number**	**Data sheet**
For the connection of sensors with connector "K24", "K35" and "K72", line cross-section 0.34 mm²	straight	yes	2.0	**R900773031**	08006
	straight	no	3.0	**R900064381**	08006
	straight	yes	5.0	**R900779498**	08006
	straight	no	10.0	**R913005668**	08006
	angled	yes	2.0	**R900779504**	08006
	angled	yes	5.0	**R900779503**	08006
	angled	no	10.0	**R913011722**	08006

Project planning, installation and commissioning

- When designing safety-related controls, observe the applicable industry-specific standards and regulations.
- Due to the flexible use of valves in systems, the user has to check and ensure that the product properties comply with all functional and safety requirements of the overall system.
- Make sure that there are no switching shocks and that the valve control spool does not vibrate.
- Valves with spool position indicator may only be installed, adjusted, commissioned and maintained by specialists trained in hydraulics and electronics.
- Improper work at safety-related parts of controls may result in personal injury and damage to property.

The following applies to all work carried out at the valve:
- Valves with spool position indicator must not be disassembled.
- The parts of the valves must not be exchanged.
- Integrated throttles must not be removed or modified.
- The spool position indicator may only be adjusted by the valve manufacturer.

Further information

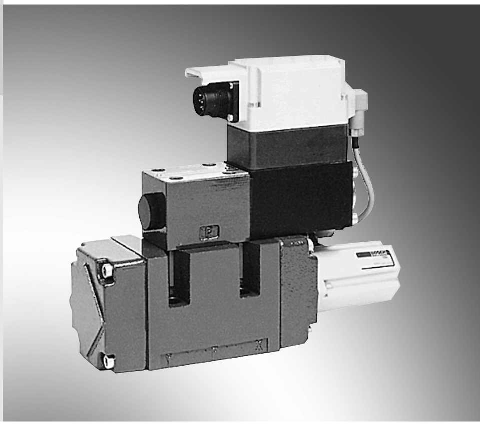
▶ Subplates	Data sheet 45100
▶ Hydraulic fluids on mineral oil basis	Data sheet 90220
▶ Environmentally compatible hydraulic fluids	Data sheet 90221
▶ Flame-resistant, water-free hydraulic fluids	Data sheet 90222
▶ Flame-resistant hydraulic fluids - containing water (HFAE, HFAS, HFB, HFC)	Data sheet 90223
▶ Reliability characteristics according to EN ISO 13849	Data sheet 08012
▶ Hexagon socket head cap screw, metric/UNC	Data sheet 08936
▶ General product information on hydraulic products	Data sheet 07008
▶ Installation, commissioning and maintenance of servo valves and high-response valves	Data sheet 07700
▶ Hydraulic valves for industrial applications	Data sheet 07600-B
▶ Assembly, commissioning and maintenance of hydraulic systems	Data sheet 07900
▶ Selection of filters	
▶ Information on available spare parts	

4/3 directional control valve, pilot operated, with electric position feedback and integrated electronics (OBE)

RE 29077/03.10
Replaces: 01.09

Type 4WRVE 10...27, symbols V, V1

Sizes 10, 16, 25, 27
Component series 2X
Maximum operating pressure P, A, B 350 bar (size 27: 280 bar)
Rated flow 40...430 l/min (Δp = 10 bar)



Type 4WRVE 10

Table of contents

Features

– Pilot operated high-response 4/3 directional control valve size 10 to size 27, with control spool and bushing in servo quality
– Integrated electronics (OBE) with position controller for pilot control and main stage, calibrated in the factory
– Main stage in servo quality with position feedback
– Flow characteristics
  • M = progressive with fine control edge
  • P = inflected characteristic curve
  • L = linear
– Electric port 11P+PE
  Differential amplifier signal input with interface B5 ±10 V

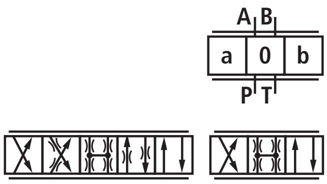
Ordering code

4WRV	E				–2X/	G24		K0/	B5	M	*

with **integrated** electronics **= E**

Size **= 10**
= 16
= 25
= 27 1)

Control spool symbols
4/3 directional design



= V, V1

For V1:
P → A: q_v B → T: $q_V/2$
P → B: $q_V/2$ A → T: q_v

Rated flow
at 10 bar valve pressure differential
(5 bar/control edge)

Size 10

40 l/min 2)	**= 40**
55 l/min 3)	**= 55**
70 l/min 2)	**= 70**
85 l/min 3)	**= 85**

Size 16

90 l/min 2)	**= 90**
120 l/min 3)	**= 120**
150 l/min 2)	**= 150**
200 l/min 3)	**= 200**

Size 25

300 l/min 2)	**= 300**
370 l/min 3)	**= 370**

Size 27

430 l/min 1) 3)	**= 430**

Further details in the plain text

Seal material
M = NBR seals suitable for mineral oils (HL, HLP) according to DIN 51524

Interface of the control electronics
B5 = Command value input ±10 V

Electrical connection
K0 = **without** mating connector, with unit connector according to DIN 43563-AM6
Mating connector – separate order

Pilot oil supply "x", pilot oil return "y"

No code =	"x" = external,	"y" =external
E =	"x" = internal,	"y" =external
ET =	"x" = internal,	"y" = internal
T =	"x" = external,	"y" = internal

Supply voltage of the electronics
G24 = +24 V direct current

2X = Component series 20 to 29
(unchanged installation and connection dimensions)

Flow characteristics
M = Progressive with linear fine control (up to 20%)
P = Inflected characteristic curve, linear (inflection at 40%)
L = Linear

1) Size 27 is the high-flow version of size 25, the connection bores P, A, B, T are designed with Ø32 mm in the main stage. In the manifold, ports P, A, B, T can be drilled with max. Ø30 mm in deviation from standard ISO 4401-08-08-0-05. Thus, the valves allow for higher flow values $Q_A : Q_B$

2) Q_N: Flow characteristics "P"

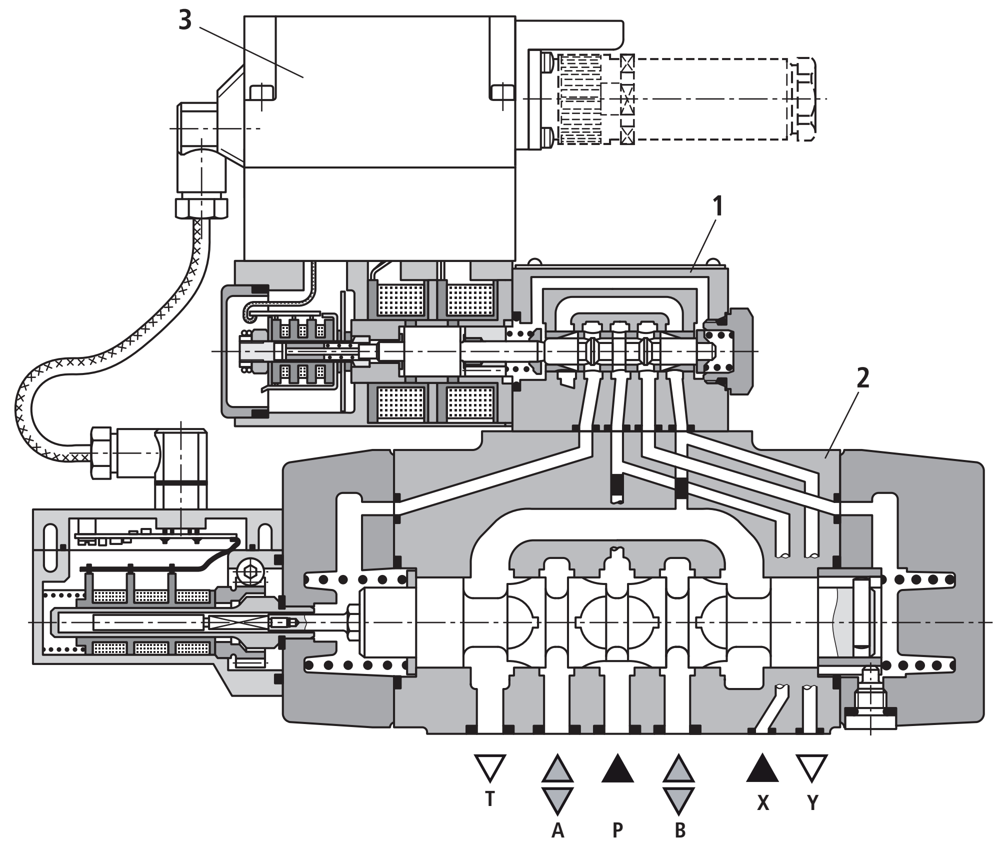
3) Q_N: Flow characteristics "M" or "L"

Function, section

Structure

The valve consists of 3 main assemblies:

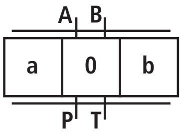
- Pilot control valve (1) with control spool and bushing, return springs, double stroke solenoid and inductive position transducer
- Main stage (2) with centering springs and position feed-back
- Integrated control electronics (3)

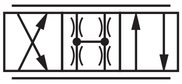


Functional description

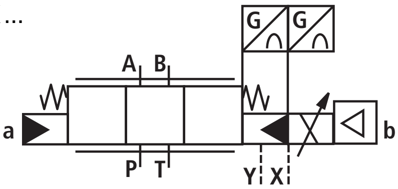
In the integrated electronics, the specified command value is compared with the actual position value of the main stage control spool. In case of control deviations, the double stroke solenoid is activated which adjusts the pilot control spool due to the changed magnetic force. The flow released through the control cross-sections causes the displacement of the main control spool, the stroke/control cross-section of which is controlled proportionally to the command value. If the command value is 0 V, the electronic controls the control spool of the main stage in the center position.
The pilot control valve is supplied with the pilot oil either internally through port P or externally through port X. The return to the tank can be implemented internally via port T or externally via port Y.
If deactivated or in case of no release, the pilot control valve is undefined in P-B/A-T (preferred) or P-A/B-T, the main stage can be completely controlled.

Symbols

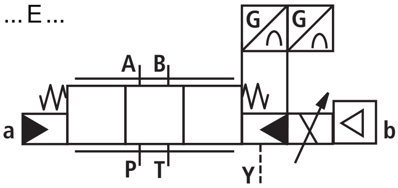




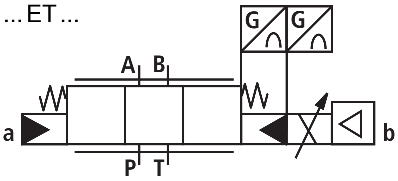
Type ... –3X ...



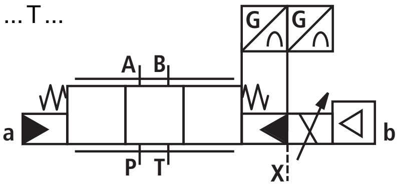
Type ... –3X ... E ...



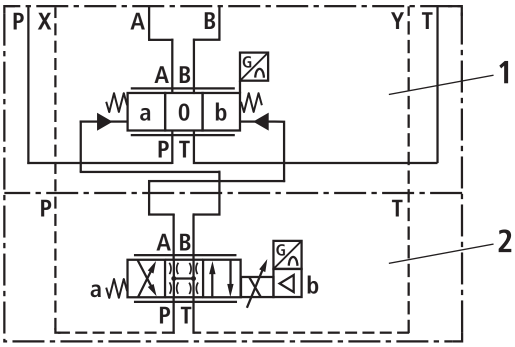
Type ... –3X ... ET ...



Type ... –3X ... T ...



Symbol, detailed
(pilot oil supply and pilot oil drain external)



1 Main valve
2 Pilot control valve

Test and service devices

– Type VT-VETSY-1 service case with test device, see RE 29685
– Measuring adapter 11P+PE type VT-PA-1, see RE 30067

Technical data

general						
Type			Spool valve, pilot operated			
Actuation			Directional control valve size 6 - OBE, with position controller for pilot control valve and main stage			
Type of connection			Subplate mounting, porting pattern according to ISO 4401-...			
Installation position			Any			
Ambient temperature range		°C	–20...+50			
Weight		kg	**Size 10** 8.0	**Size 16** 10.4	**Size 25** 18.2	**Size 27** 18.2
Vibration resistance, test condition			Max. 25 *g*, room vibration test in all directions (24 h)			
hydraulic (measured with HLP 46, ϑ_{oil} = 40 °C ±5 °C)						
Hydraulic fluid			Hydraulic oil according to DIN 51524…535, other media upon request			
Viscosity range	recommended	mm^2/s	20...100			
	max admissible	mm^2/s	10...800			
Hydraulic fluid temperature range		°C	–20...+65			
Maximum admissible degree of contamination of the hydraulic fluid cleanliness class according to ISO 4406 (c)			Class 18/16/13 [1]			
Flow direction			According to symbol			
Rated flow at Δp = 5 bar per edge [2]			**Size 10**	**Size 16**	**Size 25**	**Size 27**
		l/min	40, 55, 70, 85	90, 120, 150, 200	300, 370	430
Max. operating pressure	Ports P, A, B external pilot oil supply	bar	350	350	350	350
	Ports P, A, B internal pilot oil supply	bar	250			
	Ports T, X, Y	bar	250			
Min. pilot oil pressure "pilot control stage"		bar	10			
Q_{max}		l/min	170	450	900	1000
Q_N pilot control valve		l/min	8	24	40	40
Zero flow pilot control valve at 100 bar		cm^3/min	<180	<300	<500	<500
Zero flow main stage at 100 bar		cm^3/min	<400, <600	<1000	<1000	<1000
static / dynamic						
Hysteresis		%	<0.1 hardly measurable			
Manufacturing tolerance Q_{max}		%	< 10			
Actuating time for signal step (at X = 100 bar)	0...100 %		12	15	23	23
	0...10 %		6	7	10	10
Actuating time for signal step (at X = 10 bar)	0...100 %		40	50	90	90
	0...10 %		20	20	30	30
Switch-off behavior			after electrical shut-off: Pilot control valve not defined in P-B/A-T or P-A/B-T, main stage can be completely controlled (PB/AT or PA/BT)			
Temperature drift			Zero shift <1% at ΔT = 40 °C			
Zero compensation			ex factory ±1 %			

[1] The cleanliness classes specified for the components must be complied with in hydraulic systems.
Effective filtration prevents faults and at the same time increases the service life of the components.
For the selection of the filters, see technical data sheets RE 50070, RE 50076 and RE 50081.

[2] Flow with different Δp $Q_x = Q_{nom} \cdot \sqrt{\frac{\Delta p_x}{5}}$

Technical data

electric, control electronics integrated in the valve		
Relative duty cycle %	100 ED, max. power consumption 30 VA (24 V=)	
Protection class	IP 65 according to DIN 40050	
Port	Plug-in connector, 11P+PE	Data
Supply 24 V=$_{nom}$ [1] [2]	1 2	+24 V=$_{nom}$, fuse protection 2.5 A_F (output stages) 0 V power ground
[3]	9 10	+24 V=$_{nom}$ Signal part 0 V Signal ground
Input signal ±10 V [4]	4 5	U_{IN}, $\overline{U_{IN}}$ } Differential amplifier, R_i = 100 kΩ
Actual value signal (LVDT)	6 7	±10 V=, R_a = 1 kΩ 0 V, reference point
Release input	3	> 8.5 V to 24 V=$_{nom}$ (max. 40 V=) R_i = 10 kΩ
Messages [5]	8 11	Acknowledgement release +24 V= Error message: no error +24 V=
Protective earthing conductor	⏚	Connect only if 24 V = system transformer does not comply with standard VDE 0551
Electromagnetic compatibility tested according to	EN 61000-6-2: 2005-08 EN 61000-6-3: 2007-01	

[1] 24 V=$_{nom}$ – min. 21 V=
– max. 40 V=

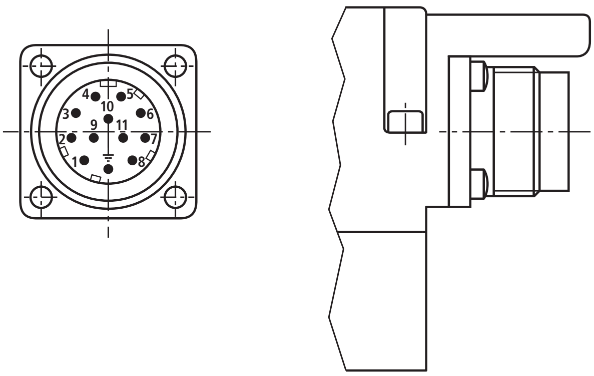
[2] U_B (pin 1) = output stage supply
– valve "OFF“ < 13.4 V=
– valve "ON" > 16.8 V=
no error message (pin 11)

[3] U_S (pin 9) = electronics supply
– valve "OFF“ < 16.8 V=
error message (pin 11)
– valve "ON“ > 19.5 V=
no error message (pin 11)

[4] inputs: voltage resistant up to max. 50 V

[5] Messages are loadable with max. 20 mA and short-circuit proof against ground

11P+PE

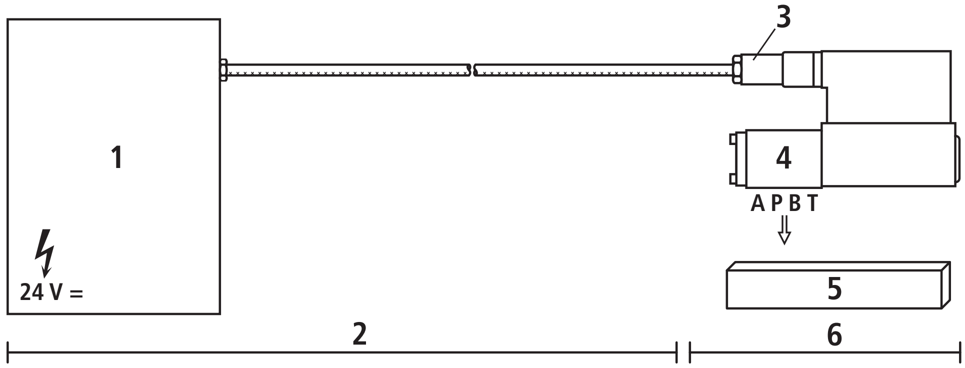


Note

Pilot operated 4/3 directional control valves fulfill their function only in active closed control loops and do not have a secured basic position when deactivated. Therefore, "additional isolator valves" are required in many applications and must be taken into account for the On/Off series.

Electrical connection

Electric data, see page 6



1 Control
2 Provided by the customer
3 Mating connector
4 Valve
5 Contact surface
6 Provided by Rexroth

Technical notes for the cable

Version:
- Multi-wire cable
- Litz wire structure, very fine wires according to VDE 0295, class 6
- Protective earthing conductor, green-yellow
- Cu shield braid

Type:
- e.g. Oilflex-FD 855 CP (company Lappkabel)

Number of wires:
- Depends on the valve type, connector type and signal assignment

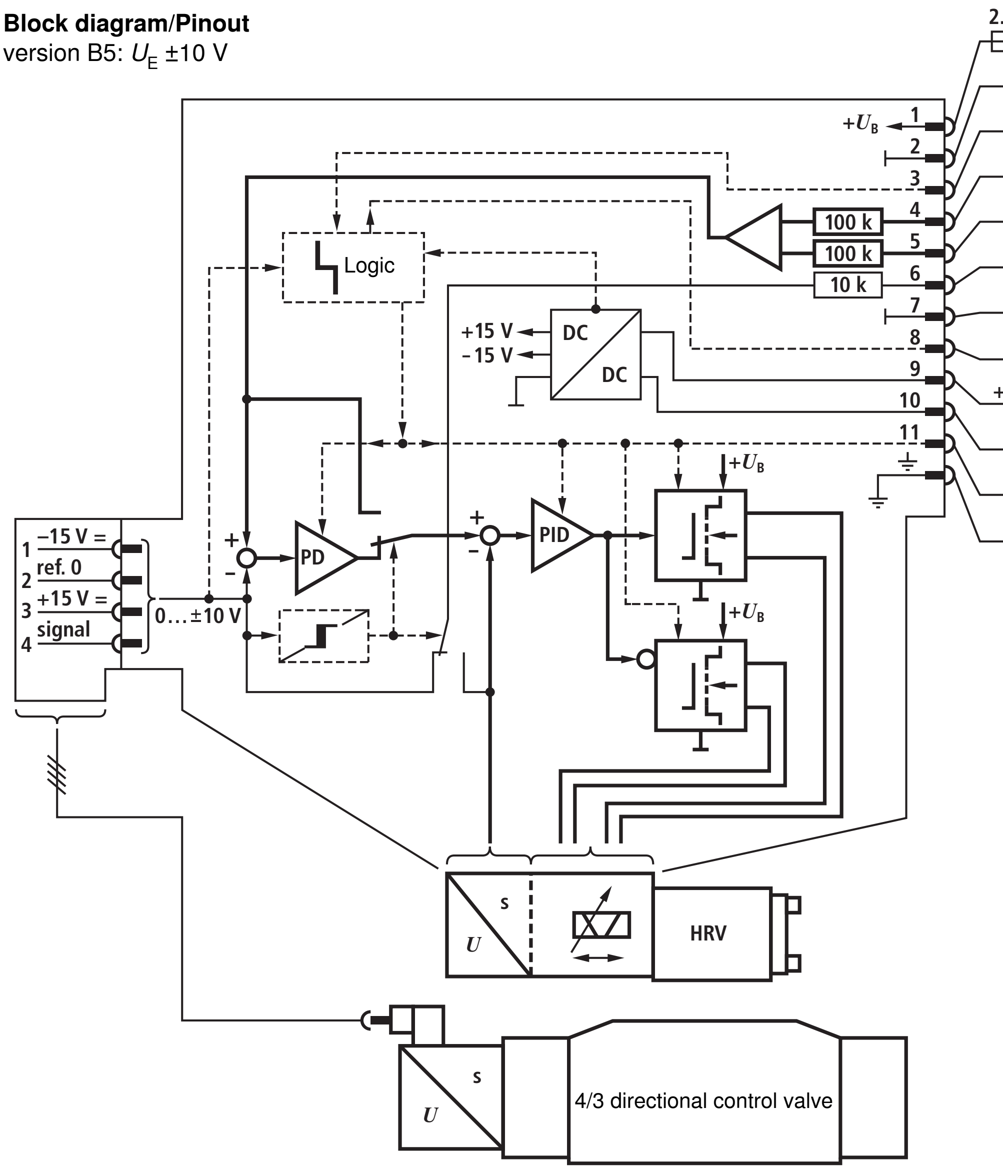
Line Ø:
- 0.75 mm^2 up to a length of 20 m
  1.0 mm^2 up to a length of 40 m

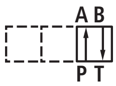
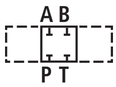
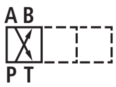
Outer Ø:
- 9.4...11.8 mm – Pg11
  12.7...13.5 mm – Pg16

Note
Electric signals taken out via control electronics (e.g. actual value) must not be used for the deactivation of safety-relevant machine functions!
(See also the European standard "Safety requirements for fluid power systems and their components - Hydraulics", EN 982!)

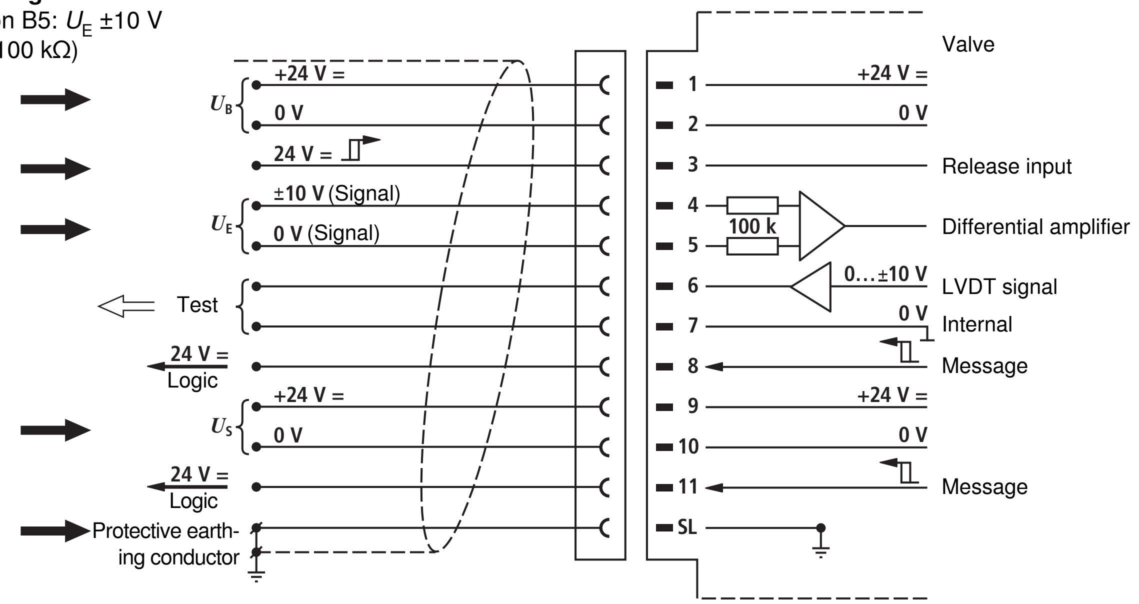
Integrated electronics

Block diagram/Pinout
version B5: U_E ±10 V



Input signal	Valve position
$U_4 - U_5 > 0$ V	
$U_4 - U_5 = 0$ V	
$U_4 - U_5 < 0$ V	

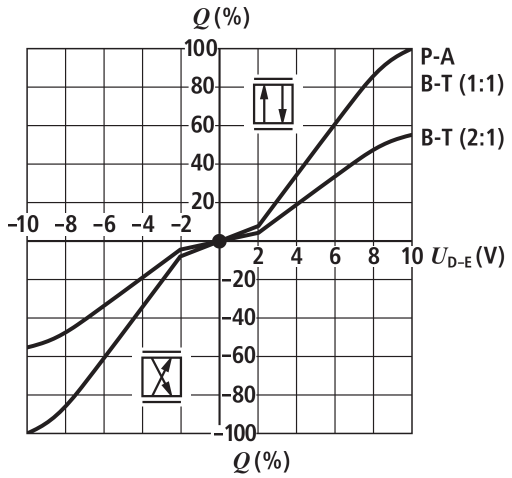
Pin assignment 11P+PE
version B5: U_E ±10 V
(R_i = 100 kΩ)



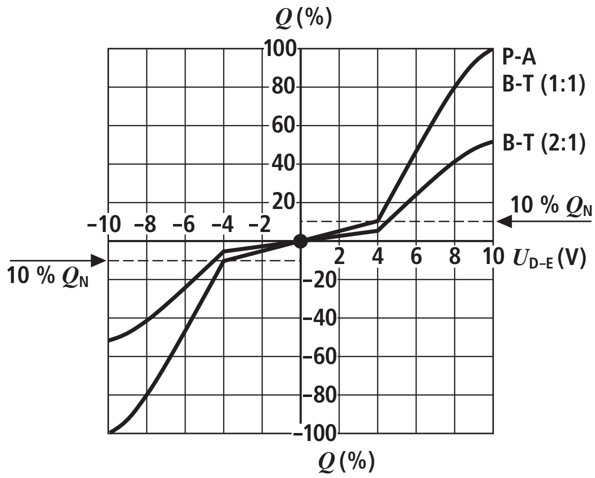
Characteristic curves (measured with HLP 46, ϑ_{Oil} = 40 °C ±5 °C)

Flow – signal function $Q = f(U_E)$

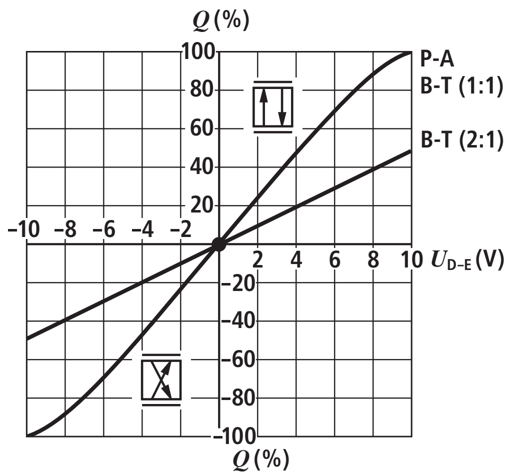
Flow characteristics M



Flow characteristics P

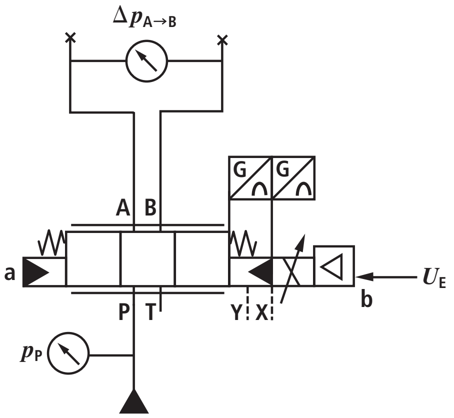


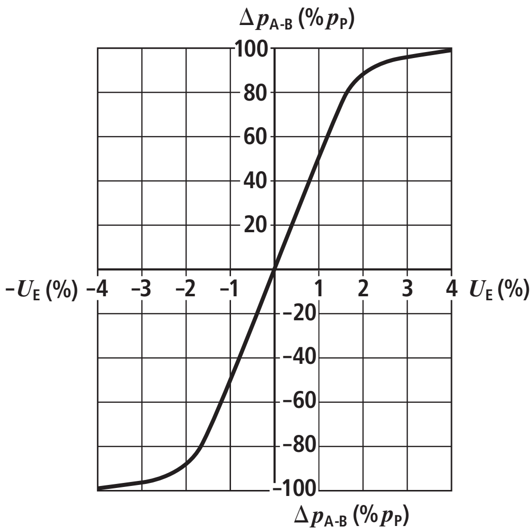
Flow characteristics L



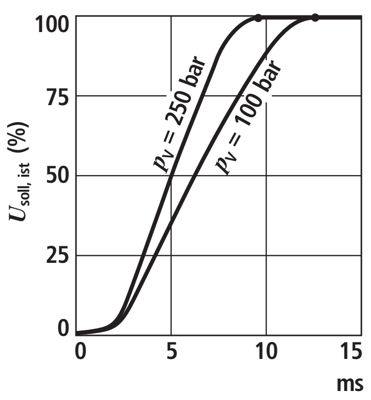
Characteristic curves (measured with HLP 46, ϑ_{Oil} = 40 °C ±5 °C)

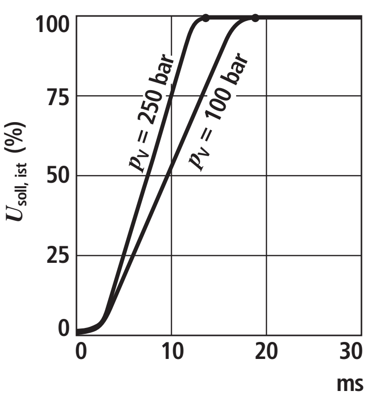
Pressure gain $\Delta = f(U_E)$

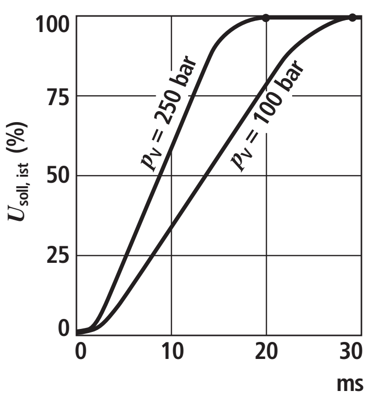




Step function 0 → 100 %



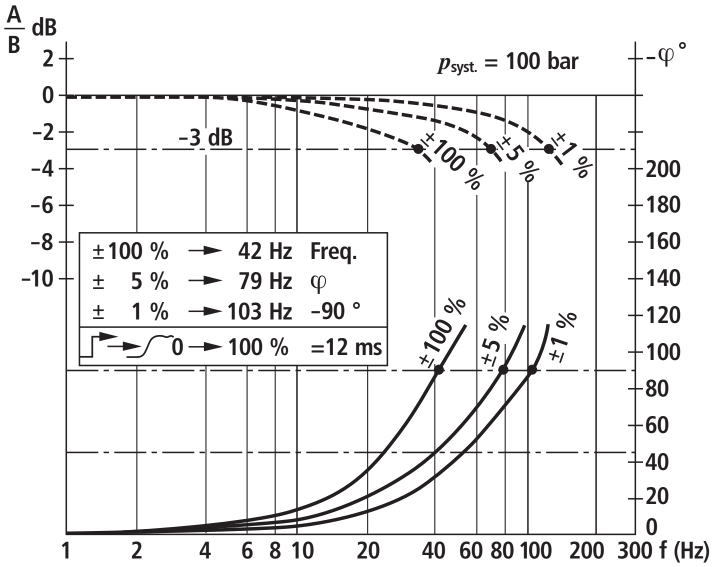




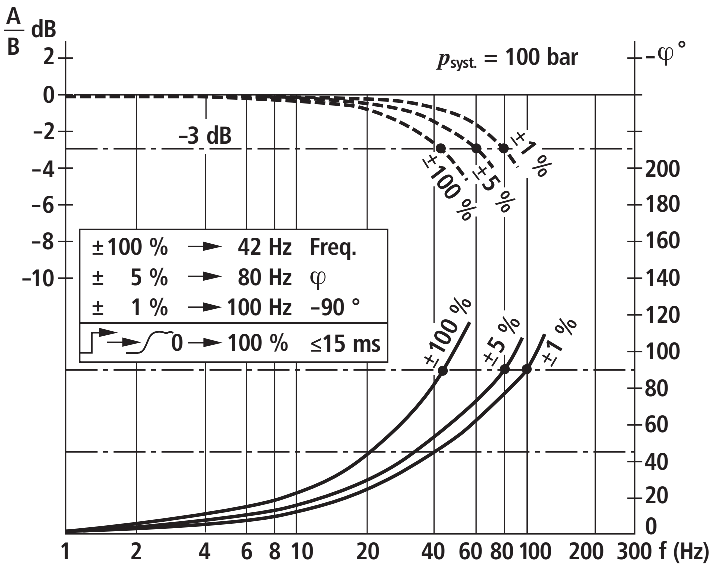
Characteristic curves (measured with HLP 46, ϑ_{Oil} = 40 °C ±5 °C)

Bode diagram

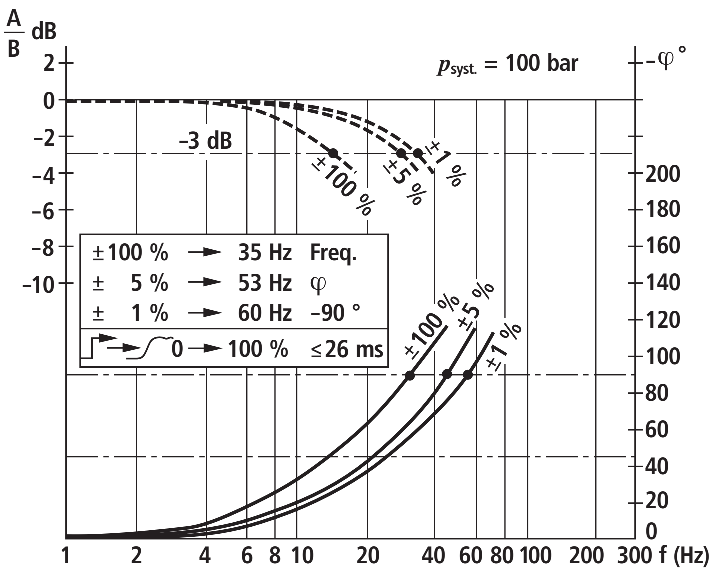
Size 10



Size 16

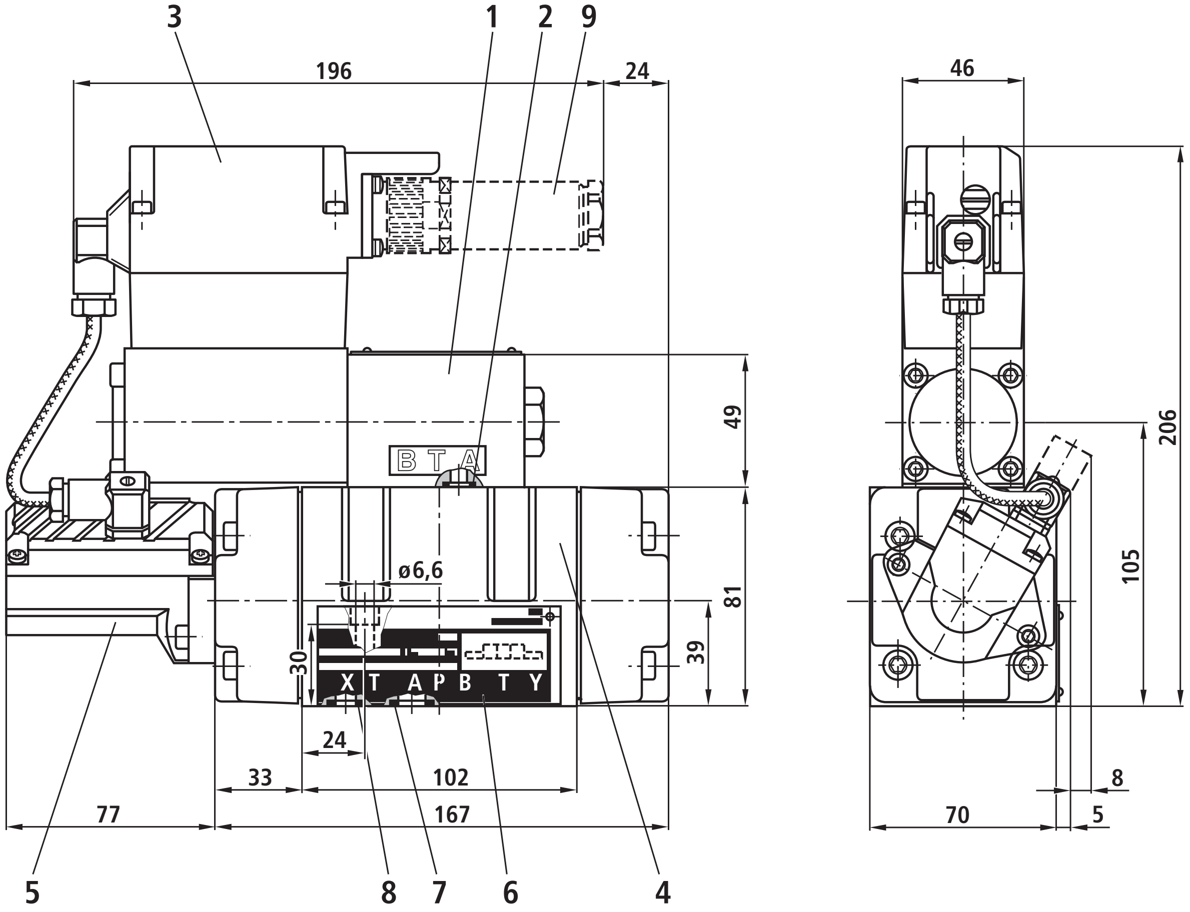


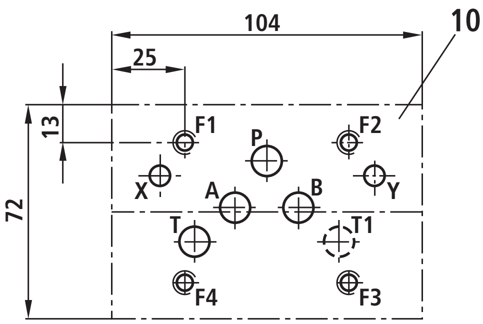
Size 25/27

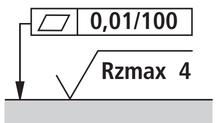


- - - - - Amplitude
——— Phase

Unit dimensions size 10 (dimensions in mm)







Required surface quality
of the valve mounting face

1 Pilot control valve
2 O-ring 9.25x1.78 (ports P, A, B, T)
3 Integrated electronics
4 Main valve
5 Inductive position transducer (main valve)
6 Name plate
7 O-ring 12x2 (ports P, A, B, T, T1)
8 O-ring 10x2 (ports X, Y)
9 Mating connector not included in the scope of delivery, see technical data sheet RE 08008 (separate order)

10 Machined valve mounting face, porting pattern according to ISO 4401-05-05-0-05

Deviating from the standard:
ports P, A, B, T, T1 Ø 10.5 mm

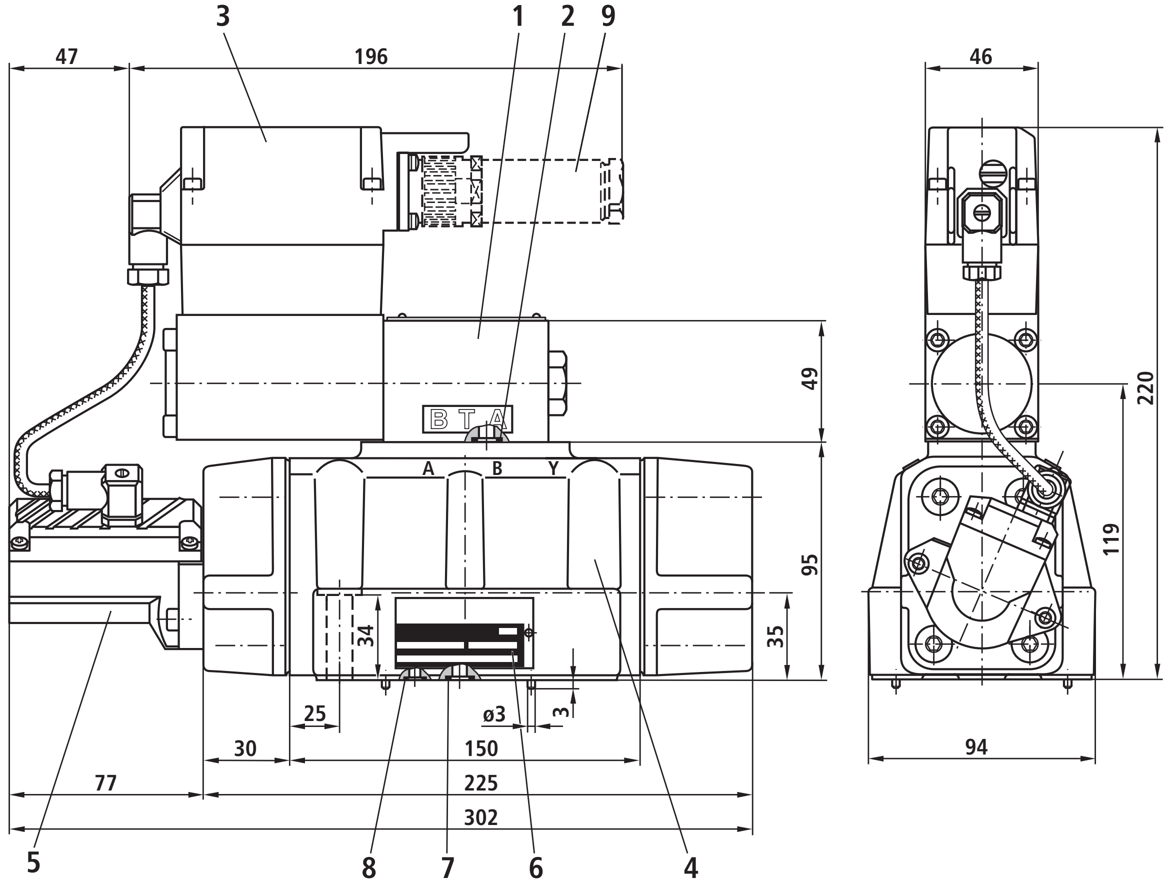
Subplates, see technical data sheet RE 45055 (separate order)

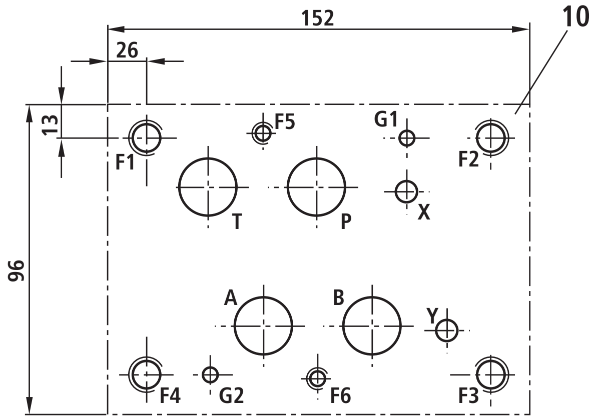
Valve mounting screws (separate order)
The following valve mounting screws are recommended:

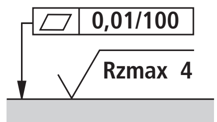
4 hexagon socket head cap screws
ISO 4762-M6x40-10.9-N67F821 70
(galvanized according to Bosch standard N67F821 70)
tightening torque M_A = 11+3 Nm

Mat. no. 2910151209

Unit dimensions size 16 (dimensions in mm)







Required surface quality
of the valve mounting face

1 Pilot control valve
2 O-ring 9.25x1.78 (ports P, A, B, T)
3 Integrated electronics
4 Main valve
5 Inductive position transducer (main valve)
6 Name plate
7 O-ring 23x2.5 (ports P, A, B, T)
8 O-ring 9x2 (ports X, Y)
9 Mating connector not included in the scope of delivery, see technical data sheet RE 08008 (separate order)

10 Machined valve mounting face, porting pattern according to ISO 4401-07-07-0-05
Deviating from the standard:
ports P, A, B, T Ø 20 mm

Subplates, see technical data sheet RE 45057 (separate order)

Valve mounting screws (separate order)
The following valve mounting screws are recommended:

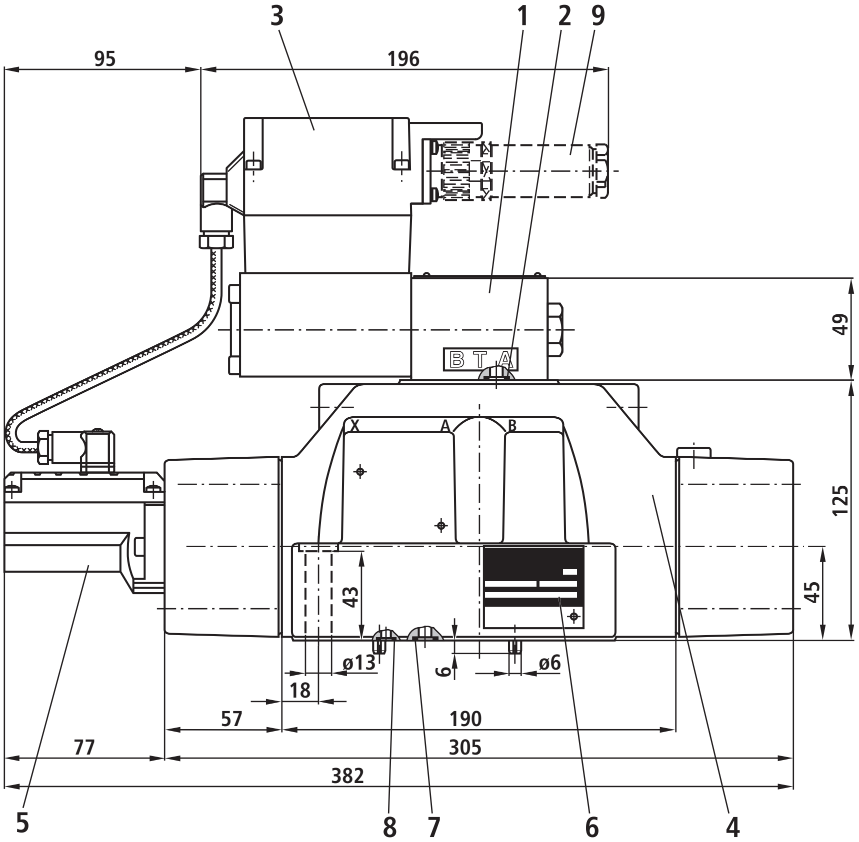
2 hexagon socket head cap screws
ISO 4762-M6x45-10.9-N67F821 70
(galvanized according to Bosch standard N67F821 70)
tightening torque M_A = 11+3 Nm

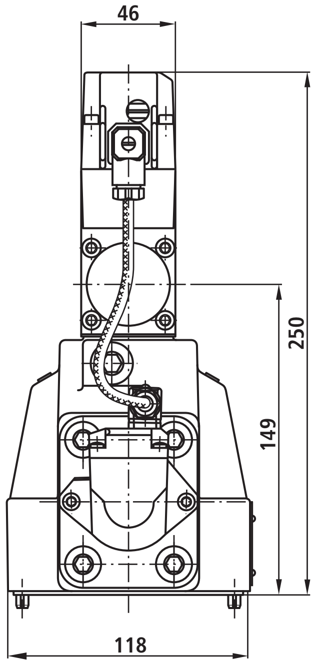
Mat. no. 2910151211

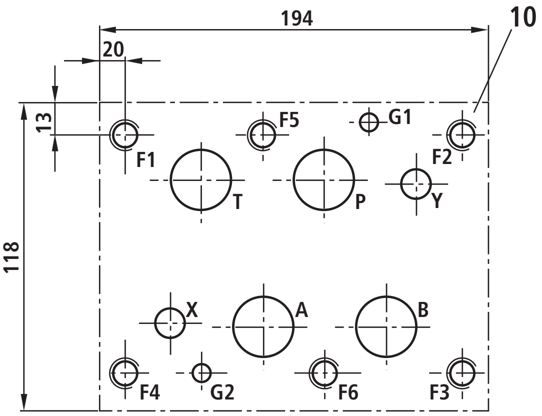
4 hexagon socket head cap screws
ISO 4762-M6x40-10.9-N67F821 70
(galvanized according to Bosch standard N67F821 70)
tightening torque M_A = 50+10 Nm

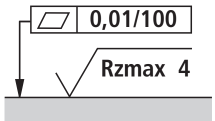
Mat. no. 2910151301

Unit dimensions size 25/27 (dimensions in mm)









Required surface quality
of the valve mounting face

1 Pilot control valve
2 O-ring 9.25x1.78 (ports P, A, B, T)
3 Integrated electronics
4 Main valve
5 Inductive position transducer (main valve)
6 Name plate
7 O-ring (ports P, A, B, T)
Size 25: 28x3
Size 27: 34.6x2.62
8 O-ring 15x2.5 (ports X, Y)
9 Mating connector not included in the scope of delivery, see technical data sheet RE 08008 (separate order)
10 Machined valve mounting face, porting pattern according to ISO 4401-08-08-0-05
Deviating from the standard:
size 25: Ports P, A, B, T Ø 25 mm
size 27: Ports P, A, B, T Ø 32 mm

Subplates, see technical data sheet RE 45059 (separate order)

Valve mounting screws (separate order)
The following valve mounting screws are recommended:

6 hexagon socket head cap screws
ISO 4762-M12x60-10.9-N67F821 70
(galvanized according to Bosch standard N67F821 70)
tightening torquesize 25 M_A = 90+30 Nm,
size 27 M_A = 90±15 Nm

Mat. no. 2910151354

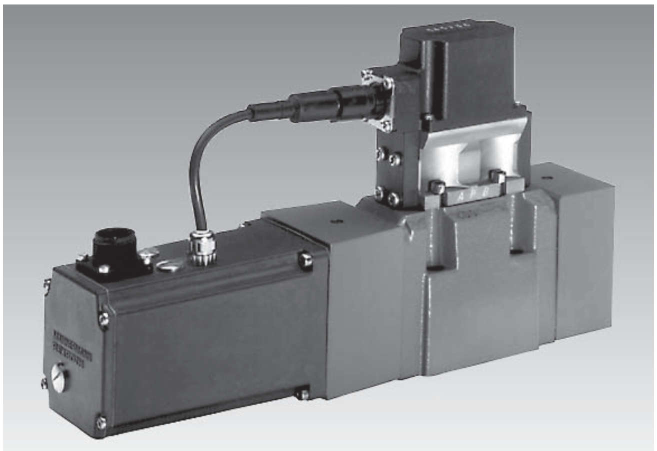
Rexroth
Bosch Group

RE 29 070/02.03

Replaces: 12.98

4/3-way fast response valve Type 4WRGE

Nom. size 10 – max. operating pressure 315 bar
Nom. sizes 16, 25 – max. operating pressure 350 bar
Series 1X
Maximum flow 870 L/min



Type 4WRGE 10…L-1X/315G24..K31...

Overview of contents

Contents	Page

Features

– Pilot operated 2-stage fast response valve with electrical closed loop position control of main spool and integrated open and closed loop control electronics
– Suitable for closed loop position, speed, pressure and force closed loop control, with simultaneous high demands on the dynamics in the small signal range and on the response sensitivity
– Pilot control valve:
Single-stage servo valve to the orifice/flapper principle
– Position acquisition of main spool via an inductive position transducer
– High response sensitivity and low hysteresis
– Easily exchangeable filter element
– Integrated control electronics using SMD technology, output stage in thick layer hybrid technology, external zero point correction possible
– For subplate mounting:
Porting pattern to DIN 24 340 form A
Subplates to catalogue sheets RE 45 054 to 45 058 (separate order), see pages 13 to 15

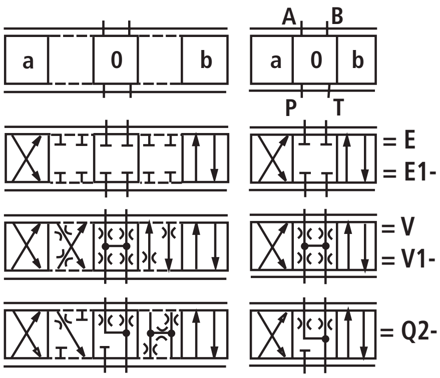
Ordering details

4WRGE				L	–1X	/	315	G24		K31	/			*

Electrically operated 2-stage fast response directional control valve of 4-way design with servo valve pilot control and integrated control electronics

Nominal size 10	**= 10**
Nominal size 16	**= 16**
Nominal size 25	**= 25**

Symbols



With symbol E1-, V1-:

P → A: q_V B → T: $q_V/2$

P → B: $q_V/2$ A → T: q_V

Note:

With the spools E and E1 there is an overlap of 15 % in the zero position, with the spools V and V1 an overlap from 0 to 0.5 %.

Further details in clear text

M = [1] NBR seals
V = FKM seals

No code = Without sandwich plate directional valve
WG152 = With sandwich plate directional valve 24 V with component plug DIN 43 650-AM2, **Without** plug-in connector Plug-in connector – separate order, see page 6

A1 = Command value input ± 10 VDC
C1 = Command value input ± 10 mA

Electrical connections

K31 = With component plug to E DIN 43 563-AM6-3, **Without** plug-in connector, Plug-in connector – separate order, see page 6

Pilot oil supply and drain

No code = Pilot oil supply, external, Pilot oil drain, external
E = Pilot oil supply, internal, Pilot oil drain, external
ET = Pilot oil supply, internal, Pilot oil drain, internal
T = Pilot oil supply, external, Pilot oil drain, internal

G24 = Supply voltage 24VDC

Pilot pressure

315 = 10 to 315 bar

1X = Series 10 to 19
(10 to 19: unchanged installation and connection dimensions)

Characteristic curve form

L = Linear

Nominal flow in L/min at 10 bar valve pressure differential

50 =	or	**100 =**	with nominal size 10
125 =	or	**200 =**	with nominal size 16
250 =	or	**350 =**	with nominal size 25

[1] Suitable for mineral oil to DIN 51 524

Preferred types

NS 10

Material no.	Type
00954120	4WRGE 10 V50L-1X/315G24ETK31/A1M
00954151	4WRGE 10 V50L-1X/315G24K31/A1M
00954152	4WRGE 10 V1-50L-1X/315G24K31/A1M
00916455	4WRGE 10 V1-50L-1X/315G24ETK31/A1M
00954153	4WRGE 10 V1-100L-1X/315G24K31/A1M

NS 16

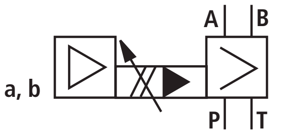
Material no.	Type
00954154	4WRGE 16 V125L-1X/315G24ETK31/A1M
00954155	4WRGE 16 V200L-1X/315G24ETK31/A1M
00954156	4WRGE 16 V200L-1X/315G24K31/A1M
00954157	4WRGE 16 V1-200L-1X/315G24ETK31/A1M
00954158	4WRGE 16 V1-200L-1X/315G24K31/A1M

NS 25

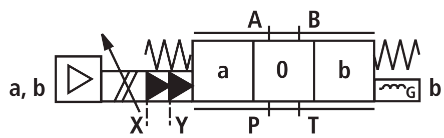
Material no.	Type
00954159	4WRGE 25 V250L-1X/315G24ETK31/A1M
00954160	4WRGE 25 V350L-1X/315G24ETK31/A1M
00954161	4WRGE 25 V350L-1X/315G24K31/A1M
00954162	4WRGE 25 V1-350L-1X/315G24ETK31/A1M
00954163	4WRGE 25 V1-350L-1X/315G24K31/A1M

Symbols

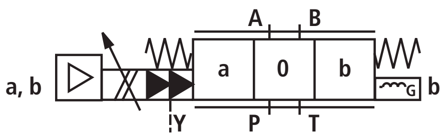
General



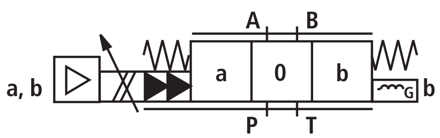
Type 4WRGE…-1X/…



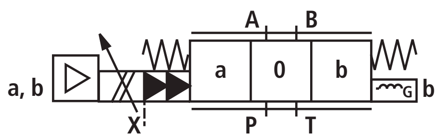
Type 4WRGE…-1X/…E…



Type 4WRGE…-1X/…ET…



Type 4WRGE…-1X/…T…



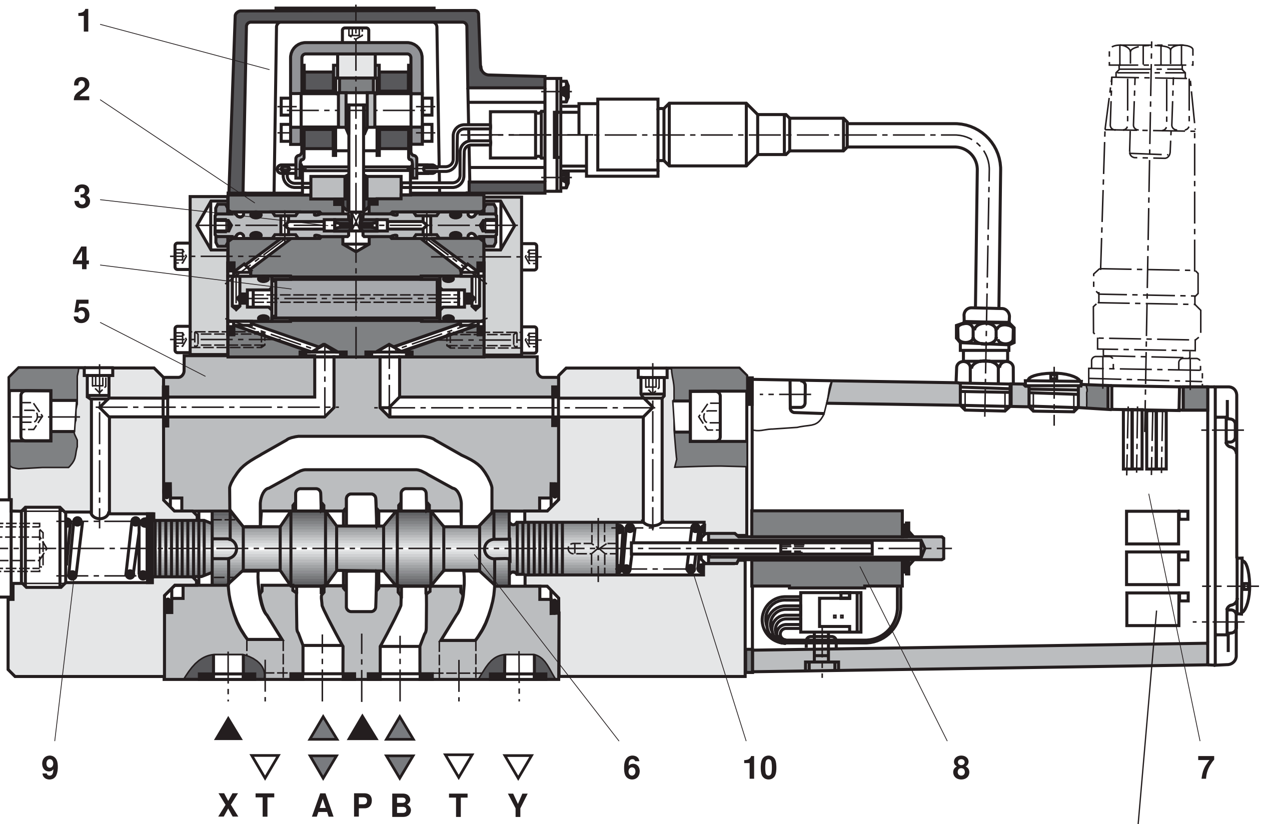
Function, section

The 4/3-way fast response valve is designed for subplate mounting with closed loop position control and integrated control electronics. It infinitely controls the flow proportional to the input signal from P to B and A to T or from P to A and B to T.

Design:

The valve consists of 4 main component groups:

– Low-friction pilot control valve (1) with a 2-gap torque motor; valve housing (2) with orifices (3) and filter (4)
– Housing of main stage (5) with spring centered spool (6)
– Control electronics (7) with amplifier for the control of the pilot control valve (1) and for closed loop position control of the main spool (6)
– Inductive position transducer (8) for position acquisition of the main spool



Type 4WRGE 10…-1X/…K31…

R316 Position transducer zero point

Functional description:

– Actuation of pilot control valve via a command value of 0 to ± 10 V or from 0 to ± 10 mA
– Comparison of the command/actual value in the control electronics → with control deviation the torque motor is operated and the flapper plate is deflected according to the control amplitude.
– Unbalancing of the pilot pressures via the variable and fixed orifices
→ movement of main spool (6)
– Reaching the position of the main spool according to the command value signal → control deviation is reduced to virtually 0 V → control process is completed
– Pilot oil supply to pilot control valve internally via port P or externally via port X. Pilot oil drain internally via port T or externally via Y to tank

⚠ Attention!

When the supply voltage fails but operating pressure remains available, the main spool (6) moves into an undefined position. The occuring accelerations may cause damage to the machinery.

By using a sandwich plate directional valve (see pages 12 to 14) both pilot lines in the main stage are short circuited when a power failure occurs.

With spool types E, E1 and Q2 the centering springs (9, 10) centre the main spool (6), V and V1 spools are moved into the preferred direction of P to B and A to T within a tolerance range of 1 % to 11 % of the spool stroke. When the operating pressure fails and sandwich plate directional valves are not used the same characteristics apply.

Technical data (for applications outside these parameters, please consult us!)

General		**NS 10**	**NS 16**	**NS 25**
Installation		optional, preferrably horizontal (commissioning guidelines see RE 07 700)		
Ambient temperature range	°C	– 20 to + 50		
Storage temperature range	°C	– 20 to + 80		
Weight	kg	8.0	9.8	18.0

Hydraulic (measured at p = 100 bar, ν = 32 mm²/s, ϑ = 40°C)

Oper. pressure: Pilot control valve, pilot oil supply	bar	10 to 315		
Main valve, ports P, A, B	bar	up to 315	up to 350	up to 350
Return pressure: Port T, Pilot oil drain, internal	bar	pressure peaks < 100 permissible		
Pilot oil drain, external	bar	up to 315	up to 250	up to 250
Port Y	bar	pressure peaks < 100 permissible		
Nominal flow $q_{V\ nom}$ ± 10 % at Δp = 10 bar [1)] [1)] Δp = valve pressure differential	L/min	50 100	125 200	250 350
Flow of main spool (max. permissible)	L/min	170	460	870
Stroke of main spool (2-stage)	mm	± 3.5	± 3.5	± 3.5
Pilot flow at ports X or Y with a jump form of input signal from 0 to 100 %	L/min	2.0	2.0	2.0
Pressure fluid		mineral oil (HL, HLP) to DIN 51 524 further pressure fluids on request!		
Filter rating of the pilot control valve		100 µm absolute		
Degree of contamination		max. permissible degree of contamination of the pressure fluid is to NAS 1638	A filter with a minimum retention rate of β_X = 75 is recommended	
Pilot control valve		class 7	x = 5	
Main valve		class 9	x = 15	
Pressure fluid temperature range	°C	– 20 to 80; preferrably 40 to 50		
Viscosity range	mm²/s	20 to 380; preferrably 30 to 45		
Hysteresis	%	≤ 0.05		
Response sensitivity	%	≤ 0.02		
Reversal span	%	≤ 0.04		

Electrical

Voltage type		DC		
Signal type		analogue		
Zero balance	%	≤ 2		
Zero deflection with alteration of:				
Pressure fluid temperature	%/10 K	< 0.2	< 0.2	< 0.3
Operating pressure	%/100 bar	< 0.02	< 0.04	< 0.04
Return pressure 0 to 10 % from p	%	< 0.01	< 0.02	< 0.02
Valve protection to DIN 40 050		IP 65		
Control electronics		VT 13037 (integrated in valve, see page 7)		

Note: For details regarding the **environmental simualtion test** covering EMC (electro-magnetic compatibility), climate and mechanical loading see RE 29 070-U (declaration regarding environmental compatibility).

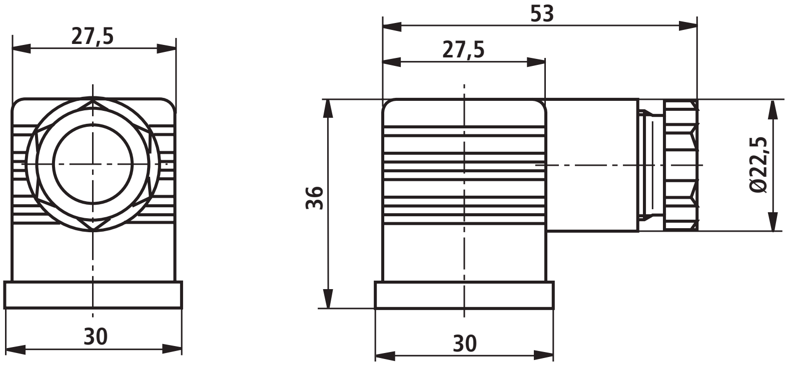
Electrical connections

Sandwich plate directional valve WG 152

Plug-in connector to DIN 43 650 -AF2/Pg11

Separate order under material no. **00074684**

(plastic version)

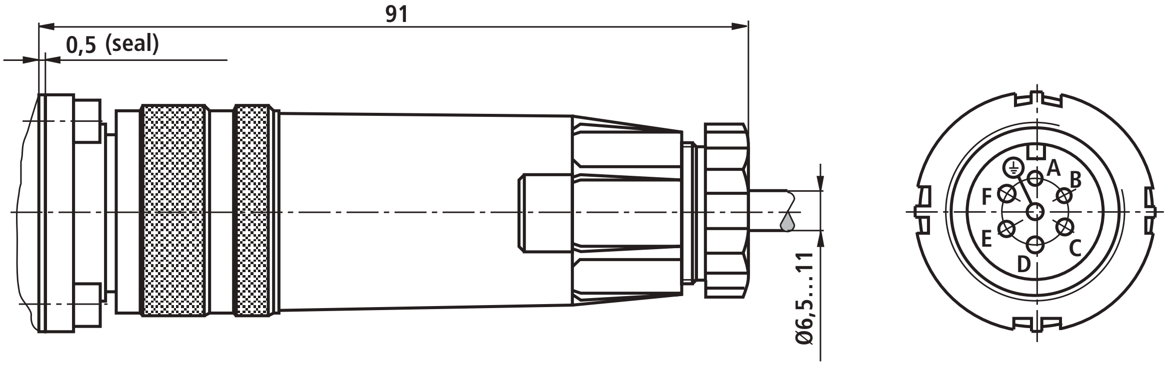


Plug-in connector to E DIN 43 563-BF6-3/Pg11

Separate order under material no. **00021267**

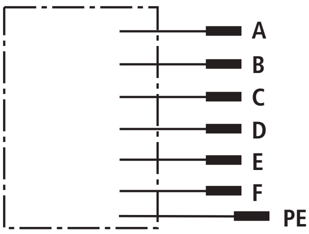
(plastic version)

For pin allocation see block circuit diagram on page 7



Integrated control electronics

Pin allocation, component plug



Integrated control electronics (see below)

	Pin	Signal [1]
Supply voltage	A B	24 VDC (19 to 35 VDC) GND
	C	n.c.
Differential amplifier input	D E	com. value (± 10 V or ± 10 mA) ref. potential [2]
Measurement output	F	act. value (± 10 V or ± 10 mA) against 0 V [3]
Earth	PE	connected to valve housing

[1] Supply voltage + 24 VDC ± 25 %; full bridge rectification with smoothing capacitor 2200 ∝F; I_{max} = 230 mA

[2] Current input ± 10 mA → input resistance 100 Ω

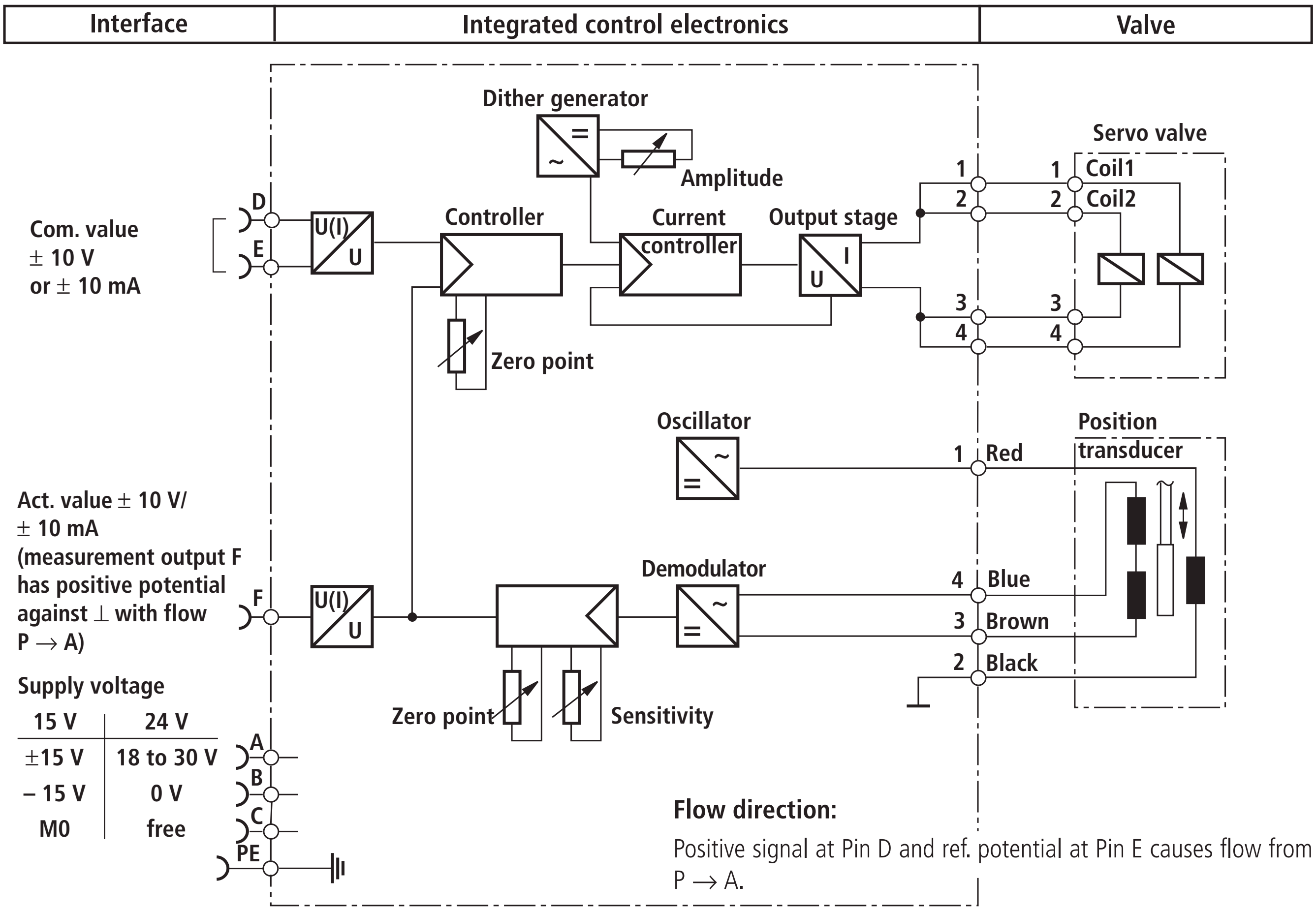
[3] ± 10 mA → max. load resistance 1 kΩ

Command value: Reference potential at E and positive command value at D causes flow from P to A and B to T.
Reference potential at E and negative command value at D causes flow from P to B and A to T.

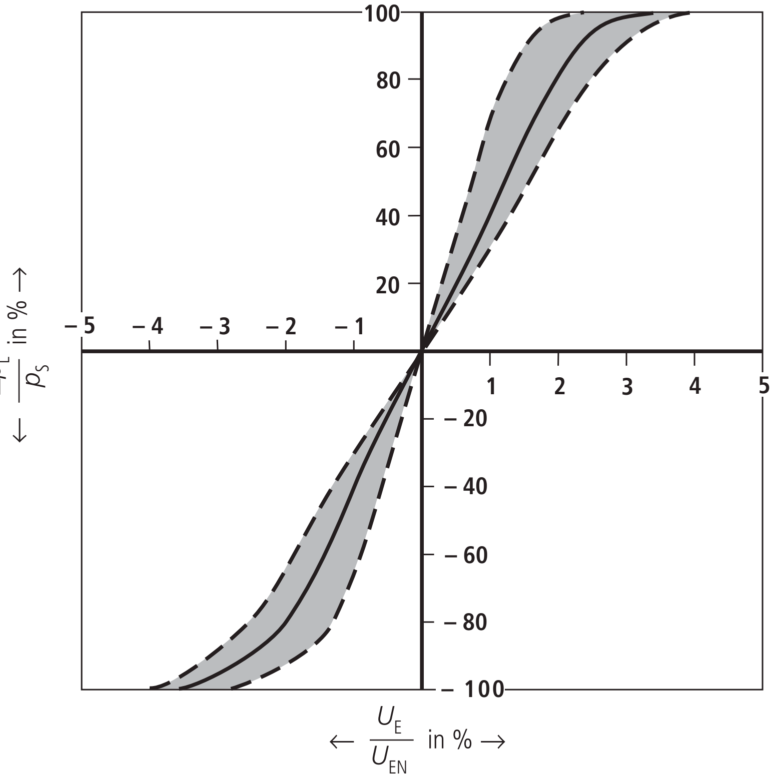
Connection cable: Recomeded: – up to 25 m cable length type LiYCY 5 x 0.75 mm²
– up to 50 m cable length type LiYCY 5 x 1.0 mm²
External diameter 6.5 to 11 mm
Connect screen to PE on supply side only.

Note: **Electrical signals (e.g. actual value) which are transmitted by the valve electronics must not be used to switch off safety related machinery functions! (Please note the „Safety requirements for fluid power operated machinery and parts – hydraulics“ according to European standard EN 982!)**

Block circuit diagram / Terminal allocation of the integrated control electronics type VT13037

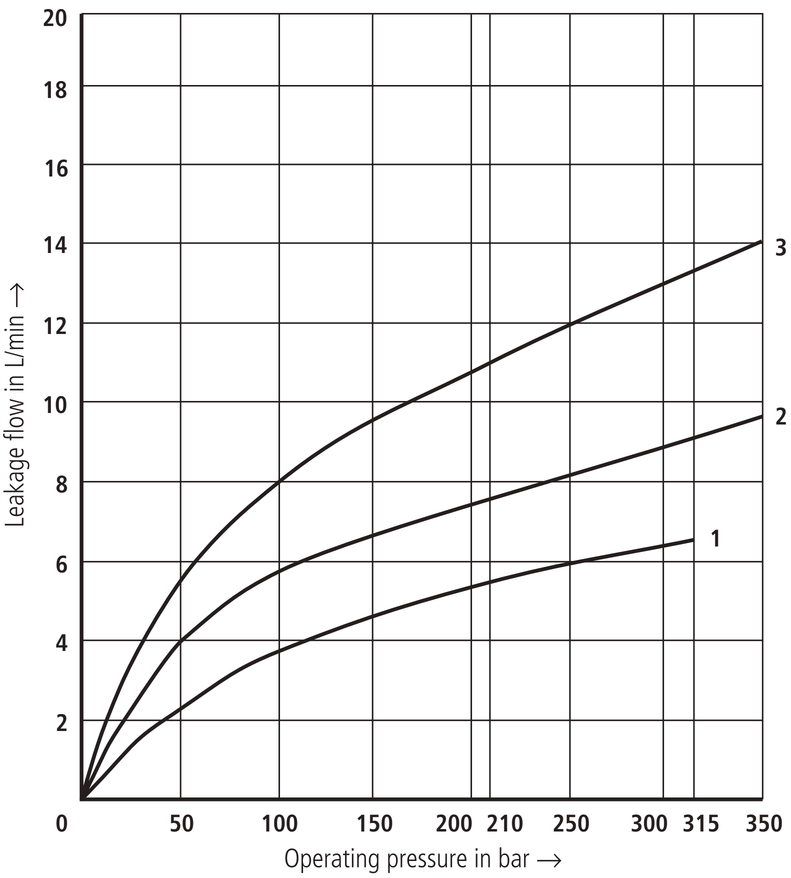


Pressure-signal-characteristic curve (V spool)



Characteristic curve measured with a pilot control pressure p_s = 210 bar

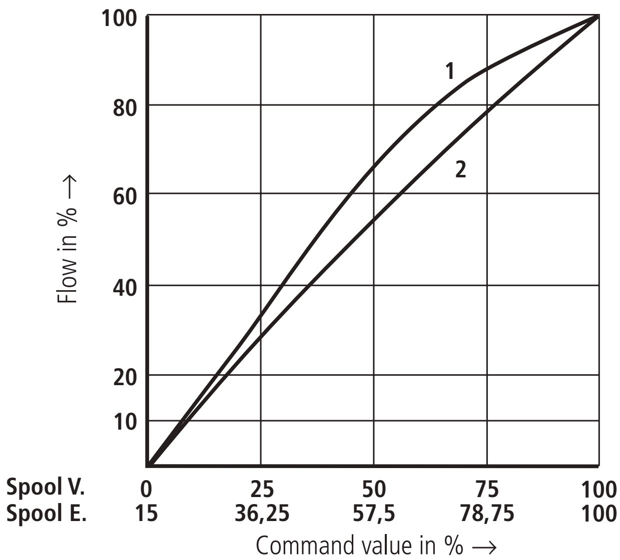
Leakage flow 4WRGE…V with pilot control valve in centre position of main spool



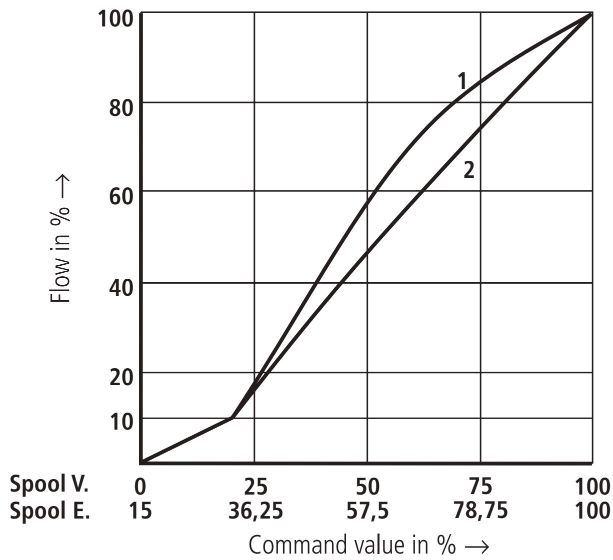
1 = Nominal size 10 (100 L/min)
2 = Nominal size 16 (200 L/min)
3 = Nominal size 25 (350 L/min)

Spool symbols E. and V.

Spool with characteristic curve **L**

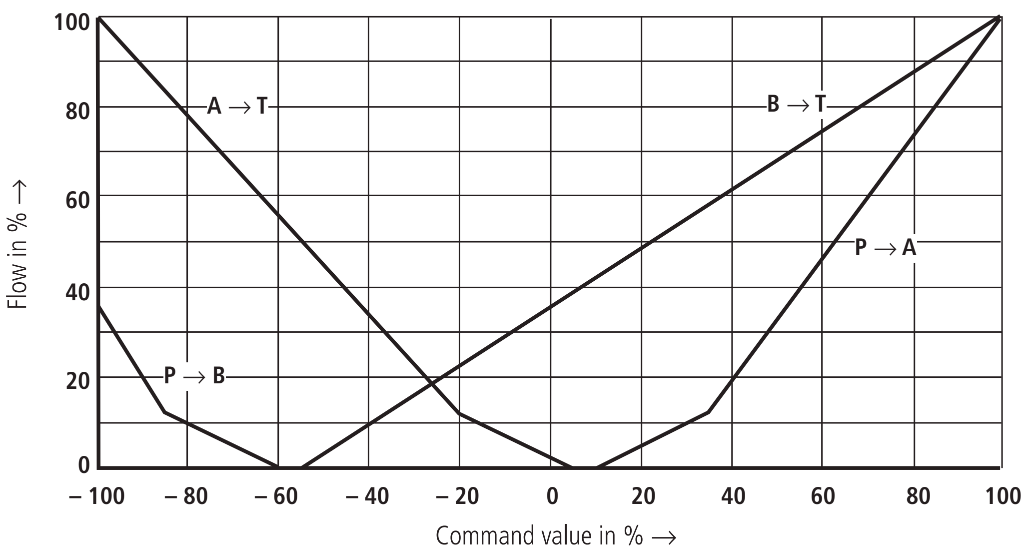


Spool with characteristic curve **P**

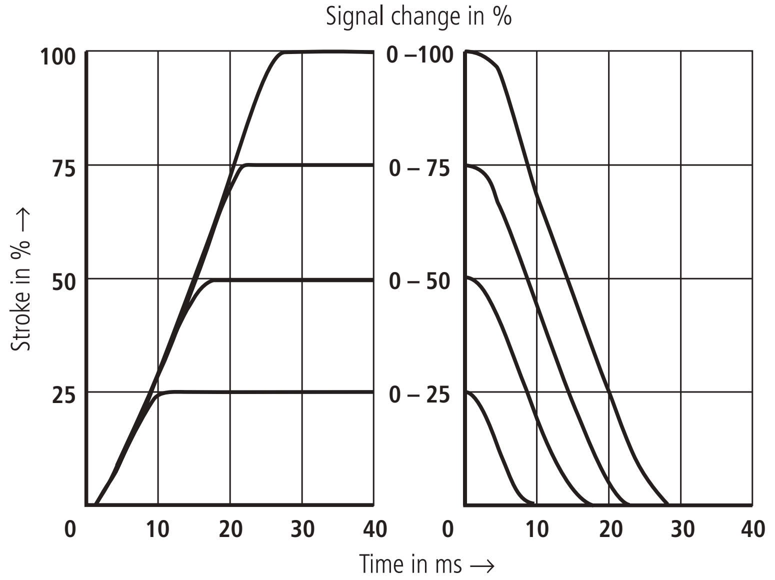


1 = Larger nominal flow
2 = Smaller nominal flow

Spool symbol Q2-

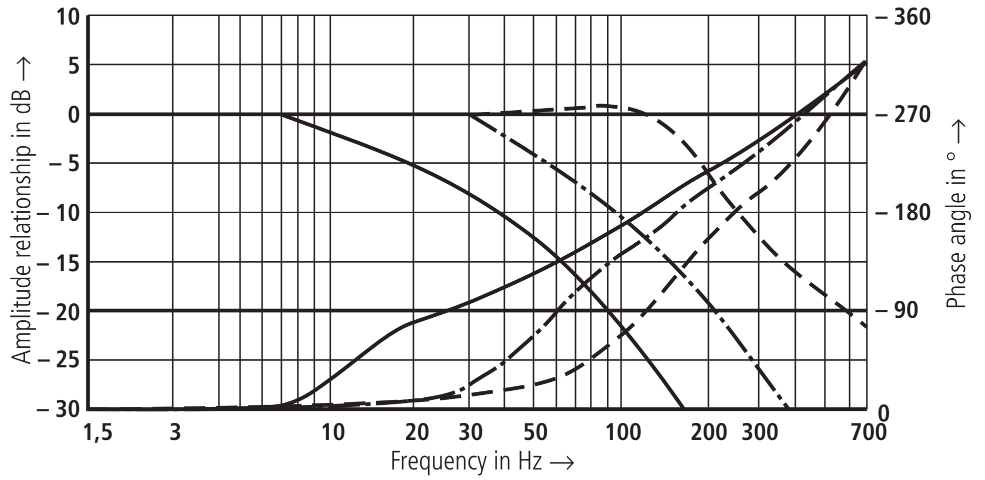


Transient function with a jump form of electrical input signal



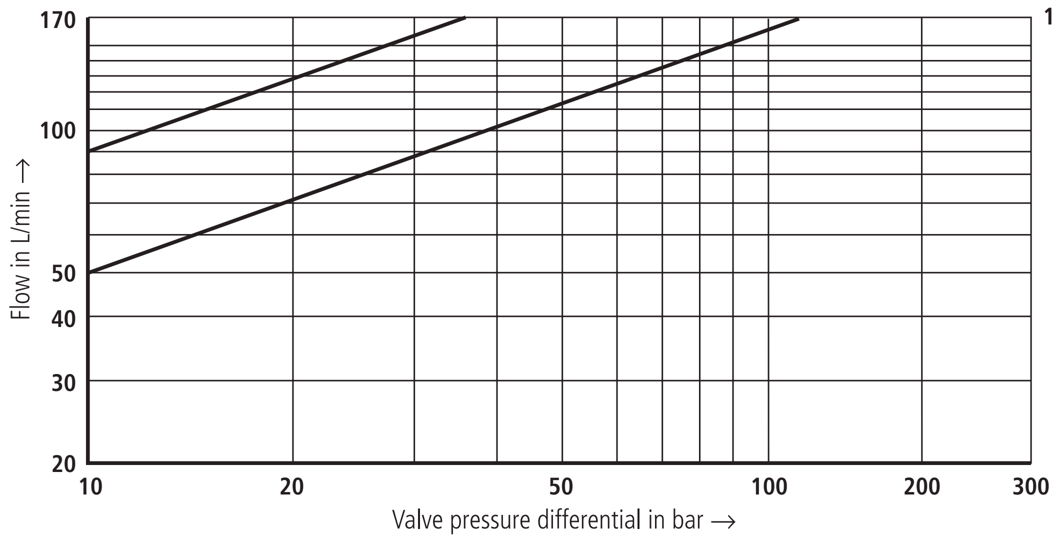
Characteristic curve measured with a pilot control pressure p_s = 210 bar

Frequency response characteristic curves



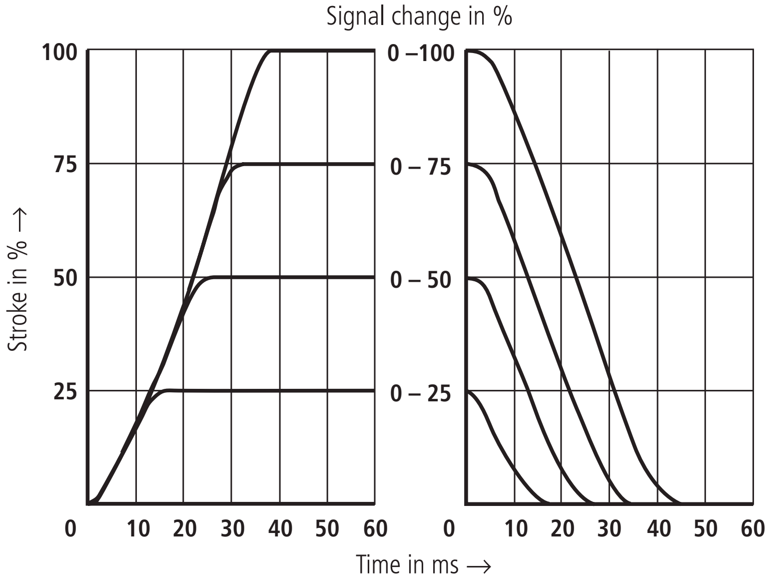
Characteristic curve measured with a pilot control pressure p_s = 210 bar

Flow/load function at max. valve opening (tolerance ± 10 %)



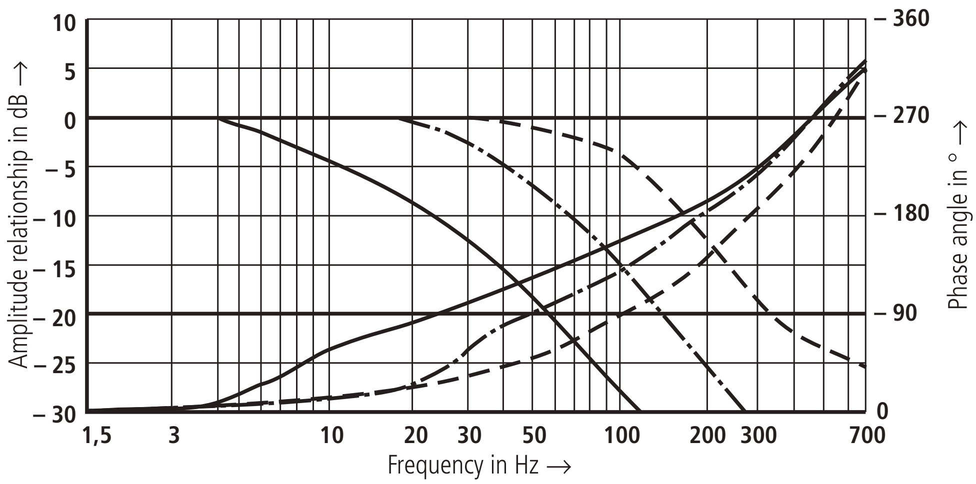
1 = Recommended flow limitation

Transient function with a jump form of input signal



Characteristic curve measured with a pilot control pressure p_s = 210 bar

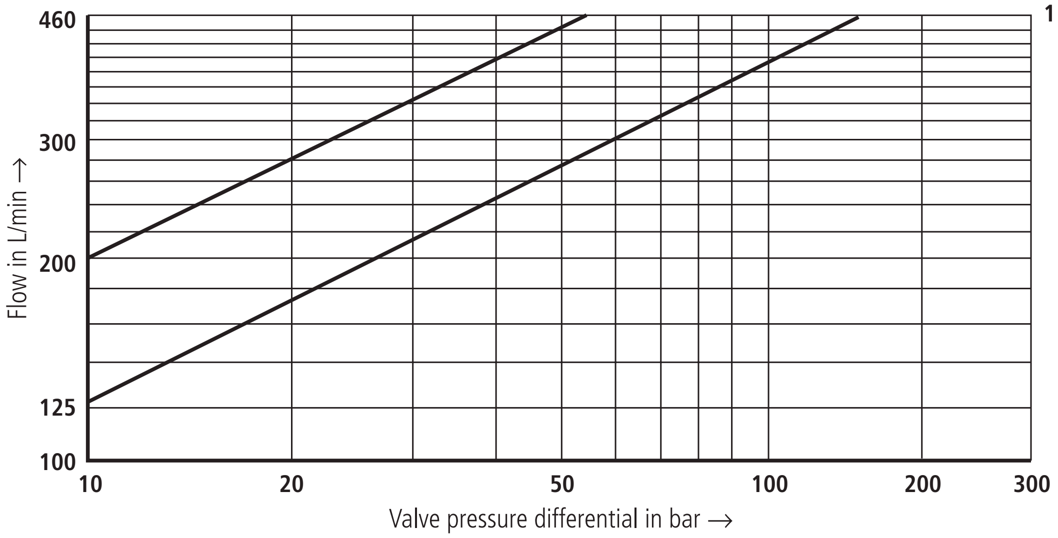
Frequency response characteristic curves



Characteristic curve measured with a pilot control pressure p_s = 210 bar

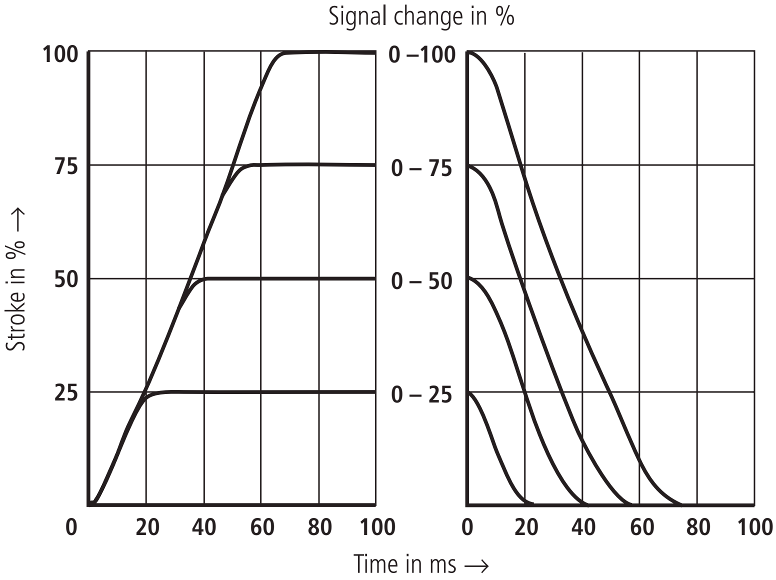
Signal ± 10 %
Signal ± 25 %
Signal ± 100 %

Flow/load function at max. valve opening (tolerance ± 10 %)



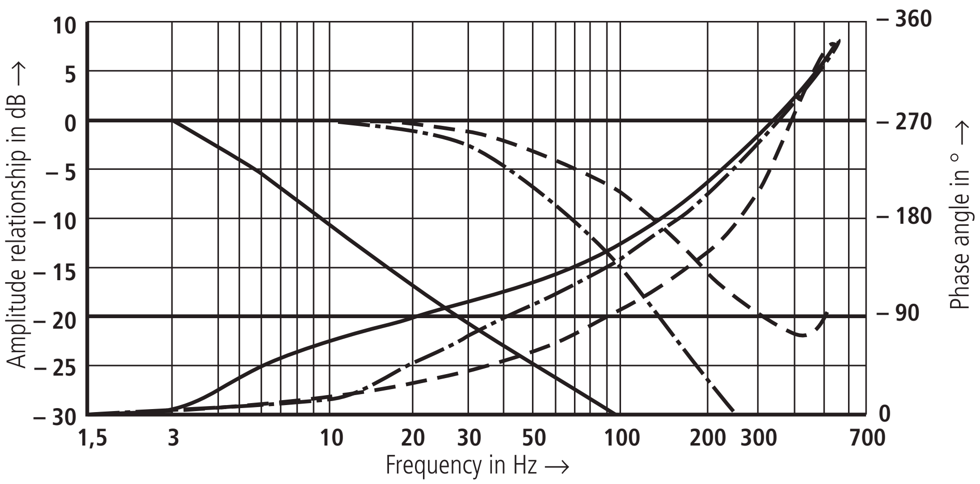
1 = Recommended flow limitation

Transient function with a jump form of electrical input signal



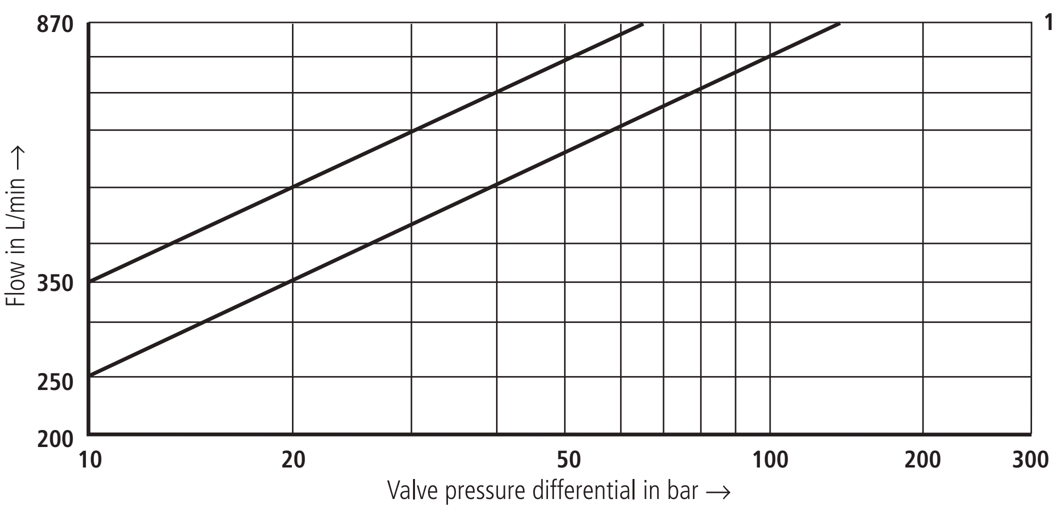
Characteristic curve measured with a pilot control pressure p_s = 210 bar

Frequency response characteristic curves

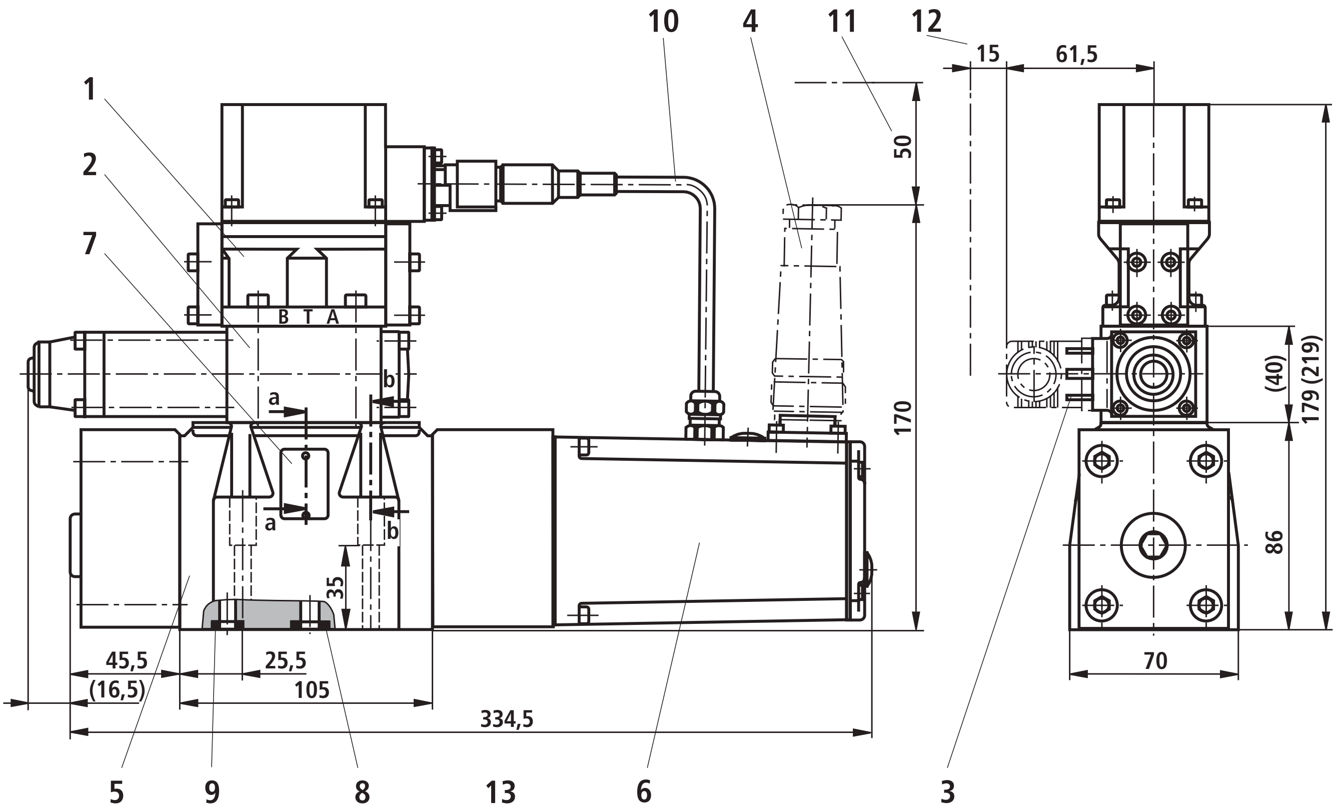


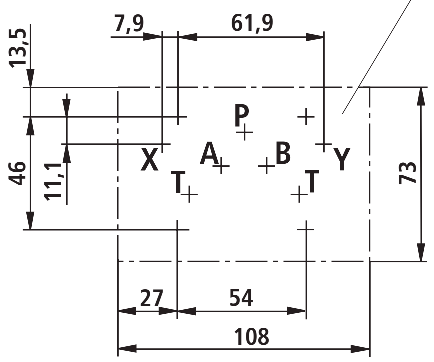
Characteristic curve measured with a pilot control pressure p_s = 210 bar

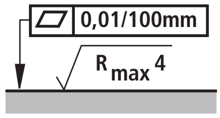
Flow/load function at max. valve opening (tolerance ± 10 %)



1 = Recommended flow limitation







Required surface finish of mating piece

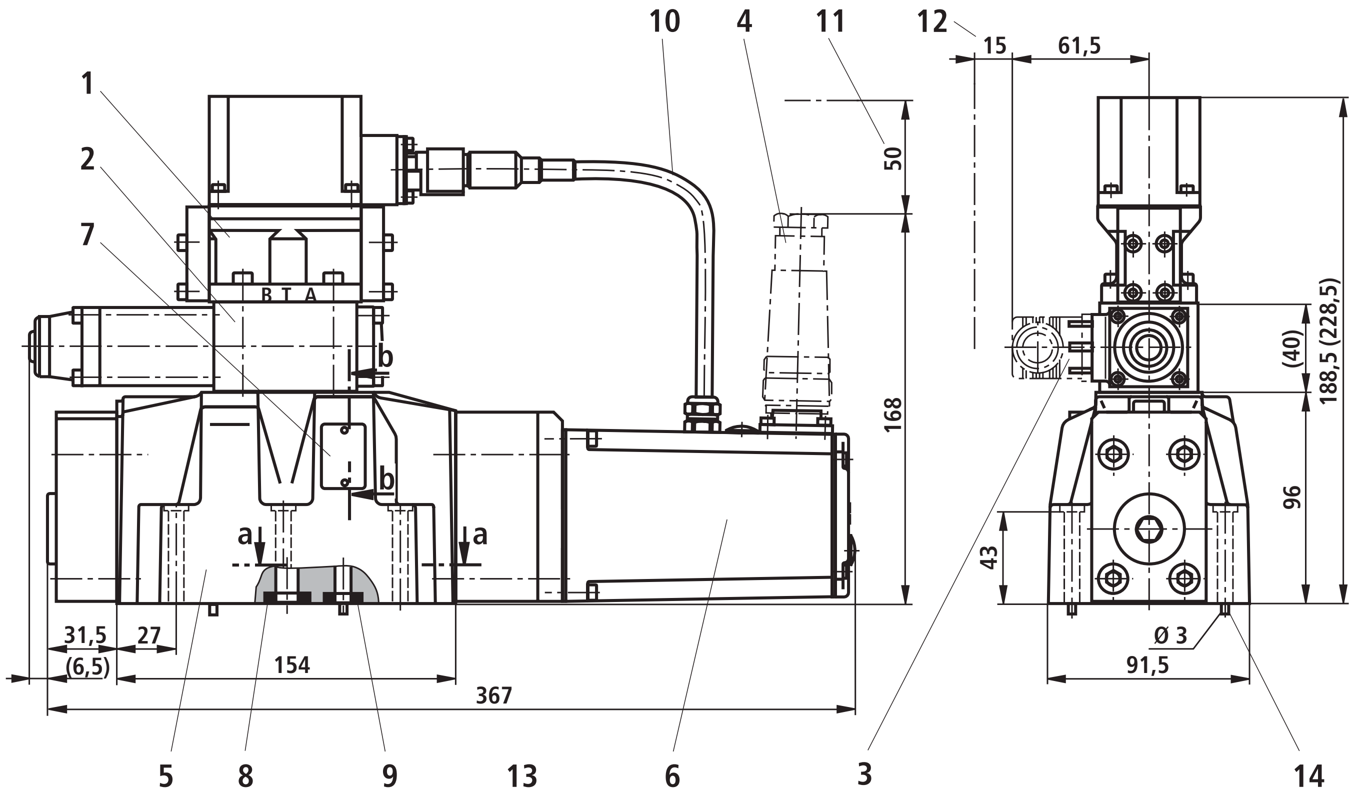
- **1** Pilot control valve
- **2** Sandwich plate directional control valve (only included with ordering detail "…WG152")
- **3** Plug-in connector to DIN 43 650-AF2/Pg11 (separate order, see page 6)
- **4** Plug-in connector to E DIN 43 563-BF6-3/Pg11 (separate order, see page 6)
- **5** Main valve
- **6** Control electronics and inductive position transducer
- **7** Name plate
- **8** R-ring 13 x 1.6 x 2 (ports A, B, P, T)
- **9** R-ring 11.18 x 1.6 x 1.78 (ports X, Y)
- **10** Connection cable
- **11** Space required for connection cable and removal of plug-in connector
- **12** Space required to remove plug-in connector
- **13** Valve mounting surface, porting pattern to DIN 24 340 form A (ports X, Y on request)

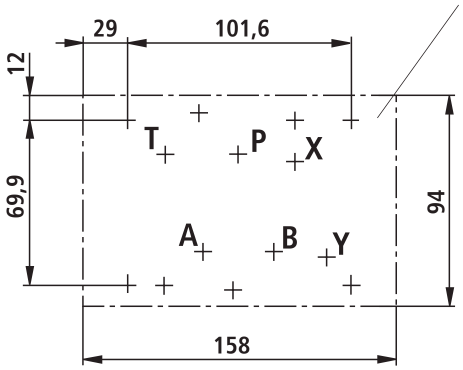
Subplates to catalogue sheet RE 45 054 and valve fixing screws must be ordered separately.

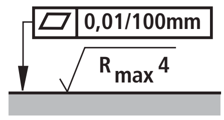
Subplates: G 534/01 (G 3/4)
G 535/01 (G 3/4) with ports X and Y
G 536/01 (G 1) with ports X and Y

Valve fixing screws:
4 off M6 x 45 DIN 912-10.9; M_A = 15.5 Nm

For section details see page 16.







Required surface finish of mating piece

1 Pilot control valve

2 Sandwich plate directional control valve (only included with ordering detail "…WG152")

3 Plug-in connector to DIN 43 650-AF2/Pg11 (separate order, see page 6)

4 Plug-in connector to E DIN 43 563-BF6-3/Pg11 (separate order, see page 6)

5 Main valve

6 Control electronics and inductive position transducer

7 Name plate

8 R-ring 22.53 x 2.3 x 2.62 (ports A, B, P, T)

9 R-ring 10 x 2 x 2 (ports X, Y)

10 Connection cable

11 Space required for connection cable and removal of plug-in connector

12 Space required to remove plug-in connector

13 Valve mounting surface, porting pattern to DIN 24 340 form A (ports X, Y on request)

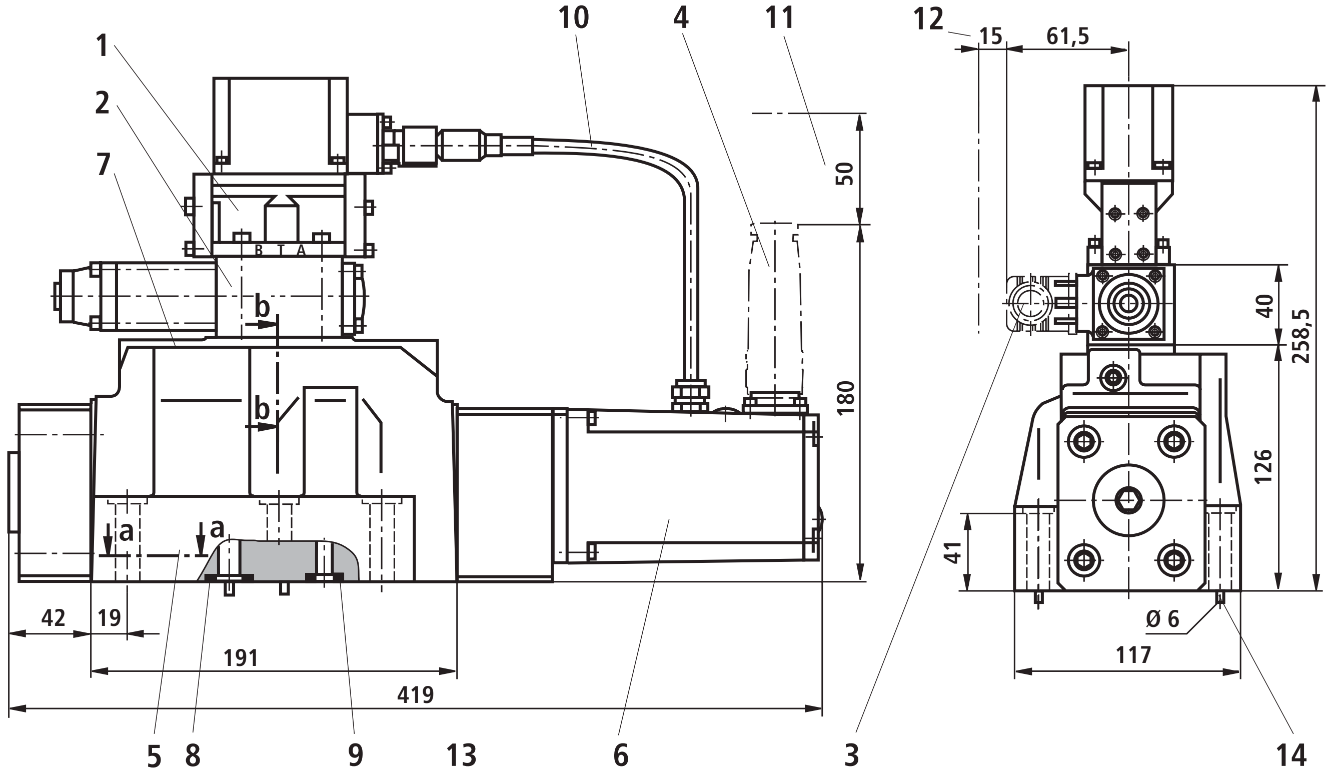
14 Locating pin (2 off)

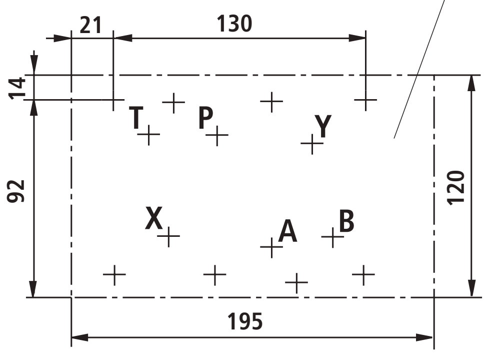
Subplates to catalogue sheet RE 45 054 and valve fixing screws must be ordered separately.

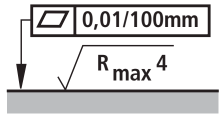
Subplates: G 172/01 (G 3/4)
G 172/02 (M27 x 2)
G 174/01 (G 1)
G 174/02 (M33 x 2)

Valve fixing screws:
2 off M6 x 60 DIN 912-10.9; M_A = 15.5 Nm
4 off M10 x 60 DIN 912-10.9; M_A = 75 Nm

For section details see page 16.







Required surface finish of mating peice

1 Pilot control valve

2 Sandwich plate directional control valve (only included with ordering detail "…WG152")

3 Plug-in connector DIN 43 650-AF2/Pg11 (separate order, see page 6)

4 Plug-in connector to E DIN 43 563-BF6-3/Pg11 (separate order, see page 6)

5 Main valve

6 Control electronics and inductive position transducer

7 Name plate

8 R-ring 27.8 x 2.6 x 3 (ports A, B, P, T)

9 R-ring 19 x 3 x 3 (ports X, Y)

10 Connection cable

11 Space required for connection cable and removal of plug-in connector

12 Space required to remove plug-in connector

13 Valve mounting surface, porting pattern to DIN 24 340 form A (ports X, Y on request)

14 Locating pin (2 off)

Subplates to catalogue sheet RE 45 054 and valve fixing screws must be ordered separately.

Subplates: G 151/01 (G 1)
G 154/01 (G 1 1/4)
G 156/01 (G 1 1/2)

Valve fixing screws:
6 off M12 x 60 DIN 912-10.9; M_A = 130 Nm

For section details see page 16.

Pilot oil supply

Type 4WRGE…-1X/… **Pilot oil supply, external**
Pilot oil drain, external

With this version the pilot oil supply is from a separate pilot pressure circuit (external).
The pilot oil drain is not into the T port of the main valve but separately into the tank via port Y (external).

Type 4WRGE…-1X/…E… **Pilot oil supply, internal**
Pilot oil drain, external

With this version the pilot oil supply is from the P port of the main valve (internal).
The pilot oil drain is not into the T port of the main valve but separately into the tank via port Y (external).
Port X must be plugged in the subplate.

Type 4WRGE…-1X/…ET… **Pilot oil supply, internal**
Pilot oil drain, internal

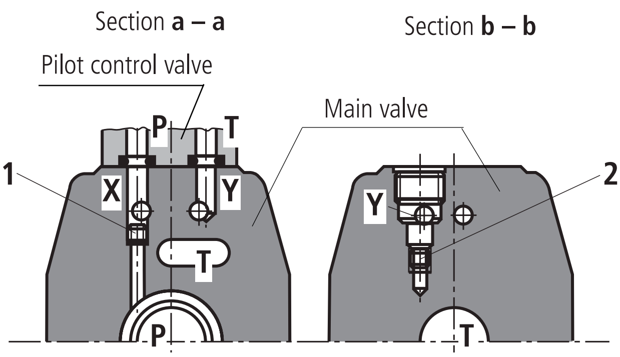
With this version the pilot oil supply is from the P port of the main valve (internal).
The pilot oil drain is directly into the T port of the main valve (internal).
Ports X and Y must be plugged in the subplate.

Type 4WRGE…-1X/…T… **Pilot oil supply, external**
Pilot oil drain, internal

With this version the pilot oil supply is from a separate pilot pressure circuit (external).
The pilot oil drain is directly into the T port of the main valve (internal).
Port Y must be plugged in the subplate.

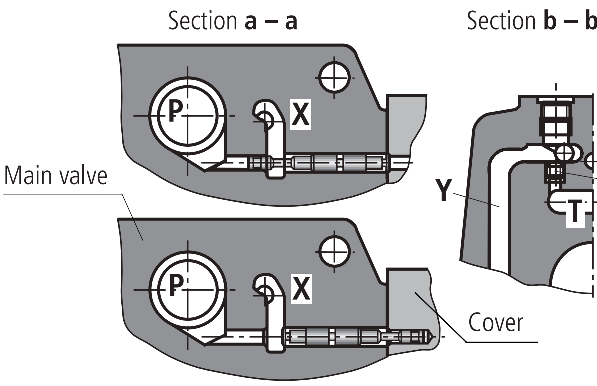
Positions **1** and **2**: Plug M6 DIN 906-8.8 A/F 3

NS 10 For section diagram see page 12



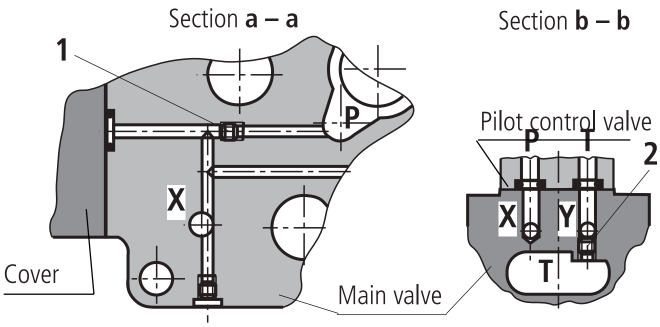
Pilot oil supply	external:	**1**	closed
(section a – a)	internal:	**1**	open
Pilot oil drain	external:	**2**	closed
(section b – b)	internal:	**2**	open

NS 16 For section diagram see page 13



Pilot oil supply	external:	**P**	closed
(section a – a)	internal:	**P**	open
Pilot oil drain	external:	**1**	closed
(section b – b)	internal:	**1**	open

NS 25 For section diagram see page 14

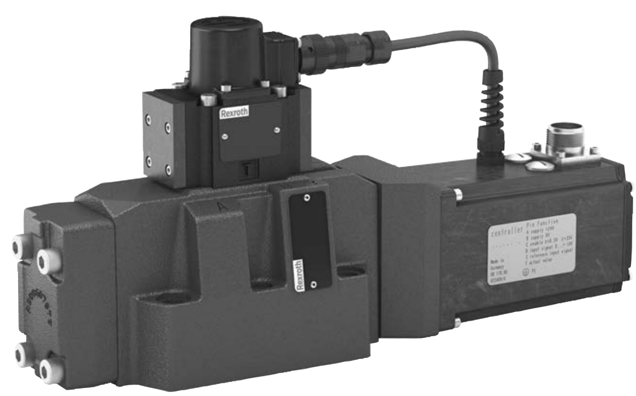


Pilot oil supply	external:	**1**	closed
(section a – a)	internal:	**1**	open
pilot oil drain	external:	**2**	closed
(section b – b)	internal:	**2**	open

Directional control valve, pilot-operated, with electrical position feedback and integrated electronics (OBE)

Type 4WRDE

RE 29097
Edition: 2018-11
Replaces: 2018-10



H8092

- Size 10 ... 27
- Component series 6X
- Maximum operating pressure 350 bar
- Rated flow 25 ... 500 ml/min

Features

- Precise – High response sensitivity and little hysteresis
- High-quality – Pilot control valve type 4WS2EM6-2X with control spool and sleeve
- Flexible – Suitable for position, velocity, force and pressure control in very exact and dynamic applications
- Reliable – Proven and robust design

Contents

Ordering code

01	02	03	04	05	06	07	08		09		10	11	12		13	14	15
4	WRD	E						–	6X	/				/	24		*

01	4 main ports	**4**
02	Directional control valve	**WRD**
03	With integrated electronics (OBE)	**E**
04	Size 10	**10**
	Size 16	**16**
	Size 25	**25**
	Size 27	**27**
05	Symbols e.g. E, E1, W etc.; possible version see page 3	

Control spool position in de-energized state

06	Not defined	**no code**
	100% P → A / B → T	**P**
	100% P → B / A → T	**N**

Rated flow at 10 bar pressure differential (5 bar per control edge)

07	**– Size 10**	
	25 l/min (only symbol E, W6-, W8- and V with version "L")	**25**
	50 l/min	**50**
	90 l/min	**100**
	– Size 16	
	150 l/min (only symbol V1 with version "L")	**150**
	220 l/min	**220**
	– Size 25	
	220 l/min	**220**
	350 l/min	**350**
	– Size 27	
	500 l/min	**500**

Flow characteristic

08	Linear	**L**
	Linear with fine control range	**P**
09	Component series 60 ... 69 (60 ... 69: unchanged installation and connection dimensions)	**6X**

Seal material

10	NBR seals	**M**
	FKM seals	**V**
	Observe compatibility of seals with hydraulic fluid used.	

Pilot oil flow

11	External pilot oil supply, external pilot oil return	**XY**
	Internal pilot oil supply, external pilot oil return	**PY**
	Internal pilot oil supply, internal pilot oil return	**PT**
	External pilot oil supply, internal pilot oil return	**XT**
12	**Without** sandwich plate shut-off valve	**no code**
	With sandwich plate shut-off valve, 24 V	**WG**
13	Supply voltage 24 V	**24**

Ordering code

01	02	03	04	05	06	07	08		09		10	11	12		13	14	15
4	**WRD**	**E**						**–**	**6X**	**/**				**/**	**24**		*****

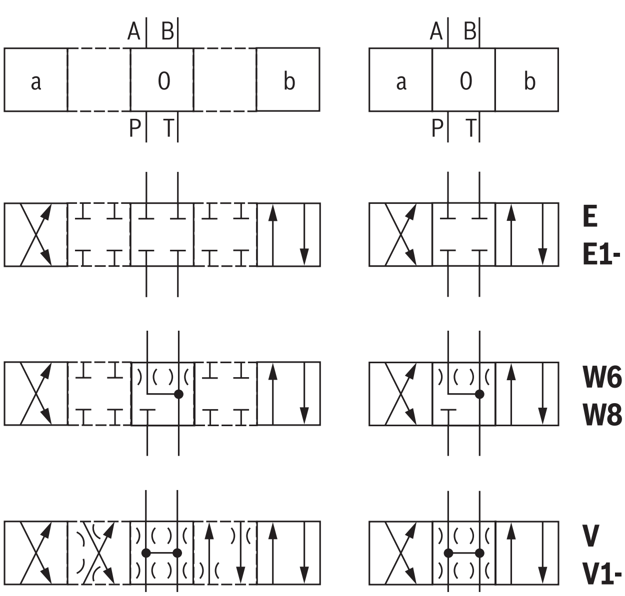
Electrical interface

14	Command value ±10 VDC, actual value ±10 VDC (connector 6+PE)	**A1** 1)
	Command value 4 ... 20 mA, actual value 4 ... 20 mA (connector 6+PE)	**F1**
	Command value ±10 mA, actual value 4 ... 20 ma (connector 6+PE), only in connection with version "P" and "N" (de-energized control spool position)	**C6-972**

15	For further information, see the plain text	

1) When replacing the component series 5X by the functionally compatible component series 6X, the electronics interface is to be defined with "A5" (as version "A1", however additionally with enable input +24V at pin C)

Symbols



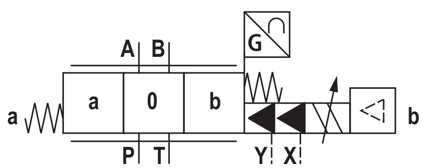
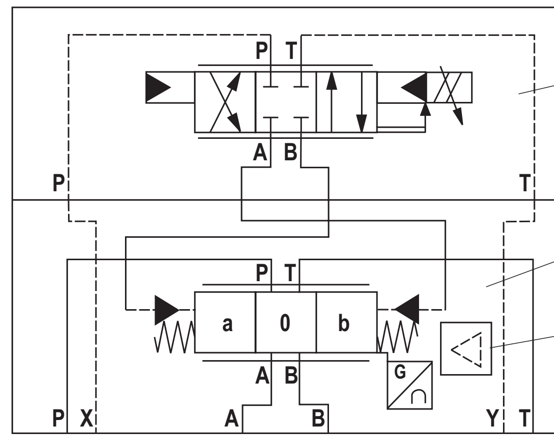
With symbol E1-, W8 and V1-:

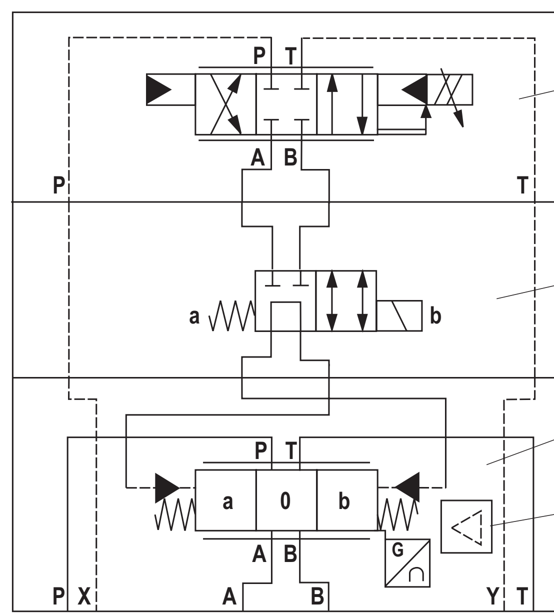
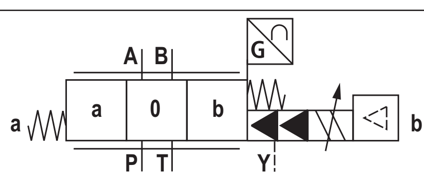
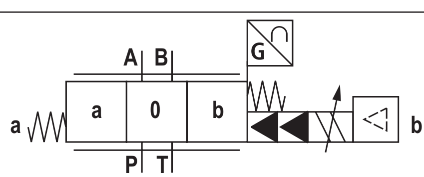
P → A: $q_{V\,max}$ B → T: $q_V/2$

P → B: $q_V/2$ A → T: $q_{V\,max}$

Notes:
- Representation according to DIN ISO 1219-1. Hydraulic interim positions are shown by dashes.
- With symbols W6 and W8 there is a connection from A to T and B to T with approx. 3% of the relevant nominal cross-section in zero position.

Symbols

<table>
<tr><th>Design</th><th>simple</th><th>detailed</th></tr>
<tr><td>"XY"</td><td>
</td><td>


</td></tr>
<tr><td>"PY"</td><td>
</td><td></td></tr>
<tr><td>"PT"</td><td>
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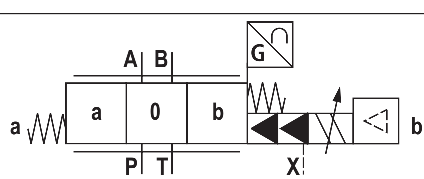
<tr><td>"XT"</td><td>
</td><td></td></tr>
</table>

1 Pilot control valve
2 Main valve
3 Directional sandwich plate valve
4 Integrated electronics (OBE)

Function, section

Valves of type 4WRDE are 3-stage, pilot-operated directional control valves with electrical position feedback and integrated electronics (OBE).

Set-up

The valves basically comprise of:

- Servo pilot control valve, 2-stage, type 4WS2EM6-2X (1)
- Main stage (2), consisting of housing and main stage control spool
- Integrated electronics (3) with inductive position transducer of the main stage

Function

In the integrated electronics (OBE), the specified command value is compared with the position actual value of the main stage control spool. In case of a difference (control deviation), the first stage of the pilot control valve is controlled (dry torque motor and nozzle flapper plate system). This way, a deflection of the flapper plate of the nozzle flapper plate system is realized. The distance of the flapper plate to one of the two control nozzles flown-through by pilot oil is reduced and increased to the other one. Through the connecting bore, the resulting flow difference leads to deflection of the control spool in the pilot control valve (2nd stage) similarly to the control signal. The flow released by the pilot control valve leads to deflection of the control spool of the main stage (3rd stage) until its position actual value corresponds to the command value. The stroke of the control spool is controlled proportionally to the command value.

Valve features

The valves are factory-set with a dither default setting with the constant frequency of 400 Hz.

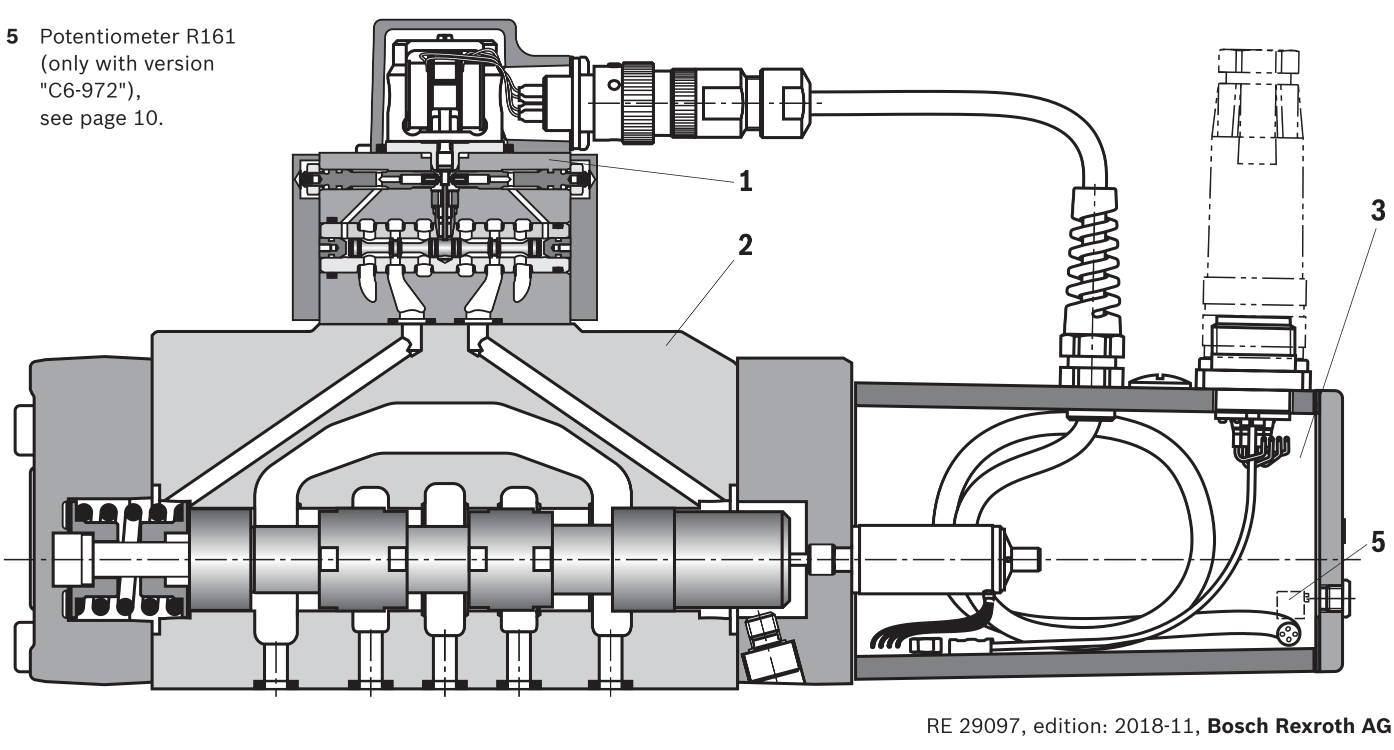
Failure of supply voltage

- With applied pilot oil pressure, the main stage control spool moves into an undefined end position. The acceleration forces occurring in this connection may cause machine damage.
- If a directional sandwich plate valve is used (see ordering code), the two pilot oil chambers in the main stage will be short-circuited in case of power failure.
  - With symbol E, E1-, W6 and W8, the main stage spool will take the spring-centered central position.
  - With symbol V and V1, the main stage spool takes the offset position, operated by the spring (P–B and A–T) (in the tolerance range 1 ... 11% of the control spool stroke).

Notes:

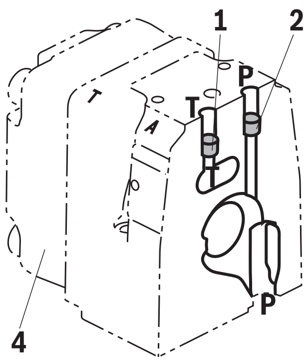
- Changes in the zero point and/or the dither amplitude may result in damage to the system and may only be implemented by instructed specialists.
- The pilot control valve may only be maintained by Rexroth employees. An exception is the replacement of the filter and the sealing according to accessories list. It has to be ensured that during the assembly, the sealing is properly seated and the plug screw is tightened. The tightening torque for the plug screw is 30 Nm.

5 Potentiometer R161 (only with version "C6-972"), see page 10.

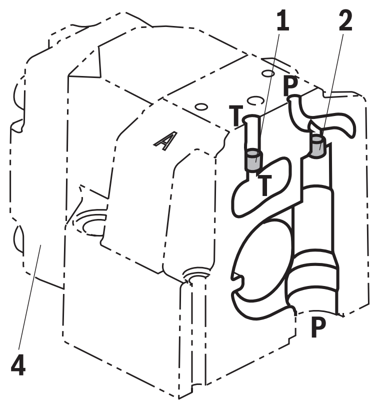


Pilot oil supply (schematic illustration)

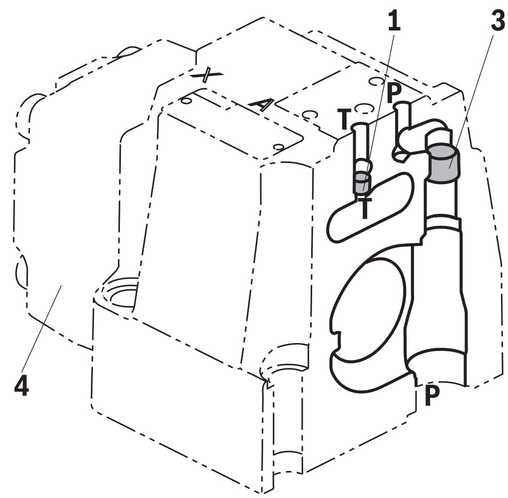
NG10



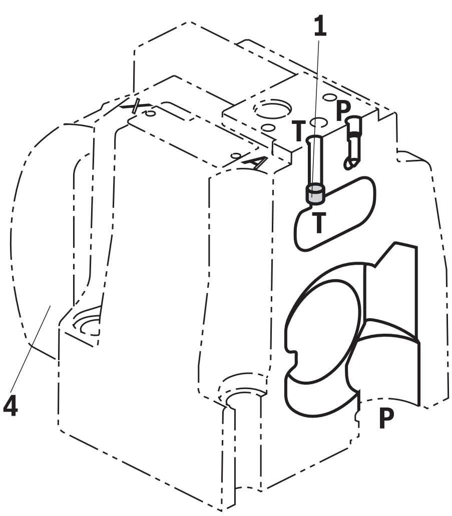
NG16



NG25



NG27



1 Plug screw M6 according to DIN 906, wrench size 3
– pilot oil return

2 Plug screw M6 according to DIN 906, wrench size 3
– pilot oil supply

3 Plug screw M12 x 1.5 according DIN 906, wrench size 6
– pilot oil supply

4 Main stage housing cover (opposite the OBE)

Pilot oil supply		**Pilot oil return**	
external	internal	external	internal
2, 3 closed	**2, 3** open	**1** closed	**1** open

Further explanations on page 7.

Pilot oil supply

Version "XY"
External pilot oil supply
external pilot oil return
With this version, the pilot oil is supplied from a separate pilot oil circuit (external).
The pilot oil return is not directed into channel T of the main valve, but is separately directed to the tank via port Y (external).

Version "PY"
Internal pilot oil supply
external pilot oil return
With this version, the pilot oil is supplied from channel P of the main valve (internal).
The pilot oil return is not directed into channel T of the main valve, but is separately directed to the tank via port Y (external).
In the subplate, port X is to be closed.

Version "PT"
Internal pilot oil supply
internal pilot oil return
With this version, the pilot oil is supplied from channel P of the main valve (internal).
The pilot oil is directly returned to channel T of the main valve (internal).
In the subplate, ports X and Y are to be closed.

Version "XT"
External pilot oil supply
internal pilot oil return
With this version, the pilot oil is supplied from a separate pilot oil circuit (external).
The pilot oil is directly returned to channel T of the main valve (internal).
In the subplate, port Y is to be closed.

Technical data
(For applications outside these parameters, please consult us!)

general						
Size		NG	10	16	25	27
Weight		kg	7.5	10.5	17.5	19.5
Installation position			any (preferably horizontal)			
Ambient temperature range		°C	−20 … +60			
Maximum storage time		Years	1 (if the storage conditions are observed; refer to the operating instructions 07600-B)			
Vibration resistance	▶ Sine test according to DIN EN 60068-2-6		10 … 2000 Hz / maximum of 10 g / 10 cycles / 3 axes			
	▶ Noise test according to DIN EN 60068-2-64		20 … 2000 Hz / 10 g_{RMS} / 30 g peak / 30 min. / 3 axes			
	▶ Transport shock according to DIN EN 60068-2-27		15 g / 11 ms / 3 axes			
Maximum relative humidity (no condensation)		%	95			

hydraulic						
Maximum operating pressure	▶ Port A, B, P					
	– Pilot oil supply external [1]	bar	350	350	350	270
	– Internal pilot oil supply	bar	25 … 250			
	▶ Port X	bar	25 … 250			
Maximum return flow pressure	▶ Port T					
	– External pilot oil return	bar	315	250	250	210
	– Pilot oil return internal	bar	Pressure peaks < 100 static < 10 admissible			
	▶ Port Y	bar	Pressure peaks < 100 static < 10 admissible			
Rated flow (**Δp** = 5 bar per control edge) [2]		l/min	25 50 90	– 150 220	– 220 350	– – 500
Maximum flow		l/min	170	460	870	1000
Maximum pilot oil flow at stepped input signal (0 → 100%, pilot pressure 250 bar)		l/min	8.3	15.6	8.6	8.6
Pilot oil volume 0 … 100%		cm³	1.1	2.9	2.3	2.3
Zero flow pilot control valve (pilot pressure 100 bar)		l/min	0.7	0.8	0.8	0.8
Maximum zero flow	▶ Symbol V, V1-		see characteristic curves page 14			
Maximum leakage flow (inlet pressure 100 bar)	▶ Symbol E, E1-					
	– Main valve	l/min	0.1	0.2	0.3	0.3
	– Main + pilot control valve	l/min	0.8	1	1.1	1.1
	▶ Symbol W6-, W8-					
	– Main valve	l/min	0.2	0.4	0.5	0.5
	– Main + pilot control valve	l/min	0.9	1.2	1.4	1.4
Hydraulic fluid			see table page 9			
Hydraulic fluid temperature range (flown-through)		°C	−20 … +80			
Viscosity range	▶ Maximum	mm²/s	20 … 380			
	▶ Recommended	mm²/s	30 … 45			
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)			Pilot control valve: Class 18/16/13 [3] Main stage: Class 20/18/15 [3]			

1) For perfect system behavior, an external pilot oil supply is recommended for pressures above 210 bar.

2) Flow for deviating **Δp**:

$$q_x = q_{Vnom} \times \sqrt{\frac{\Delta p_x}{5}}$$

3) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and simultaneously increases the life cycle of the components.

Technical data
(For applications outside these parameters, please consult us!)

Hydraulic fluid		Classification	Suitable sealing materials	Standards	Data sheet
Mineral oils		HL, HLP, HLPD, HVLP, HVLPD	NBR, FKM	DIN 51524	90220
Bio-degradable	▶ Insoluble in water	HETG	FKM	ISO 15380	90221
		HEES	FKM		
	▶ Soluble in water	HEPG	FKM	ISO 15380	
Flame-resistant	▶ Water-free	HFDU (glycol base)	FKM	ISO 12922	90222
		HFDU (ester base)	FKM		
		HFDR	FKM		
	▶ Containing water	HFC (Fuchs Hydrotherm 46M, Fuchs Renosafe 500, Petrofer Ultra Safe 620, Houghton Houghto Safe 620, Union Carbide HP5046)	NBR	ISO 12922	90223

Important information on hydraulic fluids:
- For further information and data on the use of other hydraulic fluids, please refer to the data sheets above or contact us.
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.).
- The ignition temperature of the hydraulic fluid used must be 50 K higher than the maximum surface temperature.

- **Flame-resistant – containing water:**
  - Due to increased cavitation tendency with HFC hydraulic fluids, the life cycle of the component may be reduced by up to 30% as compared to the use with mineral oil HLP. In order to reduce the cavitation effect, it is recommended - if possible specific to the installation - to back up the return flow pressure in ports T to approx. 20% of the pressure differential at the component.
  - Dependent on the hydraulic fluid used, the maximum ambient and hydraulic fluid temperature must not exceed 50 °C. In order to reduce the heat input into the component, the command value profile is to be adjusted for proportional and high-response valves.

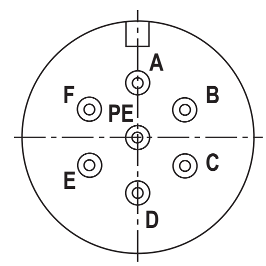
static /dynamic			
Hysteresis		%	< 0.2
Response sensitivity		%	< 0.1
Range of inversion		%	< 0.1
Manufacturing tolerance q_{Vmax}		%	10
Zero shift upon change of	▶ Hydraulic fluid temperature	%/10 K	< 0.2
	▶ Ambient temperature	%/10 K	< 0.2
	▶ Operating pressure	%/100 bar	< 0.5
	▶ Return flow pressure 0 ... 10% of p	%/100 bar	< 0.2
Zero compensation [4]			Ex plant ±1%

electrical, integrated electronics (OBE)			
Protection class according to EN 60529			IP 65 with mating connector mounted and locked
Supply voltage	▶ Nominal voltage	VDC	24 (full bridge rectification with smoothing capacitor 2200 µF, I_{max} = 230 mA)
	▶ Lower limit value	VDC	18
	▶ Upper limit value	VDC	36
Maximum current consumption		mA	< 200
Functional ground and screening			see page 10 (CE-compliant installation)
Adjustment			Calibrated in the plant, see valve characteristic curves page 14 ... 20

[4] Related to the pressure-signal characteristic curve (symbol V)

Electrical connections, assignment

Contact	Interface assignment		
	"A1" (6 + PE)	**"F1"** (6 + PE)	**"C6-972"** (6 + PE)
A	24 VDC supply voltage		
B	GND		
C	n.c.	n.c. (not to be connected)	Enable input 24 VDC (high ≥ 8.5 V; low ≤ 6.5 V) [1]
D	Command value ±10 V [2] (***Re*** > 100 kΩ)	Command value 4 ... 20 mA [3] (***Re*** = 100 Ω)	Command value ±10 mA [2] (***Re*** = 200 Ω)
E	Reference potential command value	Reference potential command value	Reference potential command value
F	Actual value ±10 V (***Ri*** ≈ 1 kΩ)	Actual value 4 ... 20 mA (load max. 500 Ω)	Actual value 4 ... 20 mA (load max. 500 Ω)
PE	Functional ground (directly connected to the valve housing)		

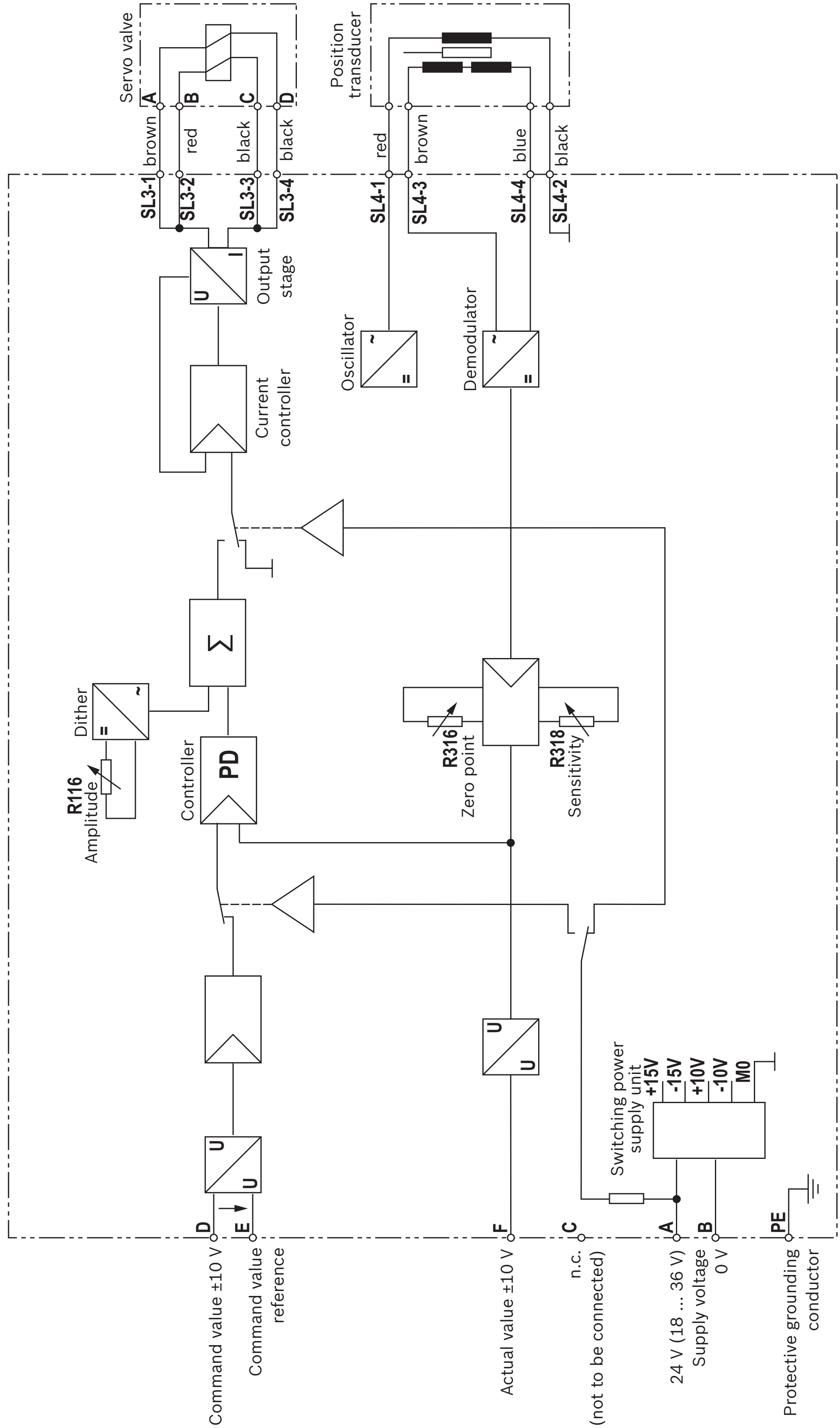


1) At active hydraulic pressure and "low" enable signal, the control spool of the main stage is in a regulated central position (preferred direction adjustable by ±10% by means of potentiometer R161).
If a directional sandwich plate valve (version "WG") is used between pilot control valve and main stage, the control chambers are unloaded from the pilot control valve to the main stage control spool. With symbols E, E1-, W6- and W8-, the centering springs set the main stage control spool in central position, symbols V- and V1 are switched to preferred direction P → B and A → T in a tolerance range of 1% to 11% of the control spool stroke. As a consequence, the cylinder axis leaves its position at minimum velocity.

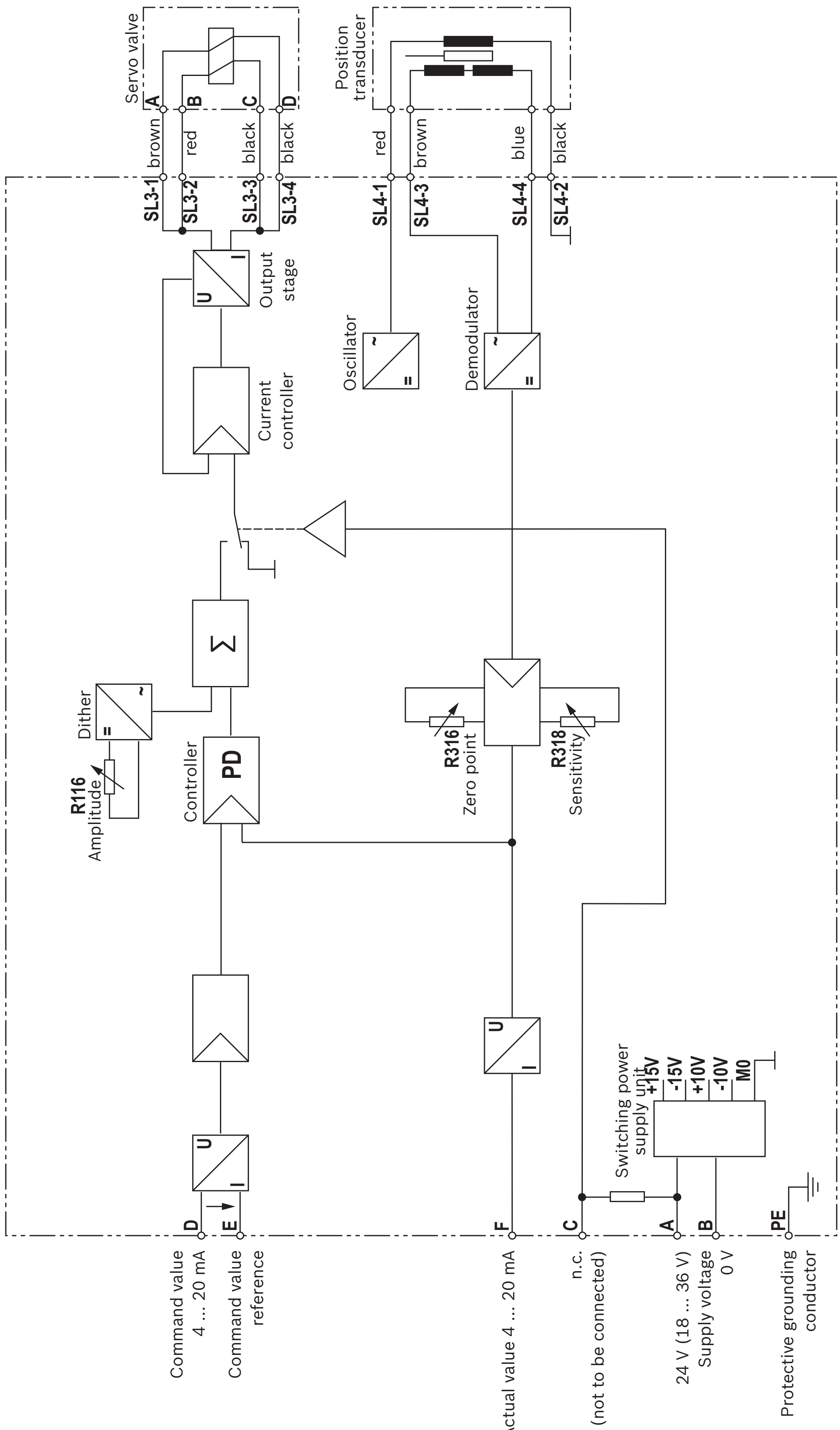
2) Differential command value input: Positive command value at D compared to E results in flow from P → A and B → T at the main stage.

3) Differential command value input: Command value of 12 ... 20 mA at D compared to E results in flow from P → A and B → T at the main stage.

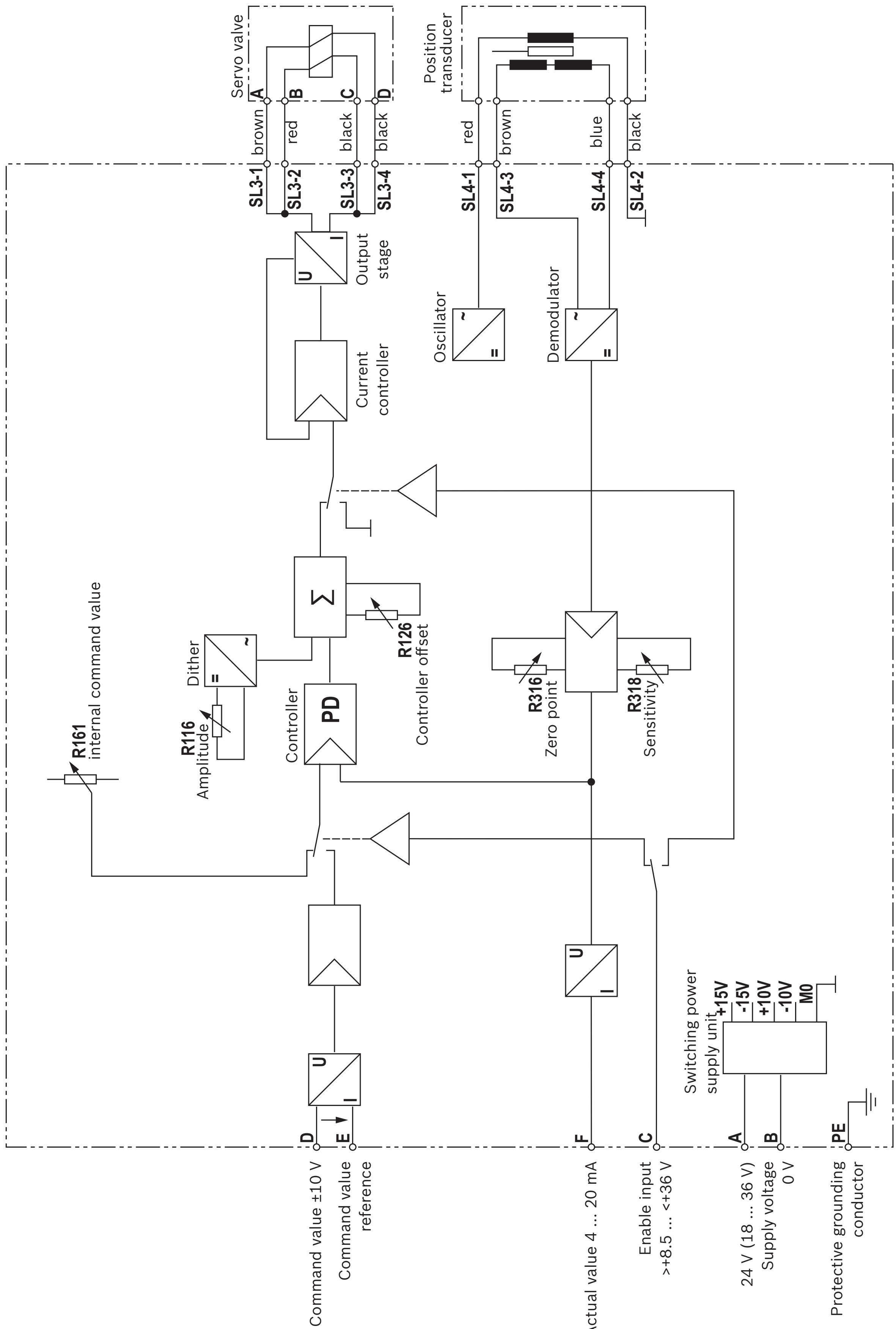
Block diagram/controller function block: Version "A1"



Block diagram/controller function block: Version "F1"



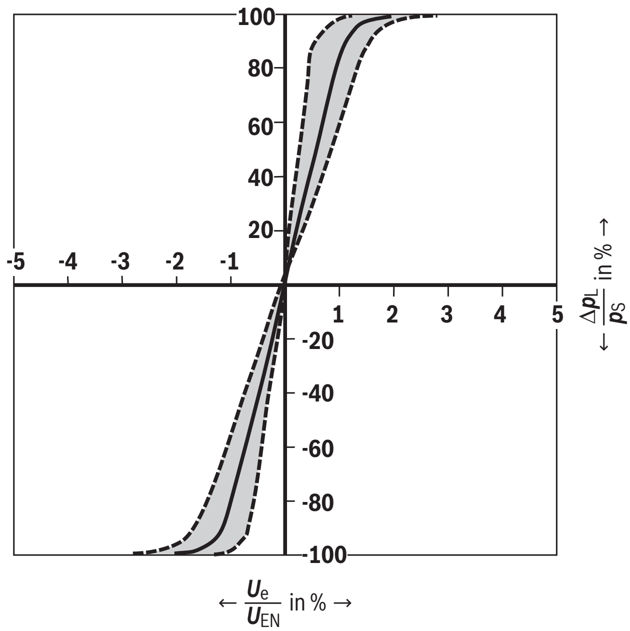
Block diagram/controller function block: Version "C6-972"



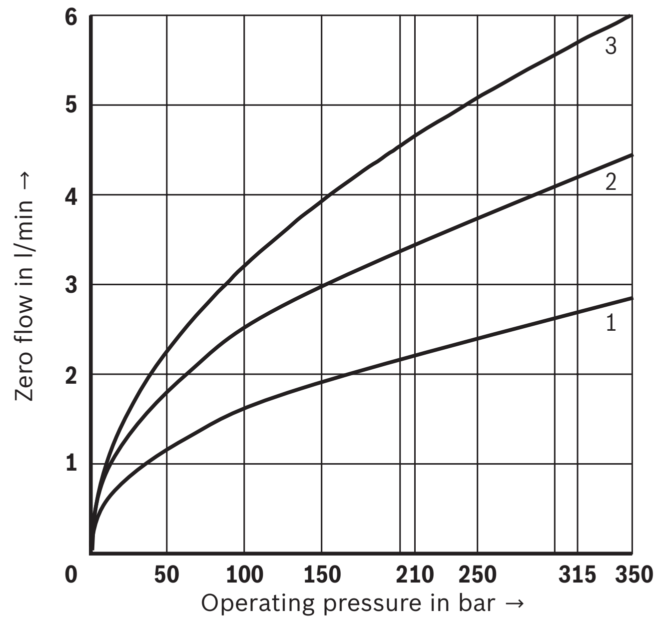
Characteristic curves

(measured with HLP46, ϑ_{Oil} = 40 °C ±5 °C and p = 100 bar)

Pressure-signal characteristic curve (symbol V)



Zero flow of the main stage (symbol V), without pilot control valve

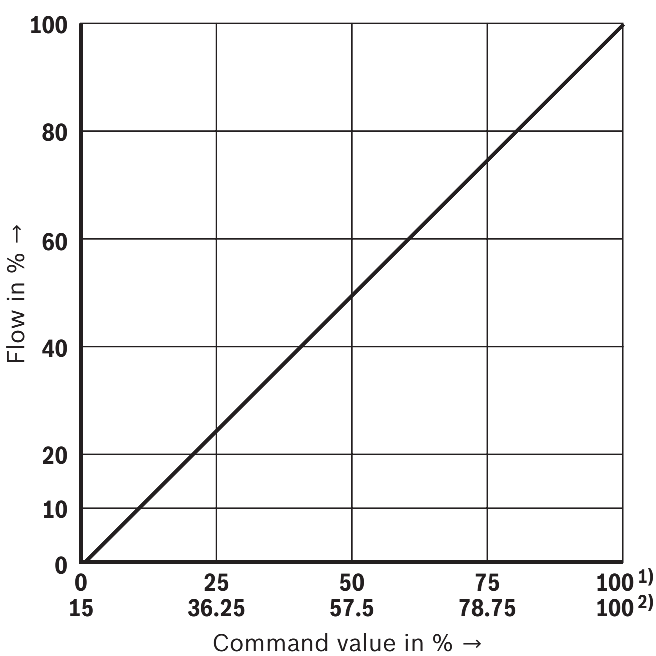


1 Size 10
2 Size 16
3 Size 25 and 27

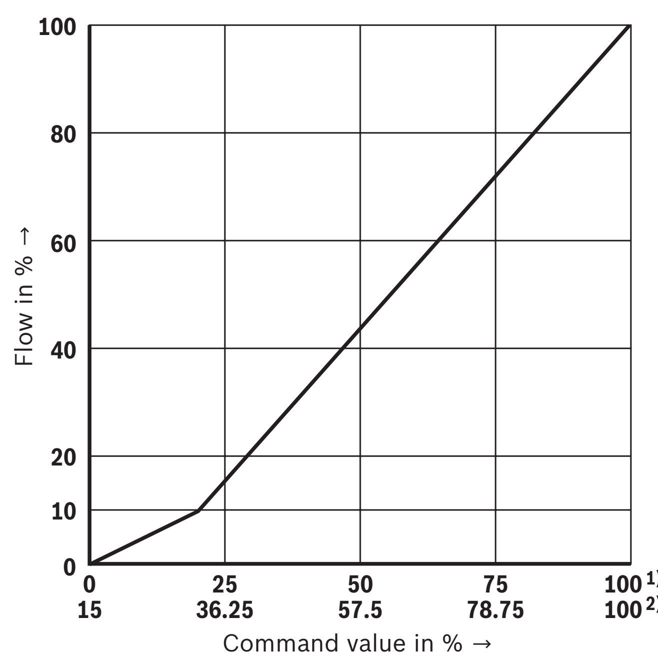
Flow command value function

(at e.g. P → A / B → T and 10 bar pressure differential or P → A or A → T and 5 bar per control edge)

Version "L" (symbols E, W and V)



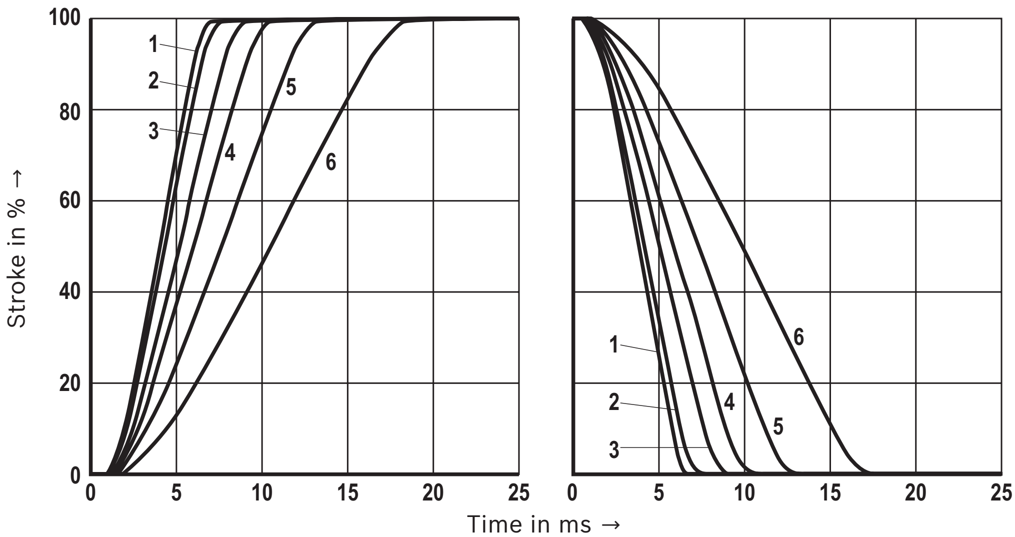
Version "P" (symbols E, W and V)



1) Positive overlap 0 ... 0.5% at symbol V
2) Positive overlap 15% at symbols E and W

Characteristic curves: Size 10
(measured with HLP46, ϑ_{Oil} = 40 ±5 °C)

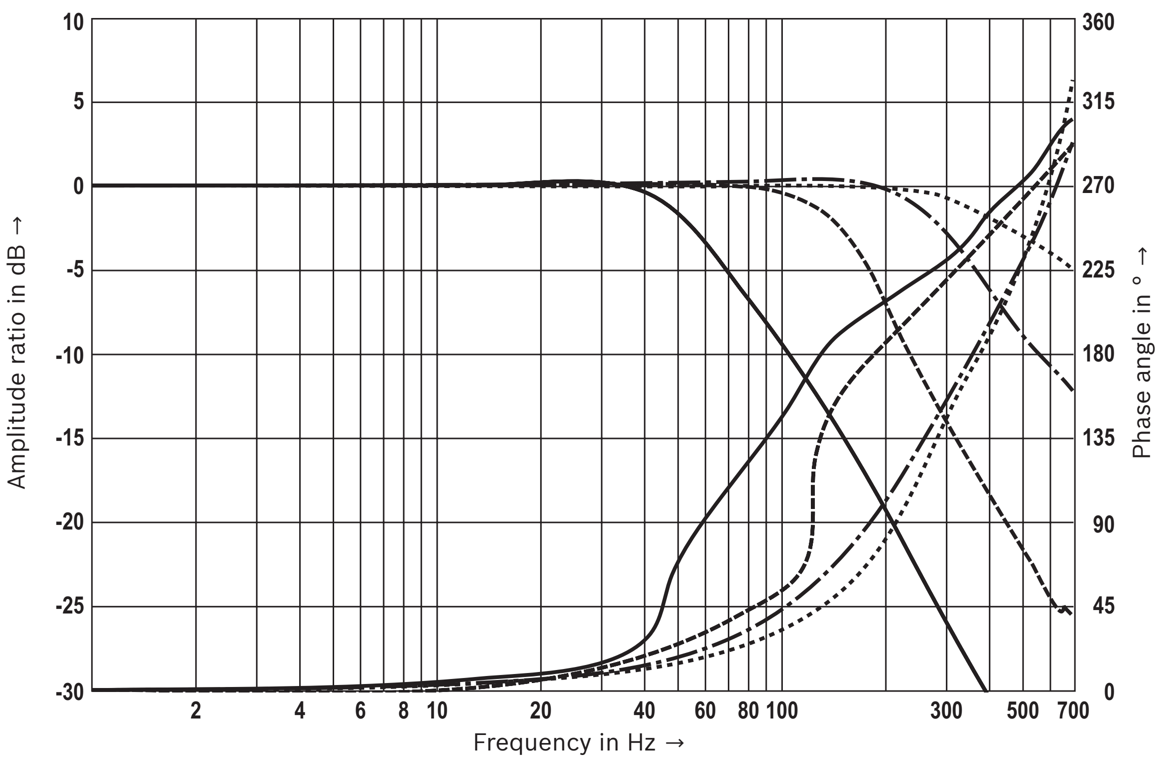
Transition function with stepped electric input signals



1 Pilot pressure 250 bar
2 Pilot pressure 210 bar
3 Pilot pressure 140 bar
4 Pilot pressure 100 bar
5 Pilot pressure 70 bar
6 Pilot pressure 40 bar

▶ Main valve, port P = 10 bar

Frequency response characteristic curves



Signal ±1%

Signal ±5%

Signal ±25%

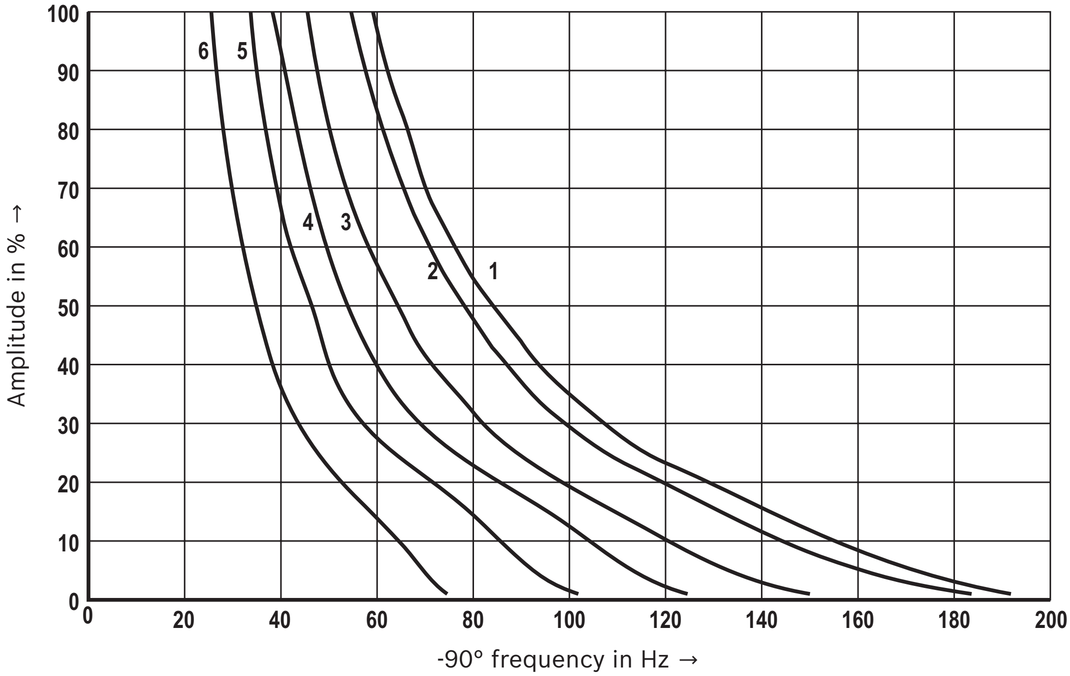
Signal ±100%

▶ Pilot control valve, port X = 250 bar

▶ Main valve, port P = 10 bar

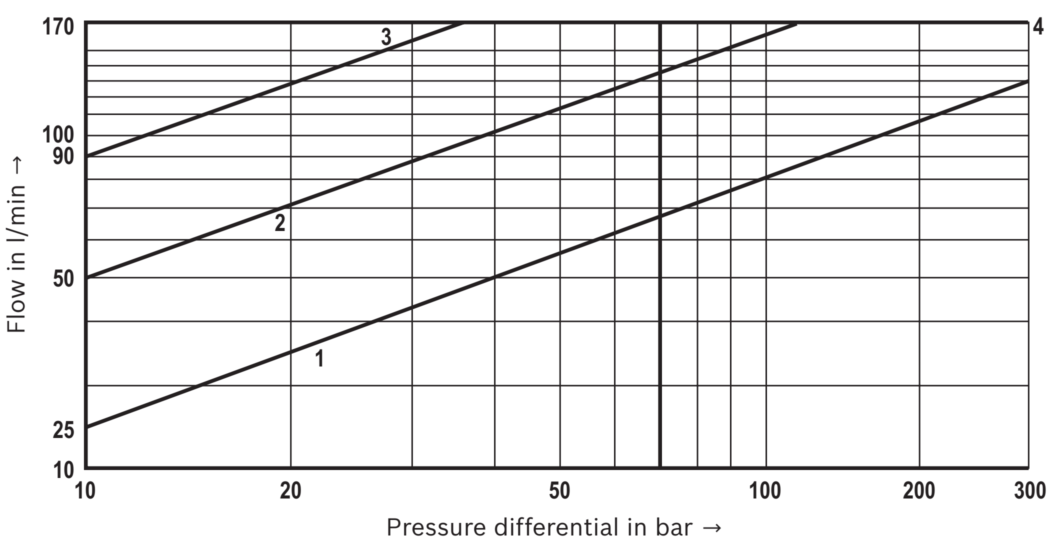
Characteristic curves: Size 10
(measured with HLP46, ϑ_{Oil} = 40 ±5 °C)

Dependency -90° frequency / pilot pressure



- **1** Pilot pressure 250 bar
- **2** Pilot pressure 210 bar
- **3** Pilot pressure 140 bar
- **4** Pilot pressure 100 bar
- **5** Pilot pressure 70 bar
- **6** Pilot pressure 40 bar

Flow/load function with maximum valve opening (tolerance ±10%)



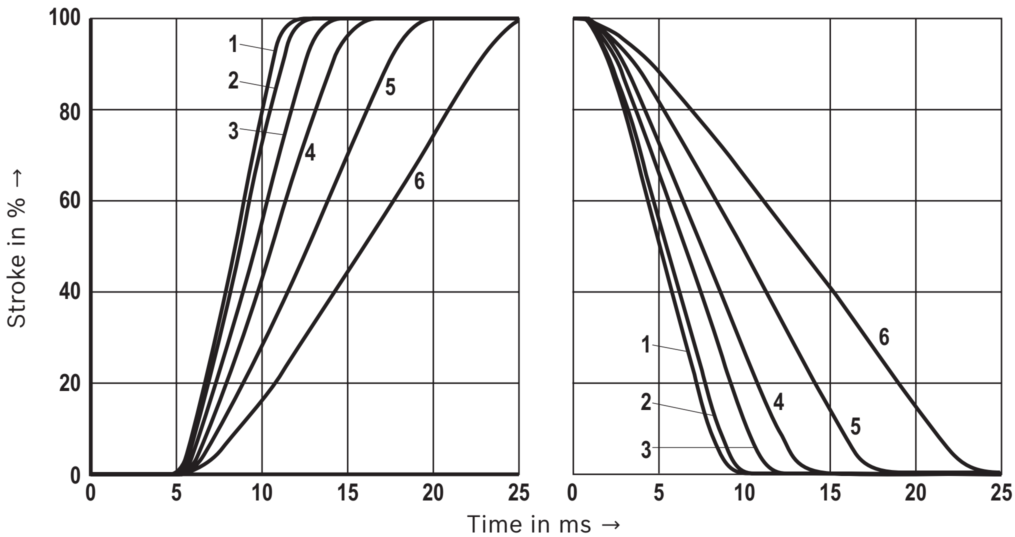
- **1** Rated flow 25 l/min
- **2** Rated flow 50 l/min
- **3** Rated flow 100 l/min
- **4** Recommended flow limitation (flow velocity 30 m/s)

$\Delta p = p_P - p_L - p_T$

Δp	Pressure differential
p_P	Inlet pressure
p_L	Load pressure
p_T	Return flow pressure

Characteristic curves: Size 16
(measured with HLP46, ϑ_{Oil} = 40 ±5 °C)

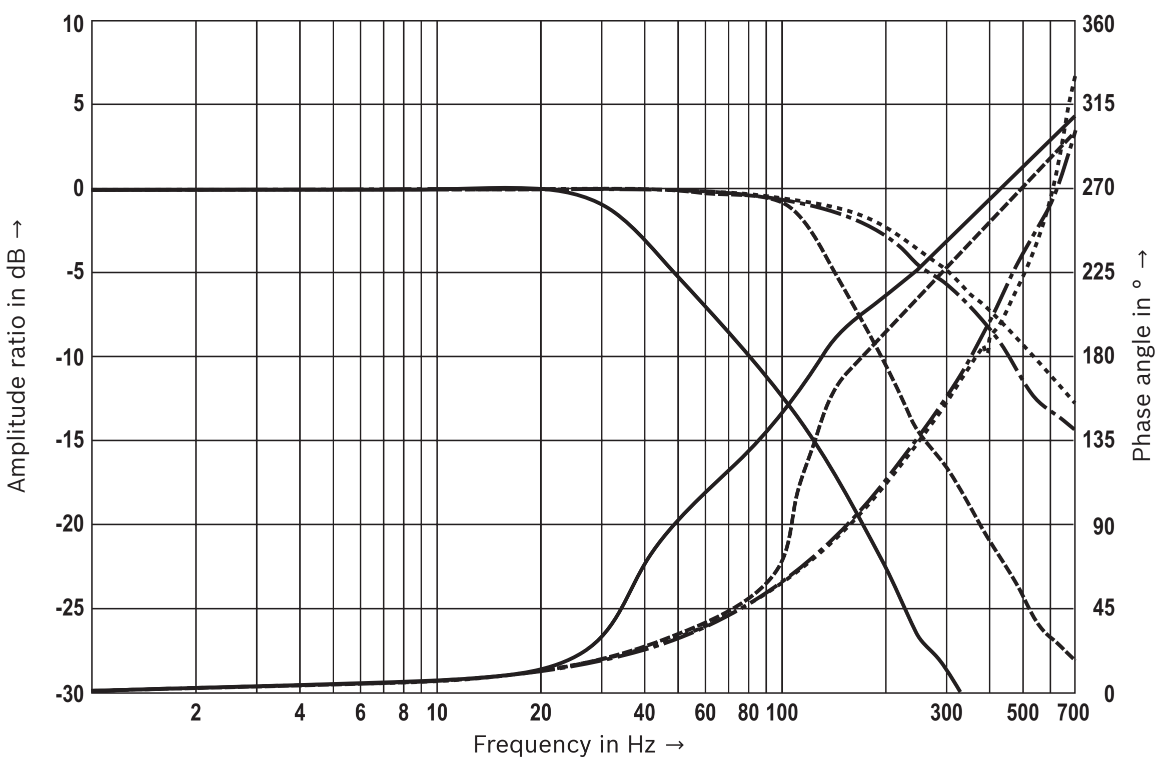
Transition function with stepped electric input signals



1 Pilot pressure 250 bar
2 Pilot pressure 210 bar
3 Pilot pressure 140 bar
4 Pilot pressure 100 bar
5 Pilot pressure 70 bar
6 Pilot pressure 40 bar

▶ Main valve, port P = 10 bar

Frequency response characteristic curves



Signal ±1%

Signal ±5%

Signal ±25%

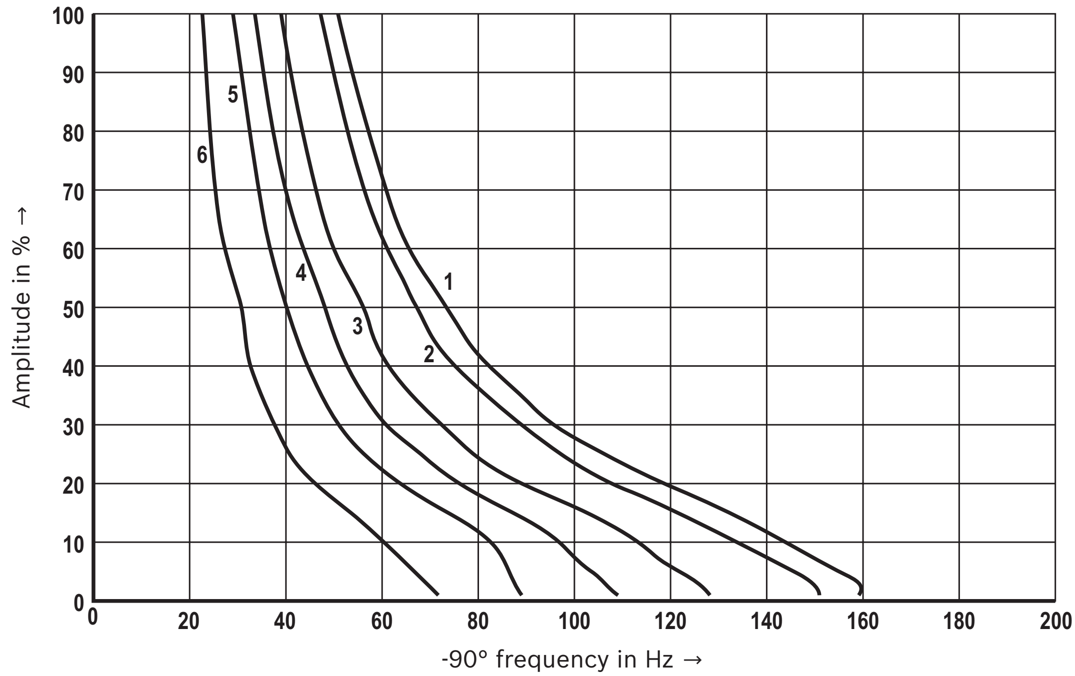
Signal ±100%

▶ Pilot control valve, port X = 250 bar

▶ Main valve, port P = 10 bar

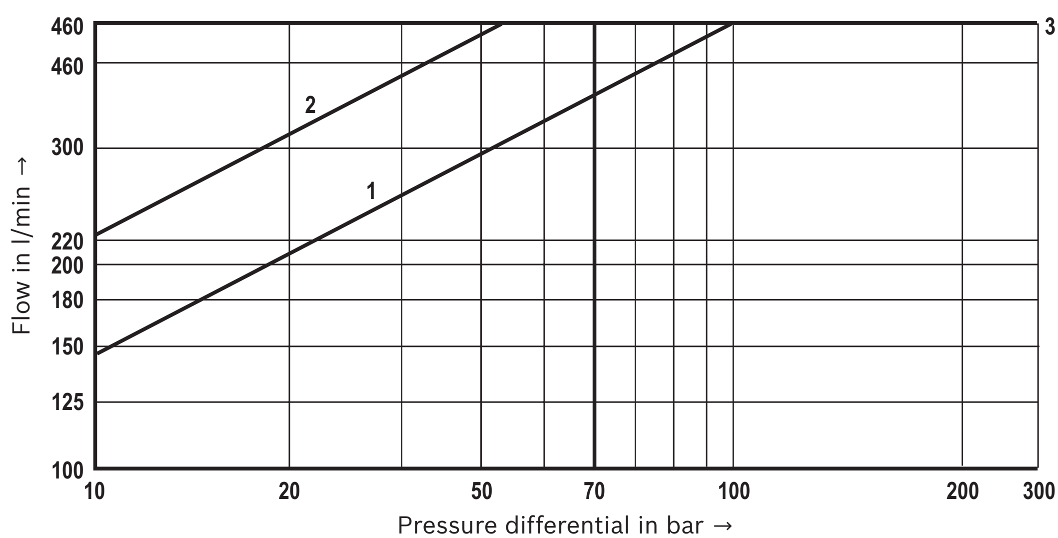
Characteristic curves: Size 16
(measured with HLP46, ϑ_{Oil} = 40 ±5 °C)

Dependency -90° frequency / pilot pressure



1 Pilot pressure 250 bar
2 Pilot pressure 210 bar
3 Pilot pressure 140 bar
4 Pilot pressure 100 bar
5 Pilot pressure 70 bar
6 Pilot pressure 40 bar

Flow/load function with maximum valve opening (tolerance ±10%)



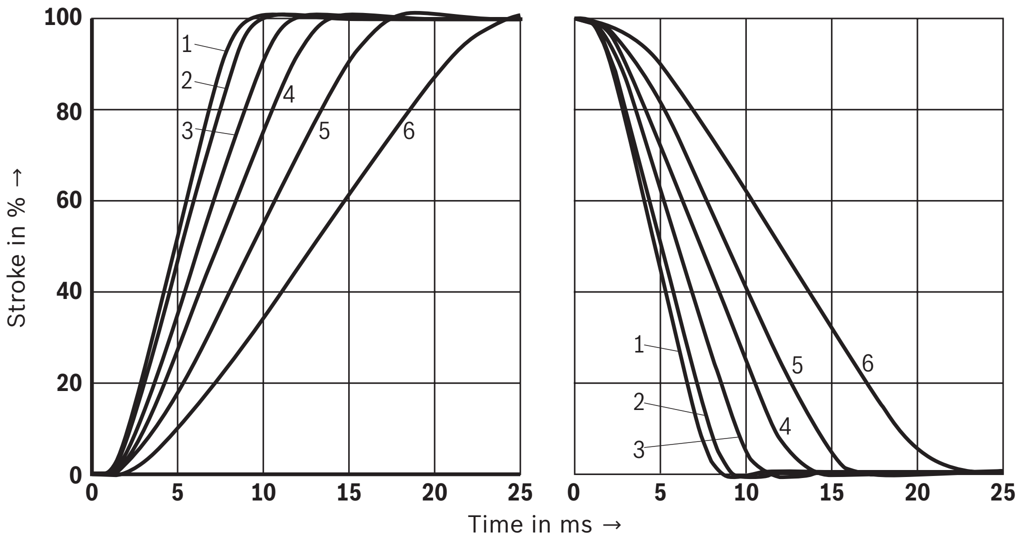
1 Rated flow 150 l/min
2 Rated flow 220 l/min
3 Recommended flow limitation (flow velocity 30 m/s)

$\Delta p = p_P - p_L - p_T$

Δp Pressure differential
p_P Inlet pressure
p_L Load pressure
p_T Return flow pressure

Characteristic curves: Size 25 and 27 (measured with HLP46, ϑ_{Oil} = 40 ±5 °C)

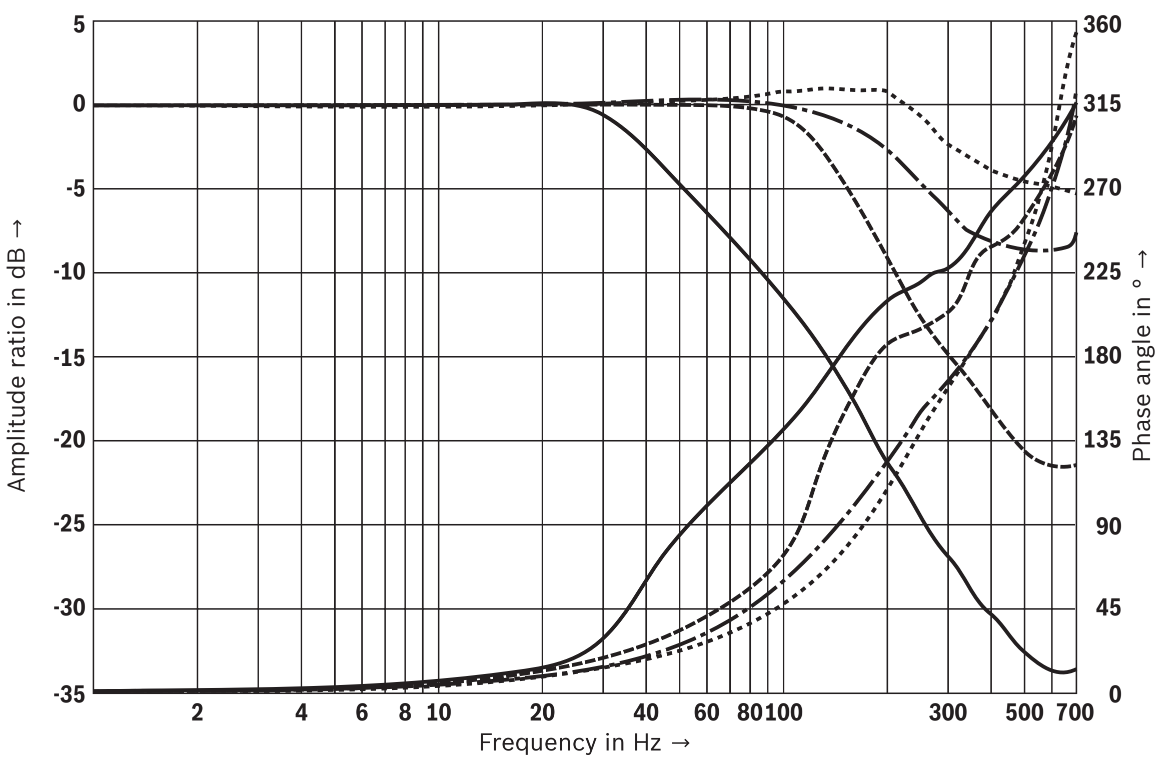
Transition function with stepped electric input signals



1 Pilot pressure 250 bar
2 Pilot pressure 210 bar
3 Pilot pressure 140 bar
4 Pilot pressure 100 bar
5 Pilot pressure 70 bar
6 Pilot pressure 40 bar

▶ Main valve, port P = 10 bar

Frequency response characteristic curves



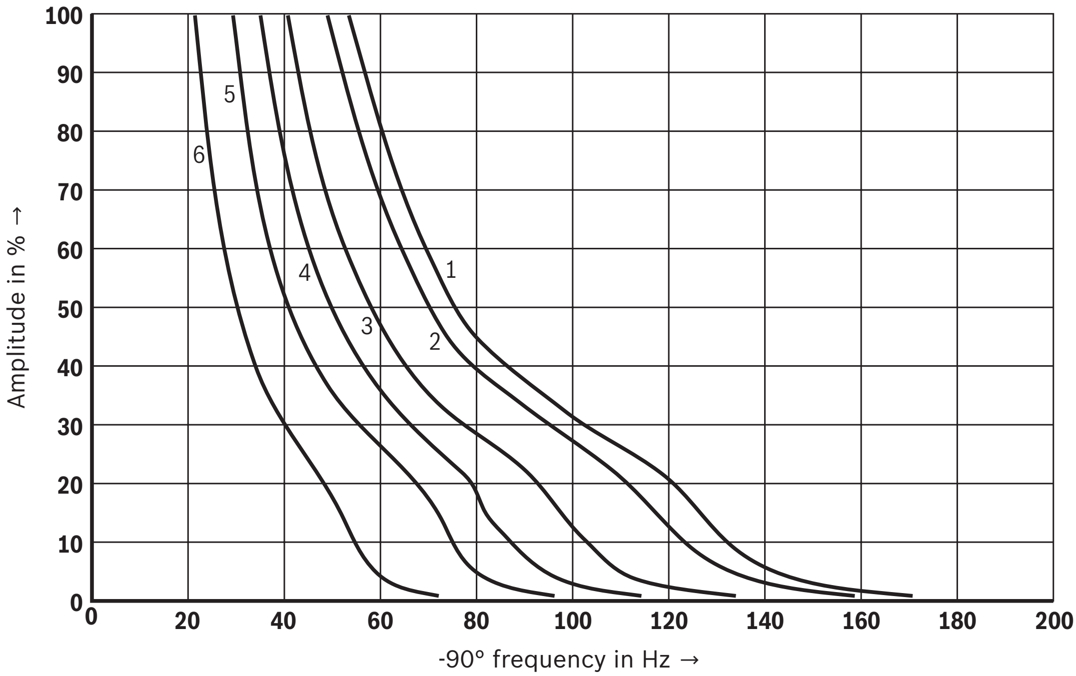
- Signal ±1% (dotted line)
- Signal ±5% (dash-dot line)
- Signal ±25% (dashed line)
- Signal ±100% (solid line)

▶ Pilot control valve, port X = 250 bar

▶ Main valve, port P = 10 bar

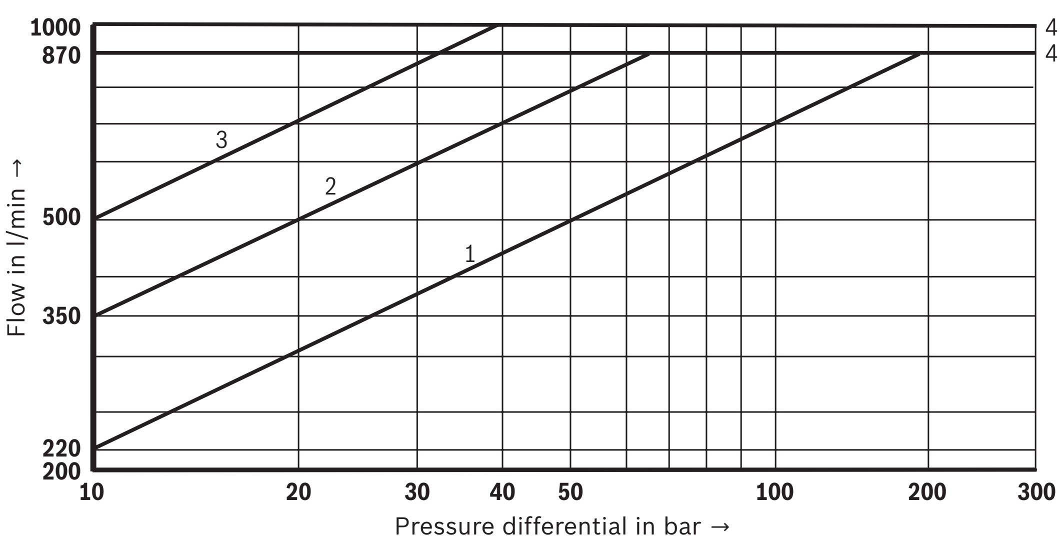
Characteristic curves: Size 25 and 27
(measured with HLP46, ϑ_{Oil} = 40 ±5 °C)

Dependency -90° frequency / pilot pressure



1 Pilot pressure 250 bar
2 Pilot pressure 210 bar
3 Pilot pressure 140 bar
4 Pilot pressure 100 bar
5 Pilot pressure 70 bar
6 Pilot pressure 40 bar

Flow/load function with maximum valve opening (tolerance ±10%)

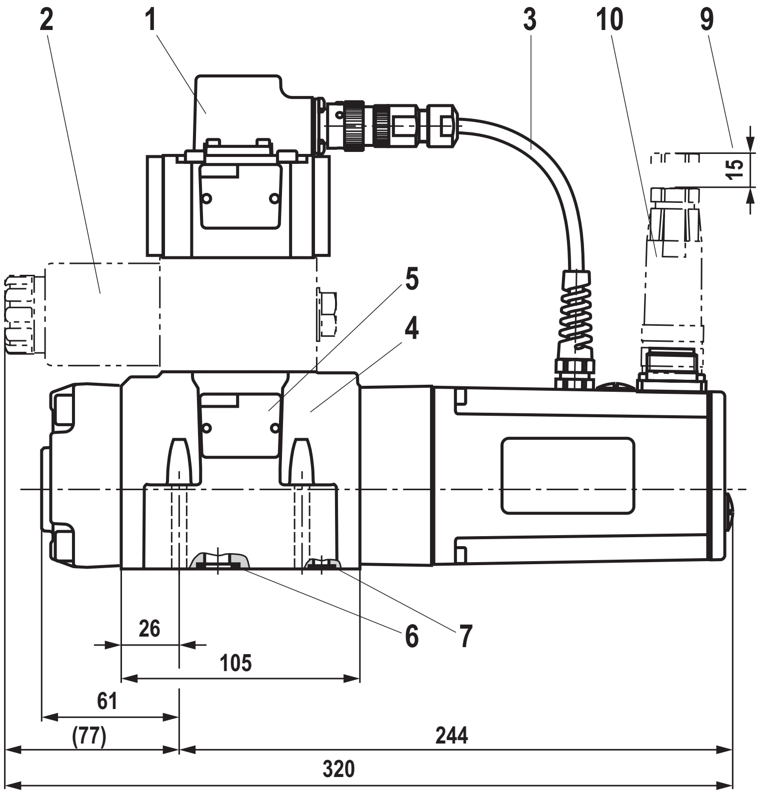


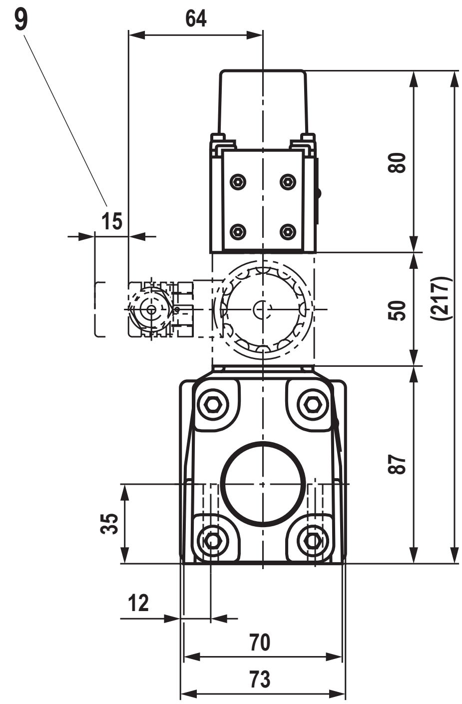
1 Rated flow 220 l/min
2 Rated flow 350 l/min
3 Rated flow 500 l/min
4 Recommended flow limitation (flow velocity 30 m/s)

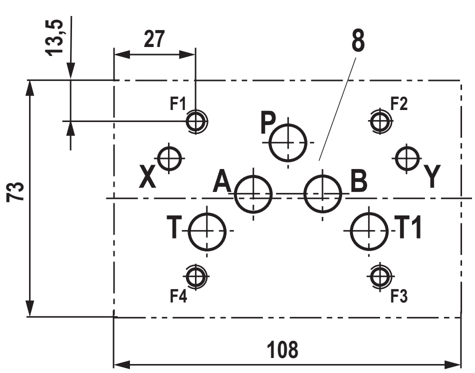
$\Delta p = p_P - p_L - p_T$

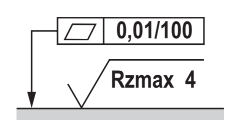
Δp Pressure differential
p_P Inlet pressure
p_L Load pressure
p_T Return flow pressure

Dimensions: Size 10
(dimensions in mm)









Required surface quality
of the valve contact surface

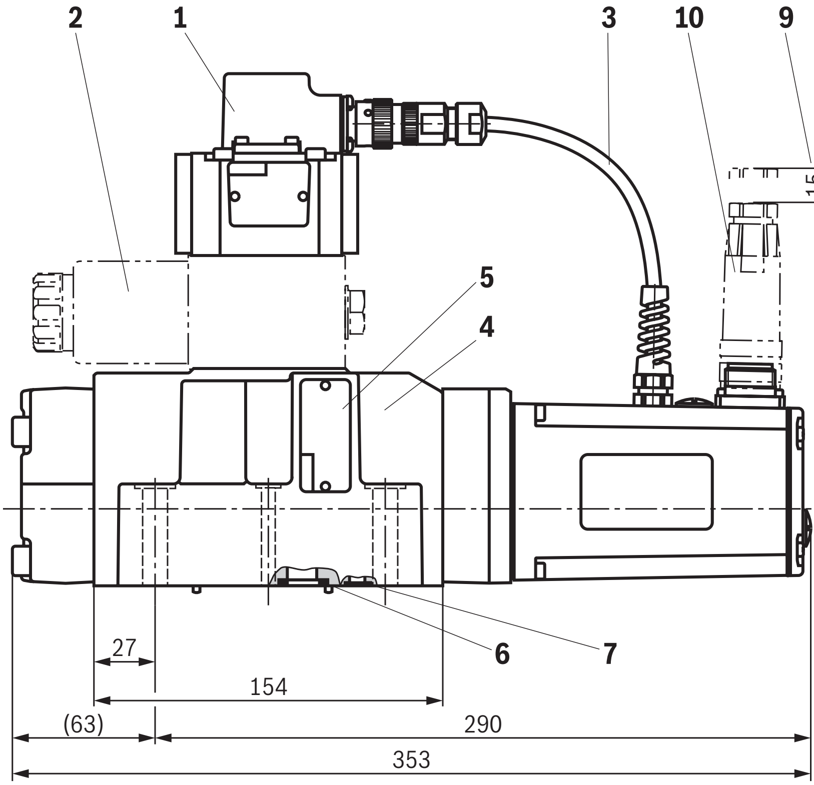
1 Pilot control valve
2 Directional sandwich plate valve (only included with version "WG")
3 Cabling
4 Main stage
5 Name plate
6 Identical seal rings for ports A, B, P, T and T1
7 Identical seal rings for ports X and Y
8 Machined valve contact surface; porting pattern according to ISO 4401-05-05-0-05 (ports X and Y as required)
9 Space required to remove the mating connectors
10 Mating connector, separate order, see page 26

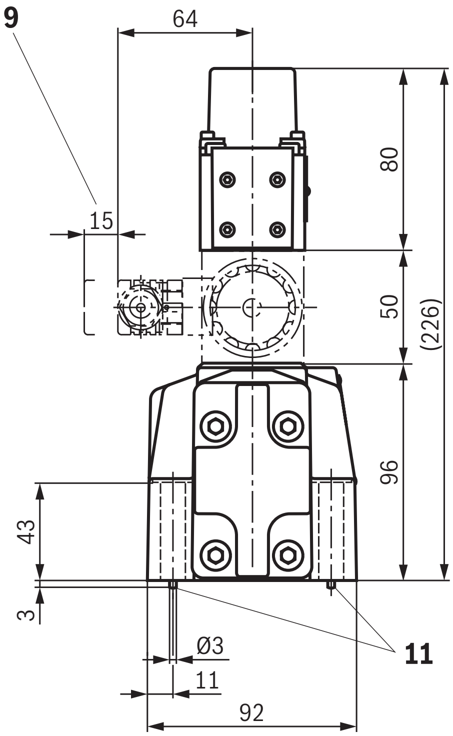
Subplates (separate order) with porting pattern according to ISO 4401-05-05-0-05 see data sheet 45100.

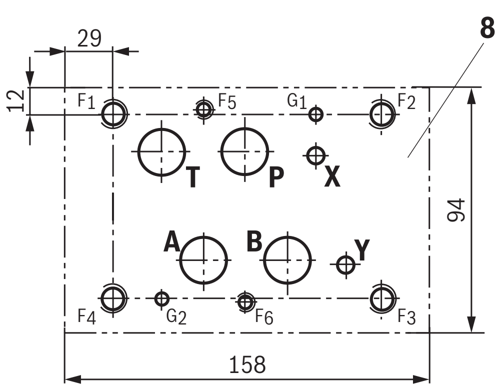
Notice:
The dimensions are nominal dimensions which are subject to tolerances.

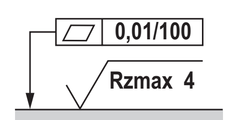
Valve mounting screws see page 25.

Dimensions: Size 16
(dimensions in mm)









Required surface quality
of the valve contact surface

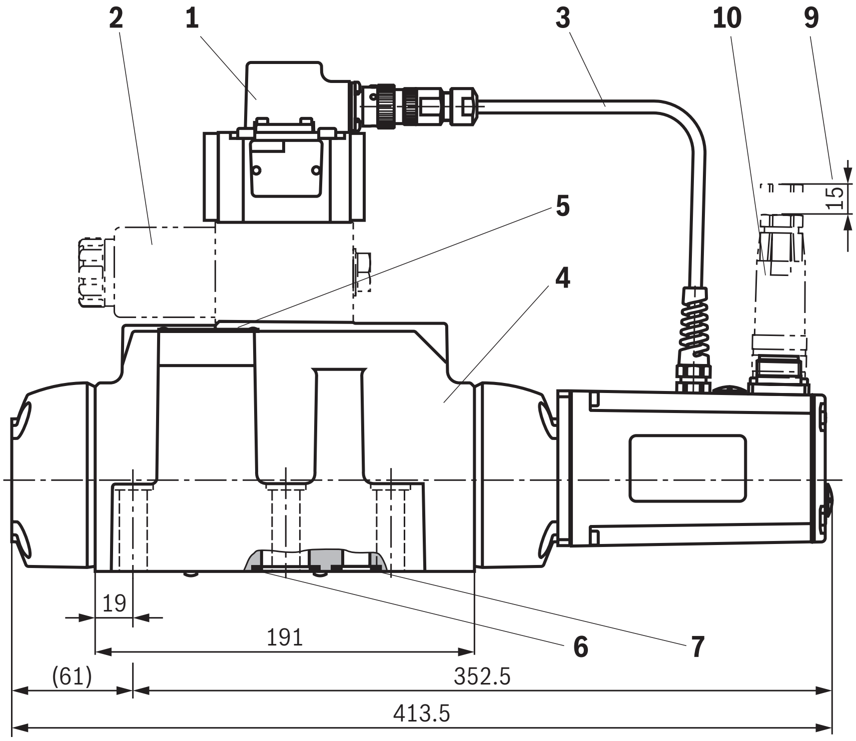
1 Pilot control valve
2 Directional sandwich plate valve (only included with version "WG")
3 Cabling
4 Main stage
5 Name plate
6 Identical seal rings for ports A, B, P, T
7 Identical seal rings for ports X, Y
8 Machined valve contact surface; porting pattern according to ISO 4401-07-07-0-05 (ports X and Y as required)
Deviating from the standard: ports A, B, P, T – Ø20 mm
9 Space required to remove the mating connectors
10 Mating connector, separate order, see page 26
11 Locking pin

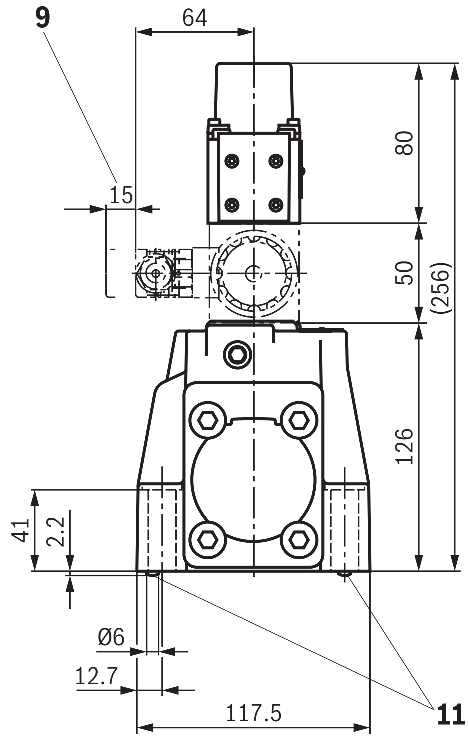
Subplates (separate order) with porting pattern according to ISO 4401-07-07-0-05 see data sheet 45100.

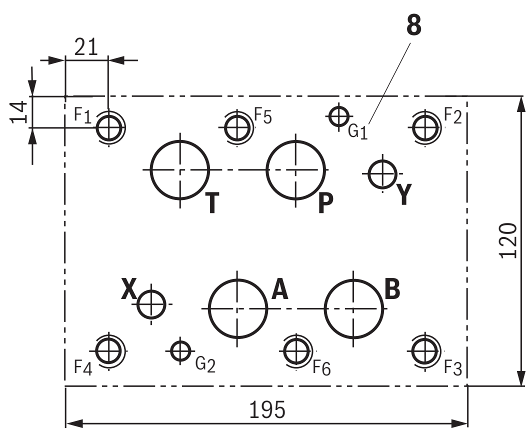
Notice:
The dimensions are nominal dimensions which are subject to tolerances.

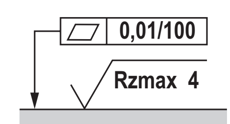
Valve mounting screws see page 25.

