Линейные модули/актуаторы

Технические характеристики

rexroth
A Bosch Company

Compact Modules CKK / CKR

Identification system for short product names

Compact Modules are identified by the type designation and size.

Example		C	K	K	-	110	-	NN	-	1
System	=	**C**ompact Module								
Guideway	=	**K**ugelschienenführung **(Ball Rail System)**								
Drive	=	**K**ugelgewindetrieb (Ball Screw Assembly) Zahn**R**iementrieb (Toothed belt drive)								
Size	=	070 / 090 / **110** / 145 / 200								
Version	=	**N**ormalausführung = Standard version)								
Generation	=	Product generation **1**								

Changes/additions at a glance

Technical modifications

- CKK-070:
  Ball Screw Assembly (BASA) 8 x 5 added
  New belt side drives

- Change of delivery form:
  The lubrication holes in the main body are removed on all CKK and CKR versions configured with "Carriage with connecting plate".

Contents

Product description

Characteristic features

- Five fine-tuned sizes based on a compact precision aluminum profile with two integrated pre-tensioned Ball Rail Systems
- Identical external dimensions between Compact Modules types CKK and CKR.
- Four different lube versions (see the following pages and the "Lubrication" chapter)
- Ready-to-install Compact Modules in any length up to L_{max}
- Aluminum carriages available in different versions depending on load

Further highlights

- Flexible thanks to options
- Ready-to-install with various attachment parts
- Center holes for simple combination with other linear motion systems and connection elements
- Economical maintenance thanks to one-point lubrication feature (grease lubrication) from both sides or via the carriage or via a connection plate

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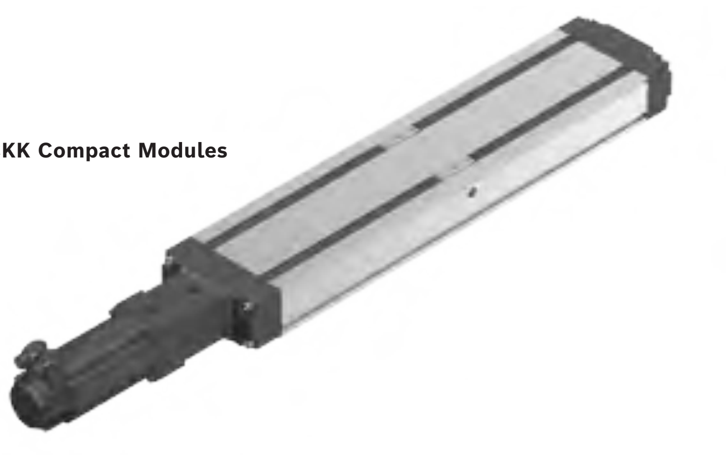
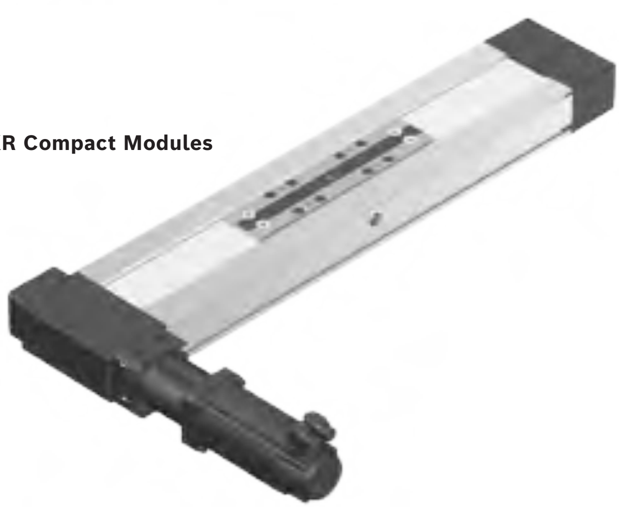
CKK Compact Modules



CKR Compact Modules



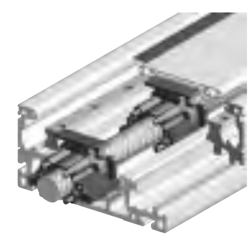
Compact Modules are available as complete solutions with motor, controller, and control system.
For more information, see the "Motors" and "EasyHandling" chapters

CKK Compact Modules with Ball Rail System and Ball Screw Assembly

- Drive via precision Ball Screw Assembly
- Screw support for the realization of high speeds on long assembly lengths for CKK-200
- Protection of installation elements through a cover plate and two cover strips; optionally increased protection thanks to "Resist" cover
- Repeatability of up to ± 0.005 mm

"Resist" cover

Connection plates



Screw support SPU for CKK-200

CKR Compact Modules with Ball Rail System and toothed belt drive

- Realization of greater lengths of up to 10,000 mm
- Pre-tensioned toothed belt
- Intelligent toothed belt guide protects inner components
- Repeatability of up to ± 0.05 mm

Connection plates

Lubrication versions

Two drive versions:

- CKK Compact Modules with Ball Rail System and Ball Screw Assembly
- CKR Compact Modules with Ball Rail System and toothed belt drive

Four different lube versions

- Standard lubrication (LSS)
- Preserved (LPG)
- Carriage with connection plate prepared for connection to central lubrication systems for liquid grease (LCF)
- Carriage with connection plate prepared for connection to central lubrication systems for oil (LCO)

Versions for oil and liquid grease lubrication prepared for connection to central lubrication systems

- High operational reliability through automated relubrication
- Need-based maintenance reduces consumption of lubricant, while ensuring high availability
- More degrees of freedom as lubrication is dependent on position and mounting location
- Low-cost unmanned maintenance

Notes:

LSS:

- Initial lubrication by Bosch Rexroth
- Relubrication using manual grease gun

LPG:

- Ball Rail System and Ball Screw Assembly only with corrosion prevention
- Relubrication using manual grease gun
- Basic lubrication required

LCF:

- Prepared for connection to central lubrication systems for liquid grease (NLGI grade 00 in accordance with DIN 51818)
- Lubrication with liquid grease only via single-line piston distributor system
- Basic lubrication required

LCO:

- Prepared for connection to central lubrication systems for oil
- Oil lubrication only via single-line piston distributor system
- Runner block and Ball Screw Assembly nut with integrated non-return valves
- Basic lubrication required

CKK Compact Modules
Lube version LSS, LPG

- Grease lubrication with manual grease gun via frame, carriage or via connection plate

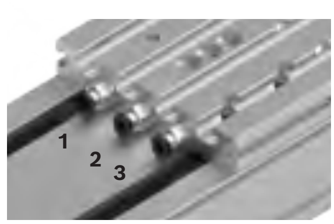
A

Connection plates

Lube version LCF, LCO

- 3 lube fittings
- Prepared for connection to central lubrication systems

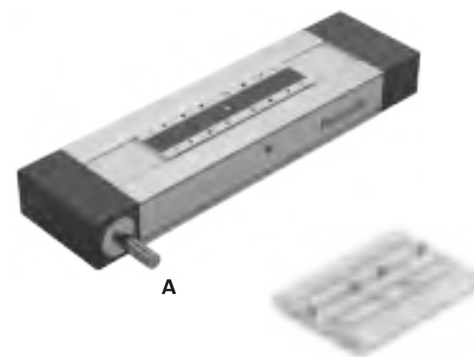
A



A Drive side
1 Lube connection, runner block left
2 Lube connection, runner block right
3 Lube connection, Ball Screw Assembly

CKR Compact Modules
Lube version LSS, LPG

- Grease lubrication with manual grease gun via frame, carriage or via connection plate

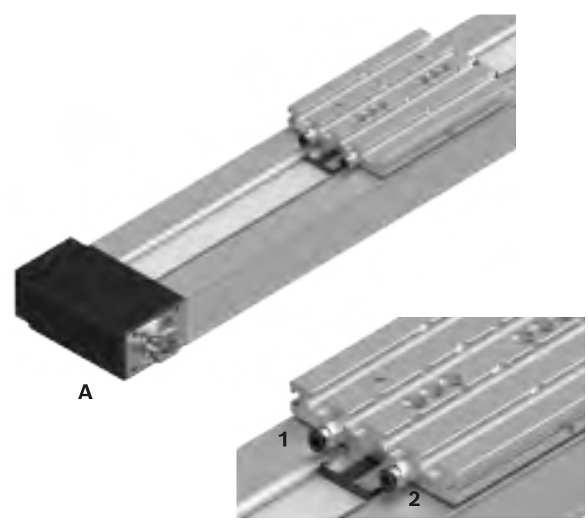


A

Connection plates

Lube version LCF, LCO

- 2 lube fittings
- Prepared for connection to central lubrication systems



A Drive side
1 Lube connection, runner block left
2 Lube connection, runner block right

Form of delivery

Compact Modules with Ball Rail System and Ball Screw Assembly or toothed belt drive are delivered completely assembled.

Motor attachment

If a combination of motor and motor attachment has been selected, then the components are attached as shown in the figure, which also shows the location of the motor connector.
When ordering motor attachments without motor, not all parts can be mounted.
Final assembly must then be carried out by the customer.
All necessary instructions and parameters for professional assembly are included.

Available options

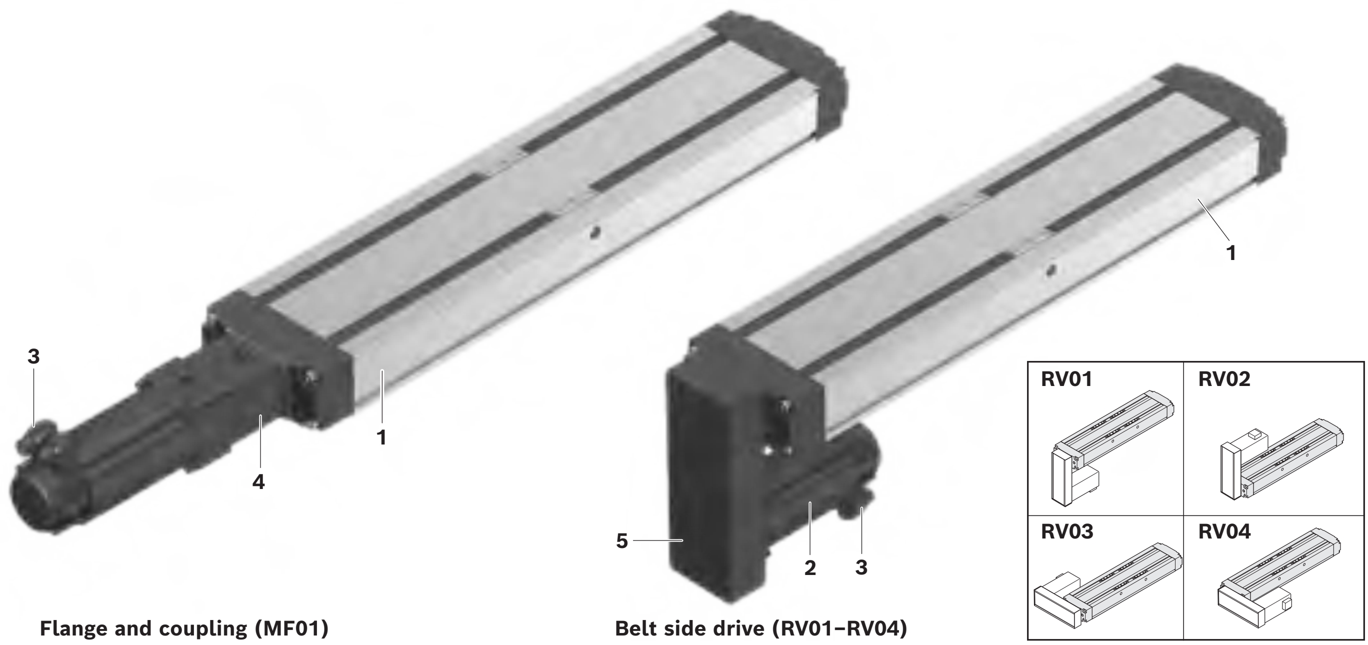
Cable duct, mounting duct, switch, switching cam and socket with plugs are included as loose parts.

Lubrication

Depending on the lube version, Compact Modules are delivered with initial greasing.
For information on lubricants, see section "Lubrication".
Documentation
Each Compact Modules is supplied with the appropriate documentation.

The lubrication holes in the main body are removed on all CKK and CKR versions configured with "Carriage with connecting plate".
All configured Compact Modules with carriages without connecting plate are still supplied with lubrication holes in the main body.

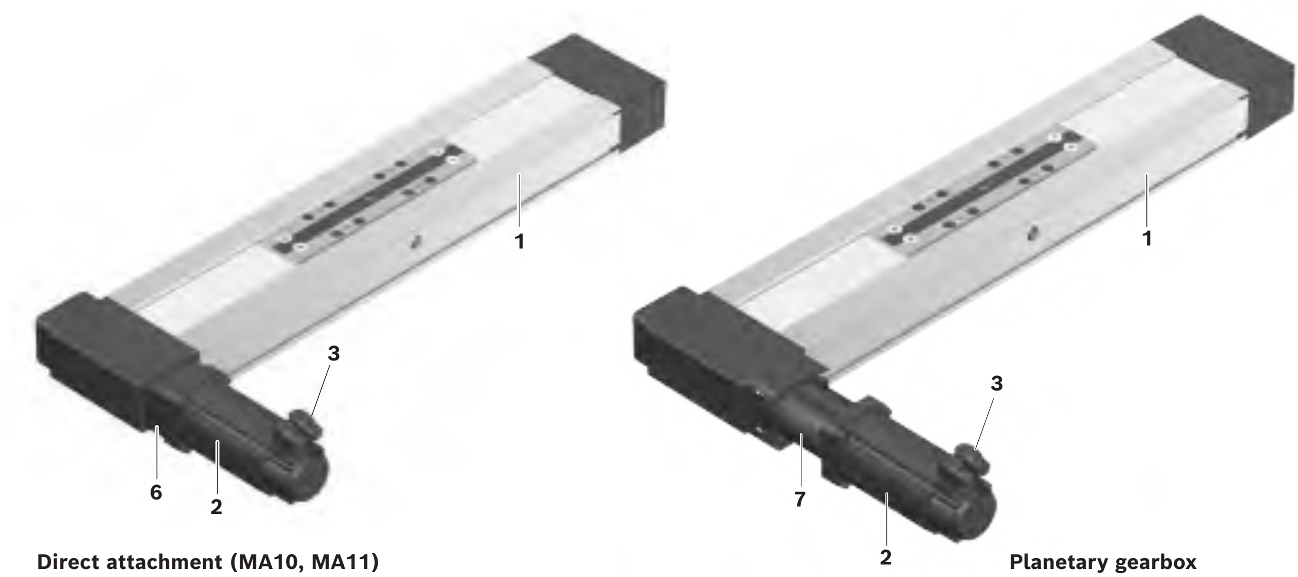
CKK



Flange and coupling (MF01)

Belt side drive (RV01–RV04)

CKR

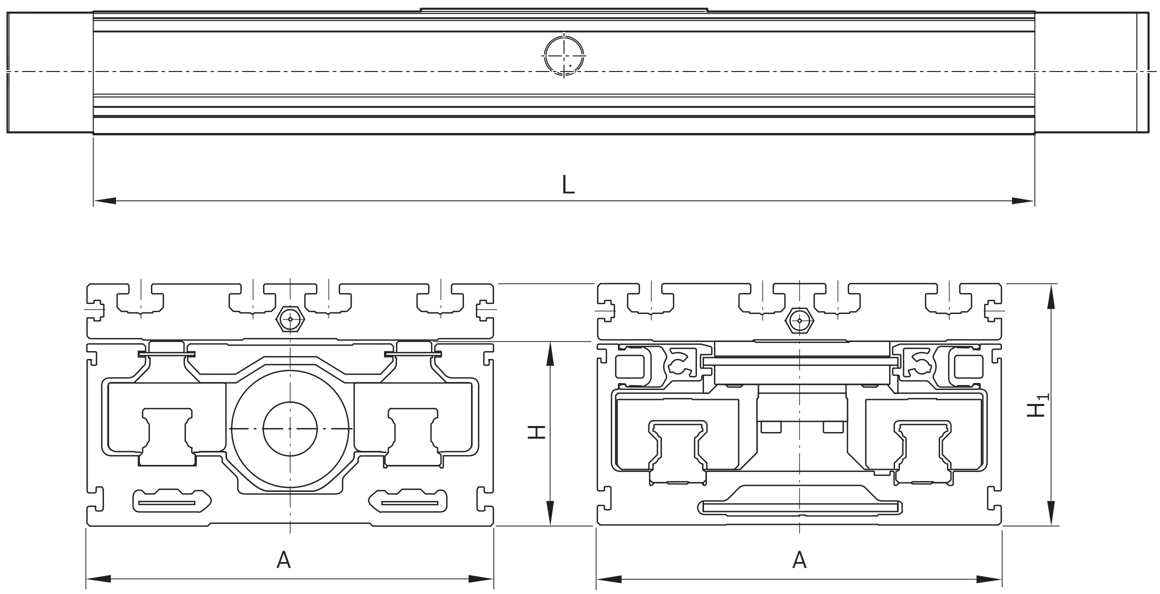


Direct attachment (MA10, MA11)

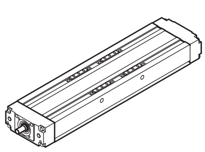
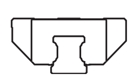
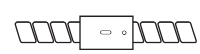
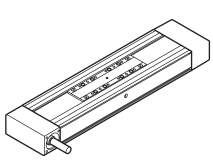
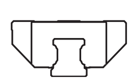
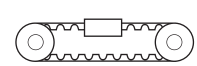
Planetary gearbox (MG10, MG11, MG01-MG04)

1 Linear motion system
2 Motor
3 Motor connector
4 Flange and coupling
5 Belt side drive
6 Direct attachment (flange)
7 Gearing

Overview of models with load capacities



CKK **CKR**

Compact Modules	Type	Guideway	Drive	
	CKK	 Ball Rail System	 Ball Screw Assembly	
	CKR	 Ball Rail System	 Toothed belt drive	

Note on dynamic load capacities and moments

Determination of the dynamic load capacities and moments is based on a total travel of 100,000 m. Often only 50,000 m of total travel are actually stipulated. For comparison: Multiply values C, M_t and M_L by a factor of 1.26.

Size	070			090			110			145			200		
Dimensions (mm)	**A**	**H**	**H_1**	**A**	**H**	**H_1**	**A**	**H**	**H_1**	**A**	**H**	**H_1**	**A**	**H**	**H_1**
	70	32	44.5	90	40	56	110	50	66	145	65	85	200	100	127
L_{max} (mm)	650			750			1,500			1,800			2,200[1]		
Dyn. load capacity C_{gw}[2] (N)	3,830			7,505			32,035			76,025			121,185		
L_{max} (mm)	1,500			5,500			5,500			5,500			10,000		
Dyn. load capacity C_{gw}[2] (N)	3,830			7,505			32,035			76,025			121,185		

[1] Up to 5500 mm are possible with screw support (SPU).
[2] The maximum permitted dynamic values are specified here.
They vary depending on the carriage length.

Compact Modules with Ball Screw Assembly (CKK)
Product overview

Features

- Five fine-tuned sizes based on a compact precision aluminum profile with two integrated pre-tensioned Ball Rail Systems
- Four different lube versions
- Ready-to-install Compact Modules in any length up to L_{max}
- Driven by precision Ball Screw Assembly in rolled design tolerance grade T7 in accordance with DIN 69051 with single nut set to zero-clearance
- High linear speeds thanks to large leads with high precision over long lengths
- Aluminum carriages available in different lengths
- Protection of installation elements through a cover plate and two cover strips; optionally increased protection thanks to "Resist" cover
- Low-cost maintenance
- Repeatability of up to ± 0.005 mm

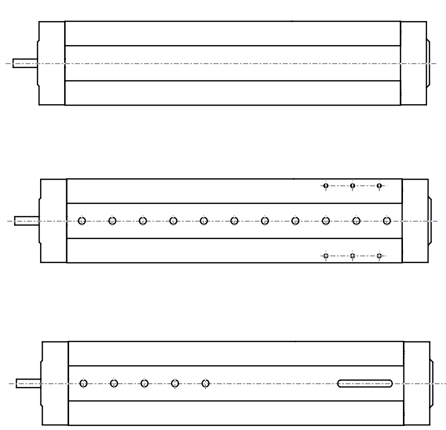
Further highlights

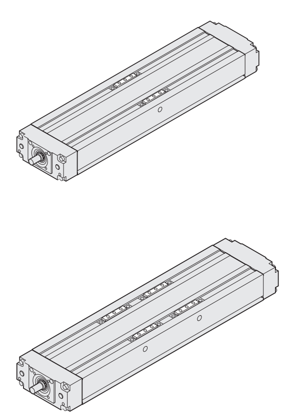
- Flexible thanks to selectable options
- Center holes for simple combination with other Linear Motion Systems and connection elements
- Extensive accessories for connection and clamping elements
- Nameplate with parameters for easy start-up

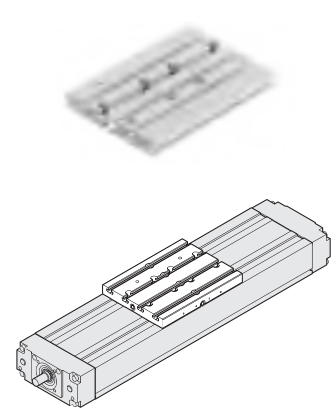
Attachments

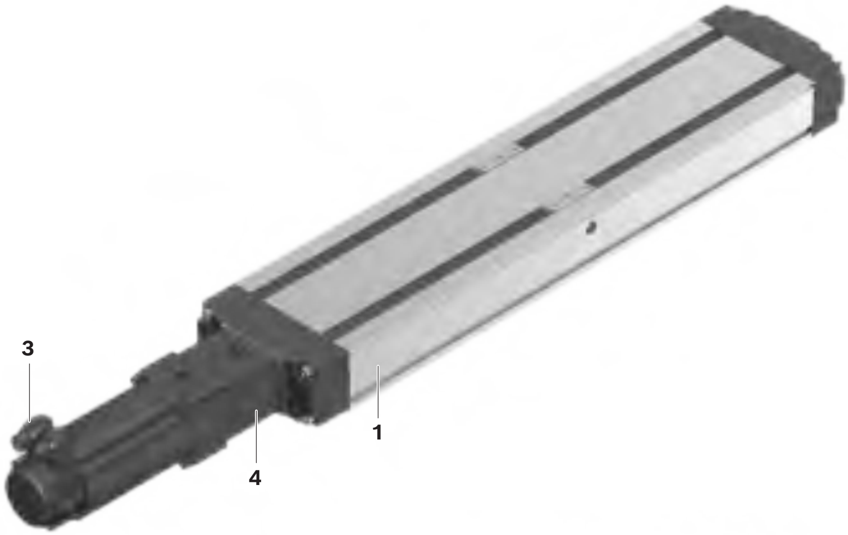
- Motor attachments with flange and coupling or via a belt side drive
- Motor attachment kits according to customer specification
- Maintenance-free servo motors with selectable brake and attached feedback
- Magnetic sensors, switch activation without additional switch flag
- Socket and plug
- Mounting duct made of aluminum for sensors

Design/options for guideway (frame), carriages, connection plates

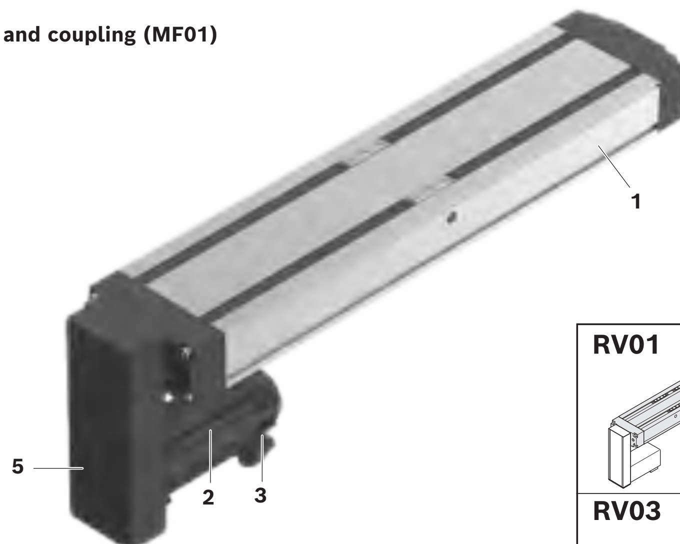

Guideway (frame)

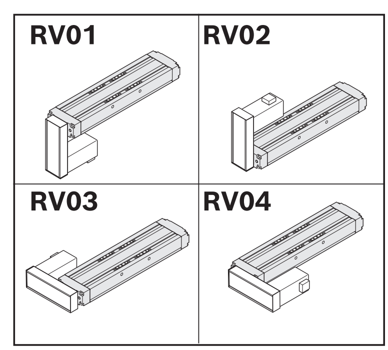

Carriages


Connection plates



Flange and coupling (MF01)





Belt side drive (RV01–RV04)

1 Linear motion system
2 Motor
3 Motor connector
4 Flange and coupling
5 Belt side drive

Screw support for Compact Modules CKK-200

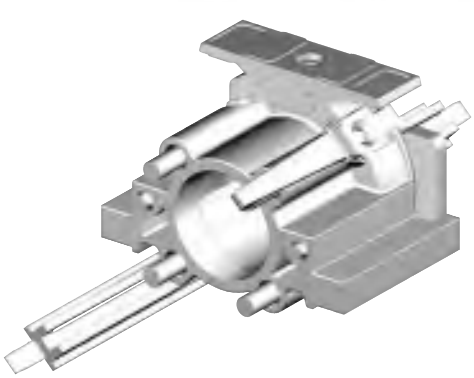
Structural design:

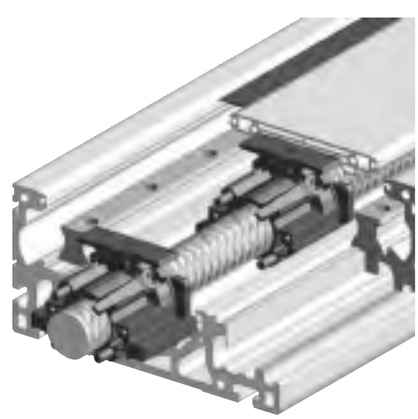
- Guidance of the screw supports in the frame.

Features:

- High speed over longer lengths of up to 5,500 mm.
- Elastomer buffer provides cushioning between carriage and screw supports.
- Screw supports are maintenance-free.
- Screw supports are protected by the cover sheet and cover strips.
- The screw supports prevent the cover sheet from sagging in all directions.

⚠ **Screw support suitable for horizontal operation only**

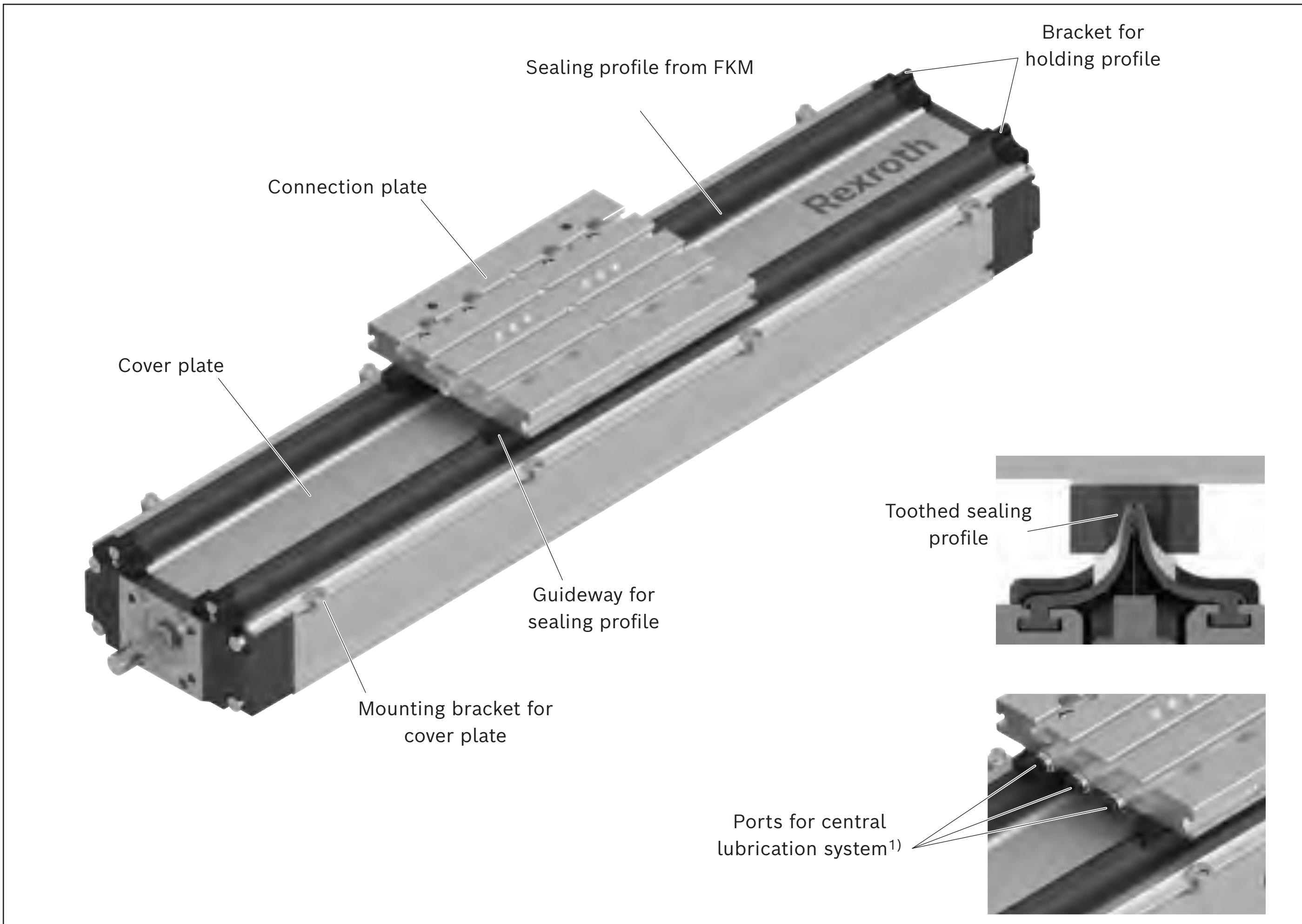




"Resist" cover

Structural design:
- Sizes: CKK -110, -145, -200
- Possible for version with connection plate

Features:
- Increased protection thanks to the toothed sealing profile
- The integrated guideway on the carriage ensures the sealing profile interlocks perfectly
- Sealing profile made of flexible FKM – material
- Free of LABS (substances harmful to paint structure)
- Replaceable sealing profile
- The sealing profile has a short-term temperature resistance of up to 300°C
- Suitable for exposure to dry chips with broken chips of aluminum and component handling during welding application
- Selectable with all lube versions



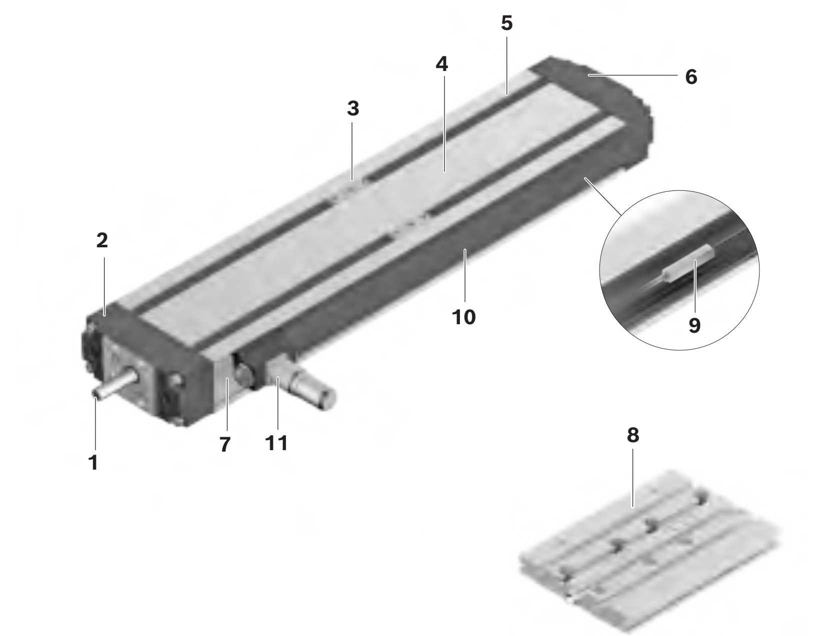
1) see "Lubrication" chapter

Structural design

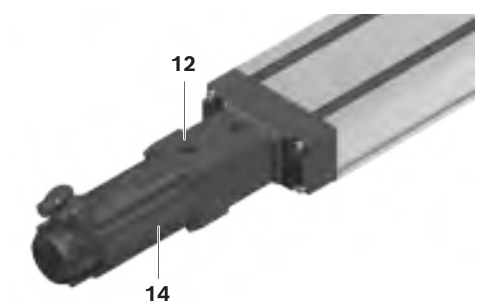
Structural design CKK

1 Ball Screw Assembly with zero-backlash single nut
2 Drive-side cross tie
3 Carriage with integrated runner block
4 Cover plate
5 Cover strip made of reinforced PU strip
6 End block
7 Frame

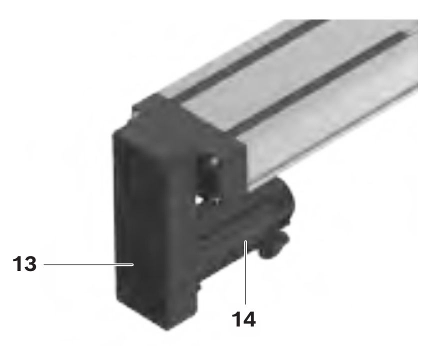
Attachments:
8 Connection plate
9 Magnetic sensor
10 Mounting channel
11 Socket/plug
12 Flange and coupling
13 Belt side drive
14 Motor



Motor attachment – flanged type and coupling



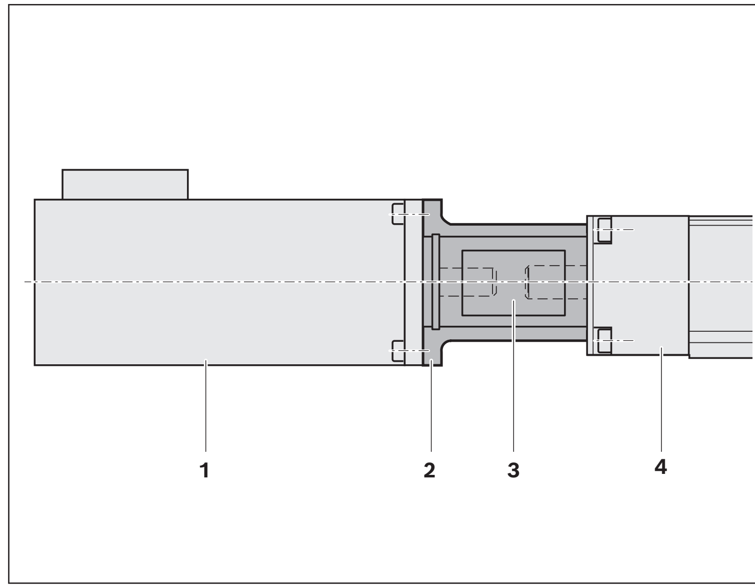
Motor attachment – belt side drive



Motor attachment with flange and coupling

A motor can be attached to all Compact Modules with Ball Screw Assembly by means of flange and coupling. The motor mount serves to fasten the motor to the Compact Modules and acts as a closed housing for the coupling. The motor's drive torque is transmitted stress-free through the coupling to the Compact Modules drive shaft.
Our standard couplings compensate for the system's thermal expansion.

1 Motor
2 Flange
3 Coupling
4 Compact module



Structural design belt side drive

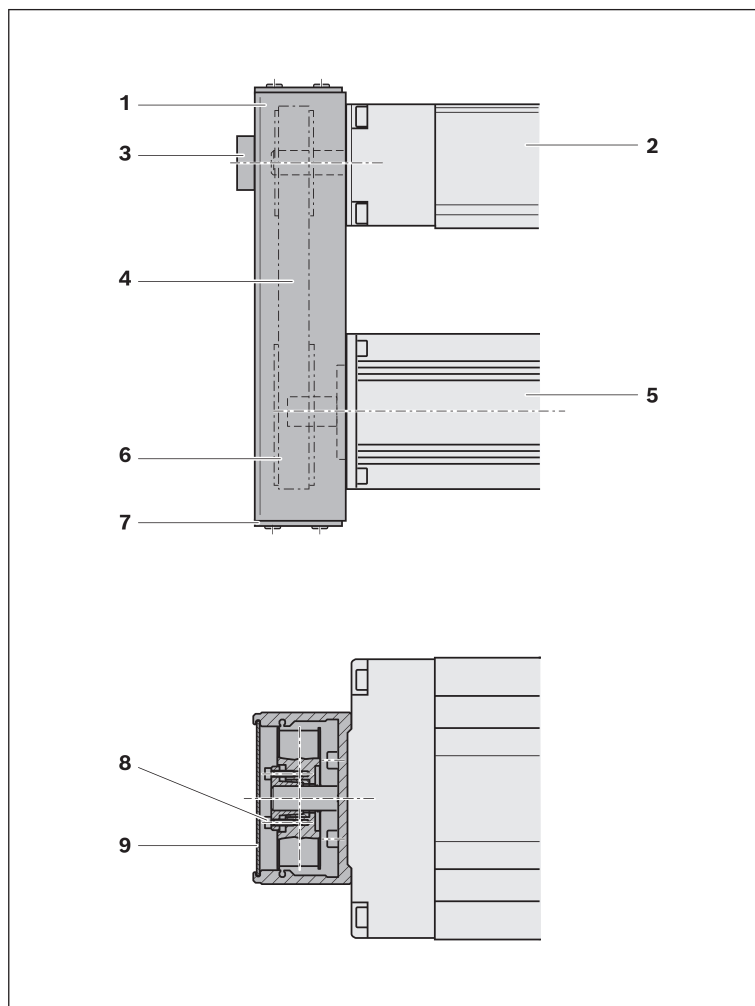
All Compact Modules with Ball Screw Assembly offer the option of attaching the motor via a belt side drive.
This makes the overall length shorter than when attaching the motor with flange and coupling.
The space-saving, closed pulley housing serves as protection for the belt and as a motor bracket.
In addition, various gear ratios are also available (depending on size):

- i = 1
- i = 1.5
- i = 2

The belt side drive can be mounted in four different directions:

- below, above (RV01 and RV02)
- left, right (RV03 and RV04)

1 Pulley housing made of anodized aluminum
2 Compact Modules
3 Support bearing at the screw journal in size CKK-070
4 Toothed belt drive
5 Motor
6 Toothed belt drive
7 Cover
8 Belt pulleys with tensioning units
9 Cover plate



Technical data

General technical data

Observe the "Project planning/calculation" chapter.

CKK	Carriage			Additional length		Min. travel range	Max. length	Rexroth Ball Screw Assembly	Dynamic characteristics				
	Connection plate			Connection plate					Load ratings			Load moments	
	without[1]	with[2]		without	with								
	L_{ca}	L_{ca}	L_W[3]	L_{ad}	L_{ad}	s_{min}[4]	L_{max}	d_0 x P	C_{gw}	C_{bs}	C_{fb}	M_t	M_L[5]
	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(N)	(N)	(N)	(Nm)	(Nm)
-070	32	60	–	30	2	40	650	8 x 2.5 8 x 5	2 360	2 250 2 500	1 600	47	7
	73	95			8			8 x 2.5 8 x 5	3 830	2 250 2 500		77	111
-090	35	60	–	50	25	40	750	12 x 2 12 x 5 12 x 10	4,620	2,420 4,100 2,700	6,900	125	16
	100	125	–	50	25	40	750	12 x 2 12 x 5 12 x 10	7,505	2,420 4,100 2,700	6,900	203	244
	variable min. 101 max. 235	–	variable min. 66 max. 200	50	–	40	750	12 x 2 12 x 5 12 x 10	7,505	2,420 4,100 2,700	6,900	203	3.75 x L_W
-110	39	60	–	51	30	50	1,500	16 x 5 16 x 10 16 x 16	19,720	13,320 10,350 6,800	13,400	651	136
	124	155	85	51	20	50	1,500	16 x 5 16 x 10 16 x 16	32,035	13,320 10,350 6,800	13,400	1,057	1,361
	variable min. 125 max. 289	–	variable min. 86 max. 250	51	–	50	1,500	16 x 5 16 x 10 16 x 16	32,035	13,320 10,350 6,800	13,400	1,057	16.01 x L_W
-145	49	80	–	61	30	60	1,800	20 x 5 20 x 20 20 x 40 25 x 10	46,800	15,480 9,810 12,600 16,920	17,000	2,059	400
	149	190	100	61	20	60	1,800	20 x 5 20 x 20 20 x 40 25 x 10	76,025	15,480 9,810 12,600 16,920	17,000	3,345	3,801
	variable min. 150 max. 349	–	variable min. 101 max. 300	61	–	60	1,800	20 x 5 20 x 20 20 x 40 25 x 10	76,025	15,480 9,810 12,600 16,920	17,000	3,345	38.01 x L_W
-200	79.5	190	–	120.5	10	80	2,200	32 x 5 32 x 10 32 x 20 32 x 32	74,600	23,310 34,200 21,240 21,060	26,000	4,849	1,053
	254.5	305	175	120.5	70	80	2,200	32 x 5 32 x 10 32 x 20 32 x 32	121,185	23,310 34,200 21,240 21,060	26,000	7,877	10,604
	variable min. 255.5 max. 429.5	–	variable min. 176 max. 350	120.5	–	80	2,200	32 x 5 32 x 10 32 x 20 32 x 32	121,185	23,310 34,200 21,240 21,060	26,000	7,877	60.59 x L_W

1) In the "without connection plate" version, carriage length L_{ca} corresponds to the dimension of the outer edge to outer edge of the fastening bridges.
Dynamic parameters and maximum permissible loads are valid only when connecting the fixing screw via customer attachment.
2) The connection plate is mounted on the "without connection plate" carriage version.
In the "with connection plate" version, carriage length L_{ca} corresponds to the length of the connection plate.
3) A variable center-to-center distance L_W is only possible for the "without connection plate" carriage design.
The variable center-to-center distance is freely selectable between minimum and maximum distance in millimeters steps.

Maximum permissible loads						Planar moments of inertia		Point of force application	
Moments			Forces					Connection plate	
								without	with
$M_{x\,max}$	$M_{y\,max}$ 5)	$M_{z\,max}$ 5)	$F_{y\,max}$	$F_{z1\,max}$	$F_{z2\,max}$	I_y	I_z	Z_1	Z_1
(Nm)	(Nm)	(Nm)	(N)	(N)	(N)	(cm^4)	(cm^4)	(mm)	(mm)
47	7	7	1270	2360	2360	12.10	63.3	19.2	31.7
77	111	60	2070	3830	3830				
112	16	16	2,490	4,620	4,140				
203	244	132	4,050	7,505	7,505	14.32	124.4	23.2	39.2
203	3.75 x L_W	2.03 x L_W	4,050	7,505	7,505				
198	32	32	3,480	6,000	6,000				
396	510	240	5,650	12,000	12,000	37.74	318.7	26.7	42.7 (60.7) 6)
396	6 x L_W	2.82 x L_W	5,650	12,000	12,000				
634	100	100	8,410	14,400	14,400				
1,267	1,440	683	13,660	28,800	28,800	114.10	986.4	31.6	51.6 (71.6) 6)
1,267	14.4 x L_W	6.83 x L_W	13,660	28,800	28,800				
1,375	299	299	12,265	21,150	21,150				
2,750	3,701	1,744	19,925	42,300	42,300	612.00	3,008.0	36.0	63.0 (86.4) 6)
2,750	21.14 x L_W	9.97 x L_W	19,925	42,300	42,300				

4) Minimum required travel distance to ensure a reliable lubrication distribution.
5) For the variable L_W, M_L, $M_{y\,max}$ and $M_{z\,max}$ must be determined according to the selected center-to-center distance L_W.
6) "Resist" cover ➡ "Resist" chapter.

Drive data

Observe the "Project planning/calculation" chapter.

CKK	BASA	Carriage Connection plate without	Carriage Connection plate with	Constant weight calculation		Moved system mass Connection plate without[1)]	Moved system mass Connection plate with
	d_0 x P (mm)	L_{ca} (mm)	L_{ca} (mm)	$k_{g\ fix}$ (kg)	$k_{g\ var}$ (kg/mm)	m_{ca} (kg)	m_{ca} (kg)
-070	8 x 2.5	32	60	0.29	0.0038	0.15	0.26
		73	95			0.25	0.42
	8 x 5	32	60			0.15	0.26
		73	95			0.25	0.42
-090	12 x 2	35	60	0.50	0.0054	0.36	0.54
		100	125			0.59	0.96
	12 x 5	35	60			0.36	0.54
		100	125			0.59	0.96
	12 x 10	35	60			0.36	0.54
		100	125			0.59	0.96
-110	16 x 5	39	60	0.91	0.0094	0.52	0.75
		124	155			0.86	1.45
	16 x 10	39	60			0.52	0.75
		124	155			0.86	1.45
	16 x 16	39	60			0.52	0.75
		124	155			0.86	1.45
-145	20 x 5	49	80	1.91	0.0179	1.21	1.71
		149	190			2.06	3.26
	20 x 20	49	80			1.21	1.71
		149	190			2.06	3.26
	20 x 40	49	80			1.21	1.71
		149	190			2.06	3.26
	25 x 10	49	80			1.21	1.71
		149	190			2.06	3.26
-200	32 x 5	79.5	190	4.06	0.0296	3.20	5.50
		254.5	305			5.20	8.90
	32 x 10	79.5	190			3.20	5.50
		254.5	305			5.20	8.90
	32 x 20	79.5	190			3.20	5.50
		254.5	305			5.20	8.90
	32 x 32	79.5	190			3.20	5.50
		254.5	305			5.20	8.90

1) For the carriage version with variable center-to-center distance L_W the larger value is valid.

Constant mass moment of inertia				Frictional torque[1)]	Max. acceleration	Max. travel speed	Max. drive torque:
Connection plate without[1)]	with						
$k_{J\ fix}$ (kgmm²)	$k_{J\ fix}$ (kgmm²)	$k_{J\ var}$ (kgmm)	$k_{J\ m}$ (mm²)	M_{Rs} (Nm)	a_{max} (m/s²)	v_{max} (m/s)	M_P (Nm)
0.769	0.786	0.004	0.158	0.07	50.0	see "Diagrams" chapter	see "Diagrams" chapter
0.785	0.812						
0.840	0.910		0.633				
0.903	1.011						
1.279	1.298	0.013	0.101	0.13	48.4		
1.303	1.340			0.14			
1.454	1.568	0.011	0.633	0.15	50.0		
1.599	1.834			0.16			
2.138	2.594	0.011	2.533	0.18	50.0		
2.720	3.658			0.20			
5.088	5.234	0.031	0.633	0.37	50.0		
5.303	5.677			0.40			
6.076	6.658	0.031	2.533	0.40	50.0		
6.937	8.432			0.43			
8.161	9.652	0.034	6.485	0.42	50.0		
10.365	14.191			0.48			
22.564	22.880	0.084	0.633	0.48	39.8		
23.102	23.862			0.52			
34.029	39.950	0.081	10.132	0.60	50.0		
42.641	54.800			0.68			
70.856	91.120	0.086	40.528	0.70	50.0		
105.305	153.939			0.86			
26.335	27.601	0.239	2.533	0.60	50.0		
28.488	31.528			0.65			
71.348	72.867	0.605	0.633	1.10	17.9		
72.741	75.147			1.20			
76.612	82.691	0.640	2.533	1.10	30.7		
82.185	91.810			1.20			
93.299	117.676	0.639	10.132	1.15	50.0		
115.590	154.092			1.25			
127.391	189.642	0.617	25.938	1.25	50.0		
184.455	283.020			1.35			

Technical data for CKK-200 with screw support

General technical data

Observe the "Project planning/calculation" chapter.

CKK	Carriage		BASA	Screw support	Additional length		Max. length	Min. travel distance	Dynamic characteristics				
	Connection plate				Connection plate				Load ratings			Load moments	
	without[1]	with[2]			without	with							
	L_{ca} (mm)	L_{ca} (mm)	d_0 x P (mm)		L_{ad} (mm)	L_{ad} (mm)	L_{max} (mm)	s_{min}[3] (mm)	C_{gw} (N)	C_{bs} (N)	C_{fb} (N)	M_t (Nm)	M_L (Nm)
-200	79.5	190	32 x 5	0	120.5	10	2,200	80	74,600	23,310	26,000	4,849	1,053
				1	235.5	–	3,500						
				2	360.5	–	4,600						
				3	485.5	–	5,500						
			32 x 10	0	120.5	10	2,200			34,200			
				1	235.5	–	3,500						
				2	360.5	–	4,600						
				3	485.5	–	5,500						
			32 x 20	0	120.5	10	2,200			21,240			
				1	235.5	–	3,500						
				2	360.5	–	4,600						
				3	485.5	–	5,500						
			32 x 32	0	120.5	10	2,200			21,060			
				1	235.5	–	3,500						
				2	360.5	–	4,600						
				3	485.5	–	5,500						
	254.5	305	32 x 5	0	120.5	70	2,200	80	121,185	23,310	26,000	7,877	10,604
				1	235.5	185	3,600						
				2	360.5	310	4,700						
				3	485.5	435	5,500						
			32 x 10	0	120.5	70	2,200			34,200			
				1	235.5	185	3,600						
				2	360.5	310	4,700						
				3	485.5	435	5,500						
			32 x 20	0	120.5	70	2,200			21,240			
				1	235.5	185	3,600						
				2	360.5	310	4,700						
				3	485.5	435	5,500						
			32 x 32	0	120.5	70	2,200			21,060			
				1	235.5	185	3,600						
				2	360.5	310	4,700						
				3	485.5	435	5,500						

1) In the "without connection plate" version, carriage length L_{ca} corresponds to the dimension of the outer edge to outer edge of the fastening bridges.
Dynamic parameters and maximum permissible loads are valid only when connecting the fixing screw via customer attachment.
2) The connection plate is mounted on the "without connection plate" carriage version.
In the "with connection plate" version, carriage length L_{ca} corresponds to the length of the connection plate.
3) Minimum required travel distance to ensure a reliable lubrication distribution.

Maximum permissible loads						Constants		Planar moments of inertia		Point of force application Connection plate	
Moments			Forces			Mass calculation				without	with
$M_{x\ max}$ (Nm)	$M_{y\ max}$ (Nm)	$M_{z\ max}$ (Nm)	$F_{y\ max}$ (N)	$F_{z1\ max}$ (N)	$F_{z2\ max}$ (N)	$k_{g\ fix}$ (kg)	$k_{g\ var}$ (kg/mm)	I_y (cm^4)	I_z (cm^4)	Z_1 (mm)	Z_1 (mm)
1,375	299	299	12,265	21,150	21,150	4.06	0.0296	612.00	3,008.0	36.0	63.0
2,750	3,701	1,744	19,925	42,300	42,300	4.06	0.0296	612.00	3,008.0	36.0	63.0

Drive data

Observe the "Project planning/calculation" chapter.

CKK	BASA d_0 x P (mm)	Screw support	Carriage – Connection plate without L_{ca} (mm)	Carriage – Connection plate with L_{ca} (mm)	Constant mass calculation $k_{g\ fix}$ (kg)	Constant mass calculation $k_{g\ var}$ (kg/mm)	Moved system mass – Connection plate without[1)] m_{ca} (kg)	Moved system mass – Connection plate with m_{ca} (kg)
-200	32 x 5	0	79.5	190	4.06	0.0296	3.20	5.50
		1					3.40	–
		2					3.60	–
		3					3.80	–
		0	254.5	305			5.20	8.90
		1					5.40	9.10
		2					5.60	9.30
		3					5.80	9.50
	32 x 10	0	79.5	190			3.20	5.50
		1					3.40	–
		2					3.60	–
		3					3.80	–
		0	254.5	305			5.20	8.90
		1					5.40	9.10
		2					5.60	9.30
		3					5.80	9.50
	32 x 20	0	79.5	190			3.20	5.50
		1					3.40	–
		2					3.60	–
		3					3.80	–
		0	254.5	305			5.20	8.90
		1					5.40	9.10
		2					5.60	9.30
		3					5.80	9.50
	32 x 32	0	79.5	190			3.20	5.50
		1					3.40	–
		2					3.60	–
		3					3.80	–
		0	254.5	305			5.20	8.90
		1					5.40	9.10
		2					5.60	9.30
		3					5.80	9.50

1) For the carriage version with variable center-to-center distance L_W the larger value is valid.

Constant mass moment of inertia				Frictional torque[1)]	Max. acceleration	Max. speed	Max. drive torque
Connection plate							
without[1)]	with						
$k_{J\ fix}$	$k_{J\ fix}$	$k_{J\ var}$	$k_{J\ m}$	M_{Rs}	a_{max}	v_{max}	M_P
(kgmm²)	(kgmm²)	(kgmm)	(mm²)	(Nm)	(m/s²)	(m/s)	(Nm)
71.348	72.867	0.605	0.633	1.10	17.9	see "Diagrams" chapter	see "Diagrams" chapter
71.474	–			1.20			
71.601	–			1.20			
71.728	–			1.40			
72.741	75.147	0.605	0.633	1.20			
72.867	75.274			1.30			
72.994	75.400			1.30			
73.121	75.527			1.50			
76.612	82.691	0.640	2.533	1.10	30.7		
77.119	–			1.20			
77.625	–			1.40			
78.132	–			1.50			
82.185	91.810	0.640	2.533	1.20			
82.691	92.317			1.30			
83.198	92.823			1.50			
83.705	93.330			1.60			
93.299	117.616	0.639	10.132	1.15	50.0		
95.326	–			1.30			
97.352	–			1.50			
99.378	–			1.70			
115.590	154.092	0.639	10.132	1.25			
117.676	156.118			1.40			
119.643	158.145			1.60			
121.669	160.171			1.80			
127.391	189.642	0.617	25.938	1.25	50.0		
132.578	–			1.40			
137.766	–			1.70			
142.953	–			1.90			
184.455	283.020	0.617	25.938	1.35			
189.642	288.207			1.50			
194.830	293.395			1.80			
200.018	298.583			2.00			

Technical data

Drive data for motor attachment via belt side drive

Observe the "Project planning/calculation" chapter.

CKK	Motor	BASA (mm) d_0 x P	up to L[1] (mm)	M_{sd}[2] (Nm) i = 1	M_{sd}[2] (Nm) i = 1.5	J_{sd} (10^{-6} kgm²) i = 1	J_{sd} (10^{-6} kgm²) i = 1.5	M_{Rsd} (Nm)	m_{sd} (kg) i = 1	m_{sd} (kg) i = 1.5	B_t i = 1	B_t i = 1.5
-070	MSM019B	8 x 2.5	450	0.71	0.47	10.7	4.1	0.06	0.28	0.26	6 AT3	6 AT3
	MS2N03-B MSM031B	8 x 2.5	450	0.71	0.47	34.77	13.05	0.15	0.66	0.63	10 AT3	10 AT3
	MSM019B	8 x 5	450	1.31	0.87	10.7	4.1	0.06	0.28	0.26	6 AT3	6 AT3
	MS2N03-B MSM031B	8 x 5	450	1.41	0.94	34.77	13.05	0.15	0.66	0.63	10 AT3	10 AT3
-090	MS2N03-B MSM031C	12 x 2	750	0.79	0.53	38.0	14.0	0.15	0.53	0.48	10 AT3	10 AT3
		12 x 5	750	2.39	1.59							
		12 x 10	750	2.73	1.82							
-110	MS2N03-B MSM031C	16 x 5	1,250	3.17	2.11	41.0	16.0	0.15	0.53	0.48	10 AT3	10 AT3
		16 x 10	1,500	3.17	2.11							
		16 x 16	1,500	3.17	2.11							
	MS2N04 MSM041B	16 x 5	850	6.76	4.51	240.0	82.0	0.40	1.34	1.24	16 AT5	16 AT5
		16 x 10	1,150	7.66	5.11							
		16 x 16	1,450	7.66	5.11							
-145	MS2N04 MSM041B	20 x 5	1,350	8.22	5.48	250.0	85.0	0.40	1.42	1.31	16 AT5	16 AT5
		20 x 20	1,800	8.22	5.48							
		20 x 40	1,800	8.22	5.48							
		25 x 10	1,800	8.22	5.48							

CKK	Motor	BASA (mm) d_0 x P	up to L[1] (mm)	M_{sd}[2] (Nm) i = 1	M_{sd}[2] (Nm) i = 2	J_{sd} (10^{-6} kgm²) i = 1	J_{sd} (10^{-6} kgm²) i = 2	M_{Rsd} (Nm)	m_{sd} (kg) i = 1	m_{sd} (kg) i = 2	B_t i = 1	B_t i = 2
-145	MS2N05	20 x 5	1,150	11.00	5.50	1,310	217	0.45	3.5	3.1	25 AT5	25 AT5
		20 x 20	1,800	17.73	8.87							
		20 x 40	1,800	17.73	8.87							
		25 x 10	1,800	17.73	8.87							
-200	MS2N06	32 x 5	2,200	19.00	9.50	1,400	260	0.50	3.8	3.5	25 AT5	32 AT5
		32 x 10	2,200	19.21	12.30							
		32 x 20	2,200	19.21	12.30							
		32 x 32	2,200	19.21	12.30							

1) For greater lengths, the permissible drive torque is determined from the length-variable value M_p of the linear motion system in accordance with the diagram ➡ "Project planning/calculation" chapter

2) Values for M_{sd} do not factor in motor torque.

Drive data for motor attachment via flange and coupling

CKK	Motor	Coupling		Flange and coupling
		M_{cN} (Nm)	J_c (10^{-6} kgm²)	m_{fc} (kg)
-070	MS2N03-B	3.7	7.00	0.30
	MSM019B	1.9	2.10	0.15
	MSM031B	3.7	7.00	0.30
-090	MS2N03-B	13.0	12.20	0.30
	MSM031C	13.0	12.20	0.35
-110	MS2N03-B	13.0	12.20	0.45
	MS2N03-D	14.0	12.20	0.45
	MS2N04	14.0	12.20	0.60
	MSM031C	14.0	12.20	0.45
	MSM041B	29.4	42.29	0.65
-145	MS2N04	26.1	42.29	0.80
	MS2N05	26.1	42.29	1.00
	MSM041B	26.1	42.29	0.80
-200	MS2N06	50.0	210.00	1.80
	MS2N07	98.0	390.00	2.25

Diagrams

Permissible drive torque

The values shown for M_p apply under the following conditions:

- Screw journal without keyway
- No radial load on screw journal

⚠ **Keep in mind the rated torque of the coupling being used! Keep in mind the minimum travel smin!**

⚠ **Screw journal with keyway**

For reasons of stress concentration and a reduction of the effective diameter, observe the maximum values for drive torque!

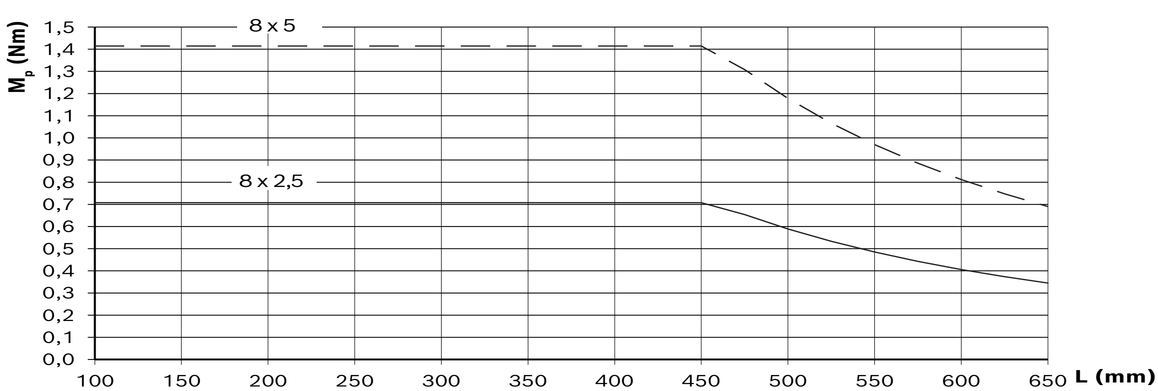
CKK	**M_p** (Nm)
-110 / -145	no reduction
-200	48.6

⚠ **For Ball Screw Assembly with keyway, the smallest value from the diagrams and table is valid.**

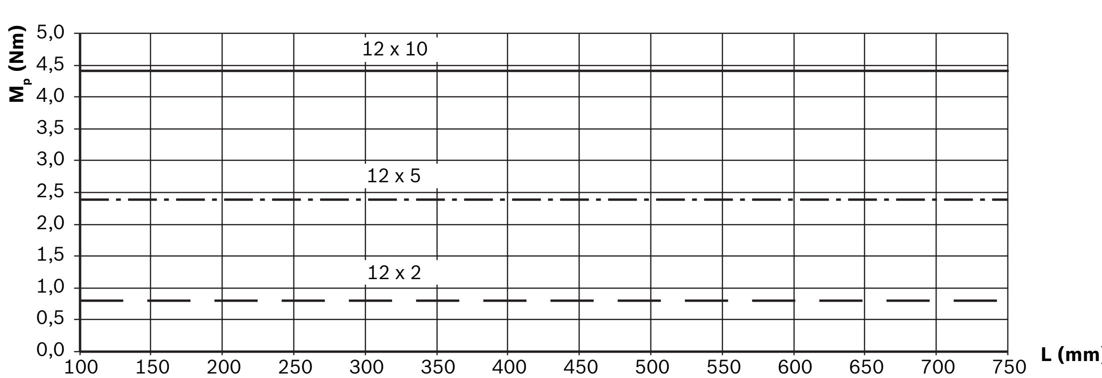
Example:

CKK-200		**(d_0 x P)**
	32 x 32	**32 x 10**
Length (mm)	1,500	1,500
M_p from diagram (Nm)	58.5	39.0
M_p maximum (Nm)	48.6	48.6
Value for dimensioning	48.6	39.0

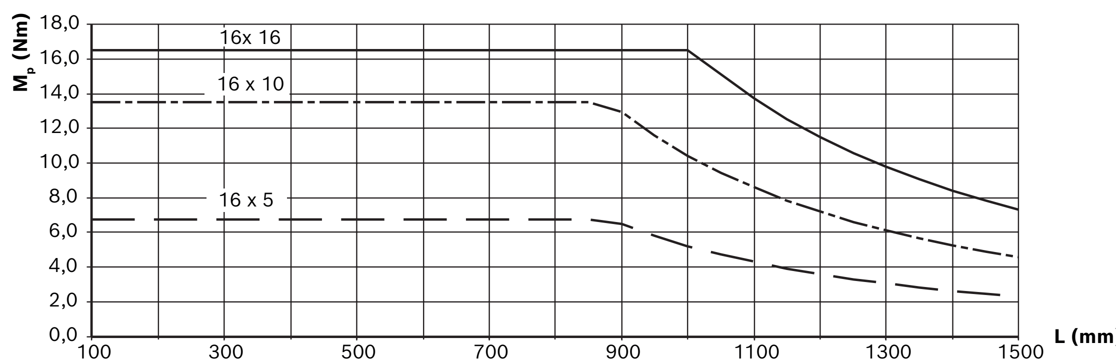
CKK-070



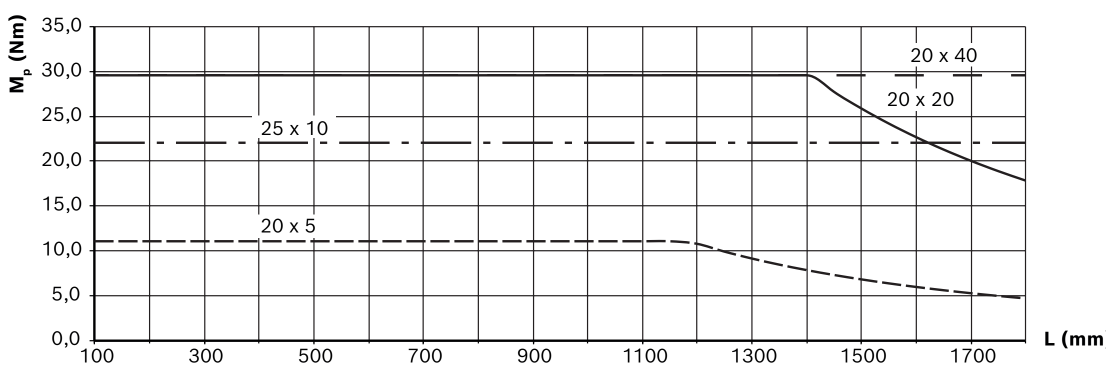
CKK-090



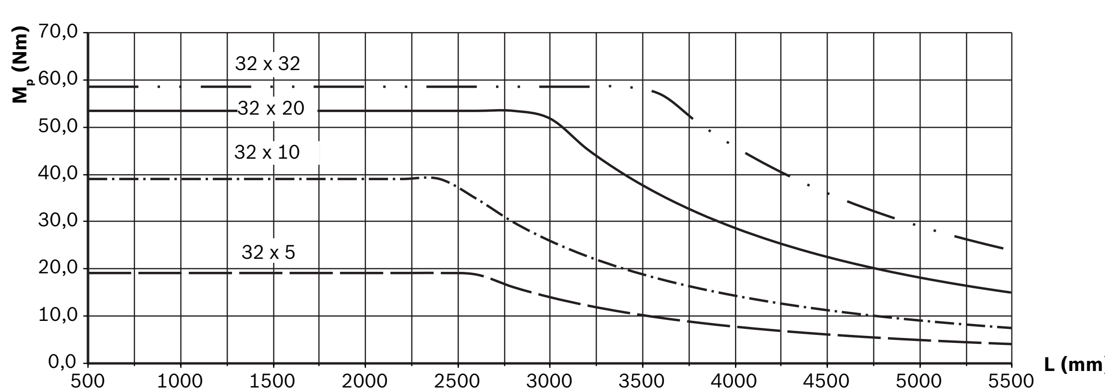
CKK-110



CKK-145



CKK-200

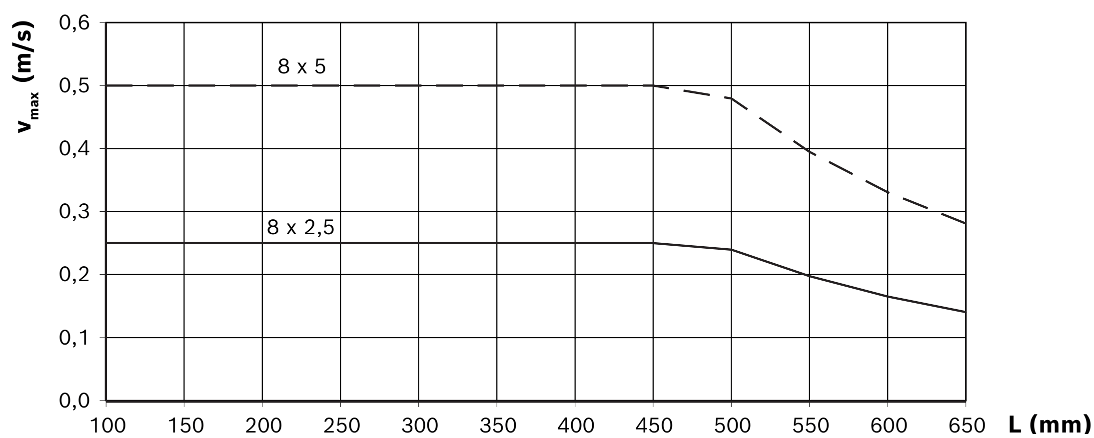


Permissible speed

Observe motor speed!

Keep in mind the minimum travel s_{min}!

CKK-070



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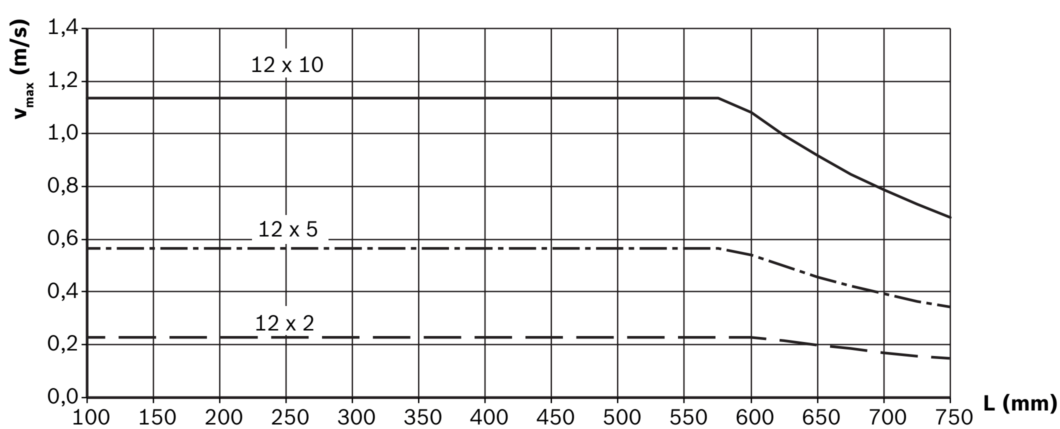

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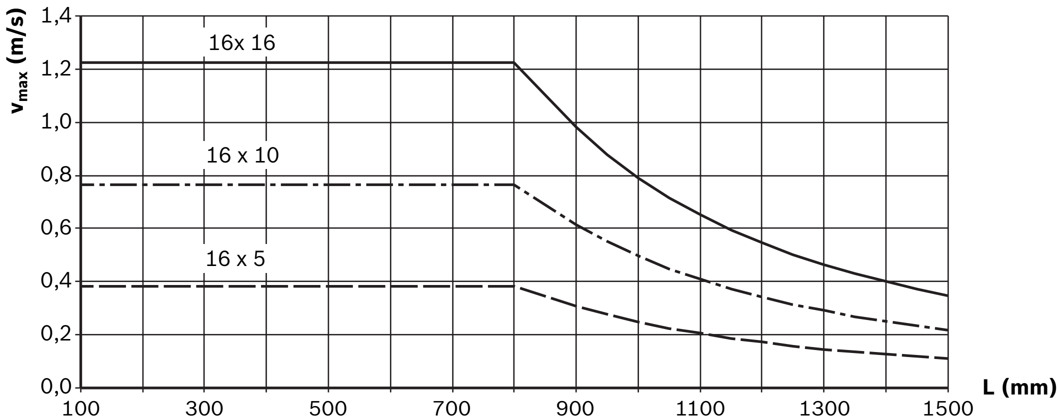
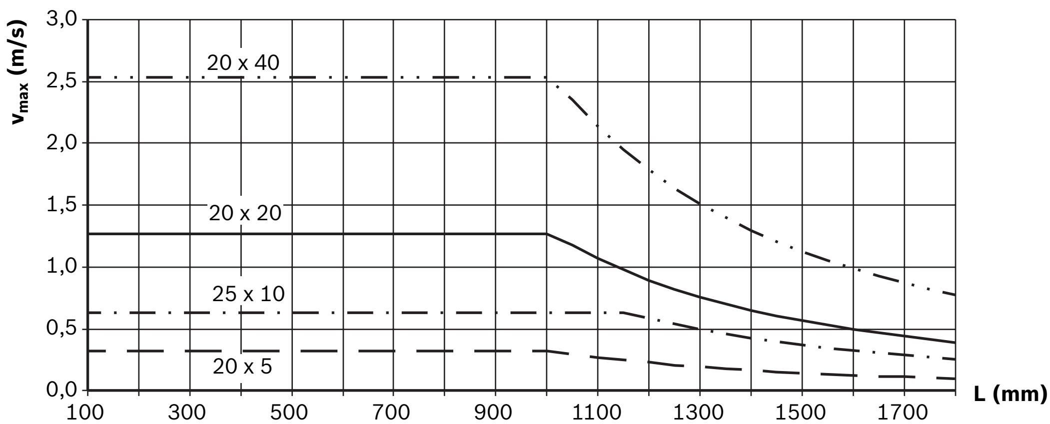
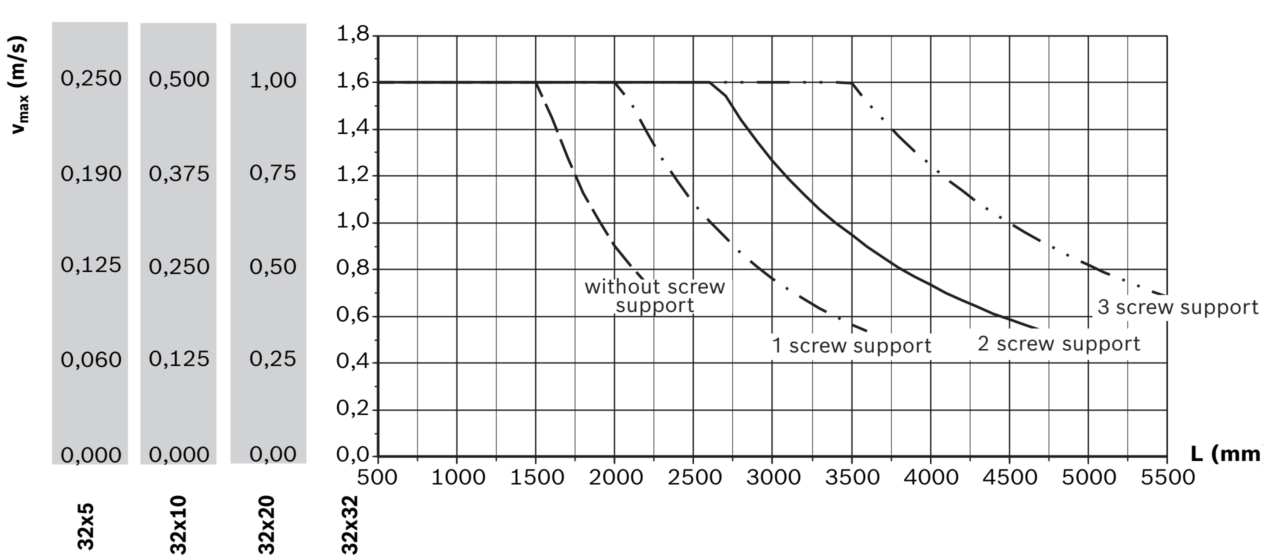


CKK-145

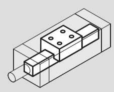
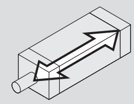
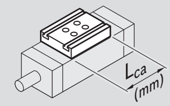


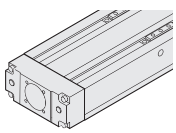
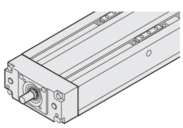
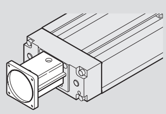
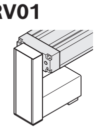
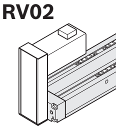
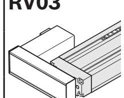
CKK-200



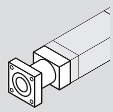
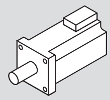
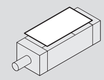
Configuration, order

CKK-070

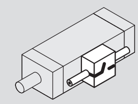




Short product name, length[1)] CKK-070-NN-1, ... mm		Guideway: Standard	Guideway: Center holes[2)]	Lubrication[3)]	Drive: Screw journal (mm)	Drive: BASA d_0 x P (mm) 8 x 2.5	Drive: BASA d_0 x P (mm) 8 x 5	Carriage: Connection plate without L_{ca} (mm) 32	Carriage: Connection plate without L_{ca} (mm) 73	Carriage: Connection plate with L_{ca} = (mm) 60	Carriage: Connection plate with L_{ca} = (mm) 95
Version											
without Drive	**OA01** 	01	03 / 04	LSS	–	050	050	01	02	40	41
				LPG				–	302	–	341
Without Attachment	**OF01** 			LSS	Ø6	01	02	01	02	40	41
Flange/ coupling	**MF01** 										
Belt side drive	**RV01**  **RV02**  **RV03**  **RV04** 			LPG	Ø6	31	32	–	302	–	341

1) Length calculation of the linear motion system ➠ "Project planning/calculation" chapter.
2) Center holes for simple combination with other linear motion systems and connection elements (see dimensional drawings).
Option 03: with center holes and fastening threads in the ground area of the frame
Option 04: with center holes and long hole in the ground area of the frame; selectable starting from length L ≥ 300 mm up to length L_{max}
3) Lubrication ➠ "Lubrication" chapter.
4) Attachment kit also available without motor. When ordering, enter the motor type "00"➠
Mounting kits according to customer specification ➠ Chapter "Mounting kits for motors according to customer specification"
5) Further information ➠ Chapter "Switching System"
6) Recommended motor, motor data and type designations ➠ "Motors" chapter
7) Assembly contains 1 x sensor, 1 x switch mounting plate including set screws and square nuts as well as 3 x cable holders including set screws
8) Measurement report: 01 = standard report; 02 = Measurement of frictional torque; 03 = Lead deviation (see also "Documentation" chapter)

Motor attachment 	i =	Attachment kit[4]	Motor[5]  Motor code	2 cables without brake	2 cables with brake	1 cable without brake	1 cable with brake	Motor connector position	Cover  Cover strip without	Cover strip with
OA01	–	–	–	–				–	01	02
OF01										
MF01	–	01	MS2N03-B0BYN	201	202	203	204	000		
		03	MSM031B-0300	136	137	–	–			
		05	MSM019B-0300	134	135	–	–			
RV01 - RV04	1	17	MS2N03-B0BYN	201	202	203	204	090		
		19	MSM031B-0300	136	137	–	–			
		15	MSM019B-0300	134	135	–	–	180		
	1.5	18	MS2N03-B0BYN	201	202	203	204			
		20	MSM031B-0300	136	137	–	–	270		
		16	MSM019B-0300	134	135	–	–			

Switching system[6]

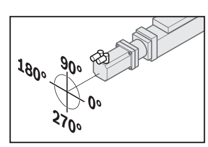


Switching system	
Without	
- Switch - Mounting channel - Socket-plug	00
Magnetic sensor	
REED, changeover (NC: C+NC, NO: C+NO)	21
Hall, PNP normally closed (NC)	22
Hall, PNP normally open (NO)	23
Mounting channel	25
Socket-plug	28
Magnetic sensor with plug[7]	
REED, changeover (NC: C+NC, NO: C+NO)	58
Hall, PNP normally closed (NC)	59

Documentation[8]

Documentation
01
02
03

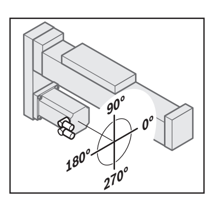
Flange	Motor connector position			
	0°	90°	180°	270°
MF01	000	090 ★	180	270



Example:
Flange MF01
Motor connector position 90°

Belt side drive	Motor connector position			
	0°	90°	180°	270°
RV01	000	–	180	270 ★
RV02	000	090 ★	180	–
RV03	000 ★	090	–	270
RV04	–	090	180 ★	270

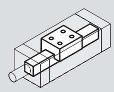
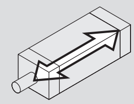
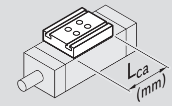
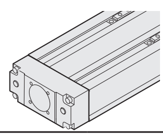
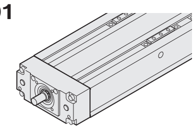
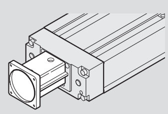
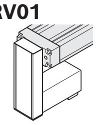
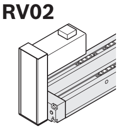
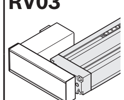
★ standard delivery



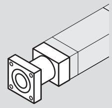
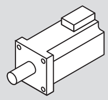
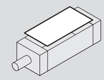
Example:
Belt side drive RV01
Motor connector position 180°

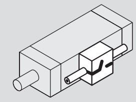
Explanation of the order parameters and order example ➟ "Order example" chapter.

CKK-090

Short product name, length[1) CKK-090-NN-1, ... mm		Guideway 			Lubrication[3)]	Drive 				Carriage 				
							BASA d_0 x P (mm)			Connection plate without L_{ca} = (mm)			with L_{ca} = (mm)	
Version		Standard	Center holes[2)]			Screw journal (mm)	12 x 2	12 x 5	12 x 10	35	100	variable[3)]	60	125
without drive	OA01 	01	03	04	LSS	–	050			01	02	05	40	41
					LPG					–	302	305	–	341
Without attachment	OF01 				LSS	Ø8	03	01	02	01	02	05	40	41
Flange/ coupling	MF01 				LPG	Ø8	31	32	33	–	302	305	–	341
Belt side drive	RV01  RV02 				LCF	Ø8	03	01	02	–				141
	RV03  RV04 				LCO	Ø8	21	22	23	–				241

1) Length calculation of the linear motion system ➠ "Project planning/calculation" chapter.
2) Center holes for simple combination with other linear motion systems and connection elements (see dimensional drawings).
Option 03: with center holes and fastening threads in the ground area of the frame
Option 04: with center holes and long hole in the ground area of the frame; selectable starting from length L ≥ 300 mm up to length L_{max}
3) Lubrication ➠ "Lubrication" chapter.
4) Attachment kit also available without motor. When ordering, enter the motor type "00"➠
Mounting kits according to customer specification ➠ Chapter "Mounting kits for motors according to customer specification"
5) Recommended motor, motor data and type designations ➠ "Motors" chapter
6) Further information ➠ Chapter "Switching System"
7) Assembly contains 1 x sensor, 1 x switch mounting plate including set screws and square nuts as well as 3 x cable holders including set screws
8) Measurement report: 01 = standard report; 02 = Measurement of frictional torque; 03 = Lead deviation (see also "Documentation" chapter)

Motor attachment 			Motor[5)] 					Motor connector position	Cover  Cover strip	
	i =	Attachment kit[4)]	Motor code	2 cables without brake	2 cables with brake	1 cable without brake	1 cable with brake		without	with
OA01	–	–	–	–				–	01	02
OF01										
MF01	–	01	MS2N03-B0BYN	201	202	203	204	000		
		05	MSM031C-0300	138	139	–	–			
RV01 - RV04	1	11	MS2N03-B0BYN	201	202	203	204	090		
		13	MSM031C-0300	138	139	–	–	180		
	1.5	21	MS2N03-B0BYN	201	202	203	204	270		
		23	MSM031C-0300	138	139	–	–			

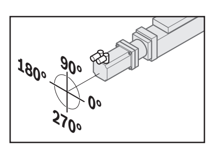
Switching system[6)] 

Without	
- Switch - Mounting channel - Socket-plug	00
Magnetic sensor	
REED, changeover (NC: C+NC, NO: C+NO)	21
Hall, PNP normally closed (NC)	22
Hall, PNP normally open (NO)	23
Mounting channel	25
Socket-plug	17
Magnetic sensor with plug[7)]	
REED, changeover (NC: C+NC, NO: C+NO)	58
Hall, PNP normally closed (NC)	59

Documentation[8)] 

01
02
03

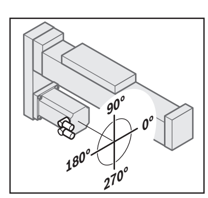
Flange	Motor connector position			
	0°	90°	180°	270°
MF01	000	090 ★	180	270



Example:
Flange MF01
Motor connector position 90°

Belt side drive	Motor connector position			
	0°	90°	180°	270°
RV01	000	–	180	270 ★
RV02	000	090 ★	180	–
RV03	000 ★	090	–	270
RV04	–	090	180 ★	270

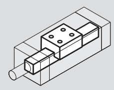
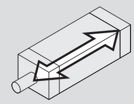
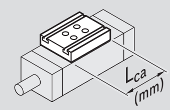
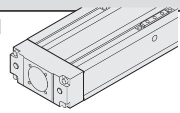
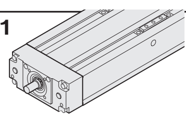
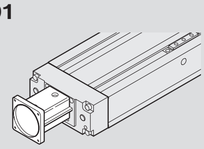
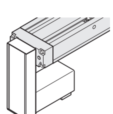
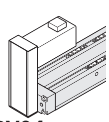
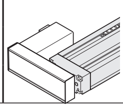
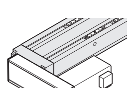
★ standard delivery



Example:
Belt side drive RV01
Motor connector position 180°

Explanation of the order parameters and order example ➟ "Order example" chapter.

CKK-110

Short product name, length[1)] CKK-110-NN-1, ... mm		Guideway			Lubrication[3)]	Drive				Carriage				
														
							BASA d_0 x P (mm)			Connection plate without L_{ca} = (mm)			with L_{ca} = (mm)	
Version		Standard	Center holes[2)]			Screw journal (mm)	16 x 5	16 x 10	16 x 16	39	124	variable[3)]	60	155
without drive	OA01 	01	03	04	LSS	–	050			01	02	05	40	41
					LPG					–	302	305	–	341
Without attachment	OF01 				LSS	Ø11 with Keyway OF01	11	12	13	01	02	05	40	41
Flange/coupling	MF01 				LSS	Ø11	01	02	03	01	02	05	40	41
					LPG	Ø11	31	32	33	–	302	305	–	341
Belt side drive	RV01  RV02  RV03  RV04 				LCF	Ø11	01	02	03	–				141
					LCO	Ø11	01	02	03	–				241

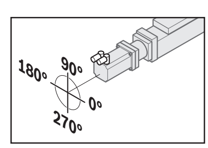
1) Length calculation of the linear motion system ➠ "Project planning/calculation" chapter.
2) Center holes for simple combination with other linear motion systems and connection elements (➠ Dimensional drawings).
Option 03: with center holes and fastening threads in the ground area of the frame
Option 04: with center holes and long hole in the ground area of the frame; selectable starting from length L ≥ 300 mm up to length L_{max}
3) Lubrication ➠ "Lubrication" chapter.
4) Attachment kit also available without motor. When ordering, enter the motor type "00"➠
Mounting kits according to customer specification ➠ Chapter "Mounting kits for motors according to customer specification"
5) Recommended motor, motor data and type designations ➠ "Motors" chapter
6) Only possible with version Carriage with connection plate L_{ca} = 155 mm;
Switch mounting only possible with magnetic sensor with plug. (It may be necessary to move the mounting clamps for Resist cover)
7) Further information ➠ Chapter "Switching System"
8) Assembly contains 1 x sensor, 1 x switch mounting plate including set screws and square nuts as well as 3 x cable holders including set screws
9) Measurement report: 01 = Standard report; 02 = Measurement of frictional torque; 03 = Lead deviation (➠ "Documentation" chapter)

Motor attachment	i =	Attachment kit[4]	Motor[5]: Motor code	2 cables: without brake	2 cables: with brake	1 cable: without brake	1 cable: with brake	Motor connector position
OA01	–	–	–	–				–
OF01								
MF01	–	01	MS2N03-B0BYN	201	202	203	204	000
		07	MS2N03-D0BYN	205	206	207	208	
		03	MS2N04-C0BTN	213	214	215	216	
			MS2N04-D0BQN	217	218	219	220	
		05	MSM031C-0300	138	139	–	–	
		06	MSM041B-0300	140	141	–	–	090
RV01 - RV04	1	11	MS2N03-B0BYN	201	202	203	204	
		13	MS2N04-C0BTN	213	214	215	216	
		15	MSM031C-0300	138	139	–	–	180
		17	MSM041B-0300	140	141	–	–	
	1.5	21	MS2N03-B0BYN	201	202	203	204	270
		23	MS2N04-B0BTN	209	210	211	212	
		25	MSM031C-0300	138	139	–	–	
		27	MSM041B-0300	140	141	–	–	

Cover: Cover strip without	Cover: Cover strip with	Resist[6]
01	02	12

Switching system[7]		Documentation[9]
Without		
- Switch - Mounting channel - Socket-plug	00	01
Magnetic sensor		
REED, changeover (NC: C+NC, NO: C+NO)	21	02
Hall, PNP normally closed (NC)	22	
Hall, PNP normally open (NO)	23	
Mounting channel	25	
Socket-plug	17	
Magnetic sensor with plug[8]		
REED, changeover (NC: C+NC, NO: C+NO)	58	03
Hall, PNP normally closed (NC)	59	

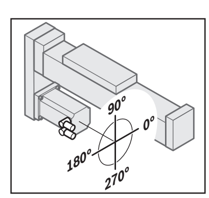
Flange	Motor connector position 0°	90°	180°	270°
MF01	000	090 ★	180	270



Example:
Flange MF01
Motor connector position 90°

Belt side drive	Motor connector position 0°	90°	180°	270°
RV01	000	–	180	270 ★
RV02	000	090 ★	180	–
RV03	000 ★	090	–	270
RV04	–	090	180 ★	270

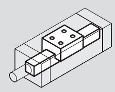
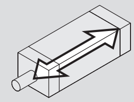
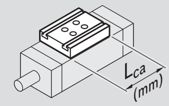
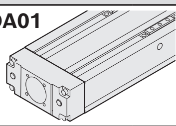
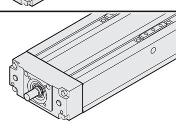
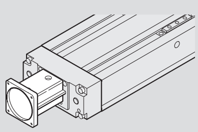
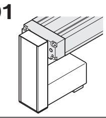
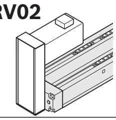
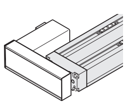
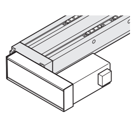
★ standard delivery



Example:
Belt side drive RV01
Motor connector position 180°

Explanation of the order parameters and order example ➟ "Order example" chapter.

CKK-145

Short product name, length[1] CKK-145-NN-1, ... mm		Guideway			Lubrication[3]	Drive					Carriage				
															
							BASA d_0 x P (mm)				Connection plate without L_{ca} = (mm)			with L_{ca} = (mm)	
Version		Standard	Center holes[2]			Screw journal (mm)	20 x 5	20 x 20	25 x 10	20 x 40	49	149	variable[1]	80	190
Without drive	OA01 	01	03	04	LSS	–	050				01	02	05	40	41
					LPG						–	302	305	–	341
Without attachment	OF01 				LSS	Ø14 with Keyway (OF01)	14	15	16	–	01	02	05	40	41
							–			17	06	07	10	08	09
Flange/coupling	MF01 				LSS	Ø14	21	22	23	–	01	02	05	40	41
							–			24	06	07	10	08	09
					LPG	Ø14	31	32	33	–	–	302	305	–	341
							–			34	–	307	310	–	309
Belt side drive	RV01  RV02  RV03  RV04 				LCF	Ø14	21	22	23	–	–				141
							–			24	–				109
					LCO	Ø14	21	22	23	–	–				241
							–			24	–				209

1) Length calculation of the linear motion system ➠ "Project planning/calculation" chapter.
2) Center holes for simple combination with other linear motion systems and connection elements (➠ Dimensional drawings).
Option 03: with center holes and fastening threads in the ground area of the frame
Option 04: with center holes and long hole in the ground area of the frame; selectable starting from length L ≥ 300 mm up to length L_{max}
3) Lubrication ➠ "Lubrication" chapter.
4) Attachment kit also available without motor. When ordering, enter the motor type "00"➠
Mounting kits according to customer specification ➠ Chapter "Mounting kits for motors according to customer specification"
5) Recommended motor, motor data and type designations ➠ "Motors" chapter
6) Only possible with version Carriage with connection plate L_{ca} = 190 mm;
Switch mounting only possible with magnetic sensor with plug. (It may be necessary to move the mounting clamps for Resist cover)
7) Further information ➠ Chapter "Switching System"
8) Assembly contains 1 x sensor, 1 x switch mounting plate including set screws and square nuts as well as 3 x cable holders including set screws
9) Measurement report: 01 = Standard report; 02 = Measurement of frictional torque; 03 = Lead deviation (➠ "Documentation" chapter)

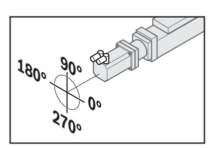
Motor attachment	i =	Attachment kit[4]	Motor[5] Motor code	2 cables without brake	2 cables with brake	1 cable without brake	1 cable with brake	Motor connector position
OA01	–	–	–	–				–
OF01								
MF01	–	30	MS2N04-C0BTN	213	214	215	216	
			MS2N04-D0BQN	217	218	219	220	
		32	MSM041B-0300	140	141	–	–	
		33	MS2N05-B0BTN	221	222	223	224	000
			MS2N05-C0BTN	225	226	227	228	
			MS2N05-D0BRN	229	230	231	232	
RV01 - RV04	1	11	MS2N04-C0BTN	213	214	215	216	090
			MS2N04-D0BQN	217	218	219	220	
		35	MS2N05-D0BRN	229	230	231	232	180
		17	MSM041B-0300	140	141	–	–	
	1.5	21	MS2N04-B0BTN	209	210	211	212	
			MS2N04-C0BTN	213	214	215	216	270
			MS2N04-D0BQN	217	218	219	220	
		27	MSM041B-0300	140	141	–	–	
	2	36	MS2N05-B0BTN	221	222	223	224	

Cover: Cover strip without	Cover strip with	Resist[6]
01	02	12

Switching system[7]	
Without	
- Switch - Mounting channel - Socket-plug	00
Magnetic sensor	
REED, changeover (NC: C+NC, NO: C+NO)	21
Hall, PNP normally closed (NC)	22
Hall, PNP normally open (NO)	23
Mounting channel	25
Socket-plug	17
Magnetic sensor with plug[8]	
REED, changeover (NC: C+NC, NO: C+NO)	58
Hall, PNP normally closed (NC)	59

Documentation[9]
01
02
03

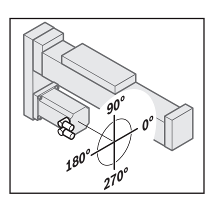
Flange	Motor connector position 0°	90°	180°	270°
MF01	000	090 ★	180	270



Example:
Flange MF01
Motor connector position 90°

Belt side drive	Motor connector position 0°	90°	180°	270°
RV01	000	–	180	270 ★
RV02	000	090 ★	180	–
RV03	000 ★	090	–	270
RV04	–	090	180 ★	270

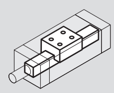
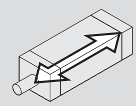
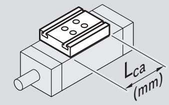
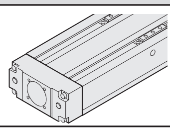
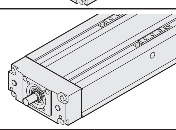
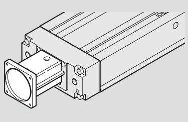
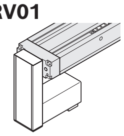
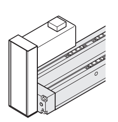
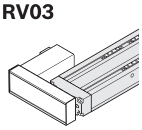
★ standard delivery



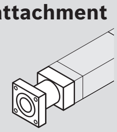
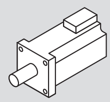
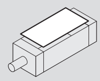
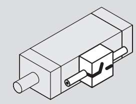
Example:
Belt side drive RV01
Motor connector position 180°

Explanation of the order parameters and order example ➠ "Order example" chapter.

CKK-200

Short product name, length[1] CKK-200-NN-1, ... mm		Guideway			Lubrication[3]	Drive					Carriage					
																
							BASA d_0 x P (mm)				Screw support Quantity	Connection plate without L_{ca} = (mm)			with L_{ca} = (mm)	
Version		Standard	Center holes[2]			Screw journal (mm)	32 x 5	32 x 10	32 x 20	32 x 32		79.5	254.5	variable[3]	190	305
Without drive	OA01 	01	03	04	LSS	–	050				–	01	11	18	40	41
					LPG						–	–	311	318	–	341
Without attachment	OF01 				LSS	Ø16 with Keyway	11	12	13	14	0	01	11	18	40	41
Flange/ coupling	MF01 										1	02	12	–	–	26
Belt side drive	RV01  RV02  RV03  RV04 					Ø16	01	02	03	04	2	03	13	–	–	27
											3	04	14	–	–	28
					LPG	Ø16	31	32	33	34	0	–	311	318	–	341
											1	–	312	–	–	326
											2		313			327
											3		314			328
					LCF	Ø16	01	02	03	04	0	–	–	–	–	141
											1					126
											2					127
											3					128
					LCO	Ø16	01	02	03	04	0	–	–	–	–	241
											1					226
											2					227
											3					228

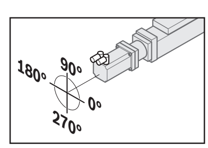
1) Length calculation of the linear motion system ➠ "Project planning/calculation" chapter.
2) Center holes for simple combination with other linear motion systems and connection elements (➠ Dimensional drawings).
Option 03: with center holes and fastening threads in the ground area of the frame; selectable up to length L ≤ 2000mm
Option 04: with center holes and long hole in the ground area of the frame; selectable starting from length L ≥ 300 mm up to length L_{max}
3) Lubrication ➠ "Lubrication" chapter.
4) Attachment kit also available without motor. When ordering, enter the motor type "00"➠
Mounting kits according to customer specification ➠ Chapter "Mounting kits for motors according to customer specification"
5) Recommended motor, motor data and type designations ➠ "Motors" chapter
6) Only possible with version Carriage with connection plate L_{ca} = 305 mm;
Switch mounting only possible with magnetic sensor with plug. (It may be necessary to move the mounting clamps for Resist cover)
7) Further information ➠ Chapter "Switching System"
8) Assembly contains 1 x sensor, 1 x switch mounting plate including set screws and square nuts as well as 3 x cable holders including set screws
9) Switch configuration with magnetic sensor and mechanical/proximity switch together on one side is not possible.
Assembly contains 1 x sensor, 1 x switch mounting plate including mounting material
10) Switching angle can be attached only in conjunction with connection plate
11) Measurement report: 01 = Standard report; 02 = Measurement of frictional torque; 03 = Lead deviation (➠ "Documentation" chapter)


Motor attachment			Motor						Cover			Switching system[7]	Documentation[11]
	i =	Attachment kit[4]	Motor code	2 cables		1 cable		Motor connector position	Cover strip		Resist[6]		
				without brake	with brake	without brake	with brake		without	with			
OA01	–	–	–	–				–	01	02	12		
OF01	–	–	–	–				–	01	02	12		
MF01	–	03	MS2N06-D0BRN	241	242	243	244	000	01	02	12		
MF01	–	03	MS2N06-E0BRN	249	250	251	252	000	01	02	12		
MF01	–	04	MS2N07-C0BQN	257	258	259	260	000	01	02	12		
MF01	–	04	MS2N07-D0BRN	265	266	–	–	000	01	02	12		
RV01 - RV04	1	27	MS2N06-B1BNN	233	234	235	236	090	01	02	12		
RV01 - RV04	1	27	MS2N06-D1BNN	245	246	247	248	180	01	02	12		
RV01 - RV04	2	28	MS2N06-C0BTN	237	238	239	240	270	01	02	12		

Switching system[7]			Documentation[11]
Without			01
- Switch - Mounting channel - Socket-plug		00	01
Magnetic sensor			01
REED, changeover (NC: C+NC, NO: C+NO)		21	01
Hall, PNP normally closed (NC)		22	01
Hall, PNP normally open (NO)		23	01
Mounting channel		25	01
Socket-plug		17	01
Magnetic sensor with plug[8]			02
REED, changeover (NC: C+NC, NO: C+NO)		58	02
Hall, PNP normally closed (NC)		59	02
Proximity / mechanical switches[9]			03
Mechanical		15	03
Proximity – PNP NC contact		11	03
Proximity – PNP NO contact		13	03
Cable duct		20	03
Switching angle[10]	1	16	03
Switching angle[10]	2	26	03
Socket-plug		17	03

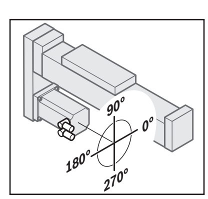
Flange	Motor connector position			
	0°	90°	180°	270°
MF01	000	090 ★	180	270



Example:
Flange MF01
Motor connector position 90°

Belt side drive	Motor connector position			
	0°	90°	180°	270°
RV01	000	–	180	270 ★
RV02	000	090 ★	180	–
RV03	000 ★	090	–	270
RV04	–	090	180 ★	270

★ standard delivery

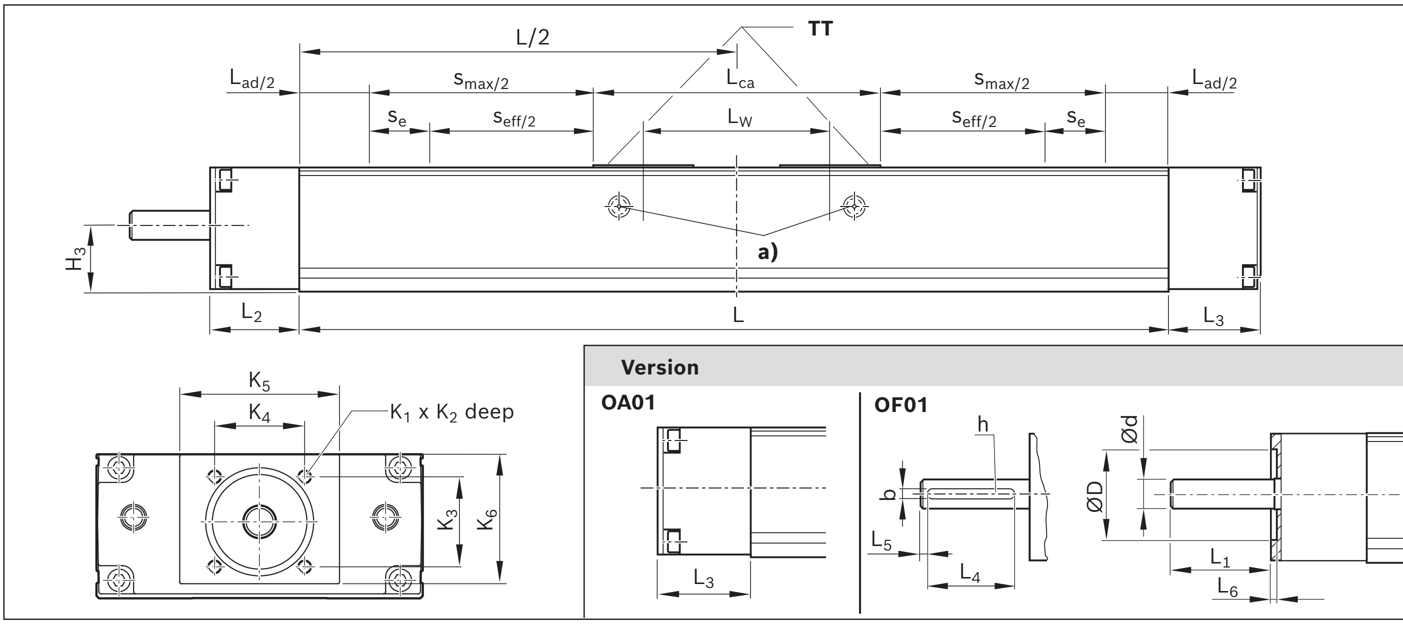


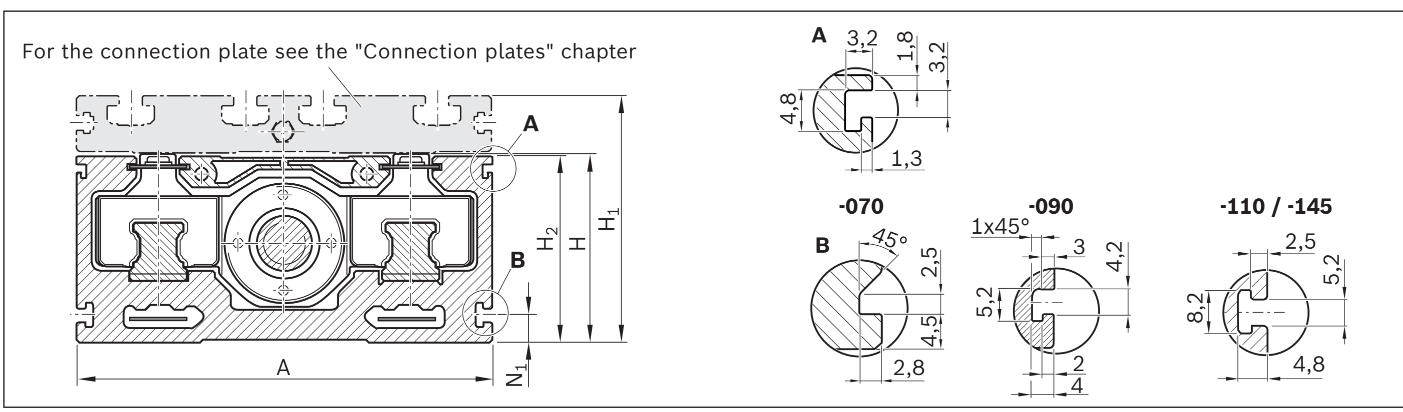
Example:
Belt side drive RV01
Motor connector position 180°

Explanation of the order parameters and order example ➟ "Order example" chapter.

Dimensional drawings

Frame CKK-070/-090/-110/-145



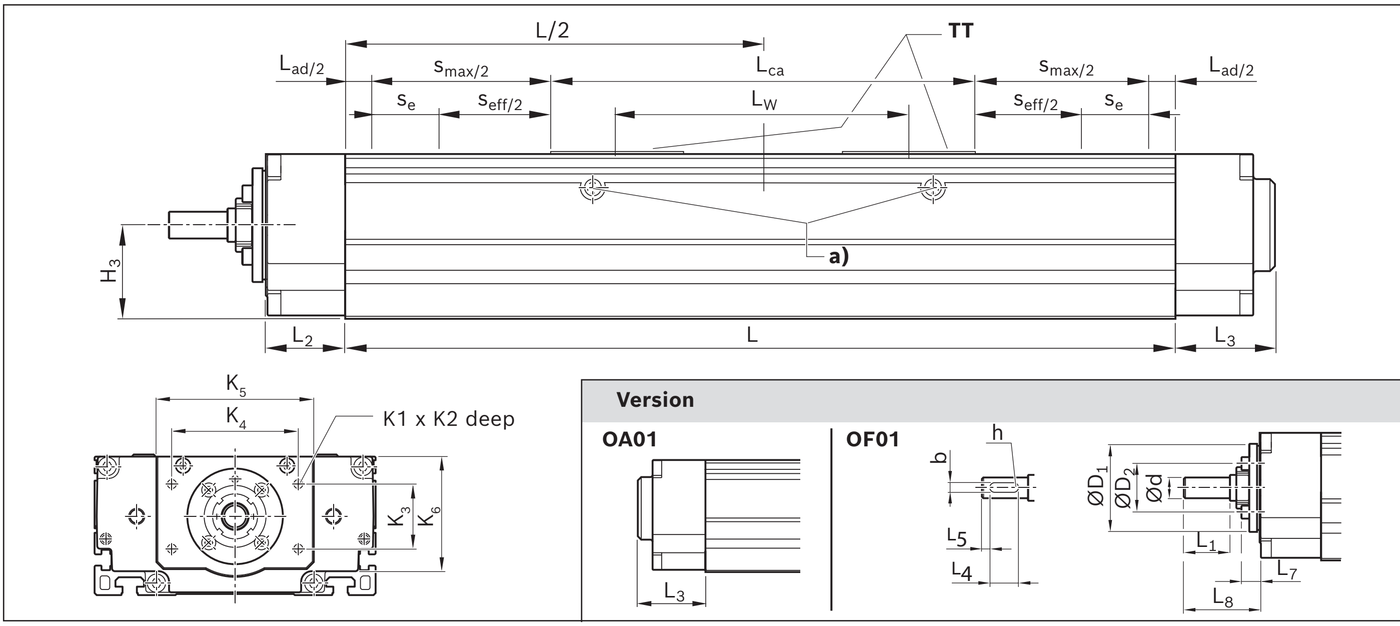


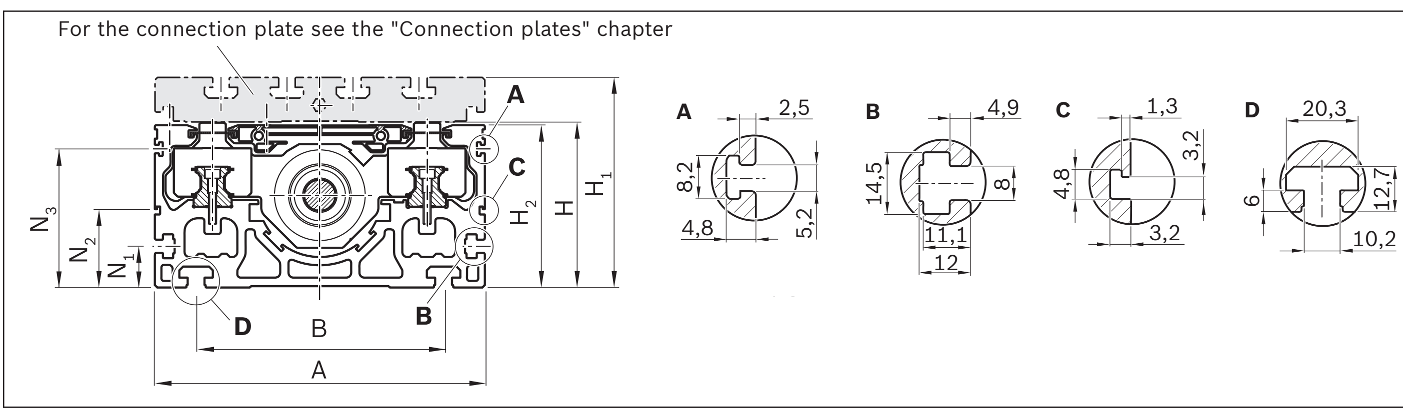
CKK	Dimensions (mm)											
	A	B	b^{P9}	H	H_1	H_2	H_3	h	$ØD^{H7}$	$ØD_1$ -0.01	$ØD_2$	$Ød_{h7}$
-070	70	–	–	32	44.5	31.3	16.0	–	28	–	–	6
-090	90	–	–	40	56.0	39.0	21.0	–	28	–	–	8
-110	110	–	4	50	66.0	49.0	25.5	2.5	40	–	–	11
-145	145	–	5	65	85.0	64.0	34.0	3.0	48	–	–	14
-200	200	150	5	100	127.0	98.5	56.0	3.0	–	68	32	16

a) Lubrication bore on both sides (grease lubrication). ➟ "Lubrication" chapter.

Straightness and flatness tolerance in accordance with DIN EN 12020-2.
Note: all dimensions in mm. Drawings not schematically to scale.
Exact contours and dimensions can be found in the CAD model.
CAD configurator available on the Internet
See following pages for dimensional drawings for frames, carriages and motor attachment.
Length calculation of the linear motion system ➟ "Technical data" and "Project planning/calculation" chapter.

Frame CKK-200



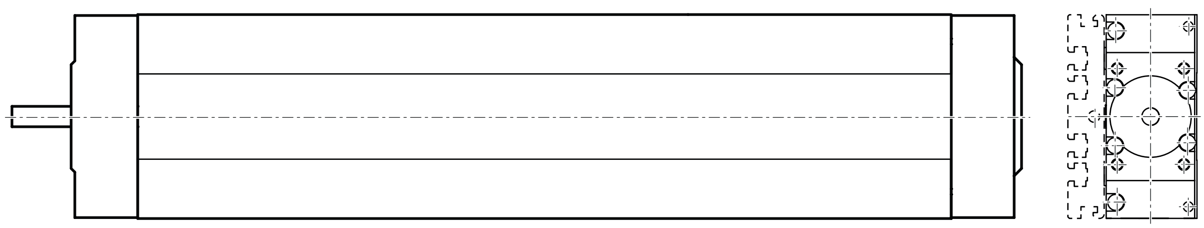


K_1	K_2	K_3	K_4	K_5	K_6	L_1	L_2	L_3	L_4	L_5	L_6	L_7	L_8	N_1	N_2	N_3
M4	8	23	33	44	31.3	18	22.0	29.0	–	–	2.5	–	–	–	–	–
M4	9	29	41	50	39.0	20	32.0	33.5	–	–	2.5	–	–	7.6	–	–
M6	12	28	40	56	49.0	32	36.0	38.0	20	3.0	2.5	–	–	9.5	–	–
M6	12	40	40	71	57.5	44	43.5	45.0	25	10.0	2.5	–	–	9.5	–	–
M8	12	46	90	112	85.5	35	47.5	59.5	28	3.5	–	14	58	25.0	47.5	84

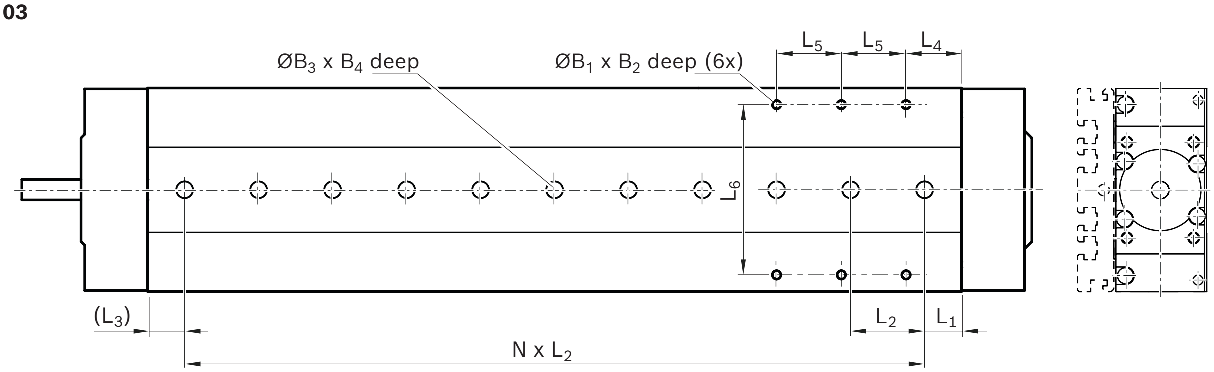
A For switch mounting arrangements
B For mounting with clamping fixtures
C For mounting duct
D For fastening with sliding blocks
TT = Carriage

Frame CKK-070/-090/-110/-145

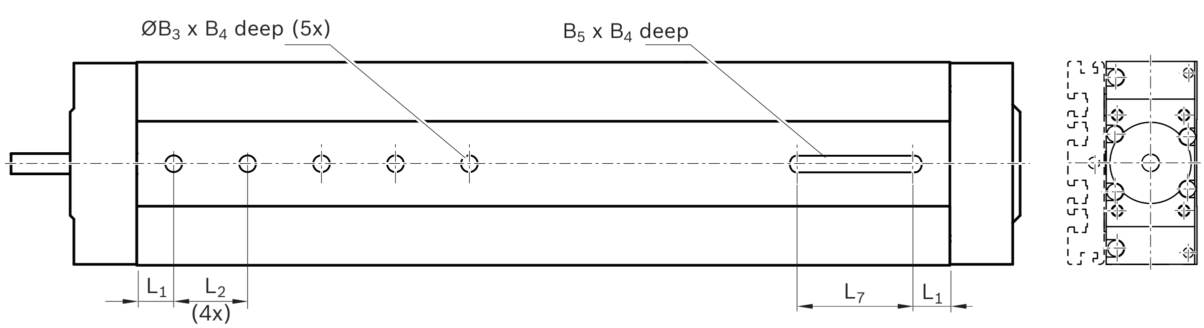
Option 01



Option 03

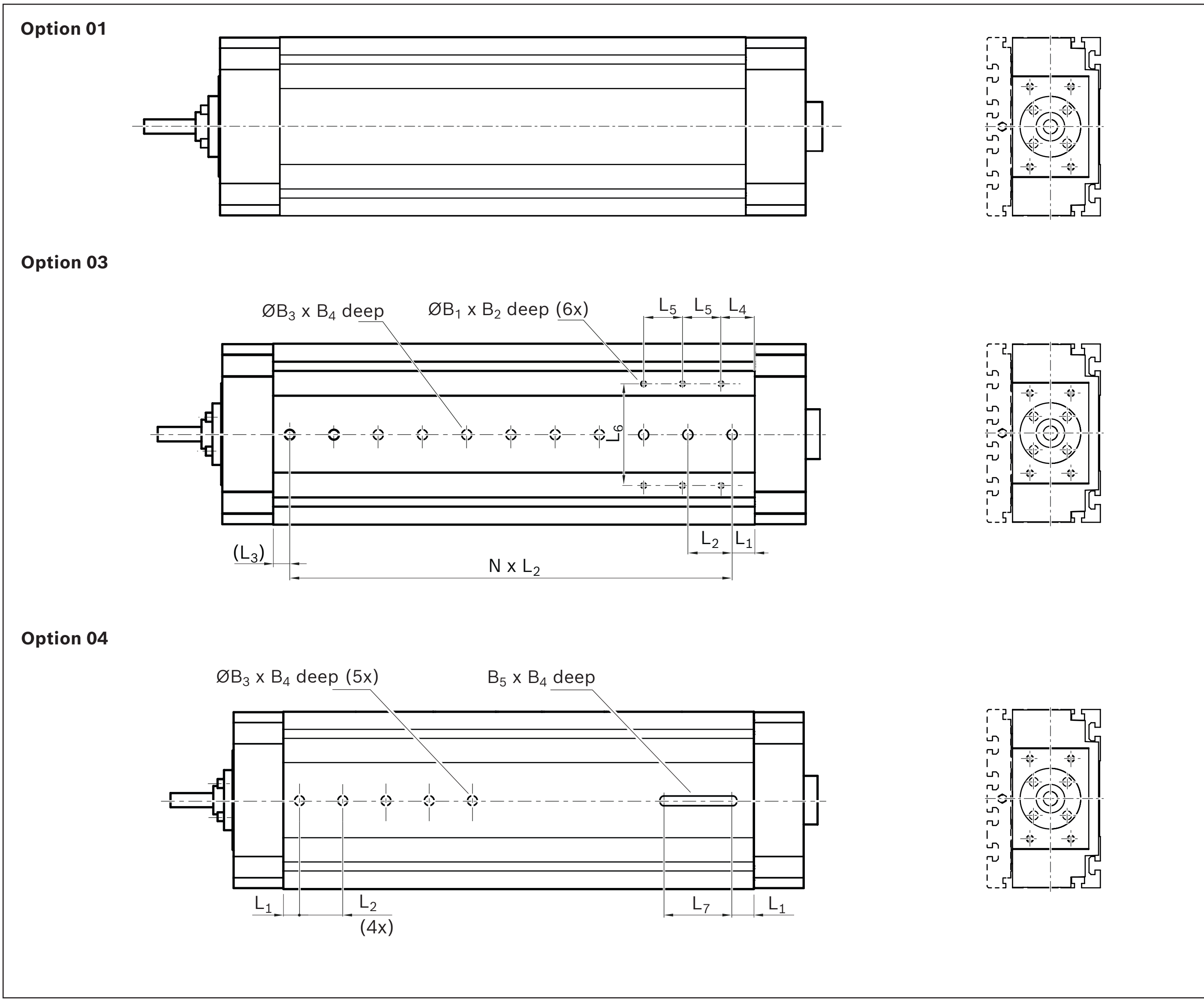


Option 04



CKK	Option	Dimensions (mm)											
		B_1	B_2	$ØB_3^{H7}$	B_4	$B5^{H8}$	L_1	L_2 $^{\pm 0.01}$	L_3 (min)	L_4	L_5	L_6	L_7
-070	03	M3	6	7	1.6	–	20	40	10	15	25	59	–
	04	–	–			7			–	–	–	–	60
-090	03	M4	7.5	9	2.1	–			10	30	35	76	–
	04	–	–			9			–	–	–	–	60
-110	03	M5	9	9	2.1	–			10	30	35	92	–
	04	–	–			9			–	–	–	–	60
-145	03	M6	13	12	2.1	–			10	30	35	124	–
	04	–	–			12			–	–	–	–	60
-200	03	M8	12	16	3.1	–			10	35	40	119	–
	04	–	–			16			–	–	–	–	60

Frame CKK-200



Views from below (ground area)
Option 01 / standard
Option 03 / with central holes
Option 04 / with central holes and long hole

Carriages CKK-070/-090/-110/-145/-200

Carriage without connection plate

Fig. 1

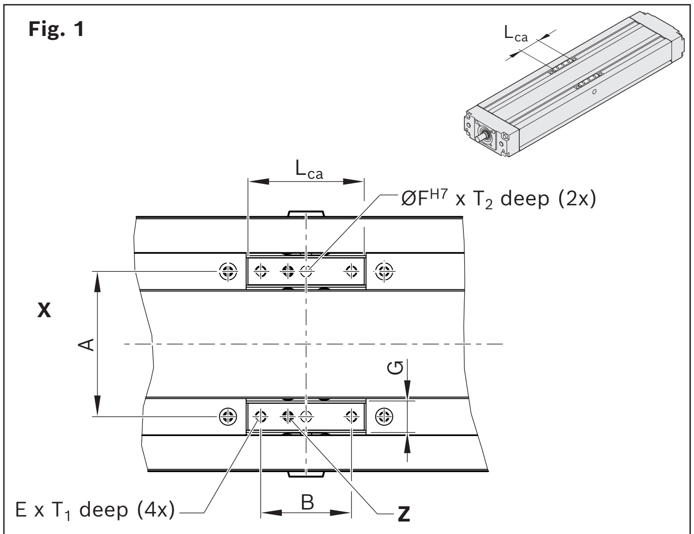


Fig. 2

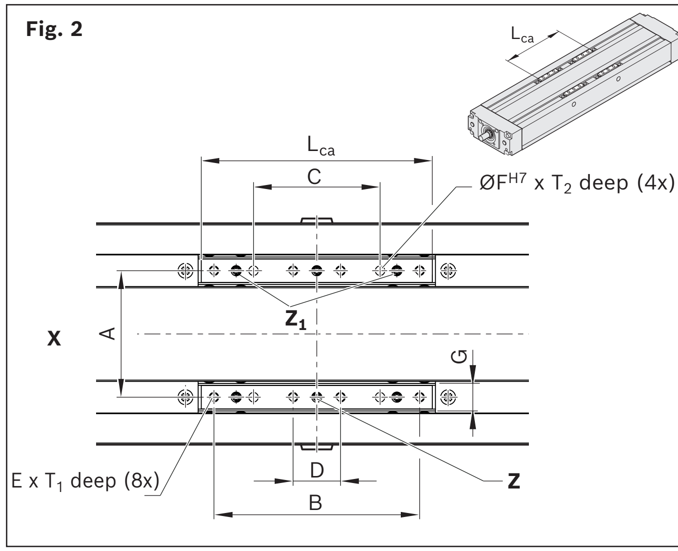
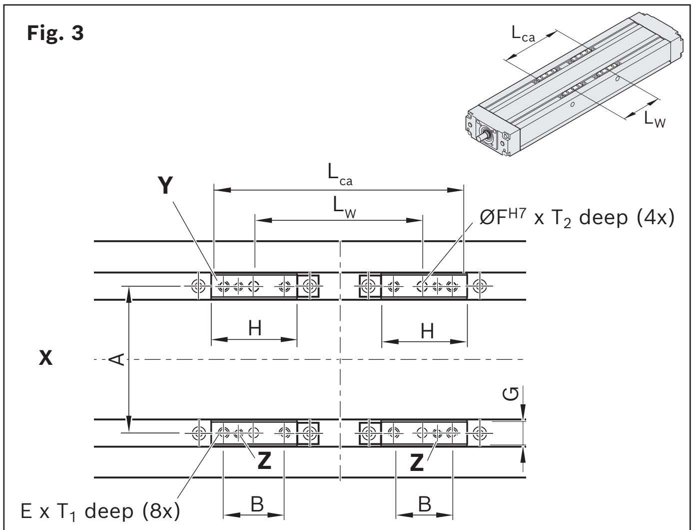


Fig. 3

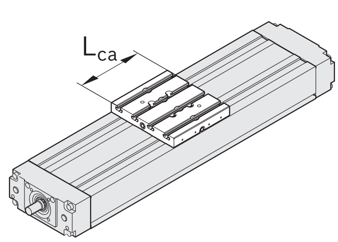


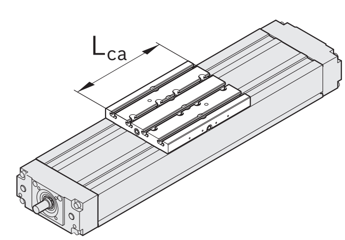
X Drive side

Y Drive carriage

Z/Z_1 Lubrication point for grease; sealed with set screw. Supplementary information on the lubrication ➟"Lubrication" chapter.

Carriage with connection plate[1)]



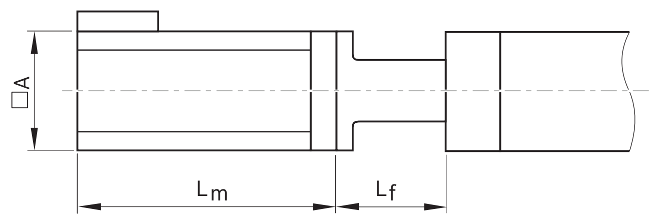


[1)] Dimensional drawings ➟ "Connection plates" chapter

CKK	Figure	Dimensions (mm)											
		L_{ca}	L_W	A	B	C	D	E	$ØF^{H7}$	G	H	T_1	T_2
-070	1	32	–	40	25	–	–	M3	3	7.5	–	5	5
	2	73			65	40	15						
-090	1	35	–	54	27	–	–	M4	4	8.0	35	7	6
	2	100			92	65	38						
	3	variable min. 101 max. 235	min. 66 max. 200		27	–	–						
-110	1	39	–	66	30	–	–	M5	5	10.0	39	10	8
	3	124	85										
	3	variable min. 125 max. 289	min. 86 max. 250										
-145	1	49	–	88	36	–	–	M6	6	12.0	49	12	10
	3	149	100										
	3	variable min. 150 max. 349	min. 101 max. 300										
-200	1	79.5	–	130	60	–	–	M8	8	16.0	79.5	16	12
	3	254.5	175										
	3	variable min. 255.5 max. 429.5	min. 176 max. 350										

Motor attachment with flange and coupling

Type MF01

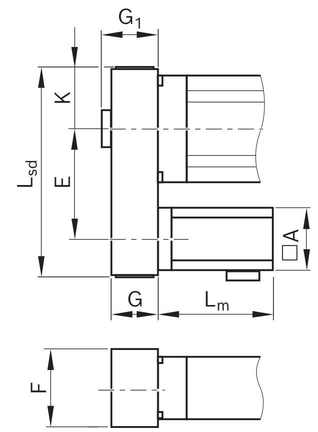


CKK	Motor code	Dimensions (mm) L_f	L_m	□A
-070	MS2N03-B0BYN	50.0	➠ "Motors" chapter	
	MSM031B-0300			
	MSM019B-0300	45.0		
-090	MS2N03-B0BYN	70.0		
	MSM031C-0300	71.5		
-110	MS2N03-B0BYN	75.0		
	MS2N03-D0BYN			
	MS2N04-C0BTN	77.5		
	MS2N04-D0BQN			
	MSM031C-0300	72.0		
	MSM041B-0300	83.0		
-145	MS2N04-C0BTN	85.0		
	MS2N04-D0BQN			
	MSM041B-0300	90.0		
	MS2N05-B0BTN	95.0		
	MS2N05-C0BTN			
	MS2N05-D0BRN			
-200	MS2N06-D0BRN	125.0		
	MS2N06-E0BRN			
	MS2N07-C0BQN	133.0		
	MS2N07-D0BRN			

Motor attachment with belt side drive

Versions RV01 – RV04

Example RV04



CKK	Motor code	Dimensions (mm)											
				E	F	G	G_1	K			L_{sd}	L_m	□A
		i=1	i=1.5	i=2					i=1	i=1.5	i= 2		
-070	MS2N03-B0BYN	103.5	89.5	–	64.5	37.0	44.0	33.5	179	165	–	➡ "Motors" chapter	
	MSM031B-0300								182	168			
	MSM019B-0300	76.5	76.5	–	48.0	27.5	28.0	27.5	139				
-090	MS2N03-B0BYN	103.5	89.5	–	64.5	37.0	–	33.0	179	165	–		
	MSM031C-0300												
-110	MS2N03-B0BYN	103.5	115.0	–	64.5	37.0	–	33.0	179	191	–		
	MS2N04-B0BTN	–	139.5		88.0	51.0		43.5	–	250			
	MS2N04-C0BTN	145.0	–		88.0	51.0		43.5	250	–			
	MSM031C-0300	103.5	115.0		64.5	37.0		33.0	179	191			
	MSM041B-0300	145.0	139.5		88.0	51.0		43.5	250	250			
-145	MS2N04-B0BTN	–	162.0	–	88.0	51.0	–	43.5	–	267	–		
	MS2N04-C0BTN	157.5	162.0	–	88.0	51.0	–	43.5	267	267	–		
	MS2N04-D0BQN												
	MS2N05-B0BTN	165.0	–	162	116.0	66.0	–	56.0	297	–	297		
	MS2N05-D0BRN												
	MSM041B-0300	157.5	162.0	–	88.0	51.0	–	43.5	267	267	–		
-200	MS2N06-B1BNN	267.5	–	–	116.0	66.0	–	59.0	403	–	–		
	MS2N06-D1BNN												
	MS2N06-C0BTN	–	–	265	116.0	66.0	–	59.0	–	–	403		

Compact Modules with toothed belt drive (CKR)

Product overview

Features

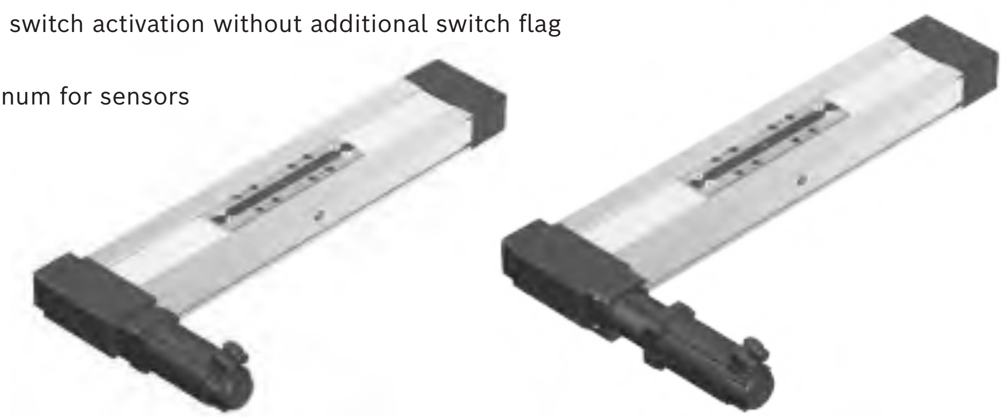
- Five fine-tuned sizes based on a compact precision aluminum profile with two integrated pre-tensioned Ball Rail Systems
- Four different lube versions
- Ready-to-install Compact Modules in any length up to L_{max}.
- Realization of greater lengths of up to 10,000 mm
- Pre-tensioned toothed belt
- Aluminum carriages available in different lengths
- Intelligent toothed belt guide protects inner components
- Low-cost maintenance
- Repeatability of up to ± 0.05 mm

Further highlights

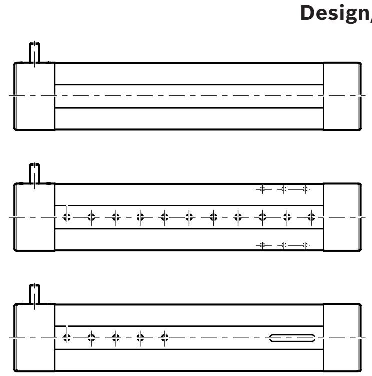
- Flexible thanks to selectable options
- Center holes for simple combination with other Linear Motion Systems and connection elements
- Extensive accessories for connection and clamping elements
- Nameplate with parameters for easy start-up

Attachments

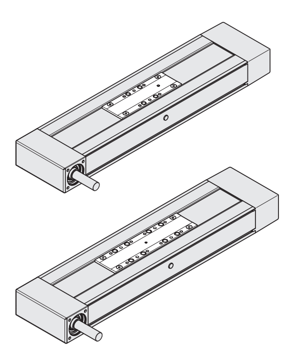
- Planetary gearbox with various gear ratios
- Maintenance-free servo motors with selectable brake and attached feedback
- Switches (magnetic sensors), switch activation without additional switch flag
- Socket and plug
- Mounting duct made of aluminum for sensors



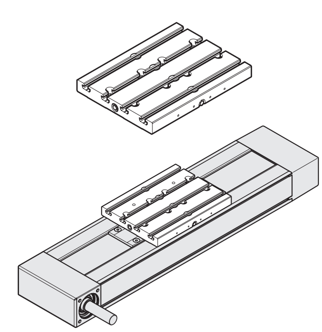
Design/options for guideway (frame), carriages, connection plates



Guideway (frame)



Carriages

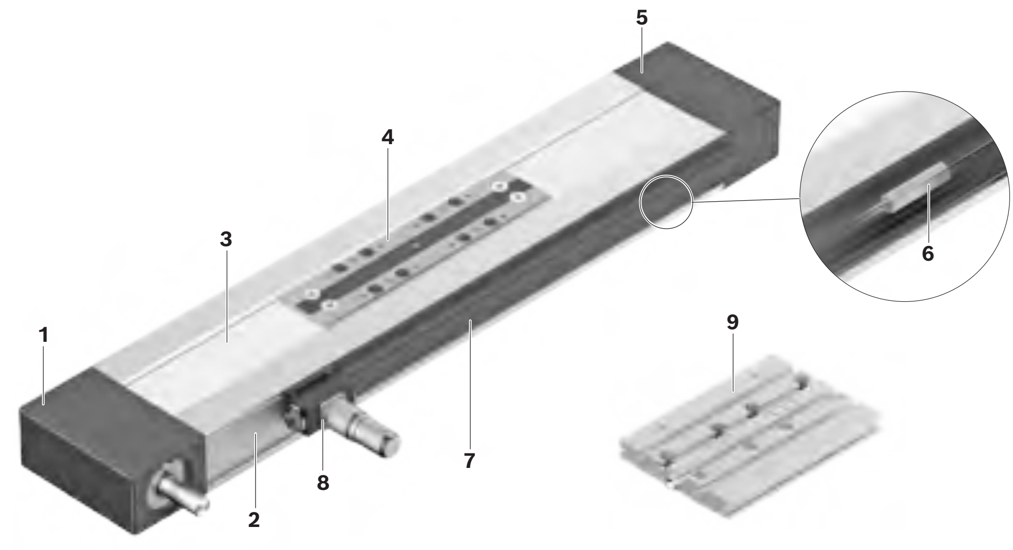


Connection plates

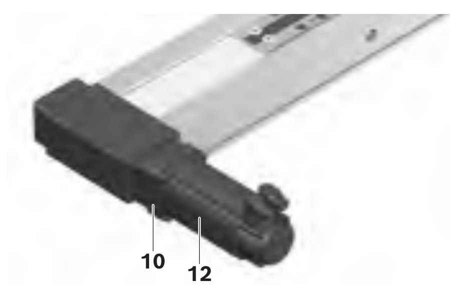
Structural design

Structural design CKR
1 Drive end enclosure
2 Frame
3 Toothed belt drive
4 Carriage
5 Idler end enclosure

Attachments:
6 Magnetic sensor
7 Mounting channel
8 Socket/plug
9 Connection plate
10 Flange
11 Planetary gearbox
12 Motor

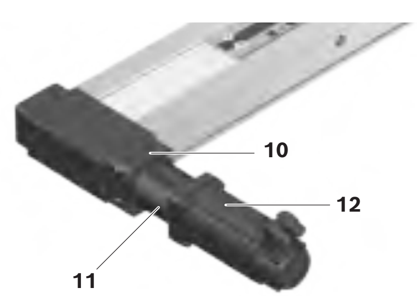


Motor attachment – direct attachment with i = 1
The motor is attached directly to the Compact Modules drive end enclosure via a flange.



Motor attachment – with gear
The planetary gearbox is attached by means of a flange.
The flange serves to fasten the gearbox to the CRK and as a closed housing. Due to the connection without coupling, the drive torque is transferred to the drive shaft of the Compact Modules in a torsionally stiff manner.

Available gear ratios: i = 3 (for CKR-145 and CKR-200)
i = 5, i = 10



Technical data

General technical data

Observe the "Project planning/calculation" chapter.

CKR	Carriage – Connection plate without[1)] L_{ca} (mm)	Carriage – Connection plate with[2)] L_{ca} (mm)	Additional length – Connection plate without L_{ad} (mm)	Additional length – Connection plate with L_{ad} (mm)	Min. travel distance s_{min}[3)] (mm)	Max. length L_{max} (mm)	Dynamic characteristics – Load ratings C_{gw} (N)	Dynamic characteristics – Load moments M_t (Nm)	Dynamic characteristics – Load moments M_L (Nm)
-070	80	60	10	30	40	1,500	2,360	47	7
	108	95	10	23			3,830	77	94
-090	102	60	25	67	40	5,500	4,620	125	16
	156	125	25	56			7,505	203	244
-110	170	110	25	85	50	5,500	19,720	651	136
	215	155	25	85			32,035	1,057	1,361
-145	180	125	25	80	60	5,500	46,800	2,059	400
	240	190	25	75			76,025	3,345	3,801
-200	265	190	25	100	80	10,000	74,600	4,849	1,053
	405	305	25	125			121,185	7,877	10,604

Drive data

Observe the "Project planning/calculation" chapter.

CKR	Gearing	Gear ratio i (–)	Max. drive torque M_p (Nm)	Feed constant u (mm/rev)	Max. speed v_{max} (m/s)	Carriage – Connection plate without L_{ca} (mm)	Carriage – Connection plate with L_{ca} (mm)	Moved system mass – Connection plate without m_{ca} (kg)	Moved system mass – Connection plate with m_{ca} (kg)
-070	–	1	3.00	72.00	3.00	80	60	0.12	0.23
	PG 040	5	0.62	14.40	1.92				
		10	0.31	7.20	0.96	108	95	0.28	0.45
-090	–	1	8.00	90.00	3.00	102	60	0.32	0.50
	PG 050	5	1.65	18.00	3.00				
		10	0.82	9.00	1.50	156	125	0.55	0.92
-110	–	1	13.50	120.00	5.00	170	60	0.52	0.90
	PG 050	5	2.72	24.00	4.40				
		10	1.26	12.00	2.20	215	155	0.87	1.45
-145	–	1	32.50	165.00	5.00	180	125	0.99	1.80
	PG 070	3	11.00	55.00	5.00				
		5	6.70	33.00	5.00	240	190	1.67	2.82
		10	3.35	16.50	2.92				
-200	–	1	112.70 99.80[6)]	250.00	5.00	265	190	2.40	4.60
	PG 090	3	38.73	83.33	5.00				
		5	20.62	50.00	5.00				
		10	9.28	25.00	2.92				
	PG 120	3	38.73	83.33	5.00	405	305	4.30	7.90
		5	23.24	50.00	5.00				
		10	11.62	25.00	2.50				

1) In the "without connection plate" carriage version, carriage length L_{ca} corresponds to the length of the clamping surface.
2) The connection plate is mounted on the "without connection plate" carriage version.
In the "with connection plate" carriage version, the carriage length corresponds to the length of the connection plate.
3) Minimum required travel distance to ensure a reliable lubrication distribution.
4) Maximum force that can be transmitted via the teeth meshing with the belt pulley.
5) The maximum permitted tensile load on the belt cross section (belt elasticity limit) is given here for easier comparability.
This value represents the load limit in terms of plastic deformation and may not be used to calculate the maximum permissible drive torque.
6) Version with keyway

Maximum permissible loads						Planar moments of inertia		Point of force application	
Moments			Forces					Connection plate without	with
$M_{x\,max}$ (Nm)	$M_{y\,max}$ (Nm)	$M_{z\,max}$ (Nm)	$F_{y\,max}$ (N)	$F_{z1\,max}$ (N)	$F_{z2\,max}$ (N)	I_y (cm^4)	I_z (cm^4)	Z_1 (mm)	Z_1 (mm)
47	7	7	1,270	2,360	2,360	8.50	55.10	20.0	32.5
77	94	51	2,070	3,830	3,830				
112	16	16	2,490	4,620	4,620	12.80	115.30	24.0	40.0
203	244	132	4,050	7,505	7,505				
198	32	32	3,480	6,000	6,000	32.70	282.90	28.7	44.7
396	510	240	5,650	12,000	12,000				
634	100	100	8,410	14,400	14,400	87.50	903.90	37.5	57.5
1,267	1,440	683	13,660	28,800	28,800				
1,375	299	299	12,265	21,150	21,150	456.60	3,316.60	45.5	72.5
2,750	3,701	1,744	19,925	42,300	42,300				

Constant mass calculation		Constant mass moment of inertia				Frictional torque	Belt pulley diameter	Belt type	Max. belt drive transmission force	Belt elasticity limit	Max. acceleration
		Connection plate without	with								
$k_{g\,fix}$ (kg)	$k_{g\,var}$ (kg/mm)	$k_{J\,fix}$ (kgmm^2)	$k_{J\,fix}$ (kgmm^2)	$k_{J\,var}$ (kgmm)	$k_{J\,m}$ (mm^2)	M_{Rs} (Nm)	d_3 (mm)	B_t	F_{bp}[4)] (N)	$F_{t\,perm}$[5)] (N)	a_{max} (m/s^2)
0.50	0.00284	22.32	36.77	0.0142	131.11	0.23	22.92	25 AT3	260	1,100	50
		43.14	65.46			0.25					
0.70	0.00440	92.45	129.38	0.0320	205.21	0.57	28.65	35 AT3	560	1,600	
		139.64	215.57			0.58					
1.27	0.00739	266.45	405.08	0.1364	364.81	1.04	38.20	50 AT5	705	4,200	
		391.07	602.66			1.42					
2.54	0.01222	1,024.28	1,582.85	0.3172	689.59	1.46	52.52	70 AT5	1,235	4,800	
		1,621.61	2,276.71			2.04					
7.83	0.02328	6,140.67	9,623.81	1.8397	1,583.24	4.55	79.58	100 AT10	2,830	17,000	
		9,020.05	14,719.73			5.69					

Gear data

Observe the "Project planning/calculation" chapter.

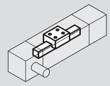
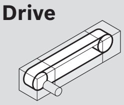
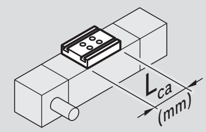
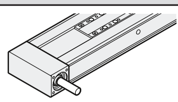
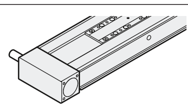
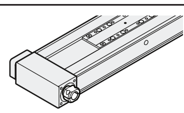
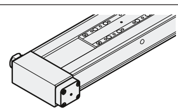
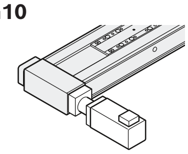
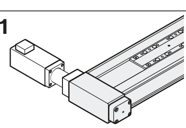
CKR	Gearing Type	Gear ratio i (–)	Max. acceleration torque[1) (at the gear output) M_{ge} (Nm)	Base frictional torque M_{Rge} (Nm)	Max. drive speed n_{ge} (min^{-1})
-070	PG040	5	11.0	0.05	8,000
		10	10.5	0.05	8,000
-090	PG050	5	14.0	0.09	10,000
		10	13.0	0.08	10,000
-110	PG050	5	14.0	0.09	10,000
		10	13.0	0.08	10,000
-145	PG070	3	32.0	0.24	8,000
		5	40.0	0.17	8,000
		10	35.0	0.12	8,000
-200	PG090	3	125.0	0.38	7,000
		5	100.0	0.26	
		10	90.0	0.17	
	PG120	3	200.0	1.00	6,000
		5	250.0	0.76	
		10	220.0	0.58	

1) The limits of the linear motion system must not be exceeded ➠ "Drive data / project planning / calculation".

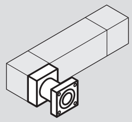
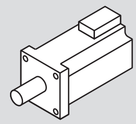
Motor	Mass moment of inertia J_{ge} (kgm^2)	Weight m_{ge} (kg)
MS2N03-B	0.0000041	0.31
MSM019-B		
MS2N03-B		
MSM019-B		
MS2N03-B	0.0000030	0.80
MS2N03-D	0.0000050	0.80
MSM031-C	0.0000130	1.30
MS2N03-B	0.0000020	0.80
MS2N03-D	0.0000040	0.80
MSM031-C	0.0000130	1.30
MS2N03-B	0.0000030	0.90
MS2N03-D	0.0000050	0.90
MS2N04	0.0000130	1.40
MSM031-C	0.0000130	1.40
MS2N03-B	0.0000020	0.90
MS2N03-D	0.0000040	0.90
MS2N04	0.0000130	1.40
MSM031-C	0.0000130	1.40
MS2N04	0.0000320	2.10
MS2N05	0.0000530	3.20
MSM041-B	0.0000530	3.20
MS2N04	0.0000270	2.10
MS2N05	0.0000460	3.20
MSM041-B	0.0000460	3.20
MS2N04	0.0000220	2.10
MS2N05	0.0000430	3.20
MSM041-B	0.0000430	3.20
MS2N06	0.0001800	4.4
	0.0001600	
	0.0001500	
MS2N07	0.0007200	17.30
	0.0005900	
	0.0005400	

Configuration, order

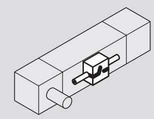
CKR-070

Short product name, length[1] CKR-070-NN-1, ... mm — Version			Guideway: Standard	Guideway: Center holes[2]		Drive: without Keyway, i = 1	Drive: for gear unit[4]	Lubrication[3]	Carriage: Connection plate without, L_{ca} = (mm) 80	Carriage: Connection plate without, L_{ca} = (mm) 108	Carriage: Connection plate with, L_{ca} = (mm) 60	Carriage: Connection plate with, L_{ca} = (mm) 95
												
Drive journal	MA01		01	03	04	01	–	LSS	01	02	40	41
Drive journal	MA02					02						
Clamping hub	MA05					06						
Clamping hub	MA06					07						
Gear attachment	MG10					–	08	LPG	–	302	–	341
Gear attachment	MG11					–	09					

[1] Length calculation of the linear motion system ➠ "Project planning/calculation" chapter.
[2] Center holes for simple combination with other linear motion systems and connection elements (➠ Dimensional drawings).
Option 03: with center holes and fastening threads in the ground area of the frame.
Option 04: with center holes and fastening threads in the ground area of the frame. Selectable starting from length L ≥ 300 mm up to length L_{max}
[3] Lubrication ➠ "Lubrication" chapter.
[4] Mounting kit for gear attachment
[5] With servo motor attached, product only available as assembled in the chapter "Form of Delivery" (note position of motor connector).
[6] Recommended motor, motor data and type designations ➠ "Motors" chapter
[7] Further information ➠ "Switching system" chapter.
[8] Assembly contains 1 x sensor, 1 x switch mounting plate including set screws and square nuts as well as 3 x cable holders including set screws
[9] Measurement report: 01 = Standard report; 02 = Measurement of frictional torque; (➠ "Documentation" chapter)
[10] Motor attachment consisting of: Adapter flange for gear unit, however "without gear unit". No motor connector position selectable.

	Motor attachment[5)] 			Motor[6)] 						Documentation[9)] 
	Direct drive	Gearing		Motor code	2 cables		1 cable		Motor connector position	
	i = 1	i = 5	i = 10		without brake	with brake	without brake	with brake		
MA01 / MA02 / MA05 / MA06	00			00						01
MG10 / MG11	–	00[10)]		00					000 / 090 / 180 / 270	02
		11	12	MS2N03-B0BYN	201	202	203	204		
		23	24	MSM019B-0300	134	135	–	–		

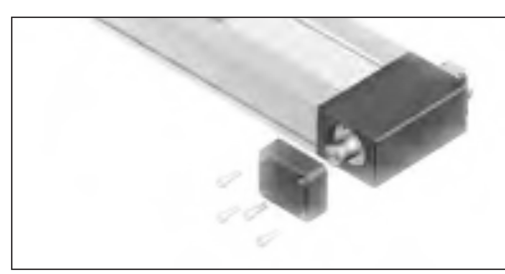
Switching system[7)]



Switching system	
Without	
- Switch - Mounting channel - Socket-plug	00
Magnetic sensor	
REED, changeover (NC: C+NC, NO: C+NO)	21
Hall, PNP normally closed (NC)	22
Hall, PNP normally open (NO)	23
Mounting channel	25
Socket-plug	17
Magnetic sensor with plug[8)]	
REED, changeover (NC: C+NC, NO: C+NO)	58
Hall, PNP normally closed (NC)	59

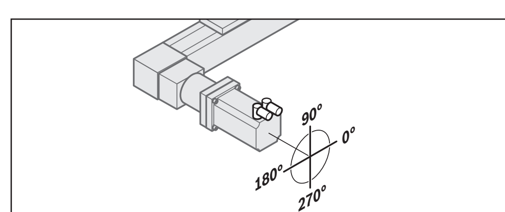
Drive end enclosure with additional drive shaft

In the versions MA05, MA06, MG10 and MG11, a second drive shaft end can be made available by removing the screws and cover.



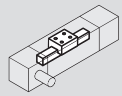
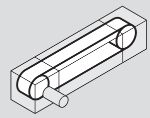
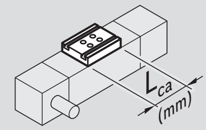
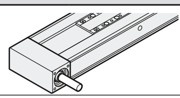
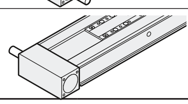
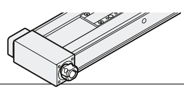
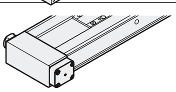
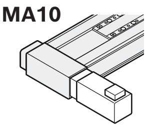
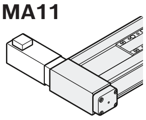
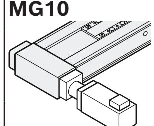
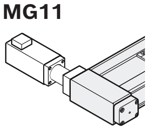
Version	Motor connector position			
	0°	90°	180°	270°
MG10 / MG11	000	090 ★	180	270

★ standard delivery

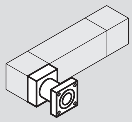
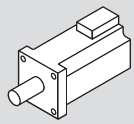
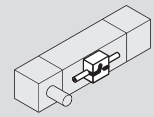


Explanation of the order parameters and order example ➠ "Order example" chapter.

CKR-090

<table>
<tr><th colspan="3" rowspan="2">Short product name, length[1)]
CKR-090-NN-1, ... mm</th><th colspan="3">Guideway
</th><th colspan="3">Drive
</th><th rowspan="2">Lubrication[3)]</th><th colspan="4">Carriage
</th></tr>
<tr><th rowspan="2">Standard</th><th colspan="2" rowspan="2">Center holes[2)]</th><th>without keyway</th><th>with keyway</th><th rowspan="2">for gear unit[4)]</th><th colspan="2">Connection plate without
L_{ca} = (mm)</th><th colspan="2">with
L_{ca} = (mm)</th></tr>
<tr><th colspan="3">Version</th><th>i = 1</th><th>i = 1</th><th></th><th>102</th><th>156</th><th>60</th><th>125</th></tr>
<tr><td rowspan="2">Drive journal</td><td colspan="2">MA01 </td><td rowspan="8">01</td><td rowspan="8">03</td><td rowspan="8">04</td><td rowspan="2">01</td><td rowspan="2">03</td><td rowspan="4">–</td><td rowspan="2">LSS</td><td rowspan="2">01</td><td rowspan="2">02</td><td rowspan="2">40</td><td rowspan="2">41</td></tr>
<tr><td colspan="2">MA02 </td></tr>
<tr><td rowspan="2">Clamping hub</td><td colspan="2">MA05 </td><td rowspan="2">06</td><td rowspan="2">–</td><td rowspan="2">LPG</td><td rowspan="2">–</td><td rowspan="2">302</td><td rowspan="2">–</td><td rowspan="2">341</td></tr>
<tr><td colspan="2">MA06 </td></tr>
<tr><td rowspan="2">Direct attachment</td><td>MA10 </td><td>MA11 </td><td rowspan="2">06</td><td rowspan="2">–</td><td rowspan="2">–</td><td rowspan="2">LCF</td><td colspan="3" rowspan="2">–</td><td rowspan="2">141</td></tr>
<tr><td></td><td></td></tr>
<tr><td rowspan="2">Gear attachment</td><td>MG10 </td><td>MG11 </td><td rowspan="2">–</td><td rowspan="2">–</td><td rowspan="2">08</td><td rowspan="2">LCO</td><td colspan="3" rowspan="2">–</td><td rowspan="2">241</td></tr>
<tr><td></td><td></td></tr>
</table>

1) Length calculation of the linear motion system ➠ "Project planning/calculation" chapter.
2) Center holes for simple combination with other linear motion systems and connection elements (➠ Dimensional drawings).
Option 03: with center holes and fastening threads in the ground area of the frame. Selectable up to a length of L ≤ 2000 mm
Option 04: with center holes and fastening threads in the ground area of the frame. Selectable starting from length L ≥ 300 mm up to length L_{max}
3) Lubrication ➠ "Lubrication" chapter.
4) Mounting kit for gear attachment
5) With servo motor attached, product only available as assembled in the chapter "Form of Delivery" (note position of motor connector).
6) Recommended motor, motor data and type designations ➠ "Motors" chapter
7) Further information ➠ "Switching system" chapter.
8) Assembly contains 1 x sensor, 1 x switch mounting plate including set screws and square nuts as well as 3 x cable holders including set screws
9) Measurement report: 01 = Standard report; 02 = Measurement of frictional torque; (➠ "Documentation" chapter)
10) Motor attachment consisting of: Adapter flange for gear unit, however "without gear unit". No motor connector position selectable.

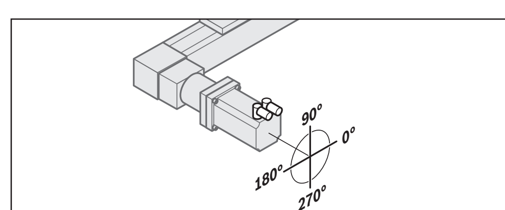

Version	Motor attachment[5)] Direct drive i = 1	Motor attachment[5)] Gearing i = 5	Motor attachment[5)] Gearing i = 10	Motor[6)] Motor code	2 cables without brake	2 cables with brake	1 cable without brake	1 cable with brake	Motor connector position	Documentation[9)]
MA01 / MA02 / MA05 / MA06	00			00						01
MA10 / MA11	01	–		MS2N04-D0BQN	217	218	219	220	000 / 090 / 180 / 270	02
MG10 / MG11	–	00[10)]		00					000 / 090 / 180 / 270	02
MG10 / MG11	–	15	16	MS2N03-B0BYN	201	202	203	204		
MG10 / MG11	–	13	14	MS2N03-D0BYN	205	206	207	208		
MG10 / MG11	–	33	34	MSM031C-0300	138	139	–	–		

Switching system[7)]	
Without	
- Switch - Mounting channel - Socket-plug	00
Magnetic sensor	
REED, changeover (NC: C+NC, NO: C+NO)	21
Hall, PNP normally closed (NC)	22
Hall, PNP normally open (NO)	23
Mounting channel	25
Socket-plug	17
Magnetic sensor with plug[8)]	
REED, changeover (NC: C+NC, NO: C+NO)	58
Hall, PNP normally closed (NC)	59

Drive end enclosure with additional drive shaft

In the versions MA05, MA06, MA10, MA11, MG10 and MG11, a second drive shaft end can be made available by removing the screws and cover.

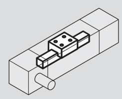
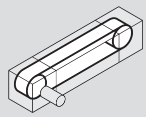
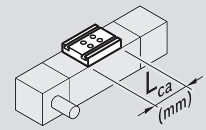
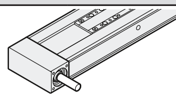
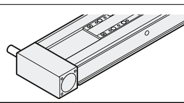
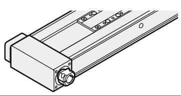
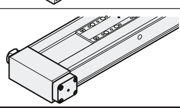
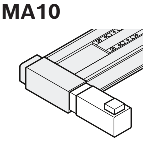
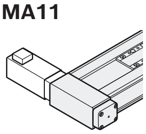
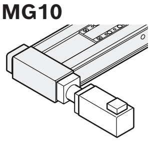
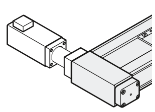
Version	Motor connector position 0°	90°	180°	270°
MA10 / MA11 MG10 / MG11	000	090 ★	180	270



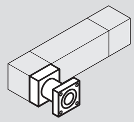
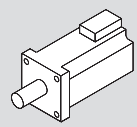
★ standard delivery

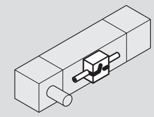
Explanation of the order parameters and order example ➠ "Order example" chapter.

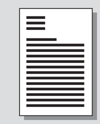
CKR-110

Short product name, length[1] CKR-110-NN-1, ... mm		Guideway			Drive			Lubrication[3]	Carriage			
												
									Connection plate without L_{ca} = (mm)		with L_{ca} = (mm)	
Version		Standard	Center holes[2]		without keyway i = 1	with keyway i = 1	for gear unit[4]		170	215	110	155
Drive journal	MA01 	01	03	04	01	03	–	LSS	01	02	40	41
	MA02 											
Clamping hub	MA05 				06	–		LPG	–	302	–	341
	MA06 											
Direct attachment	MA10  MA11 				06	–	–	LCF	–			141
Gear attachment	MG10  MG11 				–	–	08	LCO	–			241

1) Length calculation of the linear motion system ➠ "Project planning/calculation" chapter.
2) Center holes for simple combination with other linear motion systems and connection elements (➠ Dimensional drawings).
Option 03: with center holes and fastening threads in the ground area of the frame. Selectable up to a length of L ≤ 2000 mm
Option 04: with center holes and fastening threads in the ground area of the frame. Selectable starting from length L ≥ 300 mm up to length L_{max}
3) Lubrication ➠ "Lubrication" chapter.
4) Mounting kit for gear attachment
5) With servo motor attached, product only available as assembled in the chapter "Form of Delivery" (note position of motor connector).
6) Recommended motor, motor data and type designations ➠ "Motors" chapter
7) Further information ➠ "Switching system" chapter.
8) Assembly contains 1 x sensor, 1 x switch mounting plate including set screws and square nuts as well as 3 x cable holders including set screws
9) Measurement report: 01 = Standard report; 02 = Measurement of frictional torque; (➠ "Documentation" chapter)
10) Motor attachment consisting of: Adapter flange for gear unit, however "without gear unit". No motor connector position selectable.

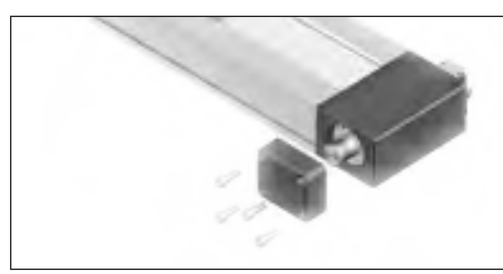
	Motor attachment[5] 			Motor[6] 					
	Direct drive	Gearing		Motor code	2 cables		1 cable		Motor connector position
	i = 1	i = 5	i = 10		without brake	with brake	without brake	with brake	
MA01 / MA02 / MA05 / MA06	00			00					
MA10 / MA11	01	–		MS2N05-D0BRN	229	230	231	232	000 090 180 270
MG10 / MG11	–	00[10]		00					
		15	16	MS2N03-B0BYN	201	202	203	204	
		13	14	MS2N03-D0BYN	205	206	207	208	
		23	24	MS2N04-B0BTN	209	210	211	212	
		23	24	MS2N04-C0BTN	213	214	215	216	
		33	34	MSM031C-0300	138	139	–	–	

Switching system[7] 	
Without	
- Switch - Mounting channel - Socket-plug	00
Magnetic sensor	
REED, changeover (NC: C+NC, NO: C+NO)	21
Hall, PNP normally closed (NC)	22
Hall, PNP normally open (NO)	23
Mounting channel	25
Socket-plug	17
Magnetic sensor with plug[8]	
REED, changeover (NC: C+NC, NO: C+NO)	58
Hall, PNP normally closed (NC)	59

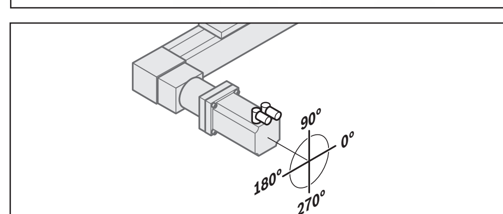
Documentation[9] 
01
02

Drive end enclosure with additional drive shaft

In the versions MA05, MA06, MA10, MA11, MG10 and MG11, a second drive shaft end can be made available by removing the screws and cover.



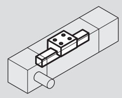
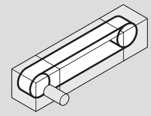
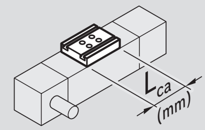
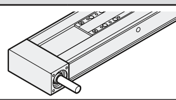
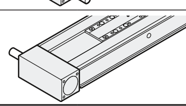
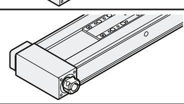
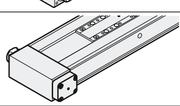
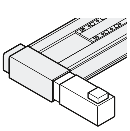
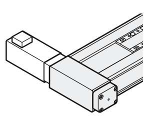
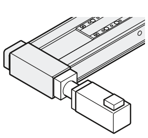
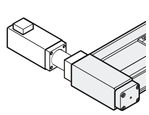
Version	Motor connector position			
	0°	90°	180°	270°
MA10 / MA11 MG10 / MG11	000	090 ★	180	270



★ standard delivery

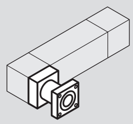
Explanation of the order parameters and order example ➟ "Order example" chapter.

CKR-145

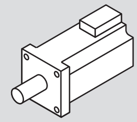
Short product name, length[1)] CKR-145-NN-1, ... mm		Guideway			Drive			Lubrication[3)]	Carriage			
												
									Connection plate without L_{ca} = (mm)		with L_{ca} = (mm)	
Version		Standard	Center holes[2)]		without keyway i = 1	with keyway i = 1	for gear unit[4)]		180	240	125	190
Drive journal	MA01  MA02 	01	03	04	01	03	–	LSS	01	02	40	41
Clamping hub	MA05  MA06 				06	–	–	LPG	–	302	–	341
Direct attachment	MA10  MA11 				06	–	–	LCF	–			141
Gear attachment	MG10  MG11 				–	–	08	LCO	–			241

1) Length calculation of the linear motion system ➠ "Project planning/calculation" chapter.
2) Center holes for simple combination with other linear motion systems and connection elements (➠ Dimensional drawings).
Option 03: with center holes and fastening threads in the ground area of the frame. Selectable up to a length of L ≤ 2000 mm
Option 04: with center holes and fastening threads in the ground area of the frame. Selectable starting from length L ≥ 300 mm up to length L_{max}
3) Lubrication ➠ "Lubrication" chapter.
4) Mounting kit for gear attachment
5) With servo motor attached, product only available as assembled in the chapter "Form of Delivery" (note position of motor connector).
6) Recommended motor, motor data and type designations ➠ "Motors" chapter
7) Further information ➠ "Switching system" chapter.
8) Assembly contains 1 x sensor, 1 x switch mounting plate including set screws and square nuts as well as 3 x cable holders including set screws
9) Measurement report: 01 = Standard report; 02 = Measurement of frictional torque; (➠ "Documentation" chapter)
10) Motor attachment consisting of: Adapter flange for gear unit, however "without gear unit". No motor connector position selectable.

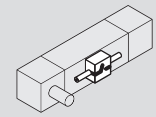
Motor attachment[5]



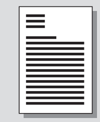
Motor[6]



Switching system[7]



Documentation[9]



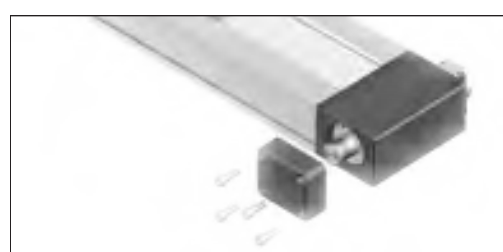
Version	Direct drive i = 1	Gearing i = 3	Gearing i = 5	Gearing i = 10	Motor code	2 cables without brake	2 cables with brake	1 cable without brake	1 cable with brake	Motor connector position	Documentation
MA01 / MA02 / MA05 / MA06	00				00						01
MA10 / MA11	01	–	–	–	MS2N06-D1BNN	245	246	247	248	000, 090, 180, 270	02
MG10 / MG11	–	00[10]			00					000, 090, 180, 270	02
		13	14	15	MS2N04-C0BTN	213	214	215	216		
					MS2N04-D0BQN	217	218	219	220		
		43	44	45	MS2N05-B0BTN	221	222	223	224		
					MS2N05-C0BTN	225	226	227	228		
					MS2N05-D0BRN	229	230	231	232		
		33	34	35	MSM041B-0300	140	141	–	–		

Switching system[7]

Switching system	
Without	
- Switch - Mounting channel - Socket-plug	00
Magnetic sensor	
REED, changeover (NC: C+NC, NO: C+NO)	21
Hall, PNP normally closed (NC)	22
Hall, PNP normally open (NO)	23
Mounting channel	25
Socket-plug	17
Magnetic sensor with plug[8]	
REED, changeover (NC: C+NC, NO: C+NO)	58
Hall, PNP normally closed (NC)	59

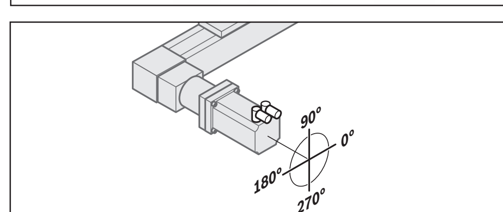
Drive end enclosure with additional drive shaft

In the versions MA05, MA06, MA10, MA11, MG10 and MG11, a second drive shaft end can be made available by removing the screws and cover.



Version	Motor connector position 0°	90°	180°	270°
MA10 / MA11 MG10 / MG11	000	090 ★	180	270

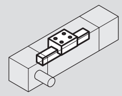
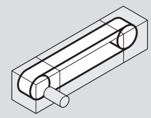
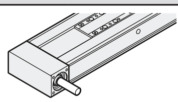
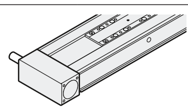
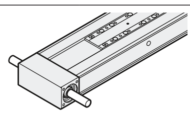
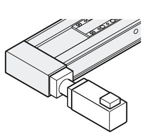
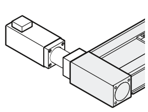
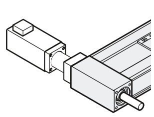
★ standard delivery



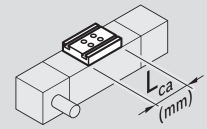
Explanation of the order parameters and order example ➠ "Order example" chapter.

CKR-200

Short product name, length[1)]
CKR-200-NN-1, ... mm

Version		Guideway: Standard	Guideway: Center holes[2)]		Drive: without keyway i = 1	Drive: with keyway i = 1	Drive: for gear unit[4)]
							
Drive journal	MA01 	01	03	04	01	03	–
Drive journal	MA02 	01	03	04	01	03	–
Drive journal	MA03 	01	03	04	02	04	–
Gear attachment	MG01 	01	03	04	–	–	PG090 10 / PG120 12
Gear attachment	MG02 	01	03	04	–	–	PG090 10 / PG120 12
Gear attachment	MG03 	01	03	04	–	–	PG090 11 / PG120 13
Gear attachment	MG04 	01	03	04	–	–	PG090 11 / PG120 13

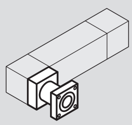
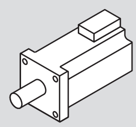
Carriage



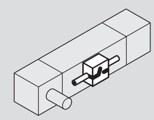
Lubrication[3)]	Connection plate without L_{ca} = (mm) 265	Connection plate without L_{ca} = (mm) 405	Connection plate with L_{ca} = (mm) 190	Connection plate with L_{ca} = (mm) 305
LSS	01	02	40	41
LPG	–	302	–	341
LCF	–			141
LCO	–			241

1) Length calculation of the linear motion system ➠ "Project planning/calculation" chapter.
2) Center holes for simple combination with other linear motion systems and connection elements (➠ Dimensional drawings).
Option 03: with center holes and fastening threads in the ground area of the frame. Selectable up to a length of L ≤ 2000 mm
Option 04: with center holes and fastening threads in the ground area of the frame. Selectable up to a length of L ≤ 5500 mm
3) Lubrication ➠ "Lubrication" chapter.
4) Mounting kit for gear attachment
5) With servo motor attached, product only available as assembled in the chapter "Form of Delivery" (note position of motor connector).
6) Recommended motor, motor data and type designations ➠ "Motors" chapter
7) Further information ➠ "Switching system" chapter.
8) Assembly contains 1 x sensor, 1 x switch mounting plate including set screws and square nuts as well as 3 x cable holders including set screws
9) Switch configuration with magnetic sensor and mechanical/proximity switch together on one side is not possible.
Assembly contains 1 x sensor, 1 x switch mounting plate including mounting material
10) Switching angle can be attached only in conjunction with connection plate
11) Measurement report: 01 = Standard report; 02 = Measurement of frictional torque; 03 = Lead deviation (➠ "Documentation" chapter)
12) Motor attachment consisting of: Adapter flange for gear unit, however "without gear unit". No motor connector position selectable.

		Motor attachment[5)] Gearing i = 3	i = 5	i = 10	Motor[6)] Motor code	2 cables without brake	2 cables with brake	1 cable without brake	1 cable with brake	Motor connector position
MA01 / MA02 / MA03		00			00					
MG01 / MG02 / MG03 / MG04	–	00[12)]			00					
	PG090	43	44	45	MS2N06-D1BNN	245	246	247	248	000
	PG120	33	34	35	MS2N07-B1BNN	253	254	255	256	090
					MS2N07-C1BRN	261	262	263	264	180
					MS2N07-D1BNN	267	268	269	270	270
					MS2N07-E1BNN	273	274	–	–	

Switching system[7)]



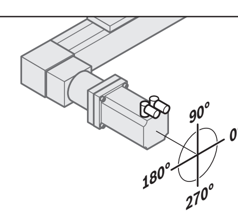
Switching system		
Without		
- Switch - Mounting channel - Socket-plug		00
Magnetic sensor		
REED, changeover (NC: C+NC, NO: C+NO)		21
Hall, PNP normally closed (NC)		22
Hall, PNP normally open (NO)		23
Mounting channel		25
Socket-plug		17
Magnetic sensor with plug[8)]		
REED, changeover (NC: C+NC, NO: C+NO)		58
Hall, PNP normally closed (NC)		59
Proximity / mechanical switches[9)]		
Mechanical		15
Proximity – PNP NC contact		11
Proximity – PNP NO contact		13
Cable duct		20
Switching angle[10)]	1	16
	2	26
Socket-plug		17

Documentation[11)]

Version	Documentation
MA01 / MA02 / MA03	01
MG01 / MG02 / MG03 / MG04	02

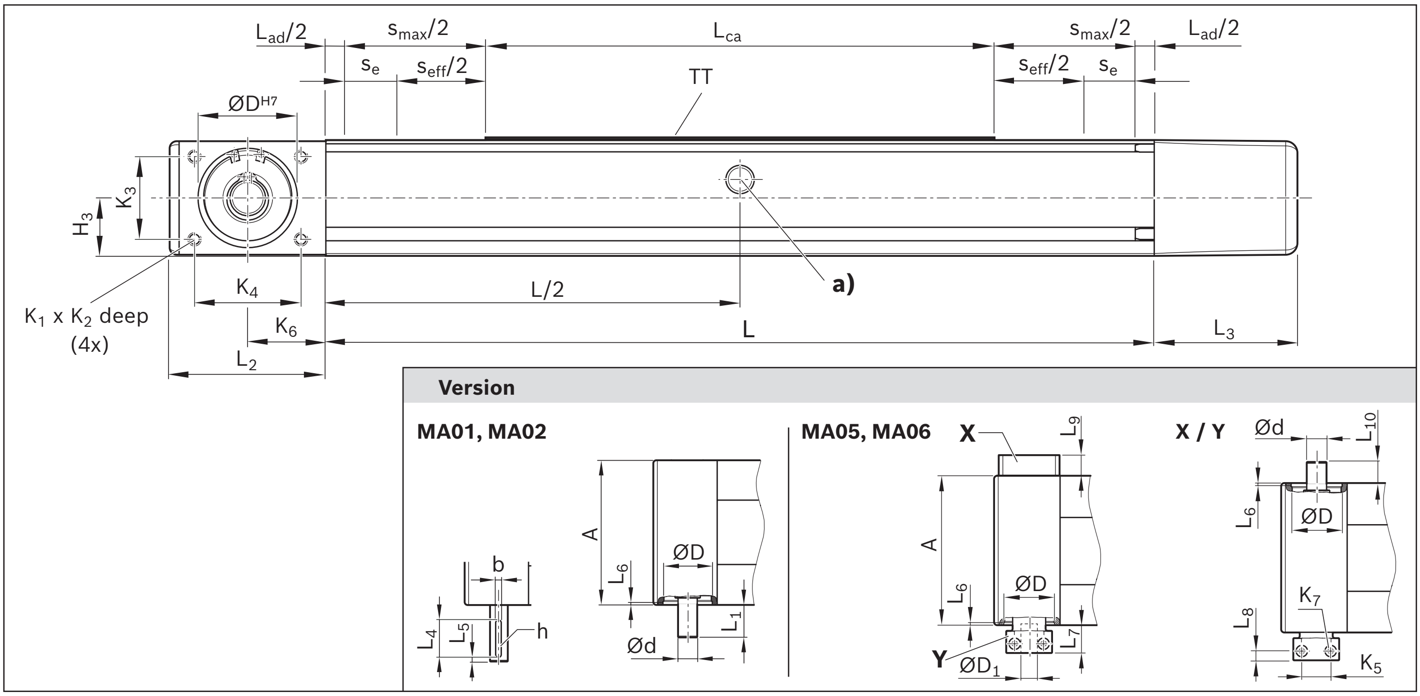
Version	Motor connector position			
	0°	90°	180°	270°
MG01-MG04	000	090 ★	180	270

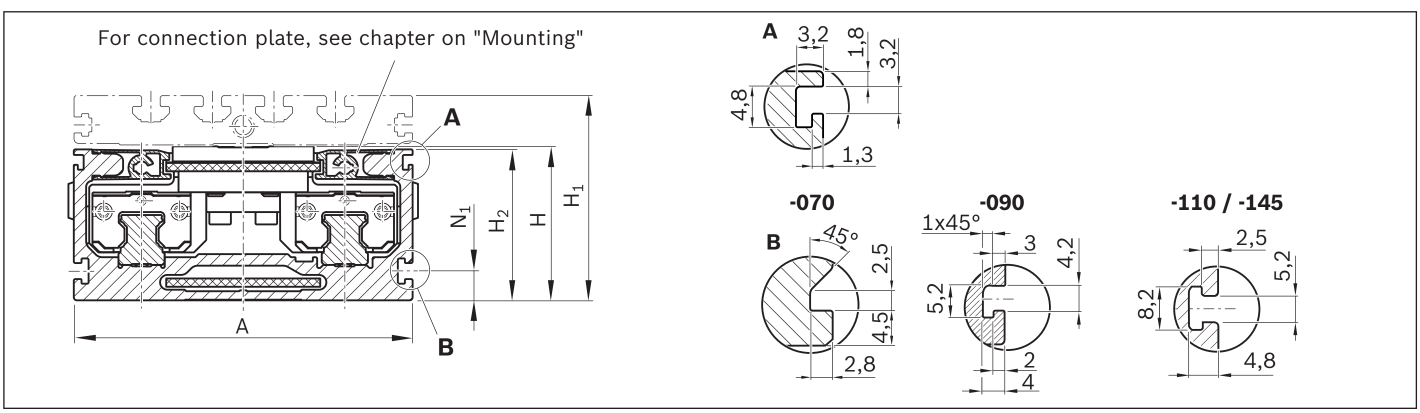
★ standard delivery



Explanation of the order parameters and order example ➟ "Order example" chapter.

Frame CKR-070/-090/-110/-145





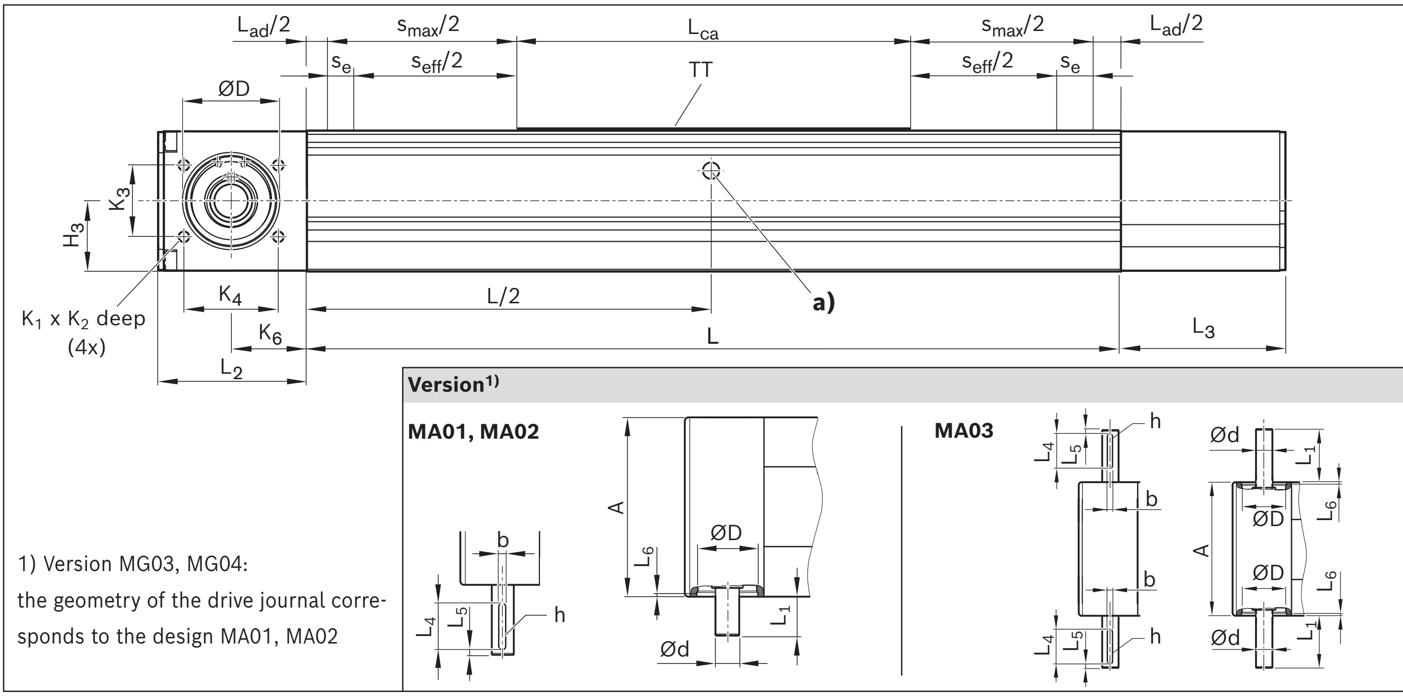
CKR	Dimensions (mm)													
	A	B	b^{P9}	H	H_1	H_2	H_3	h	ØD	ØD$_1$		Ød	K_1	K_2
									H7	H7	h7	h6		
-070	70	–	–	32	44.5	31.3	16.30	–	26.5	10	8	–	M3	6
-090	90	–	3	40	56.0	39.0	19.50	1.8	34.0	14	10	–	M4	8
-110	110	–	5	50	66.0	49.0	24.50	3.0	42.0	19	14	–	M5	10
-145	145	–	6	65	85.0	64.0	32.00	3.5	49.0	24	19	–	M6	12
-200	200	150	8	100	127.0	98.5	49.25	4.0	68.0	–	–	24	M8	15

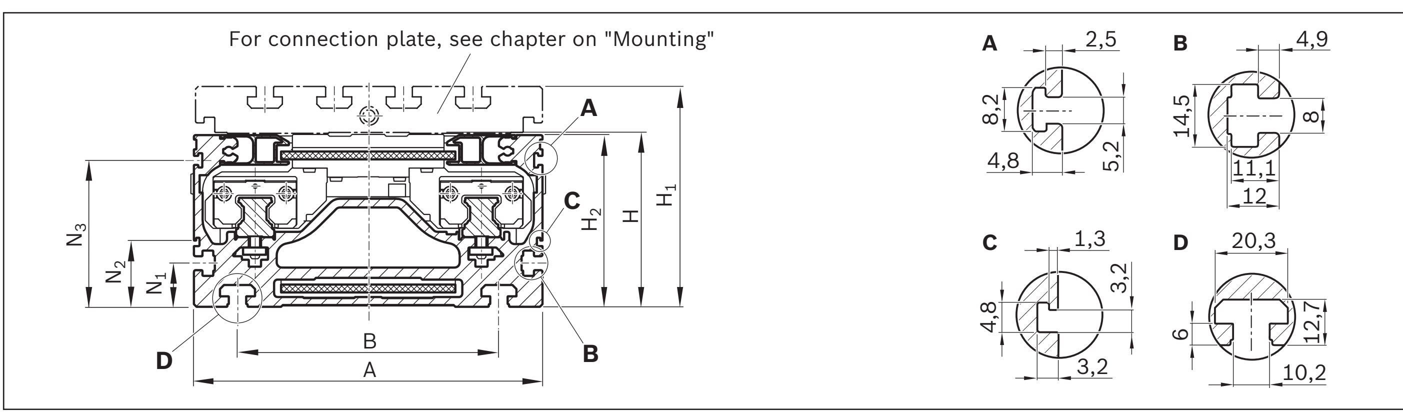
a) Lubrication bore on both sides (grease lubrication). ➠ "Lubrication" chapter.

Straightness and flatness tolerance in accordance with DIN EN 12020-2.

Note: all dimensions in mm. Drawings not schematically to scale. Exact contours and dimensions can be found in the CAD model. CAD configurator available on the Internet

Frame CKR-200



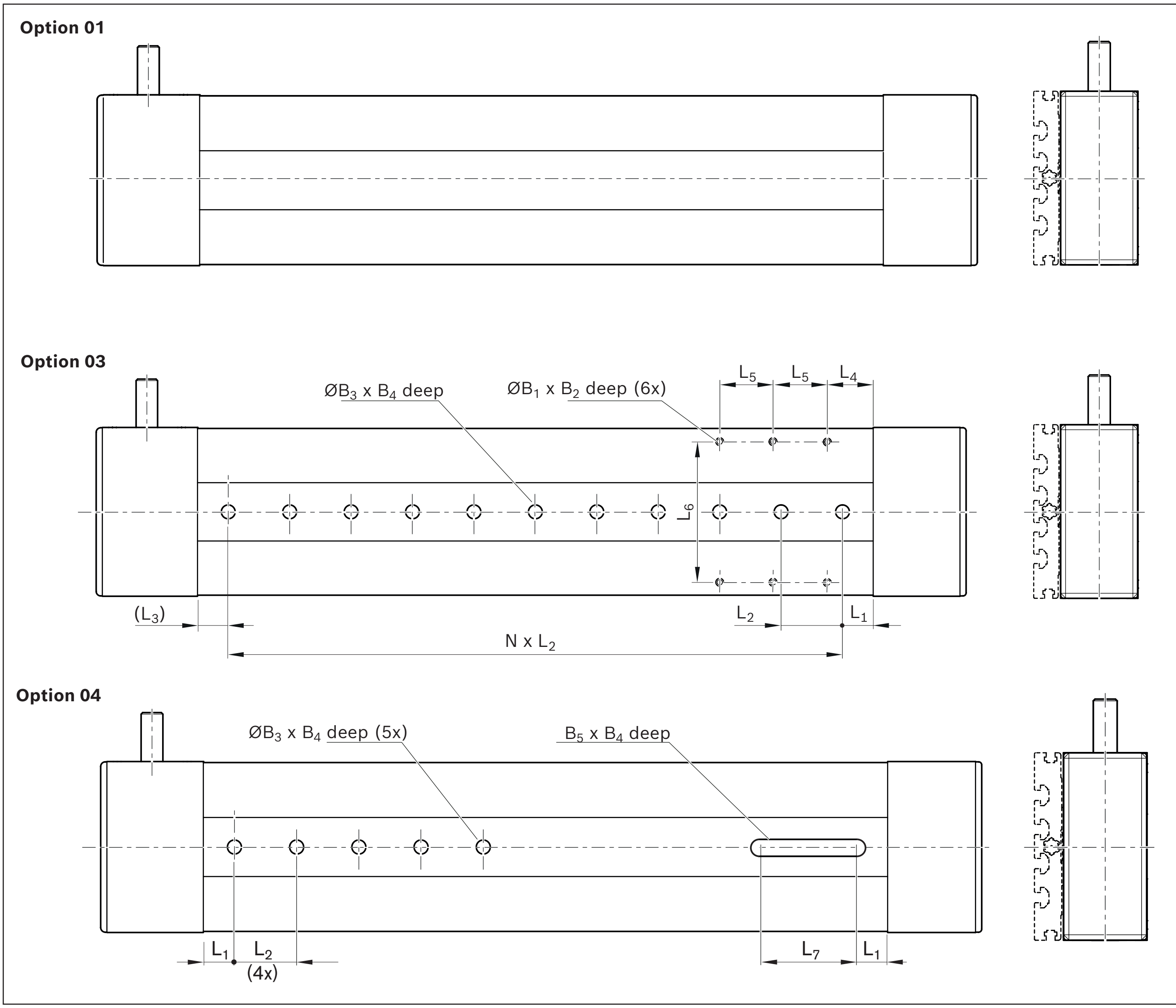


	K3	K4	K5 ± 0.1	K6	K7	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	N1	N2	N3
	12	29	14.4	18	M2.5 (ISO 4762)	14.5	36	42.0	–	–	3.0	14.5	5 ±0.2	15	12.0	–	–	–
	28	40	20.0	28	M4 (DIN 6912)	31.5	59	49.5	25	2	1.8	20.5	8 ±0.2	15	12.5	7.6	–	–
	35	45	25.0	33	M4 (ISO 4762)	31.5	66	60.5	25	2	2.0	22.0	8 ±0.2	20	17.5	9.5	–	–
	45	45	30.5	30	M5 (ISO 4762)	61.0	64	71.5	40	2	2.5	27.5	9 ±0.1	20	17.5	9.5	–	–
	50	66	–	53	–	61.0	104	115.0	40	3	2.5	–	–	–	–	25.0	38	84

See following pages for dimensional drawings for frames, carriages and motor attachment.
Length calculation of the linear motion system ➠ "Technical data" and "Project planning/calculation" chapter.

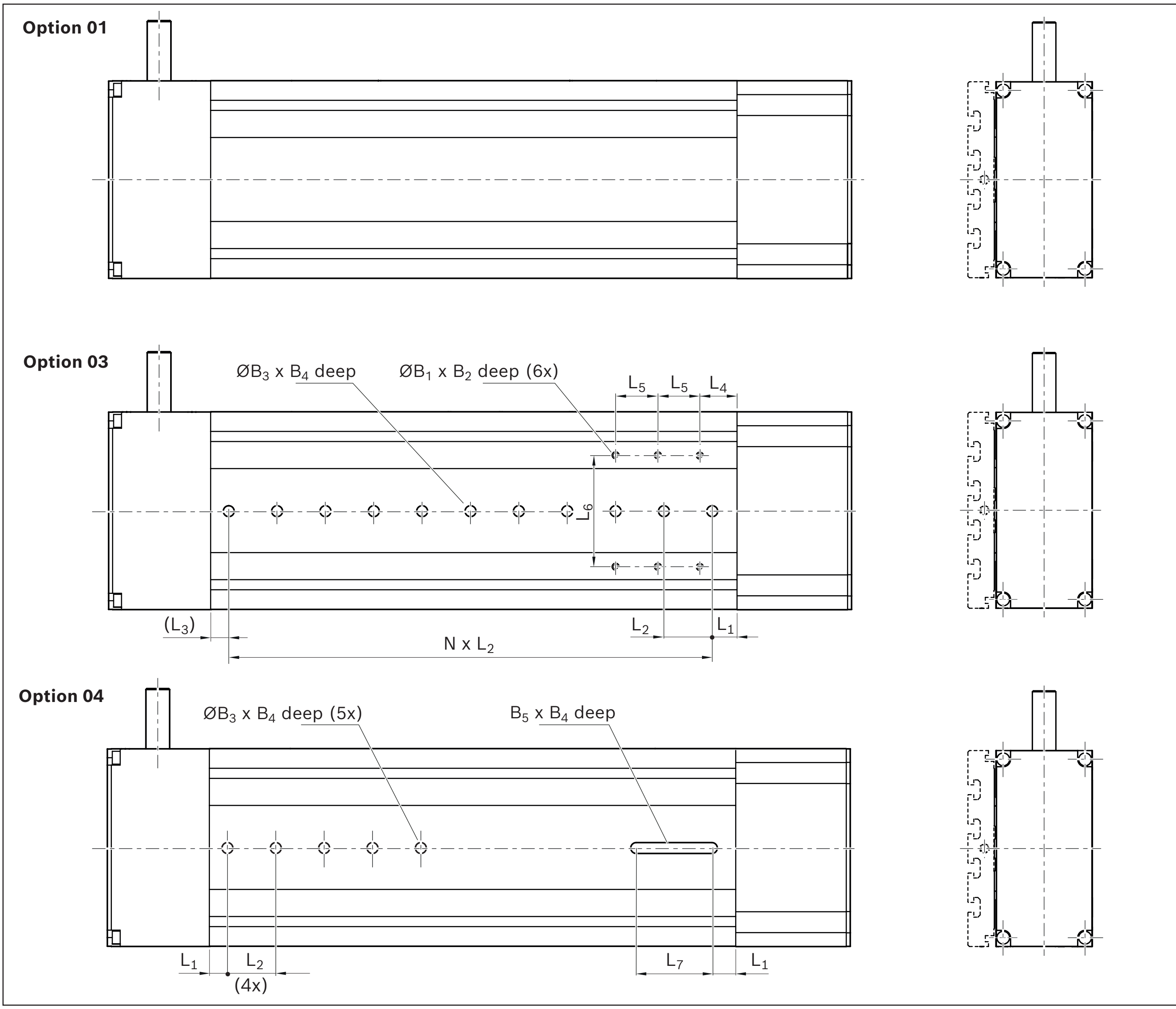
A For switch mounting arrangements
B For mounting with clamping fixtures
C For mounting duct
D For fastening with sliding blocks
TT = Carriage

Frame CKR-070/-090/-110/-145



CKR	Option	Dimensions (mm)											
		B_1	B_2	$ØB_3^{H7}$	B_4	B_5^{H8}	L_1	$L_2^{\pm 0.01}$	L_3 (min)	L_4	L_5	L_6	L_7
-070	03	M3	6.0	7	1.6	–	20	40	10	15	25	59	–
	04	–	–			7			–	–	–	–	60
-090	03	M4	7.5	9	2.1	–			10	30	35	76	–
	04	–	–			9			–	–	–	–	60
-110	03	M5	9.0	9	2.1	–			10	30	35	92	–
	04	–	–			9			–	–	–	–	60
-145	03	M6	13.0	12	2.1	–			10	30	35	124	–
	04	–	–			12			–	–	–	–	60
-200	03	M8	12.0	16	3.1	–			10	35	40	119	–
	04	–	–			16			–	–	–	–	60

Frame CKR-200



Views from below (ground area)
Option 01 / standard
Option 03 / with central holes
Option 04 / with central holes and long hole

Carriages CKR-070/-090/-110/-145/-200

Carriages without connection plate

Fig. 1

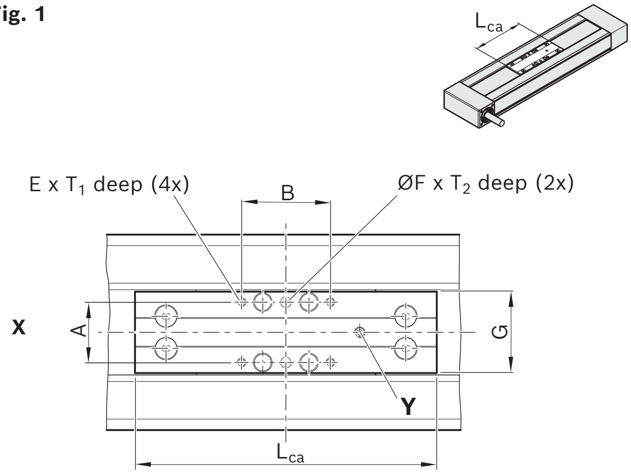


Fig. 2

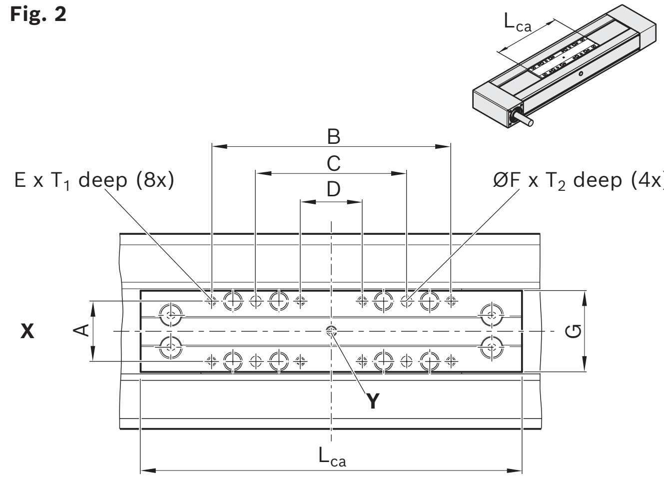


Fig. 3

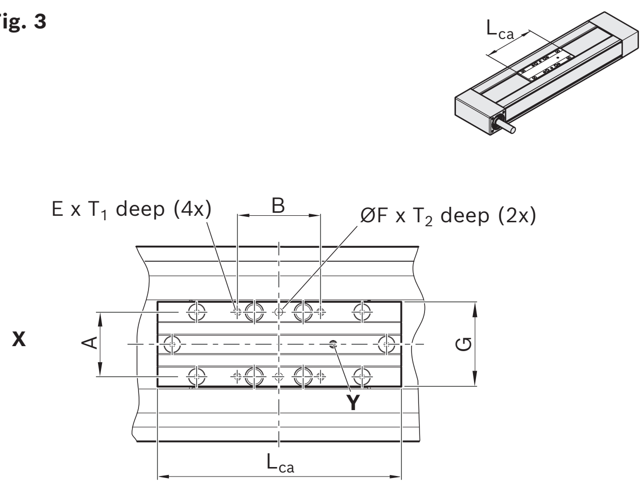
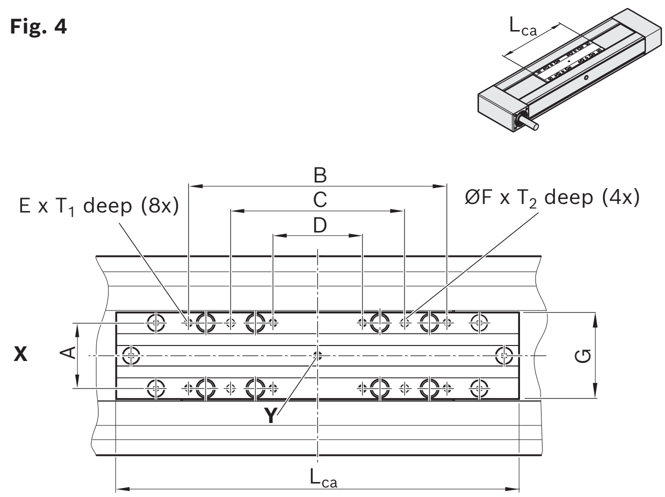
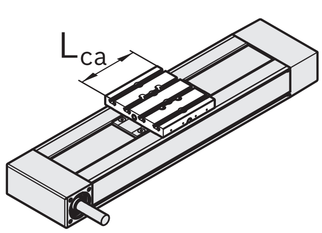
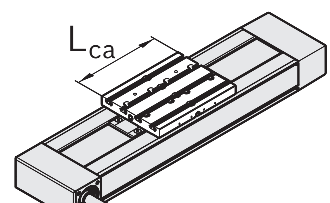


Fig. 4



Carriages with connection plate[1)]



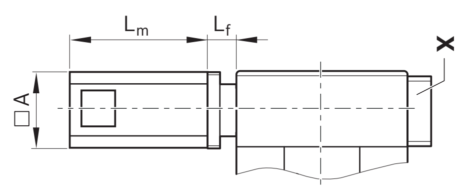
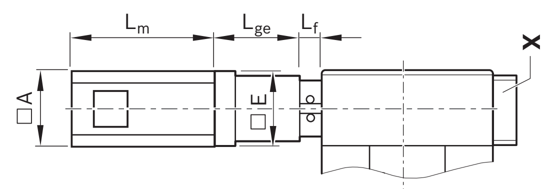


[1)] Dimensional drawings ➠ "Connection plates" chapter

CKR	Figure	Dimensions (mm)									
		L_{ca}	A	B	C	D	E	ØF^{H7}	G	T_1	T_2
-070	1	80	13.5	25	–	–	M3	3	21	6	6
	2	108		65	40	15					
-090	1	102	20	27	–	–	M4	4	27	8	6.5
	2	156		92	65	38					
-110	1	170	34	50	–	–	M5	6	46	10	6.5
	2	215		135	85	35					
-145	1	180	48	60	–	–	M6	6	62	12	7.5
	2	240		160	100	40					
-200	3	265	66	85	–	–	M8	8	87	16	10
	4	405		260	175	90					

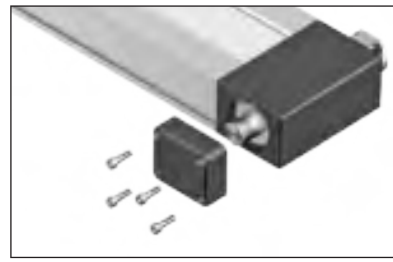
X Drive side
Y Lubrication point for grease; sealed with set screw.
Supplementary information on the lubrication ➠ "Lubrication" chapter.

Motor attachment CKR-070/-090/-110/-145

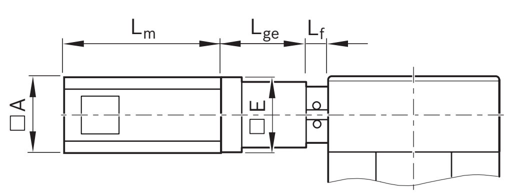
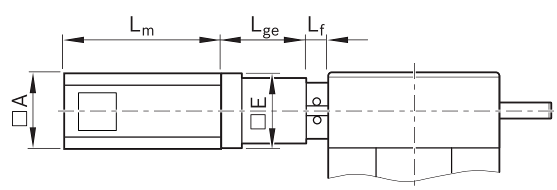
Version	
MA10, MA11	**MG10, MG11**
	

X: Drive end enclosure with additional drive shaft

In the versions MA10, MA11, MG10 and MG11, a second drive shaft end can be made available by removing the screws and cover.

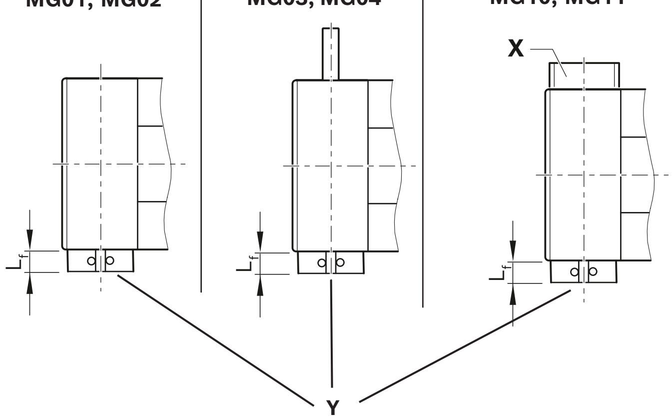


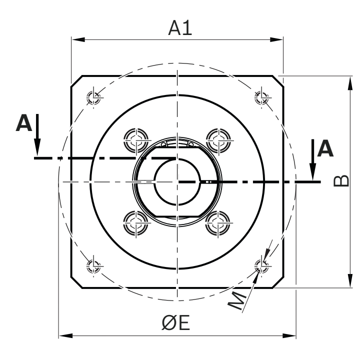
Motor attachment CKR-200

Version	
MG01, MG02	**MG03, MG04**
	

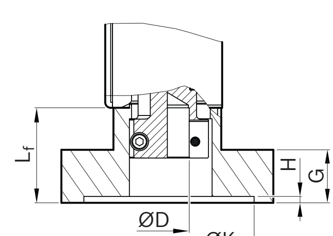
Motor attachment Option 00 (Adapter flange for mounting customer gear unit)

Version		
CKR -200	**CKR -070/-090/-110/-145**	**Y**
MG01, MG02 / **MG03, MG04**	**MG10, MG11**	



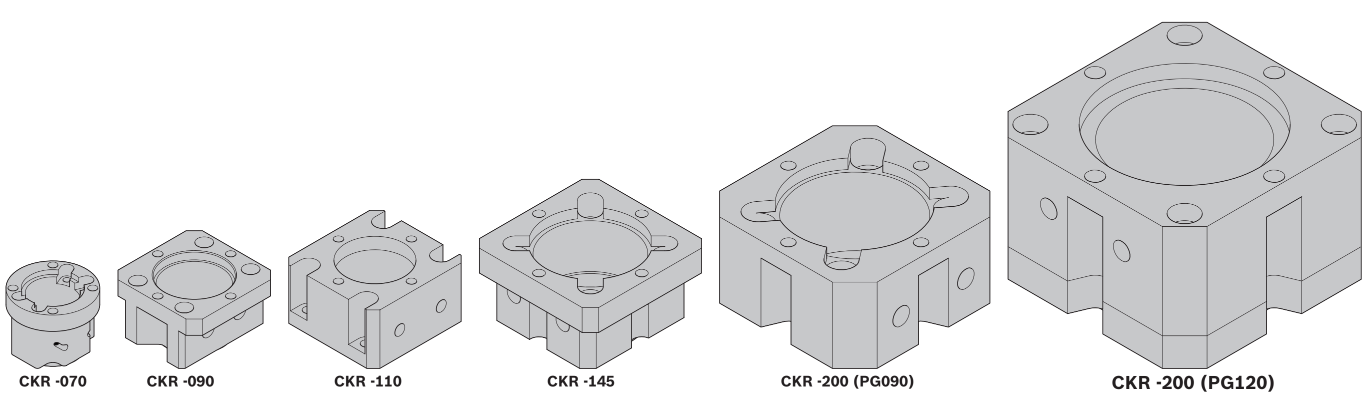


cutt A-A



CKR	Version	Motor code	Dimensions (mm) □ E	L_f	L_{ge}	L_m	□ A	A1	B	Ø E	G	H	Ø D	Ø K	Ø M
-070	MG10, MG11	MS2N03-B0BYN	55	29.5	61.5	see "Motors" chapter		Ø 40		34	8.5	2.5	10^{H7}	$27^{+0.2}$	4.3
		MSM019B-0300	40												
-090	MA10, MA11	MS2N04-D0BQN	–	34.5	–			51	51	44	8.5	4.5	14^{H7}	$35.1^{+0.3}$	4.5
	MG10, MG11	MS2N03-B0BYN	55	28.0	68.0										
		MS2N03-D0BYN													
		MSM031C-0300	70		75.0										
-110	MA10, MA11	MS2N05-D0BRN	55	46.0	–			57	55	44	–	$7^{+0.4}$	19^{H7}	35^{H7}	4.5
	MG10, MG11	MS2N03-B0BYN	55	30.5	68.0										
		MS2N03-D0BYN													
		MS2N04-B0BTN	80		75.0										
		MS2N04-C0BTN													
		MSM031C-0300	70		75.0										
-145	MA10, MA11	MS2N06-D1BNN	55	52.0	–			72	72	62	13	$5.5^{+0.3}$	24^{H7}	$53^{+0.4}$	5.5
	MG10, MG11	MS2N04-C0BTN	80	37.0	92.0										
		MS2N04-D0BQN													
		MS2N05-B0BTN	100		101.0										
		MS2N05-C0BTN													
		MS2N05-D0BRN													
		MSM041B-0300	90		97.0										
-200	MG01, MG02, MG03, MG04	MS2N06-D1BNN	120	45.0	124.5			95	95	80	–	6	22^{F7}	$68.3^{+0.2}$	6.6
		MS2N07-B1BNN	150	75.0	154.0			120	120	108	–	8	32^{F7}	$90.3^{+0.2}$	9,0
		MS2N07-C1BRN													
		MS2N07-D1BNN													
		MS2N07-E1BNN													

Adapter flange



Attachments and accessories

Mounting/mounting accessories

Compact Modules fit together perfectly – fast and flexible

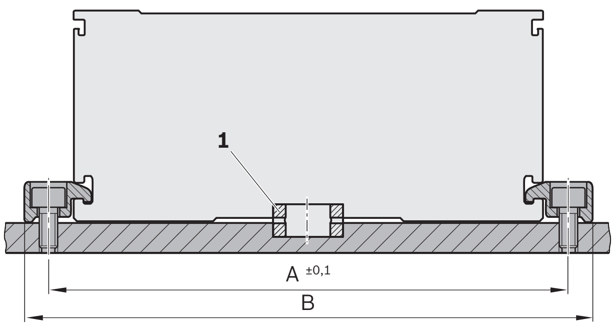
Minimal mounting times, maximum efficiency

Standardized interfaces significantly reduce the effort during mounting.
The mechanical systems have positive-locking interfaces throughout.
They can be quickly and accurately connected together without time-consuming alignment.

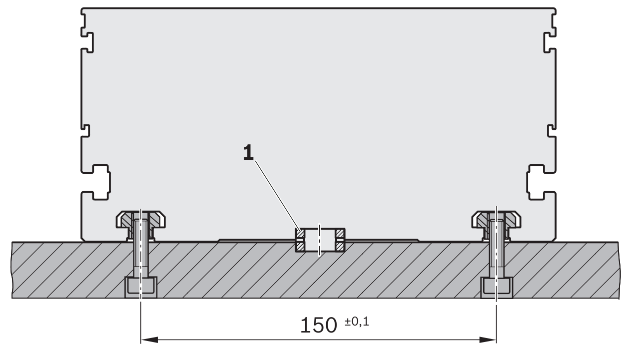
The result:

Users can respond flexibly to handling the different applications and tasks.

Fastening with clamping fixtures



Mounting with sliding blocks (size 200)



1 For Compact Modules with centering holes in the ground area (selection via the guideway option): Use centering rings to better align to other Linear Motion Systems and connection elements.

⚠ **Do not secure or support the Compact Modules at the end enclosures! The frame is the load-bearing part!**

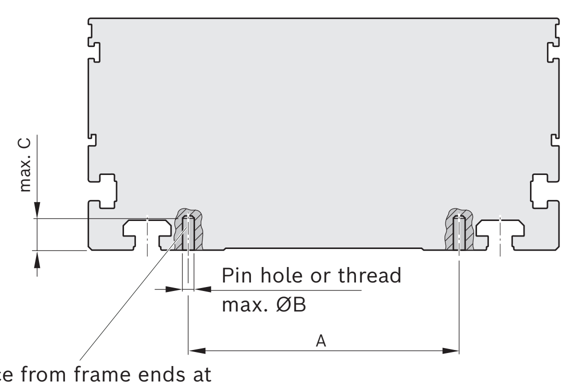
Size	**Dimensions** (mm)	
	A	**B**
-070	82	95
-090	102	112
-110	126	140
-145	161	175
-200	222	240

Mounting by means of special modification in the base surface of the frame is possible

⚠ **Option guideway 03 already includes threaded holes in the ground area of the frame (see dimension drawings).**

Size	**Dimensions** (mm)		
	A	**B**	**C**
-070	59	3	7.5
-090	76	4	7.5
-110	92	5	9.0
-145	124	6	13.0
-200	119	8	12.0

Special modification in the base surface of the frame
(not available from factory)



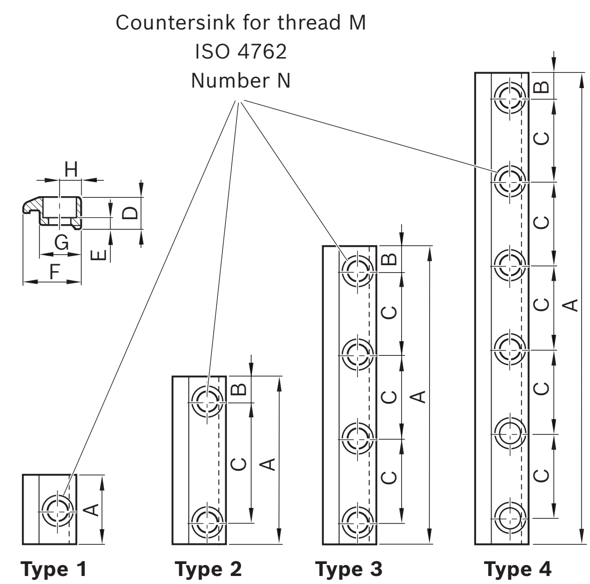
Mounting accessories

Recommended number of clamping fixtures:

- Type 1: 6/3[1)] pieces per meter and side
- Type 2: 4 per meter and side
- Type 3: 3 per meter and side
- Type 4: 3 per meter and side

1) For size 070

Clamping fixtures

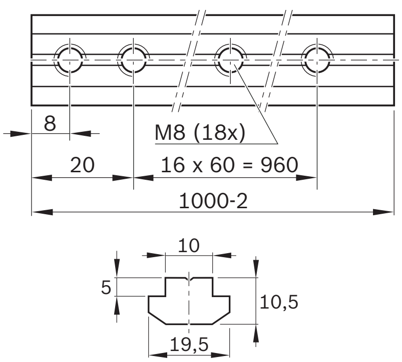


Size	for thread	Type	Number of holes N	Dimensions (mm)								Part number
				A	B	C	D	E	F	G	H	
-070	M5	1	1	22	–	–	10.0	4.8	15.0	12.2	6.5	R1419 010 01
		2	2	57	8.5	40	10.0	4.8	15.1	12.2	6.5	R1419 010 43
		1	1	25	–	–						R0375 310 00
		3	4	87	6.0	25						R0375 310 02
		3	4	107	8.5	30						R0375 310 03
-090	M4	2	2	72	11.0	50	9.0	4.6	14.5	10.5	5.0	R0375 310 32
		2	2	62	11.0	40						R0375 310 33
		3	4	87	13.5	20						R0375 310 38
		4	6	107	8.5	18						R0375 310 41
		3	4	107	8.5	30						R0375 410 02
	M5	3	4	77	8.5	20	11.5	4.8	19.3	14.0	7.0	R0375 410 26
		4	6	107	8.5	18						R0375 410 41
		1	1	25	–	–						R0375 510 00
-110 / -145		3	4	142	11.0	40						R0375 510 02
	M6	2	2	72	11.0	50	11.5	5.3	19.3	14.0	7.0	R0375 510 33
		2	2	62	11.0	40						R0375 510 34
		2	2	47	8.5	30						R0375 510 23
		4	6	142	8.5	25						R0375 510 41
		2	2	108	19.0	70		16.3				R1175 290 26
-200	M8	2	2	88	19.0	50	27.5	14.8	29	19.0	9.0	R1175 290 96
		2	2	78	19.0	40		14.8				R1175 290 97

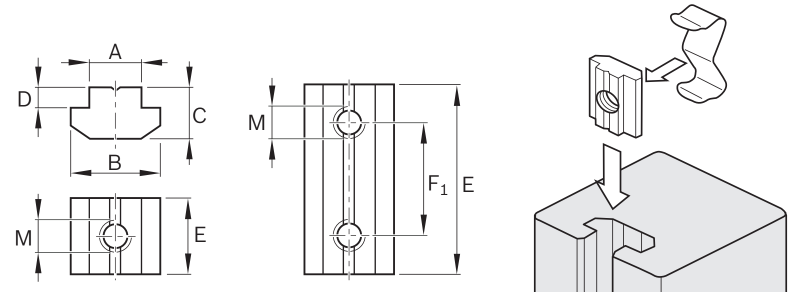
CKR Compact Modules: When mounting the clamping fixtures, observe a minimum distance of 10 mm to the end face of the frame.

Sliding blocks, springs and strips

Recommended number of sliding blocks:
with 1 thread, 6 pieces per meter and side

Strip

Part number R3447 008 01

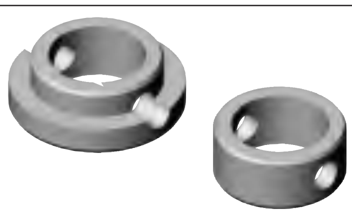
For fastening attachments on the connection plate.
The spring serves as assembly and positioning aid.

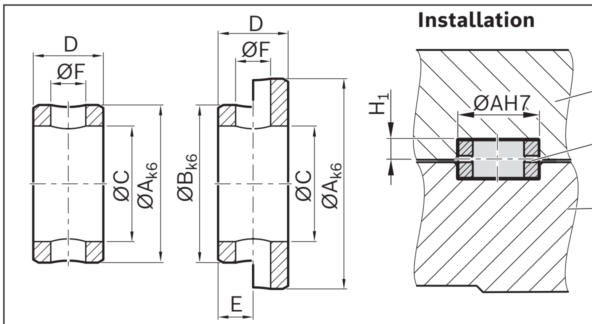


Size	for thread	Dimensions (mm) A	B	C	D	E	F_1	Part number Sliding block	Spring
-070	M4	4	7.8	3.9	0.4	10	–	R0375 210 20	–
	M4					19	10	R0375 210 21	–
-090 / -110	M4	6	11.5	4.0	1.0	12	–	R3447 014 01	R3412 010 02
	M5					45	30	R0391 710 09	–
	M5					12	–	R3447 015 01	R3412 010 02
-145	M4	8	16.0	6.0	2.0	16	–	R3447 017 01	R3412 011 02
	M5					16	–	R3447 018 01	R3412 011 02
	M6					16	–	R3447 019 01	R3412 011 02
	M6					50	36	R0391 710 08	–
	M8					16	–	R3447 020 01	R3412 011 02
-200	M4	10	19.5	10.5	5.0	20	–	R3447 012 01	R3412 009 02
	M5					20	–	R3447 011 01	R3412 009 02
	M6					20	–	R3447 010 01	R3412 009 02
	M8					20	–	R3447 009 01	R3412 009 02
	M8					90	70	R0391 710 07	–

Centering rings

The centering ring serves as a positioning aid and for positive locking when mounting customer attachments to the carriage and the frame.
It creates a positive-locking connection with good reproducibility.
Material: Steel



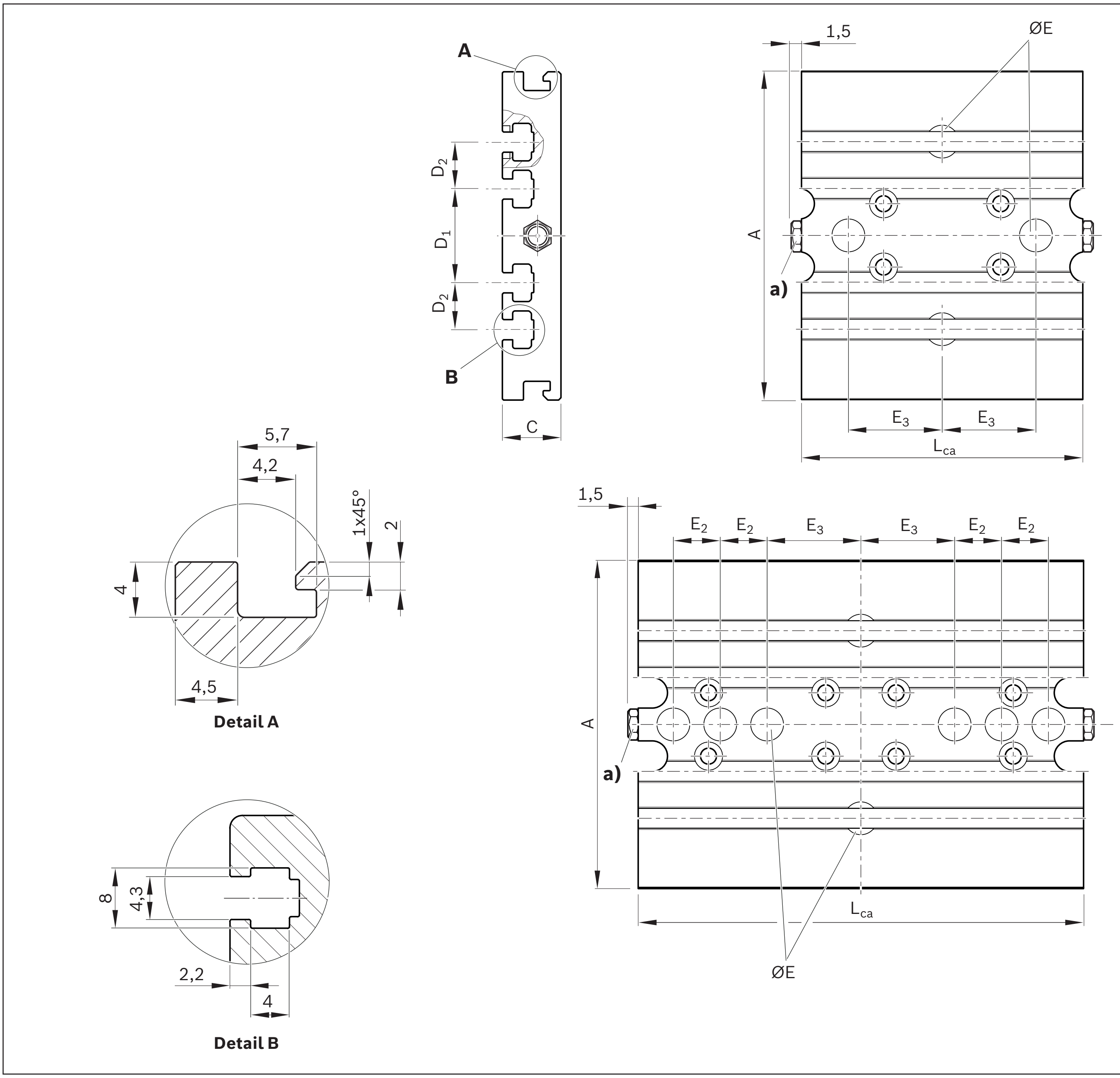


a) Customer attachment
b) Centering ring
c) Carriage

Ø Size (mm)	Dimensions (mm) A	B	C ±0.1	D −0.2	E +0.2	ØF	H_1 +0.2	H_2 +0.2	Part number
5	5	–	3.4	3.0	–	1.6	1.6	–	R0396 605 42
7	7	–	5.5	3.0	–	1.6	1.6	–	R0396 605 43
9	9	–	6.6	4.0	–	2.0	2.1	–	R0396 605 44
12	12	–	9.0	4.0	–	2.0	2.1	–	R0396 605 45
16	16	–	11.0	6.0	–	3.0	3.1	–	R0396 605 46
7 - 5	7	5	3.4	3.0	1.5	1.6	1.6	1.6	R0396 605 47
9 - 5	9	5	3.4	3.5	1.5	1.6	2.1	1.6	R0396 605 48
9 - 7	9	7	5.5	3.5	1.5	1.6	2.1	1.6	R0396 605 49
12 - 9	12	9	6.6	4.0	2.0	2.0	2.1	2.1	R0396 605 50
16 - 12	16	12	9.0	5.0	2.0	2.0	2.1	3.1	R0396 605 51

Connection plates

CKK/CKR -070



a) Funnel-type lube nipple DIN 3405-D4; lubrication possible from two sides (central lubrication only necessary with grease press on one of the two sides).

The connection plates differ in appearance in the representation. Shown here is the connection plate for CKR-070.

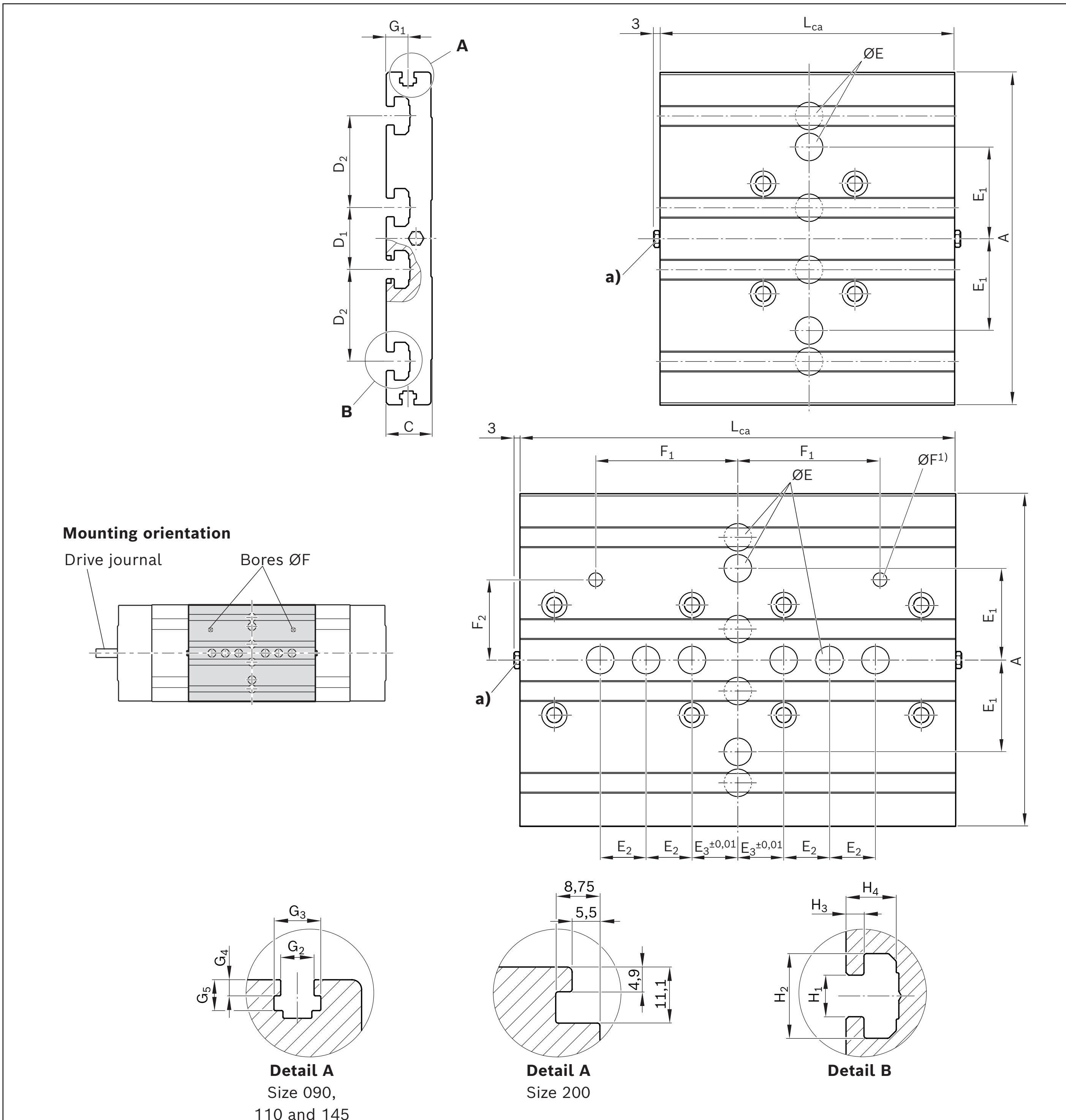
Function:
- Fastening of attachments (with sliding blocks)
- Lubrication option of the Ball Rail System and the Ball Screw Assembly possible via the connection plate
- For lube version LSS, LPG

The unit consists of:
- Connection plate
- Mounting accessories for fastening to the carriages
- Sliding blocks are not included with delivery

CKK/CKR	Dimensions (mm)								
	L_{ca}		A	C	D_1	D_2	$ØE^{H7}$	E_2	E_3
	CKK	CKR						±0,01	±0,01
-070	60	60	70	12.5	20	10	7 - $1,6^{+0.2}$ deep	10	20
	95	95							

CKK/CKR	L_{ca} (mm)	Part number		Weight (kg)
		CKK	CKR	
-070	60	R0375 200 15	R0375 200 16	0.11
	95	R0375 200 10	R0375 200 11	0.17

CKK and CKR -090, -110, -145, -200



[1] For customer attachment

a) Funnel-type lube nipple AM8 x 1 for lube version LSS/LPG; lubrication possible from two sides (central lubrication only necessary with grease press on one of the two sides).
Lube fittings for lube versions LCF/LCO see next page.

The connection plates differ in appearance in the representation. Shown here is the connection plate for CKK-145.

Function:

- Fastening of attachments (with sliding blocks)
- Lubrication option of the Ball Rail System and the Ball Screw Assembly possible via the connection plate
- For lube version LSS, LPG

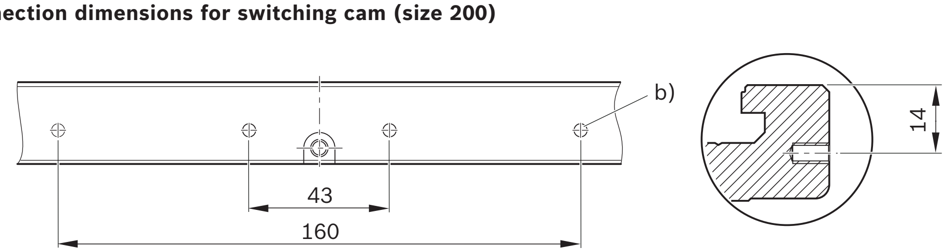
The unit consists of:

- Connection plate
- Mounting accessories for fastening to the carriages
- Sliding blocks are not included with delivery

CKK/ CKR	Dimensions (mm) L_{ca} CKK	L_{ca} CKR	A	C	D_1	D_2	$ØE^{H7}$	E_1 ±0.01	E_2 ±0.01	E_3 ±0.01	$ØF^{H7}$	F_1 ±0.01	F_2 ±0.01	G_1	G_2	G_3	G_4	G_5	H_1	H_2	H_3	H_4
-090		60	90	16	20	20	9 - 2.1 deep	–	–	20	–	–	–	7.9	4.2	7.6	2.0	4.3	6	12.0	3.5	7.7
		125							10		4 - 6 deep	38.0	20	7.6		7.3						
-110	60	110	110	16	20	20	9 - 2.1 deep	–	–		–	–	–	6.0	5.2	9.5	2.5	4.8	6	12.0	3.5	7.7
		155							10		5 - 6.5 deep	46.0	42	9.5		7.3						
-145	80	125	145	20	27	40	12 - 2.1 deep	40	–		–	–	–	10.0	5.2	9.5	2.5	4.8	8	16.5	3.5	9.8
		190							20		6 - 12 deep	62.0	35	9.5		7.3						
-200		190	200	27	40	40	16 - 3.1 deep	–	–		–	–	–	–	–	–	–	–	10	20.1	6.0	12.5
		305							20		8 - 16 deep	59.5	41									

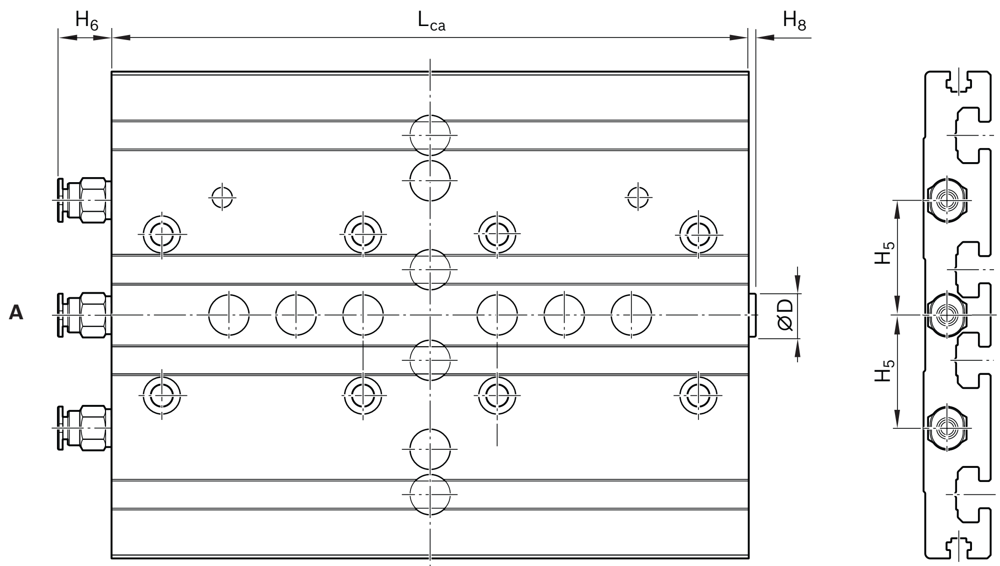
CKK/CKR	L_{ca} (mm) CKK	L_{ca} CKR	Part number CKK	Part number CKR	Weight (kg) CKK	Weight (kg) CKR
-090		60	R0375 300 15	R0375 300 16		0.18
		125	R0375 300 10	R0375 300 11		0.37
-110	60	100	R0375 400 15	R0375 400 16	0.23	0.38
		155	R0375 400 10	R0375 400 11	0.59	0.58
-145	80	125	R0375 500 15	R0375 500 16	0.50	0.81
		190	R0375 500 10	R0375 500 11	1.20	1.15
-200		190	R0375 600 15	R0375 600 16	2.20	2.20
		305	R0375 600 10	R0375 600 11	3.60	3.60

Connection dimensions for switching cam (size 200)

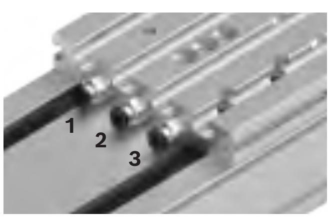


b) M4 - 6 deep

For lube version LCF/LCO

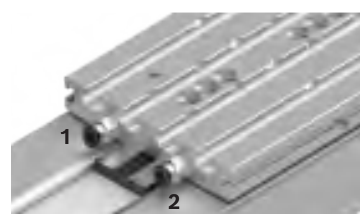


CKK



A Drive side
1 Lube connection, runner block left
2 Lube connection, runner block right
3 Lube connection, Ball Screw Assembly

CKR



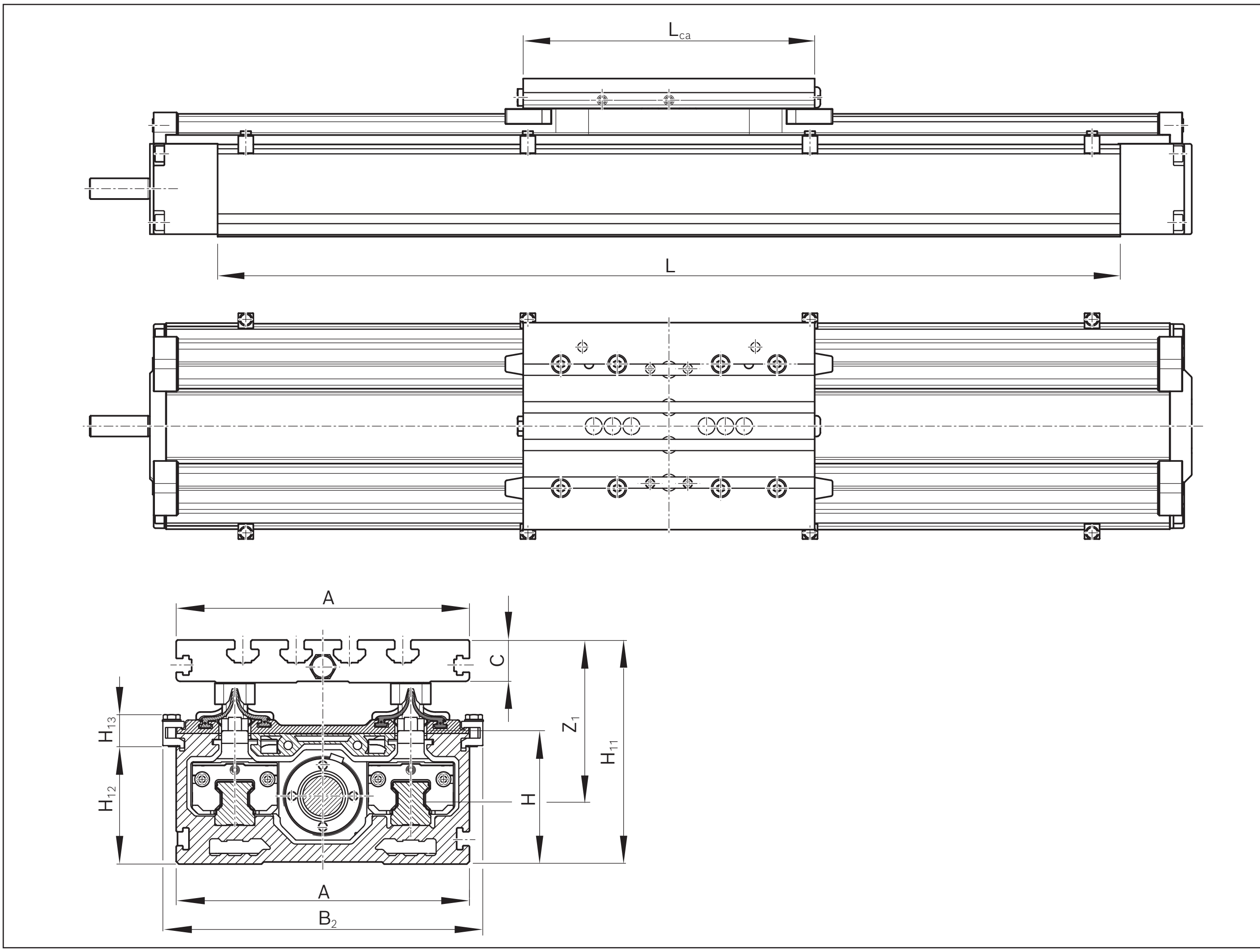
A Drive side
1 Lube connection, runner block left
2 Lube connection, runner block right

CKK/CKR	Dimensions (mm)					
	ØD	H_5		H_6	H_8	L_{ca}
		CKK	CKR			
-070	–	–	–	–	–	–
-090	8.5	19	19	12.5	3	125
-110	8.5	20	40		3	155
-145	–	26	42		–	190
-200	–	31	55		–	305

More dimensions ➠ "Connection plates" chapter.
Lubrication connection: Compact one touch fitting (SW 9), for plastic and metal pipes, with Ø 4 mm

Cover

Resist



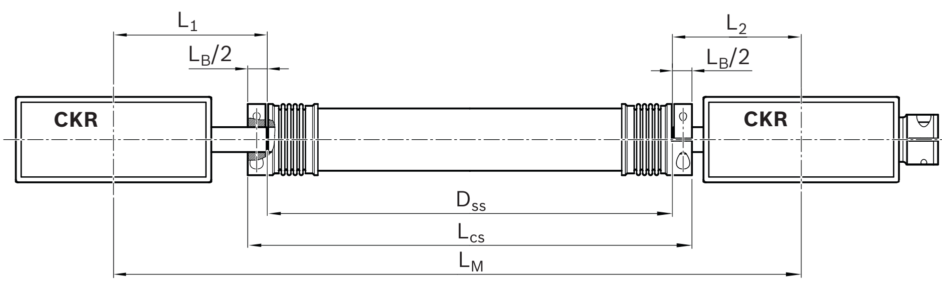
CKK	Dimensions (mm)								
	A	**B_2**	**C**	**H**	**H_{11}**	**H_{12}**	**H_{13}**	**L_{ca}**	**Z_1**
-110	100	120	16	50	84	44	12	155	60.7
-145	145	155	20	65	105	59	12	190	71.6
-200	200	212	27	100	150	82	24	305	86.4

Z_1 = Application point of the effective force

Connecting shafts

Features

- Bridging of large distances between axes
- Can be mounted radially by split clamping hub
- Mounting and removal without shifting the aligned axes
- Backlash-free and torsionally stiff



Schematic figure

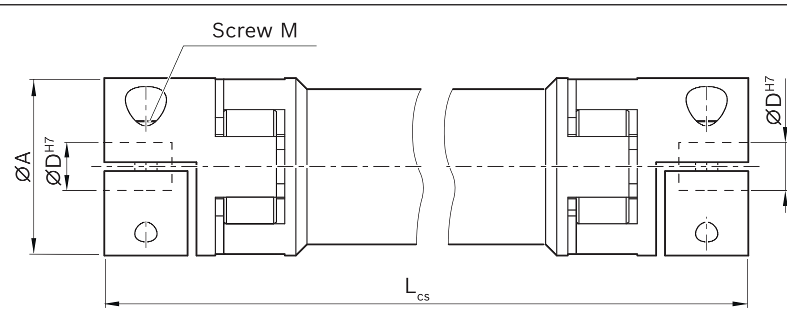
CKR-070

Material

Coupling hub: high-strength aluminum

Elastomer circle: precisely manufactured, extremely wear resistant, and thermally stable plastic

Connecting tube: high-precision aluminum tube

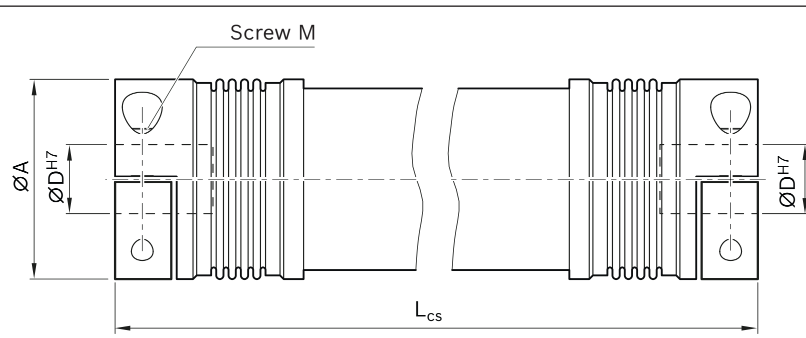


CKR-090, -110, -145, -200

Material

Bellows: highly flexible stainless steel

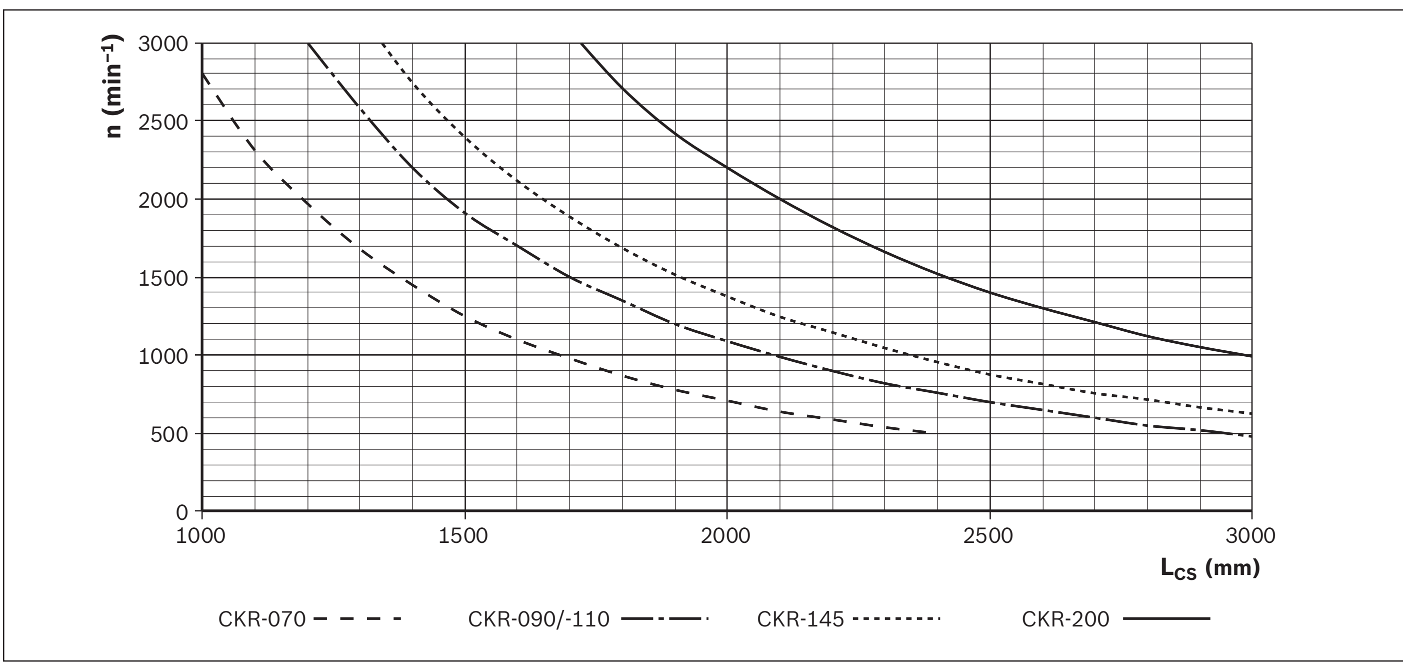
Connecting tube and clamping hub: Aluminum



Size	Part number	Dimensions (mm) A	D	M	L_B	$L_{cs\ min}$	$L_{cs\ max}$	M_A (Nm)
-070	R0391 510 22	30	8	M4	21	95	2,400	4
-090	R0391 510 16	40	10	M4	22	105	3,000	5
-110	R0391 510 20	40	14	M4	22	105	3,000	5
-145	R0391 510 18	55	19	M6	32	150	3,000	15
-200	R0391 510 19	83	24	M10	50	200	3,000	70

Size	M_S (Nm)	M_{cs} (Nm)	Mass moment of inertia (10^{-6} kgm²)	Weight (kg)
-070	25	12.5	0.090 · (L_{cs} (mm) - 80) + 30	0.00054 · (L_{cs} (mm) - 80) + 0.12
-090	17	10.0	0.032 · (L_{cs} (mm) - 80) + 68.2	0.00090 · (L_{cs} (mm) - 80) + 0.21
-110	17	10.0	0.032 · (L_{cs} (mm) - 80) + 68.2	0.00090 · (L_{cs} (mm) - 80) + 0.21
-145	45	30.0	0.670 · (L_{cs} (mm) - 118) + 246	0.00120 · (L_{cs} (mm) - 118) + 0.62
-200	170	170.0	4.500 · (L_{cs} (mm) - 160) + 2,000	0.00320 · (L_{cs} (mm) – 160) + 2.00

Bending-critical speed



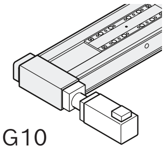
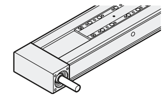
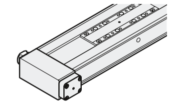
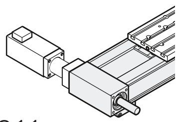
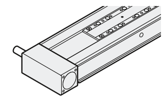
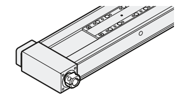
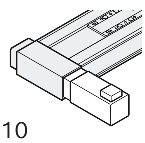
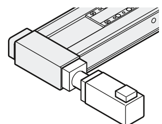
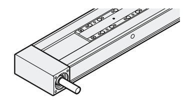
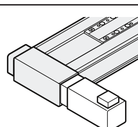
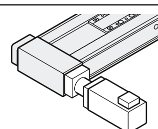
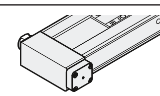
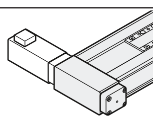
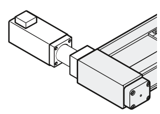
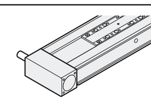
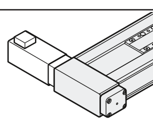
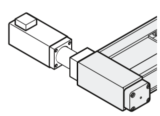
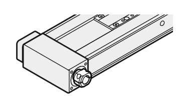
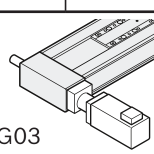
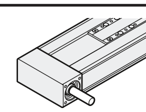
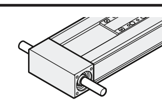
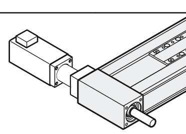
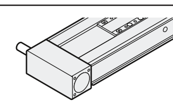
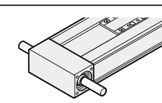
Order

Please state the part number and length L_{cs} .
e.g.: R0391 510 20, L_{cs} = 550 mm

L_{cs} = $D_{SS} + L_B$
D_{SS} = $L_M - L_1 - L_2$
L_1/L_2: For the calculation, refer to the dimensional drawings

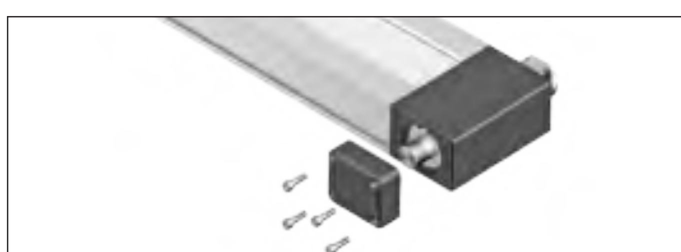
D_{SS} = Distance drive journals
L_{cs} = Overall length of the connecting shaft
L_M = Center-to-center distance between Compact Modules
M_A = Tightening torque of screws
M_{cs} = Rated torque of connecting shaft
M_S = Peak torque of connecting shaft
n = Rpm (min⁻¹)
L_{cs} = Overall length of the connecting shaft (mm)

Combination possibilities for multi-axis systems with connecting shaft

Size	Version				
-070	 MG10		↔	 MA01	 MA06
	 MG11		↔	 MA02	 MA05
-090 -110 -145	 MA10	 MG10	↔	 MA01	
	 MA10	 MG10	↔	 MA06	
	 MA11	 MG11	↔	 MA02	
	 MA11	 MG11	↔	 MA05	
-200	 MG03		↔	 MA01	 MA03
	 MG04		↔	 MA02	 MA03

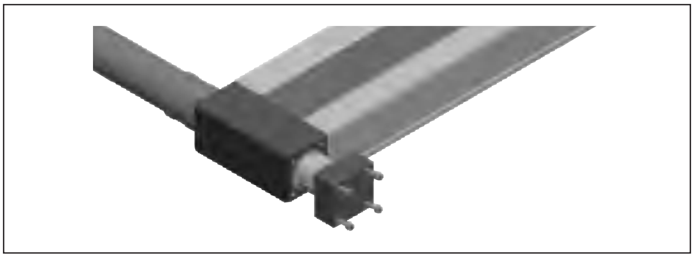
Drive end enclosure with additional drive shaft

In types MA05, MA06, MA10, MA11, MG10, and MG11 a second drive shaft end can be made available by removing the screws and cover.

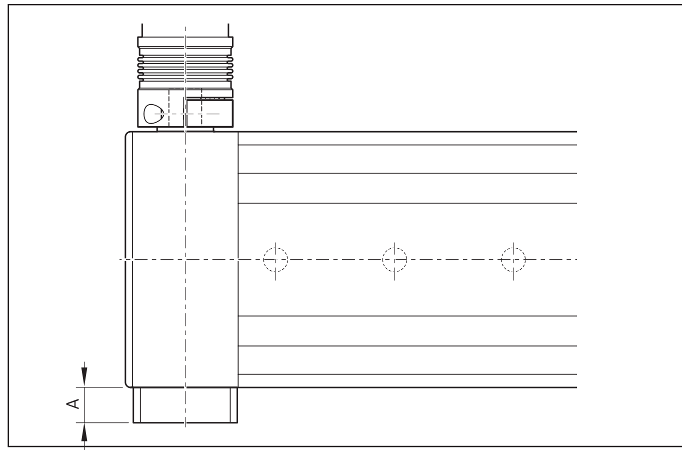


Cover

By attaching the cover, the open end of the drive (clamping hub) is closed.
This means there is no longer any risk of injury from the rotating motor holder.



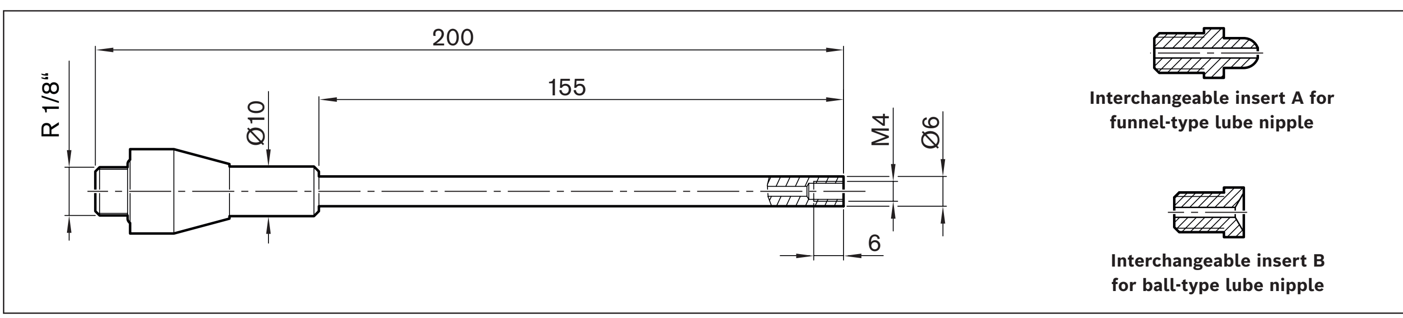
Size	Dimension (mm) A	Part number
-070	20	R0375 200 09
-090	24	R0375 300 09
-110	26	R0375 400 09
-145	31	R0375 500 09



Nozzle pipe

For manual grease guns.
For the lubrication of funnel-type and ball-type lube nipples.

Scope of delivery:
nozzle pipe, interchangeable insert A for funnel-type lube nipple, interchangeable insert B for ball-type lube nipple.



Material number	Weight (g)
R345503106	158

Frequency meter

For checking the toothed belt pre-tension on linear axes with toothed belt drive as well as the setting of the toothed belt pre-tensioning when driven by a belt pulley.

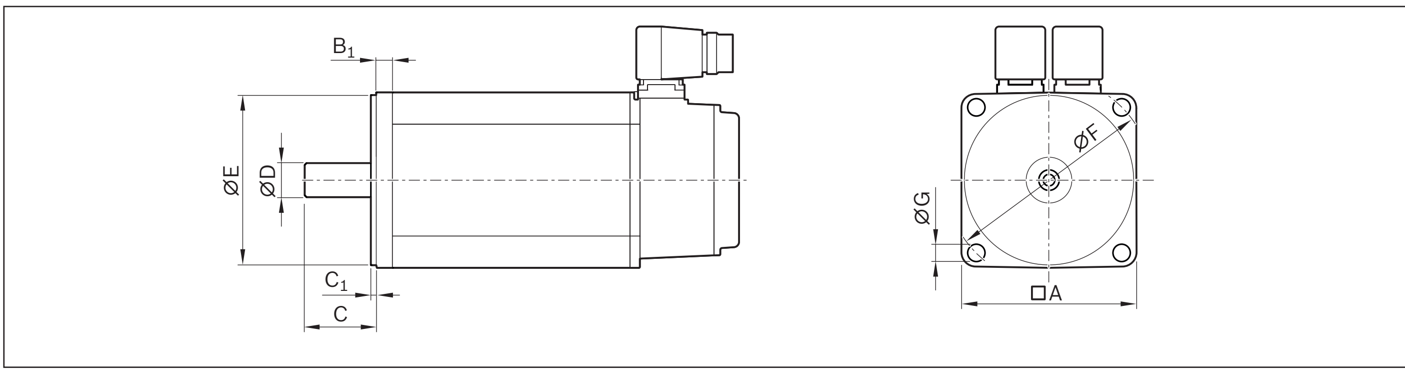
Scope of delivery:
Frequency meter TECO-S MINI, Plug-in measuring head, extension cable, leather belt bag.

Material number
R913057897

Motors

Motor attachment kits according to customer specification

The motor of linear motion systems with Ball Screw Assembly is attached by either an attachment kit with flange and coupling (MF) or a belt side drive (RV).
The available combinations are shown in the "Configuration and ordering" selection tables for each size. In addition to motor attachment kits for Rexroth motors, attachment kits for motors according to customer specification can also be ordered. In order to determine the appropriate attachment kit, the connection geometry of the motor is crucial. Characteristics required to clearly determine motor geometry are shown below.

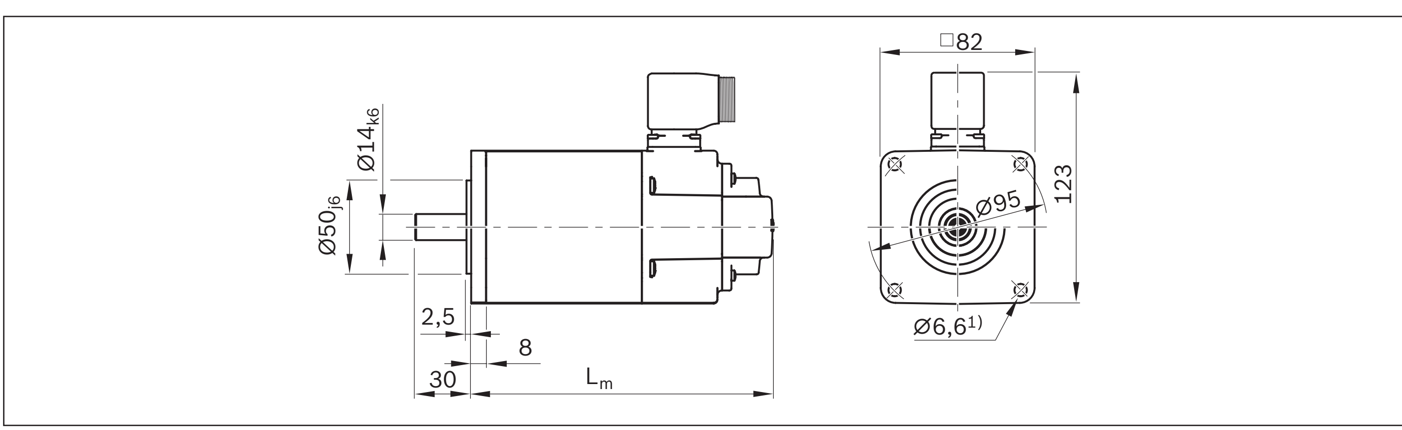


The dimensions queried result in a unique "motor geometry code":

☐☐ – ☐☐ – ☐☐☐ – ☐☐☐ – ☐☐☐ – M☐☐ – ☐☐☐ – ☐☐☐

ØD	=	Shaft diameter
C	=	Shaft length
ØE	=	Centering diameter
C_1	=	Centering depth
ØF	=	Pitch diameter
ØG	=	Through-hole for mounting screw (specify thread diameter)
B_1	=	Flange thickness
A	=	Flange edge dimension

Example illustration of servo motor IndraDyn S Type MS2N04



1 4 – 3 0 – 0 5 0 – 2 . 5 – 0 9 5 – M 0 6 – 0 0 8 – 0 8 2

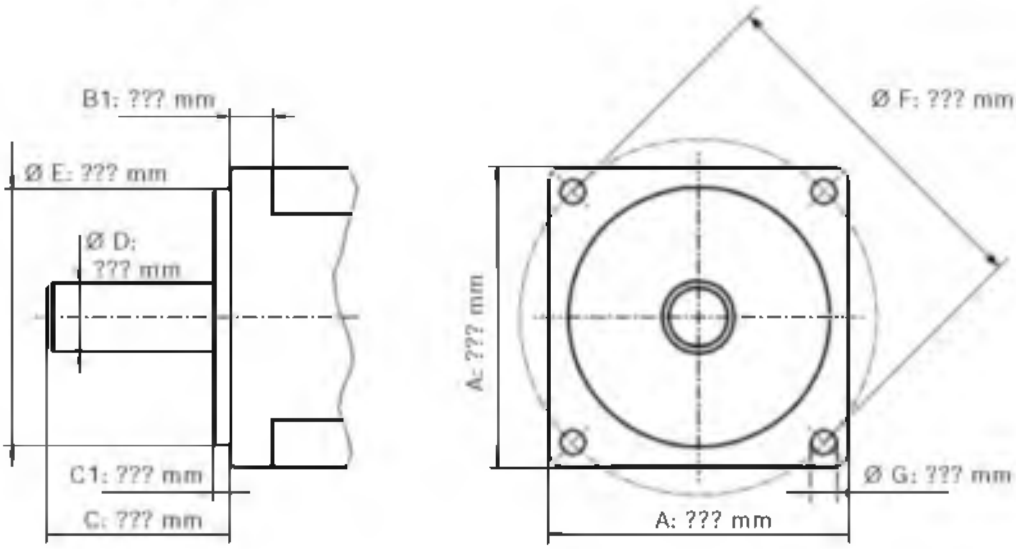
1) The drill hole Ø 6.6 mm results in the type designation M06 for the geometry motor code (nominal thread diameter mounting screw M6).

Motor attachment kits for motors according to customer specification can be selected using the online configurator in the eShop. To do this, select the "mechanical interface" and "motors according to customer specification" option.

Dimensions customer motor

Motor manufacturer

Motor type

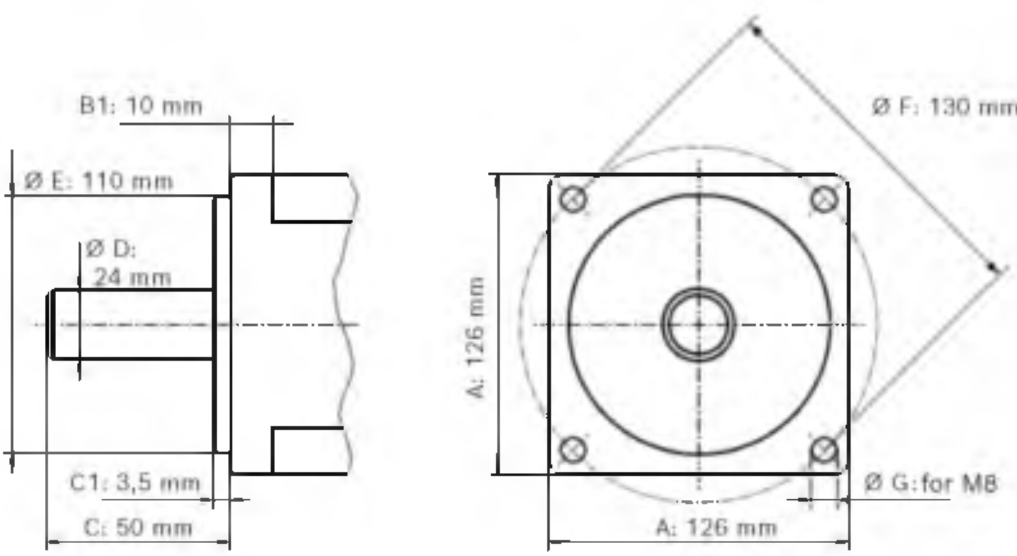


Example

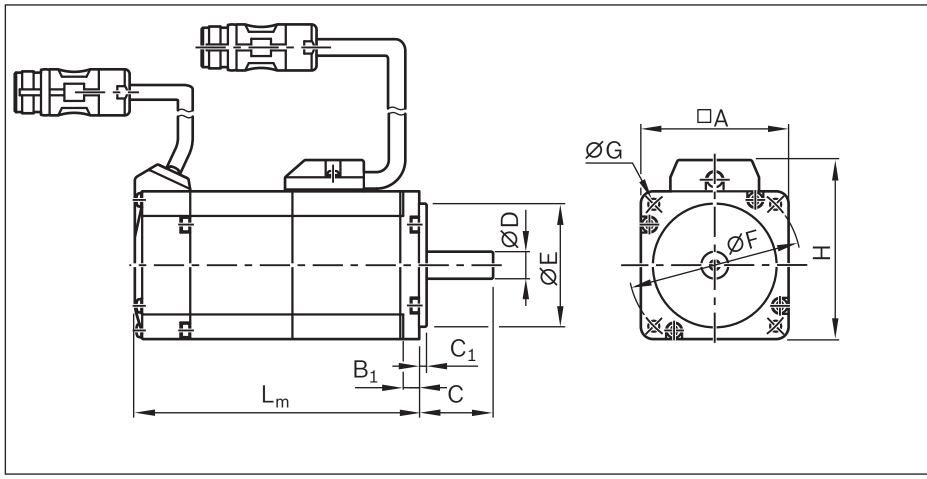
Dimensions customer motor

Motor manufacturer: Siemens

Motor type: 1FK706



IndraDyn S - MSM servo motors



Motor schematic

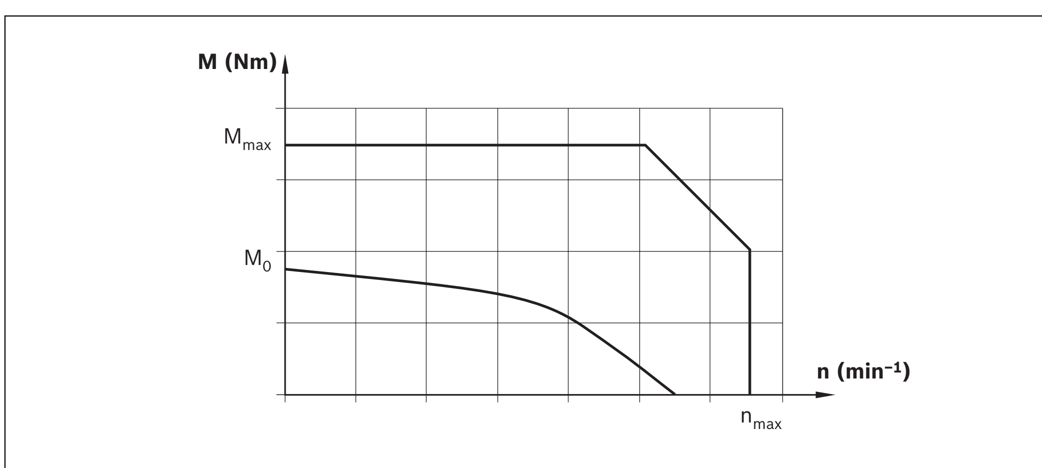
Motor code	Dimensions (mm) A	B_1	C	C_1	Ø D_{k6}	Ø E_{j7}	Ø F	Ø G	L_m Brake without	L_m Brake with
MSM 019A-0300	38	6.0	25	3	8	30	45	3.4	72.0	102.0
MSM 019B-0300	38	6.0	25	3	8	30	45	3.4	92.0	122.0
MSM 031B-0300	60	6.5	30	3	11	50	70	4.5	79.0	115.5
MSM 031C-0300	60	6.5	30	3	14	50	70	4.5	98.5	135.0
MSM 041B-0300	80	8,0	35	3	19	70	90	6.0	112.0	149.0

Version:
- Plain shaft without shaft seal
- M5 multi-turn absolute encoder (20-bit, absolute encoder function only available with backup battery)
- Cooling system: natural convection
- IP54 rating (shaft: IP40)
- With or without holding brake
- M17 metal round connector

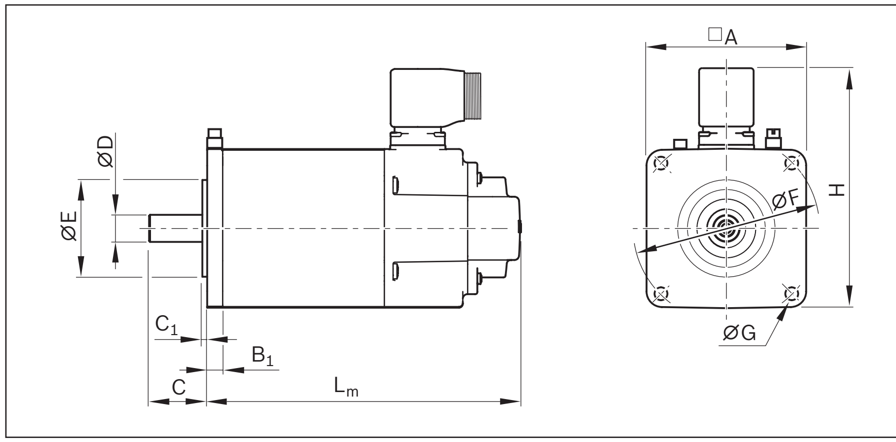
Note
Motors are available with control units and controllers. For more information on motors, controllers and control systems, please refer to the following Rexroth catalogs:
- Drive System Rexroth IndraDrive R999000018
- Automation systems and control components, R999000026

Motor data										Type code	Part number
n_{max} (min⁻¹)	M_0 (Nm)	M_{max} (Nm)	M_{br} (Nm)	J_m (kgm²)	J_{br} (kgm²)	m_m (kg)	m_{br} (kg)	Motor connection	Brake		
5,000	0.16	0.48	0.29	0.0000025	0.0000002	0.32	0.21	2	N	MSM 019A-0300-NN-M5-MH0	R911344209
									Y	MSM 019A-0300-NN-M5-MH1	R911344210
5,000	0.32	0.95	0.29	0.0000051	0.0000002	0.47	0.21	2	N	MSM 019B-0300-NN-M5-MH0	R911344211
									Y	MSM 019B-0300-NN-M5-MH1	R911344212
5,000	0.64	1.91	1.27	0.0000140	0.0000018	0.82	0.48	2	N	MSM 031B-0300-NN-M5-MH0	R911344213
									Y	MSM 031B-0300-NN-M5-MH1	R911344214
5,000	1.30	3.80	1.27	0.0000260	0.0000018	1.20	0.50	2	N	MSM 031C-0300-NN-M5-MH0	R911344215
									Y	MSM 031C-0300-NN-M5-MH1	R911344216
4,500	2.40	7.10	2.45	0.0000870	0.0000075	2.30	0.80	2	N	MSM 041B-0300-NN-M5-MH0	R911344217
									Y	MSM 041B-0300-NN-M5-MH1	R911344218

Motor characteristic
(Schematic)



IndraDyn S - MS2N servo motors



Motor schematic

Dimensions / Motor data

Motor code	Dimensions (mm)										
	A	B_1	C	C_1	Ø D_{k6}	Ø E_{j7}	Ø F	Ø G	H		L_m
									Cable		Brake
									2	1	without	with
MS2N03-B0BYN	58	7.5	20	2.5	9	40	63	4.5	84	99	163	192
MS2N03-D0BYN	58	7.5	23	2.5	11	40	63	4.5	84	99	203	232
MS2N04-B0BTN	82	8	30	2.5	14	50	95	6.6	108	123	162	194.5
MS2N04-C0BTN	82	8	30	2.5	14	50	95	6.6	108	123	194	226.5
MS2N04-D0BQN	82	8	30	2.5	14	50	95	6.6	108	123	226	258.5
MS2N05-B0BTN	98	9	40	3	19	95	115	9	124	139	188	218
MS2N05-C0BTN	98	9	40	3	19	95	115	9	124	139	224	254
MS2N05-D0BRN	98	9	40	3	19	95	115	9	124	139	260	290

Version

- Plain shaft without shaft seal ring
- Multi-turn encoder
- Standard encoder (B) in conjunction with 2-cable connector (HIPERFACE interface)
- Advanced encoder (B) in conjunction with 1-cable connector (AcuroLink interface)
- IP64 rating
- With or without holding brake
- Special ground connection terminal near motor flange (used as needed)

Motor data								Motor connection	Brake	Type code	Part number
n_{max} (min^{-1})	M_0 (Nm)	M_{max} (Nm)	M_{br} (Nm)	J_m (kgm^2)	J_{br} (kgm^2)	m_m (kg)	m_{br} (kg)				
9,000	0.73	3.46	1.8	0.000023	0.000007	1.4	0.4	2	N	MS2N03-B0BYN-BMDH0-NNNNE-NN	R911384765
								2	Y	MS2N03-B0BYN-BMDH1-NNNNE-NN	R911384766
								1	N	MS2N03-B0BYN-CMSH0-NNNNE-NN	R911384767
								1	Y	MS2N03-B0BYN-CMSH1-NNNNE-NN	R911384769
9,000	1.15	6.8	1.8	0.000037	0.000007	2.0	0.4	2	N	MS2N03-D0BYN-BMDH0-NNNNE-NN	R911384770
								2	Y	MS2N03-D0BYN-BMDH1-NNNNE-NN	R911384771
								1	N	MS2N03-D0BYN-CMSH0-NNNNE-NN	R911384772
								1	Y	MS2N03-D0BYN-CMSH1-NNNNE-NN	R911384773
6,000	1.75	5.9	5.0	0.000070	0.000040	2.7	0.7	2	N	MS2N04-B0BTN-BMDH0-NNNNE-NN	R911384525
								2	Y	MS2N04-B0BTN-BMDH1-NNNNE-NN	R911384526
								1	N	MS2N04-B0BTN-CMSH0-NNNNE-NN	R911384527
								1	Y	MS2N04-B0BTN-CMSH1-NNNNE-NN	R911384528
6,000	2.80	12.0	5.0	0.000110	0.000050	3.7	0.7	2	N	MS2N04-C0BTN-BMDH0-NNNNE-NN	R911384529
								2	Y	MS2N04-C0BTN-BMDH1-NNNNE-NN	R911384530
								1	N	MS2N04-C0BTN-CMSH0-NNNNE-NN	R911384531
								1	Y	MS2N04-C0BTN-CMSH1-NNNNE-NN	R911384532
6,000	3.85	18.1	5.0	0.000160	0.000040	4.7	0.7	2	N	MS2N04-D0BQN-BMDH0-NNNNE-NN	R911384533
								2	Y	MS2N04-D0BQN-BMDH1-NNNNE-NN	R911384534
								1	N	MS2N04-D0BQN-CMSH0-NNNNE-NN	R911384535
								1	Y	MS2N04-D0BQN-CMSH1-NNNNE-NN	R911384536
6,000	3.75	10.6	10.0	0.000170	0.000110	4.0	1.1	2	N	MS2N05-B0BTN-BMDH0-NNNNE-NN	R911384539
								2	Y	MS2N05-B0BTN-BMDH1-NNNNE-NN	R911384540
								1	N	MS2N05-B0BTN-CMSH0-NNNNE-NN	R911384542
								1	Y	MS2N05-B0BTN-CMSH1-NNNNE-NN	R911384543
6,000	6.10	20.8	10.0	0.000290	0.000110	5.9	1.1	2	N	MS2N05-C0BTN-BMDH0-NNNNE-NN	R911384544
								2	Y	MS2N05-C0BTN-BMDH1-NNNNE-NN	R911384545
								1	N	MS2N05-C0BTN-CMSH0-NNNNE-NN	R911384546
								1	Y	MS2N05-C0BTN-CMSH1-NNNNE-NN	R911384547
6,000	7.90	31.3	10.0	0.000400	0.000110	7.3	1.1	2	N	MS2N05-D0BRN-BMDH0-NNNNE-NN	R911384548
								2	Y	MS2N05-D0BRN-BMDH1-NNNNE-NN	R911384549
								1	N	MS2N05-D0BRN-CMSH0-NNNNE-NN	R911384550
								1	Y	MS2N05-D0BRN-CMSH1-NNNNE-NN	R911384551

Dimensions / Motor data

Motor code	Dimensions (mm)											
	A	B_1	C	C_1	Ø D_{k6}	Ø E_{j7}	Ø F	Ø G	H		L_m	
									Cable		Brake	
									2	1	without	with
MS2N06-B1BNN	116	14	50	3	24	95	130	9	156	156	164	201
MS2N06-C0BTN	116	14	50	3	24	95	130	9	156	156	184	202
MS2N06-D0BRN	116	14	50	3	24	95	130	9	156	156	224	261
MS2N06-D1BNN	116	14	50	3	24	95	130	9	156	156	224	261
MS2N06-E0BRN	116	14	50	3	24	95	130	9	156	156	264	301
MS2N07-B1BNN	140	18	58	4	32	130	165	11	180	180	176	230
MS2N07-C0BQN	140	18	58	4	32	130	165	11	180	180	205	259
MS2N07-C1BRN	140	18	58	4	32	130	165	11	180	180	205	259
MS2N07-D0BRN	140	18	58	4	32	130	165	11	180	180	263	317
MS2N07-D1BNN	140	18	58	4	32	130	165	11	180	180	263	317
MS2N07-E1BNN	140	18	58	4	32	130	165	11	180	180	321	375

Motor data n_{max} (min⁻¹)	M_0 (Nm)	M_{max} (Nm)	M_{br} (Nm)	J_m (kgm²)	J_{br} (kgm²)	m_m (kg)	m_{br} (kg)	Motor connection	Brake	Type code	Part number
6,000	3.25	9.5	10.0	0.000480	0.0001100	5.1	1.1	2	N	MS2N06-B1BNN-BMUH0-NNNNE-NN	R911384927
								2	Y	MS2N06-B1BNN-BMUH1-NNNNE-NN	R911384928
								1	N	MS2N06-B1BNN-CMSH0-NNNNE-NN	R911384929
								1	Y	MS2N06-B1BNN-CMSH1-NNNNE-NN	R911384930
6,000	6.00	16.0	10.0	0.000390	0.0001100	6.4	1.0	2	N	MS2N06-C0BTN-BMUH0-NNNNE-NN	R911384931
								2	Y	MS2N06-C0BTN-BMUH1-NNNNE-NN	R911384932
								1	N	MS2N06-C0BTN-CMSH0-NNNNE-NN	R911384933
								1	Y	MS2N06-C0BTN-CMSH1-NNNNE-NN	R911384934
6,000	9.70	32.0	15.0	0.000650	0.0001400	9.0	1.5	2	N	MS2N06-D0BRN-BMUH0-NNNNE-NN	R911384935
								2	Y	MS2N06-D0BRN-BMUH2-NNNNE-NN	R911384936
								1	N	MS2N06-D0BRN-CMSH0-NNNNE-NN	R911384937
								1	Y	MS2N06-D0BRN-CMSH2-NNNNE-NN	R911384938
6,000	9.00	38.4	15.0	0.001400	0.0001400	9.0	1.5	2	N	MS2N06-D1BNN-BMUH0-NNNNE-NN	R911384939
								2	Y	MS2N06-D1BNN-BMUH2-NNNNE-NN	R911384940
								1	N	MS2N06-D1BNN-CMSH0-NNNNE-NN	R911384941
								1	Y	MS2N06-D1BNN-CMSH2-NNNNE-NN	R911384942
6,000	13.0	49.0	15.0	0.000890	0.0001400	11.5	1.5	2	N	MS2N06-E0BRN-BMUH0-NNNNE-NN	R911384943
								2	Y	MS2N06-E0BRN-BMUH2-NNNNE-NN	R911384944
								1	N	MS2N06-E0BRN-CMSH0-NNNNE-NN	R911384945
								1	Y	MS2N06-E0BRN-CMSH2-NNNNE-NN	R911384946
6,000	7.40	21.0	20.0	0.001970	0.0002600	9.5	2.0	2	N	MS2N07-B1BNN-BMUH0-NNNNE-NN	R911384949
								2	Y	MS2N07-B1BNN-BMUH1-NNNNE-NN	R911384950
								1	N	MS2N07-B1BNN-CMSH0-NNNNE-NN	R911384951
								1	Y	MS2N07-B1BNN-CMSH1-NNNNE-NN	R911384952
6,000	12.8	35.7	20.0	0.001200	0.0002600	12.0	2.0	2	N	MS2N07-C0BQN-BMUH0-NNNNE-NN	R911384953
								2	Y	MS2N07-C0BQN-BMUH1-NNNNE-NN	R911384954
								1	N	MS2N07-C0BQN-CMSH0-NNNNE-NN	R911384955
								1	Y	MS2N07-C0BQN-CMSH1-NNNNE-NN	R911384956
6,000	11.50	42.2	20.0	0.003050	0.0002600	12.0	2.0	2	N	MS2N07-C1BRN-BMUH0-NNNNE-NN	R911384957
								2	Y	MS2N07-C1BRN-BMUH1-NNNNE-NN	R911384958
								1	N	MS2N07-C1BRN-CMSH0-NNNNE-NN	R911384959
								1	Y	MS2N07-C1BRN-CMSH1-NNNNE-NN	R911384960
6,000	22.0	73.2	36.0	0.002100	0.0004100	17.5	2.5	2	N	MS2N07-D0BRN-BMVH0-NNNNE-NN	R911384961
								2	Y	MS2N07-D0BRN-BMVH2-NNNNE-NN	R911384962
6,000	18.90	84.8	36.0	0.005290	0.0004100	17.5	2.5	2	N	MS2N07-D1BNN-BMUH0-NNNNE-NN	R911384963
								2	Y	MS2N07-D1BNN-BMUH2-NNNNE-NN	R911384964
								1	N	MS2N07-D1BNN-CMSH0-NNNNE-NN	R911384965
								1	Y	MS2N07-D1BNN-CMSH2-NNNNE-NN	R911384966
6,000	25.8	128.5	36.0	0.007520	0.0000410	23.0	3.0	2	N	MS2N07-E1BNN-BMVH0-NNNNE-NN	R911384969
								2	Y	MS2N07-E1BNN-BMVH2-NNNNE-NN	R911384970

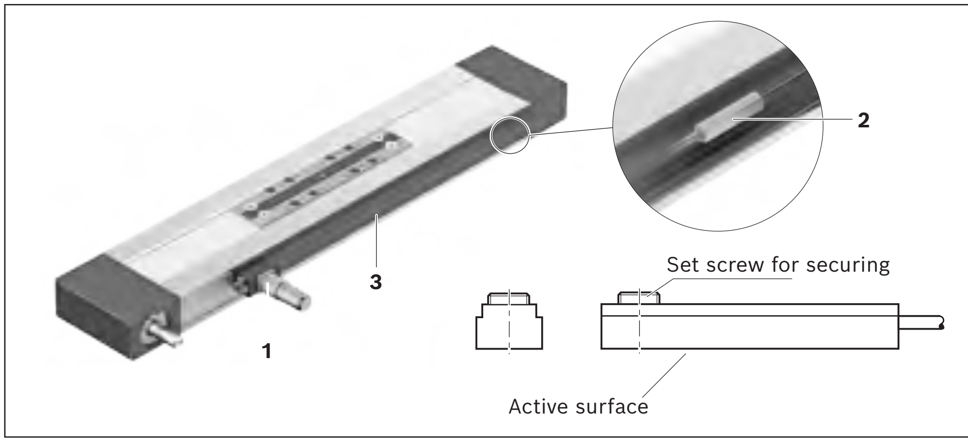
Switching system

Overview of attachment variants

Magnetic sensor with free cable end

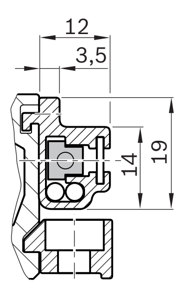
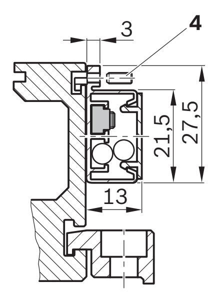
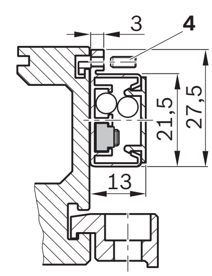
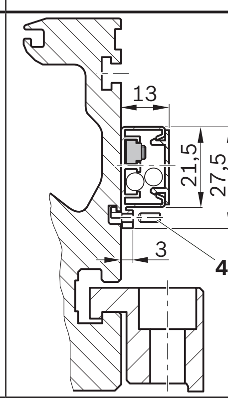
1 Socket and plug
2 Sensor
3 Mounting channel

Alternatively, the sensor can also be attached by switch mounting plate and cable holder.
See the magnetic sensor with plug.