Dimensions: Size 25
(dimensions in mm)









Required surface quality
of the valve contact surface

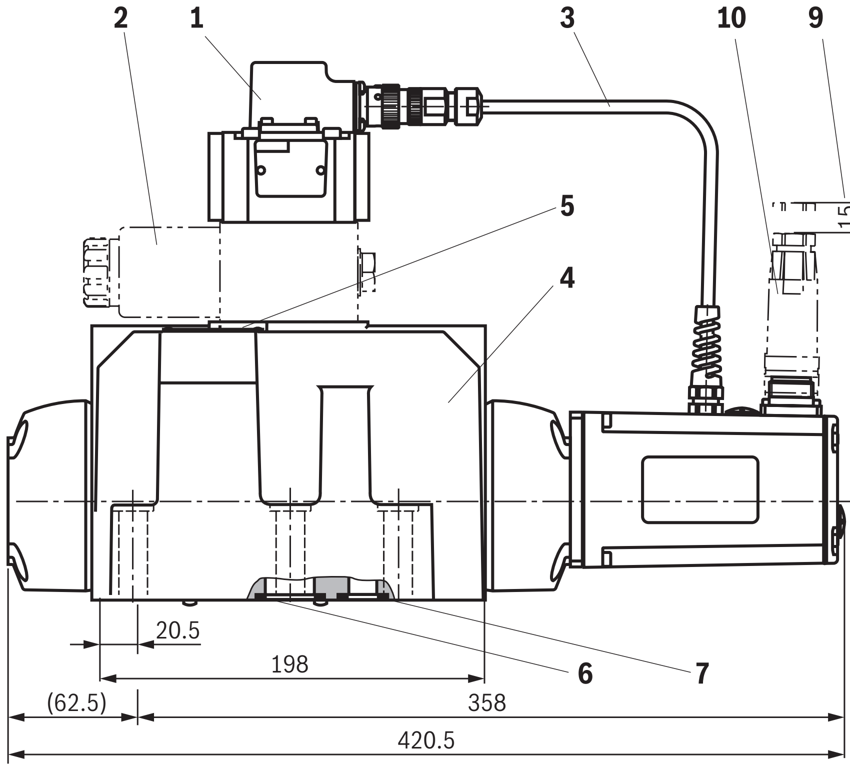
- **1** Pilot control valve
- **2** Directional sandwich plate valve (only included with version "WG")
- **3** Cabling
- **4** Main stage
- **5** Name plate
- **6** Identical seal rings for ports A, B, P, T
- **7** Identical seal rings for ports X, Y
- **8** Machined valve contact surface; porting pattern according to ISO 4401-08-08-0-05 (ports X, Y as required)
- **9** Space required to remove the mating connectors
- **10** Mating connector, separate order, see page 26
- **11** Locking pin

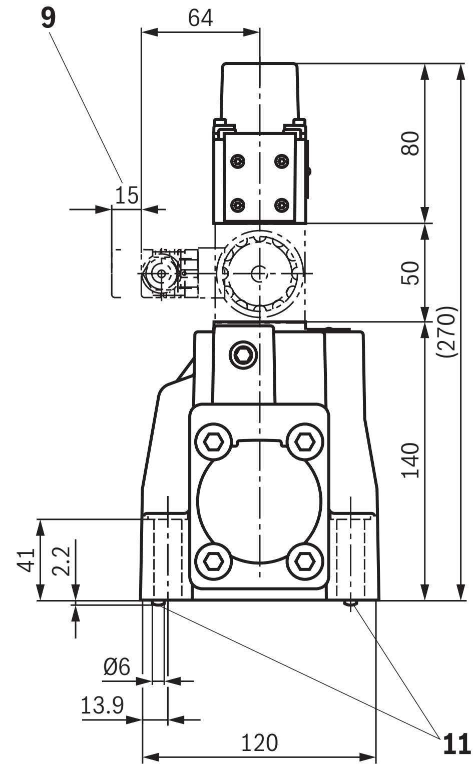
Subplates (separate order) with porting pattern according to ISO 4401-08-08-0-05 see data sheet 45100.

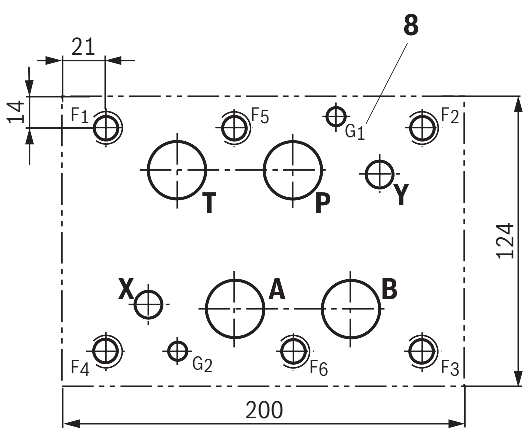
Notice:
The dimensions are nominal dimensions which are subject to tolerances.

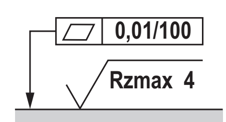
Valve mounting screws see page 25.

Dimensions: Size 27
(dimensions in mm)









Required surface quality
of the valve contact surface

- **1** Pilot control valve
- **2** Directional sandwich plate valve (only included with version "WG")
- **3** Cabling
- **4** Main stage
- **5** Name plate
- **6** Identical seal rings for ports A, B, P, T
- **7** Identical seal rings for ports X, Y
- **8** Machined valve contact surface; porting pattern according to ISO 4401-08-08-0-05 (ports X, Y as required)
  Deviating from the standard: ports A, B, P, T – Ø32 mm
- **9** Space required to remove the mating connectors
- **10** Mating connector, separate order, see page 26
- **11** Locking pin

Subplates (separate order) with porting pattern according to ISO 4401-08-08-0-05 see data sheet 45100.

Notice:
The dimensions are nominal dimensions which are subject to tolerances.

Valve mounting screws see page 25.

Dimensions

Valve mounting screws (separate order)

Size	Quantity	Hexagon socket head cap screws	Material number
10	4	**ISO 4762 - M6 x 45 - 10.9-CM-Fe-ZnNi-5-Cn-T0-H-B** Tightening torque M_A = 13.5 Nm ±10%	**R913043777**
	or		
	4	**ISO 4762 - M6 x 45 - 10.9** Tightening torque M_A = 15.5 Nm ±10%	Not included in the Rexroth delivery range
	or		
	4	**ASME B18.3 - 1/4-20 UNC x 1 3/4" - ASTM-A574** Tightening torque M_A = 15 Nm *[11 ft-lbs]* ±10%	Not included in the Rexroth delivery range
16	2	**ISO 4762 - M6 x 60 - 10.9-CM-Fe-ZnNi-5-Cn-T0-H-B** Tightening torque M_A = 12.2 Nm ±10%	**R913043410**
	4	**ISO 4762 - M10 x 60 - 10.9-flZn/nc/480h/C** Tightening torque M_A = 58 Nm ±20%	**R913014770**
	or		
	2	**ISO 4762 - M6 x 60 - 10.9** Tightening torque M_A = 15.5 Nm ±10%	Not included in the Rexroth delivery range
	4	**ISO 4762 - M10 x 60 - 10.9** Tightening torque M_A = 75 Nm ±20%	
	or		
	2	**ASME B18.3 - 1/4-20 UNC x 2 1/4" - ASTM-A574** Tightening torque M_A = 15 Nm *[11 ft-lbs]* ±10%	Not included in the Rexroth delivery range
	4	**ASME B18.3 - 3/8-16 UNC x 2 1/4" - ASTM-A574** Tightening torque M_A = 60 Nm *[44 ft-lbs]* ±10%	
25, 27	6	**ISO 4762 - M12 x 60 - 10.9-flZn/nc/480h/C** Tightening torque M_A = 100 Nm ±20%	**R913015613**
	or		
	6	**ISO 4762 - M12 x 60** Tightening torque M_A = 130 Nm ±20%	Not included in the Rexroth delivery range
	or		
	6	**ASME B18.3 - 1/2-13 UNC x 2 1/4" - ASTM-A574** Tightening torque M_A = 110 Nm *[81 ft-lbs]* ±10%	Not included in the Rexroth delivery range

☞ **Notice:**
For reasons of stability, exclusively these valve mounting screws may be used. The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure.

Accessories (separate order)

Directional control valve

Mating connectors 6-pole + PE	**Design**	**Design**	**Material number**	**Data sheet**
For the connection of valves with integrated electronics, round connector 6+PE, line cross-section 0.5 … 1.5 mm²	straight	Metal	**R900223890**	08006
	straight	Plastic	**R900021267**	

Cable sets 6-pole + PE	**Length** in m	**Material number**	**Data sheet**
For the connection of valves with integrated electronics, round connector 6+PE, straight connector, shielded, potted-in mating connector, line cross-section 0.75 mm²	3.0	**R901420483**	08006
	5.0	**R901420491**	
	10.0	**R901420496**	
	20.0	**R901448068**	–

Sandwich plate valve

Mating connectors	**Material number**	**Data sheet**
Mating connector according to DIN EN 175301-803, ISO 4400	e.g. **R901017011** (plastic)	08006

Miscellaneous

	Material number
Filter element and seal	**R961001949**

Further information

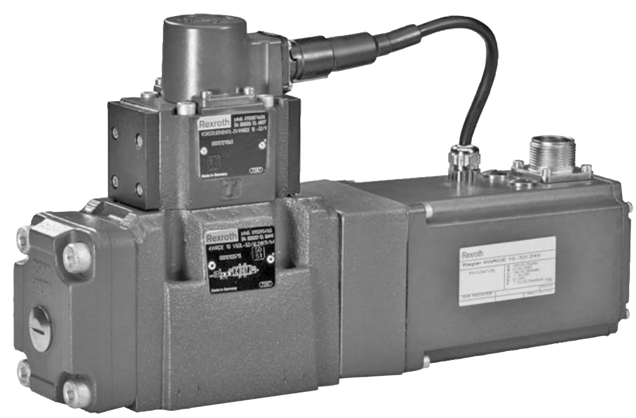
- Hydraulic valves for industrial applications — Data sheet 07600-B
- Directional servo valve with mechanical position feedback — Data sheet 29564
- Subplates — Data sheet 45100
- Hydraulic fluids on mineral oil basis — Data sheet 90220
- Flame-resistant hydraulic fluids - containing water (HFAE, HFAS, HFB, HFC) — Data sheet 90223
- Reliability characteristics according to EN ISO 13849 — Data sheet 08012
- Hexagon socket head cap screw, metric/UNC — Data sheet 08936
- General product information on hydraulic products — Data sheet 07008
- Installation, commissioning and maintenance of servo valves and high-response valves — Data sheet 07700
- Assembly, commissioning and maintenance of hydraulic systems — Data sheet 07900
- Selection of filters
- Information on available spare parts

The Drive & Control Company Rexroth Bosch Group

Directional control valves, pilot-operated, with electrical position feedback and integrated electronics (OBE)

Type 4WRDE

RE 29093
Edition: 2016-04
Replaces: 2012-11



H7443

- Size 10 ... 35
- Component series 5X
- Maximum operating pressure 350 bar
- Maximum flow 3000 l/min

Features

- 4/3-way version
- Subplate mounting
- Porting pattern according to ISO 4401
- Position sensing of the main control spool by means of an inductive position transducer
- 2-stage pilot control valve type 4WS2EM 6-2X/...
- It is particularly suitable for the position, velocity, pressure and force control with high requirements on the dynamics and the response sensitivity

Contents

Ordering code

01	02	03	04	05	06		07		08	09	10	11		12	13	14	15
4	**WRDE**					**–**	**5X**	**/**	**6L**	**24**		**K9**	**/**			**R**	*****

01	4 main ports	**4**
02	Directional control valve	**WRDE**
03	Size 10	**10**
	Size 16	**16**
	Size 25	**25**
	Size 27	**27**
	Size 32	**32**
	Size 35	**35**
04	Symbols e.g. E, E1, W etc.; possible version, see page 3	

Rated flow

05	**– Size 10**	
	25 l/min	**25** 1)
	50 l/min	**50**
	90 l/min	**100**
	– Size 16	
	125 l/min	**125**
	200 l/min	**200**
	– Size 25	
	220 l/min	**220**
	350 l/min	**350**
	– Size 27	
	500 l/min	**500**
	– Size 32	
	400 l/min	**400**
	600 l/min	**600**
	– Size 35	
	1000 l/min	**1000**

Flow characteristic

06	Linear	**L**
	Linear with fine control range	**P**
07	Component series 50 ... 59 (50 ... 59: unchanged installation and connection dimensions)	**5X**

Pilot control valve

08	Servo valve control NG6 (data sheet 29564)	**6L**
09	Direct voltage 24 V	**24**

Pilot oil flow

10	Pilot oil supply external, pilot oil return external	**no code**
	Pilot oil supply internal, pilot oil return external	**E**
	Pilot oil supply internal, pilot oil return internal	**ET**
	Pilot oil supply external, pilot oil return internal	**T**

Electrical connection

11	**Without** mating connector, with connector	**K9** 2)
12	**Without** directional sandwich plate valve	**no code**
	With directional sandwich plate valve 24 V = mating connector Z4	**WG152** 2)

Seal material

Ordering code

01	02	03	04	05	06		07		08	09	10	11		12	13	14	15
4	WRDE					–	5X	/	6L	24		K9	/			R	*

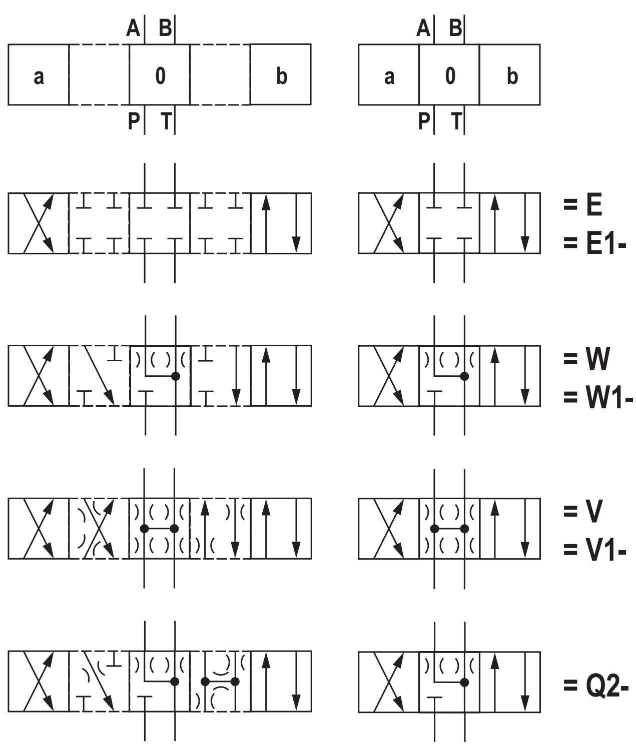
13	NBR seals	**M**
	FKM seals	**V**

14	R-rings	**R**

15	For further information, see the plain text	

1) Only with symbols E-, W- and V and with version "L".
2) Mating connectors, separate order, see page 21.

Symbols

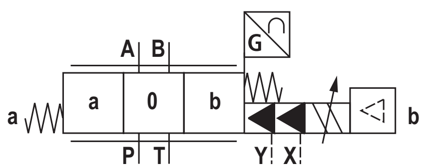
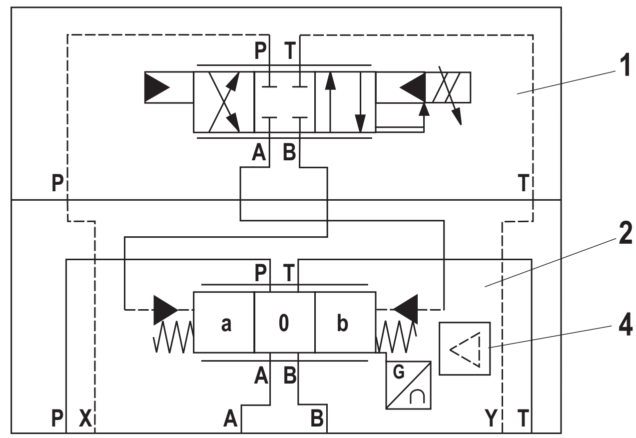
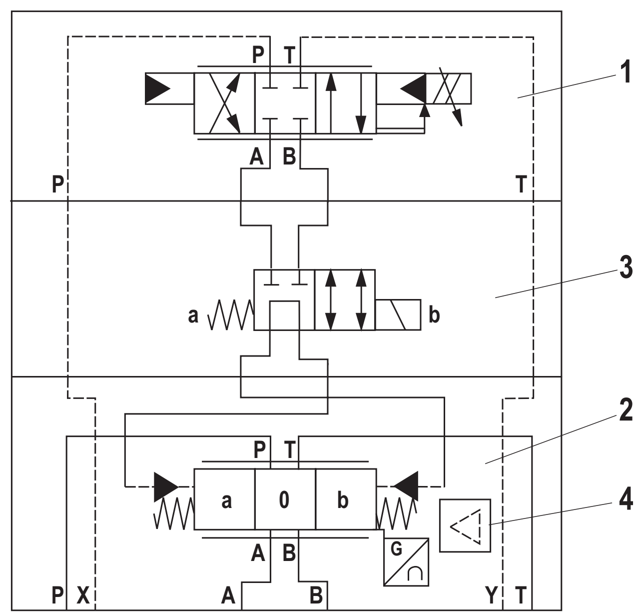
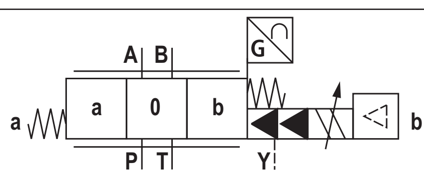
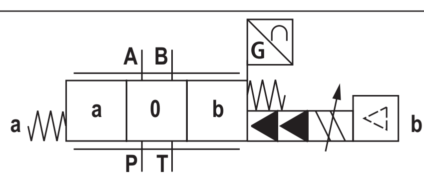
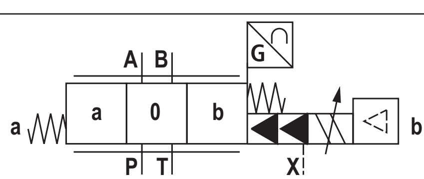


With symbol E1–, W1– and V1–:

P → A: $q_{V\ max}$ B → T: $q_V/2$
P → B: $q_V/2$ A → T: $q_{V\ max}$

Notices:
- Representation according to DIN ISO 1219-1. Hydraulic interim positions are shown by dashes.
- With symbols W and W1- there is a connection from A to T and B to T with approx. 3% of the relevant nominal cross-section in zero position.

Symbols

Version	simplified	detailed
"no code"		 
"E"		
"ET"		
"T"		

1 Pilot control valve
2 Main valve
3 Directional sandwich plate valve
4 Integrated electronics (OBE)

Function, section

Valves of type 4WRDE are 3-stage directional control valves.
They control the quantity and direction of a flow and are mainly used in control loops for different tasks.
They consist of the following assemblies:

- The 2-stage pilot control valve consisting of the control motor (1) and a hydraulic amplifier (5) designed as nozzle flapper plate valve and the control spool socket unit (6) as flow amplifier stage for actuating the 3rd stage (7).
- The 3rd stage (7) for flow control.
- An inductive position transducer (8) the core (9) of which is attached to the control spool (10) of the 3rd stage.

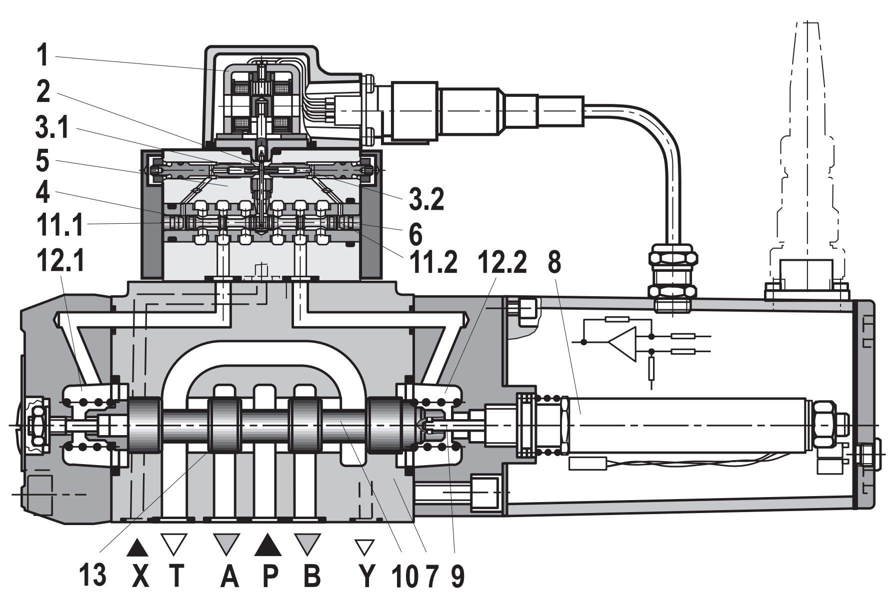
The position of the control spool (10) is measured by an inductive position transducer (8). The signal linking of the valve control loop, the supply of the position measurement system and the control of the pilot control valve are carried out via control electronics integrated in the valve. The voltage difference created by the command/actual value comparison is amplified in the control electronics and supplied to the 1st stage of the valve as control deviation. This signal deflects the flapper plate (2) between the two control nozzles (3.1, 3.2). This creates a pressure differential between the two control chambers (11.1, 11.2). The control spool (4) is moved and releases a corresponding flow into the control chamber (12.1 or 12.2). The control spool (10) with the core (9) of the inductive position transducer (8) attached to it is displaced until the actual value corresponds to the command value. In the compensated condition, the control spool (10) is held in the position specified by the command value.

The control spool stroke is proportional to the command value. For the control of the flow, a corresponding control opening results, depending on the position of the control spool (10) to the control edges (13), to which the flow is proportional. The valve dynamics are optimized via the electric gain. The control electronics is integrated in the valve (oscillator, demodulator).

Valve particularities

- The 3rd stage is basically set-up of modules of our proportional valves.
- With V control spools, the control edges of control spools and housings are ground in to each other.
- When the pilot control valve or the control electronics are exchanged, they are to be re-adjusted. All adjustments may be implemented by instructed experts only.
- The pilot control valve may only be maintained by Bosch Rexroth employees. An exception to this is the replacement of the filter and the sealing according to accessories list. It has to be ensured that during the assembly, the sealing is properly seated and the plug screw is tightened.
  The tightening torque for the plug screw is 30 Nm.

Notice:
Changes in the zero point may result in damage to the system and may only be implemented by instructed specialists.



Technical data
(For application outside these values, please consult us!)

general								
Size			10	16	25	27	32	35
Weight		kg	6.8	8.9	15.2	15.5	35.2	71
Installation position and commissioning information			Preferably horizontal, see data sheet 07700					
Storage temperature range		°C	−20 ... +80					
Ambient temperature range		°C	−20 ... +60					

hydraulic 1)								
Maximum operating pressure	▶ Port A, B, P							
	– External pilot oil supply 2)	bar	350	350	350	250	350	350
	▶ Port X	bar	25 ... 250			25 ... 210	25 ... 250	
	▶ Port A, B, P							
	– Internal pilot oil supply	bar	25 ... 250			25 ... 210	25 ... 250	
Maximum return flow pressure	▶ Port T							
	– Internal pilot oil supply	bar	Pressure peaks < 100 admissible					
	– External pilot oil supply	bar	315	250	250	210	250	250
	▶ Port Y							
	– Internal pilot oil supply	bar	Pressure peaks < 100 admissible					
Rated flow q_{Vnom} (complete valve) ±10% with valve pressure differential Δp = 10 bar and symbol V		l/min	25 50 90	– 125 200	– 220 350	– – 500	– 400 600	– – 1000
Recommended maximum flow		l/min	170	460	870	1000	1600	3000
Pilot oil flow at port X or Y with stepped input signal from 0 to 100% (250 bar)		l/min	8.8	13.5	17.4	17.4	32.5	45.3
Zero flow (at 100 bar)	▶ Main stage							
	– Symbol V, V1	l/min	4.3	5.8	8.1	8.1	10.7	12.8
	– Symbol Q2	l/min	2.2	2.9	4.1	4.1	5.4	6.4
	▶ Main stage and pilot control valve							
	– Symbol V, V1	l/min	5.5	6.6	9	9	11.7	13.8
	– Symbol Q2	l/min	2.9	3.8	4.9	4.9	6.3	7.4
Hydraulic fluid			See table page 7					
Hydraulic fluid temperature range (at the valve working ports)		°C	−20 ... +80; preferably +40 ... +50					
Viscosity range		mm^2/s	20 ... 380					
Maximum admissible degree of contamination of the hydraulic fluid Cleanliness class according to ISO 4406 (c)			Pilot control valve: Class 18/16/13 3) Main stage: Class 20/18/15 3)					
Hysteresis		%	≤ 0.2					
Response sensitivity		%	≤ 0.1					
Zero point calibration (ex works) 4)		%	≤ 1					
Zero shift upon change of:	▶ Hydraulic fluid temperature	%/20 °K	≤ 0.7					
	▶ Operating pressure	%/100 bar	≤ 0.5					
	▶ Return flow pressure 0 ... 10% of p	%	≤ 0.2					

1) Measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C.

2) For a perfect system behavior, we recommend an external pilot oil supply for pressures above 210 bar.

3) The cleanliness classes stated for the components need to be maintained in hydraulic systems. Effective filtration prevents faults and at the same time increases the life cycle of the components.

4) Related to the pressure-signal characteristic curve (symbol V).

Technical data
(For application outside these values, please consult us!)

Hydraulic fluid		Classification	Suitable sealing materials	Standards	Data sheet
Mineral oils		HL, HLP	NBR, FKM	DIN 51524	90220
Flame-resistant	▶ Containing water	HFC (Fuchs Hydrotherm 46M, Petrofer Ultra Safe 620)	NBR	ISO 12922	90223

Important information on hydraulic fluids:
- For more information and data on the use of other hydraulic fluids, please refer to the data sheets above or contact us.
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.).
- The flash point of the hydraulic fluid used must be 40 K higher than the maximum solenoid surface temperature.

- **Flame-resistant – containing water**:
  - Maximum pressure differential per control edge 175 bar
  - Pressure pre-loading at the tank port > 20% of the pressure differential, otherwise increased cavitation
  - Life cycle as compared to operation with mineral oil HL, HLP 50 to 100%

electric	
Voltage type	Direct voltage
Type of signal	Analog
Protection class according to EN 60529	IP 65 with mating connector mounted and locked
Control electronics	Integrated in the valve

Electrical connections, assignment

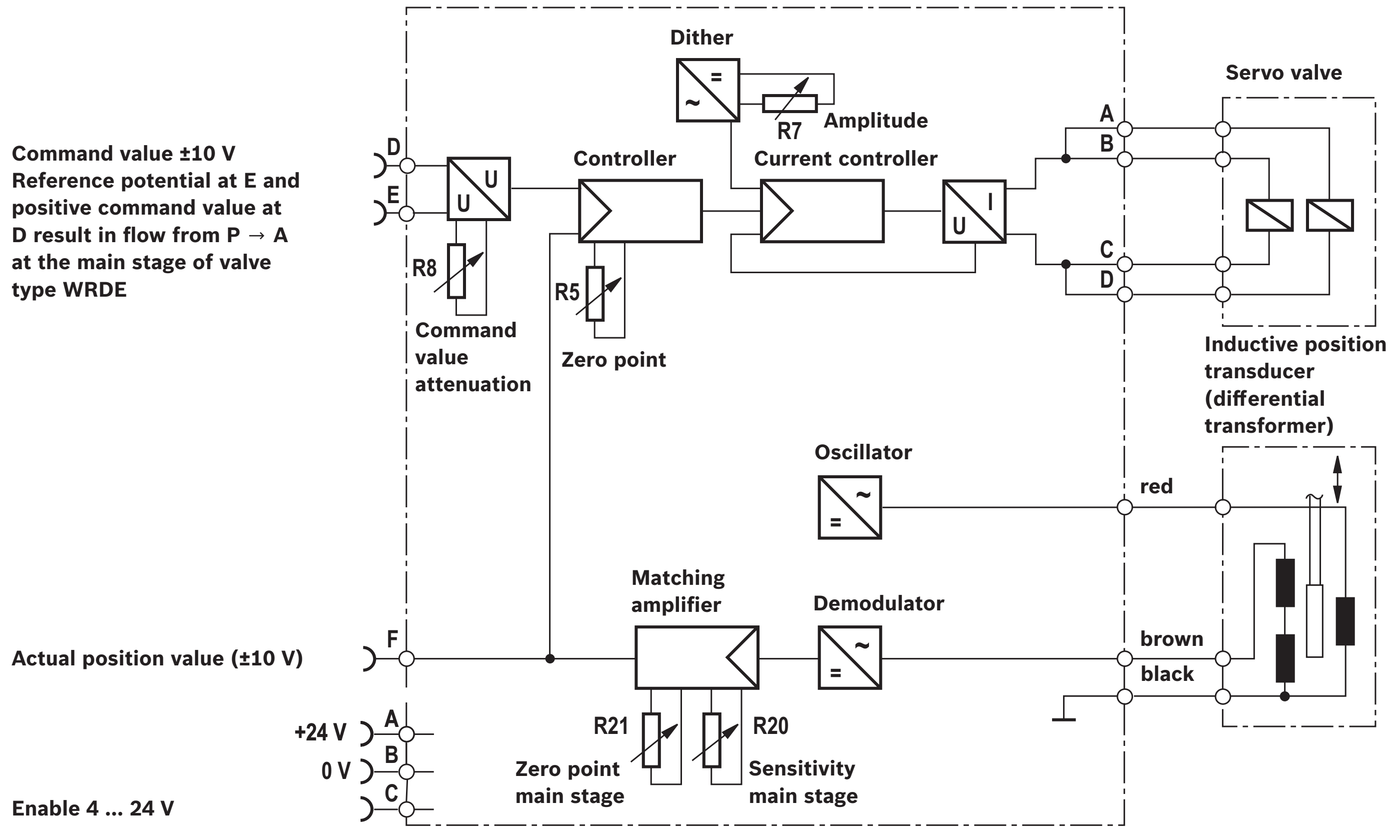
Contact	Signal	Connector pin assignment
A	24 VDC (20 ... 28 VDC); full bridge rectification smoothened with 2200 μF; I_{max} = 270 mA	Supply voltage
B	0 V	
C	4 to 24 VDC	Enable [1] (activates the valve control loop)
D	±10 V [2; 3]	Differential amplifier input (command value)
E		
F	±10 V (to contact "B")	Actual value

[1] With supplied hydraulic pressure and **deactivated enable**, the control spool of the main stage is moved into the end position and the cylinder axis leaves its position at **maximum velocity**. If a "WG152" directional sandwich plate valve is used between pilot control valve and main stage, the control chambers are unloaded from the pilot control valve to the main control spool and the control spool of the main stage is centered in central position or in a preferred position by springs. Consequently, the cylinder axis leaves its position at **minimum velocity**.

[2] Positive command value at D vis-à-vis E results in flow from P to A at the main stage.

[3] Current input ±10 mA as option, input resistance 1 kΩ; in the ordering code, extend the type by "– 280".

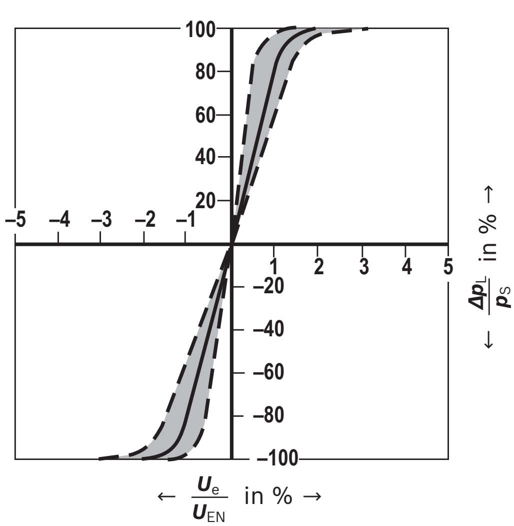
Block diagram of the integrated electronics (OBE)



> ☞ **Notice:**
> Electrical signals provided via control electronics (e.g. actual value or enable) must not be used to switch off safety-relevant machine functions.

Characteristic curves
(measured with HLP46, $\boldsymbol{v}$ = 32 mm²/s and ϑ_{Oil} = 40 ± 5 °C)

Pressure-signal characteristic curve (symbol V; measured with p_s = 100 bar)



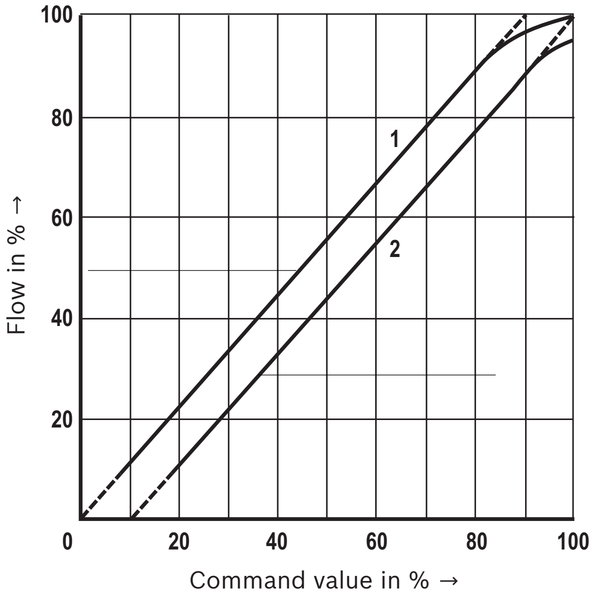
Characteristic curves

(measured with HLP46, ν = 32 mm²/s and ϑ_{Oil} = 40 ± 5 °C)

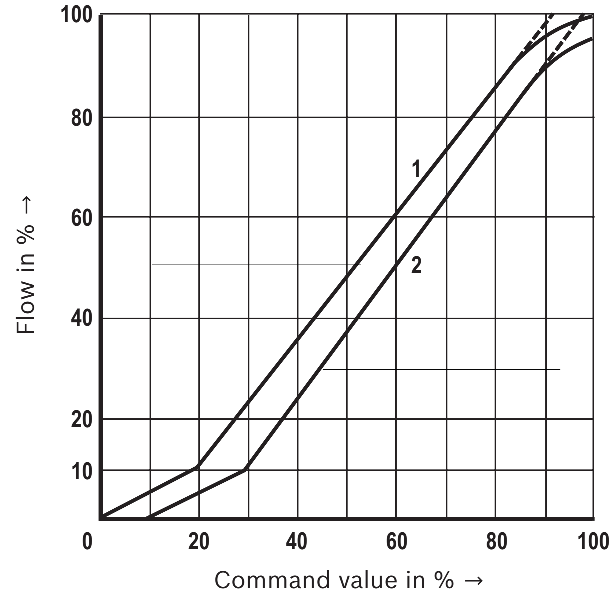
Flow command value function

(at e.g. P → A / B → T and 10 bar valve pressure differential or P → A or A → T and 5 bar per control edge)

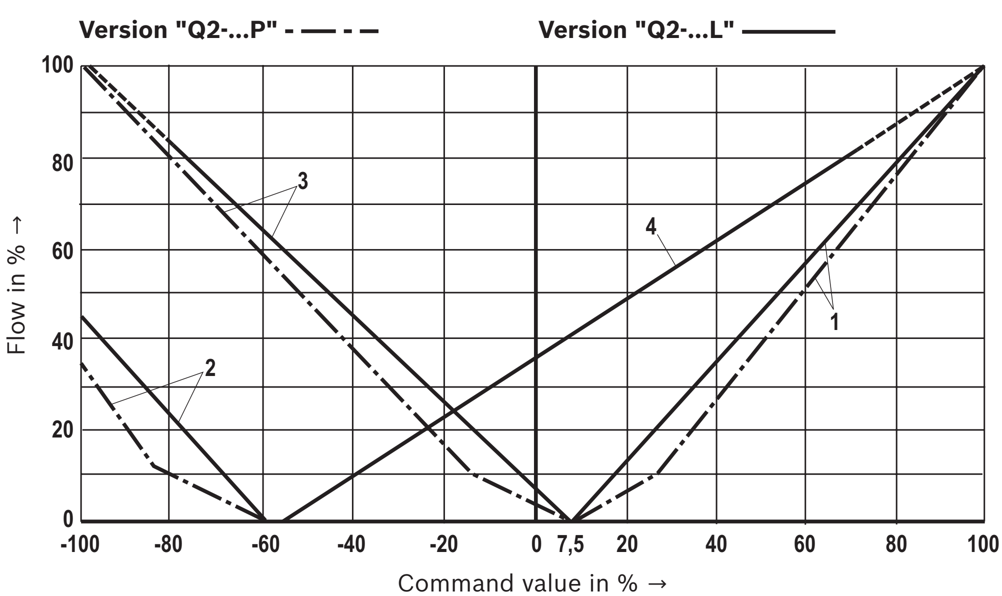
Version "L"



Version "P"



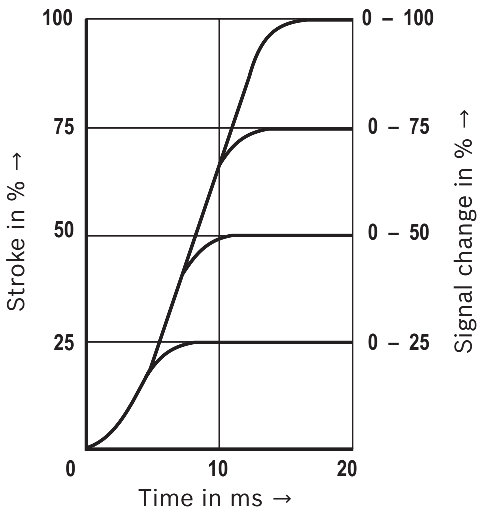
1 Symbol V
2 Symbol E or W



1 P → A
2 P → B
3 A → T
4 B → T

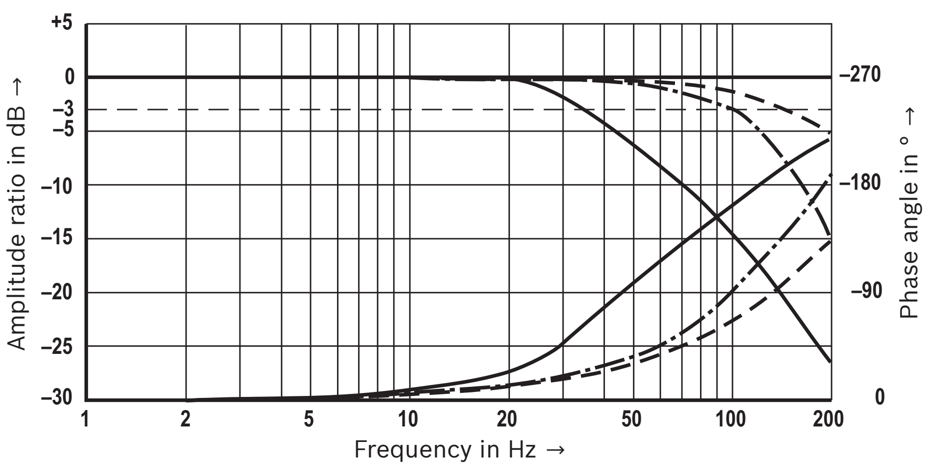
Characteristic curves: Size 10
(measured with HLP46, ϑ_{Oil} = 40 ± 5 °C)

Transition function with stepped electric input signals



Measured with:
- Pilot control valve: Port X = 140 bar
- Main stage: Port P = 10 bar

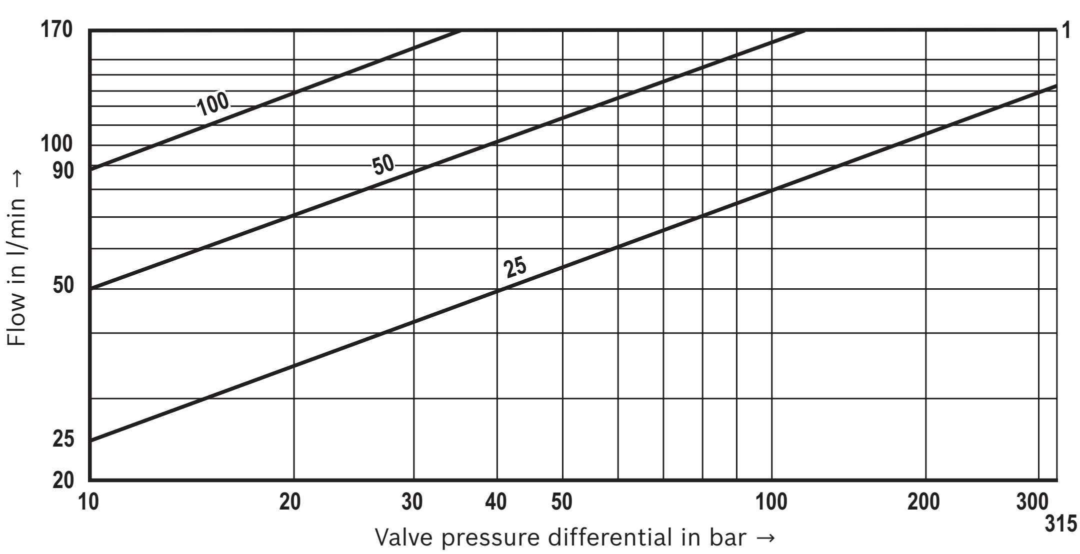
Frequency response characteristic curves



Measured with:
- Pilot control valve: Port X = 140 bar
- Main stage: Port P = 10 bar

Signal ±100%
Signal ±25%
Signal ±5%

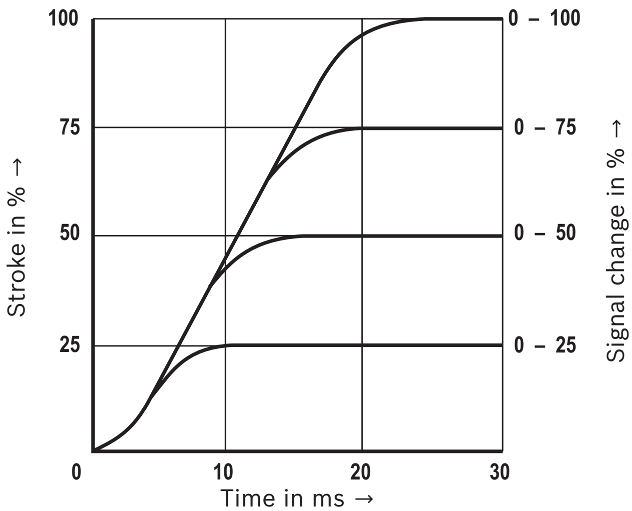
Flow/load function with maximum valve opening (tolerance ±10%)



1 Recommended flow limitation (flow velocity 30 m/s)

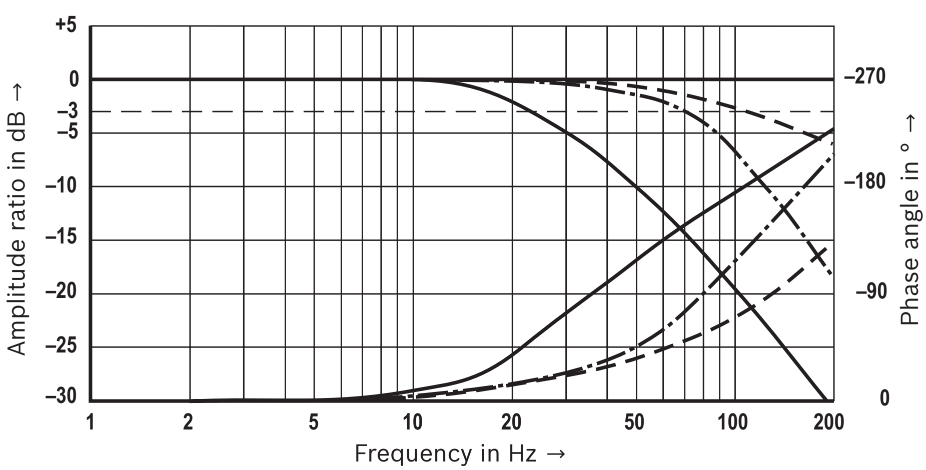
Characteristic curves: Size 16
(measured with HLP46, ϑ_{Oil} = 40 ± 5 °C)

Transition function with stepped electric input signals



Measured with:
- Pilot control valve: Port X = 140 bar
- Main stage: Port P = 10 bar

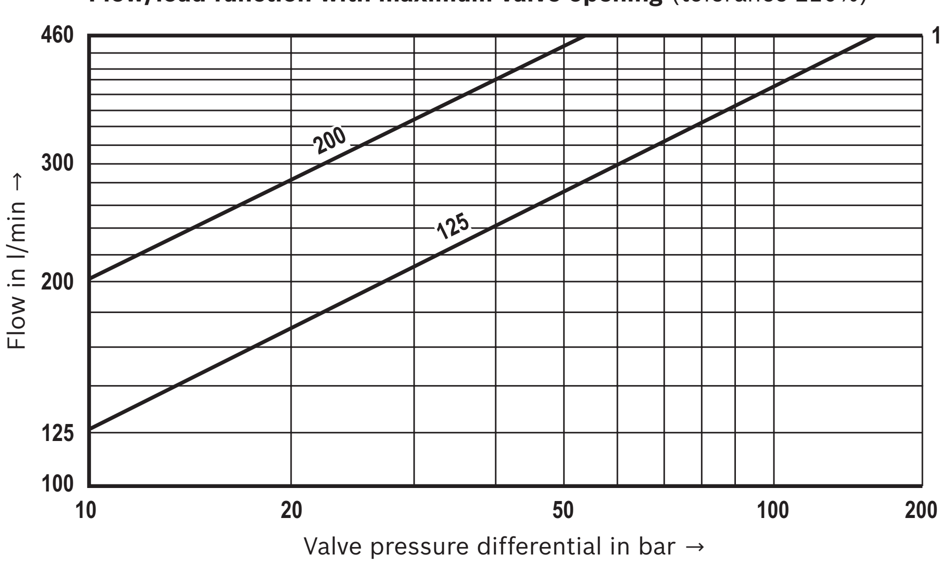
Frequency response characteristic curves



Measured with:
- Pilot control valve: Port X = 140 bar
- Main stage: Port P = 10 bar

Signal ±100%
Signal ±25%
Signal ±5%

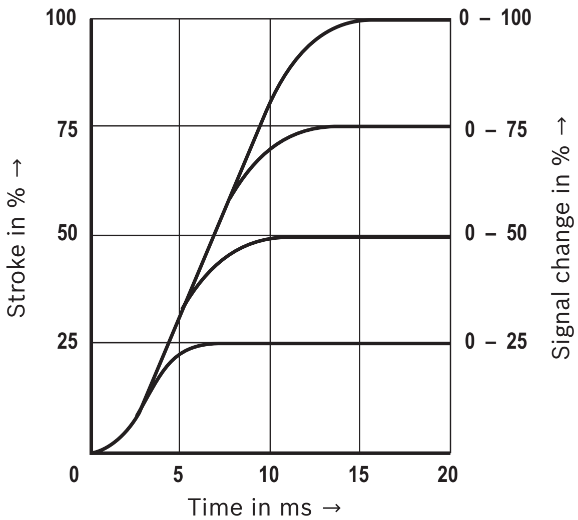
Flow/load function with maximum valve opening (tolerance ±10%)



1 Recommended flow limitation (flow velocity 30 m/s)

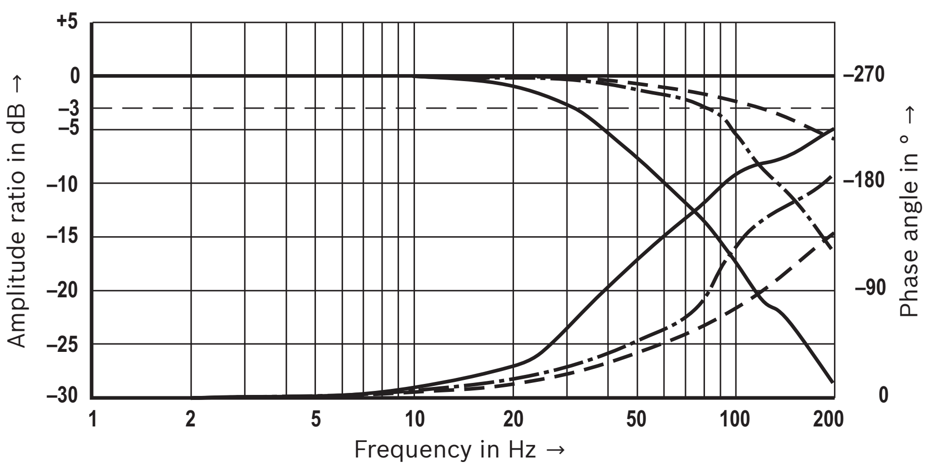
Characteristic curves: Size 25 and 27 (measured with HLP46, ϑ_{Oil} = 40 ± 5 °C)

Transition function with stepped electric input signals



Measured with:
- Pilot control valve: Port X = 140 bar
- Main stage: Port P = 10 bar

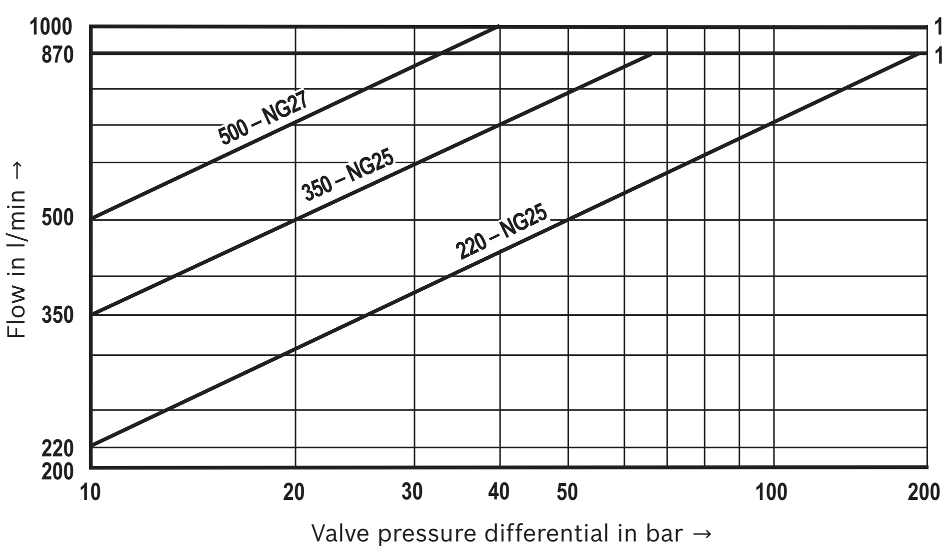
Frequency response characteristic curves



Measured with:
- Pilot control valve: Port X = 140 bar
- Main stage: Port P = 10 bar

Signal ±100%
Signal ±25%
Signal ±5%

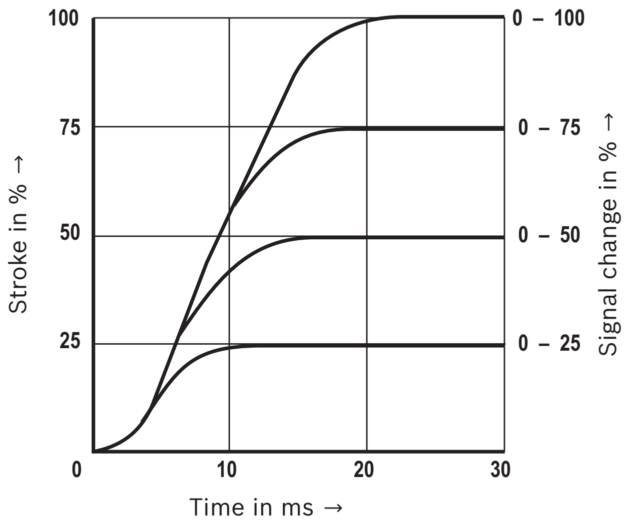
Flow/load function with maximum valve opening (tolerance ±10%)



1 Recommended flow limitation (flow velocity 30 m/s)

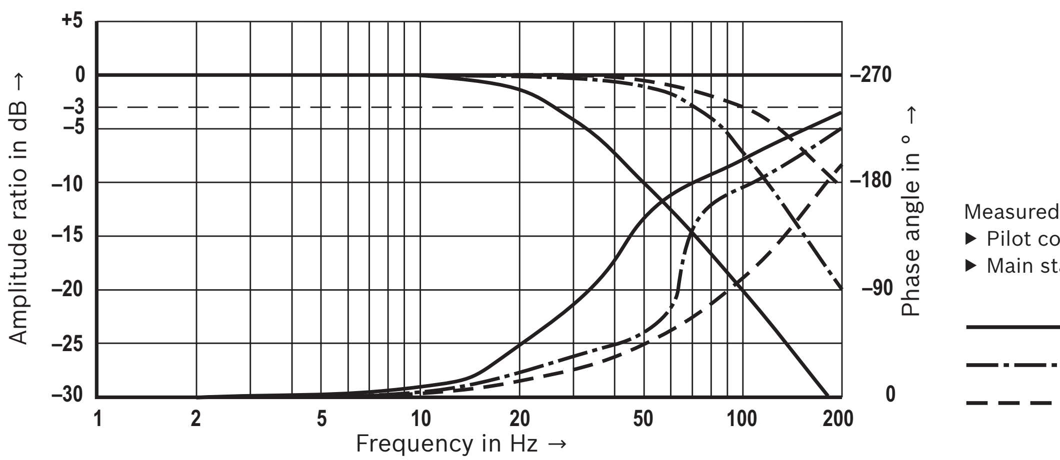
Characteristic curves: Size 32
(measured with HLP46, ϑ_{Oil} = 40 ± 5 °C)

Transition function with stepped electric input signals



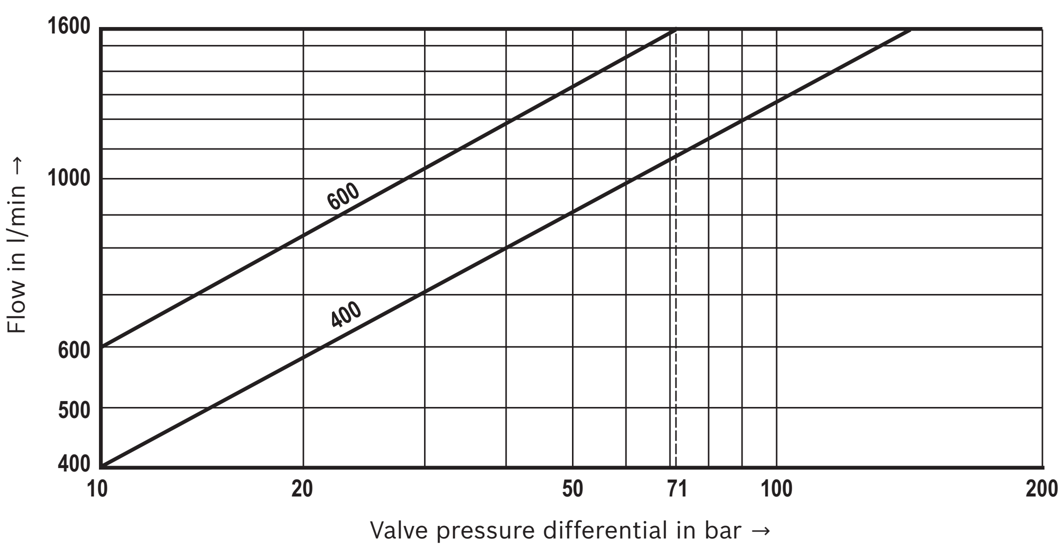
Measured with:
- Pilot control valve: Port X = 140 bar
- Main stage: Port P = 10 bar

Frequency response characteristic curves



Measured with:
- Pilot control valve: Port X = 140 bar
- Main stage: Port P = 10 bar

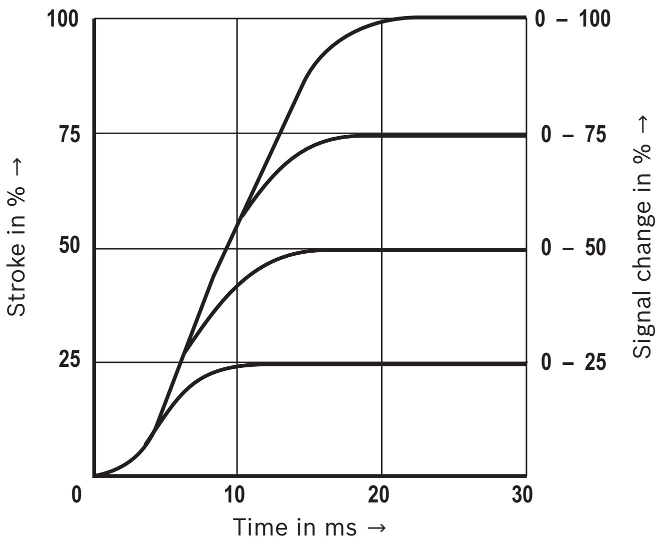
Flow/load function with maximum valve opening (tolerance ±10%)



1 Recommended flow limitation (flow velocity 30 m/s)

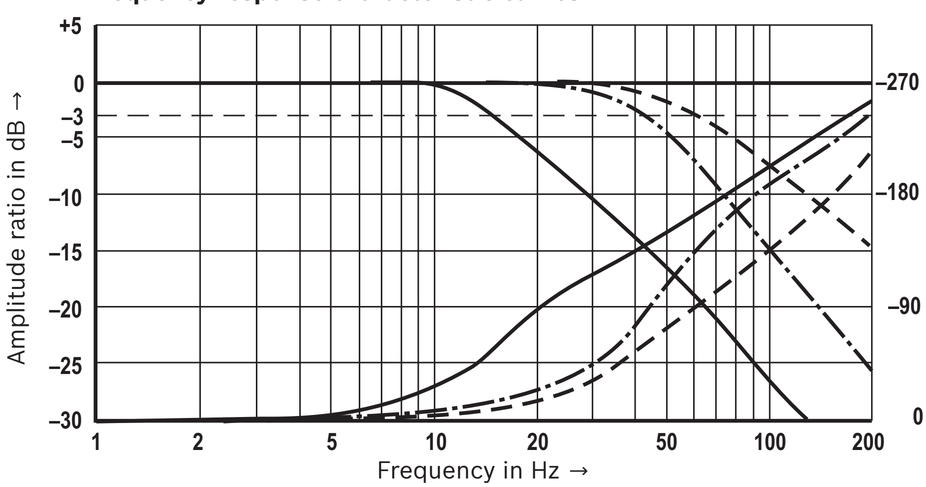
Characteristic curves: Size 35
(measured with HLP46, ϑ_{Oil} = 40 ± 5 °C)

Transition function with stepped electric input signals



Measured with:
- Pilot control valve: Port X = 140 bar
- Main stage: Port P = 10 bar

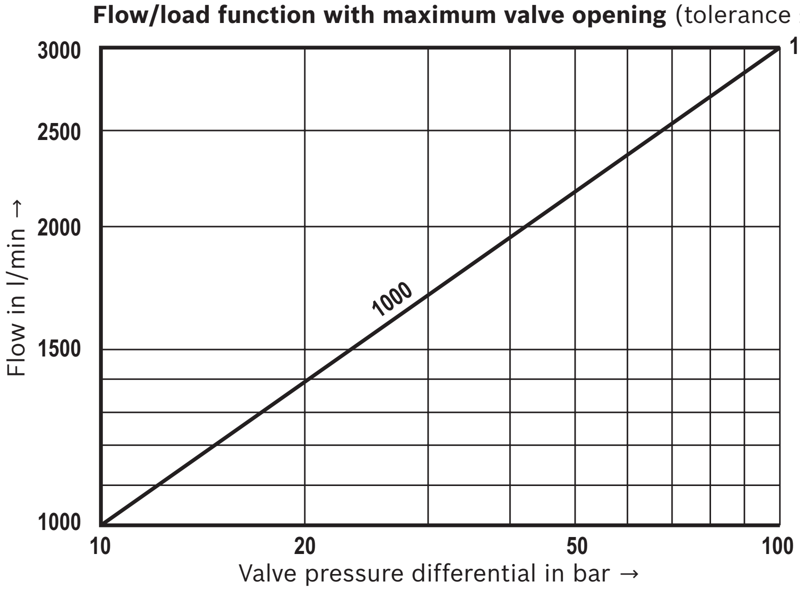
Frequency response characteristic curves



Measured with:
- Pilot control valve: Port X = 140 bar
- Main stage: Port P = 10 bar

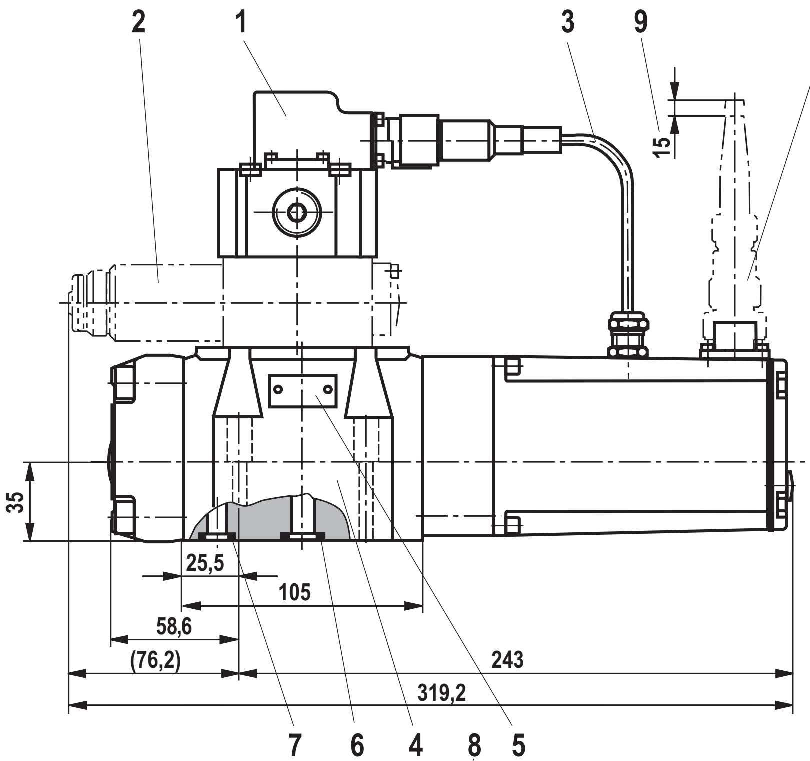
Signal ±100%
Signal ±25%
Signal ±5%

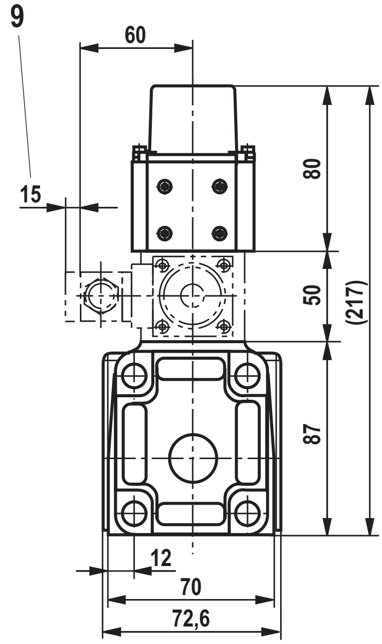
Flow/load function with maximum valve opening (tolerance ±10%)

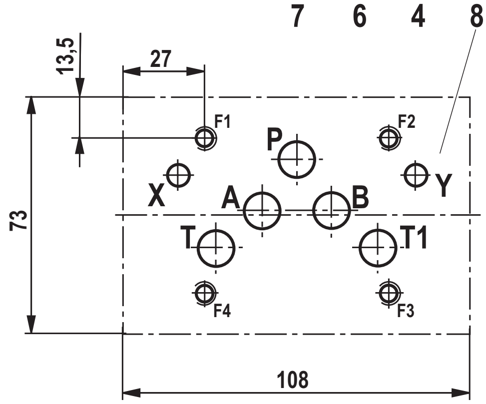


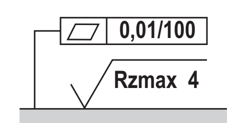
1 Recommended flow limitation (flow velocity 30 m/s)

Dimensions: Size 10
(dimensions in mm)









Required surface quality
of the valve contact surface

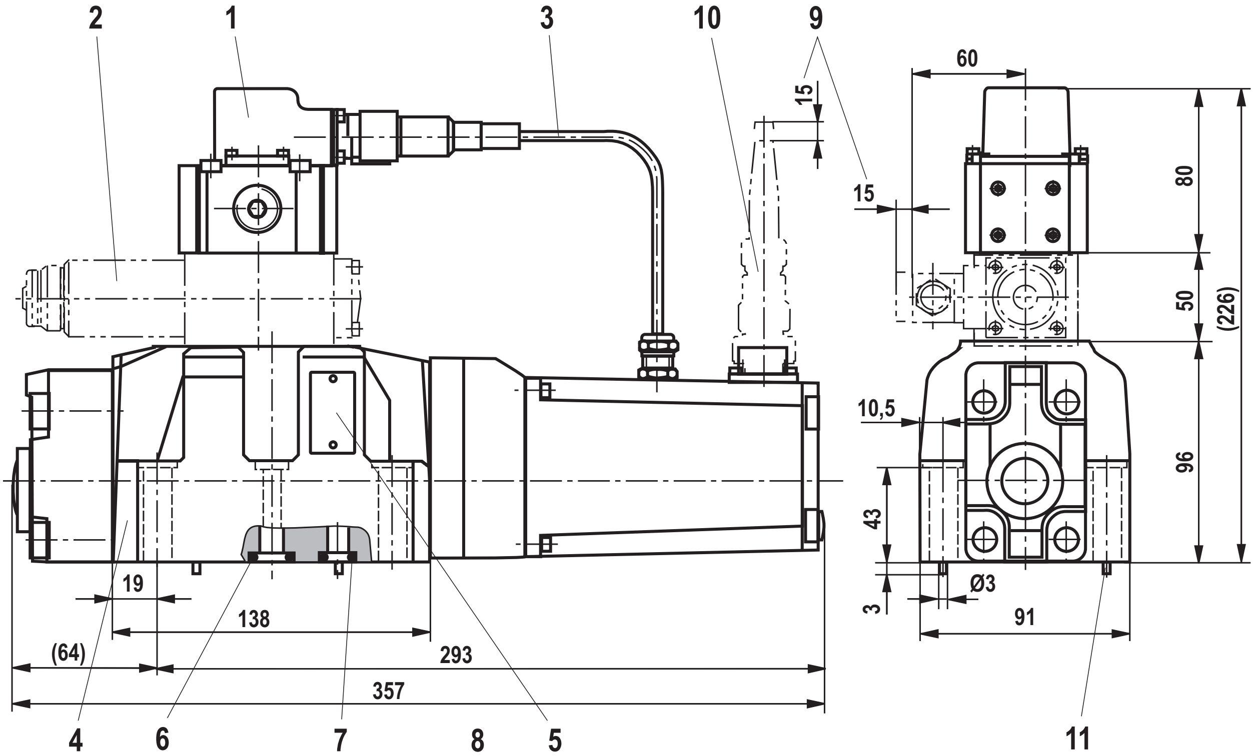
- **1** Pilot control valve
- **2** Directional sandwich plate valve (only included with version "WG152")
- **3** Cabling
- **4** Main stage
- **5** Name plate
- **6** Identical seal rings for ports A, B, P, T and T1
- **7** Identical seal rings for ports X and Y
- **8** Machined valve contact surface; porting pattern according to ISO 4401-05-05-0-05 (ports X and Y as required)
- **9** Space required to remove the mating connectors
- **10** Mating connector, separate order, see page 21

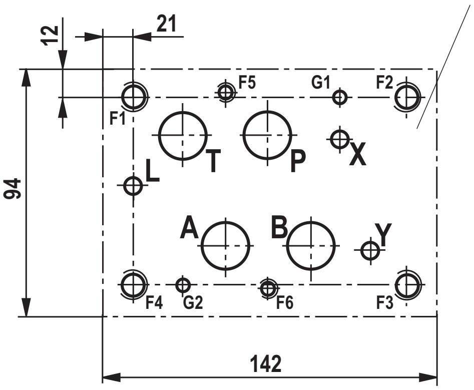
Subplates (separate order) with porting pattern according to ISO 4401-05-05-0-05, see data sheet 45100.

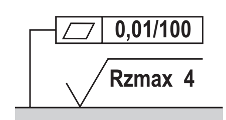
☞ **Notice:**
The dimensions are nominal dimensions which are subject to tolerances.

Valve mounting screws, see page 21.

Dimensions: Size 16
(dimensions in mm)







Required surface quality
of the valve contact surface

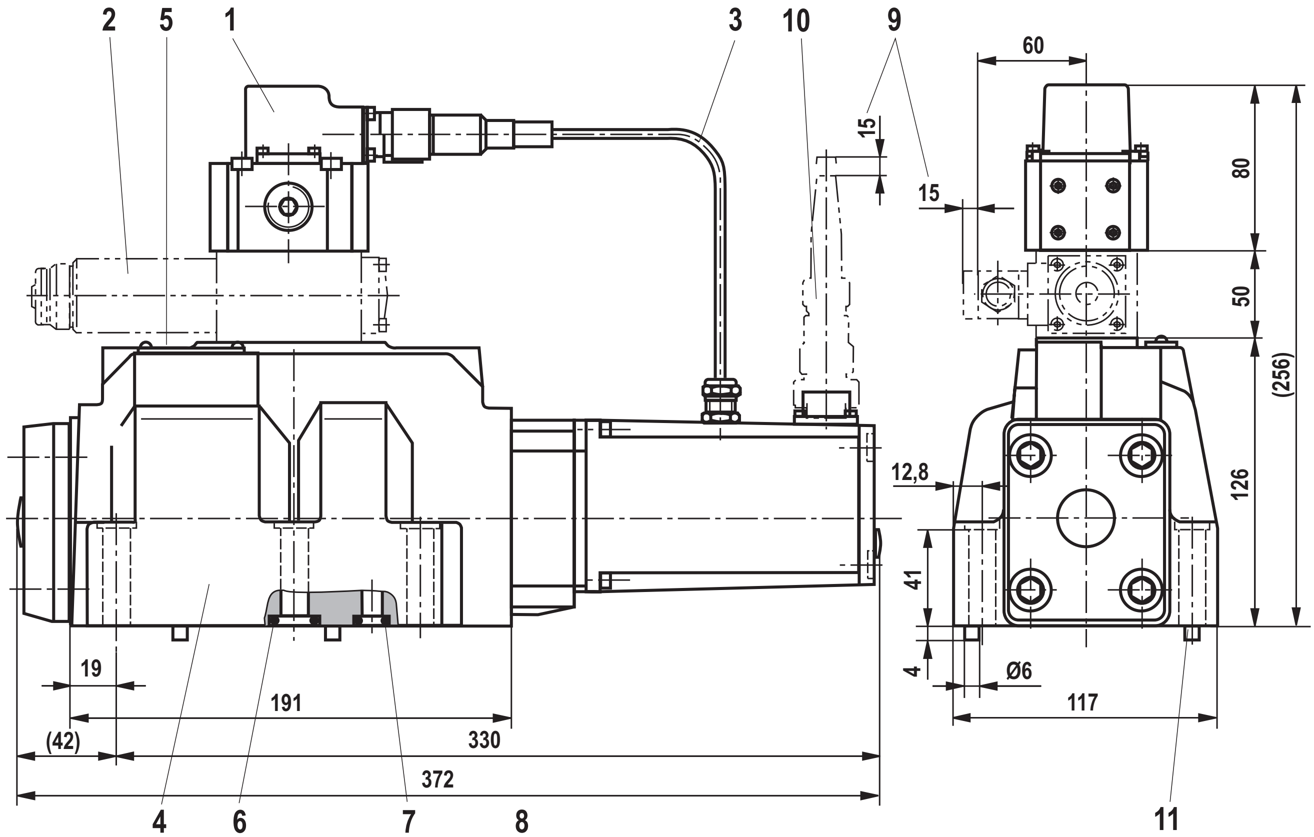
1 Pilot control valve
2 Directional sandwich plate valve (only included with version "WG152")
3 Cabling
4 Main stage
5 Name plate
6 Identical seal rings for ports A, B, P, T
7 Identical seal rings for ports X, Y, and L
8 Machined valve contact surface; porting pattern according to ISO 4401-07-07-0-05 (ports X, Y and L as required)
9 Space required to remove the mating connectors
10 Mating connector, separate order, see page 21
11 Locking pin

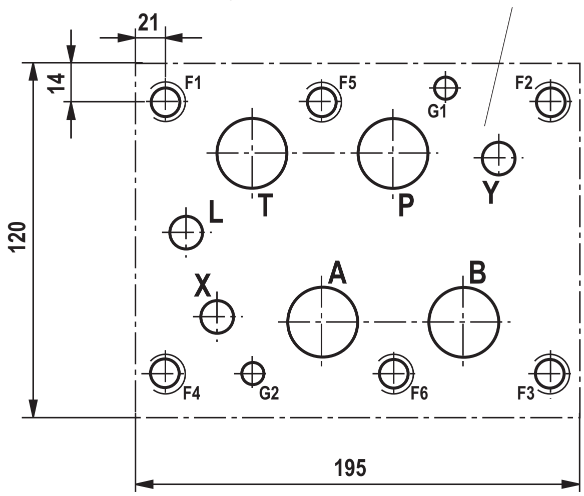
Subplates (separate order) with porting pattern according to ISO 4401-07-07-0-05, see data sheet 45100.

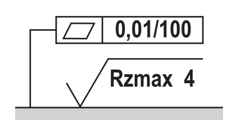
☞ **Notice:**
The dimensions are nominal dimensions which are subject to tolerances.

Valve mounting screws, see page 21.

Dimensions: Size 25
(dimensions in mm)







Required surface quality
of the valve contact surface

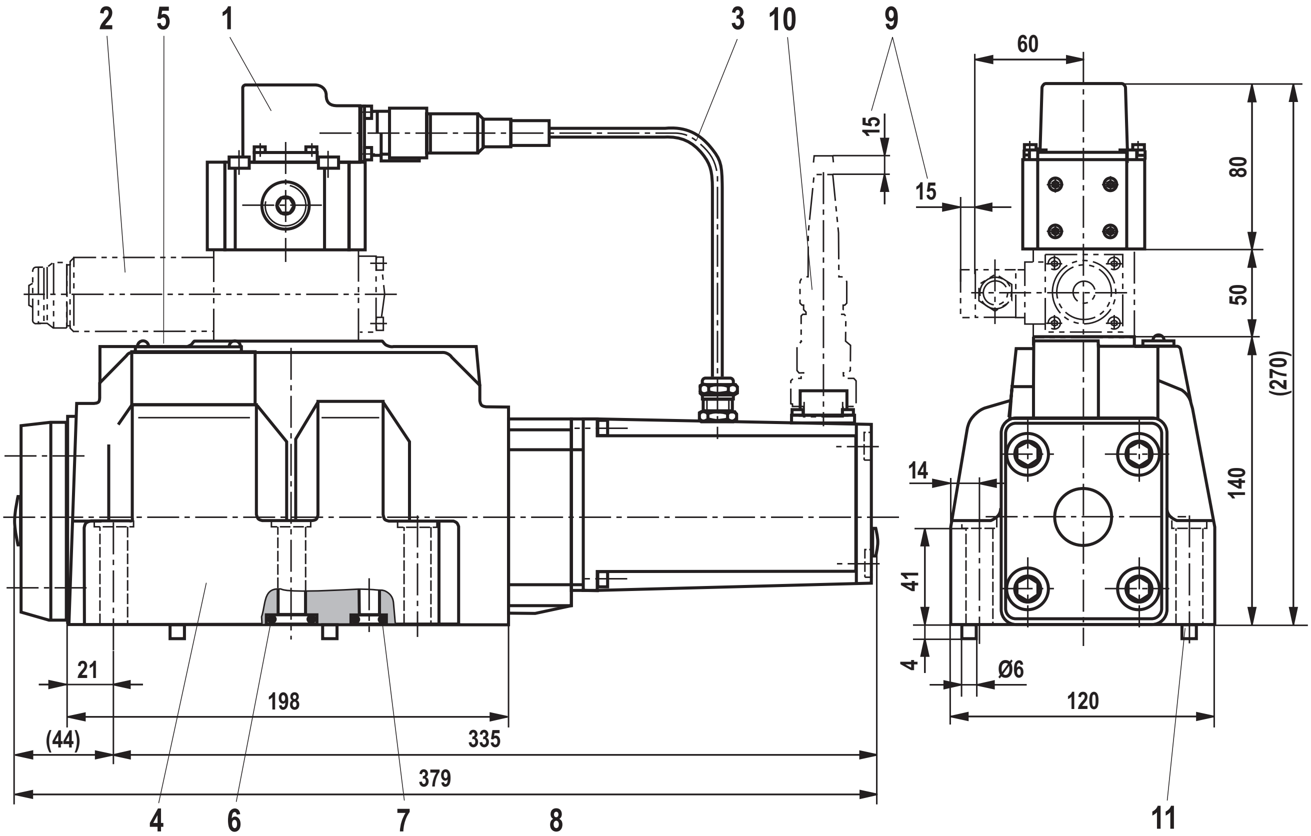
1 Pilot control valve
2 Directional sandwich plate valve (only included with version “WG152”)
3 Cabling
4 Main stage
5 Name plate
6 Identical seal rings for ports A, B, P, T
7 Identical seal rings for ports X, Y, and L
8 Machined valve contact surface; porting pattern according to ISO 4401-08-08-0-05 (ports X, Y and L as required)
9 Space required to remove the mating connectors
10 Mating connector, separate order, see page 21
11 Locking pin

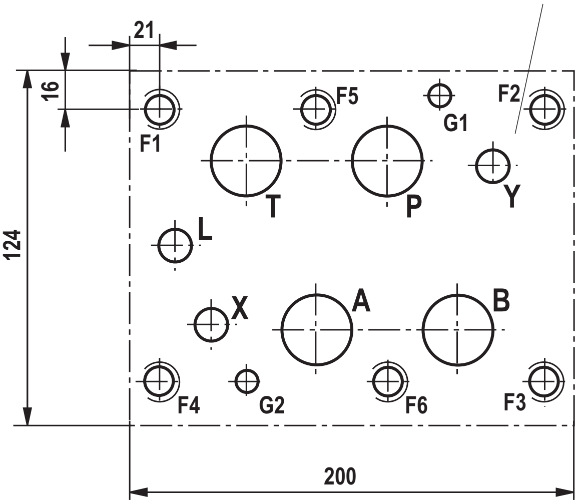
Subplates (separate order) with porting pattern according to ISO 4401-08-08-0-05, see data sheet 45100.

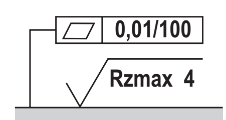
☞ **Notice:**
The dimensions are nominal dimensions which are subject to tolerances.

Valve mounting screws, see page 21.

Dimensions: Size 27
(dimensions in mm)







Required surface quality
of the valve contact surface

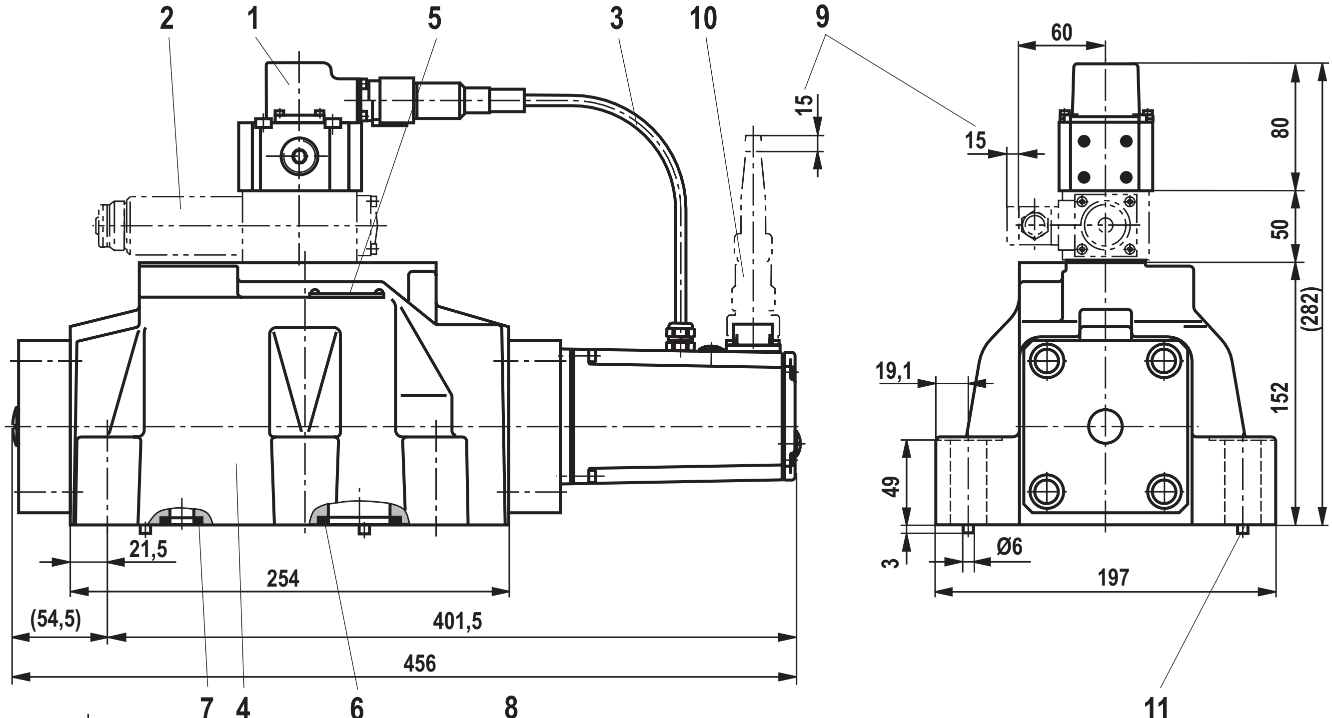
1 Pilot control valve
2 Directional sandwich plate valve (only included with version “WG152”)
3 Cabling
4 Main stage
5 Name plate
6 Identical seal rings for ports A, B, P, T
7 Identical seal rings for ports X, Y, and L
8 Machined valve contact surface; porting pattern according to ISO 4401-08-07-0-05 (ports X, Y and L as required)
Deviating from the standard:
▶ Ports P, A, B, T – Ø32 mm
9 Space required to remove the mating connectors
10 Mating connector, separate order, see page 21
11 Locking pin

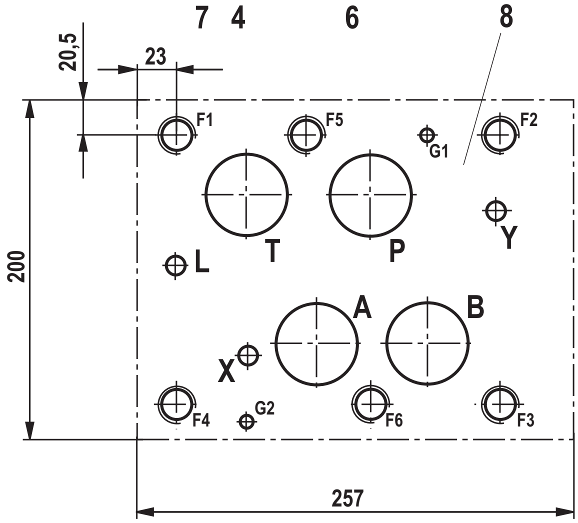
Subplates (separate order) with porting pattern according to ISO 4401-08-07-0-05, see data sheet 45100.

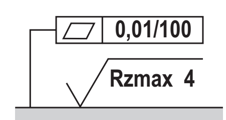
> **Notice:**
> The dimensions are nominal dimensions which are subject to tolerances.

Valve mounting screws, see page 21.

Dimensions: Size 32
(dimensions in mm)







Required surface quality
of the valve contact surface

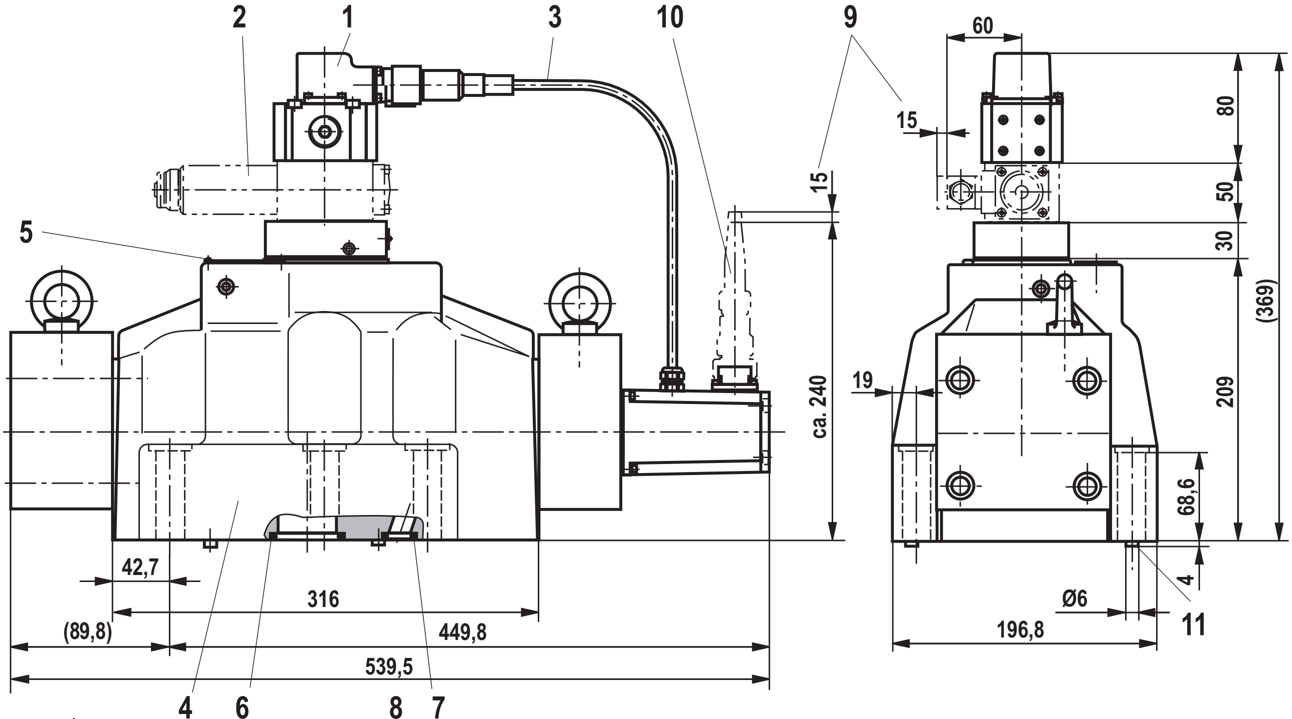
1 Pilot control valve
2 Directional sandwich plate valve (only included with version “WG152”)
3 Cabling
4 Main stage
5 Name plate
6 Identical seal rings for ports A, B, P, T
7 Identical seal rings for ports X, Y, and L
8 Machined valve contact surface, porting pattern according to ISO 4401-10-09-0-05 (ports X, Y and L as required)
9 Space required to remove the mating connectors
10 Mating connector, separate order, see page 21
11 Locking pin

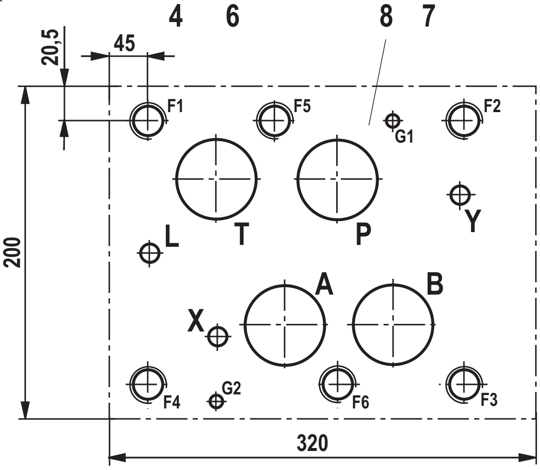
Subplates (separate order) with porting pattern according to ISO 4401-10-09-0-05, see data sheet 45100.

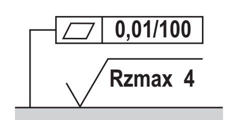
☞ **Notice:**
The dimensions are nominal dimensions which are subject to tolerances.

Valve mounting screws, see page 21.

Dimensions: Size 35
(dimensions in mm)







Required surface quality
of the valve contact surface

1 Pilot control valve
2 Directional sandwich plate valve (only included with version “WG152”)
3 Cabling
4 Main stage
5 Name plate
6 Identical seal rings for ports A, B, P, T
7 Identical seal rings for ports X, Y, and L
8 Machined valve contact surface; porting pattern according to ISO 4401-10-09-0-05 (ports X, Y and L as required)
Deviating from the standard:
▶ Ports P, A, B, T – Ø50 mm
9 Space required to remove the mating connectors
10 Mating connector, separate order, see page 21
11 Locking pin

Subplates (separate order) with porting pattern according to ISO 4401-10-09-0-05, see data sheet 45100.

☞ **Notice:**
The dimensions are nominal dimensions which are subject to tolerances.

Valve mounting screws, see page 21.

Dimensions

Valve mounting screws (separate order)

Size	Quantity	Hexagon socket head cap screws	Material number
10	4	**ISO 4762 - M6 x 45 - 10.9-flZn-240h-L** Tightening torque M_A = 13.5 Nm ± 10%	**R913000258**
16	2	**ISO 4762 - M6 x 60 - 10.9-flZn-240h-L** Tightening torque M_A = 12.2 Nm ± 10%	**R913000115**
	4	**ISO 4762 - M10 x 60 - 10.9-flZn-240h-L** Tightening torque M_A = 58 Nm ± 20%	**R913000116**
25, 27	6	**ISO 4762 - M12 x 60 - 10.9-flZn-240h-L** Tightening torque M_A = 100 Nm ± 20%	**R913000121**
32	6	**ISO 4762 - M20 x 80 - 10.9-flZn-240h-L** Tightening torque M_A = 340 Nm ± 20%	**R901035246**
35	6	**ISO 4762 - M20 x 100 - 10.9-flZn-240h-L** Tightening torque M_A = 360 Nm ± 20%	**R913000386**

☞ **Notice:**
For reasons of stability, exclusively these valve mounting screws may be used. The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure.

Accessories (separate order)

Mating connectors		Data sheet	Material number
Directional control valve	Round connector according to EN 175201-804, 6-pole + PE and 6-pole, compatible with VG 95328	08006	e.g. **R900021267** (plastic) e.g. **R900223890** (metal)
	Compatible with VG95328, size 14-6S		e.g. **R900013159** (plastic)
Sandwich plate valve	Mating connector according to DIN EN 175301-803, ISO 4400		e.g. **R901017011** (plastic)

Miscellaneous	Material number
Filter element and seal	**R961001949**

Further information

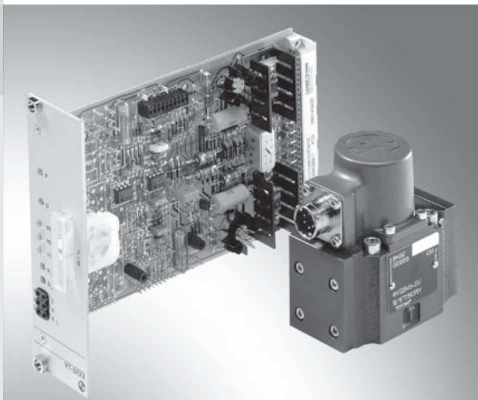
▶ Directional servo valve with mechanical position feedback	Data sheet 29564
▶ Subplates	Data sheet 45100
▶ Hydraulic fluids on mineral oil basis	Data sheet 90220
▶ Flame-resistant hydraulic fluids - containing water (HFAE, HFAS, HFB, HFC)	Data sheet 90223
▶ Reliability characteristics according to EN ISO 13849	Data sheet 08012
▶ Hexagon socket head cap screw, metric/UNC	Data sheet 08936
▶ General product information on hydraulic products	Data sheet 07008
▶ Installation, commissioning and maintenance of servo valves and high-response valves	Data sheet 07700
▶ Hydraulic valves for industrial applications	Data sheet 07600-B
▶ Assembly, commissioning and maintenance of hydraulic systems	Data sheet 07900
▶ Selection of the filters	
▶ Information on available spare parts	

4-way directional servo-valve

RE 29564/09.10
Replaces: 01.07

Type 4WS.2E

Size 6
Component series 2X
Maximum operating pressure 315 bar
Maximum flow 48 l/min



HAD5994

Table of contents

Contents	**Page**

Features

– Valve for controlling position, force, direction or velocity
– 2-stage servo-valve with mechanical feedback
– 1st stage as a nozzle-flapper plate amplifier
– For subplate mounting, porting pattern to ISO 4401-03-02-0-05
  Subplates according to data sheet RE 45052 (separate order)
– Dry torque motor, no contamination of the solenoid gaps through the hydraulic fluid
– Can also be used as 3-way version
– Wear-free spool return element
– Controlling
  • External control electronics in Euro-card format or of modular design (separate order), see page 6
  • or control electronics integrated in the valve (OBE)
– Valve and integrated control electronics are adjusted and tested
– Pressure chambers on the control bush with gap seal, no seal ring wear
– Filter for 1st stage freely accessible from outside, see pages 9 and 10

Ordering code

	6	– 2X	/		B		ET		K17		V	*

Electrically operated 2-stage servo-valve of 4-way design with mechanical feedback

For **external** control electronics **= 4WS2EM**

With **integrated** control electronics (OBE) **= 4WSE2EM**

Size 6 **= 6**

Component series 20 to 29 (20 to 29: unchanged installation and connection dimensions) **= 2X**

Nominal flow 1)

2 l/min	**= 2**
5 l/min	**= 5**
10 l/min	**= 10**
15 l/min	**= 15**
20 l/min	**= 20**
25 l/min	**= 25**

(Observe tolerance field of the flow/signal function, see page 7)

Valves for **external** control electronics 2)

Coil no. 11 (30 mA/85 Ω x per coil) **= 11**

Valves with **integrated** control electronics

Controlling:

Command value ±10 mA **= 8**

Command value ±10 V **= 9**

Further details in clear text

Seal material

V = FKM seals, suitable for mineral oil (HL, HLP) to DIN 51524 6)

Spool overlap 5)

D = 0 to 0.5 % positive

E = 0 to 0.5 % negative

Electrical connection

K17 = Without mating connector, with male connector

Mating connector – separate order, see page 6

Inlet pressure range 4)

210 = 10 to 210 bar

315 = 10 to 315 bar

ET = Internal pilot oil supply and drain 3)

1) **Nominal flow**
The nominal flow refers to a 100 % command value signal at a 70 bar valve pressure differential (35 bar per control land).
The valve pressure differential must be observed as reference variable. Differing valves cause a change in the flow.
It must be noted that the nominal flow tolerance is ±10 % (see flow/signal function on page 7).

2) **Electrical control data**
Valves for **external** control electronics: The actuating signal must be provided by a current-regulated output stage. For servo amplifiers, see page 6.
Valves with **integrated** control electronics: With integrated control electronics, the command value can be provided as voltage (ordering code “9“) or, in the case of large distances of > 25 m between the control and the valve, as current (ordering code “8“).

3) **Pilot oil**
This valve is only available with internal pilot oil supply and drain.

4) **Inlet pressure range**
The system pressure should be as constant as possible.
With regard to dynamics, the frequency relationship must be taken into account within the permissible pressure of 10 to 210 bar or 10 to 315 bar.

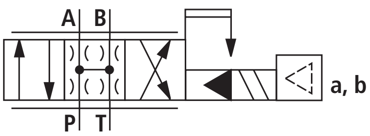
5) **Spool overlap**
The spool overlap in % is referred to the nominal stroke of the control spool.
Further spool overlaps on request.

6) **Seal material**
If you require another seal material, please consult us.

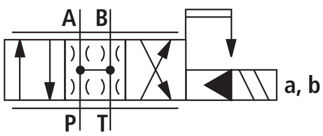
7) **Details in clear text**
Here, you can specify special requirements. These will be verified in the factory after receipt of your order and the type designation supplemented with an assigned number.

Symbols

Valves with OBE
(Example: 4WS**E**2EM 6-2X…ET…)



Valves without OBE
(Example: 4WS2EM 6-2X…ET…)



Function, section

4WS(E)2EM 6-2X/…

Valves of this type are electrically operated, 2-stage directional servo-valves with porting pattern to ISO 4401-03-02-0-05. They are mainly used for the closed-loop control of position, force, pressure or velocity.

These valves consist of an electromechanical converter (torque motor) (1), a hydraulic amplifier (nozzle flapper plate principle) (2) and a control spool (3) in a bush (2nd stage), which is connected to the torque motor via a mechanical feedback.

As a result of an electrical input signal applied at coils (4) of the torque motor, a force is generated by a permanent magnet that acts on armature (5), which generates a torque in conjunction with a bending tube (6). This causes flapper plate (7), which is connected by a pin to the bending tube (6), to be moved from the central position between the two control nozzles (8), and a pressure differential occurs across the front faces of the control spool (3). The pressure differential causes a change in the position of the spool, which results in the connection of the pressure port with an actuator port and, at the same time, in the connection of the other actuator port with the return flow port.

The control spool is connected with the flapper plate or the torque motor with the help of a bending spring (mechanical feedback) (9). The position of the spool is changed until the torque fed back by the bending tube and the electromagnetic torque of the torque motor are balanced, and the pressure differential across the nozzle flapper plate system becomes zero.

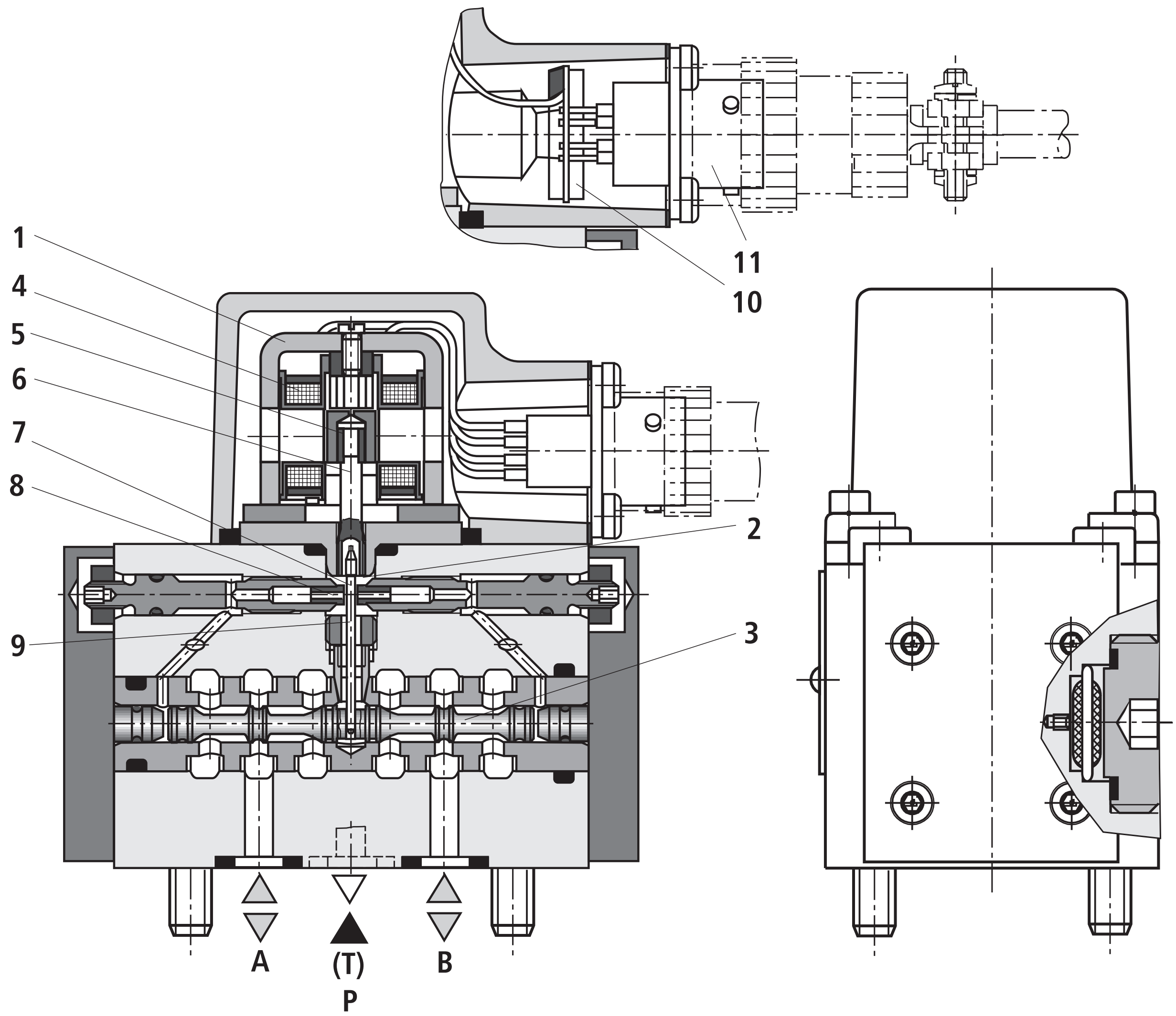
The stroke of the control spool and hence the flow through the servo-valve is therefore controlled in proportion to the electrical input signal. It must be noted that the flow depends on the valve pressure drop.

Type 4WS2EM 6-2X/… for external control electronics

For controlling the valve, an external control electronic control (servo-amplifier) is used, which amplifies an analogue input signal (command value) to a level required for the output signal to provide a current-regulated control of the servo-valve.

Type 4WSE2EM 6-2X/… with OBE

For the amplification of the analogue input signal, a control electrics (10), which is matched specifically to this valve type, is integrated in the valve. It is mounted to the male connector (11) in the cap of the torque motor.



Technical data (for applications outside these parameters, please consult us!)

General

Weight	kg	1.1
Porting pattern		ISO 4401-03-02-0-05
Installation orientation		Optional (Make sure that during start-up of the system, the valve is supplied with sufficient pressure ≥ 10 bar!)
Storage temperature range	°C	–20 to +80
Ambient temperature range	°C	–20 to +60, valve with OBE
		–30 to +100, valve without OBE

Hydraulic

Operating pressure	– Ports A, B, P	bar	10 to 210 or 10 to 315
Return flow pressure	– Port T	bar	Pressure peaks < 100, steady-state < 10
Zero flow $q_{V,L}$ [1] with spool overlap E measured without dither signal		l/min	$\sqrt{p_P/70\text{ bar}} \cdot (0.4\text{ l/min} + 0.02 \cdot q_{Vnom})$ [2; 3]
Nominal flows q_{Vnom} ± 10 % at valve pressure differential Δp = 70 bar		l/min	2; 5; 10; 15; 20; 25
Max. possible control spool stroke with mechanical end position (in the event of a failure) referred to nominal stroke		%	120 to 170
Hydraulic fluid			Mineral oil (HL, HLP) to DIN 51524; other hydraulic fluids on request
Hydraulic fluid temperature range preferably +40 to +50 °C		°C	–30 to +80, for valve with OBE
			–30 to +100, for valves without OBE
Viscosity range		mm^2/s	15 to 380, preferably 30 to 45
Permissible max. degree of contamination of the hydraulic fluid - cleanliness class to ISO 4406 (c)			Class 18/16/13 [4]
Feedback system			Mechanical
Hysteresis (dither-optimised)		%	≤ 1.5
Range of inversion (dither-optimised)		%	≤ 0.2
Response sensitivity (dither-optimised)		%	≤ 0.2
Pressure intensification at 1 % spool stroke change (from hydraulic zero point)		% of p_P [3]	≥ 50
Zero balancing current over the entire operating pressure range		%	≤ 3, long term ≤ 5
Zero drift in the case of a change in:			
	Hydraulic fluid temperature	% / 20 °C	≤ 1
	Ambient temperature	% / 20 °C	≤ 1
	Operating temperature 80 to 120 % of p_P [3]	% / 100 bar	≤ 2
	Return flow pressure 80 to 10 % of p_P [3]	% / bar	≤ 1

1) $q_{V,L}$ = nominal flow in l/min

2) q_{Vnom} = nominal flow in l/min

3) p_P = operating pressure in bar

4) The cleanliness classes specified for components must be adhered to in hydraulic systems. Effective filtration prevents malfunction and, at the same time, prolongs the service life of components.

Technical data (for applications outside these parameters, please consult us!)

Electrical

Type of protection to EN 60529			IP 65 with mating connector correctly mounted and locked
Type of signal			Analogue
Nominal current per coil		mA	30
Resistance per coil		Ω	85
Inductivity at 60 Hz and 100 % nominal current	Series connection	H	1.0
	Parallel connection	H	0.25
In case of actuating using non-Rexroth amplifiers, we recommend a superimposed dither signal			

External control electronics

Servo-amplifier (separate order)	Euro-card format	analogue	Type VT-SR2-1X/.-60 according to data sheet RE 29980
	Modular design	analogue	Type VT 11021 according to data sheet RE 29743
The coils of the valve may only be connected to these amplifiers in a parallel connection!			

Note! For details with regard to **environment simulation testing** in the fields of EMC (electromagnetic compatibility), climate and mechanical stress, see RE 29564-U (declaration on environmental compatibility).

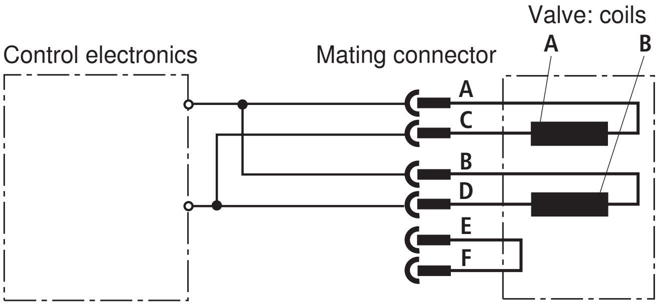
Available accessories

Service case with test unit for servo, proportional and high-response valves with integrated electronics, type VT-VETSY-1 according to data sheet RE 29685.

Service case with test unit for servo-valves for external electronics, type VT-SVTSY-1 according to data sheet RE 29681.

Electrical connection, external control electronics (example of parallel circuit)

Type 4WS2EM 6-2X/…



The coils are connected in parallel in the mating connector or on the amplifier (see figure).

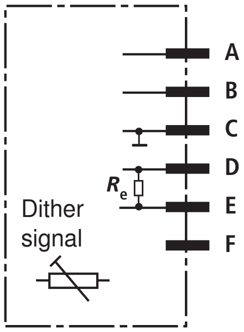
For a serial connection, contacts B and C must be connected.

Bridge E-F can be used for the electrical recognition of the correct connection of the male connector or for cable break detection.

Electrical controlling from A (+) to D (–) results in a direction of flow from P → A and B → T. Reverse electrical controlling results in a direction of flow from P → B and A → T.

Electrical connection, integrated control electronics

Type 4WSE2EM 6-2X/…



	Pin assignment of mating connector	Current control Control "**8**"	Voltage control Control "**9**"
Supply voltage (tolerance ±3 %, residual ripple content < 1 %) Current consumption	A	+15 V, max. 150 mA	+15 V max. 150 mA
	B	–15 V, max. 150 mA	–15 V max. 150 mA
	C	⊥	⊥
Commmand value	D	±10 mA R_i = 1 kΩ	±10 V R_i ≥ 8 kΩ I_i = 1i2 mA
Commmand value reference	E		
	F	Not assigned	

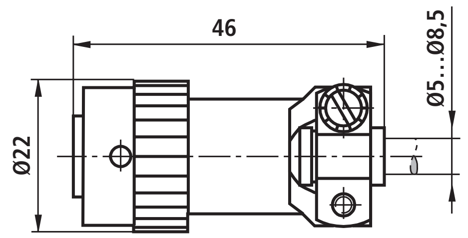
Command value at mating connector connection D = positive against mating connector connection E results in a direction of flow from P → A and B → T.

Command value at mating connector connection D = negative against mating connector connection E results in a direction of flow from P → B and A → T.

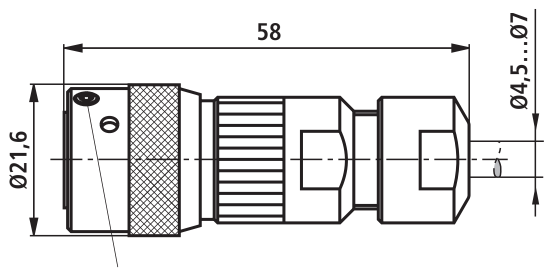
Note: **Electrical signals brought out via control electronics must not be used for switching off safety-relevant machine functions!**
(See also European standard EN 982, "Safety requirements for fluid power systems and their components – hydraulics").

Electrical connection, mating connector

Plug-in connector,
separate order stating Material no. **R900005414**



Plug-in connector,
separate order stating Material no. **R901043330**



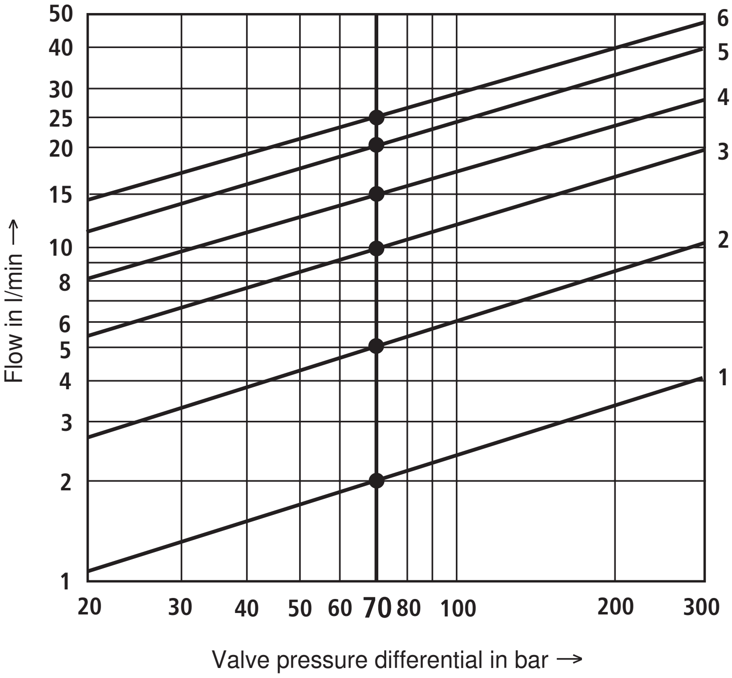
Locking: Grub screw M3, M_T = 0.3 Nm

Connection cable:

4- or 6-wire, 0.75 mm², shielded, with litz wires to DIN VDE 0812 (e.g. cable type LIYCY 4 or 6 x 0.75 mm²)

Characteristic curves (measured with HLP32, ϑ_{oil} = 40 °C ± 5 °C)

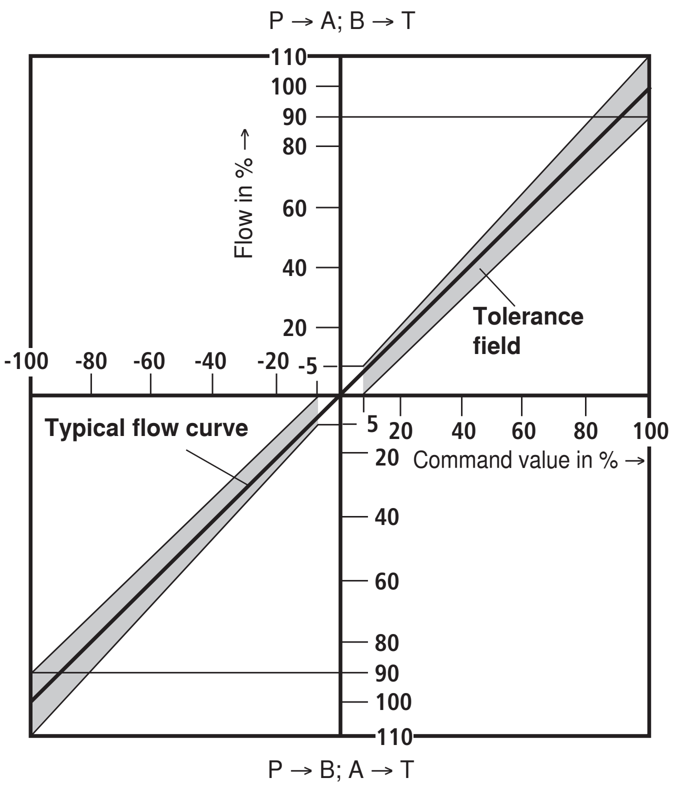
Flow/load function (tolerance ±10 %) at 100 % command value signal



Ordering code	Nominal flow	Curve
2	2 l/min	1
5	5 l/min	2
10	10 l/min	3
15	15 l/min	4
20	20 l/min	5
25	25 l/min	6

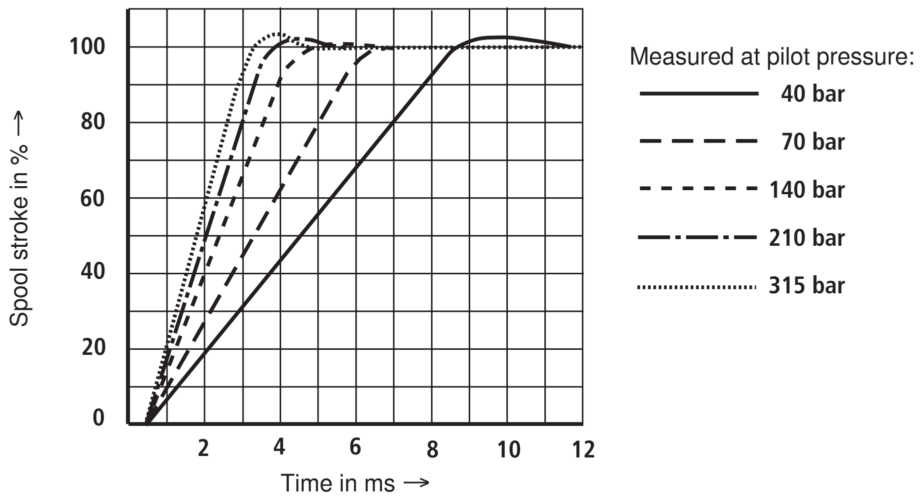
Δp = Valve pressure differential (inlet pressure p_P minus load pressure p_L minus return flow pressure p_T)

Tolerance field of flow/signal function at constant valve pressure differential Δp

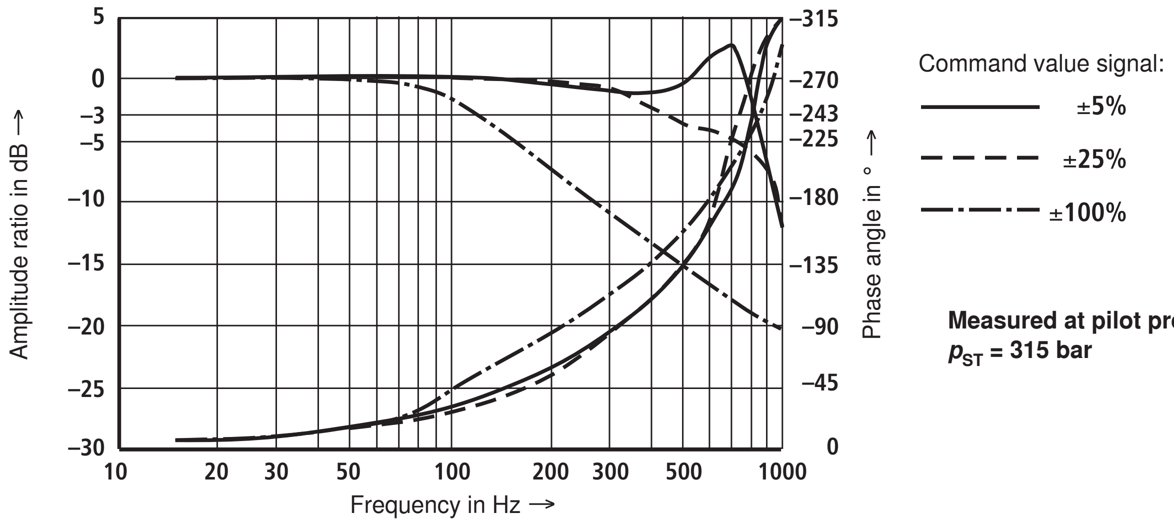


Characteristic curves (measured with HLP32, ϑ_{oil} = 40 °C ± 5 °C)

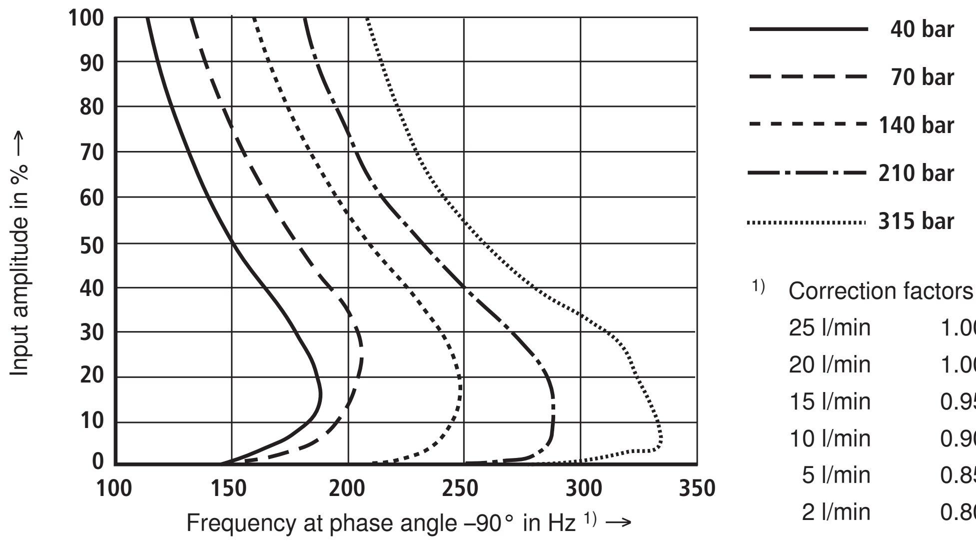
Transient function with pressure stage 315 bar



Frequency response with pressure stage 315 bar



Dependence of frequency at –90° on operating pressure *p* and input amplitude

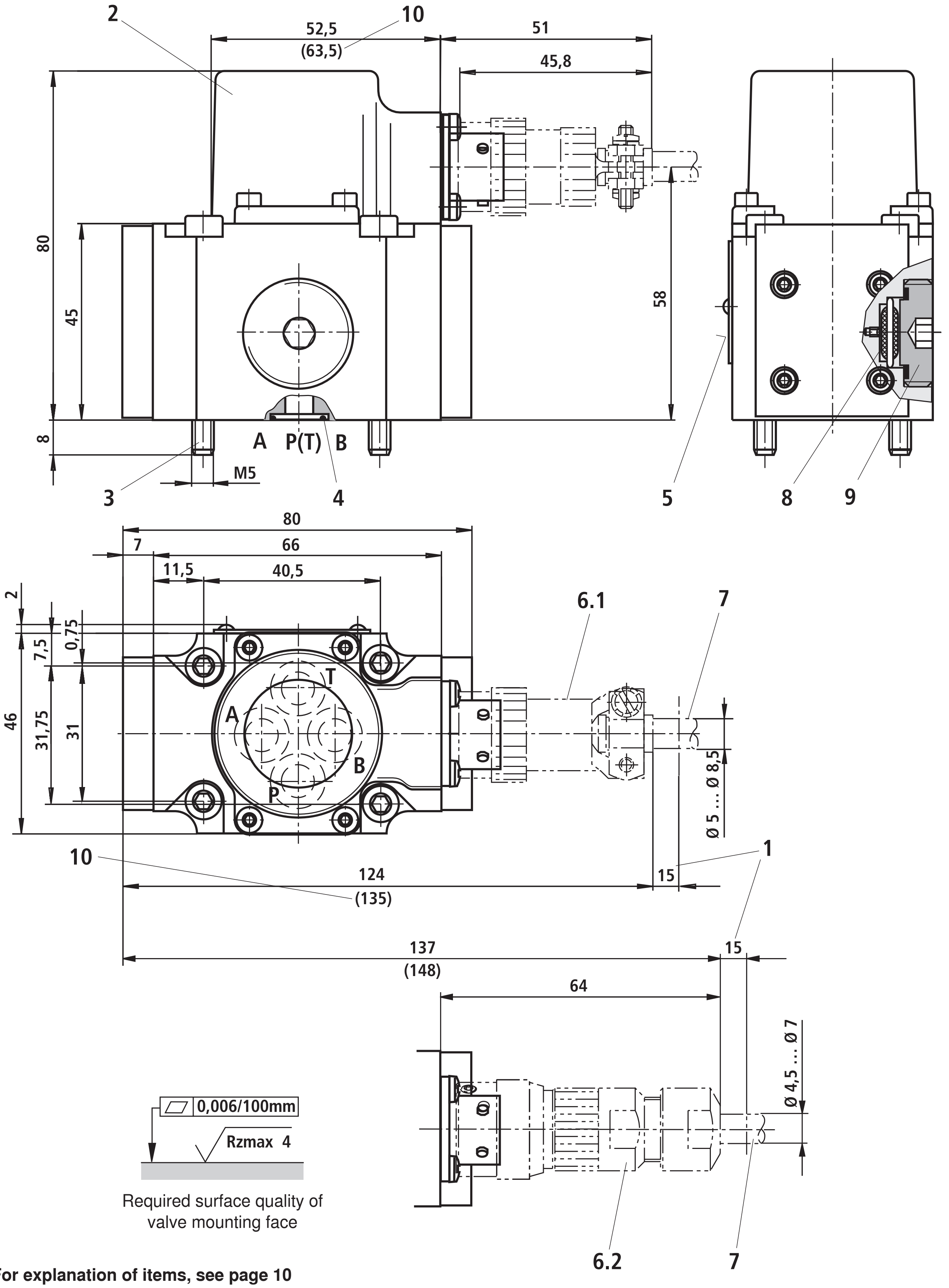


The output signal corresponds to the spool stroke with flow and without load pressure

[1] Correction factors at q_{Vnom}:

25 l/min	1.00
20 l/min	1.00
15 l/min	0.95
10 l/min	0.90
5 l/min	0.85
2 l/min	0.80

Unit dimensions: Types 4WS2EM 6 and 4WSE2EM 6 (nominal dimensions in mm)



Required surface quality of valve mounting face

For explanation of items, see page 10

Unit dimensions: Explanation of items

1 Space required to remove mating connector; in addition, take account of the bending radius of the connection cable

2 Cap

3 Valve mounting screws (included in the scope of supply)

For reasons of strength, use exclusively the following valve mounting screws:

4 hexagon socket head cap screws (4 A/F)
ISO 4762-M5 x 50-10.9-flZn-240h-L
(friction coefficient 0.09 – 0.4 to VDA 235-101)
M_T = 9.3 Nm

4 Identical seal rings for P, A, B and T

5 Nameplate

6.1 Mating connector, Material no. **R900005414** (separate order, see page 6)

6.2 Mating connector, Material no. **R901043330** (separate order, see page 6)

7 Connection cable; further information on page 6

8 Filter

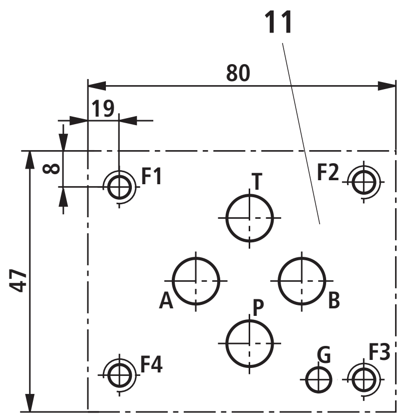
9 Plug screw (6 A/F)
Tighten to M_T = 30 Nm after filter change

10 Dimensions in ( ) for valve with integrated control electronics (OBE)

11 Machined valve mounting face

Porting pattern according to ISO 4401-03-02-0-05

Deviating from standard:
– Locating pin (G) not provided



Subplates according to data sheet RE 45052 (separate order)

G 341/01	(G1/4)
G 342/01	(G3/8)
G 502/01	(G1/2)

Flushing plate with porting pattern to ISO 4401-03-02-0-05 (nominal dimensions in mm)

Symbol

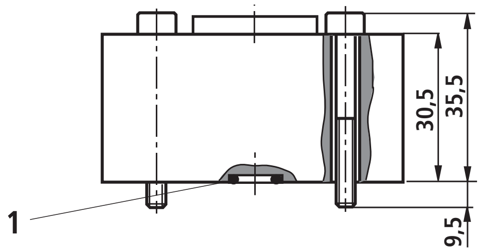
with FKM seals, Material no. **R900936049**, weight: 0.6 kg

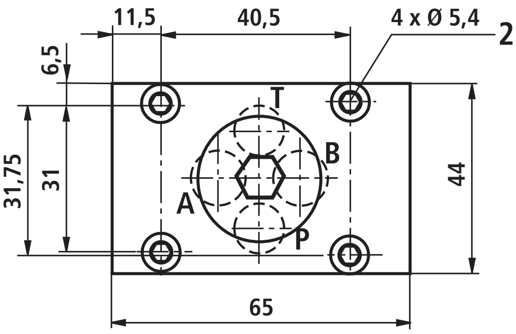
1 4 off R-rings 9.81 x 1.5 x 1.78

2 Mounting screws
(included in the scope of supply)

For strength reasons, use exclusively the following valve mounting screws:

4 hexagon socket head cap screws
ISO 4762-M5 x 40-10.9-flZn-240h-L
(friction coefficient 0.09-0.14 – to VDA 235-101)
M_T = 7 Nm ±10 %





To ensure the proper operation of servo-valves, it is indispensable to flush the system before commissioning.

The following equation provides a guideline for the flushing time per system:

$$t \geq \frac{V}{q_V} \cdot 5$$

t = flushing time in h

V = tank capacity in l

q_V = pump flow in l/min

When topping up more than 10 % of the tank capacity, repeat the flushing process.

Better than the use of a flushing plate is a directional valve with connection to ISO 4401-03-02-0-05. This valve can also be used for flushing the actuator ports. See also data sheet RE 07700.

RE 29564-XL
Edition: 2020-11
Replaces: 2018-09
RA87651324_AA

rexroth
A Bosch Company

Directional servo valve with mechanical position feedback

Type 4WS2EM ...XL

H8123

- Size 6
- Component series 2X
- Maximum operating pressure 315 bar
- Maximum flow 48 l/min

ATEX units
For potentially explosive atmospheres

Information on explosion protection:
- Area of application in accordance with the Explosion Protection Directive 2014/34/EU: **II 3G**
- Type of protection:
  Ex ic IIC T4 Gc according to EN IEC 60079-0 / EN 60079-11 and IEC 60079-0 / IEC 60079-11

Features

- 4 or 3-way version
- For intended use in potentially explosive atmosphere
- Valve for position, force, pressure or velocity control
- For subplate mounting
- Porting pattern according to ISO 4401-03-02-0-05 (however, without locating hole)
- Dry control motor, no contamination of the solenoid gaps by the hydraulic fluid
- Can also be used as 3-way version
- Wear-free control spool return element
- Pressure chambers at the control sleeve with gap seal, therefore no wear of seal ring

Contents

☞ **Notice:** The documentation version with which the product was supplied is valid.

Ordering code

01	02		03		04	05	06	07	08	09	10	11	12	13
4WS2EM	**6**	**–**	**2X**	**/**		**B**	**11**	**XL**	**ET**		**K17**		**V**	

01	Directional servo valve, 4-way version, 2-stage, with mechanical feedback, for **external** control electronics, electrically operated	**4WS2EM**

02	Size 6	**6**

03	Component series 20 … 29 (20 … 29: unchanged installation and connection dimensions)	**2X**

Nominal flow

04	2 l/min	**2**
	5 l/min	**5**
	10 l/min	**10**
	15 l/min	**15**
	20 l/min	**20**
	25 l/min	**25**
	Characteristic curves, see page 11 (observe tolerance field of the flow/signal function)	

05	Control sleeve exchangeable	**B**

06	Valve for **external** control electronics; coil no. 11 (30 mA/85 Ω per coil)	**11**

Explosion protection

07	"Type of protection ic"	**XL**
	For details, see information on explosion protection, page 6	

08	Pilot oil supply and return internal	**ET**

Inlet pressure range

09	10 … 210 bar	**210**
	10 … 315 bar	**315**

Electrical connection

10	**Without** mating connector; connector	**K17**

Control spool overlap (in % of the nominal stroke)

11	0 … 0.5% negative	**E**
	0 … 0.5% positive	**D**
	3 … 5% positive	**C**

Seal material (observe compatibility of seals with hydraulic fluid used, see page 6)

12	FKM seals	**V**

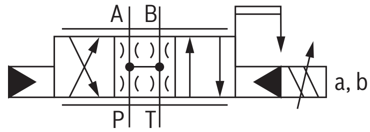
Special versions

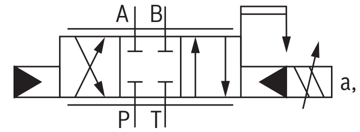
13	Standard version	**no code**
	The channels P → B and A → T are open 10% of the nominal quantity without control (de-energized state).	**-100**
	The channels P → A and B → T are open 10% of the nominal quantity without control (de-energized state).	**-102**

Symbols

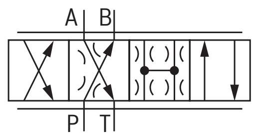
Control spool overlap "E" | **Control spool overlap "C" and "D"**

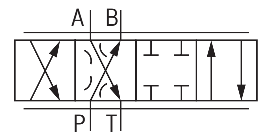
Standard



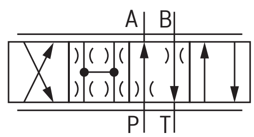


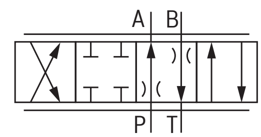
Special version "-100"





Special version "-102"



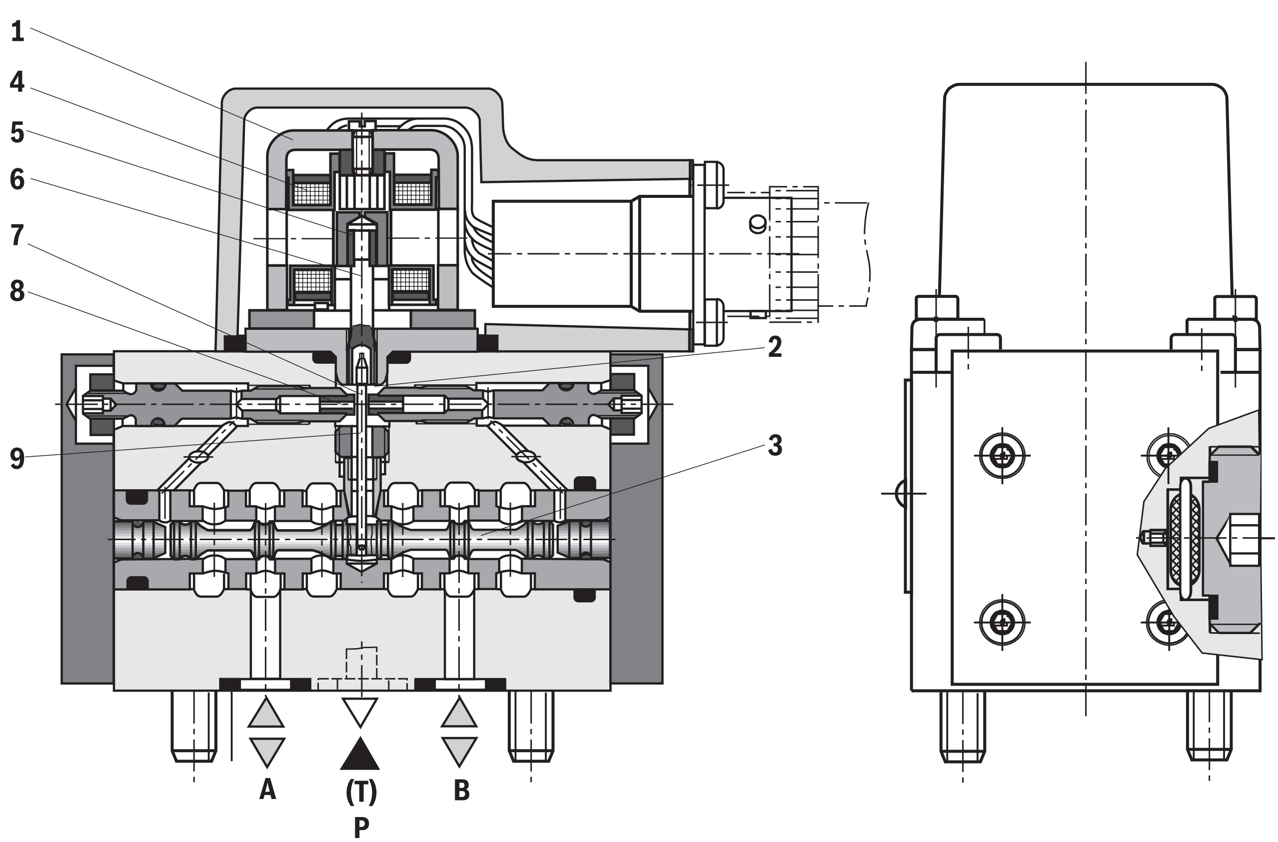


Notice:
Representation according to DIN ISO 1219-1.

Function, section, symbol

Valves of type 4WS2EM ...XL are electrically operated, 2-stage directional servo valves. They are mainly used to control position, force, pressure or velocity.
The valves are made of an electro-mechanical converter (torque motor) (1), a hydraulic amplifier (nozzle flapper plate system) (2) and a control spool (3) in a sleeve (2nd stage) which is connected with the torque motor via a mechanical feedback.
An electrical input signal at the coils (4) of the torque motor generates a force by means of a permanent magnet which acts on the armature (5), and in connection with a torque tube (6) results in a torque. This causes the flapper plate (7) which is connected to the torque tube (6) via a bolt to move from the central position between the two control nozzles (8), and a pressure differential is created across the front sides of the control spool (3). The pressure differential results in the control spool changing its position, which results in the pressure port being connected to one actuator port and, at the same time, the other actuator port being connected to the return flow port.
The control spool (3) is connected to the flapper plate or the torque motor by means of a bending spring (mechanical feedback) (9). The position of the control spool (3) is changed until the feedback torque across the bending spring and the electro-magnetic torque of the torque motor are balanced and the pressure differential at the nozzle flapper plate system becomes zero.
The stroke of the control spool (3) and consequently the flow of the servo valve are controlled proportionally to the electrical input signal. It must be noted that the flow depends on the valve pressure drop.

External control electronics (separate order)
External control electronics (servo amplifier) serve the actuation of the valve, amplifying an analog input signal (command value) so that with the output signal, the servo valve is actuated in a flow-controlled form.
For the limitation of the electric data, a safety barrier is to be connected between valve and amplifier (see page 7).



Type 4WS2EM 6 ...XL...

Technical data
(for applications outside these values, please consult us!)

General			
Installation position			Any - ensure that during start-up of the system, the valve is supplied with sufficient pressure (≥ 10 bar)
Surface protection	▶ Valve body, cover, filter screw		Nitro-carburated
	▶ Cap		Anodized
Storage temperature range		°C	+5 ... +40
Maximum storage time		Years	1
Ambient temperature range		°C	–30 ... +80
Weight		kg	1.1

Hydraulic			
Operating pressure	▶ Ports P, A, B	bar	10 ... 210 or 10 ... 315
Return flow pressure	▶ Port T	bar	Pressure peaks < 100 static < 10
Hydraulic fluid			See table page 6
Hydraulic fluid temperature range		°C	–15 ... +80; preferably +40 ... +50
Viscosity range		mm^2/s	15 ... 380; preferably 30 ... 45
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)			Class 18/16/13 [1)]
Zero flow $\boldsymbol{q}_{V,L}$		l/min	see characteristic curve on page 10
Rated flows $q_{v\ nom}$ (tolerance ±10% with valve pressure differential $\boldsymbol{\Delta p}$ = 70 bar		l/min	2; 5; 10; 15; 20; 25
Maximum control spool stroke with mechanical end position (in case of error) related to nominal stroke		%	120 ... 170
Feedback system			mechanical
Hysteresis (dither-optimized)		%	≤ 1.5
Range of inversion (dither-optimized)		%	≤ 0.2
Response sensitivity (dither-optimized)		%	≤ 0.2
Pressure amplification with 1% control spool stroke change (from the hydraulic zero point)		% of $\boldsymbol{p}_P$	≥ 50
Zero adjustment flow across the entire operating pressure range		%	≤ 3, long-term ≤ 5
Zero shift upon change of:			
	▶ Hydraulic fluid temperature	% / 20 °C	≤ 1
	▶ Ambient temperature	% / 20 °C	≤ 1
	▶ Operating pressure 80 ... 120% of $\boldsymbol{p}_P$	% / 100 bar	≤ 2
	▶ Return flow pressure 0 ... 10% of $\boldsymbol{p}_P$	% / bar	≤ 1

1) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and simultaneously increases the life cycle of the components.

$\boldsymbol{q}_{V,L}$ = zero flow in l/min
$\boldsymbol{q}_{V\ nom}$ = nominal flow in l/min
$\boldsymbol{p}_P$ = operating pressure in bar

Technical data
(for applications outside these values, please consult us!)

Hydraulic fluid		Classification	Suitable sealing materials	Standards	Data sheet
Mineral oils		HL, HLP, HLPD, HVLP, HVLPD	NBR, FKM	DIN 51524	90220
Bio-degradable	▶ Insoluble in water	HETG	FKM	ISO 15380	90221
		HEES	FKM		
	▶ Soluble in water	HEPG	FKM	ISO 15380	

Important information on hydraulic fluids:
- For further information and data on the use of other hydraulic fluids, please refer to the data sheets above or contact us.
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.).
- The ignition temperature of the hydraulic fluid used must be at least 150 °C.

Electric		
Protection class according to EN 60529		IP 65 with mating connector correctly mounted and locked
Type of signal		analog
Nominal flow per coil (command value 100%)	mA	30
Resistance per coil	Ω	85

Notice:
In case of control using non-Rexroth amplifiers, we recommend a superimposed dither signal.

Information on explosion protection	
Area of application according to Directive 2014/34/EU	II 3G
Type of protection according to EN IEC 60079-0 / EN 60079-11	Ex ic IIC T4 Gc
"IECEx Certificate of Conformity"	IECEx BVS 18.0045X
Power supply of the valve only from intrinsically safe electric circuits	Maximum values see page 7
Special application conditions for safe application	see ambient and hydraulic fluid temperature range page 5

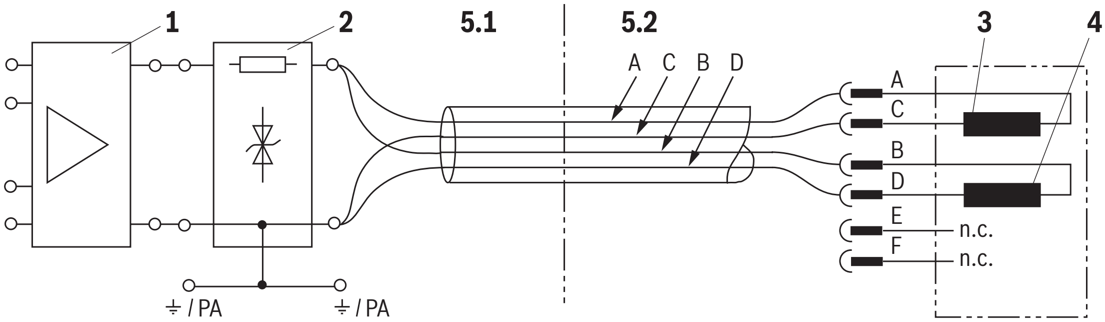
External control electronics		
Recommended safety barrier		see page 7
Servo amplifier in modular design	analog	Type VT 11021 according to data sheet 29743

Important notice:
The external servo amplifier and the safety barrier must be operated outside the potentially explosive atmospheres.

Electrical connection

The coils can be connected in **parallel connection** or individual control.

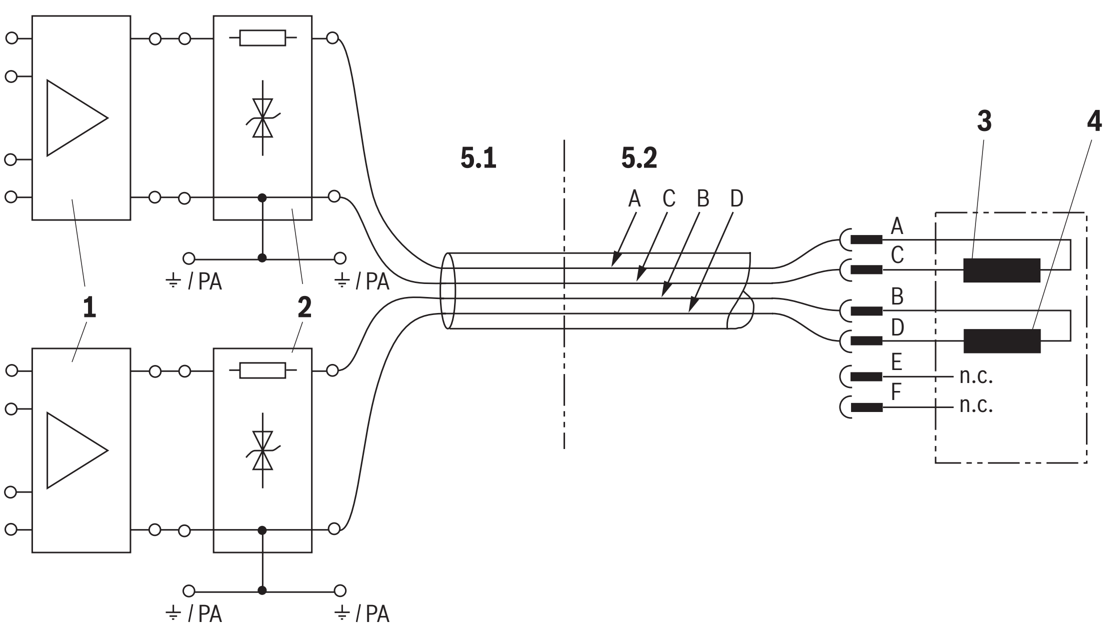
▶ Parallel connection



1 Servo amplifier
2 Safety barrier
3 Valve, coil A
4 Valve, coil B
5.1 Non-explosive area
5.2 Explosive area

Power supply of the valve only from intrinsically safe electric circuits with the following maximum values	▶ U_{max}	V	15
	▶ I_{max}	mA	153
	▶ P_{max}	mW	570
Recommended safety barrier			Type 9001/02-133-150-101 (company Stahl) or Z915 (company Pepperl+Fuchs)

▶ Individual control



1 Servo amplifier
2 Safety barrier
3 Valve, coil A
4 Valve, coil B
5.1 Non-explosive area
5.2 Explosive area

Power supply of the valve only from intrinsically safe electric circuits with the following maximum values	▶ U_{max}	V	9.3	12.5
	▶ I_{max}	mA	205	90
	▶ P_{max}	mW	476	282
Recommended safety barrier			9002/77-093-300-001 (company Stahl)	Z966 (company Pepperl+Fuchs)

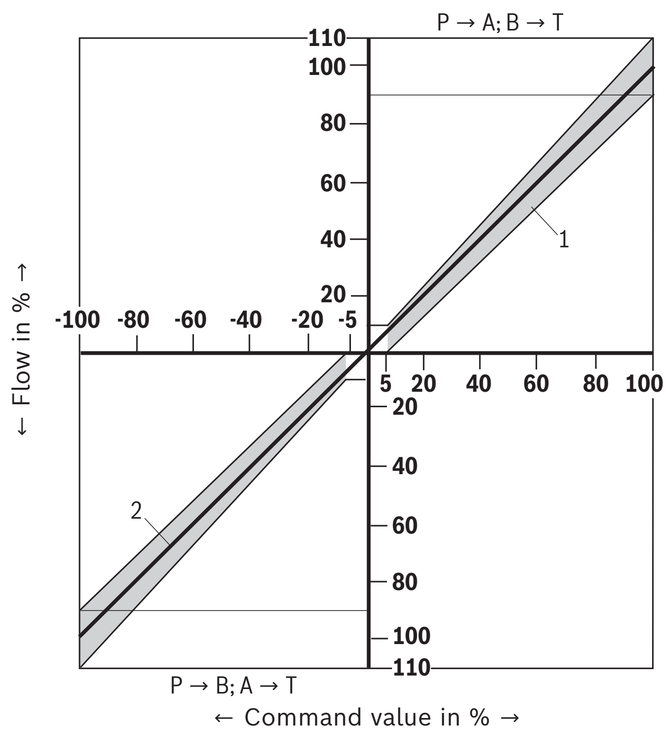
☞ **Notice:**
Only use approved cables and lines for intrinsically safe electric circuits.

The electric control with plus (+) at A and B and minus (–) at C and D results in direction of flow P → A and B → T.
Inverted electric control results in direction of flow P → B and A → T.
Pins E and F at the connector are not connected.

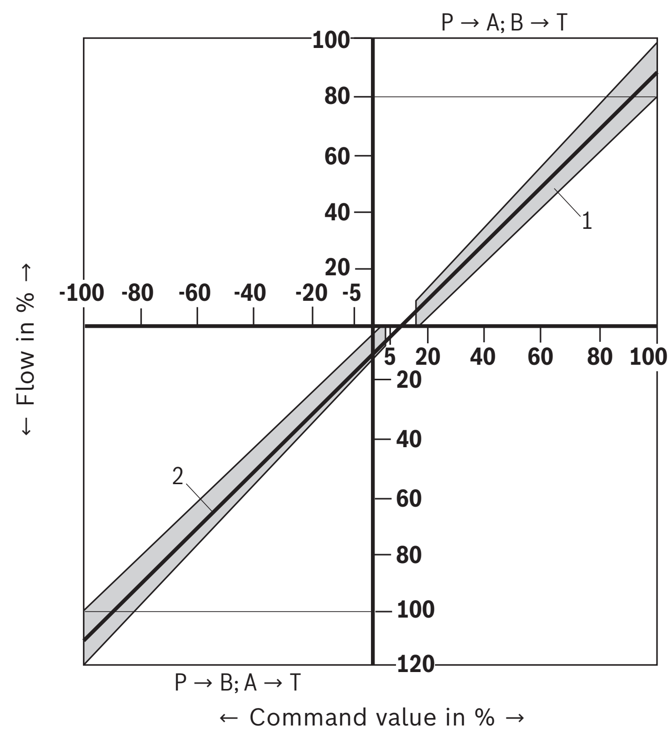
Characteristic curves
(measured with HLP 32, ϑ_{oil} = 40 °C ± 5 °C)

Tolerance field of the flow/signal function at constant valve pressure differential ***Δp***

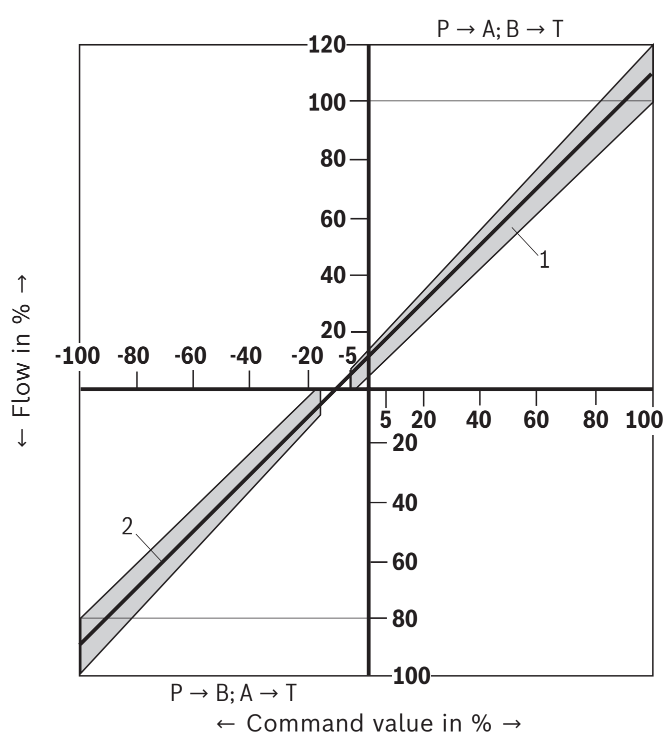
Standard



Special version "-100"



Special version "-102"

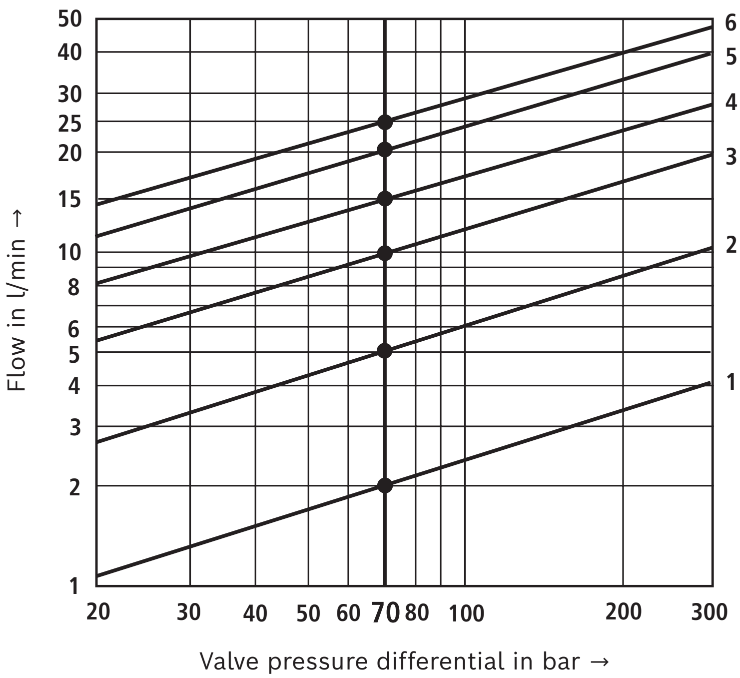


1 Tolerance field
2 Typical flow curve

Characteristic curves
(measured with HLP 32, ϑ_{oil} = 40 °C ± 5 °C)

Flow/load function

(tolerance ±10%) with 100% command value signal



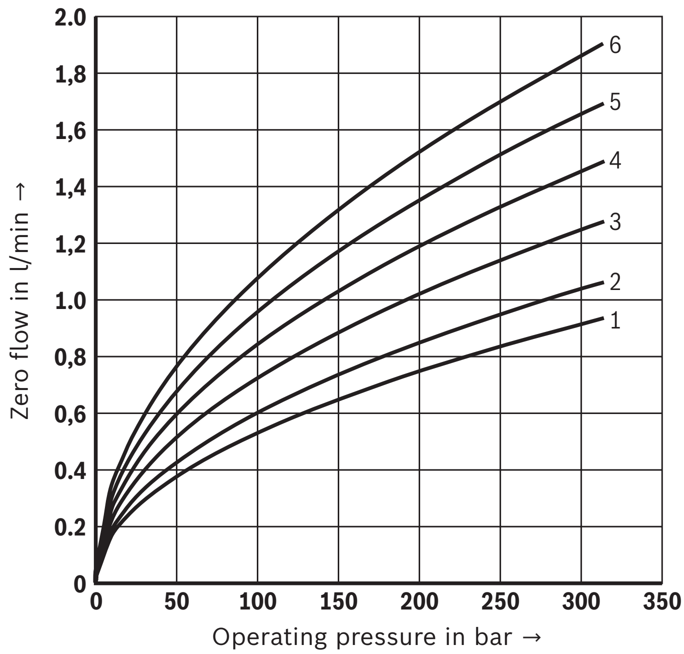
Nominal flow

1	2 l/min
2	5 l/min
3	10 l/min
4	15 l/min
5	20 l/min
6	25 l/min

Notes:
- Flow values in the maximum command value range (see tolerance field of the flow/signal function)
- $\Delta p = p_P - p_L - p_T$
  Δp valve pressure differential
  p_P inlet pressure
  p_L load pressure
  p_T return flow pressure

Characteristic curves
(measured with HLP 32, ϑ_{oil} = 40 °C ± 5 °C)

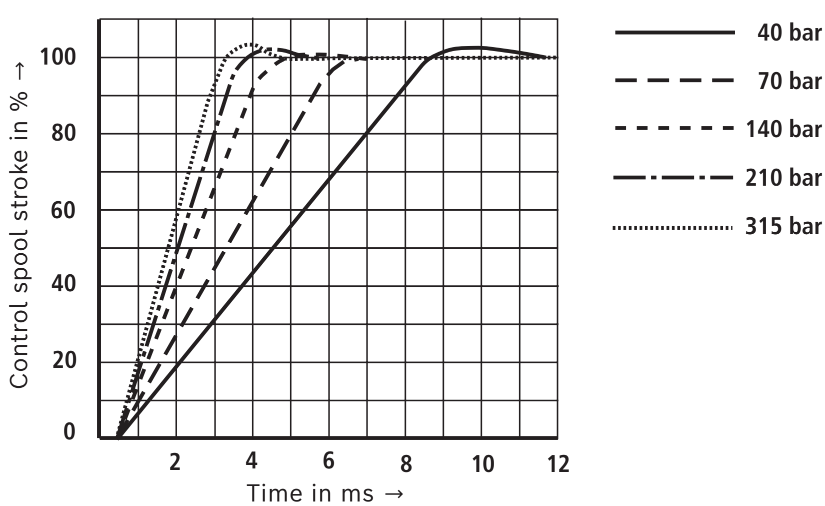
Zero flow (with control spool overlap "E", measured without dither signal)



Nominal flow

- **1** 2 l/min
- **2** 5 l/min
- **3** 10 l/min
- **4** 15 l/min
- **5** 20 l/min
- **6** 25 l/min

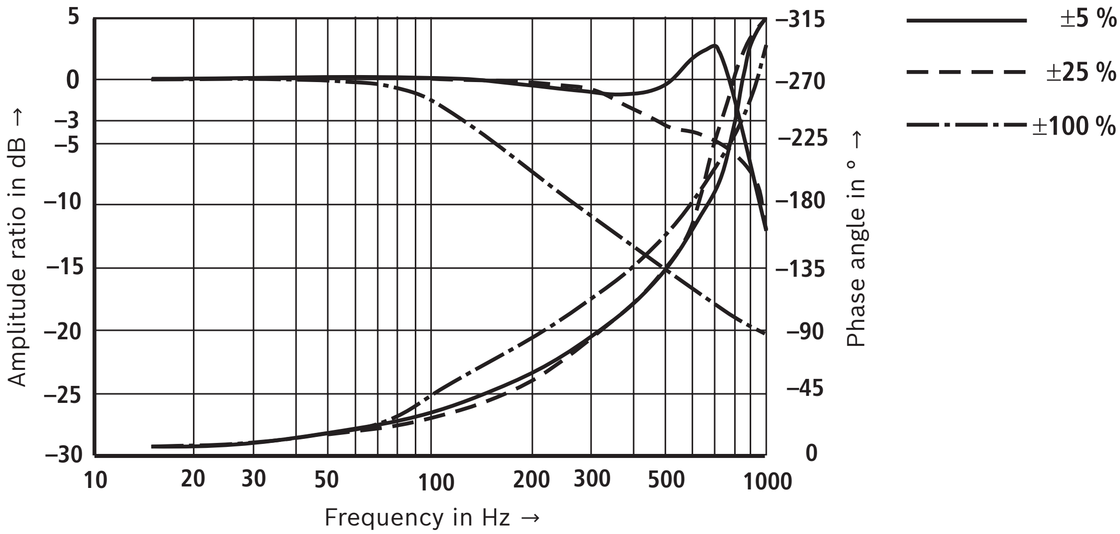
Transition function with pressure rating 315 bar, step response without flow



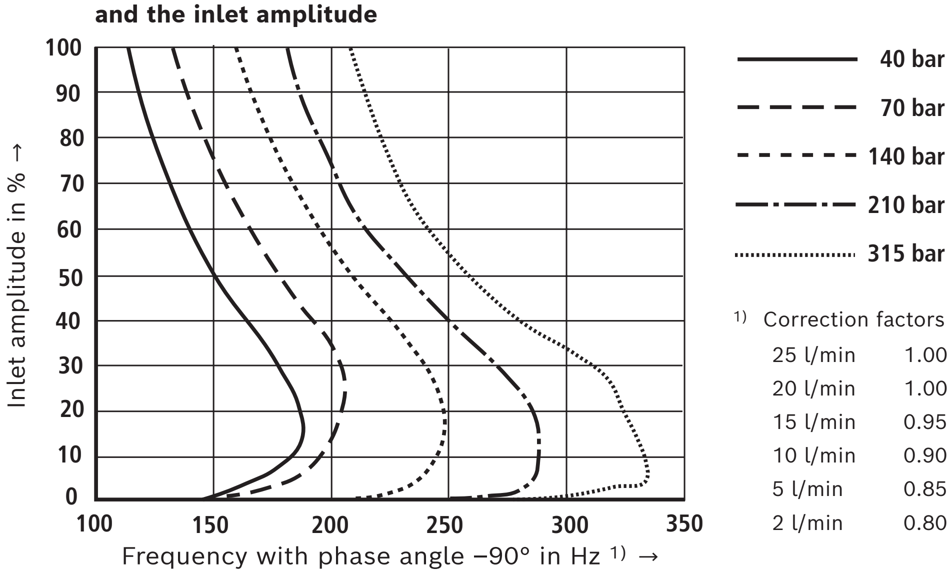
Characteristic curves

(measured with HLP 32, ϑ_{oil} = 40 °C ± 5 °C)

Frequency response with pressure rating 315 bar, stroke frequency without flow
(measured with pilot pressure p_{St} = 315 bar)



Dependency of the frequency *f* at –90° on the operating pressure *p* and the inlet amplitude

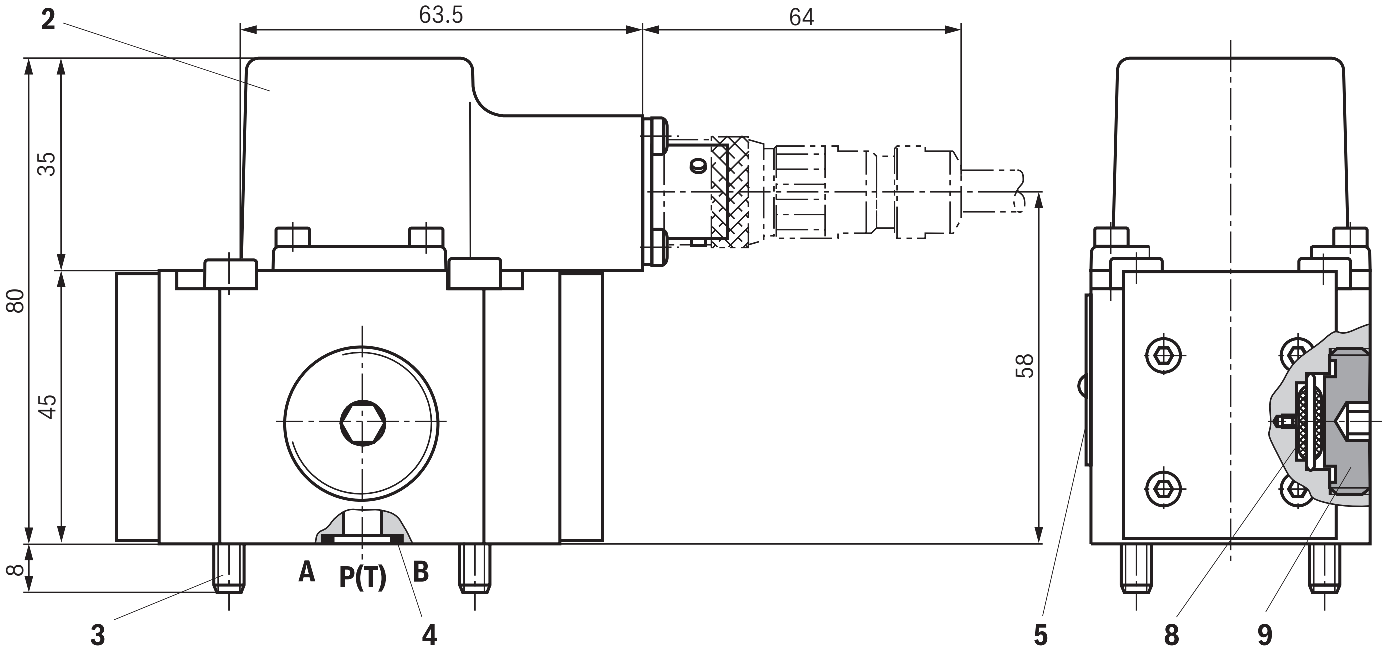


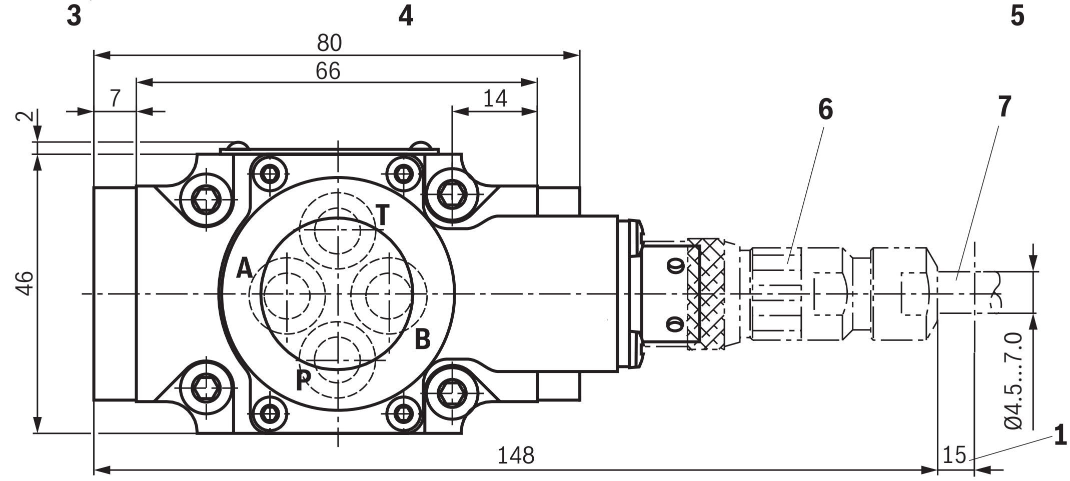
1) Correction factors with $q_{V\ nom}$:

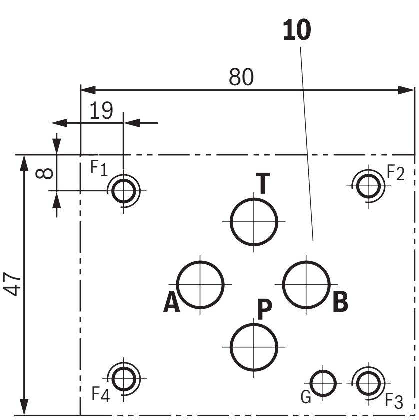
25 l/min	1.00
20 l/min	1.00
15 l/min	0.95
10 l/min	0.90
5 l/min	0.85
2 l/min	0.80

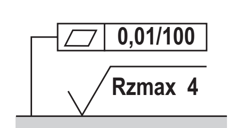
Notice:
The output signal corresponds to the control spool stroke with flow without load pressure

Dimensions
(dimensions in mm)









Required surface quality
of the valve contact surface

For item explanations, valve mounting screws and **subplates,** see page 13.

Notes:
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions

1 Space required for removing the mating connector, additionally observe the bending radius of the connection line
2 Cap
3 **Valve mounting screws** (included in the scope of delivery)
Only use valve mounting screws with the subsequently listed thread diameters and strength properties. Observe the screw-in depth.
4 hexagon socket head cap screws ISO 4762 - M5 x 50 - 10.9
(Friction coefficient μ_{total} = 0.09 ... 0.14)
Tightening torque M_A = 7 Nm ±10%
4 Identical seal rings for ports P, A, B and T
5 Name plate
6 Mating connector (separate order, see page 14)
7 Connection line, further information on page 7
8 Filter
9 Plug screw
10 Machined valve contact surface;
Porting pattern according to ISO 4401-03-02-0-05
(however, without locating hole)

Subplates (separate order) with porting pattern according to ISO 4401-03-02-0-05, see data sheet 45100.

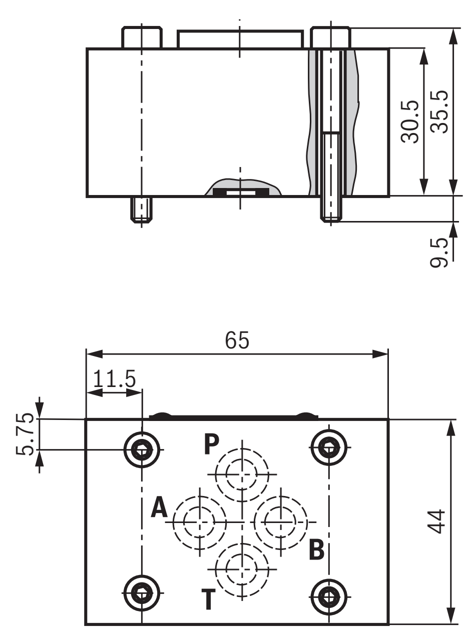
Notice:
Subplates are no components in the sense of Directive 2014/34/EU and can be used after the manufacturer of the overall system has conducted an assessment of the risk of ignition. The "G...J3" versions are free from aluminum and/or magnesium and galvanized.

Flushing plate with porting pattern according to ISO 4401-03-02-0-05 (dimensions in mm)

Symbol

Ordering code and further information

- Material number **R901541300**
- Weight 0.6 kg
- Identical seal rings for ports P, A, B and T
- Mounting screws (included in the scope of delivery)
  For reasons of stability, exclusively the following mounting screws are to be used:
  4 hexagon socket head cap screws ISO 4762 - M5 x 40 - 10.9
  (Friction coefficient μ_{total} = 0.09 ... 0.14)
  Tightening torque M_A = 7 Nm ±10%



Notice:
Before assembly and operation, observe the information in the operating instructions 29564-XL-B.

Accessories (separate order)

Mating connectors and cable sets

Item [1]	Designation	Version	Short designation	Material number	Data sheet
6	Mating connector; for valves with round connector, 6-pole	straight, metal	6P KPTC6	**R901043330**	08006

[1] See dimensions on page 12.

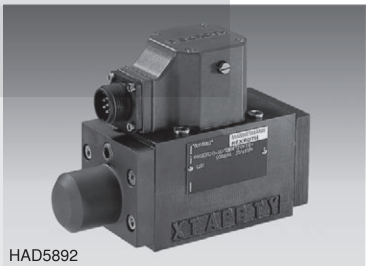
Further information

▶ Subplates	Data sheet 45100
▶ Hydraulic fluids on mineral oil basis	Data sheet 90220
▶ Environmentally compatible hydraulic fluids	Data sheet 90221
▶ Mating connectors and cable sets for valves and sensors	Data sheet 08006
▶ Analog amplifier module type VT 11021	Data sheet 29743
▶ Use of non-electrical hydraulic components in an explosive environment (ATEX)	Data sheet 07011
▶ Selection of filters	
▶ Information on available spare parts	

Directional servo-valve in 4-way design

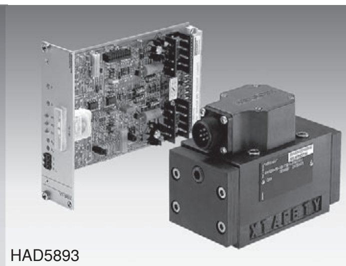
RE 29583/05.11
Replaces: 07.03

Type 4WS.2E...



HAD5892

Type 4WSE2ED 10-5X/...B...K31EV



HAD5893

Type 4WS2EM 10-5X/...B...K31EV

Size 10
Component series 5X
Maximum operating pressure 315 bar
Maximum flow 180 l/min

Table of contents

Features

– Valve to control position, force, pressure or velocity
– 2-stage servo valve with mechanical or mechanical and electric return
– 1st stage as nozzle flapper plate amplifier
– Subplate mounting:
  Porting pattern according to ISO 4401
– Dry control motor, no pollution of the solenoid gaps by the hydraulic fluid
– Can also be used as 3-way version
– Wear-free control spool return element
– Control
  • External control electronics in Eurocard format or in modular design (separate order), see page 8
  • Or control electronics integrated in the valve (OBE)
– Valve and integrated control electronics are adjusted and tested
– Control spool with flow force compensation
– Control sleeve centrically fixed; thus low susceptibility to temperature and pressure
– Pressure chambers at the control sleeve with gap seal, no wear of the seal ring
– Filter for 1st stage externally accessible, see pages 16, 17 and 18

Ordering code

		10 – 5X /	B				K31	E	V	*

Directional servo-valve in 4-way design for **external** control electronics **= 4WS2E**
with **integrated** control electronics **= 4WSE2E**

Mechanical return **= M**
Mechanical and electric return **= D**
(only available with integrated electronics)

Size 10 **= 10**

Component series 50 to 59 **= 5X**
(50 to 59: Unchanged installation and connection dimensions)

Rated flow [1)]
with valve pressure differential Δp = 70 bar

5 l/min	**= 5**
10 l/min	**= 10**
20 l/min	**= 20**
30 l/min	**= 30**
45 l/min	**= 45**
60 l/min	**= 60**
75 l/min	**= 75**
90 l/min	**= 90**

Valves for **external** control electronics: [2)]
11 = Coil no. 11 (30 mA / 85 Ω per coil)

Valves with **integrated** control electronics:

	Command value	Actual value (only available with 4WSE2ED…)
9 =	±10 V	±10 V
13 =	±10 mA	±10 mA

Pilot oil supply and return [3)]
– = Supply external, return external
E = Supply internal, return external
T = Supply external, return internal
ET = Supply internal, return internal

Inlet pressure range [4)]
210 = 10 to 210 bar
315 = 10 to 315 bar

Electrical connection
K31 = **Without** mating connector with connector according to EN 175201-804
Mating connector - separate order see page 7

Spool overlap [5)]
E = 0 to 0.5 % negative

V = FKM seals [6)]
suitable for mineral oil (HL, HLP) according to DIN 51524

Further details in the plain text [7)]

Rated flow [1)]

The rated flow refers to a 100 % command value signal at 70 bar valve pressure differential (35 bar per control edge). The valve pressure differential must be regarded as reference. Other values result in the flow being changed.

A possible rated flow tolerance of ±10 % must be taken into account (see flow signal function page 9).

Electrical control data [2)]

Valves for **external** control electronics:
The actuating signal must be formed by a current-controlled output stage. Servo amplifier see page 7.

Valves with **integrated** control electronics:
With the integrated electronics, the command value can be fed in as voltage (ordering code "9") or - with larger distances (> 25 m between control and valve) as current (ordering code "13").

Pilot oil [3)]

Care should be taken that the pilot pressure is as constant as possible. An external pilot control via port X is thus often advantageous. The valve can be operated with a higher pressure at X than at P in order to influence the dynamics in a positive form.

The ports X and Y are also pressurized in case of "Internal" pilot oil supply.

Inlet pressure range [4)]

Care should be taken that the system pressure is as constant as possible.

Pilot pressure range: 10 to 210 bar or 10 to 315 bar

With regard to the dynamics, the frequency response dependency must be observed within the admissible pressure range.

Spool overlap [5)]

The spool overlap in % refers to the nominal stroke of the control spool.

Other control spool overlaps upon request!

Seal material [6)]

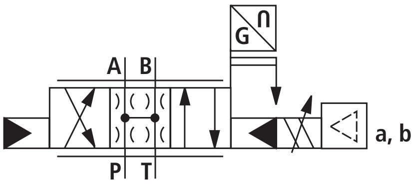
If you need any other sealing material, please contact us!

Details in the plain text [7)]

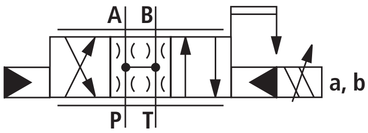
Here, special requests are to be specified in the plain text. After receipt of the order, they are checked by the plant and the type designation is amended with a related number.

Symbols

Valves with electric and mechanical return, with OBE
(example: 4WS**E**2ED 10-5X…ET…)



Valves with mechanical return, without OBE
(example: 4WS2EM 10-5X…ET…)



Function, section

4WS(E)2EM10-5X/...

Valves of type 4WS(E)2EM10-5X/... are electrically operated, 2-stage directional servo-valves. They are mainly used to control position, force and velocity.

These valves consist of an electro-mechanical converter (torque motor) (1), a hydraulic amplifier (nozzle flapper plate principle) (2) and a control spool (3) in a sleeve (2nd stage), which is connected to the torque motor via a mechanical return.

An electrical input signal at the coils (4) of the torque motor generates a force by means of a permanent magnet which acts on the armature (5), and in connection with a torque tube (6) results in a torque. This causes the flapper plate (7) which is connected to the torque tube (6) via a pin to move from the central position between the two control nozzles (8), and a pressure differential is created across the front faces of the control spool. This pressure differential results in the control spool changing its position, which results in the pressure port being connected to one actuator port and, at the same time, the other actuator port being connected to the return flow port.

The control spool is connected to the flapper plate or the torque motor by means of a bending spring (mechanical return) (9). The position of the control spool is changed until the feedback torque across the bending spring and the electromagnetic torque of the torque motor are balanced and the pressure differential at the nozzle flapper plate system becomes zero.

The stroke of the control spool and consequently the flow of the servo valve are controlled in proportion to the electrical input signal. It must be noted that the flow depends on the valve pressure drop.

External control electronics, type 4WS2EM10-5X/... (separate order)

External control electronics (servo amplifier) serve the actuation of the valve, amplifying an analog input signal (command value) so that with the output signal, the servo valve is actuated in a flow-controlled form.

Integrated control electronics, type 4WSE2EM10-5X/... and 4WSE2ED10-5X/...

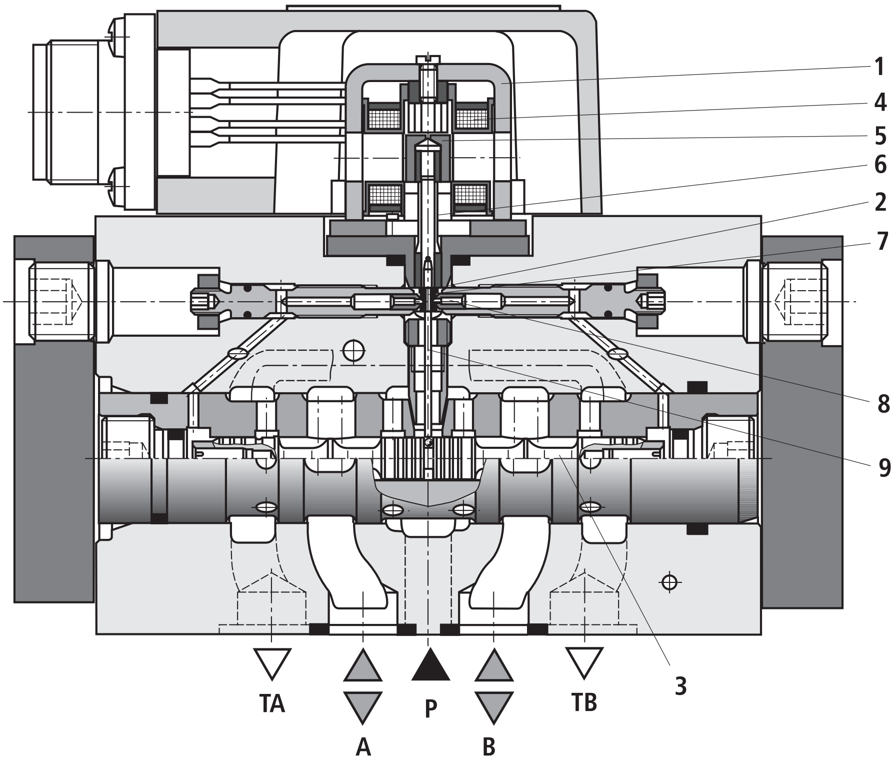
To amplify the analog input signal, control electronics (10) especially adjusted to this valve type are integrated. They are located in the torque motor cover cap. The valve zero point can be adjusted by means of an externally accessible potentiometer.

4WSE2ED10-5X/...

In addition to the mechanical control by the return spring, valves of this types are equipped with the electric spool position detection and control. The control spool position is determined by an inductive position transducer (11). The position transducer signal is compared to the command value by integrated control electronics (10). Any possible control deviation is amplified electrically and fed to the torque motor as control signal. With the additional electric return, higher dynamical values can be achieved by the electric controller gain in the small signal range than with the purely mechanical version. The additionally available mechanical return ensures that in case the electric voltage supply fails, the valve spool is positioned in the zero range.

The valve is only available with integrated control electronics. The valve zero point can be adjusted by means of an externally accessible potentiometer.

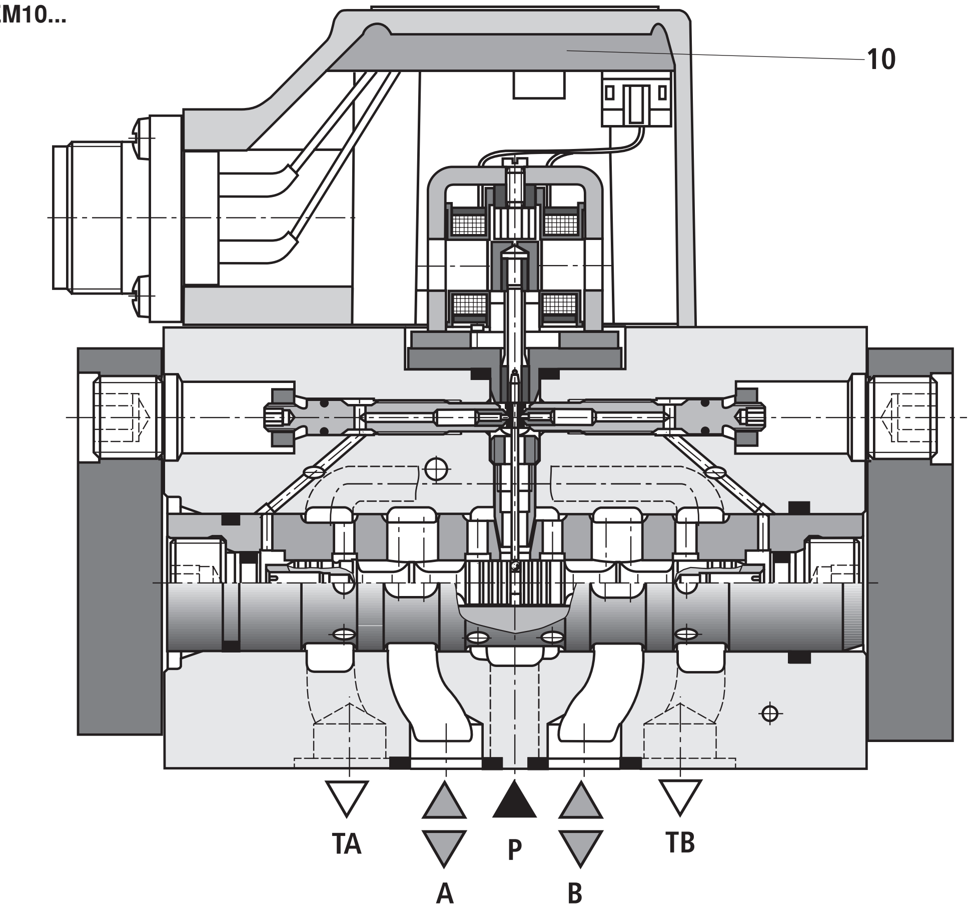
Note:
Changes in the zero point may result in damage to the system and may only be implemented by instructed specialists.



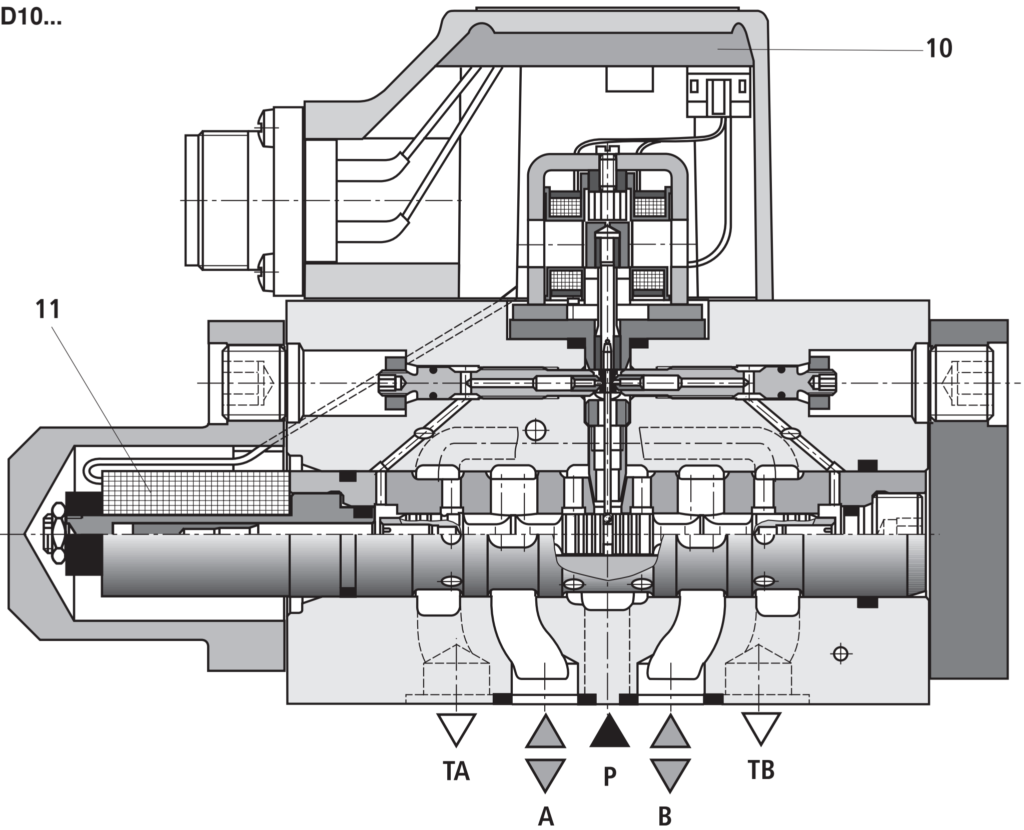
Type 4WS2EM10...

Section

Type 4WSE2EM10...



Type 4WSE2ED10...



Technical data (For applications outside these parameters, please consult us!)

general

Weight	with mechanical return	kg	3.56
	with mechanical and electric return and integrated control electronics	kg	3.65
Installation position			Optional, if it is ensured that during start-up of the system the pilot control is supplied with sufficient pressure (≥ 10 bar).
Storage temperature range		°C	–20 to +80
Ambient temperature range		°C	–20 to +60 valve with OBE
			–30 to +100 valve without OBE

hydraulic (measured with HLP 32, ϑ_{oil} = 40 °C ± 5 °C)

Operating pressure	Pilot control stage, pilot oil supply	bar	10 to 210 or 10 to 315
	Main valve, port P, A, B	bar	Up to 315
Return flow pressure	Port T		
	Pilot oil return internal	bar	Pressure peaks < 100 permitted, static < 10
	Pilot oil return external	bar	Up to 315
	Port Y	bar	Pressure peaks < 100 permitted, static < 10
Hydraulic fluid			See table page 7
Hydraulic fluid temperature range		°C	–15 to +80, preferably +40 to +50
Viscosity range		mm^2/s	15 to 380, preferably 30 to 45
Maximum admissible degree of contamination of the hydraulic fluid cleanliness class according to ISO 4406 (c)			Class 18/16/13 [1]

Zero flow $Q_{V,L}$ [2] measured without dither signal	l/min	$\sqrt{\frac{p_P{}^{4)}}{70\ bar}} \cdot 0.7 \frac{l}{min}$	$\sqrt{\frac{p_P{}^{4)}}{70\ bar}} \cdot 0.9 \frac{l}{min}$	$\sqrt{\frac{p_P{}^{4)}}{70\ bar}} \cdot 1.2 \frac{l}{min}$			$\sqrt{\frac{p_P{}^{4)}}{70\ bar}} \cdot 1.5 \frac{l}{min}$		$\sqrt{\frac{p_P{}^{4)}}{70\ bar}} \cdot 1.7 \frac{l}{min}$
Rated flow $Q_{v\ rated}$ [3], tolerance ±10 % with valve differential pressure Δp = 70 bar	l/min	5	10	20	30	45	60	75	90
Maximum control spool stroke possible with mechanical end position (in case of error) related to nominal stroke	%	120 to 170				120 to 150			
Pressure gain with 1 % spool stroke change (from the hydraulic zero point)	% of p_P [4]	≥ 30					≥ 60		≥ 80
Return system		Mechanical "M"					Mechanical and electric "D"		
Hysteresis (dither-optimized)	%	≤ 1.5					≤ 0.8		
Range of inversion (dither-optimized)	%	≤ 0.3					≤ 0.2		
Response sensitivity (dither-optimized)	%	≤ 0.2					≤ 0.1		
Zero adjustment flow over the entire operating pressure range	%	≤ 3, long-term ≤ 5					≤ 2		
Zero shift upon change of:									
Hydraulic fluid temperature	% / 20 °C	≤ 1					≤ 2		
Ambient temperature	% / 20 °C	≤ 1					≤ 2		
Operating pressure 80 to 120 % of p_P [4]	% / 100 bar	≤ 2					≤ 2		
Return flow pressure 0 to 10 % p_P [4]	% / bar	≤ 1					≤ 1		

[1] The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the service life of the components.

[2] $Q_{V,L}$ = Zero flow in l/min

[3] $Q_{V\ rated}$ = Rated flow (complete valve) in l/min

[4] p_P = Operating pressure in bar

Technical Data (For applications outside these parameters, please consult us!)

Hydraulic fluid		Classification	Suitable sealing materials	Standards
Mineral oils and related hydrocarbons		HL, HLP	NBR, FKM	DIN 51524
Flame-resistant	– Water-containing	HFC	NBR	ISO 12922

☞ **Important information on hydraulic fluids!**

- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, service life, maintenance intervals, etc.)!
- The flash point of the process and operating medium used must be 40 K higher than the maximum solenoid surface temperature.
- **Flame-resistant – water-containing**: Maximum pressure difference per control edge 175 bar, otherwise, increased cavitation erosion!
  Tank pre-loading < 1 bar or > 20 % of the pressure difference. The pressure peaks should not exceed the maximum operating pressures!

electric

Return system			Mechanical "M"	Mechanical and electric "D"
Protection class of the valve according to EN 60529			IP 65 with mating connector mounted and locked	
Type of signal			Analog	
Rated current per coil		mA	30	
Resistance per coil		Ω	85	
Inductivity with 60 Hz and 100 % rated current	Connection in series	H	1.0	
	Connection in parallel	H	0.25	
In case of actuation using non-Rexroth amplifiers, we recommend a superimposed dither signal				

electric, external control electronics (only version "M")

Amplifier (separate order)	Eurocard format	Analog	Type VT-SR2-1X/... according to data sheet 29980
	Modular design	Analog	Type VT 11021 according to data sheet 29743

Important: Information on the **environment simulation testing** for the areas EMC (electromagnetic compatibility), climate and mechanical load see data sheet 29583-U (declaration on environmental compatibility).

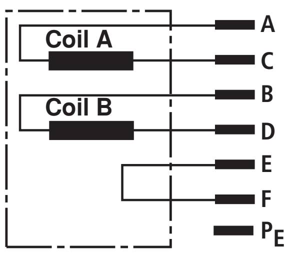
Available accessories

Service case with test device for continuous valves with integrated electronics type VT-VETSY-1 according to data sheet 29685.

Service case with test device for servo valves for external electronics type VT-SVTSY-1 according to data sheet 29681.

Electrical connection, external control electronics

Type 4WS2EM 10-5X...



The electrical connection can be designed as parallel or serial connection. For reasons of operational safety and the resulting lower coil inductivity, we recommend the connection in parallel.

The E-F bridge can be used for the electrical determination of the correct connection of the plug-in connector and/or for the identification of cable break.

Connection in parallel:
In the mating connector, connect contact A with B and C with D.

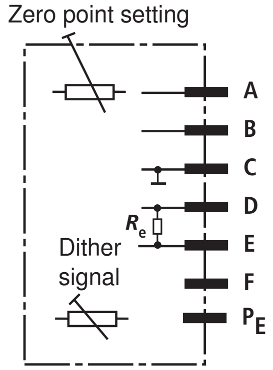
Connection in series:
In the mating connector, connect contact B with C.

Electrical control from A (+) to D (–) results in the flow direction P to A and B to T. Inverted electrical control results in the flow direction P to B and A to T.

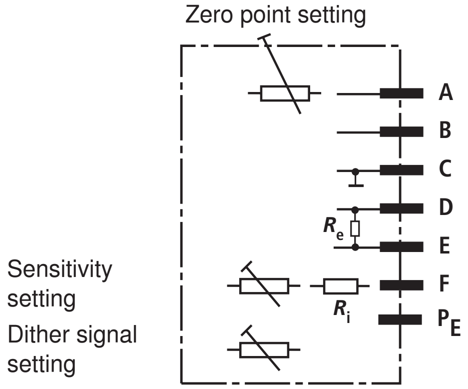
E → F = bridge

Electrical connection, integrated control electronics

Type 4WSE2EM 10-5X...



Type 4WSE2ED 10-5X...



	Mating connector assignment	Current control Control "**13**"	Voltage control Control "**9**"
Supply voltage	A	+15 V	+15 V
	B	–15 V	–15 V
	C	⊥	⊥
Command value	D	±10 mA	±10 V
	E	R_e = 100 Ω	R_e ≥ 50 kΩ
Measuring output for control spool	F [1)]	±10 mA [2)] Load max. 1 kΩ	+10 V against ⊥ [2)] R_i ≈ 4.7 kΩ

1) In valves with mechanical return, part F is not used.
2) With nominal spool stroke

Current consumption at the mating connector port	A	Max. 150 mA	Max. 150 mA
	B		
	D	0 to ±10 mA	≤ 0.2 mA
	E		

Supply voltage: ±15 V ±3 %, residual ripple < 1 %

Command value: Command value at the mating connector port D = positive against mating connector port E results in flow from P to A and B to T.
Measuring output F has positive signal against ⊥.

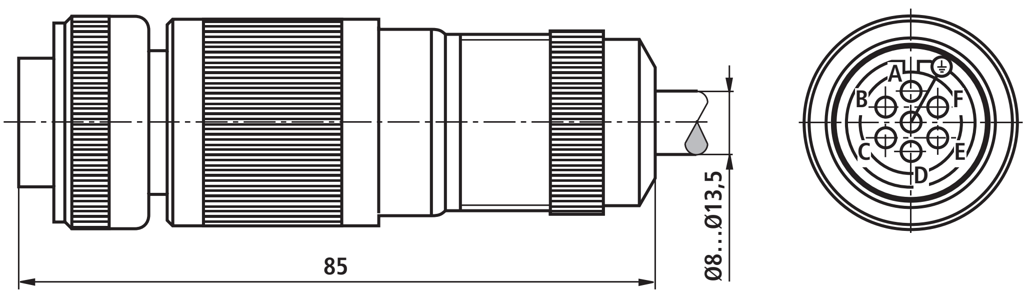
Command value at the mating connector port D = negative against mating connector port E results in flow from P to B and A to T.
Measuring output F has negative signal against ⊥.

Measuring output: The voltage or current signal is proportional to the control spool stroke.

Important: Electric signals taken out via control electronics (e.g. actual value) must not be used for switching off safety-relevant machine functions!