Attachment/actuation

A mounting duct is needed to fasten the sensors and cable guides. This is suspended at the side in a slot at the Compact Modules and secured with set screws (**4**).
The set screws are included.
The sensors are pushed into the upper T-slot (CKK/CKR-090,-110 and CKK-145) or into the lower T-slot (CKR-145, CKK/CKR-200) of the mounting duct and secured with set screws.
Switch activation is done by magnets in the carriage.

CKK/CKR-070	CKK/CKR-090 CKK/CKR-110 CKK-145	CKR-145	CKK/CKR-200
			

Mounting channel		
Compact Modules	**Part number**	**Length calculation**
CKK/CKR: 070	R039662026	$L_K = L - 5$
CKK: 090, 110, 145, 200	R039662018	$L_K = L - 5$
CKR: 090, 110, 145, 200	R039662018	$L_K = L - 10$

L_K = Length of the fastening duct (mm)
L = Length of the linear motion system (mm)

Socket - plug

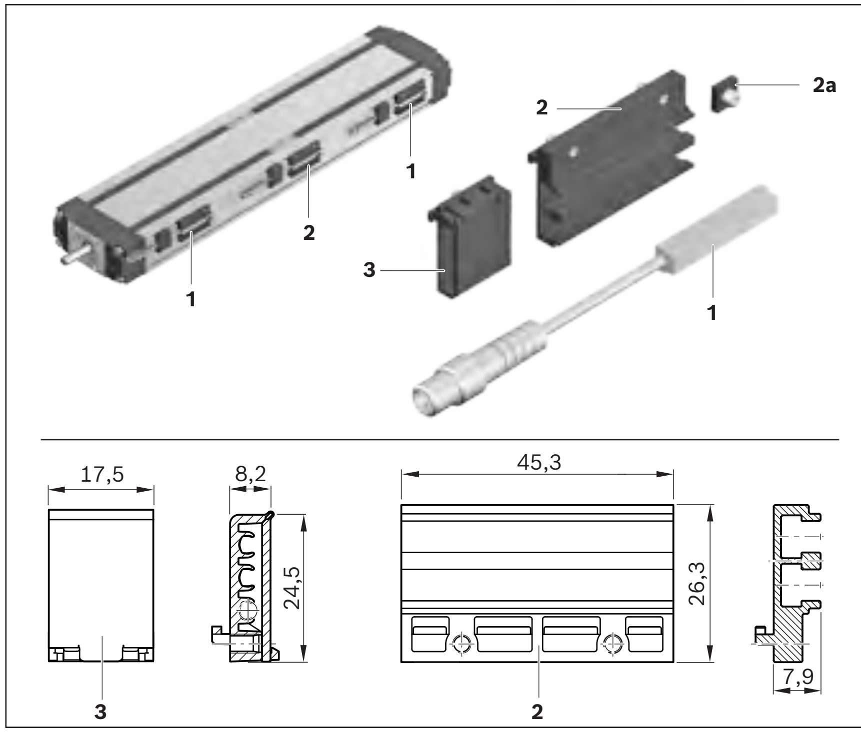
Notes:
The socket and plug are not pre-wired.
This allows optimal assignment of switching positions during start-up.
One plug is included.
The plug can be mounted in three directions.
For further information, see the section "Socket - plug".

Socket-plug	
Compact Modules	**Part number**
CKK/CKR: 070	R117560102
CKK/CKR: 090, 110, 145	R037540000

Socket-plug	
Compact Modules	**Part number**
CKK/CKR: 200	R037540000

Magnetic sensor with plug

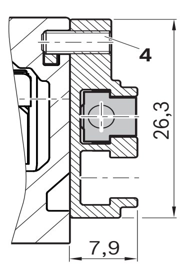
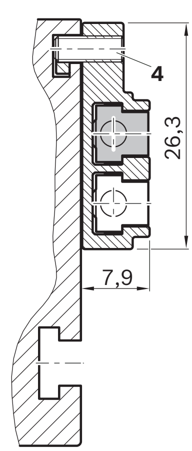
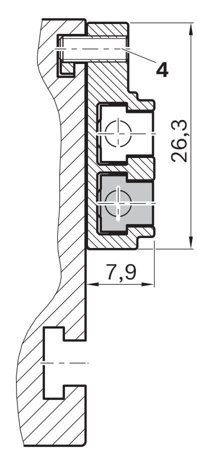
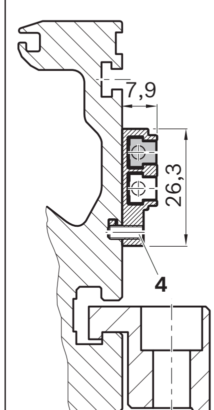
1. **1** Sensor
2. **2** Switch mounting plate including set screws (loose) and square nut (**2a**)
3. **3** Cable holder including set screw (loose)



Attachment/actuation

A switch mounting plate (**2**) is required to attach the sensors. This is suspended in the slot on the Compact Modules and secured with set screws (**4**).
The sensors are pushed into the respective slot on the switch mounting plate and secured with one set screw.
The square nut with set screw (**2a**) serves as a positive stop for the sensor (switching position when changing sensors).
Parts are included with the sensor mounting kit.

Switch activation is done by magnets in the carriage.

CKK/CKR-070	CKK/CKR-090 CKK/CKR-110 CKK-145	CKR-145	CKK/CKR-200
			

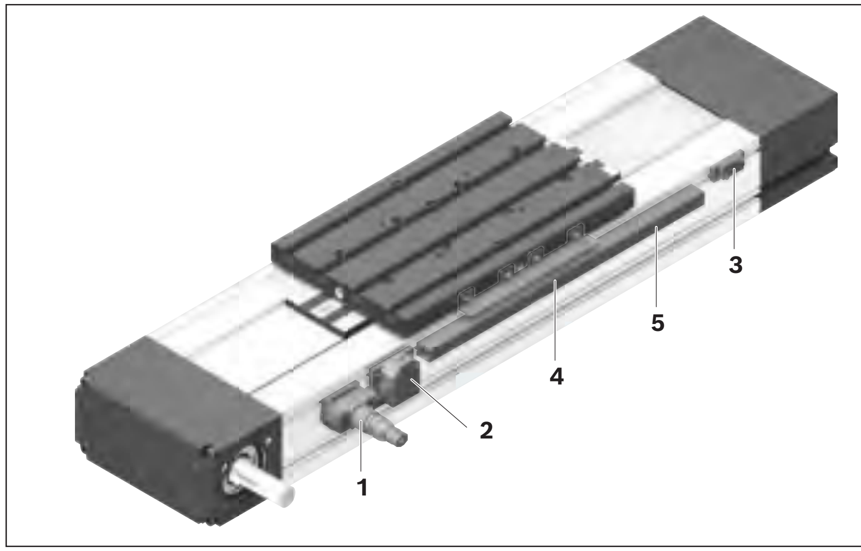
Switches and attachments

Item		Part number
1	**Magnetic sensor with plug**	See the chapter on sensors and accessories
2	**Switch mounting plate**	R037530021
3	**Cable holder**	R037530022

Inductive sensors and mechanical switches for CKK/CKR-200

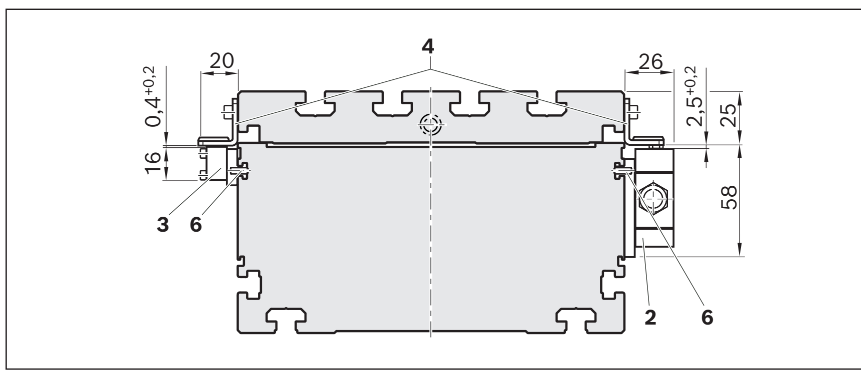
1 Socket and plug
2 Mechanical switch
(with additional components)
3 Inductive sensor
(with additional components)
4 Switching cam
(attachment only at the connection plate)
5 Cable duct

Alternatively, the connection line of the sensor can also be attached by cable holder. See "Switching system".

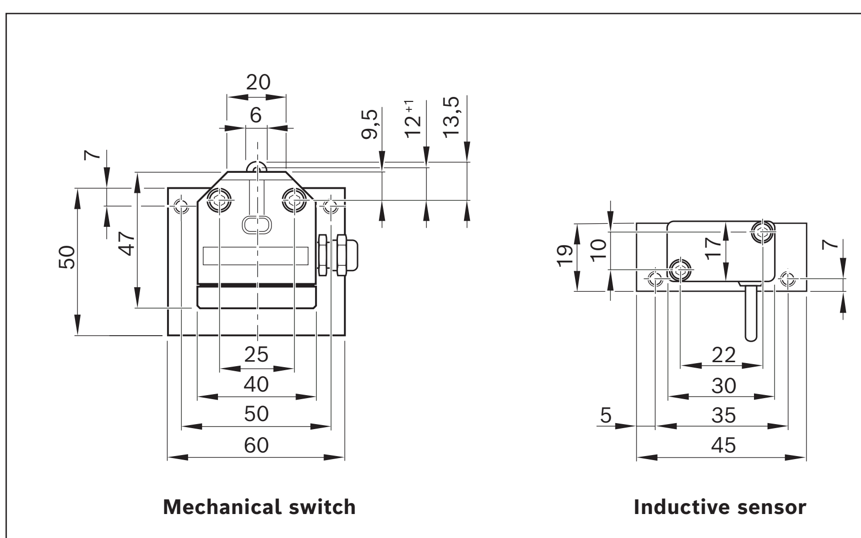


Attachment/actuation
The switches are suspended in the upper slot on the Compact Modules and secured with set screws (**6**).

The actuation is done using switching cams (**4**). This is attached with the screws to the connection plate.
Fastening screws are included.

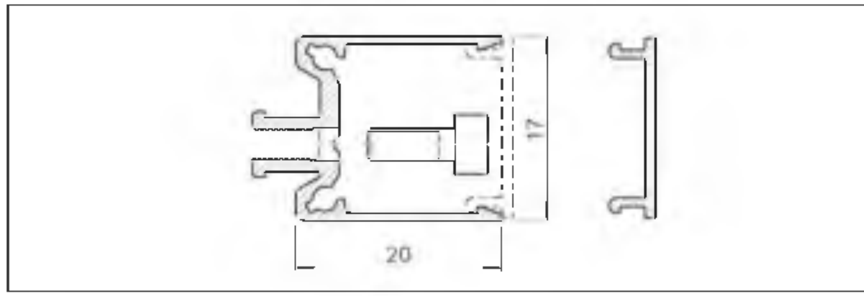


Switch with additional component



Cable duct

The attachment is done in the lateral slots of the frame. Fastening screws widen the profile and ensure that the cable duct is securely mounted.
The cable duct will accommodate up to two cables for mechanical switches and three cables for proximity switches.
Fastening screws are included.

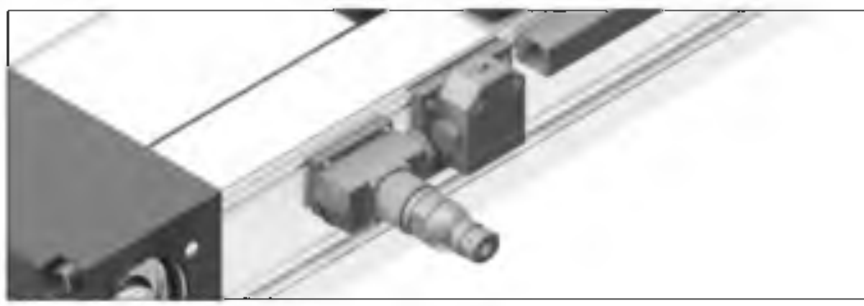


Cable duct	
Compact Modules	**Length calculation**
CKK 200	$L_K = L - 5$
CKR 200	$L_K = L - 10$

L_K = Length of the fastening and the cable duct (mm)
L = Length of the linear motion system (mm)

Socket - plug

Notes:
The socket and plug are not pre-wired.
This allows optimal assignment of switching positions during start-up.
One plug is included.
The plug can be mounted in three directions.



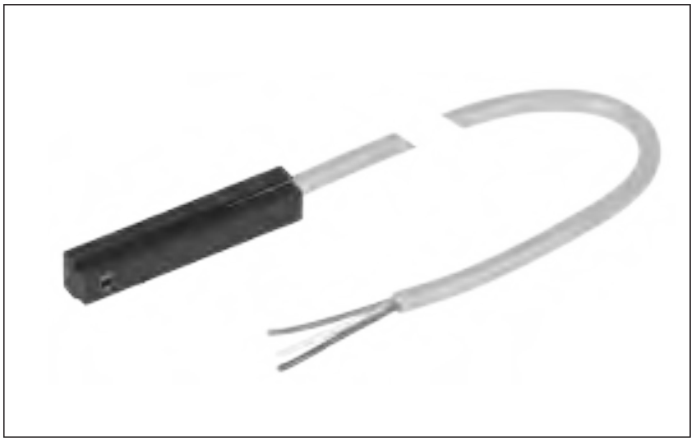
Switches and attachments

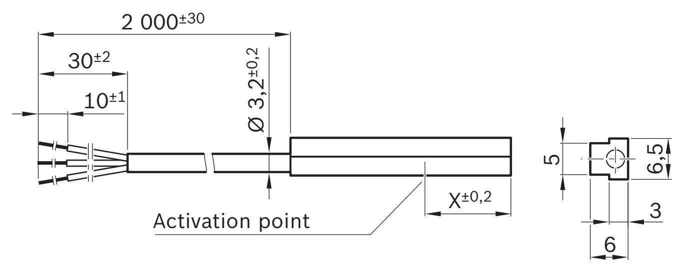
Item		Part numbers
1	**Socket-plug**	R117500153
2	**Mechanical switch**	See the chapter on sensors and accessories
	– Attachment parts without switch	R117500165
3	**Inductive sensor**	See the chapter on sensors and accessories
	– Attachment parts without sensor	R117500152
4	**Switching angle**[1]	R117500150
5	**Cable duct L_K = XX mm**	R039662017

[1] Size 200 switching angle attachment is only possible on connection plate – otherwise customer-designed solution.

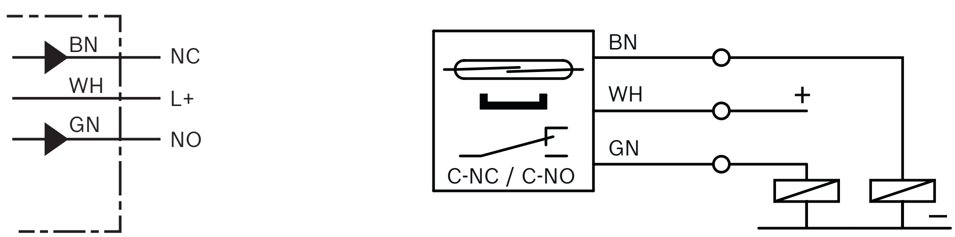
Sensors

Magnetic sensor with free cable end

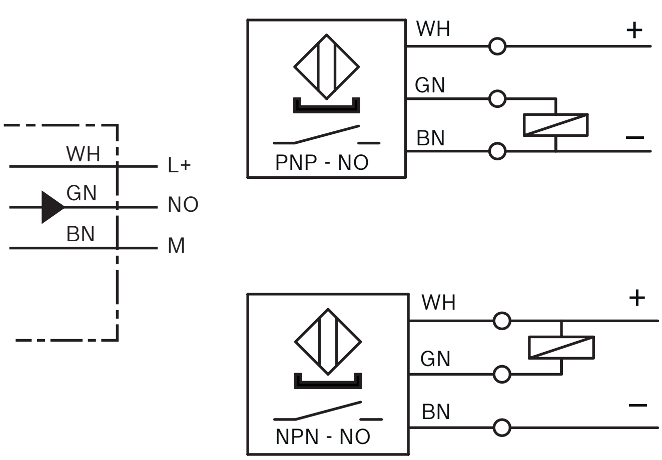




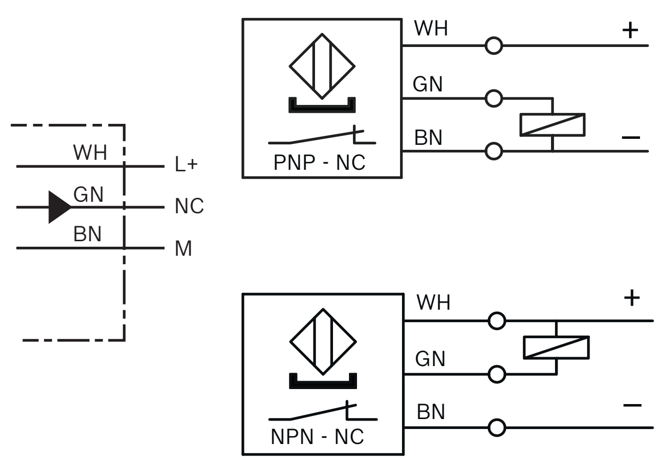
R347600903



R347601203
R347601403



R347601003
R347601303



Part number R347600903

Use	Reference, limit switch
Part number	R347600903
Designation	R12212
Functional principle	magnetic
Operating voltage	max. 30 V DC
Load current	500 mA
Switching function	REED/changeover contact: (NC: C+NC, NO: C+NO)
Activation point (dimension "X")	9 mm

Part number R347601003 / R347601203 / R347601403 / R347601303

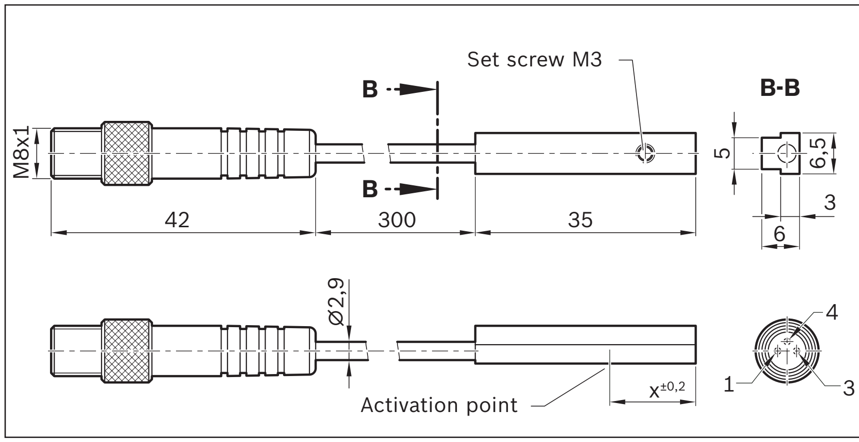
Use	Limit switch	Reference switch	Limit switch	Reference switch
Part number	R347601003	R347601203	R347601303	R347601403
Designation	H14118	H15637	H15638	H15080
Functional principle	magnetic			
Operating voltage	3.8 - 30 V DC			
Load current	≤ 20 mA			
Switching function	Hall PNP/NC	Hall PNP/NO	Hall NPN/NC	Hall NPN/NO
Activation point dimension "X"	13.65 mm			

Technical data for R347600903 / R347601003 / R347601203 / R347601403 / R347601303

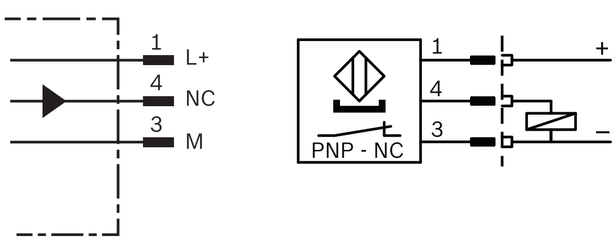
Connection type	Cable 2.0 m, 3-pin
Galvanized connection ends	4
Function indicator	–
Short-circuit protection	–
Reverse polarity protection	–
Switch-on suppression	–
Switching frequency	2.5 kHz
Pulse elongation (off delay)	–
Max. permissible starting speed	2 m/s
Suitable for drag chains[1)]	–
Torsion-resistant[1)]	–
Welding spark-resistant*	–
Cable cross-section*	3 x 0.14 mm^2
Cable diameter D	3.2 ±0.20 mm
Static bending radius[1)]	–
Dynamic bending radius[1)]	–
Bending cycles[1)]	–
Maximum permissible travel speed[1)]	–
Max. permissible acceleration[1)]	–
Ambient temperature	-40 °C to +85 °C
IP rating	IP66
MTTFd (per EN ISO 13849-1)	–
Certifications and approvals[2)]	–

1) Technical data only for the cast-on connection line at the sensor.
The available extension cables offer even better performance, e.g., when using a power cable chain (see following pages).
2) No certificate is required to introduce these products to the Chinese market.

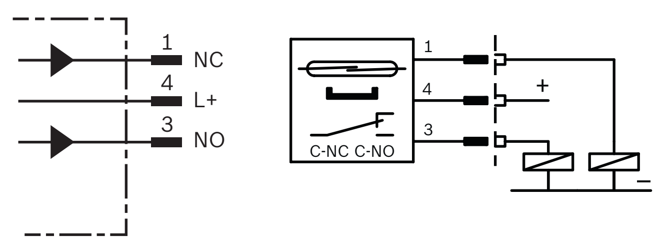
Magnetic sensor with M8x1 plug



R347602403



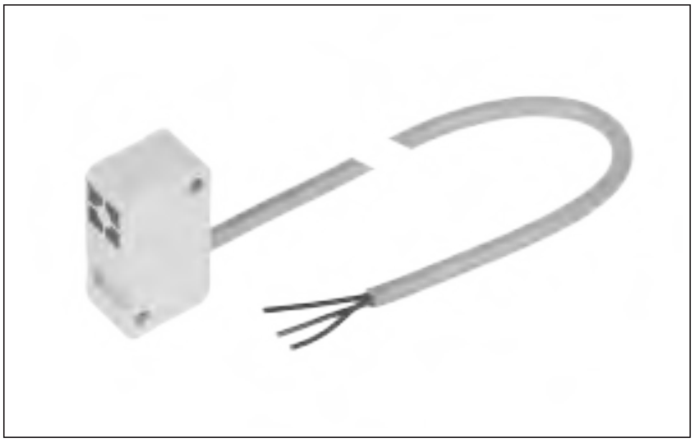
R347602303

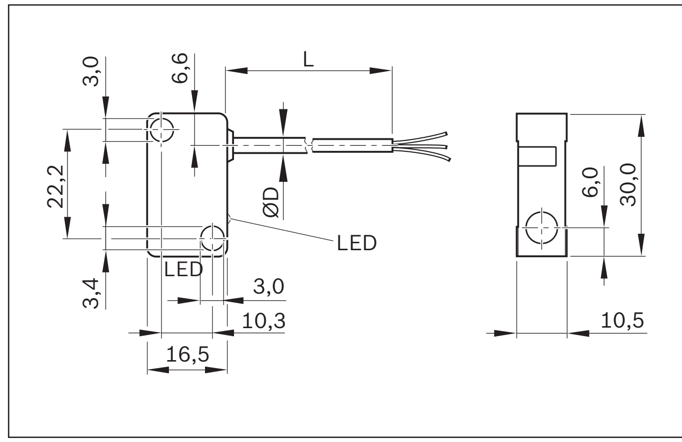


Part numbers/technical data		
Use	Reference / limit switch	Limit switch
Part number	R347602403	R347602303
Designation	H10706	R10705
Functional principle	magnetic	
Operating voltage	3.8 - 30 V DC	30 V DC
Load current	≤ 20 mA	500 mA
Switching function	Hall PNP/NC	REED/single-pole changeover (NC: C+NC, NO: C+NO)
Activation point dimension "X"	13.65 mm	9 mm
Connection type	0.3 m cable and M8x1 connector, 3-pin with knurled screw connection	
Function indicator	–	
Short-circuit protection	–	
Reverse polarity protection	–	
Switch-on suppression	–	
Switching frequency	2.5 kHz	
Pulse elongation (off delay)	–	
Max. permissible starting speed	2 m/s	
Suitable for drag chains[1)]	–	
Torsion-resistant[1)]	–	
Weld spark-resistant[1)]	–	
Cable cross-section[1)]	3 x 0.14 mm²	
Cable diameter D[1)]	3.2 ±0.20 mm	
Static bending radius[1)]	–	
Dynamic bending radius[1)]	–	
Bending cycles[1)]	–	
Maximum permissible travel speed[1)]	–	
Max. permissible acceleration[1)]	–	
Ambient temperature	-40 °C to +85 °C	
IP rating	IP66	
MTTFd (per EN ISO 13849-1)	–	
Certifications and approvals[2)]	–	

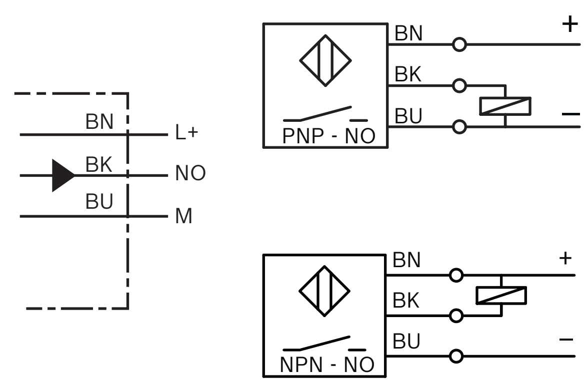
[1)] Technical data only for the cast-on connection line at the sensor.
The available extension cables offer even better performance, e.g., when using a power cable chain (see following pages).
[2)] No certificate is required to introduce these products to the Chinese market.

Inductive sensor with free line end

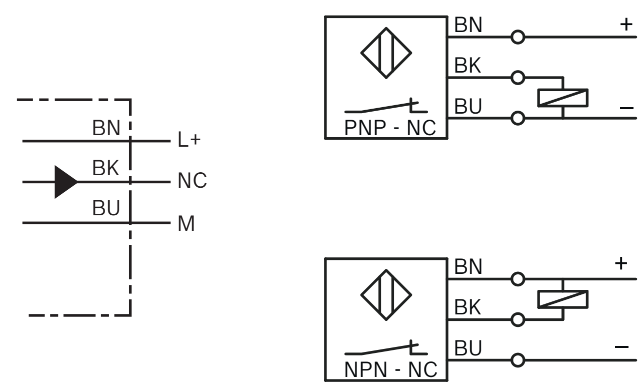




R345304003
R345304004



R345304001
R345304002

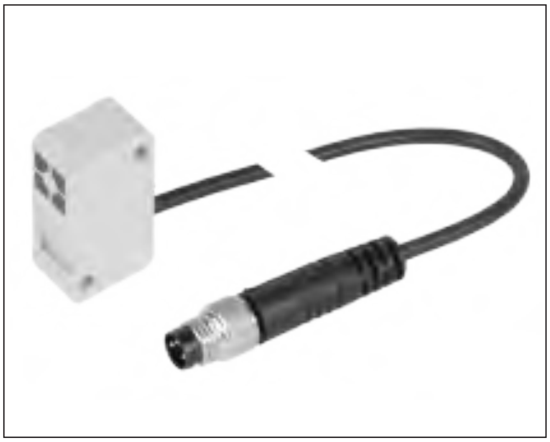


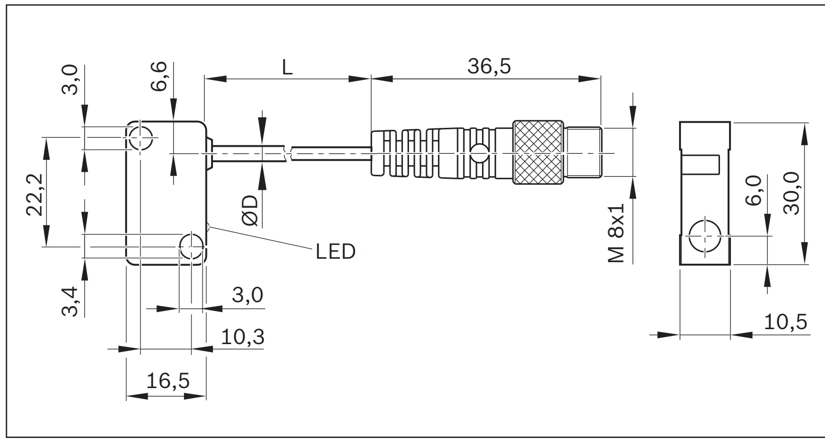
Part numbers/technical data

Use	Limit switch	Reference switch	Limit switch	Reference switch
Part number	R345304001	R345304003	R345304002	R345304004
Designation	BES 517-351-NO-C-03	BES 517-398-NO-C-03	BES 517-352-NO-C-03	BES 517-399-NO-C-03
Functional principle	inductive			
Operating voltage	10–30 V DC			
Load current	≤ 200 mA			
Switching function	PNP/NC	PNP/NO	NPN/NC	NPN/NO
Connection type	Line 3 m, 3-pin, free line end			
Function indicator	✓			
Short-circuit protection	✓			
Reverse polarity protection	✓			
Switching frequency	2.5 kHz			
Max. perm. starting speed	depending on the switching cam			
Suitable for drag chains[1]	–			
Torsion-resistant[1]	–			
Weld spark-resistant[1]	–			
Cable cross-section[1]	3 x 0.14 mm^2			
Cable diameter D[1]	3.5 ±0.15 mm			
Static bending radius[1]	12 mm			
Dynamic bending radius[1]	12 mm			
Bending cycles[1]	–			
Ambient temperature	-40 °C to +70 °C			
IP rating	IP65			
MTTFd (acc. to EN ISO 13849-1)	MTTFd = 830 years		MTTFd = 585 years	
Certifications and approvals[2]	CE, cULus, RoHS			

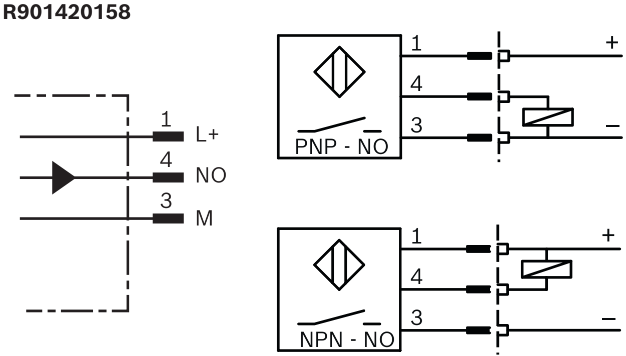
[1] Technical data only for the cast-on connection line at the sensor.
The available extension cables offer even better performance, e.g., when using a power cable chain (see following pages).
[2] No CCC certificate is required to introduce these products to the Chinese market.

Inductive sensor with M8x1 plug

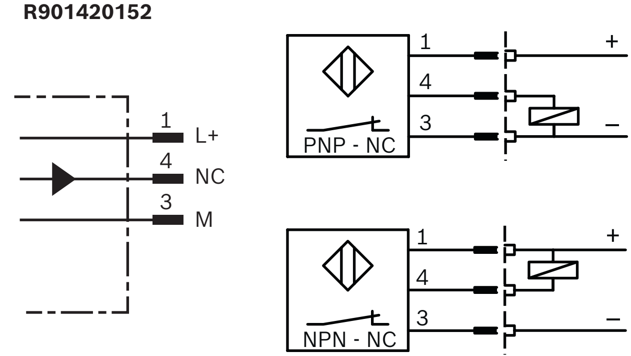




R901420156
R901420158



R901420149
R901420152



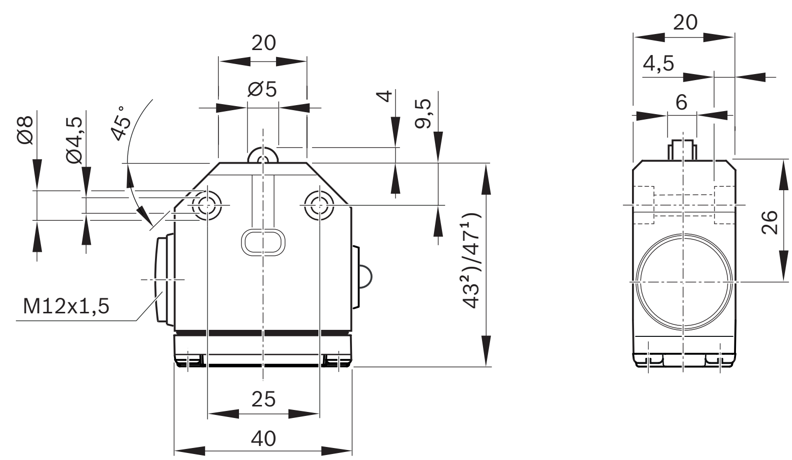
Part numbers/technical data

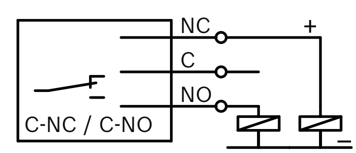
Use	Limit switch	Reference switch	Limit switch	Reference switch
Part number	R901420149	R901420156	R901420152	R901420158
Designation	BES 517-351-NO-C-S49-00.2	BES 517-398-NO-C-S49-00.2	BES 517-352-NO-C-S49-00.2	BES 517-399-NO-C-S49-00.2
Functional principle	inductive			
Operating voltage	10–30 V DC			
Load current	≤ 200 mA			
Switching function	PNP/NC	PNP/NO	NPN/NC	NPN/NO
Connection type	Cable 0.2 m and plug M8 x 1, 3-pin with knurled screw			
Function indicator	✓			
Short-circuit protection	✓			
Reverse polarity protection	✓			
Switching frequency	2.5 kHz			
Max. permissible starting speed	depending on the switching cam			
Suitable for drag chains[1]	–			
Torsion-resistant[1]	–			
Weld spark-resistant[1]	–			
Cable cross-section[1]	3x0.14 mm^2			
Cable diameter D[1]	3.5 ±0.15 mm			
Static bending radius[1]	12 mm			
Dynamic bending radius[1]	12 mm			
Bending cycles[1]	–			
Ambient temperature	-40 °C to +70 °C			
IP rating	IP65			
MTTFd (per EN ISO 13849-1)	MTTFd = 830 years		MTTFd = 585 years	
Certifications and approvals[2]				

[1] Technical data only for the cast-on connection line at the sensor.
The available extension cables offer even better performance, e.g., when using a power cable chain (see following pages).
[2] No certificate is required to introduce these products to the Chinese market.

Switches

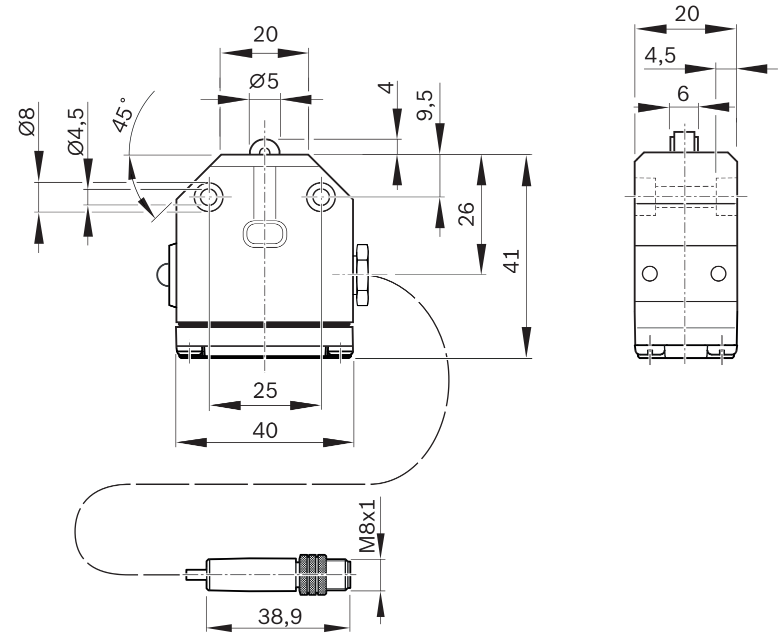
Mechanical switch



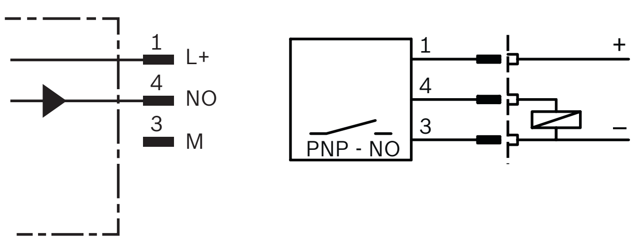


Part numbers/technical data		
Use	Limit switch	
Part number	R345304016[1)]	R347600305[2)]
Designation	BNS 819-X496-99-R-11	BNS 819-X510-99-R-10
Functional principle	mechanical, roller	
Operating voltage	250 V AC	
Load current	≤ 5 A	
Switching function	single-pole changeover/ (NC: C+NC, NO: C+NO)	
Connection type	Screw connection, without line	
Function indicator	–	
Switching frequency	3.3 Hz	
Max. permissible starting speed	1 m/s	
Ambient temperature	-5°C to +85°C	
IP rating	IP67	
B10d value	$5x10^6$ (wet area); $10x10^6$ (dependent on current load (dry area))	
Certifications and approvals, housing	CE CCC RoHS	
Certifications and approvals, switching element	CE CCC CSA RoHS	

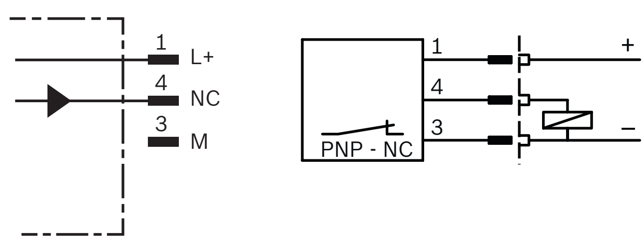
Mechanical switch with M8x1 plug



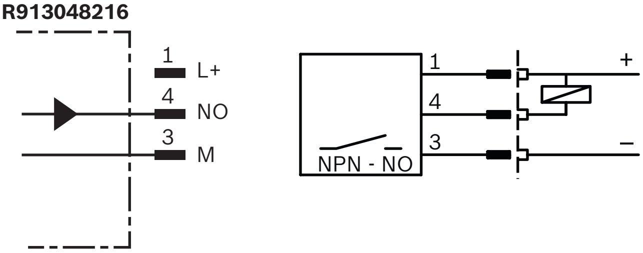
R913048214



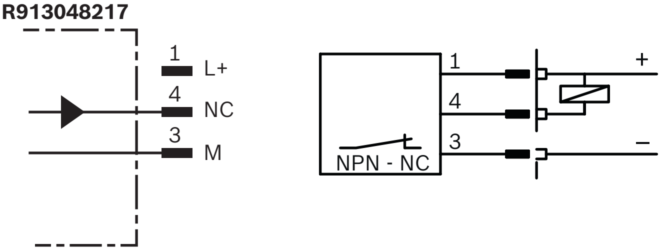
R913048215



R913048216



R913048217



Part numbers/technical data

Use	Limit switch	Reference switch	Limit switch	Reference switch
Part number	R913048215	R913048214	R913048217	R913048216
Designation	BNS 819-X1002-99-R-10	BNS 819-X1001-99-R-10	BNS 819-X1004-99-R-10	BNS 819-X1003-99-R-10
Functional principle	mechanical, roller			
Operating voltage	10 - 30 VDC			
Load current	≤ 200 mA			
Switching function	PNP/NC	PNP/NO	NPN/NC	NPN/NO
Connection type	Cable 0.2 m and plug M8 x 1, 3-pin with knurled screw			
Function indicator	–			
Short-circuit protection	–			
Reverse polarity protection	–			
Switching frequency	3.3 Hz			
Max. perm. starting velocity	1 m/s			
Suitable for drag chains[1]	–			
Torsion-resistant[1]	–			
Weld spark-resistant[1]	–			
Cable cross-section[1]	3x0.14 mm²			
Cable diameter D[1]	4.3 ±0.2 mm			
Static bending radius[1]	12 mm			
Dynamic bending radius[1]	12 mm			
Bending cycles[1]	–			
Ambient temperature	-5 °C to +70 °C			
IP rating	IP65			
B10d value	$5x10^6$ (wet area); $10x10^6$ (dependent on current load (dry area))			
Certifications and approvals[2]				

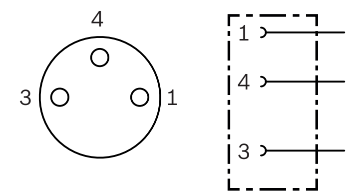
1) Technical data only for the cast-on connection line at the mechanical switch.
The available extension cables offer even better performance, e.g., when using a power cable chain (see following pages).
2) No certificate is required to introduce these products to the Chinese market.

Extensions

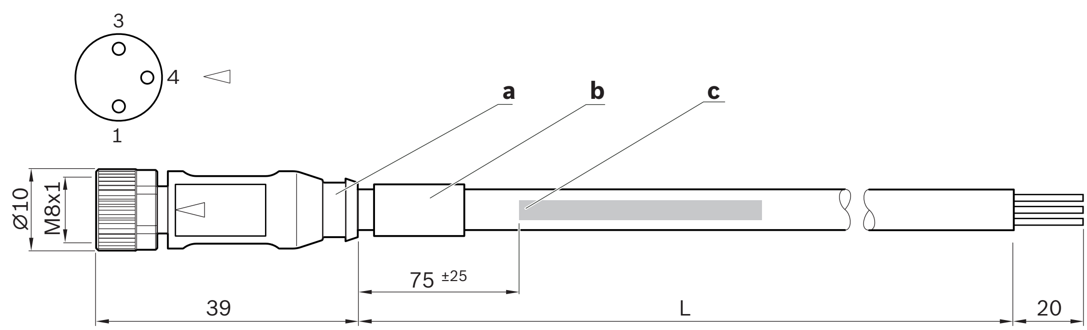
Assembled on one end

Connection diagram

1 brown (BN) (+)
3 blue (BU) (–)
4 black (BK) (signal)



Dimensional drawing



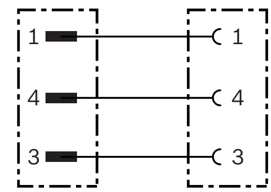
Part numbers

Use	Extension cable		
Part number	R911344602	R911344619	R911344620
Designation	7000-08041-6500500	7000-08041-6501000	7000-08041-6501500
Length (L)	5.0 m	10.0 m	15.0 m
1st connection type	M8x1 3-pin straight female connector		
2nd connection type	Unassembled cable end		

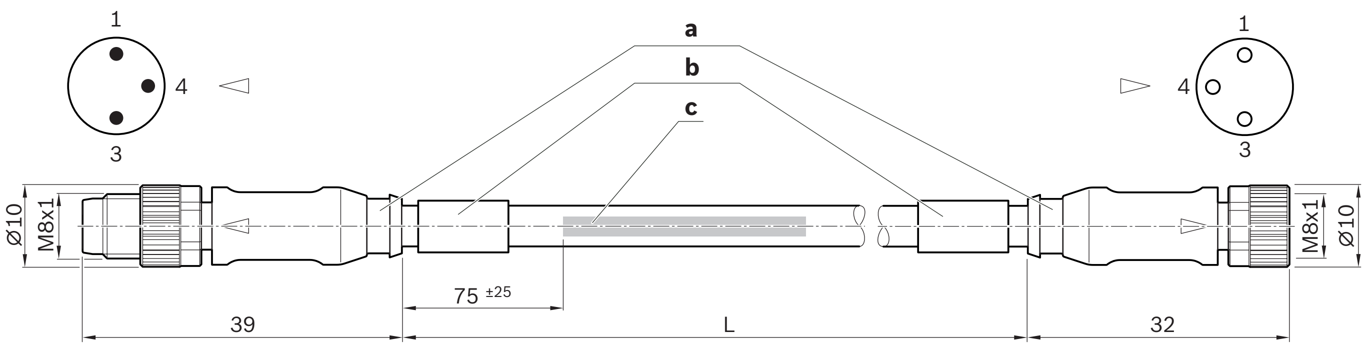
a) Contour for 6.5 mm corrugated tube (inner diameter)
b) Cable grommet
c) Cable printing per printing specification

Assembled on both ends

Connection diagram
1 brown (BN) (+)
3 blue (BU) (–)
4 black (BK) (signal)



Dimensional drawing



Part numbers

Use	Extension cable				
Part number	R911344621	R911344622	R911344623	R911344624	R911344625
Designation	7000-88001-6500050	7000-88001-6500100	7000-88001-6500200	7000-88001-6500500	7000-88001-6501000
Length (L)	0.5 m	1.0 m	2.0 m	5.0 m	10.0 m
1st connection type	M8x1 3-pole straight female connector				
2nd connection type	Straight plug, M8x1, 3-pin				

Technical data for extensions pre-assembled on one or two sides

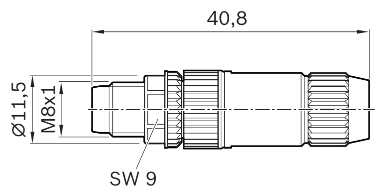
Function indicator	–
Operating voltage indicator	–
Operating voltage	10–30 V DC
Type of cable	PUR black
Suitable for drag chains	✓
Torsion-resistant	✓
Weld spark-resistant	✓
Cable cross-section	3x0.25 mm²
Cable diameter D	4.1 ±0.2 mm
Static bending radius	≥ 5xD
Dynamic bending radius	≥ 10xD
Bending cycles	> 10 mil.
Max. permissible travel velocity	3.3 m/s for 5 m travel distance (typ.), up to 5 m/s for 0.9 m travel distance
Max. permissible acceleration	≤ 30 m/s²
Ambient temperature fixed ext.	−40°C to +85°C
Ambient temperature flexible ext.	−25°C to +85°C
IP rating	IP68
Certifications and approvals	CE, cULus LISTED, CSA C US, PCT, RoHS

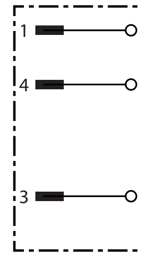
a) Contour for 6.5 mm corrugated tube (inner diameter)
b) Cable grommet
c) Cable printing per printing specification

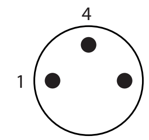
Connectors

	Dimensional drawing	Connection diagram	View Connector side

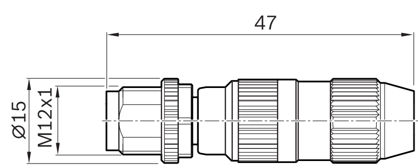
R901388333

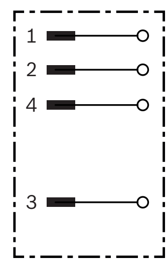


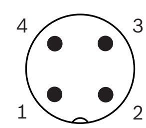




R901388352







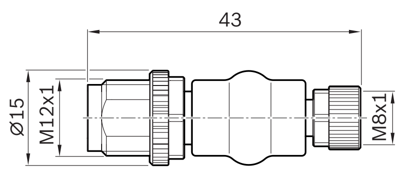
Part numbers/technical data

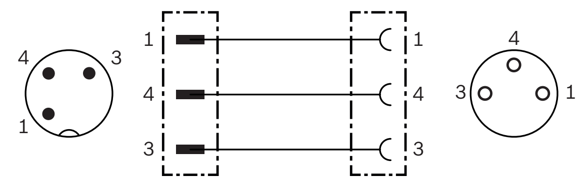
Use	Male connector, single	
Part number	R901388333	R901388352
Designation	7000-08331-0000000	7000-12491-0000000
Version	straight	
Operating current per contact	max. 4 A	
Operating voltage	max. 32 V AC/DC	
Connection type	Male connector, straight, M8x1, 3-pin Insulation displacement, self-locking screw thread	Male connector, straight, M12x1, 4-pin Insulation displacement, self-locking screw thread
Function indicator	–	
Operating voltage indicator	–	
Connection cross-section	0.14 ... 0.34 mm^2	
Ambient temperature	-25°C to +85°C	
IP rating	IP67 (inserted and locked)	
Certifications and approvals	c UL us, PC, RoHS	

Adapters

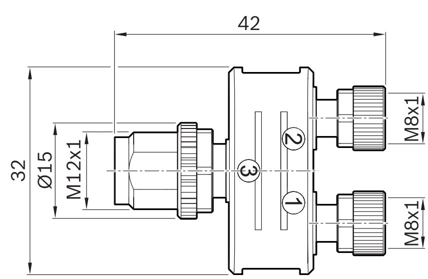
Dimensional drawing | **Connection diagram**

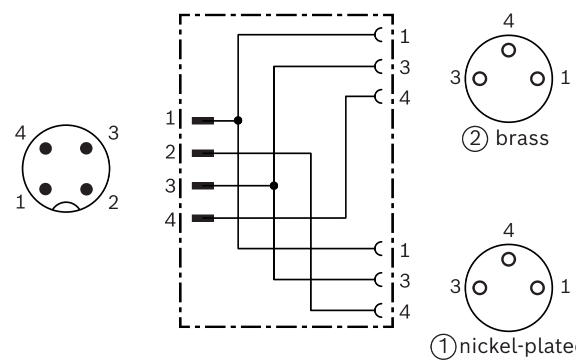
R911344591





R911344592





Part numbers/technical data

Use	Adapter	Adapter or distributor
Part number	R911344591	R911344592
Designation	7000-42201-0000000	7000-41211-0000000
Version	straight for 1 sensor	straight, for 1 - 2 sensors
Operating current per contact	max. 4 A	
Operating voltage	max. 32 V AC/DC	
1st connection type	M8x1 3-pole straight female connector self-locking screw thread	2 X straight female connectors, M8x1, 3-pin self-locking screw thread
2nd connection type	Male connector, straight, M12x1, 3-pin, self-locking screw thread	Male connector, straight, M12x1, 4-pin self-locking screw thread
Function indicator	–	
Operating voltage indicator	–	
Connection cross-section	–	
Ambient temperature	−25°C to +85°C	
IP rating	IP67 (inserted and locked)	
Certifications and approvals	RoHS	c UL us LISTED, PC, RoHS

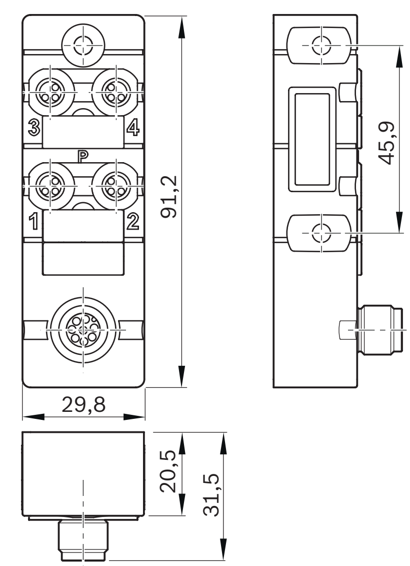
Distributors

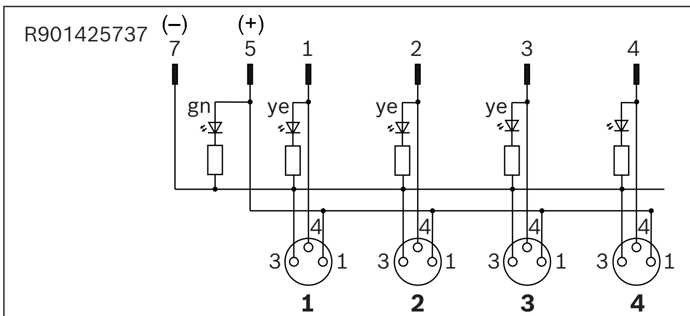
Passive distributor

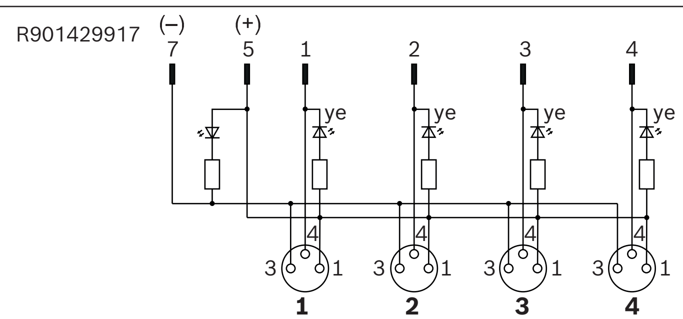
R901425737

R901429917

R911344592







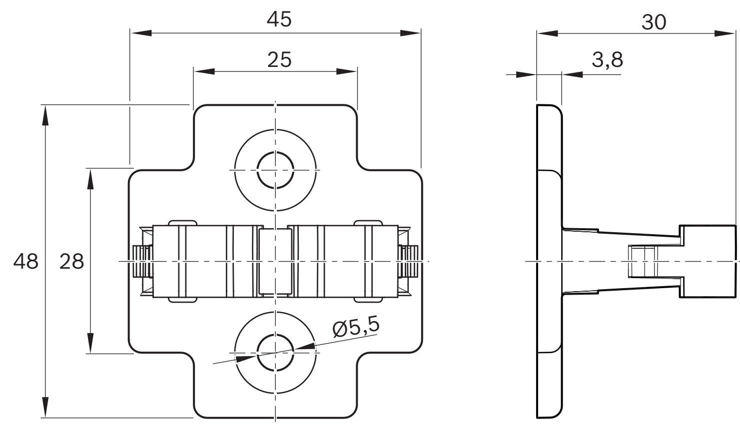
Part numbers/technical data

Use	Passive distributor		
Part number	R901425737	R901429917	R911344592
Designation	8000-84070-0000000	8000-84071-0000000	Technical data and dimensional drawing see Adapters
Version	straight, for 1 - 4 sensors		
Operating current per contact	max. 2 A		
Operating voltage	24 VDC		
Switching logic	PNP	NPN	
1st connection type	4x female connector, straight, M8x1, 3-pin, self-locking screw thread		
2nd connection type	Straight plug, M12x1, 8-pin, IDC, self-locking screw thread		
Function indicator	✓		
Operating voltage indicator	✓		
Connection cross-section	–		
Ambient temperature	–20 °C to +70 °C		
IP rating	IP67 (inserted and locked)		
Certifications and approvals	c UL us LISTED, PC, RoHS		

Accessories for passive distributors

Retainer plate

Screw plug



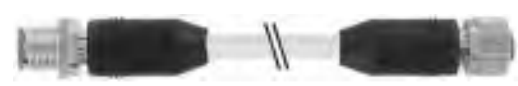
Part numbers/technical data

Use	For passive distributor R911344592	For passive distributors R901425737/R901429917
Retainer plate	R913047341	–
Designation	7000-99061-0000000	–
Set	1 unit	–
Screw plug	–	R913047322
Designation	–	3858627
Set	–	10 units

Extensions for passive distributors

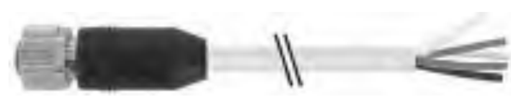
R911371982

R911371981

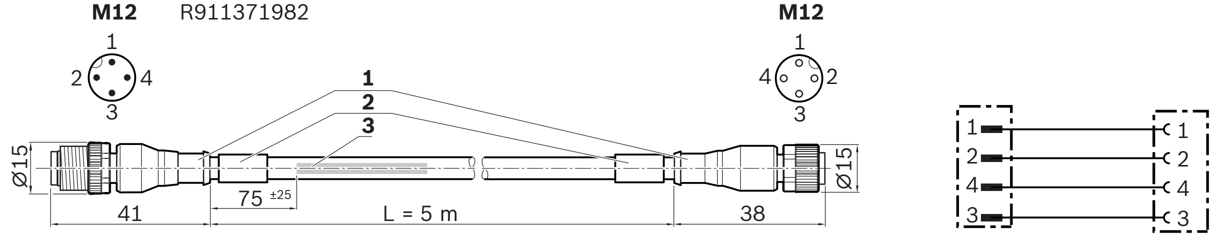


R911371980

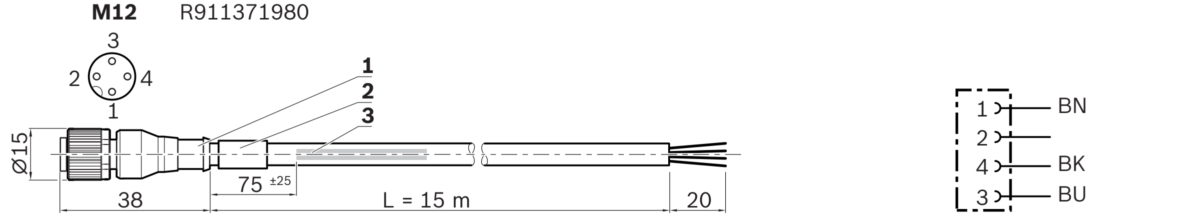
R911371983



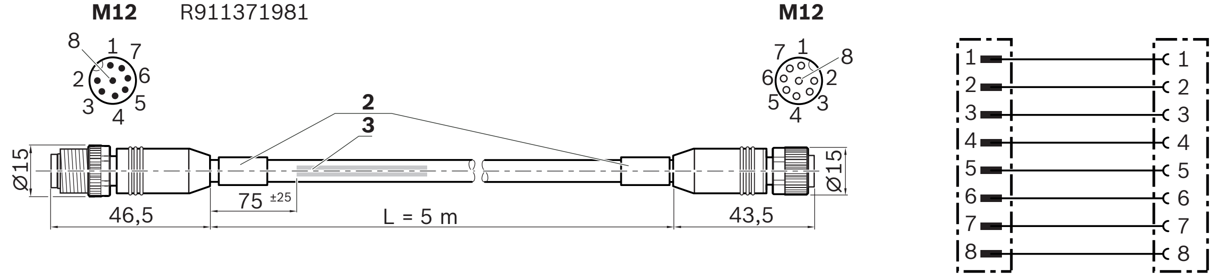
M12 R911371982 **M12**



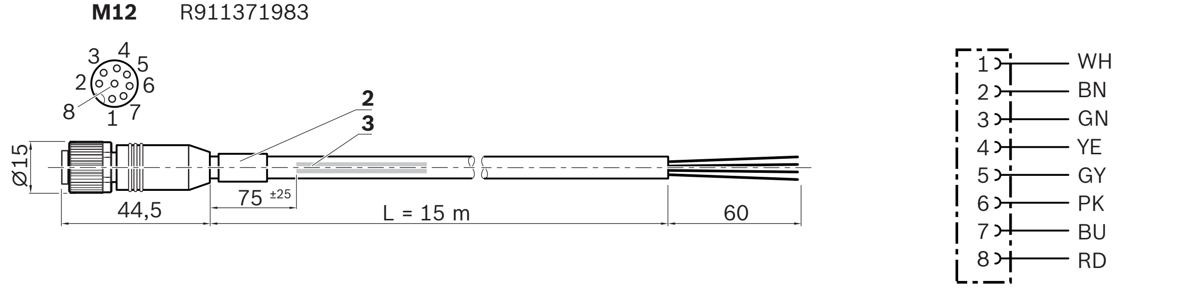
M12 R911371980



M12 R911371981 **M12**



M12 R911371983

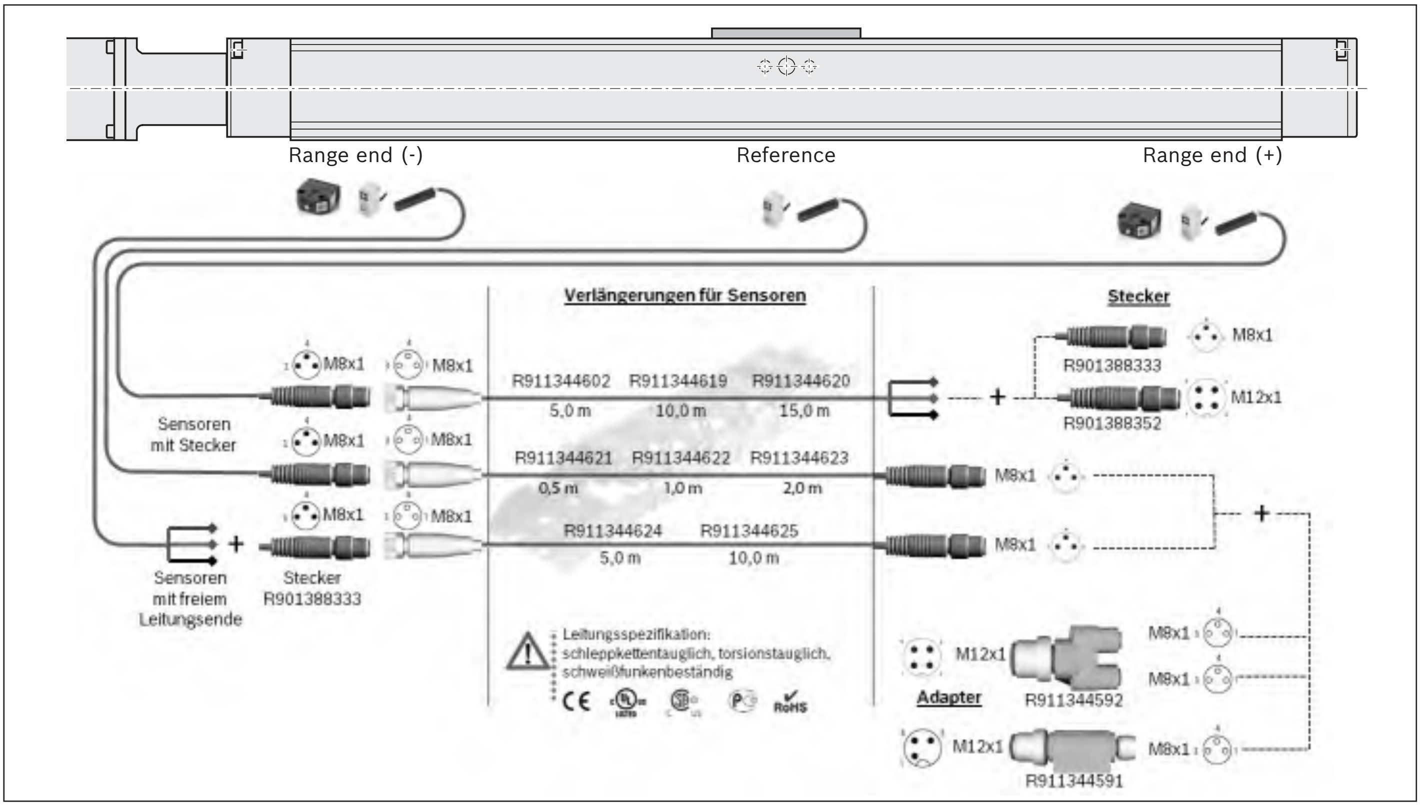


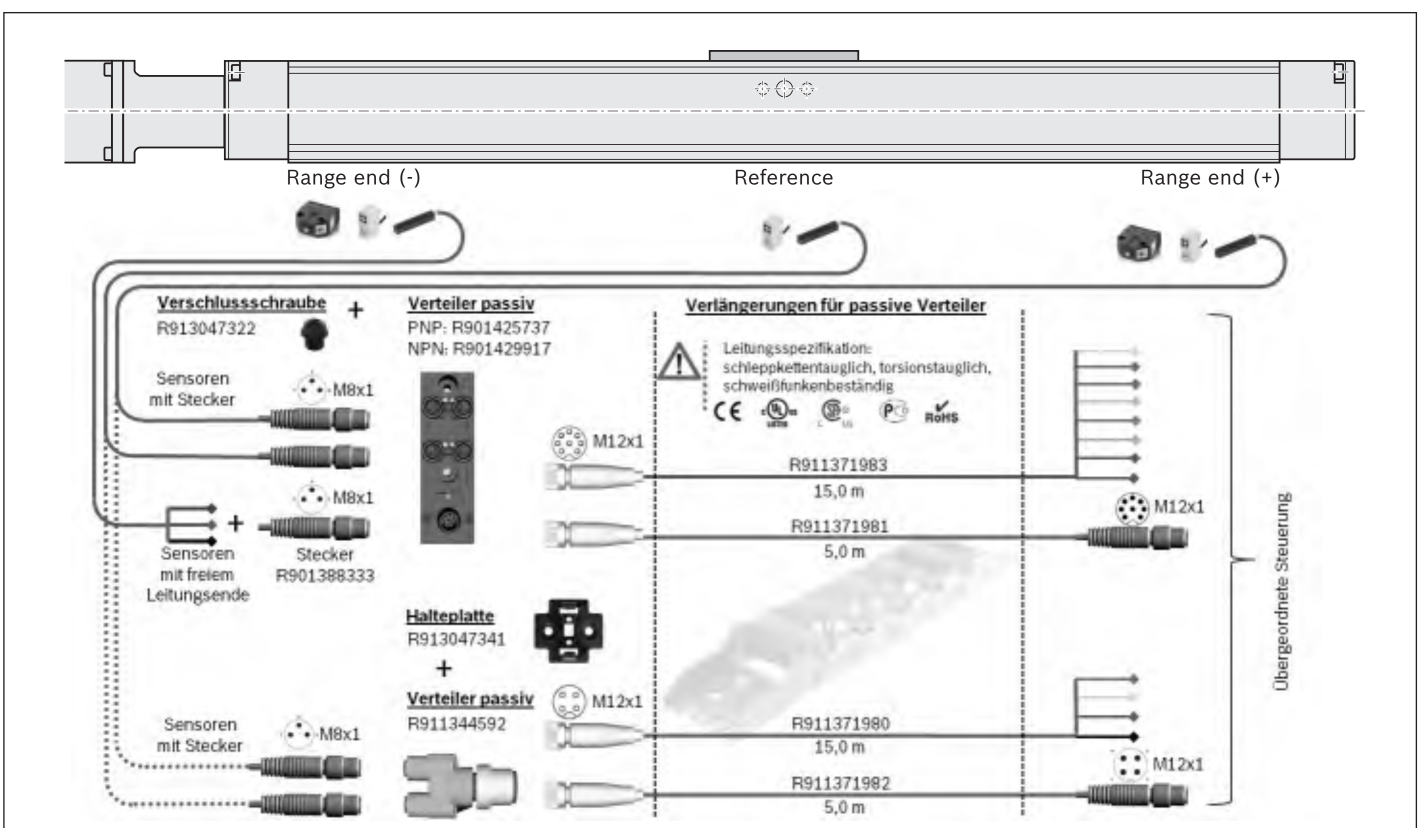
1) Contour for conduit pipe with inner diameter of 10
2) Cable grommet
3) Cable print per ordering specification 7000-08001

Part numbers/technical data

Use	Extension cable for passive distributor R911344592		Extension cable for passive distributor R901425737 / R901429917	
Part number	R911371982	R911371980	R911371981	R911371983
Designation	7000-40021-6540500	7000-12221-6541500	7000-48001-3770500	7000-17041-3771500
Length	5.0 m	15.0 m	5.0 m	15.0 m
1st connection type	Female connector, straight, M12x1, 4-pin		Female connector, straight, M12x1, 8-pin	
2nd connection type	Straight plug, M12x1, 4-pin	Unassembled cable end	Straight plug, M12x1, 8-pin	Unassembled cable end
Function indicator	–			
Operating voltage indicator	–			
Type of cable	PUR black		PUR gray	
Operating voltage	30 V AC/DC			
Operating current per contact	max. 4 A per contact		max. 2 A per contact	
Suitable for drag chains	✓			
Torsion-resistant	✓			
Weld spark-resistant	✓			
Cable cross-section	4x0.34 mm²		8x0.34 mm²	
Cable diameter D	4.7 +/– 0.2 mm		6.2 +/– 0.3 mm	
Static bending radius	≥ 5 x D			
Dynamic bending radius	≥ 10 x D			
Bending cycles	> 10 mil.			
Max. permissible travel velocity	3.3 m/s for 5 m travel distance (typ.), up to 5 m/s for 0.9 m travel distance			
Max. permissible acceleration	≤ 30 m/s²			
Ambient temperature fixed ext.	–40°C to +80°C (90° max. 10,000h)			
Ambient temperature flexible ext.	–25°C to +80°C (90° max. 10,000h)			
IP rating	IP67 (inserted and locked)			
Certifications and approvals	CE, c UL us LISTED, SP C US, PG, RoHS			

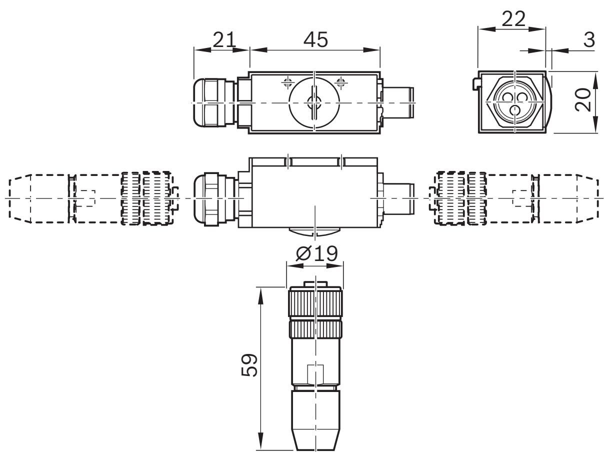
Combination examples

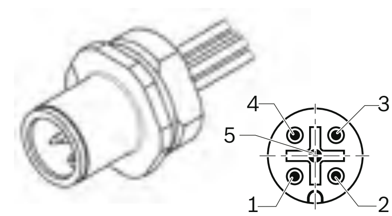




Socket and plug
Attach the socket on the side with the magnetic sensors. The socket and plug are not pre-wired. The variable sliding attachment allows switching positions to be optimized during start-up. The plug can be mounted in three directions.

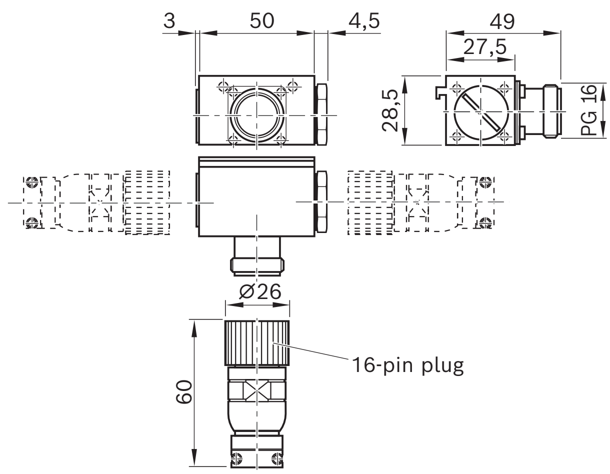
R117560102



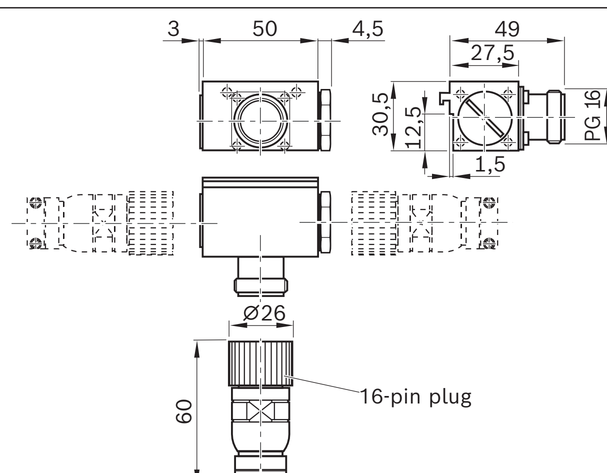


Pin		Color
1	BN	brown
2	WH	white
3	BU	blue
4	BK	Black
5	GY	gray

R037540000



R117500153



Use	Socket and plug	
Part number	R117560102	R037540000 / R117500153
Designation	for CKK / CKR-070	for CKK / CKR-090, -110, -145, -200
Version	angled, for suspension in the lateral slot of the linear motion system	
Operating current per contact	max. 4 A	max. 8 A
Operating voltage	10–30 V DC	150V AC/DC
1st connection type	Male connector, straight, M12x1, 5-pin, Spring-cage connection	Straight plug, 16-pin, Soldered connection
2nd connection type	Coupling / flange socket M12x1, 5-pin, with 0.5 m cable	Coupling / flange socket, 16-pin, Soldered connection
Housing cable bushing	Cable gland M16x1.5 with seal (hole 3x3.5 mm) incl. cap and dummy plug	1 seal with bore 2x5.5 mm, 1x3.5 mm 1 adaptable seal, max. 14 mm diameter incl. cap and dummy plug
Cable bushing, plug	Gland with pull relief	
Connection cross-section	0.14 ... 0.5 mm	0.14 ... 1 mm
Cable diameter	4 ... 8 mm	10 ... 14 mm
Ambient temperature	−25°C to +85°C	−20°C to +125°C
IP rating	–	
Certifications and approvals	–	

Service and information

Operating conditions

Normal operating conditions

Ambient temperature with Bosch Rexroth servo motor	0 °C ... 40 °C, above 40 °C loss of performance
Ambient temperature for mechanical system (no dropping below dew point)	-10 °C ... 60 °C
Travel s_{min}[1)]	see the CKK/CKR "technical data" table
Soiling	Do not allow

1) Minimum travel to ensure a reliable lubrication distribution.

Required and supplementary documentation

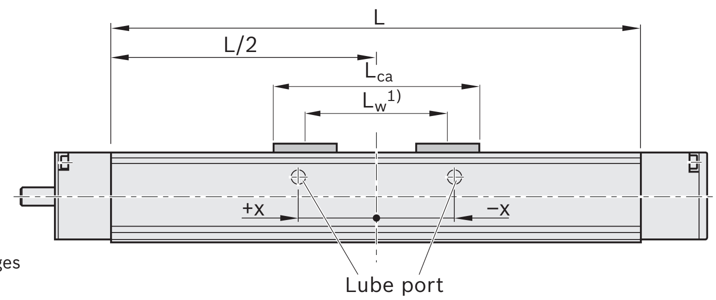
For further instructions and information, please refer to the documentation for this product.

Lubrication

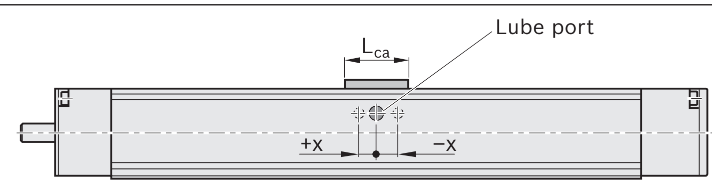
CKK Compact Modules

Lube port in frame for lube versions LSS/LPG

On each side of the frame of the CKK Compact Modules there are holes through which the lube nipples in the carriage can be accessed. Lubrication from one side only is sufficient.



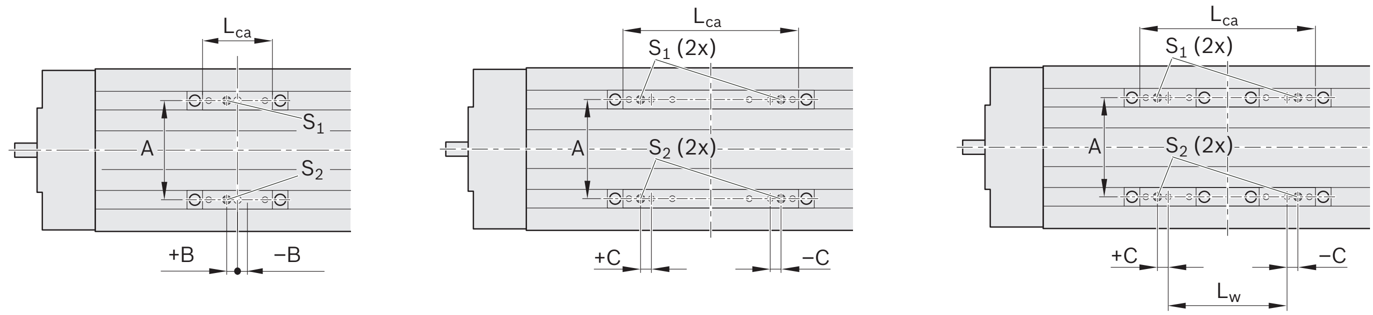
1) L_w = center-to-center distance of carriages (see dimensional drawings)



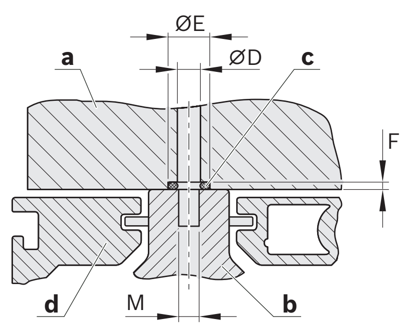
CKK	Carriage length L_{ca} (mm)	Lube port Quantity	Distance x (mm)	Lube nipple
-070	32	1	-12.5	DIN 3405-D 3
	73	1	0.0	
-090	35	1	0.0	DIN 3405-D 3
	100	2	± 32.5	
	variable	2	± L_w/2	
-110	39	1	6.5	DIN 3405-D 3
	124	2	± 49.5	
	variable	2	± (L_w/2 + 6.5)	
-145	49	1	7.0	DIN 3405-D 3
	149	2	± 57.0	
	variable	2	± (L_w/2 + 7.0)	
-200	79.5	1	-15.0	DIN 3405-A M8x1
	254.5	2	± 102.5	
	variable	2	± (L_w/2 + 15.0)	

Lube fittings for carriage attachments for lube versions LSS/LPG

The lube fittings are sealed with (a) set screw(s) in the factory before shipment. To use the lube fittings, remove the set screw(s) for $\mathbf{S_1}$ or $\mathbf{S_2}$. See drawing and table for connection dimensions and O-rings.



CKK: -070 / -090 / -110 / -145 / -200 CKK: -090 (L_{ca}=100mm) CKK: -090 / -110 / -145 / -200



a) Customer-builtattachment
b) Carriage
c) O-ring
d) Frame

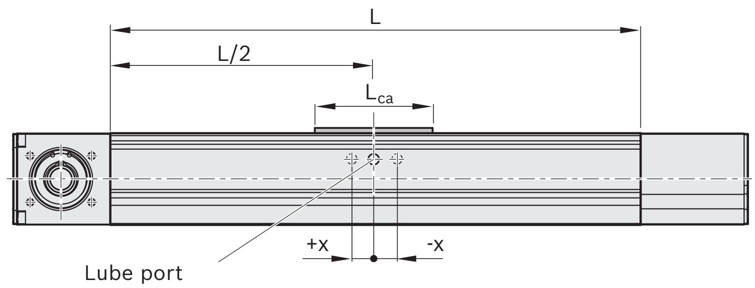
CKK	Carriage length L_{ca} (mm)	Center-to-center distance of carriages L_w (mm)	Dimensions (mm) A	B	C	Ø D ±0.2	Ø E ±0.2	F +0.2	M	O-Ring acc. to DIN3771 Size	Part number
-070	32.0	–	40	−5.0	–	2.5	5.0	0.6	M3	3 x 1.0	R341111801
	73.0	–		0.0	–						
-090	35.0	–	54	6.0	–	3.0	6.2	1.0	M3	3 x 1.5	R341100101
	100.0	–		–	6.0						
	variable	variable		–	6.0						
-110	39.0	–	66	6.5	–	3.0	6.2	1.0	M3	3 x 1.5	R341100101
	124.0	85		–	6.5						
	variable	variable		–	6.5						
-145	49.0	–	88	7.0	–	3.0	6.2	1.0	M3	3 x 1.5	R341100101
	149.0	100		–	7.0						
	variable	variable		–	7.0						
-200	79.5	–	130	−15.0	–	5.0	9.0	1.0	M4	5 x 1.5	R341110801
	254.5	175		–	15.0						
	variable	variable		–	15.0						

Lube fittings for carriages with connection plate ➟ "Connection plates" chapter

CKR Compact Modules

Lube port in frame for lube versions LSS/LPG

On each side of the frame of the CKR Compact Modules, there are holes through which the lube nipples in the carriage can be accessed. Lubrication from one side only is sufficient.

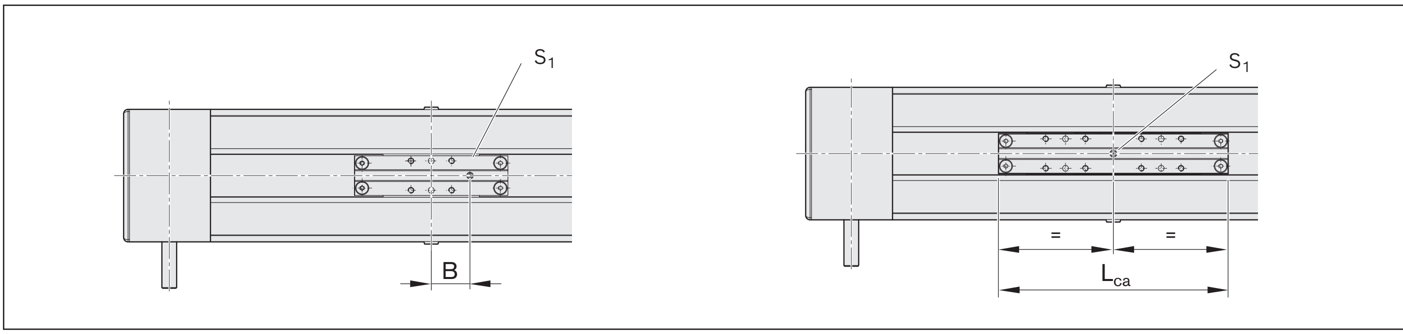


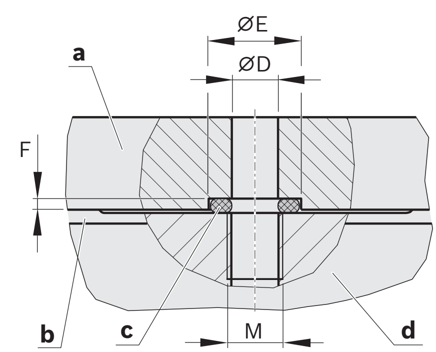
Depending on the carriage length, move to the lubrication position in accordance with the table (distance x).

CKR	Carriage length L_{ca} (mm)	Distance **x** (mm)	Lube nipple
-070	80	0.0	DIN 3405-D 4
	108	5.0	
-090	102	0.0	DIN 3405-D 4
	108		
-110	170	-41.5	DIN 3405-A M6
	215	0.0	
-145	180	-50.0	DIN 3405-A M6
	240	0.0	
-200	265	-59.0	DIN 3405-A M8x1
	405	0.0	

Lube fittings for carriage attachments for lube versions LSS/LPG

The lube fittings are sealed with a set screw in the factory before shipment. To use the lube connection, the set screw S_1 has to be removed. See the table for connection dimensions and O-rings.





a) Customer-built attachment
b) Carriage
c) O-ring
d) Frame

CKR	Carriage option	Carriage length	Dimensions					O-Ring acc. to DIN3771	
		L_{ca} (mm)	B	Ø D ±0.2	Ø E ±0.2	F +0.2	M	Size	Part number
-070	01	80	0.0	2.5	6.0	0.6	M3	3 x 1.5	R341100101
	02	108							
-090	01	102	0.0	3.0	10.0	1.7	M4	4 x 2.5	R341111901
	02	156							
-110	01	170	41.5	5.0	10.0	1.2	M6	5 x 2	R341110901
	02	215	0.0						
-145	01	180	50.0	5.0	10.0	1.2	M6	5 x 2	R341110901
	02	240	0.0						
-200	01	265	59.0	6.0	12.2	1.0	M8	8 x 2	R341100801
	02	405	0.0						

Lube fittings for carriages with connection plate ➟ "Connection plates" chapter

Lubricants

Lubrication type	LSS		LPG	
Size	CKx-110, -145, -200	CKx-070, -090	CKx-110, -145, -200	CKx-070, -090
Basic lubrication	Dynalub 510	Dynalub 520	Preserved, basic lubrication required (see instructions)	
Consistency class	NLGI 2 (DIN 51818)	NLGI 00 (DIN 51818)	–	
Identification	KP2K-20 (DIN 51825)	GP00K-20 (DIN 51826)	–	
Lubrication with grease gun	yes	yes	yes	
Prepared for connection to central lubrication systems	–	–	–	
Recommended lubricants	Dynalub 510 (grease lubricant) (NLGI 2 DIN 51818)	Dynalub 520 (liquid grease) (NLGI 00 DIN 51818)	Dynalub 510 (grease lubricant) (NLGI 2 DIN 51818)	Dynalub 520 (liquid grease) (NGLI 00 DIN 51818)
Features	• Good water resistance • Corrosion protection • Temperature range: −20 to +80 °C		• Good water resistance • Corrosion protection • Temperature range: −20 to +80 °C	
Part numbers	R3416 037 00 (400 g cartridge)	R3416 043 00 (400 g cartridge)	R3416 037 00 (400 g cartridge)	R3416 043 00 (400 g cartridge)
	R3416 035 00 (25 kg container)	R3416 042 00 (5 kg bucket)	R3416 035 00 (25 kg container)	R3416 042 00 (5 kg bucket)
Alternative lubricants	• Tribol GR 100-2 PD • Elkalub GLS 135/N2	• Tribol GR 100-00 PD • Elkalub GLS 135/N00	• Tribol GR 100-2 PD • Elkalub GLS 135/N2 • Tribol GR 100-00 PD • Elkalub GLS 135/N00 • Dynalub 520	• Tribol GR 100-00 PD • Elkalub GLS 135/N00
Alternative lubricants with H1 approval	–	–	• Berulub FG H2 SL • Cassida Grease EPS2 • VP 874	• Berulub FB 34-00 • Elkalub GLS 367/N00

⚠ Notes on lubrication

- Follow the product instructions.
- Do not use lubricants with solid particles (e.g. graphite or MoS_2).
- If using different lubricants than the ones specified, relubrication intervals may be shorter and performance may decrease with short stroke and load ratio; in addition, chemical interactions can take place between the plastics, lubricants and preservative agents. Single-line central lubrication systems also need to be able to pump these lubricants.
- If using a central lubrication system, make sure all lines and elements are filled with lubricant all the way to the connection to the consumer (carriage) and that there are no air bubbles.
- Lubricant reservoirs should contain an agitator to ensure the lubricant can flow (avoids hardening in the reservoir).
- For relubrication, it is not possible to switch from grease to oil lubrication and vice-versa.
- If environmental factors such as contamination, vibrations, impact loads, etc. are present, we recommend shorter lubrication intervals. Even under normal operating conditions, relubrication is required every two years due to grease aging.
- Rexroth recommends piston distributors by SKF. These should be installed as close to the carriage lube fittings as possible. Avoid long lines (no longer than 1 m) and narrow line diameters. Install the lines at a gradient.
- If other consumers are connected to the single-line lubrication system, the weakest link in this chain determines the lubrication cycle.
- Excess lubricant can accumulate inside of the Compact Modules or flow out and may lead to contamination of the environment
- Never put a Compact Modules into operation without basic lubrication.

	LCF	LCO
	CKx-090, -110, -145, -200	CKx-090, -110, -145, -200
	required, see instructions	required, see instructions
	NLGI 00 (DIN 51818)	–
	GP00K-20 (DIN 51826)	–
	–	–
	• only via single-line piston distributor system • smallest permitted piston distributor size: CKx-090, -110, -145, -200: 0.2 cm^3	• only via single-line piston distributor system • smallest permitted piston distributor size: CKx-090, -110: 0.2 cm^3; CKx-145: 0.4 cm^3; CKx-200: 0.6 cm^3
	Dynalub 520 (liquid grease) (NLGI 00 DIN 51818)	Shell Tonna S3 M220 (lubricant oil)
	• Good water resistance • Corrosion protection • Temperature range: −20 to +80 °C	• Special demulsifying oil CLP or CGLP as per DIN 51517-3 for machine bed tracks and tool guides • A blend of highly refined mineral base oils and additives • Can be used even when mixed with significant quantities of metalworking fluids
	R3416 043 00 (400 g cartridge)	–
	R3416 042 00 (5 kg bucket)	–
	• Tribol GR 100-00 PD • Elkalub GLS 135/N00	• Special demulsifying oil CLP or CGLP as per DIN 51517-3 for machine bed tracks and tool guides
	–	–

⚠ Use of lubricants with H1 approval:

Loss of H1 approval

H1 lubricants or release agents (preservative agents) only have H1 approval if they are separated and unmixed (including at the lubrication point). A blend of two H1 approval lubricants or separating agents does not have H1 approval.

No approval or authorization for use in the food industry

Because of the use of H1 lubricants, the Compact Modules do not have authorization or approval for the food industry.

Components lubricated at the factory

Components lubricated by the manufacturer at the factory such as deep-groove ball bearings, cover strips, gears, etc. do not use H1 lubricants.

⚠ Compact Modules with Dynalub 520 (NLGI 00 class) initial greasing must not be pre-lubricated with lubricants of consistency class NLGI 2!

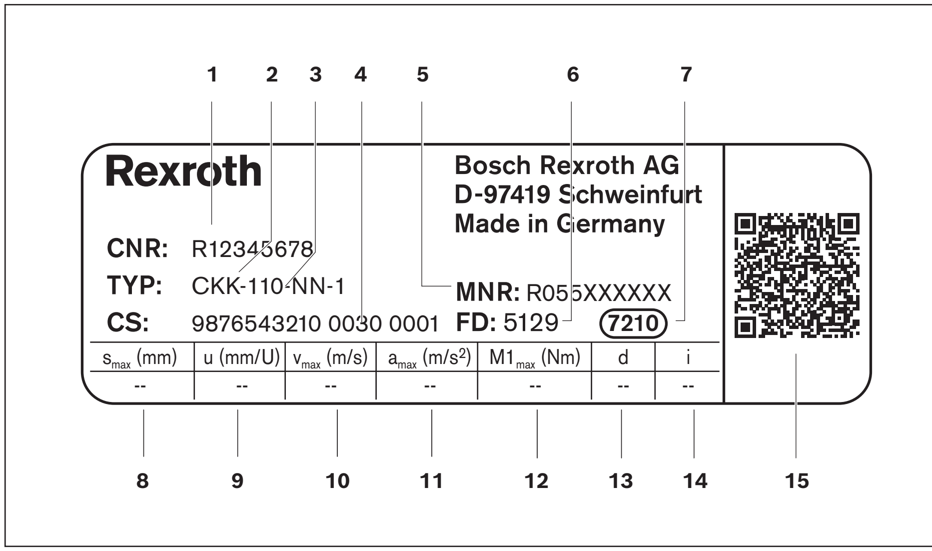
For relubrication quantity and relubrication position ⇒ see Compact Modules CKK/Compact Modules CKR instructions.

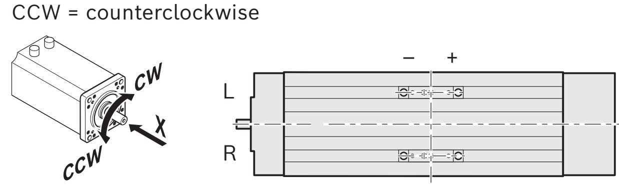
Relubrication interval

When using the standard lubrication from the manufacturer:
Relubrication interval⇒ see Compact Modules CKK/Compact Modules CKR instructions.
Use of Dynalub 520 (NLGI 00) instead of Dynalub 510 (NLGI 2):
The relubrication interval is 75% of the standard relubrication interval ⇒ CKK/CKR instructions.
Use of lubricants with H1 approval:
First relubrication takes place after 20 km. As a guideline value for relubrication intervals, 50% of the standard relubrication intervals must be applied ⇒ see Compact Modules CKK/Compact Modules CKR instructions.

Parameterization (start-up)

The nameplate contains reference information on the production of the linear motion system as well as technical start-up parameters.



1	CNR	Customer's part number
2	TYP	Short product name
3	110	Size
4	CS	Customer information
5	MNR	Part number
6	FD	Date of manufacture
7	7210	Manufacturing location
8	s_{max}	Maximum travel range
9	u	Feed constant without motor attachment
10	v_{max}	Maximum speed
11	a_{max}	Maximum acceleration
12	$M1_{max}$	Maximum drive torque at motor journal
13	d	Direction of motor rotation to move in positive (+) direction CW = clockwise CCW = counterclockwise 
14	i	Gear ratio
15		QR code

Documentation

Standard report

Option 01

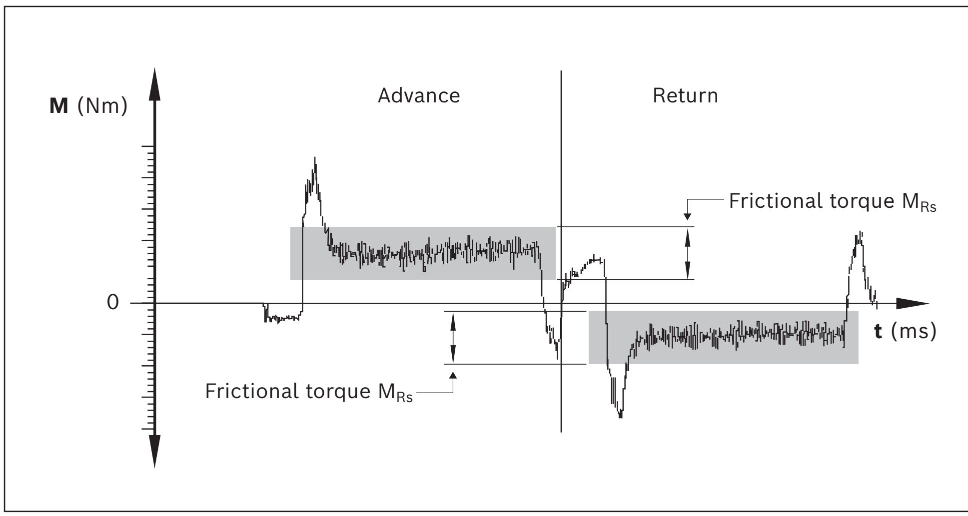
The standard report serves to confirm that the checks listed in the report have been carried out and that the measured values lie within the permissible tolerances.

Checks listed in the standard report:
- Functional checks of mechanical components
- Functional checks of electrical components
- Design is in accordance with order confirmation

Measurement of frictional torque of complete system

Option 02 (includes option 01)

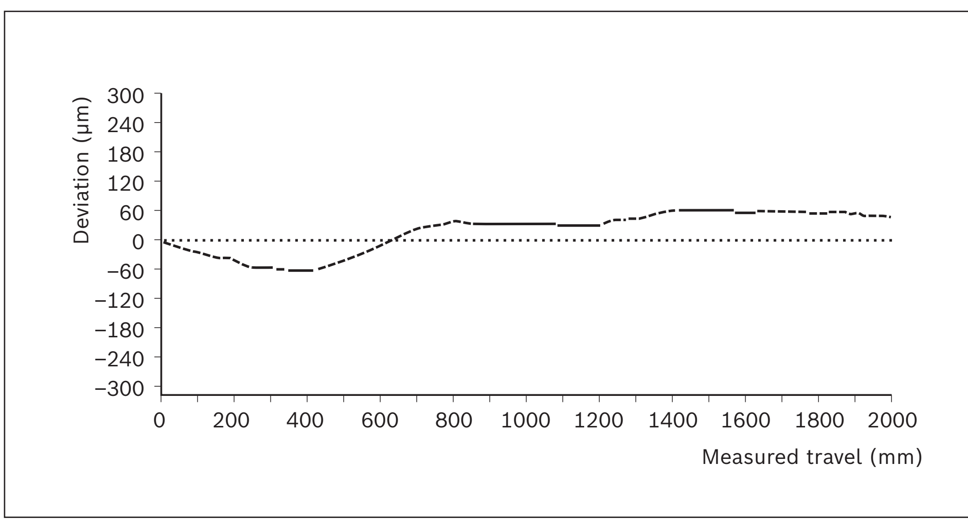
The moment of friction is measured over the entire travel range.



Lead deviation of Ball Screw Assembly for CKK Compact Modules

Option 03 (includes option 01)

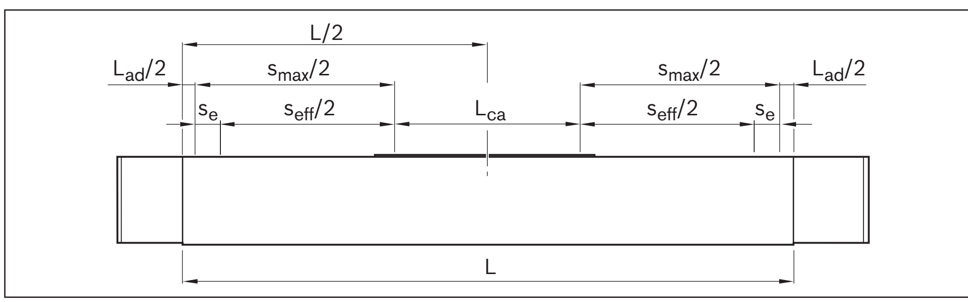
In addition to graphical representation (see illustration), a measurement report is supplied in table form.



Project planning/calculation

Calculation principles

Length calculation of the linear motion system



For length calculation values, see the section titled "Technical data" for the desired Compact Modules (CKK/CKR)

$$L = s_{eff} + 2 \cdot s_e + L_{ca} + L_{ad}$$

Effective stroke

$$s_{eff} = s_{max} - 2 \cdot s_e$$

Stroke: maximum distance from carriage center to the outer-most switch activation points.

Excess travel: Excess travel must be greater than braking distance. The acceleration travel can be adopted as the guideline value for the braking distance.

Mass of the linear motion system

Weight calculation:

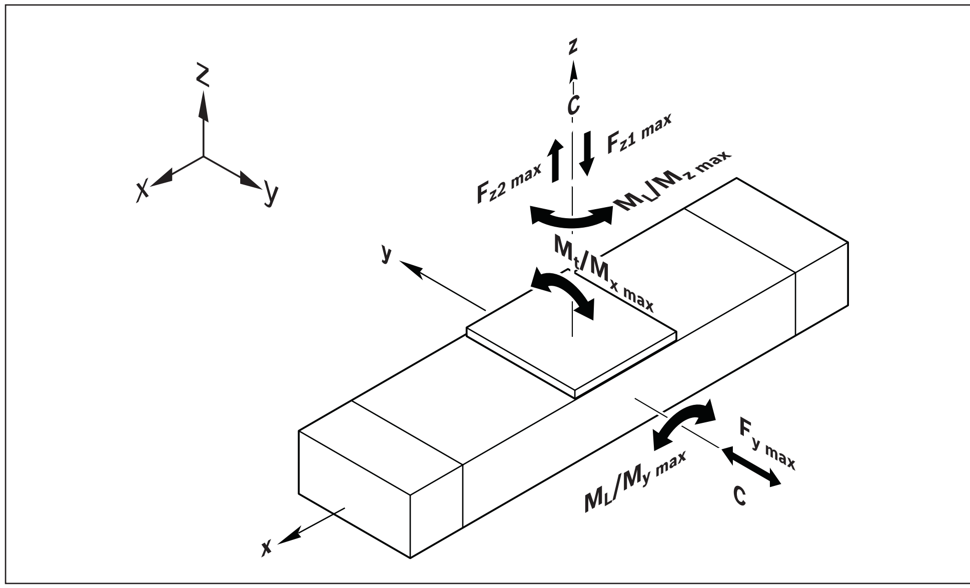
- without motor
- without switch mounting
- without motor attachment

$$m_s = k_{g\ fix} + k_{g\ var} \cdot L + m_{ca}$$

Note on dynamic load capacities and moments

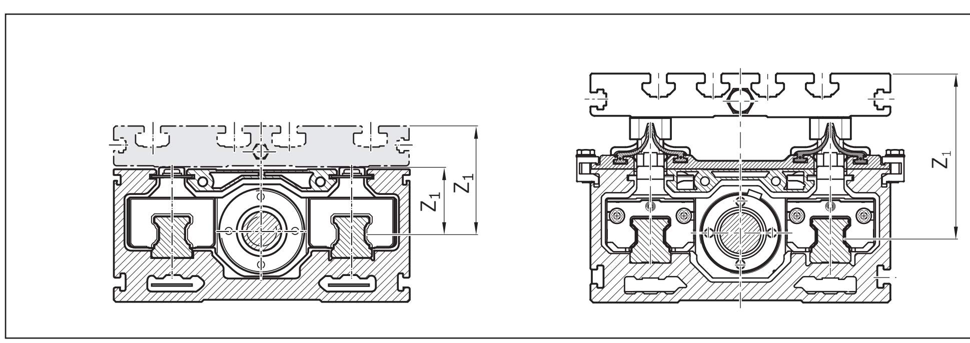
Determination of the dynamic load capacities and moments is based on a total travel of 100,000 m. Often only 50,000 m of total travel are actually stipulated.
For comparison: Multiply values C, M_t and M_L by a factor of 1.26.

Suitable loads



With respect to the desired nominal life, loads for F_{mgw}, F_{mbs} up to approx. 20% of the dynamic characteristics (C_{gw}, C_{bs}) have generally proven suitable.
See "Planning" chapter.
Do not exceed the technical data for the linear motion system.

Application point of the effective force (Z_1)



Modulus of elasticity E

E = 70 000 N/mm²

Maximum permissible load

When selecting Linear Motion Systems, it is essential to consider the maximum permissible load and force tolerances. The values depend on the system. In other words, the tolerances are determined not only by the load ratings of the bearing points but also tolerances based on design and material.
Conditions for combined loads:

$$\frac{|F_y|}{F_{y\,max}} + \frac{|F_z|}{F_{z\,max}} + \frac{|M_x|}{M_{x\,max}} + \frac{|M_y|}{M_{y\,max}} + \frac{|M_z|}{M_{z\,max}} \leq 1$$

Life expectancy calculation of the linear guide

The life of the rolling bearing points contained in a linear motion system can be calculated using the formulas given below. The roller bearings that determine the life of a linear motion system with ball screw assembly are the linear guideway, the ball screw assembly (nut) and the fixed bearing.
The linear guideway in the linear motion system must withstand the load as well as any process forces that occur.
⚠ **The life of the linear motion system is the separately calculated life that is the shortest (for linear guideway, ball screw assembly or fixed bearing).**

Where the operating conditions vary (speed and load), the service life must be calculated using the average values v_{mgw} and F_{mgw}.

Nominal life in meters:

$$L_{gw} = \left(\frac{C_{gw}}{F_{mgw}}\right)^3 \cdot 10^5$$

Nominal life in hours:

$$L_{hgw} = \frac{L_{gw}}{3600 \cdot v_{mgw}}$$

Dynamic equivalent load on bearing of the guideway:

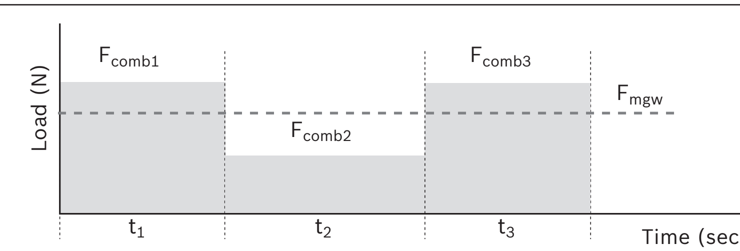
$$F_{mgw} = \sqrt[3]{|F_{eff1}|^3 \cdot \frac{q_{t1}}{100\%} + |F_{eff2}|^3 \cdot \frac{q_{t2}}{100\%} + |F_{eff3}|^3 \cdot \frac{q_{t3}}{100\%} + |F_{effn}|^3 \cdot \frac{q_{tn}}{100\%}}$$

The following applies to linear motion systems:

$$F_{eff} = F_{comb}$$

Combined equivalent bearing load:

$$F_{comb} = |F_y| + |F_z| + C_{gw} \cdot \frac{|M_x|}{M_t} + C_{gw} \cdot \frac{|M_y|}{M_L} + C_{gw} \cdot \frac{|M_z|}{M_L}$$



Mean speed of the guideway:

$$v_{mgw} = \frac{|v_1| \cdot q_{t1} + |v_2| \cdot q_{t2} + \cdot \cdot \cdot . + |v_n| \cdot q_{tn}}{100\%}$$

Service life of Ball Screw Assembly or the fixed bearing

Under variable operating conditions (rotary speed and load), the means F_{mbs} and n_m have to be used when calculating life.

Nominal life in revolutions:

$$L_{bs} = \left(\frac{C_{bs}}{F_{mbs}}\right)^3 \cdot 10^6$$

Nominal life in hours:

$$L_{hbs} = \frac{L_{bs}}{60 \cdot n_m}$$

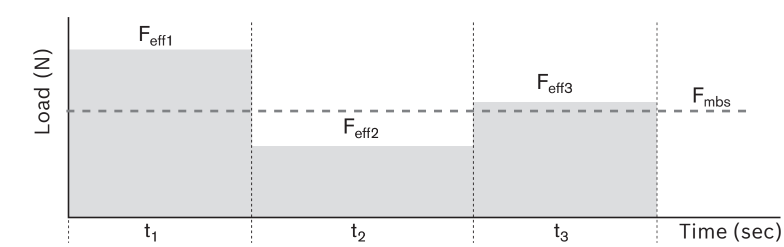
Dynamic equivalent load on bearing of the Ball Screw Assembly:

$$F_{mbs} = \sqrt[3]{|F_{eff1}|^3 \cdot \frac{|n_1|}{n_m} \cdot \frac{q_{t1}}{100\%} + |F_{eff2}|^3 \cdot \frac{|n_2|}{n_m} \cdot \frac{q_{t2}}{100\%} + |F_{eff3}|^3 \cdot \frac{|n_3|}{n_m} \cdot \frac{q_{t3}}{100\%} + \ldots + |F_{effn}|^3 \cdot \frac{|n_n|}{n_m} \cdot \frac{q_{tn}}{100\%}}$$

The following applies to the axial load F_n for linear motion systems:

$$F_{eff} = |F_n|$$

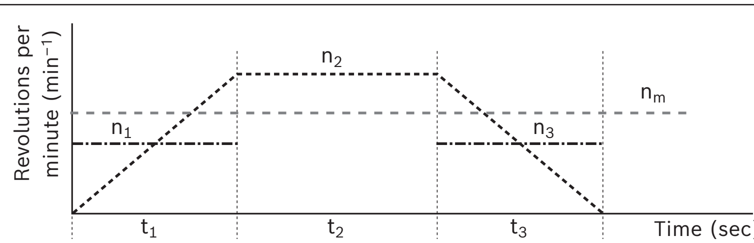
When both the load and the rotary speed vary, the average load F_{mbs} is calculated as follows:



Mean speed of the spindle:

$$n_m = \frac{|n_1| \cdot q_{t1} + |n_2| \cdot q_{t2} + \ldots + |n_n| \cdot q_{tn}}{100\%} = \frac{v_{mgw} \cdot 60\,000}{P}$$

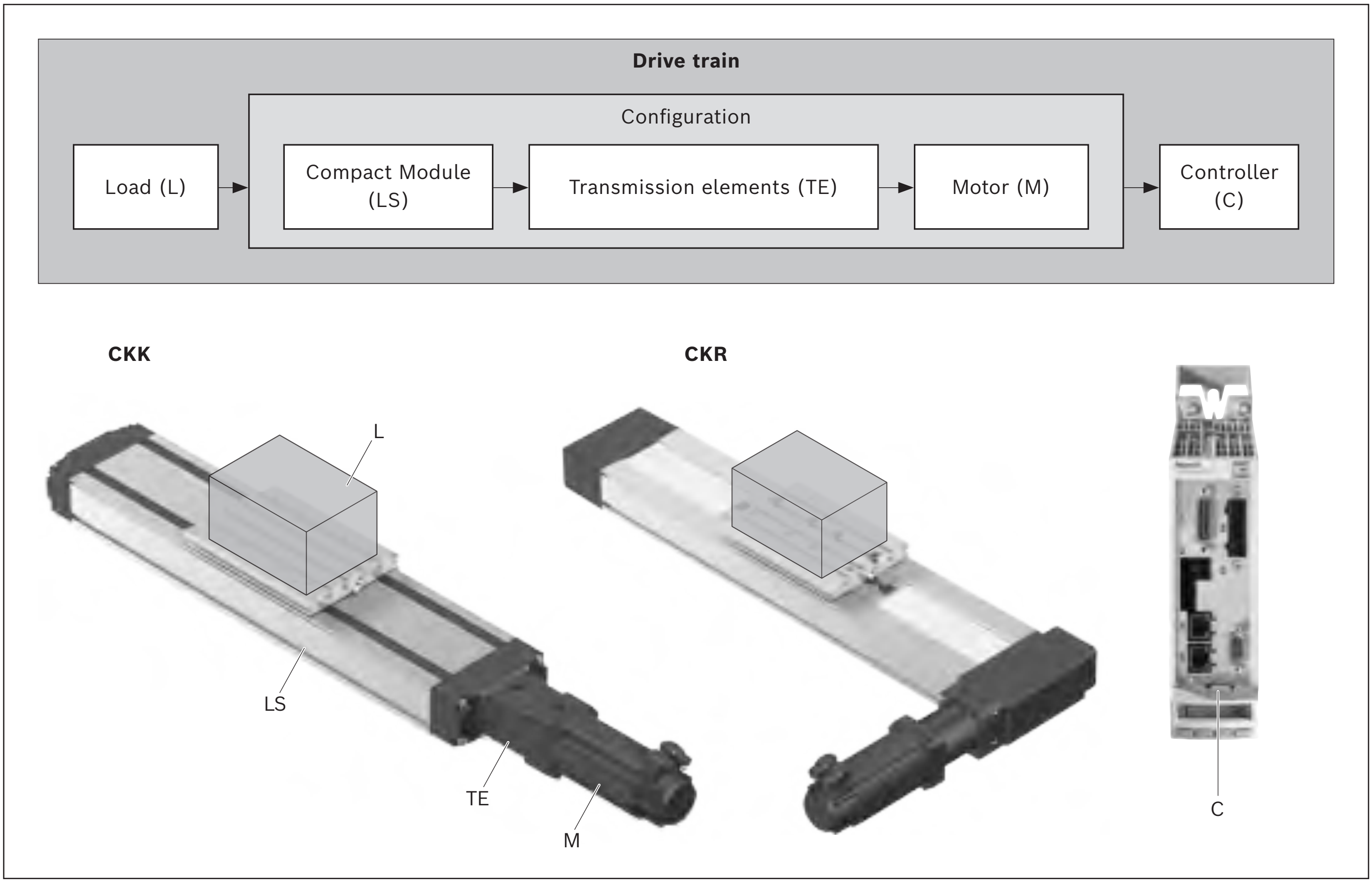
If rotary speed varies, average rotary speed n_m is calculated as follows:



Rotary speed in acceleration and braking phases $n_{1 \ldots n}$:

$$n_{1 \ldots n} = \frac{n_{A1 \ldots n} + n_{E1 \ldots n}}{2}$$

Drive dimensioning

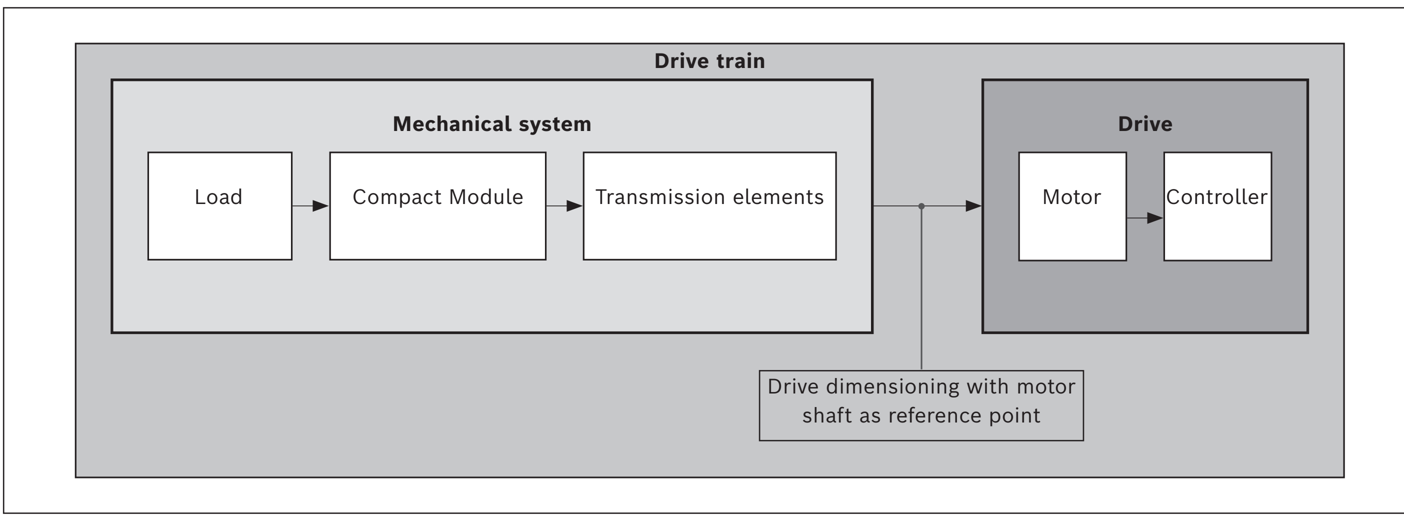


The correct dimensioning and assessment of an application requires structured consideration of the drive train as a whole.

The basic element of the drive train is the configuration – made up of the linear motion system, the transmission element (coupling, belt side drive or gear unit) and the motor – which can be ordered in that constellation in the catalog.

Basic principles

For drive dimensioning, the drive train can be divided into the mechanical system and drive system.
The **mechanical** system includes the physical components – linear motion system and the transmission elements (belt side drive, coupling) – and the load to be carried.
The electric **drive** is a motor-controller combination with corresponding performance data.
The dimensioning of the electric drive is done taking the motor shaft as a reference point.
For drive dimensioning, limits must be taken into account as well as base values. The limits must not be exceeded in order to avoid damaging the mechanical components.



Technical data and formula symbols for the mechanical system

For every component (linear motion system, coupling, belt side drive, gear unit), the corresponding maximum permissible limits for drive torque and speed, and the base values for friction moment and mass moment of inertia have to be used.
The following technical data with the associated formula symbols are used when considering the basic **mechanical system** requirements in the design calculations for dimensioning the drive. The data listed in the table below can be found in the section titled "Technical Data" or is determined using formulas based on the descriptions on the following pages.

		Mechanical system				
		Load	Linear motion system	Transmission element		
				Coupling	Belt side drive	Gearing
Weight moment	(Nm)	$M_g^{5)}$	–	–	–	–
Frictional torque	(Nm)	$–^{4)}$	$M_{Rs}^{3)}$	–	$M_{Rsd}^{3)}$	$M_{Rge}^{3)}$
Mass moment of inertia	(kgm^2)	$J_t^{1)}$	$J_s^{2)}$	$J_c^{3)}$	$J_{sd}^{3)}$	$J_{ge}^{3)}$
Max. permissible speed	(m/s)	–	$v_{max}^{3)4)}$	–	–	–
Max. permissible rotary speed	(min^{-1})	–	$n_p^{1)}$			$n_{ge}^{3)}$
Max. permissible drive torque	(Nm)	–	$M_p^{3)4)}$	$M_{cN}^{3)}$	$M_{sd}^{3)}$	$M_{ge}^{3)}$

1) Determine the value using the appropriate formula
2) Length-dependent value, determined using the appropriate formula
3) Use the value from the table
4) CKK: Length-dependent value, to be read off the graph
5) Any additional process forces are to be taken into consideration as load moments
6) For vertical mounting position: Determine the value using the appropriate formula

Drive dimensioning with motor shaft as reference point

When dimensioning the drive, all relevant design calculation values for the mechanical components in the drive train have to be determined and be expressed/reduced to the motor shaft. For a combination of mechanical components within the drive train, this will result in one value for each of the following:

- Frictional torque M_R
- Mass moment of inertia J_{ex}
- Maximum permissible speed v_{mech} (maximum permissible rotary speed n_{mech})
- Max. permissible drive torque M_{mech}

Determination of the values for each mechanical component in the drive train based on the motor shaft as a reference point

CKK Compact Modules

Frictional torque M_R

For motor attachment via flange and coupling

$$M_R = M_{Rs}$$

For motor attachment via belt side drive

$$M_R = M_{Rsd} + \frac{M_{Rs}}{i}$$

Mass moment of inertia J_{ex}

For motor attachment via flange and coupling

$$J_{ex} = J_s + J_t + J_c$$

For motor attachment via belt side drive

$$J_{ex} = J_{sd} + \frac{(J_s + J_t)}{i^2}$$

CKR Compact Modules

Frictional torque M_R

For motor attachment via gear

$$M_R = M_{Rge} + \frac{M_{Rs}}{i}$$

Mass moment of inertia J_{ex}

For direct motor attachment (without gear)

$$J_{ex} = J_s + J_t$$

For motor attachment via gear

$$J_{ex} = J_{ge} + \frac{(J_s + J_t)}{i^2}$$

Moment of inertia of the linear system

$$J_s = (k_{J\,fix} + k_{J\,var} \cdot L) \cdot 10^{-6}$$

Translatory mass moment of inertia of external load

$$J_t = m_{ex} \cdot k_{J\,m} \cdot 10^{-6}$$

Maximum permissible speed v_{mech} or max. permissible rotary speed n_{mech}
The lowest of all the values for maximum permissible speed or rpm of all mechanical components contained in the drive train determines the maximum permissible speed of the mechanical system which has to be taken into consideration as the upper limit for the drive when sizing the motor.
Depending on the system, the maximum permissible speed/rotary speed of the linear motion system with Ball Screw Assembly is always below the limits for the coupling or belt side drive components, meaning it determines the maximum permissible speed of the mechanical system.

CKK Compact Modules

Maximum permissible speed

$$v_{mech} = v_{max}$$

Maximum permissible rotary speed

For motor attachment via flange and coupling

$$n_{mech} = \frac{v_{mech} \cdot 1\,000 \cdot 60}{P}$$

For motor attachment via belt side drive

$$n_{mech} = \frac{v_{mech} \cdot i \cdot 1\,000 \cdot 60}{P}$$

CKR Compact Modules

Maximum permissible speed

For direct motor attachment (without gear)

$$v_{mech} = v_{max}$$

$$v_{mech} = \frac{n_{mech} \cdot \pi \cdot d_3}{1000 \cdot 60}$$

For motor attachment via gear

$$v_{mech} = \frac{n_{mech} \cdot \pi \cdot d_3}{i \cdot 1\,000 \cdot 60}$$

Maximum permissible rotary speed

For direct motor attachment (without gear)

$$n_{mech} = \frac{v_{mech} \cdot 1\,000 \cdot 60}{\pi \cdot d_3}$$

$$n_{mech} = n_p$$

For motor attachment via gear

$$n_p = \frac{v_{max} \cdot 1\,000 \cdot 60}{\pi \cdot d_3}$$

$$n_{mech} = \text{minimum}\ (n_p \cdot i\ ;\ n_{ge})$$

Maximum permissible drive torque M_{mech}

The lowest (minimum) of all the values for permissible drive torque of all mechanical components contained in the drive train determines the maximum permissible drive torque of the mechanical system which has to be taken into consideration as the upper limit for the drive when sizing the motor.

CKK Compact Modules

For motor attachment via flange and coupling	$M_{mech} = \text{minimum}\ (M_{cN};\ M_p)$
For motor attachment via belt side drive	$M_{mech} = \text{minimum}\ (M_{sd};\ \frac{M_p}{i})$

CKR Compact Modules

For direct motor attachment (without gear)	$M_{mech} = M_p$
For motor attachment via gear	$M_{mech} = \text{minimum}\ (\frac{M_{ge}}{i};\ \frac{M_p}{i})$

⚠ **When considering the complete drive train (mechanical system + motor/controller), the maximum torque of the motor can lie below the maximum value for the mechanical system (M_{mech}) and thus limit the maximum permissible drive torque of the overall drive train.**
If the maximum torque of the motor lies above the upper limit for the mechanical system (M_{mech}), the maximum motor torque must be limited to the permitted value for the mechanical system.

General motor preselection

The motor can be generally preselected using the following conditions.

Condition 1:

The rotary speed of the motor must be greater than or equal to the rotary speed required for the mechanical system (but not exceeding the maximum permissible limit value).

$$n_{max} \geq n_{mech}$$

Condition 2:

Consideration of the ratio of mass moments of inertia of the mechanical system and the motor. The ratio of the mass moments of inertia serves as an indicator for the control performance of a motor-controller combination. The mass moment of inertia of the motor is directly related to the motor size.

Ratio of mass moments of inertia

For preselection, experience has shown that the following ratios will result in high control performance. These are not rigid limits, but values exceeding them will require closer consideration of the specific application.

Application area	V
Handling	≤ 6.0
Processing	≤ 1.5

$$V = \frac{J_{ex}}{J_m + J_{br}}$$

Condition 3:

Estimation of the ratio of the static load moment to the continuous torque of the motor. The torque ratio must be less than or equal to an empirical value of 0.6. This condition roughly factors in the missing dynamic characteristics of an exact motion profile with the required motor torques.

Torque ratio

$$\frac{M_{stat}}{M_0} \leq 0.6$$

Static load moment

$$M_{stat} = M_R + M_g$$

CKK Compact Modules

Weight moment

For vertical mounting position only!

For motor attachment via flange and coupling: i = 1

$$M_g = \frac{P \cdot (m_{ex} + m_{ca}) \cdot g}{2\,000 \cdot \pi \cdot i}$$

CKR Compact Modules

Weight moment

For vertical mounting position only!

$$M_g = \frac{d_3 \cdot (m_{ex} + m_{ca}) \cdot g}{2\,000 \cdot i}$$

In the section titled ➟"Configuration and ordering", users can put together standard configurations, including motor attachment, gears and motor, for the various linear motion system sizes by selecting the appropriate options. By checking the above conditions, it is possible to see whether a standard motor selected in a particular configuration will generally be of a suitable size for the specific application.

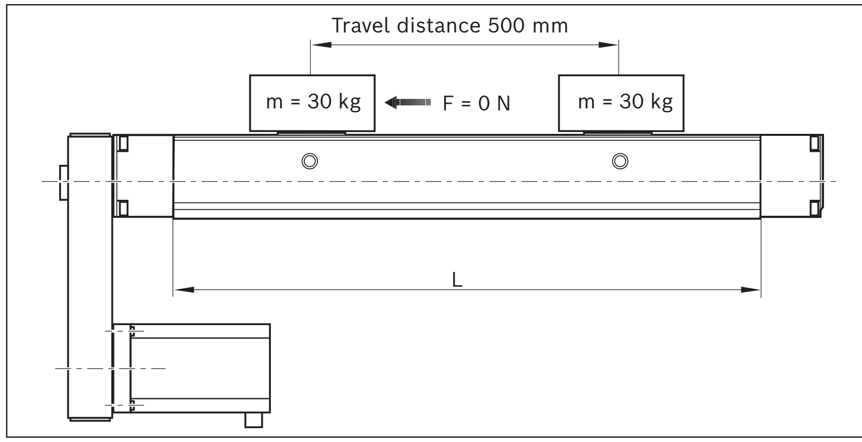
Precise drive dimensioning

Preselecting the motor according to this rough guide is no substitute for the required precise design calculations for the drive, taking all moments/torques and rotary speed levels into account. For precise calculation of the electric drive, including consideration of the specific motion profile, please refer to the performance data in the catalog "Rexroth drive technology". When dimensioning the drive, the maximum permitted values for linear speed, drive torque and acceleration must not be exceeded, in order to avoid damaging the mechanical system.

Sample calculation CKK

Given data

In a handling task, a mass of 30 kg is to be moved horizontally by 500 mm at a travel speed of 0.5 m/s. The following was selected based on the technical data and the installation space:



Compact Modules CKK-110

- Carriage with connection plate L_{ca} = 155 mm
- with cover strip
- Motor attachment via belt side drive, i = 1.5
- with motor MS2N04-B0BTN with brake

Estimation of length L

(For an initial estimate, the greatest possible lead and length are used for the calculation since the permissible velocity can decrease as length increases.)

	$L = s_{eff} + 2 \cdot s_e + L_{ca} + L_{ad}$
Excess travel:	$s_e = 2 \cdot P = 2 \cdot 16 = 32$ mm
Max. travel:	$s_{max} = s_{eff} + 2 \cdot s_e$
	$= 500 + 2 \cdot 32 = 564$ mm
Length:	$L = 564 + 155 + 20 = 739$ mm

Selection of the Ball Screw Assembly

(Better to choose the lowest lead as this is favorable in terms of resolution, braking distance, length.)

Permissible Ball Screw Assembly according to the "Permissible speed" graph at v = 0.5 m/s and L = 739 mm:

BASA 16 x 10 and BASA 16 x 16

Selected BASA (lower lead):

BASA 16 x 10

Maximum permissible speed for BASA 16 x 10 as read off from graph:

$v_{max} = 0.77$ m/s

Calculation of length L

(For selected Ball Screw Assembly)

Excess travel:	$s_e = 2 \cdot P = 2 \cdot 10 = 20$ mm
Max. travel:	$s_{max} = s_{eff} + 2 \cdot s_e$
	$= 500 + 2 \cdot 20 = 540$ mm
Length:	$L = 540 + 155 + 20 = 715$ mm

Friction moment M_R

(motor attachment via belt side drive)

	$M_R = M_{Rsd} + \frac{M_{Rs}}{i}$
Compact module:	$M_{Rs} = 0.43$ Nm
Belt side drive:	$M_{Rsd} = 0.40$ Nm (i = 1.5)
Frictional torque:	$M_R = 0.40 + \frac{0.43}{1.5} = 0.69$ Nm

Mass moment of inertia J_{ex}
(motor attachment via belt side drive)

	$J_{ex} = J_{sd} + \frac{(J_s + J_t)}{i^2}$
Belt side drive:	$J_{sd} = 82 \cdot 10^{-6}$ kgm²
Compact Modules:	$J_s = (k_{J\ fix} + k_{J\ var} \cdot L) \cdot 10^{-6}$
	$= (8.432 + 0.031 \cdot 715) \cdot 10^{-6}$
	$= 30.597 \cdot 10^{-6}$ kgm²
External load:	$J_t = m_{ex} \cdot k_{J\ m} \cdot 10^{-6}$
	$= 30 \cdot 2.533 \cdot 10^{-6}$
	$= 75.99 \cdot 10^{-6}$ kgm²
Mass moment of inertia:	$J_{ex} = 82 \cdot 10^{-6} + \frac{(30.597 \cdot 10^{-6} + 75.99 \cdot 10^{-6})}{1.5^2}$
	$= 129.372 \cdot 10^{-6}$ kgm²

Maximum permissible rotary speed n_{mech}
(motor attachment via belt side drive)
Limit for mechanical system

	$n_{mech} = \frac{(v_{mech} \cdot i \cdot 1\,000 \cdot 60)}{P}$
Max. permissible speed:	$v_{mech} = v_{max} = 0.77$ m/s
Max. permissible rotary speed:	$n_{mech} = \frac{(0.77 \cdot 1.5 \cdot 1\,000 \cdot 60)}{10}$
	$= 6\,930$ min⁻¹

Maximum rotary speed of application n_{mech}
(motor attachment via belt side drive)
Application tolerance

Travel speed:	$v_{mech} = 0.5$ m/s
Rotary speed:	$n_{mech} = \frac{0.5 \cdot 1.5 \cdot 1\,000 \cdot 60}{10}$
	$= 4\,500$ min⁻¹

Sample calculation CKK

Maximum permissible drive torque M_{mech}
(motor attachment via belt side drive)
Limit for mechanical system

$M_{mech} = \text{Minimum}\ (M_{sd}; \frac{M_p}{i})$

Belt side drive: $M_{sd} = 5.11$ Nm (gear ratio i = 1.5 for MS2N04-C0BTN)

Compact Modules: $M_p = 13.51$ Nm

Drive torque: $M_{mech} = \text{Minimum}\ (5.11; \frac{13.51}{1.5})$

$= \text{Minimum}\ (5.11; 9.0)$

$= 5.11$ Nm

Motor preselection check
Selected motor:
MS2N04-C0BTN with brake

Condition 1:

Rotary speed: $n_{max} \geq n_{mech}$

$6{,}000 \geq 4500$ condition met – motor selection OK

Condition 2:

Mass moment of inertia ratio: $V = \frac{J_{ex}}{J_m + J_{br}}$

Motor inertia: $J_m = 110 \cdot 10^{-6}\ \text{kgm}^2$

Brake moment of inertia: $J_{br} = 50 \cdot 10^{-6}\ \text{kgm}^2$

Moment of inertia ratio: $V = \frac{129.372 \cdot 10^{-6}}{(110 \cdot 10^{-6} + 50 \cdot 10^{-6})} = 0.81$

Handling condition: $V \leq 6$

$0.81 \leq 6$ condition met
– motor selection OK

Condition 3:

Torque ratio: $\frac{M_{stat}}{M_0} \leq 0.6$

Static load moment: $M_{stat} = M_R + M_g$ (installed horizontally $M_g = 0$)

$= 0.69$ Nm

Continuous motor torque: $M_0 = 2.8$ Nm

Torque ratio: $\frac{0.69}{2.8} = 0.25$

$0.25 \leq 0.6$ condition met
– motor selection OK

All three conditions met ➟ selected motor is suitable for the application.

Result

Compact Module CKK-110

Length:	L	=	715 mm	
Max. travel:	s_{max}	=	540 mm	
Carriage length:	L_{ca}	=	155 mm	
Ball Screw Assembly:	Nominal diameter:		d_0	= 16 mm
	Lead:		P	= 10 mm

with cover strip
Motor attachment via belt side drive, gear ratio i = 1.5
Motor preselection: MS2N04-B0BTN with brake

For precise dimensioning of the electric drive, the motor-controller combination must always be considered, as the performance data (e.g. max. useful speed and max. torque) will depend on the controller used.

When doing this, the following data must be considered:

Frictional torque:	M_R	= 0.69 Nm
Mass moment of inertia:	J_{ex}	= $129.372 \cdot 10^{-6}$ kgm^2
Travel speed:	v_{mech}	= 0.5 m/s (n_{mech} = 4 500 min^{-1})
Drive torque limit:	M_{mech}	= 5.11 Nm

➠ The motor torque must be limited to 5.11 Nm on the drive side!

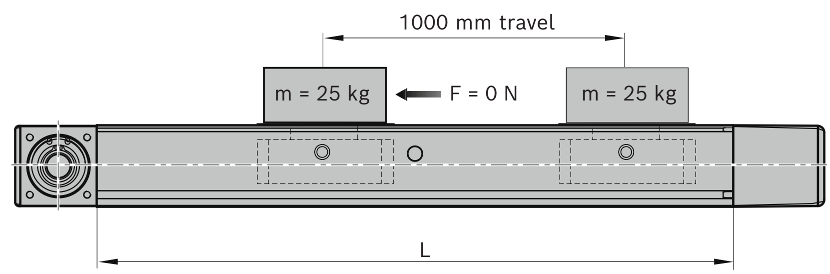
Acceleration limit:	a_{max}	= 50 m/s^2
Limit for travel speed:	v_{max}	= 0.77 m/s (n_{mech} = 6 930 min^{-1})

Besides the preferred type MS2N04-B0BTN, other motors with identical connection dimensions can be adapted while taking care not to exceed the calculated limit values.

Sample calculation CKR

Given data

In a handling task, a mass of 25 kg is to be moved horizontally by 1000 mm at a travel speed of 1.5 m/s. The following was selected based on the technical data and the installation space:



Compact Module CKR-145

- Carriage length = 190 mm
- With connection plate
- Motor attachment via planetary gearbox, i = 5
- with motor MS2N04-D0BQN without brake

Calculation of length L

(In most cases, the recommended limit for excess travel is 2x feed constant. The excess travel must be greater than the emergency stop stopping distance, which is calculated for exact dimensioning of the electrical drive.)

$$L = s_{max} + L_{ca} + L_{ad}$$

Feed constant: $u = \frac{u(i=1)}{i} = \frac{165}{5} = 33\text{ mm}$

Excess travel: $s_e = 2 \cdot u = 2 \cdot 33 = 66\text{ mm}$

Max. travel: $s_{max} = s_{eff} + 2 \cdot s_e = 1\,000 + 2 \cdot 66 = 1132\text{ mm}$

Length: $L = 1\,132 + 190 + 75 = 1397\text{ mm}$

Frictional torque M_R

$$M_R = M_{Rge} + \frac{M_{Rs}}{i}$$

Compact Module: $M_{Rs} = 2.04\text{ Nm}$

Gear: $M_{Rge} = 0.17\text{ Nm}$

Frictional torque: $M_R = 0.17 + \frac{2.04}{5} = 0.58\text{ Nm}$

Mass moment of inertia J_{ex}

$$J_{ex} = J_{ge} + \frac{(J_s + J_t)}{i^2}$$

Gear: $J_{ge} = 27 \cdot 10^{-6}$

Compact Module: $J_s = (k_{J\,fix} + k_{J\,var} \cdot L) \cdot 10^{-6}$
$= (2\,276.71 + 0.3172 \cdot 1397) \cdot 10^{-6}$
$= 2\,719.838 \cdot 10^{-6}\text{ kgm}^2$

External load: $J_t = m_{ex} \cdot k_{J\,m} \cdot 10^{-6}$
$= 25 \cdot 689.59 \cdot 10^{-6}$
$= 17\,239.75 \cdot 10^{-6}\text{ kgm}^2$

Mass moment of inertia: $J_{ex} = 27 \cdot 10^{-6} + \frac{(2\,719.838 \cdot 10^{-6} + 17\,239.75 \cdot 10^{-6})}{5^2}$
$= 825.384 \cdot 10^{-6}\text{ kgm}^2$

Maximum permissible rotary speed n_{mech}
(Motor attachment via gear reducer, without considering the motor)
Limit for mechanical system

$n_{mech} = \text{Minimum}\ (n_p \cdot i\ ;\ n_{ge})$

Compact Module: $n_p = \frac{(v_{max} \cdot 1\,000 \cdot 60)}{\pi \cdot d_3} = \frac{(5 \cdot 1\,000 \cdot 60)}{\pi \cdot 52.52} = 1\,818\ \text{min}^{-1}$

Gear: $n_{ge} = 8\,000\ \text{min}^{-1}$

Max. permissible rotary speed: $n_{mech} = \text{Minimum}\ (1\,818 \cdot 5\ ;\ 8\,000) = \text{Minimum}\ (9\,090\ ;\ 8\,000) = 8\,000\ \text{min}^{-1}$

Maximum permissible speed v_{mech}
(Motor attachment via gear reducer, without considering the motor)
Limit for mechanical system

$v_{mech} = \frac{(n_{mech} \cdot \pi \cdot d_3)}{i \cdot 1\,000 \cdot 60}$

Max. permissible speed: $v_{mech} = \frac{(8\,000 \cdot \pi \cdot 52.52)}{5 \cdot 1\,000 \cdot 60} = 4.4\ \text{m/s}$

Maximum permitted speed of the application n_{mech}
(Motor attachment via gear reducer, without considering the motor)
Application tolerance

Travel speed: $v_{mech} = 1.5\ \text{m/s}$

Rotary speed: $n_{mech} = \frac{(1.5 \cdot 5 \cdot 1\,000 \cdot 60)}{\pi \cdot 52.52} = 2\,727\ \text{min}^{-1}$

Maximum permissible drive torque M_{mech}
(Motor attachment via gear reducer, without considering the motor)
Limit for mechanical system

$M_{mech} = \text{Minimum}\ \left(\frac{M_{ge}}{i}\ ;\ \frac{M_p}{i}\right)$

Compact Module: $M_p = 32.5\ \text{Nm}$

Gear: $M_{ge} = 40\ \text{Nm}$

Drive torque: $M_{mech} = \text{Minimum}\ \left(\frac{40}{5}\ ;\ \frac{32.5}{5}\right) = \text{Minimum}\ (8.0\ ;\ 6.5) = 6.5\ \text{Nm}$

Sample calculation CKR

Motor preselection check

Selected motor:
MS2N04-D0BQN without brake

Condition 1:

Rotary speed: $n_{max} \geq n_{mech}$

$6{,}000 \geq 2727$ condition met – motor selection OK

Condition 2:

Mass moment of inertia ratio: $V = \dfrac{J_{ex}}{J_m + J_{br}}$

Motor inertia: $J_m = 160 \cdot 10^{-6}\ \text{kgm}^2$

Brake moment of inertia: $J_{br} = 0\ \text{kgm}^2$ (without brake)

Moment of inertia ratio: $V = \dfrac{825.384 \cdot 10^{-6}}{160 \cdot 10^{-6}}$

$= 5.16$

Handling condition: $V \leq 6$

$5.16 \leq 6$ condition met
– motor selection OK

Condition 3:

Torque ratio: $\dfrac{M_{stat}}{M_0} \leq 0.6$

Static load moment: $M_{stat} = M_R + M_g$ (installed horizontally $M_g = 0$)

$\dfrac{0.58}{3.85} = 0.58\ \text{Nm}$

Continuous motor torque: $M_0 = 3.85\ \text{Nm}$

Torque ratio: $= 0.15$

$0.15 \leq 0.6$ condition met
– motor selection OK

All three conditions met ➠ selected motor is suitable for the application.

Result

Compact Module CKR-145

Length L = 1 397 mm
Max. travel s_{max} = 1 132 mm
Carriage length L_{ca} = 190 mm
Belt drive
With connection plate
Motor attachment via planetary gearbox, gear ratio i = 5
Motor preselection: MS2N04-D0BQN without brake

For precise dimensioning of the electric drive, the motor-controller combination must always be considered, as the performance data (for example, maximum useful speed and maximum torque) will depend on the controller used.
When doing this, the following data must be considered.

Frictional torque M_R = 0.58 Nm
Mass moment of inertia J_{ex} = $825.384 \cdot 10^{-6}$ kgm^2
Travel speed v_{mech} = 1.5 m/s (n_{mech} = 2 727 min^{-1})
Drive torque limit M_{mech} = 6.5 Nm
➠ The motor torque must be limited to 6.5 Nm on the drive side!

Acceleration limit a_{max} = 50 m/s^2
Limit for travel speed v_{max} = 3.3 m/s (n_{max} = 6 000 min^{-1})

After determining the emergency-stop braking path during precise dimensioning, the selected excess travel must be checked to see whether it is sufficient and adjusted if necessary.

Besides the preferred type MS2N04-D0BQ, other motors with identical connection dimension can be adapted while taking care not to exceed the calculated limits.

Abbreviations

Abbreviation/ index	Designation	Unit
a	Acceleration	(m/s^2)
a_{max}	Maximum acceleration	(m/s^2)
BASA	Ball Screw Assembly	(–)
B_t	Belt type	(–)
c_{spe}	Specific spring rate	(N)
C_{gw}	Dynamic load capacity, guideway	(N)
C_{bs}	Dynamic load capacity for Ball Screw Assembly	(N)
C_{fb}	Dynamic load capacity for fixed bearing	(N)
d_0	Nominal diameter of Ball Screw Assembly	(mm)
d_3	Belt pulley diameter	(mm)
f_w	Load factor	(–)
F_n	Axial load of the Ball Screw Assembly	(N)
F_{eff}	Effective equivalent axial load	(N)
F_{bp}	Max. belt driving force	(N)
F_{comb}	Combined equivalent bearing load	(N)
F_{mbs}	Dynamic equivalent load on bearing of the Ball Screw Assembly	(N)
F_{mgw}	Dynamic load on bearing of the guideway	(N)
F_n	Axial load of the Ball Screw Assembly	(N)
$F_{t\ perm}$	Belt elasticity limit	(N)
F_y	Load from a resulting force in y-direction	(N)
$F_{y\ max}$	Max. dynamic load in y-direction	(N)
F_z	Load from a resulting force in z-direction	(N)
$F_{z\ max}$	Max. dynamic load in z-direction	(N)
g	Gravity (= 9.81)	(m/s^2)
i	Gear ratio	(–)
I_y	Planar moment of inertia about the y-axis	(cm^4)
I_z	Planar moment of inertia about the z-axis	(cm^4)
J_{br}	Mass moment of inertia of the motor brake	(kgm^2)
J_c	Mass moment of inertia of coupling	(kgm^2)
J_{dc}	Mass moment of inertia of drive train	(kgm^2)
J_{ex}	Mass moment of inertia of the mechanical system	(kgm^2)
J_{ge}	Mass moment of inertia of gear about the motor journal	(kgm^2)
J_m	Mass moment of inertia of motor	(kgm^2)
J_s	Mass moment of inertia of linear motion system	(kgm^2)
J_{sd}	Mass moment of inertia of belt side drive about the motor journal	(kgm^2)
J_t	Translatory mass moment of inertia of external load based on the linear motion system screw journal	(kgm^2)
$k_{g\ fix}$	Constant for fixed portion of mass	(kg)
$k_{g\ var}$	Constant for variable-length portion of mass	(kg/mm)
$k_{J\ fix}$	Constant for fixed portion of mass moment of inertia	($kgmm^2$)
$k_{J\ m}$	Constant for mass-specific portion of mass moment of inertia	(mm^2)
$k_{J\ var}$	Constant for variable-length portion of mass moment of inertia	(kgmm)
L	Length of the linear motion system	(mm)
L_{ad}	Additional length	(mm)
L_{ca}	Carriage length	(mm)
L_{bs}	Nominal life (Ball Screw Assembly, fixed bearing)	(min^{-1})
L_{hbs}	Nominal life (Ball Screw Assembly, fixed bearing)	(h)
L_{gw}	Nominal life of the guideway	(m)
L_{hgw}	Nominal life of the guideway	(h)
L_m	Motor length	(mm)
L_{max}	Max. length	(mm)
L_W	Center-to-center distance between carriages	(mm)
m_{br}	Holding brake mass	(kg)
m_{ca}	Moved system mass of carriage	(kg)
m_{ex}	Moved external mass	(kg)
m_{fc}	Mass of flange and coupling	(kg)
m_m	Motor mass	(kg)
m_s	Mass of the linear motion system (without attachments)	(kg)
m_{sd}	Mass of belt side drive	(kg)
M_0	Continuous motor torque	(Nm)
M_{cN}	Nominal coupling torque	(Nm)
M_g	Weight moment at motor journal	(Nm)
M_{ge}	Maximum permissible acceleration torque of the gear (on the output drive)	(Nm)
M_L	Dynamic longitudinal moment load capacity	(Nm)
M_m	Equivalent dynamic torque	(Nm)
M_{max}	Max. possible motor torque	(Nm)
M_{mech}	Max. permissible drive torque for the mechanical system	(Nm)
M_p	Max. permissible drive torque (at the drive journal)	(Nm)
M_R	Frictional torque at motor journal	(Nm)
M_{Rge}	Frictional torque of gear at motor journal	(Nm)
M_{Rs}	Frictional torque of system	(Nm)
M_{Rsd}	Friction moment of belt side drive at motor journal	(Nm)
M_{sd}	Maximum permissible drive torque of the belt side drive	(Nm)
M_{stat}	Static load moment	(Nm)
M_t	Dynamic torsional moment load capacity	(Nm)
M_x	Dynamic torsional moment around the x-axis	(Nm)
$M_{x\ max}$	Maximum permissible torsional moment around the x-axis	(Nm)

Abbreviation/ index	Designation	Unit
M_y	Dynamic torsional moment around the y-axis	(Nm)
$M_{y\ max}$	Maximum permissible torsional moment around the y-axis	(Nm)
M_z	Dynamic torsional moment around the z-axis	(Nm)
$M_{z\ max}$	Maximum permissible torsional moment around the z-axis	(Nm)
n	Rotary speed of the Ball Screw Assembly	(min^{-1})
$n_1, n_2, \ldots n_n$	Rotary speed in acceleration and braking phases	(min^{-1})
$n_{A1\ \ldots\ n}$	Starting speed in Phase 1–n	(min^{-1})
$n_{E1\ \ldots\ n}$	Ending speed in Phase 1–n	(min^{-1})
n_{ge}	Maximum permissible rotary speed of the gear	(min^{-1})
n_m	Mean rotary speed of the Ball Screw Assembly	(min^{-1})
n_{mech}	Maximum permissible speed of mechanical system	(min^{-1})
n_{max}	Max. motor speed	(min^{-1})
n_p	Maximum permissible rotary speed of the linear motion system	(min^{-1})
P	Screw lead	(mm)
P_{app}	Effective power in application	(W)
Keyway	Keyway	(–)
$q_{t1..n}$	Time step of the phases	(%)
s_a	Acceleration travel	(mm)
s_e	Excess travel (excess travel s_e should be greater than braking distance. The acceleration travel can be used as a guideline for braking distance.)	(mm)
s_{eff}	Effective stroke	(mm)
s_{min}	Min. travel range	(mm)
s_{max}	Max. travel distance	(mm)
Screw support	Screw support	
t_a	Acceleration time, braking time	(s)
$t_1, t_2, \ldots t_n$	Time for phase 1 … n	(s)
u	Feed constant	(mm/rev)
$v_1, v_2, \ldots v_n$	Speed in phase 1 … n	(m/s)
v_{max}	Maximum permissible speed	(m/s)
v_{mech}	Maximum permissible speed for mechanical system	(m/s)
v_{mgw}	Mean speed of the guideway	(m/s)
V	Ratio of mass moments of inertia of drive train and motor	(–)
z_1	Application point of the effective force	(mm)

Order example CKK-110-NN-1

Ordering data		Description
Compact Module	CKK-110-NN-1	Compact Module with ball screw assembly CKK110-NN-1
Length L	715	Length = 715 mm
Version	RV01	Belt side drive
Guideway	01	Mainbody Standard
Lubrication[1)]	LSS	Standard Lubrication
Drive		
Ball Screw Assembly (BASA d_0 x P)	02	Nominal diameter = 16 mm, lead = 10 mm
Carriage		
Carriage[2)]	41	Carriage with connection plate, L_{ca} = 155 mm
Carriage center-to-center distance L_w	–	only necessary with carriages with variable center-to-center distance
Motor attachment		
Gear ratio	–	without gear ratio
Attachment kit[3)]	23	Motor attachment for servo motor MS2N04-B0BTN
Motor		
Motor code	212	MS2N04-B0BTN, 1 cable, with brake
Motor connector position	270	Motor connector position = 270°
Cover		
Cover	02	with cover strip
Switching system (max. 6 switches/sensors selectable)		
1st sensor	21	REED, changeover contact (NC: C+NC, NO: C+NO)
2nd sensor	22	Hall, PNP normally closed (NC)
3rd sensor	21	REED, changeover contact (NC: C+NC, NO: C+NO)
Mounting duct / cable duct	25	Mounting channel
Socket-plug	17	Socket-plug
Documentation	01	Standard report

1) Not a part of the option code
2) For the permissible values refer to the "General technical data"
3) The motor geometry code is required for motors according to customer specifications

Inquiry/order form CKK-xxx-NN-1

Ordering data		**Description**
Compact module		
Length L		
Version		
Guideway		
Lubrication[1]		
Drive		
Ball Screw Assembly (BASA d_0 x P)		
Carriage		
Carriage[2]		
Carriage center-to-center distance L_w		
Motor attachment		
Gear ratio		
Attachment kit[3]		
Motor		
Motor code		
Motor connector position		
Cover		
Cover		
Switching system		
1st sensor		
2nd sensor		
3rd sensor		
Mounting duct / cable duct		
Socket-plug		
Documentation		

1) Not a part of the option code
2) For the permissible values refer to the "General technical data"
3) The motor geometry code is required for motors according to customer specifications

Motor attachment kits according to customer specification (motor geometry code)

The dimensions queried result in a unique "motor geometry code":

□□ – □□ – □□□ – □□□ – □□□ – M□□ – □□□ – □□□

ØD = Shaft diameter
C = Shaft length
ØE = Centering diameter
C_1 = Centering depth
ØF = Pitch diameter
ØG = Through-hole for mounting screw (specify thread diameter)
B_1 = Flange thickness
A = Flange edge dimension

Quantity Acceptance of: ____ pcs, _____ per month, ______ per year, per order, or ______________________

Comments:

____

From

Company: ______________________ Name: ______________________
Address: ______________________ Department: ______________________
______________________ Phone: ______________________
______________________ Telefax: ______________________

Order example CKR-110-NN-1

Ordering data		**Description**
Compact Modules	CKR-110-NN-1	Compactmodul with toothbelt drive CKR-110-NN-1
Length L	1500	Length = 1500 mm
Version	MG10	Gear attachment right side
Guide	01	Main body standard
Drive		
Toothed belt drive	08	Toothed belt drive, with attachment for gear reducer and with second drive shaft
Lubrication[1)]	LSS	Standard lubrication
Carriage		
Carriage[2)]	41	Carriage, with connecting plate, L_{ca} = 155 mm
Motor attachment		
Gearing	23	Gear reducer PG050, i=5, for motor MS2N04
Motor		
Motorcode	212	MS2N04-B0BTN, 1 cable connection, with brake
Motor plug location	090	Motor plug location = 90°
Switching system (max. 6 switches/sensors selectable)		
1st sensor	21	REED, changeover contact (NC: C+NC, NO: C+NO)
2nd sensor	22	Hall, PNP normally closed (NC)
3rd sensor	21	REED, changeover contact (NC: C+NC, NO: C+NO)
Mounting duct / cable duct	25	Mounting channel
Socket-plug	17	Socket-plug
Documentation	01	Standard report

1) Not a part of the option code
2) For the permissible values refer to the "General technical data"

Inquiry/order form CKR-xxx-NN-1

Ordering data		**Description**
Compact Modules		
Length L		
Version		
Guide		
Drive		
Toothed belt drive		
Lubrication[1]		
Carriage		
Carriage[2]		
Motor attachment		
Gearing		
Motor		
Motorcode		
Motor plug location		
Switching system (max. 6 switches/sensors selectable)		
1st sensor		
2nd sensor		
3rd sensor		
Mounting duct / cable duct		
Socket-plug		
Documentation		

1) Not a part of the option code
2) For the permissible values refer to the "General technical data"

Quantity Acceptance of: ____ pcs, _____ per month, ______ per year, per order, or ______________________

Comments:

____

From

Company: ________________________________ Name: ________________________________

Address: ________________________________ Department: ________________________________

________________________________ Phone: ________________________________

________________________________ Telefax: ________________________________

The Drive & Control Company

Rexroth
Bosch Group

Precision Modules PSK

Identification system for short product names

Short product name		Example::	P	S	K	-	050	-	N N	-	1
System	=	Precision Module (**P**)									
Guideway	=	Integrated Ball Rail System (**S**)									
Drive unit	=	Precision Ball Screw Assembly (**K**)									
Size	=	040 / **050** / 060 / 090									
Version	=	**N**ormal version									
Generation	=	Product generation **1**									

Precision Modules PSK

Product overview

Product Description

Outstanding features

Rexroth Precision Modules are precise, ready-to-install linear motion systems that combine high performance with compact dimensions.
Rexroth offers favorable price/performance ratios and fast delivery.

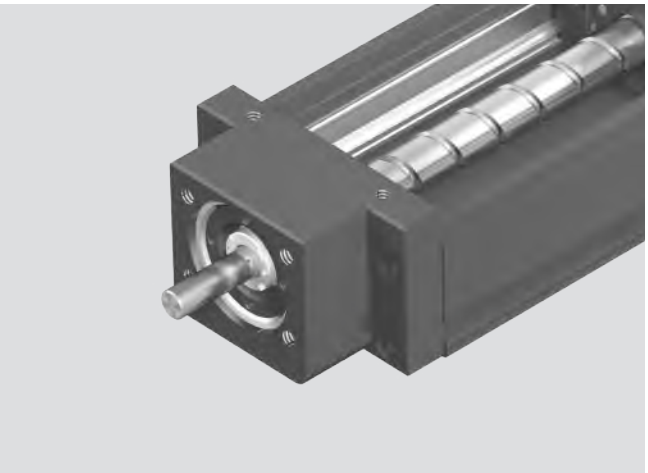
Structural design
- Extremely compact and rigid precision steel profile (frame) with reference edge and integrated Rexroth guideway geometry
- Precision ball screw drive in tolerance grade 7 with zero-backlash nut system
- Aluminum fixed bearing end block with preloaded ball bearings and ball screw journal
- Floating bearing end block with double ball bearings
- One or two steel carriages, standard length or long, for PSK without cover or with cover plate
- One aluminum carriage, standard length or long, for PSK with sealing strip

Attachments
- Maintenance-free digital AC servo drives with integrated brake and attached feedback, or stepping motors
- Motor mount and coupling or timing belt side drive for motor attachment
- Adjustable switches over the entire travel range
- Aluminum profile mounting duct

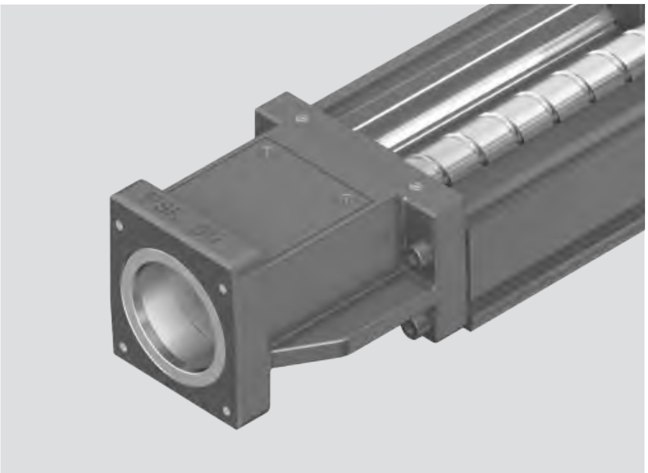
Drive controllers and control systems

Further highlights

- Extremely stiff and precise miniature drive unit
- Optimal travel performance, high load capacities, high precision and high rigidity due to integrated Rexroth Ball Rail System
- High positioning accuracy and repeatability due to Precision Ball Screw Assembly with zero-backlash nut system
- Repeatability up to 0.005 mm
  Positioning accuracy up to 0.01 mm
  Guidance accuracy up to 0.005 mm
- High travel speeds combined with high precision due to Ball Rail Systems, large screw diameters and leads, and double floating bearing
- Rapid mounting and easy axis alignment thanks to machined reference edge on the frame
- Precise alignment and secure mounting of attachments thanks to tapped bores and pin holes in the carriage
- Easy motor attachment via locating feature and fastening threads
- Low-cost maintenance provided by one-point lubrication (grease) for Ball Rail System and Precision Ball Screw Assembly
- Precision Modules in standard lengths for fast delivery



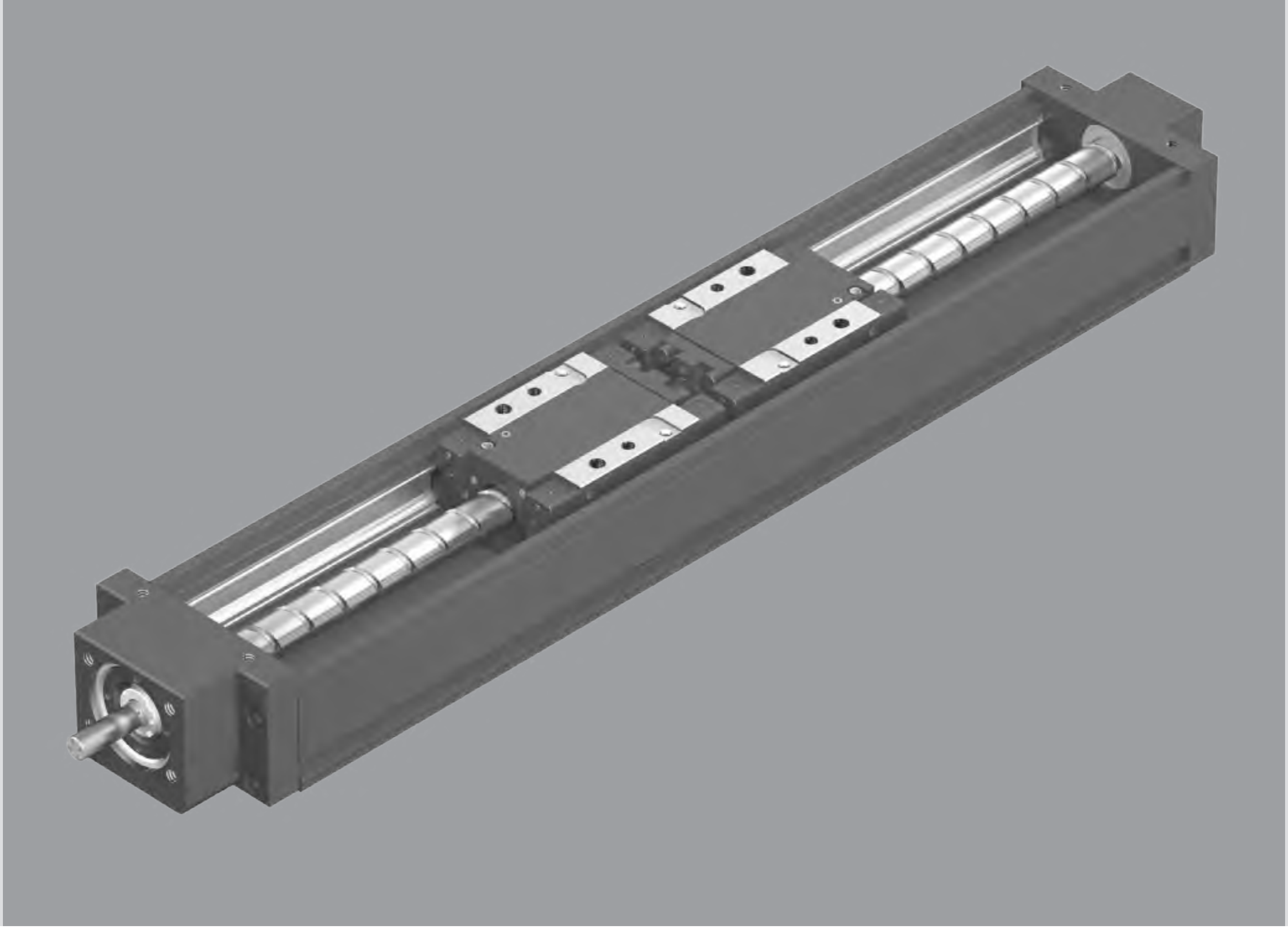
Fixed bearing end block with ball screw journal

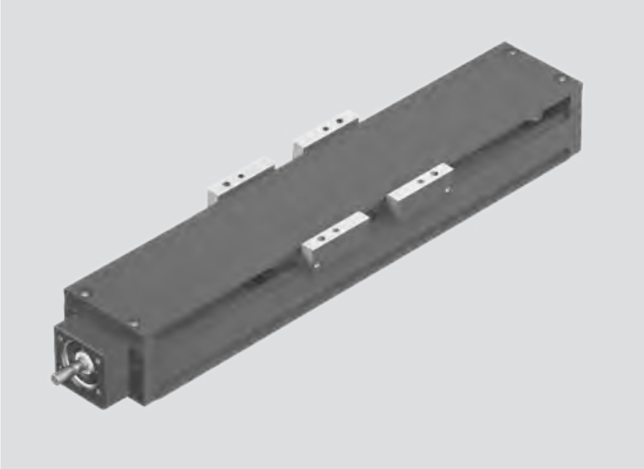


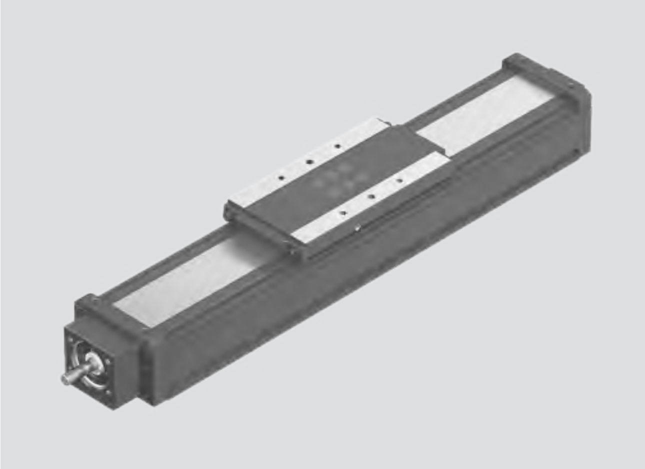
Fixed bearing end block with integrated motor mount

For mounting, maintenance and start-up, see
“Instructions for Precision Modules PSK.”

PSK without cover







Internal elements protected by cover plate
One or two steel carriages, standard length or long

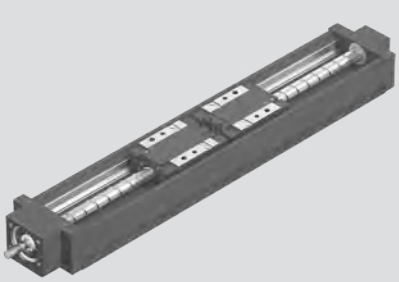
Internal elements protected by stainless steel sealing strip
Aluminum carriage, standard length or long

Product overview

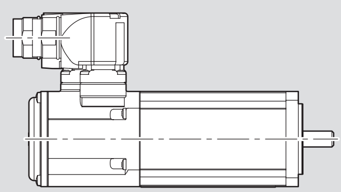
Motor selection

Based on drive controllers and control system

A choice can be made between several different motor/controller combinations to achieve the most cost-efficient solution for each customer application.
When sizing the drive, always consider the motor-controller combination.
For more information about motors and control systems, see the following Rexroth catalog:
– IndraDrive for Linear Motion Systems

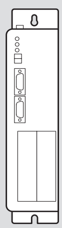


Digital AC servo motors MSK

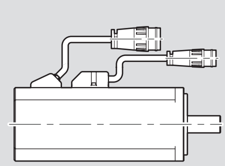


Digital controllers IndraDrive

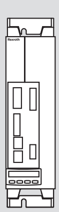
SAFETY ON BOARD



Digital AC servo motors MSM



Digital controllers IndraDrive Cs

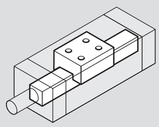
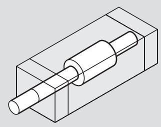
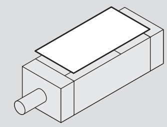
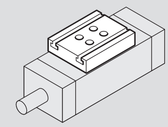
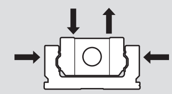


Precision Modules PSK can be supplied complete with motor, controller and control unit.

Product overview

Load capacities and sizes

Overview of types with load capacities

Type	System	Guideway	Drive unit [1]	Size	Cover	Carriage (carr.)		Load capacities
								
							Number	C (N)
PSK	Precision Module	Rail System	Precision Ball Screw Assembly	PSK-040	Without / cover plate	Standard	1 carr.	3 065
							2 carr.	4 980
				PSK-050	Without / cover plate	Standard	1 carr.	7 300
							2 carr.	11 850
					Sealing strip	Standard	1 carr.	7 300
						Long	1 carr.	11 850
				PSK-060	Without / cover plate	Standard	1 carr.	7 300
							2 carr.	11 850
						Long	1 carr.	9 000
							2 carr.	14 620
					Sealing strip	Standard	1 carr.	9 000
						Long	1 carr.	14 620
				PSK-090	Without / cover plate	Standard	1 carr.	21 300
							2 carr.	34 600
						Long	1 carr.	27 500
							2 carr.	44 670
					Sealing strip	Standard	1 carr.	21 300
						Long	1 carr.	34 600

1) All Precision Modules can also be supplied without drive unit.

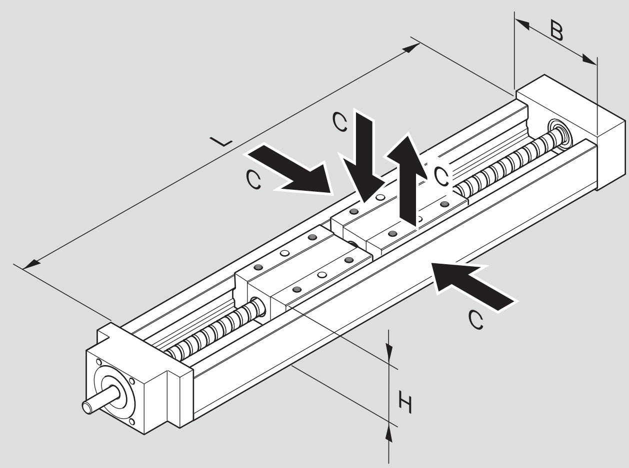
Permissible loads

Suitable loads (recommended values)
With respect to the desired service life, loads up to about 20% of the characteristic dynamic values (**C**, $\mathbf{M_t}$, $\mathbf{M_L}$) have proved acceptable.

At the same time, the following may not be exceeded:
- maximum permissible loads
- permissible drive torque
- permissible travel speed

For permissible values, see the “Technical Data” section.

Dimensions



Standard lengths L

Precision Module		PSK-040	PSK-050	PSK-060	PSK-090
B	(mm)	40	50	60	86
H	(mm)	20	26	33	46
L	(mm)	100	100	150	340
		150	150	200	440
		200	200	250	540
		250	250	300	640
		300	300	400	740
		350	350	500	840
			400	600	940
			450	700	
			500	800	
			550	900	
			600	940	

Product overview

Structural Design

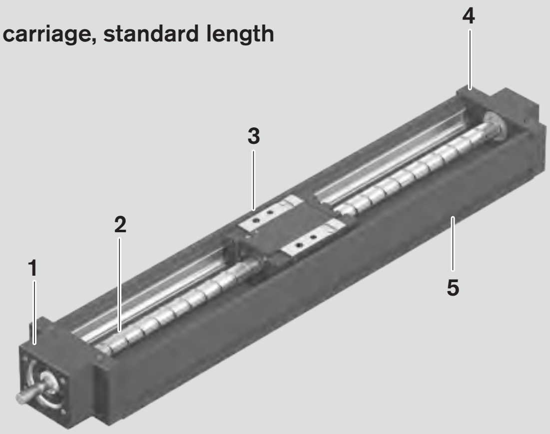
PSK without cover

1 Fixed bearing end block
2 Ball screw with zero-backlash cylindrical single nut
3 One or two steel carriages, standard length or long
4 Floating bearing end block
5 Frame with reference edge and integrated guideway geometry

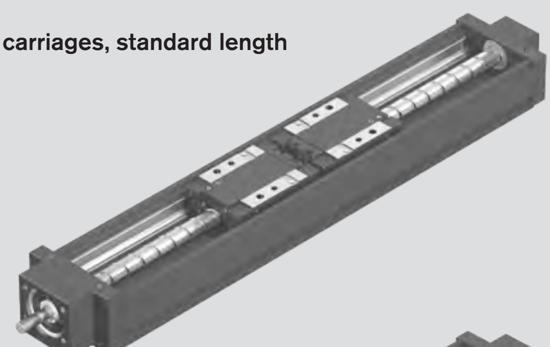
PSK with cover plate

6 Cover plate
7 One or two carriages, standard length or long
8 Carriage plate, aluminum
9 Carriage plate guide unit, steel

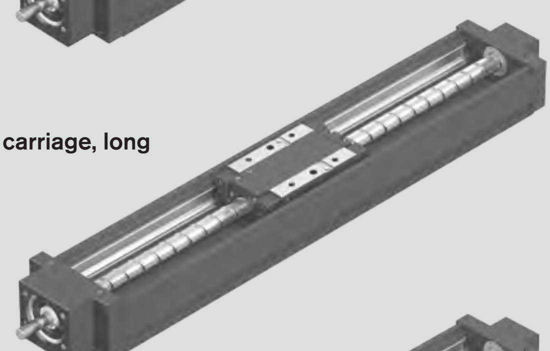
1 carriage, standard length



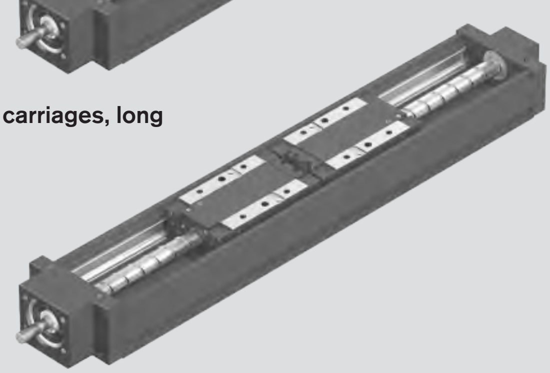
2 carriages, standard length



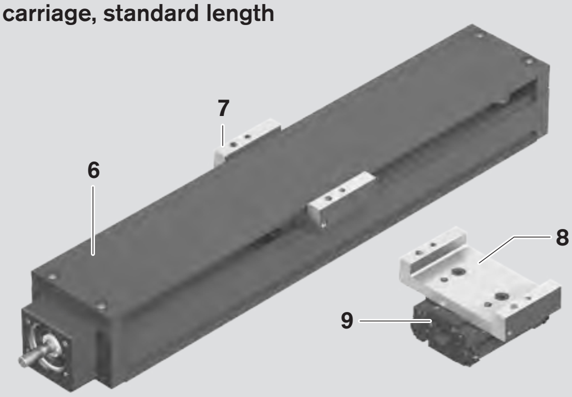
1 carriage, long



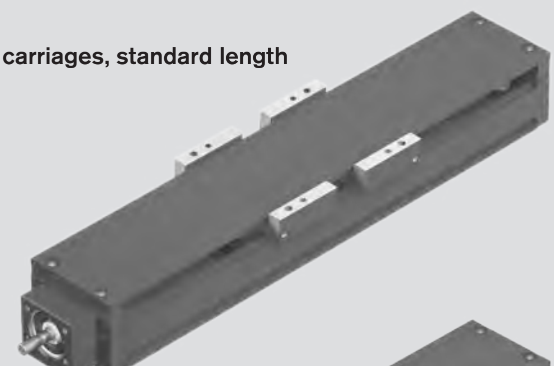
2 carriages, long



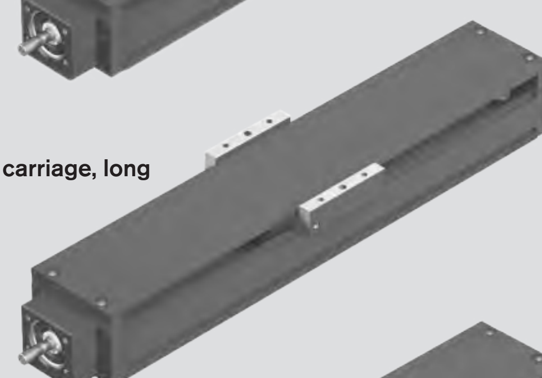
1 carriage, standard length



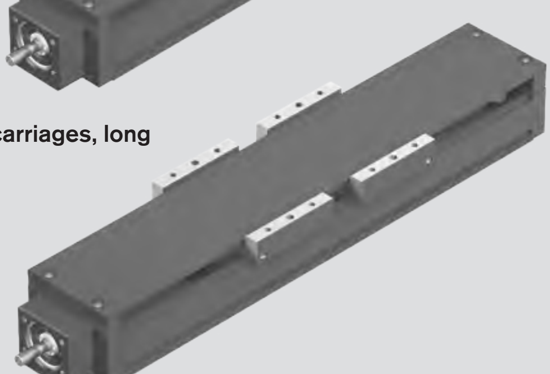
2 carriages, standard length



1 carriage, long



2 carriages, long



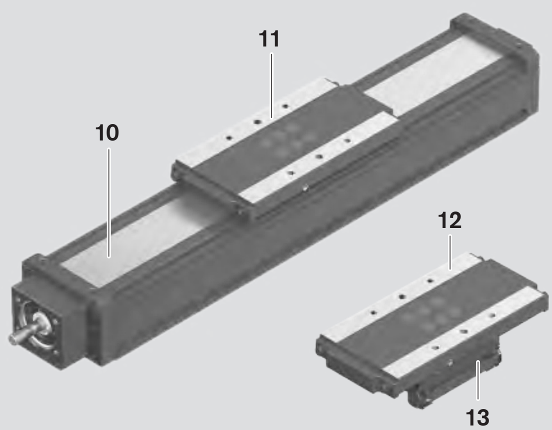
PSK with sealing strip

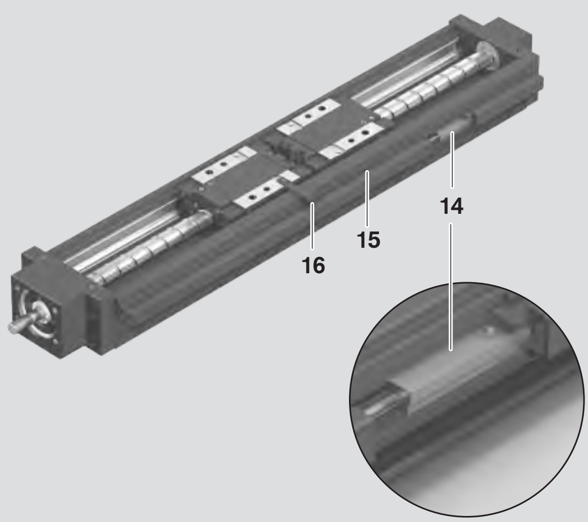
10 Sealing strip, stainless steel
11 One carriage, standard length or long
12 Carriage plate, aluminum
13 Carriage plate guide unit, aluminum

Attachments for all PSK modules

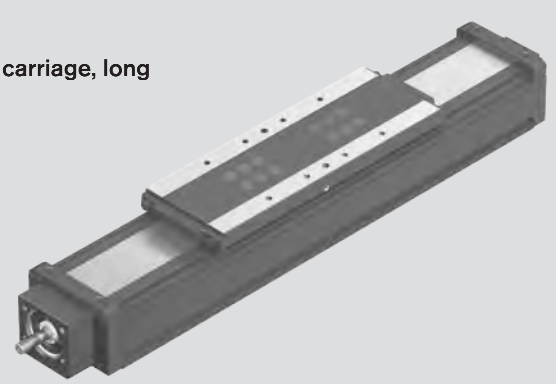
14 Switches
15 Mounting duct
16 Switching cam

1 carriage, standard length





1 carriage, long



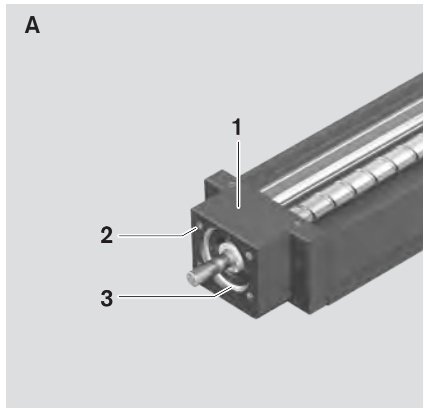
Product overview

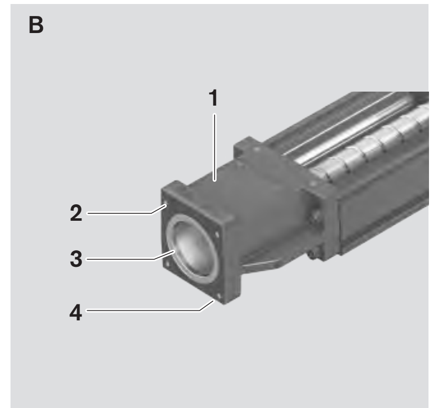
Structural Design

Fixed bearing end block

Version with ball screw journal (A)
1 End block with preloaded bearing
2 Tapped mounting hole
3 Centering feature

Version with integrated motor mount (B)
1 End block with integrated motor mount and preloaded bearing
2 Tapped mounting hole
3 Centering feature
4 Flange form suitable for motor attachment

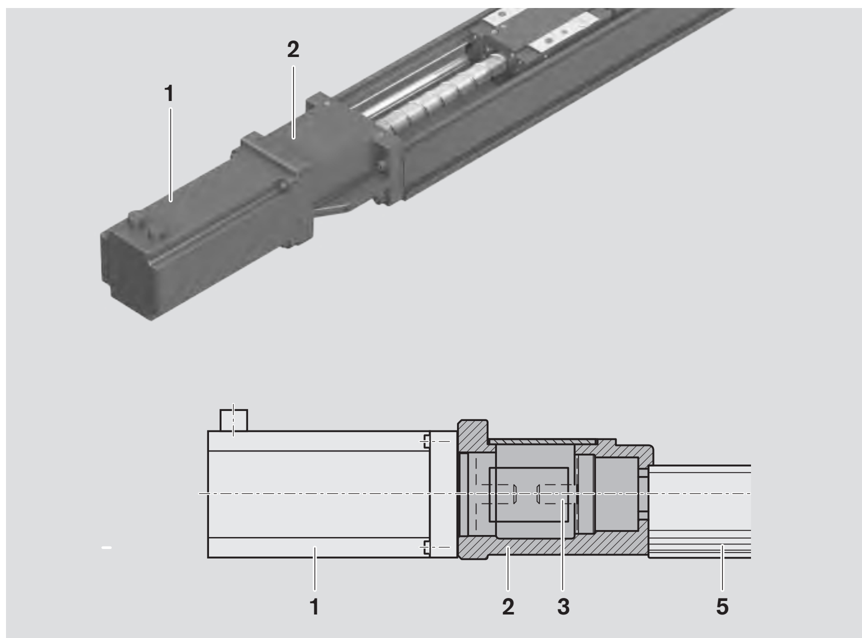




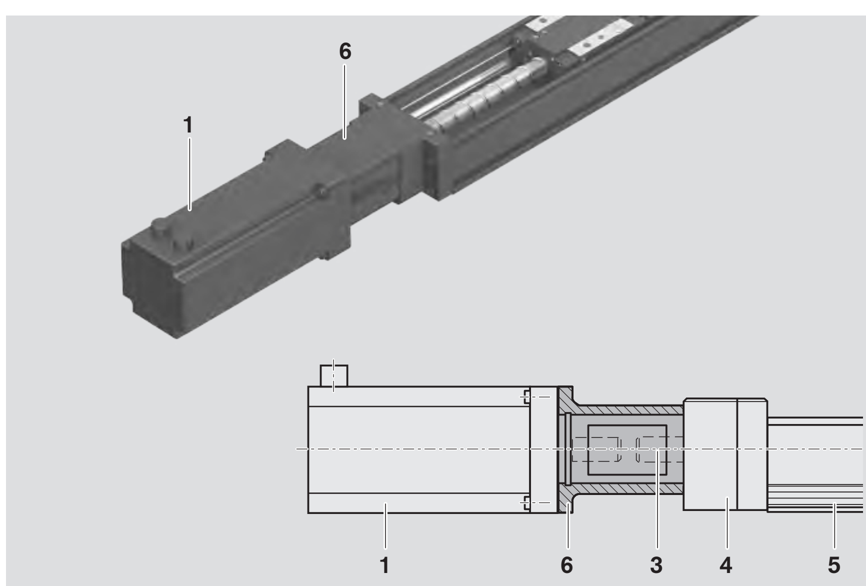
Motor attachment

Motor attachment with motor mount and coupling
A motor can be attached to all Precision Modules by means of a motor mount and coupling.
The motor mount serves to fasten the motor to the Precision Module and acts as a closed housing for the coupling.
The coupling transmits the motor drive torque free of distortive stresses to the Precision Module's ball screw journal.

Fixed bearing end block with integrated motor mount and coupling
1 Motor
2 Fixed bearing end block with integrated motor mount
3 Coupling
5 Precision module



Fixed bearing end block with attached motor mount and coupling
1 Motor
3 Coupling
4 Fixed bearing end block
5 Precision module
6 Motor mount



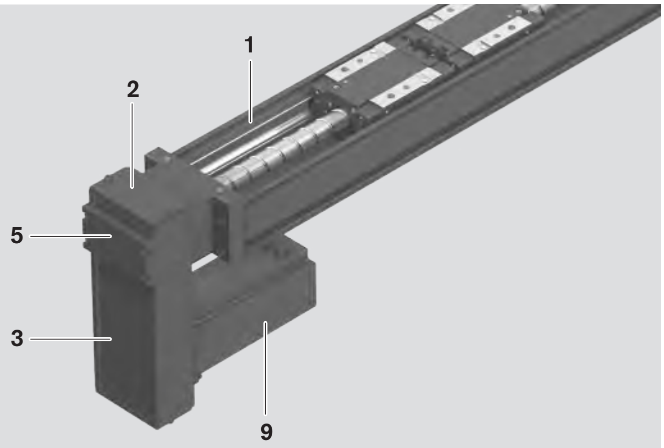
Motor attachment with timing belt side drive

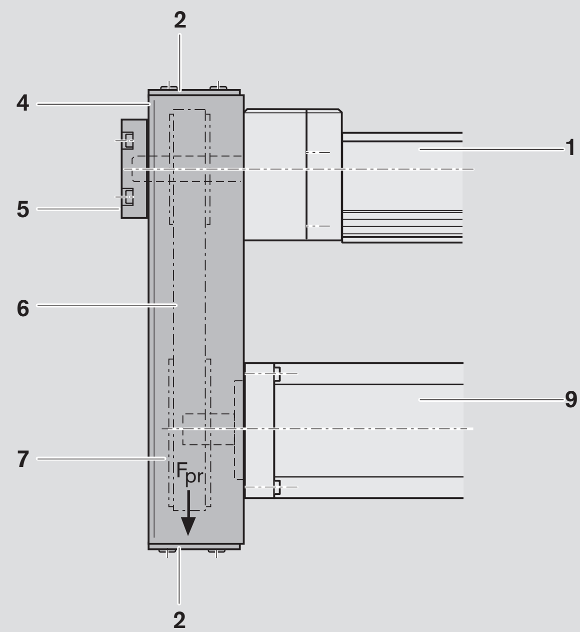
On Precision Modules PSK-050 and PSK-090 the motor (9) can be attached via a side drive with timing belt.
This makes the overall length shorter than when attaching the motor with a motor mount and coupling.
The compact, closed housing protects the belt and secures the motor.

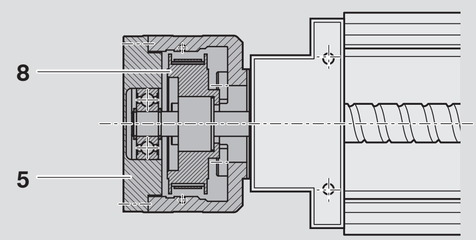
The following gear ratios are available:
i = 1 : 1
i = 1 : 1.5

The timing belt side drive can be mounted in four different directions:
- top, bottom
- left, right

1 Precision module
2 End cover
3 Cover plate
4 Drawn, anodized aluminum profile
5 Ball screw journal with support bearing
6 Toothed belt
7 Pre-tensioning of the toothed belt: Apply pretensioning force F_{pr} to motor (F_{pr} will be indicated on delivery)
8 Belt pulleys
9 AC servo motor







Technical Data

General technical data

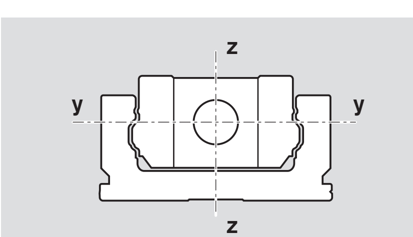
Precision Module	Planar moment of inertia I_y (cm^4)	I_z (cm^4)	Minimum center-to-center distance $l_{m\,min}$ Standard carr. (mm)	Long carr. (mm)	Mass of the linear motion system m_s (kg) Without cover, without drive	Without cover, with drive	With cover plate	With sealing strip
PSK-040	0.892	6.65	50	–	$0.0026 \cdot L + m_{ca}$	$0.0028 \cdot L + 0.075 + m_{ca}$	$0.0030 \cdot L + 0.089 + m_{ca}$	–
PSK-050	1.690	13.50	60	–	$0.0035 \cdot L + m_{ca}$	$0.0038 \cdot L + 0.179 + m_{ca}$	$0.0041 \cdot L + 0.204 + m_{ca}$	$0.0042 \cdot L + 0.208 + m_{ca}$
PSK-060	5.380	34.48	60	75	$0.0062 \cdot L + m_{ca}$	$0.0069 \cdot L + 0.254 + m_{ca}$	$0.0072 \cdot L + 0.281 + m_{ca}$	$0.0073 \cdot L + 0.272 + m_{ca}$
PSK-090	22.340	145.80	90	110	$0.0125 \cdot L + m_{ca}$	$0.0138 \cdot L + 0.638 + m_{ca}$	$0.0146 \cdot L + 0.726 + m_{ca}$	$0.0147 \cdot L + 0.736 + m_{ca}$

Dynamic characteristics

Precision Module	Type of cover	Carriage (carr.)	Number	Guideway Dynamic load capacity C (N)	Dynamic load moments M_t (Nm)	M_L (Nm)	Ball screw Size d_0 x P	Dynamic load capacity C (N)	Fixed bearing Dynamic load capacity C (N)
PSK-040	W/o and w/plate	Standard	1 carr.	3 065	43.1	14.8	6 x 1	900	820
			2 carr.	4 980	70.0	2.49 x l_m	6 x 2	890	820
PSK-050	W/o and w/plate	Standard	1 carr.	7 300	150.0	35	8 x 2.5	2 200	1 600
			2 carr.	11 850	244.0	5.93 x l_m	8 x 2.5	2 200	1 600
	Strip	Standard	1 carr.	7 300	150.0	35	8 x 2.5	2 200	1 600
		Long	1 carr.	11 850	244.0	356	8 x 2.5	2 200	1 600
PSK-060	W/o and w/plate	Standard	1 carr.	7 300	170.0	35	12 x 2	2 240	4 000
			2 carr.	11 850	276.0	5.93 x l_m	12 x 2	2 240	4 000
		Long	1 carr.	9 000	210.0	60	12 x 5	3 800	4 000
			2 carr.	14 620	341.0	7.31 x l_m	12 x 5	3 800	4 000
	Strip	Standard	1 carr.	9 000	210.0	60	12 x 10	2 500	4 000
		Long	1 carr.	14 620	341.0	541	12 x 10	2 500	4 000
PSK-090	W/o and w/plate	Standard	1 carr.	21 300	710.0	150	16 x 5	12 300	13 400
			2 carr.	34 600	1153.0	17.3 x l_m	16 x 5	12 300	13 400
		Long	1 carr.	27 500	910.0	270	16 x 10	9 600	13 400
			2 carr.	44 670	1478.0	22.34 x l_m	16 x 10	9 600	13 400
	Strip	Standard	1 carr.	21 300	710.0	150	16 x 16	6 300	13 400
		Long	1 carr.	34 600	1153.0	1557	16 x 16	6 300	13 400

Maximum acceleration: $a_{max} = 27\ m/s^2$

l_m = center-to-center distance between carriages (mm)
d_0 = screw diameter (mm)
P = screw lead (mm)
carr. = carriage(s) (mm)
m_{ca} = moved mass of system (kg)



Mass
Mass calculation without motor and switches.
Mass formula:
Mass factor (kg/mm) · length L (mm)
+ mass of all parts of fixed length (kg) +
moved mass of system m_{ca} (kg)

Modulus of elasticity E

$E = 210,000\ N/mm^2$

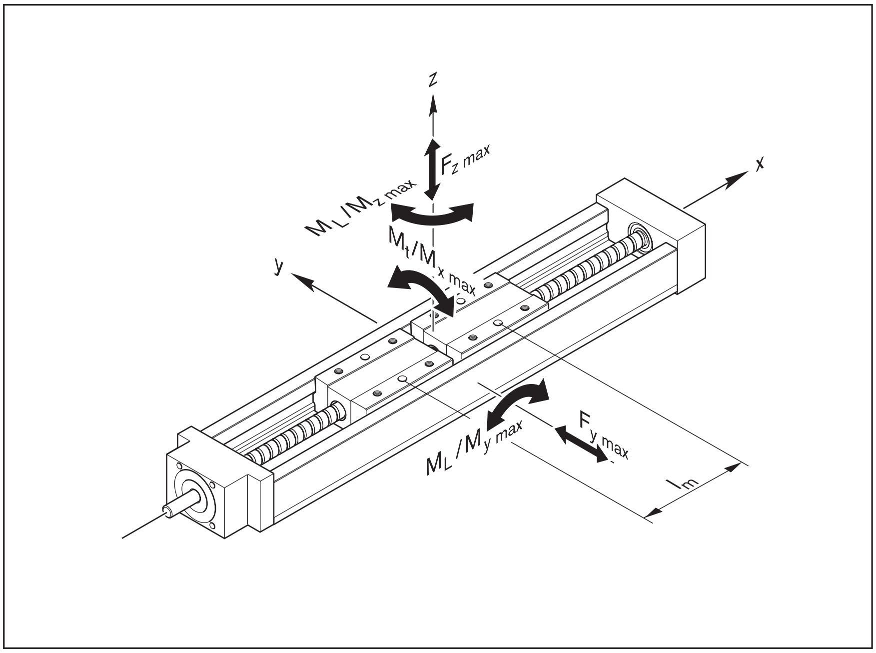
Ambient temperature

0 °C ... 40 °C

Note on dynamic load capacities and moments
Determination of the dynamic load capacities and moments is based on a travel life of 100,000 m.
Often only 50,000 m are actually stipulated.
For comparison: Multiply values **C**, $\mathbf{M_t}$ and $\mathbf{M_L}$ from the table by 1.26.

Maximum permissible loads
The maximum permissible forces ($F_{y\,max}$, $F_{z\,max}$) and moments ($M_{x\,max}$, $M_{y\,max}$, $M_{z\,max}$) are equal to half the dynamic characteristics (**C**, $\mathbf{M_t}$, $\mathbf{M_L}$).

Suitable loads (recommended values)
With respect to the desired service life, loads up to about 20% of the characteristic dynamic values (**C**, $\mathbf{M_t}$, $\mathbf{M_L}$) have proved acceptable.
At the same time, the following may not be exceeded:
- maximum permissible loads
- permissible drive torque
- permissible travel speed
- maximum permissible acceleration



l_m = center-to-center distance between carriages (mm)

Moved mass of system m_{ca}

Precision Module	Carriage	Moved mass of system m_{ca} (kg) Without cover, without drive		Without cover, with drive		With cover plate		With sealing strip
		1 carr.	2 carr.	1 carr.	2 carr.	1 carr.	2 carr.	1 carr.
PSK-040	Standard	0.08	0.17	0.09	0.18	0.14	0.28	–
PSK-050	Standard	0.20	0.40	0.22	0.42	0.29	0.56	0.20
	Long	–	–	–	–	–	–	0.37
PSK-060	Standard	0.25	0.49	0.27	0.52	0.38	0.73	0.33
	Long	0.34	0.69	0.37	0.71	0.51	1.00	0.58
PSK-090	Standard	0.77	1.54	0.85	1.62	1.09	2.10	0.80
	Long	1.04	2.08	1.11	2.15	1.43	2.79	1.40

carr. = carriage(s) (mm)

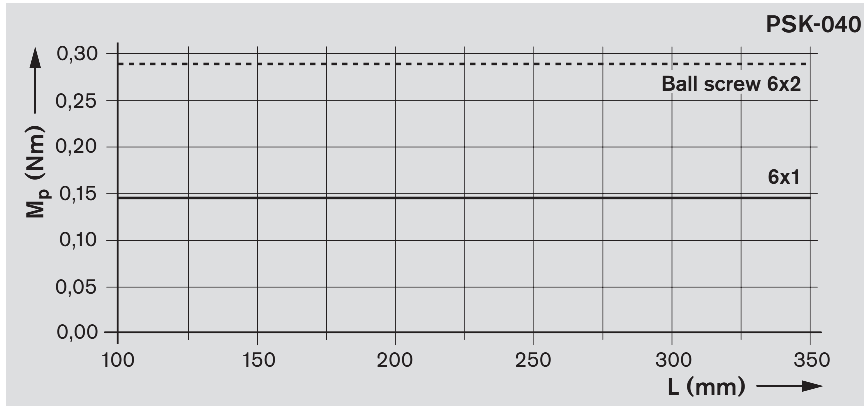
Technical Data

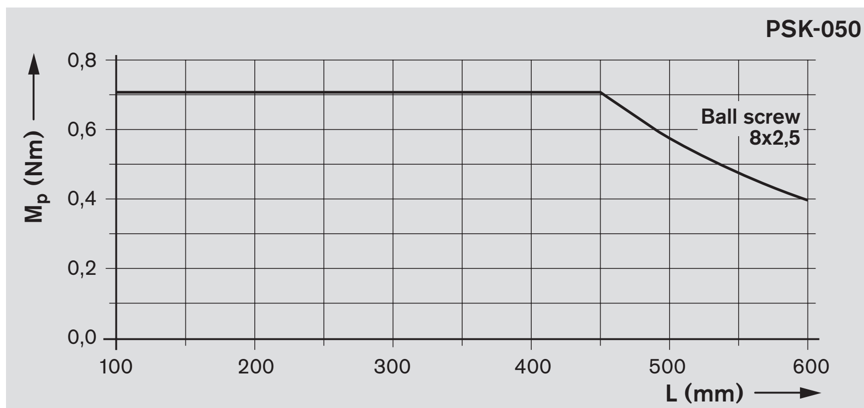
General technical data

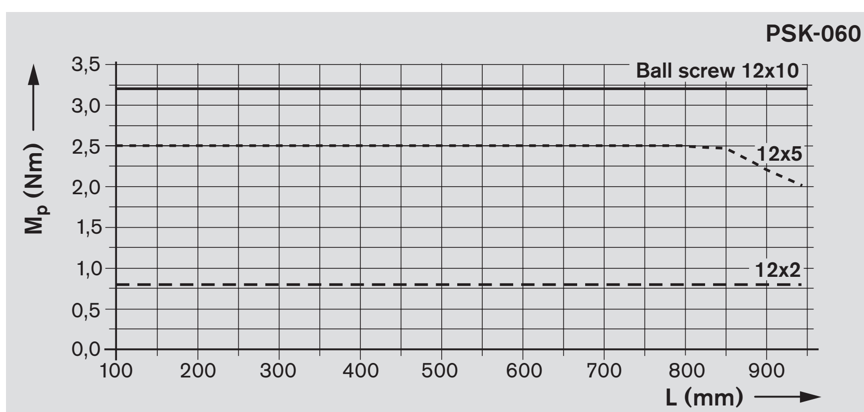
Maximum permissible drive torque at the screw journal M_p

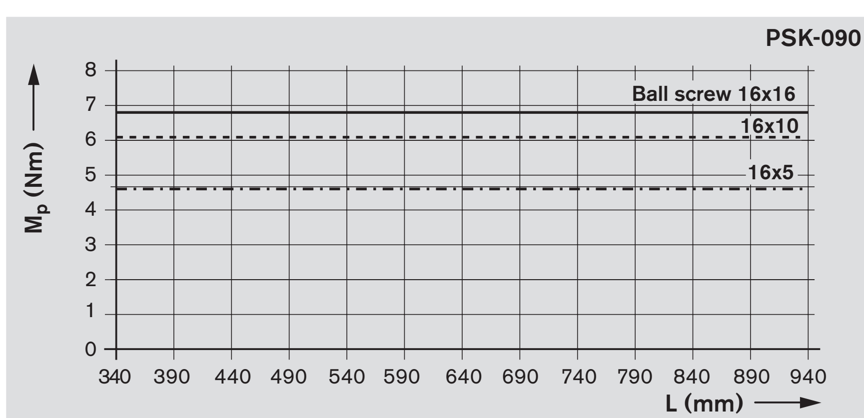
The values shown for M_p are applicable under the following conditions:
- Horizontal operation
- Ball screw journal without keyway
- No radial load on ball screw shaft

Consider the rated torque of the coupling used!





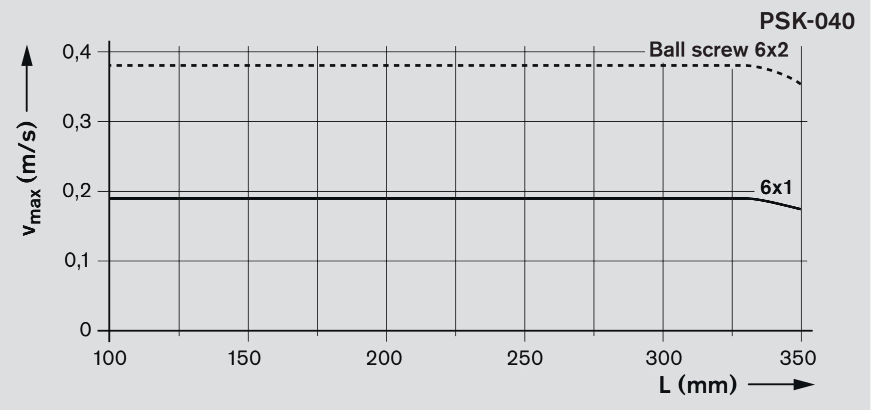


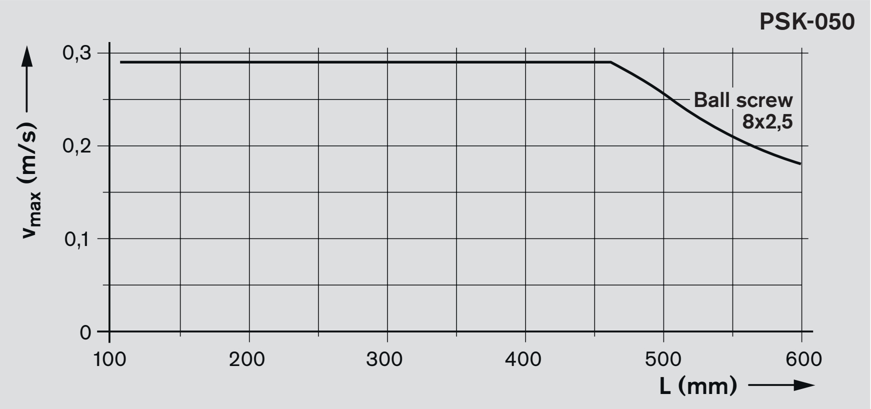


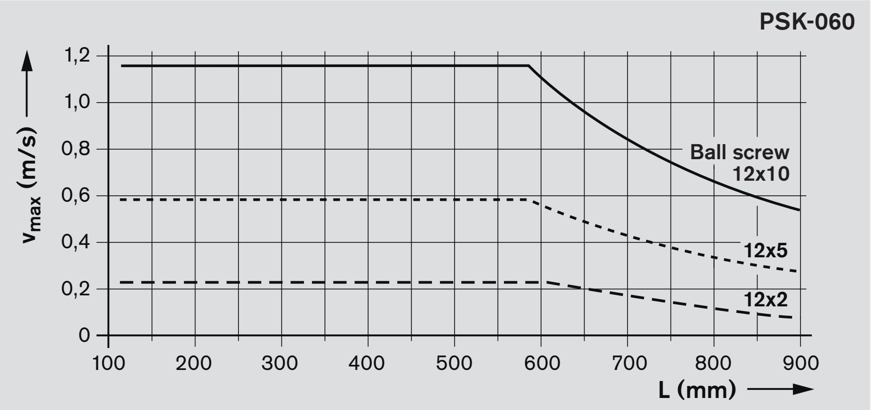
L	=	PSK length	(mm)
Ball screw	=	ball screw size: d_0 x P	
d_0	=	screw diameter	(mm)
P	=	lead	(mm)

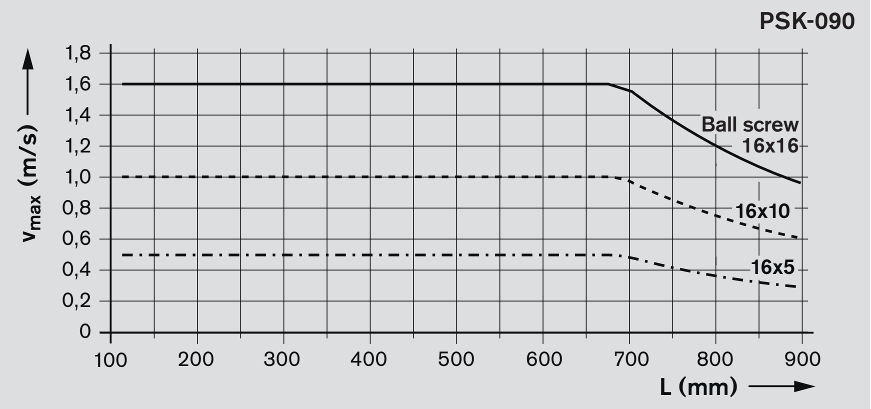
Maximum permissible linear speed v_{max}

Consider the motor speed!









L	=	PSK length	(mm)
Ball screw	=	ball screw size: d_0 x P	
d_0	=	screw diameter	(mm)
P	=	lead	(mm)

Technical Data

General technical data

Motor attachment via timing belt side drive

Motor type		MSM 019B					MSM 031B / MSM 031C / MSK 030				
F	(mm)	48					64.5				
M_{Rsd}	(Nm)	0.10					0.15				
m_{sd}	(kg)	0.28					0.65				
			M_{sd} 2)		**J_{sd}**			**M_{sd} 2)**		**J_{sd}**	
Gear ratio i			**i = 1**	**i = 1.5**	**i = 1**	**i = 1.5**		**i = 1**	**i = 1.5**	**i = 1**	**i = 1.5**
Belt type			**6 AT3**	**6 AT3**	**6 AT3**	**6 AT3**		**10 AT3**	**10 AT3**	**10 AT3**	**10 AT3**
Size	**BS**	**up to L 1)**					**up to L 1)**				
	d_0 x P	(mm)	(Nm)	(Nm)	(10^{-6} kgm²)	(10^{-6} kgm²)	(mm)	(Nm)	(Nm)	(10^{-6} kgm²)	(10^{-6} kgm²)
PSK-050	8 x 2.5	450	0.61	0.41	10.7	4.1	–	–	–	–	–
PSK-060	12 x 2	940	0.79	0.53	10.7	4.1	940	0.79	0.53	34.8	13.1
	12 x 5	940	1.31	0.87			800	2.48	1.65		
	12 x 10	940	1.31	0.87			940	2.70	1.80		
PSK-090	16 x 5	–	–	–	–	–	940	2.87	1.91	41.5	13.4
	16 x 10	–	–	–			940	2.87	1.91		
	16 x 16	–	–	–			940	2.87	1.91		

Motor type		MSM 041B / MSK 040				
F	(mm)	88				
M_{Rsd}	(Nm)	0.40				
m_{sd}	(kg)	1.45				
			M_{sd} 2)		**J_{sd}**	
Gear ratio i			**i = 1**	**i = 1.5**	**i = 1**	**i = 1.5**
Belt type			**16 AT5**	**16 AT5**	**16 AT5**	**16 AT5**
Size	**BS**	**up to L 1)**				
	d_0 x P	(mm)	(Nm)	(Nm)	(10^{-6} kgm²)	(10^{-6} kgm²)
PSK-090	16 x 5	940	4.31	2.87	234.4	83.6
	16 x 10	940	5.85	3.90		
	16 x 16	940	6.42	4.28		

1) For longer lengths, the permitted drive torque is determined by the length-dependent value M_p of the linear system as given in the graphs ➠ section “Technical Data”
2) Values for M_{sd} do not take motor torque into account.

i = timing belt side drive reduction
BS = ball Screw Assembly
d_0 = screw diameter (mm)
P = screw lead (mm)
J_{sd} = mass moment of inertia of timing belt side drive
M_{Rsd} = frictional torque of timing belt side drive at motor journal
M_{sd} = maximum permissible drive torque of the timing belt side drive
m_{sd} = mass of timing belt side drive

Frictional torque of the linear motion system M_{Rs}

Precision Module		Frictional torque of the linear motion system M_{Rs} (Nm) for carriage version			
	Ball screw size	Without cover or with cover plate		With sealing strip	
	d_0 x P	Standard carr.	Long carr.	Standard carr.	Long carr.
PSK-040	6 x 1	0.033	–	–	–
	6 x 2	0.034	–	–	–
PSK-050	8 x 2.5	0.06	–	0.06	0.07
PSK-060	12 x 2	0.10	0.10	0.10	0.11
	12 x 5	0.11	0.11	0.11	0.12
	12 x 10	0.12	0.13	0.13	0.15
PSK-090	16 x 5	0.30	0.30	0.29	0.31
	16 x 10	0.32	0.32	0.30	0.34
	16 x 16	0.34	0.36	0.32	0.37

carr. = carriage(s) (mm)
d_0 = screw diameter (mm)
P = screw lead (mm)

Mass moment of inertia of the linear motion system J_s referred to the drive journal

$$J_s = (k_{J\,fix} + k_{J\,var} \cdot L) \cdot 10^{-6}$$

J_s	=	mass moment of inertia of linear motion system (without external load)	(kgm^2)
$k_{J\,fix}$	=	constant for fixed-length portion of mass moment of inertia	(10^6 kgm^2)
$k_{J\,m}$	=	constant for mass-specific portion of mass moment of inertia	(10^6 kgm^2)
$k_{J\,var}$	=	constant for variable-length portion of mass moment of inertia	(10^9 kgm)
L	=	length	(mm)

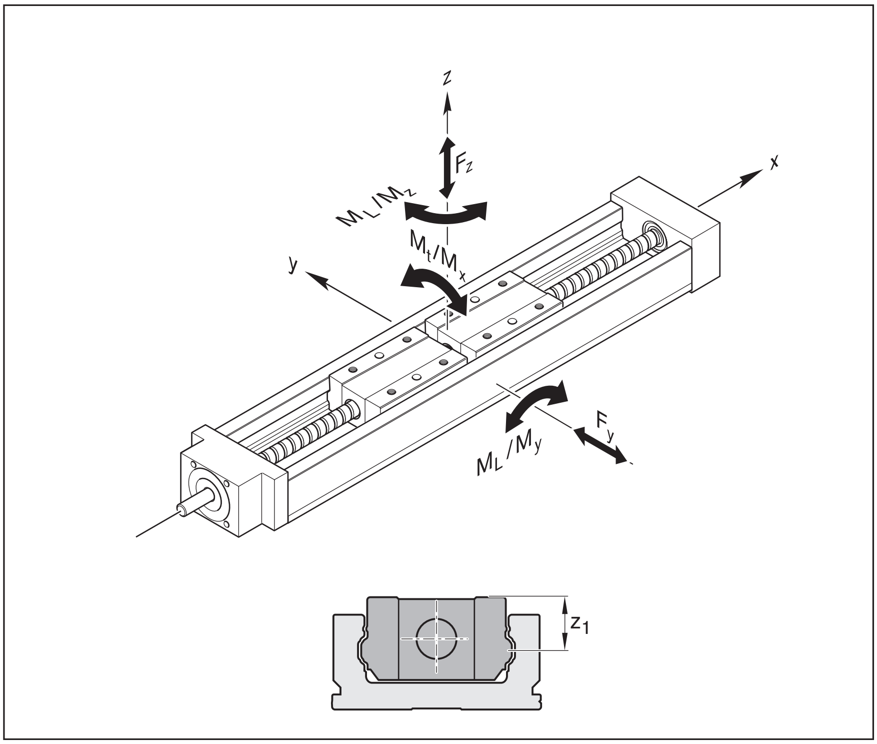
Precision Module	Ball screw size d_0 x P	Carriage	$k_{J\,fix}$ Without cover 1 carr.	Without cover 2 carr.	Cover plate 1 carr.	Cover plate 2 carr.	Sealing strip 1 carr.	$k_{J\,var}$	$k_{J\,m}$
PSK-040	6 x 1	Standard	0.115	0.117	0.116	0.120	–	0.002	0.025
	6 x 2	Standard	0.122	0.131	0.127	0.141	–	0.002	0.101
PSK-050	8 x 2,5	Standard	0.533	0.565	0.544	0.587	0.530	0.004	0.158
		Long	–	–	–	–	0.557		
PSK-060	12 x 2	Standard	0.999	1.024	1.010	1.045	1.005	0.013	0.101
		Long	1.009	1.043	1.023	1.073	1.030		
	12 x 5	Standard	1.130	1.289	1.200	1.422	1.168	0.011	0.633
		Long	1.194	1.409	1.282	1.593	1.327		
	12 x 10	Standard	1.643	2.277	1.922	2.808	1.795	0.011	2.533
		Long	1.897	2.758	2.251	3.492	2.492		
PSK-090	16 x 5	Standard	4.216	4.703	4.368	5.007	4.184	0.031	0.633
		Long	4.380	5.039	4.583	5.444	4.564		
	16 x 10	Standard	5.831	7.781	6.439	8.997	5.704	0.031	2.533
		Long	6.489	9.124	7.300	10.745	7.224		
	16 x 16	Standard	9.213	14.207	10.770	17.319	8.889	0.034	6.485
		Long	10.899	17.643	12.974	21.793	12.780		

Motor attachment via motor mount and coupling

Precision Module	for motor attachment	Coupling data Rated torque M_{cN} (Nm)	Mass moment of inertia J_c (10^{-6} kgm^2)	Mass Assembly kit Motor mount m_c (kg)
PSK-040	MSM 019B	0.70	0.12	0.09
PSK-050	MSM 019B	1.90	2.10	0.09
	MSM 031B	3.70	7.00	0.28
	MSK 030C	3.70	7.00	0.25
PSK-060	MSM 031B	3.70	7.00	0.30
	MSK 030C	1.90	2.10	0.15
PSK-090	MSM 031C	10.00	35.00	0.41
	MSM 041B	9.00	60.00	0.77
	MSK 030C	10.00	35.00	0.43
	MSK 040C	9.00	60.00	0.73

Calculations

Calculation principles



Combined equivalent load on bearing of the linear guide

(1) $$F_{comb} = |F_y| + |F_z| + C \cdot \frac{|M_x|}{M_t} + C \cdot \frac{|M_y|}{M_L} + C \cdot \frac{|M_z|}{M_L}$$

F_{comb}	=	combined equivalent load on bearing	(N)
F_y	=	force in y-direction	(N)
F_z	=	force in z-direction	(N)
M_x	=	torsional moment (about the x-axis)	(Nm)
M_y	=	torsional moment (about the y-axis)	(Nm)
M_z	=	torsional moment (about the z-axis)	(Nm)
C	=	dynamic load capacity	(N)
M_t	=	dynamic torsional moment load capacity	(Nm)
M_L	=	dynamic longitudinal moment load capacity	(Nm)

	z_1 (mm)		
	Without cover	**Cover plate**	**Sealing strip**
PSK-040	11	23	–
PSK-050	13	27	27
PSK-060	17	32	32
PSK-090	22	44	44

z_1 = distance between guideway centerline and top edge of carriage (mm)

Nominal life

Nominal life of the guideway in meters:

$$L = \left(\frac{C}{F_{comb}}\right)^3 \cdot 10^5 \text{ m} \quad (2)$$

Nominal life of the guideway in hours:

$$L_h = \frac{L}{3600 \cdot v_m} \quad (3)$$

Frictional torque

Frictional torque for motor attachment via motor mount and coupling:

$$M_R = M_{Rs} \quad (4)$$

Frictional torque for motor attachment via timing belt side drive:

$$M_R = \frac{M_{Rs}}{i} + M_{R\,sd} \quad (5)$$

Mass moment of inertia

for motor attachment via motor mount and coupling:

$$J_{ex} = J_s + J_t + J_c \quad (6)$$

for motor attachment via timing belt side drive:

$$J_{ex} = \frac{J_s + J_t}{i^2} + J_{sd} \quad (7)$$

Determination of mass moment of inertia of Linear Motion System components:

$$J_s = (k_{J\,fix} + k_{J\,var} \cdot L) \cdot 10^{-6} \quad (8)$$

Translatory mass moment of inertia of external load referred to the drive journal:

$$J_t = m_{ex} \cdot k_{Jm} \cdot 10^{-6} \quad (9)$$

C	=	dynamic load capacity	(N)
F_{comb}	=	combined equivalent load on bearing	(N)
i	=	timing belt side drive reduction	(–)
J_c	=	mass moment of inertia, coupling	(kgm^2)
J_{ex}	=	mass moment of inertia of mechanical system	(kgm^2)
J_s	=	mass moment of inertia of linear motion system (without external load)	(kgm^2)
J_{sd}	=	mass moment of inertia of belt timing belt side drive at the motor journal	(kgm^2)
J_t	=	translatory mass moment of inertia of external load referred to the drive journal	(kgm^2)
k_{Jm}	=	constant for mass-specific portion of mass moment of inertia	(10^6 m^2)
L	=	nominal life	(m)
L_h	=	nominal life	(h)
m_{ex}	=	moved external load	(kg)
M_R	=	frictional torque at motor journal	(Nm)
$M_{R\,sd}$	=	frictional torque of timing belt side drive	(Nm)
M_{Rs}	=	frictional torque of linear motion system	(Nm)
v_m	=	average speed	(m/s)

Calculation principles

Mass moment of inertia of the drive train referred to the motor journal

$$(10) \qquad V = \frac{J_{ex}}{J_m + J_{br}}$$

Mass moment of inertia ratio

$$(11) \qquad n_{mech} = \frac{v_{max} \cdot i \cdot 1\,000 \cdot 60}{P}$$

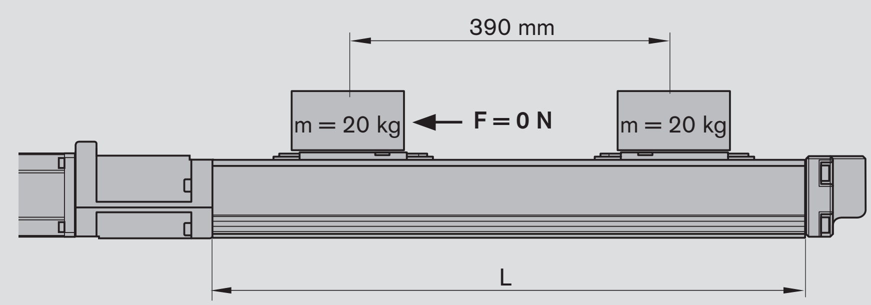
Application area	V
Handling	≤ 6.0
Machining	≤ 1.5

Condition:

$n_{mech} < n_{m\,max}$

i	=	timing belt side drive reduction	(–)
J_{br}	=	mass moment of inertia, motor brake	(kgm²)
J_{ex}	=	mass moment of inertia of mechanical system	(kgm²)
J_m	=	mass moment of inertia, motor	(kgm²)
$n_{m\,max}$	=	maximum permissible rotary speed of motor with controller	(min⁻¹)
n_{mech}	=	maximum permissible rotary speed of mechanical system	(min⁻¹)
P	=	screw lead	(mm)
V	=	ratio of mass moments of inertia of drive train and motor	(–)
v_{max}	=	maximum permissible linear speed of mechanical system	(m/s)

Calculation example



Given data

A mass of 20 kg is to be moved 390 mm at a maximum travel speed of 0.6 m/s.

Module selected based on the technical data and the connection dimensions:
- PSK-090 without cover and with a standard length steel carriage; motor attachment via integrated motor mount and coupling
- Motor type MSK 030C

When sizing the drive, the motor-controller combination must always be considered, as the motor type and performance data (e.g. maximum useful speed and maximum torque) will depend on the controller or control system used.

Estimation of the PSK module length L

Excess travel	=	$2 \cdot P = 2 \cdot 16$ mm = 32 mm (in accordance with the formula given in "PSK-090 Components and Ordering Data")

Selection of ball screw:
As a general rule:
Always choose the lowest lead (resolution, braking distance, length).

Permissible ball screws according to the "Permissible travel speed" chart at
$v_{max} = 0.6$ m/s: Ball screw 16x10 and 16x16;
Ball screw selected:
Ball screw 16x10 with $v_{max} = 1$ m/s
$M_p = 4.1$ Nm with ball screw 16x10
(according to the chart "Maximum permissible drive torque")

Calculation of PSK length L

Excess travel	=	$2 \cdot P = 2 \cdot 10$ mm = 20 mm
Length L	=	(effective stroke + 2 · excess travel) + 100 mm = (390 mm + 2 · 20 mm) + 100 mm = 530 mm
Selected:		Standard length L = 540 mm; hole spacing in frame: 70 mm / 4 · 100 mm / 70 mm

Frictional torque M_R

M_R	=	M_{Rs}
M_R	=	0.30 Nm (see "Technical Data")

Calculation example (continued)

Mass moment of inertia of mechanical system:

$J_{ex} = J_s + J_t + J_c$

$J_s = (k_{J\,fix} + k_{J\,var} \cdot L)$
$= (5.831 + 0.031 \cdot 540\text{ mm}) \cdot 10^{-6}$
$= 22.57 \cdot 10^{-6}\text{ kgm}^2$ (see "Technical Data")

$J_t = m_{ex} \cdot k_{J\,m} \cdot 10^{-6}$
$= 20\text{ kg} \cdot 2.533 \cdot 10^{-6}\text{ kgm}^2$
$= 50.66 \cdot 10^{-6}\text{ kgm}^2$ (see "Technical Data")

$J_c = 60 \cdot 10^{-6}\text{ kgm}^2$ (see "Technical Data")

$J_{ex} = (22.57 + 50.66 + 60) \cdot 10^{-6}\text{ kgm}^2$
$= 133.23 \cdot 10^{-6}\text{ kgm}^2$

Mass moment of inertia for handling (V ≤ 6):

$$V = \frac{J_{ex}}{J_m + J_{br}} \leq 6$$

$J_m = 30 \cdot 10^{-6}\text{ kgm}^2$

$J_{br} = 7.0 \cdot 10^{-6}\text{ kgm}^2$ (see „motors")

$$V = \frac{133{,}23 \cdot 10^{-6}\text{ kgm}^2}{(30 + 7{,}0) \cdot 10^{-6}\text{ kgm}^2} = 3.6 < 6$$

Rotary speed n:

$$n_{mech} = \frac{v \cdot i \cdot 1\,000 \cdot 60}{10} = \frac{0.6\text{ m/s} \cdot 1 \cdot 1\,000 \cdot 60}{10\text{ mm}} = 3\,600\text{ min}^{-1}$$

Result

Precision Module PSK-090 without cover and with one standard-length steel carriage; Motor MSK 030C, attached via integrated mount and coupling:

Standard length	L	=	540 mm;
Hole spacing in frame:			70 mm / 40 · 100 mm / 70 mm
Ball screw 16 x 10 with	v_{max}	=	1 m/s > 0.6 m/s
	M_p	=	4.1 Nm
Frictional torque	M_R	=	0.30 Nm
Mass moment of inertia	J_{ex}	=	$133.23 \cdot 10^{-6}\text{ kgm}^2$
Rotary speed	$n_{m\,max}$	=	$9\,000\text{ min}^{-1} > 3\,600\text{ min}^{-1}$
Torque	M_{max}	=	4.0 Nm < 4.1 Nm

For final motor selection, the drive and performance data must be recalculated as specified in the Rexroth catalog "Control Systems, Electrical Accessories, ..."

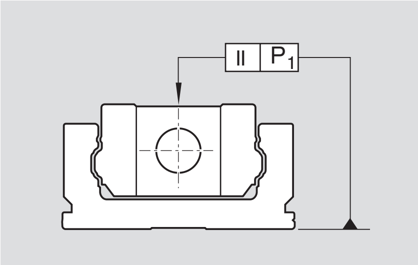
Accuracy

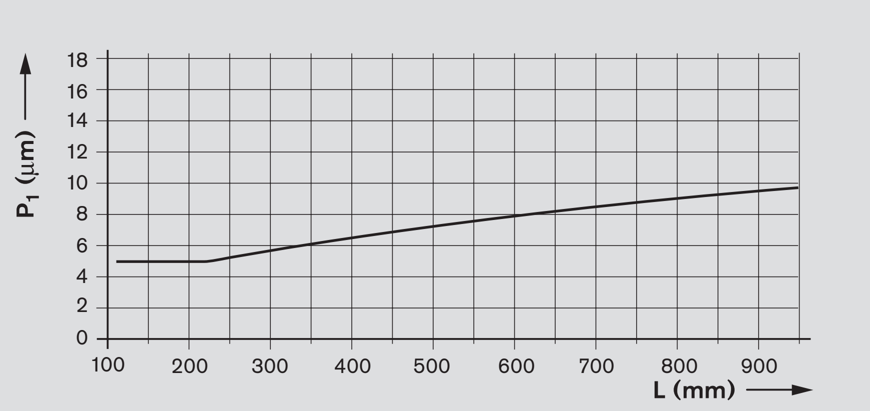
General note

All accuracy figures apply to the module when screwed down and assume an ideally flat mounting base. The values given do not take account of any shape deviations in the mounting base surface.

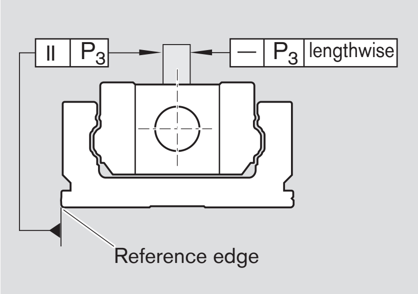
Accuracy P_1

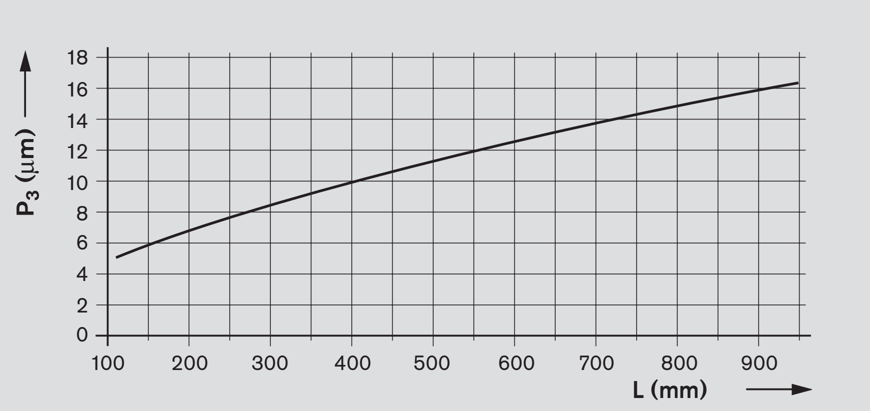
Measured at the carriage center





Accuracy P_3

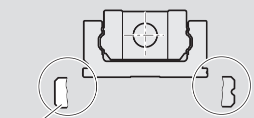
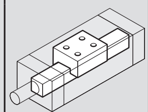
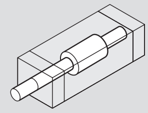
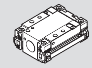
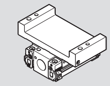
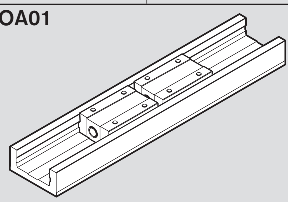
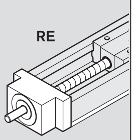
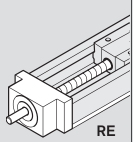
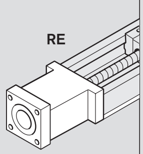
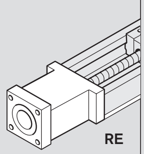




Configuration and ordering, Dimension Drawings

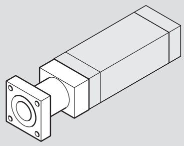
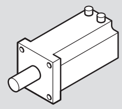
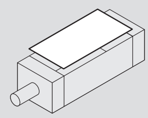
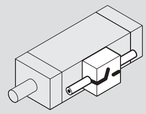
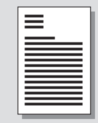
Precision Module PSK-040

Configuration and ordering

Short product name, length PSK-040-NN-1, ... mm  Reference edge (RE) Version				Guideway 	Drive unit  Screw journal	Ball screw size d_0 x P		Carriage version Steel  Without cover Standard		 Cover plate Standard	
	RE left	RE right				6 x 1	6 x 2	1 carr.	2 carr.	1 carr.	2 carr.
Without drive	OA01 		OA01	L = 100 mm 10 L = 150 mm 12 L = 200 mm 14 L = 250 mm 16 L = 300 mm 18 L = 350 mm 20	without	50		01	02	–	–
With ball screw, w/o motor mount	OF01 	OF02 	OF01 OF02		Ø4	01	02	01	02	21	22
With ball screw and integrated mount	MF10 	MF11 	MF10 MF11		Ø4	30	31	01	02	21	22

Ordering example: See “Inquiry/Order” form

d_0 = screw diameter (mm)
P = screw lead (mm)
carr. = carriage(s)
L = length

Motor attachment		Motor		Type of cover		Switches / Mounting duct / Socket-plug		Documentation	
									
Attachment kit 1)	for motor	with brake	without brake	without	cover plate			Standard report	Measurement report
00	–	00		00	–	**Without switch and Mounting duct**	00	01	02 Friction moment
00	–	00		00	01	**Switches:** – Reed sensor – Hall sensor	 21 22		03 Lead deviation
30	**NEMA 14-C 2)**	00				**Mounting duct**	27		04 Travel accuracy
31	**NEMA 17-C 2)**	00				**Switching cam for PSK:** – Without cover or with cover plate	 35		
32	**NEMA 17-D 2)**	00							
35	**MSM 019A**	133	132						05 Positioning accuracy
	MSM 019B	135	134						

1) Attachment kit also available without motor (when ordering: enter “00” for motor). For motor mounting kit for customer motor see “Motor mounting” section
2) Use motors complying with the appropriate NEMA specification. Because of the varying shaft dimensions for NEMA-specification motors, the attachment kit does not include a coupling.

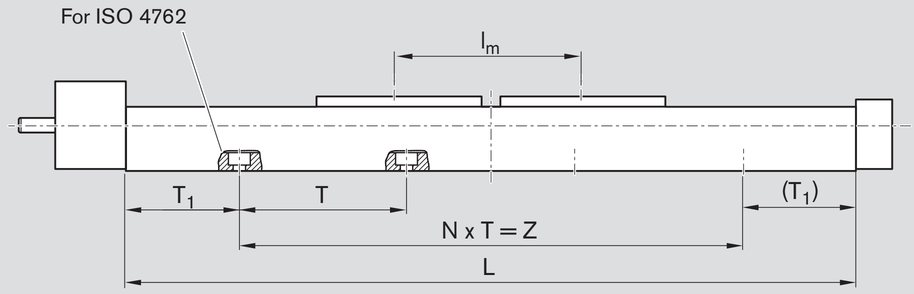
Switch mounting arrangements

Refer to “Switch mounting arrangements” for more information on switch types and switch mounting.

Configuration and ordering, Dimension Drawings

Precision Module PSK-040

Lengths and Hole Spacing



Length L

Type of cover	Number of carriages (carr.)	Carriage version Standard length
Without cover or with cover plate	1 carr.	L = (stroke + 2 · excess travel) + 55 mm
	2 carr.	L = (stroke + 2 · excess travel) + l_m + 55 mm $l_{m\ min}$ = 50 mm

l_m = center-to-center distance between carriages (consider $l_{m\ min}$)
Stroke = maximum travel of carriage center between the outermost switch activation points

In most cases the recommended limit for excess travel (braking path) is:
Excess travel = 2 · screw lead P

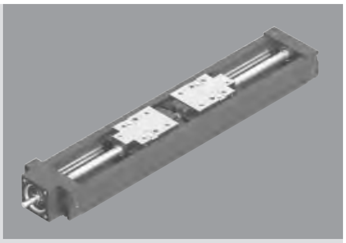
Example
Ball screw 6 x 2
(Ball screw size = d_0 x P):
Excess travel = 2 · 2 = 4 mm

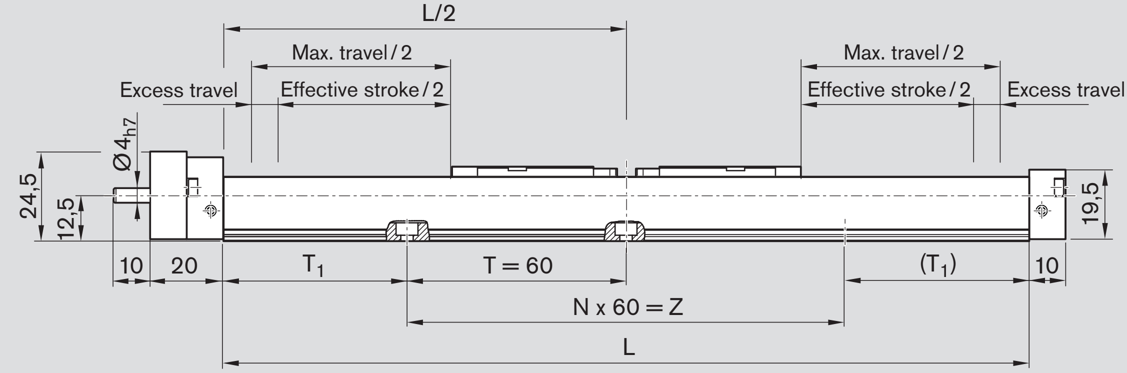
Standard lengths of frame

Length L (mm)	T (mm)	T_1 (mm)	N	Z (mm)	Mounting holes for ISO 4762 screws
100	60	20	1	60	M3
150	60	15	2	120	
200	60	40	2	120	
250	60	35	3	180	
300	60	30	4	240	
350	60	25	5	300	

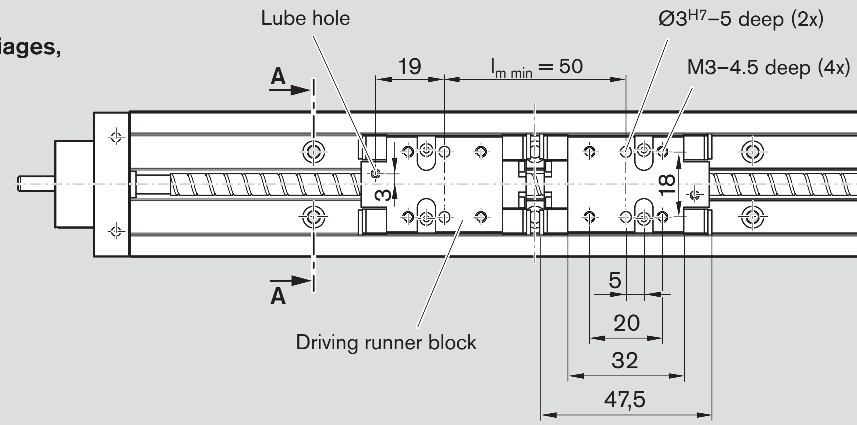
Dimension Drawings without Cover

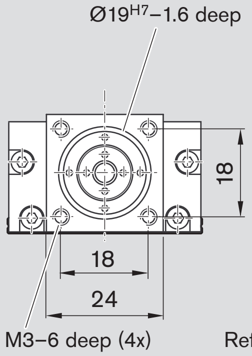
All dimensions in mm
Drawings not to scale

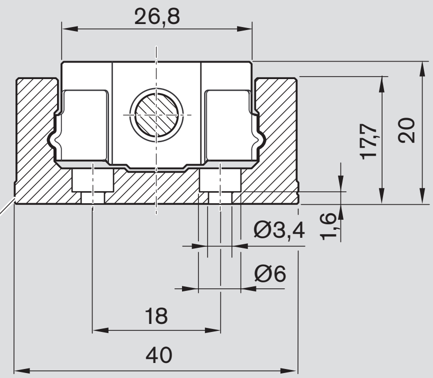




Version:
One or two carriages, standard length





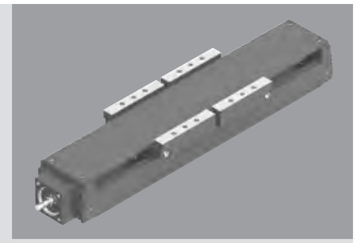


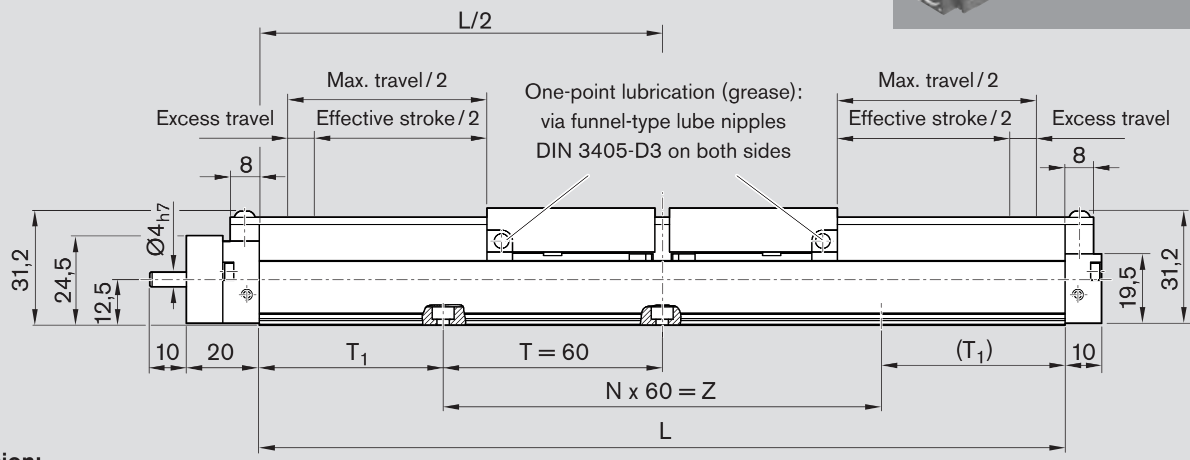
Configuration and ordering, Dimension Drawings

Precision Module PSK-040

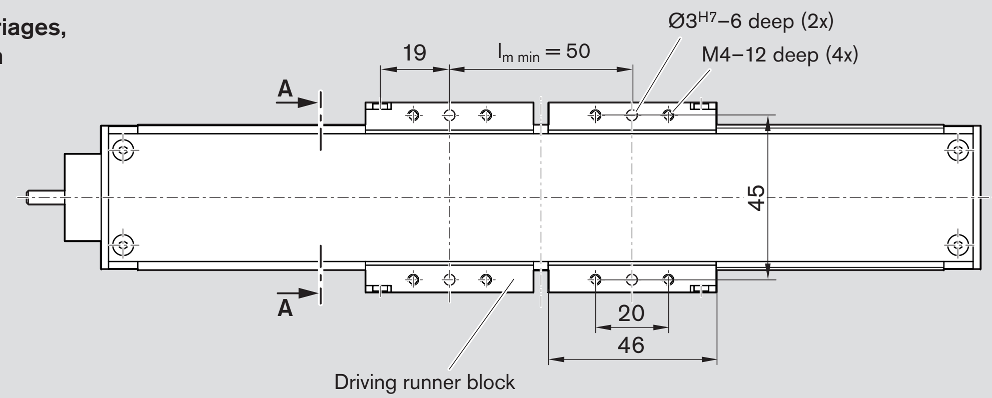
Dimension Drawings with Cover Plate

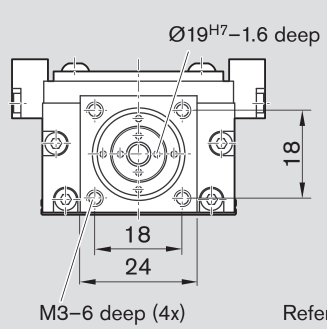
All dimensions in mm
Drawings not to scale

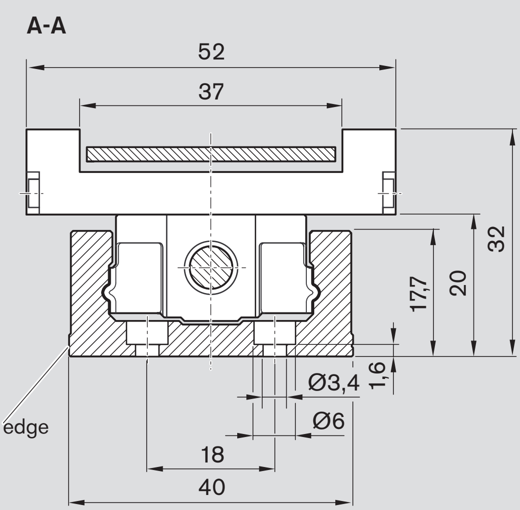




Version:
One or two carriages, standard length

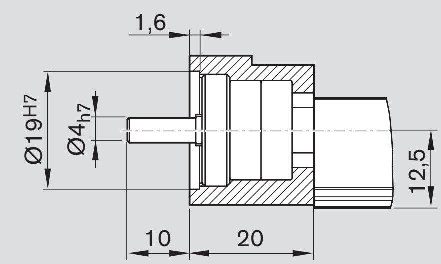






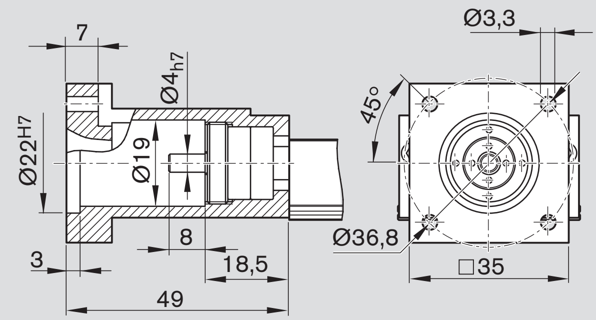
Dimension Drawings, Motor Attachment

OF01, OF02



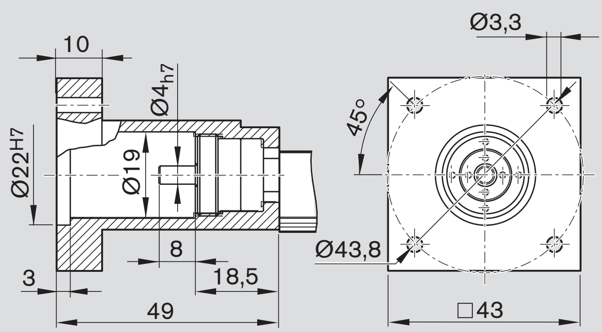
MF10, MF11

Integrated motor mount (NEMA 14 – Form C)



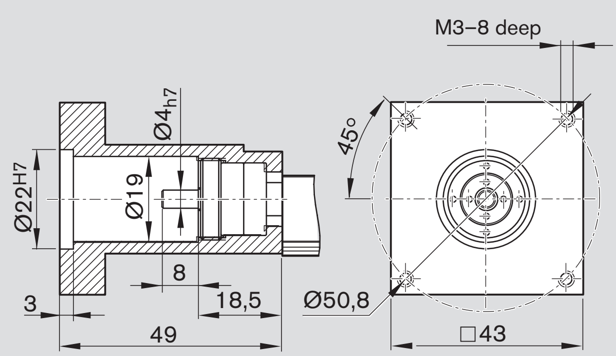
MF10, MF11

Integrated motor mount (NEMA 17 – Form C)



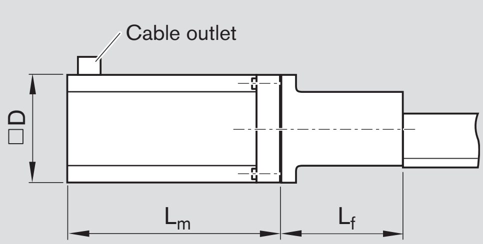
MF10, MF11

Integrated motor mount (NEMA 17 – Form D)



MF10, MF11

Motor with integrated motor mount and coupling



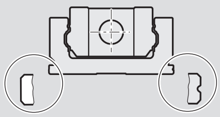
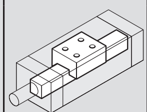
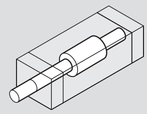
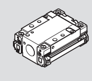
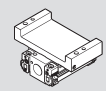
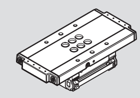
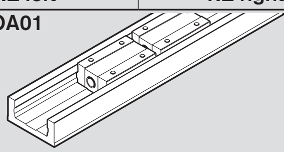
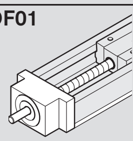
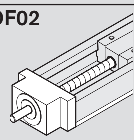
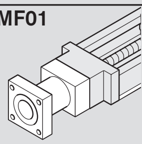
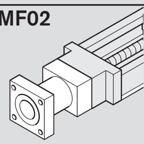
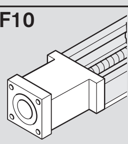
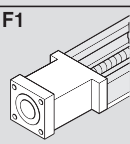
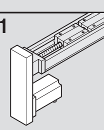
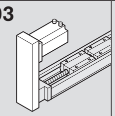
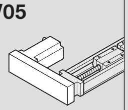
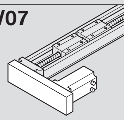
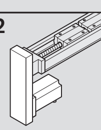
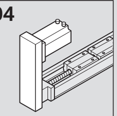
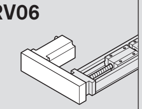
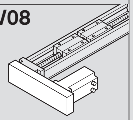
Motor type	Dimensions (mm) D	L_f	L_m without brake	L_m with brake
MSM 019A	38	54	72	102
MSM 019B	38	54	92	122

Drawings not to scale!
For further information and dimensions, see “Motors.”

Configuration and ordering, Dimension Drawings

Precision Module PSK-050

Configuration and ordering

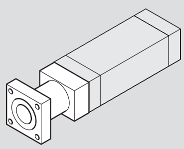
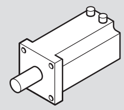
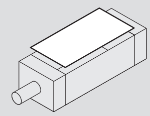
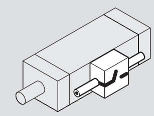
Short product name, length PSK-050-NN-1, ... mm Reference edge (RE) Version	RE left	RE right		Guideway	Drive unit: Screw journal	Drive unit: Ball screw size d_0 x P 8 x 2.5	Carriage version Steel: Without cover, Standard 1 carr.	2 carr.	Steel: Cover plate, Standard 1 carr.	2 carr.	Aluminum: Sealing strip, Stan-dard 1 carr.	Long 1 carr.
												
Without drive	OA01 		OA01		Ohne	50	01	02	–	–	–	–
With ball screw, w/o motor mount	OF01 	OF02 	OF01 OF02		Ø5	01	01	02	21	22	40	41
With ball screw and motor mount	MF01 	MF02 	MF01 MF02		Ø5	01	01	02	21	22	40	41
With ball screw and integrated mount	MF10 	MF1 	MF10 MF11		Ø5	30	01	02	21	22	40	41
With ball screw and timing belt side drive	RV01  RV03  RV05  RV07 	RV02  RV04  RV06  RV08 	RV01 to RV08		for **MSM 019B**	01	01	02	21	22	40	41

Guideway	
L = 100 mm	09
L = 150 mm	10
L = 200 mm	11
L = 250 mm	12
L = 300 mm	13
L = 350 mm	14
L = 400 mm	15
L = 450 mm	16
L = 500 mm	17
L = 550 mm	18
L = 600 mm	19

Ordering example: See “Inquiry/Order” form

⚠ **Please check whether the selected combination is a permissible one (load capacities, moments, maximum speeds, motor data, etc.)!**

d_0 = screw diameter (mm)
P = screw lead (mm)
carr. = carriage(s)
L = length

<table>
<tr><th colspan="3">Motor attachment
</th><th colspan="2">Motor
</th><th colspan="3">Type of cover
</th><th rowspan="2">Switches / Mounting duct / Socket-plug
</th><th colspan="2">Documentation
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<tr><th>Gear ratio i =</th><th>Attachment kit [1]</th><th>for motor</th><th>with brake</th><th>without brake</th><th>with-out</th><th>cover plate</th><th>strip</th><th>Standard report</th><th>Measure-ment report</th></tr>
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Switches:
– Reed sensor 21
– Hall sensor 22

Mounting duct 26

Switching cam for PSK:
– Without cover or with cover plate 32
– With sealing strip 34</td><td rowspan="9">01</td><td rowspan="9">02
Friction mo-ment

03
Lead deviation

04
Travel accuracy

05
Positioning accuracy</td></tr>
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<tr><td rowspan="2">–</td><td>01</td><td>MSM 031B</td><td>137</td><td>136</td></tr>
<tr><td>03</td><td>MSK 030C</td><td>85</td><td>84</td></tr>
<tr><td rowspan="3">–</td><td>31</td><td>NEMA 17-D[2]</td><td colspan="2">00</td></tr>
<tr><td>35</td><td>NEMA 17-C[2]</td><td colspan="2">00</td></tr>
<tr><td>36</td><td>MSM 019B</td><td>135</td><td>134</td></tr>
<tr><td>1</td><td>13</td><td rowspan="2">MSM 019B</td><td rowspan="2">135</td><td rowspan="2">134</td></tr>
<tr><td>1,5</td><td>14</td></tr>
</table>

1) Attachment kit also available without motor (when ordering: enter “00” for motor).
For motor mounting kit for customer motor see “Motor mounting” section

2) Use motors complying with the appropriate NEMA specification.
Because of the varying shaft dimensions for NEMA-specification motors, the attachment kit does not include a coupling.

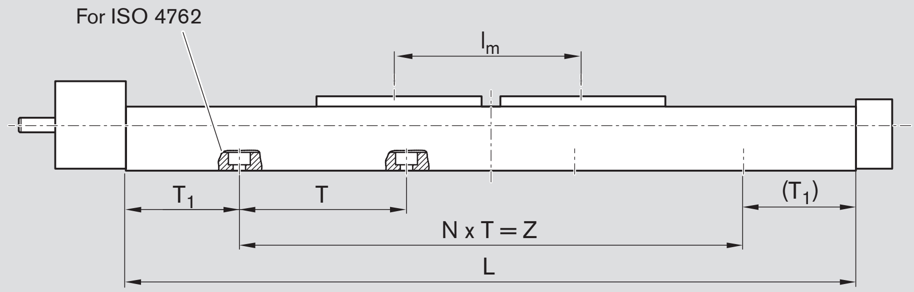
Switch mounting arrangements

Refer to “Switch mounting arrangements” for more information on switch types and switch mounting.

Configuration and ordering, Dimension Drawings

Precision Module PSK-050

Lengths and Hole Spacing



Length L

Type of cover	Number of carriages (carr.)	Carriage version Standard length	Long
Without cover or with cover plate	1 carr.	L = (stroke + 2 · excess travel) + 70 mm	–
	2 carr.	L = (stroke + 2 · excess travel) + l_m + 70 mm $l_{m\,min}$ = 60 mm	–
With sealing strip	1 carr.	L = (stroke + 2 · excess travel) + 127 mm	L = (stroke + 2 · excess travel) + 187 mm

l_m = center-to-center distance between carriages (consider $l_{m\,min}$)
Stroke = maximum travel of carriage center between the outermost switch activation points

In most cases the recommended limit for excess travel (braking path) is:
Excess travel = 2 · screw lead P

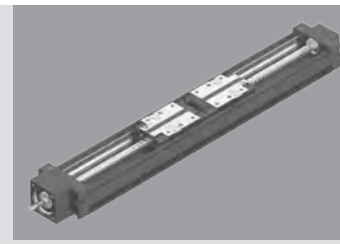
Example
Ball screw 8 x 2.5
(Ball screw size = d_0 x P):
Excess travel = 2 · 2.5 = 5 mm

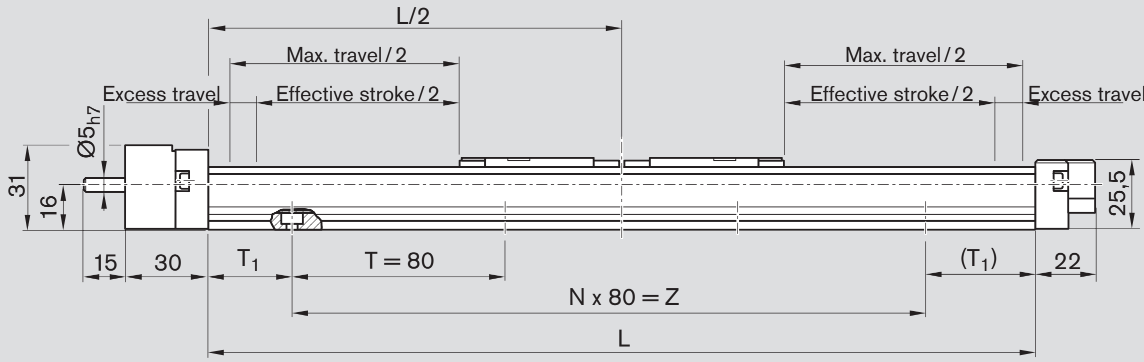
Standard lengths of frame

Length L (mm)	T (mm)	T_1 (mm)	N	Z (mm)	Mounting holes for ISO 4762 screws
100	80	10	1	80	M4
150	80	35	1	80	
200	80	20	2	160	
250	80	45	2	160	
300	80	30	3	240	
350	80	15	4	320	
400	80	40	4	320	
450	80	25	5	400	
500	80	50	5	400	
550	80	35	6	480	
600	80	20	7	560	

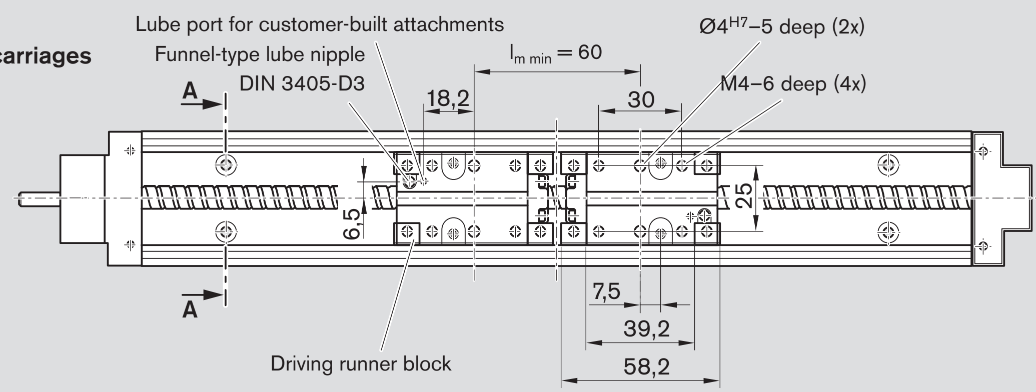
Dimension Drawings without Cover

All dimensions in mm
Drawings not to scale

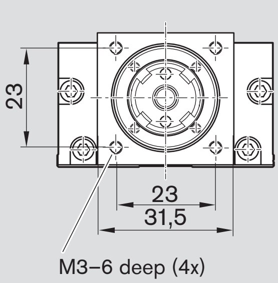


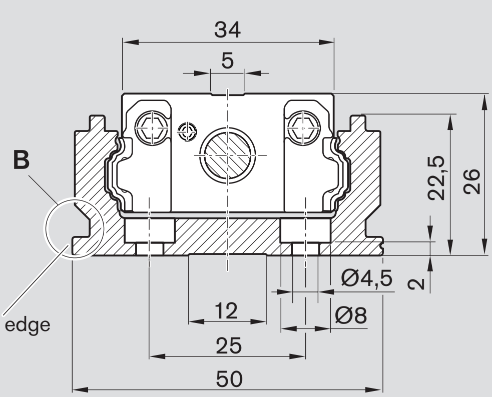


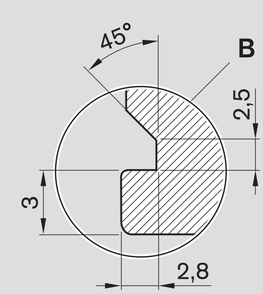
Version:
One or two carriages



A-A







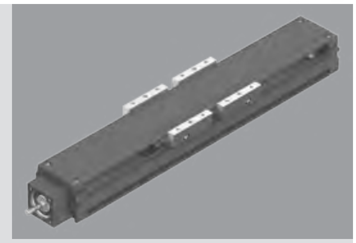
For fastening with clamping fixtures

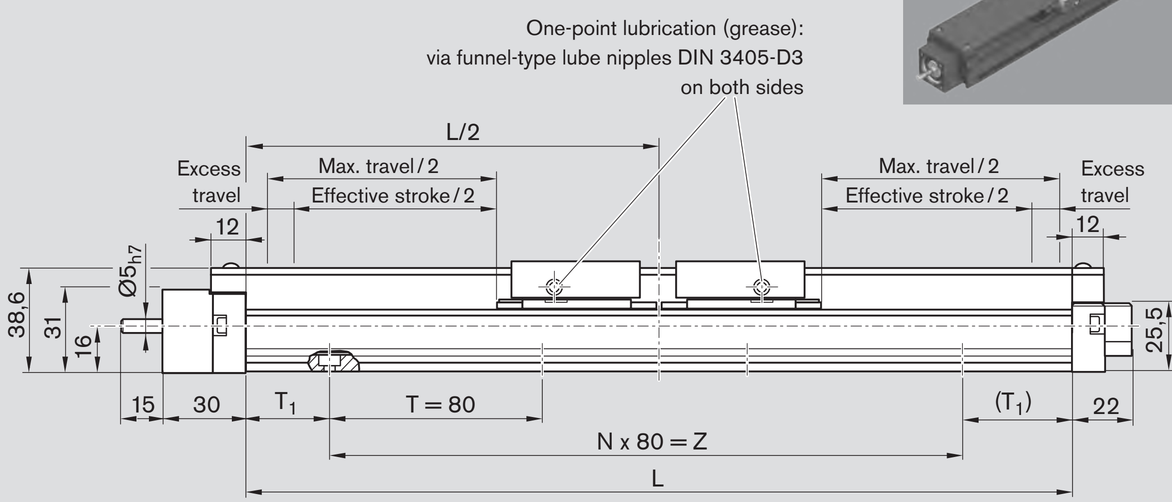
Configuration and ordering, Dimension Drawings

Precision Module PSK-050

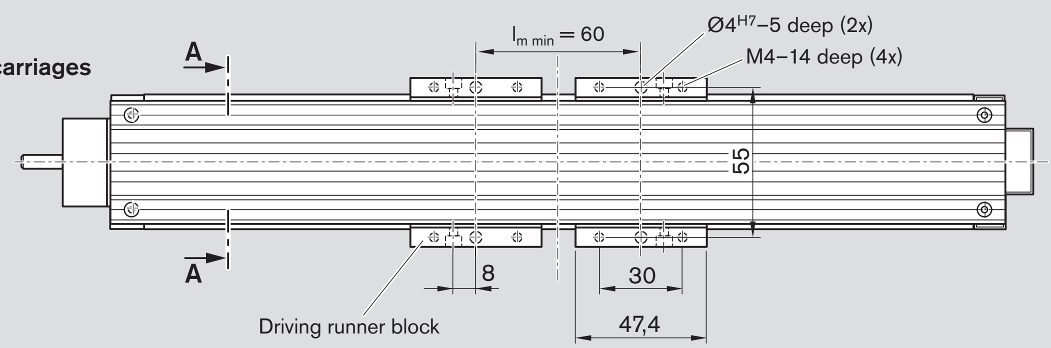
Dimension Drawings with Cover Plate

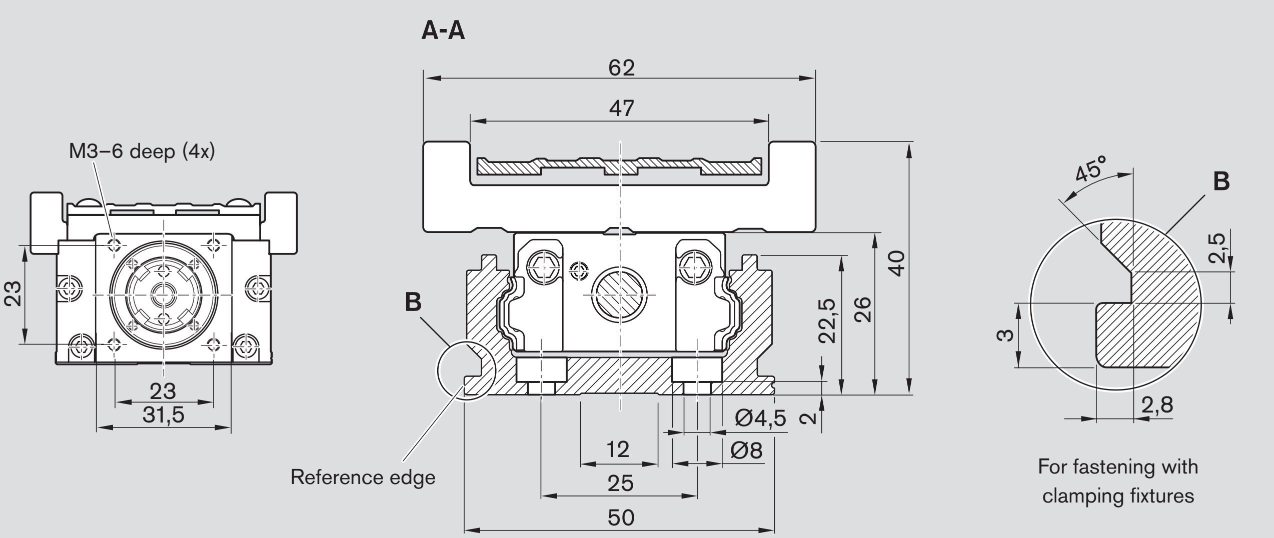
All dimensions in mm
Drawings not to scale





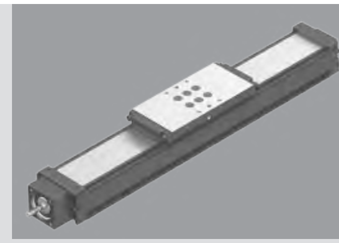
Version:
One or two carriages

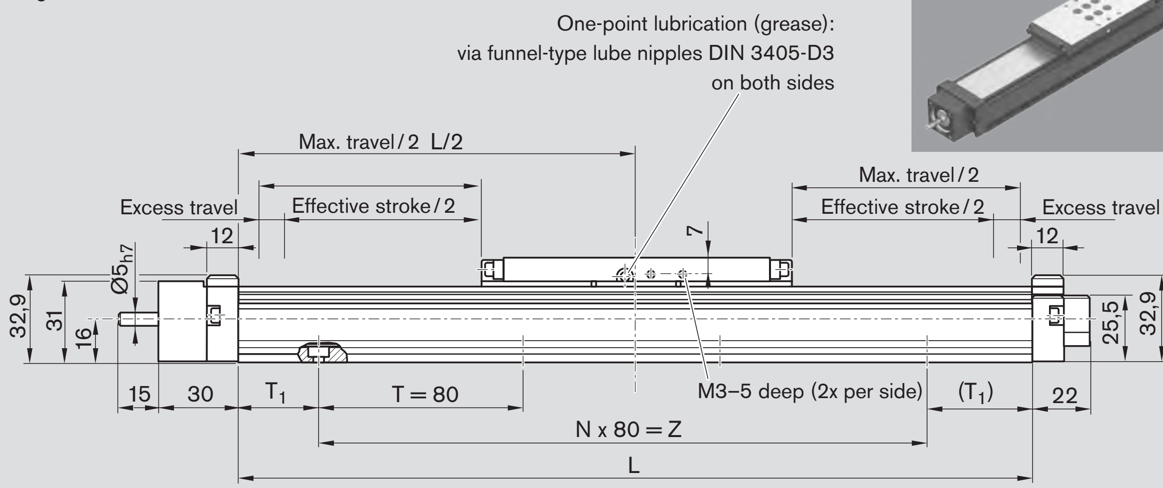




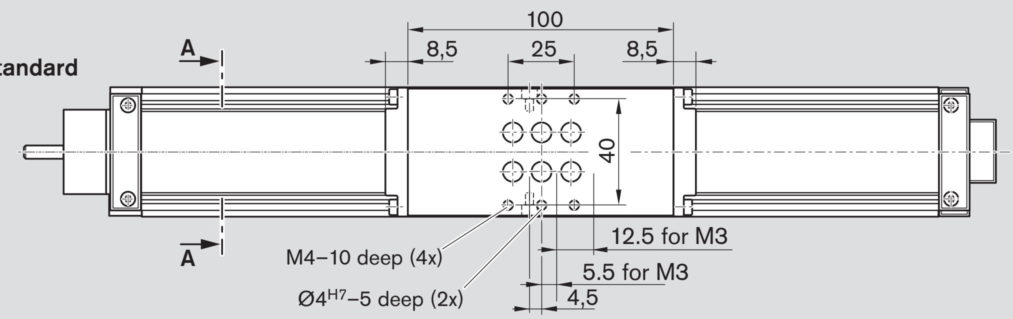
Dimension Drawings with Sealing Strip

All dimensions in mm
Drawings not to scale

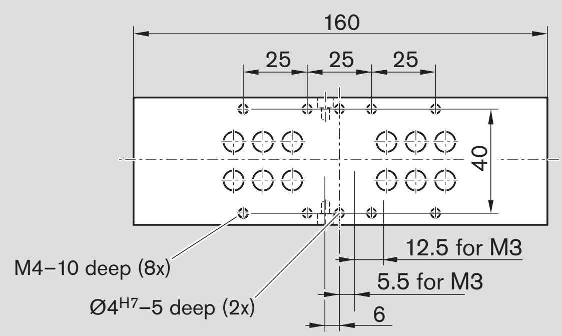


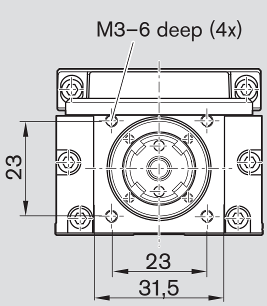


Version: Carriage, standard length

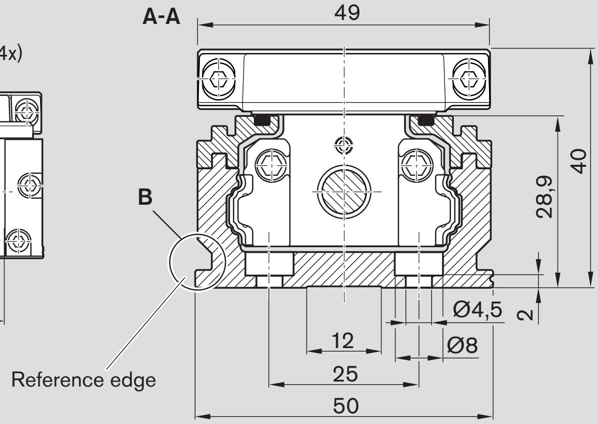


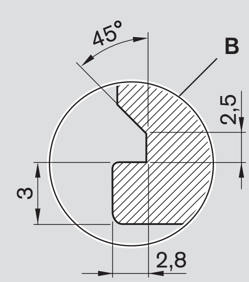
Version: Carriage, long





A-A





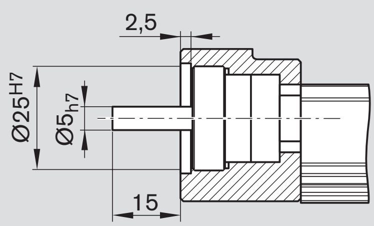
For fastening with clamping fixtures

Configuration and ordering, Dimension Drawings

Precision Module PSK-050

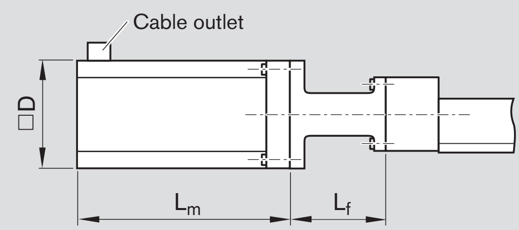
Dimension Drawings, Motor Attachment

OF01, OF02



MF01, MF02

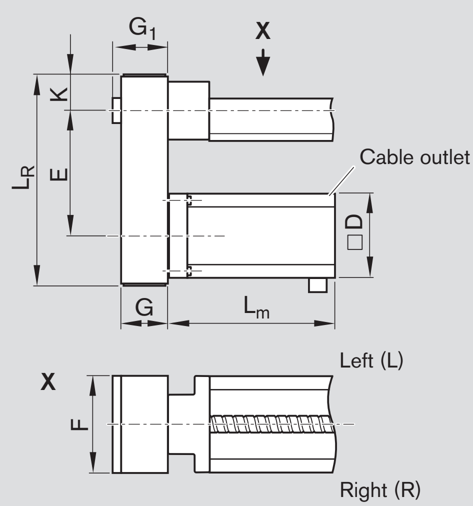
Motor with motor mount and coupling



Motor type	Dimensions (mm)			
	D	L_f	L_m without brake	L_m with brake
MSM 031B	60,0	53,0	79	115.5
MSK 030C	54,0	53,0	188	213.0

RV01–RV08

Motor with timing belt side drive

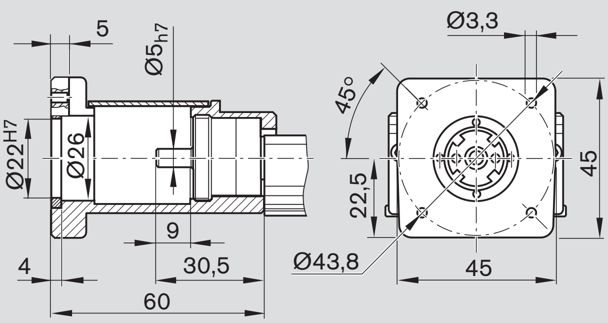


View **X** shown without motor

Version	Motor type	Dimensions (mm)									
		D	E i = 1	E i = 1.5	F	G	G_1	K	L_m without brake	L_m with brake	L_R
RV01 to RV08	**MSM 019B**	38	76.5	76.5	48	27.5	29	27.5	92	122	139

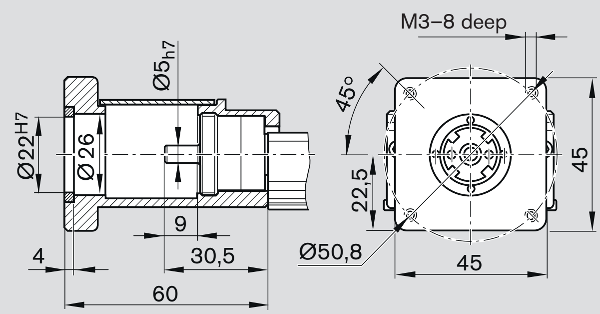
MF10, MF11

Integrated motor mount (NEMA 17 – Form C)



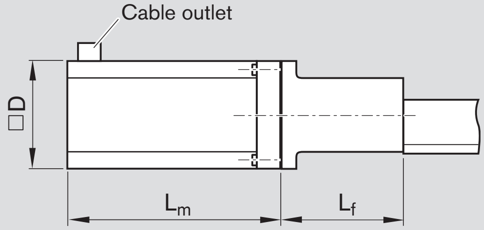
MF10, MF11

Integrated motor mount (NEMA 17 – Form D)



MF10, MF11

Motor with integrated motor mount and coupling



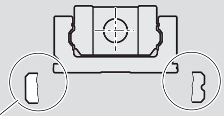
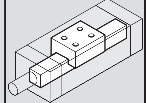
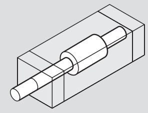
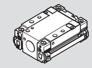
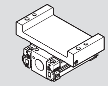
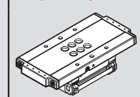
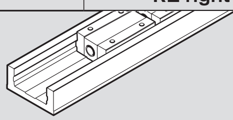
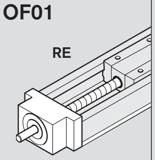
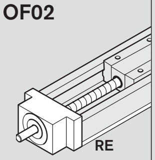
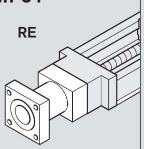
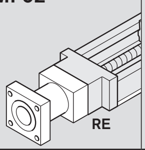
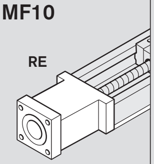
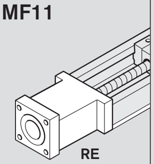
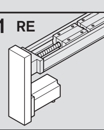
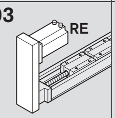
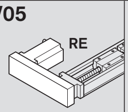
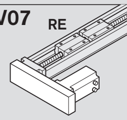
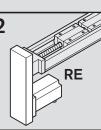
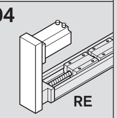
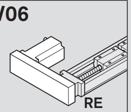
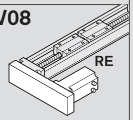
Motor type	Dimensions (mm)			
	D	L_f	L_m without brake	L_m with brake
MSM 019B	38	60	92	122

Drawings not to scale!
For further information and dimensions, see “Motors.”