Electrical connection, mating connector

Mating connector according to DIN EN 175.201-804
separate order under Material no. **R900223890**
(metal version)

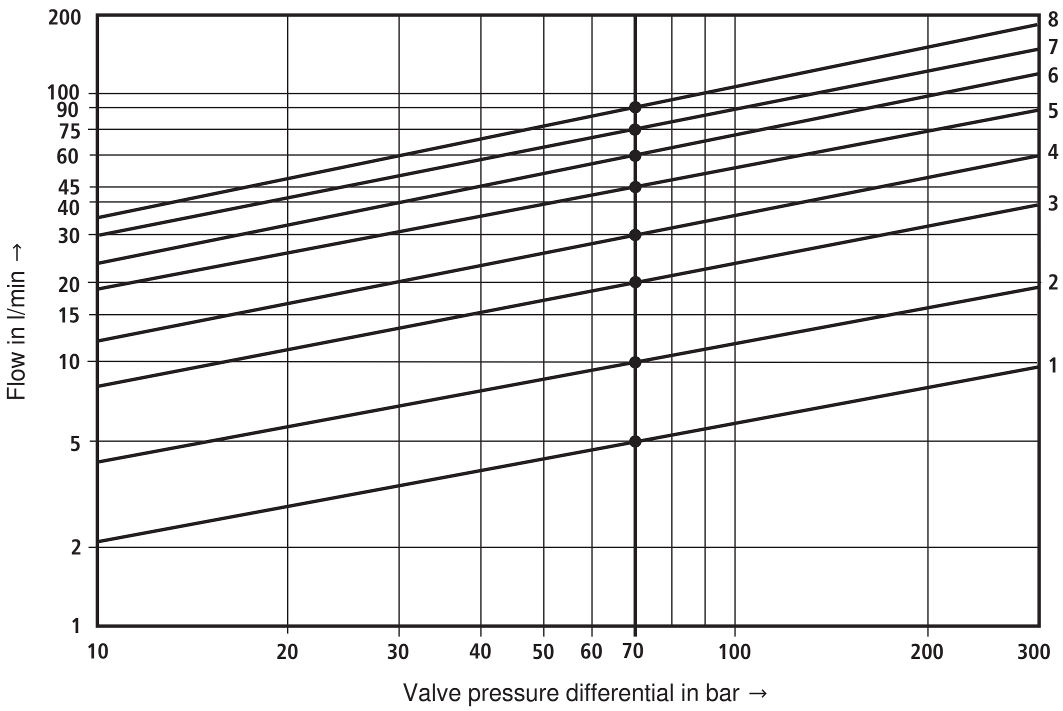


Characteristic curves (measured with HLP 32, ϑ_{oil} = 40 °C ± 5 °C)

Flow/load function (tolerance ±10 %)
with 100 % command value signal

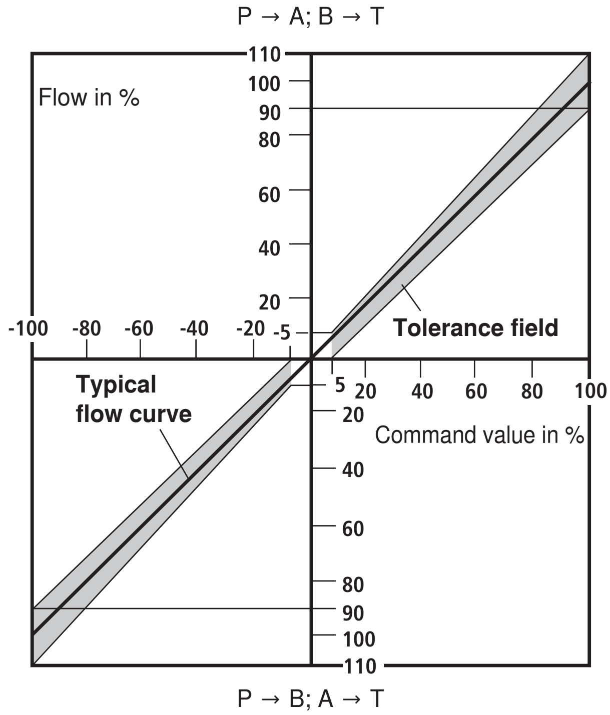
Rated flow

5 l/min	=	Curve **1**	45 l/min	=	Curve **5**
10 l/min	=	Curve **2**	60 l/min	=	Curve **6**
20 l/min	=	Curve **3**	75 l/min	=	Curve **7**
30 l/min	=	Curve **4**	90 l/min	=	Curve **8**



Δ***p*** = Valve pressure differential (inlet pressure $\boldsymbol{p}_P$ minus load pressure $\boldsymbol{p}_L$ and minus return flow pressure $\boldsymbol{p}_T$)

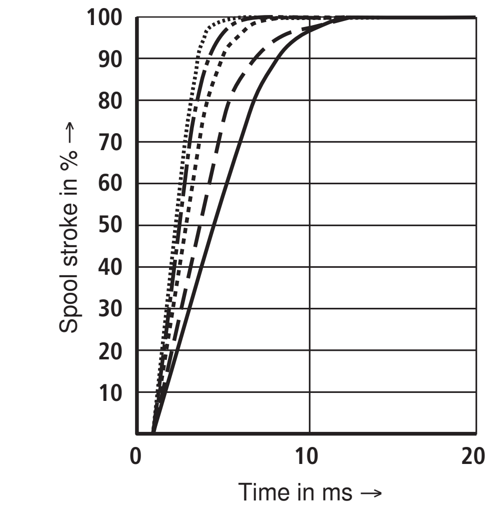
Tolerance field of the flow command value function
at constant valve pressure differential



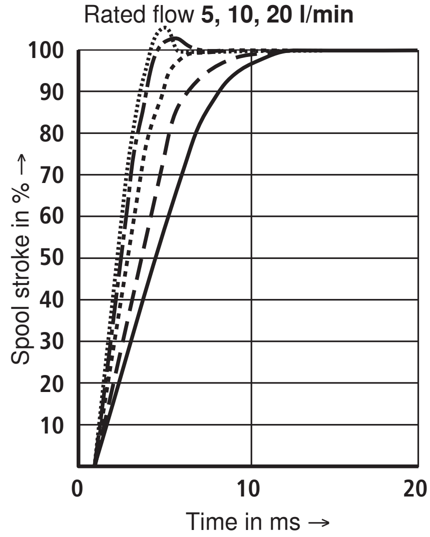
Characteristic curves: Type 4WS.2EM 10 and 4WSE2ED 10 (measured with HLP 32, ϑ_{oil} = 40 °C ± 5 °C)

Transition function with pressure rating 315 bar, step response without flow

4WS.2EM 10
Rated flow **5, 10, 20 l/min**



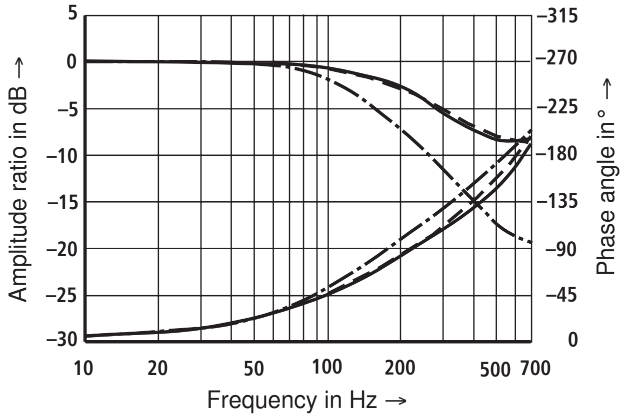
4WSE2ED 10
Rated flow **5, 10, 20 l/min**



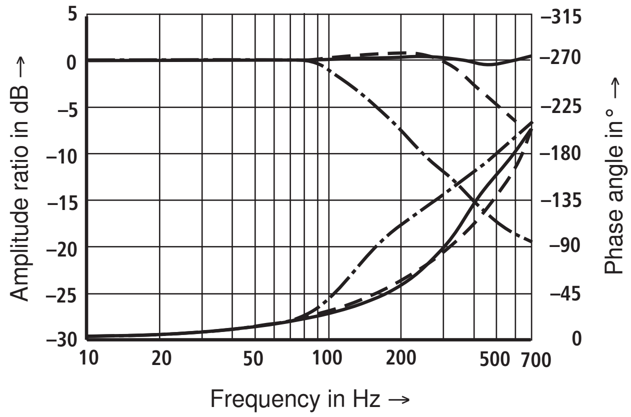
40 bar — 70 bar — 140 bar — 210 bar — 315 bar

Frequency response with pressure rating 315 bar, stroke frequency without flow

4WS.2EM 10
Rated flow **5, 10, 20 l/min**



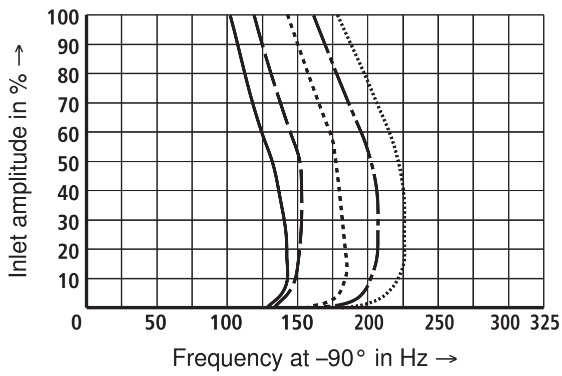
4WSE2ED 10
Rated flow **5, 10, 20 l/min**



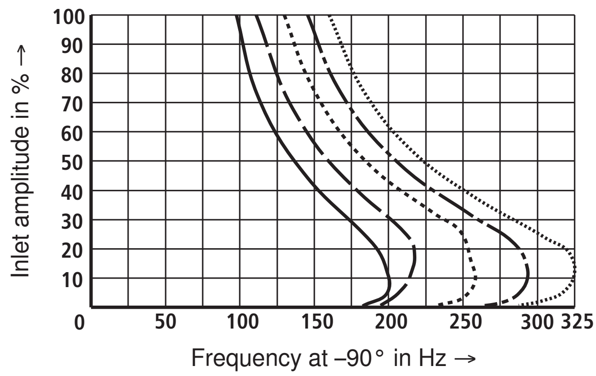
5 % — 25 % — 100 %

Dependency of the frequency *f* at –90° on the operating pressure *p* and the inlet amplitude

4WS.2EM 10
Rated flow **5, 10, 20 l/min**



4WSE2ED 10
Rated flow **5, 10, 20 l/min**

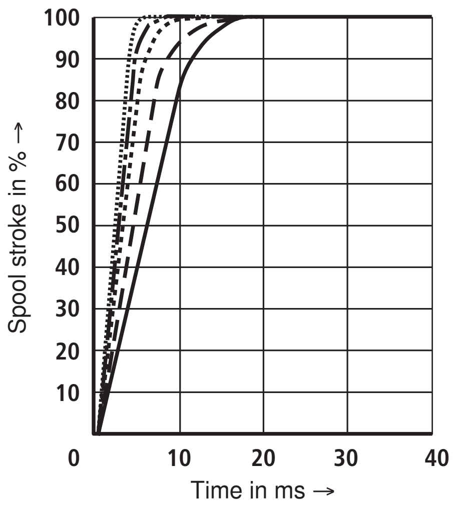


40 bar — 70 bar — 140 bar — 210 bar — 315 bar

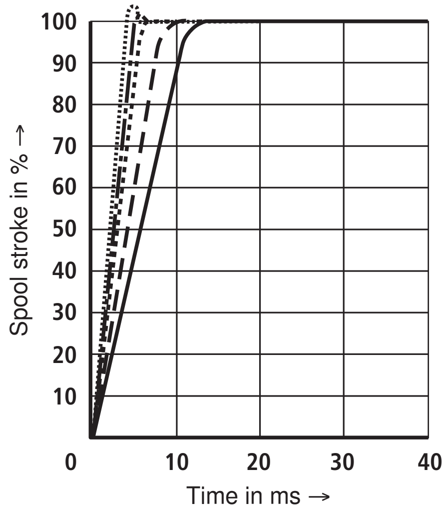
Characteristic curves: Type 4WS.2EM 10 and 4WSE2ED 10 (measured with HLP 32, ϑ_{oil} = 40 °C ± 5 °C)

Transition function with pressure rating 315 bar, step response without flow

4WS.2EM 10
Rated flow **30 l/min**



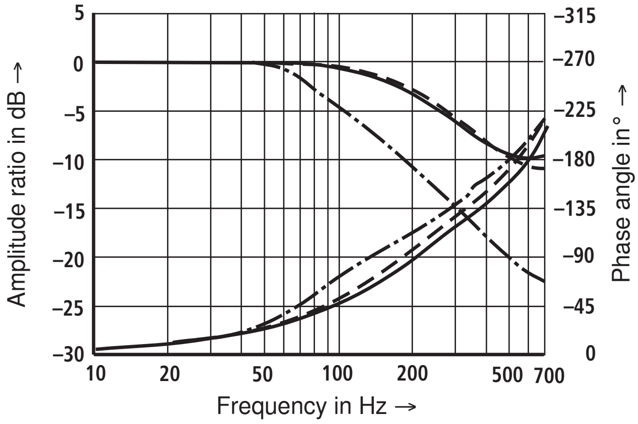
4WSE2ED 10
Rated flow **30 l/min**



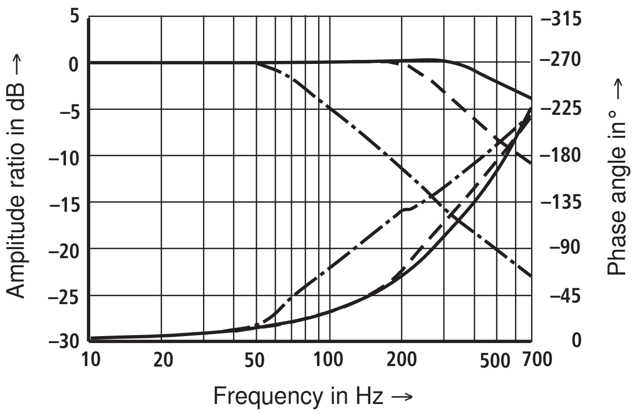
40 bar — 70 bar — 140 bar — 210 bar — 315 bar

Frequency response with pressure rating 315 bar, stroke frequency without flow

4WS.2EM 10
Rated flow **30 l/min**



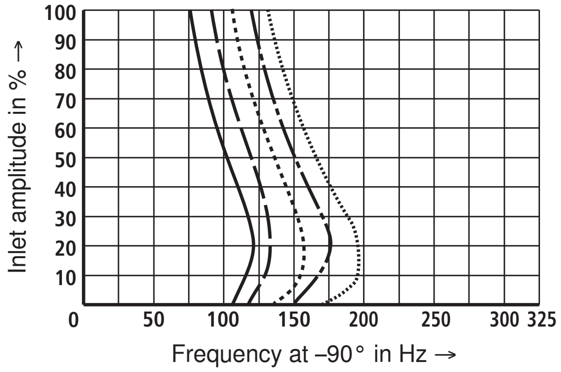
4WSE2ED 10
Rated flow **30 l/min**



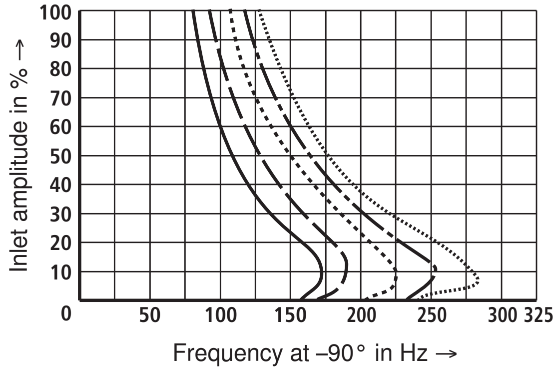
5 % — 25 % — 100 %

Dependency of the frequency *f* at –90° on the operating pressure *p* and the inlet amplitude

4WS.2EM 10
Rated flow **30 l/min**



4WSE2ED 10
Rated flow **30 l/min**

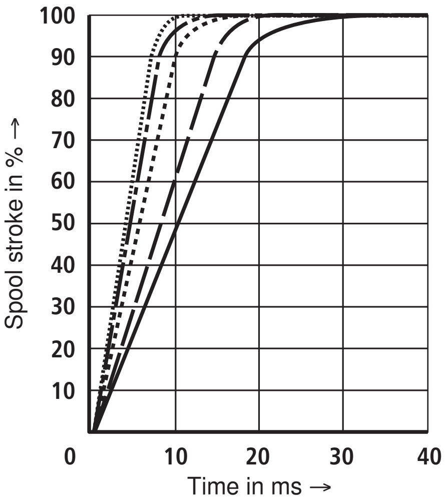


40 bar — 70 bar — 140 bar — 210 bar — 315 bar

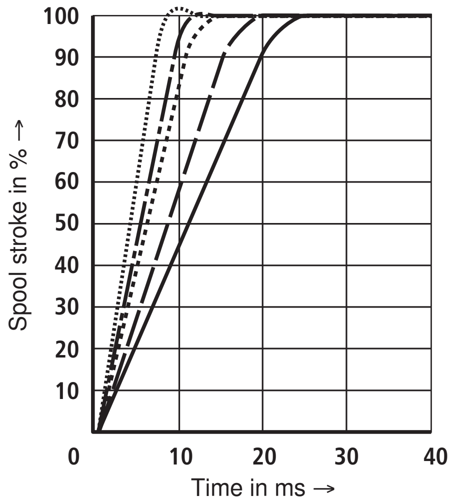
Characteristic curves: Type 4WS.2EM 10 and 4WSE2ED 10 (measured with HLP 32, ϑ_{oil} = 40 °C ± 5 °C)

Transition function with pressure rating 315 bar, step response without flow

4WS.2EM 10
Rated flow **45 l/min**



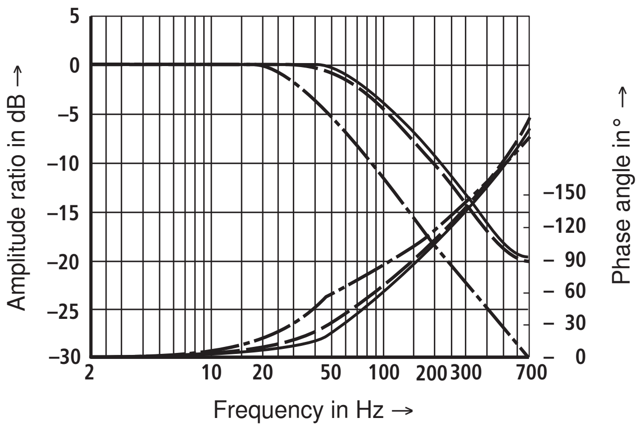
4WSE2ED 10
Rated flow **45 l/min**



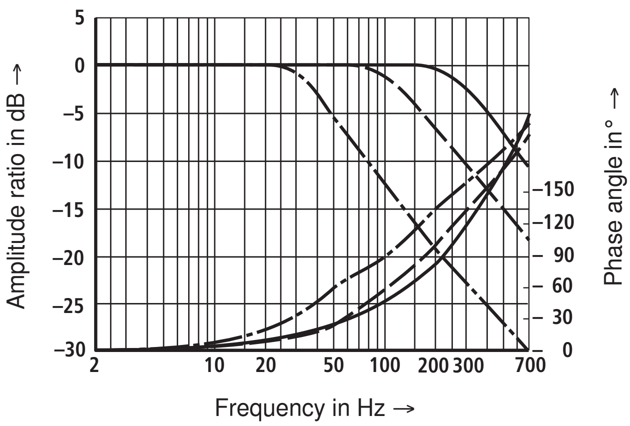
40 bar — 70 bar — 140 bar — 210 bar — 315 bar

Frequency response with pressure rating 315 bar, stroke frequency without flow

4WS.2EM 10
Rated flow **45 l/min**



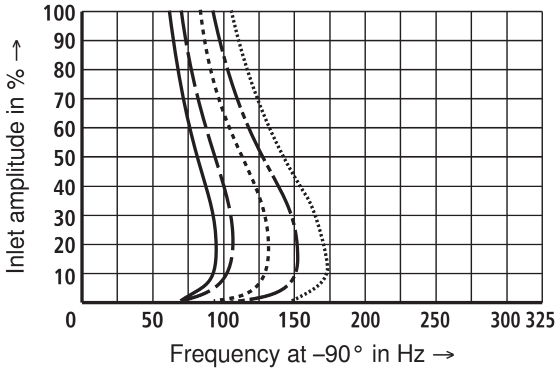
4WSE2ED 10
Rated flow **45 l/min**



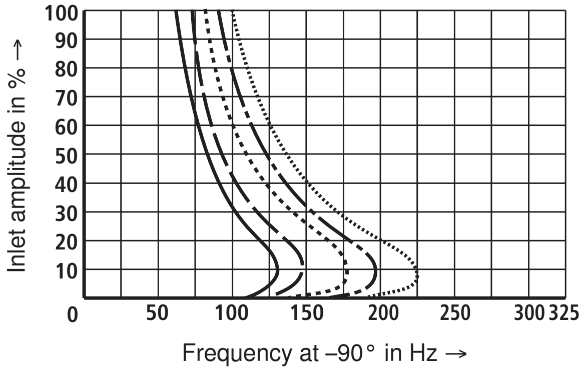
5 % — 25 % — 100 %

Dependency of the frequency *f* at –90° on the operating pressure *p* and the inlet amplitude

4WS.2EM 10
Rated flow **45 l/min**



4WSE2ED 10
Rated flow **45 l/min**

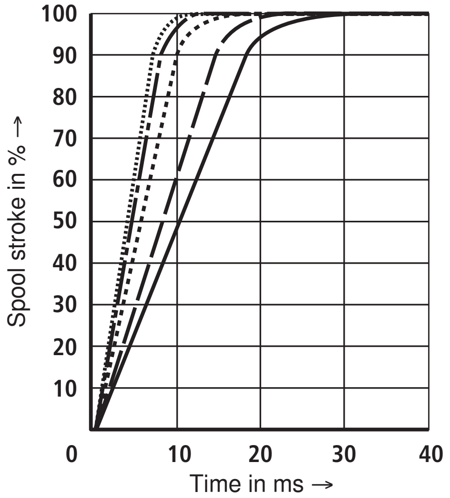


40 bar — 70 bar — 140 bar — 210 bar — 315 bar

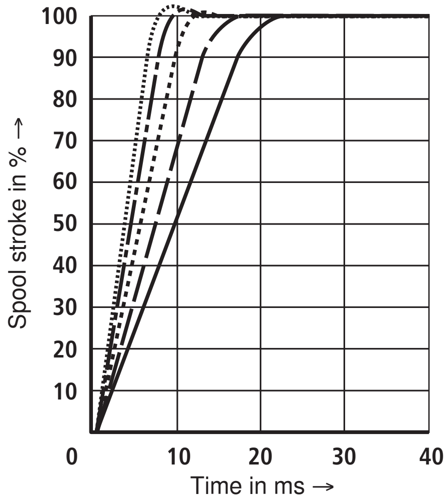
Characteristic curves: Type 4WS.2EM 10 and 4WSE2ED 10 (measured with HLP 32, ϑ_{oil} = 40 °C ± 5 °C)

Transition function with pressure rating 315 bar, step response without flow

4WS.2EM 10
Rated flow **60 l/min**



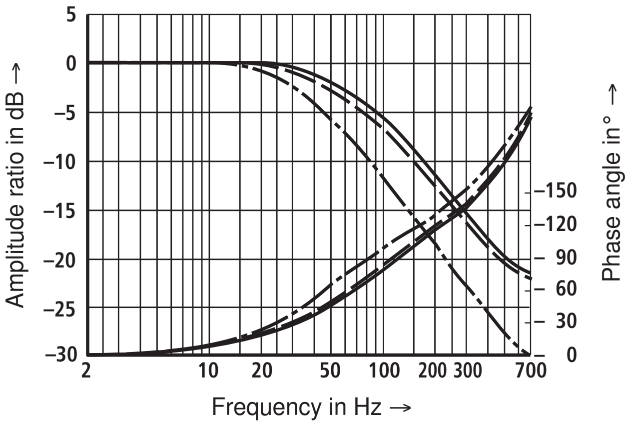
4WSE2ED 10
Rated flow **60 l/min**



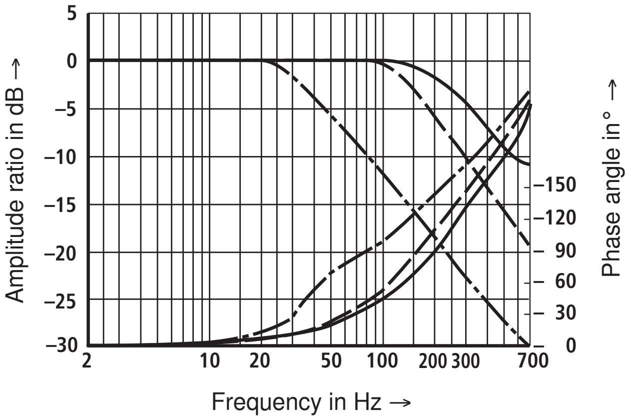
40 bar — 70 bar — 140 bar — 210 bar — 315 bar

Frequency response with pressure rating 315 bar, stroke frequency without flow

4WS.2EM 10
Rated flow **60 l/min**



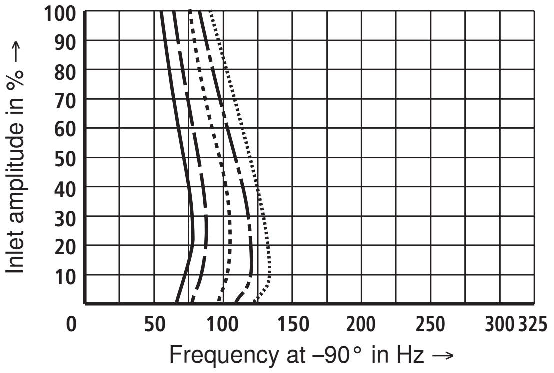
4WSE2ED 10
Rated flow **60 l/min**



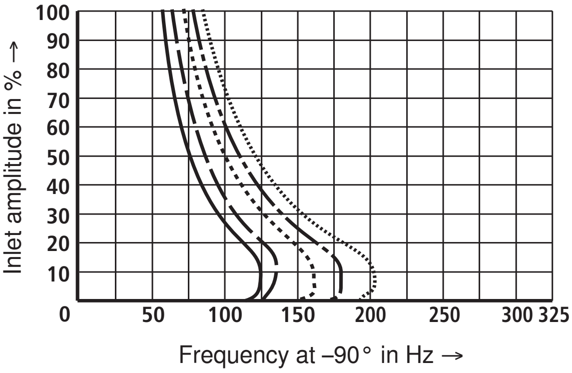
5 % — 25 % — 100 %

Dependency of the frequency *f* at –90° on the operating pressure *p* and the inlet amplitude

4WS.2EM 10
Rated flow **60 l/min**



4WSE2ED 10
Rated flow **60 l/min**

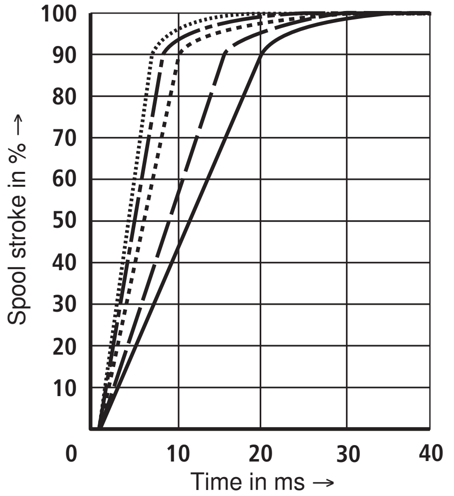


40 bar — 70 bar — 140 bar — 210 bar — 315 bar

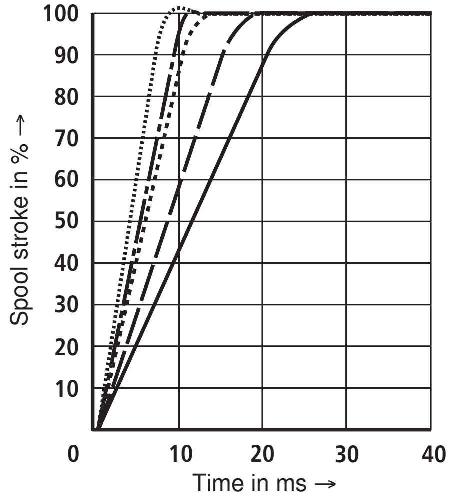
Characteristic curves: Type 4WS.2EM 10 and 4WSE2ED 10 (measured with HLP 32, ϑ_{oil} = 40 °C ± 5 °C)

Transition function with pressure rating 315 bar, step response without flow

4WS.2EM 10
Rated flow **75 l/min**



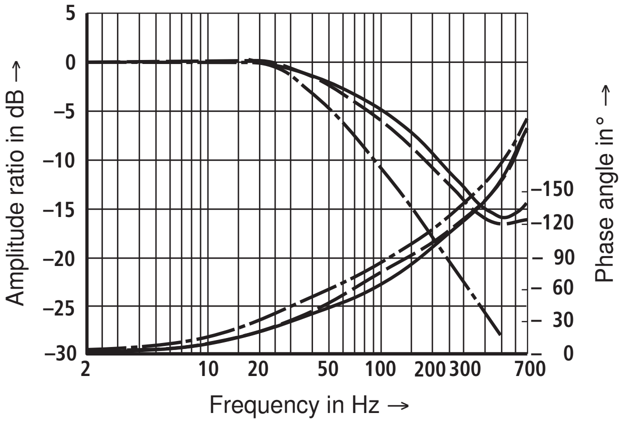
4WSE2ED 10
Rated flow **75 l/min**



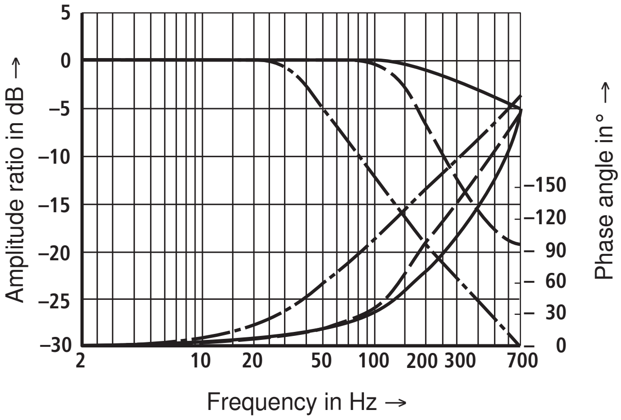
40 bar — 70 bar — 140 bar — 210 bar — 315 bar

Frequency response with pressure rating 315 bar, stroke frequency without flow

4WS.2EM 10
Rated flow **75 l/min**



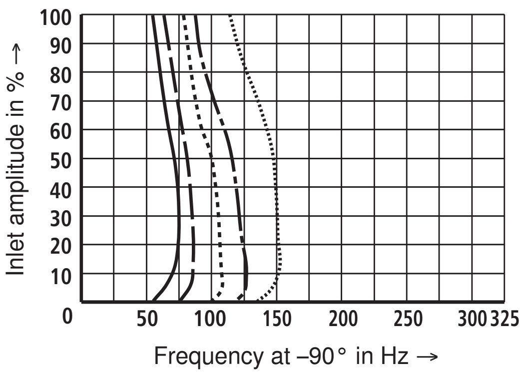
4WSE2ED 10
Rated flow **75 l/min**



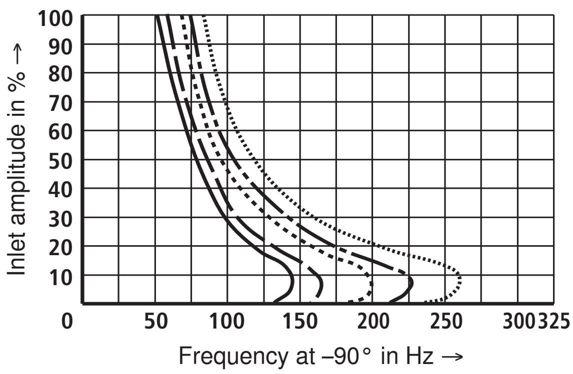
5 % — 25 % — 100 %

Dependency of the frequency *f* at –90° on the operating pressure *p* and the inlet amplitude

4WS.2EM 10
Rated flow **75 l/min**



4WSE2ED 10
Rated flow **75 l/min**

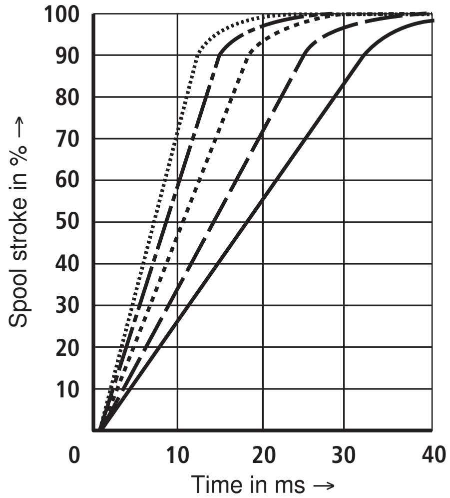


40 bar — 70 bar — 140 bar — 210 bar — 315 bar

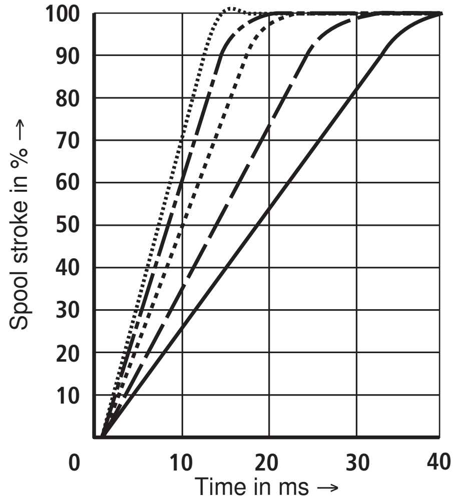
Characteristic curves: Type 4WS.2EM 10 and 4WSE2ED 10 (measured with HLP 32, ϑ_{oil} = 40 °C ± 5 °C)

Transition function with pressure rating 315 bar, step response without flow

4WS.2EM 10
Rated flow **90 l/min**



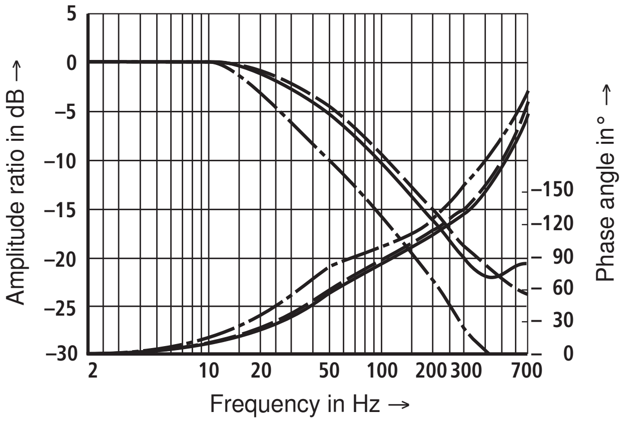
4WSE2ED 10
Rated flow **90 l/min**



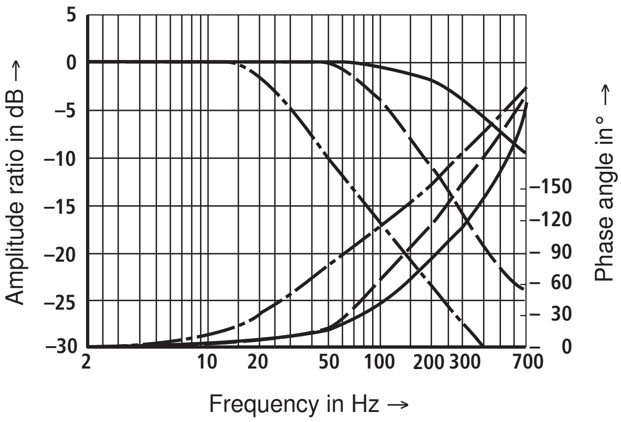
40 bar — 70 bar — 140 bar — 210 bar — 315 bar

Frequency response with pressure rating 315 bar, stroke frequency without flow

4WS.2EM 10
Rated flow **90 l/min**



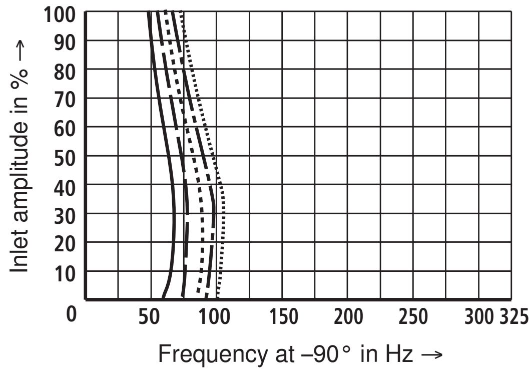
4WSE2ED 10
Rated flow **90 l/min**



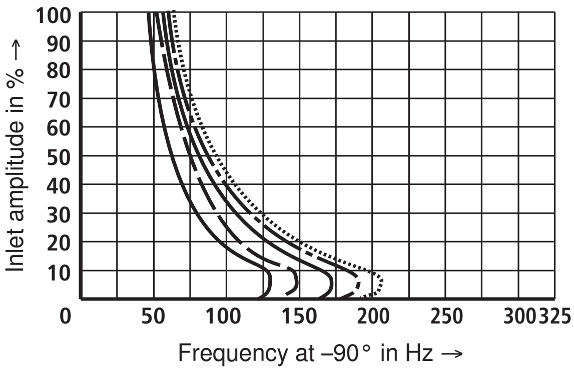
5 % — 25 % — 100 %

Dependency of the frequency *f* at –90° on the operating pressure *p* and the inlet amplitude

4WS.2EM 10
Rated flow **90 l/min**



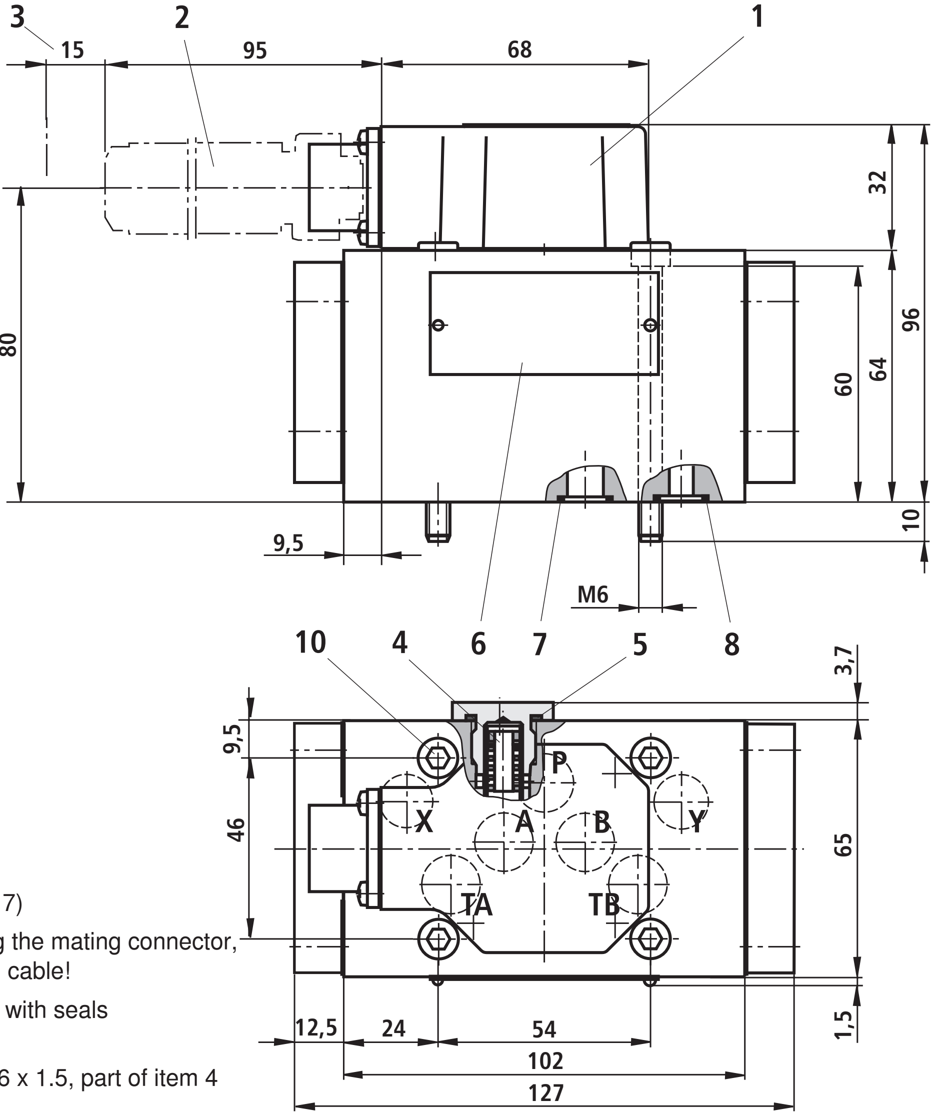
4WSE2ED 10
Rated flow **90 l/min**



40 bar — 70 bar — 140 bar — 210 bar — 315 bar

Unit dimensions: Type 4WS2EM 10 (dimensions in mm)

Mechanical return / external control electronics, type 4WS2EM 10-5X/…



1 Cap

2 Mating connector (order separately, see page 7)

3 Space required for removing the mating connector, also take care of connection cable!

4 Exchangeable filter element with seals Material no.: **R961001950**

5 Profile seal for filter screw 16 x 1.5, part of item 4

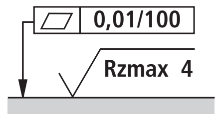
6 Name plate

7 Identical seal rings for ports A, B, P, TA and TB

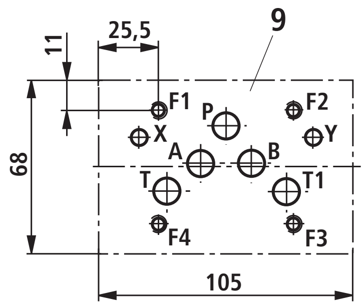
8 Identical seal rings for ports X and Y
Ports X and Y are also pressurized in case of "internal" pilot oil supply.

9 Processed valve mounting faces, porting pattern according to ISO 4401-05-05-0-05
Port T1 is optional and is recommended for reducing the pressure drop from B → T with rated flows > 45 l/min.

10 Valve mounting screws
For reasons of stability, exclusively the following valve mounting screws may be used:
4 hexagon socket head cap screws ISO 4762-M6x70-10.9-flZn-240h-L (friction coefficient 0.09 – 0.14 according to VDA 235-101) (included in the delivery)



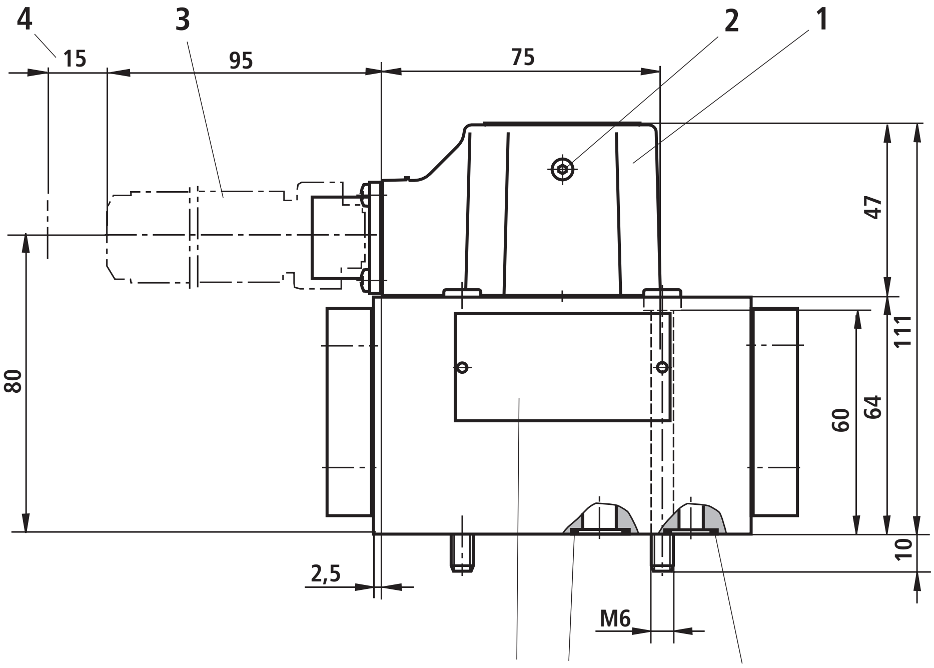
Required surface quality of the counterpart

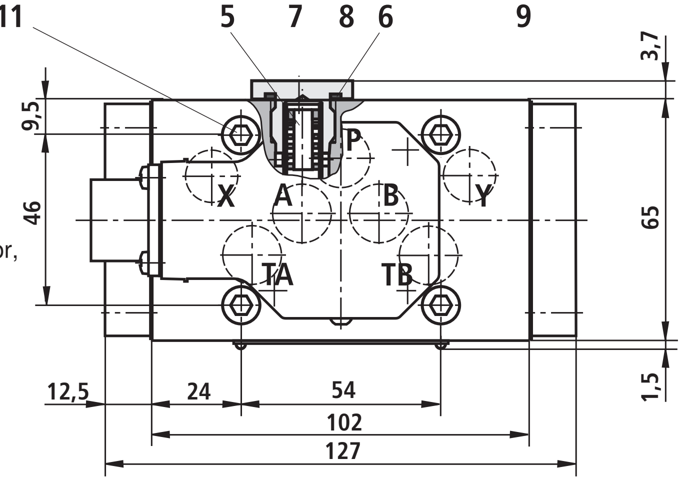


Subplates according to data sheet 45054 must be ordered separately.

Unit dimensions: Type 4WSE2EM 10 (dimensions in mm)

Mechanical return / integrated control electronics, type 4WSE2EM 10-5X/…





1 Cap **with** integrated control electronics

2 Electric zero point setting:
After removal of the SW2.5 plug screw, the zero point can be corrected using a potentiometer

3 Mating connector (order separately, see page 7)

4 Space required for removing the mating connector, also take care of connection cable!

5 Exchangeable filter element with seals
Material no.: **R961001950**

6 Profile seal for filter screw 16 x 1.5, part of item 5

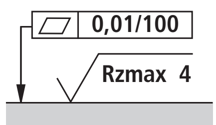
7 Name plate

8 Identical seal rings for ports A, B, P, TA and TB

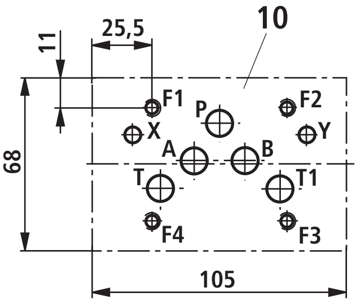
9 Identical seal rings for ports X and Y
Ports X and Y are also pressurized in case of "internal" pilot oil supply.

10 Processed valve mounting faces, porting pattern according to ISO 4401-05-05-0-05
Port T1 is optional and is recommended for reducing the pressure drop from B → T with rated flows > 45 l/min.

11 Valve mounting screws
For reasons of stability, exclusively the following valve mounting screws may be used:
4 hexagon socket head cap screws
ISO 4762-M6x70-10.9-flZn-240h-L
(friction coefficient 0.09 – 0.14 according to VDA 235-101) (included in the delivery)



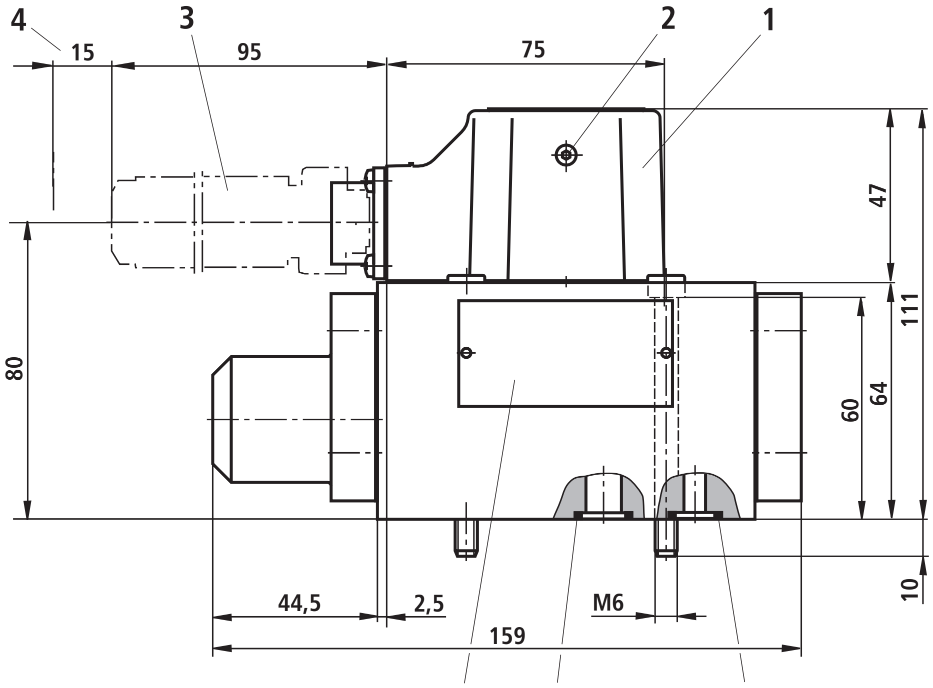
Required surface quality of the counterpart

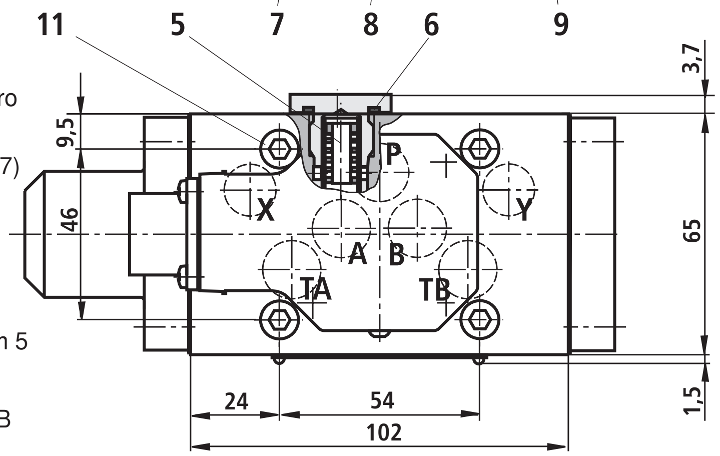


Subplates according to data sheet 45054 must be ordered separately.

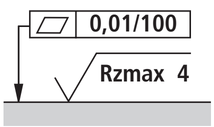
Unit dimensions: Type 4WSE2ED 10 (dimensions in mm)

Electric and mechanical return / integrated control electronics, type 4WSE2ED 10-5X/…

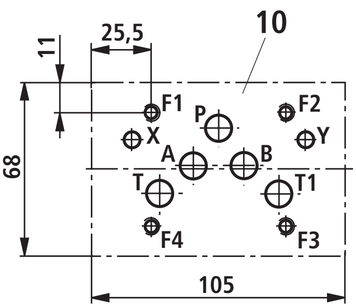




1 Cap **with** integrated control electronics
2 Electric zero point setting:
After removal of the SW2.5 plug screw, the zero point can be corrected using a potentiometer
3 Mating connector (order separately, see page 7)
4 Space required for removing the mating connector, also take care of connection cable!
5 Exchangeable filter element with seals
Material no.: **R961001950**
6 Profile seal for filter screw 16 x 1.5, part of item 5
7 Name plate
8 Identical seal rings for ports A, B, P, TA and TB
9 Identical seal rings for ports X and Y
Ports X and Y are also pressurized in case of "internal" pilot oil supply.
10 Processed valve mounting faces, porting pattern according to ISO 4401-05-05-0-05
Port T1 is optional and is recommended for reducing the pressure drop from B → T with rated flows > 45 l/min.
11 Valve mounting screws
For reasons of stability, exclusively the following valve mounting screws may be used:
4 hexagon socket head cap screws ISO 4762-M6x70-10.9-flZn-240h-L (friction coefficient 0.09 – 0.14 according to VDA 235-101) (included in the delivery)



Required surface quality of the counterpart

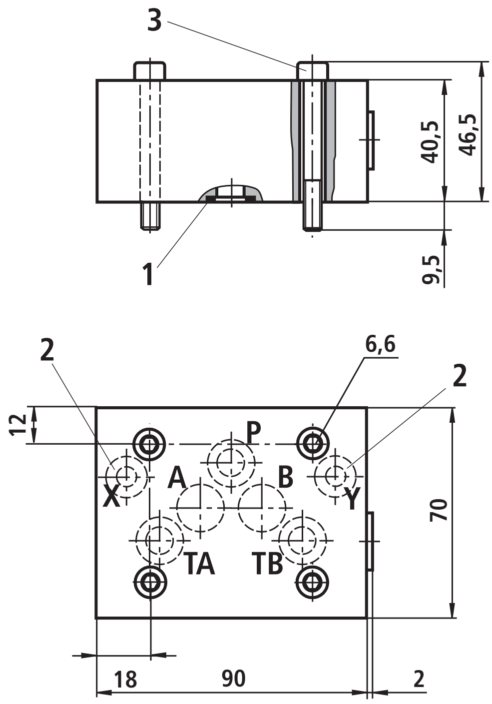


Subplates according to data sheet 45054 must be ordered separately.

Flushing plate with porting pattern according to ISO 4401-05-05-0-05 (dimensions in mm)

Symbol

with FKM seals,
Material no. **R900912450**, weight: 2 kg



1 R-ring 13 x 1.6 x 2 (A, B, P, TA and TB)

2 R-ring 11.18 x 1.6 x 1.78 (X, Y)

3 Mounting screws
For reasons of stability, exclusively the following mounting screws may be used:
4 hexagon socket head cap screws
ISO 4762-M6x50-10.9-flZn-240h-L
(friction coefficient 0.09 - 0.14 according to VDA 235-101) (included in the delivery)

To ensure proper operation of the servo-valves, it is necessary to flush the system before commissioning.

The following values are guidelines for the flushing time per system:

$$\boxed{t \geq \frac{V}{Q_V} \cdot 5}$$

t = Flushing time in h
V = Tank capacity in l
Q_V = Pump flow in l/min

When topping up more than 10 % of the tank capacity, flushing must be repeated.

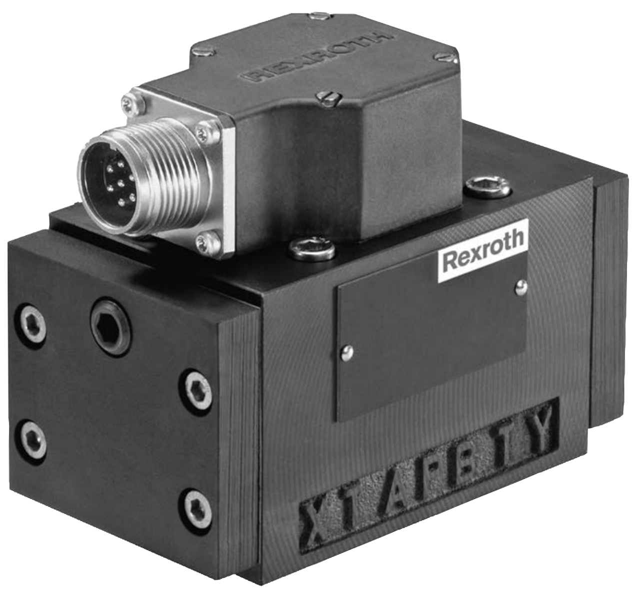
The use of a directional valve with port in accordance with ISO 4401-05-05-0-05 is suited better than a flushing plate. This valve can also be used for flushing the actuator ports. Also refer to catalog sheet RE 07700.

RE 29583-XH
Edition: 2019-10
Replaces: 04.16, 29583-XH-100 /102 / 104
RA80392244_AA

rexroth
A Bosch Company

Directional servo valve, with mechanical position feedback

Type 4WS2EM ...XH



H5893

- Size 10
- Component series 5X
- Maximum operating pressure 315 bar
- Maximum flow 180 l/min

ATEX units
For potentially explosive atmospheres

Information on explosion protection:
- Area of application in accordance with the Explosion Protection Directive 2014/34/EU: **II 1G**
- Type of protection valve:
  Ex ia h IIC T4 Ga according to EN ISO 80079-36 and EN IEC 60079-0 / EN 60079-11

Features

- 4 or 3-way version
- For intended use in potentially explosive atmospheres of zone 0
- Subplate mounting
- Porting pattern according to 4401-05-05-0-05
- Dry control motor, no contamination of the solenoid gaps by the hydraulic fluid
- Wear-free control spool return element
- External control electronics in modular design, additional safety barrier
- Control spool with flow force compensation
- Control sleeve centrically fixed, thus low susceptibility to temperature and pressure
- Pressure chambers at the control sleeve with gap seal, no wear of seal ring

Contents

☞ **Notice:** The documentation version with which the product was supplied is valid.

Ordering code

01	02	03		04		05	06	07	08	09	10	11	12	13	14
4WS2E	**M**	**10**	**–**	**5X**	**/**		**B**	**11**	**XH**			**K31**		**V**	

01	Directional servo valve, 4-way version, 2-stage, electrically operated	**4WS2E**

Control spool return

02	Mechanical	**M**

03	Size 10	**10**

04	Component series 50 ... 59 (50 ... 59: unchanged installation and connection dimensions)	**5X**

Rated flow

05	5 l/min	**5**
	10 l/min	**10**
	20 l/min	**20**
	30 l/min	**30**
	45 l/min	**45**
	60 l/min	**60**
	75 l/min	**75**
	90 l/min	**90**

06	Control sleeve exchangeable	**B**

07	Valve for **external** control electronics; coil no. 11 (30 mA/85 Ω per coil)	**11**

Explosion protection

08	"Intrinsically safe" for device group II	**XH**
	For details, see information on the explosion protection page 7	

Pilot oil supply

09	External pilot oil supply, external pilot oil return	**–**
	Internal pilot oil supply, external pilot oil return	**E**
	Internal pilot oil supply, internal pilot oil return	**ET**
	External pilot oil supply, internal pilot oil return	**T**

Inlet pressure range

10	10 ... 210 bar	**210**
	10 ... 315 bar	**315**

Electrical connection

11	**Without** mating connector; connector DIN EN 175201-804	**K31** [1)]

Control spool overlap [2)]

12	0 ... 0.5% negative	**E**
	0 ... 0.5% positive	**D**
	3 ... 5% positive	**C**

Seal material (observe compatibility of seals with hydraulic fluid used, see page 6)

13	FKM seals	**V**

Ordering code

01	02	03		04		05	06	07	08	09	10	11	12	13	14
4WS2E	**M**	**10**	**–**	**5X**	**/**		**B**	**11**	**XH**			**K31**		**V**	

Special versions

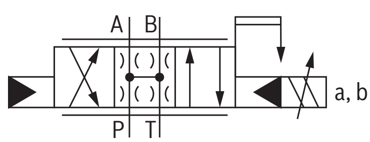
14	Without control (de-energized condition), channels P → B and A → T are open 10% of the nominal quantity.	**-100**
	Without control (de-energized condition), channels P → A and B → T are open 10% of the nominal quantity.	**-102**
	3-way version; Channel B is set to half the operating pressure without command value control (0 mA).	**-104**

[1] Mating connector, separate order, see page 14.

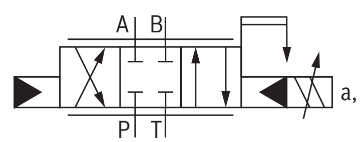
[2] The control spool overlap is specified in % of the control spool stroke.

Symbols

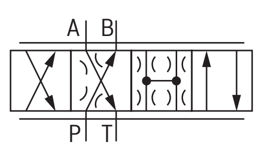
Control spool overlap "E"

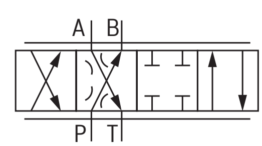


Control spool overlap "C" and "D"

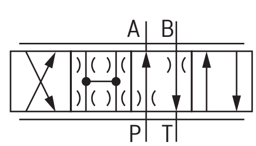


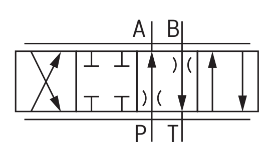
Special version "-100"



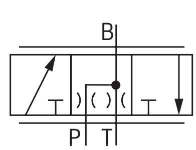


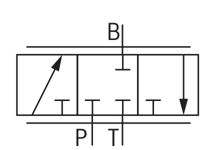
Special version "-102"





Special version "-104"





Notice:
Representation according to DIN ISO 1219-1.

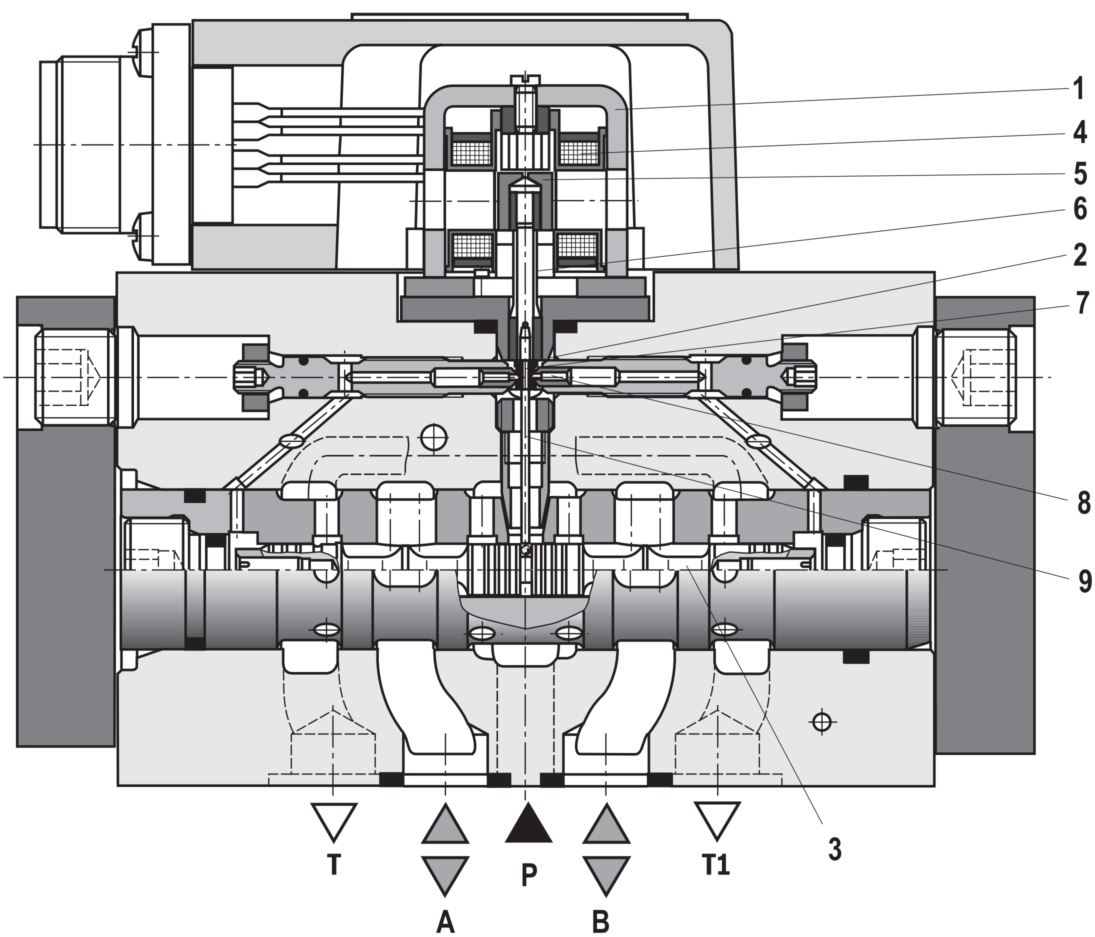
Function, section

Valves of type 4WS2EM are electrically operated, 2-stage directional servo valves. They are mainly used to control position, force, pressure or velocity.
The valves basically comprise of an electro-mechanical converter (torque motor) (1), a hydraulic amplifier (nozzle flapper plate principle) (2) and a control spool (3) in a sleeve (2ndstage) which is connected with the torque motor via a mechanical feedback.
An electrical input signal at the coils (4) of the torque motor generates a force by means of a permanent magnet which acts on the armature (5), and in connection with a torque tube (6) results in a torque. This causes the flapper plate (7) which is connected to the torque tube (6) via a bolt to move from the central position between the two control nozzles (8), and a pressure differential is created across the front sides of the control spool (3). This pressure differential results in the control spool (3) changing its position, which results in the pressure port being connected to one actuator port and, at the same time, the other actuator port being connected to the return flow port.

The control spool (3) is connected to the flapper plate or the torque motor by means of a bending spring (mechanical feedback) (9). The position of the control spool (3) is changed until the feedback torque across the bending spring and the electro-magnetic torque of the torque motor are balanced and the pressure differential at the nozzle flapper plate system becomes zero.
The stroke of the control spool (3) and consequently the flow of the servo valve are controlled proportionally to the electrical input signal. It must be noted that the flow depends on the valve pressure drop.

External control electronics (servo amplifier) serve the actuation of the valve, amplifying an analog input signal (command value) so that with the output signal, the servo valve is actuated in a flow-controlled form.

Version "-104"
This is a directional servo valve in 3-way version which means that depending on the input signal either P to B or B to T is connected. Channel A is always blocked in the control area.



Type 4WS2EM 10...

Technical data
(for applications outside these values, please consult us!)

General			
Installation position			Any - ensure that during start-up of the system, the valve is supplied with sufficient pressure (≥ 10 bar)
Ambient temperature range		°C	–20 ... +60
Storage temperature range		°C	+5 ... +40
Maximum storage time		years	1
Weight		kg	3.56
Surface protection	▶ Valve body, cover, filter screw		Nitro-carburated
	▶ Cap		Anodized

<table>
<tr><th colspan="11">Hydraulic</th></tr>
<tr><td>Operating pressure range</td><td>▶ Pilot control valve
– Pilot oil supply</td><td>bar</td><td colspan="8">10 ... 210 or 10 ... 315</td></tr>
<tr><td>Maximum operating pressure</td><td>▶ Main valve,
– Port A, B, P</td><td>bar</td><td colspan="8">315</td></tr>
<tr><td>Maximum return flow pressure</td><td>▶ Port T
– Pilot oil return internal</td><td>bar</td><td colspan="8">Pressure peaks < 100, static < 10</td></tr>
<tr><td></td><td>– Pilot oil return external</td><td>bar</td><td colspan="8">315</td></tr>
<tr><td></td><td>▶ Port Y</td><td>bar</td><td colspan="8">Pressure peaks < 100, static < 10</td></tr>
<tr><td colspan="3">Hydraulic fluid</td><td colspan="8">see table page 6</td></tr>
<tr><td colspan="2">Hydraulic fluid temperature range</td><td>°C</td><td colspan="8">–15 ... +60, preferably +40 ... +50</td></tr>
<tr><td colspan="2">Viscosity range</td><td>mm²/s</td><td colspan="8">15 ... 380; preferably 30 ... 45</td></tr>
<tr><td colspan="3">Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)</td><td colspan="8">Class 18/16/13 [1]</td></tr>
<tr><td colspan="2">Zero flow $q_{V,L}$</td><td>l/min</td><td colspan="8">see characteristic curve on page 9</td></tr>
<tr><td colspan="2">Rated flow $q_{V\ nom}$
(tolerance ±10% with valve pressure differential Δp = 70 bar) [2]</td><td>l/min</td><td>5</td><td>10</td><td>20</td><td>30</td><td>45</td><td>60</td><td>75</td><td>90</td></tr>
<tr><td colspan="2">Maximum control spool stroke with mechanical end position (in case of error) related to nominal stroke</td><td>%</td><td colspan="4">120 ... 170</td><td colspan="4">120 ... 150</td></tr>
<tr><td colspan="2">Feedback system</td><td></td><td colspan="8">mechanical</td></tr>
<tr><td colspan="2">Hysteresis (dither-optimized)</td><td>%</td><td colspan="8">≤ 1.5</td></tr>
<tr><td colspan="2">Range of inversion (dither-optimized)</td><td>%</td><td colspan="8">≤ 0.3</td></tr>
<tr><td colspan="2">Response sensitivity (dither-optimized)</td><td>%</td><td colspan="8">≤ 0.2</td></tr>
<tr><td colspan="2">Pressure amplification with 1% control spool stroke change (from the hydraulic zero point)</td><td>% of p_P</td><td colspan="5">≥ 30</td><td colspan="2">≥ 60</td><td>≥ 80</td></tr>
<tr><td colspan="2">Zero adjustment flow
across the entire operating pressure range</td><td>%</td><td colspan="8">≤ 3, long-term ≤ 5</td></tr>
<tr><td colspan="3">Zero shift upon change of:</td><td colspan="8"></td></tr>
<tr><td></td><td>▶ Hydraulic fluid temperature</td><td>% / 20 °C</td><td colspan="8">≤ 1</td></tr>
<tr><td></td><td>▶ Ambient temperature</td><td>% / 20 °C</td><td colspan="8">≤ 1</td></tr>
<tr><td></td><td>▶ Operating pressure 80 ... 120% of p_P</td><td>% / 100 bar</td><td colspan="8">≤ 2</td></tr>
<tr><td></td><td>▶ Return flow pressure 0 ... 10% of p_P</td><td>% / bar</td><td colspan="8">≤ 1</td></tr>
</table>

1) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and simultaneously increases the life cycle of the components.

2) With version "-104", valve pressure differential Δp = 35 bar/ control edge

$q_{V,L}$ = zero flow in l/min
$q_{V\ nom}$ = rated flow in l/min
p_P = operating pressure in bar

Technical data
(for applications outside these values, please consult us!)

Hydraulic fluid		Classification	Suitable sealing materials	Standards	Data sheet
Mineral oils		HL, HLP, HLPD, HVLP, HVLPD	NBR, FKM	DIN 51524	90220
Bio-degradable	▶ Insoluble in water	HETG	FKM	ISO 15380	90221
		HEES	FKM		
	▶ Soluble in water	HEPG	FKM	ISO 15380	

Important information on hydraulic fluids:
- For further information and data on the use of other hydraulic fluids, please refer to the data sheets above or contact us.
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.).
- The ignition temperature of the hydraulic fluid used must be at least 150 °C.

Electric			
Protection class according to EN 60529			IP65 (if suitable and correctly mounted mating connectors are used)
Type of signal			analog
Rated current per coil		mA	30
Resistance per coil		Ω	85
Inductivity with 60 Hz and 100% rated current	▶ Parallel connection	H	0.25

Notice:
In case of control using non-Rexroth amplifiers, we recommend a superimposed dither signal.

External control electronics		
Recommended safety barrier		see page 7
Servo amplifier in modular design	analog	Type VT 11021 according to data sheet 29743

Important notice:
The external servo amplifier and the safety barrier must be operated outside the potentially explosive area.

Technical data
(for applications outside these values, please consult us!)

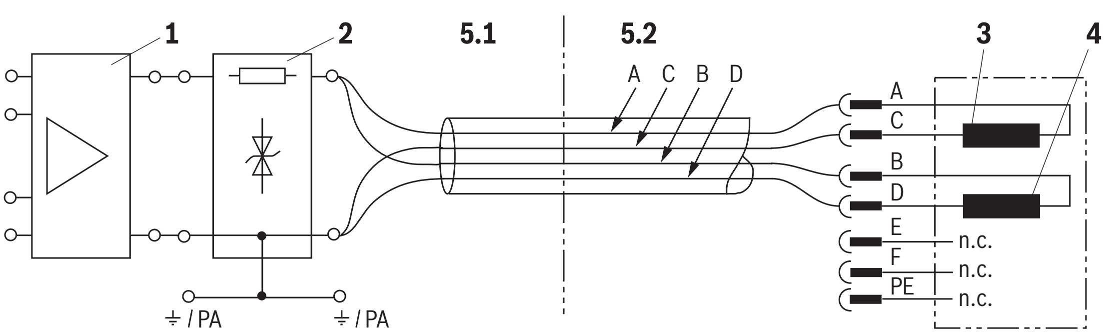
Information on explosion protection	
Area of application according to Directive 2014/34/EU	II 1G
Type of protection according to EN ISO 80079-36 and EN IEC 60079-0 / EN 60079-11	Ex ia h IIC T4 Ga
EU type examination certificate	PTB 11 ATEX 2025 X
Power supply of the valve only from intrinsically safe electric circuits	Maximum values see "Electrical connection"

Special application conditions for safe application:
- Valve cap and mating connector consist of aluminum alloys. For the use as a device of category 1 in zone 0, the valve cap must be protected in a way that ensures that even in case of rare operating failures, no explosive sparks from friction, impact or grinding can occur.
- The ignition temperature of the hydraulic fluid used must be at least 150 °C.
- The specified clearance area for the overpressure protection (see page 13) must be complied with so that in case of an error, overpressure may leak through the valve cap.

Electrical connection

The coils may only be connected **in parallel**.

- Parallel connection



1 Servo amplifier
2 Safety barrier
3 Valve, coil A
4 Valve, coil B
5.1 Non-explosive area
5.2 Explosive area

Power supply of the valve only from intrinsically safe electric circuits with the following maximum values	▶ U_{max}	V	9.3
	▶ I_{max}	mA	390
	▶ P_{max}	mW	907
Recommended safety barrier			Type 9001/02-093-390-101 (company Stahl)

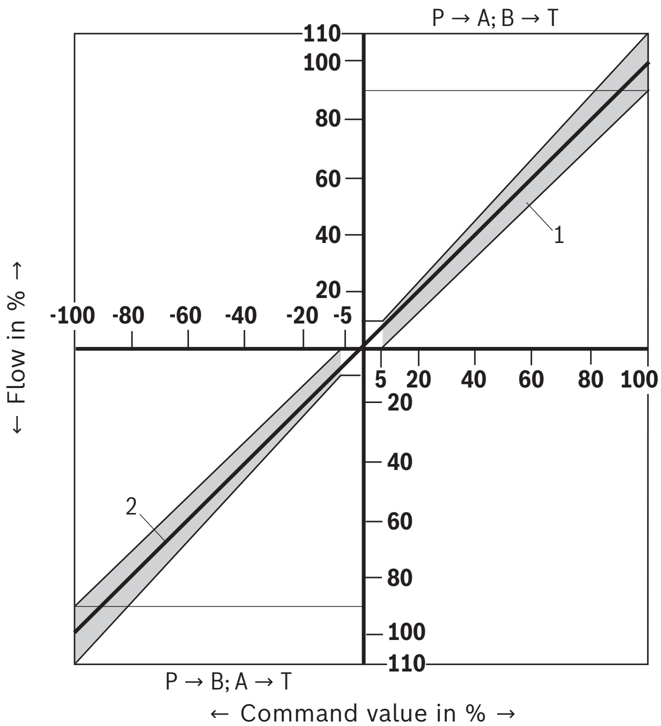
Notice:
Only use approved cables and lines for intrinsically safe electric circuits.

The electric control with plus (+) at A and B and minus (–) at C and D results in direction of flow P → A and B → T.
Inverted electric control results in direction of flow P → B and A → T.
The pins E, F and PE at the connector are not connected.

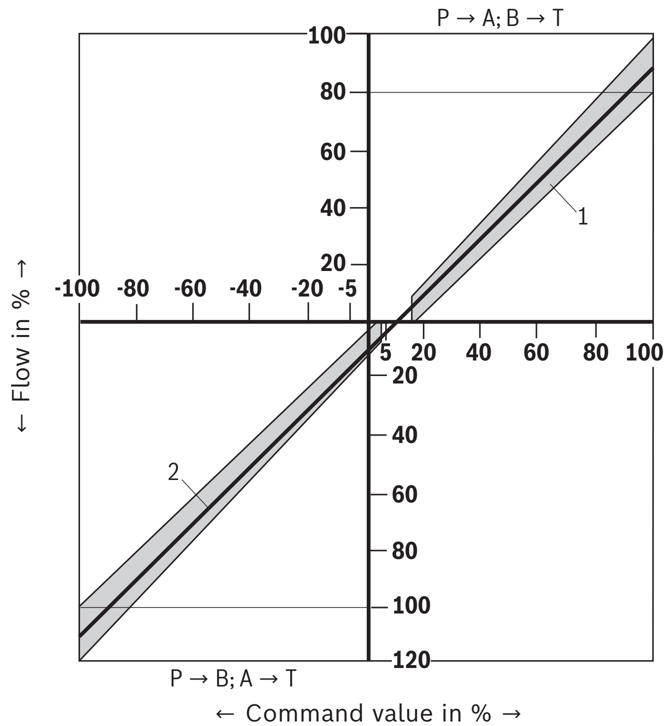
Characteristic curves
(measured with HLP 32, ϑ_{oil} = 40 °C ± 5 °C)

Tolerance field of the flow/signal function at constant valve pressure differential ***Δp***

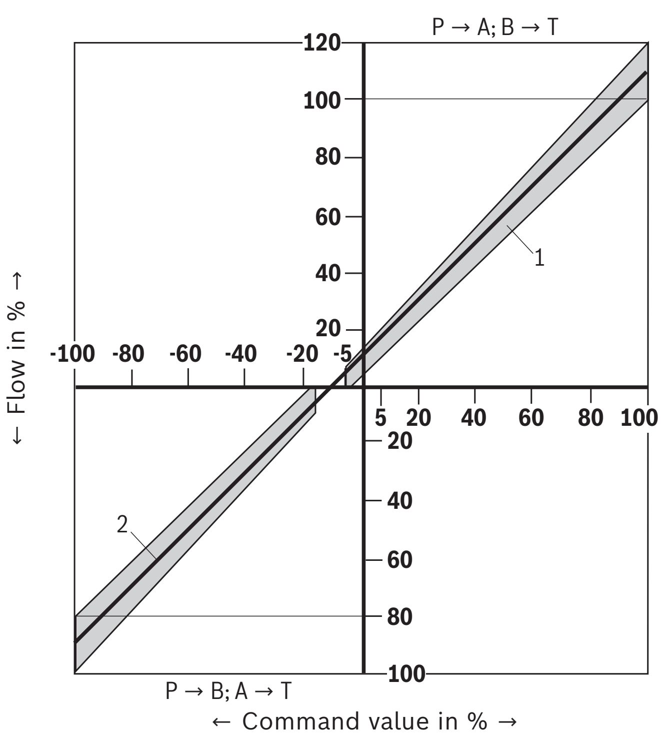
Standard



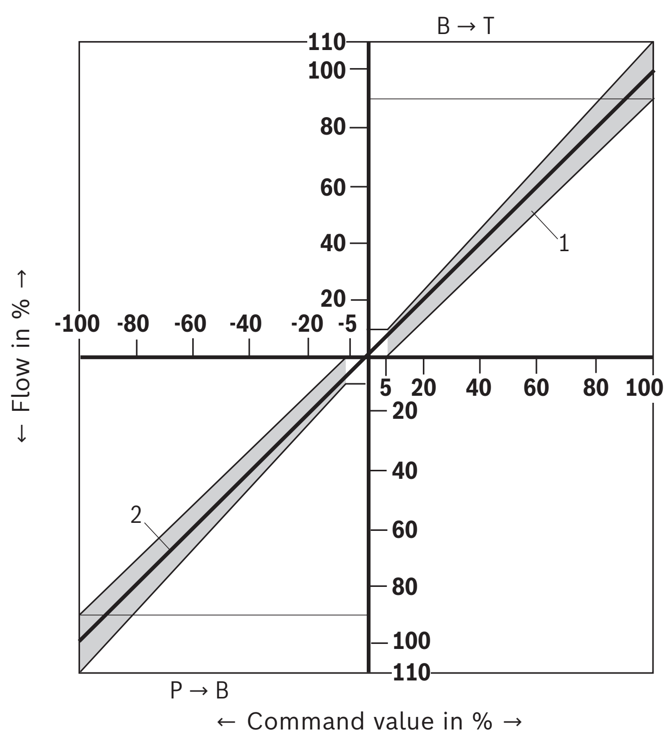
Special version "-100"



Special version "-102"



Special version "-104"

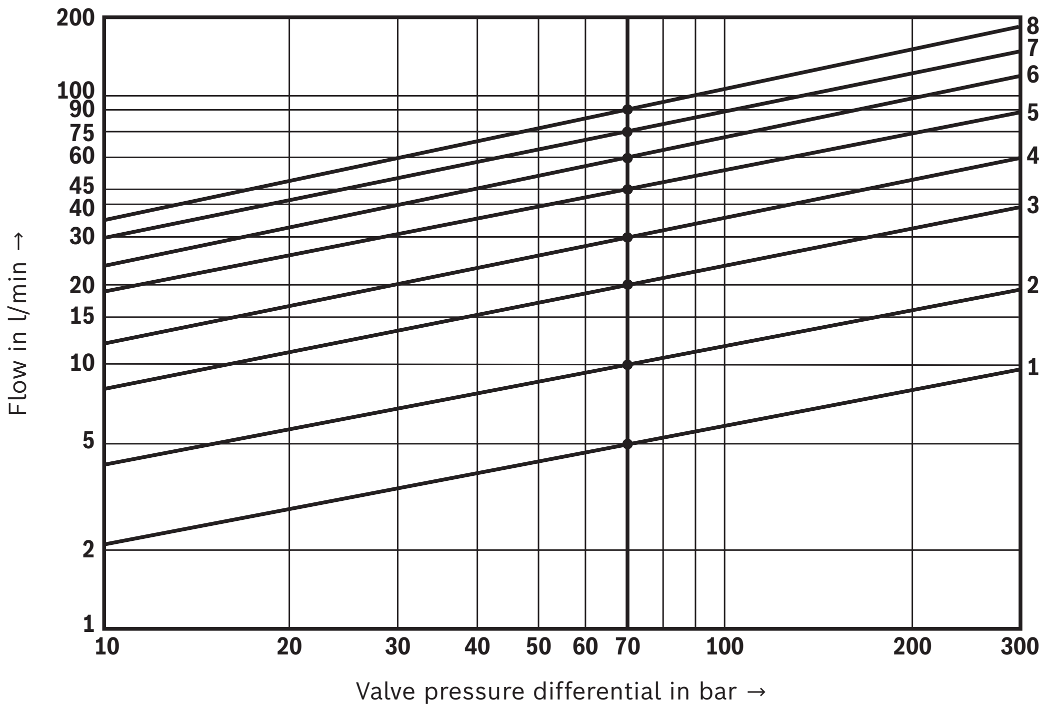


1 Tolerance field

2 Typical flow curve

Characteristic curves
(measured with HLP 32, ϑ_{oil} = 40 °C ± 5 °C)

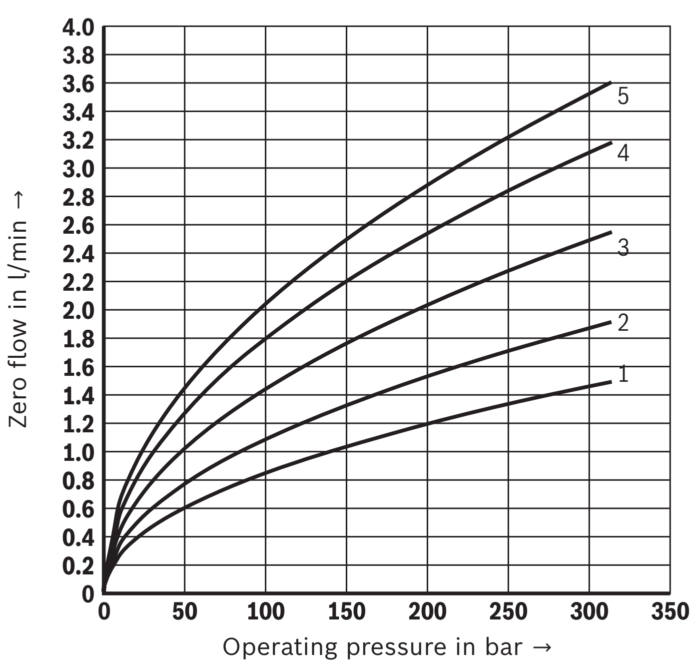
Flow/load function
(tolerance ±10%) with 100% command value signal



Version	Characteristic curve
"5"	1
"10"	2
"20"	3
"30"	4
"45"	5
"60"	6
"75"	7
"90"	8

Notice:
- $\Delta p = p_P - p_L - p_T$
  Δp valve pressure differential
  p_P inlet pressure
  p_L load pressure
  p_T return flow pressure

Zero flow (with control spool overlap "E", measured without dither signal)

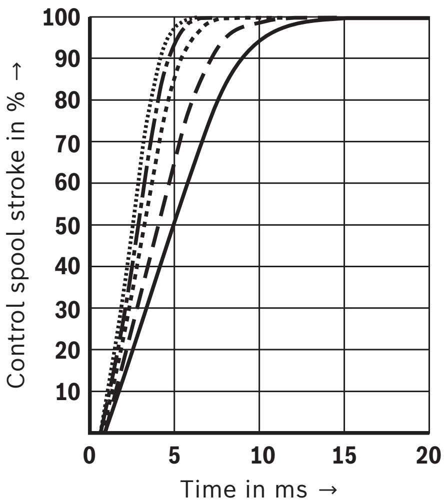


Rated flow
- **1** 5 l/min
- **2** 10 l/min
- **3** 20, 30, 45 l/min
- **4** 60, 75 l/min
- **5** 90 l/min

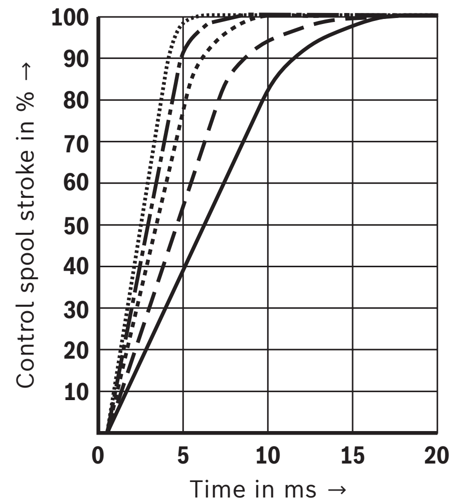
Characteristic curves
(measured with HLP 32, ϑ_{oil} = 40 °C ± 5 °C)

Transition function with pressure rating 315 bar, step response without flow

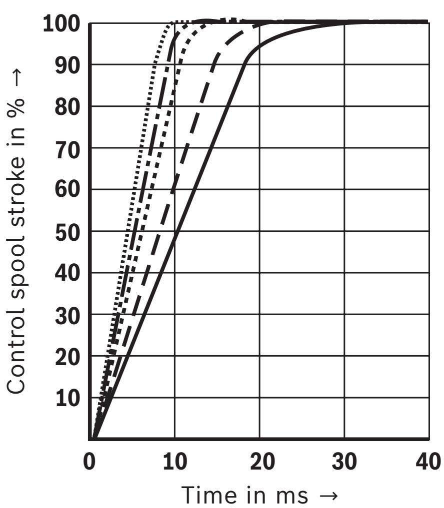
Version "5", "10" and "20"



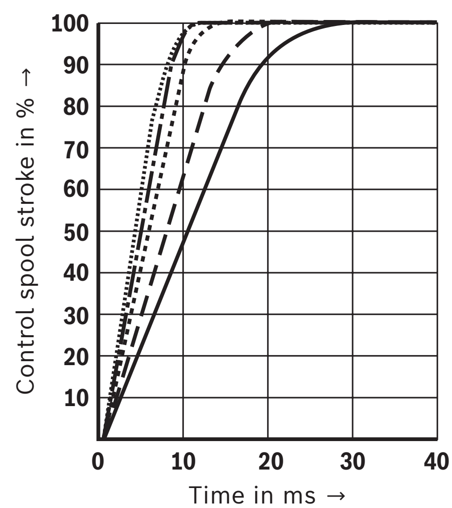
Version "30"



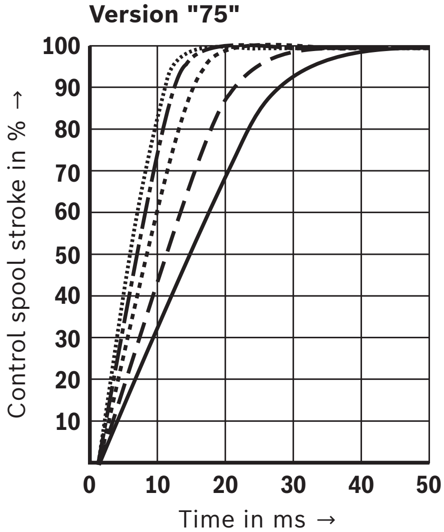
Version "45"



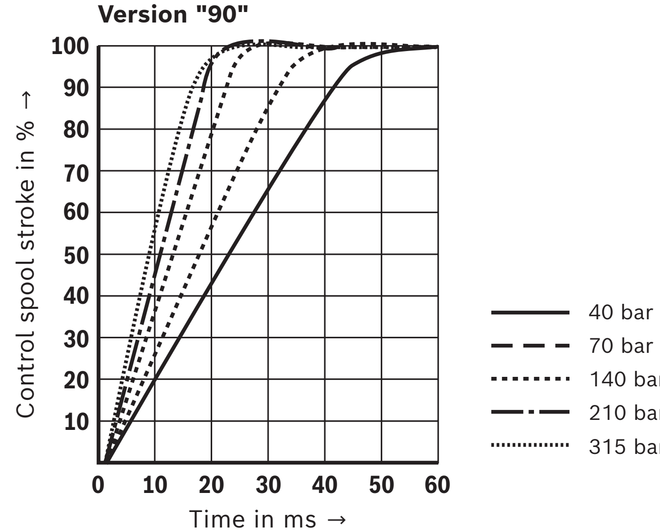
Version "60"



Version "75"



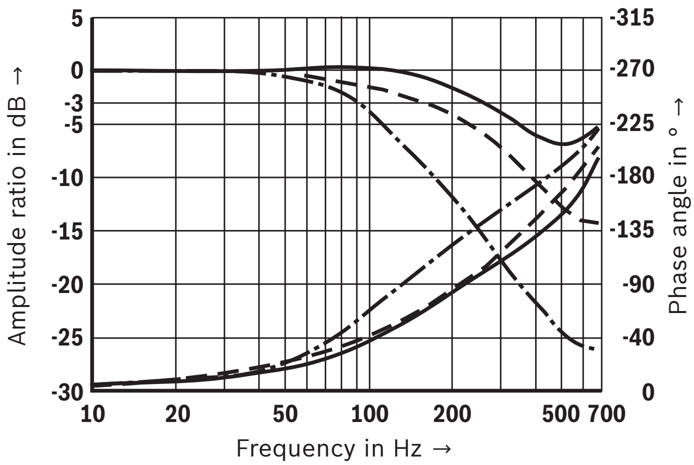
Version "90"



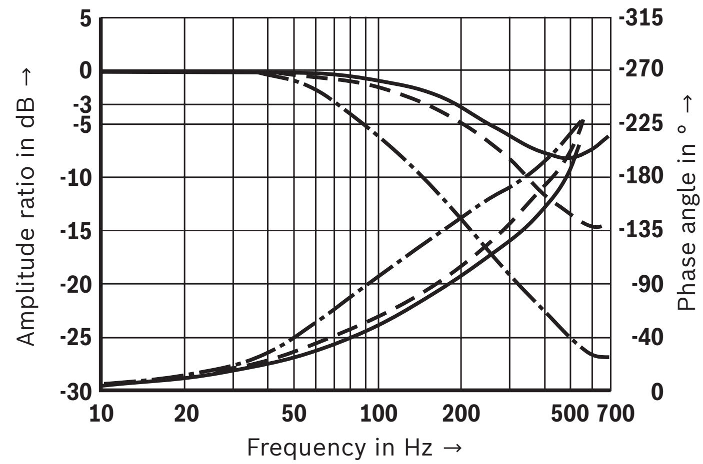
Characteristic curves
(measured with HLP 32, ϑ_{oil} = 40 °C ± 5 °C)

Frequency response with pressure rating 315 bar, stroke frequency without flow

Version "5", "10" and "20"



Version "30"



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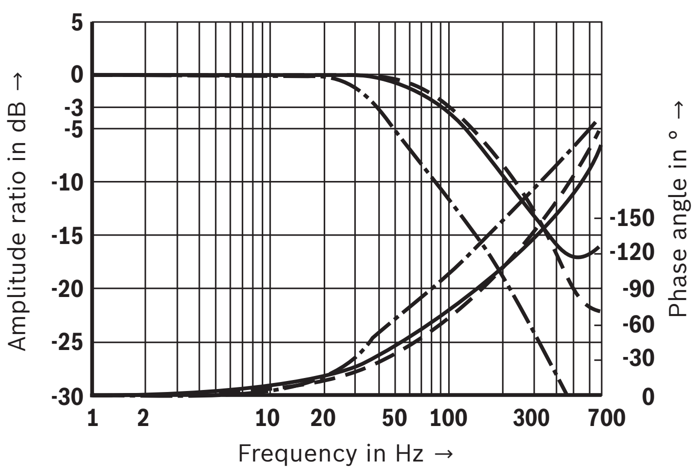
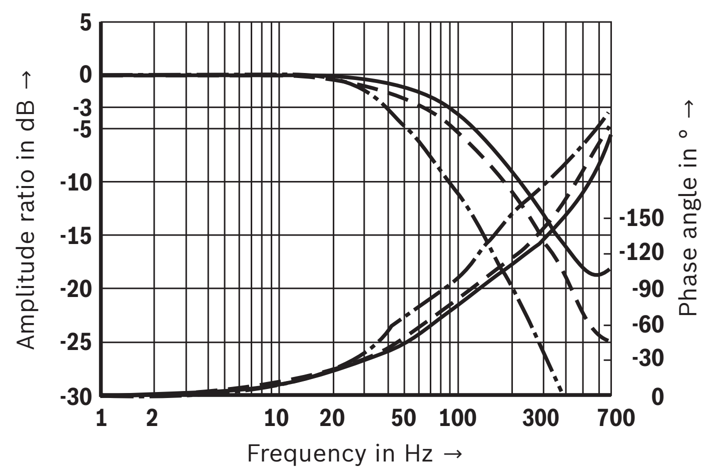
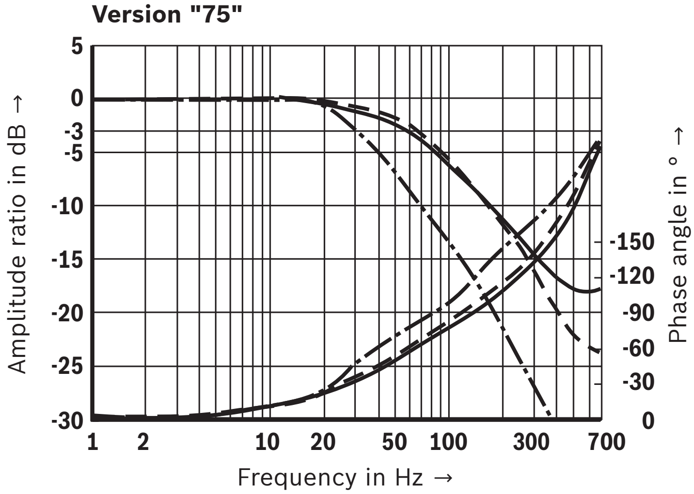


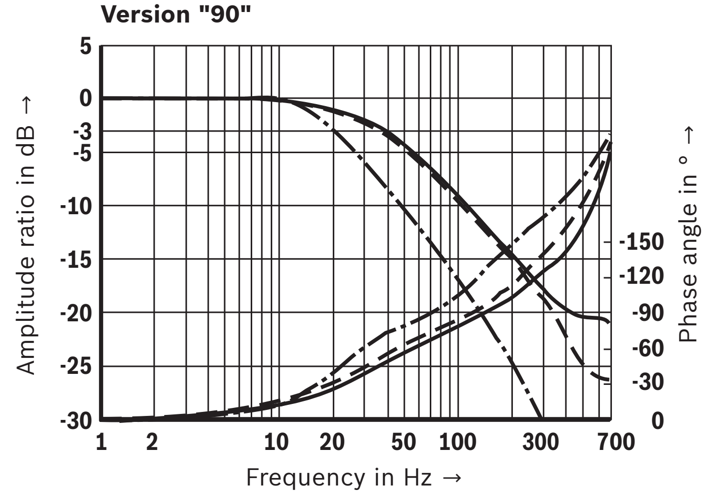
Version "60"



Version "75"



Version "90"



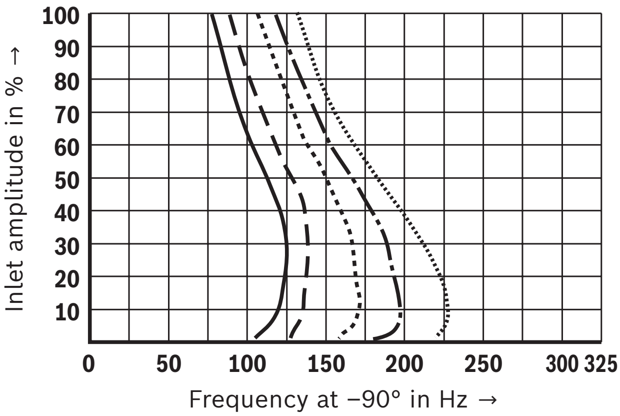
——— 5%
– – – 25%
—·— 100%

Characteristic curves

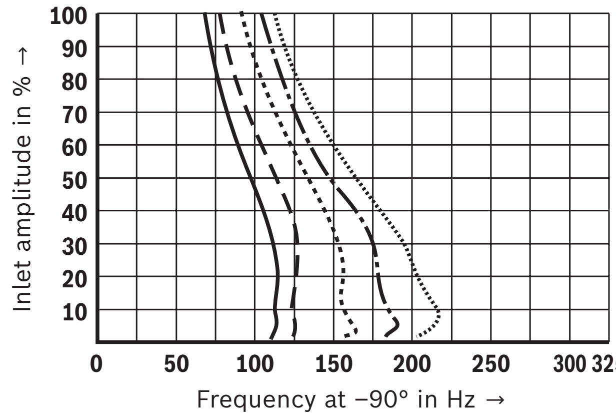
(measured with HLP 32, ϑ_{oil} = 40 °C ± 5 °C)

Frequency response with pressure rating 315 bar, stroke frequency without flow

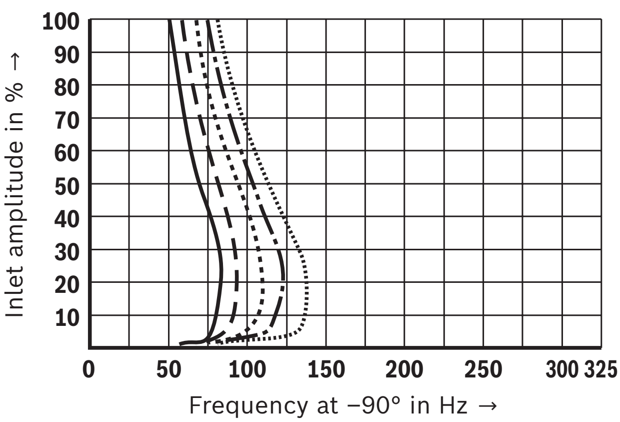
Version "5", "10" and "20"



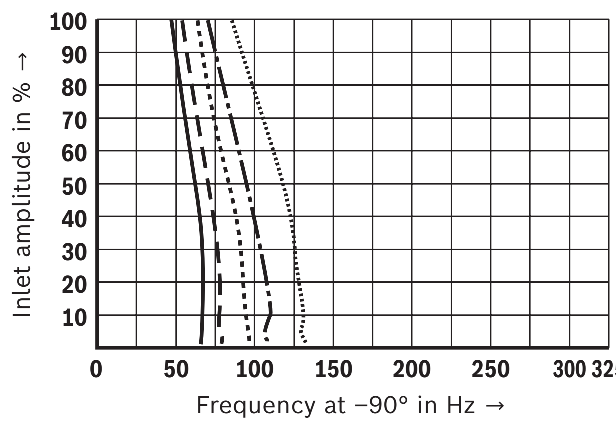
Version "30"



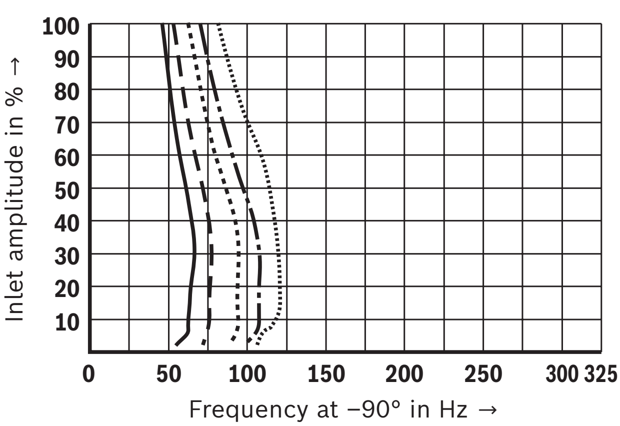
Version "45"



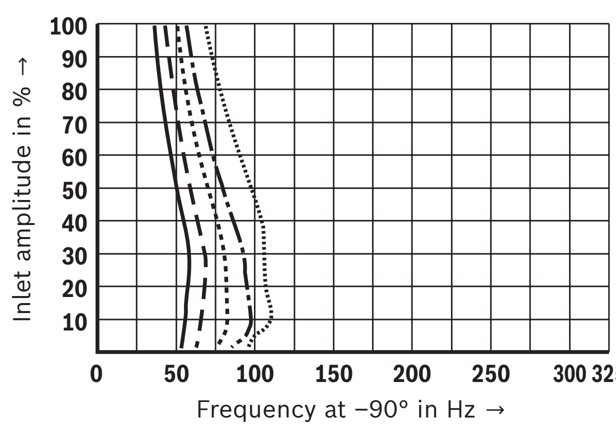
Version "60"

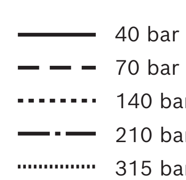


Version "75"

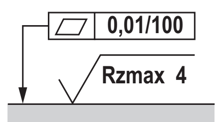


Version "90"

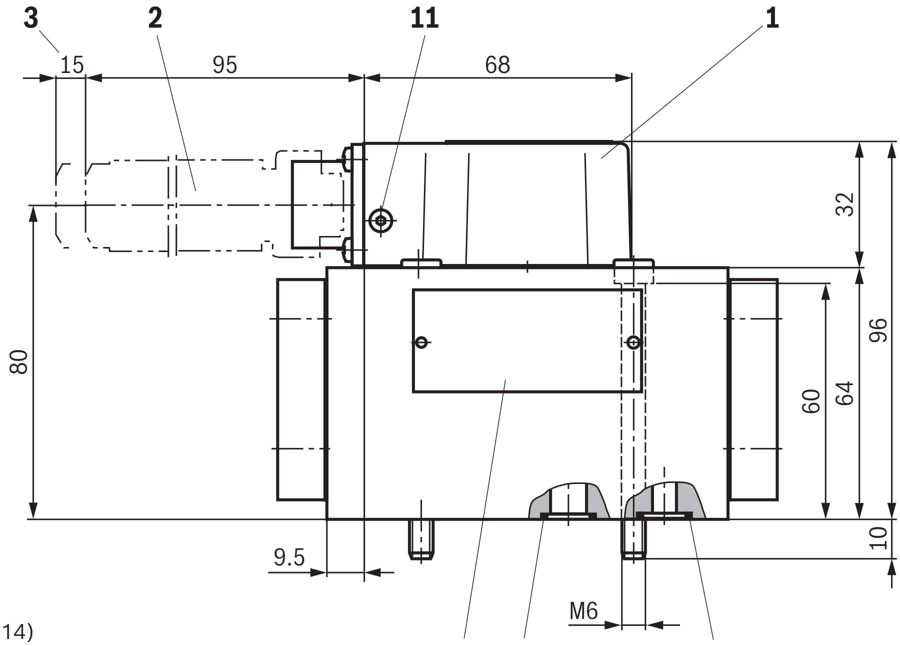


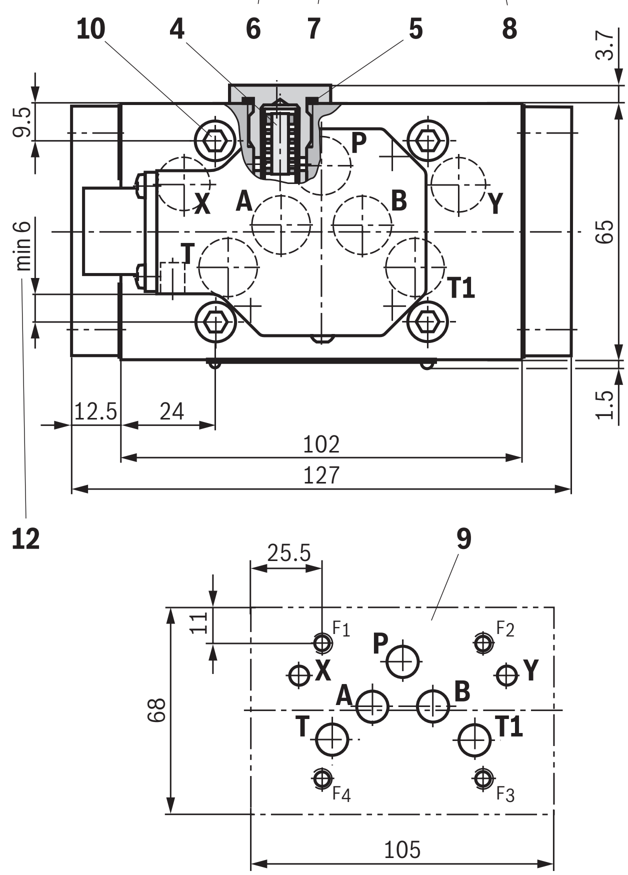


Dimensions
(dimensions in mm)



Required surface quality of the valve contact surface





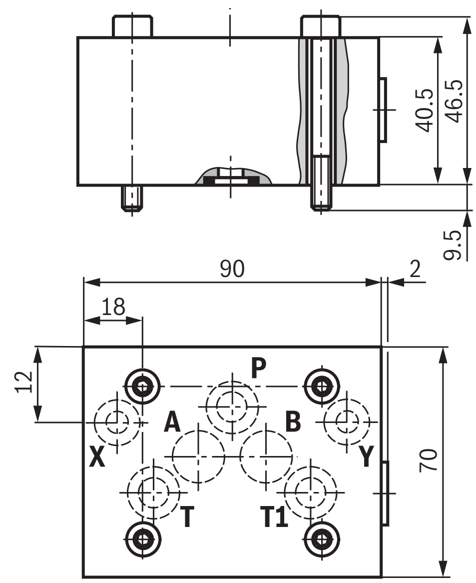
- **1** Cap
- **2** Mating connector (separate order, see page 14)
- **3** Space required for removing the mating connector, also observe the bending radius of the connection line
- **4** Exchangeable filter element with seals
  Material no.: **R961001950**
- **5** Profile seal for filter screw M16 x 1.5, part of item 4
- **6** Name plate
- **7** Identical seal rings for ports P, A, B, T and T1
- **8** Identical seal rings for ports X and Y;
  Ports X and Y are also pressurized in case of "internal" pilot oil supply and return
- **9** Machined valve contact surface;
  Porting pattern according to ISO 4401-05-05-0-05;
  Port T1 is optional and is recommended for reducing the pressure drop from B → T with rated flows > 45 l/min.
- **10** **Valve mounting screws** (included in the scope of delivery)
  Only use valve mounting screws with the subsequently listed thread diameters and strength properties. Observe the screw-in depth.
  4 hexagon socket head cap screws ISO 4762 - M6 x 70 - 10.9
  (Friction coefficient μ_{total} = 0.09 ... 0.14)
  Tightening torque M_A = 12.5 Nm ± 1.5 Nm
- **11** Overpressure protection
- **12** Clearance area for overpressure protection

Notes:
- The dimensions are nominal dimensions which are subject to tolerances.
- Subplates are no components in the sense of Directive 2014/34/EU and can be used after the manufacturer of the overall system has conducted an assessment of the risk of ignition. The "G...J3" versions are free from aluminum and/or magnesium and galvanized.

Subplates (separate order) with porting pattern according to ISO 4401-05-05-0-05, see data sheet 45100.

Flushing plate with porting pattern according to ISO 4401-05-05-0-05 (dimensions in mm)

Symbol



Ordering code and further information

- Material number **R900912450**
- Weight 2.0 kg
- Identical seal rings for ports P, A, B, T and T1
- Identical seal rings for ports X and Y
- Mounting screws (included in the scope of delivery)
  For reasons of stability, exclusively use the following valve mounting screws:
  4 hexagon socket head cap screws
  ISO 4762 - M6 x 50 -10.9
  (friction coefficient μ_{total} = 0.09 … 0.14);
  Tightening torque M_A = 12.5 Nm ± 1.5 Nm

Notice:
Before assembly and operation, please observe the information in the 29583-XH-B operating instructions.

Accessories (separate order)

Mating connectors

Item [1]	Designation	Version	Short designation	Material number	Data sheet
2	Mating connector; for valves with round connector, 6-pole + PE	straight, metal	7PZ31 …M	**R900223890**	08006

[1] See dimensions on page 13.

Further information

▶ Analog amplifier module type VT 11021	Data sheet 29743
▶ Subplates	Data sheet 45100
▶ Hydraulic fluids on mineral oil basis	Data sheet 90220
▶ Environmentally compatible hydraulic fluids	Data sheet 90221
▶ Directional servo valve with mechanical position feedback	Operating instructions 29583-XH-B
▶ Mating connectors and cable sets for valves and sensors	Data sheet 08006
▶ Use of non-electrical hydraulic components in an explosive environment (ATEX)	Data sheet 07011
▶ Selection of filters	
▶ Information on available spare parts	

RE 29583-XD
Edition: 2020-11
Replaces: 04.17
RA88690535_AA

rexroth
A Bosch Company

Directional servo valve with mechanical position feedback

Type 4WS2EM ...XD

H7684

- Size 10
- Component series 5X
- Maximum operating pressure 315 bar
- Maximum flow 180 l/min

ATEX units
For potentially explosive atmospheres

Information on explosion protection:

- Area of application in accordance with the Explosion Protection Directive 2014/34/EU: **II 2G**
- Type of protection valve: Ex db IIB T4 Gb according to EN IEC 60079-0 / EN 60079-1 and IEC 60079-0 / IEC 60079-1

Features

- 4 or 3-way version
- For intended use in potentially explosive atmosphere
- Valve for position, force, pressure or velocity control
- Subplate mounting
- Porting pattern according to 4401-05-05-0-05
- Dry control motor, no contamination of the solenoid gaps by the hydraulic fluid
- Wear-free control spool return element
- Pressure chambers at the control sleeve with gap seal, therefore no wear of seal ring

Contents

☞ **Notice:** The documentation version with which the product was supplied is valid.

Ordering code

01	02	03		04		05	06	07	08	09	10	11	12	13	14
4WS2E	**M**	**10**	**–**	**5X**	**/**		**B**	**11**	**XD**			**C**		**V**	

01	Directional servo valve, 4-way version, 2-stage, electrically operated	**4WS2E**

Control spool return

02	Mechanical	**M**

03	Size 10	**10**

04	Component series 50 ... 59 (50 ... 59: unchanged installation and connection dimensions)	**5X**

Nominal flow

05	5 l/min	**5**
	10 l/min	**10**
	20 l/min	**20**
	30 l/min	**30**
	45 l/min	**45**
	60 l/min	**60**
	75 l/min	**75**
	90 l/min	**90**

06	Control sleeve exchangeable	**B**

07	Valve for **external** control electronics; coil no. 11 (30 mA/85 Ω per coil)	**11**

Explosion protection

08	Type of protection "db"	**XD**
	For details, see information on the explosion protection, page 7	

Pilot oil supply

09	External pilot oil supply, external pilot oil return	**–**
	Internal pilot oil supply, external pilot oil return	**E**
	Internal pilot oil supply, internal pilot oil return	**ET**
	External pilot oil supply, internal pilot oil return	**T**

Inlet pressure range

10	10 ... 210 bar	**210**
	10 ... 315 bar	**315**

Electrical connection

11	Cable connection	**C**

Control spool overlap 1)

12	0 ... 0.5% negative	**E**
	0 ... 0.5% positive	**D**
	3 ... 5% positive	**C**

Seal material (observe compatibility of seals with hydraulic fluid used, see page 6)

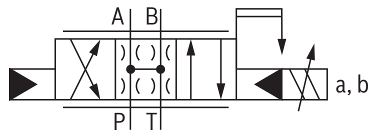
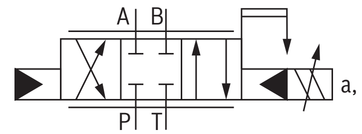
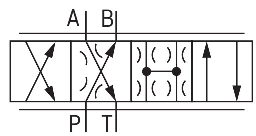
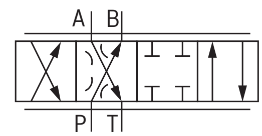
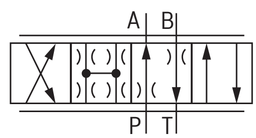
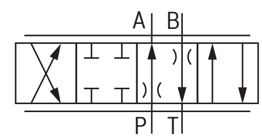
13	FKM seals	**V**

Special versions

14	Standard	**no code**
	Without control (de-energized condition), channels P → B and A → T are open 10% of the nominal quantity.	**-100**
	Without control (de-energized condition), channels P → A and B → T are open 10% of the nominal quantity.	**-102**

1) The control spool overlap is specified in % of the control spool stroke.

Symbols

	Control spool overlap "E"	Control spool overlap "C" and "D"
Standard		
Special version "-100"		
Special version "-102"		

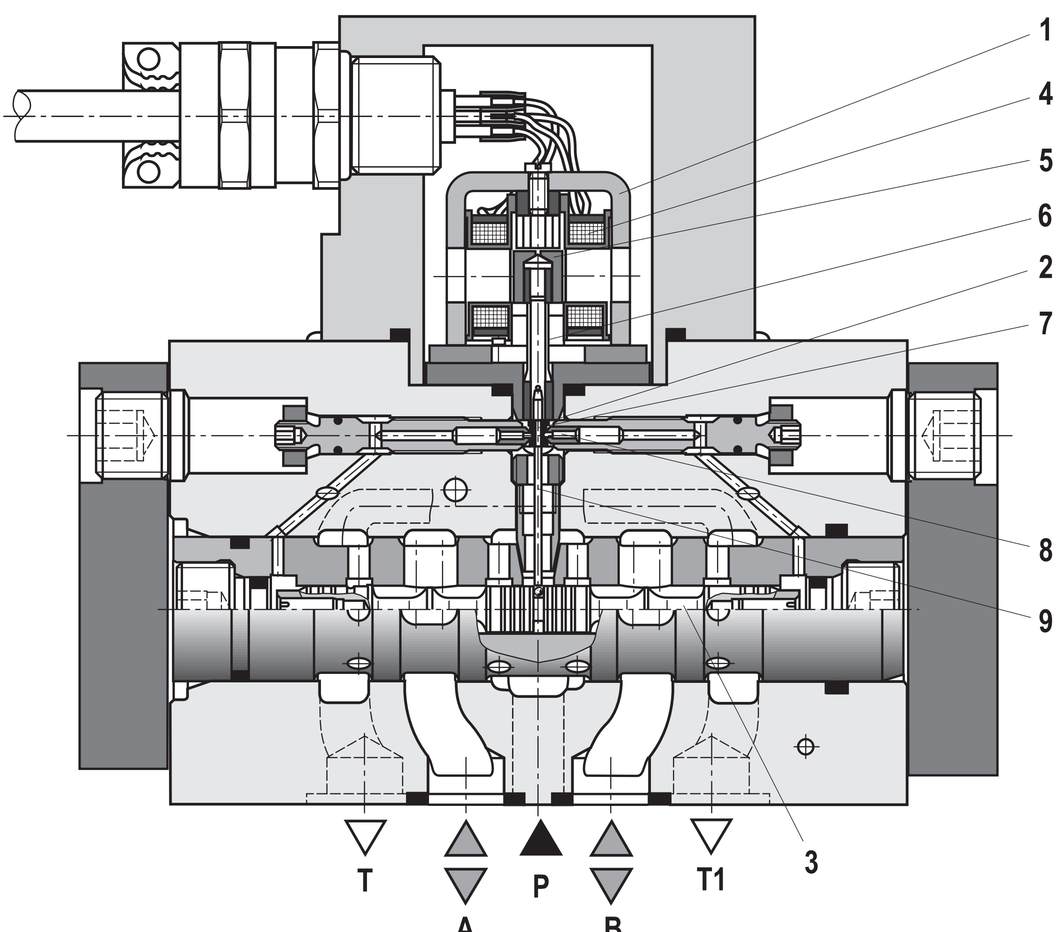
Notice:
Representation according to DIN ISO 1219-1.

Function, section

Valves of type 4WS2EM are electrically operated, 2-stage directional servo valves. They are mainly used to control position, force, pressure or velocity.
The valves basically comprise of an electro-mechanical converter (torque motor) (1), a hydraulic amplifier (nozzle flapper plate principle) (2) and a control spool (3) in a sleeve (2ndstage) which is connected with the torque motor via a mechanical feedback.
An electrical input signal at the coils (4) of the torque motor generates a force by means of a permanent magnet which acts on the armature (5), and in connection with a torque tube (6) results in a torque. This causes the flapper plate (7) which is connected to the torque tube (6) via a bolt to move from the central position between the two control nozzles (8), and a pressure differential is created across the front sides of the control spool (3). This pressure differential results in the control spool (3) changing its position, which results in the pressure port being connected to one actuator port and, at the same time, the other actuator port being connected to the return flow port.

The control spool (3) is connected to the flapper plate or the torque motor by means of a bending spring (mechanical feedback) (9). The position of the control spool (3) is changed until the feedback torque across the bending spring and the electro-magnetic torque of the torque motor are balanced and the pressure differential at the nozzle flapper plate system becomes zero.
The stroke of the control spool (3) and consequently the flow of the servo valve are controlled proportionally to the electrical input signal. It must be noted that the flow depends on the valve pressure drop.

External control electronics (servo amplifier) serve the actuation of the valve, amplifying an analog input signal (command value) so that with the output signal, the servo valve is actuated in a flow-controlled form.



Type 4WS2EM 10...XD

Technical data
(for applications outside these values, please consult us!)

General		
Installation position		Any - ensure that during start-up of the system, the valve is supplied with sufficient pressure (≥ 10 bar)
Ambient temperature range	°C	−30 ... +80
Storage temperature range	°C	+5 ... +40
Maximum storage time	Years	1
Weight	kg	3.97
Surface protection		Nitro-carburated

Hydraulic										
Operating pressure range	▶ Pilot control valve									
	– Pilot oil supply	bar	10 ... 210 or 10 ... 315							
Maximum operating pressure	▶ Main valve,									
	– Port A, B, P	bar	315							
Maximum return flow pressure	▶ Port T									
	– Pilot oil return internal	bar	Pressure peaks < 100, static < 10							
	– Pilot oil return external	bar	315							
	▶ Port Y	bar	Pressure peaks < 100, static < 10							
Hydraulic fluid			See table page 6							
Hydraulic fluid temperature range		°C	−20 ... +80, preferably +40 ... +50							
Viscosity range		mm^2/s	15 ... 380; preferably 30 ... 45							
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)			Class 18/16/13 [1]							
Zero flow $\boldsymbol{q}_{V,L}$		l/min	see characteristic curve on page 9							
Nominal flow $\boldsymbol{q}_{V\ nom}$ (tolerance ±10% with valve pressure differential $\boldsymbol{\Delta p}$ = 70 bar)		l/min	5	10	20	30	45	60	75	90
Maximum control spool stroke with mechanical end position (in case of error) related to nominal stroke		%	120 ... 170				120 ... 150			
Feedback system			mechanical							
Hysteresis (dither-optimized)		%	≤ 1.5							
Range of inversion (dither-optimized)		%	≤ 0.3							
Response sensitivity (dither-optimized)		%	≤ 0.2							
Pressure amplification with 1% control spool stroke change (from the hydraulic zero point)		% of $\boldsymbol{p}_P$	≥ 30					≥ 60		≥ 80
Zero adjustment flow across the entire operating pressure range		%	≤ 3, long-term ≤ 5							
Zero shift upon change of:										
	▶ Hydraulic fluid temperature	% / 20 °C	≤ 1							
	▶ Ambient temperature	% / 20 °C	≤ 1							
	▶ Operating pressure 80 ... 120% of $\boldsymbol{p}_P$	% / 100 bar	≤ 2							
	▶ Return flow pressure 0 ... 10% of $\boldsymbol{p}_P$	% / bar	≤ 1							

[1] The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and simultaneously increases the life cycle of the components.

$\boldsymbol{q}_{V,L}$ = zero flow in l/min
$\boldsymbol{q}_{V\ nom}$ = nominal flow in l/min
$\boldsymbol{p}_P$ = operating pressure in bar

Technical data
(for applications outside these values, please consult us!)

Hydraulic fluid		Classification	Suitable sealing materials	Standards	Data sheet
Mineral oils		HL, HLP, HLPD, HVLP, HVLPD	NBR, FKM	DIN 51524	90220
Bio-degradable	▶ Insoluble in water	HETG	FKM	ISO 15380	90221
		HEES	FKM		
	▶ Soluble in water	HEPG	FKM	ISO 15380	

Important information on hydraulic fluids:
- For further information and data on the use of other hydraulic fluids, please refer to the data sheets above or contact us.
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.).
- The ignition temperature of the hydraulic fluid used must be at least 150 °C.

Electric			
Protection class according to EN 60529			IP65
Type of signal			analog
Rated current per coil		mA	30
Resistance per coil		Ω	85
Inductivity with 60 Hz and 100% rated current	▶ Serial connection	H	1.0
	▶ Parallel connection	H	0.25

Notice:
In case of control using non-Rexroth amplifiers, we recommend a superimposed dither signal.

External control electronics		
Servo amplifier in euro-card format		Type VT-SR2-1X/.60 according to data sheet 29980
Servo amplifier in modular design	analog	Type VT 11021 according to data sheet 29743

Important notice:
The external servo amplifier and the safety barrier must be operated outside the potentially explosive atmospheres.

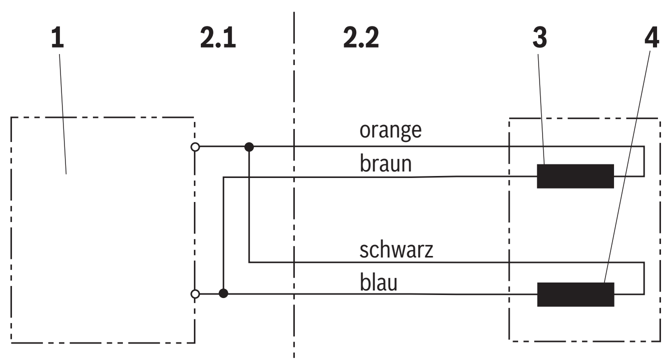
Technical data
(for applications outside these values, please consult us!)

Information on explosion protection		
Area of application according to Directive 2014/34/EU		II 2G
Type of protection according to EN IEC 60079-0 / EN 60079-1 and IEC 60079-0 / IEC 60079-1		Ex db IIB T4 Gb
IECEx Certificate of Conformity		IECEx BVS 13.0120 X
EU type examination certificate		BVS 09 ATEX E 116 X
Maximum current per coil	mA	100

Special application conditions for safe application:
For ensuring the type of protection d "flameproof enclosure", the occurrence of explosive atmospheres in the hydraulic area of the valve must be securely avoided. This may be ensured by applying a sufficiently high pilot pressure (≥ 10 bar in channel P and/or X) before applying an electrical signal at the coils or the electronics.

Electrical connection

Example: Parallel connection



1 Control electronics
2.1 Non-explosive area
2.2 Explosive area
3 Valve, coil A
4 Valve, coil B

Connection line		
Line type		non-exchangeable, four-wire connection line
Line cross-section	mm^2	0.75 finely stranded
Line diameter	mm	5.9 ±0.3
Length	m	3

The electrical connection can be designed as parallel or serial connection. For reasons of operational safety and the resulting lower coil inductivity, we recommend the parallel connection.
- **Parallel connection:**
  Connect the "orange" cable connector with "black" and "brown" with "blue".
- **Serial connection:**
  Connect the "brown" cable connector with "black".

The electrical control at "orange" (+) and "blue" (–) provides for the direction of flow P → A and B → T. Reverse electrical control provides for direction of flow P → B and A → T.

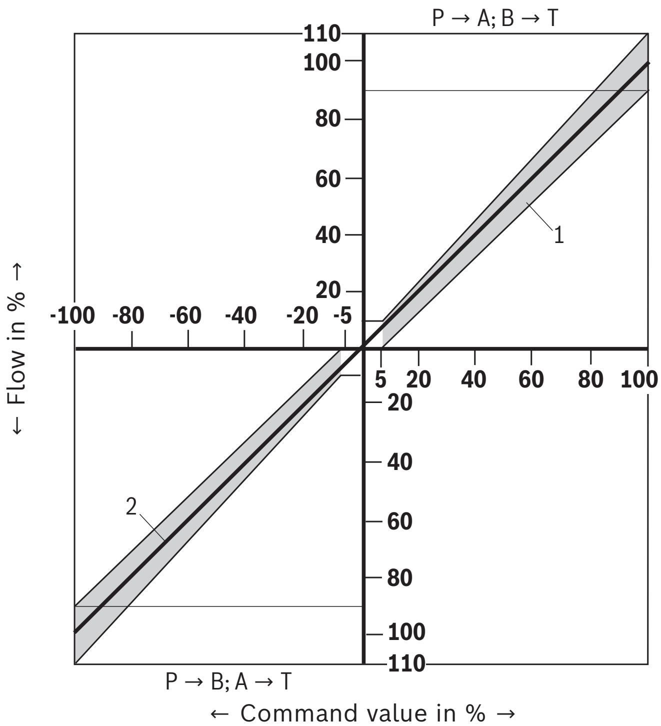
Notes:
- The free end of the connection cable must be connected as follows according to the construction provisions:
  - outside the potentially explosive area or
  - within the potentially explosive area in terminal boxes of an acknowledged type of protection
- Only use finely stranded conductors if they have pressed-on wire end ferrules.

Characteristic curves

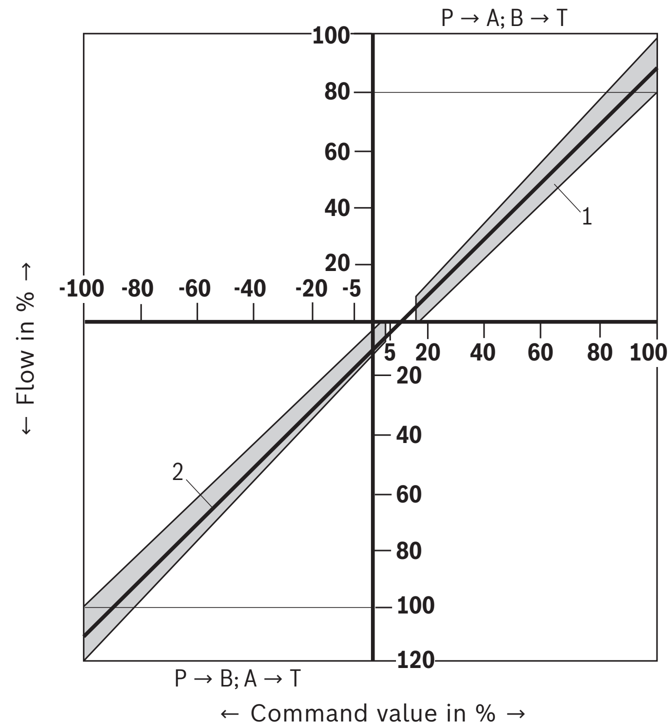
(measured with HLP 32, ϑ_{oil} = 40 °C ± 5 °C)

Tolerance field of the flow/signal function at constant valve pressure differential ***Δp***

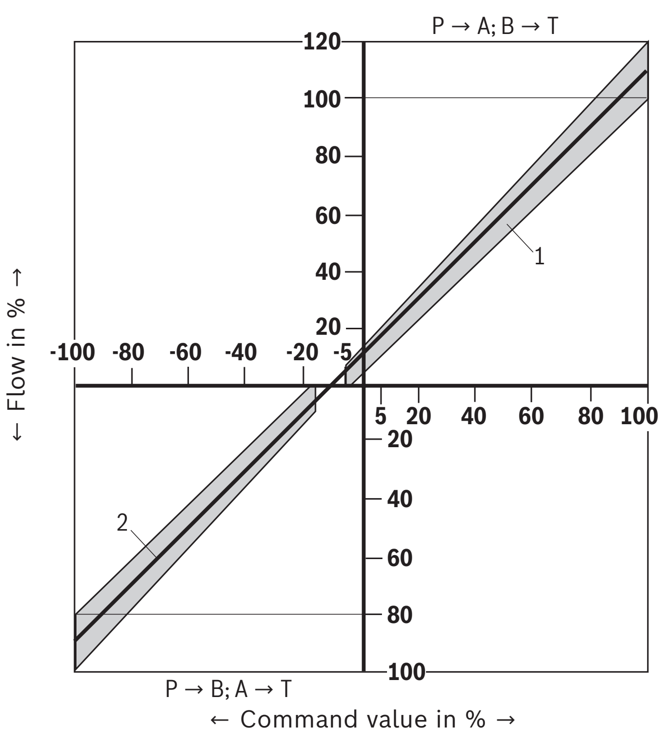
Standard



Special version "-100"



Special version "-102"

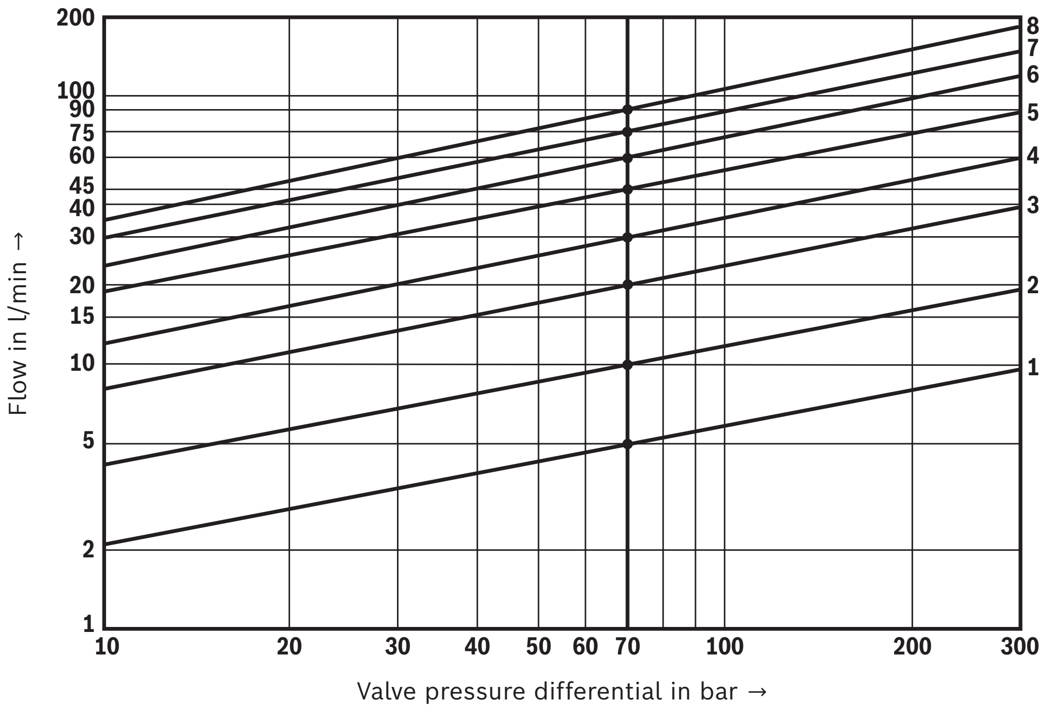


1 Tolerance field

2 Typical flow curve

Characteristic curves
(measured with HLP 32, ϑ_{oil} = 40 °C ± 5 °C)

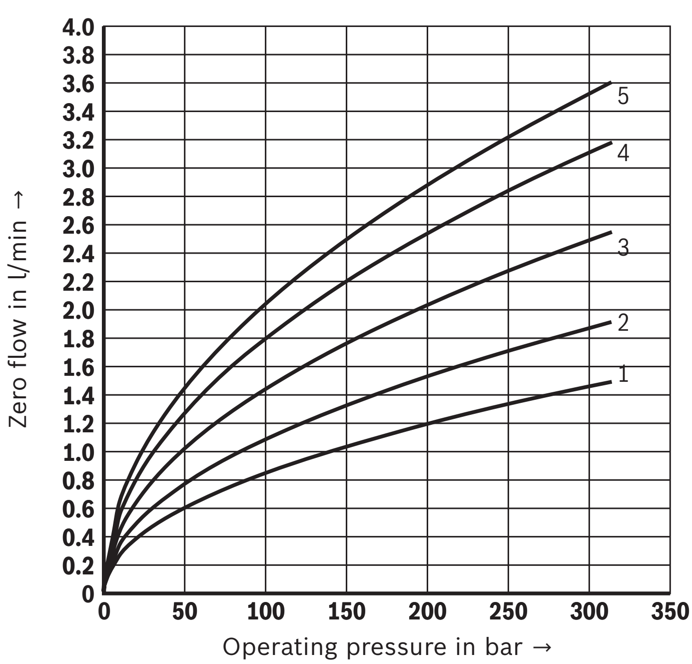
Flow/load function
(tolerance ±10%) with 100% command value signal



Version	Characteristic curve
"5"	1
"10"	2
"20"	3
"30"	4
"45"	5
"60"	6
"75"	7
"90"	8

Notes:
- Flow values in the maximum command value range (see "Tolerance field of the flow/signal function")
- $\Delta p = p_P - p_L - p_T$
  Δp valve pressure differential
  p_P inlet pressure
  p_L load pressure
  p_T return flow pressure

Zero flow (with control spool overlap "E", measured without dither signal)

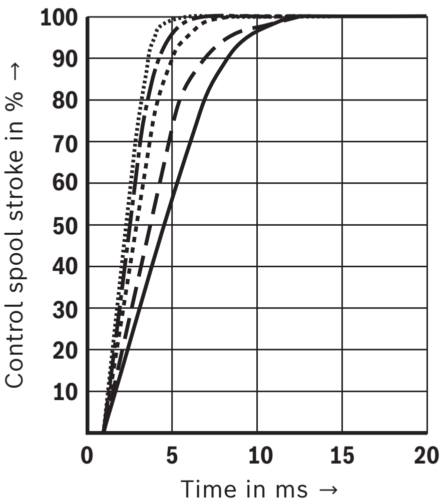


Nominal flow
- **1** 5 l/min
- **2** 10 l/min
- **3** 20, 30, 45 l/min
- **4** 60, 75 l/min
- **5** 90 l/min

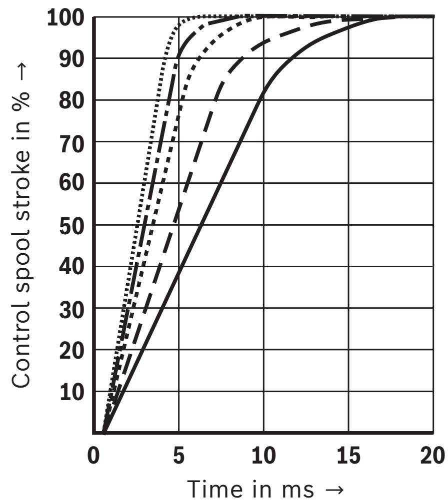
Characteristic curves
(measured with HLP 32, ϑ_{oil} = 40 °C ± 5 °C)

Transition function with pressure rating 315 bar, step response without flow

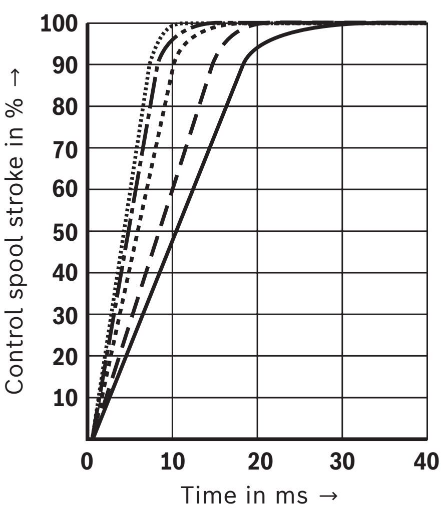
Version "5", "10" and "20"



Version "30"



Version "45"



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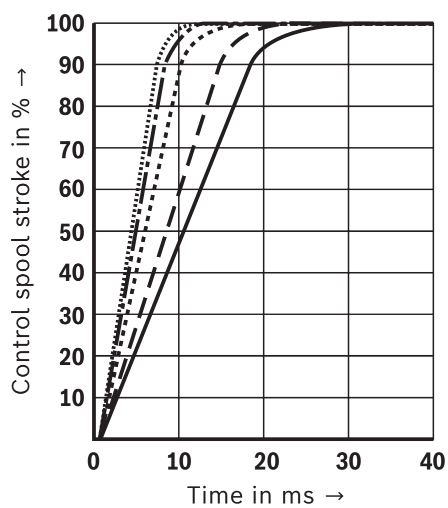
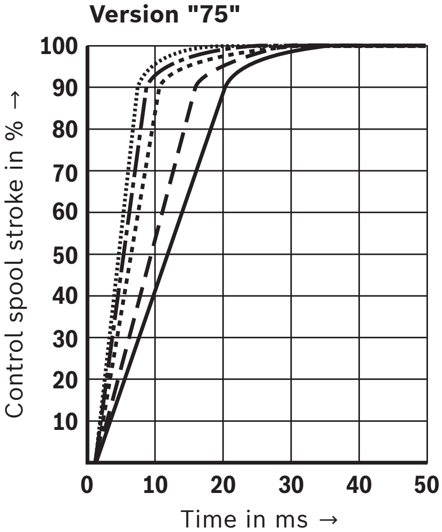
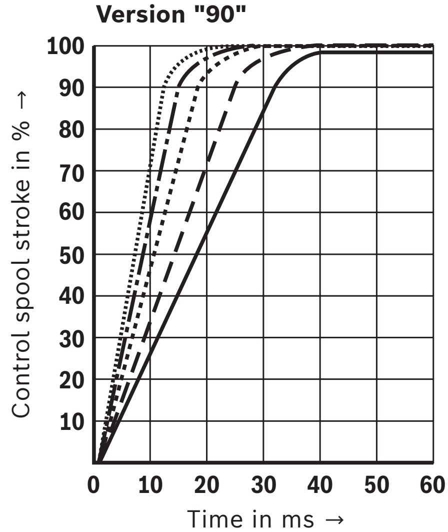
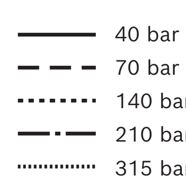


Version "75"



Version "90"

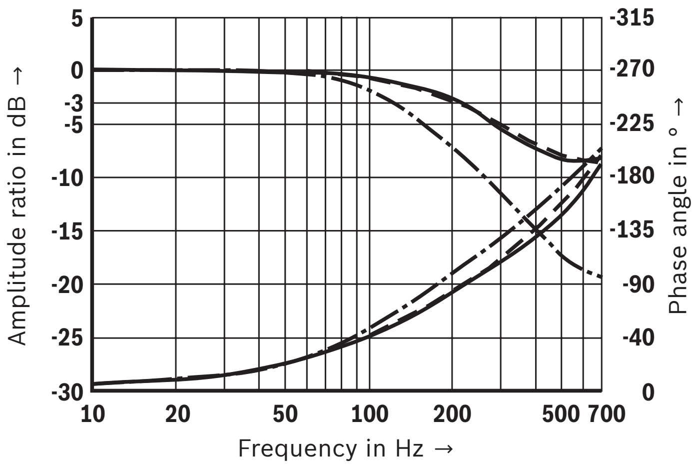




Characteristic curves
(measured with HLP 32, ϑ_{oil} = 40 °C ± 5 °C)

Frequency response with pressure rating 315 bar, stroke frequency without flow

Version "5", "10" and "20"



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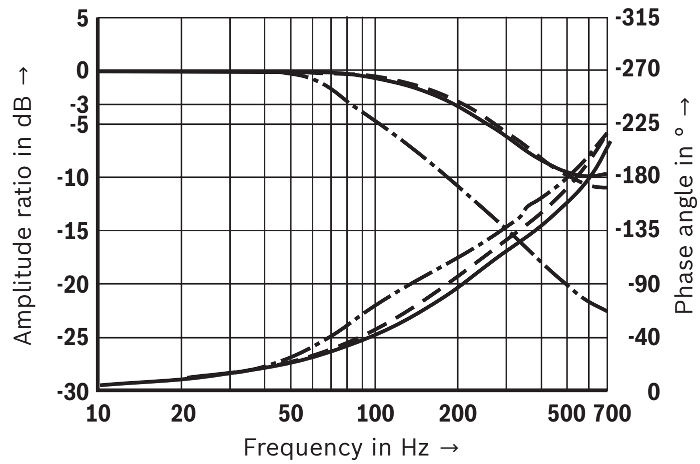
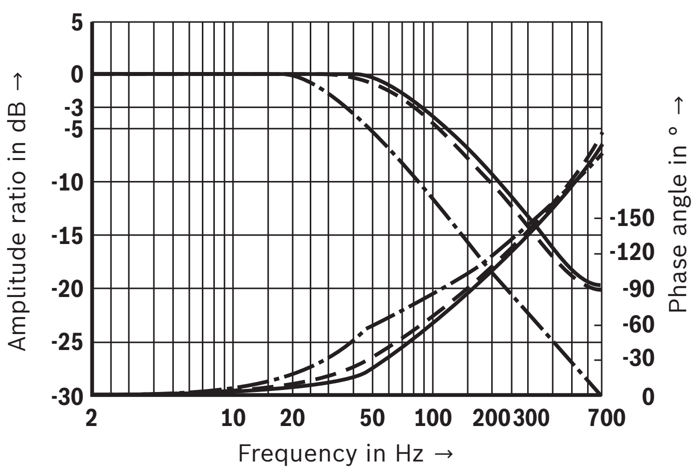


Version "45"



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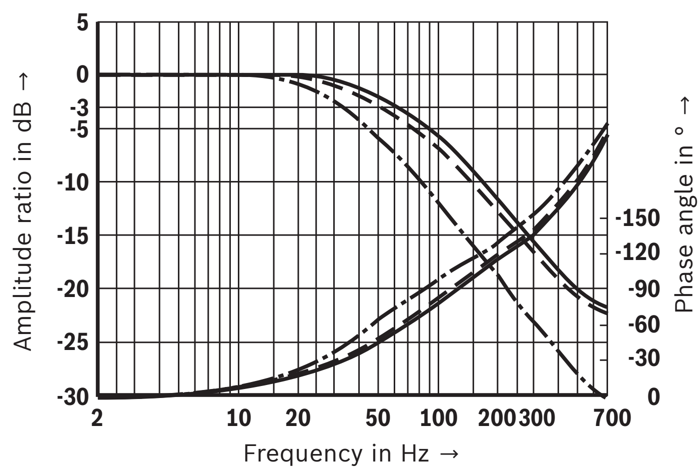

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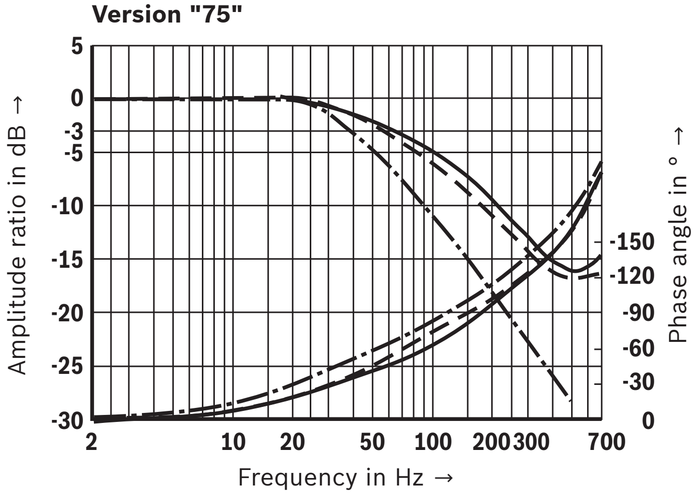

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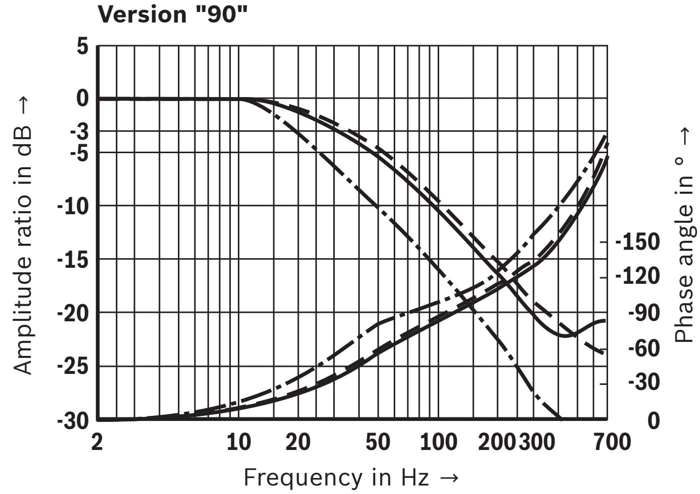
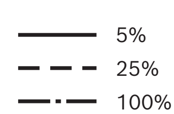
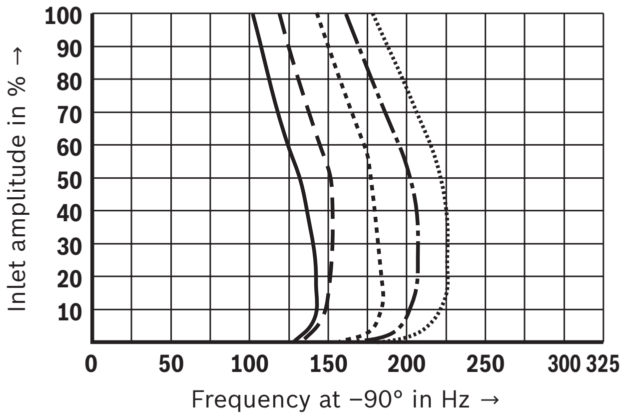




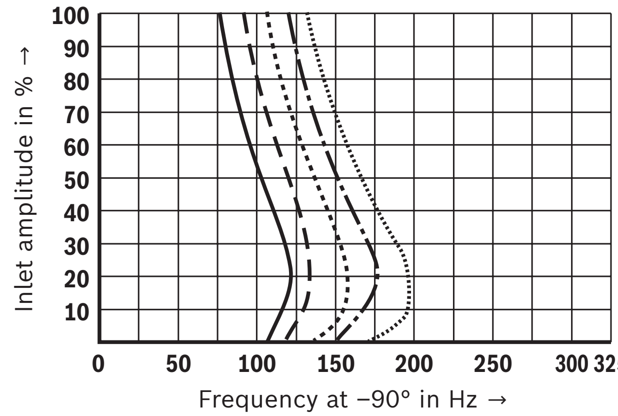
Characteristic curves
(measured with HLP 32, ϑ_{oil} = 40 °C ± 5 °C)

Frequency response with pressure rating 315 bar, stroke frequency without flow

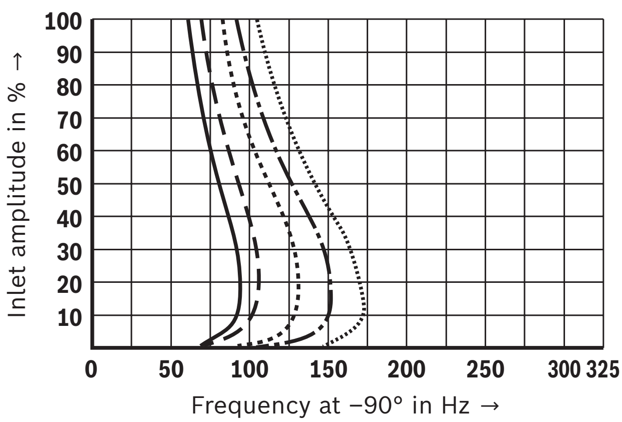
Version "5", "10" and "20"



Version "30"



Version "45"



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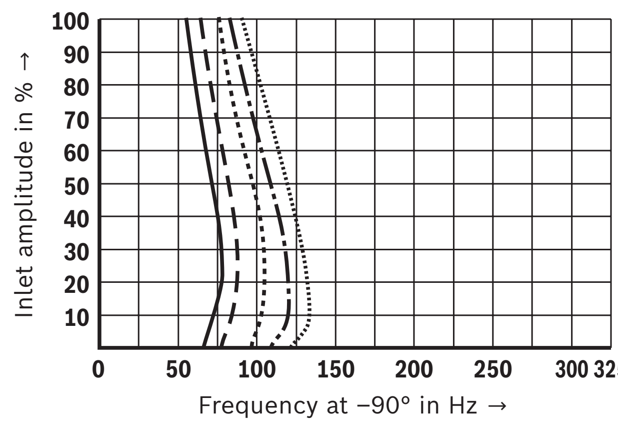
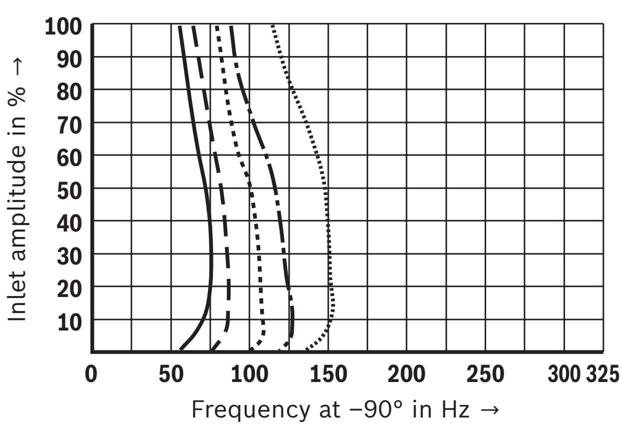
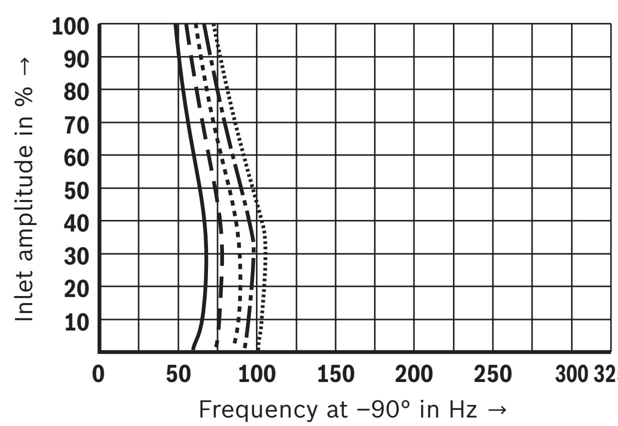


Version "75"

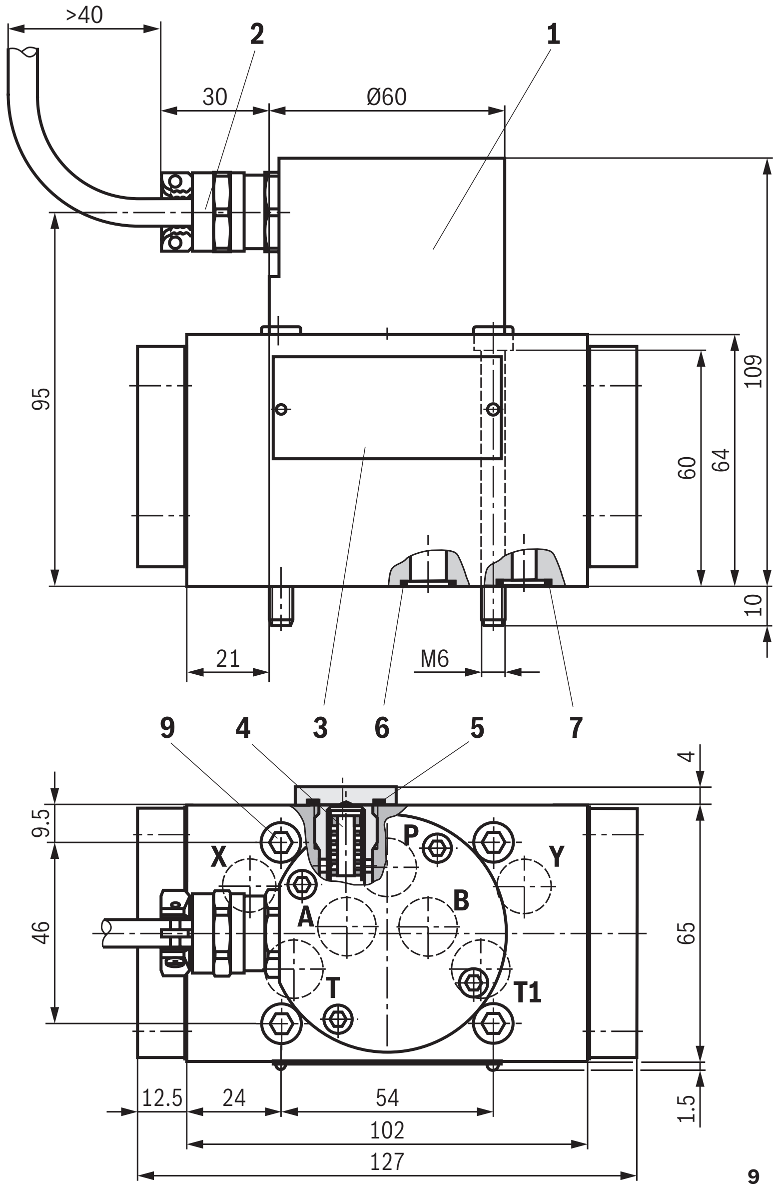


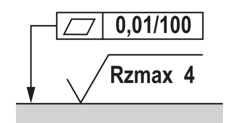
Version "90"



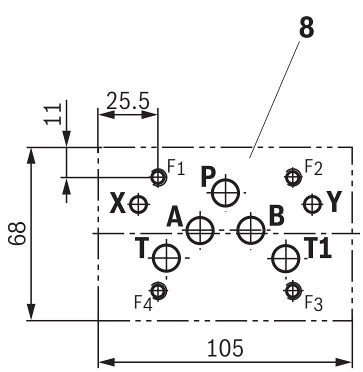
40 bar
70 bar
140 bar
210 bar
315 bar

Dimensions
(dimensions in mm)





Required surface quality
of the valve contact surface



1 Cap

2 Cable gland with 3 m cable

3 Name plate

4 Exchangeable filter element, material no.: **R961001950**

5 Profile seal for filter screw M16 x 1.5 (part of item 4)

6 Identical seal rings for ports P, A, B, T and T1

7 Identical seal rings for ports X and Y;
Ports X and Y are also pressurized in case of "internal" pilot oil supply and return

8 Machined valve contact surface;
Porting pattern according to ISO 4401-05-05-0-05;
Port T1 is optional and is recommended for reducing the pressure drop from B → T with rated flows > 45 l/min.

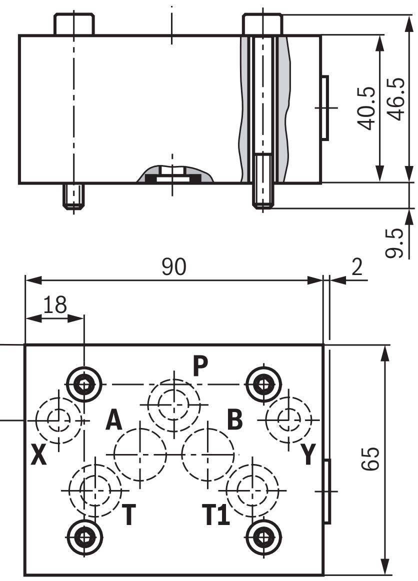
9 **Valve mounting screws** (included in the scope of delivery)
Only use valve mounting screws with the subsequently listed thread diameters and strength properties. Observe the screw-in depth.
4 hexagon socket head cap screws ISO 4762 - M6 x 70 - 10.9
(Friction coefficient μ_{total} = 0.09 ... 0.14)
Tightening torque M_A = 12.5 Nm ± 1.5 Nm

Subplates (separate order) with porting pattern according to ISO 4401-05-05-0-05, see data sheet 45100.

Notes:
- The dimensions are nominal dimensions which are subject to tolerances.
- Subplates are no components in the sense of Directive 2014/34/EU and can be used after the manufacturer of the overall system has conducted an assessment of the risk of ignition. The "G...J3" versions are free from aluminum and/or magnesium and galvanized.

Flushing plate with porting pattern according to ISO 4401-05-05-0-05 (dimensions in mm)

Symbol



Ordering code and further information

- Material number **R901541299**
- Weight 2.0 kg
- Identical seal rings for ports P, A, B, T and T1
- Identical seal rings for ports X and Y
- Mounting screws (included in the scope of delivery)
  For reasons of stability, exclusively the following mounting screws are to be used:
  4 hexagon socket head cap screws
  ISO 4762 - M6 x 50 - 10.9
  (friction coefficient μ_{total} = 0.09 ... 0.14);
  Tightening torque M_A = 12.5$^{\pm 1.5}$ Nm

Notice:
Before assembly and operation, please observe the information in the 29583-XD-B operating instructions.

Further information

- Analog amplifier module type VT 11021 — Data sheet 29743
- Analog amplifier type VT-SR2-1X/.60 — Data sheet 29980
- Subplates — Data sheet 45100
- Hydraulic fluids on mineral oil basis — Data sheet 90220
- Environmentally compatible hydraulic fluids — Data sheet 90221
- Use of non-electrical hydraulic components in an explosive environment (ATEX) — Data sheet 07011
- Selection of filters
- Information on available spare parts

RE 29583-XL
Edition: 2020-11
Replaces: 2018-09
RA87651313_AA

rexroth
A Bosch Company

Directional servo valve with mechanical position feedback

Type 4WS2EM ...XL

H5893_mod

- Size 10
- Component series 5X
- Maximum operating pressure 315 bar
- Maximum flow 180 l/min

ATEX units
For potentially explosive atmospheres

Information on explosion protection:
- Area of application in accordance with the Explosion Protection Directive 2014/34/EU: **II 3G**
- Type of protection: Ex ic IIC T4 Gc according to EN IEC 60079-0 / EN 60079-11 and IEC 60079-0 / IEC 60079-11

Features

- 4 or 3-way version
- For intended use in potentially explosive atmosphere
- Valve for position, force, pressure or velocity control
- For subplate mounting
- Porting pattern according to ISO 4401-05-05-0-05
- Dry control motor, no contamination of the solenoid gaps by the hydraulic fluid
- Can also be used as 3-way version
- Wear-free control spool return element
- Pressure chambers at the control sleeve with gap seal, therefore no wear of seal ring

Contents

☞ **Notice:** The documentation version with which the product was supplied is valid.

Ordering code

01	02		03		04	05	06	07	08	09	10	11	12	13
4WS2EM	**10**	**–**	**5X**	**/**		**B**	**11**	**XL**			**K31**		**V**	

01	Directional servo valve, 4-way version, 2-stage, with mechanical feedback, for **external** control electronics, electrically operated	**4WS2EM**

02	Size 10	**10**

03	Component series 50 ... 59 (50 ... 59: unchanged installation and connection dimensions)	**5X**

Nominal flow

04	5 l/min	**5**
	10 l/min	**10**
	20 l/min	**20**
	30 l/min	**30**
	45 l/min	**45**
	60 l/min	**60**
	75 l/min	**75**
	90 l/min	**90**
	Characteristic curves, see page 10 (observe tolerance field of the flow/signal function)	

05	Control sleeve exchangeable	**B**

06	Valve for **external** control electronics; coil no. 11 (30 mA/85 Ω per coil)	**11**

Explosion protection

07	"Type of protection ic"	**XL**
	For details, see information on explosion protection, page 6	

Pilot oil supply/return 1)

08	External pilot oil supply, external pilot oil return	**–**
	Internal pilot oil supply, external pilot oil return	**E**
	Internal pilot oil supply, internal pilot oil return	**ET**
	External pilot oil supply, internal pilot oil return	**T**

Inlet pressure range

09	10 ... 210 bar	**210**
	10 ... 315 bar	**315**

Electrical connection

10	**Without** mating connector; connector	**K31** 2)

Control spool overlap (in % of the nominal stroke)

11	0 ... 0.5% negative	**E**
	0 ... 0.5% positive	**D**
	3 ... 5% positive	**C**

Seal material (observe compatibility of seals with hydraulic fluid used, see page 6)

12	FKM seals	**V**

Ordering code

01	02		03		04	05	06	07	08	09	10	11	12	13
4WS2EM	**10**	**–**	**5X**	**/**		**B**	**11**	**XL**			**K31**		**V**	

Special versions

13	Standard version	**no code**
	The channels P → B and A → T are open 10% of the nominal quantity without control (de-energized state).	**-100**
	The channels P → A and B → T are open 10% of the nominal quantity without control (de-energized state).	**-102**

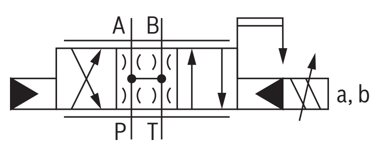
1) Care should be taken that the pilot pressure is as constant as possible. An external pilot control via port X is thus often advantageous. The valve can be operated with a higher pressure at X than at P in order to influence the dynamics in a positive form. Ports X and Y are also pressurized in case of "internal" pilot oil supply and return.

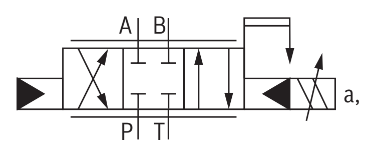
2) Mating connector, separate order, see page 15.

Symbols

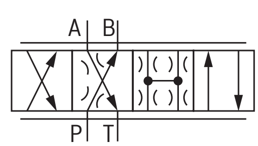
Control spool overlap "E" / **Control spool overlap "C" and "D"**

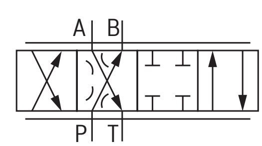
Standard



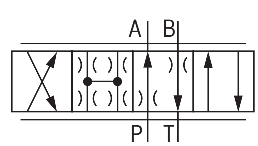


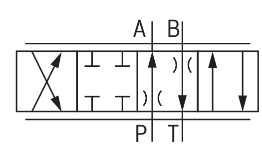
Special version "-100"





Special version "-102"





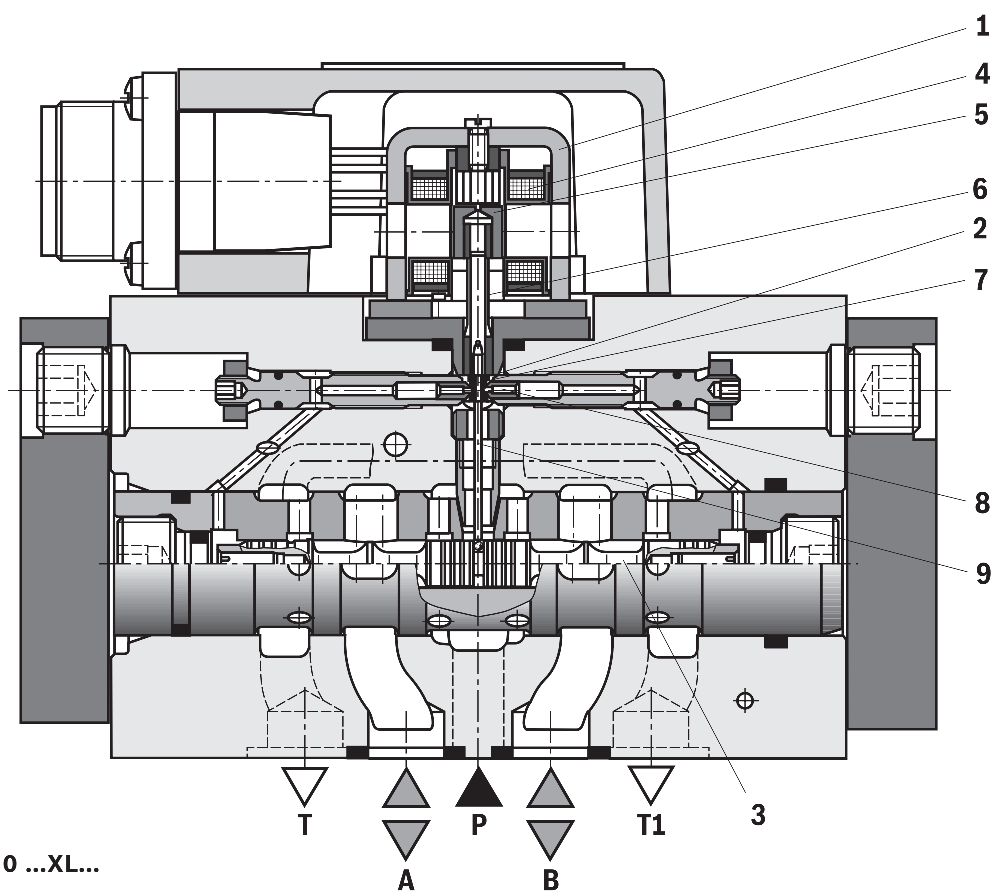
Notice:
Representation according to DIN ISO 1219-1.

Function, section

Valves of type 4WS2EM ...XL are electrically operated, 2-stage directional servo valves. They are mainly used to control position, force, pressure or velocity.
The valves are made of an electro-mechanical converter (torque motor) (1), a hydraulic amplifier (nozzle flapper plate system) (2) and a control spool (3) in a sleeve (2nd stage) which is connected with the torque motor via a mechanical feedback.
An electrical input signal at the coils (4) of the torque motor generates a force by means of a permanent magnet which acts on the armature (5), and in connection with a torque tube (6) results in a torque. This causes the flapper plate (7) which is connected to the torque tube (6) via a bolt to move from the central position between the two control nozzles (8), and a pressure differential is created across the front sides of the control spool (3). The pressure differential results in the control spool changing its position, which results in the pressure port being connected to one actuator port and, at the same time, the other actuator port being connected to the return flow port.

The control spool (3) is connected to the flapper plate or the torque motor by means of a bending spring (mechanical feedback) (9). The position of the control spool (3) is changed until the feedback torque across the bending spring and the electro-magnetic torque of the torque motor are balanced and the pressure differential at the nozzle flapper plate system becomes zero.
The stroke of the control spool (3) and consequently the flow of the servo valve are controlled proportionally to the electrical input signal. It must be noted that the flow depends on the valve pressure drop.

External control electronics (separate order)
External control electronics (servo amplifier) serve the actuation of the valve, amplifying an analog input signal (command value) so that with the output signal, the servo valve is actuated in a flow-controlled form.
For the limitation of the electric data, a safety barrier is to be connected between valve and amplifier (see page 7).



Type 4WS2EM 10 ...XL...

Technical data
(for applications outside these values, please consult us!)

General			
Installation position			Any - ensure that during start-up of the system, the valve is supplied with sufficient pressure (≥ 10 bar)
Surface protection	▶ Valve body, cover, filter screw		Nitro-carburated
	▶ Cap		Anodized
Storage temperature range		°C	+5 … +40
Maximum storage time		Years	1
Ambient temperature range		°C	–30 … +80
Weight		kg	3.46

Hydraulic										
Maximum operating pressure (main valve)	▶ Ports P, A, B	bar	315							
Operating pressure range (pilot control stage)	▶ Pilot oil supply	bar	10 … 210 or 10 … 315							
Maximum return flow pressure	▶ Port T	bar								
	– Pilot oil return internal	bar	Pressure peaks < 100							
	– Pilot oil return external	bar	315							
	▶ Port T	bar	Pressure peaks < 100, static < 10							
Hydraulic fluid			See table page 6							
Hydraulic fluid temperature range		°C	–15 … +80; preferably +40 … +50							
Viscosity range		mm^2/s	15 … 380; preferably 30 … 45							
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)			Class 18/16/13 [1]							
Zero flow $q_{V,L}$		l/min	see characteristic curve on page 10							
Rated flows $q_{v\,nom}$ (tolerance ±10% with valve pressure differential Δp = 70 bar		l/min	5	10	20	30	45	60	75	90
Maximum control spool stroke with mechanical end position (in case of error) related to nominal stroke		%	120 … 170				120 … 150			
Feedback system			mechanical							
Hysteresis (dither-optimized)		%	≤ 1.5							
Range of inversion (dither-optimized)		%	≤ 0.2							
Response sensitivity (dither-optimized)		%	≤ 0.2							
Pressure amplification with 1% control spool stroke change (from the hydraulic zero point)		% of p_P	≥ 30					≥ 60		≥ 80
Zero adjustment flow across the entire operating pressure range		%	≤ 3, long-term ≤ 5							
Zero shift upon change of:										
	▶ Hydraulic fluid temperature	% / 20 °C	≤ 1							
	▶ Ambient temperature	% / 20 °C	≤ 1							
	▶ Operating pressure 80 … 120% of p_P	% / 100 bar	≤ 2							
	▶ Return flow pressure 0 … 10% of p_P	% / bar	≤ 1							

1) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and simultaneously increases the life cycle of the components.

$q_{V,L}$ = zero flow in l/min
$q_{V\,nom}$ = rated flow in l/min
p_P = operating pressure in bar

Technical data
(for applications outside these values, please consult us!)

Hydraulic fluid		**Classification**	**Suitable sealing materials**	**Standards**	**Data sheet**
Mineral oils		HL, HLP, HLPD, HVLP, HVLPD	NBR, FKM	DIN 51524	90220
Bio-degradable	▶ Insoluble in water	HETG	FKM	ISO 15380	90221
		HEES	FKM		
	▶ Soluble in water	HEPG	FKM	ISO 15380	

Important information on hydraulic fluids:
- For further information and data on the use of other hydraulic fluids, please refer to the data sheets above or contact us.
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.).
- The ignition temperature of the hydraulic fluid used must be at least 150 °C.

Electric		
Protection class according to EN 60529		IP 65 with mating connector correctly mounted and locked
Type of signal		analog
Nominal flow per coil (command value 100%)	mA	30
Resistance per coil	Ω	85

Notice:
In case of control using non-Rexroth amplifiers, we recommend a superimposed dither signal.

Information on explosion protection	
Area of application according to Directive 2014/34/EU	II 3G
Type of protection according to EN IEC 60079-0 / EN 60079-11	Ex ic IIC T4 Gc
"IECEx Certificate of Conformity"	IECEx BVS 18.0045X
Power supply of the valve only from intrinsically safe electric circuits	Maximum values see page 7
Special application conditions for safe application	see ambient and hydraulic fluid temperature range page 5

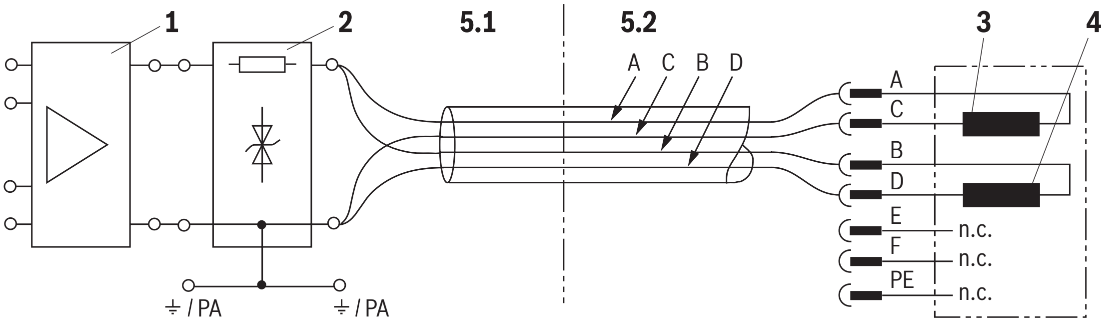
External control electronics		
Recommended safety barrier		see page 7
Servo amplifier in modular design	analog	Type VT 11021 according to data sheet 29743

Important notice:
The external servo amplifier and the safety barrier must be operated outside the potentially explosive atmospheres.

Electrical connection

The coils can be connected in **parallel connection** or individual control.

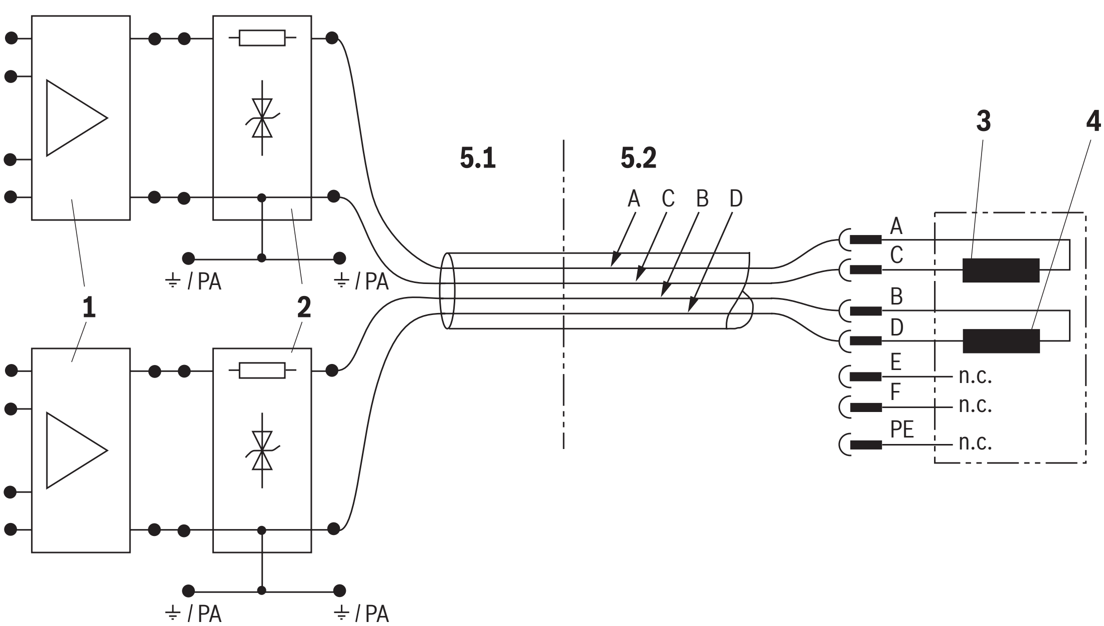
▶ Parallel connection



1 Servo amplifier
2 Safety barrier
3 Valve, coil A
4 Valve, coil B
5.1 Non-explosive area
5.2 Explosive area

Power supply of the valve only from intrinsically safe electric circuits with the following maximum values	▶ U_{max}	V	15
	▶ I_{max}	mA	153
	▶ P_{max}	mW	570
Recommended safety barrier			Type 9001/02-133-150-101 (company Stahl) or Z915 (company Pepperl+Fuchs)

▶ Individual control



1 Servo amplifier
2 Safety barrier
3 Valve, coil A
4 Valve, coil B
5.1 Non-explosive area
5.2 Explosive area

Power supply of the valve only from intrinsically safe electric circuits with the following maximum values	▶ U_{max}	V	9.3	12.5
	▶ I_{max}	mA	205	90
	▶ P_{max}	mW	476	282
Recommended safety barrier			9002/77-093-300-001 (company Stahl)	Z966 (company Pepperl+Fuchs)

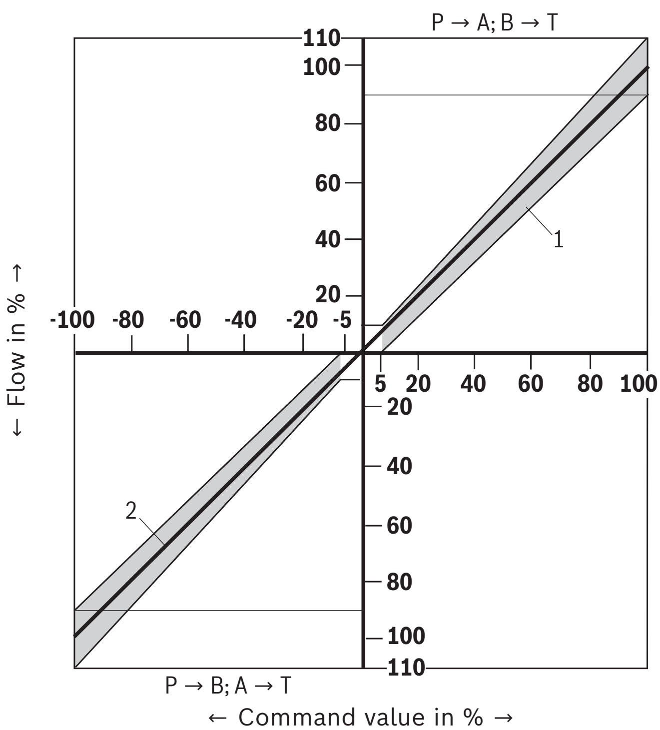
☞ **Notice:**
Only use approved cables and lines for intrinsically safe electric circuits.

The electric control with plus (+) at A and B and minus (–) at C and D results in direction of flow P → A and B → T.
Inverted electric control results in direction of flow P → B and A → T.
The pins E, F and PE at the connector are not connected.

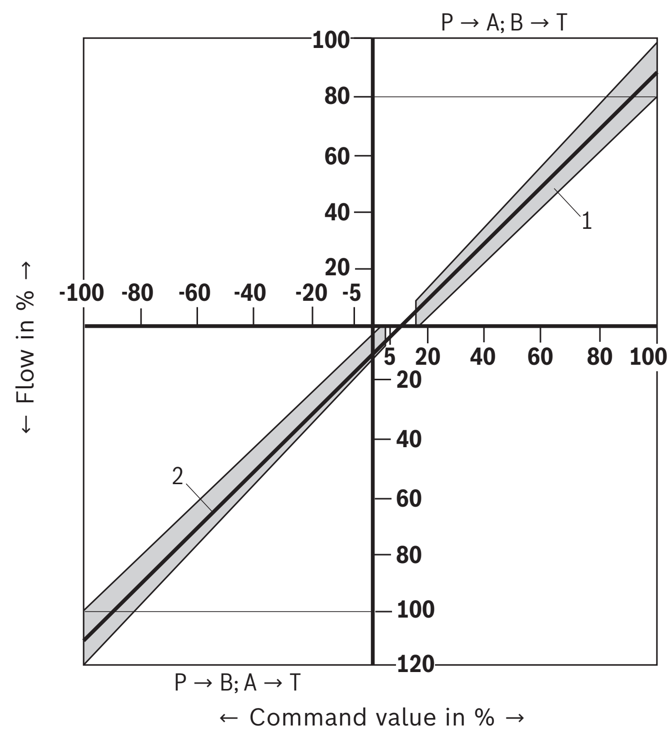
Characteristic curves
(measured with HLP 32, ϑ_{oil} = 40 °C ± 5 °C)

Tolerance field of the flow/signal function at constant valve pressure differential ***Δp***

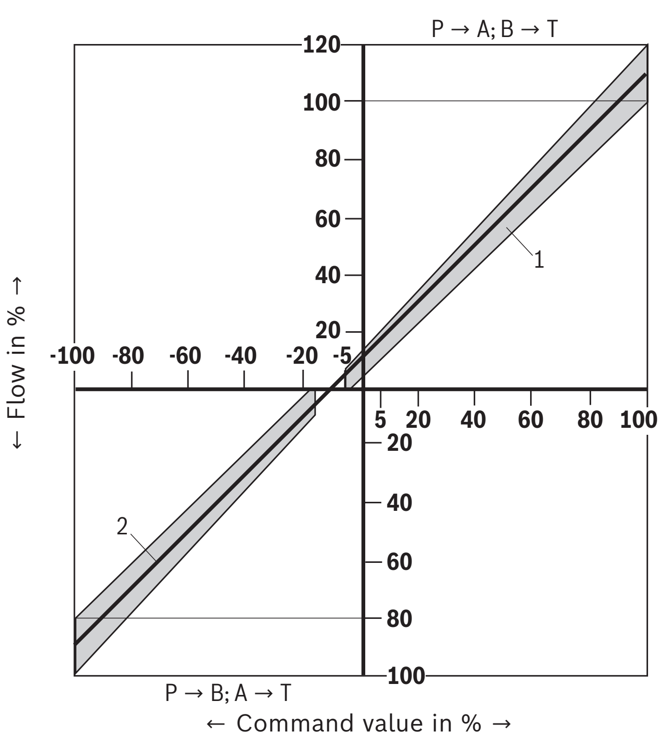
Standard



Special version "-100"



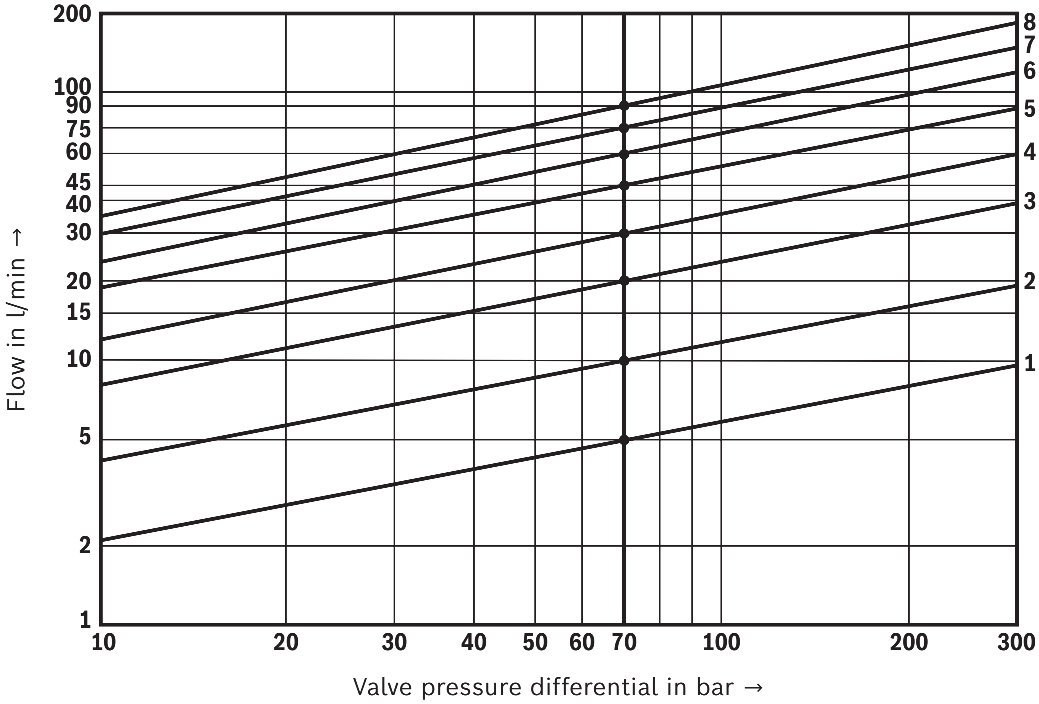
Special version "-102"



1 Tolerance field
2 Typical flow curve

Characteristic curves
(measured with HLP 32, ϑ_{oil} = 40 °C ± 5 °C)

Flow/load function
(tolerance ±10%) with 100% command value signal



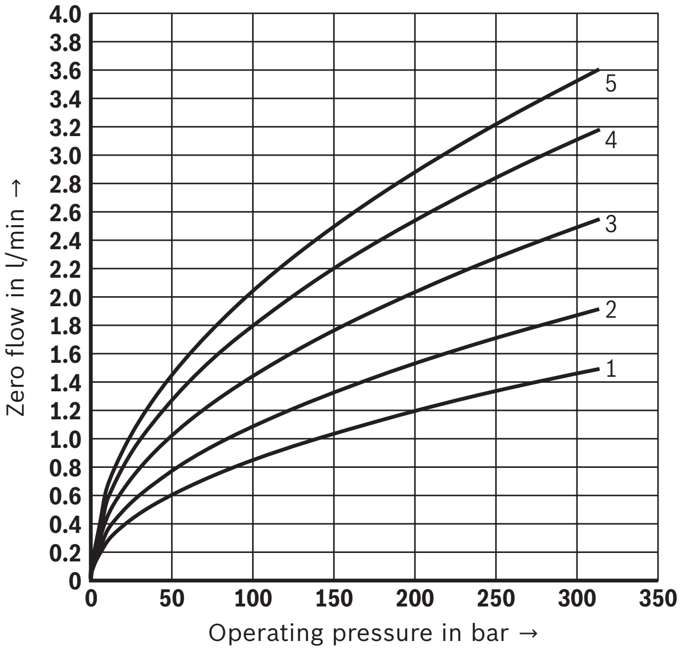
Nominal flow

1	5 l/min
2	10 l/min
3	20 l/min
4	30 l/min
5	45 l/min
6	60 l/min
7	75 l/min
8	90 l/min

Notes:
- Flow values in the maximum command value range (see tolerance field of the flow/signal function)
- $\Delta p = p_P - p_L - p_T$
  - Δp valve pressure differential
  - p_P inlet pressure
  - p_L load pressure
  - p_T return flow pressure

Characteristic curves
(measured with HLP 32, ϑ_{oil} = 40 °C ± 5 °C)

Zero flow (with control spool overlap "E", measured without dither signal)



Nominal flow

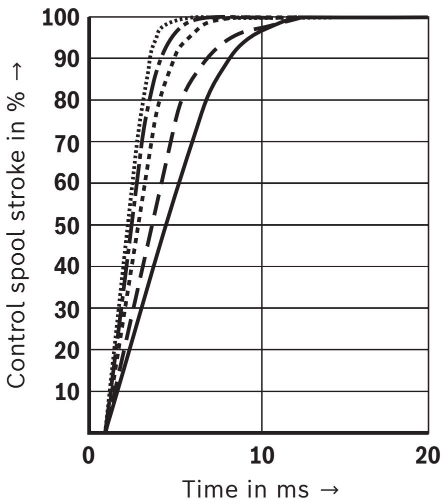
1 5 l/min
2 10 l/min
3 20, 30, 45 l/min
4 60, 75 l/min
5 90 l/min

Characteristic curves

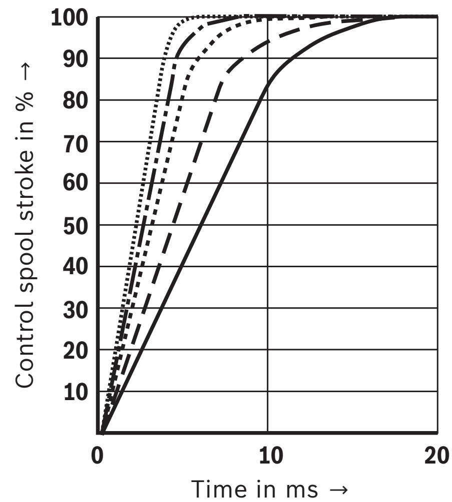
(measured with HLP 32, ϑ_{oil} = 40 °C ± 5 °C)

Transition function with pressure rating 315 bar, step response without flow

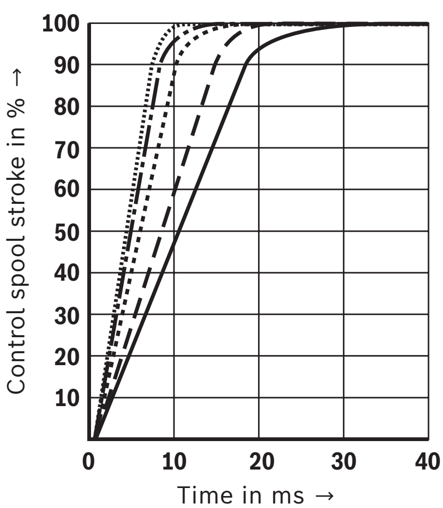
Version "5", "10" and "20"



Version "30"



Version "45"



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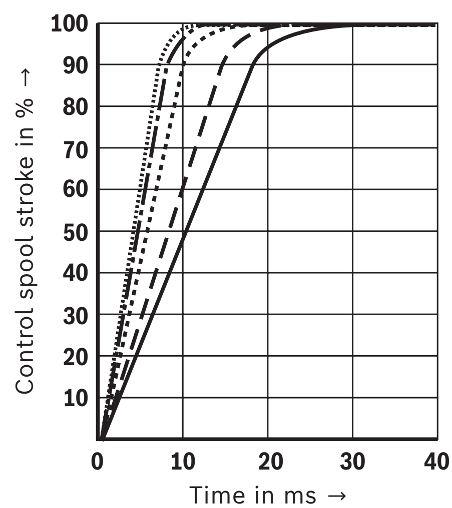
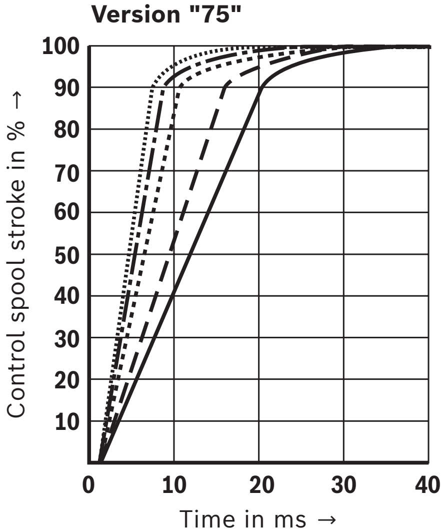
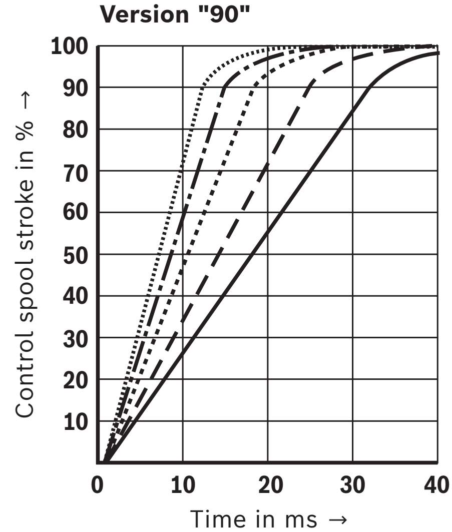
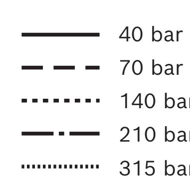


Version "75"



Version "90"



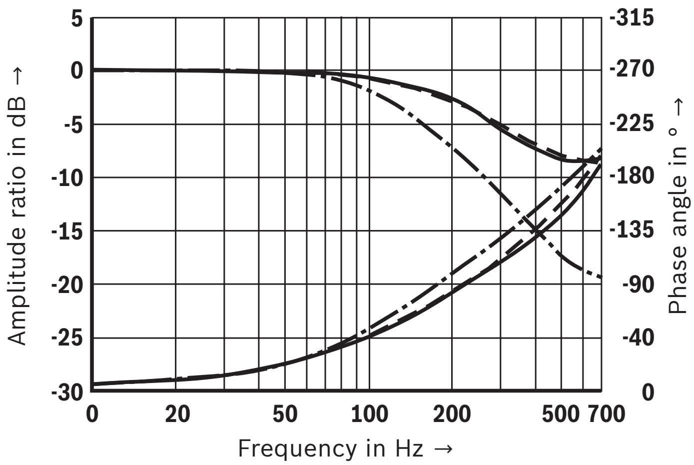


Characteristic curves

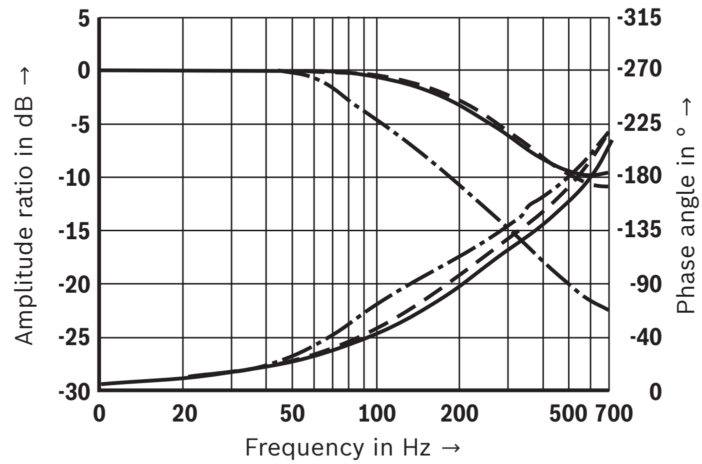
(measured with HLP 32, ϑ_{oil} = 40 °C ± 5 °C)

Frequency response with pressure rating 315 bar, stroke frequency without flow

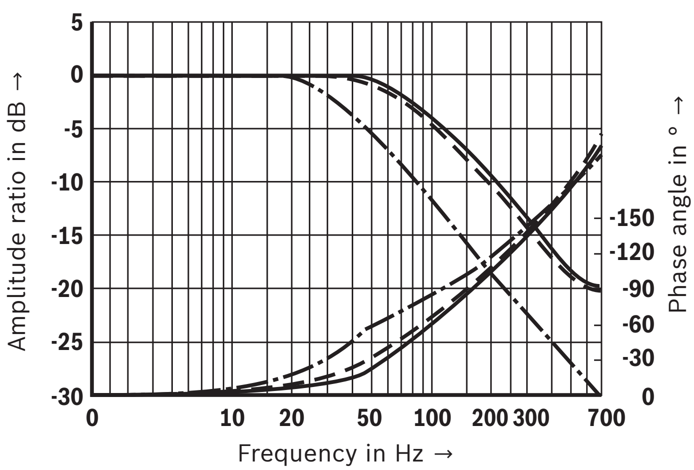
Version "5", "10" and "20"



Version "30"



Version "45"



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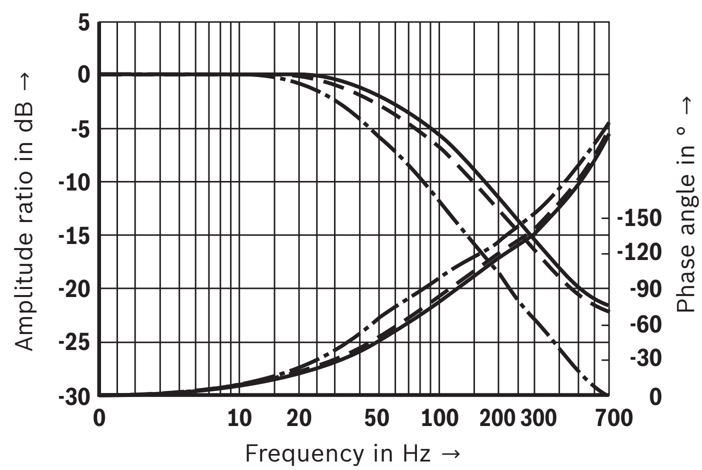

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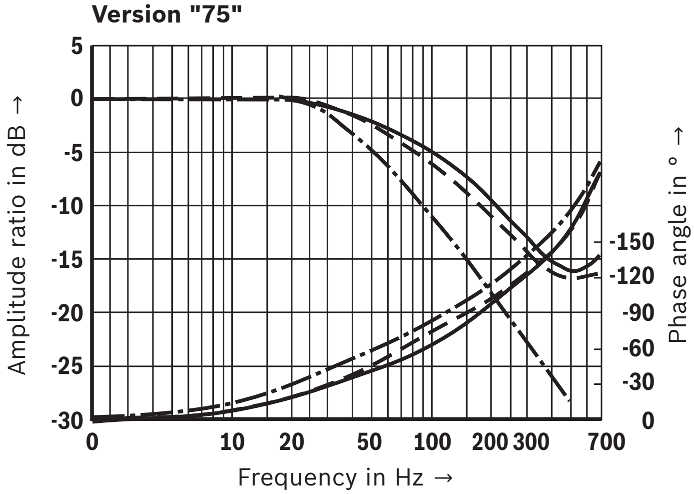

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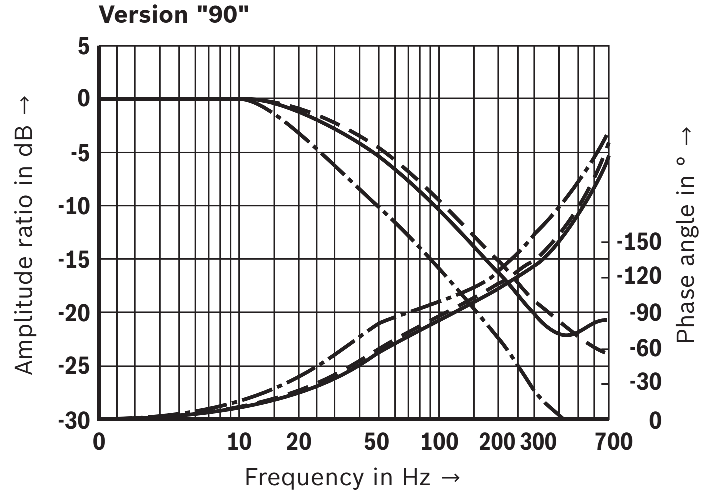
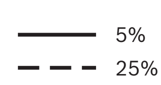
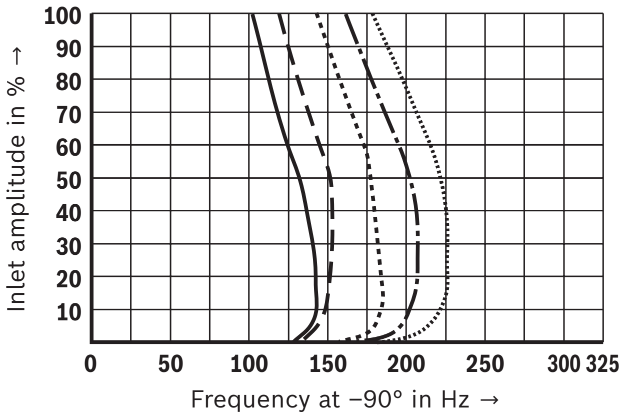




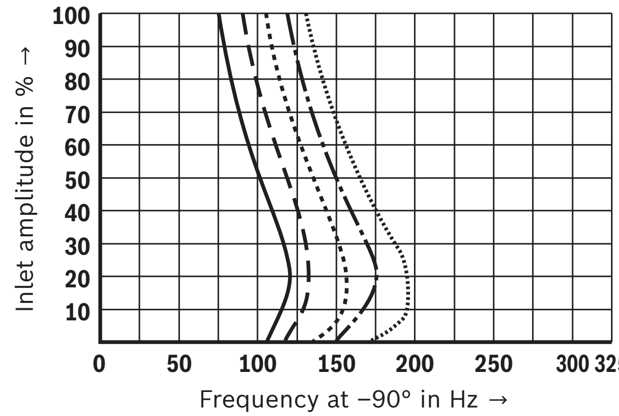
Characteristic curves
(measured with HLP 32, ϑ_{oil} = 40 °C ± 5 °C)

Dependency of the frequency *f* at –90° on the operating pressure *p* and the inlet amplitude

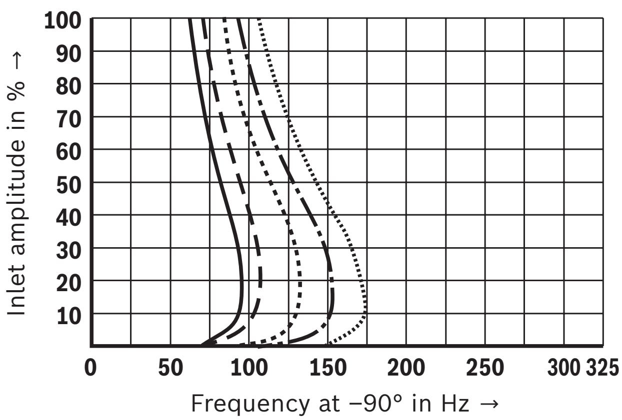
Version "5", "10" and "20"



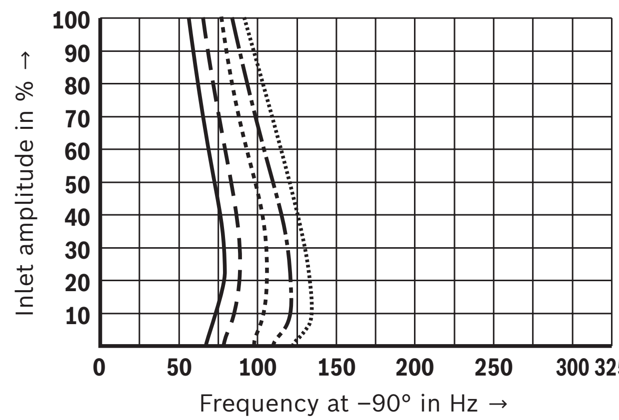
Version "30"



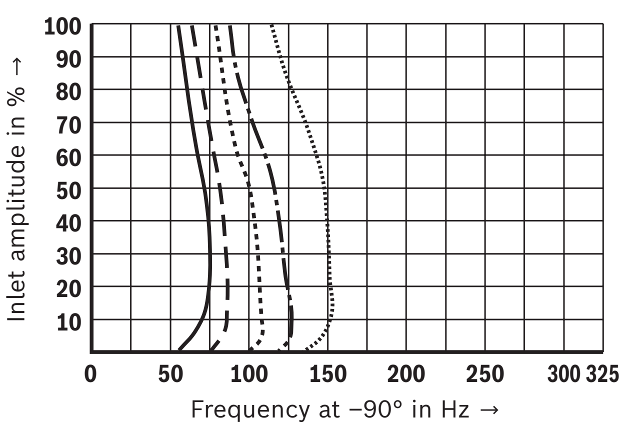
Version "45"



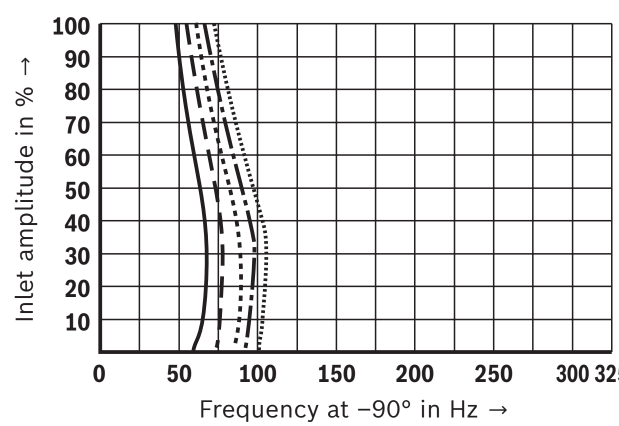
Version "60"



Version "75"

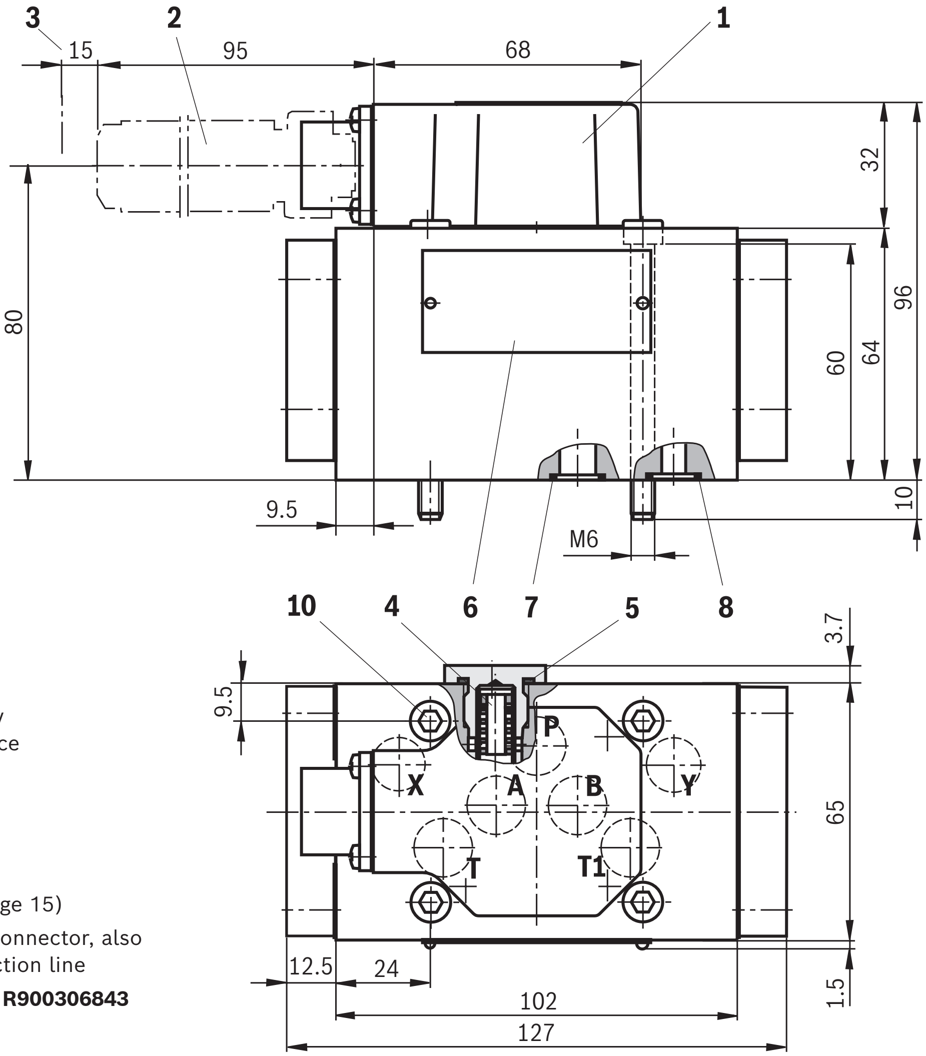


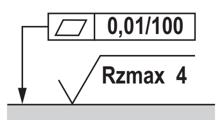
Version "90"



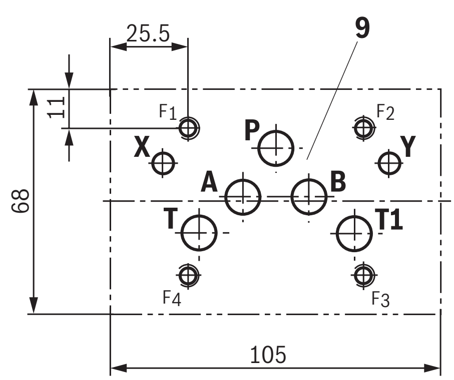
40 bar
70 bar
140 bar
210 bar
315 bar

Dimensions
(dimensions in mm)





Required surface quality
of the valve contact surface



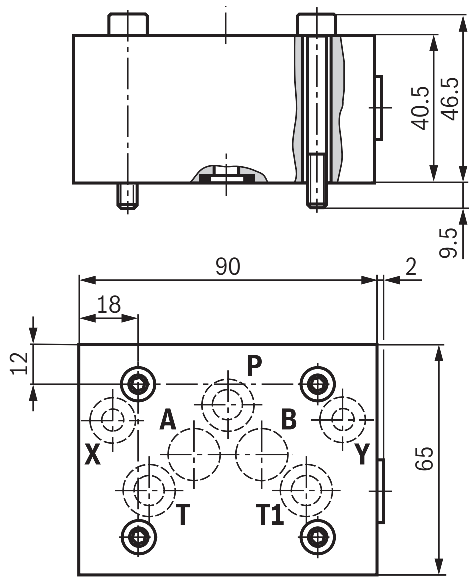
1. **1** Cap
2. **2** Mating connector (separate order, see page 15)
3. **3** Space required for removing the mating connector, also observe the bending radius of the connection line
4. **4** Exchangeable filter element, material no. **R900306843**
5. **5** Profile seal for filter screw M16 x 1.5; Material no. **R900012503** (FKM)
6. **6** Name plate
7. **7** Identical seal rings for ports P, A, B, T and T1
8. **8** Identical seal rings for ports X and Y
   Ports X and Y are also pressurized in case of "internal" pilot oil supply and return
9. **9** Machined valve contact surface;
   Porting pattern according to ISO 4401-05-05-0-05;
   Port T1 is optional and is recommended for reducing the pressure drop from B → T with rated flows > 45 l/min.
10. **10** **Valve mounting screws** (included in the scope of delivery)
    Only use valve mounting screws with the subsequently listed thread diameters and strength properties. Observe the screw-in depth.
    4 hexagon socket head cap screws ISO 4762 - M6 x 70 - 10.9
    (Friction coefficient $\boldsymbol{\mu}_{\text{total}}$ = 0.09 ... 0.14)
    Tightening torque $\boldsymbol{M_A}$ = $12.5^{\pm 1.5}$ Nm

Subplates (separate order) with porting pattern according to ISO 4401-05-05-0-05, see data sheet 45100.

Notes:
- The dimensions are nominal dimensions which are subject to tolerances.
- Subplates are no components in the sense of Directive 2014/34/EU and can be used after the manufacturer of the overall system has conducted an assessment of the risk of ignition. The "G...J3" versions are free from aluminum and/or magnesium and galvanized.

Flushing plate with porting pattern according to ISO 4401-05-05-0-05 (dimensions in mm)

Symbol



Ordering code and further information

- Material number **R901541299**
- Weight 2.0 kg
- Identical seal rings for ports P, A, B, T and T1
- Identical seal rings for ports X and Y
- Mounting screws (included in the scope of delivery)
  For reasons of stability, exclusively use the following valve mounting screws:
  4 hexagon socket head cap screws
  ISO 4762 - M6 x 50 -10.9
  (Friction coefficient μ_{total} = 0.09 ... 0.14)
  Tightening torque M_A = 12.5$^{\pm1.5}$ Nm

Notice:
Before assembly and operation, observe the information in the operating instructions 29583-XL-B.

Accessories (separate order)

Mating connectors and cable sets

Item [1]	Designation	Version	Short designation	Material number	Data sheet
2	Mating connector; for valves with round connector, 6-pole + PE	straight, metal	7PZ31 ...M	**R900223890**	08006

[1] See dimensions on page 14.

Further information

▶ Analog amplifier module type VT 11021	Data sheet 29743
▶ Subplates	Data sheet 45100
▶ Hydraulic fluids on mineral oil basis	Data sheet 90220
▶ Environmentally compatible hydraulic fluids	Data sheet 90221
▶ Mating connectors and cable sets for valves and sensors	Data sheet 08006
▶ Use of non-electrical hydraulic components in an explosive environment (ATEX)	Data sheet 07011
▶ Selection of filters	
▶ Information on available spare parts	

Rexroth
Bosch Group

RE 29 591/06.02

Replaces: 03.93

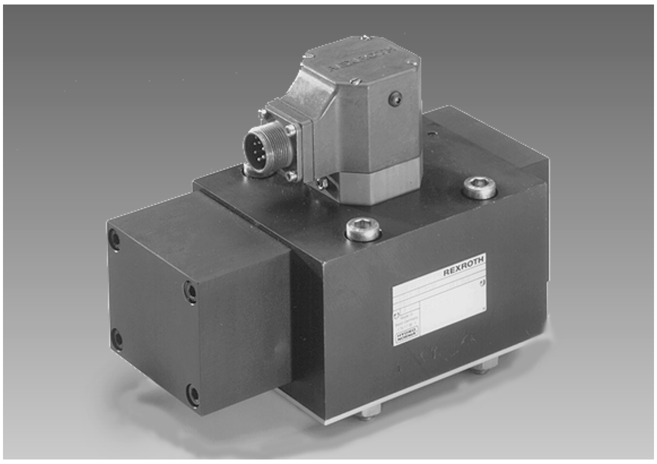
4-way directional servo valve Type 4WS.2E…

Nominal size 16

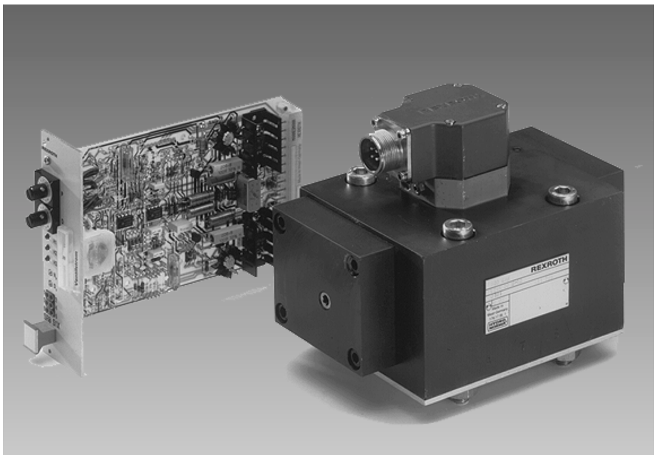
Series 2X

Maximum operating pressure 210/315 bar

Maximum flow 320 L/min



Type 4WSE2ED 16-2X/…B… with mechanical and electrical feedback and integrated control electronics



Type 4WS2EM 16-2X/…B… with mechanical feedback and associated external control electronics (separate order)

Overview of contents

Features

– Valve for closed loop position, force and speed control
– Two stage servo valve with mechanical or mechanical and electrical feedback
– 1st stage as an orifice-flapper plate amplifier
– For subplate mounting, porting pattern to DIN 24 340 form A16 with port X, subplates to catalogue sheet RE 45 054 (separate order)
– Dry torque motor, no contamination of the solenoid gap by the pressure fluid
– Can also be used as a 3-way version
– Wear-free spool return element
– Three control variations
– Control:
  • External control electronics in eurocard format (separate order), see page 7
  • Or with the control electronics integrated into the valve
– The valves with integrated control electronics are calibrated and tested
– The pilot oil supply, internal/external, can be changed without dismantling the valve
– The control sleeve can be replaced
– Filter for the 1st stage is accessible from the outside by means of a plug

Ordering details

		16	–2X /		B					E	V	*

Electrically operated
2-stage
4-way servo valve
For **external** control electronics = **4WS2E**
With **integrated** control electronics = **4WSE2E**

Mechanical feedback = **M**
Mechanical and electrical feedback (only with integrated electronics) = **D**

Nominal size 16 = **16**

Series 20 to 29 = **2X**
(20 to 29: unchanged installation and connection dimensions)

Nominal flow ❶
At a valve pressure differential Δp = 70 bar
100 L/min = **100**
150 L/min = **150**
200 L/min = **200**
(the tolerance of the flow/signal function on page 9 has to be taken into account!)

Coil or control data ❷
Valves for **external** control electronics
Coil No. 12 (50 mA/85 Ω per coil) = **12**
Valves with **integrated** electronics
Control: Command value ± 10 mA/1 kΩ = **8**
Command value ± 10 V/≥ 50 kΩ = **9**

❸ **Pilot oil supply and drain**
ET = Internal supply and drain (standard)
T = External supply, internal drain

❹ **Input pressure range for the 1st stage**
210 = 10 to 210 bar
315 = 10 to 315 bar

Electrical connection
Valve for **external** control electronics:
K8 = **Without** plug-in connector with component plug for a 4-pin plug-in connector to VG 095 342
Valve with **integrated** control electronics:
K9 = **Without** plug-in connector with component plug for a 6-pin plug-in connector to E DIN 43 563-AM6-3
Plug-in connector – separate order

❺ **Spool overlap**
E = 0 to 0.5 % negative

❻
V = FKM seals

❼ Further details in clear text

❶ Nominal flow
The nominal flow refers to a 100 % command value signal at a 70 bar valve pressure differential (35 bar per control land). This valve pressure differential is to be considered as a reference value. Other values cause a change in the flow.
Please take into account a possible nominal flow tolerance of ± 10 % (see flow/load function on page 9).

❷ Electrical control data
Valves for **external** control electronics: The positioning signal must be generated by a current regulated output stage. See page 7 for servo amplifiers.
Valves with **integrated** control electronics: The command value can be applied as a voltage (ordering detail „9") or for longer distances (> 25 m between the control and the valve) as a current (ordering detail „8").

❸ Input pressure for the pilot control
The pilot pressure must be maintained as constant as possible. Therefore an external pilot control via port X is often advantageous.

The dynamic response of the valve may be influenced using a higher pressure at X than at P.

❹ Input pressure range
The system pressure must be maintained as constant as possible.

Pilot pressure range: 10 to 210 bar or 10 to 315 bar

With referance to the dynamics, within the permissible pressure range the frequency relationship must be taken into account.

❺ Spool overlap
The spool overlap in % refers to the control spool nominal stroke.

Other spool overlaps on request!

❻ Seal material
If other seal materials are required please consult us!

❼ Details in clear text
Special requirments are to be specified in clear text. After receipt of the order they will be checked by the factory and the type code will be completed with an associated number.

Test unit

Test unit (battery operated, optionally with a power supply) to catalogue sheet RE 29 681
Attention:
– Only for valves with external control electronics

Test unit for proportional and servo valves with integrated control electronics

Type VT-VET-1, series 1X to catalogue sheet RE 29 685.

The test unit is used for the control and functional testing of proportional and servo valves with integrated electronics. It is suitable for testing valves with an operating voltage of ± 15 V or 24 V.

The following operating modes are possible:
– External operation → Linking the operating voltage and the command value from the control cabinet to the valve
– Internal/external operation → Command value is applied by the test unit; the operating voltage via the control cabinet
– Internal operation → Operating voltage via a seperate power supply; the command value is applied by the test unit
– Command value is applied via a BNC socket → Optional operating voltage

Preferred types (readily available)

Valves for external control electronics, mechanical feedback

Material No.	Type 4WS2EM
00769978	4WS2EM 16-2X/100B12ET315K8EV
00716550	4WS2EM 16-2X/150B12ET315K8EV
00960575	4WS2EM 16-2X/200B12ET315K8EV

Valves with integrated control electronics, mechanical feedback

Material No	Type 4WSE2EM
00769976	4WSE2EM 16-2X/100B9ET315K9EV
00769980	4WSE2EM 16-2X/150B9ET315K9EV
00769981	4WSE2EM 16-2X/200B9ET315K9EV

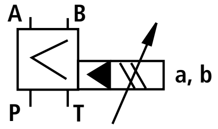
Valves with integrated control electronics, mechanical and electrical feedback

Material No.	Type 4WSE2ED
00769983	4WSE2ED 16-2X/100B9ET315K9EV
00769982	4WSE2ED 16-2X/150B9ET315K9EV
00769984	4WSE2ED 16-2X/200B9ET315K9EV

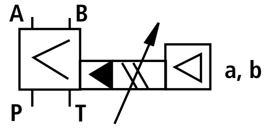
Symbols

Simplified

Valves for external control electronics

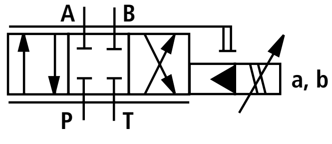


Valves with integrated control electronics

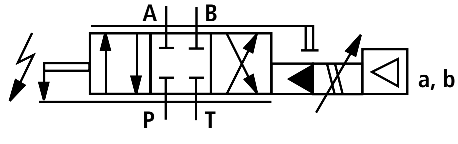


Detailed

Mechanical feedback



Electrical and mechanical feedback



Function, section

4WS(E)2EM 16-2X/...

The valve types 4WS(E)2EM... are electrically actuated, 2-stage servo directional valves with a porting pattern to DIN 24 340 form A16. They are primarily used for the closed loop control of position, force and velocity.

These valves comprise of an electro-mechanical convertor (torque motor) (1), a hydraulic amplifier (flapper jet principle) (2) and a control spool (3) in a sleeve (2nd stage), that is connected to the torque motor via a mechanical feedback.