Configuration and ordering, Dimension Drawings

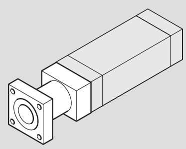
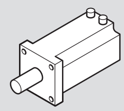
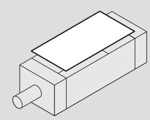
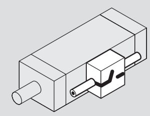
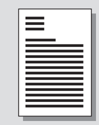
Precision Module PSK-060

Configuration and ordering

Short product name, length PSK-060-NN-1, ... mm  Reference edge (RE) Version	RE left	RE right		Guideway 	Drive unit  Screw journal	Ball screw size d_0 x P 12x2	12x5	12x10	Carriage version Steel  Without cover Standard 1carr.	2carr.	Long 1carr.	2carr.	 Cover plate Standard 1carr.	2carr.	Long 1carr.	2carr.	Aluminum  Sealing strip Standard 1carr.	Long 1carr.
Without drive	OA01 		OA01	L = 150 mm 10 L = 200 mm 11 L = 250 mm 12 L = 300 mm 13 L = 400 mm 15 L = 500 mm 17 L = 600 mm 19 L = 700 mm 21 L = 800 mm 23 L = 900 mm 25 L = 940 mm 26	without		50		01	02	03	04	–	–	–	–	–	–
With ball screw, w/o motor mount	OF01 RE 	OF02  RE	OF01 OF02		Ø6	03	01	02	01	02	03	04	21	22	23	24	40	41
With ball screw and motor mount	MF01 RE 	MF02  RE	MF01 MF02		Ø6	03	01	02	01	02	03	04	21	22	23	24	40	41
W/ball screw and integrated mount	MF10 RE 	MF11  RE	MF10 MF11		Ø6	30	31	32	01	02	03	04	21	22	23	24	40	41
With ball screw and timing belt side drive	RV01 RE  RV03 RE  RV05 RE  RV07 RE 	RV02  RE RV04  RE RV06  RE RV08  RE	RV01 to RV08		for **MSK 030C MSM 031B MSM 019B**	03	01	02	01	02	03	04	21	22	23	24	40	41

Ordering example: See "Inquiry/Order" form

d_0 = screw diameter (mm)
P = screw lead (mm)
carr. = carriage(s)
L = length

<table>
<tr><th rowspan="2"></th><th colspan="3">Motor attachment
</th><th colspan="2">Motor
</th><th colspan="3">Type of cover
</th><th rowspan="2">Switches / Mounting duct / Socket-plug
</th><th colspan="2">Documentation
</th></tr>
<tr><th>Gear ratio i =</th><th>Attach-ment kit 1)</th><th>for motor</th><th>with brake</th><th>without brake</th><th>with-out</th><th>cover plate</th><th>strip</th><th>Standard report</th><th>Measure-ment report</th></tr>
<tr><td></td><td>–</td><td>00</td><td>–</td><td colspan="2">00</td><td>00</td><td>–</td><td>–</td><td rowspan="13">Without switch and Mounting duct 00

Switches:
– Reed sensor 21
– Hall sensor 22

Mounting duct 25

Switching cam for PSK:
– Without cover or with cover plate 30
– With sealing strip 31</td><td rowspan="13">01</td><td rowspan="13">02
Friction moment

03
Lead deviation

04
Travel accuracy

05
Positioning accuracy</td></tr>
<tr><td></td><td>–</td><td>00</td><td>–</td><td colspan="2">00</td><td rowspan="12">00</td><td rowspan="12">01</td><td rowspan="12">02</td></tr>
<tr><td rowspan="2"></td><td rowspan="2">–</td><td>03</td><td>MSM 031B</td><td>137</td><td>136</td></tr>
<tr><td>05</td><td>MSM 019B</td><td>135</td><td>134</td></tr>
<tr><td rowspan="3"></td><td rowspan="3">–</td><td>31</td><td>NEMA 23-D 2)</td><td colspan="2">00</td></tr>
<tr><td>34</td><td>NEMA 23-C 2)</td><td colspan="2">00</td></tr>
<tr><td>32</td><td>MSK 030C</td><td>85</td><td>84</td></tr>
<tr><td rowspan="3"></td><td rowspan="3">i = 1</td><td>11</td><td>MSK 030C</td><td>85</td><td>84</td></tr>
<tr><td>13</td><td>MSM 031B</td><td>137</td><td>136</td></tr>
<tr><td>17</td><td>MSM 019B</td><td>135</td><td>134</td></tr>
<tr><td rowspan="3"></td><td rowspan="3">i = 1,5</td><td>12</td><td>MSK 030C</td><td>85</td><td>84</td></tr>
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<tr><td>18</td><td>MSM 019B</td><td>135</td><td>134</td></tr>
</table>

1) Attachment kit also available without motor (when ordering: enter “00” for motor). For motor mounting kit for customer motor see “Motor mounting” section.

2) Use motors complying with the appropriate NEMA specification. Because of the varying shaft dimensions for NEMA-specification motors, the attachment kit does not include a coupling.

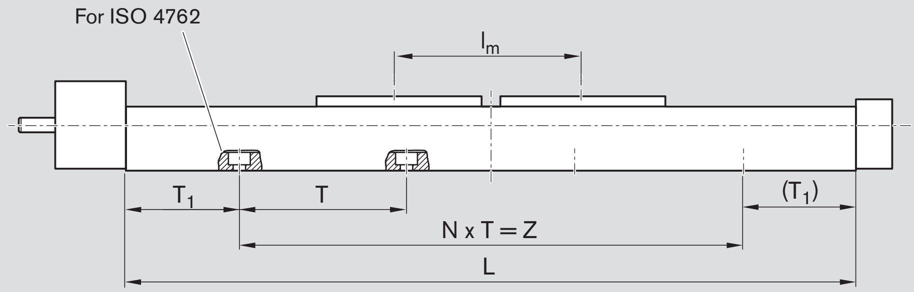
Switch mounting arrangements

Refer to “Switch mounting arrangements” for more information on switch types and switch mounting.

Configuration and ordering, Dimension Drawings

Precision Module PSK-060

Lengths and Hole Spacing



Length L

Type of cover	Number of carriages (carr.)	Carriage version Standard length	Long
Without cover or with cover plate	1 carr.	L = (stroke + 2 · excess travel) + 70 mm	L = (stroke + 2 · excess travel) + 85 mm
	2 carr.	L = (stroke + 2 · excess travel) + l_m + 70 mm $l_{m\ min}$ = 60 mm	L = (stroke + 2 · excess travel) + l_m + 85 mm $l_{m\ min}$ = 75 mm
With sealing strip	1 carr.	L = (stroke + 2 · excess travel) + 160 mm	L = (stroke + 2 · excess travel) + 215 mm

l_m = center-to-center distance between carriages (consider $l_{m\ min}$)
Stroke = maximum travel of carriage center between the outermost switch activation points

In most cases the recommended limit for excess travel (braking path) is:
Excess travel = 2 · screw lead P

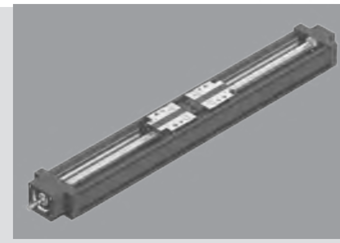
Example
Ball screw 12 x 10
(Ball screw size = d_0 x P):
Excess travel = 2 · 10 = 20 mm

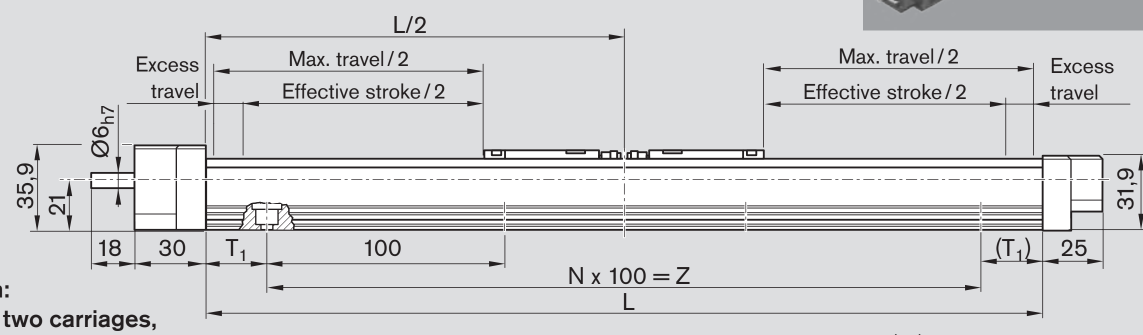
Standard lengths of frame

Length L (mm)	T (mm)	T_1 (mm)	N	Z (mm)	Mounting holes for ISO 4762 screws
150	100	25	1	100	M5
200	100	50	1	100	
250	100	25	2	200	
300	100	50	2	200	
400	100	50	3	300	
500	100	50	4	400	
600	100	50	5	500	
700	100	50	6	600	
800	100	50	7	700	
900	100	50	8	800	
940	100	20	9	900	

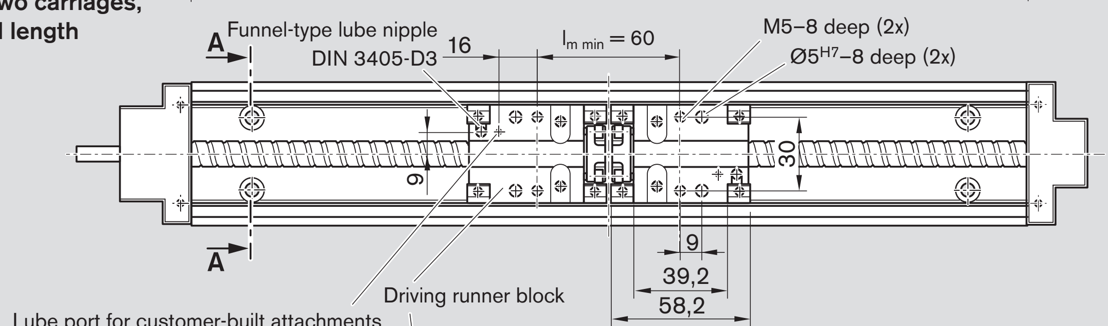
Dimension Drawings without Cover

All dimensions in mm
Drawings not to scale

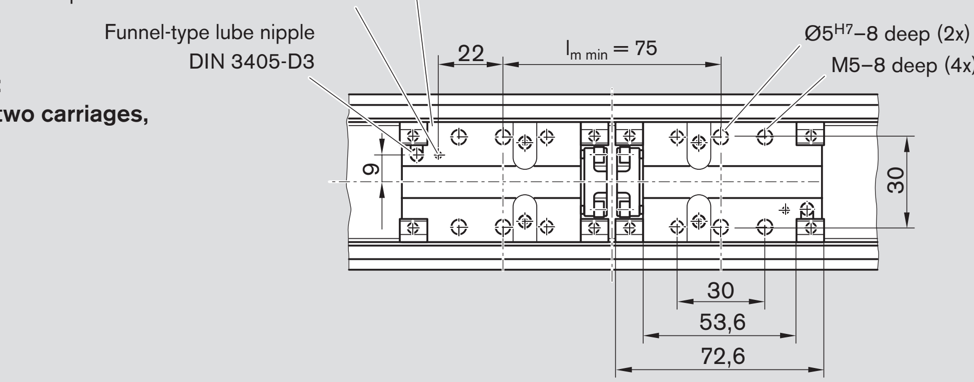


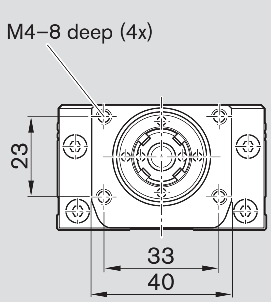


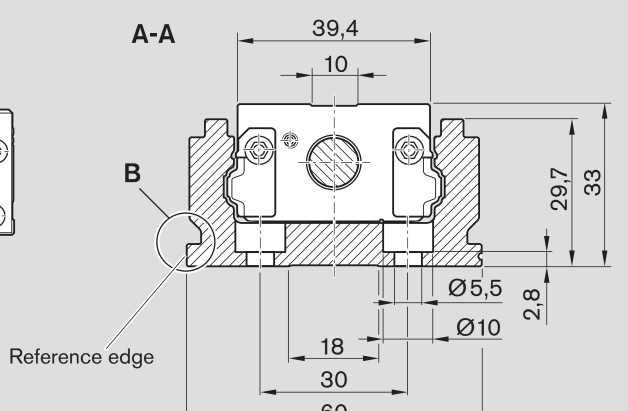
Version:
One or two carriages, standard length

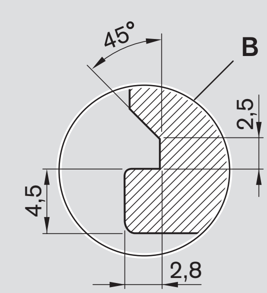


Version:
One or two carriages, long









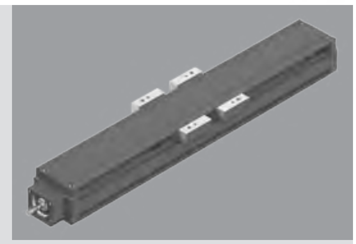
For fastening with clamping fixtures

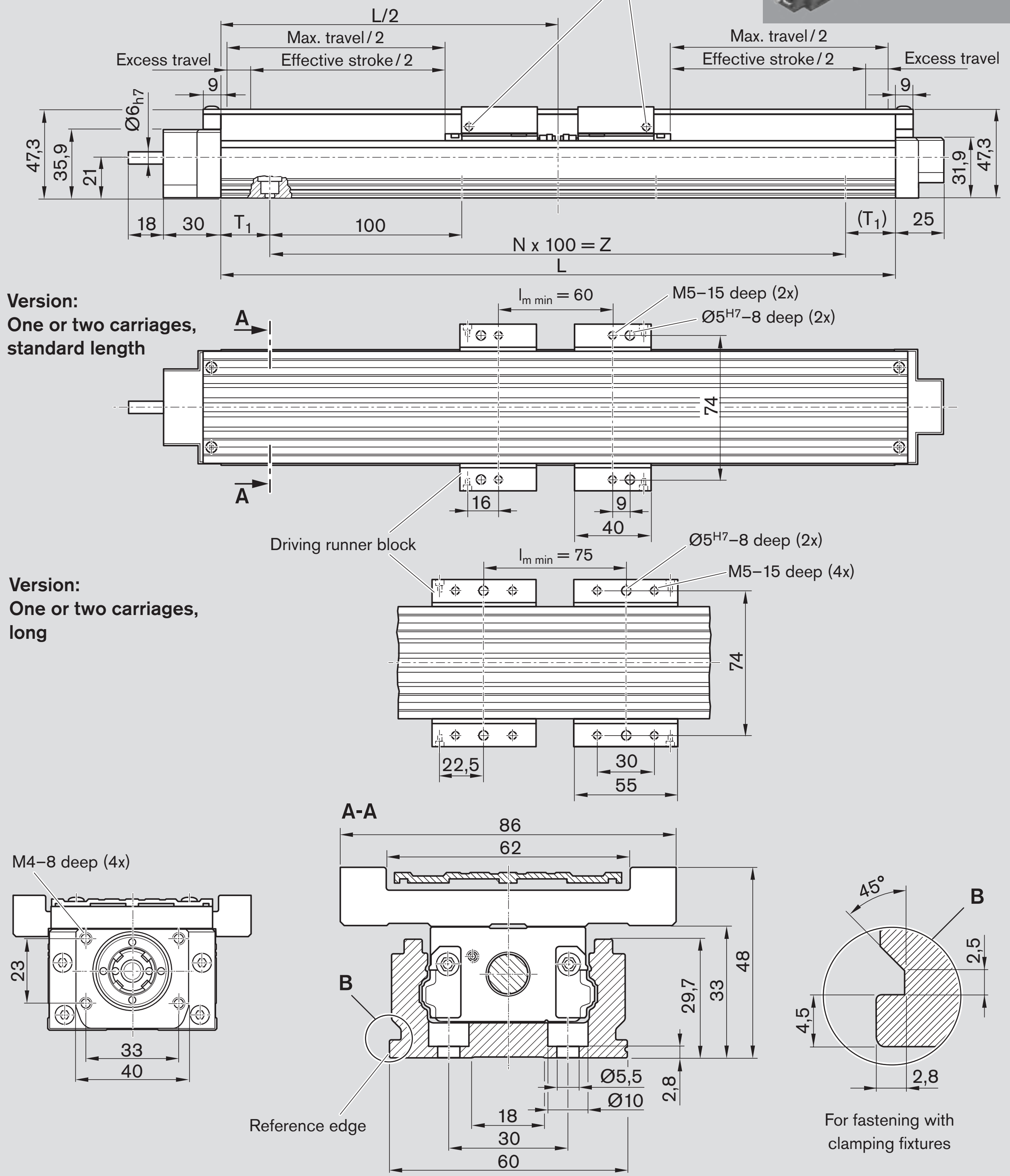
Configuration and ordering, Dimension Drawings

Precision Module PSK-060

Dimension Drawings with Cover Plate

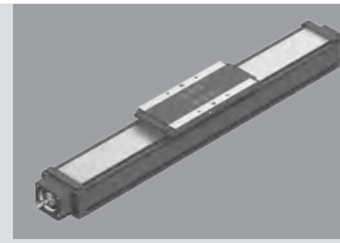
All dimensions in mm
Drawings not to scale

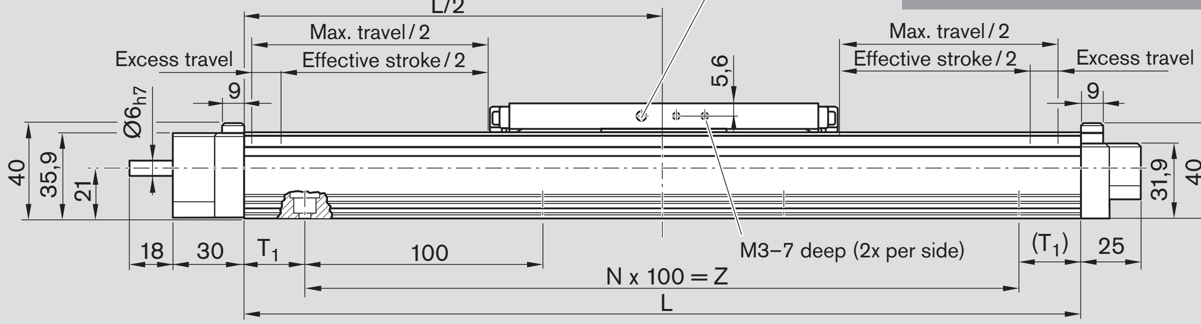




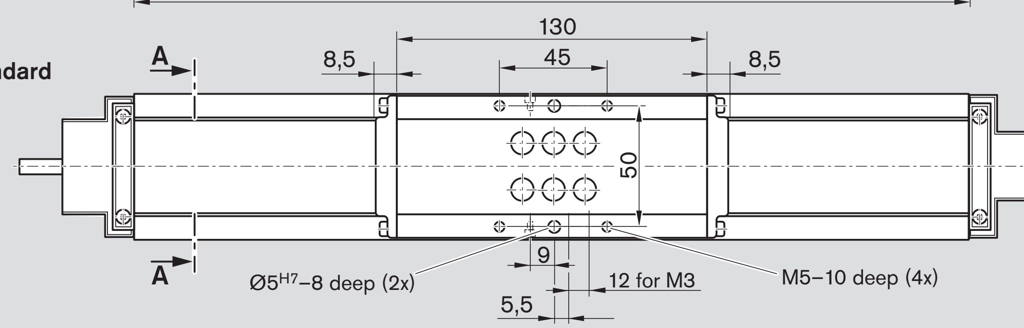
Dimension Drawings with Sealing Strip

All dimensions in mm
Drawings not to scale

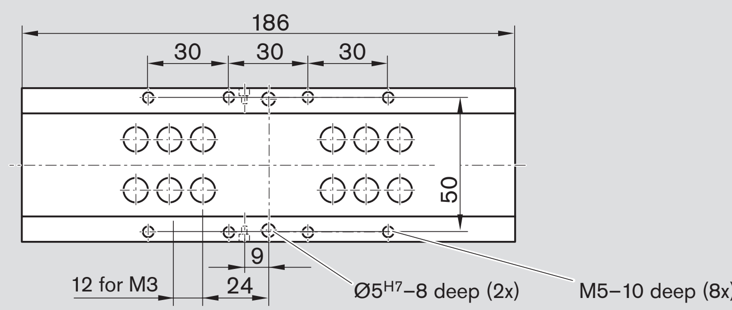


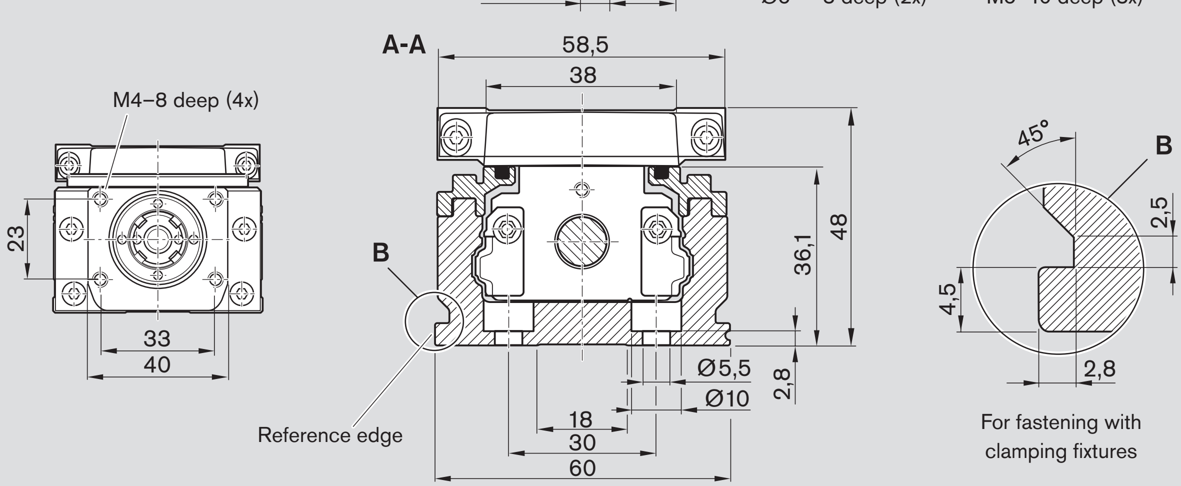


Version:
Carriage, standard length



Version:
Carriage, long



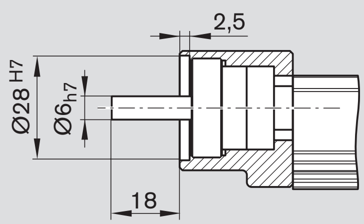


Configuration and ordering, Dimension Drawings

Precision Module PSK-060

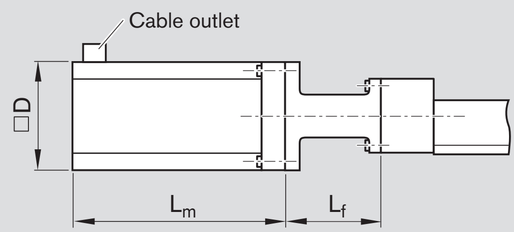
Dimension Drawings, Motor Attachment

OF01, OF02



MF01, MF02

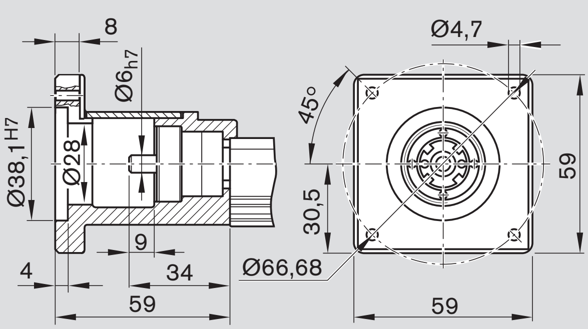
Motor with motor mount and coupling



Motor type	Dimensions (mm)			
	D	L_f	L_m without brake	L_m with brake
MSM 019B	38	45	92	122.0
MSK 030C	54	50	188	213.0
MSM 031B	60	50	79	115.5

MF10, MF11

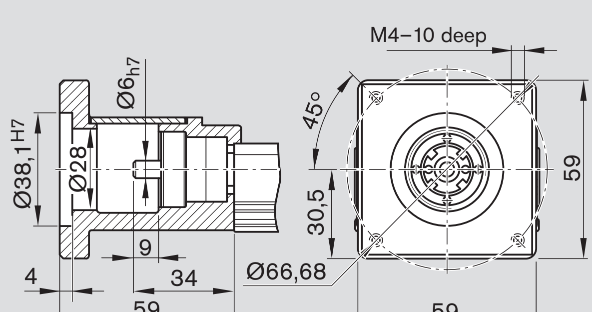
Integrated motor mount (NEMA 23 – Form C)



Drawings not to scale!
For further information and dimensions, see “Motors.”

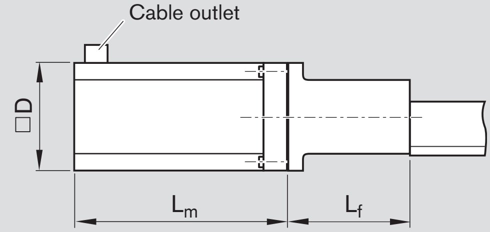
MF10, MF11

Integrated motor mount (NEMA 23 – Form D)



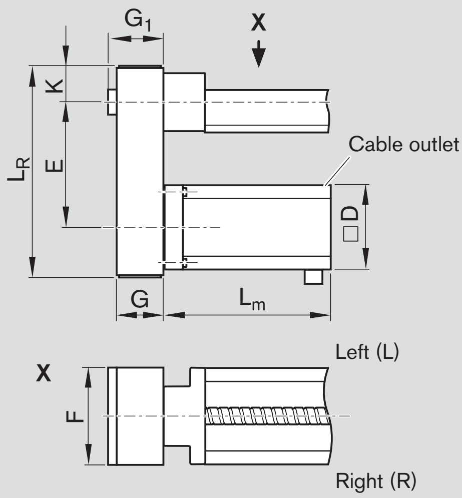
MF10, MF11

Motor with integrated motor mount and coupling



Motor type	Dimensions (mm)			
	D	L_f	L_m without brake	L_m with brake
MSK 030C	54	59	188	213

RV01–RV08

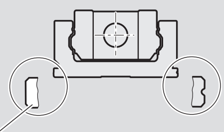
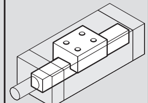
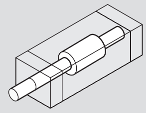
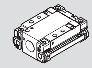
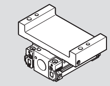
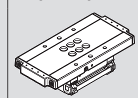
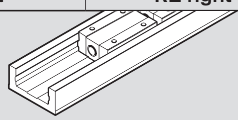
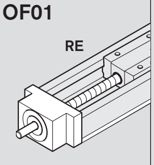
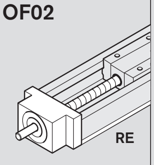
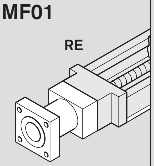
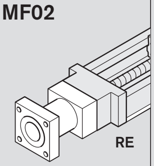
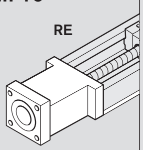
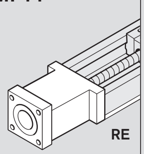
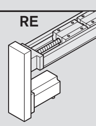
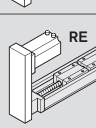
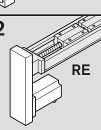
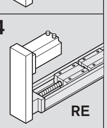
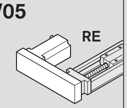
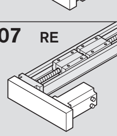
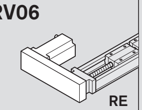
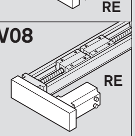


Version	Motor type	Dimensions (mm)									
		D	E		F	G	G_1	K	L_m		L_R
			i = 1	i = 1.5					without brake	with brake	
RV01 to RV08	MSM 019B	38	76,5	76,5	48,0	27,5	29,0	27,5	92	122,0	139
	MSK 030C	54	78,0	75,0	64,5	37,0	43,5	33,5	188	213,0	154
	MSM 031B	60	78,0	75,0	64,5	37,0	43,5	33,5	79	115,5	157

Configuration and ordering, Dimension Drawings

Precision Module PSK-090

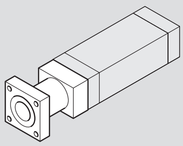
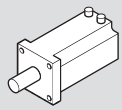
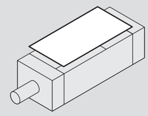
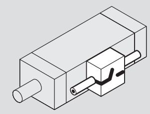
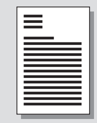
Components and Ordering Data

Short product name, length PSK-090-NN-1, ... mm				Guideway	Drive unit				Carriage version									
 Reference edge (RE)									Steel 								Aluminum 	
					Screw journal	Ball screw size d_0 x P			Without cover				Cover plate				Sealing strip	
Version									Standard		Long		Standard		Long		Standard	Long
	RE left	RE right				16x5	16x10	16x16	1carr.	2carr.	1carr.	2carr.	1carr.	2carr.	1carr.	2carr.	1carr.	1carr.
Without drive	OA01 		OA01	L = 340 mm 10 L = 440 mm 12 L = 540 mm 14 L = 640 mm 16 L = 740 mm 18 L = 840 mm 20 L = 940 mm 22	without	50			01	02	03	04	–	–	–	–	–	–
With ball screw, w/o motor mount	OF01 	OF02 	OF01 OF02		Ø9	01	02	03	01	02	03	04	21	22	23	24	40	41
					Ø9 with keyway	11	12	13										
With ball screw and motor mount	MF01 	MF02 	MF01 MF02		Ø9	01	02	03	01	02	03	04	21	22	23	24	40	41
W/ball screw and integrated mount	MF10 	MF11 	MF10 MF11		Ø9	30	31	32	01	02	03	04	21	22	23	24	40	41
With ball screw and timing belt side drive	RV01  RV03 	RV02  RV04 	RV01 to RV08		for MSK 030C MSM 031C	01	02	03	01	02	03	04	21	22	23	24	40	41
	RV05  RV07 	RV06  RV08 			for MSK 040C MSM 041B	01	02	03	01	02	03	04	21	22	23	24	40	41

Ordering example: See “Inquiry/Order” form

⚠ **Please check whether the selected combination is a permissible one (load capacities, moments, maximum speeds, motor data, etc.)!**

d_0 = screw diameter (mm)
P = screw lead (mm)
carr. = carriage(s)
L = length

	Motor attachment			Motor		Type of cover			Switches / Mounting duct / Socket-plug	Documentation	
											
	Gear ratio i =	Attach-ment kit [1]	for motor	with brake	without brake	with-out	cover plate	strip		Standard report	Measure-ment report
	–	00	–	00		00	–	–			
	–	00	–	00							02 Friction moment
	–	03	MSK 040C	87	86				**Without switch and Mounting duct** 00		
		06	MSM 041B	141	140				**Switches:** – Reed sensor 21 – Hall sensor 22		03 Lead deviation
	–	31	NEMA 23-D[2]	00							
		32	MSK 030C	85	84				**Mounting duct** 25	01	
		33	MSM 031C	139	138	00	01	02			
	i = 1	40	MSK 030C	85	84				**Switching cam for PSK:** – Without cover or with cover plate 30 – With sealing strip 31		04 Travel accuracy
	i = 1,5	41									
	i = 1	42	MSM 031C	139	138						
	i = 1,5	43									
	i = 1	44	MSK 040C	87	86						05 Positioning accuracy
	i = 1,5	45									
	i = 1	46	MSM 041B	141	140						
	i = 1,5	47									

1) Attachment kit also available without motor (when ordering: enter "00" for motor). For motor mounting kit for customer motor see "Motor mounting" section.

2) Use motors complying with the appropriate NEMA specification. Because of the varying shaft dimensions for NEMA-specification motors, the attachment kit does not include a coupling.

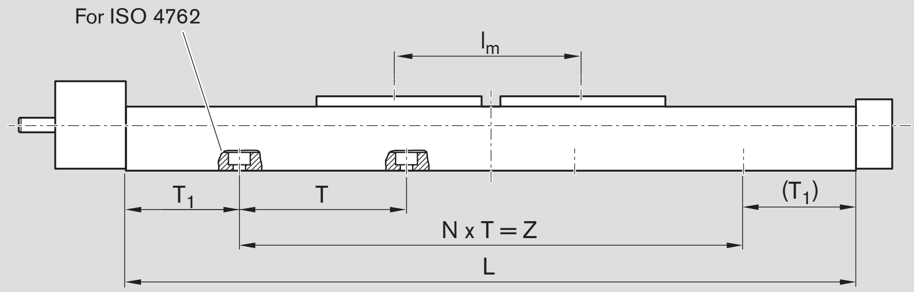
Switch mounting arrangements

Refer to "Switch mounting arrangements" for more information on switch types and switch mounting.

Configuration and ordering, Dimension Drawings

Precision Module PSK-090

Lengths and Hole Spacing



Length L

Type of cover	Number of carriages (carr.)	Carriage version Standard length	Long
Without cover or with cover plate	1 carr.	L = (stroke + 2 · excess travel) + 100 mm	L = (stroke + 2 · excess travel) + 120 mm
	2 carr.	L = (stroke + 2 · excess travel) + l_m + 100 mm $l_{m\ min}$ = 90 mm	L = (stroke + 2 · excess travel) + l_m + 120 mm $l_{m\ min}$ = 110 mm
With sealing strip	1 carr.	L = (stroke + 2 · excess travel) + 190 mm	L = (stroke + 2 · excess travel) + 265 mm

l_m = center-to-center distance between carriages (consider $l_{m\ min}$)
Stroke = maximum travel of carriage center between the outermost switch activation points

In most cases the recommended limit for excess travel (braking path) is:
Excess travel = 2 · screw lead P

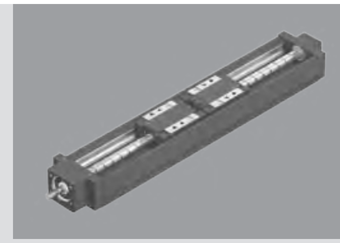
Example
Ball screw 16 x 10
(Ball screw size = d_0 x P):
Excess travel = 2 · 10 = 20 mm

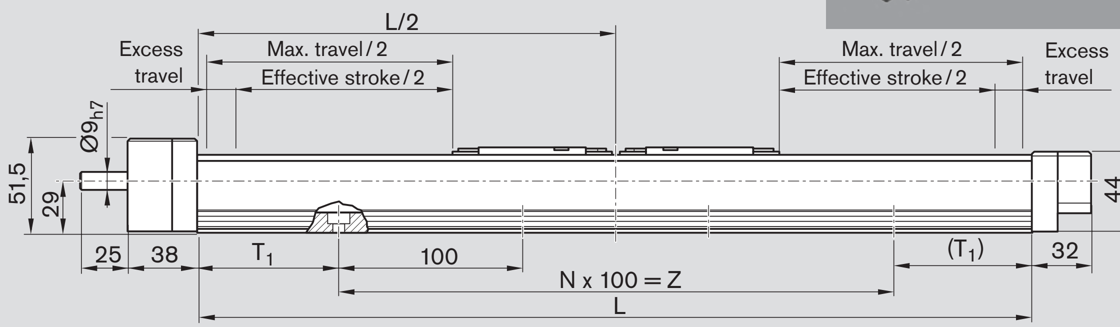
Standard lengths of frame

Length L (mm)	T (mm)	T_1 (mm)	N	Z (mm)	Mounting holes for ISO 4762 screws
340	100	70	2	200	M6
440	100	70	3	300	
540	100	70	4	400	
640	100	70	5	500	
740	100	70	6	600	
840	100	70	7	700	
940	100	70	8	800	

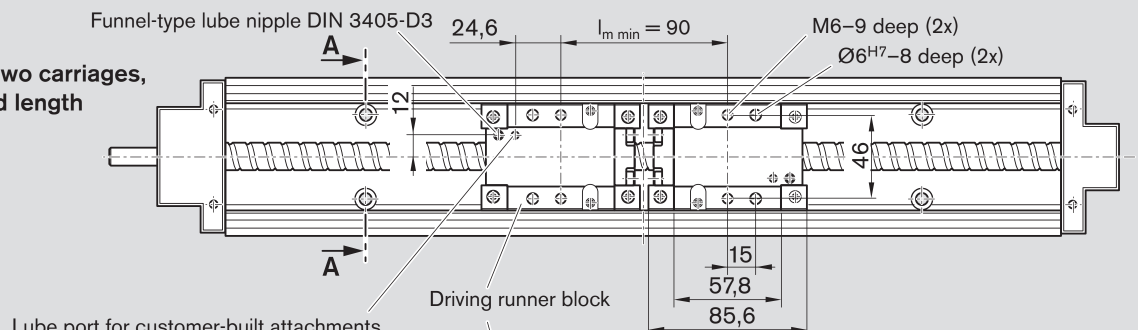
Dimension Drawings without Cover

All dimensions in mm
Drawings not to scale

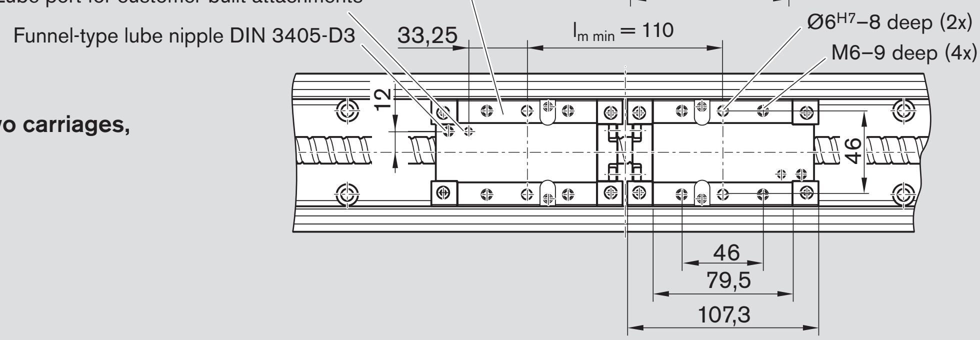


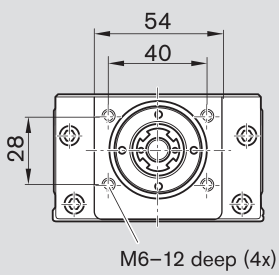


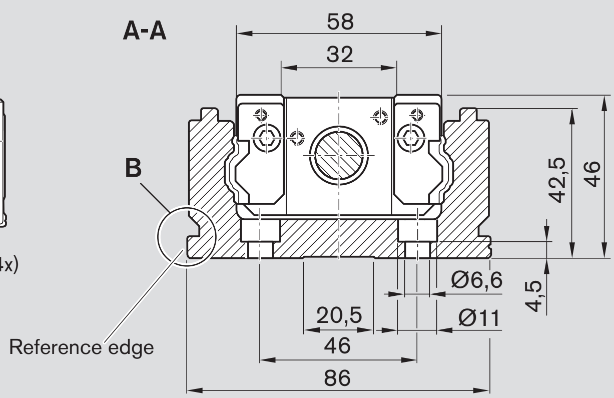
Version: One or two carriages, standard length

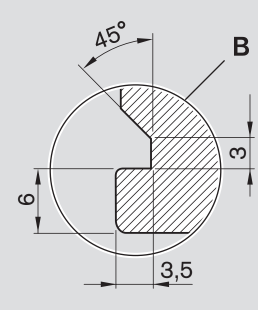


Version: One or two carriages, long









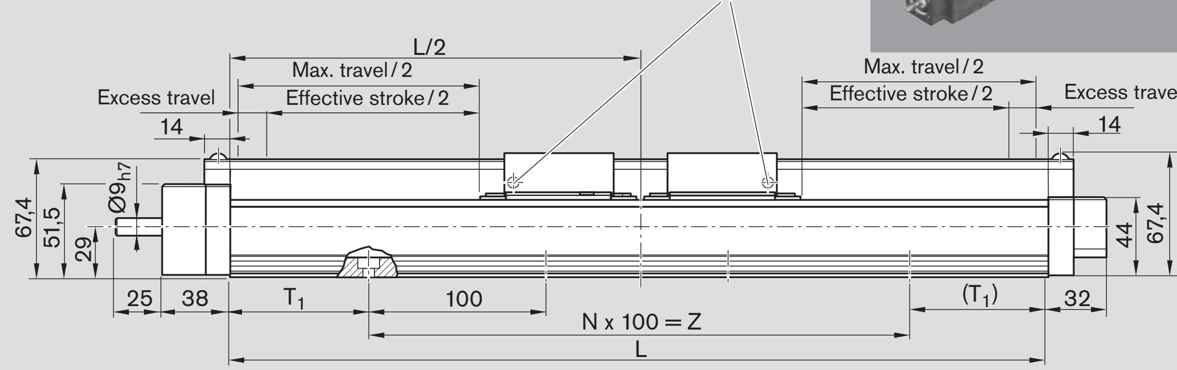
For fastening with clamping fixtures

Configuration and ordering, Dimension Drawings

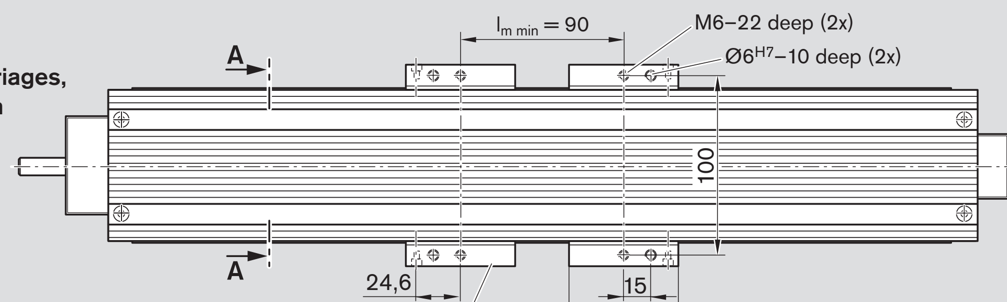
Precision Module PSK-090

Dimension Drawings with Cover Plate

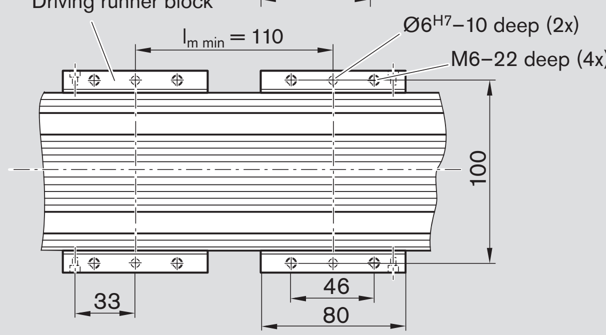
All dimensions in mm
Drawings not to scale

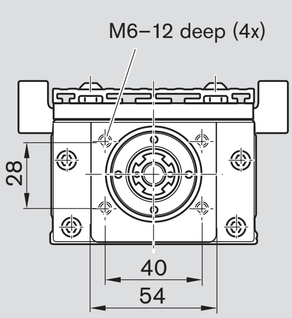


Version:
One or two carriages, standard length

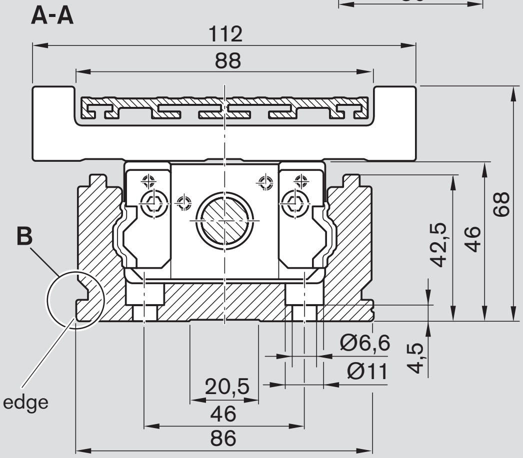


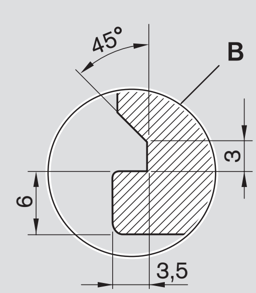
Version:
One or two carriages, long





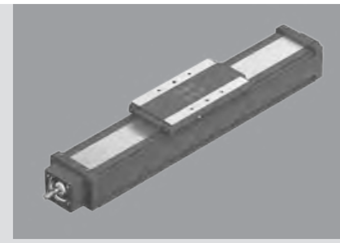
A-A



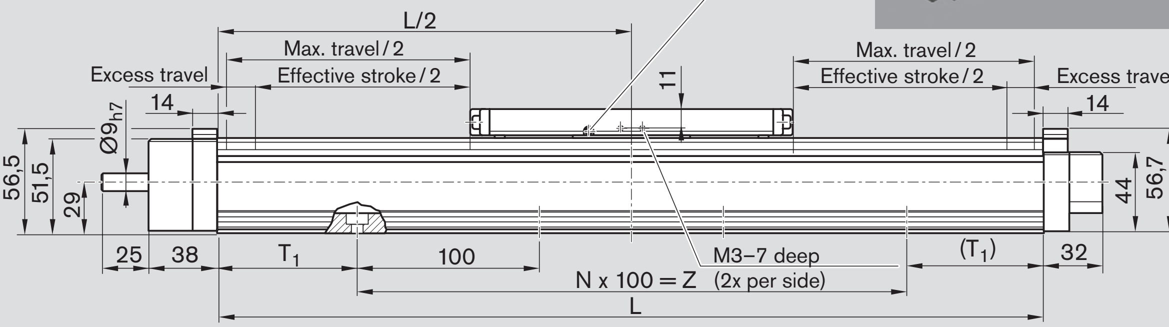


For fastening with clamping fixtures

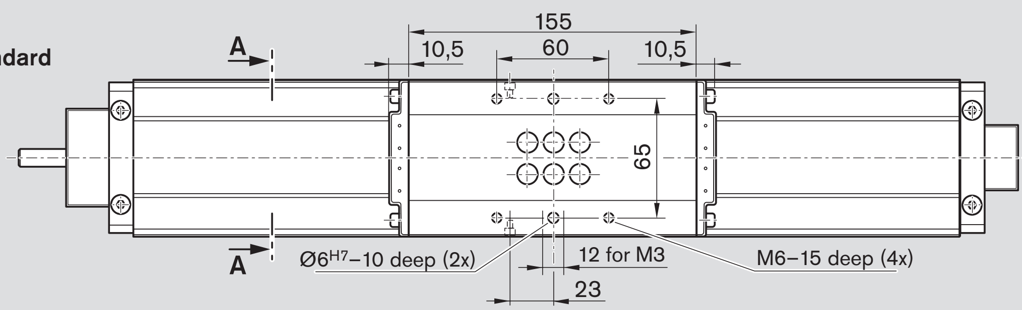
Dimension Drawings with Sealing Strip



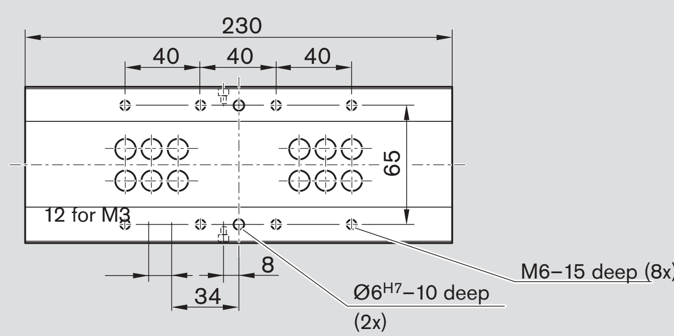
All dimensions in mm
Drawings not to scale

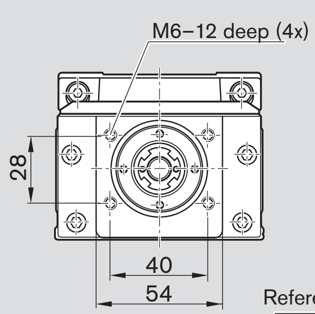


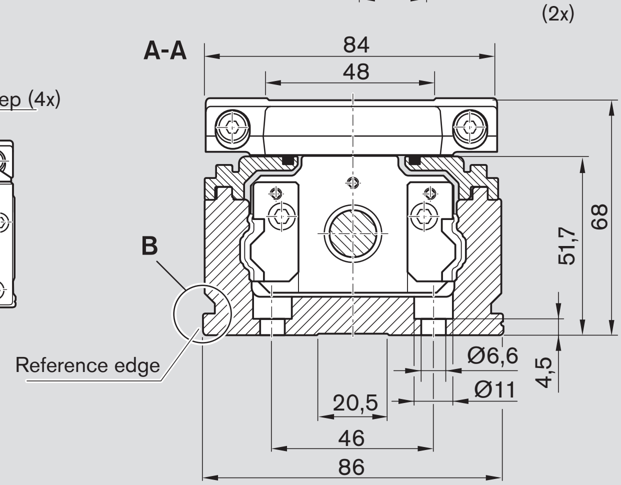
Version:
Carriage, standard length

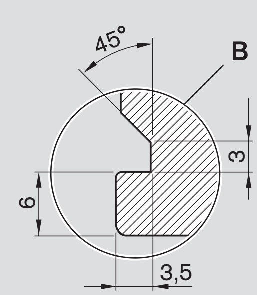


Version:
Carriage, long









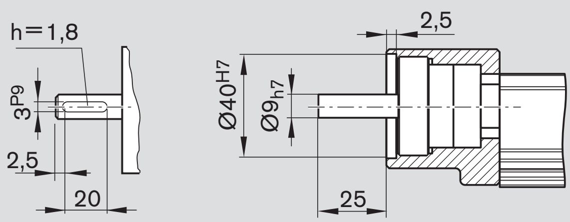
For fastening with clamping fixtures

Configuration and ordering, Dimension Drawings

Precision Module PSK-090

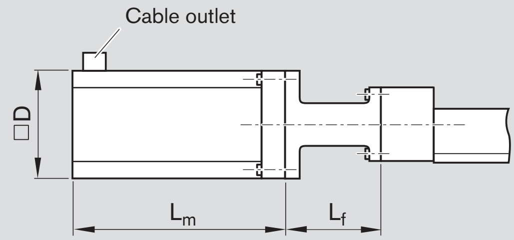
Dimension Drawings, Motor Attachment

OF01, OF02



MF01, MF02

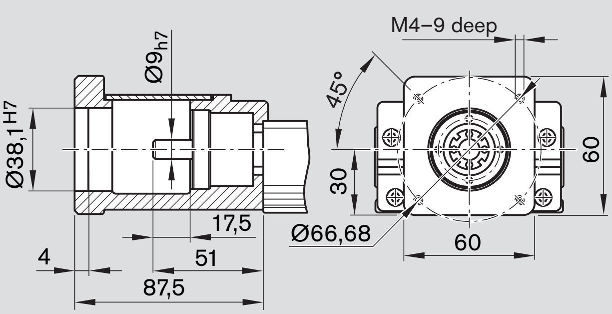
Motor with motor mount and coupling



Motor type	Dimensions (mm) D	L_f	L_m without brake	L_m with brake
MSM 031C	60.0	72.0	98.5	135.0
MSM 041B	80.0	81.0	112.0	149.0
MSK 030C	54.0	75.0	188.0	213.0
MSK 040C	82.0	77.5	185.5	215.5

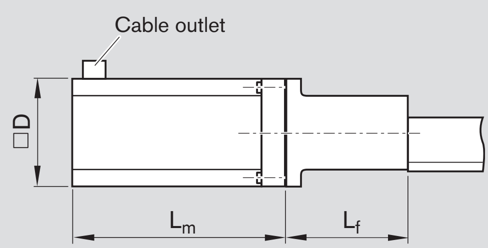
MF10, MF11

Integrated motor mount (NEMA 23 – Form D)



MF10, MF11

Motor with integrated motor mount and coupling

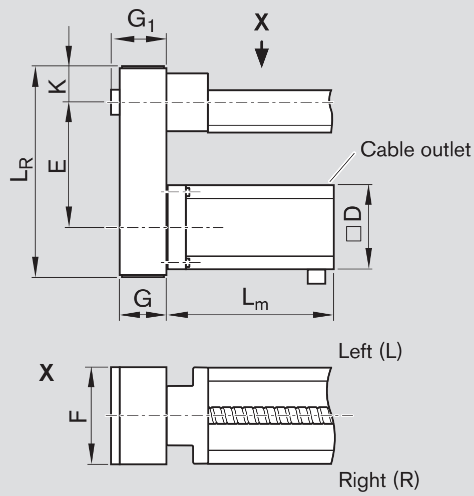


Motor type	Dimensions (mm) D	L_f	L_m without brake	L_m with brake
MSM 031C	60	87.5	98.5	135.0
MSK 030C	54	87.5	188.0	213.0

Drawings not to scale!
For further information and dimensions, see “Motors.”

RV01–RV08

Motor with timing belt side drive



View **X** shown without motor

Version	Motor type	Dimensions (mm)										
		D	E		F	G	G_1	K	L_m		L_R	
			i = 1	i = 1.5					without brake	with brake	i = 1	i = 1.5
RV01 to RV08	**MSM 031C**	60	103.5	115.0	64.5	37	43.5	33.5	98.5	135.0	180.0	191.5
	MSM 041B	80	122.0	122.0	88.0	51	57.0	45.5	112.0	149.0	231.0	231.0
	MSK 030C	54	103.5	115.0	64.5	37	43.5	33.5	188.0	213.0	180.0	191.5
	MSK 040C	80	122.0	122.0	88.0	51	57.0	45.5	185.5	215.5	231.0	231.0

Attachments and Accessories

Switch Mounting Arrangements

Overview of switching system

1 Switch
2 Switching cam
3 Mounting duct (aluminum alloy, black anodized)
4 Socket head cap screw with washer

Notes for mounting
A mounting duct is required for installation of the switches.

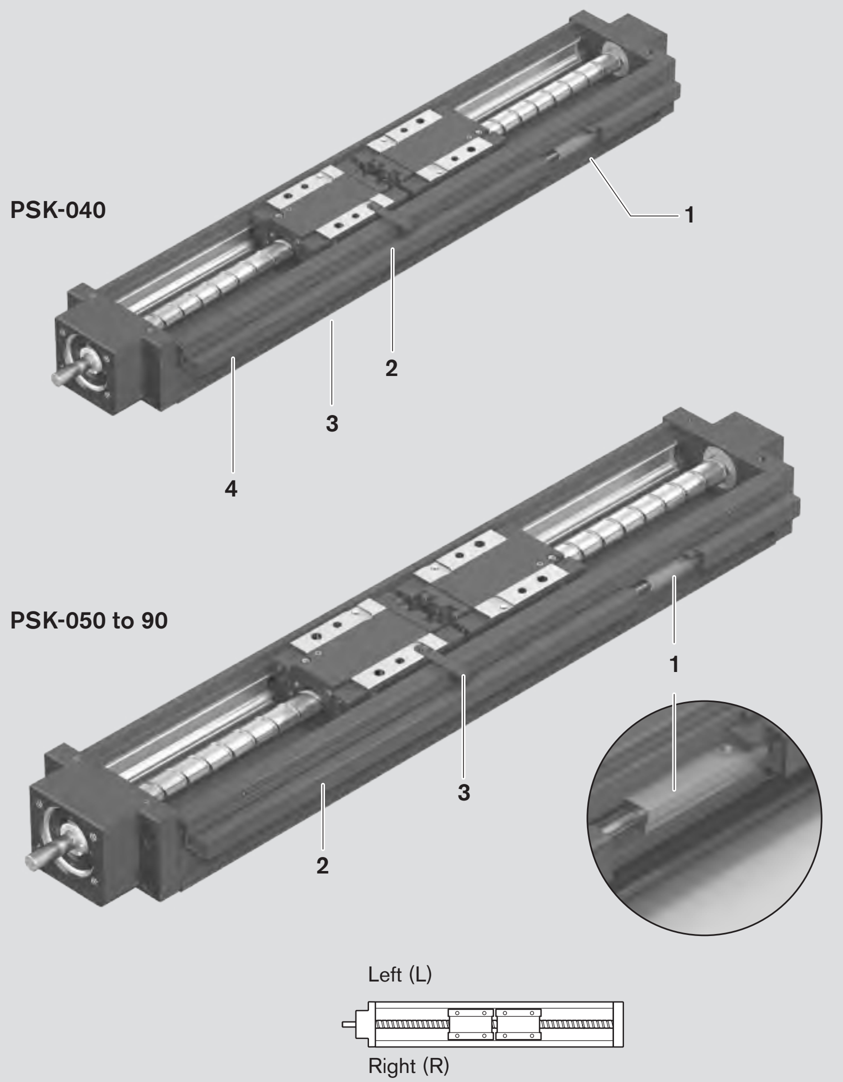
⚠ **Short stroke:**
Consider the length of the switch!

Mounting side:
Switches may be mounted on the left (L) or right (R) side of the module.

For two-carriage versions:
Switch actuation by the driving runner block (on the motor side).

The switching system (switch, switching cam, mounting duct, standard parts) is supplied loose.

Switching system



Ordering the switches and accessories

Refer to the following table for part numbers.
Accessories can also be ordered separately.

Item		Part numbers		
		PSK-040	PSK-050	PSK-060 and PSK-090
1	**Switches**			
	– Reed sensor	R3476 018 03	R3476 018 03	R3476 018 03
	– Hall sensor	R3476 019 03	R3476 019 03	R3476 019 03
2	**Mounting duct**	R0399 800 97	R0396 620 20	R0396 620 19
3	**Switching cam**			
	– For PSK without cover or with cover plate	R1419 000 12	R1419 000 10	R1419 000 04
	– For PSK with sealing strip	–	R1419 000 11	R1419 000 05

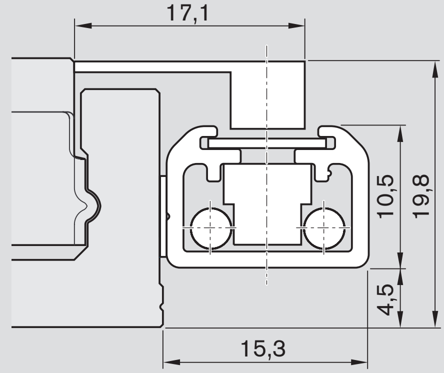
Length calculation mounting duct : PSK40: L + 15 mm
PSK-050 to PSK-090: L – 2 mm

Mounting duct

Function
– To accommodate and secure switches
– To house cables

Mounting instructions for PSK-040
The mounting duct is fastened to the same side as the switches and fixed to the end blocks of the Precision Module with socket head cap screws and washers (included in delivery).

Mounting duct PSK-040
Arrangement of switching cam and mounting duct

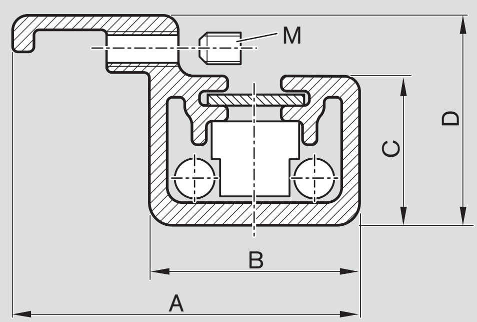


Mounting instructions for PSK-050 to PSK-090
The Mounting duct is mounted to the same side as the switches by snapping it into the T-slots on the frame of the Precision Module and securing it with set screws. The set screws (M) are supplied along with the duct.

Dimensions for mounting duct

Dimensions		PSK-050	PSK-060	PSK-090
A	(mm)	21.7	25.2	25.2
B	(mm)	15.0	15.0	15.0
C	(mm)	11.5	11.5	11.5
D	(mm)	16.5	16.5	16.5
M	(mm)	M2.0	M2.5	M2.5

Mounting duct PSK 50 to PSK 90



Installation dimensions for versions without cover or with cover plate

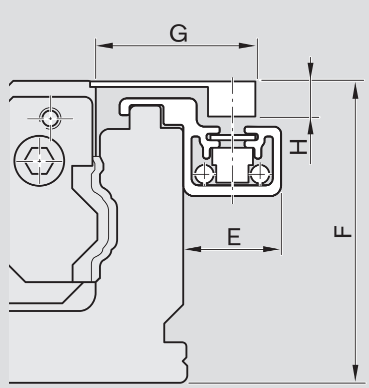
Dimensions		PSK-050	PSK-060	PSK-090
E	(mm)	15.2	15.8	15.4
F	(mm)	25.8	32.8	45.8
G	(mm)	19.7	22.6	25.8
H	(mm)	6.0	6.0	6.0

Installation dimensions for version with sealing strip

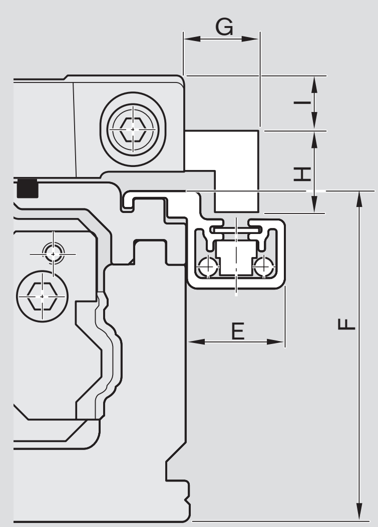
Dimensions		PSK-050	PSK-060	PSK-090
E	(mm)	15.2	15.8	15.2
F	(mm)	28.2	35.7	50.2
G	(mm)	12.2	13.0	13.0
H	(mm)	12.5	14.0	14.0
I	(mm)	3.3	1.9	7.4

Arrangement of switching cam and mounting duct

– PSK without cover or with cover plate



– PSK with sealing strip



Attachments and Accessories

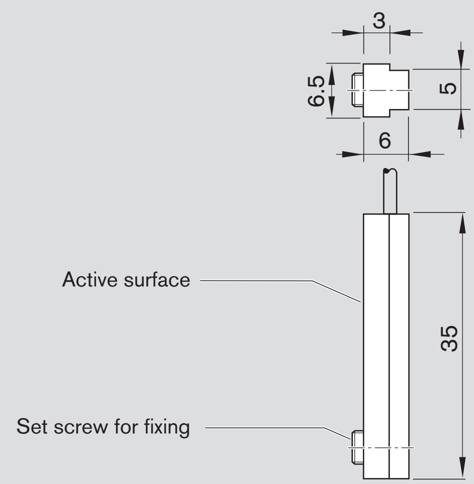
Switch Mounting Arrangements

Switches

The switches for Precision Modules PSK are magnetic field sensors with potted cable.

Versions
– Hall sensor, PNP NC
– Reed sensor (changeover)

Notes for mounting
Switches may only be mounted to one side of the Precision Module (left or right).
A mounting duct is required for installation of the switches.
The switches are pushed into the slots of the mounting duct and fixed with set screws.

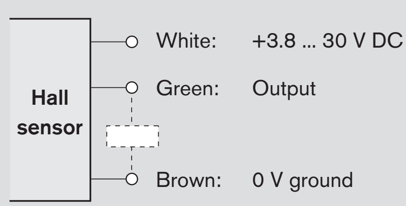


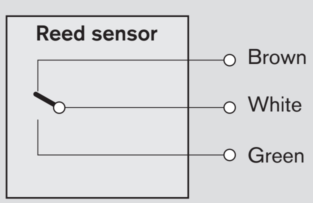
Technical data

Hall sensor	
Contact type	PNP NC
Operating voltage	3.8–30 V DC
Current consumption	max. 10 mA
Output current	max. 20 mA
Cable length	2000 mm
Protection class	IP 66
Short-circuit protection	No

Reed sensor	
Contact type	Changeover
Switching voltage	max. 100 V DC
Switching current	max. 500 mA
Cable length	2000 mm
Protection class	IP 66
Caution: 2 switching points	

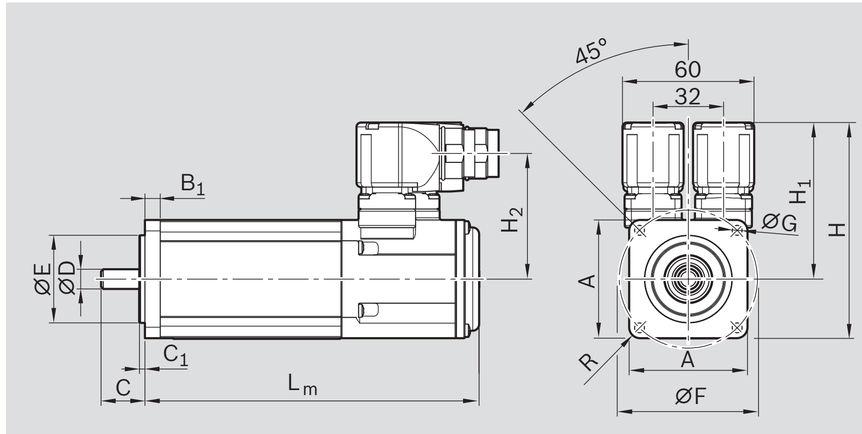
Pin assignment





Attachments and Accessories

IndraDyn S Servo Motor MSK



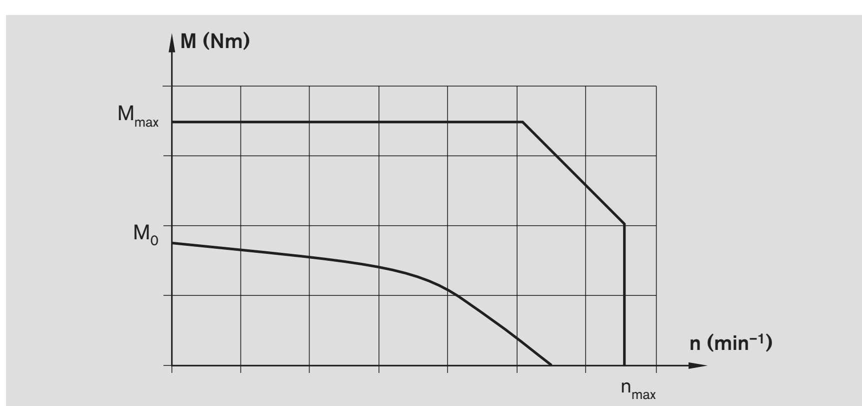
Motor type	Dimensions (mm) A	B_1	C	C_1	ØD k6	ØE j6	ØF	ØG	H	L_m without brake	L_m with brake
MSK 030C-0900	54	7	20	2,5	9	40	63	4,5	98,5	180,0	213,0
MSK 040C-0600	82	8	30	2,5	14	50	95	6,6	124,5	185,5	215,5

Motor data

Motor type	n_{max} (min^{-1})	M_0 (Nm)	M_{max} (Nm)	M_{br} (Nm)	J_m (kgm^2)	J_{br} (kgm^2)	m_m (kg)	m_{br} (kg)
MSK 030C-0900	9 000	0,8	4,0	1	0,000030	0,000007	1,9	0,2
MSK 040C-0600	7 500	2,7	8,1	4	0,000140	0,000023	3,6	0,3

J_{br} = mass moment of inertia of the holding brake
J_m = mass moment of inertia, motor
L_m = length of the motor
M_0 = standstill torque
M_{br} = holding torque of holding brake when switched off
M_{max} = maximum possible motor torque
n_{max} = maximum motor speed

Motor torque speed curve (schematic)

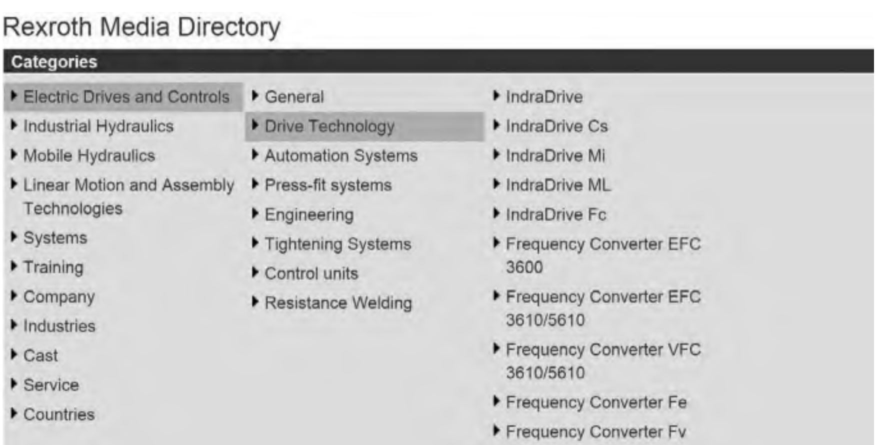


Option number[1)]	Motor	Part number	Version Holding brake without	with	Type designation
84	**MSK 030C-0900**	R911308683	X		MSK030C-0900-NN-M1-UG0-NNNN
85		R911308684		X	MSK030C-0900-NN-M1-UG1-NNNN
86	**MSK 040C-0600**	R911306060	X		MSK040C-0600-NN-M1-UG0-NNNN
87		R911306061		X	MSK040C-0600-NN-M1-UG1-NNNN

1) From the "Configuration and Ordering" table"

Specification:
- Plain shaft with shaft seal ring
- Multiturn absolute encoder M1 (Hiperface)
- Cooling system: natural convection
- Protection class IP65 (casing)
- With or without holding brake

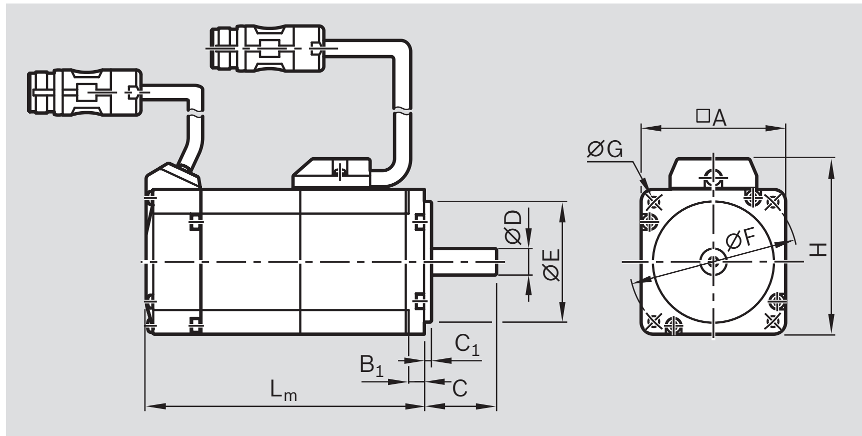
Note
The motors can be supplied complete with controllers and control units. For further motor types and more information on motors, controllers and control systems, please refer to the Rexroth catalogs on drive technology.



Recommended motor controller combinations

Motor	Controller
MSK 030C-0900	HCS 01.1E-W0005
MSK 030C-0900	HCS 01.1E-W0008
MSK 040C-0600	
MSK 040C-0600	HCS 01.1E-W0018

IndraDyn S Servo Motor MSM



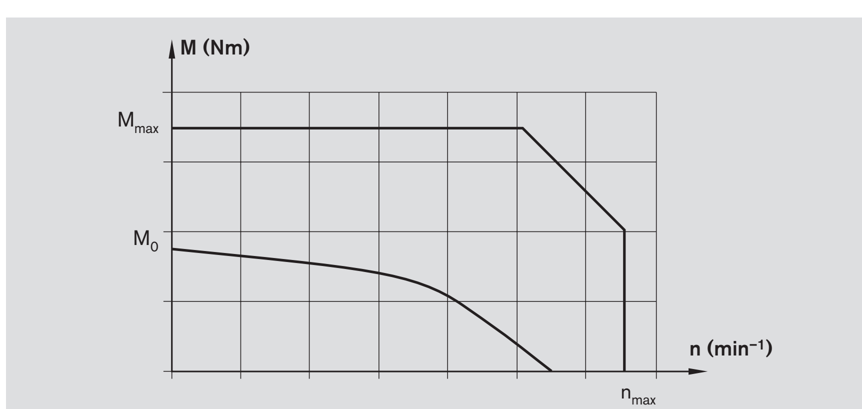
Motor type	Dimensions (mm) A	B1	C	C1	ØD h6	ØE h7	ØF	ØG	H	Lm without brake	Lm with brake
MSM 019A-0300	38	6,0	25	3	8	30	45	3,4	51	72,0	102,0
MSM 019B-0300	38	6,0	25	3	8	30	45	3,4	51	92,0	122,0
MSM 031B-0300	60	6,5	30	3	11	50	70	4,5	73	79,0	115,5
MSM 031C-0300	60	6,5	30	3	14	50	70	4,5	73	98,5	135,0
MSM 041B-0300	80	6,0	35	3	19	70	90	6,0	93	112,0	149,0

Motor data

Motor type	n_{max} (min^{-1})	M_0 (Nm)	M_{max} (Nm)	M_{br} (Nm)	J_m (kgm^2)	J_{br} (kgm^2)	m_m (kg)	m_{br} (kg)
MSM 019A-0300	5 000	0.16	0.48	0.29	0.0000025	0.0000002	0.32	0.21
MSM 019B-0300	5 000	0.32	0.95	0.29	0.0000051	0.0000002	0.47	0.21
MSM 031B-0300	5 000	0.64	1.91	1.27	0.0000140	0.0000018	0.82	0.48
MSM 031C-0300	5 000	1.30	3.80	1.27	0.0000260	0.0000018	1.20	0.50
MSM 041B-0300	4 500	2.40	7.10	2.45	0.0000870	0.0000075	2.30	0.80

J_{br} = mass moment of inertia of the holding brake
J_m = mass moment of inertia, motor
L_m = length of the motor
M_0 = standstill torque
M_{br} = holding torque of holding brake when switched off
M_{max} = maximum possible motor torque
n_{max} = maximum motor speed

Motor torque speed curve (schematic)

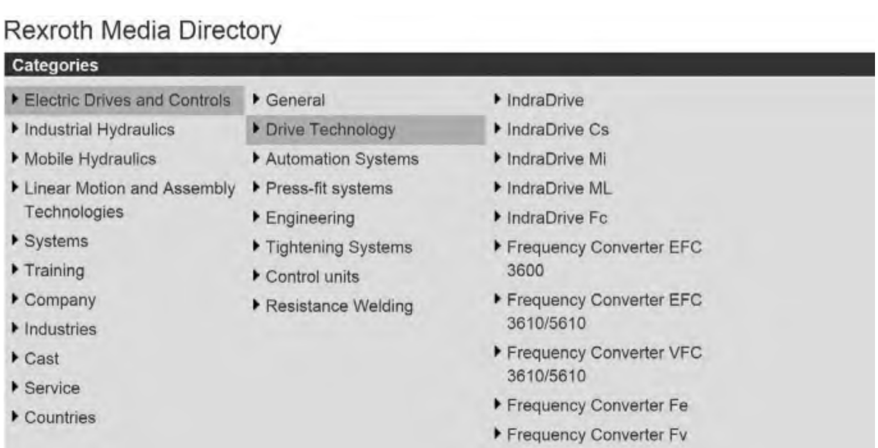


Option number[1)]	Motor	Part number	Version Holding brake without	with	Type designation
132	**MSM 019A-0300**	R911344209	X		MSM 019A-0300-NN-M5-MH0
133		R911344210		X	MSM 019A-0300-NN-M5-MH1
134	**MSM019B-0300**	R911344211	X		MSM 019B-0300-NN-M5-MH0
135		R911344212		X	MSM 019B-0300-NN-M5-MH1
136	**MSM 031B-0300**	R911344213	X		MSM 031B-0300-NN-M5-MH0
137		R911344214		X	MSM 031B-0300-NN-M5-MH1
138	**MSM 031C-0300**	R911344215	X		MSM 031C-0300-NN-M5-MH0
139		R911344216		X	MSM 031C-0300-NN-M5-MH1
140	**MSM 041B-0300**	R911344217	X		MSM 041B-0300-NN-M5-MH0
141		R911344218		X	MSM 041B-0300-NN-M5-MH1

1) From the “Configuration and Ordering” table“

Specification:
– Plain shaft without shaft seal ring
– Multiturn absolute encoder M5 (20 Bit, absolute encoder functionality only possible with back-up battery)
– Cooling system: natural convection
– Protection class IP54 (shaft IP40)
– With or without holding brake
– Metal round plug M17

Note
The motors can be supplied complete with controllers and control units. For further motor types and more information on motors, controllers and control systems, please refer to the Rexroth catalogs on drive technology.



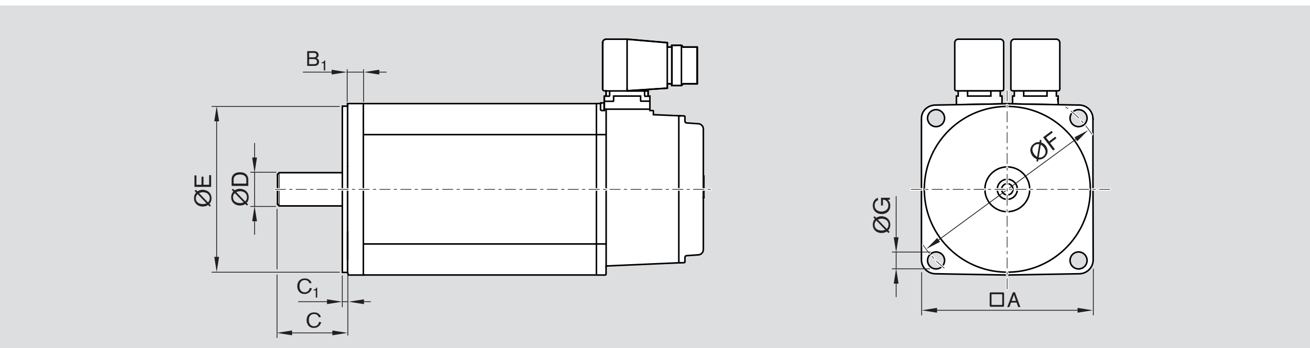
Recommended motor controller combinations

Motor	Controller
MSM 019A-0300	HCS 01.1E-W0003
MSM 019B-0300	
MSM 031B-0300	HCS 01.1E-W0006
MSM 031C-0300	HCS 01.1E-W0009
MSM 041B-0300	HCS 01.1E-W0013

Attachments and Accessories

Motor mounting kits according to customer specification

The motor mounting for linear systems with ball screw drive consists of either a mounting kit with flange and coupling (MF) or a timing belt side drive (SD). The available combinations are shown in the “Components and ordering” selection tables for the respective size.
In addition to motor options for Rexroth motors, kits for motors can also be ordered according to customer specifications. In order to establish the appropriate mounting set, the connection geometry of the motor is crucial.
Characteristics required to uniquely determine the motor geometry are shown below.

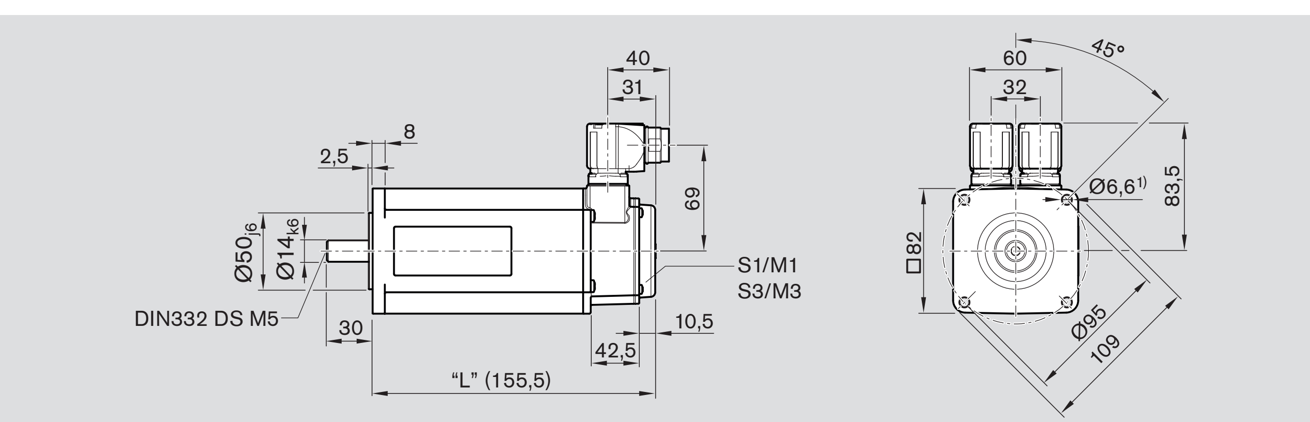


The dimensions queried result in a unique “motor geometry code”:

□□-□□-□□□-□□□-□□□-M□□-□□□-□□□

ØD	=	Shaft diameter
C	=	Shaft length
ØE	=	Centering diameter
C_1	=	Centering depth
ØF	=	Pitch diameter
ØG	=	Through hole for mounting screw (specify thread diameter)
B_1	=	Flange thickness
A	=	Flange edge dimension

Example representation of servo motor IndraDyn S Type MSK040C

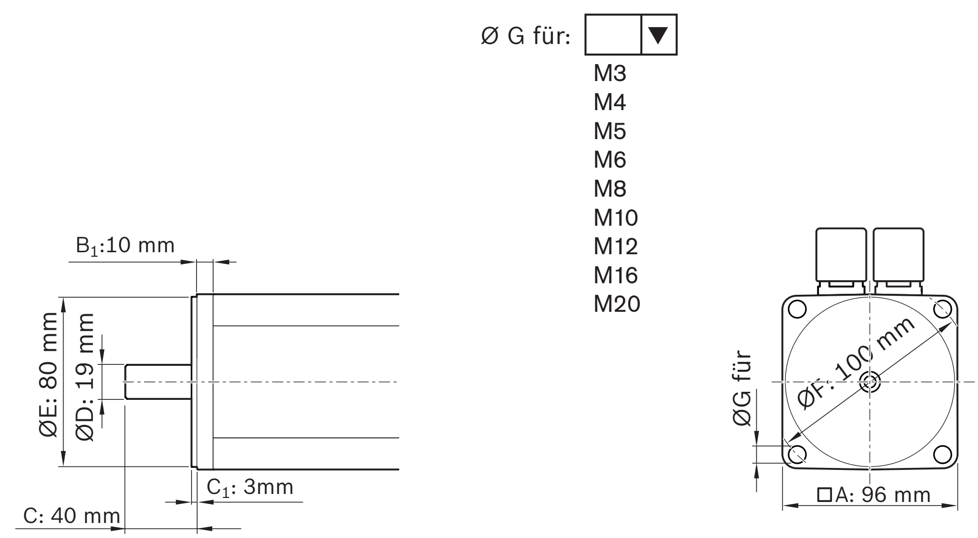


1 4 – 3 0 – 0 5 0 – 2 . 5 – 0 9 5 – M 0 6 – 0 0 8 – 0 8 2

1) The through hole Ø 6.6 mm results in the type designation M06 for the geometry motor code (nominal thread diameter mounting screw M6).

Motor mounting kits for motors according to customer specification can be configured using the online configurator in the eShop. The option “Motor mounting kits according to customer specification” needs to be selected for this.

The motor geometry is entered via the input dialog box. The dimensions can either be entered by being input directly or via a drop-down menu.



Attachments and Accessories

Mounting

General notes

⚠ **Do not mount or support the Precision Module by the end blocks! The frame is the main load-bearing part!**

Precision Modules can be mounted either with screw-fasteners in the frame itself or with external clamping fixtures. When mounting Precision Modules, please note the maximum tightening torques listed in the table.

Mounting with screws in the frame

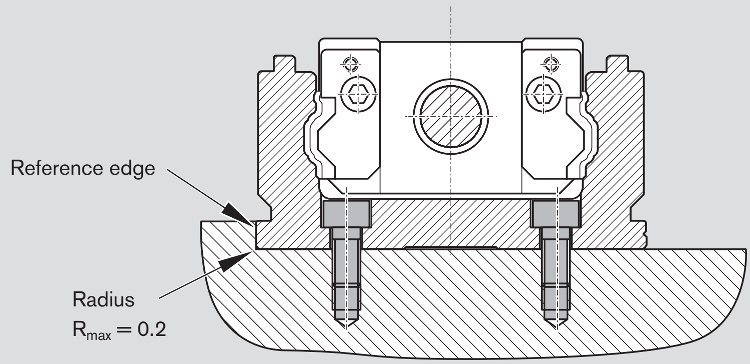
The reference edge on the frame facilitates alignment of the Precision Module.
Suitable for cover options:
– Without cover
– With cover plate (remove cover plate before mounting the module). For installation dimensions, see the relevant dimension drawings.

Mounting with clamping fixtures, PSK 50 to PSK 90

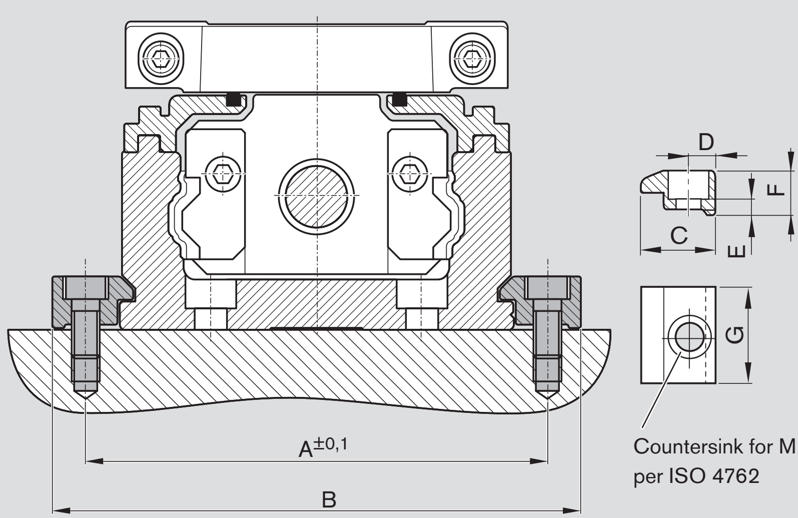
The reference edge cannot be used in the region of the clamping fixtures.
Suitable for all cover options.

Clamping fixtures
Recommended number:
– 3 per 500 mm and side

Mounting with screws in the frame



Mounting with clamping fixtures, PSK 50 to PSK 90



Precision Module	Part numbers Clamping fixtures	Dimensions (mm) A	B	C	D	E	F	G	M
PSK-050	R1419 010 02	60	70	12.5	5.0	4.0	8.5	20	M4
PSK-060	R1419 010 01	72	85	15.0	6.5	4.8	10.0	22	M5
PSK-090	R1419 010 00	100	115	17.5	7.5	5.8	12.0	25	M6

Tightening torques for the mounting screws
– At friction factor 0.125
– Strength class 8.8

			M3	M4	M5	M6
8.8		(Nm) max.	1.3	2.7	5.5	9.5

Services and Information

Lube Ports

General notes

The lubrication system on Precision Modules has been designed for grease lubricants (grease gun). The lube port supplies lubricant to both the Rail System guideway and the Precision Ball Screw Assembly. If the module has two carriages, **both** of these must be lubricated.

Lubricant

Lithium soap grease	PSK-040	PSK-050 to PSK-090
	Consistency class NGLI 00 as per DIN 51818	Consistency class NLGI 2 as per DIN 51818
Recommended	Dynalub 520	Dynalub 510
Part numbers	R3416 043 00	R3416 037 00
May also be used		
	Elkalub GLS 135 / N00	Elkalub GLS 135 / N2
	Castrol Longtime PD 00, (Castrol)	Castrol Longtime PD 2, (Castrol)

PSK without cover

- PSK-040: One-point lubrication is possible via the lube port for grease gun on each carriage. Remove the set screw from the lube hole, apply lubricant, then drive the set screw in again.
- PSK-050 to PSK-090: One-point lubrication at either of the two funnel-type lube nipples DIN 3405-D3 per carriage.
- One-point lubrication through customer-built attachment: This can be achieved in all PSK types by using the lube port in the carriage. The lube ports are closed with set screws for shipment. Before using the lube ports, the set screws must be removed and O-rings inserted to seal off the customer-built attachment.

Precision Module	O-ring DIN 3771	Part numbers
PSK-040 to PSK-060	3 x 1	R3411 118 01
PSK-090	5 x 1.5	R3411 108 01

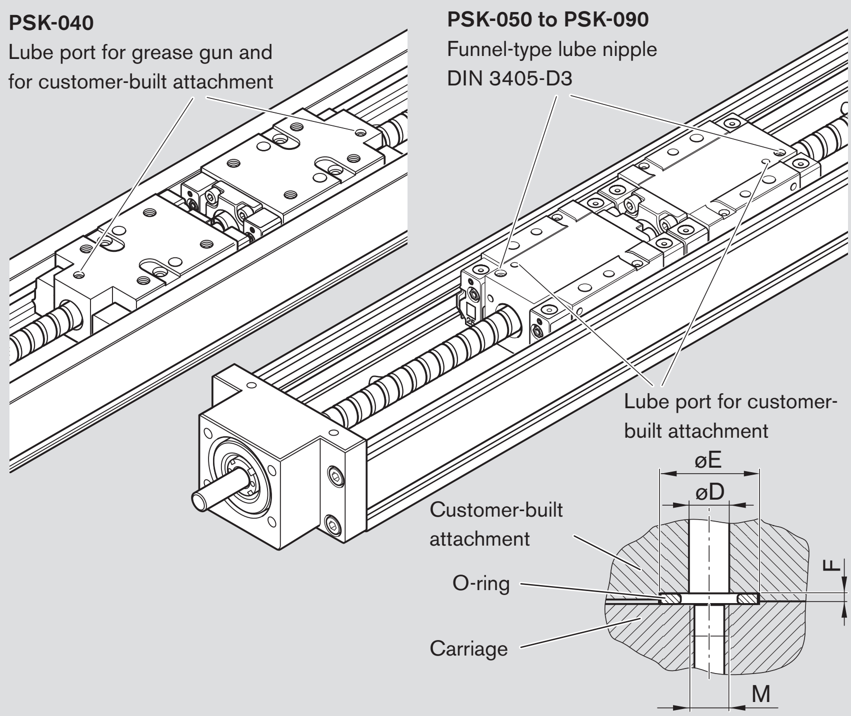
PSK with cover plate or sealing strip

One-point lubrication at either of the two funnel-type lube nipples (1) DIN 3405-D3 per carriage.

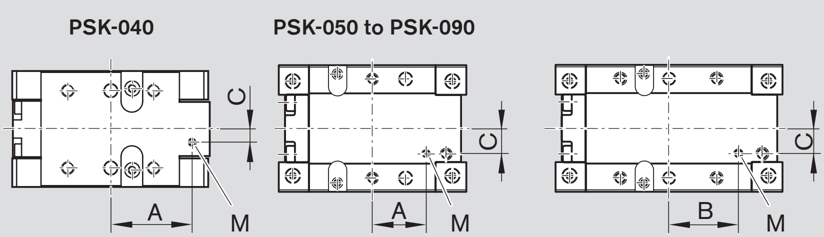
For short-stroke applications, please contact us regarding the lubrication arrangements:

PSK-040: stroke < 50 mm
PSK-050: stroke < 70 mm
PSK-060: stroke < 95 mm
PSK-090: stroke < 135 mm

Without cover

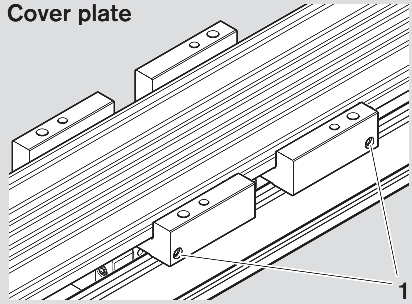


Carriage: standard length **Carriage: long**

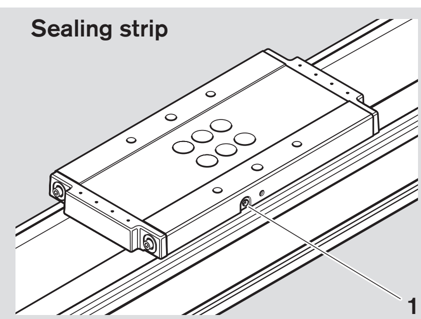


Precision Module		PSK-040	PSK-050	PSK-060	PSK-090
A	(mm)	19.0	18.2	16.0	24.6
B	(mm)	–	–	22.0	33.3
C	(mm)	3.0	6.5	9.0	12.0
D	(mm)	2.5	2.5	2.5	4.0
E	(mm)	5.0	5.0	5.0	8.0
F	(mm)	0.6 +0.1	0.6 +0.1	0.7 +0.1	0.5 +0.1
M	(mm)	M2	M2.5	M3	M4

Cover plate



Sealing strip



Services and Information

Documentation

Standard report

Option no. 01

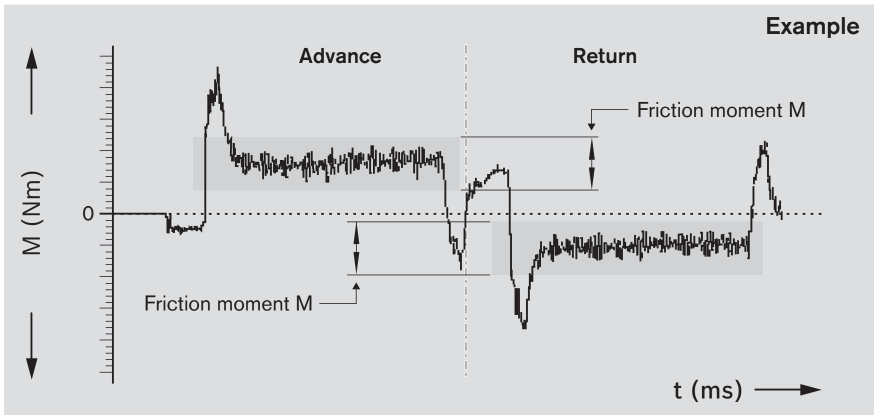
The standard report serves to confirm that the checks listed in the report have been carried out and that the measured values lie within the permissible tolerances.

Checks listed in the standard report:
- Functional checks of mechanical components
- Functional checks of electrical components
- Design is in accordance with order confirmation

Frictional moment of complete system

Option no. 02

The moment of friction M is measured over the entire travel range.

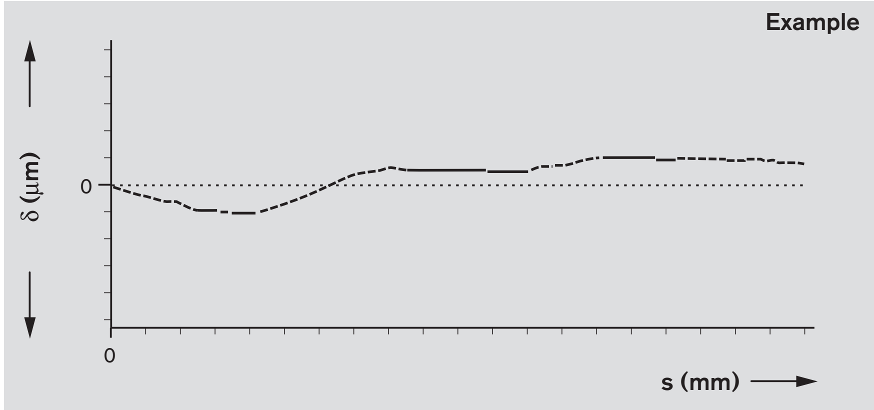


M	=	friction moment	(N)
t	=	travel time	(ms)

Lead deviation of ball screw

Option no. 03

A measurement report of the lead deviation δ over the measured travel s (see illustration) is provided in table form in addition to the graph.



δ	=	deviation	(µm)
s	=	measured travel	(mm)

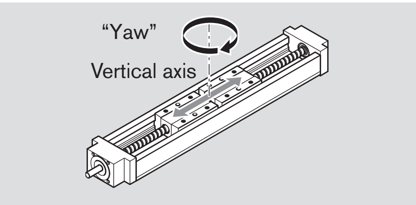
Travel accuracy

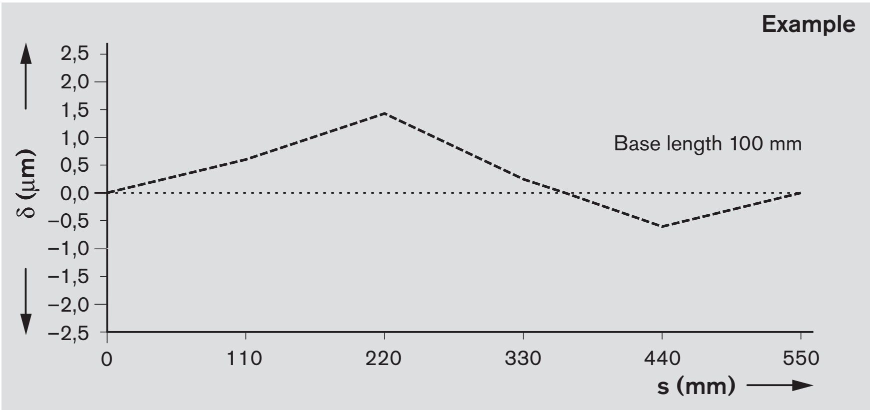
Option no. 04

Several measuring points are passed during the total travel. The yawing and pitching deviations are measured at these points.

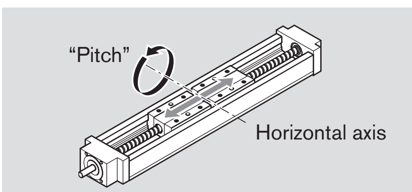
Note
The measurements are taken with the module screwed down and assuming an ideally flat mounting base surface.

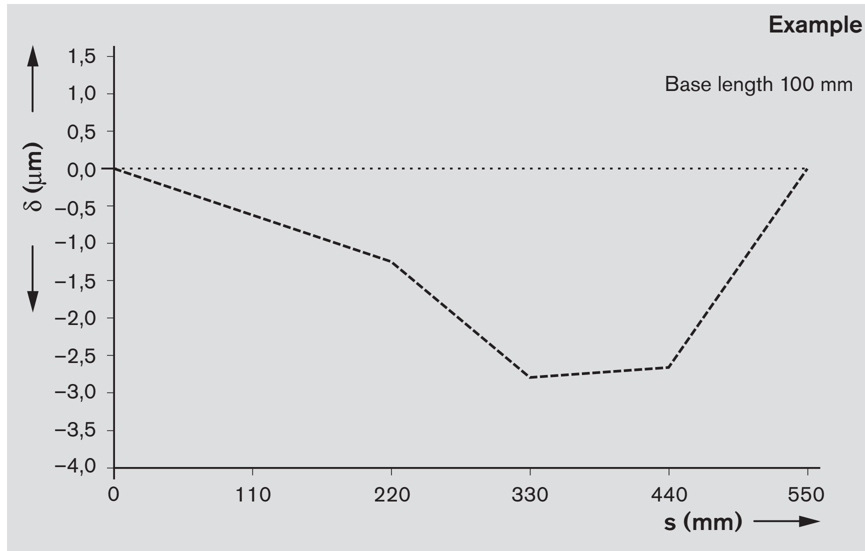
Yawing
Yawing is angular deviation about the vertical axis. This angular deviation is converted to a linear deviation δ in µm on the basis of a standard length and is plotted on the graph. The base length is given in the graph.





Pitching
Pitching means angular deviation about the horizontal axis. This angular deviation is converted to a linear deviation δ in µm on the basis of a standard length and is plotted on the graph. The base length is given in the graph.
In addition to graphical representation (see illustrations), a measurement report is supplied in table form.

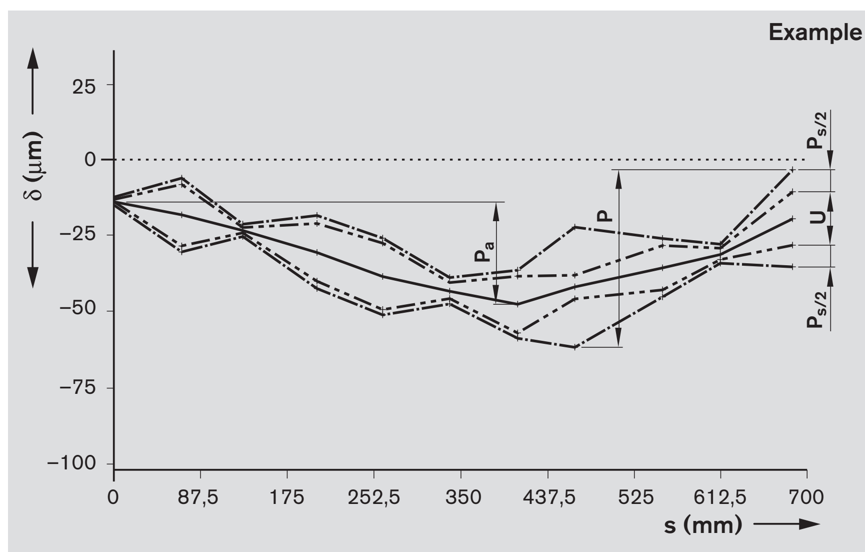




Positioning accuracy per VDI/DGQ 3441

Option no. 05

Measurement points are selected at irregular intervals along the travel range. This allows even periodical deviations δ in µm to be detected during positioning. Each measurement point is approached several times from both sides.
This gives the following parameters.



δ	=	deviation	(µm)
s	=	measured travel	(mm)

Positioning accuracy P

The positioning accuracy corresponds to the total deviation. It encompasses all the systematic and random deviations during positioning. The positioning accuracy takes the following characteristic values into consideration:
- Position deviation
- Reversal range
- Position variation range

Position deviation P_a

The position deviation corresponds to the maximum difference arising in the mean values of all the measurement points. It describes systematic deviations.

Reversal range U

The reversal range corresponds to the difference in mean values of the two approach directions.

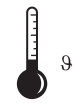
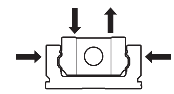
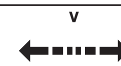
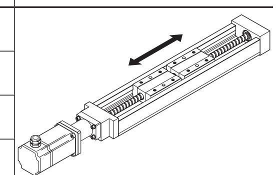
The reversal range is determined at every measurement point. It describes systematic deviations.

Position variation range P_s

The position variation range describes the effects of random deviations. It is determined at every measurement point.

Operating conditions and usage

Normal operating conditions

Ambient temperature (Temperature must not fall below dew point)		0 °C ... 40 °C	
Load		≤ 0,2 C	
Travel speed		≤ 1,0 m/s	
Travel distance s_{min}	PSK-040	> 65 mm	
	PSK-050	> 70 mm	
	PSK-060	> 95 mm	
	PSK-090	> 135 mm	
Contamination		Not permitted	

Required and supplementary documentation

For more information about Intended use and safety, see “Safety Instructions for Linear Motion Systems R320103152”.

For more information on installation / initial operation see “Instructions PSK R320103187”.

Services and Information

Inquiry/Order Form

Bosch Rexroth AG
Linear Motion and Assembly Technologies
D-97419 Schweinfurt
Germany

Telephone **+49 9721 937-0**
Telefax **+49 9721 937-350 (direct)**

Ordering example
Rexroth Precision Module PSK

Ordering data			Description
Precision Module PSK-090			Designation
Part number: PSK-090-NN-1, 740 mm			PSK-090, length = 740 mm
Version	=	MF01	With motor mount and motor, as shown in diagram MF01
Guideway	=	18	Rail system, 740 mm long
Drive unit	=	03	Ball screw 16 x 16
Carriage	=	24	Two carriages, long, steel version for cover plate
Motor attachment	=	03	With motor mount for motor MSK 040C
Motor	=	87	Motor MSK 040C with brake
Cover	=	01	With cover plate
1st switch	=	21	Reed sensor supplied loose
2nd switch	=	22	Hall sensor supplied loose
3rd switch	=	21	Reed sensor supplied loose
Mounting duct	=	25	Mounting duct supplied loose
Switching cam	=	30	Switching cam for version without cover or with cover plate
Documentation	=	01	Standard report

To be completed by customer: Inquiry ☐ / Order ☐
Precision Module

Part number: PSK-_______ -NN-1, length _________mm

Version = ☐☐☐☐
Guideway = ☐☐
Drive unit = ☐☐
Carriage = ☐☐
└── Carriage with center-to-center distance └── ☐☐☐
Motor attachment = ☐☐
└── Motor geometry code[1] └── ☐☐-☐☐-☐☐☐-☐☐☐-☐☐☐-M☐☐-☐☐☐-☐☐☐
Motor = ☐☐☐
Cover = ☐☐
1st switch = ☐☐
2nd switch = ☐☐
3rd switch = ☐☐
Mounting duct = ☐☐
Switching cam = ☐☐
Documentation = ☐☐

1) Only required for „kits for motors according to customer specifications".

Quantity **Order of: ____ pcs, _____ per month, ______ per year, per order, or ______________________________**
Comments:

____

From
Company: ______________________________ **Name:** ______________________________

Address: ______________________________ **Department:** ______________________________

______________________________ **Telephone:** ______________________________

______________________________ **Telefax:** ______________________________

Rexroth
Bosch Group

Ball Rail Tables TKK

with Ball Rail Systems

and Ball Screw Drive

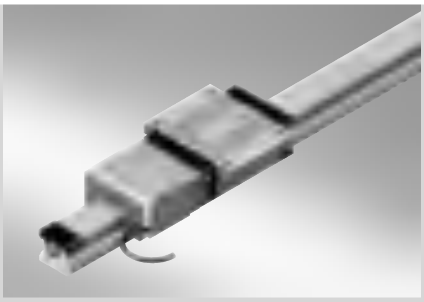
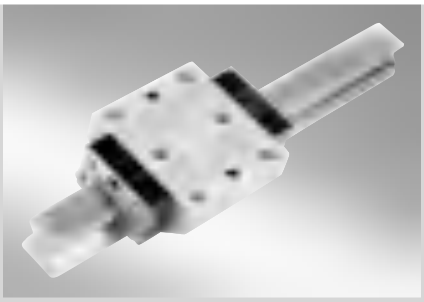
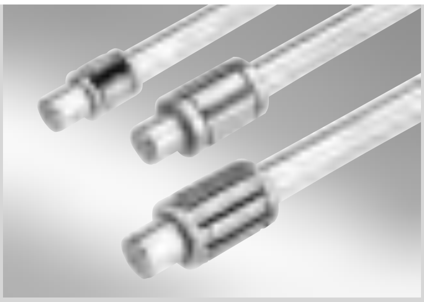
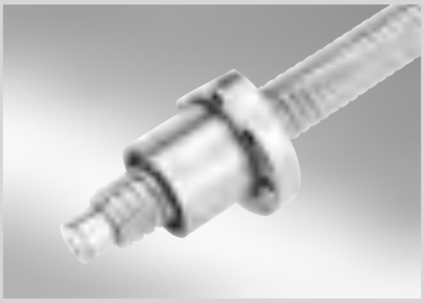
The Drive & Control Company

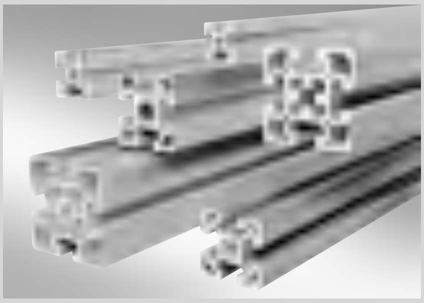
Linear Motion and Assembly Technologies

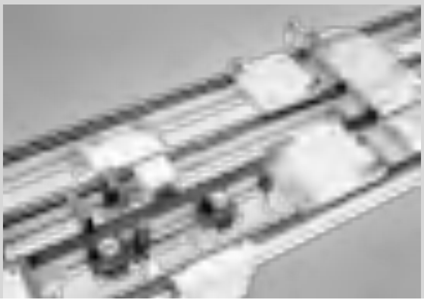
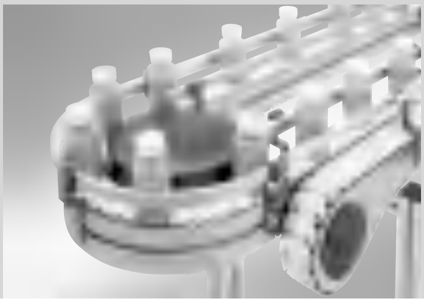
Ball Rail Systems
Roller Rail Systems
Linear Bushings and Shafts

Ball Screw Drives
Linear Motion Systems

Basic Mechanical Elements
Manual Production Systems
Transfer Systems



Ball Rail Tables TKK

A Solution to Many Problems

The tasks

- Driving
- Transporting
- Positioning

Length

Load capacities and moments

Static load

Travel speed

Precision

Linear motion system
with drive unit

Switch mounting arrangements

Multiple axis unit

Accessories

Documentation

Up to 2860 mm

Load capacity C up to 180,600 N
Dyn. longitudinal moment load capacity M_L up to 24,740 Nm
Dyn. torsional moment load capacity M_t up to 27,090 Nm

Up to 2500 kg

Up to 1.6 m/s

Repeatability up to 0.005 mm
Positioning accuracy up to 0.01 mm
Linear guidance accuracy up to 0.007 mm

AC servo motor or stepping motor with mount, coupling or timing belt side drive; complete with controller and control system

Mechanical and proximity switches over the entire travel range

Combination option provided by connectors

Sliding blocks

Moment of friction measurement, Lead deviation
Travel accuracy, Positioning accuracy

The solution

Ball Rail Tables

Product Overview

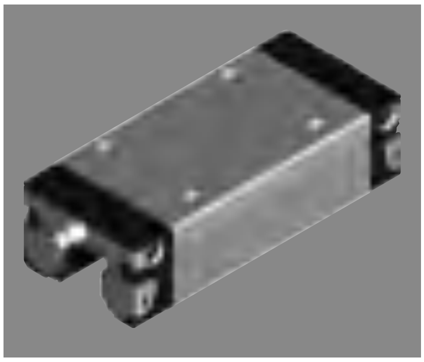
Ball Rail Tables are precision, ready-to-mount guidance systems with high performance characteristics and compact dimensions. Practical combination options and the modular construction principle make a wide range of economical applications possible.
Fast delivery is a matter of course.

Outstanding features
- Oil and temperature resistant bellows mounting through mechanical clamping of the last folds.
- Easy motor attachment via locating feature and fastening threads.
- High travel speeds over long linear distances due to Ball Rail Systems, large screw diameters and leads, and double floating bearings.
- No loss of load capacity thanks to rigid table design, reference edge for runner blocks, parallel drilled nut mounting.
- Increased load-bearing capacity generally permits the use of a smaller Ball Rail Table.
- Low-cost maintenance of the four runner blocks and the Precision Ball Screw Assembly.
  Lubrication via one central lubrication point. A lube port is readily accessible on each side of the carriage. Suitable for grease lubrication only.
- High precision ball runner blocks.
- Switches adjustable over the entire travel range. Can be mounted either internally, protected by the bellows, or externally, in freely accessible positions.
- Rapid mounting thanks to machined reference edge on the base plate.
- Integrated components protected by high-quality, welded, oil- and moisture-resistant bellows.

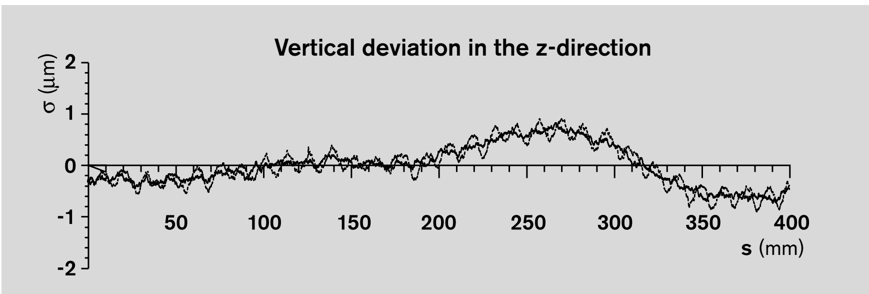
Structural design
- Base plate made from precision machined aluminum profile or steel with reference edge in finely graduated length increments
- Guideway: Ball Rail Systems with four long runner blocks per carriage
- Precision ball screw drive in tolerance grade 7 with zero-backlash nut system
- Aluminum fixed bearing end-plate with two-row, preloaded angular-contact thrust ball bearing
- Floating bearing end-plate with double floating bearing system
- Carriage made of machined aluminum profile or steel in various lengths

Attachments
- Bellows
- Internal glass scale
- Internal or external mechanically operated switch
- Internal or external proximity switch
- Socket with mating plug for the switches
- Aluminum profile cable duct
- Timing belt side drive or motor mount and coupling for attachment of the motor
- 3-phase stepping motors
- Maintenance-free digital AC servo motors with integrated brake and attached feedback

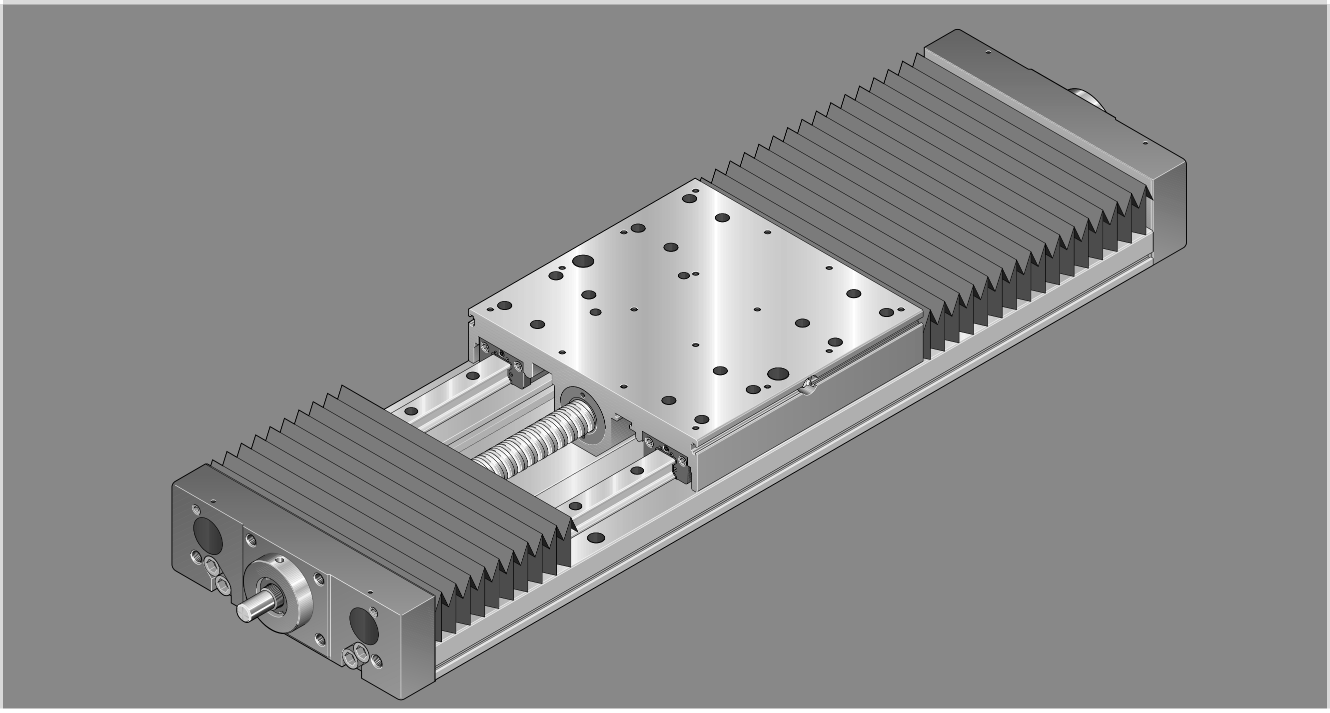
High precision ball runner blocks
(available from 3rd quarter 2008)



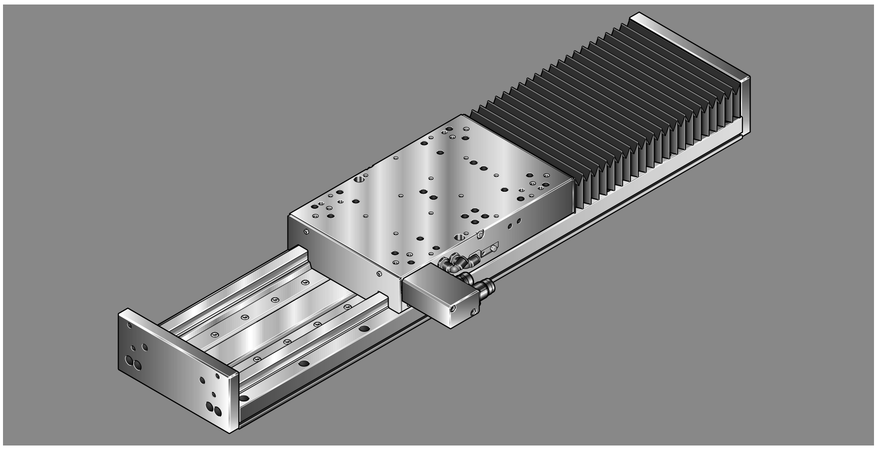
Direct comparison of the travel accuracy of two ball runner blocks
The graph clearly shows that the short-wave inaccuracies (dashed line) can be very significantly reduced by the new, innovative design of the entry zone (continuous line).



Drive controllers and control systems



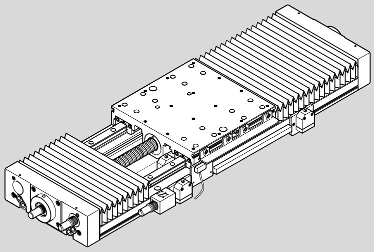
For Ball Rail Tables with two ball rail systems and linear motor, see separate catalog “Ball Rail Tables TKL.”



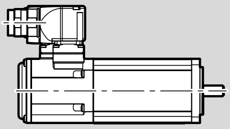
Product Overview

Motor selection
based on drive controllers and control system

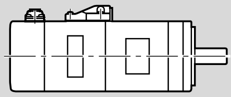
Several motor-controller combinations are available in order to provide the most cost-effective solution for every customer application.
When sizing the drive, always consider the motor-controller combination.
For more detailed information on motors and control systems, please refer to the catalogs "ECODRIVE Cs" and "IndraDrive for Linear Motion Systems."



Digital AC servo motors

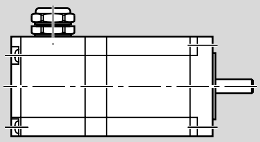


MSK

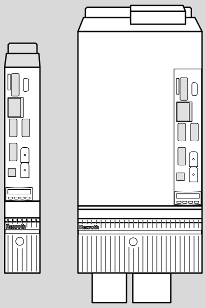


MSM

3-phase stepping motors

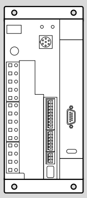


VRDM 397
VRDM 3910
VRDM 3913



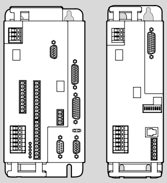
IndraDrive C

Digital controller
Power unit HCS
Control unit CSH



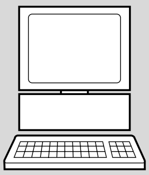
DKC

Digital controller
ECODRIVE Cs
Compact and dynamic solution
for lower power ranges



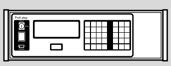
Twin Line

Power electronics
Stepping motor output stage with
or without integrated controller



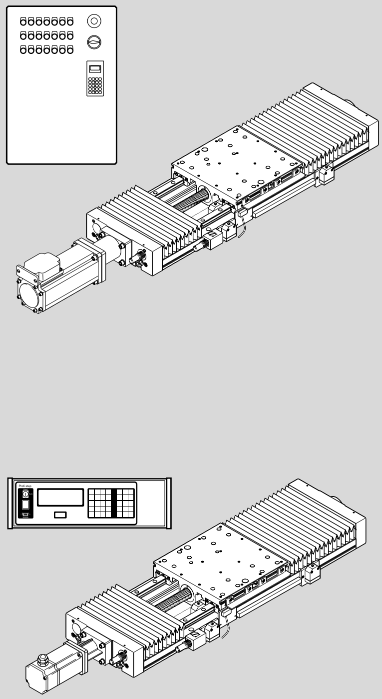
PC

PC controller board
Stepping motor controller



PROFI-step

Single- and multi-axis positioning control with power output module
The complete solution



Ball Rail Tables can be supplied complete with motor, controller and control system.

Product Overview

Type designation

The Ball Rail Tables are designated according to **type** and **size**.

Types also cover the equivalent designs without drive units.

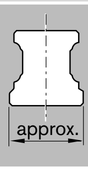
	Type			Size		
Ball Rail Table (example) =	T	K	K	20	-225	Al

System = Ball Rail Table **(T)**

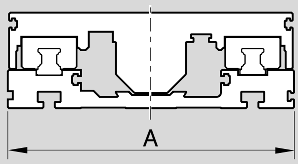
Guideway = Ball Rail System (**K**)

Drive unit = Ball Screw Drive (**K**)

Dimensions of guideway =

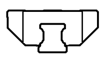
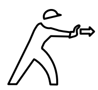
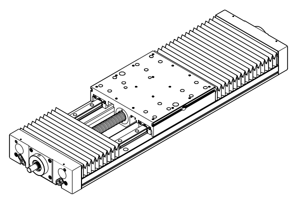
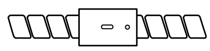


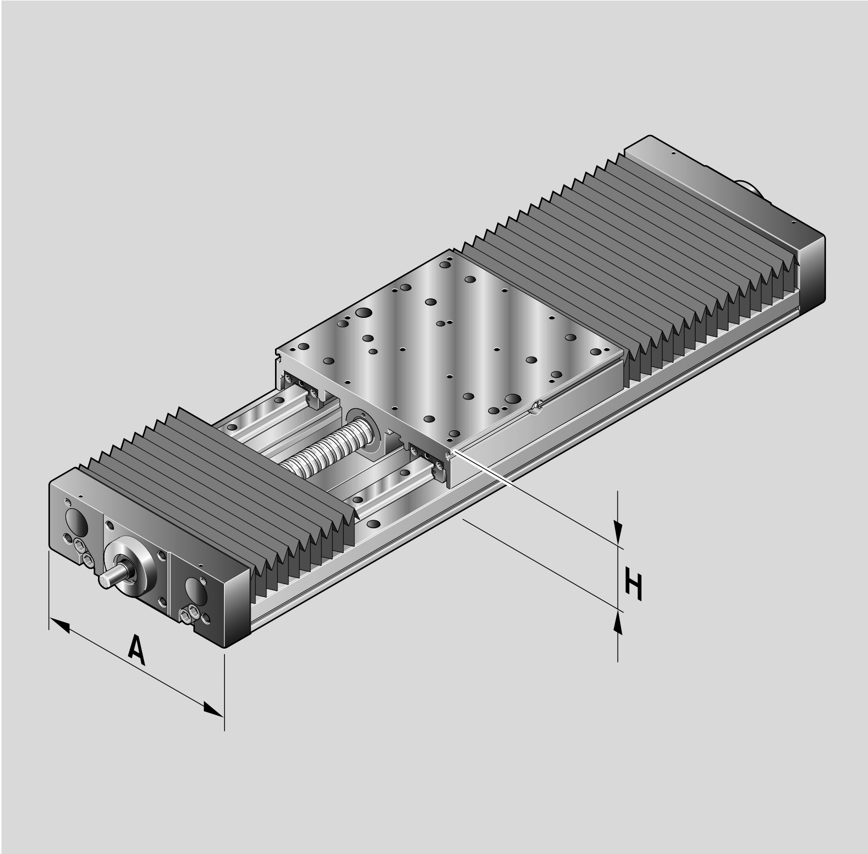
Frame size =



Material = **Al**uminum profile
Steel

Type designation, sizes

	Type	Guideway	Drive unit	Ball Rail Table
Ball Rail Tables	TKK	 Ball Rail Systems	 without drive unit	
			 Ball Screw Drive	

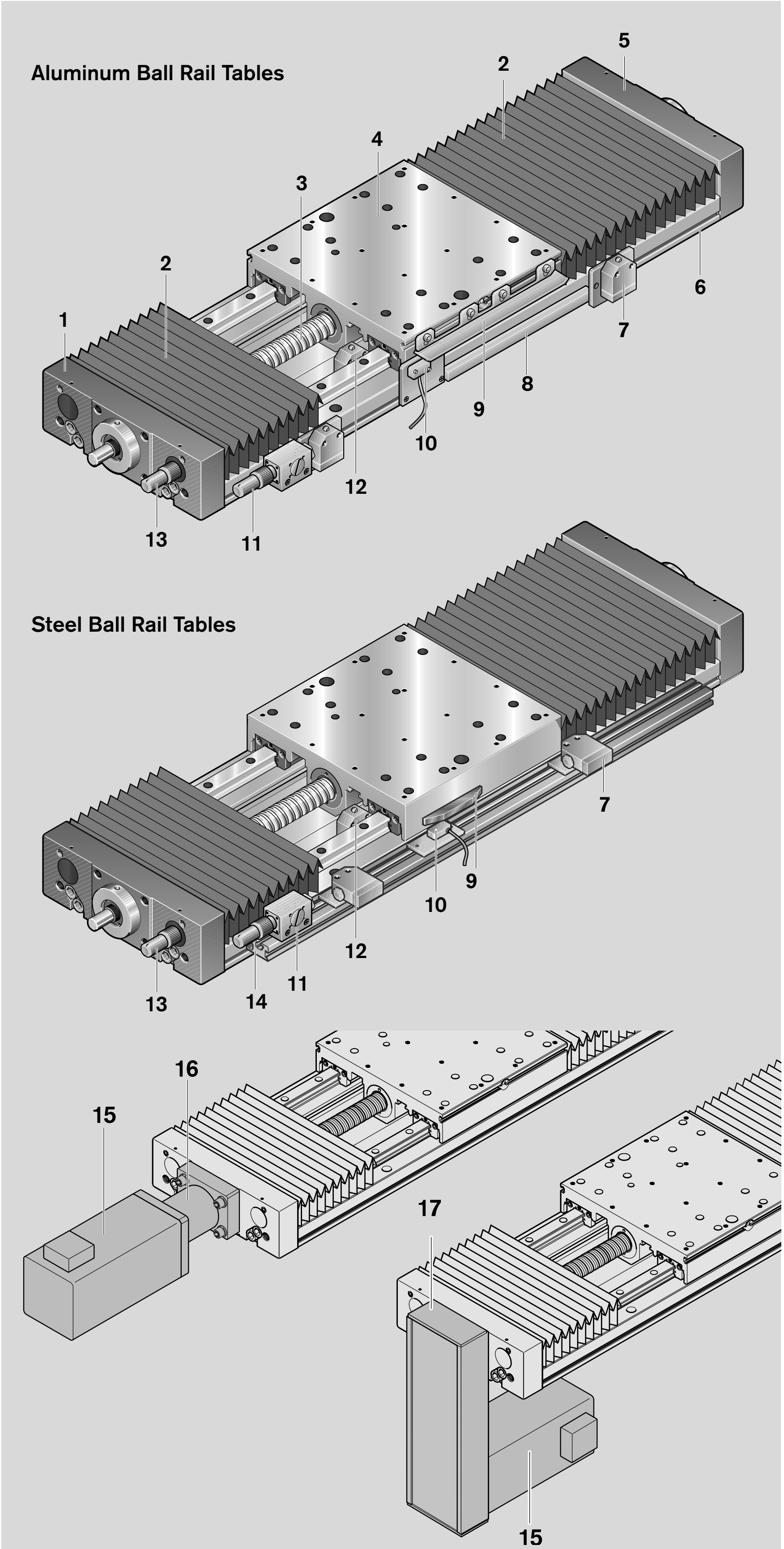


<table>
<tr><th>Size</th><th>Dimensions A x H (mm)</th><th>L_{max}</th><th>Dyn. load capacity C (N)</th></tr>
<tr><td>TKK 15 - 155 Al</td><td>155 x 60</td><td>2860</td><td>25 300</td></tr>
<tr><td>TKK 20 - 225 Al</td><td rowspan="2">225 x 75</td><td>2860</td><td rowspan="3">79 200</td></tr>
<tr><td>TKK 20 - 225 St</td><td>2380</td></tr>
<tr><td>TKK 20 - 225 Al</td><td>225 x 105</td><td>2860</td></tr>
<tr><td>TKK 30 - 325 Al</td><td rowspan="2">325 x 90</td><td>2860</td><td rowspan="3">129 960</td></tr>
<tr><td>TKK 30 - 325 St</td><td>2380</td></tr>
<tr><td>TKK 30 - 325 Al</td><td>325 x 120</td><td>2860</td></tr>
<tr><td>TKK 35 - 455 Al</td><td>455 x 120</td><td>2860</td><td>180 600</td></tr>
</table>

Structural Design

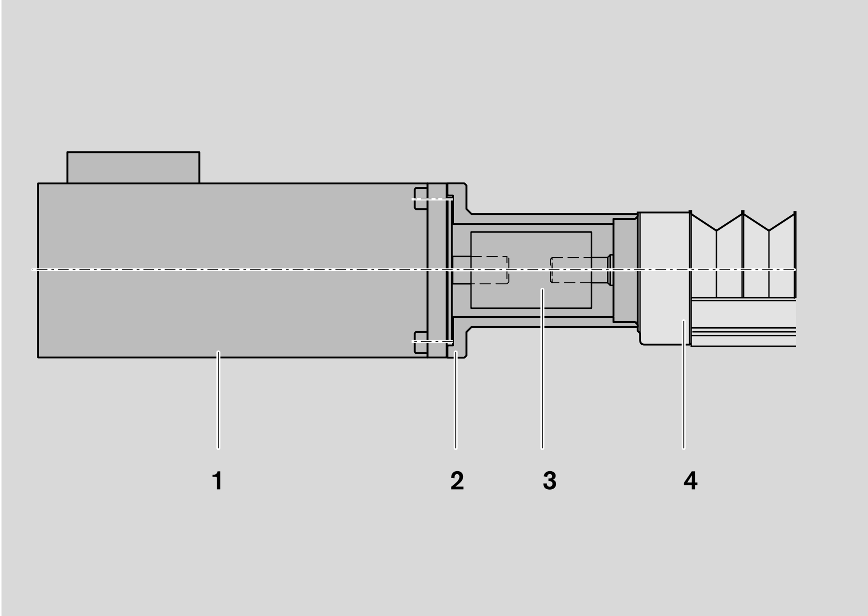
1 Fixed bearing end-plate
2 Bellows, two-part
3 Ball screw with zero-backlash single nut
4 Carriage with 4 long runner blocks
5 Floating bearing end-plate
6 Base plate

Attachments
7 Mechanical switch, external
8 Cable duct
9 Switching cam
10 Proximity switch, external
11 Socket-plug for external switches
12 Mechanical and proximity switches, internal
13 Socket-plug for internal switches
14 Profiled support
15 Motor
16 Motor mount and coupling
17 Timing belt side drive



Motor mount and coupling
A motor can be attached to all Ball Rail Tables by means of a motor mount and coupling.
The motor mount serves to fasten the motor to the Ball Rail Table and acts as a closed housing for the coupling.
The motor's drive torque is transmitted stress-free through the coupling to the Ball Rail Table's drive shaft.
Our standard couplings compensate for the thermal expansion of the system.
If other makes of couplings are used, their thermal expansion must be taken into account.

1 Motor
2 Motor mount
3 Coupling
4 Ball Rail Table

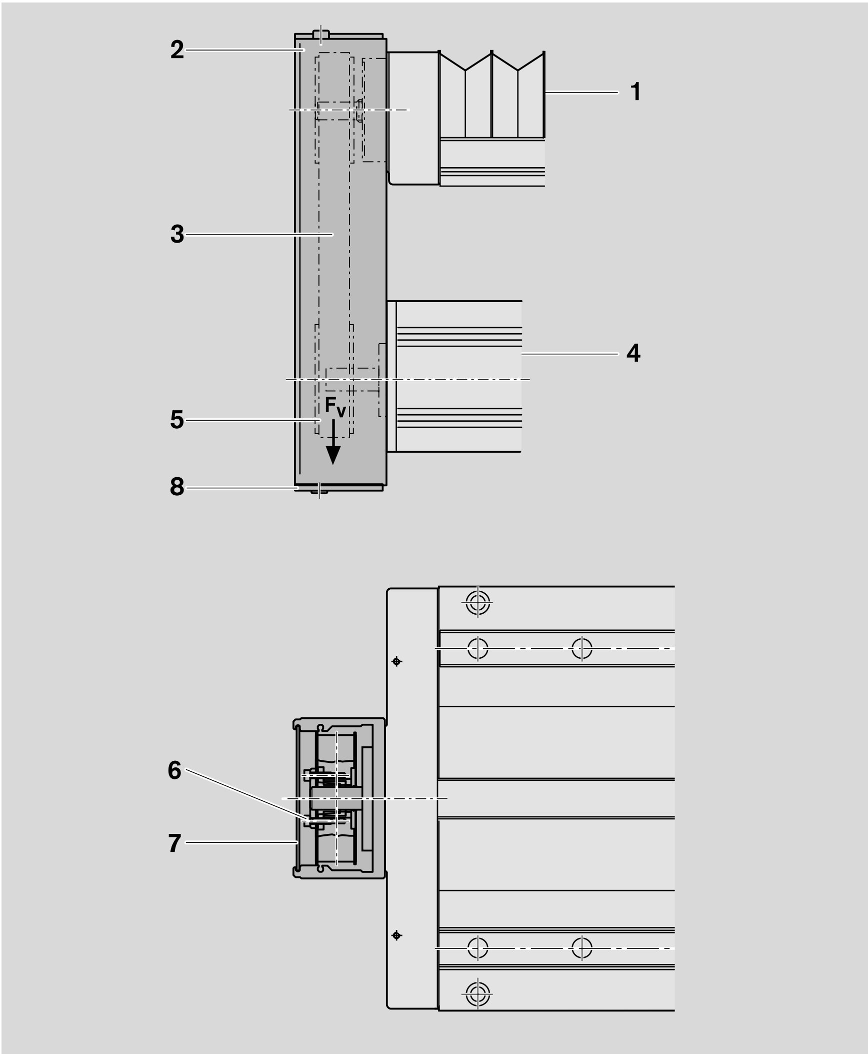


Timing belt side drive
All Ball Rail Tables offer the option of attaching the motor via a side drive with timing belt.
This makes the overall length shorter than when attaching the motor with a motor mount and coupling.
The compact, closed housing serves as protection for the belt and as a motor bracket. Different gear ratios are available:

i = 1
i = 1.5
i = 2

The timing belt side drive can be mounted in four different directions:
– below, above (RV05 and RV06)
– left, right (RV01 to RV04)

1 Ball Rail Table
2 Housing made of drawn, anodized aluminum profile
3 Toothed belt
4 AC servo motor
5 Pre-tensioning of the toothed belt: Apply pretensioning force F_v to motor (F_v will be indicated on delivery)
6 Belt pulleys attached using tensioning units
7 Cover plate
8 End cover



Fixing, Accuracy

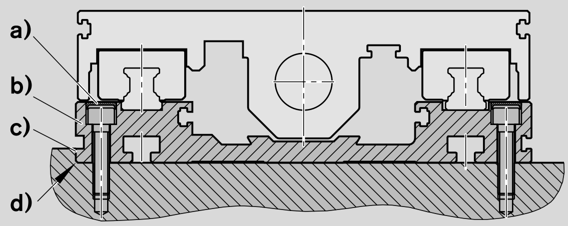
General notes on mounting

The aluminum Ball Rail Tables can be secured from above or below.
The steel Ball Rail Tables can only be mounted by bolting from above.
In both versions, a reference edge is built into the base plate to help align the unit. Mounting hole plugs are included with the unit.
For installation dimensions, see the relevant dimension drawings.

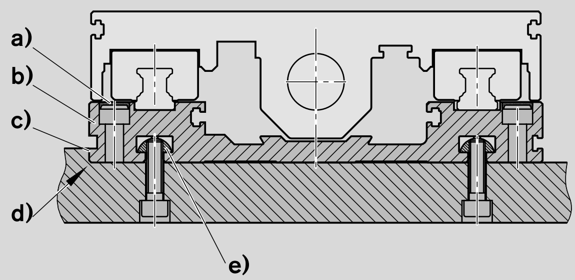
a) Plug
b) Base plate
c) Reference edge
d) R $_{max.}$ 0.3
e) Nut for T-slot (see accessories)

Aluminum Ball Rail Tables

Fixing from above

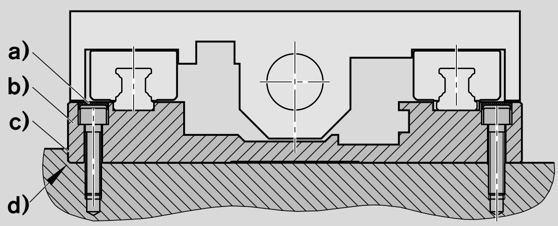


Fixing from below



Steel Ball Rail Tables

Fixing from above

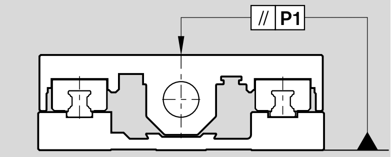


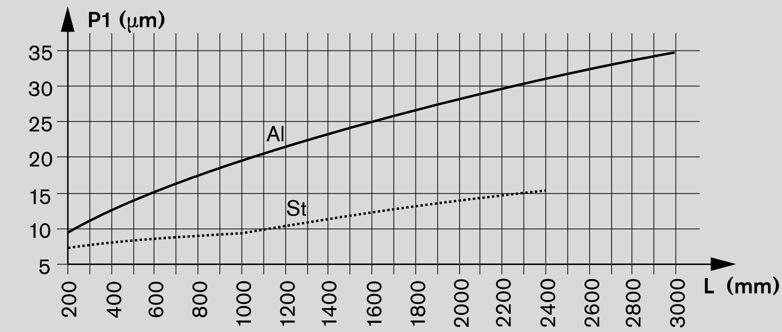
Accuracy

All accuracy data apply to the unit when screwed down and assume an ideal flat mounting base surface. Irregularities in the mounting base surface are not taken into account in the values given below.

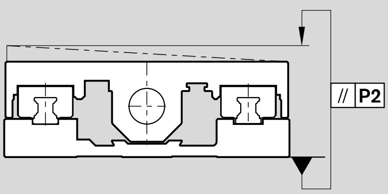
Accuracy P1

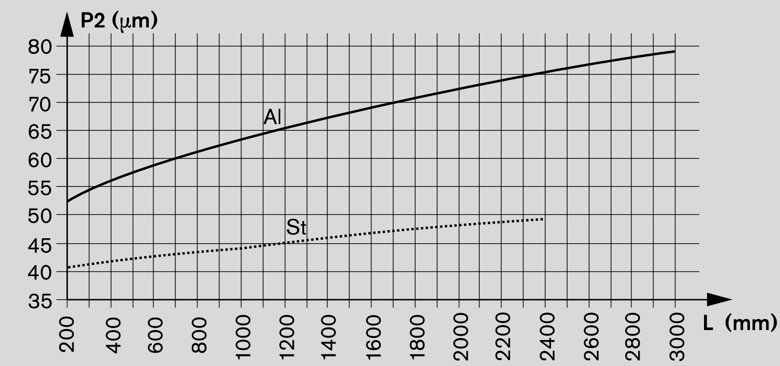
Measured in the center of the carriage



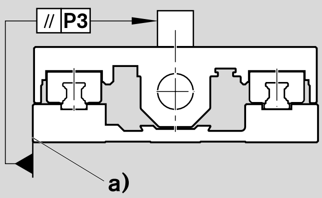


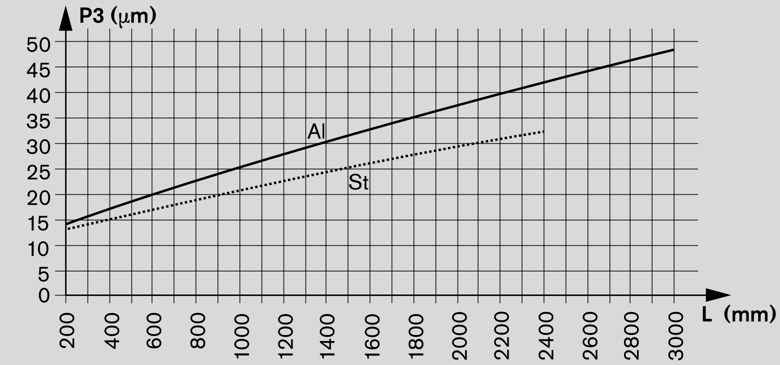
Accuracy P2



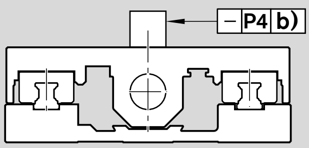


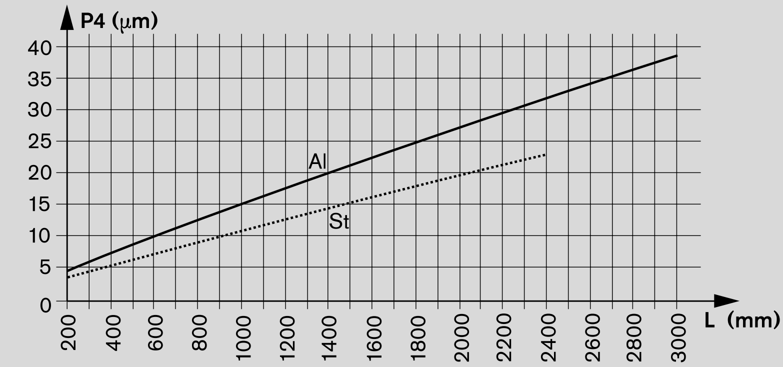
Accuracy P3





Accuracy P4





a) Reference edge **b)** Longitudinal

Technical Data

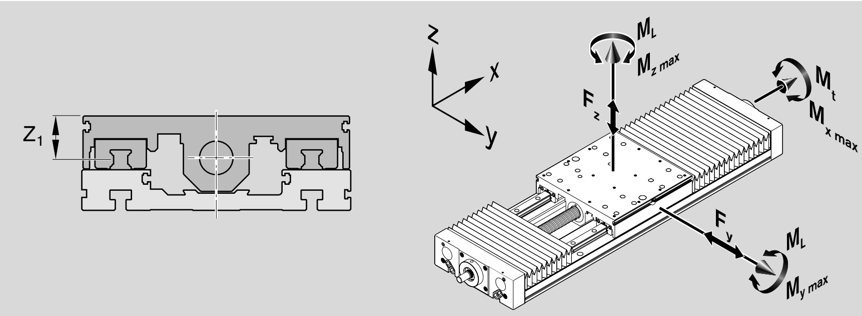
General system data

Size	Ball screw d_0 x P (mm)	Dynamic load capacity C (N) Guideway	Ball screw	Fixed bearing	Dynamic load moments (Nm) M_t	M_L		Maximum loads (N) $F_{z1\ max}$	$F_{z2\ max}$	$F_{y\ max}$
						L_{ca} = 150	L_{ca} = 220			
TKK 15-155 Al	without		–	–						
	16 x 10		9600							
	16 x 16	25300	9300		1330	1140	2027	24000	16920	6000
	20 x 5		14300	17000						
	20 x 20		13300							
TKK 20-225 Al						L_{ca} = 220	L_{ca} = 320			
TKK 20-225 St										
	without		–	–						
	20 x 5		14300	17000						
	20 x 20		13300							
	25 x 5	79200	15900		6340	5073	9037	79200	32160	19800
	25 x 10		15700	18800						
	25 x 25[1)]		14700							
TKK 30-325 Al						L_{ca} = 320	L_{ca} = 450			
TKK 30-325 St										
	without		–	–						
	32 x 5		21600							
	32 x 10	129960	31700		14940	11890	20330	123200	89040	30800
	32 x 20		19700	26000						
	32 x 32		19500							
TKK 35-455 Al						L_{ca} = 450				
	without		–	–						
	40 x 5		29100							
	40 x 10	180600	50000		27090	24740		163200	88080	40800
	40 x 20		37900	29000						
	40 x 40		37000							

1) Al only

Maximum permissible loads

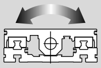
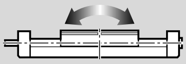
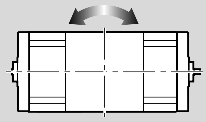
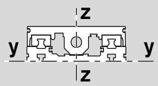
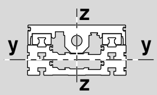
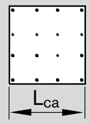
Size	Dimension (mm) Z_1
TKK 15-155	23.7
TKK 20-225	36.6
TKK 30-325	48.5
TKK 35-455	65.5



Notes on dynamic load capacities and moments

Determination of the dynamic load capacities and moments is based on a travel life of 100,000 m.
Often only 50,000 m are actually stipulated.

For comparison:
Multiply values **C, M_t** and **M_L** from the table by 1.26.
Load ratings for the ball screw as per DIN 69051.

Maximum loads (Nm)					E · I values ($\cdot 10^8$ Ncm^2)				Moved mass of system m_{ca} (kg)	
 $M_{x\,max}$		$M_{y\,max}$		$M_{z\,max}$	 $E \cdot I_y$	$E \cdot I_z$	 $E \cdot I_y$	$E \cdot I_z$		
	$L_{ca} = 150$	$L_{ca} = 220$	$L_{ca} = 150$	$L_{ca} = 220$					$L_{ca} = 150$	$L_{ca} = 220$
880	760	1350	270	480	3.07	62.17	–	–	2.3	3.0
									$L_{ca} = 220$	$L_{ca} = 320$
	$L_{ca} = 220$	$L_{ca} = 320$	$L_{ca} = 220$	$L_{ca} = 320$	TKK 20-225 Al					
2570	2050	3660	1260	2250	5.13	196.59	25.27	355.95	7.0	9.0
					TKK 20-225 St					
					9.88	577.03	–	–	13.0	18.0
									$L_{ca} = 320$	$L_{ca} = 450$
	$L_{ca} = 320$	$L_{ca} = 450$	$L_{ca} = 320$	$L_{ca} = 450$	TKK 30-325 Al					
10240	8140	13930	2810	4820	9.92	664.00	45.69	1156.91	17.0	23.0
					TKK 30-325 St					
					17.27	1826.96	–	–	33.5	45.4
	$L_{ca} = 450$		$L_{ca} = 450$						$L_{ca} = 450$	
13210	12060		5590		34.71	2554.23	–	–	41.0	

Key to table

E = modulus of elasticity
I_y = planar moment of inertia referred to the Y-axis
I_z = planar moment of inertia referred to the Z-axis
Z_1 = application point of the effective force

d_0 = nominal diameter
P = lead
L_{ca} = carriage length
Al = aluminum
St = steel

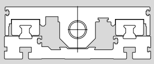
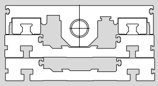
Suitable loads
(recommended values on the basis of past experience)

As far as the desired service life is concerned, loads of up to approximately 20% of the dynamic load and moment values (C, M_t, M_L) have proved acceptable.

At the same time, the following may not be exceeded:
- maximum permissible drive torque
- maximum permissible loads
- maximum permissible speeds (for precise details, see “Technical Data”)

Technical Data

Weight
Weight data does not include motor and switch attachments.

Size	Weight (kg) Base plate, low 		Base plate, high 	
TKK 15-155 Al	oA	$0.01 \cdot L + m_{ca} - 0.3$		
	mA	$0.0124 \cdot L + m_{ca} + 2$		
TKK 20-225 Al	oA	$0.015 \cdot L + m_{ca} - 0.4$	oA	$0.026 \cdot L + m_{ca} - 0.4$
	mA	$0.018 \cdot L + m_{ca} + 3$	mA	$0.029 \cdot L + m_{ca} + 3$
TKK 20-225 St	oA	$0.040 \cdot L + m_{ca} - 0.4$		
	mA	$0.043 \cdot L + m_{ca} + 3$		
TKK 30-325 Al	oA	$0.029 \cdot L + m_{ca} - 1$	oA	$0.048 \cdot L + m_{ca} - 1$
	mA	$0.035 \cdot L + m_{ca} + 5$	mA	$0.054 \cdot L + m_{ca} + 5$
TKK 30-325 St	oA	$0.070 \cdot L + m_{ca} - 1$		
	mA	$0.076 \cdot L + m_{ca} + 5$		
TKK 35-455 Al	oA	$0.056 \cdot L + m_{ca} - 2.5$		
	mA	$0,066 \cdot L + m_{ca} + 12$		

L = length in mm
m_{ca} = moved mass
Al = aluminum
St = steel
oA = without drive (without ball screw and end-plates)
mA = with drive (ball screw)

Friction moments and constants $k_{J\,fix}$, $k_{J\,var}$, $k_{J\,m}$ at the motor journal M_{Rs}
d_0 = nominal diameter of ball screw (mm)
P = lead of ball screw (mm)

Size	Ball screw size d_0 x P	Constants $k_{J\,fix}$ Short carriage	Long carriage	$k_{J\,var}$	$k_{J\,m}$	Friction moment M_{Rs} (Nm) for guideway preload 2%	8%
TKK 15-155	16 x 10	10.5	12.3	0.039	2.53	0.56	0.58
	16 x 16	19.6	24.2	0.039	6.48	0.58	0.61
	20 x 5	13.6	14.1	0.100	0.63	0.64	0.65
	20 x 20	35.5	42.5	0.100	10.13	0.72	0.75
TKK 20-225 Al	20 x 5	16.6	17.9	0.100	0.63	0.66	0.68
	20 x 20	83.1	103.3	0.100	10.13	0.82	0.90
	25 x 5	35.4	36.6	0.256	0.63	0.82	0.84
	25 x 10	48.7	53.7	0.256	2.53	0.88	0.92
	25 x 25	139.3	170.9	0.235	15.83	1.08	1.17
TKK 20-225 St	20 x 5	20.4	23.5	0.100	0.63	0.66	0.68
	20 x 20	143.9	194.5	0.100	10.13	0.82	0.90
	25 x 5	39.2	42.3	0.256	0.63	0.82	0.84
	25 x 10	63.9	76.5	0.256	2.53	0.88	0.92
TKK 30-325 Al	32 x 5	110.0	113.8	0.712	0.63	1.10	1.12
	32 x 10	142.3	157.5	0.712	2.53	1.29	1.32
	32 x 20	265.3	326.1	0.667	10.13	1.21	1.27
	32 x 32	534	689.6	0.667	25.94	1.36	1.46
TKK 30-325 St	32 x 5	120.5	128.0	0.712	0.63	1.10	1.12
	32 x 10	184.1	214.3	0.712	2.53	1.29	1.32
	32 x 20	432.5	553.0	0.667	10.13	1.21	1.27
	32 x 32	962.0	1270.6	0.667	25.94	1.36	1.46
TKK 35-455	40 x 5	319.2		1.783	0.63	1.66	1.68
	40 x 10	368.2		1.607	2.53	2.32	2.35
	40 x 20	679.7		1.607	10.13	2.24	2.29
	40 x 40	1926.0		1.607	40.53	2.59	2.69

Coupling data

Size	Rated torque of coupling M_{cN} (Nm)	Mass moment of inertia J_c ($kgm^2 \cdot 10^{-6}$)	Mass of coupling m_c (kg)
TKK 15-155	19	57	0.26
TKK 20-225	19	57	0.26
	50	200	0.7
TKK 30-325	50	200	0.7
TKK 35-455	98	390	0.9

Specifications of timing belt side drive, floating bearing end, for motor attachment via timing belt side drive

Motor type		MSK 040C, MSM 040B					MSK 050C				
Overall dimensions (mm)		51 x 88					66 x 116				
Frictional torque M_{Rsd} (Nm)		0.4					0.45				
		Permissible torque up to length L = … at (1)			Reduced mass moment of inertia at		Permissible torque up to length L = … at (1)			Reduced mass moment of inertia at	
Reduction i = …			i = 1	i = 1.5	i = 1	i = 1.5		i = 1	i = 2	i = 1	i = 2
Belt type			16 AT5	16 AT5	16 AT5	16 AT5		25 AT5	25 AT5	25 AT5	25 AT5
Size	**Ball screw d_0 x P**	**L** (mm)	**M_{sd}** (Nm)	**M_{sd}** (Nm)	**J_{sd}** (10^{-6} kgm^2)	**J_{sd}** (10^{-6} kgm^2)	**L** (mm)	**M_{sd}** (Nm)	**M_{sd}** (Nm)	**J_{sd}** (10^{-6} kgm^2)	**J_{sd}** (10^{-6} kgm^2)
TKK 15-155	16 x 10	1180	9.6	6.4	260	91					
	16 x 16	1420	9.6	6.4							
	20 x 5	1420	9.6	6.4							
	20 x 20	2260	9.6	6.4							
TKK 20-225	20 x 5	1480	9.6	6.4	270	94	1480	10.0	5.0	1420	230
	20 x 20	2200	9.6	6.4			1600	19.6	9.8		
	25 x 5	2320	9.6	6.4			1960	14.0	7.0		
	25 x 10	2860	9.6	6.4			2320	19.6	9.8		
	25 x 25	2860	9.6	6.4			2860	19.6	9.8		

Motor type		MSK 060C					MSK 076C				
Overall dimensions (mm)		66 x 116					90 x 160				
Frictional torque M_{Rsd} (Nm)		0.5					0.6				
		Permissible torque up to length L = … at (1)			Reduced mass moment of inertia at		Permissible torque up to length L = … at (1)			Reduced mass moment of inertia at	
Reduction i = …			i = 1	i = 2	i = 1	i = 2		i = 1	i = 2	i = 1	i = 2
Belt type			25 AT5	32 AT5	25 AT5	32 AT5		50 AT10	50 AT10	50 AT10	50 AT10
Size	**Ball screw d_0 x P**	**L** (mm)	**M_{sd}** (Nm)	**M_{sd}** (Nm)	**J_{sd}** (10^{-6} kgm^2)	**J_{sd}** (10^{-6} kgm^2)	**L** (mm)	**M_{sd}** (Nm)	**M_{sd}** (Nm)	**J_{sd}** (10^{-6} kgm^2)	**J_{sd}** (10^{-6} kgm^2)
TKK 30-325	32 x 5	2860	19.0	9.5	1440	280					
	32 x 10	2860	19.0	13.0							
	32 x 20	2860	19.0	13.0							
	32 x 32	2860	19.0	13.0							
TKK 35-455	40 x 5						2860	26.0	13.0	7860	1280
	40 x 10						2860	52.0	26.0		
	40 x 20						2860	67.0	33.5		
	40 x 40						2860	67.0	33.5		

1) Permissible torque for greater lengths available upon request.

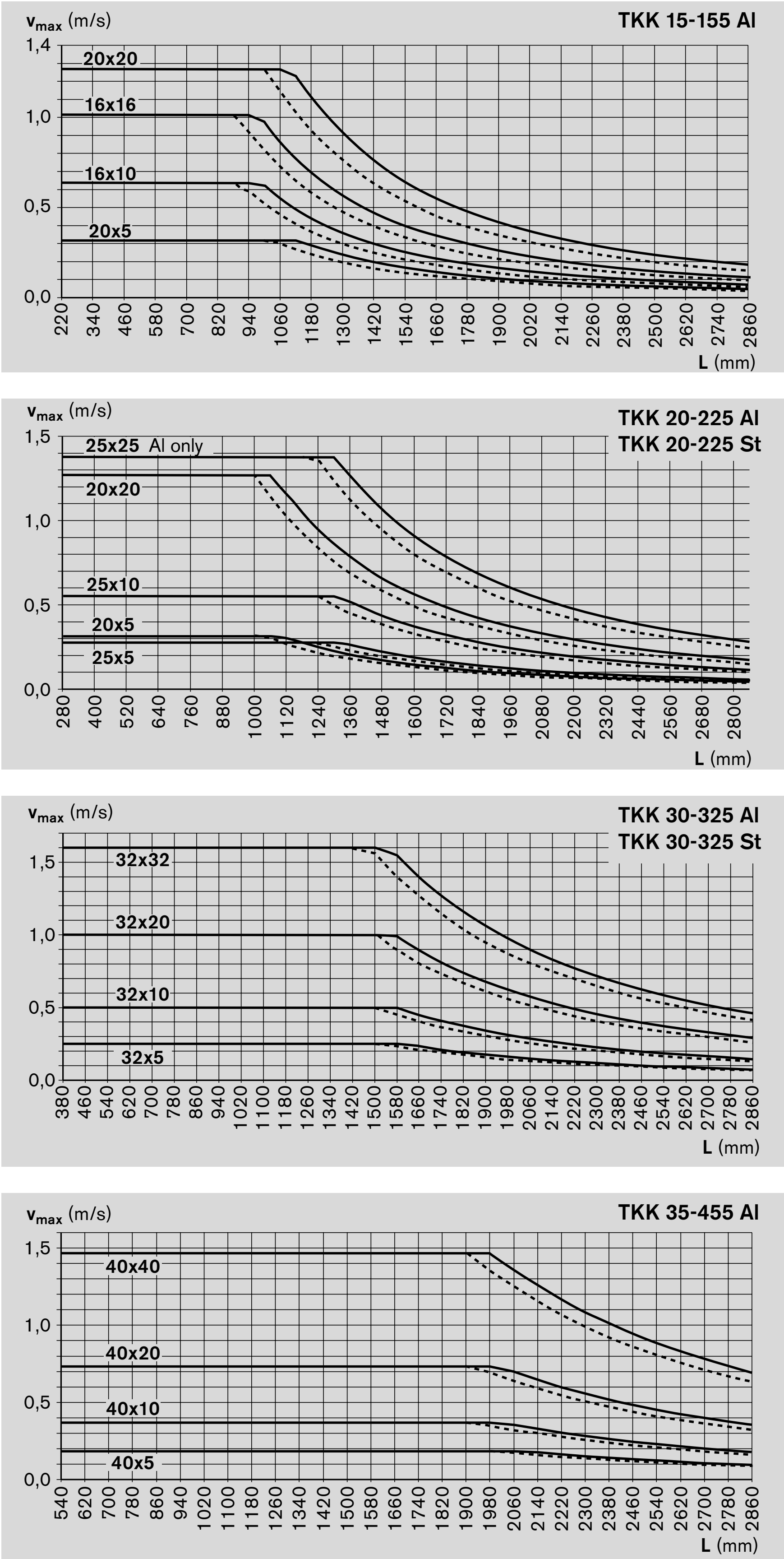
M_{sd} = maximum permissible torque at motor journal
M_{Rsd} = frictional torque of timing belt side drive at motor journal
J_{sd} = reduced mass moment of inertia of timing belt side drive
i = timing belt side drive reduction
d_0 = nominal diameter
P = lead

Technical Data

Permissible travel speed

Ball Rail Table	Permissible travel speed v_{max} (m/s)
without drive without bellows	5
without drive with bellows	1.66
with drive with bellows	see charts

When selecting the motor, take account of the permissible travel speed of the Ball Rail Table or the selected ball screw drive.



——— with bellows
- - - - - without bellows

Maximum permissible drive torque, fixed bearing end (at the drive journal)

For motor attachment via motor mount and coupling at the fixed bearing end

For the permissible torque with a motor attached via timing belt drive, see "Timing belt side drive, floating bearing end."

The values shown for M_p apply under the following conditions:
- Horizontal operation
- Ball screw journal without keyway
- No radial load on ball screw shaft end
- Ball Rail Table with polyurethane bellows

Consider the rated torque of the coupling used!

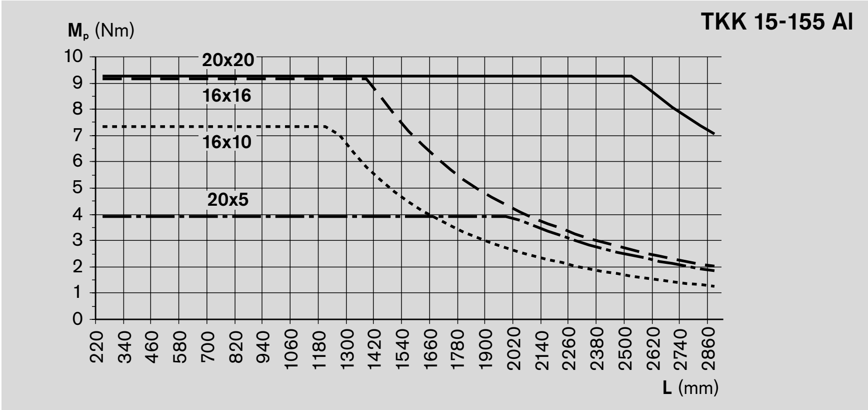
Ball screw journal with keyway
For reasons of stress concentration and a reduction of the effective diameter, do not exceed the following maximum values for drive torque!

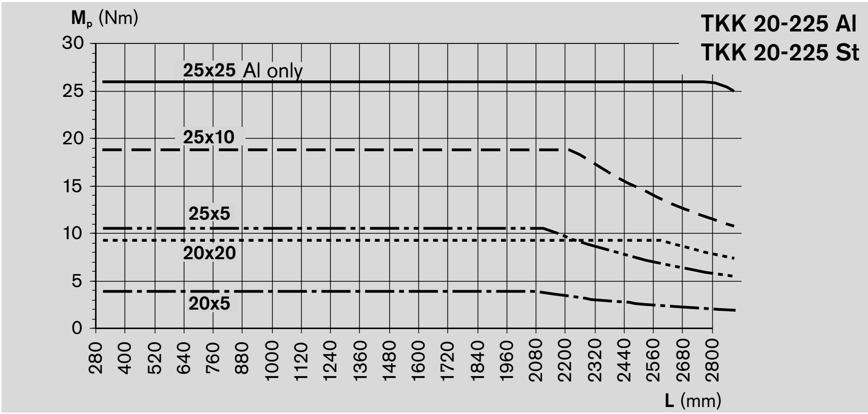
Size	M_p (Nm)
TKK 15-155	4.5
TKK 20-225	4.5 (BS ø20) 11.0 (BS ø25)
TKK 30-325	18.0
TKK 35-455	76.0

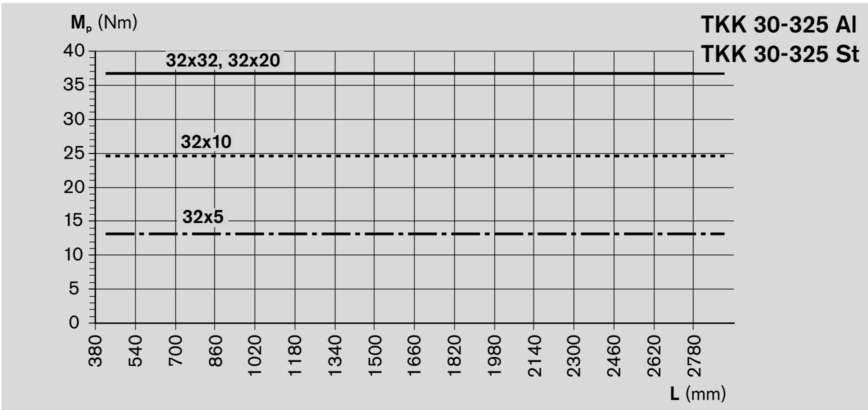
When comparing the chart and table, the lower of the two values will always apply!

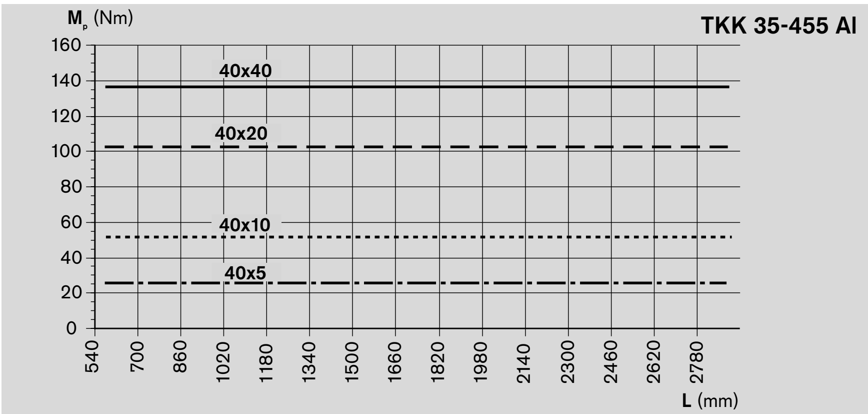
Example:
TKK 15-155, ball screw 20x5, length 1060 mm

Drive torque M_p from chart:	≈ 3.9 Nm
Maximum permissible drive torque as per table:	4.5 Nm
Drive torque for sizing:	3.9 Nm







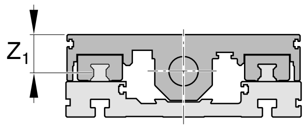


Calculations

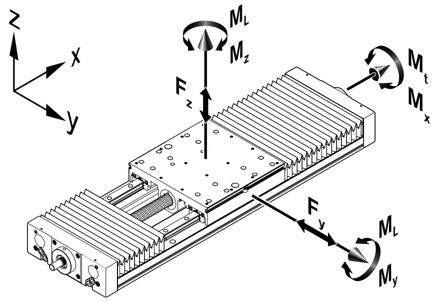
Calculation principles

Combined equivalent load on bearing of the linear guide

$$F_{comb} = |F_y| + |F_z| + C \cdot \frac{|M_x|}{M_t} + C \cdot \frac{|M_y|}{M_L} + C \cdot \frac{|M_z|}{M_L}$$



Size	Dimension (mm) Z_1
TKK 15-155	23.7
TKK 20-225	36.6
TKK 30-325	48.5
TKK 35-455	65.5



C = dynamic load capacity (N)
F_{comb} = combined equivalent load on bearing (N)
F_y = force in y-direction (N)
F_z = force in z-direction (N)
i = timing belt side drive reduction
J_s = mass moment of inertia of linear motion system (without external load) (kgm^2)
$k_{J\,fix}$ = constant for fixed-length portion of mass moment of inertia (10^6 kgm^2)
$k_{J\,var}$ = constant for variable-length portion of mass moment of inertia (10^6 kgm^2)
L = nominal life in meters (m)
L_h = nominal life in hours (h)
M_L = dynamic longitudinal moment load capacity (Nm)
M_R = frictional torque at motor journal (Nm)
M_{Rs} = frictional torque of the system (Nm)
$M_{R\,sd}$ = frictional torque of timing belt side drive at motor journal (Nm)
M_t = dynamic torsional moment load capacity (Nm)
M_x = torsional moment about the X-axis (Nm)
M_y = torsional moment about the Y-axis (Nm)
M_z = torsional moment about the Z-axis (Nm)
v_m = average travel speed (m/s)
Z_1 = application point of the effective force (mm)

Life expectancy

Nominal life of the guideway in meters:

$$L = \left(\frac{C}{F_{comb}}\right)^3 \cdot 10^5$$

Nominal life of the guideway in hours:

$$L_h = \frac{L}{3600 \cdot v_m}$$

Frictional torque

for motor attachment via motor mount and coupling:

$$M_R = M_{Rs}$$

for motor attachment via timing belt side drive:

$$M_R = \frac{M_{Rs}}{i} + M_{R\,sd}$$

Mass moment of inertia of the linear motion system J_s referred to the drive journal

$$J_s = (k_{J\,fix} + k_{J\,var} \cdot L) \cdot 10^{-6}$$

Mass moment of inertia of the mechanical system referred to the motor journal

Motor attachment via motor mount and coupling:

$$J_{ex} = J_s + J_t + J_c$$

Motor attachment via timing belt side drive:

$$J_{ex} = \frac{J_s + J_t}{i^2} + J_{sd}$$

Translatory mass moment of inertia of external load referred to the drive journal

$$J_t = m_{ex} \cdot k_{J\,m} \cdot 10^{-6}$$

Mass moment of inertia of the drive train referred to the motor journal

$$J_{dc} = J_{ex} \cdot J_{br}$$

Mass moment of inertia ratio

$$V = \frac{J_{dc}}{J_m}$$

Application area	V
Handling	≤ 6.0
Processing	≤ 1.5

Total mass moment of inertia referred to the motor journal

$$J_{tot} = J_{dc} + J_m$$

Maximum permissible rotary speed for mechanical system

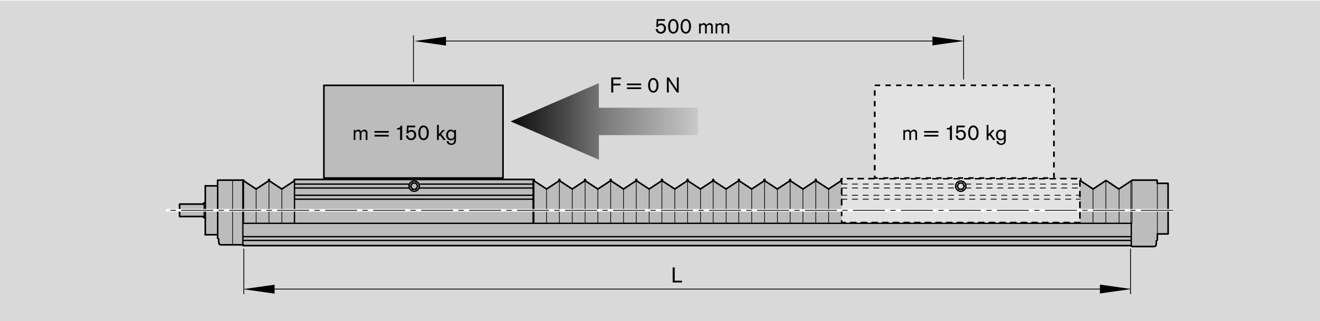
$$n_{mech} = \frac{v_{mech} \cdot i \cdot 1000 \cdot 60}{P}$$

$$n_{mech} < n_{m\,max}$$

J_{br} = mass moment of inertia, motor brake (kgm^2)
J_c = mass moment of inertia, coupling (kgm^2)
J_{dc} = mass moment of inertia, drive train (kgm^2)
J_{ex} = mass moment of inertia of mechanical system (kgm^2)
J_m = mass moment of inertia, motor (kgm^2)
J_s = mass moment of inertia of linear motion system (without external load) (kgm^2)
J_{sd} = mass moment of inertia of timing belt side drive at motor journal (kgm^2)
J_t = translatory mass moment of inertia of external load referred to the drive journal (kgm^2)
J_{tot} = total mass moment of inertia (kgm^2)
i = gear ratio of timing belt side drive (-)
$k_{J\,m}$ = constant for mass-specific portion of mass moment of inertia ($10^6\ m^2$)
m_{ex} = moved external load (kgm)
$n_{m\,max}$ = maximum permissible rotary speed of motor with controller (min^{-1})
n_{mech} = maximum permissible rotary speed of mechanical system (min^{-1})
P = screw lead (mm)
V = ratio of mass moments of inertia of drive train and motor (–)
v_{mech} = maximum permissible linear speed of mechanical system (m/s)

Calculation example

When sizing the drive, the motor-controller combination must always be considered, as the motor type and performance data (e.g. maximum useful speed and maximum torque) will depend on the controller or control system used. (See also Product Overview, “Motor selection based on drive controllers and control system.”)



Given data

A mass of 150 kg is to be moved 500 mm at a maximum travel speed of 0.66 m/s.
The following was selected based on the technical data and the connection dimensions:

Ball Rail Table TKK 30-325 Al
- $L_{ca} = 320$ mm
- 2% preload
- With protective bellows
- With motor MSK 060C attached via motor mount and coupling

Estimation of the Ball Rail Table length L

Excess travel	=	$2 \cdot P = 2 \cdot 32$ mm = 64 mm
Max. travel	=	$\text{stroke}_{eff} + 2 \cdot$ excess travel
	=	500 mm $+ 2 \cdot 64$ mm
	=	628 m
Length L:		for max. travel = 628 mm from data sheet TKK 30-325 Al
L	=	1100 mm

Selection of ball screw
See charts in “Technical Data” section.

General recommendation:
Always select the lowest lead (resolution, braking distance, length).

Permissible ball screws according to the “Permissible travel speed” chart at $v = 0.66$ m/s and $L = 1100$ mm:
Ball screw 32 x 20 and ball screw 32 x 32
Ball screw selected (lower lead)

Ball screw 32 x 20
with a maximum permissible drive torque of 36.5 Nm as per “Permissible drive torque” chart for L = 1100 mm

Calculation of the Ball Rail Table length L

Excess travel	=	$2 \cdot P = 2 \cdot 20$ mm = 40 mm
Max. travel	=	$\text{stroke}_{eff} + 2 \cdot$ excess travel
	=	500 mm $+ 2 \cdot 40$ mm
	=	580 mm
L	=	1020 mm for max. travel = 580 mm (582 mm) from data sheet TKK 30-325 Al

Frictional torque M_R

M_R	=	M_{Rs} (see “Technical Data”)
M_R	=	1.21 Nm

Mass moment of inertia of the mechanical system

$J_{ex} = J_S + J_t + J_C$

$J_S = (k_{J\,fix} + k_{J\,var} \cdot L) \cdot 10^{-6}\ kgm^2$
$= (265.3 + 0.667 \cdot 1020\ mm) \cdot 10^{-6}\ kgm^2$
$= 945.64 \cdot 10^{-6}\ kgm^2$ (see "Technical Data")

$J_t = m_{ex} \cdot k_{J\,m} \cdot 10^{-6}\ kgm^2$
$= 150 \cdot 10.13 \cdot 10^{-6}\ kgm^2$
$= 1519.5 \cdot 10^{-6}\ kgm^2$ (see "Technical Data")

$J_C = 200 \cdot 10^{-6}\ kgm^2$ (see "Technical Data")

$J_{ex} = (945.64 + 1519.5 + 200) \cdot 10^{-6}\ kgm^2$
$= 2665 \cdot 10^{-6}\ kgm^2$

$J_{dc} = J_{ex} + J_{br}$

$J_{br} = 55 \cdot 10^{-6}\ kgm^2$ (see "Motors")

$J_{dc} = (2665 + 55) \cdot 10^{-6}\ kgm^2$
$= 2720 \cdot 10^{-6}\ kgm^2$

Mass moment of inertia for handling (V ≤ 6)

$$V = \frac{J_{dc}}{J_m} \le 6$$

$$= \frac{2720 \cdot 10^{-6}\ kgm^2}{800 \cdot 10^{-6}\ kgm^2}$$

$$= 3.4 \le 6$$

The selected motor (MSK 060C) is therefore suitable.

Rotary speed n
at v = 0.66 m/s

$$n_{mech} = \frac{v_{mech} \cdot i \cdot 1000 \cdot 60}{P} = \frac{0{,}66\ m/s \cdot 1 \cdot 1000 \cdot 60}{20\ mm} = 1980\ min^{-1}$$

$v_{mech} = 0.66\ m/s$

If the permissible travel speed of 0.66 m/s is not sufficient, switch to size 32 x 32 and repeat the calculation.

Result

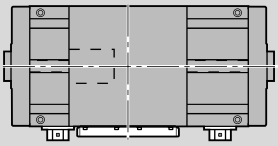
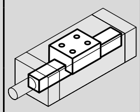
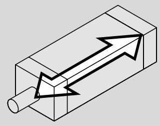
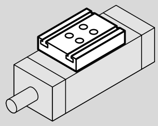
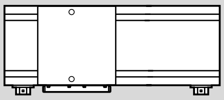
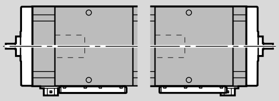
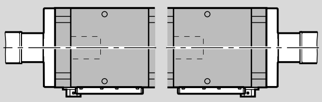
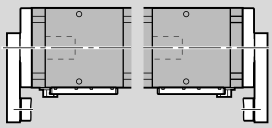
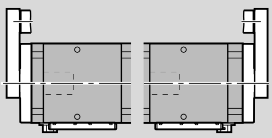
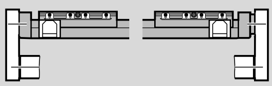
Ball Rail Table	TKK 30-325 Al
Length	L = 1020 mm
Ball screw:	
Diameter	32 mm;
Lead	20 mm;
Carriage length:	L_{ca} = 320 mm;
Preload:	2%

Motor attachment via motor mount and coupling
Motor with:
- maximum useful speed $n_{m\,max} > 2000\ min^{-1}$
- mass moment of inertia $J_m > 450 \cdot 10^{-6}\ kgm^2$
- maximum permissible drive torque $M_{max} < 36.5\ Nm$
  Consider the rated coupling torque M_{cN} and the frictional torque M_R (M_{cN} = 50 Nm; M_R = 1.21 Nm)

These requirements are fulfilled by all AC servo motors approved for TKK 30-325 Al in the "Components and Ordering Data" table.

The specific motor is selected:
- according to criteria in the "Motors" section
- and by recalculating the drive unit with performance data from the "ECODRIVE Cs" and "IndraDrive for Linear Motion Systems" catalogs.

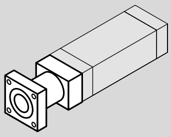
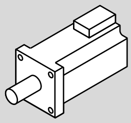
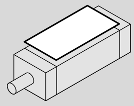
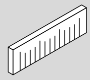
TKK 15-155 AI Components and Ordering

Part number, length R1460 205 00, ... mm Reference edge  Switches	Dimension drawing	Guideway  Base plate, low	Drive unit  Ball screw journal keyway	Ball screw 16 x 10	16 x 16	20 x 5	20 x 20	Carriage  Carriage length L_{ca} 150 mm Preload 2%	150 mm Preload 8%	220 mm Preload 2%	220 mm Preload 8%
Without drive (without end-plates) OA01 	OA01	01		00				01	02	03	04
Without motor mount and motor OF01  OF04	OF01 OF04	01	ø10 (fixed bearing end)	01	07	13	19	01	02	03	04
			ø10 (fixed bearing end) 1)	04	10	16	22				
With motor mount and coupling, with or without motor MF01  MF02	MF01 MF02	01	ø10 (fixed bearing end)	01	07	13	19	01	02	03	04
With timing belt side drive, with or without motor RV01  RV02 RV03  RV04	RV01-RV04	01	ø11 (floating bearing end)	03	09			01	02	03	04
RV05  RV06	RV05 RV05		ø14 (floating bearing end)			15	21	01	02	03	04

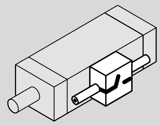
1) With keyway

Please check whether the selected combination is a permissible one (load capacities, moments, maximum speeds, motor data, etc.)!

For more information on ordering, see order example.

i	Motor attachment[2] Mounting orientation 		Motor 		Cover PU bellows  without	Cover PU bellows with	Position measuring system  without	Position measuring system Glass scale
	OA01	00	without	00	00	on request	00	on request
	OF01-OF04	00	without	00	00	01		
1	MF01-MF02	02	MSK 040C	86[3)] / 87[4)]				
		06	MSM 040B	74[3)] / 75[4)]				
		04	VRDM 397	37[3)] / 38[4)]				
			VRDM 3910	39[3)] / 40[4)]				
		05	VRDM 3913	41[3)] / 42[4)]				
1	RV01-RV04	41	MSK 040C	86[3)]				
	RV05-RV06	42						
1.5	RV01-RV04	43		87[4)]				
	RV05-RV06	44						
1	RV01-RV04	53	MSM 040B	74[3)]				
	RV05-RV06	54						
1.5	RV01-RV04	55		75[4)]				
	RV05-RV06	56						
1	RV01-RV04	45	MSK 040C	86[3)]				
	RV05-RV06	46						
1.5	RV01-RV04	47		87[4)]				
	RV05-RV06	48						
1	RV01-RV04	49	MSM 040B	74[3)]				
	RV05-RV06	50						
1.5	RV01-RV04	51		75[4)]				
	RV05-RV06	52						

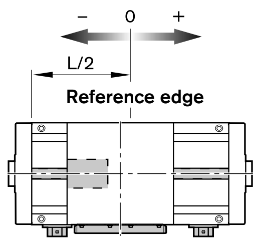
Switches (1st, 2nd, 3rd), switching cam, socket, plug, cable duct



Without switches	
without switch	00
without cable duct	

With switches

Direction

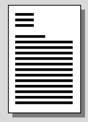


Switches

External switches		
PNP NC	Switching cam, external	External socket/ plug (loose)
11-A +/–... mm		
PNP NO		
13-A +/–... mm		
Mechanical		
15-A +/–... mm	16	17

Cable duct (loose)	
Cable duct	20 - X....

Documentation

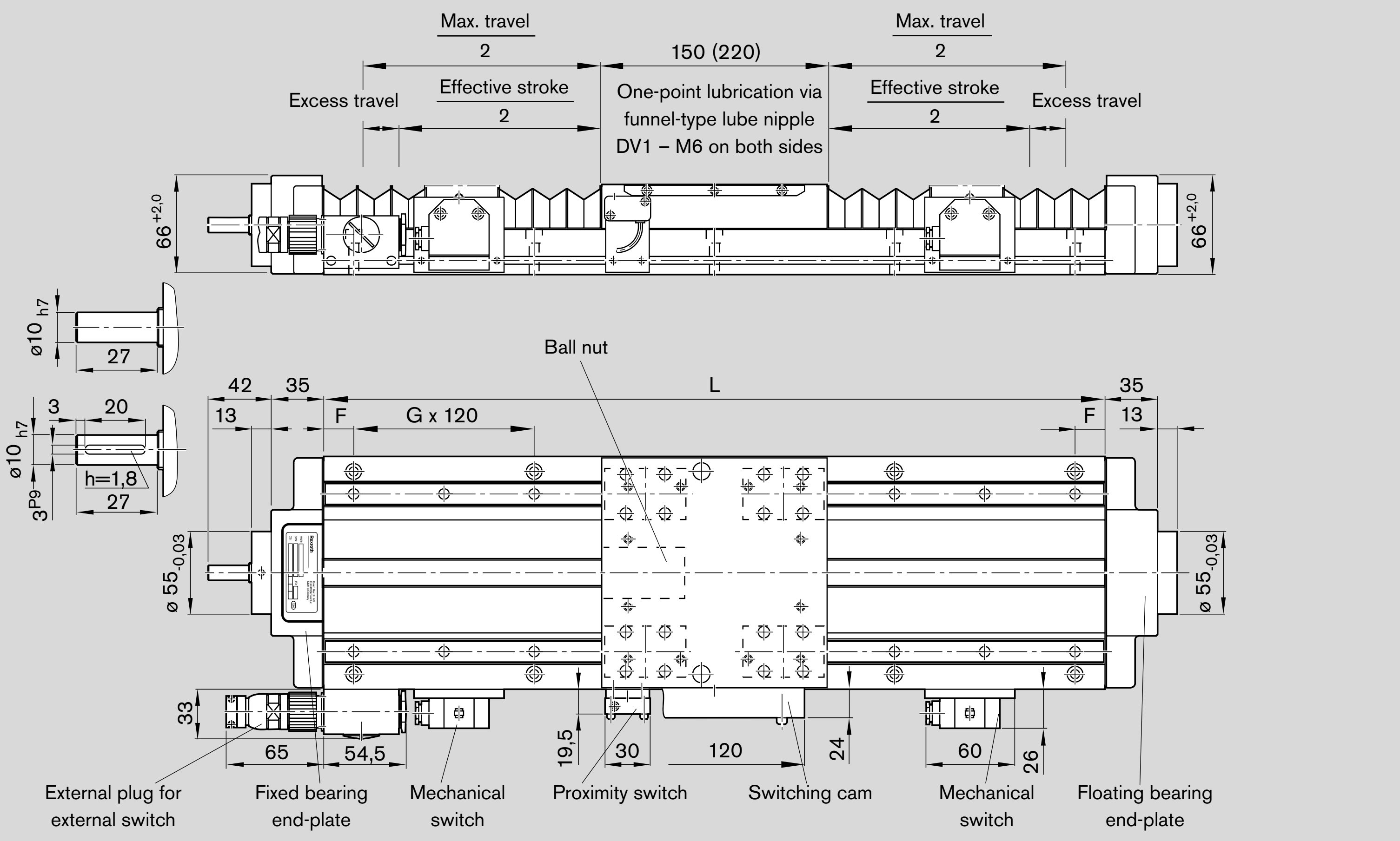


Standard report	Special report
01	02 Friction moment
	03 Lead deviation
	04 Travel accuracy
	05 Positioning accuracy

2) Attachment kit also available without motor (when ordering enter “00” for motor)
3) Without brake
4) With brake

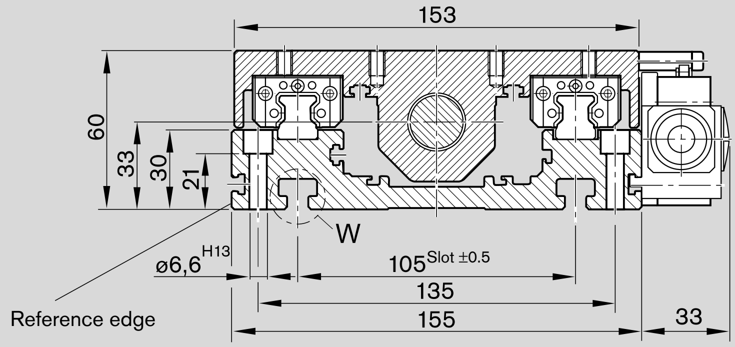
------ Optional

TKK 15-155 Al – Dimensions

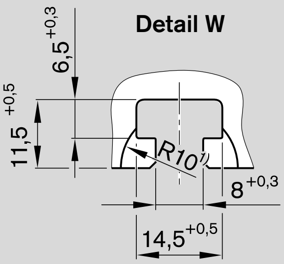


Length L	Counterbored mounting hole spacing	Max. travel (mm) for carriage length			
		with bellows		without bellows	
(mm)	F - G x 120 - F	150	220	150	220
220	50 - 1 x 120 - 50	-	-	60	-
280	20 - 2 x 120 - 20	68	-	120	-
340	50 - 2 x 120 - 50	117	59	180	110
400	20 - 3 x 120 - 20	166	109	240	170
460	50 - 3 x 120 - 50	216	158	300	230
520	20 - 4 x 120 - 20	265	207	360	290
580	50 - 4 x 120 - 50	315	257	420	350
640	20 - 5 x 120 - 20	364	306	480	410
700	50 - 5 x 120 - 50	414	356	540	470
760	20 - 6 x 120 - 20	463	405	600	530
820	50 - 6 x 120 - 50	512	454	660	590
880	20 - 7 x 120 - 20	562	504	720	650
940	50 - 7 x 120 - 50	611	553	780	710
1000	20 - 8 x 120 - 20	661	603	840	770
1060	50 - 8 x 120 - 50	710	652	900	830
1120	20 - 9 x 120 - 20	759	702	960	890
1180	50 - 9 x 120 - 50	809	751	1020	950
1240	20 - 10 x 120 - 20	858	800	1080	1010
1300	50 - 10 x 120 - 50	908	850	1140	1070
1360	20 - 11 x 120 - 20	957	899	1200	1130
1420	50 - 11 x 120 - 50	1007	949	1260	1190
1480	20 - 12 x 120 - 20	1056	998	1320	1250
1540	50 - 12 x 120 - 50	1105	1048	1380	1310

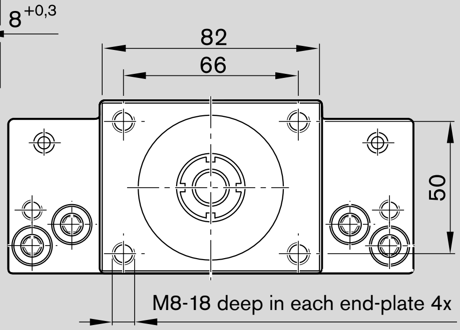
Length L	Counterbored mounting hole spacing	Max. travel (mm) for carriage length			
		with bellows		without bellows	
(mm)	F - G x 120 - F	150	220	150	220
1600	20 - 13 x 120 - 20	1155	1097	1440	1370
1660	50 - 13 x 120 - 50	1204	1146	1500	1430
1720	20 - 14 x 120 - 20	1254	1196	1560	1490
1780	50 - 14 x 120 - 50	1303	1245	1620	1550
1840	20 - 15 x 120 - 20	1353	1295	1680	1610
1900	50 - 15 x 120 - 50	1402	1344	1740	1670
1960	20 - 16 x 120 - 20	1451	1394	1800	1730
2020	50 - 16 x 120 - 50	1501	1443	1860	1790
2080	20 - 17 x 120 - 20	1550	1492	1920	1850
2140	50 - 17 x 120 - 50	1600	1542	1980	1910
2200	20 - 18 x 120 - 20	1649	1591	2040	1970
2260	50 - 18 x 120 - 50	1699	1641	2100	2030
2320	20 - 19 x 120 - 20	1748	1690	2160	2090
2380	50 - 19 x 120 - 50	1797	1739	2220	2150
2440	20 - 20 x 120 - 20	1847	1789	2280	2210
2500	50 - 20 x 120 - 50	1896	1838	2340	2270
2560	20 - 21 x 120 - 20	1946	1888	2400	2330
2620	50 - 21 x 120 - 50	1995	1937	2460	2390
2680	20 - 22 x 120 - 20	2045	1987	2520	2450
2740	50 - 22 x 120 - 50	2094	2036	2580	2510
2800	20 - 23 x 120 - 20	2143	2085	2640	2570
2860	50 - 23 x 120 - 50	2193	2135	2700	2630



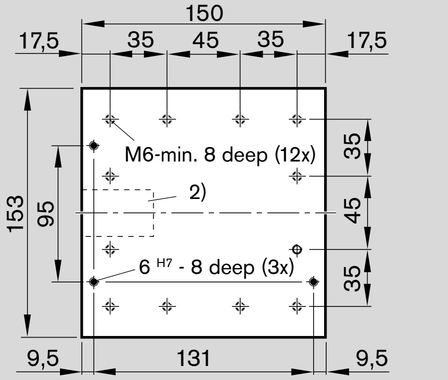
Detail W



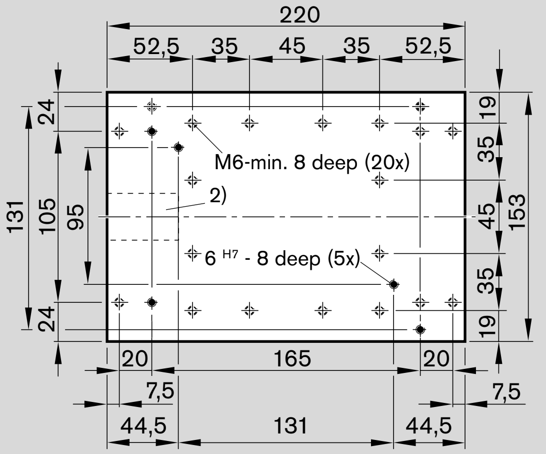
View on end face



Mounting hole pattern for carriage length L_{ca} = 150



Mounting hole pattern for carriage length L_{ca} = 220



1) Min. 25 deep (4x)
2) Ball nut

Effective stroke

For safe operation, the excess travel must be longer than the braking distance. The acceleration travel can be taken as a guideline value for the braking distance. In most cases, 2x the ball screw lead (P) will be sufficient.
Example for P = 5 mm:
Excess travel (braking distance) ≈ 10 mm
Recommended standard configuration:
– 2 mechanical switches
– 1 proximity switch

Effective stroke = max. travel – 2 · excess travel

Distance between switch activation points of two switches

Switch position	For switch combination	Min. spacing (mm)
external	mechanical – mechanical	60.0
	mechanical – proximity	45.0
	proximity – proximity	12.5

Maximum switch activation point

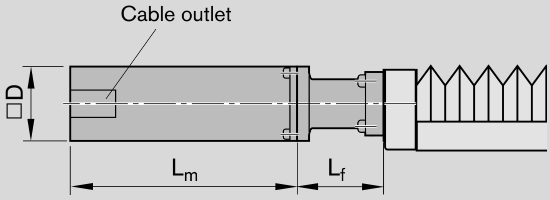
The switch activation point characterizes the position of the center of the carriage after travel. The zero point is at L/2.

Maximum switch activation point = 0.5 · max. travel – excess travel

TKK 15-155 Al – Dimension Drawings, Motor Attachment

Motor attachment with motor mount and coupling

MF01, MF02

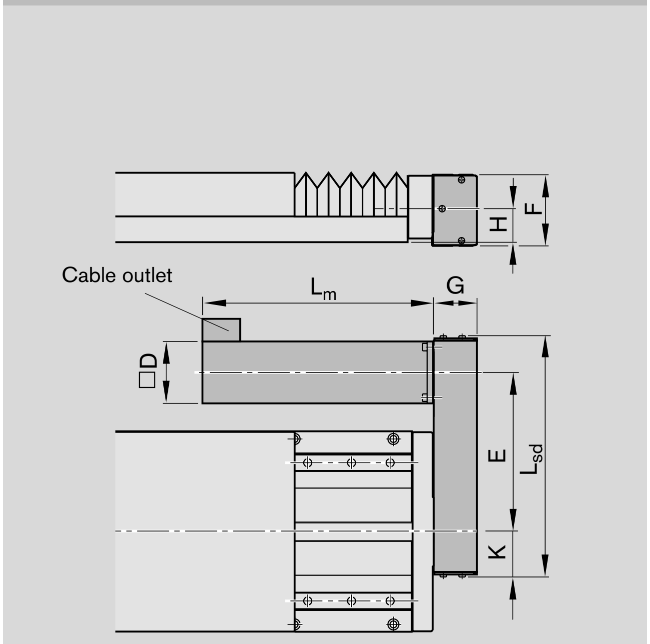


Motor	Dimensions (mm)		
	L_m	D	L_f
MSK 040C	185.5[1] 215.5[2]	82	90
MSM 040B	157.5[1] 191.5[2]	80	90
VRDM 397	110.0[1] 156.5[2]	85	90
VRDM 3910	140.0[1] 186.5[2]		
VRDM 3913	170.0[1] 216.5[2]		

1) Without brake
2) With brake

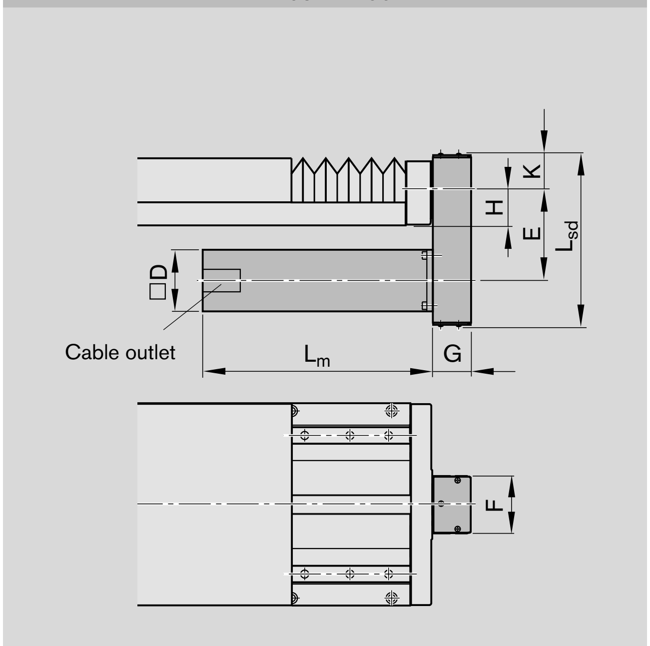
Motor attachment via timing belt side drive

RV01 - RV04



Motor	Dimensions (mm)								
	L_m	D	G	H	L_{sd}	E i=1	E i=1.5	K	F
MSK 040C	185.5[1] 215.5[2]	82	51	33	272	157.5	162.0	47.5	88
MSM 040B	157.5[1] 191.5[2]								

RV05 - RV06



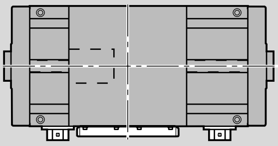
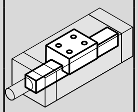
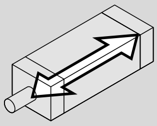
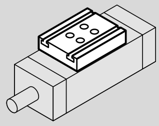
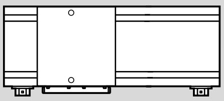
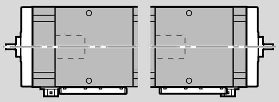
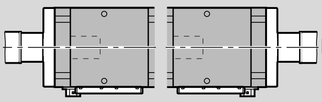
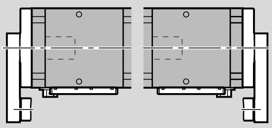
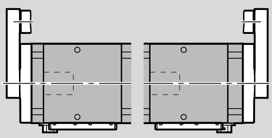
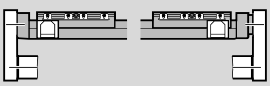
Motor	Dimensions (mm)								
	L_m	D	G	H	L_{sd}	E i=1	E i=1.5	K	F
MSK 040C	185.5[2] 215.5[2]	82	51	33	231	122.5	122.0	47.5	88
MSM 040B	157.5[1] 191.5[2]								

1) Without brake
2) With brake

Note for multi-axis units
(e.g. X-Y tables)
For multi-axis units with motor attachment via timing belt side drive, the motor may project into the working area of adjacent axes. Check for any interference contours.

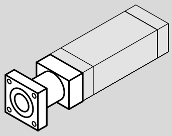
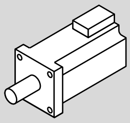
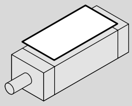
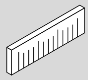
For motor dimensions, see “Motors.”

TKK 20-225 Al Components and Ordering

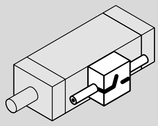
Part number, length R1460 305 00, ... mm Reference edge  Switches	Dimension drawing	Guideway  Base plate		Drive unit 						Carriage  Carriage length L_{ca}			
					Ball screw					220 mm Preload		320 mm Preload	
		low	high	Ball screw journal keyway	20 x 5	20 x 20	25 x 5	25 x 10	25 x 25	2%	8%	2%	8%
Without drive (without end-plates)													
OA01 	OA01	01	11		00					01	02	03	04
Without motor mount and motor													
OF01  **OF04**	OF01 OF04	01	11	ø10 (fixed bearing end)	01	07				01	02	03	04
				ø10 (fixed bearing end)[1]	04	10							
				ø14 (fixed bearing end)			13	19					
				ø14 (fixed bearing end)[1]			16	22					
				ø14 (fixed bearing end)					25	05	06	07	08
				ø14 (fixed bearing end)[1]					28				
With motor mount and coupling, with or without motor													
MF01  **MF02**	MF01 MF02	01	11	ø10 (fixed bearing end)	01	07				01	02	03	04
				ø14 (fixed bearing end)			13	19		01	02	03	04
									25	05	06	07	08
With timing belt side drive, with or w/o motor													
RV01  **RV02** **RV03**  **RV04**	RV01- RV04	01	11	ø14 (floating bearing end)	03	09	15	21		01	02	03	04
RV05  **RV06**	RV05 RV06								27	05	06	07	08

1) With keyway

Please check whether the selected combination is a permissible one (load capacities, moments, maximum speeds, motor data, etc.)!
For more information on ordering, see order example.

i	Motor attachment[2)] Mounting orientation 		Motor 		Cover PU bellows  without	with	Position measuring system  without	Glass scale
	OA01	00	without	00	00	on request	00	on request
	OF01-OF04	00	without	00	00	01	00	on request
1	MF01-MF02	02	MSK 040C	86[3)]	00	01	00	on request
1	MF01-MF02	02	MSK 040C	87[4)]	00	01	00	on request
1	MF01-MF02	08	VRDM 397	37[3)]	00	01	00	on request
1	MF01-MF02	08	VRDM 397	38[4)]	00	01	00	on request
1	MF01-MF02	08	VRDM 3910	39[3)]	00	01	00	on request
1	MF01-MF02	08	VRDM 3910	40[4)]	00	01	00	on request
1	MF01-MF02	09	VRDM 3913	41[3)]	00	01	00	on request
1	MF01-MF02	09	VRDM 3913	42[4)]	00	01	00	on request
1	MF01-MF02	10	MSM 040B	74[3)]	00	01	00	on request
1	MF01-MF02	10	MSM 040B	75[4)]	00	01	00	on request
1	MF01-MF02	12	MSK 050C	88[3)]	00	01	00	on request
1	MF01-MF02	12	MSK 050C	89[4)]	00	01	00	on request
1	MF01-MF02	04	MSK 040C	86[3)]	00	01	00	on request
1	MF01-MF02	04	MSK 040C	87[4)]	00	01	00	on request
1	MF01-MF02	11	MSM 040B	74[3)]	00	01	00	on request
1	MF01-MF02	11	MSM 040B	75[4)]	00	01	00	on request
1	MF01-MF02	13	MSK 050C	88[3)]	00	01	00	on request
1	MF01-MF02	13	MSK 050C	89[4)]	00	01	00	on request
1	RV01-RV04	45	MSK 040C	86[3)]	00	01	00	on request
1	RV05-RV06	46	MSK 040C	86[3)]	00	01	00	on request
1.5	RV01-RV04	47	MSK 040C	87[4)]	00	01	00	on request
1.5	RV05-RV06	48	MSK 040C	87[4)]	00	01	00	on request
1	RV01-RV04	49	MSM 040B	74[3)]	00	01	00	on request
1	RV05-RV06	50	MSM 040B	74[3)]	00	01	00	on request
1.5	RV01-RV04	51	MSM 040B	75[4)]	00	01	00	on request
1.5	RV05-RV06	52	MSM 040B	75[4)]	00	01	00	on request
1	RV01-RV04	53	MSK 050C	88[3)]	00	01	00	on request
1	RV05-RV06	55	MSK 050C	88[3)]	00	01	00	on request
2	RV01-RV04	54	MSK 050C	89[4)]	00	01	00	on request
2	RV05-RV06	56	MSK 050C	89[4)]	00	01	00	on request

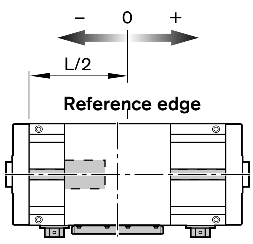
Switches (1st, 2nd, 3rd), switching cam, socket, plug, cable duct



Without switches	
without switch	00
without cable duct	00

With switches

Direction



Switches

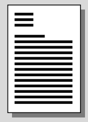
Internal switches	
PNP NC 01-I +/–... mm	Socket/plug on end-plate, switching cam 07
PNP NO 03-I +/–... mm	Socket/plug on end-plate, switching cam 07
Mechanical 05-I +/–... mm	Socket/plug on end-plate, switching cam 07

External switches		
PNP NC 11-A +/–... mm	Switching cam, external 16	External socket/plug (loose) 17
PNP NO 13-A +/–... mm	Switching cam, external 16	External socket/plug (loose) 17
Mechanical 15-A +/–... mm	Switching cam, external 16	External socket/plug (loose) 17

Cable duct (loose)	
Cable duct	20 - X....

------- Optional

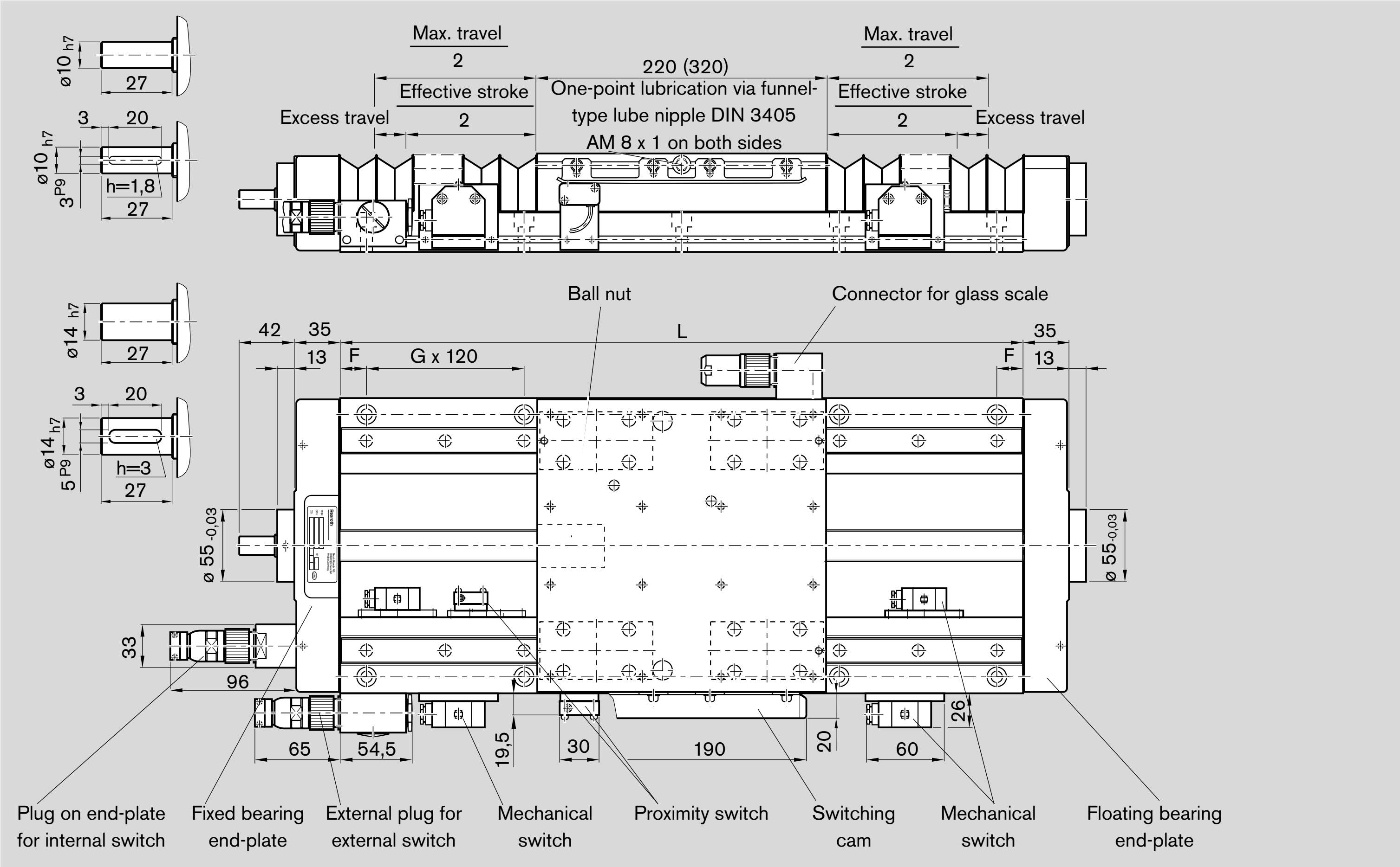
Documentation



Standard report	Special report
01	02 Friction moment
	03 Lead deviation
	04 Travel accuracy
	05 Positioning accuracy

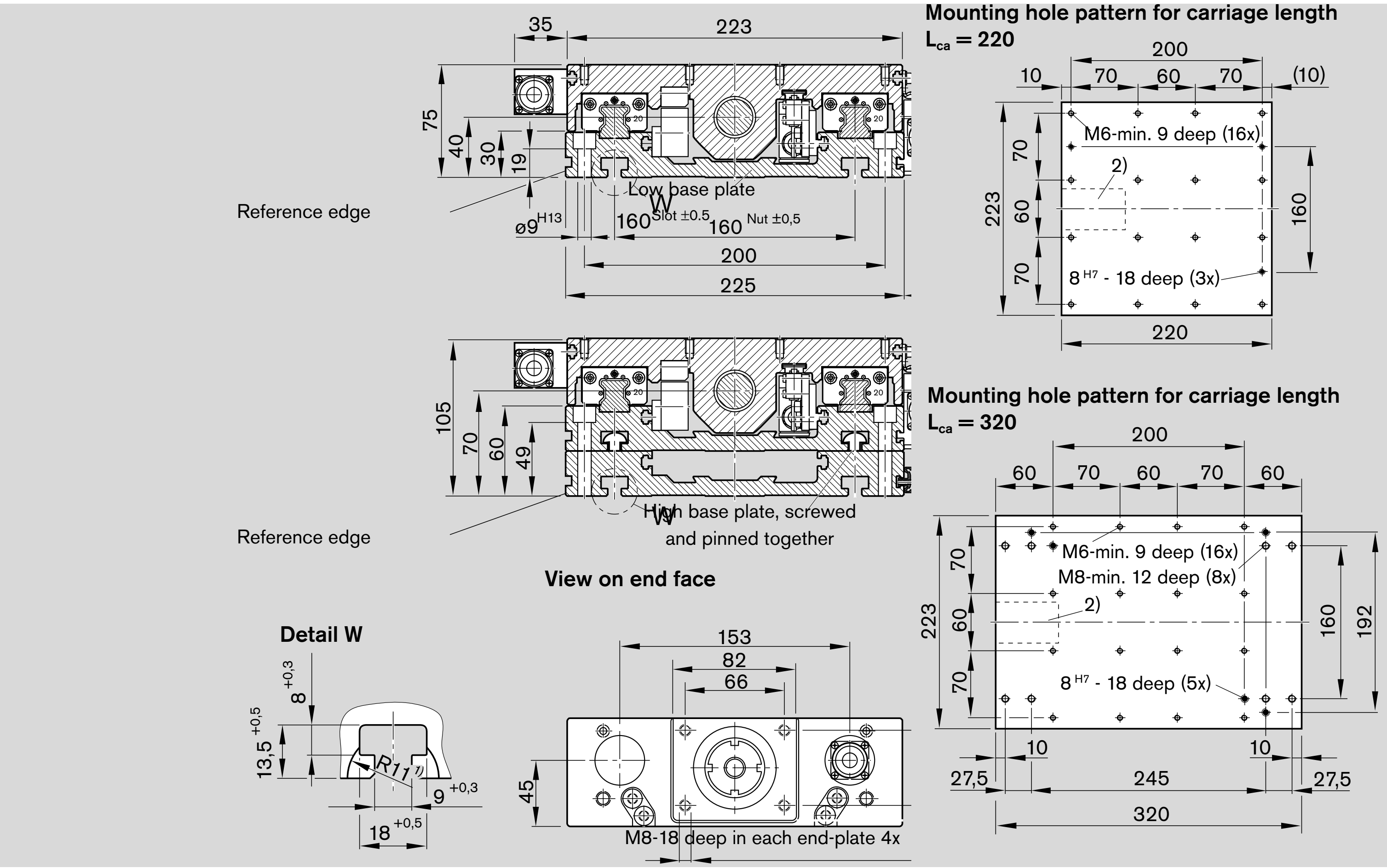
2) Attachment kit also available without motor (when ordering enter "00" for motor)
3) Without brake
4) With brake

TKK 20-225 Al – Dimensions



Length L	Counterbored mounting hole spacing	Max. travel (mm) for carriage length			
		with bellows		without bellows	
(mm)	F - G x 120 - F	220	320	220	320
340	50 - 2 x 120 - 50	70	-	110	-
400	20 - 3 x 120 - 20	122	-	170	-
460	50 - 3 x 120 - 50	174	86	230	130
520	20 - 4 x 120 - 20	226	138	290	190
580	50 - 4 x 120 - 50	278	190	350	250
640	20 - 5 x 120 - 20	330	242	410	310
700	50 - 5 x 120 - 50	382	294	470	370
760	20 - 6 x 120 - 20	434	346	530	430
820	50 - 6 x 120 - 50	486	398	590	490
880	20 - 7 x 120 - 20	538	450	650	550
940	50 - 7 x 120 - 50	590	502	710	610
1000	20 - 8 x 120 - 20	642	554	770	670
1060	50 - 8 x 120 - 50	694	606	830	730
1120	20 - 9 x 120 - 20	746	658	890	790
1180	50 - 9 x 120 - 50	798	710	950	850
1240	20 - 10 x 120 - 20	850	762	1010	910
1300	50 - 10 x 120 - 50	902	814	1070	970
1360	20 - 11 x 120 - 20	954	866	1130	1030
1420	50 - 11 x 120 - 50	1006	918	1190	1090
1480	20 - 12 x 120 - 20	1058	970	1250	1150
1540	50 - 12 x 120 - 50	1110	1022	1310	1210
1600	20 - 13 x 120 - 20	1162	1074	1370	1270

Length L	Counterbored mounting hole spacing	Max. travel (mm) for carriage length			
		with bellows		without bellows	
(mm)	F - G x 120 - F	220	320	220	320
1660	50 - 13 x 120 - 50	1214	1126	1430	1330
1720	20 - 14 x 120 - 20	1266	1178	1490	1390
1780	50 - 14 x 120 - 50	1318	1230	1550	1450
1840	20 - 15 x 120 - 20	1370	1282	1610	1510
1900	50 - 15 x 120 - 50	1422	1334	1670	1570
1960	20 - 16 x 120 - 20	1474	1386	1730	1630
2020	50 - 16 x 120 - 50	1526	1438	1790	1690
2080	20 - 17 x 120 - 20	1578	1490	1850	1750
2140	50 - 17 x 120 - 50	1630	1542	1910	1810
2200	20 - 18 x 120 - 20	1682	1594	1970	1870
2260	50 - 18 x 120 - 50	1734	1646	2030	1930
2320	20 - 19 x 120 - 20	1786	1698	2090	1990
2380	50 - 19 x 120 - 50	1838	1750	2150	2050
2440	20 - 20 x 120 - 20	1890	1802	2210	2110
2500	50 - 20 x 120 - 50	1942	1854	2270	2170
2560	20 - 21 x 120 - 20	1994	1906	2330	2230
2620	50 - 21 x 120 - 50	2046	1958	2390	2290
2680	20 - 22 x 120 - 20	2098	2010	2450	2350
2740	50 - 22 x 120 - 50	2150	2062	2510	2410
2800	20 - 23 x 120 - 20	2202	2114	2570	2470
2860	50 - 23 x 120 - 50	2254	2166	2630	2530



1) 27 deep (4x)
2) Ball nut

Effective stroke
For safe operation, the excess travel must be longer than the braking distance. The acceleration travel can be taken as a guideline value for the braking distance. In most cases, 2x the ball screw lead (P) will be sufficient.
Example for P = 5 mm:
Excess travel (braking distance) ≈ 10 mm
Recommended standard configuration:
– 2 mechanical switches
– 1 proximity switch

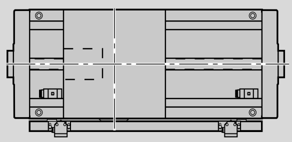
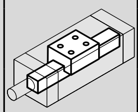
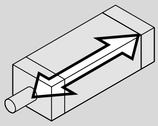
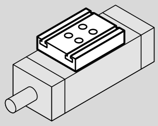
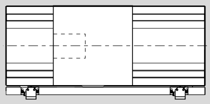
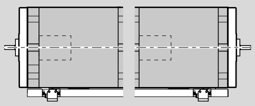
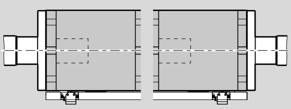
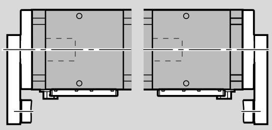
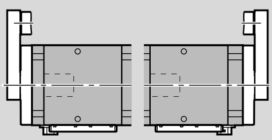
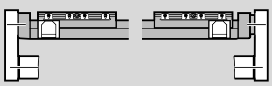
Effective stroke = max. travel – 2 · excess travel

Distance between switch activation points of two switches		
Switch position	**For switch combination**	**Min. spacing** (mm)
external	mechanical – mechanical	60.0
	mechanical – proximity	45.0
	proximity – proximity	12.5
internal	mechanical – mechanical	70.0
	mechanical – proximity	50.0
	proximity – proximity	25.0

Maximum switch activation point
The switch activation point characterizes the position of the center of the carriage after travel. The zero point is at L/2.

Maximum switch activation point = 0.5 · max. travel – excess travel

TKK 20-225 St Components and Ordering

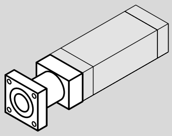
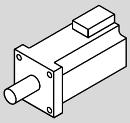
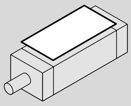
Part number, length R1460 300 00, ... mm	Dimension drawing	Guideway	Drive unit					Carriage			
Reference edge  Switches				Ball screw				 Carriage length L_{ca}			
								220 mm		320 mm	
								Preload		Preload	
		Base plate, low	Ball screw journal keyway	20 x 5	20 x 20	25 x 5	25 x 10	2%	8%	2%	8%
Without drive (without end-plates)											
OA01 	OA01	01		00				01	02	03	04
Without motor mount and motor											
OF01  **OF04**	OF01 OF04	01	ø10 (fixed bearing end)	01	07			01	02	03	04
			ø10 (fixed bearing end) 1)	04	10						
			ø14 (fixed bearing end)			13	19				
			ø14 (fixed bearing end) 1)			16	22				
With motor mount and coupling, with or without motor											
MF01  **MF02**	MF01 MF02	01	ø10 (fixed bearing end)	01	07			01	02	03	04
			ø14 (fixed bearing end)			13	19	01	02	03	04
With timing belt side drive, with or w/o motor											
RV01  **RV02** **RV03**  **RV04**	RV01-RV04	01	ø14 (floating bearing end)	03	09	15	21	01	02	03	04
RV05  **RV06**	RV05 RV06										

1) With keyway

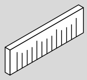
Please check whether the selected combination is a permissible one (load capacities, moments, maximum speeds, motor data, etc.)!

For more information on ordering, see order example.

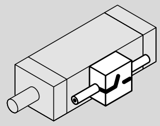
i	Motor attachment[2)] Mounting orientation		Motor		Cover PU bellows without	Cover PU bellows with
	OA01	00	without	00	00	on request
	OF01 OF04	00	without	00	00	01
1	MF01 MF02	02	MSK 040C	86[3)] / 87[4)]	00	01
1	MF01 MF02	08	VRDM 397	37[3)] / 38[4)]	00	01
1	MF01 MF02	08	VRDM 3910	39[3)] / 40[4)]	00	01
1	MF01 MF02	09	VRDM 3913	41[3)] / 42[4)]	00	01
1	MF01 MF02	10	MSM 040B	74[3)] / 75[4)]	00	01
1	MF01 MF02	12	MSK 050C	88[3)] / 89[4)]	00	01
1	MF01 MF02	04	MSK 040C	86[3)] / 87[4)]	00	01
1	MF01 MF02	11	MSM 040B	74[3)] / 75[4)]	00	01
1	MF01 MF02	13	MSK 050C	88[3)] / 89[4)]	00	01
1.5	RV01-RV04	47	MSK 040C	86[3)]	00	01
1.5	RV05-RV06	48	MSK 040C	87[4)]	00	01
1	RV01-RV04	49	MSM 040B	74[3)]	00	01
1	RV05-RV06	50	MSM 040B	74[3)]	00	01
1.5	RV01-RV04	51	MSM 040B	75[4)]	00	01
1.5	RV05-RV06	52	MSM 040B	75[4)]	00	01
1	RV01-RV04	53	MSK 050C	88[3)]	00	01
1	RV05-RV06	55	MSK 050C	88[3)]	00	01
2	RV01-RV04	54	MSK 050C	89[4)]	00	01
2	RV05-RV06	56	MSK 050C	89[4)]	00	01

Position measuring system without	Position measuring system Glass scale
00	on request



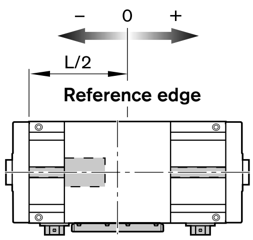
Switches (1st, 2nd, 3rd), switching cam, socket, plug, cable duct



Without switches

without switch / without cable duct	00

With switches



Internal switches

Switch	Socket/plug on end-plate, switching cam
PNP NC 01-I +/–... mm	07
PNP NO 03-I +/–... mm	07
Mechanical 05-I +/–... mm	07

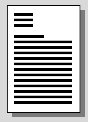
External switches

Switch	Switching cam, external	External socket/plug (loose)
PNP NC 11-A +/–... mm	26	17
PNP NO 13-A +/–... mm	26	17
Mechanical 15-A +/–... mm	26	17

Cable duct (loose)

Cable duct	20 - X....

Documentation

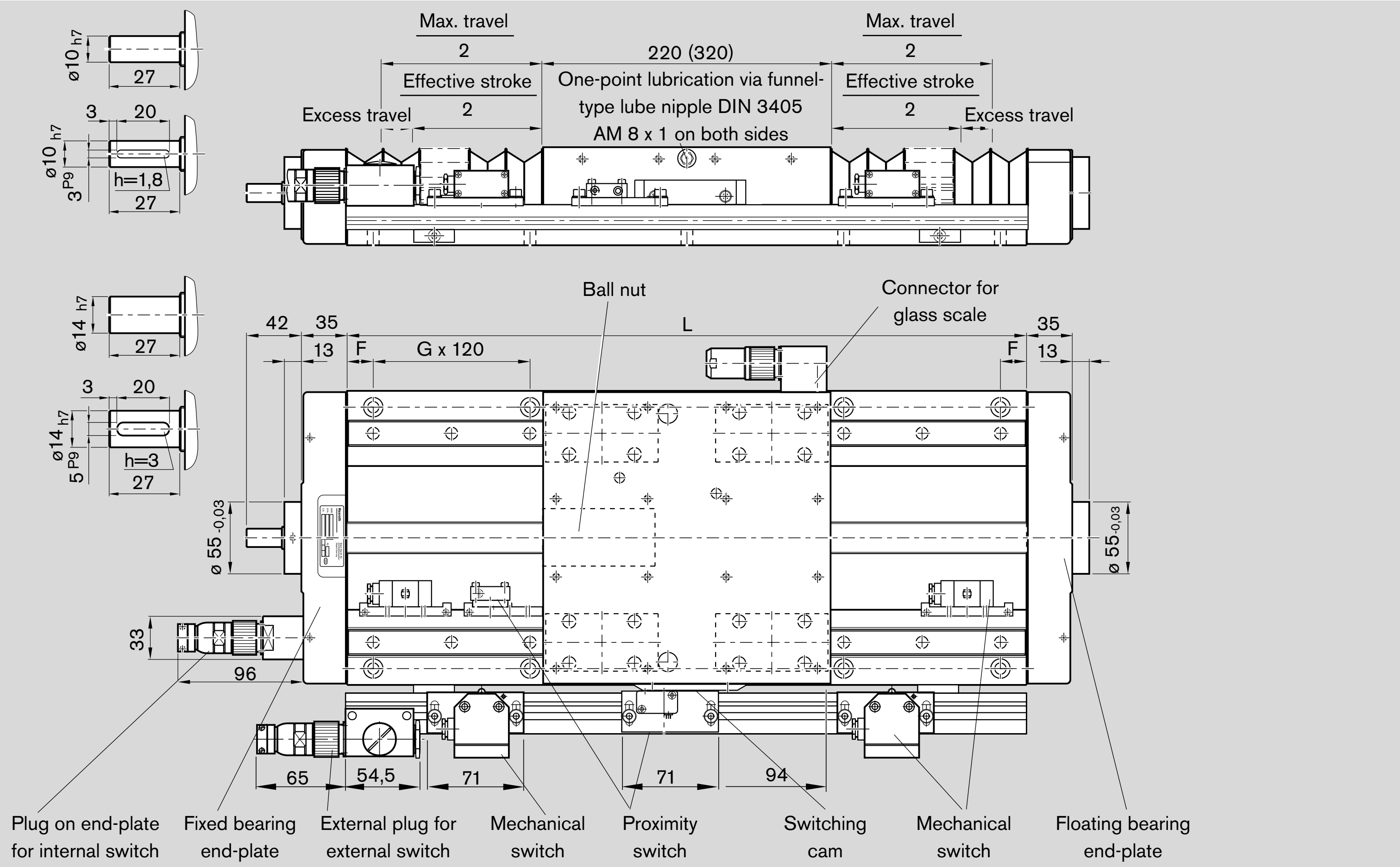


Standard report	Special report
01	02 Friction moment
	03 Lead deviation
	04 Travel accuracy
	05 Positioning accuracy

2) Attachment kit also available without motor (when ordering enter "00" for motor)
3) Without brake
4) With brake

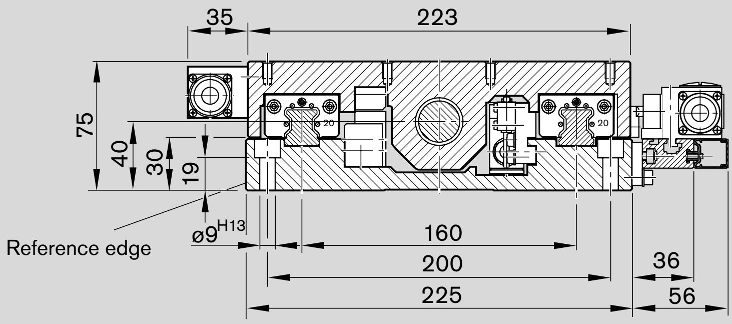
------- Optional

TKK 20-225 St – Dimensions

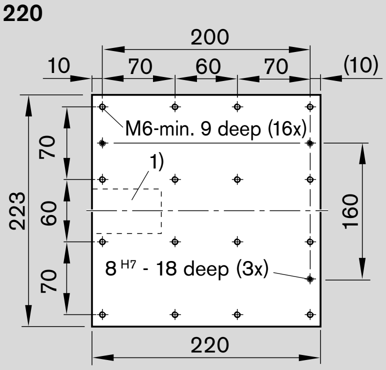


Length L (mm)	Counterbored mounting hole spacing F - G x 120 - F	Max. travel (mm) for carriage length with bellows 220	with bellows 320	without bellows 220	without bellows 320
340	50 - 2 - 120 - 50	70	-	110	-
400	20 - 3 - 120 - 20	122	-	170	-
460	50 - 3 - 120 - 50	174	86	230	130
520	20 - 4 - 120 - 20	226	138	290	190
580	50 - 4 - 120 - 50	278	190	350	250
640	20 - 5 - 120 - 20	330	242	410	310
700	50 - 5 - 120 - 50	382	294	470	370
760	20 - 6 - 120 - 20	434	346	530	430
820	50 - 6 - 120 - 50	486	398	590	490
880	20 - 7 - 120 - 20	538	450	650	550
940	50 - 7 - 120 - 50	590	502	710	610
1000	20 - 8 - 120 - 20	642	554	770	670
1060	50 - 8 - 120 - 50	694	606	830	730
1120	20 - 9 - 120 - 20	746	658	890	790
1180	50 - 9 - 120 - 50	798	710	950	850
1240	20 - 10 - 120 - 20	850	762	1010	910
1300	50 - 10 - 120 - 50	902	814	1070	970
1360	20 - 11 - 120 - 20	954	866	1130	1030
1420	50 - 11 - 120 - 50	1006	918	1190	1090
1480	20 - 12 - 120 - 20	1058	970	1250	1150
1540	50 - 12 - 120 - 50	1110	1022	1310	1210
1600	20 - 13 - 120 - 20	1162	1074	1370	1270

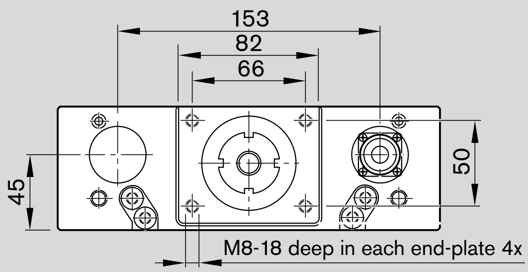
Length L (mm)	Counterbored mounting hole spacing F - G x 120 - F	Max. travel (mm) for carriage length with bellows 220	with bellows 320	without bellows 220	without bellows 320
1660	50 - 13 x 120 - 50	1214	1126	1430	1330
1720	20 - 14 x 120 - 20	1266	1178	1490	1390
1780	50 - 14 x 120 - 50	1318	1230	1550	1450
1840	20 - 15 x 120 - 20	1370	1282	1610	1510
1900	50 - 15 x 120 - 50	1422	1334	1670	1570
1960	20 - 16 x 120 - 20	1474	1386	1730	1630
2020	50 - 16 x 120 - 50	1526	1438	1790	1690
2080	20 - 17 x 120 - 20	1578	1490	1850	1750
2140	50 - 17 x 120 - 50	1630	1542	1910	1810
2200	20 - 18 x 120 - 20	1682	1594	1970	1870
2260	50 - 18 x 120 - 50	1734	1646	2030	1930
2320	20 - 19 x 120 - 20	1786	1698	2090	1990
2380	50 - 19 x 120 - 50	1838	1750	2150	2050



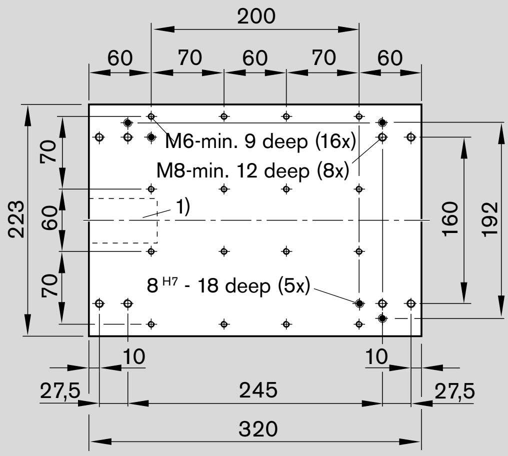
Mounting hole pattern for carriage length L_{ca} = 220



View on end face



Mounting hole pattern for carriage length L_{ca} = 320



1) Ball nut

Effective stroke
For safe operation, the excess travel must be longer than the braking distance. The acceleration travel can be taken as a guideline value for the braking distance. In most cases, 2x the ball screw lead (P) will be sufficient.
Example for P = 5 mm:
Excess travel (braking distance)
≈ 10 mm
Recommended standard configuration:
– 2 mechanical switches
– 1 proximity switch

Effective stroke = max. travel – 2 · excess travel

Distance between switch activation points of two switches		
Switch position	**For switch combination**	**Min. spacing** (mm)
external	mechanical – mechanical	62.0
	mechanical – proximity	49.0
	proximity – proximity	35.0
internal	mechanical – mechanical	70.0
	mechanical – proximity	50.0
	proximity – proximity	25.0

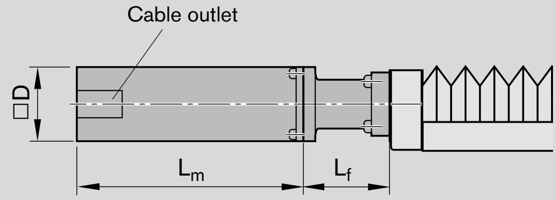
Maximum switch activation point
The switch activation point characterizes the position of the center of the carriage after travel. The zero point is at L/2.

Maximum switch activation point = 0.5 · max. travel – excess travel

TKK 20-225 – Dimension Drawings, Motor Attachment

Motor attachment with motor mount and coupling

MF01, MF02

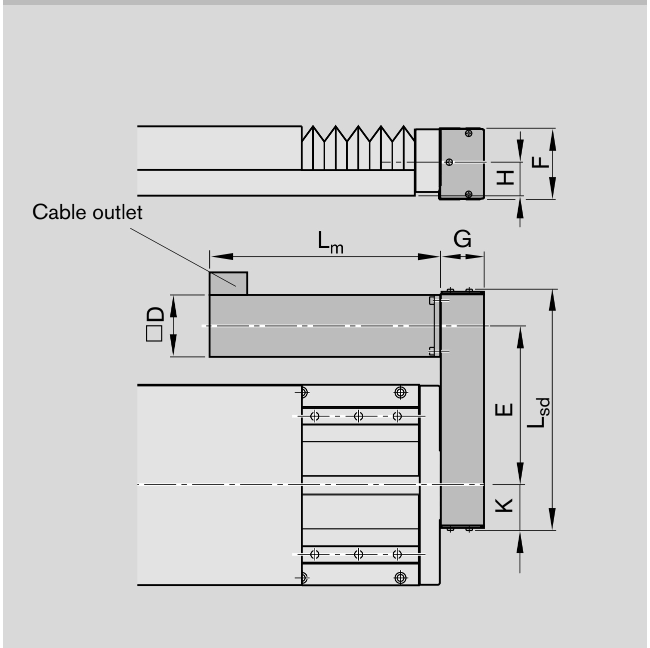


Motor	Dimensions (mm) L_m	D	L_f
MSK 040C	185.5[1)] 215.5[2)]	82	90
MSM 040B	157.5[1)] 191.5[2)]	80	90
MSK 050C	203.0[1)] 233.0[2)]	98	115
VRDM 397	110.0[1)] 156.5[2)]	85	90
VRDM 3910	140.0[1)] 186.5[2)]		
VRDM 3913	170.0[1)] 216.5[2)]		

1) Without brake
2) With brake

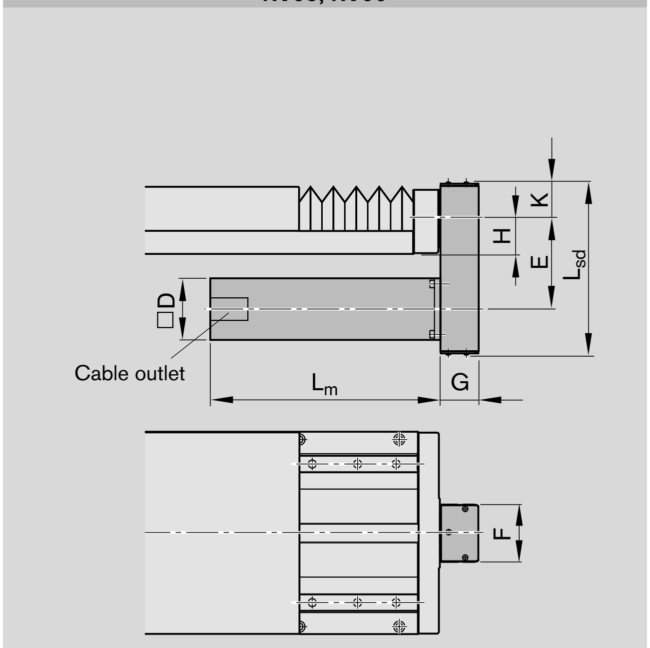
Motor attachment via timing belt side drive

RV01 - RV04



Motor	Dimensions (mm)									
	L_m	D	G	H	L_{sd}			E	K	F
						i = 1	i = 1.5	i = 2		
MSK 040C	185.5 1) 215.5 2)	82	51	40	322	210.0	213.5	–	47.5	88
MSM 040B	157.5 1) 191.5 2)									
MSK 050C	203.0 1) 233.0 2)	98	66	40	367	230.0	–	235.0	56.0	116

RV05, RV06



Motor	Dimensions (mm)									
	L_m	D	G	H	L_{sd}			E	K	F
						i = 1	i = 1.5	i = 2		
MSK 040C	185.5 1) 215.5 2)	82	51	40	231	122.5	122.0	–	47.5	88
MSM 040B	157.5 1) 191.5 2)									
MSK 050C	203.0 1) 233.0 2)	98	66	40	287	155.0	–	155.0	56.0	116

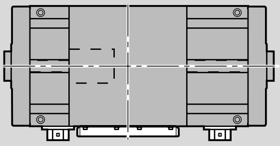
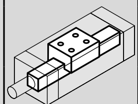
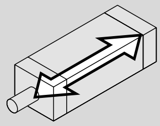
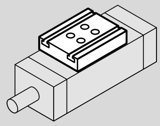
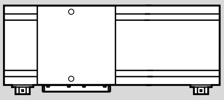
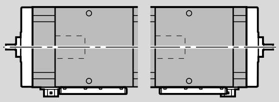
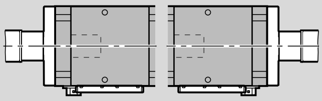
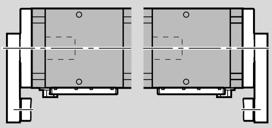
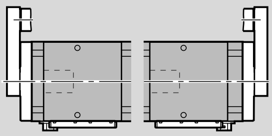
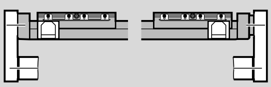
1) Without brake
2) With brake

Note for steel version
In type RV01 and RV02 with externally mounted switches:
– No switches may be mounted in the motor area!

Note for multi-axis units
(e.g. X-Y tables)
For multi-axis units with motor attachment via timing belt side drive, the motor may project into the working area of adjacent axes. Check for any interference contours.

For motor dimensions, see “Motors.”

TKK 30-325 Al Components and Ordering

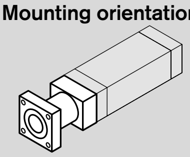
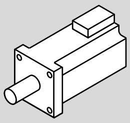
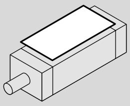
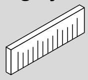
Part number, length R1460 405 00, ... mm Reference edge  Switches	Dimension drawing	Guideway  Base plate		Drive unit 					Carriage  Carriage length L_{ca}			
					Ball screw				320 mm Preload		450 mm Preload	
		low	high	Ball screw journal keyway	32 x 5	32 x 10	32 x 20	32 x 32	2%	8%	2%	8%
Without drive (without end-plates) **OA01** 	OA01	01	11		00				05	06	07	08
Without motor mount and motor **OF01**  **OF04**	OF01 OF04	01	11	ø16 (fixed bearing end)	07	13	19	25	05	06	07	08
				ø16 (fixed bearing end) [1]	10	16	22	28				
With motor mount and coupling, with or without motor **MF01**  **MF02**	MF01 MF02	01	11	ø16 (fixed bearing end)	07	13	19	25	05	06	07	08
With timing belt side drive, with or without motor **RV01**  **RV02** **RV03**  **RV04**	RV01 - RV04	01	11	ø19 (floating bearing end)	09	15	21	27	05	06	07	08
RV05  **RV06**	RV05 RV06											

1) With keyway

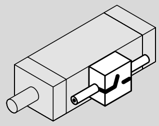
Please check whether the selected combination is a permissible one (load capacities, moments, maximum speeds, motor data, etc.)!

For more information on ordering, see order example.

i	Motor attachment[2] Mounting orientation		Motor		Cover PU bellows: without	Cover PU bellows: with	Position measuring system: without	Position measuring system: Glass scale
	OA01	00	without	00	00	on request	00	on request
	OF01-OF04	00	without	00	00	01	00	on request
1	MF01-MF02	09	MSK 060C	90[3]	00	01	00	on request
1	MF01-MF02	09	MSK 060C	91[4]	00	01	00	on request
1	MF01-MF02	08	MSK 076C	92[3]	00	01	00	on request
1	MF01-MF02	08	MSK 076C	93[4]	00	01	00	on request
1	RV01-RV04	77	MSK 060C	90[3]	00	01	00	on request
1	RV05-RV06	78	MSK 060C	90[3]	00	01	00	on request
2	RV01-RV04	79	MSK 060C	91[4]	00	01	00	on request
2	RV05-RV06	80	MSK 060C	91[4]	00	01	00	on request

Switches (1st, 2nd, 3rd), switching cam, socket, plug, cable duct

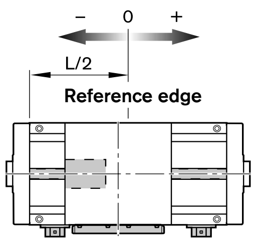


Without switches

without switch	00
without cable duct	00

With switches

Direction



Switches

Internal switches

Switch	Socket/plug on end-plate, switching cam
PNP NC: 01-I +/–... mm	07
PNP NO: 03-I +/–... mm	07
Mechanical: 05-I +/–... mm	07

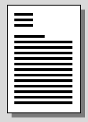
External switches

Switch	Switching cam, external	External socket/plug (loose)
PNP NC: 11-A +/–... mm	16	17
PNP NO: 13-A +/–... mm	16	17
Mechanical: 15-A +/–... mm	16	17

Cable duct (loose)

Cable duct	20 - X....

Documentation

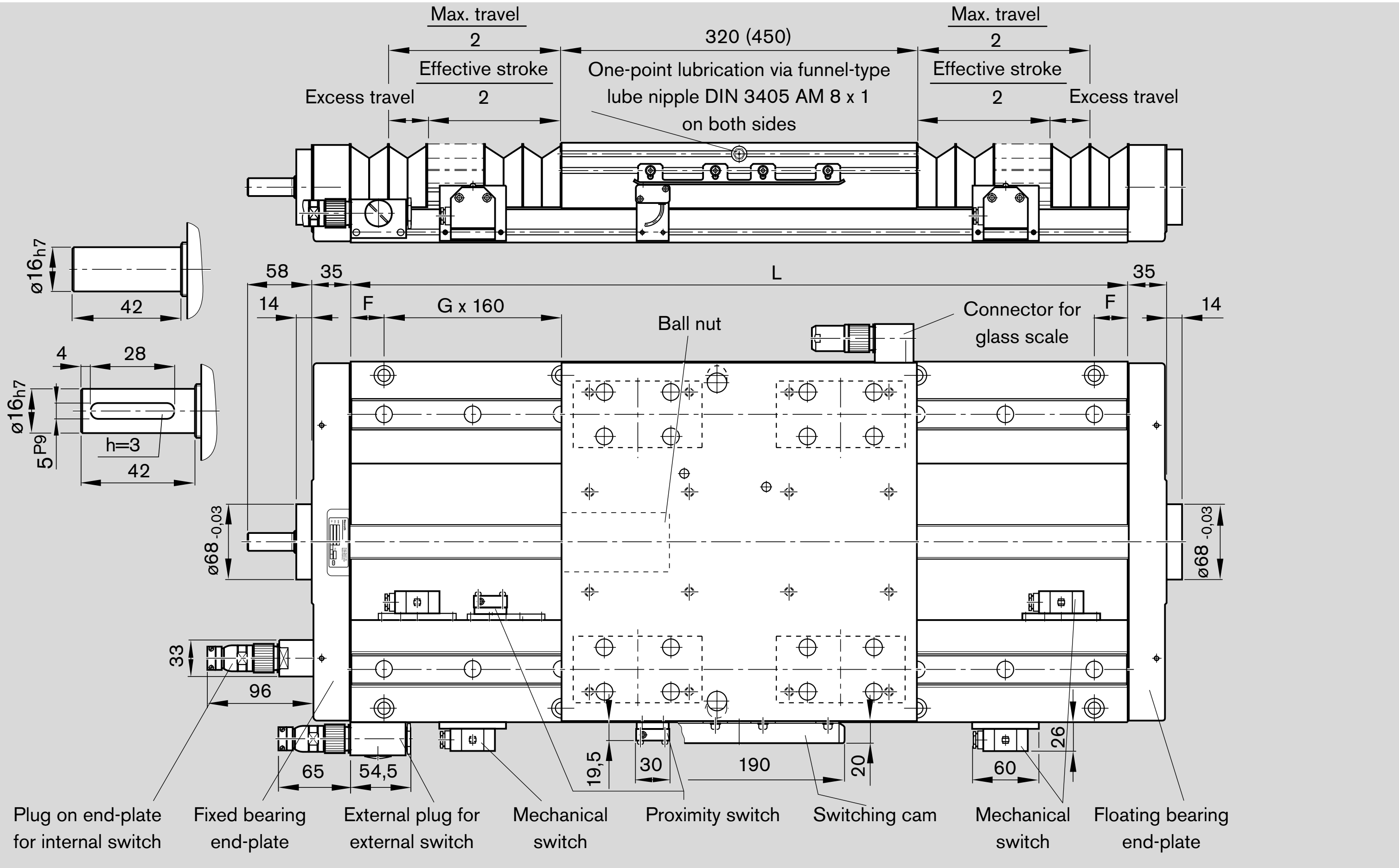


Standard report	Special report
01	02 Friction moment
01	03 Lead deviation
01	04 Travel accuracy
01	05 Positioning accuracy

2) Attachment kit also available without motor (when ordering enter "00" for motor)
3) Without brake
4) With brake

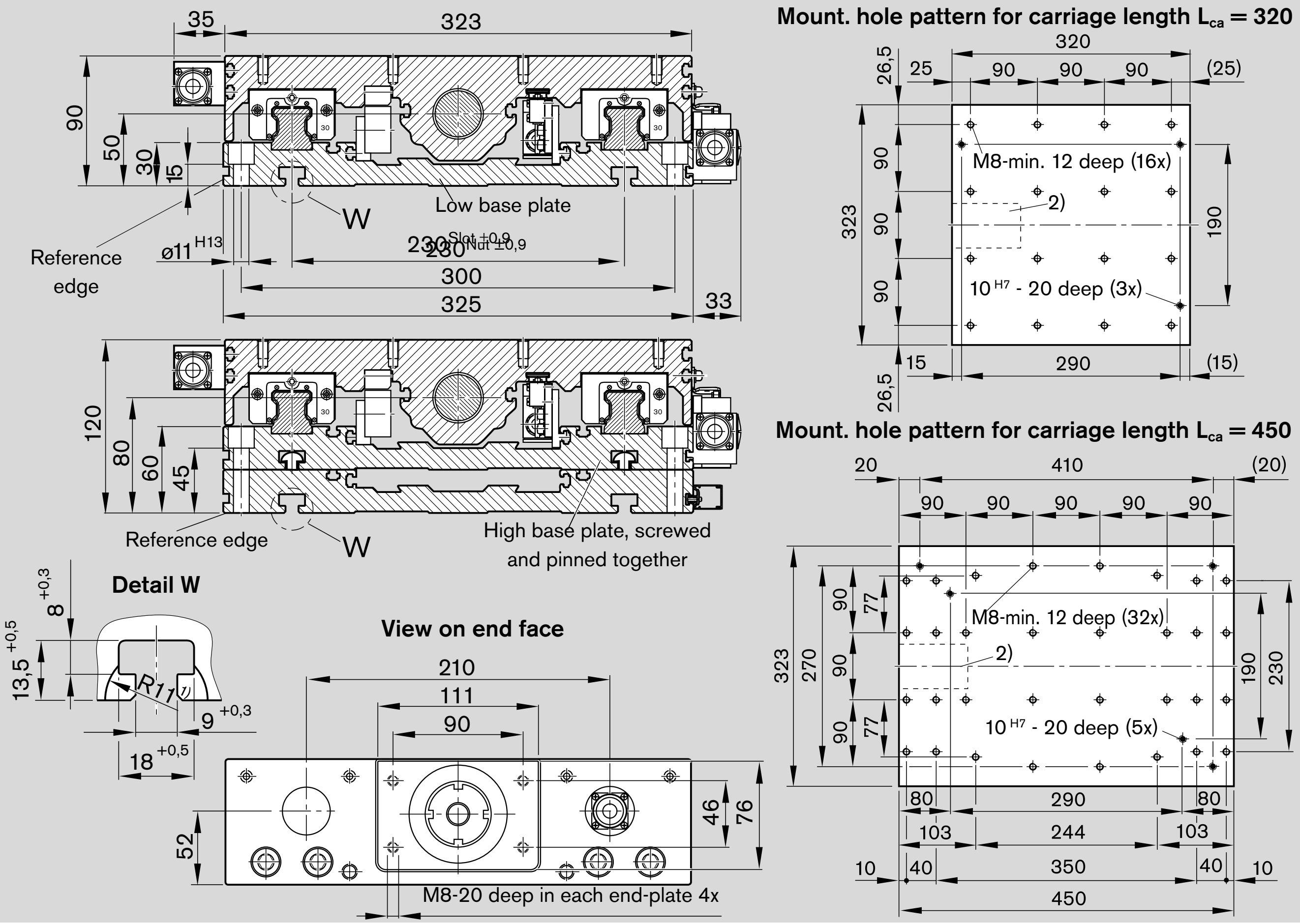
------ Optional

TKK 30-325 Al – Dimensions



Length L (mm)	**Counterbored mounting hole spacing** F - G x 160 - F	**Max. travel** (mm) **for carriage length** **with bellows** 320	450	**without bellows** 320	450
540	30 - 3 x 160 - 30	154	-	210	-
620	70 - 3 x 160 - 70	225	109	290	160
700	30 - 4 x 160 - 30	297	180	370	240
780	70 - 4 x 160 - 70	368	251	450	320
860	30 - 5 x 160 - 30	439	322	530	400
940	70 - 5 x 160 - 70	510	394	610	480
1020	30 - 6 x 160 - 30	582	465	690	560
1100	70 - 6 x 160 - 70	653	536	770	640
1180	30 - 7 x 160 - 30	724	604	850	720
1260	70 - 7 x 160 - 70	795	679	930	800
1340	30 - 8 x 160 - 30	866	750	1010	880
1420	70 - 8 x 160 - 70	938	821	1090	960
1500	30 - 9 x 160 - 30	1009	892	1170	1040
1580	70 - 9 x 160 - 70	1080	963	1250	1120
1660	30 - 10 x 160 - 30	1151	1035	1330	1200

Length L (mm)	**Counterbored mounting hole spacing** F - G x 160 - F	**Max. travel** (mm) **for carriage length** **with bellows** 320	450	**without bellows** 320	450
1740	70 - 10 x 160 - 70	1223	1106	1410	1280
1820	30 - 11 x 160 - 30	1294	1177	1490	1360
1900	70 - 11 x 160 - 70	1365	1248	1570	1440
1980	30 - 12 x 160 - 30	1436	1320	1650	1520
2060	70 - 12 x 160 - 70	1507	1391	1730	1600
2140	30 - 13 x 160 - 30	1579	1462	1810	1680
2220	70 - 13 x 160 - 70	1650	1533	1890	1760
2300	30 - 14 x 160 - 30	1721	1605	1970	1840
2380	70 - 14 x 160 - 70	1792	1676	2050	1920
2460	30 - 15 x 160 - 30	1864	1747	2130	2000
2540	70 - 15 x 160 - 70	1935	1818	2210	2080
2620	30 - 16 x 160 - 30	2006	1889	2290	2160
2700	70 - 16 x 160 - 70	2077	1961	2370	2240
2780	30 - 17 x 160 - 30	2148	2032	2450	2320
2860	70 - 17 x 160 - 70	2220	2103	2530	2400



1) 27 deep (4x)
2) Ball nut

Effective stroke
For safe operation, the excess travel must be longer than the braking distance. The acceleration travel can be taken as a guideline value for the braking distance. In most cases, 2x the ball screw lead (P) will be sufficient.
Example for P = 5 mm:
Excess travel (braking distance) ≈ 10 mm
Recommended standard configuration:
– 2 mechanical switches
– 1 proximity switch

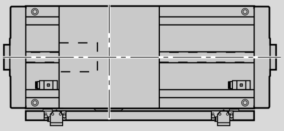
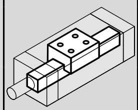
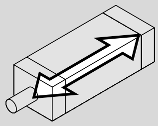
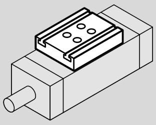
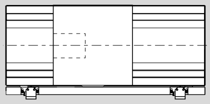
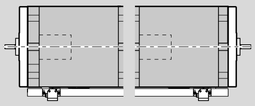
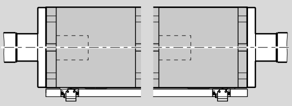
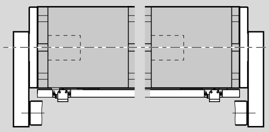
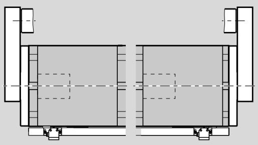
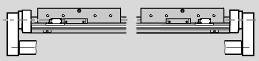
Effective stroke = max. travel – 2 · excess travel

Distance between switch activation points of two switches		
Switch position	**For switch combination**	**Min. spacing** (mm)
external	mechanical – mechanical	60.0
	mechanical – proximity	45.0
	proximity – proximity	12.5
internal	mechanical – mechanical	70.0
	mechanical – proximity	50.0
	proximity – proximity	25.0

Maximum switch activation point
The switch activation point characterizes the position of the center of the carriage after travel. The zero point is at L/2.

Maximum switch activation point = 0.5 · max. travel – excess travel

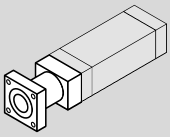
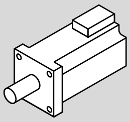
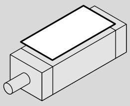
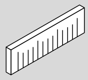
TKK 30-325 St Components and Ordering

Part number, length R1460 400 00, ... mm Reference edge  Switches	Dimension drawing	Guideway 	Drive unit 					Carriage 			
				Ball screw				Carriage length L_{ca}			
		Base plate, low	Ball screw journal keyway	32 x 5	32 x 10	32 x 20	32 x 32	320 mm Preload 2%	320 mm Preload 8%	450 mm Preload 2%	450 mm Preload 8%
Without drive (without end-plates) **OA01** 	OA01	01		00				05	06	07	08
Without motor mount and motor **OF01**  **OF04**	OF01 OF04	01	ø16 (fixed bearing end)	07	13	19	25	05	06	07	08
			ø16 (fixed bearing end) 1)	10	16	22	28				
With motor mount and coupling, with or without motor **MF01**  **MF02**	MF01 MF02	01	ø16 (fixed bearing end)	07	13	19	25	05	06	07	08
With timing belt side drive, with or without motor **RV01**  **RV02** **RV03**  **RV04**	RV01-RV04	01	ø19 (floating bearing end)	09	15	21	27	05	06	07	08
RV05  **RV06**	RV05 RV06										

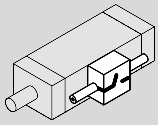
1) With keyway

Please check whether the selected combination is a permissible one (load capacities, moments, maximum speeds, motor data, etc.)!

For more information on ordering, see order example.

i	Motor attachment[2)] Mounting orientation		Motor		Cover PU bellows: without	Cover PU bellows: with	Position measuring system: without	Position measuring system: Glass scale
								
	OA01	00	without	00	00	on request	00	on request
	OF01-OF04	00	without	00	00	01		
1	MF01-MF02	09	MSK 060C	90[3)]				
				91[4)]				
		08	MSK 076C	92[3)]				
				93[4)]				
1	RV01-RV04	77	MSK 060C	90[3)]				
	RV05-RV06	78						
2	RV01-RV04	79		91[4)]				
	RV05-RV06	80						

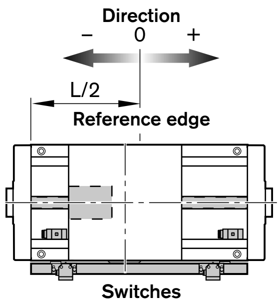
Switches (1st, 2nd, 3rd), switching cam, socket, plug, cable duct



Without switches

without switch / without cable duct	00

With switches



Internal switches

PNP NC 01-I +/–... mm	Socket/plug on end-plate, switching cam 07
PNP NO 03-I +/–... mm	
Mechanical 05-I +/–... mm	

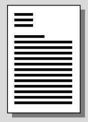
External switches

PNP NC 11-A +/–... mm	Switching cam, external 26	External socket/plug (loose) 17
PNP NO 13-A +/–... mm		
Mechanical 15-A +/–... mm		

Cable duct (loose)

Cable duct	20 - X....

Documentation

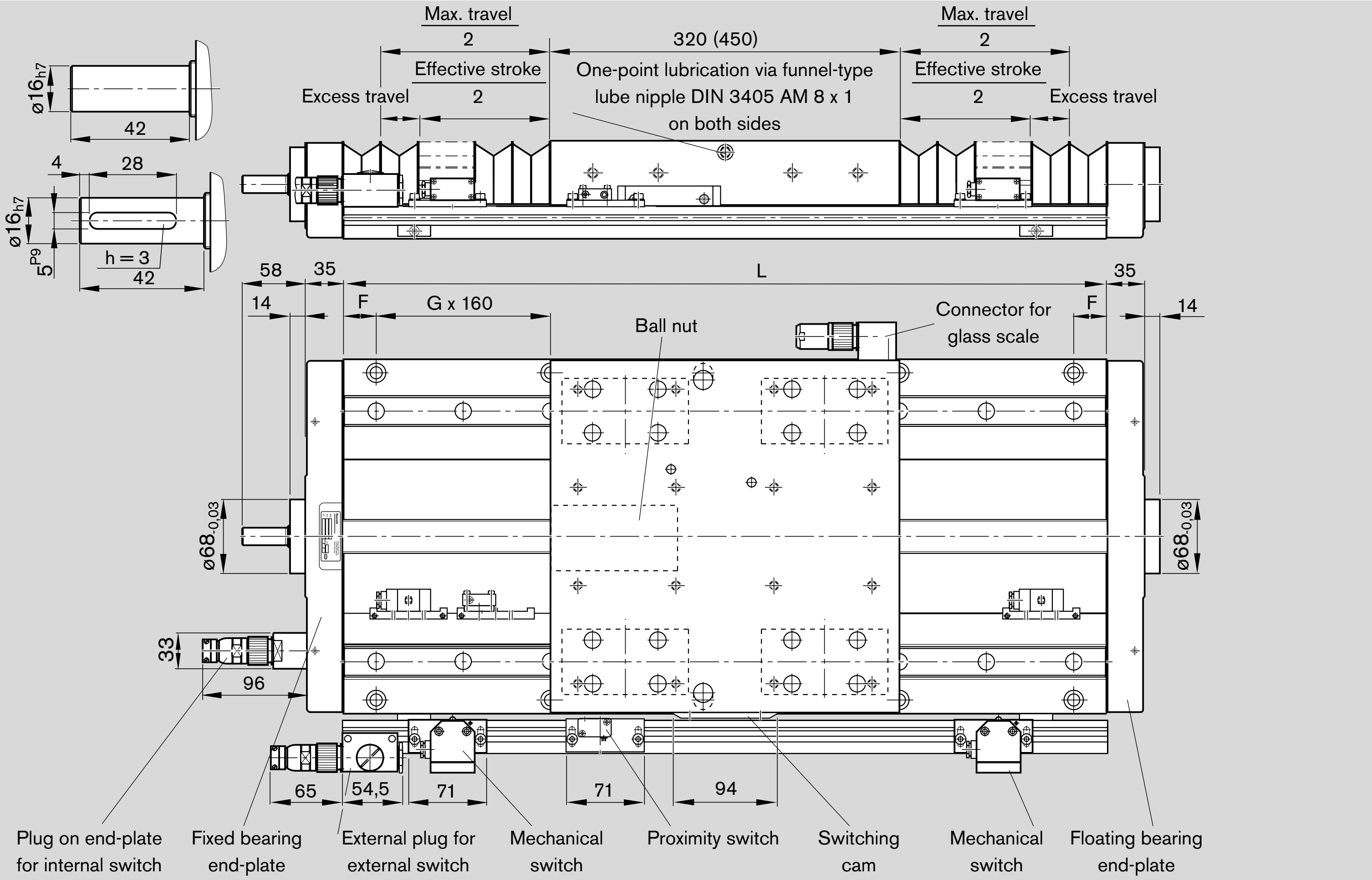


Standard report	Special report
01	02 Friction moment
	03 Lead deviation
	04 Travel accuracy
	05 Positioning accuracy

2) Attachment kit also available without motor (when ordering enter “00” for motor)
3) Without brake
4) With brake

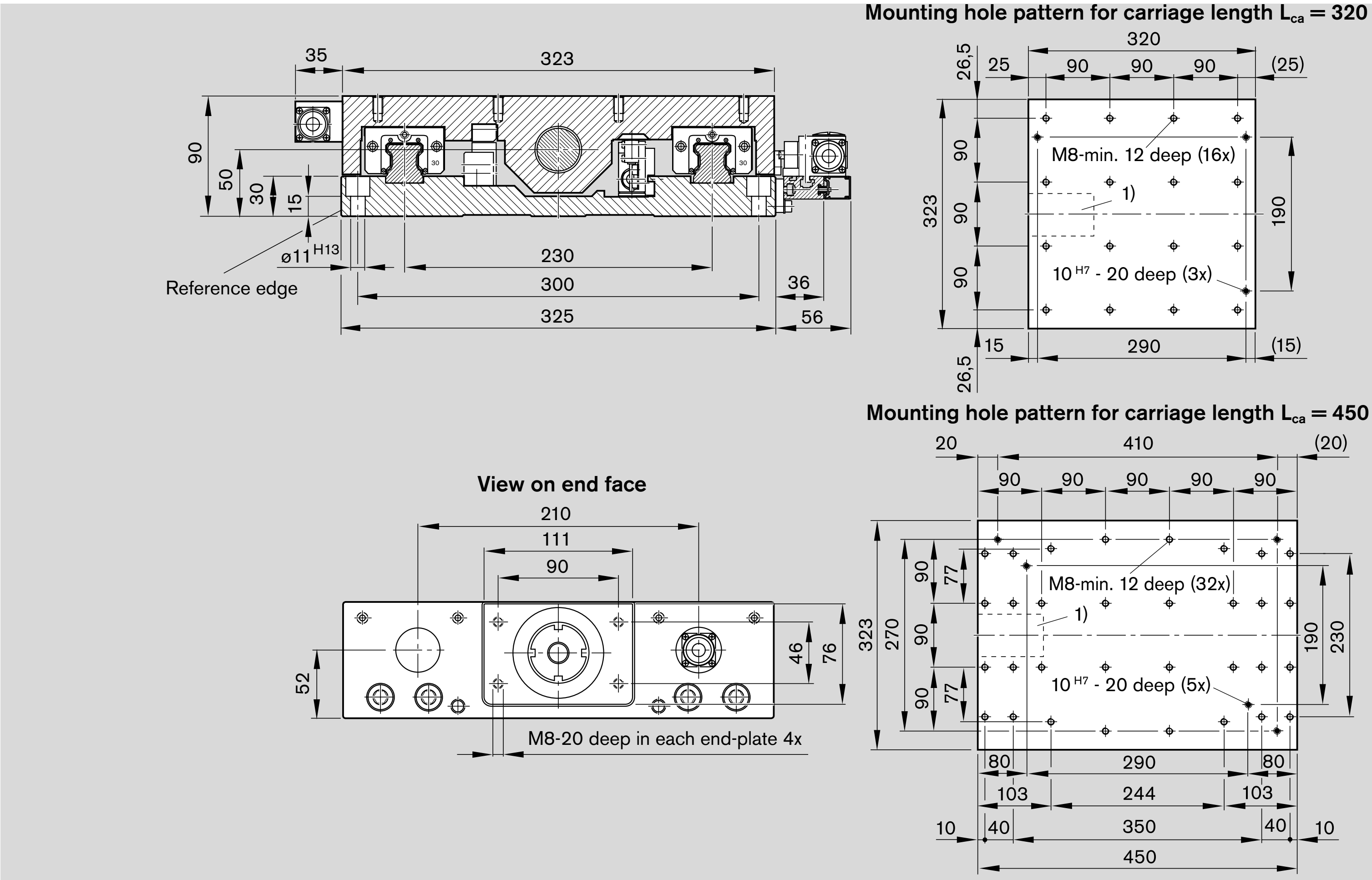
------- Optional

TKK 30-325 St – Dimensions



Length L	Counterbored mounting hole spacing	Max. travel (mm) for carriage length			
		with bellows		without bellows	
(mm)	F - G x 160 - F	320	450	320	450
540	30 - 3 x 160 - 30	154	-	210	-
620	70 - 3 x 160 - 70	225	109	290	160
700	30 - 4 x 160 - 30	297	180	370	240
780	70 - 4 x 160 - 70	368	251	450	320
860	30 - 5 x 160 - 30	439	322	530	400
940	70 - 5 x 160 - 70	510	394	610	480
1020	30 - 6 x 160 - 30	582	465	690	560
1100	70 - 6 x 160 - 70	653	536	770	640
1180	30 - 7 x 160 - 30	724	604	850	720
1260	70 - 7 x 160 - 70	795	679	930	800
1340	30 - 8 x 160 - 30	866	750	1010	880
1420	70 - 8 x 160 - 70	938	821	1090	960
1500	30 - 9 x 160 - 30	1009	892	1170	1040
1580	70 - 9 x 160 - 70	1080	963	1250	1120
1660	30 - 10 x 160 - 30	1151	1035	1330	1200

Length L	Counterbored mounting hole spacing	Max. travel (mm) for carriage length			
		with bellows		without bellows	
(mm)	F - G x 160 - F	320	450	320	450
1740	70 - 10 x 160 - 70	1223	1106	1410	1280
1820	30 - 11 x 160 - 30	1294	1177	1490	1360
1900	70 - 11 x 160 - 70	1365	1248	1570	1440
1980	30 - 12 x 160 - 30	1436	1320	1650	1520
2060	70 - 12 x 160 - 70	1507	1391	1730	1600
2140	30 - 13 x 160 - 30	1579	1462	1810	1680
2220	70 - 13 x 160 - 70	1650	1533	1890	1760
2300	30 - 14 x 160 - 30	1721	1605	1970	1840
2380	70 - 14 x 160 - 70	1792	1676	2050	1920



1) Ball nut

Effective stroke
For safe operation, the excess travel must be longer than the braking distance. The acceleration travel can be taken as a guideline value for the braking distance. In most cases, 2x the ball screw lead (P) will be sufficient.
Example for P = 5 mm:
Excess travel (braking distance) ≈ 10 mm
Recommended standard configuration:
- 2 mechanical switches
- 1 proximity switch

Effective stroke = max. travel – 2 · excess travel

Distance between switch activation points of two switches

Switch position	For switch combination	Min. spacing (mm)
external	mechanical – mechanical	62.0
	mechanical – proximity	49.0
	proximity – proximity	35.0
internal	mechanical – mechanical	70.0
	mechanical – proximity	50.0
	proximity – proximity	25.0

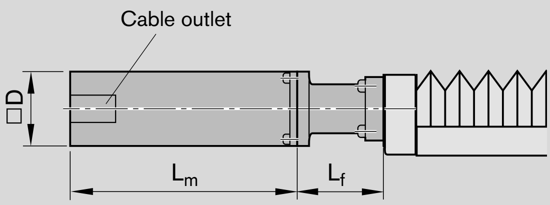
Maximum switch activation point
The switch activation point characterizes the position of the center of the carriage after travel. The zero point is at L/2.