Via an electrical input signal at the coils (4) of the torque motor, a force is generated via a permanent magnet at the armature (5) that, in conjunction with a torque tube, (6) generates a torque. Due to this the flapper plate (7), which is connected with the torque tube (6) via a rod, is moved out of the central position between the control orifices (8) a pressure differential now results which acts on the front face of the control spool. This pressure differential causes the spool to move, whereby the pressure connection is connected to an actuator connection and at the same time the other actuator connection is connected to the return connection.

The control spool is connected via a feedback spring (mechanical feedback) (9) to the flapper plate and torque motor. The control spool continues to change position until the torque feedback, via the feedback spring and the electro-magnetic torque of the torque motor are balanced, and the pressure differential at the flapper jet system becomes zero.

The stroke of the control spool and thus the flow through the pilot control valve is closed loop controlled in proportion to the electrical input signal. It has, however to be taken into account that the flow is dependent on the valve pressure differential.

External control electronics, type 4WS2EM 16-2X/... (separate order)

External control electronics, (servo amplifier), are used to control the valve, they so amplifiy the analogue input signal (command value) that the controlled current output signal is capable of driving the valve.

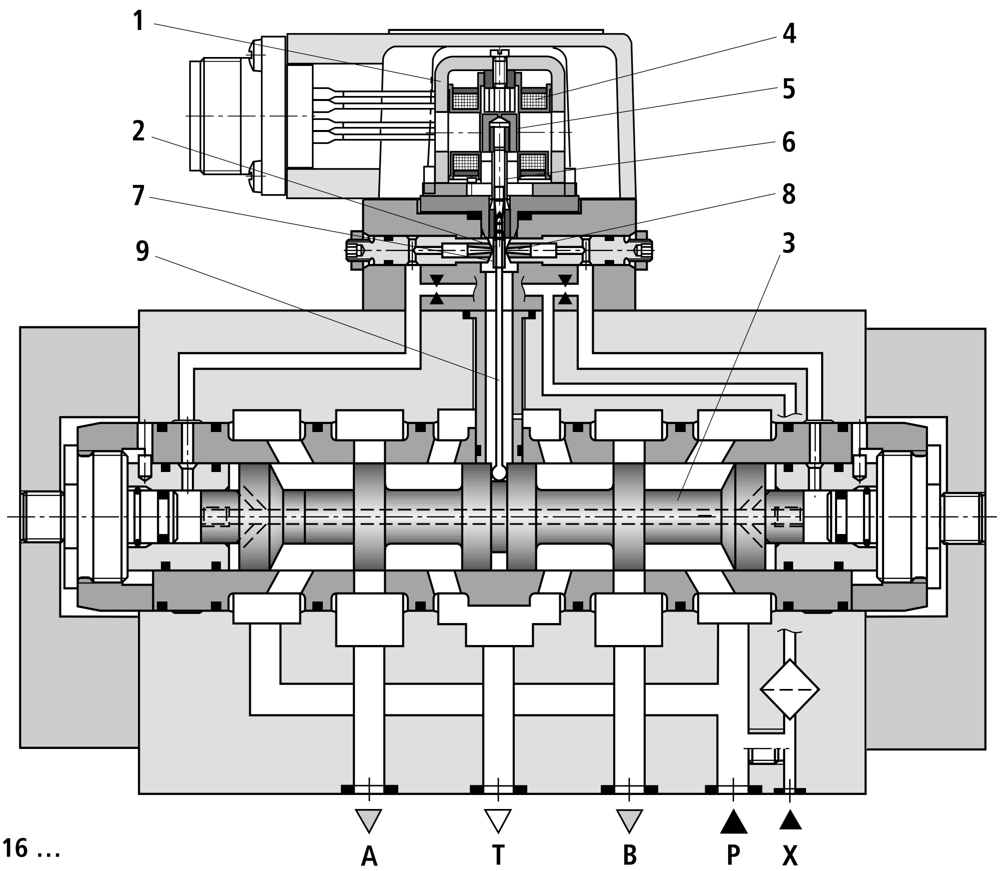
Integrated control electronics, types 4WSE2EM16-2X/... and 4WSE2ED 16-2X/...

For the amplification of the analogue input signal control electronics (10), which are specially matched to the valve, are integrated into the valve. They are built into the torque motor cover plate. The valve zero point can be adjusted by a potentiometer which is externally accessible.

4WSE2ED 16-2X/...

This type of valve is fitted with, in addition to the mechanical closed loop control via a feedback spring, an electrical spool position acquisition and control system. The spool position is obtained via an inductive position transducer (11). The position transducer signal is compared with the command value via the integrated control electronics (10). Any possible control deviation is electrically amplified and then passed onto the torque motor as a control signal. With the additional electrical feedback it is possible to obtain higher dynamic values in the small signal range than the purely mechanical version due to the electrical closed loop amplification. The mechanical feedback ensures that, in the case of failure of the electrical power supply, the spool is positioned in the zero range.

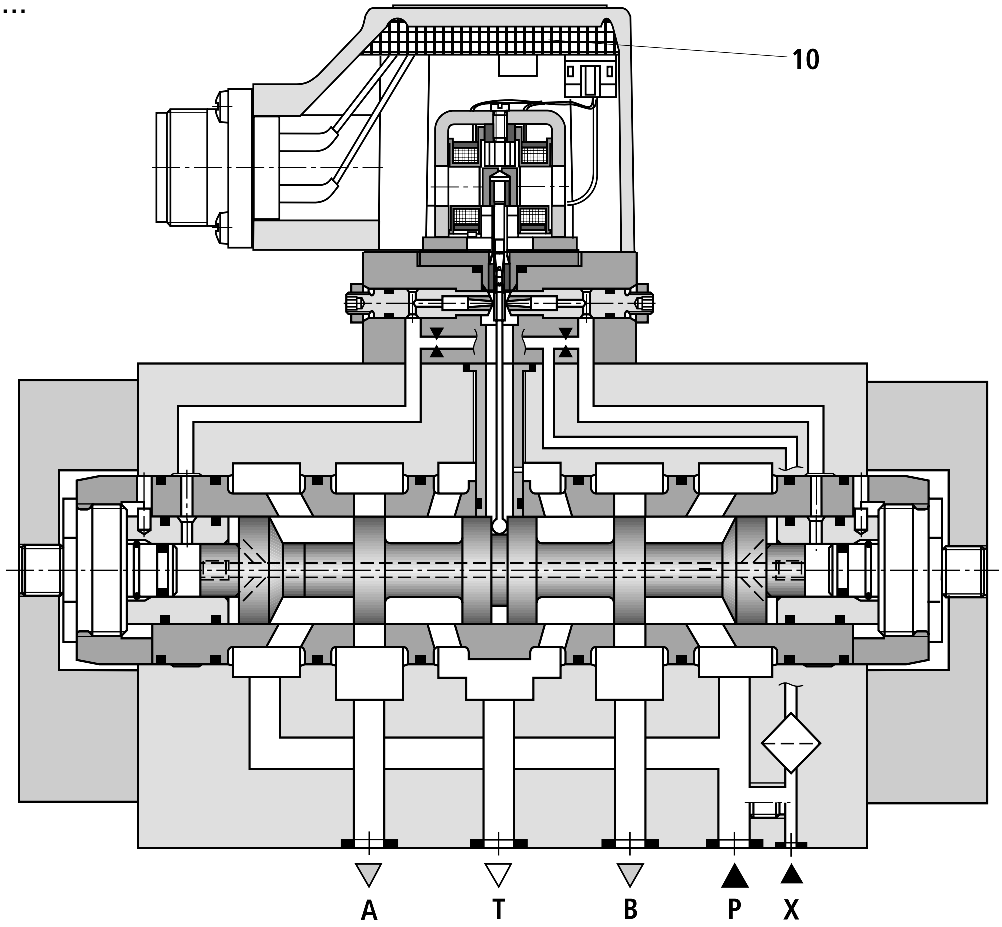
The valve is only available with integrated control electronics. The valve zero point can be adjusted by an externally accessible potentiometer.



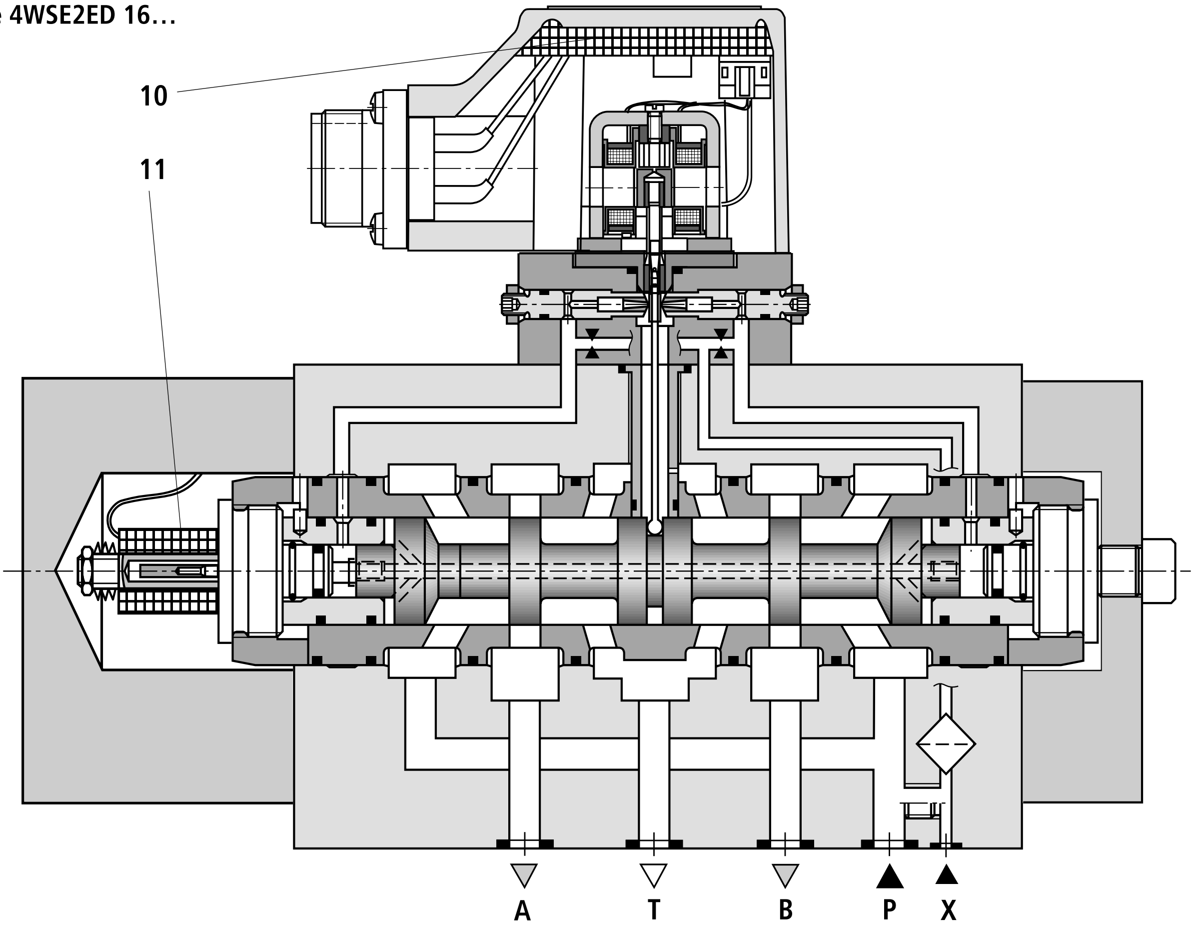
Type 4WS2EM 16 …

Section

Type 4WSE2EM 16…



Type 4WSE2ED 16…



Technical data (for applications outside these applications, please consult us!)

General

Porting pattern		DIN 24 340 form A16
Installation		Optional, it has however to be ensured that, when the system is started, the pilot control is supplied with an adequate pressure (≥ 10 bar)!
Storage temperature range	°C	–20 to +80
Ambient temperature range	°C	–30 to +70, valve for external control electronics
		–20 to +60, valve with integrated control electronics
Weight — With mechanical feedback	kg	10.0
Weight — With mechanical and electrical feedback and integrated control electronics	kg	11.0

Hydraulic (measured with a viscosity of $\nu = 32\ \text{mm}^2/\text{s}$ and $\vartheta = 40\ °\text{C}$)

Operating pressure (ports A, B, P, X)	bar	10 to 210 or 10 to 315		
Return pressure, port T	bar	Pressure peaks < 100, static < 10		
Pressure fluid		Mineral oil (HL, HLP) to DIN 51 524, other pressure fluids on request!		
Pressure fluid temperature range	°C	–20 to +80; preferably +40 to +50		
Viscosity range	mm^2/s	15 to 380; preferably 30 to 45		
Degree of contamination		Maximum permissible degree of contamination of the pressure fluid	A filter with a minimum retention rate of $\beta_X \geq 75$ is recommended without bypass valve and fitted as close as possible in front of the servo valve	
		Class 7	x = 5	
Zero flow $q_{V,L}$ [1] (spool overlap "E") measured without a dither signal	L/min	$\leq \sqrt{\frac{p}{70}} \bullet 3.5$ L/min [2]		
Nominal flow $q_{V\,nom}$ ± 10 % [3] at a valve pressure differential Δp = 70 bar [4]	L/min	100	150	200
Pressure gain (spool overlap „E") at 1% change in stroke (starting from the hyd. zero point)	% von p	≥ 65	≥ 80	≥ 90
Control spool stroke	mm	0.6	0.9	1.2
Control spool area	mm^2	78		
Feedback system		Mechanical (M)	Mechanical and electrical (D)	
Hysteresis (dither optimised)	%	≤ 1.5	≤ 0.5	
Reversal range (dither optimised)	%	≤ 0.3	≤ 0.2	
Response sensitivity (dither optimised)	%	≤ 0.2	≤ 0.1	
Zero balance	in % von I_{nom}	≤ 3	≤ 2	
Zero offset at change in:				
Pressure fluid temperature	%/20 °K	≤ 1.5	≤ 1.2	
Ambient temperature	%/20 °K	≤ 1	≤ 0.5	
Operating pressure	%/100 bar	≤ 2	≤ 1	
Return pressure 0 to 10 % of p	%	≤ 1	≤ 0.5	

[1] $q_{V,L}$ = Zero flow in L/min
[2] p = Operating pressure in bar
[3] $q_{V\,nom}$ = Nominal flow (complete valve) in L/min
[4] Δp = Valve pressure differential in bar

Technical data (for applications outside these parameters, please consult us!)

Electrical

Feedback system		Mechanical (M)	Mechanical and electrical (D)
Valve protection to EN 60 529		IP65	
Signal type		Analogue	
Nominal current per coil	mA	50	–
Resistance per coil	Ω	85	–
Inductivity at 60 Hz and 100% nominal current: Series circuit	H	0.96	–
Parallel circuit	H	0.24	–
Recommended dither signal: f = 400 Hz		The amplitude value is dependent on the hydraulic system: a max. 5 % vom of the nominal current	

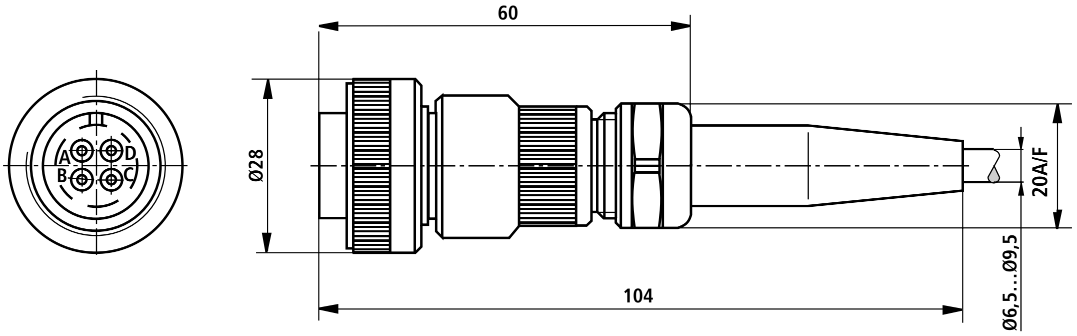
Electrical, external control electronics

Amplifier in (separate order) eurocard format	Type VT-SR2, to catalogue sheet RE 29 980

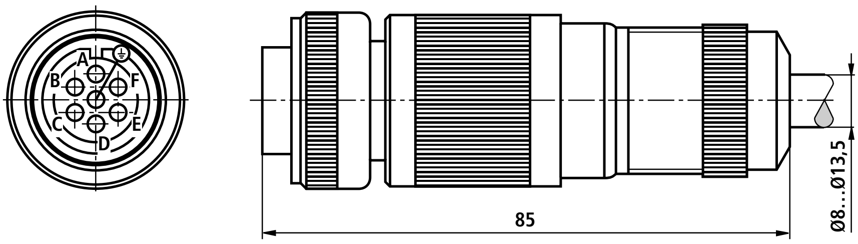
Note: For details regarding the **environmental simulation test** covering EMC (electro-magnetic compatibility), climate and mechanical loading see RE 29 591-U (declaration regarding environmental compatibility).

Plug-in connector

Plug-in connector version **K8** (external control electronics) to VG 095 342 – separate order under Material No. **00002460**



Plug-in connector version **K9** to E DIN 43 563-BF6-3/Pg11 separate order under Material No. **00223890** (metal version)



Coil electrical connections in the component plug (for valves with external control electronics)

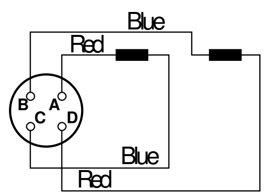
The electrical connections can be either in parallel or series. Due to operational safety considerations and the low spool inductivity, we recommend a parallel circuit.

Parallel circuit: In the plug connect contacts A with B and C with D.

Series circuit: In the plug connect contacts B with C.

Electrical control from A (+) to D (–) results in a flow direction from P to A and B to T. Reversed electrical control results in a flow direction of P to B and A to T.

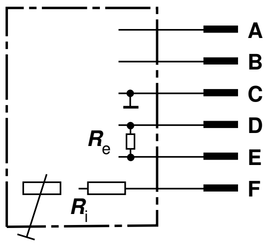
4 WS 2 EM 16-2X/...



Connection cable:
4-core, 0.75 mm², screened (e.g. cable type LiYCY 4x0.75mm²)
Outside diameter 6.5 to 9.5 mm
Only connect the screen to the supply side.

Terminal connections 4 WSE2E .16. (valves with integrated control electronics)

Integrated control electronics



Zero point adjustment

	Terminal connections	Current input signal Control "**8**"	Voltage input signal Control "**9**"
Supply voltage (± 3 %)	A	+ 15 V	+ 15 V
	B	– 15 V	– 15 V
	C	⊥	⊥
Command value	D	± 10 mA;	± 10 V
	E	R_e = 1 kΩ	R_e ≥ 50 kΩ
Measuring output for the control spool	F 1)	Nom. stroke corresponds to approx. ± 10 V with respect to ⊥ ; R_i = 1 kΩ	

Current consumption at plug terminal	A	Max. 150 mA	Max. 150 mA
	B		
	D	± 10 mA	≤ 0.2 mA
	E		

1) For valves without electrical feedback terminal F is not connected.

Supply voltage: ± 15 V ± 3 %, residual ripple < 1 %

Command value: A command value at plug connection D = negative with respect to the plug connection E results in a flow from P to B and A to T.

Measurement output F has a negative signal with respect to ⊥ .

A command value at plug connection D = positive with respect to the plug connection E results in a flow from P to A and B to T.

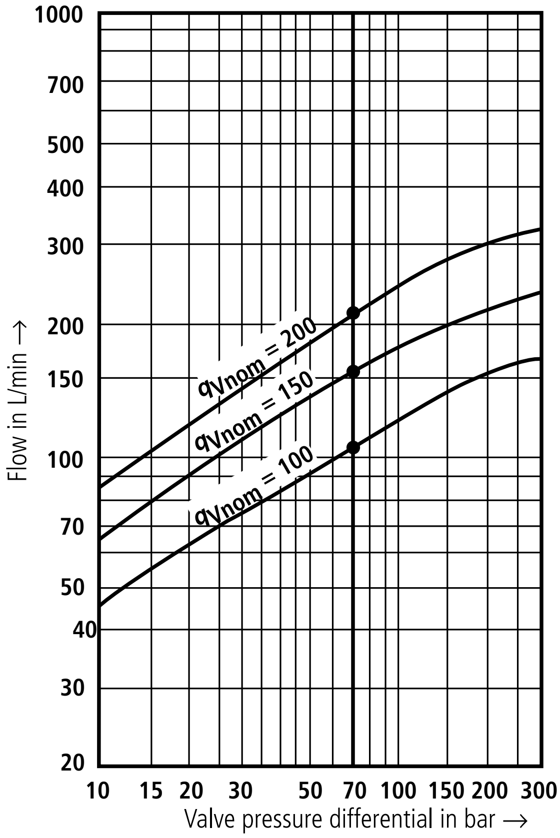
Measurement output F has a positive signal with respect to ⊥ .

Measurement output: The voltage signal U_F is proportional to the spool stroke.

Note: Electrical signals (e. g. actual value) taken via valve electronics must not be used to switch off the machine safety functions!

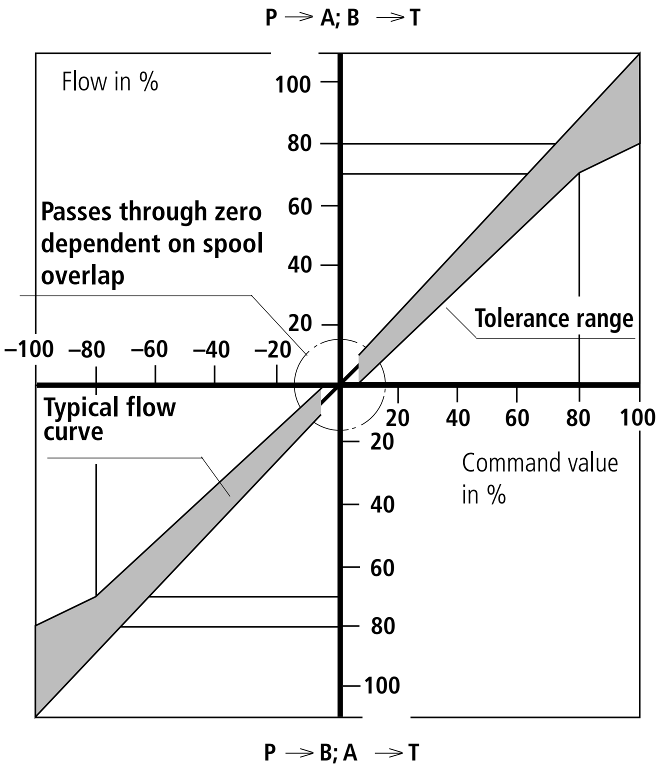
(Also see European standard "Safety requirements of fluid technology systems and components – hydraulics", prEN 982 !)

Flow/load function (tolerance ± 10 %)
at 100 % command value signal



Δp = Valve pressure differential (input pressure minus the return pressure and minus the load pressure)

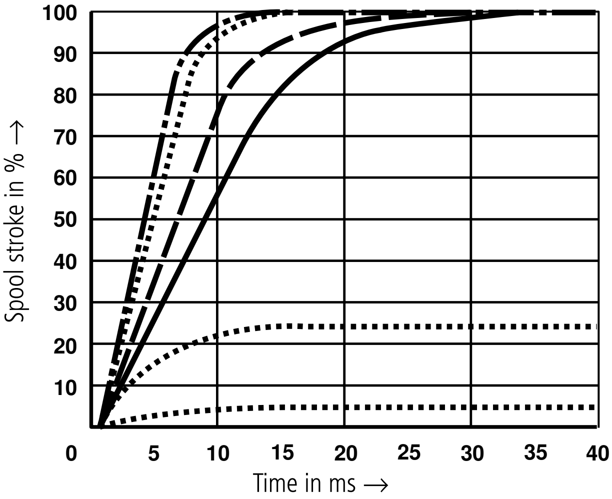
Tolerance range of flow/signal function
at constant valve pressue differential



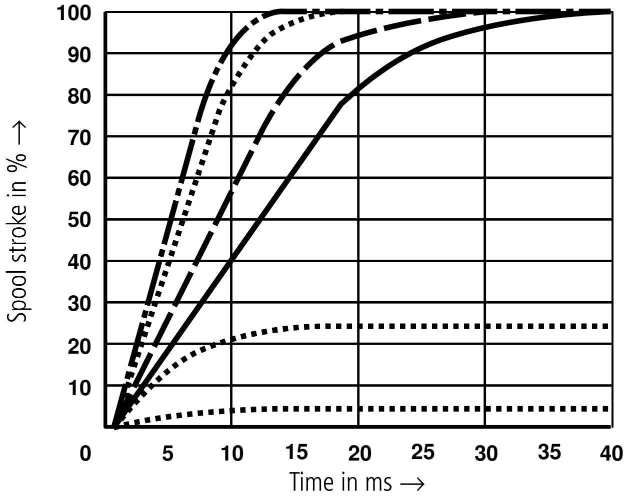
Characteristic curves: type 4WS.2EM 16 (measured with HLP32, ϑ_{oil} = 40 °C ± 5 °C)

Transient function with a 315 bar pressure stage Stop response without flow

Nominal flow **100 L/min**



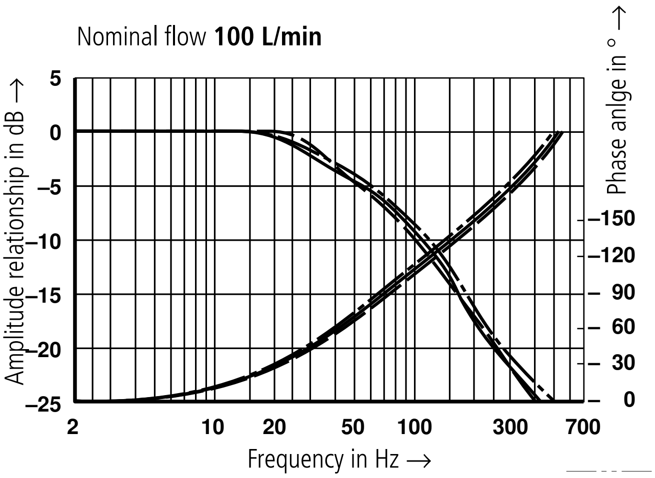
Nominal flow **150 L/min**



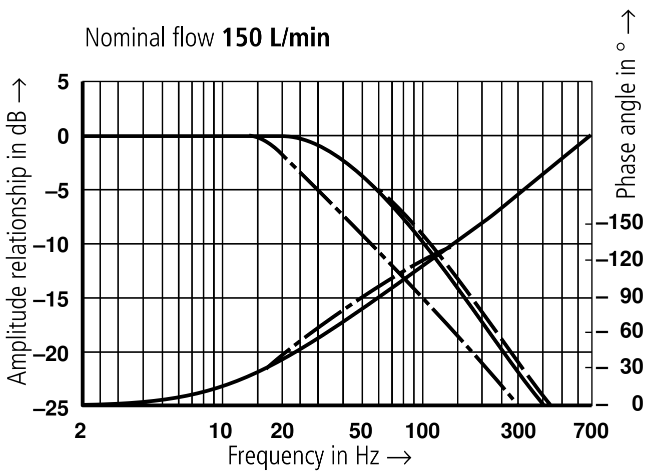
40 bar — 70 bar — 140 bar — 210 and 315 bar

Frequency response with a 315 bar pressure stage, *p* = 315 bar Stroke frequency response without flow

Nominal flow **100 L/min**



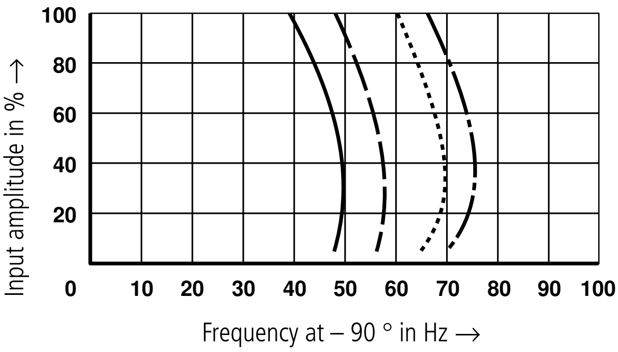
Nominal flow **150 L/min**



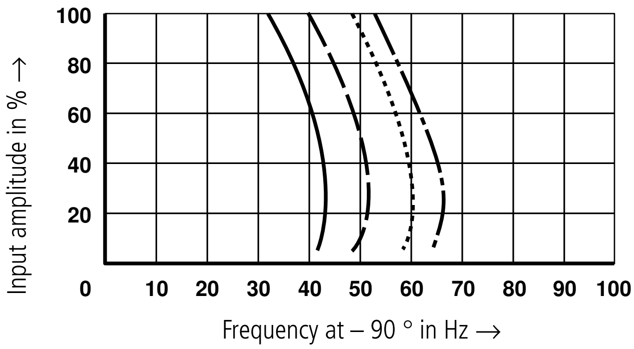
5 % — 25 % — 100 %

Relationship of the corner frequency to the operating pressure *p*

Nominal flow **100 L/min**



Nominal flow **150 L/min**

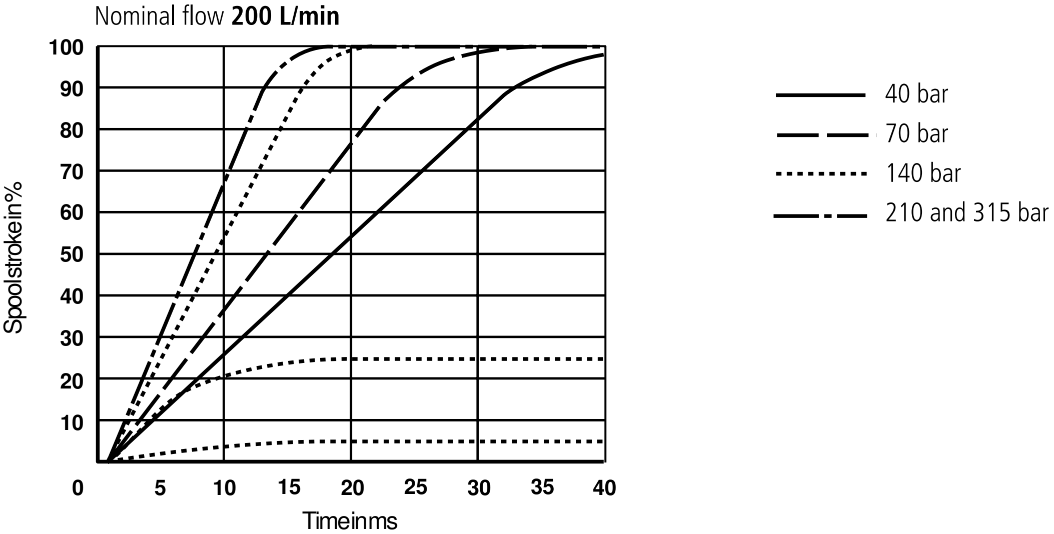


40 bar — 70 bar — 140 bar — 210 and 315 bar

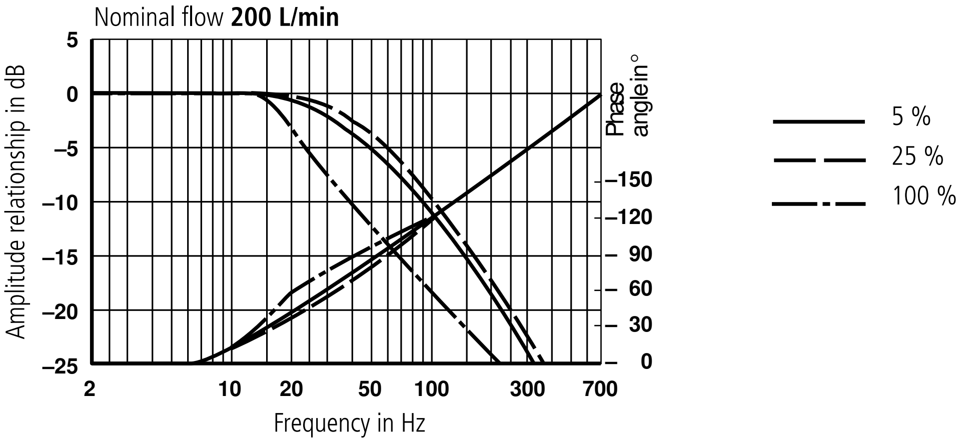
Output signal ≙ spool stroke without flow

Characteristic curves: type 4WS.2EM 16 (measured with HLP32, ϑ_{oil} = 40 °C ± 5 °C)

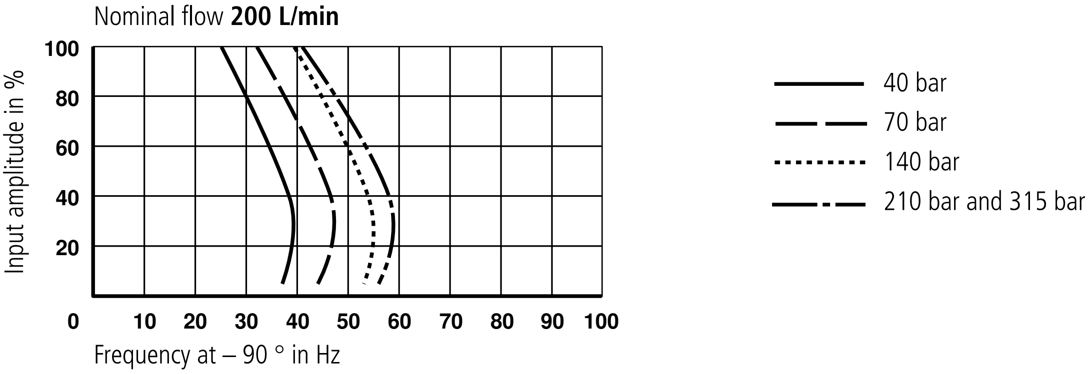
Transient function with a 315 bar pressure stage Step response without flow



Frequency response with a 315 bar pressure stage, *p* = 315 bar Stroke requency response without flow



Relationship of the corner frequency to the operating pressure *p*

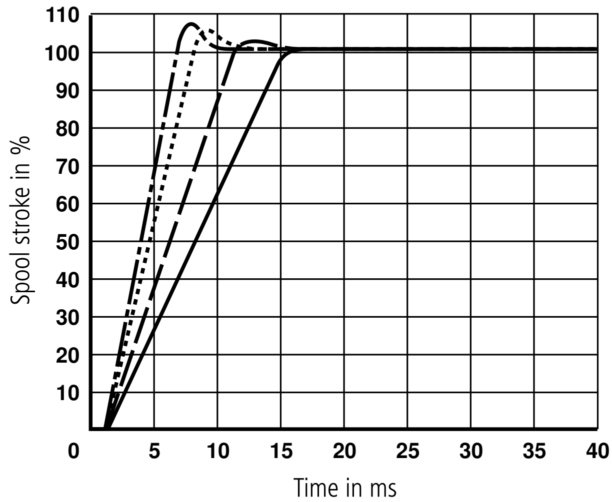


Output signal ≙ spool stroke without flow

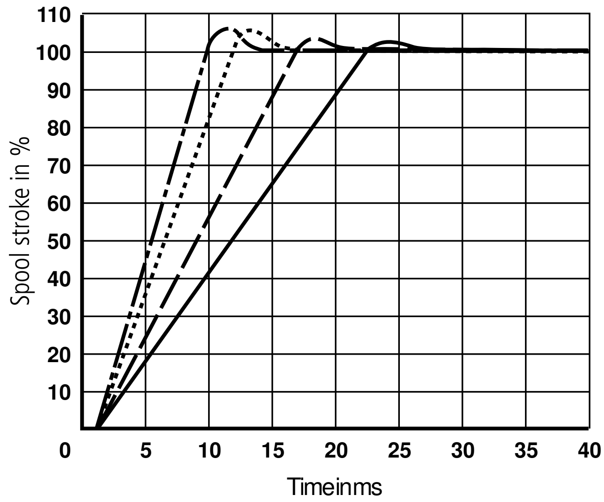
Characteristic curves: type 4WSE2ED 16 (measured with HLP32, ϑ_{oil} = 40 °C ± 5 °C)

Transient function with a 315 bar pressure stage Step response without flow

Nominal flow **100 L/min**



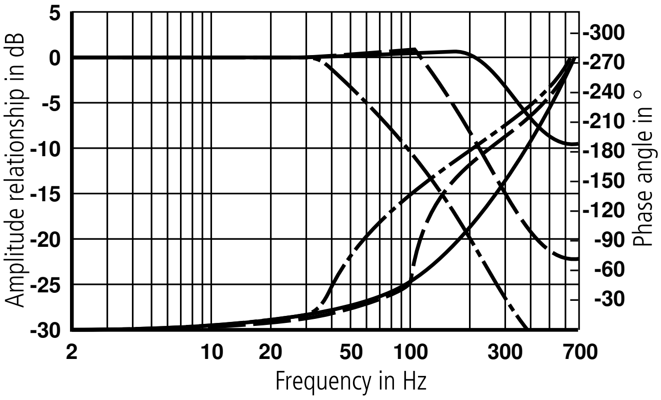
Nominal flow **150 L/min**



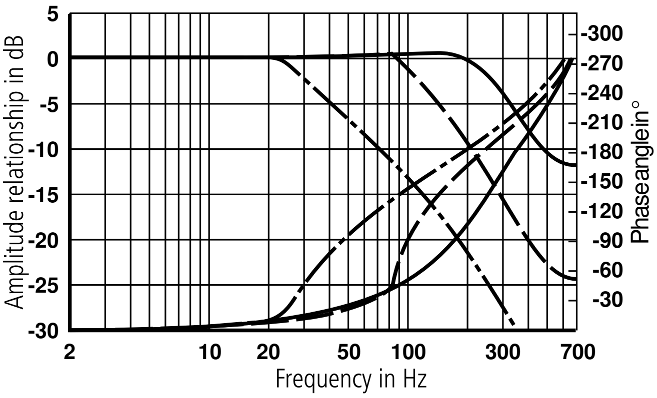
40 bar 70 bar 140 bar 210 bar and 315 bar

Frequency response with a 315 bar pressure stage, *p* = 315 bar Stroke requency response without flow

Nominal flow **100 L/min**



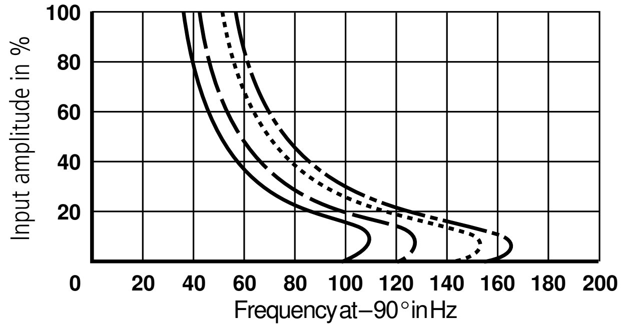
Nominal flow **150 L/min**



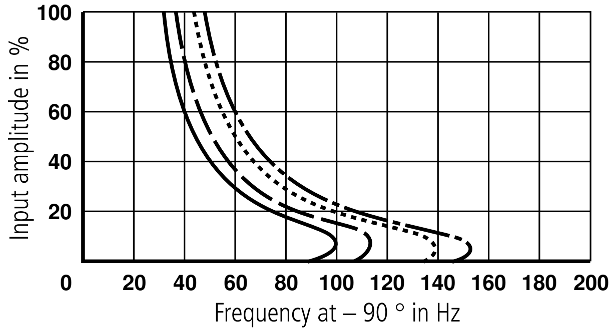
5 % 25 % 100 %

Relationship of the corner frequency to the operating pressure *p*

Nominal flow **100 L/min**



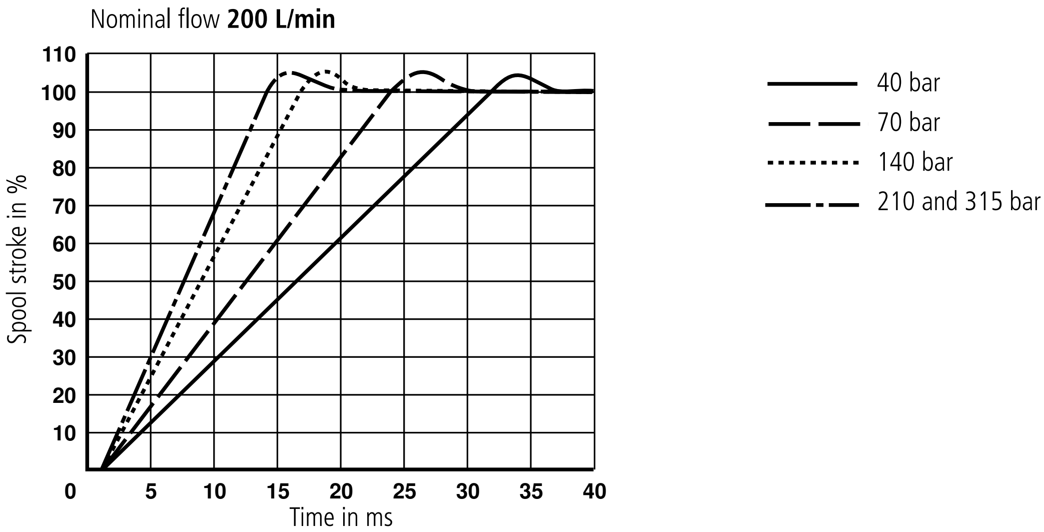
Nominal flow **150 L/min**



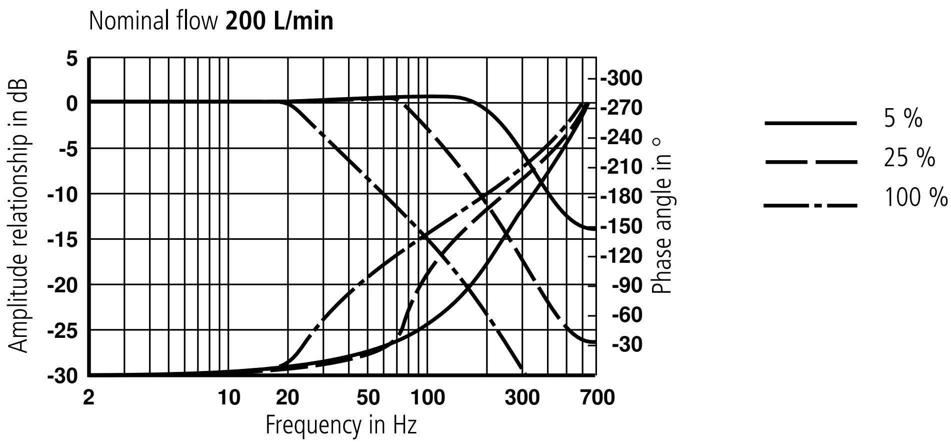
40 bar 70 bar 140 bar 210 bar and 315 bar

Output signal ≙ spool stroke without flow

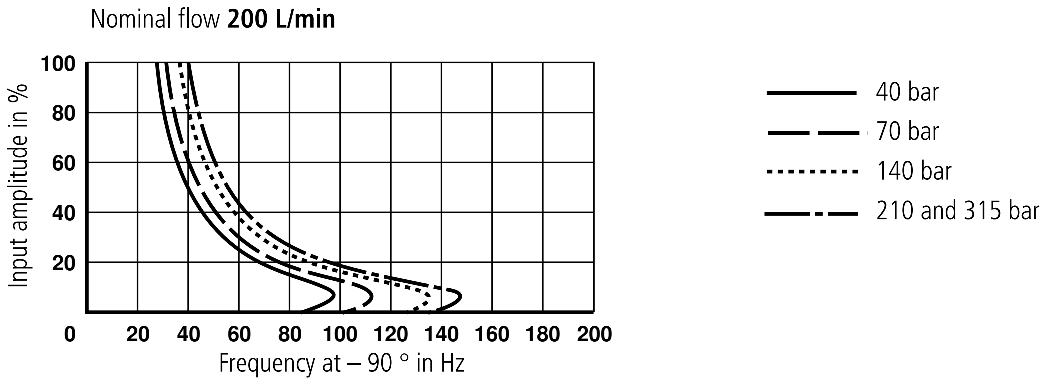
Transient function with a 315 bar pressure stage Step response without flow



Frequency response with a 315 bar pressure stage, *p* = 315 bar Stroke frequency response without flow

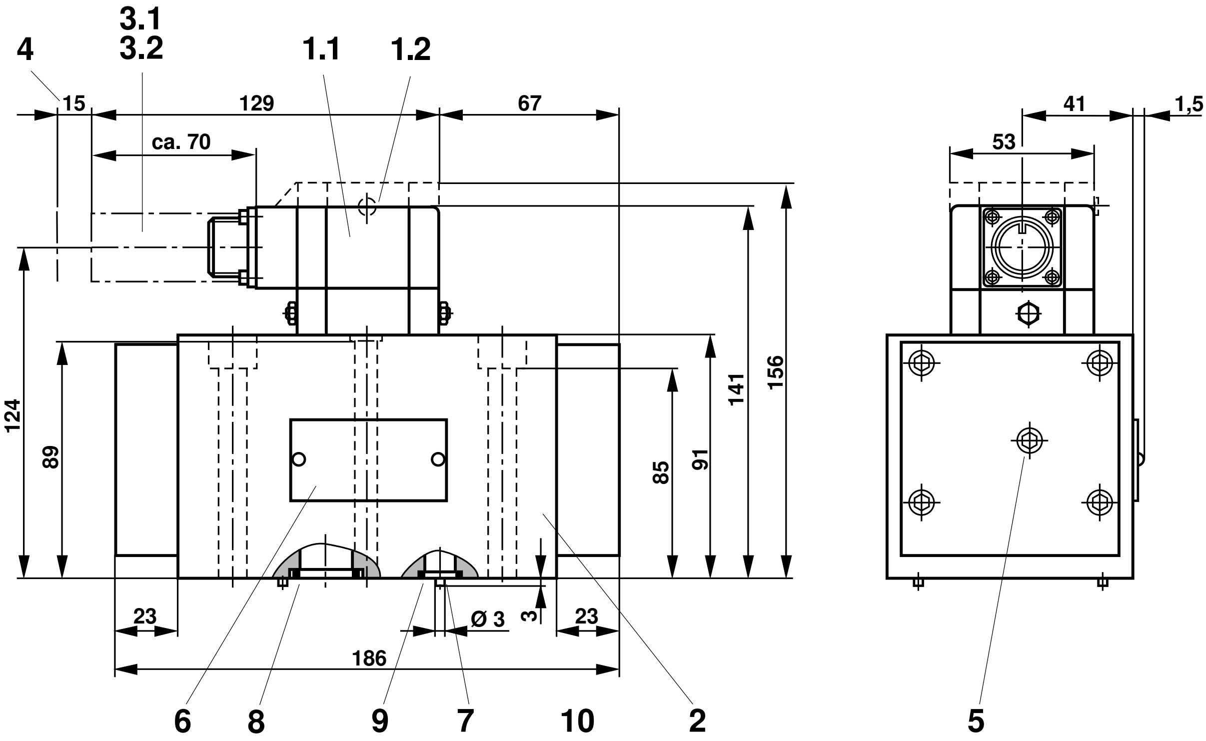


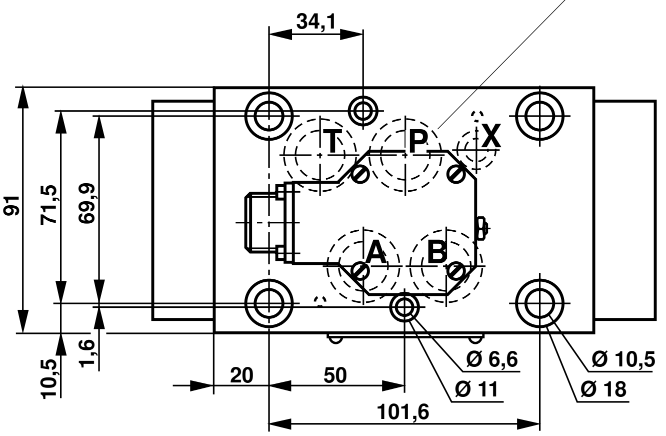
Relationship of the corner frequency to the operating pressure *p*

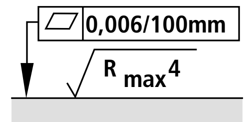


Output signal ≙ spool stroke without flow

Unit dimensions: type 4WS.2EM 16 (dimensions in mm)







Required surface finish of the mating piece

1.1 Pilot control (1st stage) **without** integrated control electronics (4 WS 2 EM 16)

1.2 Pilot control (1st stage) **with** integrated control electronics (4 WSE 2 EM 16)
Electrical zero point setting:
Having removed the plug (2.5A/F) the zero point may be corrected via the potentiometer.

2 2nd stage

3.1 **Without integrated electronics:**
4-pin plug-in connector compatible with VG 095 342

3.2 **With integrated electronics:**
6-pin plug-in connector compatible with VG 095 342

4 Space required to remove the plug-in connector, take the connection cable into account!

5 For setting the hydraulic zero point on both sides 5A/F internal hexagon

6 Name plate

7 Locating pin (2 off)

8 Identical seal rings for ports A, B, P and T

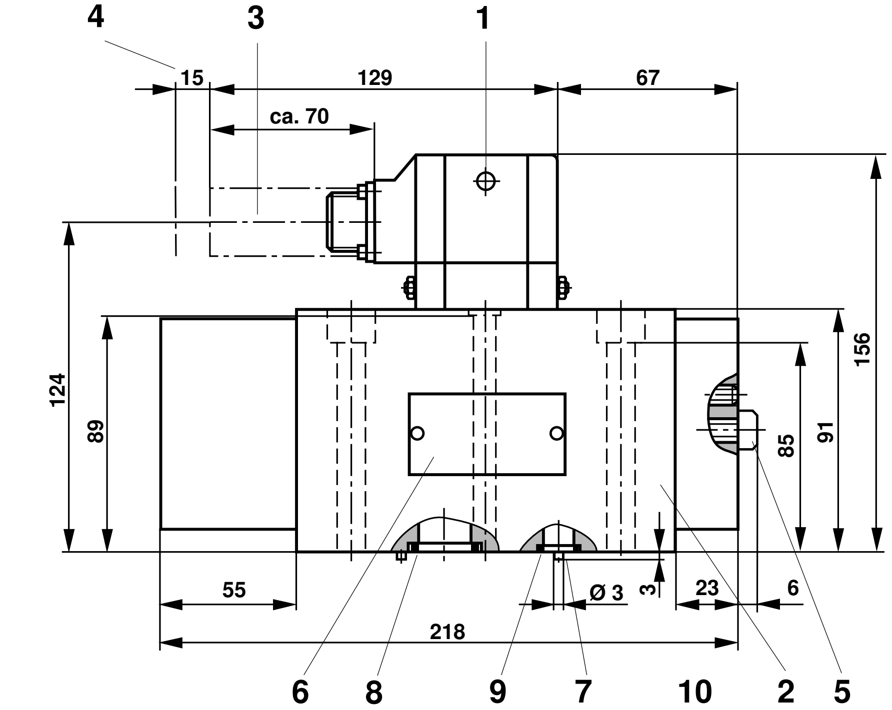
9 Seal ring for port X

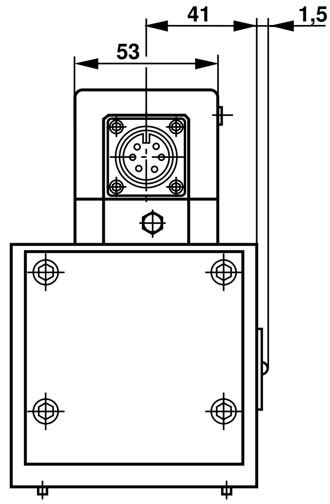
10 Porting pattern to DIN 24 340, form A 16

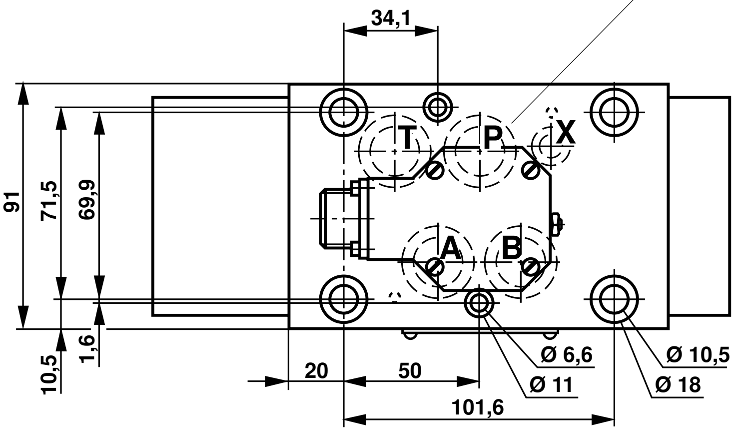
Subplates G 172/01 (G 3/4)
G 174/01 (G 1); G 174/08 (flange)
to catalogue sheet RE 45 056 must be ordered separately.

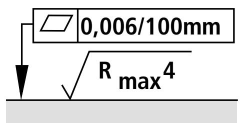
Valve fixing screws are included within the scope of supply.

4 off M10 x 100 DIN 912-10.9; M_A = 75 Nm
2 off M6 x 100 DIN 912-10.9; M_A = 15.5 Nm









Required surface finish of the mating piece

1 Pilot control (1st stage) with integrated control electronics
Electrical zero point setting:
Having removed the plug (2.5A/F) the zero pont may be corrected via the potentiometer.

2 2nd stage

3 6-pin plug-in connector compatible to VG 095 342

4 Space required to remove the plug-in connector, take the connection cable into account!

5 Setting of hydraulic zero point via two screws 5A/F and 3A/F internal hexagon

6 Name plate

7 Locating pin (2 off)

8 Identical seal rings for ports A, B, P and T

9 Seal ring for port X

10 Porting pattern to DIN 24 340, form A 16

Subplates G 172/01 (G 3/4)
G 174/01 (G 1); G 174/08 (flange)

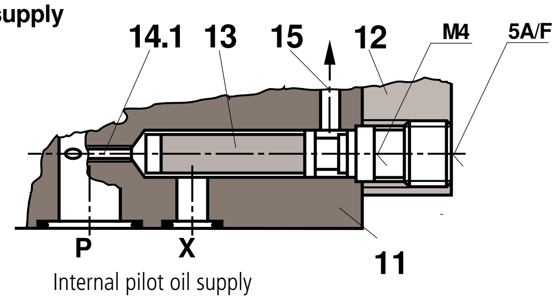
to catalogue sheet RE 45 056 must be ordered separately.

Valve fixing screws are included within the scope of supply.

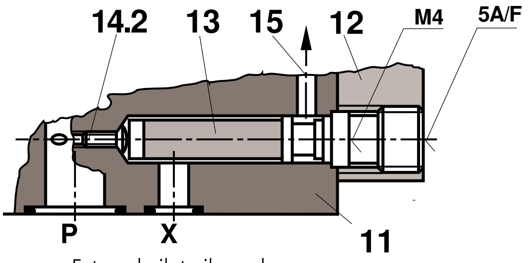
4 off M10 x 100 DIN 912-10.9; M_A = 75 Nm
2 off M6 x 100 DIN 912-10.9; M_A = 15.5 Nm

Pilot oil supply (pilot oil drain usually internal)

Pilot oil supply



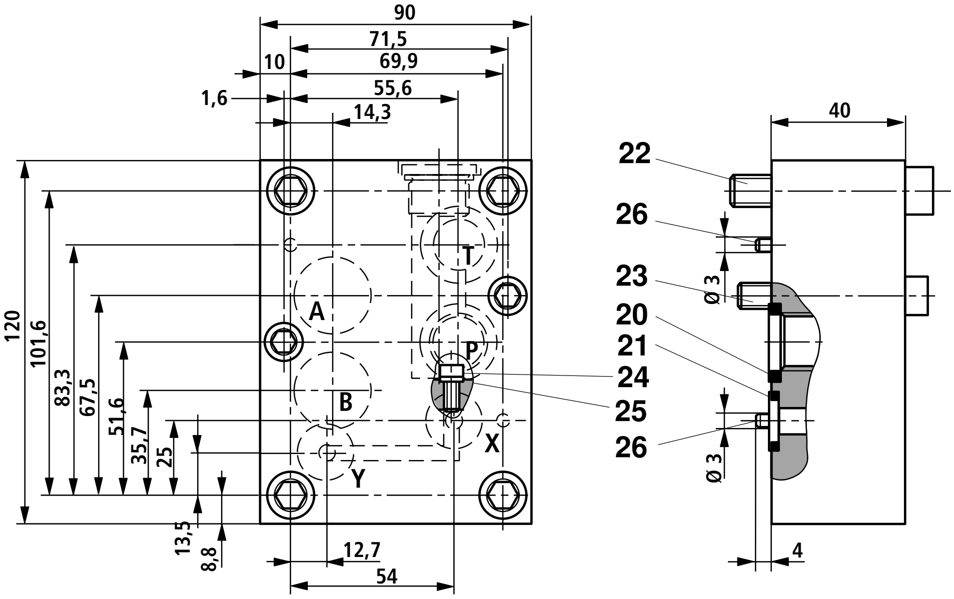
Internal pilot oil supply
(version **"ET"**)



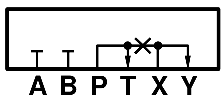
External pilot oil supply
(version **"T"**)

11 Main valve
12 Cover
13 Filter
Material No. **00649157**
14.1 Open
14.2 Closed
plug M6 x 10 DIN 906
15 For 1st stage

Flushing plate (dimensions in mm)



Symbol



With NBR seals
Material No. 00308493

20 Identical seal rings for ports A, B, P, T
21 Identical seal rings for ports X, Y
22 4 off S.H.C.S. M10 x 50 DIN 912–8.8
(are included within the scope supply); M_A = 51 Nm
23 2 off S.H.C.S. M6 x 50 DIN 912–8.8
(are included within the scope supply); M_A = 10,4 Nm
24 1 off S.H.C.S. M6 x 10 DIN 912–8.8
(are included within the scope supply)
25 Seal ring
26 Locating pin (2 off)

In order to ensure that the servo valves functions correctly it is always necessary to flush the system before commissioning
As a guideline for the flushing time per system the following may be used:

$$t \geq \frac{V}{q_V} \cdot 5$$

t = Flushing time in hours
V = Tank contents in litres
q_V = Pump flow in litres per minute

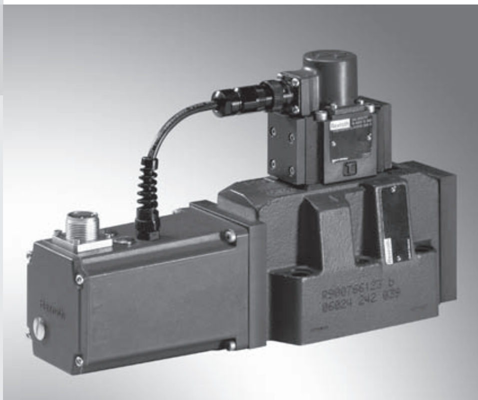
If the tank is subsequently filled with more than 10 % of the tank contents then the flushing process must be repeated.

A directional valve with a porting pattern to DIN 24 340 form A 16 is more suitable than a flushing plate. The actuator lines can also be flushed using this valve.

Directional servo-valve in 4-way version

Type 4WSE3E 16

Size 16
Component series 2X
Maximum operating pressure 350 bar
Maximum flow 570 l/min



H7359

Table of contents

Features

– Valve for position, force, pressure or velocity control
– 3-stage servo-valve with electrical position control of the control spool of the 3rd stage, position sensing of the control spool by means of an inductive position transducer
– High dynamics 2-stage pilot control valve of size 6
– 1st stage as nozzle flapper plate amplifier
– Filter for 1st stage externally accessible and replaceable
– Subplate mounting:
Porting pattern according to ISO 4401
– Can also be used as 3-way version
– Valve and integrated control electronics are adjusted and tested in the factory
– Optimized valve control loop
– High response sensitivity, very low hysteresis and zero point drift
– Internal or external pilot oil supply and return
– Gap seals at pressure chambers of the control sleeve, no wear of O-ring

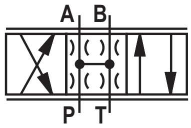
Ordering code

4WSE3E	16				–2X/		/	K31		*

3-stage servo-valve

Size
Size 16 **= 16**

Control spool symbol [1)]



= V
= V1

Control spool position in de-energized state
Not defined **= no code**
100 % P → A / B → T **= P**

Rated flow [2)]
105 l/min **= 100**
150 l/min **= 150**
200 l/min **= 200**
260 l/min **= 300**

Control spool overlap [3)]
0 to 0.5 % positive **= D**
0 to 0.5 % negative **= E**

Component series 20 to 29 **= 2X**
(20 to 29: Unchanged installation and connection dimensions)

Seal material [4)]
FKM seals **= V**
NBR seals **= M**

Further details in the plain text

Electronics interface command/actual value
A1 = 0 to 10 V
C1 = 0 to 10 mA
F1* = 4 to 20 mA

Electrical connection
K31 = 6+PE
Without mating connector

Supply voltage
15 = ±15 V
24 = +24 V
See page 6

Pressure rating [6)]
7 = 210 bar
9 = 315 bar

Pilot flow [5)]
XY = Pilot oil supply external, return external
XT = Pilot oil supply external, return internal
PY = Pilot oil supply internal, return external
PT = Pilot oil supply internal, return internal

* Only with +24 V supply voltage

1) **Control spool symbols**
with control spool symbol V
P → A: $q_{V\,max}$ B → T: $q_{V\,max}$
P → B: $q_{V\,max}$ A → T: $q_{V\,max}$
with control spool symbol V1
P → A: $q_{V\,max}$ B → T: $q_V / 2$
P → B: $q_V / 2$ A → T: $q_{V\,max}$

2) **Rated flow**
The rated flow refers to a 100 % command value signal at 70 bar valve pressure differential (35 bar per control edge). The valve pressure differential must be regarded as reference. Other values result in the flow being changed.
A possible rated flow tolerance of ±10 % and a saturation influence must be taken into account (see flow/signal function page 8).

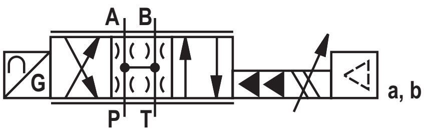
3) **Control spool overlap**
The control spool overlap in % is referred to the nominal stroke of the control spool.
(Other control spool overlaps upon request.)

4) **Seal material**
See notices on page 5

5) **Pilot oil**
Care should be taken that the pilot pressure is as constant as possible. An external pilot control via port X is thus often advantageous.

6) **Inlet pressure range**
Care should be taken that the inlet pressure is as constant as possible. Minimum control pressure ≥ 10 bar.
Up to a pilot pressure of 210 bar, pressure rating 7 is to be selected. From a pilot pressure greater than 210 bar, pressure rating 9 is to be selected.
With regard to the dynamics, the frequency response dependency must be observed within the admissible pressure range.
At an inlet pressure > 40 bar, the control pressure must not be less than 60 % of the inlet pressure as otherwise the current forces at the control spool of the 3rd stage will impair the controllability.
At an inlet pressure ≤ 40 bar working with a control pressure above port X (external supply) is in any case advantageous.

Symbol



Function, section

The valves of type 4WSE3E 16 are electrically operated, 3-stage directional servo-valves. They are mainly used for position, force or pressure and velocity controls.

These valves consist of a 2-stage pilot control valve of type 4WS2EM 6 (1), a main stage with a main control spool in a sleeve (2), an inductive position transducer (3), and the integrated control electronics (4).

The pilot control valve (1) consists of an electro-mechanical transformer (torque motor), a hydraulic amplifier (nozzle flapper plate principle) and a pilot control spool in a sleeve, which is connected to the torque motor via a mechanical feedback.

Electric currents in the coils of the torque motor generate a force by means of a permanent magnet which acts on the armature, and in connection with a torque tube results in a torque. This causes the flapper plate which is connected to the torque tube via a pin to move from the central position between the two control nozzles, and a pressure differential is created across the front sides of the pilot control spool. The pressure differential results in the control spool changing its position, which results in the pressure port being connected to one actuator port and, at the same time, the other actuator port being connected to the return flow port.

The pilot control spool is connected to the flapper plate or the torque motor by means of a bending spring (mechanical feedback).

The position of the control spool is changed until the flapper plate position and hence the pressure differential across the nozzle flapper plate system becomes zero due to the feedback torque, which acts via the bending spring against the electro-magnetic torque of the torque motor.

In doing so, the stroke of the pilot control spool and hence the flow of the pilot control valve is controlled proportionally to the electrical input signal (see data sheet 29564).

In the main stage, the main control spool (2) is operated by the pilot control valve and its position is sensed by an inductive position transducer (3). The position transducer signal is compared to the command value by integrated control electronics (4). Any possible control deviation is amplified electrically and fed to the pilot control valve as control signal. The pilot control valve starts to move and the main control spool is re-positioned.

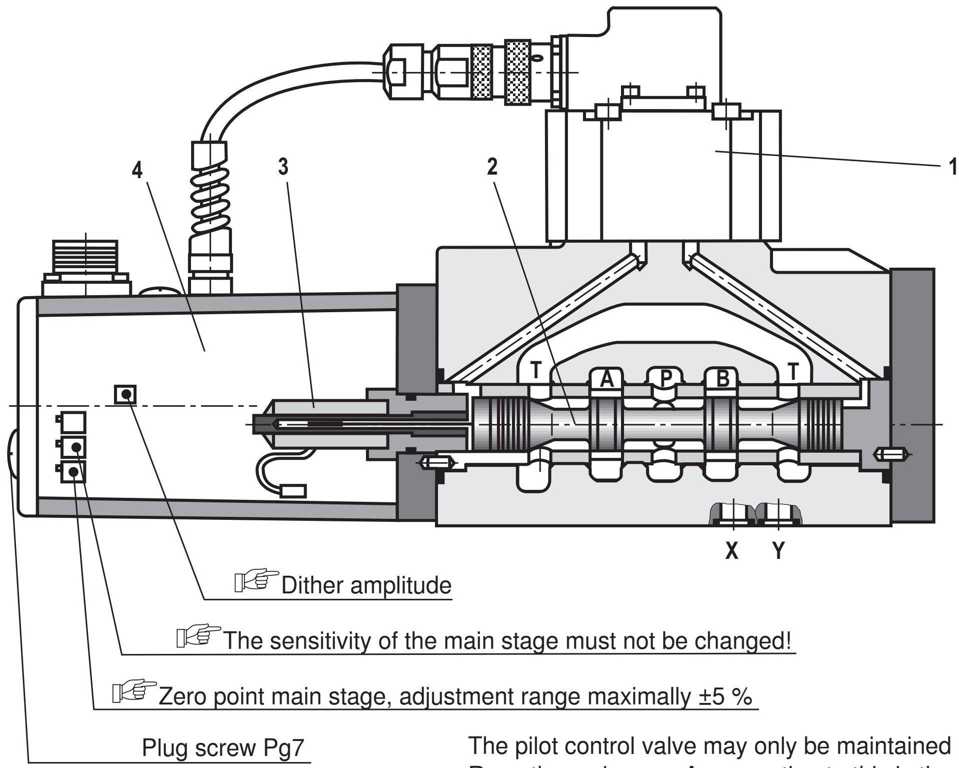
The stroke of the main control spool and consequently the flow of the servo-valve are controlled in proportion to the command value. It must be noted that the flow depends on the valve pressure differential.

The valve zero point can be adjusted by means of an externally accessible potentiometer.

The valves are factory-set with a dither default setting with the constant frequency of 400 Hz.

☞ **Notice!**

Changes in the zero point and/or the dither amplitude may result in damage to the system and may only be implemented by instructed specialists.



The pilot control valve may only be maintained by Bosch Rexroth employees. An exception to this is the replacement of the filter element – see data sheet 29564.

Technical data (For applications outside these parameters, please consult us!)

general

Weight	kg	9.5
Installation position		Any, if it is ensured that the pilot control is supplied with sufficient pressure (> 10 bar) during start-up of the system. In case of insufficient pressure supply, the control spool of the servo-valve can take any position. This may result in channel P being connected to the actuator and the build-up of pressure being delayed. This may be prevented by providing an external pressure supply at port X.
Storage temperature range	°C	–20 to +80
Ambient temperature range	°C	–20 to +60

hydraulic (measured with HLP 32, ϑ_{Oil} = 40 °C ± 5 °C)

Maximum operating pressure	Pilot control stage, pilot oil supply X		bar	10 to 210 and/or 10 to 315 (see page 2, pressure rating)
	Main valve, port P, A, B	Pilot oil supply internal	bar	315
	Main valve, port P, A, B	Pilot oil supply external	bar	350
Maximum return flow pressure	Pilot control stage, port Y		bar	Pressure peaks < 100 admissible, static < 10
	Main valve, port T	Pilot oil return internal	bar	Pressure peaks < 100 admissible, static < 10
		Pilot oil return external	bar	250
Zero flow				See page 9 (characteristic curves)
Rated flow q_{Vnom} ±10 % with Δp = 70 bar			l/min	105, 150, 200, 260
Hydraulic fluid				See table page 5
Hydraulic fluid temperature range			°C	–20 to +80; preferably +40 to +50
Viscosity range			mm²/s	15 to 380; preferably 30 to 45
Maximum admissible degree of contamination of the hydraulic fluid cleanliness class according to ISO 4406 (c)			Pilot control valve	Class 18/16/13 [1]
			Main stage	Class 20/18/15 [1]
Hysteresis			%	≤ 0.10
Range of inversion			%	≤ 0.05
Response sensitivity			%	≤ 0.05
Pressure gain				≥ 90 % of p_P [2] with 1 % change in the control spool stroke (from hydraulic zero point)
Zero shift upon change of:	Hydraulic fluid temperature		% / 10 K	≤ 0.3
	Ambient temperature		% / 10 K	≤ 0.3
	Operating pressure		% / 100 bar	≤ 0.3
	Return flow pressure 0 to 10 % of p_P		% / 100 bar	≤ 0.3

[1] The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the service life of the components.

[2] p_P = Inlet pressure/operating pressure

☞ **Notice!**
For information on the **environment simulation testing** for the areas EMC (electromagnetic compatibility), climate and mechanical load, see data sheet 29620-U.

Technical data (For applications outside these parameters, please consult us!)

Hydraulic fluid	Classification	Suitable sealing materials	Standards
Mineral oils and related hydrocarbons	HL, HLP	NBR, FKM	DIN 51524
Flame-resistant – containing water	HFC Fuchs Hydrotherm 46M Petrofer Ultra Safe 620	NBR	ISO 12922

Important information on hydraulic fluids!

- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, service life, maintenance intervals, etc.)!
- **Flame-resistant – containing water**:
  Maximum pressure differential per control edge 210 bar, otherwise, increased cavitation erosion!
  Tank pre-loading < 1 bar or > 20 % of the pressure differential of the tank edge. The pressure peaks should not exceed the maximum operating pressures!
  Maximum fluid temperature 60 °C

Technical data (For applications outside these parameters, please consult us!)

electric

Protection class according to EN 60529	IP 65 with mating connector mounted and locked
Type of signal	Analog

Electronics interface		A1	C1	F1
Current consumption at the mating connector	Pin			
	A	< ±150 mA with ±15 V < 200 mA with 24 V		< 200 mA with 24 V
	B			
	D	0 to ±0.05 mA	0 to ±10 mA	4 to 20 mA
	E			

Device connector allocation	Pin	Supply voltage 15		Supply voltage 24		
Interface		A1	C1	A1	C1	F1
Supply voltage	A	+15 VDC		+24 VDC		
	B	–15 VDC		0 VDC		
M0	C	0 VDC / reference to pins A, B		Not used		
Differential command value input	D E	0 to ±10 V R_e >100 kΩ	0 to ±10 mA R_e = 100 Ω	0 to ±10 V R_e >100 kΩ	0 to ±10 mA R_e = 100 Ω	4 to 20 mA R_e = 100 Ω
Actual value Reference with +24 V is pin B Reference with ±15 V is pin C	F	0 to ±10 V R_i ≈ 1 kΩ	0 to ±10 mA Load max. 1 kΩ	0 to ±10 V R_i ≈ 1 kΩ	0 to ±10 mA Load max. 1 kΩ	4 to 20 mA Load max. 500 Ω
Protective earth	PE	Connected to valve housing				

One end of the shield must be connected to the control!

Supply voltage: ±15 V ±3 %, residual ripple < 1 %
+24 VDC / 18 V to 35 V; full bridge rectification with smoothing capacitor
2200 µF = I_{max} = 230 mA

Command value: **A1, C1:**
Reference potential at E and positive command value at D result in flow from P → A and B → T.
Reference potential at E and negative command value at D result in flow from P → B and A → T.
F1:
Reference potential at E and signal 12 to 20 mA at D result in flow from P → A and B → T.
Reference potential at E and signal 12 to 4 mA at D result in flow from P → B and A → T.

Actual value / measuring output: The voltage / current signal is proportional to the control spool stroke and has the same sign as the command value.

Connection cable: Recommendation: – up to 25 m line length: Type LiYCY 7 x 0.75 mm^2
– up to 50 m line length: Type LiYCY 7 x 1.0 mm^2
Only connect the shield to ⊥ on the supply side.

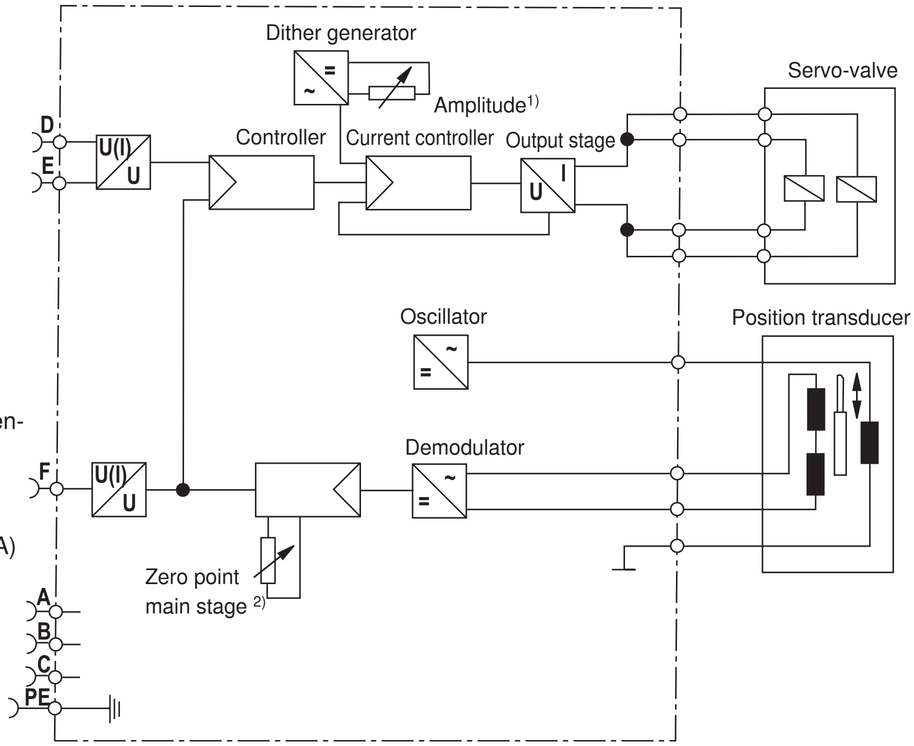
Notice: **Electric signals taken out via valve electronics (e.g. actual value) must not be used for switching off safety-relevant machine functions!**

Block diagram of the integrated electronics (OBE)

Interface | Integrated electronics (OBE) | Valve

Differential command value input
±10 V or ±10 mA or 4 to 20 mA

Actual value ±10 V / ±10 mA
(measuring output F has positive potential against ⊥ with flow P → A)
Actual value 4 to 20 mA
(measuring output F is larger than 12 mA against ⊥ with flow P → A)



Supply voltage

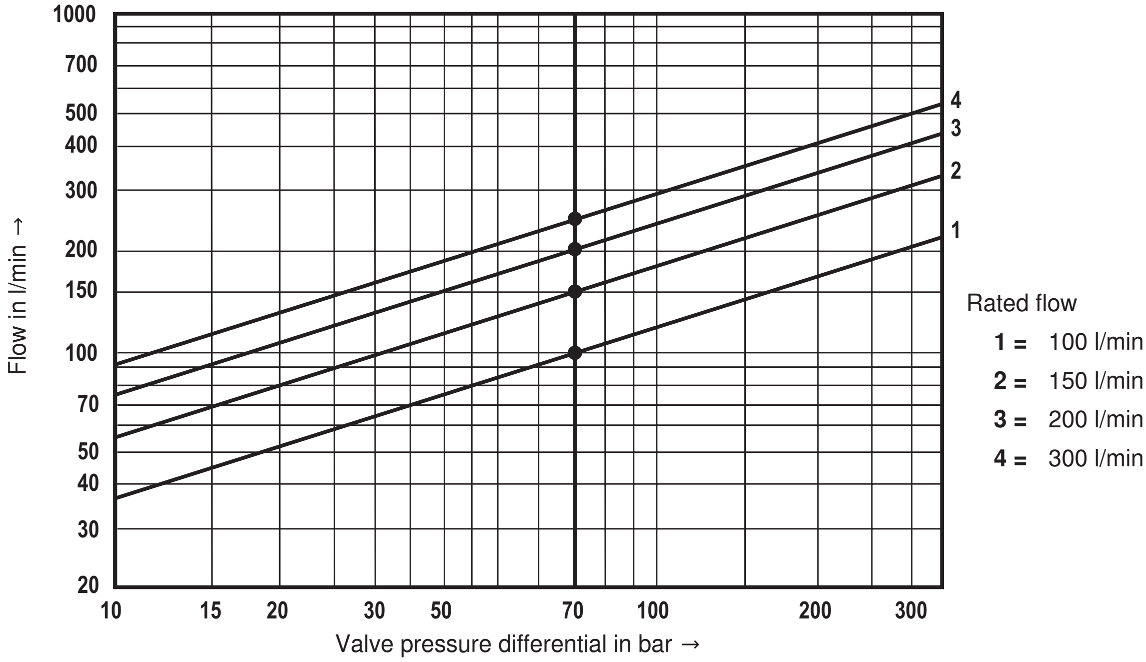
	±15 V	24 V
A	+15 V	18 V to 35 V
B	–15 V	0 V
C	⊥ M0	n.c.

1) 2)

☞ **Changes in the zero point and/or the dither amplitude may result in damage to the system and may only be implemented by instructed specialists.**

Characteristic curves (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C)

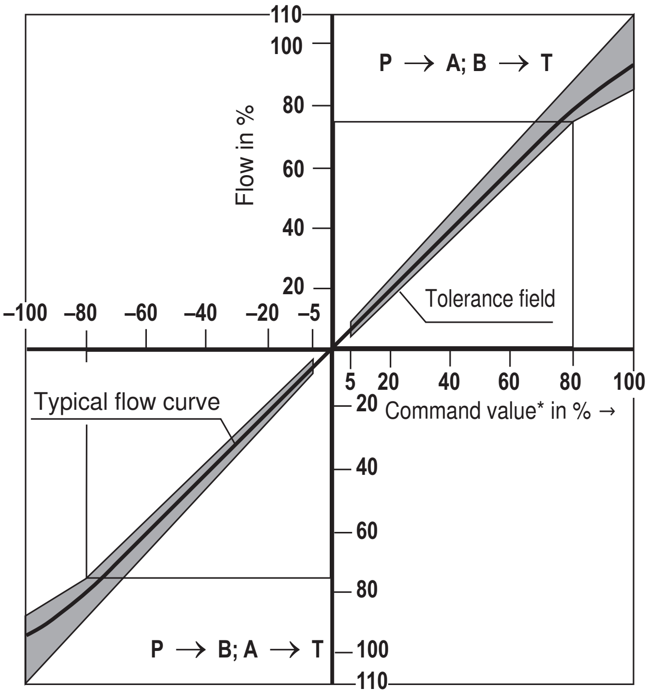
Flow/load function (tolerance ±10 %) with 100 % command value signal



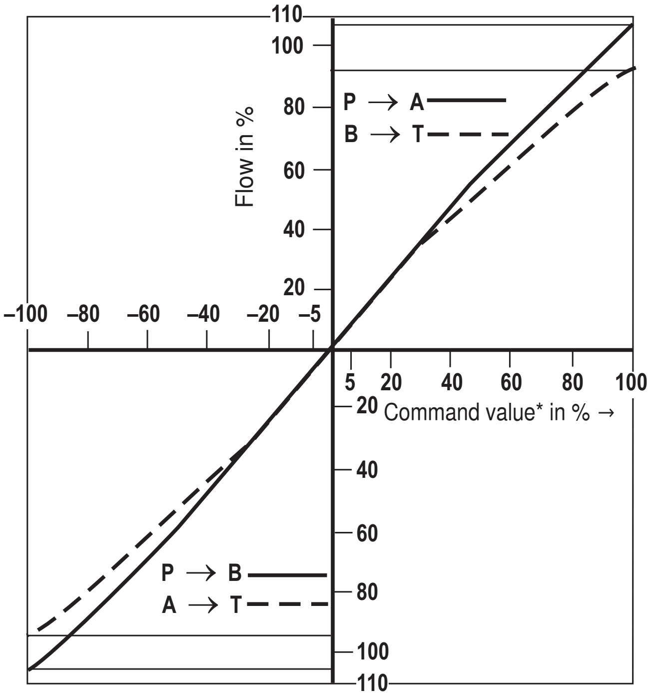
Δp = Valve pressure differential (inlet pressure $\boldsymbol{p}_P$ minus load pressure $\boldsymbol{p}_L$ minus return flow pressure $\boldsymbol{p}_T$)

Tolerance field of the flow/signal function at constant valve pressure differential

Summated edge $\boldsymbol{\Delta p}_V$ = 70 bar



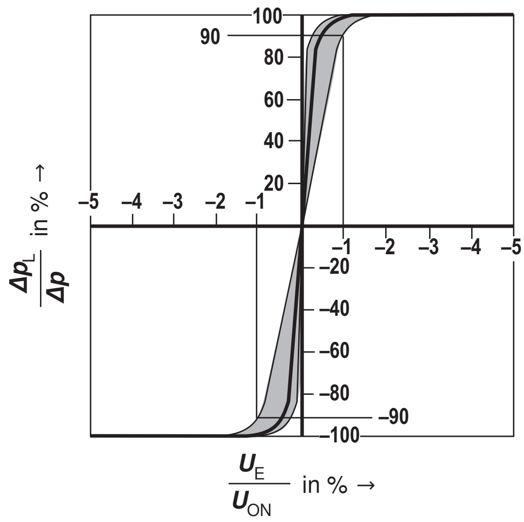
Single edge $\boldsymbol{\Delta p}_V$ = 35 bar (tolerance ±5 %)



* With interface F1, the negative command value axis corresponds to 4 to 12 mA, the positive command value axis to 12 to 20 mA

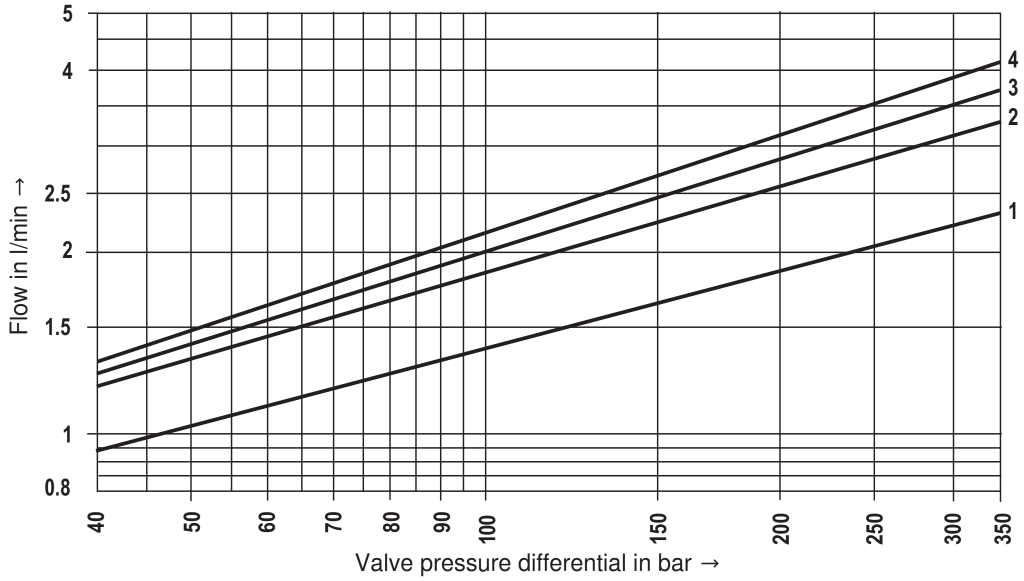
Characteristic curves (measured with HLP32, ϑ_{oil} = 40 °C ± 5 °C)

Pressure signal characteristic curve



Measured at
280 bar operating pressure

Zero flow total with "D" overlap (pilot control valve and main stage)
Tolerance ±20 %



1 = 100 l/min
2 = 150 l/min
3 = 200 l/min
4 = 300 l/min

Zero flow Data valid for overlap "E"	Pilot control valve L1	l/min	$\leq \sqrt{\frac{p_P}{70\text{ bar}}} \cdot 0.5$
	Overall valve q_V	l/min	$\leq \sqrt{\frac{p_P}{70\text{ bar}}} \cdot 0.015 \cdot q_{Vnom}$

q_{Vnom} Rated flow (overall valve) in l/min
105, 150, 200, 260

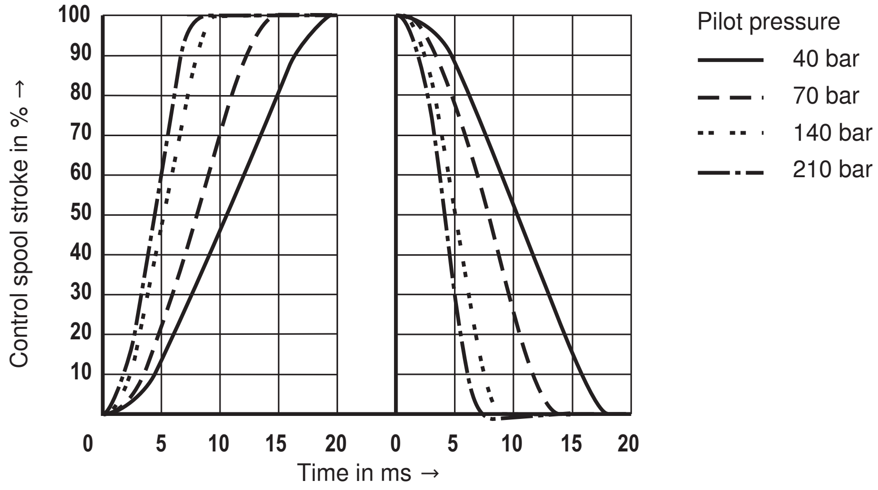
p_P Operating pressure in bar

Δp Valve pressure differential in bar

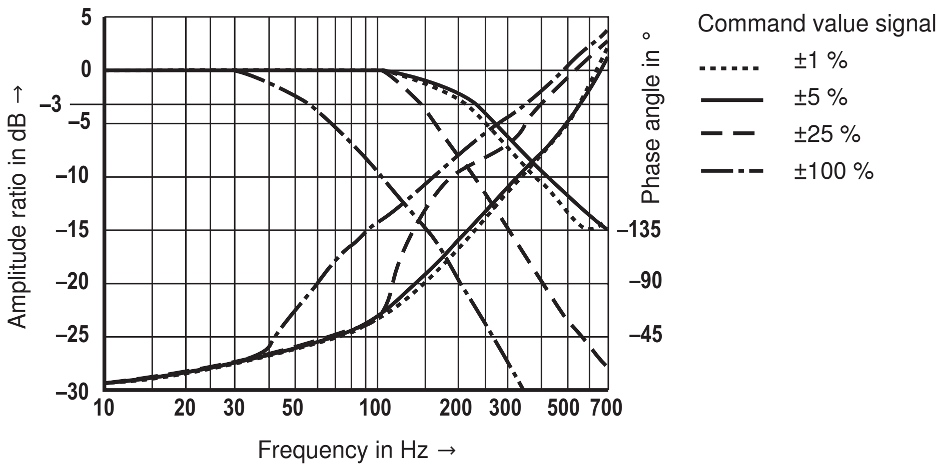
q_V 100, 150, 200, 300 l/min

Characteristic curves (measured with HLP32, $\vartheta_{\mathbf{oil}}$ = 40 °C ± 5 °C)

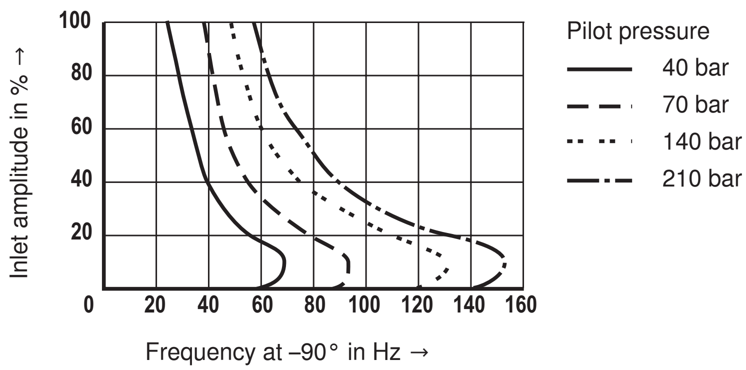
Transition function – measured with 210 bar pressure rating



Frequency response at p_P = 210 bar – measured with 210 bar pressure rating

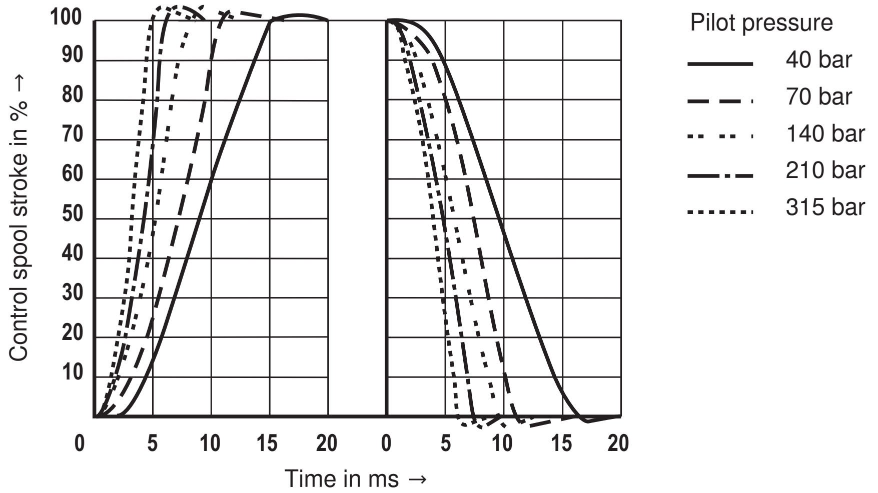


Dependence of the –90° frequency on the pilot pressure – measured with 210 bar pressure rating

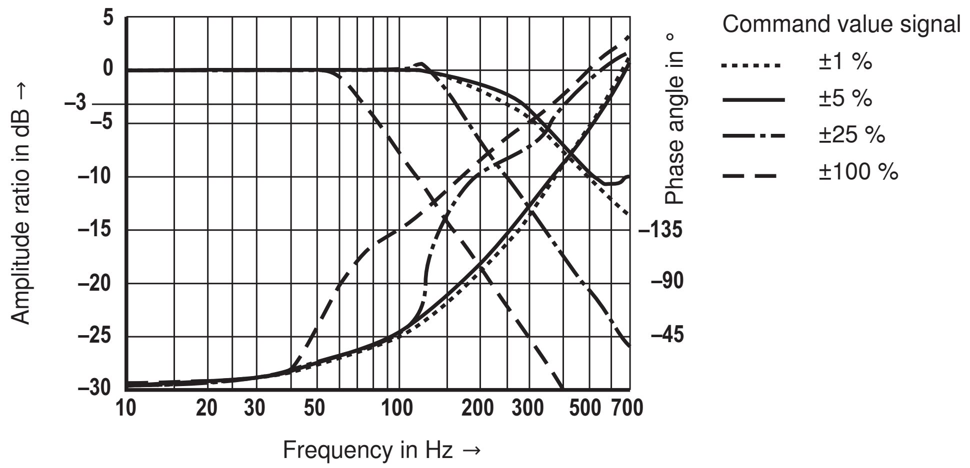


Characteristic curves (measured with HLP32, ϑ_{oil} = 40 °C ± 5 °C)

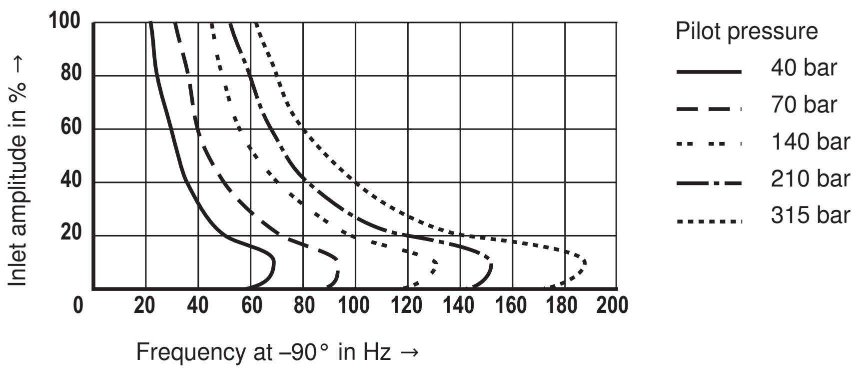
Transition function – measured with 315 bar pressure rating



Frequency response at p_P = 315 bar – measured with 315 bar pressure rating

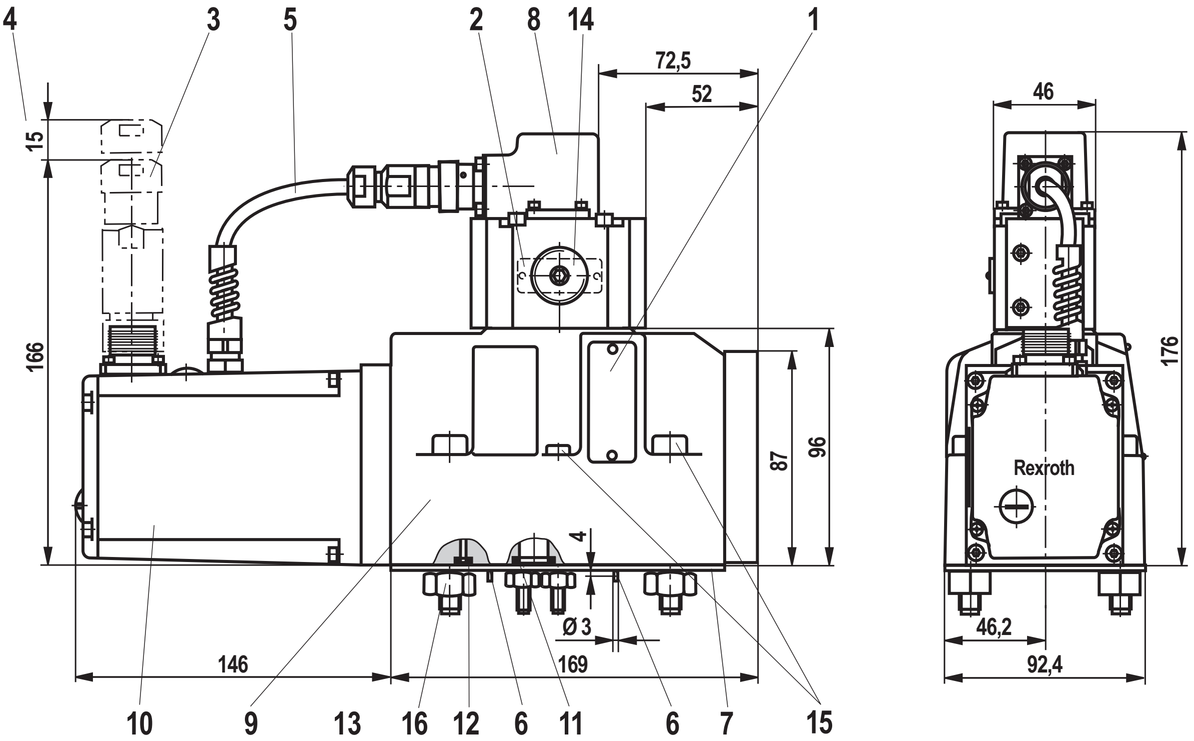


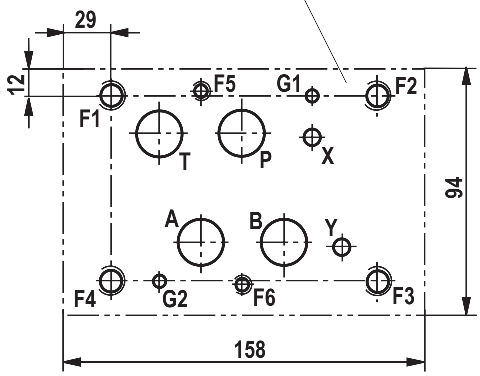
Dependence of the –90° frequency on the pilot pressure – measured with 315 bar pressure rating

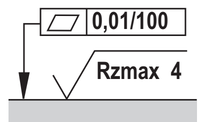


Output signal corresponds to control spool stroke without flow

Unit dimensions: Type 4WSE3E 16 (dimensions in mm)







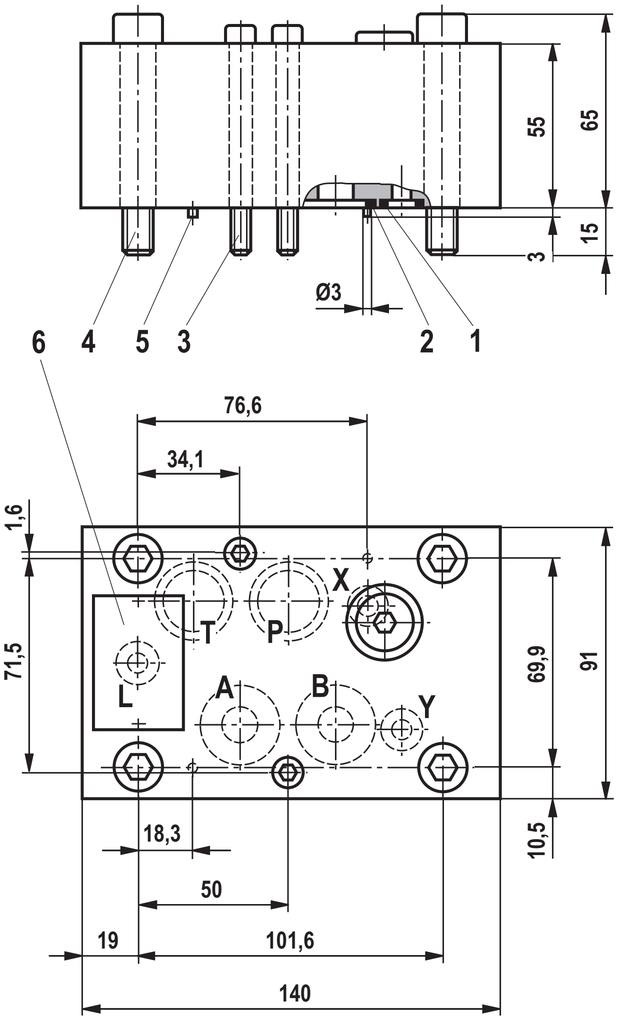
Required surface quality of the valve mounting face

1 Name plate – overall valve
2 Name plate – pilot control valve
3 Mating connector according to EN 175201-804, separate order, see page 13
4 Space required to remove the mating connector, take connection cable into account!
5 PVC cable not resistant when in contact with HFD-R fluid
6 Locating pin (2 units) G1 and G2
7 Cover plate (for transport only)
8 Pilot control valve (2-stage)
9 Main stage (3rd stage)
10 Integrated control electronics
11 Identical seal rings for ports A, B, P, and T
12 Identical seal rings for ports X and Y
The ports X and Y are also pressurized in the case of "internal" pilot oil supply
13 Machined valve mounting face, porting pattern according to ISO 4401-07-07-0-05
14 Exchangeable filter element with seal, material no. **R961001949**
15 Valve mounting screws
16 Hexagon nuts (for transport only)

Hexagon socket head cap screws (included in the delivery)		**Material number**
Size 16	2x ISO 4762 - M6 x 60 - 10.9-flZn-240h-L Tightening torque M_A = 12.5 Nm ±10 %	R913000115
	4x ISO 4762 - M10 x 60 - 10.9-flZn-240h-L Tightening torque M_A = 58 Nm ±10 %	R913000116

Notice: The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure!

Flushing plate with porting pattern according to ISO 4401-07-07-0-05 (dimensions in mm)



1 R-ring 10 x 2 x 2 (L, X, Y) included in scope of delivery

2 R-ring 22.53 x 2.30 x 2.62 (P, T, A, B) included in scope of delivery

3 2 hexagon socket head cap screws (included in the scope of delivery)
ISO4762-M6x70-10.9flZn-240h-L
(friction coefficient 0.09 to 0.14 according to VDA 235-101)
M_A = 15.5 Nm ±20 %
Material no. **R913000282**

4 4 hexagon socket head cap screws (included in the scope of delivery)
ISO4762-M10x70-10.9flZn-240h-L
(friction coefficient 0.09 to 0.14 according to VDA 235-101)
M_A = 75 Nm ±20 %
Material no. **R913000126**

5 2 locating pins 3 x 8 - A2C DIN EN 28741

6 Name plate

To ensure proper functioning of the servo-valves, it is necessary to flush the system before commissioning.

The following values are guidelines for the flushing time per system:

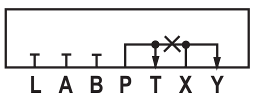
$$t \geq \frac{V}{q_V} \cdot 5$$

t = Flushing time in hours
V = Tank capacity in liters
q_V = Pump flow in liters per minute

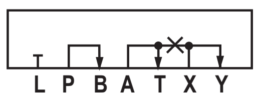
When topping up more than 10 % of the tank capacity, the flushing procedure must be repeated.

The use of a directional valve with port in accordance with ISO 4401-07-07-0-05 is better suited than a flushing plate. With this valve, you can also flush the actuator ports.

Symbols



with FKM seals,
material no. **R900904218**
Weight: 4.75 kg



with FKM seals,
material no. **R900959376**
(without fig.)
Weight: 4.5 kg

Accessories (not included in the scope of delivery)

Mating connectors		**Material number**
Mating connector for servo-valve	DIN EN 175201-804, see data sheet 08006	R900223890 (metal)

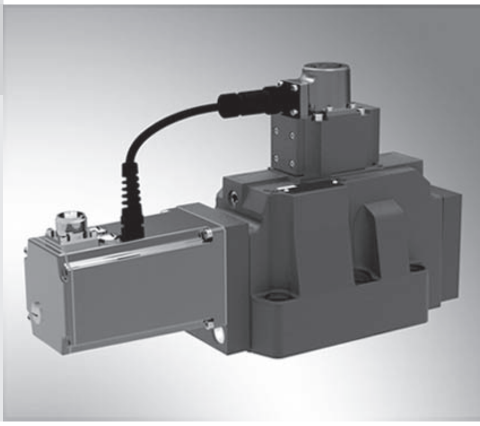
Subplates	**Data sheet**
Size 16	45056

Rexroth
Bosch Group

Directional servo-valve in 4-way version

RE 29621/03.12
Replaces: 05.09

Type 4WSE3E 25



Size 25
Component series 3X
Maximum operating pressure 350 bar
Maximum flow 1020 l/min

Table of contents

Contents	Page

Features

- Valve for position, force, pressure or velocity control
- 3-stage servo-valve with electrical position control of the control spool of the 3rd stage, position sensing of the control spool by means of an inductive position transducer
- High dynamics 2-stage pilot control valve of size 6
- 1st stage as nozzle flapper plate amplifier
- Filter for 1st stage externally accessible and replaceable
- Subplate mounting:
  Porting pattern according to ISO 4401
- Can also be used as 3-way version
- Valve and integrated control electronics are adjusted and tested in the factory
- Optimized valve control loop
- High response sensitivity, very low hysteresis and zero point drift
- Internal or external pilot oil supply and return
- Gap seals at pressure chambers of the control sleeve, no wear of O-ring

Ordering code

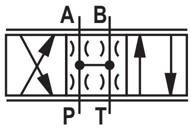
4WSE3E	25					3X /		/	K31		*

3-stage servo-valve

Size

Size 25 **= 25**

Control spool symbol 1)



= V
= V1

Control spool position in de-energized state

Not defined **= no code**
100 % P → A / B → T **= P**

Rated flow 2)

210 l/min **= 200**
300 l/min **= 300**
380 l/min **= 400**
450 l/min **= 500**

Control spool overlap 3)

0 to 0.5 % positive **= D**
0 to 0.5 % negative **= E**

Component series 30 to 39 **= 3X**
(30 to 39: Unchanged installation and connection dimensions)

Seal material 4)

FKM seals **= V**
NBR seals **= M**

Further details in the plain text

Electronics interface command/actual value

A1 = 0 to 10 V
C1 = 0 to 10 mA
F1* = 4 to 20 mA

Electrical connection

K31 = 6+PE
Without mating connector

Supply voltage

15 = ±15 V
24 = +24 V
See page 6

Pressure rating 6)

7 = 210 bar
9 = 315 bar

Pilot flow 5)

XY = Pilot oil supply external, return external
XT = Pilot oil supply external, return internal
PY = Pilot oil supply internal, return external
PT = Pilot oil supply internal, return internal

* Only with +24 V supply voltage

1) **Control spool symbols**
with control spool symbol V
P → A; $q_{V\,max}$ B → T; $q_{V\,max}$
P → B; $q_{V\,max}$ A → T; $q_{V\,max}$
with control spool symbol V1
P → A; $q_{V\,max}$ B → T; q_V / 2
P → B; q_V / 2 A → T; $q_{V\,max}$

2) **Rated flow**
The rated flow refers to a 100 % command value signal at 70 bar valve pressure differential (35 bar per control edge). The valve pressure differential must be regarded as reference. Other values result in the flow being changed. A possible rated flow tolerance of ±10 % and a saturation influence must be taken into account (see flow/signal function page 8).

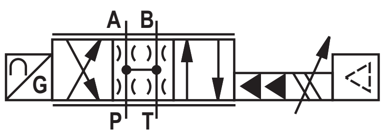
3) **Control spool overlap**
The control spool overlap in % is referred to the nominal stroke of the control spool.
(Other control spool overlaps upon request.)

4) **Seal material**
See notice on page 5

5) **Pilot oil**
Care should be taken that the pilot pressure is as constant as possible. An external pilot control via port X is thus often advantageous.

6) **Inlet pressure range**
Care should be taken that the inlet pressure is as constant as possible. Minimum pilot pressure ≥ 10 bar.
Up to a pilot pressure of 210 bar, pressure rating 7 is to be selected. From a pilot pressure greater than 210 bar, pressure rating 9 is to be selected.
With regard to the dynamics, the frequency response dependency must be observed within the admissible pressure range.
At an inlet pressure > 40 bar, the pilot pressure must not be less than 60 % of the inlet pressure as otherwise the current forces at the control spool of the 3rd stage will impair the controllability.
At an inlet pressure ≤ 40 bar, working with a pilot pressure above port X (external supply) is in any case advantageous.

Symbol



Function, section

Valves of type 4WSE3E 25 are electrically operated, 3-stage directional servo-valves. They are mainly used for position, force or pressure and velocity controls.

These valves consist of a 2-stage pilot control valve of type 4WS2EM 6 (1), a main stage with a main control spool in a sleeve (2), an inductive position transducer (3), and integrated control electronics (4).

The pilot control valve (1) consists of an electro-mechanical transformer (torque motor), a hydraulic amplifier (nozzle flapper plate principle) and a pilot control spool in a sleeve, which is connected to the torque motor via a mechanical feedback.

Electric currents in the coils of the torque motor generate a force by means of a permanent magnet which acts on the armature, and in connection with a torque tube results in a torque. This causes the flapper plate which is connected to the torque tube via a pin to move from the central position between the two control nozzles, and a pressure differential is created across the front sides of the pilot control spool. The pressure differential results in the control spool changing its position, which results in the pressure port being connected to one actuator port and, at the same time, the other actuator port being connected to the return flow port.

The pilot control spool is connected to the flapper plate or the torque motor by means of a bending spring (mechanical feedback).

The position of the control spool is changed until the flapper plate position and hence the pressure differential across the nozzle flapper plate system becomes zero due to the feedback torque, which acts via the bending spring against the electro-magnetic torque of the torque motor.

In doing so, the stroke of the pilot control spool and hence the flow of the pilot control valve is controlled proportionally to the electrical input signal (see data sheet 29564).

In the main stage, the main control spool (2) is operated by the pilot control valve and its position is sensed by an inductive position transducer (3). The position transducer signal is compared to the command value by integrated control electronics (4). Any possible control deviation is amplified electrically and fed to the pilot control valve as control signal. The pilot control valve starts to move and the main control spool is re-positioned.

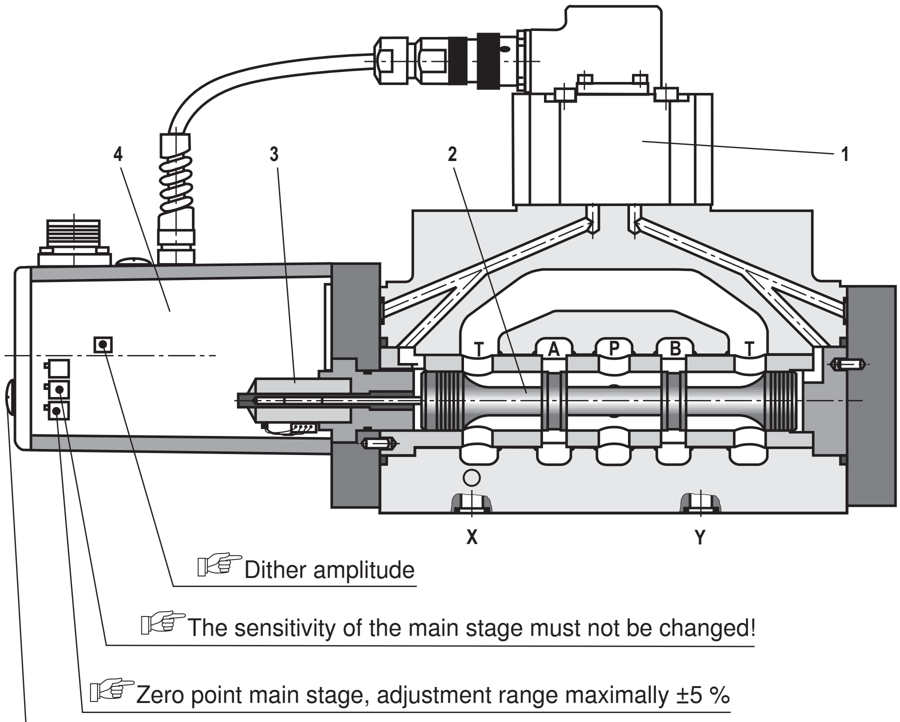
The stroke of the main control spool and consequently the flow of the servo-valve are controlled in proportion to the command value. It must be noted that the flow depends on the valve pressure differential.

The valve zero point can be adjusted by means of an externally accessible potentiometer.

The valves are factory-set with a dither default setting with the constant frequency of 400 Hz.

☞ **Notice!**

Changes in the zero point and/or the dither amplitude may result in damage to the system and may only be implemented by instructed specialists.



The pilot control valve may only be maintained by Bosch Rexroth employees. An exception to this is the replacement of the filter element – see data sheet 29564.

Technical data (For applications outside these parameters, please consult us!)

general

Weight	kg	16
Installation position		Any, if it is ensured that the pilot control is supplied with sufficient pressure (> 10 bar) during start-up of the system. In case of insufficient pressure supply, the control spool of the servo-valve can take any position. This may result in channel P being connected to the actuator and the build-up of pressure being delayed. This may be prevented by providing an external pressure supply at port X.
Storage temperature range	°C	–20 to +80
Ambient temperature range	°C	–20 to +60

hydraulic (measured with HLP 32, ϑ_{Oil} = 40 °C ± 5 °C)

Maximum operating pressure	Pilot control stage, pilot oil supply X		bar	10 to 210 and/or 10 to 315 (see page 2, pressure rating)
	Main valve, port P, A, B	Pilot oil supply internal	bar	315
	Main valve, port P, A, B	Pilot oil supply external	bar	350
Maximum return flow pressure	Pilot control stage, port Y		bar	Pressure peaks < 100 admissible, static < 10
	Main valve, port T	Pilot oil return internal	bar	Pressure peaks < 100 admissible, static < 10
		Pilot oil return external	bar	250
Leakage flow				See page 9 (characteristic curves)
Rated flow q_{Vnom} ±10 % with Δp = 70 bar			l/min	210, 300, 380, 450
Hydraulic fluid				See table page 5
Hydraulic fluid temperature range			°C	–20 to +80; preferably +40 to +50
Viscosity range			mm^2/s	15 to 380; preferably 30 to 45
Maximum admissible degree of contamination of the hydraulic fluid cleanliness class according to ISO 4406 (c)			Pilot control valve	Class 18/16/13 [1]
			Main stage	Class 20/18/15 [1]
Hysteresis			%	≤ 0.10
Range of inversion			%	≤ 0.05
Response sensitivity			%	≤ 0.05
Pressure gain				≥ 90 % of p_P [2] with 1 % change in the control spool stroke (from hydraulic zero point)
Zero shift upon change of:	Hydraulic fluid temperature		% / 10 K	≤ 0.3
	Ambient temperature		% / 10 K	≤ 0.3
	Operating pressure		% / 100 bar	≤ 0.3
	Return flow pressure 0 to 10 % of p_P		% / 100 bar	≤ 0.3

[1] The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the service life of the components.

[2] p_P = Inlet pressure/operating pressure

☞ **Notice!**
For information on the **environment simulation testing** for the areas EMC (electromagnetic compatibility), climate and mechanical load, see data sheet 29620-U.

Technical data (For applications outside these parameters, please consult us!)

Hydraulic fluid	Classification	Suitable sealing materials	Standards
Mineral oils and related hydrocarbons	HL, HLP	NBR, FKM	DIN 51524
Flame-resistant – containing water	HFC Fuchs Hydrotherm 46M Petrofer Ultra Safe 620	NBR	ISO 12922

☞ **Important information on hydraulic fluids!**

– For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!

– There may be limitations regarding the technical valve data (temperature, pressure range, service life, maintenance intervals, etc.)!

– **Flame-resistant – containing water**:
Maximum pressure differential per control edge 210 bar, otherwise, increased cavitation erosion!
Tank pre-loading < 1 bar or > 20 % of the pressure differential of the tank edge. The pressure peaks should not exceed the maximum operating pressures!
Maximum fluid temperature 60 °C

Technical data (For applications outside these parameters, please consult us!)

electric

Protection class according to EN 60529	IP 65 with mating connector mounted and locked
Type of signal	Analog

Electronics interface		A1	C1	F1
	Pin			
Current consumption at the mating connector	A	< ±150 mA with ±15 V < 200 mA with 24 V		< 200 mA with 24 V
	B			
	D	0 to ±0.05 mA	0 to ±10 mA	4 to 20 mA
	E			

Device connector allocation	Pin	Supply voltage 15		Supply voltage 24		
Interface		A1	C1	A1	C1	F1
Supply voltage	A	+15 VDC		+24 VDC		
	B	–15 VDC		0 VDC		
M0	C	0 VDC / reference to pins A, B		Not used		
Differential command value input	D	0 to ±10 V	0 to ±10 mA	0 to ±10 V	0 to ±10 mA	4 to 20 mA
	E	R_e >100 kΩ	R_e = 100 Ω	R_e >100 kΩ	R_e = 100 Ω	R_e = 100 Ω
Actual value Reference with +24 V is pin B Reference with ±15 V is pin C	F	0 to ±10 V R_i ≈ 1 kΩ	0 to ±10 mA Load max. 1 kΩ	0 to ±10 V R_i ≈ 1 kΩ	0 to ±10 mA Load max. 1 kΩ	4 to 20 mA Load max. 500 Ω
Protective earth	PE	Connected to valve housing				

☞ **One end of the shield must be connected to the control!**

Supply voltage: ±15 V ±3 %, residual ripple < 1 %
+24 VDC / 18 V to 35 V; full bridge rectification with smoothing capacitor
2200 µF = I_{max} = 230 mA

Command value: **A1, C1:**
Reference potential at E and positive command value at D result in flow from P → A and B → T.
Reference potential at E and negative command value at D result in flow from P → B and A → T.
F1:
Reference potential at E and signal 12 to 20 mA at D result in flow from P → A and B → T.
Reference potential at E and signal 12 to 4 mA at D result in flow from P → B and A → T.

Actual value / measuring output: The voltage / current signal is proportional to the control spool stroke and has the same sign as the command value.

Connection cable: Recommendation: – up to 25 m line length: Type LiYCY 7 x 0.75 mm²
– up to 50 m line length: Type LiYCY 7 x 1.0 mm²
Only connect the shield to ⊥ on the supply side.

Notice: **Electric signals taken out via valve electronics (e.g. actual value) must not be used for switching off safety-relevant machine functions!**

Block diagram of the integrated electronics (OBE)

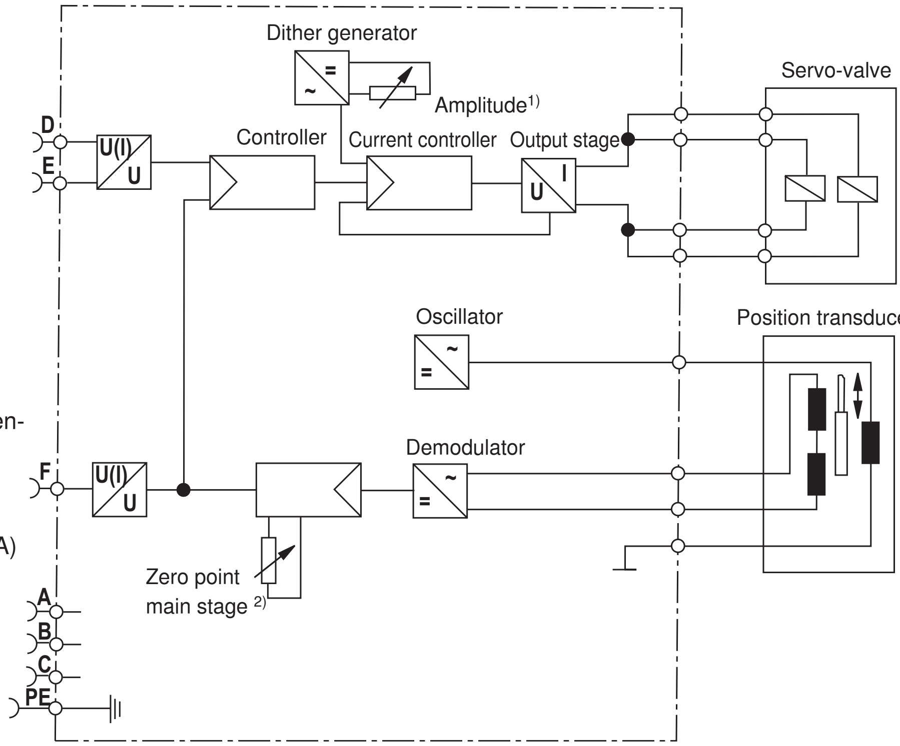
Interface | Integrated electronics (OBE) | Valve

Differential command value input
±10 V or ±10 mA or 4 to 20 mA

Actual value ±10 V /±10 mA
(measuring output F has positive potential against ⊥ with flow P → A)
Actual value 4 to 20 mA
(measuring output F is larger than 12 mA against ⊥ with flow P → A)

Supply voltage

	±15 V	24 V
A	+15 V	18 V to 35 V
B	–15 V	0 V
C	⊥ M0	n.c.

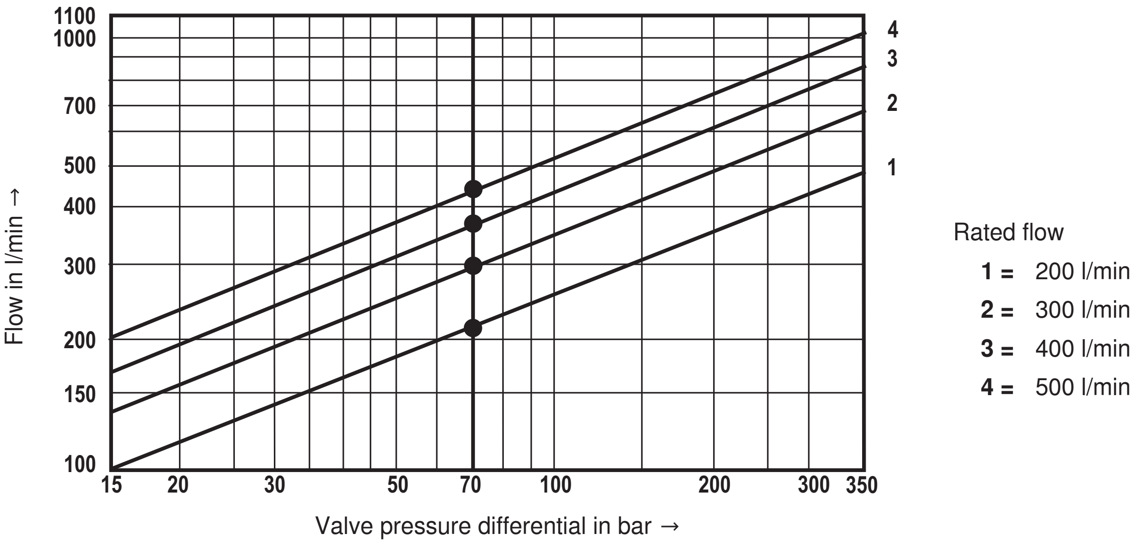


1) 2)

☞ **Changes in the zero point and/or the dither amplitude may result in damage to the system and may only be implemented by instructed specialists.**

Characteristic curves (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C)

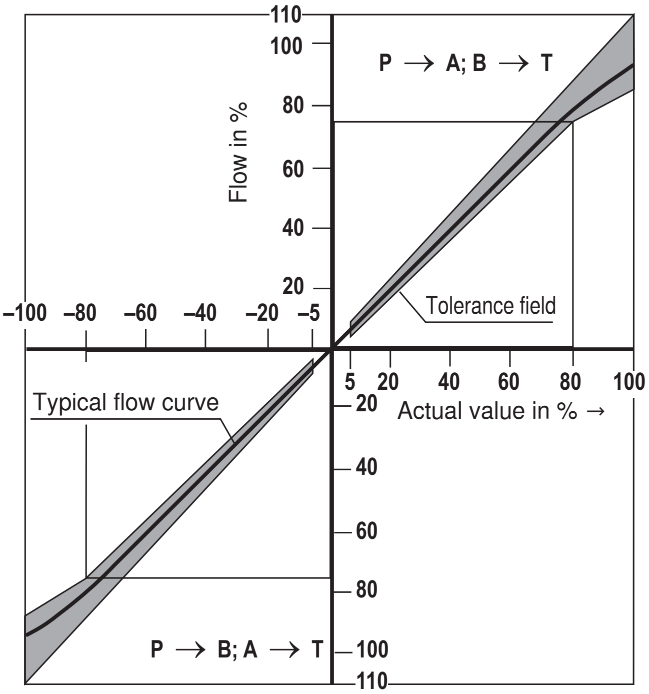
Flow/load function (tolerance ±10 %) with 100 % command value signal



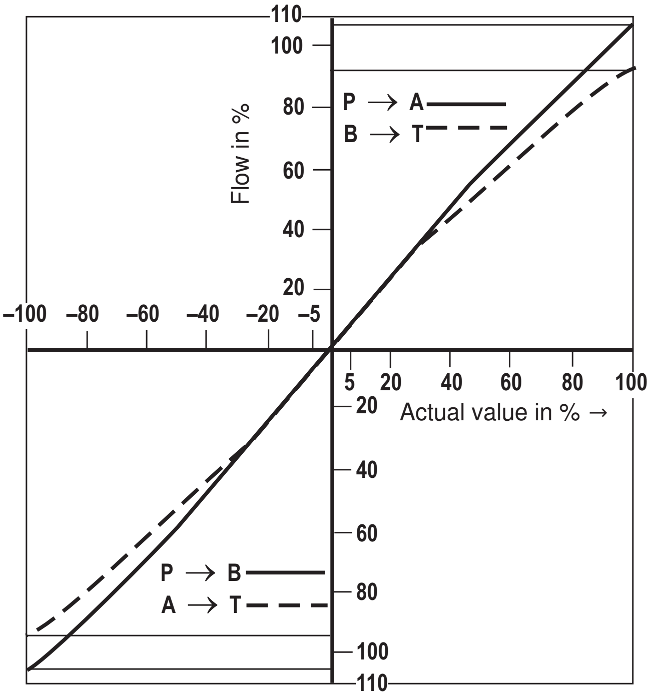
Δp = Valve pressure differential (inlet pressure p_P minus load pressure p_L minus return flow pressure p_T)

Tolerance field of the flow/signal function at constant valve pressure differential

Summated edge Δp_V = 70 bar



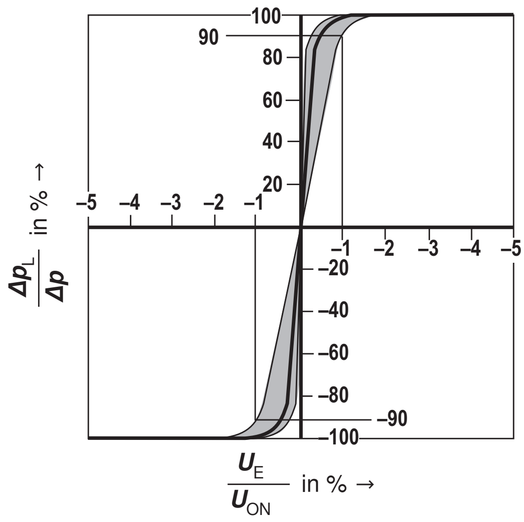
Single edge Δp_V = 35 bar (tolerance ±5 %)



* With interface F1, the negative command value axis corresponds to 4 to 12 mA, the positive command value axis to 12 to 20 mA

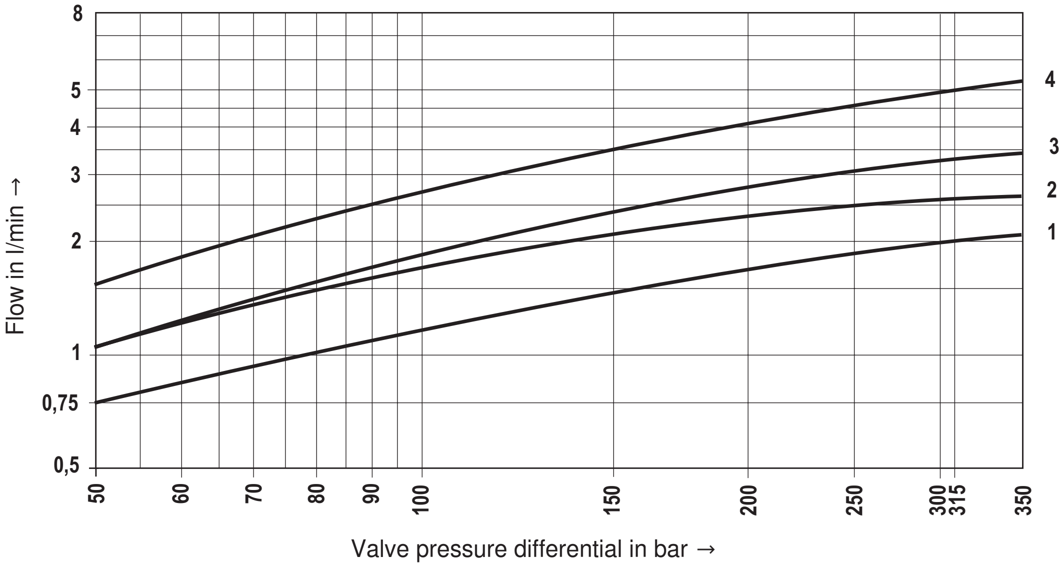
Characteristic curves (measured with HLP32, ϑ_{oil} = 40 °C ± 5 °C)

Pressure signal characteristic curve



Measured at
280 bar operating pressure

Zero flow total with "D" overlap (pilot control valve and main stage)
Tolerance ±20 %



1 = 200 l/min
2 = 300 l/min
3 = 400 l/min
4 = 500 l/min

Zero flow Data valid for overlap "E"	Pilot control valve L1	l/min	$\leq \sqrt{\frac{p_P}{70 \text{ bar}}} \cdot 0.55$
	Overall valve q_V	l/min	$\leq \sqrt{\frac{p_p}{70 \text{ bar}}} \cdot 0.015 \cdot q_{Vnom}$

q_{Vnom} Rated flow (overall valve) in l/min
210, 300, 380, 450

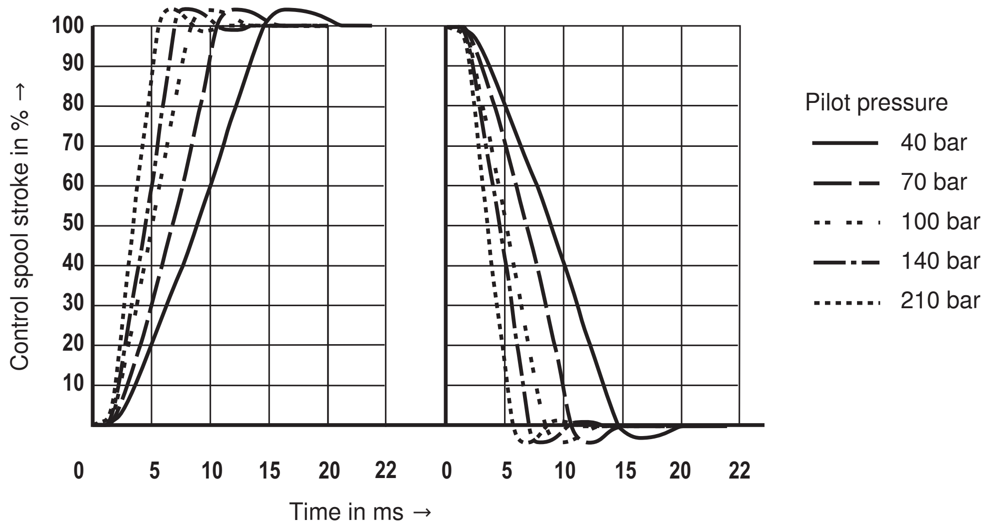
p_P Operating pressure in bar

Δp Valve pressure differential in bar

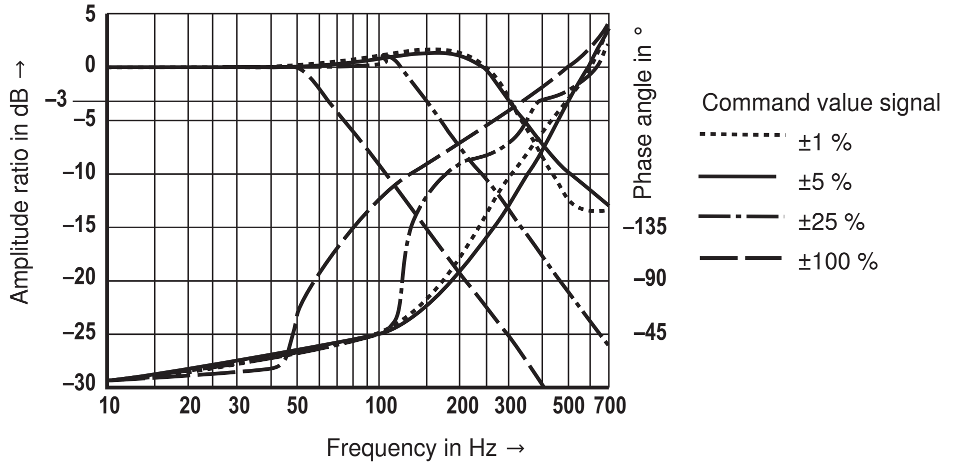
q_V 200, 300, 400, 500 l/min

Characteristic curves (measured with HLP32, ϑ_{oil} = 40 °C ± 5 °C)

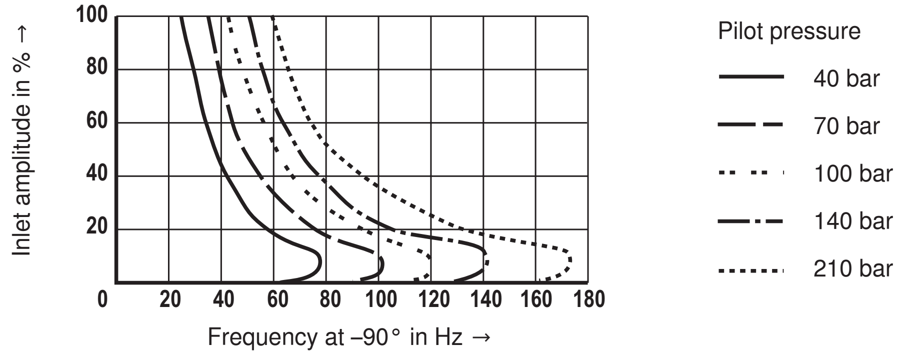
Transition function – measured with 210 bar pressure rating



Frequency response at p_P = 210 bar – measured with 210 bar pressure rating

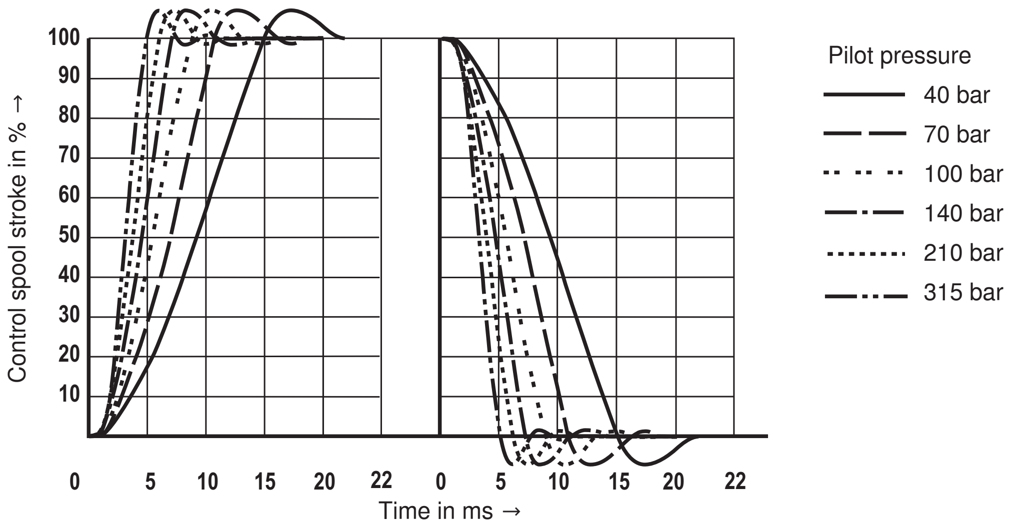


Dependence of the –90° frequency on the pilot pressure – measured with 210 bar pressure rating

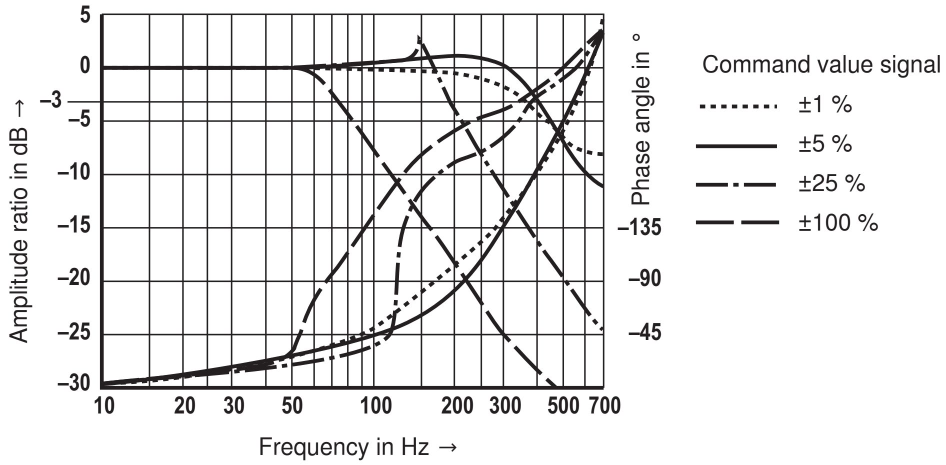


Characteristic curves (measured with HLP32, ϑ_{oil} = 40 °C ± 5 °C)

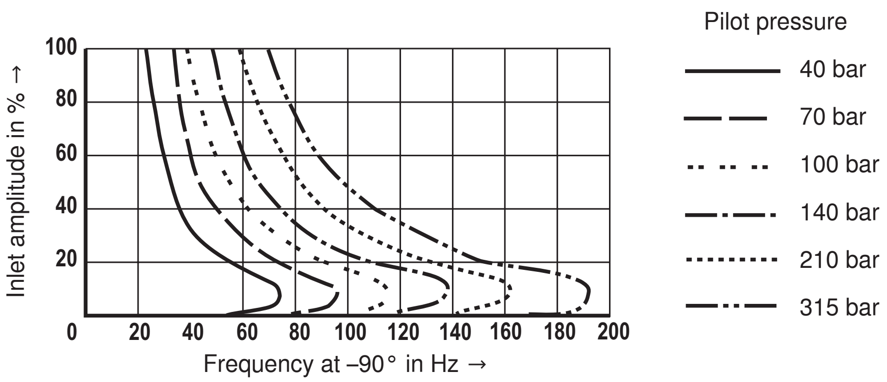
Transition function – measured with 315 bar pressure rating



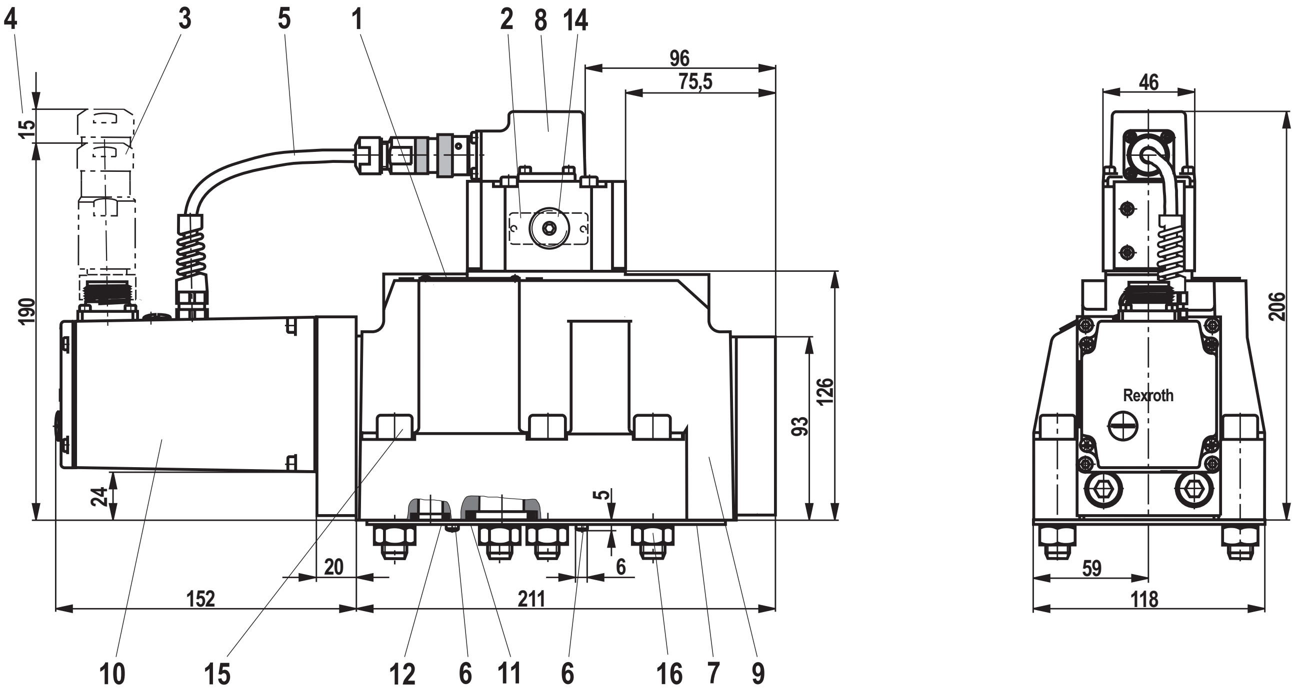
Frequency response at p_P = 315 bar – measured with 315 bar pressure rating

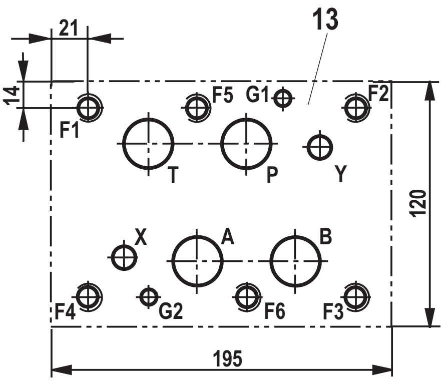


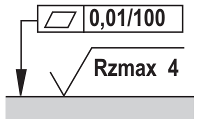
Dependence of the –90° frequency on the pilot pressure – measured with 315 bar pressure rating



Unit dimensions: Type 4WSE3E 25 (dimensions in mm)







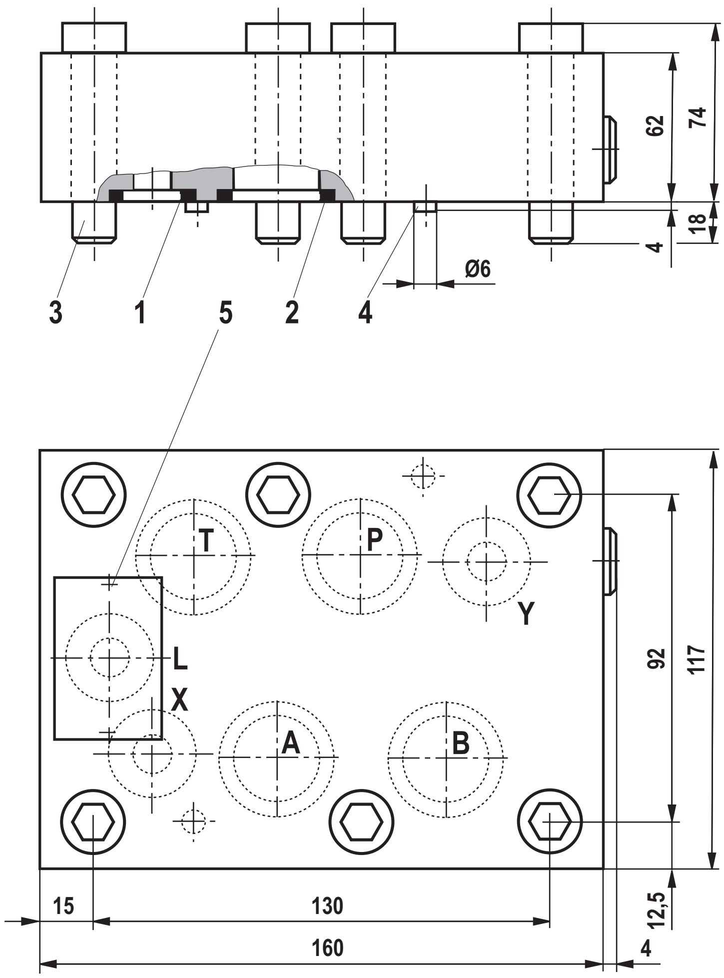
Required surface quality of the valve mounting face

1. Name plate – overall valve
2. Name plate – pilot control valve
3. Mating connector according to EN 175201-804, separate order, see page 13
4. Space required to remove the mating connector, take connection cable into account!
5. PVC cable not resistant when in contact with HFD-R fluid
6. Locating pin (2 units) G1 and G2
7. Cover plate (for transport only)
8. Pilot control valve (2-stage)
9. Main stage (3rd stage)
10. Integrated control electronics
11. Identical seal rings for ports A, B, P, and T
12. Identical seal rings for ports X and Y
    The ports X and Y are also pressurized in the case of "internal" pilot oil supply
13. Machined valve mounting face, porting pattern according to ISO 4401-08-08-0-05
14. Exchangeable filter element with seal, material no. **R961000194**
15. Valve mounting screws
16. Hexagon nuts (for transport only)

Hexagon socket head cap screws (included in the scope of delivery)		**Material number**
Size 25	6x ISO 4762 - M12 x 60 - 10.9-flZn-240h-L Tightening torque M_A = 100 Nm ±10 %	R913000121

Notice: The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure!

Flushing plate with porting pattern according to ISO 4401-08-08-0-05 (dimensions in mm)



1 R-ring 19x3x3 (X, Y) included in scope of delivery

2 R-ring 27.8x2.6x3 (P, T, A, B) included in scope of delivery

3 6 hexagon socket head cap screws (included in scope of delivery)
ISO4762-M12x80-10.9
(friction coefficient 0.09 to 0.14 according to VDA 235-101)
M_A = 100 Nm
Material no. **R913000413**

4 2 locating pins ISO8741 - 6X12-ST

5 Name plate

To ensure proper functioning of the servo-valves, it is necessary to flush the system before commissioning.

The following values are guidelines for the flushing time per system:

$$t \geq \frac{V}{q_V} \cdot 5$$

t = Flushing time in hours

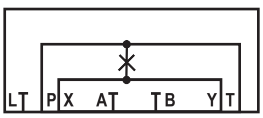
V = Tank capacity in liters

q_V = Pump flow in liters per minute

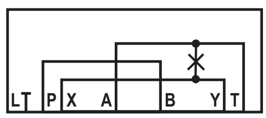
When topping up more than 10 % of the tank capacity, the flushing procedure must be repeated.

The use of a directional valve with port in accordance with ISO 4401-08-08-0-05 is better suited than a flushing plate. With this valve, you can also flush the actuator ports.

Symbols



with FKM seals,
Material no. **R900959384**
Weight: 8.4 kg



with FKM seals,
Material no. **R900959377**
(without fig.)
Weight: 8.4 kg

Accessories (not included in the scope of delivery)

Mating connectors		Material number
Mating connector for servo-valve	DIN EN 175201-804, see data sheet 08006	R900223890 (metal)

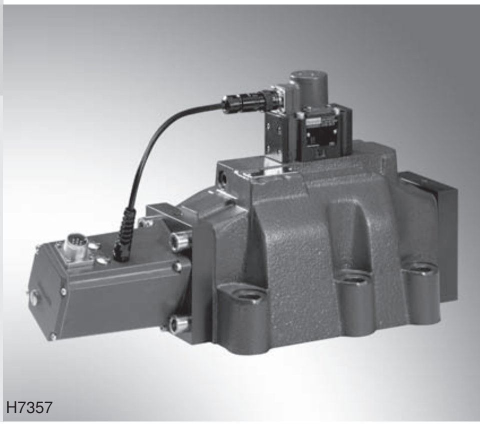
Subplates	Data sheet
Size 25	45058

Directional servo-valve in 4-way version

RE 29622/03.12
Replaces: 05.09

Type 4WSE3E 32

Size 32
Component series 5X
Maximum operating pressure 315 bar
Maximum flow 1800 l/min



H7357

Table of contents

Contents	**Page**

Features

- Valve for position, force, pressure or velocity control
- 3-stage servo-valve with electrical position control of the control spool of the 3rd stage, position sensing of the control spool by means of an inductive position transducer
- High dynamics 2-stage pilot control valve of size 6
- 1st stage as nozzle flapper plate amplifier
- Filter for 1st stage externally accessible and replaceable
- Subplate mounting:
  Porting pattern according to ISO 4401
- Can also be used as 3-way version
- Valve and integrated control electronics are adjusted and tested in the factory
- Optimized valve control loop
- High response sensitivity, very low hysteresis and zero point drift
- Internal or external pilot oil supply and return
- Gap seals at pressure chambers of the control sleeve, no O-ring wear

Ordering code

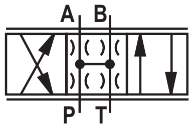
4WSE3E	32					5X/		/	K31		*

3-stage servo-valve

Size

Size 32 **= 32**

Control spool symbol 1)



= V
= V1

Control spool position in de-energized state

Not defined **= no code**
100 % P → A / B → T **= P**

Rated flow 2)

500 l/min **= 500**
670 l/min **= 700**
890 l/min **= 1000**

Control spool overlap 3)

0 to 0.5 % positive **= D**
0 to 0.5 % negative **= E**

Component series 50 to 59 **= 5X**
(50 to 59: Unchanged installation and connection dimensions)

Seal material 4)

FKM seals **= V**
NBR seals **= M**

Further details in the plain text

Electronics interface command/actual value

A1 = 0 to 10 V
C1 = 0 to 10 mA
F**1* =** 4 to 20 mA

Electrical connection

K31 = 6+PE
Without mating connector

Supply voltage

15 = ±15 V
24 = +24 V
See page 6

Pressure rating 6)

7 = 210 bar
9 = 315 bar

Pilot flow 5)

XY = Pilot oil supply external, return external
XT = Pilot oil supply external, return internal
PY = Pilot oil supply internal, return external
PT = Pilot oil supply internal, return internal

* Only with +24 V supply voltage

1) **Control spool symbols**
with control spool symbol V
P → A; $q_{V\,max}$ B → T; $q_{V\,max}$
P → B; $q_{V\,max}$ A → T; $q_{V\,max}$
with control spool symbol V1
P → A; $q_{V\,max}$ B → T; q_V / 2
P → B; q_V / 2 A → T; $q_{V\,max}$

2) **Rated flow**
The rated flow refers to a 100 % command value signal at 70 bar valve pressure differential (35 bar per control edge). The valve pressure differential must be regarded as reference. Other values result in the flow being changed. A possible rated flow tolerance of ±10 % and saturation influence must be taken into account (see flow/signal function page 8).

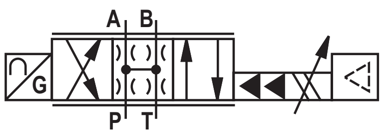
3) **Control spool overlap**
The control spool overlap in % is referred to the nominal stroke of the control spool.
(Other control spool overlaps upon request.)

4) **Seal material**
See notices on page 5

5) **Pilot oil**
Care should be taken that the pilot pressure is as constant as possible. An external pilot control via port X is thus often advantageous.

6) **Inlet pressure range**
Care should be taken that the inlet pressure is as constant as possible. Minimum control pressure ≥ 10 bar.
Up to a pilot pressure of 210 bar, pressure rating 7 is to be selected. From a pilot pressure greater than 210 bar, pressure rating 9 is to be selected.
With regard to the dynamics, the frequency response dependency must be observed within the admissible pressure range.
At an inlet pressure > 40 bar, the pilot pressure must not be less than 60 % of the inlet pressure as otherwise the current forces at the control spool of the 3rd stage will impair the controllability.
At an inlet pressure ≤ 40 bar, working with a pilot pressure above port X (external supply) is in any case advantageous.

Symbol



a, b

Function, section

Valves of type 4WSE3E 32 are electrically operated, 3-stage directional servo-valves. They are mainly used for position, force or pressure and velocity controls.

These valves consist of a 2-stage pilot control valve of type 4WS2EM 6 (1), a main stage with a main control spool in a sleeve (2), an inductive position transducer (3), and integrated control electronics (4).

The pilot control valve (1) consists of an electro-mechanical converter (torque motor), a hydraulic amplifier (nozzle flapper plate principle) and a pilot control spool in a sleeve, which is connected to the torque motor via a mechanical feedback.

Electric currents in the coils of the torque motor generate a force by means of a permanent magnet which acts on the armature, and in connection with a torque tube results in a torque. This causes the flapper plate which is connected to the torque tube via a pin to move from the central position between the two control nozzles, and a pressure differential is created across the front sides of the pilot control spool. The pressure differential results in the control spool changing its position, which results in the pressure port being connected to one actuator port and, at the same time, the other actuator port being connected to the return flow port.

The pilot control spool is connected to the flapper plate or the torque motor by means of a bending spring (mechanical feedback).

The position of the control spool is changed until the flapper plate position and hence the pressure differential across the nozzle flapper plate system becomes zero due to the feedback torque, which acts via the bending spring against the electro-magnetic torque of the torque motor.

In doing so, the stroke of the pilot control spool and hence the flow of the pilot control valve is controlled proportionally to the electrical input signal (see data sheet 29564).

In the main stage, the main control spool (2) is operated by the pilot control valve and its position is sensed by an inductive position transducer (3). The position transducer signal is compared to the command value by integrated control electronics (4). Any possible control deviation is amplified electrically and fed to the pilot control valve as control signal. The pilot control valve starts to move and the main control spool is re-positioned.

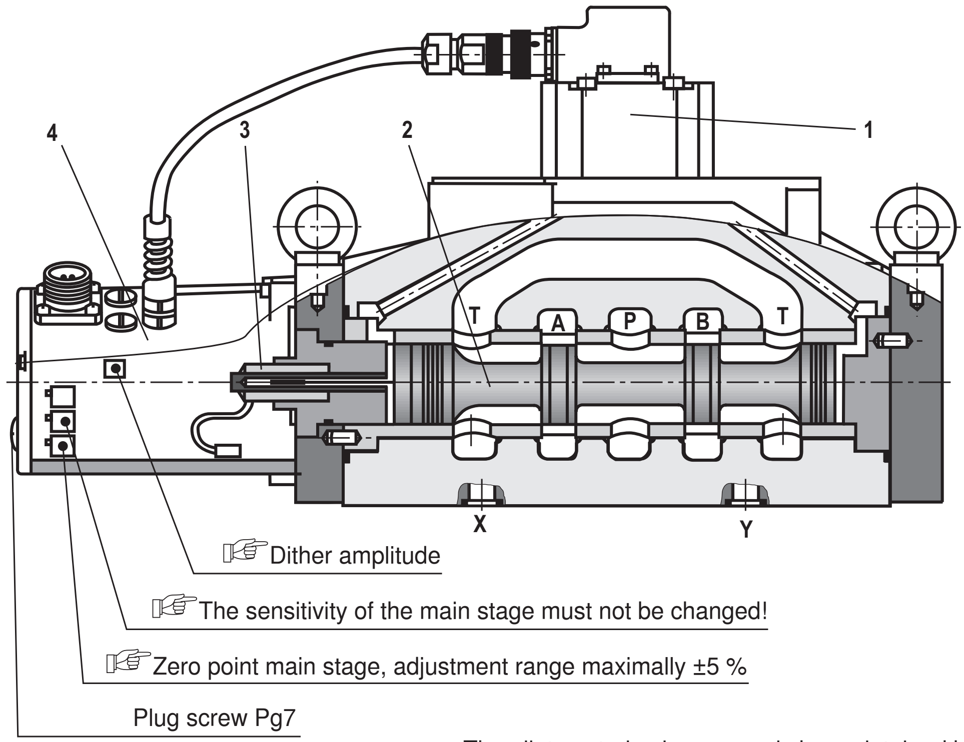
The stroke of the main control spool and consequently the flow of the servo-valve are controlled in proportion to the command value. It must be noted that the flow depends on the valve pressure differential.

The valve zero point can be adjusted by means of an externally accessible potentiometer.

The valves are factory-set with a dither default setting with the constant frequency of 400 Hz.

☞ **Notice!**

Changes in the zero point and/or the dither amplitude may result in damage to the system and may only be implemented by instructed specialists.



The pilot control valve may only be maintained by Bosch Rexroth employees. An exception to this is the replacement of the filter element – see data sheet 29564.

Technical data (For applications outside these parameters, please consult us!)

general

Weight	kg	35
Installation position		Any, if it is ensured that the pilot control is supplied with sufficient pressure (> 10 bar) during start-up of the system. In case of insufficient pressure supply, the control spool of the servo-valve can take any position. This may result in channel P being connected to the actuator and the build-up of pressure being delayed. This may be prevented by providing an external pressure supply at port X.
Storage temperature range	°C	–20 to +80
Ambient temperature range	°C	–20 to +60

hydraulic (measured with HLP 32, ϑ_{Oil} = 40 °C ± 5 °C)

Maximum operating pressure	Pilot control stage, pilot oil supply X		bar	10 to 210 or 10 to 315 (see page 2, pressure rating)
	Main valve, port P, A, B	Pilot oil supply internal	bar	315
	Main valve, port P, A, B	Pilot oil supply external	bar	315
Maximum return flow pressure	Pilot control stage, port Y		bar	Pressure peaks < 100 admissible, static < 10
	Main valve, port T	Pilot oil return internal	bar	Pressure peaks < 100 admissible, static < 10
		Pilot oil return external	bar	250
Zero flow				See page 9 (characteristic curves)
Rated flow q_{Vnom} ±10 % at Δp = 70 bar			l/min	500, 670, 890
Hydraulic fluid				See table page 5
Hydraulic fluid temperature range			°C	–20 to +80; preferably +40 to +50
Viscosity range			mm^2/s	15 to 380; preferably 30 to 45
Maximum admissible degree of contamination of the hydraulic fluid cleanliness class according to ISO 4406 (c)			Pilot control valve	Class 18/16/13 [1]
			Main stage	Class 20/18/15 [1]
Hysteresis			%	≤ 0.10
Range of inversion			%	≤ 0.05
Response sensitivity			%	≤ 0.05
Pressure gain				≥ 90 % of p_P [2] with 1 % change in control spool stroke (from hydraulic zero point)
Zero shift upon change of:	Hydraulic fluid temperature		% / 10 K	≤ 0.3
	Ambient temperature		% / 10 K	≤ 0.3
	Operating pressure		% / 100 bar	≤ 0.3
	Return flow pressure 0 to 10 % of p_P		% / 100 bar	≤ 0.3

[1] The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the service life of the components.

[2] p_P = Inlet pressure/operating pressure

☞ **Notice!**
For information on the **environment simulation testing** for the areas EMC (electromagnetic compatibility), climate and mechanical load, see data sheet 29620-U.

Technical data (For applications outside these parameters, please consult us!)

Hydraulic fluid	Classification	Suitable sealing materials	Standards
Mineral oils and related hydrocarbons	HL, HLP	NBR, FKM	DIN 51524
Flame-resistant – containing water	HFC Fuchs Hydrotherm 46M Petrofer Ultra Safe 620	NBR	ISO 12922

☞ **Important information on hydraulic fluids!**

- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, service life, maintenance intervals, etc.)!
- **Flame-resistant – containing water**:
  Maximum pressure differential per control edge 210 bar, otherwise, increased cavitation erosion!
  Tank pre-loading < 1 bar or > 20 % of the pressure differential of the tank edge. The pressure peaks should not exceed the maximum operating pressures!
  Maximum fluid temperature 60 °C

Technical data (For applications outside these parameters, please consult us!)

electric

Protection class according to EN 60529	IP 65 with mating connector mounted and locked
Type of signal	Analog

Electronics interface		**A1**	**C1**	**F1**
	Pin			
Current consumption at the mating connector	A	< ±150 mA at ±15 V < 200 mA at 24 V		< 200 mA at 24 V
	B			
	D	0 to ±0.05 mA	0 to ±10 mA	4 to 20 mA
	E			

Device connector allocation	**Pin**	**Supply voltage 15**		**Supply voltage 24**		
Interface		A1	C1	A1	C1	F1
Supply voltage	A	+15 VDC		+24 VDC		
	B	–15 VDC		0 VDC		
M0	C	0 VDC / reference to pins A, B		Not used		
Differential command value input	D	0 to ±10 V	0 to ±10 mA	0 to ±10 V	0 to ±10 mA	4 to 20 mA
	E	R_e >100 kΩ	R_e = 100 Ω	R_e >100 kΩ	R_e = 100 Ω	R_e = 100 Ω
Actual value The reference with +24 V is pin B The reference with ±15 V is pin C	F	0 to ±10 V R_i ≈ 1 kΩ	0 to ±10 mA Load max. 1 kΩ	0 to ±10 V R_i ≈ 1 kΩ	0 to ±10 mA Load max. 1 kΩ	4 to 20 mA Load max. 500 Ω
Protective earth	PE	Connected to valve housing				

☞ **One end of the shield must be connected to the control!**

Supply voltage: ±15 V ±3 %, residual ripple < 1 %
+24 VDC / 18 V to 35 V; full bridge rectification with smoothing capacitor
2200 µF = I_{max} = 230 mA

Command value: **A1, C1:**
Reference potential at E and positive command value at D result in flow from P → A and B → T.
Reference potential at E and negative command value at D result in flow from P → B and A → T.
F1:
Reference potential at E and signal 12 to 20 mA at D result in flow from P → A and B → T.
Reference potential at E and signal 12 to 4 mA at D result in flow from P → B and A → T.

Actual value / measuring output: The voltage / current signal is proportional to the control spool stroke and has the same sign as the command value.

Connection cable: Recommendation: – up to 25 m line length: Type LiYCY 7 x 0.75 mm²
– up to 50 m line length: Type LiYCY 7 x 1.0 mm²
Only connect the shield to ⊥ on the supply side.

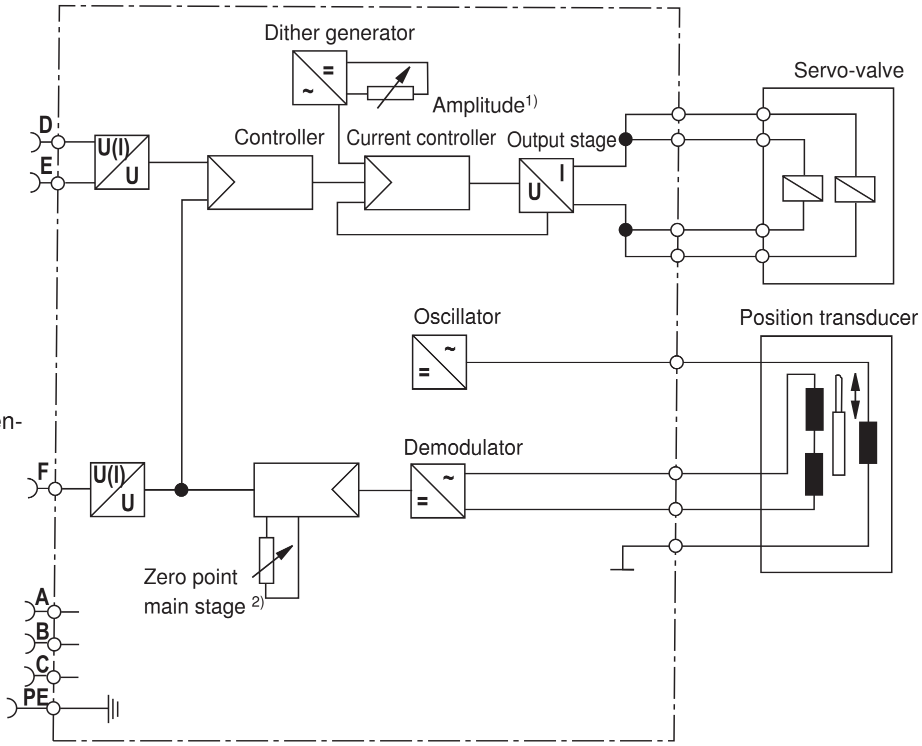
Notice: **Electric signals taken out via valve electronics (e.g. actual value) must not be used for switching off safety-relevant machine functions!**

Block diagram of the integrated electronics (OBE)

Interface | Integrated electronics (OBE) | Valve

Differential command value input
±10 V or ±10 mA or 4 to 20 mA

Actual value ±10 V / ±10 mA
(measuring output F has positive potential against ⊥ with flow P → A)
Actual value 4 to 20 mA
(measuring output F is greater 12 mA against ⊥ with flow P → A)



Supply voltage

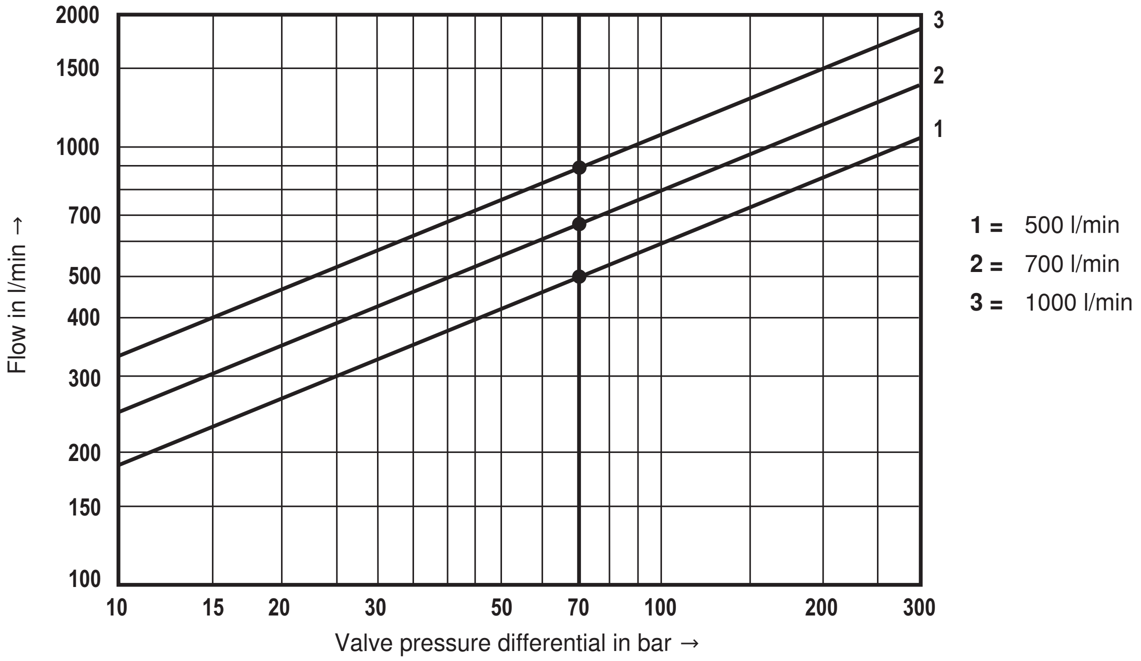
	±15 V	24 V
A	+15 V	18 V to 35 V
B	–15 V	0 V
C	⊥ M0	n.c.

1) 2)

☞ **Changes in the zero point and/or the dither amplitude may result in damage to the system and may only be implemented by instructed specialists.**

Characteristic curves (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C)

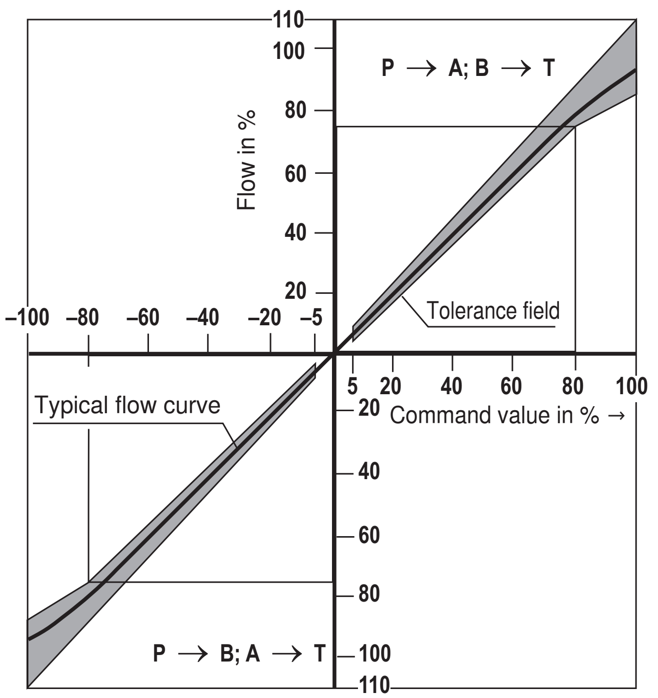
Flow/load function (tolerance ±10 %) with 100 % command value signal



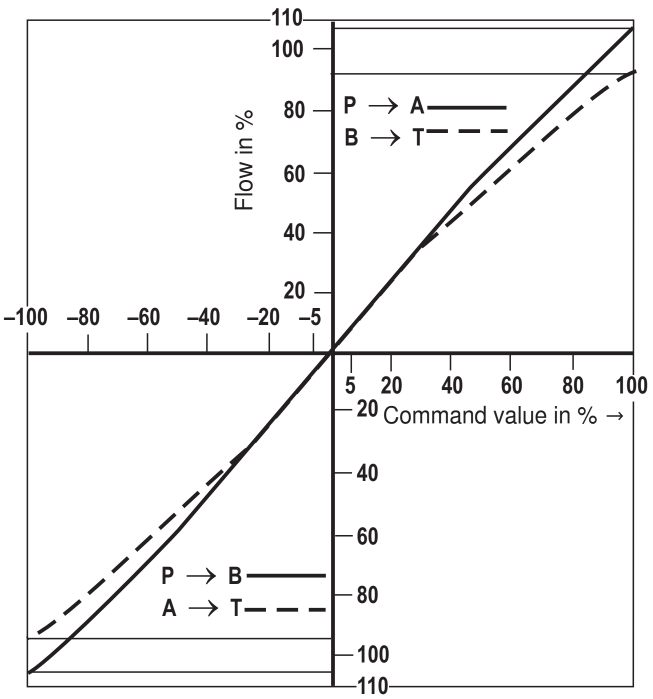
Δp = Valve pressure differential (inlet pressure p_P minus load pressure p_L minus return flow pressure p_T)

Tolerance field of the flow/signal function with constant valve pressure differential

Summated edge Δp_V = 70 bar



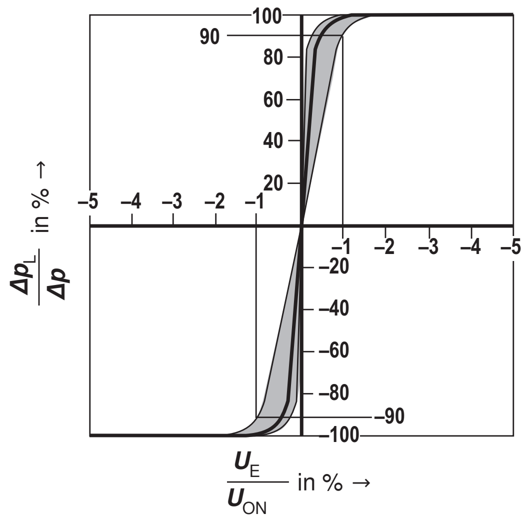
Single edge Δp_V = 35 bar (tolerance ±5 %)



* With interface F1, the negative command value axis corresponds to 4 to 12 mA, the positive command value axis to 12 to 20 mA

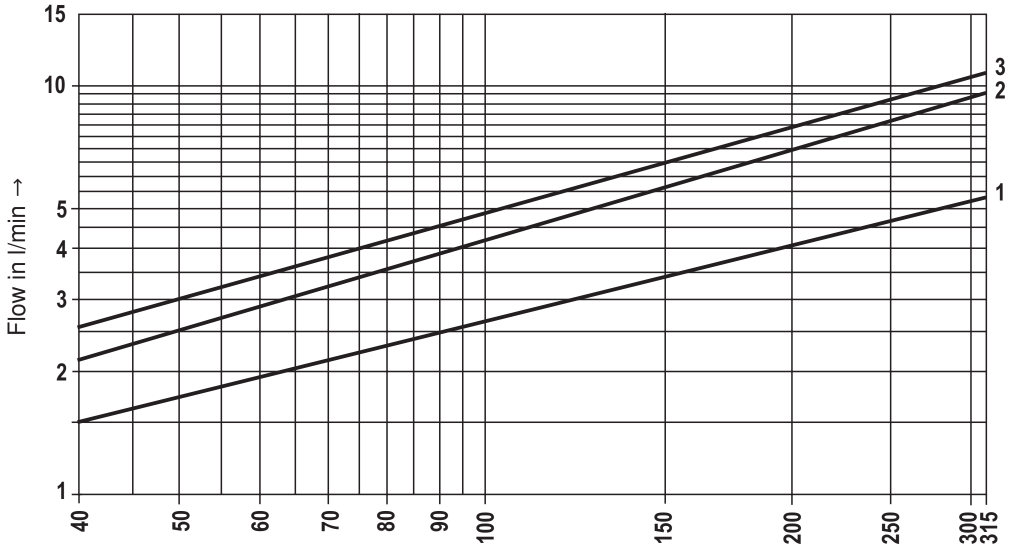
Characteristic curves (measured with HLP32, ϑ_{oil} = 40 °C ± 5 °C)

Pressure signal characteristic curve



Measured at
280 bar operating pressure

Leakage flow total with "D" overlap (pilot control valve and main stage)
Tolerance ±20 %



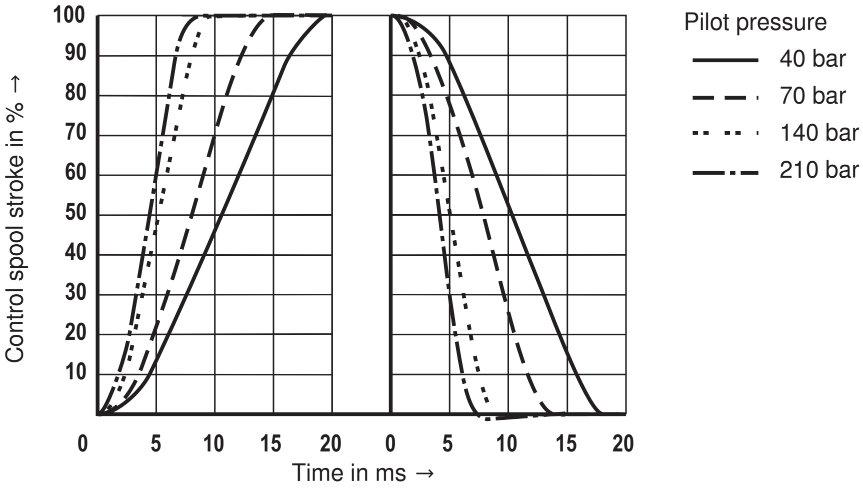
1 = 500 l/min
2 = 700 l/min
3 = 1000 l/min

Zero flow Data valid for overlap "E"	Pilot control valve L1	l/min	$\leq \sqrt{\frac{p_P}{70\ \text{bar}}} \cdot 0.8$
	Overall valve q_V	l/min	$\leq \sqrt{\frac{p_P}{70\ \text{bar}}} \cdot 0.015 \cdot q_{Vnom}$

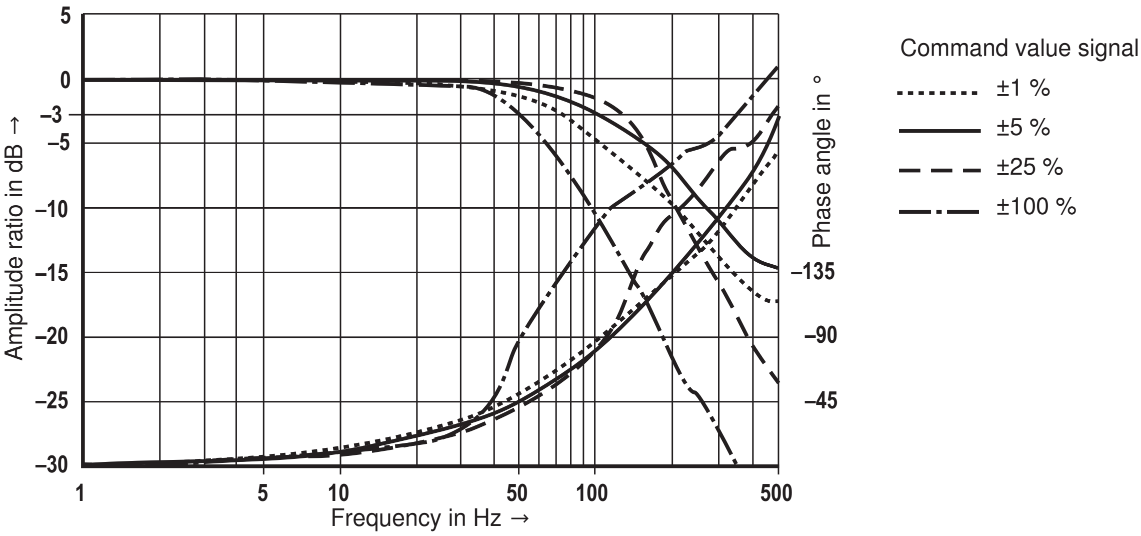
q_{Vnom} Rated flow (overall valve) in l/min 500, 670, 890
p_P Operating pressure in bar
Δp Valve pressure differential in bar
q_V 500, 700, 1000 l/min

Characteristic curves (measured with HLP32, ϑ_{oil} = 40 °C ± 5 °C)

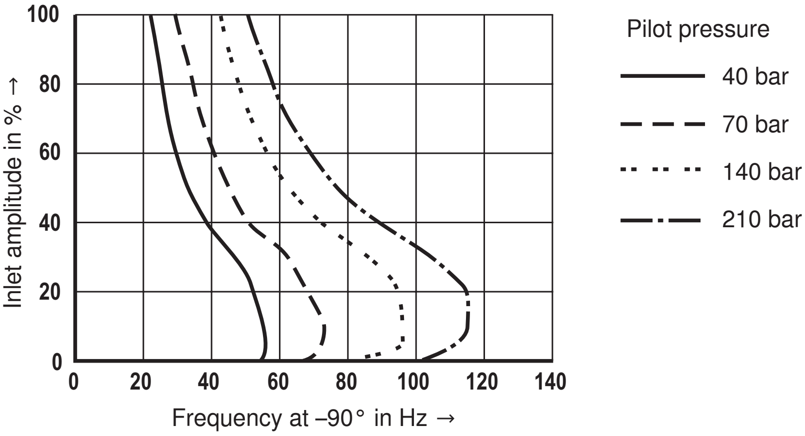
Transition function – measured with 210 bar pressure rating



Frequency response at p_P = 210 bar – measured with 210 bar pressure rating

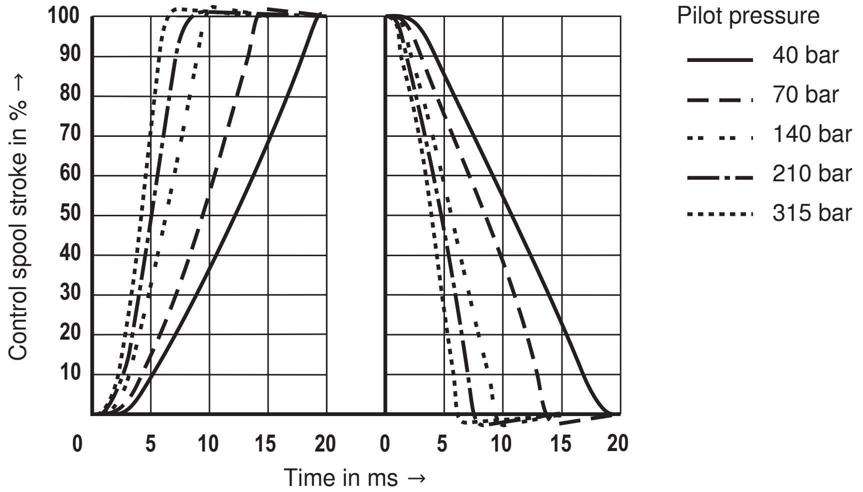


Dependence of the –90° frequency of the pilot pressure – measured with 210 bar pressure rating

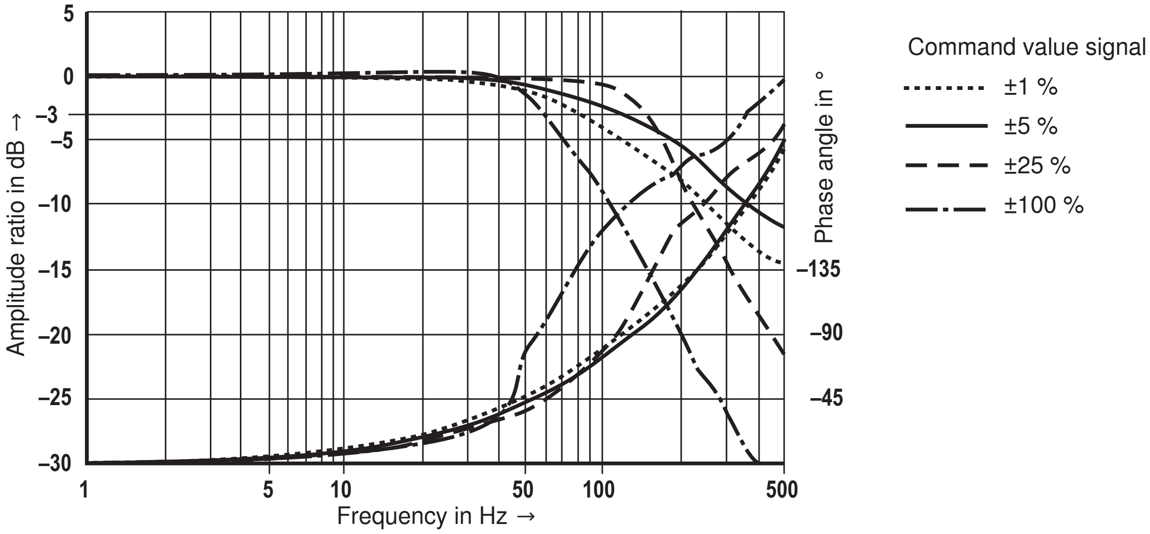


Characteristic curves (measured with HLP32, ϑ_{oil} = 40 °C ± 5 °C)

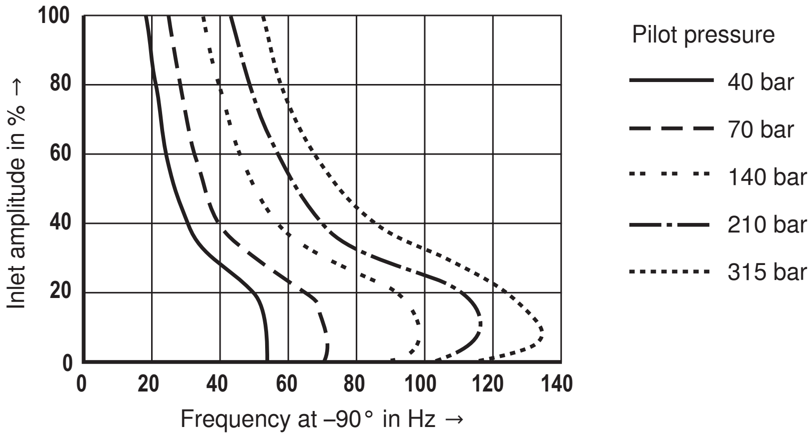
Transition function – measured with 315 bar pressure rating



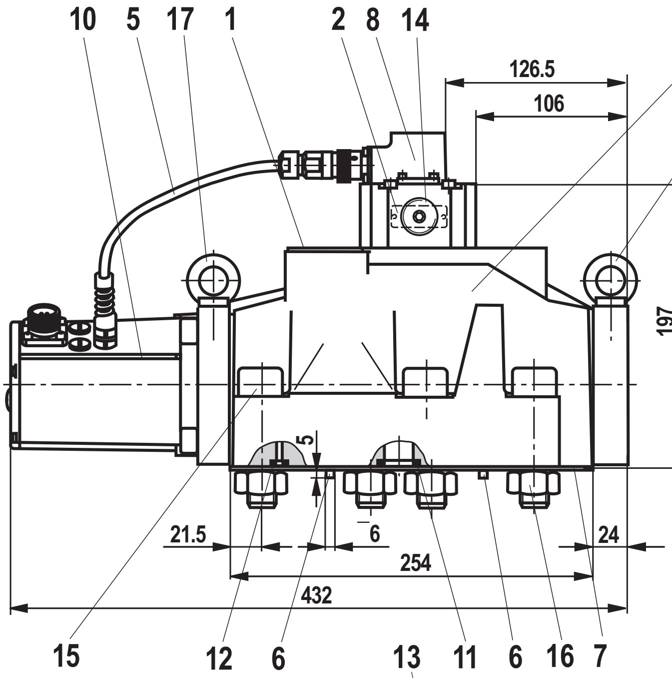
Frequency response at p_P = 315 bar – measured with 315 bar pressure rating

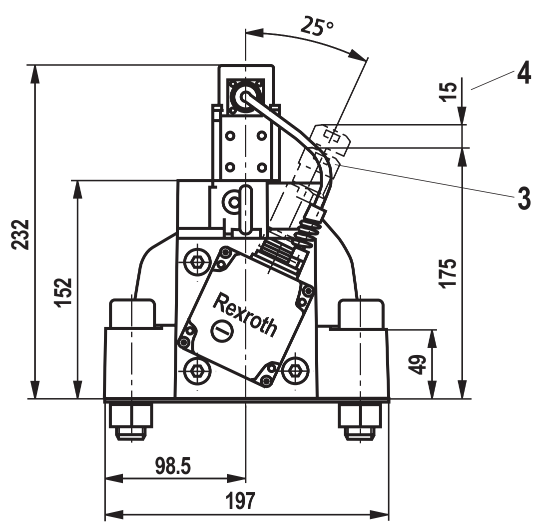


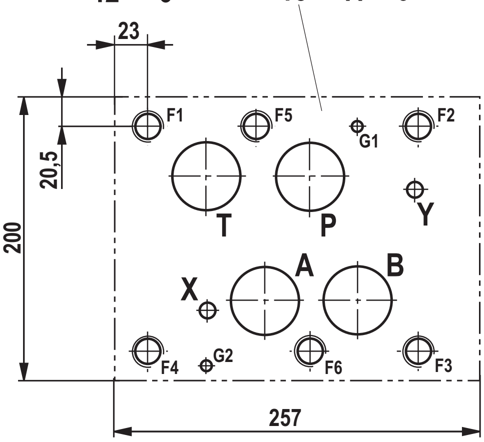
Dependence of the –90° frequency of the pilot pressure – measured with 315 bar pressure rating

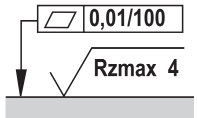


Unit dimensions: Type 4WSE3E 32 (dimensions in mm)









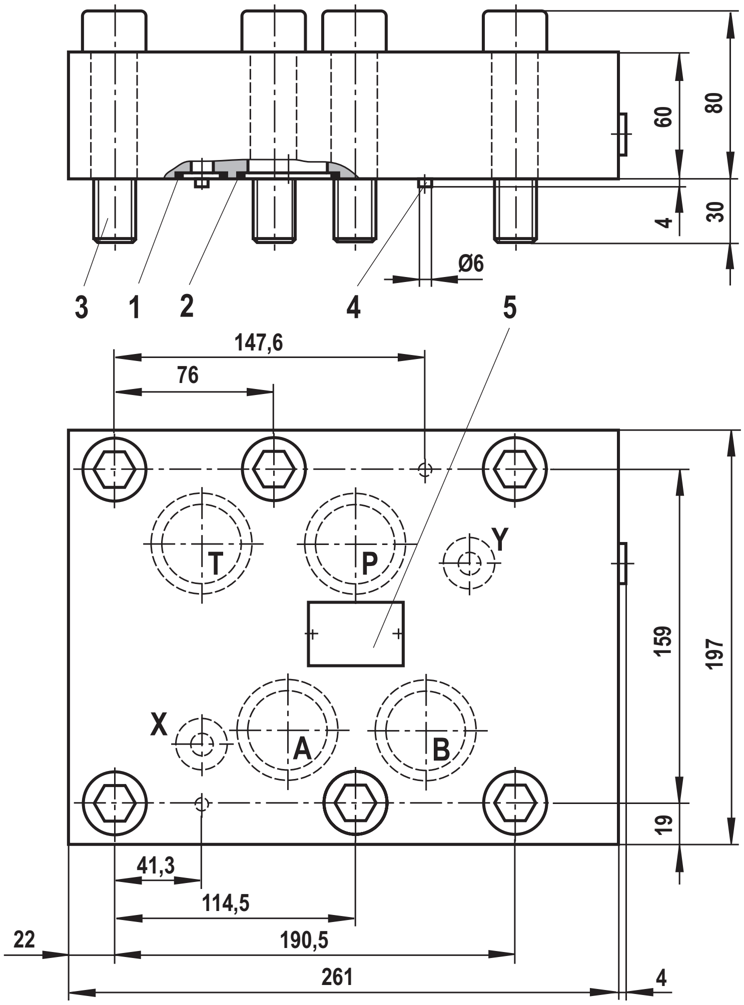
Required surface quality of the valve mounting face

1 Name plate – overall valve
2 Name plate – pilot control valve
3 Mating connector according to EN 175201-804, separate order, see page 13
4 Space required to remove the mating connector, take connection cable into account!
5 PVC cable not resistant when in contact with HFD-R fluid
6 Locating pin (2x) G1 and G2
7 Cover plate (for transport only)
8 Pilot control valve (2-stage)
9 Main stage (3rd stage)
10 Integrated control electronics
11 Identical seal rings for ports A, B, P, and T
12 Identical seal rings for ports X and Y
The ports X and Y are also pressurized in the case of "internal" pilot oil supply
13 Machined valve mounting face, porting pattern according to ISO 4401-10-09-0-05
14 Exchangeable filter element with seal, material no. **R961000194**
15 Valve mounting screws
16 Hexagon nuts (for transport only)
17 Ring bolts (for transport only)

Hexagon socket head cap screws (included in the scope of delivery)		**Material number**
Size 32	6x ISO 4762 - M20 x 80 - 10.9-flZn-240h-L Tightening torque M_A = 340 Nm ±10 %	R901035246

Notice: This tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure!

Flushing plate with porting pattern according to ISO 4401-10-09-0-05 (dimensions in mm)



1 R-ring 19x3x3 (X, Y) included in scope of delivery

2 R-ring 42.5x3x3 (P, T, A, B) included in scope of delivery

3 6 hexagon socket head cap screws (included in scope of delivery)
ISO4762-M20x90-10.9flZn-240h-L
(friction coefficient 0.09 to 0.14 according to VDA 235-101)
M_A = 340 Nm
Material no. **R913000397**

4 2 locating pins 6x12-6.8 DIN EN 28741

5 Name plate

To ensure proper operation of the servo-valves, it is necessary to flush the system before commissioning.

The following values are guidelines for the flushing time per system:

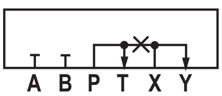
$$t \geq \frac{V}{q_V} \cdot 5$$

t = Flushing time in hours
V = Tank capacity in liters
q_V = Pump flow in liters per minute

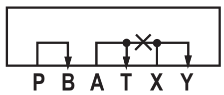
When topping up more than 10 % of the tank capacity, the flushing procedure must be repeated.

The use of a directional valve with port in accordance with ISO 4401-10-09-0-05 is better suited than a flushing plate. With this valve, you can also flush the actuator ports.

Symbols



with FKM seals
Material no. **R900550597**
Weight: 22.3 kg



with FKM seals
Material no. **R900959396**
(without fig.)
Weight: 22.3 kg

Accessories (not included in the scope of delivery)

Mating connectors		**Material number**
Mating connector for servo-valve	DIN EN 175201-804, see data sheet 08006	R900223890 (metal)

Subplates	**Data sheet**
Size 32	45060

Proportional directional cartridge valve, pilot-operated, with integrated electronics (OBE) or external control electronics

Type 2WFC and 2WFCE

RE 29403
Edition: 2018-09
Replaces: 2017-01

H8069

- Size 16 ... 50
- Component series 1X
- Maximum operating pressure 420 bar
- Maximum flow 1500 l/min (***Δp*** = 5 bar)
- CE according to EMC Directive 2014/30/EU

Features

- 2/2-way version
- Cartridge valve
- Robust
  - Pressure resistance up to 420 bar
  - High vibration resistance (acc. to DIN EN60068-2)
  - Ambient temperature up to +60 °C
- Precise
  - High response sensitivity and little hysteresis
- Reliable
  - High-quality and proven design
- Normalized
  - Installation dimensions according to ISO 7368
  - Connectors/interfaces
- Flexible
  - In connection with a pressure compensator pressure-compensated flow control possible
- Safe
  - Fail-safe position of the main stage in case of power failure, cable break or disconnected enable

Contents

Ordering code

01	02	03	04	05	06	07		08		09		10	11	12	13
2	**WFC**			**S**		**L**	**–**	**1X**	**/**		**/**				*****

01	2 main ports	**2**

02	Pilot-operated proportional directional valve (cartridge valve)	**WFC**

03	With external control electronics	**no code**
	With integrated electronics (OBE)	**E**

04	Size 16	**16**
	Size 25	**25**
	Size 32	**32**
	Size 40	**40**
	Size 50	**50**

05	Seat control spool	**S**

Rated flow at 5 bar pressure differential

06	**– Size 16**	
	125 l/min [1]	**125**
	160 l/min [2]	**160**
	– Size 25	
	220 l/min [1]	**220**
	330 l/min [2]	**330**
	– Size 32	
	320 l/min [1]	**320**
	650 l/min [2]	**650**
	– Size 40	
	500 l/min [1]	**500**
	940 l/min [2]	**940**
	– Size 50	
	1000 l/min [1]	**1000**
	1500 l/min [2]	**1500**

Flow characteristic

07	Linear	**L**

08	Component series 10 ... 19 (10 ... 19: unchanged installation and connection dimensions)	**1X**

Seal material

09	NBR seals	**M**
	FKM seals	**V**
	Observe compatibility of seals with hydraulic fluid used. (Other seals upon request)	

Electrical connection (version "With external control electronics")

10	Connector 3-pole (2 + PE) according to DIN EN 175301-803	**K4** [3; 4]

11	Without supply voltage (version "With external control electronics")	**no code**
	Supply voltage 24 V (With integrated electronics (OBE) "E")	**24**

Ordering code

01	02	03	04	05	06	07		08		09		10	11	12	13
2	**WFC**			**S**		**L**	**–**	**1X**	**/**		**/**				*****

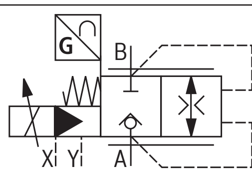
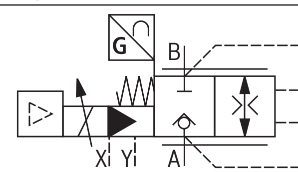
Electrical interface (With integrated electronics (OBE) "E")

12	0 ... 10 V DC (connector 6+PE)	**A1** 3)
	0 ... 10 V DC (connector 11+PE)	**B1** 3)
	4 ... 20 mA (connector 11+PE)	**G1** 3)

13	Further details in the plain text	*

1) Control spool Linear (standard)
2) Control spool Linear–Progressive
3) Mating connectors, separate order, see page24 and data sheet 08006.
4) External control electronics, see page 24.

Symbols

With external control electronics "2WFC"	With integrated electronics (OBE) "2WFCE"
	

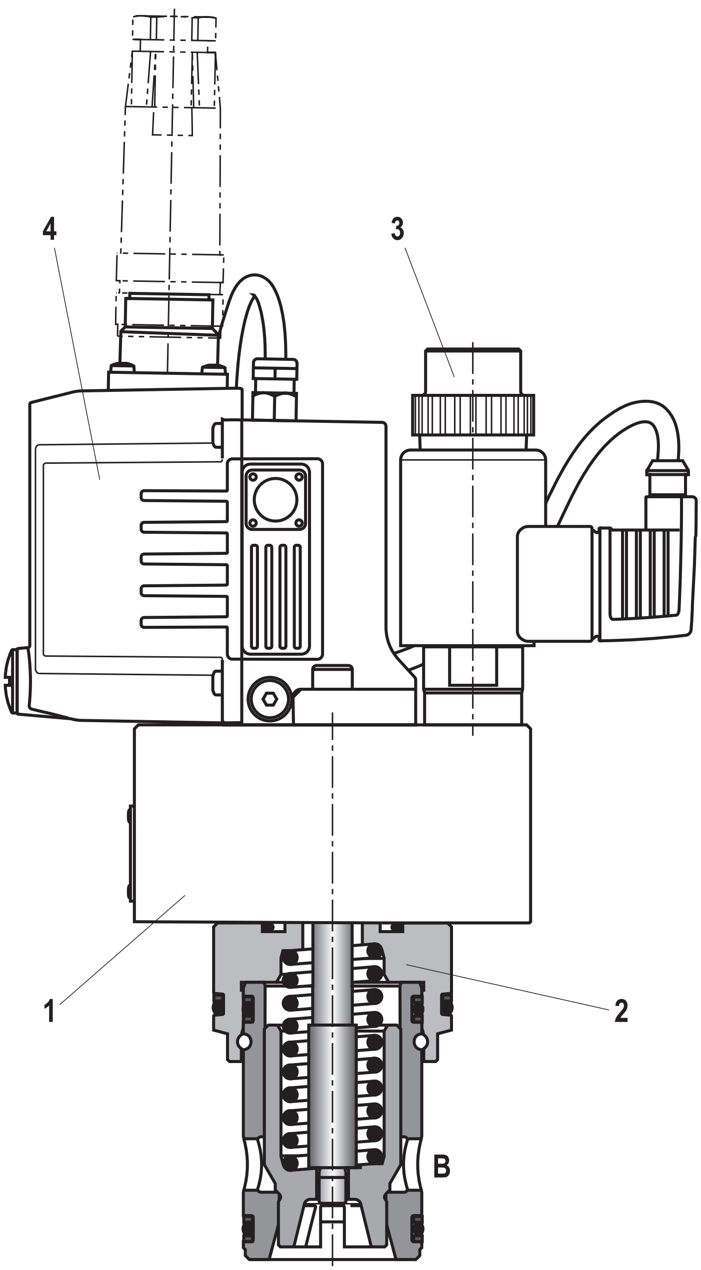
Notes:
- Representation according to DIN ISO 1219-1.
- Direction of flow
  - A → B (X connected to A)
  - B → A (X connected to B)

Function, section

Set-up

The pilot-operated proportional directional cartridge valve type 2WFC(E) basically consists of:

- Cover (1)
- Main stage (2)
- Pilot control valve with proportional solenoid (3)
- Integrated electronics with position transducer and analog interface (4) or external control electronics as module amplifier



Type 2WFCE ...

The electronics (integrated or external) compare the specified command value to the position actual value of the control spool of the main stage (2). In case of control deviations, the solenoid of the pilot control valve (3) is activated. In this way, the control spool is adjusted. Depending on the control deviation, the control chamber of the main stage (2) is either pressurized with pilot oil (the main stage closes) or unloaded (the main stage opens). Stroke and orifice cross-section are controlled proportionally to the command value until the control deviation is remedied.

For proper function, the following has to be observed:

- Direction of flow A → B (X connected to A)
- Direction of flow B → A (X connected to B)
- Port Y depressurized to the tank

Failure of supply voltage

If the minimum supply voltage fails or is fallen below, the enable is disconnected (only interfaces B1 and G1) and in case of a cable break of the solenoid conductor, the electronics will de-energize the solenoid of the pilot control valve (3). The control spool of the main stage (2) moves securely to its seat using the pressure available at port X and the force of the main stage spring and blocks the flow between A and B.

Flow control function

In connection with a pressure compensator, the pilot-operated proportional directional cartridge valve can be used for the pressure-compensated control of a flow.

Technical data
(For applications outside these parameters, please consult us!)

general							
Size		NG	16	25	32	40	50
Weight	▶ Type 2WFC	kg	3.3	4.4	5.6	7.7	10.3
	▶ Type 2WFCE	kg	3.5	4.6	5.8	7.9	10.5
Installation position			any				
Ambient temperature range		°C	–30 ... +60 (NBR seals) –20 ... +60 (FKM seals)				
Maximum storage time		Years	1 (if the storage conditions are observed; refer to the operating instructions 07600-B)				
Vibration resistance	▶ Sine test according to DIN EN 60068-2-6		10 ... 2000 Hz / maximum of 10 g / 10 cycles / 3 axes				
	▶ Noise test according to DIN EN 60068-2-64		20 ... 2000 Hz / 10 g_{RMS} / 30 g peak / 30 min. / 3 axes				
	▶ Transport shock according to DIN EN 60068-2-27		15 g / 11 ms / 3 axes				
Maximum relative humidity (no condensation)		%	95				
Maximum surface temperature (solenoid coil)		°C	150				
$MTTF_d$ value according to EN ISO 13849		Years	75 (for further details see data sheet 08012)				

hydraulic							
Maximum operating pressure	▶ Port A, B	bar	420				
Minimum operating pressure	▶ Port A (A → B) [1]	bar	12				
	▶ Port B (B → A) [1]	bar	20				
Maximum pilot pressure	▶ Port X	bar	420				
Maximum return flow pressure	▶ Port Y [1]	bar	100				
Rated flow (Δp = 5 bar [2])	▶ Linear	l/min	125	220	320	500	1000
	▶ Linear–Progressive	l/min	160	330	650	940	1500
Maximum pilot flow [3]		l/min	3	5	7	9	9
Leakage flow	▶ Pilot control valve (at 100 bar)	cm^3/min	< 150	< 200	< 200	< 400	< 400
	▶ Main stage						
	– Interface A1 (0 V) [5; 6]	cm^3/min	A → B and B → A blocked in a leakage-free manner (valve in seat position)				
	– Interface B1 (0 V)	cm^3/min	depending on Δp, see characteristic curves on page 10 ...19				
	– Interface G1 (4 mA)	cm^3/min	depending on Δp, see characteristic curves on page 10 ...19				
	– Interface B1, G1 [4; 5; 6]	cm^3/min	A → B and B → A blocked in a leakage-free manner (valve in seat position)				
Pilot volume	▶ Main stage [2]	cm^3	1	2.7	6.4	12.6	24.5
Direction of flow	▶ Pilot oil supply internal [1]						
	– A → B		A connected to X				
	– B → A		B connected to X				
	▶ Pilot oil supply external [1]						
	– A → B		Pressure in X ≥ pressure in A				
	– B → A		Pressure in X ≥ pressure in B				
Hydraulic fluid			see table page 6				
Viscosity range	▶ Recommended	mm^2/s	20 ... 100				
	▶ Maximum admissible	mm^2/s	15 ... 380				
Hydraulic fluid temperature range (flown-through)		°C	-20 ... +60				
Maximum admissible degree of contamination of the hydraulic fluid; cleanliness class according to ISO 4406 (c)			Class 18/16/13 [7]				

1) Counter pressure in port Y; values correspond to Y depressurized to the tank.

2) Flow for deviating Δp:

$$q_x = q_{Vnom} \times \sqrt{\frac{\Delta p_x}{5}}$$

3) Stepped input signal (seat position at 100%, pilot pressure 100 bar)

4) Pin 3: 0 V (release not set, see page 8)

5) Pilot oil supply internal: Observe leakage flow A → X or B → X via pilot control valve to Y (see technical data leakage flow – pilot control valve)

6) Pilot oil supply external: Leakage flow from A or B via the pilot control valve is avoided; a minimum leakage flow X → B up to 30 cm^3/min is, however, possible

7) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and simultaneously increases the life cycle of the components.

Technical data
(For applications outside these parameters, please consult us!)