Maximum switch activation point = 0.5 · max. travel – excess travel

TKK 30-325 – Dimension Drawings, Motor Attachment

Motor attachment with motor mount and coupling

MF01, MF02

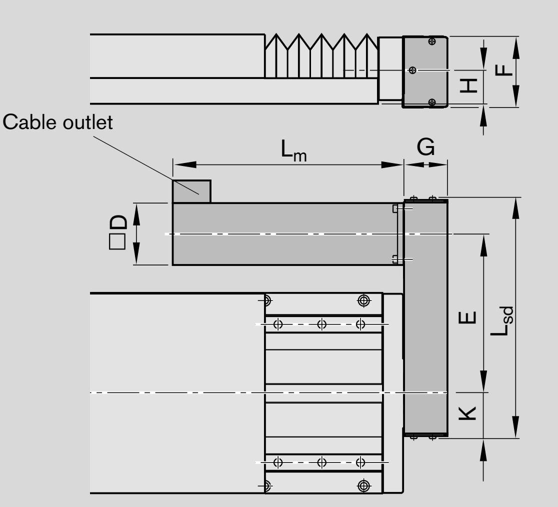


Motor	Dimensions (mm)		
	L_m	D	L_f
MSK 060C	226.0[1] 259.0[2]	115	125
MSK 076C	292.5[1)2)]	140	133

1) Without brake
2) With brake

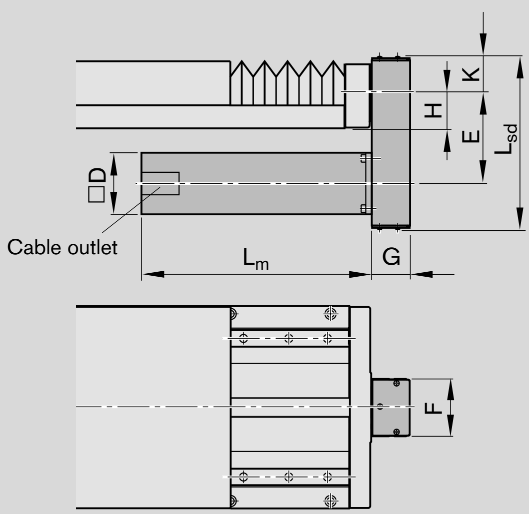
Motor attachment via timing belt side drive

RV01 - RV04



Motor	Dimensions (mm)								
	L_m	D	G	H	L_{sd}	E i = 1	E i = 2	K	F
MSK 060C	226[1)] 259[2)]	82	51	50	403	267.5	265	56	116

RV05, RV06



Motor	Dimensions (mm)								
	L_m	D	G	H	L_{sd}	E i = 1	E i = 2	K	F
MSK 060C	226[1)] 259[2)]	82	51	50	300	165	162	56	116

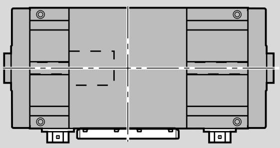
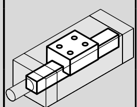
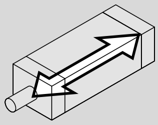
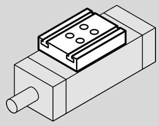
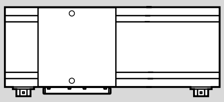
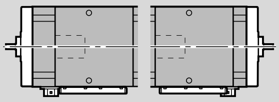
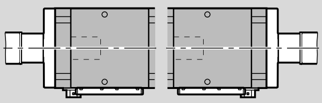
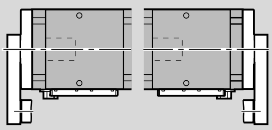
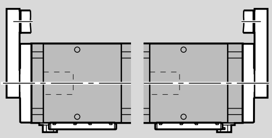
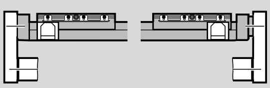
1) Without brake
2) With brake

Note for steel version
In type RV01 and RV02 with externally mounted switches:
– No switches may be mounted in the motor area!

For motor dimensions, see “Motors.”

Note for multi-axis units
(e.g. X-Y tables)
For multi-axis units with motor attachment via timing belt side drive, the motor may project into the working area of adjacent axes. Check for any interference contours.

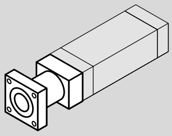
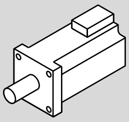
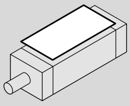
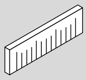
TKK 35-455 Al Components and Ordering

Part number, length R1460 505 00, ... mm Reference edge  Switches	Dimension drawing	Guideway  Base plate, low	Drive unit  Ball screw journal keyway	Ball screw 40 x 5	40 x 10	40 x 20	40 x 40	Carriage  Carriage length L_{ca} 450 mm Preload 2%	8%
Without drive (without end-plates) **OA01** 	OA01	01		00				05	06
Without motor mount and motor **OF01**  **OF04**	OF01 OF04	01	ø25 (fixed bearing end)	25	31	37	43	05	06
			ø25 (fixed bearing end) 1)	28	34	40	46		
With motor mount and coupling, with or without motor **MF01**  **MF02**	MF01 MF02	01	ø25 (fixed bearing end)	25	31	37	43	05	06
With timing belt side drive, with or without motor **RV01**  **RV02** **RV03**  **RV04**	RV01-RV04	01	ø24 (floating bearing end)	27	33	39	45	05	06
RV05  **RV06**	RV05 RV06								

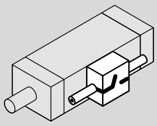
1) With keyway

Please check whether the selected combination is a permissible one (load capacities, moments, maximum speeds, motor data, etc.)!

For more information on ordering, see order example.

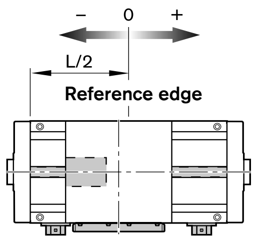
i	Motor attachment Mounting orientation 		Motor 		Cover PU bellows  without	Cover PU bellows with	Position measuring system  without	Position measuring system Glass scale
	OA01	00	without	00	00	on request	00	on request
	OF01-OF04	00	without	00	00	01		
1	MF01-MF02	08	MSK 076C	92[2)]				
				93[3)]				
1	RV01-RV04	53	MSK 076C	92[2)]				
1	RV05-RV06	54		92[2)]				
2	RV01-RV04	55		93[3)]				
2	RV05-RV06	56		93[3)]				

Switches (1st, 2nd, 3rd), switching cam, socket, plug, cable duct



Without switches	
without switch	00
without cable duct	

With switches

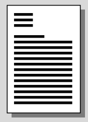


Internal switches	
PNP NC	**Socket/plug on end-plate, switching cam**
01-I +/–... mm	
PNP NO	
03-I +/–... mm	
Mechanical	07
05-I +/–... mm	

External switches		
PNP NC	**Switching cam, external**	**External socket/plug (loose)**
11-A +/–... mm		
PNP NO		
13-A +/–... mm		
Mechanical	16	17
15-A +/–... mm		

Cable duct (loose)	
Cable duct	20 - X....

Documentation

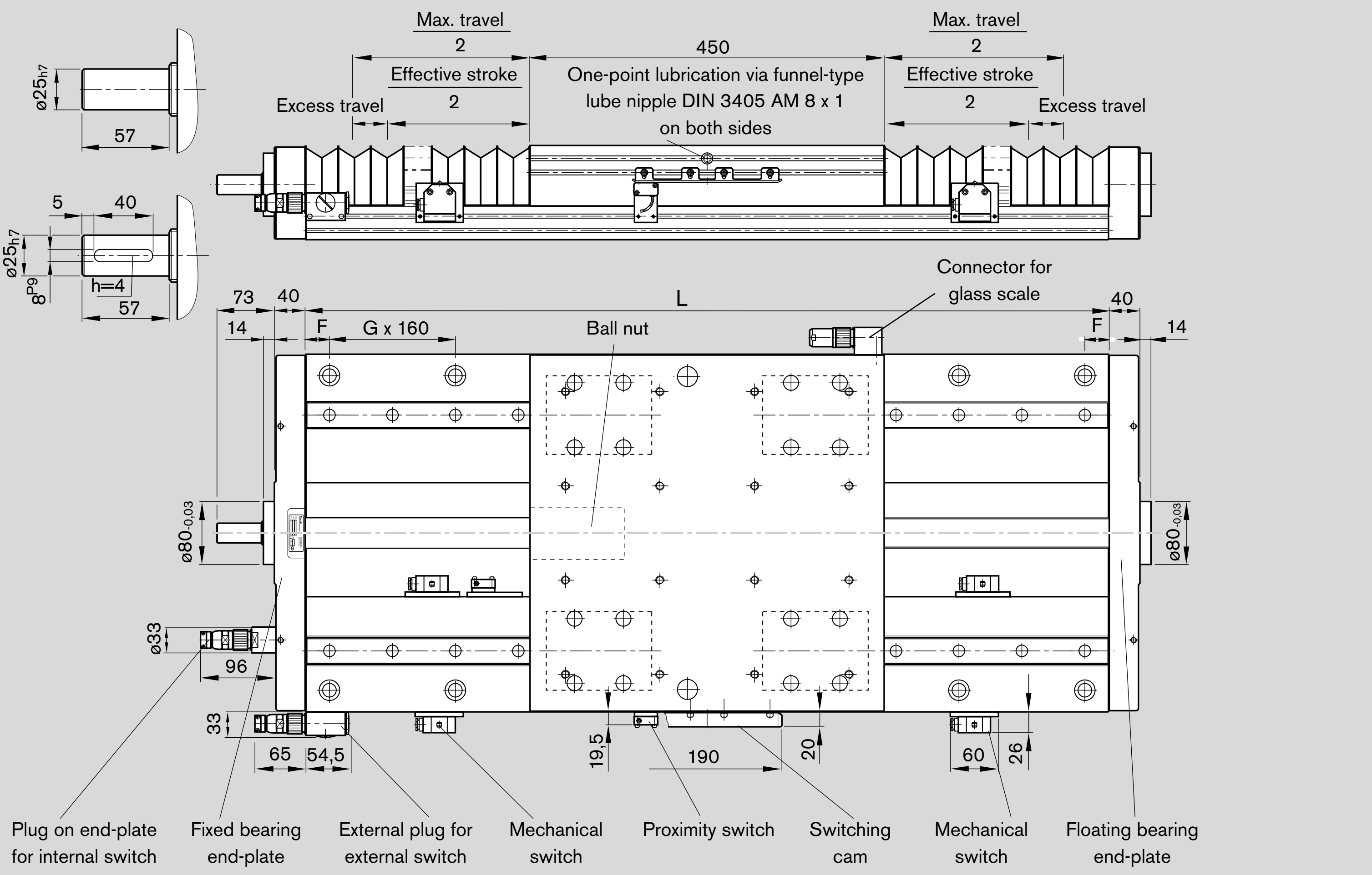


Standard report	Special report
01	02 Friction moment
	03 Lead deviation
	04 Travel accuracy
	05 Positioning accuracy

2) Without brake
3) With brake

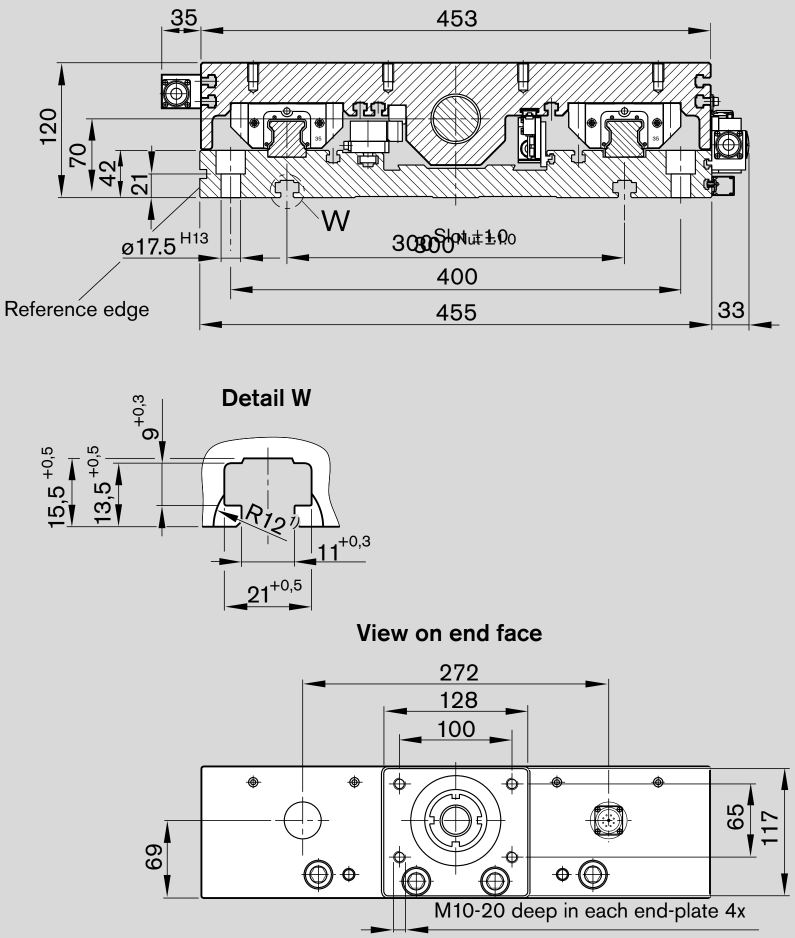
------ Optional

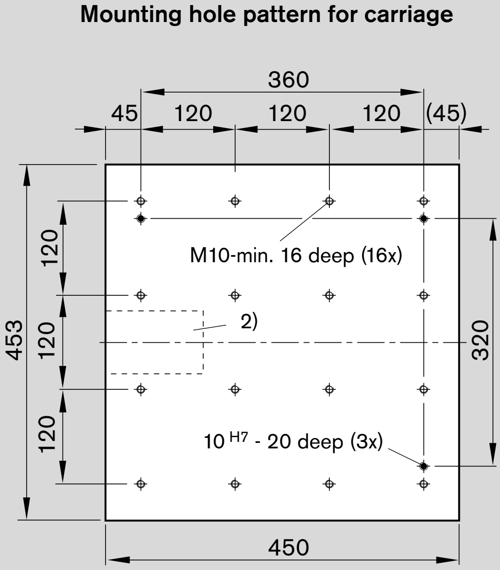
TKK 35-455 Al – Dimensions



Length L (mm)	Counterbored mounting hole spacing F - G x 160 - F	Max. travel (mm) with bellows	without bellows
620	70 - 3 x 160 - 70	110	160
700	30 - 4 x 160 - 30	183	240
780	70 - 4 x 160 - 70	256	320
860	30 - 5 x 160 - 30	328	400
940	70 - 5 x 160 - 70	401	480
1020	30 - 6 x 160 - 30	474	560
1100	70 - 6 x 160 - 70	546	640
1180	30 - 7 x 160 - 30	619	720
1260	70 - 7 x 160 - 70	692	800
1340	30 - 8 x 160 - 30	746	880
1420	70 - 8 x 160 - 70	837	960
1500	30 - 9 x 160 - 30	910	1040
1580	70 - 9 x 160 - 70	982	1120
1660	30 - 10 x 160 - 30	1055	1200
1740	70 - 10 x 160 - 70	1127	1200

Length L (mm)	Counterbored mounting hole spacing F - G x 160 - F	Max. travel (mm) with bellows	without bellows
1820	30 - 11 x 160 - 30	1200	1360
1900	70 - 11 x 160 - 70	1273	1440
1980	30 - 12 x 160 - 30	1345	1520
2060	70 - 12 x 160 - 70	1418	1600
2140	30 - 13 x 160 - 30	1491	1680
2220	70 - 13 x 160 - 70	1563	1760
2300	30 - 14 x 160 - 30	1636	1840
2380	70 - 14 x 160 - 70	1709	1920
2460	30 - 15 x 160 - 30	1781	2000
2540	70 - 15 x 160 - 70	1854	2080
2620	30 - 16 x 160 - 30	1927	2160
2700	70 - 16 x 160 - 70	1999	2240
2780	30 - 17 x 160 - 30	2072	2320
2860	70 - 17 x 160 - 70	2144	2400





1) 27 deep (4x)
2) Ball nut

Effective stroke
For safe operation, the excess travel must be longer than the braking distance. The acceleration travel can be taken as a guideline value for the braking distance. In most cases, 2x the ball screw lead (P) will be sufficient.
Example for P = 5 mm:
Excess travel (braking distance) ≈ 10 mm
Recommended standard configuration:
– 2 mechanical switches
– 1 proximity switch

Effective stroke = max. travel – 2 · excess travel

Distance between switch activation points of two switches

Switch position	**For switch combination**	**Min. spacing** (mm)
external	mechanical – mechanical	60.0
	mechanical – proximity	45.0
	proximity – proximity	12.5
internal	mechanical – mechanical	70.0
	mechanical – proximity	50.0
	proximity – proximity	25.0

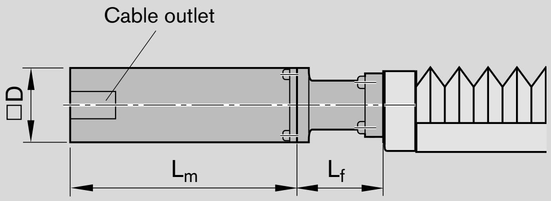
Maximum switch activation point
The switch activation point characterizes the position of the center of the carriage after travel. The zero point is at L/2.

Maximum switch activation point = 0.5 · max. travel – excess travel

TKK 35-455 Al – Dimension Drawings, Motor Attachment

Motor attachment with motor mount and coupling

MF01, MF02

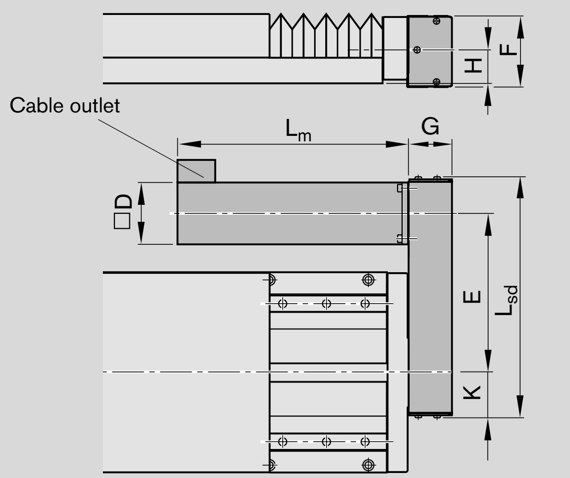


Motor	Dimensions (mm)		
	L_m	D	L_f
MSK 076C	292.5[1)2)]	140	140

1) Without brake
2) With brake

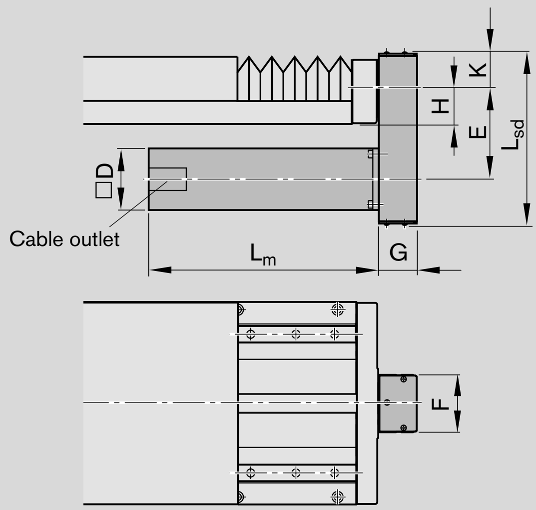
Motor attachment via timing belt side drive

RV01 - RV04



Motor	Dimensions (mm)								
	L_m	D	G	H	L_{sd}	E		K	F
						i = 1	i = 2		
MSK 076C	292.5[1)2)]	140	90	70	519	350	348.5	77	140

RV05, RV06



Motor	Dimensions (mm)							
	L_m	D	G	H	L_{sd}	E		K
						i = 1	i = 2	
MSK 076C	292.5[1)2)]	140	90	70	409	239	238	77

1) Without brake
2) With brake

For motor dimensions, see "Motors."

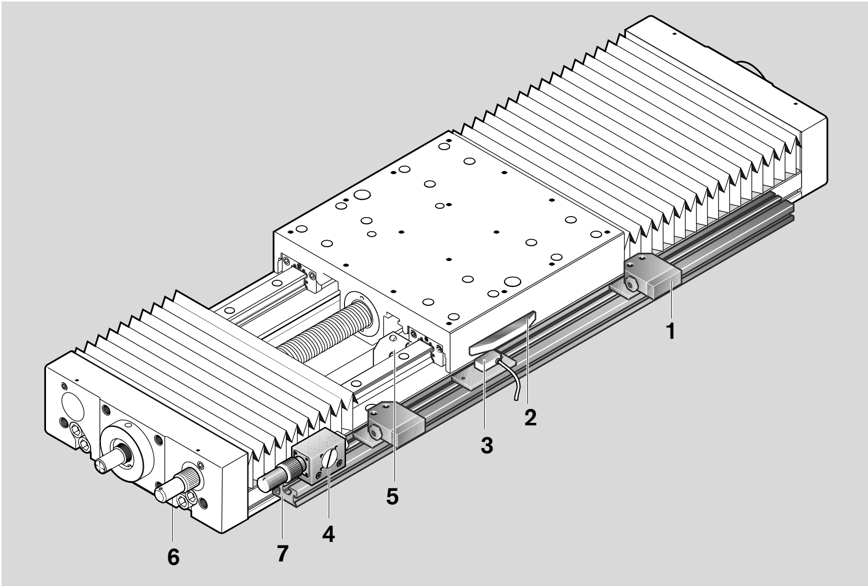
Note for multi-axis units
(e.g. X-Y tables)
For multi-axis units with motor attachment via timing belt side drive, the motor may project into the working area of adjacent axes. Check for any interference contours.

Switch Mounting Arrangements

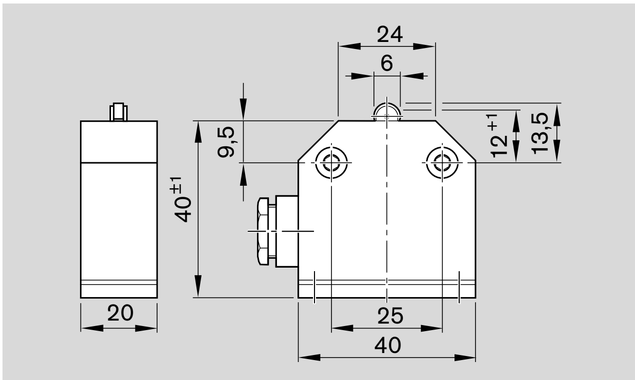
Overview of switching system

Accessories:

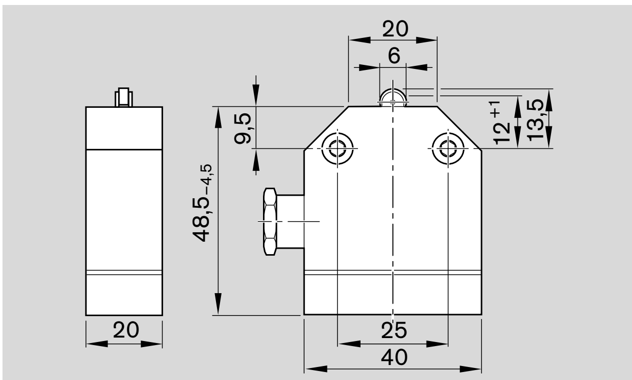
1 Mechanical switch, external
2 Switching cam
3 Proximity switch, external
4 Socket-plug for external switches
5 Mechanical and proximity switches, internal
6 Socket-plug for internal switches
7 Profiled support



Mechanical switch, internal	
Reproducibility	= ± 0.05 mm
Permissible ambient temperature	= –5 °C to +80 °C
Enclosure protection class	= DIN 40050 IP 67
Contact time	= < 2 ms
Insulation	= group C to VDE 0110
Rated voltage	= 250 V AC
Continuous current	= 5 A
Switching capacity at 220 V, 40-60 Hz	= cosφ = 0.8 at 2 A
Contact resistance when new	= < 240 mΩ
Connection	= soldered connection
Contact system	= single-pole changeover
Switch system	= snap-action



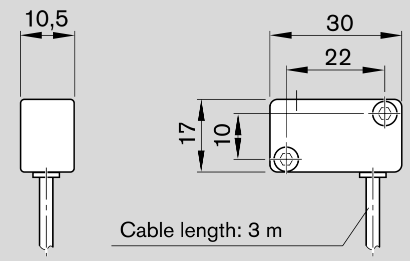
Mechanical switch, external	
Reproducibility	= ± 0.05 mm
Permissible ambient temperature	= –5 °C to +80 °C
Enclosure protection class	= DIN 40050 IP 67
Contact time	= < 2 ms
Insulation	= group C to VDE 0110
Rated voltage	= 250 V AC
Continuous current	= 5 A
Switching capacity at 220 V, 40-60 Hz	= cosφ = 0.8 at 2 A
Contact resistance when new	= < 240 mΩ
Connection	= screw connection
Contact system	= single-pole changeover
Switch system	= snap-action



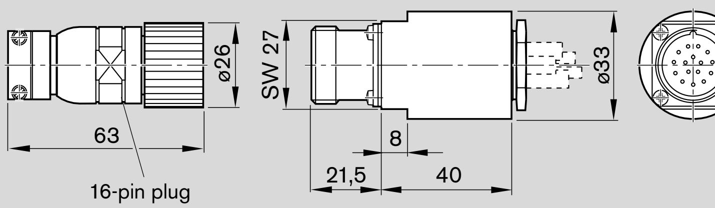
Proximity switch, internal or external

Miniature circuit-breakers with potted cable (3 x 0.14 mm² Unitronic)

Housing form	= NO
Minisensor	= Form A DIN 41635
Voltage	= 10...30 V DC
Residual ripple	= ≤ 10 %
Load	= 200 mA
No-load current	= ≤ 20 mA
Switching frequency	= max. 1500 Hz
Temperature-related shift in make point	= ≤ 4 µm/°C
Output signal steepness	= ≥ 1 V/µs
Repeatability of make point per EN 50008	= ≤ 0.1 mm

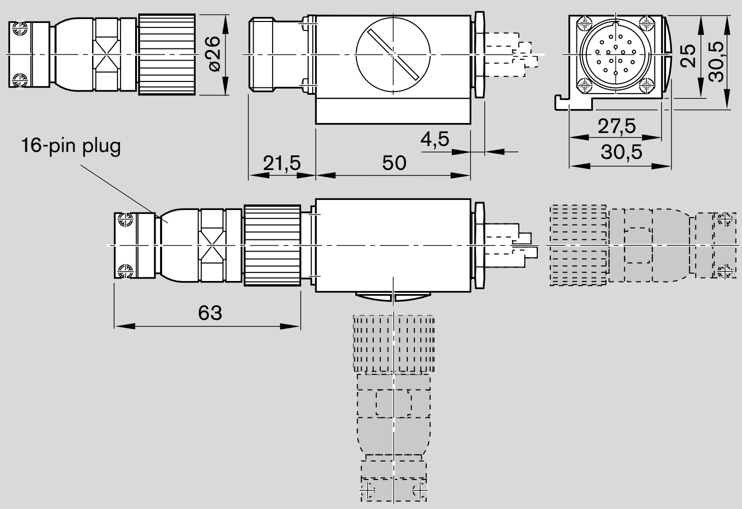


End-plate-mounted socket and plug for internal switches
- The socket and plug each have 16 pins.
- The socket and switch are pre-wired.
- A plug is provided.

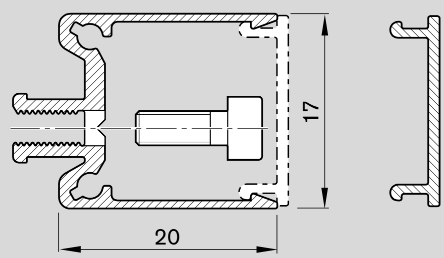


Externally mounted socket and plug for external switches
- The socket and plug each have 16 pins.
- The socket and switch are not pre-wired. The switch activation points can thus be optimized during start-up.
- A plug is provided.

The plug can be mounted in three directions (see diagram).



Cable duct
- The cable duct will accommodate up to two cables for mechanical switches and three cables for proximity switches.
- The duct is fixed by clipping it into the T-slot on the table and is secured by tightening the fixing screws.
- The fixing screws and cable grommets are supplied with the duct.



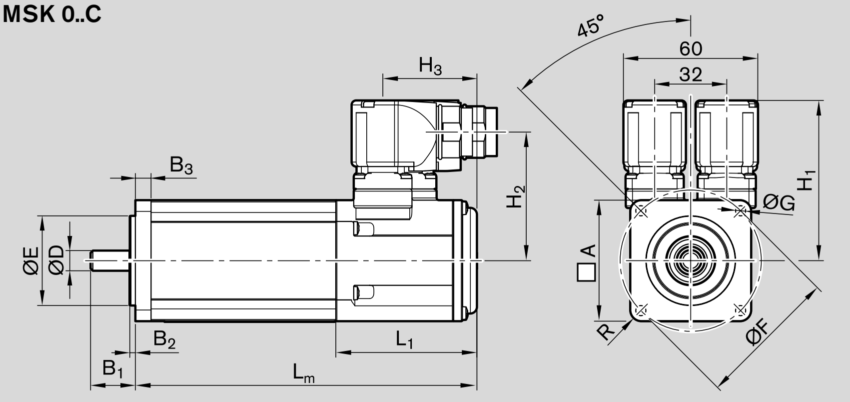
Motors

AC servo motors

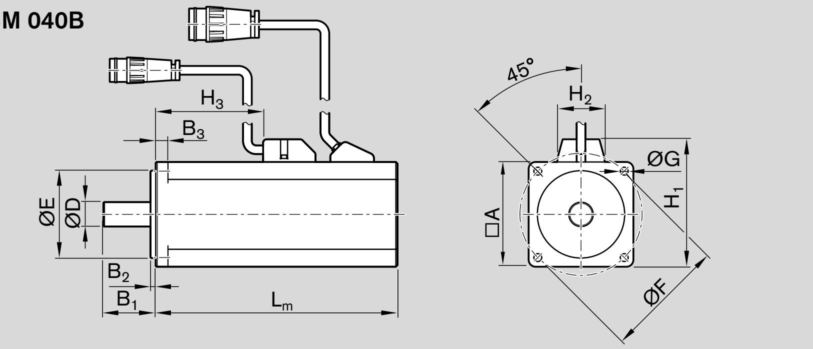
Notes
All MSK motors have an absolute multi-turn encoder (Hyperface, 128 increments with 4096 revolutions).

The motors can be supplied complete with controller and control unit.
For more detailed information on motors and control systems, please refer to the catalogs “ECODRIVE Cs” and “IndraDrive for Linear Motion Systems.”

MSK 0..C



MSM 040B



Motor type	Dimensions (mm)																
	A	B_1	B_2	B_3	ØD		ØE		ØF	ØG	H_1	H_2	H_3	L_m		L_1	R
					k6	h6	j6	h7						without brake	with brake		
MSK 040C	82	30	2.5	8.0	14		50		95	6.6	83.5	69.0	31.0	185.5	215.5	42.5	R8
MSK 050C	98	40	3.0	9.0	19		95		115	9.0	85.5	71.0	43.5	203.0	233.0	55.5	R8
MSK 060C	116	50	3.0	9.5	24		95		130	9.0	98.0	84.0	37.0	226.0	259.0	48.0	R9
MSK 076C	140	50	4.0	10.0	24		110		165	11.0	110.0	95.6	57.5	292.5	292.5	79.0	R12
MSM 040B	80	35	3.0	6.0		19		70	90	6.0	93.0	27.0	76.0	157.5	191.5	–	–

Motor data, AC servo motors

Motor type	Symbol	Unit	MSK 040C	MSK 050C	MSK 060C	MSK 076C	MSM 040B
Maximum usable speed	n_{max}	(min^{-1})	6000	6000	6000	5000	↯
Rated torque	M_N	(Nm)	2.7	5.0	8.0	12.0	2.4
Maximum torque	M_{max}	(Nm)	8.1	15.0	24.0	43.5	↯
Mass moment of inertia	$J_m + J_{br}$	(10^{-6} kgm^2)	140 + 23	330 + 107	800 + 55	4300 + 360	67.0 + 8.0
Brake holding torque	M_{br}	(Nm)	4.0	5.0	10.0	11.0	–
Mass of brake	$m_m + m_{br}$	(kg)	0.32	0.70	0.45	13.8 + 1.1	3.1 + 0.7

↯ Refer to the “ECODRIVE Cs” and “IndraDrive for Linear Motion Systems” catalogs.

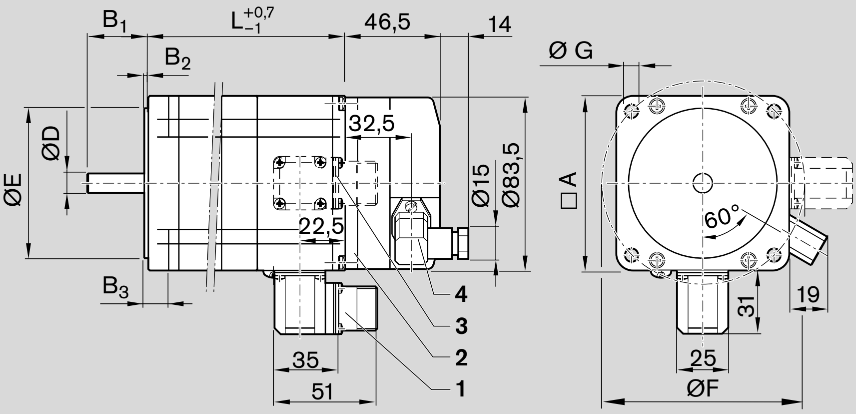
3-phase stepping motors

Notes

All VRDM motors are equipped with an encoder for rotation monitoring.

The motors can be supplied complete with controller and control unit.
For more information on motors, controllers and control systems, please refer to the catalogs "ECODRIVE Cs" and "IndraDrive for Linear Motion Systems."

VRDM 397
VRDM 3910
VRDM 3913



Key to illustration

1 Motor connector
2 Brake
3 Encoder connector
4 Brake connector

Motor	Dimensions (mm)									
	A	B_1	B_2	B_3	ØD	ØE	ØF	ØG	L without brake	L with brake
VRDM 397	85.0	30	2.0	10	12_{h6}	60.0_{h8}	99.0	6.5	110.0	156.5
VRDM 3910	85.0	30	2.0	10	12_{h6}	60.0_{h8}	99.0	6.5	140.0	186.5
VRDM 3913	85.0	30	2.0	10	12_{h6}	60.0_{h8}	99.0	6.5	170.0	216.5

Motor data

Motor	Symbol	Unit	VRDM 397	VRDM 3910	VRDM 3913
Maximum permissible torque	M_{max}	(Nm)	2.00	4.00	6.0
Motor mass moment of inertia	J_m	(10^{-6} kgm²)	110	220	330
Motor holding torque	M_m	(Nm)	2.26	4.52	6.78
Mass without brake	m_m	(kg)	2.5	3.1	4.2
Step count	z	(–)	200 / 400 / 500 / 1000 / 2 000 / 4 000 / 5 000 / 10 000		
Stepping angle per step	α	(°)	1.8 / 0.9 / 0.72 / 0.36 / 0.18 / 0.09 / 0.072 / 0.036		
Encoder resolution			1000 increments/revolution		
Holding brake					
Brake holding torque	M_{br}	(Nm)	6	6	6
Brake mass moment of inertia	J_{br}	(10^{-6} kgm²)	20	20	20
Mass of brake	m_{br}	(kg)	1.5	1.5	1.5

Accessories

Documentation

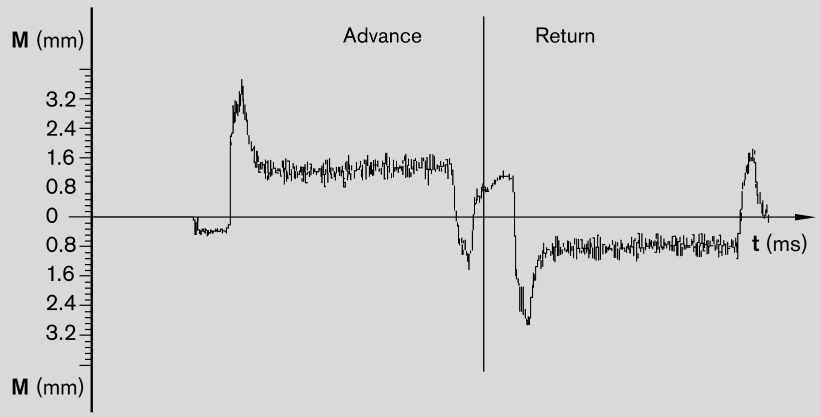
Standard report
Option 01

The standard report serves to confirm that the checks listed in the report have been carried out and that the measured values lie within the permissible tolerances.

Checks listed in the standard report:
- functional checks of mechanical components
- functional checks of electrical components
- design is in accordance with order confirmation

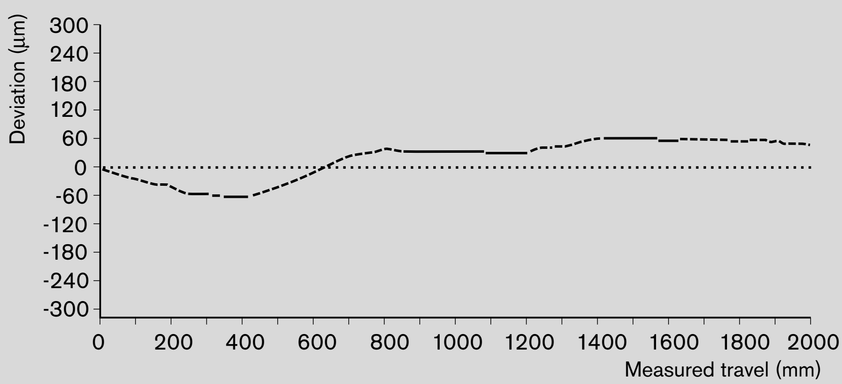
Frictional moment of complete system
Option 02
The moment of friction is measured over the entire travel range.

Example



Lead deviation of ball screw
Option 03
A measurement report in table form is provided in addition to the graph (see illustration).

Example

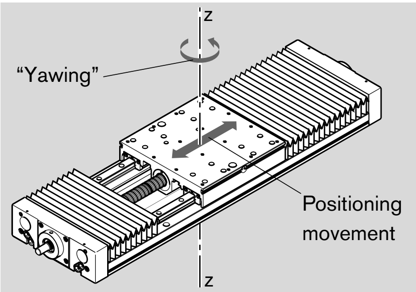


Travel accuracy
Option 04

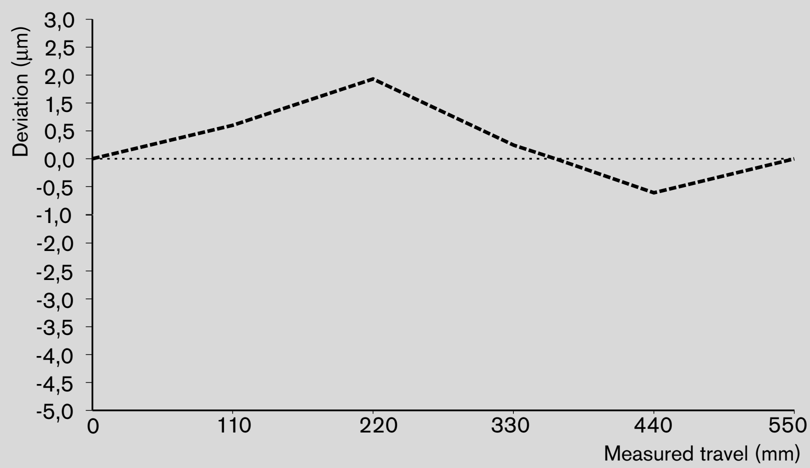
Several measuring points are passed during the total travel.
The following deviations are determined:

Note: The measurements are taken with the unit screwed down and assuming an ideally flat mounting base surface.

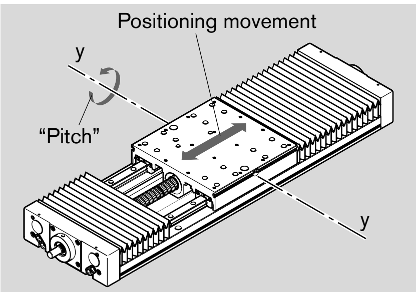
Yawing
Yawing is angular deviation about the Z-axis. This angular deviation is converted to a linear deviation in µm on the basis of a standard length and is plotted on the graph.
The base length is given in the graph.



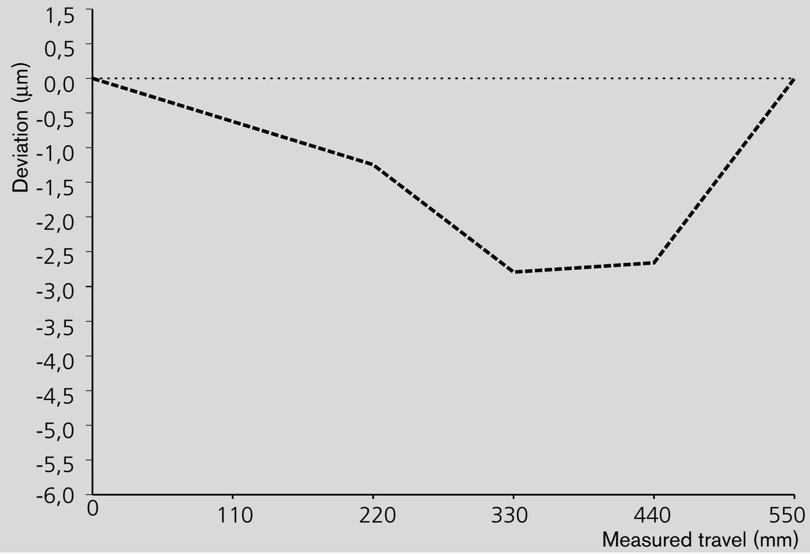
Example (Base length 100 mm)



Pitching
Pitching means angular deviation about the Y-axis. This angular deviation is converted to a linear deviation in µm on the basis of a standard length and is plotted on the graph.
The base length is given in the graph.



Example (Base length 100 mm)



In addition to graphical representation (see illustrations), a measurement report is supplied in table form.

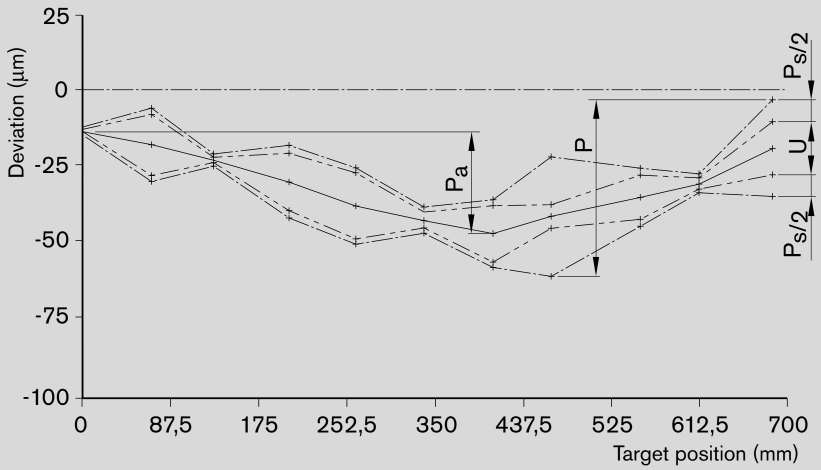
Accessories

Documentation

Positioning accuracy per VDI/DGQ 3441 Option 05

Measurement points are selected at irregular intervals along the travel range. This enables even periodical deviations to be detected during positioning. Each measurement point is approached several times from both sides. This gives the following parameters. This will give the following parameters. Note: The measurements are taken with the unit screwed down and assuming an ideally flat mounting base surface.

Example



Positioning accuracy P

The positioning accuracy corresponds to the total deviation. It encompasses all the systematic and random deviations during positioning.

The positioning accuracy takes the following characteristic values into consideration:
- position deviation
- reversal range
- position variation range

Position deviation P_a

The position deviation corresponds to the maximum difference arising in the mean values of all the measurement points. It describes systematic deviations.

Reversal range U

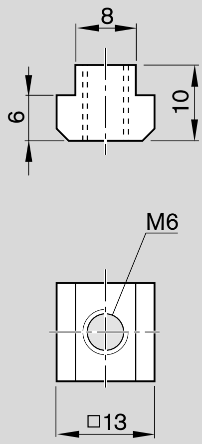
The reversal range corresponds to the difference in mean values of the two approach directions. The reversal range is determined at every measurement point. It describes systematic deviations.

Position variation range P_s

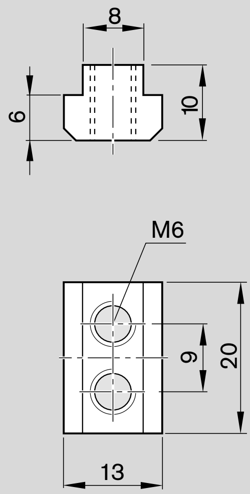
The position variation range describes the effects of random deviations. It is determined at every measurement point.

Mounting accessories

TKK 15-155 Al

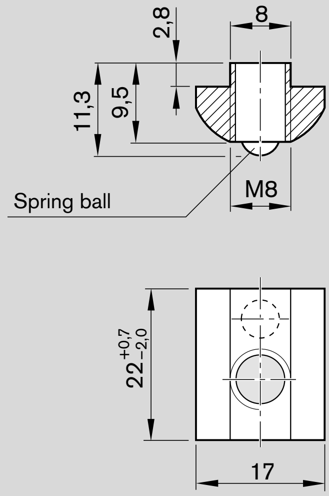


Part number	R3447 001 01
Sliding block	



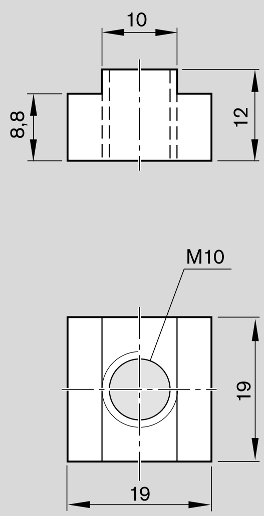
Part number	R0391 750 03
Sliding block	

TKK 20-225 Al
TKK 30-325 Al

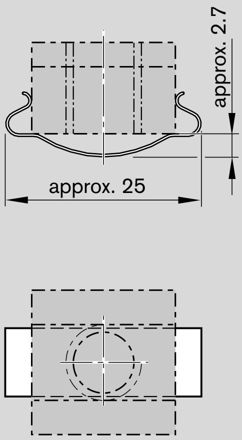


Part number	R3447 010 02
Sliding block	

TKK 35-455 Al



Part number	R3447 006 01
Sliding block	

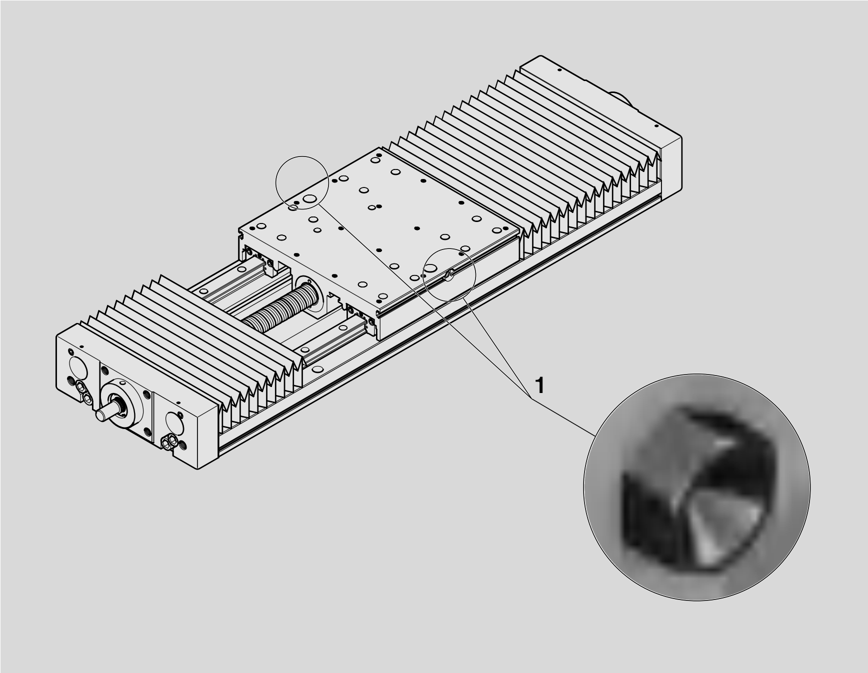


Part number	R3454 030 49
Fixing spring for sliding block	R3447 006 01

Lubrication

Lube nipples in carriage

Basic lubrication is carried out by the manufacturer.
Ball Rail Tables are designed for grease lubrication (with a manual grease gun).
The only maintenance required is relubrication via the lube nipples on the sides of the carriage.
Each carriage has 2 funnel-type lube nipples (**1**) per DIN 3405 AM8x1.
Lubrication via only one of the two lube nipples is sufficient.
Never use greases with solid lubricant components (e.g. graphite or MoS_2).



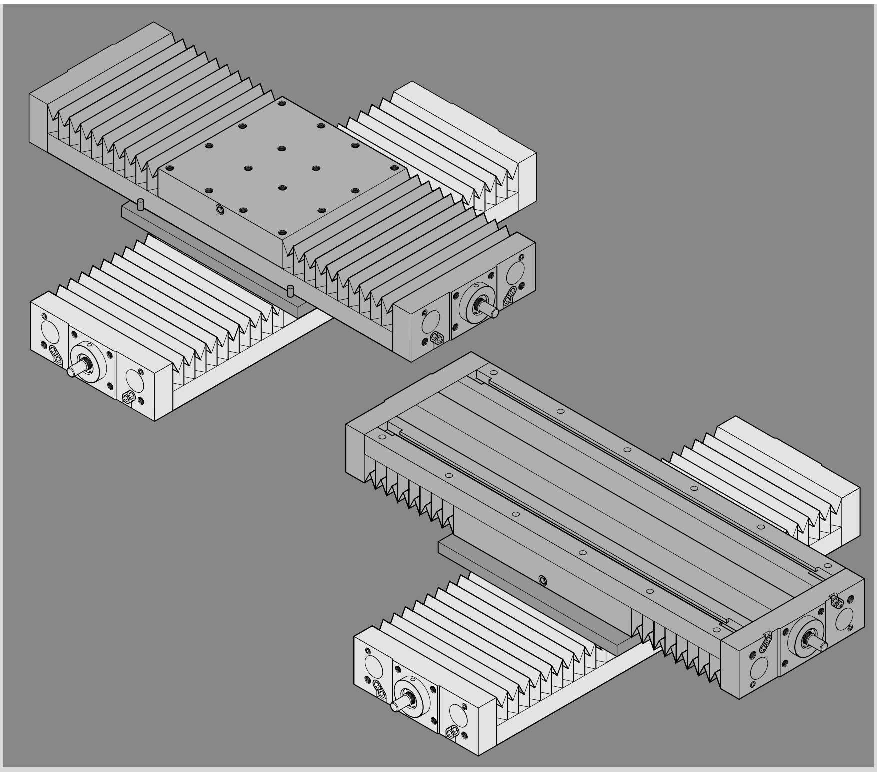
Recommended lithium soap greases:
For lubricant quantities and intervals, see “Mounting Instructions for Ball Rail Tables.”

Grease DIN 51825	Consistency class DIN 51818	Recommended grease	Part number (400g cartridge)
KP2K	NLGI 2	Dynalub 510	R3416 037 00

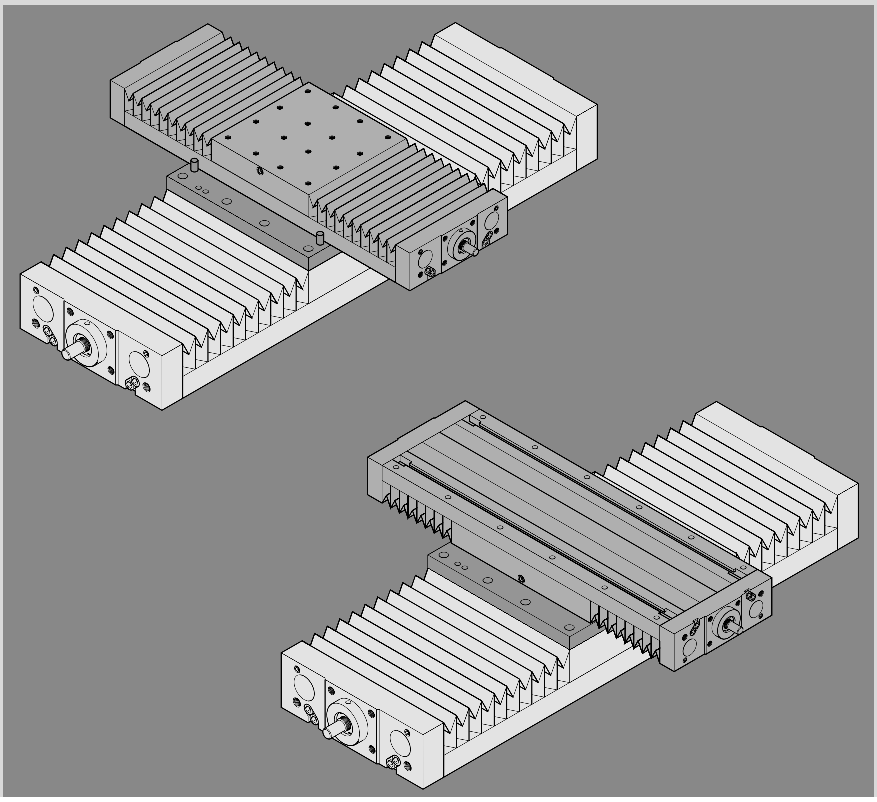
Connection System

Cross-plates have been designed for easy assembly of X-Y units. They are supplied as assembly kits containing all the screws, pins and sliding blocks required to join the two axes.

Same-size units can be combined.



A unit can be combined with the next largest or smallest size.

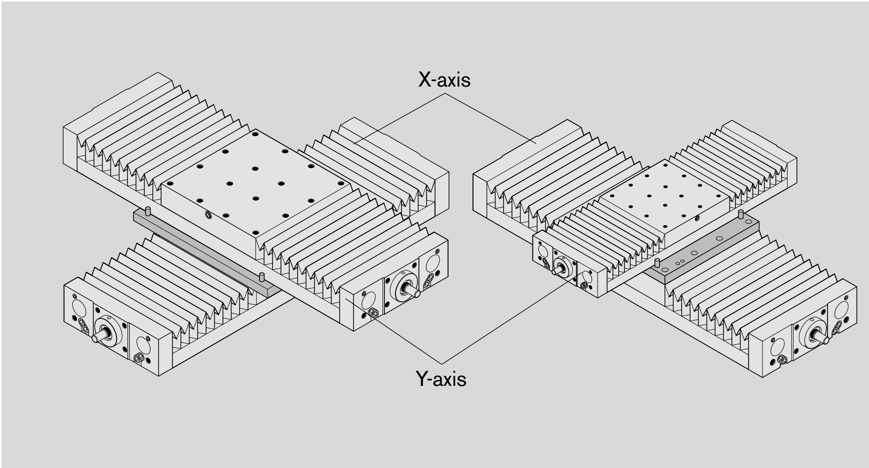


Connection System

General

In a two-axis unit, the accuracies of the individual axes and of the cross-plate are added, together with the elastic deformation of the Y-axis (not fully supported). However, this deformation can be significantly reduced by the use of the high base plate. The perpendicularities shown in the graphs are calculated maximum values and describe the angular relation of the two axes to each other. They are attained by simple joining and fixing together using existing or predrilled pin-holes, without requiring alignment. More precise perpendicularities can be produced by aligning the Y-axis and drilling the predrilled pin-holes in the cross-plate. The P4 accuracies of the individual axes must be added to the specified angularity.

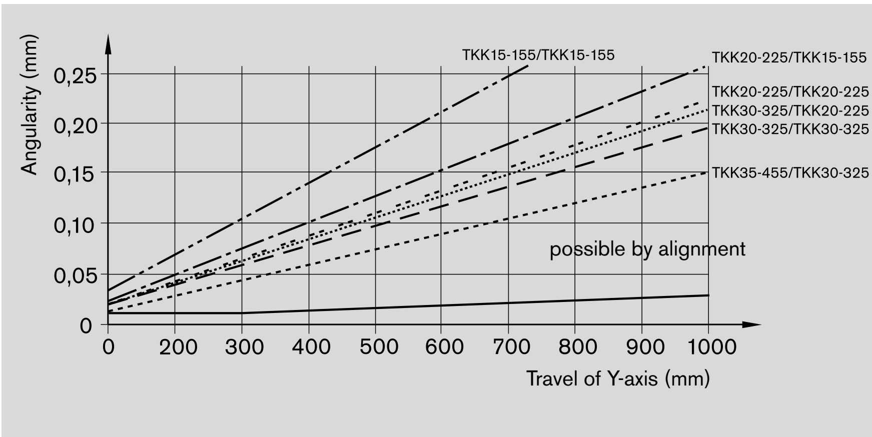
Assemblies for connection of base plate to carriage



Part numbers of cross-plate assembly kits
Consisting of: cross-plate with all fixings required to join the two axes.

	Y-axis		
X-axis	**TKK 15-155 Al**	**TKK 20-225 Al**	**TKK 30-325 Al**
TKK 15-155 Al	R0391 200 11		
TKK 20-225 Al	R0391 200 13	R0391 200 15	
TKK 30-325 Al		R0391 200 17	R0391 200 19
TKK 35-455 Al			R0391 200 21

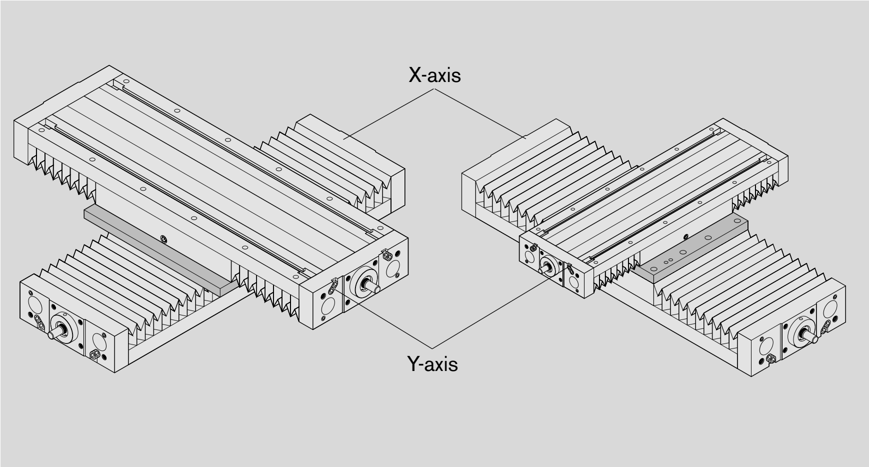
Perpendicularity of the two axes



Note

Fully assembled cross-plates and combinations of steel Ball Rail Tables available on request.
In the case of motor attachment via timing belt side drive, the motor may project into the working area of adjacent axes. Check for any interference contours.

Assemblies for connection of carriage to carriage

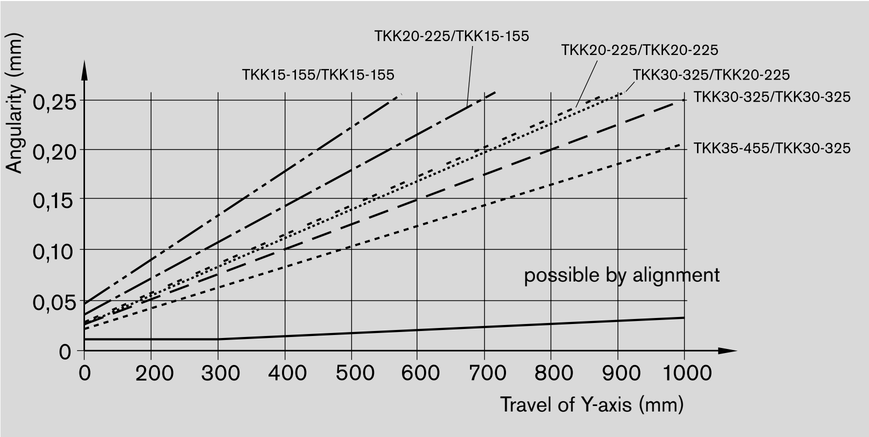


Part numbers of cross-plate assembly kits
Consisting of: cross-plate with all fixings required to join the two axes.

X-axis	Y-axis TKK 15-155 Al with $L_{ca} = 220$	TKK 20-225 Al with $L_{ca} = 320$	TKK 30-325 Al with $L_{ca} = 450$
TKK 15-155 Al	R0391 200 12		
TKK 20-225 Al	R0391 200 14	R0391 200 16	
TKK 30-325 Al		R0391 200 18	R0391 200 20
TKK 35-455 Al			R0391 200 22

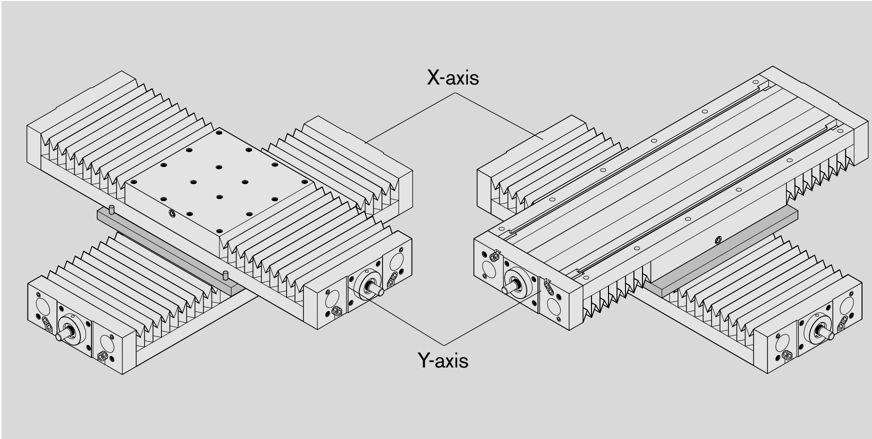
L_{ca} = carriage length

Perpendicularity of the two axes

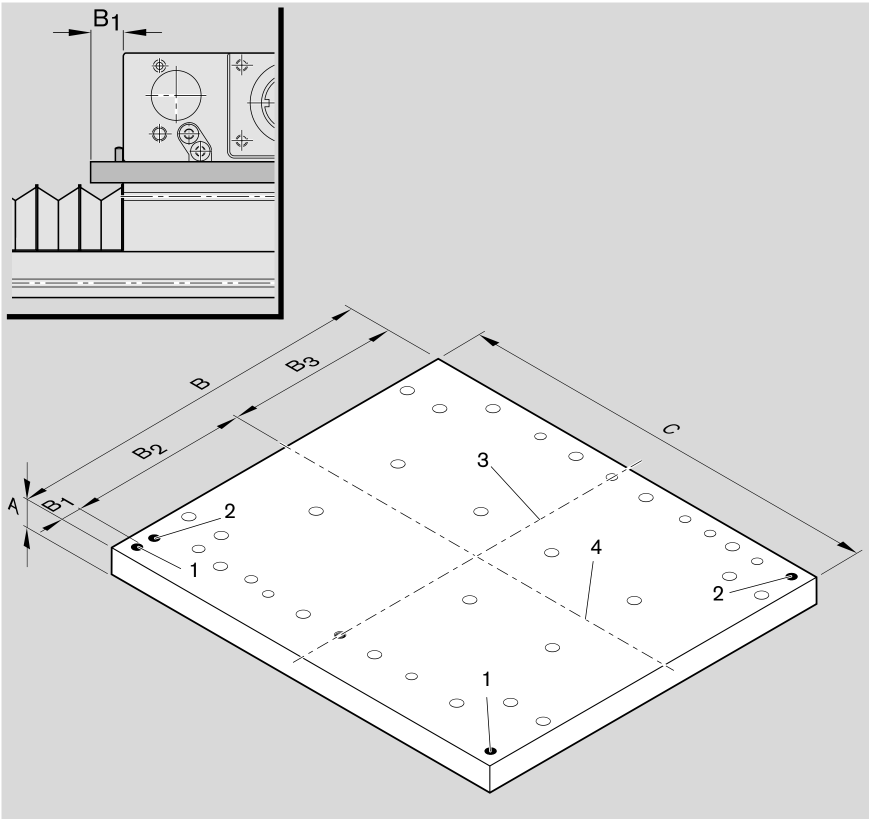


Connection System

Dimensions of the cross-plates when connecting Ball Rail Tables of the same size

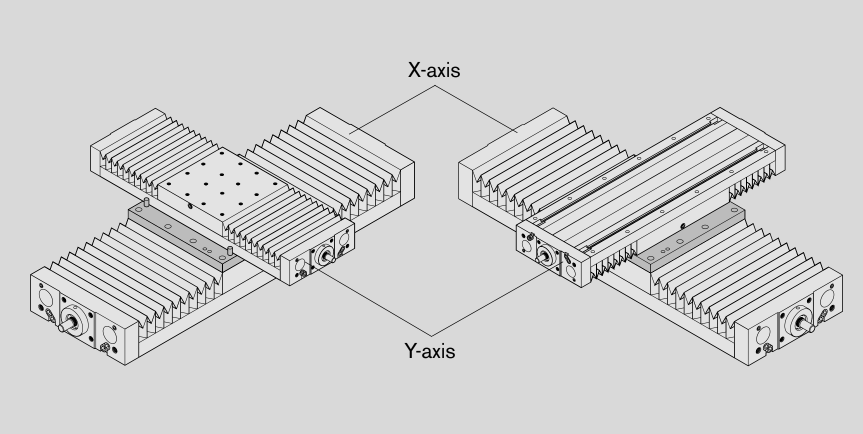


1 Pin-holes for joining the Y-axis in base-plate to carriage combinations
2 Pre-drilled pin-holes for pinning the Y-axis in base-plate to carriage combinations
3 X-axis centerline
4 Y-axis centerline

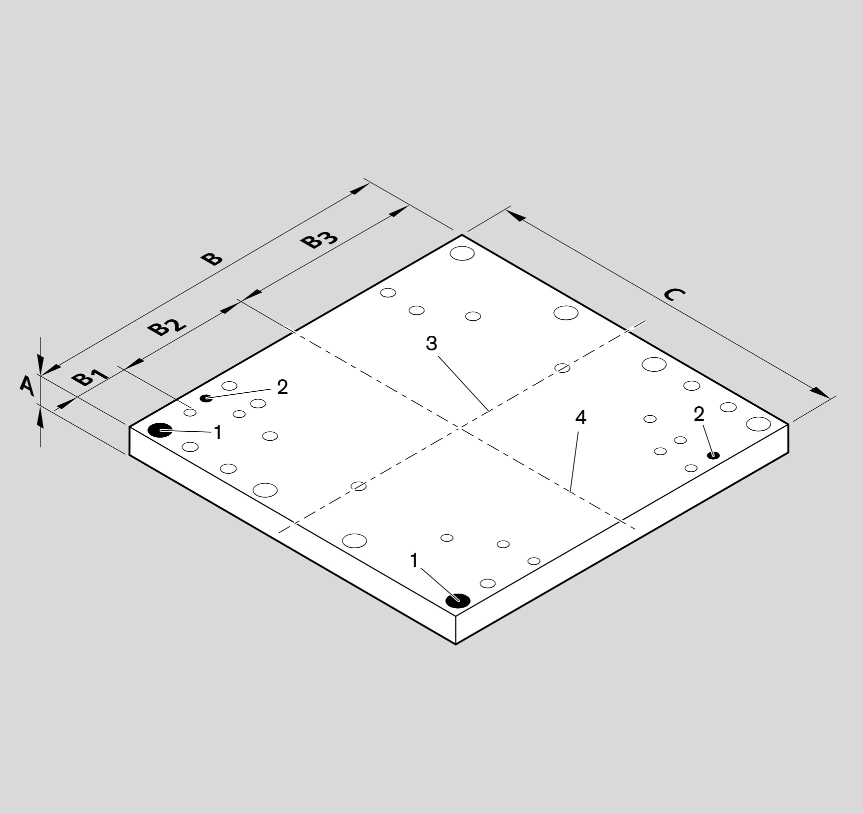


Part number of assembly kit	Dimensions (mm) A	B	C	B_1	B_2	B_3
R0391 200 11	18	165	220	11	77.5	76.5
R0391 200 12						
R0391 200 15	18	240	320	16	112.5	111.5
R0391 200 16						
R0391 200 19	25	340	450	16	162.5	161.5
R0391 200 20						

Dimensions of the cross-plates when connecting Ball Rail Tables to next largest or next smallest size



- **1** Pin-holes for joining the Y-axis in base-plate to carriage combinations
- **2** Pre-drilled pin-holes for pinning the Y-axis in base-plate to carriage combinations
- **3** X-axis centerline
- **4** Y-axis centerline



Part number	Dimensions (mm)					
of assembly kit	A	B	C	B_1	B_2	B_3
R0391 200 13	18	220	220	32.5	77.5	110
R0391 200 14						
R0391 200 17	18	320	320	47.5	112.5	160
R0391 200 18						
R0391 200 21	25	400	450	37.5	162.5	200
R0391 200 22						

Order Example

Ordering data						Description
Ball Rail Table						Ball Rail Table
(Part number): R1460 300 00, 1660 mm						TKK 20-225 St R1460 300 00, 1660 mm
Type	=	**RV04**				With timing belt side drive, mounted, as shown in diagram RV04
Guideway	=	**01**				Base plate, low
Drive unit	=	**09**				Ball screw 20 x 20 (drive via floating bearing journal ø14)
Carriage	=	**01**				One carriage 220 mm long, preload 2%
Motor attachment	=	**54**				Timing belt side drive for motor MSK 050C, i = 2
Motor	=	**89**				Motor MSK 050C
Cover	=	**01**				PU bellows
Position measuring system	=	**00**				Without glass scale
1st switch	=	**15-A**	**+**	**500**	**mm**	Mechanical switch, external, switch activation point + 500 mm
2nd switch	=	**11-A**	**±**	**0**	**mm**	PNP NC, external, switch activation point ± 0 mm
3rd switch	=	**15-A**	**–**	**500**	**mm**	Mechanical switch, external, switch activation point – 500 mm
Cable duct	=	**20-X**		**1500**	**mm**	Cable duct 1500 mm long (loose)
Socket/plug	=	**17**				Socket/plug (loose)
Switching cam	=	**26**				With external switching cam (for switch activation)
Documentation	=	**01**				With standard report

Please check whether the selected combination is a permissible one (load capacities, moments, maximum speeds, motor data, etc.)!

Length of the Ball Rail Table

Excess travel = $2 \cdot P = 2 \cdot 20$ mm = 40 mm
Effective stroke = max. travel – 2 · excess travel
Max. travel = $\text{stroke}_{eff} + 2 \cdot$ excess travel
= 1134 mm + 2 · 40 mm
= 1214 mm
L = 1660 mm for max. travel = 1214 mm
from data sheet TKK 20-225 St

For safe operation, the excess travel must be longer than the braking distance. The acceleration travel can be taken as a guideline value for the braking distance. In most cases, 2x the ball screw lead (P) will be sufficient.
Example for P = 20 mm:
Excess travel (braking distance) ≈ 40 mm

Switch mounting arrangements

A profiled support is required for mounting the switches.
Switches may only be mounted to one side of the Ball Rail Table (left or right).
Refer to the section on “Switch Mounting Arrangements” for more information on switch types and switch mounting.

Inquiry/Order Form

Bosch Rexroth AG
Linear Motion and Assembly Technologies
D-97419 Schweinfurt
Germany

Telephone **+49-9721-937-0**

Telefax (direct) **+49-9721-937-350**

Ball Rail Tables TKK

To be completed by customer: Inquiry ☐ / Order ☐
Ball Rail Table TKK ____________________
(Part number): ______-______-______, length ________mm

Type	=	☐☐☐☐
Guideway	=	☐☐
Drive unit	=	☐☐
Carriage	=	☐☐
Motor attachment	=	☐☐
Motor	=	☐☐
Cover	=	☐☐
Position measuring system	=	☐☐
1st switch	=	☐☐ – ☐ ○ ☐☐☐☐ mm
2nd switch	=	☐☐ – ☐ ○ ☐☐☐☐ mm
3rd switch	=	☐☐ – ☐ ○ ☐☐☐☐ mm
Cable duct	=	☐☐ – ☐ ○ ☐☐☐☐ mm
Socket/plug	=	☐☐
Switching cam	=	☐☐
Documentation	=	☐☐

Please check whether the selected combination is a permissible one (load capacities, moments, maximum speeds, motor data, etc.)!

Quantity Order of _____ pcs, ______ per month, _______ per year, per order, or ____________________________
Comments:

From

Company: ______________________________
Address: ______________________________
____
____

Name: ______________________________
Department: ______________________________
Telephone: ______________________________
Telefax: ______________________________

Inquiry/Ordering data for multi-axis units

X-Y table supplied as separate components (for assembly by customer)

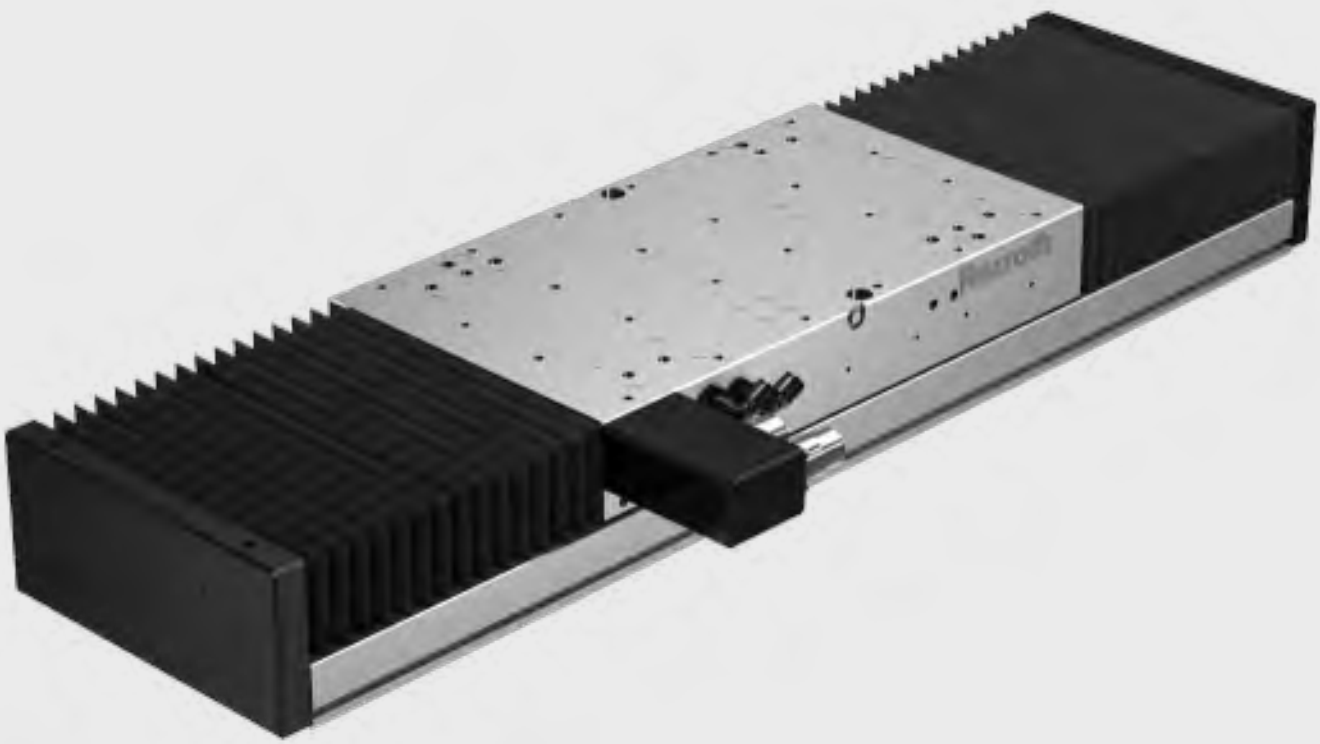
Consisting of:
– X-axis, see order example
– Y-axis, see order example
– Cross-plate assembly kit

Fully assembled X-Y table on request

The Drive & Control Company

Rexroth
Bosch Group

Ball Rail Tables TKL



Identification system for short product names

The Ball Rail Tables are designated according to type and size.

Short product name			Example: T K L - 275 - N N - 2
System	=	Ball Rail Table **(T)**	T
Guideway	=	Ball Rail System **(K)**	K
Drive	=	Linear Motor **(L)**	L
Size	=	225 / **275** / 325	275
Version	=	Standard version **(N)**	N N
Generation	=	Product generation **2**	2

Changes/additions at a glance

Catalog structure

- New catalog number
- New short product name
- New catalog structure
- Content revision of all catalog pages
- “Delivery form” section added
- “Linear motor” section added
- “Connection overview” section added
- “Switching system” section added

Technical changes

- Introduction of the Integrated Measuring System IMS-A (absolute)
- New option numbers for guideway option
- New option numbers for position measuring system option
- Change from switch with loose cable end to switch with plug M8 x1
- New option numbers for switch option
- Change in switch version on the plug holder (new design of power and encoder cable required)
- Ball Runner Block changed to BSHP version
- Increased dynamic load ratings

Ball Rail Tables TKL

Product description

Ball Rail Tables TKL with Ball Rail System and iron-core Linear Motor from Rexroth are particularly suited for use where electromechanical axes are limited due to their dynamics, precision, rigidity and/or maintenance requirements.

Outstanding features

- **Easy to install and use**: Fully integrated Linear Motor System as a ready-to-install solution for design engineers.
- **High speeds and high acceleration:** Synchronous direct linear drive. High overload factor and high dynamics are possible.
- **Precise motion and high dynamic response for life:** Thrust generated directly at the payload. There is no mechanism converting rotary to linear motion, no transmission for high rigidity. Linear high-resolution position sensing system.
- **Permits very high load cycle rates:** Excellent heat dissipation thanks to liquid cooling of primary part.
- **Easy maintenance:** Little maintenance effort required due to the low-wear direct drive and the easy-to-maintain guide system.

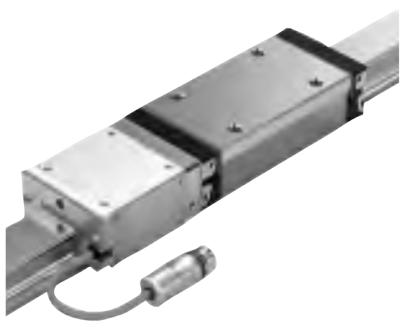
Further highlights

- Openly configurable thanks to a variety of options
- Extremely compact precision aluminum profile with fly-cut rail seat, reference edge, and base area for optimal travel.
- The Ball Rail Systems are easy to maintain due to the central lube port on each side of the carriage.
- Built-in elements are protected by high-quality, welded high-speed bellows resistant to oil and moisture.
- Clamping unit is optional
- High Precision Ball Runner Blocks

Delivery form

Ball Rail Tables TKL with Ball Rail System and iron-core Linear Motor are delivered fully assembled and with the specified documentation.
The assembly of the TKL includes the guide, the drive (Linear Motor), the carriage, the cover, the position measuring system and end position cushioning. Key components are:

Ball Rail System BSHP with Integrated Position Measuring System IMS from Rexroth



Linear motor MLF from Rexroth

Available options and accessories
Switches, switch tabs and cable ducts are selectable options and are delivered as separate part.
Cable drag chains and switch accessories are included as accessories.

Suitable electric drive and control technology
Bosch Rexroth can also provide the suitable electrical drive and control technology for operating the Ball Rail Table TKL on request. Servo controller, control and electrical accessories are delivered separately.
For further information, see “Rexroth IndraDrive drive system, R999000018” and “Automation systems and control components, R999000026”. Key component is:

Drive system HCS from Rexroth

Required and supplementary documentation
For further instructions and information, please refer to the documentation for this product.
You can find PDF files of these documents on the Internet
We would also be happy to send you the documents you want.
If you are unsure about using this product, please contact Bosch Rexroth.

Overview of types with load capacities

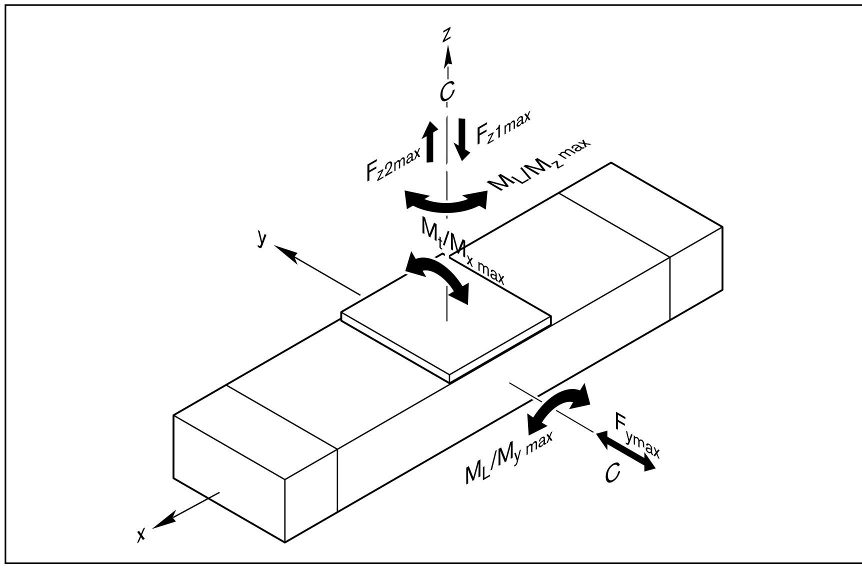
Acceptable loads (Recommended values based on experience)

In relation to the desired service life, loads for F_m, F_{comb} of up to about 20% of the dynamic load rating C have proven effective.

See the section on calculation principles.

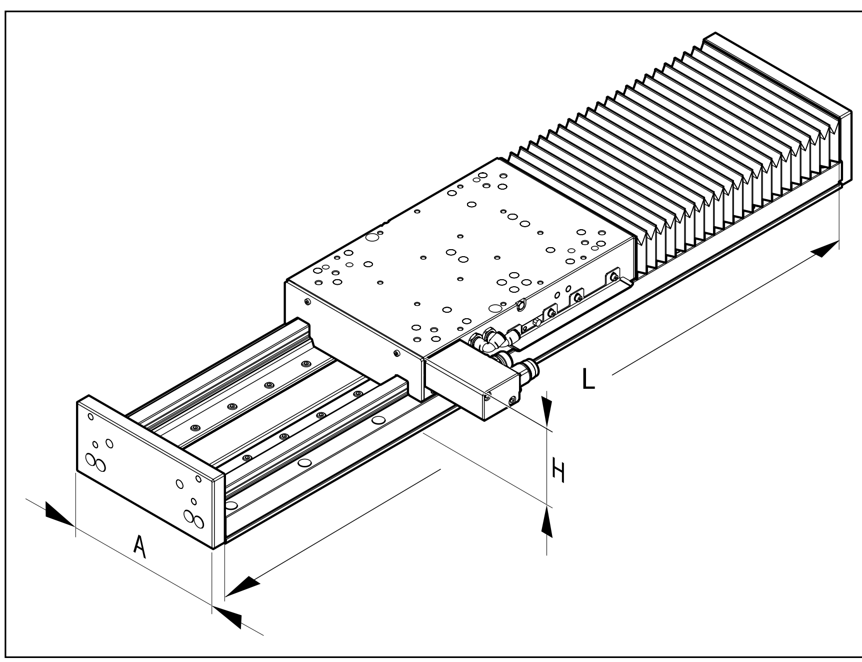
Do not exceed the technical data for the linear system.

F_m = Dynamic equivalent load on bearing of the guideway
F_{comb} = Combined equivalent load on bearing of the guideway



TKL	Dimensions A x H (mm)	L_{max} (mm)	Dyn. Load rating C (N)1)
TKL-225	225 x 100	3 940	96 100
TKL-275	275 x 110	3 940	121 100
TKL-325	325 x 120	3 940	149 400 (224 100)2)

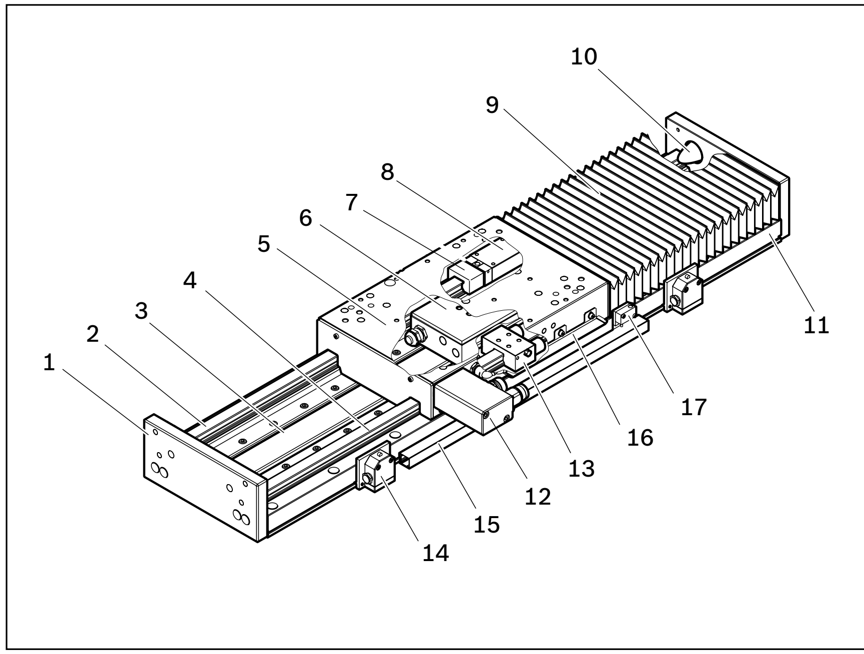
1) Take maximum loads into account.
2) Only for version with primary part C or table length 775 mm.



Structure, mounting

1 End plate
2 Guide rail with integrated scale
3 Linear motor secondary part
4 Guide rail
5 Carriage (aluminum)
6 Linear motor primary part
7 Scanner with sensors
8 Ball Runner Block (four or six pieces)
9 PU bellows cover (optional)
10 Rubber buffer
11 Base plate (aluminum)
12 Plug holder for motor flange socket and position measuring system
13 Clamping unit (optional)

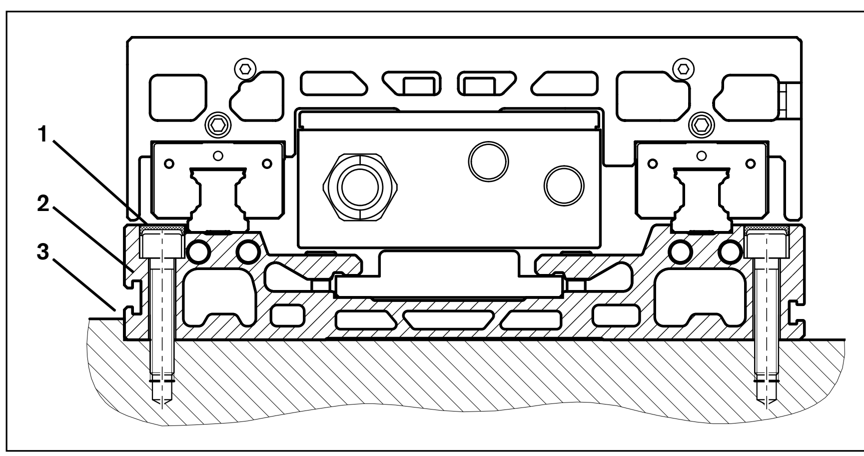
Attachments:
14 Mechanical switch (with additional components)
15 Cable duct (aluminum alloy)
16 Switching cam
17 Proximity switch (with additional components)



General notes on mounting

Ball Rail Tables TKL are mounted from above.
Mounting hole plugs are included with the unit.
For connection dimensions, see the relevant dimension drawings.

1 Mounting hole plug
2 Base plate
3 Reference edge

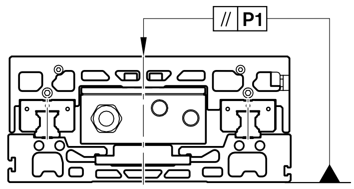


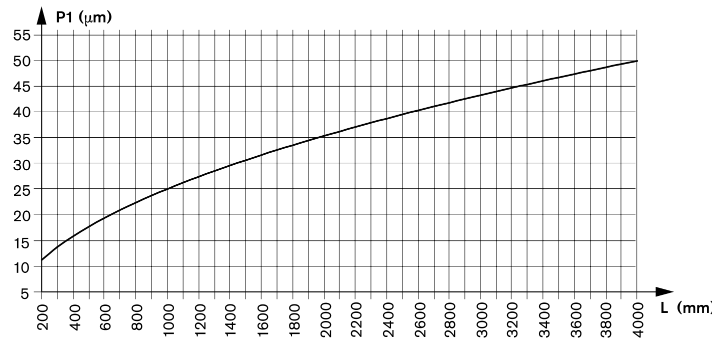
Travel accuracy

All accuracy data apply to the unit when screwed down and assume an ideally flat mounting base surface. Irregularities in the mounting base surface are not taken into account in the values given below.

Accuracy P1

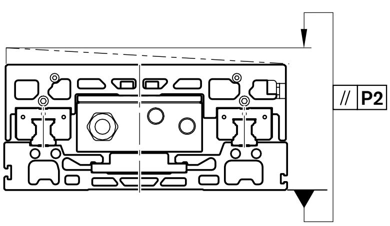
Measured in the center of the carriage

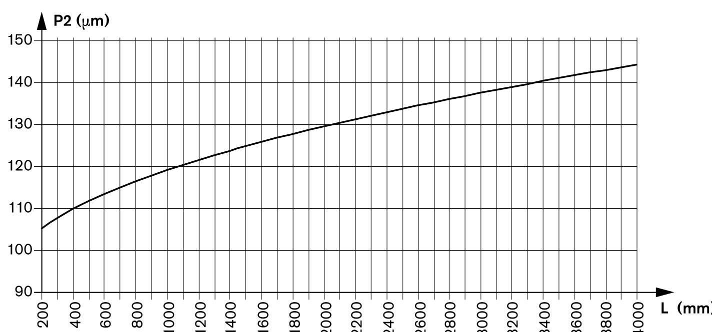




Accuracy P2

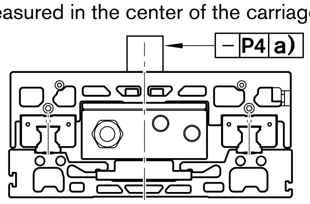
Measured in the center of the carriage

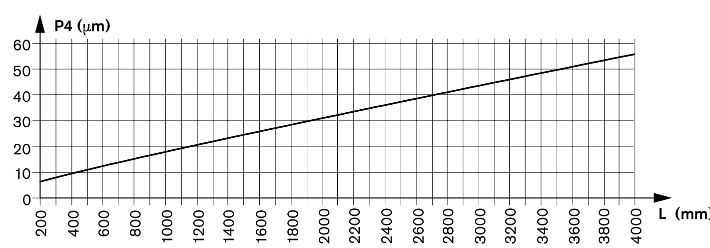




Accuracy P4

Measured in the center of the carriage





a) Lengthwise

Technical data

Guide system

TKL	Motor	Primary part	Motor winding	Encapsulation	Attractive force of the motor F_{ATT} (N)	Carriage length L_{ca} (mm)	Moved mass of system – TT with primary part m_{ca} (kg)	Moved mass of system – TT without primary part m_{ca} (kg)	Dimension Z_1 (mm)
TKL-225	MLP040	A	300	Standard encapsulation	1200	340	15.5	10.8	52.1
		B	250		1700	400	17.9	11.8	
TKL-275	MLP070	A	300		2900	395	24.2	15.8	60.4
		B	250		3750	465	27.5	17.1	
TKL-325	MLP100	A	190		5400	475	35.4	21.9	68.5
		B	250		8000	625	44.6	25.9	
		C	190		10400	775	56.1	32.1	

Calculation principles

☞ The attractive force of the motor must be taken into account in the calculations!

Maximum permissible loads

When selecting Linear Motion Systems, it is essential to consider the upper limits for permissible loads and forces, as specified in the section on “Technical data”. The values given there are system-related. In other words, the upper limits are determined not only by the load ratings of the bearing points but also include structural design and material-related considerations.

Conditions for combined loads

$$\frac{|F_y|}{F_{y\,max}} + \frac{|F_z|}{F_{z\,max}} + \frac{|M_x|}{M_{x\,max}} + \frac{|M_y|}{M_{y\,max}} + \frac{|M_z|}{M_{z\,max}} \leq 1$$

Weight calculation

TKL-225:
$m_s = 0.027 \cdot L + 4.3 + m_{ca}$

TKL-275:
$m_s = 0.038 \cdot L + 6.3 + m_{ca}$

TKL-325:
$m_s = 0.048 \cdot L + 8.8 + m_{ca}$

m_s	=	mass of the TKL	(kg)
L	=	length	(mm)
m_{ca}	=	moved mass	(kg)

Note on dynamic load capacities and load moments

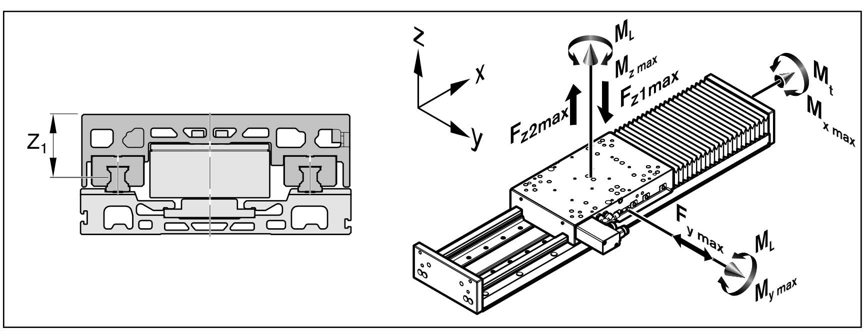
Determination of the dynamic load capacities and load moments is based on a travel life of 100,000 m as per DIN ISO 14728-1. Often, only 50 000 m are used as a basis, however.

For comparison:
Multiply values **C, M_t, and M_L** from the table by 1.26.

Dynamic load capacities	Dynamic load moments		Maximum permissible loads						Maximum length	Planar moment of inertia	
			Forces			Moments					
C (N)	M_t (Nm)	M_L (Nm)	$F_{z1\ max}$ (N)	$F_{z2\ max}$ (N)	$F_{y\ max}$ (N)	$M_{x\ max}$ (Nm)	$M_{y\ max}$ (Nm)	$M_{z\ max}$ (Nm)	L_{max} (mm)	J_y (cm^4)	J_z (cm^4)
96 100	7 600	10 400	32 100	29 200	19 800	2 330	3 180	2 150	3940	121	3132
96 100	7 600	12 900	32 100	29 200	19 800	2 330	3 940	2 670	3940	121	3132
121 100	12 100	14 600	46 800	43 200	23 400	4 320	5 220	2 830	3940	170	6204
121 100	12 100	18 200	46 800	43 200	23 400	4 320	6 520	3 530	3940	170	6204
149 400	17 900	22 400	89 000	84 400	30 800	10 120	12 660	4 620	3940	223	10 492
149 400	17 900	32 500	89 000	84 400	30 800	10 120	18 390	6 710	3940	223	10 492
224 100	26 800	42 700	89 000	84 400	30 800	10 120	24 130	8 800	3940	223	10 492

Combined equivalent load on bearing of the linear guide

$$F_{comb} = |F_y| + |F_z| + C \cdot \frac{|M_x|}{M_t} + C \cdot \frac{|M_y|}{M_L} + C \cdot \frac{|M_z|}{M_L}$$



C	=	dynamic load capacity	(N)
F_{comb}	=	combined equivalent load on bearing	(N)
$F_{y\ max}$	=	force in y-direction	(N)
$F_{z\ max}$	=	force in z-direction (Take into account the motor attractive force)	(N)
L	=	nominal life in meters	(m)
L_h	=	nominal life in hours	(h)
M_L	=	dyn. longitudinal moment load cap.	(Nm)
M_t	=	dyn. torsional moment load cap.	(Nm)
$M_{x\ max}$	=	torsional moment around the x-axis	(Nm)
$M_{y\ max}$	=	torsional moment around the y-axis	(Nm)
$M_{z\ max}$	=	torsional moment around the z-axis	(Nm)
Z_1	=	application point of the effective force	(mm)
v_m	=	average travel speed	(m/s)

Life

Nominal life of the guideway in meters:

$$L = \left(\frac{C}{F_{comb}}\right)^3 \cdot 10^5$$

Nominal life of the guideway in hours:

$$L_h = \frac{L}{3600 \cdot v_m}$$

Module of elasticity of the linear system

E = 70 000 N/mm2

Technical data

Drive system[1)]

TKL	Motor	Primary part	Motor winding	Encapsulation	Motor attractive force[2)]	Carriage length	Moved mass of system	
							Carriage with primary part	Carriage without primary part
					F_{ATT} (N)	L_{ca} (mm)	m_{ca} (kg)	m_{ca} (kg)
TKL-225	MLP040	A	300	Standard encapsulation	1200	340	15.5	10.8
		B	250		1700	400	17.9	11.8
TKL-275	MLP070	A	300		2900	395	24.2	15.8
		B	250		3750	465	27.5	17.1
TKL-325	MLP100	A	190		5400	475	35.4	21.9
		B	250		8000	625	44.6	25.9
		C	190		10400	775	56.1	32.1

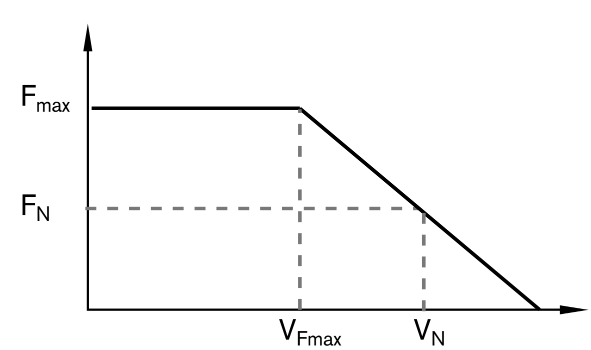
1) All information is based on operation with liquid cooling (with a coolant supply temperature of 30 °C) and 540 V DC link circuit voltage.
2) Between the primary and secondary part at rated air gap, primary part de-energized.
3) The achievable forces depend on the drive controller used.
4) The attainable speeds are dependent on the supply voltage and its tolerance.
5) This limitation is due to the permissible speed of the guideway. Please ask about applications with higher speeds.
6) Other measured variables include: Power cable chain, wiring, customer mounting base (frame), etc.

Calculation principles

☞ Moved mass of system (carriage, cable drag chain and wiring) and internal friction must be taken into account in the calculation!

It is advisable to include a reserve of 10 to 20 % in the design of the linear motor and the drive controller.

Torque/speed characteristic

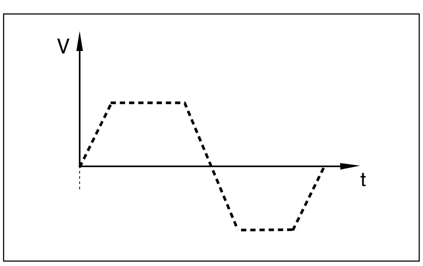


Speed-dependent friction (N)	Peak thrust[3] F_{max} (N)	Continuous nominal force[3] F_N (N)	Speed[4] at F_{max} v_{Fmax} (m/s)	Speed[4] at F_N v_N (m/s)	Max. acceleration[6] a_{max} (m/s²)
90	800	250	5.0	5.0[5]	100
	1 150	370	4.1	5.0[5]	
125	2 000	550	5.0	5.0[5]	
	2 600	820	4.1	5.0[5]	
160	3 750	1 180	3.1	4.8	
	5 600	1 785	4.1	5.0[5]	
220	7 150	2 310	3.1	4.8	

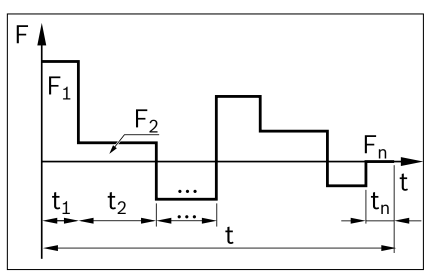
Motor dimensioning
Our design tool **IndraSize** is available for the exact dimensioning of the motor.
For further information on **IndraSize** and to download, go to: http://www.boschrexroth.de/IndraSize

Basic procedure:
The dimensioning or design of linear drives is largely determined by the application-dependent curves for speed and thrust force. The basic procedure for dimensioning linear drives is outlined in the following figures.

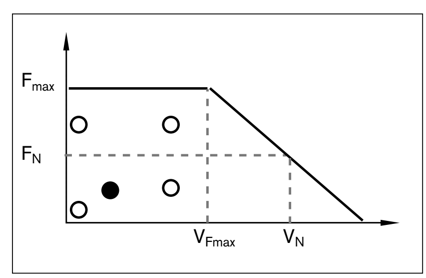
Define the speed profile



Determine the force progression



Compare the work points with torque/speed characteristic



Effective motor force $F_{m\ eff}$

$$F_{m\ eff} = \sqrt{\frac{F_1^2 \cdot t_1 + F_2^2 \cdot t_2 + \dots + F_n^2 \cdot t_n}{t}}$$

$F_1, F_2 \dots F_n$	=	motor force in phase 1 … n	(N)
$F_{m\ eff}$	=	effective force of motor	(N)
t	=	time for all phases	(s)
$t_1, t_2 \dots t_n$	=	time for phase 1 … n	(s)

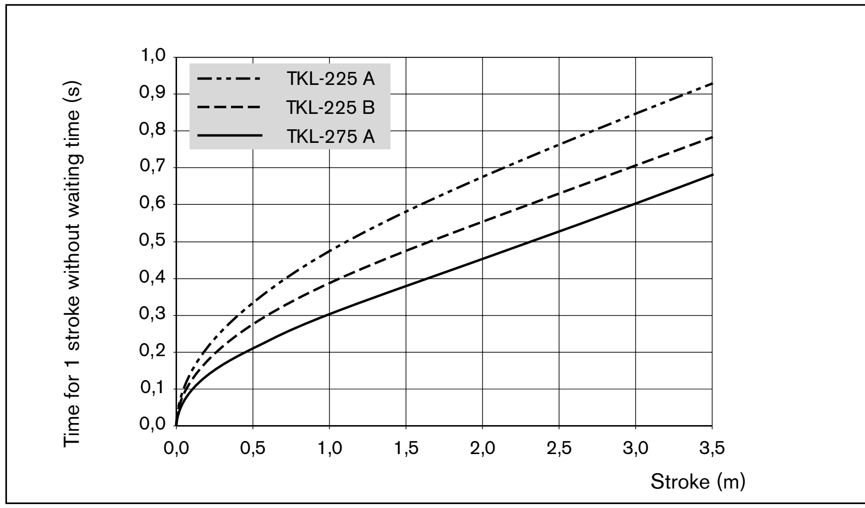
☞ Further instructions are available in the documentation for the linear motor and the drive controller

Selection charts

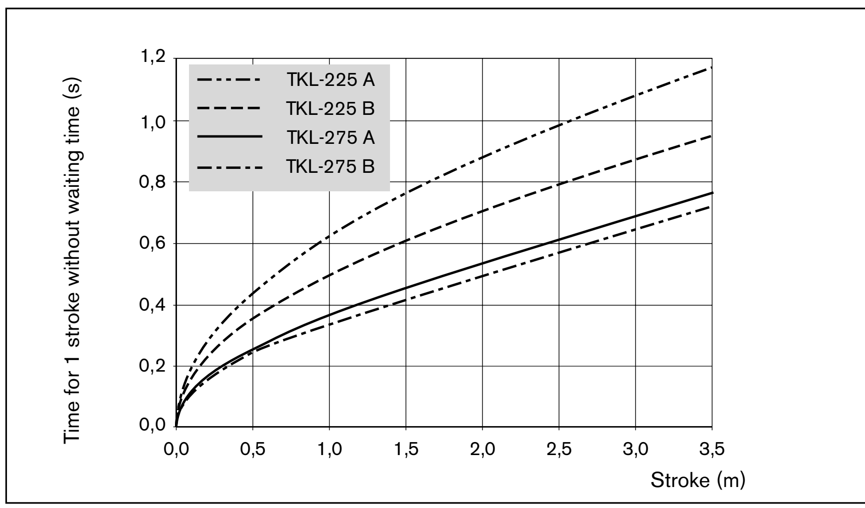
These diagrams are only intended for a rough selection of the size and do not replace the necessary drive design.

The characteristics shown in the diagrams are determined based on the following parameters:
- Horizontal application
- The peak thrust is taken into account, not the continuous force!
- Liquid cooling

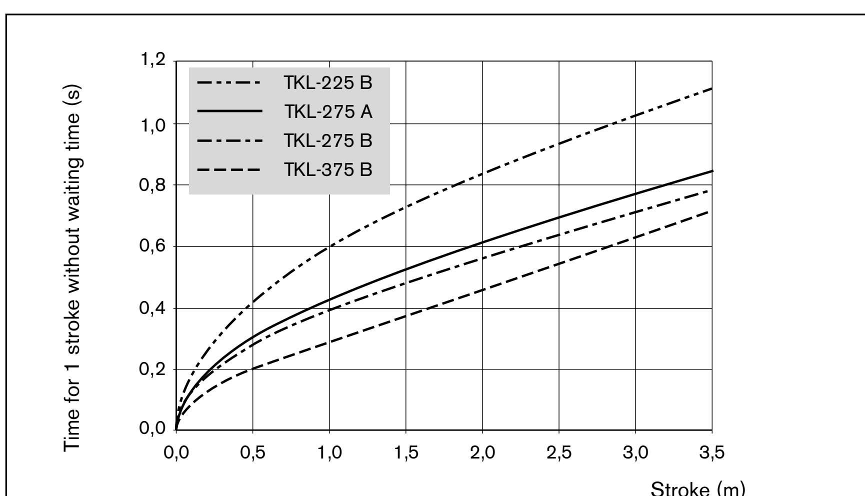
Payload 10 kg



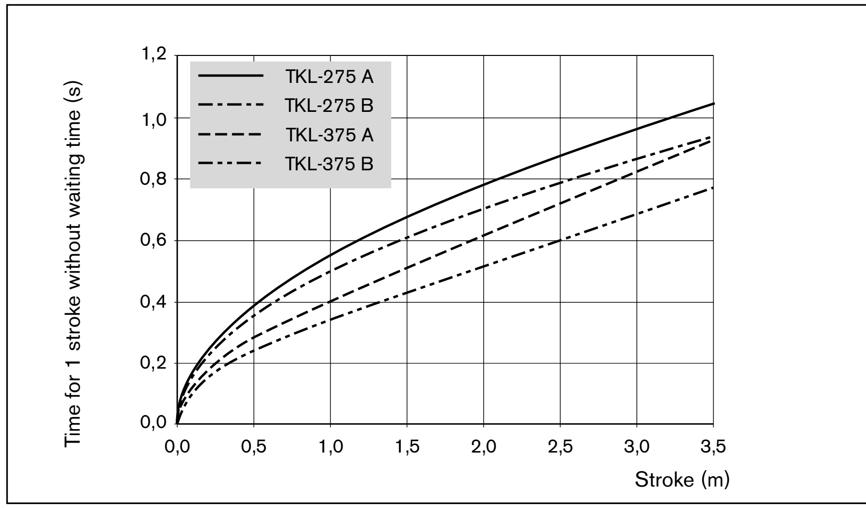
Payload 30 kg



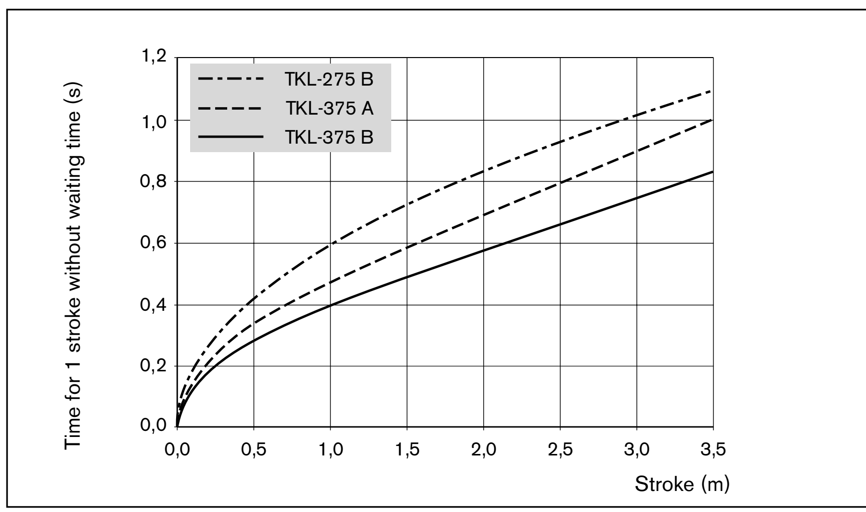
Payload 50 kg



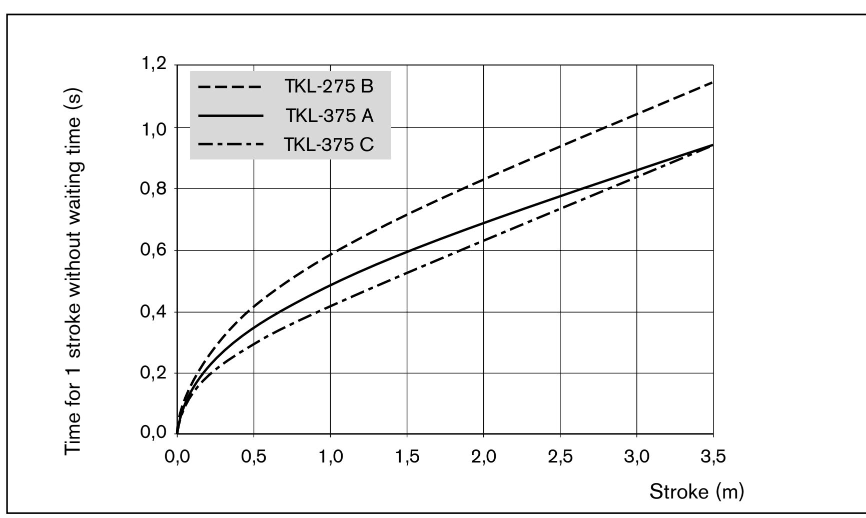
Payload 100 kg



Payload 150 kg

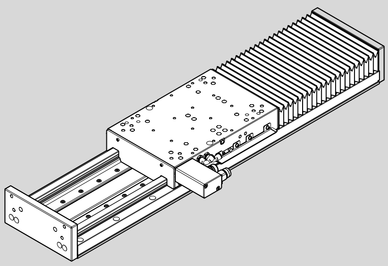
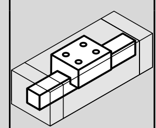
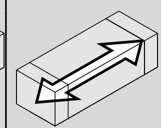
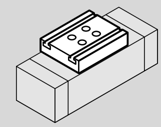
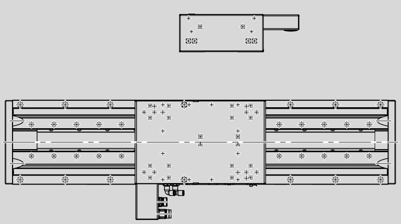


Payload 250 kg



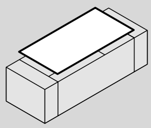
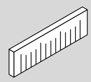
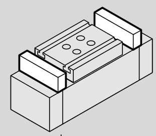
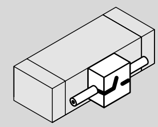
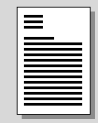
TKL-225

Configuration and ordering

Part number, length TKL-225-NN-2, ... mm 	Version	Type	Guideway 	Drive  Motor winding		Carriage  Ball Runner Blocks High Precision $V_{max} \leq 5$ m/s[1] Preload	
				250	300	8% C	
with integrated measuring system 	IM01	Primary part A $L_{ca} = 340$	03		08	02	
		Primary part B $L_{ca} = 400$	03	17		12	

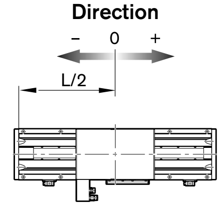
L_{ca} = carriage length
NC = normally closed
NO = normally open

1) Other influencing factors with regard to the speed include: Motor, supply voltage.
2) Recommended standard configuration: 2 proximity sensors (normally closed)
3) Switches are delivered as separate parts.
4) HIPERFACE® is a registered trademark of SICK STEGMANN GmbH.

	Cover		Position measuring system	End position damping		Switching system[2]	Documentation	
								
	PU bellows with	PU bellows without	Integrated Measuring System Absolute IMS-A (Hiperface[4])	with cushion-ing	with cush-ioning/ with clamping unit		Standard report	Special report
		05	25	11	21		01	02 Friction force 04 Travel accuracy 05 Positioning accuracy
	01			12	22			
		05	25	11	21			
	01			12	22			

Switching system[2]	
Without switch	
without switch	00
without switch tab	00
With proximity sensor[3]	
PNP - NC, plug M8 x 1	111
NPN - NC, plug M8 x 1	112
PNP - NO, plug M8 x 1	113
NPN - NO, plug M8 x 1	114
Switching cam	16
With mechanical switch[3]	
PNP - NC, plug M8 x 1	116
NPN - NC, plug M8 x 1	117
PNP - NO, plug M8 x 1	118
NPN - NO, plug M8 x 1	119
Switching cam	16
Cable duct	
without cable duct	00
with cable duct	20

Direction



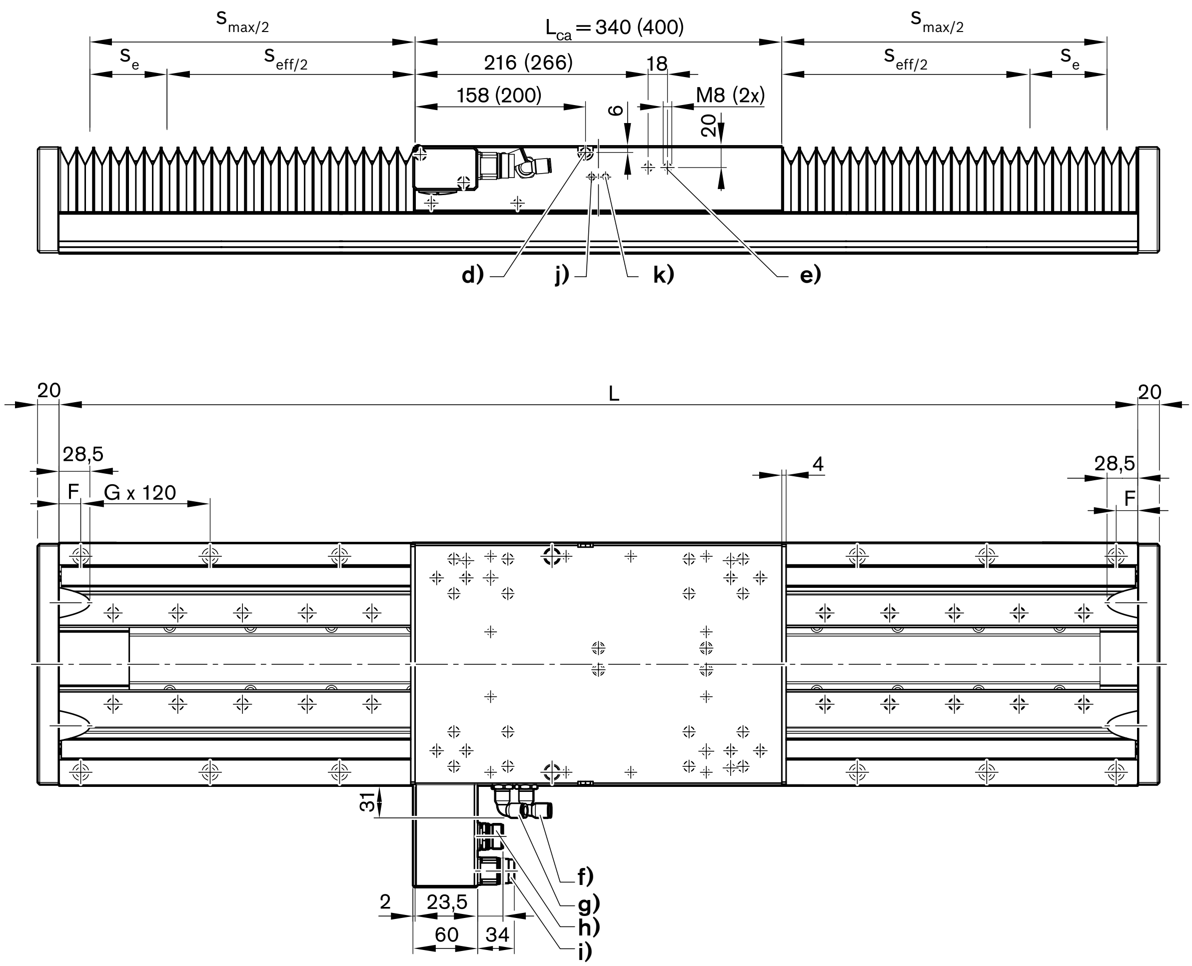
External switch

Travel distance: Effective travel distance = max. travel - 2 • excess travel

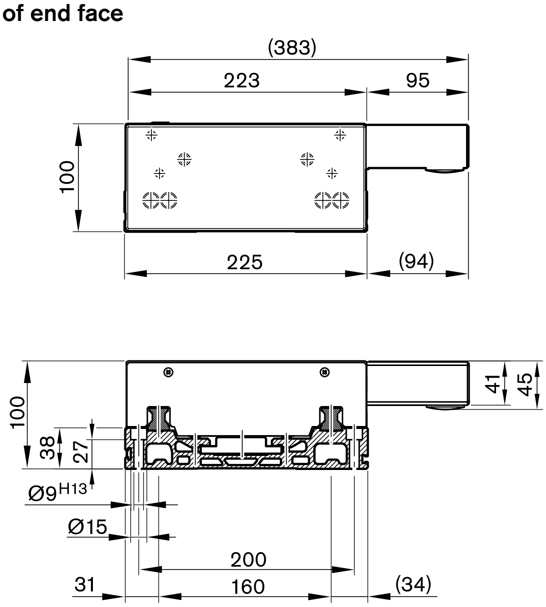
Switch activation point: Is the distance between the center of the base plate and the center of the carriage (specified in mm). Maximum switching distance = 0.5 • travel distance max. - excess travel

Excess travel: Excess travel must be greater than braking distance. To cushion the moved mass and reduce the excess travel, customers should install separate shock absorbers at the load center of gravity where required. The support is provided at the customer's site on the machine frame.

TKL-225 Dimension Drawing



View of end face

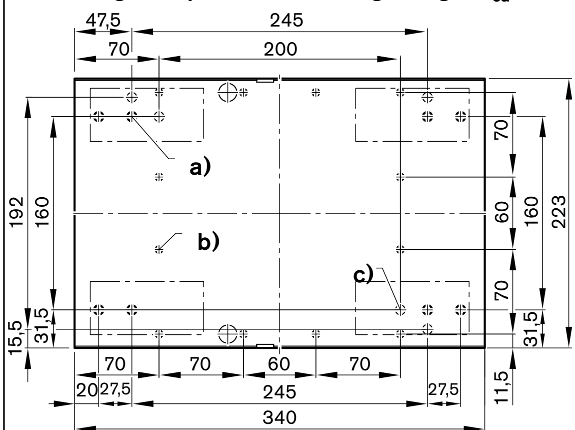


a) M8 - min. 12 deep (8x)
b) M6 - min. 9 deep (12x)
c) 8^{H7} - 18 deep (5x)
d) One-point lubrication connection via funnel-type lube nipple DIN3405 AM8x1 on both sides
e) Mounting hole pattern for power cable chain
f) Return cooling connection for hose Ø8 mm
g) Supply cooling connection for hose Ø8 mm
h) Measuring system flange socket
i) Motor flange socket
j) Air connection M5 clamping unit
k) Air filter clamping unit M5

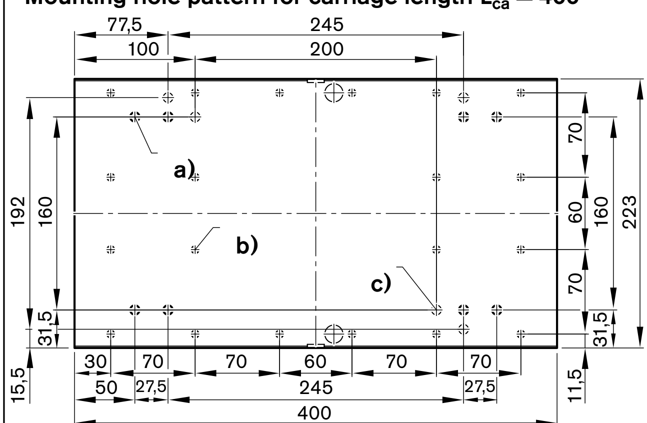
Switch assembly, see section “Switching system”

s_{max}	= maximum travel range	(mm)
s_{eff}	= effective stroke	(mm)
s_e	= excess travel	(mm)

Mounting hole pattern for carriage length L_{ca} = 340



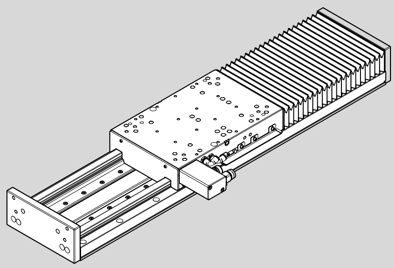
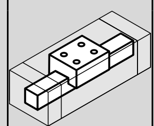
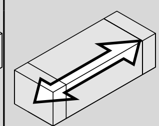
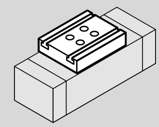
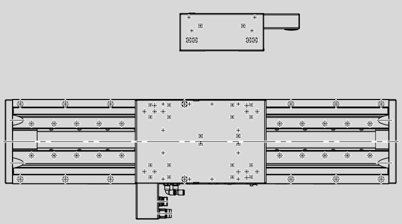
Mounting hole pattern for carriage length L_{ca} = 400



Length L (mm)	Counterbored mounting hole spacing			Max. travel (mm) for version with bellows and carriage length L_{ca}		without bellows and carr. length L_{ca}	
	F	G x 120	F	340	400	340	400
460	50	3 x120	50	70	-	-	-
520	20	4 x120	20	122	70	105	-
580	50	4 x120	50	174	122	165	105
640	20	5 x120	20	226	174	225	165
700	50	5 x120	50	278	226	285	225
760	20	6 x120	20	330	278	345	285
820	50	6 x120	50	382	330	405	345
880	20	7 x120	20	434	382	465	405
940	50	7 x120	50	486	434	525	465
1000	20	8 x120	20	538	486	585	525
1060	50	8 x120	50	590	538	645	585
1120	20	9 x120	20	642	590	705	645
1180	50	9 x120	50	694	642	765	705
1240	20	10 x120	20	746	694	825	765
1300	50	10 x120	50	798	746	885	825
1360	20	11 x120	20	850	798	945	885
1420	50	11 x120	50	902	850	1005	945
1480	20	12 x120	20	954	902	1065	1005
1540	50	12 x120	50	1006	954	1125	1065
1600	20	13 x120	20	1058	1006	1185	1125
1660	50	13 x120	50	1110	1058	1245	1185
1720	20	14 x120	20	1162	1110	1305	1245
1780	50	14 x120	50	1214	1162	1365	1305
1840	20	15 x120	20	1266	1214	1425	1365
1900	50	15 x120	50	1318	1266	1485	1425
1960	20	16 x120	20	1370	1318	1545	1485
2020	50	16 x120	50	1422	1370	1605	1545
2080	20	17 x120	20	1474	1422	1665	1605
2140	50	17 x120	50	1526	1474	1725	1665
2200	20	18 x120	20	1578	1526	1785	1725
2260	50	18 x120	50	1630	1578	1845	1785
2320	20	19 x120	20	1682	1630	1905	1845
2380	50	19 x120	50	1734	1682	1965	1905
2440	20	20 x120	20	1786	1734	2025	1965
2500	50	20 x120	50	1838	1786	2085	2025
2560	20	21 x120	20	1890	1838	2145	2085
2620	50	21 x120	50	1942	1890	2205	2145
2680	20	22 x120	20	1994	1942	2265	2205
2740	50	22 x120	50	2046	1994	2325	2265
2800	20	23 x120	20	2098	2046	2385	2325
2860	50	23 x120	50	2150	2098	2445	2385
2920	20	24 x120	20	2202	2150	2505	2445
2980	50	24 x120	50	2254	2202	2565	2505
3040	20	25 x120	20	2306	2254	2625	2565
3100	50	25 x120	50	2358	2306	2685	2625
3160	20	26 x120	20	2410	2358	2745	2685
3220	50	26 x120	50	2462	2410	2805	2745
3280	20	27 x120	20	2513	2462	2865	2805
3340	50	27 x120	50	2565	2513	2925	2865
3400	20	28 x120	20	2617	2565	2985	2925
3460	50	28 x120	50	2669	2617	3045	2985
3520	20	29 x120	20	2721	2669	3105	3045
3580	50	29 x120	50	2773	2721	3165	3105
3640	20	30 x120	20	2825	2773	3225	3165
3700	50	30 x120	50	2877	2825	3285	3225
3760	20	31 x120	20	2929	2877	3345	3285
3820	50	31 x120	50	2981	2929	3405	3345
3880	20	32 x120	20	3033	2981	3465	3405
3940	50	32 x120	50	3085	3033	3525	3465

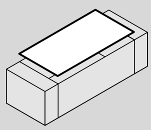
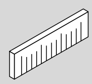
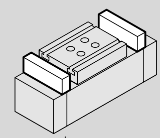
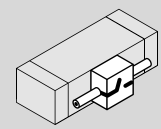
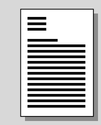
TKL-275

Configuration and ordering

Part number, length **TKL-275-NN-2, ... mm** 	**Version**	**Type**	**Guideway** 	**Drive**  **Motor winding**		**Carriage**  **Ball Runner Blocks** **High Precision** $V_{max} \le 5$ **m/s**[1] **Preload**	
				250	**300**	**8% C**	
with integrated measuring system 	IM01	Primary part A $L_{ca} = 395$	03		08	02	
		Primary part B $L_{ca} = 465$	03	17		12	

L_{ca} = carriage length
NC = normally closed
NO = normally open

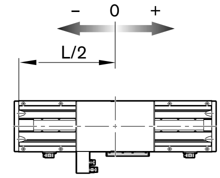
1) Other influencing factors with regard to the speed include: Motor, supply voltage, measuring system etc.
2) Recommended standard configuration: 2 proximity sensors (normally closed)
3) Switches are delivered as separate parts.
4) HIPERFACE® is a registered trademark of SICK STEGMANN GmbH.

Cover		Position measuring system	End position cushioning		Switching system[2)]	Documentation	
							
PU bellows with	PU bellows without	Integrated Measuring System Absolute IMS-A (Hiperface[4)])	with cushion-ing	with cush-ioning/ with clamping unit		Standard report	Special report
	05	25	11	21		01	02 Friction force
01		25	12	22		01	04 Travel accuracy
	05	25	11	21		01	05 Positioning accuracy
01		25	12	22		01	

Switching system[2)]

Without switch	
without switch	00
without switch tab	00
With proximity sensor[3)]	
PNP - NC, plug M8 x 1	111
NPN - NC, plug M8 x 1	112
PNP - NO, plug M8 x 1	113
NPN - NO, plug M8 x 1	114
Switching cam	16
With mechanical switch[3)]	
PNP - NC, plug M8 x 1	116
NPN - NC, plug M8 x 1	117
PNP - NO, plug M8 x 1	118
NPN - NO, plug M8 x 1	119
Switching cam	16
Cable duct	
without cable duct	00
with cable duct	20

Direction



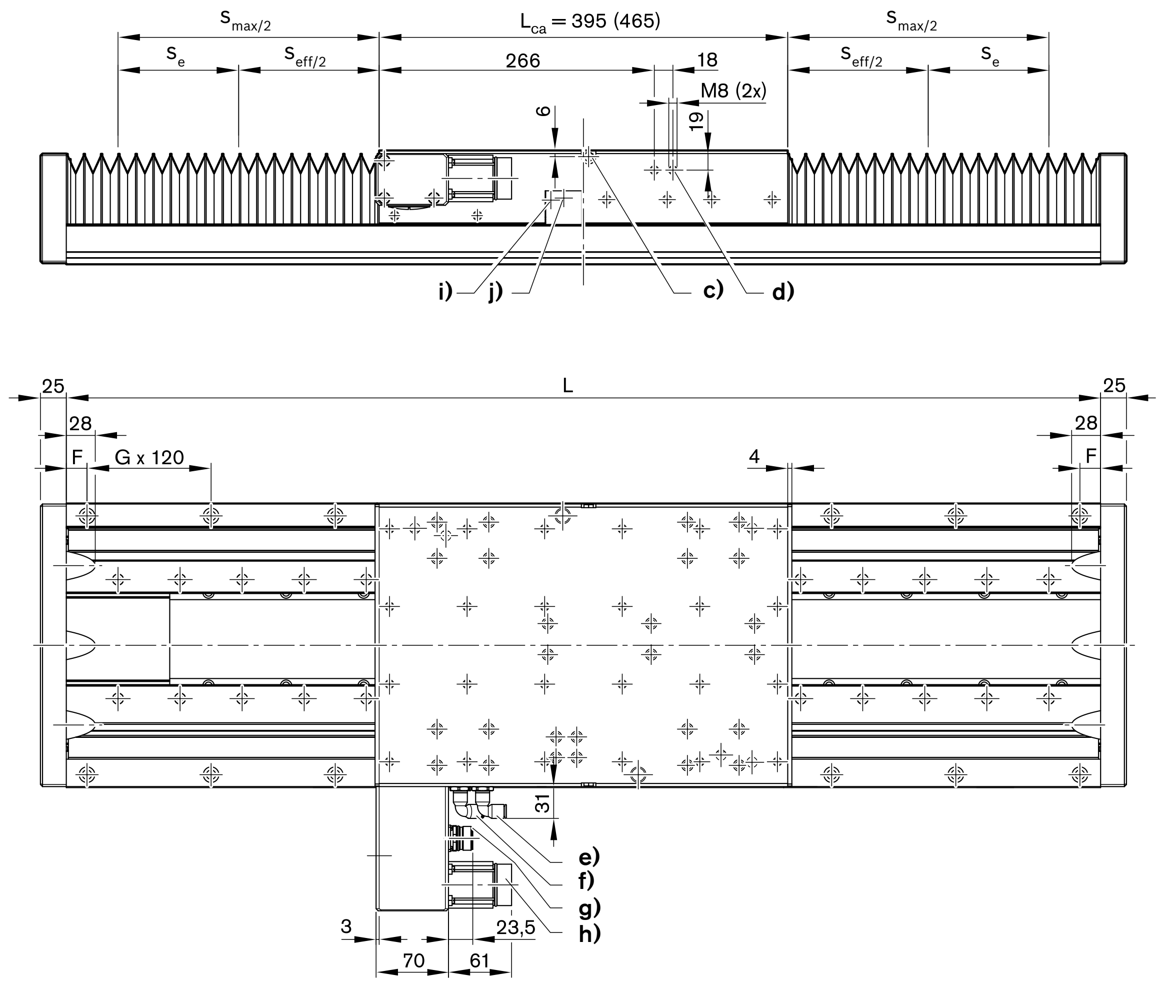
External switch

Travel distance: Effective travel distance = max. travel - 2 • excess travel

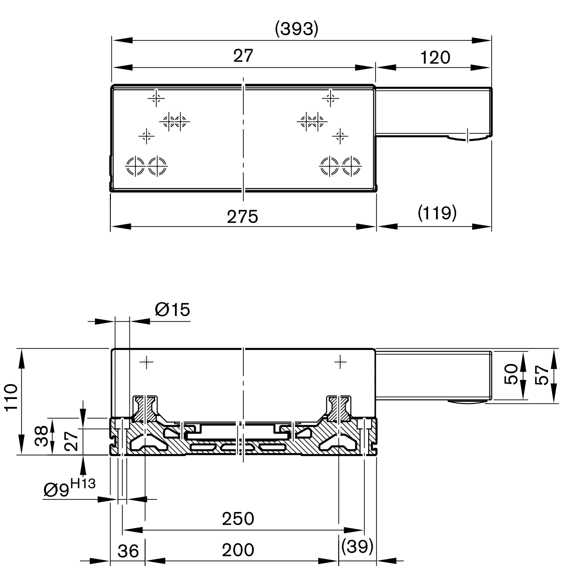
Switch activation point: Is the distance between the center of the base plate and the center of the carriage (specified in mm). Maximum switching distance = 0.5 • travel distance max. - excess travel

Excess travel: Excess travel must be greater than braking distance. To cushion the moved mass and reduce the excess travel, customers should install separate shock absorbers at the load center of gravity where required. The support is provided at the customer's site on the machine frame.

TKL-275 Dimension drawing



View of end face

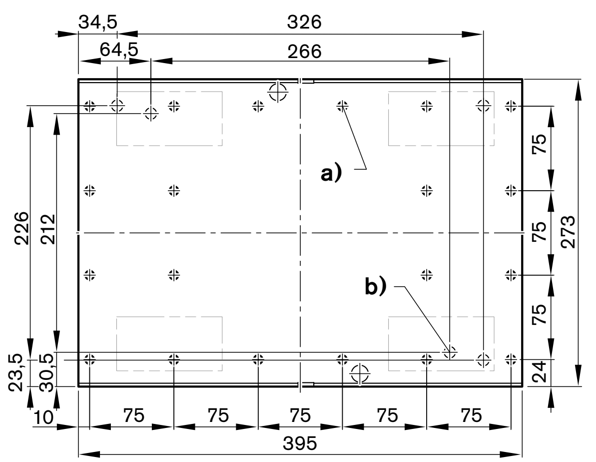


- **a)** M8 - min. 12 deep (24x)
- **b)** 10^{H7} - 20 deep (5x)
- **c)** One-point lubrication connection via funnel-type lube nipple DIN3405 AM8x1 on both sides
- **d)** Mounting hole pattern for power cable chain
- **e)** Return cooling connection for hose Ø8 mm
- **f)** Supply cooling connection for hose Ø8 mm
- **g)** Measuring system flange socket
- **h)** Motor flange socket
- **i)** Air connection M5 clamping unit
- **j)** Air filter clamping unit M5

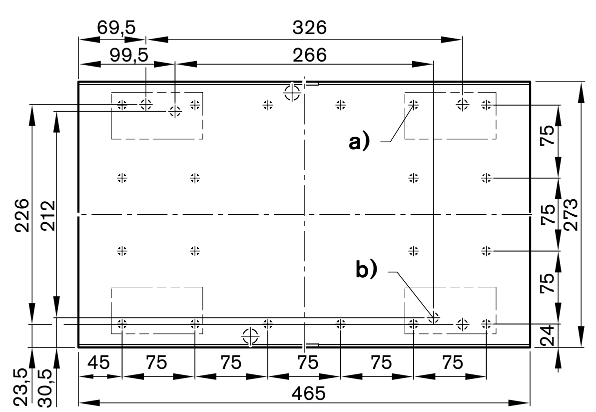
Switch assembly, see section "Switching system"

s_{max}	= maximum travel range	(mm)
s_{eff}	= effective stroke	(mm)
s_e	= excess travel	(mm)

Mounting hole pattern for carriage length $L_{ca} = 395$



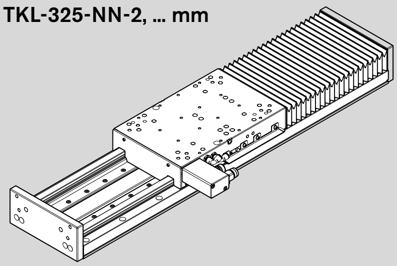
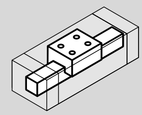
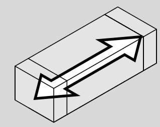
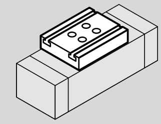
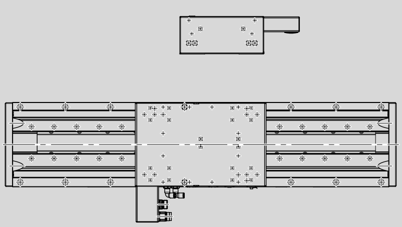
Mounting hole pattern for carriage length $L_{ca} = 465$



Length L (mm)	Counterbored mounting hole spacing			Max. travel (mm) for version with bellows and carr. length L_{ca}		without bellows and carr. length L_{ca}	
	F	G x 120	F	395	465	395	465
580	50	4 x 120	50	122	-	111	-
640	20	5 x 120	20	175	113	171	101
700	50	5 x 120	50	228	166	231	161
760	20	6 x 120	20	282	219	291	221
820	50	6 x 120	50	335	273	351	281
880	20	7 x 120	20	388	326	411	341
940	50	7 x 120	50	441	379	471	401
1000	20	8 x 120	20	494	432	531	461
1060	50	8 x 120	50	547	485	591	521
1120	20	9 x 120	20	601	539	651	581
1180	50	9 x 120	50	654	592	711	641
1240	20	10 x 120	20	707	645	771	701
1300	50	10 x 120	50	760	698	831	761
1360	20	11 x 120	20	813	751	891	821
1420	50	11 x 120	50	867	805	951	881
1480	20	12 x 120	20	920	858	1011	941
1540	50	12 x 120	50	973	911	1071	1001
1600	20	13 x 120	20	1026	964	1131	1061
1660	50	13 x 120	50	1079	1017	1191	1121
1720	20	14 x 120	20	1133	1071	1251	1181
1780	50	14 x 120	50	1186	1124	1311	1241
1840	20	15 x 120	20	1239	1177	1371	1301
1900	50	15 x 120	50	1292	1230	1431	1361
1960	20	16 x 120	20	1345	1283	1491	1421
2020	50	16 x 120	50	1399	1336	1551	1481
2080	20	17 x 120	20	1452	1390	1611	1541
2140	50	17 x 120	50	1505	1443	1671	1601
2200	20	18 x 120	20	1558	1496	1731	1661
2260	50	18 x 120	50	1611	1549	1791	1721
2320	20	19 x 120	20	1665	1602	1851	1781
2380	50	19 x 120	50	1718	1656	1911	1841
2440	20	20 x 120	20	1771	1709	1971	1901
2500	50	20 x 120	50	1824	1762	2031	1961
2560	20	21 x 120	20	1877	1815	2091	2021
2620	50	21 x 120	50	1930	1868	2151	2081
2680	20	22 x 120	20	1984	1922	2211	2141
2740	50	22 x 120	50	2037	1975	2271	2201
2800	20	23 x 120	20	2090	2028	2331	2261
2860	50	23 x 120	50	2143	2081	2391	2321
2920	20	24 x 120	20	2196	2134	2451	2381
2980	50	24 x 120	50	2250	2188	2511	2441
3040	20	25 x 120	20	2303	2241	2571	2501
3100	50	25 x 120	50	2356	2294	2631	2561
3160	20	26 x 120	20	2409	2347	2691	2621
3220	50	26 x 120	50	2462	2400	2751	2681
3280	20	27 x 120	20	2516	2454	2811	2741
3340	50	27 x 120	50	2569	2507	2871	2801
3400	20	28 x 120	20	2622	2560	2931	2861
3460	50	28 x 120	50	2675	2613	2991	2921
3520	20	29 x 120	20	2728	2666	3051	2981
3580	50	29 x 120	50	2782	2719	3111	3041
3640	20	30 x 120	20	2835	2773	3171	3101
3700	50	30 x 120	50	2888	2826	3231	3161
3760	20	31 x 120	20	2941	2879	3291	3221
3820	50	31 x 120	50	2994	2932	3351	3281
3880	20	32 x 120	20	3047	2985	3411	3341
3940	50	32 x 120	50	3101	3039	3471	3401

TKL-325

Configuration and ordering

Part number, length **TKL-325-NN-2, ... mm** 	**Version**	**Type**	**Guideway** 	**Drive**  **Motor winding**		**Carriage**  **Ball Runner Blocks High Precision** **$V_{max} \leq 5$ m/s1)** **Preload** **8% C**	
				190	**250**		
with integrated measuring system 	IM01	Primary part A $L_{ca} = 475$	03	06		02	
		Primary part B $L_{ca} = 625$	03		17	12	
		Primary part C $L_{ca} = 775$	03	26		22	

L_{ca} = carriage length
NC = normally closed
NO = normally open

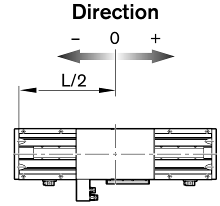
1) Other influencing factors with regard to the speed include: Motor, supply voltage, measuring system etc.
2) Recommended standard configuration: 2 proximity sensors (normally closed)
3) Switches are delivered as separate parts.
4) HIPERFACE® is a registered trademark of SICK STEGMANN GmbH.

	Cover: PU bellows with	Cover: PU bellows without	Position measuring system: Integrated Measuring System Absolute IMS-A (Hiperface[4])	End position damping: with cushioning	End position damping: with cushioning/ with clamping unit	Documentation: Standard report	Documentation: Special report
		05	25	11	21	01	02 Friction force; 04 Travel accuracy; 05 Positioning accuracy
	01			12	22		
	01		25	11	21		
		05		12	22		
	01		25	11	21		
		05		12	22		

Switching system[2]

Without switch	
without switch	00
without switch tab	00
With proximity sensor[3]	
PNP - NC, plug M8 x 1	111
NPN - NC, plug M8 x 1	112
PNP - NO, plug M8 x 1	113
NPN - NO, plug M8 x 1	114
Switching cam	16
With mechanical switch[3]	
PNP - NC, plug M8 x 1	116
NPN - NC, plug M8 x 1	117
PNP - NO, plug M8 x 1	118
NPN - NO, plug M8 x 1	119
Switching cam	16
Cable duct	
without cable duct	00
with cable duct	20

Direction



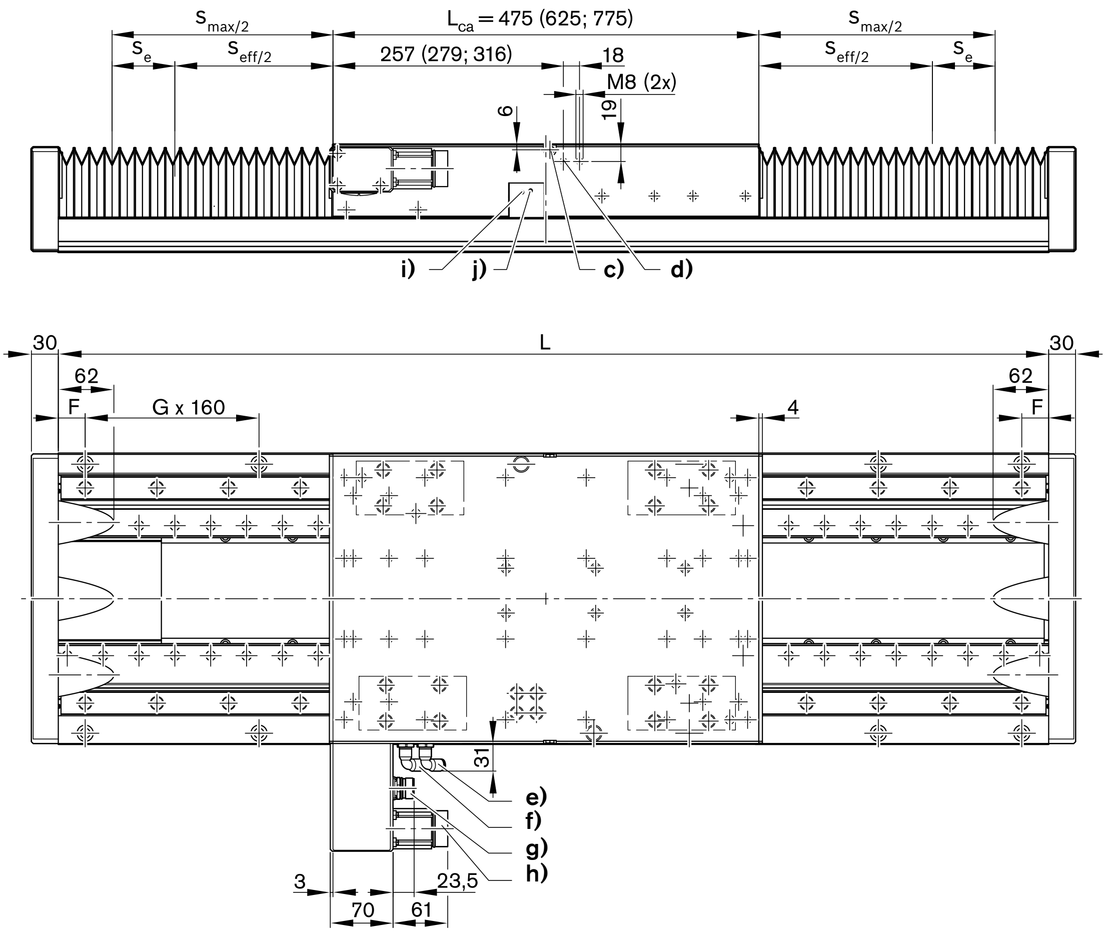
External switch

Travel distance: Effective travel distance = max. travel - 2 • excess travel

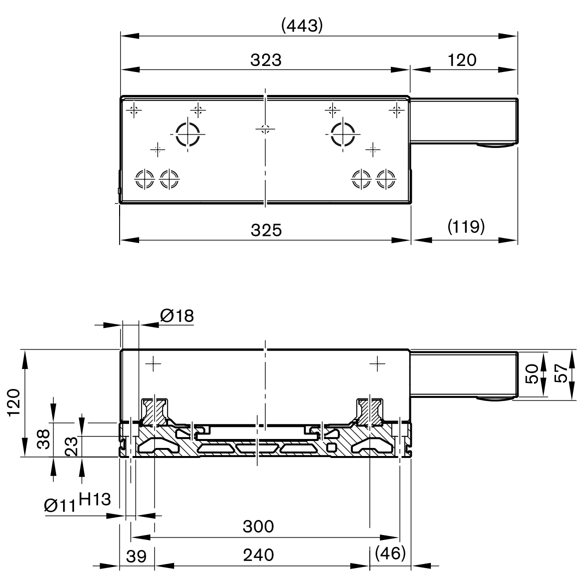
Switch activation point: Is the distance between the center of the base plate and the center of the carriage (specified in mm). Maximum switching distance = 0.5 • travel distance max. - excess travel

Excess travel: Excess travel must be greater than braking distance. To cushion the moved mass and reduce the excess travel, customers should install separate shock absorbers at the load center of gravity where required. The support is provided at the customer's site on the machine frame.

TKL-325 Dimension drawing



View of end face

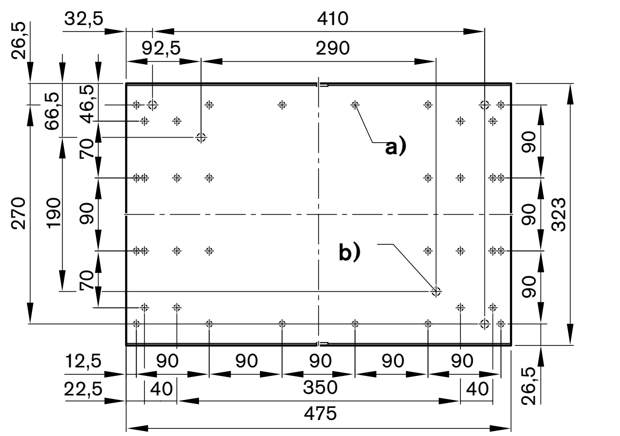


a) M8 - min. 12 deep (24x)
b) 10^{H7} - 20 deep (5x)
c) One-point lubrication connection via funnel-type lube nipple DIN3405 AM8x1 on both sides
d) Mounting hole pattern for power cable chain
e) Return cooling connection for hose Ø8 mm
f) Supply cooling connection for hose Ø8 mm
g) Measuring system flange socket
h) Motor flange socket
i) Air connection M5 clamping unit
j) Air filter clamping unit M5

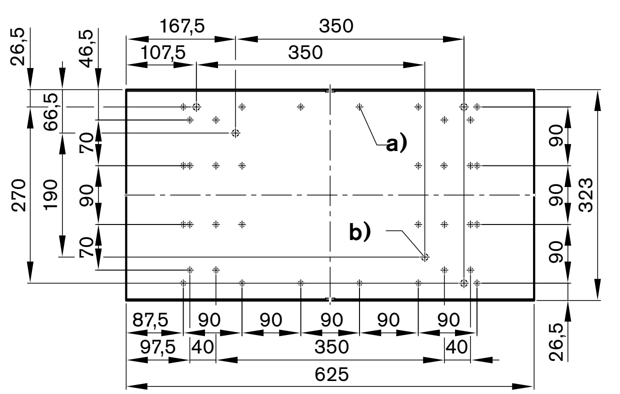
Switch assembly, see section “Switching system”

s_{max}	= maximum travel range	(mm)
s_{eff}	= effective stroke	(mm)
s_e	= excess travel	(mm)

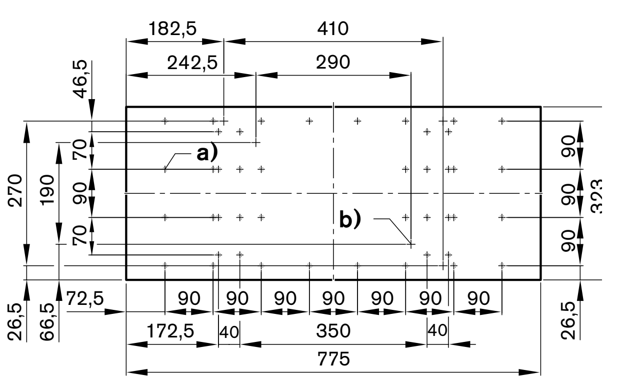
Mounting hole pattern for carriage length $L_{ca} = 475$



Mounting hole pattern for carriage length $L_{ca} = 625$



Mounting hole pattern for carriage length $L_{ca} = 775$



Length L (mm)	Counterbored mounting hole spacing			Max. travel (mm) for version with bellows and carriage length L_{ca}			without bellows and carriage length L_{ca}		
	F	G x 160	F	475	625	775	475	625	775
700	30	4 x 160	30	157	-	-	-	-	-
780	70	4 x 160	70	228	-	-	163	-	-
860	30	5 x 160	30	299	166	-	243	-	-
940	70	5 x 160	70	370	237	-	323	173	-
1020	30	6 x 160	30	441	308	175	403	253	-
1100	70	6 x 160	70	512	379	246	483	333	183
1180	30	7 x 160	30	583	450	317	563	413	263
1260	70	7 x 160	70	654	521	388	643	493	343
1340	30	8 x 160	30	725	592	459	723	573	423
1420	70	8 x 160	70	796	663	530	803	653	503
1500	30	9 x 160	30	867	734	601	883	733	583
1580	70	9 x 160	70	938	805	672	963	813	663
1660	30	10 x 160	30	1008	875	743	1043	893	743
1740	70	10 x 160	70	1079	946	813	1123	973	823
1820	30	11 x 160	30	1150	1017	884	1203	1053	903
1900	70	11 x 160	70	1221	1088	955	1283	1133	983
1980	30	12 x 160	30	1292	1159	1026	1363	1213	1063
2060	70	12 x 160	70	1363	1230	1097	1443	1293	1143
2140	30	13 x 160	30	1434	1301	1168	1523	1373	1223
2220	70	13 x 160	70	1505	1372	1239	1603	1453	1303
2300	30	14 x 160	30	1576	1443	1310	1683	1533	1383
2380	70	14 x 160	70	1647	1514	1381	1763	1613	1463
2460	30	15 x 160	30	1718	1585	1452	1843	1693	1543
2540	70	15 x 160	70	1789	1656	1523	1923	1773	1623
2620	30	16 x 160	30	1860	1727	1594	2003	1853	1703
2700	70	16 x 160	70	1930	1797	1665	2083	1933	1783
2780	30	17 x 160	30	2001	1868	1735	2163	2013	1863
2860	70	17 x 160	70	2072	1939	1806	2243	2093	1943
2940	30	18 x 160	30	2143	2010	1877	2323	2173	2023
3020	70	18 x 160	70	2214	2081	1948	2403	2253	2103
3100	30	19 x 160	30	2285	2152	2019	2483	2333	2183
3180	70	19 x 160	70	2356	2223	2090	2563	2413	2263
3260	30	20 x 160	30	2427	2294	2161	2643	2493	2343
3340	70	20 x 160	70	2498	2365	2232	2723	2573	2423
3420	30	21 x 160	30	2569	2436	2303	2803	2653	2503
3500	70	21 x 160	70	2640	2507	2374	2883	2733	2583
3580	30	22 x 160	30	2711	2578	2445	2963	2813	2663
3660	70	22 x 160	70	2782	2649	2516	3043	2893	2743
3740	30	23 x 160	30	2852	2719	2586	3123	2973	2823
3820	70	23 x 160	70	2923	2790	2657	3203	3053	2903
3900	30	24 x 160	30	2994	2861	2728	3283	3133	2983
3980	70	24 x 160	70	3065	2932	2799	3363	3213	3063

Linear motor

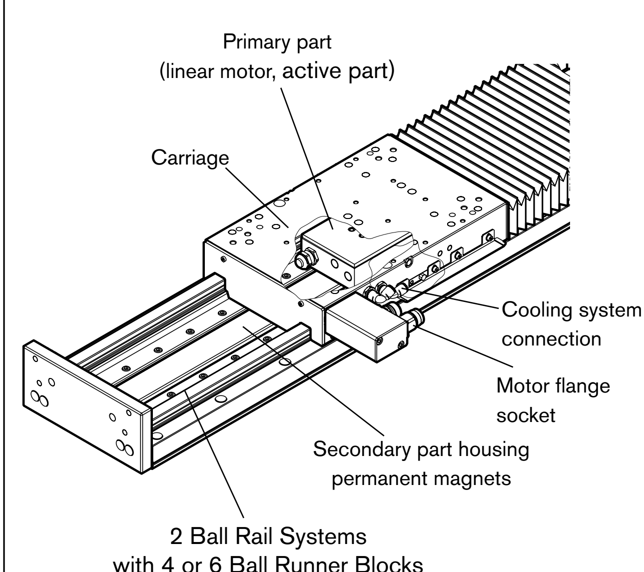
Description
The drive-related key component of the Ball Rail Table TKL is the iron-core Linear Motor MLF.
The thrust with the synchronous linear motor is generated in the same way as the torque is generated on rotary synchronous motors.

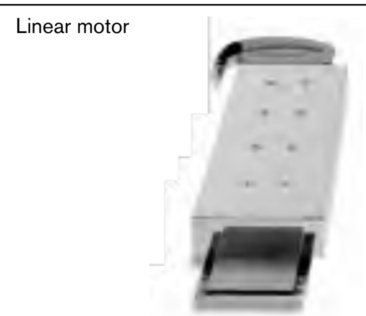
The primary part (active part) carries a three-phase winding, the secondary part (passive part) carries permanent magnets.
Two Ball Rail Systems support and guide the primary part and its load. The secondary parts are mounted on the base plate.

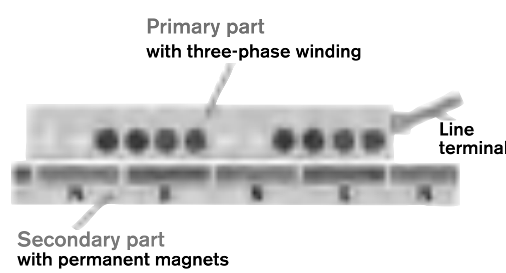
The primary part and the secondary part do not come into contact with each other.

The forces and torques originating from the payload are transferred exclusively to the Ball Rail System.
Unlike rotary drive systems, the linear motor comprises no internal moving parts and is consequently low-wearing and low-maintenance. It also eliminates the need for additional rotary-to-linear conversion mechanisms.

Due to the associated high static and dynamic load rigidity, the control accuracy and positioning behavior over the entire drive service life is unrivaled.



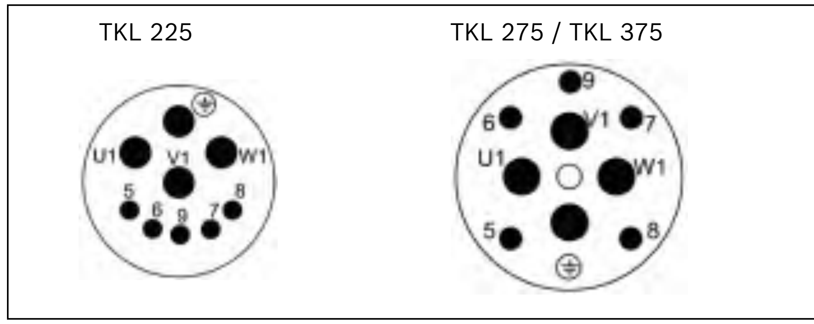




The linear direct drive technology is an optimal alternative in many cases and offers distinct advantages:
- High speed and acceleration
- Outstanding control accuracy and positioning behavior
- Direct force generation - no mechanical transfer elements (like a ball screw drive, toothed belt, toothed rack etc.)
- Low-maintenance drive (no wearing parts on the motor)
- Compact machine design
- High static and dynamic load rigidity

Motor flange socket pin assignment

Pin no.	
U1	A1
V1	A2
W1	A3
4	PE
5[1)]	SNM 150 DK +
6[1)]	SNM 150 DK -
7	n.c.
8	n.c.
9	n.c.



1) Motor temperature monitoring:
The primary parts are equipped with integrated temperature sensors for motor protection as standard.
Each motor phase contains one of three ceramic resistors (PTC) connected in series to enable thermal monitoring of the motor in all operating phases. These temperature sensors have a switching characteristic and are evaluated on all Rexroth drive control devices.

Motor flange socket technical data

Plug size	M23	M40
Enclosure	IP67	
Contact type	Pins	
Rated voltage	630 V/125 V	
Rated current	23 A	57 A
Degree of contamination	3	
Overvoltage category	III (DIN VDE 0110)	
Corresponding wiring box	RLS1101	RLS1201

Cooling circuit connection

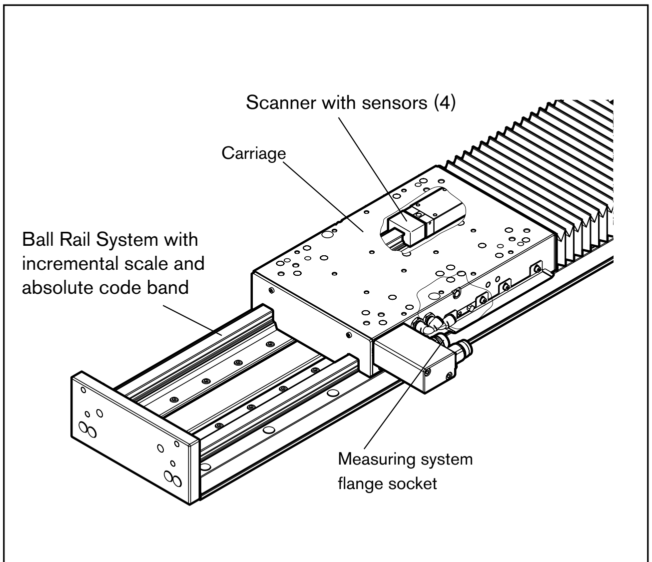
– Connect the cooling circuit on the carriage of the TKL
– Maximum pressure +10 bar must be observed
– The cooling lubricant inlet temperature must be max. 5 K below the ambient temperature.
– Only use suitable coolant additives (e. g. Aquaplus 22 / Petrofer)
– Observe the documentation for the motor and cooling unit

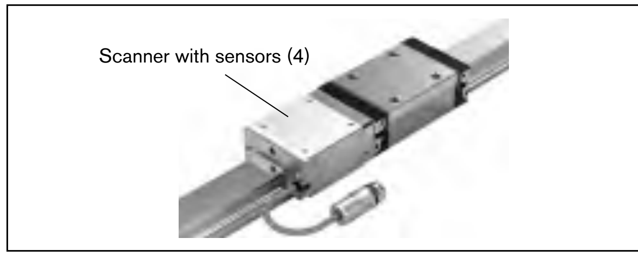
☞ Further instructions are available in the documentation for the linear motor

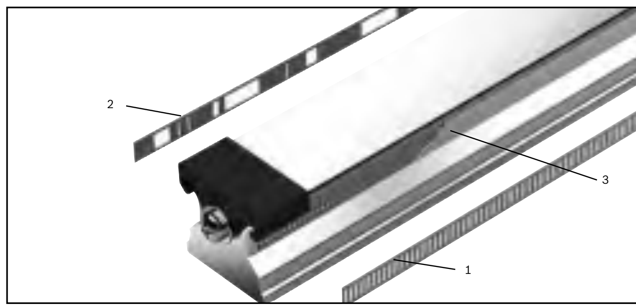
Position measuring system

Description

The key measurement component of the Ball Rail Table TKL is the Integrated Absolute Measuring System (IMS-A) from Rexroth. Integrating the measuring technology into the linear guide results in a mechatronic system which combines the ability to guide mechanical loads and to measure length in one product.







The Integrated Absolute Measuring System (IMS-A) consists of the scanner (4), the incremental scale (1) and the absolute code band (2). The scanner with sensors is mounted on the Runner Block.
As it travels over them, it evaluates the incremental scale and the absolute code band integrated in the rail.
The scales are protected by a hermetically sealed welded stainless steel band (3).

Highlights

- The guide and measuring system form a unit
- No additional space required
- No measuring inaccuracies due to deviations in parallelism between the measuring system and the guideway
- Position measurement directly at the workpiece/tool
- Protection class IP67 (only for the measuring system)
- The inductive measuring principle allows for non-contact measurement
- Contact-free scanning ensures zero maintenance
- Insusceptible to magnetic fields
- High resolution thanks to 40 µm signal period
- Precise, absolute positioning by an additional absolute code band
- No battery necessary for buffering the absolute information

Measuring system flange socket pin assignment

Pin no.	Signal assignment	Function
1	Inner shield	Inner cable shield
2	A +	Analog/digital path information
3	A –	
4	GND	Power supply GND
5	B +	Analog/digital path information
6	B –	
7	Data +	IMS-A: HIPERFACE®
8	Data –	
9	n.c.	
10	n.c.	
11	VDD	Power supply VDD
12	n.c.	
13	n.c.	
14	n.c.	
15	0 V Sense	Sense line* GND
16	5 V Sense	Sense line* VDD
17	n.c.	
Housing	Outer shield	Outer shield contacted via connector housing

Technical data measuring system flange socket

Plug size	M17
Enclosure	IP67
Contact type	Pins
Rated voltage	60 V
Rated current	3.6 A
Degree of contamination	3
Overvoltage category	III
Corresponding wiring box	RGS1711

Accuracy IMS-A

Accuracy class scale (μm/m)	± 5
Interpolation accuracy scanner (μm)	± 0.75
Repeatability scanner (μm)	± 0.25

Interface IMS-A

Signal	HIPERFACE[1)]
Resolution of the digital interface (μm)	1.25
Dissolvability of the 1 V_{SS} / 40μm signal (μm)	0.025

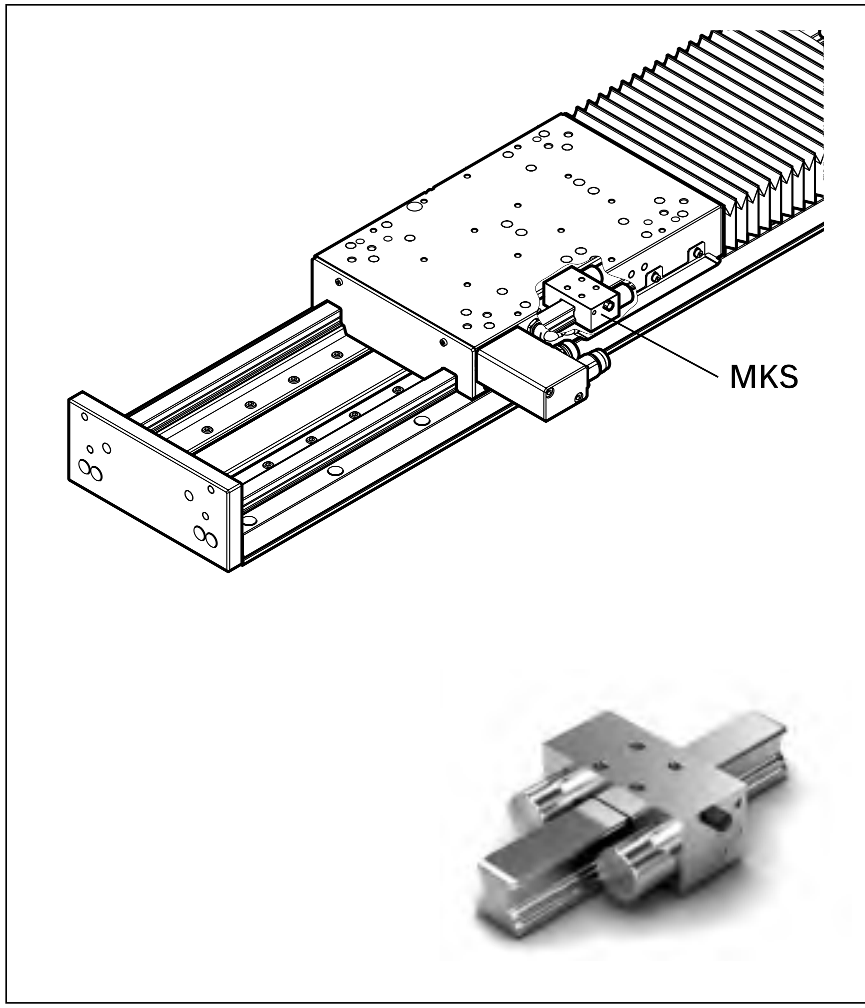
1) HIPERFACE® is a registered trademark of SICK STEGMANN GmbH.

☞ Further instructions are available in the documentation for the Integrated Measuring System

Clamping unit

Carriage with clamping unit

On carriages with an integrated clamping unit, the air ports are located on the longitudinal side of the carriage.



Clamping unit (MKS)

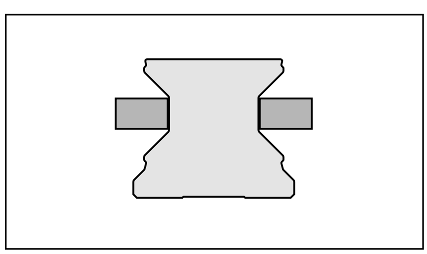
The clamping unit is used exclusively for clamping linear axes (static holding)

Owing to the spring energy accumulator, it is closed in the deenergized condition (NC).

The clamping unit is usable as a proven component in connection with a suitable function test and in category 1 controls as per DIN EN ISO 13849-1:2006.

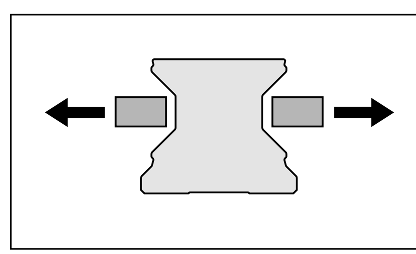
For further instructions and information, please refer to the documentation for this product (clamping unit MKS).

⚠ **The clamping unit must only be used when the axis is at a standstill.**
The clamping unit may not be used as a braking unit!
Use for the emergency braking of a moving weight is not permissible.
Clamping during movement may lead to the destruction of the clamping unit as well as the linear guide!



Air pressure: 0 bar

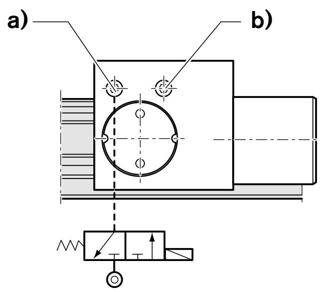
Clamps with spring force
In the event of pressure drop, the clamping profiles are pressed onto the guide rail by a spring energy accumulator.
A quick-release valve for short reaction times is required.



Air pressure: 5.5 - 6.5 bar

Decompression with air pressure
The clamping profiles are held apart by the compressed air.
– Free movement is possible

Circuitry[1] for standard air port



a) Air port M5
b) Air filter
Nominal diameter min. 6 mm
for TKL -225 min. 4 mm

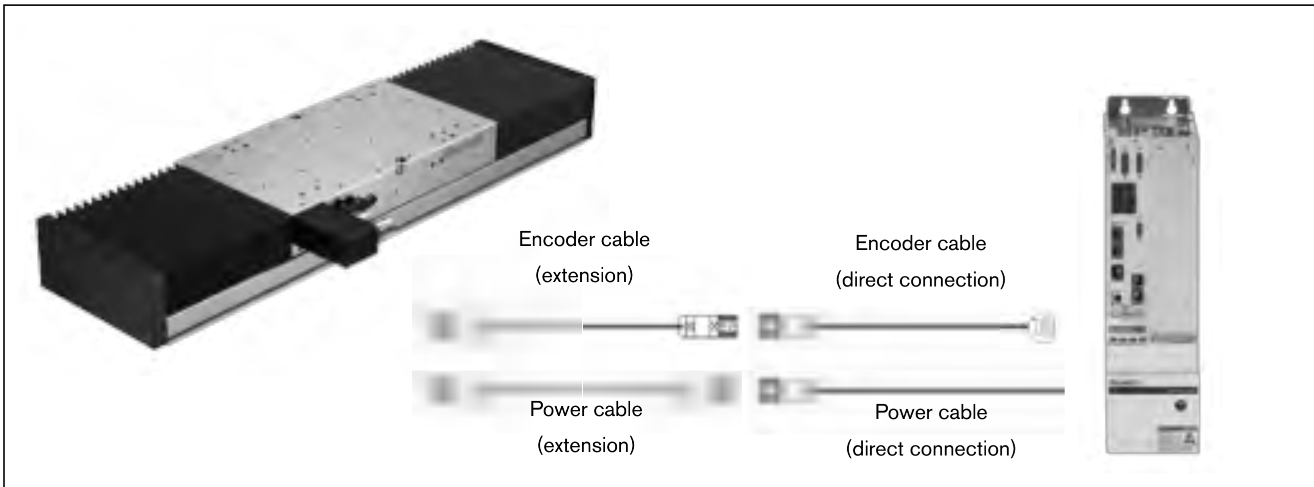
Size	TKL-225	TKL-275	TKL-325
Holding force spring mechanism[1)2)]	600 N	750 N	1050 N
Pressure min. (release pressure)	5.5 bar		
Operating pressure	6.0 bar		
Max. pressure	6.5 bar		
Spring energy accumulator	✓		
Clamping cycles	up to 5 mill. (B10d-value)[3)]		
Braking cycles	Not suitable		
Air port	Ø 4 mm		
Actuation	Pneumatic		
theor. air consumption per cycle at 6 bar	19 cm^3	21 cm^3	31 cm^3
Air quality	oiled air in accordance with ISO 8573-1 class 4, filter size 25 µm		

1) Static holding of the carriage with axial forces up to each specified value.
2) Holding force achieved by spring energy. The inspection is done in ready-mounted state with a lubricated layer (ISO-VG 68) on a hardened steel rail. Using other lubricants can impact the friction coefficient and thus the holding force.
3) The B10d-value specifies the number of switching cycles until 10% of components fail dangerously.

Connection overview

To connect a Ball Rail Table TKL to a Rexroth drive controller HCS, at least 2 prefabricated cables (power cable, encoder cable) are required. Extensions can also be used where necessary (e.g. routing in the cable drag chain).

The cooling hoses must also be taken into account with liquid cooling, the air hoses if a clamping unit is used and the electric cables if a switch is installed .



Power Cable

TKL	Motor	Rexroth Drive controller	Cable designation (raw cable) Extension	Direct connection	Cross-section
TKL-225	MLP040A-0300	HCS02.1E-W0012/28	RKL4305 (INK 0653)	RKL4302 (INK 0653)	1.0 mm²
		HCS02.1E-W0054		RKL4303 (INK 0653)	
	MLP040B-0250	HCS02.1E-W0012/28		RKL4302 (INK 0653)	
		HCS02.1E-W0054		RKL4303 (INK 0653)	
TKL-275	MLP070A-0300	HCS02.1E-W0012/28	RKL4311 (INK 0650)	RKL4306 (INK 0650)	1.5 mm²
		HCS02.1E-W0054/70		RKL4307 (INK 0650)	
	MLP070B-0250	HCS02.1E-W0012/28		RKL4306 (INK 0650)	
		HCS02.1E-W0054/70		RKL4307 (INK 0650)	
TKL-325	MLP100A-0190	HCS02.1E-W0012/28	RKL4311 (INK 0650)	RKL4306 (INK 0650)	1.5 mm²
		HCS02.1E-W0054/70		RKL4307 (INK 0650)	
	MLP100B-0250	HCS02.1E-W0054/70	RKL4312 (INK 0602)	RKL4309 (INK 0602)	2.5 mm²
		HCS03.1E-W0100/150		RKL4310 (INK 0602)	
	MLP100C-0190	HCS02.1E-W0054/70	RKL4316 (INK 0603)	RKL4314 (INK 0603)	4.0 mm²
		HCS03.1E-W0100/150		RKL4315 (INK 0603)	

Encoder cables

TKL (position measuring system)		Rexroth drive controller	Cable designation (raw cable) Extension	Direct connection
-225 / -275 / -325	IMS-A (HIPERFACE[1])	Multi-encoder interface EC	RKG0057 (REG 0011)	RKG0055 (REG 0011)

1) HIPERFACE® is a registered trademark of SICK STEGMANN GmbH.

Technical data raw cables

Raw cable	Cross-section power cores (mm²)	Diameter D (mm²)	Weight of chain (kg/m)	Use E-chain	Bending radius Fixed	Flexible	Bending cycles[1)2)]
INK 0653	1.0	12.0 ± 0.5	0.250	yes	5 x D	7.5 x D	5 million
INK 0650	1.5	12.2 ± 0.5	0.275				
INK 0602	2.5	14.8 ± 1.0	0.380				
INK 0603	4.0	17.0 ± 0.5	0.490				
REG 0011	–	10.0 ± 0.3	0.027		4 x D	7.5 x D	

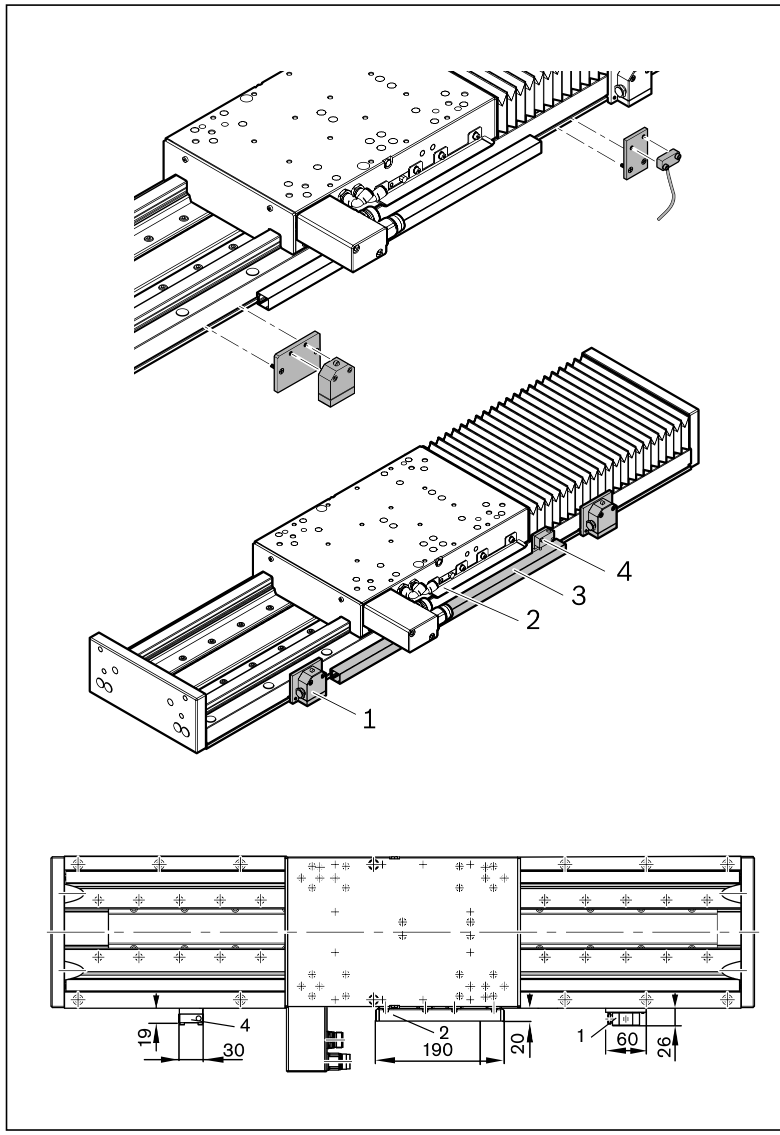
1) Drag chain parameters: Acceleration max. 10m/s²; travel speed max. 5m/s; travel distance horizontal max. 50 m (maximum values only valid individually)
2) Changes to the above parameters (acceleration, speed, travel distance) will affect the service life of the cable or the number of bending cycles! Please consult us.

☞ Further instructions are available in the documentation for the linear motor, the drive controller and the connection cables.

Switching system

Overview

Item	
1	Mechanical switch (with additional components)
2	Switching cam
3	Cable duct (length max. 4m)
4	Proximity switch (with additional components)

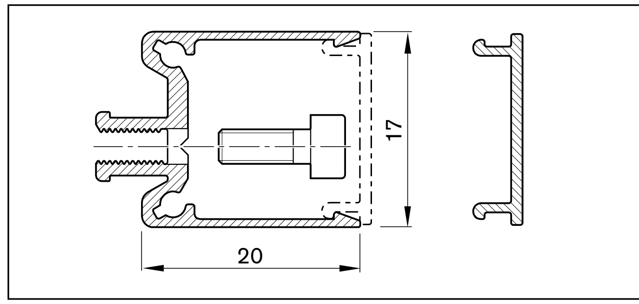


Switching point distance

Distance between switch activation points of two switches **For switch combination**	**Min. spacing** (mm)
mechanical - mechanical	60
mechanical - proximity	45
proximity - proximity	12.5

Cable duct

- The cable duct holds a maximum of two cables for mechanical switches and three cables for proximity switches.
- The duct is fixed by being clipped into the T-slot on the table and is secured by tightening the fixing screws.
- The fixing screws and cable grommets are supplied with the duct.

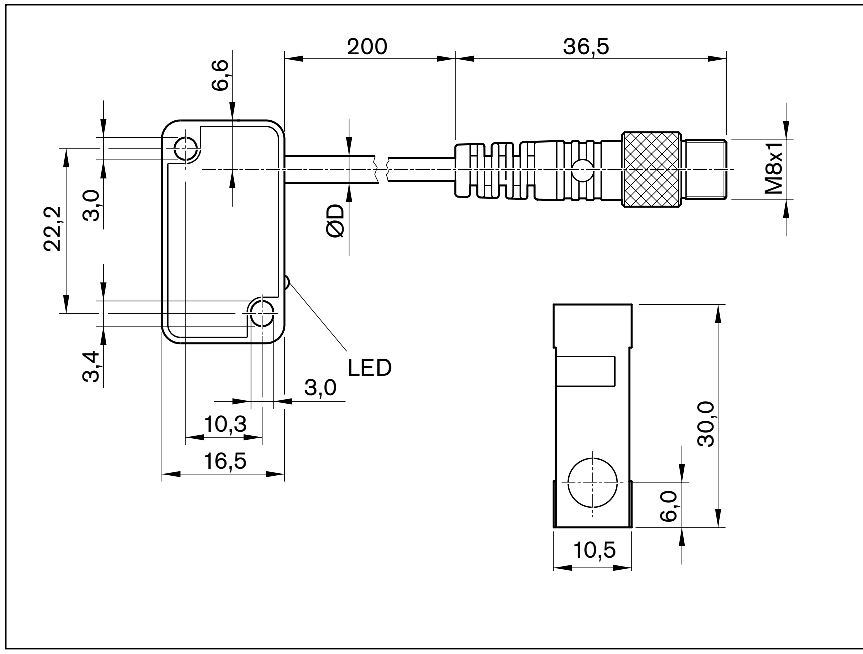


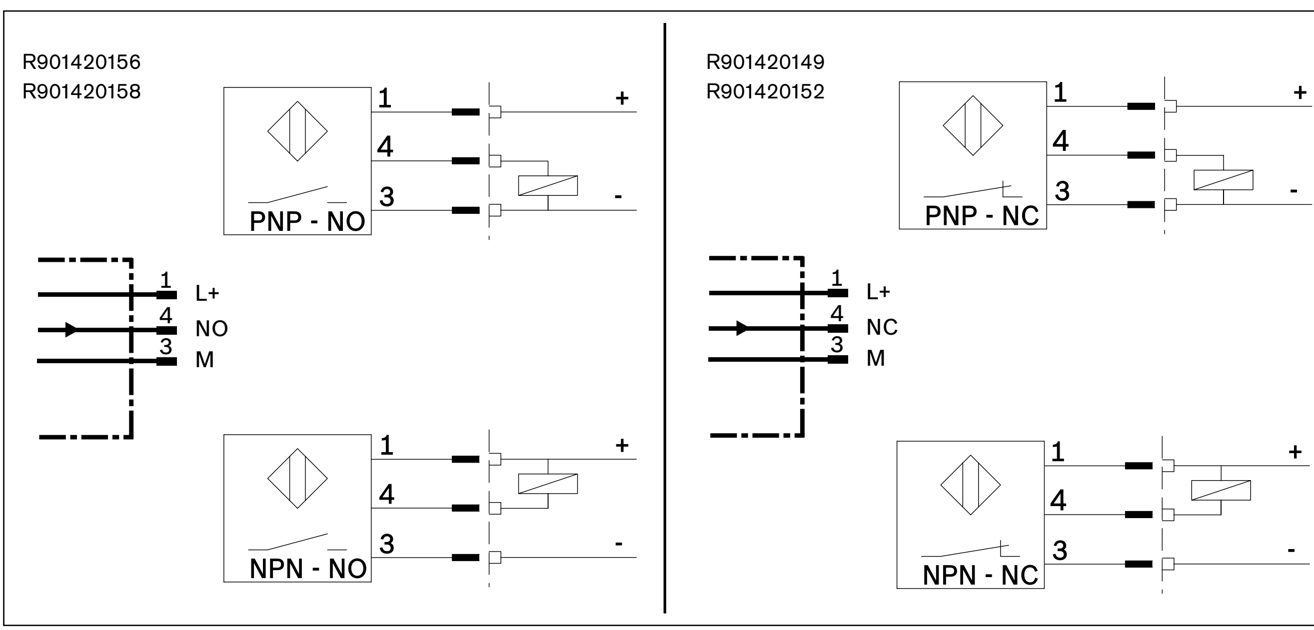
Switches and attachments

Item		Part number
1	Mechanical switches	see section on switches
	– Mounting components without switch	R117500165
2	Switching cam	R117500150
3	Cable duct (length max. 4 m)	R039662017, length .... mm
4	Proximity sensors	see section on sensors
	– Attachment parts (without sensors)	R117520152

Sensors

Proximity sensor with M8x1 plug





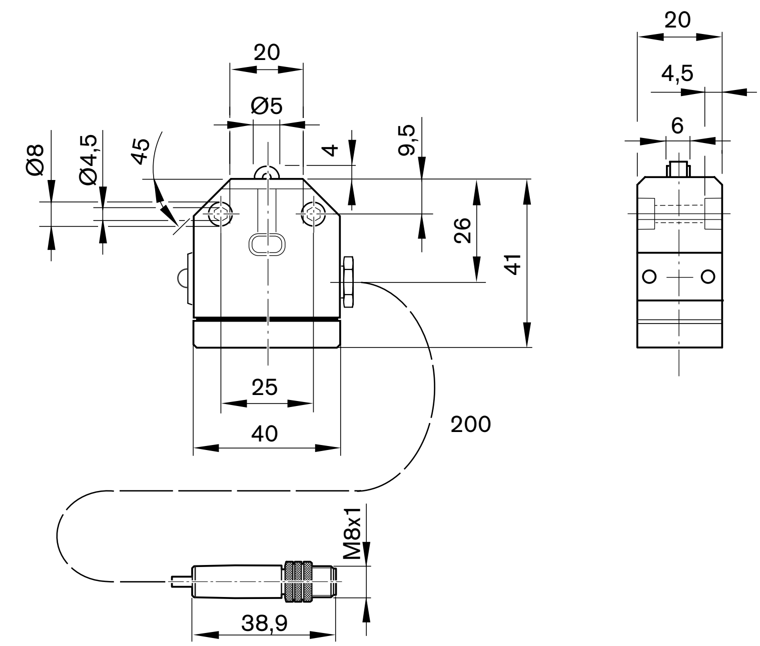
Part numbers / technical data

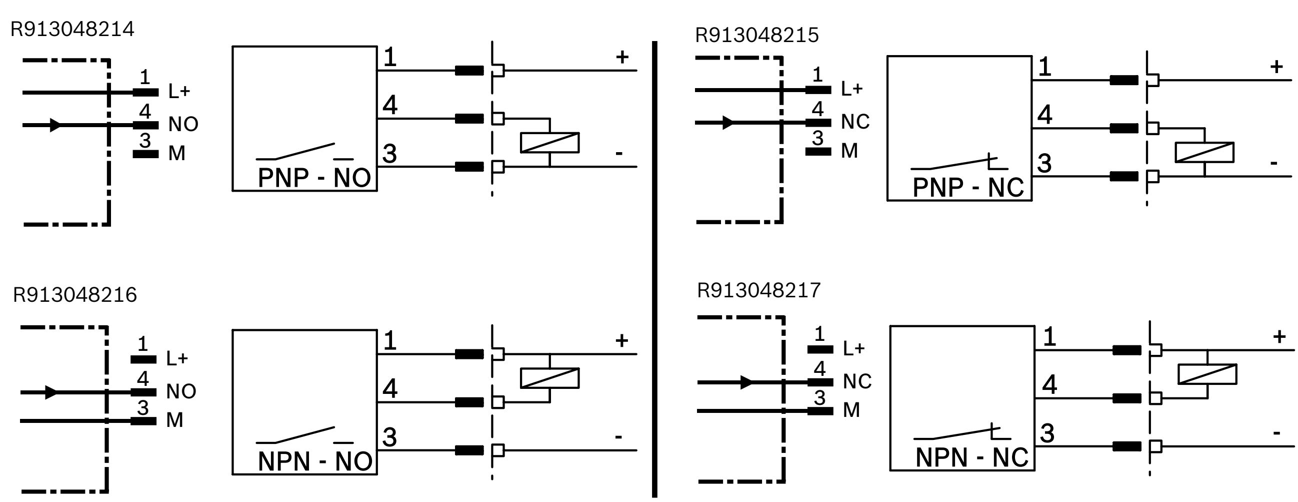
Use	Limit switch	Reference switch	Limit switch	Reference switch
Part number	R901420149	R901420156	R901420152	R901420158
Designation	BES 517-351-NO-C-S49-00.2	BES 517-398-NO-C-S49-00.2	BES 517-352-NO-C-S49-00.2	BES 517-399-NO-C-S49-00.2
Functional principle	inductive			
Operating voltage	10–30 V DC			
Load current	≤ 200 mA			
Switching function	PNP/normally closed (NC)	PNP/normally open (NO)	NPN/normally closed (NC)	NPN/normally open (NO)
Connection type	Cable 0.2 m and plug M8 x 1, 3-pin with knurled screw			
Function indicator	✓			
Short-circuit protection	✓			
Reverse polarity protection	✓			
Switching frequency	2.5 kHz			
Max. permissible approach speed	depending on the switch tab			
Suitable for drag chains1)	–			
Torsion-resistant1)	–			
Weld spark-resistant1)	–			
Cable cross-section1)	3x0.14 mm^2			
Cable diameter D1)	3.5 ±0.15 mm			
Static bending radius1)	12 mm			
Dynamic bending radius1)	12 mm			
Bending cycles1)	–			
Ambient temperature	-40 °C to +70 °C			
Enclosure	IP65			
MTTFd (acc. to EN ISO 13849-1)	MTTFd = 830 years		MTTFd = 585 years	
Certifications and approvals2)	CE, cULus LISTED, RoHS			

1) Technical data only for the cast-on connection line at the proximity sensor.
Extension cables are available for even more performance, e.g., for use in a power cable chain (see below).
2) No CCC certificate is required to introduce these products to the Chinese market.

Switches

Mechanical switch with M8x1 plug





Part numbers / technical data

Use	Limit switch	Reference switch	Limit switch	Reference switch
Part number	R913048215	R913048214	R913048217	R913048216
Designation	BNS 819-X1002-99-R-10	BNS 819-X1001-99-R-10	BNS 819-X1004-99-R-10	BNS 819-X1003-99-R-10
Functional principle	mechanical, roller			
Operating voltage	10 - 30 VDC			
Load current	≤ 200 mA			
Switching function	PNP/normally closed (NC)	PNP/normally open (NO)	NPN/normally closed (NC)	NPN/normally open (NO)
Connection type	Cable 0.2 m and plug M8 x 1, 3-pin with knurled screw			
Function indicator	–			
Short-circuit protection	–			
Reverse polarity protection	–			
Switching frequency	3.3 Hz			
Max. perm. approach speed	1 m/s			
Suitable for drag chains[1)]	–			
Torsion-resistant[1)]	–			
Weld spark-resistant[1)]	–			
Cable cross-section[1)]	3x0.14 mm^2			
Cable diameter D[1)]	4.3 ±0.2 mm			
Static bending radius[1)]	12 mm			
Dynamic bending radius[1)]	12 mm			
Bending cycles[1)]	–			
Ambient temperature	-5 °C to +70 °C			
Enclosure	IP65			
B10d value	5×10^6 (wet area); 10×10^6 dependent on current load (dry area)			
Certifications and approvals[2)]	CE CSA RoHS			

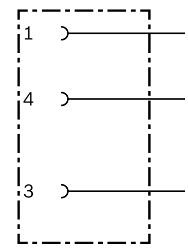
1) Technical data only for the cast-on connection line at the mechanical switch.
Extension cables are available for even more performance, e.g., for use in a power cable chain (see below).
2) No CCC certificate is required to introduce these products to the Chinese market.

Extensions

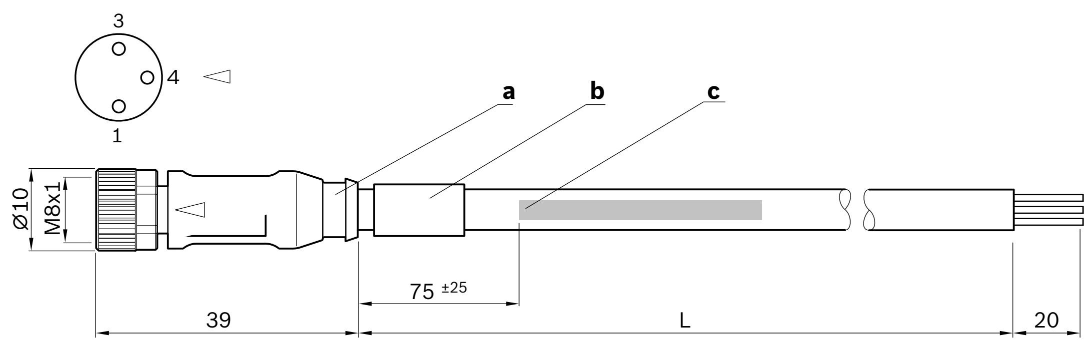
Pre-assembled on one side

Connection diagram

1 brown (BN) (+)
3 blue (BU) (–)
4 black (BK) (signal)



Dimension drawing



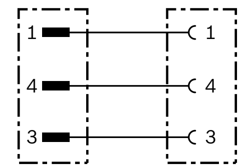
Part numbers			
Use	Extension cable		
Part number	R911344602	R911344619	R911344620
Designation	7000-08041-6500500	7000-08041-6501000	7000-08041-6501500
Length (L)	0.5 m	10.0 m	15.0 m
1. Connection type	M8x1 3-pole straight female connector		
2. Connection type	Free cable end		

a) Contour for 6.5 mm corrugated tube (inner diameter)
b) Cable grommet
c) Cable label in accordance with labeling regulation

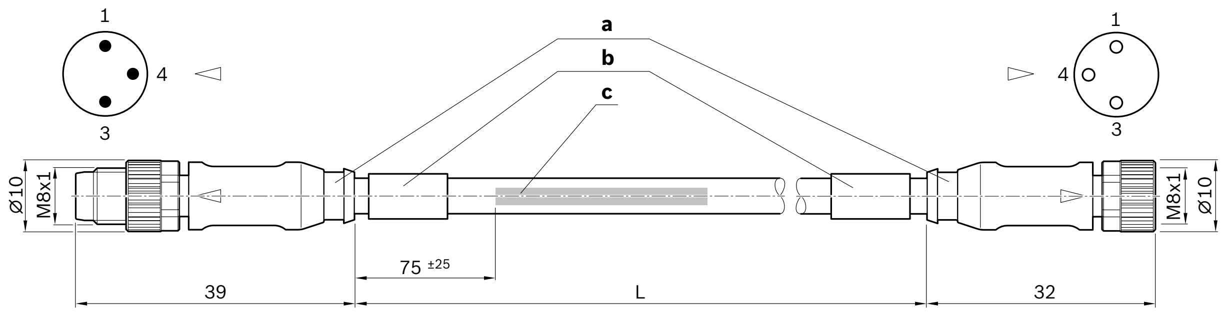
Pre-assembled on two sides

Connection diagram

1 brown (BN) (+)
3 blue (BU) (–)
4 black (BK) (signal)



Dimension drawing



Part numbers

Use	Extension cable				
Part number	R911344621	R911344622	R911344623	R911344624	R911344625
Designation	7000-88001-6500050	7000-88001-6500100	7000-88001-6500200	7000-88001-6500500	7000-88001-6501000
Length (L)	0.5 m	1.0 m	2.0 m	5.0 m	10.0 m
1. Connection type	M8x1 3-pole straight female connector				
2. Connection type	Straight plug, M8x1, 3-pin				

Technical data for extensions pre-assembled on one or two sides

Function indicator	–
Operating voltage indicator	–
Operating voltage	10–30 V DC
Type of cable	PUR black
Suitable for drag chains	✓
Torsion-resistant	✓
Weld spark-resistant	✓
Cable cross-section	3 x 0.25 mm^2
Cable diameter D	4.1 ±0.2 mm
Static bending radius	5xD
Dynamic bending radius	10xD
Bending cycles	> 10 mil.
Max. permissible travel speed	3.3 m/s - at 5 m travel range (type) up to 5 m/s at 0.9 m travel range
Max. permissible acceleration	30 m/s^2
Ambient temperature when secured	-40 °C to +85 °C
Ambient temperature when loose	-25 °C to +85 °C
Enclosure	IP68
Certifications and approvals	

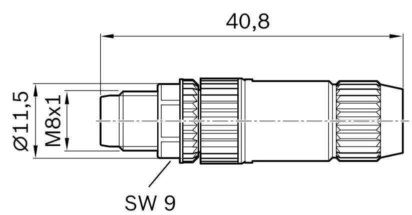
a) Contour for 6.5 mm corrugated tube (inner diameter)
b) Cable grommet
c) Cable label in accordance with labeling regulation

Extensions

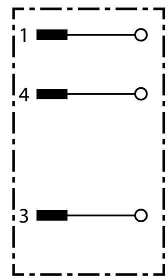
Plug


R901388333

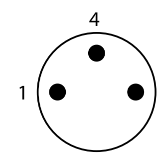
Dimension drawing



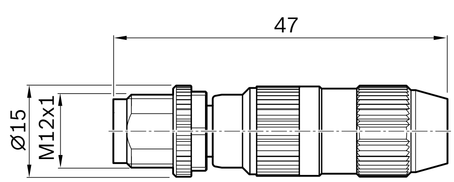
Connection diagram

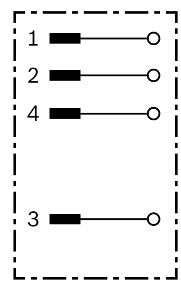


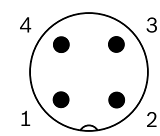
Connector side view




R901388352







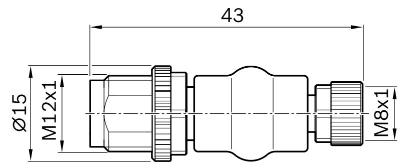
Part numbers / technical data

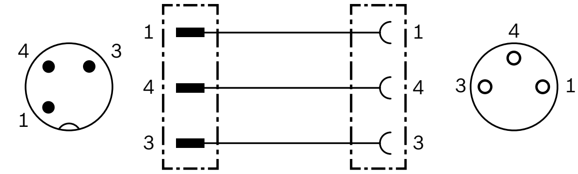
Use	Single plug	
Part number	R901388333	R901388352
Designation	7000-08331-0000000	7000-12491-0000000
Version	straight	
Operating current per contact	max. 4 A	
Operating voltage	max. 32 V AC/DC	
Connection type	Straight plug, M8x1, 3-pin, IDC, self-locking screw	Straight plug, M12x1, 4-pin, IDC, self-locking screw
Function indicator	-	
Operating voltage indicator	-	
Connection cross-section	0.14 ... 0.34 mm²	
Ambient temperature	-25 °C to +85 °C	
Enclosure	IP67 (plugged in & screwed down)	
Certifications and approvals	c UL us RoHS	

Adapter

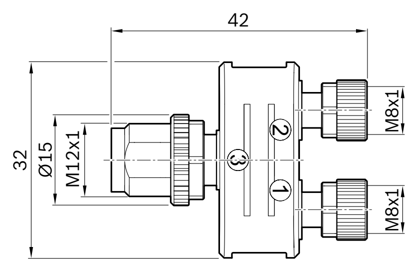
Dimension drawing | **Connection diagram**

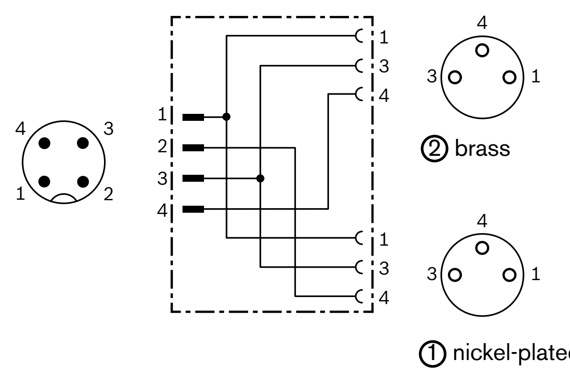
R911344591





R911344592





Part numbers / technical data

Use	Adapter	Adapter or distributor
Part number	R911344591	R911344592
Designation	7000-42201-0000000	7000-41211-0000000
Version	straight for 1 sensor	Straight, for 1 - 2 sensors
Operating current per contact	max. 4 A	
Operating voltage	max. 32 V AC/DC	
1. Connection type	Straight female connector, M8x1, 3-pin, self-locking screw thread	2 X straight female connectors, M8x1, 3-pin, self-locking screw thread
2. Connection type	Straight plug, M12x1, 3-pin, self-locking screw thread	Straight plug, M12x1, 4-pin, self-locking screw thread
Function indicator	–	
Operating voltage indicator	–	
Connection cross-section	–	
Ambient temperature	-25 °C to +85 °C	
Enclosure	IP67 (plugged in & screwed down)	
Certifications and approvals		

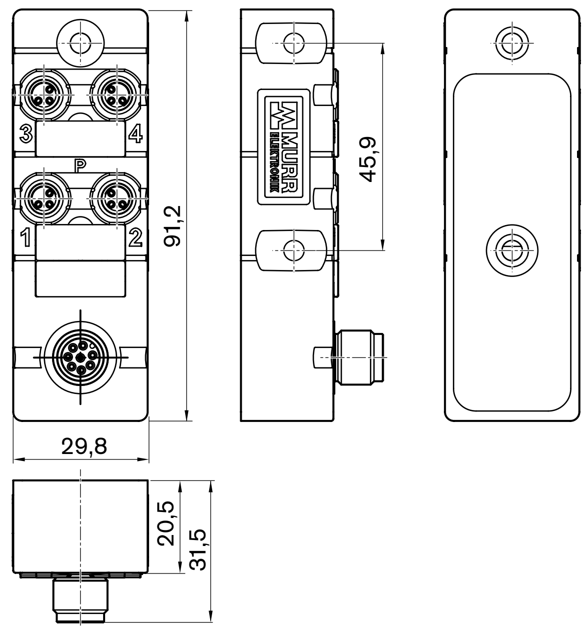
Distributors

Passive distributor

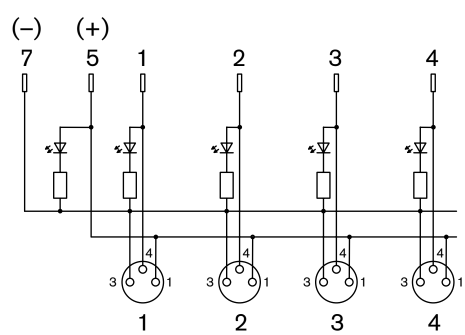
R901425737

R901429917

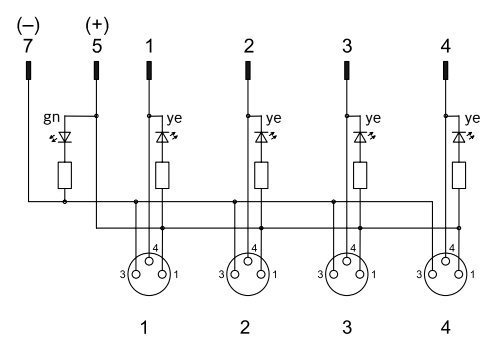
R911344592



R901425737



R901429917



Part numbers / technical data

Use	Passive distributor		
Part number	R901425737	R901429917	R911344592
Designation	8000-84070-0000000	8000-84071-0000000	See the adapter for technical data and drawing
Version	Straight, for 1 - 4 sensors		
Operating current per contact	max. 2 A		
Operating voltage	24 V DC		
Switching logic	PNP	NPN	
1. Connection type	4x straight female connector, M8x1, 3-pin, IDC, self-locking screw thread		
2. Connection type	Straight plug, M12x1, 8-pin, IDC, self-locking screw thread		
Function indicator	✓		
Operating voltage indicator	✓		
Connection cross-section	-		
Ambient temperature	-20° to +70 °C		
Enclosure	IP67 (plugged in and screwed down)		
Certifications and approvals			

Attachment parts for passive distributors

Holding plate for passive distributors

Holding plate for holding clip

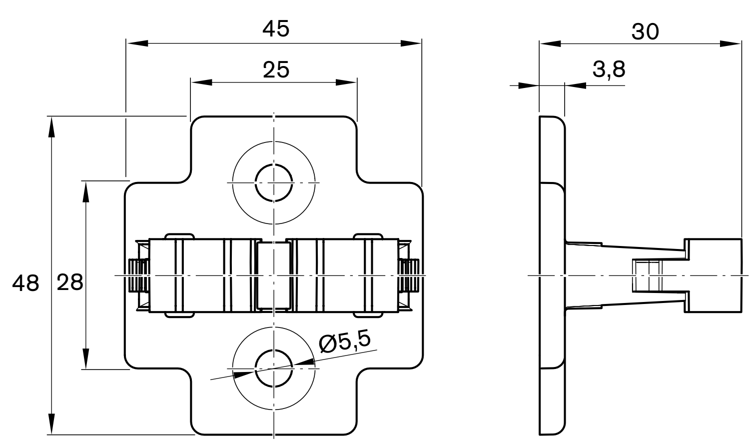
Part numbers

Use	For passive distributors R901425737/R901429917	For passive distributor R911344592
Holding plate	R117500167	R117500166

Accessories for passive distributors

Holding clip

Screw plug



Part numbers / technical data

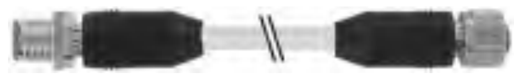
Use	For passive distributors R901425737/R901429917	For passive distributor R911344592
Holding clip	–	R913047341
Designation	–	7000-99061-0000000
Set	–	1 pc.
Screw plug	R913047322	–
Designation	3858627	–
Set	10 pcs.	–

Extensions for passive distributors

Extensions for passive plugs

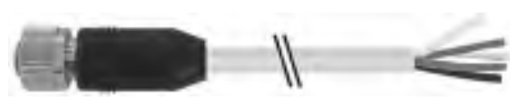
R911371982

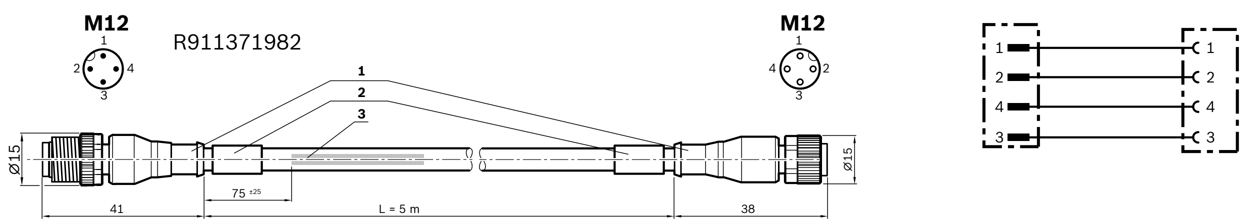
R911371981

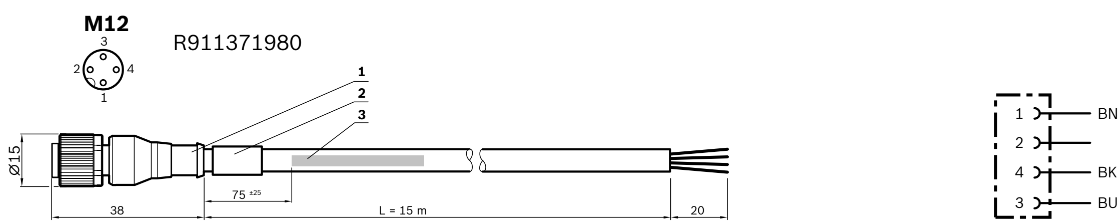


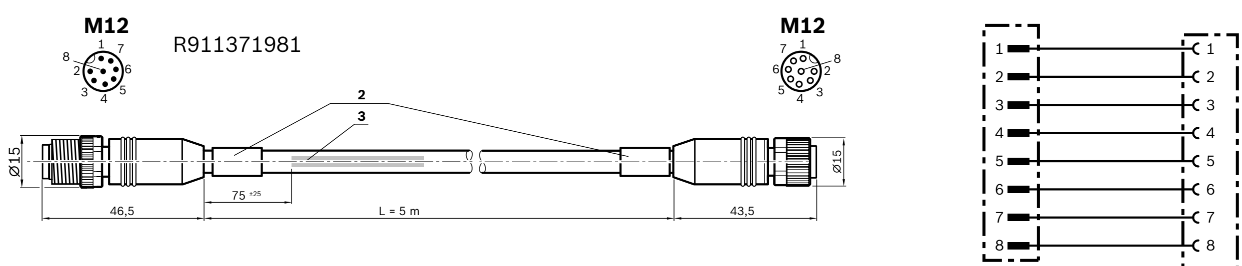
R911371980

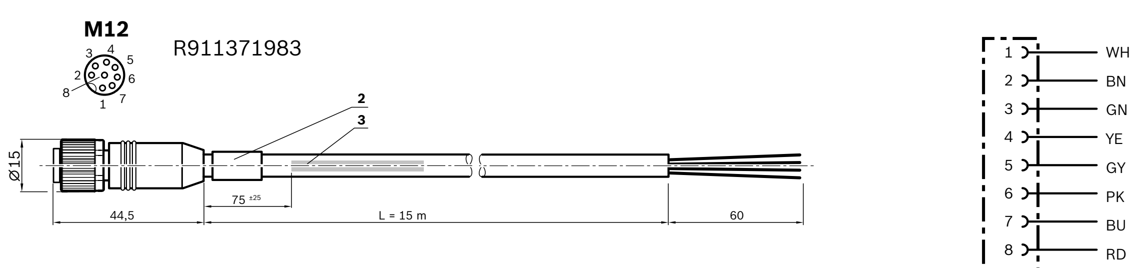
R911371983







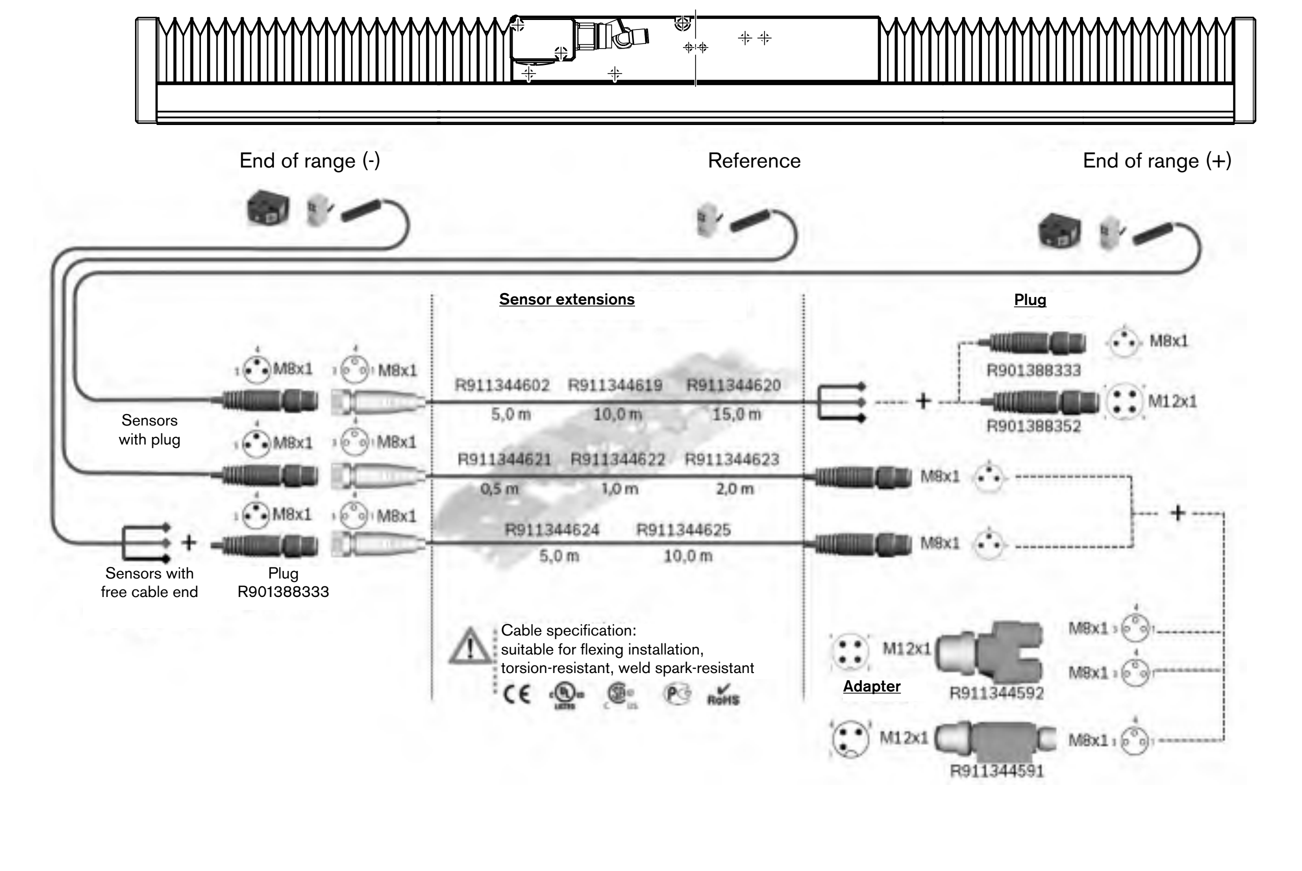


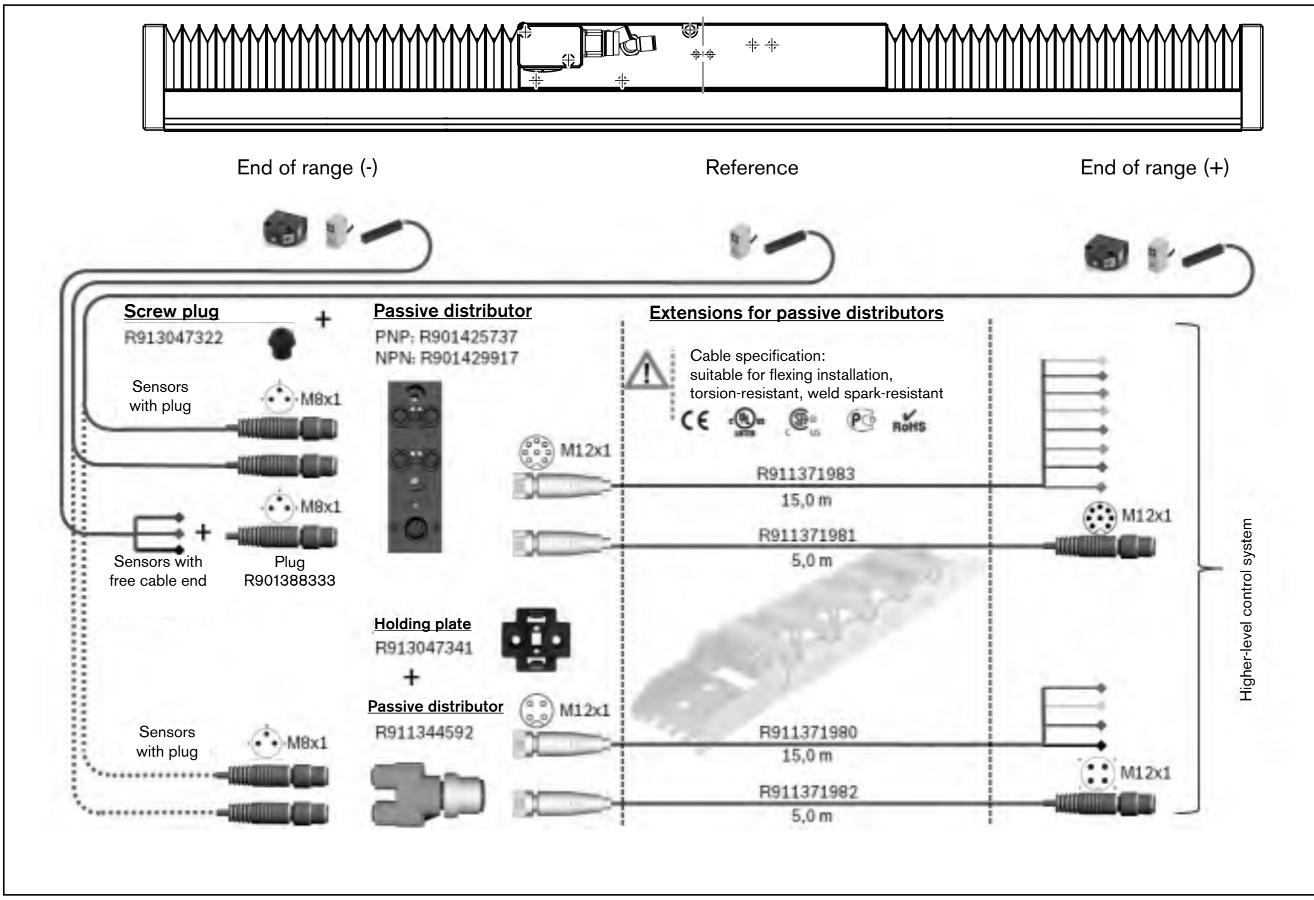


Part numbers / technical data

Use	Extension cable for passive distributor R911344592		Extension cable for passive distributors R901425737/R901429917	
Part number	R911371982	R911371980	R911371981	R911371983
Designation	7000-40021-6540500	7000-12221-6541500	7000-48001-3770500	7000-17041-3771500
Length	5.0 m	15.0 m	5.0 m	15.0 m
1. Connection type	Straight female connector, M12x1, 4-pin		Straight female connector, M12x1, 8-pin	
2. Connection type	Straight plug, M12x1, 4-pin	Free cable end	Straight plug, M12x1, 8-pin	Free cable end
Function indicator	–			
Operating voltage indicator	–			
Type of cable	PUR black		PUR gray	
Operating voltage	30 V AC/DC			
Operating current per contact	max. 4 A per contact		max. 2 A per contact	
Suitable for drag chains	✓			
Torsion-resistant	✓			
Weld spark-resistant	✓			
Cable cross-section	4 x 0.34 mm^2		8 x 0.34 mm^2	
Cable diameter D	4.7 ± 0.2 mm		6.2 ± 0.3 mm	
Static bending radius	≥ 5 x D			
Dynamic bending radius	≥ 10 x D			
Bending cycles	> 10 mill.			
Max. permissible travel speed	3.3 m/s - at 5 m travel range (type) up to 5 m/s at 0.9 m travel range			
Max. permissible acceleration	≤ 30 m/s^2			
Ambient temperature when secured	–40 °C to +80 °C (90 °C max. 10 000 h)			
Ambient temperature when loose	-25 °C to +80 °C (90 °C max. 10 000 h)			
Enclosure	IP67 (plugged in & screwed down)			
Certifications and approvals	CE, cULus LISTED, c US, RoHS			

Combination examples

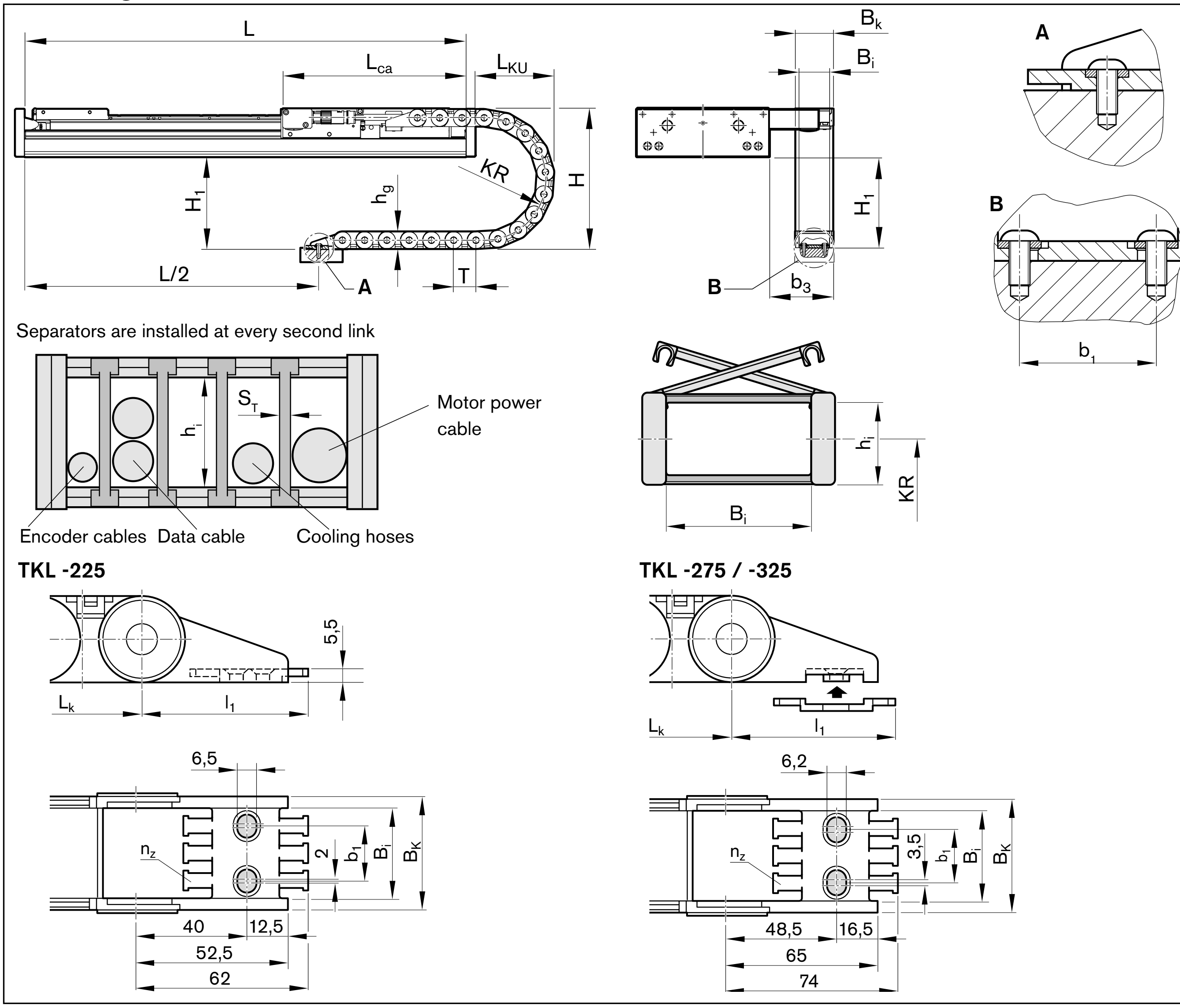




End of range (-)
Reference
End of range (+)
Screw plug
R913047322
+
Sensors with plug
M8x1
Sensors with free cable end
+
Plug R901388333
Passive distributor
PNP: R901425737
NPN: R901429917
M12x1
Extensions for passive distributors
Cable specification: suitable for flexing installation, torsion-resistant, weld spark-resistant
R911371983
15,0 m
R911371981
5,0 m
M12x1
Holding plate
R913047341
+
Passive distributor
R911344592
M12x1
R911371980
15,0 m
R911371982
5,0 m
Higher-level control system

Accessories

Cable drag chain



TKL		Part number		Dimensions (mm)														Max. accel.	Weight of chain
		Cable drag chain 1 m sections	Assembly kit Mounting accessories	b_1	b_3	B_i	B_K	H	H_1	h_g	h_i	KR	L_{KU}	n_z	S_T	T	Z	a_{perm} (m/s²)	m_c (kg/m)
TKL-225	A	R345403079	R141400023	36	104	50	63	228	130	28	20	100	100	4	2.0	34.5	475	50	0.53
	B												90				492		
TKL-275	A	R345403095	R141400024	44	121	58	76	286	180	36	26	125	150	4	2.5	45.5	610	50	0.95
	B												80				575		
TKL-325	A	R345403095	R141400024	44	121	58	76	286	170	36	26	125	50	4	2.5	45.5	561	50	0.95
	B												–				508		
	C												–				466		

Dead weight of the supply lines in the cable drag chain

TKL		-225	-275	-325
With cooling line	(kg/m)	0.6	0.7	0.9
Without cooling line	(kg/m)	0.4	0.5	0.7

Number of chain links n_c
Round up the result.

$$n_c = \frac{0.5 \cdot (L - L_{ca}) + Z}{T}$$

n_c = number of chain links
L = length of linear motion system
L_{ca} = length of carriage

Chain length L_c (without connectors)

$$L_c = n_c \cdot T$$

L_c = chain length
T = chain pitch

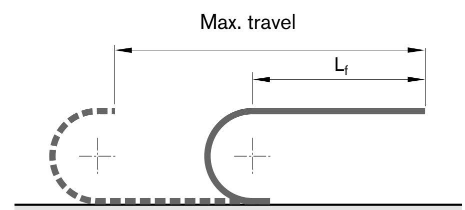
Calculation of chain length (example)

$$n_c = \frac{0.5 \cdot (1660 - 400) + 492}{34.5}$$

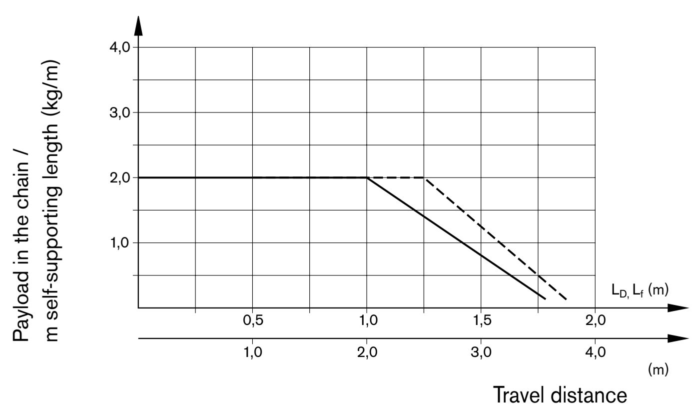
$n_c = 32.52$ round up to 33

$L_c = n_c \cdot T = 33 \cdot 34.5$ mm $= 1122$ mm round up to 2000 mm = 2 round up to (m)

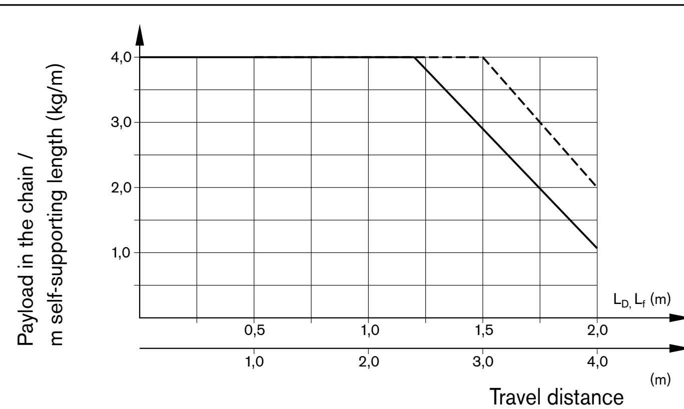
Self-supporting length L_f



TKL-225



TKL-275 / TKL-325



——— L_f = self-supporting length
– – – – L_D = length with permissible sag

Documentation

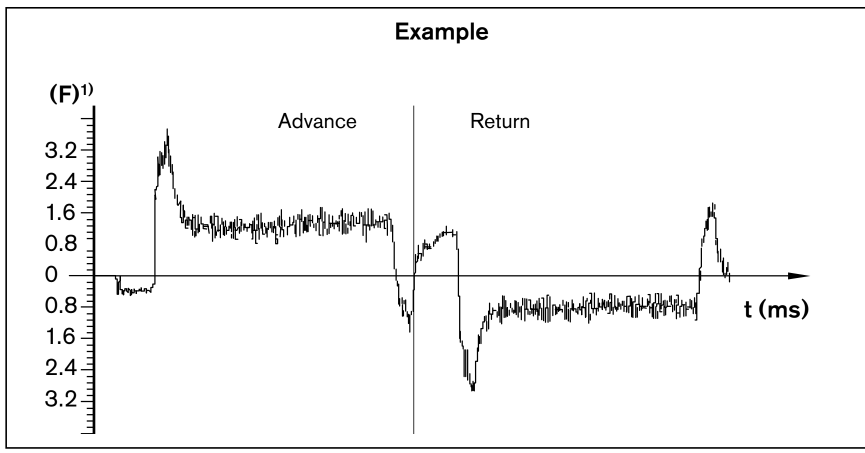
Note: The measurements are taken with the unit screwed down and assuming an ideally flat mounting base surface.

Standard report
Option 01

The standard report serves to confirm that the checks listed in the report have been carried out and that the measured values lie within the permissible tolerances.

Checks listed in the standard report:
– functional checks of mechanical components
– functional checks of electrical components
– design is in accordance with order confirmation

Frictional force of complete system
Option 02
The moment of friction force is measured over the entire travel range.

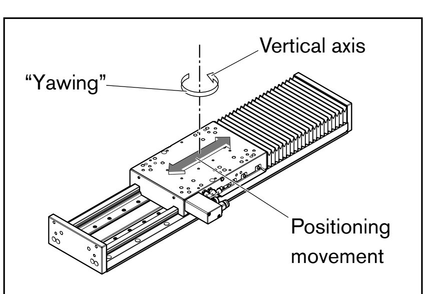


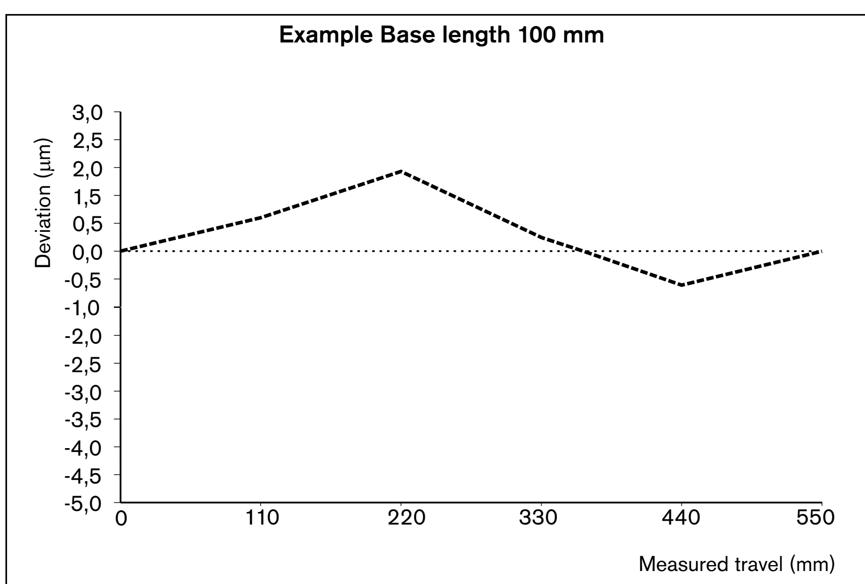
1) In % of F_{dN} = continuous force

Travel accuracy
Option 04

Several measuring points are passed during the total travel.
The following deviations are determined:

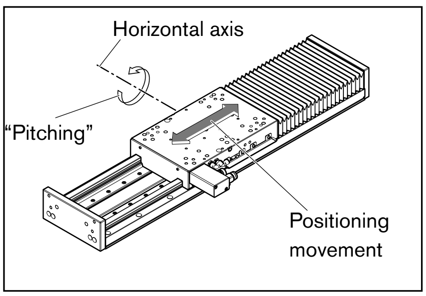
Yawing
Yawing is angular deviation about the vertical axis. This angular deviation is converted to a linear deviation in mm on the basis of a standard length and is plotted on the graph.
The base length is given in the diagram.

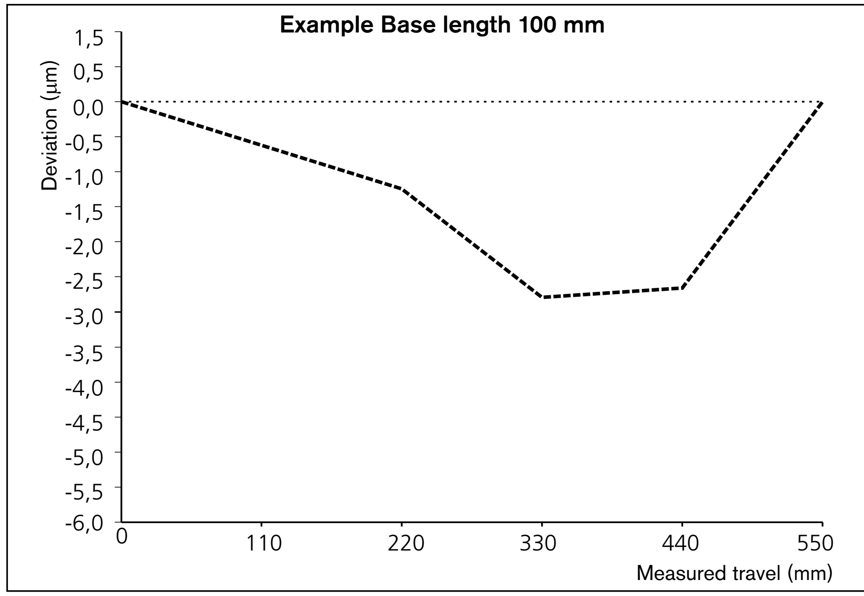




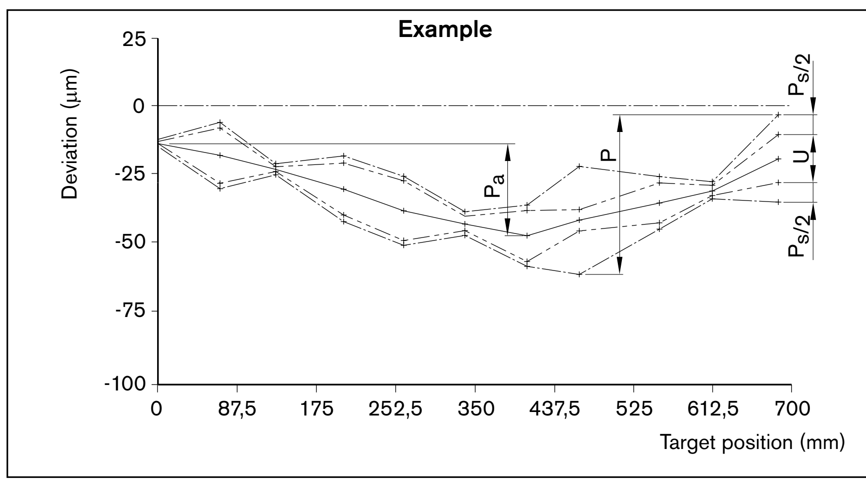
Pitching

Pitching means angular deviation about the horizontal axis. This angular deviation is converted to a linear deviation in mm on the basis of a standard length and is plotted on the graph. The base length is given in the diagram.





In addition to graphical representation (see illustrations), a measurement report is supplied in table form.



Positioning accuracy to VDI/DGQ 3441 Option 05

Measurement points are selected at irregular intervals along the travel. This enables even periodical deviations to be detected during positioning. Each measurement point is approached several times from both sides. This will give the following parameters.

Positioning accuracy P

The positioning accuracy corresponds to the total deviation.
It encompasses all the systematic and random deviations during positioning.
The positioning accuracy takes the following characteristic values into consideration:
- positioning deviation
- reversal range
- position variation range

Positioning deviation P_a

The positioning deviation corresponds to the maximum difference arising in the mean values of all the measurement points. It describes systematic deviations.

Reversal range U

The reversal range corresponds to the difference in mean values of the two approach directions. The reversal range is determined at every measurement point. It describes systematic deviations.

Position variation range P_S

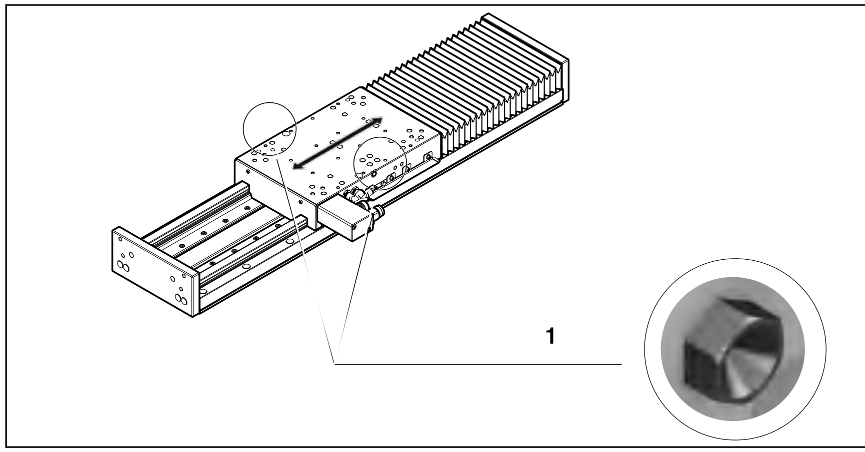
The position variation range describes the effects of random deviations.
It is determined at every measurement point.

Lubrication

Lubrication notes

⚠ The one-point lubrication connection of Ball Rail Tables TKL is designed for grease lubrication only!

Basic lubrication is applied in-factory before shipment.
The only maintenance required is re-lubrication of the guideway via the two lube ports (**1**) using a manual grease gun with extension tube.
For further information on lubricants / lubrication intervals, see instruction manual.



Normal operating conditions

Normal operating conditions	
Ambient temperature	0 °C ... 40 °C
Defrost	no
Load	See technical data
Travel speed	with High Precision Ball Runner Blocks, max. 5 m/s

Order example

Ordering data							Description
Ball Rail Table	**TKL -225**						Ball Rail Table
(Part number): R1450 305 10, 1660 mm							TKL -225, length 1660 mm
Version	**=**	**IM01**					with integrated position measuring system, as shown in diagram IM01
Guideway	**=**	**03**					Ball Rail Systems
Drive	**=**	**17**					with primary part B with motor winding 0250
Carriage	**=**	**12**					one carriage 400 mm long, Standard Ball Runner Blocks, preload 8%
Cover	**=**	**01**					with polyurethane bellows
Position measuring system	**=**	**25**					with integrated position measuring system IMS-A
End position damping	**=**	**22**					with buffers and clamping unit
1. Switches	**=**	**111**	**-A**	**+**	**400**	**mm**	proximity sensor, PNP NC, in switching position + 400 mm
2. Switches	**=**	**111**	**-A**	**–**	**400**	**mm**	proximity sensor, PNP NC, in switching position - 400 mm
Cable duct	**=**	**20**			**1500**	**mm**	cable duct 1500 mm long (loose)
Switching cam	**=**	**16**					with switching angle (for switch actuation)
Documentation	**=**	**01**					with standard report

The Drive & Control Company

Omega Modules OBB

Identification system for short product names

Short product name		Example:	O	B	B	-	085	-	N N	-	1
System	=	**O**mega module									
Guideway	=	**B**all Rail System									
Drive	=	Toothed **B**elt Drive									
Size	=	055 / **085** / 120									
Version	=	**S**tandard model									
Generation	=	Product generation **1**									

Short product name
Using the short product name, Rexroth linear axes can be identified according to their product family, size, version and product generation.

Changes/amendments at a glance

Catalog structure
- New catalog number
- New product designation
- Revised dimensional drawings
- "Delivery form" additional chapter
- "Calculation" expanded chapter
- "EasyHandling" additional chapter
- Additional chapters "Switches", "Extensions" and "Distributors"
- "Power cable chains" chapter deleted

Technical modifications
- Increase of the dynamic load capacities and moments
- Revised table structure of the tech. data tables and drive data
- Integration of new motor types (MSM)
- Technical details of clamping element (LKPS)
- Chapters "Operating conditions" and "Lubrication" revised
- "Parameterization" chapter amended
- Order example
- Query sheet

Omega modules OBB

Product overview

Product description

Omega modules (OBB) with ball rail systems and toothed belt drive for travel speeds up to 5.0 m/s.
Omega modules are ready-to-install linear axes for any desired mounting orientation in freely configurable lengths up to 5500 mm.

Due to the design, Omega modules are particularly well suited for applications where the frame enters the working area.

Characteristic features:

- Extremely compact precision aluminum profile with integrated Rexroth ball rail system for optimal travel
- Carriage with one-point lubrication
- With locating holes in the carriage and on the end plates
- Driven with toothed belts for high dynamics and high travel speed
- Mountable switches
- Available complete with motor, controller and control unit
- With planetary gearbox (PG) or angular planetary gearbox (WPG) with different gear ratios
- Pneumatic clamping elements (optional)
- Extensive range of accessories available

Sectors:

- Handling and assembly
- Electronics and semiconductor industry
- Automotive suppliers and OEMs
- Robotics and automation
- Special-purpose machines
- Packaging technology
- Building services
- Plastics processing
- Textile industry

Application areas:

- Pick and place
- Handling systems
- Component assembly systems, palletizers
- Feed units for machine tools
- Testing and analysis systems
- Feed units in transfer lines
- Load shifters

For mounting, maintenance and start-up, see the Instructions.

Mounting option

Fastening thread and locating holes

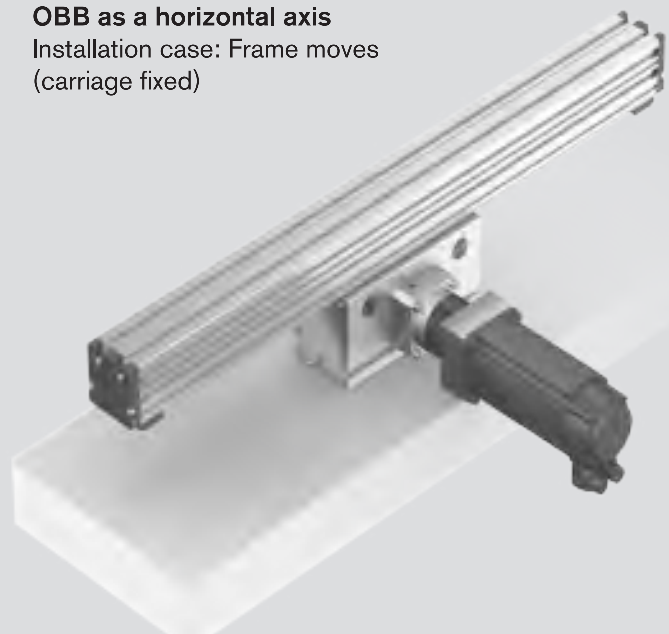
Versatile mounting options are provided by the fastening threads and locating holes on the two end plates of the frame.

Easy mounting thanks to locating holes in the carriage

Frame HK moves

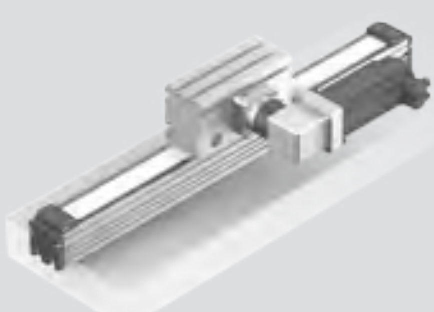
OBB as a vertical axis
Installation case: Frame moves
(carriage fixed)

OBB as a horizontal axis
Installation case: Frame moves
(carriage fixed)



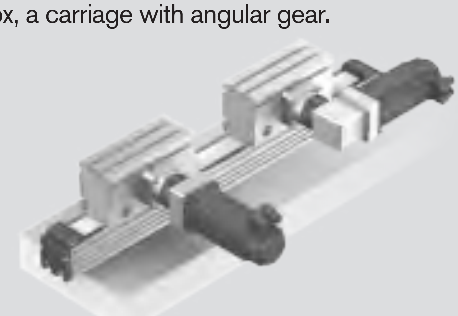
Carriage TT moves

OBB as a horizontal axis
Installation case: Carriage moves
(frame mounted)



On request:

OBB as horizontal axis with two carriages
Installation case: Carriages move independently of each other (frame fixed).
Representation (example): a carriage with planetary gearbox, a carriage with angular gear.

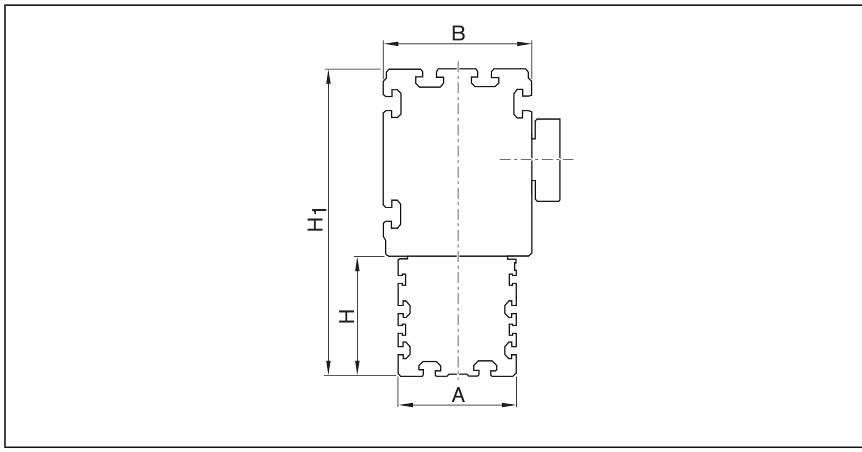


Product overview

Load ratings and sizes

Note on dynamic load ratings and torques:

Determination of the dynamic load ratings and torques is based on a total travel of 100,000 m. Often only 50,000 m of total travel are actually stipulated.
For comparison: Multiply values C, M_t and M_L by a factor of 1.26.



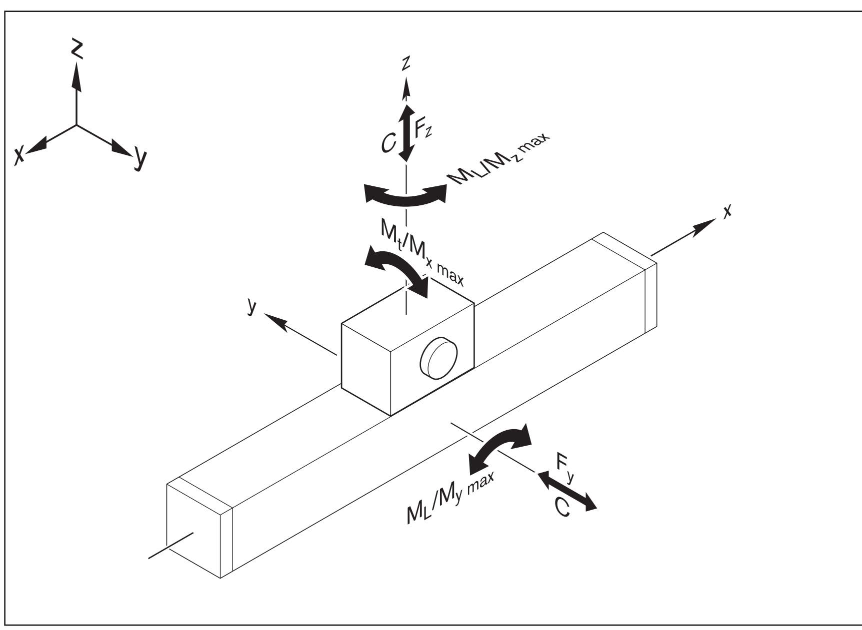
Size	Dimensions (mm) A/H	B	H_1	L_{max}	Load ratings C (N)
OBB-055	55	75	135	5 500	20 790
OBB-085	85	107	222		60 600
OBB-120	120	135	285		96 200

C = dynamic load rating
L_{max} = maximum length of the linear motion system

Suitable loads (Recommended values based on experience)

As far as the desired service life is concerned, loads of up to approximately 20 % of the dynamic characteristic values (**C**, $\mathbf{M_t}$, $\mathbf{M_L}$) have proved acceptable.

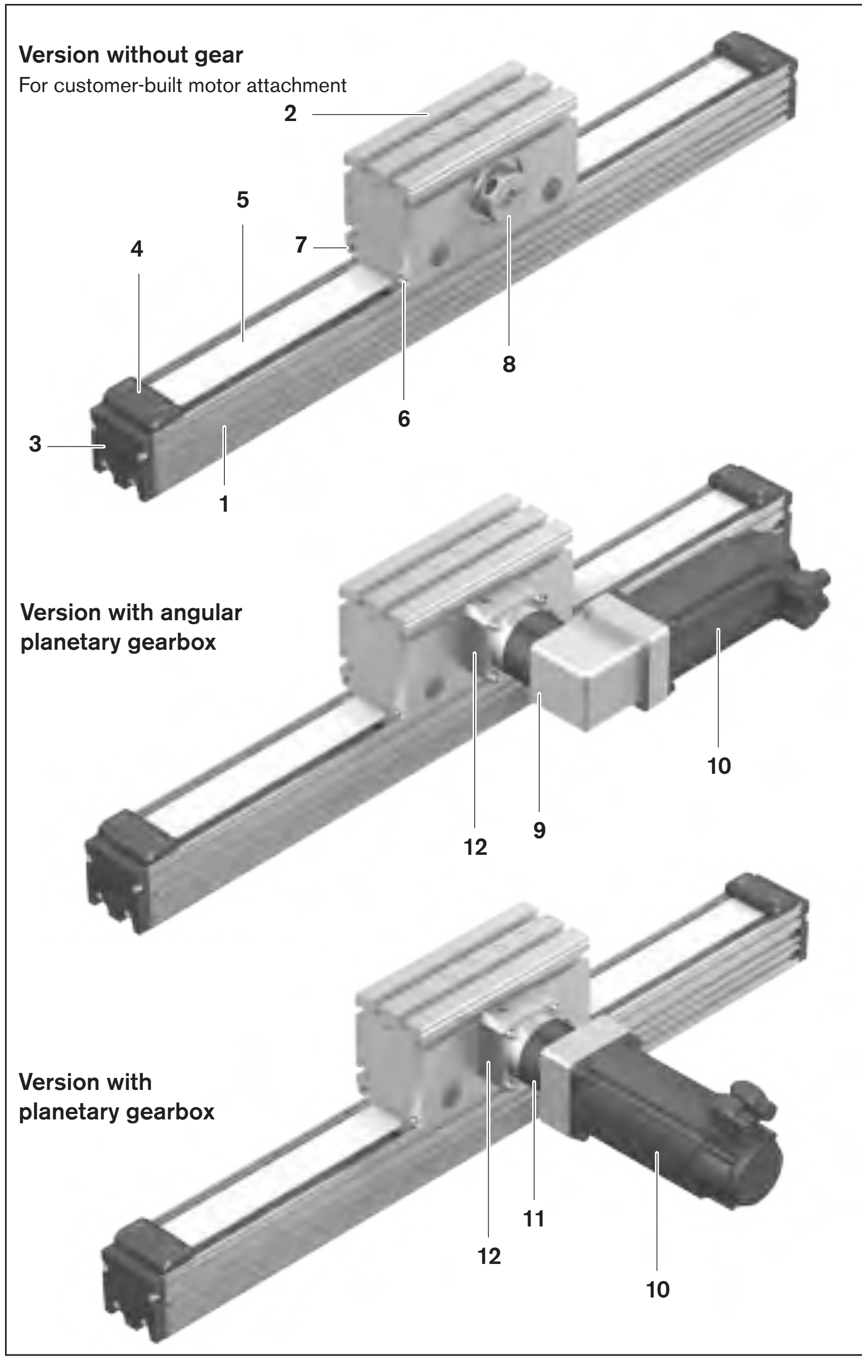
Here the following must not be exceeded:
- The maximum permissible drive torque
- The maximum permissible load
- The maximum permissible travel speed
- The maximum permissible acceleration



Structural design

Design (without switches)

1 Frame
2 Carriage
3 End plate
4 Belt clamp
5 Toothed belt
6 Lube port (at both end faces)
7 Air port (for carriage with clamping element)
8 Clamping hub for motor attachment
9 Angular planetary gearbox (WPG)
10 Motor
11 Planetary gearbox (PG)
12 Mounting flange



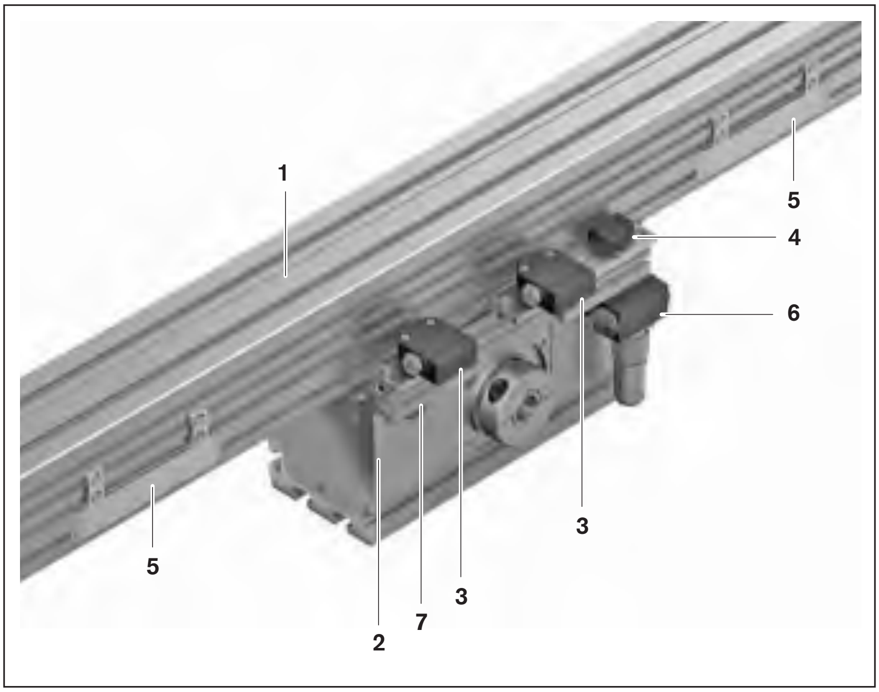
Product overview

Structural design

Attachments

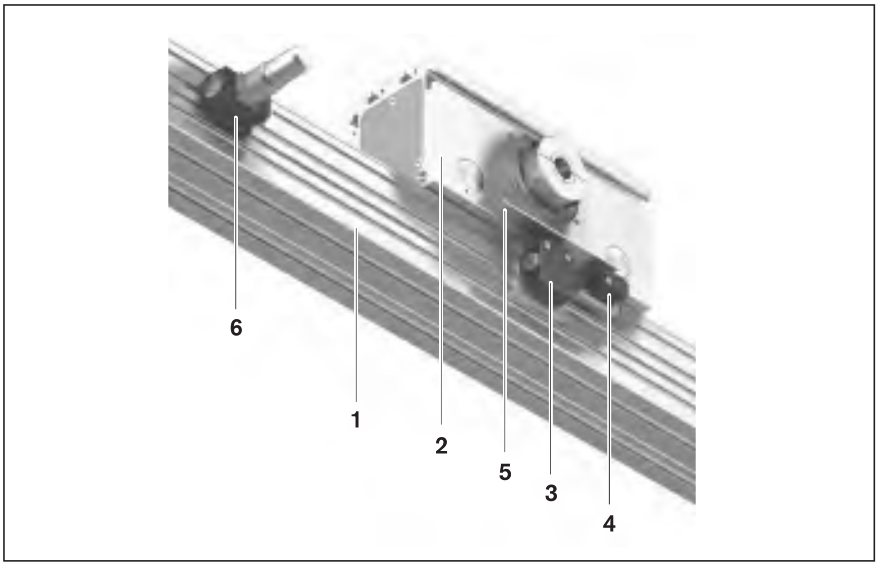
Frame moves (carriage fixed)

1 Frame
2 Carriage
3 Mechanical switches (with attachments)
4 Proximity switch (with attachments)
5 Control strip on the frame
6 Socket and plug
7 Switch mounting profile



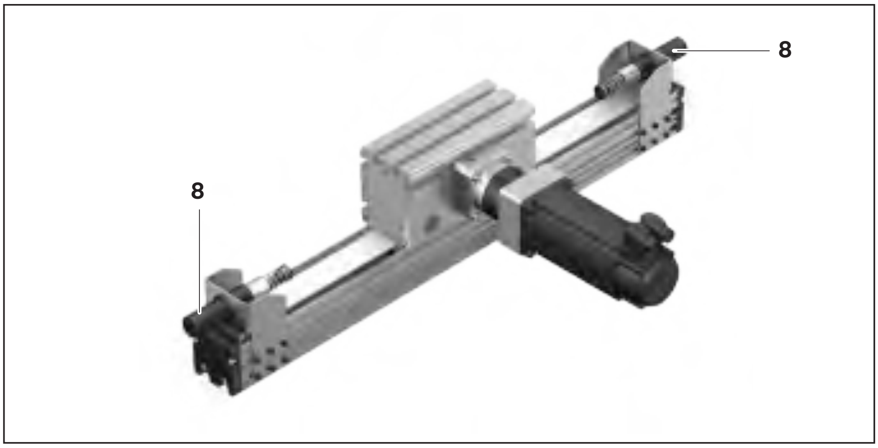
Carriage moves (frame fixed)

1 Frame
2 Carriage
3 Mechanical switch (with attachments)
4 Proximity switch (with attachments)
5 Switching angle (on the carriage)
6 Socket and plug



Accessories
8 Shock absorber

Shock absorbers are available as accessories and can be ordered separately with the relevant material number (see page 72).



Delivery form

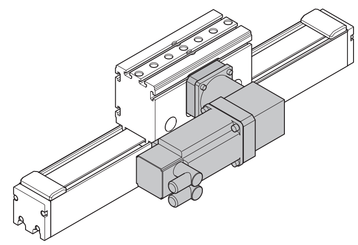
Version

Omega modules are delivered completely ready-mounted. In addition to the Omega module itself, the assembly also includes the motor attachment and motor options if they were included in the order.

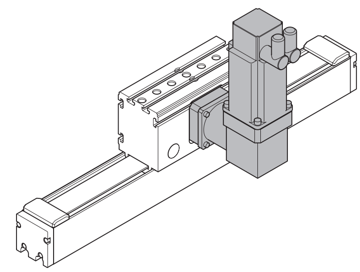
Motor attachment

If a combination of motor and motor attachment has been selected, then the attachment of the components is done as shown in the figure which also shows the location of the motor connector. The motor attachment version is selected or defined during the product configuration and is part of the order code.

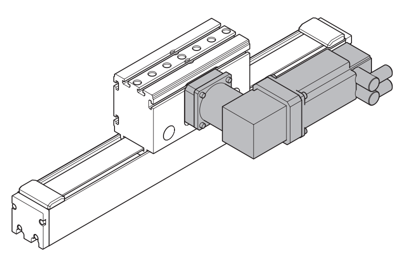
MG01



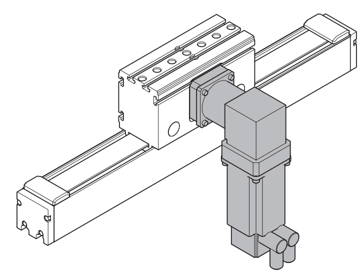
MG02



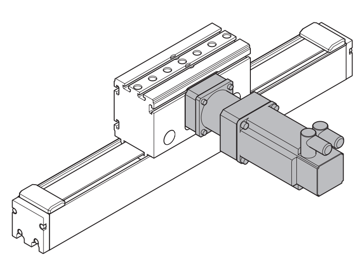
MG03



MG04



MG10



Accessories

Optional accessories like the cable duct, switch, switching angles and socket with plugs are included as loose parts in the delivery.

Lubrication

Omega modules are delivered with initial greasing. Information about lubricants can be found in the section “Lubrication”.

Documentation

The manual, safety information and a declaration of incorporation required for assembly and maintenance are included with each Omega module.

Technical data

General technical data

Observe the “Calculation” page 20 section!

Size	Carriage	Dynamic characteristic values			Maximum permissible loads					Clamping element	
	L_{ca}	C Guideway	M_t	M_L	$M_{x\,max}$	$M_{y\,max}$	$M_{z\,max}$	$F_{y\,max}$	$F_{z\,max}$	Version Carriage	Holding force
	(mm)	(N)	(Nm)	(Nm)	(Nm)	(Nm)	(Nm)	(N)	(N)		(N)
OBB-055	230	20 790	195	1 400	62	440	440	6 500	6 500	without	–
										with	370
OBB-085	260	60 600	860	4 610	280	1 500	1 500	19 760	19 760	without	–
	308	60 600	860	6 100	280	1 960	1 960	19 760	19 760	with	690
OBB-120	330	96 200	2360	10 390	776	3 424	3 424	31 700	31 700	without	–
										with	1 200

Drive data

Size	Gear type	i	M_P [3]	u [3]	v_{max} [3]	M_{Rs} [3]	Moved part (carriage TT / frame HK)	$k_{J\,fix}$ [3]	$k_{J\,var}$ [3]	$k_{J\,m}$ [3]	d_3	Belt type	F_{bp} [1]	$F_{t\,perm}$ [2]	a_{max}
			(Nm)	(mm/rev)	(m/s)	(Nm)		(kgmm²)	(kgmm)	(mm²)	(mm)		(N)	(N)	(m/s²)
OBB-055	without	1	12.0	165.00	5.00	1.10	TT	3 249.16	0.0000	689.59	52.52	25AT5	460	1 750	50
							HK	718.37	2.9825						
	PG	3	4.0	55.00	4.12	0.52	TT	458.80	0.0000	76.62					
							HK	93.32	0.3314						
		5	2.4	33.00	2.47	0.32	TT	168.11	0.0000	27.58					
							HK	36.53	0.1193						
		8	1.5	20.63	1.55	0.24	TT	69.12	0.0000	10.77					
							HK	17.72	0.0466						
	WPG	3	4.0	55.00	4.12	0.67	TT	531.20	0.0000	76.62					
							HK	104.42	0.3314						
		5	2.4	33.00	2.47	0.47	TT	201.28	0.0000	27.58					
							HK	47.63	0.1193						
		8	1.5	20.63	1.55	0.34	TT	88.84	0.0000	10.77					
							HK	28.82	0.0466						
OBB-085	without	1	40.0	255.00	5.00	3.00	TT	20 052.44	0.0000	1 647.14	81.17	50AT5	992	3 500	50
							HK	2 724.50	18.0527						
	PG	5	8.0	51.00	3.40	1.00	TT	1 077.70	0.0000	65.89					
							HK	153.98	0.7221						
		8	5.0	31.88	2.13	0.63	TT	442.40	0.0000	25.74					
							HK	81.57	0.2821						
	WPG	5	8.0	51.00	2.85	1.30	TT	1 271.13	0.0000	65.89					
							HK	195.88	0.7221						
		8	5.0	31.88	2.13	0.93	TT	543.49	0.0000	25.74					
							HK	123.47	0.2821						
OBB-120	without	1	154.0	340.00	5.00	6.00	TT	62 121.14	0.0000	2 928.43	108.23	70AT10	2 844	11 750	50
							HK	13 655.57	50.1933						
	PG	9	17.1	37.78	2.20	1.57	TT	1 310.92	0.0000	36.15					
							HK	430.59	0.6197						
	WPG	9	17.1	37.78	1.86	2.02	TT	1 838.85	0.0000	36.15					
							HK	741.59	0.6197						

1) Maximum power that can be transmitted through the engaging teeth that are in the belt pulley.
2) The permissible tensile load of the belt cross section (belt elasticity limit) is specified for better comparability. This value represents the load limit with respect to the plastic deformation and may not be used to determine the maximum permitted drive torque.
3) The specified values apply for the relevant combination shown (OBB without gear or OBB with gear) and are shown reduced based on the motor shaft. For information on the use of the values, see section “Calculation”.

Length L_{ad}[2] (mm)	s_{min}[1] (mm)	L_{max} (mm)	Version	Mass carriage m_{ca} (kg), Clamping element: without	with	Mass frame $k_{g\ fix}$ (kg)	$k_{g\ var}$ (kg/mm)	I_y (cm^4)	I_z (cm^4)
130	110	5 500	Drive i=1	3.82	4.01	0.55	0.004	24	39
166			with PG	5.13	5.32				
			with WPG	5.93	6.12				
120	160	5 500	Drive i=1	9.56	11.25	1.05	0.011	148	244
156			with PG	13.38	15.07				
			with WPG	15.68	17.37				
170	135	5 500	Drive i=1	17.70	18.45	3.08	0.017	664	725
206			with PG	27.48	28.23				
			with WPG	34.08	34.83				

1) Minimum required travel distance to ensure a reliable lubrication distribution, see "Operating conditions".
For short-stroke applications with travel distances $< s_{min}$, please ask.
2) The dimension L_{ad} is required for the length calculation (see section "Configuration and ordering" for the relevant sizes)

PG = planetary gearbox
WPG = angular planetary gearbox
TT = carriage
HK = frame

Note
Values for the gear are not listed in the "Technical data" tables, as the gear is part of the linear motion system and is already taken into account in the technical values.

Mass of the Omega module
Weight calculation does not include motor or switch.

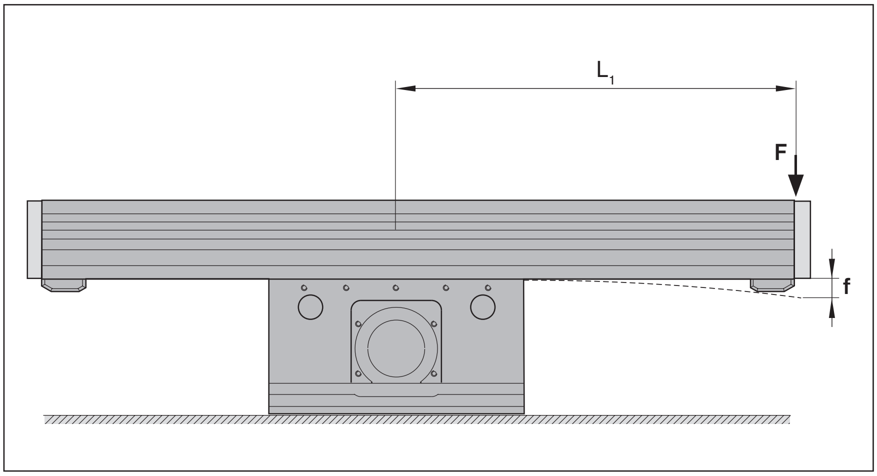
$$m_s = k_{g\ fix} + k_{g\ var} \cdot L + m_{ca}$$

$k_{g\ fix}$ = constant for fixed-length portion of the mass (kg)
$k_{g\ var}$ = constant for the variable-length portion of the mass (kg/mm)
L = length of frame (mm)
m_s = mass of the linear motion system (kg)
m_{ca} = mass of the carriage (kg)

a_{max} = maximum permissible acceleration
C = dynamic load rating
d_3 = diameter of belt pulley
F_{bp} = maximum belt drive transmission force
$F_{t\ perm}$ = permissible cable pull strength
$F_{y\ max}$, $F_{z\ max}$ = maximum permissible load in y- or z-direction
I_y, I_z = planar moment of inertia
i = gear ratio
$k_{J\ fix}$ = constant for fixed-length portion of mass moment of inertia
$k_{J\ var}$ = constant for length-variable portion of mass moment of inertia
$k_{J\ m}$ = constant for mass-specific portion of mass moment of inertia
L_{ca} = carriage length
L_{ad} = additional length
L_{max} = maximum length of the linear motion system
M_t, M_L = dynamic load moment
$M_{x\ max}$, $M_{y\ max}$, $M_{z\ max}$ = maximum permitted torsional moment around the x-, y-, z-axis
M_L = dynamic longitudinal moment load capacity
M_t = dynamic torsional moment load capacity
M_p = maximum permissible drive torque
M_{Rs} = frictional torque of system (on the drive journal)
m_{ca} = moved mass of carriage
s_{min} = minimum required travel distance
u = lead constant
v_{max} = maximum permissible travel speed

Deflection

A special feature of Omega modules is the possibility to mount them by the carriage, which remains stationary while the frame moves.
If a force acts on the overhanging frame in the area of the end plate (**F**) (direction of force transverse to the travel direction **X**), the frame undergoes a deflection (**f**) dependent on the length (**L_1**) (distance from the center of the carriage to the end of the frame).
When the OBB is used as a vertical axis in a portal, a deflection of the frame occurs due to the acceleration forces of the horizontal axes.
This deflection is reversible, i.e. deflection occurs for as long as the acceleration forces are acting.



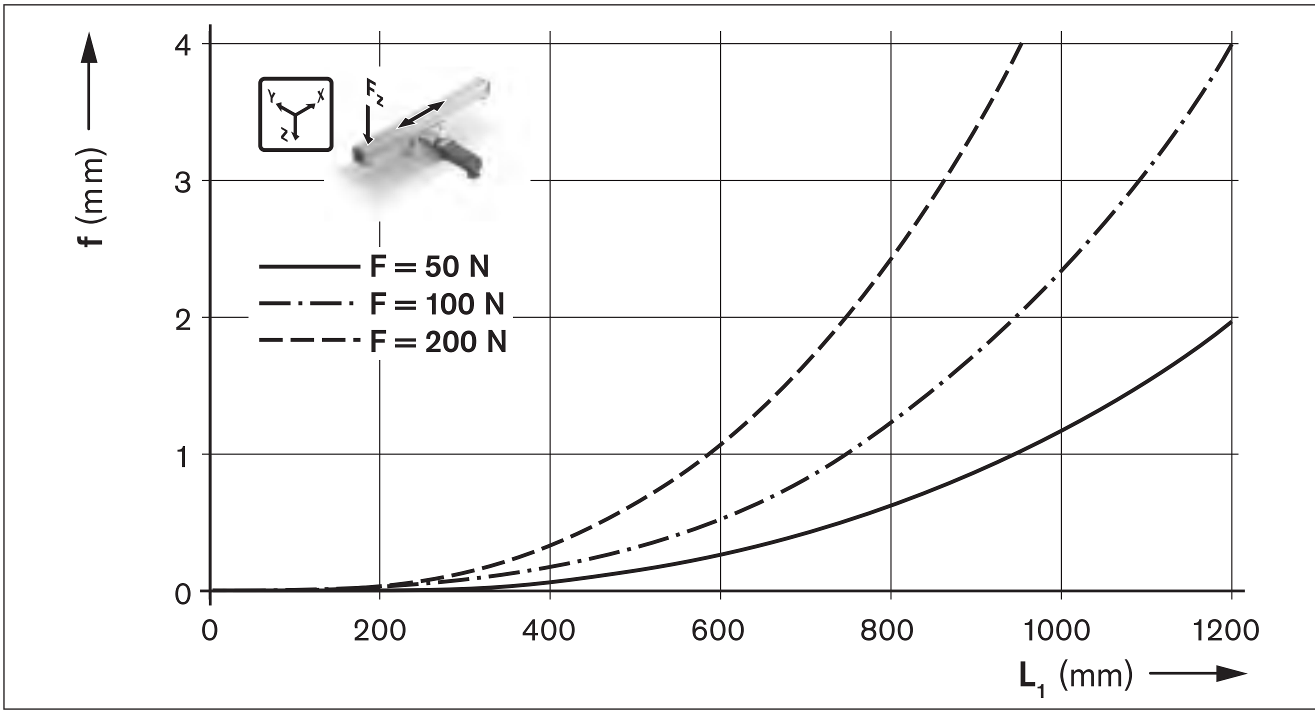
Example

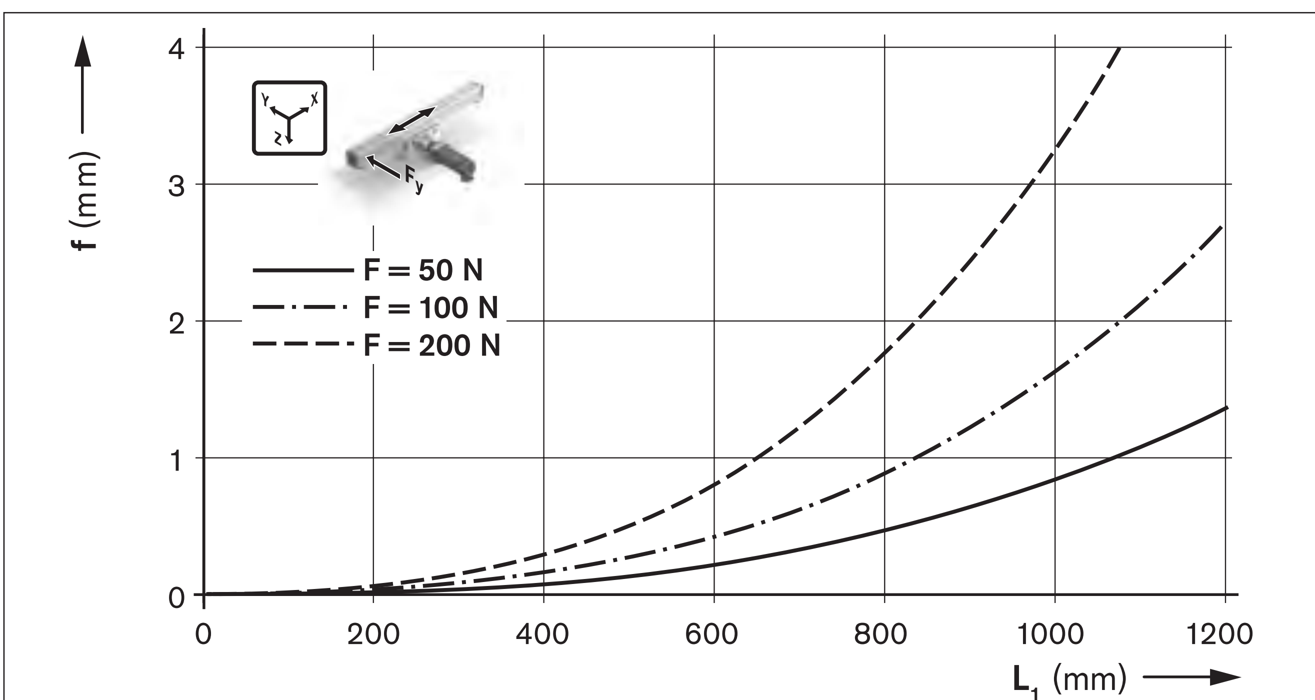
Omega module OBB-055:
L_1 = 800 mm
F = 100 N, force acting in z-direction
f = 1.2 mm

Deflection charts for loads from the z and y directions

OBB-055

The following charts apply for a carriage fixed to the mounting base over the entire area (see section “Mounting by the carriage” on page 66).
For larger lengths or loads, please ask.





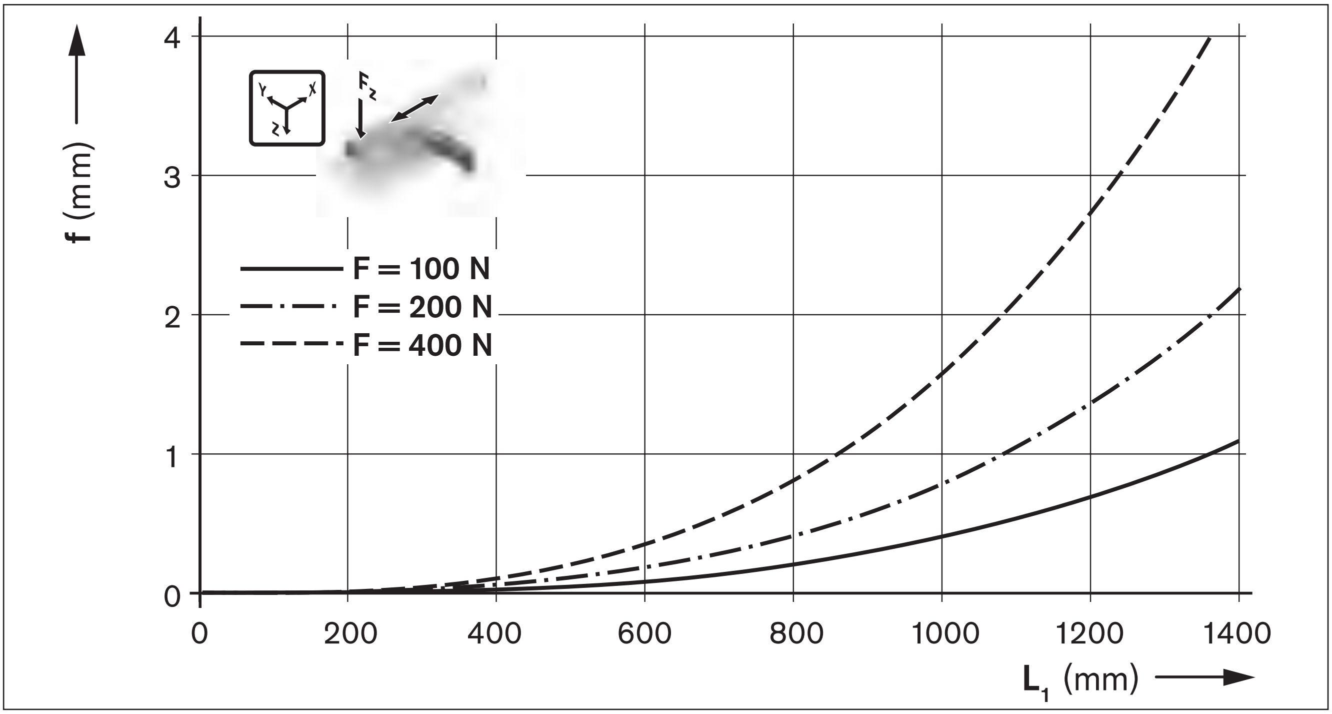
Technical data

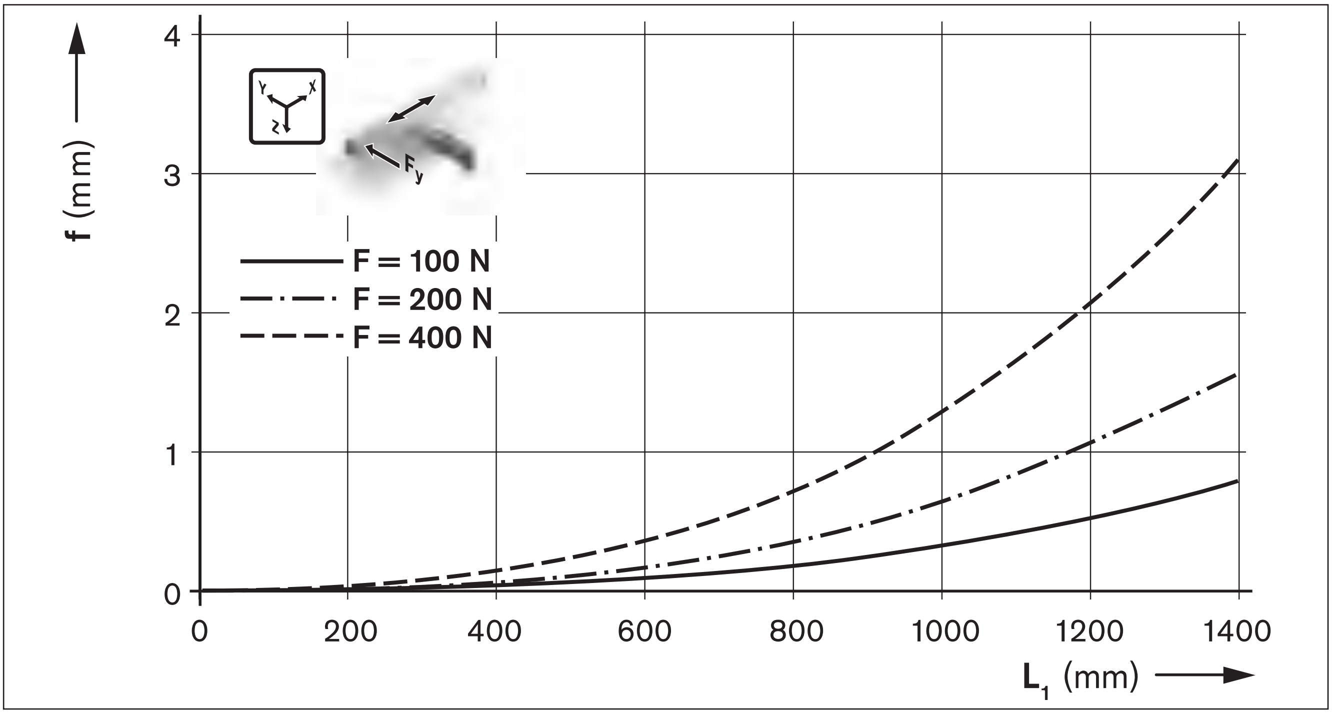
Deflection

Deflection charts for loads from the z and y directions

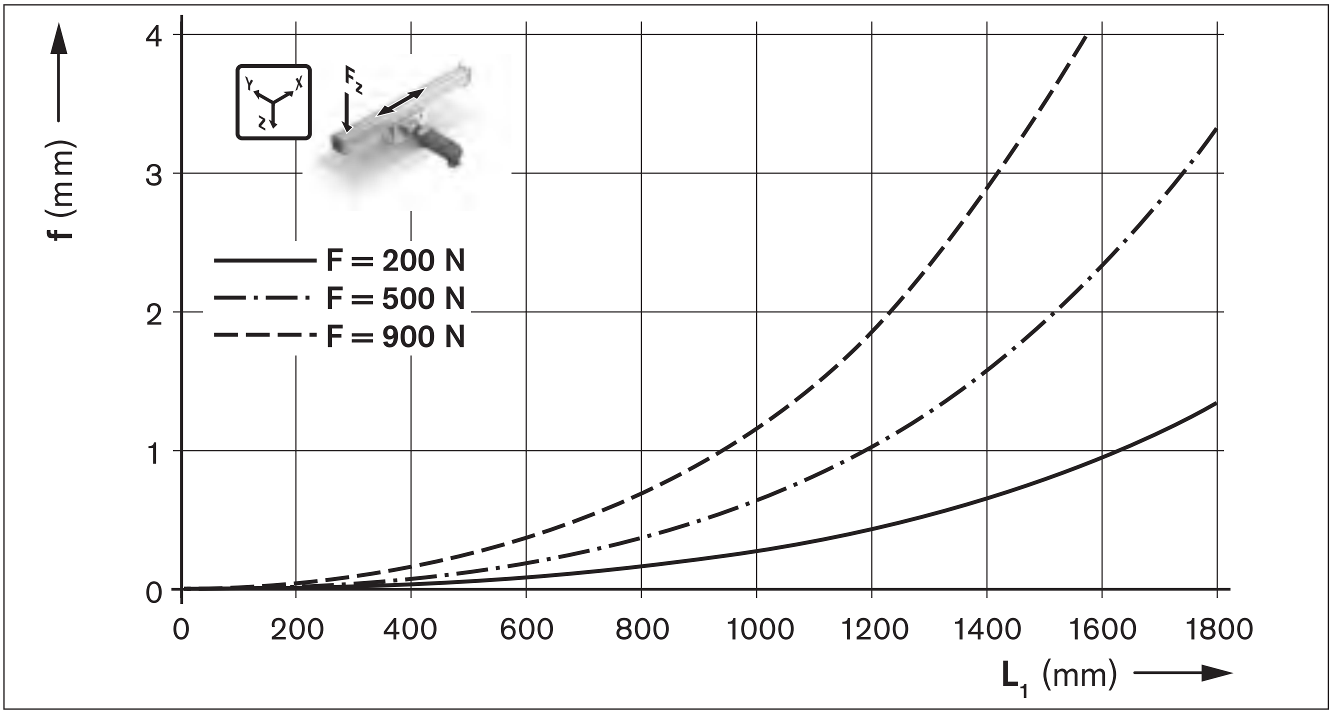
OBB-085

The following charts apply for a carriage fixed to the mounting base over the entire area (see section “Mounting by the carriage” on page 66).
For larger lengths or loads, please ask.

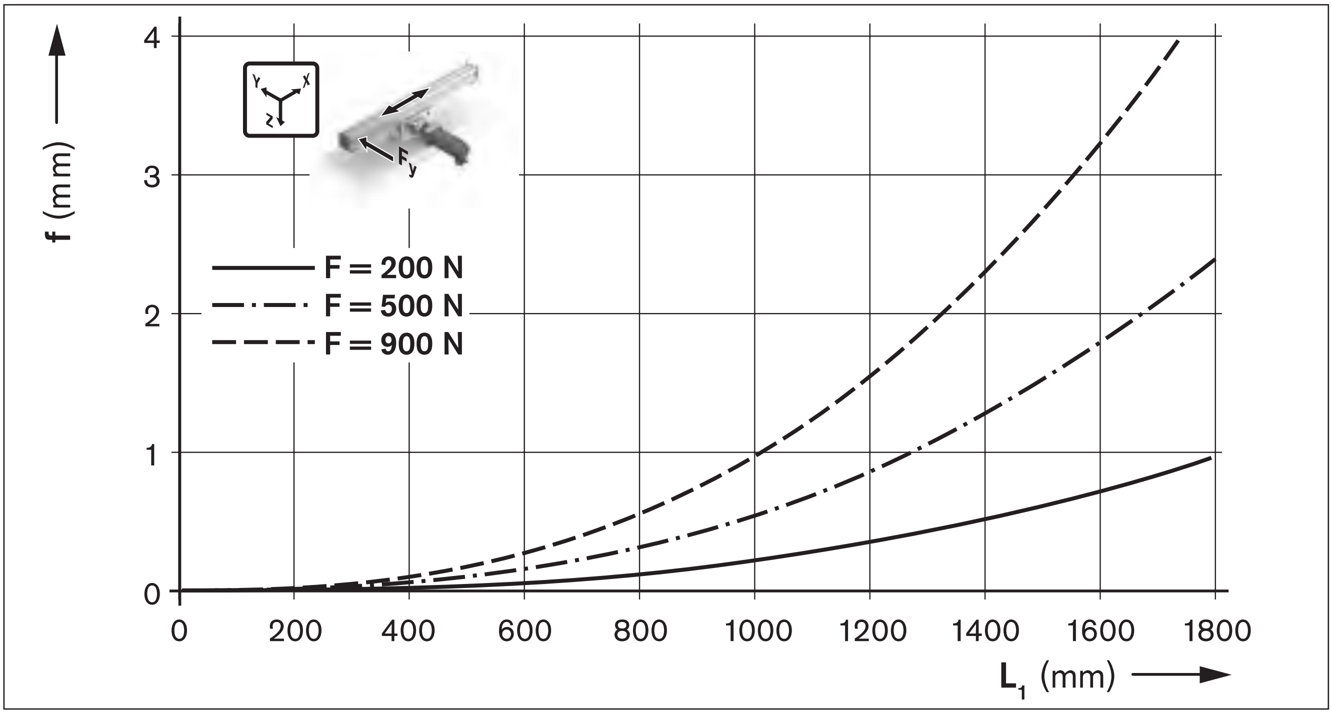




OBB-120



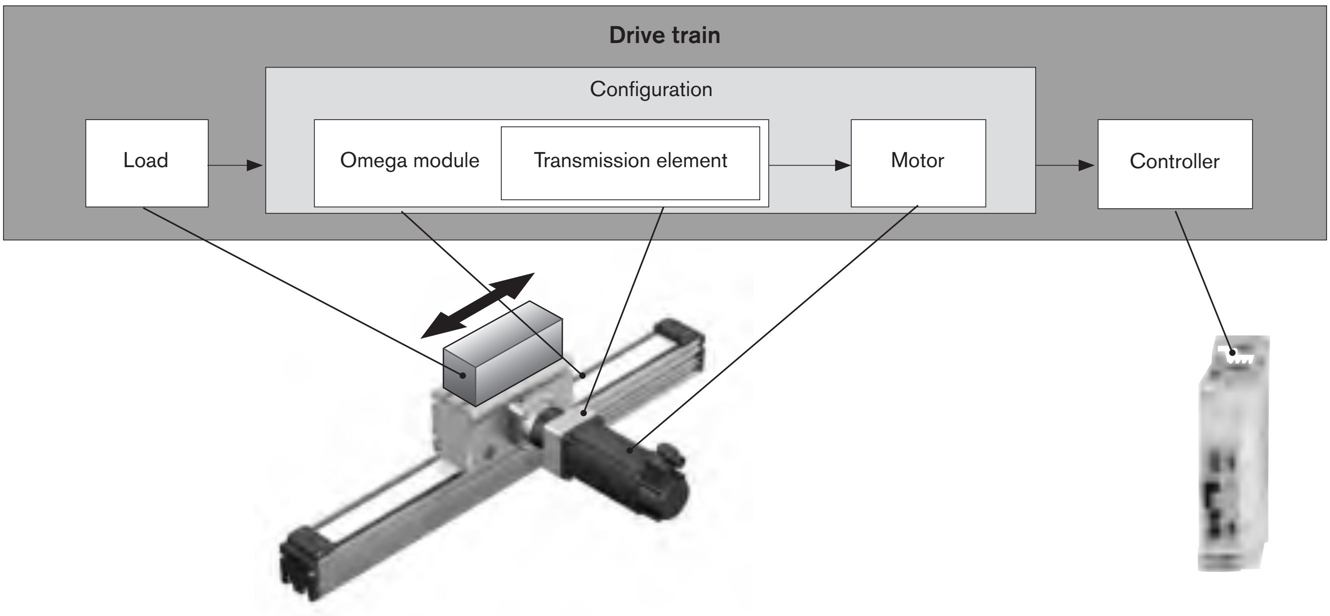
f (mm)
4
3
2
1
0
F_z
Y X Z
F = 200 N
F = 500 N
F = 900 N
0 200 400 600 800 1000 1200 1400 1600 1800
L_1 (mm)

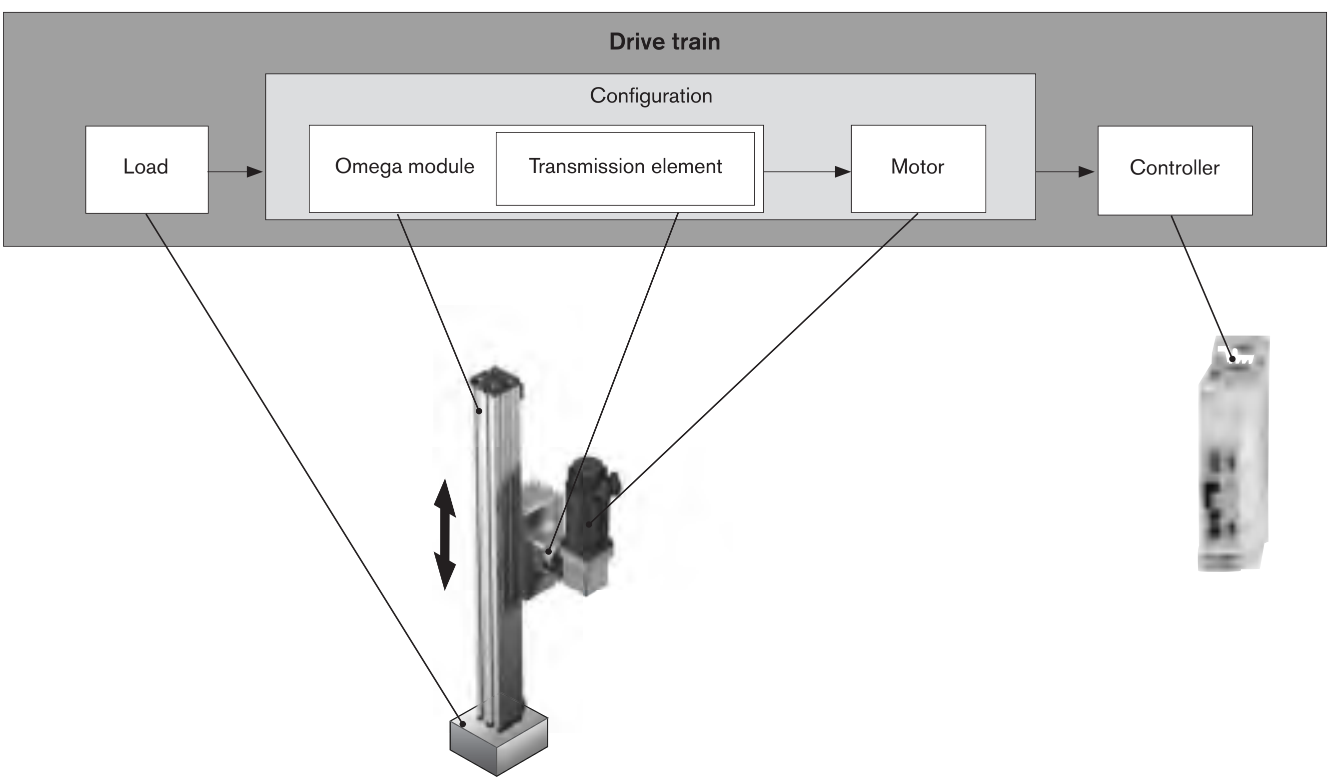


f (mm)
4
3
2
1
0
F_y
Y X Z
F = 200 N
F = 500 N
F = 900 N
0 200 400 600 800 1000 1200 1400 1600 1800
L_1 (mm)

Calculation principles

The correct dimensioning and assessment of an application requires structured consideration of the drive train as a whole. The basic element of the drive train is the configuration – comprising the linear motion system, the transmission element (gear) and the motor – which can be ordered in that constellation in the catalog.





Maximum permissible load

When selecting linear motion systems, it is essential to consider the upper limits for permissible loads and forces, as specified in the section “"General technical data" on page 10. The values stated there are system-related. In other words, the upper. limits are determined not only by the load ratings of the bearing points but also include structural design and material-related considerations.

Conditions for combined loads:

$$\frac{|F_y|}{F_{y\,max}} + \frac{|F_z|}{F_{z\,max}} + \frac{|M_x|}{M_{x\,max}} + \frac{|M_y|}{M_{y\,max}} + \frac{|M_z|}{M_{z\,max}} \leq 1$$

Service life

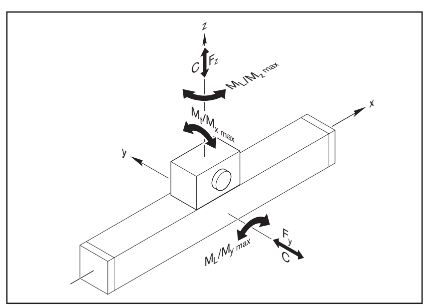
The service life of the rolling bearing points contained in a linear motion system can be calculated using the formulas given below.
The rolling bearing point that is relevant to the service life in a linear motion system with toothed belt drive is generally the linear guide.
The calculated service life specification for the linear motion system is determined by the service life value of the linear guide.

Service life of the linear guide

The linear guide of a linear motion system must bear the load, the side torques of the motor attachment / motor and any processing forces.

Combined equivalent load on bearing of the linear guide:

$$F_{comb} = F_y + F_z + C \cdot \frac{|M_x|}{M_t} + C \cdot \frac{|M_y|}{M_L} + C \cdot \frac{|M_z|}{M_L}$$



C	=	dynamic load rating	(N)
F_{comb}	=	combined equivalent load on bearing	(N)
F_y	=	force in y-direction	(N)
F_z	=	force in z-direction	(N)
L	=	nominal life in meters	(m)
L_h	=	nominal life in hours	(h)
M_L	=	dynamic longitudinal moment load capacity	(Nm)
M_t	=	dynamic torsional moment load capacity	(Nm)
M_x	=	torsional moment about the x-axis	(Nm)
M_y	=	torsional moment about the y-axis	(Nm)
M_z	=	torsional moment about the z-axis	(Nm)
v_m	=	average travel speed	(m/s)

Nominal life

Nominal life in meters:

$$L = \left(\frac{C}{F_{comb}}\right)^3 \cdot 10^5$$

Nominal life in hours:

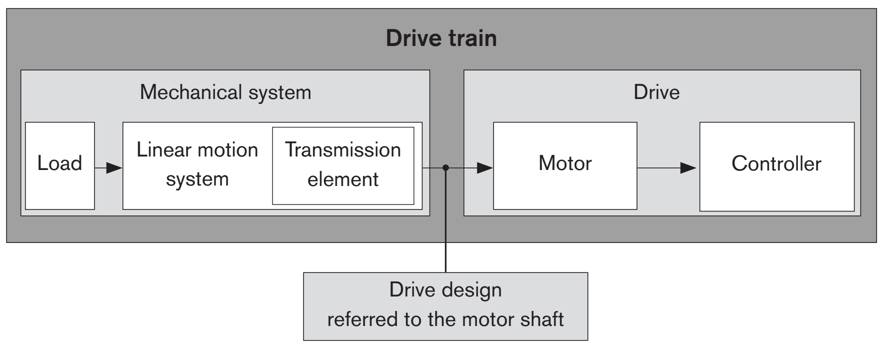
$$L_h = \frac{L}{3\,600 \cdot v_m}$$

Calculations

General

Drive design - Basic principles

When calculating the required size of drive, the drive train can be subdivided into the mechanical system and the drive itself.
The **mechanical system** includes the linear motion system component (including transmission element gear), as well as taking into account the load.
The electric **drive** is a motor-controller combination with the appropriate performance data. The sizing or dimensioning of the electric drive is done taking the motor shaft as a reference point.
When sizing the drive, limit values must be taken into account as well as basic values. The limit values are to be observed in order to avoid damaging the mechanical components.



Technical data and formula symbols for the mechanical system

The technical values for the linear motion system already include the relevant gear data and take into account the gear ratio. In other words, the corresponding maximum permissible limits for torque and speed, as well as the underlying friction torque and mass moment of inertia with respect to the motor shaft are reduced and can be taken directly from the tables (see section "Drive data").

The following technical data with the associated formula symbols are used when considering the basic mechanical system requirements in the design calculations for sizing the drive. The data listed in the table below can be found in the section "Technical data" or they are determined using the formulas described on the following pages.

	Mechanical system	
	Load	Linear motion system incl. transmission element gear
Weight moment (Nm)	M_g 5)	–
Frictional torque (Nm)	– 4)	M_{Rs} 3)
Mass moment of inertia (kgm²)	J_t 1)	J_S 2)
Max. permissible travel speed (m/s)	–	v_{max} 3)
Max. permissible rotary speed (min⁻¹)	–	n_P 1)
Max. permissible drive torque (Nm)	–	M_P 3)

1) Determine the value using the appropriate formula
2) Length-dependent value, determined using the appropriate formula
3) Use the value from the table
4) Any additional process forces are to be taken into consideration as load moments
5) For vertical mounting position: Determine the value using the appropriate formula

Drive sizing referred to the motor shaft:

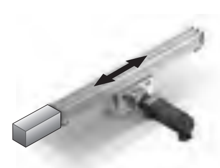
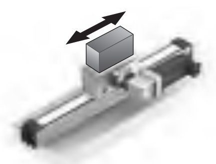
For the drive configuration, all the relevant design calculation values for the mechanical components contained in the drive train must be determined – and be expressed in terms of or reduced to – the motor shaft. In other words, for a combination of mechanical components within the drive train, this will result in one value for each of the following:

– Frictional torque $\mathbf{M_R}$
– Mass moment of inertia $\mathbf{J_{ex}}$
– Maximum permissible travel speed $\mathbf{v_{mech}}$ or maximum permissible rotary speed $\mathbf{n_{mech}}$
– Maximum permissible drive torque $\mathbf{M_{mech}}$

The determination of the values for the **mechanics** in the drive chain based on the reference point motor shaft differs with regard to the “frame moves” and “carriage moves” constellation and is compared with the relevant formula to highlight the differences. For better transparency, the installation orientations “**horizontal**” and “**vertical**” are addressed and outlined in different sections.

Calculations

Mounting orientation HORIZONTAL

	Frame moves	Carriage moves
Installation case		

Frictional torque M_R

The value for the frictional torque of the linear motion system already includes the friction for an appropriately configured gear unit and has been reduced with reference to the motor shaft.

	Frame moves	Carriage moves
Frictional torque	$M_R = M_{Rs}$	$M_R = M_{Rs}$

M_R = frictional torque at motor journal (Nm)
M_{Rs} = frictional torque of system (Nm)

Mass moment of inertia J_{ex}

The constants used in the formulas $k_{J\ fix}$, $k_{J\ var}$ and $k_{J\ m}$ are determined dependent on the installation case “frame moves” or “carriage moves” and can be found in the table "Drive data" on page 10. The inertia of a configured gear is therefore already taken into account and reduced based on the motor shaft.

	Frame moves	Carriage moves
Mass moment of inertia of the mechanical system	$J_{ex} = J_s + J_t$	$J_{ex} = J_s + J_t$
Mass moment of inertia of the linear motion system	$J_s = (k_{J\ fix} + k_{J\ var} \cdot L) \cdot 10^{-6}$	$J_s = (k_{J\ fix} + k_{J\ var} \cdot L) \cdot 10^{-6}$
Translatory mass moment of inertia of the additional masses to be moved	$J_t = m_{ex} \cdot k_{J\ m} \cdot 10^{-6}$	$J_t = (m_{ex} + m_m + m_{br}) \cdot k_{J\ m} \cdot 10^{-6}$

J_{ex} = mass moment of inertia of mechanical system (kgm^2)
J_s = mass moment of inertia of linear motion system (without external load) (kgm^2)
J_t = translatory mass moment of inertia of external load referred to the drive journal (kgm^2)
$k_{J\ fix}$ = constant for fixed-length portion of mass moment of inertia ($kgmm^2$)
$k_{J\ m}$ = constant for mass-specific portion of mass moment of inertia (mm^2)
$k_{J\ var}$ = constant for variable-length portion of mass moment of inertia (kgmm)
L = length of the linear motion system (mm)
m_{br} = mass of the holding brake (kg)
m_m = mass of motor (kg)
m_{ex} = moved external load (kg)

Maximum permissible travel speed v_{mech} or maximum permissible rotary speed n_{mech}

The value for the maximum permissible travel speed of the linear motion system already includes the permissible rotary speed for any gear configured accordingly.

	Frame moves	Carriage moves
Maximum permissible speed	$v_{mech} = v_{max}$	$v_{mech} = v_{max}$
Maximum permissible rotary speed	$n_{mech} = \frac{v_{mech} \cdot i \cdot 1\,000 \cdot 60}{\pi \cdot d_3}$	$n_{mech} = \frac{v_{mech} \cdot i \cdot 1\,000 \cdot 60}{\pi \cdot d_3}$

v_{max} = maximum permissible travel speed of the linear motion system (m/s)
v_{mech} = maximum permissible travel speed of mechanical system (m/s)
n_{mech} = maximum permissible rotary speed of mechanical system (min^{-1})
d_3 = diameter of belt pulley (mm)
π = pi (–)
i = gear ratio (–)

Maximum permissible drive torque M_{mech}

The lowest (minimum) of all the values for permissible drive torque of all mechanical components contained in the drive train determines the maximum permissible drive torque of the mechanical system which has to be taken into consideration as the upper limit for the drive when sizing the motor.

	Frame moves	Carriage moves
Maximum permissible drive torque	$M_{mech} = M_p$	$M_{mech} = M_p$

M_p = maximum permissible drive torque of the linear motion system (Nm)
M_{mech} = maximum permissible drive torque of mechanical system (Nm)

⚠ When considering the complete drive train (mechanical system + motor/controller), the maximum torque of the motor can lie below the maximum value for the mechanical system (Mmech) and thus limit the maximum permissible drive torque of the overall drive train.
If the maximum torque of the motor lies above the upper limit for the mechanical system (Mmech), the maximum motor torque must be limited to the permitted value for the mechanical system.

Rough guide for pre-selection of the motor

The following conditions can be used as a rough guide for pre-selecting the motor.

Condition 1

The speed of the motor must be the same as or higher than the rotary speed for the mechanical system (but not exceeding the maximum permissible value).

$$n_{max} \geq n_{mech}$$

n_{max} = maximum rotary speed of motor (min^{-1})
n_{mech} = maximum permissible rotary speed of mechanical system (min^{-1})

Calculations

Mounting orientation HORIZONTAL

Condition 2
Consideration of the ratio of mass moments of inertia of the mechanical system and the motor. The mass moment of inertia ratio serves as an indicator for the control performance of a motor-controller combination.
The mass moment of inertia of the motors is directly related to the motor size.

$$V = \frac{J_{ex}}{J_m + J_{br}}$$

V = ratio of mass moments of inertia of drive train and motor (–)
J_{ex} = mass moment of inertia of mechanical system (kgm^2)
J_m = mass moment of inertia, motor (kgm^2)
J_{br} = mass moment of inertia, motor brake (kgm^2)

For preselection, experience has shown that the following ratios will result in high control performance. These are not rigid limits, but values exceeding them will require closer consideration of the specific application.

Application area	V
Handling	≤ 6.0
Processing	≥ 1.5

Condition 3
Estimation of the ratio of the static load torque to the continuous torque of the motor.
The torque ratio must be smaller than or equal to the empirical value of 0.6.
By looking at the required motor torque levels, this estimation roughly covers the dynamic characteristics which still have to be determined by plotting an exact movement profile.

$$\frac{M_{stat}}{M_0} \leq 0.6$$

M_0 = continuous motor torque (Nm)
M_{stat} = static load torque (Nm)

	Frame moves	Carriage moves
Static load torque	$M_{stat} = M_R$	$M_{stat} = M_R$

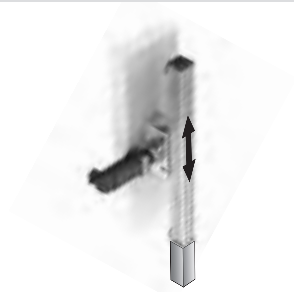
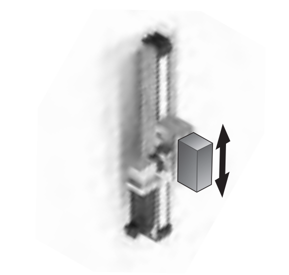
M_R = frictional torque at motor journal (Nm)

Any additional forces arising from the use of power cable chains, for example, are not included in the observation of the moving total mass and must be taken into account additionally in the calculation where applicable.

In the overview **Configuration and ordering**, users can put together standard configurations, including gears and motor, for the various linear motion system sizes by selecting the appropriate options. By fulfilling the three conditions it is possible to see whether a standard motor selected in a particular configuration will generally be of a suitable size for the specific application.

Precise drive design
Pre-selecting the motor according to this rough guide is no substitute for the precise design calculations required for the drive, where all moments/torques and speed levels are taken into account. For precise calculation of the electric drive, including consideration of the specific movement profile, please refer to the performance data in the catalogs **IndraDrive Cs** and **IndraDrive C**.
When sizing the drive, the maximum permitted values for speed, drive torque and acceleration must not be exceeded, in order to avoid damaging the mechanical system!

Mounting orientation VERTICAL

	Frame moves	Carriage moves
Installation case		

Frictional torque M_R

The value for the frictional torque of the linear motion system already includes the friction for an appropriately configured gear unit and has been reduced with reference to the motor shaft.

	Frame moves	Carriage moves
Frictional torque	$M_R = M_{Rs}$	$M_R = M_{Rs}$

M_R = frictional torque at motor journal (Nm)
M_{Rs} = frictional torque of system (Nm)

Mass moment of inertia J_{ex}

The constants used in the formulas $k_{J\ fix}$, $k_{J\ var}$ and $k_{J\ m}$ are determined dependent on the installation case “frame moves” or “carriage moves” and can be found in the table "Drive data" on page 10. The inertia of a configured gear is therefore already taken into account and reduced based on the motor shaft.

	Frame moves	Carriage moves
Mass moment of inertia of the mechanical system	$J_{ex} = J_s + J_t$	$J_{ex} = J_s + J_t$
Mass moment of inertia of the linear motion system	$J_s = (k_{J\ fix} + k_{J\ var} \cdot L) \cdot 10^{-6}$	$J_s = (k_{J\ fix} + k_{J\ var} \cdot L) \cdot 10^{-6}$
Translatory mass moment of inertia of the additional masses to be moved	$J_t = m_{ex} \cdot k_{J\ m} \cdot 10^{-6}$	$J_t = (m_{ex} + m_m + m_{br}) \cdot k_{J\ m} \cdot 10^{-6}$

J_{ex} = mass moment of inertia of mechanical system (kgm^2)
J_s = mass moment of inertia of linear motion system (without external load) (kgm^2)
J_t = translatory mass moment of inertia of external load referred to the drive journal (kgm^2)
$k_{J\ fix}$ = constant for fixed-length portion of mass moment of inertia ($kgmm^2$)
$k_{J\ m}$ = constant for mass-specific portion of mass moment of inertia (mm^2)
$k_{J\ var}$ = constant for variable-length portion of mass moment of inertia (kgmm)
L = length of the linear motion system (mm)
m_{br} = mass of the holding brake (kg)
m_m = mass of motor (kg)
m_{ex} = moved external load (kg)

Calculations

Mounting orientation VERTICAL

Maximum permissible travel speed v_{mech} or maximum permissible rotary speed n_{mech}

The value for the maximum permissible travel speed of the linear motion system already includes the permissible rotary speed for any gear configured accordingly.

	Frame moves	Carriage moves
Maximum permissible speed	$v_{mech} = v_{max}$	$v_{mech} = v_{max}$
Maximum permissible rotary speed	$n_{mech} = \frac{v_{mech} \cdot i \cdot 1\,000 \cdot 60}{\pi \cdot d_3}$	$n_{mech} = \frac{v_{mech} \cdot i \cdot 1\,000 \cdot 60}{\pi \cdot d_3}$

v_{max} = maximum permissible travel speed of the linear motion system (m/s)
v_{mech} = maximum permissible travel speed of mechanical system (m/s)
n_{mech} = maximum permissible rotary speed of mechanical system (min^{-1})
d_3 = diameter of belt pulley (mm)
π = pi (–)
i = gear ratio (–)

Maximum permissible drive torque M_{mech}

The lowest (minimum) of all the values for permissible drive torque of all mechanical components contained in the drive train determines the maximum permissible drive torque of the mechanical system which has to be taken into consideration as the upper limit for the drive when sizing the motor.

	Frame moves	Carriage moves
Maximum permissible drive torque	$M_{mech} = M_p$	$M_{mech} = M_p$

M_p = maximum permissible drive torque of the linear motion system (Nm)
M_{mech} = maximum permissible drive torque of mechanical system (Nm)

⚠ When considering the complete drive train (mechanical system + motor/controller), the maximum torque of the motor can lie below the maximum value for the mechanical system (M_{mech}) and thus limit the maximum permissible drive torque of the overall drive train.
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The speed of the motor must be the same as or higher than the rotary speed for the mechanical system (but not exceeding the maximum permissible value).

$$n_{max} \geq n_{mech}$$

n_{max} = maximum rotary speed of motor (min^{-1})
n_{mech} = maximum permissible rotary speed of mechanical system (min^{-1})

Condition 2
Consideration of the ratio of mass moments of inertia of the mechanical system and the motor. The mass moment of inertia ratio serves as an indicator for the control performance of a motor-controller combination.
The mass moment of inertia of the motors is directly related to the motor size.

$$V = \frac{J_{ex}}{J_m + J_{br}}$$

V = ratio of mass moments of inertia of drive train and motor (–)
J_{ex} = mass moment of inertia of mechanical system (kgm^2)
J_m = mass moment of inertia, motor (kgm^2)
J_{br} = mass moment of inertia, motor brake (kgm^2)

For preselection, experience has shown that the following ratios will result in high control performance. These are not rigid limits, but values exceeding them will require closer consideration of the specific application.

Application area	V
Handling	≤ 6.0
Processing	≥ 1.5

Condition 3
Estimation of the ratio of the static load torque to the continuous torque of the motor.
The torque ratio must be smaller than or equal to the empirical value of 0.6.
By looking at the required motor torque levels, this estimation roughly covers the dynamic characteristics which still have to be determined by plotting an exact movement profile.

$$\frac{M_{stat}}{M_0} \leq 0.6$$

M_0 = continuous motor torque (Nm)
M_{stat} = static load torque (Nm)

	Frame moves	Carriage moves
Static load torque	$M_{stat} = M_R + M_g$	$M_{stat} = M_R + M_g$
Weight moment	$M_g = d_3 \cdot \frac{m_{tot\ mb} \cdot g}{2\,000 \cdot i}$	$M_g = d_3 \cdot \frac{m_{tot\ ca} \cdot g}{2\,000 \cdot i}$
Moved total mass	$m_{tot\ mb} = m_{ex} + m_{mb}$ $m_{mb} = k_{g\ fix} + k_{g\ var} \cdot L$	$m_{tot\ ca} = m_{ex} + m_{ca} + m_m + m_{br}$

d_3 = diameter of belt pulley (mm)
M_R = frictional torque at journal (Nm)
$m_{tot\ ca}$ = total mass with moving carriage (kg)
$m_{tot\ mb}$ = total mass with moving frame (kg)
m_{mb} = mass of the moving frame (kg)
$k_{g\ fix}$ = fixed mass proportion on the frame (kg)
$k_{g\ var}$ = variable mass proportion on the frame (kg/mm)
M_g = weight moment (Nm)
m_{ca} = mass of the carriage incl. gear (kg)
m_{ex} = moved external load (kg)
m_m = mass of motor (kg)
m_{br} = mass of the holding brake (kg)

Any additional forces arising from the use of power cable chains, for example, are not included in the observation of the moving total mass and must be taken into account additionally in the calculation where applicable.

In the overview **Configuration and ordering**, users can put together standard configurations, including gears and motor, for the various linear motion system sizes by selecting the appropriate options. By fulfilling the three conditions it is possible to see whether a standard motor selected in a particular configuration will generally be of a suitable size for the specific application.

Precise drive design
Pre-selecting the motor according to this rough guide is no substitute for the precise design calculations required for the drive, where all moments/torques and speed levels are taken into account. For precise calculation of the electric drive, including consideration of the specific movement profile, please refer to the performance data in the catalogs **IndraDrive Cs** and **IndraDrive C**. When sizing the drive, the maximum permitted values for speed, drive torque and acceleration must not be exceeded, in order to avoid damaging the mechanical system!

Calculations

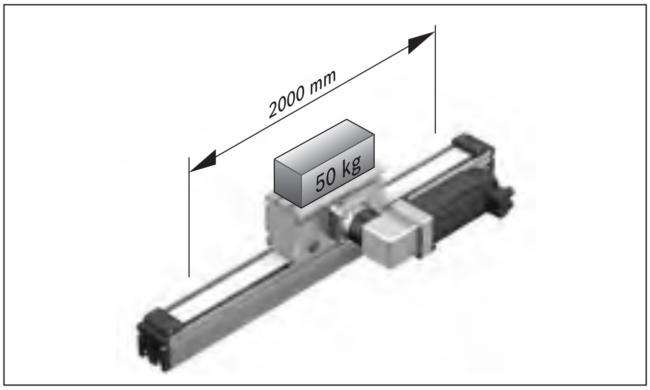
Calculation example

Mounting orientation HORIZONTAL

Arrangement: Carriage moves
(frame mounted on the mounting base)

Output data

In a handling task in horizontal installation position, a mass of 50 kg is to be moved by 2000 mm at a travel speed of 1.5 m/s. The frame should be mounted on the mounting base (carriage moves). No additional axial forces act. The selection was made based on the technical data and the installation space:



Omega module OBB-120:
– Carriage length = 330 mm (without clamping element)
– Motor attachment via angular planetary gearbox, i = 9
– with servo motor MSK 076C without brake

Module length L:
(In most cases, the recommended limit for excess travel is 2x lead constant. The excess travel must be greater than the excess travel stopping distance, which is calculated for an exact design of the electrical drive.)

	L	$= s_{max} + L_{ca} + L_{ad}$
Excess travel:	s_e	$= 2 \cdot u = 2 \cdot 37.78 = 75.74 = 76$ mm
Max. travel distance:	s_{max}	$= s_{eff} + 2 \cdot s_e$
		$= 2\,000 + 2 \cdot 76 = 2\,152$ mm
Module length:	L	$= 2\,152 + 330 + 170 = 2\,652$ mm

Frictional torque M_R:
(including the gear with gear ratio i = 9)

	M_R	$= M_{Rs}$
Linear module:	M_{Rs}	$= 2.02$ Nm

Mass moment of inertia J_{ex}:
(including the gear with gear ratio i = 9)

	J_{ex}	$= J_s + J_t$
Linear module:	J_s	$= (k_{J\,fix} + k_{J\,var} + L) \cdot 10^{-6}$
		$= (1\,838.85 + 0 \cdot 2\,652) \cdot 10^{-6}$
		$= 1\,838.85 \cdot 10^{-6}$ kgm²
External load:	J_t	$= (m_{ex} + m_m + m_{br}) \cdot k_{J\,m} \cdot 10^{-6}$
		$= (50 + 13.8 + 0) \cdot 36.15 \cdot 10^{-6}$
		$= 2\,306.37 \cdot 10^{-6}$ kgm²
Moment of inertia:	J_{ex}	$= 1\,838.85 \cdot 10^{-6} + 2\,306.37 \cdot 10^{-6}$
		$= 4\,145.22 \cdot 10^{-6}$ kgm²

Maximum permissible rotary speed n_{mech}:
(Motor attachment via gear, without consideration of the motor)
Limit value application

$n_{mech} = (V_{mech} \cdot i \cdot 1\,000 \cdot 60) / \pi \cdot d_3$

Max. permissible travel speed:

$V_{mech} = V_{max} = 1.86$ m/s

Max. permissible rotary speed:

$n_{mech} = (1.86 \cdot 9 \cdot 1\,000 \cdot 60) / \pi \cdot 108.23)$

$= 2\,954$ min^{-1}

Maximum speed of the application M_{mech}:
(Motor attachment via gear)
Limit value application

Speed:	v_{mech}	$= 1.5$ m/s
Speed:	n_{mech}	$= (1.5 \cdot 9 \cdot 1\,000 \cdot 60) / \pi \cdot 108.23)$
		$= 2\,382$ min^{-1}

Maximum permissible drive torque M_{mech}:
(Motor attachment via gear)
Limit value application

	M_{mech}	$= M_P$
Drive torque:	M_{mech}	$= 17.1$ Nm

Checking the motor preselection:
selected motor MSK 076C without brake

Condition 1:

Speed:	n_{max}	$\geq n_{mech}$
	4 500	$\geq$ 2 382
condition fulfilled – motor size OK		

Condition 2:

Mass moment of inertia ratio:	V	$= J_{ex} / (J_m + J_{Br})$
Motor inertia:	J_m	$= 4\,300 \cdot 10^{-6}$ kgm^2
Brake moment of inertia:	J_{Br}	$= 0$ kgm^2 (without brake)
Inertia ratio:	V	$= 4\,145.22 \cdot 10^{-6}/(4\,300 \cdot 10^{-6} + 0 \cdot 10^{-6})$
		$= 0.96$
Condition for handling:	V	≤ 6
	$0.96 \leq 6$	
condition fulfilled – motor size OK		

Condition 3:

Torque ratio:	$M_{stat} / M_0 \leq 0.6$	
Static Load torque:	M_{stat}	$= M_R + Mg$
Weight moment:	M_g	$= 0$ Nm (horizontal mounting orientation)
Static Load torque:	M_{stat}	$= 2.02$ Nm
Continuous motor torque:	M_0	$= 12$ Nm
Torque ratio:	$2.02 / 12 = 0.17$	
	0.17	≤ 0.6
condition fulfilled – motor size OK		

Result:

Omega module OBB-120

Length	L	$= 2\,652$ mm
Max. travel distance	s_{max}	$= 2\,152$ mm
Carriage length	L_{ca}	$= 330$ mm
Drive	toothed belt drive	
Motor mounting	via angular planetary gearbox	
Gear ratio	$i = 9$	
Preselected motor:	MSK 076C without brake	
Arrangement:	Frame mounted on the mounting base, carriage moving Mounting orientation horizontal	

For precise sizing of the electric drive, the motor-controller combination must always be considered, as the performance data (e.g. maximum useful speed and maximum torque) will depend on the controller used.

When doing this, the following data must be considered:

- Frictional torque: M_R $= 2.02$ Nm
- Mass moment of inertia: J_{ex} $= 4\,145.22 \cdot 10^{-6}$ kgm^2
- Speed: v_{mech} $= 1.5$ m/s (n_{mech} $= 2\,382$ min^{-1})
- Limit value for Drive torque: M_{mech} $= 17.1$ Nm

The motor torque must be limited to 17.1 Nm on the drive side!

- Limit value for acceleration: a_{max} $= 50$ m/s^2
- Limit value for speed: v_{mech} $= 1.86$ m/s (n_{mech} $= 2\,954$ min^{-1})

After the excess travel stopping distance has been determined during the exact design, check whether the selected excess travel is sufficient or whether, if appropriate, an adjustment must be made. Besides the preferred type MSK 076C, other motors with identical connection dimensions can be adapted while taking care not to exceed the calculated limits.

Calculations

Calculation example

Mounting orientation VERTICAL

Arrangement: Frame moves
(carriage mounted on the mounting base)

Output data
In a handling task in vertical installation position, a mass of 20 kg is to be moved by 1 000 mm at a travel speed of 1.5 m/s. No additional axial forces act. The frame should enter the working range (frame moves). The selection was made based on the technical data and the installation space:

Omega module OBB-085:
- Carriage length = 260 mm (without clamping element
- Motor attachment via angular planetary gearbox, i = 8
- with servo motor MSK 050C wit brake

Module length L:
(In most cases, the recommended limit for excess travel is 2x lead constant. The excess travel must be greater than the excess travel stopping distance, which is calculated for an exact design of the electrical drive.)

	L	$= s_{max} + L_{ca} + L_{ad}$
Excess travel:	s_e	$= 2 \cdot u = 2 \cdot 31.88 = 63.76 = 64$ mm
Max. travel distance:	s_{max}	$= s_{eff} + 2 \cdot s_e$
		$= 1\ 000 + 2 \cdot 64 = 1\ 128$ mm
Module length:	L	$= 1\ 128 + 260 + 130 = 1\ 518$ mm

Frictional torque M_R:
(including the gear with gear ratio i = 8)

	M_R	$= M_{Rs}$
Linear module:	M_{Rs}	$= 0.93$ Nm

Mass moment of inertia J_{ex}:
(including the gear with gear ratio i = 8)

	J_{ex}	$= J_s + J_t$
Linear module:	J_s	$= (k_{J\,fix} + k_{J\,var} + L) \cdot 10^{-6}$
		$= (123.47 + 0.2821 \cdot 1\ 518) \cdot 10^{-6}$
		$= 551.657 \cdot 10^{-6}$ kgm^2
External load:	J_t	$= m_{ex} \cdot k_{J\,m} \cdot 10^{06}$
		$= 20 \cdot 25.74 \cdot 10^{-6}$ kgm^2
		$= 514.732 \cdot 10^{-6}$ kgm^2
Moment of inertia:	J_{ex}	$= 551.657 \cdot 10^{-6} + 514.732 \cdot 10^{-6}$
		$= 1\ 066.389 \cdot 10^{-6}$ kgm^2

Maximum permissible rotary speed n_{mech}:
(Motor attachment via gear,
without consideration of the motor)
Limit for mechanical system

$n_{mech} = (V_{mech} \cdot i \cdot 1\ 000 \cdot 60) / \pi \cdot d_3$

Max. permissible travel speed:

$V_{mech} = V_{max} = 2.13$ m/s

Max. permissible rotary speed:

$n_{mech} = (2.13 \cdot 8 \cdot 1\ 000 \cdot 60) / \pi \cdot 81.17$

$= 4\ 009$ min^{-1}

Maximum speed of the application M_{mech}:
(Motor attachment via gear)
Limit value application

Speed:	v_{mech}	$= 1.5$ m/s
Speed:	n_{mech}	$= (1.5 \cdot 8 \cdot 1\ 000 \cdot 60) / \pi \cdot 81.17$
		$= 2\ 823$ min^{-1}

Maximum permissible drive torque M_{mech}:
(Motor attachment via gear)
Limit for mechanical system

	M_{mech}	$= M_P$
Drive torque:	M_{mech}	$= 5$ Nm

Checking the motor preselection:
selected motor MSK 050C with brake

Condition 1:

Speed: $n_{max} \geq n_{mech}$

$6\,000 \geq 2\,823$

condition fulfilled – motor size OK

Condition 2:

Mass moment of inertia ratio: $V = J_{ex} / (J_m + J_{Br})$

Motor inertia: $J_m = 330 \cdot 10^{-6}$ kgm²

Brake moment of inertia: $J_{Br} = 107 \cdot 10^{-6}$ kgm² (with brake)

Inertia ratio: $V = 1\,066.389 \cdot 10^{-6} / (330 \cdot 10^{-6} + 107 \cdot 10^{-6})$

$= 2.44$

Condition for handling: $V \leq 6$

$2.44 \leq 6$

condition fulfilled – motor size OK

Condition 3:

Torque ratio: $M_{stat} / M_0 \leq 0.6$

Static Load torque: $M_{stat} = M_R + M_g$

Weight moment: $M_g = d_3 \cdot (m_{ex} + m_{mb}) \cdot g / 2\,000 \cdot i$

Mass of the moving frame:

$m_{mb} = k_{g\,fix} + k_{g\,var} \cdot L$

$= 1.05 + 0.0108 \cdot 1\,518$

$= 17.44$ kg

Moved external load $m_{ex} = 20$ kg

$M_g = 81.17 \cdot (17.44 + 20) \cdot 9.81 / 2\,000 \cdot 8$

$= 1.86$ Nm

Static Load torque: $M_{stat} = 0.93 + 1.86 = 2.79$ Nm

Continuous motor torque: $M_0 = 5$ Nm

Torque ratio: $2.79/5 = 0.56$

$0.56 \leq 0.6$

condition fulfilled – motor size OK

Result:

Omega module OBB-085

Length	L	= 1 518 mm
Max. travel distance	s_{max}	= 1 128 mm
Carriage length	L_{ca}	= 260 mm
Drive	toothed belt drive	
Motor mounting	via angular planetary gearbox	
Gear ratio	$i = 8$	
Preselected motor:	MSK 050C with brake	
Arrangement:	Carriage fixed on the mounting base, frame moves Mounting orientation vertical	

For precise sizing of the electric drive, the motor-controller combination must always be considered, as the performance data (e.g. maximum useful speed and maximum torque) will depend on the controller used.

When doing this, the following data must be considered:

- Frictional torque: $M_R = 0.93$ Nm
- Mass moment of inertia: $J_{ex} = 1\,066.389 \cdot 10^{-6}$ kgm²
- Speed: $v_{mech} = 1.5$ m/s ($n_{mech} = 2\,823$ min⁻¹)
- Limit value for Drive torque: $M_{mech} = 5$ Nm

The motor torque must be limited to 5 Nm on the drive side!

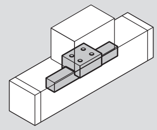
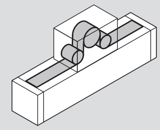
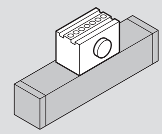
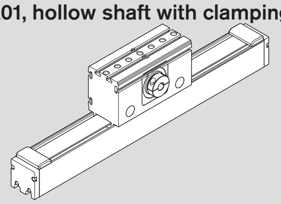
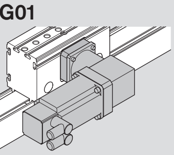
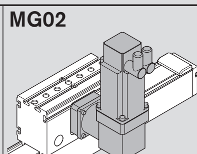
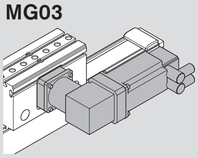
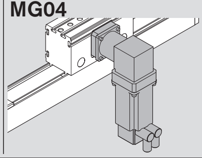
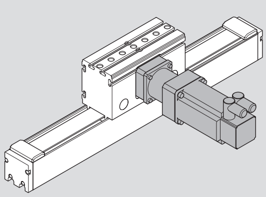
- Limit value for acceleration: $a_{max} = 50$ m/s²
- Limit value for speed: $v_{mech} = 2.13$ m/s ($n_{mech} = 4\,009$ min^{-1})

After the excess travel stopping distance has been determined during the exact design, check whether the selected excess travel is sufficient or whether, if appropriate, an adjustment must be made.
Besides the preferred type MSK 050C, other motors with identical connection dimensions can be adapted while taking care not to exceed the calculated limits.

Configuration and ordering

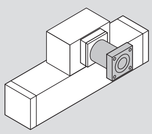
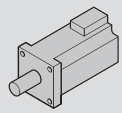
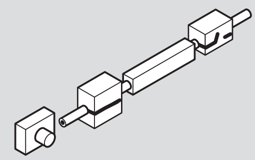
OBB-055

Configuration and ordering

Short product name, length OBB-055-NN-1, ... mm		Guideway	Drive				Carriage	
			 Reduction				 L_{ca} = 230 mm	
Version[2)]							without	with
			i = 1	i = 3	i = 5	i = 8	Clamping element	
with drive (MA), without gear i = 1	MA01, hollow shaft with clamping hub 	01	01	–			01	02
with gear (MG), angular planetary gearbox WPG	MG01  MG02  MG03  MG04 	01	–	10			01	02
with gear (MG), planetary gearbox PG	MG10 	01	–	10			01	02

Ordering example: see “Inquiry/order”

Note:
When a shock absorber is used, the maximum travel distance is reduced due to the construction (s_{max}). For the calculation, the maximum travel distance must therefore be reduced by the value s_{red} per side or per shock absorber, see section “Accessories”.

Motor attachment				Motor		Switching system[4]		Documentation
								
Speed reduction i =	Attachment kit[3] with gear MG01 MG03	Attachment kit[3] with gear MG02 MG04	for motor	without Brake	with Brake			standard report
–	00		–	00		Without switch and without cable duct	00	01
i = 3	45	55	MSK 040C	86	87	**Carriage moves**		
i = 5	47	57	MSK 040C	86	87	Switch: – PNP NC	71	
i = 5	46	56	MSM 031C	138	139	– PNP NO	73	
i = 8	44	54	MSM 031C	138	139	– Mechanical	75	
i = 3	41		MSK 040C	86	87	Cable duct[1]	20	
i = 5	43		MSK 040C	86	87	Socket-plug	17	
i = 5	42		MSM 031C	138	139	Switching angle	36	
i = 8	40		MSM 031C	138	139	**Frame moves**		
						Switch: – PNP NC	61	
						– PNP NO	63	
						– Mechanical	65	
						Socket-plug	17	
						Two control strips	39	

1) The delivery length of the cable duct corresponds to the length of the profiled support. For a different length, please order the cable duct as a single item (ordering "Switches and attachments" page 44)
2) When the servo motor is mounted, the delivery is only made in accordance with the motor assembly shown in the "Delivery form" section (note the position of the motor connectors)!
3) Attachment kit can also be delivered without motor. When ordering, enter the motor type "00"!
4) The switches are selected according to the installation situation (carriage / frame moves)! See section "Switch mounting".

Length L (mm)**:**

$$L = s_{max} + L_{ca} + L_{ad}$$

$$s_{max} = s_{eff} + 2 \cdot s_e$$

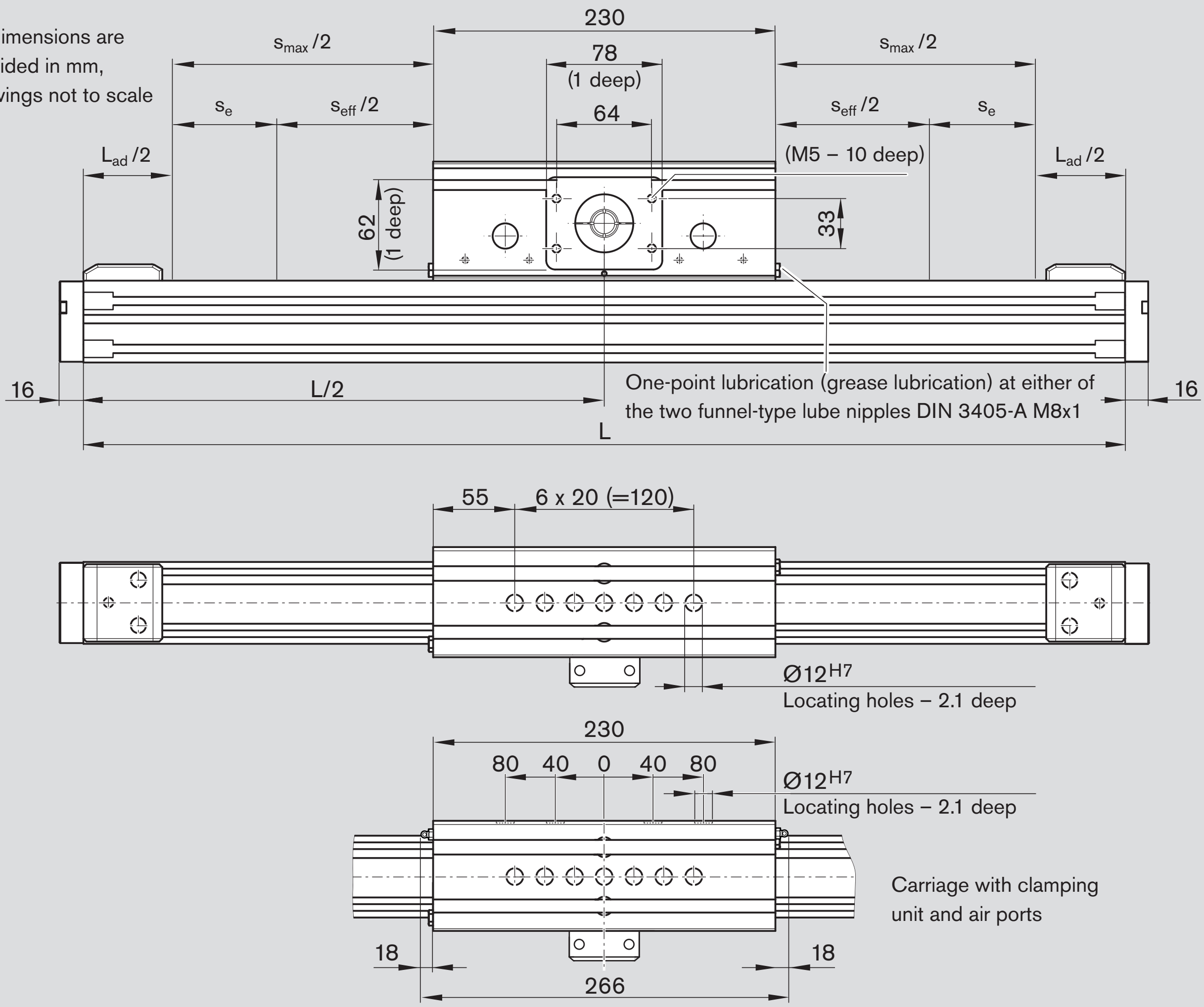
L_{ca} = carriage length (mm)
L_{ad} = additional length (mm) (for the value, see the table in the section "General technical data")
s_{max} = maximum travel distance (mm)
s_{eff} = effective travel distance (mm)
s_e = excess travel (mm)

Configuration and ordering

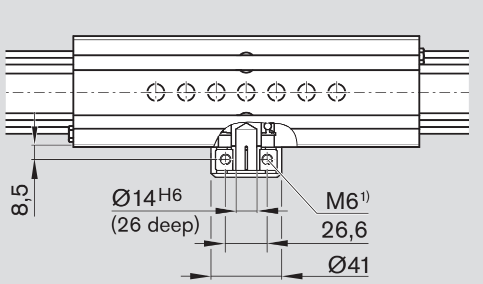
OBB-055

Dimensions

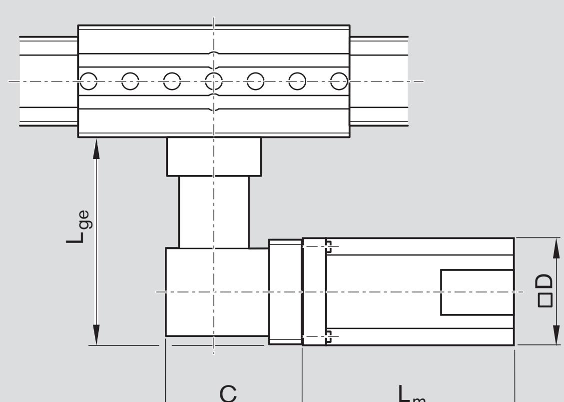
All dimensions are provided in mm, drawings not to scale

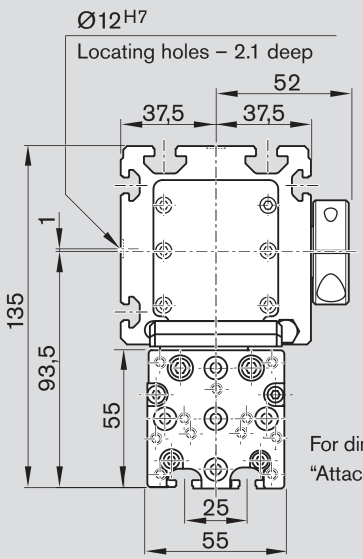


MA01	MG01, MG02, MG03, MG04

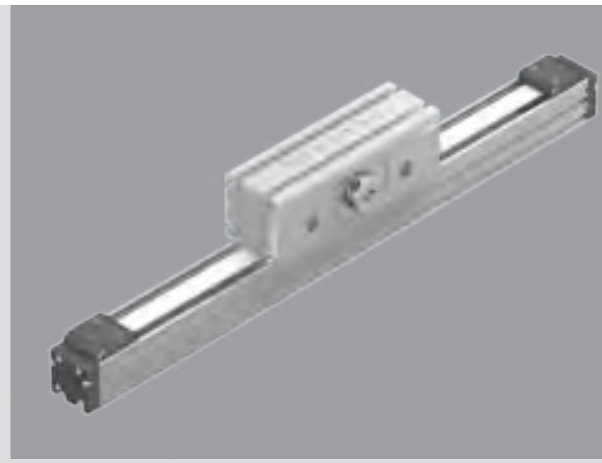


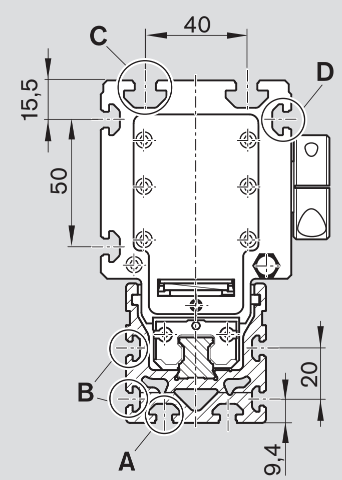
1) Cylinder screw ISO 4762

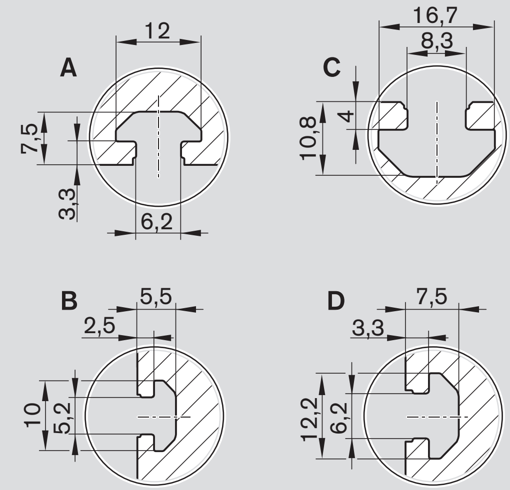




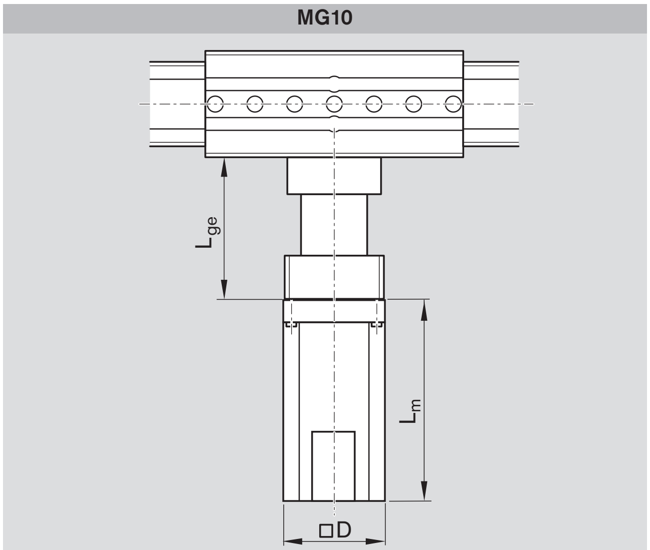
For dimensions of end plate, see section “Attachment of additional devices”







MG10



Motor[1)]	Dimensions (mm)					
	Gear unit			Motor		
	MG 01/02/03/04		MG 10	D	L_m	
	L_{ge}	C	L_{ge}		without brake	with brake
MSK 040C	150.5	97.5	111.5	82	185.5	215.5
MSM 031C	135.5	97.5	111.5	60	98.5	135.0

1) For the connector position of the motor, observe section “Delivery form”

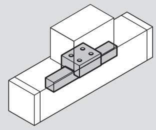
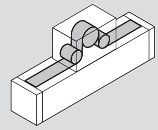
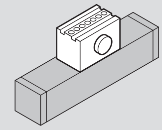
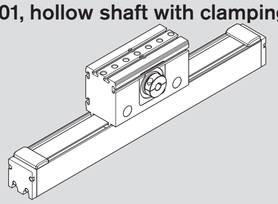
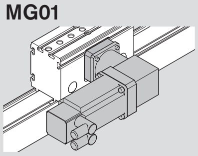
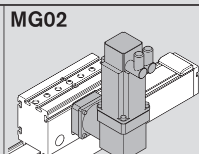
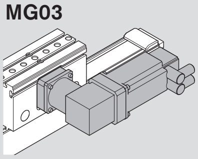
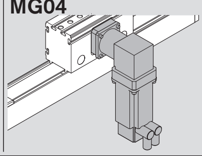
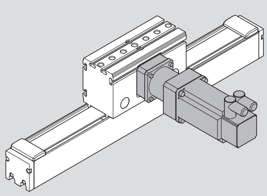
L = length
C = gear height
L_{ge} = gear length
D = motor width
L_m = motor length

L_{ca} = carriage length (mm)
L_{ad} = additional length (mm)
(for the value, see the table in the section “General technical data”)
s_{max} = maximum travel distance (mm)
s_{eff} = effective travel distance (mm)
s_e = excess travel (mm)

Configuration and ordering

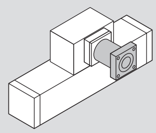
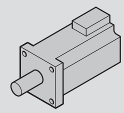
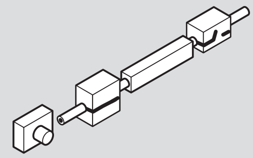
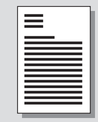
OBB-085

Configuration and ordering

Short product name, length OBB-085-NN-1, ... mm		Guideway	Drive			Carriage		
								
			Reduction			L_{ca} = 260 mm	L_{ca} = 308 mm	
Version[2)]						without	with	
			i = 1	i = 5	i = 8	Clamping element		
with drive (MA), without gear i = 1	MA01, hollow shaft with clamping hub 	01	01	–		01	02	
with gear (MG), angular planetary gearbox WPG	MG01  MG02  MG03  MG04 	01	–	10		01	02	
with gear (MG), planetary gearbox PG	MG10 	01	–	10		01	02	

Ordering example: see "Inquiry/order"

Note:
When a shock absorber is used, the maximum travel distance is reduced due to the construction (s_{max}). For the calculation, the maximum travel distance must therefore be reduced by the value s_{red} per side or per shock absorber, see section "Accessories".

Motor attachment  **Motor**  **Switching system** [4]  **Documentation** 

Speed reduction i =	Attachment kit [3] with gear MG01 MG03	Attachment kit [3] with gear MG02 MG04	for motor	Motor without brake	Motor with brake
–	00		–	00	
i = 5	33	43	MSK 050C	88	89
i = 8	35	45	MSK 050C	88	89
i = 8	34	44	MSM 041B	140	141
i = 5	30		MSK 050C	88	89
i = 8	32		MSK 050C	88	89
i = 8	31		MSM 041B	140	141

Switching system [4]	
Without switch and without cable duct	00
Carriage moves	
Switch:	
– PNP NC	71
– PNP NO	73
– Mechanical	75
Cable duct [1]	20
Socket-plug	17
Switching angle	36
Frame moves	
Switch:	
– PNP NC	61
– PNP NO	63
– Mechanical	65
Socket-plug	17
Two control strips	41

Documentation	
standard report	01

1) The delivery length of the cable duct corresponds to the length of the profiled support. For a different length, please order the cable duct as a single item (ordering "Switches and attachments" page 44)
2) When the servo motor is mounted, the delivery is only made in accordance with the motor assembly shown in the "Delivery form" section (note the position of the motor connectors)!
3) Attachment kit can also be delivered without motor. When ordering, enter the motor type "00"!
4) The switches are selected according to the installation situation (carriage / frame moves)! See section "Switch mounting".

Length L (mm):

$$L = s_{max} + L_{ca} + L_{ad}$$

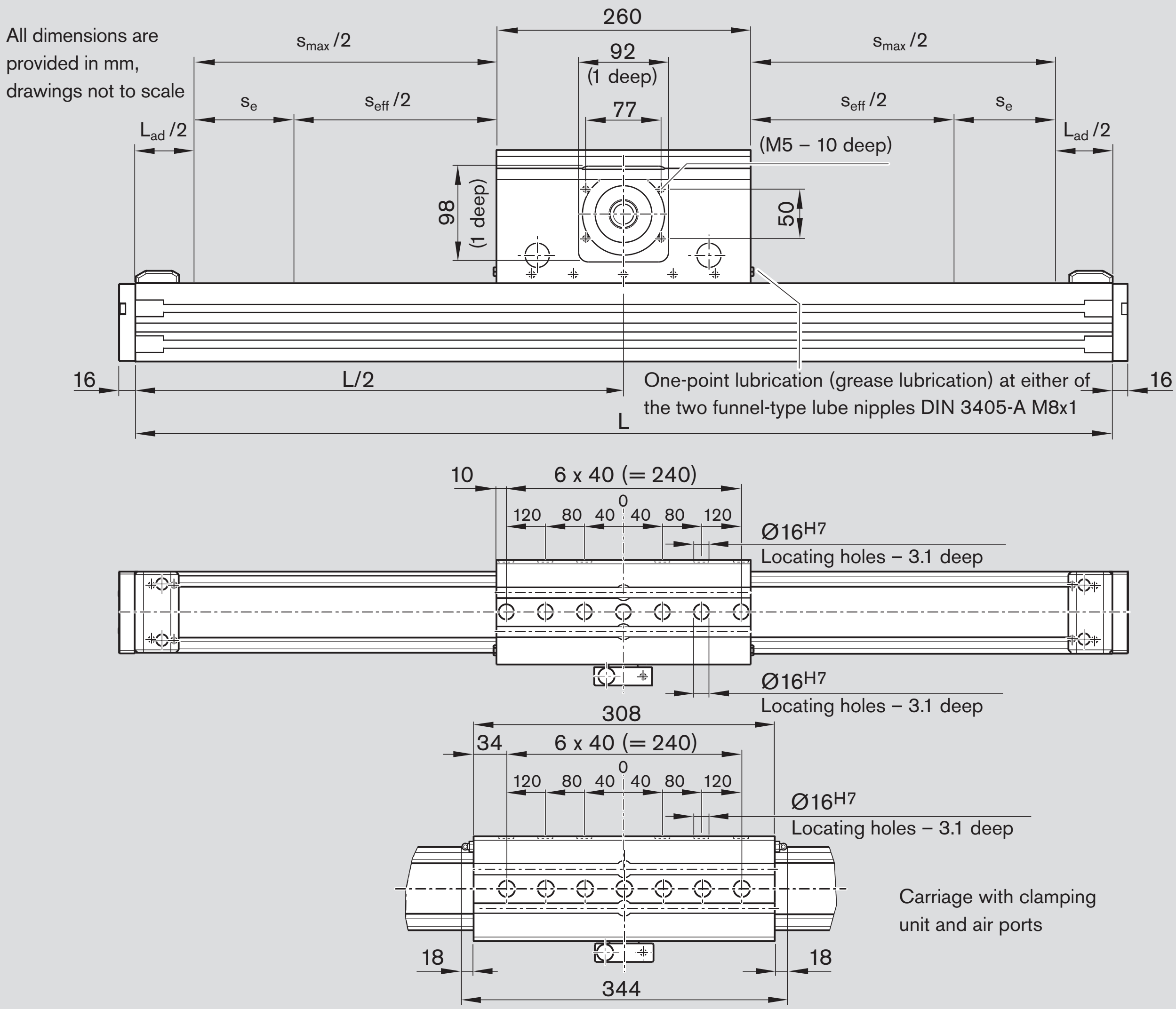
$$s_{max} = s_{eff} + 2 \cdot s_e$$

L_{ca} = carriage length (mm)
L_{ad} = additional length (mm) (for the value, see the table in the section "General technical data")
s_{max} = maximum travel distance (mm)
s_{eff} = effective travel distance (mm)
s_e = excess travel (mm)

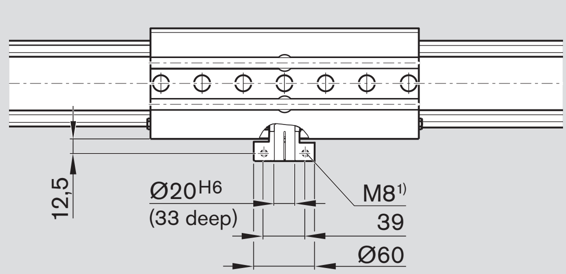
Configuration and ordering

OBB-085

Dimensions

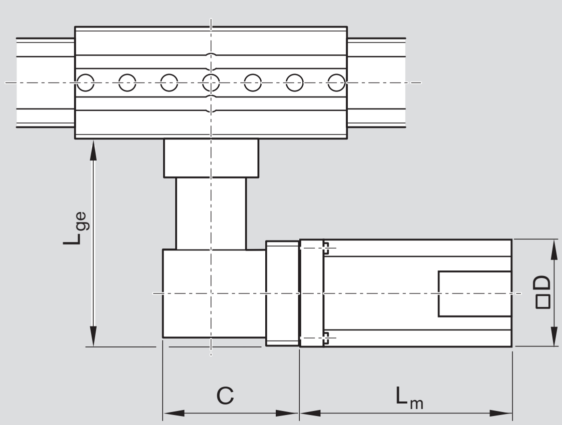


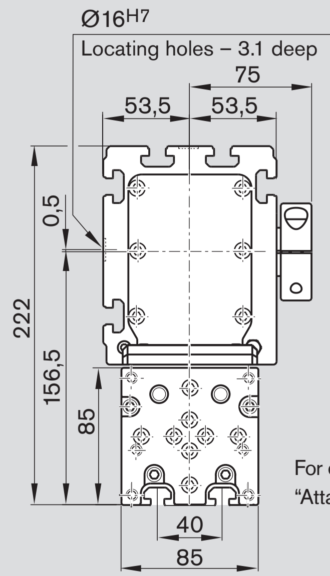
MA01



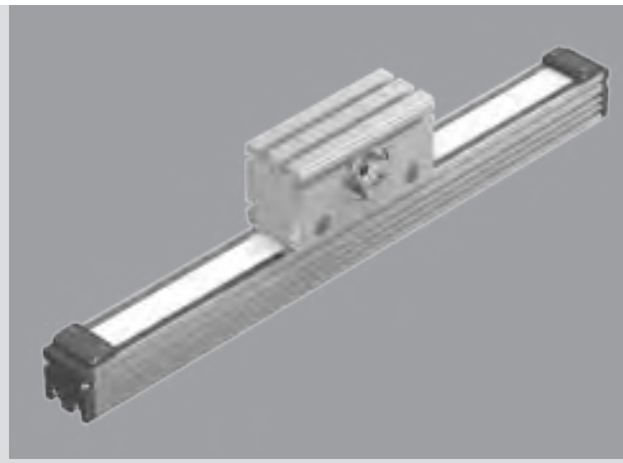
1)Cylinder screw ISO 4762

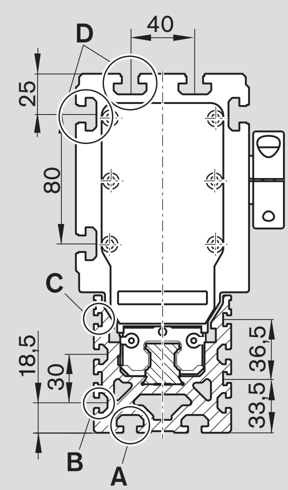
MG01, MG02, MG03, MG04

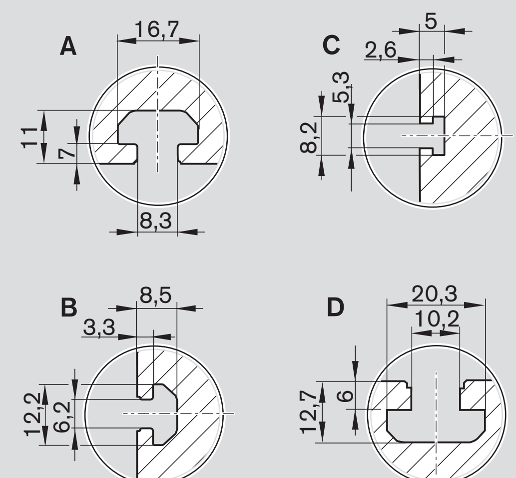




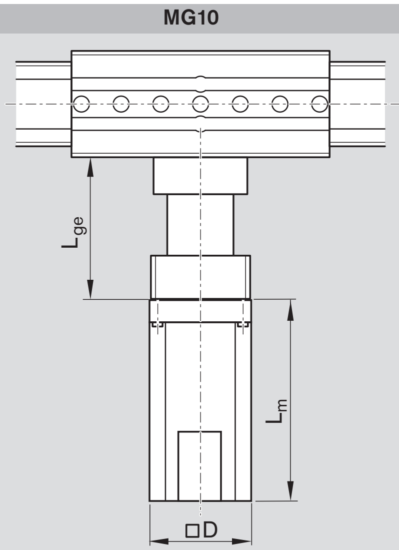
For dimensions of end plate, see section “Attachment of additional devices”







MG10



Motor[1)]	Dimensions (mm)					
	Gear unit			Motor		
	MG 01/02/03/04		MG 10	D	L_m	
	L_{ge}	C	L_{ge}		without brake	with brake
MSK 050C	192.5	124.5	142	98	203.0	233.0
MSM 041B	187.5	124.5	142	80	112.0	149.0

1) For the connector position of the motor, observe section “Delivery form”

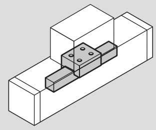
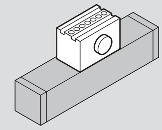
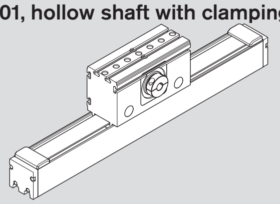
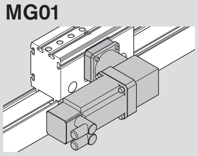
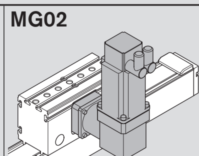
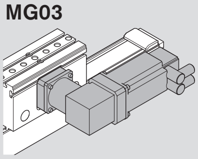
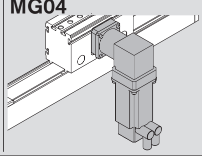
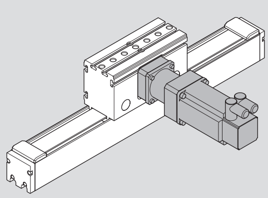
L = length
C = gear height
L_{ge} = gear length
D = motor width
L_m = motor length

L_{ca} = carriage length (mm)
L_{ad} = additional length (mm) (for the value, see the table in the section “General technical data”)
s_{max} = maximum travel distance (mm)
s_{eff} = effective travel distance (mm)
s_e = excess travel (mm)

Configuration and ordering

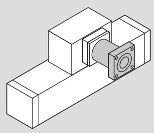
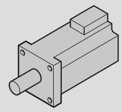
OBB-120

Configuration and ordering

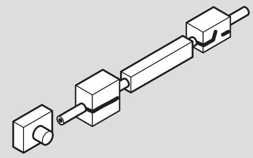
Short product name, length OBB-120-NN-1, ... mm		Guideway	Drive		Carriage	
			Reduction		 L_{ca} = 330 mm	
Version[2)]			i = 1	i = 9	without Clamping element	with Clamping element
with drive (MA), without gear i = 1	MA01, hollow shaft with clamping hub 	01	01	–	01	02
with gear (MG), angular planetary gearbox WPG	MG01  MG02  MG03  MG04 	01	–	10	01	02
with gear (MG), planetary gearbox PG	MG10 	01	–	10	01	02

Ordering example: see "Inquiry/order"

Note:
When a shock absorber is used, the maximum travel distance is reduced due to the construction (s_{max}). For the calculation, the maximum travel distance must therefore be reduced by the value s_{red} per side or per shock absorber, see section "Accessories".

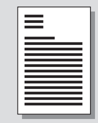
Motor attachment				Motor	
					
Speed reduction i =	Attachment kit 3) with gear MG01 MG03	MG02 MG04	for motor	without brake	with brake
–	00		–	00	
i = 9	31	32	**MSK 076C**	92	93
i = 9	30		**MSK 076C**	92	93

Switching system 4)



Without switch and without cable duct	00
Carriage moves	
Switch:	
– PNP NC	71
– PNP NO	73
– Mechanical	75
Cable duct 1)	20
Socket-plug	17
Switching angle	36
Frame moves	
Switch:	
– PNP NC	61
– PNP NO	63
– Mechanical	65
Socket-plug	17
Two control strips	43

Documentation



standard report
01

1) The delivery length of the cable duct corresponds to the length of the profiled support. For a different length, please order the cable duct as a single item (ordering “Switches and attachments” page 44)
2) When the servo motor is mounted, the delivery is only made in accordance with the motor assembly shown in the “Delivery form” section (note the position of the motor connectors)!
3) Attachment kit can also be delivered without motor. When ordering, enter the motor type “00”!
4) The switches are selected according to the installation situation (carriage / frame moves)! See section “Switch mounting”.

Length L (mm):

$$L = s_{max} + L_{ca} + L_{ad}$$

$$s_{max} = s_{eff} + 2 \cdot s_e$$

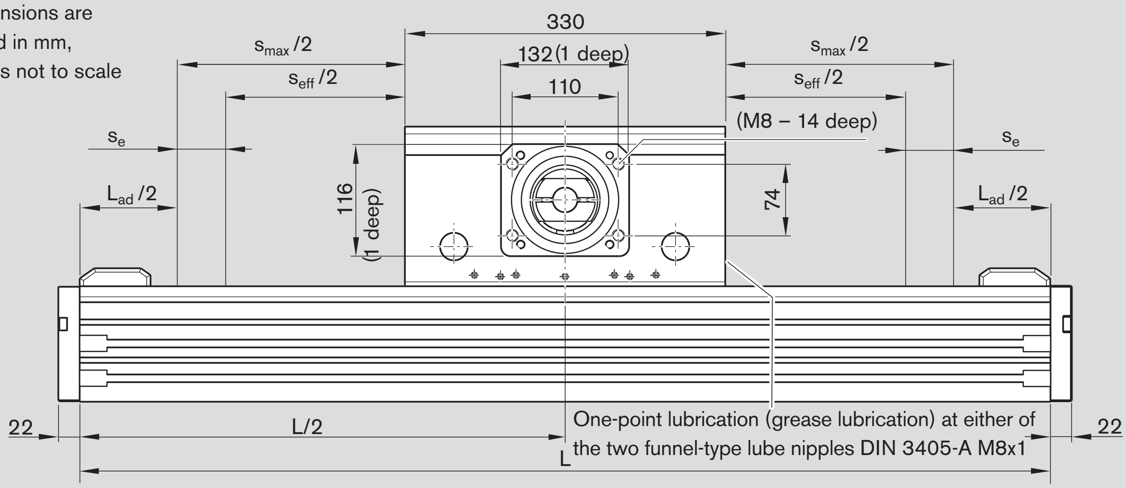
L_{ca} = Carriage length (mm)
L_{ad} = additional length (mm) (for the value, see the table in the section “General technical data”)
s_{max} = maximum travel distance (mm)
s_{eff} = effective travel distance (mm)
s_e = excess travel (mm)

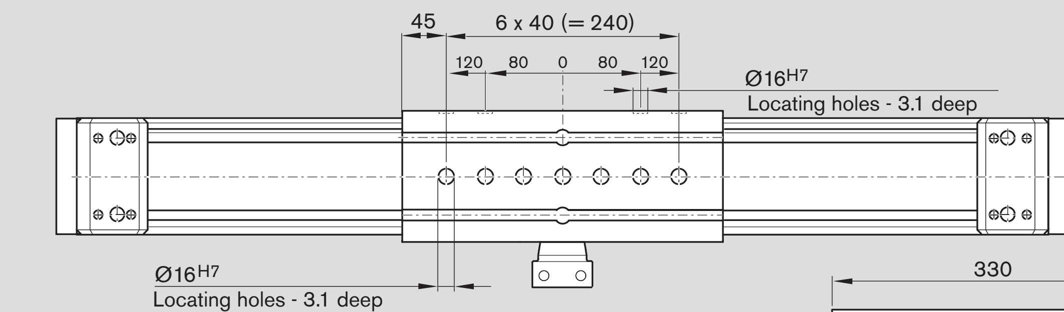
Configuration and ordering

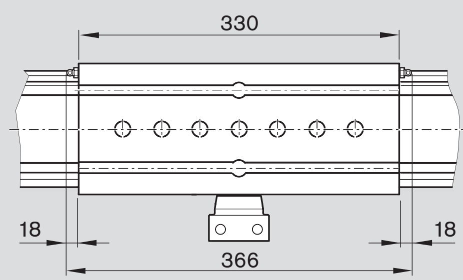
OBB-120

Dimensions

All dimensions are provided in mm, drawings not to scale

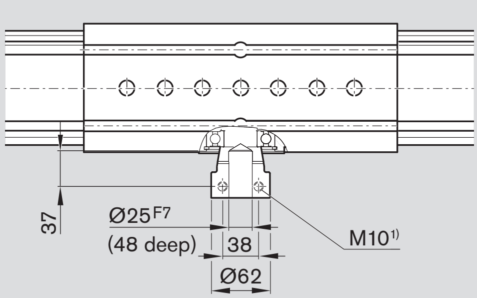






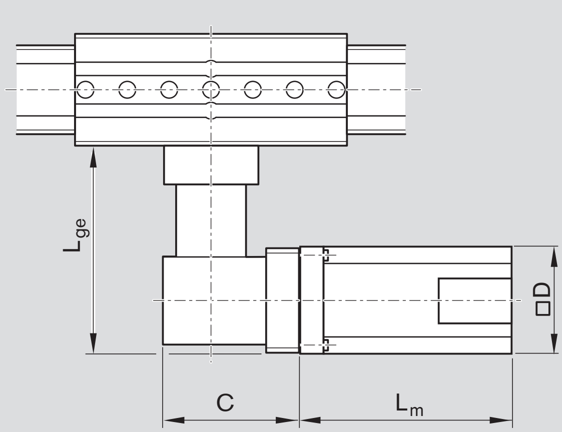
Carriage with clamping unit and air ports

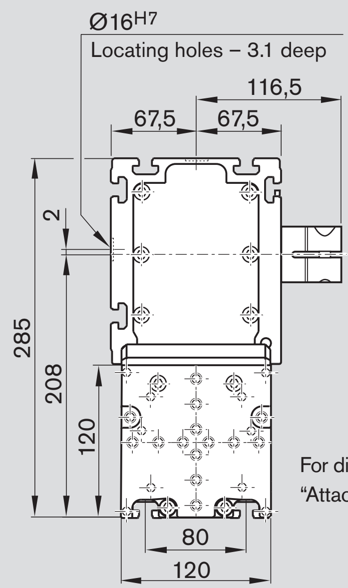
MA01



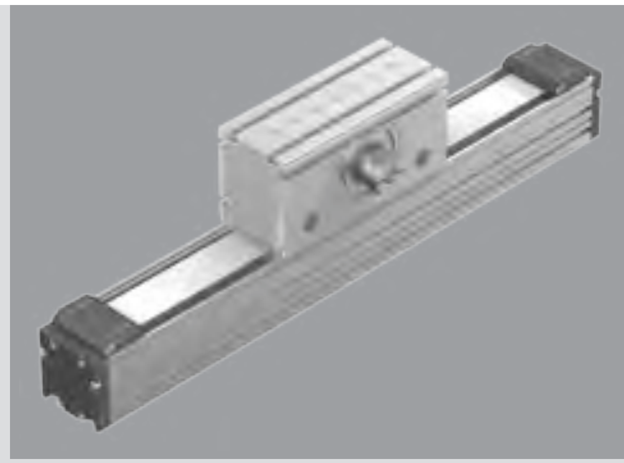
[1)]Cylinder screw ISO 4762

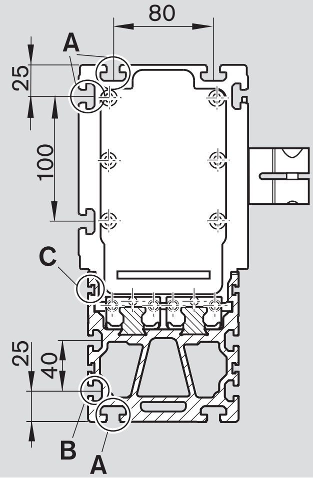
MG01, MG02, MG03, MG04

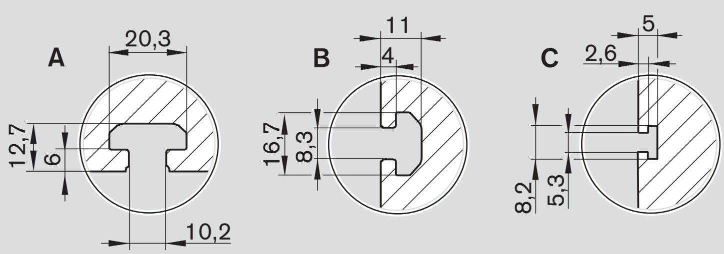




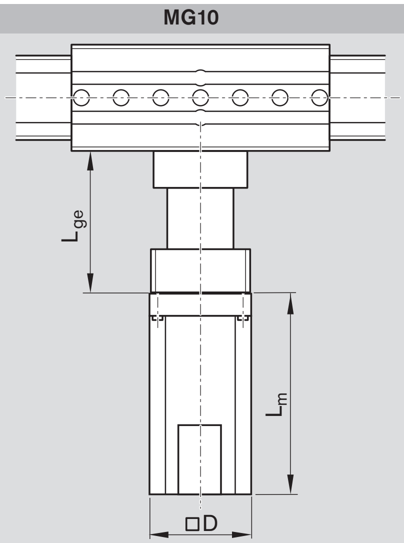
For dimensions of end plate, see section “Attachment of additional devices”







MG10



Motor[1)]	Dimensions (mm)					
	Gear unit			Motor		
	MG 01/02/03/04		MG 10	D	L_m	
	L_{ge}	C	L_{ge}		without brake	with brake
MSK 076C	287.5	155.5	212	140	292.5	292.5

1) For the connector position of the motor, observe section “Delivery form”

L = length
C = gear height
L_{ge} = gear length
D = motor width
L_m = motor length

L_{ca} = carriage length (mm)
L_{ad} = additional length (mm)
(for the value, see the table in the section “General technical data”)
s_{max} = maximum travel distance (mm)
s_{eff} = effective travel distance (mm)
s_e = excess travel (mm)

Attachments and accessories

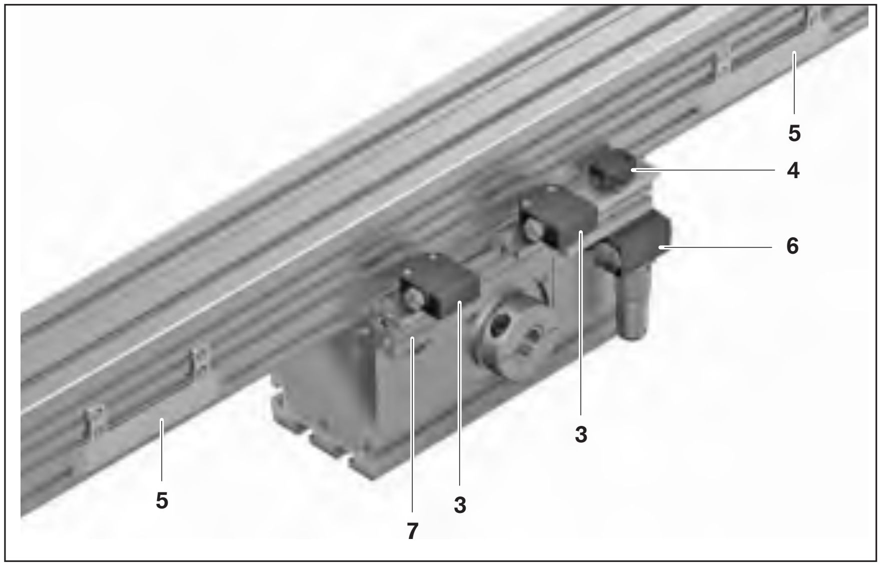
Switch mounting – frame moves (carriage fixed)

Switching principle

- Proximity or mechanical switches on the carriage (TT)
- Switch activation via control strip on the frame (HK)

Overview of switching system

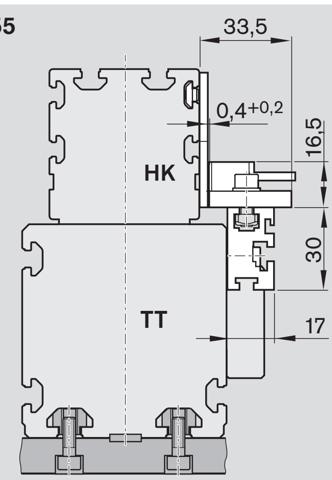
3 Mechanical switches (with attachments)
4 Proximity switch (with attachments)
5 Control strip on the frame
6 Socket and plug
7 Switch mounting profile



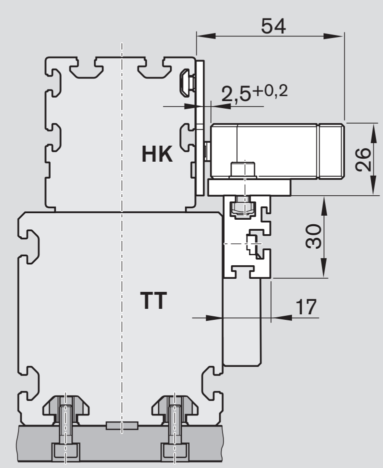
Pos.	Description	OBB-055 Material number included in (option[1])		OBB-085 Material number included in (option[1])		OBB-120 Material number included in (option[1])	
3	Mechanical switch with attachments	R1175 001 62	(65)	R1175 001 62	(65)	R1175 001 62	(65)
	Mechanical switch	R3453 040 16	(65)	R3453 040 16	(65)	R3453 040 16	(65)
4	Proximity switch, PNP NC	R3453 040 01	(61)	R3453 040 01	(61)	R3453 040 01	(61)
	Proximity switch, PNP NO	R3453 040 03	(63)	R3453 040 03	(63)	R3453 040 03	(63)
	Attachments for proximity switch	R1175 001 63	(61), (63)	R1175 001 63	(61), (63)	R1175 001 63	(61), (63)
5	2 control strips with attachments	R1175 001 59	(39)	R1175 001 60	(41)	R1175 001 61	(42)
6	Socket + plug	R1175 001 53	(17)	R117 5001 53	(17)	R1175 001 53	(17)
7	Switch mounting profile with attachments	R1175 001 64	(39)	R1175 001 64	(41)	R1175 001 64	(42)

1) For options, see “Configuration and ordering”

OBB-055

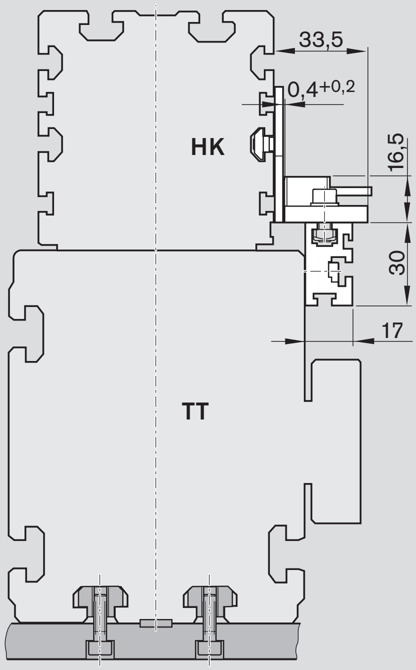


Proximity switches with attachments

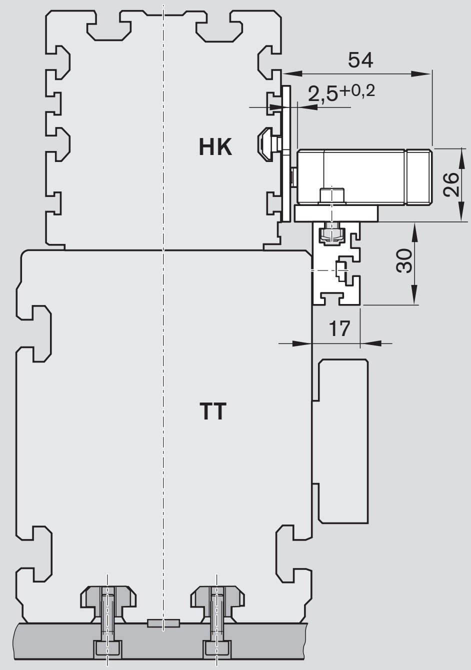


Mechanical switches with attachments

OBB-085

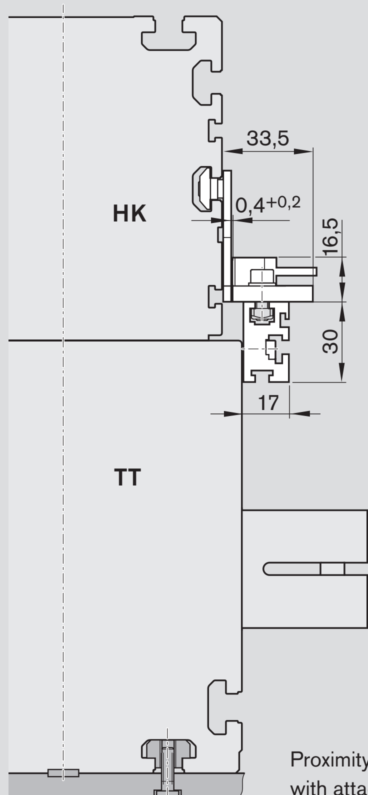


Proximity switches
with attachments

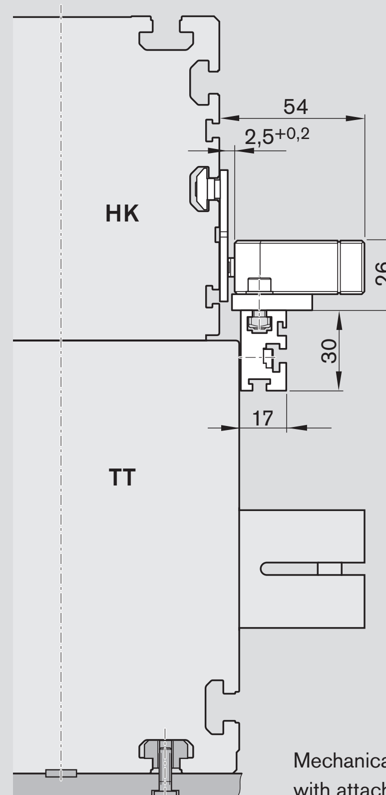


Mechanical switches
with attachments

OBB-120



Proximity switches
with attachments



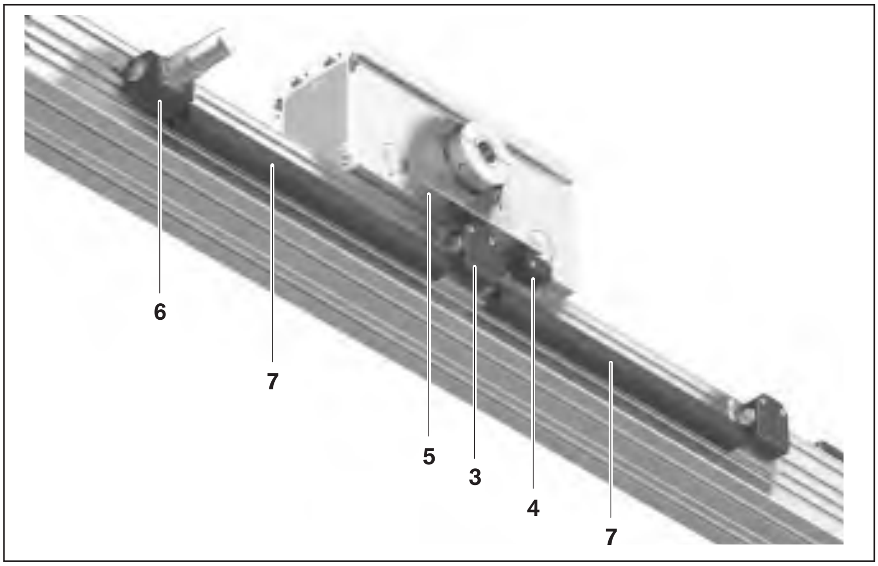
Mechanical switches
with attachments

Attachments and accessories

Switch mounting – carriage moves (frame fixed)

Switching principle

- Proximity or mechanical switches on the frame (HK)
- Switch activation via switching angle on the carriage (TT)



Overview of switching system

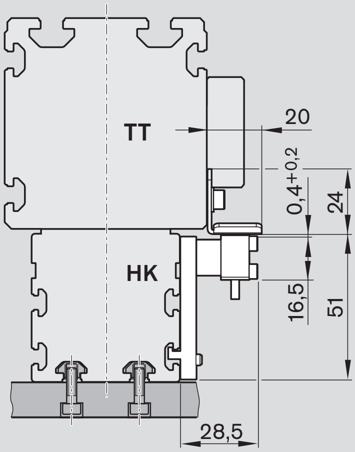
3 Mechanical switch (with attachments)
4 Proximity switch (with attachments)
5 Switching angle
6 Socket and plug
7 Cable duct

Pos.	Description	OBB-055 Material number included in (option1))		OBB-085 Material number included in (option1))		OBB-120 Material number included in (option1))	
3	Mechanical switch with attachments	R1175 001 51	(75)	R1175 001 51	(75)	R1175 001 51	(75)
	Mechanical switch without attachments	R3453 040 16	(75)	R3453 040 16	(75)	R3453 040 16	(75)
4	Proximity switch, PNP NC	R3453 040 01	(61)	R3453 040 01	(61)	R3453 040 01	(61)
	Proximity switch, PNP NO	R3453 040 03	(63)	R3453 040 03	(63)	R3453 040 03	(63)
	Attachments for proximity switch	R1175 001 57	(71), (73)	R1175 001 58	(71), (73)	R1175 001 58	(71), (73)
5	Switching angle with attachments	R1175 001 56	(36)	R1175 001 56	(36)	R1175 001 56	(36)
6	Socket + plug	R1175 001 53	(7)	R1175 001 53	(17)	R1175 001 53	(17)
7	Cable duct, L_K =	R0396 620 17 2)	(20)	R0396 620 17 2)	(20)	R0396 620 17 2)	(20)

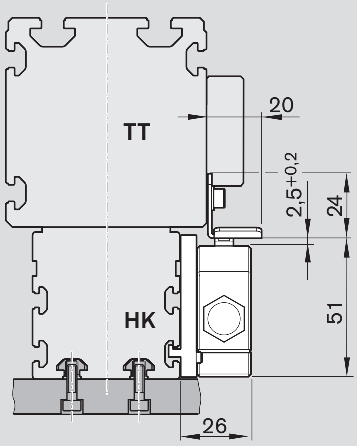
1) For options, see “Configuration and ordering”
2) A length must always be specified when ordering cable ducts. For example “R0396 620 17, 285 mm”.

L_K = length of the cable duct (mm)

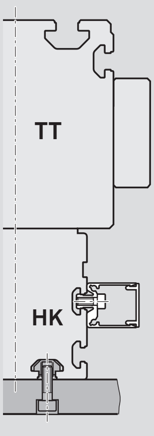
OBB-055



Proximity switches with attachments

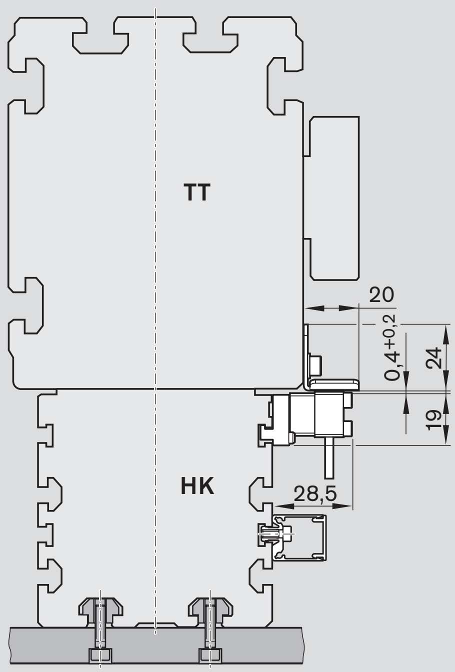


Mechanical switches with attachments

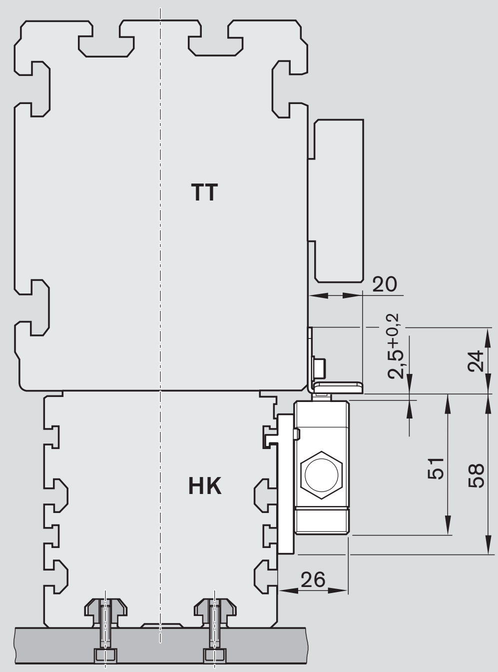


Cable duct

OBB-085

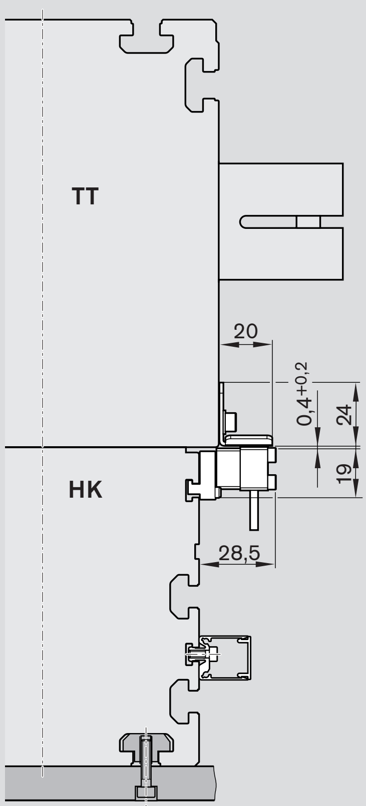


Proximity switches with attachments / cable duct

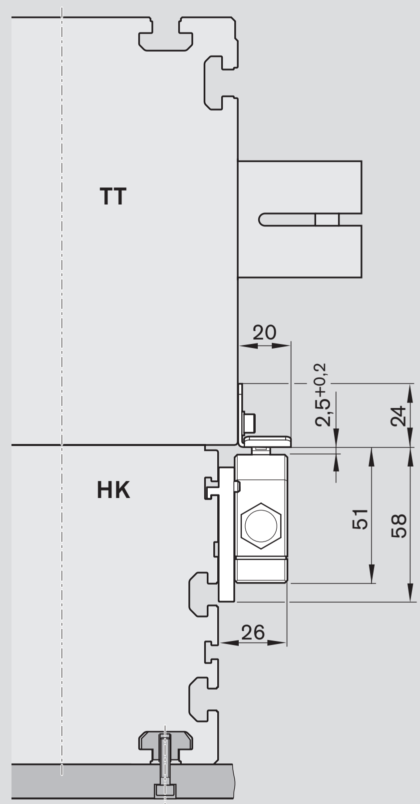


Mechanical switches with attachments

OBB-120



Proximity switches with attachments / cable duct

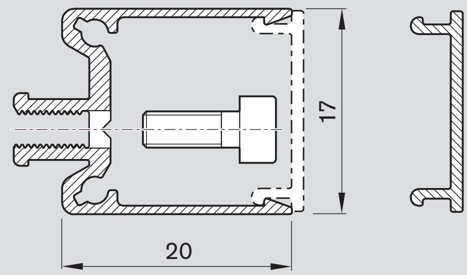


Mechanical switches with attachments

Cable duct

- The cable duct is fastened in the T-slots on the side of the frame. Fastening screws widen the profile and give the cable duct a secure hold.

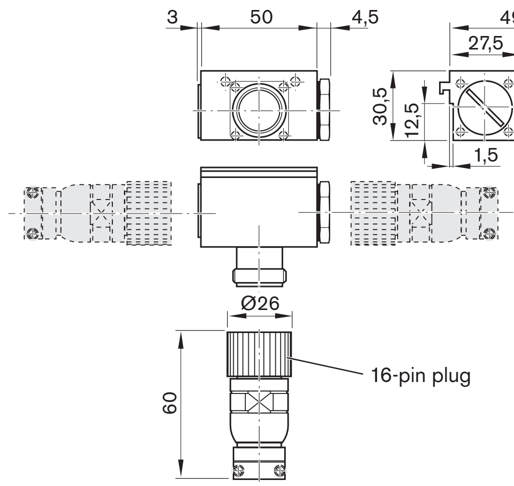
For the slot position, see "Configuration and ordering" tables and "Dimension drawings".
The cable duct will accommodate up to two cables for mechanical switches and three cables for proximity switches.
Fastening screws and cable grommets are included.



Socket and plug

Attach the socket at the end with the sensors or switches. The socket and plug are not pre-wired. Since the mounting arrangements allow shifting of the switches, the switch activation points can be optimized during commissioning. The plug can be mounted in three directions.

R117500153

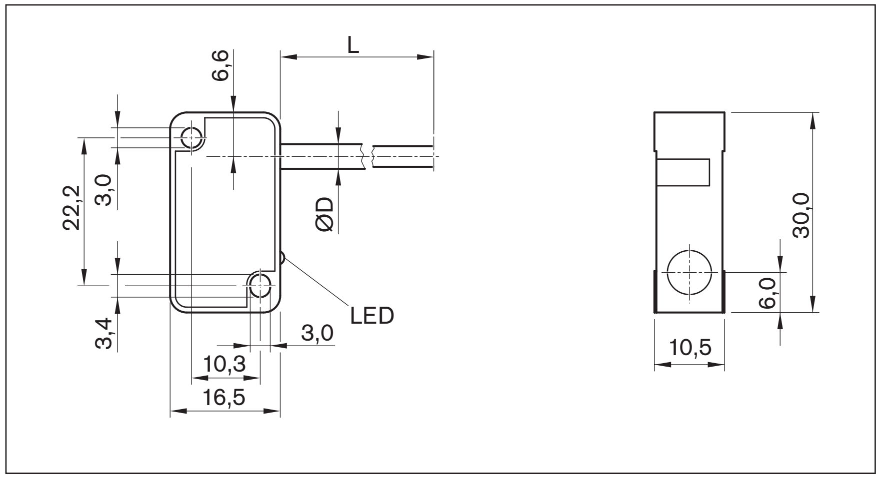


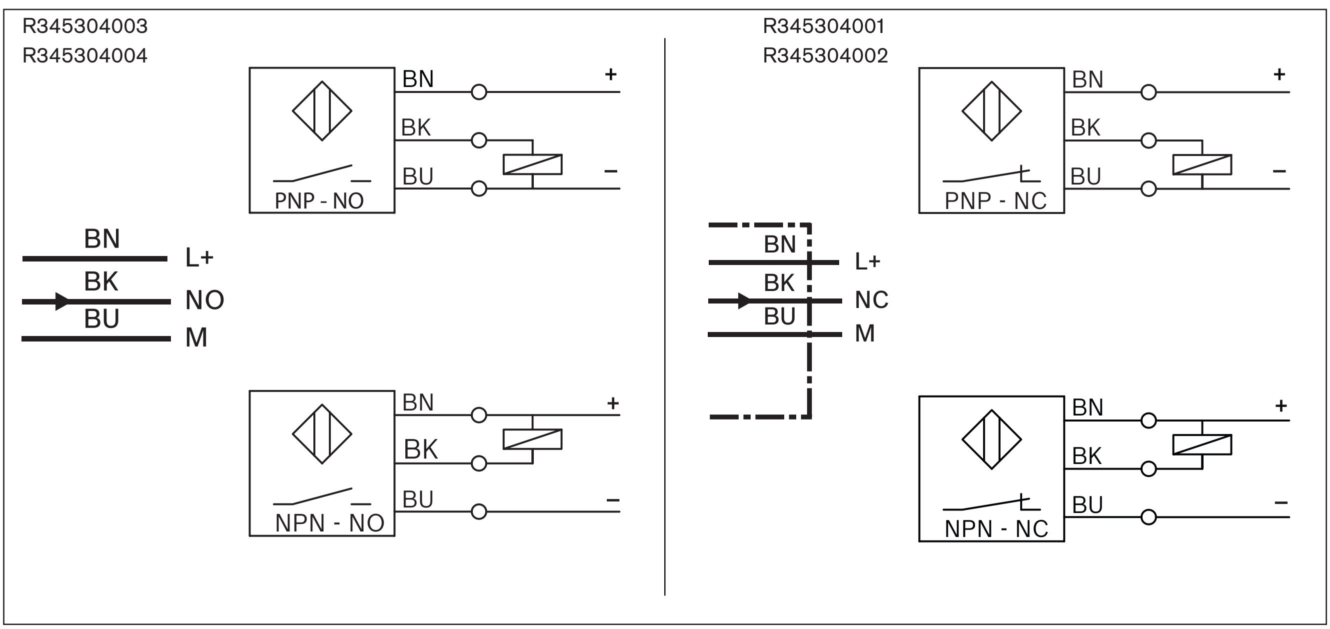
Use	Socket and plug
Material number	R117500153
Designation	for OBB-055, -085, -120
Version	angled, for suspension in the lateral slot of the OBB
Operating current per contact	max. 8 A
Operating voltage	150 V AC/DC
1. Connection type	Straight socket, 16-pin, soldered connection
2. Connection type	Coupling / flange socket, 16-pin, soldered connection
Cable bushing, housing	1 seal with hole 2x5.5 mm, 1x3.5 mm 1 adaptable seal, max. 14 mm diameter incl. cap and blind plug
Cable bushing, plug	Bolting with strain relief
Connection cross-section	0.14 … 1 mm
Cable diameter	10 … 14 mm
Ambient temperature	-20 °C to +125 °C
Protection class	–
Certifications and approvals	–

Attachments and accessories

Sensors

Proximity sensor with free line end





Material numbers / technical data

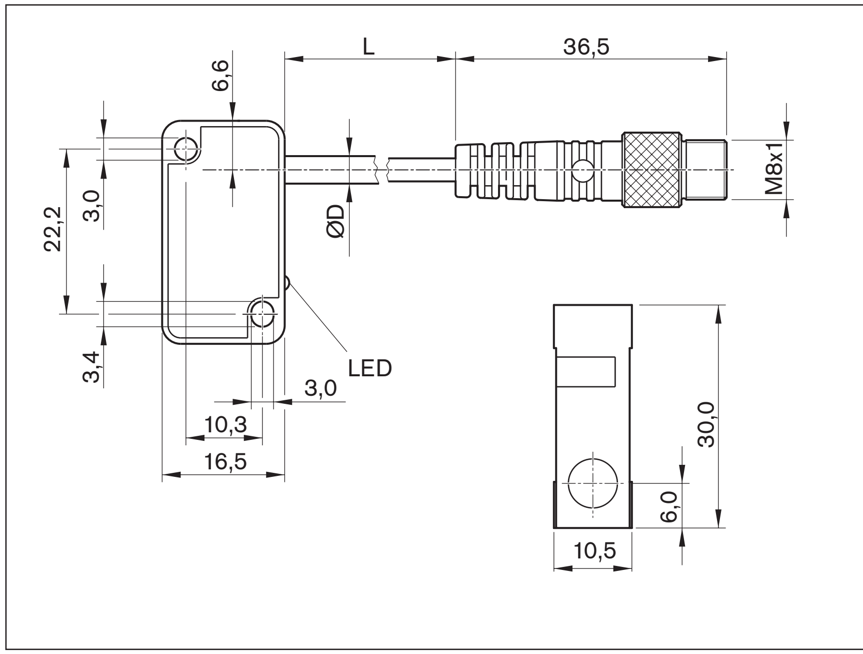
Use	Limit switch	Reference switch	Limit switch	Reference switch
Material number	R345304001	R345304003	R345304002	R345304004
Designation	BES 517-351-NO-C-03	BES 517-398-NO-C-03	BES 517-352-NO-C-03	BES 517-399-NO-C-03
Functional principle	proximity			
Operating voltage	10 - 30 V DC			
Load current	≤ 200 mA			
Switching function	PNP/normally closed (NC)	PNP/normally open (NO)	NPN/normally closed (NC)	NPN/normally open (NO)
Connection type	Line 3 m, 3-pin, free line end			
Function indication	✓			
Short-circuit protection	✓			
Reverse polarity protection	✓			
Switching frequency	2.5 kHz			
Max. perm. approach speed	depending on the switch flag length			
Suitable for drag chains[1]	–			
Can withstand torsion[1]	–			
Weld spark resistant[1]	–			
Cable cross-section[1]	3x0.14 mm^2			
Cable diameter D[1]	3.5 $^{\pm 0.13}$ mm			
Bending radius, static[1]	12 mm			
Bending radius, dynamic[1]	12 mm			
Bending cycles[1]	–			
Ambient temperature	-40 °C to +70 °C			
Protection class	IP65			
MTTFd (acc. to EN ISO 13849-1)	MTTFd = 830 years		MTTFd = 585 years	
Certifications and approvals[2]	CE c UL us LISTED RoHS			

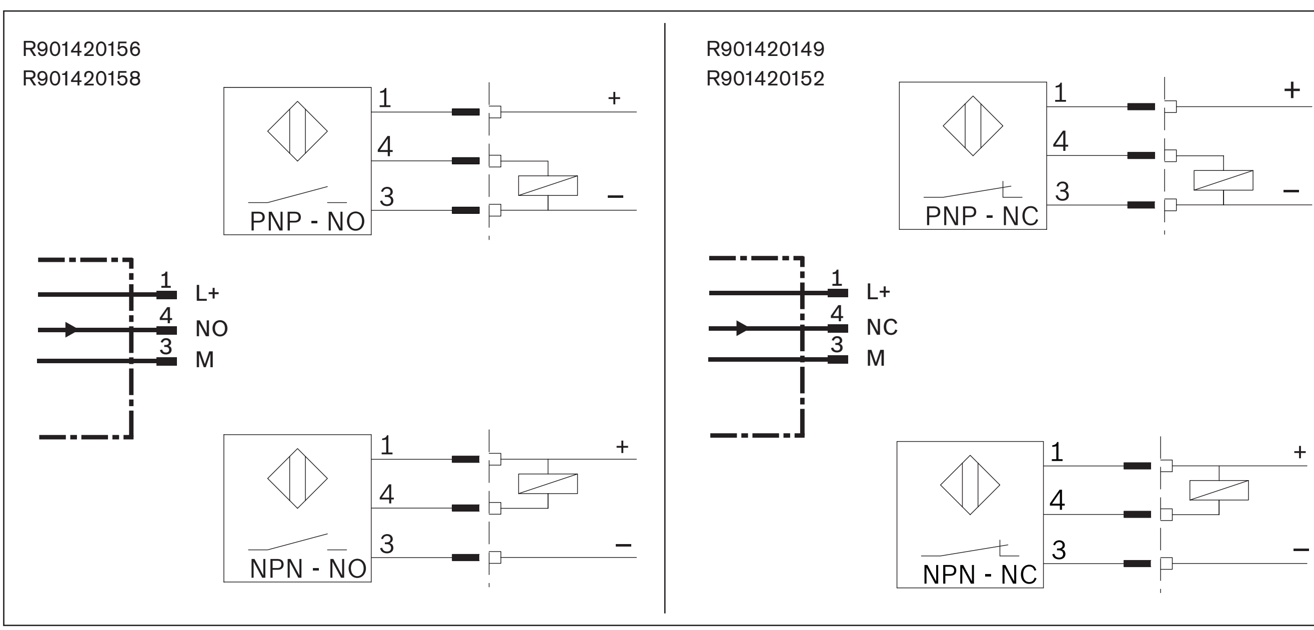
1) Technical data only for the cast-on connection line at the proximity sensor.
Even more performance, e.g. extension cables are offered for use in a power cable chain (see the following pages).
2) For these products no CCC certificate is necessary for introduction into the Chinese market.

Attachments and accessories

Sensors

Proximity sensor with M8x1 plug





Material numbers / technical data

Use	Limit switch	Reference switch	Limit switch	Reference switch
Material number	R901420149	R901420156	R901420152	R901420158
Designation	BES 517-351-NO-C-S49-00.2	BES 517-398-NO-C-S49-00.2	BES 517-352-NO-C-S49-00.2	BES 517-399-NO-C-S49-00.2
Functional principle	proximity			
Operating voltage	10 - 30 V DC			
Load current	≤ 200 mA			
Switching function	PNP/normally closed (NC)	PNP/normally open (NO)	NPN/normally closed (NC)	NPN/normally open (NO)
Connection type	Cable 0.2 m and plug M8 x 1, 3-pin with knurled screw			
Function indication	✓			
Short-circuit protection	✓			
Reverse polarity protection	✓			
Switching frequency	2.5 kHz			
Max. permissible approach speed	depending on the switch flag length			
Suitable for drag chains[1)]	–			
Can withstand torsion[1)]	–			
Weld spark resistant[1)]	–			
Cable cross-section[1)]	3x0.14 mm^2			
Cable diameter D[1)]	3.5 $^{\pm 0.15}$ mm			
Bending radius, static[1)]	12 mm			
Bending radius, dynamic[1)]	12 mm			
Bending cycles[1)]	–			
Ambient temperature	-40 °C to +70 °C			
Protection class	IP65			
MTTFd (acc. to EN ISO 13849-1)	MTTFd = 830 years		MTTFd = 585 years	
Certifications and approvals[2)]	CE cULus LISTED RoHS			

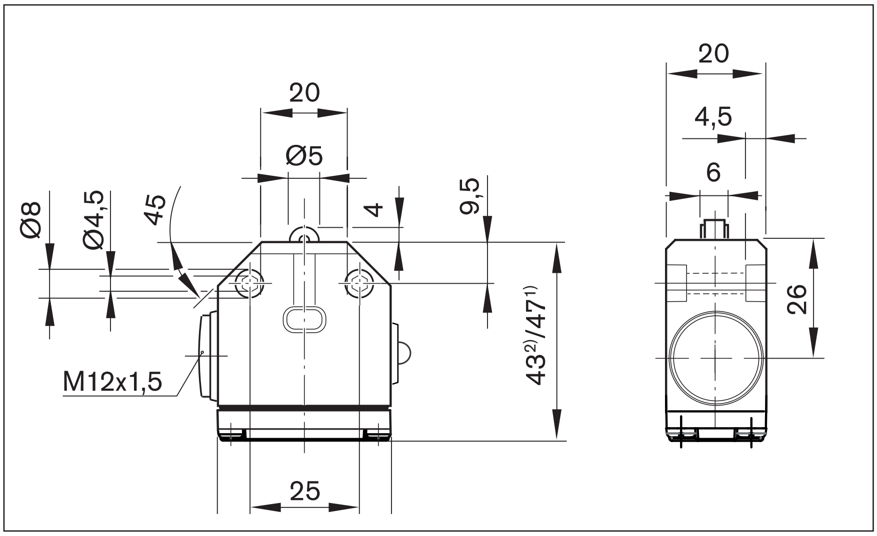
1) Technical data only for the cast-on connection line at the proximity sensor.
Even more performance, e.g. extension cables are offered for use in a power cable chain (see the following pages).

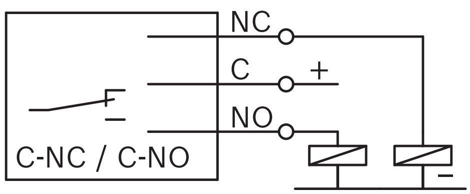
2) For these products no CCC certificate is necessary for introduction into the Chinese market.

Attachments and accessories

Switches

Mechanical switch



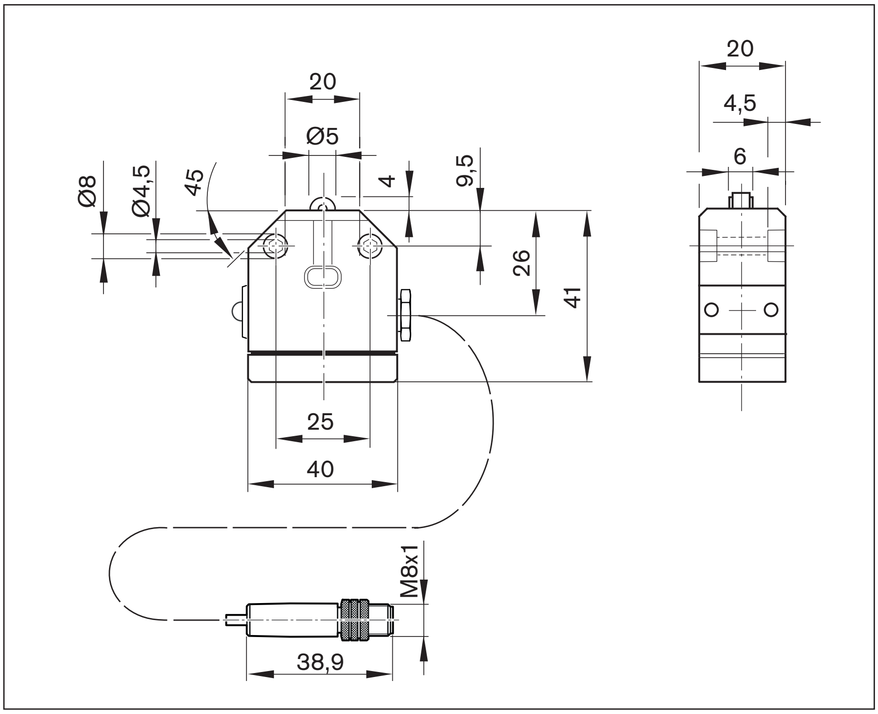


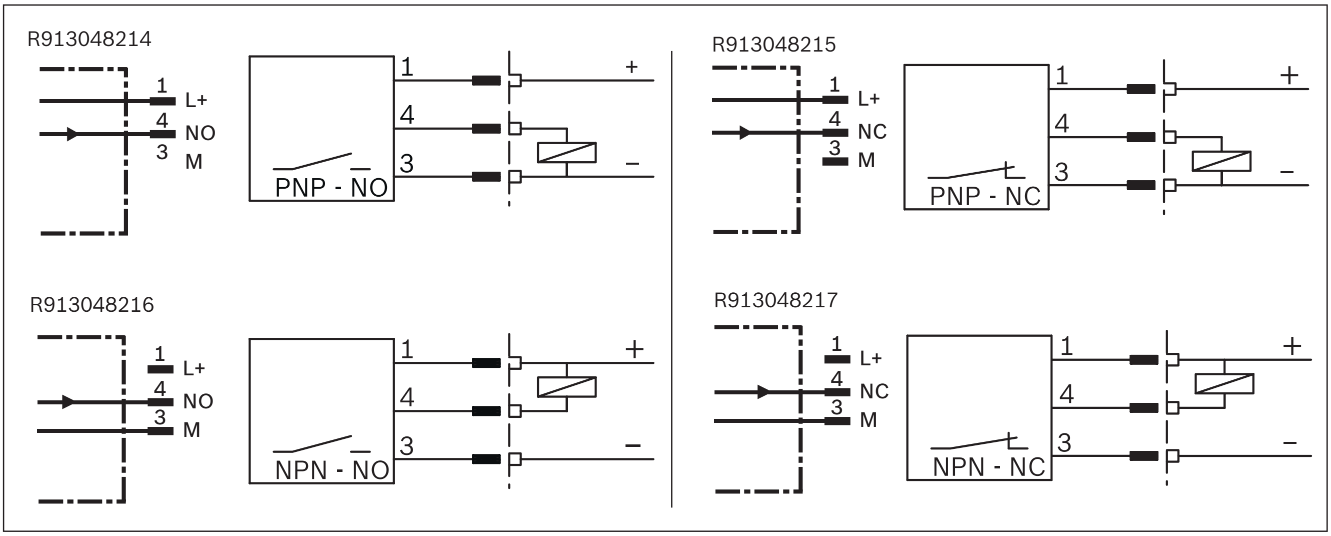
Material numbers / technical data		
Use	Limit switch	
Material number	R345304016[1)]	R347600305[2)]
Designation	BNS 819-X496-99-R-11	BNS 819-X510-99-R-10
Functional principle	Mechanical, roller	
Operating voltage	250 V AC	
Load current	≤ 5 A	
Switching function	Single-pole changeover/ (NC: C+NC, NO: C+NO)	
Connection type	Screw connection, without line	
Function indication	–	
Switching frequency	3.3 Hz	
Max. permissible approach speed	1 m/s	
Ambient temperature	-5 °C to +85 °C	
Protection class	IP67	
B10d value	$5x10^6$ (wet area); $10x10^6$ (dependent on current load (dry area))	
Certifications and approvals, housing		
Certifications and approvals, switching element		

Attachments and accessories

Switches

Mechanical sensor with M8x1 plug





Material numbers / technical data

Use	Limit switch	Reference switch	Limit switch	Reference switch
Material number	R913048215	R913048214	R913048217	R913048216
Designation	BNS 819-X1002-99-R-10	BNS 819-X1001-99-R-10	BNS 819-X1004-99-R-10	BNS 819-X1003-99-R-10
Functional principle	Mechanical, roller			
Operating voltage	10 - 30 VDC			
Load current	≤ 200 mA			
Switching function	PNP/normally closed (NC)	PNP/normally open (NO)	NPN/normally closed (NC)	NPN/normally open (NO)
Connection type	Cable 0.2 m and plug M8 x 1, 3-pin with knurled screw			
Function indication	–			
Short-circuit protection	–			
Reverse polarity protection	–			
Switching frequency	3.3 Hz			
Max. perm. approach speed	1 m/s			
Suitable for drag chains[1)]	–			
Can withstand torsion[1)]	–			
Weld spark resistant[1)]	–			
Cable cross-section[1)]	3x0.14 mm^2			
Cable diameter D[1)]	4.3 $^{\pm 0.2}$ mm			
Bending radius, static[1)]	12 mm			
Bending radius, dynamic[1)]	12 mm			
Bending cycles[1)]	–			
Ambient temperature	–5 °C to +70 °C			
Protection class	IP65			
B10d value	5x10^6 (wet area); 10x10^6 dependent on current load (dry area)			
Certifications and approvals[2)]				

1) Technical data only for the cast-on connection line at the mechanical switch.
Even more performance, e.g. extension cables are offered for use in a power cable chain (see the following pages).

2) For these products no certificate is necessary for introduction into the Chinese market.

Attachments and accessories

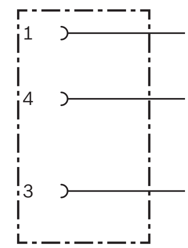
Extension pieces

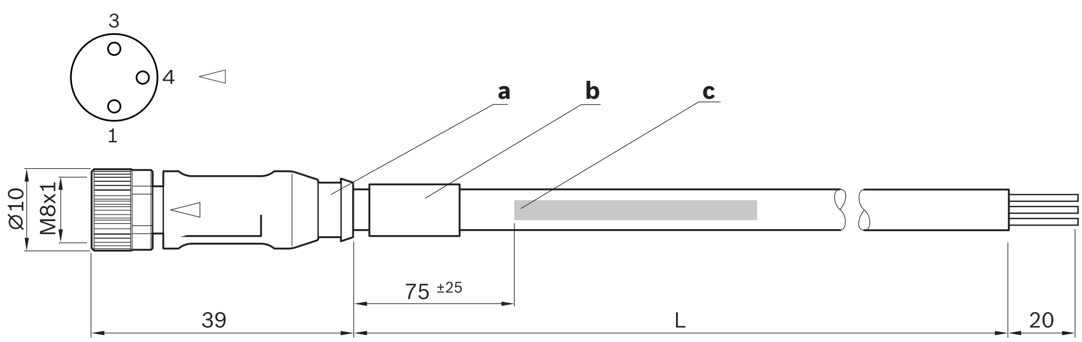
Assembled single-sided

Drawing

Connection scheme

1 brown (BN) (+)
3 blue (BU) (–)
4 black (BK) (signal)





Material numbers

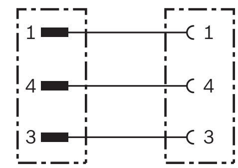
Use	Extension cable		
Material number	R911344602	R911344619	R911344620
Designation	7000-08041-6500500	7000-08041-6501000	7000-08041-6501500
Length (L)	5.0 m	10.0 m	15.0 m
1. Connection type	Straight socket, M8 x 1, 3-pin		
2. Connection type	free line end		

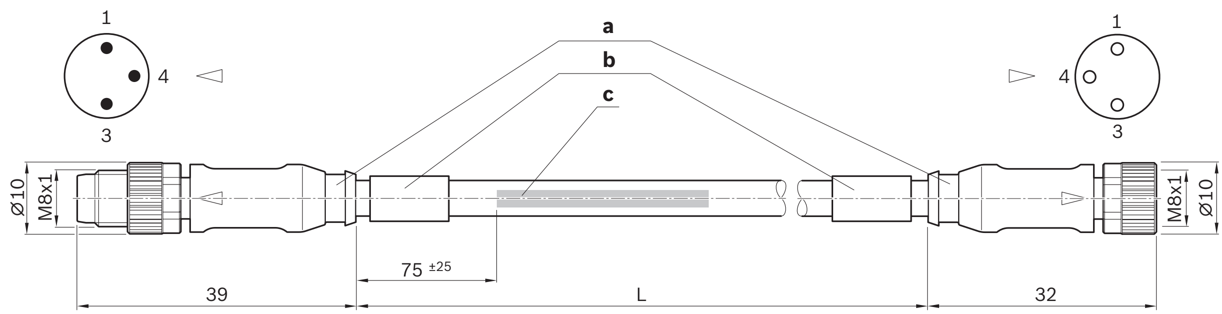
Assembled double-sided

Drawing

Connection scheme

1 brown (BN) (+)
3 blue (BU) (–)
4 black (BK) (signal)





Material numbers

Use	Extension cable			
Material number	R911344621	R911344622	R911344623	R911344624
Designation	7000-88001-6500050	7000-88001-6500100	7000-88001-6500200	7000-88001-6500500
Length (L)	0.5 m	1.0 m	2.0 m	5.0
1. Connection type	Straight socket, M8x1, 3-pin			
2. Connection type	Straight socket, M8x1, 3-pin			

Technical data for single and double-sided pre-assembled extensions

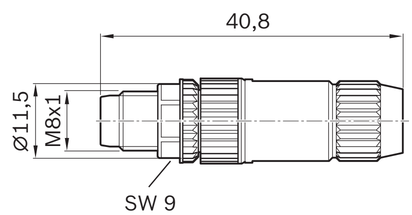
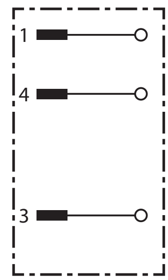
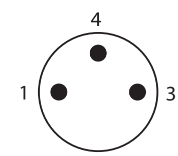
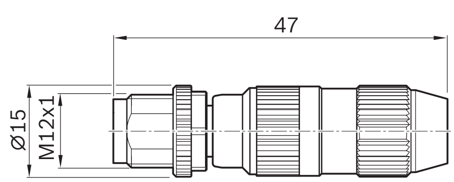
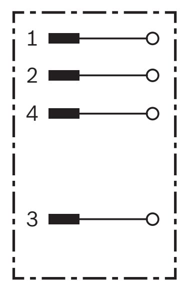
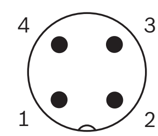
Function indication	–
Operating voltage indicator	–
Operating voltage	10 - 30 V DC
Type of cable	PUR black
Suitable for drag chains	✓
Can withstand torsion	✓
Weld spark resistant	✓
Cable cross-section	3x0.25 mm^2
Cable diameter D	4.1 $^{\pm 0.2}$ mm
Bending radius, static	5xD
Bending radius, dynamic	10xD
Bending cycles	> 10 million
Max. perm. travel speed	3.3 m/s - at 5 m travel distance (typ.) to 5 m/s - at 0.9 m travel distance
Max. perm. acceleration	30 m/s^2
Ambient temperature, fixed lay	-40 °C to +85 °C
Ambient temperature, flexible lay	-25 °C to +85 °C
Protection class	IP68
Certifications and approvals	

a) Contour for corrugated tube inner diameter 6.5 mm
b) Cable grommet
c) Cable label in accordance with labeling directive

Attachments and accessories

Extension pieces

Plug

	Drawing	**Connection scheme**	**View Plug side**
 R901388333			
 R901388352			

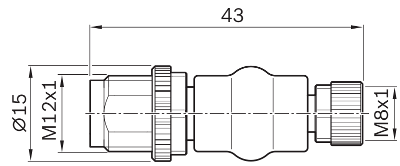
Material numbers / technical data		
Use	Plug, single	
Material number	R901388333	R901388352
Designation	7000-08331-0000000	7000-12491-0000000
Version	straight	
Operating current per contact	max. 4 A	
Operating voltage	max. 32 V AC/DC	
Connection type	Straight socket, M8x1, 3-pin Insulation displacement contact technology, self-locking screw thread	Straight socket, M12x1, 4-pin Insulation displacement contact technology, self-locking screw thread
Function indication	-	
Operating voltage indicator	-	
Connection cross-section	0.14 ... 0.34 mm^2	
Ambient temperature	-25 °C to +85 °C	
Protection class	IP67 (plugged in & screwed down)	
Certifications and approvals	c UL us RoHS	

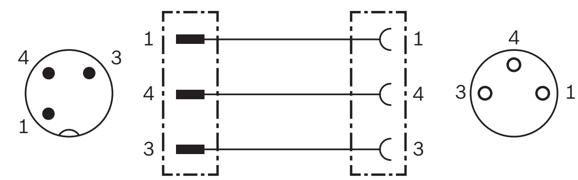
Adapter

Drawing

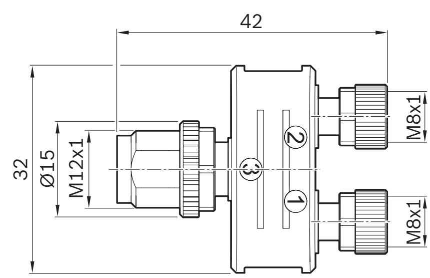
Connection scheme

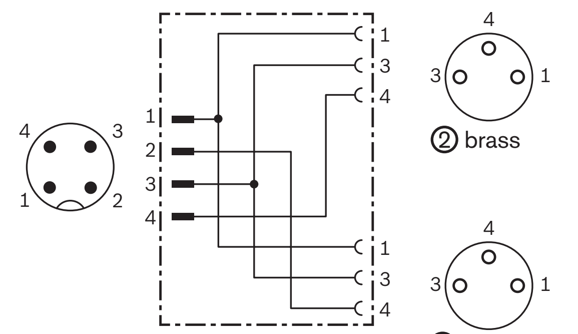
R911344591





R911344592





Material numbers / technical data

Use	Adapter	Adapter or distributor
Material number	R911344591	R911344592
Designation	7000-42201-0000000	7000-41211-0000000
Version	straight for 1 sensor	straight, for 1 - 2 sensors
Operating current per contact	max. 4 A	
Operating voltage	max. 32 V AC/DC	
1. Connection type	Straight socket, M8x1, 3-pin, self-locking screw thread	2 x straight sockets, M8x1, 3-pin, self-locking screw thread
2. Connection type	Straight plug, M12x1, 3-pin, self-locking screw thread	Straight plug, M12x1, 4-pin, self-locking screw thread
Function indication	–	
Operating voltage indicator	–	
Connection cross-section	–	
Ambient temperature	-25 °C to +85 °C	
Protection class	IP67 (plugged in & screwed down)	
Certifications and approvals		

Attachments and accessories

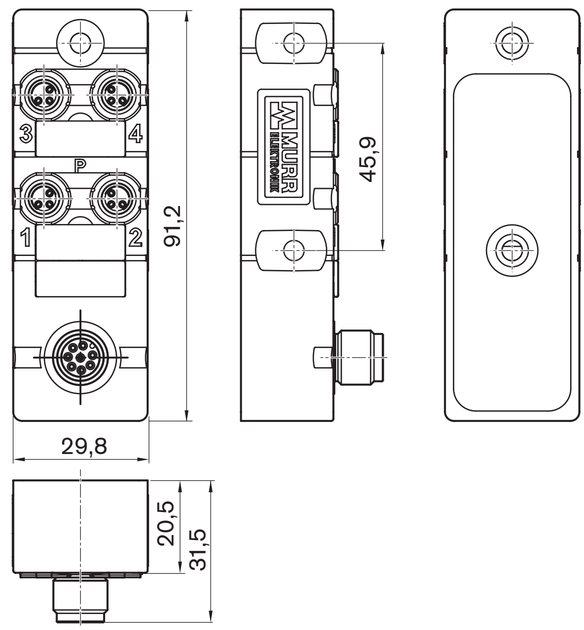
Distributors

Passive distributors

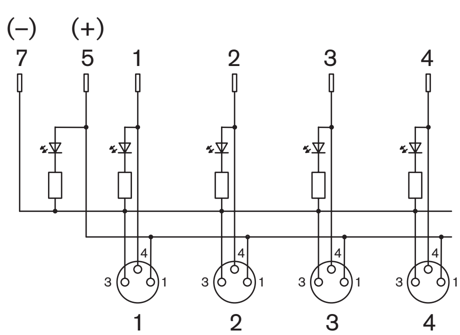
R901425737

R901429917

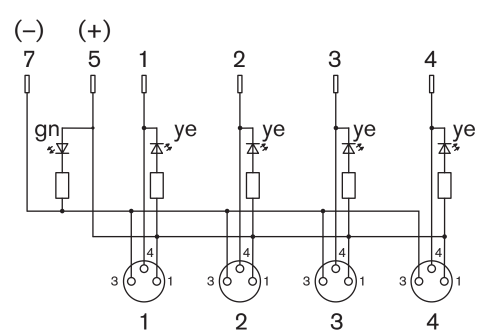
R911344592



R901425737



R901429917



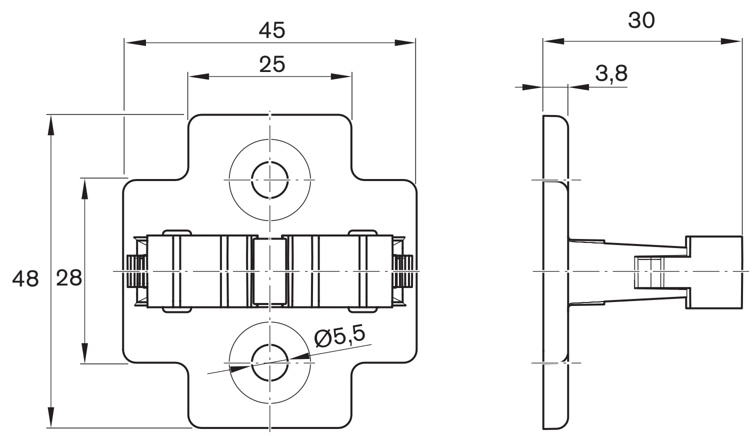
Material numbers / technical data

Use	Passive distributors		
Material number	R901425737	R901429917	R911344592
Designation	8000-84070-0000000	8000-84071-0000000	See the adapter for technical data and drawing
Version	straight, for 1 - 4 sensors		
Operating current per contact	max. 2 A		
Operating voltage	24 V DC		
Switching logic	PNP	NPN	
1. Connection type	4x straight socket, M8x1, 3-pin, self-locking screw thread		
2. Connection type	Straight plug, M12x1, 8-pin, self-locking screw thread		
Function indication	✓		
Operating voltage indicator	✓		
Connection cross-section	-		
Ambient temperature	–20° to +70 °C		
Protection class	IP67 (plugged in and screwed down)		
Certifications and approvals			

Accessories for passive distributors

Holding plate

Screw plug



Material numbers / technical data

Use	For passive distributor R911344592	For passive distributors R901425737/ R901429917
Holding plate	R913047341	–
Designation	7000-99061-0000000	–
Packaging unit	1 pc.	–
Screw plug	–	R913047322
Designation	–	3858627
Packaging unit	–	10 pc.

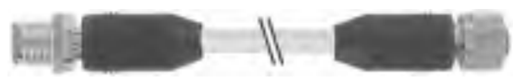
Attachments and accessories

Extensions for passive distributors

Extensions for passive plugs

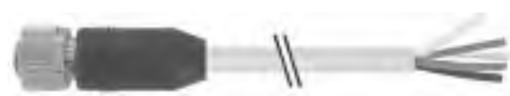
R911371982

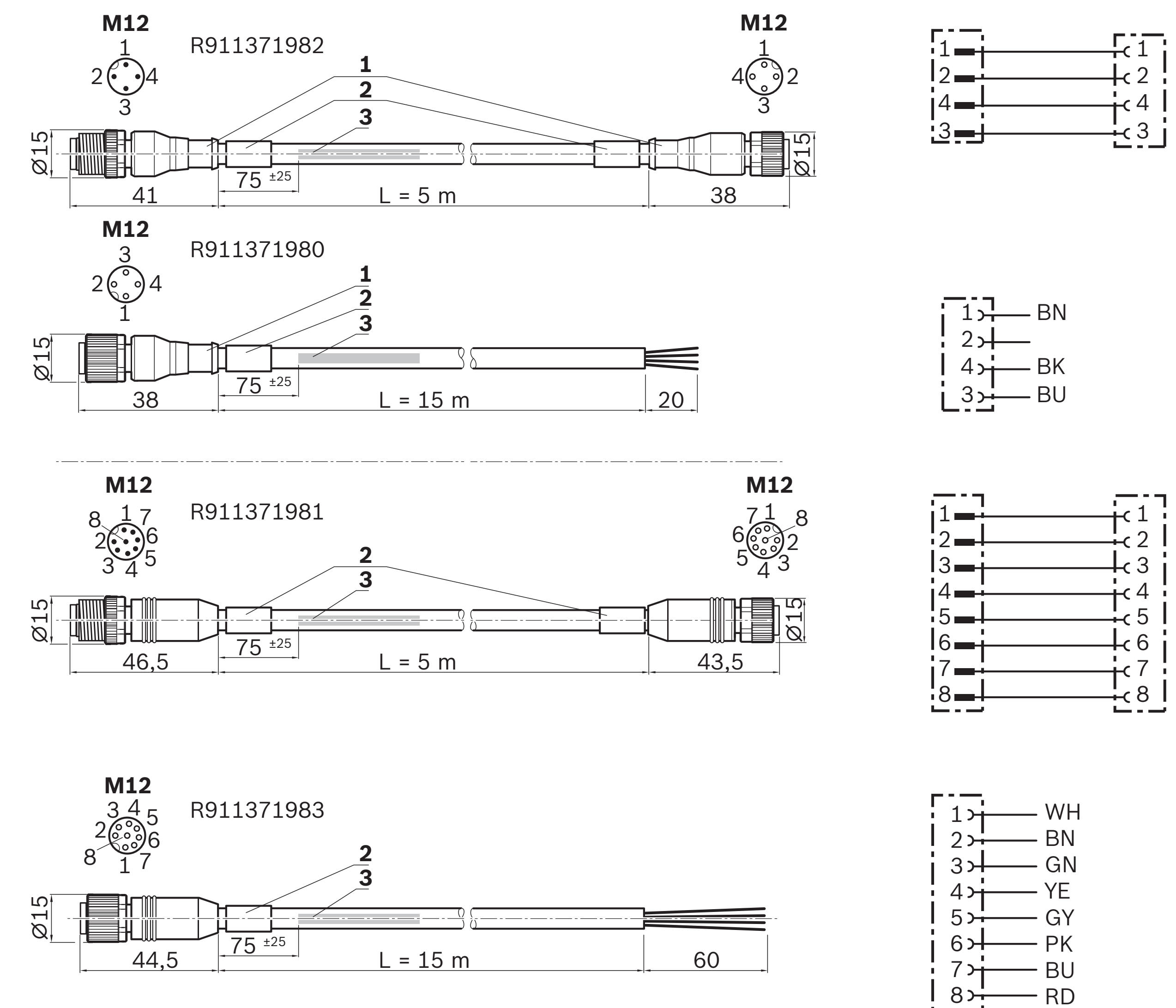
R911371981



R911371980

R911371983



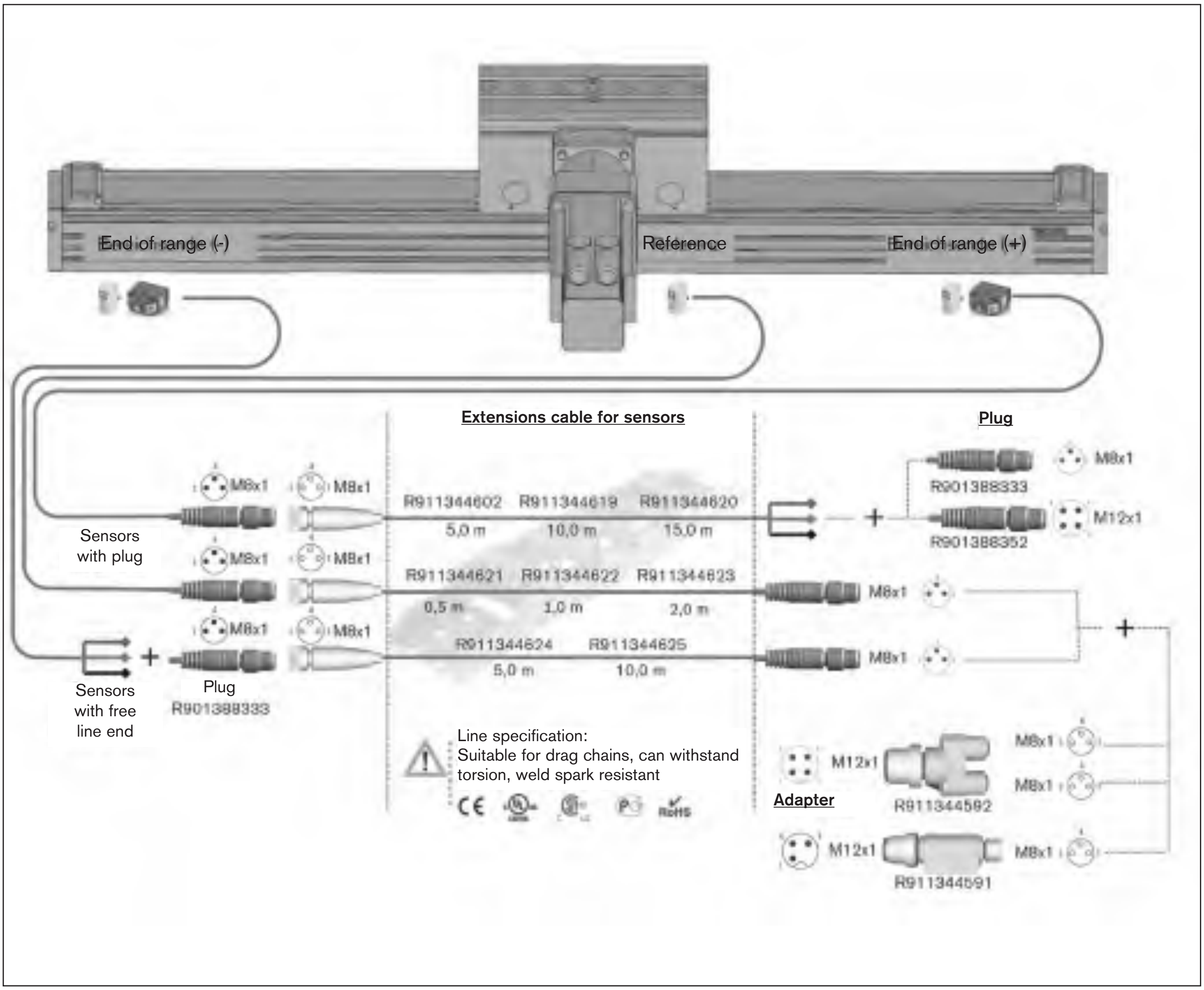


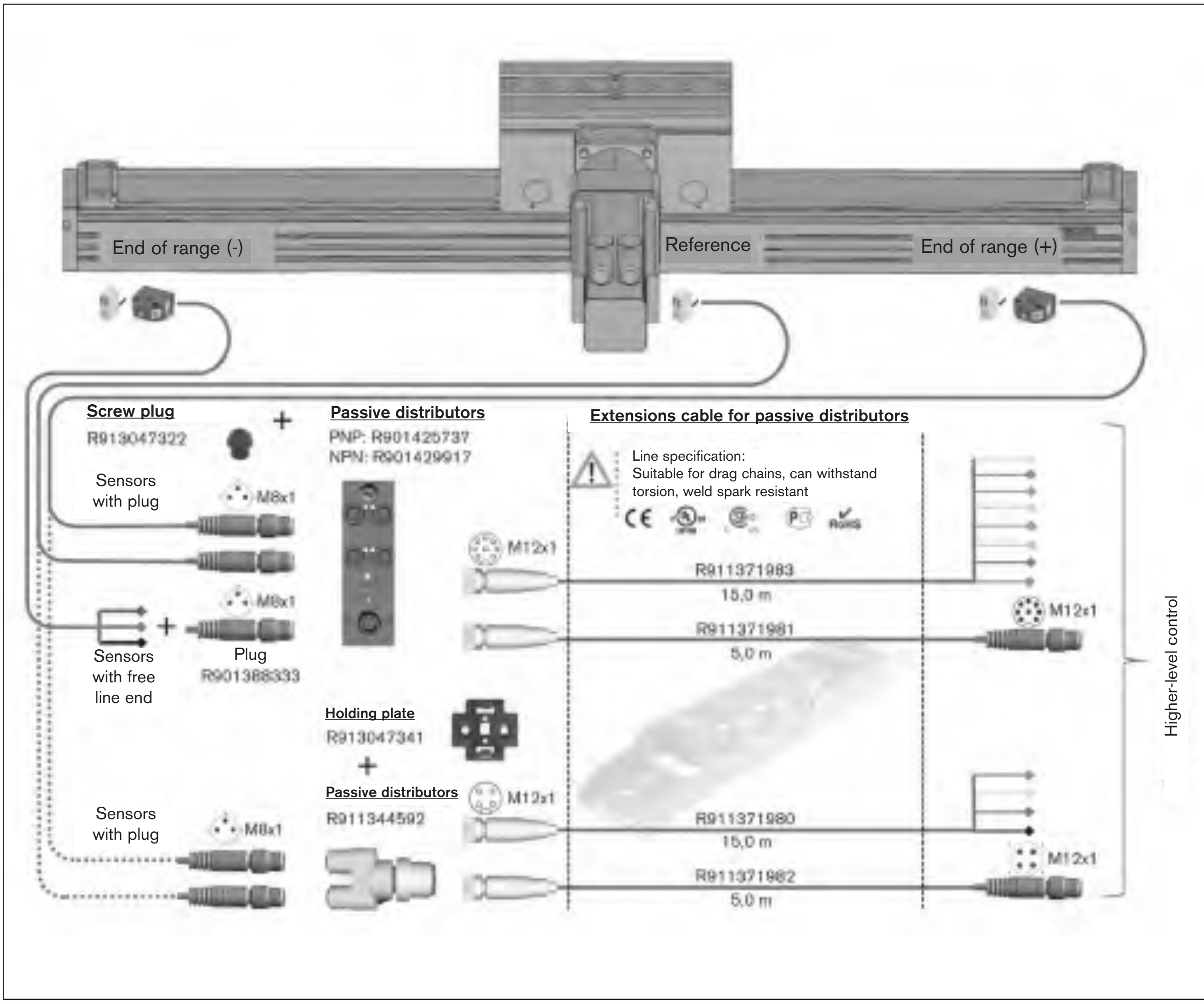
Material numbers / technical data

Use	Extension cable for passive distributor R911344592		Extension cable for passive distributors R901425737 / R901429917	
Material number	R911371982	R911371980	R911371981	R911371983
Designation	7000-40021-6540500	7000-12221-6541500	7000-48001-3770500	7000-17041-3771500
Length	5.0 m	15.0 m	5.0 m	15.0 m
1. Connection type	Straight socket, M12x1, 4-pin		Straight socket, M12x1, 8-pin	
2. Connection type	Straight plug, M12x1, 4-pin	free line end	Straight plug, M12x1, 8-pin	free line end
Function indication	–			
Operating voltage indicator	–			
Type of cable	PUR black		PUR gray	
Operating voltage	30 V AC/DC			
Operating current per contact	max. 4 A per contact		max. 2 A per contact	
Suitable for drag chains	✓			
Can withstand torsion	✓			
Weld spark resistant	✓			
Cable cross-section	4x0.34 mm^2		8x0.34 mm^2	
Cable diameter D	4.7 $^{\pm 0.2}$ mm		6.2 $^{\pm 0.3}$ mm	
Bending radius, static	≥ 5 x D			
Bending radius, dynamic	≥ 10 x D			
Bending cycles	> 10 million			
Max. perm. travel speed	3.3 m/s - at 5 m travel distance (typ.) to 5 m/s - at 0.9 m travel distance			
Max. perm. acceleration	≤ 30 m/s^2			
Ambient temperature, fixed lay	–40 °C to +80 °C (90 °C max. 10 000 h)			
Ambient temperature, flexible lay	-25 °C to +80 °C (90 °C max. 10 000 h)			
Protection class	IP67 (plugged in & screwed down)			
Certifications and approvals	CE, cULus LISTED, SP C US, PCT, RoHS			

Attachments and accessories

Combination examples




End of range (-)
Reference
End of range (+)
Screw plug
R913047322
Sensors with plug
M8x1
Sensors with free line end
Plug
R901388333
Sensors with plug
M8x1
Passive distributors
PNP: R901425737
NPN: R901429917
Holding plate
R913047341
Passive distributors
R911344592
M12x1
M12x1
Extensions cable for passive distributors
Line specification:
Suitable for drag chains, can withstand torsion, weld spark resistant
R911371983
15,0 m
R911371981
5,0 m
R911371980
15,0 m
R911371982
5,0 m
M12x1
M12x1
Higher-level control

Attachments and accessories

Mounting

General notes

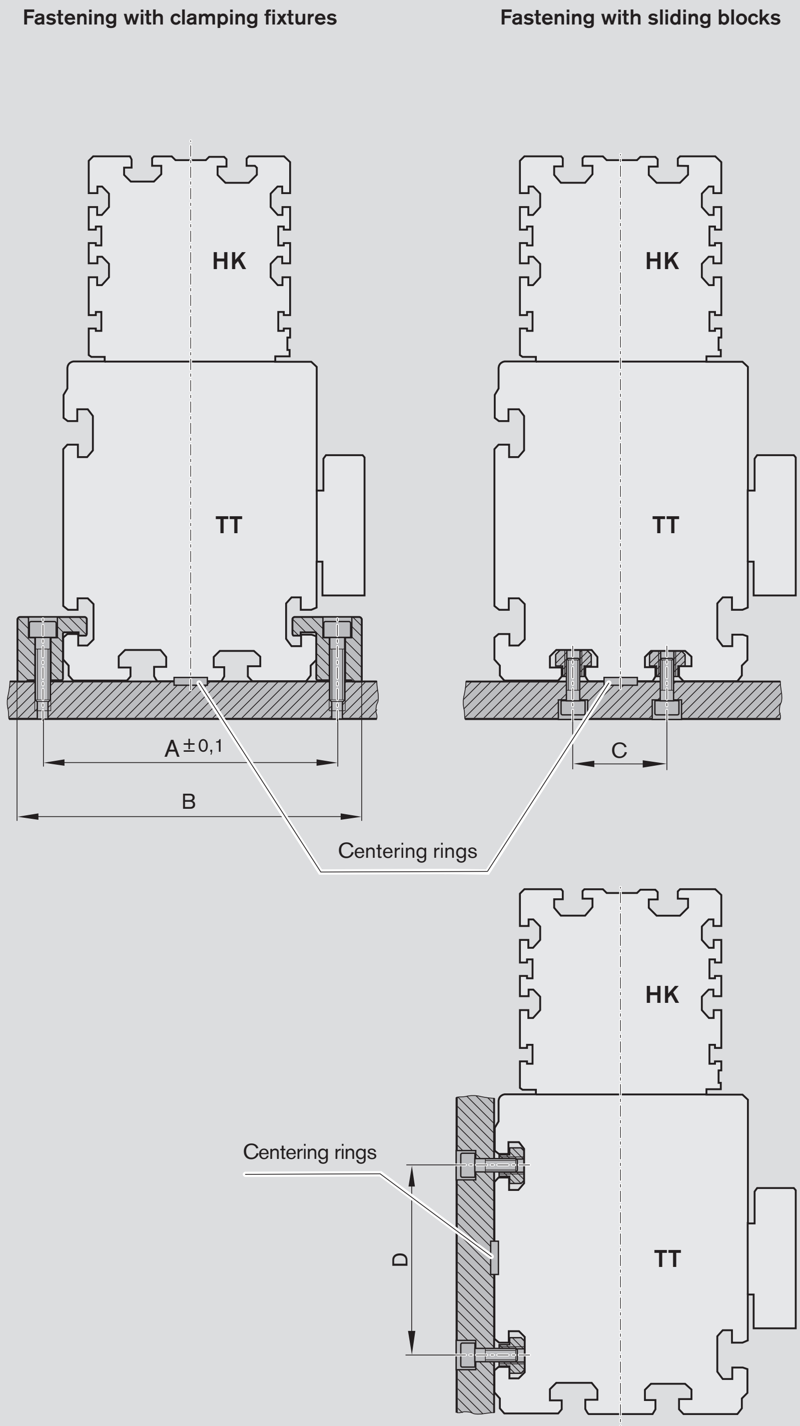
The Omega modules are mounted using various fastening elements:
- Clamping fixtures
- Sliding blocks
- Square nuts
- Screws for T-slots as per DIN 787 (not shown).
- Centering rings on carriage as positioning aids

Length dependent on base.

Mounting by the carriage (frame moves)

OBB	A (mm)	B (mm)	C (mm)	D (mm)
55	91	105	40	50
85	130	148	40	80
120	157	175	80	100

Mounting by the carriage (TT) (frame moves)

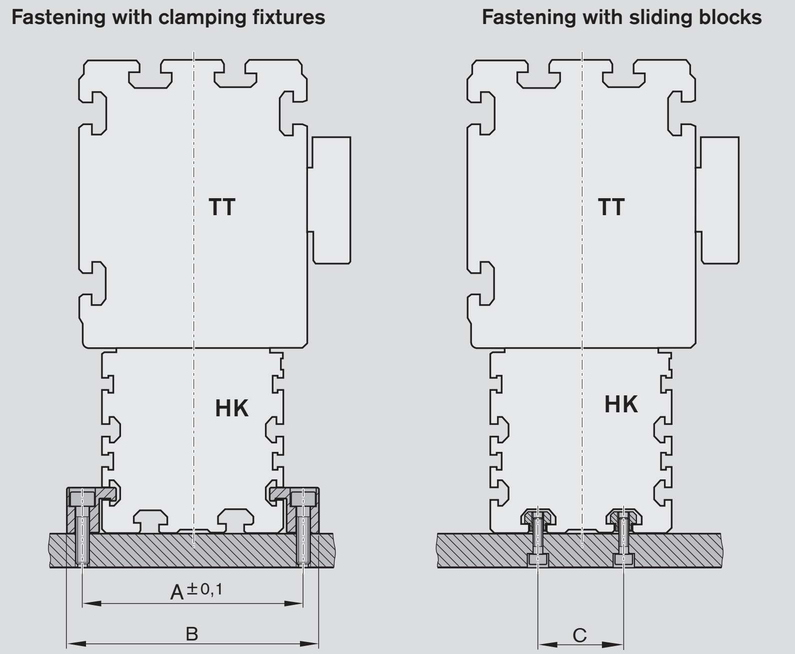


Mounting by the frame (HK)
(carriage moves)

⚠ Do not fix the Omega module at the end plates!
The frame is the main load-bearing part!

OBB	A (mm)	B (mm)	C (mm)
55	71	85	25
85	101	115	40
120	144	162	80

Mounting by the frame
(carriage moves)



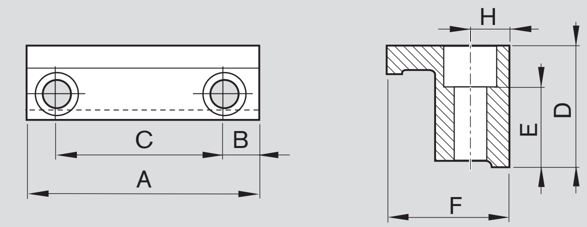
Attachments and accessories

Mounting

Clamping fixtures

Recommended number of clamping fixtures for the installation case carriage moves (frame fixed):
– 3 pieces on side opposite motor
– 2 pieces on motor side

Recommended number of clamping fixtures for the installation case frame moves (carriage fixed):
– 4 pieces per side/m



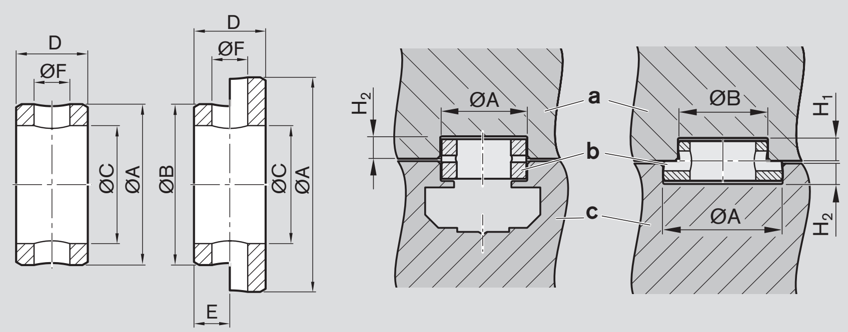
Type 2

Size	Mounting on…	Countersink ISO 4762 for	Number Holes N	Dimensions (mm) A	B	C	D	E	F	H	Material number
OBB-055	Carriage	M6	2	65	12.5	40	17.0	10.2	21.0	7	R1175 192 04
	Frame	M6	2	72	11.0	50	11.5	5.3	19.3	7	R0375 510 33
OBB-085	Carriage	M8	2	68	15.0	38	27.5	18.0	30.0	9	R0375 410 52
	Frame	M6	2	78	14.0	50	20.0	11.3	21.0	7	R1175 390 30
OBB-120	Carriage	M8	2	88	19.0	50	27.5	18.0	30.0	9	R0375 410 50
	Frame	M8	2	108	19.0	70	27.5	16.3	29.0	9	R1175 290 26

Centering rings

The centering ring serves as a positioning aid and for positive locking when mounting customer attachments to the carriage. It creates a positive-locking connection with good reproducibility.
Material: Steel (stainless)

Mounting

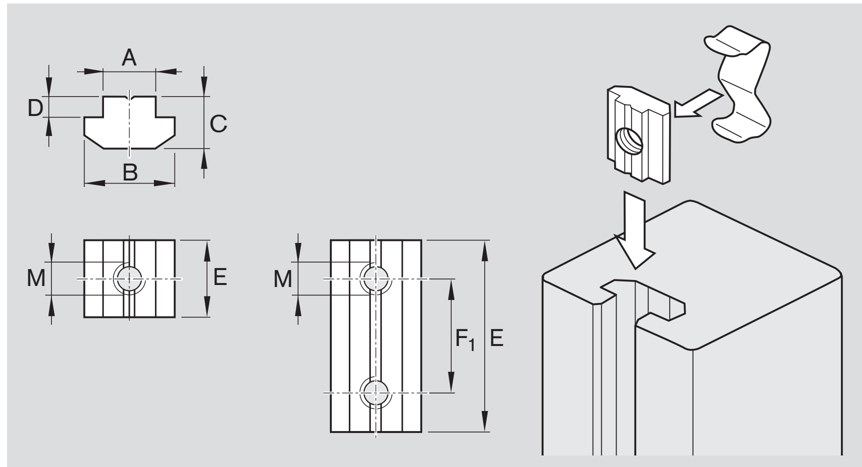


a) Customer attachment
b) Centering ring
c) Carriage

	OBB	Size Ø (mm)	Dimensions (mm) ØA H7/k6	ØB H7/k6	C ±0.1	D -0.2	E +0.2	ØF	H_1 +0.2	H_2 +0.2	Material number
Carriage	055	12	12	–	9.0	4.0	–	2.0	–	2.1	R0396 605 45
		12 - 7	12	7	5.5	3.5	1.5	1.6	1.6	2.1	R0396 605 77
		12 - 9	12	9	6.6	4.0	2.0	2.0	2.1	2.1	R0396 605 50
	085, 120	16	16	–	11.0	6.0	–	3.0	–	3.1	R0396 605 46
		16 - 12	16	12	9.0	5.0	2.0	2.0	2.1	3.1	R0396 605 51
End plate	055, 085	9	9	–	6.6	4.0	–	2.0	–	2.1	R0396 605 44
		9 - 5	9	5	3.4	3.5	1.5	1.6	1.6	2.1	R0396 605 48
		9 - 7	9	7	5.5	3.5	1.5	1.6	1.6	2.1	R0396 605 49
	120	12	12	–	9.0	4.0	–	2.0	–	2.1	R0396 605 45
		12 - 7	12	7	5.5	3.5	1.5	1.6	1.6	2.1	R0396 605 77
		12 - 9	12	9	6.6	4.0	2.0	2.0	2.1	2.1	R0396 605 50

Sliding blocks and springs

The spring serves as a mounting and positioning aid.
(only for OBB-085 and OBB-120)

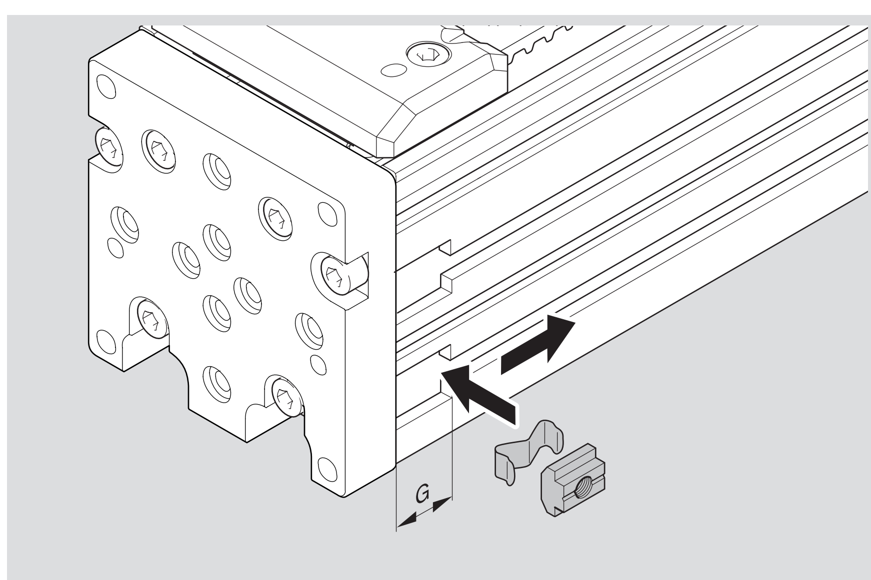


Overview of sliding blocks

Dimensions (mm)						for thread	Material number Sliding block	Material number Spring
A	B	C	D	E	F_1			
5	9.2	4.0	1.7	10	–	M4	R0391 710 38	–
6	11.5	4.0	1.0	12	–	M4	R3447 014 01	R3412 010 02
				12	–	M5	R3447 015 01	R3412 010 02
				45	30	M5	R0391 710 09	–
8	16.0	6.0	2.0	16	–	M4	R3447 017 01	R3412 011 02
				16	–	M5	R3447 018 01	R3412 011 02
				16	–	M6	R3447 019 01	R3412 011 02
				16	–	M8	R3447 020 01	R3412 011 02
				50	36	M6	R0391 710 08	–
10	19.5	10.5	5.0	20	–	M4	R3447 012 01	R3412 009 02
				20	–	M5	R3447 011 01	R3412 009 02
				20	–	M6	R3447 010 01	R3412 009 02
				20	–	M8	R3447 009 01	R3412 009 02
				90	70	M8	R0391 710 07	–

Sliding blocks for lateral mounting on frame

Size	A (mm)	E (mm)	G (mm)
OBB-055	5	10	12
OBB-085	6	12	14
OBB-120	8	16	18

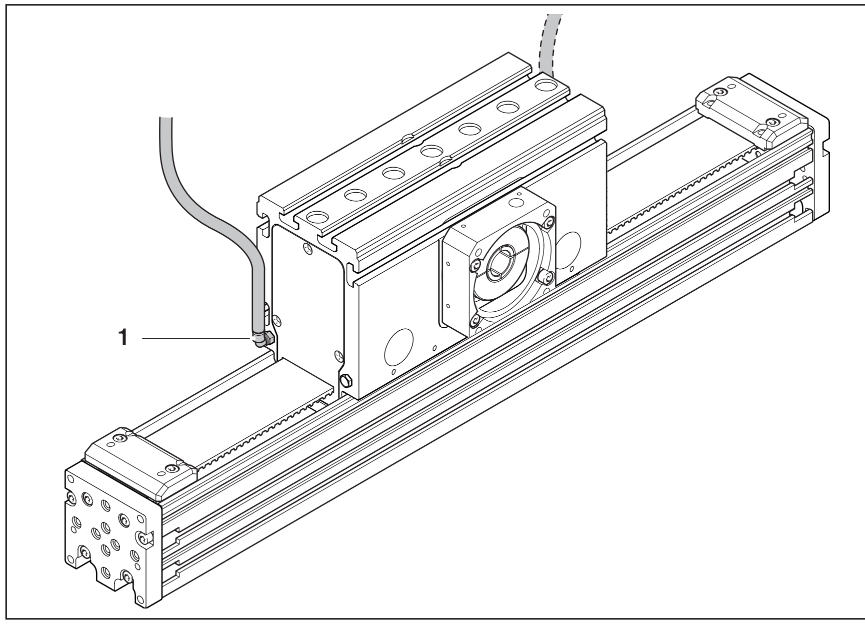


Attachments and accessories

Carriage with clamping element

Carriage

For carriages with integrated clamping element there is a standard air port (1) at each end face of the carriage opposite the lube nipples. Connection on an air port is sufficient.



Clamping element (LKPS)

The clamping element is only used for clamping (static holding) linear axes

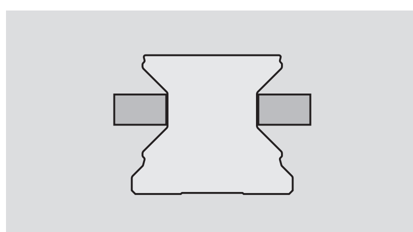
It is closed in deenergized state due to the spring energy accumulator (NC).

The clamping element can be used as a tried-and-tested part in conjunction with a suitable function test and in category 1 control units in accordance with DIN EN ISO 13849-1:2006.

If the risk assessment of the user specifies a Performance Level (s. Appendix A, DIN EN ISO 13849-1:2006) that requires a higher category, additional measures are required in the control technology to ensure that the start-up from the rest position is upheld or prevented safely.

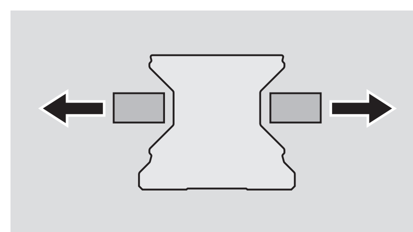
For further instructions and information, please refer to documentation belonging to this product.

⚠ The clamping element may only be used when the axis is at a standstill!
The clamping element may not be used as a braking unit!
Use for emergency braking of a moving mass is not permitted!
Clamping actions while the mass is moving may result in the clamping element and the linear guide being destroyed!



Air pressure: 0 bar

Clamping by spring force
When the pressure drops, the clamping profiles are pressed against the guide rail by means of a spring energy accumulator. A quick venting valve is required for fast response.



Air pressure: 5.5 - 8 bar

Release by air pressure
The clamping profiles are held apart by compressed air.
– Allows free movement

Size	OBB-055	OBB-085	OBB-120
Holding force 1)	400 N	750 N	1300 N
Pressure min. (release pressure)	5.5 bar		
Pressure max.	8.0 bar		
Spring energy accumulator	✓		
Clamping cycles	up to 5 mill. (B10d value)2)		
Braking cycles	not permitted		
Connector connection for tubing	Ø 4 mm		
Actuation	pneumatic		
theor. air consumption per cycle at 6 bar	23 cm^3	54 cm^3	74 cm^3
Air quality	lubricated air in accordance with ISO 8573-1 class 4, filter mesh size 25 µm		

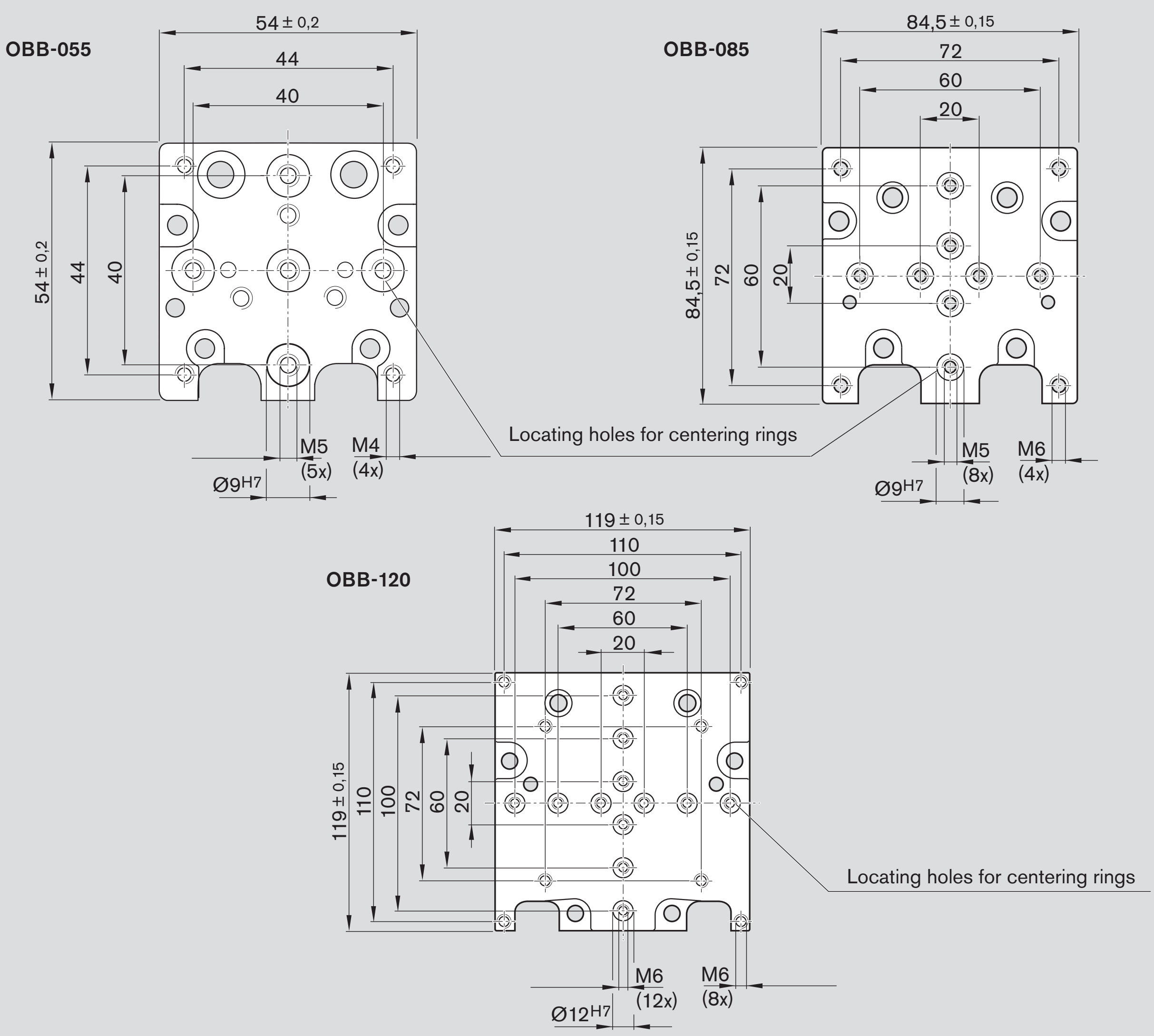
1) Static holding of the Omega module carriage or frame with axial forces up to the relevant specified value.
2) The B10d-value specifies the number of switching cycles, until 10% of the components have failed dangerously.

Attachment of additional devices

End plate for attachment

The end plates of the Omega modules feature mounting holes, threads and locating holes for attachment of additional devices.

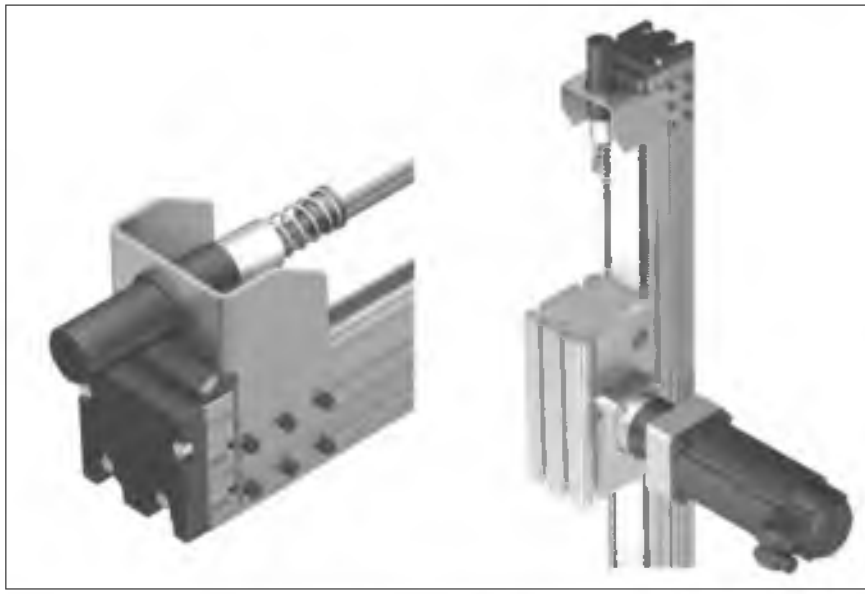
Further information on possible combinations with the Omega module OBB is available in the catalog “Connection technology for linear motion systems”.



Attachments and accessories

Shock absorber

Suitable shock absorbers are available for end position cushioning of the Omega module.
The shock absorber serves to avoid damage in the event of uncontrolled movements. It is not suitable for continuous operation.



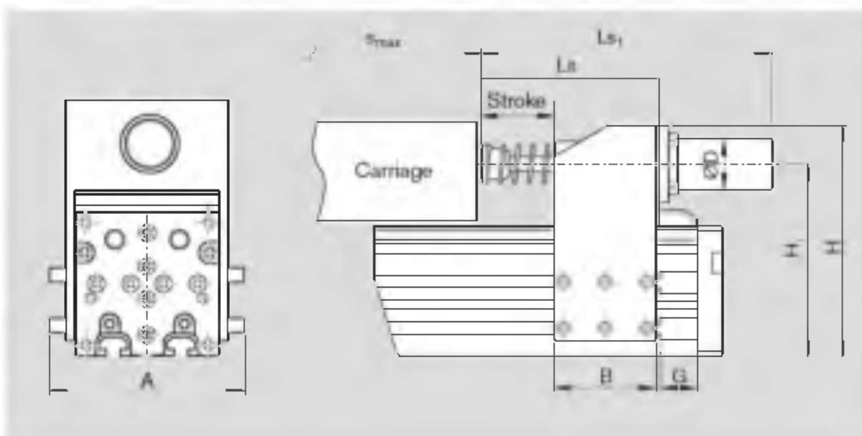
Notes

Follow the mounting instructions.

Shortened stroke

⚠ The maximum travel distance is shortened if a shock absorber is installed.

Note:
When a shock absorber is used, the maximum travel distance is reduced due to the construction (s_{max}). For the calculation, the maximum travel distance must therefore be reduced by the value s_{red} per side or per shock absorber.
If the carriage is at the end of the maximum travel distance, the front face of the carriage is on the damper head.



Mounting bracket

Size	Material number[1]	Dimensions (mm)									
		A	B	H	H_1	L_S[2]	L_S	L_{S1}	Stroke	Ø D	G
OBB-055	R1175 101 17	70	56.5	113	90.5	133	133	189	50	M33 x 1.5	12
OBB-085	R1175 301 17	104	68.0	150	125.0	149	149	209	50	M33 x 1.5	14
OBB-120	R1175 601 17	145	99.0	210	210.0	206	205	246	75	M45 x 1.5	16

1) Scope of delivery: holding ring, shock absorber and mounting material
2) Carriage with clamping element

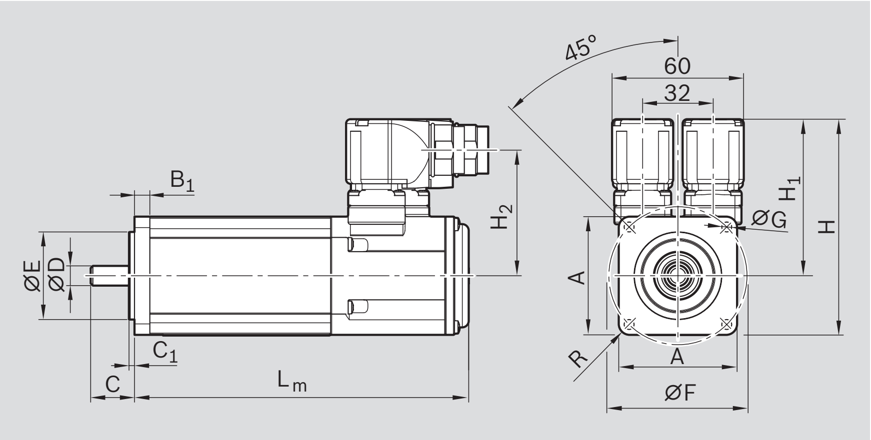
Shock absorber

Size	Max. mass to be braked (kg)	Energy absorption (Nm/stroke)	s_{red}[1] (mm)	Weight (Mounting bracket and shock absorber) (kg)
OBB-055	20	620	62	0.95
OBB-085	43	1 125	85	1.62
OBB-120	90	2 040	121	4.00

1) Reduction of the maximum travel distance of the Omega module (minimum value per side or damper)

Attachments and accessories

IndraDyn S servo motors MSK



Schematic motor illustration

Motor	Dimensions (mm)													
	A	B_1	C	C_1	ØD k6	ØE j6	ØF	ØG	H	H_1	H_2	L_m without holding brake	L_m with holding brake	R
MSK 040C-0600	82	8.0	30	2.5	14	50	95	6.6	124.5	83.5	69.0	185.5	215.5	R8
MSK 050C-0600	98	9.0	40	3.0	19	95	115	9.0	134.5	85.5	71.0	203.0	233.0	R8
MSK 076C-0450	140	14.0	50	4.0	24	110	165	11.0	180.0	110.0	95.6	292.5	292.5	R12

Motor data

Motor	n_{max} (min^{-1})	M_0 (Nm)	M_{max} (Nm)	M_{br} (Nm)	J_m (kgm^2)	J_{br} (kgm^2)	m_m (kg)	m_{br} (kg)
MSK 040C-0600	7 500	2.7	8.1	4	0.000140	0.000023	3.6	0.3
MSK 050C-0600	6 000	5.0	15.0	5	0.000330	0.000107	5.4	0.7
MSK 076C-0450	5 000	12.0	43.5	11	0.004300	0.000360	13.8	1.1

Motor data independent of the Omega module

J_{br} = mass moment of inertia of holding brake
J_m = mass moment of inertia of the motor
L_m = length of the motor
M_0 = torque at standstill
M_{br} = holding torque of holding brake when switched off
M_{max} = maximum possible motor torque
m_m = mass of motor
m_{br} = mass of the holding brake
n_{max} = maximum speed

Option number[1]	Motor	Material number	Version Holding brake Without	With	Type designation
86	MSK040C-0600	R911306060	X		MSK040C-0600-NN-M1-UG0-NNNN
87		R911306061		X	MSK040C-0600-NN-M1-UG1-NNNN
88	MSK050C-0600	R911298354	X		MSK050C-0600-NN-M1-UG0-NNNN
89		R911298355		X	MSK050C-0600-NN-M1-UG1-NNNN
92	MSK076C-0450	R911318098	X		MSK076C-0450-NN-M1-UG0-NNNN
93		R911315713		X	MSK076C-0450-NN-M1-UG1-NNNN

1) From “Configuration and ordering” table

Version

- Plain shaft with shaft seal
- Multi-turn absolute encoder M1 (Hiperface)
- Cooling system: natural convection
- Protection class IP65 (housing)
- With or without holding brake

Notes

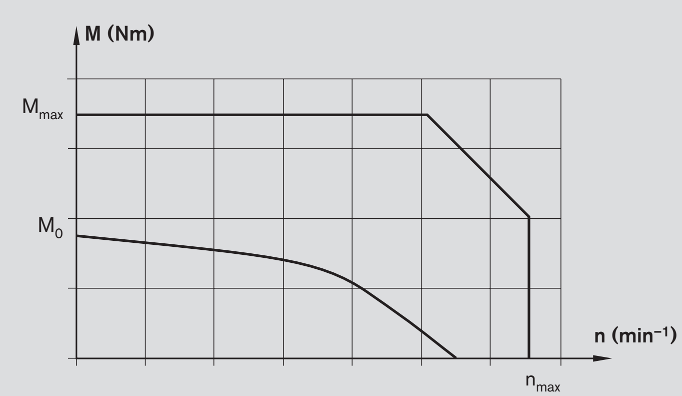
The motors can be supplied complete with controllers and control units. For further motor types and more information on motors, controllers and control units, please refer to the following Rexroth catalogs on drive technology:

- Drive System Rexroth IndraDrive, R999000018
- Automation systems and control components, R999000026
- Rexroth IndraDyn S Synchronous Motors MSK, R911296288

Recommended motor/controller combination

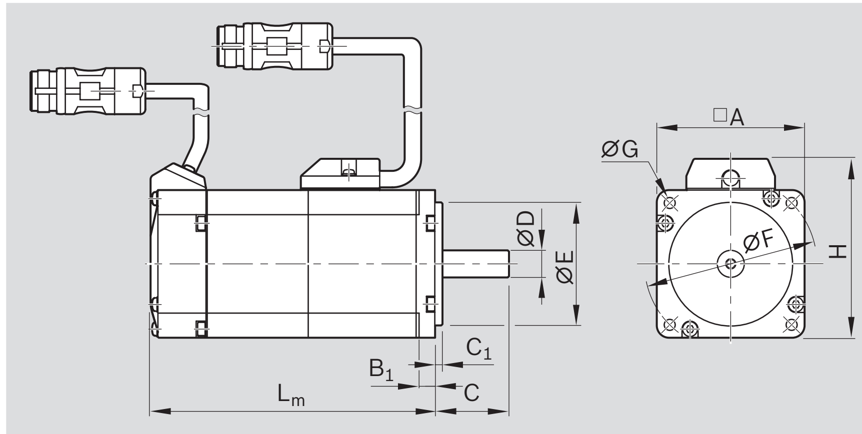
Motor	Controller
MSK 040C-0600	HCS 01.1E-W0008
MSK 040C-0600	HCS 01.1E-W0018
MSK 050C-0600	HCS 01.1E-W0028
MSK 076C-0450	HCS 01.1E-W0054

Torque/speed characteristic (schematic)



Attachments and accessories

IndraDyn S servo motors MSM



Schematic motor illustration

Motor	Dimensions (mm)									
	A	B_1	C	C_1	ØD k6	ØE j6	ØF	ØG	H	L_m Without holding brake	With holding brake
MSM 031C-0300	60	6.5	30	3	14	50	70	4.5	73	98.5	135.0
MSM 041B-0300	80	6.0	35	3	19	70	90	6.0	93	112.0	149.0

Motor data

Motor	n_{max} (min^{-1})	M_0 (Nm)	M_{max} (Nm)	M_{br} (Nm)	J_m (kgm^2)	J_{br} (kgm^2)	m_m (kg)	m_{br} (kg)
MSM 031C-0300	5 000	1.30	3.80	1.27	0.0000260	0.0000018	1.20	0.50
MSM 041B-0300	4 500	2.40	7.10	2.45	0.0000870	0.0000075	2.30	0.80

J_{br} = mass moment of inertia of holding brake
J_m = mass moment of inertia of the motor
L_m = length of the motor
M_0 = torque at standstill
M_{br} = holding torque of the holding brake (normally closed)
M_{max} = maximum possible motor torque
m_m = mass of motor
m_{br} = mass of holding brake
n_{max} = maximum speed

Option number[1)]	Motor	Material number	Version Holding brake		Type designation
			Without	With	
138	**MSM 031C-0300**	R911344215	X		MSM 031C-0300-NN-M5-MH0
139		R911344216		X	MSM 031C-0300-NN-M5-MH1
140	**MSM 041B-0300**	R911344217	X		MSM 041B-0300-NN-M5-MH0
141		R911344218		X	MSM 041B-0300-NN-M5-MH1

1) From “Configuration and ordering” table

Version:
- Plain shaft without shaft seal
- Mutiturn absolute encoder M5 (20 bit, absolute encoder function only available with buffer battery)
- Cooling system: natural convection
- Protection class IP54 (shaft IP40)
- With or without holding brake
- Metal round connector M17

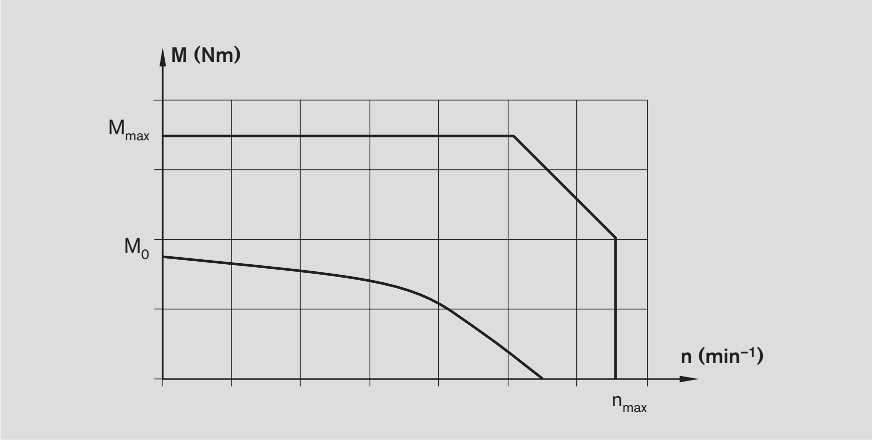
Notes

The motors can be supplied complete with controllers and control units. For further motor types and more information on motors, controllers and control units, please refer to the following Rexroth catalogs:
- Drive System Rexroth IndraDrive, R999000018
- Automation systems and control components, R999000026
- Rexroth IndraDyn S Synchronous Motors MSM R911329337

Recommended motor/controller combination

Motor	Controller
MSM 031C-0300	HCS 01.1E-W0009
MSM 041B-0300	HCS 01.1E-W0013

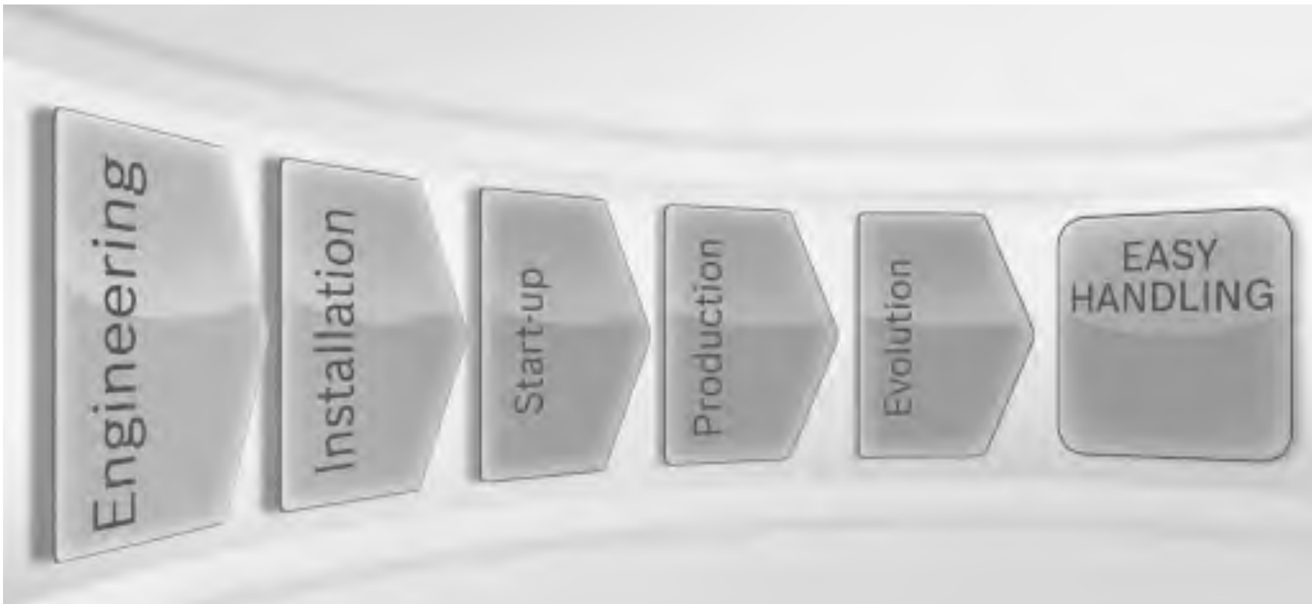
Torque/speed characteristic (schematic)



The perfect system solution for every application

Efficient production processes are the key to your success in the marketplace. Today's environment, defined by rapid change and short product cycles, demands flexible systems with an optimal design and configuration. EasyHandling gives you the tools you need to automate your handling applications with greater ease, speed, and efficiency. EasyHandling is more than just a modular collection of mechanical components; it takes an evolutionary step forward by providing an all-inclusive system solution – our best solution for your requirements.

EasyHandling – Easier. Faster. More Economical.



Easier
to get results that fit
Tailor-made solutions just like that – with support throughout.

Faster
route to your ideal application
Effortless adaptation, even to future requirements – fast and flexible scalability.

More economical
through unparalleled efficiency
Optimizes processes from project planning through to operations – with significant savings on resources.

Engineering – up to 70% faster
EasyHandling tools help users right from the component selection stage, proposing solutions with all the necessary information on parts lists, technical data and CAD drawings.

Installation – saves up to 60% on time
Thanks to positive-locking interfaces, the mechanical components are perfectly aligned and accurately connected right away.

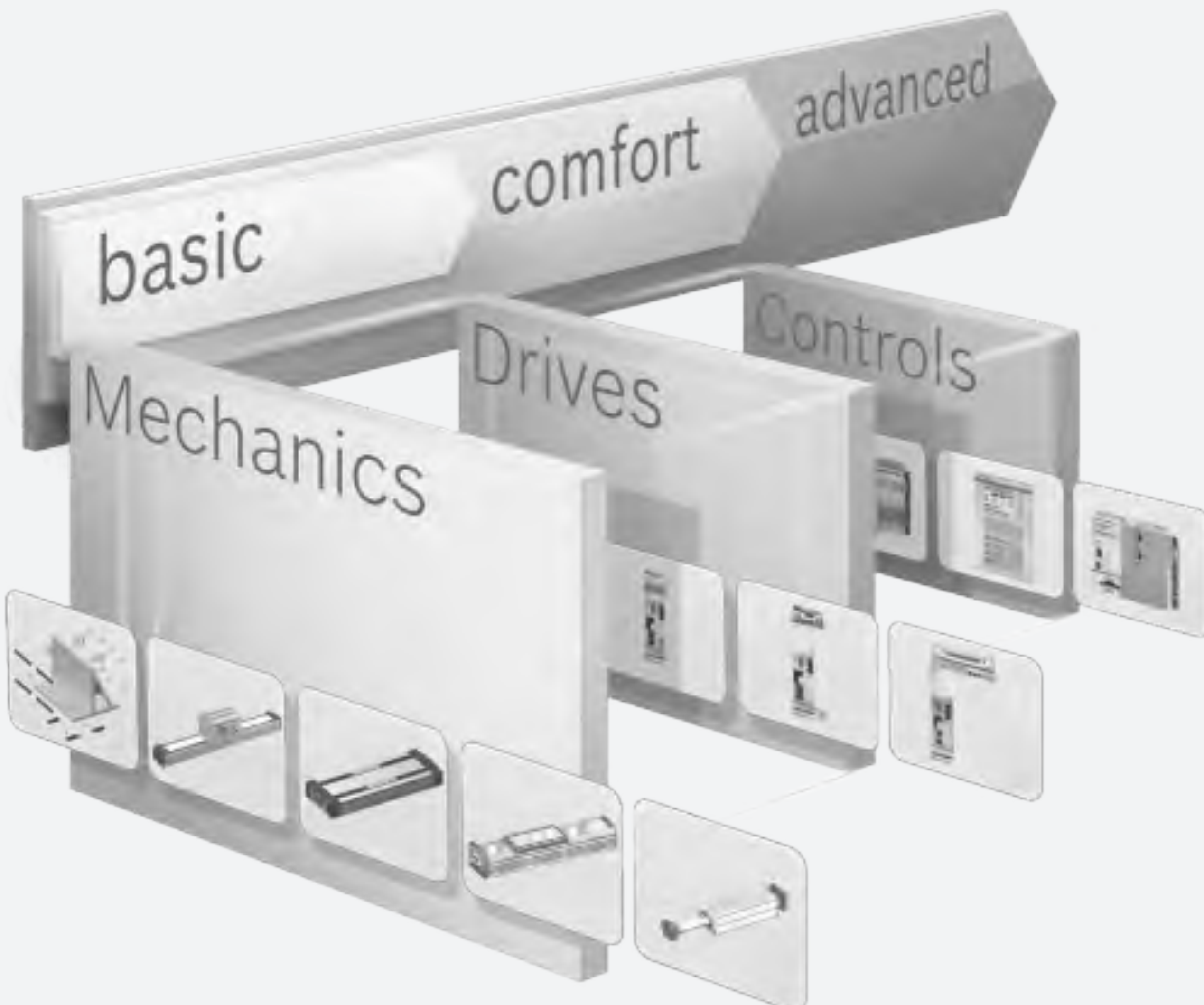
Start-up – reduces your effort by up to 90%
With the smart start-up assistant EasyWizard, parameterization and configuration become child's play. Your handling system will be ready to go in just a few clicks.

Production – more economical and more efficient
Rexroth enhances the system effectiveness still further with smart application tools: The drive controller software outputs maintenance-related messages to the user based on operating hours and travel to help schedule servicing at the right intervals. The result: longer life and reduced risk of failure.

Future developments – continuous improvement
Prepare for future market developments now: One of the great features of EasyHandling systems is their systematic openness. The flexibility of the mechanical and electrical components allows you to adapt quickly and efficiently to new production requirements.

EasyHandling – more than just a kit of components

The modular system concept that ideally builds on itself



basic – Made-to-measure mechanics

EasyHandling basic contains all the mechatronic components you need to build complete, **single- or multi-axis systems** to match your individual needs. All of the component interfaces are systematically standardized, making it possible to combine them at will. Practical tools and aids make selection and configuration even easier.

comfort – Getting started even faster

EasyHandling comfort expands the Basic component range by adding **powerful servo drives with multiple protocol capability**. The universal, smart control units are ideally suited for a variety of handling tasks. Unique: with the **EasyWizard start-up assistant**, linear systems are ready to use after entering just a few product-specific parameters.

advanced – Controls for demanding requirements

With the **freely scalable, high-performing motion logic control system**, EasyHandling advanced makes configuration and handling even easier. Predefined functions covering more than 90 percent of all handling applications eliminate the need for lengthy programming.

For more information about EasyHandling, see the brochure “EasyHandling – more than just a kit of components” R999000044.

Operating conditions

Normal operating conditions

Ambient temperature No passing below the dew point	0 °C ... 40 °C	ϑ
Load	≤ 0.2 C	
Travel distance s_{min} 1)	OBB-055 ≥ 110 mm	
	OBB-085 ≥ 160 mm	
	OBB-120 ≥ 135 mm	
Contamination	Not permitted	

1) Minimum travel distance to ensure a reliable lubrication distribution.

Design notes

⚠ **Moved parts:**
Safety devices and guards necessary

⚠ **For vertical installations:**
Arresting devices necessary to protect against falling loads

Required and supplementary documentation

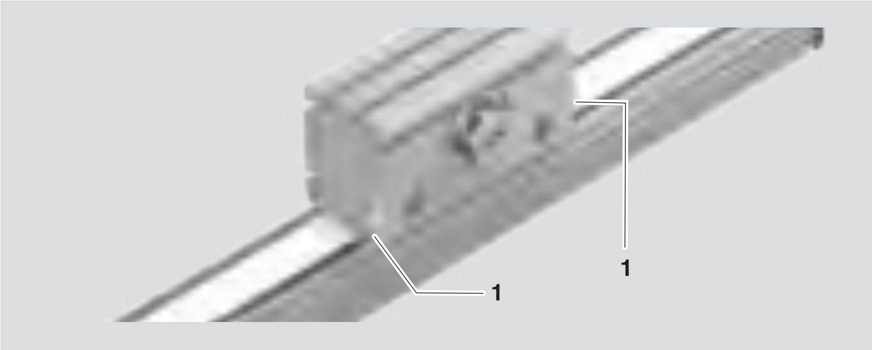
For further instructions and information, please refer to documentation belonging to this product. “Safety Instructions for Linear Motion Systems”

We would also be pleased to send you the documents.
If you are unsure about using this product, please contact Bosch Rexroth.

Lubrication

Lubrication notes
Omega modules receive basic lubrication with Dynalub 510 and are only designed for grease lubrication using a manual grease gun.
The only maintenance required is relubrication of the integrated Ball Rail System via one of the two funnel-type lube nipples (**1**).

Lubrication point
1 Funnel-type lube nipple
DIN 3405 Type D1



Lubricants
For lubricant quantities and intervals, see “Instructions for Omega Modules”.

Size	Grease	Material number
OBB-055 **OBB-085** **OBB-120**	Dynalub 510 (Bosch Rexroth) NLGI grade 2 lithium-based high-performance grease as per DIN 51818 (KP2K-20 as per DIN 51825)	R3416 037 00 (Cartridge 400 g)
	Alternative greases	
	Elkalub GLS 135 / N2 (Chemie-Technik)	
	Castrol Longtime PD2 (Castrol)	

⚠ Do not use greases containing solid particles (e.g. graphite or MoS_2)!

⚠ For lubrication in short-stroke applications (travel path < s_{min}), please consult us.

Documentation
Standard report
Option 01

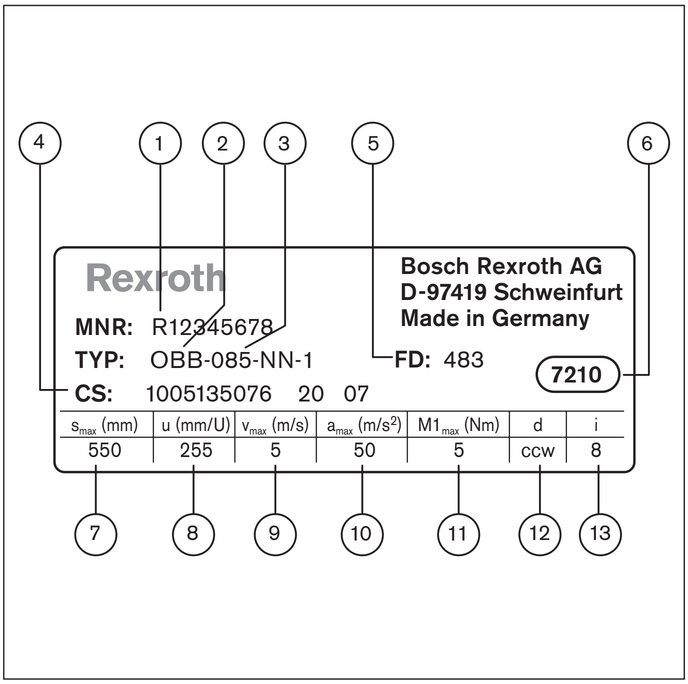
The standard report serves to confirm that the checks listed in the report have been carried out and that the measured values lie within the permissible tolerances.

Controls listed in the standard report:
– functional checks of mechanical components
– functional checks of electrical components
– design is in accordance with order confirmation

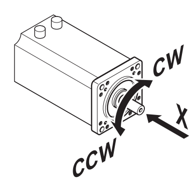
Service and information

Parameterization (commissioning)

Besides reference information for the production of the linear motion system, there are also technical parameters specified for commissioning on the nameplate.



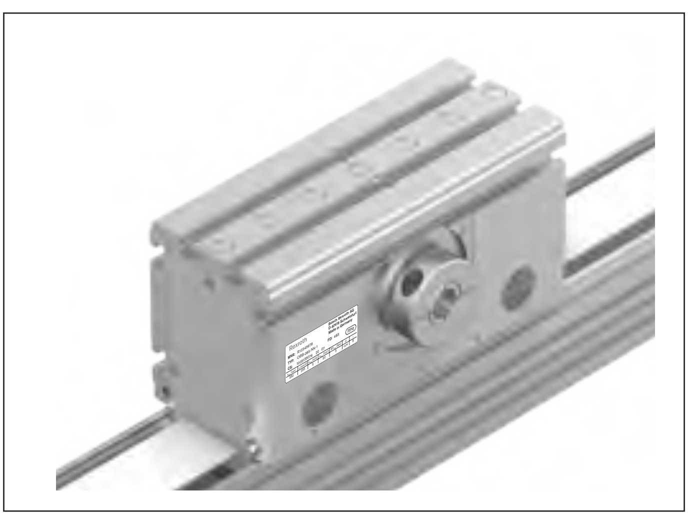
1 Material number
2 Type designation
3 Size
4 Customer information
5 Date of manufacture
6 Manufacturing location
7 s_{max} = max. travel range (mm)
8 u = lead constant (mm/rev)
9 v_{max} = max. speed (m/s)
10 a_{max} = max. acceleration (m/s^2)
11 $M1_{max}$ = max. drive torque at motor journal (Nm)
12 d = rotational direction of the motor to move in positive direction



Clockwise
Counter clockwise

13 i = gear ratio

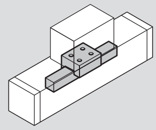
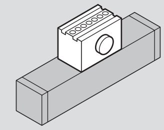
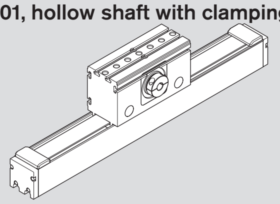
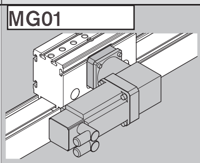
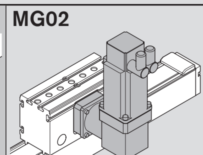
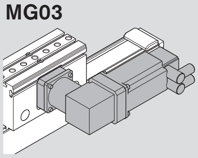
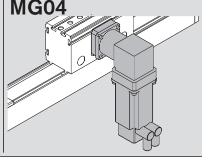
For Omega modules, the nameplate is mounted on the carriage on the drive side. (See fig.)



Service and information

Ordering example OBB-085

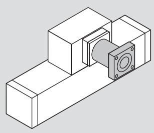
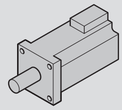
Configuration and ordering

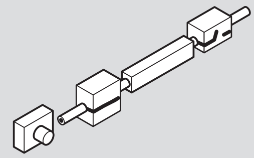
Short product name, length: OBB-085-NN-1, ... mm		Guideway	Drive			Carriage	
							
			Reduction			L_{ca} = 260 mm	L_{ca} = 308 mm
Version[2)]						without	with
			i = 1	i = 5	i = 8	Clamping element	
with drive (MA), without gear i = 1	MA01, hollow shaft with clamping hub 	01	01	–		01	02
with gear (MG), Angular planetary gearbox WPG	MG01  MG02  MG03  MG04 	01	–	10		01	02
	MG10						

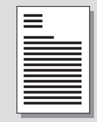
▭ (grey) = Mark of the selection area to the decision about version

▭ = Selected option that is to be entered at “Inquiry/Order” in the the order form at the end of the catalog

Ordering data	Option	Description
Omega module		
Short product name, length	OBB-085-NN-1, 910 mm	Length 910 mm
Version	MG01	Omega module with angular planetary gearbox, mounted as shown in fig. MG01
Guideway	01	Ball Rail System
Drive	10	Toothed belt drive
Carriage	01	Carriage with length L_{ca} = 260 mm (without clamping element)
Motor attachment	33	with angular planetary gearbox, i = 5, for motor MSK 050C
Motor	89	Motor MSK 050C with brake
1. Switch	61	PNP NC (frame moves)
2. Switch	65	Mechanical switch (frame moves)
Socket-plug	17	Socket-plug on the switch side (frame moves)
Control strip	42	Two control strips on the frame (frame moves)
Documentation	01	Standard report

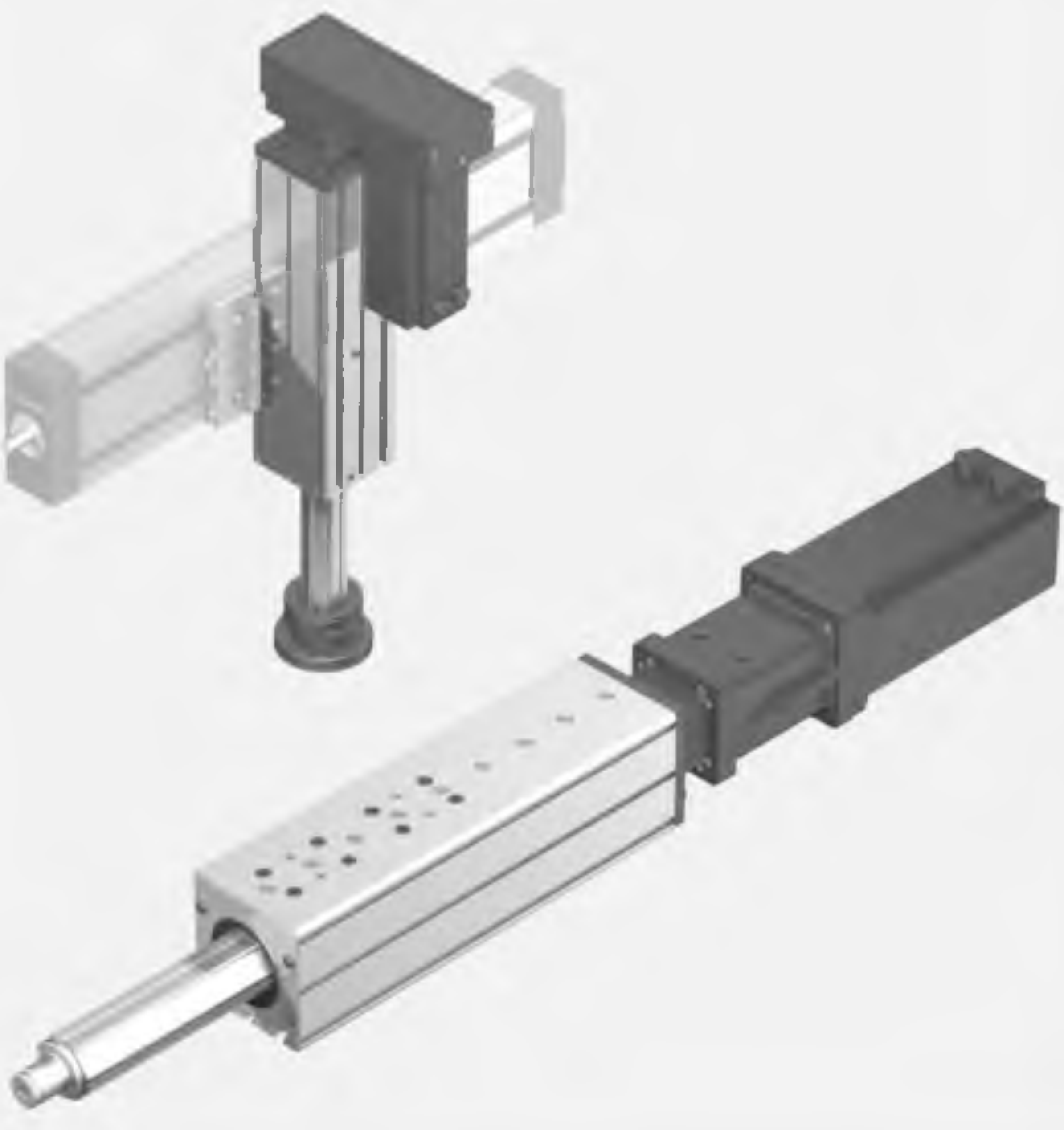
Motor attachment				Motor	
					
Speed reduction i =	Attachment kit 3) MG01 MG03	Attachment kit 3) MG02 MG04	for motor	without brake	with brake
–	00		–	00	
i = 5	33	43	MSK 050C	88	89
i = 8	35	45			
i = 8	34	44	MSM 041B	140	141
	30		MSK 050C	88	89
			B	140	141

Switching system 4)	
	
Without switch and without cable duct	00
Carriage moves	
Switch:	
– PNP NC	71
– PNP NO	73
– Mechanical	75
Cable duct 1)	20
Socket-plug	17
Switching angle	36
Frame moves	
Switch:	
– PNP NC	61
– PNP NO	63
– Mechanical	65
Socket-plug	17
Two control strips	41

Documentation

standard report
01

rexroth
A Bosch Company

Feed Modules VKK



Identification system for short product names

Short product name	=	Example:	**VKK – 070 – NN – 1**
System	=	**F**eed Modules	
Size		050 / **070** / 100	
Version	=	**S**tandard version	
Generation	=	Product generation **1**	

Changes/additions at a glance

- New catalog number
- New short product name
- Revised technical data table and drive data structure
- “Calculation” section revised
- “Configuration, ordering, dimension drawings, options” section revised
- “Attachments and accessories” (motors according to customer specification, switch mounting, sensors, etc.) section added

Contents

Product Description

Rexroth Feed Modules VKK are precise, ready-to-install linear motion systems that combine high performance with space-saving dimensions.

Characteristic features

- Rexroth Feed Modules VKK are especially suitable for handling tasks requiring high precision as well as high thrust and torque transfer capabilities.
- Because of their low moved mass, Feed Modules VKK are ideal for vertical motion in z-axes.

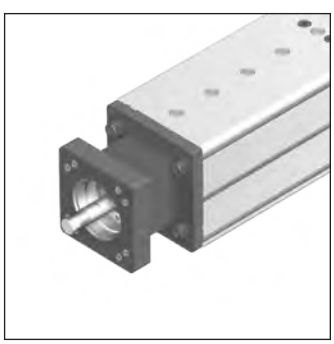
Structural design

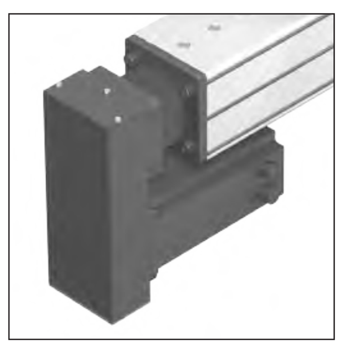
- Extremely compact extruded aluminum profile (frame) with zero-clearance Ball Rail System
- Integrated precision ball screw drive (BASA) in tolerance grade 7 with zero-backlash nut system
- Fixed bearing end block made of aluminum

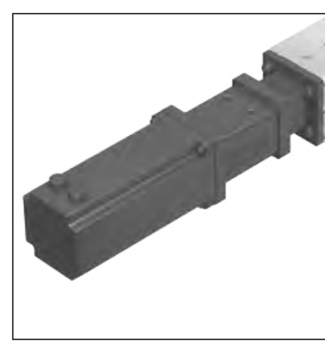
Attachments

- Maintenance-free servo drives with or without brake
- Motor mount and coupling or timing belt side drive for motor attachment
- Switch
- Bellows

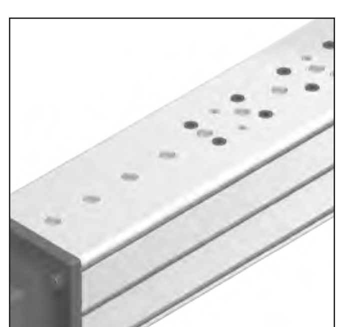
- Without motor attachment
- Motor attachment
  – via timing belt side drive
  – via motor mount

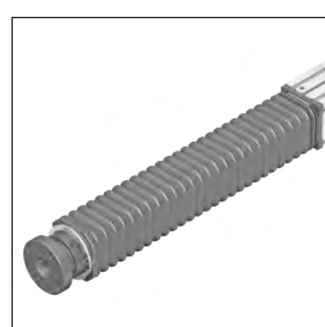






- Thrust rod with adapter flange for customer attachments
- Centering holes for positive- locking connections with good reproducibility and simplified installation
- Bellows cover



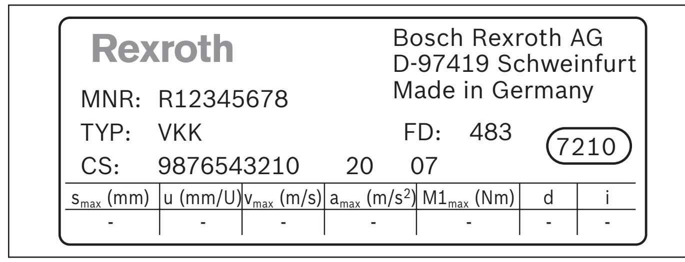


Further highlights

- Optimal travel performance, high load capacities and high rigidity due to integrated, zero-clearance ball rail system
- Space-saving design
- Ball screw drive with zero-backlash nut system assures high positioning accuracy and repeatability
- Easy motor attachment due to locating feature and fastening threads
- Encapsulated guideway
- Switches positionable over the entire travel range
- Switch activation via internal magnets
- Allows easy installation of various attachments
- Fully compatible with the EasyHandling system
- Positive-locking connection technology with centering rings

Nameplate

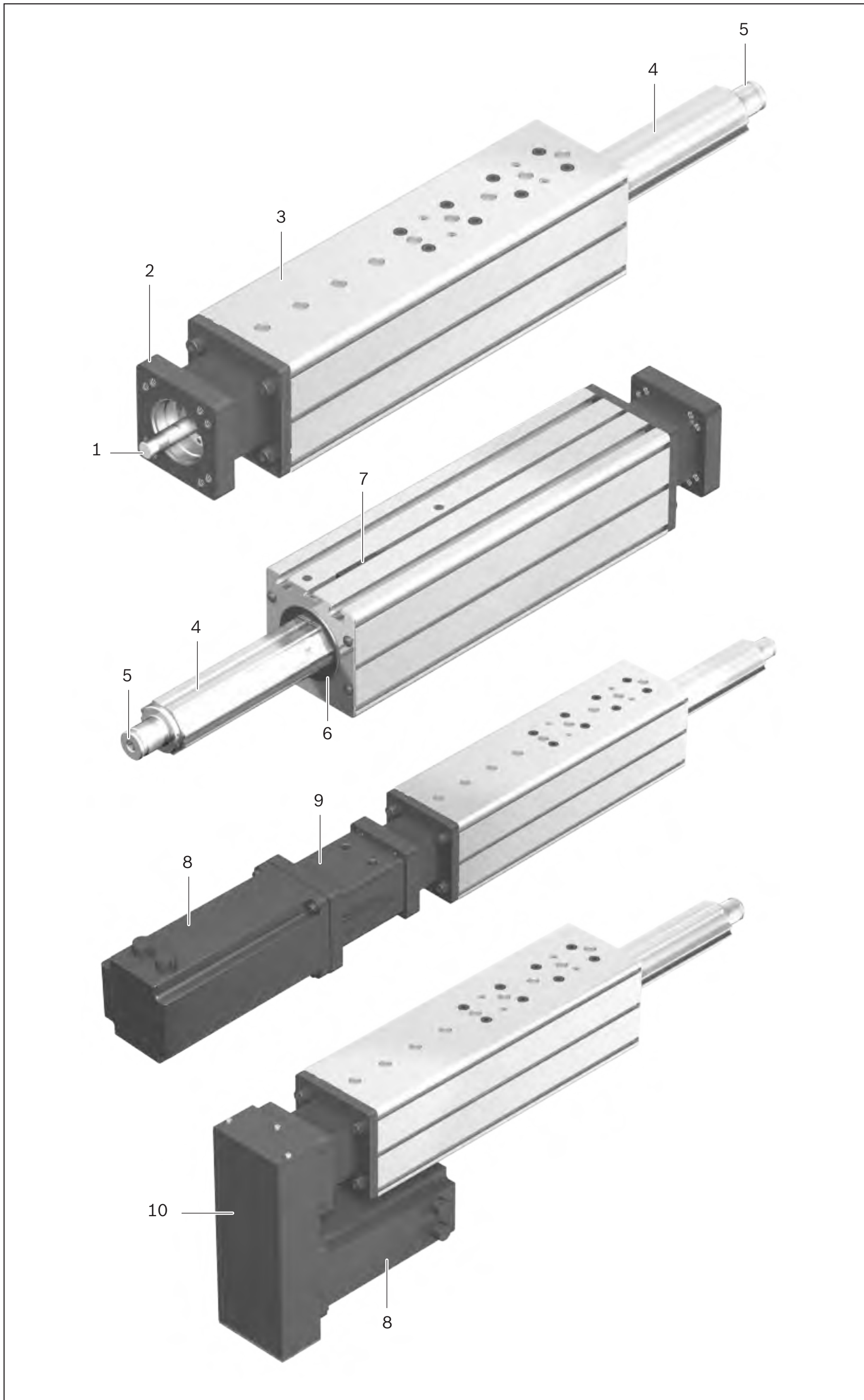
- On the nameplate you will find technical data for start-up. With these technical data and the EasyWizard software, starting up linear motion systems becomes easier, faster and more effective than ever before.



Structural Design

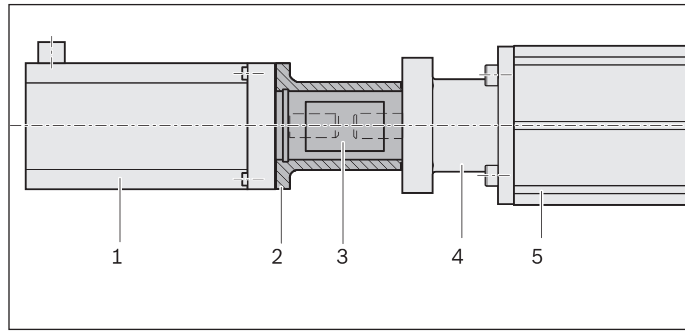
1 Ball screw drive with zero-backlash nut
2 Fixed bearing end block
3 Frame
4 Thrust rod
5 Mounting interface for adapter flange
6 Front seal

Attachments
7 Magnetic field sensor
8 Motor
9 Motor mount and coupling
10 Timing belt side drive



Motor mount and coupling

A motor can be attached to all Feed Modules by means of a motor mount and coupling.
The motor mount serves to fasten the motor to the Feed Module and acts as a closed housing for the coupling. The motor's drive torque is transmitted stress-free through the coupling to the Feed Module's screw journal.

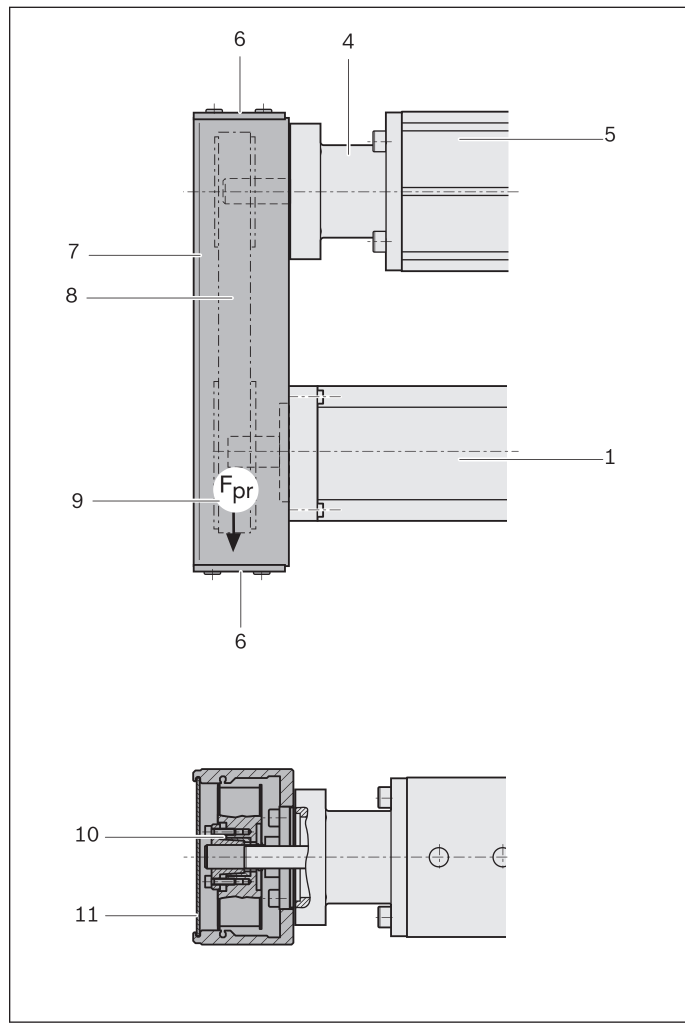


Timing belt side drive

All feed modules offer the option of attaching the motor via a side drive with timing belt.
This results in a shorter overall length compared to a motor attachment via motor mount and coupling.
The space-saving, closed housing protects the belt and secures the motor. Various gear ratios are also available:

- i = 1 : 1
- i = 1 : 1.5
- i = 1 : 2

The timing belt side drive can be mounted in four different directions.

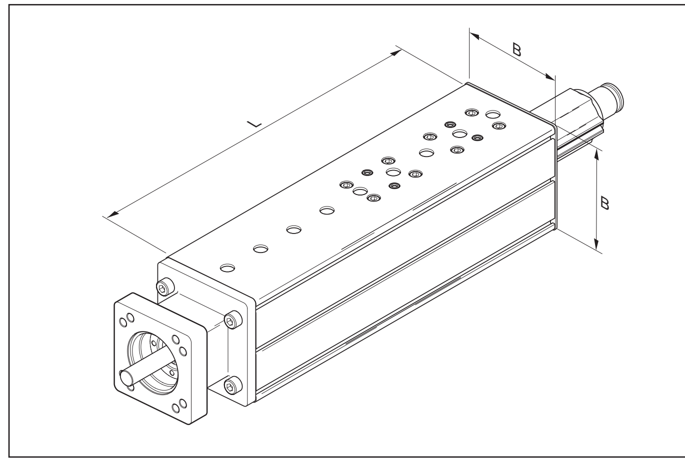


1 Motor
2 Motor mount
3 Coupling
4 Fixed bearing end block
5 Feed Module
6 Cover
7 Drawn, anodized aluminum profile
8 Toothed belt
9 Pre-tensioning the of the toothed belt: apply pre-tensioning force F_{pr} to motor (F_{pr} will be indicated on delivery)
10 Belt pulleys
11 Cover plate

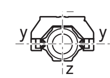
General technical data

Size		VKK-050	VKK-070	VKK-100
B	**(mm)**	50	70	100
L [1]	**(mm)**	240	280	360
		280	320	400
		360	400	480
		480	520	600
		–	600	680
s_{max} [2]	**(mm)**	378	452	476

1) Length
2) Max. travel (without bellows) at max. length.
For further travel distances, see dimension drawings.



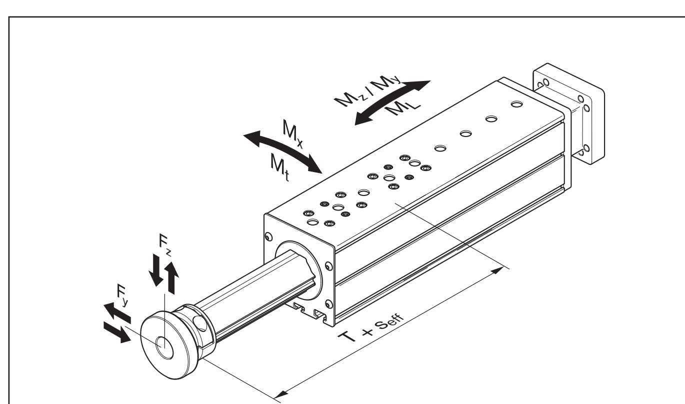
Load capacities and moments

Size	BASA	Dynamic characteristic values					Maximum permissible loads		Planar moment of inertia Thrust rod 		
		Dynamic load capacity C (N)			Dynamic moments (Nm)		Maximum permissible moments (Nm)				
	d_0 x P (mm)	Guideway	BASA	Fixed bearing	M_t	M_L	$M_{t\,max}$	$M_{L\,max}$	I_y (cm^4)	I_z (cm^4)	T (mm)
VKK-050	12 x 2	6 950	2 240	4 000	97	61	48	30	2.6	2.3	101,5
	12 x 5		3 800								
	12 x 10		2 500								
VKK-070	16 x 5	8 120	12 300	13 400	160	280	55	110	5.7	6.7	125,0
	16 x 10		9 600								
	16 x 16		6 300								
VKK-100	20 x 5	26 000	14 300	17 900	670	1 300	100	360	12.9	16.2	167,5
	20 x 20		13 300								
	25 x 10		15 700								

Acceptable loads
(value on the basis of past experience)

As far as the desired nominal life is concerned, loads for F_m, F_{comb} of up to about 20% of the dynamic load capacity (C) have proven acceptable. See the section on calculation principles.

Do not exceed the technical data



Note on dynamic load capacities and moments

Determination of the dynamic load capacities and moments of the guideway is based on a travel life of 100,000 m. Often only 50,000 m are actually stipulated. For comparison: Multiply values C, M_t and M_L from the table by 1.26.

See page 12 for short product names

Mass of VKK
(without motor attachment, motor, switching system).

Size	Length L (mm)	Mass of VKK (kg) Adapter flange without	with	with bellows[1)]	Moved mass of system (kg) Adapter flange without	with	with bellows[1)]
VKK-050	240	1.32	1.72	2.02	0.37	0.77	1.07
	280	1.47	1.87	2.17	0.42	0.82	1.12
	360	1.78	2.18	2.48	0.51	0.91	1.21
	480	2.24	2.64	2.94	0.64	1.04	1.34
VKK-070	280	2.99	3.39	3.69	0.73	1.13	1.43
	320	3.28	3.68	3.98	0.80	1.20	1.50
	400	3.88	4.28	4.58	0.92	1.32	1.62
	520	4.77	5.17	5.47	1.11	1.51	1.81
	600	5.37	5.77	6.07	1.23	1.63	1.93
VKK-100	360	8.26	8.66	9.26	1.67	2.07	2.57
	400	8.83	9.23	9.83	1.76	2.16	2.66
	480	9.98	10.38	10.98	1.93	2.33	2.83
	600	11.70	12.10	12.70	2.19	2.59	3.09
	680	12.84	13.24	13.84	2.36	2.76	3.26

1) With adapter flange

Maximum permissible drive torque M_p at the screw journal
Requirement:
No radial load on screw journal.

Maximum permissible speed v_{max}

Maximum permissible acceleration a_{max}

Constants $k_{j\ fix}$, $k_{j\ var}$, $k_{j\ m}$
System frictional torque M_{Rs}
The constants are required to determine the mass moment of inertia of the system J_s.

Size	BASA $d_0 \times P$	M_p (Nm)	M_{Rs} (Nm)	v_{max}[1)] (m/s)	$k_{j\ fix}$	$k_{j\ var}$	$k_{j\ m}$	a_{max} (m/s²)
VKK-050	12 x 2	0.79	0.22	0.23	1.193	0.013	0.101	27
	12 x 5	2.50	0.22	0.57	1.212	0.012	0.633	
	12 x 10	3.20	0.23	1.16	1.824	0.034	2.533	
VKK-070	16 x 5	4.60	0.33	0.38	4.035	0.032	0.633	27
	16 x 10	6.10	0.34	0.77	4.350	0.039	2.533	
	16 x 16	6.80	0.37	1.23	4.958	0.047	6.485	
VKK-100	20 x 5	12.64	0.52	0.32	39.342	0.086	0.633	22
	25 x 10	20.50	0.67	0.63	44.273	0.244	10.132	27
	20 x 20	25.60	0.69	1.27	46.551	0.122	2.533	27

1) For all lengths

See page 12 for short product names

Drive data

Drive data for motor attachment via motor mount and coupling

Size	Motor	Coupling data: Nominal torque M_{cN} (Nm)	Coupling data: Mass moment of inertia J_c (10^{-6} kgm²)	Mass: Motor mount and coupling m_{fc} (kg)
VKK-050	MSM 019B	1.9	2.1	0.2
	MSM 031B	3.7	7.0	0.3
	MSM 031C			
VKK-070	MSM 041B	9	61	0.4
	MSM 031C	19	60	0.5
	MSK 030C			0.6
	MSK 040C			
VKK-100	MSM 041B	19	64	0.6
	MSK 050C	50	200	1.0

Drive data for motor attachment via timing belt side drive

Size	BASA	MSM 019B								MSM 031B							
	d_0 x P	M_{sd} (Nm) i		J_{sd} (10^{-6} kgm²) i		M_{Rsd} (Nm)	m_{sd} (kg)	F (mm)	B_t	M_{sd} (Nm) i		J_{sd} (10^{-6} kgm²) i		M_{Rsd} (Nm)	m_{sd} (kg)	F (mm)	B_t
		1	**1.5**	**1**	**1.5**					**1**	**1.5**	**1**	**1.5**				
VKK-050	12 x 2	0.79	0.53	10.7	4.1	0.10	0.28	48	6 AT3	0.79	0.53	34.8	13.0	0.15	0.63	64.5	10 AT3
	12 x 5	1.31	0.87							2.48	1.65						
	12 x 10	1.31	0.87							2.70	1.80						

Size	BASA	MSM 031C								MSM 041B							
	d_0 x P	M_{sd} (Nm) i		J_{sd} (10^{-6} kgm²) i		M_{Rsd} (Nm)	m_{sd} (kg)	F (mm)	B_t	M_{sd} (Nm) i		J_{sd} (10^{-6} kgm²) i		M_{Rsd} (Nm)	m_{sd} (kg)	F (mm)	B_t
		1	**1.5**	**1**	**1.5**					**1**	**1.5**	**1**	**1.5**				
VKK-070	16 x 5	3.17	2.11	41.5	13.3	0.35	0.28	64.5	10 AT3	4.31	2.87	233.9	79.1	0.4	1.45	88	16 AT5
	16 x 10	3.17	2.11							5.85	3.90						
	16 x 16	3.17	2.11							6.42	4.28						
VKK-100	20 x 5									8.01	5.34	240	84				
	20 x 20	–	–	–	–	–	–	–	–	8.01	5.34						
	25 x 10									8.01	5.34						

Drive data for motor attachment via timing belt side drive

Size	BASA	MSK 030C								MSK 040C							
	d_0 x P	M_{sd} (Nm) i		J_{sd} (10^{-6} kgm²) i		M_{Rsd} (Nm)	m_{sd} (kg)	F (mm)	B_t	M_{sd} (Nm) i		J_{sd} (10^{-6} kgm²) i		M_{Rsd} (Nm)	m_{sd} (kg)	F (mm)	B_t
		1	1.5	1	1.5					1	1.5	1	1.5				
VKK-050	12 x 2	0.79	0.53	34.3	12.5	0.35	0.65	64.5	10 AT3	–	–	–	–	–	–	–	–
	12 x 5	2.48	1.65														
	12 x 10	2.70	1.80														
VKK-070	16 x 5	3.17	2.11	37.3	13.4					4.31	2.87	234.4	83.6	0.4	1.42	88	16 AT5
	16 x 10	3.17	2.11							5.85	3.90						
	16 x 16	3.17	2.11							6.42	4.28						

Size	BASA	MSK 050C							
	d_0 x P	M_{sd} (Nm) i		J_{sd} (10^{-6} kgm²) i		M_{Rsd} (Nm)	m_{sd} (kg)	F (mm)	B_t
		1	2	1	2				
VKK-100	20 x 5	10.20	5.10	1 420	230	0.45	3.2	116	25 AT5
	20 x 20	14.30	7.15						
	25 x 10	13.10	6.55						

M_t = dynamic torsional moment
M_L = dynamic longitudinal moment load capacity
$M_{t\,max}$ = maximum permissible torsional moment
$M_{t\,max}$ = maximum permissible longitudinal moment
I_y = y-axis planar moment of inertia
I_z = z-axis planar moment of inertia
a_{max} = max. acceleration (m/s²)
d_0 = nominal diameter (mm)
BASA = ball screw drive
M_p = maximum permissible drive torque (Nm)
M_{Rs} = frictional torque of system (Nm)
P = lead (mm)
v_{max} = maximum permissible speed (m/s)
B_t = belt type
F = timing belt side drive width
i = timing belt side drive gear ratio
J_c = coupling mass moment of inertia
J_{sd} = timing belt side drive mass moment of inertia at motor journal
$k_{j\,fix}$ = constant for fixed-length portion of mass moment of inertia
$k_{j\,var}$ = constant for variable-length portion of mass moment of inertia
$k_{j\,m}$ = constant for mass-specific portion of mass moment of inertia
J_{sd} = reduced mass moment of inertia of timing belt side drive
M_{Rsd} = frictional torque of timing belt side drive at motor journal
M_{cN} = rated torque of coupling
M_{sd} = permissible torque for system with timing belt side drive at motor journal (Nm); consider maximum permissible motor torque M_{max}
m_{sd} = mass of timing belt side drive
m_{fc} = mass of motor mount and coupling

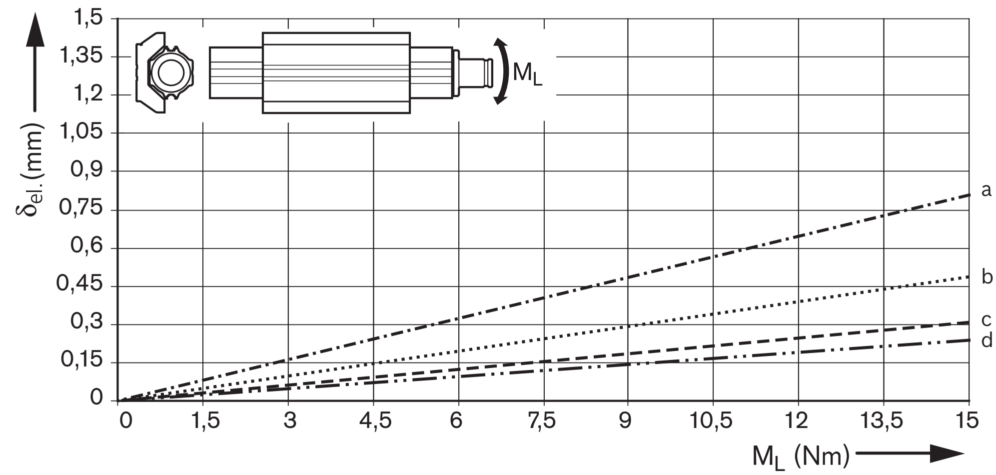
Rigidity

Rigidity of thrust rod
Feed Module VKK-050
Rigidity in y-direction

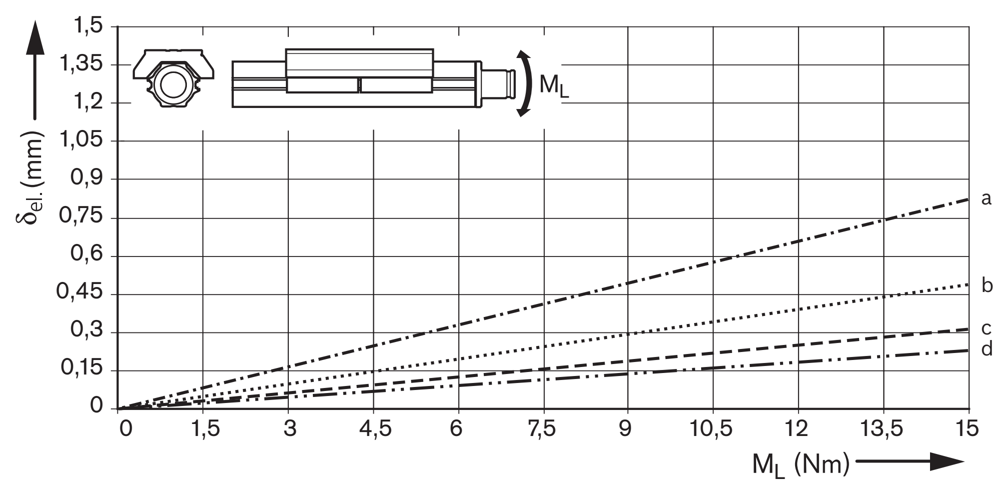
Measured values

Key to graph
- **a)** Length = 480 mm
- **b)** Length = 360 mm
- **c)** Length = 280 mm
- **d)** Length = 240 mm

δ_{el} = elastic deformation (mm)
M_L = dynamic longitudinal moment load capacity (Nm)



Rigidity in z-direction



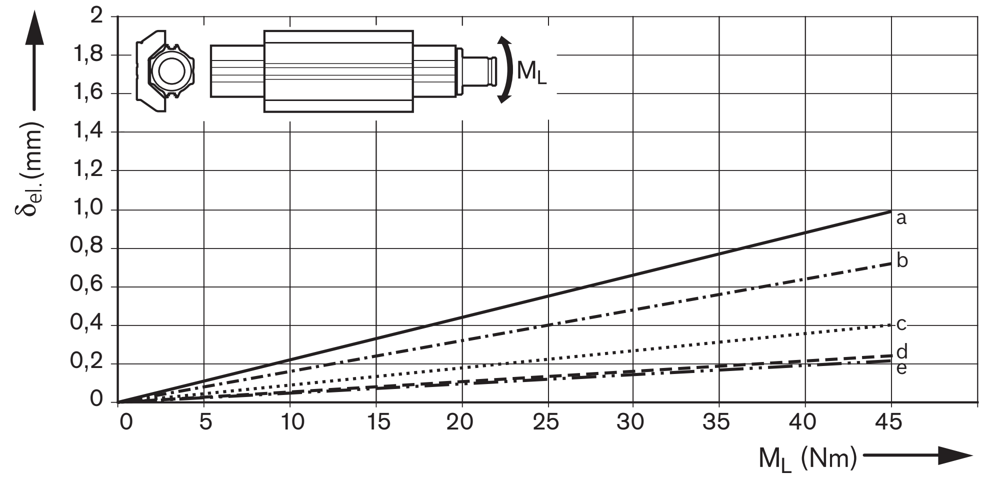
Rigidity of thrust rod
Feed Module VKK-070
Rigidity in y-direction

Measured values

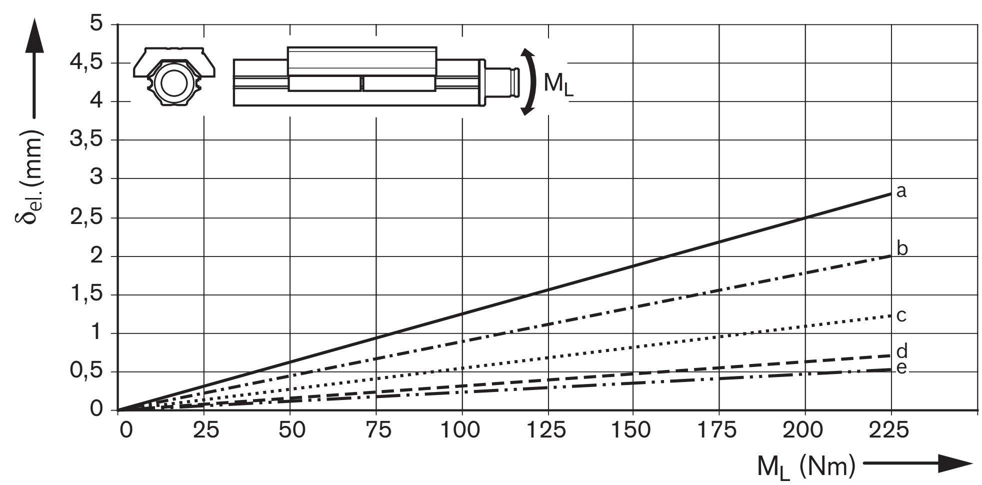
Key to graph

a) Length = 600 mm
b) Length = 520 mm
c) Length = 400 mm
d) Length = 320 mm
e) Length = 280 mm

δ_{el} = elastic deformation (mm)
M_L = dynamic longitudinal moment load capacity (Nm)



Rigidity in z-direction

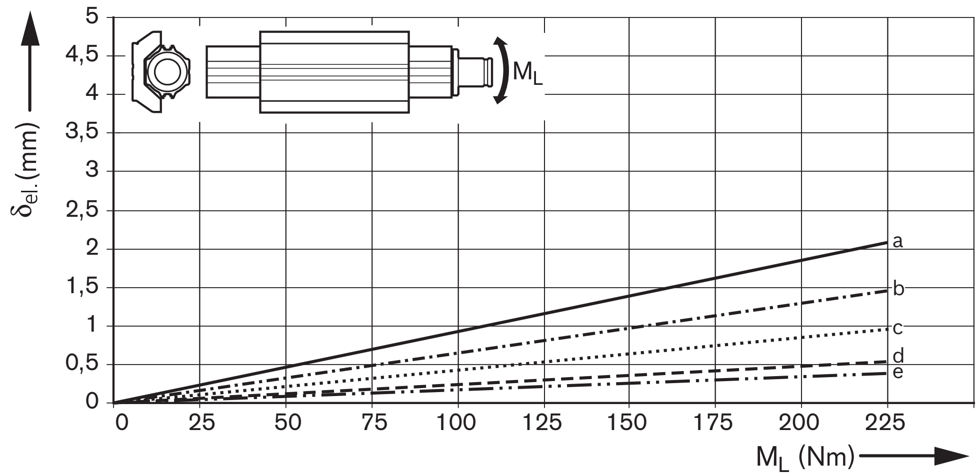


Rigidity of thrust rod
Feed Module VKK-100
Rigidity in y-direction

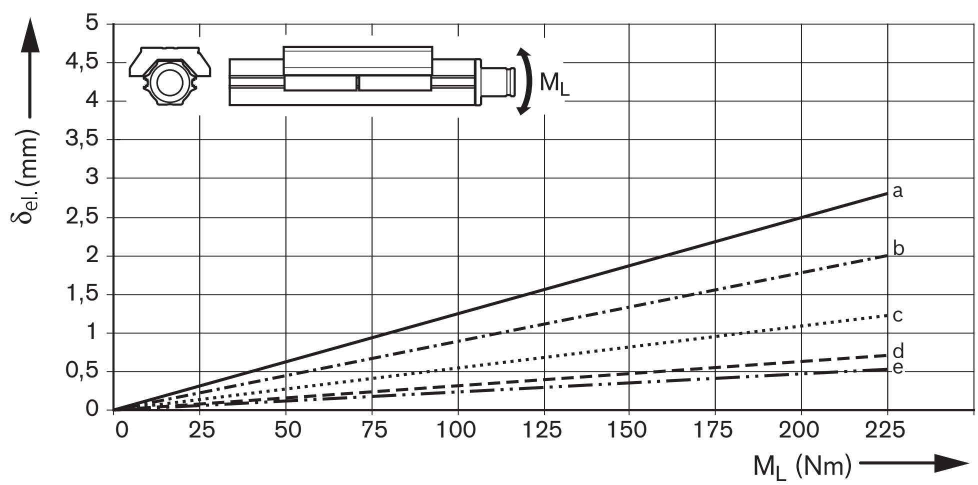
Measured values

Key to graph
a) Length = 680 mm
b) Length = 600 mm
c) Length = 480 mm
d) Length = 400 mm
e) Length = 360 mm

δ_{el} = elastic deformation (mm)
M_L = dynamic longitudinal moment load capacity (Nm)

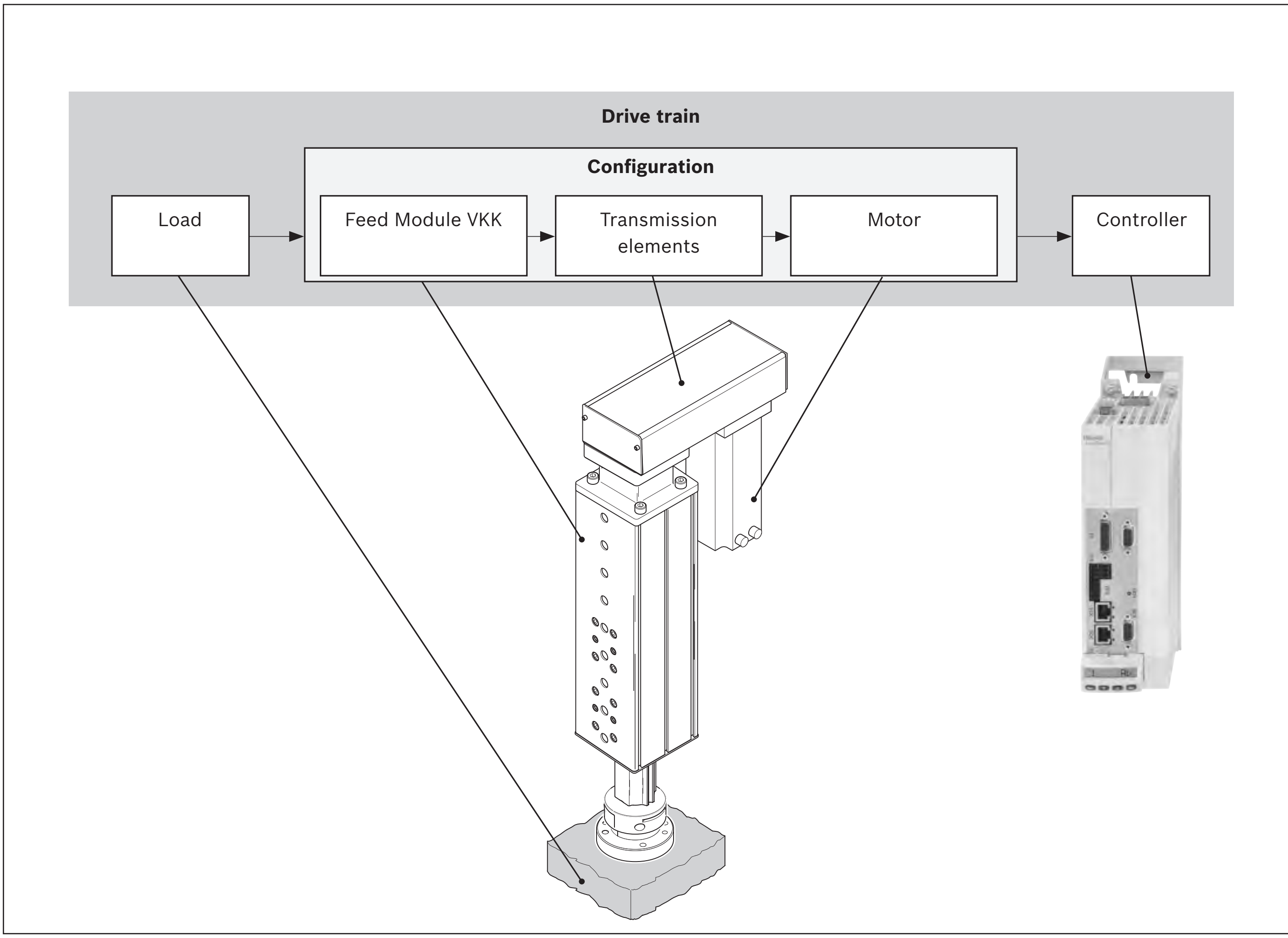


Rigidity in z-direction



Calculation principles

Drive train



The correct dimensioning and assessment of an application requires structured consideration of the drive train as a whole. The basic element of the drive train is the configuration – made up of the linear motion system, the transmission element (coupling or timing belt side drive) and the motor – which can be ordered in that constellation in the catalog.

Maximum permissible loads

When selecting linear motion systems, it is essential to consider the upper limits for permissible loads and forces, as specified in the section "Technical Data". The values given there are system-related. In other words, the upper limits are determined not only by the load ratings of the bearing points but also include structural design and material-related considerations.

Conditions for combined loads

$$\frac{|F_y|}{F_{y\,max}} + \frac{|F_z|}{F_{z\,max}} + \frac{|M_x|}{M_{x\,max}} + \frac{|M_y|}{M_{y\,max}} + \frac{|M_z|}{M_{z\,max}} \leq 1$$

Service life

The service life of the rolling bearing points contained in a linear motion system can be calculated using the formulas given below. In a linear motion system with ball screw drive, the rolling bearing points that are relevant for the service life are the linear guide, the ball screw drive (ball nut), and the fixed bearing.

Note

The projected service life of the linear motion system is determined by the lowest of the separately calculated service life values for the linear guide, the ball screw drive and the fixed bearing.

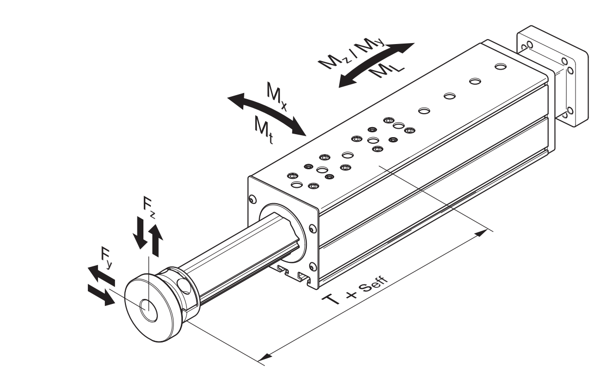
Service life of the linear guide

The linear guide of a linear motion system must bear the load and any processing forces.

Combined equivalent load on bearing of the guideway

Size	T (mm)
VKK-050	101.5
VKK-070	125.0
VKK-100	167.5

$$F_{comb} = C \cdot \frac{|M_x|}{M_t} + C \cdot \frac{|M_y|}{M_L} + C \cdot \frac{|M_z|}{M_L}$$



Nominal life in meters

$$L = \left(\frac{C}{F_{comb}}\right)^3 \cdot 10^5$$

In hours

$$L_h = \frac{L}{3\,600 \cdot v_m}$$

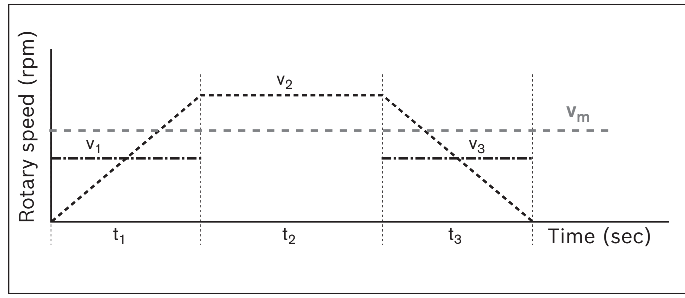
C	=	dynamic load capacity	(N)
F_{comb}	=	combined equivalent load on bearing	(N)
L	=	nominal life	(m)
L_h	=	nominal life	(h)
M_L	=	dynamic longitudinal moment load capacity	(Nm)
M_t	=	dynamic torsional moment	(Nm)
M_x	=	dynamic torsional moment about the x-axis	(Nm)
M_y	=	dynamic torsional moment about the y-axis	(Nm)
M_z	=	dynamic torsional moment about the z-axis	(Nm)
v_m	=	average travel speed	(m/s)
s_{eff}	=	effective stroke	(mm)
T + s_{eff}	=	center-to-center distance between runner block and mounting interface	

Calculation principles

Service life of ball screw drive or fixed bearing

Where the rotary speed and load vary, the service life must be calculated using the averages $\mathbf{F}_m$ and $\mathbf{n}_m$.