Hydraulic fluid		Classification	Suitable sealing materials	Standards	Data sheet
Mineral oils		HL, HLP, HLPD, HVLP, HVLPD	NBR, FKM	DIN 51524	90220
Bio-degradable	▶ Insoluble in water	HETG	FKM	ISO 15380	90221
		HEES	FKM		
	▶ Soluble in water	HEPG	FKM	ISO 15380	
Flame-resistant	▶ Water-free	HFDU (glycol base)	FKM	ISO 12922	90222
		HFDU (ester base)	FKM		
		HFDR	FKM		
	▶ Containing water	HFC (Fuchs Hydrotherm 46M, Fuchs Renosafe 500, Petrofer Ultra Safe 620, Houghton Houghto Safe 620, Union Carbide HP5046)	NBR	ISO 12922	90223

☞ **Important information on hydraulic fluids:**
- For further information and data on the use of other hydraulic fluids, please refer to the data sheets above or contact us.
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.).
- The ignition temperature of the hydraulic fluid used must be 50 K higher than the maximum surface temperature.
- **Bio-degradable and flame-resistant – containing water:** **w**If components with galvanic zinc coating or parts containing zinc are used, small amounts of dissolved zinc may get into the hydraulic system and cause accelerated aging of the flame-resistant hydraulic fluid. Zinc soap may form as a chemical reaction product, which may clog filters, nozzles or solenoid valves - particularly in connection with local heat input.
- **Flame-resistant – containing water:**
  - Due to increased cavitation tendency with HFC hydraulic fluids, the life cycle of the component may be reduced by up to 30% as compared to the use with mineral oil HLP. In order to reduce the cavitation effect, it is recommended - if possible specific to the installation - to back up the return flow pressure in ports T to approx. 20% of the pressure differential at the component.
  - Dependent on the hydraulic fluid used, the maximum ambient and hydraulic fluid temperature must not exceed 50 °C. In order to reduce the heat input into the component, the command value profile is to be adjusted for proportional and high-response valves.

static /dynamic		
Hysteresis	%	< 0.2
Range of inversion	%	< 0.1
Response sensitivity	%	< 0.1
Manufacturing tolerance q_{Vmax} (control spool Linear)	%	≤ 10
Temperature drift	%/40 K	< 1
Zero compensation		ex plant ±1%

electrical, integrated electronics (OBE)			
Relative duty cycle		%	100 (continuous operation)
Protection class according to EN 60529			IP 65 with mating connector mounted and locked
Supply voltage	▶ Nominal voltage	VDC	24
	▶ Lower limit value	VDC	18
	▶ Upper limit value	VDC	36
	▶ Maximum admissible residual ripple	Vpp	2.5 (Comply with absolute supply voltage limit value)
Current consumption	▶ Maximum	A	2
	▶ Impulse current	A	3
Maximum power consumption		W	50
Functional ground and screening			see connector pin assignment (CE-compliant installation) page 9
Required fuse protection, external		A	2.5 time-lag
Adjustment			calibrated in the plant, see characteristic curves page 10 ... 19
Conformity			▶ CE according to EMC directive 2014/30/EU, tested according to EN 61000-6-2 and EN 61000-6-3 ▶ RoHS directive 2015/65/EU ▶ REACH ordinance (EC) no. 1907/2006

Integrated electronics (OBE)

Function

1. Switch-on procedure/Fault behavior

After applying the supply voltage of 24 V, the electronics are ready for operation provided that the following conditions are met:

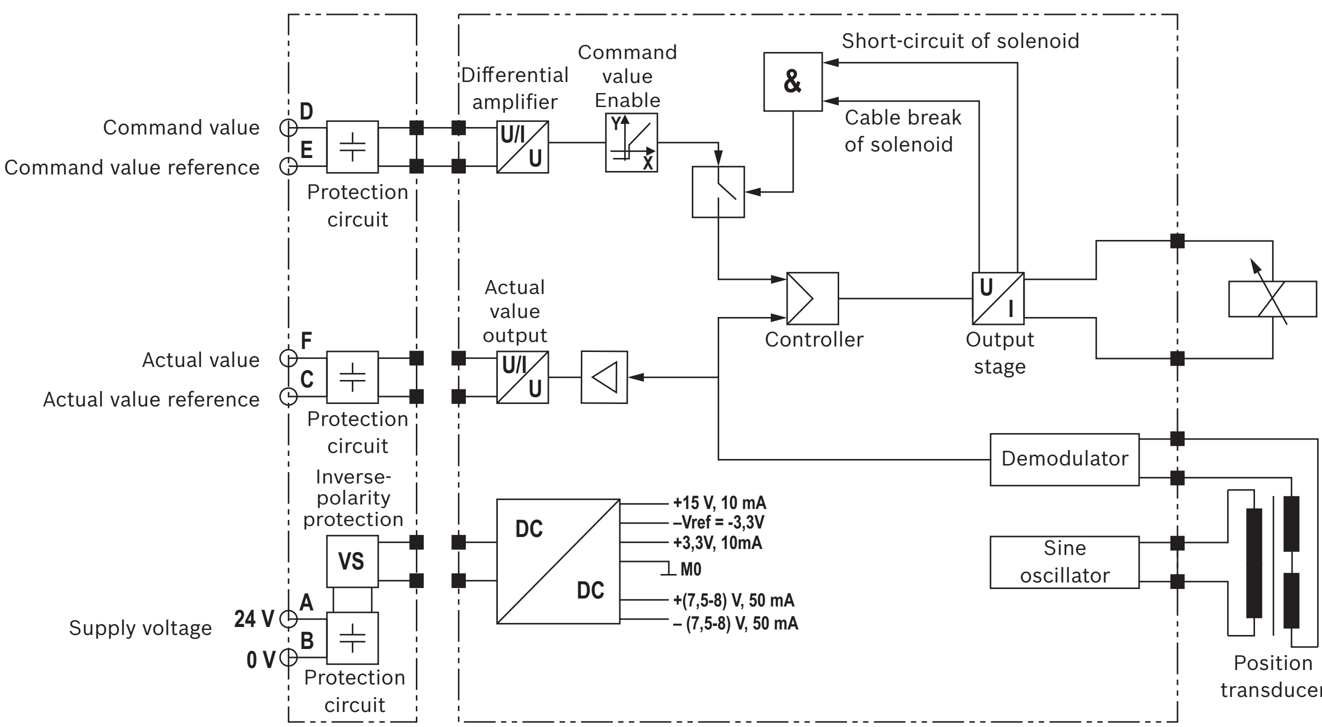
- ▶ Supply voltage U_B > 18 V DC
- ▶ Connection to solenoid not interrupted
- ▶ Command value line not interrupted and command value > 2.7 mA (interface "G1" only)

If one of the conditions is not met, the controllers and the output stage will be blocked and the ready for operation signal to pin 11 (interface "B1" and "G1" only) will be set to 0 V.

2. Actual value output signals

- ▶ Electrical interfaces "A1" (pin F) and "B1" (pin 6)
  - – "A1": 0.35 V ... +10 V corresponds to 0% ... 100% valve opening; control spool in seat position if actual value < -2.5 V
  - – "B1": 0 V ... +10 V corresponds to 0% ... 100% valve opening; control spool in seat position if actual value < -1.5 V
- ▶ Electrical interface "G1" (pin 6)
  - – 4 mA ... 20 mA corresponds to 0% ... 100% valve opening; control spool in seat position if actual value < 2.7 mA

Block diagram/controller function block: Version 6 + PE

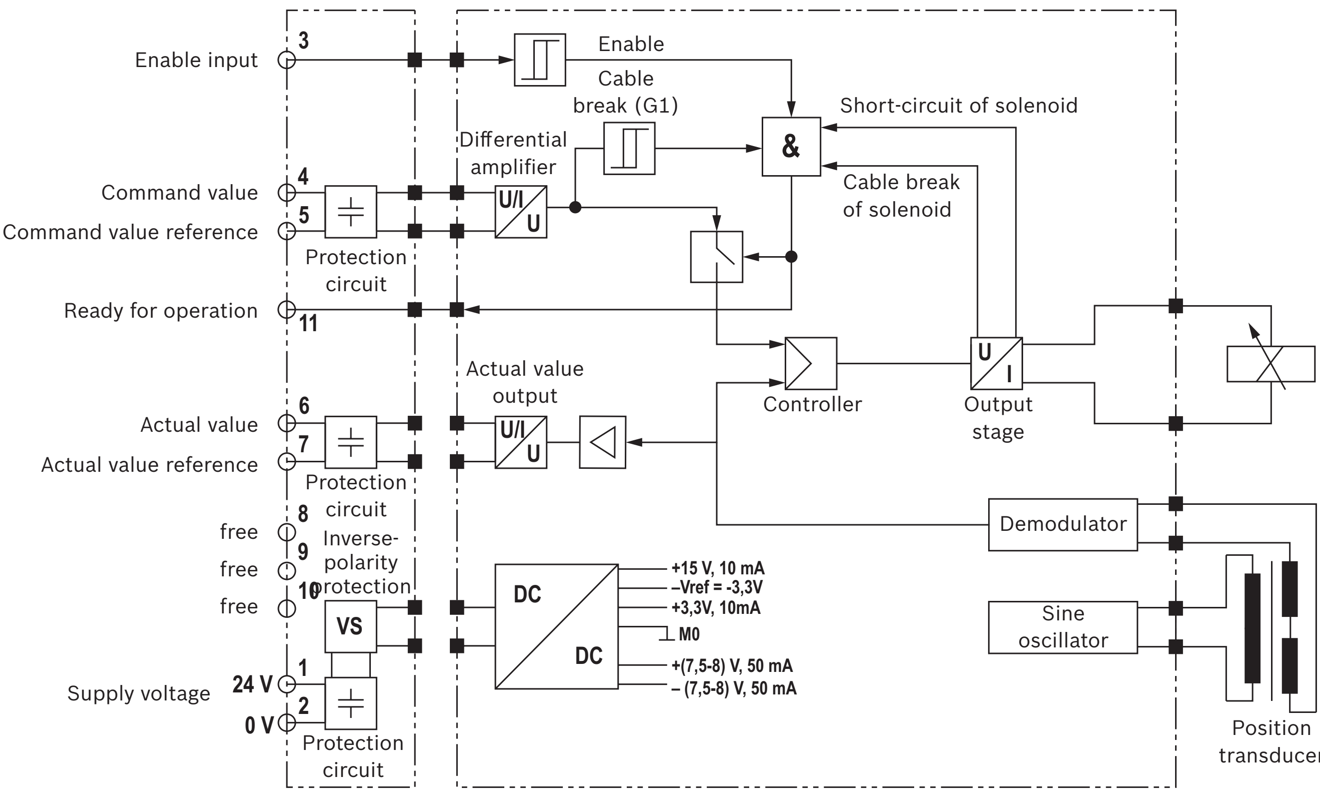


Notes:

- ▶ Electrical interface "A1"
  - – in opening direction: Valve active if command value ≥ 0.5 V
  - – in closing direction: Valve deactivated if command value ≤ 0.3 V ("on seat")
- ▶ Electrical interfaces "B1" and "G1"
  - – in opening direction: Valve active if enable pin 3 is set, command value > -1 V ("B1") or > 2 mA ("G1")
  - – in closing direction: Valve deactivated if enable pin 3 is not set, command value < -1 V ("B1") or < 2 mA ("G1") ("on seat")

Command value	"B1" and "G1"	"A1"
Without enable		–
0 V	⊥ T	
>0 V ... 0,35 V		
>0,35 V ... <0,5 V		⊥ T
>0,5 V		

Block diagram/controller function block: Version 11 + PE

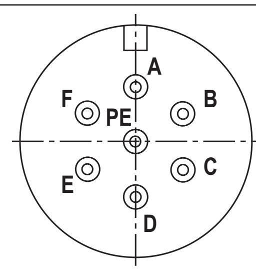
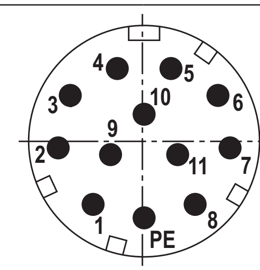


Notes:
- Electrical interface "A1"
  - in opening direction: Valve active if command value ≥ 0.5 V
  - in closing direction: Valve deactivated if command value ≤ 0.3 V ("on seat")
- Electrical interfaces "B1" and "G1"
  - in opening direction: Valve active if enable pin 3 is set, command value > -1 V ("B1") or > 2 mA ("G1")
  - in closing direction: Valve deactivated if enable pin 3 is not set, command value < -1 V ("B1") or < 2 mA ("G1") ("on seat")

Command value	"1" and "G1"	"A1"
Without enable		–
0 V	⊥ ⊤	
>0 V ... 0,35 V	)|(	
>0,35 V ... <0,5 V		⊥ ⊤
>0,5 V		)|(

Electrical connections and assignment

Connector pin assignment

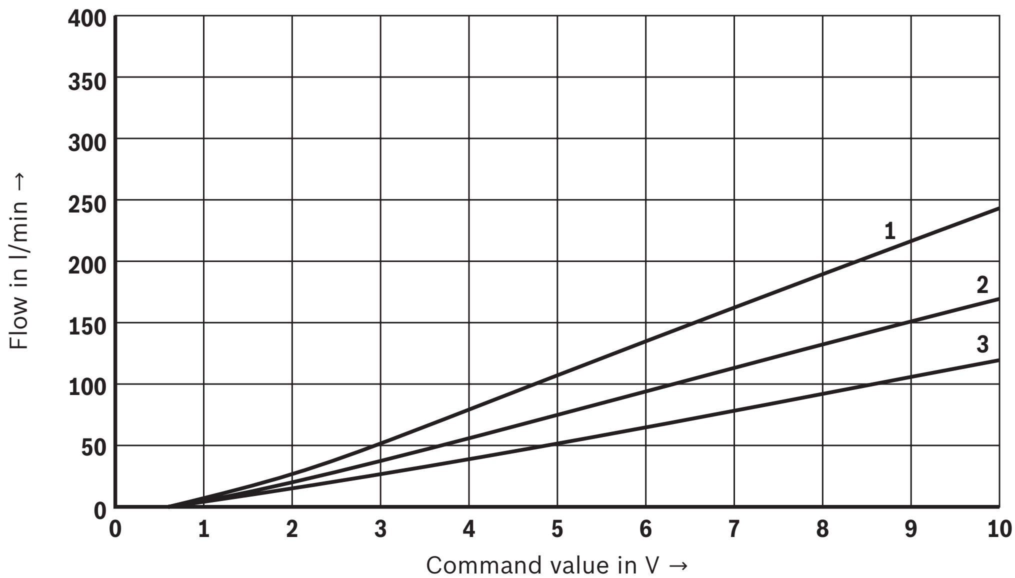
Pin		Core marking [1]	Interface assignment		
6 + PE	**11 + PE**		**"A1"** (6 + PE)	**"B1"**(11 + PE)	**"G1"**(11 + PE)
A	1	1	Supply voltage 24 VDC		
B	2	2	GND		
C	3	3	Reference potential actual value	Enable input 24 VDC (high ≥ 12 V; low ≤5 V)	
D	4	4	Command value 0 ... 10 V		Command value 4 ...20 mA
E	5	5	Reference potential command value		
F	6	6	Actual value 0 ... 10 V		Actual value 4 ... 20 mA
	7	7		Reference potential actual value	
	8	8	–		
	9	9	–		
	10	10	–		
	11	11	–	Switching output 24 V – fault-free operation (supply voltage -1 V)/error (0 V) or power circuit signal), maximum 50 mA	
PE	PE	green-yellow	Functional ground (directly connected to the valve housing)		
					

[1] Core marking of the connection lines for mating connector with cable set, see accessories, page 24.

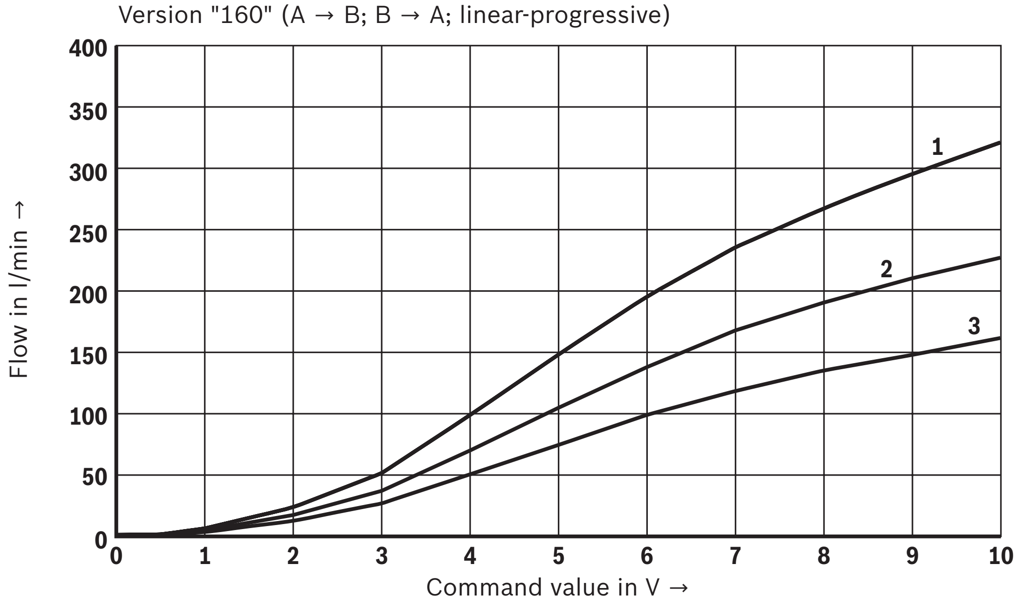
Characteristic curves: Size 16
(measured with HLP46, ϑ_{Oil} = 40 ±5 °C)

Flow/signal function

Version "125" (A → B; B → A; linear)



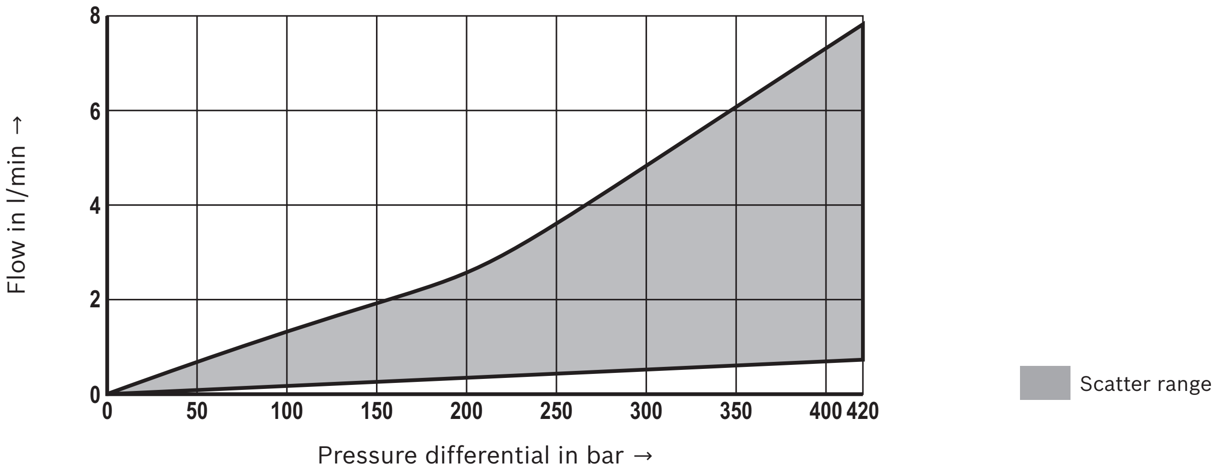
Version "160" (A → B; B → A; linear-progressive)



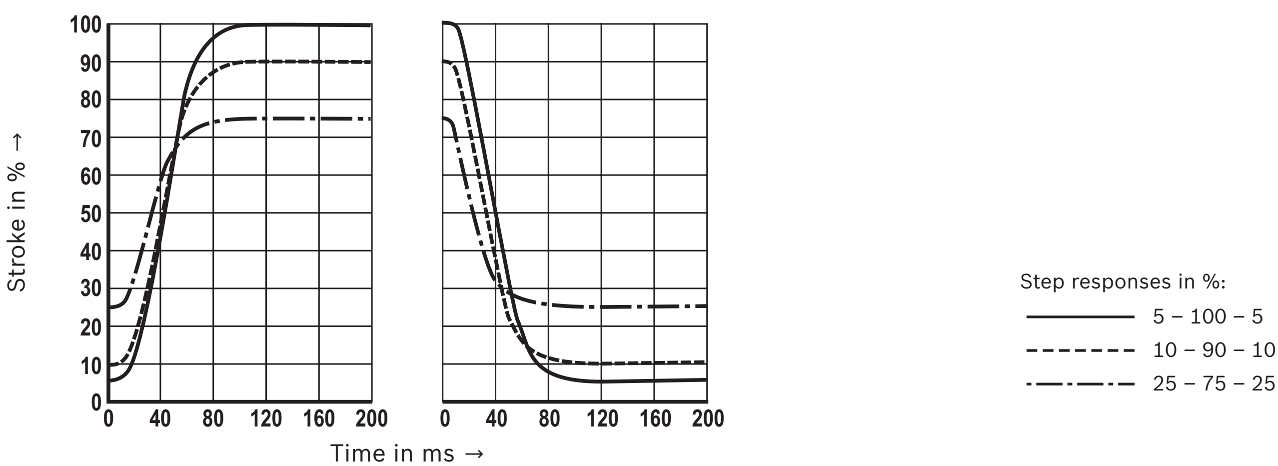
1 Pressure differential 20 bar
2 Pressure differential 10 bar
3 Pressure differential 5 bar

Characteristic curves: Size 16
(measured with HLP46, ϑ_{Oil} = 40 ±5 °C)

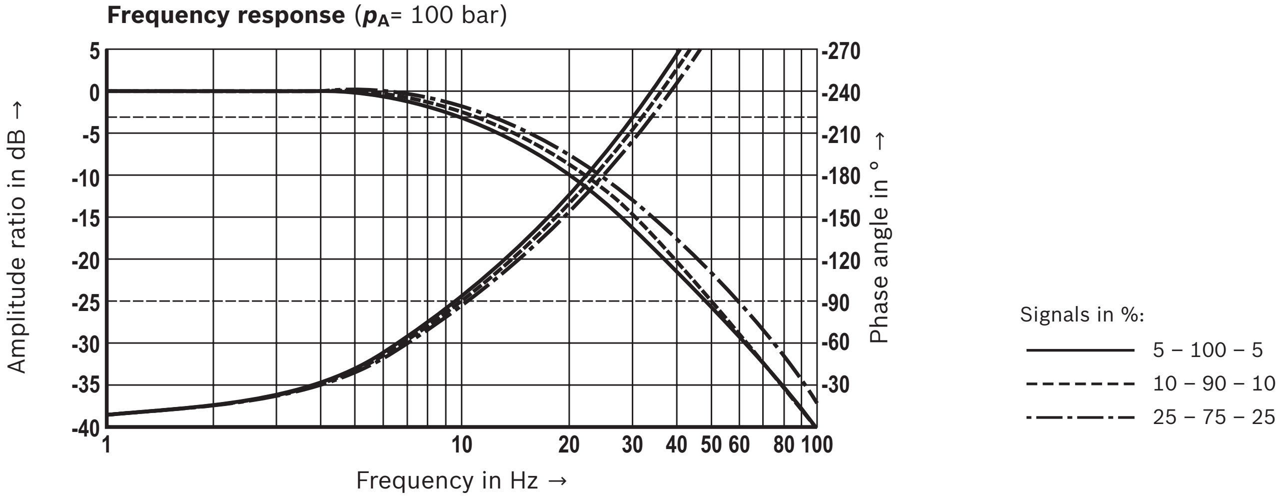
Leakage as a function of the pressure differential
(Command value: A1 – 0.5 V; B1 – 0 V; G1 – 4 mA)



Transition function with stepped electric input signals
(p_A = p_B = 100 bar; port B closed)



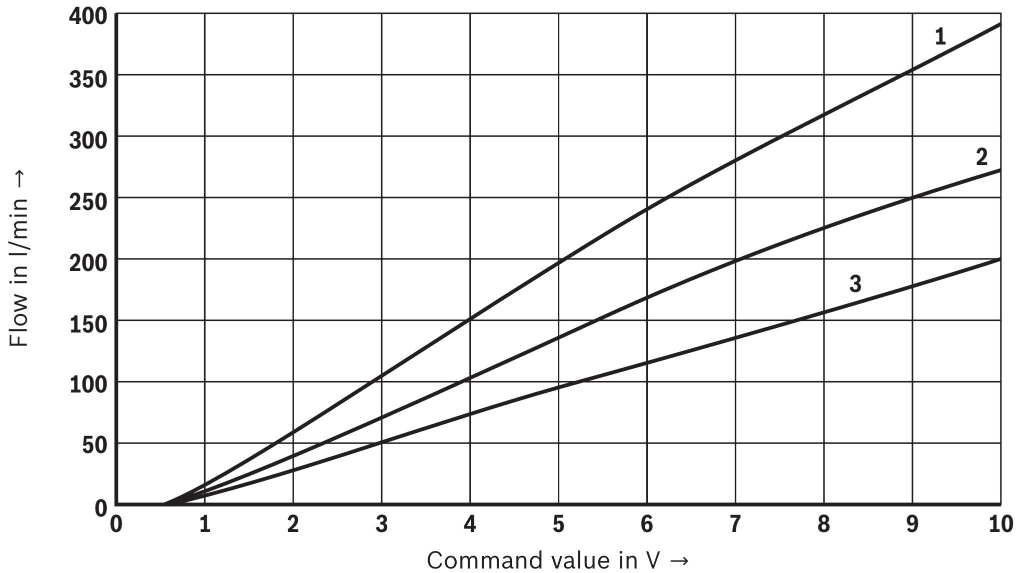
Frequency response (p_A= 100 bar)



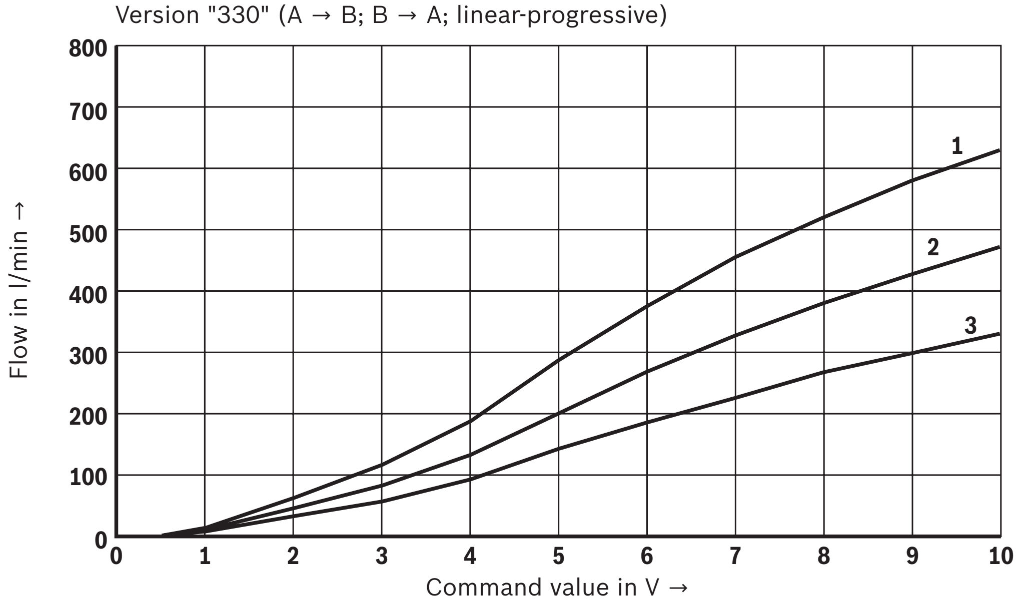
Characteristic curves: Size 25
(measured with HLP46, ϑ_{Oil} = 40 ±5 °C)

Flow/signal function

Version "220" (A → B; B → A; linear)



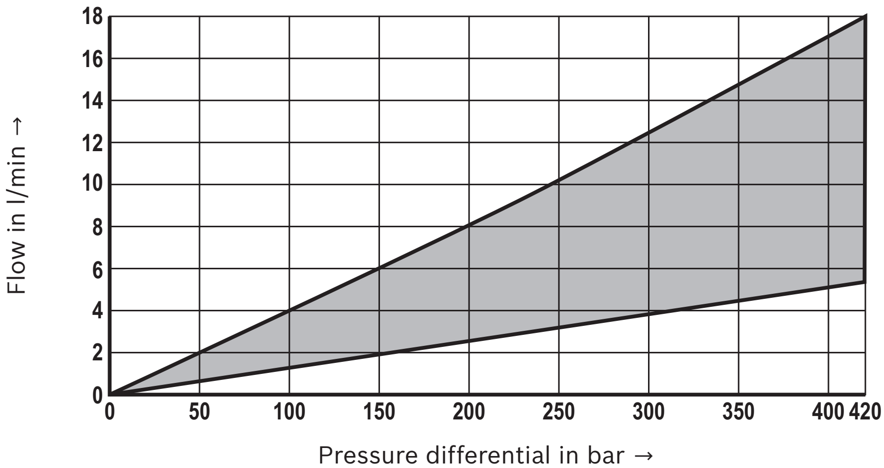
Version "330" (A → B; B → A; linear-progressive)



1 Pressure differential 20 bar
2 Pressure differential 10 bar
3 Pressure differential 5 bar

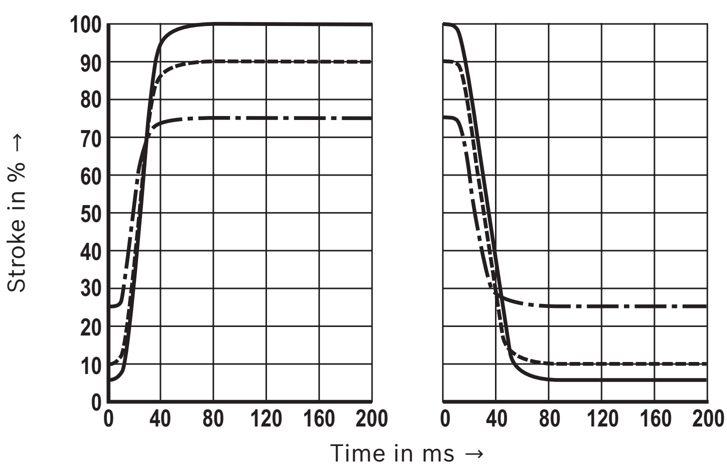
Characteristic curves: Size 25
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Leakage as a function of the pressure differential
(Command value: A1 – 0.5 V; B1 – 0 V; G1 – 4 mA)



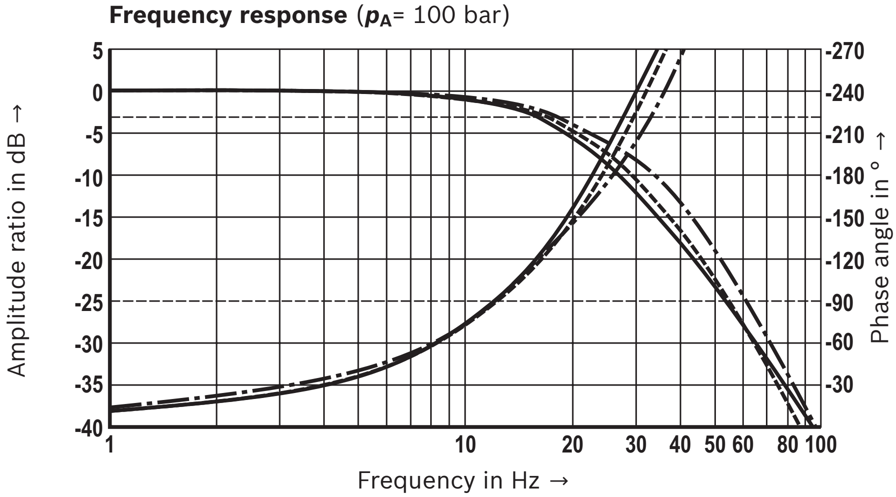
Scatter range

Transition function with stepped electric input signals
(p_A = p_B = 100 bar; port B closed)



Step responses in %:
- 5 – 100 – 5
- 10 – 90 – 10
- 25 – 75 – 25

Frequency response (p_A= 100 bar)

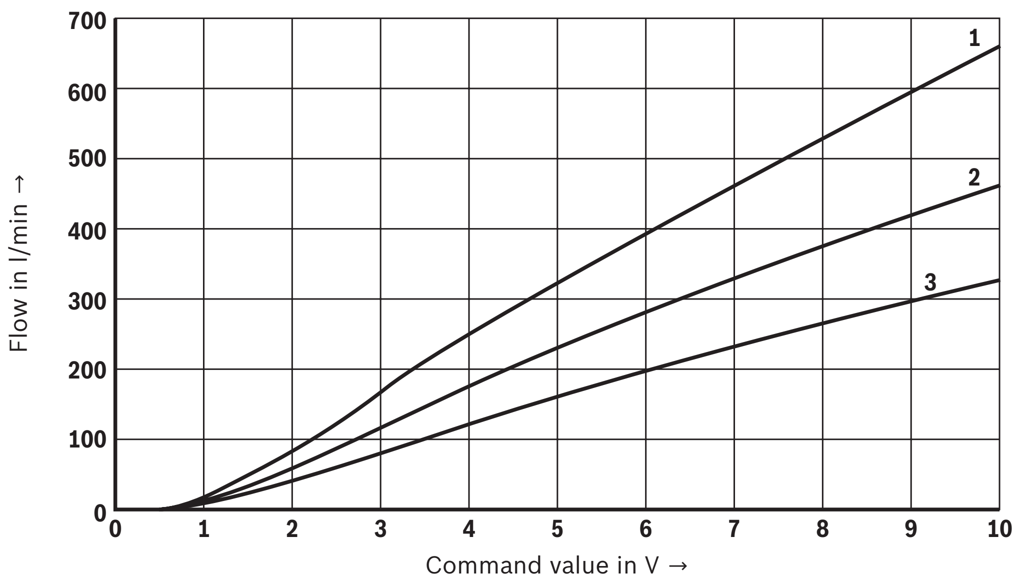


Signals in %:
- 5 – 100 – 5
- 10 – 90 – 10
- 25 – 75 – 25

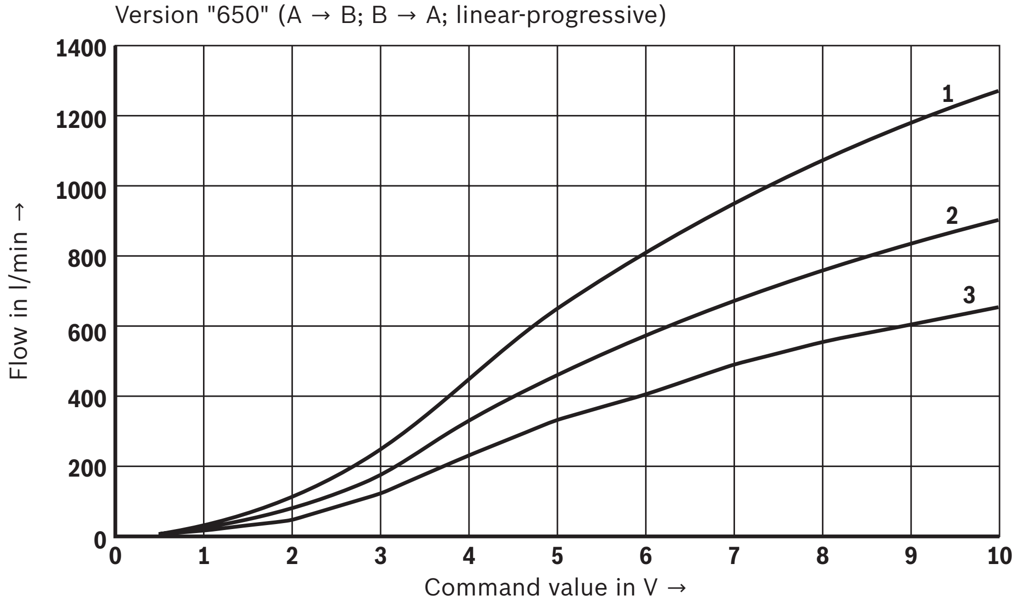
Characteristic curves: Size 32
(measured with HLP46, ϑ_{Oil} = 40 ±5 °C)

Flow/signal function

Version "320" (A → B; B → A; linear)



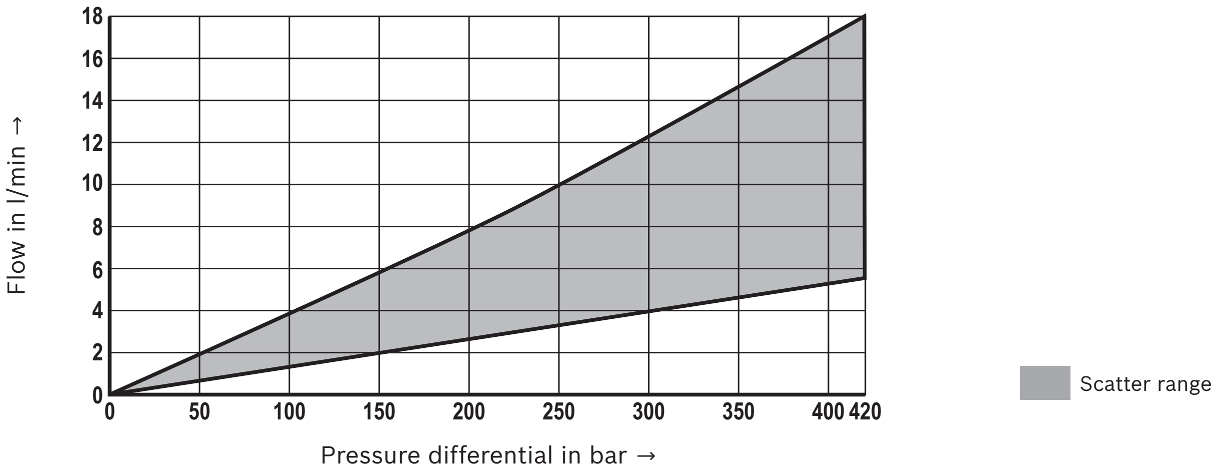
Version "650" (A → B; B → A; linear-progressive)



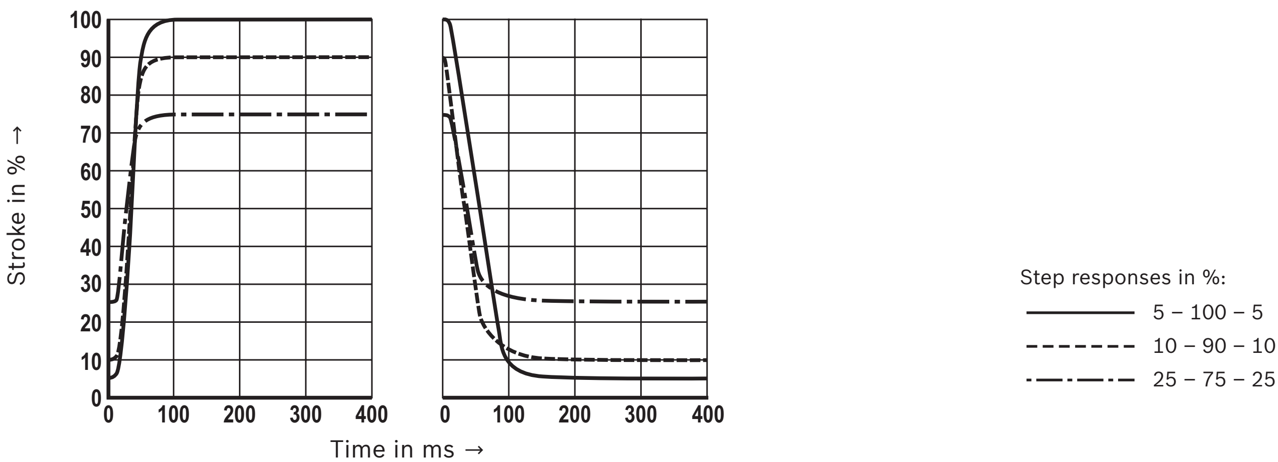
1 Pressure differential 20 bar
2 Pressure differential 10 bar
3 Pressure differential 5 bar

Characteristic curves: Size 32
(measured with HLP46, ϑ_{Oil} = 40 ±5 °C)

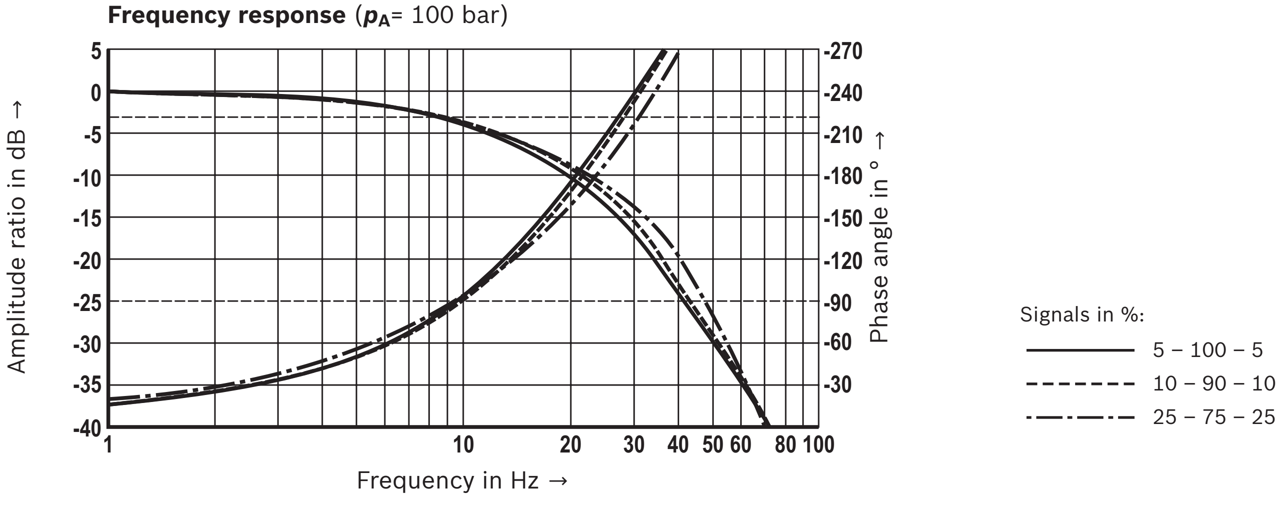
Leakage as a function of the pressure differential
(Command value: A1 – 0.5 V; B1 – 0 V; G1 – 4 mA)



Transition function with stepped electric input signals
(p_A = p_B = 100 bar; port B closed)

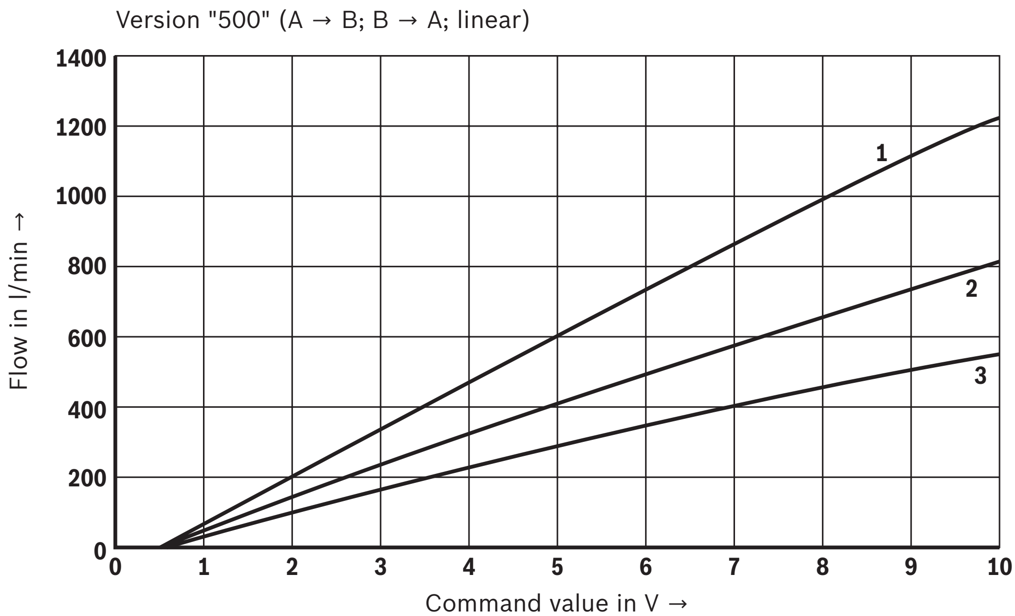


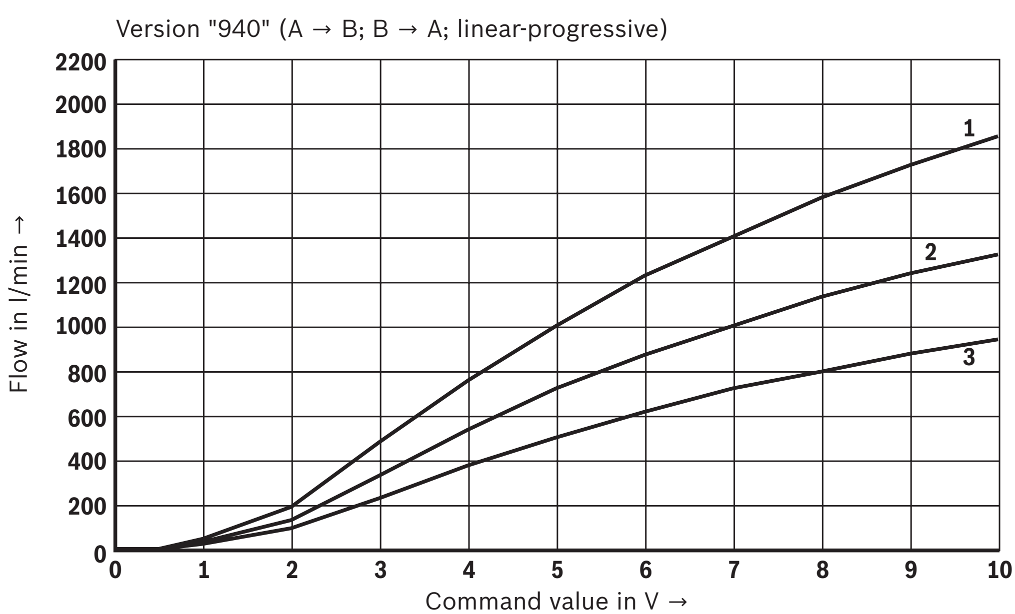
Frequency response (p_A= 100 bar)



Characteristic curves: Size 40
(measured with HLP46, ϑ_{Oil} = 40 ±5 °C)

Flow/signal function

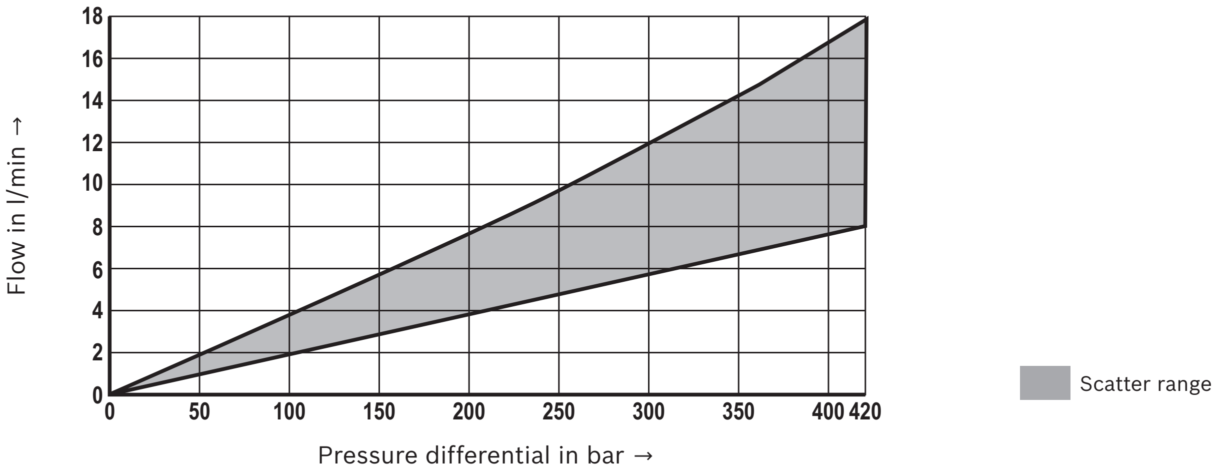




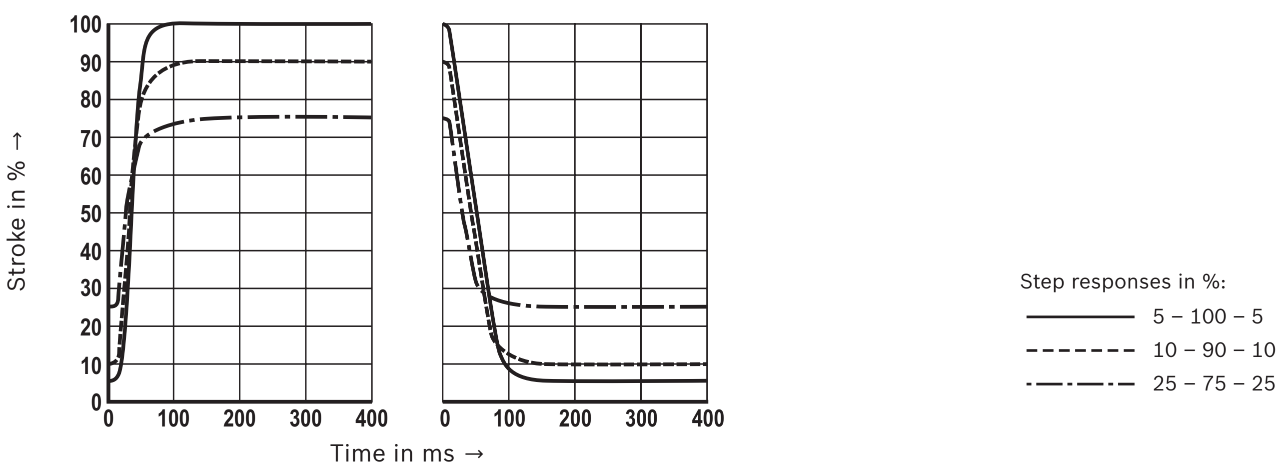
1 Pressure differential 20 bar
2 Pressure differential 10 bar
3 Pressure differential 5 bar

Characteristic curves: Size 40
(measured with HLP46, ϑ_{Oil} = 40 ±5 °C)

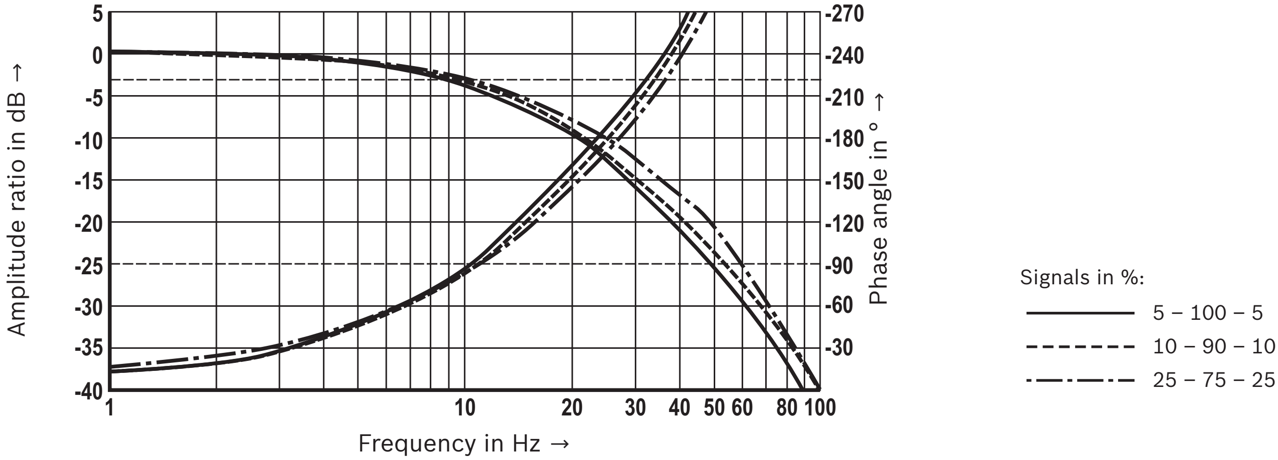
Leakage as a function of the pressure differential
(Command value: A1 – 0.5 V; B1 – 0 V; G1 – 4 mA)



Transition function with stepped electric input signals
(p_A = p_B = 100 bar; port B closed)



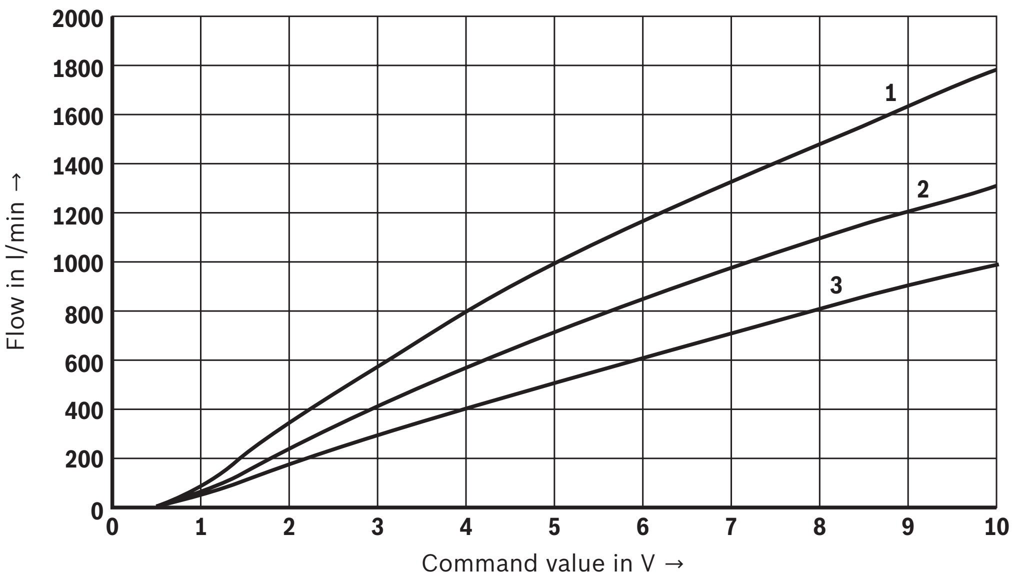
Frequency response (p_A= 100 bar)



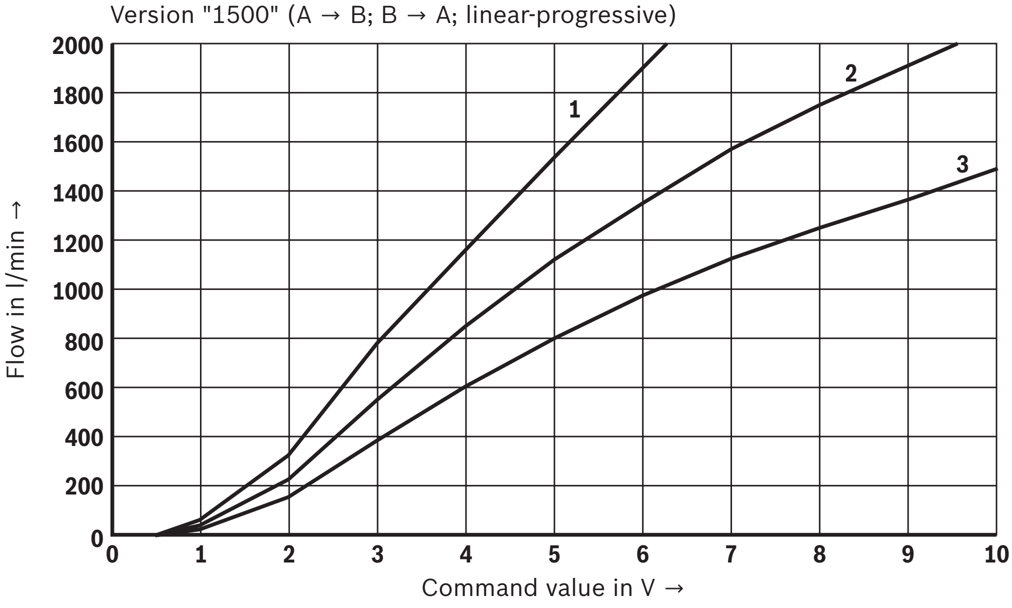
Characteristic curves: Size 50
(measured with HLP46, ϑ_{Oil} = 40 ±5 °C)

Flow/signal function

Version "1000" (A → B; B → A; linear)



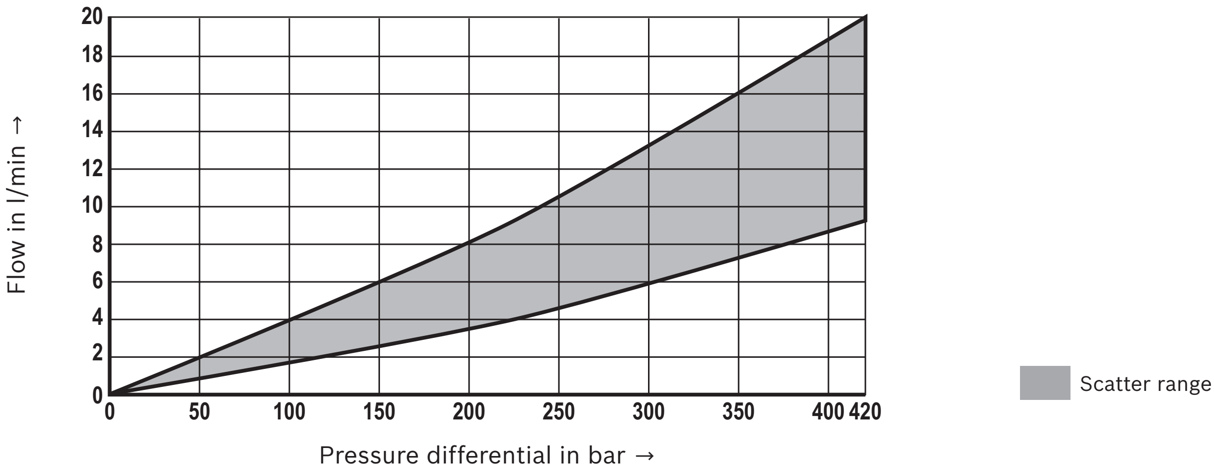
Version "1500" (A → B; B → A; linear-progressive)



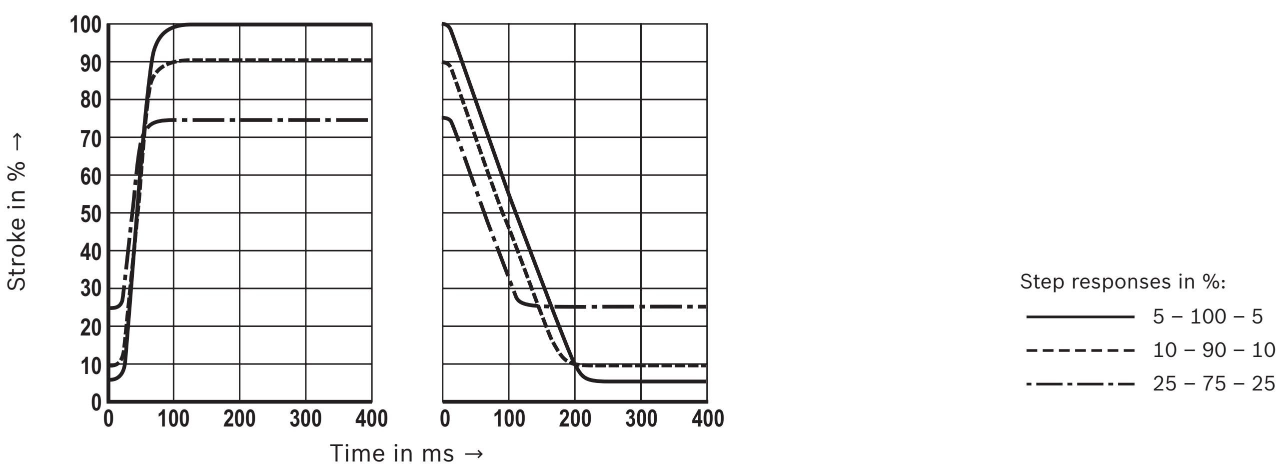
1 Pressure differential 20 bar
2 Pressure differential 10 bar
3 Pressure differential 5 bar

Characteristic curves: Size 50
(measured with HLP46, ϑ_{Oil} = 40 ±5 °C)

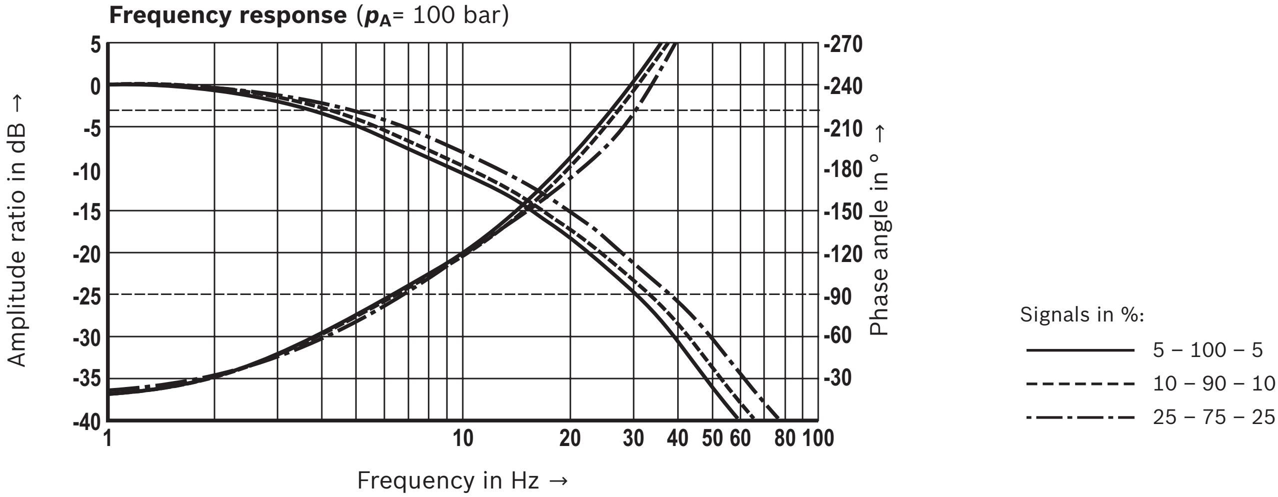
Leakage as a function of the pressure differential
(Command value: A1 – 0.5 V; B1 – 0 V; G1 – 4 mA)



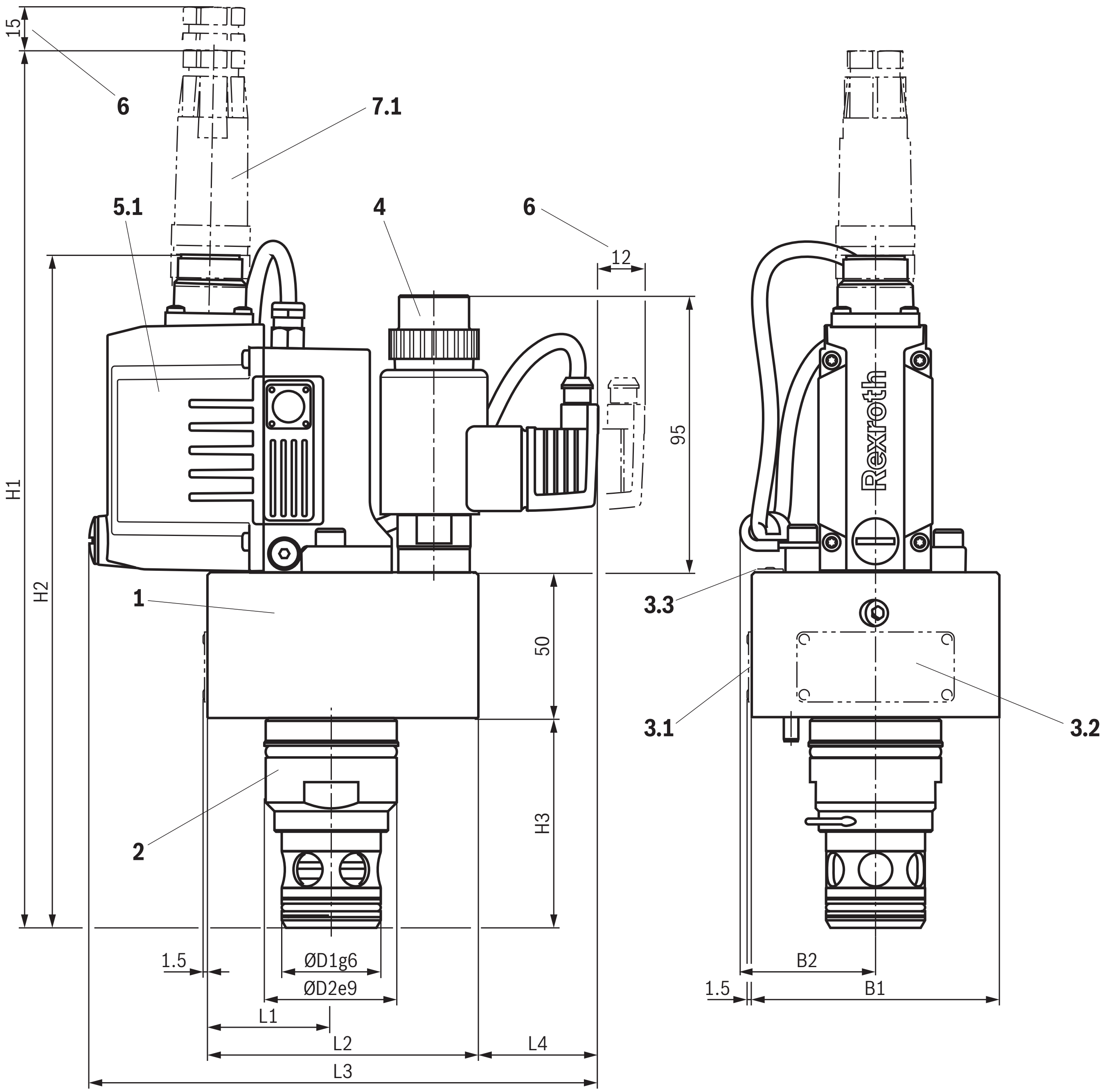
Transition function with stepped electric input signals
(p_A = p_B = 100 bar; port B closed)



Frequency response (p_A= 100 bar)



Dimensions: With integrated electronics (OBE) "E"
(dimensions in mm)

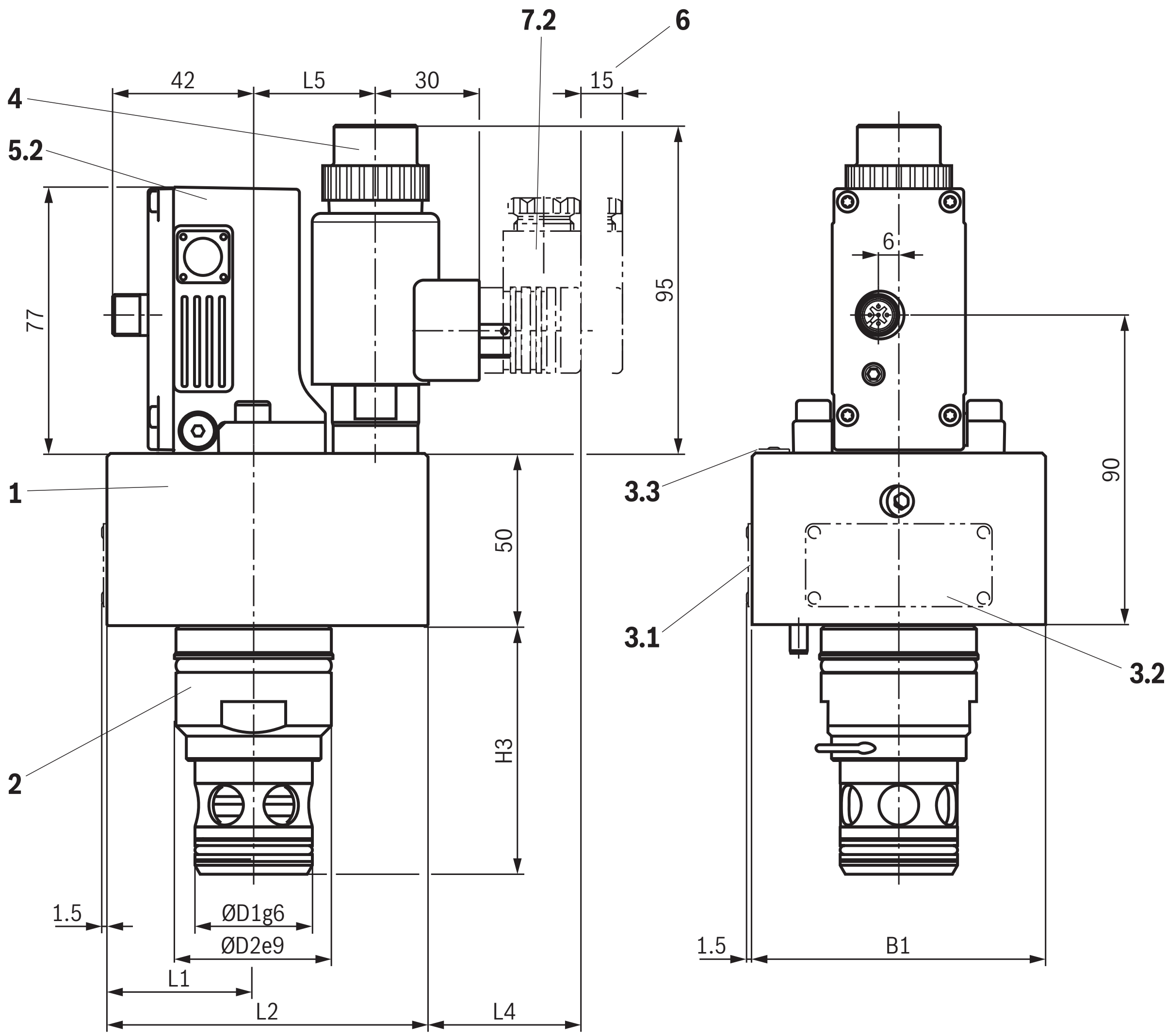


NG	B1	B2	H1	H2	H3	L1	L2	L3	L4	ØD1	ØD2
16	65	47	286	215	56	32.5	83	175	42	24	32
25	85	47	302	231	72	42.5	93	175	42	34	45
32	100	–	315	244	85	50	100	175	42	45	60
40	125	–	335	264	105	62.5	125	190	45	55	75
50	140	–	352	281	122	70	140	190	38	68	90

☞ **Notice:**
The dimensions are nominal dimensions which are subject to tolerances.

Item explanations and **valve mounting screws** see page 23.

Dimensions: With external control electronics (dimensions in mm)

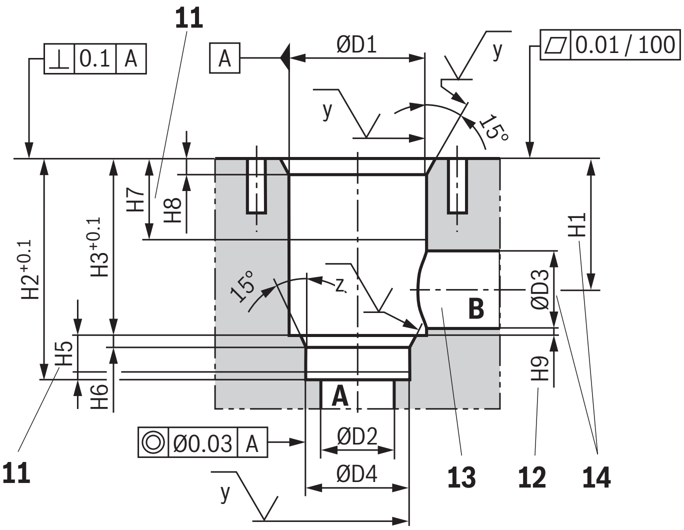


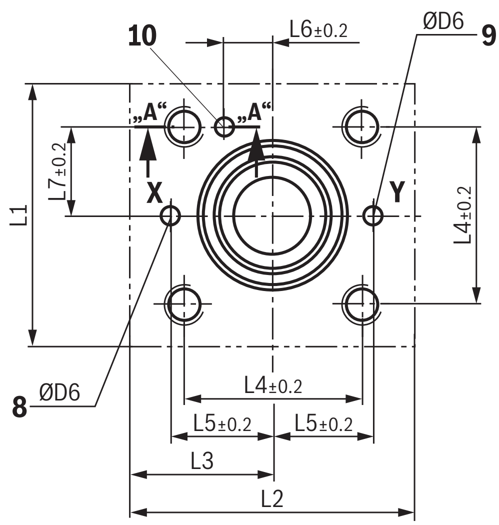
NG	B1	H3	L1	L2	L4	L5	ØD1	ØD2
16	65	56	32.5	83	42	36	24	32
25	85	72	42.5	93	42	36	34	45
32	100	85	50	100	42	36	45	60
40	125	105	62.5	125	45	42	55	75
50	140	122	70	140	38	46.5	68	90

☞ **Notice:**
The dimensions are nominal dimensions which are subject to tolerances.

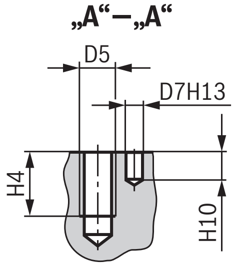
Item explanations and **valve mounting screws** see page 23.

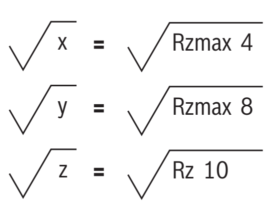
Installation bore
(dimensions in mm)





„A“–„A“





Installation dimensions according to DIN ISO 7368

NG	16	25	32	40	50
ØD1H7	32	45	60	75	90
ØD2	16	25	32	40	50
ØD3	16	25	32	40	50
max. ØD3	25	32	40	50	63
ØD4H7	25	34	45	55	68
D5	M8	M12	M16	M20	M20
max. ØD6	4	6	8	8	10
ØD7H13	4	6	6	6	8
H1	34	44	52	64	72
H1 1)	29.5	40.5	48	59	65.5
H2	56	72	85	105	122
H3	43	58	70	87	100
H4	20	25	35	45	45
min. H5	11	12	13	15	17
H6	2	2.5	2.5	3	3
min. H7	20	30	30	30	35
H8	2	2.5	2.5	3	4
min. H9 2)	0.5	1	1.5	2.5	2.5
min. H10	8	8	8	8	8
L1	65	85	100	125	140
L2	83	93	100	125	140
L3	32.5	42.5	50	62.5	70
L4	46	58	70	85	100
L5	25	33	41	50	58
L6	10.5	16	17	23	30
L7	23	29	35	42.5	50

NG	Installation dimensions according to DIN ISO 7368
16	ISO 7368-BA-06-2-A
25	ISO 7368-BB-08-2-A
32	ISO 7368-BC-09-2-A
40	ISO 7368-BD-10-2-A
50	ISO 7368-BE-11-2-A

Tolerances according to: General tolerances ISO 2768-mK

Item explanations and **valve mounting screws** see page 23.

1) Bore center at ØD3 max.

2) Control dimension

Dimensions

1 Cover
2 Main stage
3.1 Name plate NG16
3.2 Name plate NG25 ... 40
3.3 Name plate NG50
4 Pilot control valve with proportional solenoid
5.1 Integrated electronics with position transducer and analog interface
5.2 External control electronics with position transducer. Mating connectors for valves with "M12" connector (separate order, see page 24 and data sheet 08006)
6 Space required for removing the mating connectors
7.1 Mating connectors/cable set for valves with round connector (separate order, see page 24 and data sheet 08006)
7.2 Mating connectors for valves with "K4" connector (separate order, see page 24 and data sheet 08006)
8 Port X
9 Port Y
10 Locating hole for locking pin
11 Depth of fit
12 Control dimension
13 Port B may be at any position around the central axis of port A. However, it must be observed that the mounting bores and the control bores are not damaged.
14 If a different diameter is used for port B than indicated in the dimensional table, the distance from the cover support surface to the bore center must be calculated.

Valve mounting screws (separate order)

Size	Hexagon socket head cap screws	Material number
16	**4 hexagon socket head cap screws ISO 4762 - M8 x 30 - 10.9** tightening torque M_A = 35 ±5 Nm	**R913022205**
25	**4 hexagon socket head cap screws ISO 4762 - M12 x 40 - 10.9** tightening torque M_A = 105 ±15 Nm	**R913022052**
32	**4 hexagon socket head cap screws ISO 4762 - M16 x 50 - 10.9** tightening torque M_A = 265 ±25 Nm	**R913015664**
40 **50**	**4 hexagon socket head cap screws ISO 4762 - M20 x 60 - 10.9** tightening torque M_A = 500 ±50 Nm	**R913022102**

Accessories (separate order)

Mating connectors and cable sets

Item [1]	Designation	Version	Short designation	Material number	Data sheet
5.2	Mating connectors; for sensors and valves with "M12 x 1" connector, 4-pole	straight, PG7	4PZ24	**R900773042**	08006
		straight, PG9		**R900031155**	
		angled, PG7		**R900779509**	
		angled, PG9		**R900082899**	
7.1	Mating connector; for valves with round connector, 6-pole + PE and 6-pole	straight, metal	7PZ31...M	**R900223890**	
		straight, plastic	7PZ31...K	**R900021267**	
	Cable sets; for valves with round connector, 6-pole + PE	Plastic, 3.0 m	7P Z31 BF6	**R901420483**	
		Plastic, 5.0 m		**R901420491**	
		Plastic, 10.0 m		**R901420496**	
	Mating connector; for valves with round connector, 11-pole + PE	Metal, shielded	12PN11... EMC	**R901268000**	
		Plastic, two cable outlets	12PN11...2XD8	**R900884671**	
	Cable sets; For valves with round connector, 11-pole + PE	Metal, shielded, 5.0 m	12PN11REFS EMC...BG	**R901272854**	
		Metal, shielded, 20.0 m		**R901272852**	
		Plastic, shielded, 5.0 m	12PN11REFF 2X...	**R900032356**	
		Plastic, shielded, 20.0 m		**R900860399**	
7.2	Mating connector; for valves with "K4" connector, 2-pole + PE, design A	Without circuitry, 12 ... 240 V, "a"	Z4	**R901017010**	
		Without circuitry, 12 ... 240 V, "b"		**R901017011**	

[1] See dimensions page 20 and 21.

External control electronics

	Designation	Version	Material no.	Data sheet
Modular design	VT-MRPA1-2X	Command value 0 ... 10 V	R901476413	30220
		Command value 4 ... 20 mA	R901476414	

Further information

- Hydraulic fluids on mineral oil basis — Data sheet 90220
- Environmentally compatible hydraulic fluids — Data sheet 90221
- Flame-resistant, water-free hydraulic fluids — Data sheet 90222
- Flame-resistant hydraulic fluids - containing water (HFAE, HFAS, HFB, HFC) — Data sheet 90223
- Reliability characteristics according to EN ISO 13849 — Data sheet 08012
- Hydraulic valves for industrial applications — Operating instructions 07600-B
- Selection of filters
- Information on available spare parts

Rexroth
Bosch Group

2-way proportional throttle valve for block installation

Types FE; FEE

Size 16
Component series 2X
Maximum operating pressure 315 bar
Maximum flow 190 L/min bei Δp = 10 bar

H4538

Table of contents

Contents	Page

Features

– Pilot operated 2-way proportional throttle valve for block installation
– Installation dimensions to DIN ISO 7368-BA-06-2-A
– Electrically position-controlled orifice spool
– Direction of flow A to B
– In the event of a power failure or cable break (or withdrawal of the enable [1]) the orifice spool moves automatically to the closed position and blocks the flow from A to B
– In conjunction with a pressure compensator, can be used for pressure-compensated flow control
– Type FE for external control electronics (separate order), see page 5
– Type FEE: completely matched unit with integrated electronics (OBE), optionally available with voltage or current interface

[1] Type FEE only

Ordering code

FE		16	C –2X /				*

Electrically operated
2-way proportional throttle valve
for block installation

For external control electronics = **No code**
With integrated electronics (OBE) = **E**

Size 16 = **16**

Kit = **C**

Component series 20 to 29 = **2X**
(20 to 29: unchanged installation and connection dimensions)

Flow characteristic "linear" [1)]
100 L/min = **100L**
190 L/min = **190L**

[1)] Nominal flow in L/min at Δp = 10 bar between ports A and B (see also hydraulic technical data on page 4)

Further details in clear text

Seal material
M = NBR seals, suitable for mineral oil (HL, HLP) to DIN 51524
V = FKM seals

Electronics interface (see page 7)
B1 = Command value input 0 to 10 V/ actual value output 0 to –10 V
G1 = Command value input 4 to 20 mA/ actual value output 4 to 20 mA
No code = For FE for external control electronics

Electrical connection
for FE:
K4 = **Without** cable sockets, with component plug to DIN EN 175301-803 for proportional solenoid and GSA20 made by Hirschmann for position transducer
Cable sockets – separate order, see page 6

for FEE:
K0 = **Without** cable socket, with component plug to DIN 43651, cable socket – separate order, see page 7

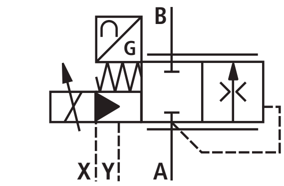
Standard type

Type	Material no.
FEE 16 C-2X/190LK0B1M	R900954413

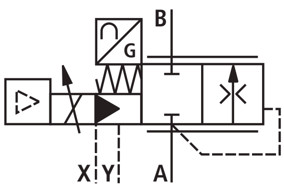
Symbols

Simplified

FE 16 C-2X/… [2)]

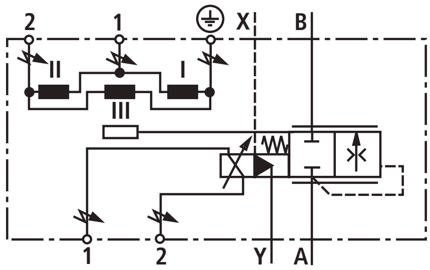


FEE 16 C-2X/… [2)]



Detailed (example of type FE)

FE 16 C-2X/…



Direction of flow: A to B (X connected with A)

☞ **Note:** Connect pilot oil port X with A or connect externally

⚠ **Caution**! In the case of external pilot oil supply at X, the pressure in X **must be** ≥ pressure in A!

[2)] **A** service port
B service port
X pilot oil supply
Y pilot oil drain

Function, section

Valves of type FE(E) are pilot operated 2-way proportional throttle valves for block installation for the infinitely variable control of a flow.

Technical structure:
The valve consists of four main assemblies:
- Cover (1) with mounting face for pilot oil ports.
- Main valve (2) with orifice spool (3).
- Pilot valve (4) with proportional solenoid (5).
- Integrated control electronics (6) (not provided for type FE) with position transducer (7).

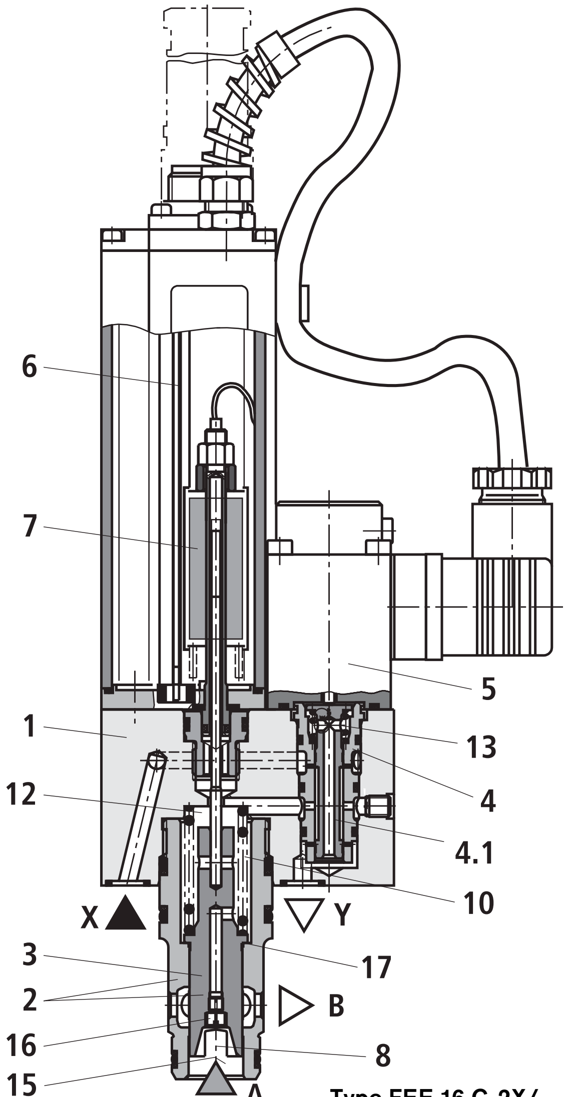
General function:
- Command value-related closed-loop position control of orifice spool (3) and therefore defined opening of orifice (8).
- The flow depends on the Δp across orifice (8) and the position of orifice spool (3).
- Actual value acquisition of the position of orifice spool (3) by position transducer (7); command/actual value comparison in electronics (6); deviations are conditioned and passed on to proportional solenoid (5) of pilot valve (4) in the form of a control output for correcting the position of orifice spool (3).
- Area ratio of area (15) to area (12) = 1 : 1.
- Direction of flow A → B; connect X to A or connect externally.
- **Caution!** With external pilot oil supply, the pressure in X must be ≥ pressure in A to ensure proper functioning of the valve.
- A pilot oil by-pass via nozzle (16) increases vibration damping.
- When the enable is withdrawn, orifice spool (3) moves against mechanical limit stop (17) in the valve bushing (closed position) and blocks the flow A → B.
- The orifice spool position is already controlled at a command value of 0 V or 4 mA, with orifice (8) still being in the positive overlap position and closing A → B.
- For leakage across orifice spool (3) and pilot valve (4) at command 0 V or 4 mA and inactive enable, see Technical data on page 4.

Function of opening orifice spool:
Flow A → B and A connected with X
- Proportional solenoid (5) shifts pilot spool (4.1) against spring (13) and opens the connection between control chamber (12) and Y; the pressure in control chamber (12) is reduced, and orifice spool (3) moved to the direction of opening by the pressure in A that acts on area (15).

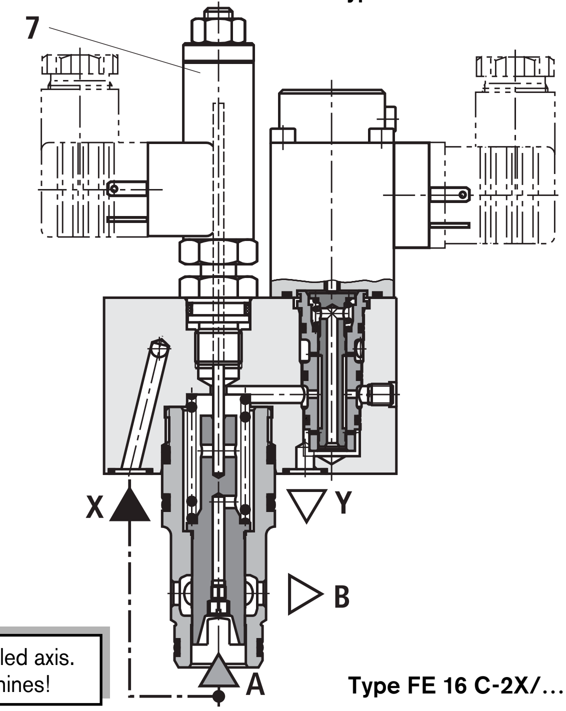
Function of closing orifice spool:
Flow A → B and A connected with X
- Current reduced in proportional solenoid (5); spring (13) shifts pilot spool (4.1) against the proportional solenoid and opens the connection between X and control chamber (12); pressure builds up in control chamber (12); the pressure acting on the orifice spool area in control chamber (12) plus spring force (10) shift orifice spool (3) in the closing direction.

Flow control function:
- In conjunction with a pressure compensator, can be used for the pressure-compensated control of a flow.

Failure of the supply voltage:
- The integrated electronics de-energises the solenoid in the event of a supply voltage failure or cable break in position transducer (7).
- The spool is shifted to the closed position by the pressure applied to pilot port X plus spring force (10) and blocks the flow A → B.



Type FEE 16 C-2X/…



Type FE 16 C-2X/…

⚠ **Caution:** A voltage supply failure results in a sudden standstill of the controlled axis. Accelerations that can occur in conjunction with this can cause damage to machines!

Technical data (for applications outside these parameters, please consult us!)

General

Weight	– FE	kg	2.7
	– FEE	kg	2.9
Installation orientation			Optional
Storage temperature range		°C	– 20 to + 80
Ambient temperature range	– FE	°C	– 20 to + 70
	– FEE	°C	– 20 to + 50

Hydraulic (measured with HLP 46; $\vartheta_{oil} = 40\ °C \pm 5\ °C$)

Max. operating pressure	– Ports A, B	bar	315
Max. pilot pressure	– Port X	bar	315
Return flow pressure	– Port Y		At zero pressure to tank
Min. inlet pressure	– in A (direction of flow A → B)	bar	7
Max. flow $q_{V\max}$ of main valve at Δp 10 bar	Direction of flow A → B	L/min	190
Pilot oil volume for switching process from seated position	0 → 100%	cm^3	0.9
Max. pilot oil flow in port Y:	With stepped input signal	L/min	2.5
Direction of flow			A → B
Pilot oil port			Connect X to A or connect externally. ⚠ **Caution!** With external pilot oil supply, the pressure in X must be ≥ pressure in A.
Leakage fluid	– State: Command value 0 V or 4 mA		From A → B, see characteristic curve on page 9 Max. 0.4 L/min from A → X and across the nozzle in the main spool to Y at Δp 315 bar
	– State: Enable inactive (solenoid de-energised)		Max. 1 .5 L/min from A → B at Δp 315 bar; max. 0.2 L/min from A → X and across the nozzle in the main spool to Y at Δp 315 bar
Hydraulic fluid			Mineral oil (HL, HLP) to DIN 51524; further hydraulic fluids on enquiry!
Hydraulic fluid temperature range		°C	– 20 to + 80
Viscosity range		mm^2/s	15 to 380
Max. permissible degree of contamination of the hydraulic fluid			
Cleanliness class to ISO 4406 (c)	– Pilot valve		Class 17/15/12 [1]
	– Main valve		Class 20/18/15/ [1]
Hysteresis		%	< 0.2
Response sensitivity		%	< 0.1
Range of inversion		%	< 0.15

[1] The cleanliness classes specified for components must be adhered to in hydraulic systems. Effective filtration prevents malfunction and, at the same time, prolongs the service life of components.

For the selection of filters, see data sheets RE 50070, RE 50076, RE 50081, RE 50086 and RE 50088.

Technical data (for applications outside these parameters, please consult us!)

Type FE – external control electronics

Electrical, solenoid (pilot valve for type FE)

Type of voltage		V	24 DC
Nominal current		mA	1000
Coil resistance	– Cold value at 20 °C	Ω	12.7
	– Max. hot value	Ω	19.3
Duty cycle		%	100
Electrical connection			With component plug to DIN EN 175301-803
			Cable socket to DIN EN 175301-803 [1]
Type of protection of the valve to EN 60529			IP65 with cable socket mounted and locked

Electrical, inductive position transducer (main stage)

Coil resistance	Total resistance of coils between		1 and 2	2 and ⏚	⏚ and 1
at 20 °C (see Symbols on page 2)		Ω	31.5	45.5	31.5
Inductance		mH	6 to 8		
Oscillator frequency		kHz	2.5		
Electrical connection			With component plug GSA20 made by Hirschmann		
			Cable socket GM209N (Pg9) made by Hirschmann [1]		
Type of protection to EN 60529			IP65 with cable socket mounted and locked		
Electrical position measuring system			Differential throttle		

Control electronics (type FE only; separate order)

Amplifier in Euro-card format	analogue	VT-VRPA1-50-1X to data sheet RE 30117

Type FEE – integrated electronics (OBE)

Electrical

Duty cycle		%	100
Current consumption	– I_{max}	A	1.3
	– Pulse load	A	1.5
Electrical connection			With component plug to DIN 43651
			Cable socket to DIN 43651 11-pin + PE/Pg16 [2]
Type of protection of the valve			IP65 with cable socket mounted and locked
Control electronics			Integrated in the valve (see page 8)

[1] Separate order, see page 6

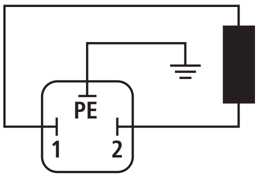
[2] Separate order, see page 7

☞ **Note:** For details regarding **environment simulation testing** in the fields of EMC (electromagnetic compatibility), climate and mechanical stress, see RE 29202-U (declaration on environmental compatibility).

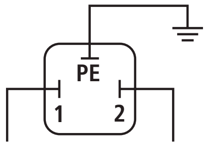
Electrical connection, cable sockets (nominal dimensions in mm)

Type FE – for external ontrol electronics

Connection to component plug

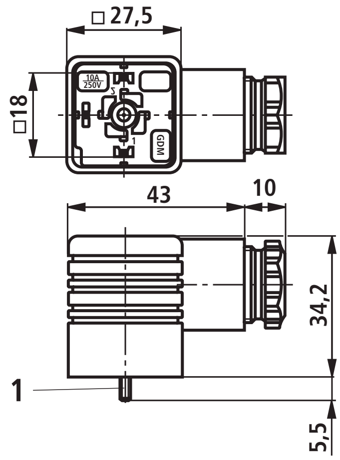


Connection to cable socket



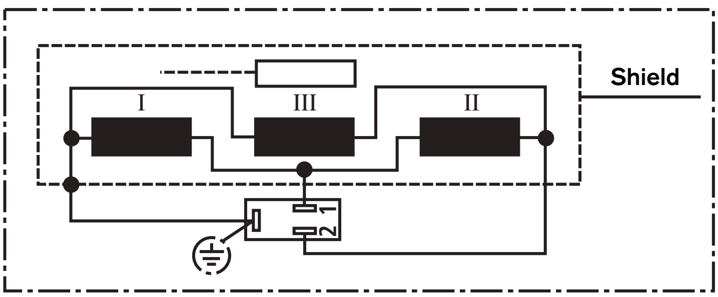
to amplifier

Cable socket to DIN EN 175301-803
Separate order stating material no. **R901017011**
(plastic version)

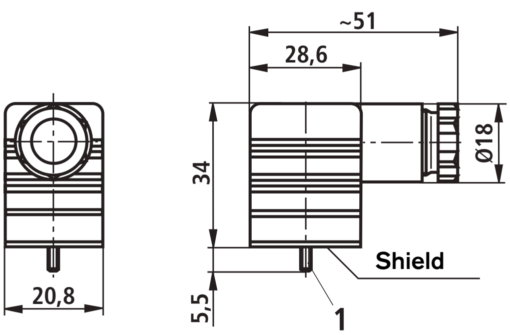


1 Fixing screw M3
Tightening torque $M_T = 0.5$ Nm

Inductive position transducer



Cable socket GM209N (Pg 9) made by Hirschmann
Separate order stating material no. **R900013674**
(plastic version)



1 Fixing screw M3
Tightening torque $M_T = 0,5$ Nm

Electrical connection, cable sockets (nominal dimensions in mm)

Type FEE – with integrated electronics (OBE)

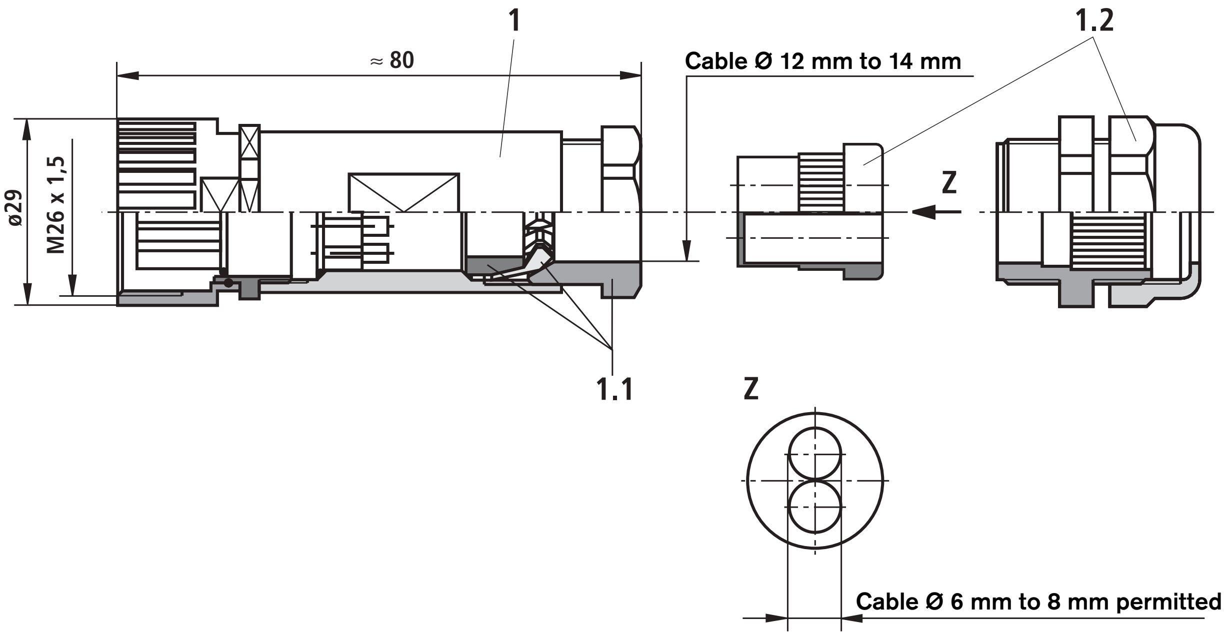
Cable socket to DIN 43651/11-pin + PE/Pg16

Separate order stating material no. **R900884671** (plastic version)

Assembly consisting of items 1 and 1.1 or items 1 and 1.2, type of protection IP65

Note:

- If **one** cable is used, combine item 1 with item 1.1
- If **two** cables are used, combine item 1 with item 1.2



Pin	Function	Conditions	
1	Operating voltage +UL	$U_O = 24$ VDC; $u_O(t)_{max} = 36$ V; $u_O(t)_{min} = 21{,}6$ V	
2	Ground L0		
3	Enable input / reference for pin 2	log 1 = 10 V to 36 V; log 0 = $U < 8$ V	
		Type **FEE…/…B1…**	Type **FEE…/…G1…**
		Voltage interface	Current interface
4	Command value input	0 V to + 10 V ($R_i > 50$ kΩ)	+ 4 mA to + 20 mA / load = 100 Ω
5	Command value input, reference		
6	Actual value output	0 V to – 10 V ($I_{max} = 5$ mA)	+ 4 mA to + 20 mA / load ≤ 500 Ω
7	Actual value output, reference		
8	free		
9	free		
10	free		
11	Ready for operation (output)	Valve not ready for operation: Valve ready for operation: Reference – pin 2:	$U_{Pin11} < 8$ V; $U_{Pin11} = U_O - 3$ V (I_{max} against 0 V; 50 mA);
PE	Protective conductor ⏚		

Recommended connecting cable – Up to 25 m → min. 0.75 mm^2 per wire
– Up to 50 m → min. 1.5 mm^2 per wire
– Connect shield to PE only on the supply side

Integrated electronics (OBE) bei Type FEE

Function

1. Making operation/disturbance characteristic:

After the supply voltage of 24 V was applied, the electronics is ready for operation, if the following conditions are fulfilled:

- Operating voltage $U_O > 18$ VDC
- The internal ± 7.5 V supply voltage is symmetrical
- The connection to the position transducer is not interrupted.
- The command value cable is not interrupted (only with 4 mA to 20 mA interface)

If one of these conditions is not fulfilled, the controller and the output stage are blocked and the signal “ready for operation” is set to < 8 V.

2. Normal operation

When the enable is inactive (< 8 V) and an optional command value is fed forward (0 to 10V or 4 to 20 mA) the orifice spool is in the seated position and blocks the flow from A to B.

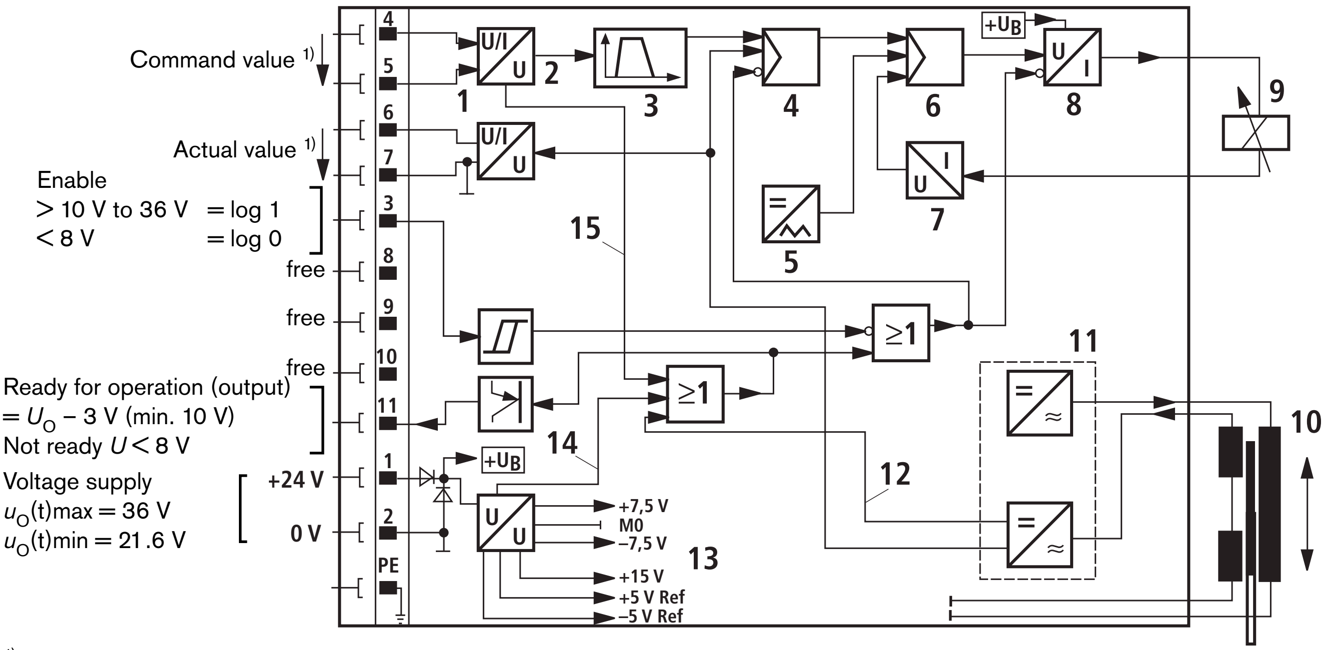
By applying a voltage > 10 V to the enable, the position controller for the orifice spool and the output stage for the pilot valve are switched on. At the same time, the position controller (PID) compares the actual value of the orifice spool position with the applied command value, and a control output is fed to the output stage, which changes the solenoid current until the orifice spool position corresponds to the command value.

The actual value of the orifice spool position is sensed by an inductive position transducer. The signal of the latter is rectified by the demodulator and fed back to the PID-controller.

The following output signals are available on the plug:

- Actual position value FEE.../...B1 (pin 6)
  - 0 V to – 10 V corresponds to 0 % to 100 % valve opening
  - Orifice spool at mechanical limit stop → actual value > 0.2 V
- Actual position value FEE.../...G1 (pin 6)
  - 4 mA to 20 mA corresponds to 0 % to 100 % valve opening
  - Orifice spool at mechanical limit stop → actual value < 3.65 mA
- Signal “ready for operation” (pin 11)
  - All conditions listed above are fulfilled → > 10 V
  - One of the conditions is not fulfilled → < 8V

Block circuit diagram / pin assignment of integrated electronics



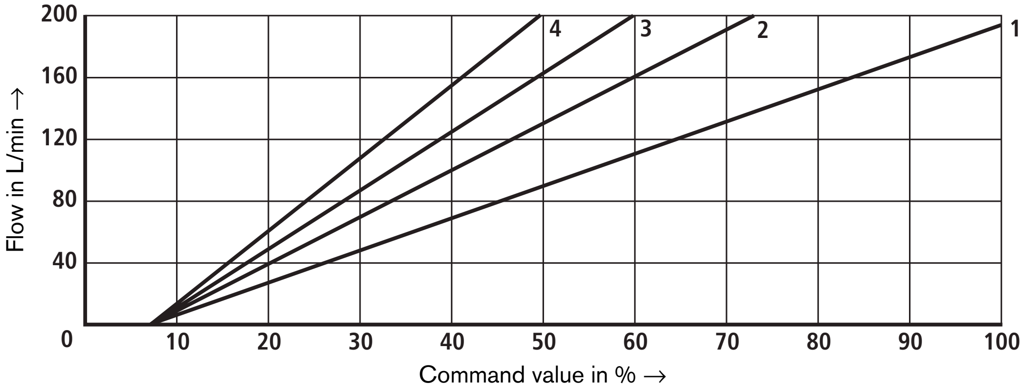
[1] With current version (4 mA to 20 mA), please observe:
Between connections 5 and 4, load = 100 Ω
Between connections 6 and 7, load ≤ 500 Ω

1 Input
2 Output
3 Fixed ramp
4 Position controller
5 Clock pulse
6 Current regulator
7 I/U converter
8 Output stage
9 Proportional solenoid
10 Position transducer
11 Oscillator / demodulator
12 Fault signal of position transducer
13 Power supply unit
14 Fault signal in the event of $+U_O$ undervoltage and asymmetry in the power supply unit
15 Cable break signal with current command value

Characteristic curves (measured with HLP 46 and $\vartheta_{oil} = 40\ °C \pm 5\ °C$)

Flow characteristic linear

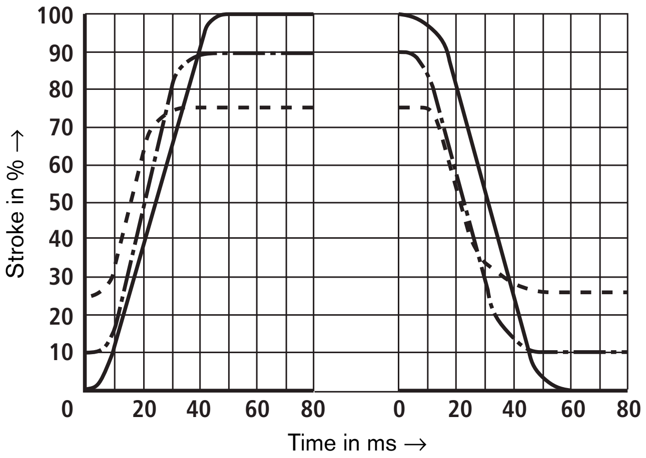
FE(E) 16 C…



1 $\Delta p =$ 10 bar
2 $\Delta p =$ 20 bar
3 $\Delta p =$ 30 bar
4 $\Delta p =$ 50 bar

Transient function with stepped command value change [1)]

FE(E) 16 C…

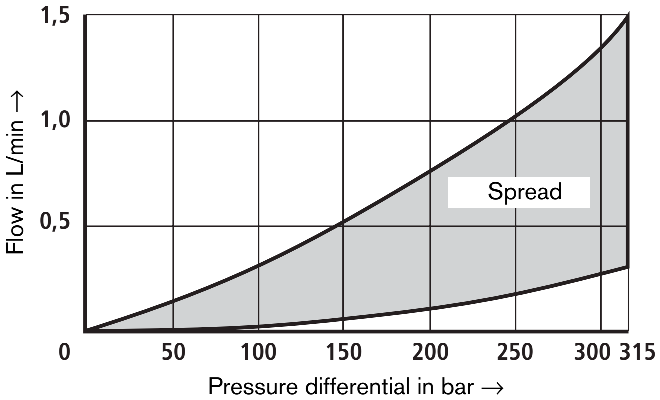


Step responses
0 – 100 – 0 %
10 – 90 – 10 %
25 – 75 – 25 %

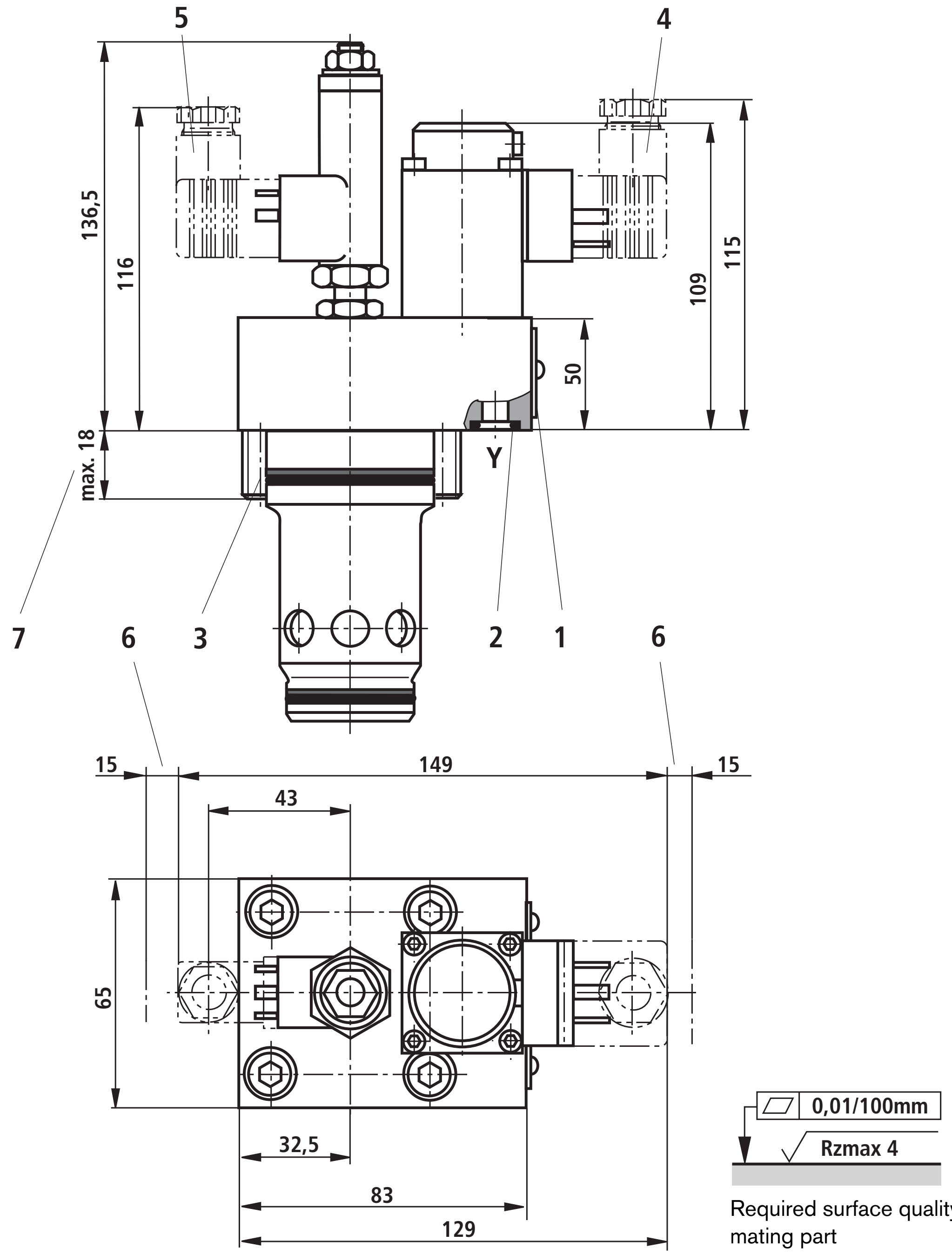
1) Measurement conditions
Pressure in A = 50 bar
Command value change 0 → 100%
Pressure in A < 50 bar → actuating time extends
Pressure in A > 50 bar → actuating time shortens
Command value change 100 → 0%
No change in actuating time, if pressure in X = A

Leakage from A → B in dependence upon the pressure differential Δp (command value 0 V or 4 mA, resp.)

FE(E) 16 ../..190L..



Unit dimensions: Type FE (nominal dimensions in mm)



Required surface quality of mating part

1 Nameplate

2 Identical seal rings for ports X and Y

3 Valve fixing screws
(included in the scope of supply)
4 socket head cap screws M8 x 35 to ISO 4762-10.9
(friction coefficient 0.09 ... 0.14 to VDA 235-101)
Tightening torque M_T = 25 Nm

4 Cable socket to DIN EN 175301-803
Separate order, see page 6

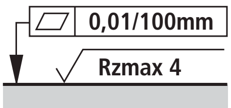
5 Cable socket GM209N (Pg 9) made by Hirschmann
Separate order, see page 6

6 Space required to remove cable socket

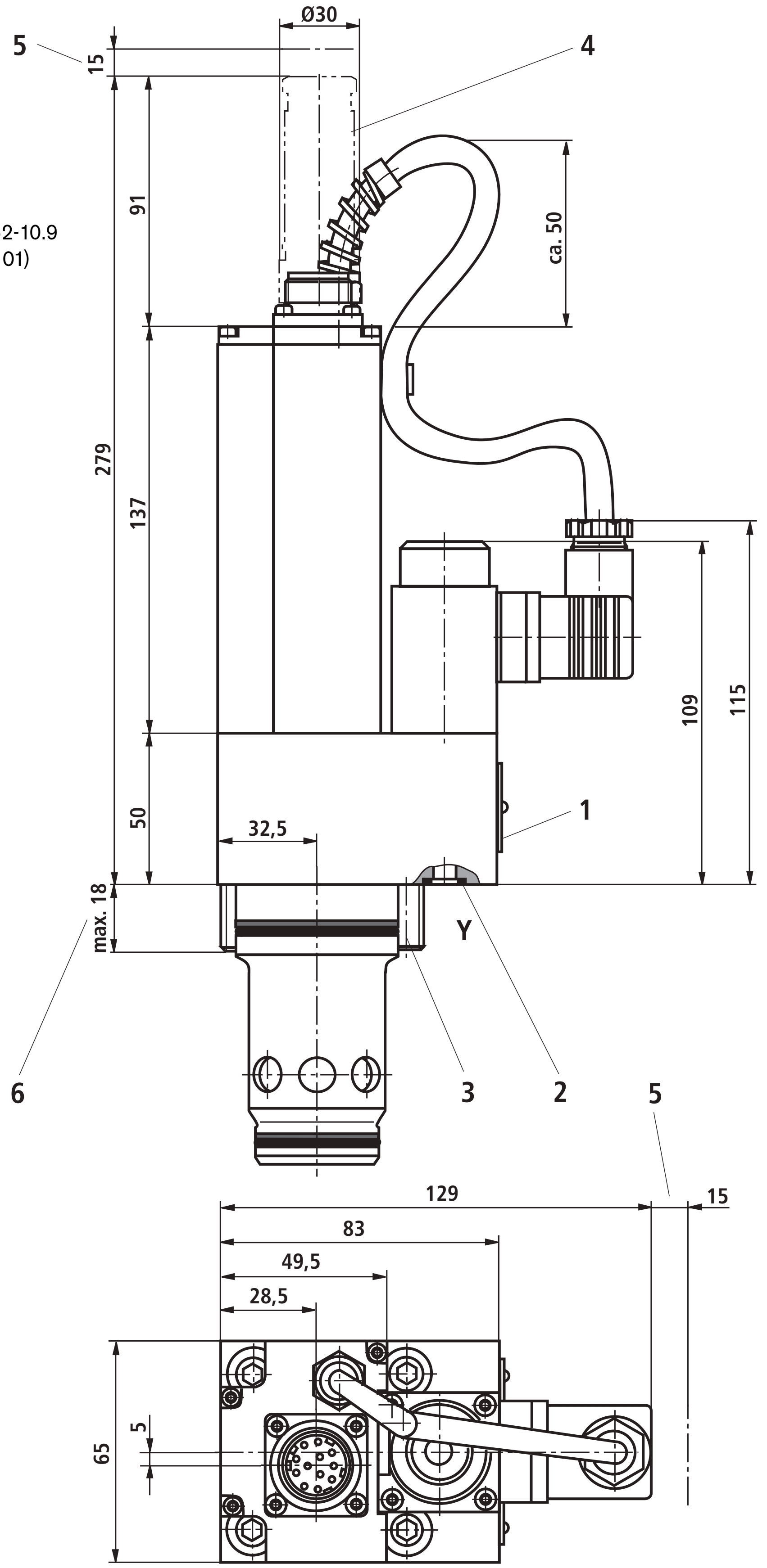
7 Screw-in length of valve fixing screws

Unit dimensions: Type FEE (nominal dimensions in mm)

1 Nameplate
2 Identical seal rings for ports X and Y
3 Valve fixing screws
(included in the scope of supply)
4 socket head cap screws M8 x 35 to ISO 4762-10.9
(friction coefficient 0.09 ... 0.14 to VDA 235-101)
Tightening torque $M_T = 25$ Nm
4 Cable socket to DIN 43651
11-pin + PE/Pg16
Separate order, see page 7
5 Space required to remove cable socket
6 Screw-in length of valve fixing screws



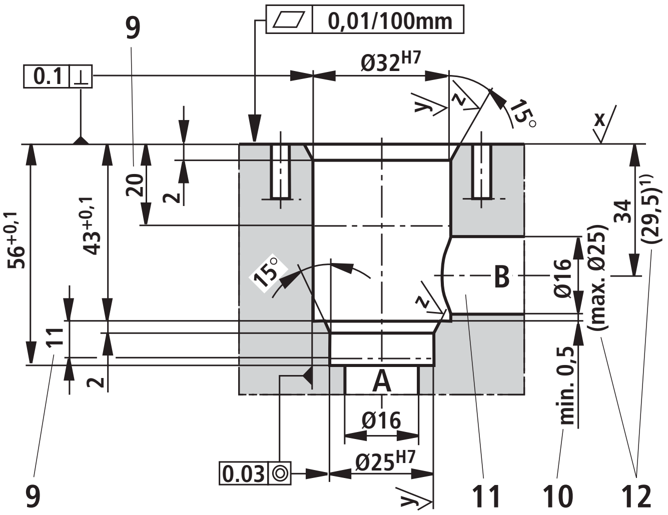
Required surface quality of mating part



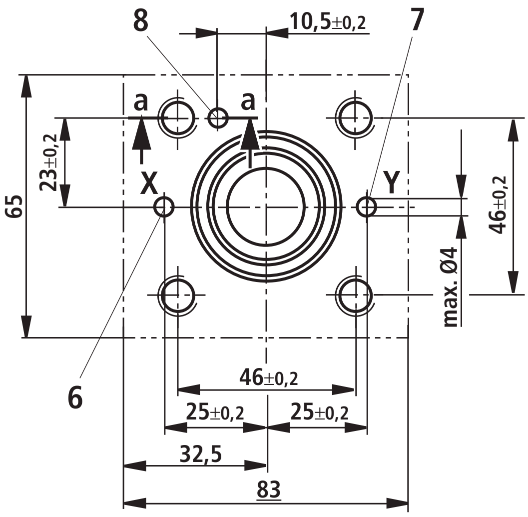
Installation dimensions (nominal dimensions in mm)

Installation dimensions to DIN ISO 7368-BA-06-2-A

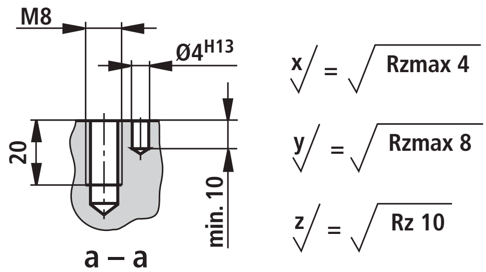
6 Port X
7 Port Y
8 Locating bore for locating pin
9 Depth of fit
10 Reference dimension
11 Port B can optionally be arranged around the central axis of port A. However, care must be taken that the fixing bores and pilot bores are not drilled.
12 In the case of a diameter of port B other than specified, the distance from the cover contact face to the centre of the bore must be calculated.



1) Minimum distance (29.5 mm) with maximum diameter (Ø25 mm)



Tolerances to:
– General tolerances ISO 2768-mK

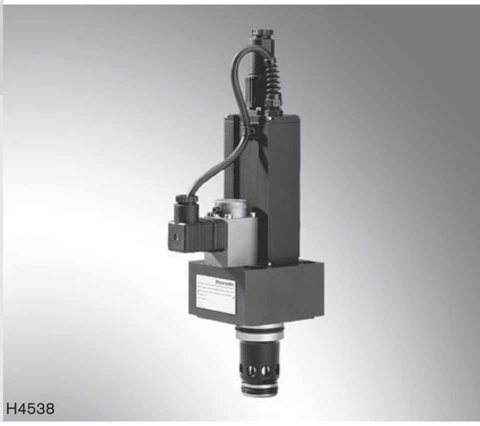


2-way proportional throttle valve for block installation

RE 29209/04.07
Replaces: 07.05

Types FES; FESE

Sizes 25 to 63
Component series 3X
Maximum operating pressure 315 bar
Maximum flow 1800 l/min at $\Delta p = 10$ bar



H4538

Table of contents

Features

– Pilot operated 2-way proportional throttle valve for block installation
– Installation dimensions to DIN ISO 7368
– Orifice spool electrically closed-loop position controlled
– Flow in both directions
– In the event of a power failure, cable break or withdrawal of the enable, the orifice spool automatically moves to the seated position and blocks the flow in both directions
– Can be used in conjunction with a pressure compensator for pressure-compensated flow control
– Type FES for external control electronics (separate order), see page 5
– Type FESE: completely matched unit with integrated electronics (OBE), optionally available with voltage or current interface

Ordering code

FES			C	A –3X /				*

For external control electronics = **No code**
With integrated electronics (OBE) = **E**

Size 25 = **25**
Size 32 = **32**
Size 40 = **40**
Size 50 = **50**
Size 63 = **63**

Kit = **C**

Direction of flow
A to B (X connected to A)
B to A (X connected to B) = **A**

Component series 30 to 39 = **3X**
(30 to 39: unchanged installation and connection dimensions)

Flow characteristics "linear" [1)]
Size 25 up to 315 l/min = **315L**
Size 32 up to 450 l/min = **450L**
Size 40 up to 670 l/min = **670L**
Size 50 up to 1400 l/min = **1400L**
Size 63 up to 1800 l/min = **1800L**

[1)] Nominal flow in L/min at Δp 10 bar between ports A and B (see also hydraulic technical data on page 4)

Further details in clear text

Seal material
M = NBR seals, suitable for mineral oil (HL, HLP) to DIN 51524
V = FKM seals

Electronics interface
(see page 7)
B1 = Command value input 0 to 10 V/ actual value output 0 to –10 V
G1 = Command value input 4 to 20 mA/ actual value output 4 to 20 mA
No code = For FES for external control electronics

Electrical connection
For FES:
K4 = **Without** cable sockets, with component plug to DIN EN 175301-803 for proportional solenoid and GSA20 made by Hirschmann for position transducer
Cable sockets – separate order, see page 6

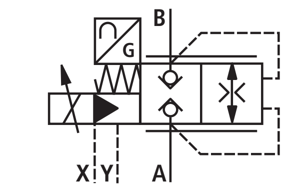
For FESE:
K0 = **Without** cable socket, with component plug to DIN 43651, cable socket – separate order, see page 7

Standard types

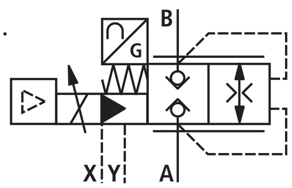
Type	Material no.
FESE 25 CA-3X/315LK0B1M	R900973604
FESE 32 CA-3X/450LK0B1M	R900973605
FESE 40 CA-3X/670LK0B1M	R900973607
FESE 50 CA-3X/1400LK0B1M	R900954504
FESE 63 CA-3X/1800LK0B1M	R900954505

Symbols

Simplified
FES .. CA-3X/…

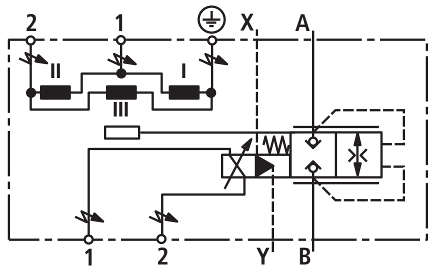


FESE .. CA-3X/…



Direction of flow: A to B (X connected with A)
B to A (X connected with B)

Detailed
(example of FES)
FES .. CA-3X/…



A = service port
B = service port
X = pilot oil supply
Y = pilot oil drain

Function, section

Valve types FES(E) are pilot operated 2-way proportional throttle valves for block installation for the infinitely variable control of a flow.

Technical structure:

The valve consists of four main assemblies:

– Cover (1) with mounting face for pilot oil ports.
– Main valve (2) with orifice spool (3).
– Pilot valve (4) with proportional solenoid (5).
– Integrated control electronics (6) (not provided for type FES) with position transducer (7).

General function:

– Command value-related closed-loop position control of orifice spool (3) and therefore defined opening of orifice (8).
– The flow depends on the Δp across orifice (8) and the position of orifice spool (3).
– Actual value acquisition of the position of orifice spool (3) by position transducer (7); command/actual value comparison in electronics (6); deviations are conditioned and passed on to proportional solenoid (5) of pilot valve (4) in the form of a control output for correcting the position of orifice spool (3).
– Area ratio of area (14) to area (15) = 2 : 1 for size 25; 32; 40, and 1.6 : 1 for size 50; 63.
– Direction of flow A → B (connect X with A); direction of flow B → A (connect X with B); external pilot oil supply via X possible.
– When the enable is withdrawn, orifice spool (3) moves onto valve seat (9) and closes the direction of flow A ↔ B leak-free. Spool seal (11) ensures the leak-free isolation of port B from control chamber (12); with internal pilot oil supply, take leakage oil from X via the pilot valve to Y into account!
– Orifice spool position is already controlled at a command value of 0 V or 4 mA, with orifice (8) still being in the positive overlap position.

Function of opening orifice spool:

(Assumption: flow A → B and A connected with X)

• Proportional solenoid (5) shifts pilot spool (4.1) against spring (13) and opens the connection between control chamber (12) and Y; the pressure in control chamber (12) is reduced and orifice spool (3) moved to the direction of opening by the pressure in A that acts on area (15) plus the pressure in B that acts on the annulus area (16).

Function of closing orifice spool:

(Assumption: flow A → B and A connected with X)

• Current reduced in proportional solenoid (5); spring (13) shifts pilot spool (4.1) against the proportional solenoid and opens the connection between X and control chamber (12); the pressure acting on area (14) plus spring force (10) shift orifice spool (3) in the closing direction.

Flow control function:

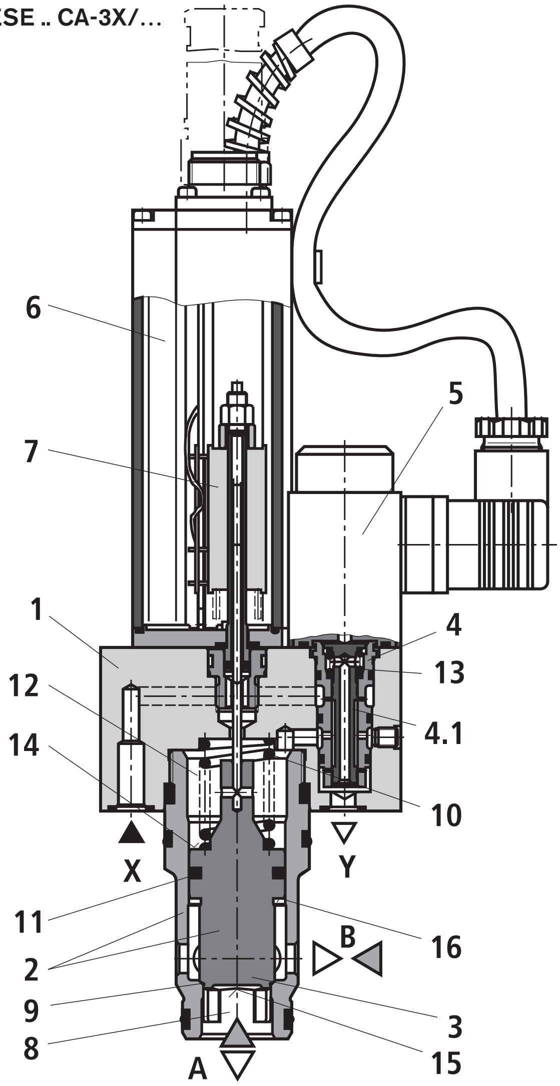
• In conjunction with a pressure compensator, can be used for the pressure-compensated control of a flow.

Failure of supply voltage:

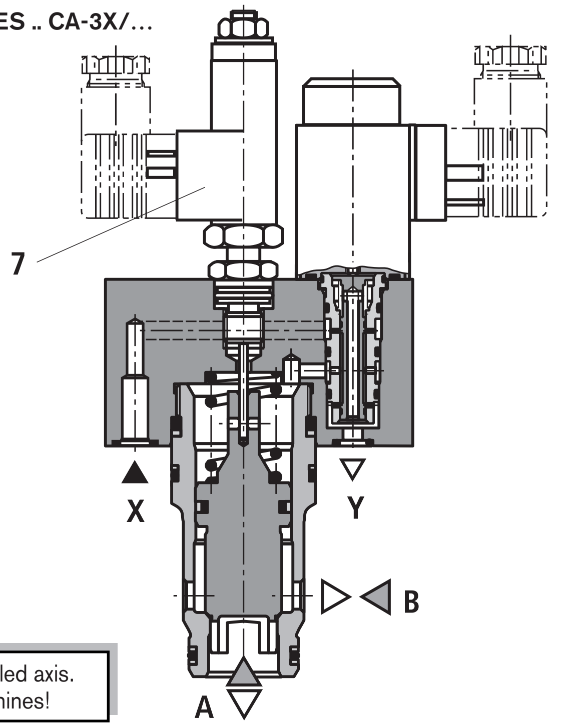
• The integrated electronics de-energises the solenoid in the event of a supply voltage failure or cable break in position transducer (7).
• The spool is shifted to valve seat (9) by the pressure applied to pilot port X plus spring force (10) and blocks the flow A → B.

⚠ **Caution:** A voltage supply failure results in a sudden standstill of the controlled axis. Accelerations that can occur in conjunction with this can cause damage to machines!

Type FESE .. CA-3X/…



Type FES .. CA-3X/…



Technical data (for applications outside these parameters, please consult us!)

General

Size			25	32	40	50	63
Weight	– FES	kg	3.8	5.5	8.2	12.5	21
	– FESE	kg	4	5.7	8.4	12.7	21 .2
Installation orientation			Optional				
Storage temperature range		°C	– 20 to + 80				
Ambient temperature range	– FES	°C	– 20 to + 70				
	– FESE	°C	– 20 to + 50				

Hydraulic (measured with HLP 46; $\vartheta_{oil} = 40\ °C \pm 5\ °C$)

Size			Size	25	32	40	50	63
Max. operating pressure	– Ports A, B		bar	315				
Max. pilot pressure	– Port X		bar	315				
Return flow pressure	– Port Y			At zero pressure to tank				
Min. inlet pressure	– in A (direction of flow A → B)		bar	12	15	15	20	20
	– in B (direction of flow B → A)		bar	15	20	20	25	25
Max. flow q_{Vmax} of main valve at Δp 10 bar	– Direction of flow A → B		l/min	360	480	680	1400	1800
	– Direction of flow B → A		l/min	330	460	585	1400	1800
Pilot oil volume for switching process from seated position → 100%			cm^3	3.9	7.6	12	23.4	52
Max. pilot oil volume in port Y:	– With stepped input signal		l/min	5.0	6.5	10	12	17
Pilot oil volume	at control position (0 to 100% command value) from X via pilot valve to Y		l/min	< 0.3 for all sizes				
Direction of flow	– Internal pilot oil supply	A → B		Connect A to X				
		B → A		Connect B to X				
	– External pilot oil supply	A → B		Pressure at X > pressure in A				
		B → A		Pressure at X > pressure in B				
Leakage fluid	– State:	Command value 0 V or 4 mA, from A → B / B → A in dependence on Δp		See characteristic curves on pages 9 to 14				
		from A → X / B → X via pilot control to Y at $p = 315$ bar		< 0.3 for all sizes				
	– State:	Enable inactive		A → B / B → A leak-free isolation				
		Solenoid de-energised ("fail-safe" position)		⚠ **Caution!** In the case of internal pilot oil supply, observe leakage from A or B to X via the pilot valve to Y. $q_V < 0.2$ l/min at $\Delta p = 315$ bar With external pilot oil supply to X, this fluid loss caused by leakage from A or B can be avoided. The external pressure at X must be ≥ the pressure in A with direction of flow A → B and ≥ the pressure in B with direction of flow B → A.				
Hydraulic fluid				Mineral oil (HL, HLP) to DIN 51524; further hydraulic fluids on enquiry!				
Hydraulic fluid temperature range			°C	– 20 to + 80				
Viscosity range			mm^2/s	15 to 380				
Max. permissible degree of contamination of the hydr. fluid Cleanliness class to ISO 4406 (c)	– Pilot valve			Class 17/15/12 [1]				
	– Main valve			Class 20/18/15/ [1]				
Hysteresis			%	< 0.2				
Response sensitivity			%	< 0.1				
Range of inversion			%	< 0.15				

Technical data (for applications outside these parameters, please consult us!)

Type FES – external control electronics

Electrical, solenoid (pilot valve)

Type of voltage		V	24 DC
Nominal current		mA	1000
Coil resistance	– Cold value at 20 °C	Ω	12.7
	– Max. hot value	Ω	19.3
Duty cycle		%	100
Electrical connection			With component plug to DIN EN 175301-803
			Cable socket to DIN EN 175301-803 2)
Type of protection of the valve to EN 60529			IP65 with cable socket mounted and locked

Electrical, inductive position transducer (main stage; only for type FES)

Coil resistance	Total resistance of coils between		1 and 2	2 and ⏚	⏚ and 1
at 20 °C (see Symbols on page 2)		Ω	31.5	45.5	31.5
Inductance		mH	6 to 8		
Oscillator frequency		kHz	2.5		
Electrical connection			With component plug GSA20 made by Hirschmann		
			Cable socket GM209N (Pg9) made by Hirschmann 2)		
Type of protection to EN 60529			IP65 with cable socket mounted and locked		
Electrical position measuring system			Differential throttle		

Control electroncis (only for type FES; separate order)

Amplifier in Euro-card format		Size	25	32	40	50	63
	to data sheet RE 30117	analogue	VT-VRPA1-50	VT-VRPA1-51		VT-VRPA1-52	
Amplifier of modular design to data sheet RE 29756		analogue	VT 11037				

Type FESE – integrated electronics (OBE)

Electrical

Current consumption	– I_{max}	A	1.3
	– Pulse load	A	1.5
Duty cycle		%	100
Electrical connection			With component plug to DIN 43651
			Cable socket to DIN 43651 11-pin + PE/Pg16 3)
Type of protection of the valve			IP65 with cable socket mounted and locked
Control electronics			Integrated in the valve (see page 8)

1) The cleanliness classes specified for components must be adhered to in hydraulic systems. Effective filtration prevents malfunction and, at the same time, prolongs the service life of components.
For the selection of filters, see data sheets RE 50070, RE 50076, RE 50081, RE 50086 and RE 50088.

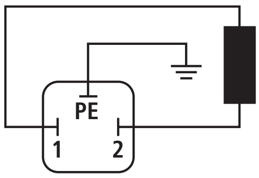
2) Separate order, see page 6

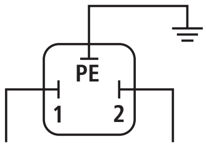
3) Separate order, see page 7

☞ **Note:** Details with regard to **environment simulation testing** in the fields of EMC (electromagnetic compatibility), climate and mechanical stress, see RE 29209-U (declaration on environmental compatibility).

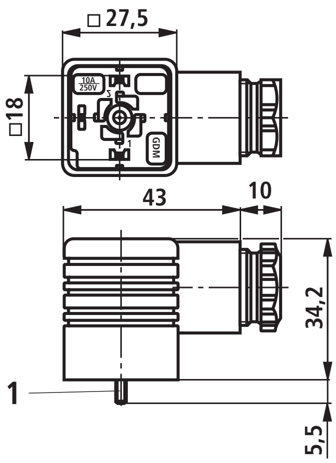
Electrical connection, cable sockets (nominal dimensions in mm)

Type FES – for external control electronics



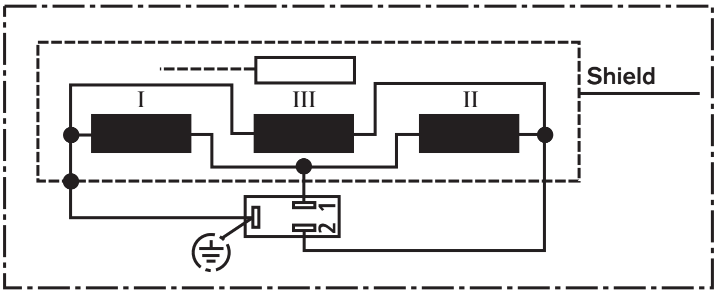


Cable socket to DIN EN 175301-803
Separate order stating material no. **R901017011**
(plastic version)

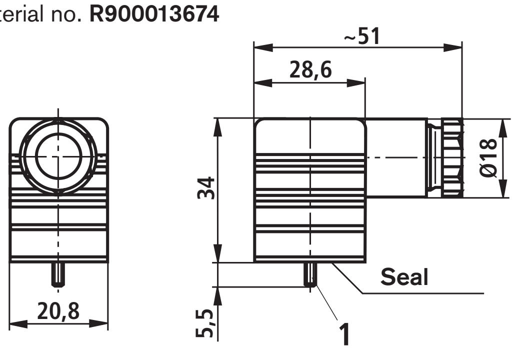


1 Fixing screw M3
Tightening torque M_T = 0.5 Nm

Inductive position transducer



Cable socket GM209N (Pg9) made by Hirschmann
Separate order stating material no. **R900013674**
(plastic version)



1 Fixing screw M3
Tightening torque M_T = 0.5 Nm

Electrical connection, cable sockets (nominal dimensions in mm)

Type FESE – with integrated electronics (OBE)

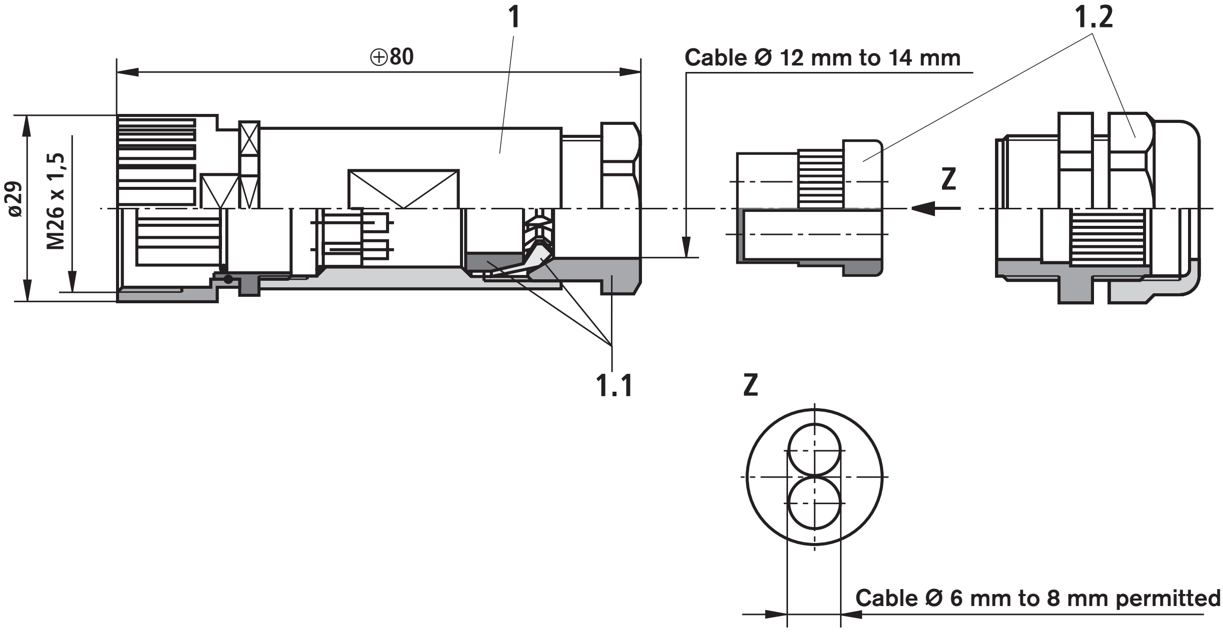
Cable socket to DIN 43651/11-pin + PE/Pg16

Separate order stating material no. **R900884671** (plastic version)

Assembly consisting of items 1 and 1.1 or items 1 and 1.2, type of protection IP65

Note:

- If you use **one** cable, combine item 1 with item 1.1
- If you use **two** cables, combine item 1 with item 1.2



Pin	Function	Conditions	
1	Operating voltage +UL	U_O = 24 VDC; $u_O(t)_{max}$ = 36 V; $u_O(t)_{min}$ = 21.6 V	
2	Ground L0		
3	Enable input / reference for pin 2	log 1 = 10 V to 36 V; log 0 = U < 8 V	
		Type **FESE.../...B1...**	Type **FESE.../...G1...**
		Voltage interface	Current interface
4	Command value input	0 V to + 10 V (R_I > 50 kΩ)	+ 4 mA to + 20 mA / load = 100 Ω
5	Command value input, reference		
6	Actual value output	0 V to – 10 V (I_{max} = 5 mA)	+ 4 mA to + 20 mA / load ≤ 500 Ω
7	Actual value output, reference		
8	free		
9	free		
10	free		
11	Ready for operation (output)	Valve not ready for operation:	U_{Pin11} < 8 V;
		Valve not ready for operation:	$U_{Pin11} = U_O - 3$ V
		Reference – pin 2:	(I_{max} against 0 V; 50 mA);
PE	Protective conductor ⏚		

Recommended connecting cable
- Up to 25 m → min. 0.75 mm² per wire
- Up to 50 m → min. 1.5 mm² per wire
- Connect shield to PE only on the supply side

Integrated electronics (OBE) of type FESE

Function

1. Making operation/disturbance characteristic:

After the supply voltage of 24 V was applied, the electronics is ready for operation, if the following conditions are fulfilled:

– Operating voltage $U_O > 18$ VDC

– The internal ± 7.5 V supply voltage is symmetrical

– The connection to the position transducer is not interrupted.

– The command value cable is not interrupted (only with 4 mA to 20 mA interface)

If one of these conditions is not fulfilled, the controller and the output stage are blocked and the signal “ready for operation” is set to < 8 V.

2. Normal operation

When the enable is inactive (< 8 V) and an optional command value is fed forward (0 to 10V or 4 to 20 mA) the orifice spool is in the seated position and blocks the flow from A to B.

By applying a voltage > 10 V to the enable, the position controller for the orifice spool and the output stage for the pilot valve are switched on. At the same time, the position controller (PID) compares the actual value of the orifice spool position with the applied command value, and a control output is fed to the output stage, which changes the solenoid current until the orifice spool position corresponds to the command value.

The actual value of the orifice spool position is sensed by an inductive position transducer. The signal of the latter is rectified by the demodulator and fed back to the PID-controller.

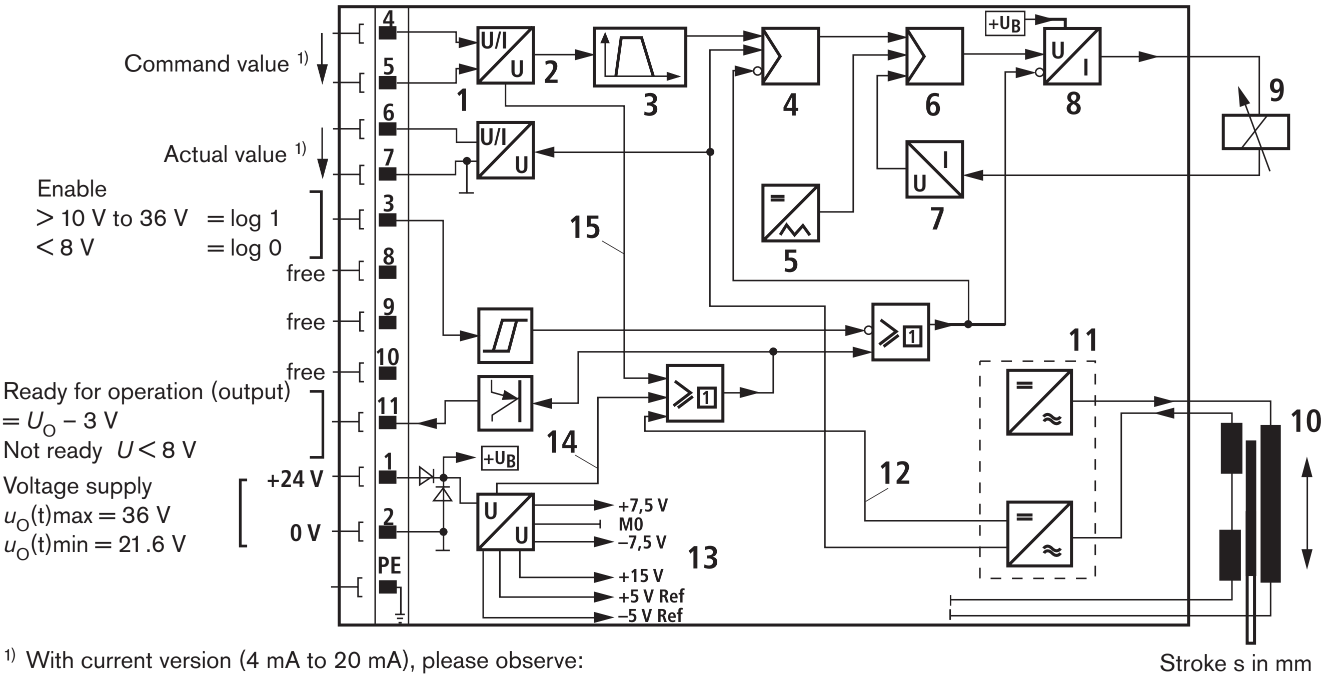
The following output signals are available on the plug:

– Actual position value FESE.../...B1 (pin 6)
  • 0 V to – 10 V corresponds to 0 % to 100 % valve opening
  • Orifice spool in seated position → actual value > 0.8 V

– Actual position value FESE.../...G1 (pin 6)
  • 4 mA to 20 mA corresponds to 0 % to 100 % valve opening
  • Orifice spool in seated position → actual value < 2.7 mA

– Signal “ready for operation” (pin 11)
  • All conditions listed above are fulfilled → > 10 V
  • One of the conditions is not fulfilled → < 8V

Block circuit diagram / pin assignment of integrated electronics



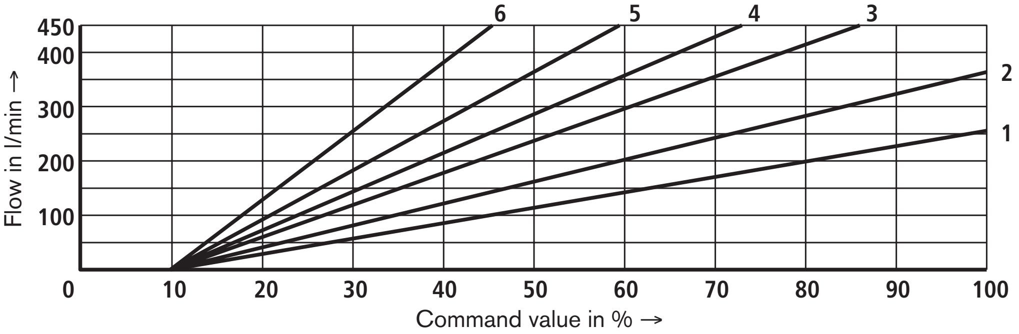
1) With current version (4 mA to 20 mA), please observe:
Between connections 5 and 4, load = 100 Ω
Between connections 6 and 7, load ≤ 500 Ω

1 Input
2 Output
3 Fixed ramp
4 Position controller
5 Clock pulse
6 Current regulator
7 I/U converter
8 Output stage
9 Proportional solenoid
10 Position transducer
11 Oscillator / demodulator
12 Fault signal of position transducer
13 Power supply unit
14 Error signal in the case of $+U_O$ undervoltage and asymmetry in the power supply unit
15 Cable break signal with current command value

Characteristic curves (measured with HLP 46 and $\vartheta_{oil} = 40$ °C ± 5 °C) Size 25

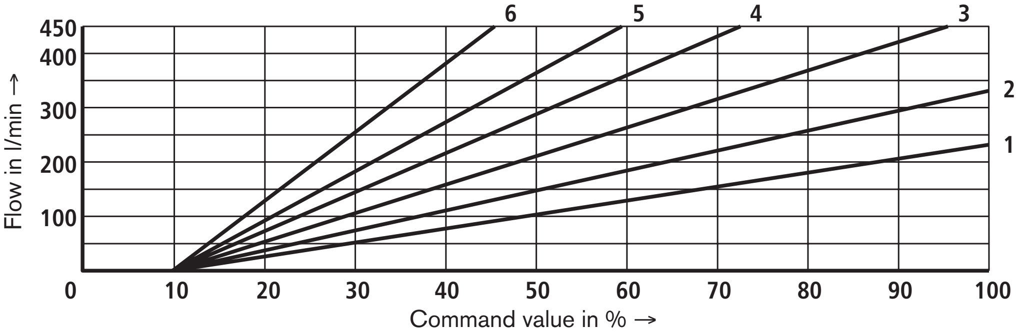
Flow characteristic linear

FES(E) 25 C…/315L… direction of flow A → B



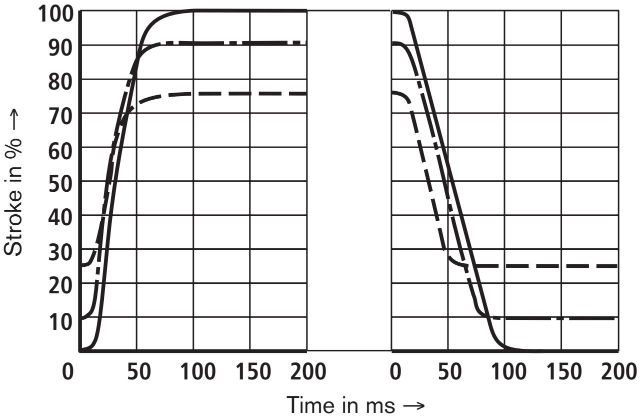
1 Δp = 5 bar
2 Δp = 10 bar
3 Δp = 20 bar
4 Δp = 30 bar
5 Δp = 50 bar
6 Δp = 100 bar

FES(E) 25 C…/315L… direction of flow B → A



1 Δp = 5 bar
2 Δp = 10 bar
3 Δp = 20 bar
4 Δp = 30 bar
5 Δp = 50 bar
6 Δp = 100 bar

Transient function in the case of stepped command value change [1]



Step responses 0 – 100 – 0 %
10 – 90 – 10 %
25 – 75 – 25 %

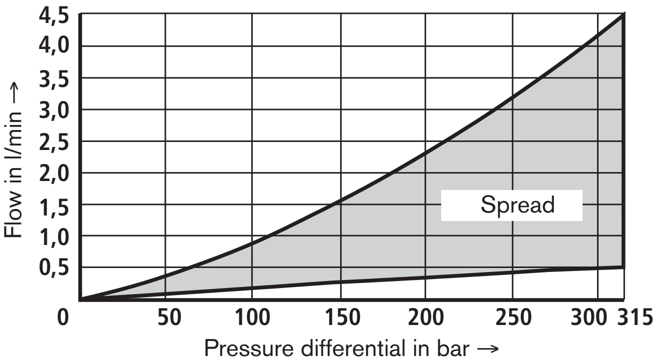
[1] Measurement conditions

Pressure in A = 50 bar
Actuator in B closed ($p_A = p_B = 50$ bar)
Pressure in A < 50 bar → actuating time is extended
Pressure in A > 50 bar → actuating time is shortened
The area ratio of the orifice spool has an influence on the actuating time as follows:

→ Command value 0 → 100%: The actuating time becomes shorter, the higher the inlet pressure and the smaller the Δp across the valve.

→ Command value 100 → 0%: The actuating time becomes shorter, the higher the inlet pressure and the higher the Δp across the valve.

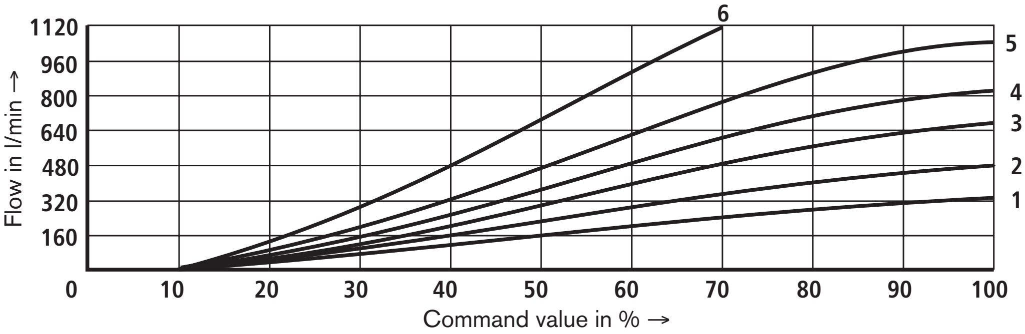
Leakage from A → B and B → A in dependence upon the pressure differential Δp (command value 0 V or 4 mA, resp.)



Characteristic curves (measured with HLP 46 and $\vartheta_{oil} = 40\ °C \pm 5\ °C$) **Size 32**

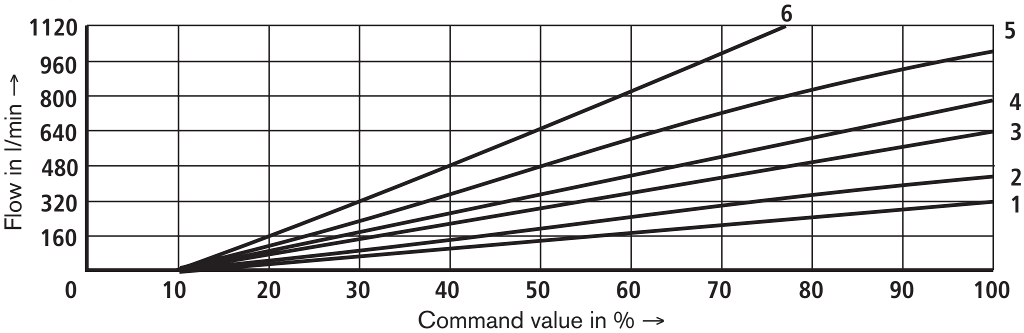
Flow characteristic linear

FES(E) 32 C…/450L… direction of flow A → B



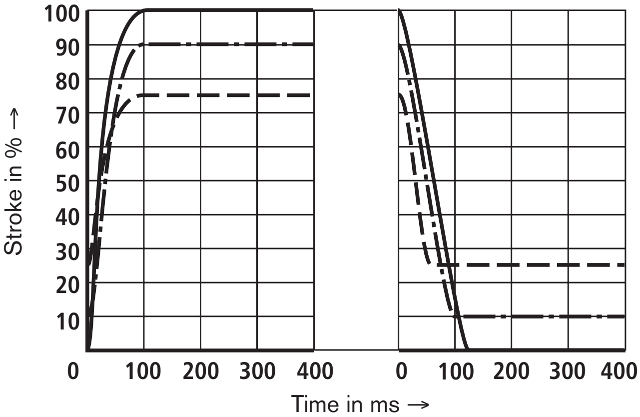
1 $\Delta p =$ 5 bar
2 $\Delta p =$ 10 bar
3 $\Delta p =$ 20 bar
4 $\Delta p =$ 30 bar
5 $\Delta p =$ 50 bar
6 $\Delta p =$ 100 bar

FES(E) 32 C…/450L… direction of flow B → A



1 $\Delta p =$ 5 bar
2 $\Delta p =$ 10 bar
3 $\Delta p =$ 20 bar
4 $\Delta p =$ 30 bar
5 $\Delta p =$ 50 bar
6 $\Delta p =$ 100 bar

Transient function with stepped command value change [1)]



Step responses 0 – 100 – 0 %
10 – 90 – 10 %
25 – 75 – 25 %

1) Measurement conditions

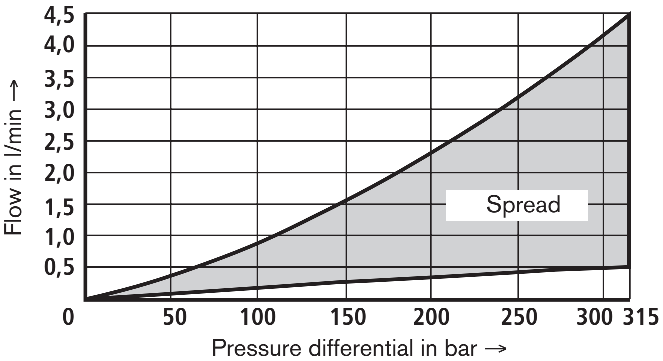
Pressure in A = 50 bar
Verbraucher in B geschlossen ($p_A = p_B = 50$ bar)
Pressure in A < 50 bar → actuating time is extended
Pressure in A > 50 bar → actuating time is shortened

The area ratio of the orifice spool has an influence on the actuating time as follows:

→ Command value 0 → 100%: The actuating time becomes shorter, the higher the inlet pressure and the smaller the Δp across the valve.

→ Command value 100 → 0%: The actuating time becomes shorter, the higher the inlet pressure and the higher the Δp across the valve.

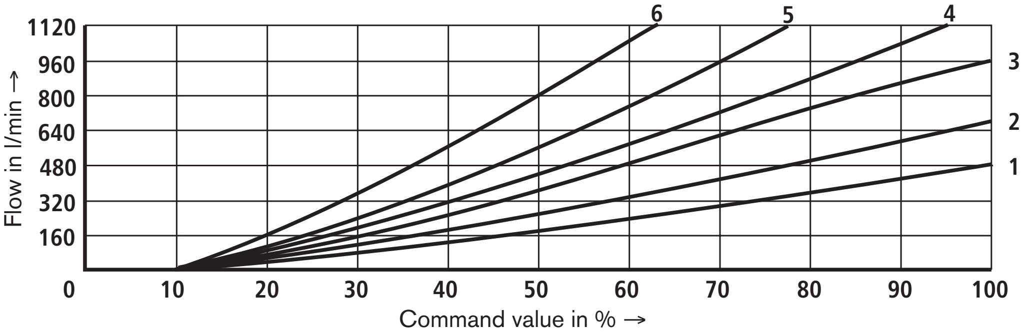
Leckage from A → B and B → A in dependence upon the pressure differential Δp (command value 0 V or 4 mA, resp.)



Characteristic curves (measured with HLP 46 and $\vartheta_{oil} = 40\ °C \pm 5\ °C$) Size 40

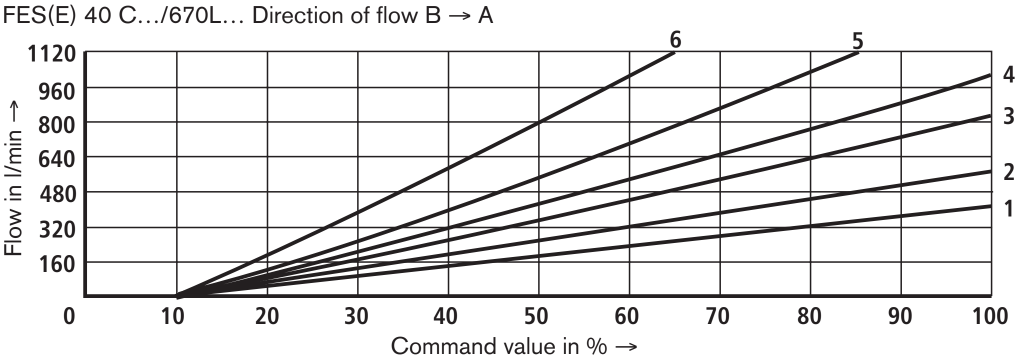
Flow characteristic linear

FES(E) 40 C…/670L… Direction of flow A → B



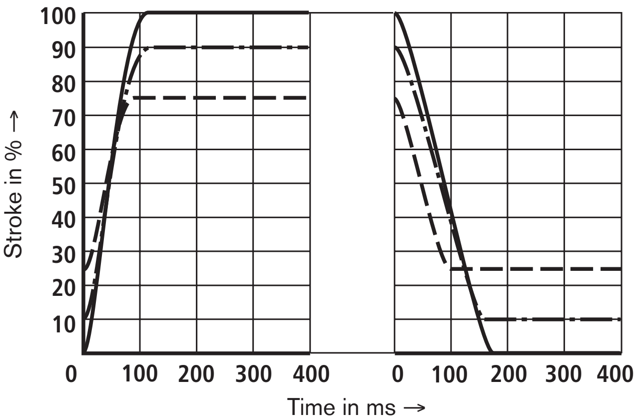
1 $\Delta p =$ 5 bar
2 $\Delta p =$ 10 bar
3 $\Delta p =$ 20 bar
4 $\Delta p =$ 30 bar
5 $\Delta p =$ 50 bar
6 $\Delta p =$ 100 bar

FES(E) 40 C…/670L… Direction of flow B → A



1 $\Delta p =$ 5 bar
2 $\Delta p =$ 10 bar
3 $\Delta p =$ 20 bar
4 $\Delta p =$ 30 bar
5 $\Delta p =$ 50 bar
6 $\Delta p =$ 100 bar

Transient function with stepped command value change [1)]



Step responses
0 – 100 – 0 %
10 – 90 – 10 %
25 – 75 – 25 %

[1)] Measurement conditions

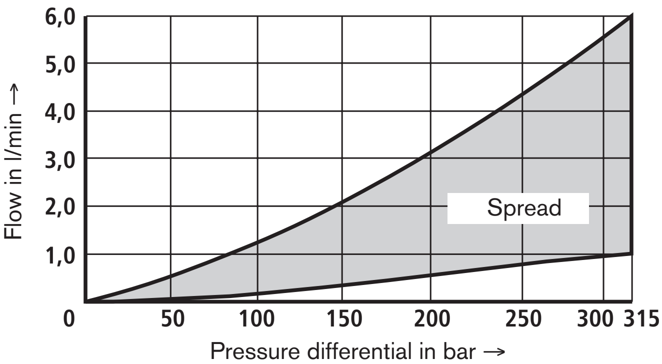
Pressure in A = 50 bar
Verbraucher in B geschlossen ($p_A = p_B = 50$ bar)
Pressure in A < 50 bar → actuating time is extended
Pressure in A > 50 bar → actuating time is shortened

The area ratio of the orifice spool has an influence on the actuating time as follows:

→ Command value 0 → 100%: The actuating time becomes shorter, the higher the inlet pressure and the smaller the Δp across the valve.

→ Command value 100 → 0%: The actuating time becomes shorter, the higher the inlet pressure and the higher the Δp across the valve.

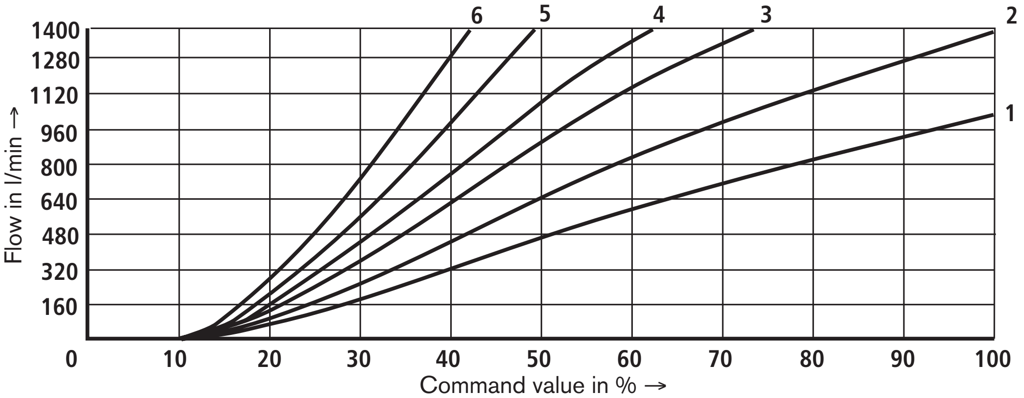
Leakage from A → B and B → A in dependence upon the pressure differential Δp (command value 0 V or 4 mA, resp.)



Characteristic curves (measured with HLP 46 and $\vartheta_{oil} = 40\ °C \pm 5\ °C$) **Size 50**

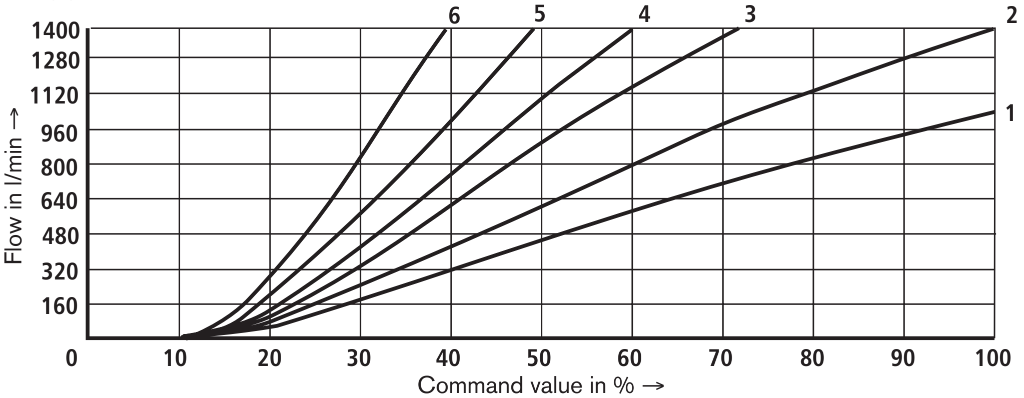
Flow characteristic linear [1]

FES(E) 50 C…/1400L… direction of flow A → B



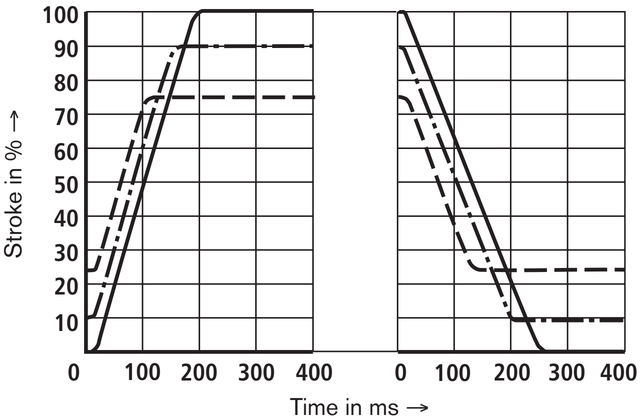
1 $\Delta p =$ 5 bar
2 $\Delta p =$ 10 bar
3 $\Delta p =$ 20 bar
4 $\Delta p =$ 30 bar
5 $\Delta p =$ 50 bar
6 $\Delta p =$ 100 bar

FES(E) 50 C…/1400L… direction of flow B → A



1 $\Delta p =$ 5 bar
2 $\Delta p =$ 10 bar
3 $\Delta p =$ 20 bar
4 $\Delta p =$ 30 bar
5 $\Delta p =$ 50 bar
6 $\Delta p =$ 100 bar

Transient function with stepped command value change [2]



Step responses 0 – 100 – 0 % ———
10 – 90 – 10 % —·—·—
25 – 75 – 25 % – – – –

[1] Flow values above 1200 l/min are no measured values!

[2] Measurement conditions

Pressure in A = 50 bar
Verbraucher in B geschlossen ($p_A = p_B = 50$ bar)

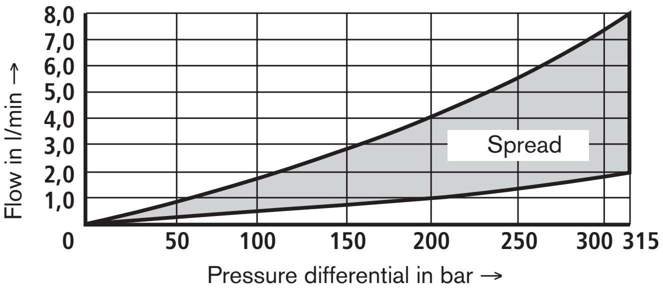
Pressure in A < 50 bar → actuating time is extended
Pressure in A > 50 bar → actuating time is shortened

The area ratio of the orifice spool has an influence on the actuating time as follows:

→ Command value 0 → 100%: The actuating time becomes shorter, the higher the inlet pressure and the smaller the Δp across the valve.

→ Command value 100 → 0%: The actuating time becomes shorter, the higher the inlet pressure and the higher the Δp across the valve.

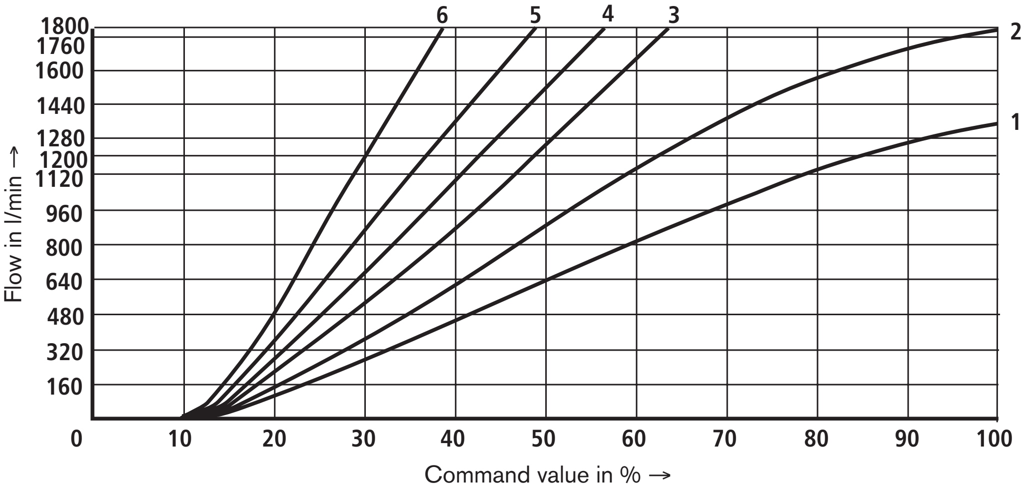
Leakage from A → B and B → A in dependence upon pressure differential Δp (command value 0 V or 4 mA, resp.)



Characteristic curves (measured with HLP 46 and $\vartheta_{oil} = 40\ °C \pm 5\ °C$) Size 63

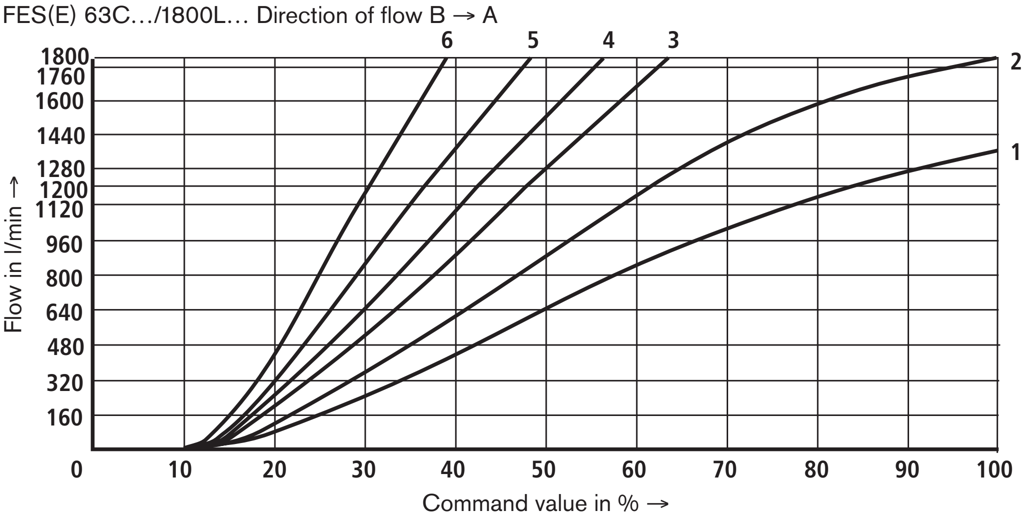
Flow characteristic linear [1]

FES(E) 63 C…/1800L… direction of flow A → B



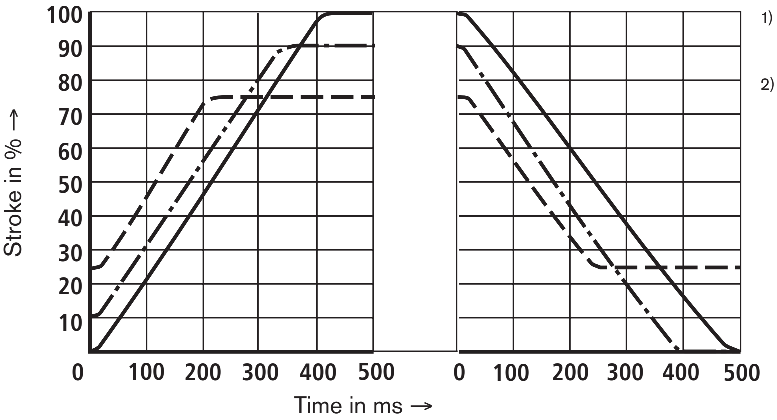
1 $\Delta p =$ 5 bar
2 $\Delta p =$ 10 bar
3 $\Delta p =$ 20 bar
4 $\Delta p =$ 30 bar
5 $\Delta p =$ 50 bar
6 $\Delta p =$ 100 bar

FES(E) 63C…/1800L… Direction of flow B → A



1 $\Delta p =$ 5 bar
2 $\Delta p =$ 10 bar
3 $\Delta p =$ 20 bar
4 $\Delta p =$ 30 bar
5 $\Delta p =$ 50 bar
6 $\Delta p =$ 100 bar

Transient function with stepped command value change [2]



Step responses 0 – 100 – 0 %
10 – 90 – 10 %
25 – 75 – 25 %

[1] Flow values above 1200 l/min are no measured values!

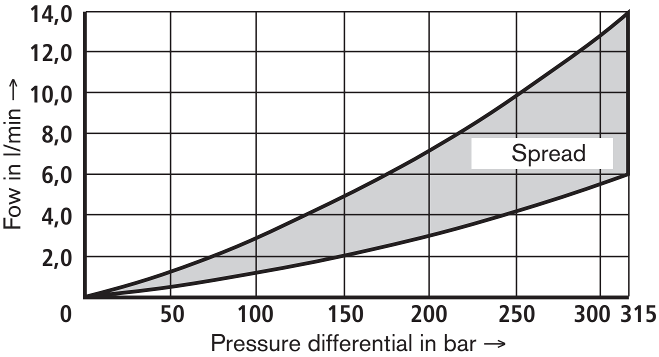
[2] Measurement conditions
Pressure in A = 50 bar
Actuator in B closed ($p_A = p_B = 50$ bar)
Pressure in A < 50 bar → actuating time is extended
Pressure in A > 50 bar → actuating time is shortened
The area ratio of the orifice spool has an influence on the actuating time as follows:

→ Command value 0 → 100%: he actuating time becomes shorter, the higher the inlet pressure and the smaller the Δp across the valve.

→ Command value 100 → 0%: The actuating time becomes shorter, the higher the inlet pressure and the higher the Δp across the valve.

Characteristic curves (measured with HLP 46 and $\vartheta_{oil} = 40\ °C \pm 5\ °C$) Size 63

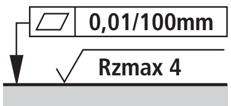
Leakage from A → B and B → A in dependence upon the pressure differential Δ*p* (command value 0 V or 4 mA, resp.)

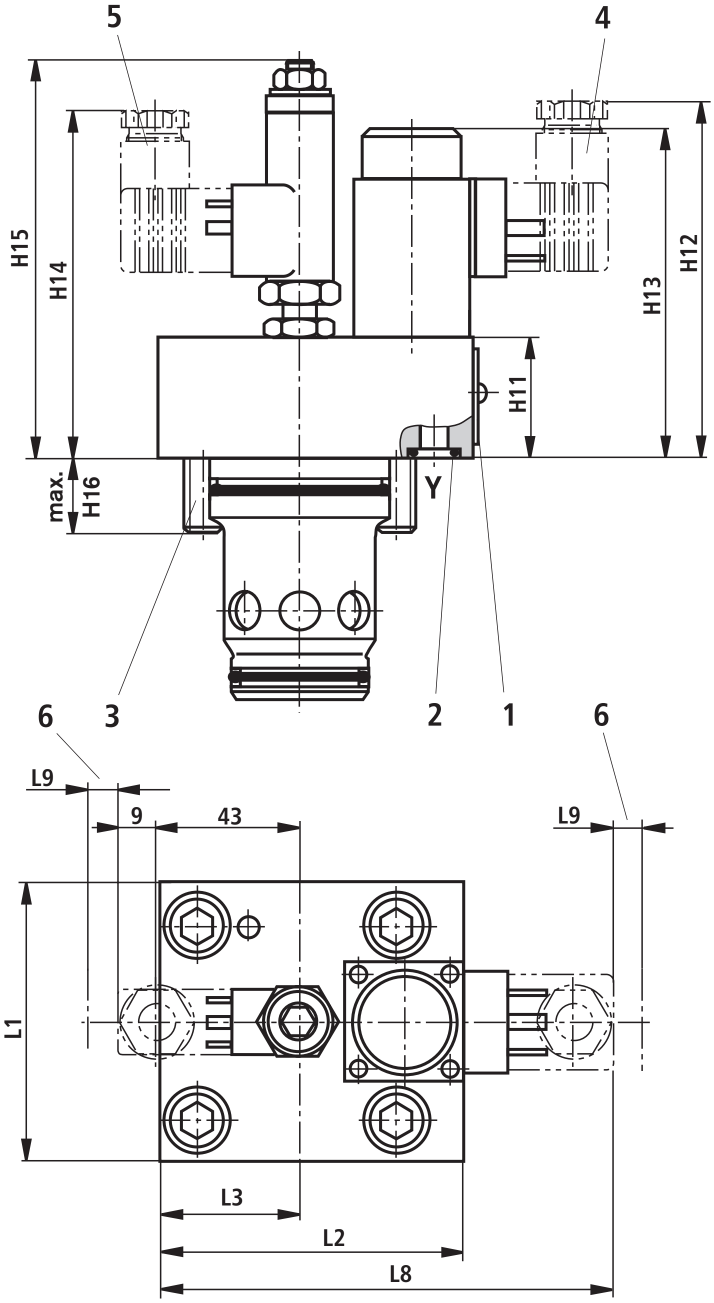


Unit dimensions: Type FES (nominal dimensions in mm)

Size	25	32	40	50	63
H11	51	63	62	73	90
H12	116	128	127	138	155
H13	110	122	121	132	149
H14	118	130	129	140	157
H15	137.5	149.5	148.5	159.5	176.5
H16	25	35	45	45	65
L1	85	102.5	126	140	180
L2	93.5	102.5	126	140	180
L3	42.5	51 .25	63	70	90
L8	139	150	169	184	219
L9	15	15	15	15	15

Required surface quality of mating part

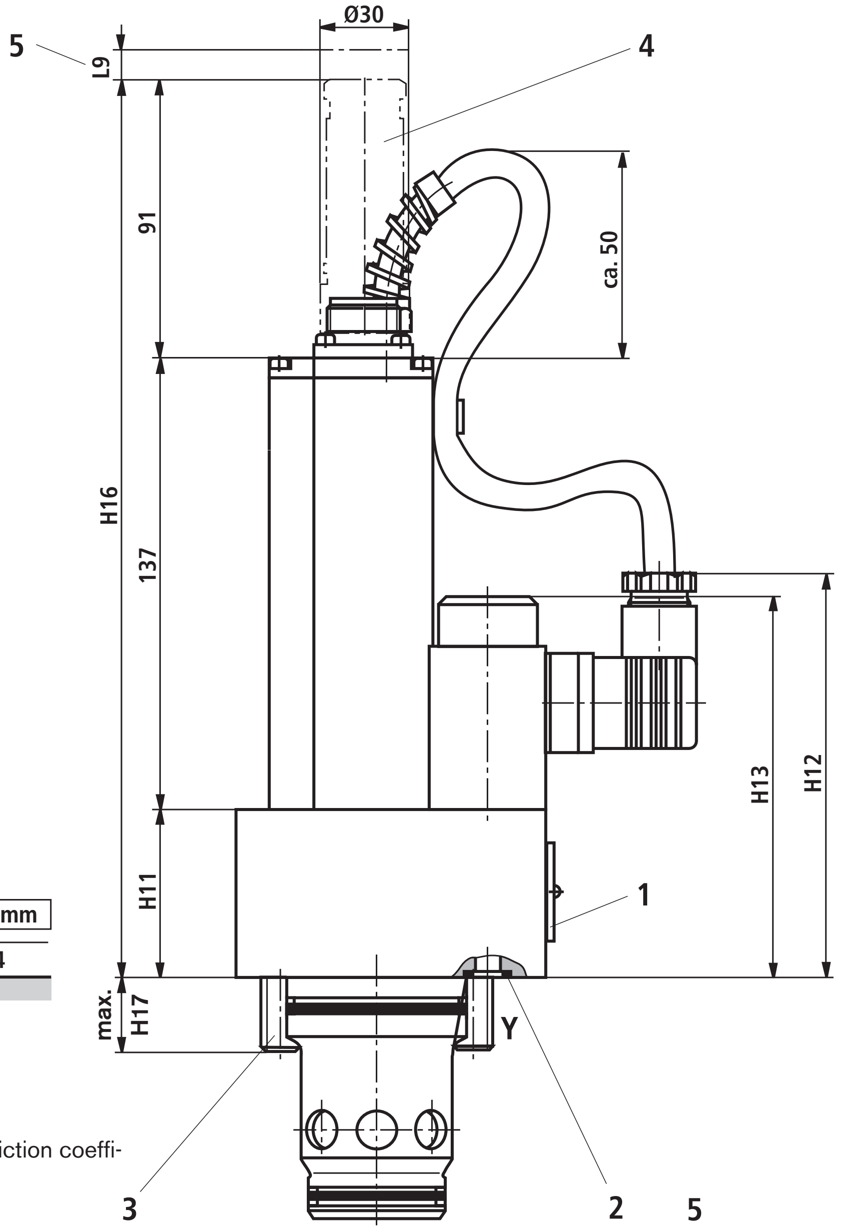




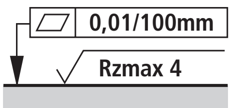
1 Nameplate
2 Identical seal rings for ports X and Y
3 4 off valve fixing screws to ISO 4762-10.9 (friction coefficient 0.09 ... 0.14 to VDA 235-101) are included in the scope of supply:
Size 25: M12 x 60, tightening torque $M_T = 75$ Nm
Size 32: M16 x 75, tightening torque $M_T = 170$ Nm
Size 40: M20 x 80, tightening torque $M_T = 350$ Nm
Size 50: M20 x 90, tightening torque $M_T = 380$ Nm
Size 63: M30 x 100, tightening torque $M_T = 1200$ Nm
4 Cable socket for proportional solenoid, separate order see, page 6
5 Cable socket for inductive position transducer, separate order, see page 6
6 Space required to remove cable socket

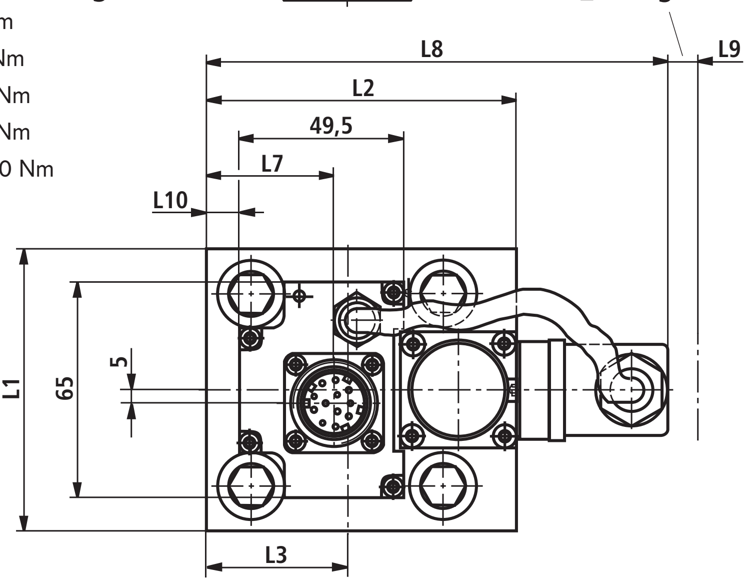
Unit dimensions: Type FESE (nominal dimensions in mm)

Size	25	32	40	50	63
H11	51	63	62	73	90
H12	116	128	127	138	155
H13	110	122	121	132	149
H16	279	291	290	301	318
H17	25	35	45	45	65
L1	85	102.5	126	140	180
L2	93.5	102.5	126	140	180
L3	42.5	51.25	63	70	90
L7	38.5	51.25	63	66	86
L8	139	150	169	184	219
L9	15	15	15	15	15
L10	10	18.75	30.5	37.5	57.5



Required surface quality of mating part





1 Nameplate

2 Identical seal rings for ports X and Y

3 4 off valve fixing screws to ISO 4762-10.9 (friction coefficient 0.09 ... 0.14 to VDA 235-101) are included in the scope of supply:
Size 25: M12 x 60, tightening torque M_T = 75 Nm
Size 32: M16 x 75, tightening torque M_T = 170 Nm
Size 40: M20 x 80, tightening torque M_T = 350 Nm
Size 50: M20 x 90, tightening torque M_T = 380 Nm
Size 63: M30 x 100, tightening torque M_T = 1200 Nm

4 Cable socket
separate order, see page 7

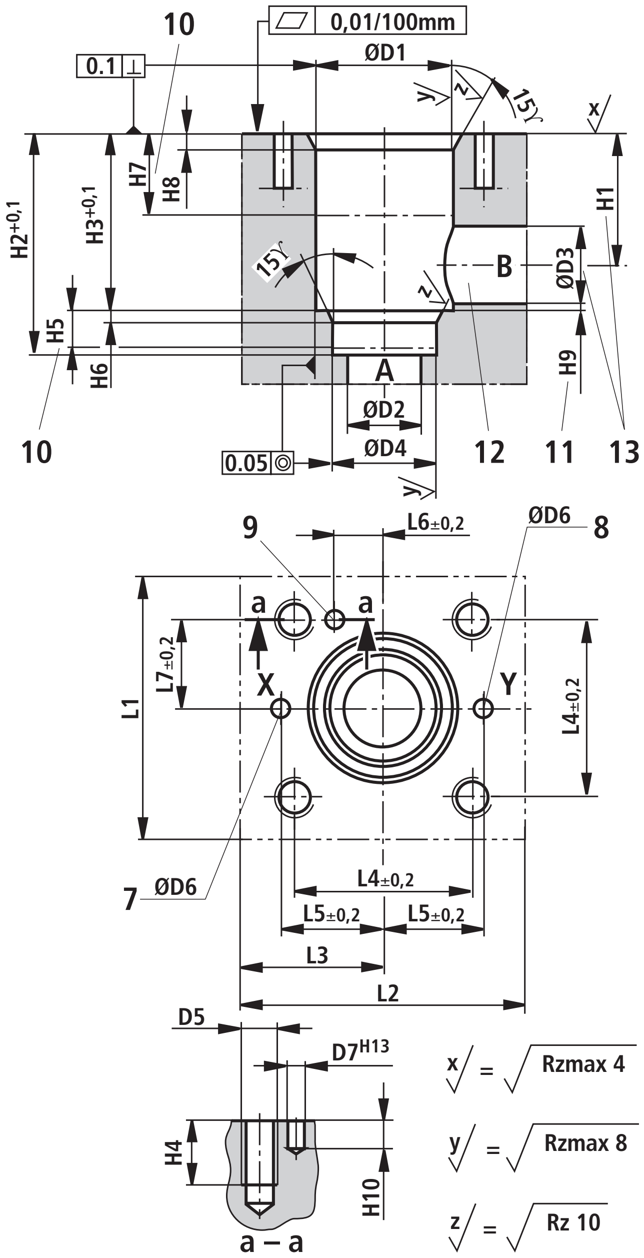
5 Space required to remove cable socket

Installation dimensions (nominal dimensions in mm)

Installation dimensions to DIN ISO 7368					
Size	**25**	**32**	**40**	**50**	**63**
ØD1 H8	45	60	75	90	120
ØD2	25	32	40	50	63
ØD3	25	32	40	50	63
max. ØD3	32	40	50	63	80
ØD4 H8	34	45	55	68	90
D5	M12	M16	M20	M20	M30
max. ØD6	6	8	10	10	12
ØD7 H13	6	6	6	8	8
H1	44	52	64	72	95
H1 [1]	40.5	48	59	65.5	86.5
H2	72	85	105	122	155
H3	58	70	87	100	130
H4	25	35	45	45	65
H5	12	13	15	17	20
H6	2.5	2.5	3	3	4
H7	30	30	30	35	40
H8	2.5	2.5	3	4	4
min. H9, (ref. dimension)	1	1.5	2.5	2.5	3
min. H10	8	8	8	8	8
L1	85	102.5	126	140	180
L2	93.5	102.5	126	140	180
L3	42.5	51.25	63	70	90
L4	58	70	85	100	125
L5	33	41	50	58	75
L6	16	17	23	30	38
L7	29	35	42.5	50	62.5

[1] Bore centre at max. ØD3

Size	Installation dimensions to DIN ISO 7368
25	ISO 7368-BB-08-2-A
32	ISO 7368-BC-09-2-A
40	ISO 7368-BD-10-2-A
50	ISO 7368-BE-12-2-A
63	ISO 7368-BF-12-2-A



Tolerances to: General tolerances ISO 2768-mK

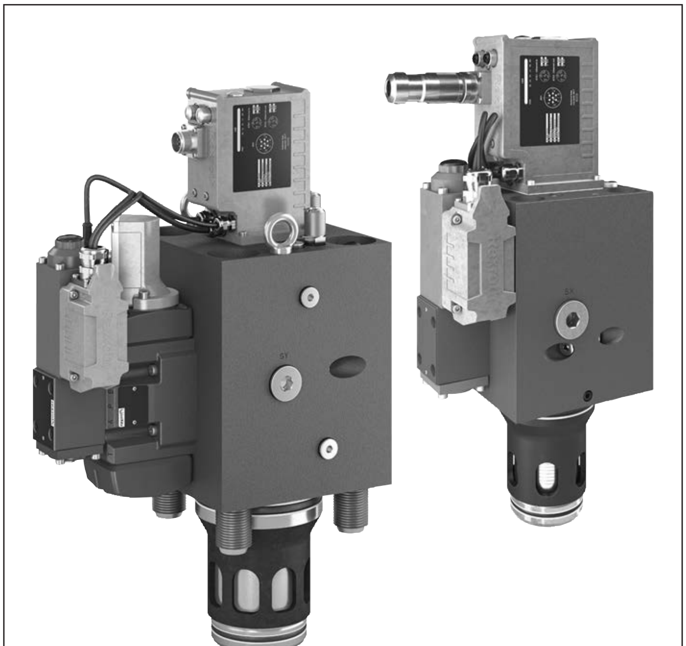
7 Port X
8 Port Y
9 Locating bore for locating pin
10 Depth of fit
11 Reference dimension
12 Port B can optionally arranged around the central axis of port A. However, care must be taken not to drill the fixing bores and the pilot bores.
13 In the case of a diameter for port B other than specified in the dimensional table, the distance from the cover contact face to the centre of the bore must be calculated.

RE 29406
Edition: 2021-06
Replaces: 2021-03

rexroth
A Bosch Company

High-response directional cartridge valve, pilot-operated with integrated electronics (OBE) and analog or field bus interface

Type 2WRCE and 2WRCF


H8133+8174

- Size 32 ... 100
- Component series 4X
- Maximum operating pressure 420 bar
- Nominal flow 1000 ... 12500 l/min (***Δp*** = 5 bar)

CE

Features

- 2-way cartridge valve
- Pilot control valve: Highly dynamic directional control valve with control spool and sleeve in servo quality
- Open
  - Integrated electronics (OBE)
  - Analog or field bus interface (IFB-Multi-Ethernet) (EtherNet/IP, PROFINET RT, Sercos, EtherCAT, VARAN)
- Robust
  - Pressure resistance up to 420 bar
  - High vibration resistance (acc. to DIN EN 60068-2)
  - Ambient temperature up to +60 °C
- Precise
  - High response sensitivity and low hysteresis
- Normalized
  - Installation dimensions according to ISO 7368
- Flexible
  - Suitable for position, pressure, force and velocity control

Contents

Ordering code

01	02	03	04	05	06	07		08		09	10	11	12		13	14	15	16	17
2	**WRC**			**S**			**–**	**4X**	**/**	**H**				**/**	**24**				*****

01	2 main ports	**2**

02	High-response directional cartridge valve, pilot-operated	**WRC**

03	With integrated electronics (OBE)	**E**
	With integrated field bus electronics (IFB)	**F**

04	Size 32	**32**
	Size 40	**40**
	Size 50	**50**
	Size 63	**63**
	Size 80	**80**
	Size 100	**100**

05	Seat control spool	**S**

Rated flow at 5 bar pressure differential

06	**– Size 32**	
	1000 l/min (only version "R")	**1K0**
	1100 l/min (only version "L")	**1K1**
	– Size 40	
	1600 l/min (only version "R")	**1K6**
	1800 l/min (only version "L")	**1K8**
	– Size 50	
	2600 l/min (only version "R")	**2K6**
	2700 l/min (only version "L")	**2K7**
	– Size 63	
	4300 l/min (only version "R")	**4K3**
	4500 l/min (only version "L")	**4K5**
	– Size 80	
	6700 l/min (only version "R")	**6K7**
	7200 l/min (only version "L")	**7 K2**
	Size 100	
	12000 l/min (only version "R")	**12K0**
	12500 l/min (only version "L")	**12K5**

Flow characteristic

07	Linear	**L**
	Linear with progressive fine control range	**R**
	Other versions available on request	

08	Component series 40 ... 49 (40 ... 49: Unchanged installation and mounting dimensions)	**4X**

Pilot control valve

09	Highly dynamic directional control valve in servo quality	**H**

Seal material (observe compatibility of seals with hydraulic fluid used, see page 9)

10	NBR seals	**M**
	FKM seals	**V**

Ordering code

01	02	03	04	05	06	07		08		09	10	11	12		13	14	15	16	17
2	**WRC**			**S**			**–**	**4X**	**/**	**H**				**/**	**24**				*****

Sandwich plate shut-off valve

11	**Without** shut-off valve	
	De-energized pilot control valve actively **closes** "2WRC" with applied pilot pressure	**K**
	De-energized pilot control valve actively **opens** "2WRC" with applied pilot pressure	**L**
	With shut-off valve	
	De-energized shut-off valve actively **closes** "2WRC" with applied pilot pressure	**WK**
	De-energized shut-off valve actively **opens** "2WRC" with applied pilot pressure	**WL**

Spool position monitoring (at the sandwich plate shut-off valve)

12	**Without** position switch	**without designation**
	With position switch	**E**
13	Supply voltage 24 V	**24**

Ethernet interface

14	**Without** (only with integrated electronics (OBE) "E")	**without designation**
	EtherNET/IP	**E**
	PROFINET RT	**N**
	Sercos	**S**
	EtherCAT (CANopen profile)	**T**
	VARAN	**V**

Electrical interface

15	Command value 0 ... 10 V (only with integrated electronics (OBE) "E")	**A1**
	Command value 4 ... 20 mA (only with integrated electronics (OBE) "E")	**F1**
	Command value Ethernet interface (only with integrated field bus electronics (IFB) "F")	**D9**

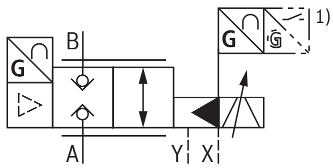
16	**Without** damping plate	**without designation**
	With damping plate	**D**

17	Further details in the plain text	

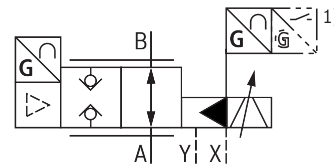
Symbols: Size 32 ... 50

Simplified

Version "K" and **"WK"**

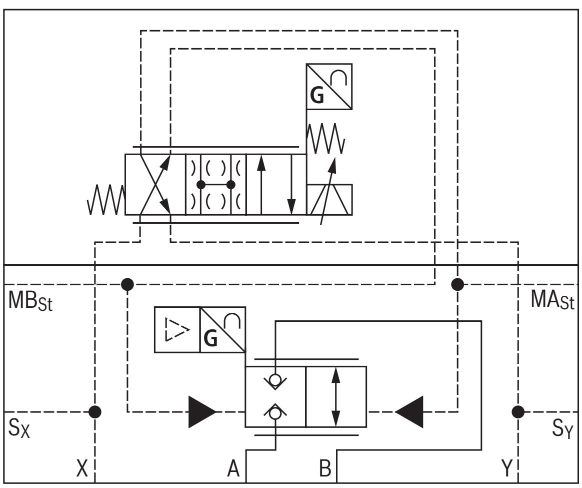


Version "L" and **"WL"**

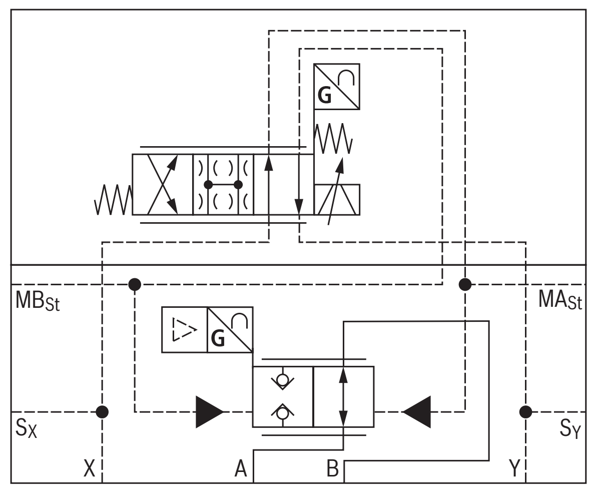


Detailed

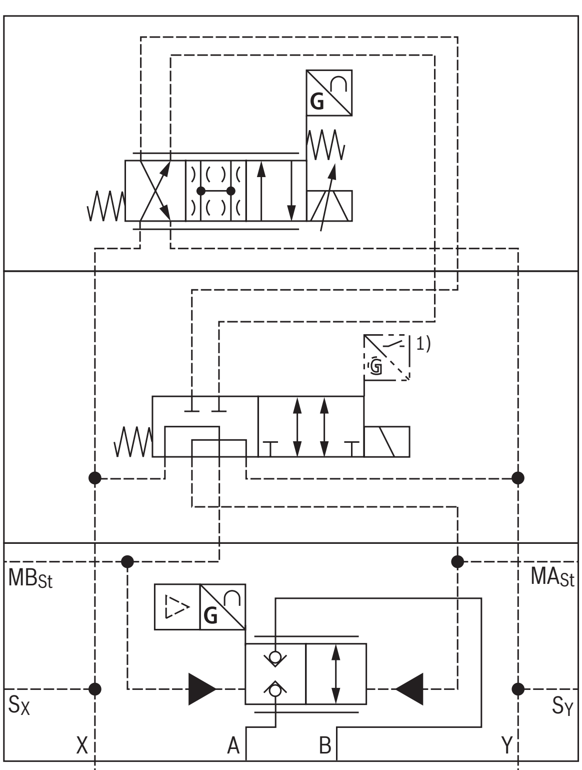
Version "K"



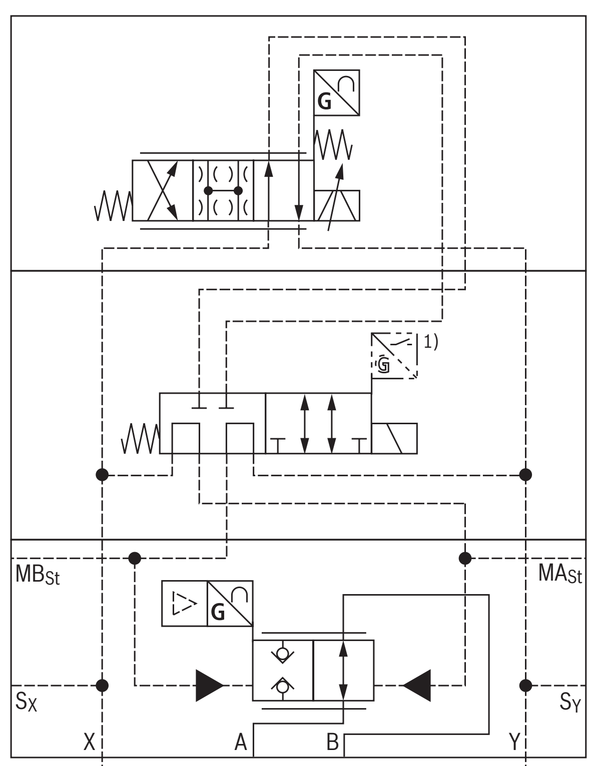
Version "L"



Version "WK"



Version "WL"



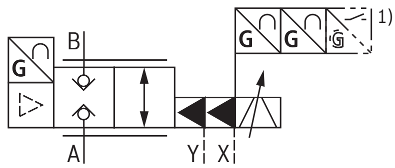
1) Version with position switch "E"

Notice: Representation according to DIN ISO 1219-1.

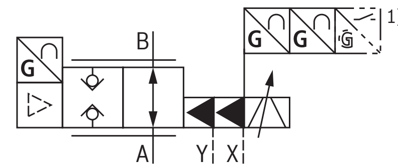
Symbols: Size 63 ... 100

Simplified

Version "K" and **"WK"**

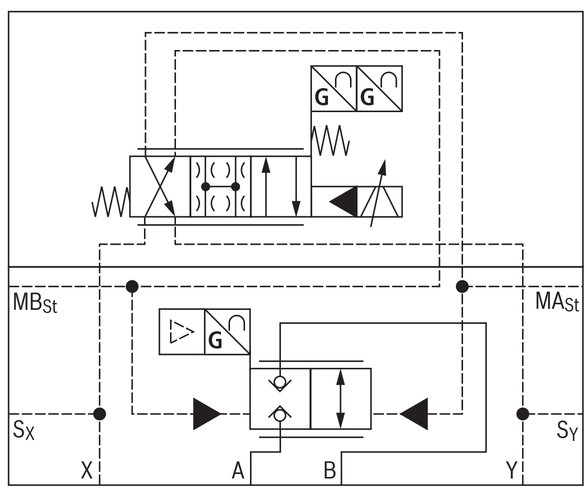


Version "L" and **"WL"**

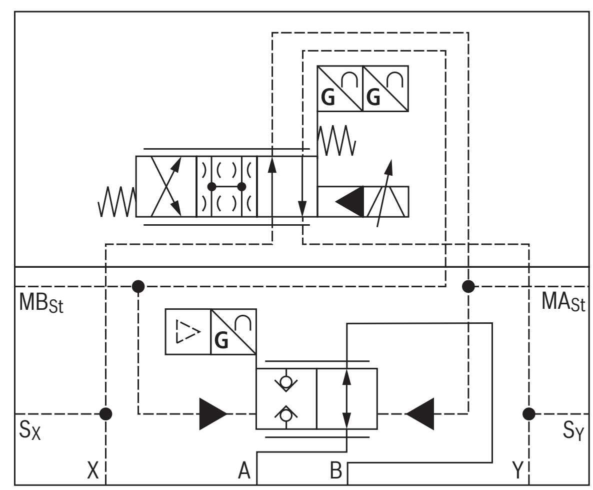


Detailed

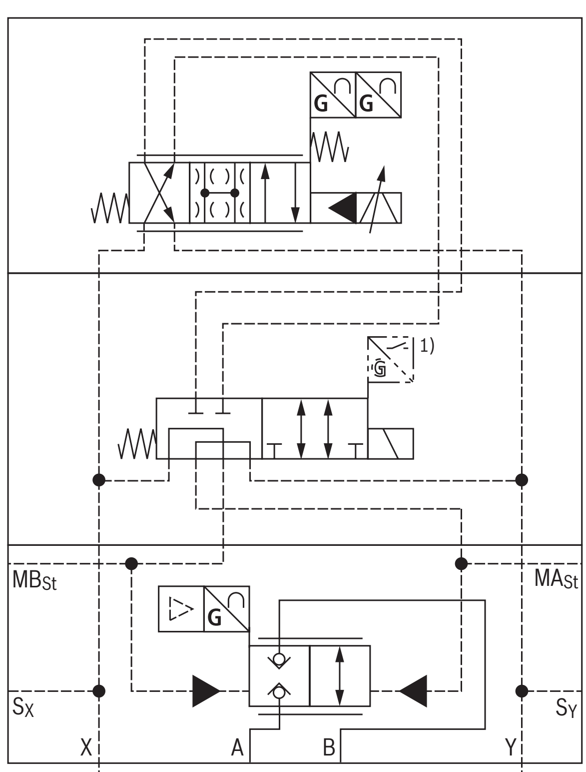
Version "K"



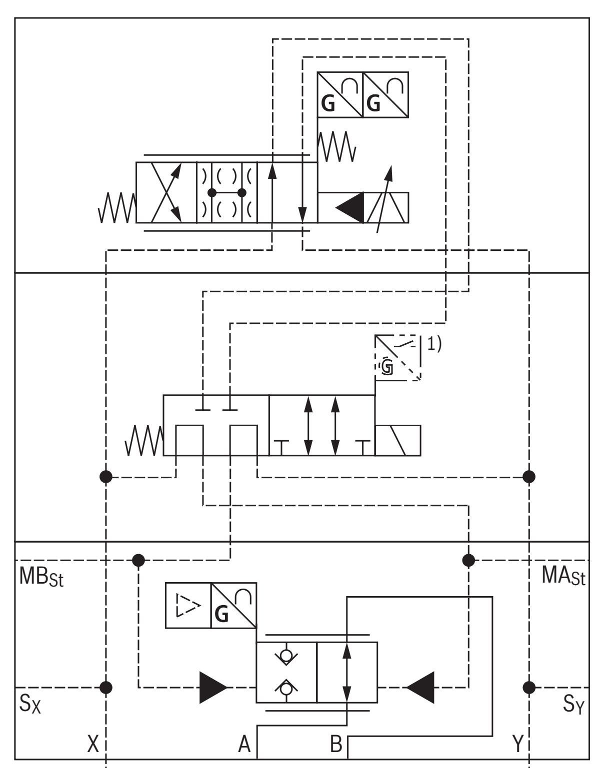
Version "L"



Version "WK"



Version "WL"



1) Version with position switch "E"

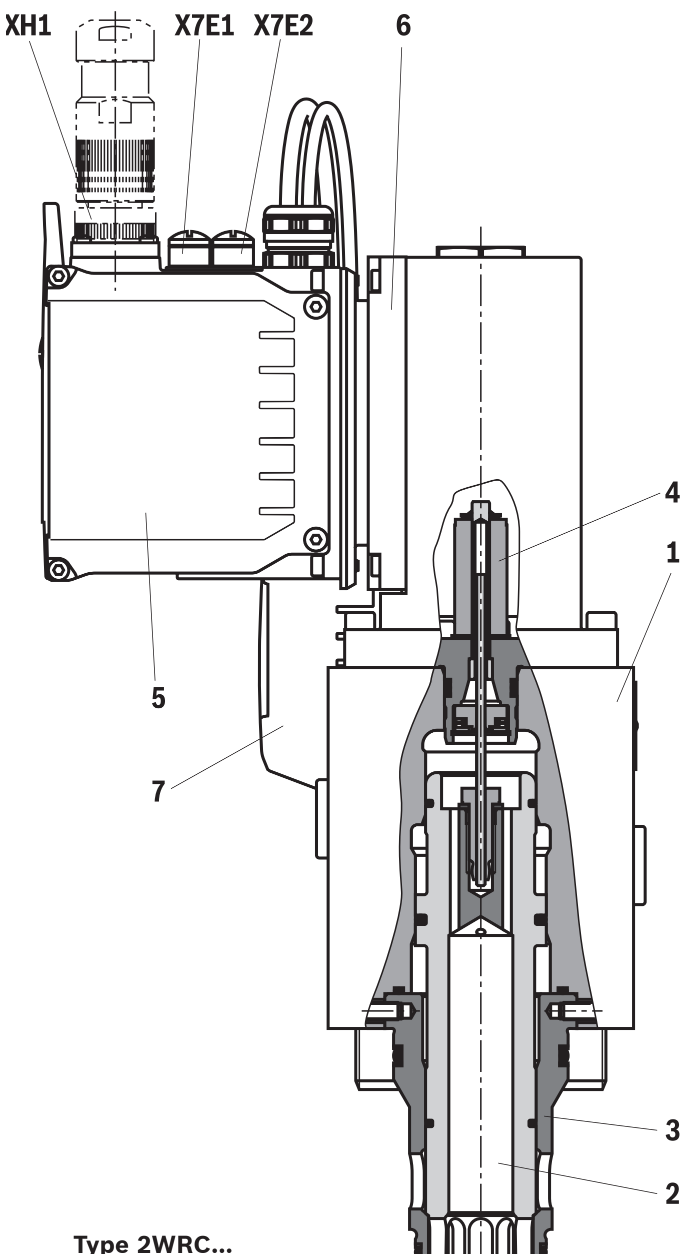
Notice: Representation according to DIN ISO 1219-1.