Where the rotational speed varies, the average speed n_m is as follows:



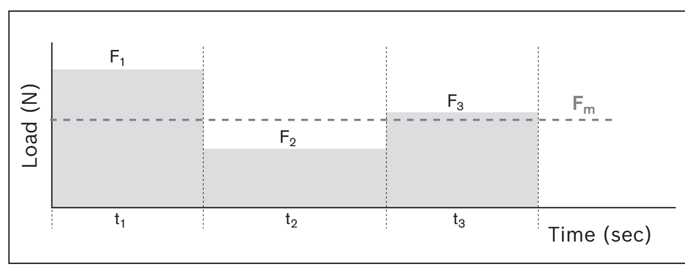
$$n_m = \frac{|n_1| \cdot t_1 + |n_2| \cdot t_2 + \dots + |n_n| \cdot t_n}{t_{total}}$$

$$t_{total} = t_1 + t_2 + \dots + t_n$$

Rotary speed in acceleration and braking phases $n_{1 \dots n}$:

$$n_{1 \dots n} = \frac{n_{A1 \dots n} + n_{E1 \dots n}}{2}$$

Where both the load and the rotational speed vary, the average load $_F$m is calculated as follows:



$$F_m = \sqrt[3]{|F_1|^3 \cdot \frac{|n_1|}{n_m} \cdot \frac{t_1}{t_{total}} + |F_2|^3 \cdot \frac{|n_2|}{n_m} \cdot \frac{t_2}{t_{total}} + \dots + |F_n|^3 \cdot \frac{n_n}{n_m} \cdot \frac{t_n}{t_{total}}}$$

Nominal life in revolutions

$$L = \left(\frac{C}{F_m}\right)^3 \cdot 10^6$$

In hours

$$L_h = \frac{L}{n_m \cdot 60}$$

C	= dynamic load capacity	(N)
$F_1, F_2, \dots F_n$	= axial load during phases 1 … n	(N)
F_m	= equivalent dynamic axial load	(N)
L	= nominal life	(–)
L_h	= nominal life	(h)
$n_1, n_2, \dots n_n$	= otational speed in acceleration and braking phases 1 … n	(rpm)
$n_{E1 \dots n}$	= speed at finish in phase 1 … n	(rpm)
n_m	= average rotary speed	(rpm)
$n_{A1 \dots n}$	= speed at start in phase 1 … n	(rpm)
$n_{E1 \dots n}$	= speed at finish in phase 1 … n	(rpm)
$t_1, t_2, \dots t_n$	= discrete time step in phases 1 … n	(sec)
t_{tot}	= sum of the discrete time steps	(sec)

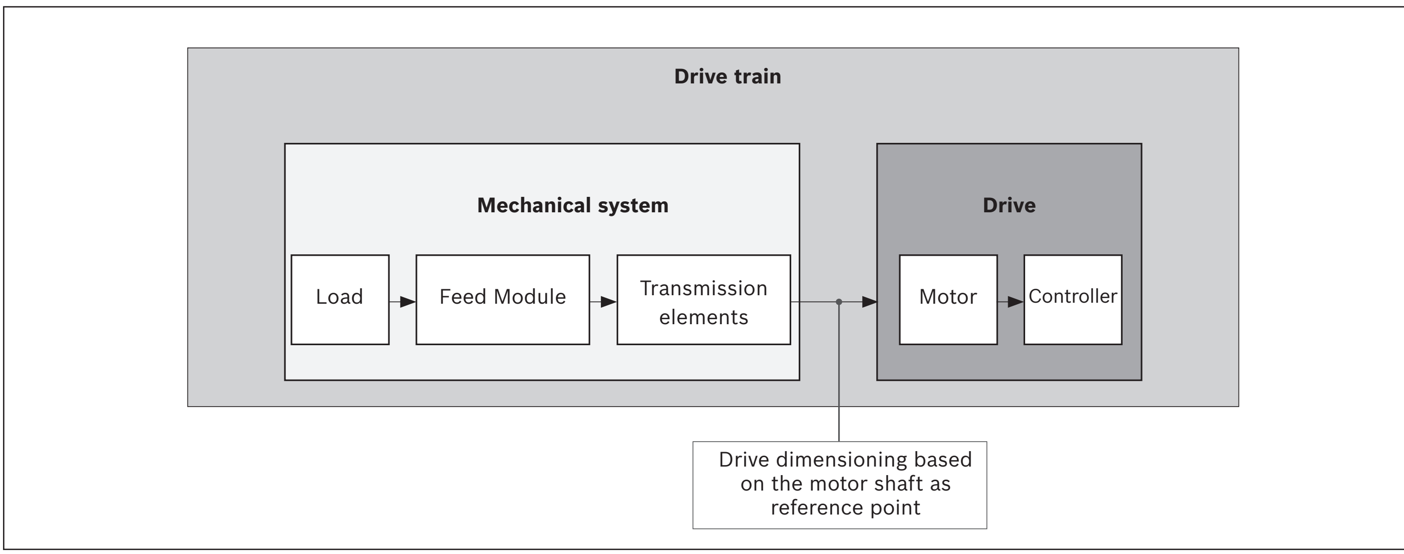
Drive dimensioning

Principles

When dimensioning the drive, the drive train can be subdivided into the mechanical system and the drive itself.

The **mechanical system** includes the physical components – linear motion system and transmission elements (timing belt side drive, coupling) – and the load to be carried.
The electric **drive** is a motor/controller combination with the appropriate performance data.

The dimensioning of the electric drive is done taking the motor shaft as a reference point.
When dimensioning the drive, limit values must be taken into account as well as basic values. The limit (i.e. maximum) values must not be exceeded, in order to avoid damaging the mechanical components.



Mechanical system technical data and symbols

For each component (linear motion system, coupling, timing belt side drive), the relevant maximum permissible values must be identified for the drive torque and travel speed, as well as the basic values for frictional torque and mass moment of inertia (see “Drive Data” in the section “General Technical Data”).

The following technical data with the associated symbols are used when considering the basic mechanical system requirements in the design calculations for dimensioning the drive. The data listed in the table below can be found in the “General Technical Data” section or they are determined using the formulas described on the following pages.

		Mechanical system			
		Load	linear motion system	Transmission elements	
				Coupling	Timing belt side drive
Weight moment	**(Nm)**	M_g 6)	–	–	–
Frictional torque	**(Nm)**	– 5)	M_{Rs} 3)	–	M_{Rsd} 3)
Mass moment of inertia	**(kgm²)**	J_t 1)	J_s 2)	J_c 3)	J_{sd} 3)
Max. permissible travel speed	**(m/s)**	–	v_{max} 4)	–	–
Max. permissible drive torque	**(Nm)**	–	M_p 4)	M_{cN} 3)	M_{sd} 3)

1) Determine the value using the appropriate formula
2) Length-dependent value, determined using the appropriate formula
3) Value as per table
4) Length-dependent value, to be read off graph
5) Any additional process forces are to be taken into consideration as load moments

Drive dimensioning

Drive dimensioning based on the motor journal as reference point

For drive dimensioning, all the relevant design calculation values for the mechanical components in the drive train must be determined as they relate to – and be expressed in terms of or reduced to – the motor journal. For a combination of mechanical components within the drive train, this will result in one value for each of the following:

- Frictional torque M_R
- Mass moment of inertia J_{ex}
- Max. permissible travel speed v_{mech} (max. rotary speed n_{mech})
- Max. permissible drive torque M_{mech}

Determination of the values for the individual mechanical components in the drive train, based on the motor shaft as reference point.

Frictional torque M_R

For motor attachment via motor mount and coupling

$$M_R = M_{Rs}$$

For motor attachment via timing belt side drive

$$M_R = M_{Rsd} + \frac{M_{Rs}}{i}$$

Mass moment of inertia J_{ex}

For motor attachment via motor mount and coupling

$$J_{ex} = J_s + J_t + J_c$$

For motor attachment via timing belt side drive

$$J_{ex} = J_{sd} + \frac{(J_s + J_t)}{i^2}$$

Mass moment of inertia for linear motion system components

$$J_s = (k_{j\ fix} + k_{j\ var} \cdot L) \cdot 10^{-6}$$

Determination of the translatory mass moment of inertia for external load

$$J_t = m_{ex} \cdot k_{j\ m} \cdot 10^{-6}$$

Max. permissible travel speed v_{mech}

The lowest of all the values for max. permissible speed of all mechanical components contained in the drive train determines the maximum permissible speed of the mechanical system which has to be taken into consideration as the upper limit for the drive when dimensioning the motor.

Because it is a system in itself, a linear motion system with ball screw drive will always have a maximum permissible or rotary speed that is lower than the maximum values for the other components in the mechanical system, such as coupling or timing belt side drive, and therefore determines the max. permissible speed of the overall mechanical system.

Maximum permissible speed

$$v_{mech} = v_{max}$$

Maximum permissible rotary speed

For motor attachment via motor mount and coupling

$$n_{mech} = \frac{v_{mech} \cdot 1\,000 \cdot 60}{P}$$

For motor attachment via timing belt side drive

$$n_{mech} = \frac{v_{mech} \cdot i \cdot 1\,000 \cdot 60}{P}$$

Max. permissible drive torque M_{mech}

The lowest (minimum) of all the values for permissible drive torque of all mechanical components contained in the drive train determines the maximum permissible drive torque of the mechanical system which has to be taken into consideration as the upper limit for the drive when dimensioning the motor.

For motor attachment via motor mount and coupling

$$M_{mech} = \text{Minimum}\ (M_{cn}; M_p)$$

For motor attachment via timing belt side drive

$$M_{mech} = \text{Minimum}\ \left(M_{sd}; \frac{M_p}{i}\right)$$

Note

When considering the complete drive train (mechanical system and motor/controller), the maximum torque of the motor can lie below the maximum value for the mechanical system (M_{mech}) and thus limit the maximum permissible drive torque of the overall drive train.

If the maximum torque of the motor lies above the upper limit for the mechanical system (M_{mech}), the maximum motor torque must be limited to the permitted value for the mechanical system.

i	=	gear ratio of timing belt side drive	(–)
J_c	=	mass moment of inertia of the coupling	(kgm^2)
J^{ex}	=	mass moment of inertia of mechanical system	(kgm^2)
J^s	=	mass moment of inertia of the linear motion system	(kgm^2)
J_{sd}	=	mass moment of inertia of timing belt side drive at motor journal	(kgm^2)
J_t	=	translatory mass moment of inertia of external load based on the linear motion system screw journal	(kgm^2)
$k_{j\ fix}$	=	constant for fixed-length portion of mass moment of inertia	(–)
$k_{j\ m}$	=	constant for mass-specific portion of mass moment of inertia	(–)
$k_{j\ var}$	=	constant for variable-length portion of mass moment of inertia	(–)
L	=	length of linear motion system	(mm)
m_{ex}	=	moved external load	(kg)
M_R	=	frictional `torque at motor journal	(Nm)
M_{Rs}	=	frictional torque of system	(Nm)
M_{Rsd}	=	frictional torque of timing belt side drive at motor journal	(Nm)

Drive dimensioning

Drive dimensioning

Rough guide for motor selection

The following conditions can be used as a rough guide for preselecting the motor.

Condition 1:

The rotational speed of the motor must be the same as or higher than the speed required for the mechanical system (but not exceeding the maximum permissible value):

$$n_{max} \geq n_{mech}$$

Condition 2:

Consideration of the ratio of mass moments of inertia of the mechanical system and the motor. The mass moments of inertia ratio serves as an indicator for the control performance of a motor/controller combination. The mass moment of inertia of the motor is directly related to the motor size.

Mass moment of inertia ratio

For preselection, experience has shown that the following ratios will result in high control performance. These are not rigid limits, but values exceeding them will require closer consideration of the specific application.

$$V = \frac{J_{ex}}{J_m + J_{br}}$$

Application area	V
Handling	≤ 6.0
Processing	≤ 1.5

i = gear ratio of timing belt side drive (–)
J_{br} = mass moment of inertia of the motor brake (kgm^2)
J_{ex} = mass moment of inertia of mechanical system (kgm_2)
J_m = mass moment of inertia of the motor (kgm^2)
M_p = maximum permissible drive torque of the linear motion system (Nm)
M_{cN} = rated torque of coupling (Nm)
M_{sd} = maximum permissible drive torque of the timing belt side drive (Nm)
M_{mech} = maximum permissible drive torque for mechanical system (Nm)
n_{max} = maximum speed of the motor (rpm)
n_{mech} = maximum permissible rotary speed of mechanical system (rpm)
P = screw lead (mm)
v_{max} = maximum permissible speed of linear motion system (m/s)
V = ratio of mass moments of inertia of drive train and motor (–)
v_{mech} = maximum permissible speed of mechanical system (m/s)

Condition 3:

Estimation of the ratio of the static load moment to the continuous torque of the motor. The torque ratio must be smaller than or equal to the empirical value of 0.6. By looking at the required motor torque levels, this estimation roughly covers the dynamic characteristics which still have be determined by plotting an exact motion profile.

Torque ratio:

$$\frac{M_{stat}}{M_0} \leq 0.6$$

Static load moment:

$$M_{stat} = M_R + M_g$$

Weight moment:

For vertical mounting only.
For motor attachment via motor mount and coupling: i = 1

$$M_g = \frac{P \cdot (m_{ex} + m_{ca}) \cdot g}{2\,000 \cdot \pi \cdot i}$$

g	=	force of gravity (= 9.81)	(m/s^2)
i	=	gear ratio of timing belt side drive	(–)
m_{ca}	=	moved mass of carriage	(kg)
m_{ex}	=	moved external load	(kg)
M_g	=	weight moment at motor journal	(Nm)
M_0	=	continuous motor torque	(Nm)
M_R	=	frictional torque at motor journal	(Nm)
M_{stat}	=	static longitudinal moment load	(Nm)
P	=	screw lead	(mm)
π	=	pi	(–)

In the section “Configuration and Ordering” users can put together standard configurations, including motor attachment and motor, for the various linear motion system sizes by selecting the appropriate options.
By checking the above conditions it is possible to see whether a standard motor selected in a particular configuration will generally be of a suitable size for the specific application.

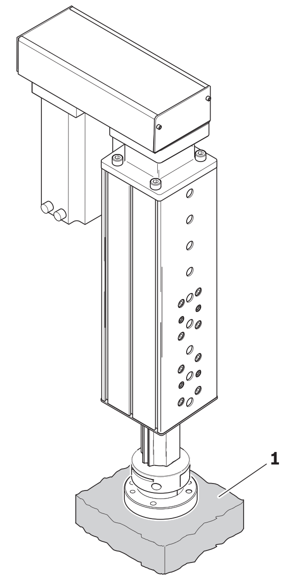
Precise dimensioning of the drive

Preselecting the motor according to this rough guide is no substitute for the required precise design calculations for the drive, taking all moments/torques and speed levels into account. For precise calculation of the electric drive, including consideration of the specific motion profile, please refer to the performance data in the catalogs “IndraDrive Cs” and “IndraDrive C”.
When dimensioning the drive, the maximum permissible values for linear speed, drive torque and acceleration must not be exceeded, in order to avoid damaging the mechanical system.

Drive dimensioning

Given data:
In a handling task, a mass (m_{ex}) of 15 kg is to be moved vertically by 300 mm at a travel speed of 0.5 m/s. The following was selected based on the technical data and the installation space:

Feed module VKK-070:
- with adapter flange
- without bellows cover
- motor attachment via timing belt side drive, i = 1.5
- with servo motor MSM 031C with brake



1 External load (m_{ex})

Selection of the ball screw drive:
(Always choose the lowest lead as this is favorable in terms of resolution, braking distance, length)

Permitted ball screw drives according to “Max. permissible travel speed” graph
at v = 0.5 m/s:
BASA 16 x 10 and BASA 16 x 16
Selected ball screw drive (lower lead):
BASA 16 x 10
Maximum permissible speed for BASA 16 x 10 from graph:
$v_{max} = 0.77$ m/s

Calculation of slide length L
(for selected BASA)

Excess travel (per side): $s_e = 2 \cdot P = 2 \cdot 10 = 20$ mm
Max. travel: $s_{max} = s_{eff} + 2 \cdot s_e = 300 + 2 \cdot 20 = 340$ mm
Next longest available max. travel from table: $s_{max} = 374$ mm
Corresponding length from table:
L = 520 mm

Frictional torque M_R:
(motor attachment via timing belt side drive)

$$M_R = M_{Rsd} + \frac{M_{RS}}{i}$$

VKK: $M_{Rs} = 0.34$ Nm
Timing belt side drive: $M_{Rsd} = 0.35$ Nm
Frictional torque: $M_R = 0.35 + \dfrac{0.34}{1.5} = 0.57$ Nm

Mass moment of inertia J_{ex}
For motor attachment via timing belt side drive

$$J_{ex} = J_{sd} + \frac{(J_s + J_t)}{i^2}$$

Timing belt side drive excess travel	$J_{ex} = 13.3 \cdot 10^{-6}\ kgm^2$
VKK	$J_S = (k_{J\ fix} + k_{J\ var} \cdot L) \cdot 10^{-6} = (4.35 + 0.039 \cdot 520) \cdot 10^{-6} = 24.63 \cdot 10^{-6}\ kgm^2$
External load	$J_t = m_{ex} \cdot k_{J\ m} \cdot 10^{-6} = 15 \cdot 2.533 \cdot 10^{-6} = 37.995 \cdot 10^{-6}\ kgm^2$
Moment of inertia	$J_{ex} = 13.3 \cdot 10^{-6} + = \frac{(24.63 \cdot 10^{-6} + 37.995 \cdot 10^{-6})}{1.52} = 41.133 \cdot 10^{-6}\ kgm^2$

Maximum permissible rotary speed n_{mech}:
For motor attachment via timing belt side drive

$$n_{mech} = \frac{v_{mech} \cdot i \cdot 1\,000 \cdot 60}{P}$$

Max. permissible travel speed:	$v_{mech} = v_{max} = 0.77\ m/s$
Max. permissible rotary speed:	$n_{mech} = \frac{(0.77 \cdot 1.5 \cdot 1\,000 \cdot 60)}{10} = 6\,930\ rpm$

Rotary speed of application n_{mech}:
For motor attachment via timing belt side drive

Travel speed:	$v_{mech} = 0.5\ m/s$
Rotary speed:	$n_{mech} = \frac{(0.5 \cdot 1.5 \cdot 1\,000 \cdot 60)}{10} = 4\,500\ rpm$

Max. permissible drive torque M_{mech}
For motor attachment via timing belt side drive with limit for mechanical system

$$M_{mech} = \text{minimum}\ (M_{sd}; \frac{M_p}{i})$$

Timing belt side drive:	M_{sd} = 2.11 Nm (gear ratio i = 1.5 for MSM 031C)
VKK:	M_P = 6.1 Nm
Drive torque:	$M_{mech} = \text{minimum}\ (2.11; \frac{6.1}{1.5}) = \text{minimum}\ (2.11; 4.06) = 2.11\ Nm$

Calculation example

Calculation example for drive dimensioning

Checking the motor preselection:
Selected motor: MSM 031C with brake

Condition 1:

$n_{max} \geq n_{mech}$

5 000 ≥ 4 500; Condition met – motor size OK

Condition 2

Mass moment of inertia ratio:	$V = \dfrac{J_{ex}}{J_m + J_{br}}$
Motor inertia:	$J_m = 26 \cdot 10^{-6}\ \mathrm{kgm}^2$
Brake moment of inertia:	$J_{br} = 1.8 \cdot 10^{-6}\ \mathrm{kgm}^2$
Moment of inertia ratio:	$V = \dfrac{41.133 \cdot 10^{-6}}{(26 \cdot 10^{-6} + 1.8 \cdot 10^{-6})} = 1.48$
Condition for handling:	$V \leq 6$; 1.48 ≤ 6; Condition met – motor size OK

Condition 3

Torque ratio:	$M_{stat} / M_0 \leq 0.6$
Static load moment:	$M_{stat} = M_R + Mg$
Weight moment:	$M_g = P \cdot (m_{ex} + m_{ca}) \cdot g/2\,000 \cdot \pi \cdot i = 10 \cdot (15 + 1.51) \cdot 9.81/2\,000 \cdot \pi \cdot 1.5 = 0.17$ Nm
Static load moment:	$M_{stat} = 0.57 + 0.17 = 0.74$ Nm
Continuous motor torque:	$M_0 = 1.3$ Nm
Torque ratio:	0.74 /1.3 = 0.57, 0.57 ≤ 0.6; Condition met – motor size OK

Result

Feed module: VKK-070
Length: L = 520 mm
Max. travel: s_{max} = 374 mm
with adapter flange
BASA 16 x 10
without bellows cover
motor attachment via timing belt side drive, gear ratio i =1.5
Preselected motor: MSM 031C with brake

For precise dimensioning of the electric drive, the motor-controller combination must always be considered, as the performance data (e.g. maximum useful speed and maximum torque) will depend on the controller used.

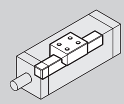
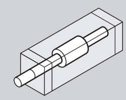
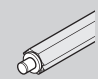
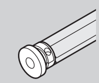
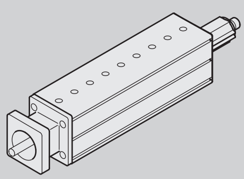
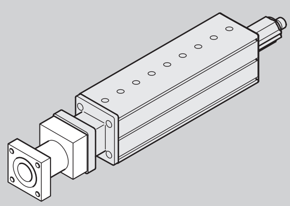
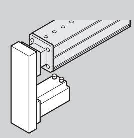
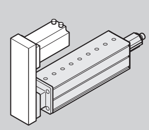
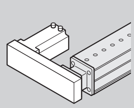
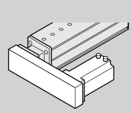
When doing this, the following data must be considered.

Frictional torque: M_R = 0.57 Nm
Mass moment of inertia: J_{ex} = $41.133 \cdot 10^{-6}$ kgm^2
Travel speed: v_{mech} = 0.5 m/s (n_{mech} = 4 500 rpm)
Limit for drive torque: M_{mech} = 2.11 Nm
=> The motor torque must be limited to 2.11 Nm on the drive side!
Acceleration limit: a_{max} = 27 m/s^2
Limit for travel speed: v_{mech} = 0.77 m/s (n_{mech} = 6 930 rpm)

Besides the preferred type MSM 031C, other motors with identical connection dimension can be adapted while taking care not to exceed the calculated limits.

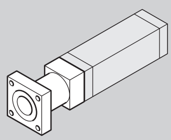
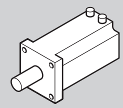
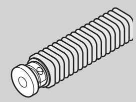
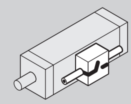
VKK-050

Configuration and ordering

Short product name, length VKK-050-NN-1, ... mm Version			Guideway 	Drive  Screw journal	BASA size d_0 x P 12x2	12x5	12x10	Carriage without adapter flange 	with adapter flange 
with BASA, without motor mount	OF01 	OF01	L = 240 mm 12 L = 280 mm 13 L = 360 mm 15 L = 480 mm 18	Ø 6	01	02	03	03	04
with BASA and motor mount	MF01 	MF01		Ø 6	01	02	03	03	04
with BASA and timing belt side drive	RV01[1]  RV02  RV03  RV04 	RV01 to RV04		Ø 6	01	02	03	03	04

Ordering example: See “Inquiry/Order Form”

BASA = ball screw drive
d_0 = nominal diameter (mm)
P = lead (mm)

	Motor attachment			Motor		Cover		Switching system		Documentation	
											
	Gear ratio i =	Attachment kit[2]	for motor	without brake	with brake	without bellows	with bellows			Standard report	Measurement report[5]
		00	–	00		00	01[3]			01	
	1	04	MSM 019B	134	135			Without switch	00		02
		02	MSK 030C	84	85			Magnetic field sensor: – Reed sensor – Hall sensor (PNP NC)	 21 22		03
		03	MSM 031B	136	137			Magnetic field sensor with connector: – Reed sensor – Hall sensor (PNP NC)	58 59		05
	1	27	MSM 019B	134	135						
	1.5	28									
	1	23	MSM 031B	136	137						
	1.5	24									
	1	21	MSK 030C	84	85						
	1.5	22									

Switch mounting arrangements

Refer to “Switch mounting arrangements” for more information on switch types and switch mounting.

1) Consider the position of the lube ports! Please refer to the “Lubrication” section.

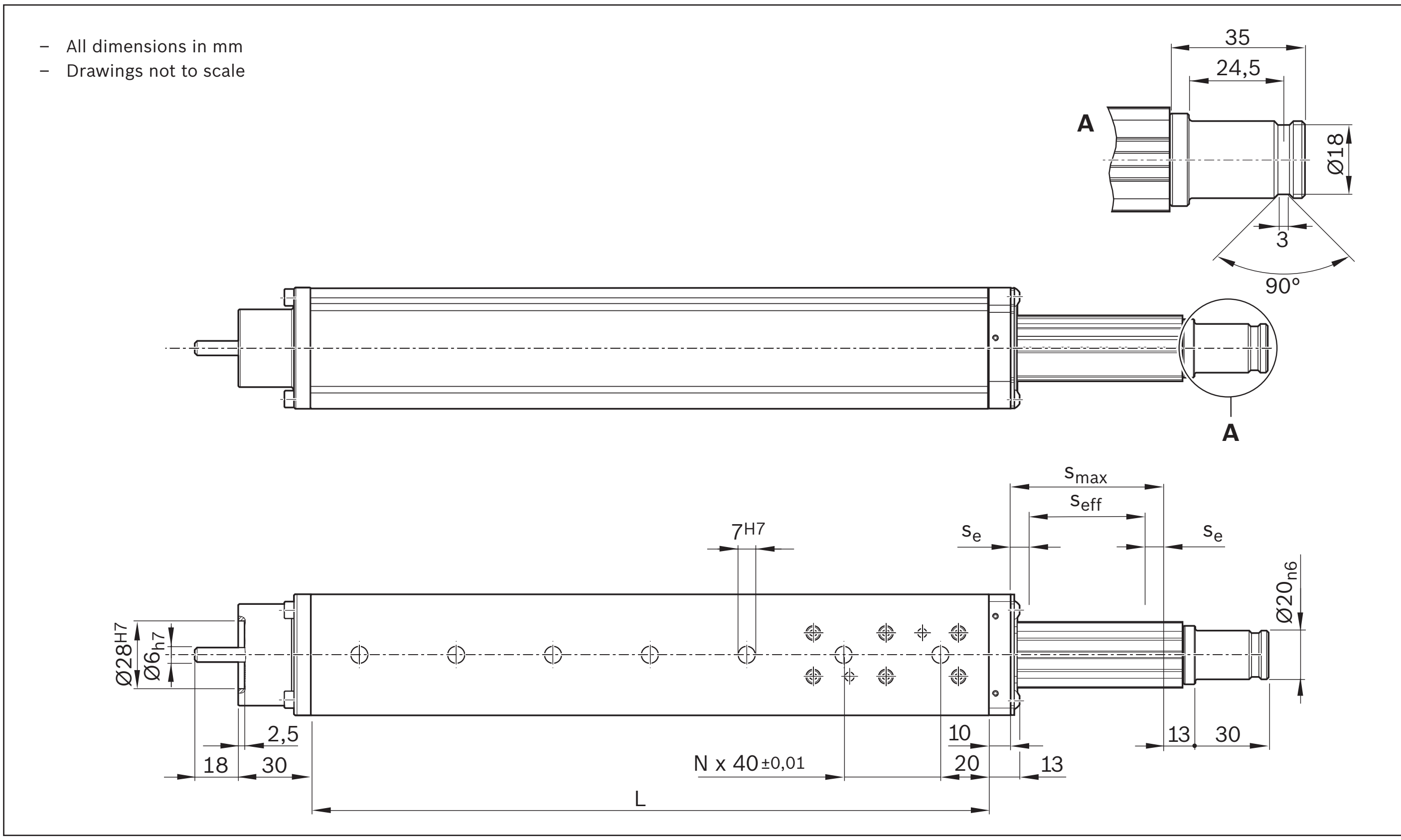
2) Attachment kit also available without motor (when ordering: enter “00” for motor)

3) Can only be selected in combination with adapter flange (carriage option 04)

4) “02” = Frictional torque measurement,
“03” = Lead deviation:
“05” = Positioning accuracy (see section “Documentation”)

VKK-050

Dimension drawings



L	s_{max} 1)	
	without bellows	**with bellows**
(mm)	**(mm)**	**(mm)**
240	138	97
280	178	131
360	258	199
480	378	301

1) Consider excess travel!

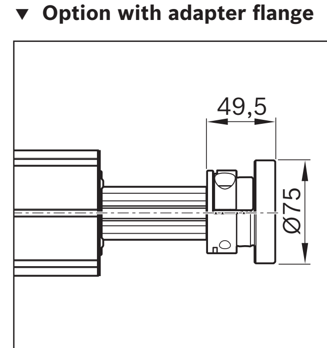
s_e = excess travel
s_{eff} = effective stroke
s_{max} = maximum travel

$$S_{eff} = S_{max} - S_e$$

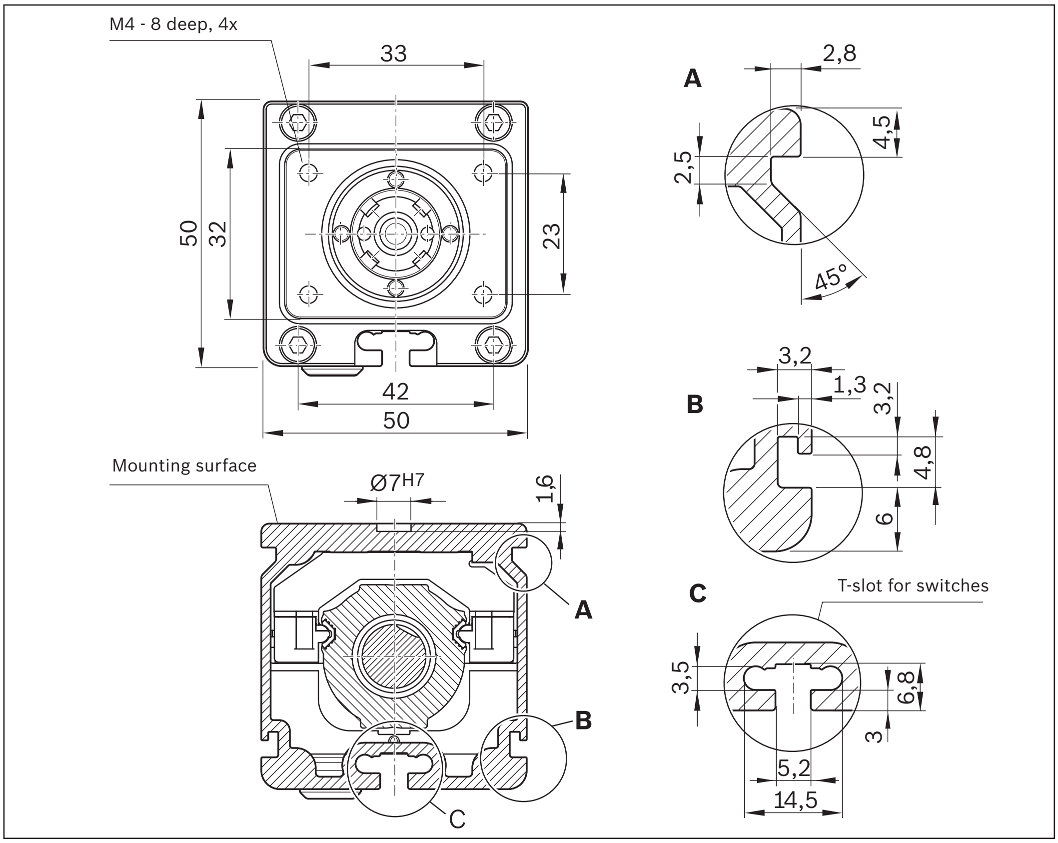
Maximum travel = effective stroke + 2 · excess travel
For safe operation the excess travel must be longer than the braking distance.

In most cases the general guideline value for excess travel (braking distance) is:
Excess travel = 2 · screw lead P
Example: BASA 12 x 5 (d_0 x P)

▼ **Option with adapter flange**

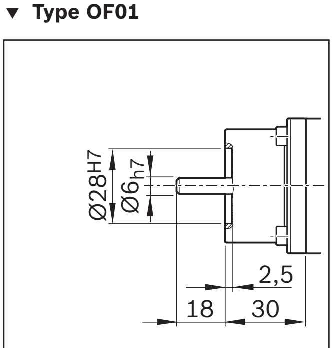


See section "Connection elements" for more information.

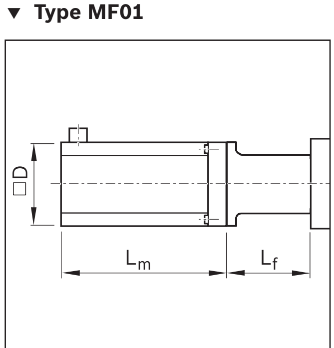


Version	Motor	Dimensions (mm)											
		D	E		F	G	G_1	K	L_f	Lm		L_{sd}	
			i = 1	i = 1.5						without brake	with brake	i = 1	i = 1.5
RV01 to RV04	MSM 019B	42	76.5	76.5	48.0	27	29.0	27.5	–	92	122.0	139	139
	MSM 031B	60	78.0	75.0	64.5	37	43.5	33.5	–	79	115.5	157	157
	MSK 030C	54	78.0	75.0	64.5	37	43.5	33.5	–	188	213.0	154	154
MF01	MSM 019B	42	–	–	–	–	–	–	44	92	122.0	–	–
	MSM 031B	60	–	–	–	–	–	–	50	79	115.5	–	–
	MSK 030C	54	–	–	–	–	–	–	50	188	213.0	–	–

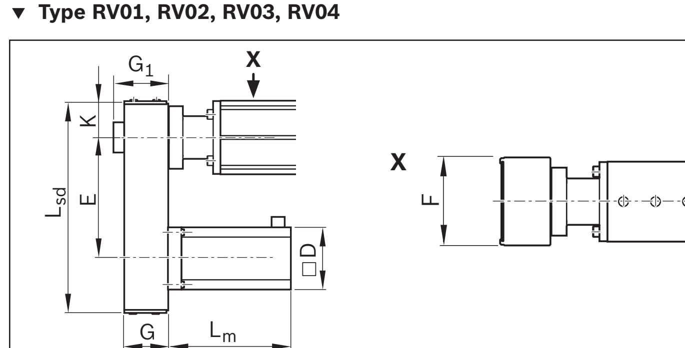
▼ **Type OF01**



▼ **Type MF01**

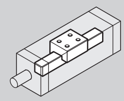
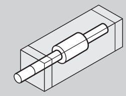
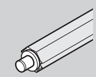
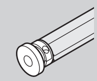
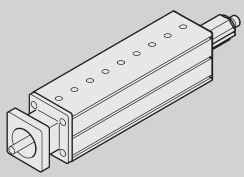
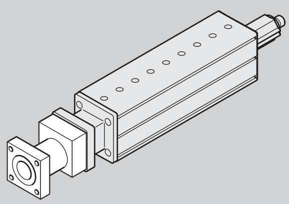
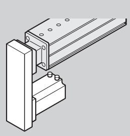
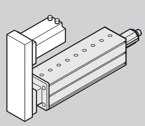
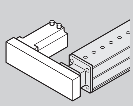
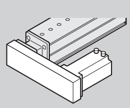


▼ **Type RV01, RV02, RV03, RV04**



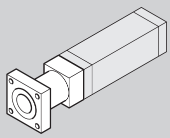
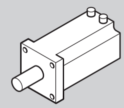
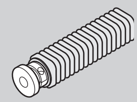
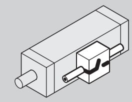
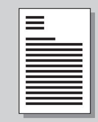
VKK-070

Configuration and ordering

Short product name, length VKK-070-NN-1, ... mm			Guideway	Drive				Carriage	
									
Version				Screw journal	BASA size d_0 x P 16x5	16x10	16x16	without adapter flange 	with adapter flange 
with BASA, without motor mount	OF01 	OF01	L = 280 mm 12 L = 320 mm 13 L = 400 mm 15 L = 520 mm 18 L = 600 mm 20	Ø 9	01	02	03	03	04
				Ø 9 key-way	11	12	13		
with BASA and motor mount	MF01 	MF01		Ø 9	01	02	03	03	04
with BASA and timing belt side drive	RV01[1)]  RV02  RV03  RV04 	RV01 to RV04		Ø 9	01	02	03	03	04

Ordering example: See "Inquiry/Order Form"

BASA = ball screw drive
d_0 = nominal diameter (mm)
P = lead (mm)

Motor attachment			Motor		Cover		Switching system	Documentation	
									
Gear ratio i =	**Attachment kit[2)]**	**For motor**	**without brake**	**with brake**	**without bellows**	**with bellows**		**Standard report**	**Measurement report[5)]**
	00	–	00		00	01[3)]	**without switch** 00 **Magnetic field sensor:** – Reed sensor 21 – Hall sensor (PNP NC) 22 **Magnetic field sensor with connector:** 58 – Reed sensor – Hall sensor (PNP NC) 59	01	02 03 05
1	01	MSM 031C	138	139					
1	02	MSK 030C	84	85					
1	03	MSM 041B	140	141					
1	04	MSM 040C	116	117					
1	33	MSM 031C	138	139					
1.5	34	MSM 031C	138	139					
1	31	MSK 030C	84	85					
1.5	32	MSK 030C	84	85					
1	37	MSM 041B	140	141					
1.5	38	MSM 041B	140	141					
1	35	MSK 040C	86	87					
1.5	36	MSK 040C	86	87					

Switch mounting arrangements

Refer to “Switch mounting arrangements” for more information on switch types and switch mounting.

1) Consider the position of the lube ports! Please refer to the “Lubrication” section.

2) Attachment kit also available without motor (when ordering: enter “00” for motor)

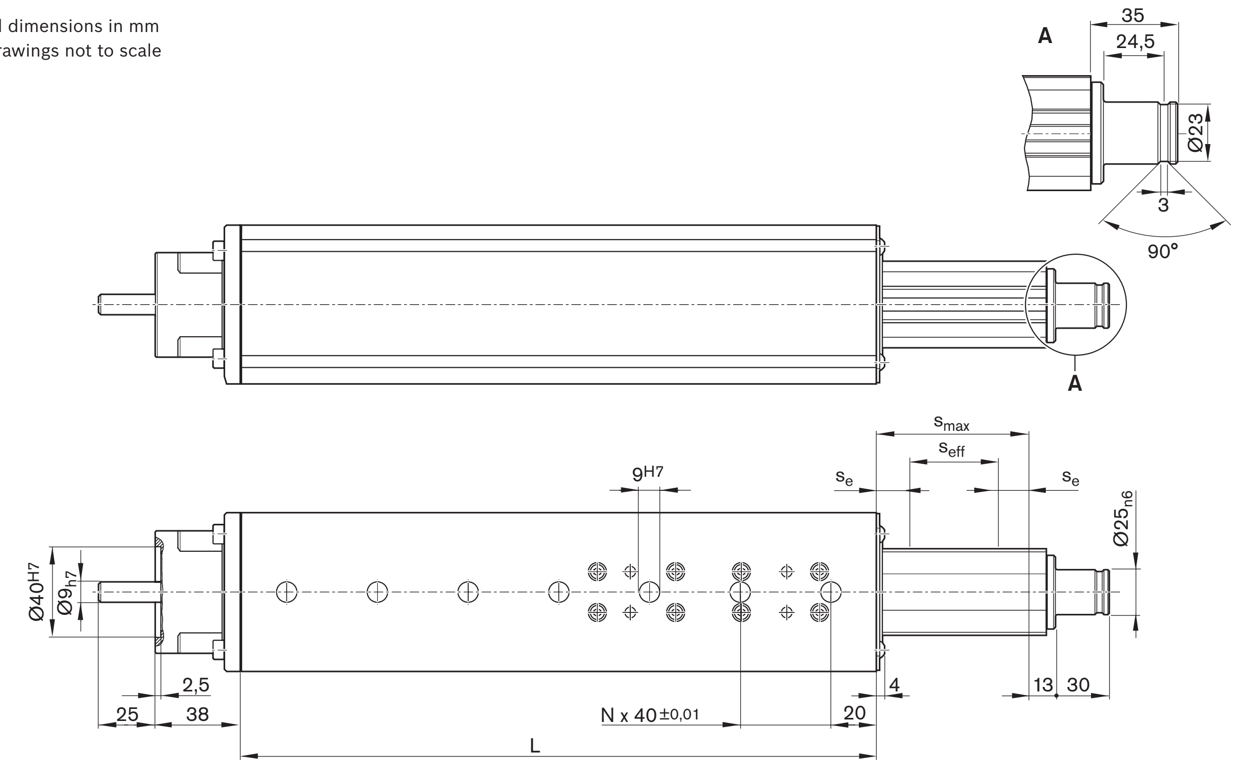
3) Can only be selected in combination with adapter flange (carriage option 04)

4) “02” = Frictional torque measurement,
“03” = Lead deviation:
“05” = Positioning accuracy (see section “Documentation”)

VKK-070

Dimension drawings

- All dimensions in mm
- Drawings not to scale



L (mm)	s_{max} [1] without bellows (mm)	s_{max} [1] with bellows (mm)
280	132	95
320	172	129
400	252	197
520	372	299
600	452	367

1) Consider excess travel!

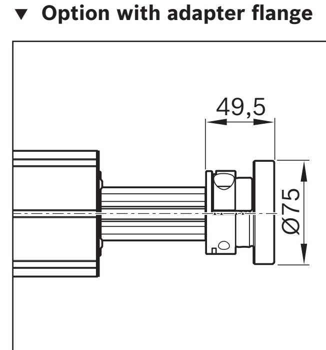
s_e = excess travel
s_{eff} = effective stroke
s_{max} = maximum travel

$$S_{eff} = S_{max} - S_e$$

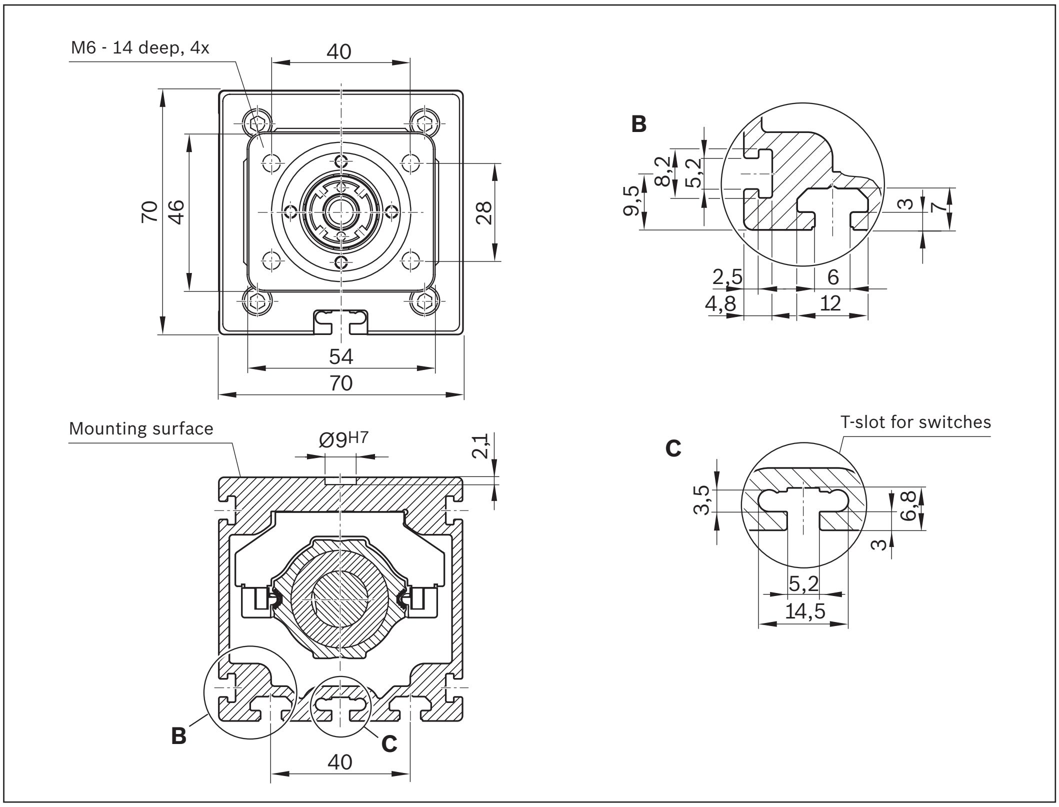
Maximum travel = effective stroke + 2 · excess travel
For safe operation the excess travel must be longer than the braking distance.

In most cases the general guideline value for excess travel (braking distance) is:
Excess travel = 2 · screw lead P
Example: BASA 12 x 5 (d_0 x P)

▼ Option with adapter flange

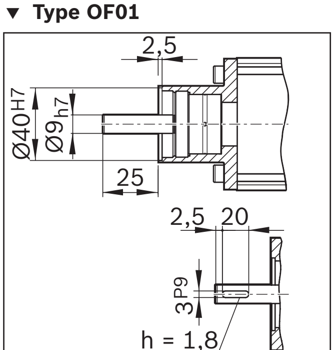


See section "Connection elements" for more information.

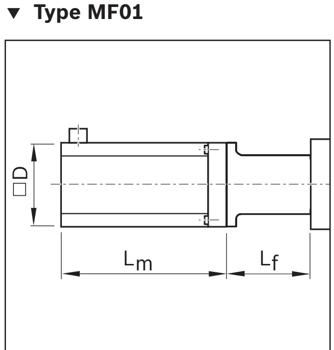


Version	Motor	Dimensions (mm)											
		D	E		F	G	G_1	K	L_f	L_m		L_{sd}	
			i = 1	i = 1.5						without brake	with brake	i = 1	i = 1.5
RV01 to RV04	MSM 031C	60	103.5	115	64.5	37	43.5	33.5	–	98.5	135.0	179	191
	MSM 041B	80	122.0	122	88.0	51	57.0	45.5	–	112.0	149.0	220	220
	MSK 030C	54	103.5	115	64.5	37	43.5	33.5	–	188.0	213.0	179	191
	MSK 040C	82	122.0	122	88.0	51	57.0	45.5	–	185.5	215.5	220	220
MF01	MSM 031C	60	–	–	–	–		–	72.0	98.5	135.0	–	–
	MSM 041B	80	–	–	–	–		–	83.0	112.0	149.0	–	–
	MSK 030C	54	–	–	–	–		–	75.5	188.0	213.0	–	–
	MSK 040C	82	–	–	–	–		–	77.5	185.5	215.5	–	–

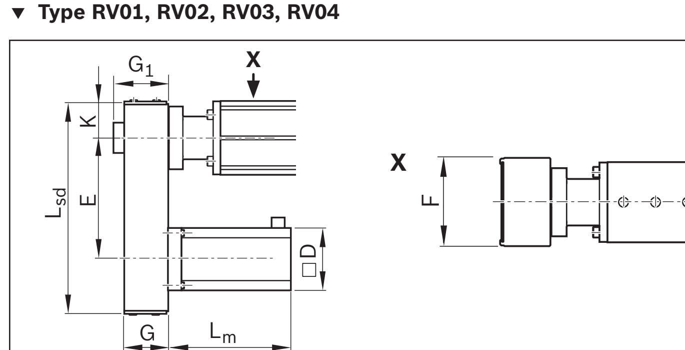
▼ **Type OF01**



▼ **Type MF01**

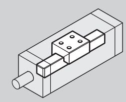
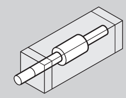
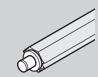
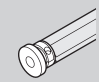
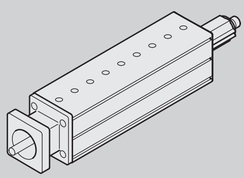
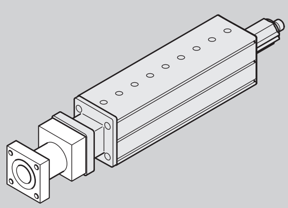
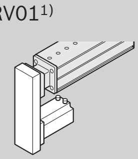
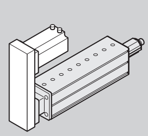
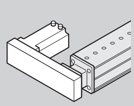
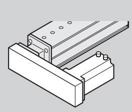


▼ **Type RV01, RV02, RV03, RV04**



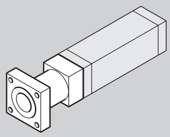
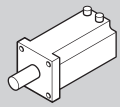
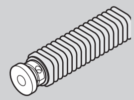
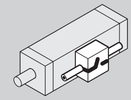
VKK-100

Configuration and ordering

Short product name, length VKK-100-NN-1, ... mm			Guideway	Drive				Carriage	
									
Version				Screw journal	BASA size d_0 x P 20x5	 25x10	 20x20	without adapter flange 	with adapter flange 
With BASA, without motor mount	OF01 	OF01	L = 360 mm 12 L = 400 mm 13 L = 480 mm 15 L = 600 mm 18 L = 680 mm 20	Ø 14	01	02	03	03	04
				Ø 14 key-way	11	12	13		
with BASA and motor mount	MF01 	MF01		Ø 14	01	02	03	03	04
with BASA and timing belt side drive	RV01[1)  RV02  RV03  RV04 	RV01 to RV04		Ø 14	01	02	03	03	04

Ordering example: See "Inquiry/Order Form"

BASA = ball screw drive
d_0 = nominal diameter (mm)
P = lead (mm)

<table>
<tr><th colspan="3">Motor attachment
</th><th colspan="2">Motor
</th><th colspan="2">Cover
</th><th colspan="2">Switching system
</th><th colspan="2">Documentation
</th></tr>
<tr><th>Gear ratio i =</th><th>Attachment kit[2]</th><th>for motor</th><th>without brake</th><th>with brake</th><th>without bellows</th><th>with bellows</th><th colspan="2"></th><th>Standard report</th><th>Measurement report[5]</th></tr>
<tr><td></td><td>00</td><td>–</td><td colspan="2">00</td><td rowspan="7">00</td><td rowspan="7">01[3]</td><td rowspan="7">**without switch**
Magnetic field sensor:
– Reed sensor
– Hall sensor (PNP NC)
Magnetic field sensor with connector:
– Reed sensor
– Hall sensor (PNP NC)</td><td rowspan="7">00

21
22
58

59</td><td rowspan="7">01</td><td rowspan="7">02
03
05</td></tr>
<tr><td rowspan="2">1</td><td>03</td><td>MSM 041B</td><td>140</td><td>141</td></tr>
<tr><td>05</td><td>MSK 050C</td><td>88</td><td>89</td></tr>
<tr><td>1</td><td>27</td><td rowspan="2">MSM 041B</td><td rowspan="2">140</td><td rowspan="2">141</td></tr>
<tr><td>1.5</td><td>28</td></tr>
<tr><td>1</td><td>29</td><td rowspan="2">MSK 050C</td><td rowspan="2">88</td><td rowspan="2">89</td></tr>
<tr><td>1.5</td><td>30</td></tr>
</table>

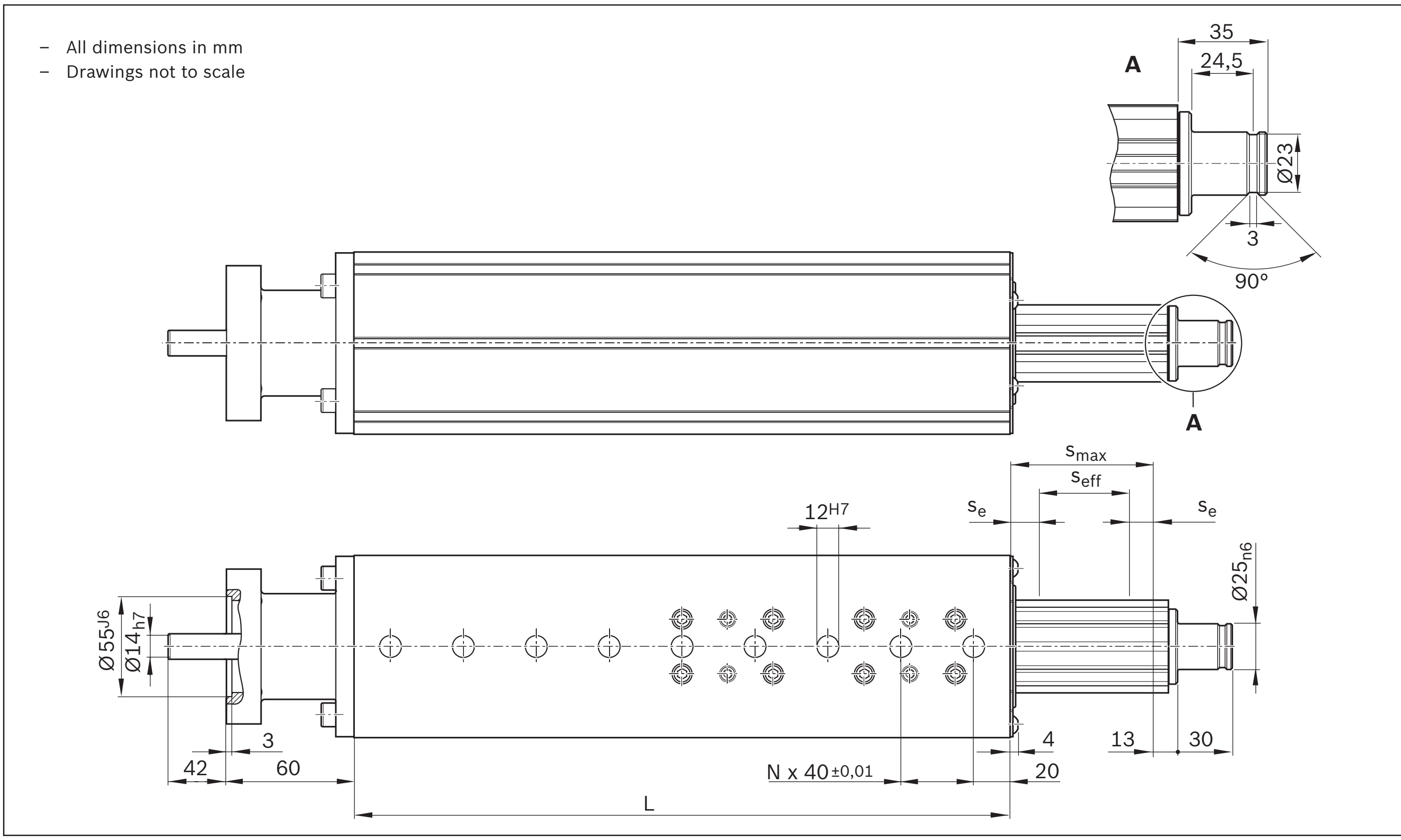
Switch mounting arrangements

Refer to “Switch mounting arrangements” for more information on switch types and switch mounting.

1) Consider the position of the lube ports! Please refer to the “Lubrication” section.
2) Attachment kit also available without motor (when ordering: enter “00” for motor)
3) Can only be selected in combination with adapter flange (carriage option 04)
4) “02” = Frictional torque measurement,
“03” = Lead deviation:
“05” = Positioning accuracy (see section “Documentation”)

VKK-100

Dimension drawings



L	s_{max}[1]	
	without bellows	with bellows
(mm)	(mm)	(mm)
360	156	119
400	197	154
480	276	224
600	396	330
680	476	400

[1] Consider excess travel!

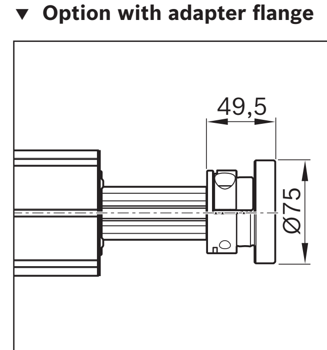
s_e = excess travel
s_{eff} = effective stroke
s_{max} = maximum travel

$$S_{eff} = S_{max} - S_e$$

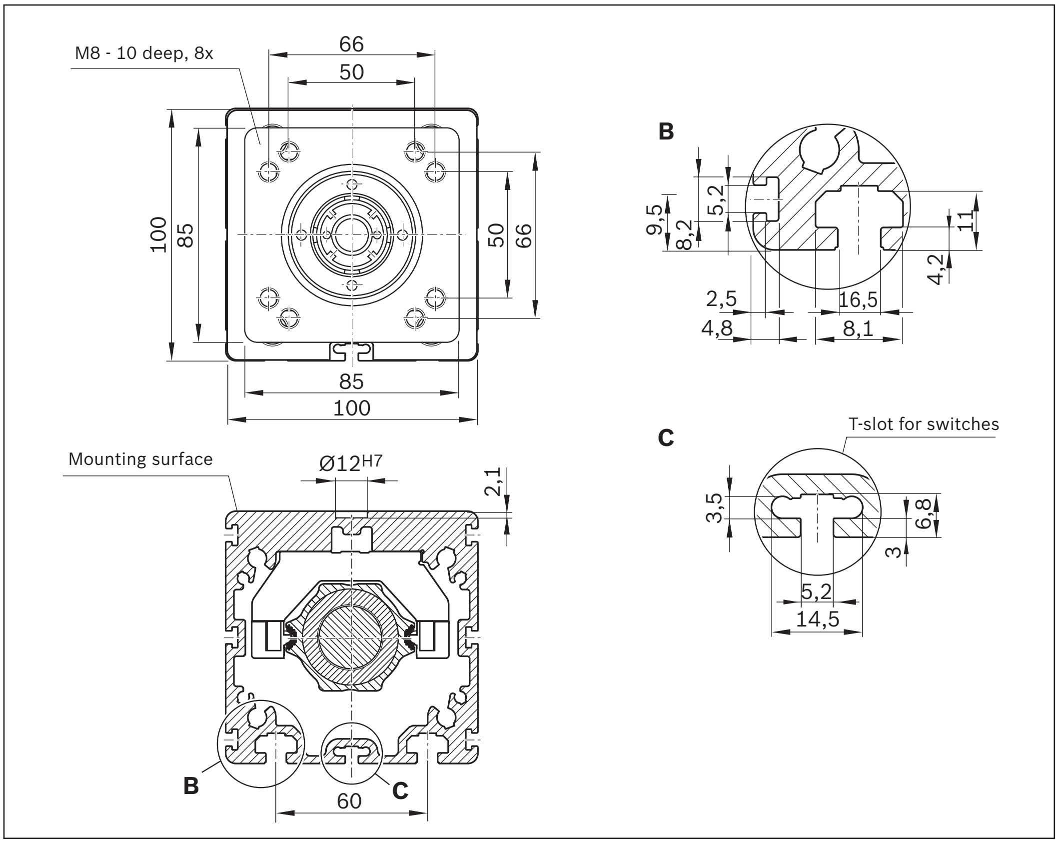
Maximum travel = effective stroke + 2 · excess travel
For safe operation the excess travel must be longer than the braking distance.

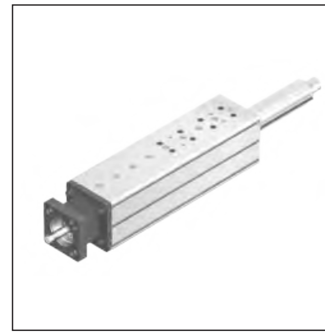
In most cases the general guideline value for excess travel (braking distance) is:
Excess travel = 2 · screw lead P
Example: BASA 12 x 5 (d_0 x P)

▼ **Option with adapter flange**



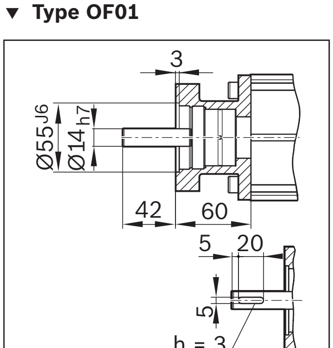
See section "Connection elements" for more information.



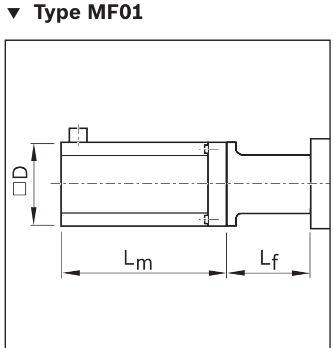


Version	Motor	Dimensions (mm)												
		D			E	F	G	K	L_f		L_m			L_{sd}
			i = 1	i = 1.5	i = 2					without brake	with brake	i = 1	i = 1.5	i = 2
RV01 to RV04	MSM 041B	80	122	122	–	88	51	45.5	–	112	149	231	231	–
	MSK 050C	98	154	–	154	116	66	57.0	–	203	233	280	–	280
MF01	MSM 041B	80	–	–	–	–	–	–	90	112	149	–	–	–
	MSK 050C	98	–	–	–	–	–	–	115	203	233	–	–	–

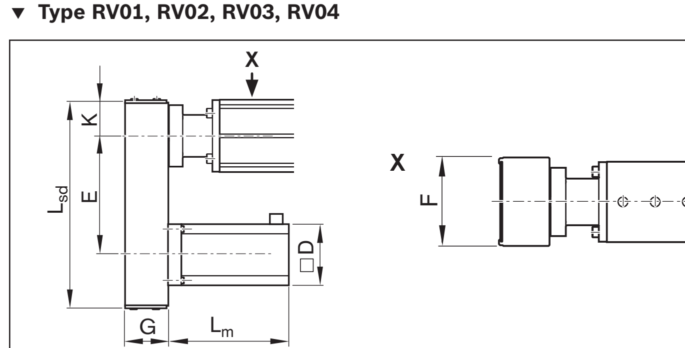
▼ **Type OF01**



▼ **Type MF01**



▼ **Type RV01, RV02, RV03, RV04**



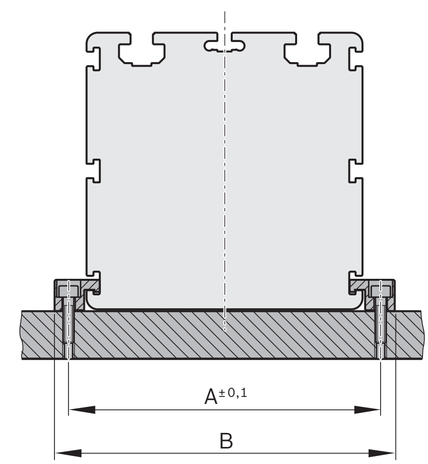
Mounting

Fastening with clamping fixtures

The modules are mounted using clamping fixtures which engage in the T-slots on the side of the frame.

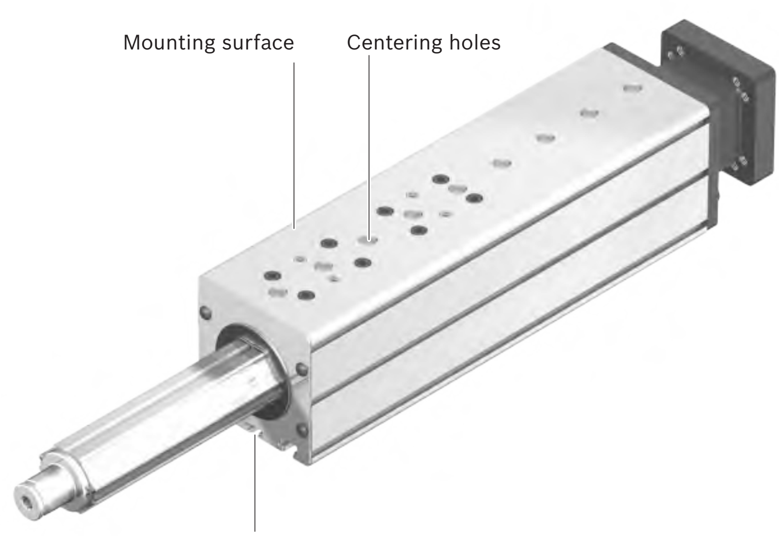
Clamping fixtures

Size	Dimensions (mm)	
	A	B
VKK-050	62.5	75.5
VKK-070	86.0	100.0
VKK-100	116.0	130.0



Mounting surface

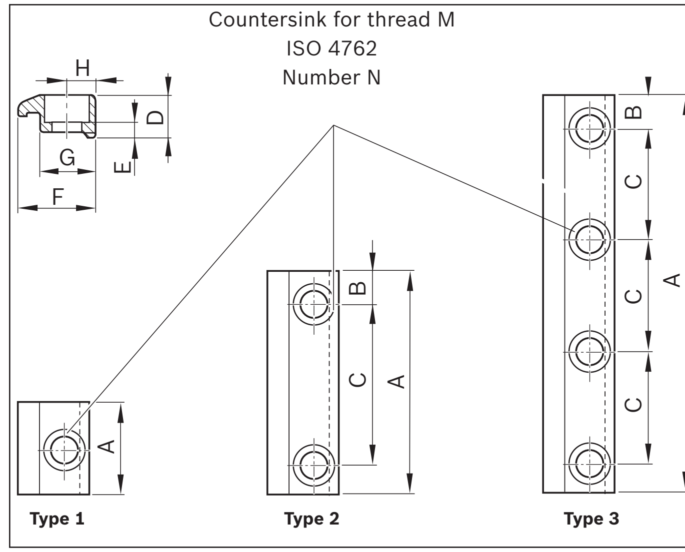
The Feed Module may only be installed/connected to other modules by the mounting surface with the centering holes.



Clamping fixtures

Recommended number of clamping fixtures:

- Type 1: 4 pieces per side/per 300mm
- Type 2: 2 pieces per side/per 300 mm
- Type 3: 1 piece per side/per 300 mm



Size	for	Type	Number of bores	Dimensions (mm)								Part number
			N	A	B	C	D	E	F	G	H	
VKK-050	M5	1	1	22	–	–	10.0	4.8	15.1	12.2	6.5	R1419 010 01
		2	2	57	8.5	40						R1419 010 43
		3	4	77	8.5	20						R1419 010 44
VKK-070	M5	3	4	107	8.5	30	11.5	4.8	19.3	14	7.0	R0375 410 02
		3	4	77	8.5	20						R0375 410 26
VKK-070 **VKK-100**	M6	1	1	25	–	–	11.5	5.3	19.3	14	7.0	R0375 510 00
		3	4	142	11	40						R0375 510 02
		2	2	72	11	50						R0375 510 33
		2	2	62	11	40						R0375 510 34
		2	2	47	8.5	30						R0375 510 23

Mounting to Installed Modules

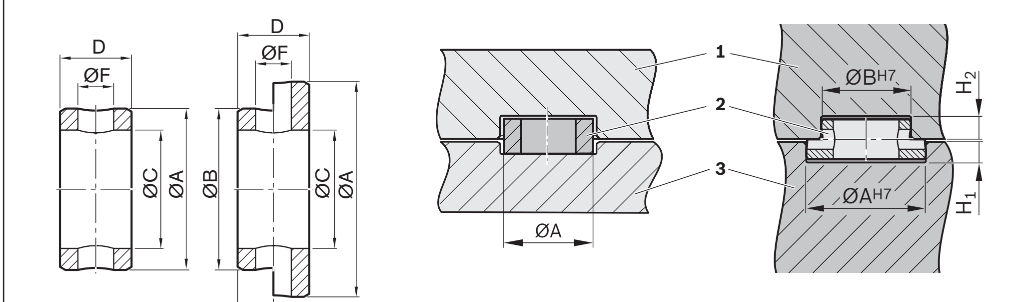
- No intermediate plates required
- Positive lock via centering rings (EasyHandling compatible)
- Easy mounting with clamping fixtures

▼ **Feed Module VKK mounted to Compact Module CKK**

See “Connection technology for linear motion systems” catalog for more detailed information

Mounting Accessories

Centering ring



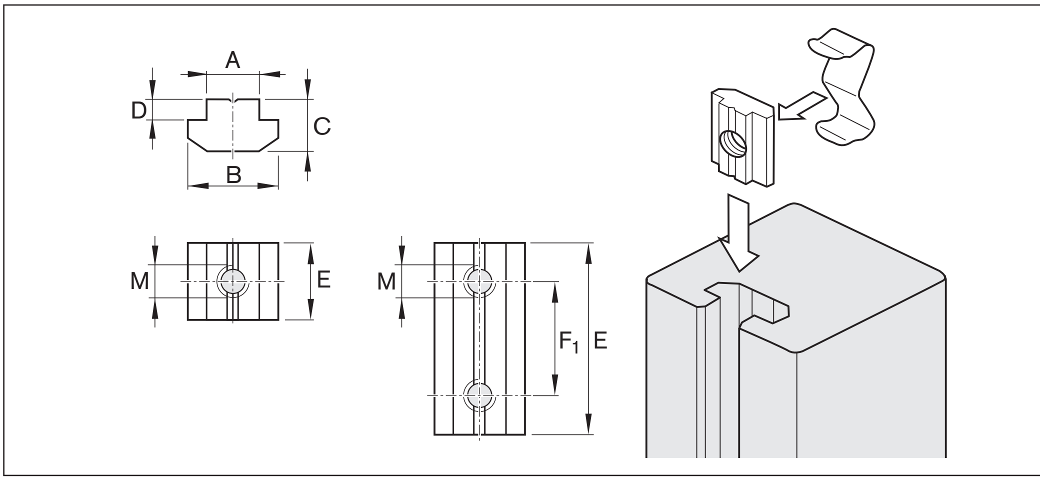
1) Customer's attachment
2) Centering ring
3) Mounting surface VKK

The centering ring serves as a positioning aid and for positive locking when fastening the VKK. It creates a positive-locking connection with good reproducibility. Material: steel (corrosion-resistant).

Ø Size (mm)	Dimensions (mm) A k6	B k6	C ±0.1	D −0.2	E +0.2	ØF	H1 +0.2	H2 +0.2	Part number
7	7	–	5.5	3.0	–	1.6	1.6	–	R0396 605 43
9	9	–	6.6	4.0	–	2.0	2.1	–	R0396 605 44
12	12	–	9.0	4.0	–	2.0	2.1	–	R0396 605 45
7 - 5	7	5	3.4	3.0	1.5	1.6	1.6	1.6	R0396 605 47
9 - 5	9	5	3.4	3.5	1.5	1.6	2.1	1.6	R0396 605 48
9 - 7	9	7	5.5	3.5	1.5	1.6	2.1	1.6	R0396 605 49
12 - 9	12	9	6.6	4.0	2.0	2.0	2.1	2.1	R0396 605 50

Sliding blocks and springs

For mounting attachments using the T-slots

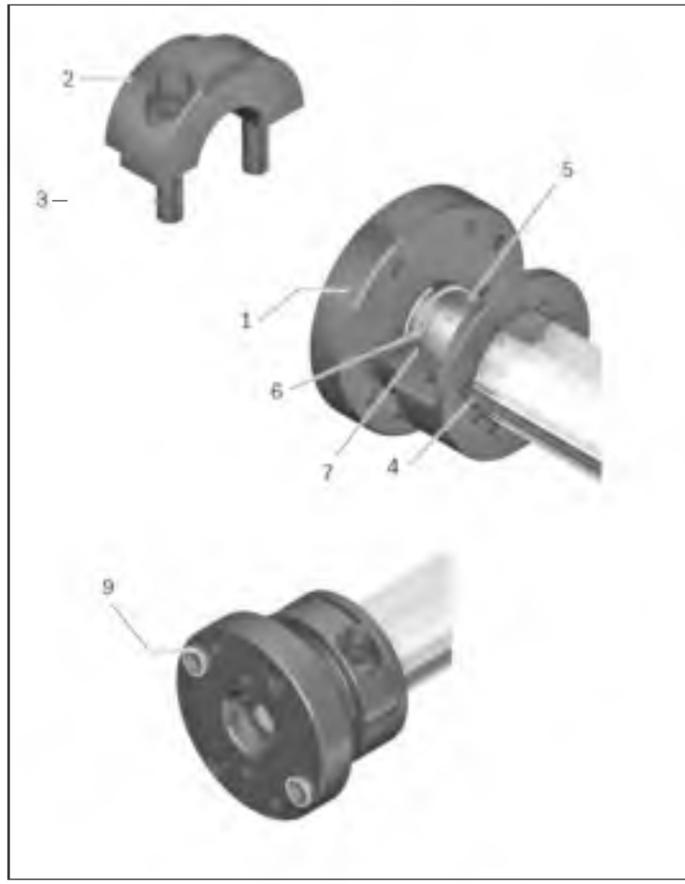


Size	For thread	Dimensions (mm)						Part number	
		A	B	C	D	E	F1	T-nut	Spring
VKK-050	–	–	–	–	–	–	–	–	–
VKK-070	M4	6	11.5	4	1	12	–	R3447 014 01	R3412 010 02
	M4					45	30	R0391 710 09	–
	M5					12	–	R3447 015 01	R3412 010 02
VKK-100	M5	8	16.0	6	2	16	–	R3447 017 01	R3412 010 02
	M5					16	–	R3447 018 01	R3412 010 02
	M6					16	–	R3447 019 01	R3412 010 02
	M6					50	36	R0391 710 08	–

Connection Elements

Adapter flange

For mounting customer attachments, grippers and rotary compact modules



The assembly kit consists of:

1 Adapter flange
2 Half shell (for clamping)
3 Socket head cap screws (2x ISO 4762)
4 Locating pin*)
5 Mounting interface
6 Groove for locating feature
7 Locating feature
8 Straight pin with internal thread*)
9 Centering rings*)

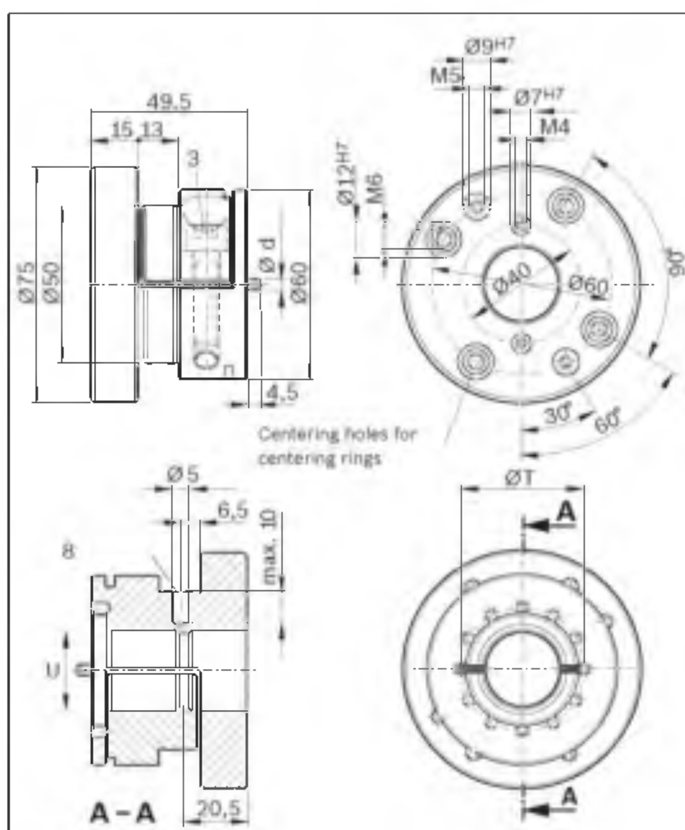
*)Included in delivery

Note on ordering

The adapter flange can be ordered either by selecting the carriage option 04 (carriage with adapter flange) or by stating the following part numbers.

Size	Adapter flange Part number
VKK-050	R1419 000 35
VKK-070	R1419 000 36
VKK-100	R1419 000 37

Size	(3) ISO4762	12.9	Ø U H7	Ø d m6	Ø T
		(Nm)	(mm)	(mm)	(mm)
VKK-050	M6x25	14	20	3.5	29.0
VKK-070	M8x30	35	25	3.5	38.7
VKK-100	M8x30		25	5.5	51.5



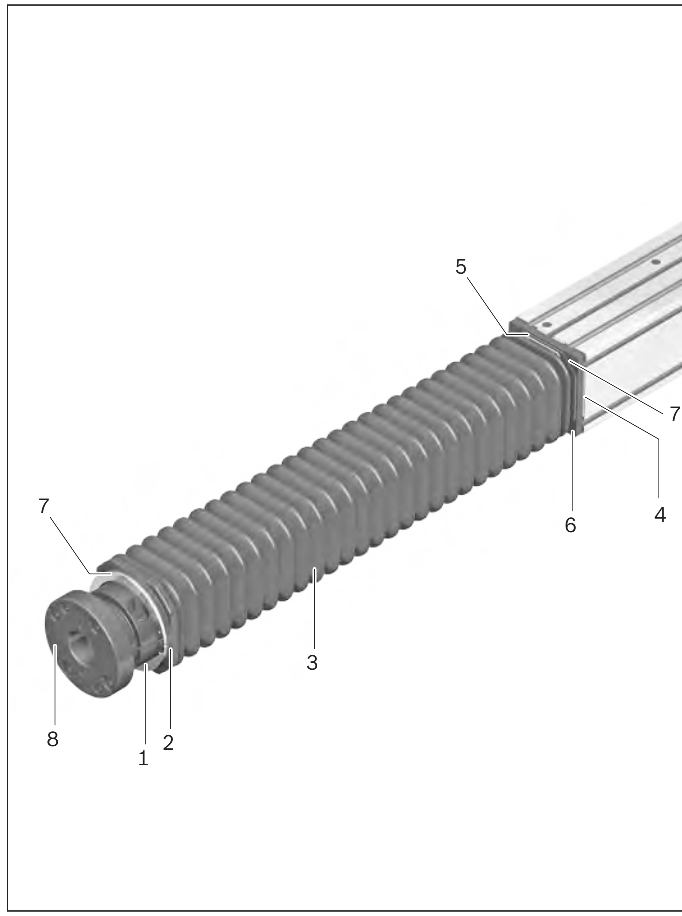
Bellows cover

Protects the thrust rod and guideway from contamination

Sealed polyester fabric bellows coated with polyurethane on two sides, welded version. Oil- and moisture-resistant.

The assembly kit consists of:

1 Retaining plate (2x)
2 Lower mounting flange
3 Polyurethane bellows
4 Outside clamping plate (8x)
5 Inside clamping plate (2x)
6 Upper mounting flange
7 Fastening screws (22x)
8 Adapter flange



Note on ordering

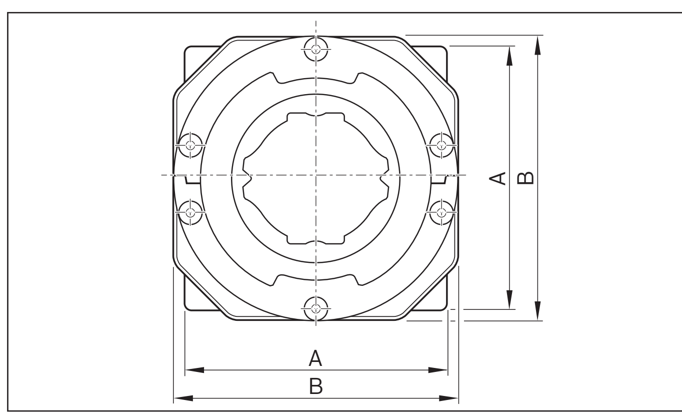
The bellows can be ordered by selecting the Cover Option 01 and is only available with the adapter flange (Carriage Option 04).

Note for mounting

The adapter flange is required for installing the bellows.

Note

If the bellows cover or adapter flange is removed, the fastening screws must be secured again on re-installation. (For example with liquid medium-strength threadlocking adhesive.)



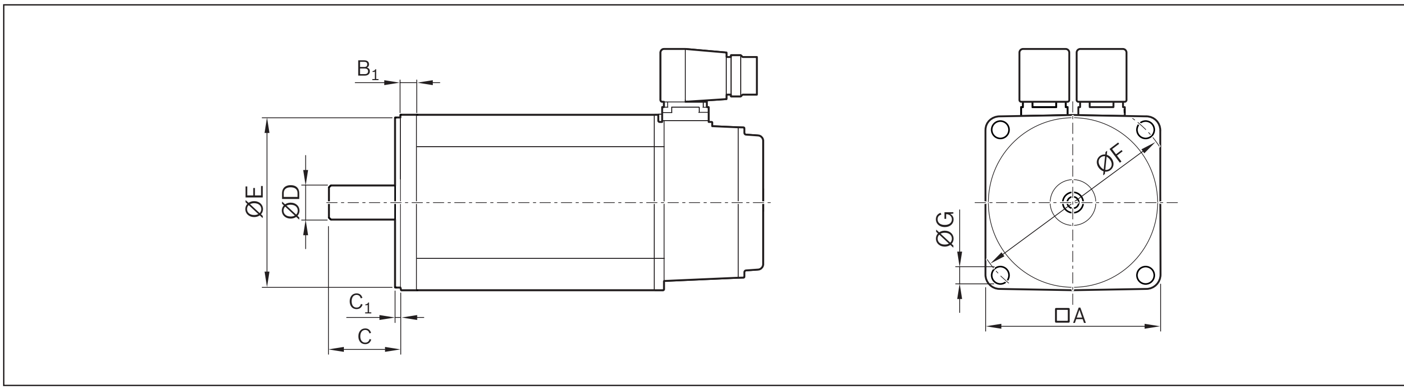
Size	Dimensions (mm)	
	A	B
VKK-050	50	75
VKK-070	70	75
VKK-100	100	100

Cable drag chains

For detailed information see catalog „Connection technology for Linear Motion Systems“

Attachment kits for motors according to customer specification

The motor of a linear motion system with ball screw drive can be mounted using an attachment kit with motor mount and coupling (MF) or a timing belt side drive (RV).
The available combinations are shown in the “Configuration and ordering” selection tables for each size. In addition to motor attachment kits for Rexroth motors, attachment kits for motors according to customer specification can also be ordered. The connection geometry of the motor is essential for determining the right attachment kit. Characteristics required to clearly determine motor geometry are shown below.

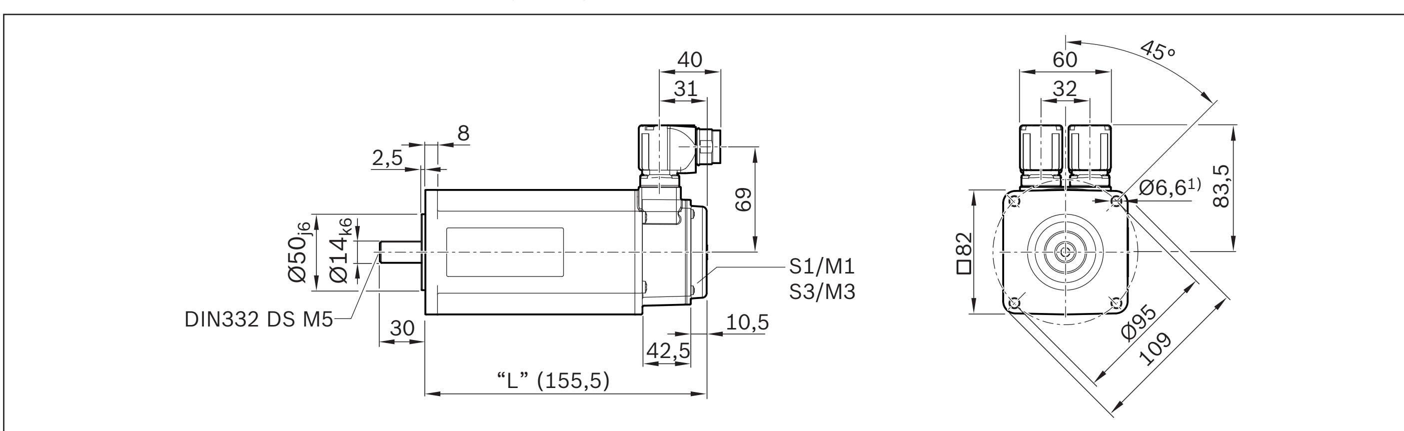


The entered dimensions produce a unique “motor geometry code”:

□□ - □□ - □□□ - □□□ - □□□ - M□□ - □□□ - □□□

ØD	=	Shaft diameter
C	=	Shaft length
ØE	=	Centering diameter
C_1	=	Centering depth
ØF	=	Pitch diameter
ØG	=	Through-hole for fastening screw (specify thread diameter)
B_1	=	Motor mount thickness
A	=	Motor mount edge dimension

Example illustration of servo motor IndraDyn S Type MSK040C

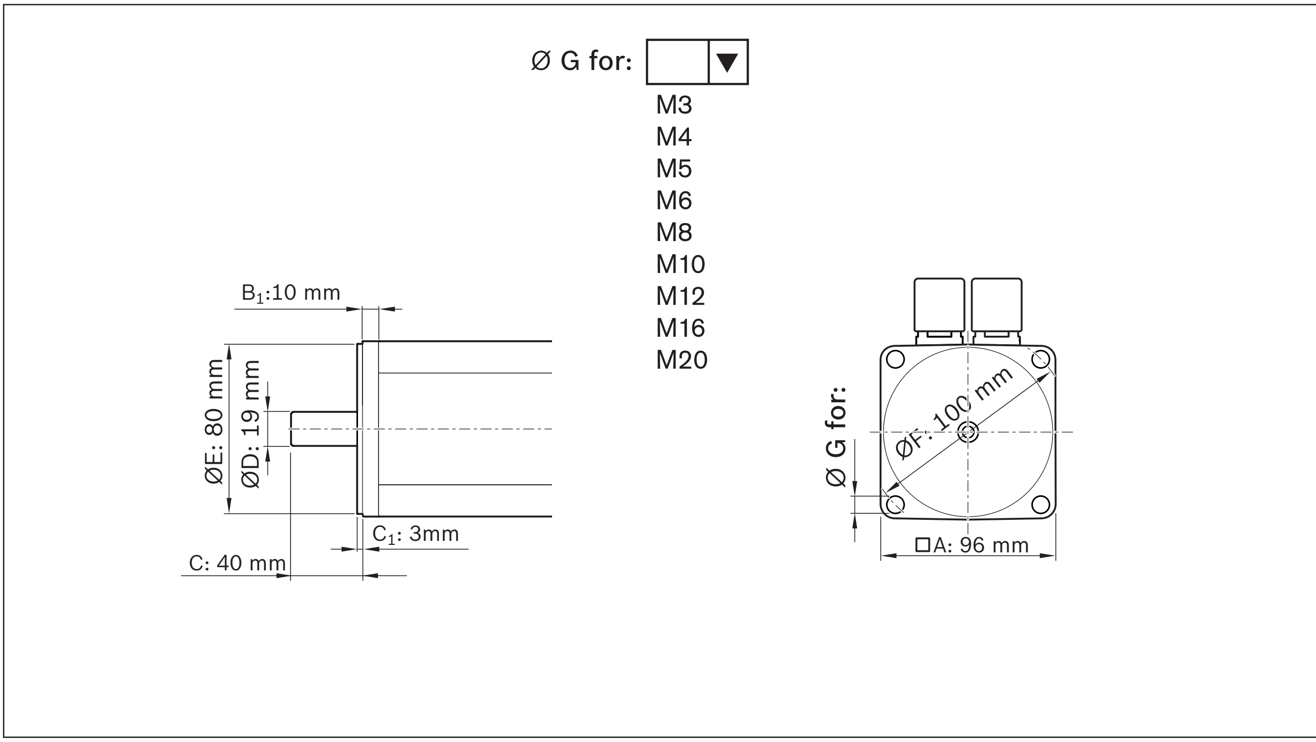


1 4 – 3 0 – 0 5 0 – 2 . 5 – 0 9 5 – M 0 6 – 0 0 8 – 0 8 2

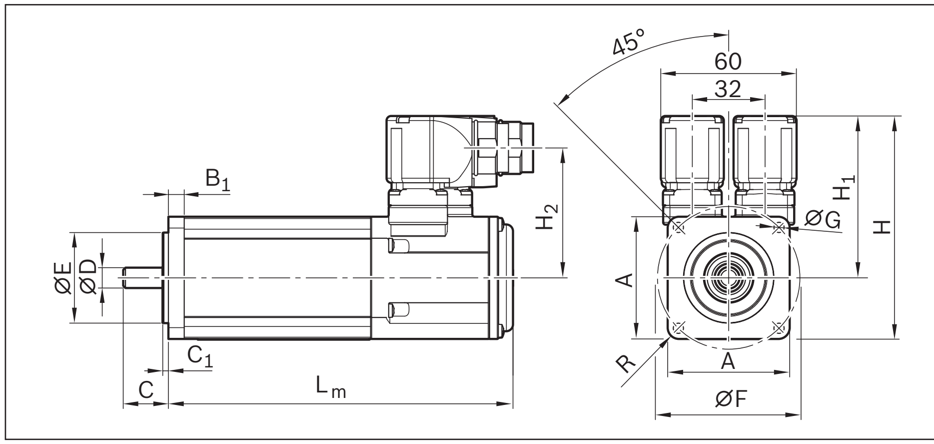
1 The 6.6 mm diameter through-hole results in the type designation M06 for the motor geometry code (M6 nominal fastening screw thread diameter).

Attachment kits for motors according to customer specification can be configured using the online configuration tool in the eShop. This requires the “attachment kits for motors according to customer specification” option to be selected.

An input dialog box is available for entering motor geometry. The dimensions can be entered directly or by a drop-down menu.



IndraDyn S - MSK servo motor



Motor schematic

Dimensions

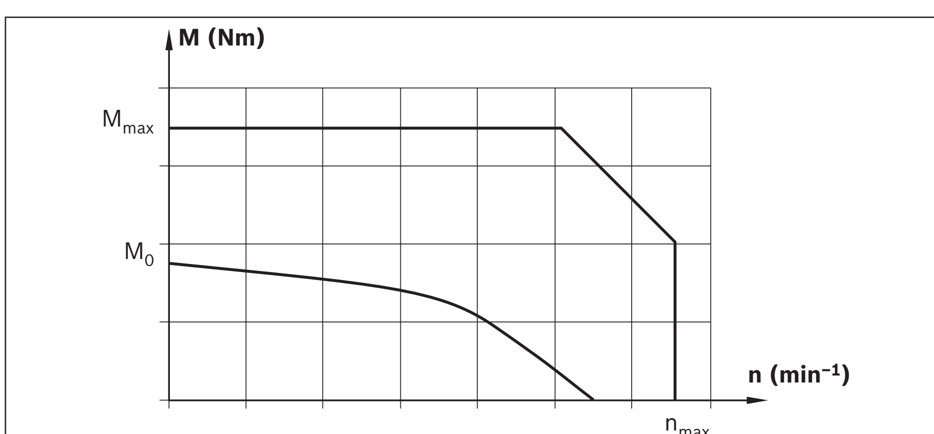
Motor	Dimensions (mm)								
	A	C	ØD k6	ØE j6	ØF	ØG	H	L_m without holding brake	L_m with holding brake
MSK 030C-0900	54	20	9	40	63	4.5	98.5	180.0	213.0
MSK 040C-0600	82	30	14	50	95	6.6	124.5	185.5	215.5
MSK 050C-0600	98	40	19	95	115	9.0	134.5	203.0	233.0

Motor data

Motor	n_{max} (rpm)	M_0 (Nm)	M_{max} (Nm)	M_{br} (Nm)	J_m (kgm²)	J_{br} (kgm²)	mm (kg)	m_{br} (kg)
MSK 030C-0900	9 000	0.8	4.0	1	0.000030	0.000007	1.9	0.2
MSK 040C-0600	7 500	2.7	8.1	4	0.000140	0.000023	3.6	0.3
MSK 050C-0600	6 000	5.0	15.0	5	0.000330	0.000107	5.4	0.7

J_{br} = mass moment of inertia of the holding brake
J_m = mass moment of inertia of the motor
L_m = length of the motor
M_0 = standstill torque
M_{br} = holding torque of holding brake when switched off
M_{max} = maximum possible motor torque
m_{br} = mass of the holding brake
n_{max} = maximum motor speed

Torque/speed characteristic
(schematic)



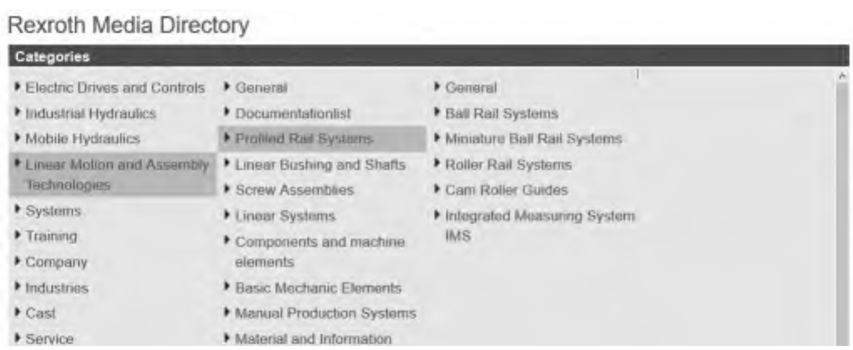
Option number[1)]	Motor	Part number	Version holding brake without	with	Type designation
84	MSK 030C-0900	R911308683	X		MSK030C-0900-NN-M1-UG0-NNNN
85		R911308684		X	MSK030C-0900-NN-M1-UG1-NNNN
86	MSK 040C-0600	R911306060	X		MSK040C-0600-NN-M1-UG0-NNNN
87		R911306061		X	MSK040C-0600-NN-M1-UG1-NNNN
88	MSK 050C-0600	R911298354	X		MSK050C-0600-NN-M1-UG0-NNNN
89		R911298355		X	MSK050C-0600-NN-M1-UG1-NNNN

1) from the “Components and ordering” table

Version:
- ▶ Plain shaft with shaft seal ring
- ▶ M1 multi-turn absolute encoder (Hiperface)
- ▶ Cooling system: natural convection
- ▶ IP65 rating (housing)
- ▶ With or without holding brake

Note

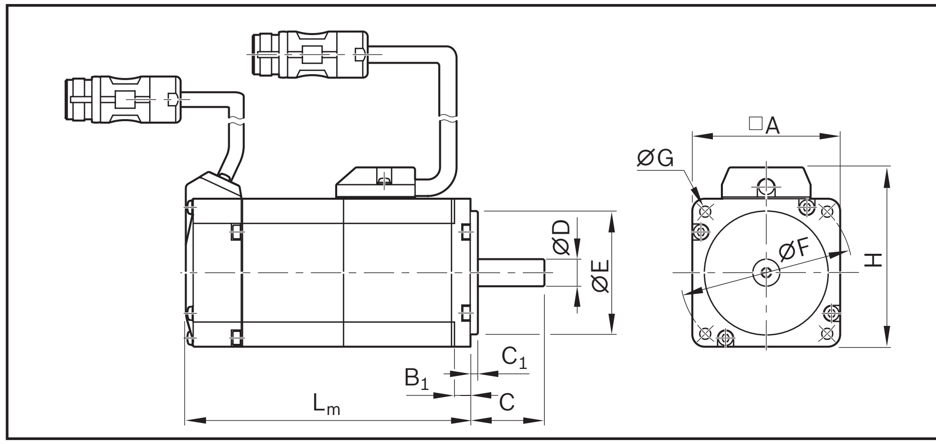
The motors are available complete with control units and controllers. For further motor types and more information on motors, controllers and control systems, please refer to the following Rexroth catalogs on drive technology:



Recommended motor/ controller combinations

Motor	Controller
MSK 030C-0900	HCS 01.1E-W0005
MSK 030C-0900	HCS 01.1E-W0008
MSK 040C-0600	
MSK 040C-0600	HCS 01.1E-W0018
MSK 050C-0600	
MSK 050C-0600	HCS 01.1E-W0028
MSK 060C-0600	
MSK 060C-0600	HCS 01.1E-W0054
MSK 076C-0450	

IndraDyn S - servo motors MSM



Motor schematic

Dimensions

Motor	Dimensions (mm)									
	A	B_1	C	C_1	ØD h6	ØE h7	ØF	ØG	H	L_m without holding brake	L_m with holding brake
MSM 019B-0300	38	6.0	25	3	8	30	45	3.4	51	92.0	122.0
MSM 031B-0300	60	6.5	30	3	11	50	70	4.5	73	79.0	115.5
MSM 031C-0300	60	6.5	30	3	14	50	70	4.5	73	98.5	135.0
MSM 041B-0300	80	8.0	35	3	19	70	90	6.0	93	112.0	149.0

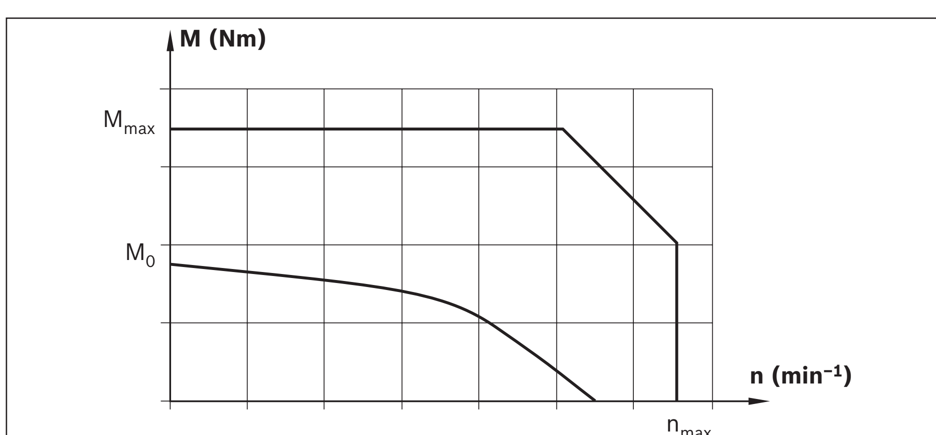
Motor data

Motor	n_{max} (rpm)	M_0 (Nm)	M_{max} (Nm)	M_{br} (Nm)	J_m (kgm²)	J_{br} (kgm²)	mm (kg)	m_{br} (kg)
MSM 019B-0300	5 000	0.32	0.95	0.29	0.0000051	0.0000002	0.47	0.21
MSM 031B-0300	5 000	0.64	1.91	1.27	0.0000140	0.0000018	0.82	0.48
MSM 031C-0300	5 000	1.30	3.80	1.27	0.0000260	0.0000018	1.20	0.50
MSM 041B-0300	4 500	2.40	7.10	2.45	0.0000870	0.0000075	2.30	0.80

J_{br} = mass moment of inertia of the holding brake
J_m = mass moment of inertia, motor
L_m = length of the motor
M_0 = standstill torque

M_{br} = holding torque of holding brake when switched off
M_{max} = maximum possible motor torque
m_{br} = mass of the holding brake
n_{max} = maximum motor speed

Torque/speed characteristic
(schematic)

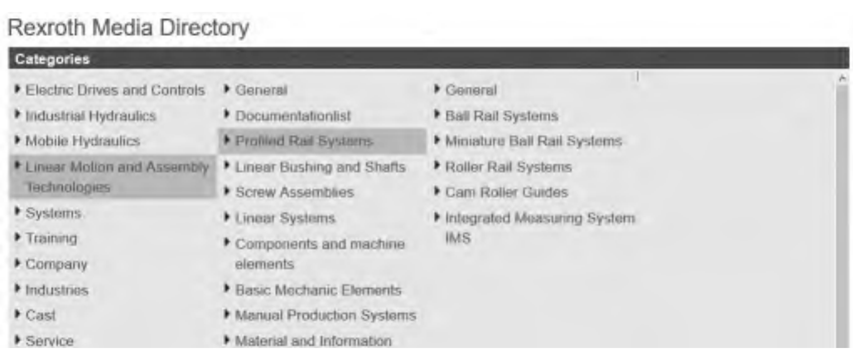


Option number[1)]	Motor	Part number	Version		Type designation
			holding brake without	with	
134	MSM019B-0300	R911344211	X		MSM 019B-0300-NN-M5-MH0
135		R911344212		X	MSM 019B-0300-NN-M5-MH1
136	MSM 031B-0300	R911344213	X		MSM 031B-0300-NN-M5-MH0
137		R911344214		X	MSM 031B-0300-NN-M5-MH1
138	MSM 031C-0300	R911344215	X		MSM 031C-0300-NN-M5-MH0
139		R911344216		X	MSM 031C-0300-NN-M5-MH1
140	MSM 041B-0300	R911344217	X		MSM 041B-0300-NN-M5-MH0
141		R911344218		X	MSM 041B-0300-NN-M5-MH1

1) From the “Configuration and ordering” table

Version:
- Plain shaft without shaft seal ring
- Multiturn absolute encoder M5 (20 bit, absolute encoder functionality only possible with back-up battery)
- Cooling system: natural convection
- IP54 rating (shaft IP40)
- With or without holding brake
- M17 metal round connector

Note
The motors are available complete with control units and controllers. For further motor types and more information on motors, controllers and control systems, please refer to the following Rexroth catalogs on drive technology:



Recommended motor/controller combination

Motor	Controller
MSM 019A-0300	HCS 01.1E-W0003
MSM 019B-0300	
MSM 031B-0300	HCS 01.1E-W0006
MSM 031C-0300	HCS 01.1E-W0009
MSM 041B-0300	HCS 01.1E-W0013

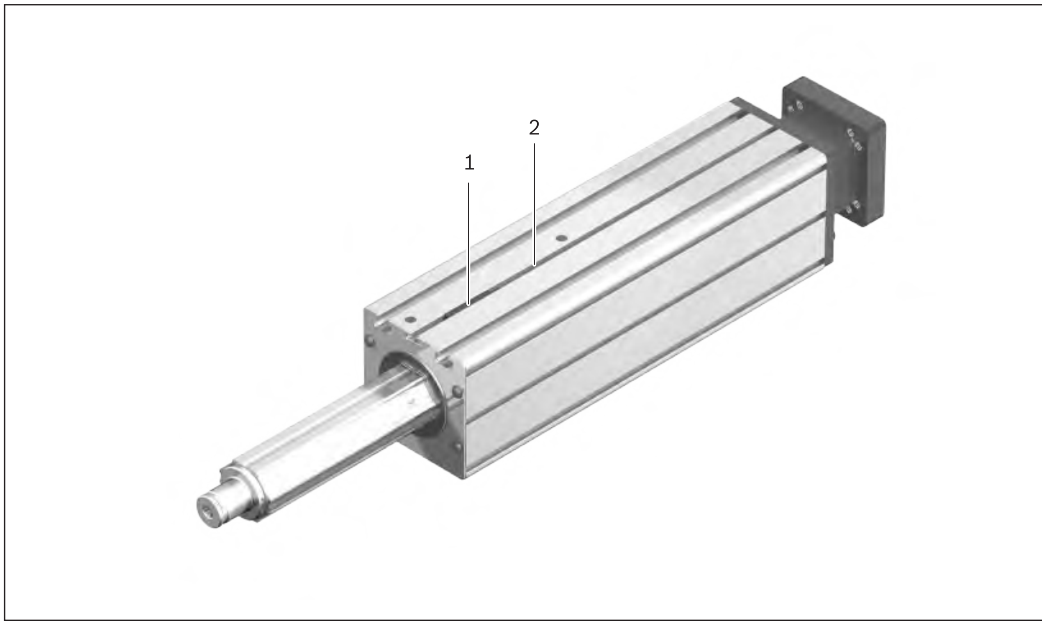
Switch Mounting Arrangements

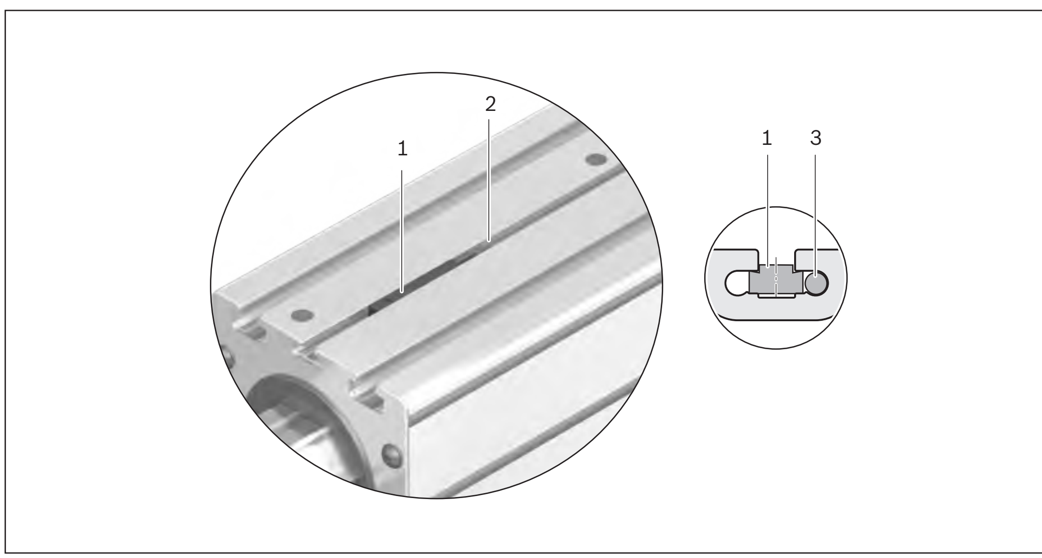
1 Switch (magnetic field sensor)
2 T-slot for switches
3 Cable

The switch activator is a magnet integrated in the thrust rod.

Note
For short-stroke applications: Consider the length of the switch!

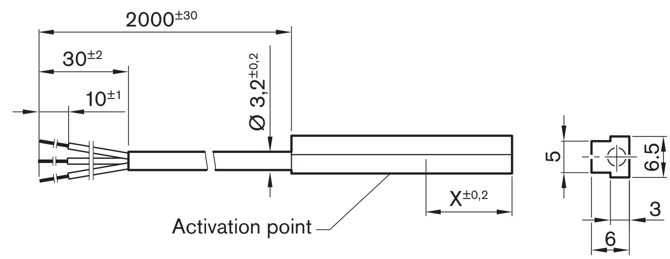
Note for mounting
The magnetic field sensors (MFS) are pushed into the T-slot for switches and fixed with set screws.
The MFS cables are routed along the side of the T-slot for switches (3).
For details regarding the switching position, see "Instructions for Feed Modules."



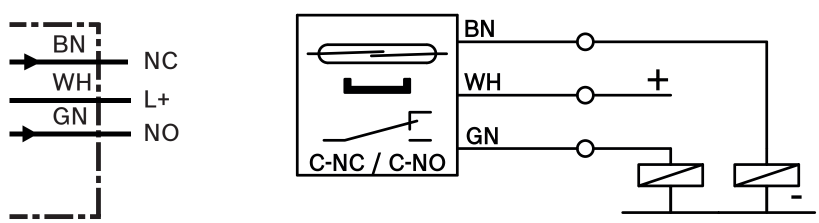


Sensors

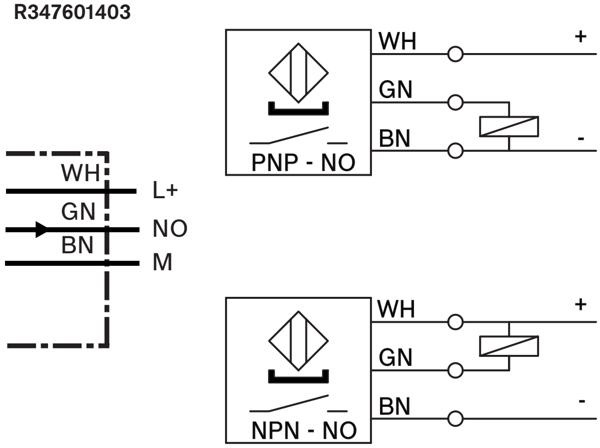
Magnetic sensor with open cable end



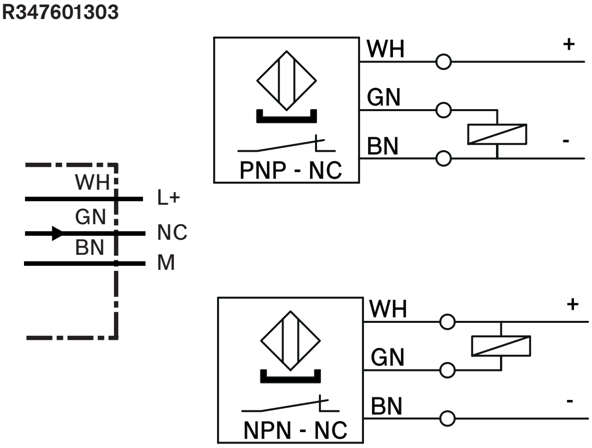
R347600903



R347601203
R347601403



R347601003
R347601303



Part number R347600903	
Use	Limit switch
Part number	R347600903
Designation	R12212
Function principle	Magnetic
Operating voltage	max. 30 V DC
Load current	500 mA
Switching function	REED/changeover contact: (NC: C+NC, NO: C+NO)
Activation point (dimension “X”)	9 mm

Part numbers R347601003 / R347601203 / R347601403 / R347601303				
Use	Limit switch	Reference switch	Limit switch	Reference switch
Part number	R347601003	R347601203	R347601303	R347601403
Designation	H14118	H15637	H15638	H15080
Function principle	Magnetic			
Operating voltage	3.8 - 30 V DC			
Load current	≤ 20 mA			
Switching function	Hall PNP/normally closed (NC)	Hall PNP/normally open (NO)	Hall NPN/normally closed (NC)	Hall NPN/normally open (NO)
Activation point (dimension “X”)	13.65 mm			

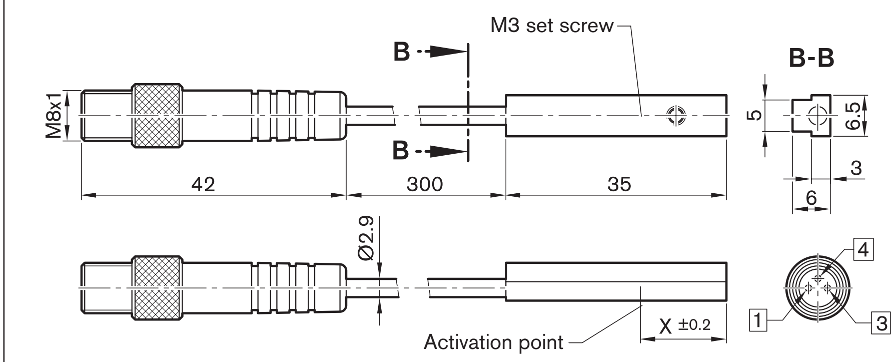
Technical data for R347600903 / R347601003 / R347601203 / R347601403 / R347601303	
Connection type	Cable 2,0 m, 3-pin
Galvanized connection ends	✔
Function indication	–
Short-circuit protection	–
Reverse polarity protection	–
Switch-on suppression	–
Switching frequency	2.5 kHz
Pulse delay (Off delay)	–
Max. permissible approach speed	2 m/s
Suitable for flexing installation*	–
Torsion-resistant*	–
Weld spark-resistant*	–
Wire gauge*	3 x 0.14 mm^2
Cable diameter D	3.2 ± 0.20 mm
Static bending radius*	–
Dynamic bending radius*	–
Bending cycles*	–
Max. permissible speed*	–
Max. permissible acceleration*	–
Ambient temperature	–40 °C bis +85 °C
Protection rating	IP66
MTTFd (in accordance with EN ISO 13849-1)	–
Certifications and approvals**	–

*) Technical data only for the one-piece connection cable on the sensor.
The available extension cables offer even better performance, e.g., when using a power cable chain (see following pages).

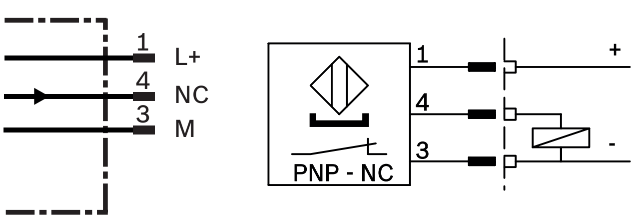
**) No CCC certificate necessary for these products for introduction into the Chinese market.

Sensors

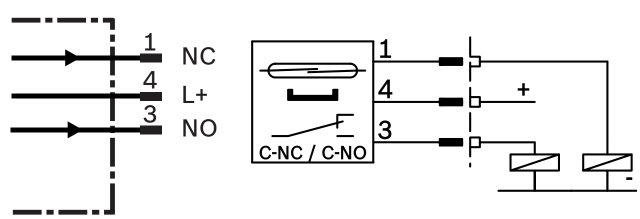
Magnetic sensor with M8x1 plug



R347602403



R347602303



Part numbers/technical data

Use	Limit switch	Limit switch
Part number	R347602403	R347602303
Designation	H10706	R10705
Function principle	Magnetic	
Operating voltage	3.8 - 30 V DC	30 V DC
Load current	≤ 20 mA	500 mA
Switching function	Hall PNP/normally closed (NC)	REED/single-pole changeover (NC: C+NC, NO: C+NO)
Activation point (dimension “X”)	13.65 mm	9 mm
Connection type	Cable 0.3 m and plug M8x1, 3-pin with knurled screws	
Function indication	–	
Short-circuit protection	–	
Reverse polarity protection	–	
Switch-on suppression	–	
Switching frequency	2.5 kHz	
Pulse delay (Off delay)	–	
Max. permissible approach speed	2 m/s	
Suitable for flexing installation*	–	
Torsion-resistant*	–	
Weld spark-resistant*	–	
Wire gauge*	3 x 0.14 mm^2	
Cable diameter D*	3.2 ± 0.20 mm	
Static bending radius*	–	
Dynamic bending radius*	–	
Bending cycles*	–	
Max. permissible speed*	–	
Max. permissible acceleration*	–	
Ambient temperature	–40 °C bis +85 °C	
Protection rating	IP66	
MTTFd (in accordance with EN ISO 13849-1)	–	
Certifications and approvals**	–	

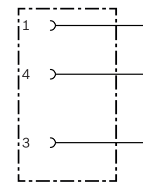
*) Technical data only for the one-piece connection cable (0.3 m) on the magnetic sensor.
The available extension cables offer even better performance, e.g., when using a power cable chain (see following pages).
**) No certificate necessary for these products for introduction into the Chinese market.

Extension pieces

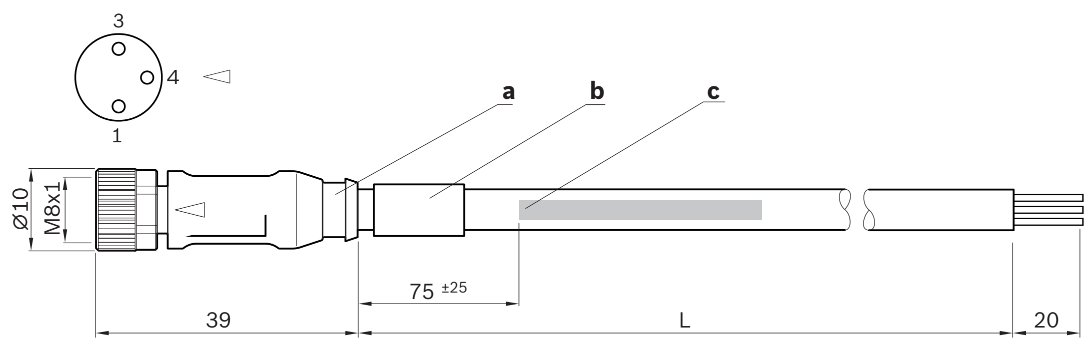
Pre-assembled on one side

Wiring diagram

1 brown (BN) (+)
3 blue (BU) (–)
4 black (BK) (signal)



Dimension drawing



Part numbers

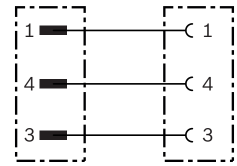
Use	Extension cable		
Part number	R911344602	R911344619	R911344620
Designation	7000-08041-6500500	7000-08041-6501000	7000-08041-6501500
Length (L)	5.0 m	10.0 m	15.0 m
1st connection type	Straight female connector, M8 x 1, 3-pin		
2nd connection type	Open end		

a) Contour for corrugated tube with 6.5 mm inner diameter
b) Cable grommet
c) Cable label in accordance with Labeling Directive

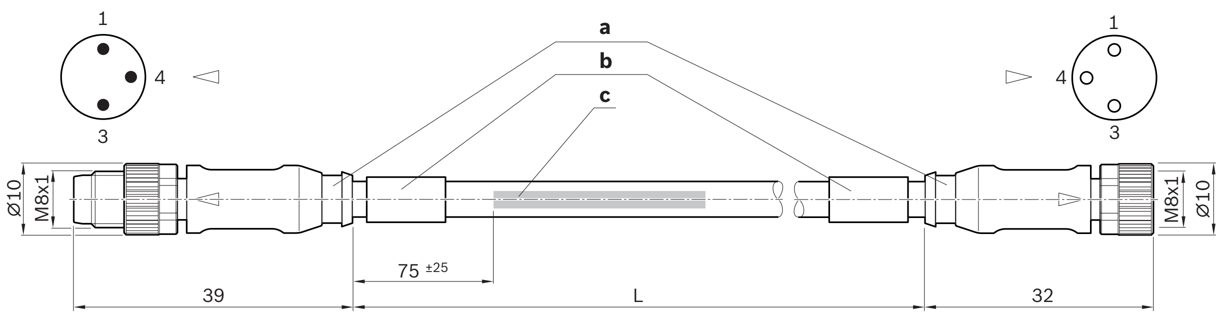
Pre-assembled on two sides

Wiring diagram

1 brown (BN) (+)
3 blue (BU) (–)
4 black (BK) (signal)



Dimension drawing



Part numbers

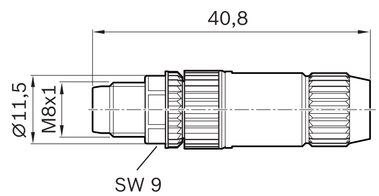
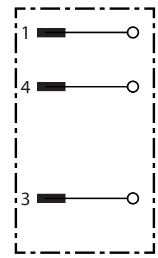
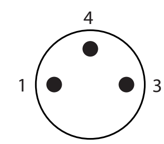
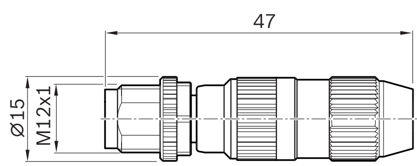
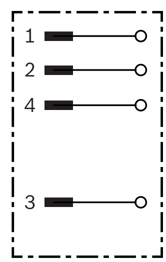
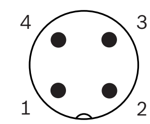
Use	Extension cable				
Part number	R911344621	R911344622	R911344623	R911344624	R911344625
Designation	7000-88001-6500050	7000-88001-6500100	7000-88001-6500200	7000-88001-6500500	7000-88001-6501000
Length (L)	0.5 m	1.0 m	2.0 m	5.0 m	10.0 m
1st connection type	Straight female connector, M8x1, 3-pin				
2nd connection type	Straight plug, M8x1, 3-pin				

Technical data for one-sided and two-sided pre-assembled extension pieces

Function indication	–
Operating voltage indicator	–
Operating voltage	10 - 30 V DC
Cable type	Black polyurethane
Suitable for flexing installation	✓
Torsion-resistant	✓
Weld spark-resistant	✓
Wire gauge	3 x 0.25 mm²
Cable diameter D	4.1 ±0.2 mm
Static bending radius	≥ 5xD
Dynamic bending radius	≥ 10xD
Bending cycles	> 10 million
Max. permissible travel speed	3.3 m/s over 5 m (typ.) to 5 m/s over 0.9 m
Max. permissible acceleration	≤ 30 m/s²
Ambient temperature when fixed	–40 °C bis +85 °C
Ambient temperature when flexible	–25 °C to +85 °C
Protection rating	IP68
Certifications and approvals	CE, c UL us LISTED, C US, RoHS

a) Contour for corrugated tube with 6.5 mm inner diameter
b) Cable grommet
c) Cable label in accordance with Labeling Directive

Plugs

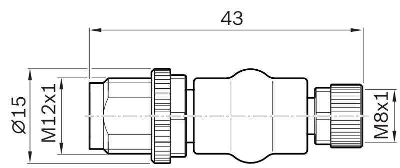
	Dimension drawing	Wiring diagram	Plug side view
 R901388333			
 R901388352			

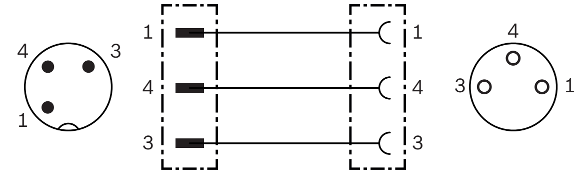
Part numbers/technical data		
Use	Single plug	
Part number	R901388333	R901388352
Designation	7000-08331-0000000	7000-12491-0000000
Version	Straight	
Operating current per contact	Max. 4 A	
Operating voltage	Max. 32 V AC/DC	
Connection type	Straight plug, M8x1, 3-pin, insulation displacement, self-locking screw thread	Straight plug, M12x1, 4-pin, insulation displacement, self-locking screw thread
Function indication	-	
Operating voltage indicator	-	
Connection cross-section	0.14 ... 0.34 mm²	
Ambient temperature	–25 °C to +85 °C	
Protection rating	IP67 (plugged in & screwed down)	
Certifications and approvals	c UL us, RoHS	

Adapters

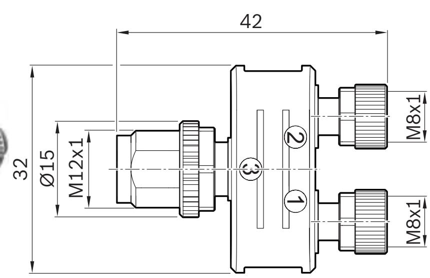
Dimension drawing **Wiring diagram**

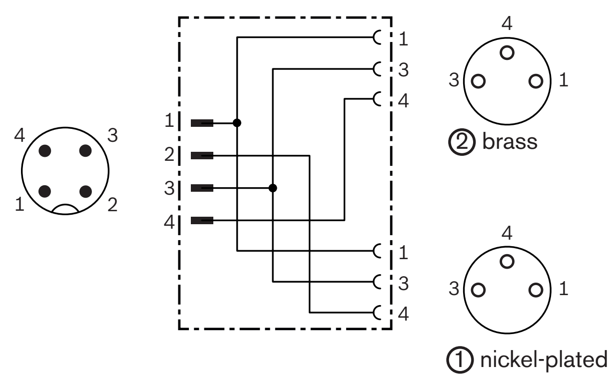
R911344591





R911344592





Part numbers/technical data

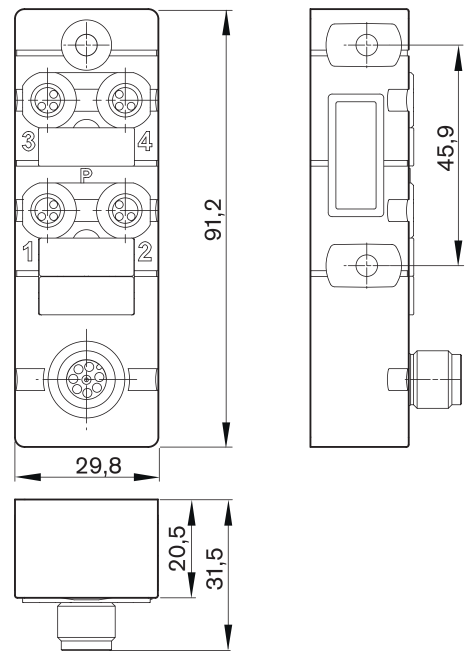
Use	Adapter	Adapter or distributor
Part number	R911344591	R911344592
Designation	7000-42201-0000000	7000-41211-0000000
Version	Straight, for 1 sensor	Straight, for 1 - 2 sensors
Operating current per contact	Max. 4 A	
Operating voltage	Max. 32 V AC/DC	
1st connection type	Straight female connector, M8x1, 3-pin, self-locking screw thread	2 X straight female connector, M8x1, 3-pin, self-locking screw thread
2nd connection type	Straight plug, M12x1, 3-pin, self-locking screw thread	Straight plug, M12x1, 4-pin, self-locking screw thread
Function indication	–	
Operating voltage indicator	–	
Connection cross-section	–	
Ambient temperature	–25 °C to +85 °C	
Protection rating	IP67 (plugged in & screwed down)	
Certifications and approvals	RoHS	c UL us LISTED, RoHS

Passive distributors

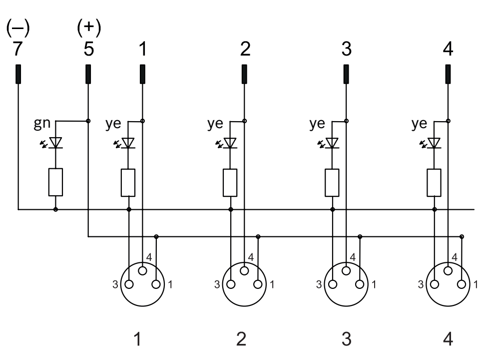
R901425737

R901429917

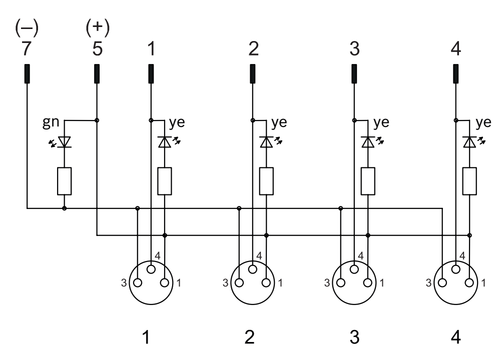
R911344592



R901425737



R901429917



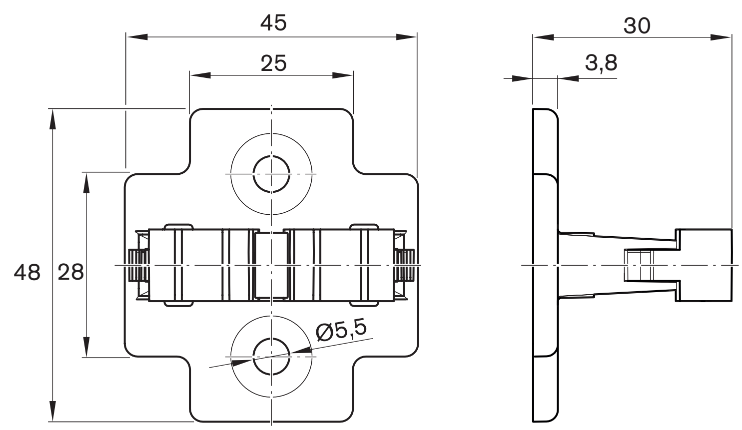
Part numbers/technical data

Use	Passive distributors		
Part number	R901425737	R901429917	R911344592
Designation	8000-84070-0000000	8000-84071-0000000	See “Adapters” for technical data and dimension drawing
Version	Straight, for 1 - 4 sensors		
Operating current per contact	Max. 2 A		
Operating voltage	24 V DC		
Switching logic	PNP	NPN	
1st connection type	4x straight female connector, M8x1, 3-pin, self-locking screw thread		
2nd connection type	Straight plug, M12x1, 8-pin, self-locking screw thread		
Function indication	✓		
Operating voltage indicator	✓		
Connection cross-section	-		
Ambient temperature	–20 °C bis +70 °C		
Protection rating	IP67 (plugged in & screwed down)		
Certifications and approvals	c UL us LISTED, RoHS		

Passive distributor accessories

Holding plate

Screw plug



Part numbers/technical data

Use	For passive distributor R911344592	For passive distributors R901425737 / R901429917
Holding plate	R913047341	–
Designation	7000-99061-0000000	–
Quantity per set	1 piece	–
Screw plug	–	R913047322
Designation	–	3858627
Quantity per set	–	10 pieces

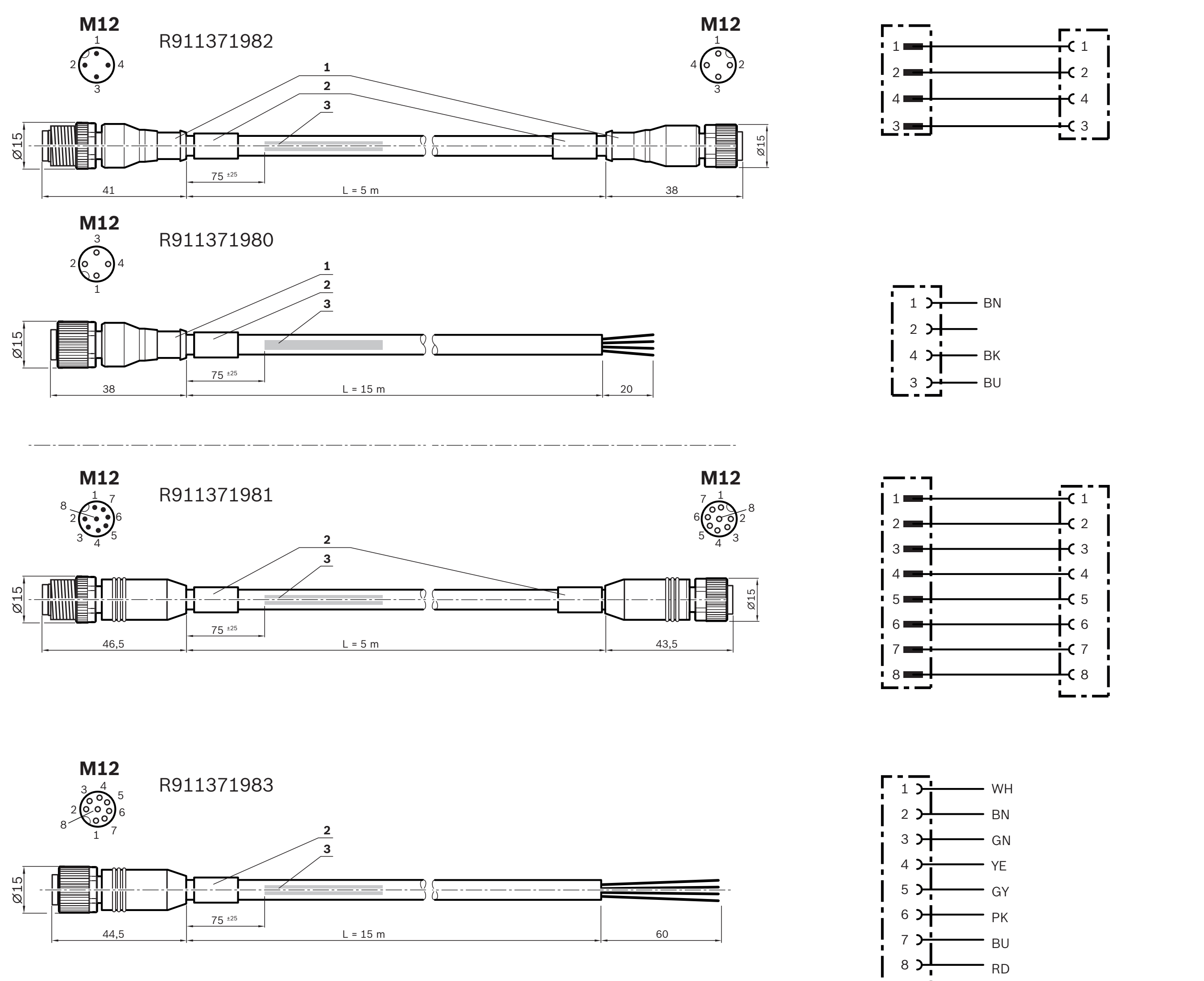
Extensions for passive distributors

R911371982

R911371981

R911371980

R911371983



1) Contour for 10 mm corrugated tube (inner diameter)

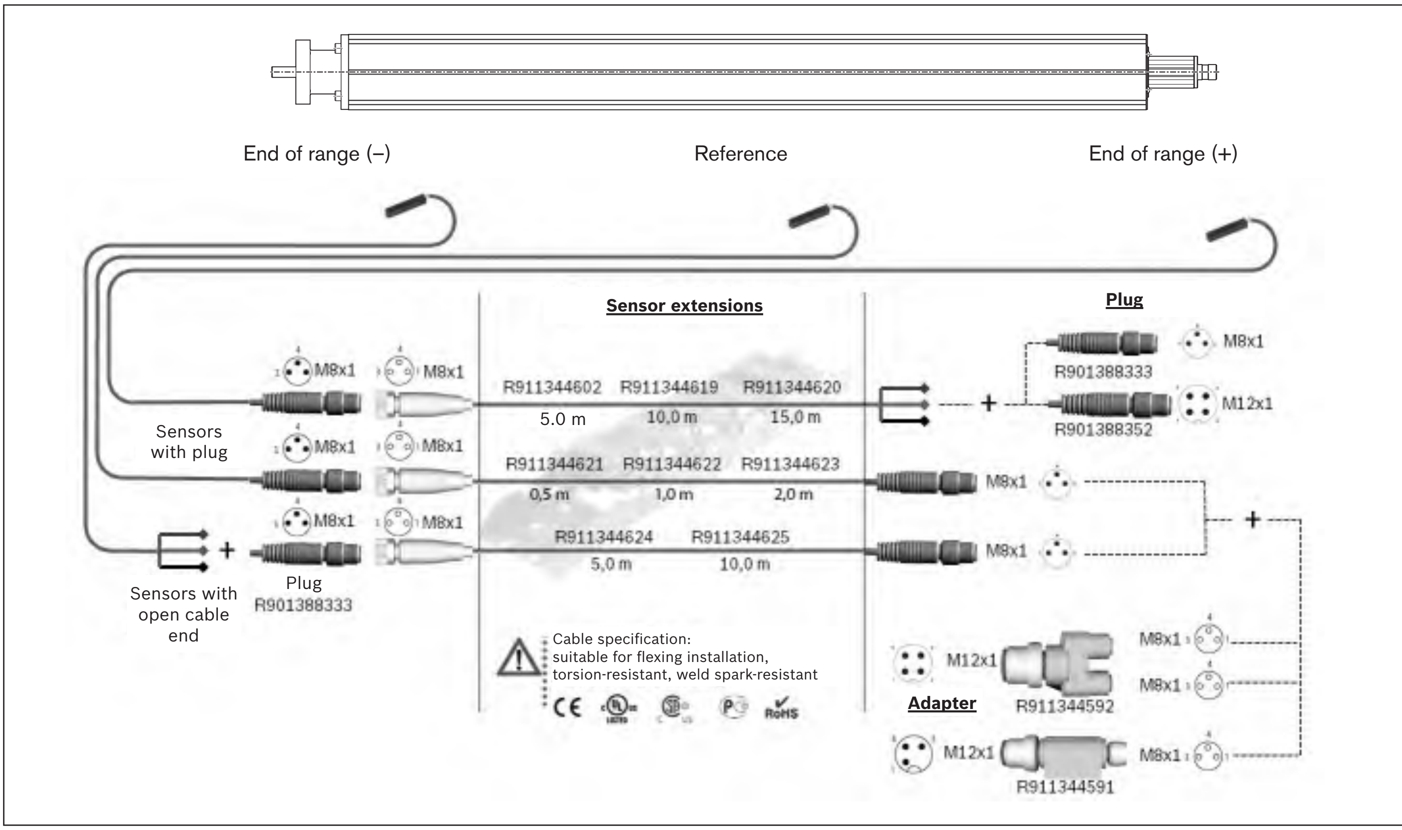
2) Cable grommet

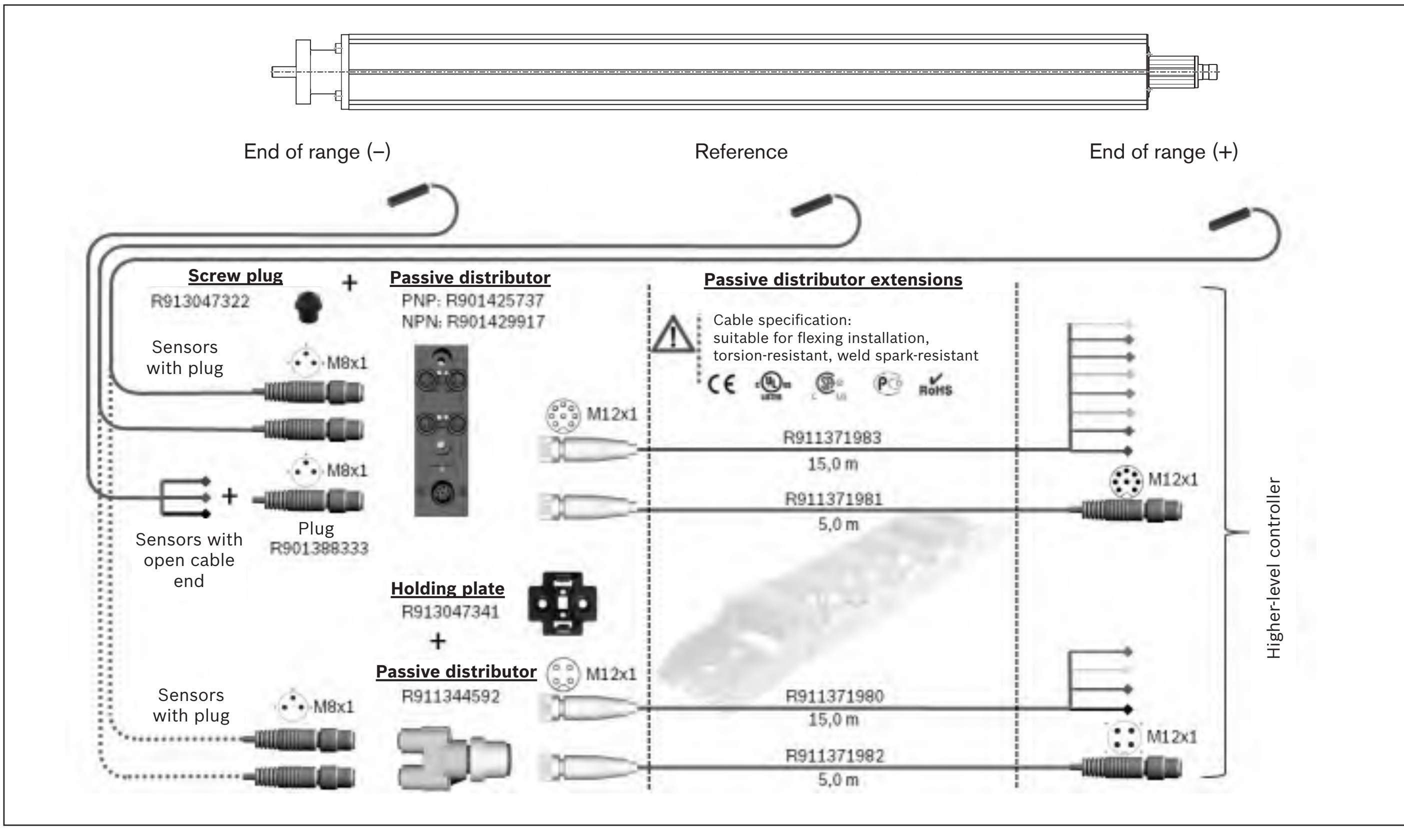
3) Cable label in accordance with ordering regulation 7000-08001

Part numbers/technical data

Use	Extension cable for passive distributor R911344592		Extension cable for passive distributors R901425737 / R901429917	
Part number	R911371982	R911371980	R911371981	R911371983
Designation	7000-40021-6540500	7000-12221-6541500	7000-48001-3770500	7000-17041-3771500
Length	5.0 m	15.0 m	5.0 m	15.0 m
1st connection type	Straight female connector, M12x1, 4-pin		Straight female connector, M12x1, 8-pin	
2nd connection type	Straight socket, M12x1, 4-pin	Open end	Straight socket, M12x1, 8-pin	Open end
Function indication	–			
Operating voltage indicator	–			
Cable type	Black polyurethane		Gray polyurethane	
Operating voltage	30 V AC/DC			
Operating current per contact	Max. 4 A per contact		Max. 2 A per contact	
Suitable for flexing installation	✓			
Torsion-resistant	✓			
Weld spark-resistant	✓			
Wire gauge	4x 0.34 mm^2		8x 0.34 mm^2	
Cable diameter D	4.7 ± 0.2 mm		6.2 ± 0.3 mm	
Static bending radius	≥ 5 x D			
Dynamic bending radius	≥ 10 x D			
Bending cycles	> 10 million			
Max. permissible travel speed	3.3 m/s over 5 m (typ.) to 5 m/s over 0.9 m			
Max. permissible acceleration	≤ 30 m/s^2			
Ambient temperature when fixed	–40 °C to 80 °C (90° max. 10,000 hrs)			
Ambient temperature when flexible	–25 °C to 80 °C (90° max. 10,000 hrs)			
Protection rating	IP67 (plugged in & screwed down)			
Certifications and approvals	CE, c UL us LISTED, C US, RoHS			

Combination examples



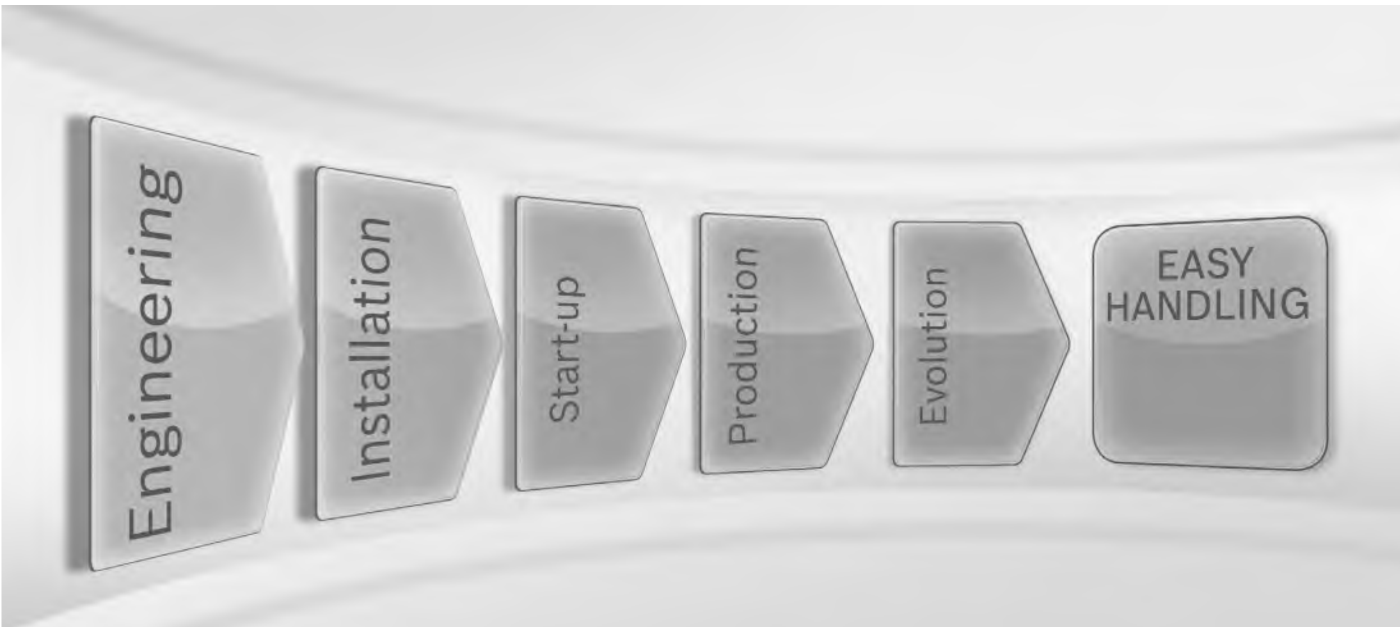


End of range (–)
Reference
End of range (+)
Screw plug
R913047322
Passive distributor
PNP: R901425737
NPN: R901429917
Passive distributor extensions
Cable specification:
suitable for flexing installation,
torsion-resistant, weld spark-resistant
Sensors
with plug
M8x1
M12x1
R911371983
15,0 m
R911371981
5,0 m
M12x1
Sensors with
open cable
end
Plug
R901388333
Holding plate
R913047341
Passive distributor
R911344592
M12x1
Sensors
with plug
M8x1
R911371980
15,0 m
R911371982
5,0 m
M12x1
Higher-level controller

The perfect system solution for every application

Efficient production processes are the key to your success in the marketplace. Today's environment, defined by rapid change and short product cycles, demands flexible systems with an optimal design and configuration. EasyHandling gives you the tools you need to automate your handling tasks with greater ease, speed, and efficiency. EasyHandling is more than just a modular collection of mechanical components; it takes an evolutionary step forward by providing an all-inclusive system solution – our best solution for your requirements.

EasyHandling –
Easier. Faster. Better.



The easier way to get the result you want
Get customized solutions in next to no time – with consistent support.

The faster route to the optimal application
Effortless adaptation, even to future requirements – fast and flexible scalability.

Better thanks to maximum efficiency
Optimizes processes from planning to operation – while saving significantly on resources.

Planning – up to 70% faster
EasyHandling tools help users right from the component selection stage, proposing solutions with all the necessary information on parts lists, technical data and CAD drawings.

Installation – time reduced by up to 60%
Thanks to positive-locking interfaces, mechanical components align perfectly and fit exactly.

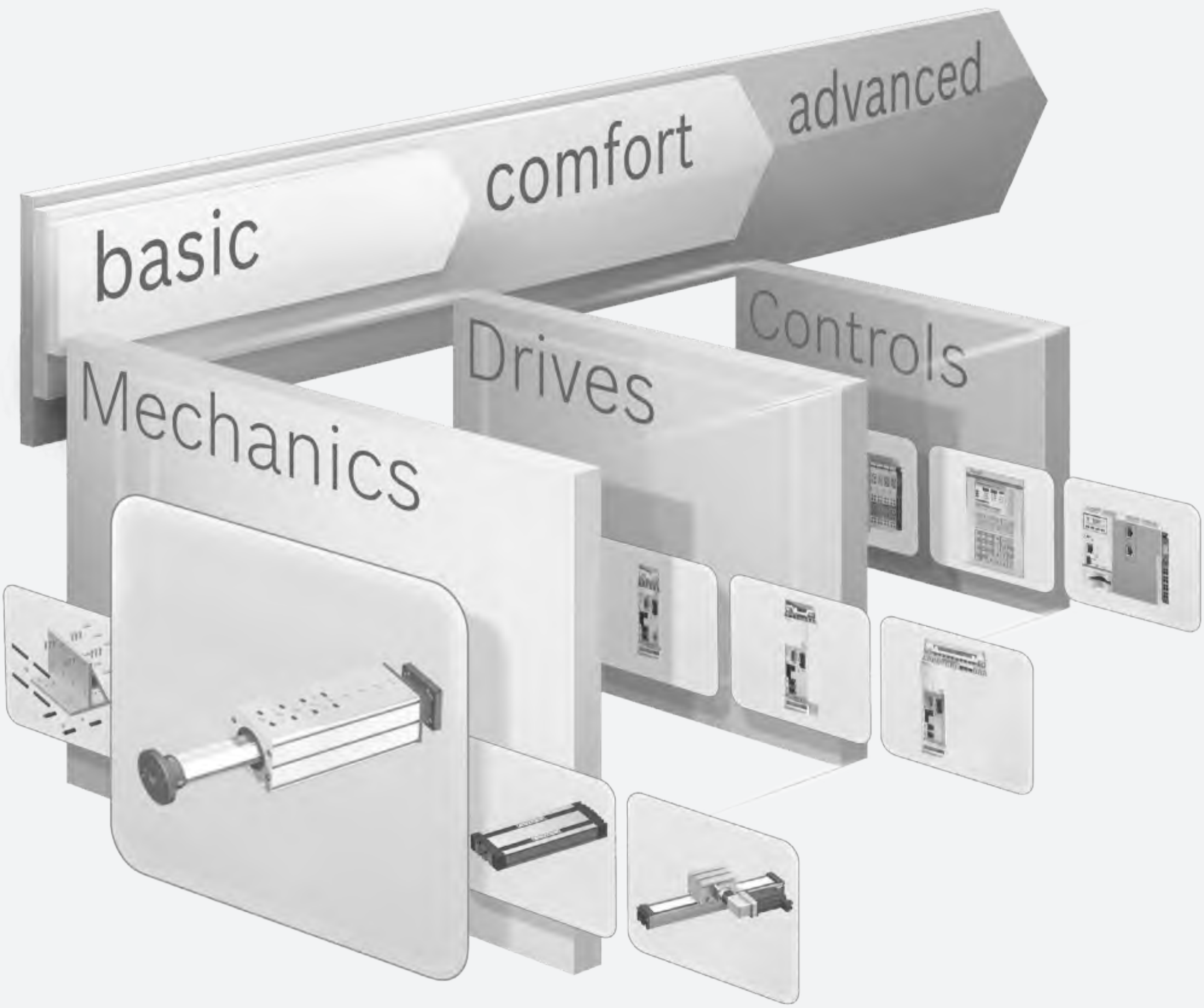
Start-up – time reduced by up to 90%
With the EasyWizard smart start-up wizard, parameterization and configuration become child's play. Your handling system will be ready to go in just a few clicks.

Production – more economical and more efficient
Rexroth enhances system effectiveness with smart application tools: The drive controller software outputs maintenance-related messages to the user based on operating hours and travel to help schedule servicing at the right intervals. The result: longer service life and reduced risk of failure.

Further developments – continuous improvement
Be ready for tomorrow's market developments today: One of the great features of EasyHandling systems is their systematic openness. The flexibility of the mechanical and electrical components allows you to adapt quickly and efficiently to new production requirements.

EasyHandling –
more than just a building system

The modular system concept for perfect scalability



basic – made-to-measure mechanics

EasyHandling basic contains all the mechatronic components you need to build complete, **single or multiaxis systems** to meet your needs.
All of the component interfaces are systematically standardized, making it possible to combine them with ease. Practical tools and aids make selection and configuration even easier.

Comfort – getting started even faster

EasyHandling comfort expands the basic component range by adding **powerful servo drives with multi-protocol capability**. The universal, smart control units are perfectly suited for a variety of handling tasks.
One-of-a-kind: with the **EasyWizard start-up wizard**, linear motion systems are ready to use after entering just a few product-specific parameters.

advanced – controls for demanding requirements

With the **freely scalable, high-performance Motion Logic control system**, EasyHandling advanced makes configuration and handling even easier. Predefined functions covering more than 90 percent of all handling applications eliminate the need for lengthy programming.

For more information about EasyHandling, see the brochure “EasyHandling – more than just a building system” R999000044.

Operating conditions

Normal operating conditions

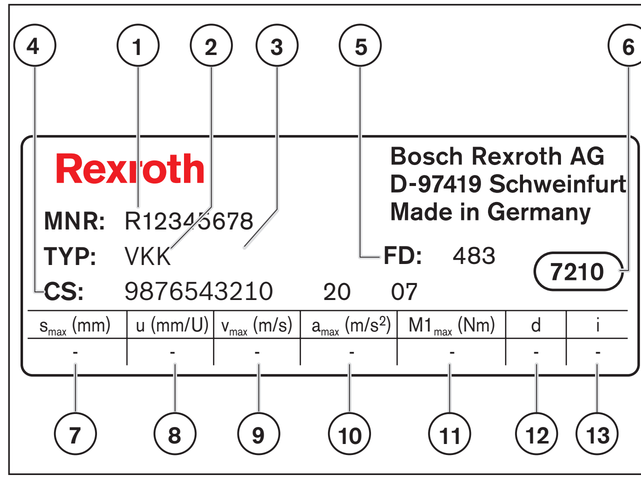
Ambient temperature with Rexroth servo motor	0 °C ... 40 °C, loss of performance above 40 °C
Ambient temperature for mechanical system (no dropping below dew point)	-10 °C ... 60 °C
Protection rating	IP 54
Motors	Take into account motor temperature limits.

Required and supplementary documentation

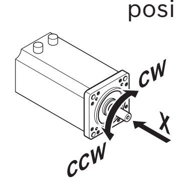
For further instructions and information, please refer to documentation for this product.

Parameterization (start-up)

The nameplate contains reference information on the production of the linear motion system as well as technical parameters for start-up.



1 Part number
2 Type designation
3 Size
4 Customer information
5 Date of manufacture
6 Manufacturing location
7 s_{max} = max. travel range (mm)
8 u = lead constant without gear unit (mm/U)
9 v_{max} = max. travel speed without gear unit (m/s)
10 a_{max} = max. acceleration without gear unit (m/s^2)
11 $M1_{max}$ = max. drive torque at motor journal (Nm)
12 d = motor direction of rotation for travel in positive direction



CW = Clockwise
CCW = Counterclockwise

13 i = gear ratio

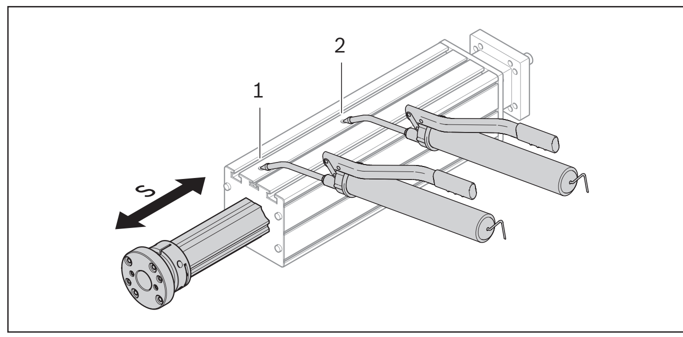
Lubrication and maintenance

Grease lubrication

The advantage of grease lubrication is that ball screw drives can run for prolonged periods without needing relubrication. This means a lubricating system is not required in many cases.
Any high-quality ball bearing lubricating grease can be used. Follow the lubricant manufacturer's instructions. Greases in accordance with DIN 51825 K2K and, for higher loads, KP2K of NLGI grade 2 in accordance with DIN 51818 are recommended for the longest possible lubrication intervals. Tests have shown that greases of NLGI grade 00 achieve only about 50% of the running performance of Class 2 at higher loads.
The lubrication interval depends on many factors, such as degree of contamination, operating temperature, load, etc. Therefore, the following information is for reference only.

Notes on lubrication

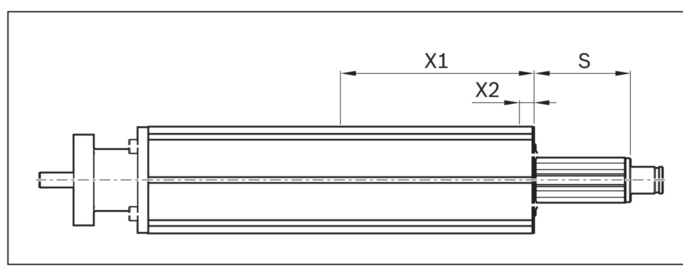
Basic lubrication is applied in-factory before shipment. Feed Modules are designed for grease lubrication. Only the ball screw drive and guideway require lubrication. No other maintenance is necessary.
Apply lubricant to all lubrication points. To do this, push the thrust rod down to lubricating position "S". When considering adjoining structures, make sure the lubricating position can be reached.
For more information, see "Instructions for VKK".



Lube ports for:
1) Guideway
2) Ball screw drive

Lube nipple location

– To access the lube ports, extend the thrust rod to lubricating position **S**.



Size	Dimensions (mm)			
	Length	S	X1	X2
VKK-050	240	138	85.0	–5.75 [1]
	280	178		
	360	258		
	480	378		
VKK-070	280	120	123.5	7.50
	320	160		
	400	240		
	520	360		
	600	440		
VKK-100	360	130	154.0	10.00
	400	170		
	480	250		
	600	370		
	680	450		

[1] The lube port is located in a front-mounted lube plate.

Recommended lubricants

Notes on lubrication

Feed Modules receive initial greasing with Dynalub 510 or Dynalub 520 and are only designed for grease lubrication using a manual grease gun.

Lubricant quantities

See “Instructions for feed modules” for lubricant quantities intervals.

⚠ **Do not use greases with solid lubricant components (e.g., graphite or MoS_2 additives).**

VKK	Grease (DIN)	Consistency class DIN 51818	Recommended grease	Part number (400 g cartridge)
-050	KP00K (DIN 51825)	NLGI 00	Dynalub 520	R3416 043 00
-070, -100	KP2K (DIN 51826)	NLGI 2	Dynalub 510	R3416 037 00

Documentation

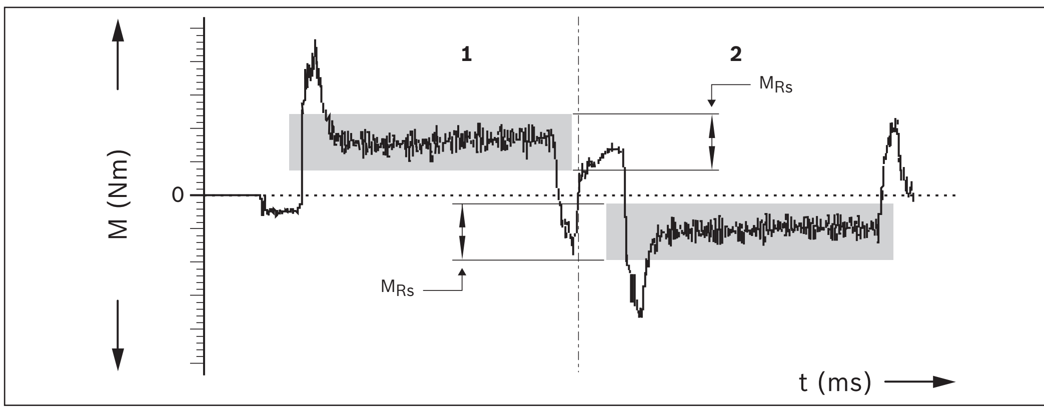
Standard report
Option 01

The standard report serves to confirm that the checks listed in the report have been carried out and that the measured values lie within the permissible tolerances.

Checks listed in the standard report:
- ▶ Functional checks of mechanical components
- ▶ Functional checks of electrical components
- ▶ Design is in accordance with order confirmation

Frictional torque measurement of complete system
Option 02
All items as per standard report.
Frictional torque M is measured over the entire travel range.

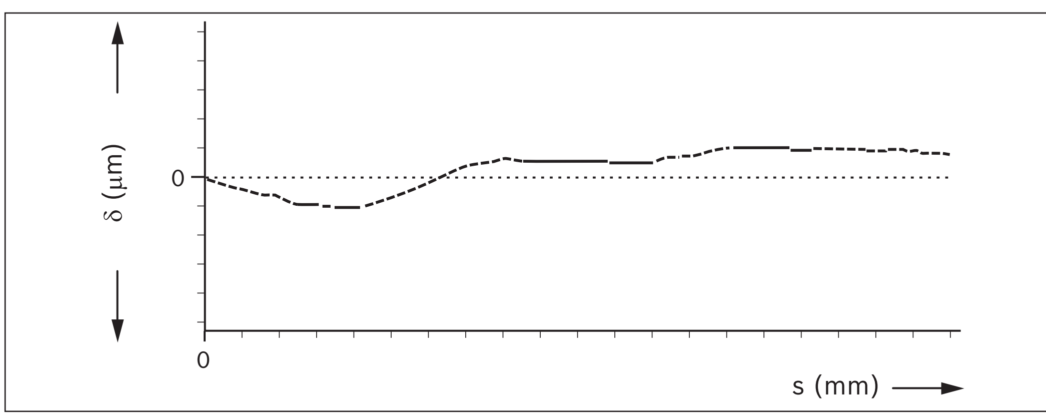
Example graph



M_{Rs} = Frictional torque (N)
t = Travel time (ms)

1) Advance
2) Return

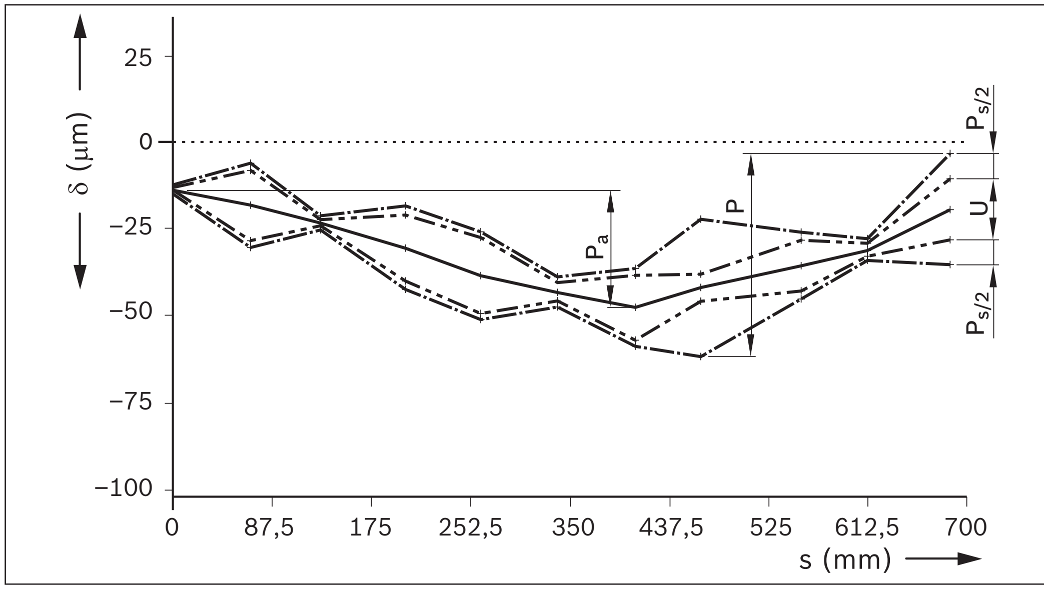
Screw drive lead deviation
Option 03
All items as per standard report.
In addition to graph (see figure), a measurement report is included as a table.



δ = deviation (µm)
s = measured travel (mm)

Positioning accuracy per VDI/DGQ 3441
Option 05
Measurement points are selected at irregular intervals along the travel range. This allows even periodic deviations δ in µm to be detected during positioning. Each measurement point is approached several times from both sides.
This gives the following parameters.

Example graph



δ = Deviation (µm)
s = Measured travel (mm)

Positioning accuracy P

The positioning accuracy corresponds to the total deviation.
It includes all systematic and random deviations during positioning.
The positioning accuracy takes the following characteristic values into consideration:
- Position deviation
- Reversal range
- Position variation range

Position deviation P_a

The position deviation corresponds to the maximum difference arising in the mean values of all the measurement points. It describes systematic deviations.

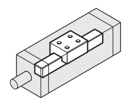
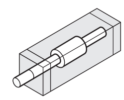
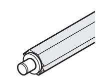
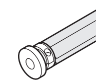
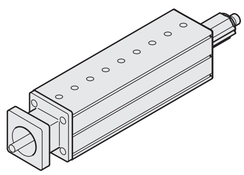
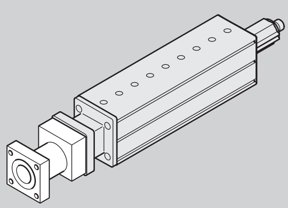
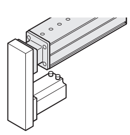
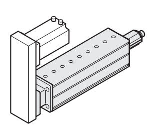
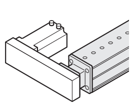
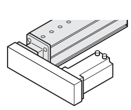
Reversal range U

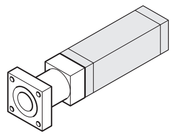
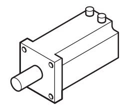
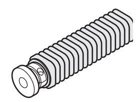
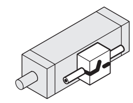
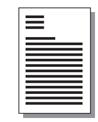
The reversal range corresponds to the difference in mean values of the two approach directions. The reversal range is determined at every measurement point. It describes systematic deviations.

Position variation range P_s

The position variation range describes the effects of random deviations.
It is determined at every measurement point.

Ordering example VKK-100

Short product name, length VKK-100-NN-1, ... mm		**Guideway**	**Drive**				**Carriage**	
								
Version			**Screw journal**	**BASA size d_0 x P**			**without adapter flange**	**with adapter flange**
				20x5	25x10	20x20		
With BASA, without motor mount	OF01 	OF01	Ø 14	01	02	03	03	04
			Ø 14 key-way	11	12	13		
with BASA and motor mount	MF01 	MF01	L = 280 mm 12 L = 320 mm 13 L = 400 mm 15 L = 520 mm 18 L = 600 mm 20	Ø 14	01	02	03	03	04
with BASA and timing belt side drive	RV01  RV02  RV03  RV04 	RV01 to RV04		Ø 14	01	02	03	03	04

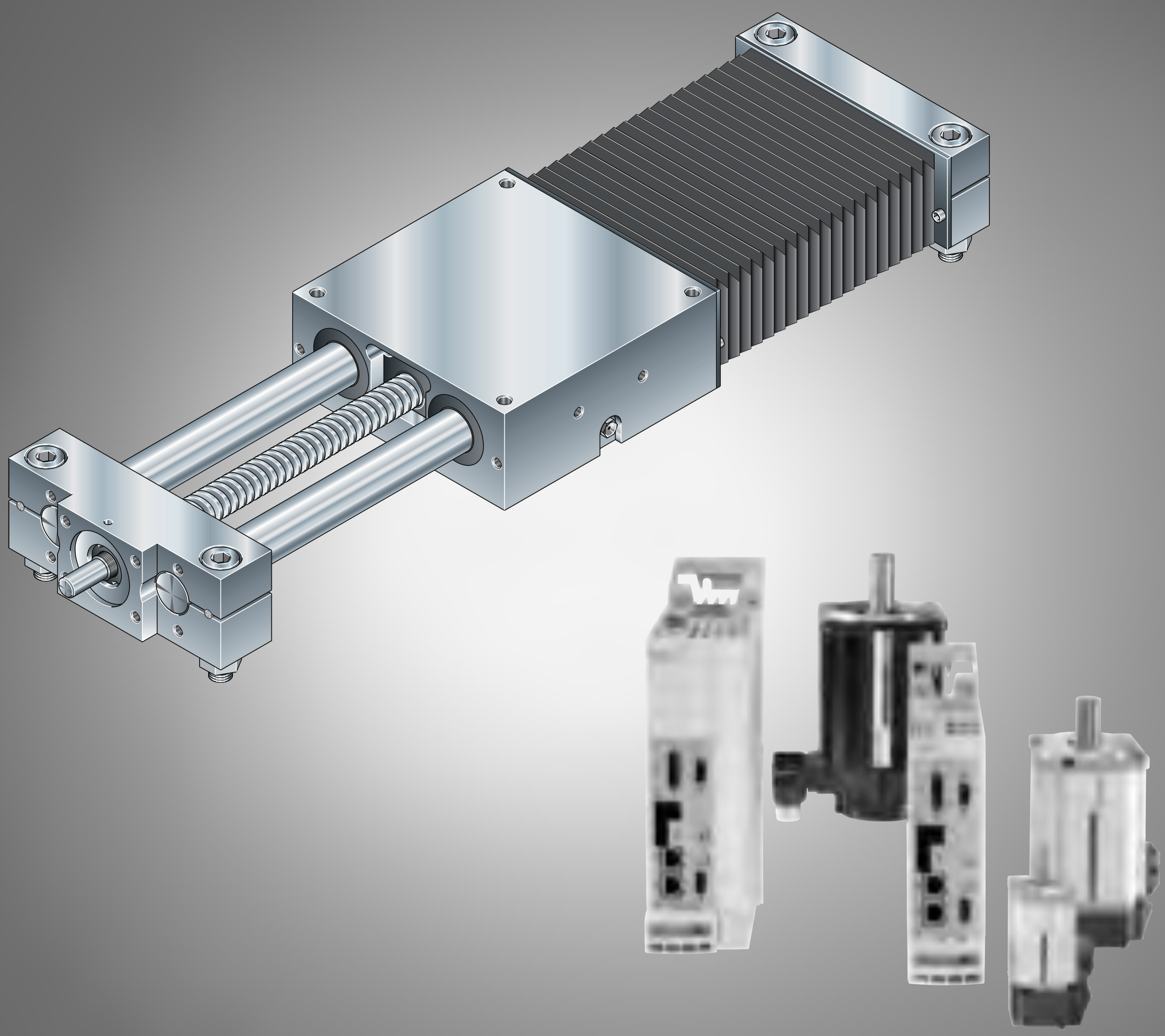
Motor attachment			Motor		Cover		Switch	Documentation	
									
Gear ratio i =	**Attachment kit**	**for motor**	**without brake**	**with brake**	**without bellows**	**with bellows**		**Standard report**	**Measurement report**
	00	–	00		00	01	**without switch** 00 **Magnetic field sensor:** – Reed sensor 21 – Hall sensor (PNP NC) 22 **Magnetic field sensor with connector:** 58 – Reed sensor – Hall sensor (PNP NC) 59	01	02 03 05
1	03	MSM 041B	130	131					
	05	MSK 050C	88	89					
1	27	MSM 041B	130	131					
1.5	28								
1	29	MSK 050C	88	89					
1.5	30								

Electric Drives and Controls | Hydraulics | Linear Motion and Assembly Technologies | Pneumatics | Service

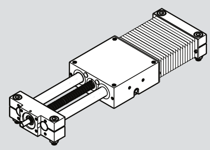
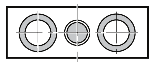
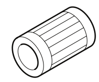
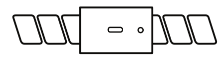
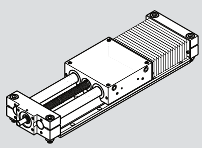
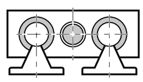
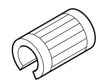
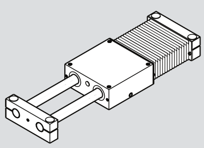
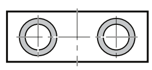
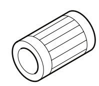
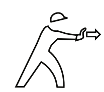
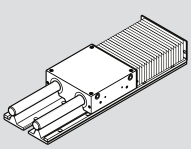
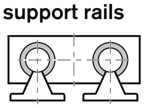
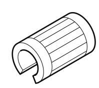
Rexroth
Bosch Group

Linear Motion Slides

The Drive & Control Company



Rexroth Linear Motion Slides

Linear Motion Slide	Type	Construction form	Guide	Drive unit	Page
	SGK	**Closed type for cantilever-type installation** 	 **Super Linear Bushing closed type**	 **Precision ball screw assembly**	Page 36
	SOK	**Open type for installation with shaft support rails** 	 **Super Linear Bushing open type**		Page 44
	SGO	**Closed type for cantilever-type installation** 	 **Super Linear Bushing [1] closed type**	 **Without drive unit**	Page 54
	SOO	**Open type for installation with shaft support rails** 	 **Super Linear Bushing open type**		Page 58

1) Size 8-65 with Standard Linear Bushings

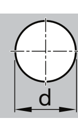
Identification system for short product names

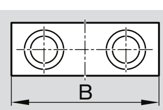
	Type			Size	
Slide (example) =	S	G	K	16	-100

System = Linear Motion Slide (**S**)

Construction form = Closed type (**G**)
Open type (**O**)

Drive unit = Precision ball screw assembly (**K**)
Without drive unit (**O**)

Dimensions of guideway = 

Overall width = 

Rexroth Linear Motion Slides

General Product Description

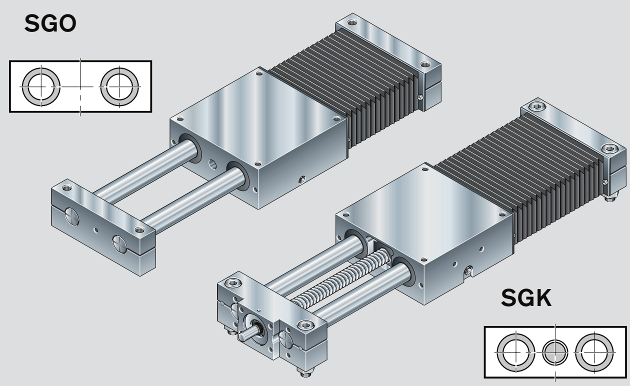
Product Description

Characteristic features

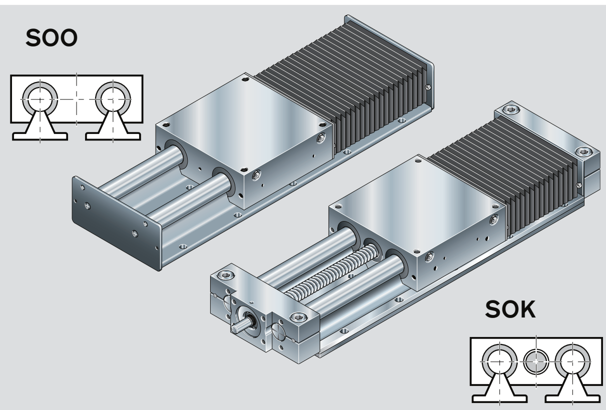
- Particularly smooth running and long service life thanks to Rexroth Super Linear Bushings
- Oil- and moisture-resistant PU bellows-type protective cover (the last fold is mechanically clamped)
- Ready-to-install Linear Motion Slides in any length up to L_{max}
- Integrated Rexroth Super Linear Bushings
- Version with drive unit includes Precision Ball Screw Assembly

Further highlights
- Greater flexibility due to options
- One-point lubrication ports for the Super Linear Bushings are provided on both sides of the carriage
- Ready for installation with different attachments

Closed-type construction form for cantilevered installation
High thrust forces
- Especially suited for environments with heavy contamination (closed bellows)



Open-type construction form for installation with shaft support rails
- Shaft support rails permit long travel distances
- High thrust forces
- With protective bellows



Note:
Bellows are installed on both sides of the carriage. The units are shown here with bellows on only one side of the carriage to better illustrate structural design and the function of the Linear Motion Slides.

General information

Delivery condition:

Linear motion slide with drive unit (closed and open construction form) SGK and SOK:
The Linear Motion Slides with ball screw drive are delivered fully assembled. Also assembled are the bellows, motor attachment and motor, if these options were included in the order. All further attachments, such as switches, switching cams, cable ducts, etc., are delivered as separate parts along with the slide. Linear Motion Slides with drive unit are delivered prelubricated with grease.

Linear Motion Slide without drive unit (closed and open construction form) SGO and SOO:
Linear Motion Slides without drive unit are delivered unassembled. Shafts and end blocks are provided. The carriage is mounted as a sub-assembly without pregreasing. Initial grease lubrication must be performed by the customer in accordance with the instructions provided. If bellows have been ordered, these are mounted on frames and included in the delivery. Fastening screws are not included in scope of delivery. Linear Motion Slides without drive unit can also be supplied with corrosion-resistant steel shafts per DIN 17230 / EN 10088.
For more information on Linear Bushings and precision steel shafts, see the "Linear Bushings and Shafts" catalog.

Linear Motion Slides in open construction form (with and without drive unit) SOK and SOO:
The precision steel shafts are screw-fastened to the shaft support rails.

Length L:

Linear Motion Slides consist of components of varying length and assemblies of fixed length. The length-dependent components are cut to size as required for each order. Linear Motion Slides can thus be custom-designed in any desired length (infinitely variable).
Lengths in excess of the specified L_{max} are available on request.

Instructions:

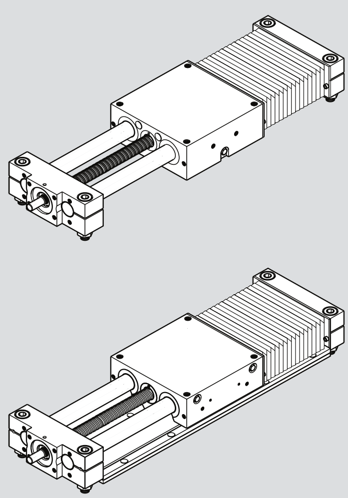
Each Linear Motion Slide is delivered complete with the relevant instructions for mounting and maintenance.

General Product Description

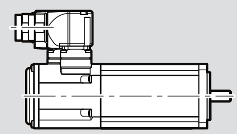
Product Overview, Motors and Controllers (Control Systems)

Motor Selection
in accordance with controllers and control systems

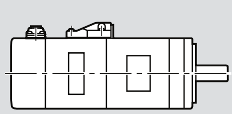
Several motor-controller combinations are available in order to provide the most cost-effective solution for every customer application.
When sizing the drive, always consider the motor-controller combination
➟ “Motors” on page 66.
For more information on motors, controllers and control systems, please refer to the Rexroth catalog “Drive System Rexroth IndraDrive” R999000018.



SAFETY ON BOARD

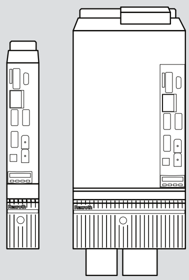


IndraDyn S servo motor MSK

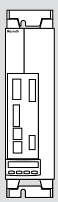


IndraDyn S servo motor MSM

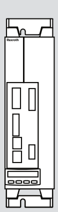
SAFETY ON BOARD



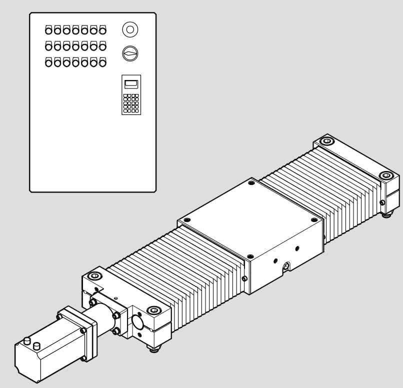
Digital controller
IndraDrive C
Power unit HCS
Control unit CSH



Digital controller
IndraDrive Cs
HCS 01
Compact and dynamic solution
for lower power ranges



Digital controller
IndraDrive Cs
HCS 01
Compact and dynamic solution
for lower power ranges



Linear Motion Slides can be supplied complete with motor, controller and control system.

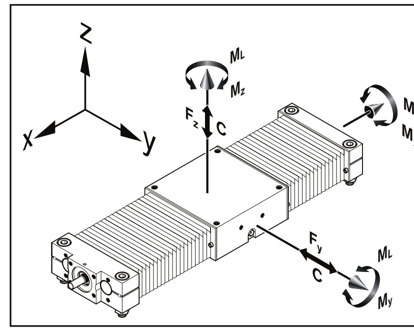
General Product Description

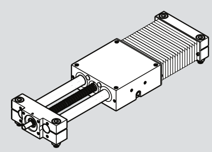
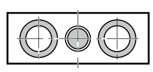
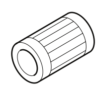
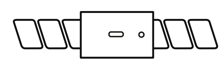
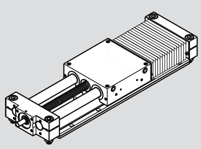
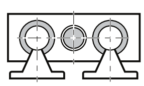
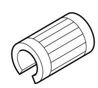
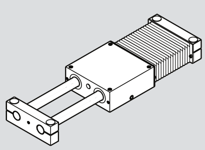
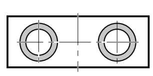
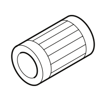
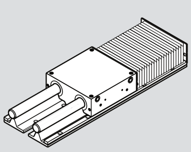
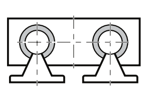
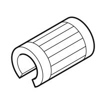
Overview of Types with Load Capacities

**Suitable loads
(recommended values on the basis of past experience)**

As far as the desired service life is concerned, loads of up to approximately 20% of the dynamic characteristic values (**C**, **M_t**, **M_L**) have proved acceptable.

At the same time, the following may not be exceeded:
– the maximum permissible shaft deflection
– maximum permissible drive torque
– the maximum permissible load
– the permissible travel speed
– the maximum permissible acceleration



Linear Motion Slide	Type	Construction form	Guide	Drive unit	
	SGK	**Closed type for cantilever-type installation** 	 **Super Linear Bushing closed type**	 **Precision ball screw assembly**	
	SOK	**Open type for installation with shaft support rails** 	 **Super Linear Bushing open type**		
	SGO	**Closed type for cantilever-type installation** 	 **SSuper Linear Bushing 1) closed type**	 **Without drive unit**	
	SOO	**Open type for installation with shaft support rails** 	 **Super Linear Bushing open type**		

1) Size 8-65 with Standard Linear Bushings

Note on dynamic load capacities and moments:

Determination of the dynamic load capacities and moments is based on a travel life of 100 000 m. Often only 50 000 m are actually stipulated.
For comparison: Multiply values C, M_t and M_L by 1.26.

Type	Size	8-65	12-85	16-100	20-130	25-160	30-180	40-230	50-280
SGK	**Maximum length L_{max}** (mm)		1 000	1 500	2 500	3 000	3 000	4 000	4 000
	Dynamic load capacity C (N)		2 700	3 310	6 560	12 830	15 600	26 770	39 180
SOK	**Maximum length L_{max}** (mm)		1 000	1 500	2 500	3 000	3 000	4 000	4 000
	Dynamic load capacity C (N)		2 850	3 440	6 100	11 950	14 520	24 950	36 380
SGO	**Maximum length L_{max}** (mm)	700	1 000	1 500	2 500	3 000	3 000	4 000	4 000
	Dynamic load capacity C (N)	1 040	2700	3 310	6 560	12 830	15 600	26 770	39 180
SOO	**Maximum length L_{max}** (mm)		4 000	4 000	4 000	5 300	5 300	5 300	5 300
	Dynamic load capacity C (N)		2 850	3 440	6 100	11 950	14 520	24 950	36 380

The load capacities of the open versions are reduced as follows under lift-off loads:

Sizes 12 and 16 $C' = 0.42 \cdot C$

Sizes 20 to 50 $C' = 0.60 \cdot C$

General Product Description

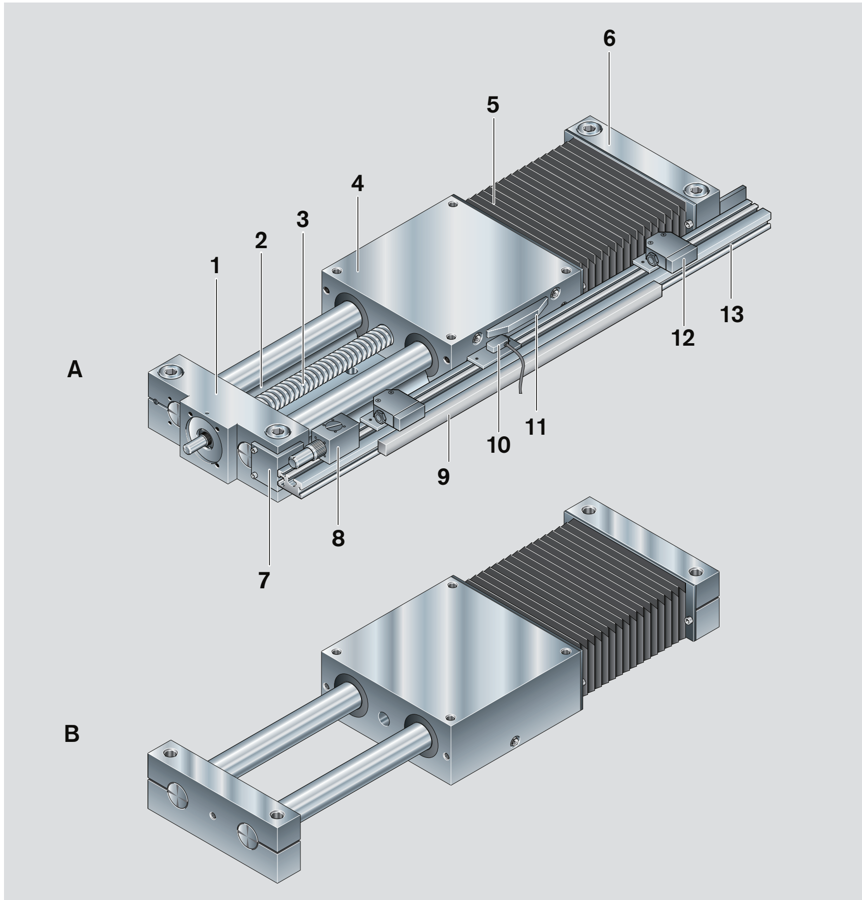
Structural Design

Linear Motion Slide (closed / open)

A with ball screw drive
B without drive unit

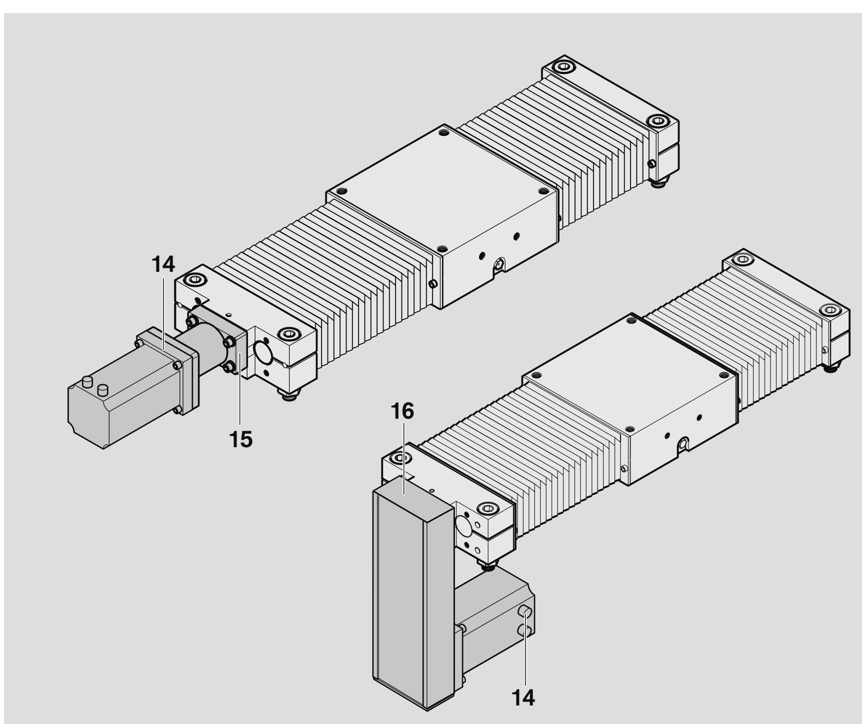
1 Fixed bearing end block
2 Shaft support rails (for open version only)
3 Ball screw with zero-backlash cylindrical single nut
4 Carriage with four Super Linear Bushings[1)] (closed or open type)
5 Polyurethane bellows-type protective cover
6 Floating bearing end block

Accessories:
7 Mounting bracket
8 Socket + plug
9 Cable duct (aluminum alloy)
10 Proximity switch (with mounting accessories)
11 Switching cam
12 Mechanical switch (with mounting accessories)
13 Mounting profile



14 Motor
15 Motor mount and coupling
16 Timing belt side drive

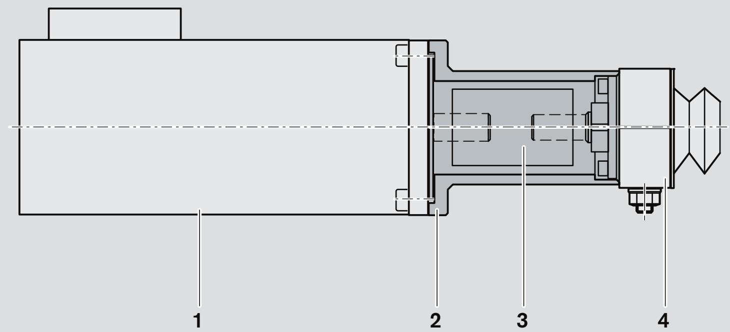
1) Size 8-65 with Standard Linear Bushings



Motor attachment with mount and coupling

A motor can be attached via a mount and coupling to all Linear Motion Slides equipped with a ball screw drive. The motor mount serves to fasten the motor to the Linear Motion Slide and acts as a closed housing for the coupling. The coupling transmits the motor drive torque free of distortive stresses to the Linear Motion Slide's drive shaft.
Our standard couplings compensate for the thermal expansion of the system.
If other makes of couplings are used, their thermal expansion must be taken into account.

1 Motor
2 Motor mount
3 Coupling
4 Linear Motion Slide

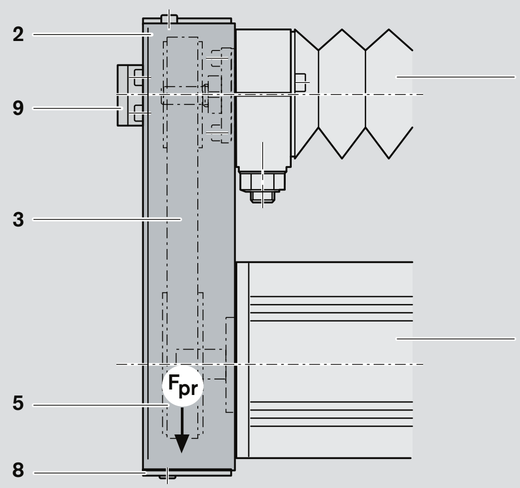


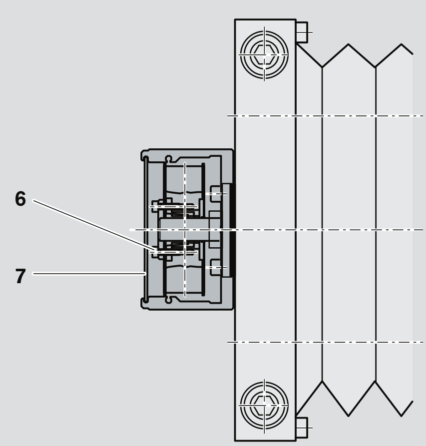
Motor attachment via timing belt side drive

For Linear Motion Slides from size 25-160 and up, the motor can be attached via a side drive with timing belt. This makes the overall length shorter than when attaching the motor with a motor mount and coupling.
The compact, closed housing protects the belt and secures the motor.
Different gear ratios are available:
i = 1 : 1
i = 1 : 1.5 (size 25-160, 30-180)
i = 1 : 2 (size 40-230, 50-280)

The timing belt side drive can be mounted in four different directions:
– below, above (RVO1 and RV02)
– left, right (RVO3 and RV04)

1 Linear Motion Slide
2 Housing (extruded, anodized aluminum profile)
3 Toothed belt
4 Motor
5 Pre-tensioning of the toothed belt: Apply pretensioning force F_{pr} to motor (F_{pr} will be indicated on delivery)
6 Belt pulleys attached using tensioning units
7 Cover plate
8 Cover
9 On sizes 25-160 and 30-180: Ball screw journal with additional support bearing

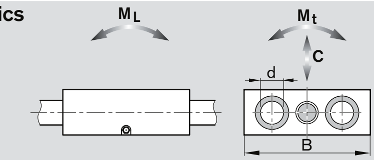




Technical Data

Load Capacities and Moments

Please note the “Calculations” section ➟ page 21!



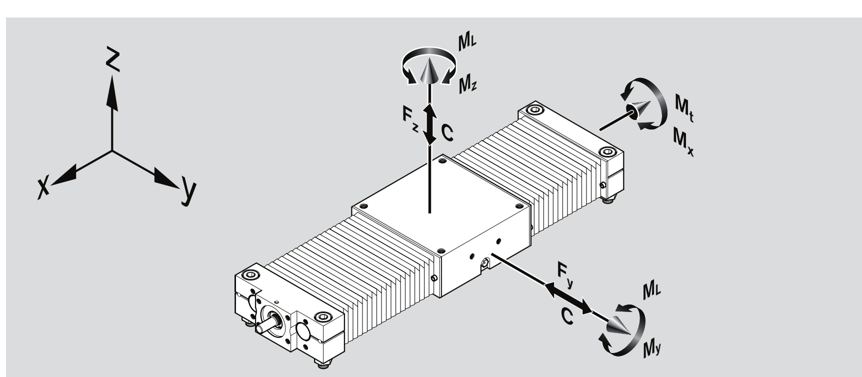
		Ball screw	Dynamic characteristics					Maximum permissible loads		
Type	**Size**	**d_0 x P** (mm)	**C Guideway** (N)	**C_{bs}** (N)	**C_{fb}** (N)	**M_t** (Nm)	**M_L** (Nm)	**F_{ymax}, F_{zmax}** (N)	**M_{xmax}** (Nm)	**M_{ymax}, M_{zmax}** (Nm)
SGK	12-85	8 x 2.5	2 700	2 200	5 280	56	62	840	18	19
	16-100	12 x 5	3 310	3 800	5 280	89	94	1 060	29	30
		12 x 10		2 500						
	20-130	16 x 5	6 560	12 300	13 400	236	249	2 100	76	80
		16 x 10		9 600						
		16 x 16		6 300						
	25-160	20 x 5	12 830	14 300	17 000	564	596	4 360	192	203
		20 x 20		9 100						
		25 x 10		15 700						
	30-180	20 x 5	15 600	14 300	17 000	748	787	5 580	268	282
		20 x 20		9 100						
		25 x 10		15 700						
	40-230	32 x 5	26 770	21 600	26 000	1 633	1 860	8 700	531	605
		32 x 10		31 700						
		32 x 20		19 700						
		32 x 32		19 500						
	50-280	32 x 5	39 180	21 600	26 000	2 977	3 271	12 940	983	1 080
		32 x 10		31 700						
		32 x 20		19 700						
		32 x 32		19 500						
SGO	8-65	–	1 040	–	–	16	17	480	8	8
	12-85	–	2 700	–	–	56	62	840	18	19
	16-100	–	3 310	–	–	89	94	1 060	29	30
	20-130	–	6 560	–	–	236	249	2 100	76	80
	25-160	–	12 830	–	–	564	596	4 360	192	203
	30-180	–	15 600	–	–	748	787	5 580	268	282
	40-230	–	26 770	–	–	1 633	1 860	8 700	531	605
	50-280	–	39 180	–	–	2 977	3 271	12 940	983	1 080

C = dynamic load capacity
C_{bs} = dyn. load rating of the ball screw
C_{fb} = dynamic load rating of the fixed bearing
d_0 = screw diameter
F_{ymax} = max. dynamic load in y-direction
F_{zmax} = max. dynamic load in z-direction
M_L = dynamic longitudinal moment load capacity
M_t = dynamic torsional moment load capacity

Suitable loads (recommended values on the basis of past experience)

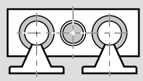
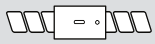
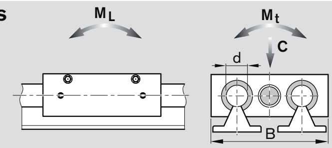
As far as the desired service life is concerned, loads of up to approximately 20% of the dynamic characteristic values (**C**, **M_t**, **M_L**) have proved acceptable. At the same time, the following may not be exceeded:

- the maximum permissible shaft deflection ➟ page 20
- maximum permissible drive torque
- the maximum permissible load
- the permissible travel speed
- the maximum permissible acceleration



Note on dynamic load capacities and moments:

Determination of the dynamic load capacities and moments is based on a travel life of 100 000 m. Often only 50 000 m are actually stipulated.
For comparison: Multiply values C, M_t and M_L by 1.26.

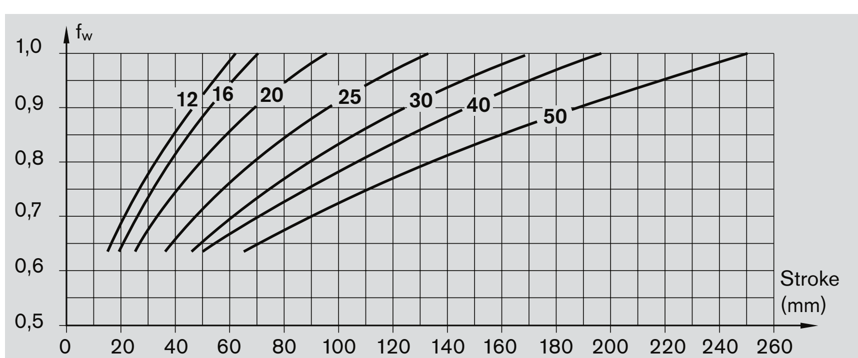
		Ball screw 	Dynamic characteristics 					Maximum permissible loads		
Type	Size	d_0 x P (mm)	C Guideway (N)	C_{bs} (N)	C_{fb} (N)	M_t (Nm)	M_L (Nm)	F_{ymax}, F_{zmax} (N)	M_{xmax} (Nm)	M_{ymax}, M_{zmax} (Nm)
SOK	12-85	8 x 2.5	2 850	2 200	5 280	25	27	1 020	10	11
	16-100	12 x 5	3 440	3 800	5 280	39	41	1 260	16	17
		12 x 10		2 500						
	20-130	16 x 5	6 100	12 300	13 400	134	141	2 140	49	52
		16 x 10		9 600						
		16 x 16		6 300						
	25-160	20 x 5	11 950	14 300	17 000	320	339	4 500	127	134
		20 x 20		9 100						
		25 x 10		15 700						
	30-180	20 x 5	14 520	14 300	17 000	425	447	5 760	177	186
		20 x 20		9 100						
		25 x 10		15 700						
	40-230	32 x 5	24 950	21 600	26 000	928	1 057	8 960	350	399
		32 x 10		31 700						
		32 x 20		19 700						
		32 x 32		19 500						
	50-280	32 x 5	36 380	21 600	26 000	1 687	1 853	13 240	644	708
		32 x 10		31 700						
		32 x 20		19 700						
		32 x 32		19 500						
SOO	8-65	–	–	–	–	–	–	–	–	–
	12-85	–	2 850	–	–	25	27	1 020	10	11
	16-100	–	3 440	–	–	39	41	1 260	16	17
	20-130	–	6 100	–	–	134	141	2 140	49	52
	25-160	–	11 950	–	–	320	339	4 500	127	134
	30-180	–	14 520	–	–	425	447	5 760	177	186
	40-230	–	24 950	–	–	928	1 057	8 960	350	399
	50-280	–	36 380	–	–	1 687	1 853	13 240	644	708

M_{xmax} = maximum permissible torsional moment about the X-axis
M_{ymax} = maximum permissible torsional moment about the Y-axis
M_{zmax} = maximum permissible torsional moment about the Z-axis
P = lead

Reduced load capacity in short-stroke applications

In short-stroke applications, the service life of the shafts is shorter than that of the Super Linear Bushings.

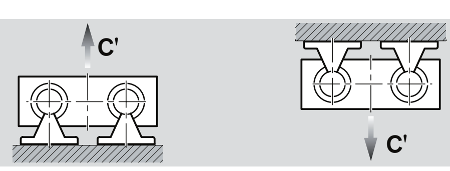
For this reason, the dynamic load capacities and moments given in the tables must be multiplied by the factor f_W.



Reduced load capacity under lift-off loads

The load capacities of the open versions are reduced as follows under lift-off loads:

Sizes 12 and 16 $C' = 0.42 \cdot C$
Sizes 20 to 50 $C' = 0.60 \cdot C$



Technical Data

General Technical Data

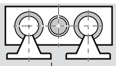
Please note the “Calculations” section ➠ page 21!

Type	Size	Ball screw d_0 x P (mm)	m_{ca} (kg)	m_s (kg)	s_{min} (mm)	L_{max} (mm)	F_R (N)	M_{Rs} (Nm)	a_{max} (m/s²)	v_{max} (m/s)
SGK	12-85	8 x 2.5	0.54	0.0021 · L + 0.92	65	1 000	–	0.06	27	[2]
	16-100	12 x 5	0.80	0.004 · L + 1.4	70	1 500	–	0.13	27	
		12 x 10					–	0.16	27	
	20-130	16 x 5	1.80	0.006 · L + 3.0	95	2 500	–	0.40	27	
		16 x 10					–	0.43	27	
		16 x 16					–	0.46	27	
	25-160	20 x 5	3.30	0.011 · L + 5.5	135	3 000	–	0.53	22	
		20 x 20					–	0.64	27	
		25 x 10					–	0.66	27	
	30-180	20 x 5	4.60	0.014 · L + 7.4	170	3 000	–	0.53	22	
		20 x 20					–	0.64	27	
		25 x 10					–	0.66	27	
	40-230	32 x 5	9.30	0.025 · L + 14.2	190	4 000	–	1.14	8	
		32 x 10					–	1.24	15	
		32 x 20					–	1.23	27	
		32 x 32					–	1.27	27	
	50-280	32 x 5	16.00	0.036 · L + 22.8	250	4 000	–	1.14	8	
		32 x 10					–	1.25	15	
		32 x 20					–	1.25	27	
		32 x 32					–	1.30	27	
SGO	8-65	–	0.28	0.0008 · L + 0.39	50	700	3	–	150[1]	3[3]
	12-85	–	0.55	0.0018 · L + 0.8	65	1 000	7	–		
	16-100	–	0.82	0.003 · L + 1.2	70	1 500	9	–		
	20-130	–	1.80	0.005 · L + 2.6	95	2 500	11	–		
	25-160	–	3.30	0.008 · L + 4.8	135	3 000	14	–		
	30-180	–	4.70	0.011 · L + 6.7	170		18	–		
	40-230	–	9.40	0.020 · L + 13.3	190	4 000	22	–		
	50-280	–	16.40	0.031 · L + 22.1	250		27	–		

a_{max} = maximum acceleration
d_0 = nominal diameter
F_R = friction force
L = length of linear motion system
m_{ca} = moved mass
M_{Rs} = frictional torque of system
m_s = mass of the linear system
P = lead
v_{max} = maximum travel speed
s_{min} = minimum required travel in order to ensure reliable distribution of lubricant ➠ “Operating Conditions” on page 70.

Mass of the Linear Motion Slide:
Weight calculation does not include motor attachment, timing belt side drive and switches.

m_s = weight factor (kg/mm) · length L (mm) + weight of all parts of fixed length (kg)



Type	Size	Ball screw d_0 x P (mm)	m_{ca} (kg)	m_s (kg)	s_{min} (mm)	$L_{max.}$ (mm)	F_R (N)	M_{Rs} (Nm)	a_{max} (m/s^2)	v_{max} (m/s)
SOK	12-85	8 x 2.5	0.47	0.0040 · L + 0.82	65	1 000	–	0.06	27	2)
	16-100	12 x 5	0.76	0.006 · L + 1.3	70	1 500	–	0.13	27	
		12 x 10					–	0.16	27	
	20-130	16 x 5	1.60	0.010 · L + 2.7	95	2 500	–	0.40	27	
		16 x 10					–	0.43	27	
		16 x 16					–	0.46	27	
	25-160	20 x 5	2.90	0.015 · L + 5.0	135	3 000	–	0.53	22	
		20 x 20					–	0.64	27	
		25 x 10					–	0.66	27	
	30-180	20 x 5	4.20	0.020 · L + 6.8	170	3 000	–	0.53	22	
		20 x 20					–	0.64	27	
		25 x 10					–	0.66	27	
	40-230	32 x 5	8.50	0.032 · L + 13.2	190	4 000	–	1.14	8	
		32 x 10					–	1.24	15	
		32 x 20					–	1.23	27	
		32 x 32					–	1.27	27	
	50-280	32 x 5	14.80	0.046 · L + 21.3	250	4 000	–	1.14	8	
		32 x 10					–	1.25	15	
		32 x 20					–	1.25	27	
		32 x 32					–	1.30	27	
SOO	12-85	–	0.47	0.0035 · L + 0.47	65	4 000	7	–	150 1)	3 3)
	16-100	–	0.75	0.005 · L + 0.75	70		9	–		
	20-130	–	1.60	0.008 · L + 1.6	95		11	–		
	25-160	–	2.80	0.011 · L + 2.8	135	5 300	14	–		
	30-180	–	4.10	0.016 · L + 4.1	170		18	–		
	40-230	–	8.30	0.026 · L + 8.3	190		22	–		
	50-280	–	14.80	0.039 · L + 14.8	250		27	–		

1) Linear Motion Slides without drive unit SGO/SOO differ from the SGK/SOK models as they have no ball screw drive acting as a limiting factor for the acceleration.

2) v_{max} ➟ graphs on page 17

3) Travel speeds of up to 5 m/s are possible. Service life is limited by the increased wear on plastic parts.

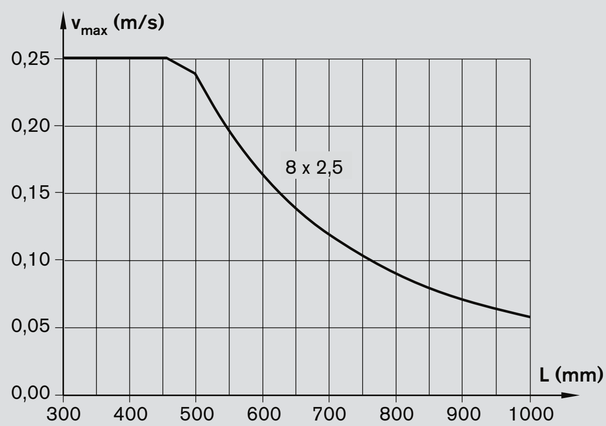
Technical Data

Drive Data

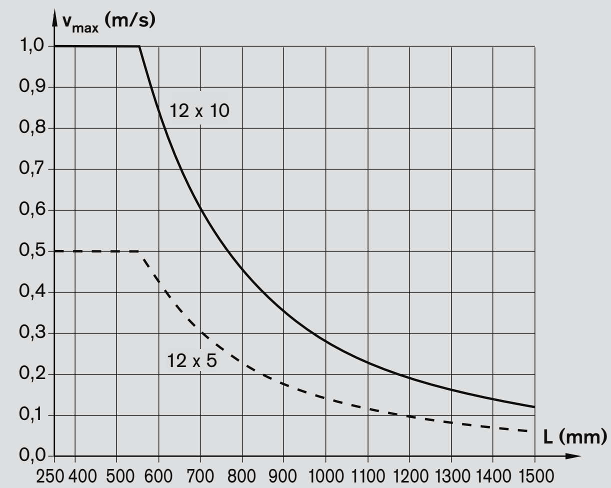
Please note the “Calculations” section ➟ page 21!

Maximum permissible linear speed v_{max}

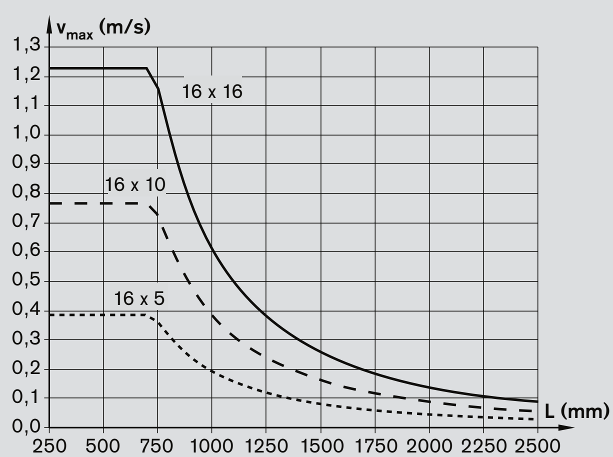
SGK / SOK 12-85



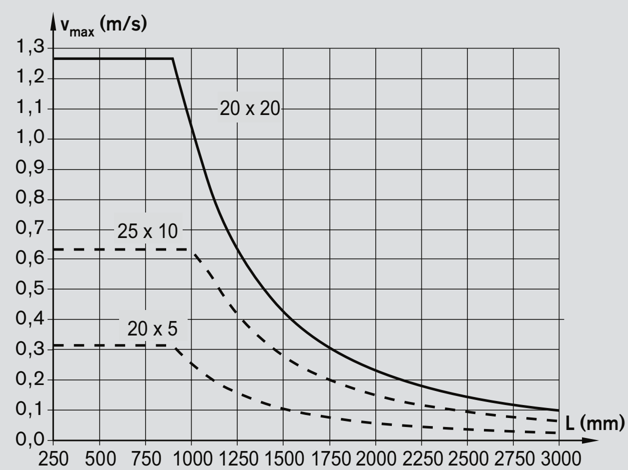
SGK / SOK 16-100



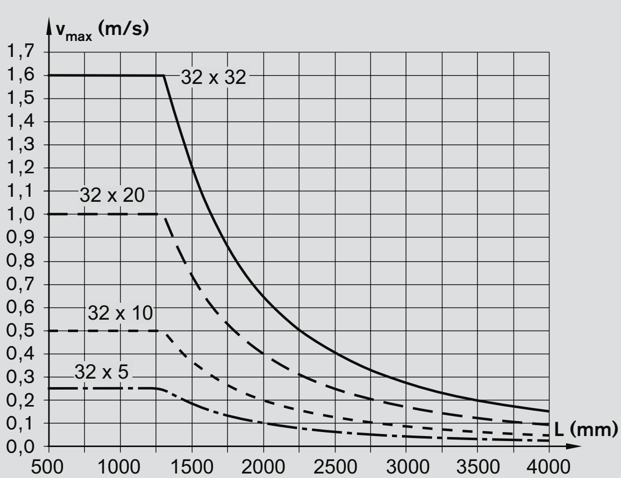
SGK / SOK 20-130



SGK / SOK 25-160/30-180

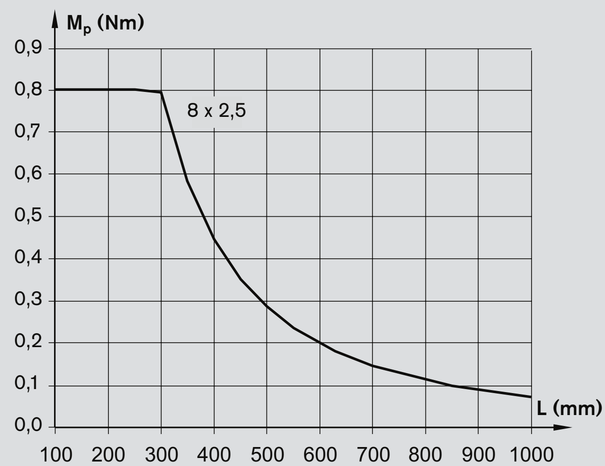


SGK / SOK 40-230/50-280

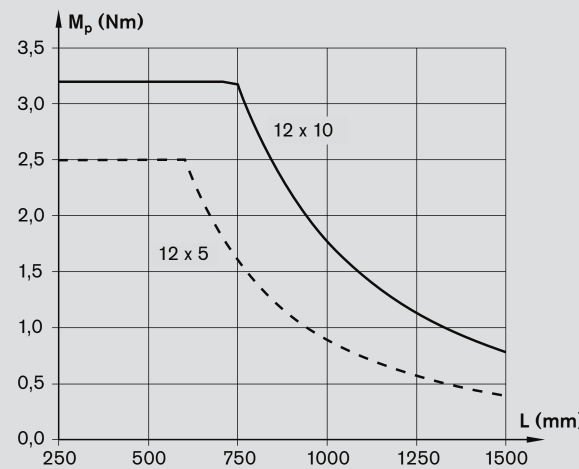


Maximum permissible drive torque at the screw journal M_p
(no radial load on ball screw shaft journal)

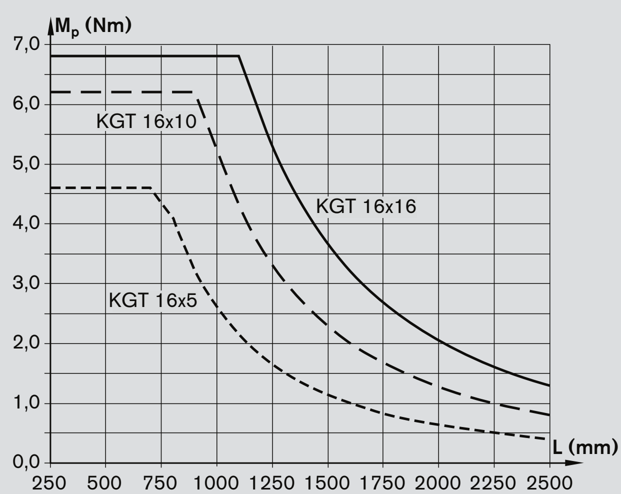
SGK / SOK 12-85



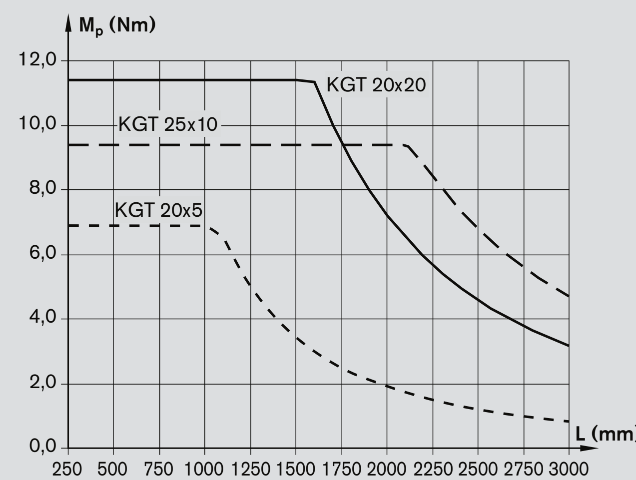
SGK / SOK 16-100



SGK / SOK 20-130[1)]

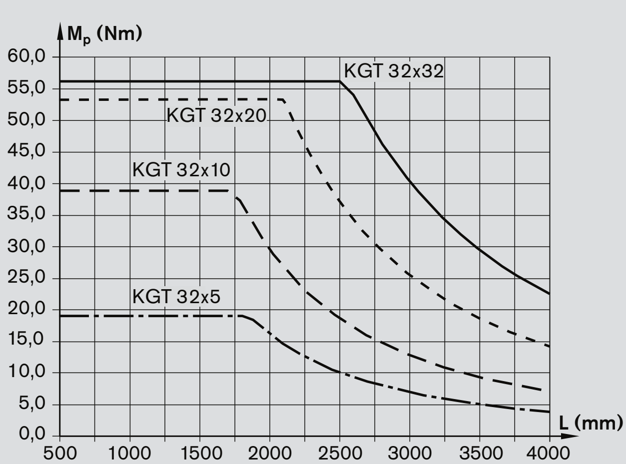


SGK / SOK 25-160/ 30-180[2)]



SGK / SOK 40-230/ 50-280[3)]

KGT = ball screw



Ball screw journal with keyway

For reasons of stress concentration and a reduction of the effective diameter, do not exceed the following maximum values for drive torque!

Size	M_p (Nm)
SGK/SOK 40-230	48.6
SGK/SOK 50-280	

⚠ **If a ball screw with keyway is used, when comparing the chart against the table, the lower of the two values will always apply.**

Example: Linear Motion Slide 40-230, ball screw 32x20, length 1500 mm.
M_p from graph: approx. 53.0 Nm
M_p from table: 48.6 Nm
Value for design calculations: 48.6 Nm

Technical Data

Drive Data

Please note the “Calculations” section ➠ page 21!

Motor attachment via timing belt side drive (on fixed bearing side of the Linear Motion Slide)

	Ball screw	up to L[2]	MSK 040C-0600, MSM 041B-0300							
			M_{sd}[1] (Nm)		J_{sd} (10^{-6} kgm^2)		M_{Rsd} (Nm)	m_{sd} (kg)	F (mm)	B_t
	d_0 x P	(mm)	i = 1	i = 1.5	i = 1	i = 1.5				
SGK/SOK 25-160	20 x 5	1000	6.61	4.41	250	84	0.4	1.5	88	16 AT5
SGK/SOK 30-180	20 x 20	1800	8.22	5.48						
	25 x 10	2200								

	Ball screw	up to L[2]	MSK 060C-0600								
			M_{sd}[1] (Nm)		J_{sd} (10^{-6} kgm^2)		M_{Rsd} (Nm)	m_{sd} (kg)	F (mm)	B_t	
	d_0 x P	(mm)	i = 1	i = 2	i = 1	i = 2				i = 1	i = 2
SGK/SOK 40-230	32 x 5	1800	19.10	9.55	1400	260	0.5	3.8	116	25 AT5	32 AT5
SGK/SOK 50-280	32 x 10	2200	19.21	12.30							
	32 x 20	3000									
	32 x 32	3800									

1) Values for M_{sd} do not take motor torque into account.
2) For longer lengths, the permitted drive torque is determined by the length-dependent value M_p of the linear system as given in the graphs ➠ graphs in “Drive Data” section, page 17.

Motor attachment via motor mount and coupling (on fixed bearing side of the Linear Motion Slide)

The couplings with the specifications shown in the table are used with standard motors.

Linear Motion Slide	Motor type	M_{cN} (Nm)	J_c (10^{-6} kgm^2)	m_{fc} (kg)
SGK/SOK 12-85	MSM 031B-0300	3.7	7	0.3
SGK/SOK 16-100				
SGK/SOK 20-130	MSK 030C-0900	19.0	57	0.5
	MSK 040C-0600			0.6
	MSM 031C-0300			0.5
	MSM 041B-0300			0.7
SGK/SOK 25-160	MSM 041B-0300	19.0	57	0.8
	MSK 040C-0600			
SGK/SOK 30-180	MSM 041B-0300			
	MSK 040C-0600			
SGK/SOK 40-230	MSK 060C-0600	50.0	200	1.7
	MSK 076C-0450	98.0	390	2.2
SGK/SOK 50-280	MSK 060C-0600	50.0	200	1.7
	MSK 076C-0450	98.0	390	2.2

B_t = belt type
i = gear ratio of timing belt side drive
J_c = mass moment of inertia, coupling
J_{sd} = reduced mass moment of inertia of timing belt side drive at motor journal
F = width of belt pulley housing (➠ page 52)
M_{cN} = rated torque of coupling
m_{fc} = mass of motor mount and coupling
M_{Rsd} = frictional torque of timing belt side drive at motor journal
M_{sd} = maximum permissible drive torque of the timing belt side drive
m_{sd} = mass of timing belt side drive

Determination of mass moment of inertia of the linear system components

$$J_s = (k_{j\,fix} + k_{j\,var} \cdot L) \cdot 10^{-6}$$

Determination of translatory mass moment of inertia of the external load

$$J_t = m_{ex} \cdot k_{j\,m} \cdot 10^{-6}$$

J_s	=	mass moment of inertia of system	(kgm^2)
J_t	=	translatory mass moment of inertia of external load	(kgm^2)
$k_{j\,fix}$	=	constant for fixed-length portion of mass moment of inertia	(–)
$k_{j\,var}$	=	constant for variable-length portion of mass moment of inertia	(–)
$k_{j\,m}$	=	constant for mass-specific portion of mass moment of inertia	(–)
L	=	length of the Linear Motion Slide	(mm)
m_{ex}	=	moved external load	(kg)

Constants for the individual sizes
with ball screw drive

Size SGK/SOK	Ball screw d_0 x P	Constant $k_{j\,fix}$	$k_{j\,var}$	$k_{j\,m}$
12-85	8 x 2.5	0.203	0.002	0.158
16-100	12 x 5	1.088	0.013	0.633
	12 x 10	2.367	0.013	2.533
20-130	16 x 5	3.238	0.039	0.633
	16 x 10	6.692	0.039	2.533
	16 x 16	13.878	0.039	6.485
25-160	20 x 5	8.216	0.100	0.633
	20 x 20	39.990	0.100	10.132
	25 x 10	23.575	0.256	2.533
30-180	20 x 5	9.103	0.100	0.633
	20 x 20	54.169	0.100	10.132
	25 x 10	27.120	0.256	2.533
40-230	32 x 5	51.853	0.712	0.633
	32 x 10	69.446	0.712	2.533
	32 x 20	138.210	0.667	10.132
	32 x 32	268.830	0.667	25.938
50-280	32 x 5	56.025	0.712	0.633
	32 x 10	87.214	0.712	2.533
	32 x 20	209.280	0.667	10.132
	32 x 32	468.780	0.667	25.938

Technical Data

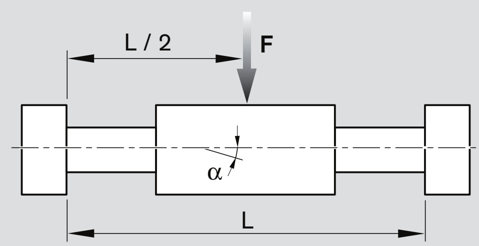
Deflection

The maximum permissible deflection of the Linear Motion Slides in the closed version SGK (with drive unit) and SGO (without drive unit) is determined according to the permissible shaft inclination for the linear bushings installed in the carriage.

Permissible shaft inclination in the linear bushing

Due to the use of Super Linear Bushings (except in size 8-65), the permissible shaft inclination in the linear bushing is greater than with conventional linear bushings. When selecting the length **L** and the size, be sure to consider the permissible shaft inclination in the linear bushing.

$\tan\alpha \leq \tan\alpha_{max}$



Permissible shaft inclination in the linear bushing in the individual sizes for the closed-type construction form

$$\tan\alpha \leq \tan\alpha_{max}$$

F	=	load	(N)
$\tan\alpha$	=	shaft inclination	(–)
$\tan\alpha_{max}$	=	max. permissible shaft inclination	(–)

Linear Motion Slide	$\tan\alpha =$	$\tan\alpha_{max} =$
SGO 8-65	$F \cdot (L - 9) \cdot 4.970 \cdot 10^{-8}$	$10 \cdot 10^{-4}$
SGO 12-85	$F \cdot (L - 18) \cdot 1.376 \cdot 10^{-8}$	$8.72 \cdot 10^{-3}$
SGO 16-100	$F \cdot (L - 21) \cdot 5.381 \cdot 10^{-9}$	$8.72 \cdot 10^{-3}$
SGO 20-130	$F \cdot (L - 36) \cdot 2.932 \cdot 10^{-9}$	$8.72 \cdot 10^{-3}$
SGO 25-160	$F \cdot (L - 43) \cdot 1.468 \cdot 10^{-9}$	$8.72 \cdot 10^{-3}$
SGO 30-180	$F \cdot (L - 51) \cdot 7.698 \cdot 10^{-10}$	$8.72 \cdot 10^{-3}$
SGO 40-230	$F \cdot (L - 79) \cdot 3.407 \cdot 10^{-10}$	$8.72 \cdot 10^{-3}$
SGO 50-280	$F \cdot (L - 107) \cdot 1.649 \cdot 10^{-10}$	$8.72 \cdot 10^{-3}$

Mass of the Linear Motion Slide:
Weight calculation does not include motor attachment, timing belt side drive and switches.

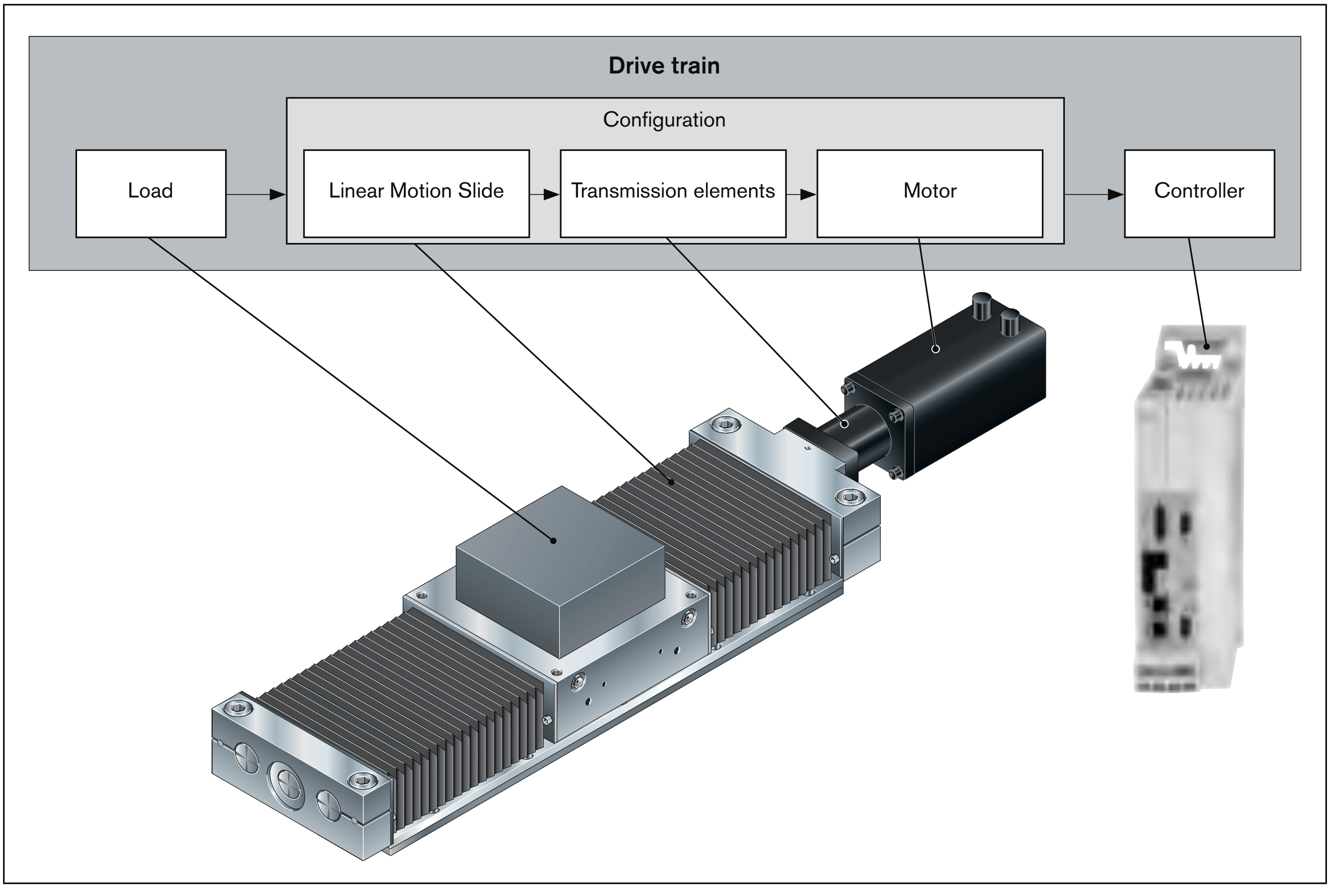
$$m_s = \text{weight factor (kg/mm)} \cdot \text{length L (mm)} + \text{weight of all parts of fixed length (kg)}$$

L	=	length	(mm)
m_s	=	mass of the linear system	(kg)

Calculations

Calculation Principles

Drive train



The correct dimensioning and assessment of an application requires structured consideration of the drive train as a whole. The basic element of the drive train is the configuration – made up of the linear system, the transmission element (coupling or timing belt side drive) and the motor – which can be ordered in that constellation in the catalog.

Maximum permissible loads

When selecting linear systems, it is essential to consider the upper limits for permissible loads and forces, as specified in the section “Technical Data” on page 12. The values given there are system-related. In other words, the upper limits are determined not only by the load ratings of the bearing points but also include structural design and material-related considerations.

Calculations

Calculation Principles

Service life

The service life of the rolling bearing points contained in a linear system can be calculated using the formulas given below. In a linear system with ball screw drive, the rolling bearing points that are relevant for the service life are the linear guide, the ball screw drive (ball nut), and the fixed bearing.

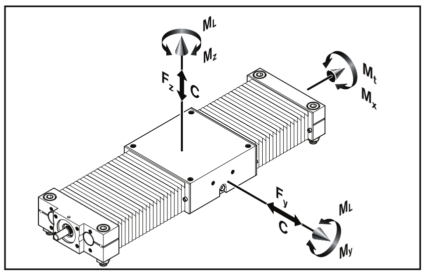
⚠ **The value to be indicated for the calculated service life of linear system is determined by the lowest of the separately calculated service life values for the linear guide, the ball screw drive or the fixed bearing.**

Service life of the linear guide

The linear guide of a linear system must bear the load and any processing forces.

Combined equivalent load on bearing of the linear guide

$$F_{comb} = |F_y| + |F_z| + C \cdot \frac{|M_x|}{M_t} + C \cdot \frac{|M_y|}{M_L} + C \cdot \frac{|M_z|}{M_L}$$



Nominal life

Nominal life in meters

$$L_{10} = \left(\frac{C}{F_{comb}}\right)^3 \cdot 10^5$$

Nominal life in hours

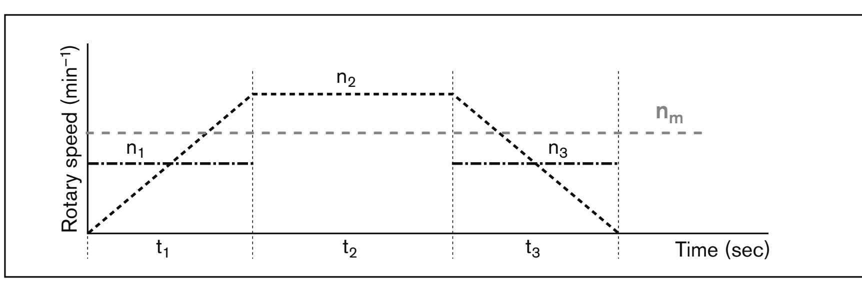
$$L_{10h} = \frac{L_{10}}{3600 \cdot v_m}$$

- C = dynamic load capacity (N)
- F_{comb} = combined equivalent load on bearing (N)
- F_y = load due to a resulting force in the y-direction (N)
- F_z = load due to a resulting force in the z-direction (N)
- L_{10} = nominal life (m)
- L_{10h} = nominal life (h)
- M_L = dynamic longitudinal moment load (Nm)
- M_t = dynamic torsional moment load (Nm)
- M_x = dynamic torsional moment about the X-axis (Nm)
- M_y = dynamic torsional moment about the Y-axis (Nm)
- M_z = dynamic torsional moment about the Z-axis (Nm)
- v_m = average travel speed (m/s)

Service life of ball screw or the fixed bearing

Where the rotary speed and load fluctuate, the service life must be calculated using the averages $\mathbf{F_m}$ and $\mathbf{n_m}$.

Where the rotary speed fluctuates, the average speed $\mathbf{n_m}$ is calculated as follows:



$$n_m = \frac{|n_1| \cdot t_1 + |n_2| \cdot t_2 + \ldots + |n_n| \cdot t_n}{t_{tot}}$$

$$t_{tot} = t_1 + t_2 + \ldots + t_n$$

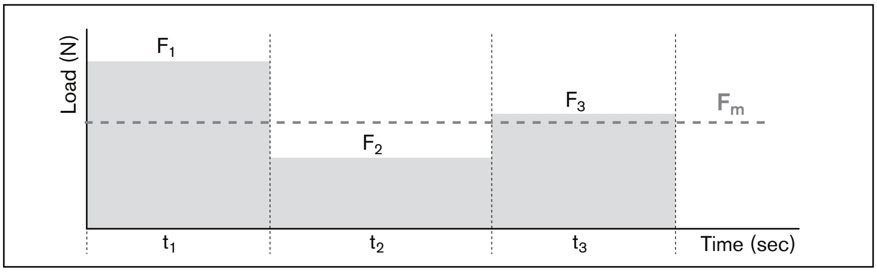
- $n_1, n_2, \ldots n_n$ = rotary speed in phases 1 … n (min^{-1})
- n_m = average speed (min^{-1})
- $t_1, t_2, \ldots t_n$ = discrete time step in phases 1 … n (sec)
- t_{tot} = sum of the discrete time steps (sec)

Rotary speed in acceleration and braking phases $\mathbf{n_{1 \ldots n}}$:

$$n_{1 \ldots n} = \frac{n_{A1 \ldots n} + n_{E1 \ldots n}}{2}$$

- n_1 = rotary speed in acceleration and braking phases
- $n_{A1 \ldots n}$ = speed at start in phase 1 … n (min^{-1})
- $n_{E1 \ldots n}$ = speed at finish in phase 1 … n (min^{-1})

Where both the load and the speed fluctuate, the average load $\mathbf{F_m}$ is calculated as follows:



$$F_m = \sqrt[3]{\left|F_1\right|^3 \cdot \frac{|n_1|}{n_m} \cdot \frac{t_1}{t_{tot}} + \left|F_2\right|^3 \cdot \frac{|n_2|}{n_m} \cdot \frac{t_2}{t_{tot}} + \ldots + \left|F_n\right|^3 \cdot \frac{|n_n|}{n_m} \cdot \frac{t_n}{t_{tot}}}$$

$F_1, F_2, \ldots F_n$	=	axial load during phases 1 ... n	(N)
F_m	=	equivalent dynamic axial load	(N)
$n_1, n_2, \ldots n_n$	=	rotary speed in phases 1 … n	(min^{-1})
n_m	=	average rotary speed	(min^{-1})
$t_1, t_2, \ldots t_n$	=	discrete time step in phases 1 ... n	(sec)
t_{tot}	=	sum of the discrete time steps	(sec)

Life expectancy

Service life in revolutions:

$$L_{10} = \left(\frac{C}{F_m}\right)^3 \cdot 10^6$$

Service life in hours:

$$L_{10h} = \frac{L_{10}}{n_m \cdot 60}$$

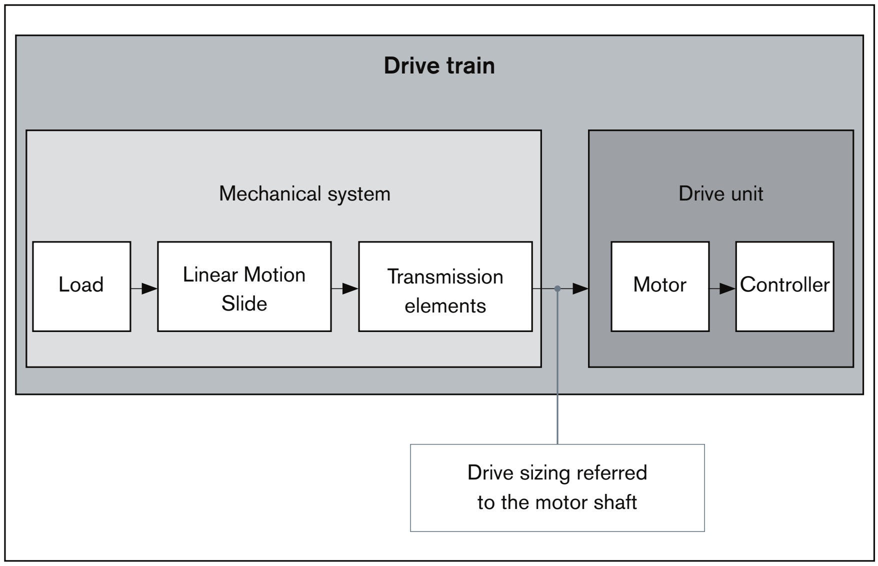
C	=	dynamic load rating	(N)
F_m	=	equivalent dynamic axial load	(N)
L_{10}	=	service life	(–)
L_{10h}	=	service life	(h)
n_m	=	average rotary speed	(min^{-1})

Calculations

Sizing the Drive Unit

Basic principles

When calculating the required size of drive, the drive train can be subdivided into the mechanical system and the drive itself.
The **mechanical system** includes the physical components – linear system and the transmission elements (timing belt side drive, coupling) – and the load to be carried.
The electric **drive** is a motor-controller combination with the appropriate performance data. The sizing or dimensioning of the electric drive is done taking the motor shaft as a reference point.
When sizing the drive, limit values must be taken into account as well as basic values. The limit (i.e. maximum) values must not be exceeded, in order to avoid damaging the mechanical components.



Technical data and symbols for the mechanical system

For each component (linear system, coupling, timing belt side drive), the relevant maximum permissible values must be identified for the drive torque and travel speed, as well as the basic values for frictional torque and mass moment of inertia ➠ “Drive Data” on page 18.
The following technical data with the associated symbols are used when considering the basic **mechanical system** requirements in the design calculations for sizing the drive. The data listed in the table below can be found in the “Technical Data” section or they are determined using the formulas described on the following pages.

		Mechanical system			
		Load	Linear system	Transmission elements	
				Coupling	Timing belt side drive
Weight moment	(Nm)	M_g 6)	–	–	–
Frictional torque	(Nm)	– 5)	M_{Rs} 3)	–	M_{Rsd} 3)
Mass moment of inertia	(kgm²)	J_t 1)	J_s 2)	J_c 3)	J_{sd} 3)
Max. permissible linear speed	(m/s)	–	v_{max} 4)	–	–
Max. permissible drive torque	(Nm)	–	M_p 4)	M_{cN} 3)	M_{sd} 3)

1) Determine the value using the appropriate formula
2) Length-dependent value, determined using the appropriate formula
3) Value as per table
4) Length-dependent value, to be read off from the graph
5) Any additional process forces are to be taken into consideration as load moments
6) For vertical mounting orientation: determine the value using the appropriate formula

Drive sizing referred to the motor shaft

For drive sizing, all the relevant design calculation values for the mechanical components contained in the drive train must be determined as they relate to – and be expressed in terms of or reduced to – the motor shaft. For a combination of mechanical components within the drive train, this will result in one value for each of the following:

- Frictional torque M_R
- Mass moment of inertia J_{ex}
- Max. permissible linear speed v_{mech} (max. permissible rotary speed n_{mech})
- Max. permissible drive torque M_{mech}

Determination of the values for the individual mechanical components in the drive train, referred to the motor shaft

Frictional torque M_R

For motor attachment via motor mount and coupling

$$M_R = M_{Rs}$$

For motor attachment via timing belt side drive

$$M_R = M_{Rsd} + \frac{M_{Rs}}{i}$$

Mass moment of inertia J_{ex}

For motor attachment via motor mount and coupling

$$J_{ex} = J_s + J_t + J_c$$

For motor attachment via timing belt side drive

$$J_{ex} = J_{sd} + \frac{(J_s + J_t)}{i^2}$$

Determination of mass moment of inertia of the linear system components

$$J_s = (k_{j\ fix} + k_{j\ var} \cdot L) \cdot 10^{-6}$$

Determination of translatory mass moment of inertia of the external load

$$J_t = m_{ex} \cdot k_{j\ m} \cdot 10^{-6}$$

i	=	gear ratio of timing belt side drive	(–)
J_c	=	mass moment of inertia, coupling	(kgm^2)
J_{ex}	=	mass moment of inertia of mechanical system	(kgm^2)
J_s	=	mass moment of inertia of the linear system	(kgm^2)
J_{sd}	=	mass moment of inertia of timing belt side drive at motor journal	(kgm^2)
J_t	=	translatory mass moment of inertia of external load referred to the linear system screw journal	(kgm^2)
$k_{j\ fix}$	=	constant for fixed-length portion of mass moment of inertia	(–)
$k_{j\ m}$	=	constant for mass-specific portion of mass moment of inertia	(–)
$k_{j\ var}$	=	constant for variable-length portion of mass moment of inertia	(–)
L	=	length of linear system	(mm)
m_{ex}	=	moved external load	(kg)
M_R	=	frictional torque at motor journal	(Nm)
M_{Rs}	=	frictional torque of system	(Nm)
M_{Rsd}	=	frictional torque of timing belt side drive at motor journal	(Nm)

Calculations

Sizing the Drive Unit

Maximum permissible linear speed v_{mech}

The lowest of all the values for max. permissible linear speed of all mechanical components contained in the drive train determines the maximum permissible linear speed of the mechanical system which has to be taken into consideration as the upper limit for the drive when sizing the motor. Because it is a system in itself, a linear system with ball screw drive will always have a maximum permissible linear or rotary speed that is lower than the maximum values for the other components in the mechanical system, such as coupling or timing belt side drive, and therefore determines the max. permissible linear speed of the overall mechanical system.

Maximum permissible linear speed

$$v_{mech} = v_{max}$$

Maximum permissible rotary speed

For motor attachment via motor mount and coupling

$$n_{mech} = \frac{v_{mech} \cdot 1000 \cdot 60}{P}$$

For motor attachment via timing belt side drive

$$n_{mech} = \frac{v_{mech} \cdot i \cdot 1000 \cdot 60}{P}$$

i = gear ratio of timing belt side drive (–)
n_{mech} = maximum permissible rotary speed of mechanical system (min^{-1})
P = screw lead (mm)
v_{max} = maximum permissible linear speed of linear system (m/s)
v_{mech} = maximum permissible linear speed of mechanical system (m/s)

Max. permissible drive torque M_{mech}

The lowest (minimum) of all the values for permissible drive torque of all mechanical components contained in the drive train determines the maximum permissible drive torque of the mechanical system which has to be taken into consideration as the upper limit for the drive when sizing the motor.

For motor attachment via motor mount and coupling

$$M_{mech} = \text{minimum } (M_{cN}; M_p)$$

For motor attachment via timing belt side drive

$$M_{mech} = \text{minimum } \left(M_{sd} ; \frac{M_p}{i}\right)$$

i = gear ratio of timing belt side drive (–)
M_p = maximum permissible drive torque of the linear system (Nm)
M_{cN} = rated torque of coupling (Nm)
M_{sd} = maximum permissible drive torque of the timing belt side drive (Nm)
M_{mech} = maximum permissible drive torque for mechanical system (Nm)

⚠ **When considering the complete drive train (mechanical system + motor/controller), the maximum torque of the motor can lie below the maximum value for the mechanical system (M_{mech}) and thus limit the maximum permissible drive torque of the overall drive train.**
If the maximum torque of the motor lies above the upper limit for the mechanical system (M_{mech}), the maximum motor torque must be limited to the permitted value for the mechanical system.

Rough guide for motor selection

The following conditions can be used as a rough guide for preselecting the motor.

Condition 1:

The speed of the motor must be the same as or higher than the speed required for the mechanical system (but not exceeding the maximum permissible value).

$$n_{max} \geq n_{mech}$$

n_{max} = maximum speed of the motor (min^{-1})
n_{mech} = maximum permissible rotary speed of mechanical system (min^{-1})

Condition 2:

Consideration of the ratio of mass moments of inertia of the mechanical system and the motor. The ratio of the mass moments of inertia serves as an indicator for the control performance of a motor-controller combination. The mass moment of inertia of the motor is directly related to the motor size.

Mass moment of inertia ratio:

$$V = \frac{J_{ex}}{J_m + J_{br}}$$

For preselection, experience has shown that the following ratios will result in high control performance.
These are not rigid limits, but values exceeding them will require closer consideration of the specific application.

Application area	V
Handling	≤ 6.0
Processing	≤ 1.5

J_{br} = mass moment of inertia of the motor brake (kgm^2)
J_{ex} = mass moment of inertia of mechanical system (kgm^2)
J_m = mass moment of inertia, motor (kgm^2)
V = ratio of mass moments of inertia of drive train and motor (–)

Calculations

Sizing the Drive Unit

Condition 3:
Estimation of the ratio of the static load moment to the continuous torque of the motor. The torque ratio must be smaller than or equal to the empirical value of 0.6. By looking at the required motor torque levels, this estimation roughly covers the dynamic characteristics which still have be determined by plotting an exact motion profile.

Torque ratio:

$$\frac{M_{stat}}{M_0} \leq 0.6$$

Static load moment:

$$M_{stat} = M_R + M_g$$

Weight moment:
For vertical mounting orientation only!
For motor attachment via motor mount and coupling: i = 1

$$M_g = \frac{P \cdot (m_{ex} + m_{ca}) \cdot g}{2000 \cdot \pi \cdot i}$$

g	=	gravitational acceleration (= 9.81)	(m/s^2)
i	=	gear ratio of timing belt side drive	(–)
m_{ca}	=	moved mass of carriage	(kg)
m_{ex}	=	moved external load	(kg)
M_g	=	weight moment at motor journal	(Nm)
M_0	=	continuous motor torque	(Nm)
M_R	=	frictional torque at motor journal	(Nm)
M_{stat}	=	static longitudinal moment load	(Nm)
P	=	screw lead	(mm)
π	=	pi	(–)

In the section ➟ “Components and Ordering” users can put together standard configurations, including motor attachment and motor, for the various linear system sizes by selecting the appropriate options. By checking the above conditions it is possible to see whether a standard motor selected in a particular configuration will generally be of a suitable size for the specific application.

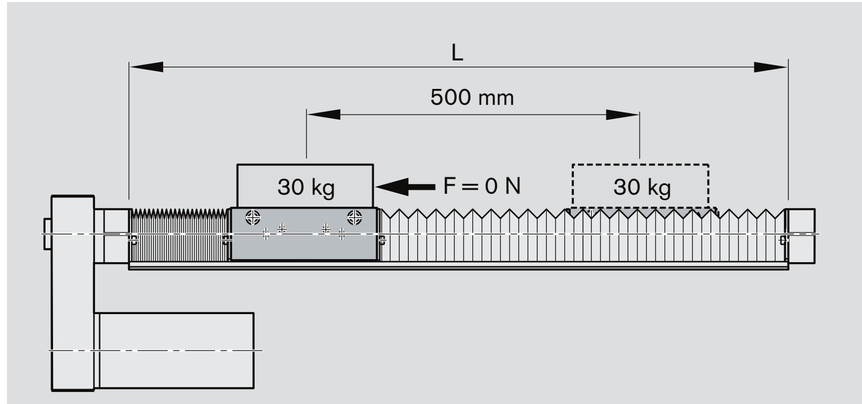
Precise sizing of the drive unit
Preselecting the motor according to this rough guide is no substitute for the required precise design calculations for the drive, taking all moments/torques and speed levels into account. For precise calculation of the electric drive, including consideration of the specific motion profile, please refer to the performance data in the catalogs “IndraDrive Cs” and “IndraDrive C”.
When sizing the drive, the maximum permitted values for linear speed, drive torque and acceleration must not be exceeded, in order to avoid damaging the mechanical system.

Calculation Example for Sizing the Drive Unit

Given data:

In a handling task, a mass of 30 kg is to be moved horizontally by 500 mm at a travel speed of 0.4 m/s. The following was selected based on the technical data and the installation space:

Linear Motion Slide SOK 25-160:
- open-type design
- with protective bellows
- motor attachment via timing belt side drive, i = 1.5
- with IndraDyn S servo motor MSK 040C with brake



Estimation of the slide length L:

(For a first estimation, the largest possible lead and therefore length is assumed, since the permitted linear speed can decrease with increasing length.)
For length formula, see Dimension Tables.

	L	=	$s_{max} \cdot 1.24 + L_{ca} + 39$
Excess travel (per side):	s_e	=	$2 \cdot P = 2 \cdot 20 = 40$ mm
Max. travel:	s_{max}	=	$s_{eff} + 2 \cdot s_e$
		=	$500 + 2 \cdot 40 = 580$ mm
Slide length:	L	=	$580 \cdot 1.24 + 160 + 39 = 919$ mm

Selection of ball screw

(Always choose the lowest lead as this is favorable in terms of resolution, braking distance, length.)

Permitted ball screw assemblies from “Permissible speed” chart for v = 0.4 m/s and L = 919 mm:

Ball screw 25 x 10 and ball screw 20 x 20

Ball screw selected (lower lead):

Ball screw 25 x 10

Maximum permissible linear speed for ball screw 25 x 10 as read off from chart:

$v_{max} = 0.63$ m/s

Calculation of the slide length L:

(for selected ball screw)

Excess travel (per side):	s_e	=	$2 \cdot P = 2 \cdot 10 = 20$ mm
Max. travel:	s_{max}	=	$s_{eff} + 2 \cdot s_e$
		=	$500 + 2 \cdot 20 = 540$ mm
Slide length:	L	=	$540 \cdot 1.24 + 160 + 39 = 869$ mm

Friction moment M_R:

(motor attachment via timing belt side drive)

	M_R	=	$M_{Rsd} + \frac{M_{Rs}}{i}$
Linear Motion Slide:	M_{Rs}	=	0.66 Nm
Timing belt side drive:	M_{Rsd}	=	0.4 Nm
Frictional torque:	M_R	=	$0.4 + \frac{0,66}{1.5} = 0.84$ Nm

Calculations

Calculation Example for Sizing the Drive Unit

Mass moment of inertia J_{ex}:
(motor attachment via timing belt side drive)

$$J_{ex} = J_{sd} + \frac{(J_s + J_t)}{i^2}$$

Timing belt side drive: $J_{sd} = 84 \cdot 10^{-6}\ \text{kgm}^2$

Linear Motion Slide: $J_s = (k_{J\ fix} + k_{J\ var} \cdot L) \cdot 10^{-6}$

$= (23.575 + 0.256 \cdot 869) \cdot 10^{-6}$

$= 246.039 \cdot 10^{-6}\ \text{kgm}^2$

External load: $J_t = m_{ex} \cdot k_{J\ m} \cdot 10^{-6}$

$= 30 \cdot 2.533 \cdot 10^{-6}$

$= 75.99 \cdot 10^{-6}\ \text{kgm}^2$

Mass moment of inertia: $J_{ex} = 84 \cdot 10^{-6} + \dfrac{(246.039 \cdot 10^{-6} + 75.99 \cdot 10^{-6})}{1.5^2}$

$= 227.124 \cdot 10^{-6}\ \text{kgm}^2$

Maximum permissible rotary speed n_{mech}:
(motor attachment via timing belt side drive)
Limit for mechanical system

$$n_{mech} = \frac{(v_{mech} \cdot i \cdot 1000 \cdot 60)}{P}$$

Max. permissible linear speed: $v_{mech} = v_{max} = 0.63\ \text{m/s}$

Max. permissible rotary speed: $n_{mech} = \dfrac{(0.63 \cdot 1.5 \cdot 1000 \cdot 60)}{10}$

$= 5670\ \text{min}^{-1}$

Rotary speed of application n_{mech}:
(motor attachment via timing belt side drive)

Travel speed: $v_{mech} = 0.4\ \text{m/s}$

Rotary speed: $n_{mech} = \dfrac{0.4 \cdot 1.5 \cdot 1000 \cdot 60}{10}$

$= 3600\ \text{min}^{-1}$

Maximum permissible drive torque M_{mech}:

(motor attachment via timing belt side drive)
Limit for mechanical system

$M_{mech} = \text{minimum}\left(M_{sd}, \frac{M_p}{i}\right)$

Timing belt side drive: $M_{sd} = 4.41$ Nm (gear ratio $i = 1.5$ and MSK 040C)

Linear Motion Slide: $M_p = 9.4$ Nm

Drive torque: $M_{mech} = \text{minimum}\left(4.41; \frac{9.4}{1.5}\right)$

$= \text{minimum}\ (4.41; 6.26)$

$= 4.41$ Nm

Checking the motor preselection:

Selected motor: MSK 040C with brake

Condition 1:

Rotary speed: $n_{max} \geq n_{mech}$

$7500 \geq 3600$ Condition met – motor size OK.

Condition 2:

Mass moment of inertia ratio: $V = \frac{J_{ex}}{J_m + J_{br}}$

Motor moment of inertia: $J_m = 140 \cdot 10^{-6}\ \text{kgm}^2$

Brake moment of inertia: $J_{br} = 23 \cdot 10^{-6}\ \text{kgm}^2$

Mass moment of inertia ratio: $V = \frac{227.124 \cdot 10^{-6}}{(140 \cdot 10^{-6} + 23 \cdot 10^{-6})}$

$= 1.393$

Condition for handling: $V \leq 6$

$1.393 \leq 6$ Condition met – motor size OK.

Condition 3:

Torque ratio: $\frac{M_{stat}}{M_0} \leq 0.6$

Static load moment: $M_{stat} = M_R + M_g$ (horizontal mounting orientation $M_g = 0$)

$= 0.84$ Nm

Continuous motor torque: $M_0 = 2.7$ Nm

Torque ratio: $\frac{0.84}{2.7} = 0.31$

$0.31 \leq 0.6$ Condition met – motor size OK.

Calculation Example for Sizing the Drive Unit

Result:

Linear Motion Slide SOK 25-160

Length	L =	869 mm,
Max. travel	s_{max} =	540 mm
Carriage length	L_{ca} =	160 mm
Ball screw:	Diameter d_0:	25 mm
	Lead P:	10 mm

With protective bellows
Motor attachment via timing belt side drive, gear ratio i = 1.5
Preselected motor: MSK 040C with brake

For precise sizing of the electric drive, the motor-controller combination must always be considered, as the performance data (e.g. maximum useful speed and maximum torque) will depend on the controller used.

When doing this, the following data must be considered.

Frictional torque	M_R	= 0.84 Nm
Mass moment of inertia	J_{ex}	= $227.124 \cdot 10^{-6}$ kgm^2
Travel speed	v_{mech}	= 0.4 m/s ($n_{mech} = 3600$ min^{-1})
Limit for drive torque	M_{mech}	= 4.41 Nm

➠ The motor torque must be limited to 4.41 Nm on the drive side!

Limit for acceleration	a_{max}	= 27 m/s^2
Limit for travel speed	v_{max}	= 0.63 m/s ($n_{mech} = 5670$ min^{-1})

Besides the preferred type MSK 040C, other motors with identical connection dimensions can be adapted while taking care not to exceed the calculated limits.

Linear Motion Slide with Ball Screw Drive

Product Description

Characteristics

- Particularly smooth running and long service life thanks to Rexroth Super Linear Bushings
- High travel speed thanks to large leads
- Low-cost maintenance provided by one-point lubrication (grease) on either side of the guide system
- Ready-to-install Linear Motion Slides in any length up to L_{max}
- Oil- and moisture-resistant PU bellows-type protective cover (fixed by mechanical clamping of the last folds)

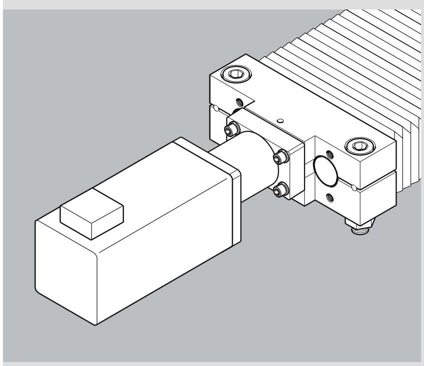
Further highlights

- Rexroth Precision Ball Screw Assembly in rolled quality, tolerance grade T7 as per DIN 69051, with zero-backlash cylindrical single nut
- Simple motor attachment due to locating feature and tapped mounting hole
- Greater flexibility due to options
- Extensive range of accessories

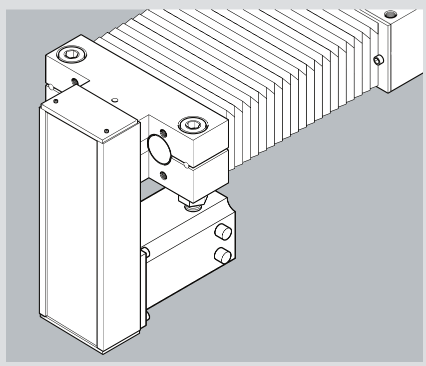
Add-on parts

- Motor with control units
- Switches (proximity and mechanical)
- Socket and plug
- Aluminum profile cable duct

Choice of motor attachment methods

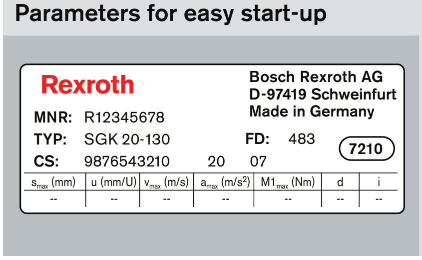


Motor attachment with motor mount and coupling

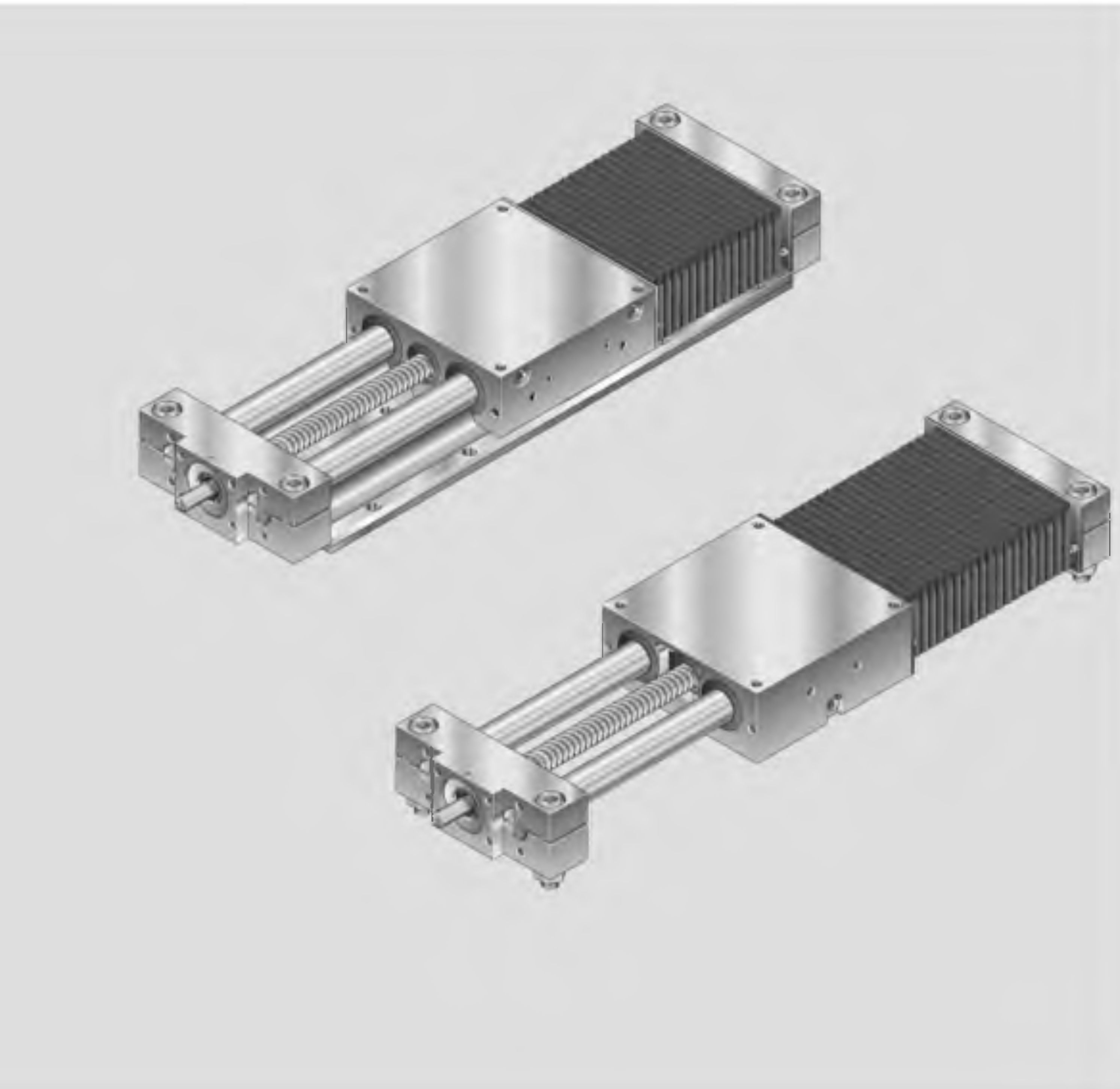


Motor attachment via timing belt side drive

Parameters for easy start-up

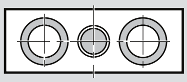
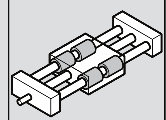
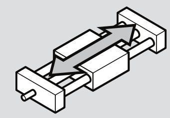
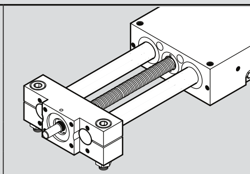
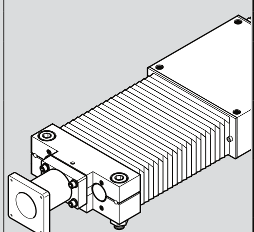


On the nameplate you will find technical data for start-up. With these parameters and the EasyWizard assistant from Bosch Rexroth, starting up the drives of linear systems becomes easier, faster and more effective than ever before.



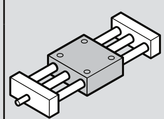
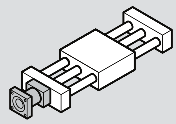
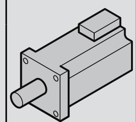
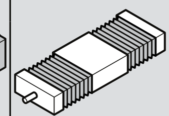
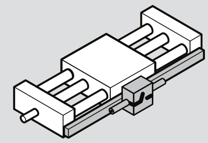
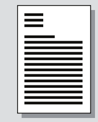
Linear Motion Slide with Ball Screw Drive

SGK 12-85 to SGK 20-130 Components and Ordering Data

					Guide 	Drive unit 						
		Slide	Part number, length[1] R0261 .00 00, ... mm	Type	Standard shafts	Screw journal	Ball screw d_0 x P 8 x 2.5	12 x 5	12 x 10	16 x 5	16 x 10	16 x 16
With ball screw, w/o motor mount		SGK 12-85	R0261 000 00	OF01	01	Ø6	01					
		SGK 16-100	R0261 100 00		01	Ø6		01	02			
		SGK 20-130	R0261 200 00		01	Ø9				01	02	03
						Ø9[2]				04	05	06
With ball screw and motor mount		SGK 12-85	R0261 000 00	MF01	01	Ø6	01					
		SGK 16-100	R0261 100 00		01	Ø6		01	02			
		SGK 20-130	R0261 200 00		01	Ø9				01	02	03

d_0 = screw diameter (mm)
P = screw lead (mm)
i = transmission ratio

For explanations of the ordering parameters and an order example ➠ "Inquiry/Order" on page 76

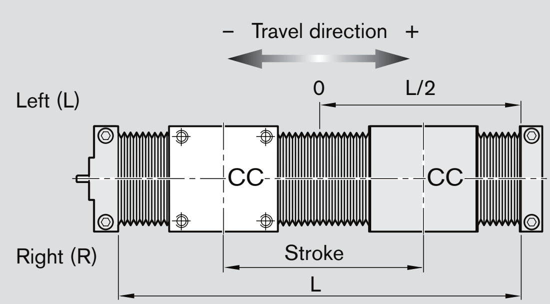
	Carriage	Motor attachment			Motor		Cover		Switches / Cable duct / Socket-plug	Documentation	
											
	Standard	i =	Attachment kit[3]	for motor	Brake without	Brake with	PU bellows without	PU bellows with		Standard report	Measurement report[6]
	01	–	00		00		00	01	**Without switches** **Without cable duct** 00 **Without socket and plug** **Switches:** – PNP NC 11 – PNP NO 13 – Mechanical 15 **Ordering data:** Switch type **Cable duct[5]** 20 **Socket-plug** 17 **Switching cam and profiled support for switches** 16	01	02
	01	–	00		00						
	01	–	00		00						
	01	–	03	MSM 031B	106[4]	107[4]					
	01	–	03	MSM 031B	106[4]	107[4]					
	01	–	01	MSK 040C	86[4]	87[4]					03
			04	MSK 030C	84[4]	85[4]					
			05	MSM 031C	108[4]	109[4]					
			06	MSM 041B	110[4]	111[4]					

1) Length calculation ➠ Dimensions tables.
2) With keyway
3) Attachment kit also available without motor. When ordering, enter “00” for motor!
4) Recommended motor. Motor data and type designations ➠ “Motors” on page 66.
5) The length of the delivered cable duct is the same as that of the profiled support. If a different length is required, please order the cable duct as a separate part (➠ “Ordering the switches and accessories” on page 62).
6) “02” = Moment of friction measurement; “03” = Lead deviation: ➠ “Documentation” on page 73.

Determining the switch activation point
The switch activation point is determined by the mounting side, the direction of travel and the switching distance (see table above and ordering example).
Mounting side: Switches may be mounted on the left (L) or right (R) side of the slide.
Direction of travel: Switches may be mounted on the minus (-) or plus (+) side of zero.

Switching distance: The switching distance is the distance between the carriage center (CC) and the zero point (0) when a switch is activated (given in mm).
Refer to the section “Switch mounting arrangements” for more information on switch mounting, switch types, and fixing the mounting duct.

Switch mounting side:

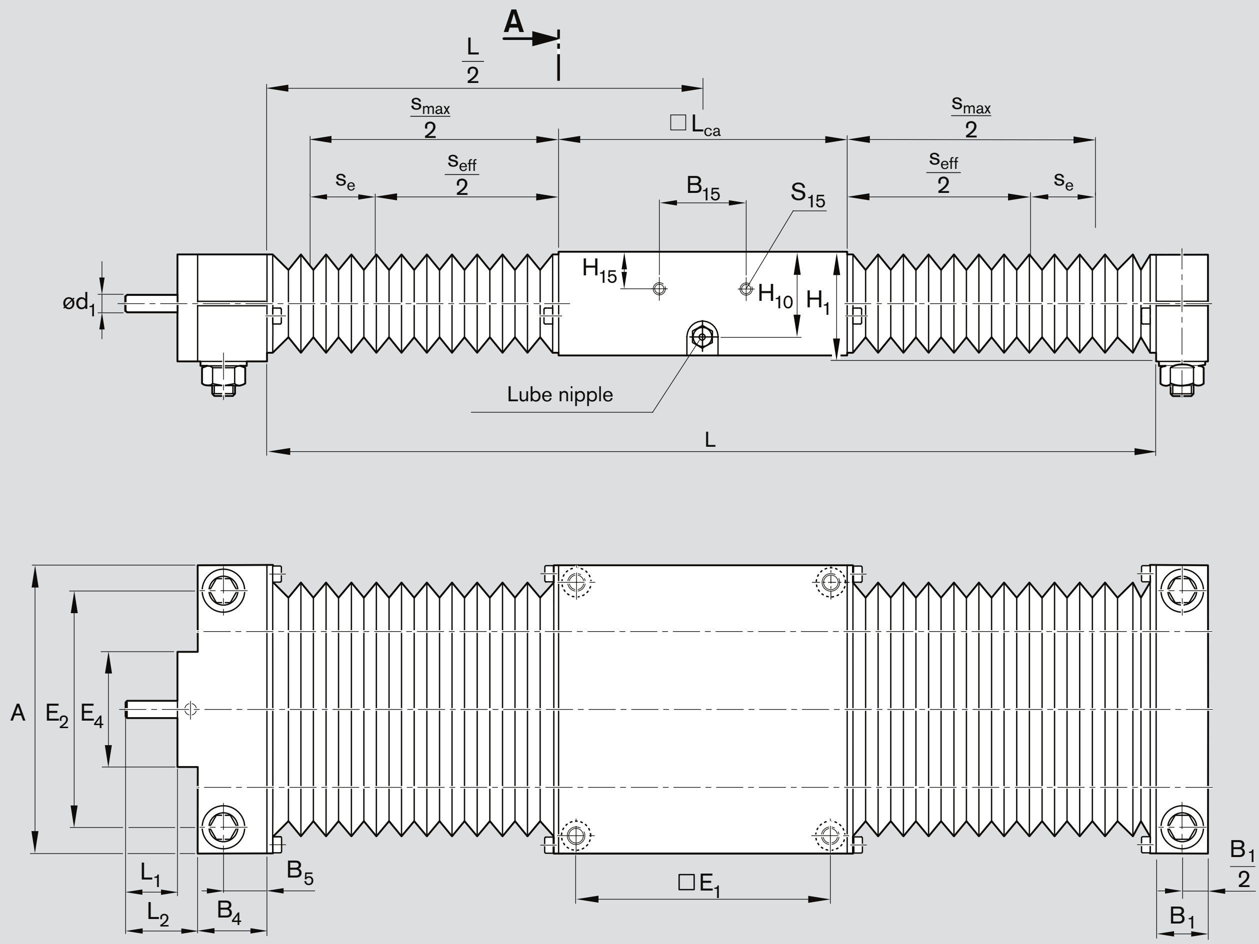


Linear Motion Slide with Ball Screw Drive

SGK 12-85 to SGK 20-130

Dimensions

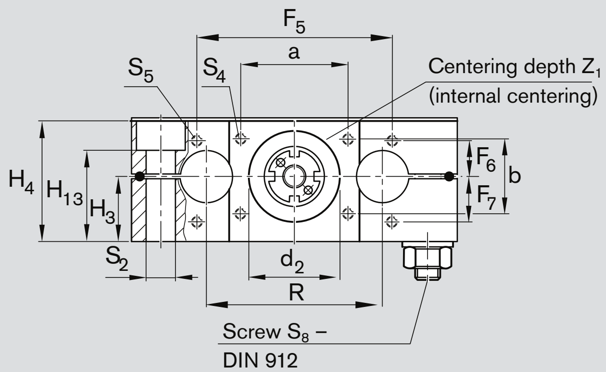
All dimensions in mm
Drawings not to scale

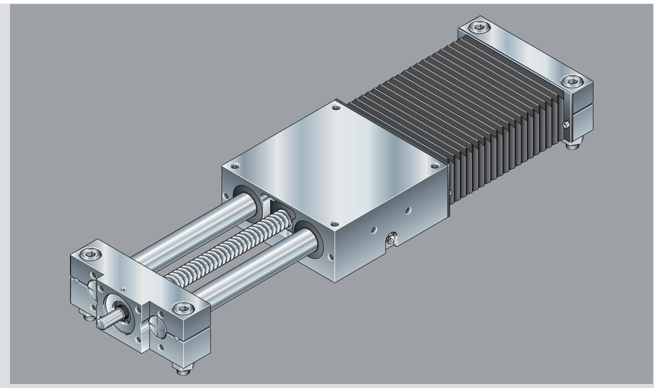


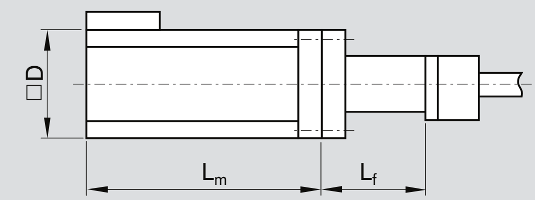
Motor dimensions ➠ "Motors" on page 66.

Slide	Screw journal		Mounting geometry							Holes for locating bracket in both end blocks				For switching cam			Air pressure relief holes		
	d_1 h7	d_2 H7	L_1	L_2	Z_1	E_4	a	b	S	F_5	F_6	F_7	S_5	B_{15}	H_{15}	S_{15}	F_{12}	H_{12}	d_{12}
SGK 12-85	6	28	18	25.0	2.1	40	33	23	M4 - 8 deep	53	9.5	11.5	M4 - 8 deep	30	13.5	M4 - 7 deep	16.0	10.4	6.8
SGK 16-100	6	28	18	25.0	2.1	40	33	23	M4 - 8 deep	60	11.0	14.0	M4 - 8 deep	30	13.0	M4 - 7 deep	24.4	12.0	8.5
SGK 20-130	9	40	25	34.5	2.1	52	40	28	M6-12 deep	74	15.5	18.5	M5 - 12 deep	64	23.0	M4 - 8 deep	37.0	15.5	10.0

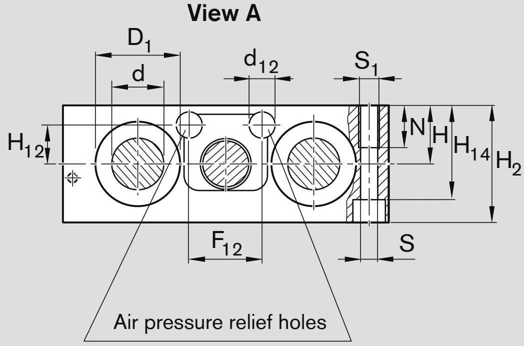
Slide	Dimensions (mm)																				
	d h6	R	B_1	B_4	B_5	H ±0.02	H_1	H_2	H_3 ± 0.015	H_4	H_{10}	H_{13}	H_{14}	D_1	E_1	E_2	L_{ca}	S	S_1	S_2	S_8	N
SGK 12-85	12	42	14	24	17	16	34	32	18	33	27	26.6	25.0	22	73	70	85	5.3	M6	6.6	M6 x 35	13
SGK 16-100	16	54	18	24	15	18	38	36	20	37	31	28.6	29.0	26	88	82	100	5.3	M6	9.0	M8 x 40	13
SGK 20-130	20	72	20	29	19	23	48	46	25	47	39	36.6	37.5	32	115	108	130	6.6	M8	11.0	M10 x 55	18







View A

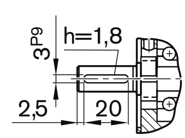
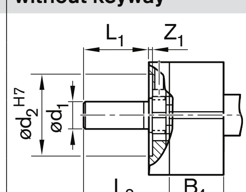


Motor	Slide	Dimensions (mm)			
		L_m		D	L_f
		without brake	with brake		
MSM 031B	SGK 12-85	79.0	115.5	60.0	30.0
	SGK 16-100				
MSM 031C	SGK 20-130	98.5	135.0	60.0	72.0
MSM 041B		112.0	149.0	80.0	83.0
MSK 030C		188.0	213.0	51.0	75.0
MSK 040C		185.5	215.5	82.0	77.5

$$s_{eff} = s_{max} - 2 \cdot s_e$$

s_e = excess travel (mm)
s_{eff} = effective stroke (mm)
s_{max} = maximum travel (mm)

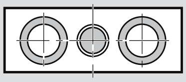
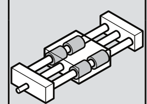
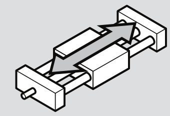
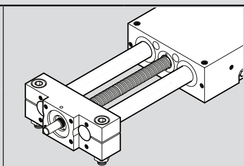
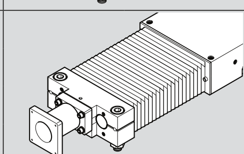
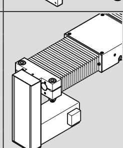
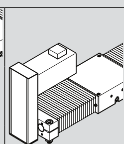
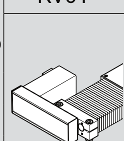
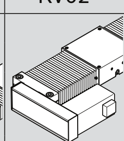
Length calculation L (mm)	
with bellows	without bellows
$L = s_{max} \cdot 1.33 + L_{ca} + 37$	$L = s_{max} + L_{ca} + 3$
$L = s_{max} \cdot 1.33 + L_{ca} + 37$	
$L = s_{max} \cdot 1.30 + L_{ca} + 38$	

Size	Screw journal	
	with keyway	without keyway
SGK 20-130 with centering depth Z_1, internal		

Lube nipple DIN 3405	For any required work on the carriage, the following drawings are available as downloads[1)]
AM6	TB02-016-01
AM6	TB02-016-02
AM6	TB02-016-03

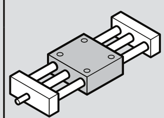
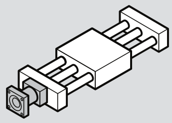
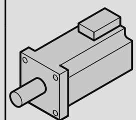
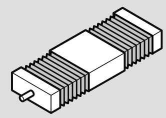
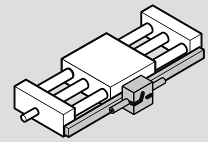
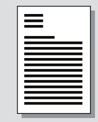
Linear Motion Slide with Ball Screw Drive

SGK 25-160 to SGK 50-280 Components and Ordering Data

		Slide	Part number, length[2)] R0261 .00 00, ... mm	Type	Guide  Standard shafts	Drive unit  Screw journal	Ball screw d_0 x P 20 x 5	20 x 20	25 x 10	32 x 5	32 x 10	32 x 20	32 x 32
With ball screw, w/o motor mount		SGK 25-160 SGK 30-180	R0261 300 00 R0261 400 00	OF01	01	Ø10	01	02	04				
						Ø10[3)]	05	06	08				
		SGK 40-230 SGK 50-280	R0261 500 00 R0261 600 00		01	Ø16				01	02	03	04
						Ø16[3)]				05	06	07	08
With ball screw and motor mount		SGK 25-160 SGK 30-180	R0261 300 00 R0261 400 00	MF01	01	Ø10	01	02	04				
		SGK 40-230 SGK 50-280	R0261 500 00 R0261 600 00		01	Ø16				01	02	03	04
With ball screw and timing belt side drive	 RV01  RV02	SGK 25-160 SGK 30-180	R0261 300 00 R0261 400 00	RV01 RV02	01	Ø10[4)]	11	12	14				
				RV03 RV04	01	Ø10[4)]	11	12	14				
	 RV03[1)]  RV04[1)]	SGK 40-230 SGK 50-280	R0261 500 00 R0261 600 00	RV01 RV02	01	Ø16				01	02	03	04
				RV03 RV04	01	Ø16				01	02	03	04

d_0 = screw diameter (mm)
P = screw lead (mm)
i = transmission ratio

For explanations of the ordering parameters and an order example ➠ “Inquiry/Order” on page 76

	Carriage 	Motor attachment 			Motor 		Cover 		Switches / Cable duct / Socket-plug 		Documentation 	
	Standard	i =	Attachment kit[5]	for motor	Brake without	Brake with	PU bellows without	PU bellows with			Standard report	Measurement report[8]
	01	–	00		00		00	01			01	
	01	–	00		00				Without switches Without cable duct Without socket and plug	00		02
	01	–	03	MSK 040C	86[6]	87[6]			Switches:			
			06	MSM 041B	110[6]	111[6]			– PNP NC	11		
	01	–	02	MSK 076C	92[6]	93[6]			– PNP NO	13		
			05	MSK 060C	90[6]	91[6]			– Mechanical	15		
	01	1	10	MSK 040C	86[6]	87[6]			Ordering data:			
			20	MSM 041B	110[6]	111[6]			Switch type			
		1.5	12	MSK 040C	86[6]	87[6]						
			22	MSM 041B	110[6]	111[6]			Cable duct (loose)[7]	20		
	01	1	14	MSK 040C	86[6]	87[6]						
			24	MSM 041B	110[6]	111[6]			Socket-plug	17		
		1.5	16	MSK 040C	86[6]	87[6]			Switching cam and profiled support for switches	16		03
			26	MSM 041B	110[6]	111[6]						
	01	1	30	MSK 060C	90[6]	91[6]						
		2	31									
	01	1	32									
		2	33									

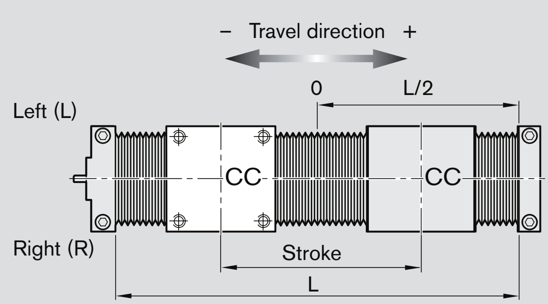
1) Switches can only be mounted on the side opposite the timing belt side drive.
2) Length calculation ➠ Dimensions tables.
3) With keyway
4) Journal version for timing belt side drive with support bearing.
5) Attachment kit also available without motor. When ordering, enter “00” for motor!
6) Recommended motor. Motor data and type designations ➠ “Motors” on page 66.
7) The length of the delivered cable duct is the same as that of the profiled support. If a different length is required, please order the cable duct as a separate part (➠ “Ordering the switches and accessories” on page 62).
8) “02” = Moment of friction measurement; “03” = Lead deviation: ➠ “Documentation” on page 73.

Determining the switch activation point

The switch activation point is determined by the mounting side, the direction of travel and the switching distance (see table above and ordering example).
Mounting side: Switches may be mounted on the left (L) or right (R) side of the slide.
Direction of travel: Switches may be mounted on the minus (-) or plus (+) side of zero.

Switching distance: The switching distance is the distance between the carriage center (CC) and the zero point (0) when a switch is activated (given in mm).
Refer to the section “Switch mounting arrangements” for more information on switch mounting, switch types, and fixing the mounting duct.

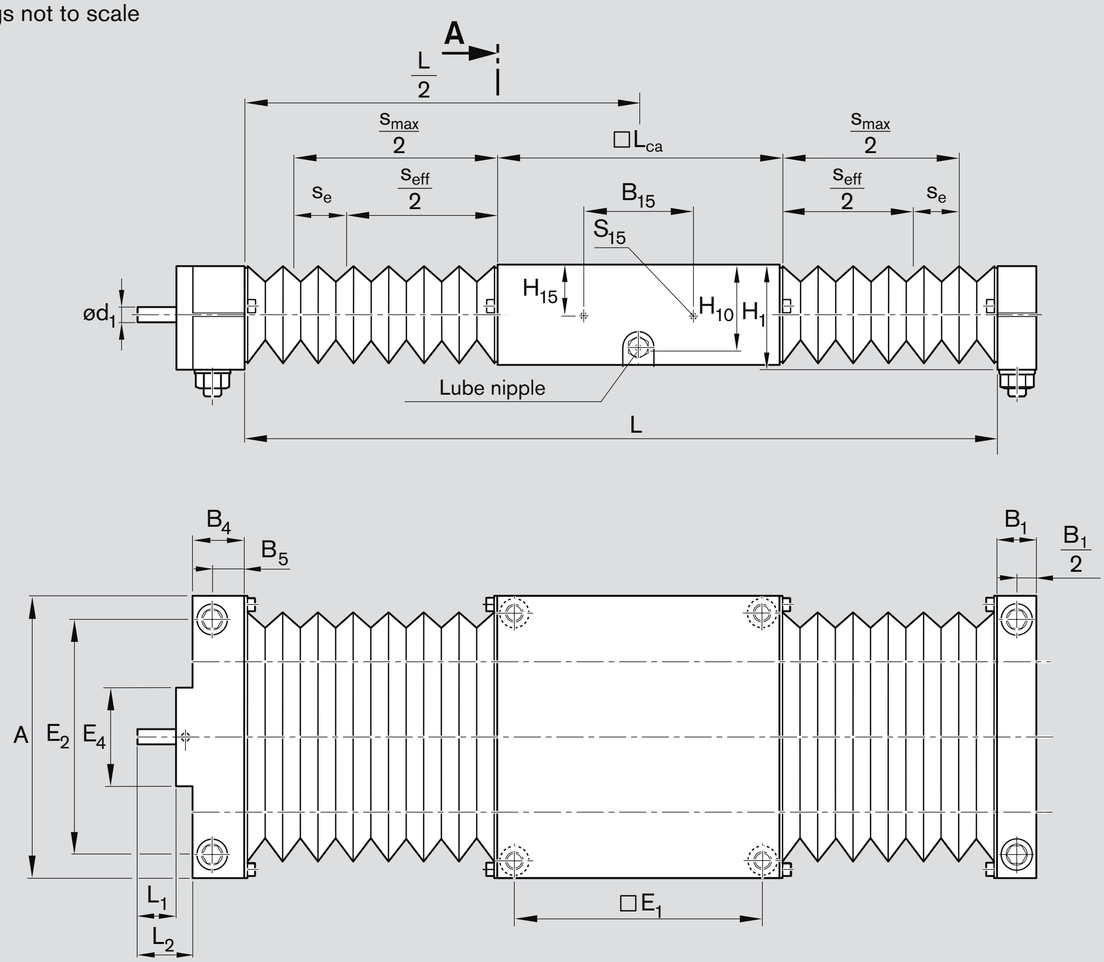
Switch mounting side:



Linear Motion Slide with Ball Screw Drive

SGK 25-160 to SGK 50-280 Dimensions

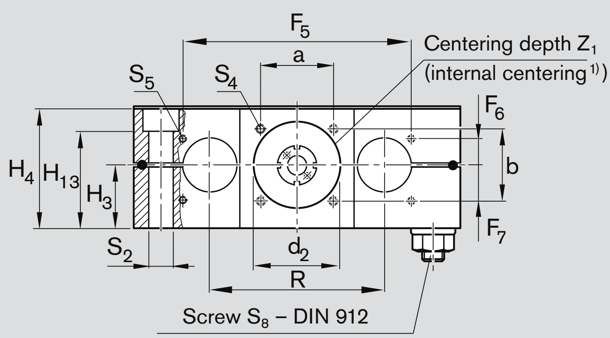
All dimensions in mm
Drawings not to scale

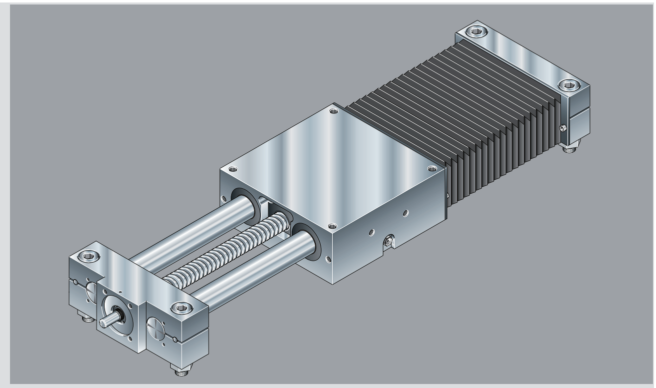


Dimensions for motor attachment ➠ "Motor attachment for SGK / SOK 25-160 to 50-280" on page 52.
Motor dimensions ➠ "Motors" on page 66.

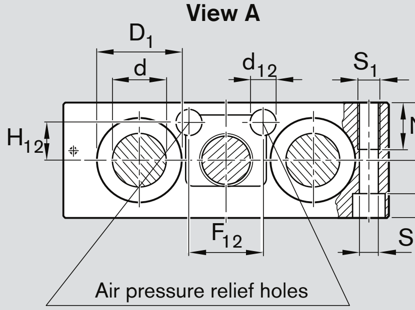
Slide	Screw journal									Holes for locating bracket in both end blocks			
	d_1 h7	d_2	L_1	L_2	Z_1	E_4	a	b	S_4	F_5	F_6	F_7	S_5
SGK 25-160	10	48 ^{H7}	25	35.5	2.1	63	40	40	M6 - 12 deep	104	17.5	16.5	M5 - 12 deep
SGK 30-180	10	48 ^{H7}	25	35.5	2.1	63	40	40	M6 - 12 deep	126	14.5	19.5	M5 - 12 deep
SGK 40-230	16	$68_{-0.01}$	35	58.0	8.0	–	90	46	M8 - 16 deep	221	14.0	20.0	M5 - 12 deep
SGK 50-280	16	$68_{-0.01}$	35	58.0	8.0	–	90	46	M8 - 16 deep	271	22.0	12.0	M5 - 12 deep

Slide	Dimensions (mm)																					
	d h6	R	B_1	B_4	B_5	H ±0.02	H_1	H_2	H_3 ± 0.015	H_4	H_{10}	H_{13}	H_{14}	D_1	E_1	E_2	L_{ca}	S	S_1	S_2	S_8	N
SGK 25-160	25	88	25	33	20.5	28	58	56	30	57	48	44.6	45.0	40	140	132	160	8.4	M10	13.0	M12 x 60	22
SGK 30-180	30	96	25	33	20.5	32	67	64	35	66	55	53.6	50.5	47	158	150	180	10.5	M12	13.0	M12 x 70	26
SGK 40-230	40	122	30	30	15.0	40	84	80	44	83	71	66.6	64.0	62	202	190	230	13.5	M16	17.0	M16 x 90	34
SGK 50-280	50	152	30	30	15.0	48	100	96	52	99	86	82.6	80.0	75	250	240	280	13.5	M16	17.0	M16 x 100	34

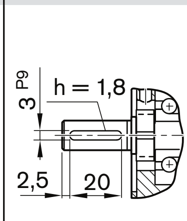
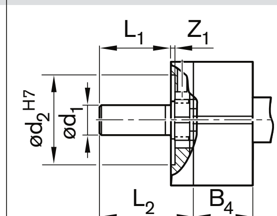
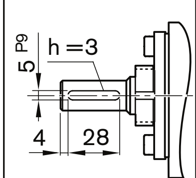
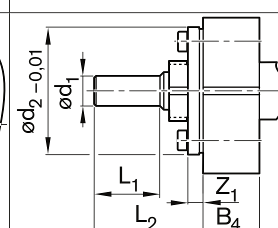




View A



1) Only for SOK 25-160 and SOK 30-180

Size	Screw journal with keyway	without keyway
SGK 25-160 SGK 30-180 with centering depth Z_1, internal		
SGK 40-230 SGK 50-280 with centering depth Z_1, external		

$$s_{eff} = s_{max} - 2 \cdot s_e$$

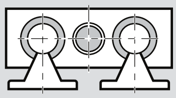
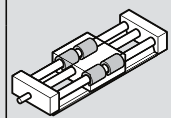
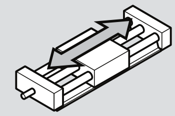
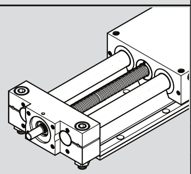
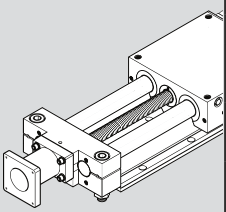
s_e = excess travel (mm)
s_{eff} = effective stroke (mm)
s_{max} = maximum travel (mm)

For switching cam			Air pressure relief holes			Length calculation L (mm)	
						with bellows	without bellows
B_{15}	H_{15}	S_{15}	F_{12}	H_{12}	d_{12}		
64	26	M4 - 10 deep	40	18.5	12.5	$L = s_{max} \cdot 1.24 + L_{ca} + 39$	$L = s_{max} + L_{ca} + 3$
64	33	M4 - 10 deep	40	21.0	15.0	$L = s_{max} \cdot 1.20 + L_{ca} + 38$	
64	21	M4 - 10 deep	54	28.0	18.0	$L = s_{max} \cdot 1.17 + L_{ca} + 43$	
64	21	M4 - 10 deep	60	30.0	22.0	$L = s_{max} \cdot 1.14 + L_{ca} + 43$	

Lube nipple DIN 3405	For any required work on the carriage, the following drawings are available as downloads[2)]
AM8 x 1	TB02-016-04
AM8 x 1	TB02-016-05
AM8 x 1	TB02-016-06
AM8 x 1	TB02-016-07

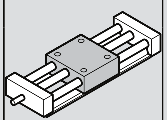
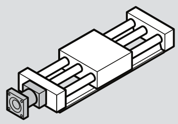
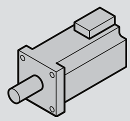
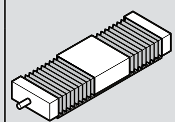
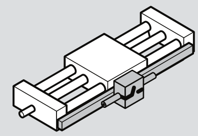
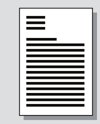
Linear Motion Slide with Ball Screw Drive

SOK 12-85 to SOK 20-130 Components and Ordering Data

					Guide 	Drive unit 						
		Slide	Part number, length[1) R0266 .00 00, ... mm	Type	Standard shafts	Screw journal	Ball screw d_0 x P 8 x 2.5	12 x 5	12 x 10	16 x 5	16 x 10	16 x 16
With ball screw, w/o motor mount		SOK 12-85	R0266 000 00	OF01	02	Ø6	01					
		SOK 16-100	R0266 100 00		02	Ø6		01	02			
		SOK 20-130	R0266 200 00		02	Ø9				01	02	03
						Ø9[2)				04	05	06
With ball screw and motor mount		SOK 12-85	R0266 000 00	MF01	02	Ø6	01					
		SOK 16-100	R0266 100 00		02	Ø6		01	02			
		SOK 20-130	R0266 200 00		02	Ø9				01	02	03

d_0 = screw diameter (mm)
P = screw lead (mm)

For explanations of the ordering parameters and an order example ➠ "Inquiry/Order" on page 76

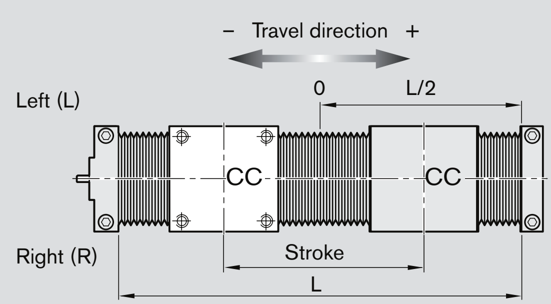
	Carriage	Motor attachment			Motor		Cover		Switches / Cable duct / Socket-plug	Documentation	
											
	Standard	i =	Attachment kit[3]	for motor	Brake without	Brake with	PU bellows without	PU bellows with		Standard report	Measurement report[6]
	01	–	00		00				**Without switches** **Without cable duct** 00 **Without socket and plug**		
	01	–	00		00						
	01	–	00		00				**Switches:** – PNP NC 11 – PNP NO 13 – Mechanical 15 **Ordering data:** Switch type		02
	01	–	03	MSM 031B	106[4]	107[4]					
	01	–	03	MSM 031B	106[4]	107[4]	00	01		01	
			01	MSK 040C	86[4]	87[4]			**Cable duct (loose)**[5] 20		
	01	–	04	MSK 030C	84[4]	85[4]			**Socket-plug** 17		03
			05	MSM 031C	108[4]	109[4]			**Switching cam and profiled support for switches** 16		
			06	MSM 041B	110[4]	111[4]					

1) Length calculation ➠ Dimensions tables.
2) With keyway
3) Attachment kit also available without motor. When ordering, enter “00” for motor!
4) Recommended motor. Motor data and type designations ➠ “Motors” on page 66.
5) The length of the delivered cable duct is the same as that of the profiled support. If a different length is required, please order the cable duct as a separate part (➠ “Ordering the switches and accessories” on page 62).
6) “02” = Moment of friction measurement; “03” = Lead deviation: ➠ “Documentation” on page 73.

Determining the switch activation point
The switch activation point is determined by the mounting side, the direction of travel and the switching distance (see table above and ordering example).
Mounting side: Switches may be mounted on the left (L) or right (R) side of the slide.
Direction of travel: Switches may be mounted on the minus (-) or plus (+) side of zero.

Switching distance: The switching distance is the distance between the carriage center (CC) and the zero point (0) when a switch is activated (given in mm).
Refer to the section “Switch mounting arrangements” for more information on switch mounting, switch types, and fixing the mounting duct.

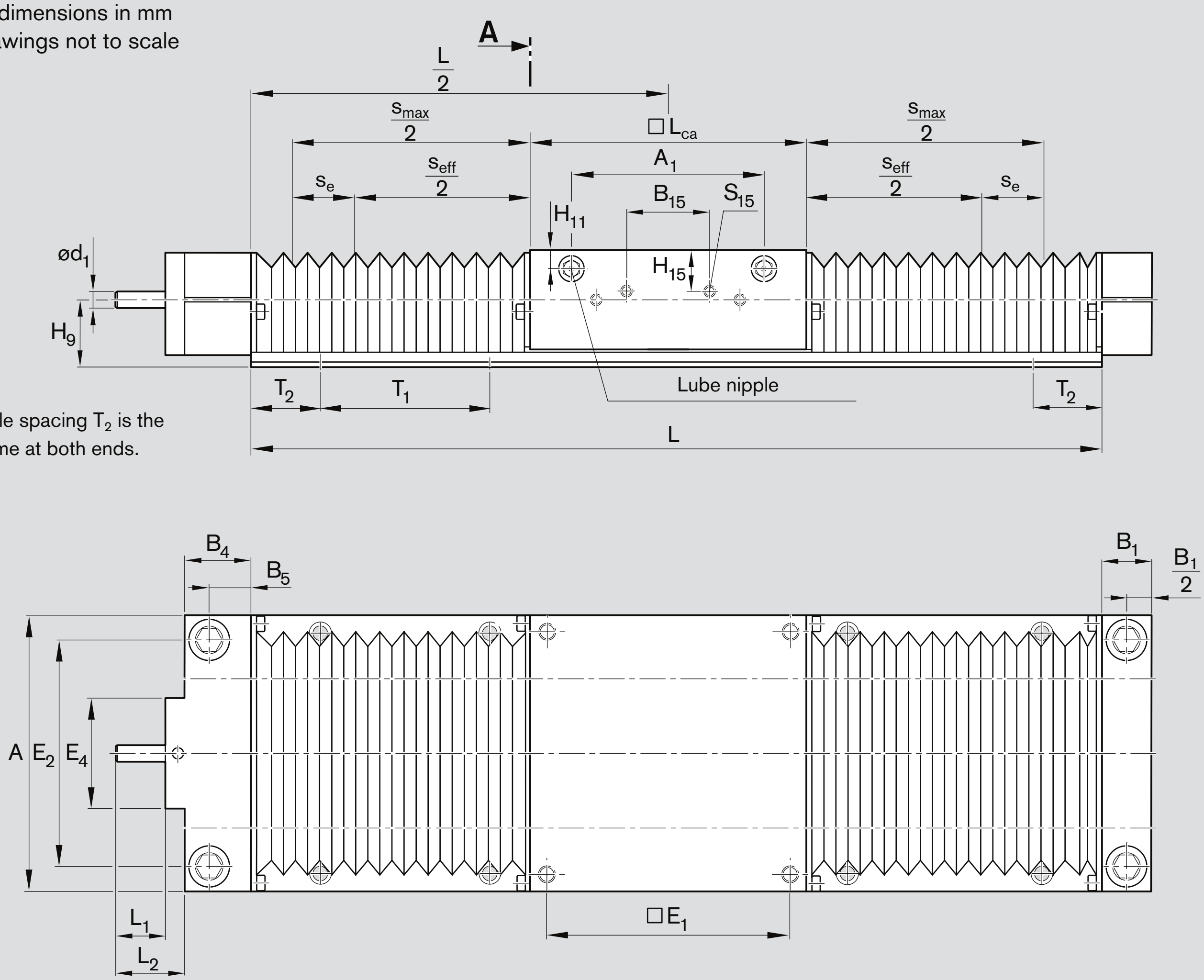
Switch mounting side:



Linear Motion Slide with Ball Screw Drive

SOK 12-85 to SOK 20-130 Dimensions

All dimensions in mm
Drawings not to scale

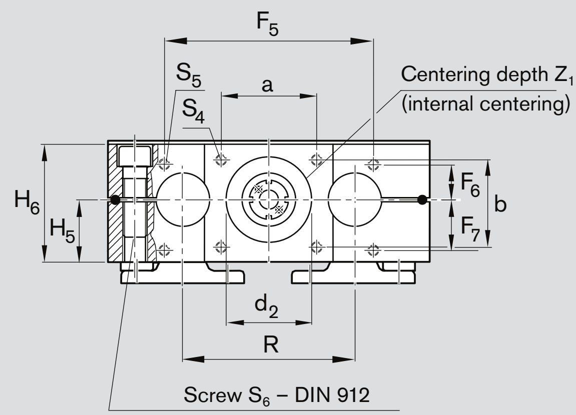


Hole spacing T_2 is the same at both ends.

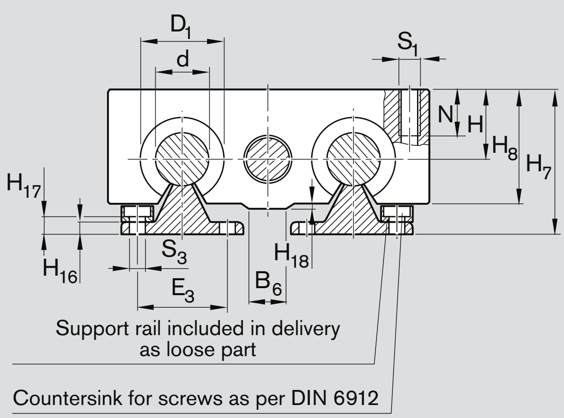
Motor dimensions ➠ "Motors" on page 66.

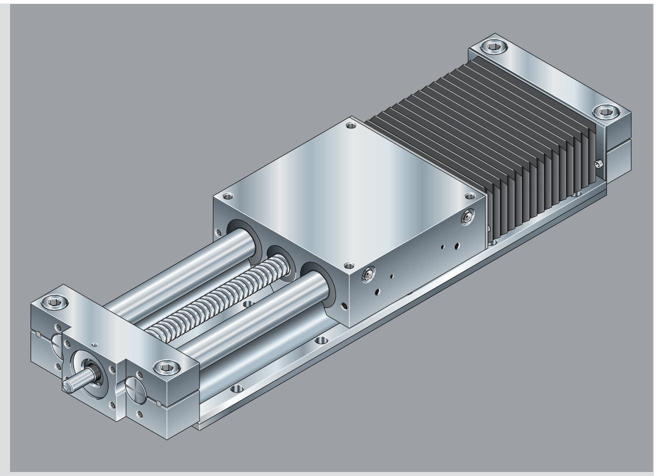
Slide	Screw journal									Holes for locating bracket in both end blocks				For switching cam		
	d_1 h7	d_2 H7	L_1	L_2	Z_1	E_4	a	b	S_4	F_5	F_6	F_7	S_5	B_{15}	H_{15}	S_{15}
SOK 12-85	6	28	18	25.0	2.1	40	33	23	M4 - 8 deep	53	9.5	11.5	M4 - 8 deep	30	13.5	M4 - 7 deep
SOK 16-100	6	28	18	25.0	2.1	40	33	23	M4 - 8 deep	60	11.0	14.0	M4 - 8 deep	30	13.0	M4 - 7 deep
SOK 20-130	9	40	25	34.5	2.1	52	40	28	M6 - 12 deep	74	15.5	18.5	M5 - 12 deep	64	23.0	M4 - 8 deep

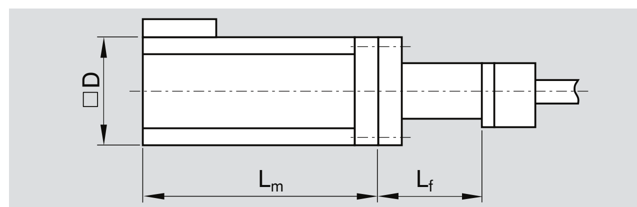
Slide	Dimensions (mm)																		
	d h6	R	B_1	B_4	B_5	H ± 0.02	H_5	H_6	H_7	H_8	H_9	H_{18}	B_6	D_1	E_1	E_2	L_{ca}	S_1	S_6	N
SOK 12-85	12	42	14	24	17	18	15	30	40	30	22	–	–	22	73	70	85	M6	M6 x 22	13
SOK 16-100	16	54	18	24	15	22	17	34	48	35	26	3.0	15	26	88	82	100	M6	M8 x 25	13
SOK 20-130	20	72	20	29	19	25	22	44	57	42	32	3.5	12	32	115	108	130	M8	M10 x 30	18



View A





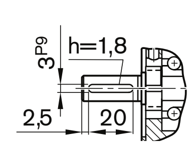
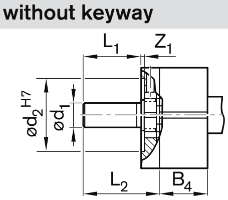


Motor	Slide	Dimensions (mm)			
		L_m		D	L_f
		without brake	with brake		
MSM 031B	SOK 12-85	79.0	115.5	60.0	50.0
	SOK 16-100				
MSM 031C	SOK 20-130	98.5	135.0	60.0	72.0
MSM 041B		112.0	149.0	80.0	83.0
MSK 030C		188.0	213.0	51.0	75.0
MSK 040C		185.5	215.5	82.0	77.5

$$s_{eff} = s_{max} - 2 \cdot s_e$$

s_e = excess travel (mm)
s_{eff} = effective stroke (mm)
s_{max} = maximum travel (mm)

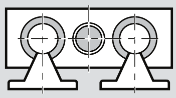
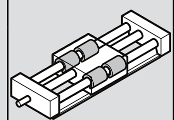
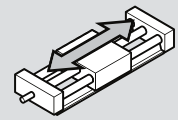
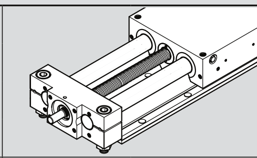
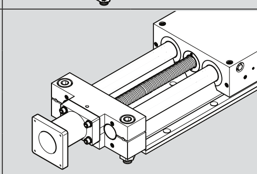
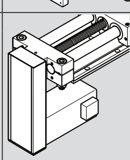
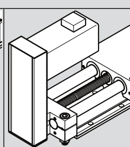
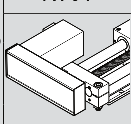
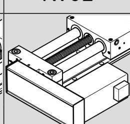
	Length calculation L (mm)	
	with bellows	without bellows
	$L = s_{max} \cdot 1.33 + L_{ca} + 37$	$L = s_{max} + L_{ca} + 3$
	$L = s_{max} \cdot 1.33 + L_{ca} + 37$	
	$L = s_{max} \cdot 1.30 + L_{ca} + 38$	

Size	Screw journal with keyway	without keyway
SOK 20-130 with centering depth Z_1, internal		

	Shaft support rails						Lube nipple			For any required work on the carriage, the following drawings are available as downloads[1)]
	H_{16}	H_{17}	E_3	S_3	T_1	T_2	A_1	H_{11}	DIN 3405	
	5	6.5	29	4.5	75	≥ 15	57	7.0	AM6	TB02-016-11
	5	8.3	33	5.5	100	≥ 20	68	7.2	AM6	TB02-016-12
	6	9.8	37	6.6	100	≥ 20	94	7.2	AM6	TB02-016-13

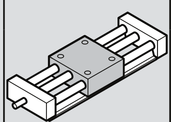
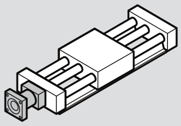
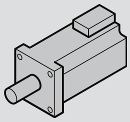
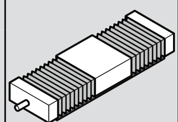
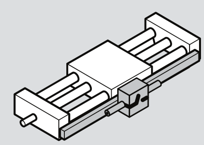
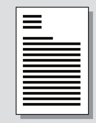
Linear Motion Slide with Ball Screw Drive

SOK 25-160 to SOK 50-280 Components and Ordering Data

					Guide 	Drive unit 							
		Slide	Part number, length[2] R0266 .00 00, ... mm	Type	Standard shafts	Screw journal	Ball screw d_0 x P: 20 x 5	20 x 20	25 x 10	32 x 5	32 x 10	32 x 20	32 x 32
With ball screw, w/o motor mount		SOK 25-160 SOK 30-180	R0266 300 00 R0266 400 00	OF01	02	Ø10	01	02	04				
						Ø10[3]	05	06	08				
		SOK 40-230 SOK 50-280	R0266 500 00 R0266 600 00		02	Ø16				01	02	03	04
						Ø16[3]				05	06	07	08
With ball screw and motor mount		SOK 25-160 SOK 30-180	R0266 300 00 R0266 400 00	MF01	02	Ø10	01	02	04				
		SOK 40-230 SOK 50-280	R0266 500 00 R0266 600 00		02	Ø16				01	02	03	04
With ball screw and timing belt side drive	 RV01  RV02	SOK 25-160 SOK 30-180	R0266 300 00 R0266 400 00	RV01 RV02	02	Ø10[4]	11	12	14				
	 RV03[1]  RV04[1]			RV03 RV04	02	Ø10[4]	11	12	14				
		SOK 40-230 SOK 50-280	R0266 500 00 R0266 600 00	RV01 RV02	02	Ø16				01	02	03	04
				RV03 RV04	02	Ø16				01	02	03	04

d_0 = screw diameter (mm)
P = screw lead (mm)
i = transmission ratio

For explanations of the ordering parameters and an order example ➠ “Inquiry/Order” on page 76

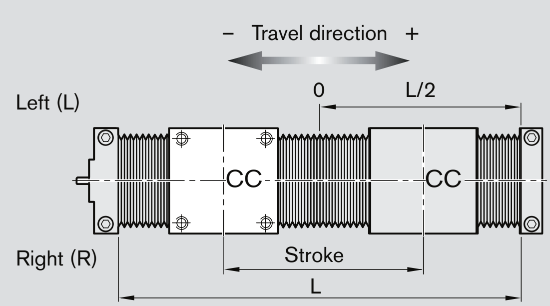
Carriage	Motor attachment			Motor		Cover		Switches / Cable duct / Socket-plug	Documentation	
										
Standard	i =	Attach-ment kit[5)]	for motor	Brake with-out	Brake with	PU bellows with-out	PU bellows with		Standard report	Measure-ment report[8)]
01	1	00		00		00	01	**Without switches** **Without cable duct** **Without socket and plug** 00	01	02
01	1	00		00						
01	1	03	MSK 040C	86[6)]	87[6)]			**Switches:**		
		06	MSM 041B	110[6)]	111[6)]			– PNP NC 11		
01	1	02	MSK 076C	92[6)]	93[6)]			– PNP NO 13		
		05	MSK 060C	90[6)]	91[6)]			– Mechanical 15		
01	1	10	MSK 040C	86[6)]	87[6)]			**Ordering data:**		
		20	MSM 041B	110[6)]	111[6)]			Switch type		
	1.5	12	MSK 040C	86[6)]	87[6)]					
		22	MSM 041B	110[6)]	111[6)]			**Cable duct (loose)**[7)] 20		
01	1	14	MSK 040C	86[6)]	87[6)]					03
		24	MSM 041B	110[6)]	111[6)]			**Socket-plug** 17		
	1.5	16	MSK 040C	86[6)]	87[6)]			**Switching cam and profiled support for switches** 16		
		26	MSM 041B	110[6)]	111[6)]					
01	1	30	MSK 060C	90[6)]	91[6)]					
	2	31								
01	1	32								
	2	33								

1) Switches can only be mounted on the side opposite the timing belt side drive.
2) Length calculation ➠ Dimensions tables.
3) With keyway
4) Journal version for timing belt side drive with support bearing.
5) Attachment kit also available without motor. When ordering, enter “00” for motor!
6) Recommended motor. Motor data and type designations ➠ “Motors” on page 66.
7) The length of the delivered cable duct is the same as that of the profiled support. If a different length is required, please order the cable duct as a separate part (➠ “Ordering the switches and accessories” on page 62).
8) “02” = Moment of friction measurement; “03” = Lead deviation: ➠ “Documentation” on page 73.

Determining the switch activation point
The switch activation point is determined by the mounting side, the direction of travel and the switching distance (see table above and ordering example).
Mounting side: Switches may be mounted on the left (L) or right (R) side of the slide.
Direction of travel: Switches may be mounted on the minus (-) or plus (+) side of zero.

Switching distance: The switching distance is the distance between the carriage center (CC) and the zero point (0) when a switch is activated (given in mm).
Refer to the section “Switch mounting arrangements” for more information on switch mounting, switch types, and fixing the mounting duct.

Switch mounting side:

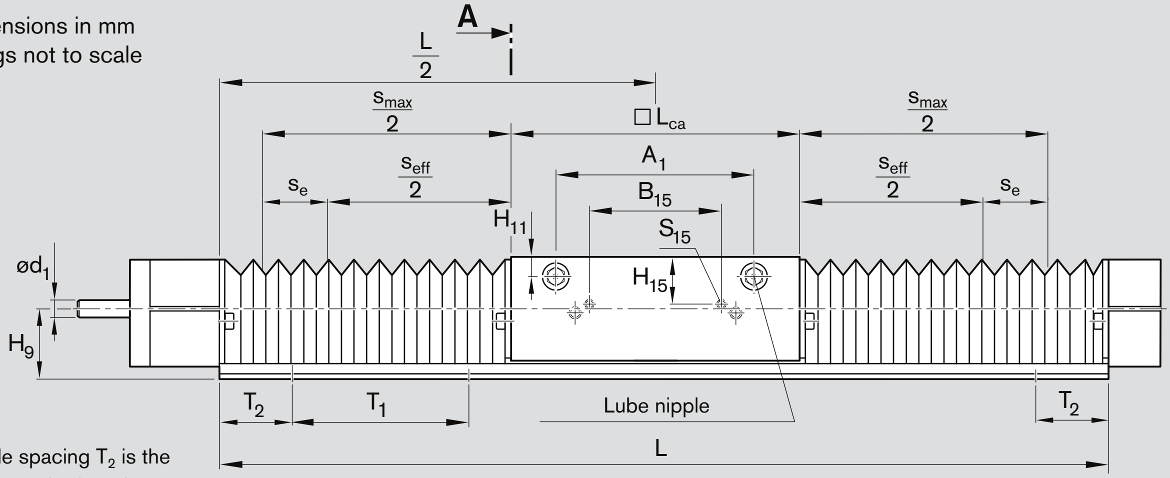


Linear Motion Slide with Ball Screw Drive

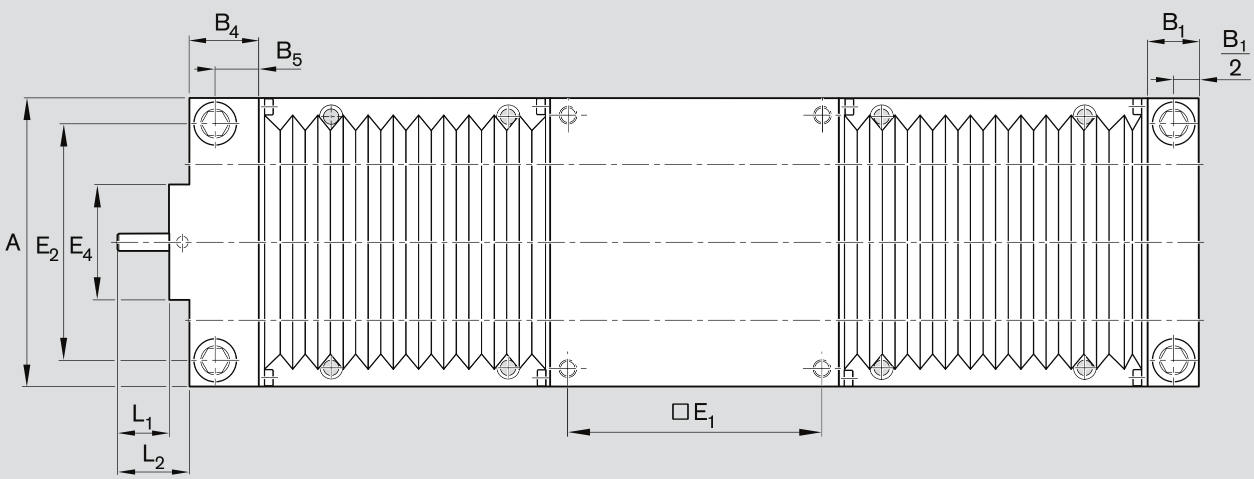
SOK 25-160 to SOK 50-280

Dimensions

All dimensions in mm
Drawings not to scale



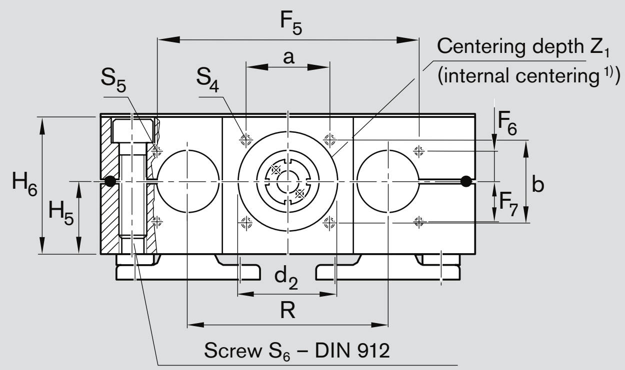
Hole spacing T_2 is the same at both ends.

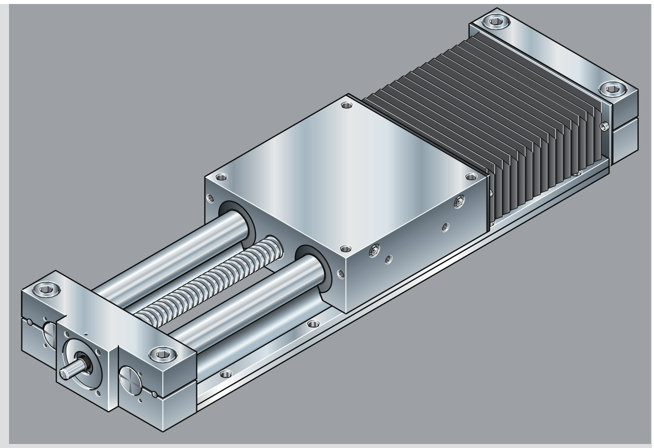


Dimensions for motor attachment ➠ “Motor attachment for SGK / SOK 25-160 to 50-280” on page 52.
Motor dimensions ➠ “Motors” on page 66.

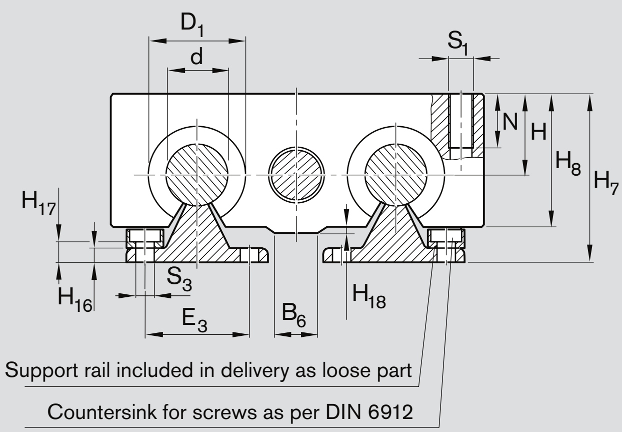
Slide	Screw journal, Mounting geometry (mm)										Holes for locating bracket in both end blocks			
	d_1 h7	d_2	L_1	L_2	L_{ca}	Z_1	E_4	a	b	S_4	F_5	F_6	F_7	S_5
SOK 25-160	10	48 H7	25	35.5	160	2.1	63	40	40	M6 - 12 deep	104	17.5	16.5	M5 - 12 deep
SOK 30-180	10	48 H7	25	35.5	180	2.1	63	40	40	M6 - 12 deep	126	14.5	19.5	M5 - 12 deep
SOK 40-230	16	$68_{-0.01}$	35	58.0	230	8.0	–	90	46	M8 - 16 deep	221	14.0	20.0	M5 - 12 deep
SOK 50-280	16	$68_{-0.01}$	35	58.0	280	8.0	–	90	46	M8 - 16 deep	271	22.0	12.0	M5 - 12 deep

Slide	Dimensions (mm)																
	d h6	R	B_1	B_4	B_5	H ± 0.02	H_5	H_6	H_7	H_8	H_9	H_{18}	B_6	D_1	E_1	E_2		S_1
SOK 25-160	25	88	25	33	20.5	30	27	54	66	51	36	2.5	15	40	140	132	160	M10
SOK 30-180	30	96	25	33	20.5	35	31	62	77	60	42	–	–	47	158	150	180	M12
SOK 40-230	40	122	30	30	15.0	45	39	78	95	77	50	–	–	62	202	190	230	M16
SOK 50-280	50	152	30	30	15.0	55	47	94	115	93	60	–	–	75	250	240	280	M16

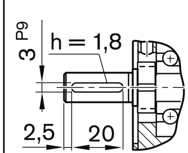
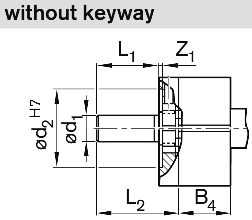
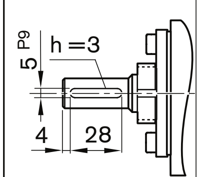
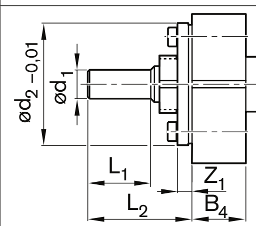




View A



1) Only for SOK 25-160 and SOK 30-180

Size	Screw journal with keyway	without keyway
SOK 25-160 SOK 30-180 with centering depth Z_1, internal		
SOK 40-230 SOK 50-280 with centering depth Z_1, external		

$$s_{eff} = s_{max} - 2 \cdot s_e$$

s_e	=	excess travel	(mm)
s_{eff}	=	effective stroke	(mm)
s_{max}	=	maximum travel	(mm)

For switching cam B_{15}	H_{15}	S_{15}	Length calculation[2)] L (mm) with bellows	without bellows
64	28	M4 - 10 deep	$L = s_{max} \cdot 1.24 + L_{ca} + 39$	$L = s_{max} + L_{ca} + 3$
64	36	M4 - 10 deep	$L = s_{max} \cdot 1.20 + L_{ca} + 38$	
64	26	M4 - 10 deep	$L = s_{max} \cdot 1.14 + L_{ca} + 39$	
64	28	M4 - 10 deep	$L = s_{max} \cdot 1.112 + L_{ca} + 40$	

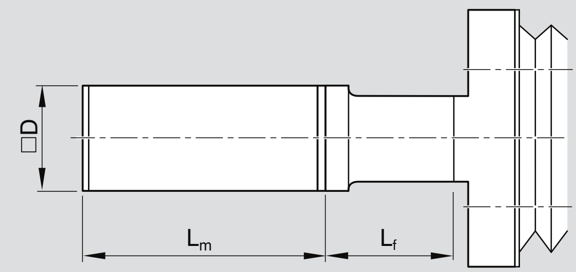
2) For Linear Motion Slides SOK 40-230 L > 400 and L < 460 and Linear Motion Slides SOK 50-280 L > 600 and L < 660 please request information concerning spacing and mounting hole pattern for shafts and shaft support rails.

Shaft support rails S_6	N	H_{16}	H_{17}	E_3	S_3	T_1	T_2	Lube nipple A_1	H_{11}	DIN 3405	For any required work on the carriage, the following drawings are available as downloads[3)]
M12 x 40	22	6	9.8	42	6.6	120	≥ 24	116	9.5	AM8 x 1	TB02-016-14
M12 x 45	26	7	10.0	51	9.0	150	≥ 30	130	9.5	AM8 x 1	TB02-016-15
M16 x 60	34	8	11.8	55	9.0	200	≥ 30	170	11.5	AM8 x 1	TB02-016-16
M16 x 60	34	9	14.3	63	11.0	200	≥ 30	220	15.0	AM8 x 1	TB02-016-17

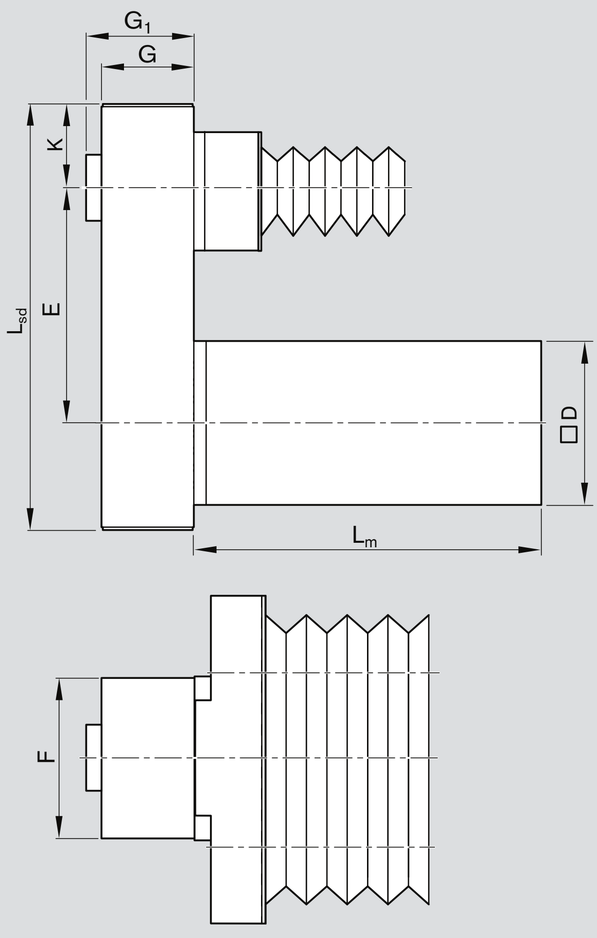
Linear Motion Slide with Ball Screw Drive

Motor attachment for SGK / SOK 25-160 to 50-280

MF01



RV01, RV02

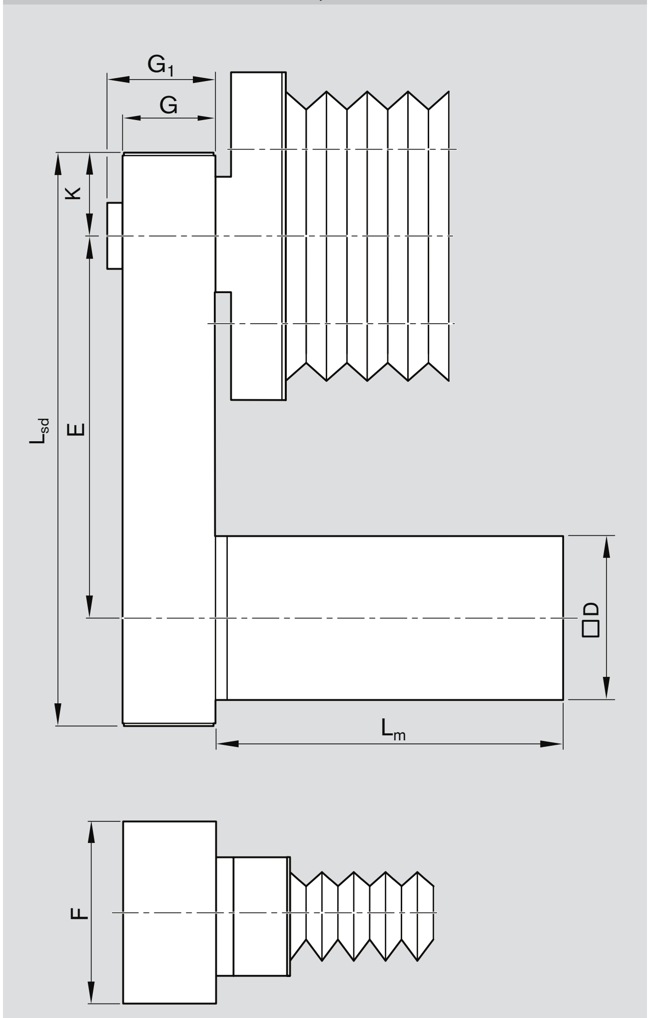


Motor	Dimensions (mm)			
	D	L_f		L_m
			Brake without	with
MSM 031B	60.0	50	79.0	115.5
MSM 031C	60.0	72	98.5	135.0
MSM 041B	80.0	83	112.0	149.0
MSK 030C	54.0	75	188.0	213.0
MSK 040C	82.0	81	185.5	215.5
MSK 060C	116.0	125	226.0	259.0
MSK 076C	140.0	125	292.5	292.5

L_f = length of motor mount
L_m = length of motor
L_{sd} = length of timing belt side drive
F = width of belt pulley housing

Motor	Dimensions (mm)										
	D			E	G_1	G	F	K		L_m	L_{sd}
		i = 1	i = 1.5	i = 2					Brake w/o	with	
MSM 041B	80.0	165.0	162	–	57	66	116	59.0	112.0	149.0	300
MSK 040C	82.0	122.5	122	–	57	51	88	43.5	185.5	215.5	227
MSK 060C	116.0	165.0	–	162	–	66	116	59.0	226.0	259.0	300

RV03, RV04



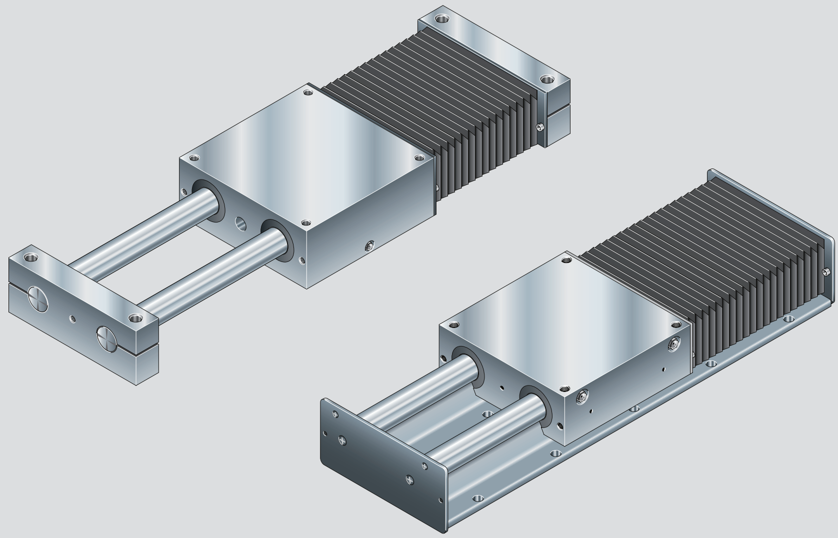
Motor	Dimensions (mm)										
	D	E			G_1	G	F	K	L_m		L_{sd}
		i = 1	i = 1.5	i = 2					Brake		
									w/o	with	
MSM 041B	80.0	267.5	265	–	57	66	116	59.0	112.0	149.0	403
MSK 040C	82.0	157.5	162	–	57	51	88	43.5	185.5	215.5	267
MSK 060C	116.0	267.5	–	265	–	66	116	59.0	226.0	259.0	403

Linear Motion Slide without Drive Unit

Product Description

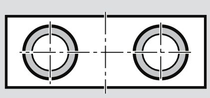
Characteristics

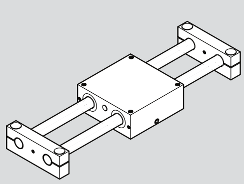
- Particularly smooth running and long service life thanks to Rexroth Super Linear Bushings[1)]
- One-point lubrication on either side of the guide system, for grease lubrication only
- Freely selectable length
- Oil- and moisture-resistant PU bellows-type protective cover (the last fold is mechanically clamped)

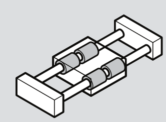


1) Size 8-65 with Standard Linear Bushings

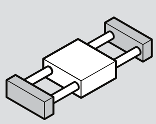
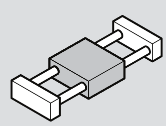
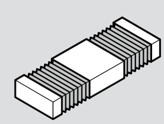
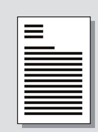
SGO 8-65 to SGO 50-280 Components and Ordering Data



	Slide	Part number, length[1)] R0260 .00 00, ... mm	Type	Guide: Standard shafts	Guide: Corrosion-resistant steel shafts per DIN 17230 / EN 10088
	SGO 8-65	R0260 900 00	OA01	01	02
	SGO 12-85	R0260 000 00			
	SGO 16-100	R0260 100 00			
	SGO 20-130	R0260 200 00			
	SGO 25-160	R0260 300 00			
	SGO 30-180	R0260 400 00			
	SGO 40-230	R0260 500 00			
	SGO 50-280	R0260 600 00			



1) Length calculation ➠ table on page 57

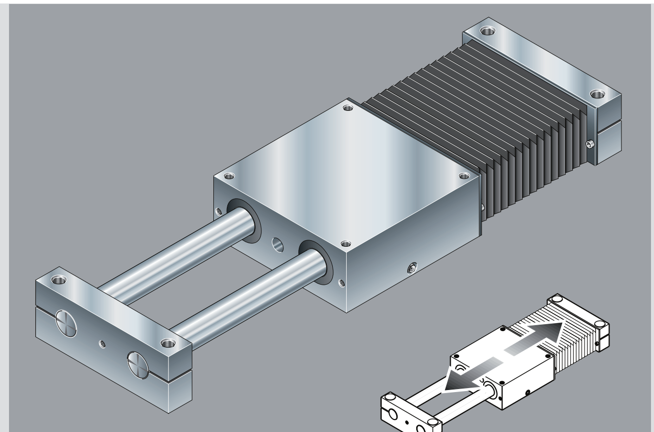
	Drive Unit (end block)		Carriage	Cover		Documentation
						
	End block A	End block B	Standard	Polyurethane bellows without	with	Standard
	01	02	01	00	01	01

Linear Motion Slide without Drive Unit

SGO 8-65 to SGO 50-280

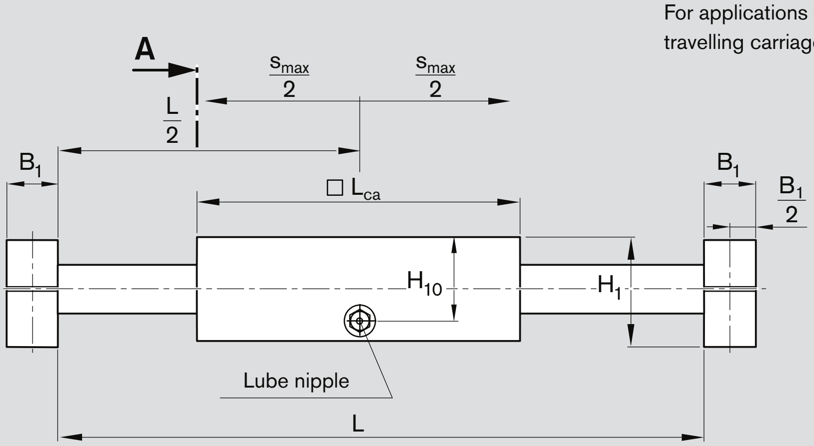
Dimensions

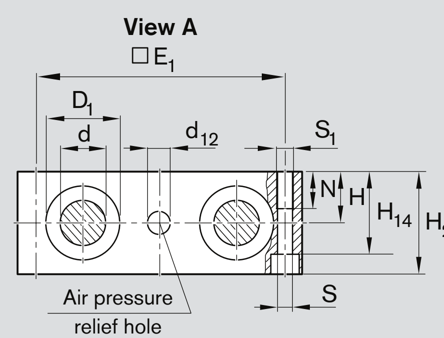
Linear Motion Slides consist of:
- carriage (Al alloy)
- four Super Linear Bushings; size 8: Standard Linear Bushings
- four seals
- two end blocks (Al alloy)
- two precision steel shafts: tolerance grade h6
- air pressure relief holes for versions with installed bellows

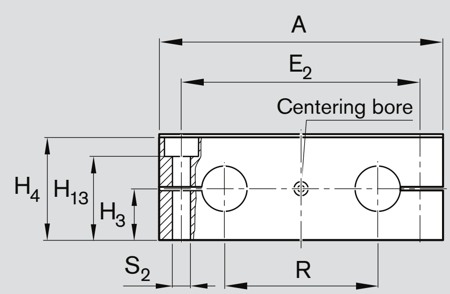

Delivered without fastening screws

End block A

For applications with screwed-down end blocks and travelling carriage

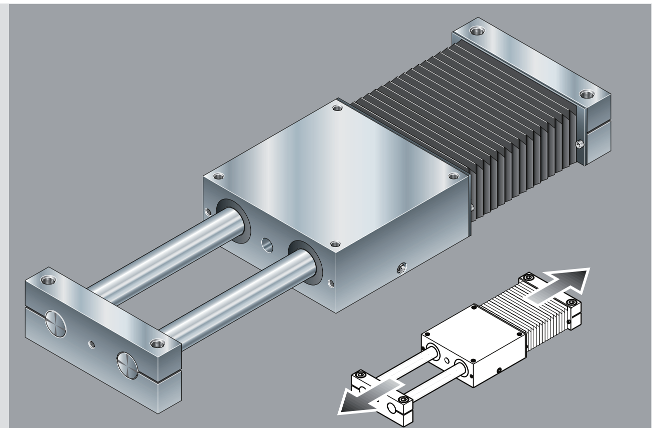






Slide	Dimensions (mm)																		
	d h6	L_{ca}	R	B_1	H ± 0.02	H_1 1)	H_2	H_3 ± 0.015	H_4	H_{10}	H_{13}	H_{14}	D_1	E_1	E_2	S	S_1	S_2	N
SGO 8-65	8	65	32	12	11.5	24	23	12.5	23.5	19.5	18.1	17.5	16	55	52	4.3	M5	5.5	11
SGO 12-85	12	85	42	14	16	34	32	18.0	33.0	27.0	26.6	25.0	22	73	70	5.3	M6	6.6	13
SGO 16-100	16	100	54	18	18	38	36	20.0	37.0	31.0	28.6	29.0	26	88	82	5.3	M6	9.0	13
SGO 20-130	20	130	72	20	23	48	46	25.0	47.0	39.0	36.6	37.5	32	115	108	6.6	M8	11.0	18
SGO 25-160	25	160	88	25	28	58	56	30.0	57.0	48.0	44.6	45.0	40	140	132	8.4	M10	13.0	22
SGO 30-180	30	180	96	25	32	67	64	35.0	66.0	55.0	53.6	50.5	47	158	150	10.5	M12	13.0	26
SGO 40-230	40	230	122	30	40	84	80	44.0	83.0	71.0	66.6	64.0	62	202	190	13.5	M16	17.0	34
SGO 50-280	50	280	152	30	48	100	96	52.0	99.0	86.0	82.6	80.0	75	250	240	13.5	M16	17.0	34

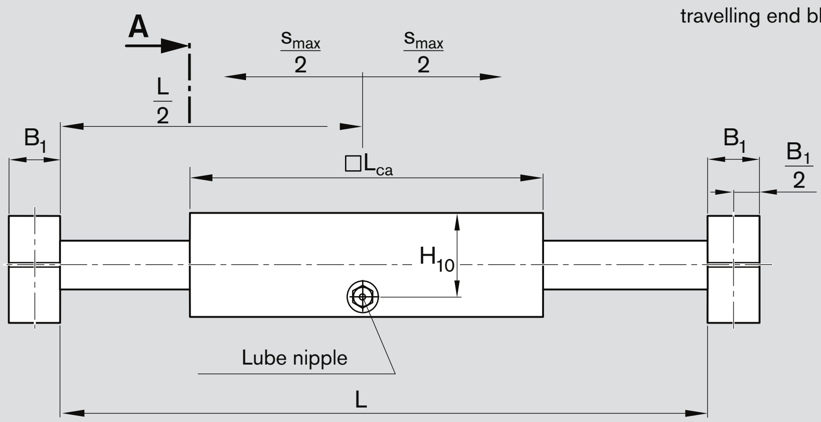
1) Only for end block A

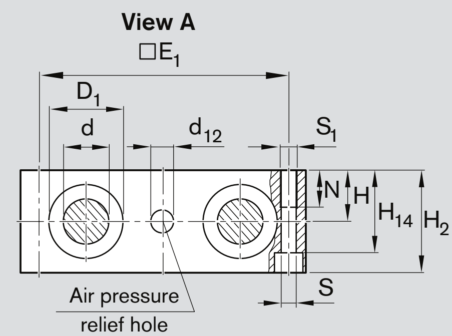


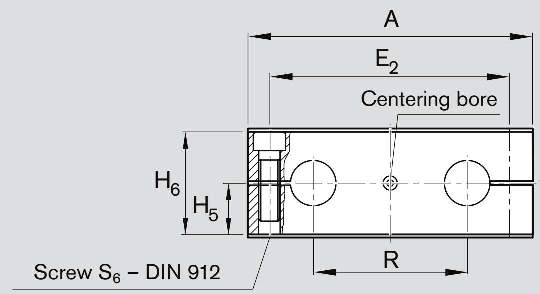
Delivered without fastening screws

End block B

For applications with screwed-down carriage and travelling end blocks





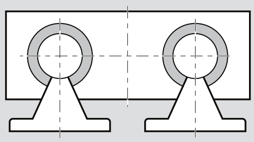


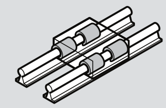
End block B S_6	H_5	H_6	Lube nipple DIN 3405	For versions with bellows: air pressure relief hole d_{12} (mm)	Length calculation L (mm) with bellows	without bellows
M 5 x 15	11	22	D 4	8	$L = s_{max} \cdot 1.40 + L_{ca} + 34$	$L = s_{max} + L_{ca} + 3$
M 6 x 22	15	30	AM 6	10	$L = s_{max} \cdot 1.33 + L_{ca} + 37$	
M 8 x 25	17	34	AM 6	12	$L = s_{max} \cdot 1.33 + L_{ca} + 37$	
M 10 x 30	22	44	AM 6	14	$L = s_{max} \cdot 1.30 + L_{ca} + 38$	
M 12 x 40	27	54	AM 8 x 1	16	$L = s_{max} \cdot 1.24 + L_{ca} + 39$	
M 12 x 45	31	62	AM 8 x 1	20	$L = s_{max} \cdot 1.20 + L_{ca} + 38$	
M 16 x 60	39	78	AM 8 x 1	22	$L = s_{max} \cdot 1.17 + L_{ca} + 43$	
M16 x 60	47	94	AM 8 x 1	25	$L = s_{max} \cdot 1.14 + L_{ca} + 43$	

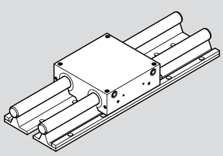
s_{max} = maximum travel (mm)

Linear Motion Slide without Drive Unit

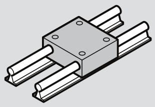
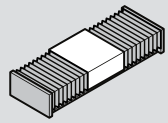
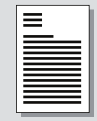
SOO 12-85 to SOO 50-280 Components and Ordering Data





	Slide	Part number, length[1] R0265 .00 00, ... mm	Type	Guide: Standard shafts, Bellows[3] without	Guide: Standard shafts, Bellows[3] with	Guide: Corrosion-resistant steel shafts[2], Bellows[3] without	Guide: Corrosion-resistant steel shafts[2], Bellows[3] with
	SOO 12-85	R0265 000 00					
	SOO 16-100	R0265 100 00					
	SOO 20-130	R0265 200 00					
	SOO 25-160	R0265 300 00	OA01	01	04	02	05
	SOO 30-180	R0265 400 00					
	SOO 40-230	R0265 500 00					
	SOO 50-280	R0265 600 00					

1) Length calculation ➠ table on page 60
2) As per DIN 17230 / EN 10088
3) In the Linear Motion Slide SOO with bellows, end plates are screwed to each end of the shafts. (See Dimensions).

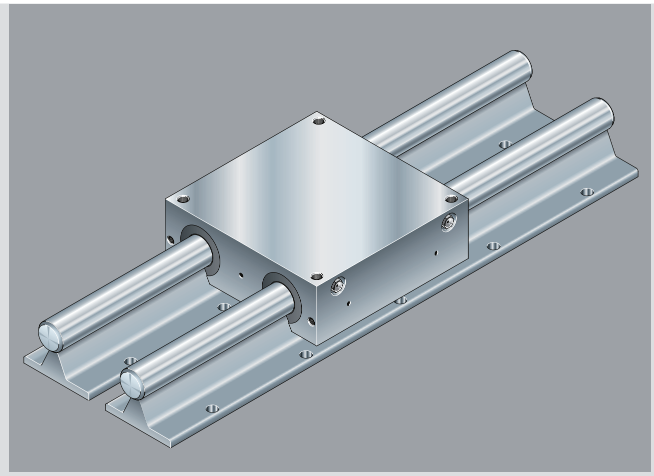
	Carriage	Cover		Documentation
				
	Standard	Polyurethane bellows		Standard
		without	with	
	01	00	01	01

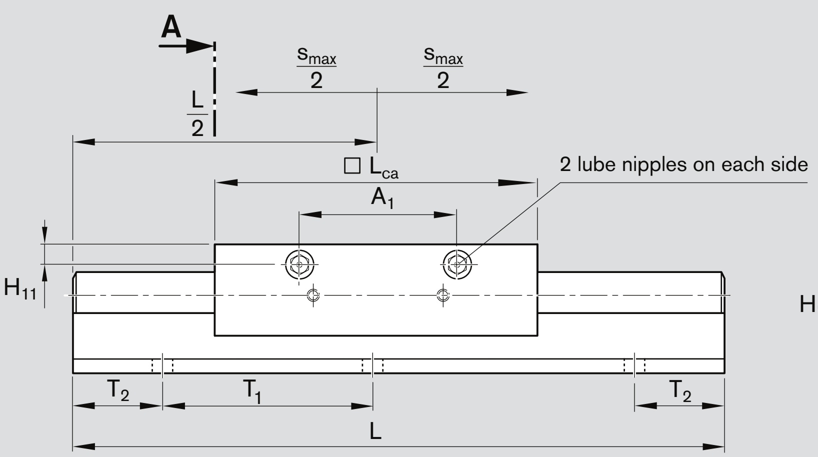
Linear Motion Slide without Drive Unit

SOO 12-85 to SOO 50-280

Dimensions

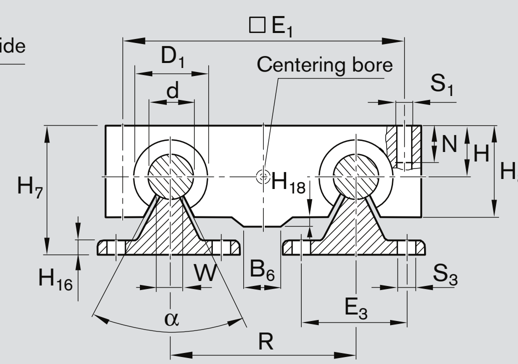
Linear Motion Slides consist of:
- carriage (Al alloy)
- four Super Linear Bushings
- four seals
- two precision steel shafts, tolerance grade h6, with shaft support rails (Al alloy)





Hole spacing T2 is the same at both ends.

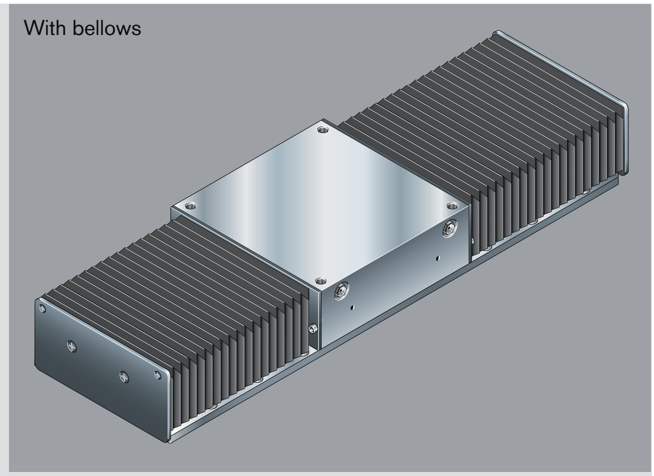
View A

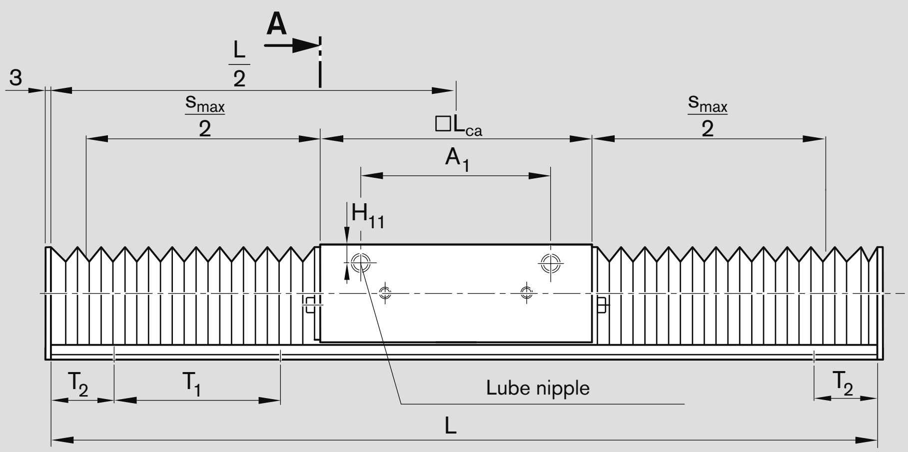


Slide	Dimensions (mm) – except for angle α												
	d h6	L_{ca}	R	H ± 0.02	H_7	H_8	H_{18}	B_6	W	α	D_1	E_1	S_1	N
SOO 12-85	12	85	42	18	40	30	–	–	6.5	66°	22	73	M6	13
SOO 16-100	16	100	54	22	48	35	3.0	15	9.0	68°	26	88	M6	13
SOO 20-130	20	130	72	25	57	42	3.5	12	9.0	55°	32	115	M8	18
SOO 25-160	25	160	88	30	66	51	2.5	15	11.5	57°	40	140	M10	22
SOO 30-180	30	180	96	35	77	60	–	–	14.0	57°	47	158	M12	26
SOO 40-230	40	230	122	45	95	77	–	–	19.5	56°	62	202	M16	34
SOO 50-280	50	280	152	55	115	93	–	–	22.5	54°	75	250	M16	34

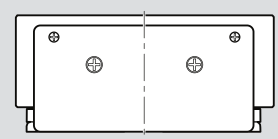
All dimensions in mm
Drawings not to scale

With bellows

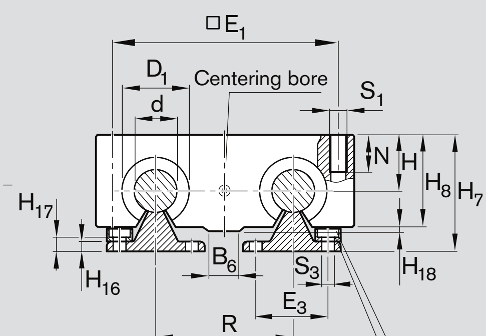




Hole spacing T2 is the same at both ends.



View A



Support rail included in delivery as loose part

Countersink for screws as per DIN 6912

Shaft support rails						Lube nipple			Length calculation[1] L (mm)	
H_{16}	H_{17}	S_3	E_3	T_1	T_2	A_1	H_{11}	DIN 3405	with bellows	without bellows
5	6.5	4.5	29	75	≥ 15	57	7.0	AM6	$L = s_{max} \cdot 1.330 + L_{ca} + 37$	$L = s_{max} + L_{ca} + 3$
5	8.3	5.5	33	100	≥ 20	68	7.2	AM6	$L = s_{max} \cdot 1.330 + L_{ca} + 37$	
6	9.8	6.6	37	100	≥ 20	94	7.2	AM6	$L = s_{max} \cdot 1.300 + L_{ca} + 38$	
6	9.8	6.6	42	120	≥ 24	116	9.5	AM8 x 1	$L = s_{max} \cdot 1.240 + L_{ca} + 39$	
7	10.0	9.0	51	150	≥ 30	130	9.5	AM8 x 1	$L = s_{max} \cdot 1.200 + L_{ca} + 38$	
8	11.8	9.0	55	200	≥ 30	170	11.5	AM8 x 1	$L = s_{max} \cdot 1.140 + L_{ca} + 39$	
9	14.3	11.0	63	200	≥ 30	220	15.0	AM8 x 1	$L = s_{max} \cdot 1.112 + L_{ca} + 40$	

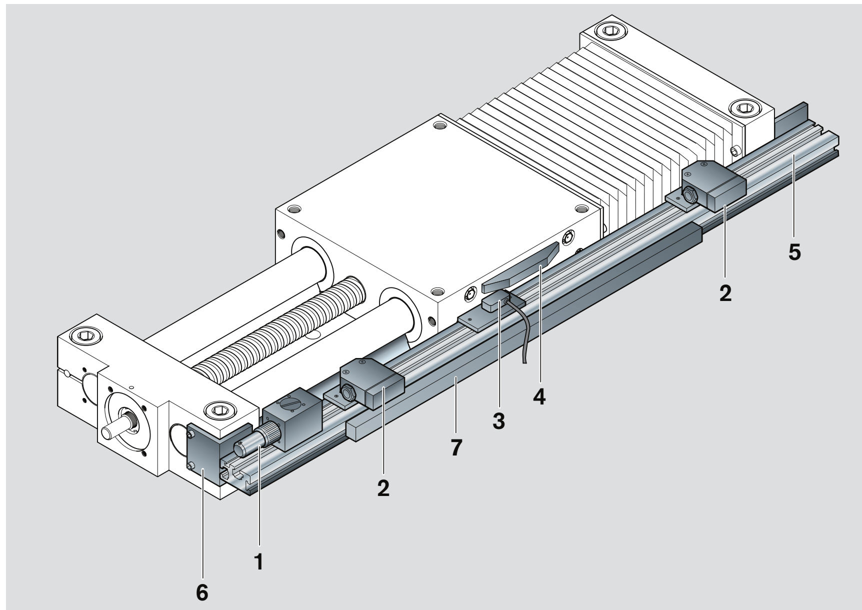
1) For Linear Motion Slides SOO 40-230 L > 400 and L < 460 and for Linear Motion Slides SOO 50-280 L > 600 and L < 660 please request information concerning spacing and mounting hole pattern for shafts and shaft support rails.

s_{max} = maximum travel (mm)

Switch Mounting Arrangements

Overview of Switching System

1 Socket and plug
2 Mechanical switch (with mounting accessories)
3 Proximity switch (with mounting accessories)
4 Switching cam
5 Cable duct (aluminum alloy)
6 Mounting bracket
7 Profiled support



Ordering the switches and accessories

Refer to the following table for part numbers.
Accessories can also be ordered separately.

Item		Option number[1]	Linear Motion Slides SGK / SOK 12-85	16-100	20-130 / 25-160 30-180 / 40-230 / 50-280
1	Socket + plug	**17**	R1414 000 61	R1414 000 61	R1414 000 61
2	Mechanical switches with mounting accessories	**15**	R0236 203 01	R0236 203 01	R0236 203 01
	Mechanical switches without mounting accessories		R3453 040 16	R3453 040 16	R3453 040 16
3	Proximity switches (option no. includes switch and accessories)				
	– Accessories without switch		R0236 203 02	R0236 203 02	R0236 203 02
	– PNP NC (option no. includes switch and accessories)	**11**	R3453 040 01	R3453 040 01	R3453 040 01
	– PNP NO (option no. includes switch and accessories)	**13**	R3453 040 03	R3453 040 03	R3453 040 03
4+6	Switching cam + mounting bracket with all accessories for mounting profiled support	**16**	R0236 003 03	R0236 103 03	R0236 203 03
5	Profiled support, L_T =		R0396 620 08 [2]	R0396 620 08 [2]	R0396 620 08 [2]
7	Cable duct, L_K =	**20**	R0396 620 17 [2]	R0396 620 17 [2]	R0396 620 17 [2]

1) From the “Components and Ordering” table
2) When ordering cable ducts or profiled supports, please always state the required length. Example: “R0396 620 17, 285 mm”.

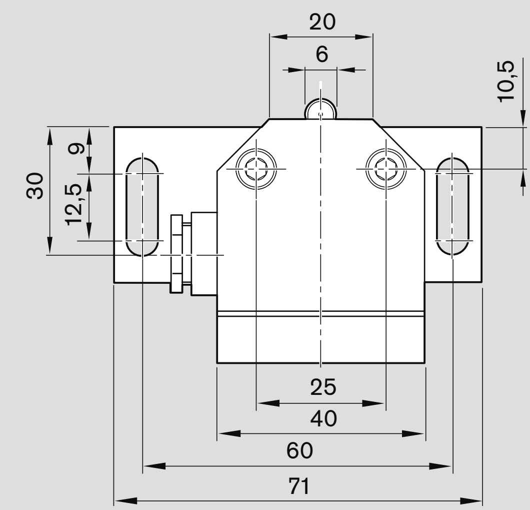
Length calculation for cable duct and profiled support

Slide	Length of profiled support L_T (mm)
SGK/SOK 12-85	$L_T = L + 38$
SGK/SOK 16-100	$L_T = L + 87$
SGK/SOK 20-130	$L_T = L + 94$
SGK/SOK 25-160	$L_T = L + 103$
SGK/SOK 30-180	$L_T = L + 103$
SGK/SOK 40-230	$L_T = L + 105$
SGK/SOK 50-280	$L_T = L + 105$

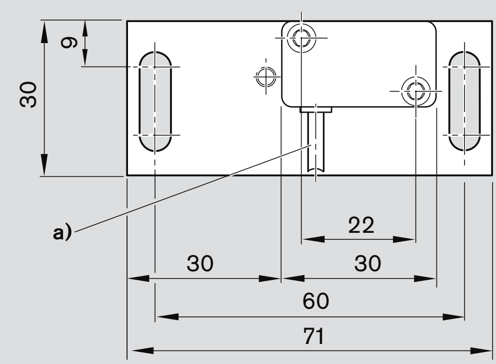
$L_T = L_K$

L_K = length of cable duct (mm)
L_T = length of profiled support (mm)
L = length of linear system (mm)

Mechanical switch (with mount)		
Repeatability	=	± 0.05 mm
Permissible ambient temperature	=	–5 °C … +80 °C
Protection class	=	IP 67
Bounce time	=	< 2 ms
Insulation class	=	Group C as per VDE 0110
Permitted voltage for combination of switch and socket-plug	=	10 ... 30 V AC
Continuous current		5 A
Switching capacity at 220 V, 40-60 Hz	=	cosφ = 0.8 at 2 A
Contact resistance when new	=	< 240 mΩ
Connection type	=	Screw connector
Contact system	=	Single-pole changeover
Switching system	=	Snap-action



Proximity switch (with mount)		
Miniature circuit-breaker with potted cable (3 x 0.14 mm² Unitronic)		
Switching function	=	PNP NO / NC
Repeatability	=	≤ 0.1 mm
MTTFd (as per EN 13849)	=	835 years
Operating voltage	=	10 ... 30 V DC
Residual ripple	=	≤ 3.6 V
No-load current	=	≤ 3 mA
Load current	=	≤ 200 mA
Voltage drop at load current	=	≤ 2 V
Permissible ambient temperature	=	–25 °C ... +70 °C
Protection class	=	IP 65
Cable length	=	3 m
Connection at cable end	=	flying leads

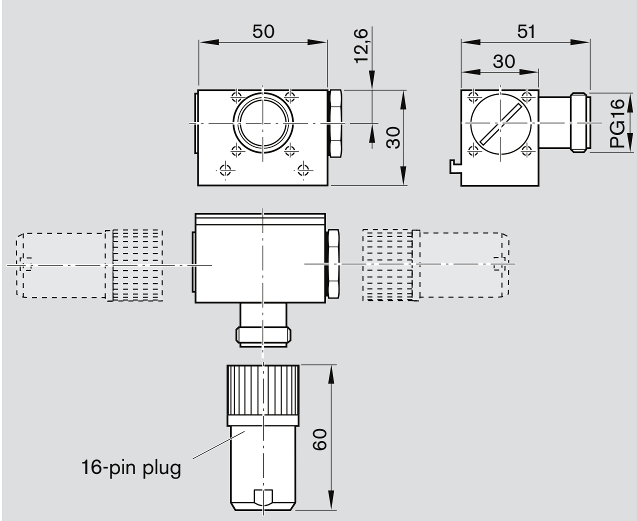


a) Cable length: 3 m

Socket and plug

A plug is provided.
The plug can be mounted in three directions (see diagram).

Socket/plug subassembly	
No. of pins	16
Permitted voltage for combination of switch and socket-plug	10 ... 30 V DC
Rated current (at 25 °C)	8 A / contact
Permissible ambient temperature	–20 °C to +125 °C
Mating cycles	> 50
Cable entry into housing	1 seal with hole 2 x 5.5 mm, 1 x 3.5 mm 1 seal adaptable, max. Ø 14 mm
Connection to flanged socket	Soldered connection, ≤ 1 mm
Connection to plug	Soldered connection, ≤ 1 mm
Cable entry into plug	Screw connection with strain relief Cable Ø 10 - 14 mm



Switch Mounting Arrangements SGK/SOK

The switch activation point characterizes the position of the center of the carriage (CC) after travel. The zero point is at L / 2.

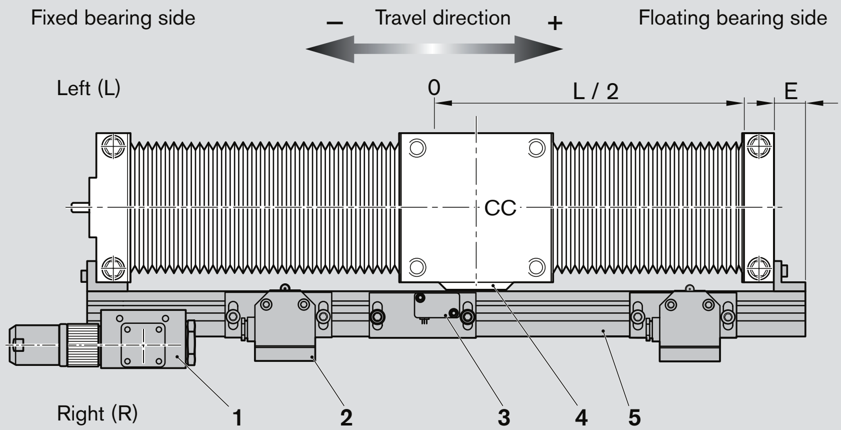
Maximum switch activation point
= 0.5 max. travel – excess travel

For safe operation of the Linear Motion Slide, the excess travel must be longer than the braking distance.
The acceleration travel can be taken as a guideline value for the braking distance.

1 Socket with plug
2 Proximity switch
3 Mechanical switch
4 Switching cam
5 Profiled support

Recommended standard configuration:
– 2 mechanical switches
– 1 proximity switch
Slide the mounting plates with switches into the slot and fix with the screws and square nuts.

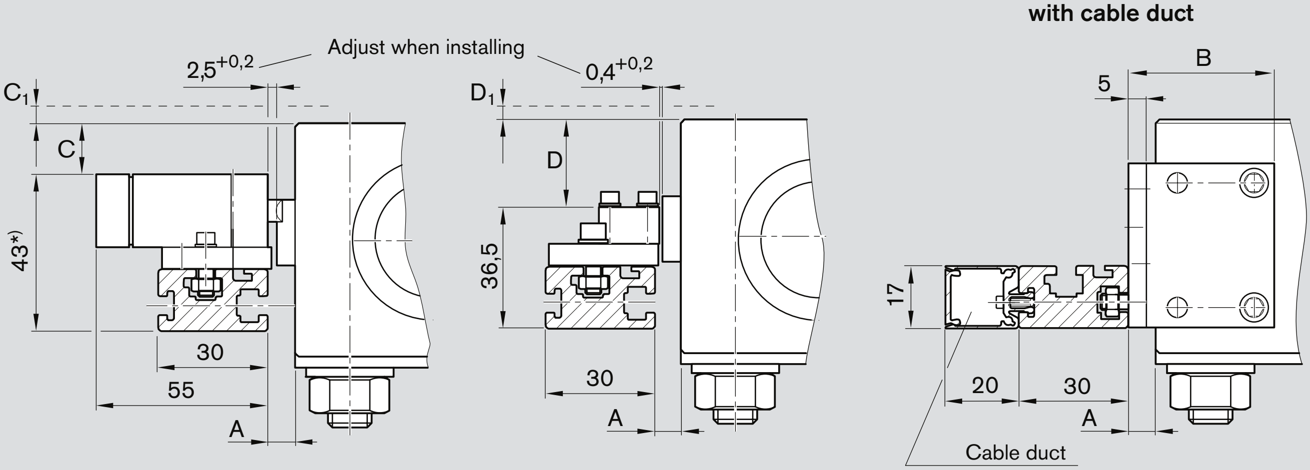
Switch mounting side:



Do not go below the minimum switching distance:
mechanical / mechanical = 62 mm
mechanical / proximity = 49 mm
proximity / proximity = 35 mm

⚠ **The mounting plates must be installed mirror-inverted.**

View of mechanical switch | **View of proximity switch** | **View of mounting bracket with cable duct**



*) 37 for SGK / SOK 12-85

Switch mounting:
- Adjust the switching distances for the mechanical and proximity switches during installation.
- In special operating conditions (vibrations, switches in the middle of the travel range) the profiled support may have to be provided with additional support.

Dimensions of mechanical switches (mm)

	A	B	C	C1[1]	D	D1[1]	E
SGK 12-85	5.5	27		4		3.5	40
SGK 16-100	5.5	30		6	0.5		40
SGK 20-130	6.5	40	4		10.5		40
SGK 25-160	6.5	40	7		13.5		40
SGK 30-180	7.5	40	14		20.5		40
SGK 40-230	9.0	40	2		8.5		40
SGK 50-280	9.0	40	2		8.5		40

Dimensions of proximity switches (mm)

	A	B	C	C1[1]	D	D1[1]	E
SOK 12-85	5.5	27		2		1.5	40
SOK 16-100	5.5	30		2	4.5		40
SOK 20-130	6.5	40	6		12.5		40
SOK 25-160	6.5	40	9		15.5		40
SOK 30-180	7.5	40	17		23.5		40
SOK 40-230	9.0	40	7		13.5		40
SOK 50-280	9.0	40	9		15.5		40

1) The switch projects beyond the upper edge of the carriage.

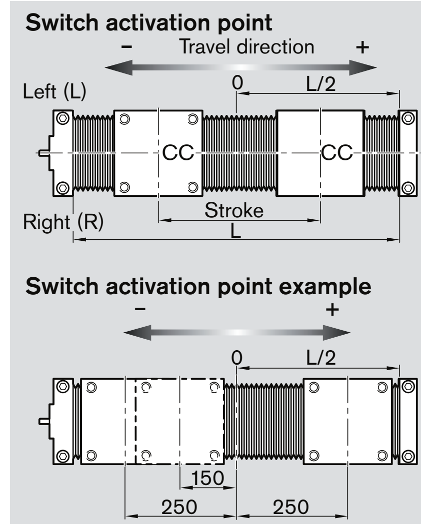
Determining the switch activation point

The switch activation point is determined by the following factors:

- Mounting side:
  Switches may be mounted on the left (L) or right (R) side of the slide.
- Direction of travel:
  Switches may be mounted on the minus (-) or plus (+) side of zero.
- Switching distance:
  The switching distance is the distance between the carriage center (CC) and the zero point (0) when a switch is activated (given in mm).

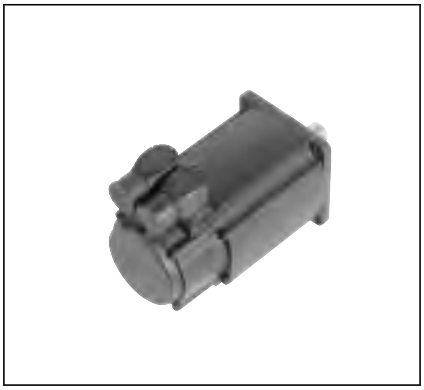
Example
Effective stroke = 500 mm
Limit switches:
Switch position for 1st switch = + 250 mm
Switch position for 3rd switch = – 250 mm
Positioning switch:
Switch position for 2nd switch = – 150 mm

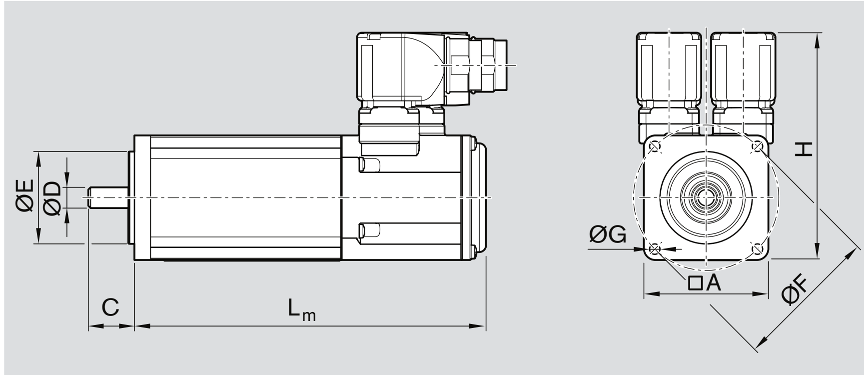
Length L
For length calculations, see “Length calculation” for the respective Linear Motion Slide.



Motors

IndraDyn S Servo Motors MSK





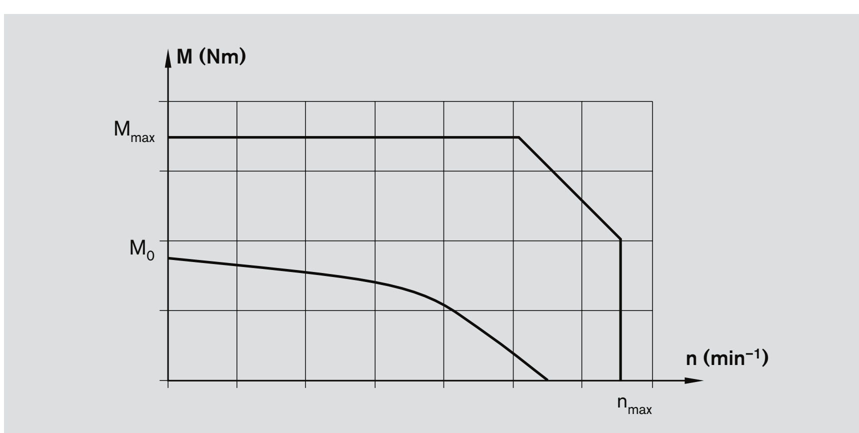
Motor	Dimensions (mm)								
	A	C	ØD	ØE	ØF	ØG	H	L_m	
								Without holding brake	With holding brake
MSK 030C-0900	54	20	9	40	63	4.5	98.5	188.0	213.0
MSK 040C-0600	82	30	14	50	95	6.6	124.5	185.5	215.5
MSK 060C-0600	116	50	24	95	130	9.0	156.0	226.0	259.0
MSK 076C-0450	140	50	24	110	165	11.0	180.0	292.5	292.5

Motor data

Motor	n_{max} (min^{-1})	M_0 (Nm)	M_{max} (Nm)	M_{br} (Nm)	J_{rm} (kgm^2)	J_{br} (kgm^2)	m_m (kg)	m_{br} (kg)
MSK 030C-0900	9 000	0.8	4.0	1	0.000030	0.000007	1.9	0.2
MSK 040C-0600	7 500	2.7	8.1	4	0.000140	0.000023	3.6	0.3
MSK 060C-0600	6 000	8.0	24.0	10	0.000800	0.000059	8.4	0.8
MSK 076C-0450	5 000	12.0	43.5	11	0.004300	0.000360	13.8	1.1

J_{br} = mass moment of inertia of the holding brake
J_m = mass moment of inertia, motor
L_m = length of the motor
M_0 = standstill torque
M_{br} = holding torque of holding brake when switched off
M_{max} = maximum possible motor torque
n_{max} = maximum motor speed

Motor torque speed curve (schematic)



Option number[1)]	Motor	Part number	Version Holding brake without	 with	Type designation
84	**MSK 030C-0900**	R911308683	X		MSK030C-0900-NN-M1-UG0-NNNN
85		R911308684		X	MSK030C-0900-NN-M1-UG1-NNNN
86	**MSK 040C-0600**	R911306060	X		MSK040C-0600-NN-M1-UG0-NNNN
87		R911306061		X	MSK040C-0600-NN-M1-UG1-NNNN
90	**MSK 060C-0600**	R911306052	X		MSK060C-0600-NN-M1-UG0-NNNN
91		R911306053		X	MSK060C-0600-NN-M1-UG1-NNNN
92	**MSK 076C-0450**	R911318098	X		MSK076C-0450-NN-M1-UG0-NNNN
93		R911315713		X	MSK076C-0450-NN-M1-UG1-NNNN

1) From the “Components and Ordering” table

Specification:
- Plain shaft with shaft seal ring
- Multiturn absolute encoder M1 (Hiperface)
- Cooling system: natural convection
- Protection class IP65 (casing)
- With or without holding brake

Note

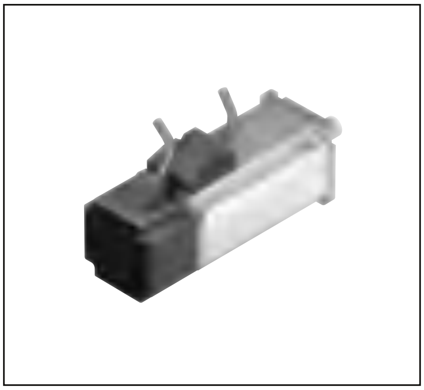
The motors can be supplied complete with controllers and control units. For further motor types and more information on motors, controllers and control systems, please refer to the following Rexroth catalogs on drive technology:
- Drive System Rexroth IndraDrive, R999000018
- Rexroth IndraDyn S Synchronous Motors MSK, R911296289
- Rexroth IndraDrive C Drive Controllers, R911314904
- Rexroth IndraDrive Cs Drive Systems with HCS01, R911322209.

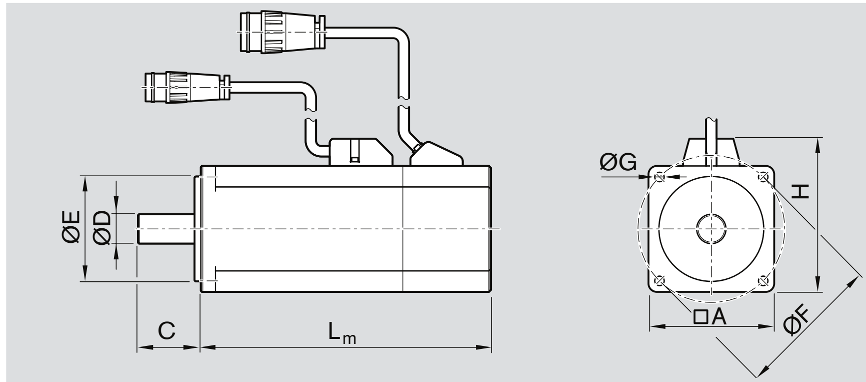
Recommended motor controller combinations

Motor	Controller
MSK 030C-0900	HCS 01.1E-W0005
MSK 040C-0600	HCS 01.1E-W0008
	HCS 01.1E-W0018
MSK 060C-0600	HCS 01.1E-W0028
MSK 076C-0450	with HNL01.1E

Motors

IndraDyn S Servo Motors MSM





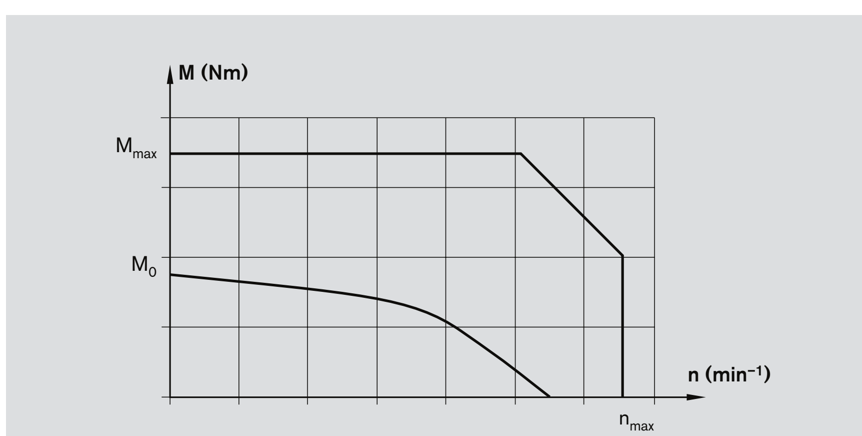
Motor	Dimensions (mm)								
	A	C	ØD	ØE	ØF	ØG	H	L_m	
								Without holding brake	With holding brake
MSM 031B-0300	60	30	11	50	70	4.5	73	79.0	115.5
MSM 031C-0300	60	30	14	50	70	4.5	73	98.5	135.0
MSM 041B-0300	80	35	19	70	90	6.0	93	112.0	149.0

Motor data

Motor	n_{max} (min^{-1})	M_0 (Nm)	M_{max} (Nm)	M_{br} (Nm)	J_m (kgm^2)	J_{br} (kgm^2)	m_m (kg)	m_{br} (kg)
MSM 031B-0300	5 000	0.64	1.91	1.27	0.0000140	0.0000018	0.82	0.48
MSM 031C-0300	5 000	1.30	3.80	1.27	0.0000260	0.0000018	1.20	0.50
MSM 041B-0300	4 500	2.40	7.10	2.45	0.0000870	0.0000075	2.30	0.80

J_{br} = mass moment of inertia of the holding brake
J_m = mass moment of inertia, motor
L_m = length of the motor
M_0 = standstill torque
M_{br} = holding torque of holding brake when switched off
M_{max} = maximum possible motor torque
n_{max} = maximum motor speed

Motor torque speed curve (schematic)



Option number[1)]	Motor	Part number	Version Holding brake without	with	Type designation
106	**MSM 031B-0300**	R911325135	X		MSM031B-0300-NN-M0-CH0
107		R911325136		X	MSM031B-0300-NN-M0-CH1
108	**MSM 031C-0300**	R911325139	X		MSM031C-0300-NN-M0-CH0
109		R911325140		X	MSM031C-0300-NN-M0-CH1
110	**MSM 041B-0300**	R911325143	X		MSM041B-0300-NN-M0-CH0
111		R911325144		X	MSM041B-0300-NN-M0-CH1

1) From the “Components and Ordering” table

Specification:
- Plain shaft without shaft seal ring
- Multiturn absolute encoder M0 (absolute encoder functionality only possible with back-up battery)
- Cooling system: natural convection
- Protection class IP54 (casing)
- With or without holding brake

Note
The motors can be supplied complete with controllers and control units. For further motor types and more information on motors, controllers and control systems, please refer to the following Rexroth catalogs on drive technology:
- Drive System Rexroth IndraDrive, R999000018
- Rexroth IndraDyn S Synchronous Motors MSM, R911329338
- Rexroth IndraDrive C Drive Controllers, R911314904
- Rexroth IndraDrive Cs Drive Systems with HCS01, R911322209.

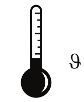
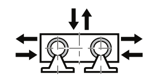
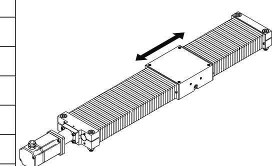
Recommended motor controller combinations

Motor	Controller
MSM 031B-0300	HCS 01.1E-W0006
MSM 031C-0300	HCS 01.1E-W0009
MSM 041B-0300	HCS 01.1E-W0013

Maintenance

Operating Conditions

Normal operating conditions

Ambient temperature must not fall below dew point		0 °C ... 40 °C	
Load		≤ 0.2 C	
Travel distance s_{min}	SGK/SOK 12-85	> 65 mm	
	SGK/SOK 16-100	> 70 mm	
	SGK/SOK 20-130	> 95 mm	
	SGK/SOK 25-160	> 135 mm	
	SGK/SOK 30-180	> 170 mm	
	SGK/SOK 40-230	> 190 mm	
	SGK/SOK 50-280	> 250 mm	
Contamination		Not permitted	

Design notes

⚠ **Moved parts:**
Safety devices and guards necessary

⚠ **For vertical installations:**
Arresting devices necessary to protect against falling loads

Intended use

The product is an assembly.
The product may be used in accordance with the technical documentation (product catalog) for the following purposes:
– for precise positioning in space.
The product is intended exclusively for professional use and not for private use.
Use for the intended purpose also includes the requirement that you must have read and understood the product documentation completely, in particular these “Safety instructions”.
The product is exclusively intended for incorporation into a final machine or a system or for assembly to other components for the purpose of building a final machine or a system.

Misuse

Use of the product in any other way than as described under “Intended use” is considered to be misuse and is therefore not permitted. If unsuitable products are installed or used in safety-relevant applications, this may lead to uncontrolled operating statuses in the application which can cause personal injury and/or damage to property.
The product may only be used in safety-relevant applications if this use has been expressly specified in the product documentation and is permitted, e.g. in zones with potentially explosive atmospheres or in safety-critical parts of a control system (functional safety).
Bosch Rexroth AG will not accept any liability for injury or damage caused by misuse of the product. The risks associated with any misuse of the product shall be borne by the user alone. Misuse of the product includes:
– the transport of persons

Lubrication

Lubrication notes: Basic lubrication is applied in-factory before shipment. Linear Motion Slides have been designed for lubrication with grease using a manual grease gun. The only maintenance required is lubricating the linear bushings and the ball screw assembly of the Linear Motion Slides.

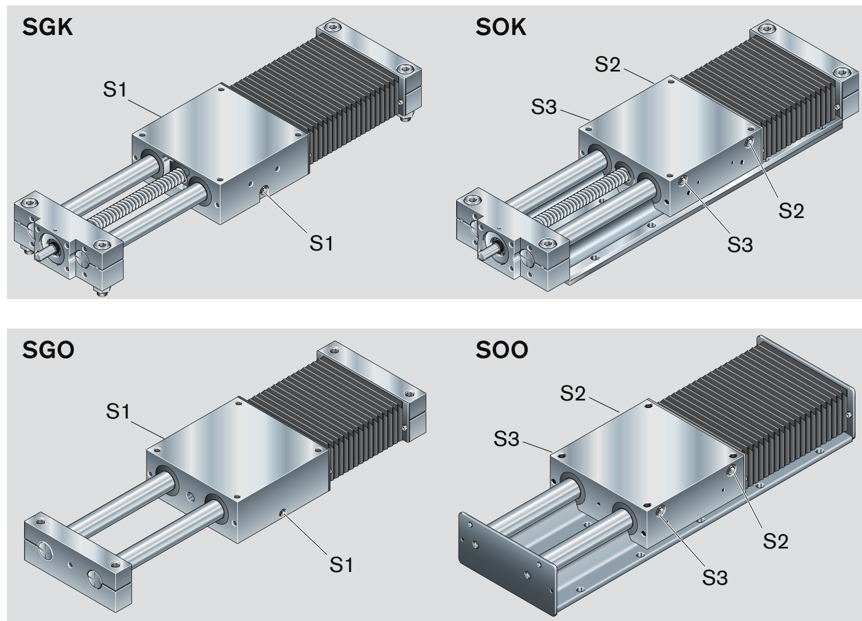
Lubrication points

Lube nipples are provided on both sides of the carriage. Lubricating from one side only is sufficient.
In the open types SOK/SOO, lubricant must be applied through one each of the S2 and S3 lube nipples (see illustration).

S1 One-point lubrication for closed types SGK/SGO

S2 Lube nipple in open types SOK/SOO for the linear bushing pair on the floating bearing side, and – but only in SOK – also for the ball screw drive

S3 Lube nipple in the open types SOK/SOO for the linear bushing pair on the fixed bearing side



Size	Lube nipple
12-85 … 20-130	DIN 3405 AM 6
25-160 … 50-280	DIN 3405 AM 8x1

Lubricants

⚠ **Linear Motion Slides have been designed for lubrication with grease only!**

⚠ **Do not use greases containing solid particles (e.g., graphite or MoS_2)!**

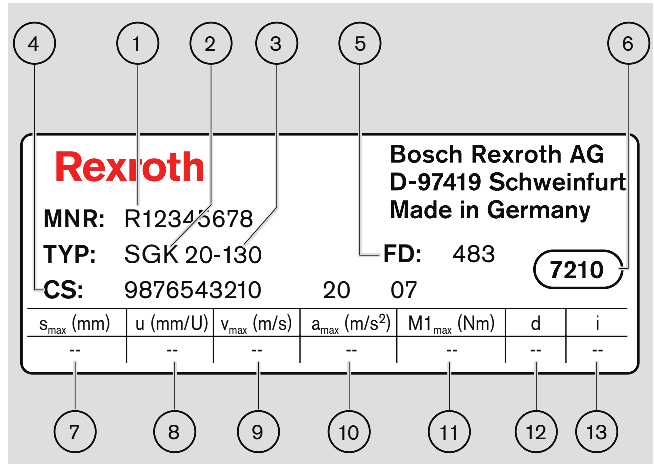
Lithium soap grease KP2K (DIN 51825) Consistency class NLGI 2 (DIN 51818)	Part number
We recommend: Dynalub 510 (Bosch Rexroth)	Cartridge (400 g) R341603700 Bucket (5 kg) R341603500
May also be used: Elkalub GLS 135 / N2 (Chemie-Technik) Castrol Longtime PD2 (Castrol)	

Size	Construction form		Relubrication quantity (g)		
	With drive unit	Without drive unit	S1	S2	S3
8 - 65		SGO	2.0	–	–
12 - 85	SGK		3.5	–	–
	SOK		–	3.9	2.6
		SGO	2.2	–	–
		SOO	–	2.6	2.6
16 - 100	SGK		6.0	–	–
	SOK		–	5.6	3.7
		SGO	4.1	–	–
		SOO	–	3.7	3.7
20 - 130	SGK		8.4	–	–
	SOK		–	9.8	6.5
		SGO	5.1	–	–
		SOO	–	6.5	6.5
25 - 160	SGK		9.8	–	–
	SOK		–	16.7	11.2
		SGO	4.3	–	–
		SOO	–	11.2	11.2
30 - 180	SGK		16.3	–	–
	SOK		–	25.1	16.7
		SGO	7.9	–	–
		SOO	–	16.7	16.7
40 - 230	SGK		35.8	–	–
	SOK		–	26.5	17.7
		SGO	27.0	–	–
		SOO	–	17.7	17.7
50 - 280	SGK		55.8	–	–
	SOK		–	69.8	46.5
		SGO	32.5	–	–
		SOO	–	46.5	46.5

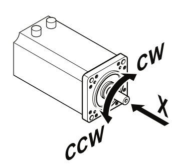
Parameterization (start-up)

Easy start-up thanks to integrated assistant
EasyWizard is an assistant that is integrated as a standard feature of Rexroth's engineering framework IndraWorks DS. It was designed to help users start-up the drives of linear systems easily, rapidly and safely. Starting up electromechanical axes often used to be a complicated, time-consuming and error-prone procedure. EasyWizard has changed all that – preconfigured data sets and equipment nameplates designed to dovetail with the assistant take the hassle out of getting your linear systems up and running.

Advantages
- Fast, simple and intuitive start-up
- Online help texts and supporting graphics guide you through the input fields
- Plausibility checks for free data input
- Suitable for all Rexroth linear systems
- Parameter input errors are minimized by having the data on the nameplate and in the Wizard input mask arranged in a similar order
- For system optimization after parameter input, the axis can be run in the test mode



1 Part number
2 Type designation
3 Size
4 Customer information
5 Date of manufacture
6 Manufacturing location
7 s_{max} – max. travel range (mm)
8 u – lead constant without gear unit (mm/rev)
9 v_{max} – max. linear speed without gear unit (m/s)
10 a_{max} – max. acceleration without gear unit (m/s^2)
11 $M1_{max}$ – max. drive torque at motor journal (Nm)
12 d – motor direction of rotation for travel in positive direction



CW – clockwise
CCW – counter clockwise

13 i – gear ratio

Documentation

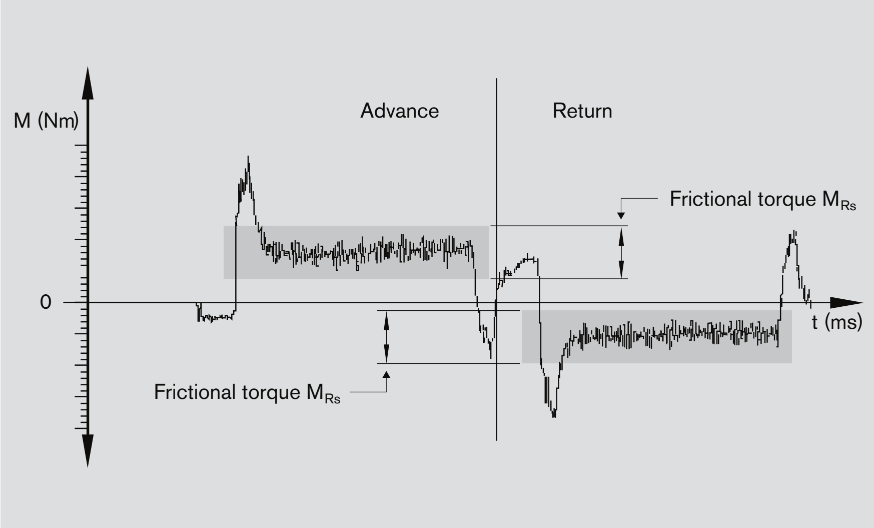
Standard report
Option 01

The standard report serves to confirm that the checks listed in the report have been carried out and that the measured values lie within the permissible tolerances. Each Linear Motion Slide is delivered complete with the relevant instructions for mounting and maintenance.

Checks listed in the standard report:
- functional checks of mechanical components
- functional checks of electrical components
- design is in accordance with order confirmation

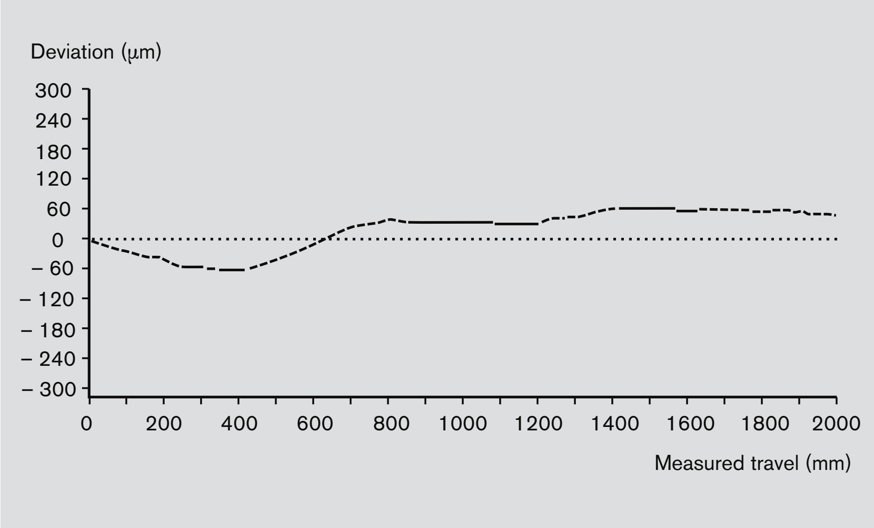
Frictional moment of complete system
Option 02

- All items contained in the standard report.
- Additionally, the moment of friction is measured over the entire travel range.



Lead deviation of ball screw for SGK and SOK
Option 03

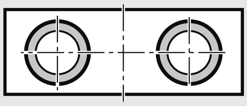
- All items contained in the standard report.
- In addition to graphical representation (see illustration), a measurement report is supplied in table form.

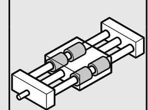
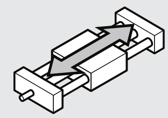
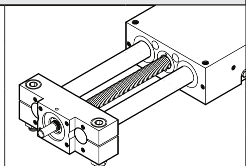
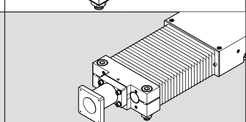
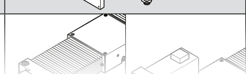


Inquiry/Order

Selection and Ordering Example

Based on the “Components and Ordering” table

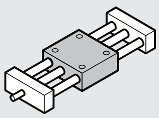
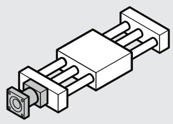
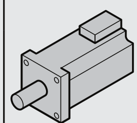
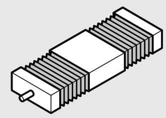
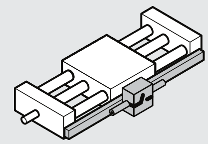
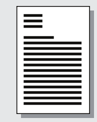


		Slide	Part number, length R0261 .00 00, ... mm	Type	Guide  Standard shafts	Drive unit  Screw journal	Ball screw d_0 x P 20 x 5	20 x 20	25 x 10	32 x 5	32 x 10	32 x 20	32 x 32
With ball screw, w/o motor mount		SGK 25-160 SGK 30-180	R0261 300 00 R0261 400 00	OF01	01	Ø10	01	02	04				
						Ø10[1)]	05	06	08				
		SGK 40-230 SGK 50-280	R0261 500 00 R0261 600 00		01	Ø16				01	02	03	04
						Ø16[1)]				05	06	07	08
With BS and motor mount		SGK 25-160 SGK 30-180	R0261 300 00 R0261 400 00	$\boxed{\text{MF01}}$	01	Ø10	01	02	04				
		$\boxed{\text{SGK 40-230}}$ SGK 50-280	$\boxed{\text{R0261 500 00}}$ R0261 600 00		$\boxed{01}$	Ø16				01	02	03	$\boxed{04}$
				RV01	01[6)]	Ø10	11	12	14				

▭ (grey) = Highlighting of the selection area after deciding on the specific version

▭ = Selected option to be entered into the “Inquiry/Order Form” at the end of this catalog

Ordering Data **Option**		**Description**
Linear Motion Slide, size	SGK 40-230	Closed-type linear motion slide SGK with ball screw drive, size 40-230
Part number, length	R0261 500 00, 1310 mm	Length 1310 mm
Type	MF01	Linear Motion Slide with motor mount and motor, as shown in diagram MF01
Guide	01	Standard shafts
Drive unit	04	Ball screw 32 x 32
Carriage	01	Standard carriage
Motor attachment	05	with attachment kit for motor
Motor	90	Motor MSK 060C with brake
Cover	01	Polyurethane bellows
1st switch	15	Mechanical switch
2nd switch	11	PNP NC
3rd switch	15	Mechanical switch
Cable duct	20	Cable duct (loose)
Socket-plug	17	Socket-plug on switch side
Switching cam	16	Switching cam for switch activation and profiled support
Documentation	03	Measurement report: Lead deviation for ball screw

Carriage	Motor attachment			Motor		Cover		Switches / Cable duct / Socket-plug	Documentation	
										
Standard	i =	Attach-ment kit[3)]	for motor	Brake		PU bellows			Standard report	Measure-ment report[4)]
				with-out	with	without	with			
01	–	00		00		00	[01]	Without switches Without cable duct 00 Without socket and plug	01	02
01	–	00		00				Switches: – PNP NC [11] – PNP NO 13 – Mechanical [15]		
01	–	03	MSK 040C	86	87			Ordering data: Switch type		
		06	MSM 041B	74	75			Cable duct[5)] [20]		
[01]	–	02	MSK 076C	–	93			Socket-plug [17]		
		[05]	MSK 060C	[90]	91			Switching cam and profiled support for switches [16]		[03]
01	1	10	MSK 040C	86	87					
		20	MSM 041B	74	75					
	1.5	12	MSK 040C	86	87					
		22	MSM 041B	74	75					
	1	14	MSK 040C	74	75					
		24	MSM 041B	86	87					
		16	MSK 040C	86	87					
		26	MSM 041B	74	75					
		[illegible]	MSK 060C	90	91					

Inquiry/Order Form

Rexroth – Linear Motion Slides

Ordering example

Ordering Data		Option	Description
Linear Motion Slide SGK 40-230			Linear Motion Slide designation
Part number R0261 500 00, 1310 mm			SGK 40-230, length = 1310 mm
Type	=	MF01	Linear Motion Slide with motor mount and motor, as shown in diagram MF01
Guide	=	01	Standard shafts
Drive unit	=	04	Ball screw size 32 x 32 (d_0 x P)
Carriage	=	01	Standard carriage
Motor attachment	=	05	with attachment kit for motor, gear ratio i = 1
Motor	=	90	Motor MSK 060C with brake
Cover	=	01	Polyurethane bellows
1st switch	=	15	Mechanical switch
2nd switch	=	11	PNP NC
3rd switch	=	15	Mechanical switch
Cable duct	=	20	Cable duct (loose)
Socket-plug	=	17	Socket-plug on switch side
Switching cam	=	16	Switching cam for switch activation and profiled support
Documentation	=	03	Measurement report: Lead deviation for ball screw

To be completed by customer: Inquiry ☐ / Order ☐

Linear Motion Slide ________________________________

(Part number): R______ ______ ______, length _________mm

Type = ☐☐☐☐
Guide = ☐☐
Drive unit = ☐☐
Carriage = ☐☐
Motor attachment = ☐☐
Motor = ☐☐
Cover = ☐☐
1st switch = ☐☐
2nd switch = ☐☐
3rd switch = ☐☐
Cable duct = ☐☐
Socket-plug = ☐☐
Switching cam = ☐☐
Documentation = ☐☐

Quantity Order of: ____ pcs, _____ per month, ______ per year, per order, or ____________________

Comments:

Sender

Company: ______________________________ Name: ______________________________
Address: ______________________________ Department: ______________________________
______________________________ Telephone: ______________________________
______________________________ Telefax: ______________________________

The Drive & Control Company

Rexroth
Bosch Group

Drive Units AOK, AGK

Identification system for short product names

Short product name

Short product names are used to identify the product family, size, version and product generation of Rexroth linear motion axes.

Example			A	O	K	-	032	-	NN	-	1
System	=	**D**rive Unit									
Format	=	**O**pen **C**losed									
Drive	=	**B**all screw drive									
Size	=	020 / **032** / 040									
Version	=	**S**tandard version									
Generation	=	Product generation **1**									

Changes/additions at a glance

Catalog structure

- New catalog number
- New short product name
- Dimension drawings revised
- “Delivery form” section added
- Technical data and drive data table layout revised
- “Calculation” section revised
- “Configuration, ordering, dimension drawings, options” section revised
- “Attachment kits for motors according to customer specification” section added
- “Motors” section added
- “AGK switch mounting arrangements/switching system” section added

Technical changes

- Range of available nuts expanded
- Range of available Nut Housings expanded
- Permissible drive torques increased
- “Switching system” section revised
- Ordering example
- Query sheet

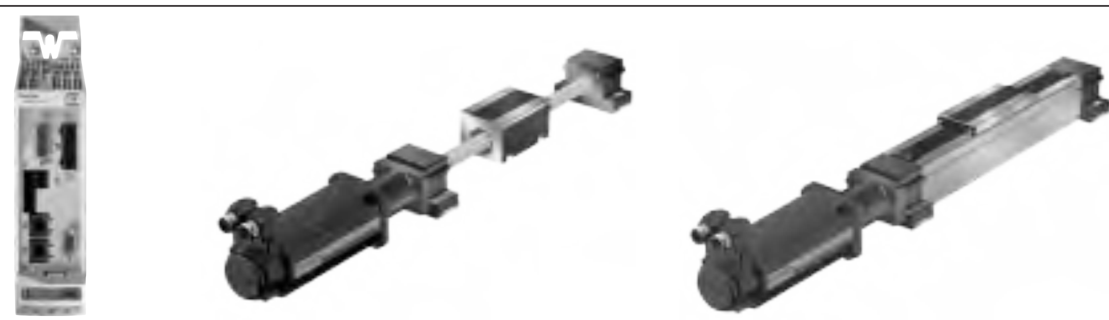
Contents

AOK/AGK product description

AOK and AGK Drive Units consist of Rexroth's proven ball screw drive (**BASA** - **BA**ll **S**crew **A**ssembly), which with Nut Housings and Pillow Block Units make it into a ready-to-install drive axis. When combined with an external linear guide, this Drive Unit becomes a fully functional linear motion axis for a variety of applications.

Advantages

- Each available in three sizes with freely configurable lengths up to 5600 mm
- Variable lengths and versions thanks to configuration with numerous options
- Technical data for the entire unit, e.g., maximum permissible drive torque, speed, etc.
- Nameplate with technical start-up parameters
- High positioning accuracy and repeatability due to ball screw drive with zero-backlash, pre-tensioned nut system
- When paired with Rexroth linear guides, they offer design engineers full design freedom for every application.



Drive Units are available complete with motor, controller and control system.
For more information, see the “Motors” section

Application areas

Drive Units can be used in many ways as a drive axis for linear motion and positioning tasks in the application areas and industries below.

Possible applications

- Pick and place
- Handling systems
- Placement systems, palletizers
- Machine tool feed units
- Inspection and analysis systems
- Transfer line feed units
- Motion units

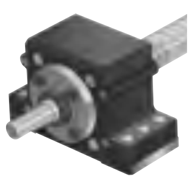
Possible industries

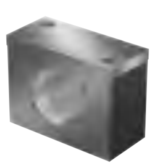
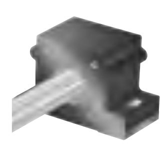
- Handling and assembly
- Electronics and semiconductors
- Automotive suppliers and manufacturers
- Robotics and automation
- Special-purpose machinery
- Packaging technology
- Plastics
- Textiles

AOK Drive Units, open format

- Quick Drive Unit installation and easy alignment thanks to machined reference edges on the Nut Housing and pillow block
- Available with and without floating bearings
- Motor attachment via mount and coupling or timing belt side drive
- Rexroth servo motor (MSK/MSM)



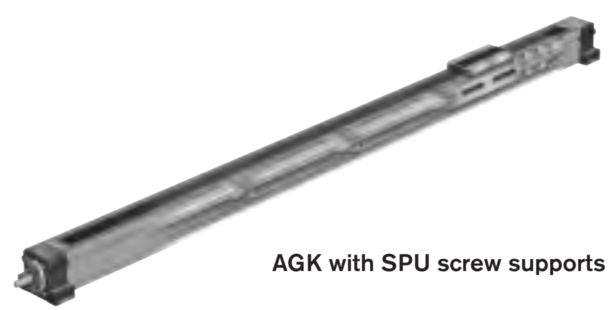


AOK Drive Units, closed format

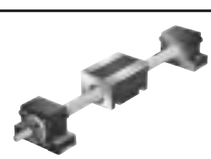
- Rapid mounting and easy alignment of the Drive Unit due to the machined reference edge on the Pillow Block Housing
- Optimal sealing with extruded aluminum profile and steel or polyurethane sealing strip
- Traveling screw supports for maximum speeds in horizontal operation
- Motor attachment via mount and coupling or timing belt side drive
- Rexroth servo motor (MSK/MSM)





AGK with SPU screw supports

Overview

Drive Unit	Type	Format	Max. parameters	Size -020	-032	-040
	**AOK**	**open**	**L_{max} (mm)**	3 000	4 000	5 000
			Dynamic load rating C (N)	14 300	31 700	50 000
	**AGK**	**closed**	**L_{max} (mm)**	3 000	5 000	5 600
			Dynamic load rating C (N)	14 300	31 700	50 000

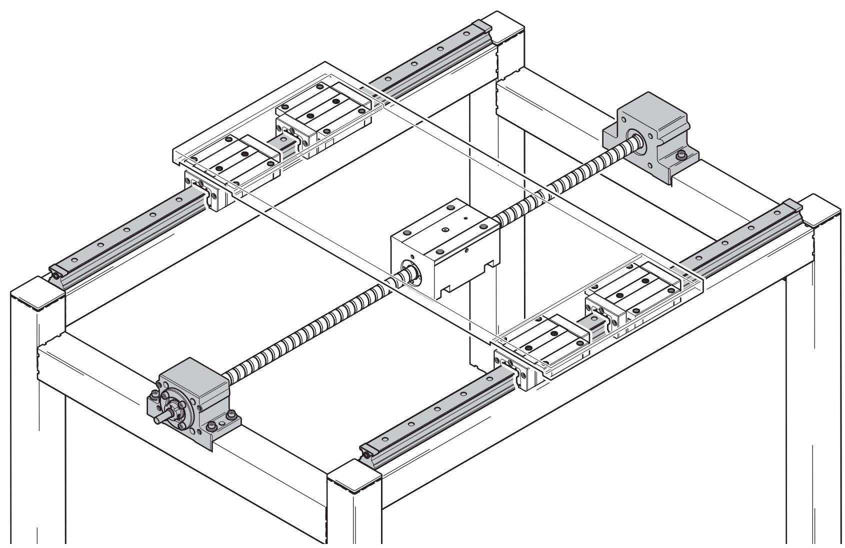
AOK/AGK product description

Notes on applications

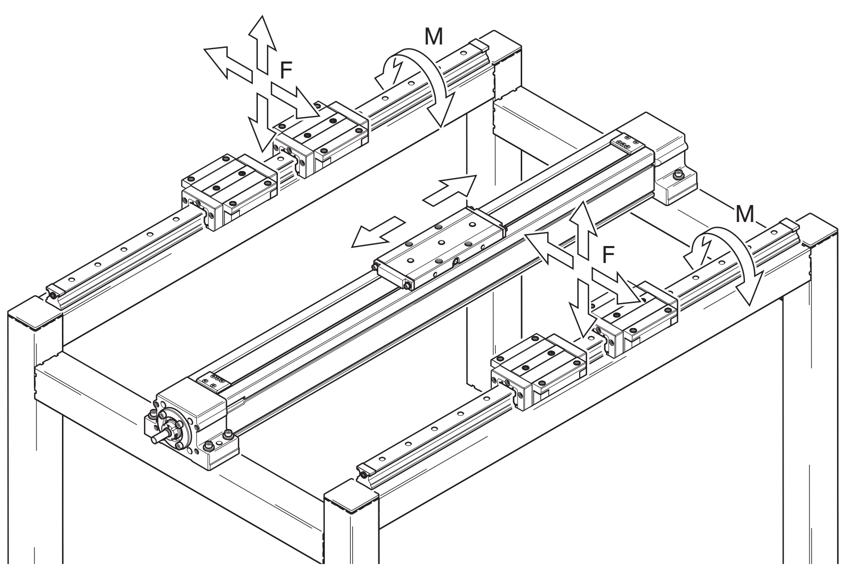
AOK and AGK Drive Units are designed for drive tasks only and can only absorb axial forces.
When using a Drive Unit, always make sure to include adequate, separate linear guides that can handle the structure being moved as well as the resulting reaction forces and torques.
This results in a linear motion unit (e.g. table top) that can be moved automatically thanks to an AOK or AGK Drive Unit.

Examples

Example of basic motion unit structure with table top and AOK Drive Unit



In this example, two separate linear guides, each with two Runner Blocks, absorb forces and torques so that when moving the structure only axial forces act on the Drive Unit (here AGK).



⚠ **Follow the assembly instructions and installation tolerances in the “Attachments and accessories” section.**

Delivery form

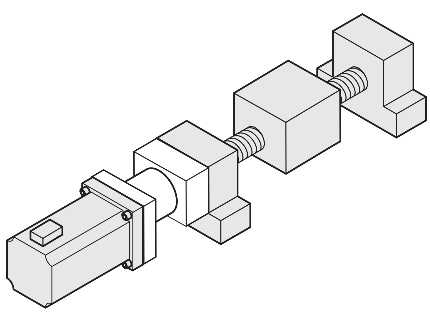
Drive Units come ready-mounted.

Motor attachment

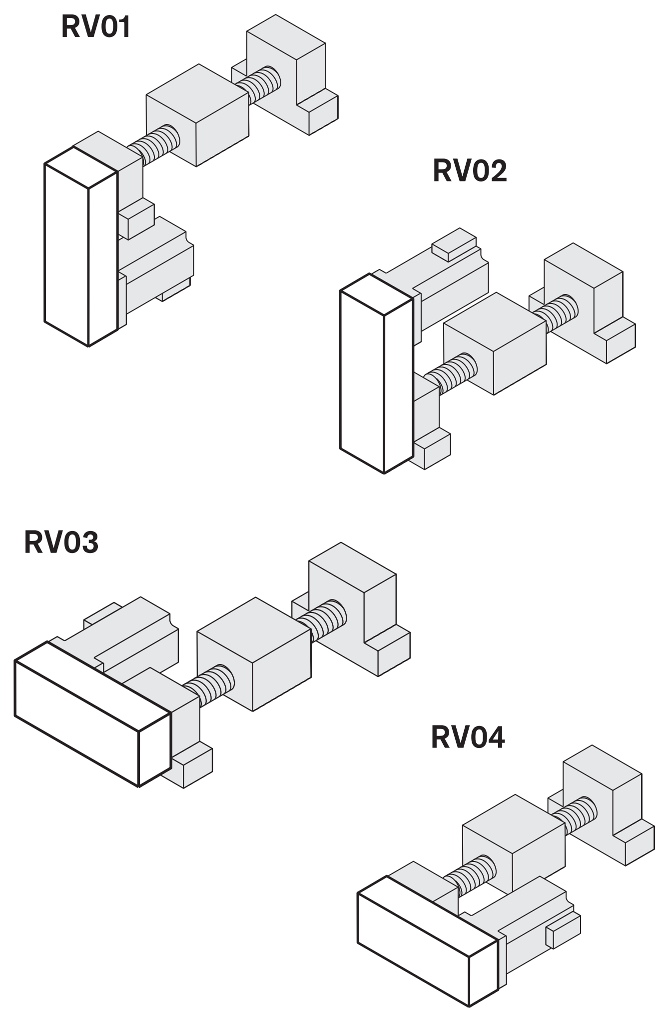
If a combination of motor and motor attachment has been selected, then the components are attached as shown in the figure, which also shows the location of the motor connector.
Motor attachments ordered without a motor must be assembled by the customer.
All necessary instructions and parameters for professional assembly are included.

AOK (example)

Mount and coupling (MF01)



Timing belt side drive (RV01–RV04)



Available options

Switches and sockets with plugs are included in delivery (installation required).

Lubrication

Drive Units delivered with initial greasing.
For further information, see the “Lubrication” section.

Documentation

Each Drive Unit delivered with appropriate documentation.

Product description

Properties

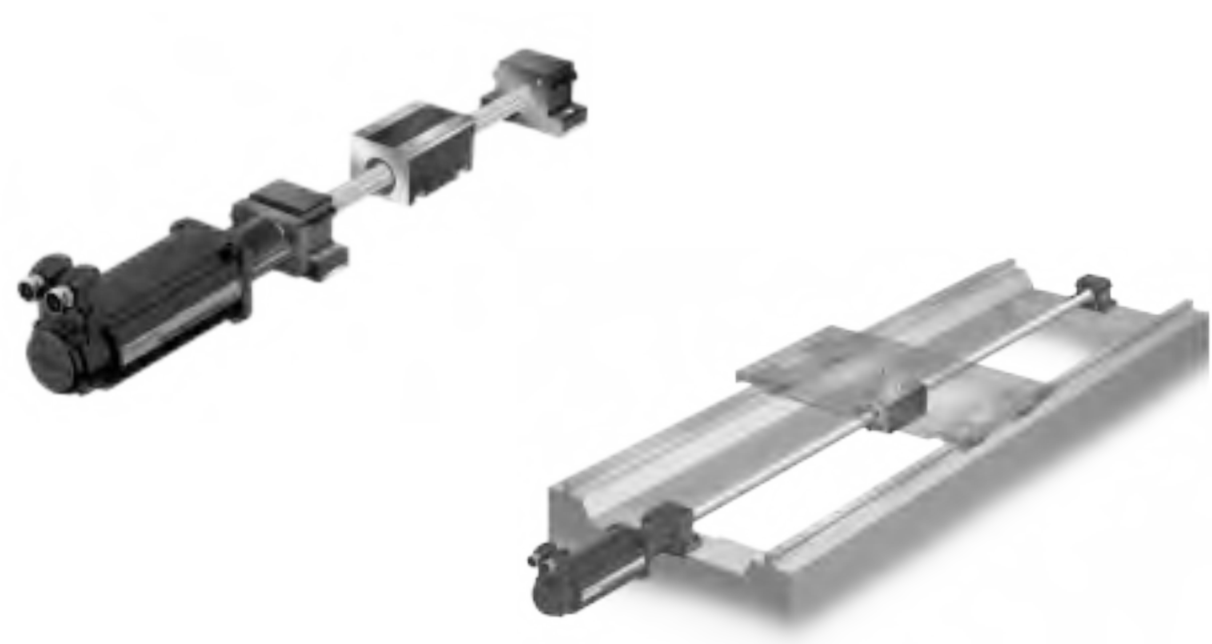
- AOK Drive Units in open format are ready-to-install drive axes consisting of a ball screw drive with nuts and pillow blocks, as well as an optional Nut Housing
- Three coordinated sizes available in any length up to L_{max}
- A version with fixed and floating bearing or fixed bearing only is also available
- Driven by a precision ball screw drive in rolled design in accordance with DIN 69051
  - Screws in tolerance grade T5 or T7 available
  - Various nut versions available depending on size and lead
  - Three different preloads available (C1, C2 and C3)
- Pillow blocks available in aluminum or steel
- High linear speeds thanks to large leads with high precision over long lengths
- Nuts can be optionally selected with Front Lube Unit for longer lubrication intervals

Other highlights

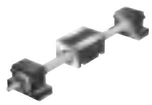
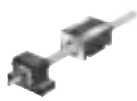
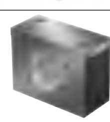
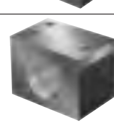
- Flexible thanks to selectable options
- Easy motor attachment via locating feature and threads
- Clearly structured technical data for the complete unit as a “linear motion system without guideway”
- Nameplate with parameters for easy start-up

Attachments

- Motor attachments with mount and coupling or via a timing belt side drive
- Attachment kits for motors according to customer specification
- Maintenance-free servo motors with selectable brake and integrated feedback



Ball screw drive component overview

Components		Short product name	Description
Version		Fixed/floating bearing	With Pillow Block Housings on fixed or floating bearing end
		Fixed bearing only	With Pillow Block Housings on fixed bearing end only
Nut		ZEM-E	Cylindrical Single Nut (only with MGA Nut Housing)
		FEM-E-S	Single Nut with flange (Rexroth mounting dimensions)
		FEP-E-S	
		FEM-E-C	Single Nut with flange (mounting dimensions similar to DIN 69051, Part 5)
Front Lube Unit		VSE	Front Lube Unit (VSE) for long-term, maintenance-free operation of the ball screw drive. (Only available in combination with nut with initial greasing).
Nut Housing		MGA	Aluminum Nut Housing, compatible with Cylindrical Single Nut ZEM-E
		MGS	Steel Nut Housing, suitable for Single Nut with flange FEM-E-S / FEP-E-S
		MGD	Steel Nut Housing, suitable for Single Nut with flange FEM-E-C

Nut preload

Preload classes	Definition
C1	Moderate preload
C2	Medium preload
C3	High preload

For further information, see the “Screw Drive” catalog.

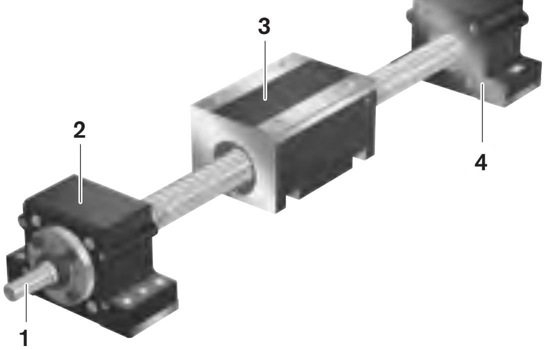
Precision Screw accuracy

Tolerance grade	Permissible travel deviation over 300 mm (v300p)
T5	23 µm / 300 mm
T7	52 µm / 300 mm

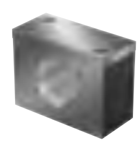
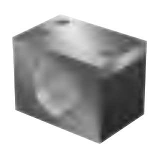
Structural design

1 Ball screw drive
2 Pillow block on fixed bearing end (drive side)
3 Housing with nut
4 Pillow block on floating bearing end

With fixed and floating bearing



With fixed bearing only

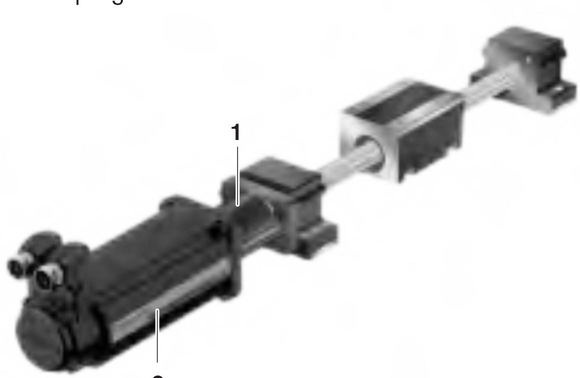
Nut	ZEM-E	FEM-E-S / FEP-E-S	FEM-E-C
		 	
can be combined with*			
Nut Housing	MGA	MGS	MGD
			

* Only the combination options in the “Configuration and ordering” tables are valid.

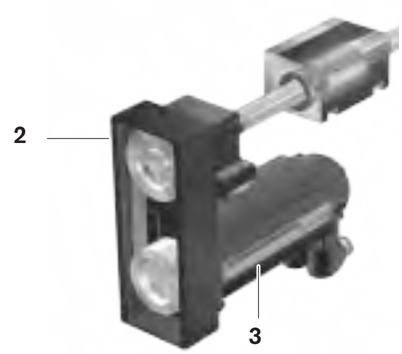
Motor attachment

Attachments:
1 Mount and coupling
2 Timing belt side drive
3 Motor

Mount and coupling



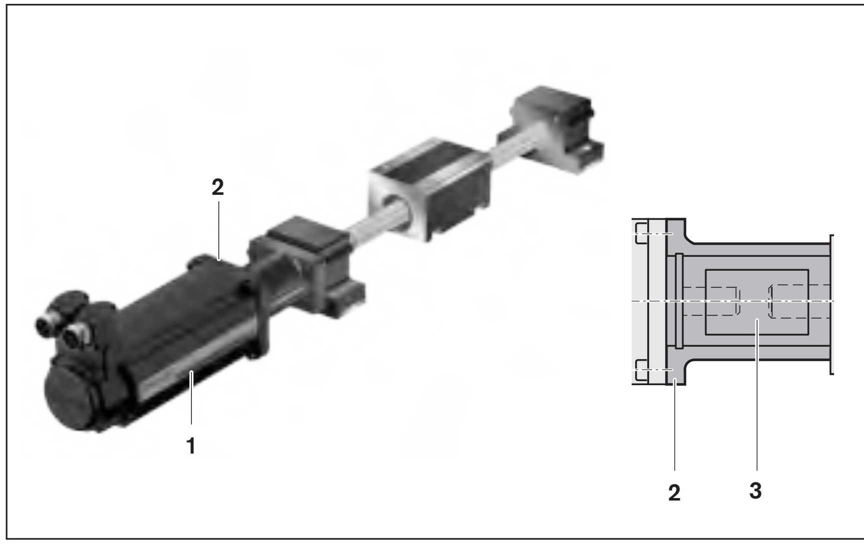
Timing belt side drive



Structural design of mount and coupling

A motor can be attached to all Drive Units via mount and coupling.
The mount secures the motor to the Drive Unit and serves as a closed housing for the coupling.
The coupling transmits the motor drive torque to the Drive Unit's drive shaft without distortive stresses.
Our standard couplings compensate for the system's thermal expansion.

1 Motor
2 Mount
3 Coupling

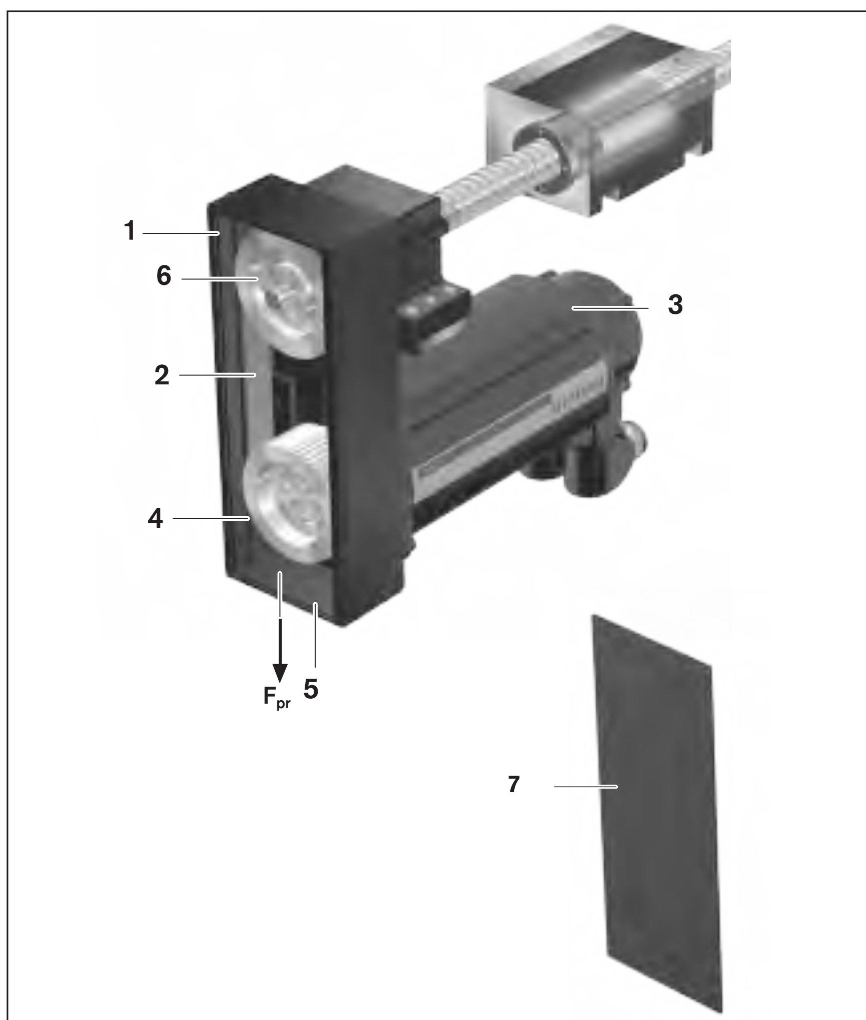


Structural design of timing belt side drive

All Drive Units can be attached to the motor by a timing belt side drive.
This makes the overall length shorter than when attaching the motor via mount and coupling.
The space-saving, closed pulley housing protects the belt and acts as a motor bracket.
Various gear ratios are also available (depending on size):
- i = 1
- i = 2

The timing belt side drive can be installed in four directions:
- below, above (RV01 and RV02)
- left, right (RV03 and RV04)

1 Pulley housing made of anodized aluminum frame
2 Toothed belt
3 Motor
4 Pre-tensioning the belt:
Apply pre-tensioning force F_{pr} to motor (F_{pr} is provided upon delivery)
5 Cover
6 Fastening of belt pulleys with tensioning units
7 Timing belt side drive cover panel



Technical data

See the “Calculation” section.

General technical data

AOK	BASA	Dynamic load rating C				Min. travel range	Max. length		Additional length		Nut length	
		ZEM-E[2]	FEM-E-S/ FEP-E-S[1]	FEM-E-C	Fixed bearing		Fixed/ floating bearing	Fixed bearing only	Fixed/ floating bearing	Fixed bearing only	Nut FEM-E-S FEP-E-S[1]	FEM-E-C
	d_0 x P (mm)	(N)	(N)	(N)	(N)	s_{min} (mm)	L_{max} (mm)	L_{max} (mm)	L_{ad} (mm)	L_{ad} (mm)	L_c (mm)	L_c (mm)
AOK-020	20 x 5	14 300	14 300	14 300	17 000	100	3 000	750	120	70	40	40
	20 x 10	14 100	14 100	14 100							60	60
	20 x 20	13 300	9 100	13 300							57	77
	20 x 40[1]	14 000	14 000	–							57	–
AOK-032	32 x 5	21 600	21 600	21 600	26 000	150	4 000	1 500	128	74	48	48
	32 x 10	31 700	31 700	31 700							77	77
	32 x 20	19 700	13 500	19 700							64	84
	32 x 32	19 500	13 400	19 500							88	120
AOK-040	40 x 5	29 100	29 100	29 100	29 000	180	5 000	2 000	160	90	54	54
	40 x 10	50 000	50 000	50 000							70	70
	40 x 20	37 900	37 900	37 900							88	88
	40 x 40	37 000	25 500	37 000							102	142

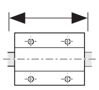
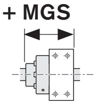
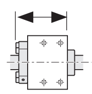
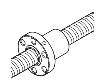
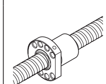
Weight calculation
(without motor attachment, without motor)

$$m_s = k_{g\ fix} + k_{g\ var} \cdot L + m_{ca}$$

Drive data

AOK	BASA	Constant mass moment of inertia						
		Nut		Nut and housing				
		FEM-E-S FEP-E-S[1]	FEM-E-C	ZEM-E + MGA	FEM-E-S/ FEP-E-S[1] + MGS	FEM-E-C + MGD		
	d_0 x P (mm)	$k_{J\ fix}$ (kgmm²)	$k_{J\ fix}$ (kgmm²)	$k_{J\ fix}$ (kgmm²)	$k_{J\ fix}$ (kgmm²)	$k_{J\ fix}$ (kgmm²)	$k_{J\ var}$ (kgmm)	$k_{J\ m}$ (mm²)
AOK-020	20 x 5	15.5	15.6	16.3	16.2	16.3	0.1004	0.6333
	20 x 10	16.3	16.4	19.3	18.9	19.4	0.1004	2.5330
	20 x 20	21.4	20.3	31.6	33.4	32.3	0.1004	10.1321
	20 x 40[1]	36.0	–	73.1	83.8	–	0.1004	40.5285
AOK-032	32 x 5	129.9	129.9	131.6	131.0	131.4	0.7117	0.6333
	32 x 10	131.3	131.6	137.8	135.8	137.4	0.7117	2.5330
	32 x 20	139.9	138.6	163.6	163.8	161.6	0.7117	10.1321
	32 x 32	165.8	160.9	217.5	227.2	219.8	0.7117	25.9382
AOK-040	40 x 5	374.8	375.0	378.3	376.3	377.3	1.7827	0.6333
	40 x 10	340.7	340.4	353.4	349.8	349.6	1.6068	2.5330
	40 x 20	353.0	352.0	401.7	389.4	388.6	1.6068	10.1321
	40 x 40	482.9	425.0	597.3	733.7	571.3	1.6068	40.5285

1) Nut version FEP-E-S only available with BASA 20 x 40
2) Nut version ZEM-E only available with housing MGA

Nut and housing length			Moved mass of system					Mass constants				
			Nut		Nut and housing			Fixed/floating bearing		Fixed bearing only		
ZEM-E + MGA	FEM-E-S/ FEP-E-S[1] + MGS	FEM-E-C + MGD	FEM-E-S FEP-E-S[1]	FEM-E-C	ZEM-E + MGA	FEM-E-S/ FEP-E-S[1] + MGS	FEM-E-C + MGD	Alumi-num	Steel	Alumi-num	Steel	
												
L_c (mm)	L_c (mm)	L_c (mm)	m_{ca} (kg)	m_{ca} (kg)	m_{ca} (kg)	m_{ca} (kg)	m_{ca} (kg)	$k_{g\ fix}$ (kg)	$k_{g\ fix}$ (kg)	$k_{g\ fix}$ (kg)	$k_{g\ fix}$ (kg)	$k_{g\ var}$ (kg/mm)
100	52	67	0.28	0.31	1.55	1.33	1.49	3.13	7.03	1.89	3.77	0.0021
100	60	67	0.36	0.40	1.57	1.41	1.58					
100	78	77	0.60	0.49	1.61	1.78	1.67					
100	63	–	0.51	–	1.42	1.69	–					
150	63	83	0.54	0.62	3.33	2.29	2.89	4.14	9.65	2.48	4.91	0.0056
150	77	83	0.72	0.84	3.27	2.47	3.11					
150	75	84	1.02	0.90	3.36	3.39	3.17					
150	114	120	1.40	1.21	3.39	3.77	3.48					
180	75	95	0.71	1.03	6.23	3.08	4.64	6.86	14.98	4.12	7.68	0.0088
180	80	95	1.29	1.19	6.29	4.88	4.80					
180	88	95	1.54	1.44	6.34	5.13	5.05					
180	151	142	3.59	2.16	6.41	9.78	5.77					

Frictional torque		Maximum permissible acceleration	Maximum drive torque	Maximum speed
Fixed/floating bearing or fixed bearing only for preload class				
C1	C2 or C3			
M_{Rs} (Nm)	M_{Rs} (Nm)	a_{max} (m/s²)	M_P (Nm)	v_{max} (m/s)
0.34	0.51	39.8	See graphs	See graphs
0.36	0.54	50.0		
0.35	0.51	50.0		
0.27	–	50.0		
0.72	1.08	17.9		
0.79	1.32	30.7		
0.71	1.04	50.0		
0.70	1.04	50.0		
1.19	1.80	12.2		
1.37	2.31	16.8		
1.26	1.98	33.0		
1.26	1.95	50.0		

See next spread for designations

Technical data

See the “Calculation” section.

Drive data for motor attachment via timing belt side drive

AOK	Motor	BASA (mm) d_0 x P	up to L[2] (mm) Fixed/ floating bearing	Only fixed bearing	M_{sd}[1] (Nm) i = 1	i = 2	J_{sd} (10^{-6} kgm²) i = 1	i = 2	M_{Rsd} (Nm)	m_{sd} (kg)	F (mm)	B_t i = 1	i = 2
AOK-020	**MSK 040C, MSM 041B**	20 x 5	1 500	300	6.00	–	240	–	0.40	1.24	88	16 AT5	–
		20 x 10	1 900	400	7.90								
		20 x 20	2 600	600	7.94								
		20 x 40	2 200	500	7.94								
	MSK 050C	20 x 5	1 500	300	6.00	–	1 420	–	0.45	3.20	116	25 AT5	–
		20 x 10	1 900	400	7.90								
		20 x 20	2 500	600	8.70								
		20 x 40	2 100	500	8.90								
AOK-032	**MSK 060C**	32 x 5	2 500	600	19.10	9.55	1 400	260	0.50	3.20	116	25 AT5	32 AT5
		32 x 10	3 400	700	19.21	12.30							
		32 x 20	4 000	1 100	19.21	12.30							
		32 x 32	4 000	1 500	19.21	12.30							
AOK-040	**MSK 076C**	40 x 5	3 500	800	25.60	12.80	7 780	1 260	0.60	8.40	160	50 AT10	50 AT10
		40 x 10	3 000	700	51.20	25.60							
		40 x 20	3 100	700	99.30	49.65							
		40 x 40	4 400	1 100	99.30	49.65							

1) Values for M_{sd} do not factor in motor torque.

2) For greater lengths, the permissible drive torque is determined from the variable-length value M_p of the Drive Unit in accordance with the graph
➠ See the “Calculation principles” section.

Drive data for motor attachment via mount and coupling

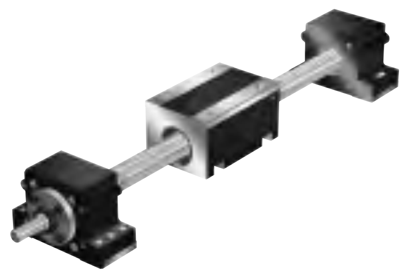
AOK	Motor	Coupling M_{cN} (Nm)	J_c (10^{-6} kgm²)	Mount and coupling m_{fc} (kg)
AOK-020	MSM 041B	14.5	63	0.85
	MSK 040C	19.0	57	0.55
	MSK 050C	50.0	200	2.00
AOK-032	MSK 060C	50.0	200	1.80
	MSK 076C	98.0	390	2.40
AOK-040	MSK 076C	98.0	390	2.80

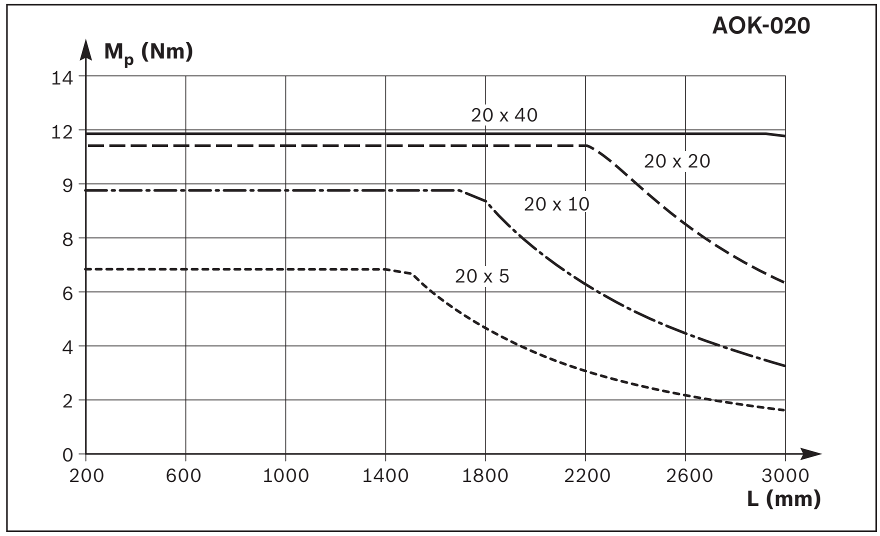
Designations

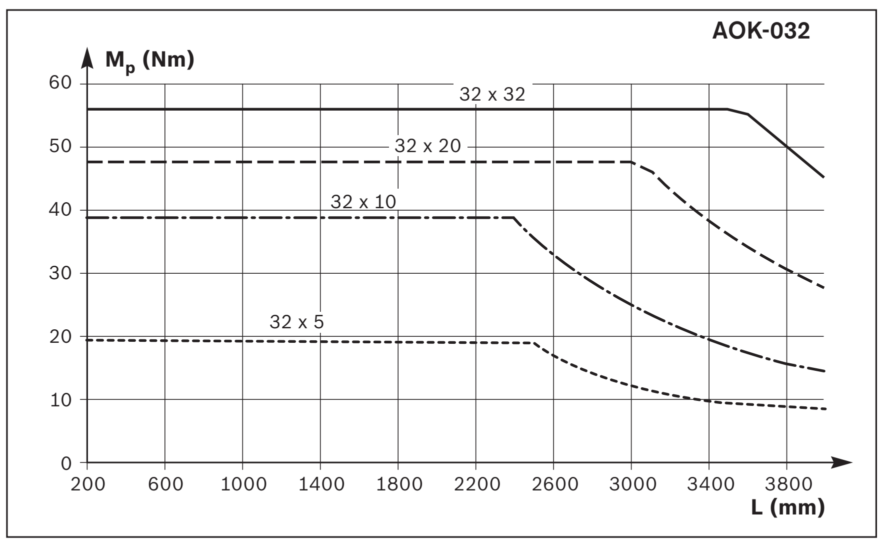
a_{max} = maximum acceleration
B_t = belt type
C = dynamic load rating
d_0 = nominal diameter
F = pulley housing width
i = timing belt side drive gear ratio
J_c = mass moment of inertia of the coupling
J_{sd} = reduced mass moment of inertia of timing belt side drive at motor journal
$k_{g\ fix}$ = constant for fixed-length portion of the mass
$k_{g\ var}$ = constant for variable-length portion of the mass
$k_{J\ fix}$ = constant for fixed-length portion of mass moment of inertia
$k_{J\ var}$ = constant for variable-length portion of mass moment of inertia
$k_{J\ m}$ = constant for mass-specific portion of mass moment of inertia
L = length
L_{ad} = additional length
L_c = nut length/nut and housing length
L_{max} = maximum length
M_p = drive torque
M_{Rs} = frictional torque of system
M_{cN} = rated torque of coupling
M_{Rsd} = frictional torque of timing belt side drive at motor journal
M_{sd} = maximum permissible drive torque of timing belt side drive
m_{fc} = mass of mount and coupling
m_{sd} = mass of timing belt side drive
m_{ca} = moved mass of system
P = lead
s_{min} = minimum travel
v_{max} = maximum speed

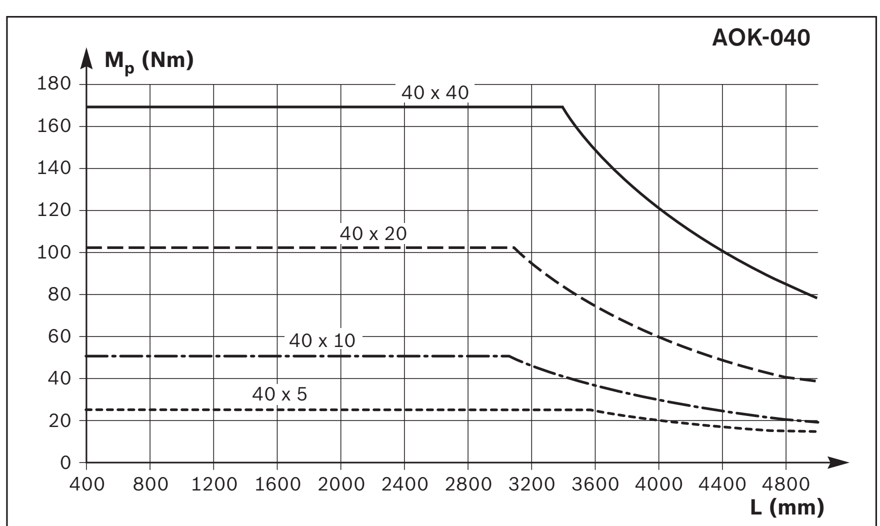
Technical data

Permissible drive torque M_P with fixed and floating bearing

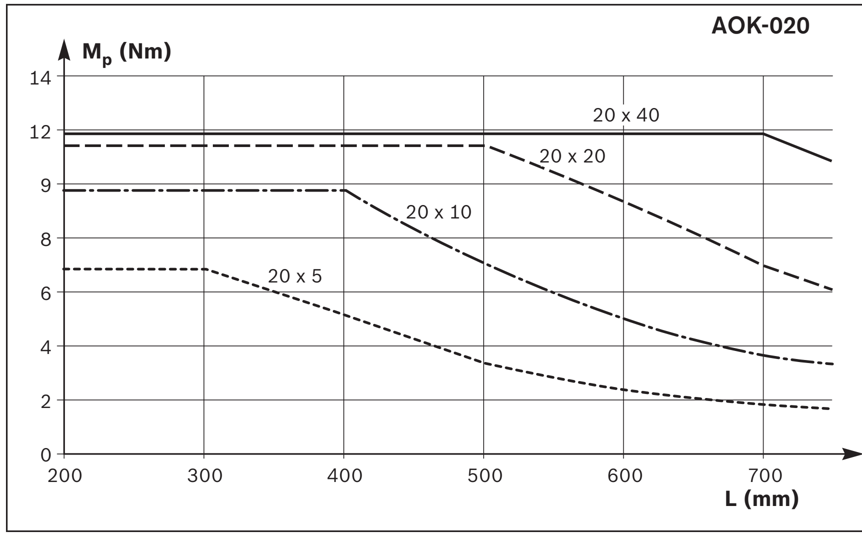


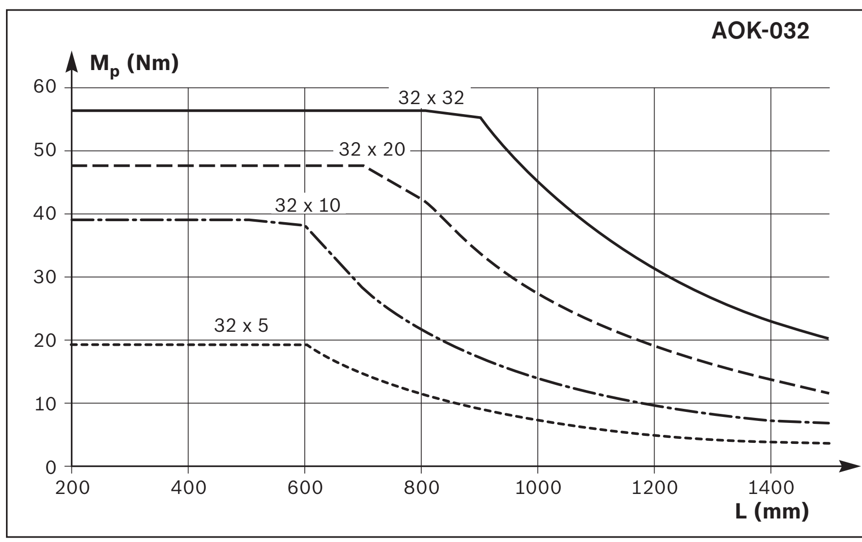


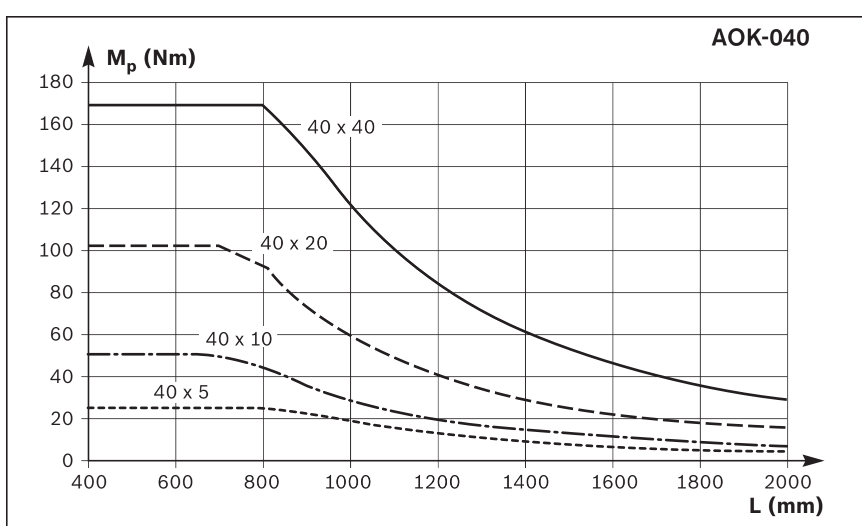




Permissible drive torque M_P with fixed bearing only







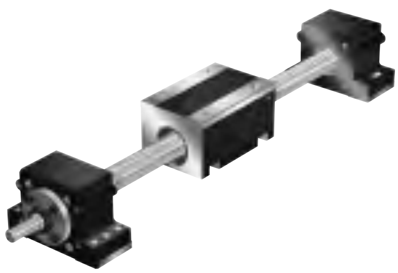
Note

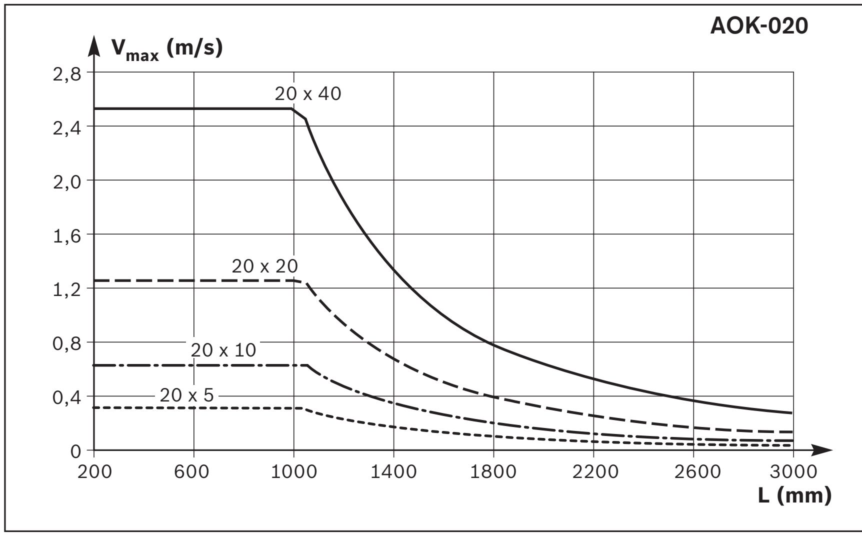
The values shown for M_p apply under the following conditions:

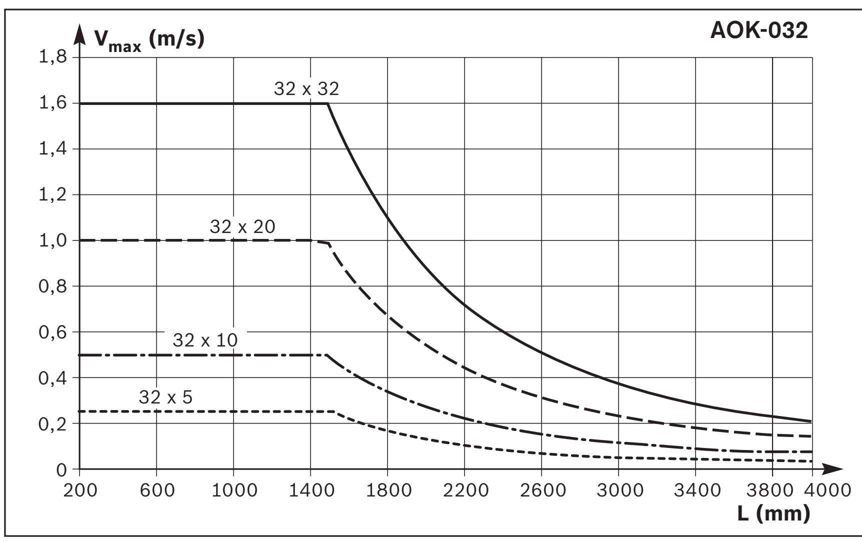
– No radial loads on screw journal

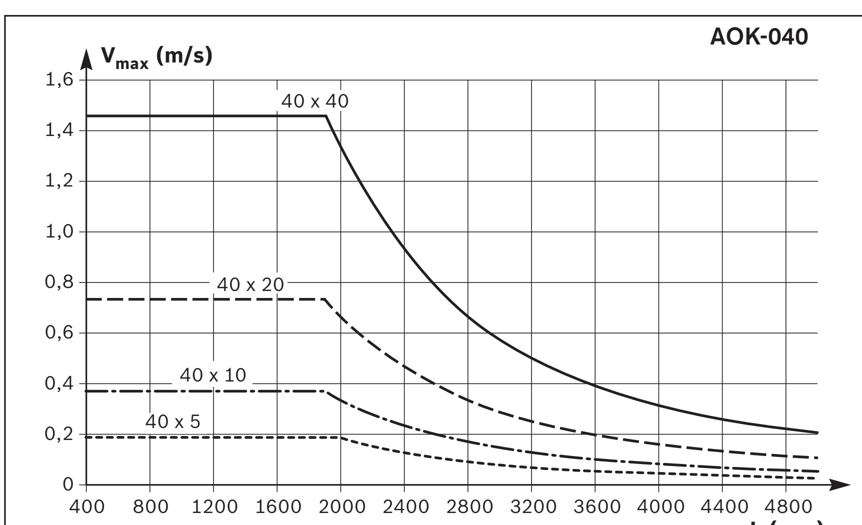
Technical data

Maximum permissible speed v_{max} with fixed and floating bearing

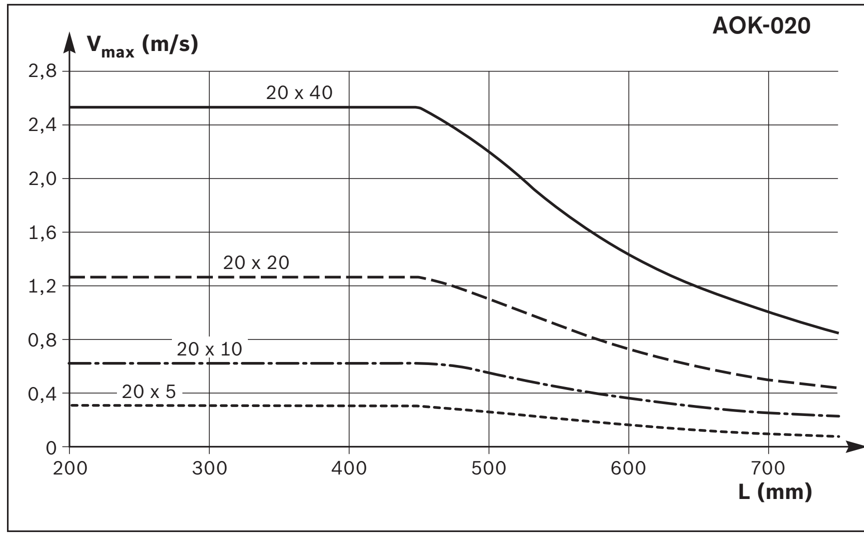


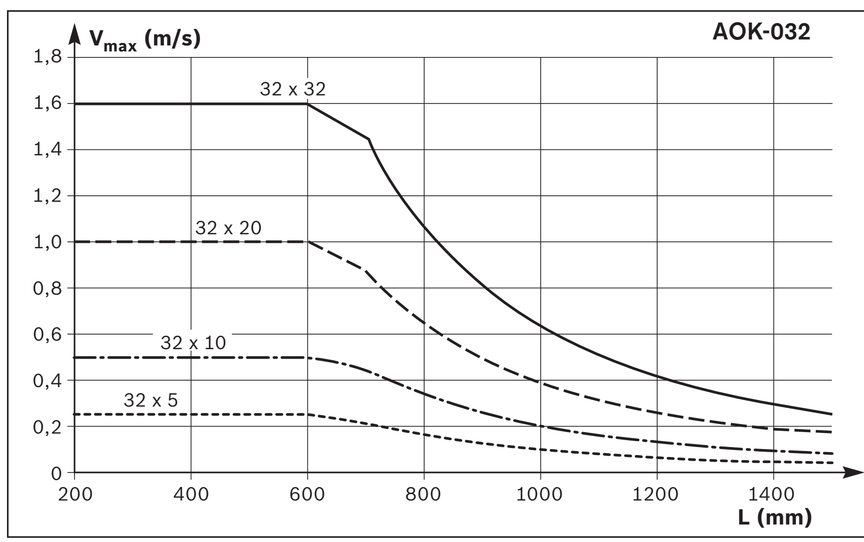


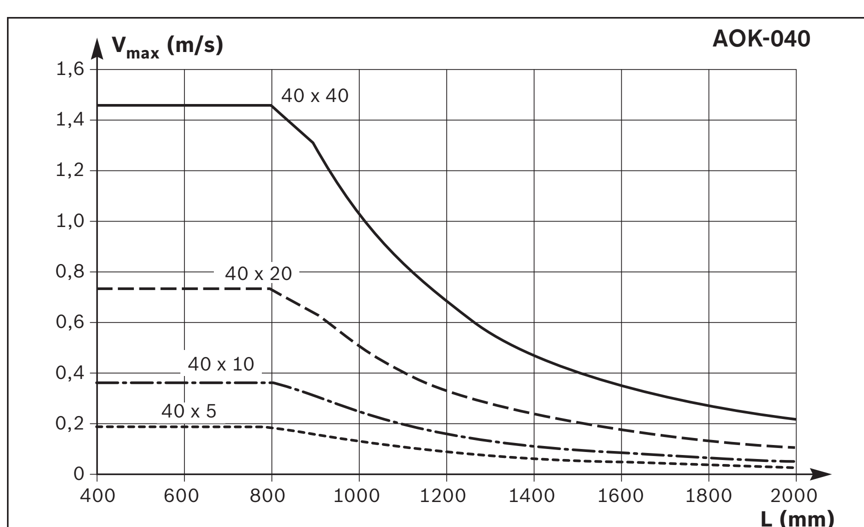




Maximum permissible speed v_{max} with fixed bearing only

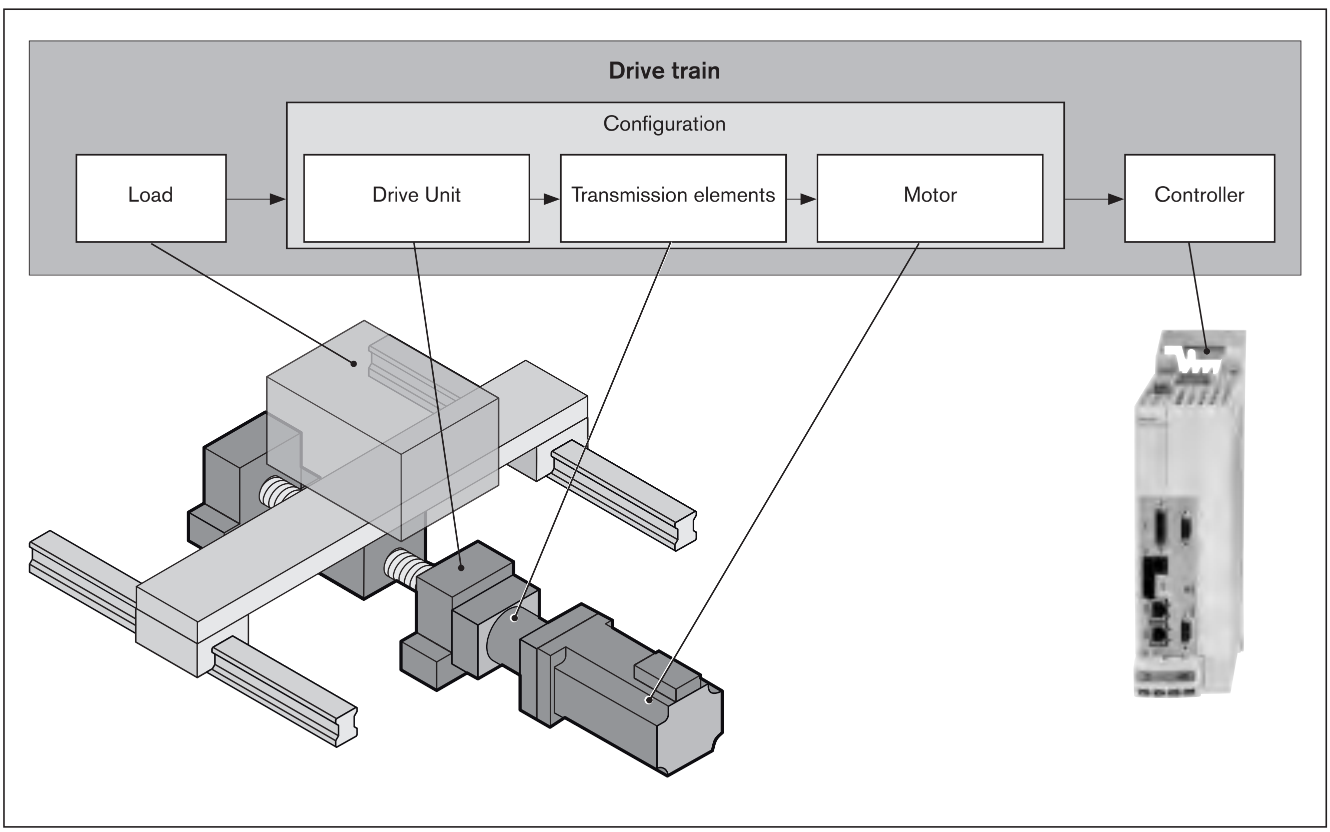






Calculation

Calculation principles



Correct dimensioning and assessment for an application requires structured consideration of the entire drive train.
The basic element of the drive train is the configuration comprising the Drive Unit, the transmission element (coupling or timing belt side drive) and the motor, which can be ordered in this constellation as per the catalog.

Calculation

Drive Unit service life

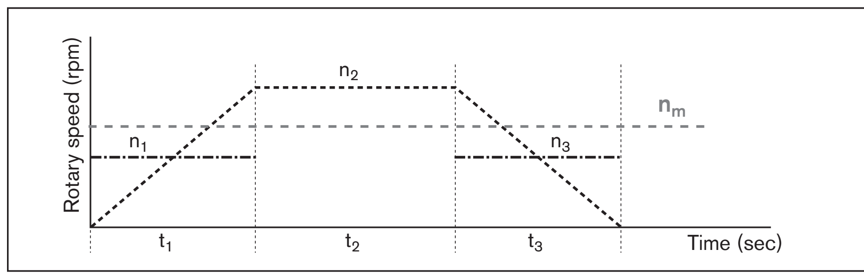
The service life of the rolling bearing points contained in a Drive Unit can be calculated using the formulas given below. In a Drive Unit with ball screw drive, the rolling bearing points that are relevant for the service life are the linear guide, the ball screw drive (nut), and the fixed bearing.

⚠ **Whichever independently calculated service life is shorter, that of the ball screw drive or of the fixed bearing, is then used as the estimated service life of the Drive Unit.**

Service life of the ball screw drive or the fixed bearing

If operating conditions vary (rotary speed and load), service life must be calculated using the averages $\mathbf{F_m}$ and $\mathbf{n_m}$.

If rotary speed varies, average rotary speed $\mathbf{n_m}$ is calculated as follows:



$$n_m = \frac{|n_1| \cdot t_1 + |n_2| \cdot t_2 + \ldots + |n_n| \cdot t_n}{t_{tot}}$$

$$t_{tot} = t_1 + t_2 + \ldots + t_n$$

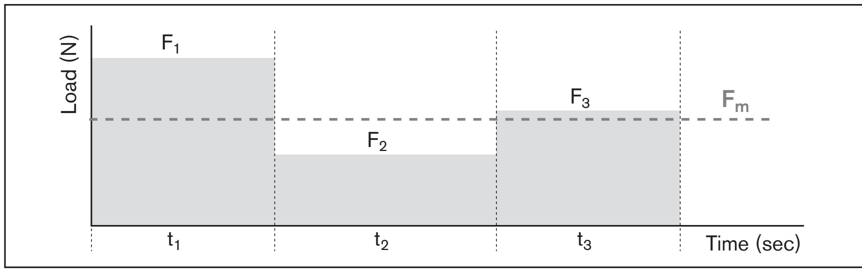
Rotary speed in acceleration and braking phases $\mathbf{n_{1 \ldots n}}$:

$$n_{1 \ldots n} = \frac{n_{A1 \ldots n} + n_{E1 \ldots n}}{2}$$

$n_1, n_2, \ldots n_n$	=	rotary speed in phases 1 … n	(rpm)
n_m	=	average rotary speed	(rpm)
$t_1, t_2, \ldots t_n$	=	discrete time step in phases 1 … n	(sec)
t_{tot}	=	sum of the discrete time steps	(sec)
n_1	=	rotary speed in acceleration and braking phases	
$n_{A1 \ldots n}$	=	rotary speed at start in phase 1 … n	(rpm)
$n_{E1 \ldots n}$	=	rotary speed at end in phase 1 … n	(rpm)

Calculation

Where both the load and the rotary speed vary, the average load $\mathbf{F_m}$ is calculated as follows:



$$F_m = \sqrt[3]{\left|F_1\right|^3 \cdot \frac{|n_1|}{n_m} \cdot \frac{t_1}{t_{ges}} + \left|F_2\right|^3 \cdot \frac{|n_2|}{n_m} \cdot \frac{t_2}{t_{ges}} + \ldots + \left|F_n\right|^3 \cdot \frac{|n_n|}{n_m} \cdot \frac{t_n}{t_{ges}}}$$

Nominal life
Nominal life in revolutions:

$$L = \left(\frac{C}{F_m}\right)^3 \cdot 10^6$$

Nominal life in hours:

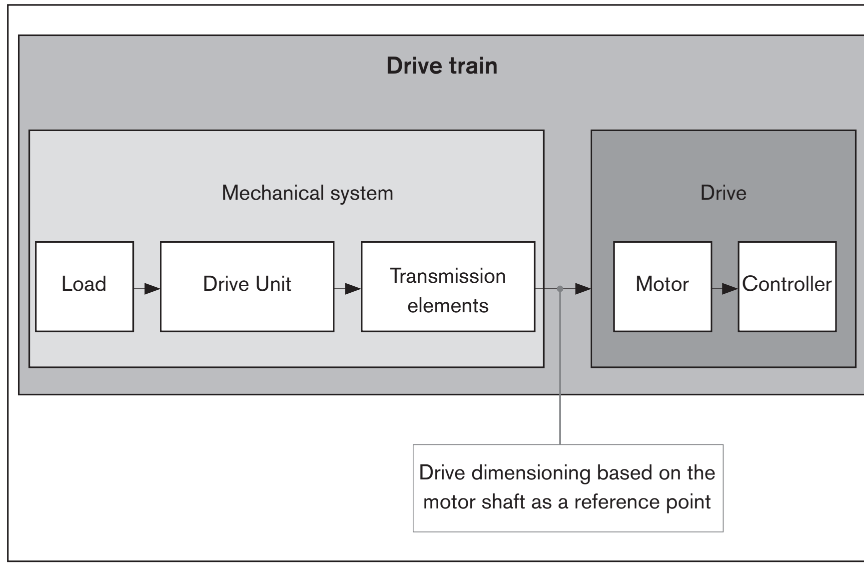
$$L_h = \frac{L}{n_m \cdot 60}$$

C	=	dynamic load rating	(N)
$F_1, F_2, \ldots F_n$	=	axial load during phases 1 … n	(N)
F_m	=	equivalent dynamic axial load	(N)
$n_1, n_2, \ldots n_n$	=	rotary speed in phases 1 … n	(rpm)
n_m	=	average rotary speed	(rpm)
$t_1, t_2, \ldots t_n$	=	discrete time step in phases 1 … n	(sec)
t_{tot}	=	sum of the discrete time steps	(sec)
L	=	nominal life	(–)
L_h	=	nominal life	(h)

Drive dimensioning

Basic principles

When dimensioning the drive, the drive train can be divided into the mechanical system and the drive itself.
The **mechanical system** includes the Drive Unit and transmission elements (timing belt side drive, coupling), and the load to be carried.
The electric **drive** is a motor/controller combination with corresponding performance data.
The dimensioning of the electric drive is done taking the motor shaft as a reference point.
Both basic values and limit values must be factored in when dimensioning the drive. Limit values should be observed to avoid damaging the mechanical components.



Technical data and formula symbols for the mechanical system

For each component (Drive Unit, coupling, timing belt side drive), the relevant maximum permissible values must be identified for the drive torque and travel speed, as well as the basic values for frictional torque and mass moment of inertia.
The following technical data with the associated formula symbols are used when considering the basic **mechanical system** requirements in the design calculations for dimensioning the drive. The data in the table below can be found in the "Technical data" section or they are determined using the formulas described on the following pages.

		Mechanical system			
		Load	Drive Unit	Transmission elements	
				Coupling	Timing belt side drive
Weight moment	**(Nm)**	M_g 6)	–	–	-
Frictional torque	**(Nm)**	- 5)	M_{Rs} 3)	–	M_{Rsd} 3)
Mass moment of inertia	**(kgm²)**	J_t 1)	J_s 2)	J_c 3)	J_{sd} 3)
Max. permissible speed	**(m/s)**	–	v_{max} 4)	–	–
Maximum permissible drive torque	**(Nm)**	–	M_p 4)	M_{cN} 3)	M_{sd} 3)

1) Determine the value using the appropriate formula
2) Length-dependent value, determined using the appropriate formula
3) Use the value from the table
4) Length-dependent value, to be read off the graph
5) Any additional process forces are to be taken into consideration as load moments
6) For vertical mounting position: Determine the value using the appropriate formula

Drive dimensioning

Drive dimensioning based on the motor shaft as a reference point

When dimensioning the drive, all relevant design calculation values for the mechanical components in the drive train have to be determined and be expressed in terms of or reduced to the motor shaft. For a combination of mechanical components in the drive train, this will result in one value for each of the following:
- Frictional torque M_R
- Mass moment of inertia J_{ex}
- Maximum permissible speed v_{mech} (maximum permissible rotary speed n_{mech})
- Maximum permissible drive torque M_{mech}

Determination of the values for each mechanical component in the drive train based on the motor shaft as a reference point

Frictional torque M_R

For motor attachment via mount and coupling

$$M_R = M_{Rs}$$

For motor attachment via timing belt side drive

$$M_R = M_{Rsd} + \frac{M_{Rs}}{i}$$

Mass moment of inertia J_{ex}

For motor attachment via mount and coupling

$$J_{ex} = J_s + J_t + J_c$$

For motor attachment via timing belt side drive

$$J_{ex} = J_{sd} + \frac{(J_s + J_t)}{i^2}$$

Determination of the mass moment of inertia of the Drive Unit

$$J_s = (k_{J\ fix} + k_{J\ var} \cdot L) \cdot 10^{-6}$$

Determination of the translatory mass moment of inertia of the external load

$$J_t = m_{ex} \cdot k_{J\ m} \cdot 10^{-6}$$

i	=	gear ratio of timing belt side drive	(–)
J_c	=	mass moment of inertia of the coupling	(kgm^2)
J_{ex}	=	mass moment of inertia of mechanical system	(kgm^2)
J_s	=	mass moment of inertia of the Drive Unit	(kgm^2)
J_{sd}	=	mass moment of inertia of timing belt side drive at motor journal	(kgm^2)
J_t	=	translatory mass moment of inertia of external load based on the Drive Unit screw journal	(kgm^2)
$k_{J\ fix}$	=	constant for fixed-length portion of mass moment of inertia	($kgmm^2$)
$k_{j\ m}$	=	constant for mass-specific portion of mass moment of inertia	(mm^2)
$k_{j\ var}$	=	constant for variable-length portion of mass moment of inertia	(kgmm)
L	=	length of Drive Unit	(mm)
m_{ex}	=	moved external load	(kg)
M_R	=	frictional torque at motor journal	(Nm)
M_{Rs}	=	frictional torque of system	(Nm)
M_{Rsd}	=	frictional torque of timing belt side drive at motor journal	(Nm)

Maximum permissible speed v_{mech}
The lowest of all the values for the maximum permissible speed of all mechanical components contained in the drive train determines the maximum permissible speed of the mechanical system which has to be taken into consideration as the upper limit for the drive when dimensioning the motor. By design, the maximum permissible speed or rotary speed of a Drive Unit with ball screw drive will always be less than that of the other components in the mechanical system, such as the coupling or timing belt side drive, and therefore determines the maximum permissible speed of the mechanical system.

Maximum permissible speed

$$v_{mech} = v_{max}$$

Maximum permissible rotary speed
For motor attachment via mount and coupling

$$n_{mech} = \frac{v_{mech} \cdot 1000 \cdot 60}{P}$$

For motor attachment via timing belt side drive

$$n_{mech} = \frac{v_{mech} \cdot i \cdot 1000 \cdot 60}{P}$$

i	=	gear ratio of timing belt side drive	(–)
n_{mech}	=	maximum permissible rotary speed of mechanical system	(rpm)
P	=	screw lead	(mm)
v_{max}	=	maximum permissible speed of the Drive Unit	(m/s)
v_{mech}	=	maximum permissible speed of mechanical system	(m/s)

Maximum permissible drive torque M_{mech}
The lowest (minimum) permissible drive torque of all of the mechanical components in the drive train determines the maximum permissible drive torque of the mechanical system, which should be considered the drive limit when dimensioning the motor.

For motor attachment via mount and coupling

$$M_{mech} = \text{minimum } (M_{cN}; M_p)$$

For motor attachment via timing belt side drive

$$M_{mech} = \text{minimum } \left(M_{sd} ; \frac{M_p}{i}\right)$$

i	=	gear ratio of timing belt side drive	(–)
M_p	=	maximum permissible drive torque of the Drive Unit	(Nm)
M_{cN}	=	rated torque of coupling	(Nm)
M_{sd}	=	maximum permissible drive torque of the timing belt side drive	(Nm)
M_{mech}	=	maximum permissible drive torque for mechanical system	(Nm)

⚠ **When considering the complete drive train (mechanical system + motor/controller), the maximum torque of the motor can lie below the maximum value for the mechanical system (M_{mech}) and thus limit the maximum permissible drive torque of the overall drive train.**
If the maximum torque of the motor lies above the upper limit for the mechanical system (M_{mech}), the maximum motor torque must be limited to the permitted value for the mechanical system.

Drive dimensioning

Motor pre-selection

The following conditions can be used as a general guide for pre-selecting the motor.

Condition 1:
The rotary speed of the motor must be greater than or equal to the rotary speed required for the mechanical system (but not exceeding the maximum permissible limit value).

$$n_{max} \geq n_{mech}$$

n_{max}	=	max. rotary speed of motor	(rpm)
n_{mech}	=	maximum permissible rotary speed of the mechanical system	(rpm)

Condition 2:
Consideration of the ratio of mass moments of inertia of the mechanical system and the motor. The ratio of the mass moments of inertia serves as an indicator for the control performance of a motor/controller combination. The mass moment of inertia of the motor is directly related to motor size.

Ratio of mass moments of inertia

$$V = \frac{J_{ex}}{J_m + J_{br}}$$

For pre-selection, past experience has shown the following values will result in high control performance.
While these are not fixed limits, exceeding them will require closer evaluation of the application.

Application area	V
Handling	≤ 6.0
Processing	≤ 1.5

J_{br}	=	mass moment of inertia of motor brake	(kgm^2)
J_{ex}	=	mass moment of inertia of mechanical system	(kgm^2)
J_m	=	mass moment of inertia of motor	(kgm^2)
V	=	ratio of mass moments of inertia of drive train and motor	(–)

Condition 3:
Estimation of the ratio of the static load moment to the torque of the motor at standstill. The torque ratio must be less than or equal to the empirical value of 0.6. By looking at the required motor torque levels, this estimation roughly covers the dynamic characteristics which still have to be determined by plotting an exact motion profile.

Torque ratio

$$\frac{M_{stat}}{M_0} \leq 0.6$$

Static load moment

$$M_{stat} = M_R + M_g$$

Weight moment
For vertical mounting only!
For motor attachment via mount and coupling: $i = 1$

$$M_g = \frac{P \cdot (m_{ex} + m_{ca}) \cdot g}{2000 \cdot \pi \cdot i}$$

g	=	force of gravity (= 9.81)	(m/s^2)
i	=	gear ratio of timing belt side drive	(–)
m_{ca}	=	moved mass of carriage	(kg)
m_{ex}	=	moved external load	(kg)
M_g	=	weight moment at motor journal	(Nm)
M_0	=	torque of the motor at standstill	(Nm)
M_R	=	frictional torque at motor journal	(Nm)
M_{stat}	=	static load moment	(Nm)
P	=	screw lead	(mm)
π	=	pi	(–)

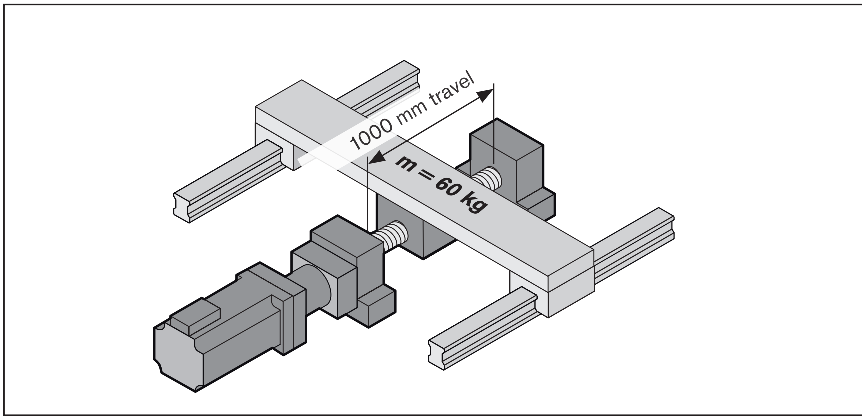
In the section ➠“Configuration and ordering”, users can put together standard configurations, including motor attachment and motor, for the various Drive Unit sizes by selecting the appropriate options. By checking the above conditions, it is possible to see whether a standard motor selected in a particular configuration will generally be of a suitable size for the specific application.

Precise drive dimensioning
Pre-selecting the motor according to this general guide is no substitute for the precise design calculations required for the drive with detailed consideration of torques and rotary speed levels. For precise calculation of the electric drive, including consideration of the specific motion profile, please refer to the performance data in the catalogs “IndraDrive Cs” and “IndraDrive C”.
When dimensioning the drive, the maximum permissible speed, drive torque and acceleration should not be exceeded in order to avoid damaging the mechanical system.

Calculation example

Starting data

An object weighing 60 kg needs to be moved horizontally 1000 mm at a max. speed of 0.6 m/s. The object travels over a separate linear guide whose frictional drag is 200 N. The following was selected based on technical data and installation space:



AOK Drive Unit-032:
- Nut version FEM-E-S with Nut Housing MGS
- Nut with preload class factor C1 (moderate preload)
- Motor attachment via timing belt side drive, i = 2
- Motor MSK 060C without brake

Estimating length L

(The first estimate assumes the largest possible lead and therefore length, since the permissible speed can decrease as length increases.)

	L	$= s_{max} + L_{ca} + L_{ad}$
Excess travel:	s_e	$= 2 \cdot P = 2 \cdot 32 = 64$ mm
Max. travel:	s_{max}	$= s_{eff} + 2 \cdot s_e$
		$= 1000 + 2 \cdot 64 = 1128$ mm
Length:	L	$= 1128 + 114 + 128 = 1370$ mm

Selecting the ball screw drive

(Better to choose the lowest lead as this is favorable in terms of resolution, braking distance, length.)

Permissible ball screw drive according to the "Permissible speed" graph at v = 0.6 m/s and L = 1370 mm:
BASA 32 x 32 and BASA 32 x 20
Ball screw drive selected (smaller lead):
BASA 32 x 20
Max. permissible speed for BASA 32 x 20 from graph:

$v_{max} = 1.0$ m/s

Calculation of length L

(for selected BASA)

Excess travel:	s_e	$= 2 \cdot P = 2 \cdot 20 = 40$ mm
Max. travel:	s_{max}	$= s_{eff} + 2 \cdot s_e$
		$= 1000 + 2 \cdot 40 = 1080$ mm
Length:	L	$= 1080 + 114 + 128 = 1322$ mm

Frictional torque M_R

(motor attachment via timing belt side drive)

	M_R	$= M_{Rsd} + (M_{Rs} + M_{Rad})/i$
Separate guideway:	M_{Rad}	$= (P \cdot F_R)/(2000 \cdot \pi)$
		$= (20 \cdot 200)/(2000 \cdot \pi)$
		$= 0.64$ Nm
Drive Unit:	M_{Rs}	$= 0.71$ Nm
Timing belt side drive:	M_{Rsd}	$= 0.50$ Nm ($i = 2$)
Frictional torque:	M_R	$= 0.50 + (0.71 + 0.64)/2 = 1.175$ Nm

Mass moment of inertia J_{ex}

(motor attachment via timing belt side drive)

	$J_{ex} = J_{sd} + \frac{(J_s + J_t)}{i^2}$
Timing belt side drive:	$J_{sd} = 260 \cdot 10^{-6}\ kgm^2$
Drive Unit:	$J_s = (k_{J\ fix} + k_{J\ var} \cdot L) \cdot 10^{-6}$
	$= (163.8 + 0.7117 \cdot 1322) \cdot 10^{-6}$
	$= 1104.67 \cdot 10^{-6}\ kgm^2$
External load:	$J_t = m_{ex} \cdot k_{J\ m} \cdot 10^{-6}$
	$= 60 \cdot 10.1321 \cdot 10^{-6}$
	$= 607.93 \cdot 10^{-6}\ kgm^2$
Moment of inertia:	$J_{ex} = 260 \cdot 10^{-6} + \frac{(1104.67 \cdot 10^{-6} + 607.93 \cdot 10^{-6})}{2^2}$
	$= 688.15 \cdot 10^{-6}\ kgm^2$

Maximum permissible rotary speed n_{mech}

(motor attachment via timing belt side drive)
Limit for mechanical system

	$n_{mech} = \frac{(v_{mech} \cdot i \cdot 1000 \cdot 60)}{P}$
Max. permissible speed:	$v_{mech} = v_{max} = 1\ m/s$
Max. permissible rotary speed:	$n_{mech} = \frac{(1 \cdot 2 \cdot 1000 \cdot 60)}{20}$
	$= 6000\ rpm$

Max. rotary speed of application n_{mech}:

(motor attachment via timing belt side drive)
Application limit

Speed:	$v_{mech} = 0.6\ m/s$
Rotary speed:	$n_{mech} = \frac{0.6 \cdot 2 \cdot 1000 \cdot 60}{20}$
	$= 3600\ rpm$

Calculation example

Maximum permissible drive torque M_{mech}

(motor attachment via timing belt side drive) mechanical system limit

	M_{mech}	=	minimum (M_{sd}; $\frac{M_p}{i}$)
Timing belt side drive:	M_{sd}	=	12.3 Nm (gear ratio i = 2 for MSK 060C)
Drive Unit:	M_p	=	47 Nm
Drive torque:	M_{mech}	=	minimum (12.3; $\frac{47}{2}$)
		=	minimum (12.3; 23.5)
		=	12.3 Nm

Checking motor preselection

Selected motor:
MSK 060C without brake

Condition 1:

Rotary speed: $n_{max} \geq n_{mech}$

$6000 \geq 3600$ condition met – motor selection OK

Condition 2:

Mass moment of inertia ratio: $V = \frac{J_{ex}}{J_m + J_{br}}$

Motor inertia: $J_m = 800 \cdot 10^{-6}$ kgm²

Brake inertia: $J_{br} = 0 \cdot 10^{-6}$ kgm² (without brake)

Mass moment of inertia ratio: $V = \frac{688.15 \cdot 10^{-6}}{(800 \cdot 10^{-6} + 0 \cdot 10^{-6})}$

$= 0.86$

Condition for handling: $V \leq 6$

$0.86 \leq 6$ condition fulfilled – motor selection OK

Condition 3:

Torque ratio: $\frac{M_{stat}}{M_0} \leq 0.6$

Static load moment: $M_{stat} = M_R + M_g$ (horizontal mounting $M_g = 0$)

$= 1.175$ Nm

Torque of the motor

at standstill $M_0 = 8$ Nm

Torque ratio: $\frac{1.175}{8} = 0.15$

$0.15 \leq 0.6$ condition met – motor selection OK

All three conditions met ➠ Selected motor is suitable for the application.

Result

AOK-032 Drive Unit

Length:	L = 1322 mm		
Max. travel	s_{max} = 1080 mm		
Carriage length:	L_{ca} = 114 mm		
Ball screw drive:	Nominal diameter:	$d_0 = 32$ mm	
	Lead:	$P = 20$ mm	

Motor attachment via timing belt side drive, gear ratio $i = 2$
Pre-selected motor: MSK 060C without brake

The motor-controller combination should always be considered for precise dimensioning of the electric drive, since the performance data (e.g., max. useful speed and max. torque) will depend on the controller used.

When doing this, the following data must be considered.

Frictional torque:	M_R = 1.175 Nm
Mass moment of inertia:	J_{ex} = $688.15 \cdot 10^{-6}$ kgm^2
Speed:	v_{mech} = 0.6 m/s (n_{mech} = 3600 rpm)
Drive torque limit:	M_{mech} = 12.3 Nm

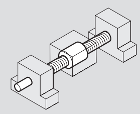
➠ Motor torque should be limited to 12.3 Nm on the drive side.

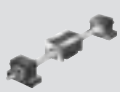
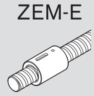
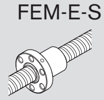
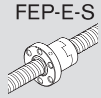
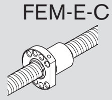
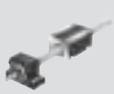
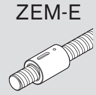
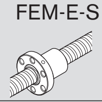
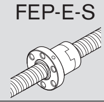
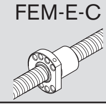
Acceleration limit:	a_{max} = 50 m/s^2
Speed limit value:	v_{max} = 1 m/s (n_{mech} = 6000 rpm)

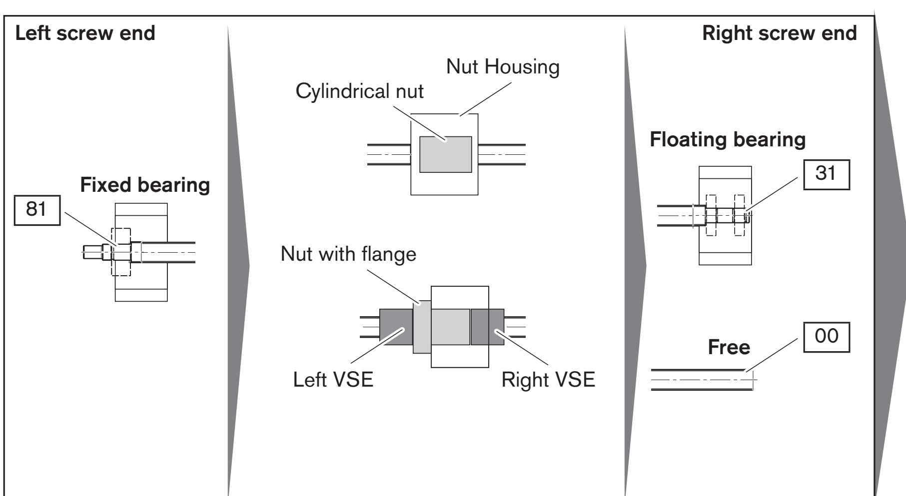
Besides the preferred type MSK 060C, other motors with identical connection dimensions can be adapted while taking care not to exceed the limits.

AOK-020

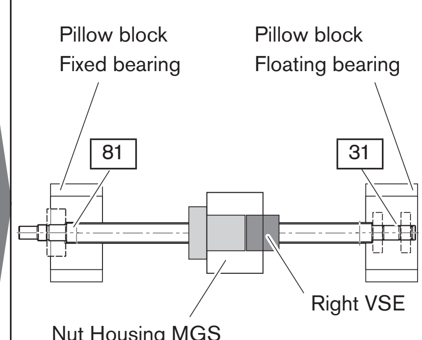
Configuration and ordering

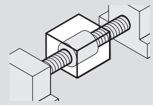
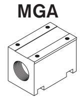
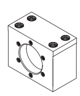
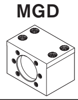
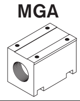
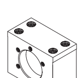
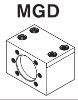


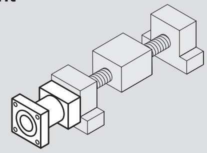
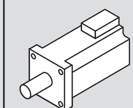
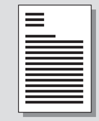
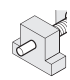
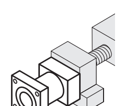
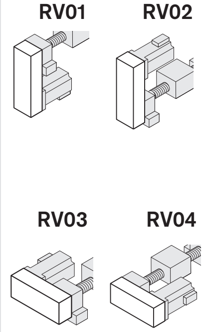
Short product name, length: AOK-020-NN-1, ... mm	Drive BASA nut	Size d_0 x P 20 x 5	20 x 10	20 x 20	20 x 40	Tolerance grade		Standard seal	Lubrication Initial greasing	Left VSE	Right VSE	Preload class C1 (moderate)	C2 (medium)	C3 (high)
Fixed and floating bearing 	ZEM-E 	01	04	02	–	T5	T7	1	1	–	–	3	6	2
		–	–	–	03									
	FEM-E-S 	11	–	–	–	T5	T7	1	1	2	3	3	6	2
		–	13	–	–					–	–			
		–	–	12	–					2	3			
	FEP-E-S 	–	–	–	33	T5	T7	1	1	–	–	3	6	2
	FEM-E-C 	21	–	–	–	T5	T7	1	1	2	3	3	6	2
		–	23	–	–					–	–			
		–	–	22	–					2	3			
Version with fixed bearing only 	ZEM-E 	06	09	07	–	T5	T7	1	1	–	–	3	6	2
		–	–	–	08									
	FEM-E-S 	16	–	–	–	T5	T7	1	1	2	–	3	6	2
		–	18	–	–					–	–			
		–	–	17	–					2	–			
	FEP-E-S 	–	–	–	38	T5	T7	1	1	–	–	3	6	2
	FEM-E-C 	26	–	–	–	T5	T7	1	1	2	–	3	6	2
		–	28	–	–					–	–			
		–	–	27	–					2	–			



Example FEM-E-S 20 x 20

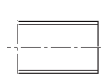


Screw ends: Left	Screw ends: Right	Pillow block: Aluminum	Pillow block: Steel	Nut Housing: with-out	Nut Housing: with	Type
						
81	31	02	12	–	01	MGA 
				–	02	
81	31	02	12	00	11	MGS 
				00	14	
				00	12	
81	31	02	12	00	13	
81	31	02	12	00	21	MGD 
				00	23	
				00	22	
81	00	01	11	–	01	MGA 
				–	12	
81	00	01	11	00	11	MGS 
				00	14	
				00	12	
81	00	01	11	00	13	
81	00	01	11	00	21	MGD 
				00	23	
				00	12	

Motor attachment: Version		Gear ratio	Attachment kit 1)	for motor	Motor: without brake	Motor: with brake	Documentation: Standard report	Documentation: Measurement report
								
without mount	OF01 	–	00	–	00		01	03 Lead deviation
with mount	MF01 	–	06	MSM 041B[2)]	110	111		
			02	MSK 040C[2)]	86	87		
			07	MSK 050C[2)]	88	89		
with timing belt side drive	RV01 RV02 RV03 RV04 	i = 1	32	MSM 041B[2)]	110	111		
			30	MSK 040C[2)]	86	87		
			23	MSK 050C[2)]	88	89		

Screw ends

Free end

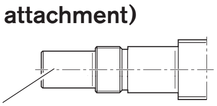


00

Floating bearing end

31

Fixed bearing end (motor attachment)



81

Screw journal for motor attachment

1) Attachment kit available without motor (when ordering: enter "00" for motor)
2) Recommended motor (motor data and type designation ➠ "Motors")

Ordering example: See "Service and information/ordering example"

Length calculation

$$L = s_{max} + L_c + L_{ad}$$

Effective stroke

$$s_{eff} = s_{max} - 2 \cdot s_e$$

d_0 = nominal diameter
P = lead
VSE = Front Lube Unit
s_e = excess travel
s_{max} = max. travel
s_{eff} = effective stroke
L = length
L_c = nut length/nut and housing length
L_{ad} = additional length (see "Technical data" section)

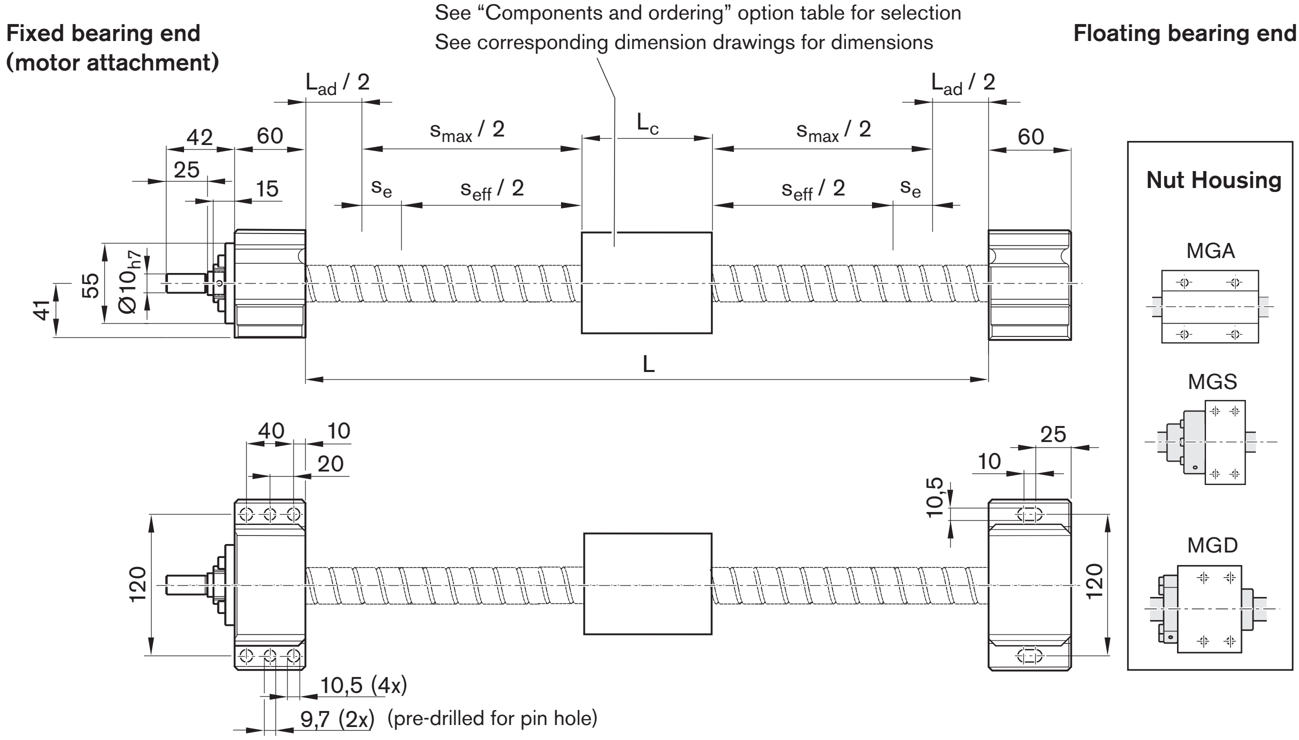
See ordering example for sample length calculation.

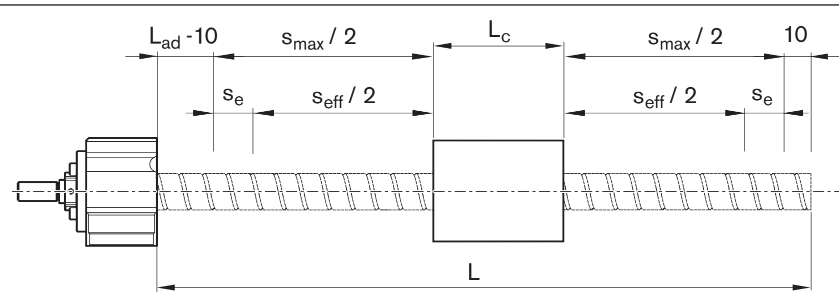
AOK-020

Dimensional drawings

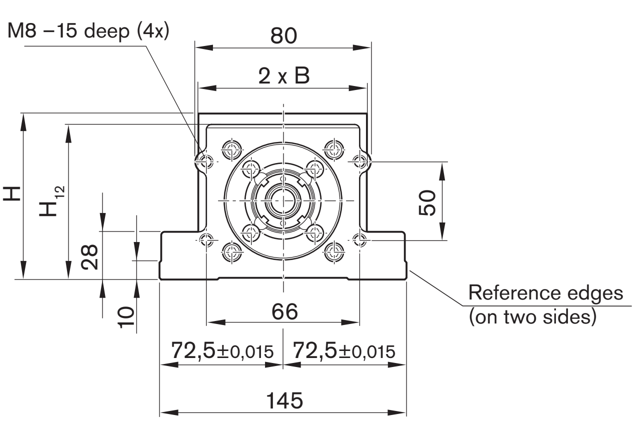
All dimensions in mm. Drawings not to scale.
Straightness and flatness tolerance in accordance with DIN EN 12020-02

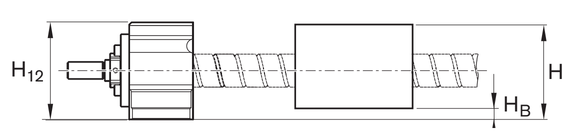
Nut / nut and housing
See "Components and ordering" option table for selection
See corresponding dimension drawings for dimensions





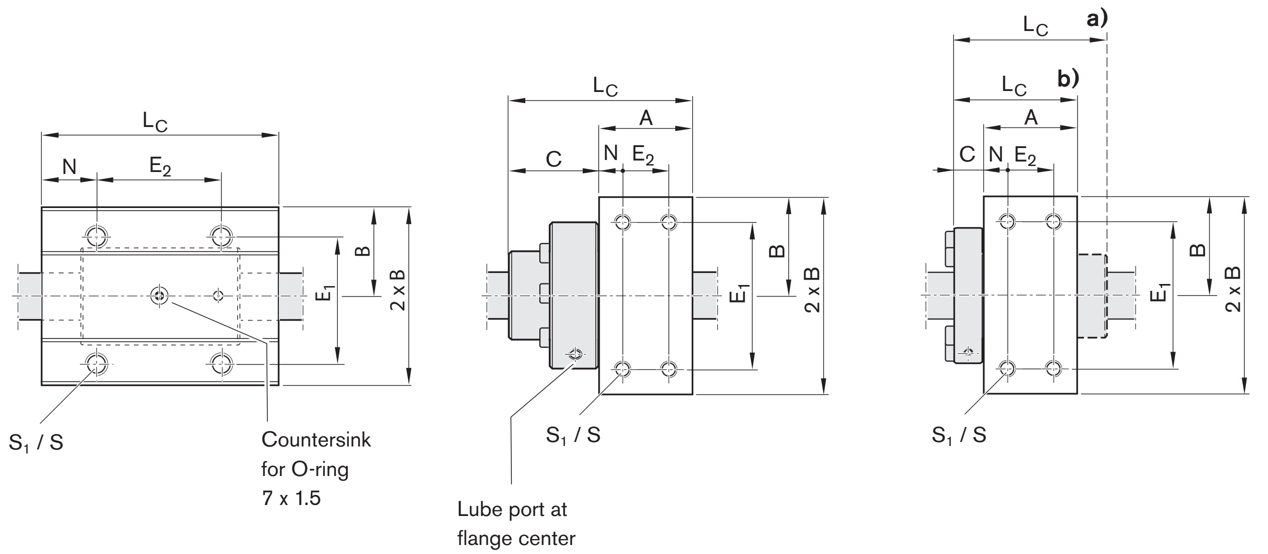
No floating bearing



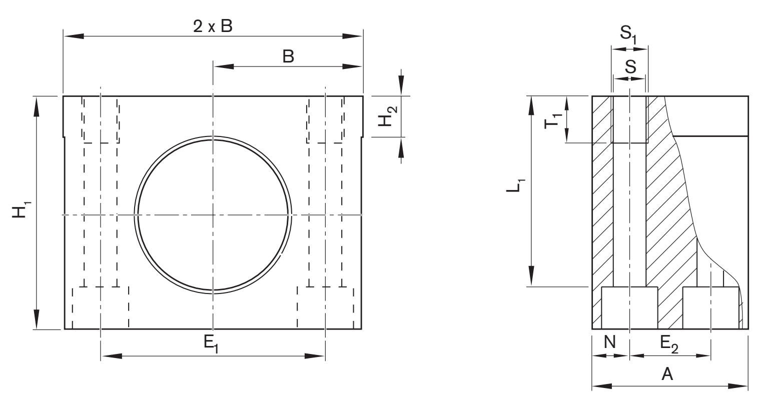


Nut and housing dimension drawings

Figure 1 (MGA) **Figure 2 (MGS, MGD)** **Figure 3 a) / Figure 3 b) (MGS, MGD)**



Dimension drawing for all Nut Housings (Figure 1, 2, 3)



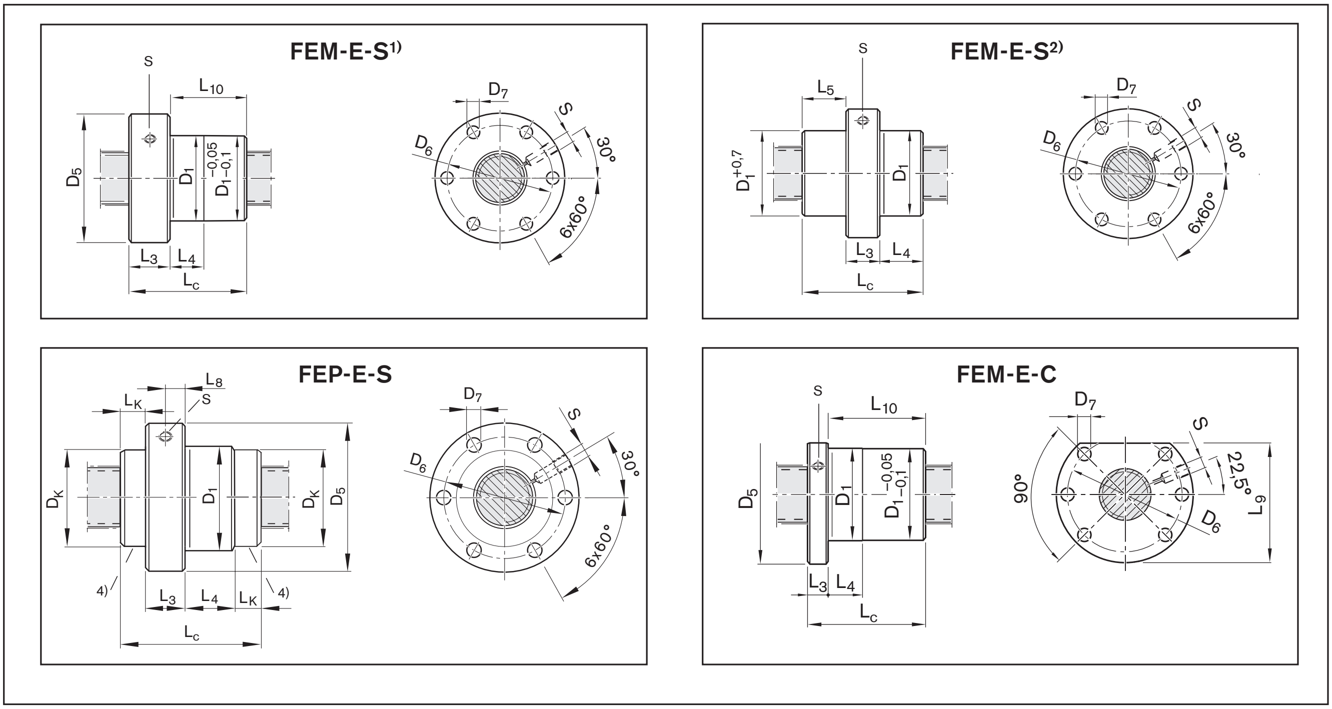
S_1 = 4x thread
S = 4x through-hole

AOK-020 d_0 x P	Nut	Nut Housing	Fig-ure	Dimensions (mm) A	B ±0.01	C	E_1	E_2	H	H_1	H_2	H_{12} ±0.15	H_B	L_C	L_1	N	S_1	S	T_1
20 x 5	ZEM-E	MGA	1	–	37.5	–	55	60	85	62	10	81	10	100	51	20	M10	8.6	15
	FEM-E-S	MGS	3 b)	40	37.5	12	$56^{\pm0.1}$	$20^{\pm0.1}$	73				11	52		10	M10	8.4	
	FEM-E-C	MGD	3 b)	55	37.5	12	$55^{\pm0.1}$	$23^{\pm0.1}$	69				13	67		22	M10	8.4	
20 x 10	ZEM-E	MGA	1	–	37.5	–	55	60	85	62			10	100	51	20	M10	8.6	
	FEM-E-S	MGS	3 a)	40	37.5	12	$56^{\pm0.1}$	$20^{\pm0.1}$	73				11	60		10	M10	8.4	
	FEM-E-C	MGD	3 b)	55	37.5	12	$55^{\pm0.1}$	$23^{\pm0.1}$	69				13	67		22	M10	8.4	
20 x 20	ZEM-E	MGA	1	–	37.5	–	55	60	85	65			10	100	54	20	M10	8.6	
	FEM-E-S	MGS	2	40	42.5	38	$63^{\pm0.1}$	$20^{\pm0.1}$	75				10	78		10	M10	8.4	
	FEM-E-C	MGD	3 a)	55	37.5	12	$55^{\pm0.1}$	$23^{\pm0.1}$	69				13	77		22	M10	8.4	
20 x 40	ZEM-E	MGA	1	–	37.5	–	55	60	85	65			10	100	54	20	M10	8.6	
	FEP-E-S	MGS	2	40	42.5	23	$63^{\pm0.1}$	$20^{\pm0.1}$	75				10	63		10	M10	8.4	

L_{ad} = additional length (see “Technical data” section)

AOK-020

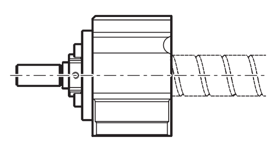
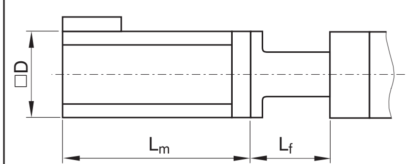
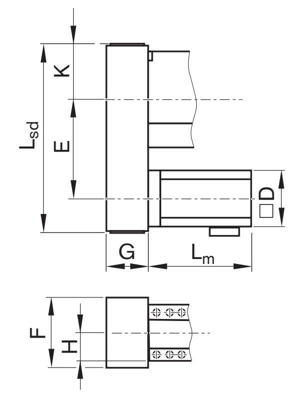
Nut dimension drawings



AOK-020 d_0 x P	Nut	Dimensions (mm)													
		D_1 (g6)	D_5	D_6	D_7	D_K	L_C	L_3	L_4	L_5	L_8	L_9	L_{10}	L_K	S[3)]
20 x 5	FEM-E-S[1)]	33	58	45	6.6	–	40	12	10.0	–	–	–	28	–	M6
	FEM-E-C	36	58	47	6.6	–	40	12	10.0	–	–	51	28	–	M6
20 x 10	FEM-E-S[1)]	33	58	45	6.6	–	60	12	16.0	18.5	–	–	48	–	M6
	FEM-E-C	36	58	47	6.6	–	60	12	16.0	–	–	51	48	–	M6
20 x 20	FEM-E-S[2)]	38	63	50	6.6	–	57	20	18.5	18.5	–	–	–	–	M6
	FEM-E-C	36	58	47	6.6	–	77	12	25.0	–	–	51	65	–	M6
20 x 40	FEP-E-S	38	63	50	6.6	37.5	$57^{\pm 0.5}$	12	23.0	–	8	–	–	11	M6

3) Lube hole (S) (in flange center on FEM-E-S, FEM-E-C); lube port machining: flat surface L3 ≤ 15 mm, countersink L3 > 15 mm;
4) Plastic recirculation cap

Motor attachment dimension drawings

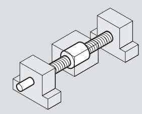
Version		
OF01	MF01	RV01, RV02, RV03, RV04
		

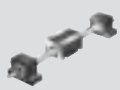
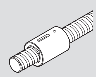
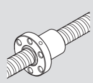
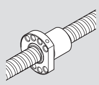
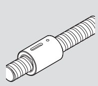
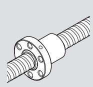
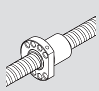
Version	Motor	Dimensions (mm) D	E i = 1	F	G	H	K	L_f	L_m without brake	L_m with brake	L_{sd} i = 1
RV01, RV02, RV03, RV04	**MSM 041B**	80	122.5	88	51	41	47.5	–	112.0	149.0	231
	MSK 040C	82	122.5	88	51	41	47.5	–	185.5	215.5	231
	MSK 050C	100	155	116	66	41	56	–	203.0	233.0	287
MF01	**MSM 041B**	80	–	–	–	–	–	90	112.0	149.0	–
	MSK 040C	82	–	–	–	–	–	90	185.5	215.5	–
	MSK 050C	98	–	–	–	–	–	115	203.0	233.0	–

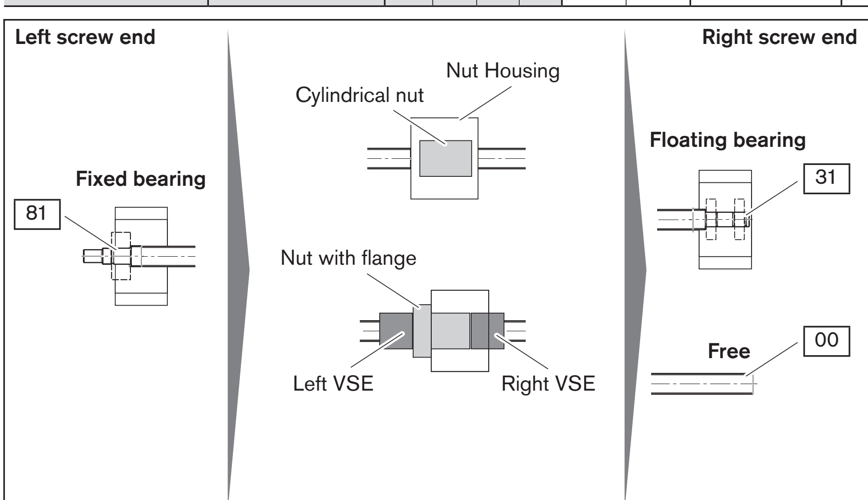
See "Motors" section for more information and dimensions

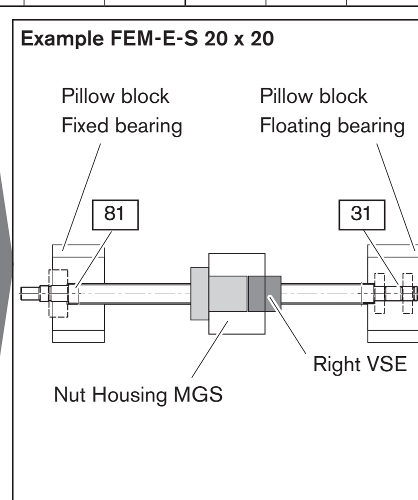
AOK-032

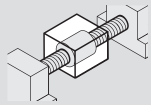
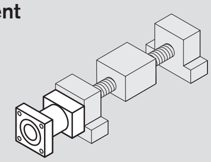
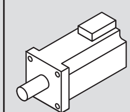
Configuration and ordering



Short product name, length: AOK-032-NN-1, ... mm	Drive BASA nut	Size d_0 x P 32 x 5	32 x 10	32 x 20	32 x 32	Tolerance grade		Standard seal	Lubrication Initial greasing	Left VSE	Right VSE	Preload class C1 (moderate)	C2 (medium)	C3 (high)
Fixed and floating bearing 	ZEM-E 	01	02	03	04	T5	T7	1	1	–	–	3	6	2
	FEM-E-S 	11	–	–	–	T5	T7	1	1	2	3	3	6	2
		–	12	–	–									
		–	–	13	–									
		–	–	–	14									
	FEM-E-C 	21	–	–	–	T5	T7	1	1	2	3	3	6	2
		–	22	–	–									
		–	–	23	–									
		–	–	–	24									
Version with fixed bearing only 	ZEM-E 	06	07	08	09	T5	T7	1	1	–	–	3	6	2
	FEM-E-S 	16	–	–	–	T5	T7	1	1	2	–	3	6	2
		–	17	–	–									
		–	–	18	–									
		–	–	–	19									
	FEM-E-C 	26	–	–	–	T5	T7	1	1	2	–	3	6	2
		–	27	–	–									
				28										
		–	–	–	29									



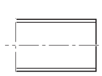



Screw ends: Left	Screw ends: Right	Pillow block: Aluminum	Pillow block: Steel	Nut Housing: without	Nut Housing: with	Type
81	31	02	12	–	01	MGA
81	31	02	12	00	11	MGS
				00	13	
				00	12	
				00	14	
81	31	02	12	00	21	MGD
				00	22	
				00	23	
				00	24	
81	00	01	11	–	01	MGA
81	00	01	11	00	11	MGS
				00	13	
				00	12	
				00	14	
81	00	01	11	00	21	MGD
				00	22	
				00	23	
				00	24	

Motor attachment	Version	Gear ratio	Attachment kit[1]	for motor	Motor: without brake	Motor: with brake	Documentation: Standard report	Documentation: Measurement report
without mount	OF01	–	00	–	00		01	03 Lead deviation
with mount	MF01	–	03	**MSK 60C**[2]	90	91		
			02	**MSK 76C**[2]	92	93		
with timing belt side drive	RV01 RV02	i = 1	23	**MSK 60C**[2]	90	91		
	RV03 RV04	i = 2	24	**MSK 60C**[2]	90	91		

Screw ends
Free end

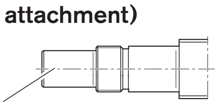


00

Floating bearing end

31

Fixed bearing end (motor attachment)



81

1) Attachment kit available without motor (when ordering: enter “00” for motor)
2) Recommended motor (motor data and type designation ➠ “Motors”)

Ordering example: See “Service and information/ordering example”

Length calculation

$$L = s_{max} + L_c + L_{ad}$$

Effective stroke

$$s_{eff} = s_{max} - 2 \cdot s_e$$

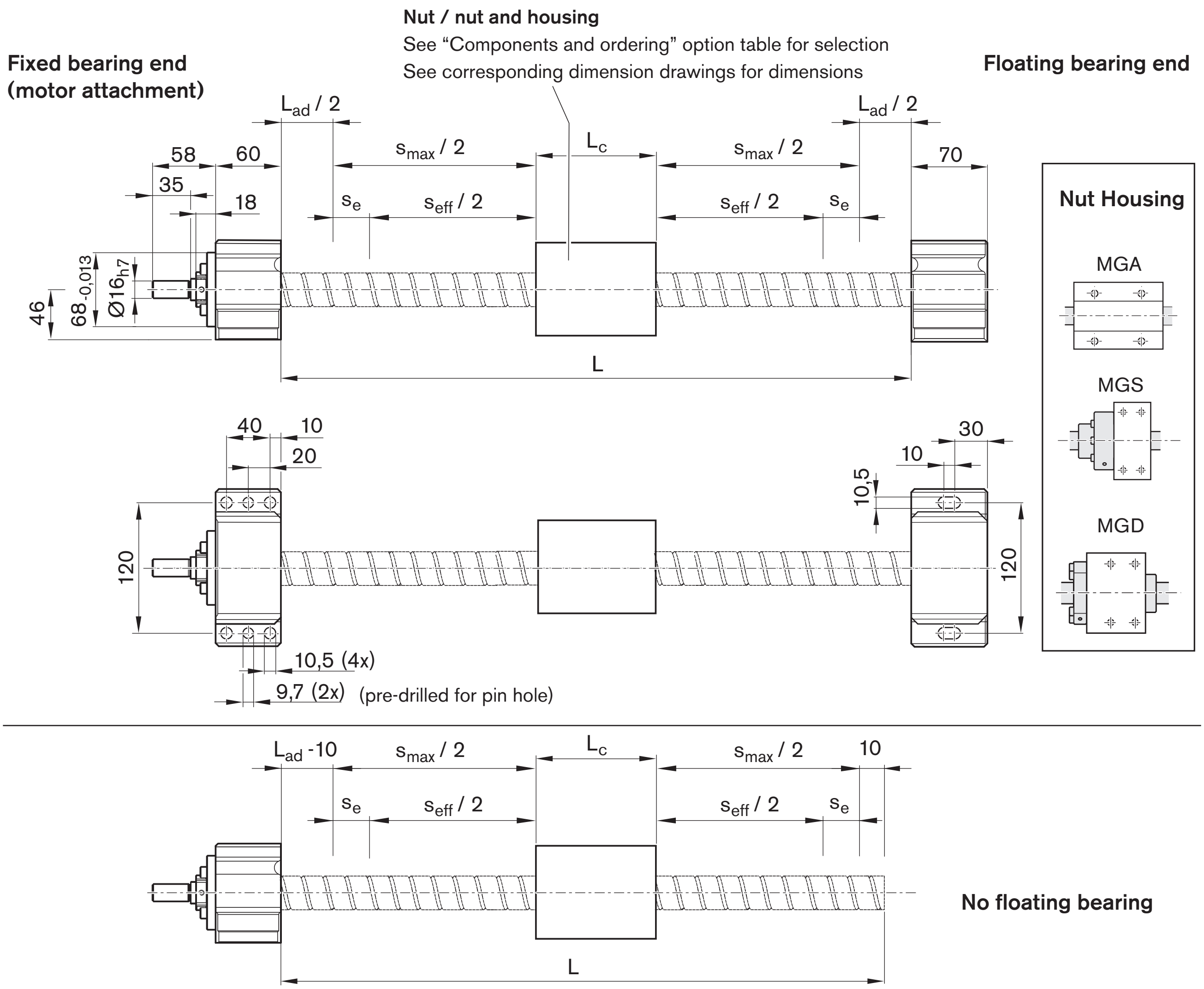
d_0 = nominal diameter
P = lead
VSE = Front Lube Unit
s_e = excess travel
s_{max} = max. travel
s_{eff} = effective stroke
L = length
L_c = nut length/nut and housing length
L_{ad} = additional length (see “Technical data” section)

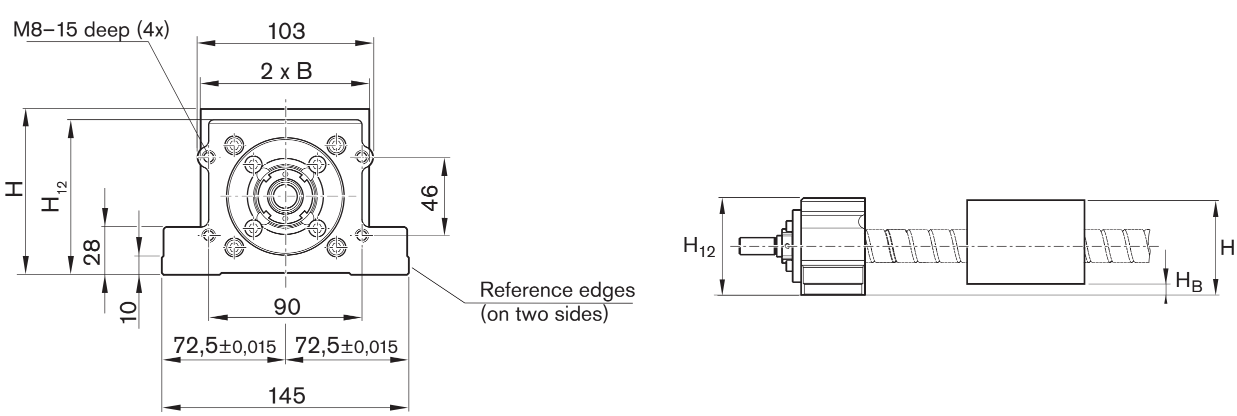
See ordering example for sample length calculation.

AOK-032

Dimensional drawings

All dimensions in mm. Drawings not to scale.
Straightness and flatness tolerance in accordance with DIN EN 12020-02





Nut and housing dimension drawings

Figure 1 (MGA)

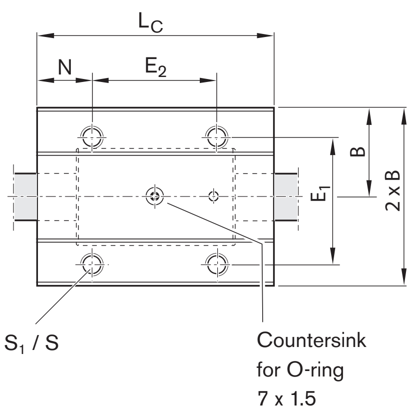


Figure 2 (MGS, MGD)

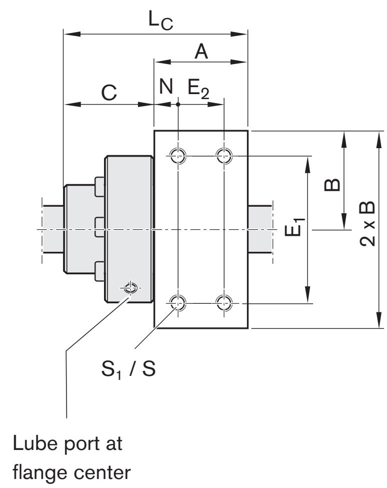
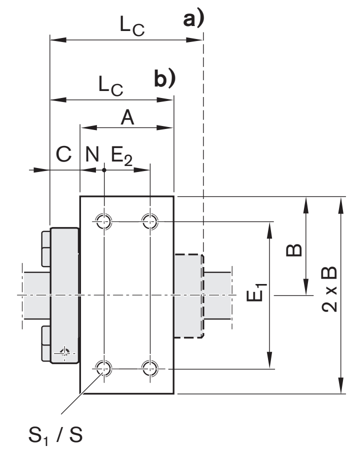
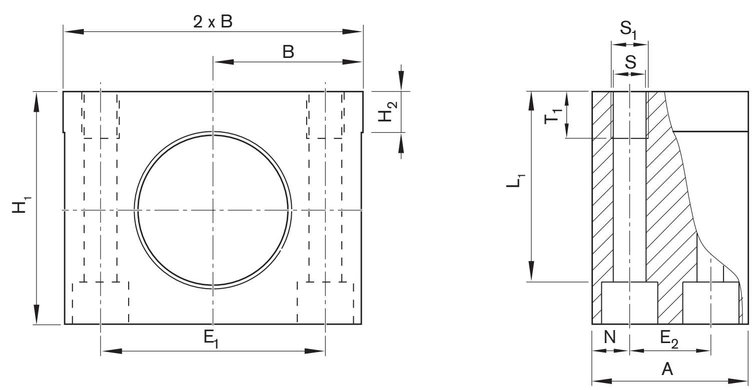


Figure 3 a) / Figure 3 b) (MGS, MGD)



Dimension drawing for all Nut Housings (Figure 1, 2, 3)

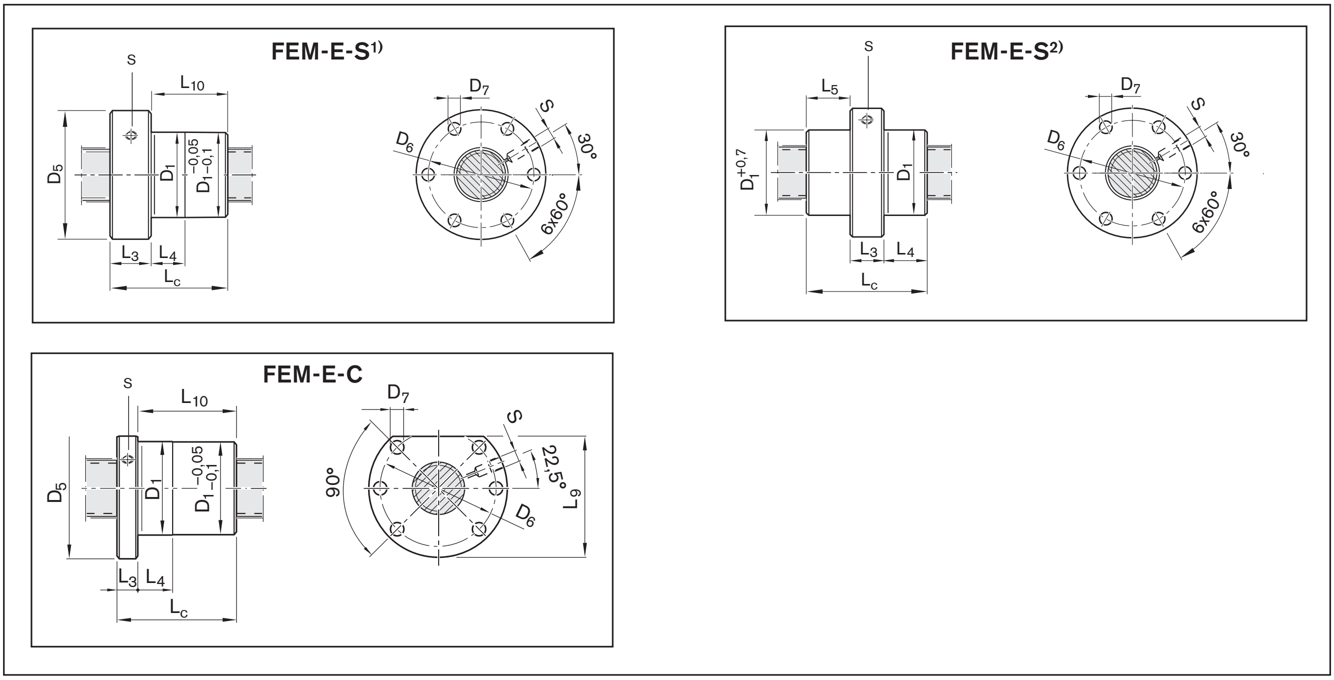


S_1 = 4x thread
S = 4x through-hole

AOK-032 d_0 x P	Nut	Nut Housing	Fig-ure	Dimensions (mm) A	B ±0.01	C	E_1	E_2	H	H_1	H_2	H_{12} ±0.15	H_B	L_C	L_1	N	S_1	S	T_1
32 x 5	ZEM-E	MGA	1	–	50	–	75	100	95	75	10	91	15	150	61	25	M12	10.5	18
	FEM-E-S	MGS	3 b)	50	47.5	13	$72^{\pm0.1}$	$26^{\pm0.1}$	84				9	63		12	M12	10.5	15
	FEM-E-C	MGD	3 b)	70	50	13	$75^{\pm0.1}$	$30^{\pm0.1}$	81				11	83		27	M16	13.0	20
32 x 10	ZEM-E	MGA	1	–	50	–	75	100	95				15	150	61	25	M12	10.5	18
	FEM-E-S	MGS	3 a)	50	47.5	13	$72^{\pm0.1}$	$26^{\pm0.1}$	84				9	77		15	M12	10.5	15
	FEM-E-C	MGD	3 b)	70	50	13	$75^{\pm0.1}$	$30^{\pm0.1}$	81				11	83		27	M16	13.0	20
32 x 20	ZEM-E	MGA	1	–	50	–	75	100	95	82	12		15	150	64	25	M12	10.5	18
	FEM-E-S	MGS	3 b)	60	52.5	15	$82^{\pm0.1}$	$30^{\pm0.1}$	88				6	75		15	M16	13.0	20
	FEM-E-C	MGD	3 a)	70	50	13	$75^{\pm0.1}$	$30^{\pm0.1}$	81				11	84		27	M16	13.0	20
32 x 32	ZEM-E	MGA	1	–	50	–	75	100	95				15	150	64	25	M12	10.5	18
	FEM-E-S	MGS	2	60	52.5	54	$82^{\pm0.1}$	$30^{\pm0.1}$	88				6	114		15	M16	13.0	20
	FEM-E-C	MGD	3 a)	70	50	13	$75^{\pm0.1}$	$30^{\pm0.1}$	81				11	120		27	M16	13.0	20

L_{ad} = additional length (see "Technical data" section)

AOK-032 Nut dimension drawings

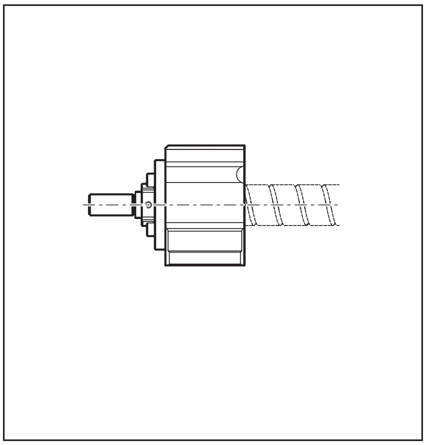
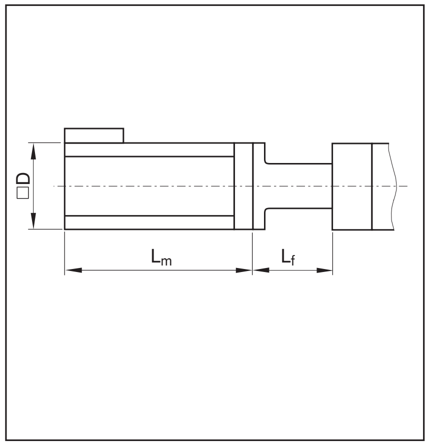
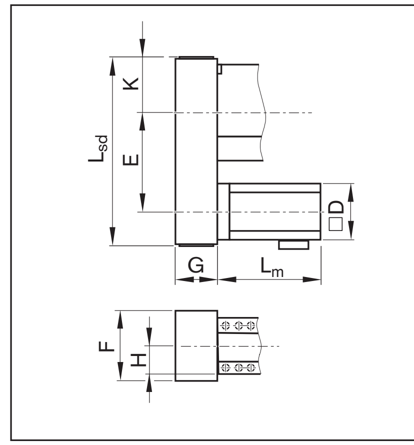


AOK-032	Nut	(mm)										
d_0 x P		D_1 (g6)	D_5	D_6	D_7	L_C	L_3	L_4	L_5	L_9	L_{10}	S[3]
32 x 5	FEM-E-S[1]	48	73	60	6.6	48	13	10	–	–	35	M6
	FEM-E-C	50	80	65	9.0	48	13	10	–	71	35	M6
32 x 10	FEM-E-S[1]	48	73	60	6.6	77	13	16	–	–	64	M6
	FEM-E-C	50	80	65	9.0	77	13	16	–	71	64	M6
32 x 20	FEM-E-S[1]	56	80	60	6.6	64	15	25	–	–	49	M6
	FEM-E-C	50	80	65	9.0	84	13	25	–	71	71	M6
32 x 32	FEM-E-S[2]	56	80	60	6.6	88	20	34	34	–	–	M6
	FEM-E-C	50	80	65	9.0	120	13	40	–	71	107	M6

3) Lube hole (S) (in flange center on FEM-E-S, FEM-E-C); lube port machining: flat surface L3 ≤ 15 mm, countersink L3 > 15 mm;

Motor attachment dimension drawings

Version

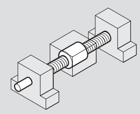
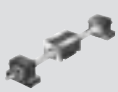
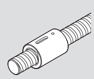
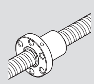
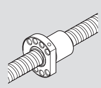
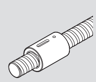
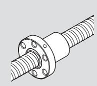
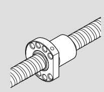
OF01	MF01	RV01, RV02, RV03, RV04
		

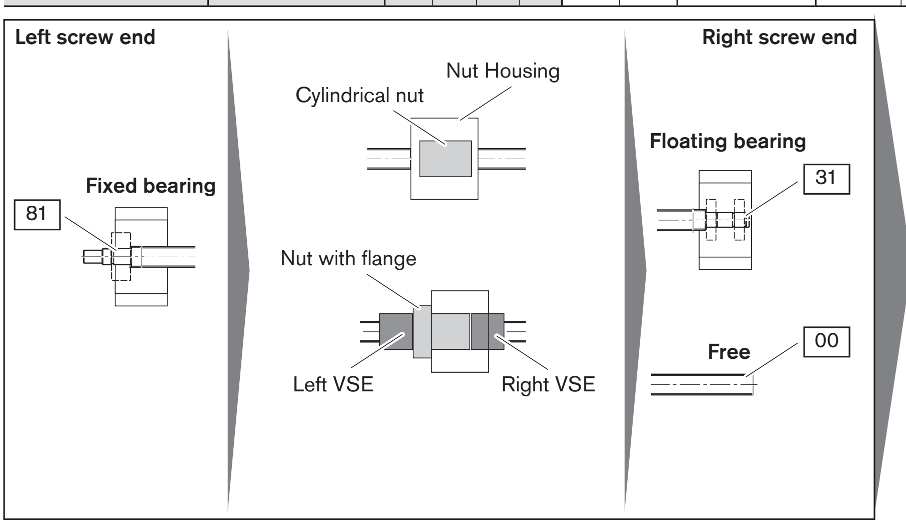
Version	Motor	Dimensions (mm) D	E i = 1	E i = 2	F	G	H	K	L_f	L_m without brake	L_m with brake	L_{sd} i = 1	L_{sd} i = 2
RV01, RV02, RV03, RV04	**MSK 060C**	116	165	162	116	66	46	59	–	226.0	259.0	300	300
MF01	**MSK 060C**	116	–	–	–	–	–	–	125	226.0	259.0	–	–
	MSK 076C	140	–	–	–	–	–	–	133	292.5	292.5	–	–

See “Motors” section for more information and dimensions

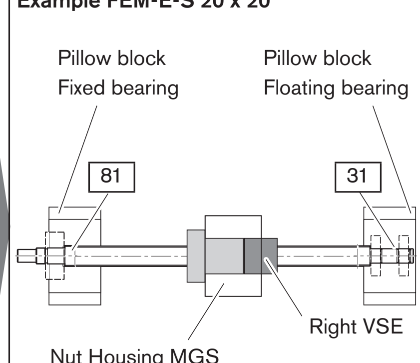
AOK-040

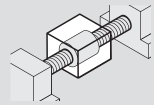
Configuration and ordering

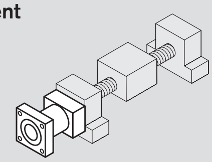
Short product name, length: AOK-040-NN-1, ... mm	Drive BASA  nut	Size d_0 x P 40 x 5	40 x 10	40 x 20	40 x 40	Tolerance grade		Seal Standard	Lubrication Initial greasing	Left VSE	Right VSE	Preload class C1 (moderate)	C2 (medium)	C3 (high)
Fixed and floating bearing 	ZEM-E 	01	02	03	04	T5	T7	1	1	–	–	3	6	2
	FEM-E-S 	11	–	–	–	T5	T7	1	1	2	3	3	6	2
			12											
		–	–	13	–									
					14									
	FEM-E-C 	21	–	–	–	T5	T7	1	1	2	3	3	6	2
			22											
				23										
					24									
Version with fixed bearing only 	ZEM-E 	06	07	08	09	T5	T7	1	1	–	–	3	6	2
	FEM-E-S 	16	–	–	–	T5	T7	1	1	2	–	3	6	2
			17											
		–	–	18	–									
					19									
	FEM-E-C 	26	–	–	–	T5	T7	1	1	2	–	3	6	2
			27											
				28										
					29									

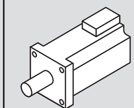


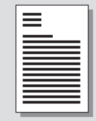
Example FEM-E-S 20 x 20









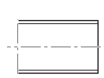


Screw ends Left	Screw ends Right	Pillow block Aluminum	Pillow block Steel	Nut Housing without	Nut Housing with	Type
81	31	02	12	–	01	MGA
81	31	02	12	00	11	MGS
				00	12	
				00	14	
				00	13	
81	31	02	12	00	21	MGD
				00	22	
				00	23	
				00	24	
81	00	01	11	–	01	MGA
81	00	01	11	00	11	MGS
				00	12	
				00	14	
				00	13	
81	00	01	11	00	21	MGD
				00	22	
				00	23	
				00	24	

Motor attachment Version		Gear ratio	Attachment kit 1)	for motor	Motor without brake	Motor with brake
without mount	OF01	–	00	–	00	
with mount	MF01	–	02	MSK 076C2)	92	93
with timing belt side drive	RV01 RV02	i = 1	23	MSK 076C2)	92	93
with timing belt side drive	RV03 RV04	i = 2	24	MSK 076C2)	92	93

Documentation Standard report	Documentation Measurement report
01	03 Lead deviation

Screw ends
Free end

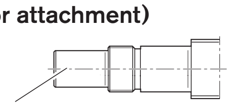


00

Floating bearing end

31

Fixed bearing end (motor attachment)



81

Screw journal for motor attachment

1) Attachment kit available without motor (when ordering: enter "00" for motor)
2) Recommended motor (motor data and type designation ➠ "Motors")

Ordering example: See "Service and information/ordering example"

Length calculation

$$L = s_{max} + L_c + L_{ad}$$

Effective stroke

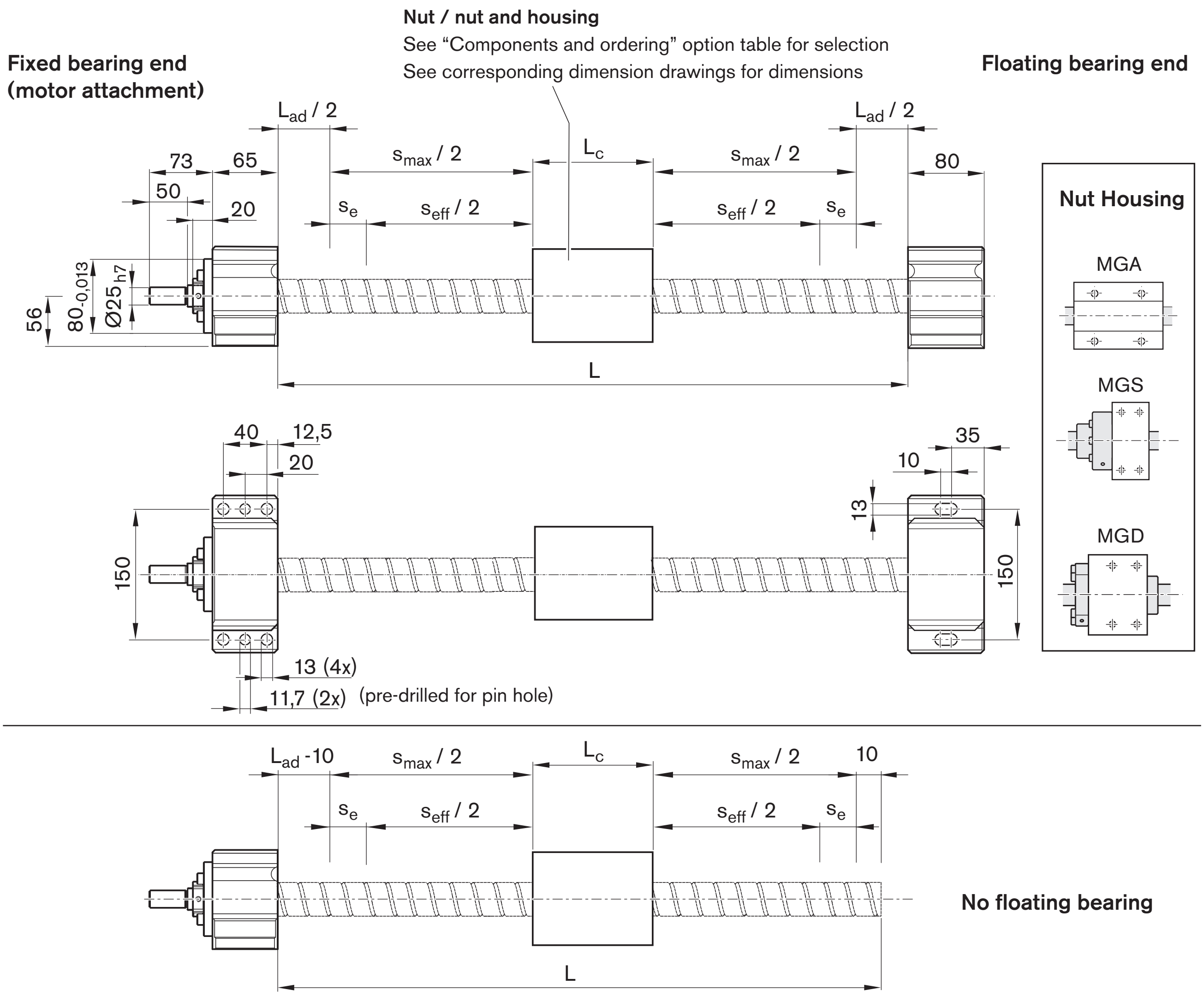
$$s_{eff} = s_{max} - 2 \cdot s_e$$

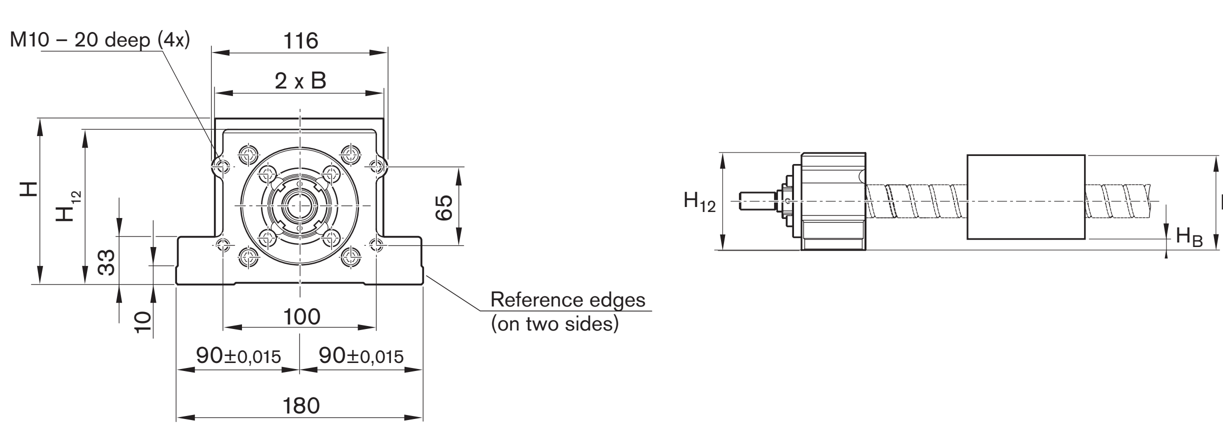
d_0 = nominal diameter
P = lead
VSE = Front Lube Unit
s_e = excess travel
s_{max} = max. travel
s_{eff} = effective stroke
L = length
L_c = nut length/nut and housing length
L_{ad} = additional length (see "Technical data" section)

See ordering example for sample length calculation.

AOK-040 Dimensional drawings

All dimensions in mm. Drawings not to scale.
Straightness and flatness tolerance in accordance with DIN EN 12020-02





Nut and housing dimension drawings

Figure 1 (MGA)

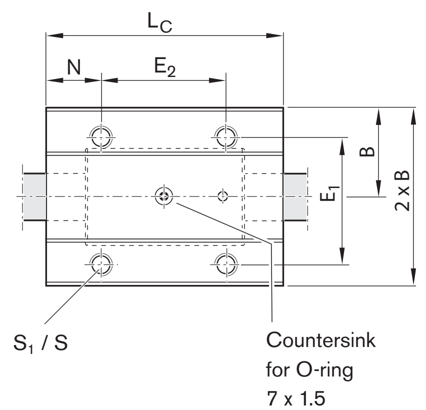


Figure 2 (MGS, MGD)

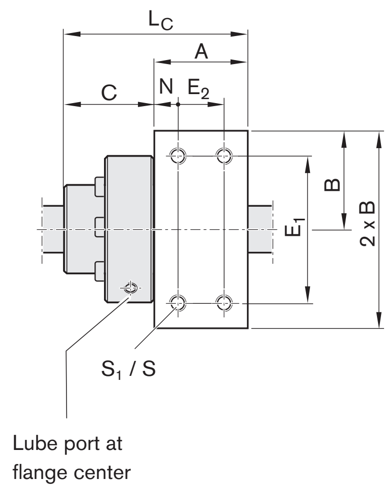
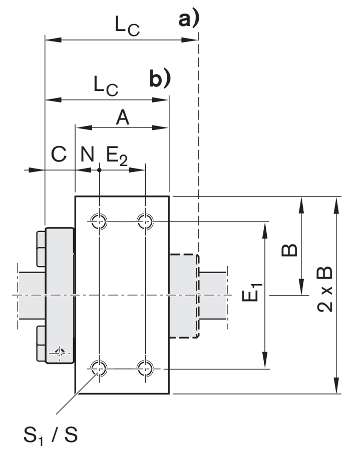
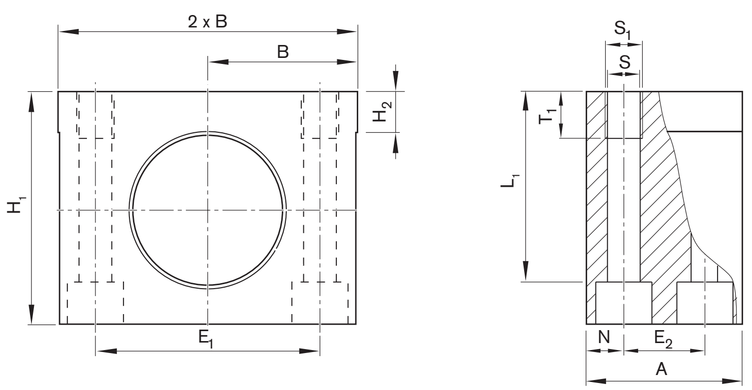


Figure 3 a) / Figure 3 b) (MGS, MGD)



Dimension drawing for all Nut Housings (Figure 1, 2, 3)



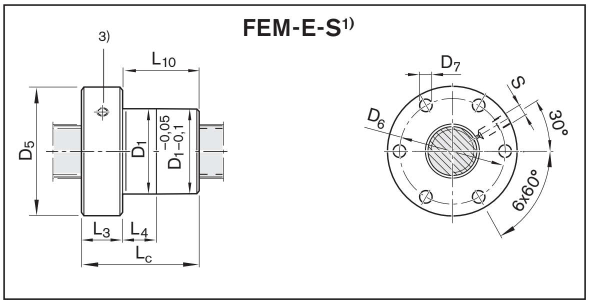
S_1 = 4x thread
S = 4x through-hole

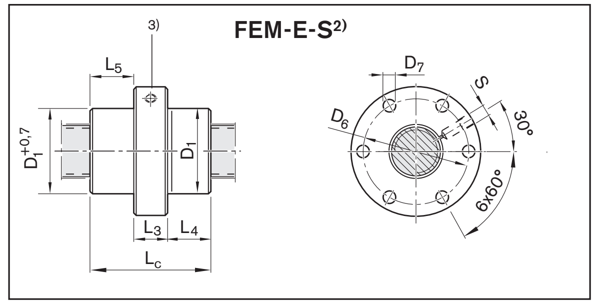
AOK-040 d_0 x P	Nut	Nut Housing	Figure	Dimensions (mm) A	B ±0.01	C	E_1	E_2	H	H_1	H_2	H_{12} ±0.15	H_B	L_C	L_1	N	S_1	S	T_1
40 x 5	ZEM-E	MGA	1	–	60	–	90	120	115				10	180		30	M16	14.5	24
	FEM-E-S	MGS	3 b)	60	52.5	13	$82^{\pm0.1}$	$30^{\pm0.1}$	98	82			16	75	64	15	M16	13.0	20
	FEM-E-C	MGD	3 b)	80	60	13	$90^{\pm0.1}$	$35^{\pm0.1}$	98				14	95		31	M18	15.0	25
40 x 10	ZEM-E	MGA	1	–	60	–	90	120	115				10	180		30	M16	14.5	24
	FEM-E-S	MGS	3 b)	65	60	13	$93^{\pm0.1}$	$35^{\pm0.1}$	106	98			8	80	79	15	M18	15.0	25
	FEM-E-C	MGD	3 b)	80	60	13	$90^{\pm0.1}$	$35^{\pm0.1}$	98				14	95		31	M18	15.0	25
40 x 20	ZEM-E	MGA	1	–	60	–	90	120	115		12	111	10	180		30	M16	14.5	24
	FEM-E-S	MGS	3 a)	65	60	15	$93^{\pm0.1}$	$35^{\pm0.1}$	106	98			8	88	79	15	M18	15.0	25
	FEM-E-C	MGD	3 b)	80	60	13	$90^{\pm0.1}$	$35^{\pm0.1}$	98				14	95		31	M18	15.0	25
40 x 40	ZEM-E	MGA	1	–	60	–	90	120	115				10	180		30	M16	14.5	24
	FEM-E-S	MGS	2	80	70	54	$108^{\pm0.1}$	$46^{\pm0.1}$	114	113			1	151	92	17	M20	17.0	30
	FEM-E-C	MGD	3 a)	80	60	13	$90^{\pm0.1}$	$35^{\pm0.1}$	98				14	142		31	M18	15.0	25

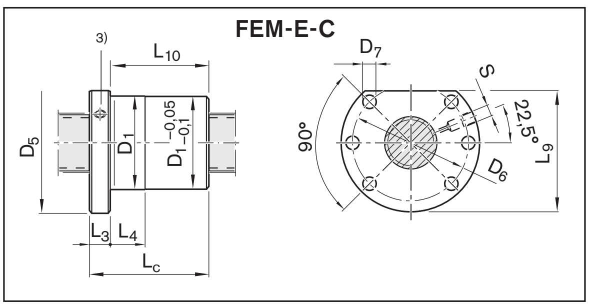
L_{ad} = additional length (see “Technical data” section)

AOK-040

Nut dimension drawings





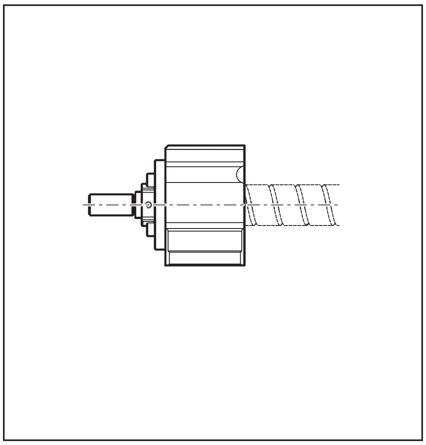


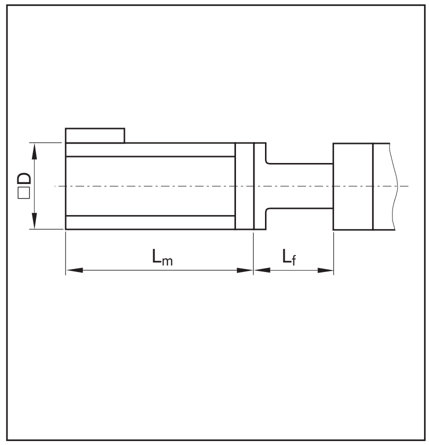
AOK-040	**Nut**	(mm)										
d_0 x P		**D_1 (g6)**	**D_5**	**D_6**	**D_7**	**L_C**	**L_3**	**L_4**	**L_5**	**L_9**	**L_{10}**	**S[3)]**
40 x 5	FEM-E-S[1)]	56	80	68	6.6	54	15	10	–	–	39	M8x1
	FEM-E-C	63	93	78	9.0	54	15	10		81.5	39	M8x1
40 x 10	FEM-E-S[1)]	63	95	78	9.0	70	15	16	–	–	55	M8x1
	FEM-E-C	63	93	78	9.0	70	15	16		81.5	55	M8x1
40 x 20	FEM-E-S[1)]	63	95	78	9.0	88	15	25	–	–	73	M8x1
	FEM-E-C	63	93	78	9.0	88	15	25	–	81.5	73	M8x1
40 x 40	FEM-E-S[2)]	72	110	90	11.0	102	40	31	31	–	–	M8x1
	FEM-E-C	63	93	78	9.0	142	15	45	–	81.5	127	M8x1

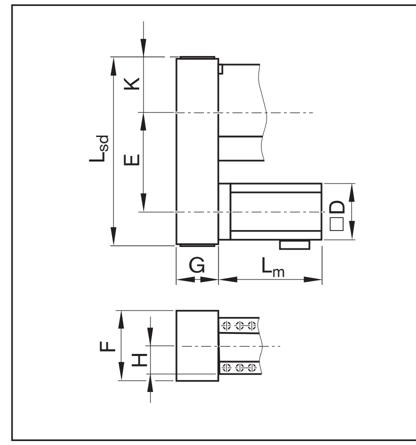
3) Lube hole (S) (in flange center on FEM-E-S, FEM-E-C)
Lube port machining: flat surface L3 ≤ 15 mm, countersink L3 > 15 mm;

Motor attachment dimension drawings

Version		
OF01	**MF01**	**RV01, RV02, RV03, RV04**







Version	Motor	Dimensions (mm) D	E i = 1	E i = 2	F	G	H	K	L_f	L_m without brake	L_m with brake	L_{sd} i = 1	L_{sd} i = 2
RV01, RV02, RV03, RV04	**MSK 076C**	140	240	238	160	90	56	77	–	292.5	292.5	409	409
MF01	**MSK 076C**	140	–	–	–	–	–	–	140	292.5	292.5	–	–

See “Motors” section for more information and dimensions

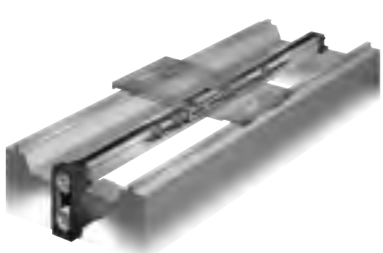
Product description

Properties
- AGK Drive Units in closed format are ready-to-install drive axes consisting of ball screw drive, Nut Housings and pillow blocks, as well as a protective aluminum profile with cover strip as an enclosure
- Three coordinated sizes available in any length up to L_{max}
- The BASA is optimally protected by the protective profile with steel or polyurethane sealing strip
- Driven by zero-backlash, pre-tensioned, precision ball screw drive in rolled design, in accordance with DIN 69051 in tolerance grade T5 or T7
- High linear speeds thanks to large leads with high precision over long lengths
- Optional traveling screw supports to use in horizontal mounting positions for max. speeds over longer lengths

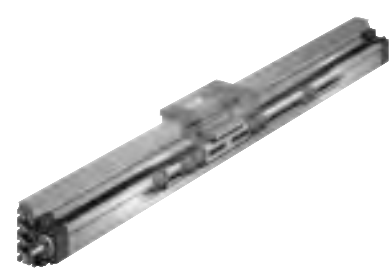
Other highlights
- Flexible thanks to selectable options
- Easy motor attachment via locating feature and threads
- Clearly structured technical data for the complete unit as “Linear motion axes without guideway”
- Nameplate with parameters for easy start-up

Attachments
- Motor attachments with mount and coupling or via a timing belt side drive
- Attachment kits for motors according to customer specification
- Maintenance-free servo motors with selectable brake and integrated feedback
- Switches (magnetic sensor), switch activation without additional switching lug
- Socket and plug

Application examples



The table is supported symmetrically on two rail guides with four Runner Blocks. The Nut Housing of the ball screw drive is located at the top.