Function, section

Set-up

The pilot-operated high-response directional cartridge valve type 2WRC. basically consists of:

- Cover (1)
- Control spool (2)
- Socket (3)
- Position transducer (4)
- Integrated electronics (5)
- Damping plate (6)
- Pilot control valve (7)
- Ethernet IN (X7E1); Ethernet OUT (X7E2)
- Connector, voltage supply (XH1)



Type 2WRC...

Function

The integrated electronics (5) compares the command and the actual values and actuates the solenoid of the pilot control valve with a proportional current according to the control deviation.
The pilot control valve (7) takes a proportionally controlled position and controls the flows that actuate the control spool (2) through the closed valve control loop up to zero control deviation.
This means that the stroke of the control spool (2) is regulated proportionally to the command value. It must be noted that the flow also depends on the valve pressure drop.

Valve features

The flow can pass through the valve from A to B or from B to A. The control spool (2) closes or opens at 5% of the command value. At lower command values, the valve control loop attempts to guide the control spool (2), thus presses it onto the seat at full pilot pressure and blocks the connection in a leakage-free way. The specified valve dynamics only apply to the control area of the valve. At command value steps from the seat to lower opening values, additional delay times occur. The opening point of 5% (= 0.5 V or 4.8 mA) is set at the factory. The pilot control valve (7) is designed as bi-directionally controlled longitudinal spool valve with double stroke solenoid and control sleeve and has a mechanical trimming in case of power failure. The integrated electronics (5) regulates the position of the control spools of the main and the pilot control stage and offers either the analog interfaces "A1" and "F1" or the full bus functionality with interface "D9".

Damping plate "D"

The damping plate (6) reduces the acceleration amplitudes on the on-board electronics (frequencies >300 Hz).

> ☞ **Notice:**
> Using the damping plate is not recommended for applications with mainly low-frequency excitation < 300 Hz.

IndraWorks DS PC program

To implement the project planning task and for the parameterization, the user may use the IndraWorks DS engineering tool (see page 33):

- Project planning
- Parameterization
- Commissioning
- Diagnosis
- Comfortable administration of all data on a PC
- PC operating systems: Windows 7 ... 10

Technical data
(For applications outside these values, please consult us!)

General									
Size		NG	32	40	50	63	80	100
Weight	▶ Without shut-off valve ("K"; "L")	kg	15.6	21.2	32.3	56.8	115	164
	▶ With shut-off valve ("WK"; "WL")	kg	17.2	22.8	33.9	64.5	123	172
	▶ Position switch "E"	kg	1.1	1.1	1.1	0.9	0.9	0.9
Installation position			any, preferably horizontal					
Ambient temperature range		°C	–20 ... +60					
Maximum storage time		Years	1 (if the storage conditions are observed; refer to the operating instructions 07600-B)					
Sine test according to DIN EN 60068-2-6			10 ... 2000 Hz/maximum of 10 g/10 cycles/3 axes					
Noise test according to DIN EN 60068-2-64	▶ Without damping plate (NG32 and 40)		20 ... 2000 Hz / 10 g_{RMS} / 30 g peak / 30 min / 3 axes					
	▶ Without damping plate (NG50 and 63)		20 ... 2000 Hz / 10 g_{RMS} / 30 g peak / 24 h / 3 axes					
	▶ With damping plate [1]		20 ... 2000 Hz / 10 g_{RMS} / 30 g peak / 24 h / 3 axes					
Transport shock according to DIN EN 60068-2-27			15 g / 11 ms / 3 axes					
Shock according to DIN EN 60068-2-27	▶ With damping plate [1]		35 g / 6 ms / 3 axes					
Maximum relative humidity (no condensation)		%	95					
Load cycles			10 million					
Conformity	▶ CE according to EMC Directive 2014/30/EU tested according to		EN 61000-6-2 and EN 61000-6-3		EN 61000-6-2 and EN 61000-6-4			
	▶ RoHS directive		2011/65/EU [2]					

[1] Not recommended for applications with mainly low-frequency excitation < 300 Hz

[2] The product fulfills the substance requirements of the RoHS directive 2011/65/EU.

Technical data
(For applications outside these values, please consult us!)

Hydraulic								
Size		NG	32	40	50	63	80	100
Maximum operating pressure	▶ Port A, B	bar	420 [2]					
Maximum pilot pressure	▶ Port X							
	– Version "K", "L"	bar	350					
	– Version "WK", "WL"	bar	315					
Maximum return flow pressure	▶ Port Y	bar	210					
Minimum pilot pressure (in % of the system pressure)	▶ A → B	%	70					
	▶ B → A	%	35					
Rated flow (**Δp** = 5 bar [3; 4; 5])	▶ Version "L"	l/min	1100 (1500)	1800 (2200)	2700 (3900)	4500 (6200)	7200 (10200)	12500 (16500)
	▶ Version "R"	l/min	1000 (1300)	1600 (1950)	2600 (3600)	4300 (5800)	6700 (9700)	12000 (15500)
Maximum flow [6]		l/min	2900	4300	6600	9100	17000	22000
Pilot flow [7]		l/min	78	78	95	220	350	380
Zero flow (pre-stage at 100 bar)	▶ Maximum	cm^3/min	900					
	▶ Average value	cm^3/min	400					
Pilot oil volume		cm^3	5.9	8.5	22.5	42.8	84.5	154
Hydraulic fluid			see table page 9					
Hydraulic fluid temperature range	▶ Recommended	°C	+40 ... +60					
	▶ Maximum admissible	°C	–20 ... +70					
Viscosity range	▶ Recommended	mm^2/s	30 ... 45					
	▶ Maximum admissible	mm^2/s	20 ... 380					
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)	▶ Pilot control valve		Class 18/16/13 [8]					
	▶ Main stage		Class 20/18/15 [8]					

2) In port B, in a closed state 500 bar (valve must not be opened). If the valve is opened, a value of 420 bar applies.

3) Flow for deviating **Δp**:

$$\boldsymbol{q}_x = \boldsymbol{q}_{Vnom} \times \sqrt{\frac{\boldsymbol{\Delta p_x}}{5}}$$

4) Recommended direction of flow B → A (from A → B increased cavitation erosion)

5) Values () for two opposite, radial bores B with maximum diameter (see page 32)

6) Flow velocity 30 m/s in port A (otherwise increased cavitation erosion)

7) Stepped input signal (seat position at 100%, pilot pressure 350 bar)

8) The cleanliness classes specified for the components must be adhered to in hydraulic systems. An effective filtration prevents faults and simultaneously increases the life cycle of the components.

Technical data

(For applications outside these values, please consult us!)

Hydraulic fluid		Classification	Suitable sealing materials	Standards	Data sheet
Mineral oils		HL, HLP, HLPD, HVLP, HVLPD	NBR, FKM	DIN 51524	90220
Bio-degradable	▶ Insoluble in water	HETG	FKM	ISO 15380	90221
		HEES	FKM		
	▶ Soluble in water	HEPG	FKM	ISO 15380	
Flame-resistant	▶ Anhydrous	HFDU (glycol base)	FKM	ISO 12922	90222
		HFDU (ester base)	FKM		
		HFDR	FKM		
	▶ Hydrous	HFC (Fuchs: Hydrotherm 46M, Renosafe 500; Petrofer: Ultra Safe 620; Houghton: Safe 620; Union: Carbide HP5046)	NBR	ISO 12922	90223

Important information on hydraulic fluids:

- For further information and data on the use of other hydraulic fluids, please refer to the data sheets above or contact us.
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.).
- The ignition temperature of the hydraulic fluid used must be 50 K higher than the maximum surface temperature.
- **Bio-degradable and flame-resistant – containing water:** If components with galvanic zinc coating (e.g. version "J3" or "J5") or parts containing zinc are used, small amounts of dissolved zinc may get into the hydraulic system and cause an accelerated aging of the hydraulic fluid. Zinc soap may form as a chemical reaction product, which may clog filters, nozzles and solenoid valves – particularly in connection with local heat input.
- **Flame-resistant – containing water:**
  - Due to the increased cavitation tendency with HFC hydraulic fluids, the life cycle of the component may be reduced by up to 30% as compared to the use with mineral oil HLP. In order to reduce the cavitation effect, it is recommended – if possible specific to the installation – backing up the return flow pressure in ports T to approx. 20% of the pressure differential at the component.
  - Dependent on the hydraulic fluid used, the maximum ambient and hydraulic fluid temperature must not exceed 50 °C. In order to reduce the heat input into the component, the command value profile is to be adjusted for proportional and high-response valves.

Technical data
(For applications outside these values, please consult us!)

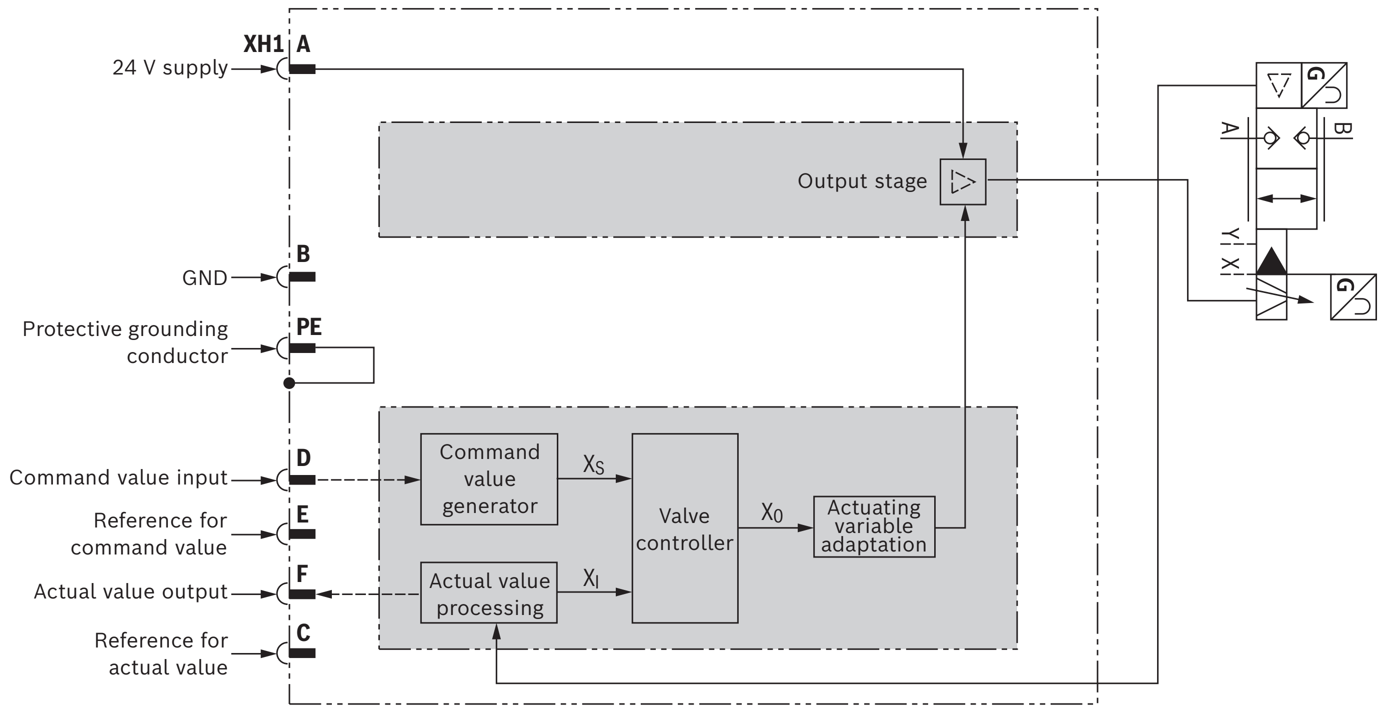
Static / dynamic								
Size			32	40	50	63	80	100
Hysteresis		%	< 0.2					
Range of inversion		%	< 0.1					
Response sensitivity		%	< 0.1					
Step response time according to ISO 10770-1 [9)]		ms	12	14	24	25	27	34
Reaching of the preferred position [10)]		ms	52 ... 38	62 ... 48	130 ... 85	160 ... 90	335 ... 198	612 ... 356
Zero compensation			ex plant ±1%					
Zero shift upon change of:	▶ Hydraulic fluid temperature	%/10 K	≤ 0.3					
	▶ Pilot pressure in X	%/100 bar	≤ 0.2					

Electrical, integrated electronics			
Relative duty cycle		%	100 (continuous operation)
Protection class according to EN 60529			IP 65 with mating connector mounted and locked
Supply voltage	▶ Nominal voltage	VDC	24
	▶ Lower limit value	VDC	18
	▶ Upper limit value	VDC	36
Maximum admissible residual ripple		Vpp	2.5 (comply with the absolute supply voltage limit values)
Current consumption	▶ Maximum	A	2.5
	▶ Impulse current	A	4
Maximum power consumption		W	40
Functional ground and screening			see connector pin assignment (CE-compliant installation) page 12
Required fuse protection, external		A	4 time-lag
Adjustment			Calibrated in the plant, see characteristic curves page 14 ... 19

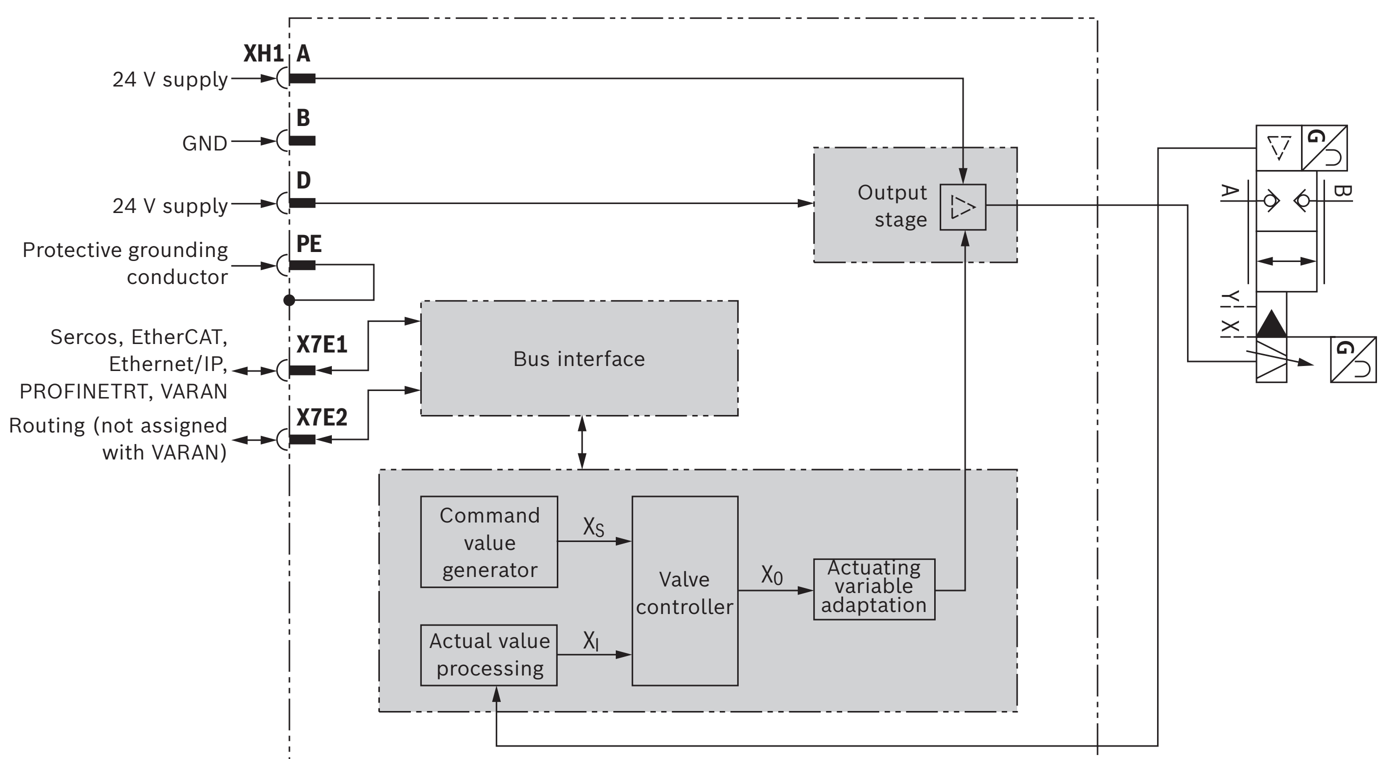
9) Without shut-off valve; 10% → 100%, pilot pressure 150 bar
10) With shut-off valve "WK" and "WL", pilot pressure 100 ... 315 bar

Block diagram/controller function block

▶ **With integrated electronics** (version "WRC**E**")



▶ **With integrated field bus electronics** (version "WRC**F**")



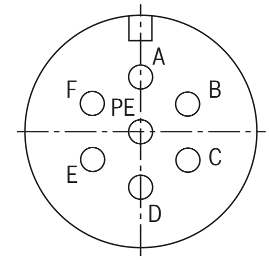
Electrical connections and assignment

Connector pin assignment: "A1", "F1" and "D9"

Pin 6 + PE	Signal	Interface assignment		
		Version "WRC**E**"		Version "WRC**F**"
		"A1" 1)	**"F1"** 2)	**"D9"**
A	Supply voltage	24 V DC		
B		GND		
C	Reference potential actual value	Reference potential actual value 3)	Reference potential actual value	–
D	Differential amplifier input	Command value 0 ... 10 V	Command value 4 ... 20 mA	24 V DC
E		Reference potential command value		–
F	Measuring output (actual value)	Actual value 0.5 ... 10 V	Actual value 4.8 ... 20 mA	–
PE		Functional ground (directly connected to the valve housing)		

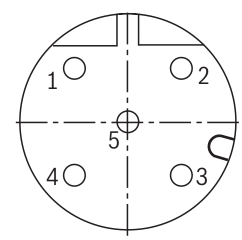
Notices:
- Do not connect PE if the valve has already been grounded via the system.
- In case of a cable break, valves of version "K" are regulated according to the factory setting and by default held in a closed position. Valves of version "L" are by default held in an open position. The customer may define a standstill valued in IndraWorks DS by changing the parameters.

1) Pin D positive against E results in opening of the main control spool
2) Command value 4 ... 20 mA results in opening of the main control spool
3) With version "A1", pin C should be connected to GND (pin B) at the ground neutral point of the system.



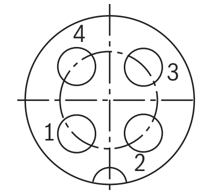
Connector pin assignment: M12 x 1, 4-pole, coding D
(for Ethernet interfaces "X7E1" and "X7E2")

Pin	Assignment
1	TxD +
2	RxD +
3	TxD –
4	RxD –
5	not used

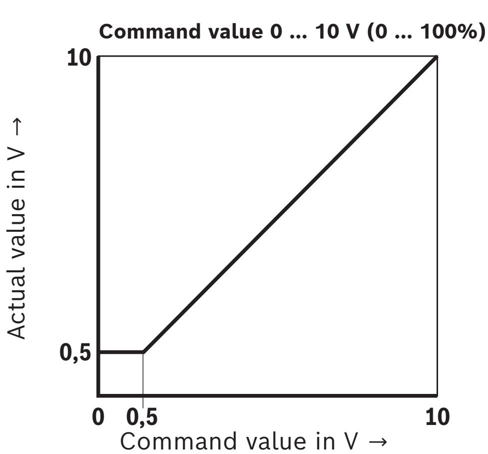


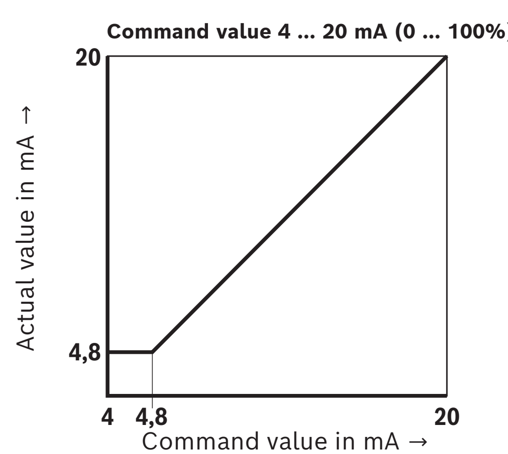
Connector pin assignment: M12 x 1, 4-pole
(position switch for sandwich plate shut-off valve)

Pin	Assignment
1	+24 V
2	Switching output: 200 mA
3	0 V, GND
4	Switching output: 200 mA



Nominal command value range

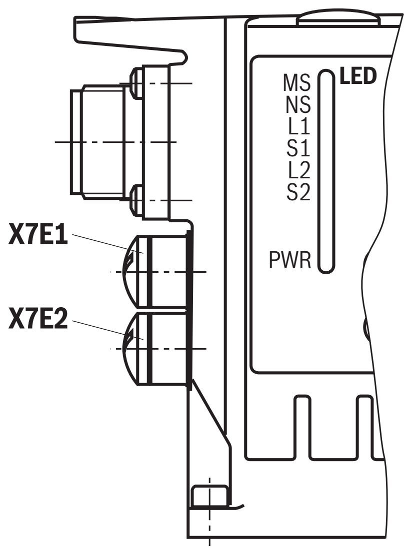




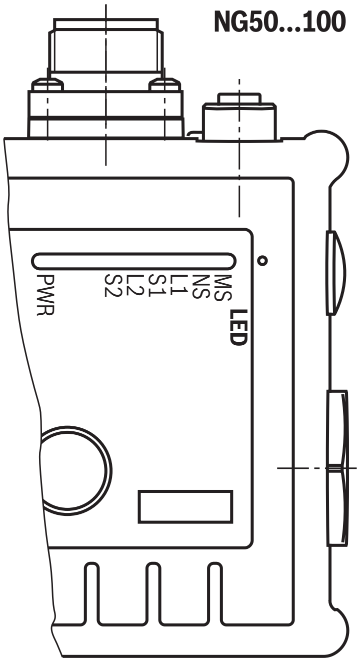
LED displays

LED	Interface	Analog	Sercos	EtherNET/IP	EtherCAT	PROFINET RT	VARAN
MS	**Electronics module**	Module status	Module status	Module status	Module status	Module status	Module status
NS		–	S	Network status and others	Network status and others	Network status and others	Network status and others
L1	**X7E1**	Link and others	Link and others	Link and others	Link/activity	Link and others	Link and others
S1		Activity and others	Activity and others	Activity and others	not used	Activity and others	Active and others
L2	**X7E2**	Link and others	Link and others	Link and others	Link/activity	Link and others	not used
S2		Activity and others	Activity and others	Activity and others	not used	Activity and others	not used
PWR	**XH1**	Power	Power	Power	Power	Power	Power

NG32 ... 40



NG50...100



Displays of the status LEDs

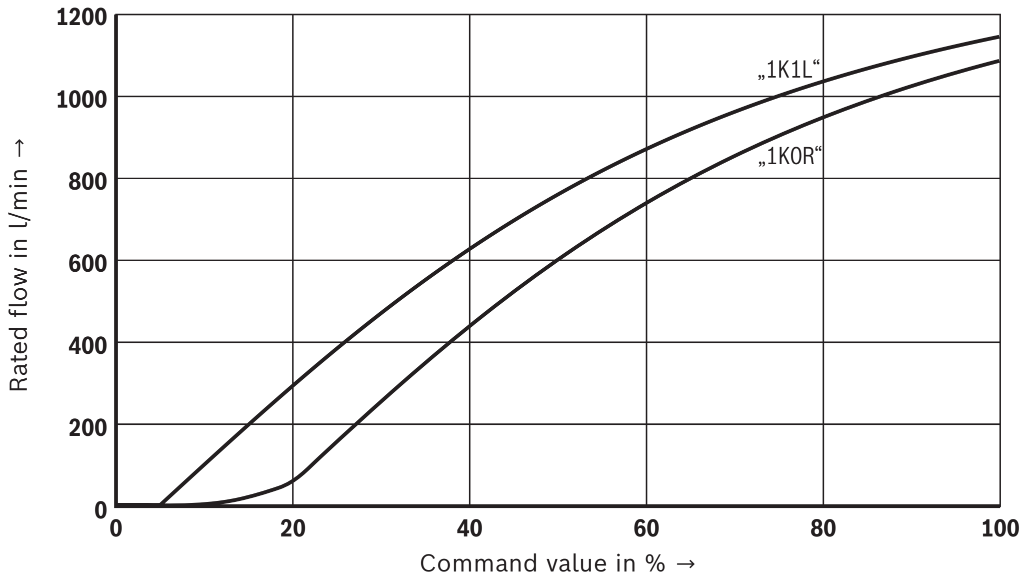
Power LED (LED PWR)	Display status
Off	No voltage supply
Green	Operation

Module status LED (LED MS)	Display status
Off	No voltage supply
Green-red, flashing	Initialization
Green, flashing	Drive ready for operation
Green	Drive active
Orange, flashing	Warning
Red, flashing	Error
Green, rapidly flashing	Firmware must be loaded

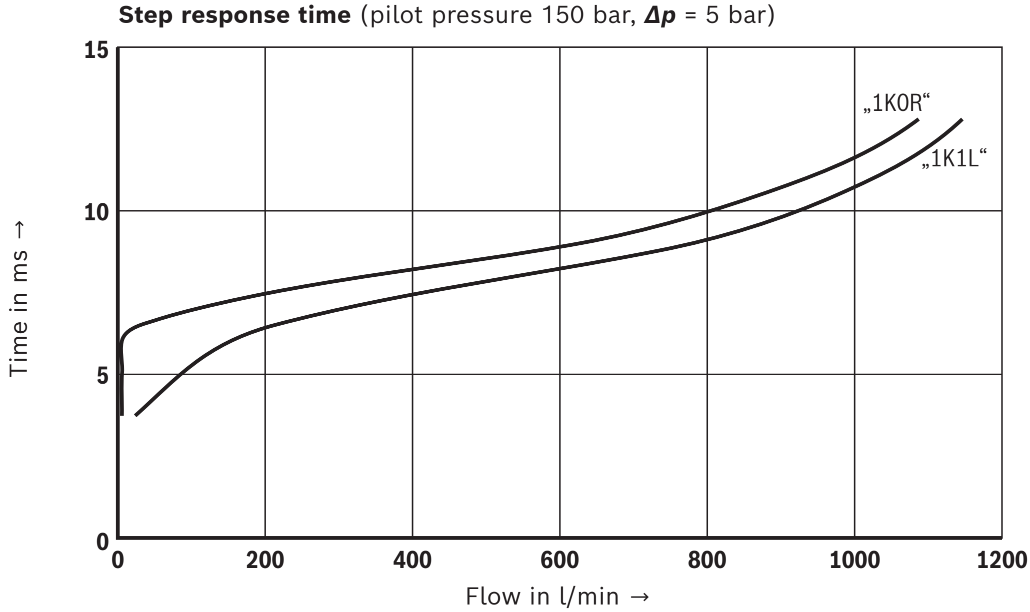
Notices:
- For the connection to the M12 sockets, we recommend using self-locking mating connectors
- The MS module status LED relates to the electronics module
- The NS network status LED indicates the status of the control communication, see application description 30338-FK
- LEDs L1, S1, L2 and S2 relate to interfaces "X7E1" and "X7E2"
  - Link: Cable plugged in, connection established (permanently lit)
  - Activity: Data sent/received (flashing)
- For a detailed description of the diagnosis LEDs, please refer to the functional description Rexroth HydraulicDrive HDx.

Characteristic curves: Size 32
(measured with HLP32, ϑ_{oil} = 40 ±5 °C)

Nominal flow (***Δp*** = 5 bar)

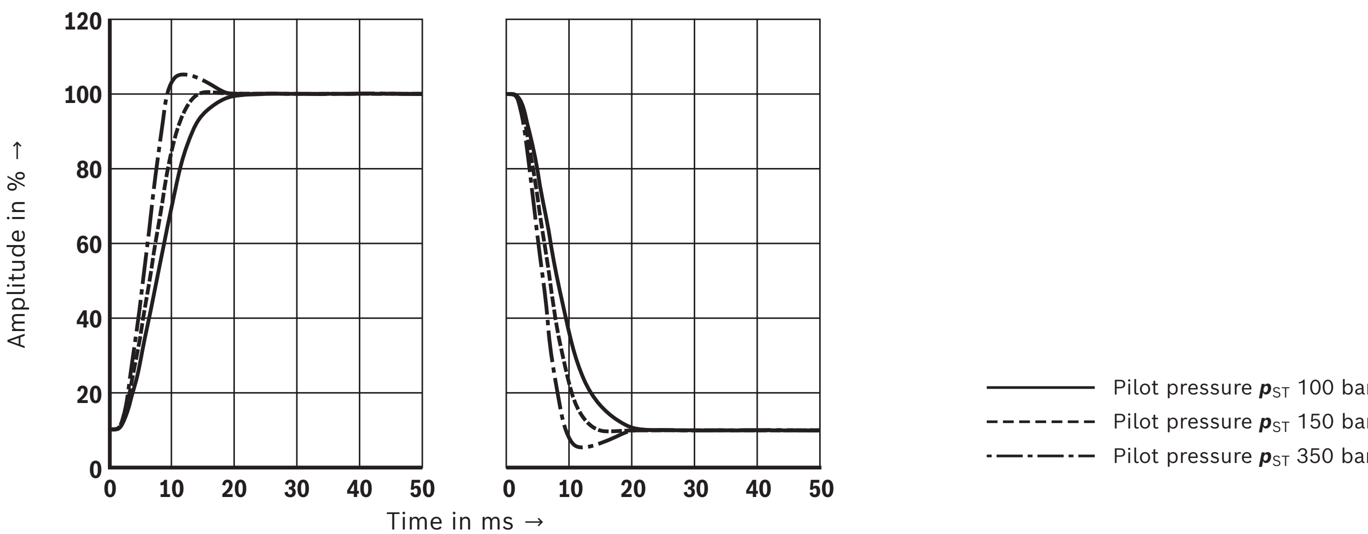


Step response time (pilot pressure 150 bar, ***Δp*** = 5 bar)

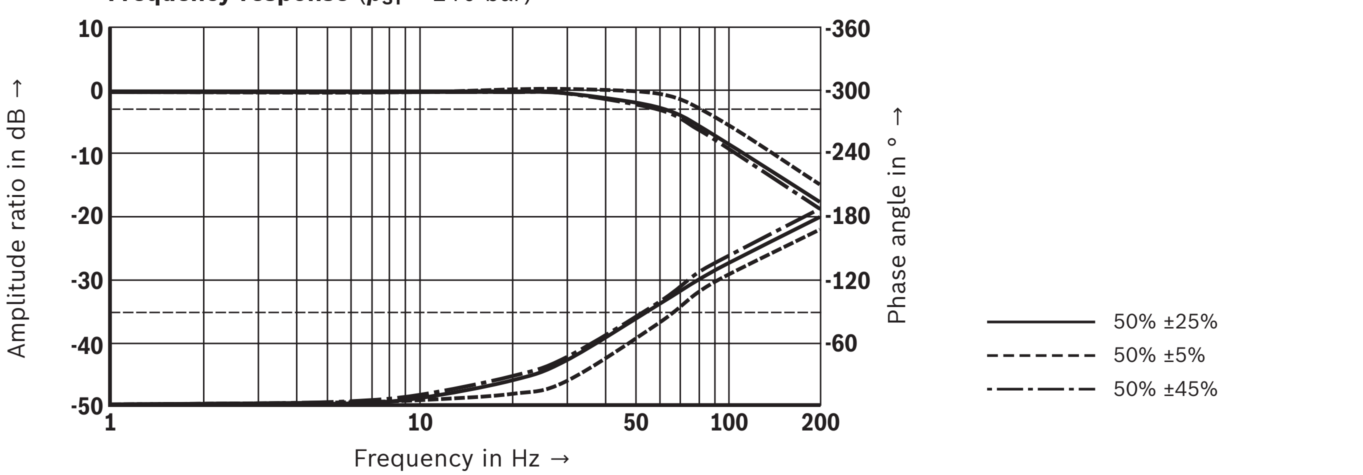


Characteristic curves: Size 32
(measured with HLP32, ϑ_{oil} = 40 ±5 °C)

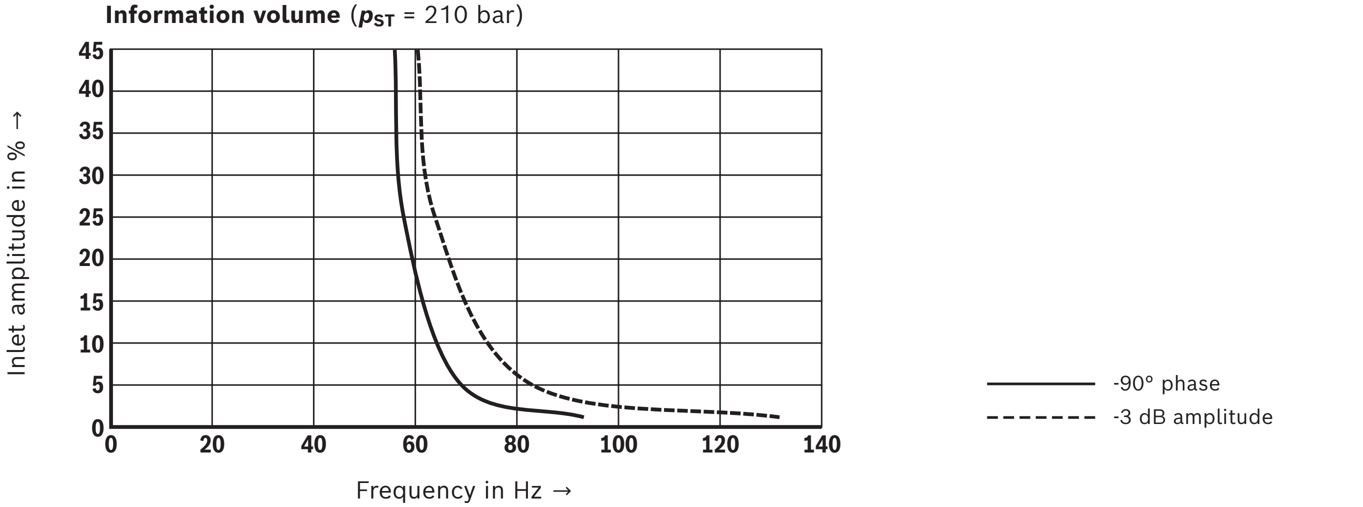
Transition function with stepped electric input signals



Frequency response (p_{ST} = 210 bar)

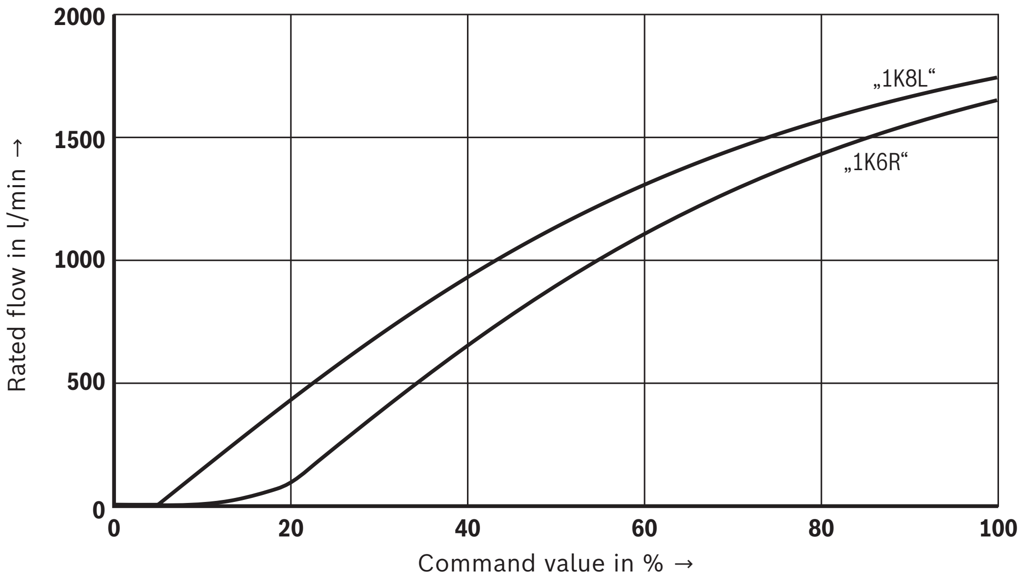


Information volume (p_{ST} = 210 bar)

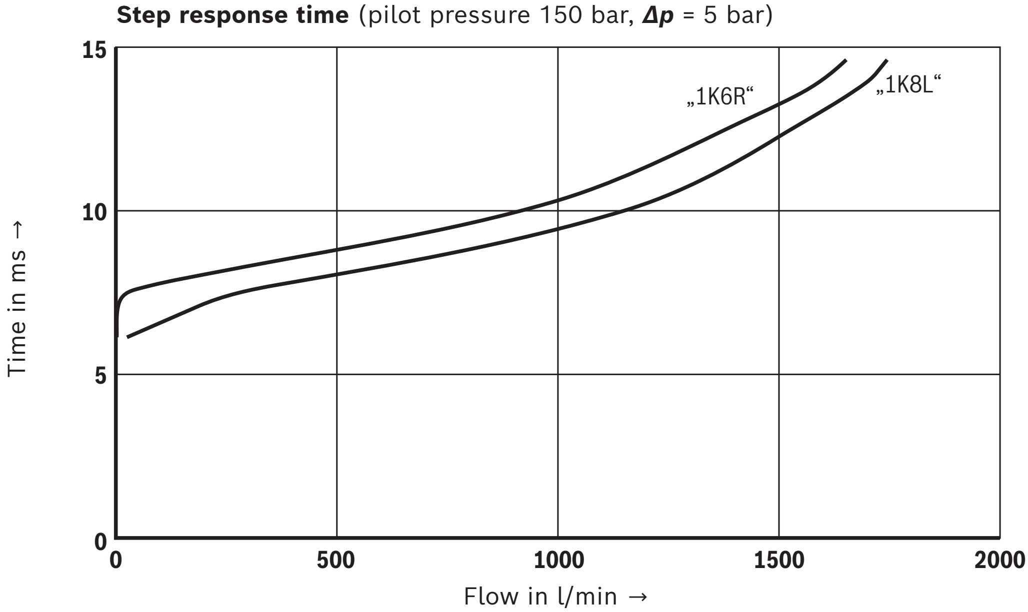


Characteristic curves: Size 40
(measured with HLP32, ϑ_{oil} = 40 ±5 °C)

Nominal flow (***Δp*** = 5 bar)

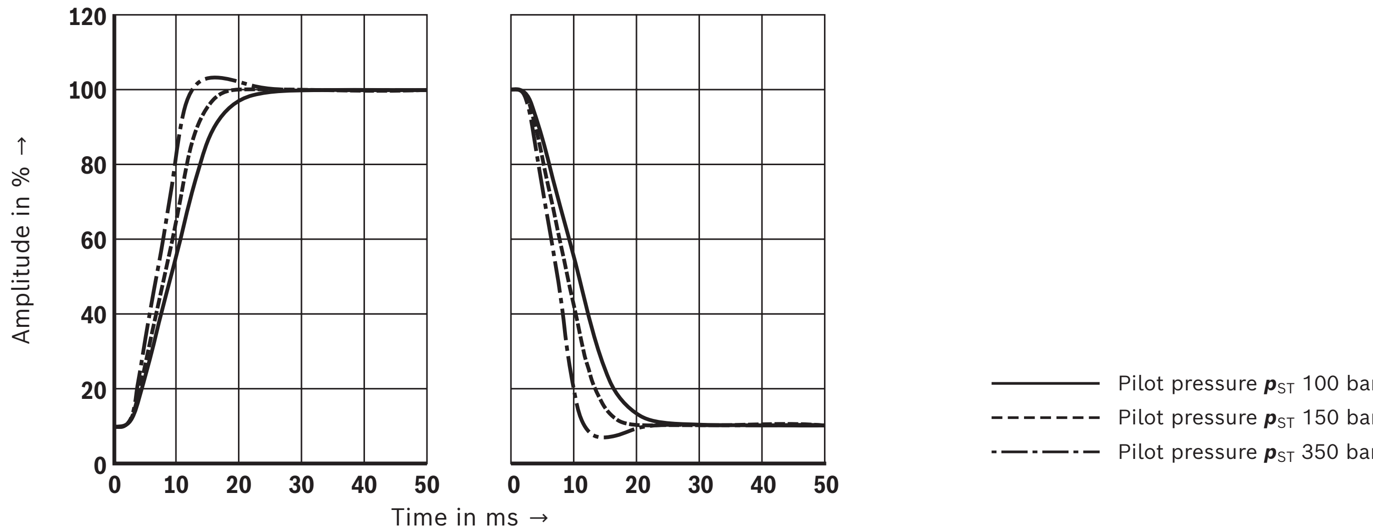


Step response time (pilot pressure 150 bar, ***Δp*** = 5 bar)

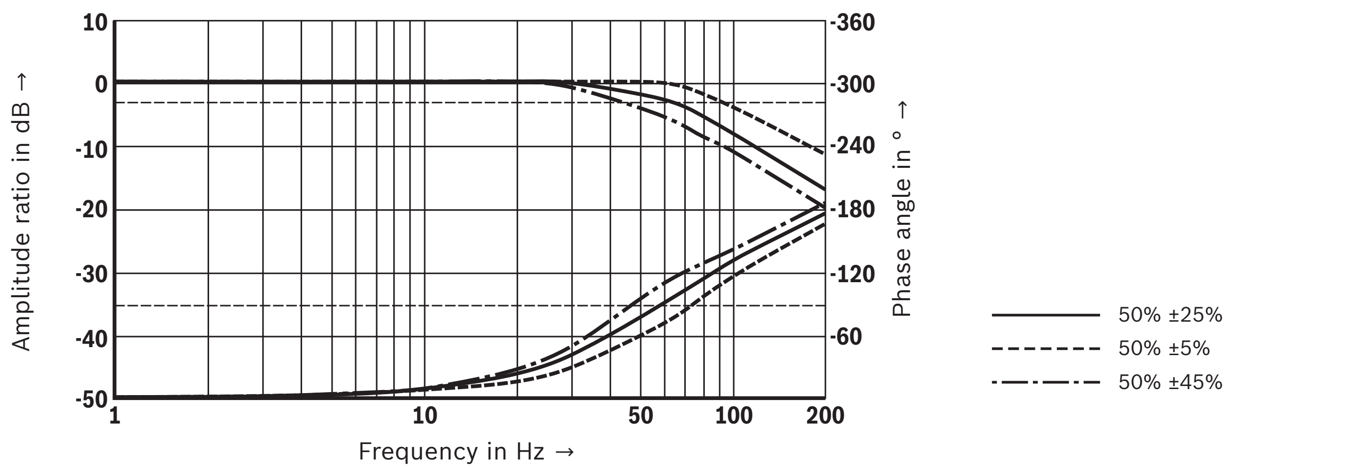


Characteristic curves: Size 40
(measured with HLP32, ϑ_{oil} = 40 ±5 °C)

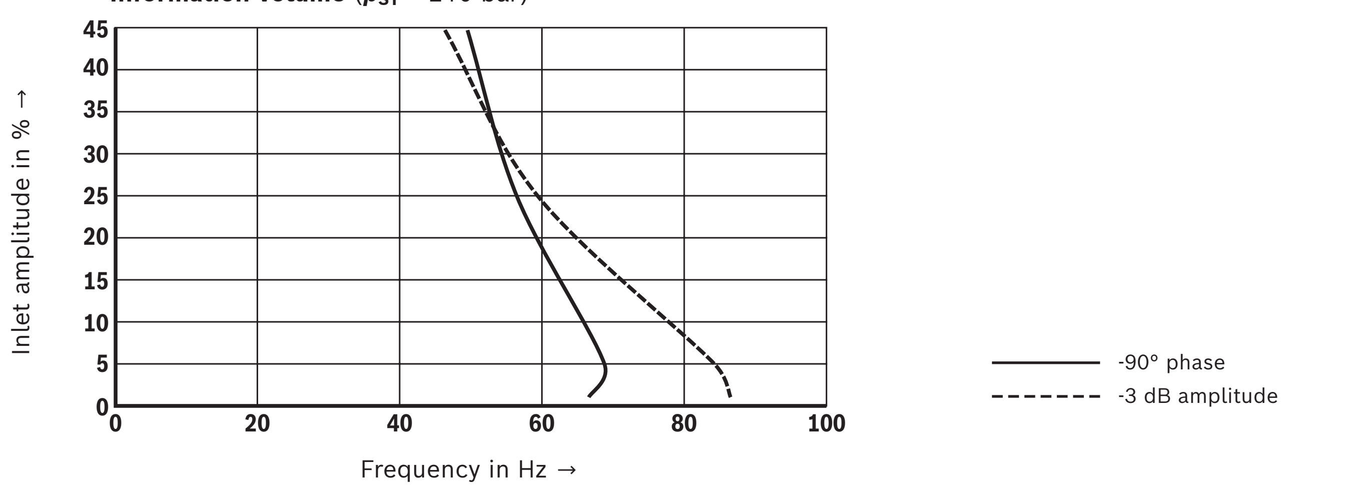
Transition function with stepped electric input signals



Frequency response (p_{ST} = 210 bar)

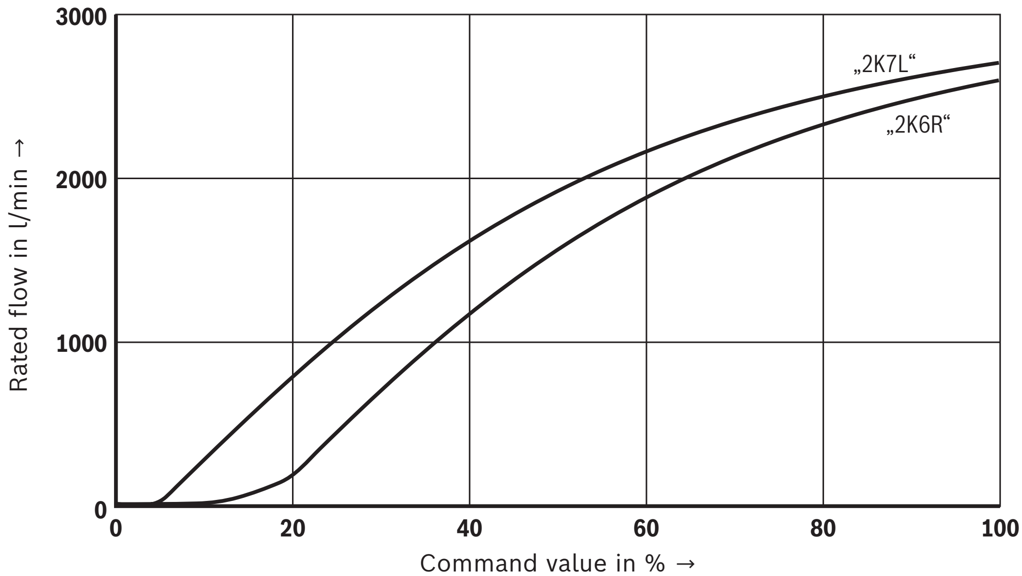


Information volume (p_{ST} = 210 bar)

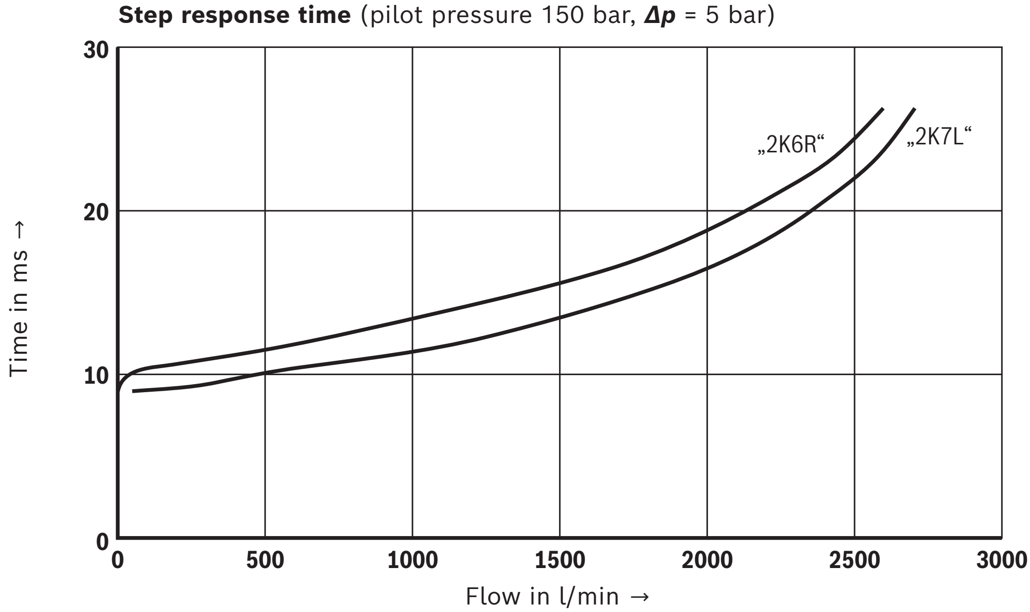


Characteristic curves: Size 50
(measured with HLP32, ϑ_{oil} = 40 ±5 °C)

Nominal flow (***Δp*** = 5 bar)

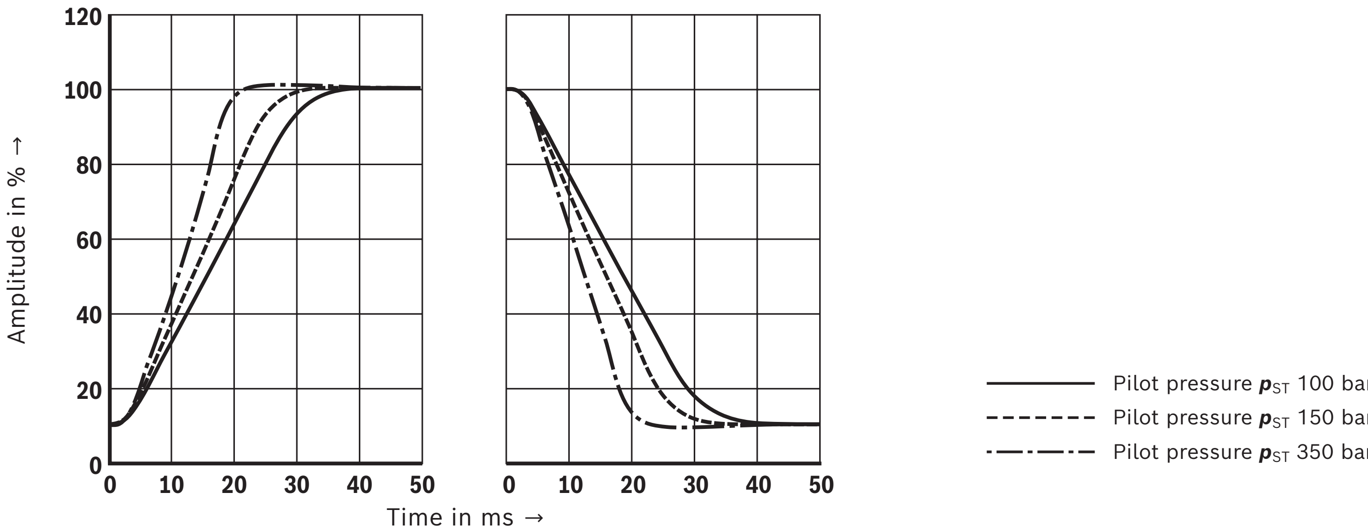


Step response time (pilot pressure 150 bar, ***Δp*** = 5 bar)

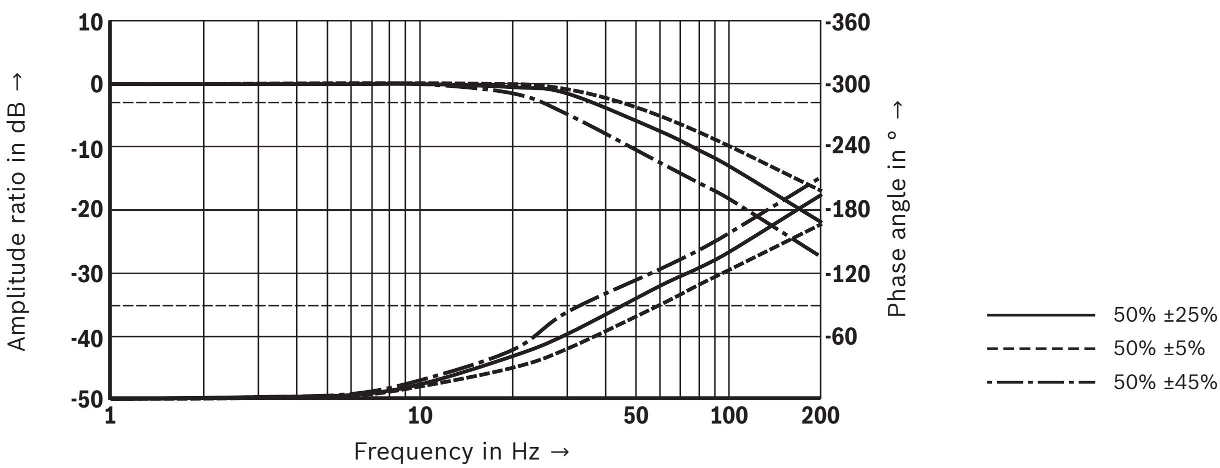


Characteristic curves: Size 50
(measured with HLP32, ϑ_{oil} = 40 ±5 °C)

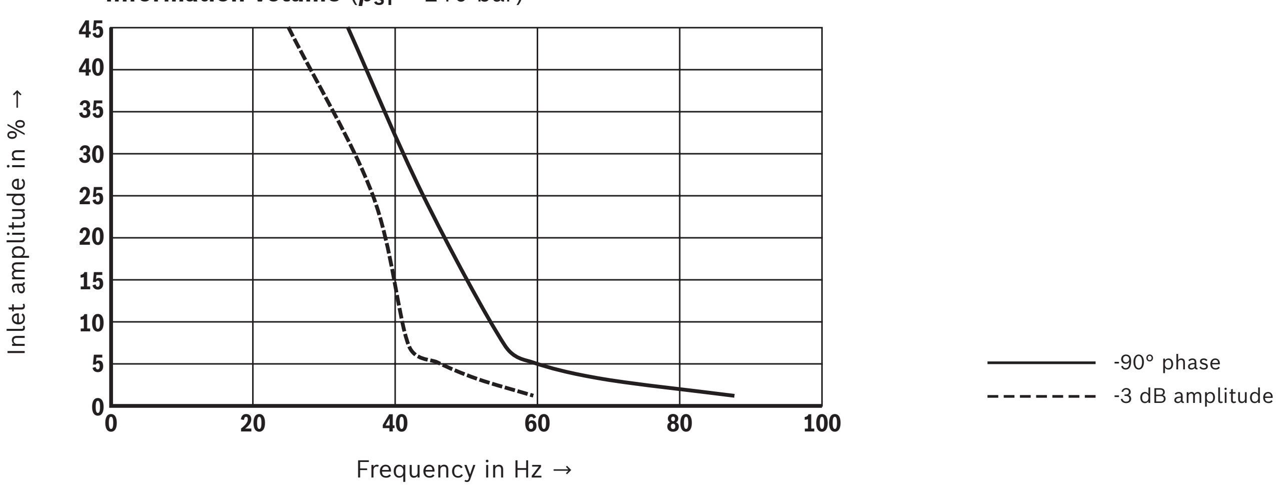
Transition function with stepped electric input signals



Frequency response (p_{ST} = 210 bar)

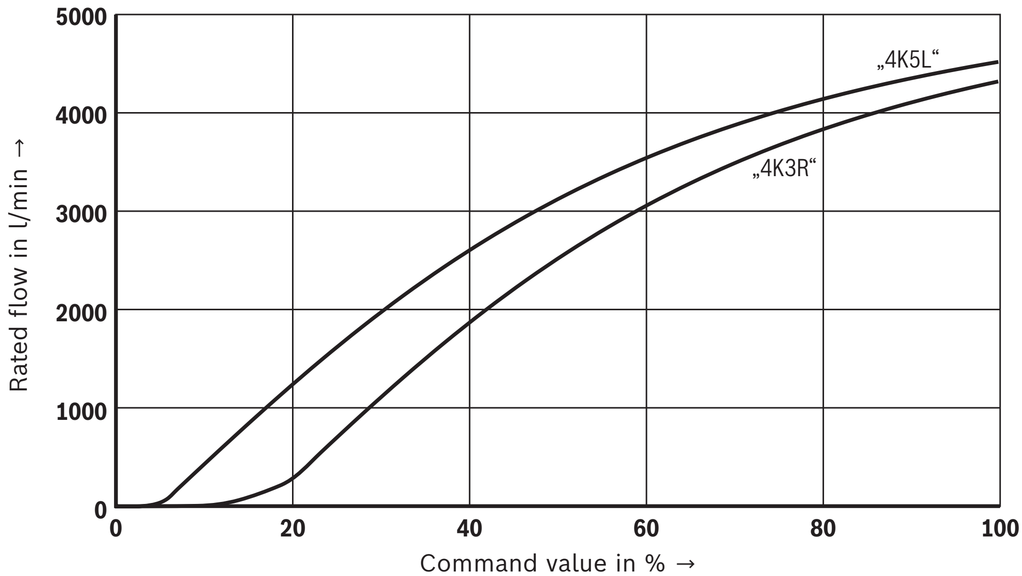


Information volume (p_{ST} = 210 bar)

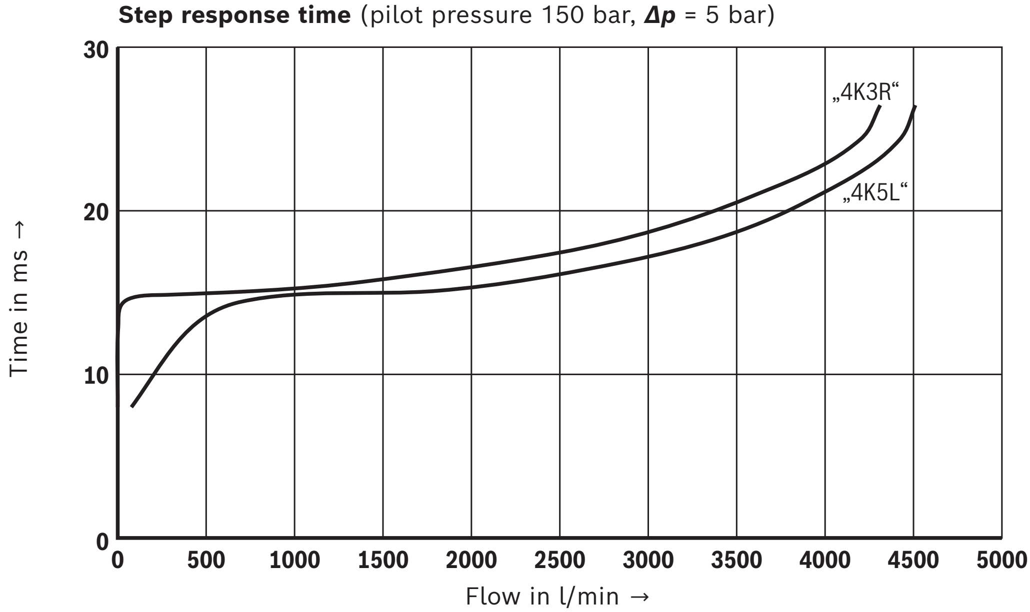


Characteristic curves: Size 63
(measured with HLP32, ϑ_{oil} = 40 ±5 °C)

Nominal flow (***Δp*** = 5 bar)

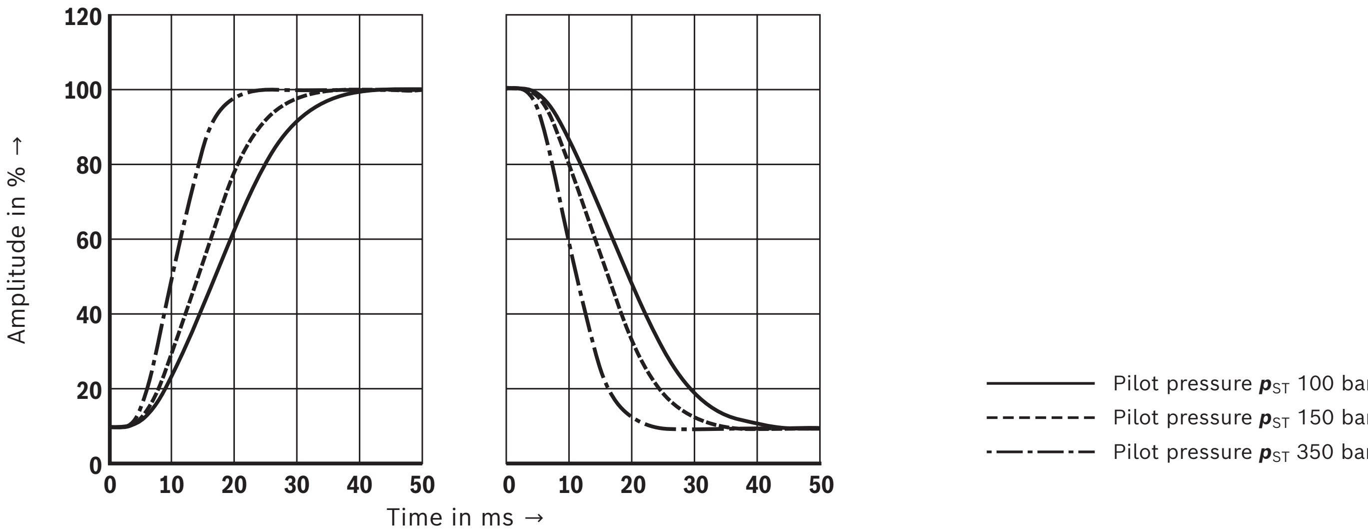


Step response time (pilot pressure 150 bar, ***Δp*** = 5 bar)

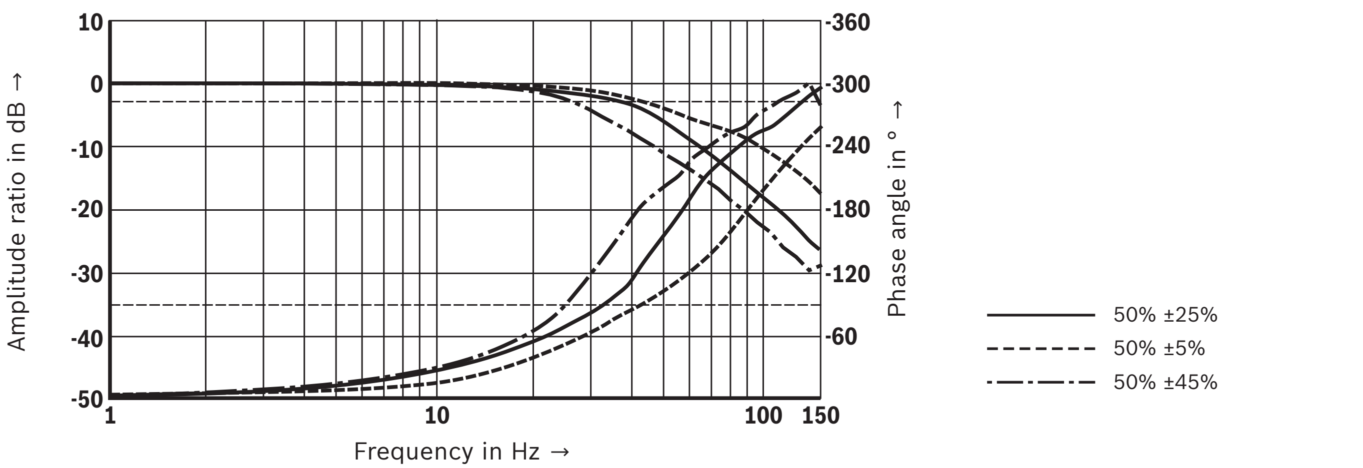


Characteristic curves: Size 63
(measured with HLP32, ϑ_{oil} = 40 ±5 °C)

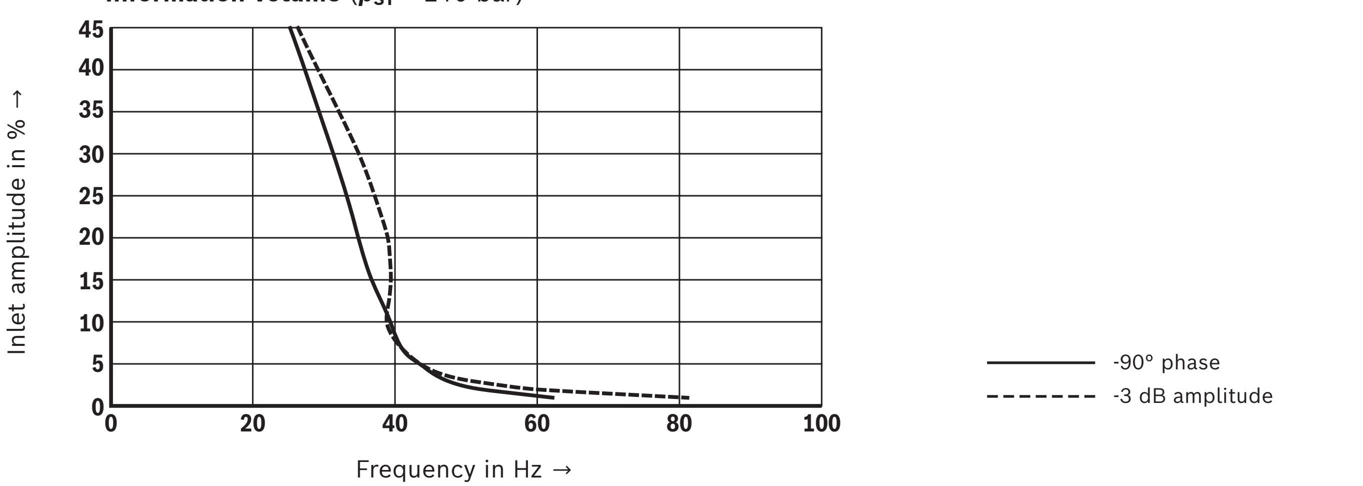
Transition function with stepped electric input signals



Frequency response (p_{ST} = 210 bar)

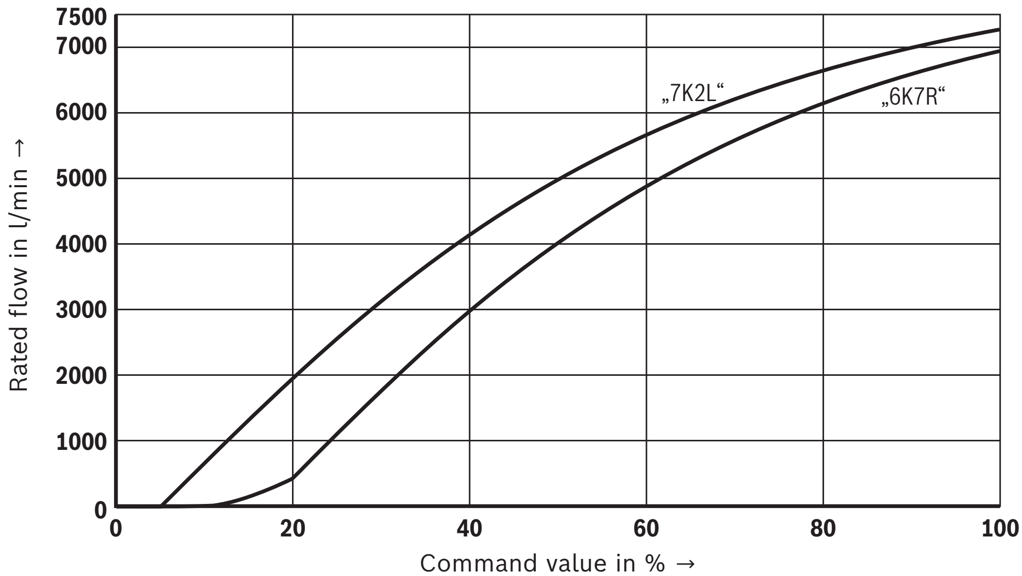


Information volume (p_{ST} = 210 bar)

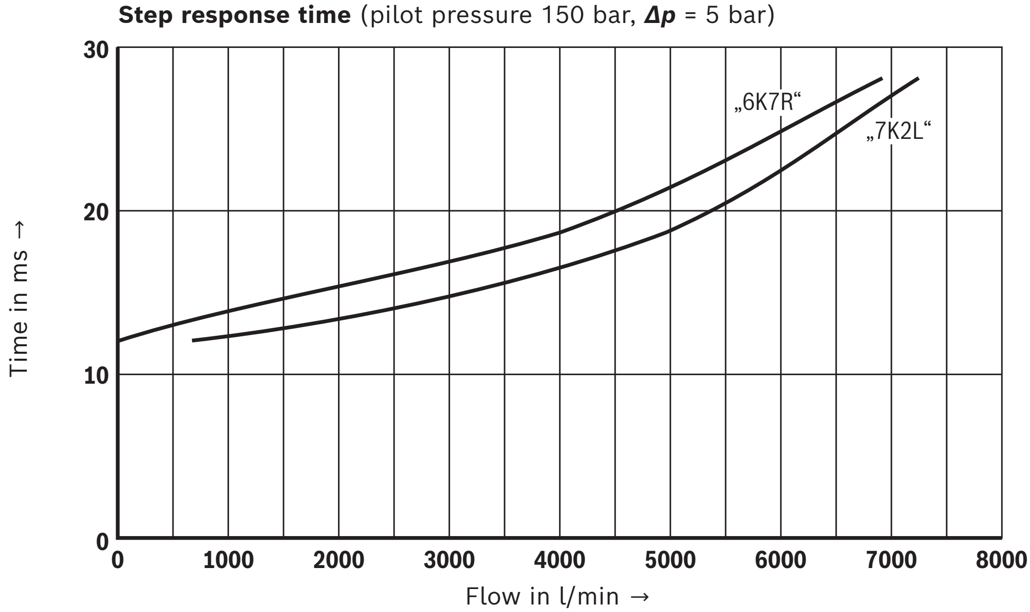


Characteristic curves: Size 80
(measured with HLP32, ϑ_{oil} = 40 ±5 °C)

Nominal flow (***Δp*** = 5 bar)

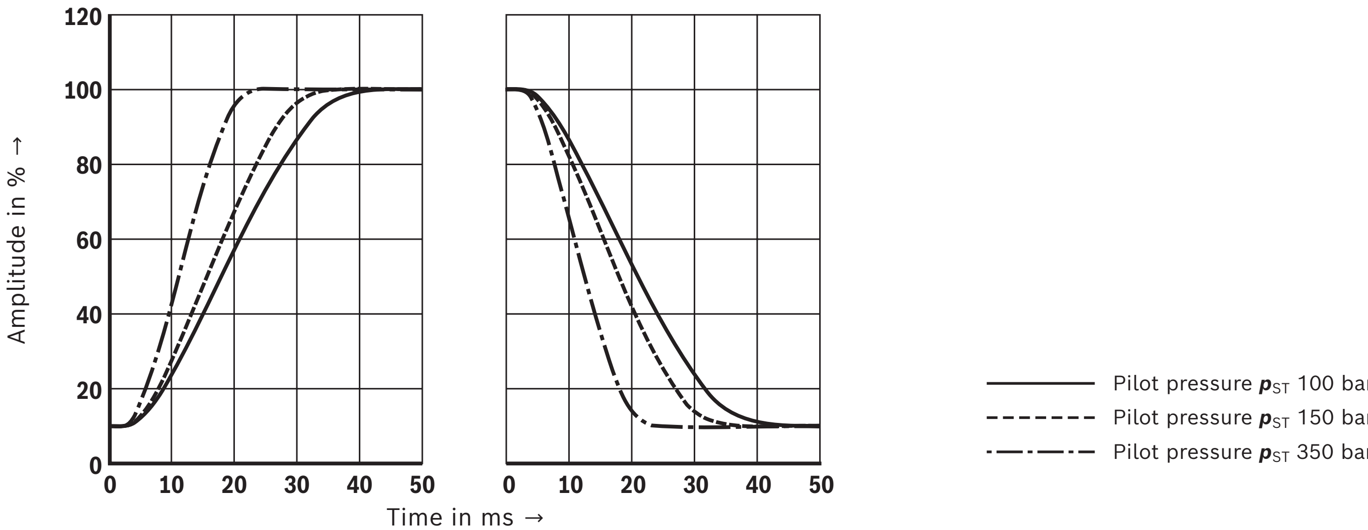


Step response time (pilot pressure 150 bar, ***Δp*** = 5 bar)

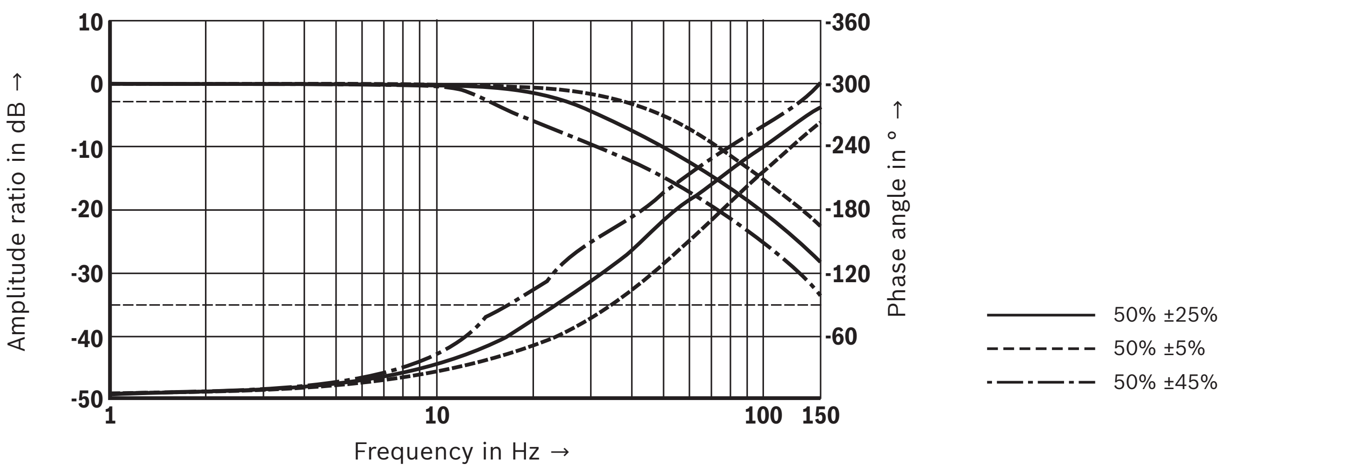


Characteristic curves: Size 80
(measured with HLP32, ϑ_{oil} = 40 ±5 °C)

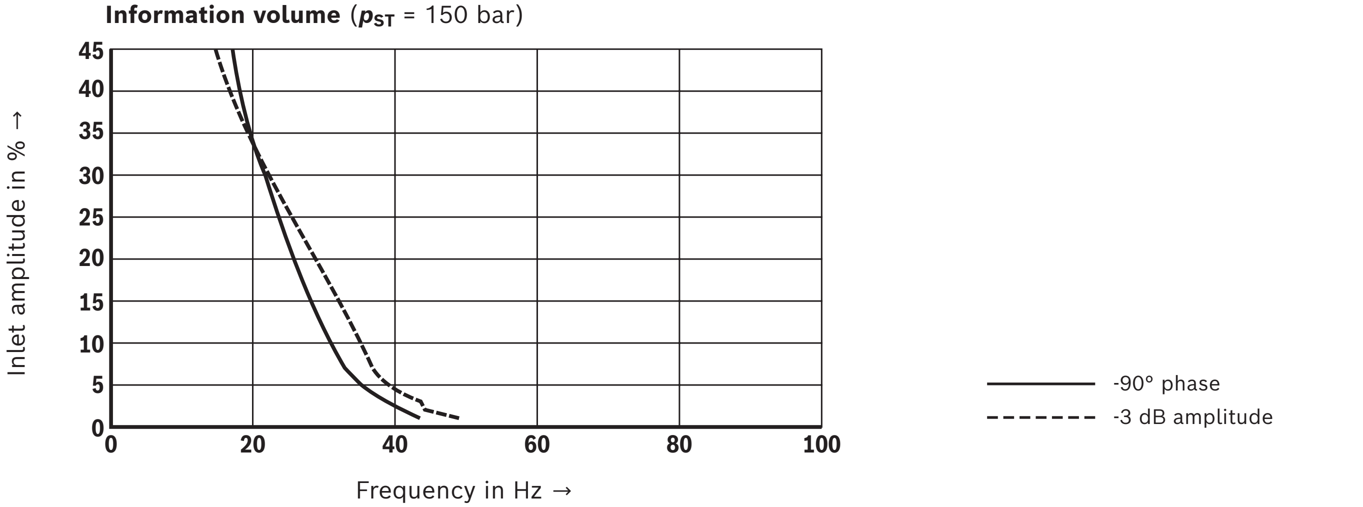
Transition function with stepped electric input signals



Frequency response (p_{ST} = 150 bar)

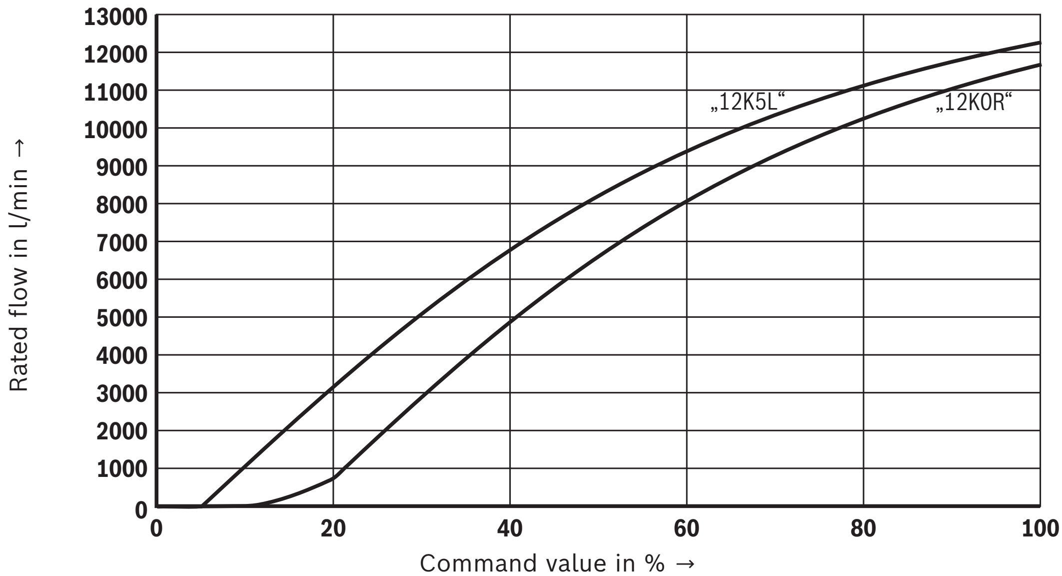


Information volume (p_{ST} = 150 bar)

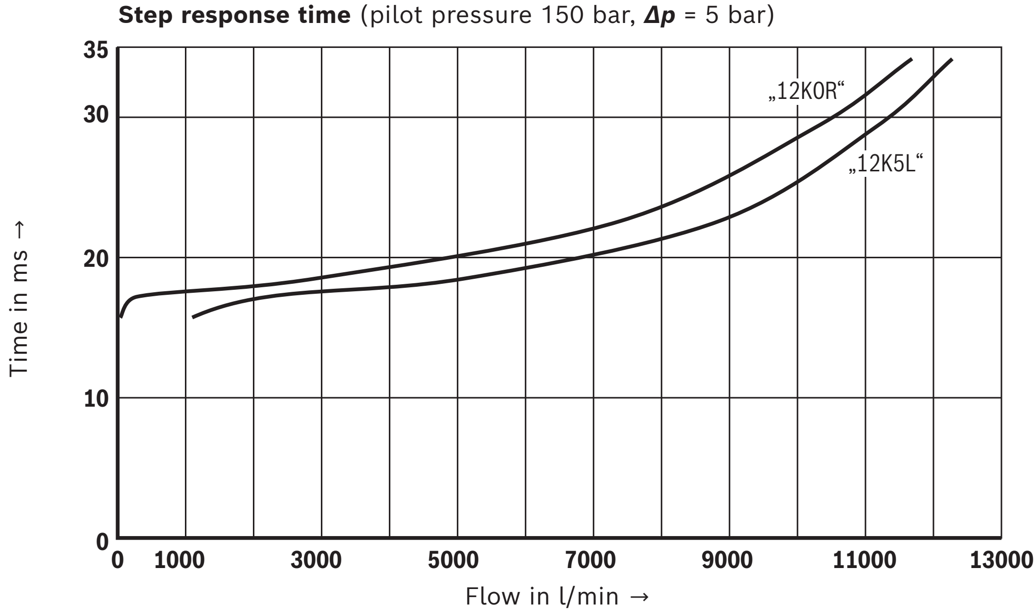


Characteristic curves: Size 100
(measured with HLP32, ϑ_{oil} = 40 ±5 °C)

Nominal flow (*Δp* = 5 bar)

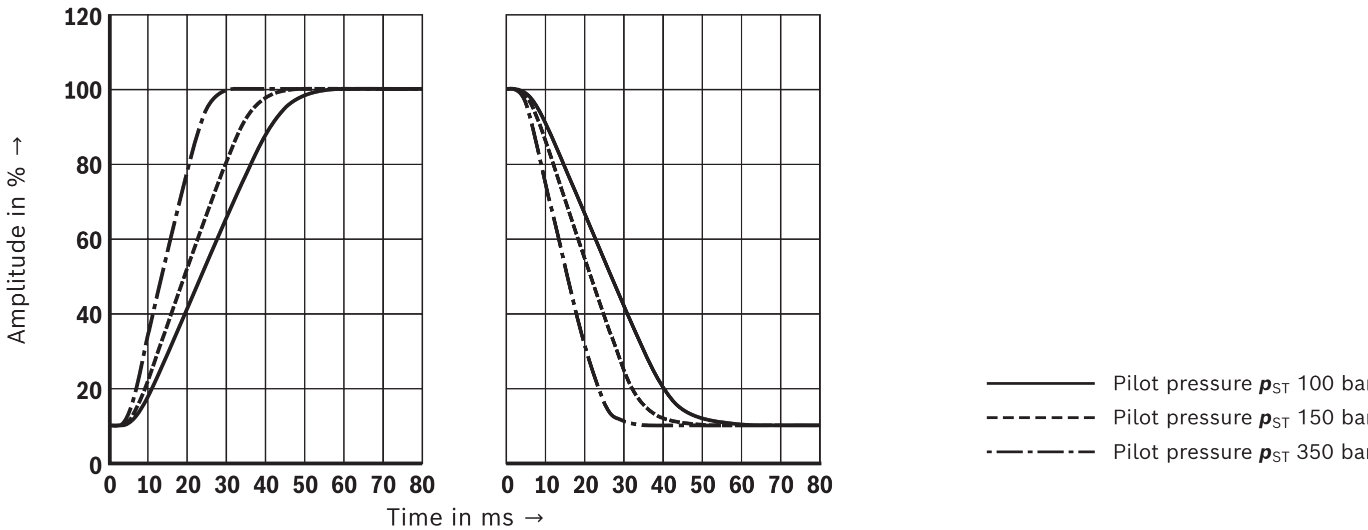


Step response time (pilot pressure 150 bar, *Δp* = 5 bar)

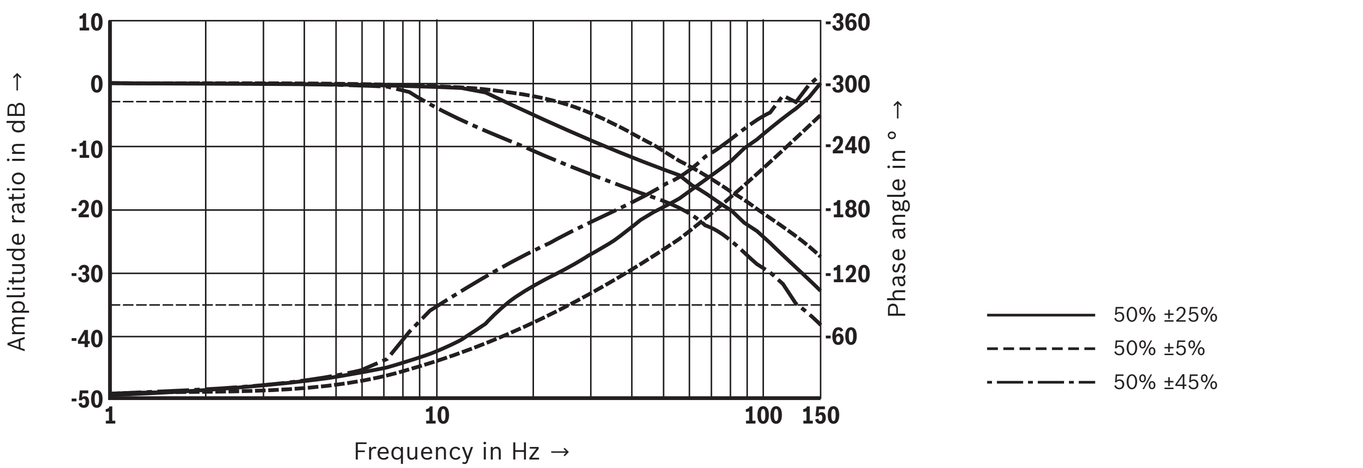


Characteristic curves: Size 100
(measured with HLP32, ϑ_{oil} = 40 ±5 °C)

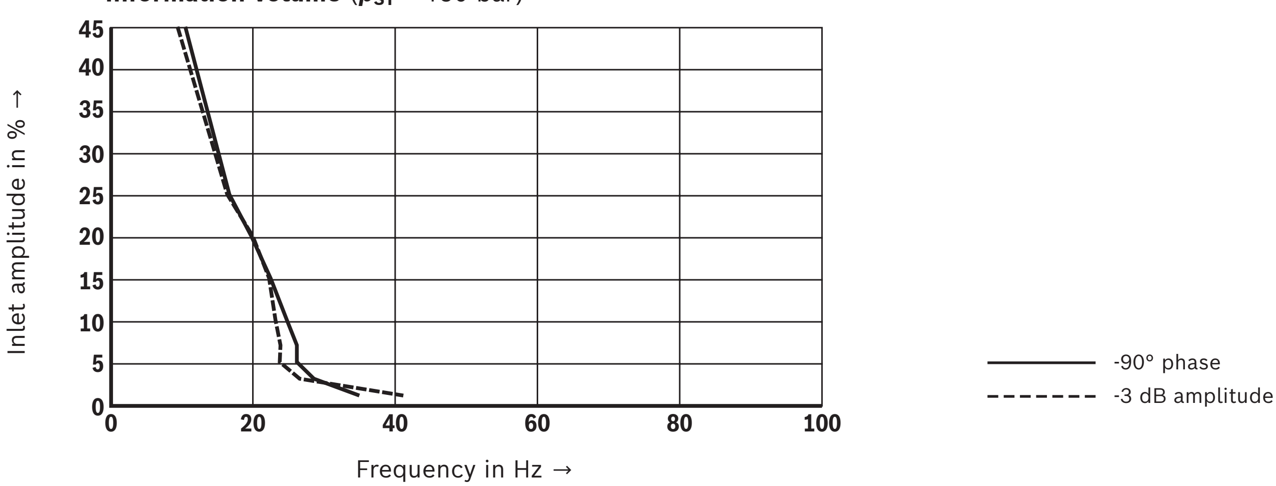
Transition function with stepped electric input signals



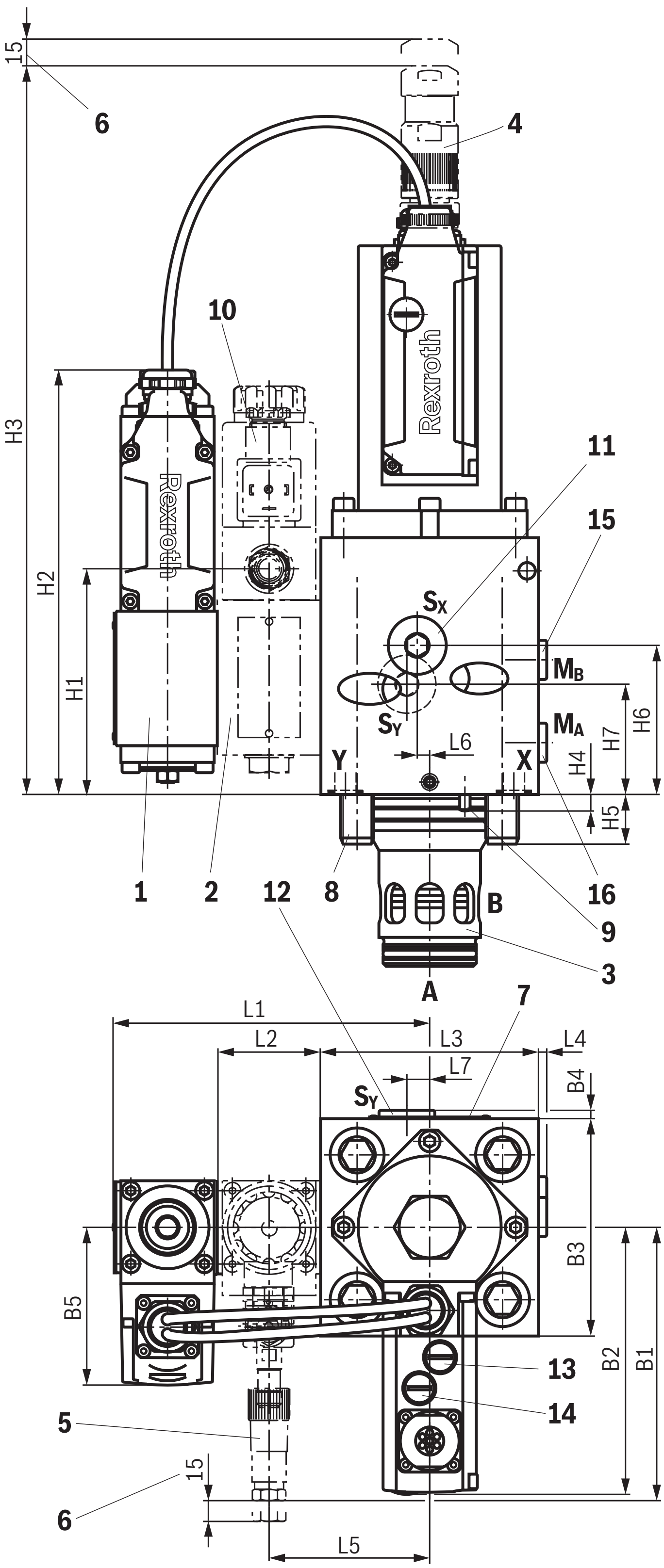
Frequency response (p_{ST} = 150 bar)



Information volume (p_{ST} = 150 bar)



Dimensions: Sizes 32 and 40 (dimensions in mm)



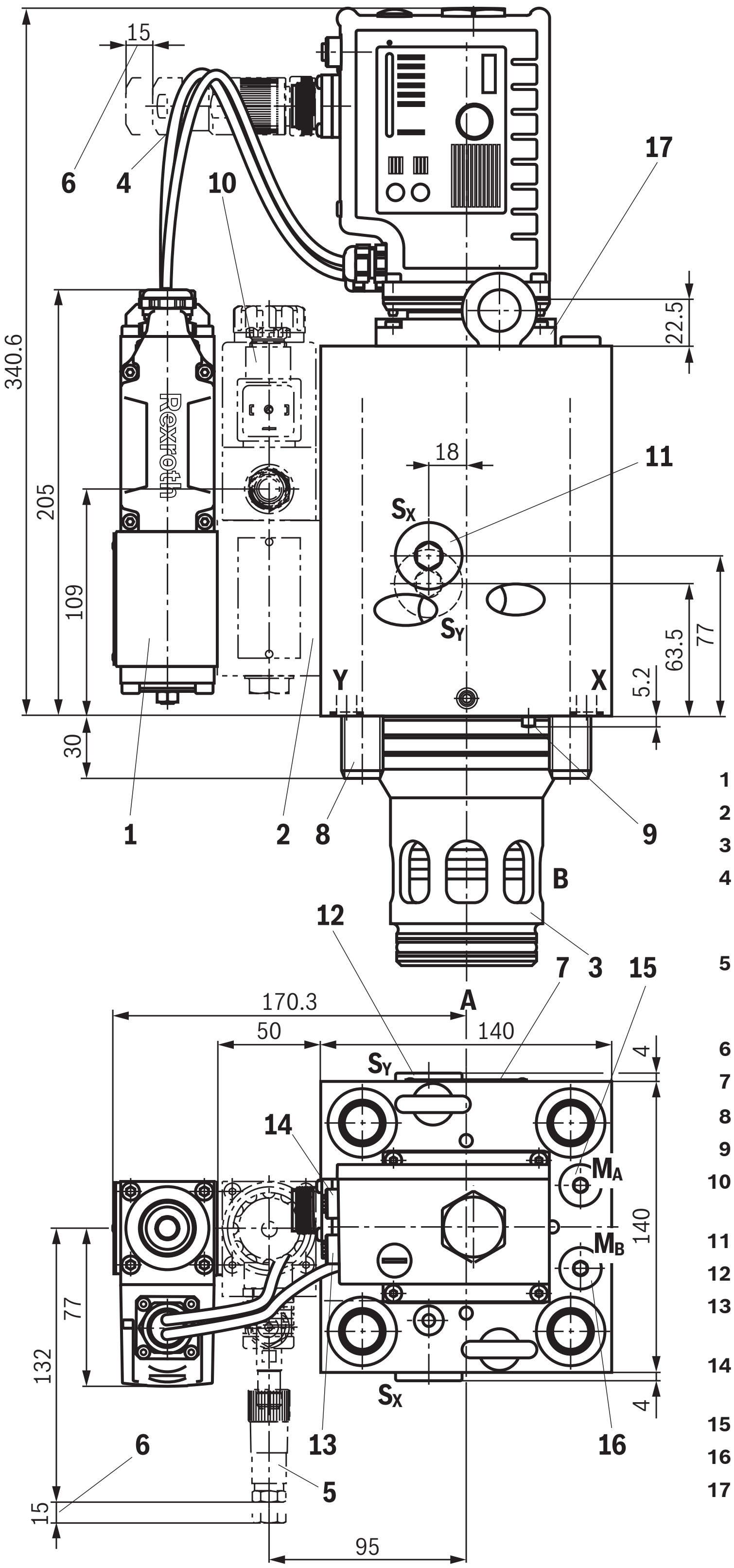
1 Pilot control valve (proportional directional valve NG6)
2 Sandwich plate shut-off valve (version "WK" and "WL")
3 Bushing
4 Mating connectors for valves with round connector, 6-pole + PE (separate order, see page 33 and data sheet 08006)
5 Mating connector M12 x 1, 4-pole, for spool position monitoring (separate order, see page 33 and data sheet 08006)
6 Space required for removing the mating connector
7 Name plate
8 Valve mounting screws (separate order, see page 33)
9 Locking pin for fixing
10 Mating connectors for valves with connector "K4" (separate order, see page 33 and data sheet 08006)
11 Accumulator port for pilot pressure in channel X (G1/2)
12 Accumulator port for pilot pressure in channel Y (G1/2)
13 Field bus interface "Ethernet OUT" (X7E2); (cable sets, separate order, see page 33)
14 Field bus interface "Ethernet IN" (X7E1); (cable sets, separate order, see page 33)
15 Measuring port for pilot pressure in channel A (G1/4)
16 Measuring port for pilot pressure in channel B (G1/4)

Notice:
The dimensions are nominal dimensions which are subject to tolerances.

NG	H1	H2	H3	H4	H5	H6	H7	B1	B2 [1]	B3	B4	B5	L1	L2	L3	L4	L5	L6	L7
32	109	205	352	8	24	81	56	132	129 (151.5)	105	4	77	153	50	105	4	77.5	6	11
40	109	205	355	8	30	89	56	132	129 (151.5)	125	4	77	163	50	125	4	87.5	0	10

[1] Dimensions () for version with damping plate "D"

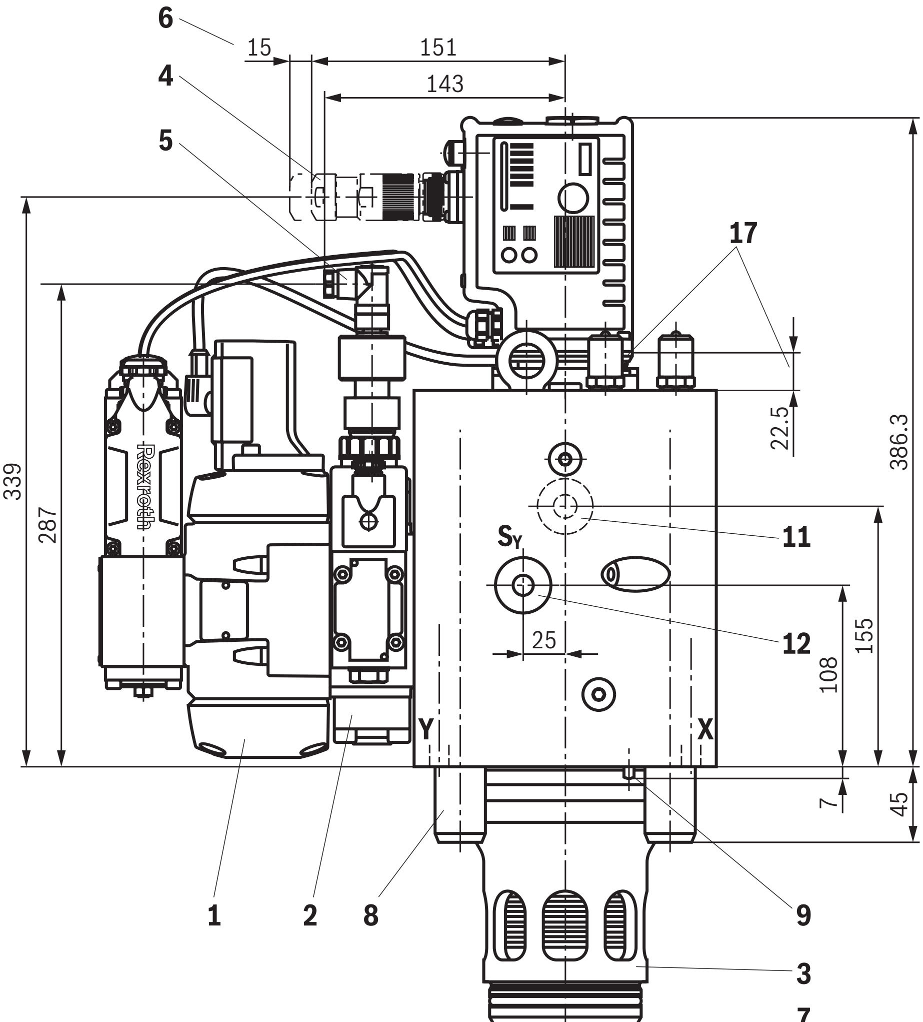
Dimensions: Size 50
(dimensions in mm)

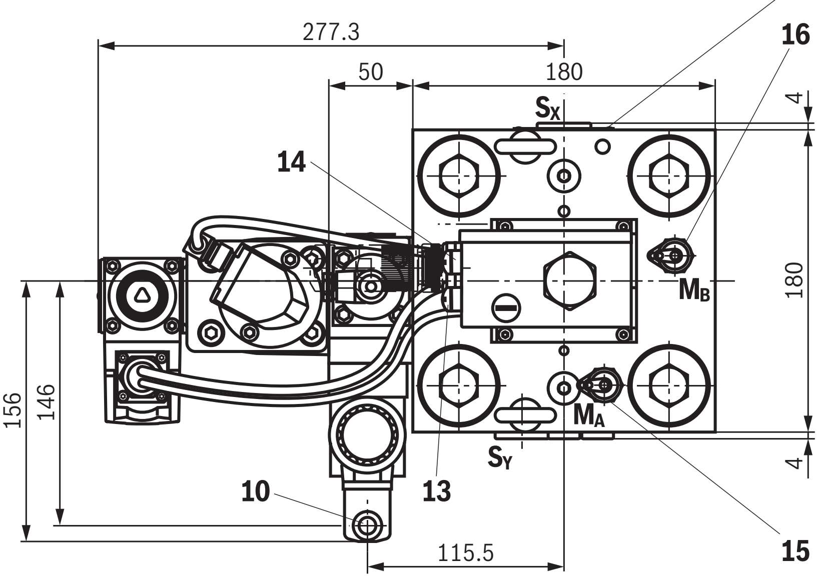


1 Pilot control valve (proportional directional valve NG6)
2 Sandwich plate shut-off valve (version "WK" and "WL")
3 Bushing
4 Mating connectors for valves with round connector, 6-pole + PE (separate order, see page 33 and data sheet 08006)
5 Mating connector M12 x 1, 4-pole, for spool position monitoring (separate order, see page 33 and data sheet 08006)
6 Space required for removing the mating connector
7 Name plate
8 Valve mounting screws (separate order, see page 33)
9 Locking pin for fixing
10 Mating connectors for valves with connector "K4" (separate order, see page 33 and data sheet 08006)
11 Accumulator port for pilot pressure in channel X (G3/4)
12 Accumulator port for pilot pressure in channel Y (G3/4)
13 Field bus interface "Ethernet OUT" (X7E2); (cable sets, separate order, see page 33)
14 Field bus interface "Ethernet IN" (X7E1); (cable sets, separate order, see page 33)
15 Measuring port for pilot pressure in channel A (G1/4)
16 Measuring port for pilot pressure in channel B (G1/4)
17 Damping plate

Notice:
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions: Size 63
(dimensions in mm)

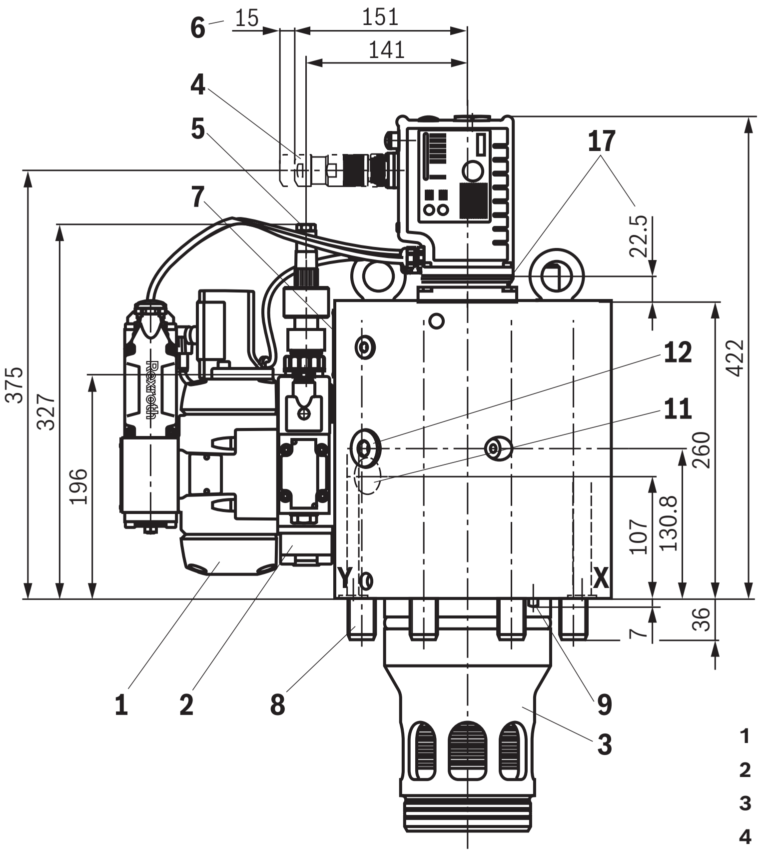


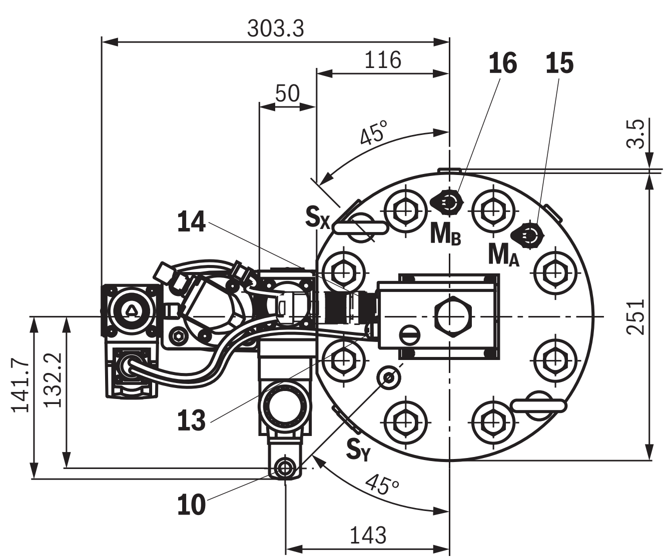


1. Pilot control valve (proportional directional valve NG10)
2. Sandwich plate shut-off valve (version "WK" and "WL")
3. Bushing
4. Mating connectors for valves with round connector, 6-pole + PE (separate order, see page 33 and data sheet 08006)
5. Mating connector M12 x 1, 4-pole, angled, for spool position monitoring (separate order, see page 33 and data sheet 08006)
6. Space required for removing the mating connector
7. Name plate
8. Valve mounting screws (separate order, see page 33)
9. Locking pin for fixing
10. Mating connectors for valves with connector "K4" (separate order, see page 33 and data sheet 08006)
11. Accumulator port for pilot pressure in channel X (G3/4)
12. Accumulator port for pilot pressure in channel Y (G3/4)
13. Field bus interface "Ethernet OUT" (X7E2); (cable sets, separate order, see page 33)
14. Field bus interface "Ethernet IN" (X7E1); (cable sets, separate order, see page 33)
15. Measuring port for pilot pressure in channel A (G1/4)
16. Measuring port for pilot pressure in channel B (G1/4)
17. Damping plate

Notice:
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions: Size 80
(dimensions in mm)





1 Pilot control valve (proportional directional valve NG10)
2 Sandwich plate shut-off valve (version "WK" and "WL")
3 Bushing
4 Mating connectors for valves with round connector, 6-pole + PE (separate order, see page 33 and data sheet 08006)
5 Mating connector M12 x 1, 4-pole, angled, for spool position monitoring (separate order, see page 33 and data sheet 08006)
6 Space required for removing the mating connector
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8 Valve mounting screws (separate order, see page 33)
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10 Mating connectors for valves with connector "K4" (separate order, see page 33 and data sheet 08006)
11 Accumulator port for pilot pressure in channel X (G3/4)
12 Accumulator port for pilot pressure in channel Y (G3/4)
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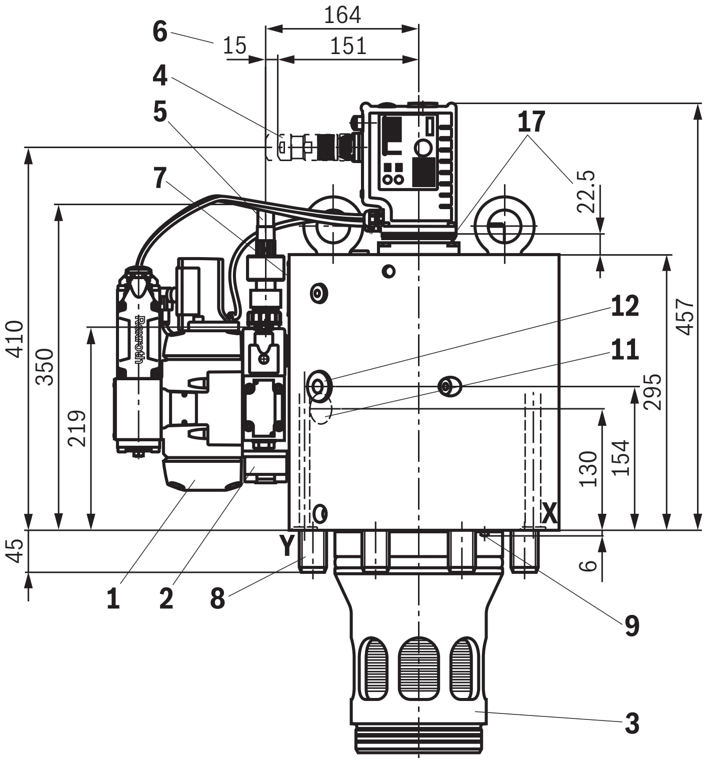
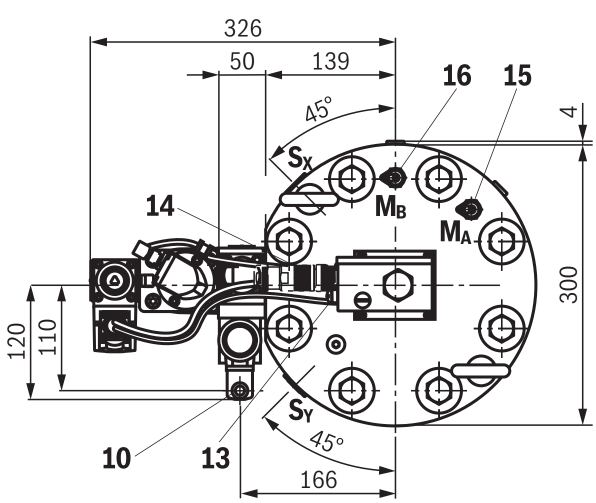
14 Field bus interface "Ethernet IN" (X7E1); (cable sets, separate order, see page 33)
15 Measuring port for pilot pressure in channel A (G1/4)
16 Measuring port for pilot pressure in channel B (G1/4)
17 Damping plate

Notice:
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions: Size 100
(dimensions in mm)





1 Pilot control valve (proportional directional valve NG10)
2 Sandwich plate shut-off valve (version "WK" and "WL")
3 Bushing
4 Mating connectors for valves with round connector, 6-pole + PE (separate order, see page 33 and data sheet 08006)
5 Mating connector M12 x 1, 4-pole, angled, for spool position monitoring (separate order, see page 33 and data sheet 08006)
6 Space required for removing the mating connector
7 Name plate
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15 Measuring port for pilot pressure in channel A (G1/4)
16 Measuring port for pilot pressure in channel B (G1/4)
17 Damping plate

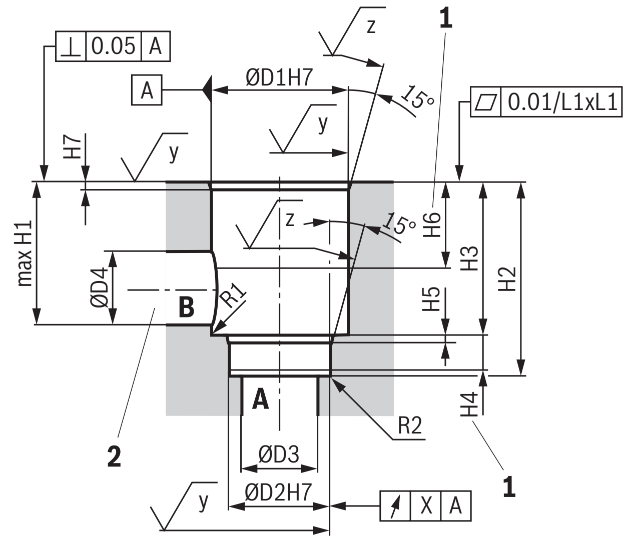
Notice:
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions

Valve mounting screws (separate order)

Size	Quantity	Hexagon socket head cap screws	Material number
32	4	**ISO 4762 - M16 x 110 - 10.9-flZn/nc/480h/C** Tightening torque M_A = 250 Nm ±10 %	**R913015642**
	or		
	4	**ISO 4762 - M16 x 110 - 10.9** Tightening torque M_A = 300 Nm ±10 %	Not included in the Rexroth delivery range
40	4	**ISO 4762 - M20 x 120 - 10.9-flZn/nc/480h/C** Tightening torque M_A = 480 Nm ±10 %	**R913015672**
	or		
	4	**ISO 4762 - M20 x 120 - 10.9** Tightening torque M_A = 590 Nm ±10 %	Not included in the Rexroth delivery range
50	4	**ISO 4762 - M20 x 160 - 10.9-flZn/nc/480h/C** Tightening torque M_A = 480 Nm ±10 %	**R913015677**
	or		
	4	**ISO 4762 - M20 x 160 - 10.9** Tightening torque M_A = 590 Nm ±10 %	Not included in the Rexroth delivery range
63	4	**ISO 4762 - M30 x 220 - 10.9-flZn/nc/480h/C** Tightening torque M_A = 1650 Nm ±10 %	**R913015755**
	or		
	4	**ISO 4762 - M30 x 220 - 10.9** Tightening torque M_A = 2000 Nm ±10 %	Not included in the Rexroth delivery range
80	8	**ISO 4762 - M24 x 240 - 10.9-flZn/nc/480h/C** Tightening torque M_A = 830 Nm ±10 %	**R913015721**
	or		
	8	**ISO 4762 - M24 x 240 - 10.9** Tightening torque M_A = 1000 Nm ±10 %	Not included in the Rexroth delivery range
100	8	**ISO 4762 - M30 x 290 - 10.9-flZn/nc/480h/C** Tightening torque M_A = 1650 Nm ±10 %	**R913015761**
	or		
	8	**ISO 4762 - M30 x 290 - 10.9** Tightening torque M_A = 2000 Nm ±10 %	Not included in the Rexroth delivery range

Installation bore
(dimensions in mm)



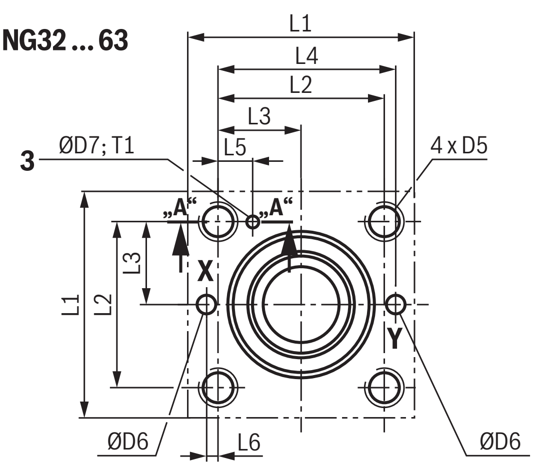
Installation dimensions according to DIN ISO 7368

NG	32	40	50	63	80	100
ØD1H7	60	75	90	120	145	180
ØD2H7	45	55	68	90	110	135
ØD3 max 1; 2)	45	55	68	90	110	135
ØD4 max 1; 2)	48	58	70	80	110	125
ØD5	M16	M20	M20	M30	M24	M30
ØD6 max	8	10	10	12	16	20
ØD7H13	6	6	8	8	10	10
H1 max	68.5	84.5	97.5	127	170.5	205.5
H2^{+1}	85	105	122	155	205	245
H3	70±0.2	87±0.3	100±0,3	130±0,3	175±0,4	210±0,4
H4 min	13	15	17	20	25	29
H5	2.5	3	3	4	5	5
H6 min 1)	20	20	27	40	40	50
H7	2.5	3	3	4	5	5
H8 1)	26	33	33	48	39	48
L1	105 1)	125	140	180	251 1)	300
L2±0.2	70	85	100	125	–	–
L3±0.2	35	42.5	50	62.5	200±0,3	245±0,3
L4±0.2	76	92.5	108	137.5	–	–
L5±0.2	18	19.5	20	24.5	–	–
L6±0.2	6	7.5	8	12.5	–	–
X	0.03	0.05	0.05	0.05	0.05	0.05
R1 max	2	4	4	4	4	4
R2 max 1)	1	1	1	1	1	1
T1 min	8	8	8	8	8	8

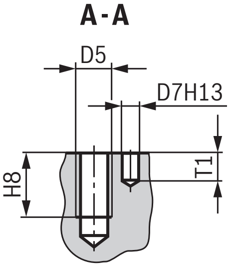
1) Deviating from DIN ISO 7368

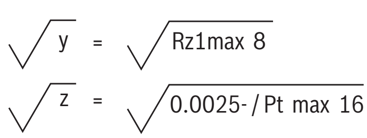
2) Smaller bore causes a reduction of the flow

NG32 ... 63



A-A



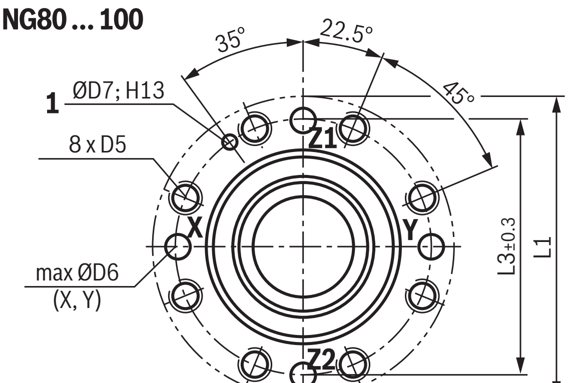


1 Depth of fit, minimum dimension

2 Port B can be of any size within the range between H6 min and H1 max. The durability of the block depends on its material and geometry.

3 Locating hole for locking pin

NG80 ... 100



NG	Installation dimensions according to DIN ISO 7368
32	7368-09-5-1-16
40	7368-10-7-1-16
50	7368-11-9-1-16
63	7368-12-11-1-16
80	7368-13-13-1-16
100	7368-14-14-1-16

Tolerances according to: General tolerances ISO 2768-mK

Valve mounting screws see page 33.

Accessories (separate order)

Mating connectors and cable sets

Item [1]	Designation	Version	Short designation	Material number	Data sheet
4	Mating connector; for valves with round connector, 6-pole + PE	Straight, metal	7PZ31...M	**R900223890**	08006
		Straight, plastic	7PZ31...K	**R900021267**	
		Angled, plastic	–	**R900217845**	–
	Cable sets; for valves with round connector, 6-pole + PE	Plastic, 3.0 m	7P Z31 BF6	**R901420483**	08006
		Plastic, 5.0 m		**R901420491**	
		Plastic, 10.0 m		**R901420496**	
		Plastic, 20.0 m	–	**R901448068**	–
5	Mating connectors; for sensors and valves with connector, 4-pole	M12 x 1, straight, PG 7	4PZ24	**R900773042**	08006
		M12 x 1, straight, PG 9		**R900031155**	
		M12 x 1, angled, PG 7		**R900779509**	
		M12 x 1, angled, PG 9		**R900082899**	
10	Mating connector; for valves with "K4" connector, 2-pole + PE, design A	Without circuitry, 12 ... 240 V	Z4	**R901017010**	
		With indicator light, 12 ... 240 V	Z5L	**R901017022**	
		With rectifier, 12 ... 240 V	RZ5	**R901017025**	
		Z-diode-suppressor 24 V	Z5L1	**R901017026**	

[1] See dimensions on page 26 and 27.

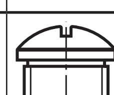
Parameterization

The following is required for the parameterization with PC		**Material number/download**
Commissioning software	IndraWorks, Indraworks D, Indraworks DS	
Connection cable, 3 m	Shielded, M12 on RJ45, length can be freely selected (= xx.x)	**R911172135** (additionally indication of type designation RKB0044/xx.x)

Ethernet connections X7E1 and X7E2

Cable set (Ethernet interface)	**Length** in m	**Material number**
Cable set, shielded, 4-pole, D coding, straight connector M12, on straight connector M12, line cross-section 0.25 mm2, CAT 5e	freely selectable (= xx.x)	**R911172111** (additionally indication of type designation RKB0040/xx.x)
Cable set, shielded, 4-pole, straight connector M12, on straight connector RJ45, line cross-section 0.25 mm^2, CAT 5e	freely selectable (= xx.x)	**R911172135** (additionally indication of type designation RKB0044/xx.x)

Protective cap

Protective cap M12	**Version**	**Material number**
		**R901075563**

Project planning and maintenance instructions

- The supply voltage must be permanently connected; otherwise, bus communication is not possible.
- If electro-magnetic interference is to be expected, take appropriate measures for ensuring the function (depending on the application, e.g. shielding, filtration).
- The devices have been tested in the plant and are supplied with default settings.
- Only complete devices can be repaired. Repaired devices are returned with default settings. User-specific settings will not be applied. The machine end-user will have to retransfer the corresponding user parameters.

Further information

▶ Hydraulic fluids on mineral oil basis	Data sheet 90220
▶ Environmentally compatible hydraulic fluids	Data sheet 90221
▶ Flame-resistant, water-free hydraulic fluids	Data sheet 90222
▶ Flame-resistant hydraulic fluids - containing water (HFAE, HFAS, HFB, HFC)	Data sheet 90223
▶ Hydraulic valves for industrial applications	Operating instructions 07600-B
▶ General product information on hydraulic products	Data sheet 07008
▶ Assembly, commissioning and maintenance of hydraulic systems	Data sheet 07900
▶ Operation fieldbus electronics (xx = software version):	
– Functional description Rexroth HydraulicDrive HDx-20	– 30338-FK
– Parameter description Rexroth HydraulicDrive HDS-16, HDx-17 ... HDx-20	– 30330-PA
– Description of diagnosis Rexroth HydraulicDrive HDS-16, HDx-17 ... HDx-20	– 30330-WA
▶ Commissioning software and documentation on the Internet	
▶ Selection of filters	
▶ Information on available spare parts	

Directional high-response cartridge valve, pilot-operated, with integrated electronics (OBE)

Type WRCE

RE 29137
Edition: 2019-04
Replaces: 08.13

H6871+6872

- Size 32 ... 50
- Component series 2X
- Maximum operating pressure 420 bar
- Maximum flow 4500 l/min

Features

- 2/2- oder 3/3-way directional cartridge valve
- Pilot control valve: Proportional directional valve
- Main stage: position-controlled
- Normalized:
  - Installation dimensions according to ISO 7368 ("2WRCE")
- Flexible:
  - Suitable for position, pressure, force and velocity control
- Typical applications:
  - Presses
  - Die casting machines
  - Punching axes

Contents

Ordering code: “2WRCE”

01	02	03	04	05	06		07		08	09	10		11	12	13	14
2	**WRCE**		**S**			**–**	**2X**	**/**	**P**	**G24**	**K31**	**/**				*****

01	2 main ports	**2**
02	Directional high-response cartridge valve, pilot-operated, with integrated electronics (OBE)	**WRCE**
03	Size 32	**32**
	Size 40	**40**
	Size 50	**50**
04	Control spool in seat design	**S**

Rated flow at 5 bar pressure differential

05	**– Size 32**	
	480 l/min (only version “R”)	**480**
	650 l/min (only version “L”)	**650**
	– Size 40	
	700 l/min (only version “R”)	**700**
	1000 l/min (only version “L”)	**1000**
	– Size 50	
	1100 l/min (only version “R”)	**1100**
	1600 l/min (only version “L”)	**1600**

Flow characteristic

06	Linear	**L**
	Linear with progressive fine control range	**R**
07	Component series 20 ... 29 (20 ... 29: unchanged installation and connection dimensions)	**2X**

Pilot control valve

08	Proportional directional valve	**P**

Supply voltage

09	Direct voltage 24 V	**G24**

Electrical connection

10	Without mating connector; connector according to DIN EN 175201-804	**K31** [1)]

Electrical interface

11	Command value 0 ... 10 V, actual value 0.5 ... 10 V	**A1**
	Command value 0 ... 10 mA, actual value 0.5 ... 10 mA	**C1**

Sandwich plate shut-off valve

12	**Without** shut-off valve	**no code**
	With shut-off valve [1)]	
	Shut-off valve switched to de-energized actively **closes** "2WRCE" with applied pilot pressure	**WK15**
	Shut-off valve switched to de-energized actively **opens** "2WRCE" with applied pilot pressure	**WL15**

Seal material(observe compatibility of seals with hydraulic fluid used, see page 10)

13	NBR seals	**M**
	FKM seals	**V**
14	Further details in the plain text	

1) Mating connectors, separate order, see page 28 and data sheet 08006.

Ordering code: "3WRCE"

01	02	03	04	05	06		07		08	09	10		11	12	13	14
3	**WRCE**					**–**	**2X**	**/**	**P**	**G24**	**K31**	**/**				*****

01	3 main ports	**3**

02	Directional high-response cartridge valve, pilot-operated, with integrated electronics (OBE)	**WRCE**

03	Size 32	**32**
	Size 40	**40**
	Size 50	**50**

04	Control spool in spool design – zero overlap (+0.5 ... +1.5%)	**V**
	Control spool in spool design – positive overlap 10 ... 13%	**E**

Rated flow at 5 bar pressure differential

05	**– Size 32**	
	250 l/min (only versions "E" and "P")	**250**
	290 l/min (only versions "V" and "L")	**290**
	– Size 40	
	410 l/min (only versions "E" and "P")	**410**
	460 l/min (only versions "V" and "L")	**460**
	– Size 50	
	620 l/min (only versions "E" and "P")	**620**
	720 l/min (only versions "V" and "L")	**720**

Flow characteristic

06	Linear	**L**
	Linear with progressive fine control range	**P**

07	Component series 20 ... 29 (20 ... 29: unchanged installation and connection dimensions)	**2X**

Pilot control valve

08	Proportional directional valve	**P**

Supply voltage

09	Direct voltage 24 V	**G24**

Electrical connection

10	Without mating connector; connector according to DIN EN 175201-804	**K31** [1)]

Electrical interface

11	Command value ±10 V, actual value ±10 V	**A1**
	Command value ±10 mA, actual value ±10 mA	**C1**

Sandwich plate shut-off valve

12	**Without** shut-off valve	**no code**
	With shut-off valve [1)]	
	Shut-off valve switched to de-energized actively **closes** "3WRCE" with applied pilot pressure	**WK15**
	Shut-off valve switched to de-energized actively **opens** "3WRCE" with applied pilot pressure	**WL15**

Seal material(observe compatibility of seals with hydraulic fluid used, see page 10)

13	NBR seals	**M**
	FKM seals	**V**

14	Further details in the plain text	

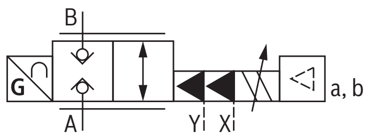
[1)] Mating connectors, separate order, see page 28 and data sheet 08006.

Notice:
Version "3WRCE" is not recommended for new applications, see page 7.

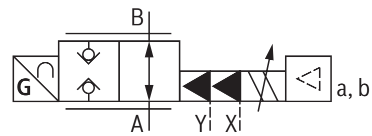
Symbols: “2WRCE”

Simplified

“No code" and **“WK15” version**

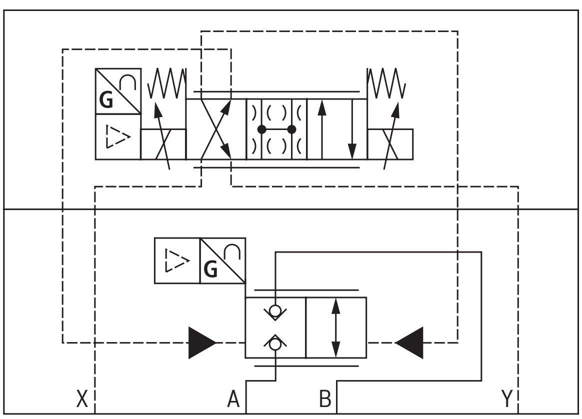


Version "WL15"

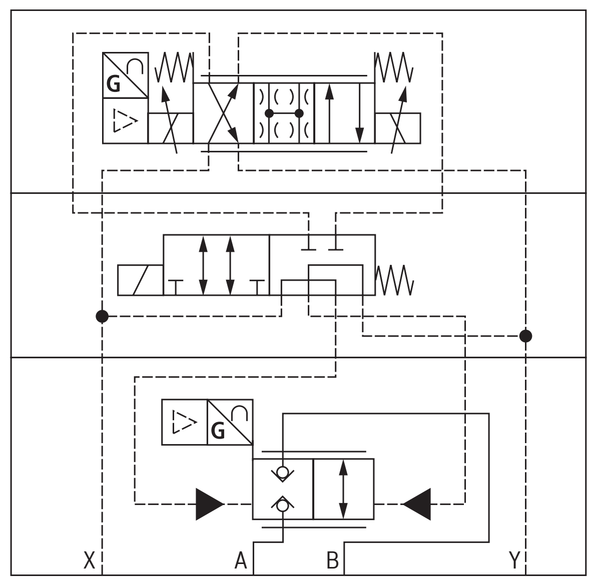


Detailed

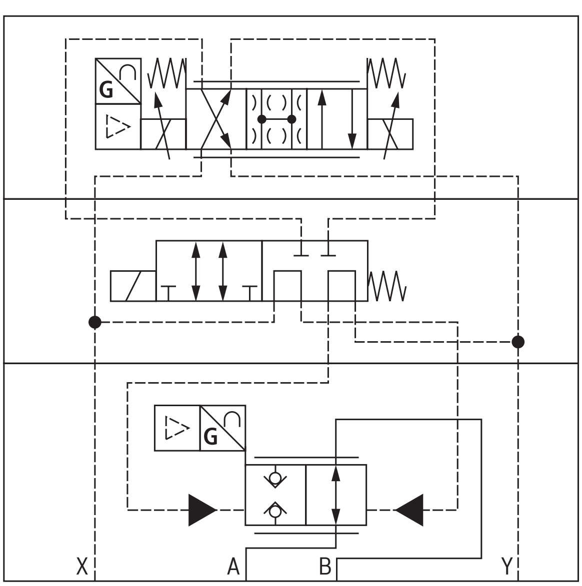
"No code" version



Version "WK15"



Version "WL15"

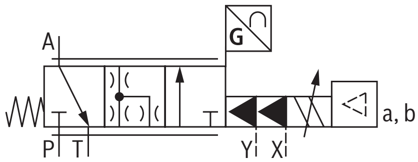


Notice: Representation according to DIN ISO 1219-1.

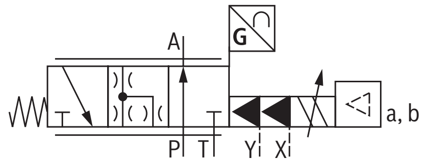
Symbols: “3WRCE”

Simplified

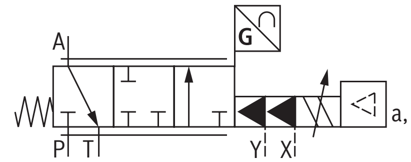
Version “V...no code” and **“V...WK15”**



Version “V...WL15”

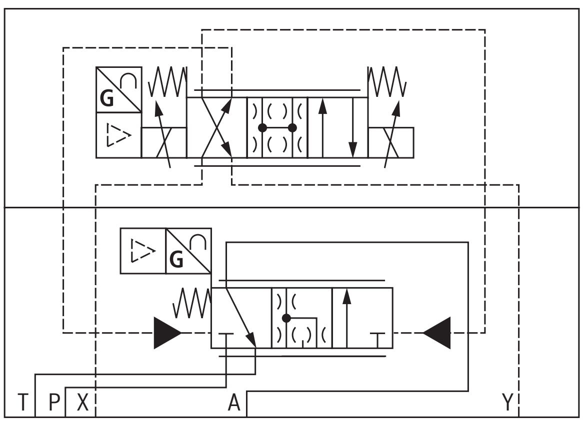


Version “E...no code”

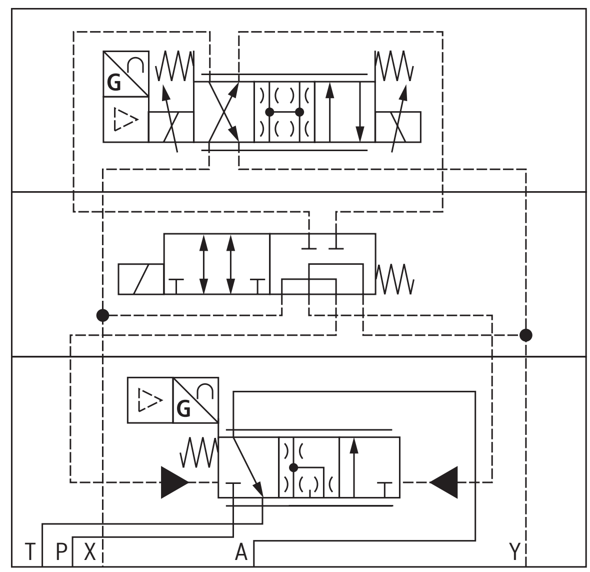


Detailed

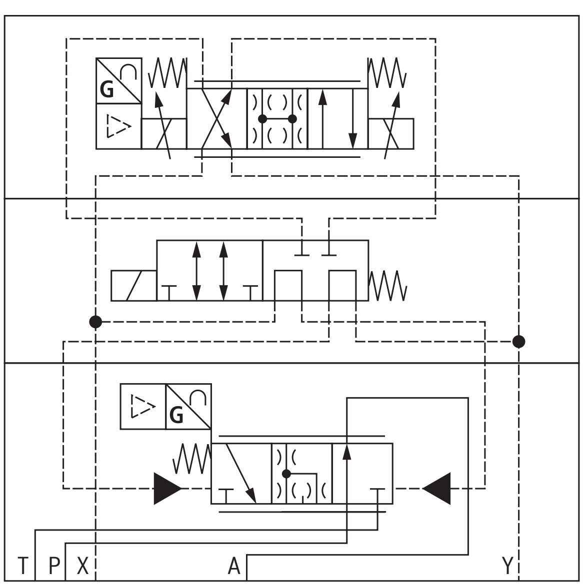
Version “V...no code”



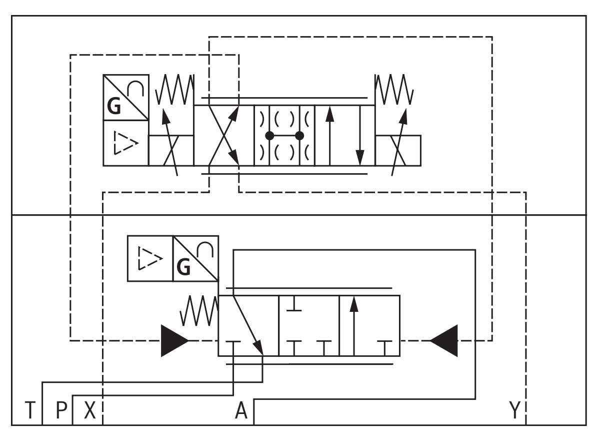
Version “V...WK15”



Version “V...WL15”



Version “E...no code”



☞ **Notice:** Representation according to DIN ISO 1219-1.

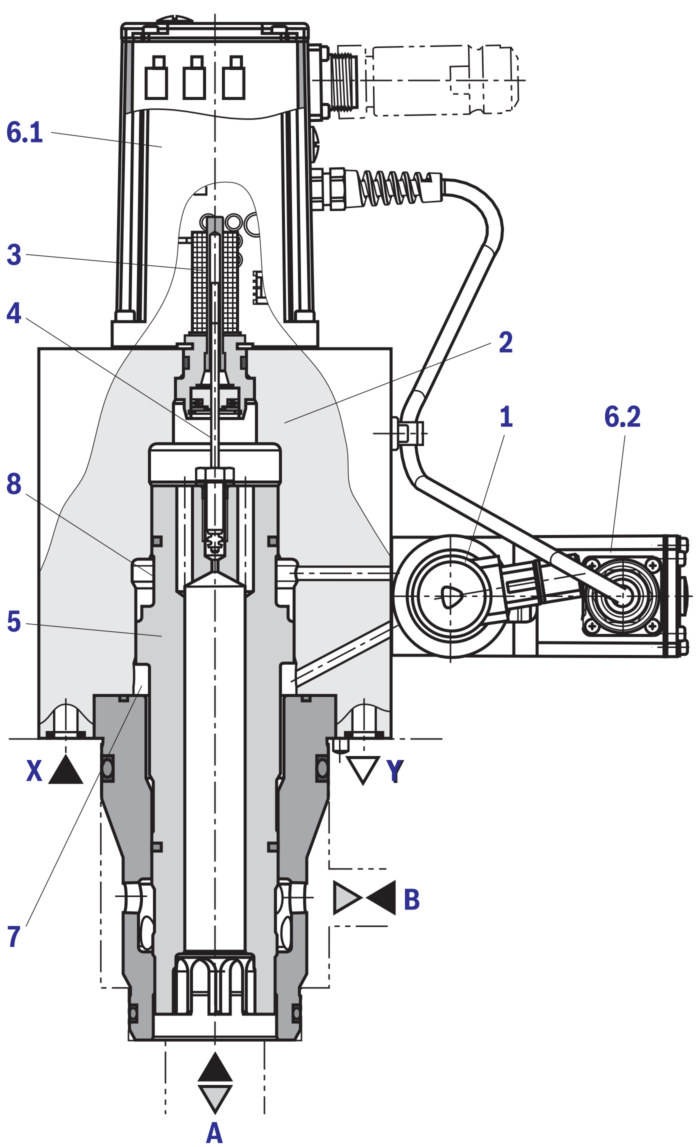
Function, section: “2WRCE”

Valves of type 2WRCE are pilot-operated, 2-stage directional high-response cartridge valves. They control the quantity and direction of a flow and are mainly used in control loops.

Set-up

The valves consist of the following assemblies:

- 1-stage pilot control valve (1)
  - with two solenoids as electro-mechanical converters and a control spool that is connected to the integrated pilot electronics (6.2) via electrical feedback
- Second stage (2) for flow control
- An inductive position transducer (3) the core (4) of which is attached to the main control spool (5) of the second stage
- Integrated electronics (OBE) (6.1).



Function

The integrated electronics (OBE) compares command and actual values and the solenoids of the pilot control valve (1) are actuated with a proportional current according to the control deviation.
The pilot control valve (1) takes a proportionally controlled position and controls the flow in and out of the control chambers A (7) and B (8) that actuate the main control spool (5) through the closed valve control loop up to 0 control deviation.
This means that the stroke of the main control spool (5) is regulated proportionally to the command value. It must be noted that the flow also depends on the valve pressure drop.

Valve features

The flow can pass through the valve from A to B or from B to A.
The control spool (seat design) closes or opens at 5% of the command value. At lower command values, the valve control loop attempts to guide the control spool, thus presses it onto the seat at full pilot pressure and blocks the connection in a leakage-free way.
The specified valve dynamics only apply to the control area of the valve. At command value steps from the seat to lower opening values, additional delay times occur.
The opening point of 5% (= 0.5 V or 0.5 mA) is set at the factory.
Due to the internal setting of the pilot control valve, the pilot pressure is connected to control chamber B (8) in case of a power failure, i.e. the main stage is closed.
The control electronics feature an offset setting to compensate pilot trimming.
Due to differences in diameter in the seat range, the control spools are statically not pressure-compensated.
To compensate the force differential, 6% of the system pressure is required for version “L” and 22% of the system pressure is required for version “R” as pilot pressure. With reserves for flow force and dynamics, this defines the recommended minimum pilot pressure.

Notice:
Preferably, port B is to be connected to the actuator.

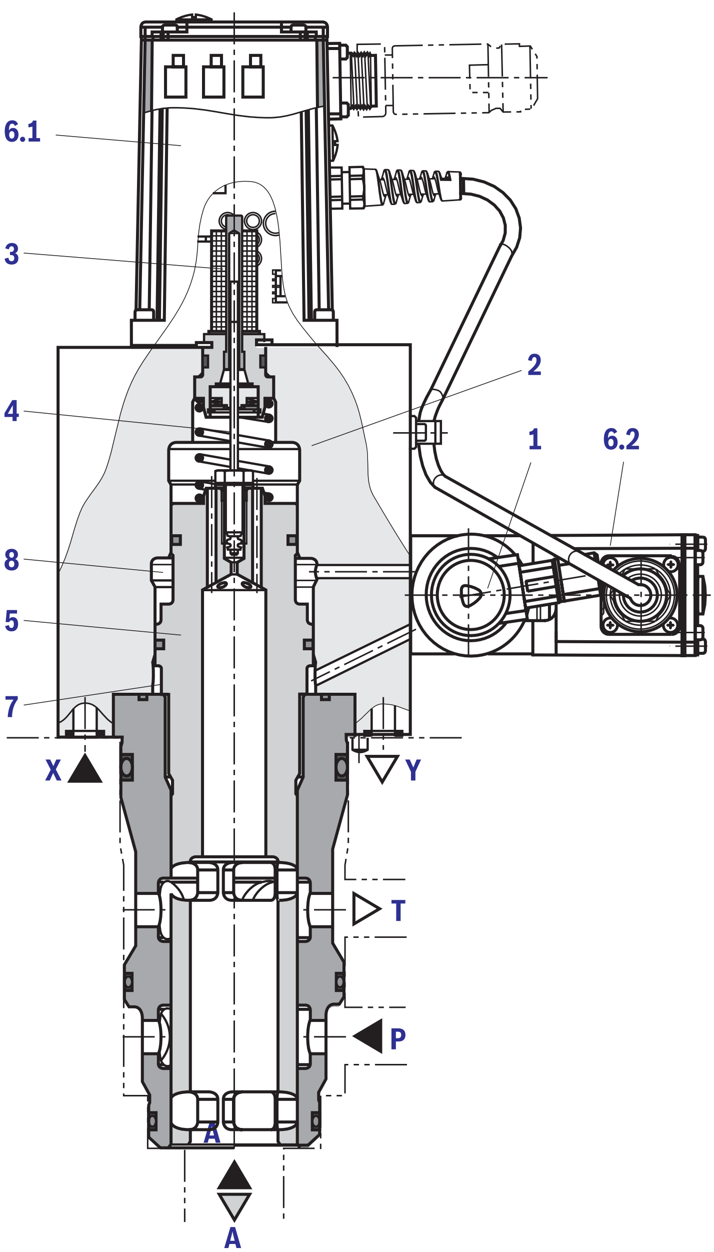
Function, section: "3WRCE"

Valves of type 3WRCE are pilot-operated, 3-stage directional high-response cartridge valves. They control the quantity and direction of a flow and are mainly used in control loops.

Set-up

The valves consist of the following assemblies:

- 1-stage pilot control valve (1)
  - with two solenoids as electro-mechanical converters and a control spool that is connected to the integrated pilot electronics (6.2) via electrical feedback
- Second stage (2) for flow control
- Inductive position transducer (3) the core (4) of which is attached to the main control spool (5) of the second stage
- Integrated electronics (OBE) (6.1).



Function

The integrated electronics (OBE) compares command and actual values and the solenoids of the pilot control valve (1) are actuated with a proportional current according to the control deviation.
The pilot control valve (1) takes a proportionally controlled position and controls the flow in and out of the control chambers A (7) and B (8) that actuate the main control spool (5) through the closed valve control loop up to 0 control deviation.
This means that the stroke of the main control spool (5) is regulated proportionally to the command value. It must be noted that the flow also depends on the valve pressure drop.

Valve features

The opening point of 0% (symbol V) is set at the factory.
Due to the internal setting of the pilot control valve, the pilot pressure is connected to control chamber B (8) in case of a power failure, i.e. the main stage is opened from A to T or the connection P to A is closed.
The spring behind the main control spool moves the control spool only into position so that P to A is closed if no pressure is applied (e.g. prior to installation, before the pressures are reapplied after tool change).
The integrated control electronics (OBE) feature an offset setting to compensate pilot trimming.

Notice:
Version "3WRCE" is not recommended for new applications.
If version "3WRCE" is used, ports A and P have to be exchanged. Upon request.

Technical data: “2WRCE”
(for applications outside these values, please consult us!)

General						
Sizes		NG	32	40	50
Installation position; commissioning			any, preferably horizontal		
Storage temperature range		°C	−20 ... +80		
Ambient temperature range		°C	−20 ... +50		
Weight	▶ Without shut-off valve (“no code”)	kg	12.5	19.9	26.8
	▶ With shut-off valve (“WK15”, “WL15”)	kg	13.7	21.1	28
Size of the pilot control valve		NG	6		
Sine test according to DIN EN 60068-2-6			5 ... 2000 Hz / maximum 10 g / 10 cycles		
Noise test according to DIN EN 60068-2-64			20 ... 2000 Hz / 10 g_{RMS} / 30 min		
Shock test according to DIN EN 60068-2-27			15 g / 11 ms		

Hydraulic					
Maximum operating pressure	▶ Main stage				
	– Ports A, B	bar	420		
	▶ Pilot control valve				
	– Port X	bar	315		
	– Port Y	bar	210		
Minimum pilot pressure (in % of the system pressure)	▶ Version “L”	%	15		
	▶ Version "R"	%	45		
Rated flow (q_{Vnom} +10%; Δp = 5 bar)	▶ Version “L”	l/min	650	1000	1600
	▶ Version "R"	l/min	480	700	1100
Maximum flow	▶ Version “L”	l/min	1500	2200	3500
	▶ Version "R"	l/min	2000	3000	4500
Pilot flow [1)]		l/min	37	45	60
Zero flow (pre-stage)			see characteristic curves page 13		
Pilot oil volume		cm^3	4.52	8.48	17.3
Hydraulic fluid			see table page 10		
Hydraulic fluid temperature range	▶ Recommended	°C	+40 ... +50		
	▶ Maximum admissible		−20 ... +80		
Viscosity range	▶ Recommended	mm^2/s	30 ... 45		
	▶ Maximum admissible		20 ... 380		
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)			Class 20/18/15 [2)]		
Hysteresis		%	≤ 0.2		
Range of inversion		%	≤ 0.1		
Response sensitivity		%	≤ 0.1		
Closing time [3)]	▶ Pilot control valve	ms	≤ 200		
	▶ With shut-off valve	ms	≤ 200		

1) Stepped input signal (from 0 to 100%, pilot pressure 315 bar)

2) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and simultaneously increases the life cycle of the components.

3) Pilot pressure 40 ... 315 bar

Technical data: "3WRCE"
(for applications outside these values, please consult us!)

General						
Sizes		NG	32	40	50
Installation position; commissioning			any, preferably horizontal		
Storage temperature range		°C	−20 ... +80		
Ambient temperature range		°C	−20 ... +50		
Weight	▶ Without shut-off valve ("no code")	kg	12.8	20.2	28
	▶ With shut-off valve ("WK15", "WL15")	kg	14	21.4	29.2
Size of the pilot control valve		NG	6		
Sine test according to DIN EN 60068-2-6			5 ... 2000 Hz / maximum 10 g / 10 cycles		
Noise test according to DIN EN 60068-2-64			20 ... 2000 Hz / 10 g_{RMS} / 30 min		
Shock test according to DIN EN 60068-2-27			15 g / 11 ms		

Hydraulic					
Maximum operating pressure	▶ Main stage – Ports A, B, T	bar	315		
	▶ Pilot control valve – Port X	bar	315		
	– Port Y	bar	210		
Rated flow (q_{Vnom} +10%; Δp = 5 bar)		l/min	290	460	720
Maximum flow		l/min	900	1400	2200
Pilot flow [1]		l/min	20	35	55
Maximum zero flow (main stage; p_P = 300 bar)		l/min	4	6	8
Zero flow (pre-stage)			see characteristic curves page 13		
Pilot oil volume		cm^3	±2.26	±4.24	±8.65
Hydraulic fluid			see table page 10		
Hydraulic fluid temperature range	▶ Recommended	°C	+40 ... +50		
	▶ Maximum admissible		−20 ... +80		
Viscosity range	▶ Recommended	mm^2/s	30 ... 45		
	▶ Maximum admissible		20 ... 380		
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)			Class 20/18/15 [2]		
Hysteresis		%	≤ 0.2		
Range of inversion		%	≤ 0.1		
Response sensitivity		%	≤ 0.1		
Closing time [3]	▶ Pilot control valve	ms	≤ 200		
	▶ With shut-off valve	ms	≤ 200		

1) Stepped input signal (from 0 to 100%, pilot pressure 315 bar)

2) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and simultaneously increases the life cycle of the components.

3) Pilot pressure 40 ... 315 bar

Technical data
(for applications outside these values, please consult us!)

Hydraulic fluid		Classification	Suitable sealing materials	Standards	Data sheet
Mineral oils		HL, HLP, HLPD, HVLP, HVLPD	NBR, FKM	DIN 51524	90220
Bio-degradable	▶ Insoluble in water	HETG	FKM	ISO 15380	90221
		HEES	FKM		
	▶ Soluble in water	HEPG	FKM	ISO 15380	
Flame-resistant	▶ Water-free	HFDU (glycol base)	FKM	ISO 12922	90222
		HFDU (ester base)	FKM		
		HFDR	FKM		
	▶ Containing water	HFC (Fuchs: Hydrotherm 46M, Renosafe 500; Petrofer: Ultra Safe 620; Houghton: Safe 620; Union: Carbide HP5046)	NBR	ISO 12922	90223

Important information on hydraulic fluids:
- For further information and data on the use of other hydraulic fluids, please refer to the data sheets above or contact us.
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.).
- The ignition temperature of the hydraulic fluid used must be 50 K higher than the maximum surface temperature.
- **Bio-degradable and flame-resistant – containing water:** If components with galvanic zinc coating (e.g. version "J3" or "J5") or parts containing zinc are used, small amounts of dissolved zinc may get into the hydraulic system and cause accelerated aging of the hydraulic fluid. Zinc soap may form as a chemical reaction product, which may clog filters, nozzles and solenoid valves - particularly in connection with local heat input.
- **Flame-resistant – containing water**:
  - Due to increased cavitation tendency with HFC hydraulic fluids, the life cycle of the component may be reduced by up to 30% as compared to the use with mineral oil HLP. In order to reduce the cavitation effect, it is recommended - if possible specific to the installation - to back up the return flow pressure in ports T to approx. 20% of the pressure differential at the component.
  - Dependent on the hydraulic fluid used, the maximum ambient and hydraulic fluid temperature must not exceed 50 °C. In order to reduce the heat input into the component, the command value profile is to be adjusted for proportional and high-response valves.

Electric			
Protection class of the valve according to EN 60529			IP65 with mating connector mounted and locked
Voltage type			Direct voltage
Type of signal			analog
Zero compensation		%	≤ 1
Zero shift upon change of:	▶ Hydraulic fluid temperature	%/10 K	≤ 0.3
	▶ Pilot pressure in X	%/100 bar	≤ 0.7
	▶ Return flow pressure in Y	%/bar	≤ 0.3

Notice:
For information on the environment simulation testing for the areas EMC (electromagnetic compatibility), climate and mechanical
load see data sheet 29137-U (declarations on environmental compatibility).

Electrical connections and assignment

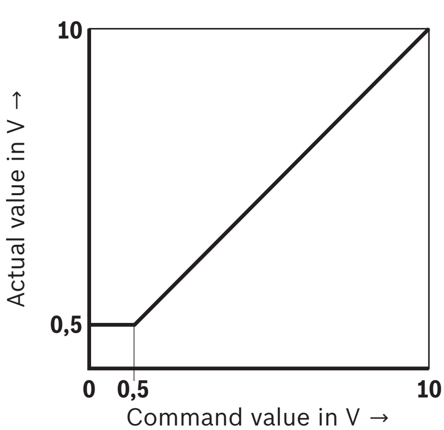
Connector pin assignment

Pin	Signal	Interface assignment „A1“ “2WRCE”	Interface assignment „A1“ “3WRCE”	Interface assignment “C1” “2WRCE”	Interface assignment “C1” “3WRCE”
A	Supply voltage	24 VDC nominal (18 ... 30 V; $I_{average}$ = 1 A, I_{peak} = 3 A)			
B		0 VDC			
C	Measurement zero	Reference to pin F			
D	Differential command value input	0 to +10 V Input resistance > 100 kΩ		0 ... +10 mA Load 100 Ω	
E					
F	Actual value Reference with pin C	+0.5 to +10 V maximum 10 mA	0 ... ±10 V maximum 10 mA	+0.5 to +10 mA Maximum load 1 kΩ	0 ... ±10 mA Maximum load 1 kΩ
PE	Protective ground	Functional ground (directly connected to the valve housing)			

Notes:
- Do not connect PE if the valve has already been grounded via the system.
- Command value and actual value have the same polarity. In case of failure of the fuse “1A fast”, the actual value may temporarily also be measured between F and B.
- Electrical signals provided via control electronics (e. g. actual value) must not be used to switch off safety-relevant machine functions.
- Mating connectors, separate order, see page 28 and data sheet 08006.

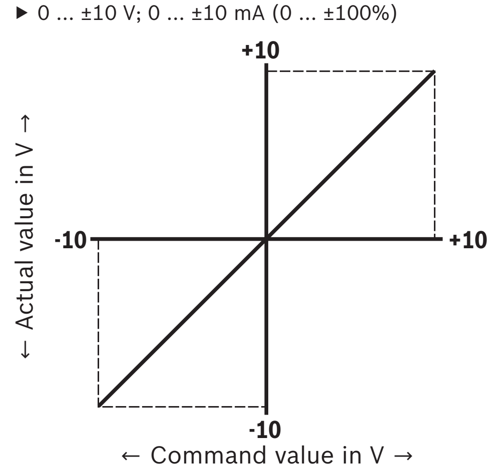
Nominal command value range

Version “2WRCE”
- 0 ... +10 V; 0 ... +10 mA (0 ... 100%)



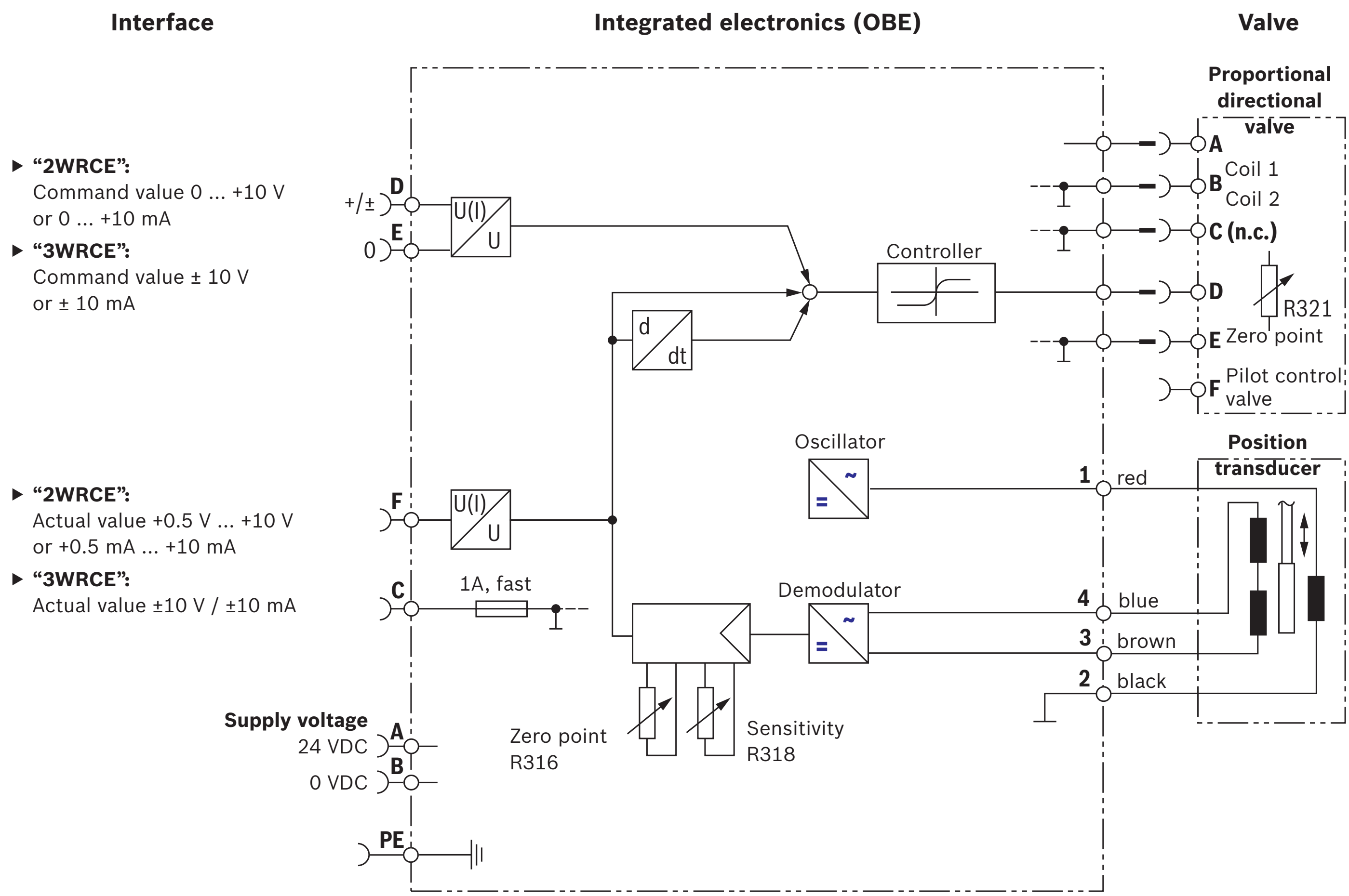
- In case of a slow command value modification from +0.5 V to +10 V, the actual value follows the command value within ±0.15 V.
- For command values over +10 V, the actual value follows up to approx. +12 V.
- In the command value range of 0 ... +0.5 V, the actual value remains constant at 0.5 V.
- At a command value step to +10 V, the actual value can temporarily reach values of up to approx. +10.5 V.

Version “3WRCE”
- 0 ... ±10 V; 0 ... ±10 mA (0 ... ±100%)



- In case of a slow command value modification from +0 V ... ±10 V, the actual value follows the command value within ±0.15 V.
- For command values over 10 V, the actual value follows up to approx. ±13 V.
- At a command value step to +10 V, the actual value can temporarily reach values of up to approx. +10.5 V.

Block diagram/controller function block: Integrated electronics (OBE)

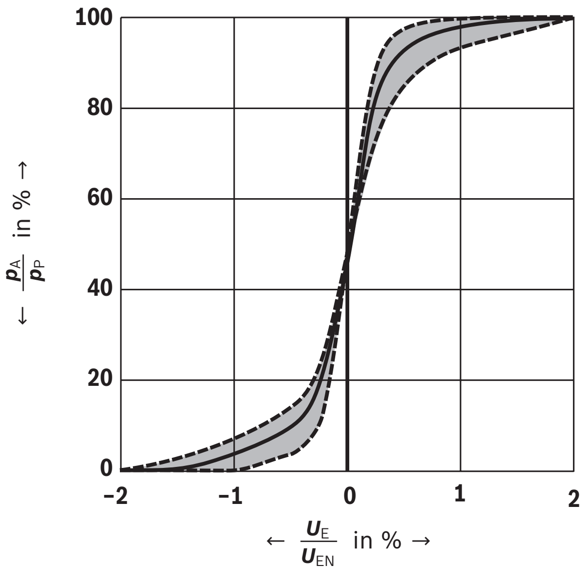


Effect of the control:

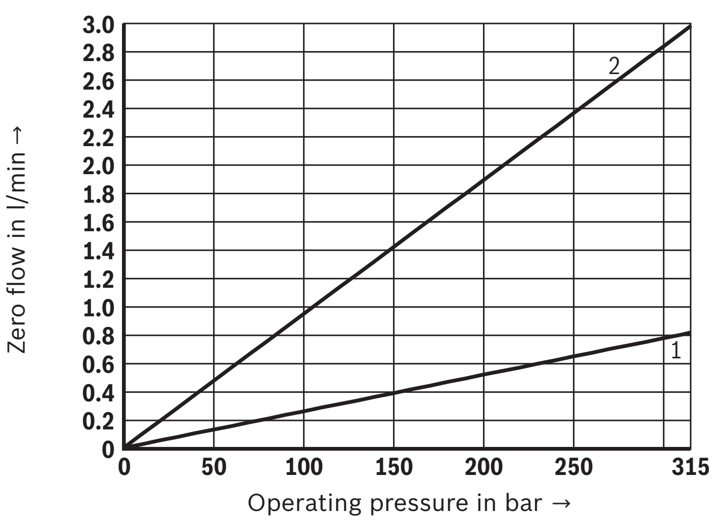
- A positive signal at pin D and a reference potential at pin E results in
  - "2WRCE": Flow A → B or B → A
  - "3WRCE": Flow P → A
- A positive signal at pin F and a reference potential at pin C results in
  - "2WRCE": Flow A → B or B → A
  - "3WRCE": Flow P → A

Characteristic curves
(measured with HLP32, ϑ_{oil} = 40 ±5 °C)

Pressure-signal function
("3WRCE...V"; limit and average characteristic curves)



Zero flow at the pilot control valve

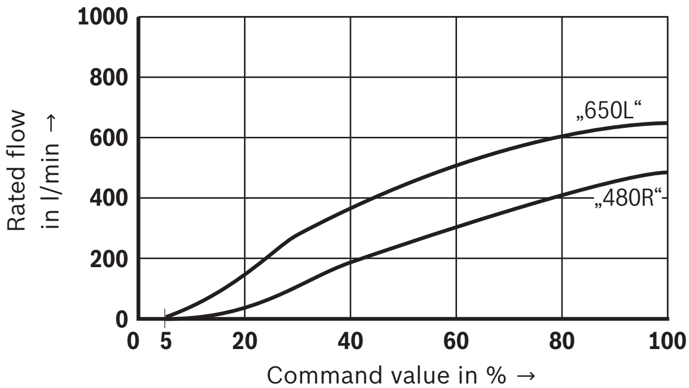


1 Minimum zero flow
2 Maximum zero flow

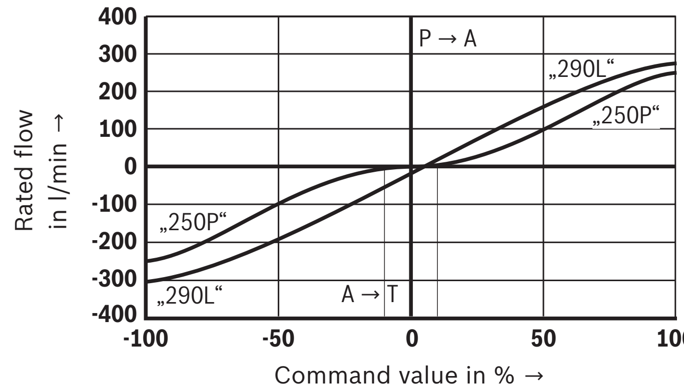
Characteristic curves: Size 32
(measured with HLP32, ϑ_{oil} = 40 ±5 °C)

Rated flow

"2WRCE" (Δp = 5 bar; A → B, B → A)



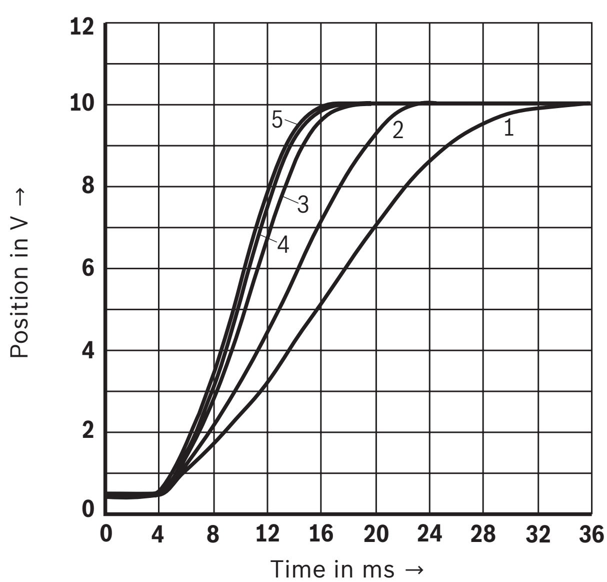
"3WRCE" (Δp = 5 bar)



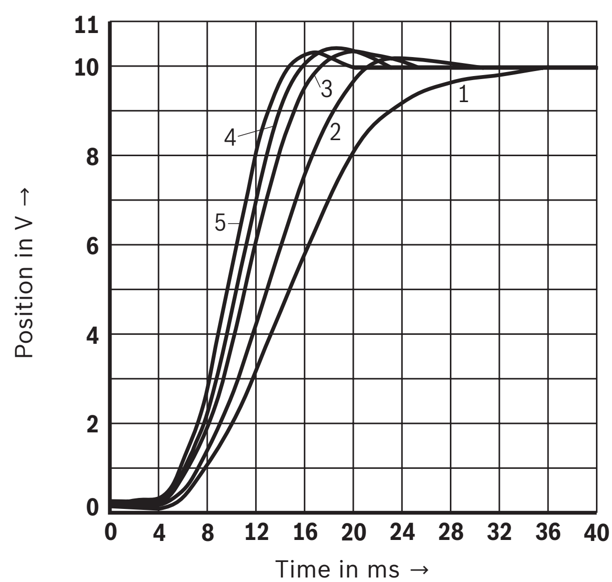
"E250P" 10% overlap
"V290L" 0.5 ... 1.5% overlap

Transition function

"2WRCE"



"3WRCE"

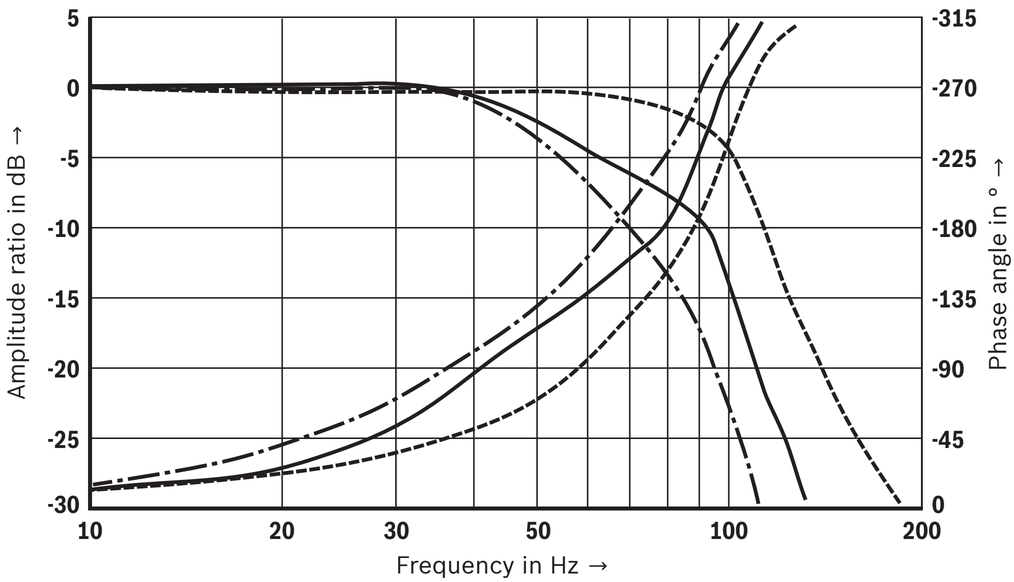


1 40 bar
2 70 bar
3 140 bar
4 210 bar
5 315 bar

Characteristic curves: Size 32
(measured with HLP32, ϑ_{oil} = 40 ±5 °C)

Frequency response (p_P = 315 bar)

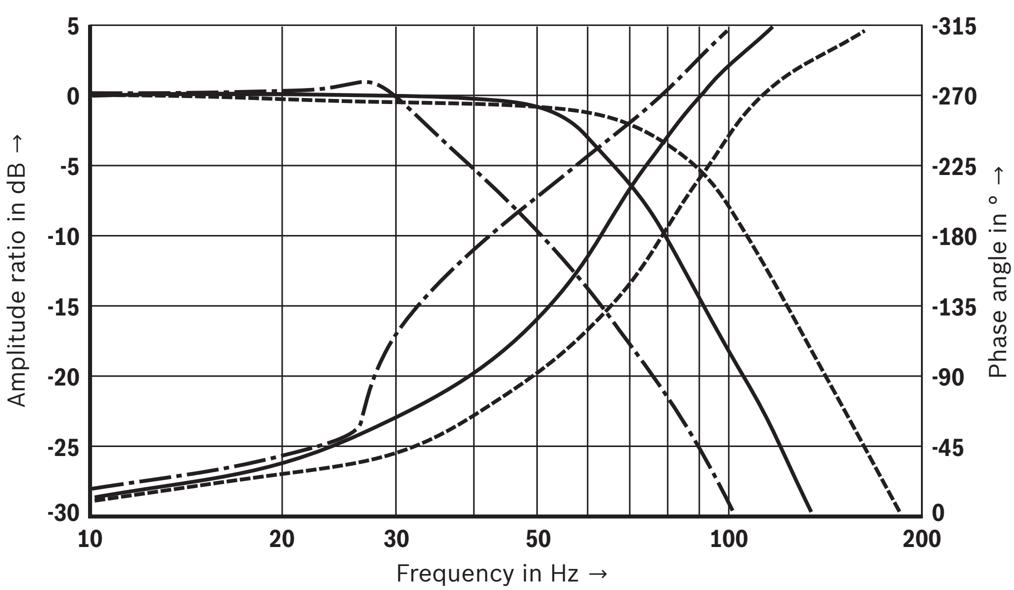
“2WRCE”



Command value

- 50% ±5% (dashed)
- 50% ±25% (solid)
- 50% ±45% (dash-dot)

“3WRCE”



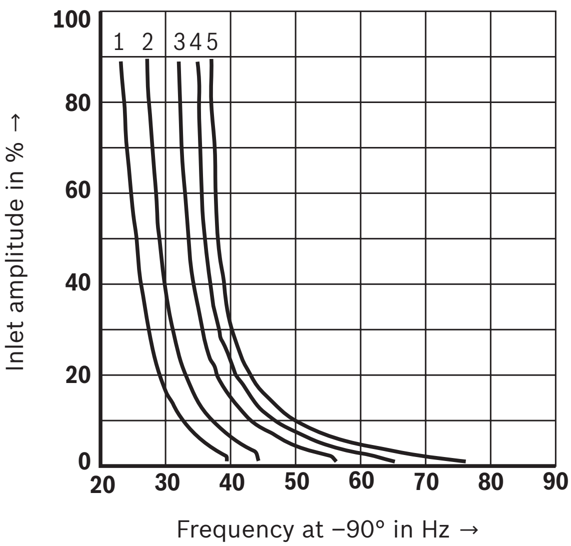
Command value

- ±5% (dashed)
- ±25% (solid)
- ±100% (dash-dot)

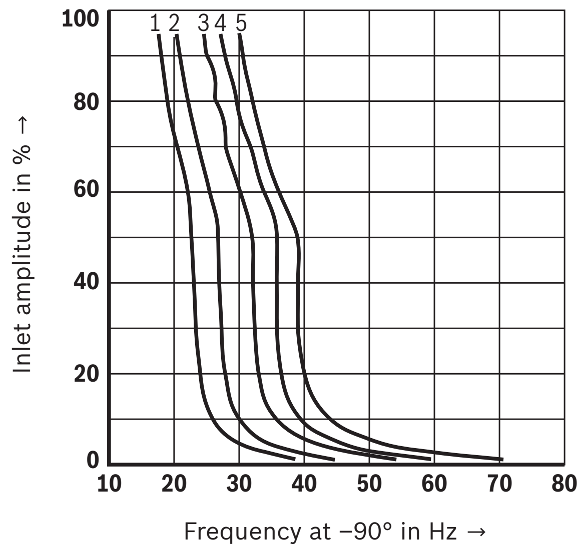
Characteristic curves: Size 32
(measured with HLP32, ϑ_{oil} = 40 ±5 °C)

Frequency *f* dependent on operating pressure and inlet amplitude

“2WRCE”



“3WRCE”

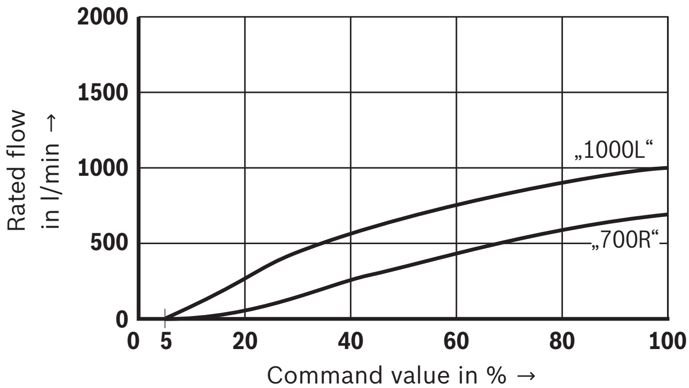


1 40 bar
2 70 bar
3 140 bar
4 210 bar
5 315 bar

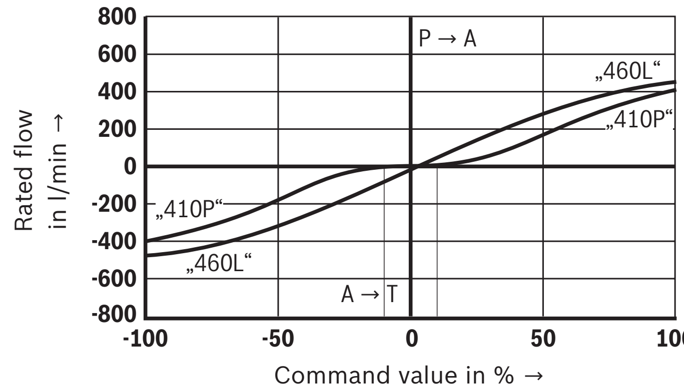
Characteristic curves: Size 40
(measured with HLP32, ϑ_{oil} = 40 ±5 °C)

Rated flow

"2WRCE" (***Δp*** = 5 bar; A → B, B → A)



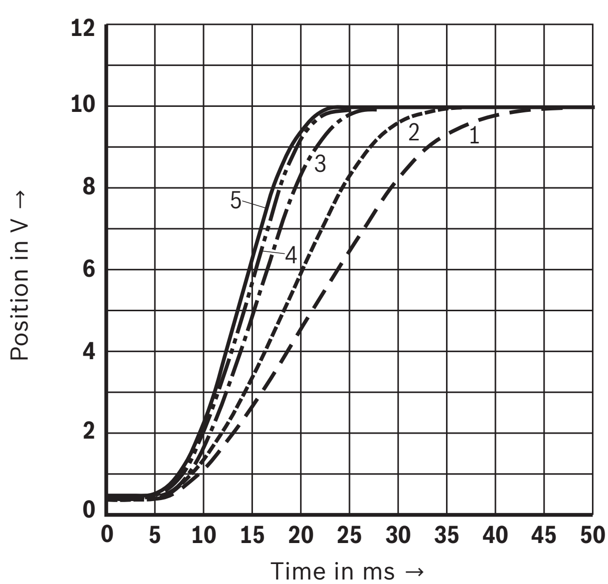
"3WRCE" (***Δp*** = 5 bar)



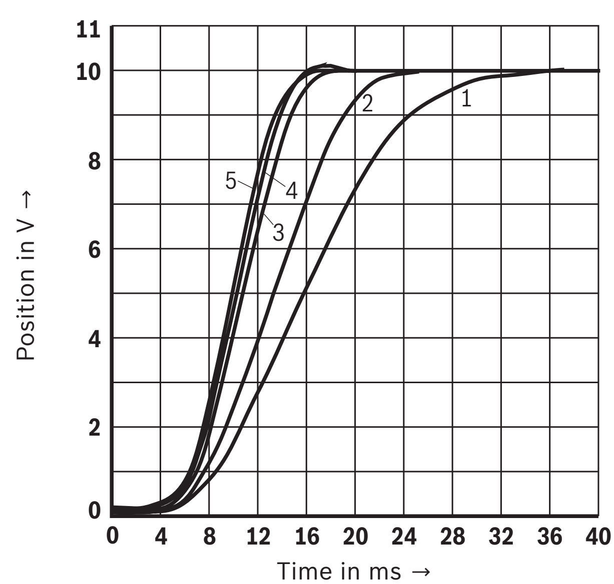
"E410P"	10% overlap
"V460L"	0.5 ... 1.5% overlap

Transition function

"2WRCE"



"3WRCE"

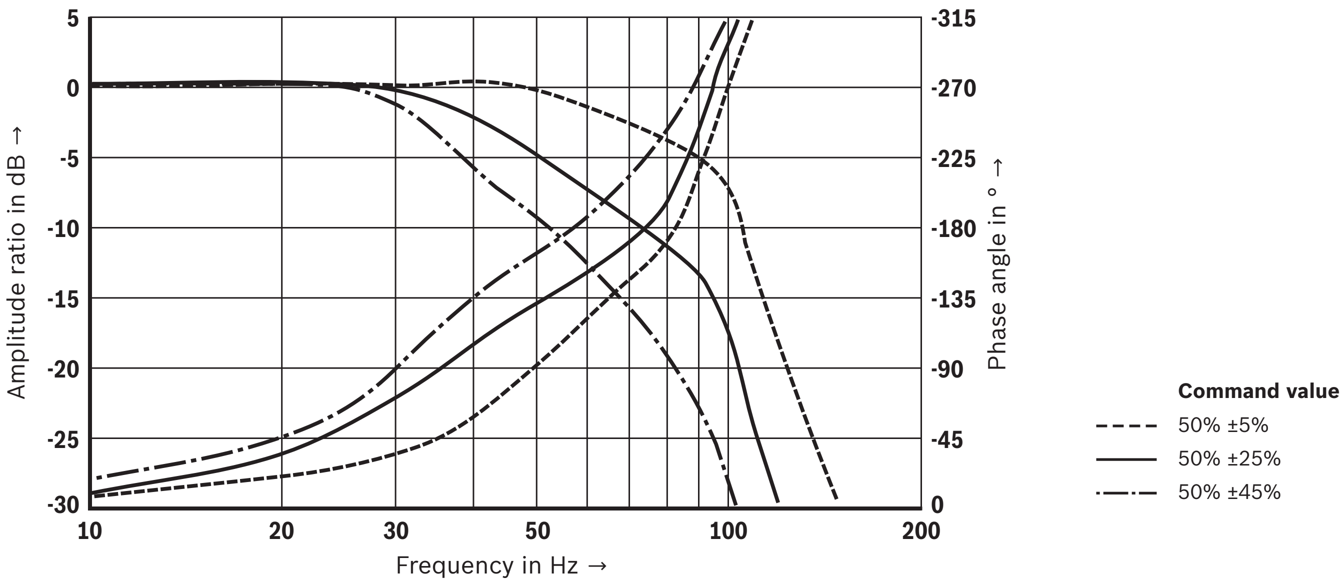


1 40 bar
2 70 bar
3 140 bar
4 210 bar
5 315 bar

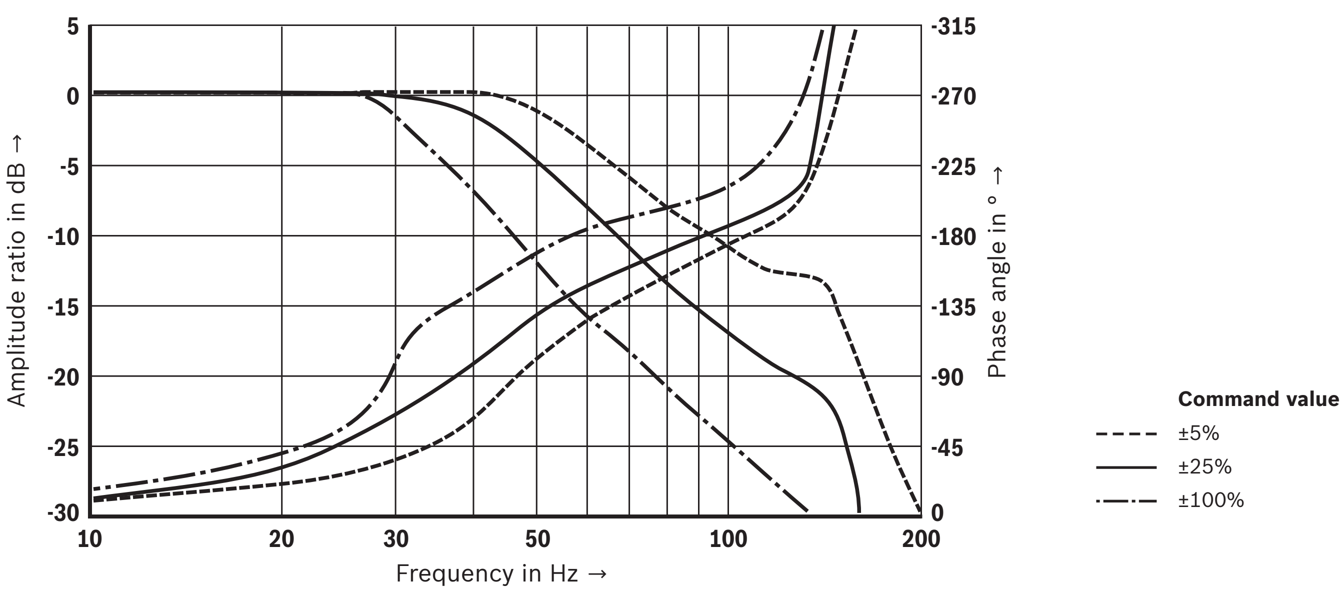
Characteristic curves: Size 40
(measured with HLP32, ϑ_{oil} = 40 ±5 °C)

Frequency response (p_P = 315 bar)

"2WRCE"



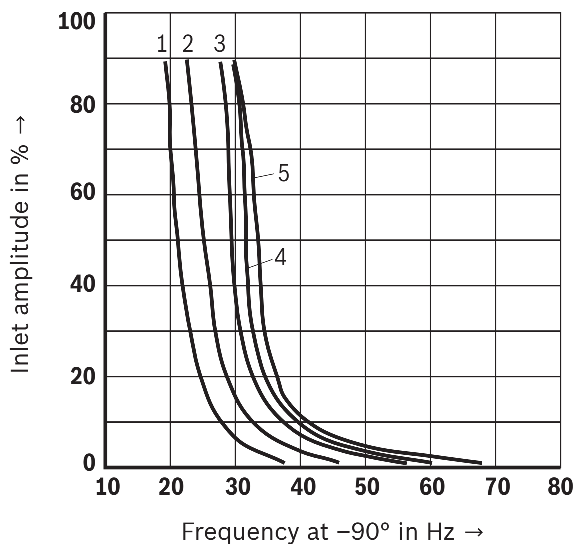
"3WRCE"



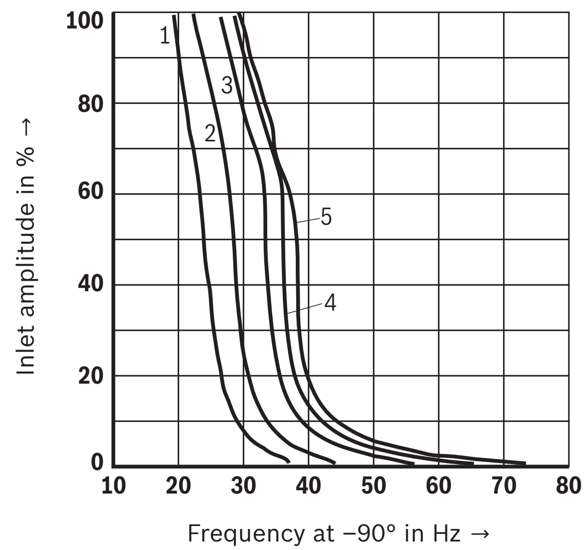
Characteristic curves: Size 40
(measured with HLP32, ϑ_{oil} = 40 ±5 °C)

Frequency *f* dependent on operating pressure and inlet amplitude

"2WRCE"



"3WRCE"

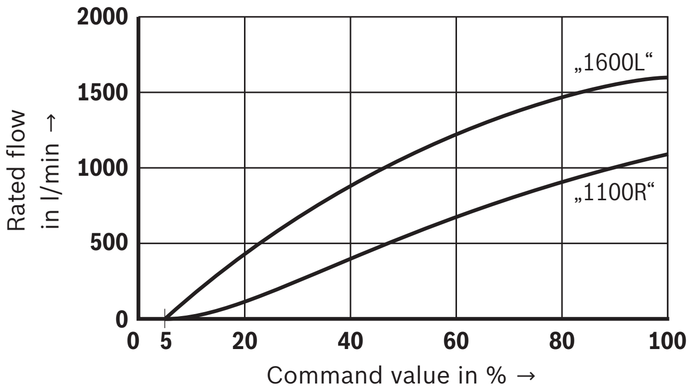


1 40 bar
2 70 bar
3 140 bar
4 210 bar
5 315 bar

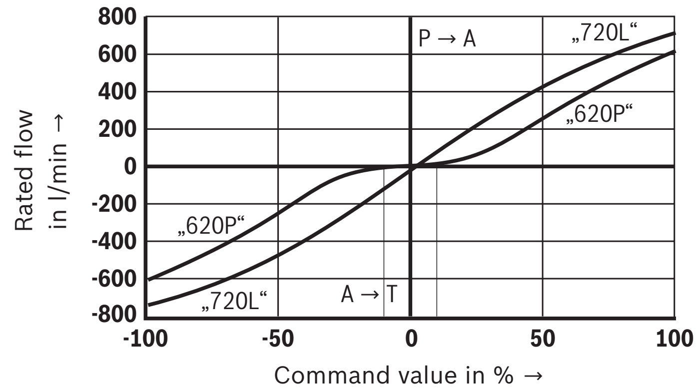
Characteristic curves: Size 50
(measured with HLP32, ϑ_{oil} = 40 ±5 °C)

Rated flow

"2WRCE" (Δp = 5 bar; A → B, B → A)



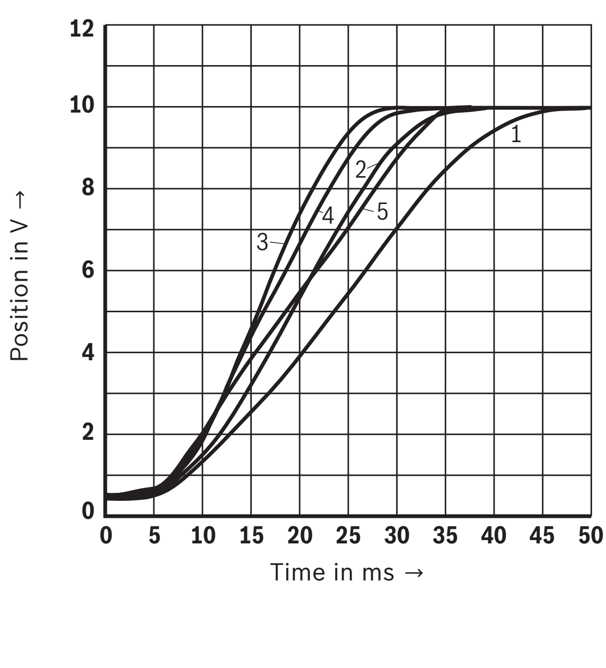
"3WRCE" (Δp = 5 bar)



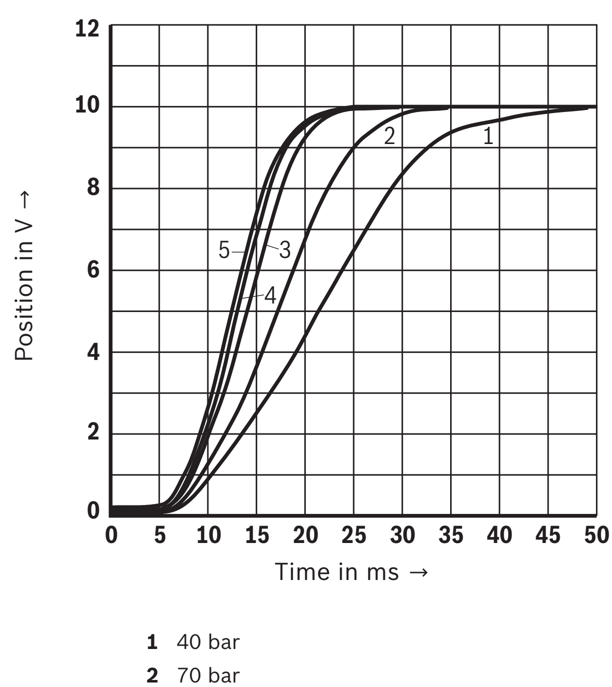
"E620P" 10% overlap
"V720L" 0.5 ... 1.5% overlap

Transition function

"2WRCE"



"3WRCE"

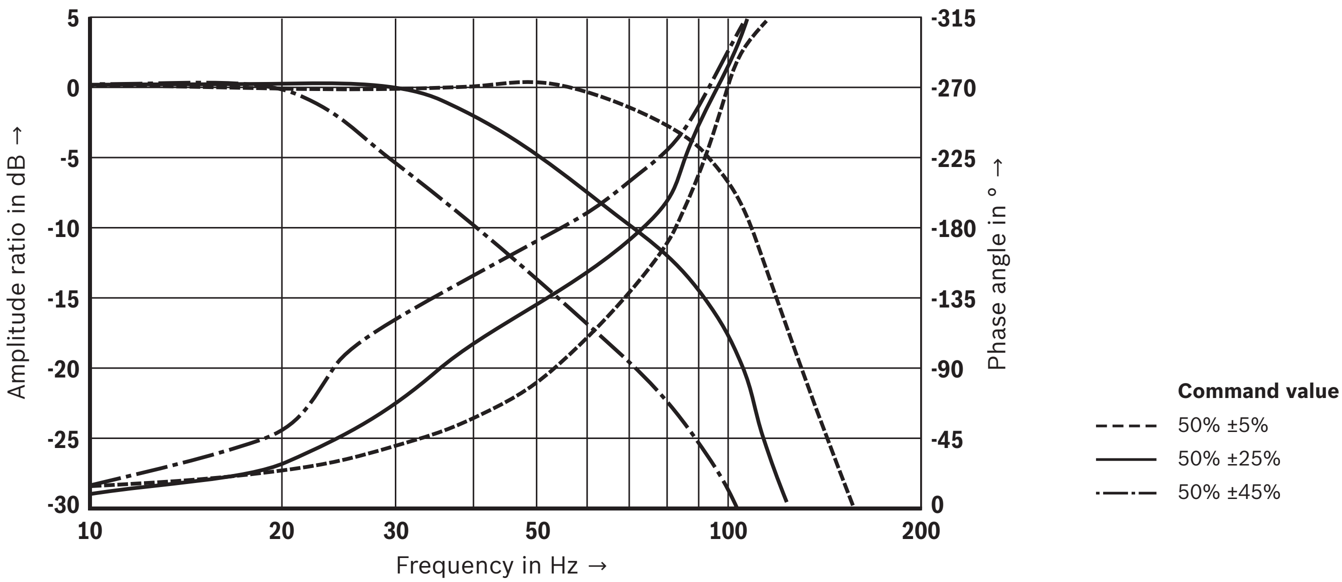


1 40 bar
2 70 bar
3 140 bar
4 210 bar
5 315 bar

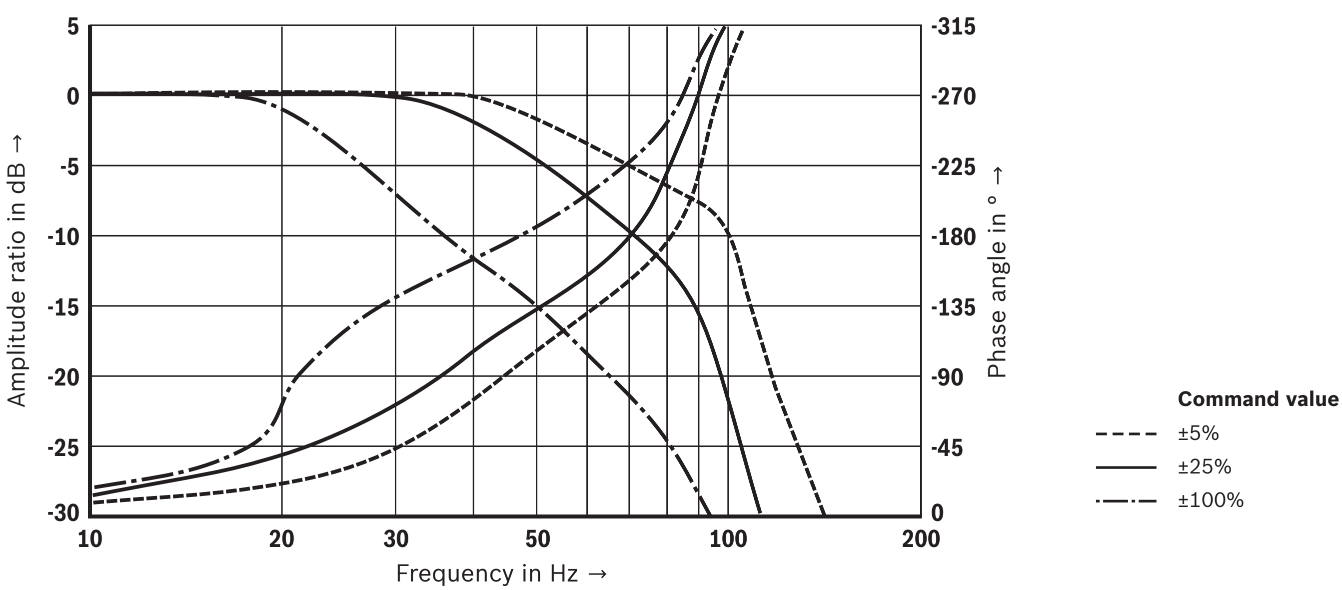
Characteristic curves: Size 50
(measured with HLP32, ϑ_{oil} = 40 ±5 °C)

Frequency response (p_P = 315 bar)

"2WRCE"

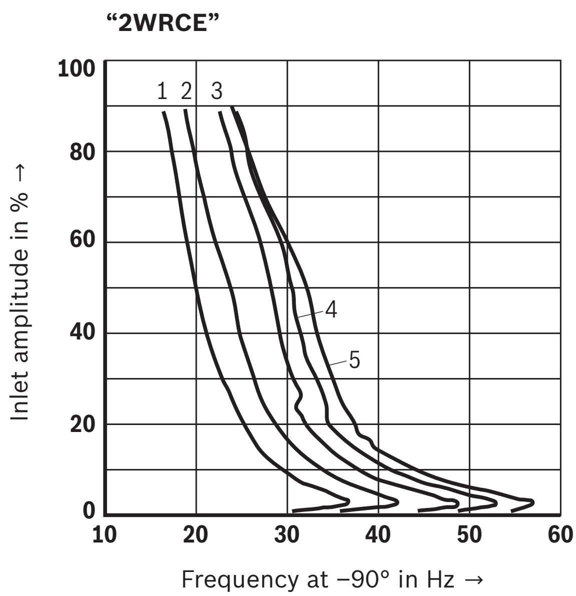


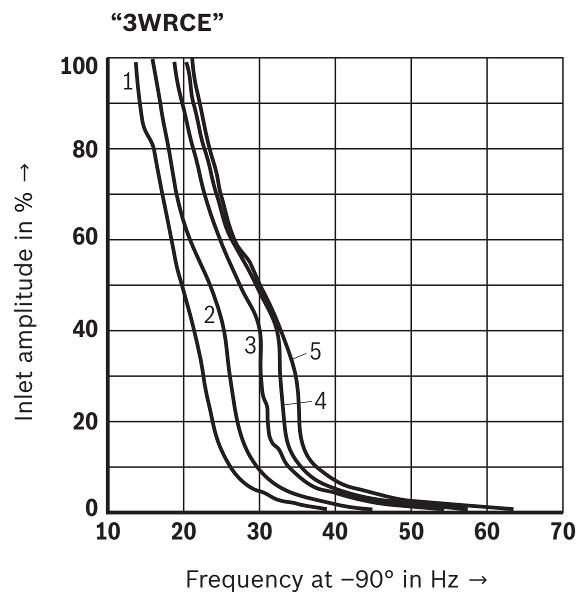
"3WRCE"



Characteristic curves: Size 50
(measured with HLP32, ϑ_{oil} = 40 ±5 °C)

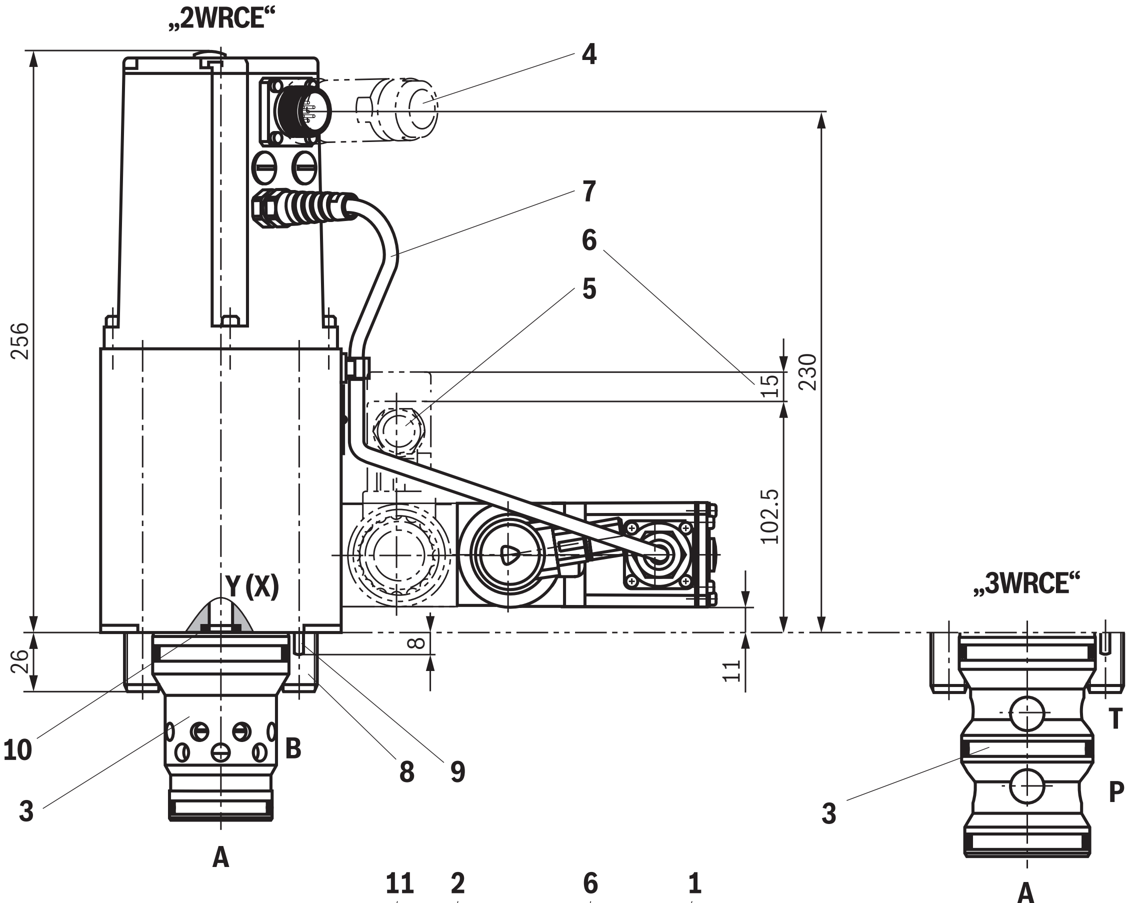
Frequency *f* dependent on operating pressure and inlet amplitude

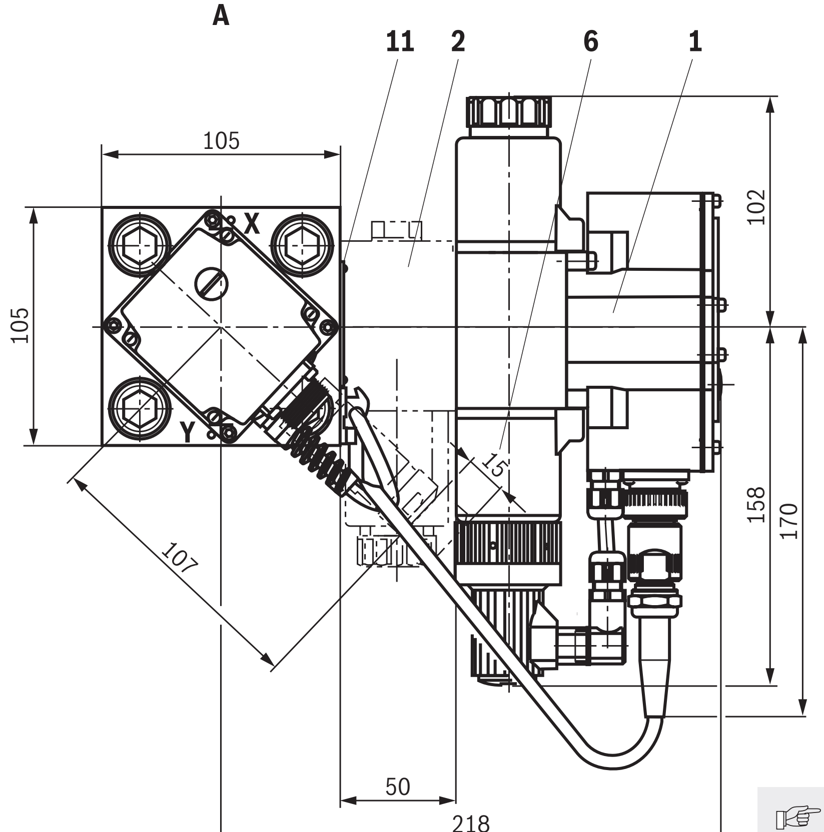




1 40 bar
2 70 bar
3 140 bar
4 210 bar
5 315 bar

Dimensions: Size 32
(dimensions in mm)

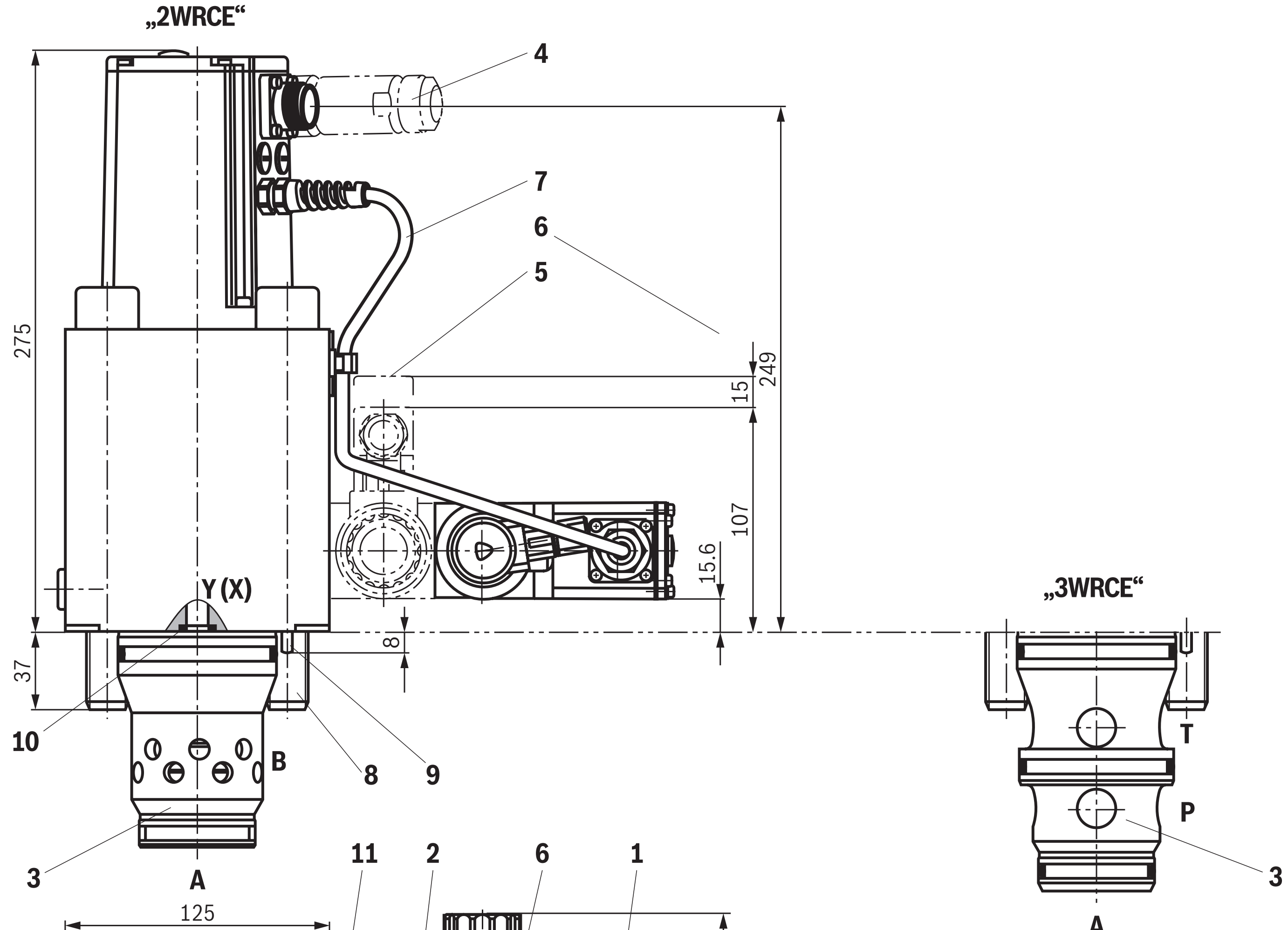


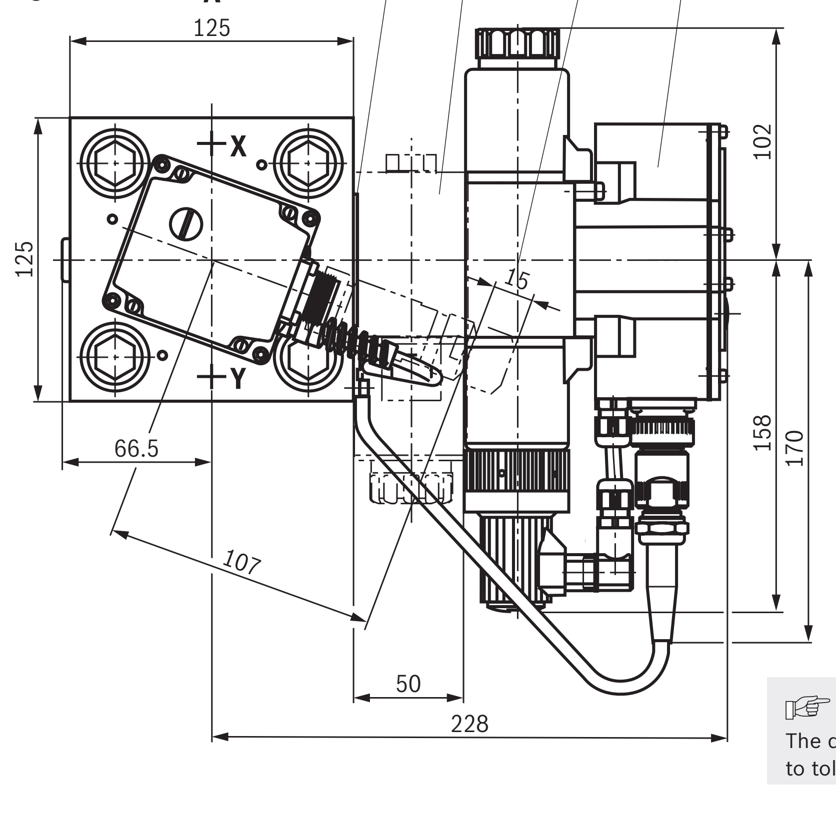


Item explanations and **valve mounting screws** see page 26.

☞ **Notice:**
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions: Size 40
(dimensions in mm)

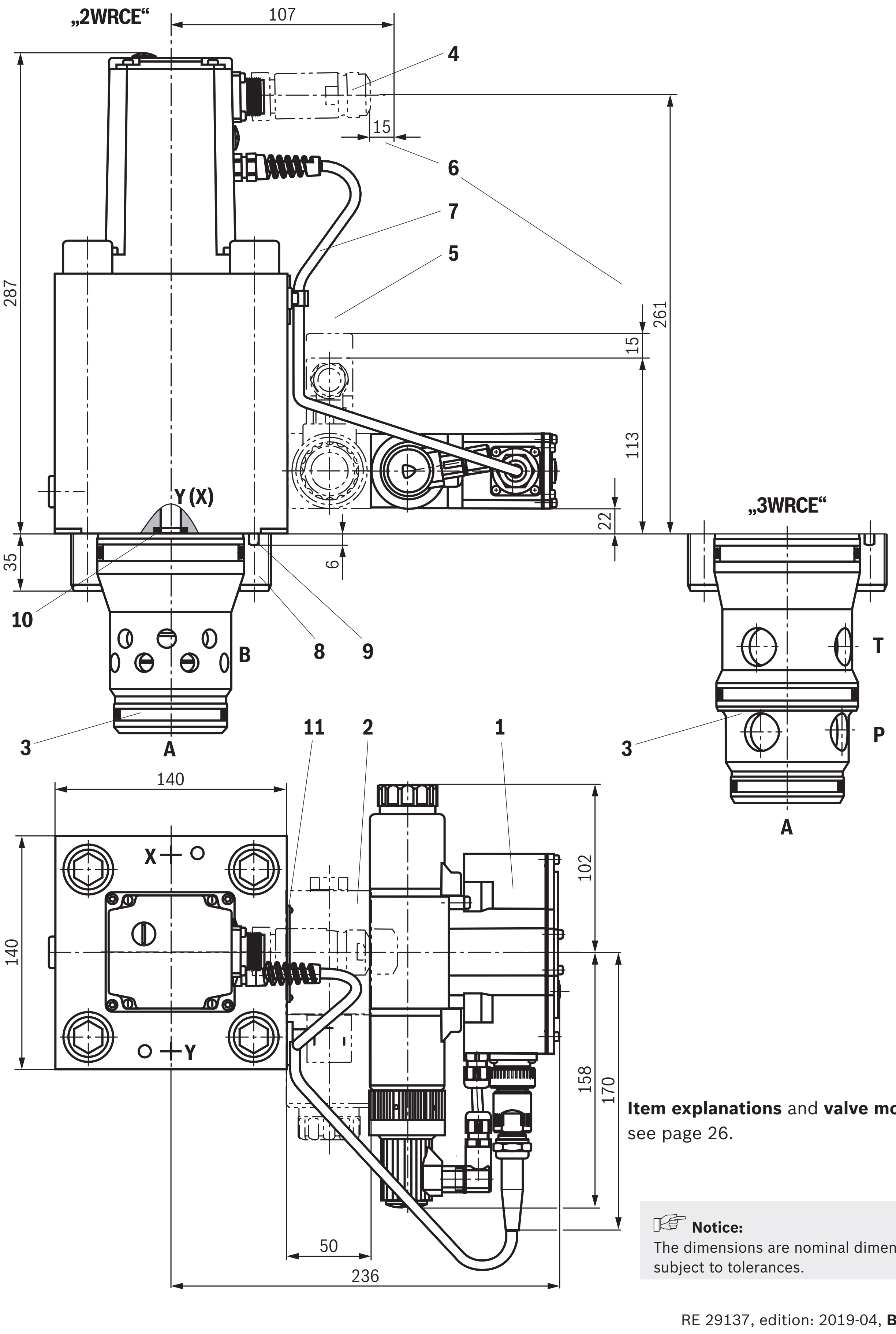




Item explanations and **valve mounting screws** see page 26.

☞ **Notice:**
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions: Size 50
(dimensions in mm)



Item explanations and **valve mounting screws**
see page 26.

Notice:
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions

1 Pilot control valve (proportional directional valve)
2 Sandwich plate shut-off valve (version “WK15” and “WL15”)
3 Bushing
4 Mating connectors for valves with round connector, 6-pole + PE (separate order, see page 28 and data sheet 08006)
5 Mating connectors for valves with connector “K4” (separate order, see page 28 and data sheet 08006)
6 Space required for removing the mating connector
7 Cabling
8 Valve mounting screws (included in the scope of delivery), see below
9 Locating pin
10 Identical seal rings for ports X and Y
11 Name plate

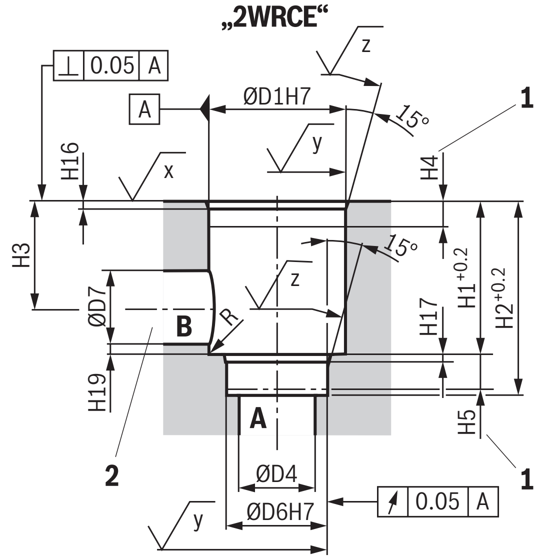
Valve mounting screws (included in the scope of delivery)

Size	Quantity	Hexagon socket head cap screws
32	4	**ISO 4762 - M16 x 100 -10.9-flZn/nc/480h/C** Tightening torque $\boldsymbol{M}_{\mathrm{A}}$ = 250 Nm ±10%
40	4	**ISO 4762 - M20 x 180 -10.9** Tightening torque $\boldsymbol{M_A}$ = 590 Nm ±10%
50	4	**ISO 4762 - M20 x 190 -10.9** Tightening torque $\boldsymbol{M}_{\mathrm{A}}$ = 590 Nm ±10%

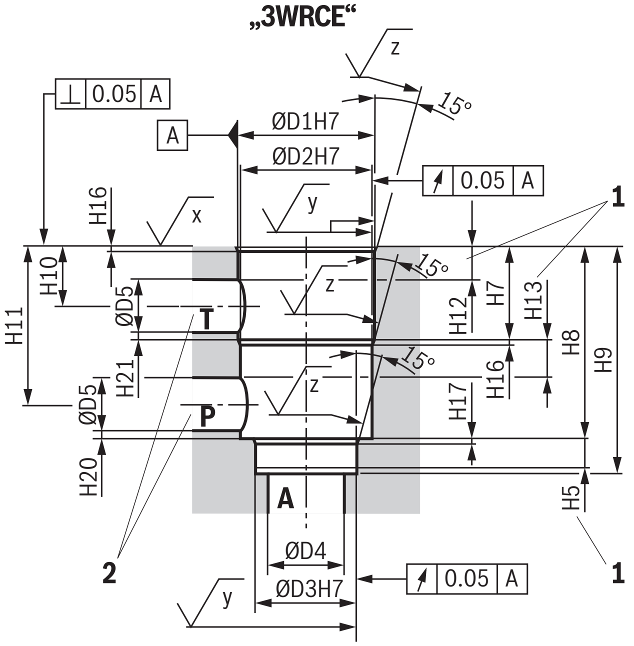
☞ **Notice:**
For tightening, a manual torque wrench with a tolerance of ≤10% is to be used.

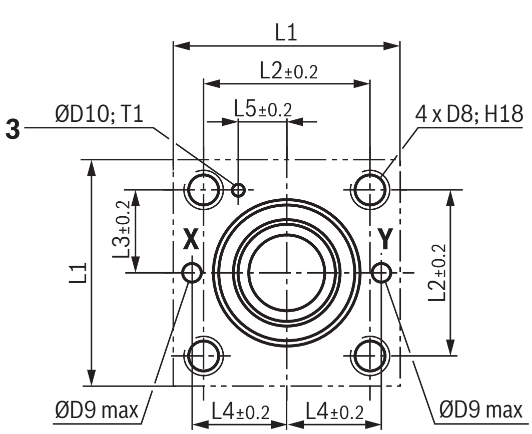
Installation bore
(dimensions in mm)

„2WRCE“



„3WRCE“





Installation dimensions according to DIN ISO 7368

NG	32	40	50
ØD1H7	60	75	90
ØD2H7	58	73	87
ØD3H7	55	55	68
ØD4	32	40	50
ØD5	24	30	35
ØD6H7	45	55	68
ØD7	32	40	50
D8	M16	M20	M20
ØD9 max	8	10	10
ØD10	6	6	8
H1	70	87	100
H2	85	105	122
H3	52	64	72
H4	30	30	35
H5	13	15	17
H7	43.5	54	87
H8	85	105	143
H9	100	125	165
H10	30	36	66
H11	70.5	87	122
H12	18	21	48
H13	15	18	18
H16	2.5	3	4
H17	2.5	3	3
H18	35	45	45
H19	2	3	3
H20	2.5	3	3.5
H21	1.5	3	3.5
L1	105	125	140
L2	70	85	100
L3	35	42.5	50
L4	41	50	58
L5	17	23	30
T1	10	10	10

1 Depth of fit, minimum dimension

2 The ports P, T and B can be positioned around the central axis of port A. However, it must be observed that the mounting bores and the control bores are not damaged.

3 Bore for locating pin

Tolerances according to: General tolerances ISO 2768-mK

Valve mounting screws see page 28.

$\sqrt{x} = \sqrt{\text{Rzmax } 4}$ $\sqrt{z} = \sqrt{\text{Rz } 10}$

$\sqrt{y} = \sqrt{\text{Rzmax } 8}$

Accessories (separate order)

Mating connectors and cable sets

Item [1]	Designation	Version	Short designation	Material number	Data sheet
4	Mating connector; for valves with round connector, 6-pole + PE	straight, metal	7PZ31...M	**R900223890**	08006
		straight, plastic	7PZ31...K	**R900021267**	
5	Mating connector; for valves with "K4" connector, 2-pole + PE, design A	Without circuitry, 12 ... 240 V	Z4	**R901017010**	08006
		With indicator light, 12 ... 240 V	Z5L	**R901017022**	
		With rectifier, 12 ... 240 V	RZ5	**R901017025**	
		Z-diode-suppressor 24 V	Z5L1	**R901017026**	

[1] See dimensions on page 23 of 25.

Further information

- Directional high-response cartridge valve, pilot-operated, with integrated electronics (OBE) — Data sheet 29136
- Hydraulic valves for industrial applications — Operating instructions 07600-B
- Hydraulic fluids on mineral oil basis — Data sheet 90220
- Environmentally compatible hydraulic fluids — Data sheet 90221
- Flame-resistant, water-free hydraulic fluids — Data sheet 90222
- Flame-resistant hydraulic fluids - containing water (HFAE, HFAS, HFB, HFC) — Data sheet 90223
- Selection of filters
- Information on available spare parts

RE 29136
Edition: 2019-12
Replaces: 2019-02

rexroth
A Bosch Company

Directional high-response cartridge valve, pilot-operated, with integrated electronics (OBE)

Type WRCE


H6869+6870

- Size 32 ... 50
- Component series 2X
- Maximum operating pressure 420 bar
- Maximum flow 4500 l/min

Features

- 2 or 3-way directional cartridge valve
- Pilot control valve: 2-stage directional servo valve
- Main stage: position-controlled
- Normalized:
  – Installation dimensions according to ISO 7368 ("2WRCE")
- Flexible:
  – Suitable for position, pressure, force and velocity control
- Typical applications:
  – Presses
  – Die casting machines
  – Punching axes

Contents

Ordering code: "2WRCE"

01	02	03	04	05	06		07		08	09	10		11	12	13	14
2	WRCE		S			–	2X	/	S		K31	/				*

01	2 main ports	**2**
02	Directional high-response cartridge valve, pilot-operated, with integrated electronics (OBE)	**WRCE**
03	Size 32	**32**
	Size 40	**40**
	Size 50	**50**
04	Control spool in seat design	**S**

Rated flow at 5 bar pressure differential

05	**– Size 32**	
	480 l/min (only version "R")	**480**
	650 l/min (only version "L")	**650**
	– Size 40	
	700 l/min (only version "R")	**700**
	1000 l/min (only version "L")	**1000**
	– Size 50	
	1100 l/min (only version "R")	**1100**
	1600 l/min (only version "L")	**1600**

Flow characteristic

06	Linear	**L**
	Linear with progressive fine control range	**R**
07	Component series 20 ... 29 (20 ... 29: Unchanged installation and connection dimensions)	**2X**

Pilot control valve

08	Directional servo valve	**S**

Supply voltage

09	Direct voltage 24 V	**G24**
	DC voltage ±15 V	**G15**

Electrical connection

10	Without mating connector; connector according to DIN EN 175201-804	**K31** 1)

Electrical interface

11	Command value 0 ... 10 V, actual value 0.5 ... 10 V	**A1**
	Command value 0 ... 10 mA, actual value 0.5 ... 10 mA	**C1**

Sandwich plate shut-off valve

12	**Without** shut-off valve	**no code**
	With shut-off valve 1)	
	Shut-off valve switched to de-energized actively **closes** "2WRCE" with applied pilot pressure	**WK15**
	Shut-off valve switched to de-energized actively **opens** "2WRCE" with applied pilot pressure	**WL15**

Seal material (observe compatibility of seals with hydraulic fluid used, see page 10)

13	NBR seals	**M**
	FKM seals	**V**
14	Further details in the plain text	

1) Mating connectors, separate order, see page 28 and data sheet 08006.

Ordering code: "3WRCE"

01	02	03	04	05	06		07		08	09	10		11	12	13	14
3	WRCE					–	2X	/	S		K31	/				*

01	3 main ports	**3**
02	Directional high-response cartridge valve, pilot-operated, with integrated electronics (OBE)	**WRCE**
03	Size 32	**32**
	Size 40	**40**
	Size 50	**50**
04	Control spool in spool design – zero overlap (+0.5 ... +1.5 %)	**V**
	Control spool in spool design – positive overlap 10 ... 13 %	**E**

Rated flow at 5 bar pressure differential

05	**– Size 32**	
	250 l/min (only versions "E" and "P")	**250**
	290 l/min (only versions "V" and "L")	**290**
	– Size 40	
	410 l/min (only versions "E" and "P")	**410**
	460 l/min (only versions "V" and "L")	**460**
	– Size 50	
	620 l/min (only versions "E" and "P")	**620**
	720 l/min (only versions "V" and "L")	**720**

Flow characteristic

06	Linear	**L**
	Linear with progressive fine control range	**P**
07	Component series 20 ... 29 (20 ... 29: Unchanged installation and connection dimensions)	**2X**

Pilot control valve

08	Directional servo valve	**S**

Supply voltage

09	Direct voltage 24 V	**G24**
	DC voltage ±15 V	**G15**

Electrical connection

10	Without mating connector; connector according to DIN EN 175201-804	**K31** [1)]

Electrical interface

11	Command value ±10 V, actual value ±10 V	**A1**
	Command value ±10 mA, actual value ±10 mA	**C1**

Sandwich plate shut-off valve

12	**Without** shut-off valve	**no code**
	With shut-off valve [1)]	
	Shut-off valve switched to de-energized actively **closes** "2WRCE" with applied pilot pressure	**WK15**
	Shut-off valve switched to de-energized actively **opens** "2WRCE" with applied pilot pressure	**WL15**

Seal material (observe compatibility of seals with hydraulic fluid used, see page 10)

13	NBR seals	**M**
	FKM seals	**V**
14	Further details in the plain text	

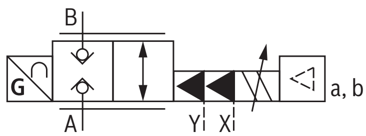
[1)] Mating connectors, separate order, see page 28 and data sheet 08006.

☞ **Notice:** Version "3WRCE" is not recommended for new applications, see page 7.

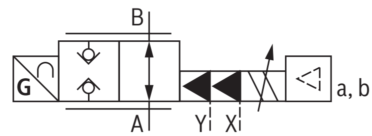
Symbols: "2WRCE"

Simplified

"No code" and **"WK15" version**

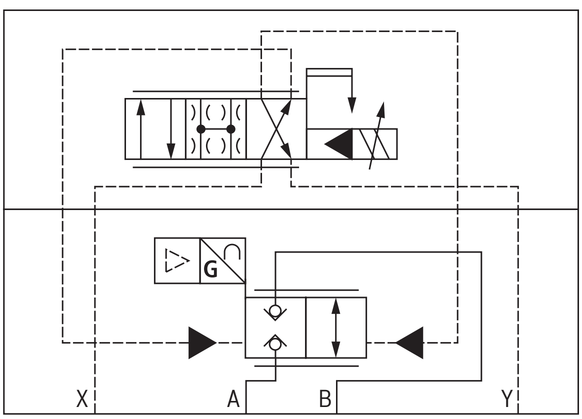


Version "WL15"

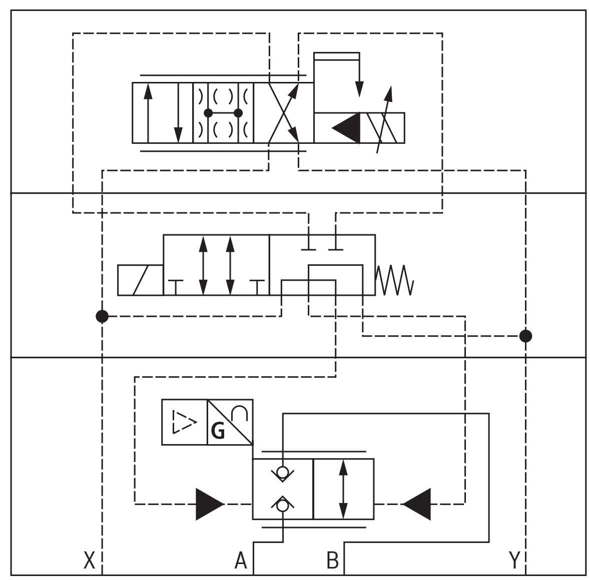


Detailed

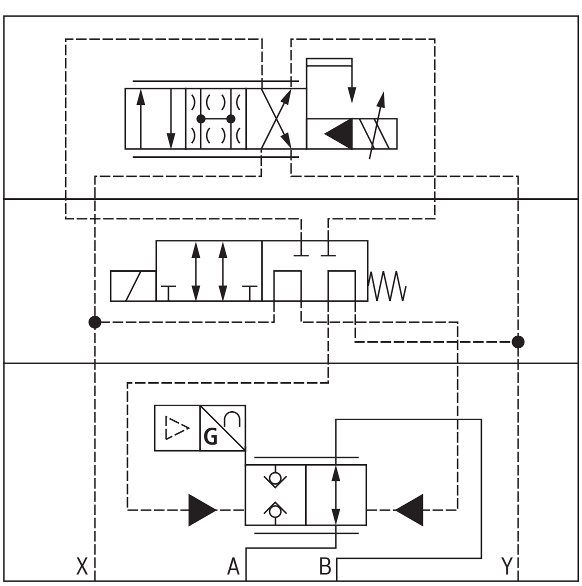
"No code" version



Version "WK15"



Version "WL15"

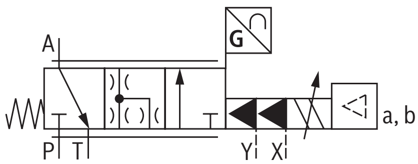


☞ **Notice:** Representation according to DIN ISO 1219-1.

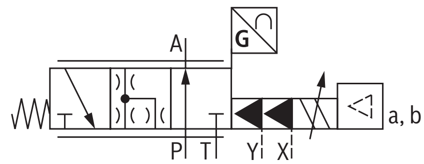
Symbols: "3WRCE"

Simplified

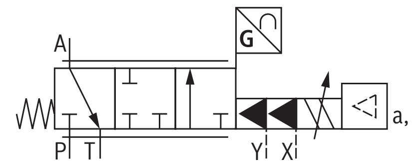
Version "V...no code" and **"V...WK15"**



Version "V...WL15"

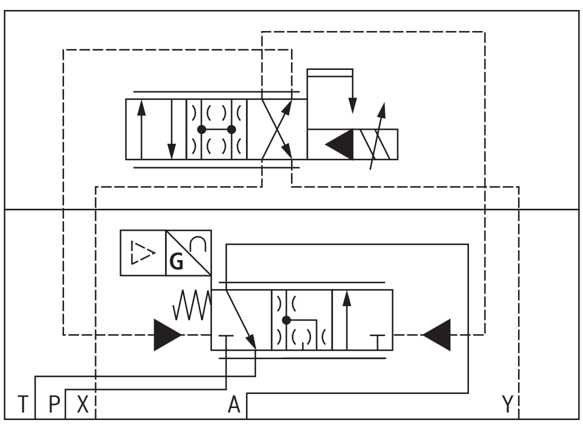


Version "E...no code"

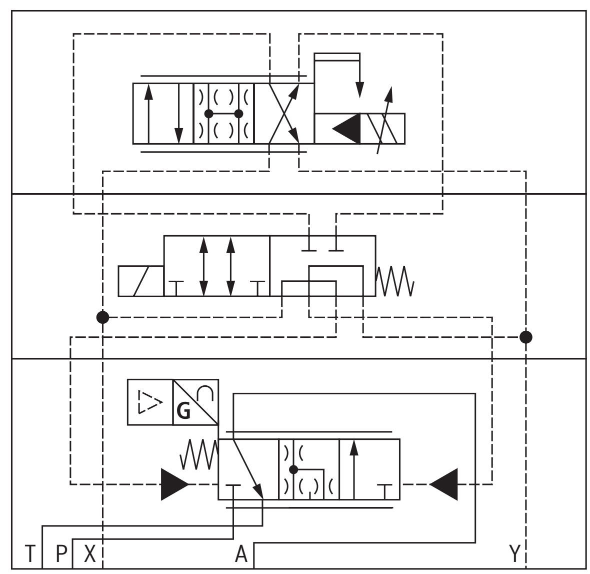


Detailed

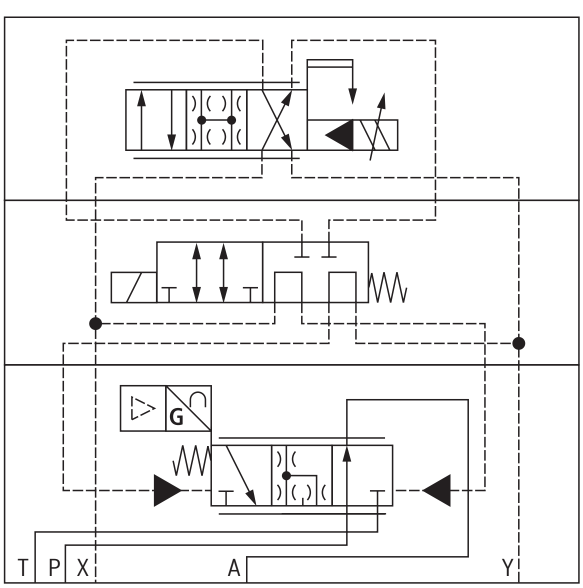
Version "V...no code"



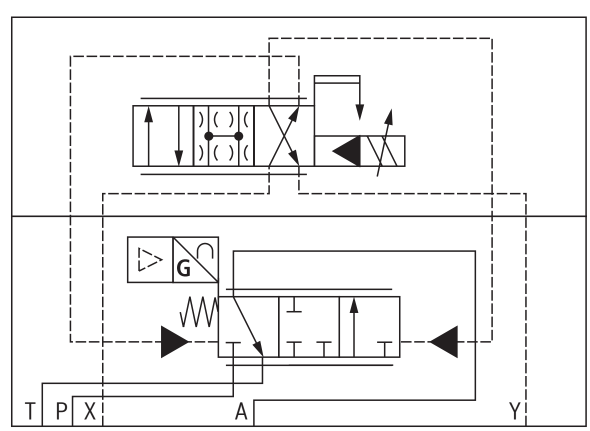
Version "V...WK15"



Version "V...WL15"



Version "E...no code"



Notice: Representation according to DIN ISO 1219-1.

Function, section: "2WRCE"

Valves of type 2WRCE are pilot-operated, 3-stage directional high-response cartridge valves. They control the quantity and direction of a flow and are mainly used in control loops.

Set-up

The valves consist of the following assemblies:

- 2-stage pilot control valve (1)
  - with dry torque motor
  - low-friction nozzle flapper plate amplifier
  - mechanical feedback of the control spool position
- Main stage (2) for flow control
- Inductive position transducer (3) the core (4) of which is attached to the main control spool (5) of the second stage
- Integrated electronics (6).

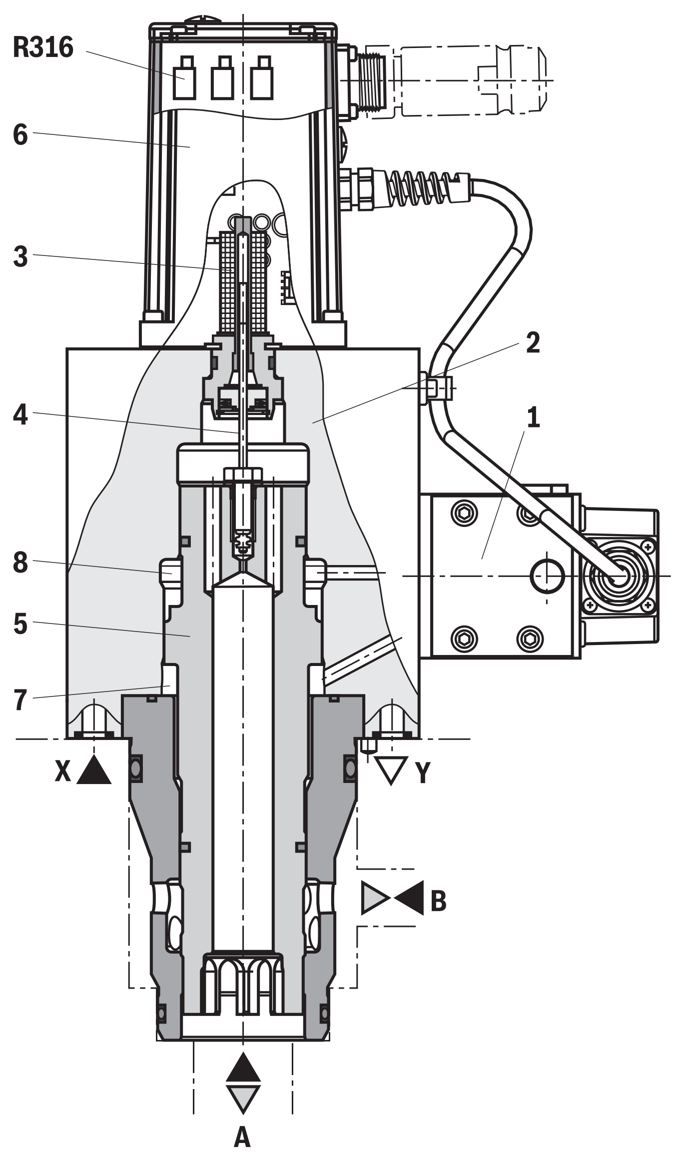
Function

The integrated electronics compares command and actual values, and the torque motor of the pilot control valve is actuated with a proportional current according to the control deviation.
The pilot control valve (1) takes a proportionally controlled position and controls the flow in and out of the control chambers A (7) and B (8) that actuate the main control spool (5) through the closed valve control loop up to 0 control deviation.
This means that the stroke of the main control spool (5) is regulated proportionally to the command value. It must be noted that the flow also depends on the valve pressure drop.

Valve features

The flow can pass through the valve from A to B or from B to A.
The control spool (seat design) closes or opens at 5 % of the command value. At lower command values, the valve control loop attempts to guide the control spool, thus presses it onto the seat at full pilot pressure and blocks the connection in a leakage-free way.
The specified valve dynamics only apply to the control area of the valve. At command value steps from the seat to lower opening values, additional delay times occur.
The opening point of 5 % (= 0.5 V or 0.5 mA) is set at the factory. Upon replacement of the pilot control valve (1) or the integrated electronics (6), the opening point can be readjusted using the zero adjustment potentiometer R316 (accessible via a plug screw).
During the exchange, no settings must be made at the control electronics (= controller or control electronics) and the pilot control valve (1), except for the zero adjustment at the controller.

At the pilot control valve (1), only the filter element may be exchanged. The pilot control valve (1) is trimmed so that the pilot pressure is connected to control chamber B (8) in case of a power failure, i.e. the main stage is closed.
The integrated electronics (6) features an offset to compensate the trimming (pilot trimming) of the pilot control valve (1).
Due to differences in diameter in the seat range, the control spools are statically not pressure-compensated.
To compensate the force differential, 6 % of the system pressure is required for version "L" and 22 % of the system pressure is required for version "R" as pilot pressure.
With reserves for flow force and dynamics, this defines the recommended minimum pilot pressure.



Function, section: "3WRCE"

Valves of type 3WRCE are pilot-operated, 3-stage directional high-response cartridge valves. They control the quantity and direction of a flow and are mainly used in control loops.

Set-up

The valves consist of the following assemblies:

- 2-stage pilot control valve (1)
  - with dry torque motor
  - low-friction nozzle flapper plate amplifier
  - mechanical feedback of the control spool position
- Main stage (2) for flow control
- Inductive position transducer (3) the core (4) of which is attached to the main control spool (5) of the second stage
- Integrated electronics (6).

Function

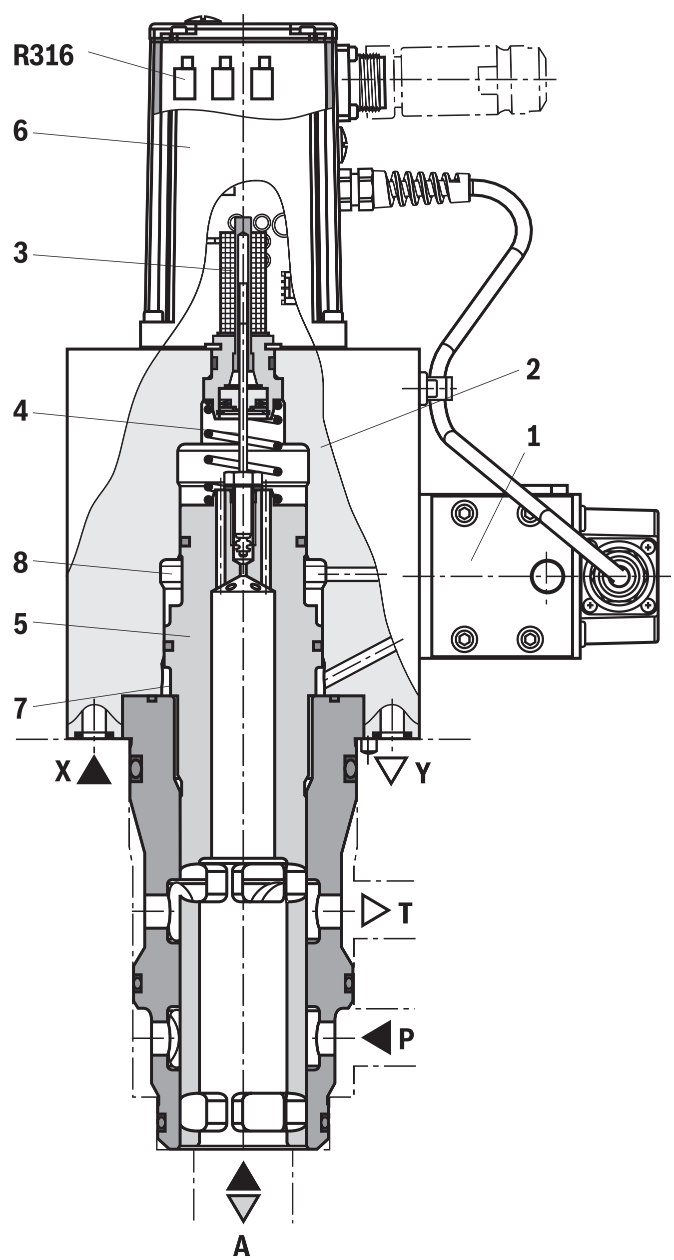
The integrated electronics compares command and actual values, and the torque motor of the pilot control valve is actuated with a proportional current according to the control deviation.
The pilot control valve (1) takes a proportionally controlled position and controls the flow in and out of the control chambers A (7) and B (8) that actuate the main control spool (5) through the closed valve control loop up to 0 control deviation.
This means that the stroke of the main control spool (5) is regulated proportionally to the command value. It must be noted that the flow also depends on the valve pressure drop.

Valve features

The opening point of 0 % (symbol V) is set at the factory. Upon replacement of the pilot control valve (1) or the integrated electronics (6), the opening point can be readjusted using the zero adjustment potentiometer R316 (accessible via a plug screw).
During the exchange, no settings must be made at the control electronics (= controller or control electronics) and the pilot control valve (1), except for the zero adjustment.

☞ **Notice:**
Version "3WRCE" is not recommended for new applications.
If version "3WRCE" is used, ports A and P have to be exchanged. Upon request.

At the pilot control valve (1), only the filter element may be exchanged. The pilot control valve (1) is trimmed so that the pilot pressure is connected to control chamber B (8) in case of a power failure, i.e. the main stage opens from A to T and/or closes the connection from P to A.
The spring behind the main control spool (5) moves it into position so that P to A is closed if no pressure is applied (e.g. prior to installation, before the pressures are reapplied after tool change).
The integrated electronics (6) features an offset to compensate the trimming (pilot trimming) of the pilot control valve (1).



Technical data: "2WRCE"
(For applications outside these values, please consult us!)

General					
Sizes		NG	32	40	50
Installation position; commissioning			Any, preferably horizontal		
Storage temperature range		°C	−20 ... +80		
Ambient temperature range		°C	−20 ... +60		
Weight	▶ Without shut-off valve ("no code")	kg	11.2	21.1	28
	▶ With shut-off valve ("WK15", "WL15")	kg	12.4	24.8	31.7
Size of the pilot control valve		NG	6	10	10

Hydraulic					
Maximum operating pressure	▶ Main stage – Ports A, B	bar	420		
	▶ Pilot control valve – Port X	bar	315		
	– Port Y	bar	Pressure peaks < 100, static < 10		
Minimum pilot pressure (in % of the system pressure)	▶ Version "L"	%	15		
	▶ Version "R"	%	45		
Rated flow (q_{Vnom} +10 %; Δp = 5 bar)	▶ Version "L"	l/min	650	1000	1600
	▶ Version "R"	l/min	480	700	1100
Maximum flow	▶ Version "L"	l/min	1500	2200	3500
	▶ Version "R"	l/min	2000	3000	4500
Pilot flow [1]		l/min	38	56	80
Zero flow (pre-stage)			See characteristic curves page 13		
Pilot oil volume		cm^3	4.52	8.48	17.3
Nominal stroke		mm	10	12	15
Hydraulic fluid			See table page 10		
Hydraulic fluid temperature range	▶ Recommended	°C	+40 ... +50		
	▶ Maximum admissible		−20 ... +80		
Viscosity range	▶ Recommended	mm^2/s	30 ... 45		
	▶ Maximum admissible		20 ... 380		
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)	▶ Pilot control valve		Class 18/16/13 [2]		
	▶ Main stage		Class 20/18/15 [2]		
Hysteresis		%	≤ 0.2		
Range of inversion		%	≤ 0.1		
Response sensitivity		%	≤ 0.1		
Closing time [3]	▶ With pilot trimming	ms	≤ 550		
	▶ With shut-off valve	ms	≤ 200		

1) Stepped input signal (from 0 to 100 %, pilot pressure 315 bar)

2) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and simultaneously increases the life cycle of the components.

3) Pilot pressure 40 ... 315 bar

Technical data: "3WRCE"
(For applications outside these values, please consult us!)

General					
Sizes		NG	32	40	50
Installation position; commissioning			Any, preferably horizontal		
Storage temperature range		°C	−20 ... +80		
Ambient temperature range		°C	−20 ... +60		
Weight	▶ Without shut-off valve ("no code")	kg	11.5	18.9	29.2
	▶ With shut-off valve ("WK15", "WL15")	kg	12.7	20.1	32.9
Size of the pilot control valve		NG	6	6	10

Hydraulic					
Maximum operating pressure	▶ Main stage				
	– Ports A, B, T	bar	315		
	▶ Pilot control valve				
	– Port X	bar	315		
	– Port Y	bar	Pressure peaks < 100, static < 10		
Rated flow (q_{Vnom} +10 %; Δp = 5 bar)	▶ Version "L"	l/min	290	460	720
	▶ Version "P"	l/min	250	410	620
Maximum flow	▶ Version "L"	l/min	900	1400	2200
	▶ Version "P"	l/min	900	1400	2200
Pilot flow [1]		l/min	27	42	65
Zero flow	▶ Pilot control valve		See characteristic curves page 13		
	▶ Main stage (p_p = 300 bar)		4	6	8
Pilot oil volume		cm^3	±2.26	±4.24	±8.65
Nominal stroke		mm	±5	±6	±7.5
Hydraulic fluid			see table 10		
Hydraulic fluid temperature range	▶ Recommended	°C	+40 ... +50		
	▶ Maximum admissible		−20 ... +80		
Viscosity range	▶ Recommended	mm^2/s	30 ... 45		
	▶ Maximum admissible		20 ... 380		
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)	▶ Pilot control valve		Class 18/16/13 [2]		
	▶ Main stage		Class 20/18/15 [2]		
Hysteresis		%	≤ 0.2		
Range of inversion		%	≤ 0.1		
Response sensitivity		%	≤ 0.1		
Closing time [3]	▶ With pilot trimming	ms	≤ 550		
	▶ With shut-off valve	ms	≤ 200		

1) Stepped input signal (from 0 to 100 %, pilot pressure 315 bar)
2) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and simultaneously increases the life cycle of the components.

3) Pilot pressure 40 ... 315 bar

Technical data
(For applications outside these values, please consult us!)

Hydraulic fluid		Classification	Suitable sealing materials	Standards	Data sheet
Mineral oils		HL, HLP, HLPD, HVLP, HVLPD	NBR, FKM	DIN 51524	90220
Bio-degradable	▶ Insoluble in water	HETG	FKM	ISO 15380	90221
		HEES	FKM		
	▶ Soluble in water	HEPG	FKM	ISO 15380	
Flame-resistant	▶ Water-free	HFDU (glycol base)	FKM	ISO 12922	90222
		HFDU (ester base)	FKM		
		HFDR	FKM		
	▶ Containing water	HFC (Fuchs: Hydrotherm 46M, Renosafe 500; Petrofer: Ultra Safe 620; Houghton: Safe 620; Union: Carbide HP5046)	NBR	ISO 12922	90223

Important information on hydraulic fluids:
- ▶ For further information and data on the use of other hydraulic fluids, please refer to the data sheets above or contact us.
- ▶ There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.).
- ▶ The ignition temperature of the hydraulic fluid used must be 50 K higher than the maximum surface temperature.
- ▶ **Bio-degradable and flame-resistant – containing water:** If components with galvanic zinc coating (e.g. version "J3" or "J5") or parts containing zinc are used, small amounts of dissolved zinc may get into the hydraulic system and cause accelerated aging of the hydraulic fluid. Zinc soap may form as a chemical reaction product, which may clog filters, nozzles and solenoid valves – particularly in connection with local heat input.
- ▶ **Flame-resistant – containing water:**
  - – Due to increased cavitation tendency with HFC hydraulic fluids, the life cycle of the component may be reduced by up to 30 % as compared to the use with mineral oil HLP. In order to reduce the cavitation effect, it is recommended – if possible specific to the installation – to back up the return flow pressure in ports T to approx. 20 % of the pressure differential at the component.
  - – Dependent on the hydraulic fluid used, the maximum environment and hydraulic fluid temperature must not exceed 50 °C. In order to reduce the heat input into the component, the command value profile is to be adjusted for proportional and high-response valves.

Electric			
Protection class of the valve according to EN 60529			IP65 with mating connector mounted and locked
Voltage type			Direct voltage
Type of signal			Analog
Zero compensation		%	≤ 1
Zero shift upon change of:	▶ Hydraulic fluid temperature	%/10 K	≤ 0.3
	▶ Pilot pressure in X	%/100 bar	≤ 0.7
	▶ Return flow pressure in Y (0 ... 10 % of the pilot pressure)	%/bar	≤ 0.3

Notice:
For information on the environment simulation testing for the areas EMC (electromagnetic compatibility), climate and mechanical load, see data sheet 29136-U (declarations on environmental compatibility).

Electrical connections and assignment

Connector pin assignment

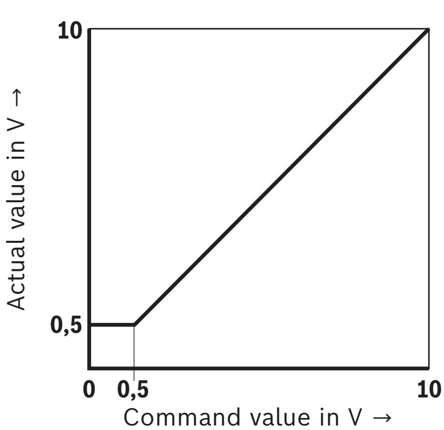
Pin	Signal	Interface assignment "A1" "2WRCE"	Interface assignment "A1" "3WRCE"	Interface assignment "C1" "2WRCE"	Interface assignment "C1" "3WRCE"
A	Supply voltage	+24 VDC (+15 VDC)		+24 VDC (+15 VDC)	
B		0 VDC (−15 VDC)		0 VDC (−15 VDC)	
C	M0 at ±15 V "G15"	n.c. (reference to pins A, B)		n.c. (reference to pins A, B)	
D	Differential command value input	0 to +10 V	0 to ±10 V	0 to +10 mA	0 to ±10 mA
E					
F	Actual value Reference with "G24" is pin B Reference with "G15" is pin C	+0.5 to +10 V	0 to ±10 V	+0.5 to +10 mA	0 to ±10 mA
PE	Protective ground	Functional ground (directly connected to the valve housing)			

Supply voltage:	▶ +24 VDC ±6 V; full bridge rectification with smoothing capacitor 2200 µF = I_{max} = 230 mA ▶ ±15 VDC ±0.45 V; stabilized and smoothened; I_{max} = 180 mA
Command value:	▶ 0 ... +10 mA / ±10 mA → input resistance 100 Ω
Actual value:	▶ 0.5 mA ... +10 mA / ±10 mA → maximum load resistance 1 kΩ

Notice:
- ▶ Do not connect PE if the valve has already been grounded via the system.
- ▶ Command value and actual value have the same polarity
- ▶ Electrical signals provided via control electronics (e.g. actual value) must not be used to switch off safety-relevant machine functions.
- ▶ Mating connectors, separate order, see page 28 and data sheet 08006.

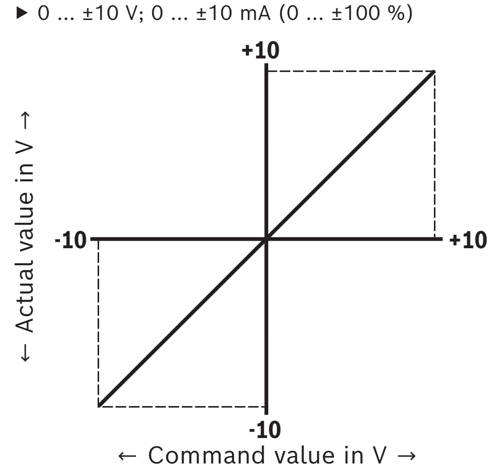
Nominal command value range

Version "2WRCE"
- ▶ 0 ... +10 V; 0 ... +10 mA (0 ... 100 %)



- ▶ In case of a slow command value modification from +0.5 V to +10 V, the actual value follows the command value within ±0.1 V.
- ▶ For command values over +10 V, the actual value follows up to approx. +12 V.
- ▶ In the command value range of 0 ... +0.5 V, the actual value remains constant at 0.5 V.
- ▶ At a command value step to +10 V, the actual value can temporarily reach values of up to approx. +10.5 V.

Version "3WRCE"
- ▶ 0 ... ±10 V; 0 ... ±10 mA (0 ... ±100 %)

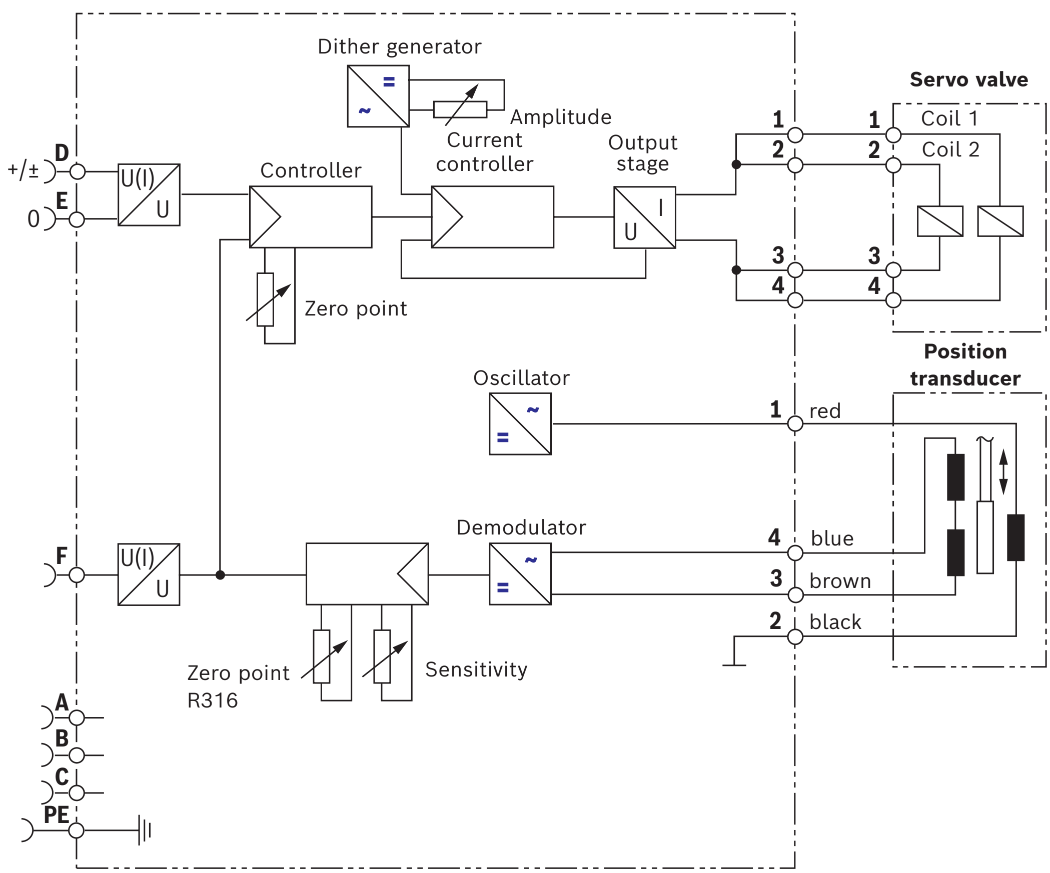


- ▶ In case of a slow command value modification from +0 V ... ±10 V, the actual value follows the command value within ±0.1 V.
- ▶ For command values over 10 V, the actual value follows up to approx. ±13 V.
- ▶ At a command value step to +10 V, the actual value can temporarily reach values of up to approx. +10.5 V.

Block diagram/controller function block: Integrated electronics (OBE)

Interface | **Integrated electronics (OBE)** | **Valve**

- **"2WRCE":** Command value 0 ... +10 V or 0 ... +10 mA
- **"3WRCE":** Command value ± 10 V or ± 10 mA



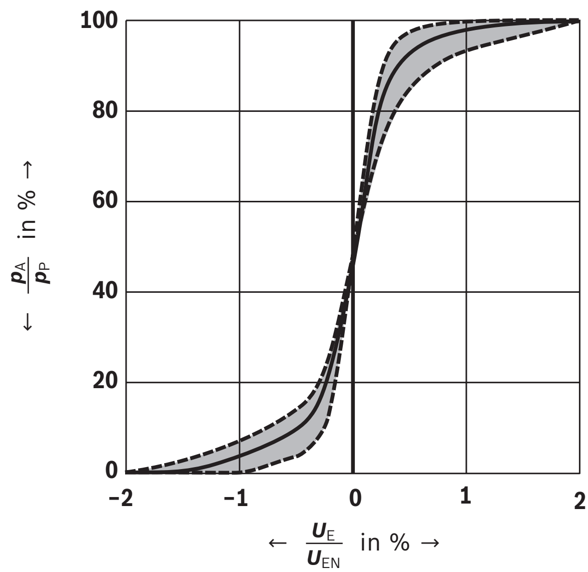
- **"2WRCE":** Actual value +0.5 V ... +10 V or +0.5 mA ... +10 mA
- **"3WRCE":** Actual value ±10 V / ±10 mA (measuring output F has positive potential against ⊥ with flow P → A)

Supply voltage	
±15 V	24 V
+15 V	18 ... 30 V
– 15 V	0 V
M0	free

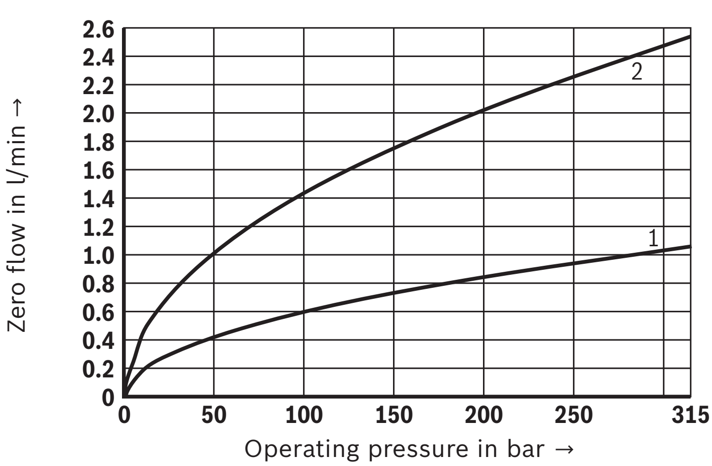
Effect of the control:
A positive signal at pin D and a reference potential at pin E results in
- "2WRCE": Flow A → B or B → A
- "3WRCE": Flow P → A

Characteristic curves
(measured with HLP32, ϑ_{oil} = 40 ±5 °C)

Pressure-signal function
("3WRCE...V"; limit and average characteristic curves)



Zero flow at the pilot control valve

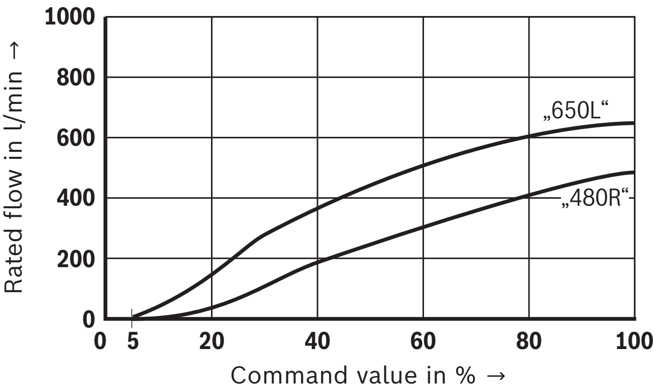


1 Sizes 32 and 40 ("3WRCE")
2 Sizes 40 ("2WRCE") and 50

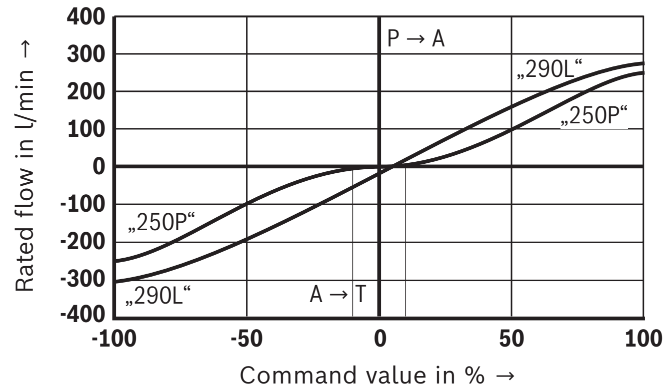
Characteristic curves: Size 32
(measured with HLP32, ϑ_{oil} = 40 ±5 °C)

Rated flow

"2WRCE" (**Δp** = 5 bar; A → B, B → A)



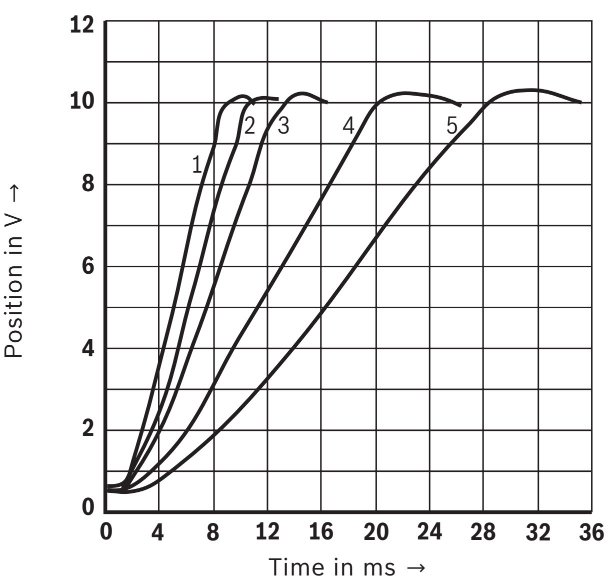
"3WRCE" (**Δp** = 5 bar)



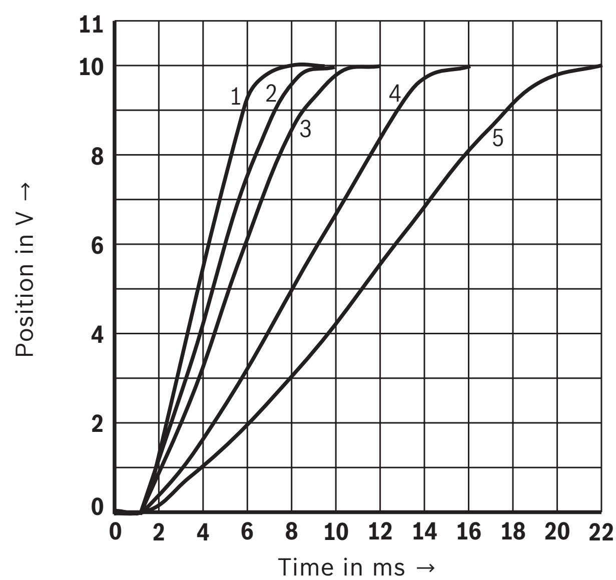
"E250P" 10 % overlap
"V290L" 0.5 ... 1.5 % overlap

Transition function

"2WRCE"



"3WRCE"

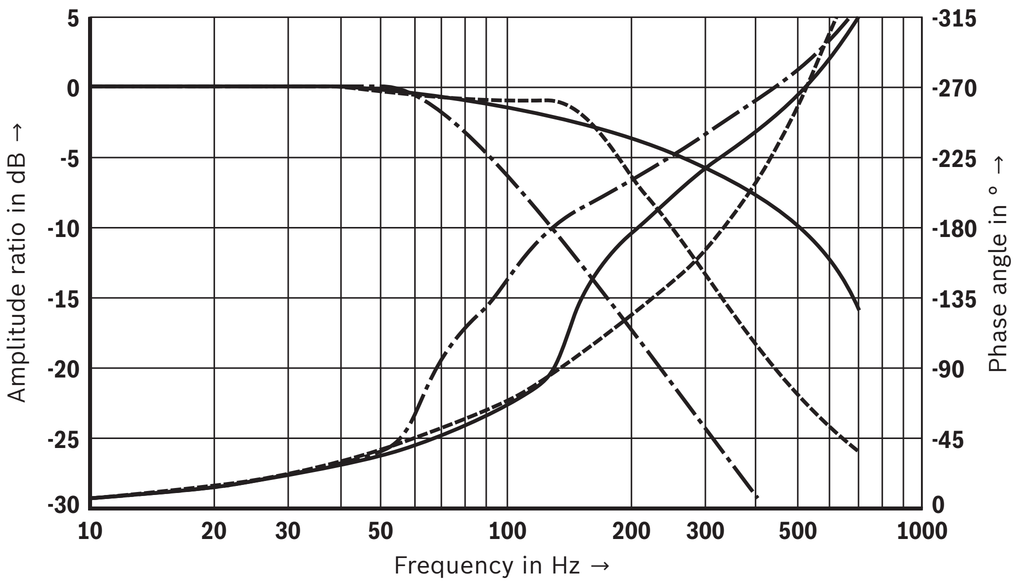


1 315 bar
2 210 bar
3 140 bar
4 70 bar
5 40 bar

Characteristic curves: Size 32
(measured with HLP32, ϑ_{oil} = 40 ±5 °C)

Frequency response (p_P = 315 bar)

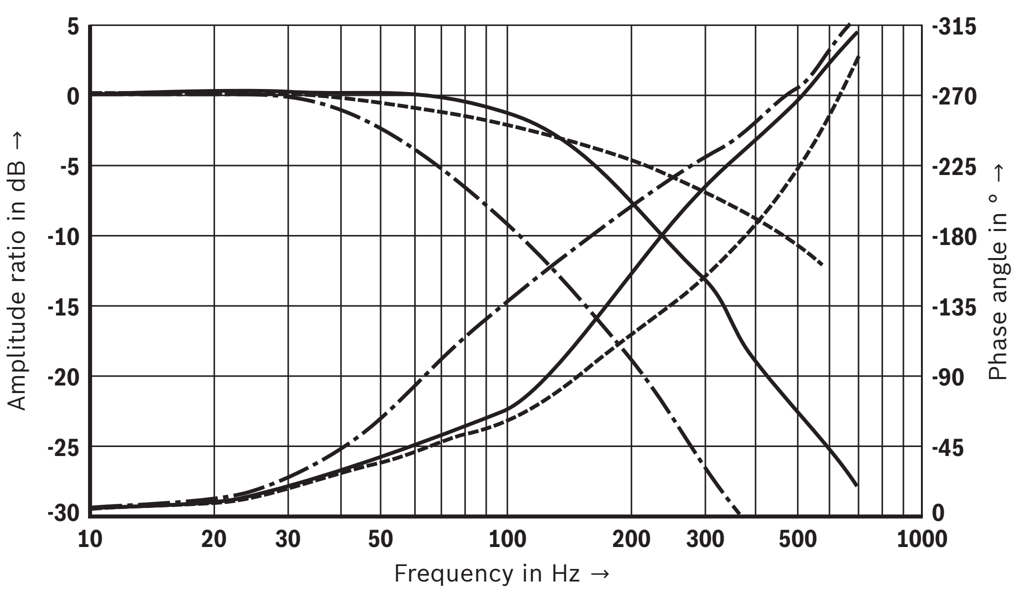
"2WRCE"



Command value

- - - - 50 % ±5 %
—— 50 % ±25 %
-·-·- 50 % ±45 %

"3WRCE"



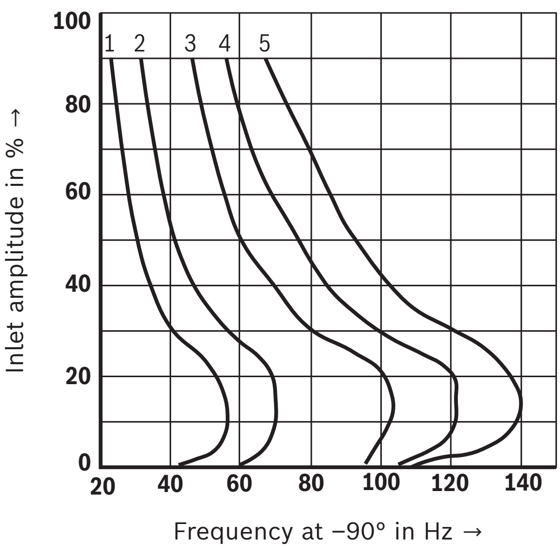
Command value

- - - - ±5 %
—— ±25 %
-·-·- ±100 %

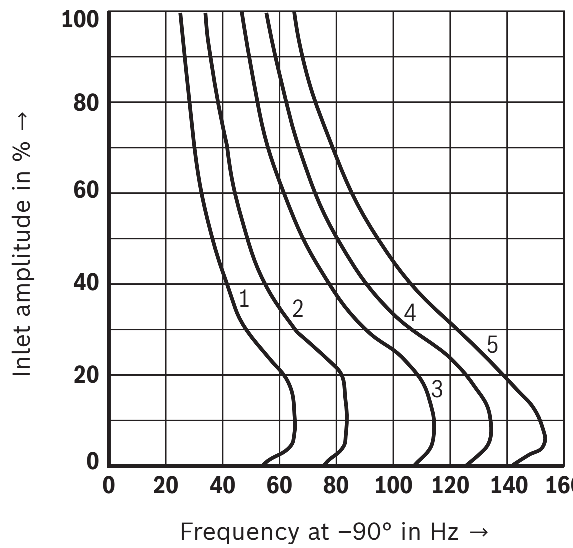
Characteristic curves: Size 32
(measured with HLP32, ϑ_{oil} = 40 ±5 °C)

Frequency *f* dependent on operating pressure and inlet amplitude

"2WRCE"



"3WRCE"

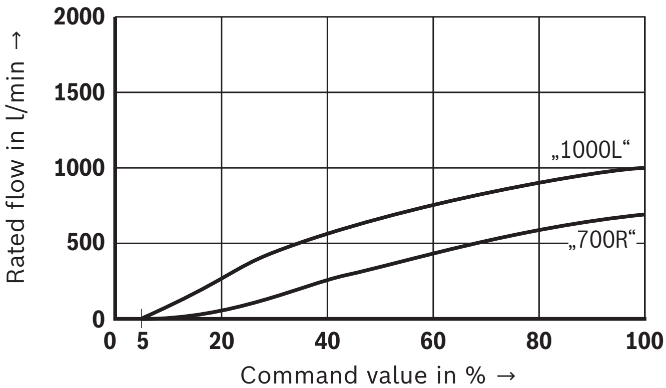


1 40 bar
2 70 bar
3 140 bar
4 210 bar
5 315 bar

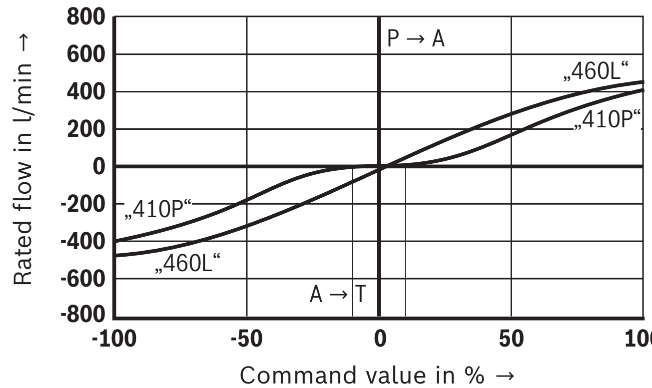
Characteristic curves: Size 40
(measured with HLP32, ϑ_{oil} = 40 ±5 °C)

Rated flow

"2WRCE" (***Δp*** = 5 bar; A → B, B → A)



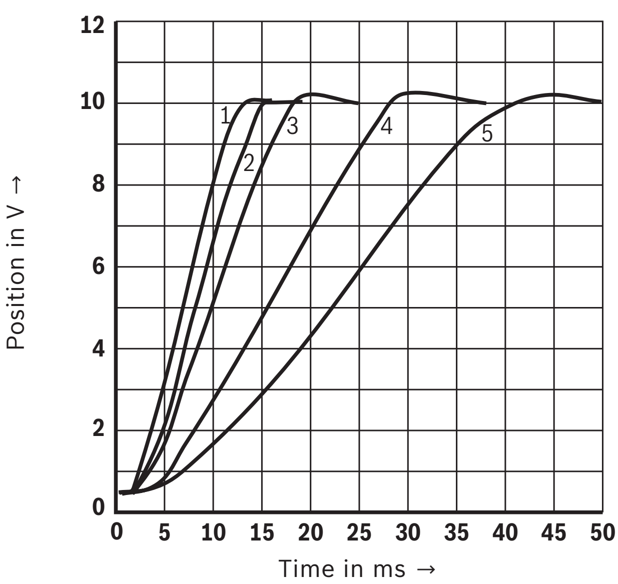
"3WRCE" (***Δp*** = 5 bar)



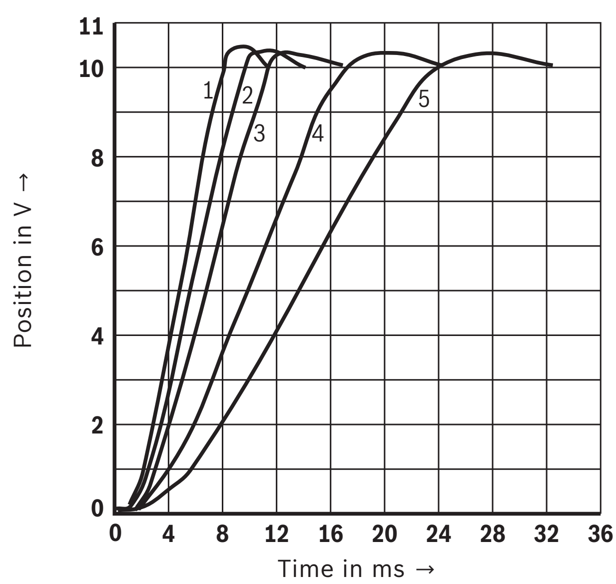
"E410P" 10 % overlap
"V460L" 0.5 ... 1.5 % overlap

Transition function

"2WRCE"



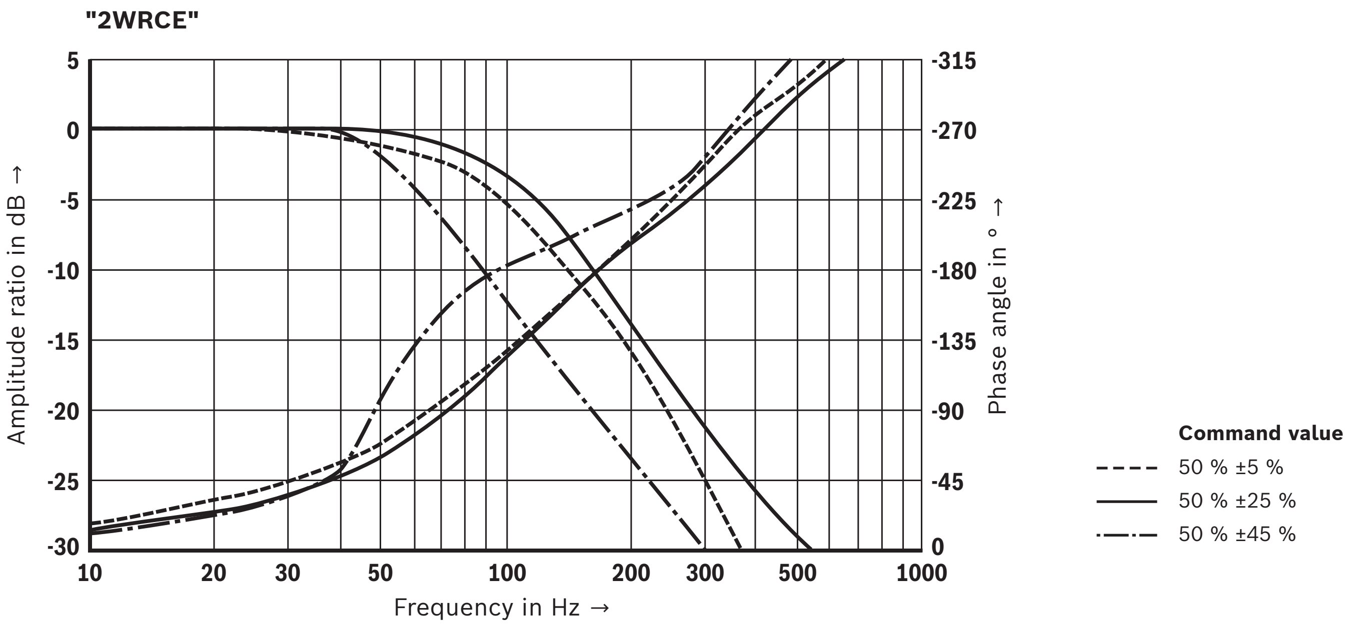
"3WRCE"

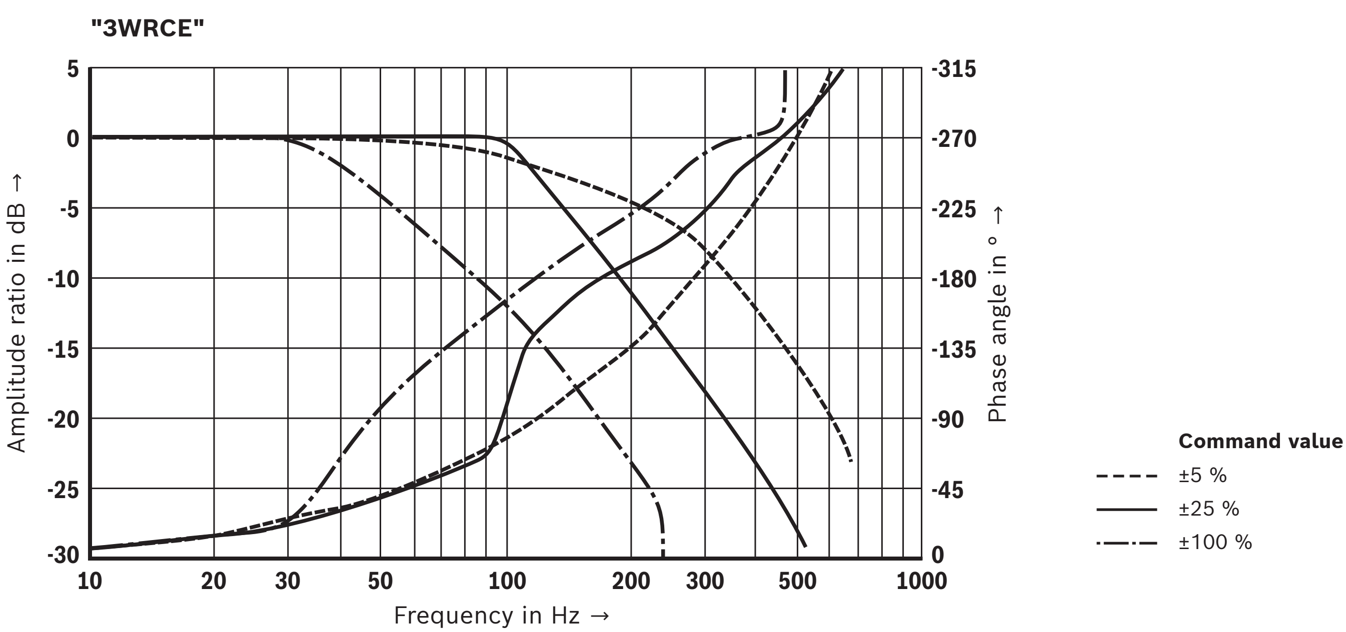


1 315 bar
2 210 bar
3 140 bar
4 70 bar
5 40 bar

Characteristic curves: Size 40
(measured with HLP32, ϑ_{oil} = 40 ±5 °C)

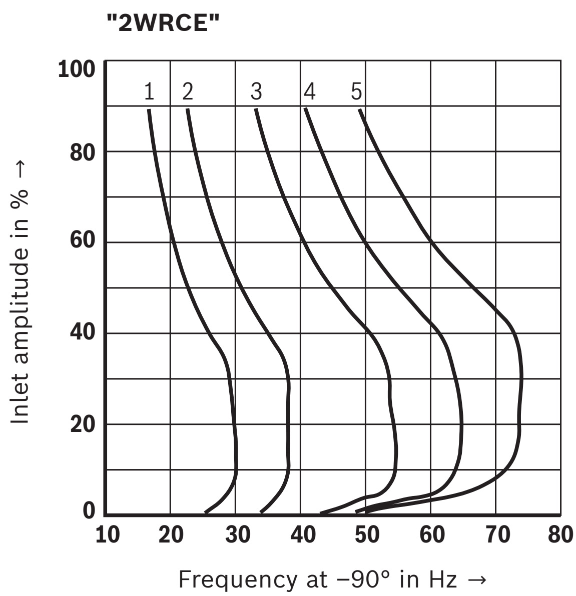
Frequency response (p_P = 315 bar)

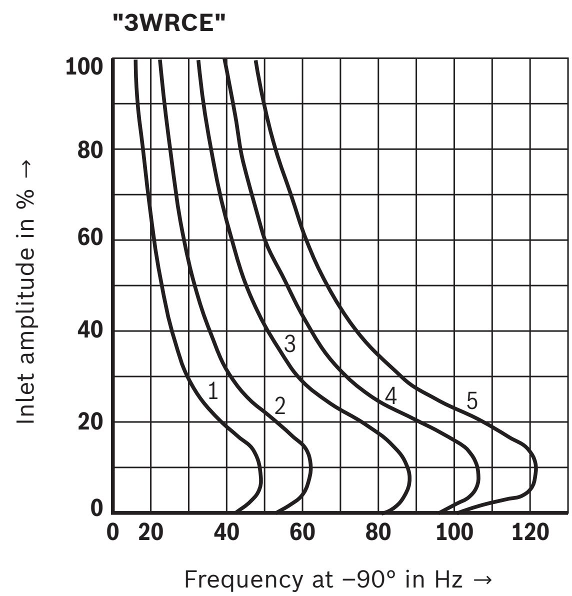




Characteristic curves: Size 40
(measured with HLP32, ϑ_{oil} = 40 ±5 °C)

Frequency *f* dependent on operating pressure and inlet amplitude

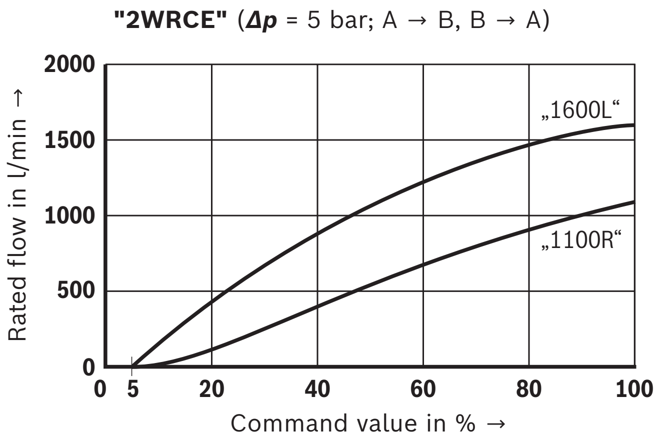


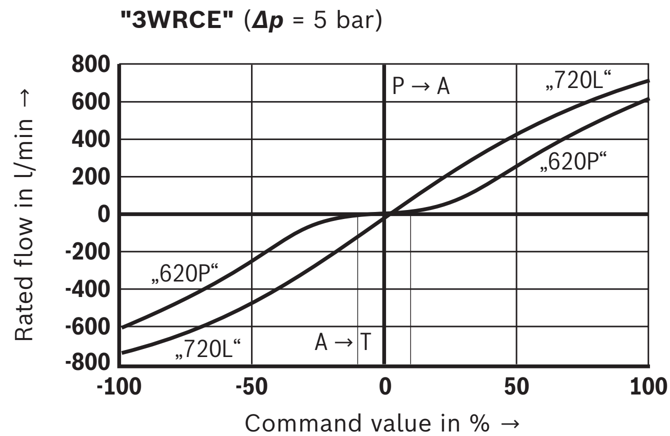


1 40 bar
2 70 bar
3 140 bar
4 210 bar
5 315 bar

Characteristic curves: Size 50
(measured with HLP32, ϑ_{oil} = 40 ±5 °C)

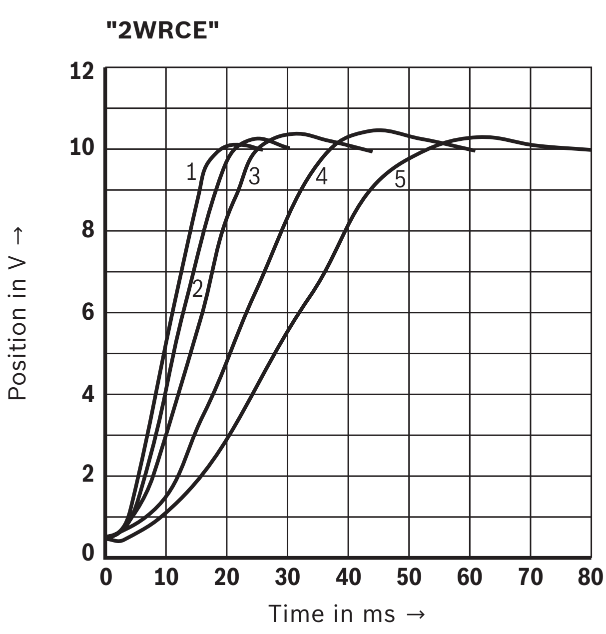
Rated flow

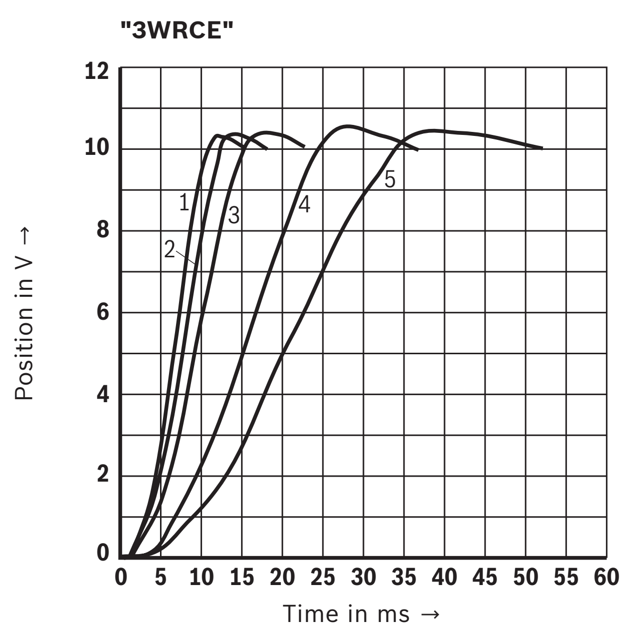




"E620P" 10 % overlap
"V720L" 0.5 ... 1.5 % overlap

Transition function



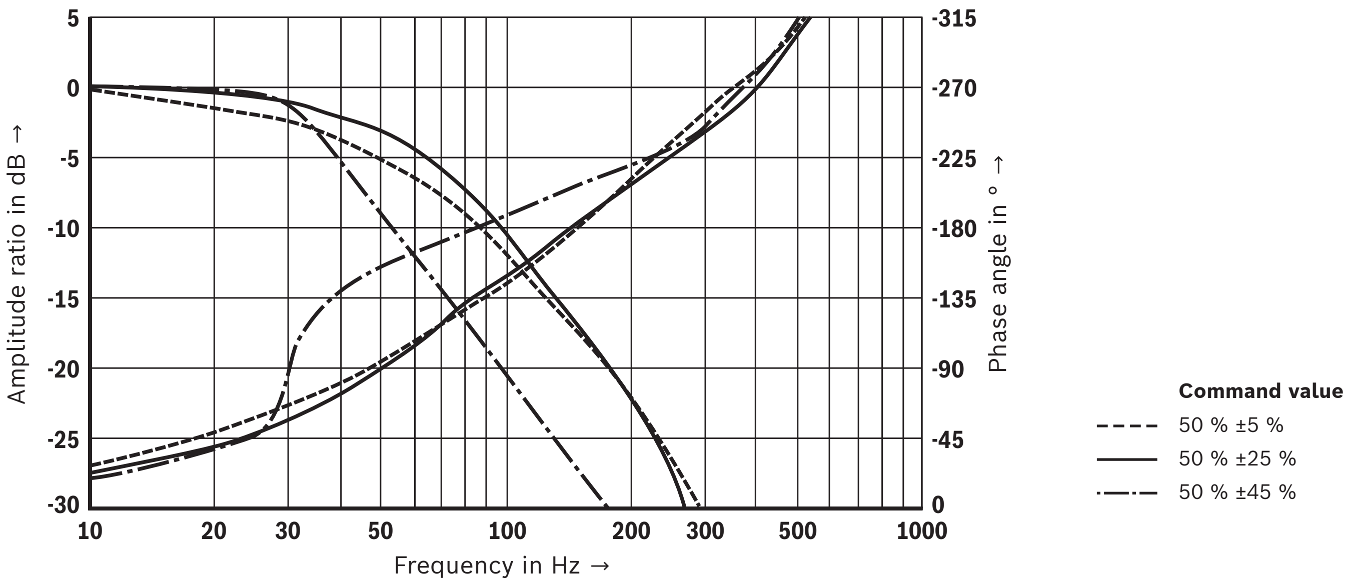


1 315 bar
2 210 bar
3 140 bar
4 70 bar
5 40 bar

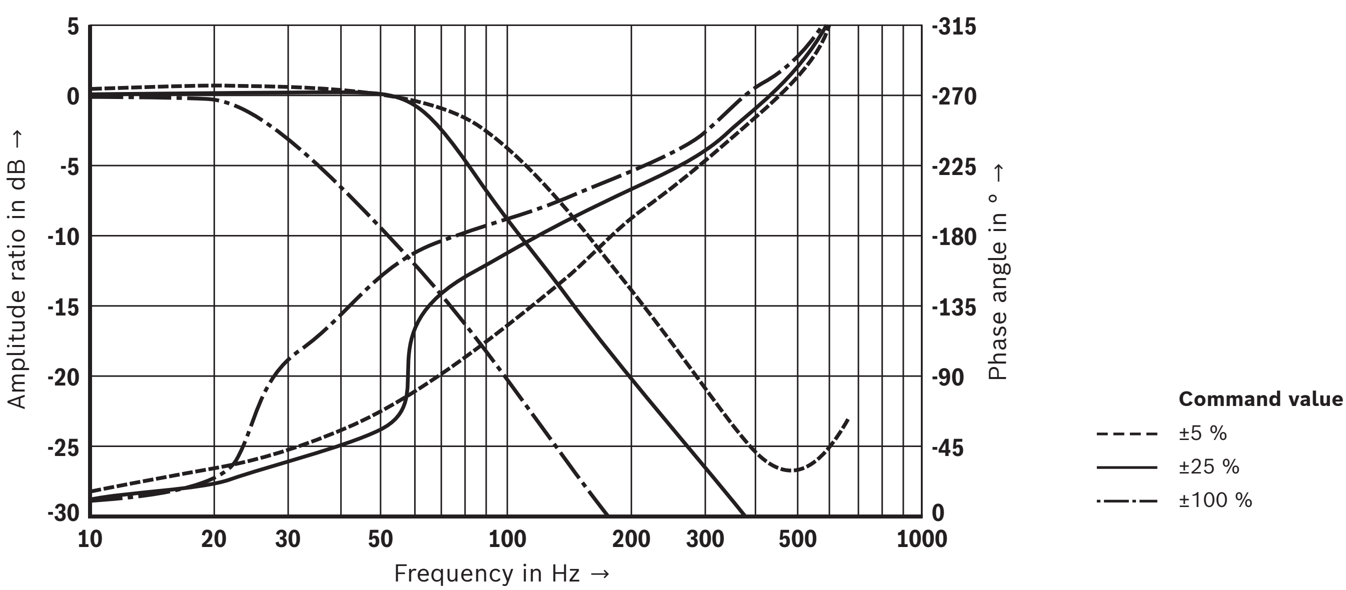
Characteristic curves: Size 50
(measured with HLP32, ϑ_{oil} = 40 ±5 °C)

Frequency response (p_P = 315 bar)

"2WRCE"



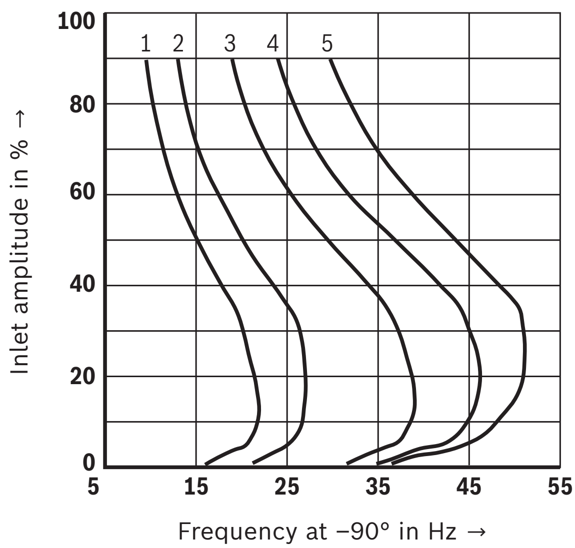
"3WRCE"



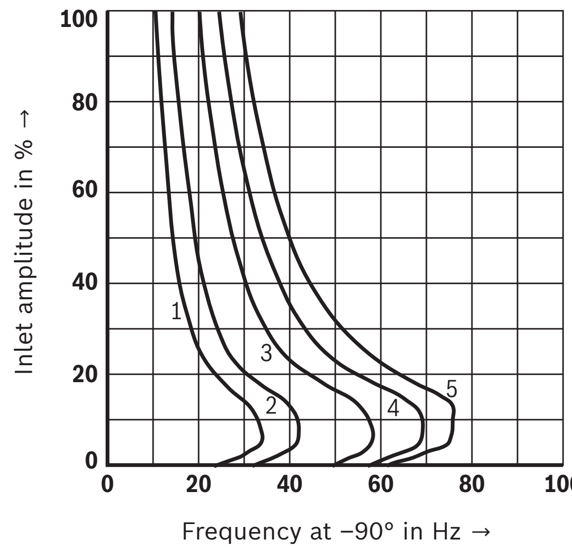
Characteristic curves: Size 50
(measured with HLP32, ϑ_{oil} = 40 ±5 °C)

Frequency *f* dependent on operating pressure and inlet amplitude

"2WRCE"

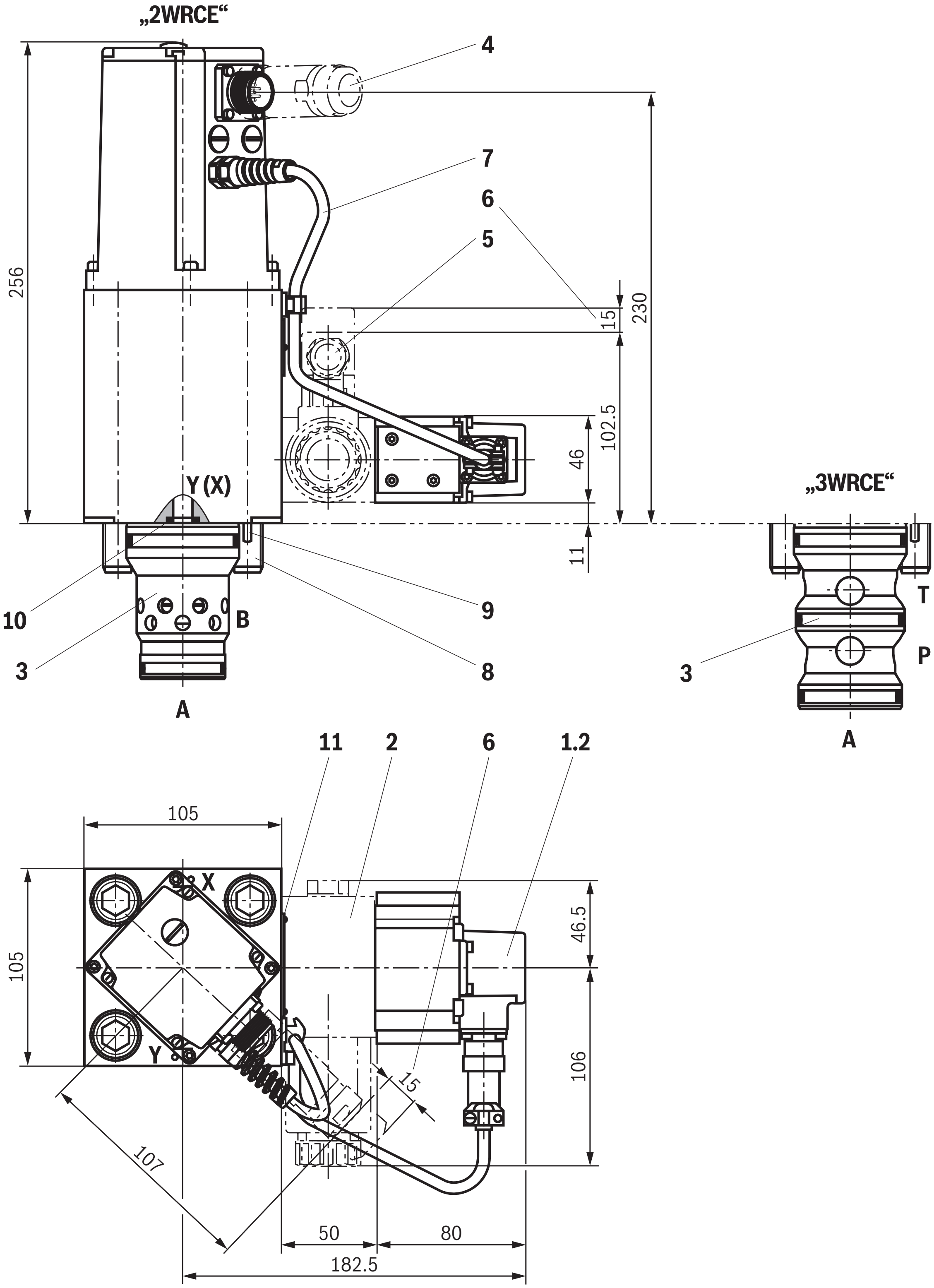


"3WRCE"



1 40 bar
2 70 bar
3 140 bar
4 210 bar
5 315 bar

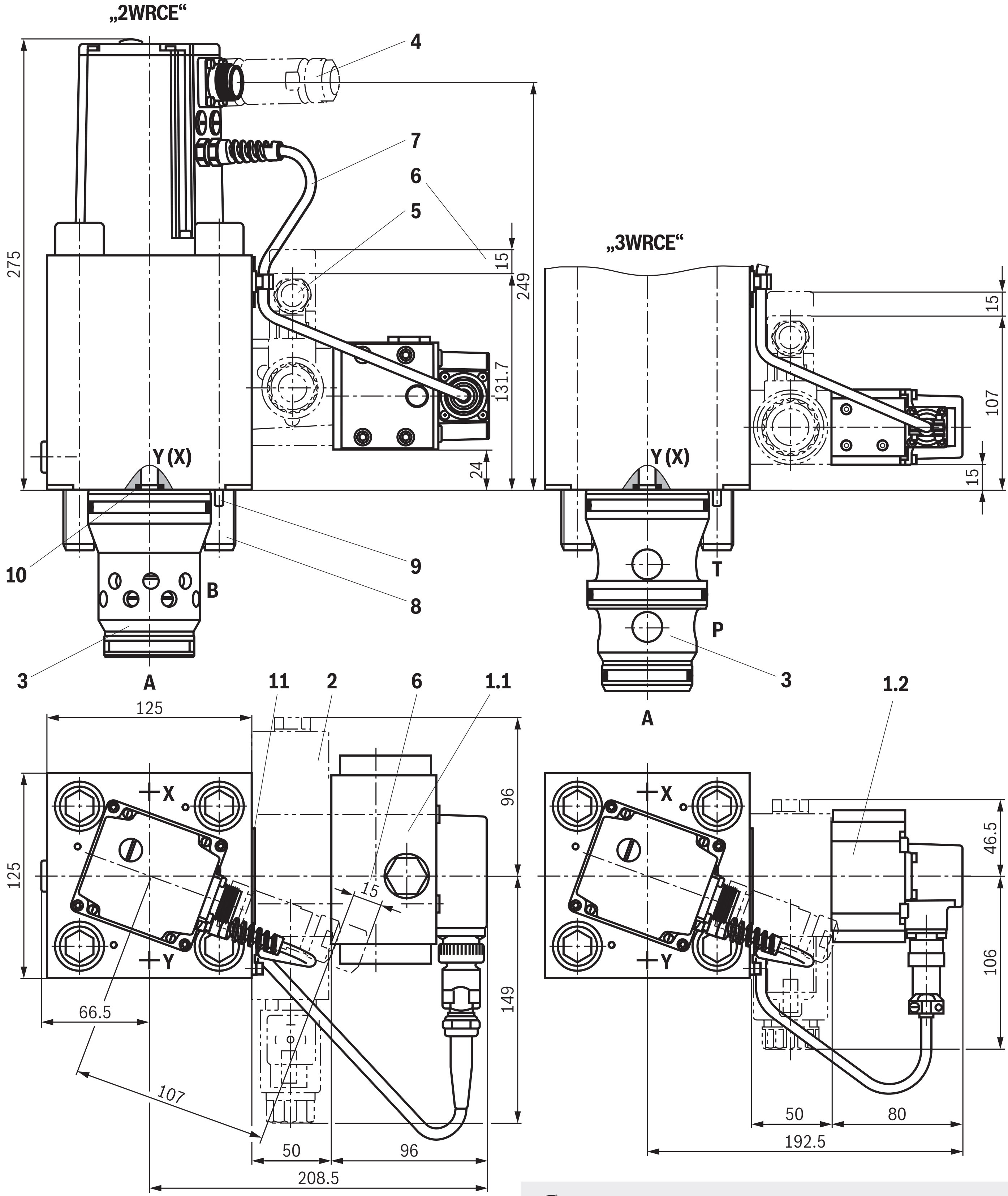
Dimensions: Size 32
(dimensions in mm)



Item explanations and **valve mounting screws**
see page 26.

☞ **Notice:**
The dimensions are nominal dimensions which are subject to tolerances.

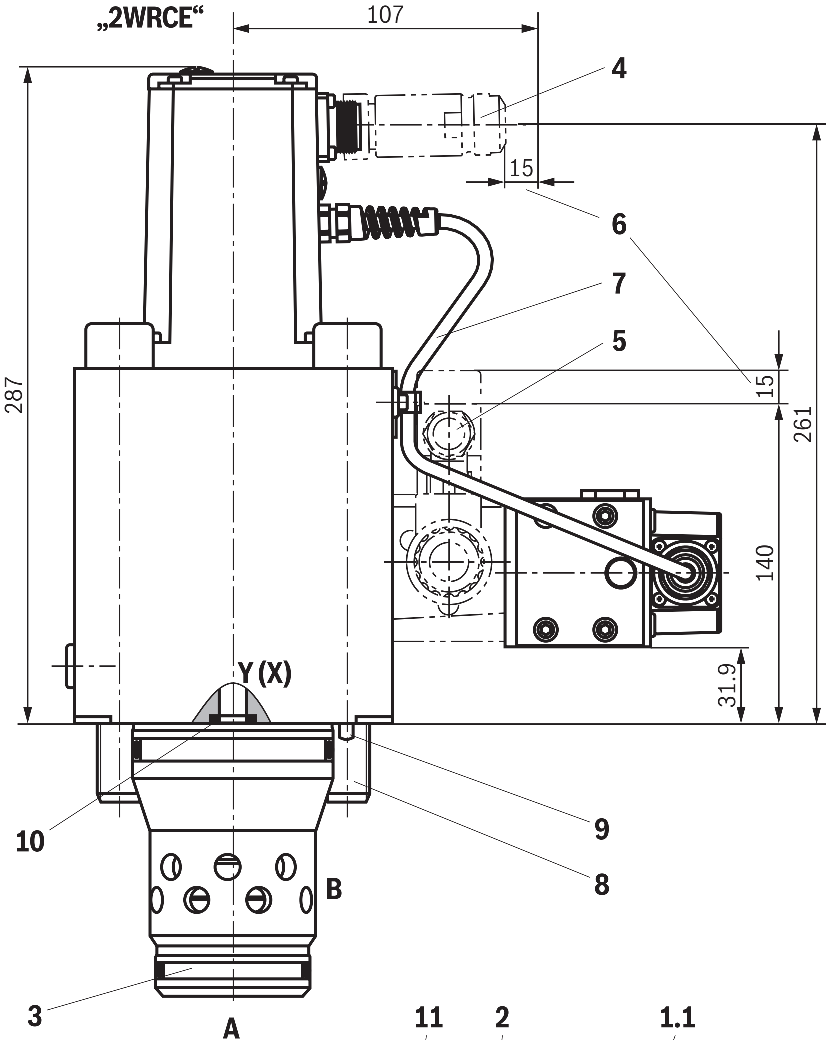
Dimensions: Size 40
(dimensions in mm)

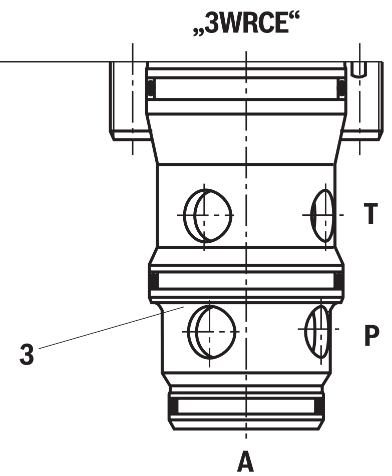


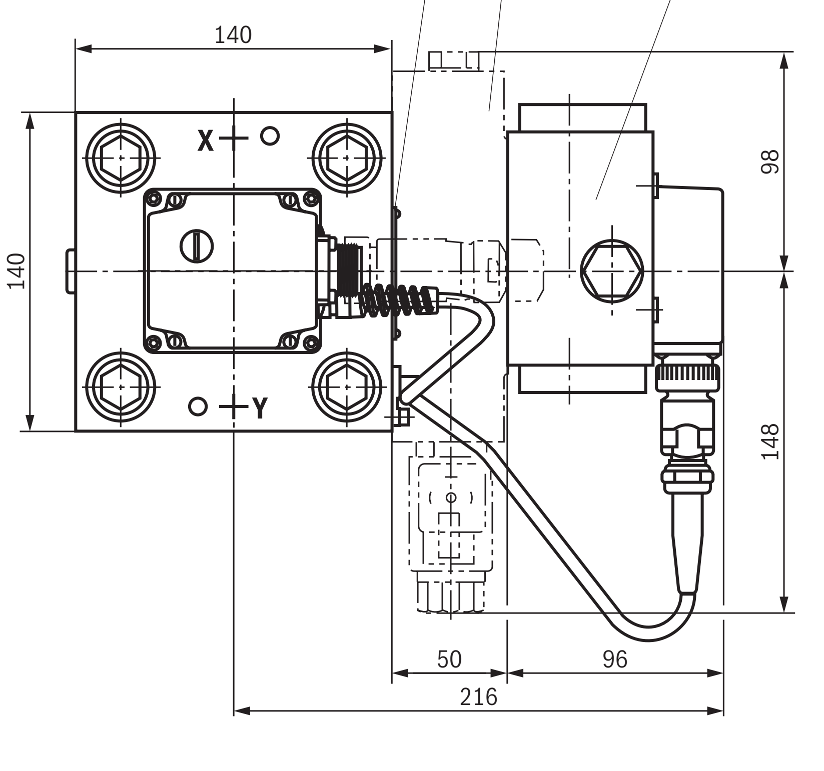
Item explanations and **valve mounting screws**
see page 26.

☞ **Notice:**
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions: Size 50
(dimensions in mm)







Item explanations and **valve mounting screws** see page 26.

Notice:
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions

1.1 Pilot control valve (servo valve NG10)
1.2 Pilot control valve (servo valve NG6)
2 Sandwich plate shut-off valve (version "WK15" and "WL15")
3 Bushing
4 Mating connectors for valves with round connector, 6-pole + PE (separate order, see page 28 and data sheet 08006)
5 Mating connectors for valves with connector "K4" (separate order, see page 28 and data sheet 08006)
6 Space required for removing the mating connector
7 Cabling
8 Valve mounting screws (included in the scope of delivery), see below
9 Locating pin
10 Identical seal rings for ports X and Y
11 Name plate

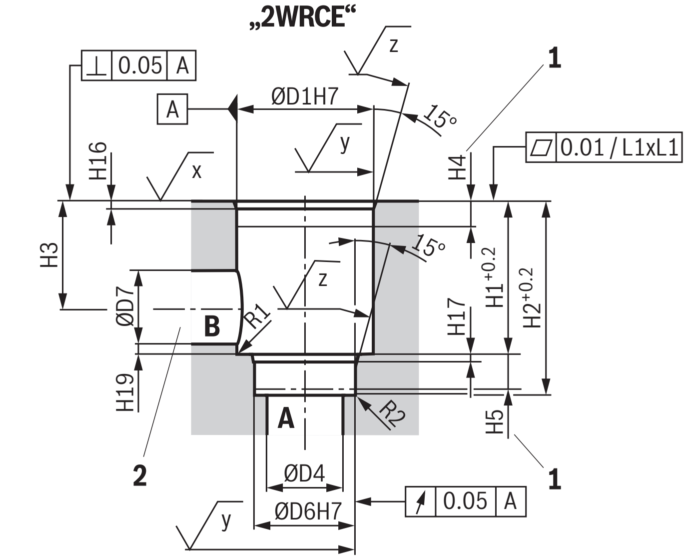
Valve mounting screws (included in the scope of delivery)

Size	Quantity	Hexagon socket head cap screws
32	4	**ISO 4762 - M16 x 100 -10.9-flZn/nc/480h/C** Tightening torque M_A = 250 Nm ±10 %
40	4	**ISO 4762 - M20 x 180 -10.9** Tightening torque M_A = 590 Nm ±10 %
50	4	**ISO 4762 - M20 x 190 -10.9** Tightening torque M_A = 590 Nm ±10 %

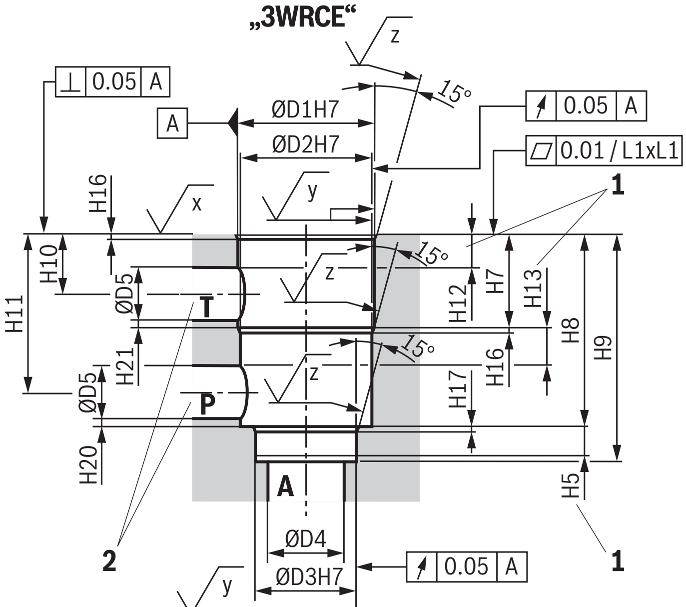
☞ **Notice:**
For tightening, a manual torque wrench with a tolerance of ≤10 % is to be used.

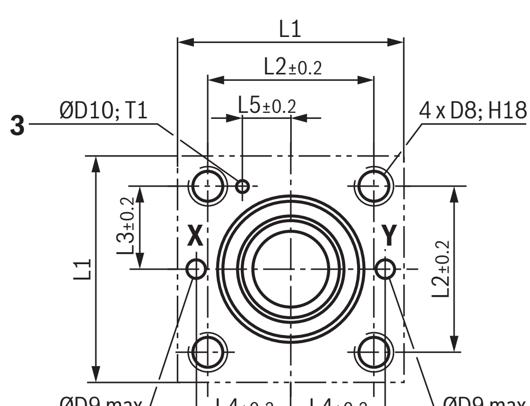
Installation bore
(dimensions in mm)

„2WRCE“



„3WRCE“





x = Rzmax 4   y = Rzmax 8   z = Rz 10

Installation dimensions according to DIN ISO 7368

NG	32	40	50
ØD1H7	60	75	90
ØD2H7	58	73	87
ØD3H7	55	55	68
ØD4	32	40	50
ØD5	24	30	35
ØD6H7	45	55	68
ØD7	32	40	50
D8	M16	M20	M20
ØD9 max	8	10	10
ØD10	6	6	8
H1	70	87	100
H2	85	105	122
H3	52	64	72
H4	30	30	35
H5	13	15	17
H7	43.5	54	87
H8	85	105	143
H9	100	125	165
H10	30	36	66
H11	70.5	87	122
H12	18	21	48
H13	15	18	18
H16	2.5	3	4
H17	2.5	3	3
H18	35	45	45
H19	2	3	3
H20	2.5	3	3.5
H21	1.5	3	3.5
L1	105	125	140
L2	70	85	100
L3	35	42.5	50
L4	41	50	58
L5	17	23	30
T1	10	10	10
R1 max	2	4	4
R2 max 1)	1	1	1

1 Depth of fit, minimum dimension
2 The ports P, T and B can be positioned around the central axis of port A. However, it must be observed that the mounting bores and the control bores are not damaged.
3 Bore for locating pin

1) Deviating from ISO 7368

Tolerances according to: General tolerances ISO 2768-mK

Valve mounting screws see page 28.

Accessories (separate order)

Mating connectors and cable sets

Item [1]	Designation	Version	Short designation	Material number	Data sheet
4	Mating connector; for valves with round connector, 6-pole + PE	Straight, metal	7PZ31...M	**R900223890**	08006
		Straight, plastic	7PZ31...K	**R900021267**	
5	Mating connector; for valves with "K4" connector, 2-pole + PE, design A	Without circuitry, 12 ... 240 V	Z4	**R901017010**	08006
		With indicator light, 12 ... 240 V	Z5L	**R901017022**	
		With rectifier, 12 ... 240 V	RZ5	**R901017025**	
		Z-diode-suppressor 24 V	Z5L1	**R901017026**	

1) See dimensions on page 23 of 25.

Further information

- Hydraulic valves for industrial applications — Operating instructions 07600-B
- Hydraulic fluids on mineral oil basis — Data sheet 90220
- Environmentally compatible hydraulic fluids — Data sheet 90221
- Flame-resistant, water-free hydraulic fluids — Data sheet 90222
- Flame-resistant hydraulic fluids - containing water (HFAE, HFAS, HFB, HFC) — Data sheet 90223
- Selection of filters
- Information on available spare parts

RE 29135
Edition: 2020-09
Replaces: 02.16

rexroth
A Bosch Company

Directional high-response cartridge valve, pilot-operated

Type WRC...S


H6869+6870

- Size 63 ... 160
- Component series 1X
- Maximum operating pressure 420 bar
- Maximum flow 50,000 l/min

Features

- 2- or 3-way directional cartridge valve
- Pilot control valve: 2-stage directional servo valve
- Position sensing of the control spool by means of an inductive position transducer
- Normalized:
  – Installation dimensions according to ISO 7368 ("2WRCE")
- Control spool in seat or spool design
- External control electronics or integrated electronics (OBE), optional
- Typical applications:
  – Forging manipulators
  – Press cylinders
  – Die casting machines

Contents

Ordering code: "2WRC"

01	02	03	04	05		06		07	08		09	10
2	**WRC**				**-**	**1X**	**/**	**S**		**/**		*****

01	2 main ports	**2**

02	Directional high-response cartridge valve, pilot-operated	**WRC**

03	For external control electronics	**no code**
	Integrated electronics (OBE)	**E**

04	Size 63	**63**
	Size 80	**80**
	Size 100	**100**
	Size 125	**125**
	Size 160	**160**

Control spool, flow characteristic

05	Standard cone seat (linear)	**K001**
	Double cone (linear fine control range)	**D001**
	Control window (progressive fine control range)	**S001**

06	Component series 10 ... 19 (10 ... 19: unchanged installation and connection dimensions)	**1X**

Pilot control valve

07	Directional servo valve	**S**

Supply voltage

08	External control electronics	**no code**
	Integrated electronics (OBE)	
	Direct voltage +24 V	**G24**
	Direct voltage +15 V	**G15**

Seal material (observe compatibility of seals with hydraulic fluid used, see page 9)

09	NBR seals	**M**
	FKM seals	**V**

10	Further details in the plain text	

Ordering code: "3WRC"

01	02	03	04	05		06		07	08		09	10
3	**WRC**				**-**	**1X**	**/**	**S**		**/**		*****

01	3 main ports	**3**

02	Directional high-response cartridge valve, pilot-operated	**WRC**

03	For external control electronics	**no code**
	Integrated electronics (OBE)	**E**

04	Size 63	**63**
	Size 80	**80**
	Size 100	**100**

Control spool, flow characteristic

05	0 ... 0.5% positive overlap (linear)	**L006**
	0 ... 0.5% negative overlap (linear fine control range)	**V001**
	10% positive overlap (linear fine control range)	**I001**

06	Component series 10 ... 19 (10 ... 19: unchanged installation and connection dimensions)	**1X**

Pilot control valve

07	Directional servo valve	**S**

Supply voltage

08	External control electronics	**no code**
	Integrated electronics (OBE)	
	Direct voltage +24 V	**G24**
	Direct voltage +15 V	**G15**

Seal material (observe compatibility of seals with hydraulic fluid used, see page 9)

09	NBR seals	**M**
	FKM seals	**V**

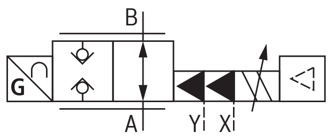
10	Further details in the plain text	

☞ **Notice:** Version "3WRC" is not recommended for new applications, see page 6.

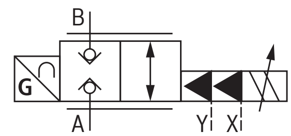
Symbols: "2WRC"

Simplified

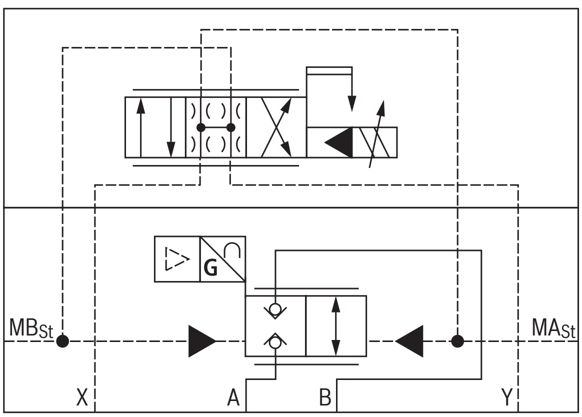
Integrated electronics (OBE)



External control electronics



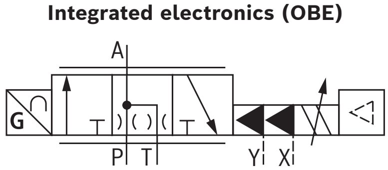
Detailed



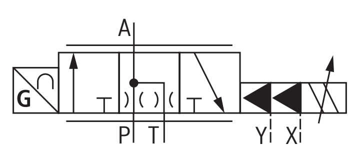
Symbols: "3WRC"

Simplified

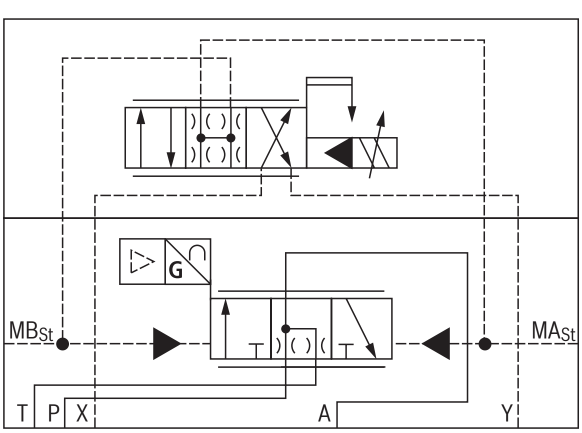
Integrated electronics (OBE)



External control electronics



Detailed



Notice: Representation according to DIN ISO 1219-1.

Function, section: "2WRC(E)"

Valves of type 2WRC(E) are pilot-operated, 3-stage directional high-response cartridge valves. They control the quantity and direction of a flow and are mainly used in control loops.

Set-up

The valves consist of the following assemblies:

- 2-stage pilot control valve (1)
  - with dry torque motor
  - low-friction nozzle flapper plate amplifier
  - mechanical feedback of the control spool position
- Main control spool (2) for flow control
- An inductive position transducer (3) the core (4) of which is attached to the main control spool (2) of the third stage
- External control electronics or integrated electronics (OBE) (5).

Function

In the control electronics, command and actual values are compared and the torque motor of the pilot control valve is actuated with a proportional current according to the control deviation.

The pilot control valve (1) takes a proportionally controlled position and controls the flows in and out of the control chambers A (6) and B (7), which actuate the main control spool (2) through the closed valve control loop up to 0 control deviation.

This means that the stroke of the main control spool (2) is regulated proportionally to the command value. It must be noted that the flow also depends on the valve pressure drop.

Valve features

The flow can pass through the valve from A to B or from B to A.

The control spool (seat design) closes or opens at 2% of the command value. At lower command values, the valve control loop attempts to guide the control spool, thus presses it onto the seat at full pilot pressure and blocks the connection in a leakage-free way.

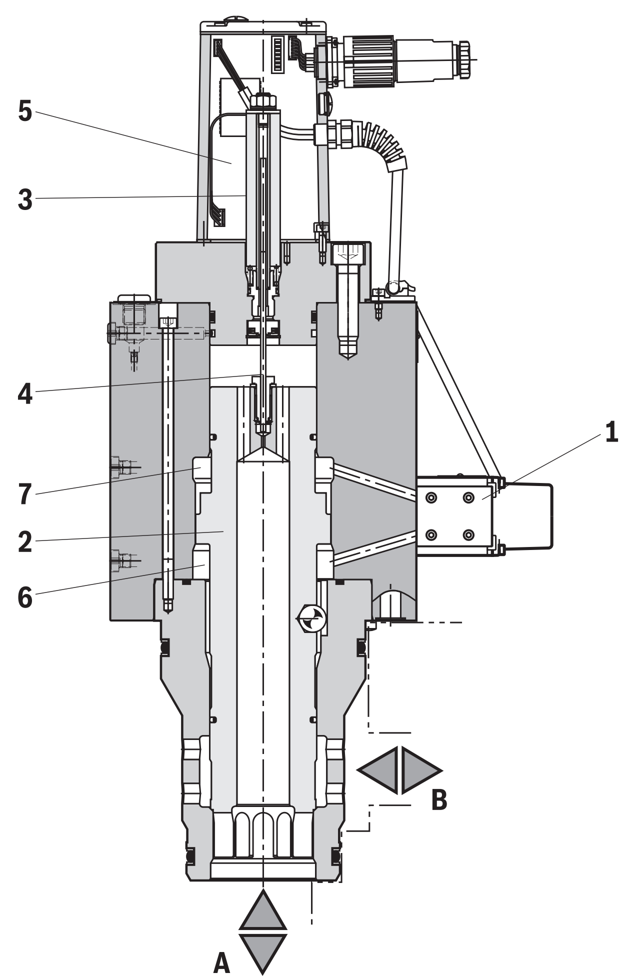
The specified switching times only apply to the control area of the valve. At command value steps from the seat to lower opening values, additional delay times occur.

The opening point of 2% (= 0.2 V) is set at the factory.

When the pilot control valve (1) or the control electronics is exchanged, the opening point can be readjusted by shifting the position transducer coil (3) by means of the nut (SW13).

Notes:

- Power failure at the pilot control valve leads to an undefined position of the main control spool (2).
- Preferably, port B should be connected to the actuator.



Function, section: "3WRC(E)"

Valves of type 3WRC(E) are pilot-operated, 3-stage directional high-response cartridge valves. They control the quantity and direction of a flow and are mainly used in control loops.

Set-up

The valves consist of the following assemblies:

- 2-stage pilot control valve (1)
  - with dry torque motor
  - low-friction nozzle flapper plate amplifier
  - mechanical feedback of the control spool position
- Main control spool (2) for flow control
- An inductive position transducer (3) the core (4) of which is attached to the main control spool (2) of the third stage
- External control electronics or integrated electronics (OBE) (5).

Function

In the control electronics, command and actual values are compared and the torque motor of the pilot control valve is actuated with a proportional current according to the control deviation.

The pilot control valve (1) takes a proportionally controlled position and controls the flows in and out of the control chambers A (6) and B (7), which actuate the main control spool (2) through the closed valve control loop up to 0 control deviation.

This means that the stroke of the main control spool (2) is regulated proportionally to the command value. It must be noted that the flow also depends on the valve pressure drop.

Valve features

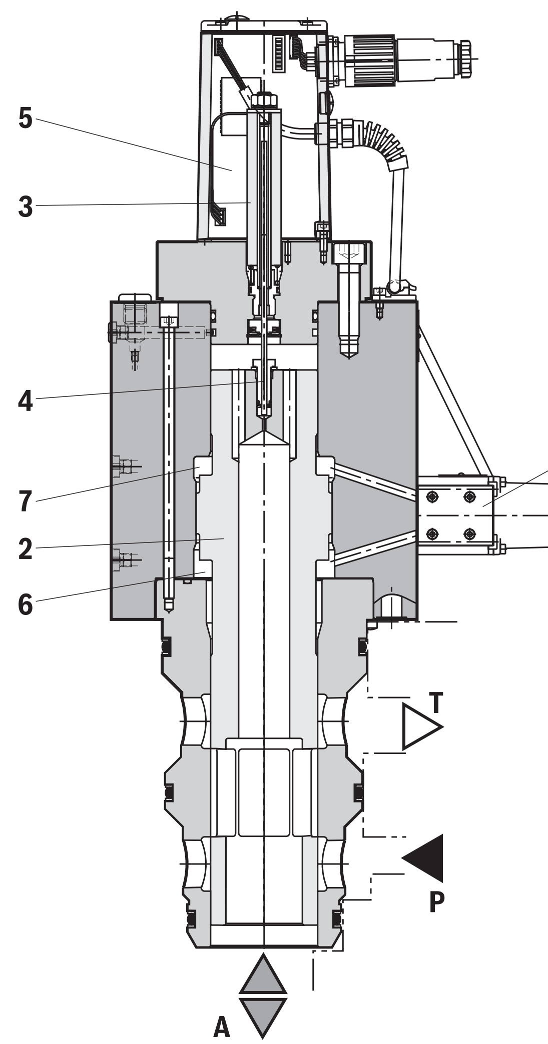
The opening point of 0% (versions "L006" and "V001") is set at the factory. When the pilot control valve (1) or the control electronics is exchanged, the opening point can be readjusted by shifting the position transducer coil (3) by means of the nut (SW13).

No settings must be made at the control electronics (= controller or control electronics) and the pilot control valve (1) during exchange, except for the zero adjustment.

At the pilot control valve, only the filter element may be exchanged.

Notes:

- Version "3WRCE" is not recommended for new applications.
  If version "3WRCE" is used, ports A and P have to be exchanged. Upon request.
- Power failure at the pilot control valve leads to an undefined position of the main control spool (2).



Technical data: "2WRC(E)"
(For applications outside these parameters, please consult us!)

General								
Sizes		NG	63	80	100	125	160
Installation position; commissioning			Any, preferably horizontal				
Storage temperature range		°C	–20 ... +80				
Ambient temperature range	▶ Version "WRC"	°C	–20 ... +70				
	▶ Version "WRCE"	°C	–20 ... +60				
Weight		kg	56	114	198	357	635
Size of the pilot control valve		NG	6	10	10	16	16

Hydraulic							
Maximum operating pressure	▶ Main stage						
	– Ports A, B	bar	420				
	▶ Pilot control valve						
	– Port X	bar	315				
	– Port Y	bar	Pressure peaks < 100, static < 10				
Minimum pilot pressure (in % of the system pressure)	▶ Version "K001"	%	15				
	▶ Version "D001"; "S001"	%	45				
Nominal flow (q_{Vnom} –10 %; Δp = 5 bar)	▶ Version "K001"	l/min	2600	4100	6300	10100	17000
	▶ Version "D001"	l/min	2300	3600	5800	9200	15000
	▶ Version "S001"	l/min	1800	3000	5200	7800	13300
Maximum flow	▶ Version "K001"; D"001"	l/min	5500	9000	14000	22000	35000
	▶ Version "S001"	l/min	8000	13000	20000	30000	50000
Pilot flow [1]		l/min	42	135	165	320	430
Zero flow (pre-stage)			See characteristic curves page 12				
Pilot oil volume		cm³	36.3	67,9	132,5	313.4	565.5
Switching time	▶ 200 bar						
	– Stroke 50 %	ms	37	32	45	50	70
	– Stroke 100 %	ms	70	50	75	90	120
	▶ 315 bar						
	– Stroke 50 %	ms	30	25	35	40	60
	– Stroke 100 %	ms	60	40	60	70	100
Hydraulic fluid			see table page 9				
Hydraulic fluid temperature range	▶ Recommended	°C	+40 ... +50				
	▶ Maximum admissible		–20 ... +80				
Viscosity range	▶ Recommended	mm²/s	30 ... 45				
	▶ Maximum admissible		20 ... 380				
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)	▶ Pilot control valve		Class 18/16/13 [2]				
	▶ Main stage		Class 20/18/15 [2]				
Hysteresis		%	≤ 0.5				
Range of inversion		%	≤ 0.2				
Response sensitivity		%	≤ 0.2				

1) Input signal stepped (from 0 to 100%, pilot pressure 315 bar)

2) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and simultaneously increases the life cycle of the components.

Technical data: "3WRC(E)"
(For applications outside these parameters, please consult us!)

General					
Sizes		NG	63	80	100
Installation position; commissioning			Any, preferably horizontal		
Storage temperature range		°C	–20 ... +80		
Ambient temperature range	▶ Version "WRC"	°C	–20 ... +70		
	▶ Version "WRCE"	°C	–20 ... +60		
Weight		kg	57	116	200
Size of the pilot control valve		NG	6	10	10

Hydraulic					
Maximum operating pressure	▶ Main stage				
	– Ports P, A, T	bar	315		
	▶ Pilot control valve				
	– Port X	bar	315		
	– Port Y	bar	Pressure peaks < 100, static < 10		
Nominal flow (q_{Vnom} –10 %; Δp = 5 bar)	▶ Version "L006"	l/min	1200	1850	2800
	▶ Version "V001"	l/min	1250	1900	2700
	▶ Version "E001"	l/min	1180	1820	2750
Maximum flow		l/min	3500	5600	8500
Pilot flow 1)		l/min	42	130	170
Zero flow (pre-stage)			See characteristic curves page 12		
Pilot oil volume		cm^3	±18.1	±33.9	±66.2
Switching time	▶ 200 bar				
	– Stroke 50 %	ms	20	18	25
	– Stroke 100 %	ms	37	32	40
	▶ 315 bar				
	– Stroke 50 %	ms	17	13	20
	– Stroke 100 %	ms	30	25	35
Hydraulic fluid			see table page 9		
Hydraulic fluid temperature range	▶ Recommended	°C	+40 ... +50		
	▶ Maximum admissible		–20 ... +80		
Viscosity range	▶ Recommended	mm^2/s	30 ... 45		
	▶ Maximum admissible		20 ... 380		
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)	▶ Pilot control valve		Class 18/16/13 2)		
	▶ Main stage		Class 20/18/15 2)		
Hysteresis		%	≤ 0.5		
Range of inversion		%	≤ 0.2		
Response sensitivity		%	≤ 0.2		

1) Input signal stepped (from 0 to 100%, pilot pressure 315 bar)

2) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and simultaneously increases the life cycle of the components.

Technical data

(For applications outside these parameters, please consult us!)

Hydraulic fluid		Classification	Suitable sealing materials	Standards	Data sheet
Mineral oils		HL, HLP, HLPD, HVLP, HVLPD	NBR, FKM	DIN 51524	90220
Bio-degradable	▶ Insoluble in water	HETG	FKM	ISO 15380	90221
		HEES	FKM		
	▶ Soluble in water	HEPG	FKM	ISO 15380	
Flame-resistant	▶ Water-free	HFDU (glycol base)	FKM	ISO 12922	90222
		HFDU (ester base)	FKM		
		HFDR	FKM		
	▶ Containing water	HFC (Fuchs: Hydrotherm 46M, Renosafe 500; Petrofer: Ultra Safe 620; Houghton: Safe 620; Union: Carbide HP5046)	NBR	ISO 12922	90223

Important information on hydraulic fluids:

- For further information and data on the use of other hydraulic fluids, please refer to the data sheets above or contact us.
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.).
- The ignition temperature of the hydraulic fluid used must be 50 K higher than the maximum surface temperature.
- **Bio-degradable and flame-resistant – containing water:** If components with galvanic zinc coating (e.g. version "J3" or "J5") or parts containing zinc are used, small amounts of dissolved zinc may get into the hydraulic system and cause accelerated aging of the hydraulic fluid. Zinc soap may form as a chemical reaction product, which may clog filters, nozzles and solenoid valves – particularly in connection with local heat input.
- **Flame-resistant – containing water:**
  - Due to the increased cavitation tendency with HFC hydraulic fluids, the life cycle of the component may be reduced by up to 30% as compared to the use with mineral oil HLP. In order to reduce the cavitation effect, it is recommended – if possible specific to the installation – backing up the return flow pressure in ports T to approx. 20% of the pressure differential at the component.
  - Dependent on the hydraulic fluid used, the maximum environment and hydraulic fluid temperature must not exceed 50 °C. In order to reduce the heat input into the component, the command value profile is to be adjusted for proportional and high-response valves.

Electric			
Voltage type			Direct voltage
Type of signal			Analog
Zero compensation		%	≤ 1
Zero shift upon change of:	▶ Hydraulic fluid temperature	%/10 K	≤ 0.3
	▶ Pilot pressure in X	%/100 bar	≤ 0.7
	▶ Return flow pressure in Y (0 ... 10 % of the pilot pressure)	%/bar	≤ 0.3
Protection class of the valve according to EN 60529			IP65 (If suitable and correctly mounted mating connectors are used)

Electrical connections and assignment

Connector pin assignment

Pin	Signal	Interface assignment			
		"G24"		"G15"	
		"2WRCE"	"3WRCE"	"2WRCE"	"3WRCE"
A	Supply voltage	+24 VDC		+15 VDC	
B		0 V DC		–15 VDC	
C		Enable (+24 V) [1]		Reference to pins A, B	
D, E	Differential command value input	0 TO +10 V; $R_e \geq$ 100 kΩ	0 ... ±10 V; $R_e \geq$ 100 kΩ	0 TO +10 V; $R_e \geq$ 100 kΩ	0 ... ±10 V; $R_e \geq$ 100 kΩ
F	Actual value	+0.2 ... +10 V; Reference is pin B	0 ... ±10 V; Reference is pin B	+0.2 ... +10 V; Reference is pin C	0 ... ±10 V; Reference is pin C
PE	Protective ground	Functional ground (directly connected to the valve housing)			

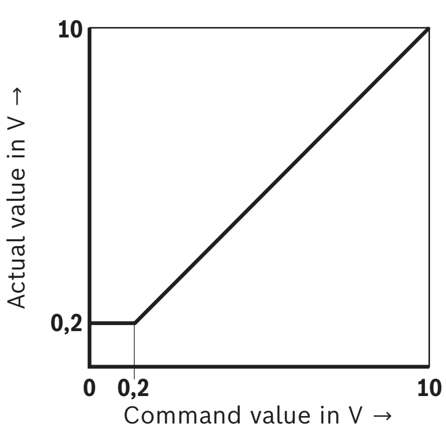
[1] Without enable = SO37 (add -37 to type designation)

Supply voltage:	▶ +24 VDC ±6 V; full bridge rectification with smoothing capacitor 2200 µF = I_{max} = 230 mA ▶ ±15 VDC ±0.45 V; stabilized and smoothened; I_{max} = 180 mA

Notes:
- Do not connect PE if the valve has already been grounded via the system.
- Command value and actual value have the same polarity
- Electrical signals provided via control electronics (e. g. actual value) must not be used to switch off safety-relevant machine functions.
- Mating connectors, separate order, see page 22 and data sheet 08006.

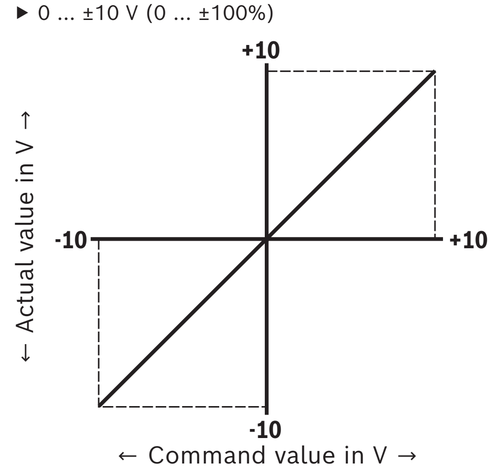
Nominal command value range

Version "2WRCE"
- 0 ... +10 V (0 ... 100 %)



- In case of a slow command value modification from +0.2 V to +10 V, the actual value follows the command value within ±0.1 V.
- In the command value range of 0 ... +0.2 V, the actual value remains constant at 0.2 V.
- At a command value step to +10 V, the actual value can temporarily reach values of up to approx. +10.5 V.

Version "3WRCE"
- 0 ... ±10 V (0 ... ±100%)



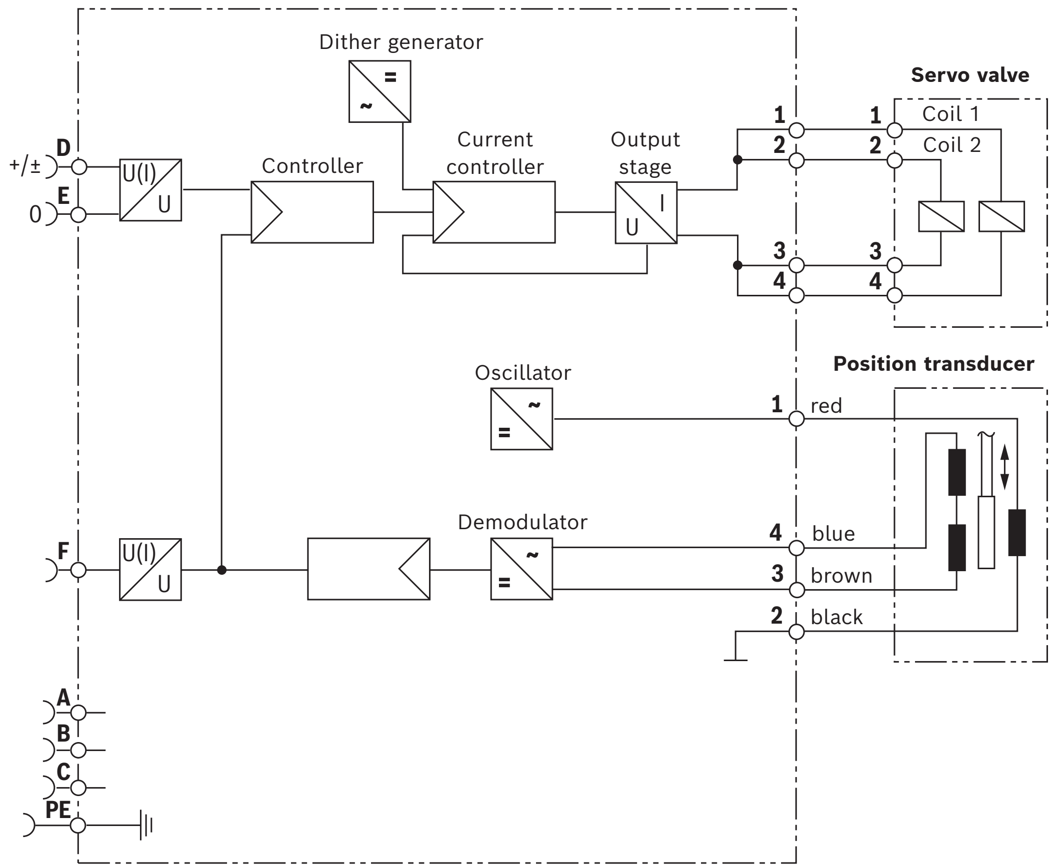
- In case of a slow command value modification from +0 V ... ±10 V, the actual value follows the command value within ±0.1 V.
- At a command value step to +10 V, the actual value can temporarily reach values of up to approx. +10.5 V.

Block diagram/controller function block: Integrated electronics (OBE)

Interface | **Integrated electronics (OBE)** | **Valve**

- **"2WRCE":**
  Command value 0 ... +10 V
- **"3WRCE":**
  Command value ±10 V

- **"2WRCE":**
  Actual value +0.2 V ... +10 V
- **"3WRCE":**
  Actual value ±10 V
  (measuring output F has positive potential against ⊥ at flow P → A)



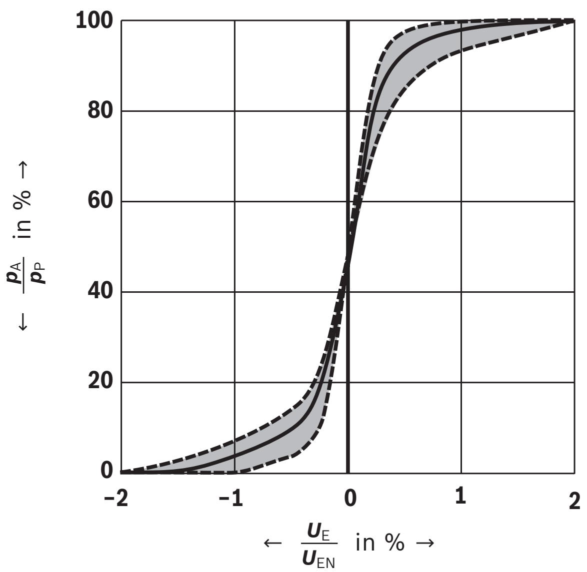
Supply voltage	
15 V	24 V
±15 V	18 ... 30 V
– 15 V	0 V
M0	18 ... 30 V

Effect of the control:
A positive signal at pin D and a reference potential at pin E results in
- "2WRCE": Flow A → B or B → A
- "3WRCE": Flow P → A

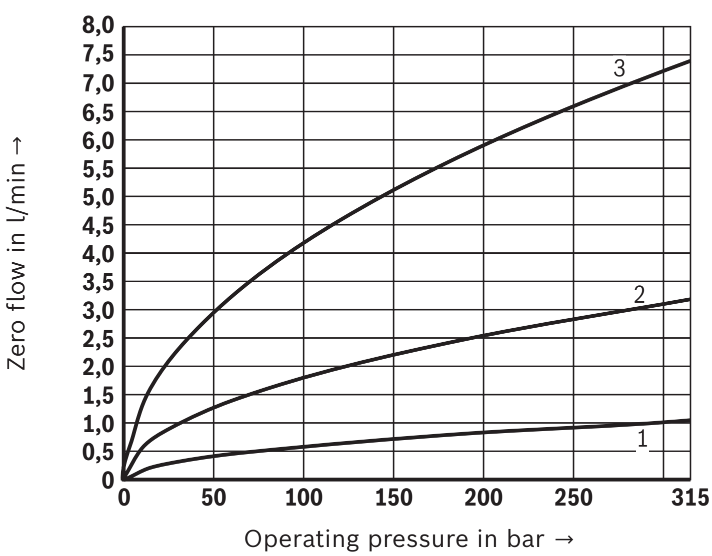
☞ **Notice:**
External control electronics, see data sheet 29931.

Characteristic curves
(measured with HLP32, ϑ_{Oil} = 40 ±5 °C)

Pressure-signal function
("3WRC(E)", versioszn "L006" and "V001"; limit and average value characteristic curves)



Zero flow at the pilot control valve

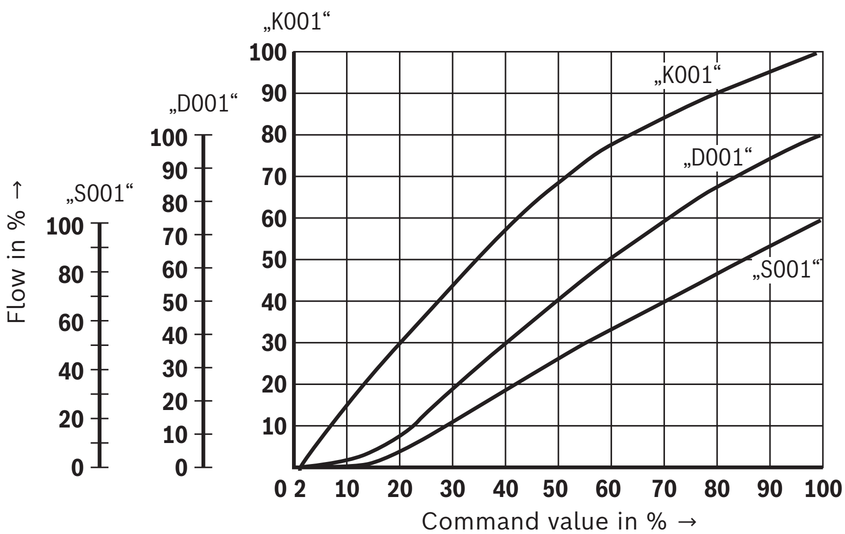


1 Size 63
2 Size 80 and 100
3 Size 125 and 160 ("2WRC(E)")

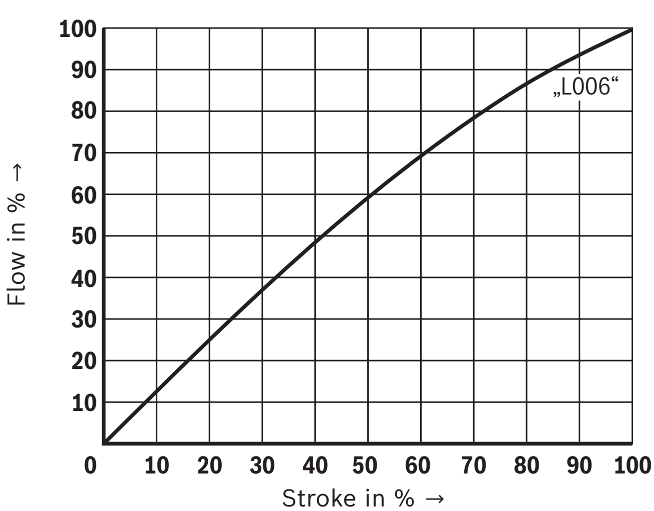
Characteristic curves
(measured with HLP32, ϑ_{Oil} = 40 ±5 °C)

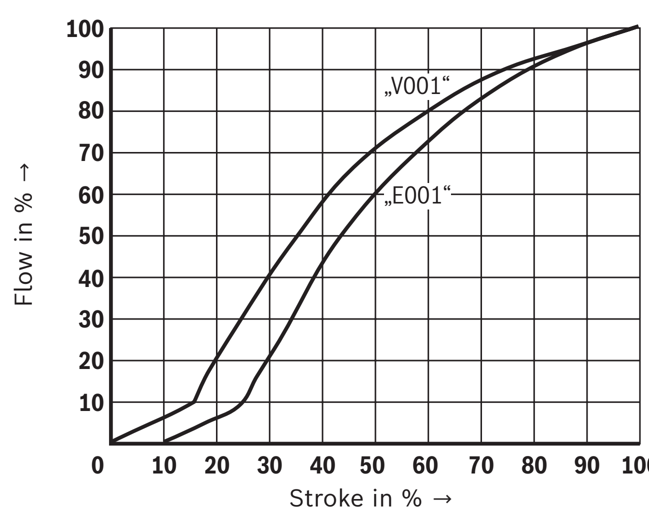
Nominal flow

"2WRC(E)" (Δp = 5 bar)

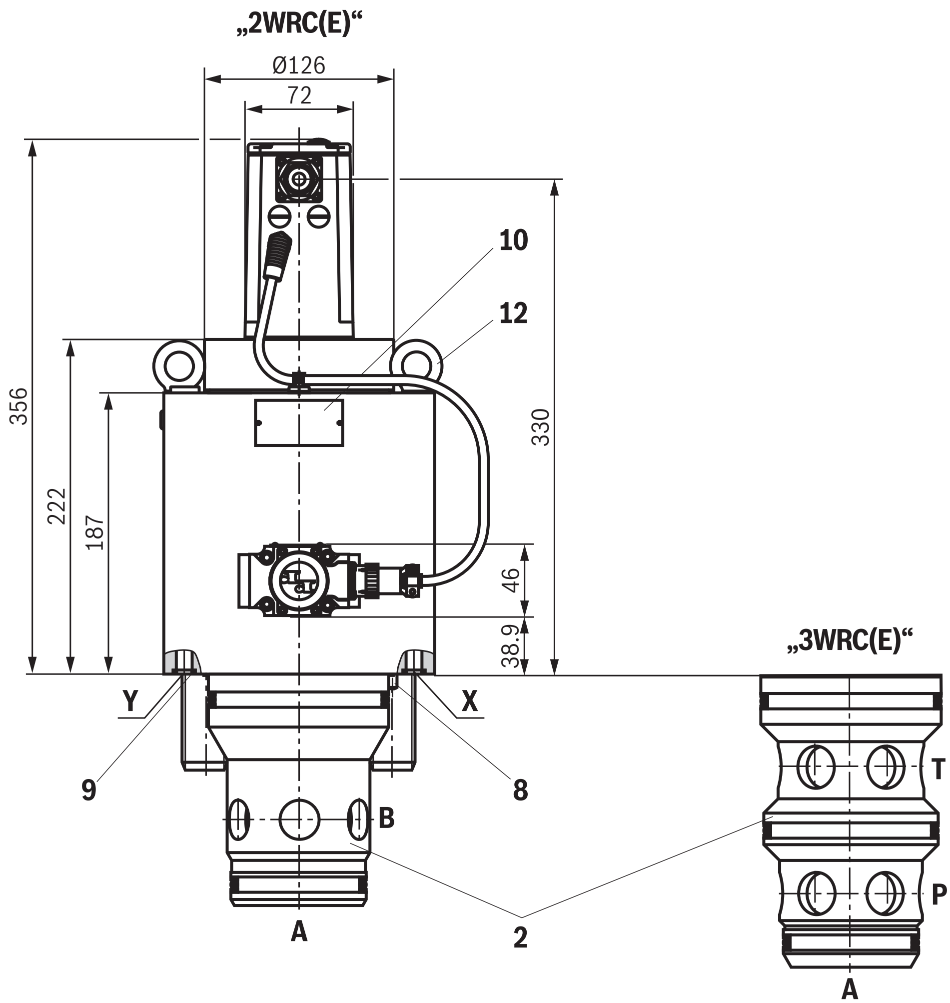


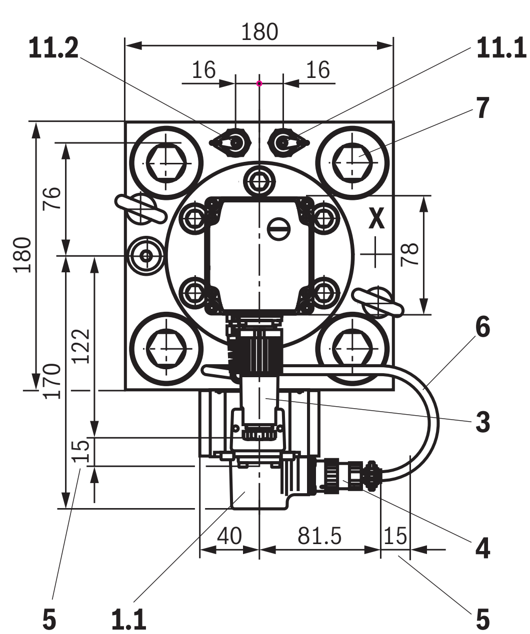
"3WRCE" (Δp = 5 bar)





Dimensions: Size 63
(dimensions in mm)

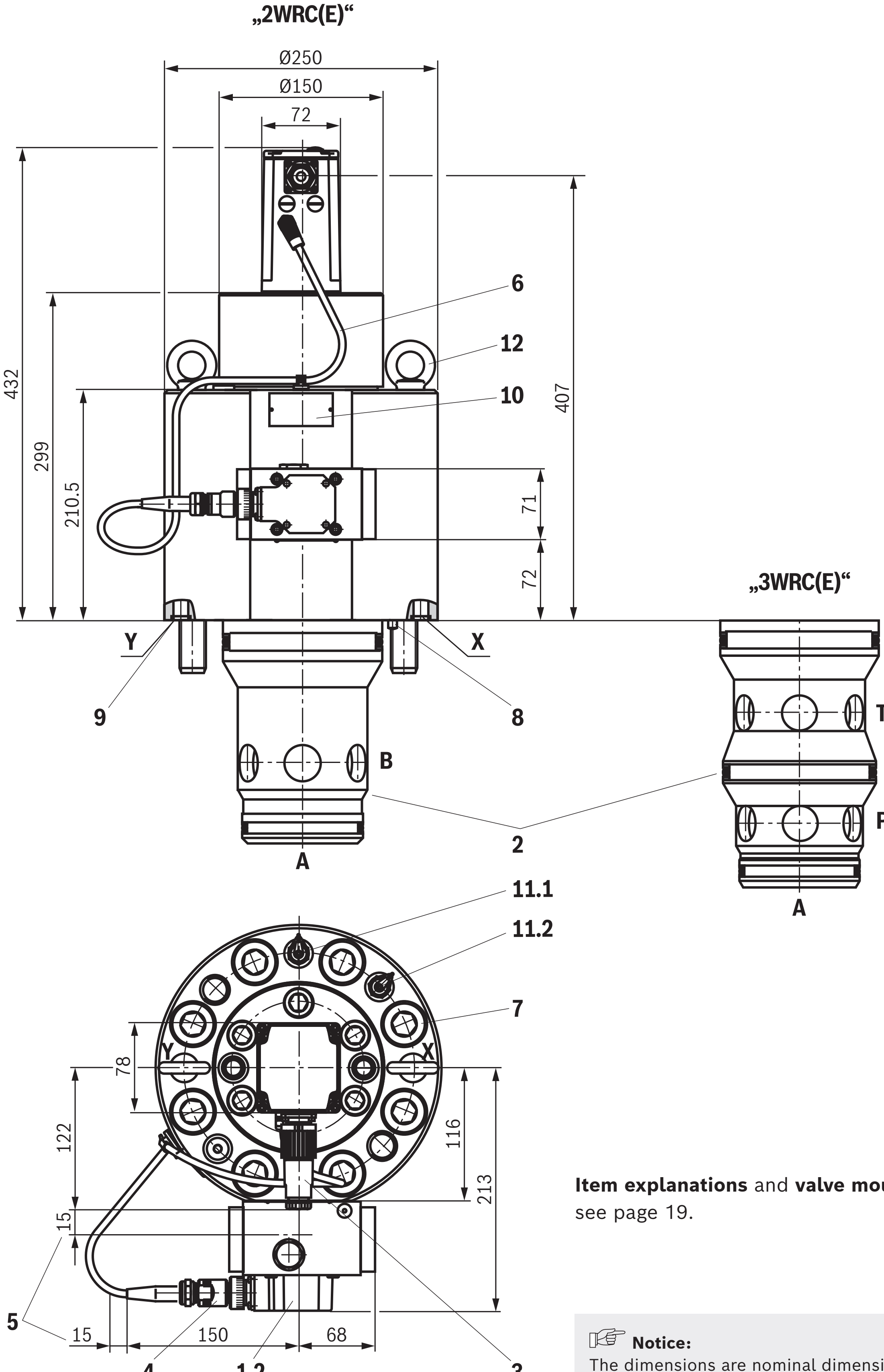




Item explanations and **valve mounting screws**
see page 19.

☞ **Notice:**
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions: Size 80
(dimensions in mm)

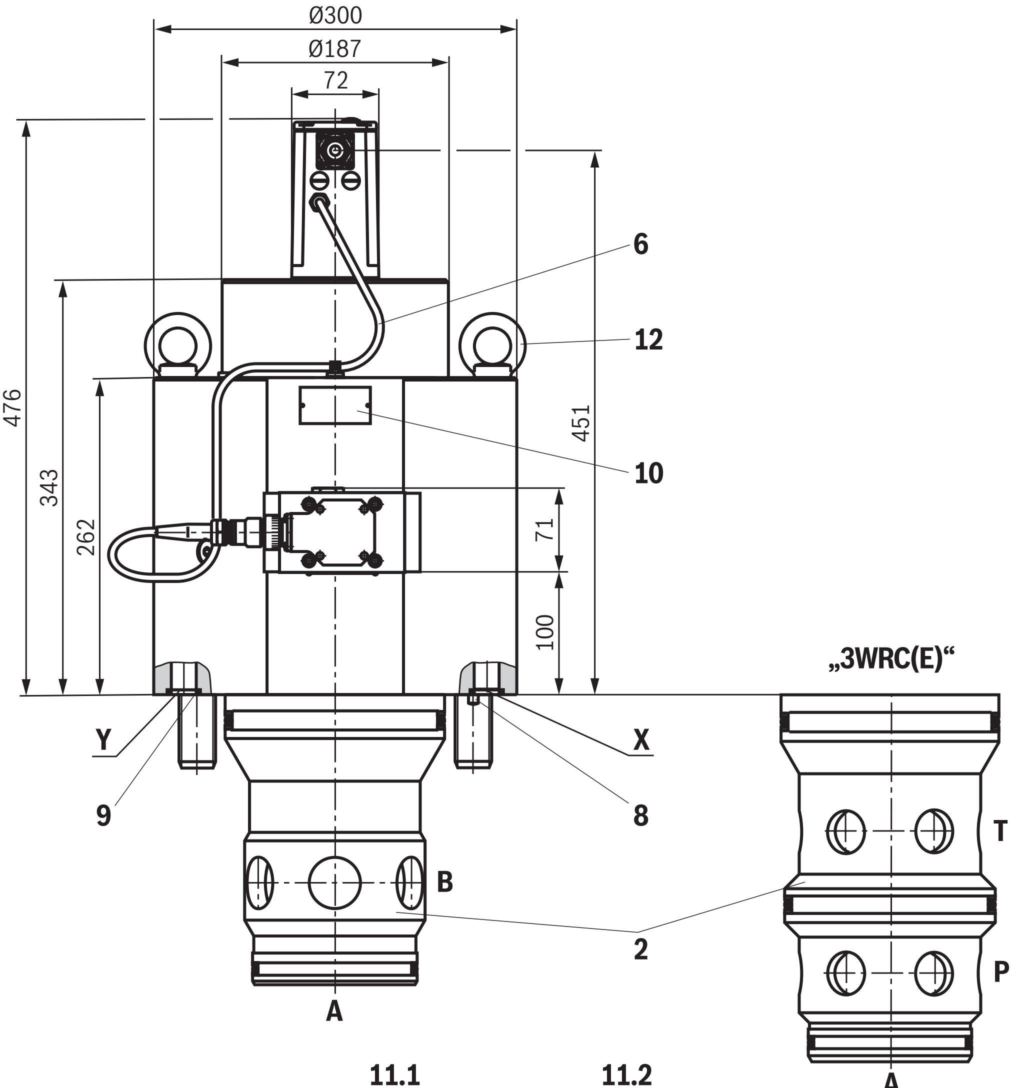


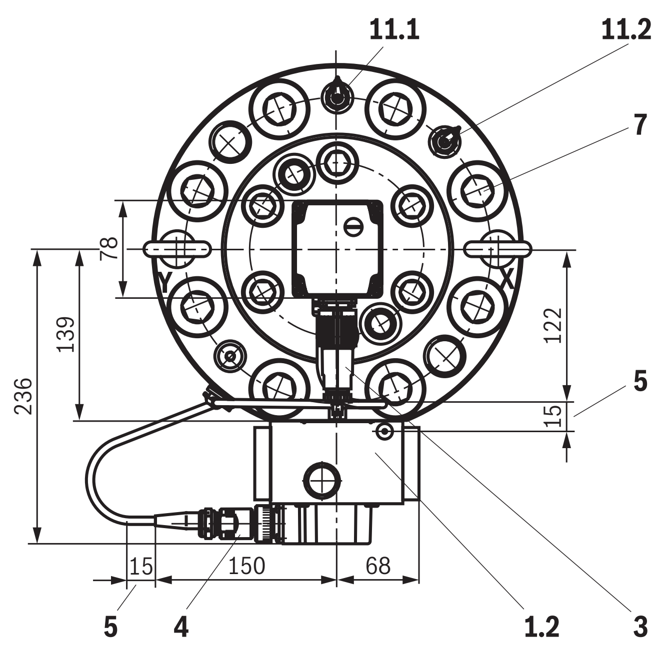
Item explanations and **valve mounting screws**
see page 19.

Notice:
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions: Size 100
(dimensions in mm)

„2WRC(E)“

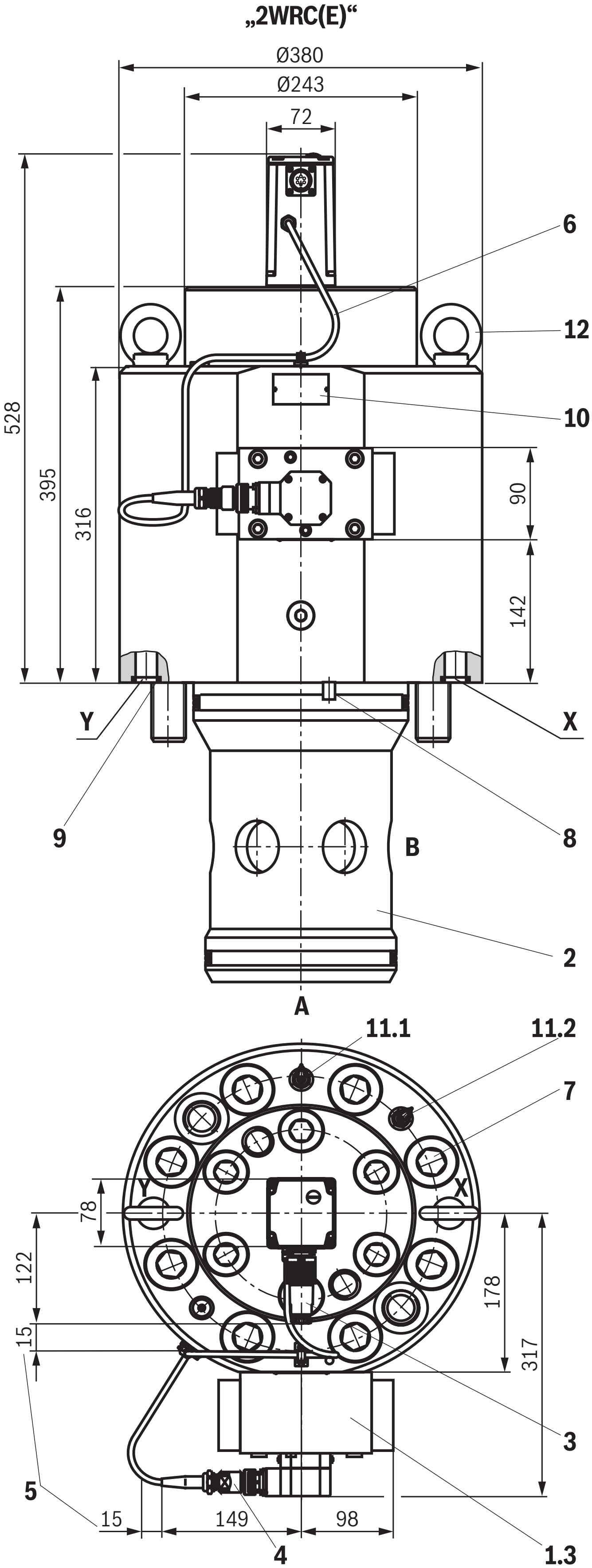




Item explanations and **valve mounting screws**
see page 19.

Notice:
The dimensions are nominal dimensions which are subject to tolerances.

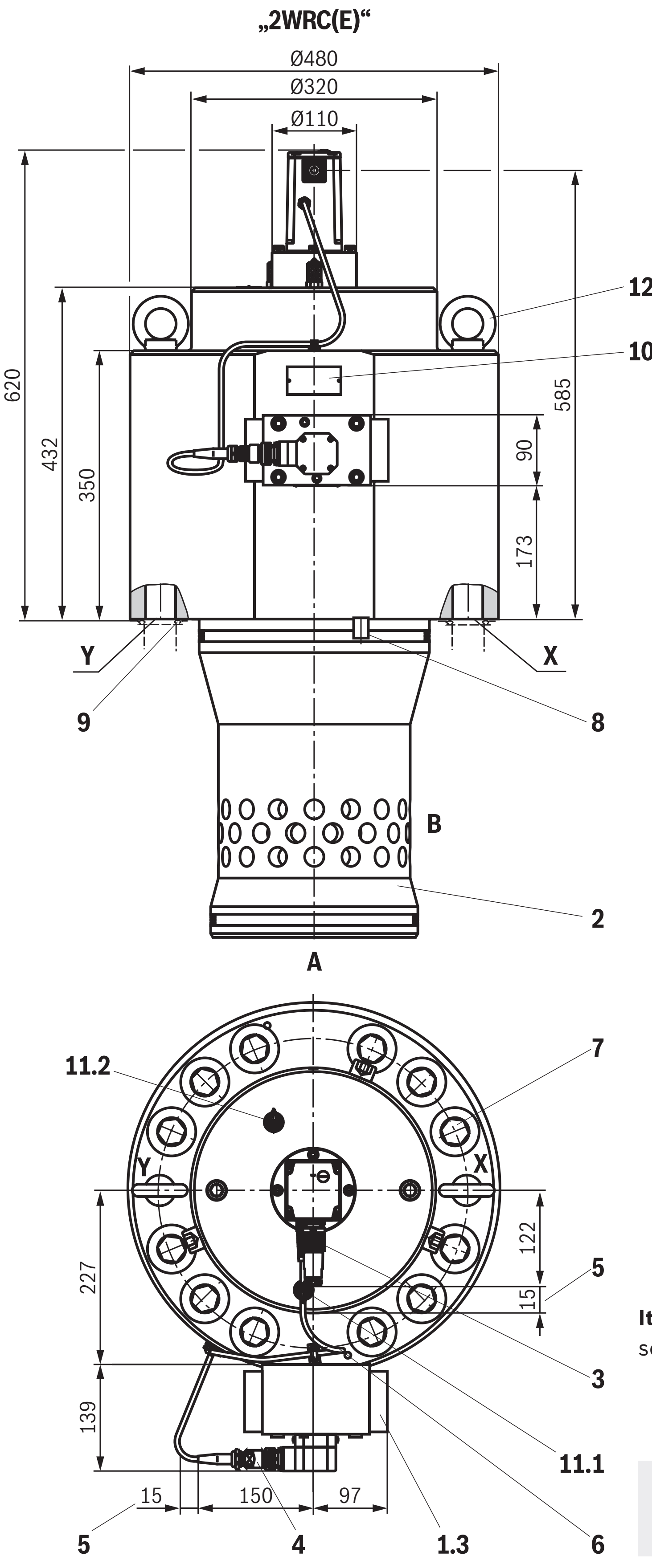
Dimensions: Size 125
(dimensions in mm)



Item explanations and **valve mounting screws** see page 19.

Notice:
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions: Size 160
(dimensions in mm)



Item explanations and **valve mounting screws** see page 19.

Notice:
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions

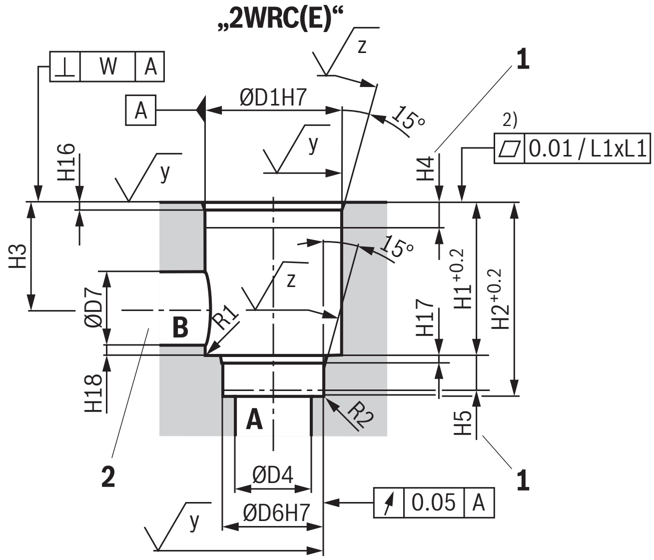
1.1 Pilot control valve (servo valve NG6)
1.2 Pilot control valve (servo valve NG10)
1.3 Pilot control valve (servo valve NG16)
2 Bush
3 Mating connectors for valves with round connector, 6-pole + PE (separate order, see page 22 and data sheet 08006)
4 Mating connectors, separate order, see page 22.
5 Space required to remove the mating connector
6 Wiring ("WRCE")
7 Valve mounting screws (included in the scope of delivery), see below
8 Locking pin for locating hole
9 Identical seal rings for ports X and Y
10 Name plate
11.1 Measuring port MA_{St} for control pressures, threaded coupling G1/4
11.2 Measuring port MB_{St} for control pressures, threaded coupling G1/4
12 Transport aid

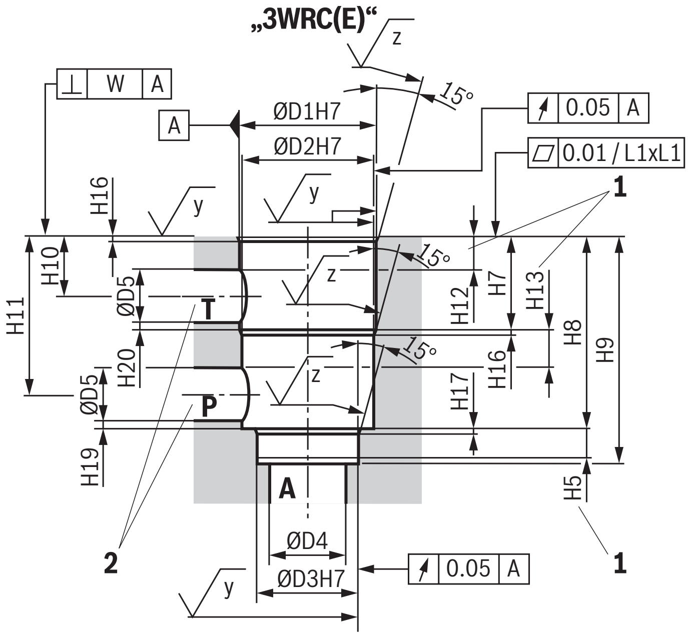
Valve mounting screws (included in the scope of delivery)

Size	Quantity	Hexagon socket head cap screws
63	4	**ISO 4762 - M30 x 220 -10.9** Tightening torque M_A = 2000 Nm ±10 %
80	8	**ISO 4762 - M24 x 220 -10.9** Tightening torque M_A = 1000 Nm ±10 %
100	8	**ISO 4762 - M30 x 290 -10.9** Tightening torque M_A = 2000 Nm ±10 %
125	8	**ISO 4762 - M36 x 300 -10.9-flZn/nc/480h/C** Tightening torque M_A = 2800 Nm ±10 %
160	12	**ISO 4762 - M42 x 420 -10.9-flZn/nc/480h/C** Tightening torque M_A = 4500 Nm± 10%

☞ **Notice:**
For tightening, a manual torque wrench with a tolerance of ≤10 % is to be used.

Installation bore
(dimensions in mm)





2) $\sqrt{y}$ = $\sqrt{\text{Rz1max 8}}$

2) $\sqrt{z}$ = $\sqrt{\text{0.0025- / Ptmax 16}}$

Installation dimensions according to ISO 7368 3)

NG	63	80	100	125	160
ØD1H7	120	145	180	225	300
ØD2H7	116	140	174	–	–
ØD3H7	90	110	135	–	–
ØD4	63	80	100	150 1)	200 1)
ØD5	48	60	75	–	–
ØD6H7	90	110	135	200	270
ØD7	63	80	100	125	200
H1 2)	130	175	210	257	370
H2 2)	155	205	245	300	425
H3 2)	95	130	155	192	268
H4	40 2)	40	50	40 2)	50
H5	20	25	29	31	45
H7	85	125	155	–	–
H8	165	215	270	–	–
H9	195	245	305	–	–
H10	57	90	112	–	–
H11	137	180	225	–	–
H12	33	60	75	–	–
H13	28	25	32	–	–
H16	4	5	5	5.5	5.5
H17	4	5	5	7	8
H18 2)	3.5	5	5	2.5	2
H19	4	5	7.5	–	–
H20	4	5	5.5	–	–
W	0.05 2)	0.1	0.2 2)	0.2 2)	0.2 2)
R1 max	4	4	4	4	4
R2 max 2)	1	1	1	1	1

1) Maximum dimension
2) Deviating from ISO 7368
3) "3WRC(E)" not according to ISO 7368

1 Depth of fit, minimum dimension
2 The ports P, T and B can be positioned around the central axis of port A. However, it must be observed that the mounting bores and the control bores are not damaged.

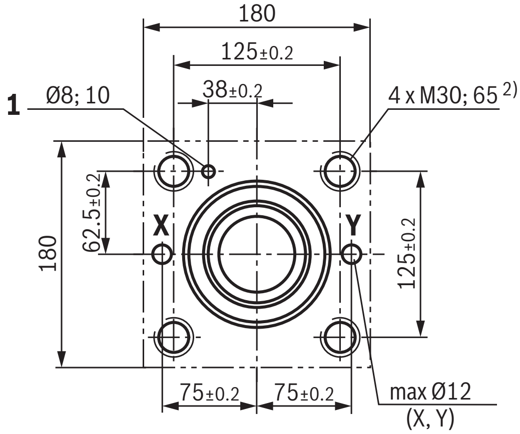
Tolerances according to: General tolerances ISO 2768-mK

Valve mounting screws see page 19.

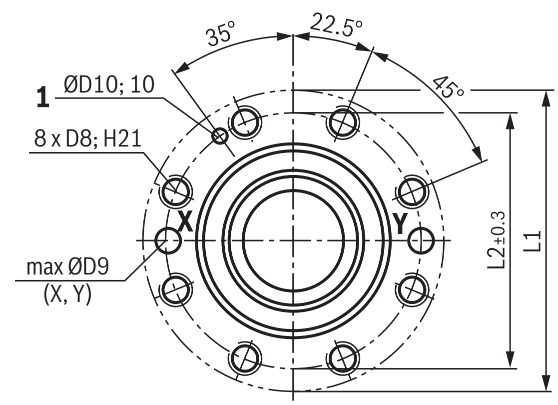
NG	Installation dimensions according to ISO 7368 3)
63	7368-12-12-1-16
80	7368-13-13-1-16
100	7368-14-14-1-16
125	7368-15-15-1-16
160	7368-16-16-1-16

Installation bore
(dimensions in mm)

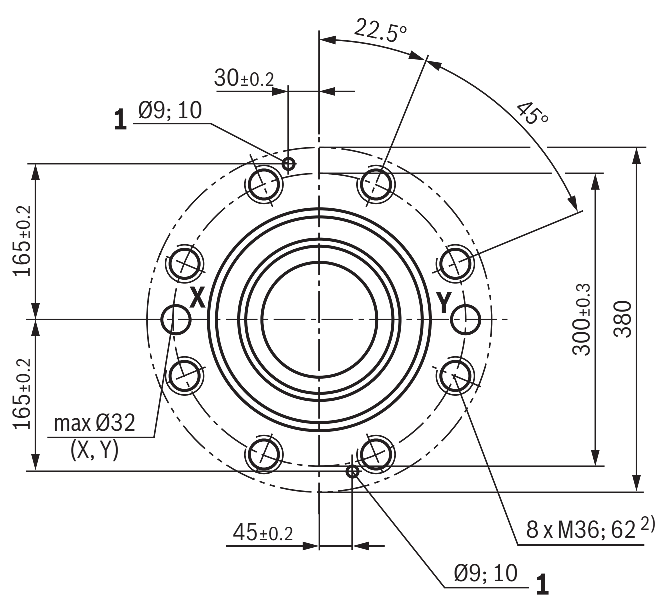
NG63



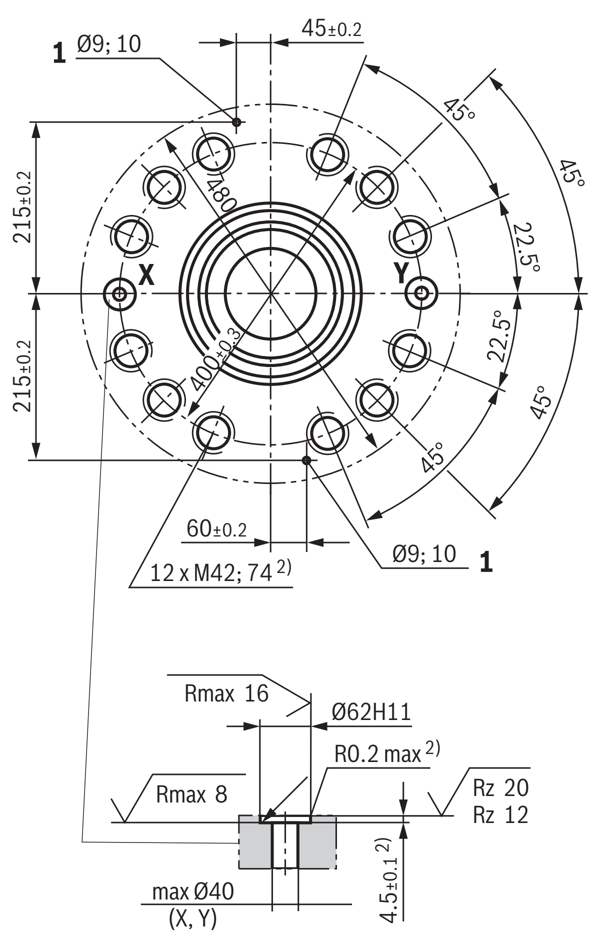
NG80; NG100



NG125



NG160



Installation dimensions according to ISO 7368

NG	80	100
D8	M24	M30
ØD9 max	16	20
ØD10	10	10
H21 2)	50	63
L1	250	300
L2	200	245

2) Deviating from ISO 7368

1 Bore for locating pin

Tolerances according to: General tolerances ISO 2768-mK

Valve mounting screws see page 19.

Accessories (separate order)

Mating connectors and cable sets

Item [1]	Designation	Version	Short designation	Material number	Data sheet
3	Mating connector; for valves with round connector, 6-pole + PE	Straight, metal	7PZ31...M	**R900223890**	08006
		Straight, plastic	7PZ31...K	**R900021267**	
4	Mating connector for pilot control valve NG6	straight, metal	6P Z17	**R900005414**	–
	Mating connector for pilot control valve NG10 and 16	straight, metal	4P Z8	**R900002460**	

[1] See dimensions page 14 ... 18.

Further information

- Directional servo valve in 4-way version, NG6 — Data sheet 29564
- Directional servo valve in 4-way version, NG10 — Data sheet 29583
- Directional servo valve in 4-way version, NG16 — Data sheet 29591
- Valve amplifier for high-response valves with servo valve pilot control — Data sheet 29931
- Hydraulic valves for industrial applications — Operating instructions 07600-B
- Hydraulic fluids on mineral oil basis — Data sheet 90220
- Environmentally compatible hydraulic fluids — Data sheet 90221
- Flame-resistant, water-free hydraulic fluids — Data sheet 90222
- Flame-resistant hydraulic fluids - containing water (HFAE, HFAS, HFB, HFC) — Data sheet 90223
- Selection of filters
- Information on available spare parts

RE 29217
Edition: 2021-01
Replaces: 2020-02

rexroth
A Bosch Company

Directional high-response cartridge valve, pilot-operated, with hydraulic actuation and inductive position transducer

Type 3WRCBH

- Size 25, 32, and 50
- Component series 1X
- Maximum operating pressure 315 bar
- Maximum flow 2250 l/min

Features

- 3-way cartridge valve
- Control spool with anti-rotation feature and control edges in servo quality
- Pressure-resistant up to 315 bar
- Control line A of the pilot control valve according to X generally required
- Dynamic reset "Z" (B to Z) possible for version "F" (only NG25 and 50)
- Inductive position transducer, position-controlled by external pilot control valve and valve electronics
- Pilot control valve at the manifold externally assigned
- Hysteresis < 0.1%, hardly measurable
- Flow characteristic, progressive with fine control edge

Contents

Ordering code

01	02	03	04	05	06	07	08		09		10	11	12
3	**WRCB**	**H**		**V**			**M**	**–**	**1X**	**/**		**M**	*****

01	3 main ports	**3**
02	Directional high-response cartridge valve, pilot-operated	**WRCB**
03	Hydraulic operation	**H**
04	Size 25	**25**
	Size 32	**32**
	Size 50	**50**
05	Control spool with zero overlap	**V**

Area ratio at the control spool (determined at the factory)

06	1:1	**no code**
	1:1.5	**F**

Rated flow (***Δp*** = 5 bar/control edge)

07	**– Size 25**	
	65 l/min	**65**
	190 l/min	**190**
	– Size 32	
	380 l/min	**380**
	– Size 50	
	300 l/min	**300**
	750 l/min	**750**

Flow characteristic

08	Inflected characteristic curve, progressive with linear fine control range	**M**
09	Component series 10 ... 19 (10 ... 19: unchanged installation and connection dimensions)	**1X**

Pilot oil port

10	Without	**no code**
	Additional pilot oil port (only version "F" and NG25 and 50)	**Z**

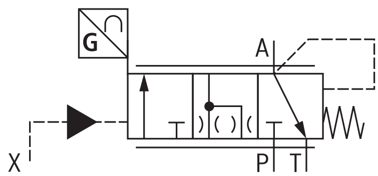
Seal material (observe compatibility of seals with hydraulic fluid used, see page 6)

11	NBR seals	**M**
12	Further details in the plain text	

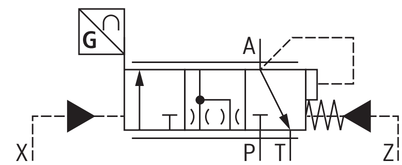
Notice:
Pilot control valves and accessories see page 15.

Symbols

"No code" version (area ratio 1:1)

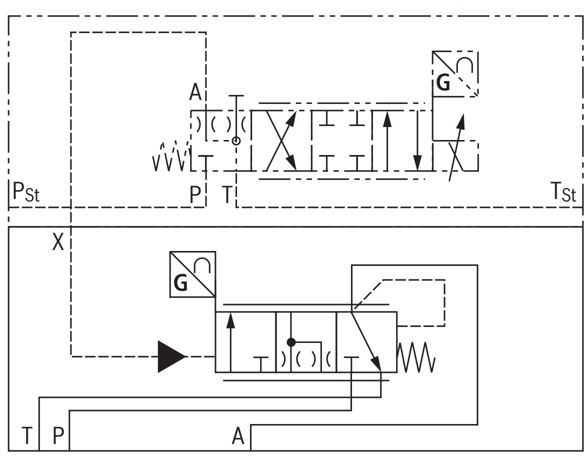


Version "F...Z" (area ratio 1:1.5)

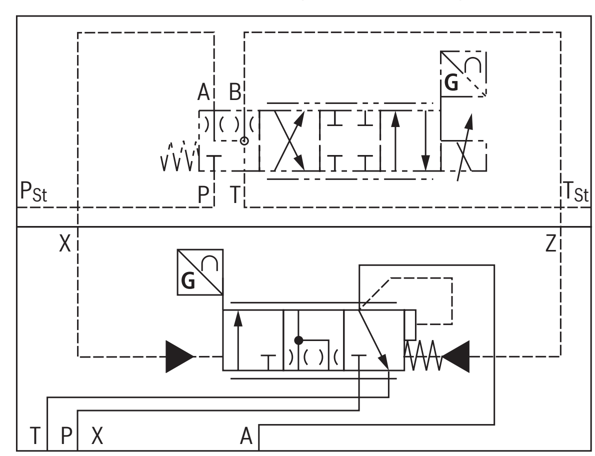


Pilot oil supply

"No code" version (area ratio 1:1)



Version "F...Z" (area ratio 1:1.5)



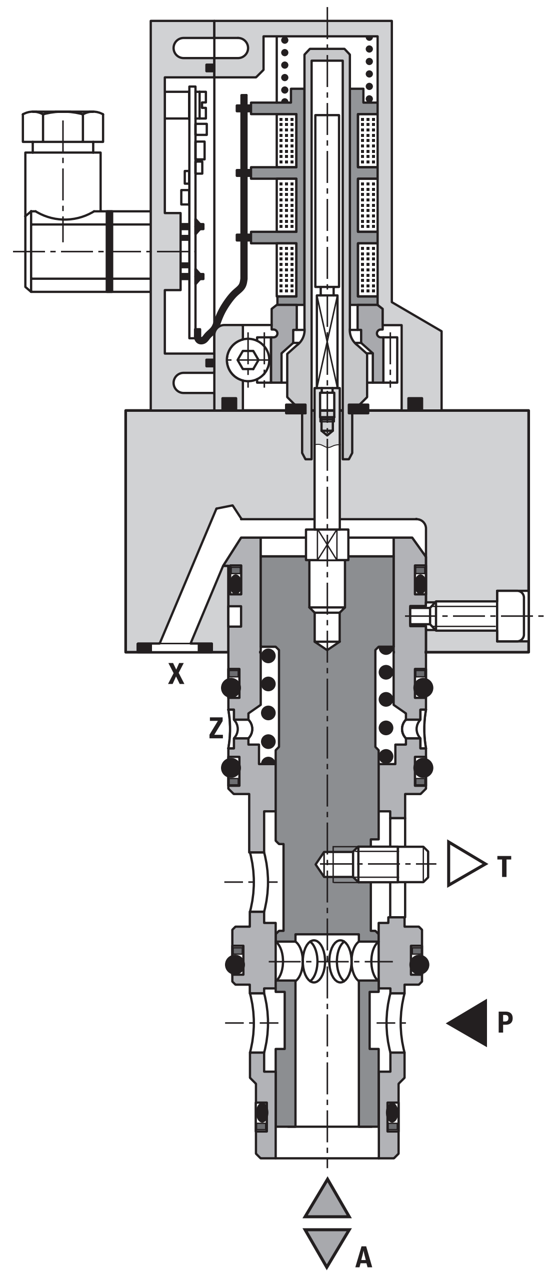
Function, section

In connection with pilot control valves, valves of type 3WRCBH are pilot-operated directional high-response cartridge valves with 2 control edges in servo quality, P–A / A–T. They control size and direction of a flow. The transition was designed by means of fine control edges for minimum leakage at high and linear pressure amplification. The control spool position is deflected by the pilot oil of the pilot control valve. In case X is unloaded and/or in case of power failure, the load pressure in A and the internal spring result in a control spool reset (A–T). The control spool position is recorded by an inductive position transducer. Its signal and the valve electronics allow for position control via a pilot control valve.
An additional pilot oil port Z (only version "F" and NG25 and 50) allows for fast reset in case of low load in port A. In this connection, the pilot control valve must be connected to A–X and B–Z.

For the external position control, the following components are required:
- Pilot control valve type 4WRP(E)H 6 (separate order, see page 15)
- Integrated electronics (OBE) or external control electronics (separate order, see page 15)
- Valve block (customer side).

The pilot oil guidance in the valve block and the electrical connection design the pilot-operated valve function for control tasks in the system. In most cases, this is a process for velocity and pressure control. The process controllers of the system generate the valve signal for the control loop.

Main stage
Type 3WRCBH . VF...Z



Technical data
(For applications outside these values, please consult us!)

General				
Size	NG	25	32	50
Installation position		Horizontal or position transducer downwards		
Ambient temperature range	°C	−20 ... +50		
Mass	kg	3.9	5.6	14.7
Vibration resistance, test condition		max. 25*g*, room vibration test in all directions (24h)		

Hydraulic							
Maximum operating pressure	▶ Port P, A, T, X, Z	bar	315				
Minimum pilot pressure		bar	p_A + 4				
Rated flow (Δp = 5 bar/control edge) [1]		l/min	65	190	380	300	750
Maximum flow		l/min	350	570	820	1600	
Pilot flow [2]		l/min	8		16	28	
Leakage flow (at 100 bar)	▶ Pilot control valve	cm³/min	<300		<500	<900	
	▶ Main stage	cm³/min	<350	<350	<500	<500	<600
Hydraulic fluid			see table page 6				
Hydraulic fluid temperature range		°C	−20 ... +80				
Viscosity range	▶ Recommended	mm²/s	20 ... 100				
	▶ Maximum admissible	mm²/s	10 ... 800				
Maximum admissible degree of contamination of the hydraulic fluid; cleanliness class according to ISO 4406 (c)			Class 18/16/13 [3]				
Pilot control valve	▶ Type 4WRPH 6		see page 15				
	▶ Type 4WRPEH 6		see page 15				

Static/dynamic					
Size		NG	25	32	50
Manufacturing tolerance q_{Vmax}		%	≤10		
Actuating time [4]	▶ A–X	ms	33	28	60
	▶ A–X; B–Z	ms	27	–	50
Switch-off behavior (after electrical shut-off)			Pilot control valve in "fail-safe" position, main valve moves to position A-T		
Temperature drift (ΔT = 40 °C)		%	Zero shift < 1		
Zero compensation			Valve amplifier ±5% adjustable, pilot control valve with integrated electronics (OBE) set in the plant		

1) Flow for deviating Δp (control edge):

$$\boxed{q_x = q_{Vnom} \cdot \sqrt{\frac{\Delta p_x}{5}}}$$

2) p = 100 bar; maximum dynamics

3) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and simultaneously increases the life cycle of the components.

4) Signal step 0 ... 100% at p_X = 100 bar / p_A = 50 bar

Notice:
Information on rated flow/maximum flow only in case of compliance with the installation dimensions.

Technical data
(For applications outside these values, please consult us!)

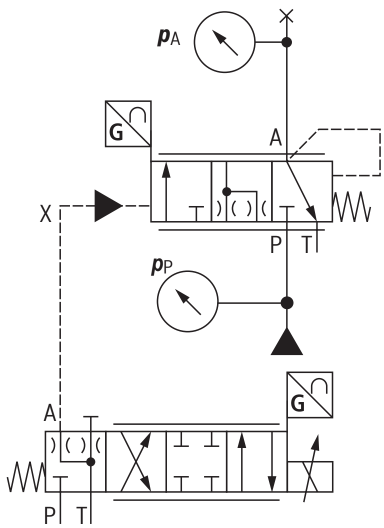
Hydraulic fluid		**Classification**	**Suitable sealing materials**	**Standards**	**Data sheet**
Mineral oils		HL, HLP, HLPD, HVLP, HVLPD	NBR, FKM	DIN 51524	90220
Bio-degradable	▶ Insoluble in water	HETG	FKM	ISO 15380	90221
		HEES	FKM		
	▶ Soluble in water	HEPG	FKM	ISO 15380	
Flame-resistant	▶ Water-free	HFDU (glycol base)	FKM	ISO 12922	90222
		HFDU (ester base)	FKM		
		HFDR	FKM		
	▶ Containing water	HFC (Fuchs: Hydrotherm 46M, Renosafe 500; Petrofer: Ultra Safe 620; Houghton: Safe 620; Union: Carbide HP5046)	NBR	ISO 12922	90223

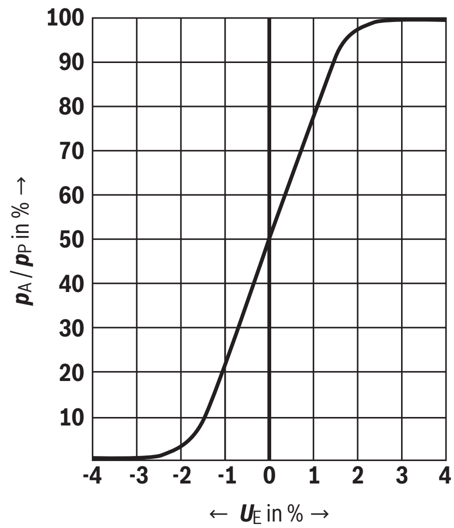
Important information on hydraulic fluids:
- For further information and data on the use of other hydraulic fluids, please refer to the data sheets above or contact us.
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.).
- The ignition temperature of the hydraulic fluid used must be 50 K higher than the maximum surface temperature.
- **Bio-degradable and flame-resistant – containing water:** If components with galvanic zinc coating (e.g. version "J3" or "J5") or parts containing zinc are used, small amounts of dissolved zinc may get into the hydraulic system and cause accelerated aging of the hydraulic fluid. Zinc soap may form as a chemical reaction product, which may clog filters, nozzles and solenoid valves – particularly in connection with local heat input.
- **Flame-resistant – containing water:**
  – Due to the increased cavitation tendency with HFC hydraulic fluids, the life cycle of the component may be reduced by up to 30% as compared to the use with mineral oil HLP. In order to reduce the cavitation effect, it is recommended – if possible specific to the installation – backing up the return flow pressure in ports T to approx. 20% of the pressure differential at the component.
  – Dependent on the hydraulic fluid used, the maximum environment and hydraulic fluid temperature must not exceed 50 °C. In order to reduce the heat input into the component, the command value profile is to be adjusted for proportional and high-response valves.

Electric			
Position transducer DC/DC technology	▶ Supply		+15 V/35 mA; -15 V/25 mA
	▶ Signal (R_L ≥ 10 kΩ)	V	0 ... ±10
Pilot control valve	▶ Type 4WRPH 6		Data sheet 29028
	▶ Type 4WRPEH 6		Data sheet 29035

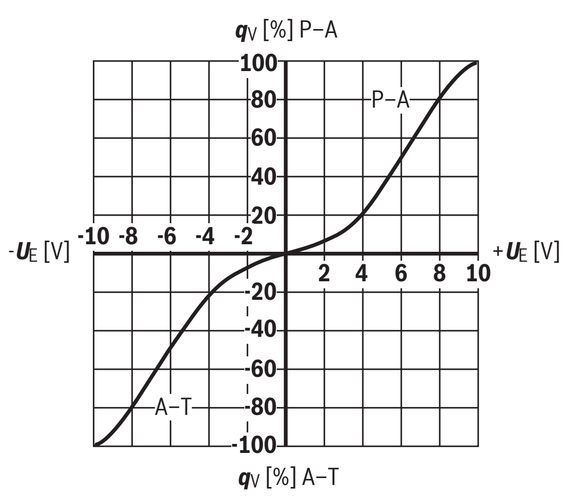
Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ± 5 °C)

Pressure amplification





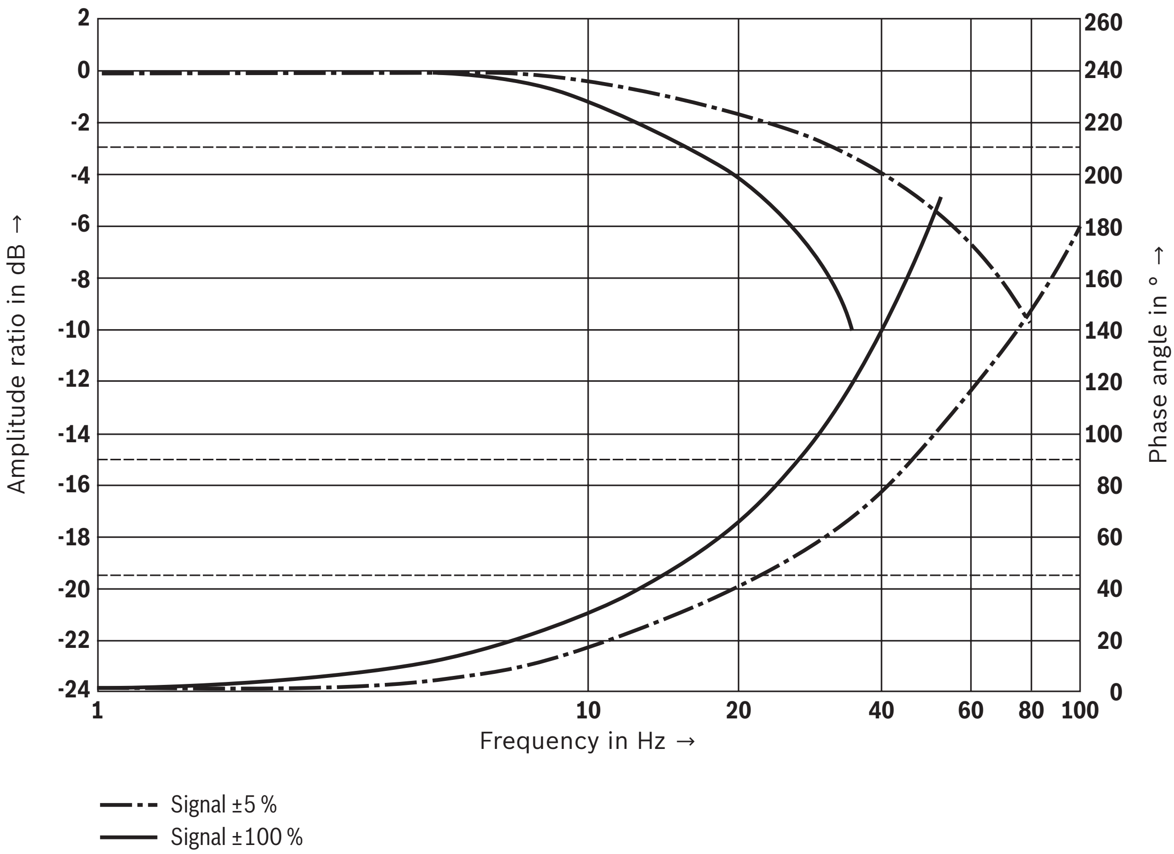
Flow/signal function



Characteristic curves: Size 25
(measured with HLP46, ϑ_{oil} = 40 ± 5 °C)

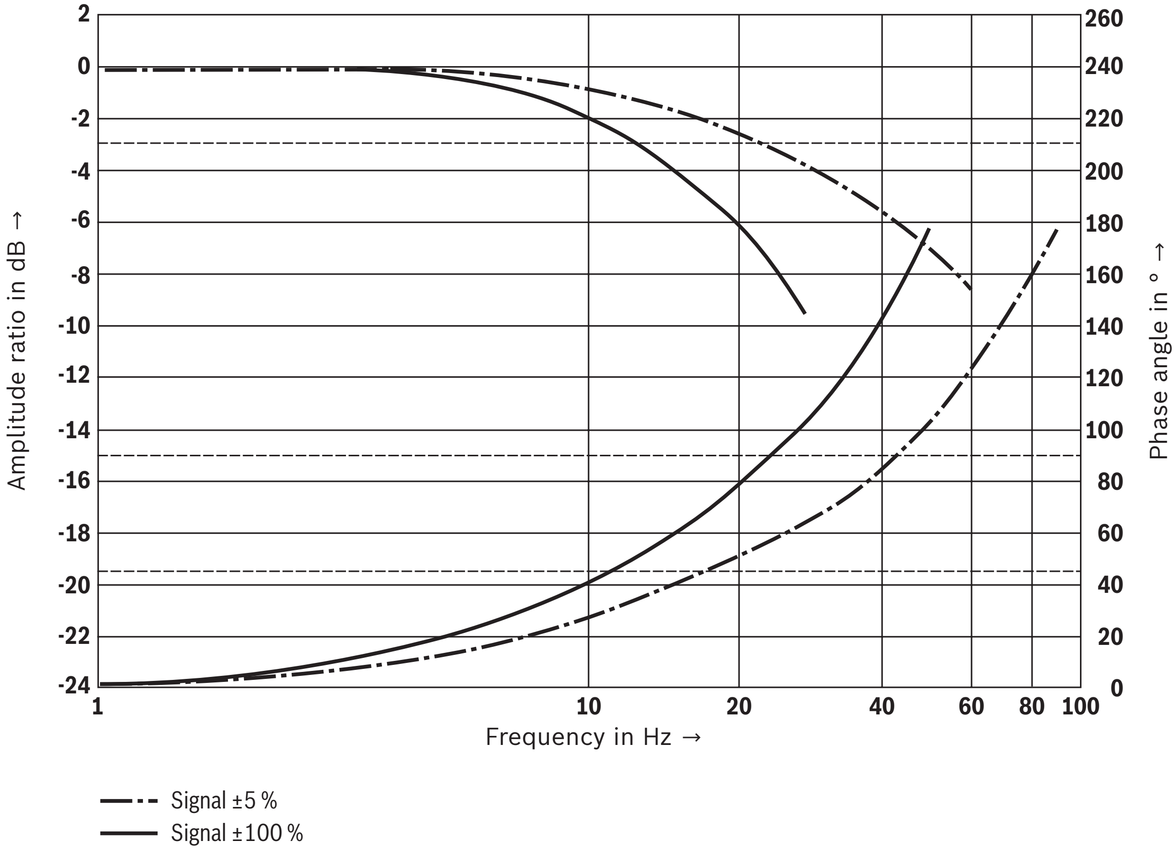
Frequency response

(p_{St} = 100 bar, p_A = 50 bar)



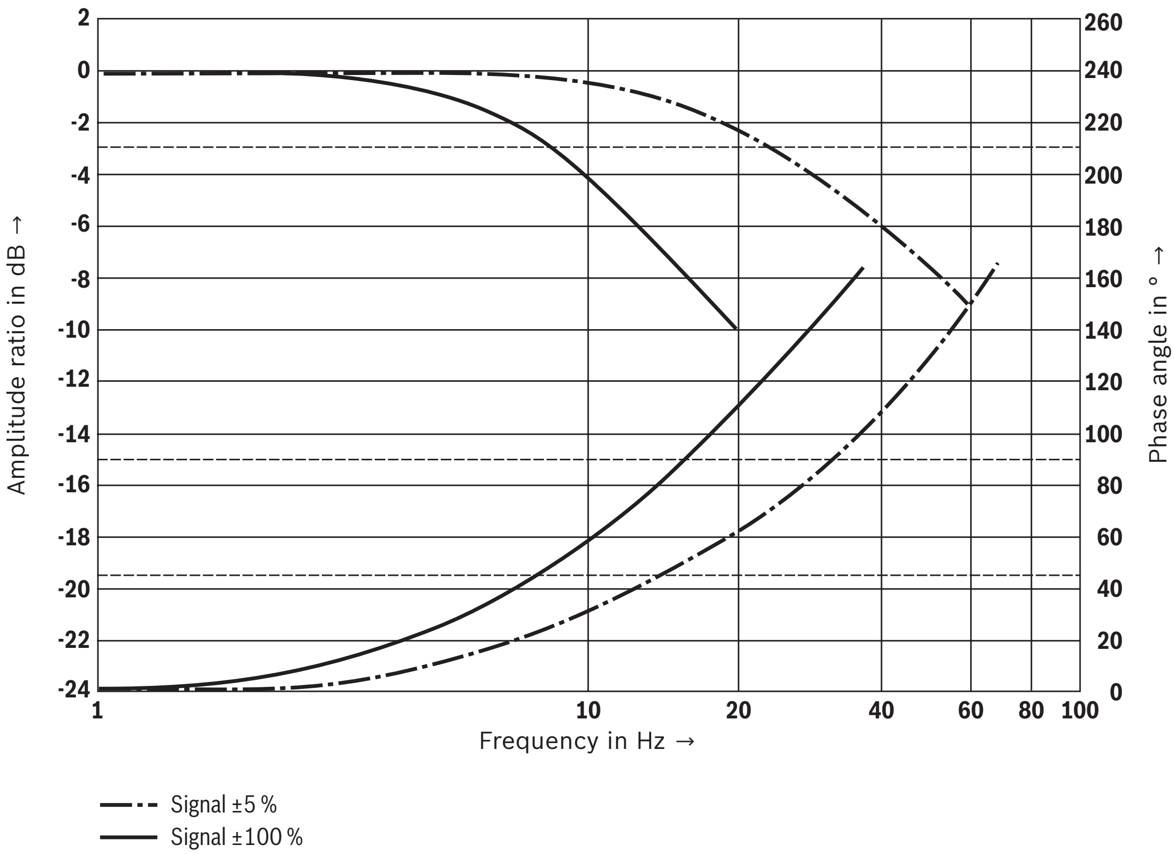
Characteristic curves: Size 32
(measured with HLP46, ϑ_{oil} = 40 ± 5 °C)

Frequency response
(p_{St} = 100 bar, p_A = 50 bar)

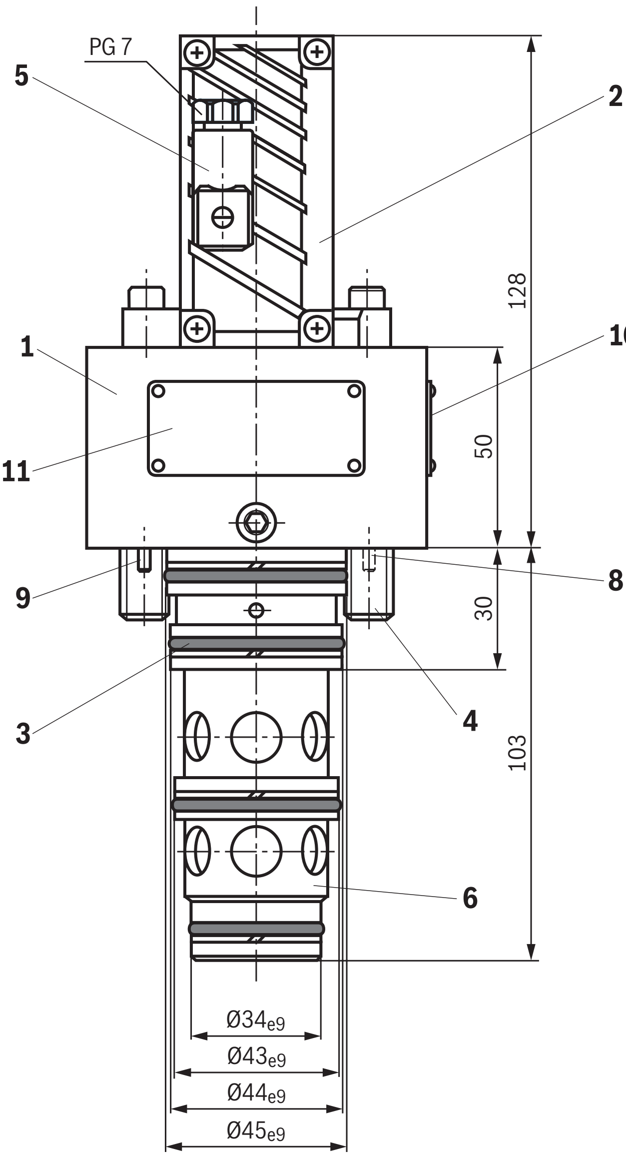


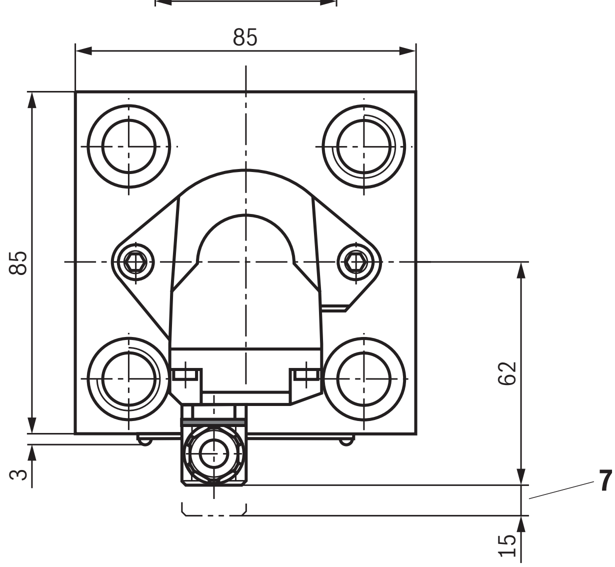
Characteristic curves: Size 32
(measured with HLP46, ϑ_{oil} = 40 ± 5 °C)

Frequency response
(p_{St} = 100 bar, p_A = 50 bar)



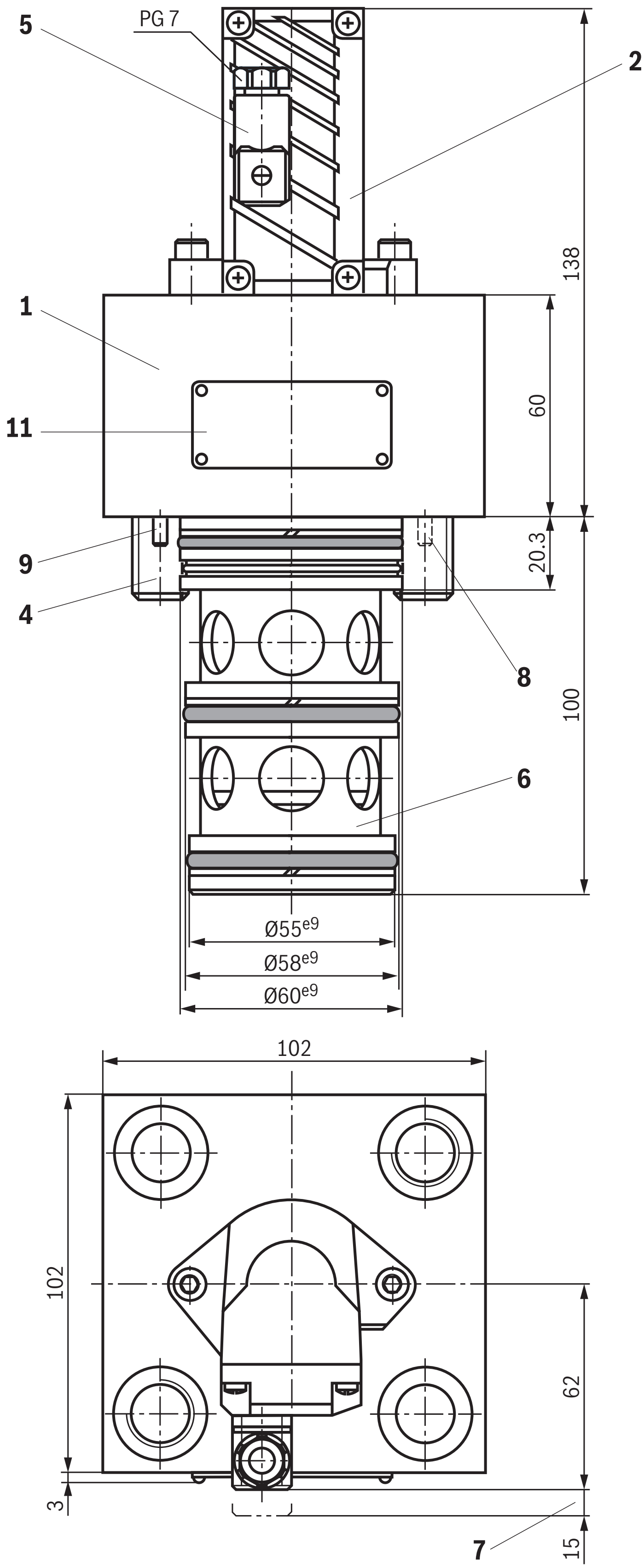
Dimensions: Size 25
(dimensions in mm)





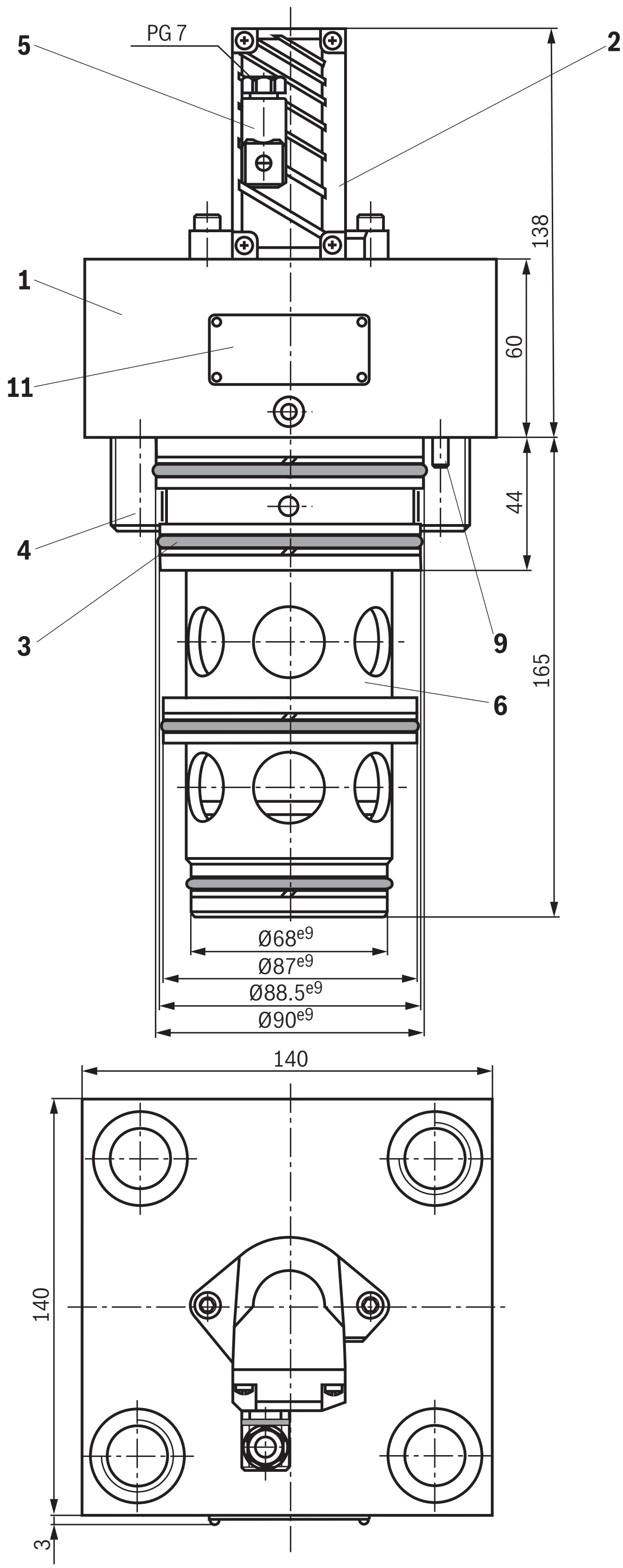
1 Directional high-response cartridge valve (main stage)
2 Position transducer
3 Seal ring (only version "Z")
4 Valve mounting screws (included in the scope of delivery, see page 15)
5 Mating connector (included in the scope of delivery, see page 15)
6 Installation bore see page 14
7 Space required for removing the mating connector
8 Locating pin version "F"
9 Locating pin
10 Name plate version "F"
11 Name plate

Dimensions: Size 32
(dimensions in mm)



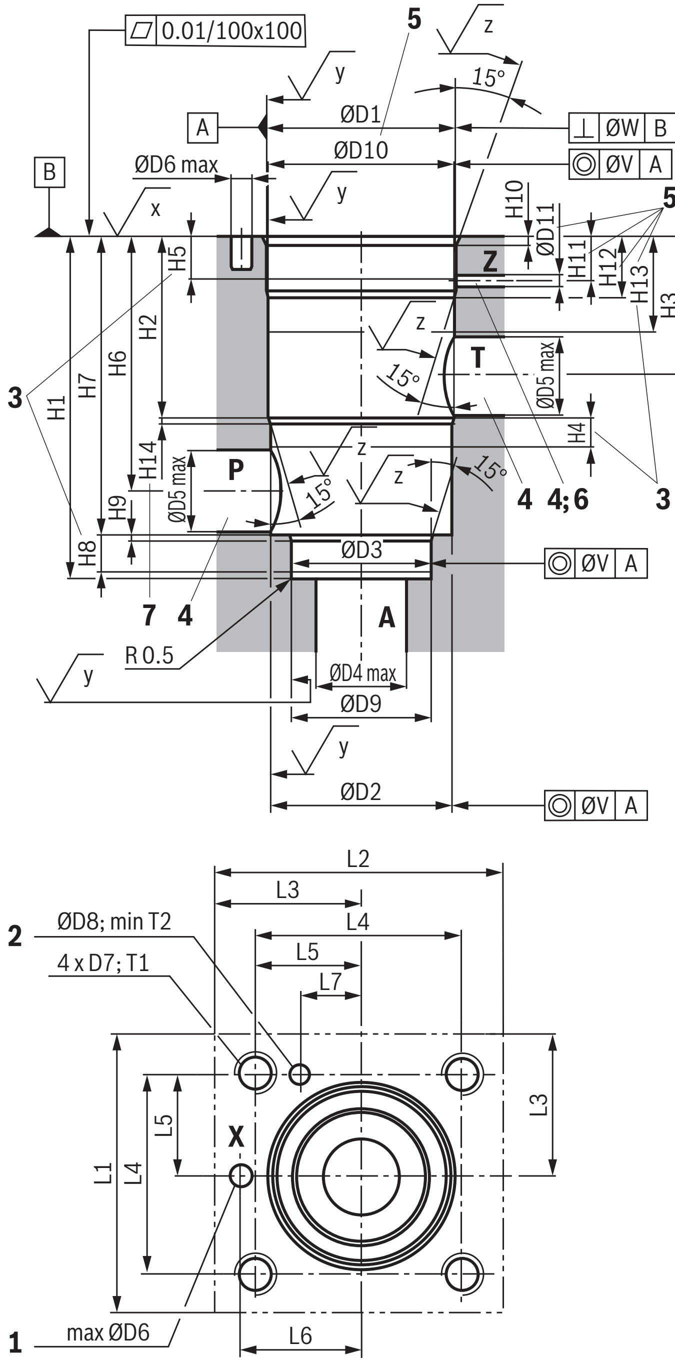
1 Directional high-response cartridge valve (main stage)
2 Position transducer
4 Valve mounting screws (included in the scope of delivery, see page 15)
5 Mating connector (included in the scope of delivery, see page 15)
6 Installation bore see page 14
7 Space required for removing the mating connector
8 Locating pin version "F"
9 Locating pin
11 Name plate

Dimensions: Size 50
(dimensions in mm)



1 Directional high-response cartridge valve (main stage)
2 Position transducer
3 Seal ring (only version "Z")
4 Valve mounting screws (included in the scope of delivery, see page 15)
5 Mating connector (included in the scope of delivery, see page 15)
6 Installation bore see page 14
9 Locating pin
11 Name plate

Installation bore
(dimensions in mm)



$\sqrt{x}$ = $\sqrt{\text{Rzmax } 4}$ $\sqrt{y}$ = $\sqrt{\text{Rzmax } 8}$

$\sqrt{z}$ = $\sqrt{\text{Rz } 16}$

NG	25	32	50
L1	85	102	140
L2	85	102	140
L3	42.5	51	70
L4$^{\pm0.2}$	58	70	100
L5$^{\pm0.1}$	29	35	50
L6$^{\pm0.2}$	33	41	58
L7$^{\pm0.2}$	16	17	30
H1$^{+0.1}$	103	100	165
H2$^{+0.2}$	56	43.5	87
H3$^{\pm0.2}$	45	30	–
H3$^{\pm0.3}$	–	–	66
H4	15	15	16
H5	12.5	18	20
H6$^{\pm0.2}$	78	71.5	–
H6$^{\pm0.3}$	–	–	122
H7$^{+0.3}$	89	–	–
H7$^{+0.1}$	–	85	–
H7$^{\pm0.3}$	–	–	143
H8	11.5	–	18
H8$^{\pm0.2}$	–	13	–
H9	2.5	3	3
H10	2.5	2.5	4
H11	14.5	–	21
H12	–	–	29
H12$^{-0.2}$	19	–	–
H13	32	–	46
H14	3	3	3
ØD1H7Ⓔ	45	60	90
ØD2H7Ⓔ	43	58	87
ØD3H7Ⓔ	34	55	68
max. ØD4	22	28	44
max. ØD5	21	26	39
max. ØD6	6	8	10
D7	M12	M16	M20
ØD8H13	6	6	8
ØD9$^{+0.2}$	33.7	54.7	67.7
ØD10H7Ⓔ	44	–	88.5
ØD11	4	–	6
T1	25	35	45
min. T2	10	10	10
V	0.03	0.03	0.03
W	0.05	0.1	0.1

1 Connect port X to port A of the pilot control valve.
2 Bore for locating pin
3 Depth of fit
4 The ports P, T and Z can be positioned around the central axis of port A. However, it must be observed that the mounting bores and the control bores are not damaged.
5 Only version "Z"
6 Connect port Z to port B of the pilot control valve.
7 Not version "Z"

Tolerances according to: General tolerances ISO 2768-mK

Dimensions

Valve mounting screws (included in the scope of delivery)

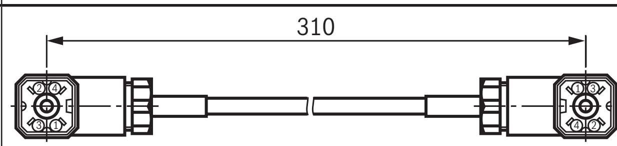
Size	Quantity	Hexagon socket head cap screws
25	4	**ISO 4762 - M12 x 35 -10.9-flZn/nc/480h/C** Friction coefficient $\boldsymbol{\mu}_{total}$ = 0.09 ... 0.14; tightening torque $\boldsymbol{M_A}$ = 90 Nm ±10%
32	4	**ISO 4762 - M16 x 50 - 10.9-flZn/nc/480h/C** Friction coefficient $\boldsymbol{\mu}_{total}$ = 0.09 ... 0.14; tightening torque $\boldsymbol{M_A}$ = 250 Nm ±10%
50	4	**ISO 4762 - M20 x 70 -10.9-flZn/nc/480h/C** Friction coefficient $\boldsymbol{\mu}_{total}$ = 0.09 ... 0.14; tightening torque $\boldsymbol{M_A}$ = 450 Nm ±10%

Mating connectors (included in the scope of delivery)

Item [1)]	Designation	Version	Material number	Data sheet
5	Mating connectors for position transducer	4P, PG7	**1834484063**	08008

Accessories

Connection cable (separate order)

Designation	Version	Material number	Data sheet
Cable for connection of main stage and pilot control valve (type 4WRPEH 6 ...)		**1834463005**	–

Pilot control valves with integrated electronics (OBE) – type 4WRPEH 6 (separate order)

Size	Material number Control electronics interface "A1"	 "F1"	Data sheet
25	0811404601	0811404632	29035
32	0811404602	0811404633	
50	0811404603	0811404634	

Pilot control valves with external control electronics – type 4WRPH 6 (separate order)

Size	Material number	Data sheet
25	0811404034	29028
32	0811404035	
50	0811404036	

External control electronics – Eurocard; for pilot control valve type 4WRPH 6 (separate order)

Valve amplifier for high-response valves	Material number	Data sheet
VT-VRRA1-527-20/V0/2STV	0811405063	30045

Further information

▶ Directional control valves, direct operated, with electrical position feedback	Data sheet 29028
▶ Directional control valves, direct operated, with electrical position feedback and integrated electronics (OBE)	Data sheet 29035
▶ Valve amplifier for high-response valves	Data sheet 30045
▶ Hydraulic fluids on mineral oil basis	Data sheet 90220
▶ Environmentally compatible hydraulic fluids	Data sheet 90221
▶ Flame-resistant, water-free hydraulic fluids	Data sheet 90222
▶ Flame-resistant hydraulic fluids - containing water (HFAE, HFAS, HFB, HFC)	Data sheet 90223
▶ Mating connectors for controlling electrically operated valves and sensors	Data sheet 08008
▶ Hydraulic valves for industrial applications	Operating instructions 07600-B
▶ Selection of filters	
▶ Information on available spare parts	

RE 29222
Edition: 2019-07
Replaces: 02.09

rexroth
A Bosch Company

Directional high-response cartridge valve, pilot-operated, with integrated electronics (OBE)

Type 3WRCBEE

tb0216

- Size 25, 32, and 50
- Component series 1X
- Maximum operating pressure 315 bar
- Maximum flow 2250 l/min

Features

- 3-way cartridge valves
- Control spool with anti-rotation feature and control edges in servo quality
- With inductive position transducer at the main control spool and pilot control valve
- Position-controlled with integrated electronics (OBE).
- Completely adjusted unit

Contents

Ordering code

01	02	03	04	05	06	07	08		09		10	11		12	13	14
3	**WRCB**	**EE**		**V**			**M**	**–**	**1X**	**/**	**G24**	**K31**	**/**		**M**	*****

01	3 main ports	**3**
02	Directional high-response cartridge valve, pilot-operated	**WRCB**
03	Integrated electronics (OBE)	**EE**
04	Size 25	**25**
	Size 32	**32**
	Size 50	**50**
05	Control spool with zero overlap	**V**

Area ratio at the control spool (determined at the factory)

06	1:1 (NG50)	**no code**
	1:1.5 (NG25 and 32)	**F**

Rated flow at 5 bar pressure differential

07	**– Size 25**	
	190 l/min	**190**
	– Size 32	
	380 l/min	**380**
	– Size 50	
	750 l/min	**750**

Flow characteristic

08	Inflected characteristic curve, progressive with linear fine control range	**M**
09	Component series 10... 19 (10 ... 19: unchanged installation and connection dimensions)	**1X**

Supply voltage

10	Direct voltage 24 V	**G24**

Electrical connection

11	Without mating connector; connector according to DIN EN 175201-804	**K31** [1)]

Electrical interface

12	Command value ±10 V, actual value ±10 V	**A1**
	Command value 4 ... 20 mA, actual value 4 ... 20 mA	**F1**

Seal material (observe compatibility of seals with hydraulic fluid used, see page 6)

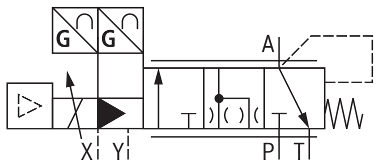
13	NBR seals	**M**
14	For further details, see the plain text	

1) Mating connectors, separate order, see page 20 and data sheet 08008.

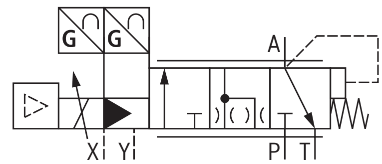
Symbols

Simplified

"No code" version (area ratio 1:1)

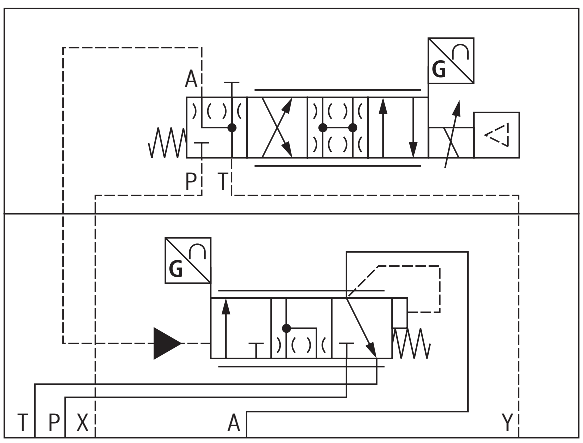


Version "F" (area ratio 1:1.5)



Detailed

Version "F"



Function, section

Valves of type 3WRCBEE are pilot-operated, 2-stage directional high-response cartridge valves. They control the flow direction and size.

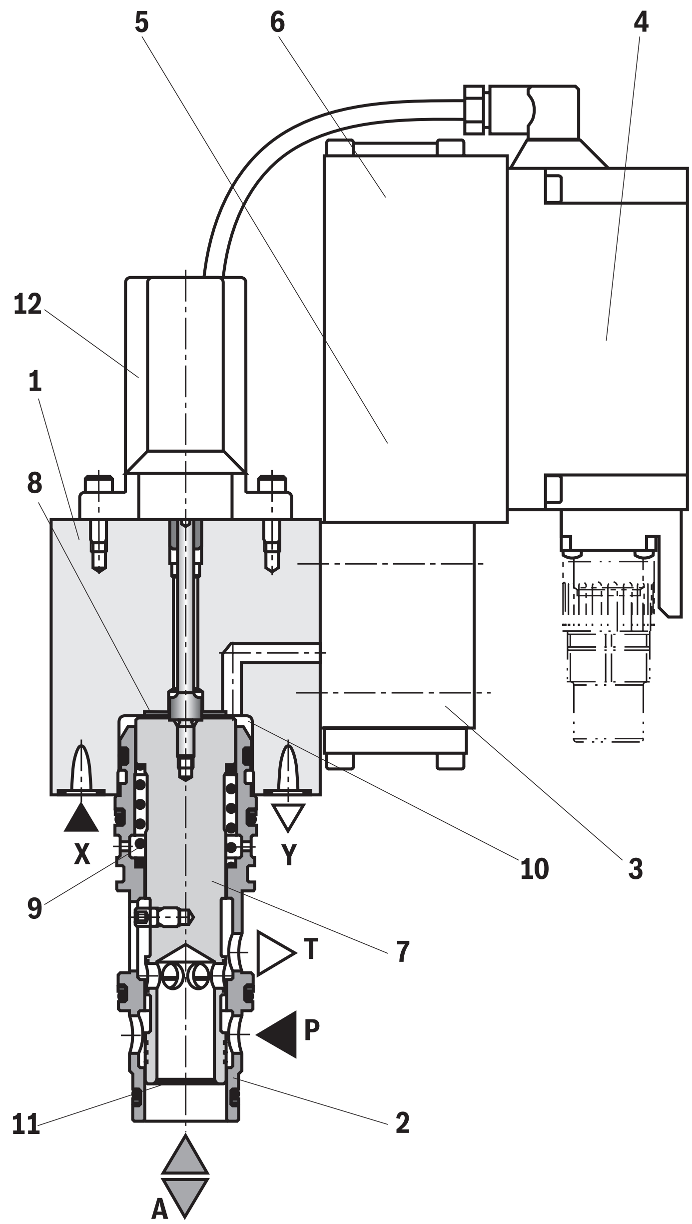
Set-up

The valves consist of the following assemblies:

- Cover (1) with connection surfaces,
- Main control spool (7) with control edges,
- Socket (2),
- Pilot control valve (3) with paired control spool socket unit and inductive position transducer (6)
- Integrated electronics (OBE) (4) with inductive position transducer (12) of the main control spool

Function

- Switching of the main control spool (7) via the pilot control valve (3); pressure build-up in the control chamber (10) acts on the surface (8) – the pressure of the connection A counteracts on the area (11) and the spring force (9).
- Control of the control spool of the pilot control valve through the proportional solenoid (5) against the spring force in the pilot control valve.
- Linking the command values (4) and actual values (12 and 6) in the microcontroller of the integrated electronics (OBE) (4).
- Pilot oil supply Y to pilot control valve connection P; pilot oil drain via Y to the container.
- With a command value of 0 V or 12 mA, the electronics controls the main control spool (7) in central position. This way, fifty percent of the system pressure ($\boldsymbol{p}_P/2$) will be set in connection A.
- Area ratio of area (11) to area (8) at:
  - Size 25 = 1:1.5
  - Size 32 = 1:1.5
  - Size 50 = 1:1



Failure of supply voltage

- Integrated electronics (OBE) de-energize the solenoid in case of supply voltage failure or cable break
- Depressurizing the control spool surface (8) via the pilot control valve (3) after Y to the container.
- Spring force (9) and pressure in connection A of the area (11) will cause the main control spool (7) to open the connection A to T and close P to A

Notice:
Supply voltage failure will cause an abrupt standstill of the control loop. The acceleration forces occurring in this connection may cause machine damage.

Technical data
(for applications outside these values, please consult us!)

General					
Size		NG	25	32	50
Installation position			any (for set-up of the valve on an actuator, avoid arranging the main control spool in parallel to the acceleration or delay direction of the actuator.)		
Storage temperature range		°C	-20 ... +80		
Ambient temperature range		°C	-20 ... +50		
Weight		kg	11.8	16.2	23.2

Hydraulic					
Maximum operating pressure	▶ Port P, A, T, X	bar	315		
Maximum return flow pressure	▶ Port Y	bar	250		
Rated flow (***Δp*** = 5 bar)		l/min	190	380	750
Maximum flow		l/min	600	1000	2250
Pilot flow [1]		l/min	12	16	30
Maximum zero flow (p_P = 315 bar)		l/min	1.5	2.5	3.5
Leakage in spring-centered position (p_P = 315 bar; command value -100%)		l/min	0.2	0.4	0.8
Area ratio at the main control spool			1:1.5	1:1.5	1:1
Pressure differential main control spool spring on control spool area at port A		bar	2.5		
Hydraulic fluid			see table page 6		
Hydraulic fluid temperature range		°C	-20 ... +80		
Viscosity range		mm²/s	15 ... 380		
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)	▶ Main stage		Class 20/18/15 [2]		
	▶ Pilot control valve		Class 18/16/13 [2]		
Hysteresis		%	≤ 0.1		
Response sensitivity		%	≤ 0.1		

1) X or Y for minimum actuating time (command value ±100%

2) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and simultaneously increases the life cycle of the components.

Technical data
(for applications outside these values, please consult us!)

Hydraulic fluid		Classification	Suitable sealing materials	Standards	Data sheet
Mineral oils		HL, HLP, HLPD, HVLP, HVLPD	NBR, FKM	DIN 51524	90220
Bio-degradable	▶ Insoluble in water	HETG	FKM	ISO 15380	90221
		HEES	FKM		
	▶ Soluble in water	HEPG	FKM	ISO 15380	
Flame-resistant	▶ Water-free	HFDU (glycol base)	FKM	ISO 12922	90222
		HFDU (ester base)	FKM		
		HFDR	FKM		
	▶ Containing water	HFC (Fuchs: Hydrotherm 46M, Renosafe 500; Petrofer: Ultra Safe 620; Houghton: Safe 620; Union: Carbide HP5046)	NBR	ISO 12922	90223

Important notices on hydraulic fluids:

- For further information and data on the use of other hydraulic fluids, please refer to the data sheets above or contact us.
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.).
- The ignition temperature of the hydraulic fluid used must be 50 K higher than the maximum surface temperature.
- **Bio-degradable and flame-resistant – containing water:** If components with galvanic zinc coating (e.g. version "J3" or "J5") or parts containing zinc are used, small amounts of dissolved zinc may get into the hydraulic system and cause accelerated aging of the hydraulic fluid. Zinc soap may form as a chemical reaction product, which may clog filters, nozzles and solenoid valves – particularly in connection with local heat input.
- **Flame-resistant – containing water**:
  - Due to increased cavitation tendency with HFC hydraulic fluids, the life cycle of the component may be reduced by up to 30 % as compared to the use with mineral oil HLP. In order to reduce the cavitation effect, it is recommended – if possible specific to the installation – to back up the return flow pressure in ports T to approx. 20 % of the pressure differential at the component.
  - Dependent on the hydraulic fluid used, the maximum ambient and hydraulic fluid temperature must not exceed 50 °C. In order to reduce the heat input into the component, the command value profile is to be adjusted for proportional and high-response valves.

Electric					
Sizes		NG	25	32	50
Supply voltage	▶ Nominal voltage	VDC	24		
	▶ Lower limit value	VDC	21		
	▶ Upper limit value	VDC	35		
Current consumption	▶ Maximum	A	1.8		
	▶ Impulse load	A	3		
Duty cycle		%	100		
Protection class according to EN 60529			IP65 (If suitable and correctly mounted mating connectors are used)		
Temperature drift main control spool		%/10 K	0.16	0.34	0.02

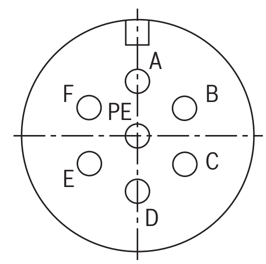
Electrical connections and assignment

Connector pin assignment

Pin 6 + PE	Signal	Interface assignment „A1“	Interface assignment „F1“
A	Supply voltage	24 VDC	
B		GND	
C	Reference potential actual value	Reference potential actual value	
D	Differential amplifier input	Command value ±10 V	Command value 4 ...20 mA
E		Reference potential command value	
F	Measuring output (actual value)	Actual value ±10 V	Actual value 4 ... 20 mA
PE		Functional ground (directly connected to the valve housing)	

Effect of the control:

- Version "A1"
  - Reference potential at pin E and positive command value at pin D causes volume flow P → A
  - Reference potential at pin E and negative command value at pin D causes volume flow A → T
- Version "F1"
  - Reference potential at pin E and signal 12 ... 20 mA at pin D causes volume flow P → A
  - Reference potential at pin E and signal 12 ... 4 mA at pin D causes volume flow A → T



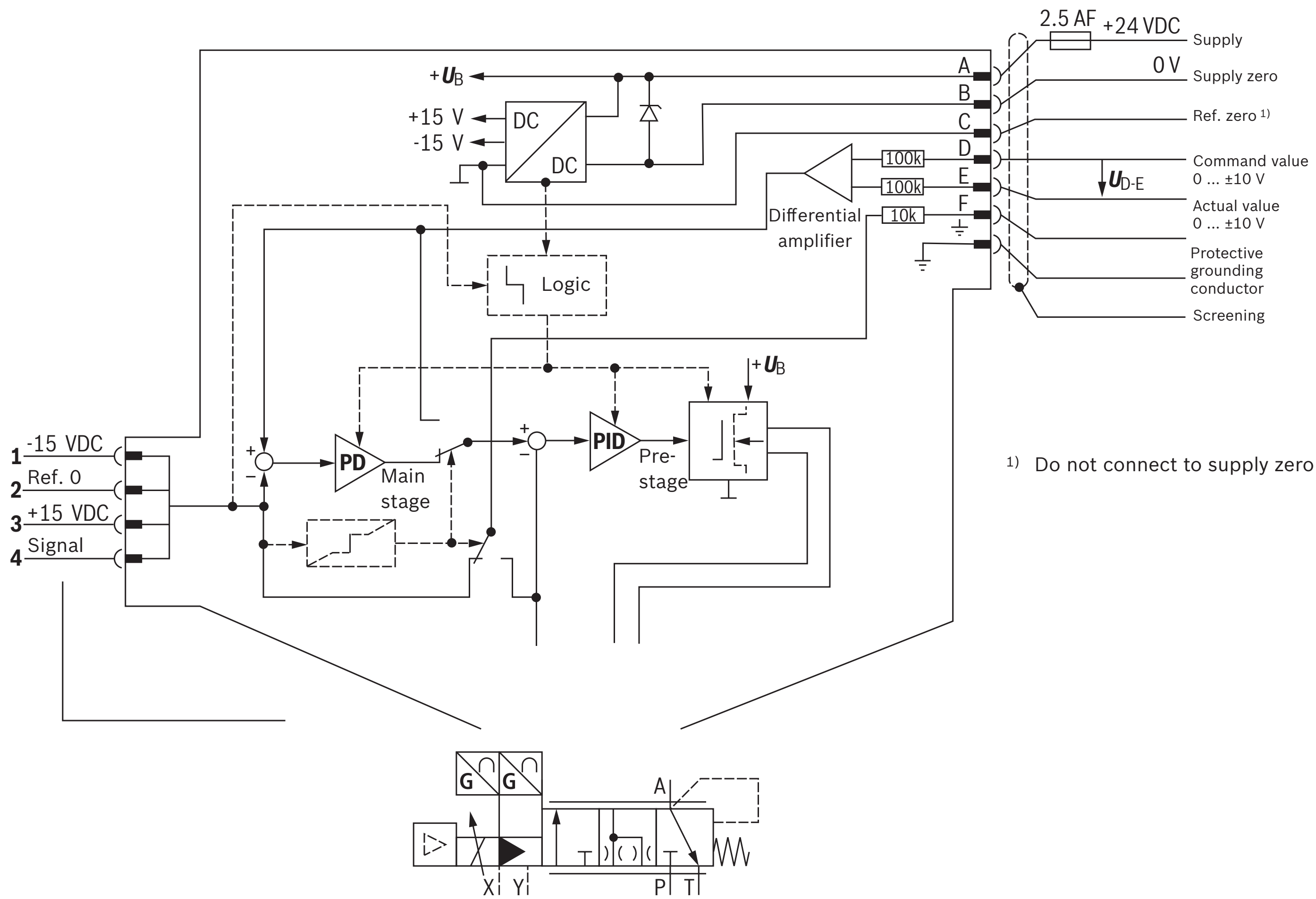
Recommendation connection cable:

- Up to 25 m – min 0.75 mm² per conductor
- Up to 50 m – min 1.5 mm² per conductor
- With shield braid (connect screening on one side of the supply zero of the power supply unit)
- Maximum external diameter 7 ... 11 mm

Notices:

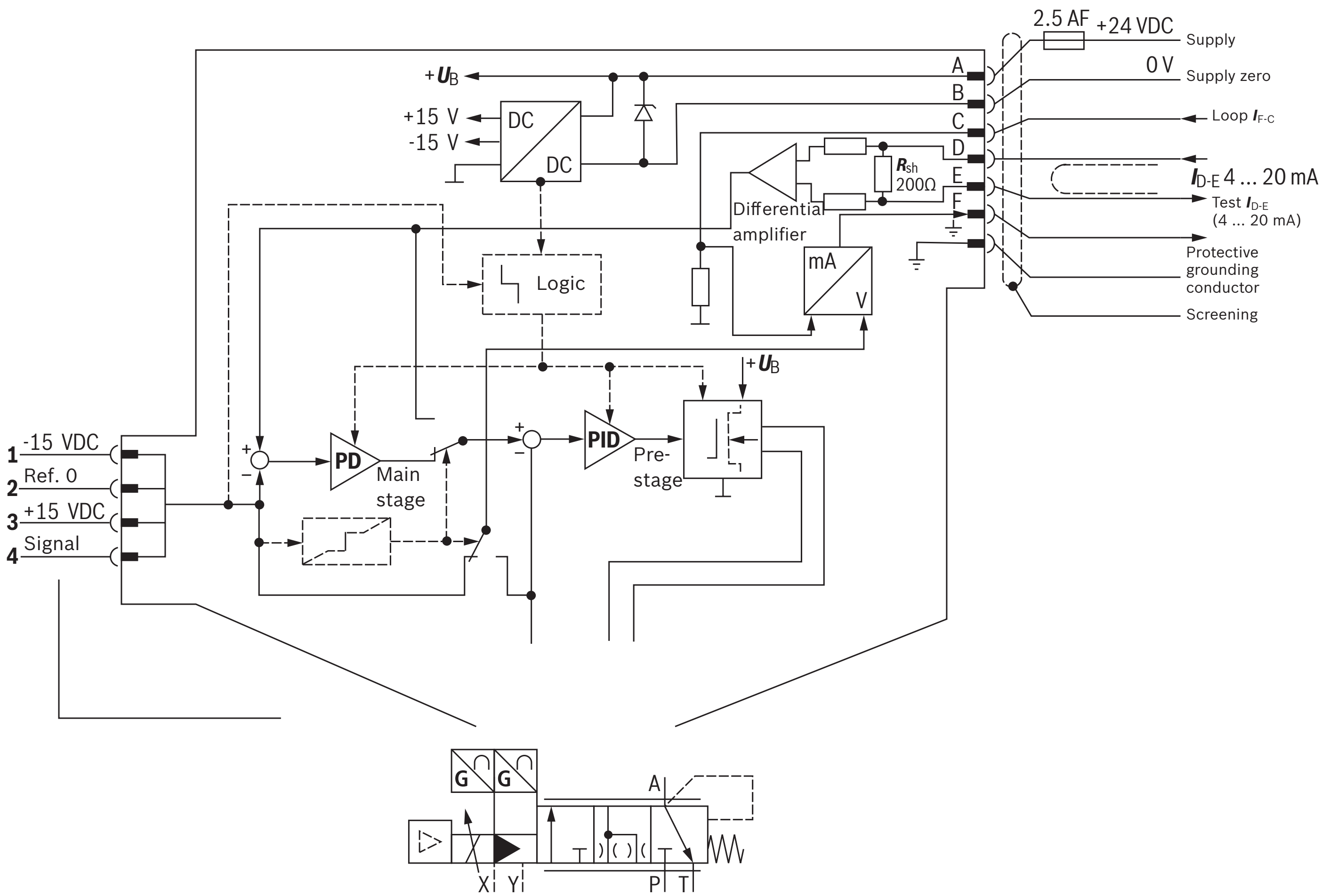
- Do not connect PE if the valve has already been grounded via the system.
- Mating connectors, separate order, see page 20 and data sheet 08008.

Block diagram/controller function block: Version "A1"



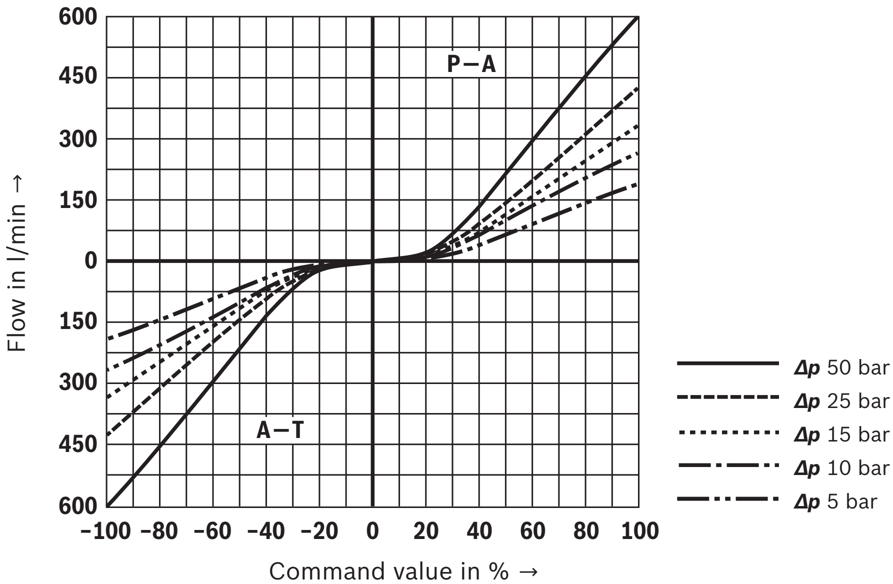
1) Do not connect to supply zero

Block diagram/controller function block: Version "F1"

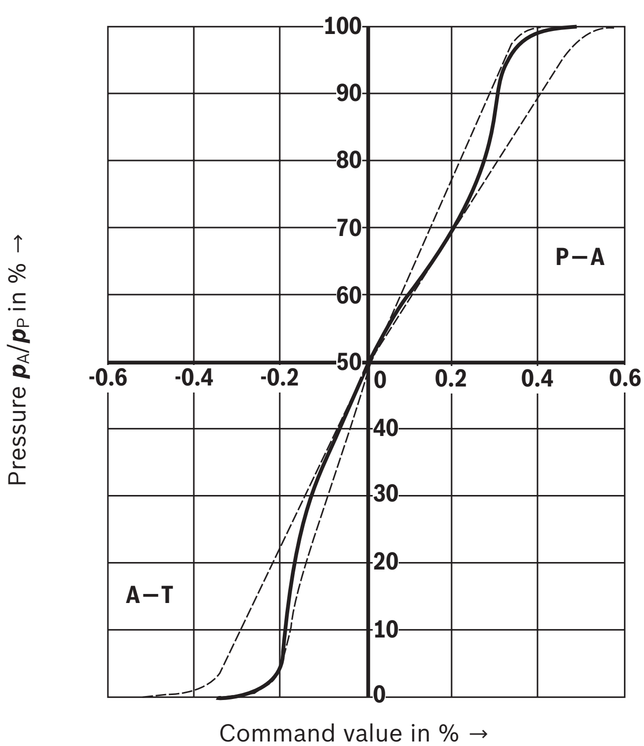


Characteristic curves: Size 25
(measured with HLP32, ϑ_{oil} = 40 ± 5 °C)

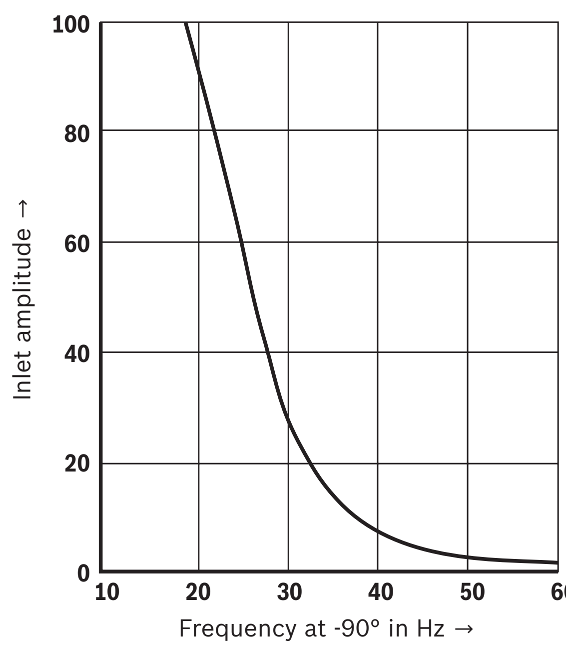
Rated flow



Pressure-signal function

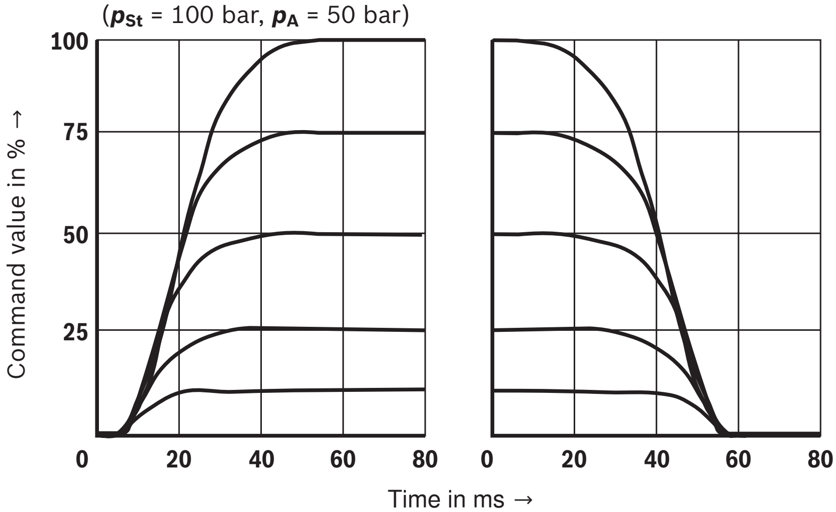


Dependent on the frequency response at -90°
(p_{St} = 100 bar, p_A = 50 bar)

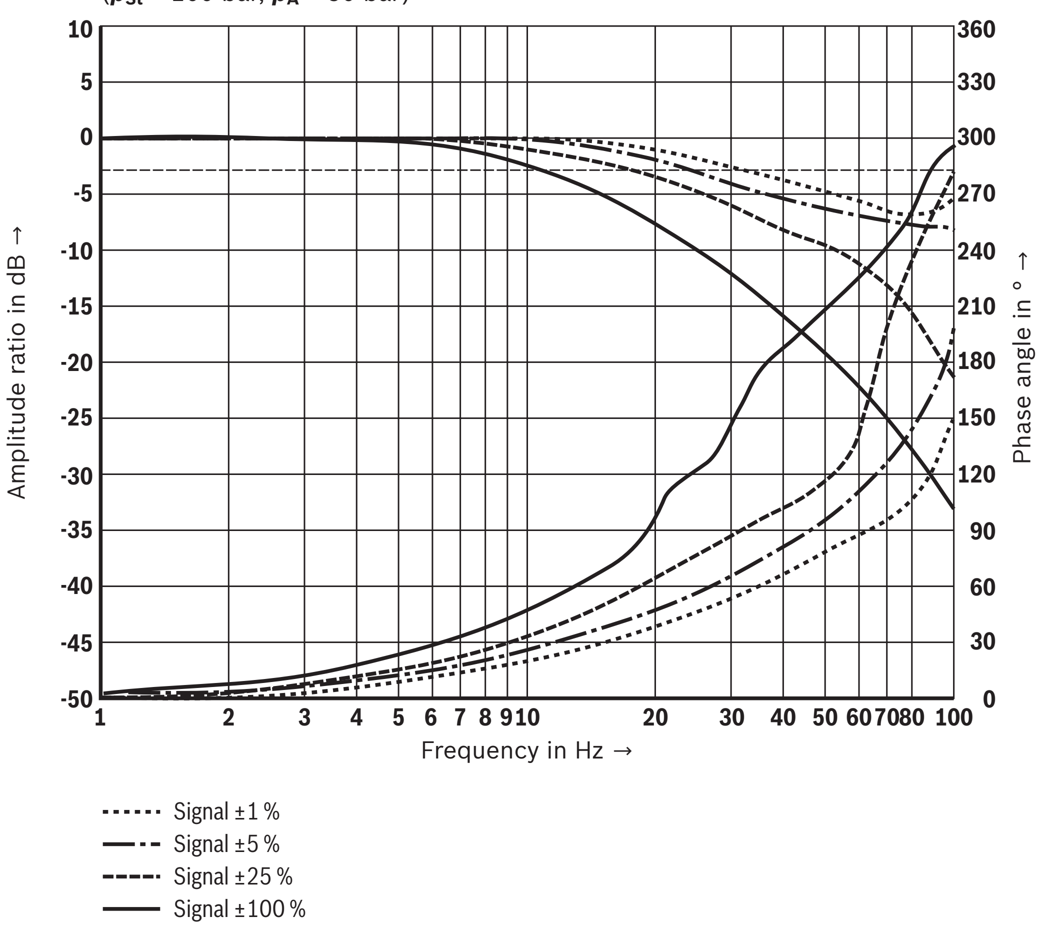


Characteristic curves: Size 25
(measured with HLP32, ϑ_{oil} = 40 ± 5 °C)

Transition function with stepped electric input signal
(p_{St} = 100 bar, p_A = 50 bar)

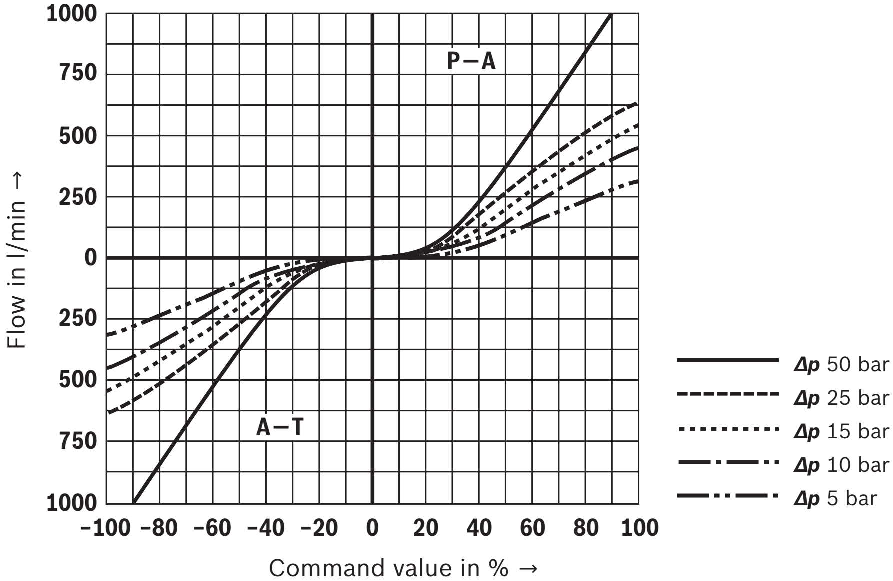


Frequency response
(p_{St} = 100 bar, p_A = 50 bar)

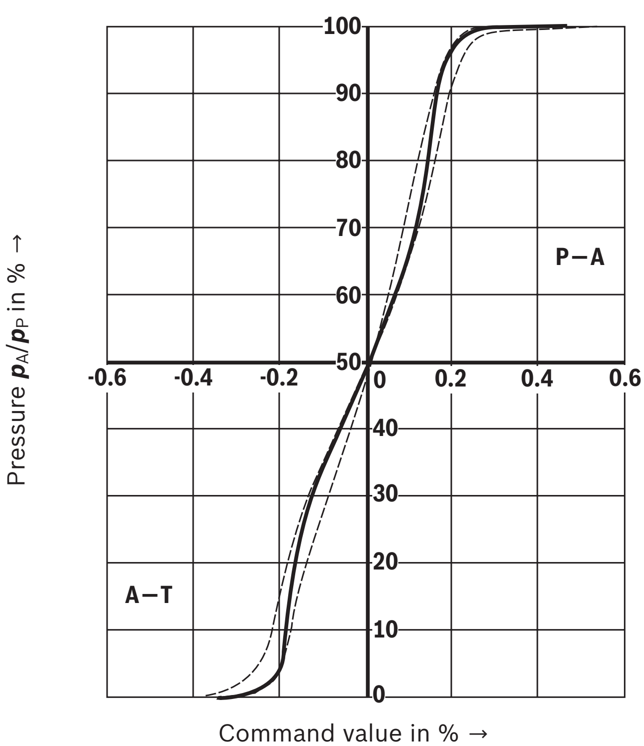


Characteristic curves: Size 32
(measured with HLP32, ϑ_{oil} = 40 ± 5 °C)

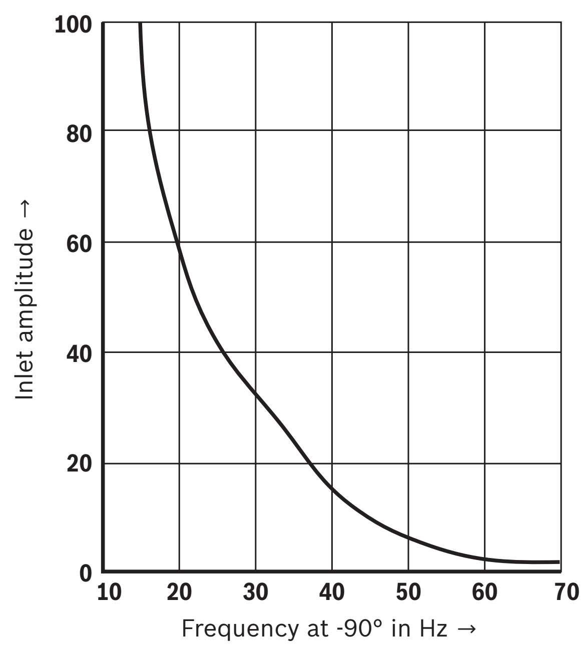
Rated flow



Pressure-signal function

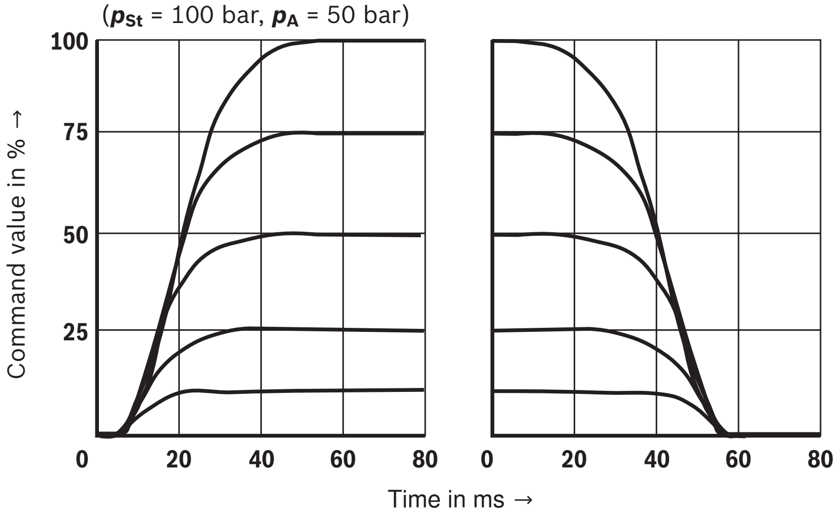


Dependent on the frequency response at -90°
(p_{St} = 100 bar, p_A = 50 bar)

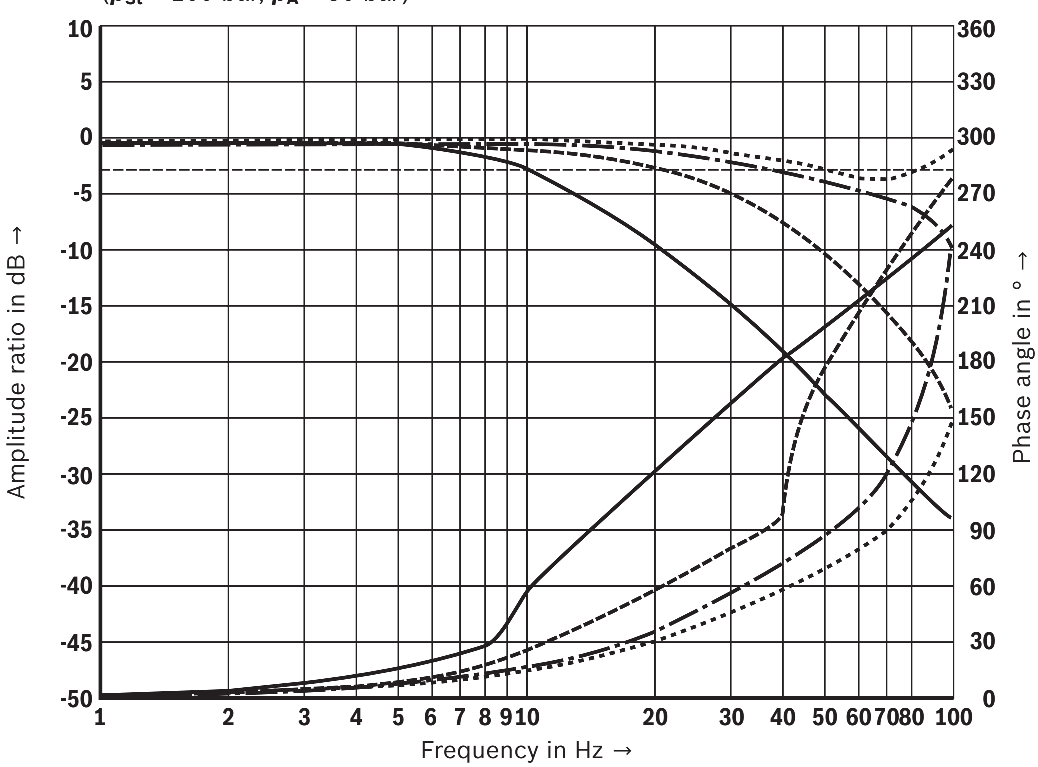


Characteristic curves: Size 32
(measured with HLP32, ϑ_{oil} = 40 ± 5 °C)

Transition function with stepped electric input signal
(p_{St} = 100 bar, p_A = 50 bar)



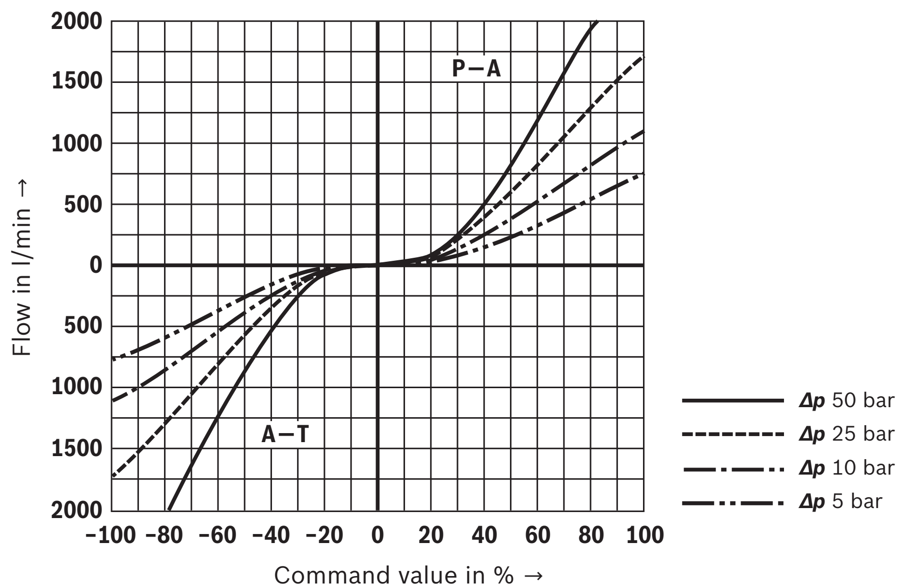
Frequency response
(p_{St} = 100 bar, p_A = 50 bar)



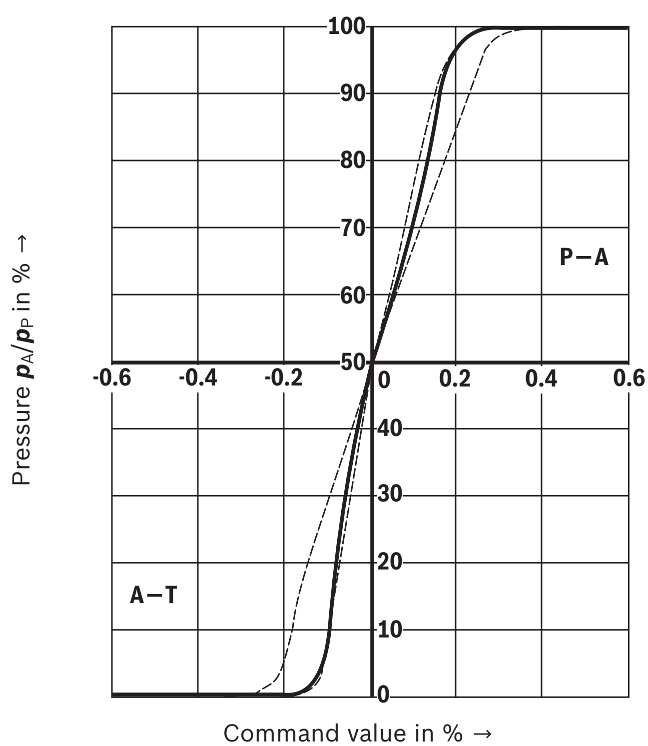
Signal ±1 %
Signal ±5 %
Signal ±25 %
Signal ±100 %

Characteristic curves: Size 50
(measured with HLP32, ϑ_{oil} = 40 ± 5 °C)

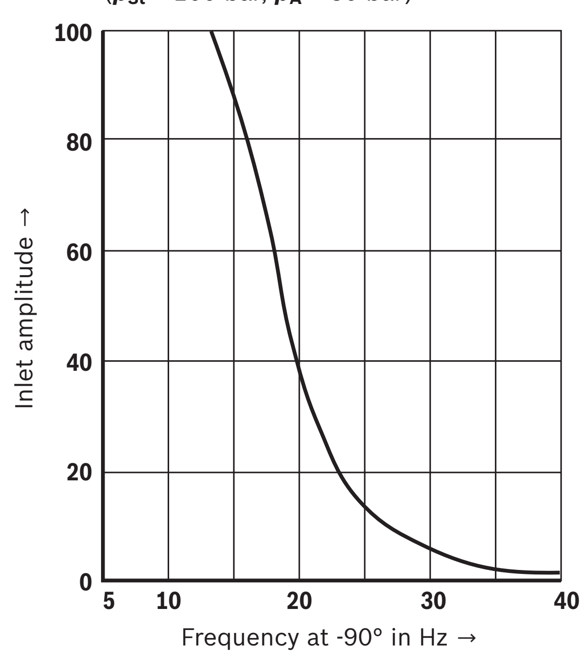
Rated flow



Pressure-signal function

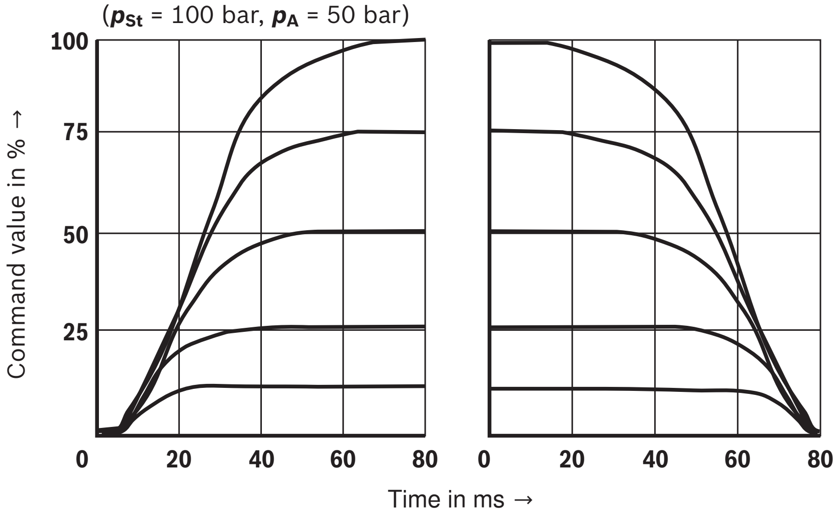


Dependent on the frequency response at -90°
(p_{St} = 100 bar, p_A = 50 bar)

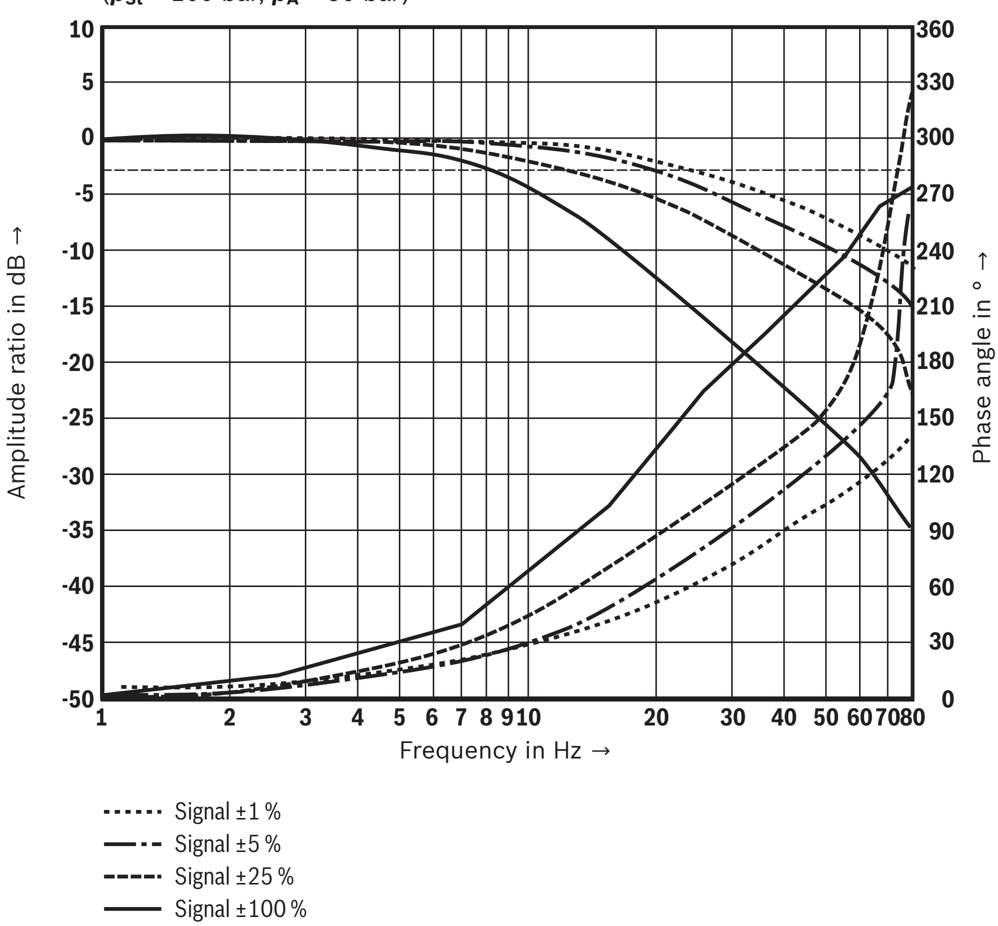


Characteristic curves: Size 50
(measured with HLP32, ϑ_{oil} = 40 ± 5 °C)

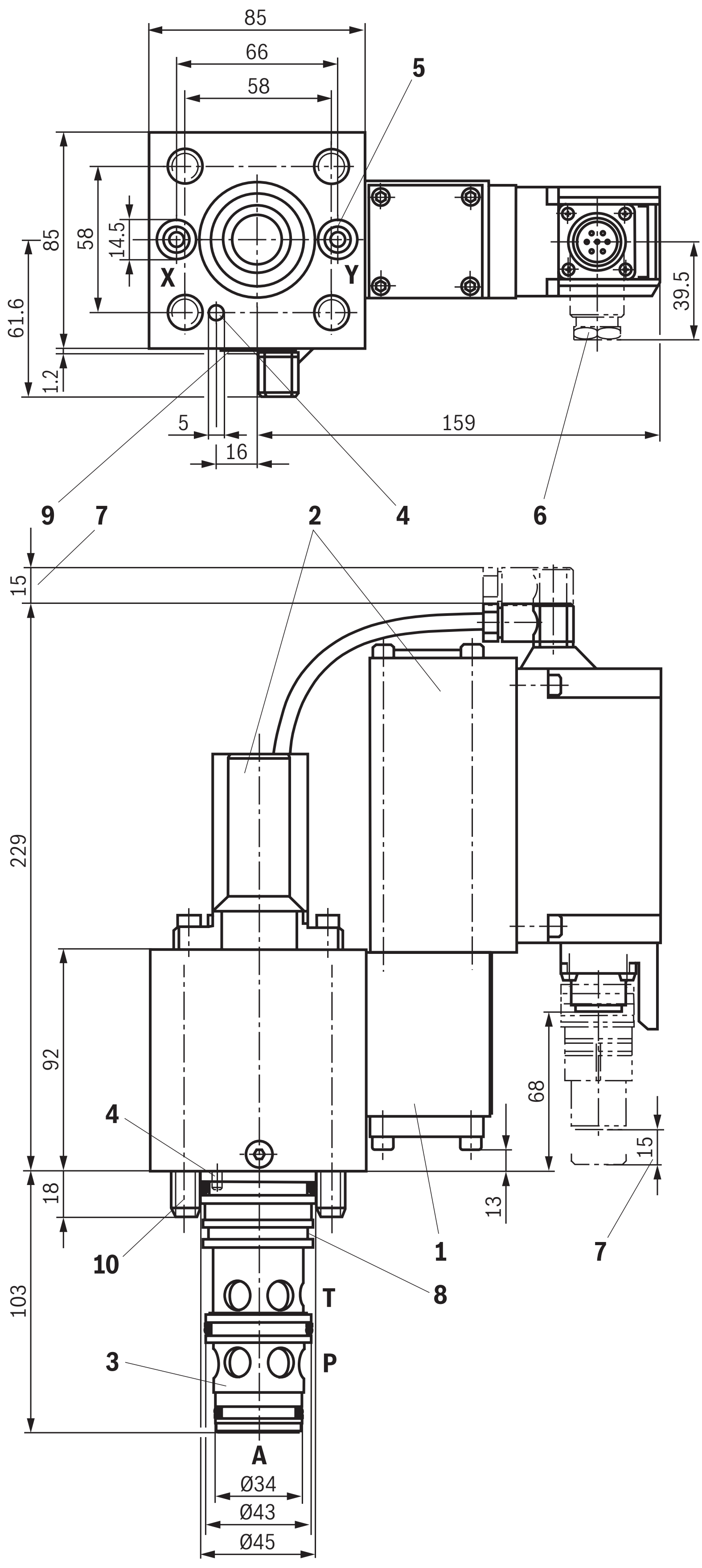
Transition function with stepped electric input signal
(p_{St} = 100 bar, p_A = 50 bar)



Frequency response
(p_{St} = 100 bar, p_A = 50 bar)

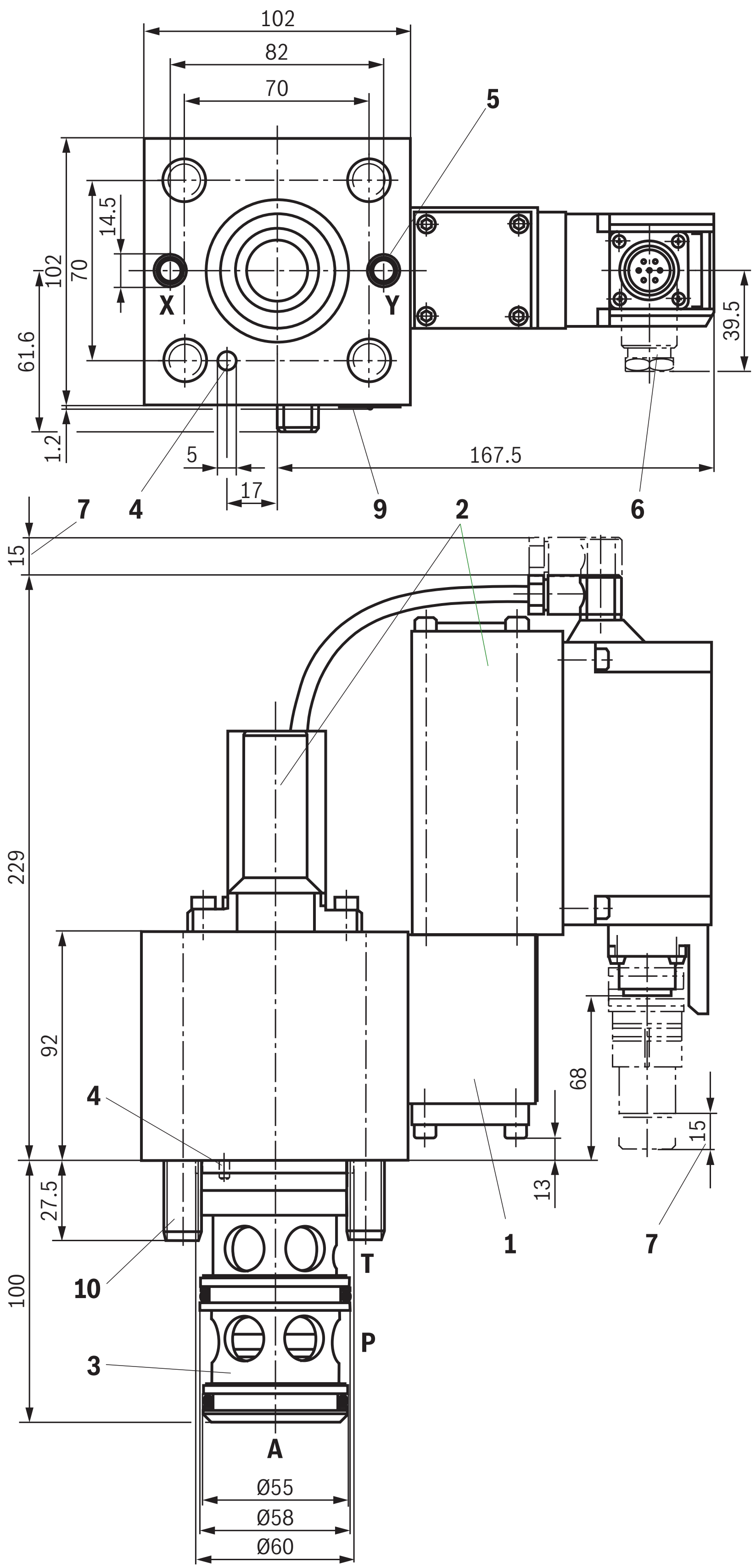


Dimensions: Size 25
(dimensions in mm)



1 Pilot control valve with integrated electronics (OBE)
2 Position transducer pilot control and main stage
3 Bushing
4 Locating pin
5 Identical seal rings for ports X and Y
6 Mating connector (separate order, see page 20)
7 Space required for removing the mating connector
8 No seal admissible
9 Name plate
10 Valve mounting screws (included in the scope of delivery), see page 20

Dimensions: Size 32
(dimensions in mm)



1 Pilot control valve with integrated electronics (OBE)

2 Position transducer pilot control and main stage

3 Bushing

4 Locating pin

5 Identical seal rings for ports X and Y

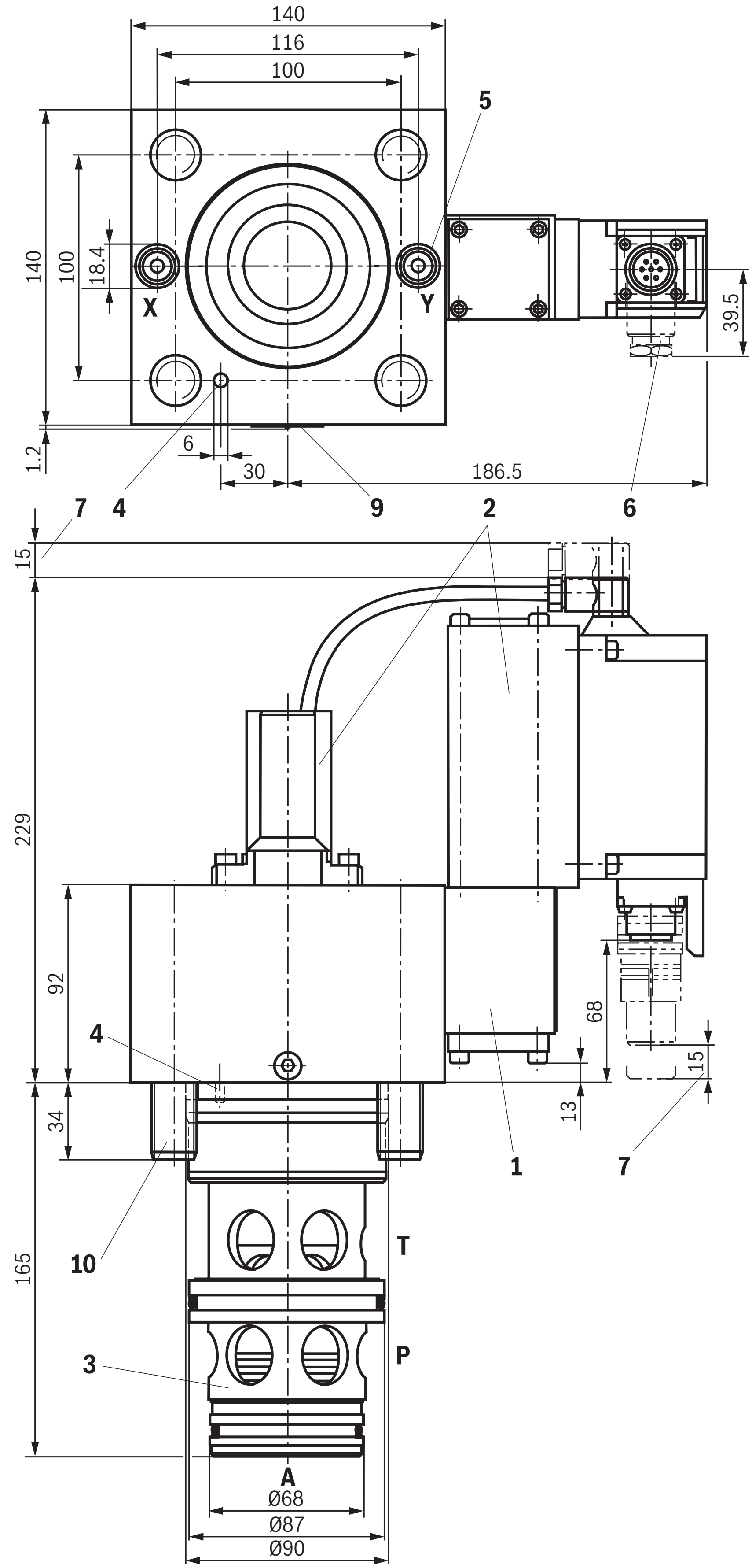
6 Mating connector (separate order, see page 20)

7 Space required for removing the mating connector

9 Name plate

10 Valve mounting screws (included in the scope of delivery), see page 20

Dimensions: Size 50
(dimensions in mm)



1 Pilot control valve with integrated electronics (OBE)

2 Position transducer pilot control and main stage

3 Bushing

4 Locating pin

5 Identical seal rings for ports X and Y

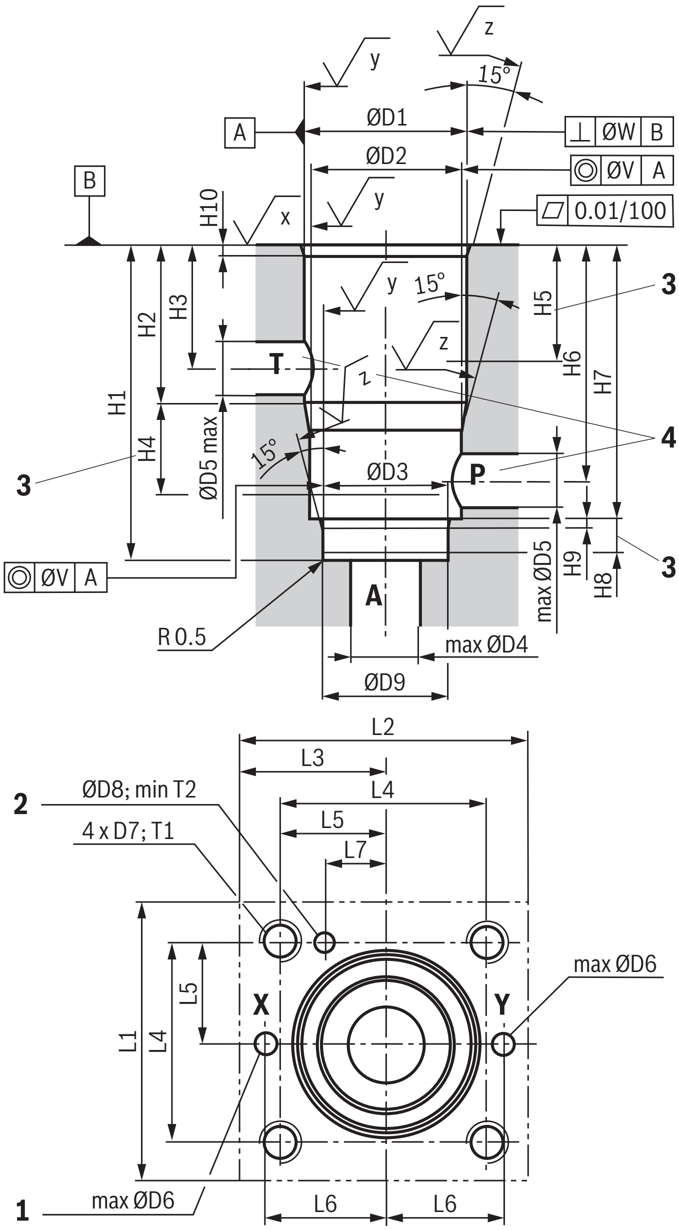
6 Mating connector (separate order, see page 20)

7 Space required for removing the mating connector

9 Name plate

10 Valve mounting screws (included in the scope of delivery), see page 20

Installation bore
(dimensions in mm)



√x = √Rzmax 4

√y = √Rzmax 8

√z = √Rz 16

NG	25	32	50
L1	85	102	140
L2	85	102	140
L3	42.5	51	70
L4$^{\pm 0.2}$	58	70	100
L5$^{\pm 0.1}$	29	35	50
L6$^{\pm 0.2}$	33	41	58
L7$^{\pm 0.2}$	16	17	30
H1$^{+0.1}$	103	100	165
H2	56	43.5	87
H3	45	30	66
H4	15	16	40
H5	15	18	20
H6$^{\pm 0.3}$	78	70.5	122
H7$^{+0.3}$	89	85	143
H8	11.5	13.5	18
H9	2.5	3	3
H10	2.5	2.5	4
ØD1H7Ⓔ	45	60	90
ØD2H7Ⓔ	43	58	87
ØD3H7Ⓔ	34	55	68
max. ØD4	20	30	35
max. ØD5	20	24	35
max. ØD6	6	8	10
D7	M12	M16	M20
ØD8H13	6	6	8
ØD9$^{+0.2}$	33.7	54.7	67.7
T1	25	35	45
min. T2	10	10	10
V	0.03	0.03	0.03
W	0.05	0.1	0.1

Tolerances according to: General tolerances ISO 2768-mK

Valve mounting screws see page 20.

1. Connect port X to port P or connect externally
2. Bore for locating pin
3. Depth of fit
4. The ports P and T can be positioned around the central axis of port A. However, it must be observed that the mounting bores and the control bores are not damaged.

Accessories

Valve mounting screws (included in the scope of delivery)

Size	Quantity	Hexagon socket head cap screws	Material number
25	4	**ISO 4762 - M12 x 35 -10.9-flZn-240h-L** Friction coefficient μ_{total} = 0.09 ... 0.14; tightening torque M_A = 110 Nm ±10%	–
32	4	**ISO 4762 - M16 x 50 - 10.9-flZn/nc/480h/C** Friction coefficient μ_{total} = 0.09 ... 0.14; tightening torque M_A = 250 Nm ±10%	–
50	4	**ISO 4762 - M20 x 70 -10.9-flZn-240h-L** Friction coefficient μ_{total} = 0.09 ... 0.14; tightening torque M_A = 540 Nm ±10%	–

Mating connectors and cable sets (separate order)

Item [1]	Designation	Version	Short designation	Material number	Data sheet
6	Mating connectors; for valves with installed electronics (OBE)	6P+PE, angled, plastic, PG 11, crimp technology	–	**1834484252**	08008

[1] See dimensions page 16 ... 18.

Further information

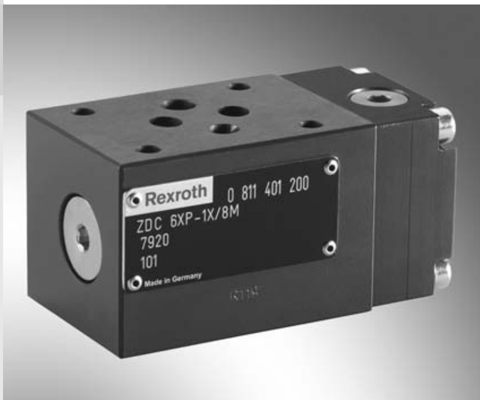
- Hydraulic fluids on mineral oil basis — Data sheet 90220
- Environmentally compatible hydraulic fluids — Data sheet 90221
- Flame-resistant, water-free hydraulic fluids — Data sheet 90222
- Flame-resistant hydraulic fluids - containing water (HFAE, HFAS, HFB, HFC) — Data sheet 90223
- Mating connectors for controlling electrically operated valves and sensors — Data sheet 08008
- Hydraulic valves for industrial applications — Operating instructions 07600-B
- Selection of filters
- Information on available spare parts

Rexroth
Bosch Group

Supply pressure compensator, direct operated

Type ZDC

Size 6
Component series 1X
Maximum operating pressure 250 bar
Maximum flow 35 l/min



H7870

Table of contents

Contents	Page

Features

– Sandwich plate valve
– Porting pattern according to DIN 24340 form A
– Load compensation in channel P → A or P → B by installed shuttle valve
– 2-way version "P"
– Flow control in case of interaction with proportional directional valve

Ordering code

Z	DC	6	X	P – 1X /		M		*

Sandwich plate valve

Supply pressure compensator

Size 6 **= 6**

Porting pattern according to DIN 24340 form A **= X**

Load compensation in channel P **= P**
Load compensation in channel A **= A**

Component series 10 to 19 **= 1X**
(10 to 19: Unchanged installation and connection dimensions)

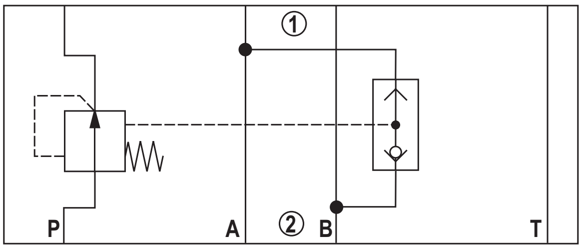
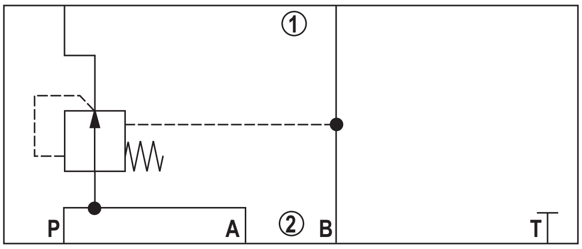
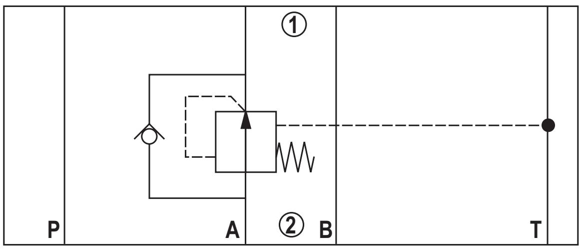
Preferred types and standard units are contained in the EPS (standard price list).

Further details in the plain text

No code = No special version
Possible special versions see below

Seal material
M = NBR seals
(other seals upon request)
Attention!
Observe compatibility of seals with hydraulic fluid used!

Pressure differential
8 = 8 bar
14 = 14 bar
25 = 25 bar

Symbols (① = component side, ② = plate side)	Ordering code: Load compensation in channel	Ordering code: Pressure differential	Ordering code: Special version	Material no.
	P	8	–	0811401200
	P	14	–	0811401208
	P	25	-291 Special setting with directional valve type 4WRPE [1]; flow Δp 100 bar > 33 l/min	R901140492
	P	8	-287 Closed-loop control in P component-side; supply optionally A or P; pilot pressure from B	0811401201
	A	8	-292 Flow in A; pilot pressure from T	0811401202

[1] Material no. 0811404618

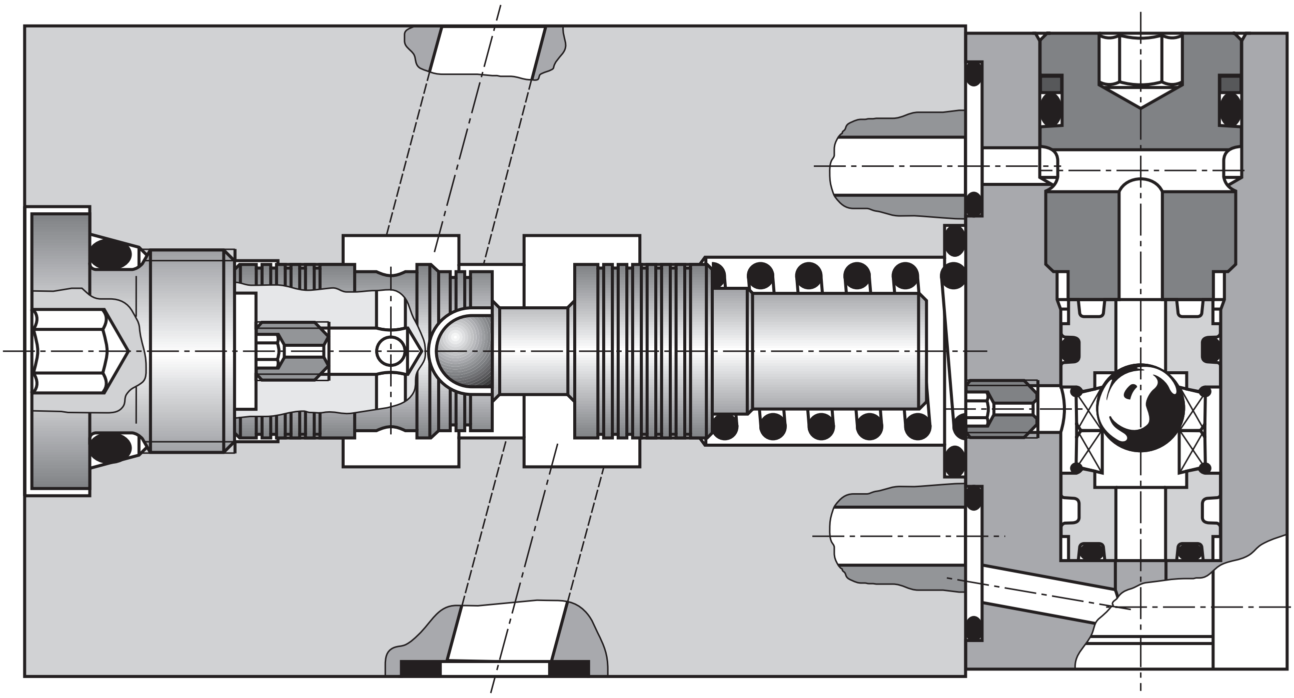
Function, section

Valves of type ZDC are direct operated supply pressure compensators in 2-way design.

As with all throttle cross-sections, the flow of proportional throttle valves and directional valves depends on the pressure differential Δ***p***.

The effect of a load-compensated, electrical flow control valve results from the combination of throttle valve (measurement throttle) and pressure compensator which keeps the pressure differential Δ***p*** at the measurement throttle constant. The pressure differential is determined by the pressure compensator spring and depending on the select design ranges between 8 and 25 bar

The combination of a proportional directional valve with a pressure compensator results in the effect of a flow control valve for 2 directions. The changing load pressure is to be scanned via a shuttle valve. If pulling loads result during deceleration of mass, backpressure valves are to be provided.



Technical data (For applications outside these parameters, please consult us!)

general

Weight	kg	1.5
Installation position		Any

hydraulic

Maximum operating pressure	bar	250
Maximum flow	l/min	35 (depending on the pressure differential)
Hydraulic fluid		See table below
Hydraulic fluid temperature range	°C	–20 to +70
Viscosity range	mm^2/s	15 to 380
Maximum permitted degree of contamination of the hydraulic fluid - cleanliness class according to ISO 4406 (c)		Class 20/18/15 [1)]

Hydraulic fluid	Classification	Suitable sealing materials	Standards
Mineral oils and related hydrocarbons	HL, HLP, HLPD, HVLP, HVLPD	NBR	DIN 51524

☞ **Important Information on hydraulic fluids!**

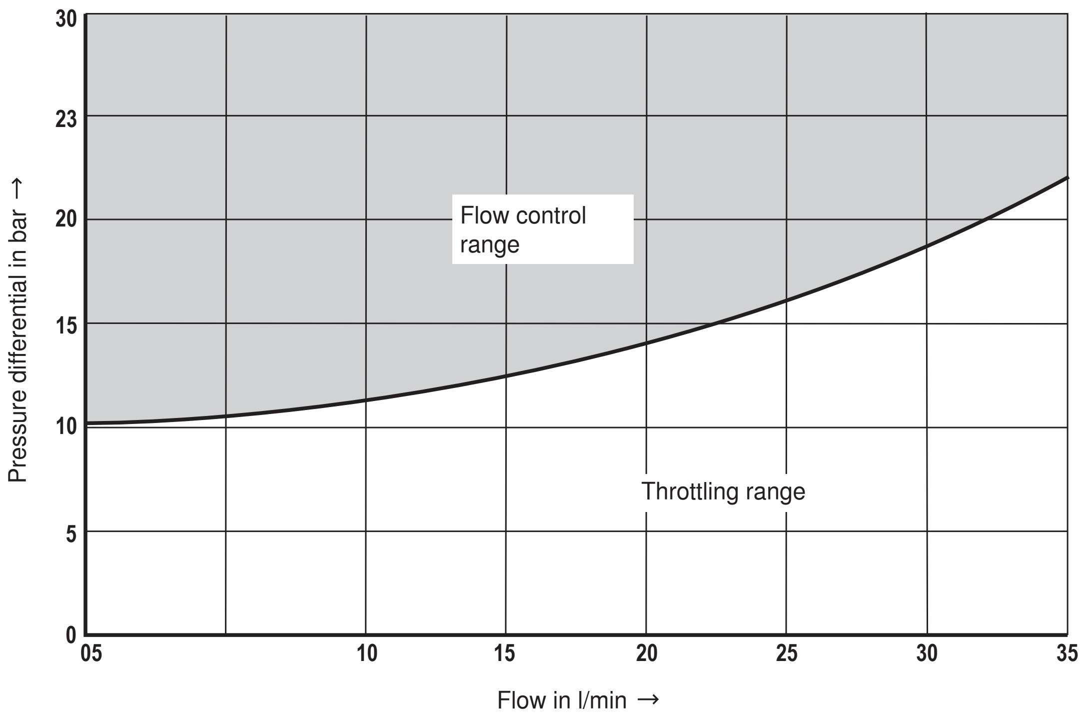
– For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!

– There may be limitations regarding the technical valve data (temperature, pressure range, service life, maintenance intervals, etc.)!

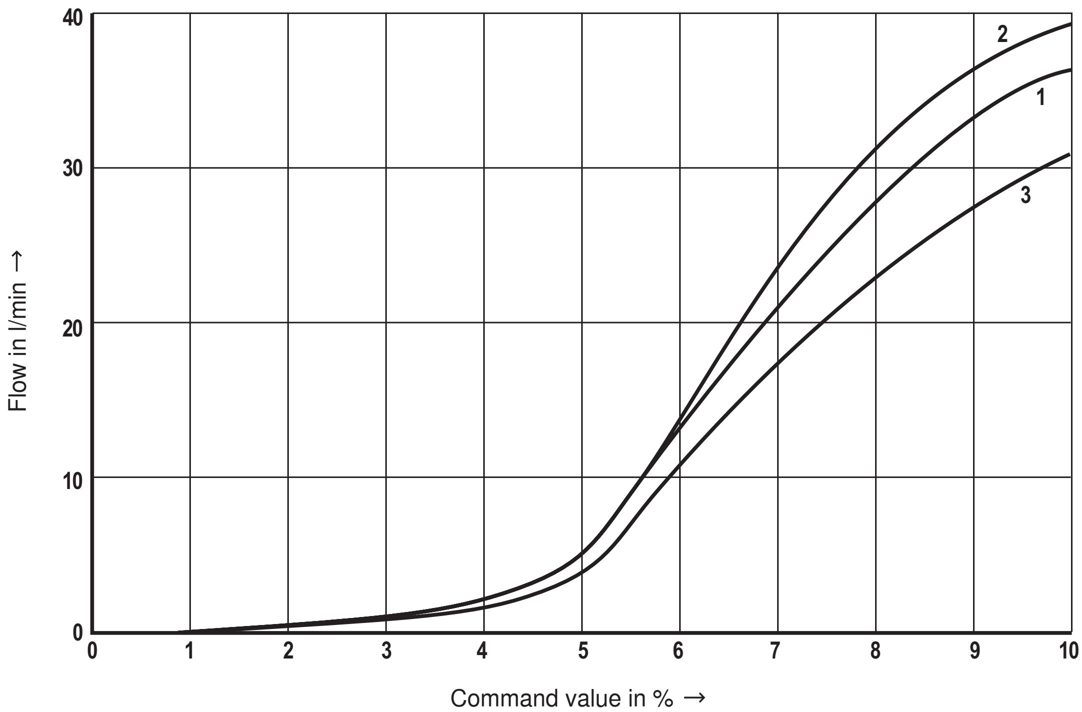
[1)] The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the service life of the components.

Characteristic curves (measured with HLP46 and ϑ_{oil} = 40 °C ± 5 °C)

Flow control P to A, P to B



Pressure differential $\Delta \boldsymbol{p}_{min} = \boldsymbol{p}_{Pump} - \boldsymbol{p}_{Load}$



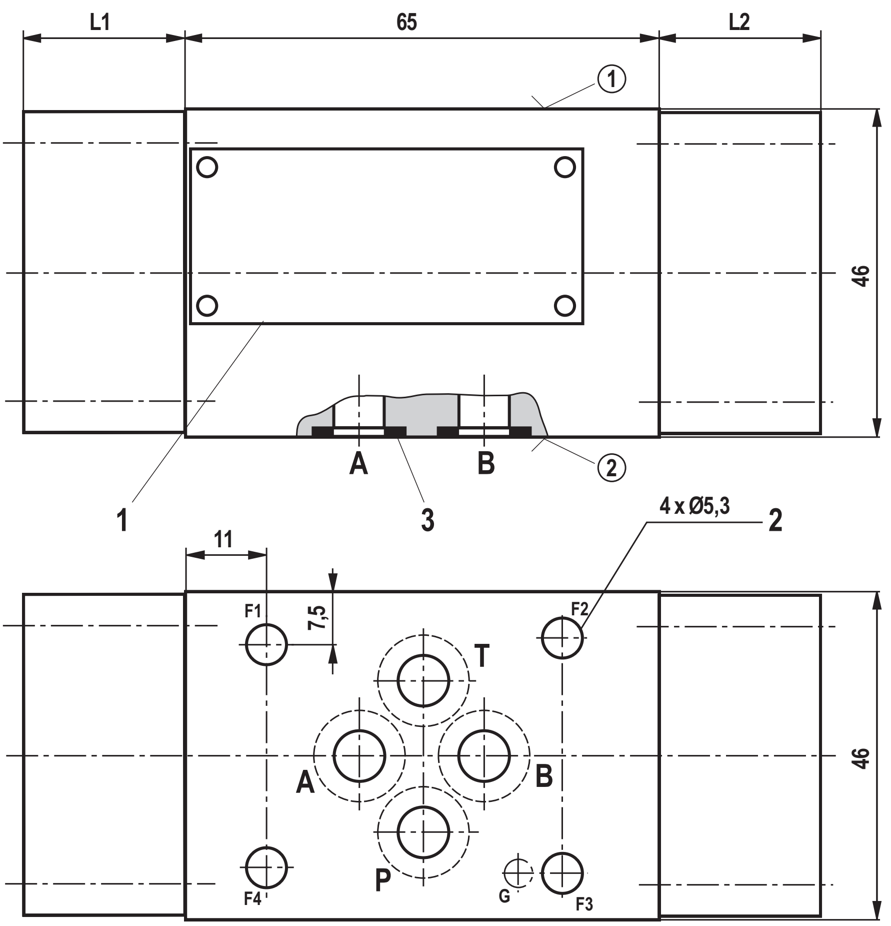
Characteristic curves measured with directional control valve type 4WRPE 6 ...

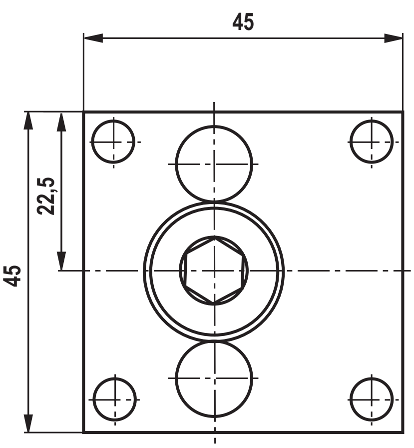
1 Version "8M"

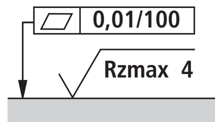
2 Version "14M"

3 Version "25M-291"

Unit dimensions (dimensions in mm)







Required surface quality of the valve mounting face

① Component side – porting pattern according to DIN 24340 form A

② Plate side – porting pattern according to DIN 24340 form A

1 Name plate

2 Valve mounting bores

3 Identical seal rings for ports A, B, P, T

Valve mounting screws (separate order)

4 hexagon socket head cap screws ISO 4762 - M5 - 10.9

☞ **Notice!**

Length and tightening torque of the valve mounting screws must be calculated according to the components mounted under and over the sandwich plate valve.

Meter-in pressure compensator, direct operated

RE 29224/11.07
Replaces: 02.03

Type ZDC

Sizes 10 to 32
Component series 2X
Maximum operating pressure 350 bar
Maximum flow 520 l/min

tb0217

Table of contents

Content	**Page**

Features

- Sandwich plate valve
- Porting pattern to ISO 4401
- Load compensation in channel P → A or P → B by integrated shuttle valve
- 2-way design “P“
- 3-way design “PT“ (sizes 10 to 25)
- Flow control in interaction with proportional directional valve

Ordering code

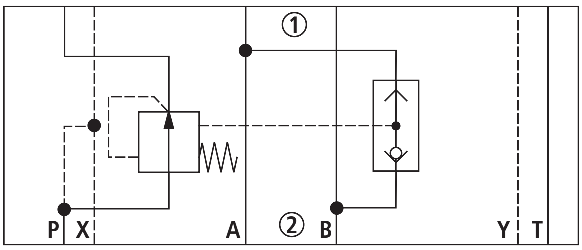
ZDC		–2X/			*

Size 10	**= 10**
Size 16	**= 16**
Size 25	**= 25**
Size 32 (variant “P“ only)	**= 32**
2-way design (pressure reducing function)	**= P**
3-way design (pressure relief function)	**= PT**
Component series 20 to 29 (20 to 29: unchanged installation and connection dimensions)	**= 2X**
Pilot oil supply “internal”	**= No code**
Pilot oil supply “external	**= X**
Pilot oil supply external, port X on component side plugged (size 10 only)	**= XL**
No code =	Without special type of protection
J =	Seawater-resistant
Seal material	
M =	NBR seals
V =	FKM seals
	(other seals on request)
	⚠ Attention! Observe compatibility of seals with hydraulic fluid used!
Further details in clear text	*

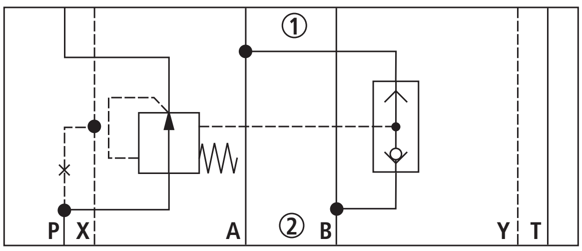
Standard types and components can be found in the EPS (standard price list).

Symbols: 2-way design “P“ (① = component side, ② = plate side)

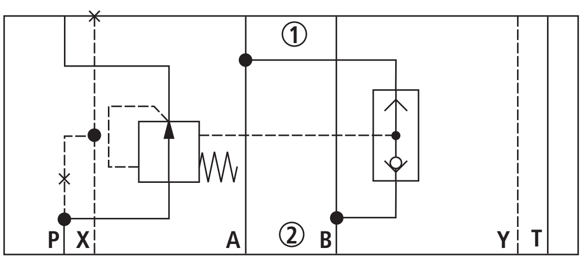
Pilot oil supply “internal“
Type ZDC . P-2X/…



Pilot oil supply “external“
Type ZDC . P-2X/**X**…

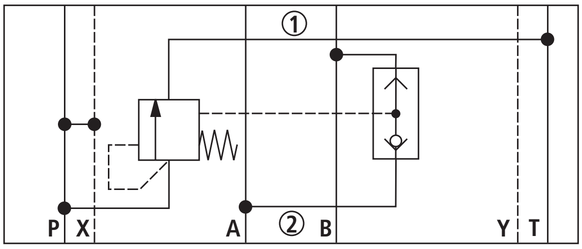


Pilot oil supply “external“,
port X on component side plugged (size 10 only)
Type ZDC 10 P-2X/**XL**…

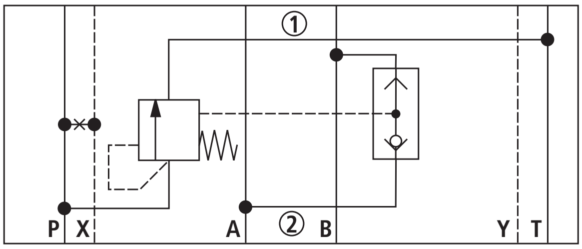


Symbols: 3-way design “PT“ (① = component side, ② = plate side)

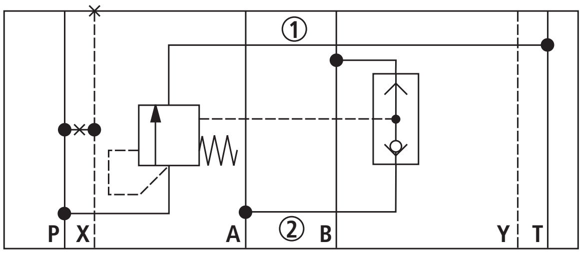
Pilot oil supply “internal“
Type ZDC . PT-2X/…



Pilot oil supply “external“
Type ZDC . PT-2X/**X**…



Pilot oil supply “external“,
port X on component side plugged (size 10 only)
Type ZDC 10 PT-2X/**XL**…



Function, section

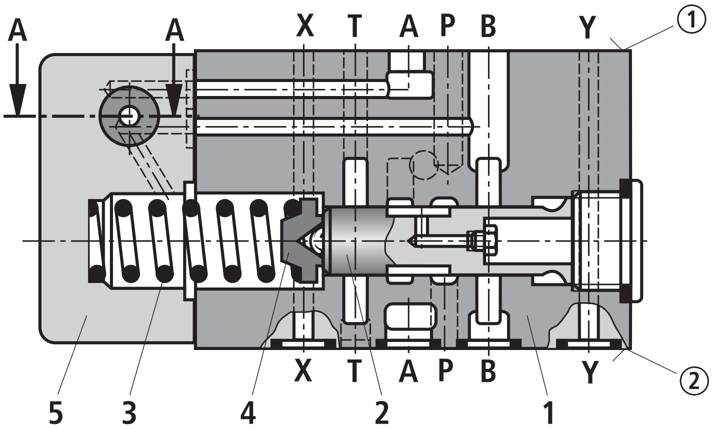
Valves of type ZDC are direct operated meter-in pressure compensators of 2- or 3-way design.

They are used for load compensation as meter-in pressure compensator in channel P.

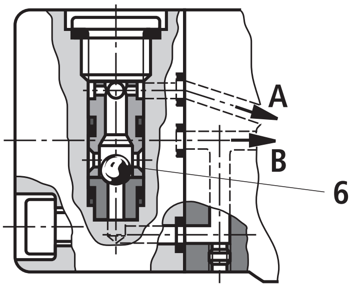
These valves basically consist of housing (1), control spool (2), compression spring (3) with spring plate (4), and cover (5) with integrated shuttle valve (6).

Compression spring (3) holds control spool (2) in the open position from P2 to P1, when pressure differential P1 → A1 or P1 → B1 is less than 10 bar.

When the pressure differential exceeds 10 bar, control spool (2) is pushed to the left until the pressure differential is restored.



Section A–A



Technical data (for applications outside these parameters, please consult us!)

General

Size		Size	**10**	**16**	**25**	**32**
Weight		kg	3.0	3.5	8.9	64.7
Installation position			Optional			

Hydraulic

Maximum operating pressure	– Ports A, B, P	bar	350			
	– Port T	bar	250			
	– Port X	bar	30 to 100			
	– Port Y	bar	150; up to 30 bar in conjunction with pilot operated proportional directional valve			
Maximum flow		l/min	85	150	325	520
Hydraulic fluid			Mineral oil (HL, HLP) to DIN 51524 [1]; fast bio-degradable hydraulic fluids to VDMA 24568 (see also RE 90221); HETG (rape seed oil) [1]; HEPG (polyglycols) [2]; HEES (synthetic esters) [2]; other hydraulic fluids on request			
Hydraulic fluid temperature range		°C	–20 to +70			
Viscosity range		mm^2/s	15 to 380			
Permissible max. degree of contamination of the hydraulic fluid - cleanliness class to ISO 4406 (c)			Class 20/18/15 [3]			

[1] Suitable for NBR and FKM seals

[2] Suitable only for FKM seals

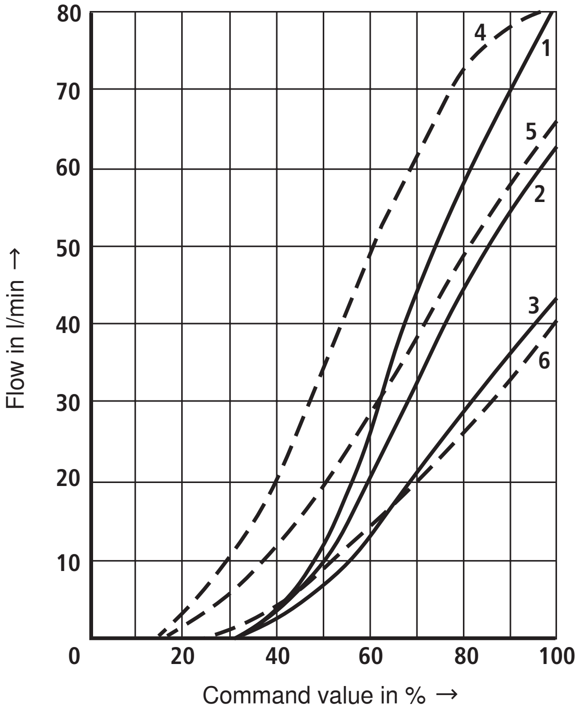
[3] The cleanliness classes specified for components must be adhered to in hydraulic systems. Effective filtration prevents malfunction and, at the same time, prolongs the service life of components.

For the selection of filters, see data sheets RE 50070, RE 50076, RE 50081, RE 50086, RE 50087 and RE 50088.

Characteristic curves (measured with HLP46 and ϑ_{oil} = 40 °C ±5 °C)

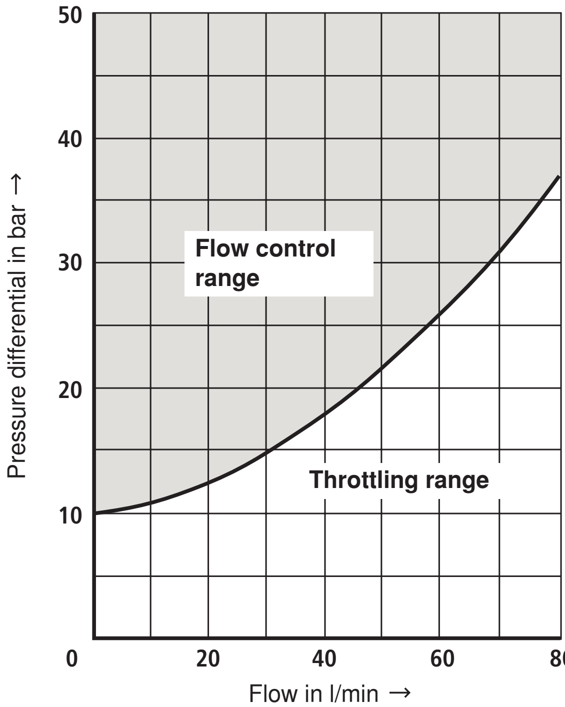
Flow control P to A, P to B

Size 10



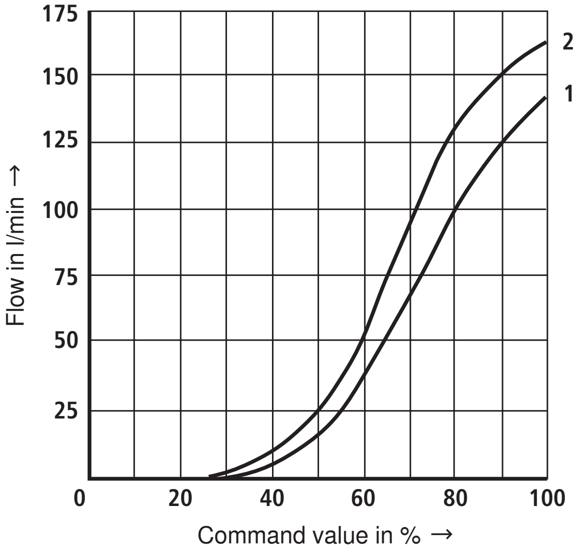
1 With type 4WRZ 10…85…
2 With type 4WRZ 10…50…
3 With type 4WRZ 10…25…
4 With type 4WRZ 10…64…
5 With type 4WRZ 10…32…
6 With type 4WRZ 10…16…

Size 10



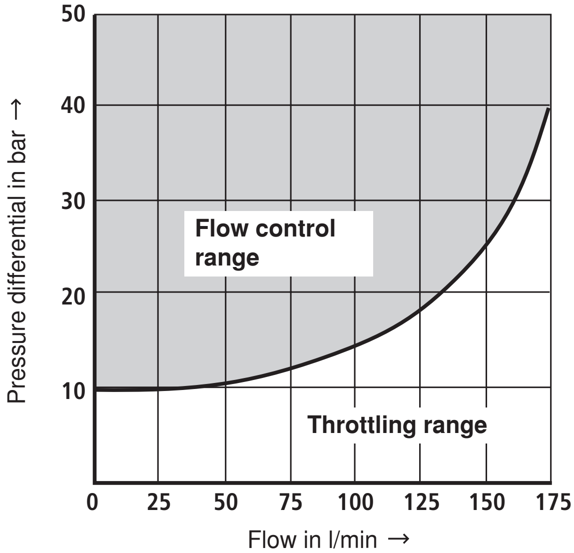
Pressure differential $\Delta \boldsymbol{p}_{min} = \boldsymbol{p}_{pump} - \boldsymbol{p}_{load}$

Size 16



1 With type 4 WRZ 16…100…
2 With type 4 WRZ 16…150…

Size 16

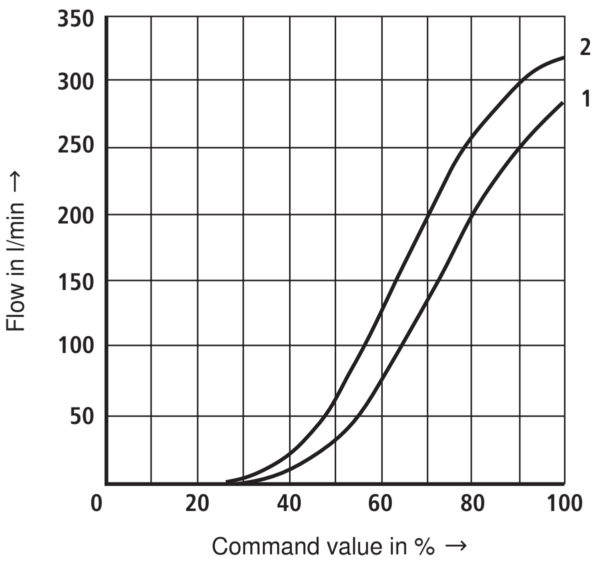


Pressure differential $\Delta \boldsymbol{p}_{min} = \boldsymbol{p}_{pump} - \boldsymbol{p}_{load}$

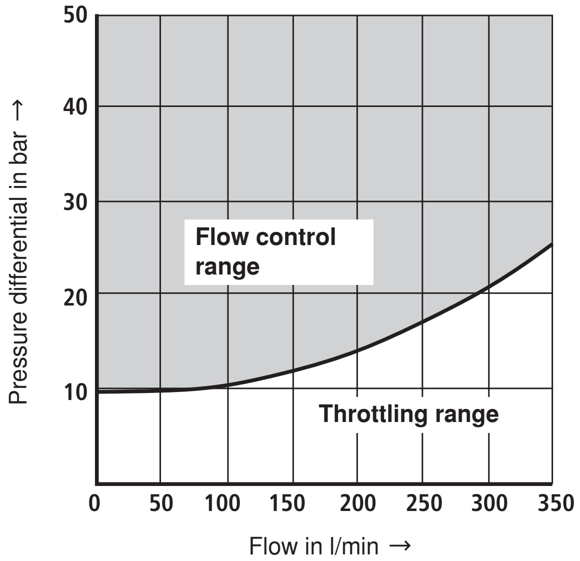
Characteristic curves (measured with HLP46 and ϑ_{oil} = 40 °C ±5 °C)

Flow control P to A, P to B

Size 25



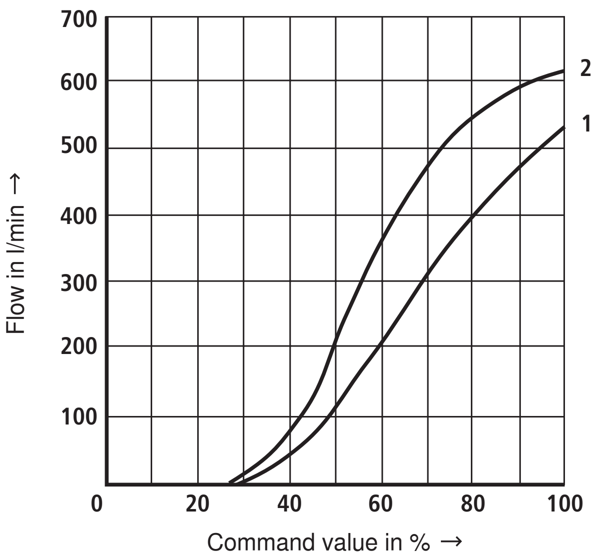
Size 25



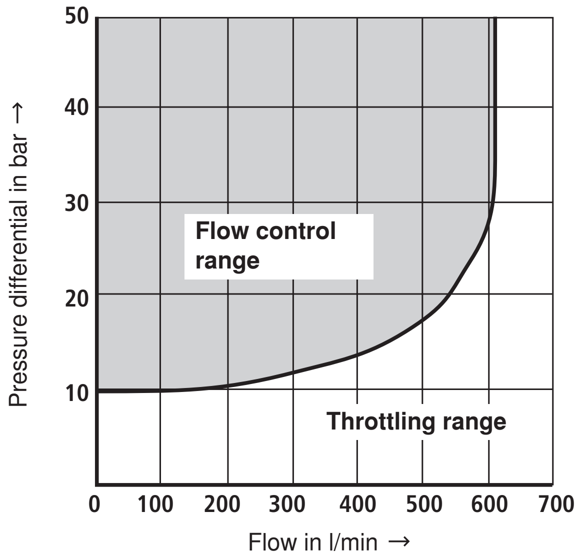
1 With type 4 WRZ 25…270…
2 With type 4 WRZ 25…325…

Pressure differential $\Delta \boldsymbol{p}_{min} = \boldsymbol{p}_{pump} - \boldsymbol{p}_{load}$

Size 32



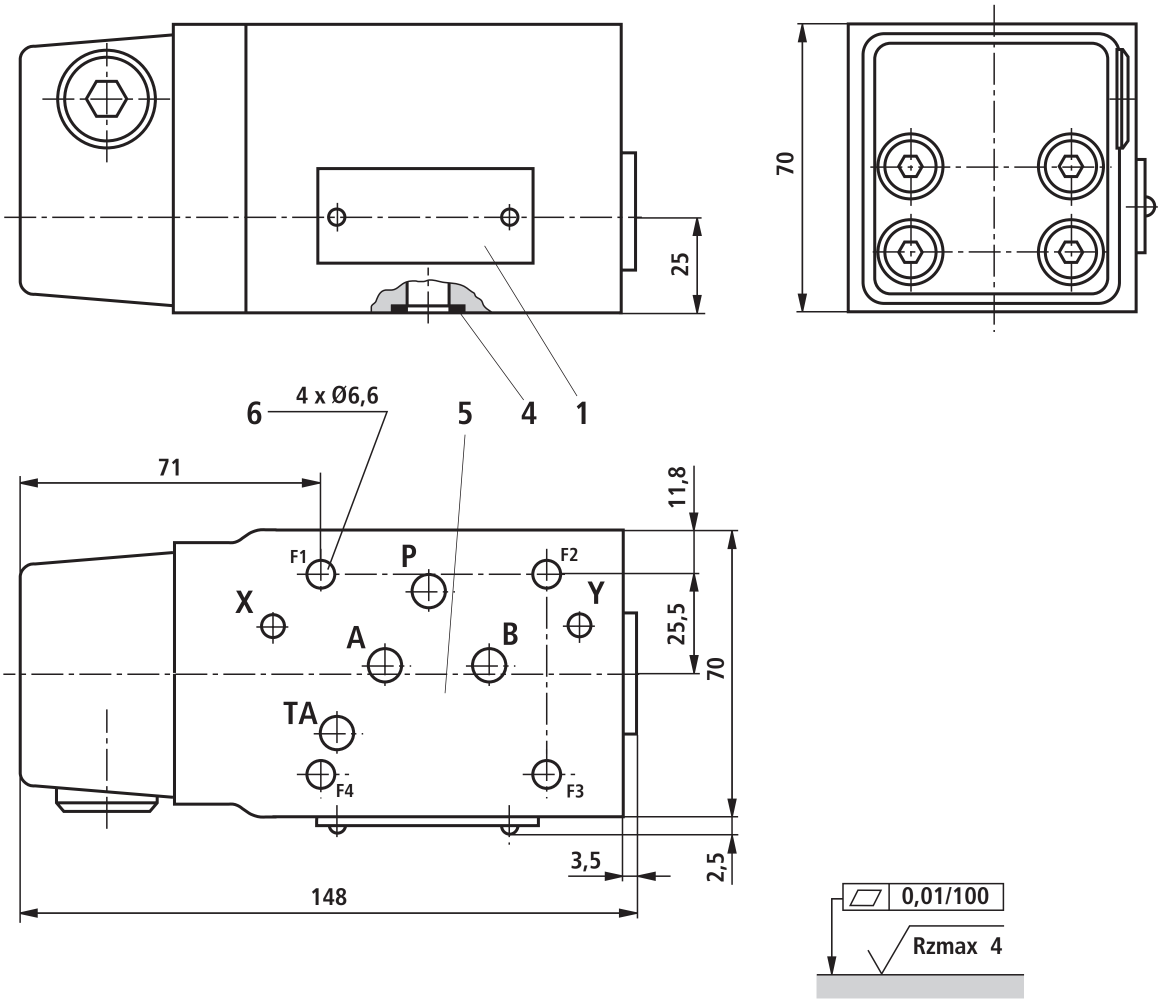
Size 32



1 With type 4 WRZ 32…360…
2 With type 4 WRZ 32…520…

Pressure differential $\Delta \boldsymbol{p}_{min} = \boldsymbol{p}_{pump} - \boldsymbol{p}_{load}$

Unit dimensions: Size 10 (dimensions in mm)



Required surface quality of valve mounting face

1 Nameplate

4 Idential seal rings for ports A, B, P, T;
Idential seal rings for ports X, Y (plate side)

5 Porting pattern ISO 4401-05-05-0-05

6 Valve mounting screws (see on the right)

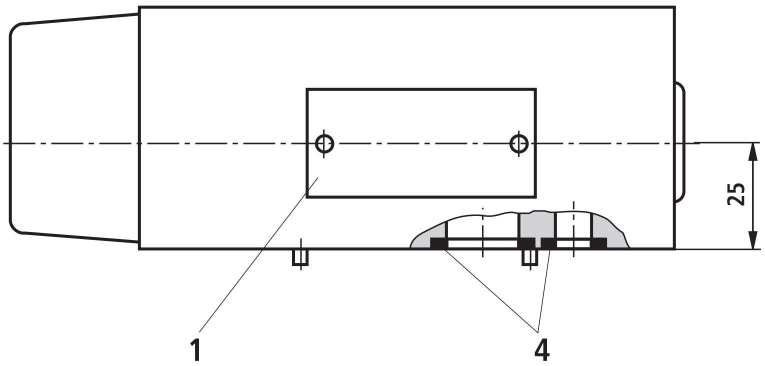
Valve mounting screws (separate order)

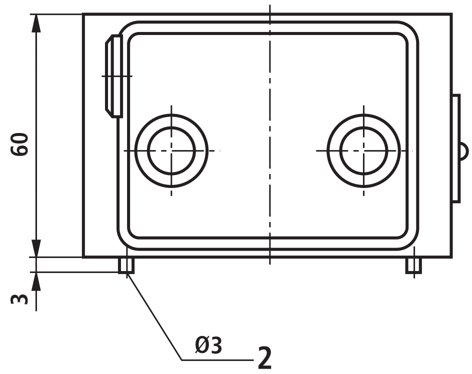
4 hexagon socket head cap screws ISO 4762 - M6 - 10.9

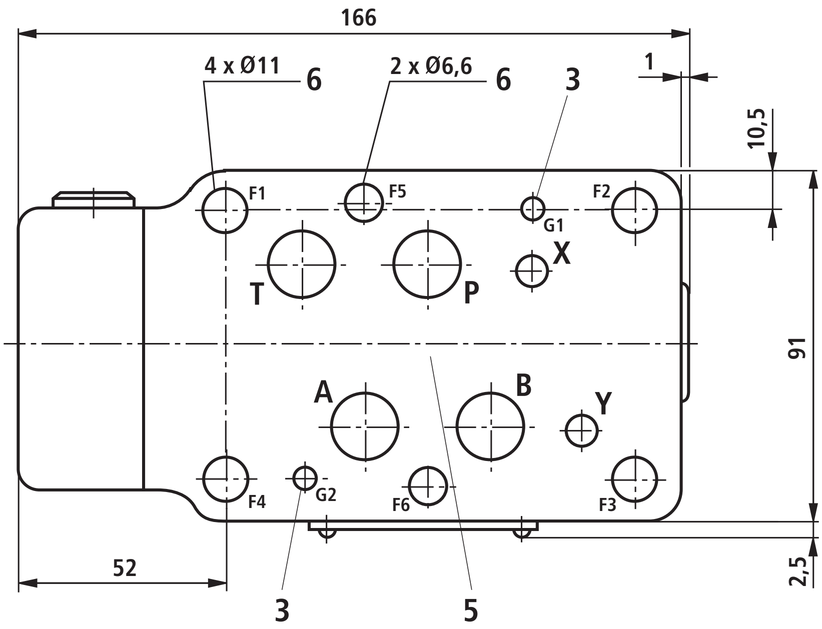
☞ **Note!**

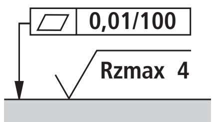
The length and tightening torque of the valve mounting screws must be calculated in conjunction with the components mounted below and above the sandwich plate valve.

Unit dimensions: Size 16 (dimensions in mm)









Required surface quality of valve mounting face

1 Nameplate
2 Locating pin
3 Bore for locating pins
4 Idential seal rings for ports A, B, P, T; Idential seal rings for ports X, Y (plate side)
5 Porting pattern ISO 4401-07-07-0-05
6 Valve mounting screws (see on the right)

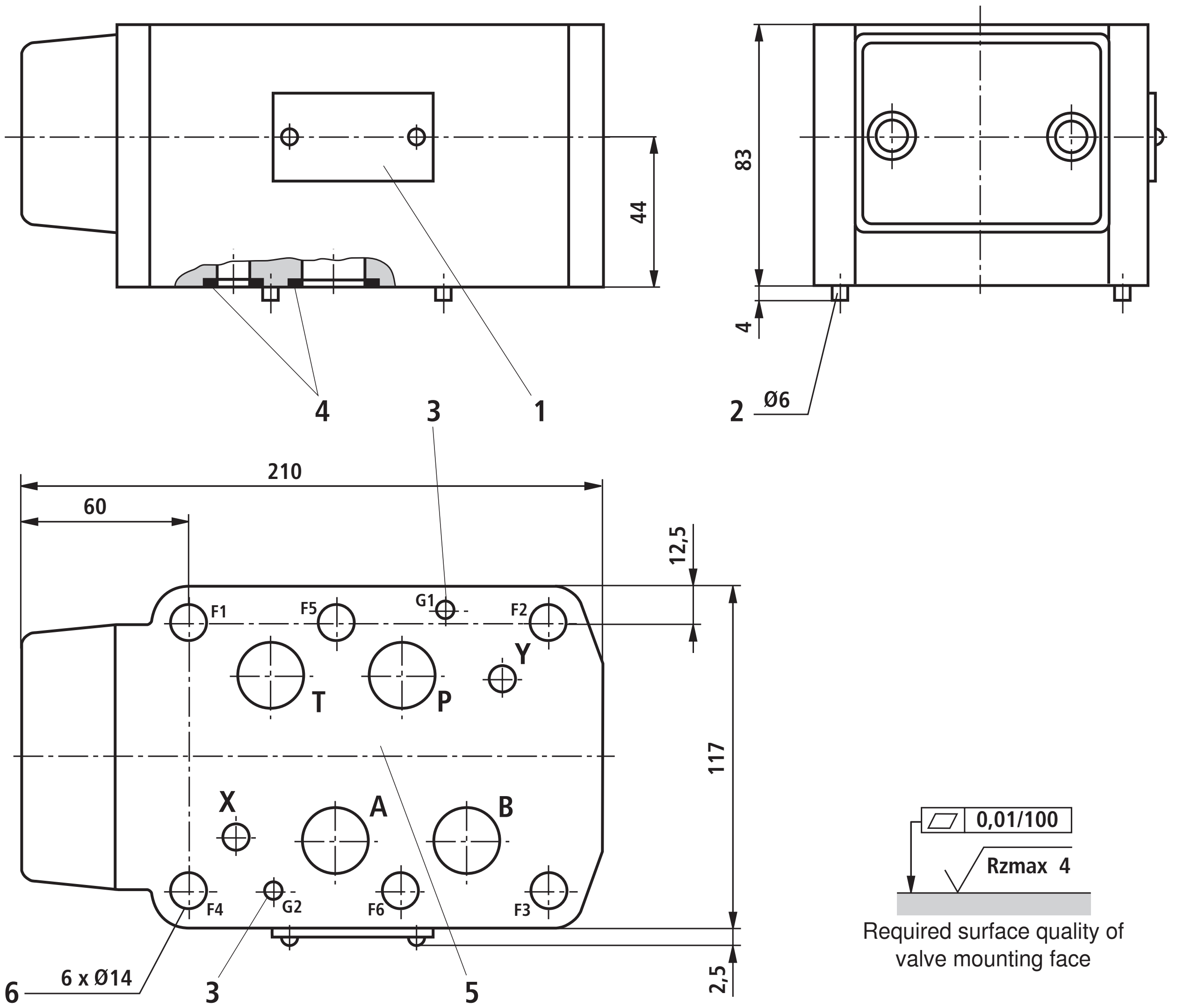
Valve mounting screws (separate order)

4 hexagon socket head cap screws ISO 4762 - M10 - 10.9
2 hexagon socket head cap screws ISO 4762 - M6 - 10.9

Note!

The length and tightening torque of the valve mounting screws must be calculated in conjunction with the components mounted below and above the sandwich plate valve.

Unit dimensions: Size 25 (dimensions in mm)



1 Nameplate
2 Locating pin
3 Bore for locating pins
4 Idential seal rings for ports A, B, P, T;
Idential seal rings for ports X, Y (plate side)
5 Porting pattern ISO 4401-08-08-0-05
6 Valve mounting screws (see on the right)

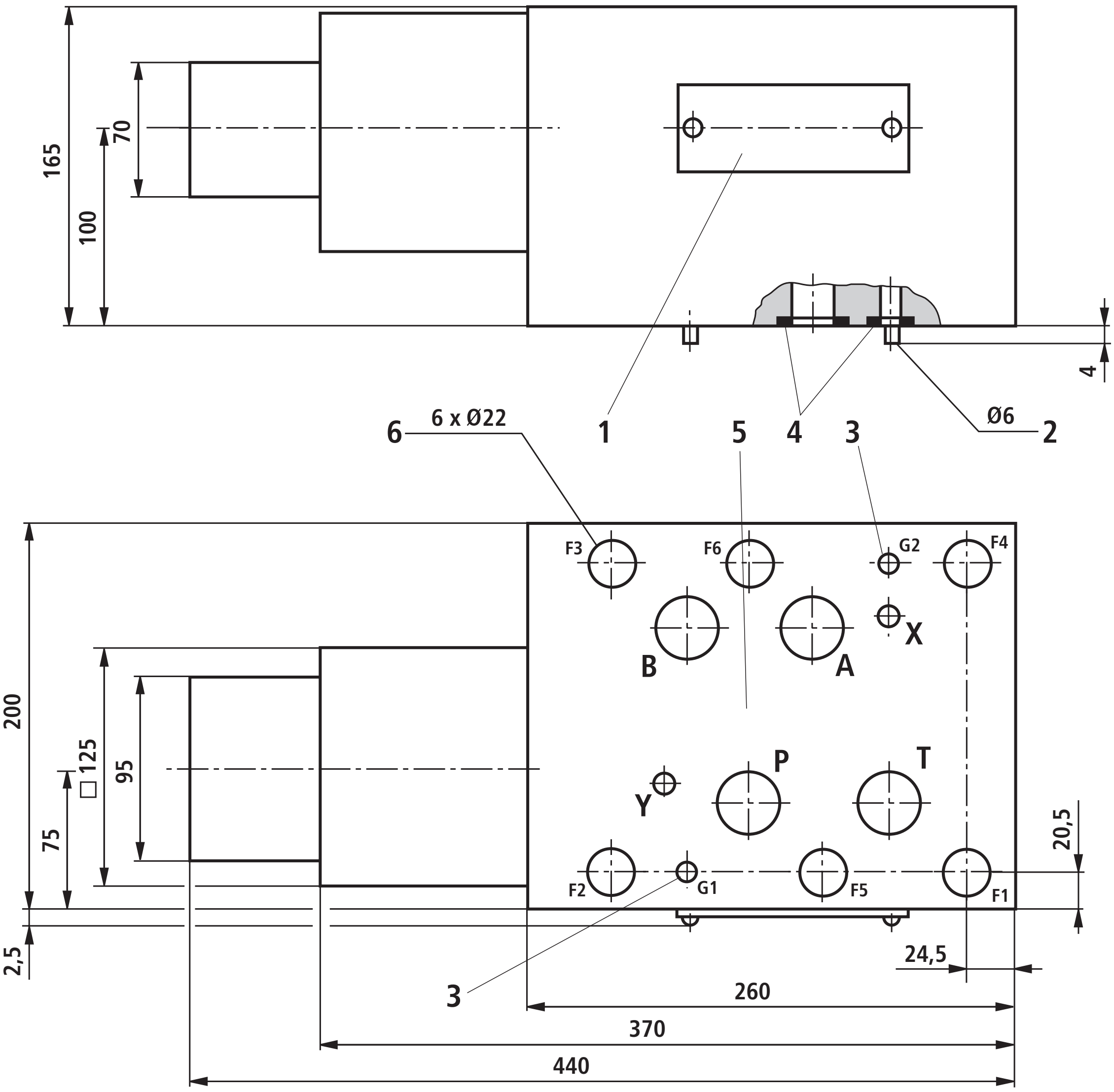
Valve mounting screws (separate order)

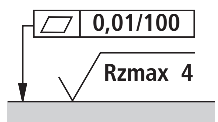
6 hexagon socket head cap screws ISO 4762 - M12 - 10.9

☞ **Note!**

The length and tightening torque of the valve mounting screws must be calculated in conjunction with the components mounted below and above the sandwich plate valve.

Unit dimensions: Size 32 (dimensions in mm)





Required surface quality of valve mounting face

1. **1** Nameplate
2. **2** Locating pin
3. **3** Bore for locating pins
4. **4** Idential seal rings for ports A, B, P, T; Idential seal rings for ports X, Y (plate side)
5. **5** Porting pattern ISO 4401-10-09-0-05
6. **6** Valve mounting screws (see on the right)

Valve mounting screws (separate order)

6 hexagon socket head cap screws ISO 4762 - M20 - 10.9

☞ **Note!**

The length and tightening torque of the valve mounting screws must be calculated in conjunction with the components mounted below and above the sandwich plate valve.

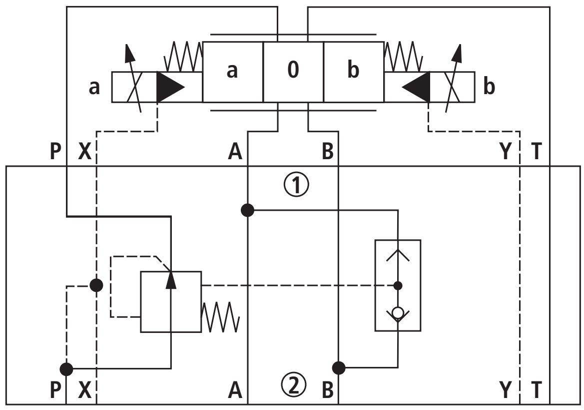
Pilot oil supply

⚠ Attention!

In conjunction with the meter-in pressure compensator the pilot operated proportional valve must be used in the variant with “**external pilot oil supply**“!

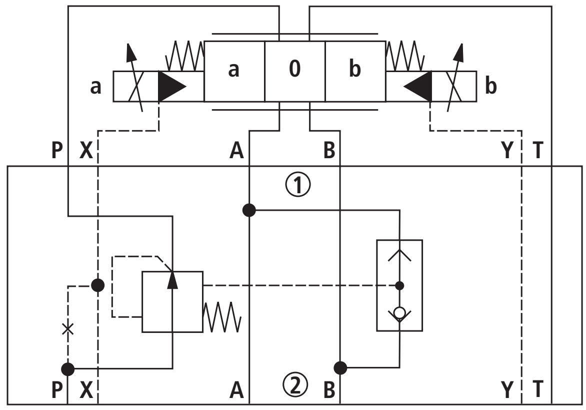
With **external** pilot oil supply the connection to channel P is closed. The pilot oil is taken from a separate control circuit. With **internal** pilot oil supply the connection to channel P is open. The pilot oil is taken from the throttle side of the pressure compensator (port X in the subplate is closed).

Type 4WRZ…



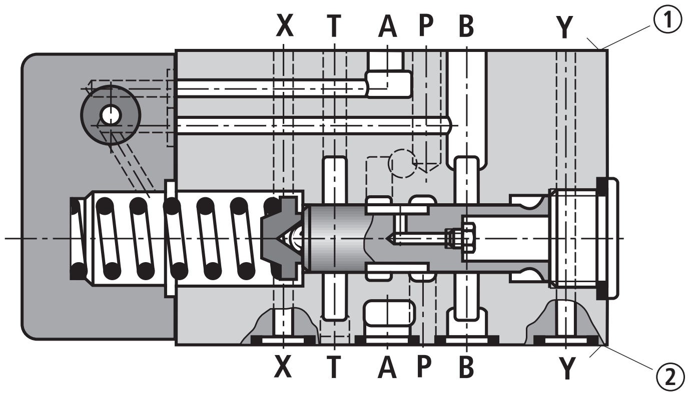
Type ZDC..P-2X/…

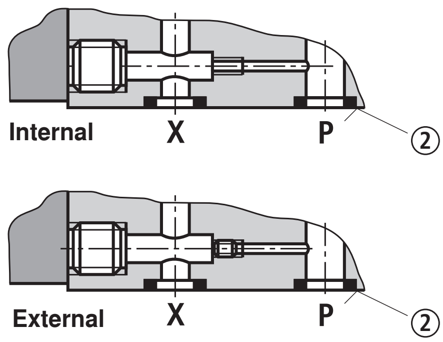
Type 4WRZ…



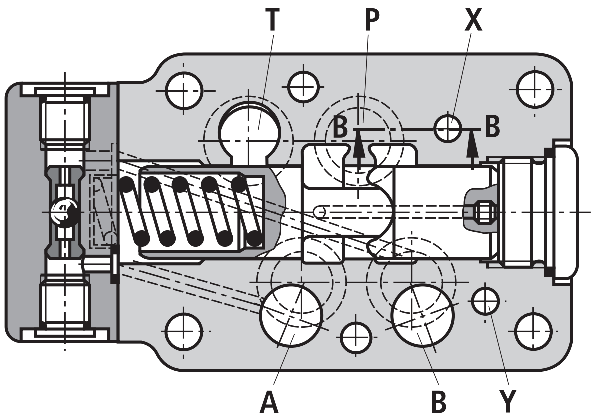
Type ZDC..P-2X/**X**…

Size 10

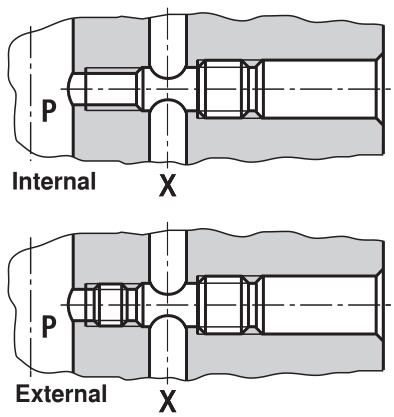




Size 16

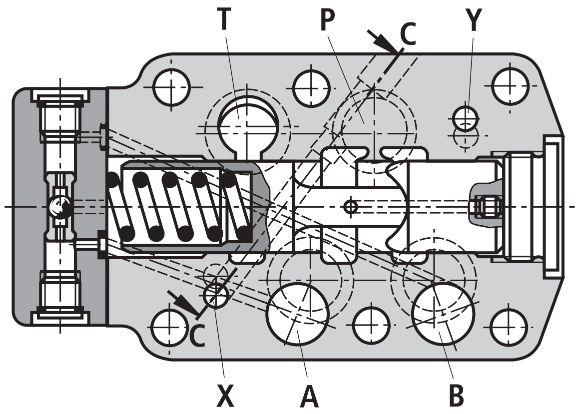


Section B–B

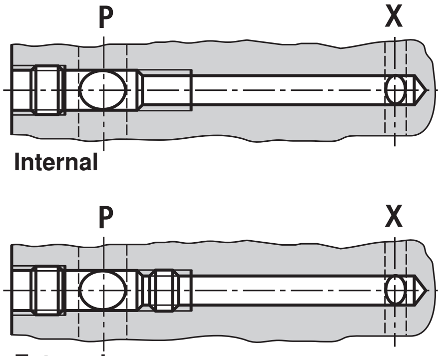


Pilot oil supply

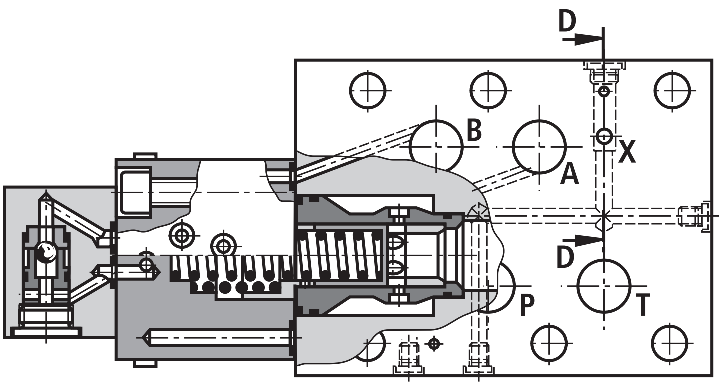
Size 25



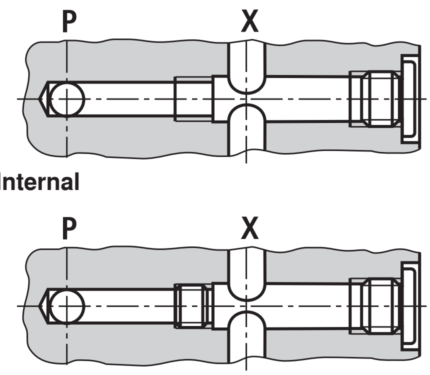
Section C–C



Size 32



Section D–D



MANNESMANN REXROTH

Meter out pressure compensator
Sandwich plate design
Type SCA... /Series 2X

RE 29 247/02.96

Replaces: 09.87

Sizes 16, 25	up to 315 bar	up to 325 L/min

– Sandwich plate design

– Load compensation in lines A + B, or only A, or only B, used in conjunction with a pilot operated proportional directional valve

– Leak tight closing in one or both service lines

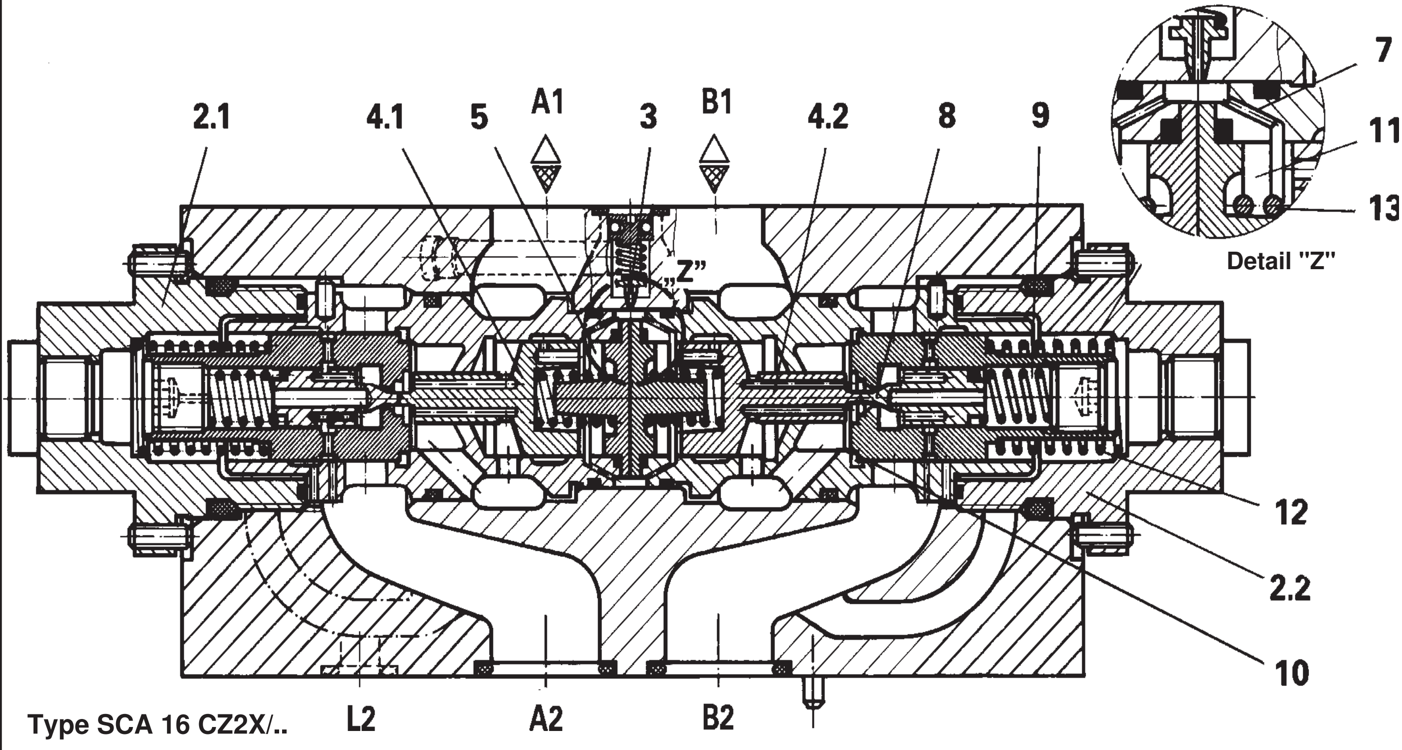
– Connection dimensions to DIN 24 340 Form A, ISO 4401 and CETOP-RP 121 H

K 3807/5
Type SCA 16 CZ2X/..

Description of function, Section

This valve is used in conjunction with a proportional directional valve to form a meter out flow control circuit to control both negative and positive loads.
Service ports A2 and B2 may be locked to support loads.
The value and direction of an oil flow can be set at the potentiometer controlling the proportional directional valve.
If, for example, the pump is directed to port A1, oil flows via valve set (2.1) to the actuator. Valve set (2.1) in this case, functions as a non return valve. At the same time, a pilot oil flow is taken from the main oil flow, and passes through the pilot piston (4.1) (acting as a pressure compensated flow control), into chamber (5). This pilot flow causes a pressure to build up at the relief valve (3), and an the pilot piston (4.2), via orifice (7), on the B side.

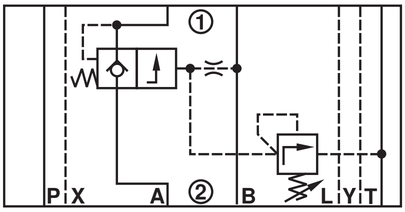
In addition, the outlet of the pressure relief valve is connected to the T port of the main valve.
The unloading poppet (8) thus cuts off the connection to the load pressure. The pressure before the proportional valve is then present in chamber (9) via the pressure take off at the unloading poppet (8). Pressure is also present on both the full bore and the annulus sides of the opening piston (4.2)
The pressure drop from B to T via the proportional directional valve is thus held constant. This pressure drop in controlled by land (10), and is the pressure in chamber (11) minus the spring (12). The force of spring (13) plays no part at this stage.
When the pump pressure is directed to port B, valve set (2.1) operates in exactly the same way in port A.



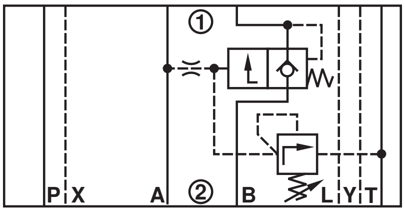
Type SCA 16 CZ2X/..

Simplified symbols (Subscripts: ① = Component Side, ② = Mounting Interface Side)

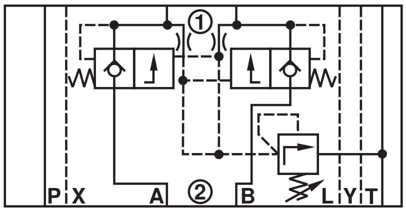
Type SCA.. AZ2X/...



Type SCA.. BZ2X/...

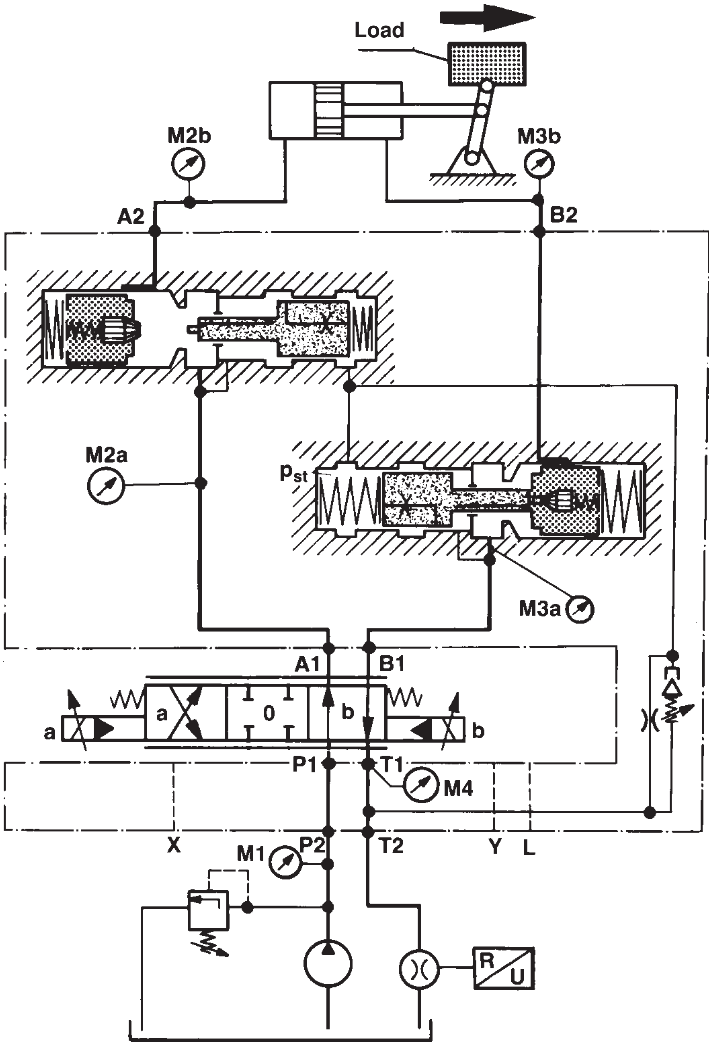


Type SCA.. CZ2X/...



Typical circuit (detailed)

Operation in lines A and B



Ordering Code

SCA			Z	2X /		*

Meter out pressure compensator = **SCA**

Size 16 = **16**
Size 25 = **25**

Operation in line A = **A**
Operation in line B = **B**
Operation in lines A and B = **C**

Special insulations on request!
Valve types which result from the order variations in the grey-shaded areas are available at short notice!

Further details in clear text

M = NBR seals, suitable for mineral oil to DIN 51 524 (HL, HLP)
V = FPM seals, suitable for phosphate ester (HFD-R)

2X = Series 20 to 29 (20 to 29: installation and connection dimensions remain unchanged)

Z = Sandwich plate design

Technical Data (For applications outside these parameters, please consult us!)

Operating Pressure:
- Ports A1, A2, B1, B2, p_{max} 315 bar
  Warning: When used with single rod cylinders, beware of intensification.
- Ports T1, T2 separat to tank
- Ports X1, X2 max. 315 bar
- Ports Y1, Y2 max. 30 bar

Flow: Size 16 max. 130 L/min
Size 25 max. 325 L/min

Min. pressure differential:
Flow resistance: } see diagrams pages 3,4 and 5

Dynamic charact: (measured at a load pressure of 150 bar with prop. valve type 4WRZ $\frac{16}{25}$ E $\frac{150}{325}$ …)

Size	Response in % [1] (type 4WRZ... + type SCA...)	$q_{V\,min}$ to $q_{V\,max}$ $T_u + T_g$ in ms	$q_{V\,max}$ to $q_{V\,min}$ $T_u + T_g$ in ms
16	0 to 100	270	80
	50 to 75	100	70
25	0 to 100	280	200
	50 to 75	130	100

[1]) 100 % input signal = 700 mA Solenoid current T_g = setting time T_u = signal delay

Pilot oil volume
from pressure relief valve to tank:
for size 16 max. 1,8 L/min
for size 25 max. 2,5 L/min

Pressure/Flow relationship:
see diagrams pages 4 and 5

Fluids: Mineral oil to DIN 51 524 (HL, HLP)
Phosphate ester (HFD-R)

Maximum degree of contamination of the fluid
to NAS 1638 classes 7 to 9. We therefore recommend a filter with a minimum retention rate of $\beta_{10} \geq 75$.

Fluid temperature range: – 20 to + 70 °C

Viscosity range: 15 to 380 mm²/s

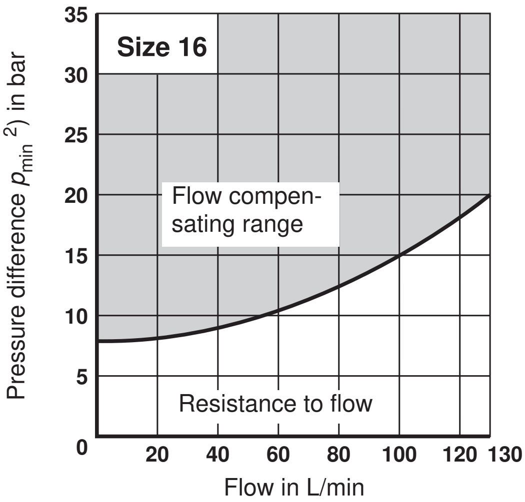
Installation position: optional

Weights: Size 16 6,0 kg
Size 25 11,3 kg

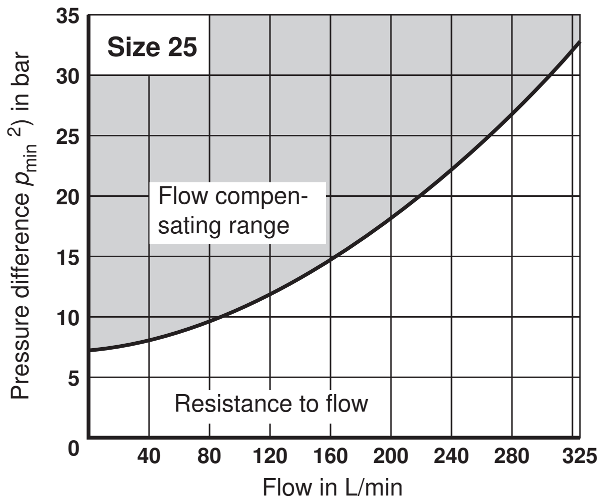
Note: Good settling characteristics are achieved with systems having natural frequencies > 4 Hz.

Operation Curves (measured at ν = 41 mm²/s and t = 50 °C)

Minimum differential pressure $\Delta p = f(q_V)$
Start of control



Start of control

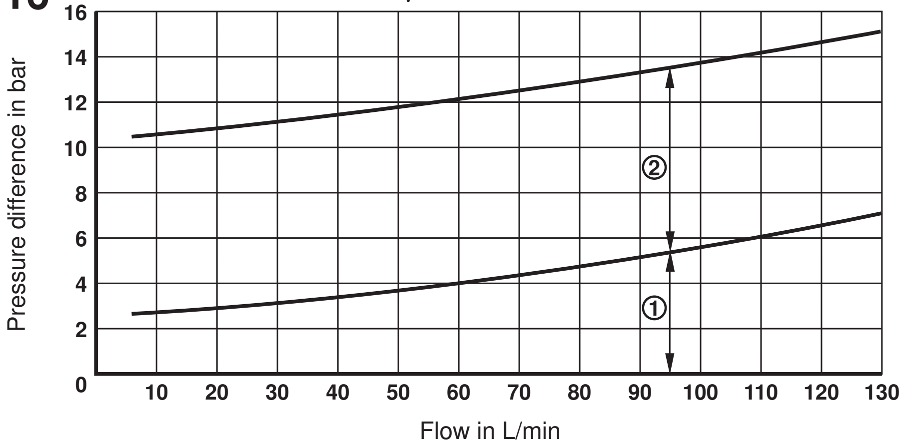


[2]) $p_{min} = p_{M3b} - p_{M4}$ (For test points M3b, M4 see page 2)

Operating Curves (measured at ν = 41 mm²/s and t = 50 °C)

Size 16

Resistance to flow $\Delta p = f\,(q_V)$

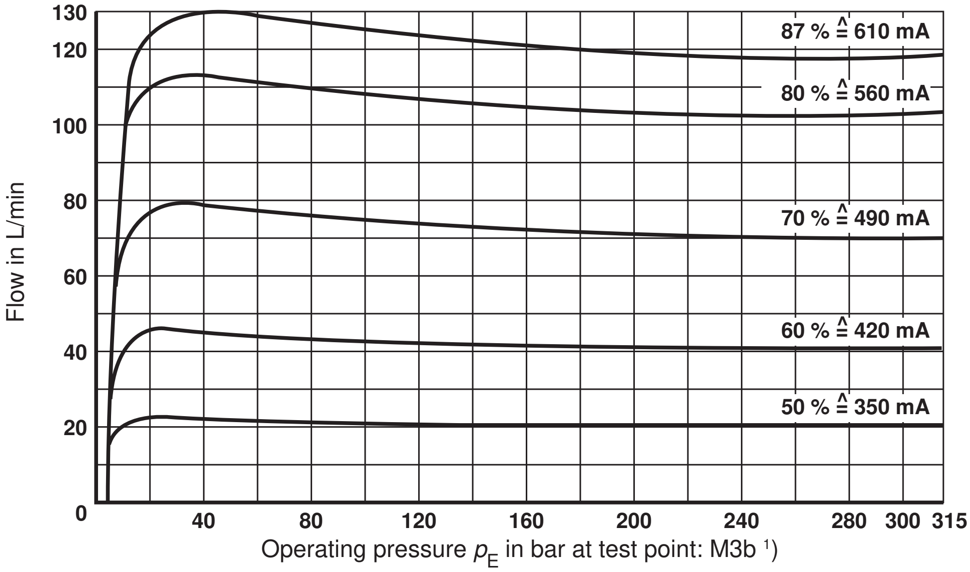


① Resistance in flow:
Non return valve function
(Test point: M2a - M2b or
M3a - M3b) [1])

② Resistance to flow at proportional directional valve input land
(Test point: M1 - M2a or
M4 - M3a) [1])

Note:
In the "one side" model, "no compensator in A",the resistance to flow in the "A" line M1 - M2a (8 bar).
In the "one side" model "no compensator in B", the resistance to flow in the "B" line M3a - M4 (8 bar).

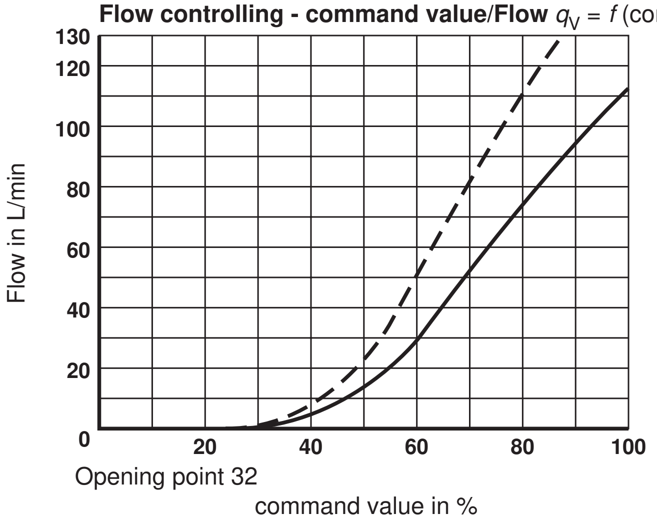
Flow/Pressure relationship $q_V = f\,(p_E$ + command value); command value constant



p_E-Test point M3b [1]) in ports A and B.

Note:
The diagram refers to a spool for 150 L/min nominal flow (Valve Type 4WRZ 16 E150..)

Flow controlling - command value/Flow $q_V = f$ (command value)



Meter out pressure compensator Type SCA 16... with proportional directional valve

Type 4WRZ 16 E100... ————
Type 4WRZ 16 E150... — — — —
(P → A, B → T)

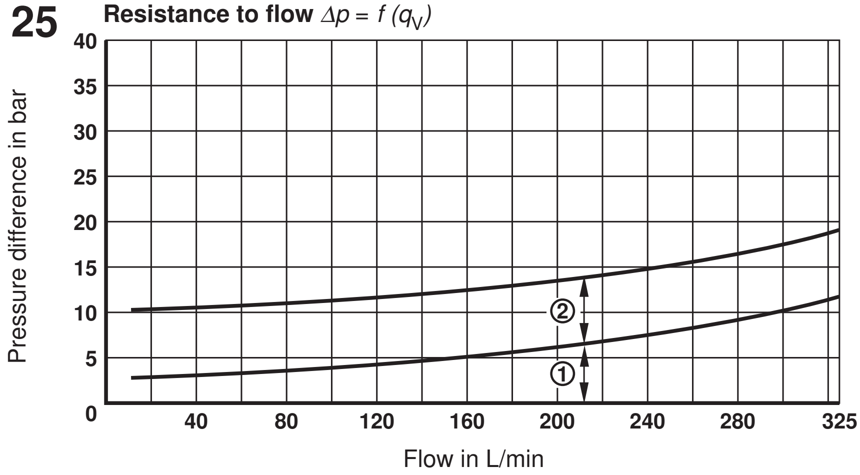
Curve $q_V = f$ (command value) in ports A and B;
p_E = 50 bar constant at test point M3b [1])

[1]) see cicuit page 2

Operating Curves (measured at ν = 41 mm^2/s and t = 50 °C)

Size 25

Resistance to flow $\Delta p = f(q_V)$

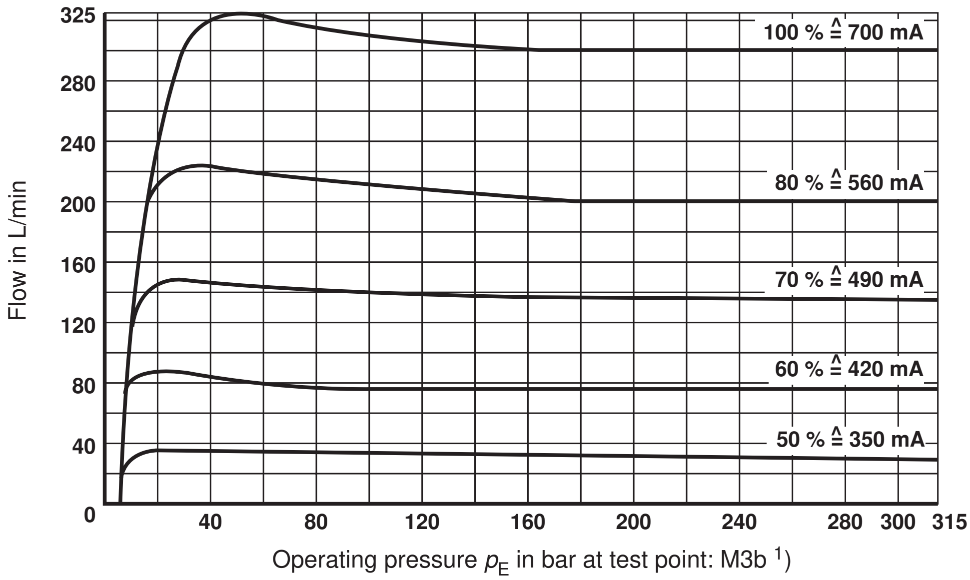


① Resistance to flow:
Non return valve function
(Test point: M2a - M2b or M3a - M3b) [1])

② Resistance to flow at proportional directional valve input land
(Test point: M1 - M2a or M4 - M3a) [1])

Note:
In the “one sided” model, “no compensator in A” the resistance to flow in the “A” line M1 - M2a (8 bar).
In the “one sided” model, “no compensator in B” the resistance to flow in the “B” line M3a - M4 (8 bar).

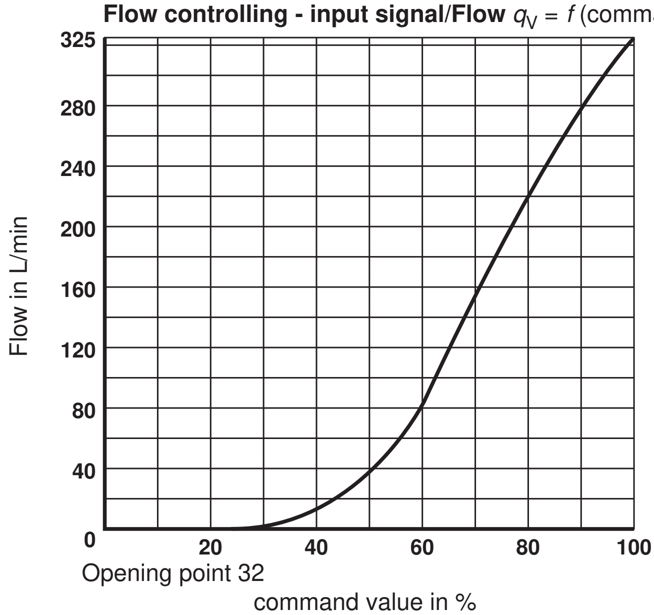
Flow/Pressure relationship $q_V = f(p_E$ + command value); command value constant



p_E-Test point M3b [1]) in ports A and B.

Note:
The diagram refers to a spool for 325 L/min nominal flow (Valve Type 4WRZ 25 E325...)

Flow controlling - input signal/Flow $q_V = f$ (command value)



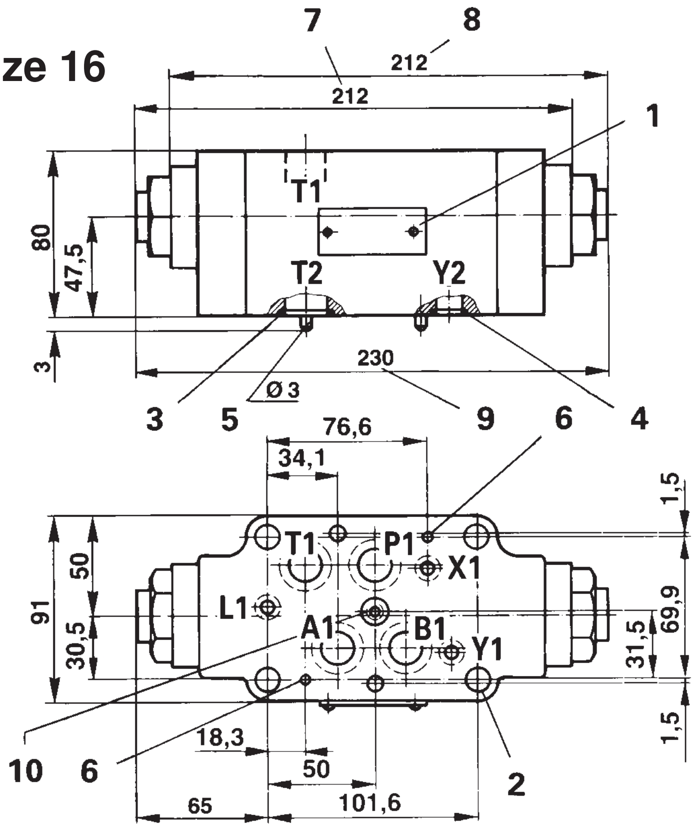
Meter out pressure compensator Typw SCA 25... with proportional directional valve
Type 4WRZ 25 E325...
(P → A)

Curve $q_V = f$ (command value)
p_E = 50 bar constant at test point M3b [1])

[1]) see circuit on page 2

Unit dimensions (in mm)

Size 16



1 Nameplate

2 6 thro' holes for fixing screws

3 R-rings for ports A2, B2, P2, T2
Size 16 R-ring 22,53 x 2,3 x 2,62
Size 25 R-ring 27,8 x 2,6 x 3,0

4 R-rings for ports X2, Y2, L2
Size 16 R-ring 10 x 2,0 x 2,0
Size 25 R-ring 19 x 3,0 x 3,0

5 Locating pin

6 Drilling for locating pin

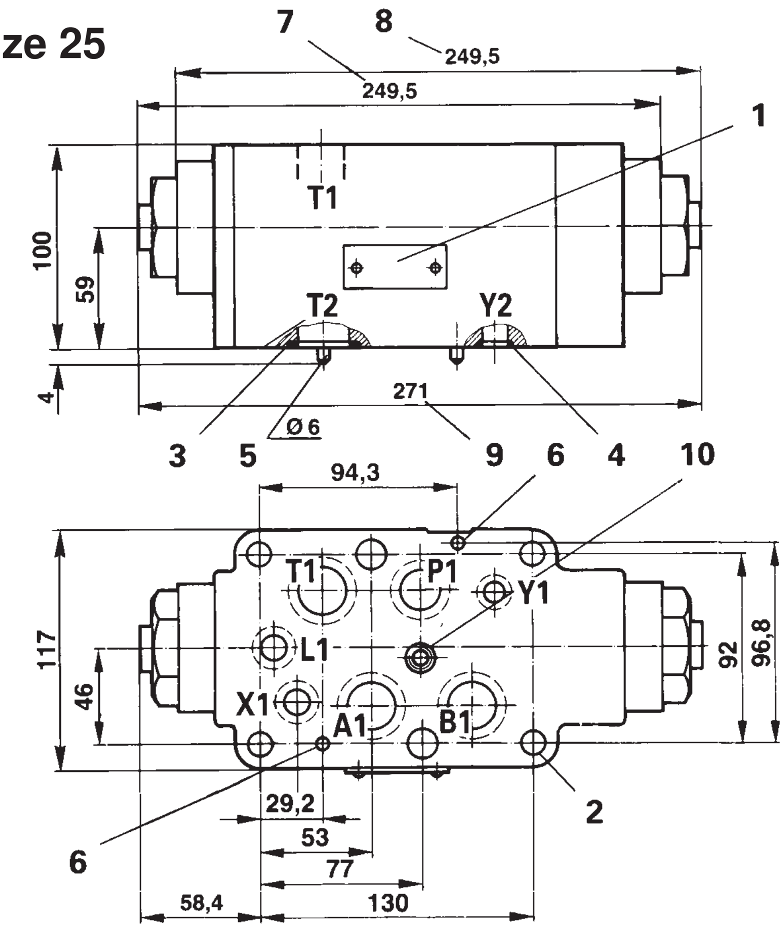
7 Valve operational in port A (Type SCA.. AZ2X/...)

8 Valve operational in port B (Type SCA..BZ2X/...)

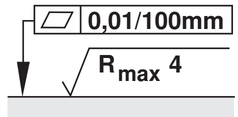
9 Valve operational in port A and B (Type SCA..CZ2X/...)

10 Pressure relief valve

Size 25



Required surface finish of mating piece



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MANNESMANN REXROTH	Meter-out Check-Q-Meter Sandwich plate Type SC$^{A}_{B}$ 32.. /Series 1X			RE 29 249/02.96
	Size 32	up to 350 bar	up to 700 L/min	Replaces: 12.90

– Sandwich plate model

– Load compensated flow control optionally in line A and B or only in A or only B together with a pilot operated proportional directional control valve **(only W-spool)**

– Brake function optionally in line A and B, or only A or only B together with a pilot operated proportional directional control valve and with or without meter-in pressure compensator

– Leak free isolation, optionally in one or both service ports

– Porting pattern to DIN 24 340 form A32, ISO 4401 and CETOP-RP 121 H

Type SCA 32 Z1X/..

Functional description, section

The type SCA... meter-out check-Q-meter, pressure compensator can, together with a proportional directional control valve, be used as a flow controller for the load compensated control of positive and negative loads.

The type SCB... meter-out check-Q-meter, pressure compensator can, together with a proportional directional control valve, be used as a brake valve for the control of negative loads. When fitted with an additional meter-in pressure compensator, the actuator can be load compensated controlled. Leak free isolation of the A2 and B2 actuator ports for load support.

The volume and direction of flow is set at the command value potentiometer of the proportional directional control valve.

Type SCA
If for example the pump is switched to port A1, the pressure fluid flows via the valve insert (2.1) to the actuator. The valve inserts (2.1) in this case act as a check valve. At the same time the pump pressure is applied to the pressure reducing valve (3). The pressure reducing valve (3) holds a constant pressure in area (4) which acts on the pilot piston (5). In addition the 3rd way of the pressure reducing valve (3) is connected to port T.

The pilot piston (5) opens the unloading poppet (6) against the load pressure in connection B2 and spring chamber (7) (max. 350 bar). Thereby the unloading poppet (6) closes the connection to the load pressure . Now, pressure is present via the internal connection of the unloading poppet (6) in chamber (7) and at the same time in chamber (8) against the pilot piston (5), as well as in front of the proportional directional control valve in port B1.

The pressure drop from B to T across the proportional directional control valve is therefore constant. This pressure drop is controlled by control land (9) and is the pressure difference in chamber (4) minus Δp of the compression springs (10 and 11).

It must be noted that the pump pressure muliplied by the intensification ratio of the cylinder ± the load pressure plus the brake pressure is present in port B2.

If via the proportional directional valve the pump is switched to B, the valve insert (2.1) in A acts as described above.

Type SCB
If the proportional directional control valve switches the pump to port A1, the pressure fluid flows via the valve insert (2.1) to the actuator. The valve insert (2.1) acts in this case as a check valve. At the same time the pressure in port A acts on the pilot poppet (5) via the insert (3.1). The pilot piston (5) opens the unloading poppet (6) against the load pressure (max. 350 bar) present in spring chamber (7). The unloading poppet (6) closes the connection to the load pressure. Now, pressure is present via the internal connection of the unloading poppet (6) in chamber (7) and at the same time in chamber (8) against the pilot piston (5), as well as in front of the proportional directional control valve in port B1.

With a meter-in pressure compensator in port P before the proportional valve, the control land (9) begins to control, when the pressure in port A has fallen due to the pressure drop within the meter-in pressure compensator plus that which is set (10 bar) by the springs (10 and 11). A precondition, is that the area ratio of the actuator (cylinder) and the area ratio of the throttle cross sections in the proportional valve are the same.

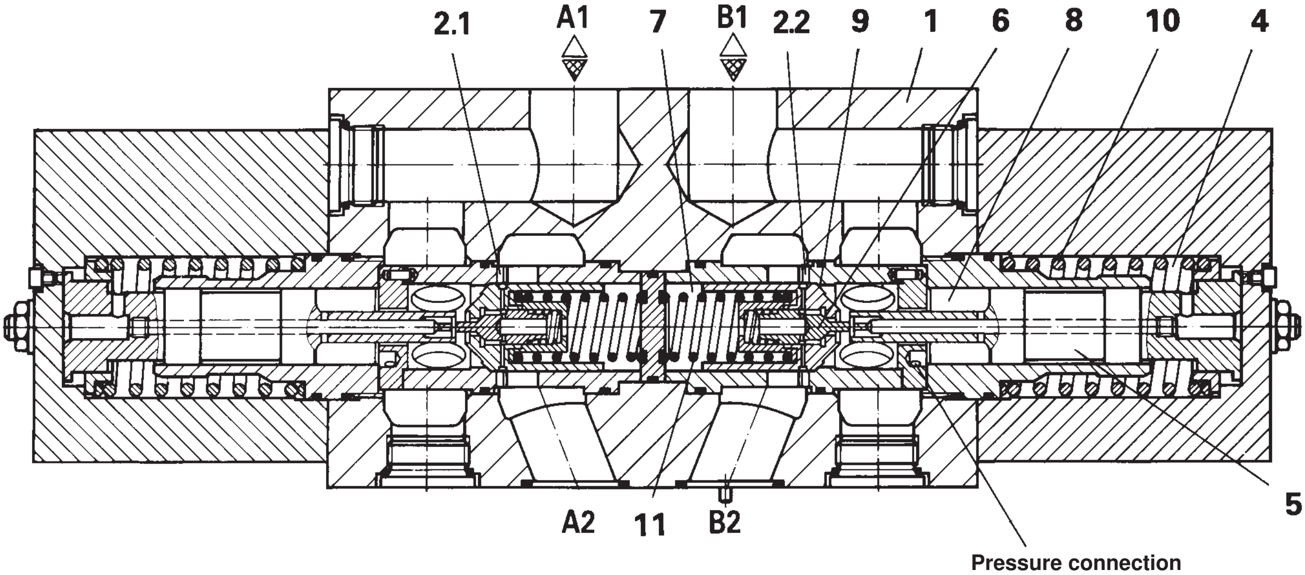
When the brake valve starts to react via the control land (9) then the pressure in port B2 is the sum of the load pressure plus brake pressure [the pressure drop of the meter-in pressure compensator plus the pressure drop (10 bar) resulting from the springs (10 and 11)] multiplied by the cylinder area ratio.

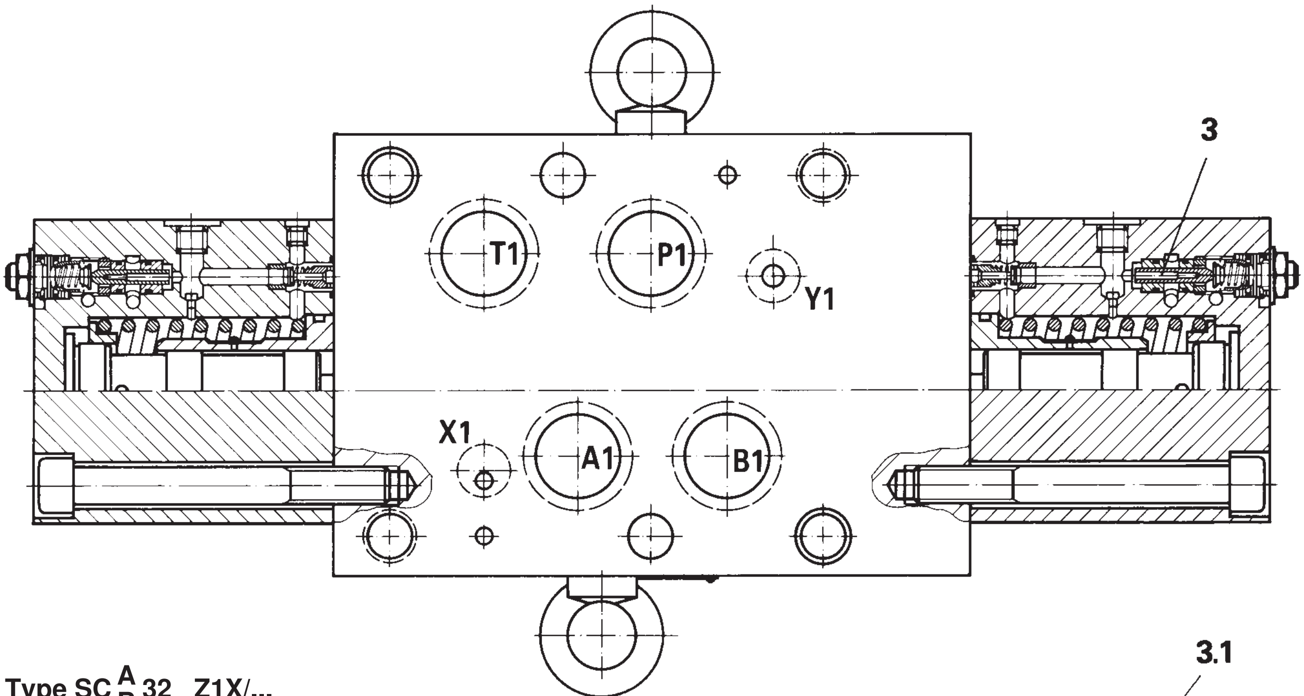
Funtional description, section

The brake valve can also be fitted in the port P before the proportional directional control valve without the meter-in pressure compensator. When the proportional directional control valve is in the switched position where P is to A, the valve insert (2.1) acts as a check valve. Until the pressure in port A is > 0.5 x pump pressure + 5 bar the valve insert (2.2) is fully open at control land (9). If this pressure drops slightly, the control land (9) starts to throttle and controls in port A a constant pressure which is 0.5 x pump pressure + 5 bar.

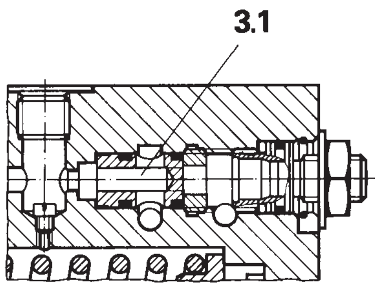
In port B the pressure 0.5 x pump pressure – 5 bar is constant. This pressure is the sum of the pressure drops of P to A and A to T when the area ratio of the cylinder and throttle area are the same.
When the brake valve starts to regulate with the control land (9), then the pressure in connection B2 is the load pressure plus brake pressure (0.5 x pump pressure + 5 bar) multiplied by the area ratio of the cylinder.

When the pump is connected to port B by the proportional valve, valve insert (2.1) operates as described above.





Type SC $\frac{A}{B}$ 32 Z1X/...



Type SCB 32..Z 1X/...

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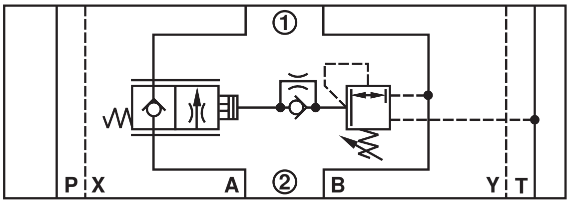
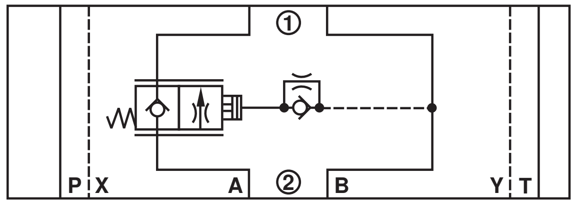
Symbols, simplified (codes: ① = component side, ② = sub-plate side)

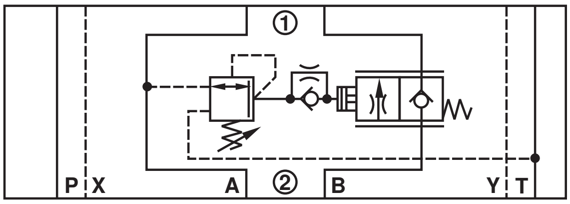
Type SCA 32 AZ1X/...



Type SCB 32 AZ1X/...



Type SCA 32 BZ1X/...



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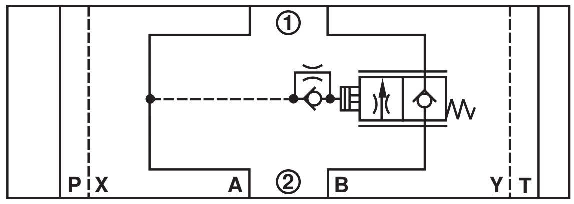
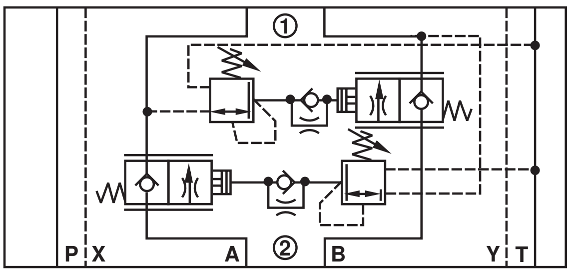
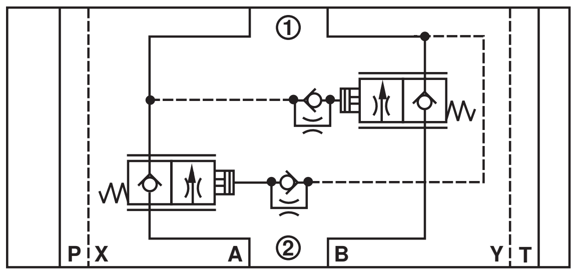


Type SCA 32 CZ1X/...

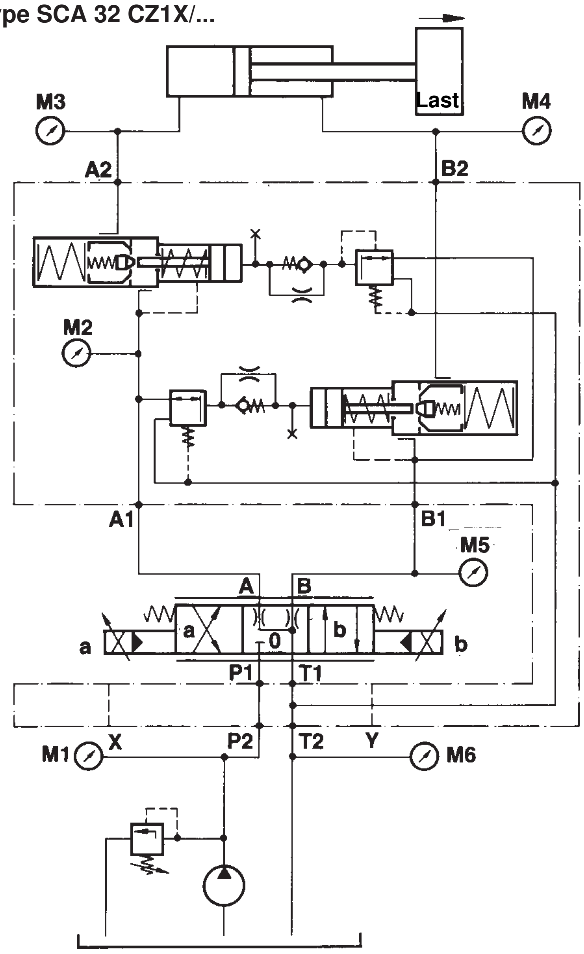


Type SCB 32 CZ1X/...

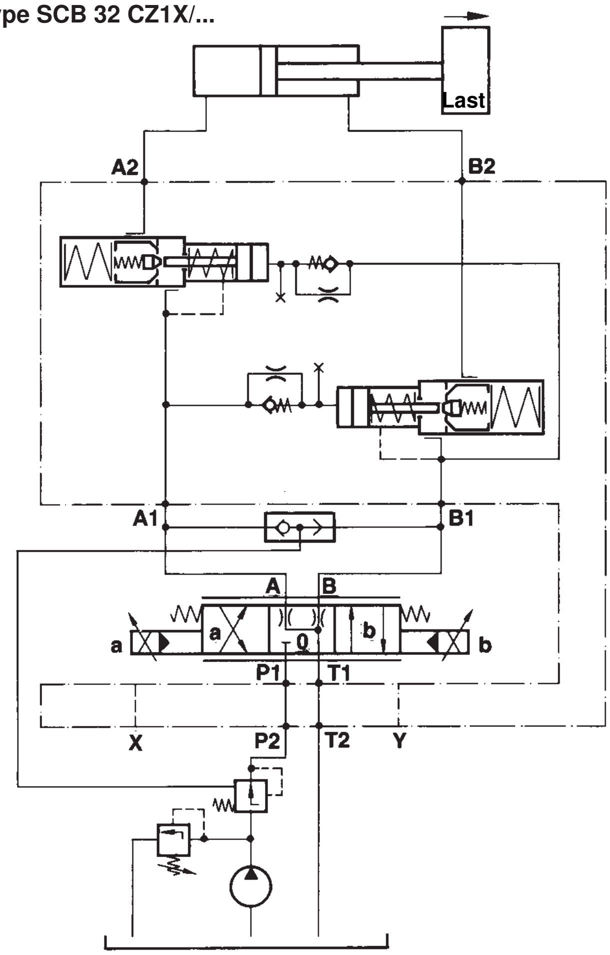


Circuit examples, comprehensive

Type SCA 32 CZ1X/...



Type SCB 32 CZ1X/...



Ordering code

	32		Z	1X	/		*

Meter-out check-Q-meter
For load compensation = **SCA**
As counter balance valve = **SCB**

Nominal size 32 = **32**

Function in line A = **A**
Function in line B = **B**
Function in lines A and B = **C**

Valve types which are marked in grey are readily available!

Further details in clear text

M = NBR seals, suitable for use with mineral oil (HL, HLP) to DIN 51 524
V = FPM seals, suitable for use with phosphate ester (HFD-R)

1X = Series 10 to 19
(10 to 19 : unchanged installation and connection dimensions)

Z = Sandwich plate model

Technical data (for applications outside these parameters, please consult us!)

Operating pressure:
- Ports A1, A2, B1, B2, p_{max} perm. 350 bar
  Attention: When using a single rod cylinder, please note the possibility of pressure intensification!
- Ports T1, T2 separate to tank
- Ports X1, X2 max. 350 bar
- Ports Y1, Y2 max. 30 bar

Flow: max. 700 L/min

Minimum pressure drop: see diagram below

Pressure differential across the check valve: see diagrams on page 5

Pressure/flow characteristics: see diagrams on page 5

Pressure fluid: Mineral oil (HL, HLP) to DIN 51 524
Phosphate ester (HFD-R)

Maximum degree of fluid contamination to NAS 1638 class 7 to 9. We, therefore, recommend a filter with a minimum retention rate of $\beta_{10} \geq 75$.

Pressure fluid - temperature range: – 20 to + 70 °C

Viscosity range: 15 to 380 mm²/s

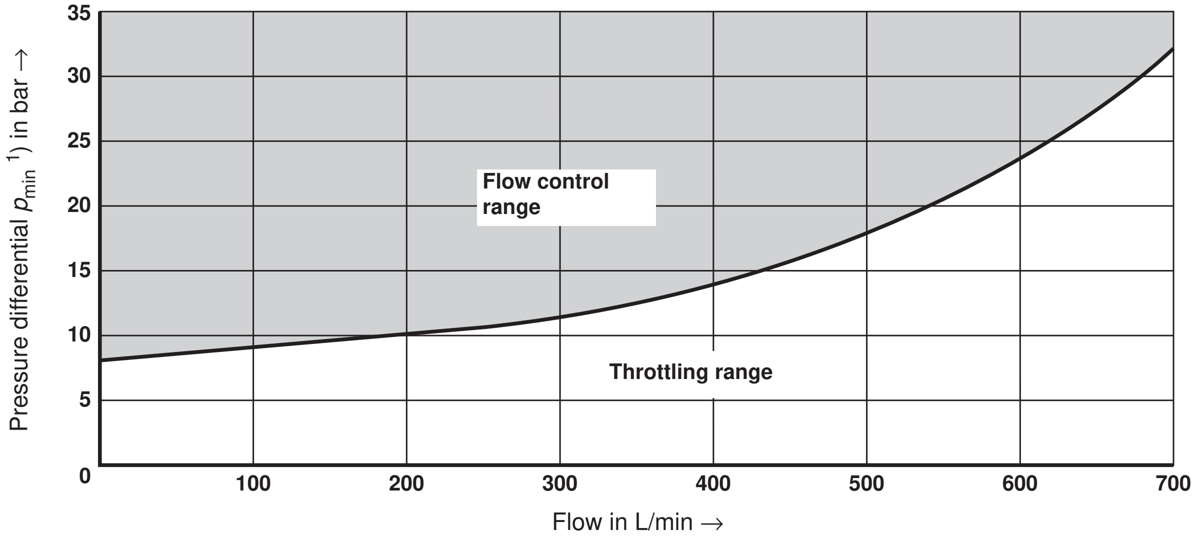
Installation position: optional

Weight:
– Type SC $^{A}_{B}$ 32 $^{A}_{B}$ Z1X/.. 81 kg
– Type SC $^{A}_{B}$ 32 CZ1X/.. 91 kg

Note: Good setting characteristics will be achieved with systems having natural frequencies > 5 Hz.

Characteristic curves (measured at ν = 41 mm²/s and t = 50 °C)

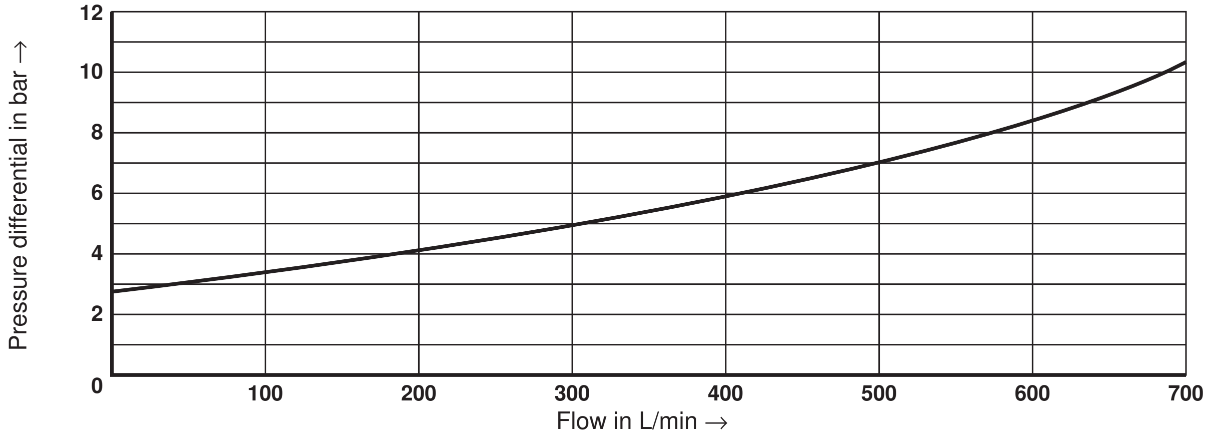
Minimum pressure differential $\Delta p = f(q_V)$
Start of control



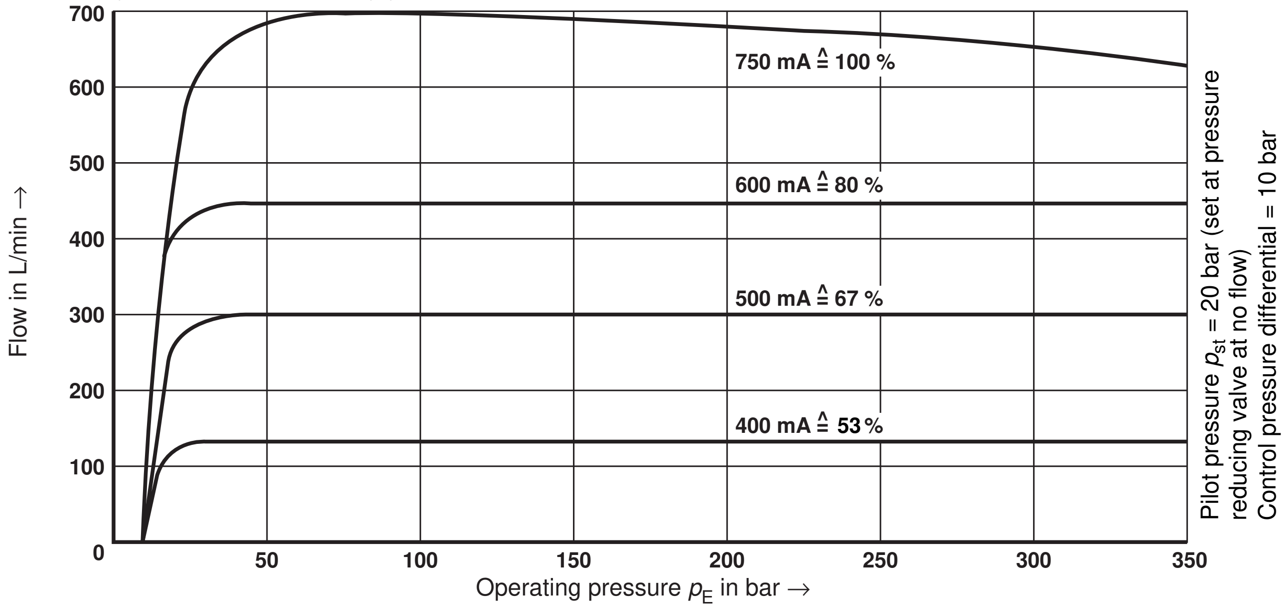
[1]) $p_{min} = p_{M4} - p_{M5}$ (measured at M4, M5 see circuit examples on page 3)

Characteristic curves (measured at ν = 41 mm²/s and t = 50 °C)

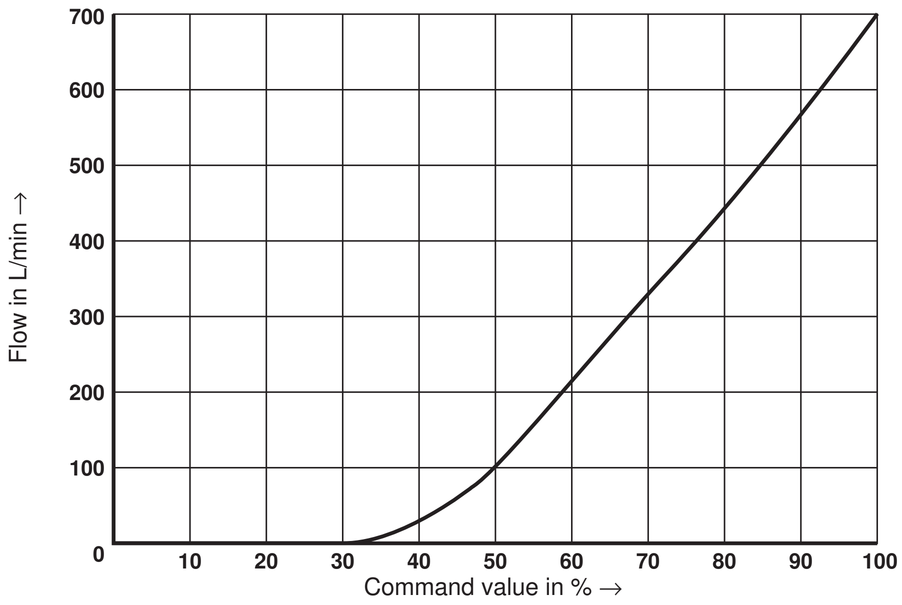
Pressure differential $\Delta p = f\,(q_V)$ Check valve function (measured at: M2 – M3 or M5 – M4) [1])



Pressure flow relationship $q_V = f\,(p_E$ + command value); the command value is constant (measured at: M4 or M3) [1])



Command value - flow $q_V = f$ (command value)
Flow control function



Meter-out check-Q-meter with proportional valve type 4WRZ 32 W520...
(P → A)

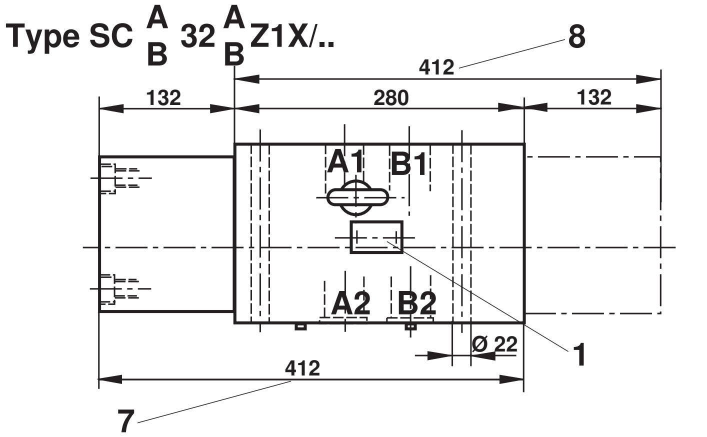
p_E = 50 bar (constant)

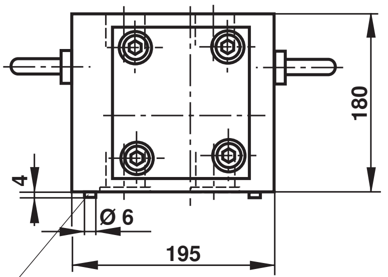
[1]) see circuit examples on page 3

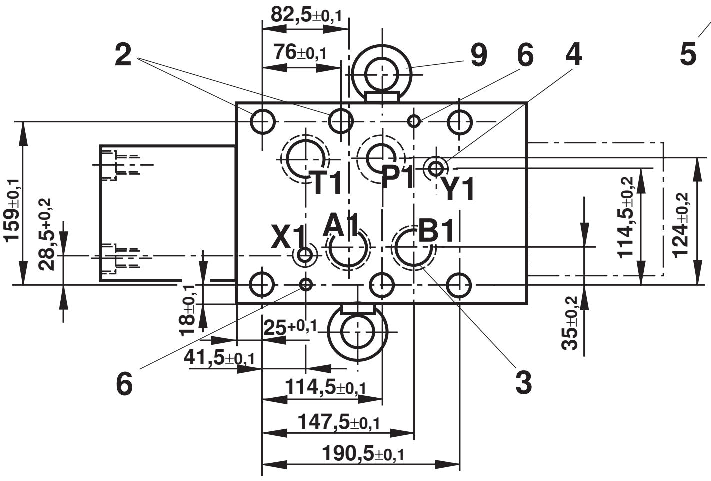
Unit dimensions

(Dimensions in mm)

Type SC $^{A}_{B}$ 32 $^{A}_{B}$ Z1X/..

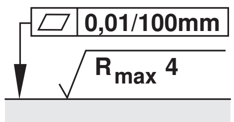




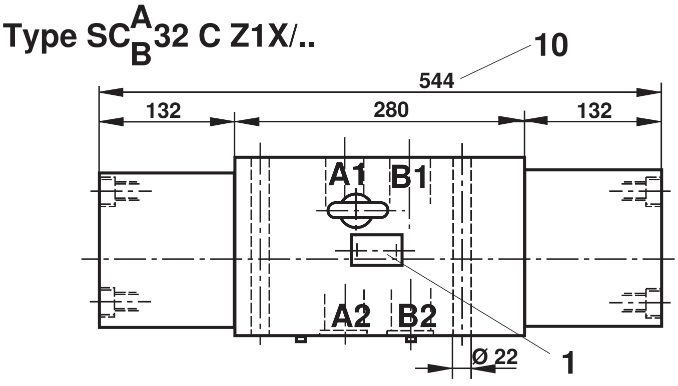


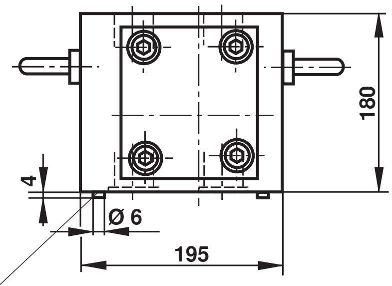
1 Name plate
2 6 through holes for valve fixing screws
3 R-ring 42.5 x 3.0 x 3.0 for ports A2, B2, P2, T2
4 R-ring 19 x 3.0 x 3.0 for ports X2, Y2
5 Locating pin
6 Drilling for locating pin
7 Valve with function in port A (type SC. 32 A1X/..)
8 Valve with function in port B (type SC. 32 B1X/..)
9 Ring bolt

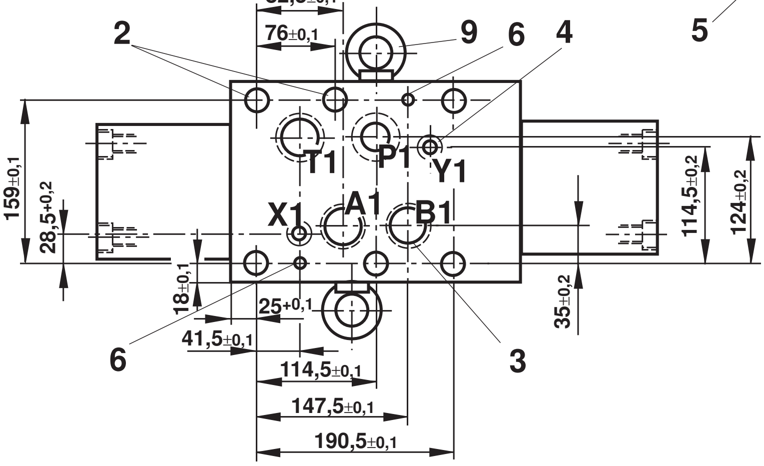
Required surface finish of mating piece



Type SC$^{A}_{B}$32 C Z1X/..

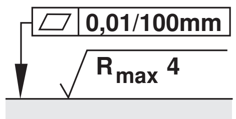






1 Name plate
2 6 through holes for valve fixing screws
3 R-ring 42.5 x 3.0 x 3.0 for ports A2, B2, P2, T2
4 R-ring 19 x 3.0 x 3.0 for ports X2, Y2
5 Locating pin
6 Drilling for locating pin
9 Ring bolt
10 Valve with function in ports A and B

Required surface finish of mating piece



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