Depending on the application requirements, the Nut Housing can also be on the side instead of the top.

SPU product description

Patented screw support (SPU)

The screw support SPU provides the following benefits:

- Screw supports can be selected as a standard option
- Max. speed over long lengths
- Guideway of the screw supports in protective profile
- Elastomer buffer provides cushioning between carriage and screw support
- Maintenance-free screw supports
- Covered screw supports

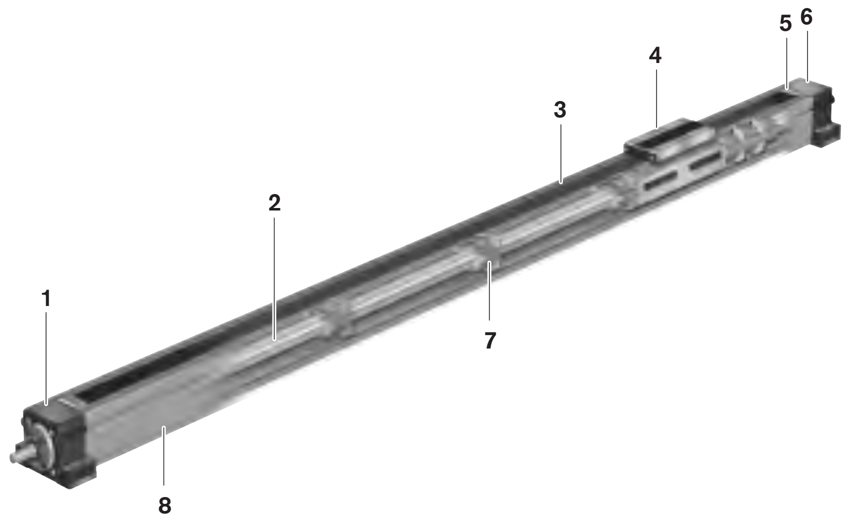
⚠ **Screw support designed for horizontal operation only.**

As the length of screw-driven Linear Motion Axes increases, the distance between screw supports increases. As the unsupported length increases, undesirable screw oscillation causes the resonance range to be reached more quickly, reducing rotary speed/max. permissible speed accordingly.

The traveling screw supports are located at defined support points to reduce the length of screw that is unsupported. The result is consistently high speeds over long lengths.

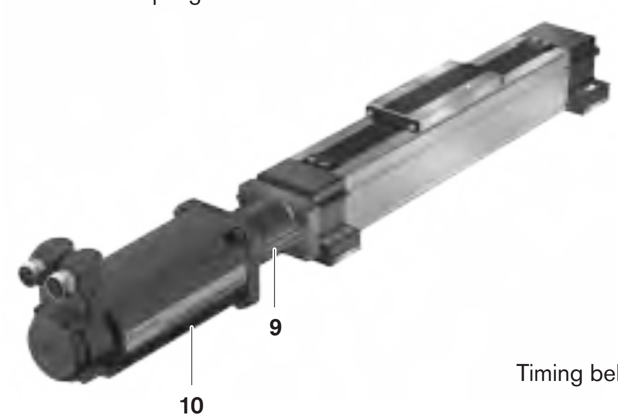
Structural design

1 Pillow block (fixed bearing)
2 Ball screw drive with zero-backlash Cylindrical Single Nut
3 Steel or plastic sealing strip
4 Nut Housing
5 Strip fixing
6 Pillow block (floating bearing)
7 Screw support (SPU)
8 Protective profile

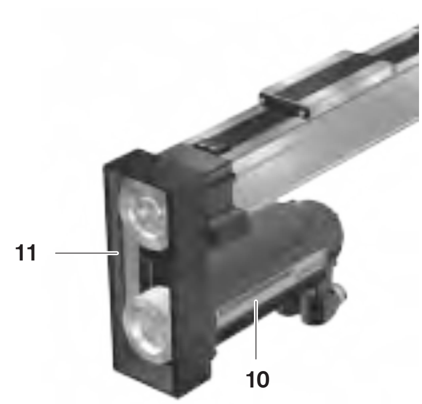


Motor attachment
9 Mount and coupling
10 Servo motor
11 Timing belt side drive

Mount and coupling



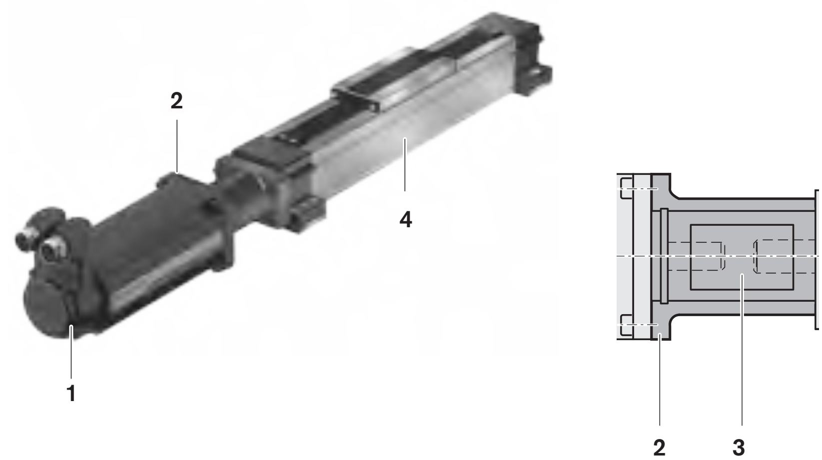
Timing belt side drive



Structural design of mount and coupling

A motor can be attached to all Drive Units via mount and coupling.
The mount secures the motor to the Drive Unit and serves as a closed housing for the coupling.
The coupling transmits the motor drive torque to the Drive Unit's drive shaft without distortive stresses.
Our standard couplings compensate for the system's thermal expansion.

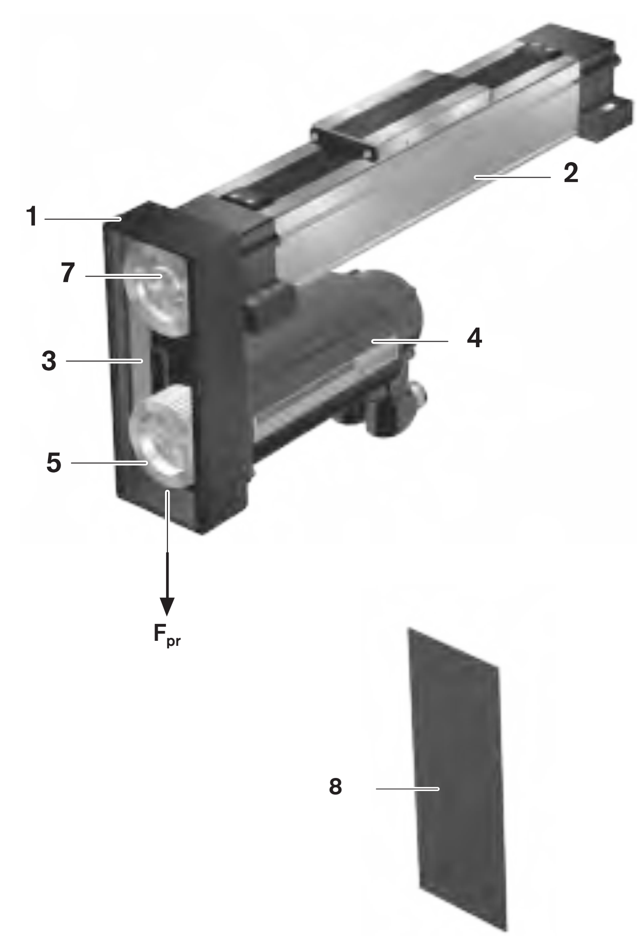
1 Motor
2 Mount
3 Coupling
4 Drive Unit



Structural design of timing belt side drive

All Drive Units can be attached to the motor by a timing belt side drive.
This makes the overall length shorter than when attaching the motor via mount and coupling.
The space-saving, closed pulley housing protects the belt and acts as a motor bracket.
Various gear ratios are also available (depending on size):
– i = 1
– i = 2
The timing belt side drive can be installed in four directions:
– below, above (RV01 and RV02)
– left, right (RV03 and RV04)

1 Pulley housing made of anodized aluminum frame
2 Drive Unit
3 Toothed belt
4 Motor
5 Pre-tensioning the belt: Apply pre-tensioning force F_{pr} to motor (F_{pr} is provided upon delivery)
6 Cover
7 Fastening of belt pulleys with tensioning units
8 Cover panel



Technical data

See the “Calculation” section.

General technical data

AGK	BASA	Dynamic characteristic values Dynamic load rating C		Min. travel range	Max. length	Additional length				Nut Housing length	Moved mass of system	Mass constants	
		Nut	Fixed bearing			with number of SPU							
						without	1	2	3				
	d_0 x P (mm)	(N)	(N)	s_{min} (mm)	L_{max} (mm)	L_{ad} (mm)				L_C (mm)	m_{ca} (kg)	$k_{g\ fix}$ (kg)	$k_{g\ var}$ (kg/mm)
AGK-020	20 x 5	14300	17000	100	3000	86	201	326	451	204	2.50	3.50	0.0062
	20 x 10	14100											
	20 x 20	13300											
	20 x 40	14000											
AGK-032	32 x 5	21600	26000	150	5000	86	201	326	451	204	3.50	4.70	0.0099
	32 x 10	31700											
	32 x 20	19700											
	32 x 32	19500											
AGK-040	40 x 5	29100	29000	180	5600	86	201	326	451	264	6.60	7.70	0.0160
	40 x 10	50000											
	40 x 20	37900											
	40 x 40	37000											

Calculation of the mass of the linear motion system
(without motor attachment, without motor)

$$m_s = k_{g\ fix} + k_{g\ var} \cdot L + m_{ca}$$

Drive data

AGK	BASA	Constant mass moment of inertia			Frictional torque				Max. permissible acceleration	Maximum permissible drive torque	Max. speed
					with number of SPU						
					without	1	2	3			
	d_0 x P (mm)	$k_{J\ fix}$ (kgmm²)	$k_{J\ var}$ (kgmm)	$k_{J\ m}$ (mm²)	M_{Rs} (Nm)				a_{max} (m/s²)	M_P (Nm)	v_{max} (m/s)
AGK-020	20 x 5	16.9	0.1004	0.633	0.55	0.6	0.6	0.7	39.8	See graphs	See graphs
	20 x 10	21.7	0.1004	2.533	0.55	0.6	0.7	0.7	50.0		
	20 x 20	40.7	0.1004	10.132	0.60	0.7	0.8	0.9	50.0		
	20 x 40	116.7	0.1004	40.5285	0.70	0.9	1.1	1.3	50.0		
AGK-032	32 x 5	131.7	0.7117	0.633	0.9	0.9	1.0	1.0	17.9		
	32 x 10	138.4	0.7117	2.533	1.0	1.1	1.1	1.2	30.7		
	32 x 20	165.0	0.6668	10.132	1.1	1.2	1.3	1.5	50.0		
	32 x 32	220.3	0.6668	25.938	1.2	1.4	1.6	1.8	50.0		
AGK-040	40 x 5	378.5	1.783	0.633	1.5	1.5	1.6	1.6	12.2		
	40 x 10	354.1	1.607	2.533	1.5	1.6	1.7	1.8	16.8		
	40 x 20	404.3	1.607	10.132	1.6	1.8	1.9	2.1	33.0		
	40 x 40	604.9	1.607	40.528	1.8	2.1	2.5	2.8	50.0		

Drive data for motor attachment via timing belt side drive

AGK	Motor	BASA (mm) d_0 x P	up to L[2] (mm)	M_{sd}[1] (Nm) i = 1	M_{sd} (Nm) i = 2	J_{sd} (10^{-6} kgm²) i = 1	J_{sd} (10^{-6} kgm²) i = 2	M_{Rsd} (Nm)	m_{sd} (kg)	F (mm)	B_t i = 1	B_t i = 2
AGK-020	**MSK 040C, MSM 041B**	20 x 5	1600	6.00	–	240	–	0.40	1.24	88	16 AT5	–
		20 x 10	2000	7.90								
		20 x 20	2700	7.94								
		20 x 40	3000	7.94								
	MSK 050C	20 x 5	1600	6.00	–	1420	–	0.45	3.20	116	25 AT5	–
		20 x 10	2000	7.90								
		20 x 20	2600	8.70								
		20 x 40	3000	8.90								
AGK-032	**MSK 060C**	32 x 5	2500	19.10	9.55	1400	260	0.50	3.20	116	25 AT5	32 AT5
		32 x 10	3000	19.21	12.30							
		32 x 20	4200	19.21	12.30							
		32 x 32	5000	19.21	12.30							
AGK-040	**MSK 076C**	40 x 5	3600	25.60	12.80	7780	1260	0.60	8.40	160	50 AT10	50 AT10
		40 x 10	3100	51.20	25.60							
		40 x 20	3100	99.30	49.65							
		40 x 40	4400	99.30	49.65							

1) Values for M_{sd} do not factor in motor torque.
2) For greater lengths, the permissible drive torque is determined from the variable-length value M_p of the Drive Unit in accordance with the graph ➟ See the “Calculation principles” section.

Drive data for motor attachment via mount and coupling

AGK	Motor Type	Coupling M_{cN} (Nm)	Coupling J_c (10^{-6} kgm²)	Mount and coupling m_{fc} (kg)
AGK-020	MSM 041B	14.5	63	0.85
	MSK 040C	19.0	57	0.55
	MSK 050C	50.0	200	2.00
AGK-032	MSK 060C	50.0	200	1.80
	MSK 076C	98.0	390	2.40
AGK-040	MSK 076C	98.0	390	2.80

a_{max} = maximum acceleration
C = dynamic load rating
d_0 = nominal diameter
$k_{g\ fix}$ = constant for fixed-length portion of the mass
$k_{g\ var}$ = constant for variable-length portion of the mass
$k_{J\ fix}$ = constant for fixed-length portion of mass moment of inertia
$k_{J\ var}$ = constant for variable-length portion of mass moment of inertia
$k_{J\ m}$ = constant for mass-specific portion of mass moment of inertia
L = length
L_{ad} = additional length
L_c = Nut Housing length
L_{max} = maximum length
m_{ca} = moved mass of system
P = lead

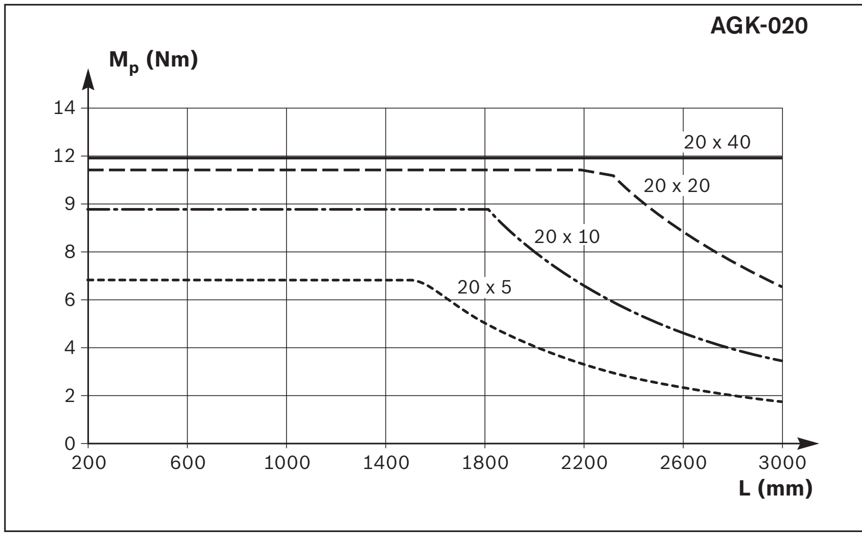
s_{min} = minimum travel
SPU = screw support
M_p = drive torque
M_{Rs} = frictional torque of system
v_{max} = maximum speed
B_t = belt type
i = timing belt side drive gear ratio
J_c = mass moment of inertia of the coupling
J_{sd} = reduced mass moment of inertia of timing belt side drive at motor journal
M_{cN} = rated torque of coupling
m_{fc} = mass of mount and coupling
M_{Rsd} = frictional torque of timing belt side drive at motor journal
M_{sd} = maximum permissible drive torque of timing belt side drive
m_{sd} = mass of timing belt side drive

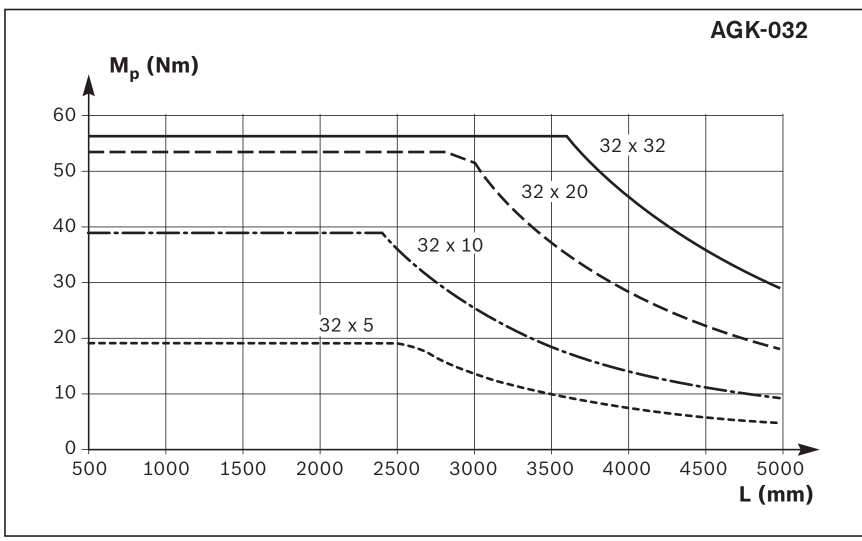
Technical data

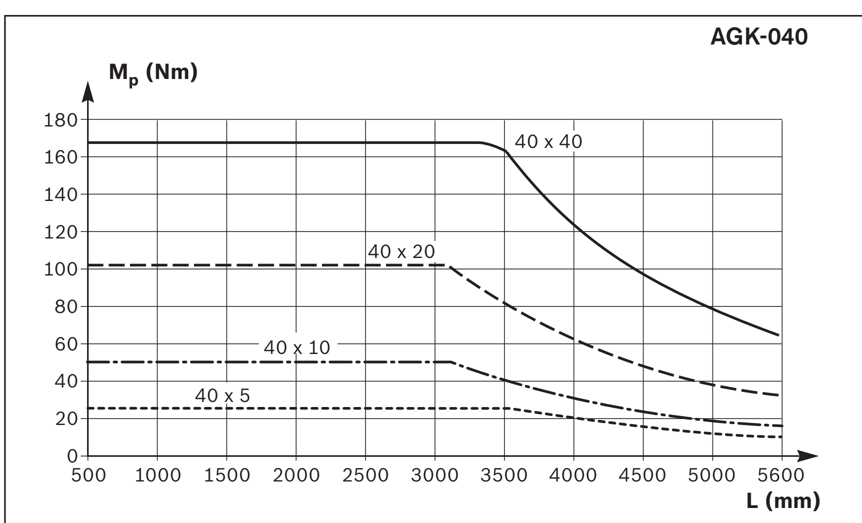
Permissible drive torque M_p

The values shown for M_p apply under the following conditions:

– No radial loads on screw journal

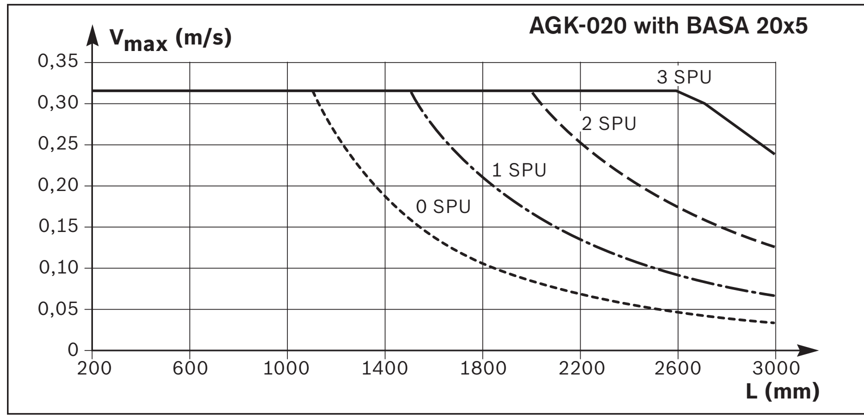




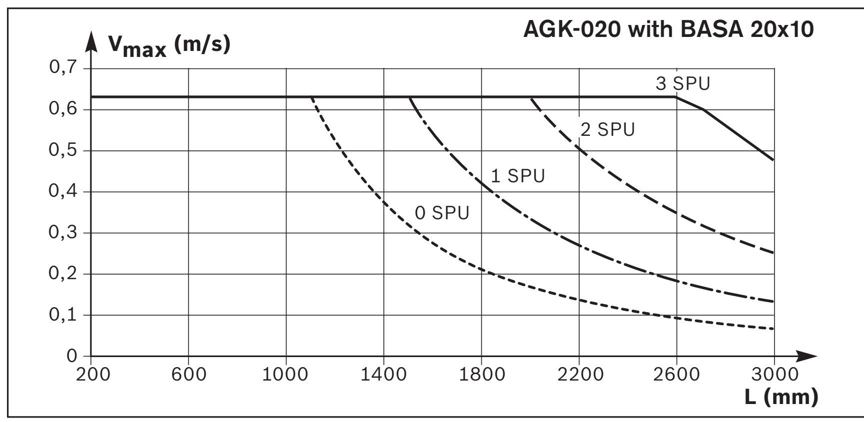


Permissible speed v_{max}

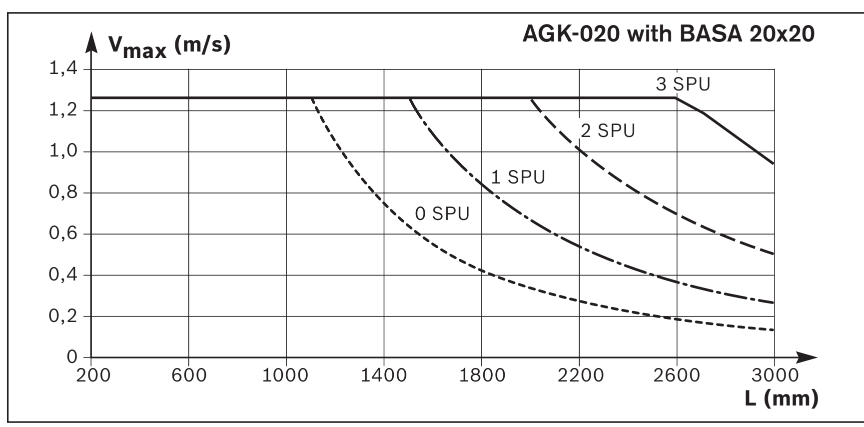
SPU = screw support



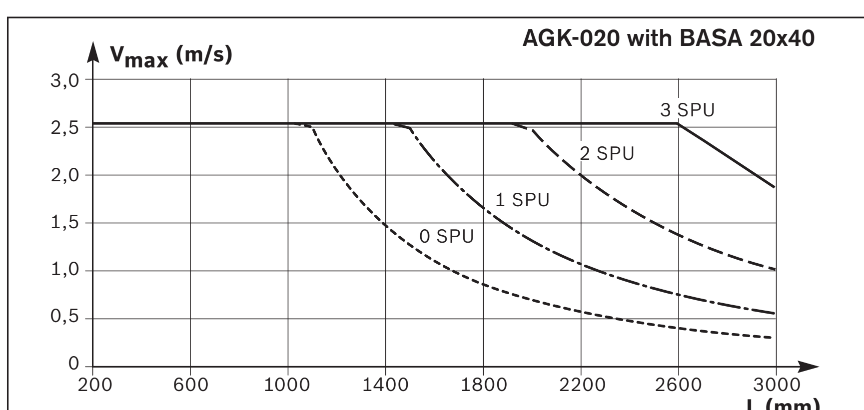
AGK-020 with BASA 20x5



AGK-020 with BASA 20x10



AGK-020 with BASA 20x20

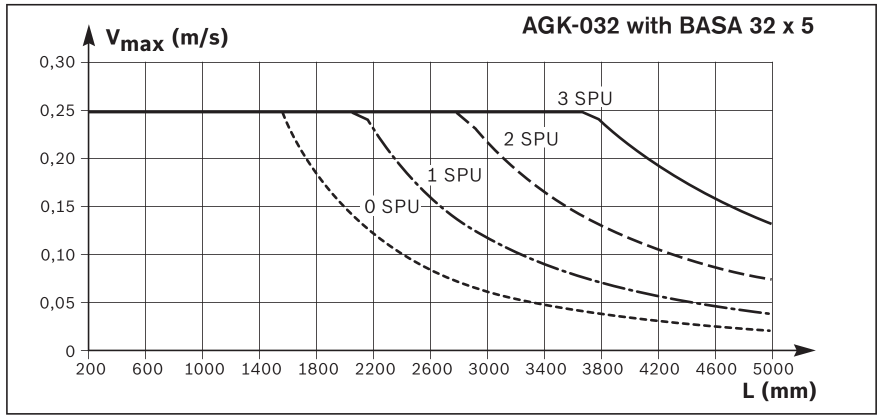


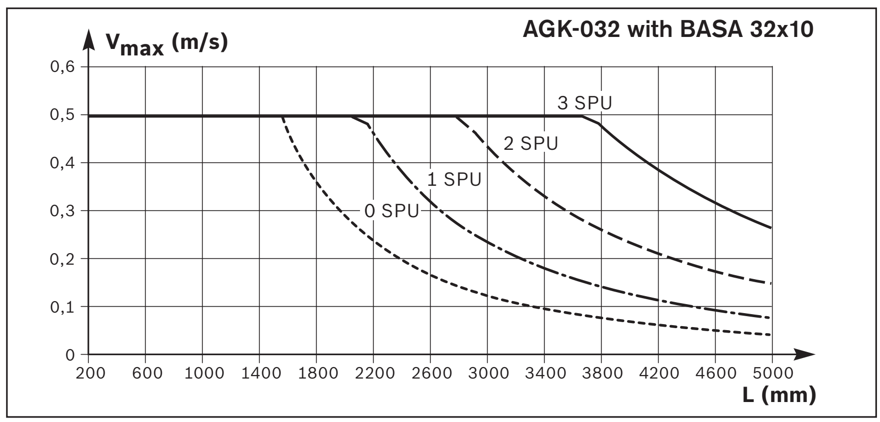
AGK-020 with BASA 20x40

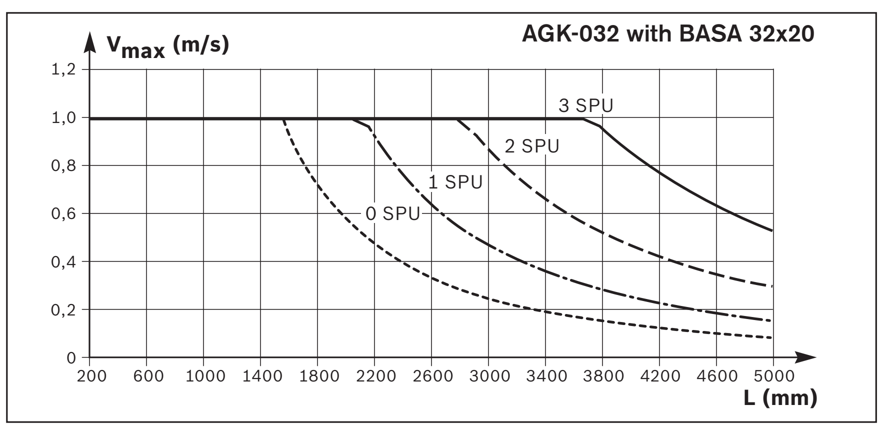
Technical data

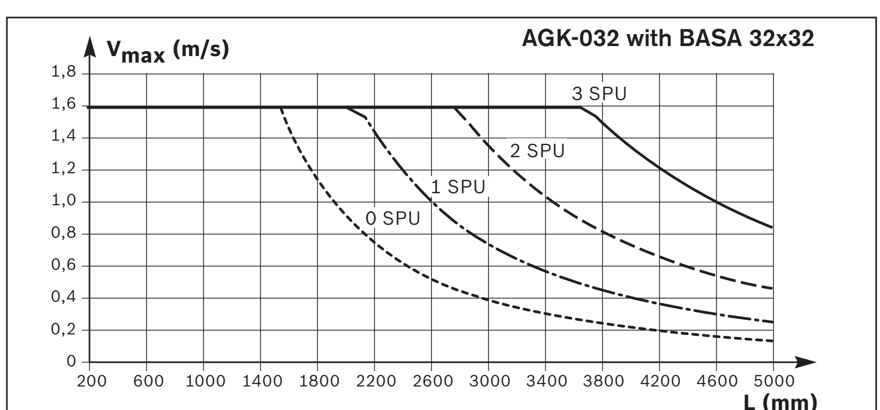
Permissible speed v_{max}

SPU = screw support



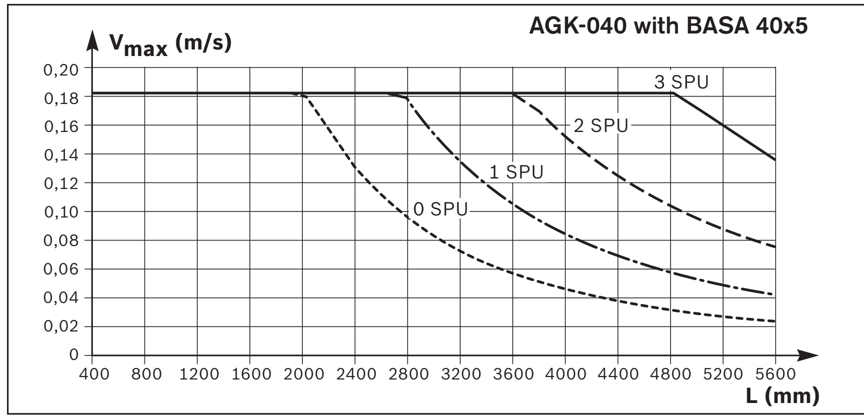


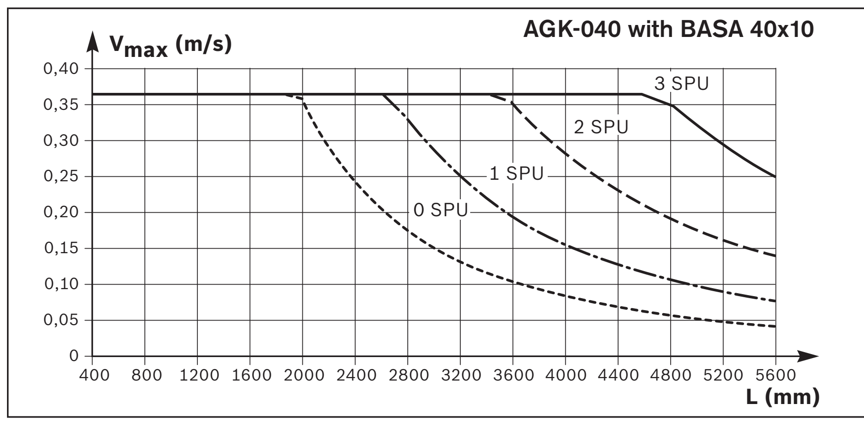


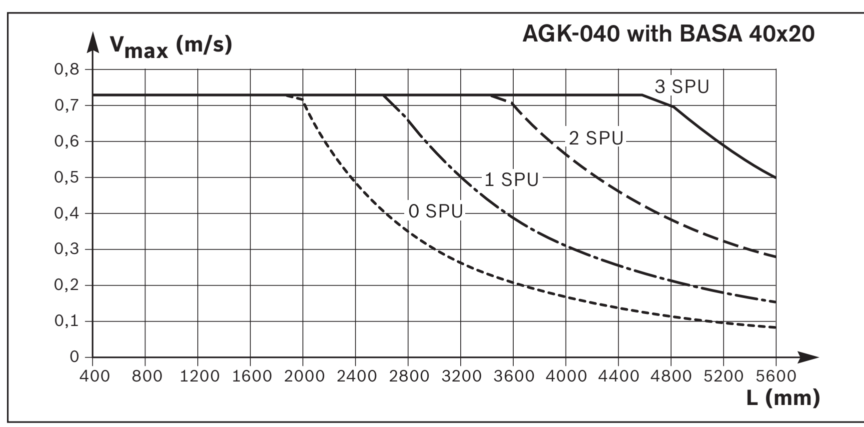


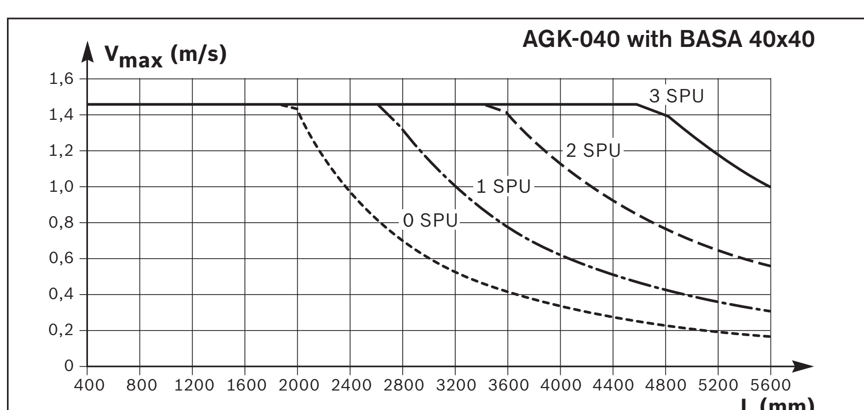
Permissible speed v_{max}

SPU = screw support



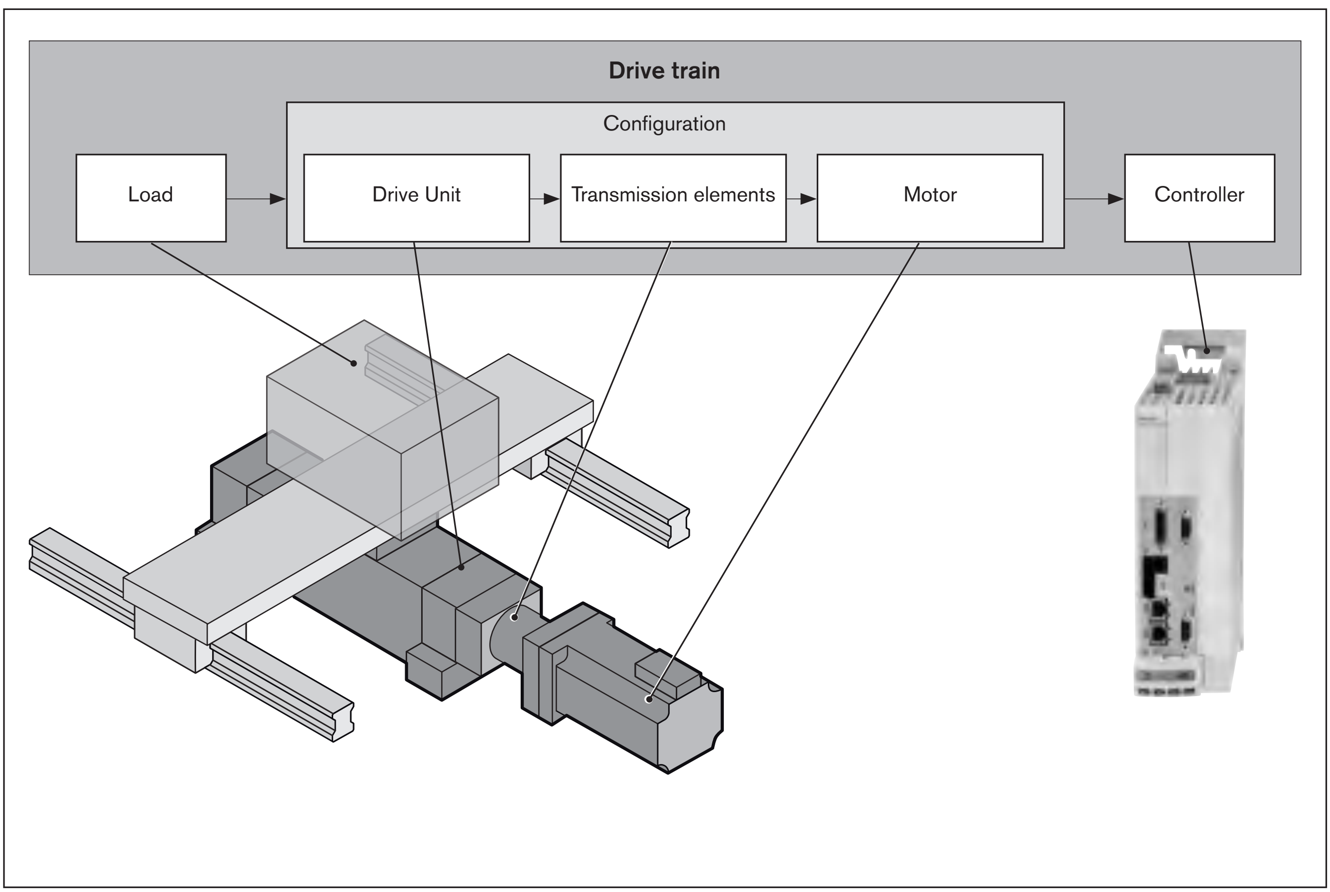






Calculation

Calculation principles



Correct dimensioning and assessment for an application requires structured consideration of the entire drive train.
The basic element of the drive train is the configuration, consisting of the Drive Unit, the transmission element (coupling or timing belt side drive) and the motor, that can be ordered from the catalog.

Drive Unit service life

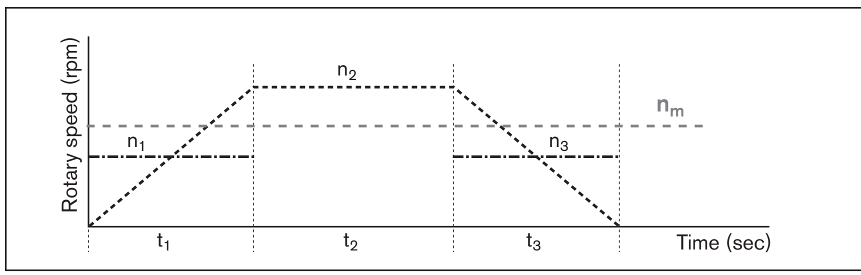
The service life of the rolling bearing points contained in a Drive Unit can be calculated using the formulas given below. In a Drive Unit with ball screw drive, the rolling bearing points that are relevant for the service life are the linear guide, the ball screw drive (nut), and the fixed bearing.

⚠ **Whichever independently calculated service life is shorter, that of the ball screw drive or of the fixed bearing, is then used as the estimated service life of the Drive Unit.**

Service life of the ball screw drive or the fixed bearing

If operating conditions vary (rotary speed and load), service life must be calculated using the averages $\mathbf{F_m}$ and $\mathbf{n_m}$.

If rotary speed varies, average rotary speed $\mathbf{n_m}$ is calculated as follows:



$$n_m = \frac{|n_1| \cdot t_1 + |n_2| \cdot t_2 + \ldots + |n_n| \cdot t_n}{t_{tot}}$$

$$t_{tot} = t_1 + t_2 + \ldots + t_n$$

$n_{1,}\, n_{2,} \ldots\, n_n$	=	rotary speed in phases 1 … n	(rpm)
n_m	=	average rotary speed	(rpm)
$t_{1,}\, t_{2,} \ldots\, t_n$	=	discrete time step in phases 1 … n	(sec)
t_{tot}	=	sum of the discrete time steps	(sec)

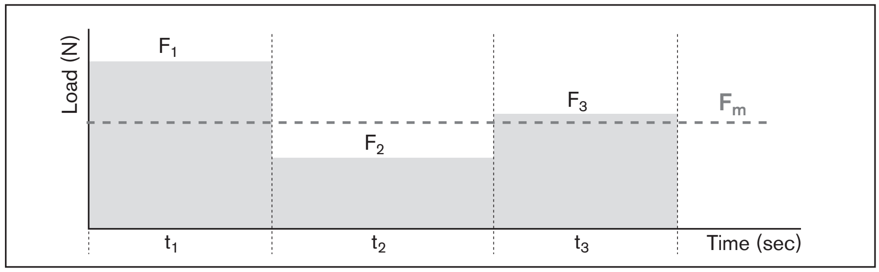
Rotary speed in acceleration and braking phases $\mathbf{n_{1 \ldots n}}$:

$$n_{1 \ldots n} = \frac{n_{A1 \ldots n} + n_{E1 \ldots n}}{2}$$

n_1	=	rotary speed in acceleration and braking phases	
$n_{A1 \ldots n}$	=	rotary speed at start in phase 1 … n	(rpm)
$n_{E1 \ldots n}$	=	rotary speed at end in phase 1 … n	(rpm)

Calculation

Where both the load and the rotary speed vary, the average load $\mathbf{F_m}$ is calculated as follows:



$$F_m = \sqrt[3]{\left|F_1\right|^3 \cdot \frac{|n_1|}{n_m} \cdot \frac{t_1}{t_{ges}} + \left|F_2\right|^3 \cdot \frac{|n_2|}{n_m} \cdot \frac{t_2}{t_{ges}} + \ldots + \left|F_n\right|^3 \cdot \frac{|n_n|}{n_m} \cdot \frac{t_n}{t_{ges}}}$$

Nominal life
Nominal life in revolutions:

$$L = \left(\frac{C}{F_m}\right)^3 \cdot 10^6$$

Nominal life in hours:

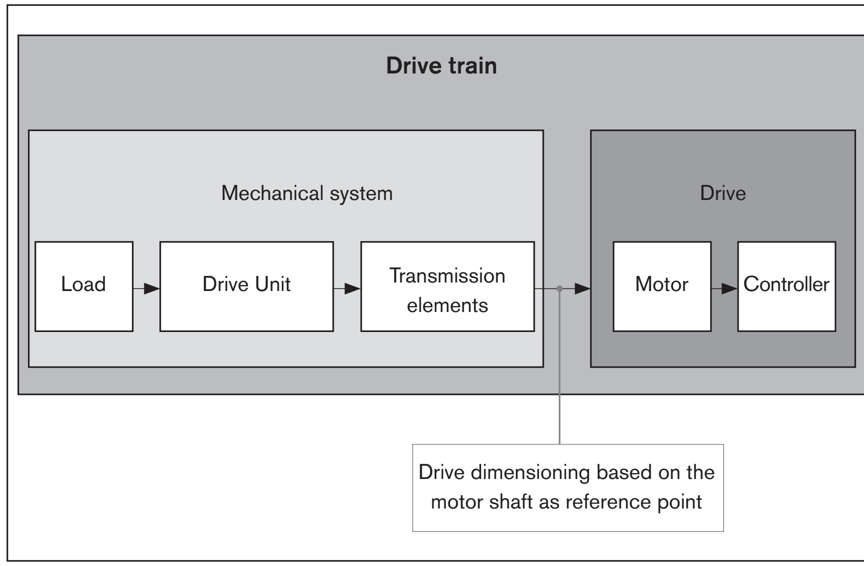
$$L_h = \frac{L}{n_m \cdot 60}$$

C	=	dynamic load rating	(N)
$F_1, F_2, \ldots F_n$	=	axial load during phases 1 … n	(N)
F_m	=	equivalent dynamic axial load	(N)
$n_1, n_2, \ldots n_n$	=	rotary speed in phases 1 … n	(rpm)
n_m	=	average rotary speed	(rpm)
$t_1, t_2, \ldots t_n$	=	discrete time step in phases 1 … n	(sec)
t_{tot}	=	sum of the discrete time steps	(sec)
L	=	nominal life	(–)
L_h	=	nominal life	(h)

Drive dimensioning

Basic principles

When dimensioning the drive, the drive train can be divided into the mechanical system and the drive itself.
The **mechanical system** includes the Drive Unit and transmission elements (timing belt side drive, coupling), and the load to be carried.
The electric **drive** is a motor/controller combination with corresponding performance data.
The dimensioning of the electric drive is done taking the motor shaft as a reference point.
Both basic values and limit values must be factored in when dimensioning the drive. Limit values should be observed to avoid damaging the mechanical components.



Technical data and formula symbols for the mechanical system

For each component (Drive Unit, coupling, timing belt side drive), the relevant maximum permissible values must be identified for the drive torque and travel speed, as well as the basic values for frictional torque and mass moment of inertia.
The following technical data with the associated formula symbols are used when considering the basic **mechanical system** requirements in the design calculations for dimensioning the drive. The data in the table below can be found in the "Technical data" section or they are determined using the formulas described on the following pages.

		Mechanical system			
		Load	Drive Unit	Transmission elements	
				Coupling	Timing belt side drive
Weight moment	**(Nm)**	M_g[6]	–	–	–
Frictional torque	**(Nm)**	–[5]	M_{Rs}[3]	–	M_{Rsd}[3]
Mass moment of inertia	**(kgm²)**	J_t[1]	J_s[2]	J_c[3]	J_{sd}[3]
Max. permissible speed	**(m/s)**	–	v_{max}[4]	–	–
Maximum permissible drive torque	**(Nm)**	–	M_p[4]	M_{cN}[3]	M_{sd}[3]

1) Determine the value using the appropriate formula
2) Length-dependent value, determined using the appropriate formula
3) Use the value from the table
4) Length-dependent value, to be read off the graph
5) Any additional process forces are to be taken into consideration as load moments
6) For vertical mounting position: Determine the value using the appropriate formula

Drive dimensioning

Drive dimensioning based on the motor shaft as a reference point

When dimensioning the drive, all relevant design calculation values for the mechanical components in the drive train have to be determined and be expressed in terms of or reduced to the motor shaft. For a combination of mechanical components in the drive train, this will result in one value for each of the following:

- Frictional torque M_R
- Mass moment of inertia J_{ex}
- Maximum permissible speed v_{mech} (maximum permissible rotary speed n_{mech})
- Maximum permissible drive torque M_{mech}

Determination of the values for each mechanical component in the drive train based on the motor shaft as a reference point

Frictional torque M_R

For motor attachment via mount and coupling

$$\boxed{M_R = M_{Rs}}$$

For motor attachment via timing belt side drive

$$\boxed{M_R = M_{Rsd} + \frac{M_{Rs}}{i}}$$

Mass moment of inertia J_{ex}

For motor attachment via mount and coupling

$$\boxed{J_{ex} = J_s + J_t + J_c}$$

For motor attachment via timing belt side drive

$$\boxed{J_{ex} = J_{sd} + \frac{(J_s + J_t)}{i^2}}$$

Determination of the mass moment of inertia of the Drive Unit

$$\boxed{J_s = (k_{J\,fix} + k_{J\,var} \cdot L) \cdot 10^{-6}}$$

Determination of the translatory mass moment of inertia of the external load

$$\boxed{J_t = m_{ex} \cdot k_{J\,m} \cdot 10^{-6}}$$

i	=	gear ratio of timing belt side drive	(–)
J_c	=	mass moment of inertia of the coupling	(kgm^2)
J_{ex}	=	mass moment of inertia of mechanical system	(kgm^2)
J_s	=	mass moment of inertia of the Drive Unit	(kgm^2)
J_{sd}	=	mass moment of inertia of timing belt side drive at motor journal	(kgm^2)
J_t	=	translatory mass moment of inertia of external load based on the Drive Unit screw journal	(kgm^2)
$k_{J\,fix}$	=	constant for fixed-length portion of mass moment of inertia	($kgmm^2$)
$k_{j\,m}$	=	constant for mass-specific portion of mass moment of inertia	(mm^2)
$k_{j\,var}$	=	constant for variable-length portion of mass moment of inertia	(kgmm)
L	=	length of Drive Unit	(mm)
m_{ex}	=	moved external load	(kg)
M_R	=	frictional torque at motor journal	(Nm)
M_{Rs}	=	frictional torque of system	(Nm)
M_{Rsd}	=	frictional torque of timing belt side drive at motor journal	(Nm)

Maximum permissible speed v_{mech}

The lowest of all the values for the maximum permissible speed of all mechanical components contained in the drive train determines the maximum permissible speed of the mechanical system which has to be taken into consideration as the upper limit for the drive when dimensioning the motor. By design, the maximum permissible speed or rotary speed of the Drive Unit with ball screw drive will always be less than that of the other components in the mechanical system, such as the coupling or timing belt side drive, meaning it is the maximum permissible speed of the mechanical system.

Maximum permissible speed

$$\boxed{v_{mech} = v_{max}}$$

Maximum permissible rotary speed

For motor attachment via mount and coupling

$$\boxed{n_{mech} = \frac{v_{mech} \cdot 1000 \cdot 60}{P}}$$

For motor attachment via timing belt side drive

$$\boxed{n_{mech} = \frac{v_{mech} \cdot i \cdot 1000 \cdot 60}{P}}$$

i	=	gear ratio of timing belt side drive	(–)
n_{mech}	=	maximum permissible rotary speed of mechanical system	(rpm)
P	=	screw lead	(mm)
v_{max}	=	maximum permissible speed of the Drive Unit	(m/s)
v_{mech}	=	maximum permissible speed of mechanical system	(m/s)

Maximum permissible drive torque M_{mech}

The lowest (minimum) permissible drive torque of all of the mechanical components in the drive train determines the maximum permissible drive torque of the mechanical system, which should be considered the drive limit when dimensioning the motor.

For motor attachment via mount and coupling

$$\boxed{M_{mech} = \text{minimum } (M_{cN}; M_p)}$$

For motor attachment via timing belt side drive

$$\boxed{M_{mech} = \text{minimum } \left(M_{sd}\,; \frac{M_p}{i}\right)}$$

i	=	gear ratio of timing belt side drive	(–)
M_p	=	maximum permissible drive torque of the Drive Unit	(Nm)
M_{cN}	=	rated torque of coupling	(Nm)
M_{sd}	=	maximum permissible drive torque of the timing belt side drive	(Nm)
M_{mech}	=	maximum permissible drive torque for mechanical system	(Nm)

⚠ **When considering the complete drive train (mechanical system + motor/controller), the maximum torque of the motor can lie below the maximum value for the mechanical system (M_{mech}) and thus limit the maximum permissible drive torque of the overall drive train.**
If the maximum torque of the motor lies above the upper limit for the mechanical system (M_{mech}), the maximum motor torque must be limited to the permitted value for the mechanical system.

Drive dimensioning

Motor pre-selection

The following conditions can be used as a general guide for pre-selecting the motor.

Condition 1:
The rotary speed of the motor must be greater than or equal to the rotary speed required for the mechanical system (but not exceeding the maximum permissible limit value).

$$n_{max} \geq n_{mech}$$

n_{max} = max. rotary speed of motor (rpm)
n_{mech} = maximum permissible rotary speed of the mechanical system (rpm)

Condition 2:
Consideration of the ratio of mass moments of inertia of the mechanical system and the motor. The ratio of the mass moments of inertia serves as an indicator for the control performance of a motor/controller combination. The mass moment of inertia of the motor is directly related to motor size.

Ratio of mass moments of inertia

$$V = \frac{J_{ex}}{J_m + J_{br}}$$

For pre-selection, past experience has shown the following values will result in high control performance.
These are not rigid limits, but values exceeding them will require closer consideration of the specific application.

Application area	V
Handling	≤ 6.0
Processing	≤ 1.5

J_{br} = mass moment of inertia of motor brake (kgm^2)
J_{ex} = mass moment of inertia of mechanical system (kgm^2)
J_m = mass moment of inertia of motor (kgm^2)
V = ratio of mass moments of inertia of drive train and motor (–)

Condition 3:
Estimation of the ratio of the static load moment to the torque of the motor at standstill. The torque ratio must be less than or equal to the empirical value of 0.6. By looking at the required motor torque levels, this estimation roughly covers the dynamic characteristics which still have to be determined by plotting an exact motion profile.

Torque ratio

$$\frac{M_{stat}}{M_0} \leq 0.6$$

Static load moment

$$M_{stat} = M_R + M_g$$

Weight moment
For vertical mounting only!
For motor attachment via mount and coupling: $i = 1$

$$M_g = \frac{P \cdot (m_{ex} + m_{ca}) \cdot g}{2000 \cdot \pi \cdot i}$$

g	=	force of gravity (= 9.81)	(m/s²)
i	=	gear ratio of timing belt side drive	(–)
m_{ca}	=	moved mass of carriage	(kg)
m_{ex}	=	moved external load	(kg)
M_g	=	weight moment at motor journal	(Nm)
M_0	=	torque of the motor at standstill	(Nm)
M_R	=	frictional torque at motor journal	(Nm)
M_{stat}	=	static load moment	(Nm)
P	=	screw lead	(mm)
π	=	pi	(–)

In the section ➟“Configuration and ordering”, users can put together standard configurations, including motor attachment and motor, for the various Drive Unit sizes by selecting the appropriate options. By checking the above conditions, it is possible to see whether a standard motor selected in a particular configuration will generally be of a suitable size for the specific application.

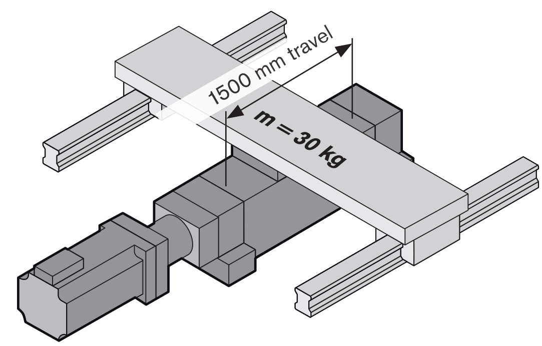
Precise drive dimensioning
Pre-selecting the motor according to this general guide is no substitute for the precise design calculations required for the drive with detailed consideration of torques and rotary speed levels. For precise calculation of the electric drive, including consideration of the specific motion profile, please refer to the performance data in the catalogs “IndraDrive Cs” and “IndraDrive C”.
When dimensioning the drive, the maximum permissible speed, drive torque and acceleration should not be exceeded in order to avoid damaging the mechanical system.

Calculation example

Starting data

An object weighing 30 kg needs to be moved horizontally 1500 mm at a max. speed of 0.3 m/s. The object travels over a separate linear guide whose frictional drag is 100 N. The following was selected based on technical data and installation space:

AOK-020 Drive Unit:
- motor attachment via mount and coupling
- with motor MSK 040C without brake



Estimating length L

(The first estimate assumes the largest possible lead and therefore length, since the permissible speed can decrease as length increases.)

	L	$= s_{max} + L_{ca} + L_{ad}$
Excess travel:	s_e	$= 2 \cdot P = 2 \cdot 40 = 80$ mm
Max. travel:	s_{max}	$= s_{eff} + 2 \cdot s_e$
		$= 1500 + 2 \cdot 80 = 1660$ mm
Length:	L	$= 1660 + 204 + 86 = 1950$ mm

Selecting the ball screw drive

(Better to choose the lowest lead as this is favorable in terms of resolution, braking distance, length.)

Permissible ball screw drives according to “Permissible speed” graph given $v = 0.3$ m/s and $L = 1950$ mm:

BASA 20 x 40 and BASA 20 x 20

Ball screw drive selected (smaller lead):

BASA 20 x 20

Maximum permissible speed for BASA 20 x 20 from graph:

$v_{max} = 0.4$ m/s

Calculation of length L

(for selected BASA)

Excess travel:	s_e	$= 2 \cdot P = 2 \cdot 20 = 40$ mm
Max. travel:	s_{max}	$= s_{eff} + 2 \cdot s_e$
		$= 1500 + 2 \cdot 40 = 1580$ mm
Length:	L	$= 1580 + 204 + 86 = 1870$ mm

Frictional torque M_R

(motor attachment via mount and coupling)

	M_R	$= M_{Rs} + M_{Rad}$
Separate guideway:	M_{Rad}	$= (P \cdot F_R)/(2000 \cdot \pi)$
		$= (20 \cdot 100)/(2000 \cdot \pi)$
		$= 0.32$ Nm
Drive Unit:	M_{Rs}	$= 0.60$ Nm
Frictional torque:	M_R	$= 0.60 + 0.32 = 0.92$ Nm

Mass moment of inertia J_{ex}
(motor attachment via mount and coupling)

	J_{ex}	$= J_s + J_t + J_c$
Coupling:	J_c	$= 57 \cdot 10^{-6}$ kgm²
Drive Unit:	J_s	$= (k_{J\ fix} + k_{J\ var} \cdot L) \cdot 10^{-6}$
		$= (40.7 + 0.1004 \cdot 1870) \cdot 10^{-6}$
		$= 228.45 \cdot 10^{-6}$ kgm²
External load:	J_t	$= m_{ex} \cdot k_{J\ m} \cdot 10^{-6}$
		$= 30 \cdot 10.1321 \cdot 10^{-6}$
		$= 303.96 \cdot 10^{-6}$ kgm²
Moment of inertia:	J_{ex}	$= 228.45 \cdot 10^{-6} + 303.96 \cdot 10^{-6} + 57 \cdot 10^{-6}$
		$= 589.41 \cdot 10^{-6}$ kgm²

Maximum permissible rotary speed n_{mech}
(motor attachment via mount and coupling)
Limit for mechanical system

$$n_{mech} = \frac{(v_{mech} \cdot 1000 \cdot 60)}{P}$$

Max. permissible speed: $v_{mech} = v_{max} = 0.4$ m/s

Max. permissible rotary speed: $n_{mech} = \frac{(0.4 \cdot 1000 \cdot 60)}{20} = 1200$ rpm

Max. rotary speed of application n_{mech}:
(motor attachment via mount and coupling)
Application limit

Speed: $v_{mech} = 0.3$ m/s

Rotary speed: $n_{mech} = \frac{0.3 \cdot 1000 \cdot 60}{20} = 900$ rpm

Calculation example

Maximum permissible drive torque M_{mech}

(motor attachment via mount and coupling)
Limit for mechanical system

	M_{mech} = minimum (M_{cN}; M_p)
Coupling:	M_{cN} = 19 Nm (for MSK 040C)
Drive Unit:	M_p = 11.5 Nm
Drive torque:	M_{mech} = minimum (19; 11.5)
	= 11.5 Nm

Checking motor preselection

Selected motor:
MSK 040C without brake

Condition 1:

Rotary speed: $n_{max} \geq n_{mech}$

$6000 \geq 900$ condition met – motor selection OK

Condition 2:

Mass moment of inertia ratio: $V = \frac{J_{ex}}{J_m + J_{br}}$

Motor inertia: $J_m = 140 \cdot 10^{-6}$ kgm²

Brake inertia: $J_{br} = 0 \cdot 10^{-6}$ kgm² (without brake)

Mass moment of inertia ratio: $V = \frac{589.41 \cdot 10^{-6}}{(140 \cdot 10^{-6} + 0 \cdot 10^{-6})}$

$= 4.21$

Condition for handling: $V \leq 6$

$4.21 \leq 6$ condition met – motor selection OK

Condition 3:

Torque ratio: $\frac{M_{stat}}{M_0} \leq 0.6$

Static load moment: $M_{stat} = M_R + M_g$ (horizontal mounting $M_g = 0$)

$= 0.92$ Nm

Torque of the motor at standstill: $M_0 = 2.7$ Nm

Torque ratio: $\frac{0.92}{2.7} = 0.34$

$0.34 \leq 0.6$ condition met – motor selection OK

All three conditions met ➠ Selected motor is suitable for the application.

Result

AOK-020 Drive Unit

Length:	L =	1870 mm	
Max. travel	s_{max} =	1580 mm	
Carriage length:	L_c =	204 mm	
Ball screw drive:	Nominal diameter:		$d_0 = 20$ mm
	Lead:		$P = 20$ mm

Motor attachment via mount and coupling
Pre-selected motor: MSK 040C without brake

The motor-controller combination should always be considered for precise dimensioning of the electric drive, since the performance data (e.g., max. useful speed and max. torque) will depend on the controller used.

When doing this, the following data must be considered.

Frictional torque:	M_R	$= 0.92$ Nm
Mass moment of inertia:	J_{ex}	$= 589.41 \cdot 10^{-6}$ kgm²
Speed:	v_{mech}	$= 0.3$ m/s ($n_{mech} = 900$ rpm)
Drive torque limit:	M_{mech}	$= 11.5$ Nm

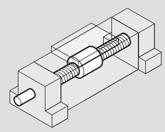
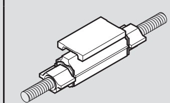
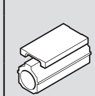
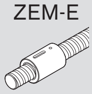
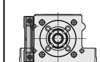
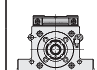
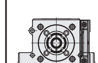
➠ Motor torque should be limited to 11.5 Nm on the drive side.

Acceleration limit:	a_{max}	$= 50$ m/s²
Limit value for speed:	v_{max}	$= 0.4$ m/s ($n_{mech} = 1200$ rpm)

Besides the preferred type MSK 040C, other motors with identical connection dimensions can be adapted while taking care not to exceed the calculated limit values.

AGK-020

Configuration and ordering

Short product name, length AGK-020-NN-1, ... mm	Drive BASA 									Screw ends		Pillow block	Nut Housing without SPU	Nut Housing with SPU 			Nut Housing Mounting orientation
	Nut	BASA size d_0 x P				Tolerance grade	Seal	Lubrication	Preload class					Number of SPU per side[3]			
		20 x 5	20 x 10	20 x 20	20 x 40		Standard	Initial greasing	C1 (moderate)	Left (fixed bearing)	Right (floating bearing)	Aluminum		1	2	3	
	ZEM-E 	01	04	02	03	T5 T7	1	1	3	81	31	02	01	21	22	23	 MR01 Left  MR02 Top  MR03 Right

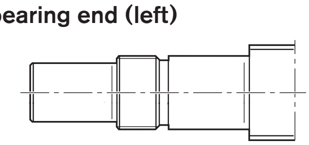
Ordering example: See "Request/order"

BASA = ball screw drive
d_0 = nominal diameter BASA (mm)
P = lead (mm)
SPU = screw support

Screw ends:

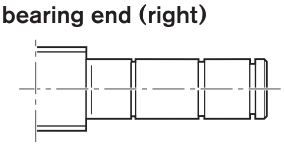
Fixed bearing end (left)

81

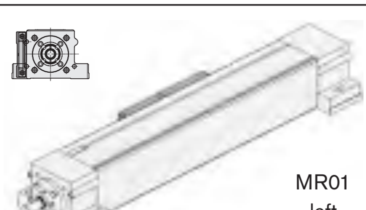


Floating bearing end (right)

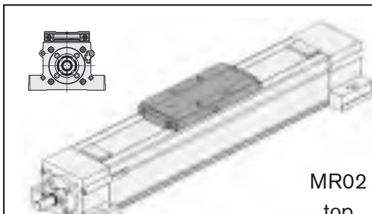
31



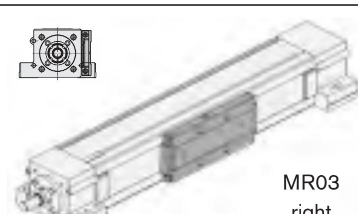
Nut Housing
Mounting orientation



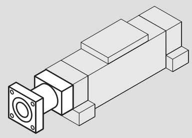
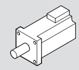
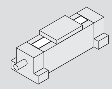
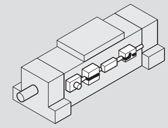
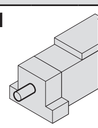
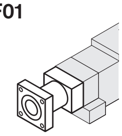
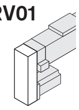
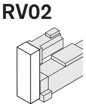
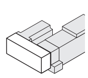
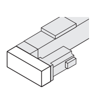
MR01
left



MR02
top



MR03
right

Motor attachment  Version		Gear ratio	Attachment kit[1]	for motor	Motor  without Brake	with Brake	Cover  Steel	PU	Switch/ socket-plug 	Documentation  Standard report	Measurement report
without mount	OF01 		00	–	00		01	02	see below	01	02 Frictional torque 03 Lead deviation
with mount	MF01 		06	**MSM 041B**[2]	140	141					
			02	**MSK 040C**[2]	86	87					
			07	**MSK 050C**[2]	88	89					
with timing belt side drive	RV01  RV02  RV03  RV04 	i = 1	32	**MSM 041B**[2]	140	141					
			30	**MSK 040C**[2]	86	87					
			23	**MSK 050C**[2]	88	89					

Switch/socket-plug	
Without switch Without socket-plug	00
Magnetic sensor	
REED sensor	21
Hall sensor PNP NC	22
Socket-plug	17

1) Attachment kit available without motor (when ordering: enter “00” for motor)
2) Recommended motor (motor data and type designation ➠ “Motors”)
3) SPUs always have the same number on each side of the Nut Housing example: 3 SPUs (Option 13) mean a total 6 SPUs (3 left and 3 right)

Length calculation

$L = s_{max} + L_c + L_{ad}$

Effective stroke

$s_{eff} = s_{max} - 2 \cdot s_e$

s_e = excess travel
s_{max} = maximum travel
s_{eff} = effective stroke
L = length
L_c = Nut Housing length
L_{ad} = additional length (see “Technical data” section)

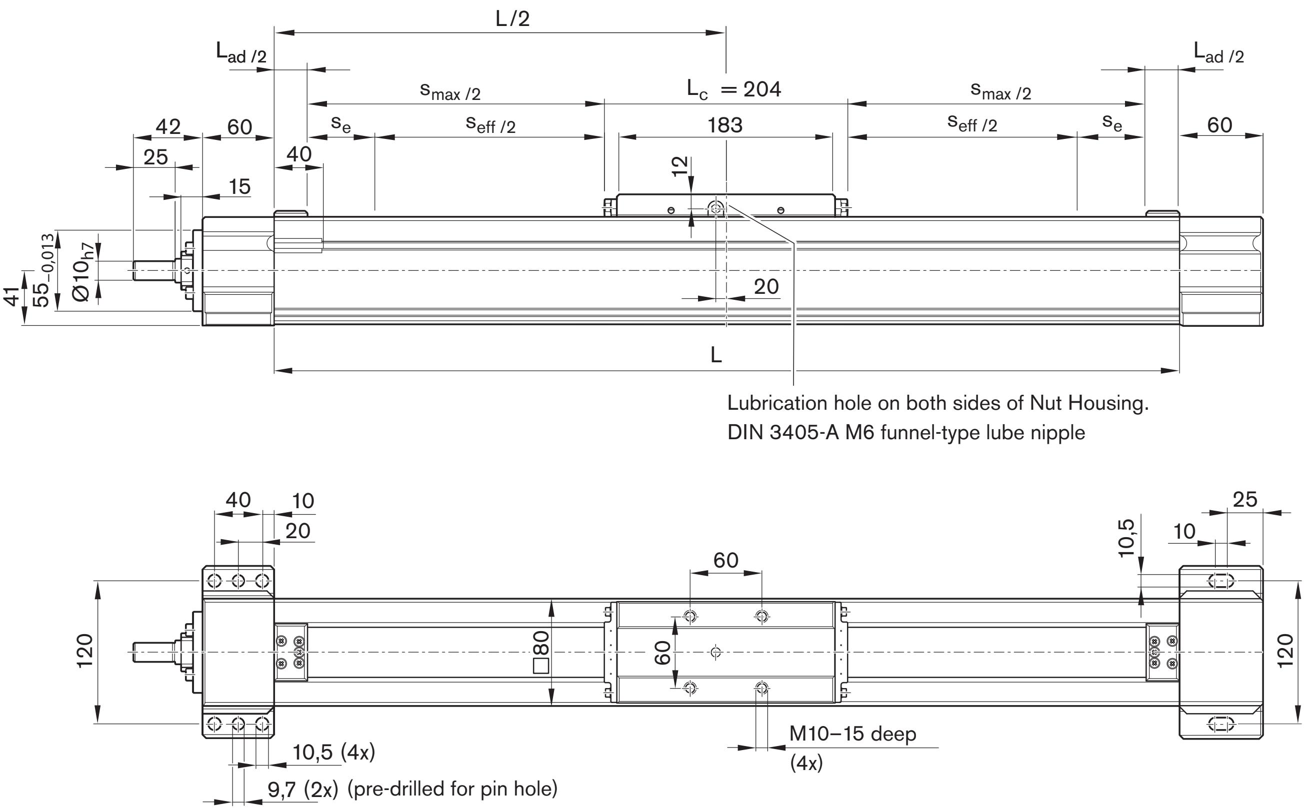
AGK-020

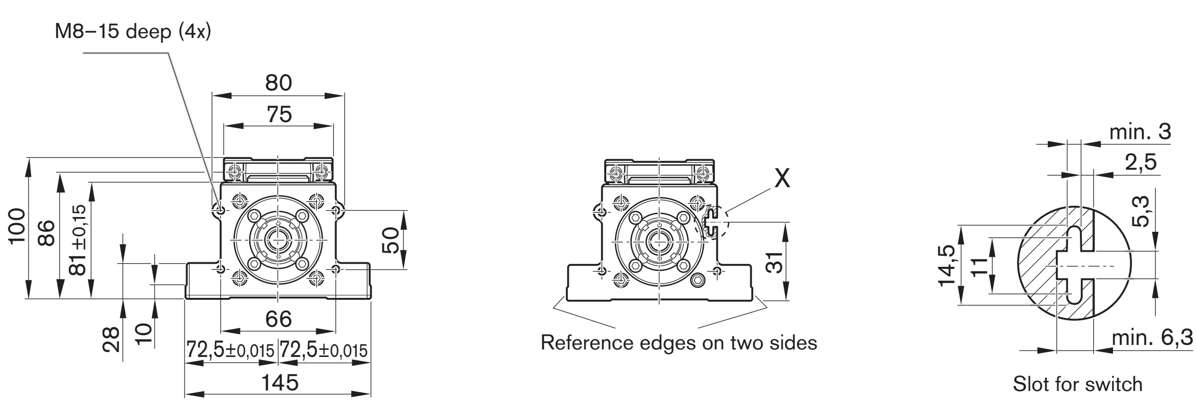
Dimensional drawings

All dimensions in mm. Drawings not to scale.
Straightness and flatness tolerance in accordance with DIN EN 12020-02

Fixed bearing end

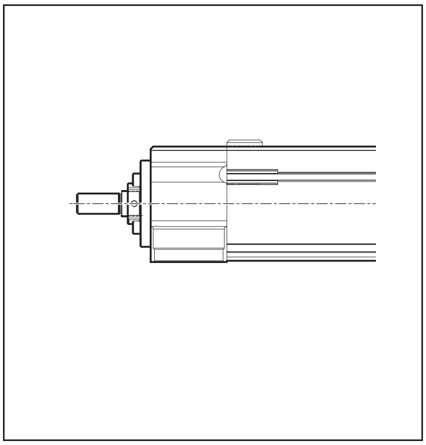
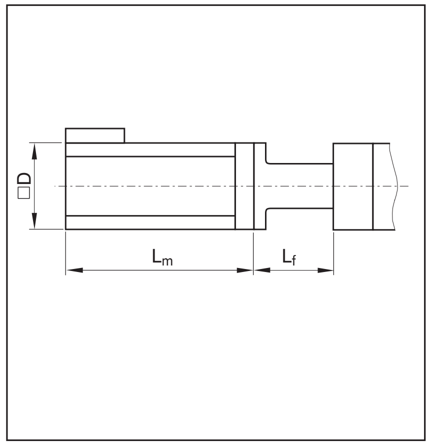
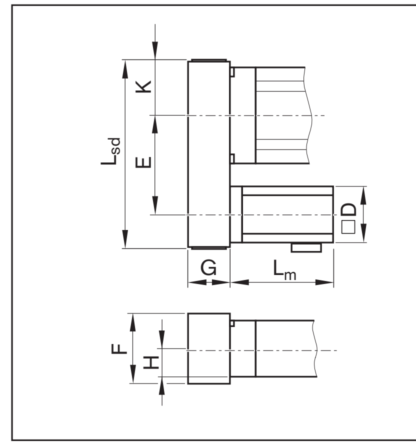
Floating bearing end





Motor attachment dimension drawings

Version

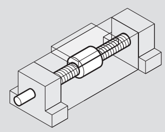
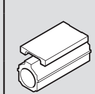
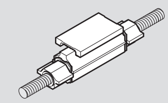
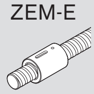
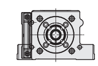
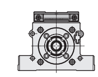
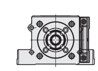
OF01	MF01	RV01, RV02, RV03, RV04
		

Version	Motor	Dimensions (mm) D	E i = 1	F	G	H	K	L_f	L_m without brake	L_m with brake	L_{sd} i = 1
RV01, RV02, RV03, RV04	MSM 041B	80	122.5	88	51	41	47.5	–	112.0	149.0	231
	MSK 040C	82	122.5	88	51	41	47.5	–	185.5	215.5	231
	MSK 050C	100	155	116	66	41	56	–	203.0	233.0	287
MF01	MSM 041B	80	–	–	–	–	–	90	112.0	149.0	–
	MSK 040C	82	–	–	–	–	–	90	185.5	215.5	–
	MSK 050C	98	–	–	–	–	–	115	203.0	233.0	–

See “Motors” section for more information and dimensions
L_{ad} = additional length (see “Technical data” section)

AGK-032

Configuration and ordering

Short product name, length AGK-032-NN-1, ... mm	Drive BASA  Nut	BASA size d_0 x P: 32 x 5	32 x 10	32 x 20	32 x 32	Tolerance grade	Seal: Standard	Lubrication: Initial greasing	Preload class: C1 (moderate)	Screw ends: Left (fixed bearing)	Screw ends: Right (floating bearing)	Pillow block: Aluminum	Nut Housing without SPU 	Nut Housing with SPU  Number of SPU per side[3)]: 1	2	3	Nut Housing Mounting orientation
	ZEM-E 	01	02	03	04	T5 T7	1	1	3	81	31	02	01	11	12	13	 MR01 Left  MR02 Top  MR03 Right

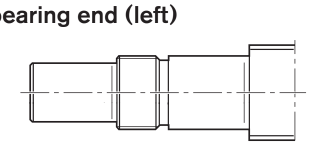
Ordering example: See "Request/order"

BASA = Ball screw drive
d_0 = nominal diameter BASA (mm)
P = lead (mm)
SPU = screw support

Screw ends:

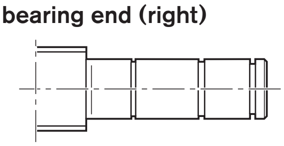
Fixed bearing end (left)

81

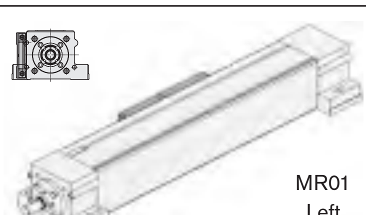


Floating bearing end (right)

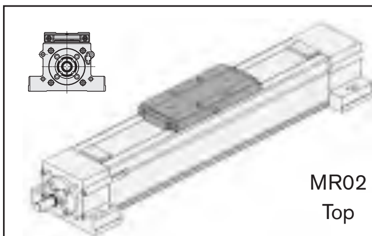
31



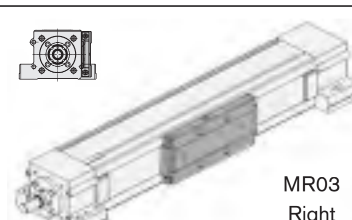
Nut Housing Mounting orientation



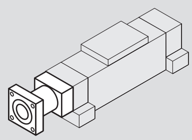
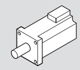
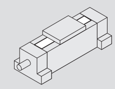
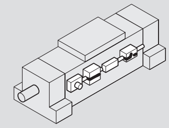
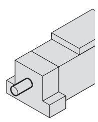
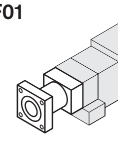
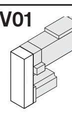
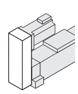
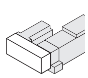
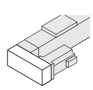
MR01
Left



MR02
Top



MR03
Right

	Motor attachment Version		Gear ratio	Attachment kit[1]	for motor	Motor without Brake	Motor with Brake	Cover Steel	Cover PU	Switch/socket-plug	Documentation Standard report	Documentation Measurement report
												
without mount	OF01 			00	–	00		01	02	Without switch Without socket-plug: 00 **Magnetic sensor** REED sensor: 21 Hall sensor PNP NC: 22 Socket-plug: 17	01	02 Frictional torque 03 Lead deviation
with mount	MF01 			03	**MSK 060C[2]**	90	91					
				02	**MSK 076C[2]**	92	93					
with timing belt side drive	RV01 	RV02 	i = 1	23	**MSK 060C[2]**	90	91					
	RV03 	RV04 	i = 2	24	**MSK 060C[2]**	90	91					

1) Attachment kit available without motor (when ordering: enter “00” for motor)
2) Recommended motor (motor data and type designation ➠ “Motors”)
3) SPUs always have the same number on each side of the Nut Housing Example: 3 SPUs (Option 13) mean a total 6 SPUs (3 left and 3 right)

Length calculation

$$L = s_{max} + L_c + L_{ad}$$

Effective stroke

$$s_{eff} = s_{max} - 2 \cdot s_e$$

s_e = excess travel
s_{max} = maximum travel
s_{eff} = effective stroke
L = length
L_c = Nut Housing length
L_{ad} = additional length (see “Technical data” section)

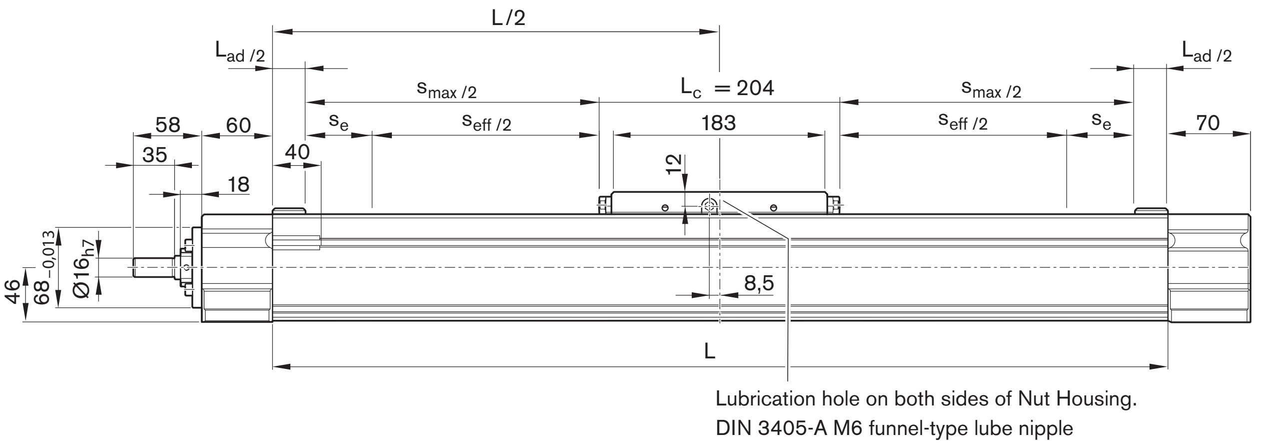
AGK-032

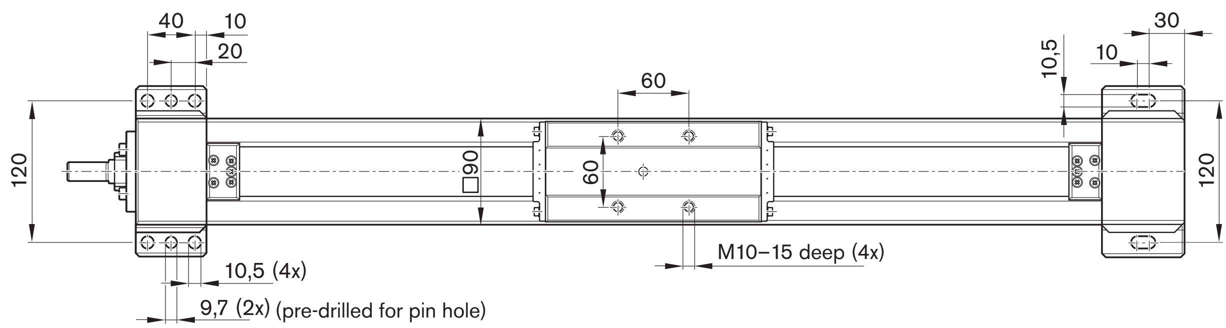
Dimensional drawings

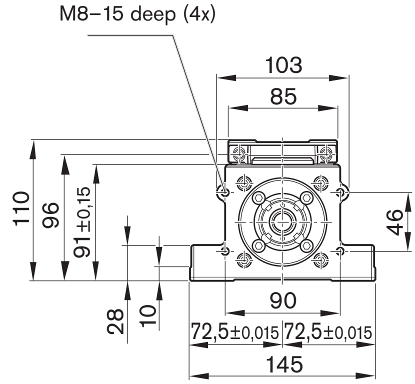
All dimensions in mm. Drawings not to scale.
Straightness and flatness tolerance in accordance with DIN EN 12020-02

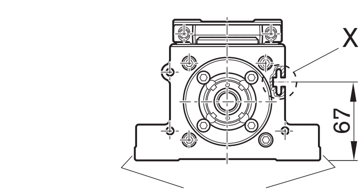
Fixed bearing end

Floating bearing end

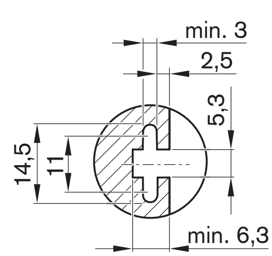








Reference edges on two sides

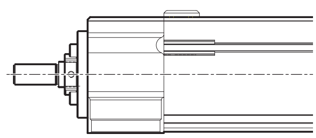


Slot for switch

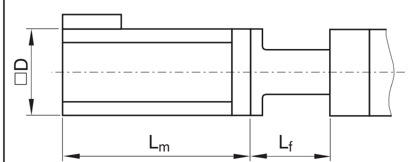
Motor attachment dimension drawings

Version

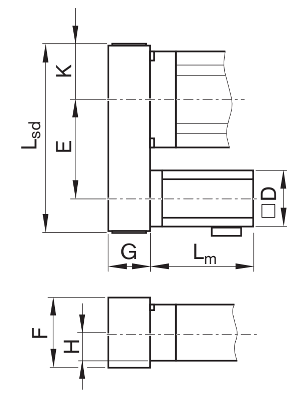
OF01



MF01



RV01, RV02, RV03, RV04

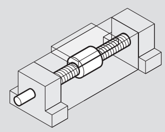
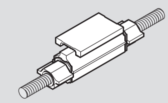
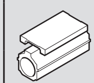


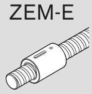
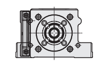
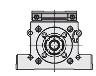
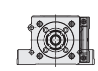
Version	Motor	Dimensions (mm) D	E i = 1	E i = 2	F	G	H	K	L_f	L_m without brake	L_m with brake	L_{sd} i = 1	L_{sd} i = 2
RV01, RV02, RV03, RV04	**MSK 060C**	116	165	162	116	66	46	59	–	226.0	259.0	300	300
MF01	**MSK 060C**	116	–	–	–	–	–	–	125	226.0	259.0	–	–
	MSK 076C	140	–	–	–	–	–	–	133	292.5	292.5	–	–

See “Motors” section for more information and dimensions
L_{ad} = additional length (see “Technical data” section)

AGK-040

Configuration and ordering

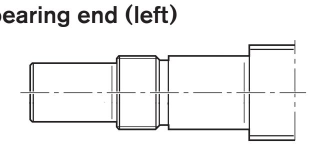




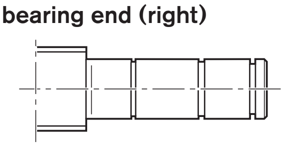
Short product name, length AGK-040-NN-1, ... mm	Drive BASA Nut	BASA size d_0 x P 40 x 5	40 x 10	40 x 20	40 x 40	Tolerance grade	Seal Standard	Lubrication Initial greasing	Preload class C1 (moderate)	Screw ends Left (fixed bearing)	Screw ends Right (floating bearing)	Pillow block Aluminum	Nut Housing without SPU	Nut Housing with SPU, Number of SPU per side[3)] 1	2	3	Nut Housing Mounting orientation
	ZEM-E 	01				T5 T7	1	1	3	81	31	02	01	11	12	13	 MR01 left  MR02 top  MR03 right
			02	03	04	T5 T7	1	1	3	81	31	02	01	21	22	23	

Ordering example: See “Request/order”

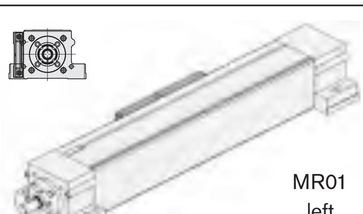
BASA = Ball screw drive
d_0 = nominal diameter BASA (mm)
P = lead (mm)
SPU = screw support

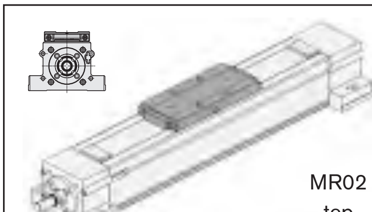
Screw ends:

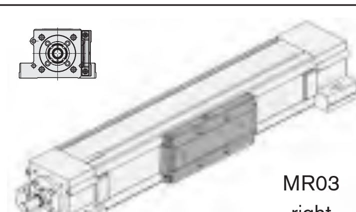
Fixed bearing end (left)
81


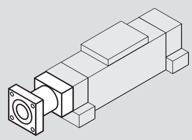
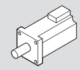
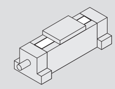
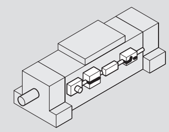
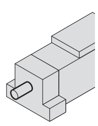
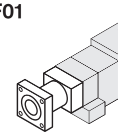
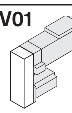
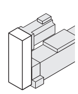
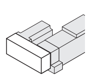
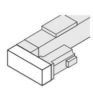
Floating bearing end (right)
31


Nut Housing
Mounting orientation


MR01
left


MR02
top


MR03
right

Motor attachment					Motor		Cover		Switch/socket-plug	Documentation	
											
Version		Gear ratio	Attachment kit[1]	for motor	without Brake	with Brake	Steel	PU		Standard report	Measurement report
without mount	OF01 		00	–	00		01	02	without switch without socket-plug: 00 **Magnetic sensor** REED sensor: 21 Hall sensor PNP NC: 22 Socket-plug: 17	01	02 Frictional torque 03 Lead deviation
with mount	MF01 		02	**MSK 076C**[2]	92	93					
with timing belt side drive	RV01  RV02 	i = 1	23	**MSK 076C**[2]	92	93					
with timing belt side drive	RV03  RV04 	i = 2	24	**MSK 076C**[2]	92	93					

1) Attachment kit available without motor (when ordering: enter "00" for motor)
2) Recommended motor (motor data and type designation ➟ "Motors")
3) SPUs always have the same number on each side of the Nut Housing example: 3 SPUs (option 13) mean a total 6 SPUs (3 left and 3 right)

Length calculation

$$L = s_{max} + L_c + L_{ad}$$

Effective stroke

$$s_{eff} = s_{max} - 2 \cdot s_e$$

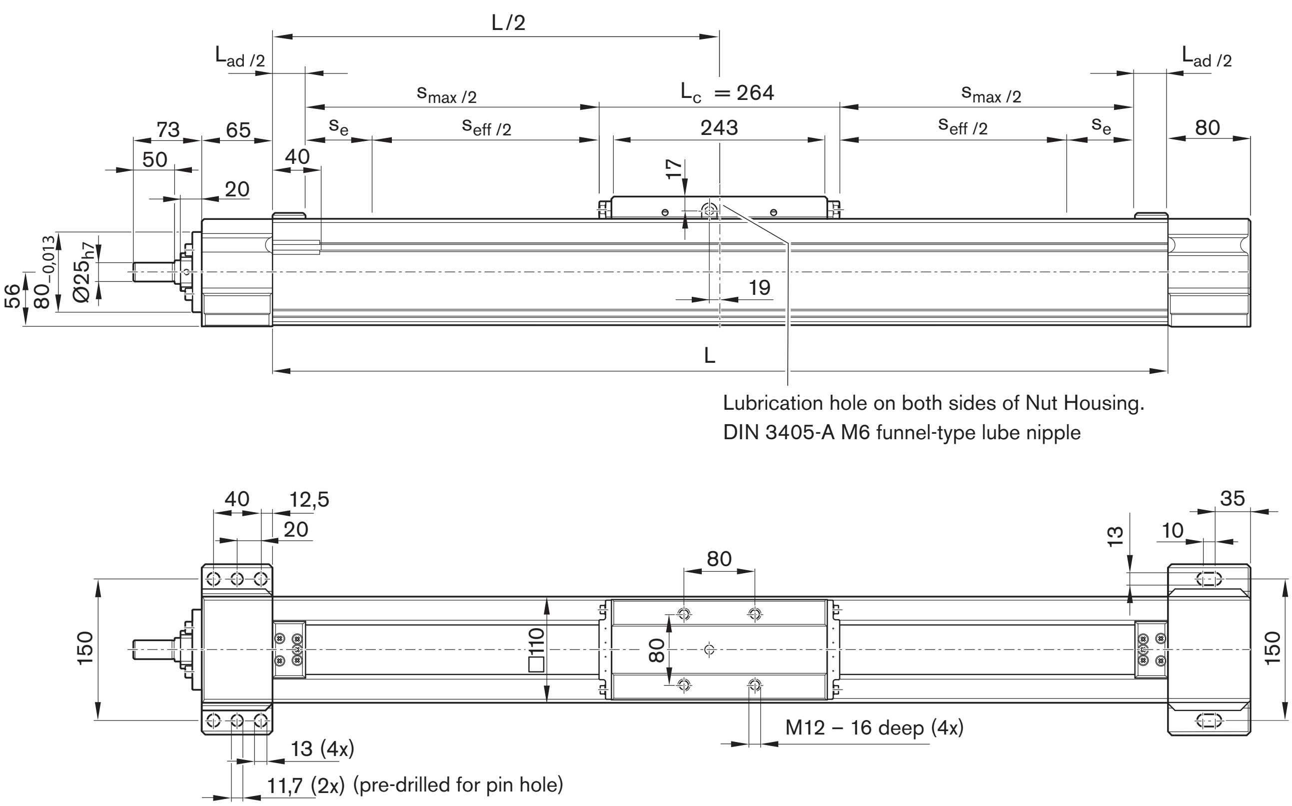
s_e = excess travel
s_{max} = maximum travel
s_{eff} = effective stroke
L = length
L_c = Nut Housing length
L_{ad} = additional length (see "Technical data" section)

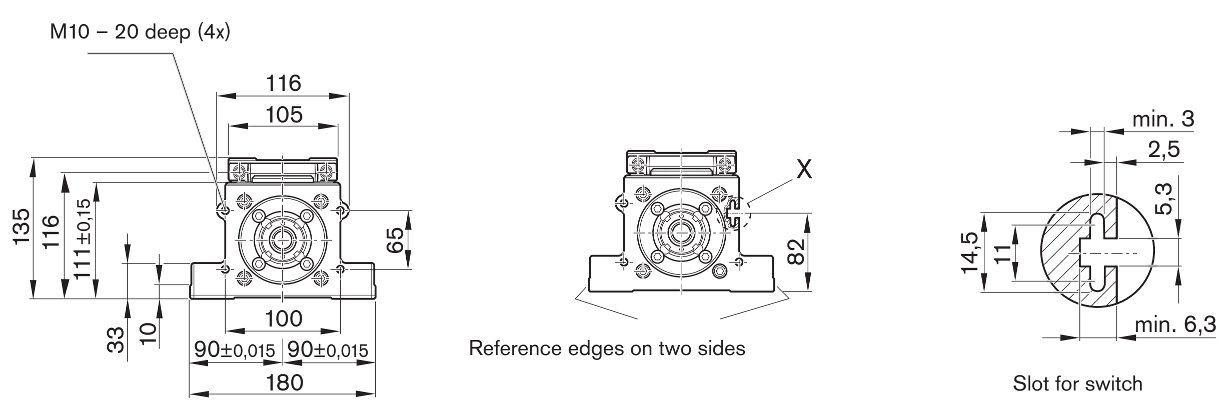
AGK-040

Dimensional drawings

All dimensions in mm. Drawings not to scale.
Straightness and flatness tolerance in accordance with DIN EN 12020-02

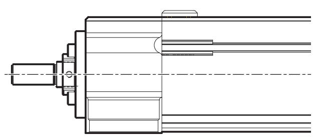
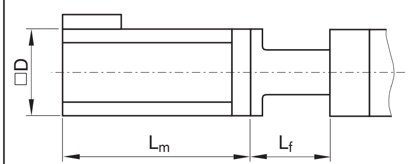
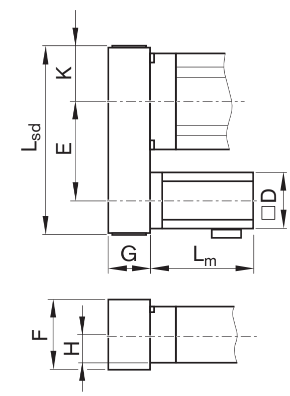
Fixed bearing end **Floating bearing end**





Motor attachment dimension drawings

Version

OF01	MF01	RV01, RV02, RV03, RV04
		

Version	Motor	Dimensions (mm)											
		D	E		F	G	H	K	L_f	L_m		L_{sd}	
			i = 1	i = 2						without brake	with brake	i = 1	i = 2
RV01, RV02, RV03, RV04	**MSK 076C**	140	240	238	160	90	56	77	–	292.5	292.5	409	409
MF01	**MSK 076C**	140	–	–	–	–	–	–	140	292.5	292.5	–	–

See "Motors" section for more information and dimensions
L_{ad} = additional length (see "Technical data" section)

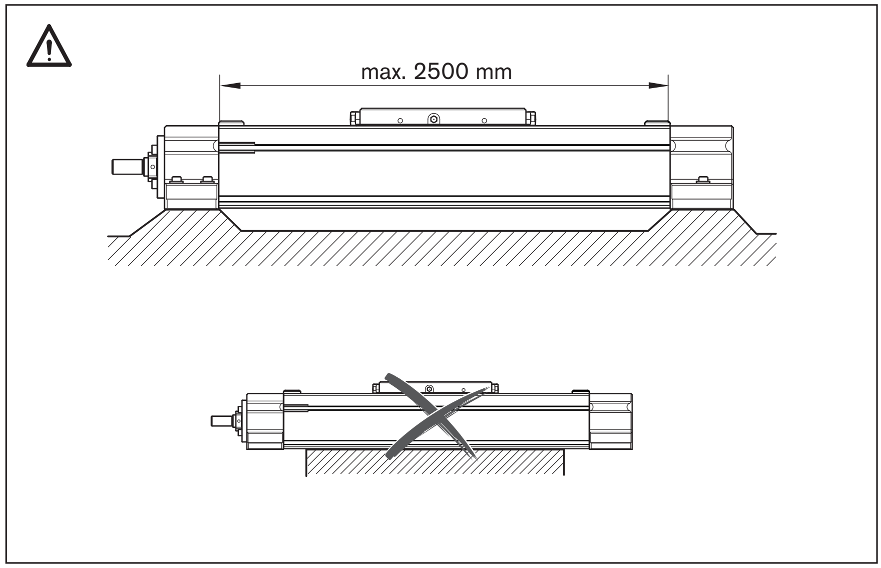
AGK fastening instructions

Fastening Drive Unit to customer-built attachment

Drive Unit fastening points

⚠ Fasten Drive Unit to both pillow blocks only. The protective profile is not a load-bearing part and cannot transmit any forces.

For more information on fastening see “Instructions for AGK Drive Unit” R310D4 3372

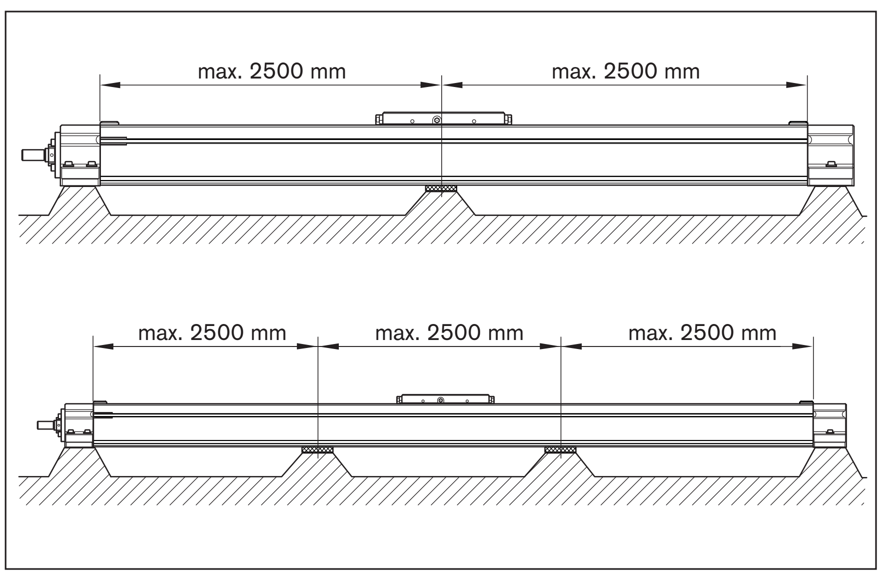


Provide supports for the protective profile

The protective profile may sag under its own weight.
This is why supports should be installed for the protective profile over open lengths of more than 2500 mm.

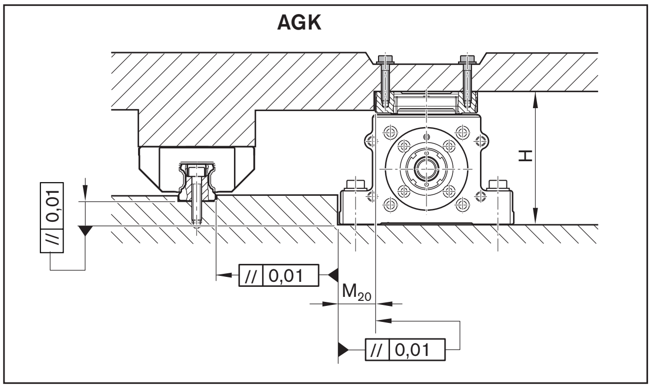
- Spacing between the support points: max. 2500 mm
- The mounting bases for the protective profile supports and the pillow blocks should be on the same level.

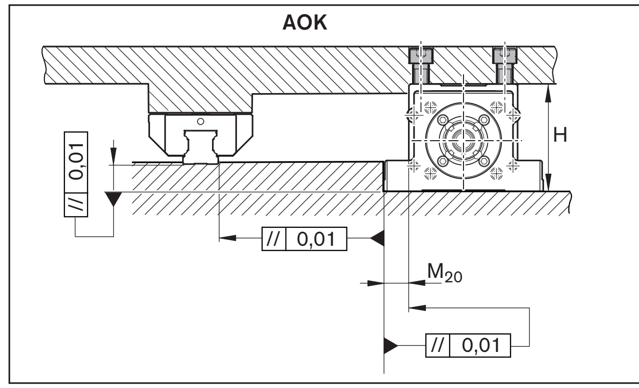
When the Drive Unit is in operation, the protective profile lifts as the drive carriage passes over it, then sinks back down onto the supporting surface. Provide cushioning material on the surfaces of the protective profile supports, e.g., foam rubber pads.



AGK/AOK installation tolerances

Parallelism of customer-built attachments, pillow blocks and rail guides





	Dimensions (mm)	
	H $^{\pm 0.01}$	M_{20} $^{\pm 0.01}$
AGK-020	100	35.0
AGK-032	110	30.0
AGK-040	135	37.5

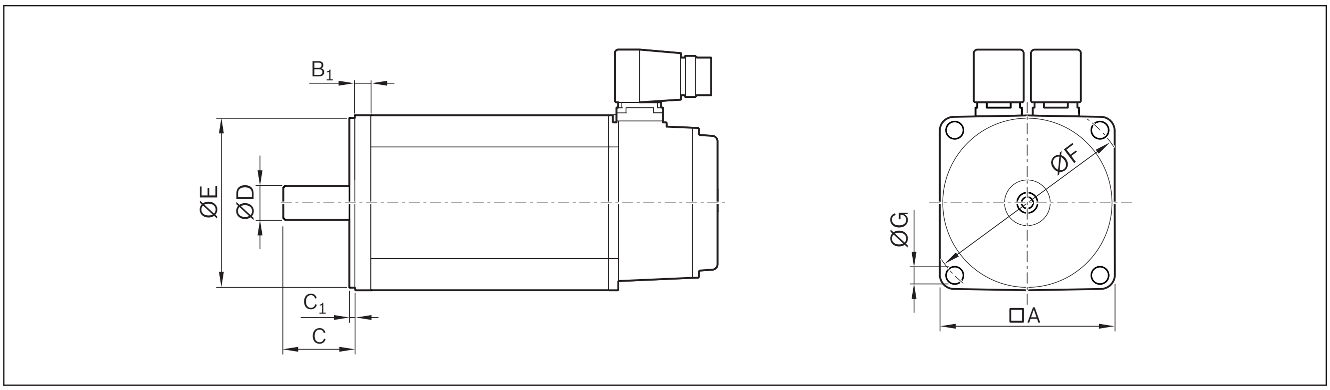
AOK-020 d_0 **x P**	**Nut**	**Nut Housing**	**Dimensions** (mm) H $^{\pm 0.01}$	M_{20} $^{\pm 0.01}$
20 x 5	ZEM-E	MGA	85	35
	FEM-E-S	MGS	73	35
	FEM-E-C	MGD	69	35
20 x 10	ZEM-E	MGA	85	35
	FEM-E-S	MGS	73	35
	FEM-E-C	MGD	73	35
20 x 20	ZEM-E	MGA	85	35
	FEM-E-S	MGS	75	30
	FEM-E-C	MGD	69	35
20 x 40	ZEM-E	MGA	85	35
	FEP-E-S	MGS	75	30

AOK-032 d_0 **x P**	**Nut**	**Nut Housing**	**Dimensions** (mm) H $^{\pm 0.01}$	M_{20} $^{\pm 0.01}$
32 x 5	ZEM-E	MGA	95	22.5
	FEM-E-S	MGS	84	25
	FEM-E-C	MGD	81	22.5
32 x 10	ZEM-E	MGA	95	22.5
	FEM-E-S	MGS	84	25
	FEM-E-C	MGD	81	22.5
32 x 20	ZEM-E	MGA	95	22.5
	FEM-E-S	MGS	88	20
	FEM-E-C	MGD	81	22.5
32 x 40	ZEM-E	MGA	95	22.5
	FEP-E-S	MGS	88	20
	FEM-E-C	MGD	81	22.5

AOK-040 d_0 **x P**	**Nut**	**Nut Housing**	**Dimensions** (mm) H $^{\pm 0.01}$	M_{20} $^{\pm 0.01}$
40 x 5	ZEM-E	MGA	115	30
	FEM-E-S	MGS	98	37.5
	FEM-E-C	MGD	98	30
40 x 10	ZEM-E	MGA	115	30
	FEM-E-S	MGS	106	30
	FEM-E-C	MGD	98	30
40 x 20	ZEM-E	MGA	115	30
	FEM-E-S	MGS	106	30
	FEM-E-C	MGD	98	30
40 x 40	ZEM-E	MGA	115	30
	FEP-E-S	MGS	114	20
	FEM-E-C	MGD	98	30

Attachment kits for motors according to customer specification

The motor of a linear motion system with ball screw drive is attached by either an attachment kit with mount and coupling (MF) or a timing belt side drive (RV).
The available combinations are shown in the “Configuration and ordering” selection tables for each size. In addition to attachment kits for Rexroth motors, attachment kits for motors according to customer specification are also available. In order to determine the appropriate attachment kit, the connection geometry of the motor is crucial. Characteristics required to clearly determine motor geometry are shown below.

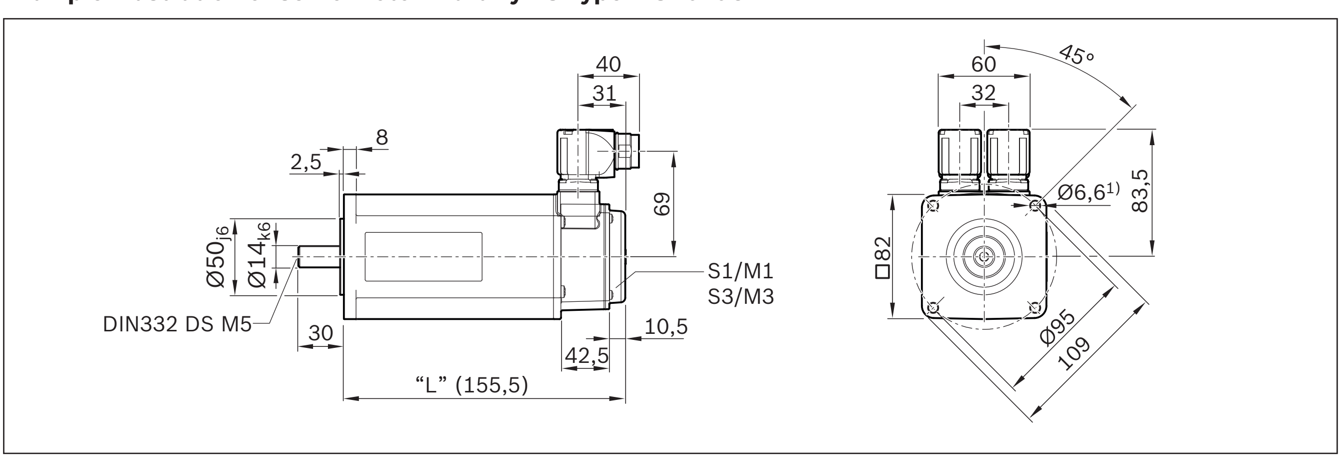


The dimensions queried result in a unique “motor geometry code”:

□□ - □□ - □□□ - □□□ - □□□ - M□□ - □□□ - □□□

ØD	=	Shaft diameter
C	=	Shaft length
ØE	=	Centering diameter
C_1	=	Centering depth
ØF	=	Pitch diameter
ØG	=	Through-hole for mounting screw (specify thread diameter)
B_1	=	Mount thickness
A	=	Mount edge dimension

Example illustration of servo motor IndraDyn S Type MSK040C

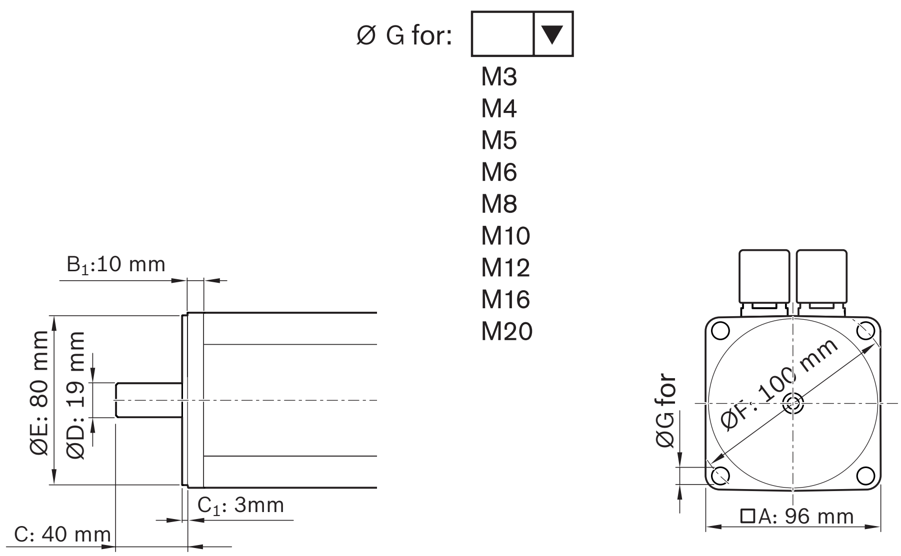


1 4 – 3 0 – 0 5 0 – 2 . 5 – 0 9 5 – M 0 6 – 0 0 8 – 0 8 2

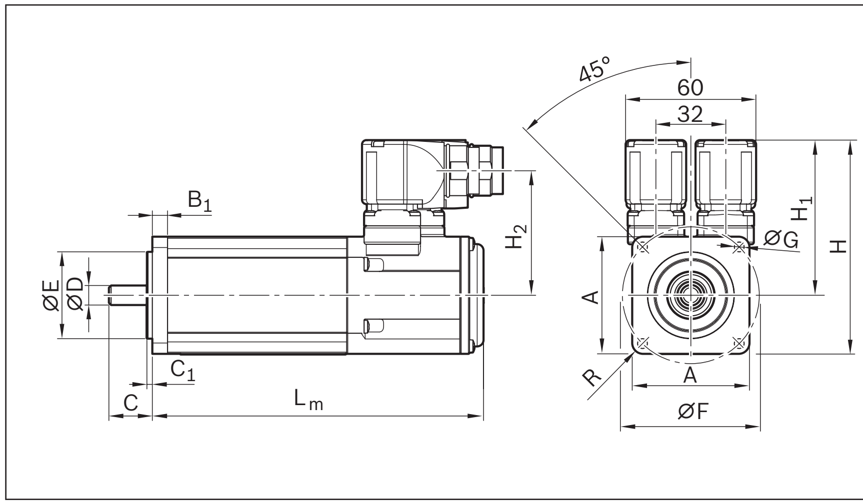
[1] The through-hole Ø 6.6 mm results in the type designation M06 for the geometry motor code (M6 fastening screw nominal thread).

Attachment kits for motors according to customer specification can be configured using the online configurator in the eShop. To do this, select the “Attachment kits for motors according to customer specification” option.

Enter motor geometry in the input dialog box. The dimensions can be entered directly or by using a drop-down menu.



IndraDyn S - MSK servo motors



Motor schematic

Motor	Dimensions (mm)													
	A	B_1	C	C_1	ØD k6	ØE j6	ØF	ØG	H	H_1	H_2	L_m without holding brake	L_m with holding brake	R
MSK 040C-0600	82	8.0	30	2.5	14	50	95	6.6	124.5	83.5	69.0	185.5	215.5	R8
MSK 050C-0600	98	9.0	40	3.0	19	95	115	9.0	134.5	85.5	71.0	203.0	233.0	R8
MSK 060C-0600	116	9.5	50	3.0	24	95	130	9.0	156.5	98.5	84.0	226.0	259.0	R9
MSK 076C-0450	140	14.0	50	4.0	24	110	165	11.0	180.0	110.0	95.6	292.5	292.5	R12

Motor data

Motor	n_{max} (rpm)	M_0 (Nm)	M_{max} (Nm)	M_{br} (Nm)	J_m (kgm^2)	J_{br} (kgm^2)	m_m (kg)	m_{br} (kg)
MSK 040C-0600	7 500	2.7	8.1	4	0.000140	0.000023	3.6	0.3
MSK 050C-0600	6 000	5.0	15.0	5	0.000330	0.000107	5.4	0.7
MSK 060C-0600	6 000	8.0	24.0	10	0.000800	0.000059	8.4	0.8
MSK 076C-0450	5 000	12.0	43.5	11	0.004300	0.000360	13.8	1.1

J_{br} = holding brake mass moment of inertia
J_m = motor mass moment of inertia
L_m = motor length
M_0 = torque at standstill
M_{br} = holding torque of holding brake when switched off

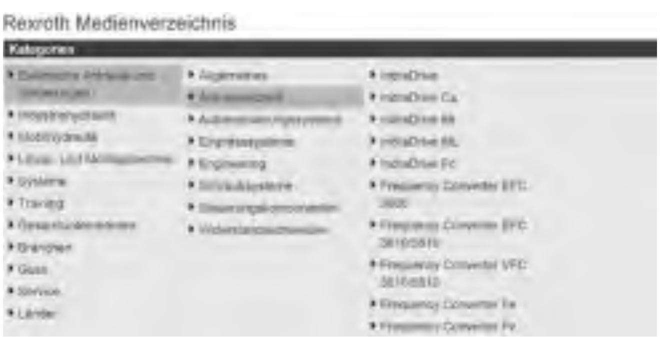
M_{max} = max. motor torque
m_m = motor mass
m_{br} = holding brake mass
n_{max} = max. rotary speed

Option number[1)]	Motor	Part number	Version		Type designation
			Holding brake		
			Without	With	
86	MSK040C-0600	R911306060	X		MSK040C-0600-NN-M1-UG0-NNNN
87		R911306061		X	MSK040C-0600-NN-M1-UG1-NNNN
88	MSK050C-0600	R911298354	X		MSK050C-0600-NN-M1-UG0-NNNN
89		R911298355		X	MSK050C-0600-NN-M1-UG1-NNNN
90	MSK060C-0600	R911306052	X		MSK060C-0600-NN-M1-UG0-NNNN
91		R911306053		X	MSK060C-0600-NN-M1-UG1-NNNN
92	MSK076C-0450	R911318098	X		MSK076C-0450-NN-M1-UG0-NNNN
93		R911315713		X	MSK076C-0450-NN-M1-UG1-NNNN

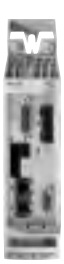
1) From “Configuration and ordering” table

Version
- Plain shaft with shaft seal
- Multi-turn absolute encoder M1 (Hiperface)
- Cooling system: natural convection
- IP65 rating (housing)
- With or without holding brake

Note
Motors are available with controllers and control systems. See the Rexroth Drive Technology catalog for other motor types and more information on motors, controllers and control systems.

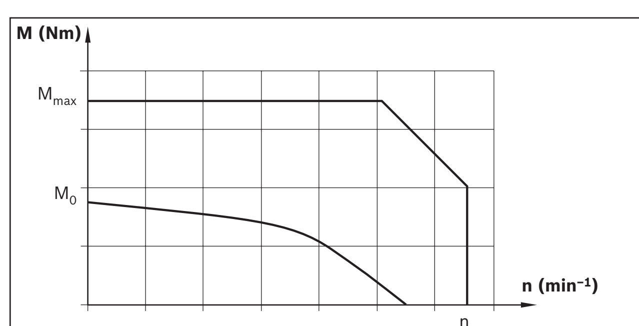


Recommended motor/controller combination

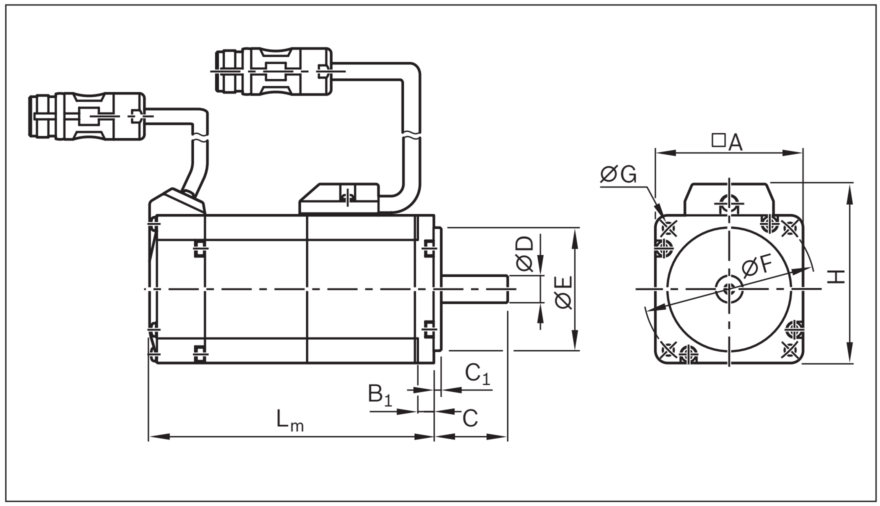


Motor	Controller
MSK 040C-0600	HCS 01.1E-W0008
MSK 040C-0600	HCS 01.1E-W0018
MSK 050C-0600	
MSK 050C-0600	HCS 01.1E-W0028
MSK 060C-0600	
MSK 060C-0600	HCS 01.1E-W0054
MSK 076C-0450	

Torque/speed characteristic
(schematic)



IndraDyn S - MSM servo motors



Motor schematic

Motor	Dimensions (mm)										
	A	B_1	C	C_1	ØD h6	ØE h7	ØF	ØG	H	L_m without holding brake	L_m with holding brake
MSM 041B-0300	80	8.0	35	3	19	70	90	6.0	93	112.0	149.0

Motor data

Motor	n_{max} (rpm)	M_0 (Nm)	M_{max} (Nm)	M_{br} (Nm)	J_m (kgm^2)	J_{br} (kgm^2)	m_m (kg)	m_{br} (kg)
MSM 041B-0300	4 500	2.40	7.10	2.45	0.0000870	0.0000075	2.30	0.80

J_{br} = holding brake mass moment of inertia
J_m = motor mass moment of inertia
L_m = motor length
M_0 = torque at standstill
M_{br} = holding torque of holding brake when switched off

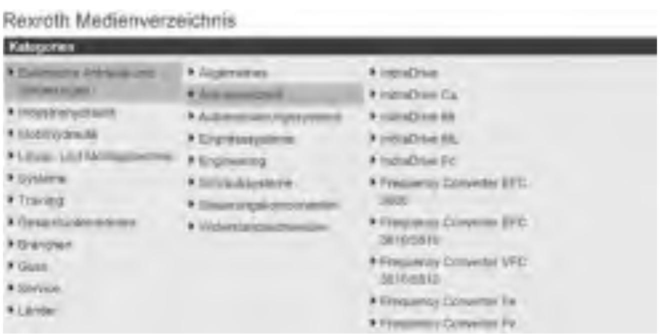
M_{max} = max. motor torque
m_m = motor mass
m_{br} = holding brake mass
n_{max} = max. rotary speed

Option number[1)]	Motor	Part number	Version		Type designation
			Holding brake		
			Without	With	
140	MSM 041B-0300	R911344217	X		MSM 041B-0300-NN-M5-MH0
141		R911344218		X	MSM 041B-0300-NN-M5-MH1

[1)] From “Configuration and ordering” table

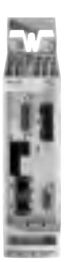
Versions:
- Plain shaft without shaft seal
- Multiturn absolute encoder M5 (20 bit, absolute encoder function only available with backup battery)
- Cooling system: natural convection
- Protection class IP54 (shaft IP40)
- With or without holding brake
- Metal round connector M17

Note
Motors are available with controllers and control systems. See the Rexroth Drive Technology catalog for other motor types and more information on motors, controllers and control systems.

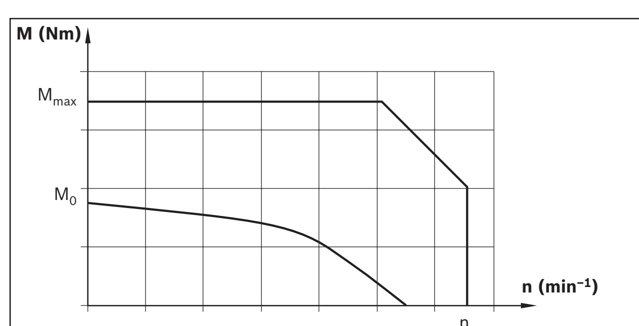


Recommended motor/controller combination

Motor	Controller
MSM 041B-0300	HCS 01.1E-W0013



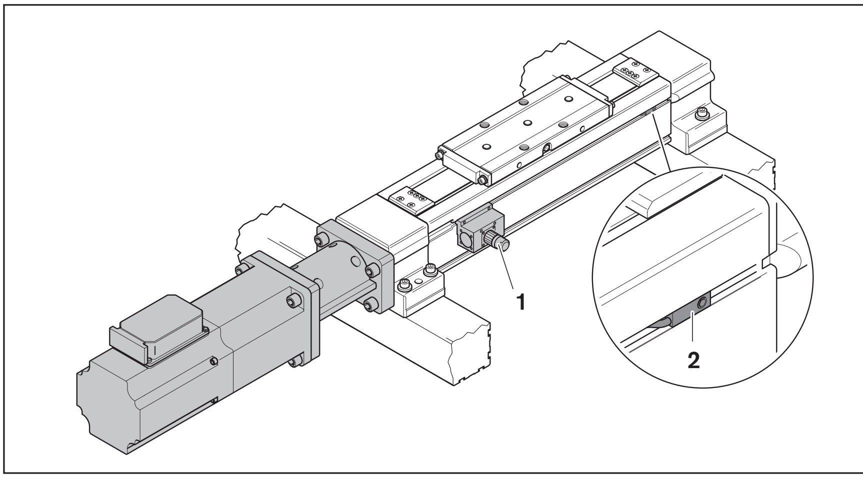
Torque/speed characteristic
(schematic)



AGK switch mounting arrangements

Switching system overview

1 Socket and plug
2 Magnetic field sensor



Switch mounting arrange-ments

1 Switch (magnetic field sensor) with potted cable
2 Set screw for securing
3 Cable

The switch activator is a magnet integrated in the Nut Housing (no switching angle required).
The switching positions can be freely configured via the stroke.

Version

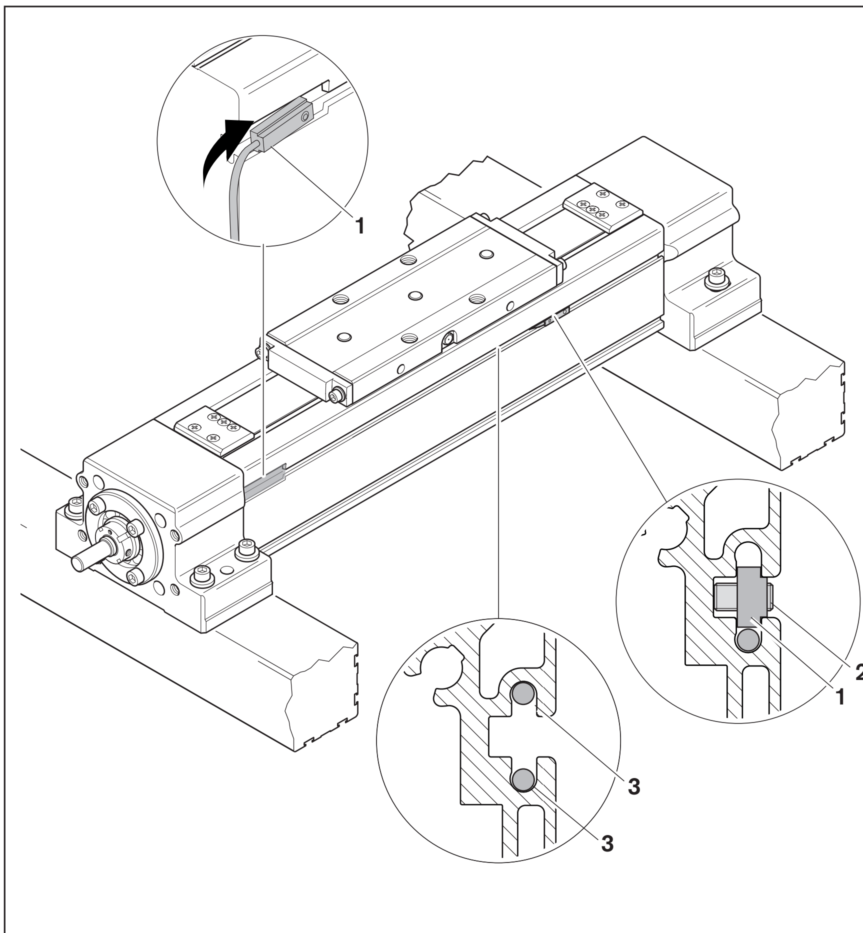
– Hall sensor (PNP NC) or
– REED sensor (changeover)

See "Sensors" section for technical data

Notes for mounting

- Insert sensor (1) with set screw (2) facing outward into upper T-slot of housing.
- Set switching point and secure sensor with set screw (2).
- Press the signal cable (3) into the upper or lower cable run of the T-slot to secure it.

See instructions for more specific information on installation and switching positions.



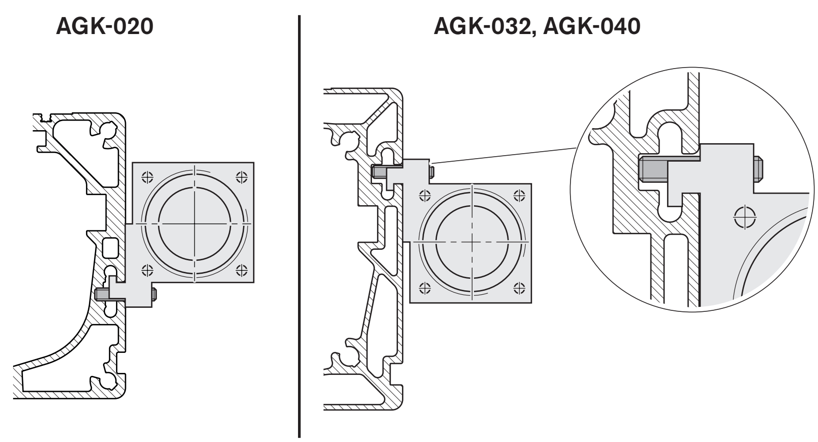
Socket-plug mounting arrangements

Mounting orientation

Various socket and plug arrangements are possible depending on requirements. See "Sockets and plugs" section for technical data.

Securing socket to AGK protective profile

- AGK-020:
  Attach socket in lower T-slot of protective profile and secure with two set screws.
- AGK-032, AGK-040:
  Attach socket to upper T-slot of protective profile and secure with two set screws.



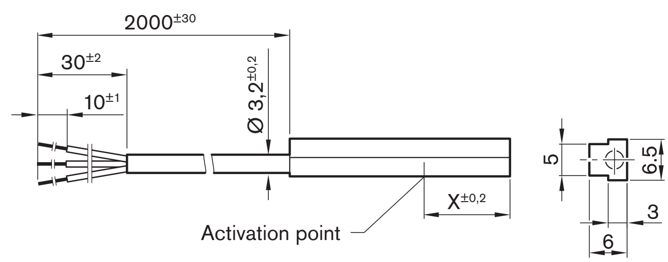
Switches and attachments

Description	Switching function		Option number[1]	Part number
Socket-plug	–		17	R117500153
Magnetic sensor	REED	Changeover contact (NC: C+NC; NO:C+NO)	21	R347600903
	Hall	PNP/normally closed (NC)	22	R347601003
	Hall	PNP/normally open (NO)	nv[2]	R347601203
	Hall	NPN/normally closed (NC)	nv[2]	R347601303
	Hall	NPN/normally open (NO)	nv[2]	R347601403

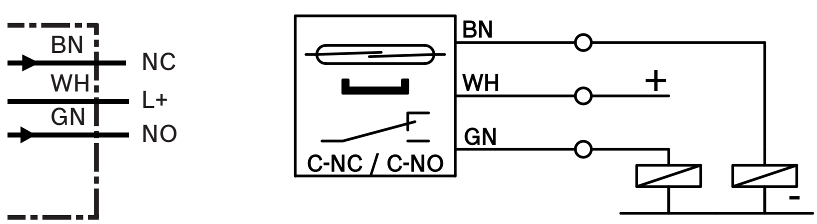
1) From "Configuration and ordering" table
2) Option not available. Switch only available as accessory with part number

Sensors

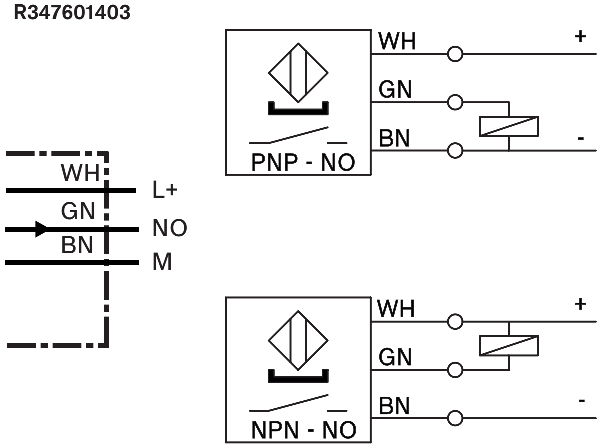
Magnetic sensor with free cable end



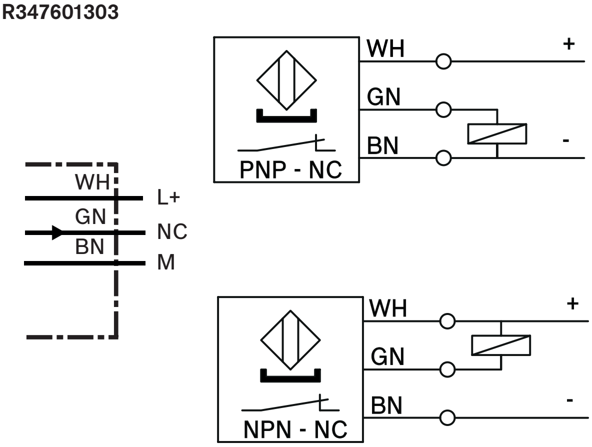
R347600903



R347601203
R347601403



R347601003
R347601303



Part number R347600903

Use	Reference, limit switch
Part number	R347600903
Designation	R12212
Functional principle	Magnetic
Operating voltage	max. 30 V DC
Load current	500 mA
Switching function	REED/changeover contact (NC: C+NC, NO: C+NO)
Activation point (dimension "X")	9 mm

Part number R347601003 / R347601203 / R347601403 / R347601303

Use	Limit switch	Reference switch	Limit switch	Reference switch
Part number	R347601003	R347601203	R347601303	R347601403
Designation	H14118	H15637	H15638	H15080
Functional principle	Magnetic			
Operating voltage	3.8 - 30 V DC			
Load current	≤ 20 mA			
Switching function	Hall PNP/normally closed (NC)	Hall PNP/normally open (NO)	Hall NPN/normally closed (NC)	Hall NPN/normally open (NO)
Activation point, dimension "X"	13.65 mm			

Technical data for R347600903/R347601003/R347601203/R347601403/R347601303

Connection type	Cable 2.0 m, 3-pin
Galvanized connection ends	4
Function indicator	–
Short-circuit protection	–
Reverse polarity protection	–
Switch-on suppression	–
Switching frequency	2.5 kHz
Pulse delay (Off delay)	–
Max. permissible approach speed	2 m/s
Suitable for drag chains*	–
Torsion-resistant*	–
Weld spark-resistant*	–
Cable cross-section*	3x 0.14 mm^2
Cable diameter D	3.2 ± 0.20 mm
Static bending radius*	–
Dynamic bending radius*	–
Bending cycles*	–
Max. permissible linear speed*	–
Max. permissible acceleration*	–
Ambient temperature	–40 °C to +85 °C
Protection rating	IP66
MTTFd (acc. to EN ISO 13849-1)	–
Certifications and approvals**	–

* Technical data only for built-in sensor connection cable.

Extension cables are available for even more performance, e.g., for use in a power cable chain (see below).

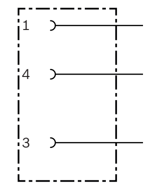
** No certificate is required to introduce these products to the Chinese market.

Extensions

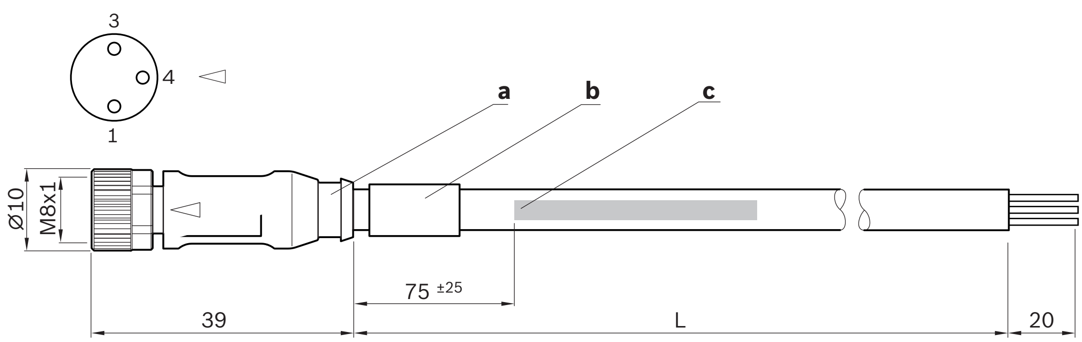
Pre-assembled on one side

Connection diagram

1 brown (BN) (+)
3 blue (BU) (–)
4 black (BK) (signal)



Dimension drawing

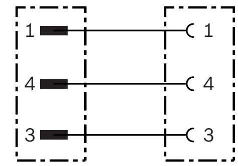


Part numbers

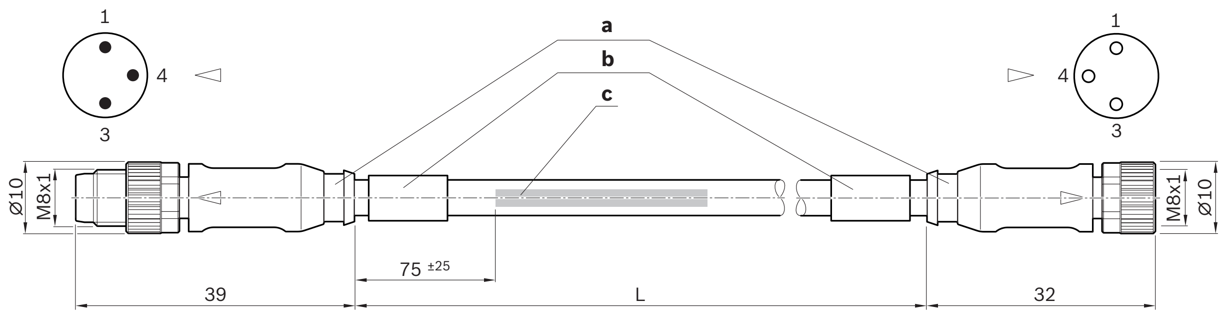
Use	Extension cable		
Part number	R911344602	R911344619	R911344620
Designation	7000-08041-6500500	7000-08041-6501000	7000-08041-6501500
Length (L)	5.0 m	10.0 m	15.0 m
1st connection type	Straight plug, M8x1, 3-pin		
2nd connection type	free cable end		

Pre-assembled on two sides

Connection diagram
1 brown (BN) (+)
3 blue (BU) (–)
4 black (BK) (signal)



Dimension drawing



Part numbers

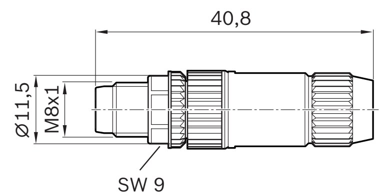
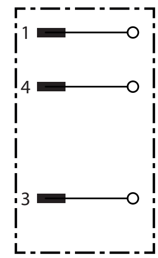
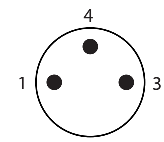
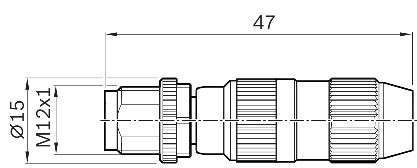
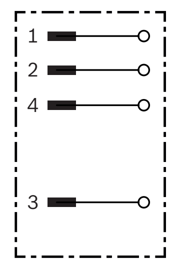
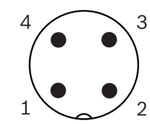
Use	Extension cable				
Part number	R911344621	R911344622	R911344623	R911344624	R911344625
Designation	7000-88001-6500050	7000-88001-6500100	7000-88001-6500200	7000-88001-6500500	7000-88001-6501000
Length (L)	0.5 m	1.0 m	2.0 m	5.0 m	10.0 m
1st connection type	M8x1 3-pole straight female connector				
2nd connection type	Straight plug, M8x1, 3-pin				

Technical data for extensions pre-assembled on one or two sides

Function indicator	–
Operating voltage indicator	–
Operating voltage	10–30 V DC
Type of cable	PUR black
Suitable for drag chains	✓
Torsion-resistant	✓
Weld spark-resistant	✓
Cable cross-section	3 x 0.25 mm²
Cable diameter D	4.1 ± 0.2 mm
Static bending radius	≥ 5xD
Dynamic bending radius	≥ 10xD
Bending cycles	> 10 mil.
Max. permissible linear speed	3.3 m/s over 5 m (typ.) to 5 m/s over 0.9 m
Max. permissible acceleration	≤ 30 m/s²
Ambient temperature when secured	-40 °C to +85 °C
Ambient temperature when loose	-25 °C to +85 °C
Protection rating	IP68
Certifications and approvals	CE, cULus LISTED, CSA C US, PG, RoHS

a) Contour for 6.5 mm corrugated tube (inner diameter)
b) Cable grommet
c) Cable label in accordance with labeling regulation

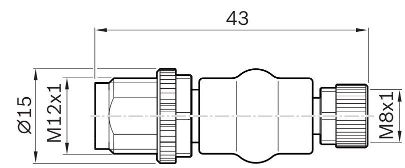
Plugs

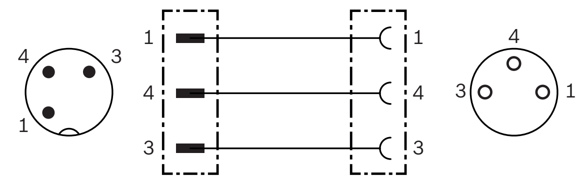
	Dimension drawing	**Connection diagram**	**Connector side view**
 R901388333			
 R901388352			

Part numbers / technical data		
Use	Single plug	
Part number	R901388333	R901388352
Designation	7000-08331-0000000	7000-12491-0000000
Version	straight	
Operating current per contact	max. 4 A	
Operating voltage	Max. 32 V AC/DC	
Connection type	Straight plug, M8x1, 3-pin, IDC, self-locking screw	Straight plug, M12x1, 4-pin, IDC, self-locking screw
Function indicator	-	
Operating voltage indicator	-	
Connection cross-section	0.14...0.34 mm²	
Ambient temperature	-25 °C to +85 °C	
Protection rating	IP67 (plugged in & screwed down)	
Certifications and approvals		

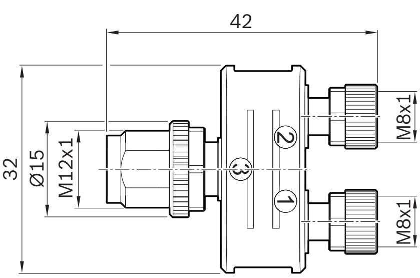
Adapters

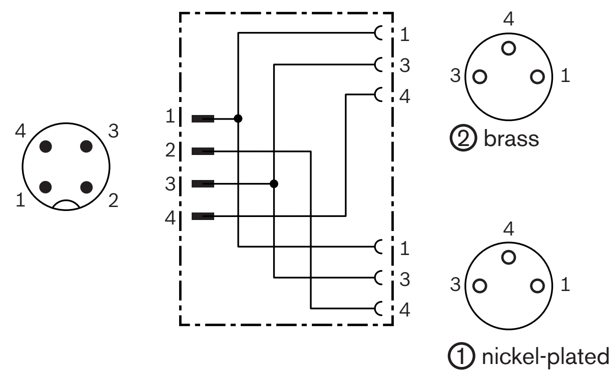
Dimension drawing **Connection diagram**





R911344591





R911344592

Part numbers / technical data

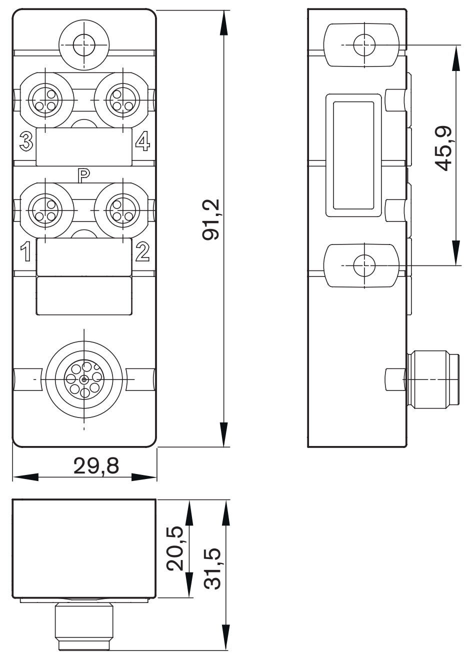
Use	Adapter	Adapter or distributor
Part number	R911344591	R911344592
Designation	7000-42201-0000000	7000-41211-0000000
Version	straight for 1 sensor	straight, for 1 - 2 sensors
Operating current per contact	max. 4 A	
Operating voltage	max. 32 V AC/DC	
1st connection type	Straight female connector, M8x1, 3-pin, IDC, self-locking screw thread	2 X straight female connectors, M8x1, 3-pin, IDC, self-locking screw thread
2nd connection type	Straight plug, M12x1, 3-pin, IDC, self-locking screw thread	Straight plug, M12x1, 4-pin, IDC, self-locking screw thread
Function indicator	–	
Operating voltage indicator	–	
Connection cross-section	–	
Ambient temperature	-25 °C to +85 °C	
Protection rating	IP67 (plugged in & screwed down)	
Certifications and approvals		

Passive distributors

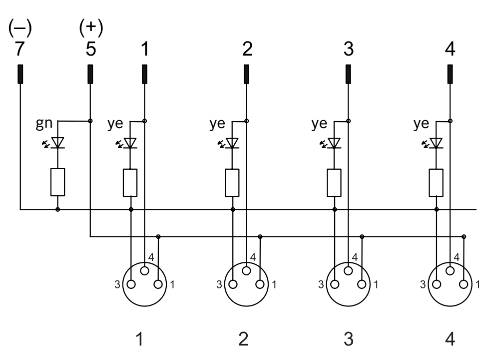
R901425737

R901429917

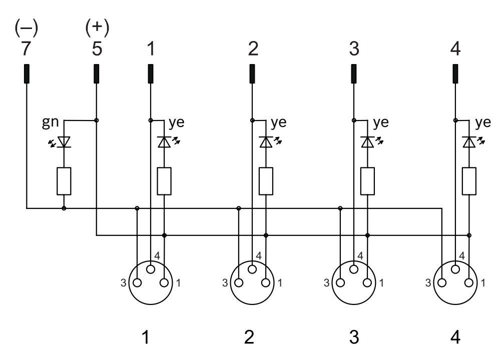
R911344592



R901425737



R901429917



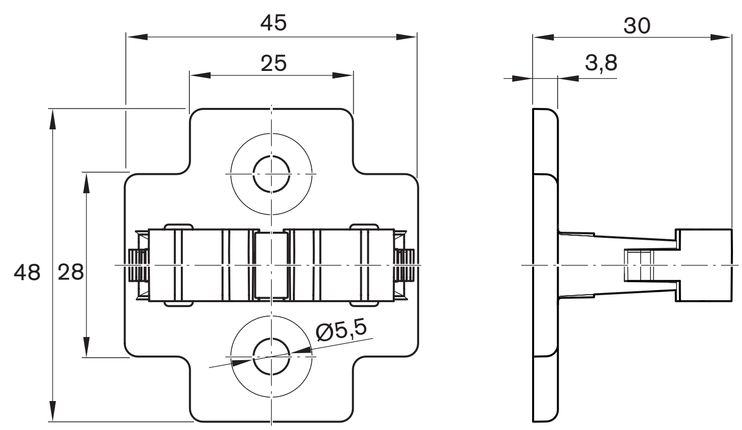
Part numbers / technical data

Use	Passive distributor		
Part number	R901425737	R901429917	R911344592
Designation	8000-84070-0000000	8000-84071-0000000	
Version	Straight, for 1 - 4 sensors		
Operating current per contact	max. 2 A		
Operating voltage	24 V DC		
Switching logic	PNP	NPN	
1st connection type	4x straight female connector, M8x1, 3-pin, IDC, self-locking screw thread		
2nd connection type	Straight plug, M12x1, 8-pin, IDC, self-locking screw thread		See the adapter for technical data and drawing
Function indicator	✓		
Operating voltage indicator	✓		
Connection cross-section	-		
Ambient temperature	-20° to +70 °C		
Protection rating	IP67 (plugged in & screwed down)		
Certifications and approvals			

Accessories for passive distributors

Holding plate

Screw plug



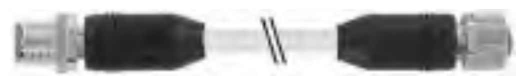
Part numbers / technical data

Use	For passive distributor R911344592	For passive distributors R901425737/R901429917
Holding plate	R913047341	–
Designation	7000-99061-0000000	–
Set	1 pc.	–
Screw plug	–	R913047322
Designation	–	3858627
Set	–	10 pcs.

Extensions for passive distributors

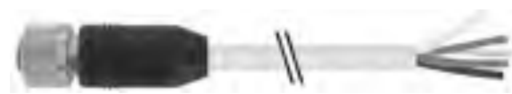
R911371982

R911371981

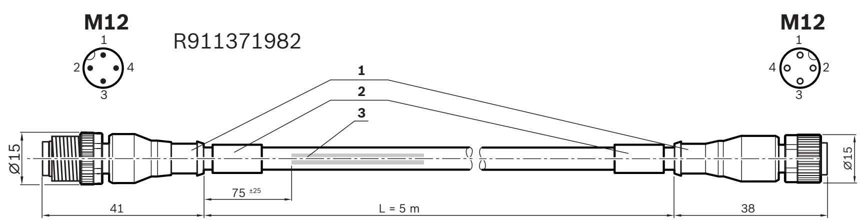


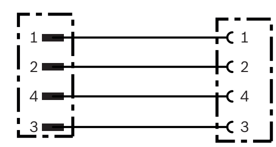
R911371980

R911371983

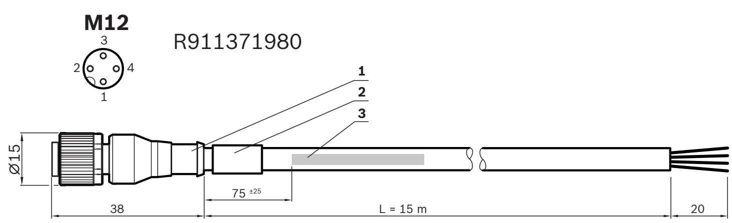


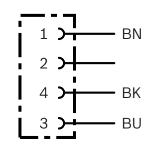
R911371982



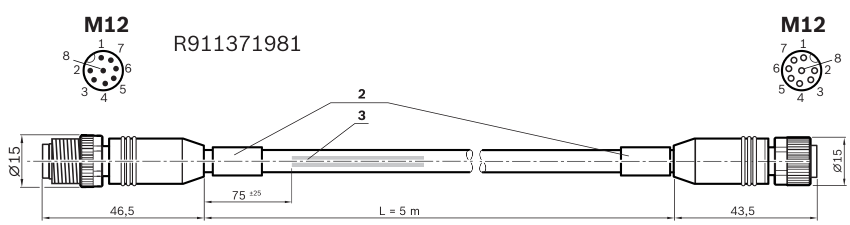


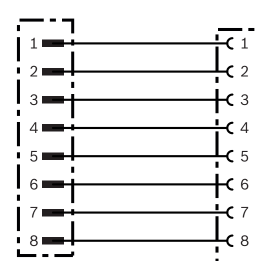
R911371980



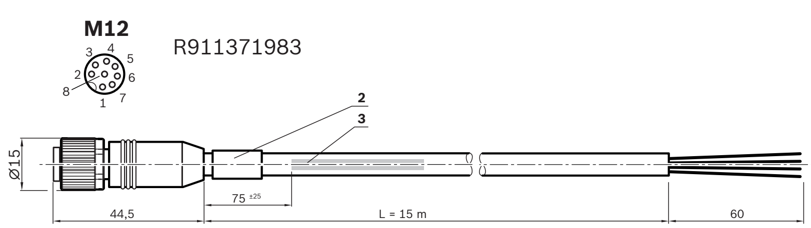


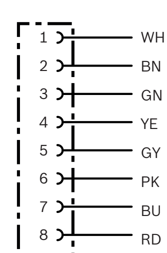
R911371981





R911371983



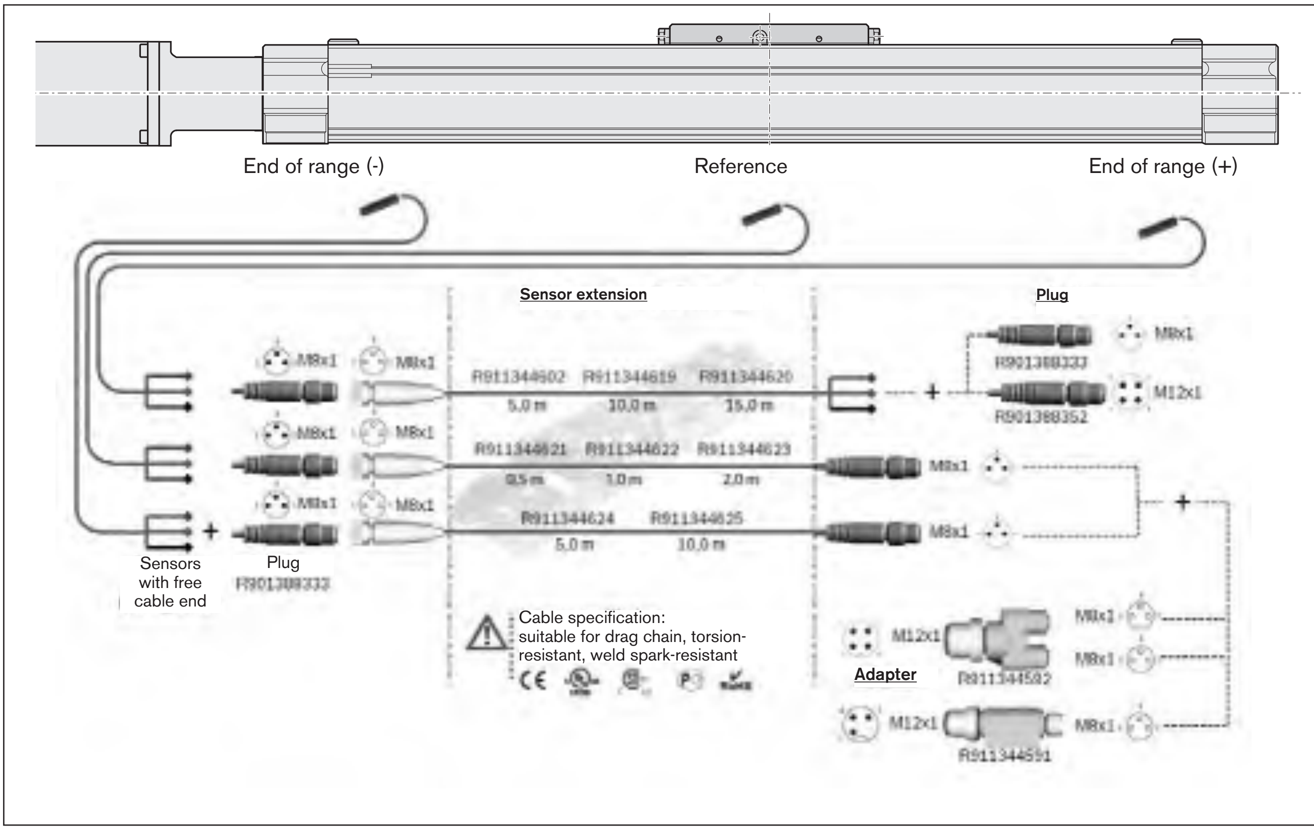


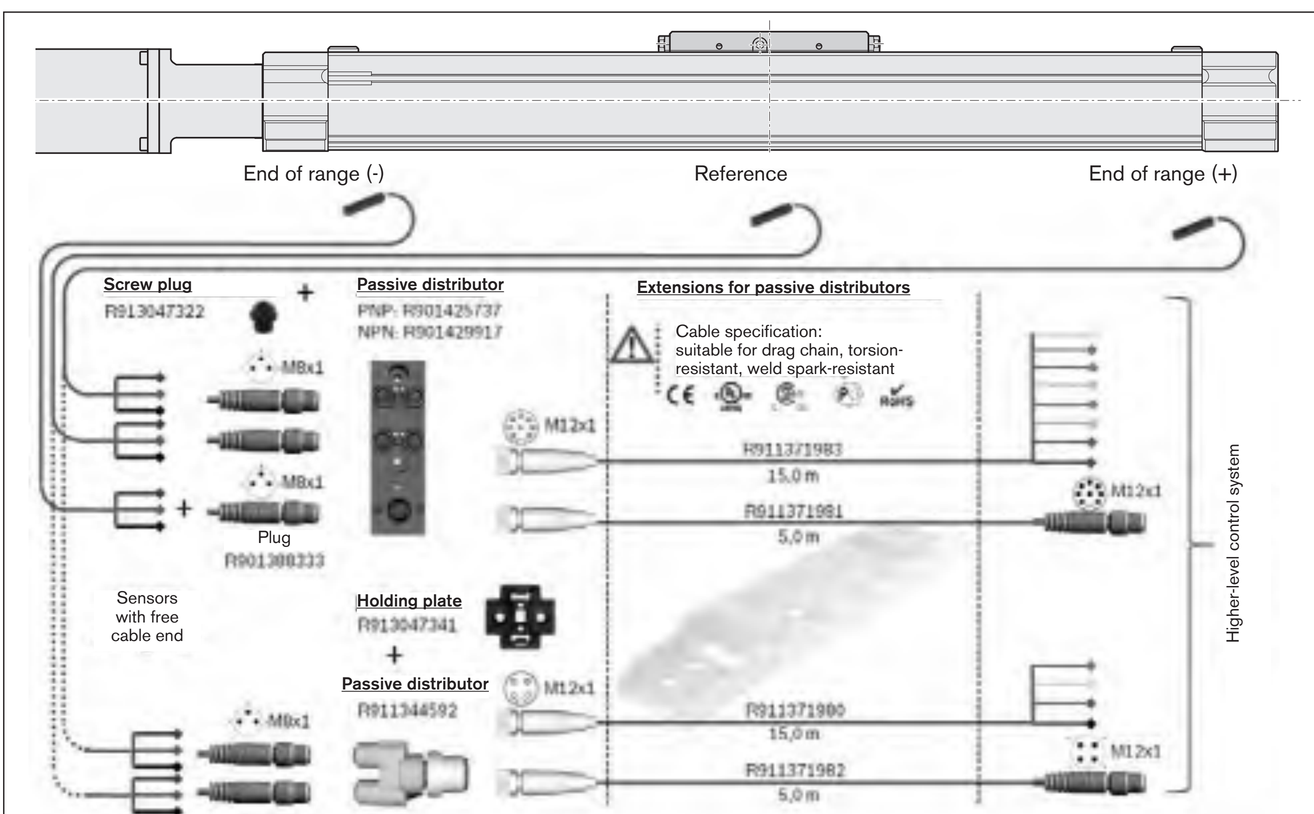
1) Contour for 10 mm corrugated tube (inner diameter)
2) Cable grommet
3) Label in accordance with ordering regulation 7000-08001

Part numbers / technical data

Use	Extension cable for passive distributor R911344592		Extension cable for passive distributors R901425737/R901429917	
Part number	R911371982	R911371980	R911371981	R911371983
Designation	7000-40021-6540500	7000-12221-6541500	7000-48001-3770500	7000-17041-3771500
Length	5.0 m	15.0 m	5.0 m	15.0 m
1st connection type	Straight female connector, M12x1, 4-pin		Straight female connector, M12x1, 8-pin	
2nd connection type	Straight plug, M12x1, 4-pin	Free cable end	Straight plug, M12x1, 8-pin	Free cable end
Function indicator	–			
Operating voltage indicator	–			
Type of cable	PUR black		PUR gray	
Operating voltage	30 V AC/DC			
Operating current per contact	max. 4 A per contact		max. 2 A per contact	
Suitable for drag chains	✓			
Torsion-resistant	✓			
Weld spark-resistant	✓			
Cable cross-section	4x 0.34 mm²		8x 0.34 mm²	
Cable diameter D	4.7 +/- 0.2 mm		6.2 +/- 0.3 mm	
Static bending radius	≧ 5 x D			
Dynamic bending radius	≧ 10 x D			
Bending cycles	> 10 mil.			
Max. permissible linear speed	3.3 m/s - at 5m travel range (type) up to 5 m/s at 0.9m travel range			
Max. permissible acceleration	≤ 30 m/s²			
Ambient temperature when secured	-40 °C to +80 °C (90° max. 10000 h)			
Ambient temperature when loose	-25 °C to +80 °C (90° max. 10000 h)			
Protection rating	IP67 (plugged in & screwed down)			
Certifications and approvals				

Combination examples

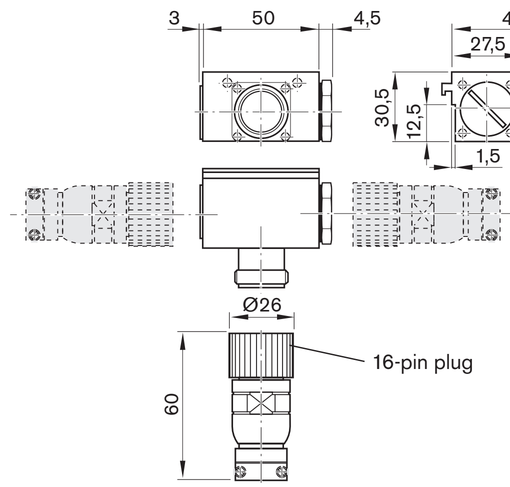


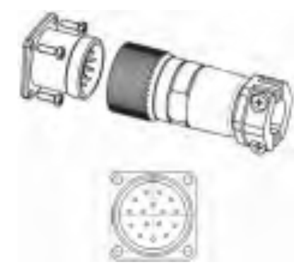


Socket and plug

Attach the socket on the side with the magnetic switches. Socket and plug are not pre-wired. The variable sliding attachment allows switching positions to be optimized during start-up. The plug can be installed in three directions.

R117500153





Use	Socket and plug
Part number	R117500153
Designation	for AGK-020 -032 -040
Version	angled, for suspension in the lateral slot of the linear motion system
Operating current per contact	max. 8 A
Operating voltage	150 V AC/DC
1st connection type	Straight plug, 16-pin, soldered connection
2nd connection type	Coupling / flange socket, 16-pin, soldered connection
Housing cable bushing	1 seal with bore 2x5.5 mm, 1x3.5 mm hole 1 adaptable seal, max. 14 mm diameter incl. cap and dummy plug
Cable bushing, plug	Gland with pull relief
Connection cross-section	0.14…1 mm
Cable diameter	10…14 mm
Ambient temperature	-20 °C to +125 °C
Protection rating	–
Certifications and approvals	–

Operating conditions

Normal operating conditions

Ambient temperature with Rexroth servo motor	0 °C ... 40 °C, loss of performance above 40 °C
Ambient temperature for mechanical system (without dropping below dew point)	-10 °C ... 60 °C
Travel s_{min} 1)	See “Technical data” tables
Contamination	not permissible

1) Minimum travel to ensure a reliable lubrication distribution.

Required and supplementary documentation

For further instructions and information, please refer to the documentation for this product.

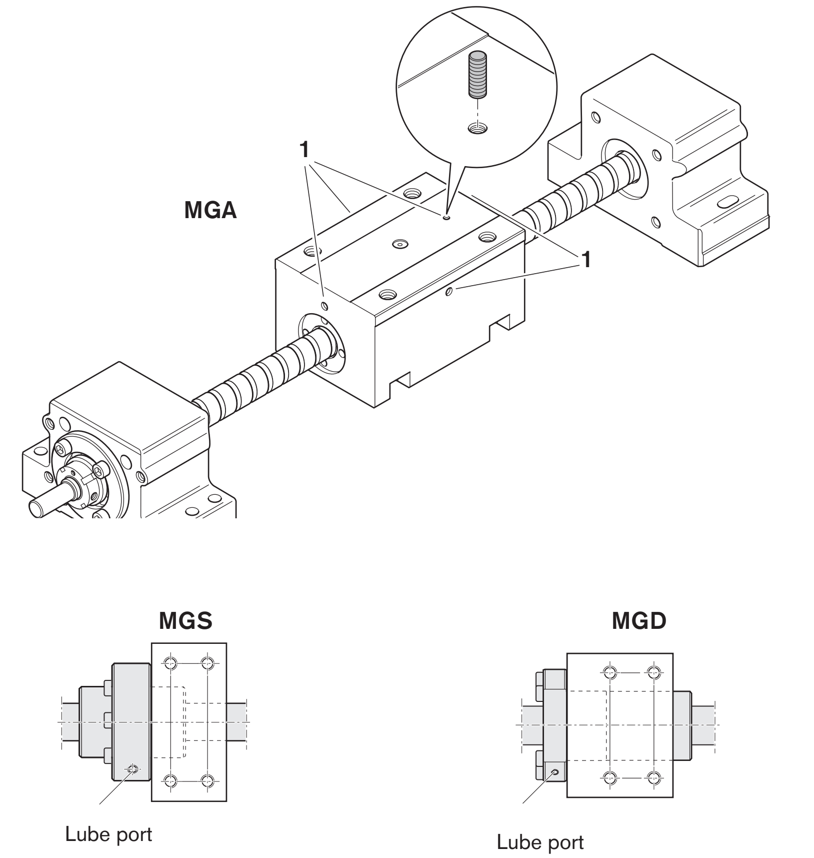
Lubrication

Lube fittings

AOK
Housing MGA has one lube fitting (1) on each side.
Lubrication through one of the five lube fittings is adequate.

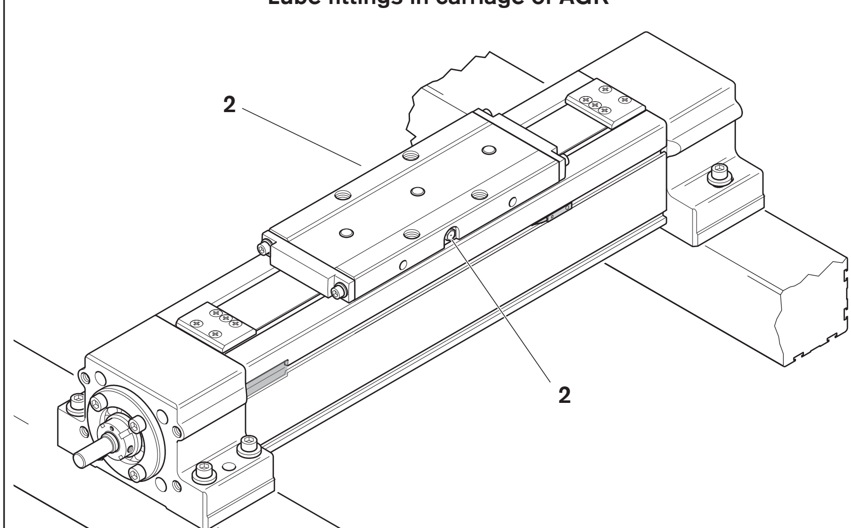
The nuts in all other version are lubricated. See dimensional drawings for location of lube port.

Lube fittings in AOK



AGK
The carriage has one funnel-type lube nipple (2) on each side.
Lubrication through only one of the two lube nipples is sufficient.

Lube fittings in carriage of AGK



Lubrication

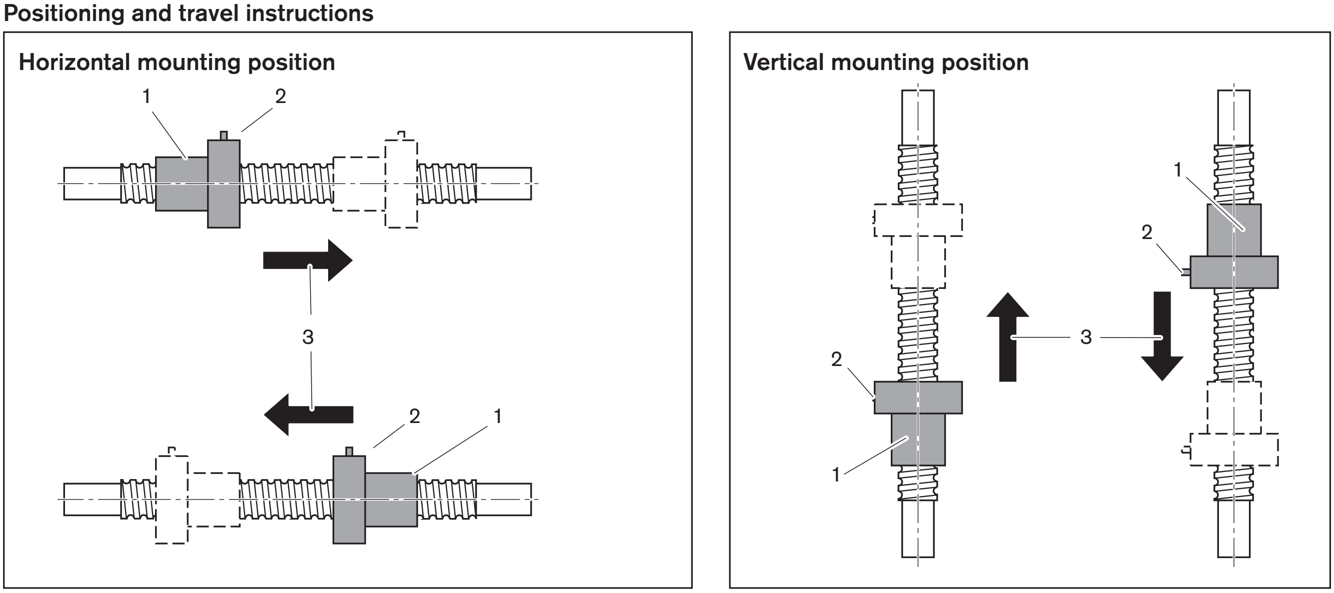
Overview

The ball screw drives in the Drive Units come with initial greasing standard. Basic lubrication with Dynalub 510 grease lubricant (see “Grease lubrication” section for lubricant properties)

The following lubrication procedures are generally acceptable for relubrication and are also described in separate sections.
- **Grease lubrication**
  with grease guns or progressive lubrication systems
- **Liquid grease lubrication**
  with single-line piston distributor systems
- **Oil lubrication**
  with single-line piston distributor systems

Follow the positioning and travel instructions in the figure below when relubricating the ball screw drive nuts regardless of which of the above lubrication procedures is used.

Positioning and travel instructions



1 Position of the nut during lubricating procedure
2 Mount with lube port (if installed horizontally, the port should be as close to the top as possible)
3 Direction of travel after lubrication. Travel ≥ s_{min} (see “Technical data” tables).

Basic information on lubrication intervals:

The lubrication intervals in the following sections are based on a load ratio of F_m/C. The load ratio describes the quotient of average load F_m and dynamic load rating C (see “Calculation” section).
Lubrication intervals depend on load and are calculated in revolutions based on the characteristic curve graph for the type of lubrication. Revolutions can be converted into km depending on lead.
Lubrication intervals are constant up to a load ratio of 0.2, so they can also be taken directly from the relubrication quantities and intervals tables. For higher load ratios, lubrication intervals have to be determined accordingly. Due to aging, relubrication should occur no less than every two years, even under normal operating conditions, regardless of application-specific lubrication intervals.

Notes:

Attention: Do not use lubricants with solid particles (e.g., graphite or MoS_2 additives).

If other lubricants are used than specified in the following sections, they may cause reduced relubrication intervals, loss of short-stroke and load-carrying performance, and chemical reactions between plastics, lubricants and anti-corrosion agents.

For strokes less than or equal to travel S_{min} (as per “Technical data” tables), executing a longer stroke (“lubricating stroke”) according to positioning and travel instructions and reducing lubrication intervals are recommended.

Short-stroke:

A short stroke is when the stroke is less than $S_{min}/2$

Effect of short stroke on service life:	Short strokes increase the number of time a rolling load passes over each point in the load zone, which reduces service life.
Effect of short stroke on lubrication:	Short strokes mean the ball does not make a full turn in the nut. This makes it impossible for an adequate grease film to form, which can result in premature wear.

Please contact one of our regional centers for short-stroke applications, since their effects on service life and lubrication require separate assessment.

Please contact us for applications in extreme conditions (e.g., heavy contamination, vibrations, shocks, corrosive media, etc.), since a separate assessment is necessary and a custom lubrication recommendation may be required.

Lubrication

Grease lubrication

With grease guns or progressive lubrication systems

Grease lubricant: We recommend using Dynalub 510 with the following properties:
- NLGI grade 2 lithium-based high-performance grease in accordance with DIN 51818 (KP2K-20 according to DIN 51825)
- Good water resistance
- Corrosion protection
- Temperature range: −20 °C to +80 °C

When using progressive lubrication systems, make sure all the lines and distributors (including the connection to the BASA nut) are filled before relubricating.

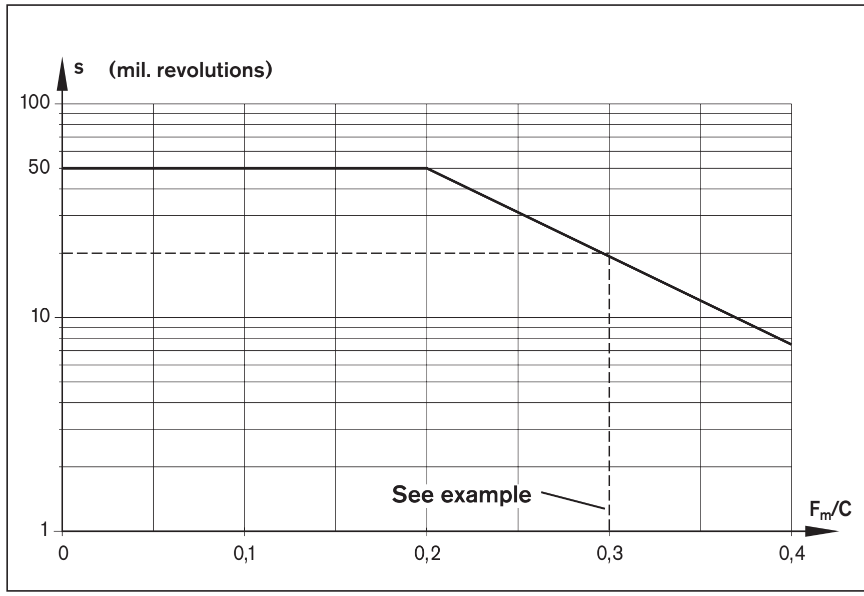
Grease lubrication			
		Maintenance lubrication quantity	**Maintenance lubrication interval**
Size	**BASA**	**ZEM-E/FEM-E-S/FEP-E-S/FEM-E-C**	**Based on load ratio Fm/C ≤ 0.2**
	d_0xP	**(cm^{33})**	**(km)**
AOK-020 **AGK-020**	20x5	1.0	250
	20x10	1.5	500
	20x20	2.4	1 000
	20x40	1.8	2 000
AOK-032 **AGK-032**	32x5	2.2	250
	32x10	3.1	500
	32x20	3.6	1 000
	32x32	5.5	1 600
AOK-040 **AGK-040**	40x5	3.0	250
	40x10	6.7	500
	40x20	8.7	1 000
	40x40	14.3	2 000

The load ratio F_m/C is the quotient of the average load F_m and the dynamic load rating C (see “Calculation”).

Graph for determining load-based lubrication intervals for grease lubrication using grease guns or progressive lubrication systems

This applies to the following conditions:
- Dynalub 510 grease or, alternatively, Castrol Longtime PD 2, Elkalub GLS 135/N2 grease lubricant
- No exposure to media
- Ambient temperature: T = 20 to 30 °C

s	=	lubrication interval in millions of revolutions	(10^6 revolutions)
C	=	dynamic load rating	(N)
F_m	=	average load	(N)
d_0	=	nominal diameter	(mm)



Conversion of lubrication interval s from millions of revolutions to kilometers:

$$\text{s in kilometers} = \frac{\text{s in millions (of revs)} \cdot \text{lead P (mm)}}{10^6}$$

Example:
AOK-032, BASA 32x20
From application: Load ratio $F_m/C = 0.3$
Taken from graph, with P = 20 mm and $F_m/C = 0.3$: $20 \cdot 10^6$ revs

$$\text{s in kilometers} = \frac{20 \cdot 10^6 \text{ (revs)} \cdot 20 \text{ (mm)}}{10^6} = 400 \text{ km}$$

Lubrication

Liquid grease lubrication

With single-line piston distributor systems

Grease lubricant

We recommend using Dynalub 520 with the following properties:

– Lithium-based, high-performance grease of NLGI grade 00 in accordance with DIN 51818 (GP00K-20 in accordance with DIN 51826)
– Good water resistance
– Corrosion protection
– Temperature range: −20 to +80 °C

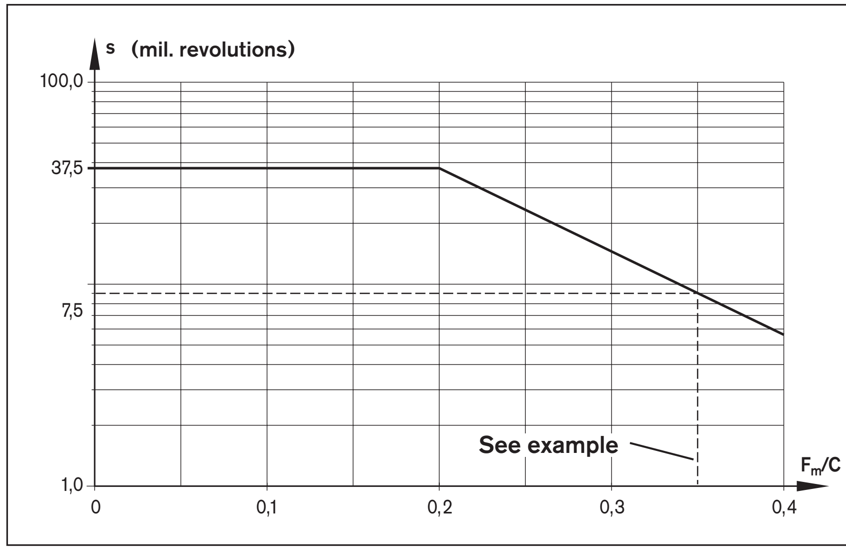
When using single-line distributor systems, always make sure all lines and the piston distributors (including the connection to the BASA nut) are filled before relubricating.
The pulse count that is needed for this is the integer quotient of the relubrication quantity according to the table and the piston distributor size. Make sure the piston distributor size is at least 0.03 cm³. The lubricating cycle time is then the result of dividing the lubrication interval by the determined pulse count.

Liquid grease lubrication

		Maintenance lubrication quantity	Maintenance lubrication interval
Size	**BASA**	**ZEM-E/FEM-E-S/FEP-E-S/FEM-E-C**	**Based on load ratio Fm/C ≤ 0.2**
	d_0xP	**(cm^{33})**	**(km)**
AOK-020 AGK-020	20x5	1.0	188
	20x10	1.5	375
	20x20	2.4	750
	20x40	1.8	1 500
AOK-032 AGK-032	32x5	2.2	188
	32x10	3.1	375
	32x20	3.6	750
	32x32	5.5	1 200
AOK-040 AGK-040	40x5	3.0	188
	40x10	6.7	375
	40x20	8.7	750
	40x40	14.3	1 500

The load ratio F_m/C is the quotient of the average load F_m and the dynamic load rating C (see “Calculation”).

Graph for determining load-based lubrication intervals for liquid grease lubrication using single-line piston distributor systems



This applies to the following conditions:
- Dynalub 520 grease or, alternatively, Castrol Longtime PD 00, Elkalub GLS 135/N00 grease lubricant
- No exposure to media
- Ambient temperature: T = 20 to 30 °C

s	=	lubrication interval in millions of revolutions	(10^6 revolutions)
C	=	dynamic load rating	(N)
F_m	=	average load	(N)
d_0	=	nominal diameter	(mm)

Conversion of lubrication interval s from millions of revolutions to kilometers:

$$\text{s in kilometers} = \frac{\text{s in millions (of revs)} \cdot \text{lead P (mm)}}{10^6}$$

Example:
AOK-032, BASA 32x10
From application: Load ratio $F_m/C = 0.35$
Taken from graph, with P = 10 mm and $F_m/C = 0.35$: 10 • 10^6 revs

$$\text{s in kilometers} = \frac{10 \cdot 10^6 \text{ (revs)} \cdot 20 \text{ (mm)}}{10^6} = 100 \text{ km}$$

Note:
We recommend using piston distributors from SKF. These should be installed as close as possible to the lube port of the nut. Long lines and small line diameters should be avoided, and the lines should be laid on an upward slant.
If other consumers are connected to the single-line lubrication system, the weakest link in the chain determines the lubrication cycle time.
Pumping or storage tanks for the lubricant should be fitted either with a stirrer or a follower piston to guarantee the flow of lubricant (to avoid funneling in the tank).

Lubrication

Oil lubrication

With single-line piston distributor systems

Lubricant oil

We recommend using Shell Tonna S 220, which has the following properties:

– Special demulsifying oil CLP or CGLP as per DIN 51517-3 for machine bed tracks and tool guides
– A blend of highly refined mineral oils and additives
– Can be used even when mixed with significant quantities of metalworking fluids

When using single-line distributor systems, always make sure all lines and the piston distributors (including the connection to the BASA nut) are filled before relubricating.
The pulse count that is needed for this is the integer quotient of the relubrication quantity according to the table and the piston distributor size. Make sure the piston distributor size is at least 0.03 cm³. The lubricating cycle time is then the result of dividing the lubrication interval by the determined pulse count.

Oil lubrication				
		Maintenance lubrication quantity	**Maintenance lubrication interval**	
Size	**BASA**	**ZEM-E/FEM-E-S/FEP-E-S/FEM-E-C**	**Based on load ratio Fm/C ≤ 0.2**	**Time**
	d_0xP	**(cm³³)**	**(km)**	**(h)**
AOK-020 AGK-020	20x5	0.06	5	10
	20x10	0.06	10	
	20x20	0.06	20	
	20x40	0.06	40	
AOK-032 AGK-032	32x5	0.06	5	
	32x10	0.06	10	
	32x20	0.06	20	
	32x32	0.06	32	
AOK-040 AGK-040	40x5	0.40	5	
	40x10	0.40	10	
	40x20	0.40	20	
	40x40	0.40	40	

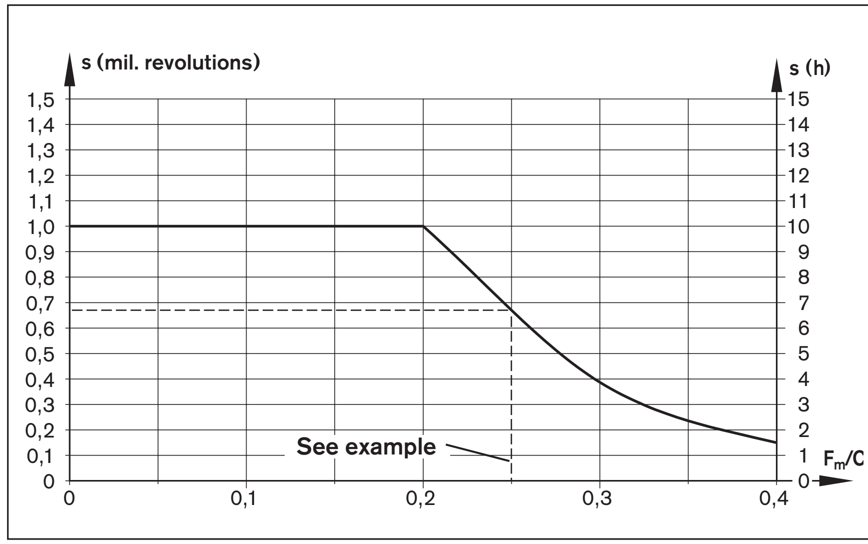
The load ratio F_m/C is the quotient of the average load F_m and the dynamic load rating C (see “Calculation”).

The lubrication interval s is defined either by millions of revolutions or operating time in km or hours. The value reached first defines the lubricating interval.

Graph for determining load-based lubrication intervals for oil lubrication using single-line piston distributor systems.

This applies to the following conditions:
– Lubricant oil is Shell Tonna S 220
– No exposure to media
– Ambient temperature:
T = 20 to 30 °C

s =	lubrication interval
C =	dynamic load rating (N)
F_m =	average load (N)
d_0 =	nominal diameter (mm)



Conversion of lubrication interval s from millions of revolutions to kilometers:

$$\text{s in kilometers} = \frac{\text{s in millions (of revs)} \cdot \text{lead P (mm)}}{10^6}$$

Example:
AOK-020, BASA 20x20
From application: Load ratio $F_m/C = 0.25$
Taken from graph, with P = 20 mm and $F_m/C = 0.25$: $0.65 \cdot 10^6$ revs

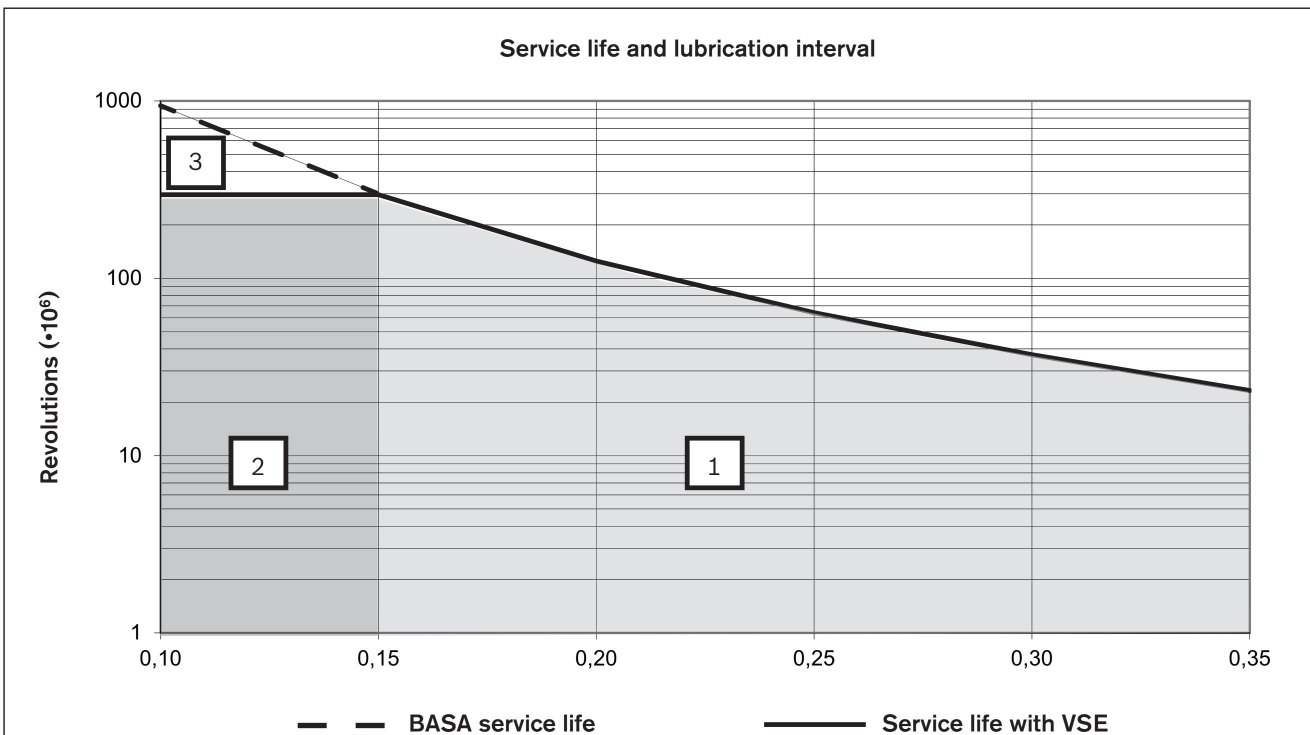
$$\text{s in kilometers} = \frac{0.65 \cdot 10^6 \text{ (revs)} \cdot 20 \text{ (mm)}}{10^6} = 13 \text{ km}$$

Note:
We recommend using piston distributors from SKF. These should be installed as close as possible to the lube port of the nut. Long lines and small line diameters should be avoided, and the lines should be laid on an upward slant.
If other consumers are connected to the single-line lubrication system, the weakest link in the chain determines the lubrication cycle time.

Lubrication

Front Lube Unit (VSE)

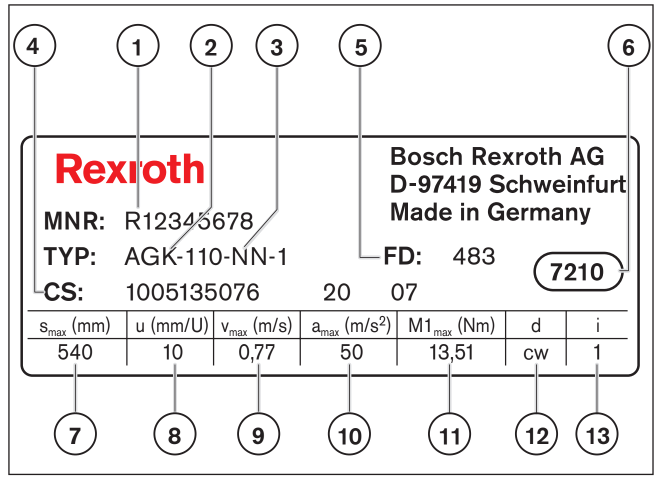
If a VSE is selected (not available with all versions), it comes ready-mounted with a pre-greased nut for excellent travel performance without relubricating. The VSE is designed to ensure long-term, maintenance-free operation of the ball screw drive.
The effective life of a Rexroth VSE is the same as the theoretical service life curve of the ball screw drive for travel up to 300 mil. revolutions without relubrication.



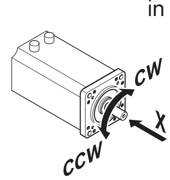
1	Lifelong lubrication: For load ratios of $0.15 \leq F_m/C \leq 0.35$ (graph area 1), the readable revolutions correspond to the theoretical service life of the BASA and the effective life of the VSE. This means the BASA is lubricated for life.
2	Maintenance-free up to 300 x 10^6 revolutions: For load ratios F_m / C < 0.15 (graph area 2), the ball screw drive is maintenance-free up to 300 mil. revolutions. The VSE will continue to lubricate past the interval up to this limit.
3	Relubrication required: After 300 mil. revolutions (graph area 3), the nut should be relubricated as usual. The VSE does not have to be removed, however it will no longer continue to lubricate past the interval.

Parameterization (start-up)

The nameplate contains reference information on the production of the linear motion system as well as technical start-up parameters.



1 Part number
2 Type designation
3 Size
4 Customer information
5 Date of manufacture
6 Manufacturing location
7 s_{max} = max. travel range (mm)
8 u = lead constant without gears (mm/rev)
9 v_{max} = max. speed without gears (m/s)
10 a_{max} = max. acceleration without gear (m/s²)
11 $M1_{max}$ = max. drive torque at motor journal (Nm)
12 d = direction of rotation of the motor for travel in positive direction



cw = clockwise
ccw = counterclockwise

13 i = gear ratio

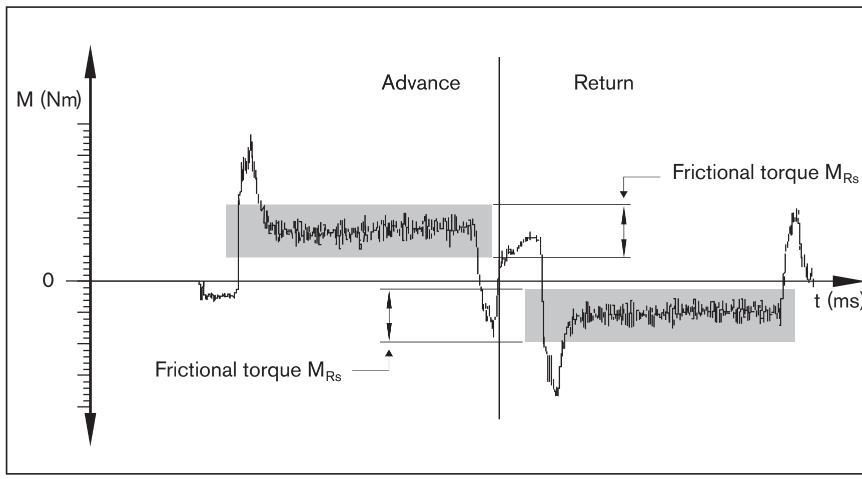
Documentation

Standard report
Option 01

The standard report contains:
- Confirmation of proper mechanical and electrical function
- Confirmation of version as per order confirmation
- Technical delivery information as per nameplate

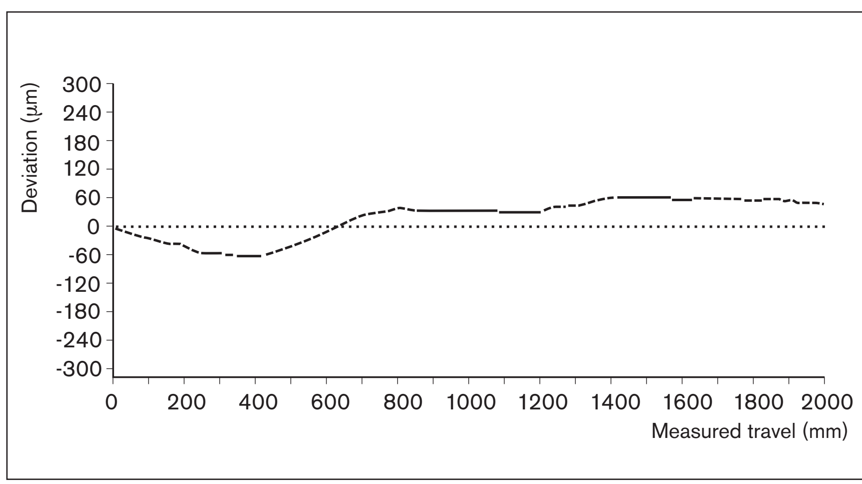
Frictional torque measurement for entire system (for AGK)
Option 02 (includes Option 01)

Frictional torque is measured over the entire travel range.

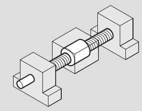
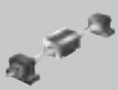
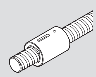
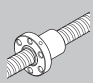
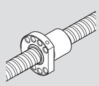


Lead deviation of the ball screw drive
Option 03 (includes Option 01)

A table containing the measurement report is included in addition to the graph (see figure).



AOK-032

Short product name, length: AOK-032-NN-1, ... mm	Drive BASA  nut	Size d_0 x P 32 x 5	32 x 10	32 x 20	32 x 32	Tolerance grade		Standard seal	Lubrication Initial greasing	Left VSE	Right VSE	Preload class C1 (moderate)	C2 (medium)	C3 (high)
Fixed and floating bearing 	ZEM-E 	01	02	03	04	T5	T7	1	1	–	–	3	6	2
	FEM-E-S 	11	–	–	–	T5	$\boxed{T7}$	$\boxed{1}$	$\boxed{1}$	2	3	$\boxed{3}$	6	2
		–	$\boxed{12}$	–	–									
		–	–	13	–									
		–	–	–	14									
	FEM-E-C 	21	–	–	–	T5	T7	1	1	2	3	3	6	2
		–	22	–	–									
		–	–	23	–									
		–	–	–	24									
Version with fixed bearing only	ZEM-E	06	07	08	09	T5	T7	1	1	–	–	3	6	2

■ = Selection area mark after version is chosen
□ = Selected option to be entered under “Request/order” in the order form at the end of the catalog

AOK length calculation

$$L = s_{max} + L_c + L_{ad}$$

$$s_{max} = s_{eff} + 2 \cdot s_e$$

d_0 = screw diameter (mm)
P = lead (mm)
L_c = nut length/nut and housing length (mm)

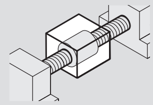
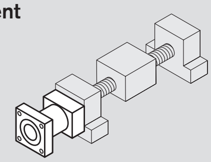
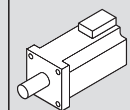
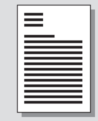
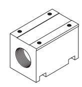
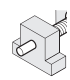
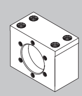
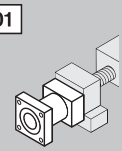
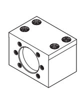
Max. travel: s_{max} = 1000 mm
Drive: BASA 32x10 (d_0 x P)
Nut length/nut and housing length L_c = 77 mm
Additional length: L_{ad} = 128 mm

L = 1000 + 77 + 128
<u>L = 1205 mm</u>

Excess travel:
Excess travel must be greater than braking distance. Acceleration travel can be used as a guideline value for braking distance.

Also see “Drive dimensioning calculation example”

AGK length calculation: same as for AOK Drive Unit, except: L_c = length of nut with housing

Screw ends		Pillow block		Nut Housing 			Motor attachment 				Motor 		Documentation 	
				without	with		Version			for motor	without brake	with brake		
Left	Right	Aluminum	Steel			Type		Gear ratio	Attachment kit[1]				Standard report	Measurement report
81	31	02	12	–	01	MGA 	without mount: OF01 	–	00	–	00			
$\boxed{81}$	$\boxed{31}$	$\boxed{02}$	12	00	11	MGS 	with mount: $\boxed{\text{MF01}}$ 	–	$\boxed{03}$	**MSK 60C[2]**	90	$\boxed{91}$	$\boxed{01}$	03 Lead deviation
				00	$\boxed{13}$				02	**MSK 76C[2]**	92	93		
				00	12									
				00	14									
81	31	02	12	00	21	MGD 								
				00	22									
				00	23									
				00	24									
81	00	01	11	–	01	MGA								

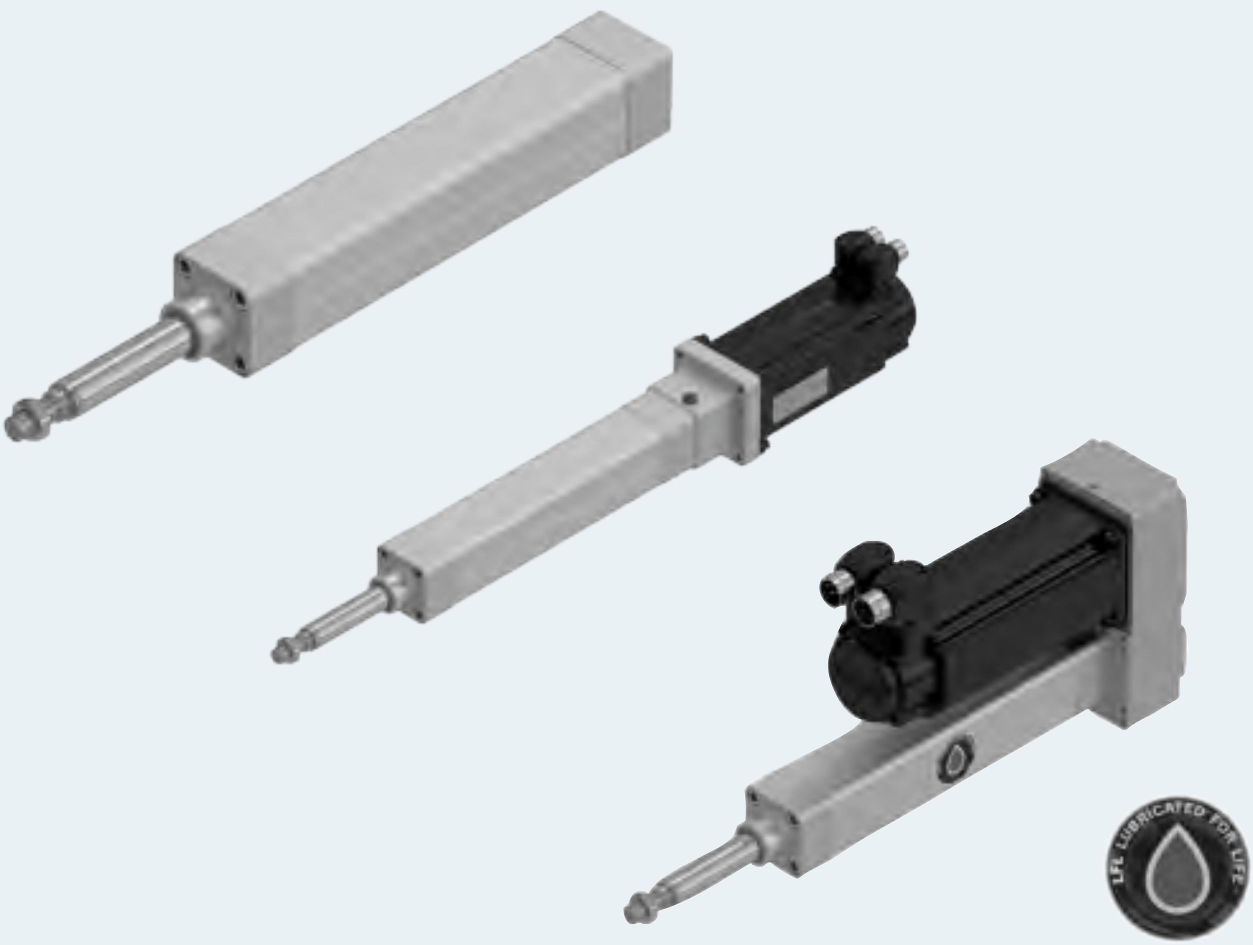
Type code: AOK-032-NN-1, 1205 mm/12/T7/1/1/3/81/31/02/13/MF01/03/91/01

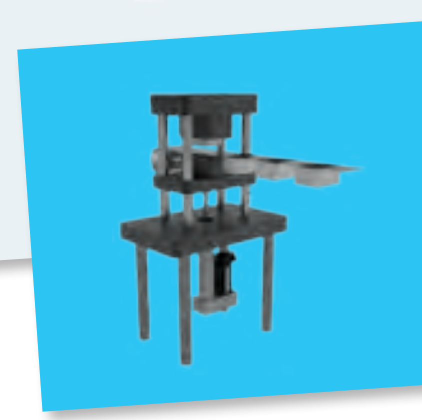
Ordering data	Option	Explanation
Drive Unit (short product name)	AOK-032-NN-1, 1205 mm	Open Drive Unit (AOK-032), length = 1205 mm
Basic version		Version with fixed and floating bearing
Ball screw drive	12	BASA 32x10 with Single Nut with flange FEM-E-S
Tolerance grade	T7	Tolerance grade T7
Seal	1	Standard seal
Lubrication	1	Preserved and with initial greasing
Preload class C1	3	Moderate preload
Left screw end type	81	Type 81
Right screw end type	31	Type 31
Pillow block	02	Fixed and floating bearing (Al)
Nut Housing	13	MGS (32x10)
Version	MF01	Mount/coupling for motor attachment as per MF01 illustration
Motor attachment	03	Mount/coupling for motor MSK 060C
Motor	91	Motor MSK 060C with brake
Documentation	01	Standard final testing

The order code for the AGK Drive Unit has the same format as the AOK Drive Unit

rexroth
A Bosch Company

Electromechanical cylinders EMC





Identification system for short product names

Short product name	Example: **EMC** - **063** - **NN** - **2**
System	**E**lectro**M**echanical **C**ylinder
Size	032 / 040 / 050 / **063** / 080 / 100
Version	**NN** Normal version XC Extra Capacity
Generation	Product generation **2**

Changes/additions at a glance:

- LFL lifelong lubrication supplemented
- Information on lubrication versions supplemented

Contents

Product description

A variable and complete system: hygienic, flexible, energy efficient
Its high variability makes the EMC so interesting for many industries and applications. By using the available configuration options, a cheaper, simpler base cylinder can be adjusted to virtually any customer requirement: chemical resistant, with perfect sealing and a high IP enclosure protection class. All these properties ensure a long service life – even under harsh industrial conditions. The powerful EMC always performs very efficiently. The resulting energy saving potential makes it an economical alternative to pneumatic systems.

Structural design

The mechanical system in the electromechanical cylinder is based on proven Rexroth ball screw assemblies in a variety of diameter and lead combinations. The Rexroth ball screw assembly converts the motor torque into linear motion with high mechanical efficiency. During this process, the piston rod fastened to the screw drive nut is extended and retracted.
Both the screw drive nut and the piston rod are guided in the housing and cannot twist.
Optional limit switches prevent damage to the cylinder in operation. A reference point switch is available for the use of incremental encoder systems.
Thanks to grease lubrication, electromechanical cylinders EMC require only minimal maintenance at long intervals.

Advantages

- High-precision Rexroth ball screw assemblies: for high performance with maximum cost-effectiveness
- Complete building system with great variability: can be adapted to a wide range of applications
- A ready to install and turn on system for low design and assembly costs
- The smart, freely programmable drive system allows the realization of complex travel profiles (parameters for force, position and travel speed can be set as required over the complete working travel range)
- Optimized lubrication concept: optional connection to a central lubrication system reduces downtime
- Soundly sealed against dirt and water from the outside and lubrication leakage from the cylinder by selecting the IP65 enclosure protection class option
- Hygienic design: High resistance to chemicals and cleaning agents by selecting the option IP65 + R (resistant)

Notes on lubrication

- Liquid grease lubrication prepared for connection to central lubrication systems
- High operational reliability through automated relubrication
- Need-based maintenance reduces consumption of lubricant, while ensuring high availability
- More degrees of freedom as lubrication is not dependent on position and installation location
- Low-cost unmanned maintenance
- Observe the "Lubrication position" for relubrication. Further information on this and on lubrication see chapter "Lubrication and maintenance"

Lubrication versions

LSS:

- Initial lubrication (standard lubrication) carried out by Bosch Rexroth with Dynalub 510
- Relubrication using manual grease gun

LCF:

- Prepared for connection to central lubrication systems for liquid grease (grade NLGI 00 in accordance with DIN 51818) with Dynalub 520
- Lubrication with liquid grease only via single-line piston distributor system
- Basic lubrication required

LPG:

- With corrosion prevention; relubrication with manual grease gun; basic lubrication required

LHG:

- Initial lubrication with NSF-H1 grease

LFL:

- Lifelong lubrication with Mobilith SHC 460 (R913073149)
  Application conditions:
  - Service life ≤ 15,000 km
  - Average load (F_m /C) ≤ 0.05
  - Average linear speed (V_m) ≥ 0.05 m/s

Application areas

Electromechanical cylinders EMC can be used in many application areas. Due to their specific characteristics, they offer advantages in terms of accuracy, dynamics and controllability, and can therefore not only help to shorten cycle times but also to increase flexibility and quality in the manufacturing process. Their space-saving design makes them ideal for use in tightly confined spaces.

Possible application areas are:

- Servo presses and forming technology
- Joining technology
- Thermoforming
- Injection molding and blow molding machines
- Woodworking machines
- Assembly and handling technology
- Packaging machines and conveyor systems
- Food processing machines
- Testing equipment and laboratory applications
- Special machines

Application examples

Joining and pressing

Transport

Forming / thermoforming

Lifting

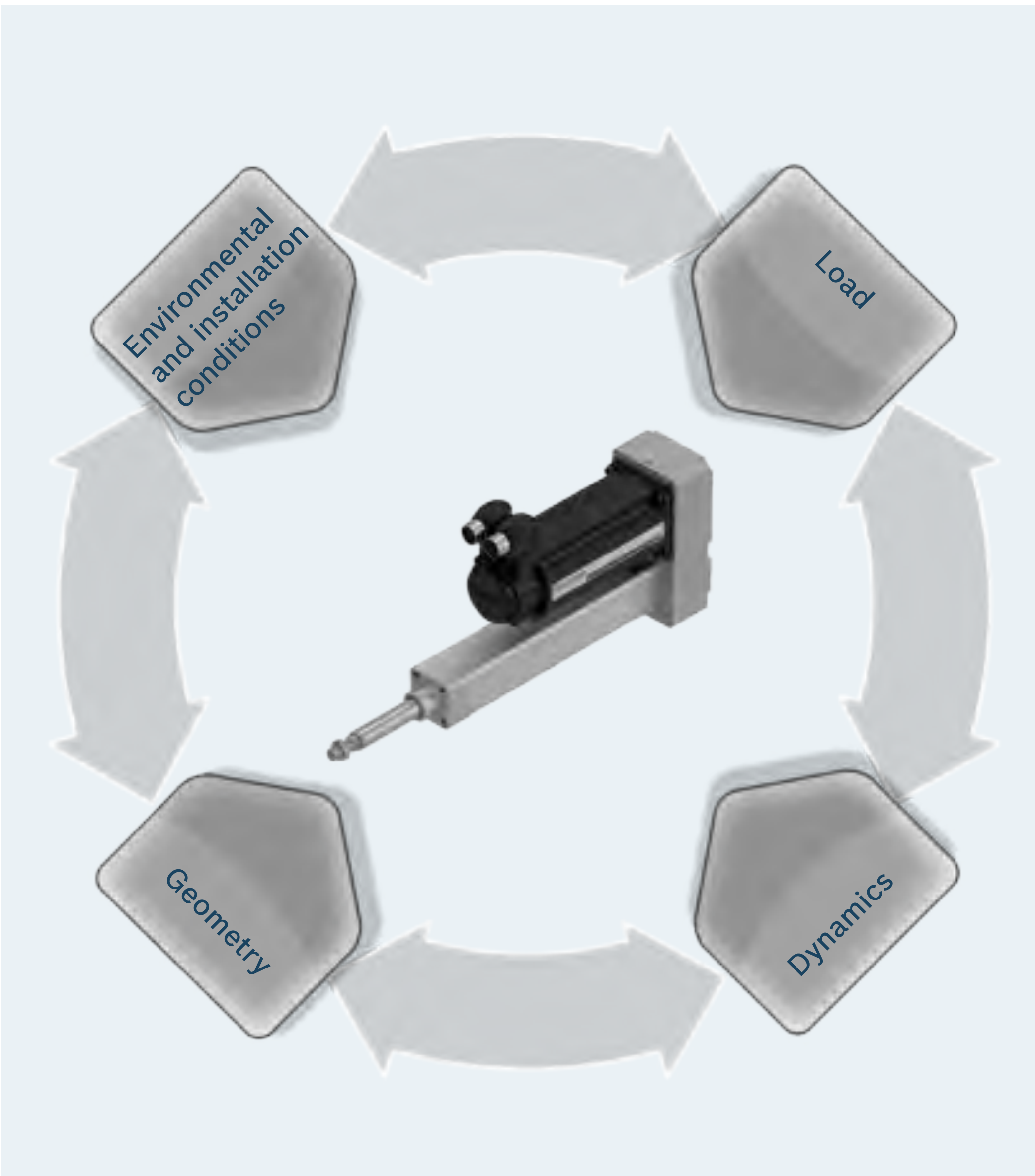
FASTER, MORE PRODUCTIVE, SMARTER.
THE NEW SMART FUNCTION KIT.

Times are changing. And so are industry requirements and processes. The trend is shifting away from individual products to simple and fast solutions with greater independence. The same applies to all pressing and joining processes in the Factory of the Future. With the new Smart Function Kit, Bosch Rexroth is meeting precisely these requirements for machine and plant manufacturers. It is a simple, fast and efficient package solution for versatile applications with pressing and joining functions. It functions according to the Plug & Produce principle and works with proven Rexroth components as well as browser-based software interfaces for all types of devices. Thanks to simple product selection, short delivery times as well as fast start-up and process configuration, the time spent on engineering can be reduced by up to 95%.

Product selection guide

To make sure your electromechanical solution delivers optimal performance, both technically and economically, the right decisions have to be made as early as the planning phase. The following key parameters have a decisive influence on the choice of system and its structural design:

- Load
- Dynamics
- Geometry
- Environmental and installation conditions



Load
- Process force
- Masses
- Duty cycle
- Service life requirement
- etc.

Dynamics
- Acceleration
- Travel speed
- Cycle time
- etc.

Geometry
- Working area
- Installation space
- Stroke length
- Interference contours
- etc.

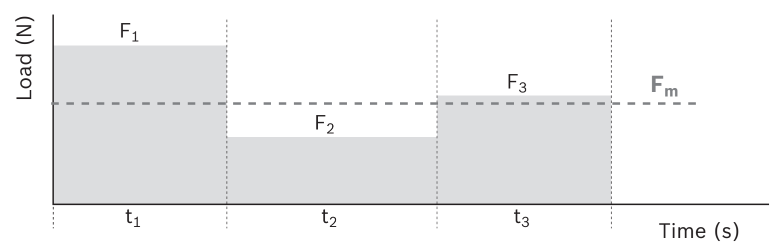
Environmental and installation conditions
- Installation position
- Fastening options
- Degrees of freedom
- Temperature
- Humidity
- Contamination
- Vibration and shocks
- etc.

An electromechanical cylinder EMC that is optimal for your needs in just six steps

Electromechanical cylinders EMC offer higher dynamics and precision, better controllability, and greater mechanical efficiency than the majority of fluid-power drives (e.g. hydraulic cylinders). It is particularly important to fully define application requirements in advance because of the special characteristics compared to fluid-driven technology.
To find the most cost-efficient solution for your application, the following input parameters should be known:

1. Loads

An EMC solution that is both economical and reliable can be found when the loads (process forces and masses) are known as accurately as possible. Along with the maximum force in the application, it is important to also state changing forces over the stroke so that the average load over the entire cycle can be determined. This average load forms the basis for the service life calculation.
Large safety factors for the force required, as are common in some fluid-power applications, should be avoided so that the axis is not over-sized. A differentiation also needs to be made between static load (cylinder at standstill) and dynamic load (during feed motion).



2. Duty cycle

The duty cycle is the percentage ratio of operating time to total cycle time. The duty cycle is an important input parameter for both the estimation of the total service life of the cylinder and for the thermal assessment of cylinder and motor.
Pause times should always be stated in the calculation as well.

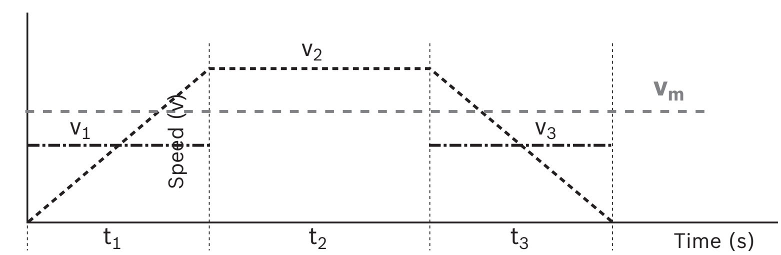
$$ED = \frac{t_B}{t_B + t_P} \cdot 100\%$$

ED	=	Duty cycle	(%)
t_B	=	Operating time	(s)
t_P	=	Pause time	(s)

Product selection guide

3. Total cycle

By stating the acceleration and linear speeds as accurately as possible or the necessary cycle time and the travel range, it is possible to adapt the complete drive chain to maximize results for the application.
The EMC and drive can be selected so that requirements are met precisely and efficiently.

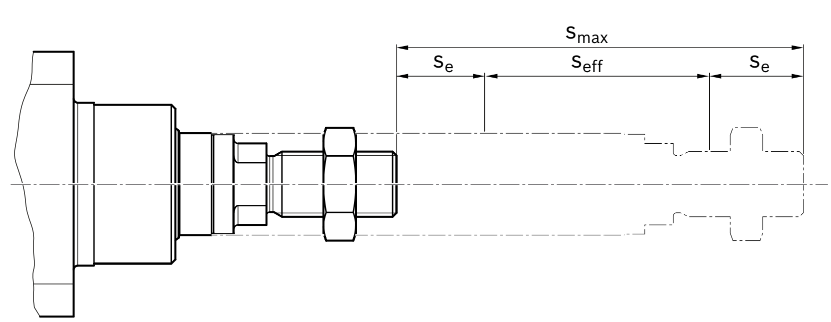


4. Integration in the machine

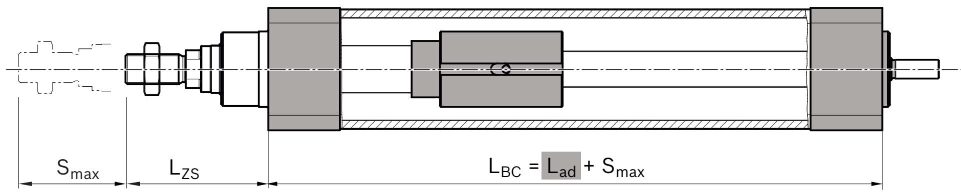
Transverse forces on the piston rod and alignment errors during assembly can shorten the service life of the electromechanical cylinder EMC.
During fastening, it must be ensured that the cylinder is mounted free of distortive stresses and heavy transverse loads are absorbed by an external guideway.
In addition, the type of attachment and the EMC fastening element have an effect on the maximum permissible axial load. (see section "Axial load" in the chapter "Technical data", see also "Fastening elements").
For an extensive and optimally balanced range of fastening elements, please refer to chapter "Attachments and accessories".

5. Travel range and overall dimensions

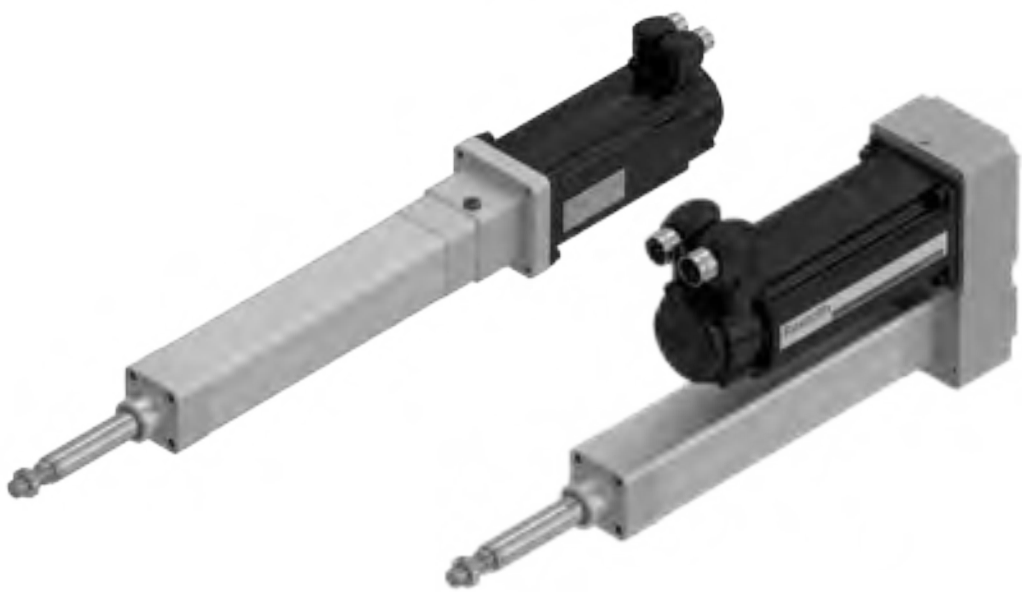
Determine the necessary operating stroke in your application. As electromechanical cylinders EMC must not be allowed to travel right up to the mechanical end stop, it is important to add excess travel (s_e) to both ends of the effective operating stroke (s_{eff}). This maximum travel range (s_{max}) is the parameter to be stated when ordering the cylinder.



For structural design reasons, the overall length of the cylinder is greater than the maximum travel range (s_{max}), as it includes the length of components such as the screw drive nut and the bearings (represented by L_{ad}), in addition to the travel range. The dimension L_{ZS} describes the position of the piston rod in the retracted position.



The cylinder can be adapted to the available installation space by mounting the motor as an extension to the axis (flange and coupling) or parallel to the axis (belt side drive). The type of motor attachment chosen also has an effect on the technical performance data and the selectable fastening methods.



6. Ambient conditions

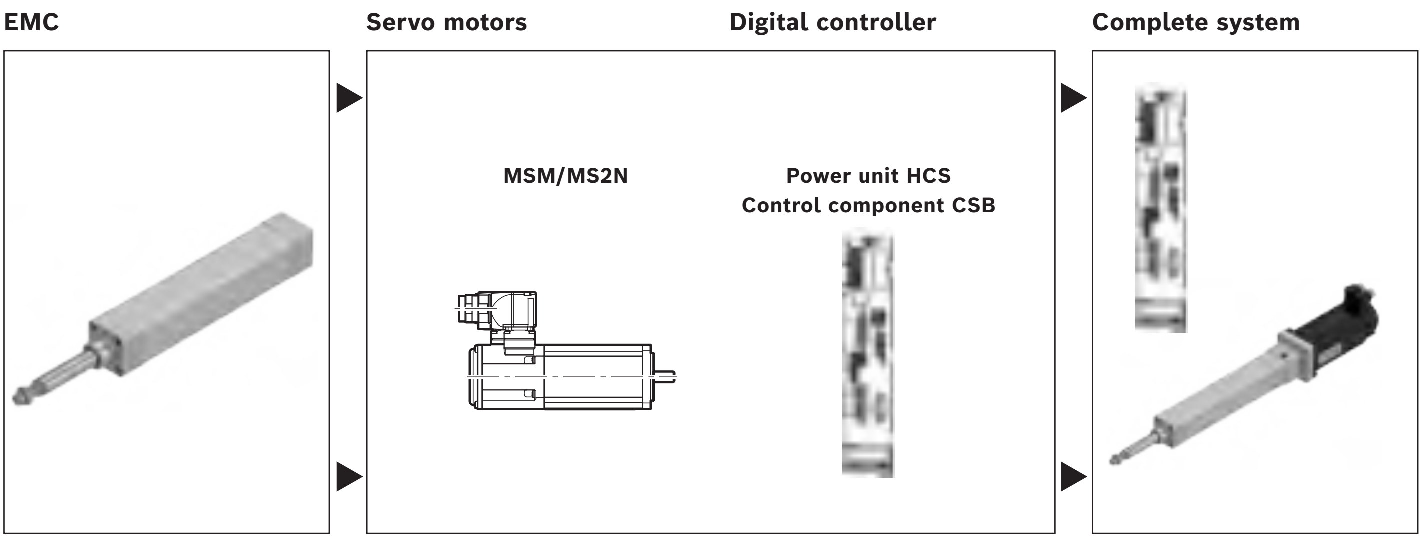
The environment in which a cylinder is operated can have a significant effect on its service life. Both very high and very low temperatures can affect seals, lubrication and the performance of the motor. Abrasive dirt and chemicals can damage the seals and ultimately cause the screw drive to fail over the long term.
Please ask if your application involves special environmental conditions.

Motor-controller combination

Several motor-controller combinations are available in order to provide the most cost-effective solution for every customer application. When sizing the drive, always consider the motor-controller combination.

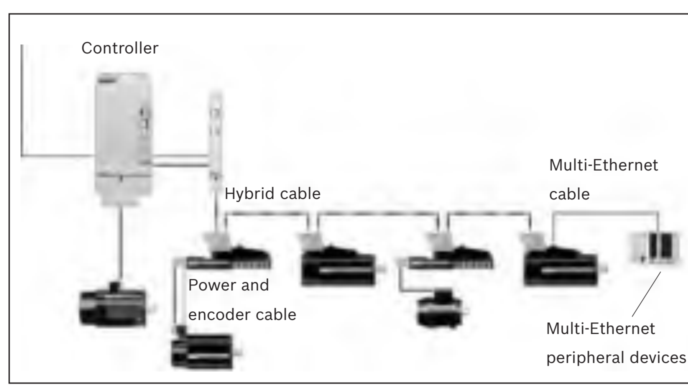
Notes on motors and controllers

- Motors are available with control units and controllers
- For recommended motor-controller combinations, see chapter "Motors"



IndraDrive Mi distributed drive system

Control electronics and servo motor in one space-saving unit. The IndraDrive Mi is the ideal solution for applications that depend on minimum space yet require maximum flexibility and cost-effectiveness.
IndraDrive Mi – the new generation of cabinet-free drive technology from Rexroth.
For more information, see "Drive system Rexroth IndraDrive, R999000018".

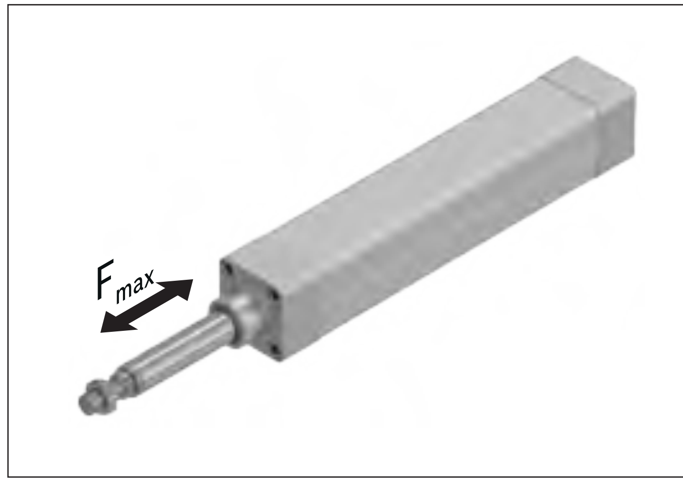


Up to 20 IndraDrive Mi in a chain - these motor-integrated servo drives (KSM) and servo drives close to the motor (KMS) are freely combinable. Via further KCU, additional IndraDrive Mi chains can be integrated.

Product overview

Note on dynamic load rating
In relation to the desired service life, generally speaking an equivalent dynamic axial load of up to about 20% of the dynamic load rating (C) has proven effective.
(see also service life graphs in chapter "Technical data".)

Do not exceed the technical data.



The size designation 32 to 100 is selected according to the piston diameter of an ISO 15552 standard cylinder.
The built-in Rexroth ball screw assemblies have a diameter of 12 mm to 50 mm.

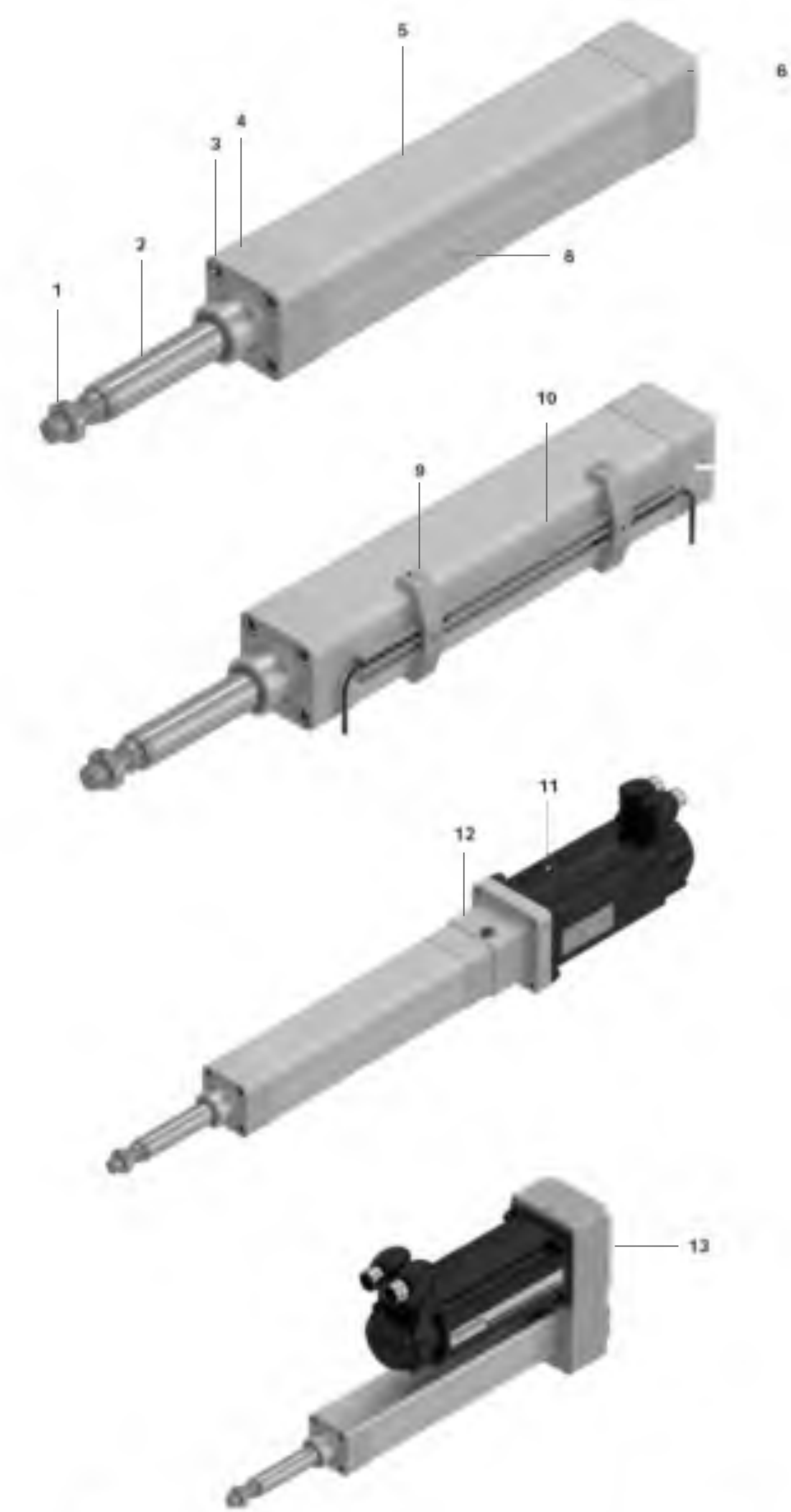
EMC	d_0 x P	C (N)	F_{max} (N)	$s_{max\ zul}$ (mm)	v_{max} (m/s)
32	12x5	4 100	1 200	750	0.57
	12x10	2 700	750		1.13
40	16x5	13 300	4 500	750	0.38
	16x10	10 400	3 000		0.77
	16x16	10 400	2 000		1.23
50	20x5	15 400	7 800	900	0.32
	20x10	15 200	5 500		0.63
	20x20	14 400	3 200		1.27
63	25x5	17 200	15 900	1 200	0.28
	25x10	17 000	14 800		0.55
	25x25	15 900	8 000		1.38
80	32x5	23 300	21 600	1 500	0.25
	32x10	26 000	22 000		0.50
	32x20	21 300	15 000		1.00
	32x32	21 100	10 400		1.60
100	40x5	31 400	29 000	1 500	0.18
	40x10	42 100	29 000		0.37
	40x20	40 900	29 000		0.73
	40x40	40 000	22 900		1.47
100XC	50x10	86 100	56 000	1 500	0.50
	50x20	104 900	50 000		1.00

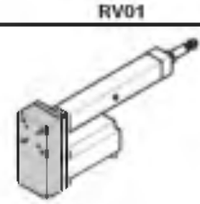
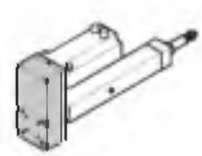
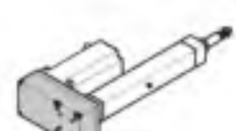
For short product names, see chapter "Abbreviations".

Structural design

1 Hexagon nut
2 Piston rod (stainless steel)
3 Hex socket head cap screw (for mounting fastening element and motor attachments)
4 Cover
5 Housing
6 Bottom
7 Screw journal
8 Slot for sensor profile (opposite the lube connection)

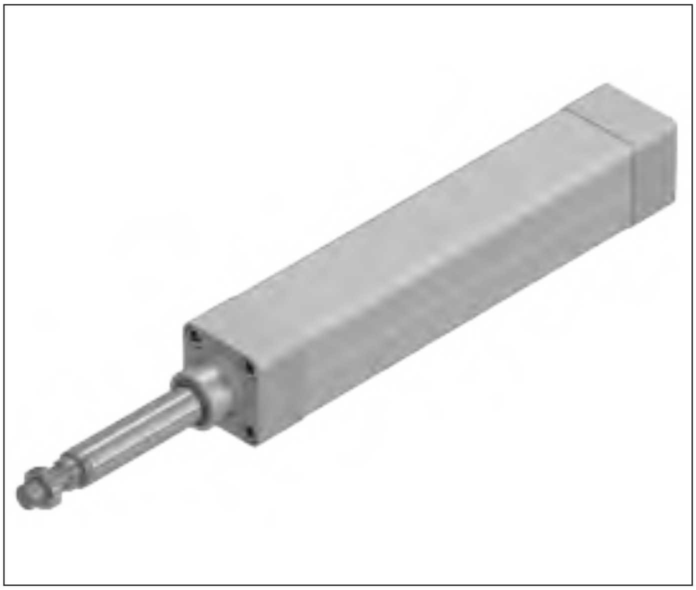
Attachments
9 Retaining bracket (for sensor profile)
10 Sensor profile
11 Motor
12 Flange and coupling
13 Belt side drive
14 Lube connection for lubrication versions LSS, LCF, LPG, LHG; for lubrication version LFL: Housing without lube connection
15 Connection for pressure compensation



RV01	RV02	RV03
		

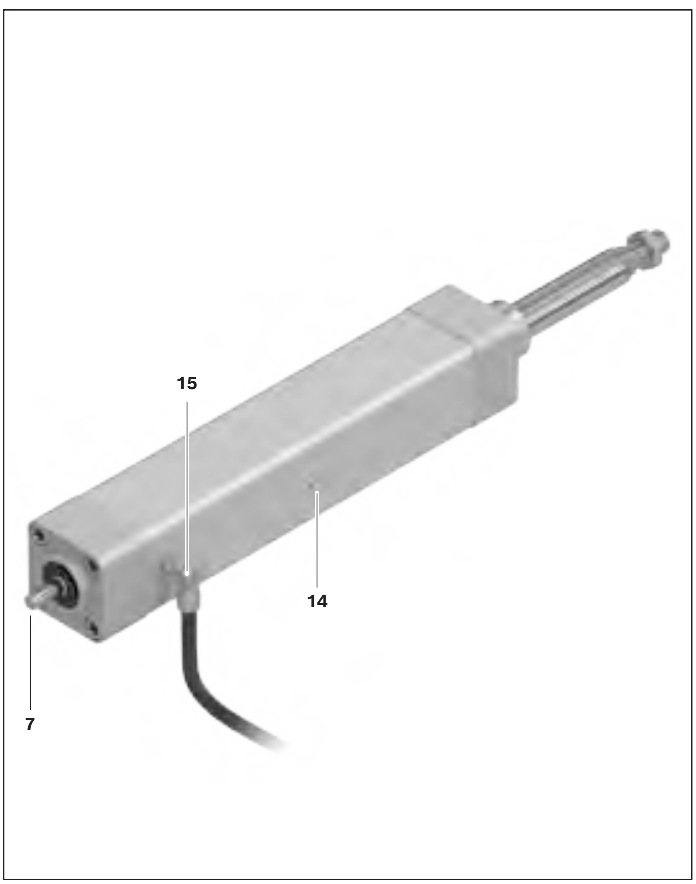
Motor flange and coupling
The motor flange is used to fasten the motor to the EMC and as a closed housing unit for the coupling. With the coupling, the drive torque of the motor is transmitted free of distortive stresses on the screw journal of the EMC.

Belt side drive
This configuration results in the shortest possible overall length of the EMC.
The space-saving, closed housing serves as protection for the belt, motor bracket and to connect fastening elements.
Various gear ratios are available:
i = 1 : 1
i = 1 : 1.5
i = 1 : 2
The belt side drive can be mounted in three directions (RV01 to RV03).



Features at a glance

- The hygienic design of the EMC with smooth surfaces prevents the formation of dirt and allows for easy cleaning of the cylinder. A sensor profile can be mounted to the housing to allow the use of limit and/or reference switches outside of the aluminum profile.
  The EMC is pre-lubricated with standard grease or NSF-H1 grease and is therefore ready for immediate use. Alternatively, the built-in Rexroth ball screw assembly can also be ordered only conserved for initial lubrication by the customer. The EMC can be connected to a central lubrication system with liquid grease. A lube connection is included if the appropriate lubrication option has been selected.



IP65 enclosure protection class

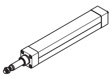
- Seals between the end caps and the housing and a reinforced seal on the piston rod ensure reliable protection against dust and water ingress. A connection for pressure compensation (15) in the housing prevents underpressure in the cylinder by allowing controlled air flow between interior and environment. The electric cylinder and motor mountings with IP65 fulfill the requirements according to IEC 60 529.

IP65 enclosure protection class +R (resistant)

- In addition to the benefits of the IP65 rating, this version provides chemical resistant seals between the end caps and the housing, as well as at the piston rod.
  The lube connection (14), the connection for pressure compensation (15) and the hexagon nut (1) are made from stainless steel.
  As additional accessories corrosion-resistant plug screws for the hex socket head cap screws in the cover are available.

Technical data

Drive data without motor attachment

EMC 	d_0xP (mm)	C (N)	F_{max} (N)	M_p (Nm)	s_{min} (mm)	$s_{max\ zul}$ (mm)	v_{max} (m/s)	n_p (min^{-1})	a_{max} (m/s^2)	L_{ad} (mm)	M_{Rs} (Nm)
32	12x5	4 100	1 200	1.1	30	750	0.57	6 800	50.0	132.00	0.16
	12x10	2 700	750	1.3	40		1.13	6 800	50.0	136.00	0.20
40	16x5	13 300	4 500	4.0	35		0.38	4 600	50.0	134.00	0.28
	16x10	10 400	3 000	5.3	45	750	0.77	4 600	50.0	143.00	0.33
	16x16	10 400	2 000	5.7	65		1.23	4 600	50.0	159.00	0.40
50	20x5	15 400	7 800	6.9	40		0.32	3 800	39.8	142.00	0.50
	20x10	15 200	5 500	9.7	60	900	0.63	3 800	50.0	161.00	0.55
	20x20	14 400	3 200	11.3	80		1.27	3 800	50.0	180.00	0.65
63	25x5	17 200	15 900	14.1	45		0.28	3 300	28.9	148.00	0.75
	25x10	17 000	14 800	26.2	65	1 200	0.55	3 300	50.0	167.00	0.80
	25x25	15 900	8 000	35.4	95		1.38	3 300	50.0	199.00	1.00
80	32x5	23 300	21 600	19.1	50		0.25	3 000	17.9	163.00	1.20
	32x10	26 000	22 000	38.9	80	1 500	0.50	3 000	30.7	187.00	1.30
	32x20	21 300	15 000	53.1	85		1.00	3 000	50.0	195.00	1.40
	32x32	21 100	10 400	58.9	120		1.60	3 000	50.0	230.00	1.60
100	40x5	31 400	29 000	25.7	55		0.18	2 200	12.2	171.00	2.40
	40x10	42 100	29 000	51.3	70	1 500	0.37	2 200	16.8	185.00	2.50
	40x20	40 900	29 000	102.6	90		0.73	2 200	33.0	203.00	2.60
	40x40	40 000	22 900	162.0	145		1.47	2 200	50.0	258.00	2.80
100XC	50x10	86 100	56 000	99.0	90	1 500	0.50	3 000	12.1	316.00	4.00
	50x20	104 900	50 000	176.8	115		1.00	3 000	22.0	338.00	5.00

1) Total axial clearance of the EMC when new
2) Constants for calculating the mass moment of inertia. For formulas, see chapter "Drive dimensioning"

Note:
The travel range can be selected in mm steps between s_{min} and $s_{max\ zul}$.

Mass of the EMC

Weight calculation without the motor and without motor attachment

$$m_s = k_{g\ fix} + k_{g\ var} \cdot s_{max}$$

Weight calculation without motor with belt side drive

$$m_s = k_{g\ fix} + k_{g\ var} \cdot s_{max} + m_{sd}$$

Weight calculation without motor with flange and coupling

$$m_s = k_{g\ fix} + k_{g\ var} \cdot s_{max} + m_{fc}$$

Moved mass of system

$$m_{ca} = m_{ca\ fix} + m_{ca\ var} \cdot s_{max}$$

Length calculation

$$L_{BC} = s_{max} + L_{ad}$$

Total axial clearance cylinder[1]	$k_{J\ fix}$[2]	$k_{J\ var}$[2]	$k_{J\ m}$[2]	m_s		m_{ca}	
				$k_{g\ fix}$	$k_{g\ var}$	$m_{ca\ fix}$	$m_{ca\ var}$
(µm)				(kg)	(kg/mm)	(kg)	(kg/mm)
10	1.945	0.012	0.633	0.885	0.004	0.311	0.001
15	2.618	0.013	2.533	0.911	0.004	0.326	0.001
10	6.616	0.032	0.633	1.255	0.005	0.432	0.001
15	7.839	0.033	2.533	1.336	0.005	0.481	0.001
20	11.114	0.040	6.485	1.487	0.005	0.567	0.001
5	15.815	0.085	0.633	2.115	0.008	0.695	0.001
10	19.092	0.088	2.533	2.382	0.008	0.838	0.001
20	27.304	0.095	10.132	2.560	0.008	0.896	0.001
5	39.693	0.223	0.633	3.018	0.010	1.059	0.002
10	48.227	0.243	2.533	3.417	0.010	1.291	0.002
20	76.002	0.242	15.831	4.047	0.010	1.679	0.002
5	92.538	0.607	0.633	5.185	0.015	1.871	0.003
10	119.067	0.647	2.533	6.182	0.015	2.495	0.003
10	145.503	0.665	10.132	6.525	0.015	2.739	0.003
20	225.036	0.684	25.938	7.610	0.015	3.404	0.003
5	276.160	1.568	0.633	8.795	0.025	3.249	0.006
5	291.780	1.369	2.533	9.684	0.025	3.829	0.006
10	349.478	1.408	10.132	10.479	0.025	4.281	0.006
20	628.583	1.567	40.528	13.410	0.025	6.166	0.006
5	1 080,741	3.588	2.533	16.828	0.031	5.292	0.007
10	1 184,852	3.519	10.132	18.020	0.031	5.994	0.007

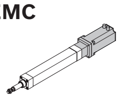
Mechanical efficiency η = 0.9 (for all sizes)

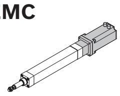
Note:

F_{max} and v_{max} depend on the selected travel range (s_{max}) of the EMC. See the following tables.

Technical data

Drive data for motor attachment via flange and coupling

EMC 	d_0 x P (mm)	for motor	Flange and coupling F_{max}[2) (N)	M_p[2) (Nm)	v_{max}[2) (m/s)	M_{Rs} (Nm)	$k_{J\ fix}$[1)	$k_{J\ var}$[1)	$k_{J\ m}$[1)	m_{fc} (kg)	a_{max} (m/s²)
32	12 x 5	MSM019B MSM031B MS2N03B	1 200	1.1	0.57	0.16	8.945	0.012	0.633	0.37	50.0
	12 x 10	MSM019B MSM031B MS2N03B	750	1.3	1.13	0.20	9.618	0.013	2.533	0.37	
40	16 x 5	MSM031C MS2N03B MS2N03D	4 500	4.0	0.38	0.28	41.616	0.032	0.633	0.56	
		MS2N04								0.68	
	16 x 10	MSM031C MS2N03B MS2N03D	3 000	5.3	0.77	0.33	42.839	0.033	2.533	0.56	
		MS2N04								0.68	
	16 x 16	MSM031C MS2N03B MS2N03D	2 000	5.7	1.23	0.40	46.114	0.040	6.485	0.56	
		MS2N04								0.68	
50	20 x 5	MSM031C MSM041B MS2N04	7 800	6.9	0.32	0.50	78.815	0.085	0.633	1.10	39.8
		MS2N05								1.13	
	20 x 10	MSM031C MSM041B MS2N04	5 500	9.7	0.63	0.55	82.092	0.088	2.533	1.10	50.0
		MS2N05								1.13	
	20 x 20	MSM031C MSM041B MS2N04	3 200	11.3	1.27	0.65	90.304	0.095	10.132	1.10	
		MS2N05								1.13	
63	25 x 5	MSM041B MS2N05	15 900	14.1	0.28	0.75	249.693	0.223	0.633	1.77	28.9
		MS2N04					103.693			1.28	
		MS2N06					249.693			1.97	
	25 x 10	MSM041B MS2N05	14 800	26.2	0.55	0.80	258.227	0.243	2.533	1.77	50.0
		MS2N04	10 700	18.9			112.227			1.28	
		MS2N06	14 800	26.2			258.227			1.97	
	25 x 25	MSM041B MS2N05	8 000	35.4	1.38	1.00	286.002	0.242	15.831	1.77	
		MS2N04	4 300	19.0			140.002			1.28	
		MS2N06	8 000	35.4			286.002			1.97	

EMC 	d_0 x P (mm)	for motor	Flange and coupling F_{max} [2] (N)	M_p [2] (Nm)	v_{max} [2] (m/s)	M_{Rs} (Nm)	$k_{J\ fix}$ [1]	$k_{J\ var}$ [1]	$k_{J\ m}$ [1]	m_{fc} (kg)	a_{max} (m/s^2)
80		MS2N05								2.29	
	32 x 5	MS2N06	21 600	19.1	0.25	1.20	302.538	0.607	0.633	2.49	17.9
		MS2N07								2.80	
		MS2N05								2.29	
	32 x 10	MS2N06	22 000	38.9	0.50	1.30	329.067	0.647	2.533	2.49	30.7
		MS2N07								2.80	
		MS2N05								2.29	
	32 x 20	MS2N06	15 000	53.1	1.00	1.40	355.503	0.665	10.132	2.49	
		MS2N07								2.80	50.0
		MS2N05								2.29	
	32 x 32	MS2N06	10 400	58.9	1.60	1.60	435.036	0.684	25.938	2.49	
		MS2N07								2.80	
100	40 x 5	MS2N06	29 000	25.7	0.18	2.40	686.160	1.568	0.633	3.77	12.2
		MS2N07								3.94	
	40 x 10	MS2N06	29 000	51.3	0.37	2.50	701.780	1.369	2.533	3.77	16.8
		MS2N07								3.94	
	40 x 20	MS2N06	29 000	102.6	0.73	2.60	759.478	1.408	10.132	3.77	33.0
		MS2N07								3.94	
	40 x 40	MS2N06	21 900	154.9	1.47	2.80	1 038,583	1.567	40.528	3.77	50.0
		MS2N07								3.94	
100XC	50 x 10	MS2N07	56 000	99.0	0.50	4.00	1 980,741	3.588	2.533	6.06	12.1
		MS2N10								7.45	
	50 x 20	MS2N07	50 000	176.8	1.00	5.00	2 084,852	3.519	10.132	6.06	22.0
		MS2N10								7.45	

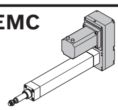
1) Constants for calculating the mass moment of inertia. For formulas, see chapter "Drive dimensioning"
2) Force or torque and speed can be limited by the motor

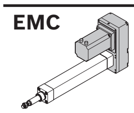
Mechanical efficiency η = 0.9 (for all sizes)

Note:
All data is given for the complete mechanical drive chain (EMC with coupling) at the reference point motor shaft.
F_{max} and v_{max} depend on the selected travel range (s_{max}) of the EMC. See the following tables.
Actual results depend on the selected motor-controller combination.
The motor torque might need to be limited.
For short product names, see chapter "Abbreviations".

Technical data

Drive data for motor attachment via belt side drive

EMC 	d_0 x P (mm)	i[1)]	for motor	Belt side drive F_{max}[3)] (N)	M_p[3)] (Nm)	v_{max}[3)] (m/s)	M_{Rs} (Nm)	$k_{J\ fix}$[2)]	$k_{J\ var}$[2)]	$k_{J\ m}$[2)]	m_{sd} (kg)	a_{max} (m/s²)
32			MSM019				0.22	14.2	0.012		0.55	
	12 x 5	1	MSM031B	680	0.6	0.57	0.31	45.6	0.012	0.633	0.95	
			MS2N03B					38.0			0.80	50.0
			MSM019				0.26	14.9			0.55	
	12 x 10	1	MSM031B	450	0.8	1.13	0.35	46.3	0.013	2.533	0.95	
			MS2N03B					38.7			0.80	
40			MSM031C	3 100	2.8		0.43	47.6			0.80	
		1	MS2N03B					43.5	0.032	0.633	0.75	
	16 x 5		MS2N04	3 400	3.0	0.38	0.68	247.7			1.70	
			MSM031C	3 100	1.9		0.34	15.4		0.281	0.75	
		1.5	MS2N03B					16.0	0.014		0.75	
			MS2N04	3 400	2.0		0.59	84.0		0.281	1.60	
			MSM031C	1 800	3.2		0.48	48.8			0.80	
		1	MS2N03B					44.7	0.033	2.533	0.75	
	16 x 10		MS2N04	2 200	4.0	0.77	0.73	248.9			1.70	50.0
			MSM031C	1 800	2.1		0.37	16.0			0.75	
		1.5	MS2N03B					16.3	0.015	1.126	0.75	
			MS2N04	2 200	2.7		0.62	84.5			1.60	
			MSM031C	1 100	3.2		0.55	52.1			0.80	
		1	MS2N03B					48.0	0.040	6.485	0.75	
	16 x 16		MS2N04	1 400	4.0	1.23	0.80	252.2			1.70	
			MSM031C	1 100	2.1		0.42	17.4			0.75	
		1.5	MS2N03B					17.7	0.018	2.882	0.75	
			MS2N04	1 400	2.7		0.67	86.0			1.60	
50			MSM031C					256.4			1.70	
		1	MSM041B	6 200	5.5	0.32	0.90	257.1	0.085	0.633	1.70	
			MS2N04					256.4			1.80	
	20 x 5		MS2N05	6 300	5.6		0.95	1,161.1	0.085	0.633	4.05	39.8
			MSM031C					89.0			1.60	
		1.5	MSM041B	6 200	3.7	0.32	0.73	91.1	0.038	0.281	1.60	
			MS2N04					89.0			1.55	
			MSM031C					259.7			1.70	
		1	MSM041B	4 300	7.7		0.95	260.3	0.088	2.533	1.70	
			MS2N04					259.7			1.80	
	20 x 10		MS2N05	4 400	7.9	0.63	1.00	1,164.4			4.05	
			MSM031C					90.4			1.60	
		1.5	MSM041B	4 300	5.1		0.77	92.6	0.039	1.126	1.60	
			MS2N04					90.4			1.55	50.0
			MSM031C					267.9			1.70	
		1	MSM041B	2 300	8.2		1.05	268.5	0.095	10.132	1.70	
			MS2N04					267.9			1.80	
	20 x 20		MS2N05	2 400	8.5	1.27	1.10	1,172.5			4.05	
			MSM031C					94.1			1.60	
		1.5	MSM041B	2 300	5.5		0.83	96.2	0.042	4.503	1.60	
			MS2N04					94.1			1.55	

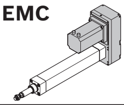
EMC 	d_0 x P (mm)	i[1]	for motor	Belt side drive F_{max}[3] (N)	M_p[3] (Nm)	v_{max}[3] (m/s)	M_{Rs} (Nm)	$k_{J\ fix}$[2]	$k_{J\ var}$[2]	$k_{J\ m}$[2]	m_{sd} (kg)	a_{max} (m/s^2)
63	25 x 5	1	MSM041B	15 900	14.1	0.28	1.20	1,081.2	0.223	0.633	4.2	28.9
			MS2N04					1,082.9			4.6	
			MS2N05				1.25	1,350.2			4.5	
			MS2N06					1,359.7			4.7	
		2	MSM041B	15 900	7.0		0.83	202.2	0.056	0.158	3.9	
			MS2N04					188.2			4.2	
			MS2N05				0.88	232.0			4.2	
	25 x 10	1	MSM041B	10 400	18.5	0.55	1.25	1,089.7	0.243	2.533	4.2	50.0
			MS2N04					1,091.5			4.6	
			MS2N05	11 400	20.2	0.55	1.30	1,358.7			4.5	
			MS2N06					1,368.2			4.7	
		2	MSM041B	10 400	9.3	0.55	0.85	204.3	0.061	0.633	3.9	
			MS2N04					190.4			4.2	
			MS2N05	11 400	10.1		0.90	234.1			4.2	
	25 x 25	1	MSM041B	4 200	18.6	1.38	1.45	1,117.5	0.242	15.831	4.2	
			MS2N04					1,119.2			4.6	
			MS2N05	5 200	23.1		1.50	1,386.5			4.5	
			MS2N06					1,396.0			4.7	
		2	MSM041B	4200	9.3		0.95	211.3	0.060	3.958	3.9	
			MS2N04					197.3			4.2	
			MS2N05	5200	11.6		1.00	241.0			4.2	
80	32 x 5	1	MS2N05	21600	19.1	0.25	1.70	1,469.0	0.607	0.633	4.3	17.9
			MS2N06				1.75	5,161.9			10.1	
			MS2N07								10.4	
		2	MS2N05		9.5		1.10	261.7	0.152	0.158	4.4	
			MS2N06				1.15	861.3			9.2	
	32 x 10	1	MS2N05	13 900	24.6	0.50	1.80	1,495.5	0.647	2.533	4.3	30.7
			MS2N06	18 400	32.6		1.85	5,188.4			10.1	
			MS2N07								10.4	
		2	MS2N05	13 900	12.3		1.15	268.3	0.162	0.633	4.4	
			MS2N06	18 400	16.3		1.20	867.9			9.2	
	32 x 20	1	MS2N05	6 900	24.6	1.00	1.90	1,521.9	0.665	10.132	4.3	50.0
			MS2N06	11 500	40.8		1.95	5,214.8			10.1	
			MS2N07								10.4	
		2	MS2N05	6 900	12.3		1.20	274.9	0.166	2.533	4.4	
			MS2N06	11 500	20.4		1.25	874.5		2.533	9.2	
	32 x 32	1	MS2N05	4 300	24.6	1.60	2.10	1,601.5	0.684	25.938	4.3	
			MS2N06	7 600	43.3		2.15	5,294.4			10.1	
			MS2N07				2.15	5,294.4			10.4	
		2	MS2N05	4 300	12.3		1.30	294.8	0.171	6.485	4.4	
			MS2N06	7 600	21.7		1.35	894.4			9.2	

1) Gear ratio of the belt side drive.
2) Constants for calculating the mass moment of inertia. For formulas, see chapter "Drive dimensioning"
3) Force or torque and speed can be limited by the motor

Please pay attention to the note at the end of the table

Drive data

Drive data for motor attachment via belt side drive

EMC	d_0 x P	i[1]	for motor	Belt side drive								
	(mm)			F_{max}[3] (N)	M_p[3] (Nm)	v_{max}[3] (m/s)	M_{Rs} (Nm)	$k_{J\ fix}$[2]	$k_{J\ var}$[2]	$k_{J\ m}$[2]	m_{sd} (kg)	a_{max} (m/s²)
100	40 x 5	1	MS2N06	29 000	25.6	0.18	2.95	5,466.6	1.568	0.633	10.2	12.2
			MS2N07				3.00	7,933.1			11.7	
		2	MS2N06		12.8		1.75	937.5	0.392	0.158	9.3	
			MS2N07				1.80	1,331.6			10.4	
	40 x 10	1	MS2N06	29 000	51.3	0.37	3.05	5,482.2	1.369	2.533	10.2	16.8
			MS2N07				3.10	7,948.7			11.7	
		2	MS2N06		25.6		1.80	941.4	0.342	0.633	9.3	
			MS2N07				1.85	1,335.5			10.4	
	40 x 20	1	MS2N06	19 200	68.1	0.73	3.15	5,539.9	1.408	10.132	10.2	33.0
			MS2N07	29 000	102.6		3.20	8,006.4			11.7	
		2	MS2N06	19 200	34.1		1.85	955.8	0.352	2.533	9.3	
			MS2N07	29 000	51.3		1.90	1,349.9		2.533	10.4	
	40 x 40	1	MS2N06	9 600	68.1	1.47	3.05	5,819.0	1.567	40.528	10.2	50.0
			MS2N07	15 000	106.4		3.10	8,285.5			11.7	
		2	MS2N06	9 600	34.1		1.80	1,025.6	0.392	10.132	9.3	
			MS2N07	15 000	53.2		1.85	1,419.7			10.4	
100XC	50 x 10	1	MS2N07	56 000	99.0	0.50	4.60	11,127.9	3.588	2.533	16.9	12.1
			MS2N10					10,690.7			17.7	
		1.5	MS2N07		66.0		3.27	3,897.4	1.595	1.126	16.0	
			MS2N10					3,626.9			16.9	
	50 x 20	1	MS2N07	37 400	132.4	1.00	5.60	11,232.0	3.519	10.132	16.9	22.0
			MS2N10					10,794.8			17.7	
		1.5	MS2N07		88.3		3.93	3,943.7	1.564	4.503	16.0	
			MS2N10					3,673.1			16.9	

[1] Gear ratio of the belt side drive.
[2] Constants for calculating the mass moment of inertia. For formulas, see chapter "Drive dimensioning"
[3] Force or torque and speed can be limited by the motor

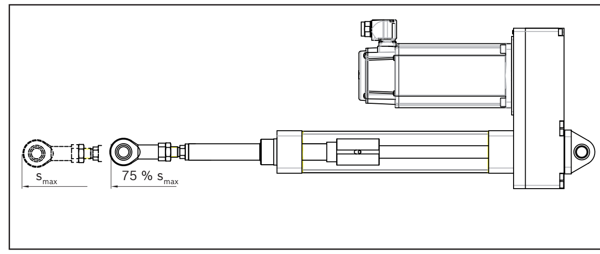
Mechanical efficiency η = 0.9 (for all sizes)

Note:
All data is given for the complete mechanical drive chain (EMC with belt side drive) at the motor shaft reference point.
F_{max} and v_{max} depend on the selected travel range (s_{max}) of the EMC. See the following tables.
Actual results depend on the selected motor-controller combination.
The motor torque might need to be limited.
For short product names, see chapter "Abbreviations".

Axial load on the cylinder mechanics

Note on special installation and usage example

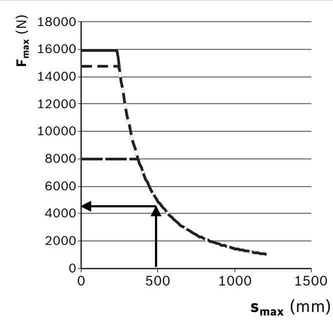
Installation case III



Note: In this installation case the cylinder mechanism of the EMC is loaded by its dead weight in a horizontal position.
Thus, the piston rod may be extended horizontally only up to 75% of s_{max}.

Application example:
Installation case III: Swivel clevis mount on the belt side drive, piston rod guided by means of rod end bearing or fork clevis.

Example for determining the permissible axial load on the cylinder mechanics



Pre-selection for the above installation case III as an application example:

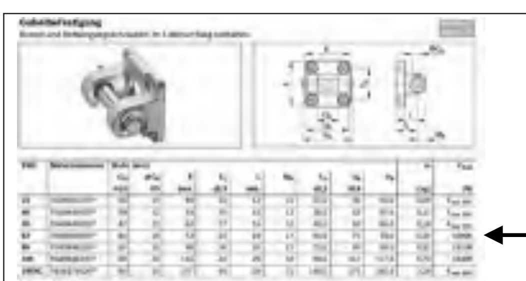
- EMC-063 with Rexroth ball screw assembly 25 x 10
- selected travel range s_{max} 500 mm
- with belt side drive i=1 for MS2N05
- fastening with clevis mount and swivel mount

Max. permissible axial load according for installation case in the diagram: approx. 4,200 N.

EMC	d_0 x P (mm)	i		F max (N)	
63	25 x 5	1	MSM041B	15 900	11.1
			MS2N04		
			MS2N05		
			MS2N06		
		2	MSM041B	15 900	7.0
			MS2N04		
			MS2N05		
	25 x 10	1	MSM041B	10 400	15.5
			MS2N04		
			MS2N05	11 400	23.2
			MS2N06		
		2	MSM041B	10 400	9.3
			MS2N04		
			MS2N05	11 400	16.1

F_{max} in table "Drive data" with motor attachment via belt side drive:
F_{max} = 11,400 N

The actual achievable axial force of the system also depends on the selected motor / controller combination
(see chapter "Drive dimensioning").

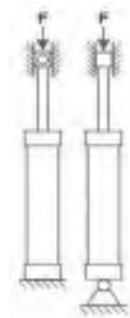
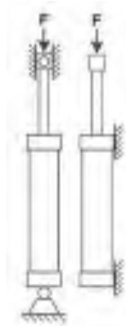
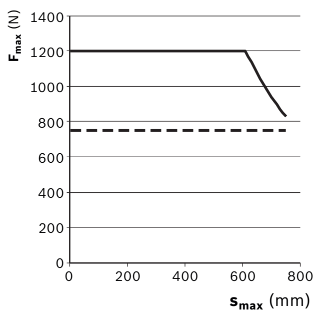
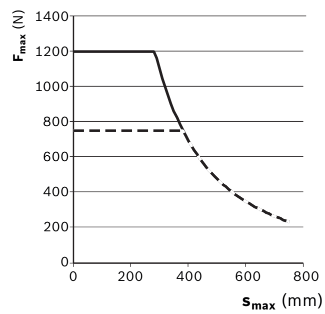
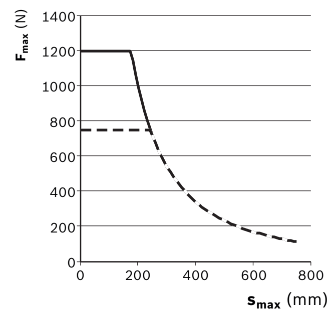
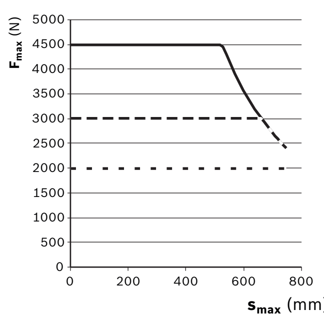
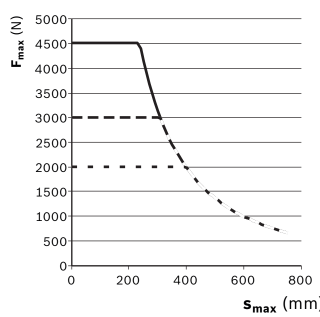
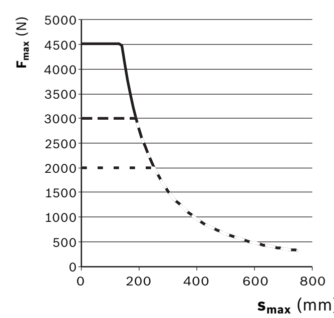
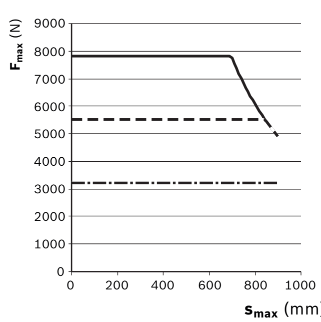
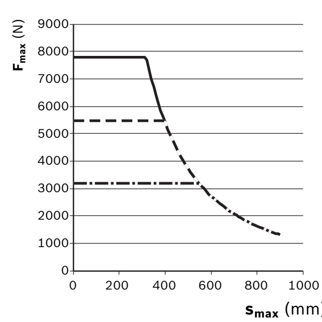
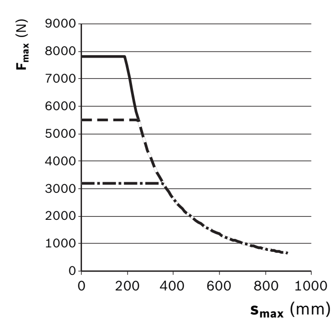
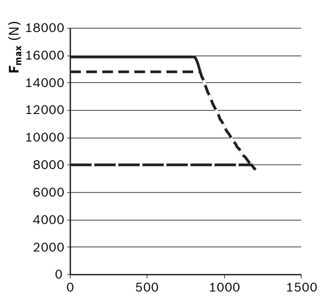
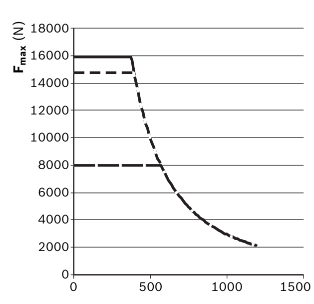
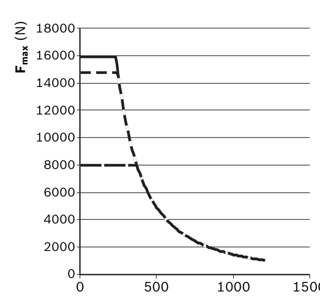


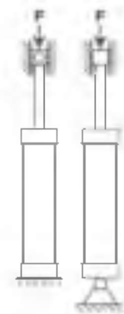
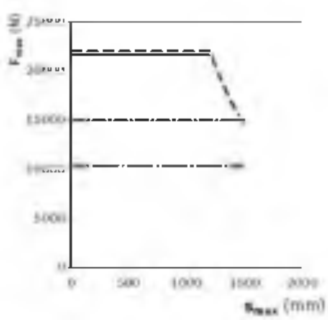
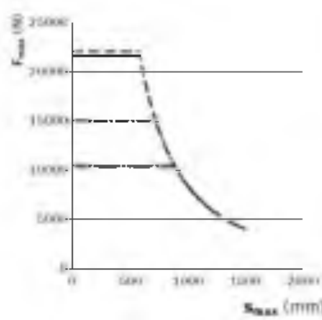
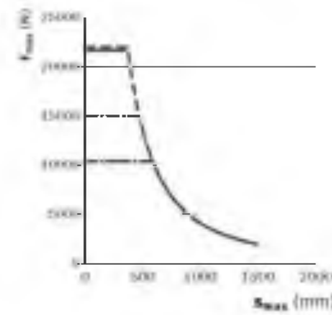
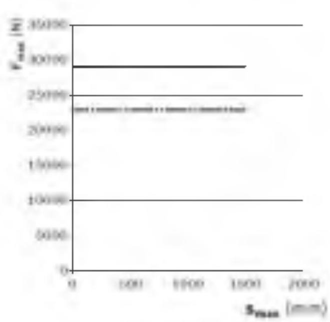
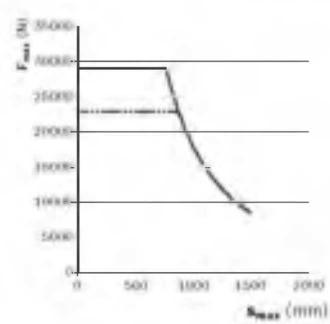
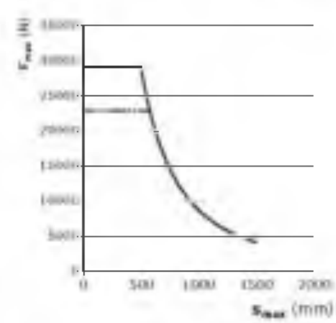
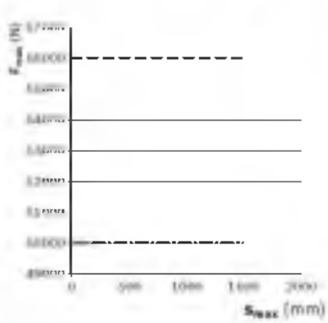
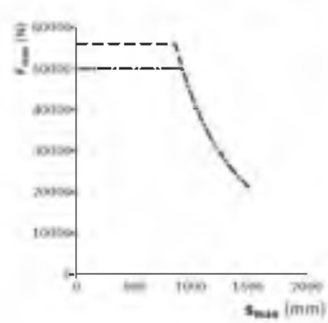
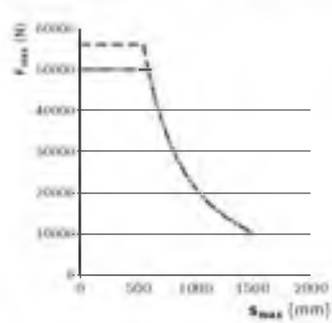
Note: Limitations caused by additional orderable fastening elements are not taken into account in the consideration of the drive chain.

The F_{max} for the size 63 clevis mount, for example, is 10,900 N.

For F_{max} the smallest value is 4,200 N.

Axial load on the cylinder mechanics

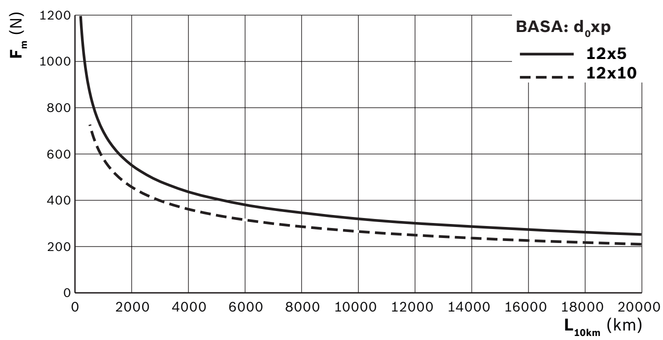
	Case I	Case II	Case III
	 only permissible vertically		
EMC-32 **d_0 x P** —— 12 x 5 - - - - 12 x 10			
EMC-40 **d_0 x P** —— 16 x 5 - - - - 16 x 10 · · · · · · 16 x 16			
EMC-50 **d_0 x P** —— 20 x 5 - - - - 20 x 10 -·-·-·- 20 x 20			
EMC-63 **d_0 x P** —— 25 x 5 - - - - 25 x 10 — — — 25 x 25			

	Case I	Case II	Case III
			
EMC-80 **d_0 x P** 32 x 5 32 x 10 32 x 20 32 x 32			
EMC-100 **d_0 x P** 40 x 5/40 x 10 40 x 20/40 x 40			
EMC-100XC **d_0 x P** 50 x 10 50 x 20			

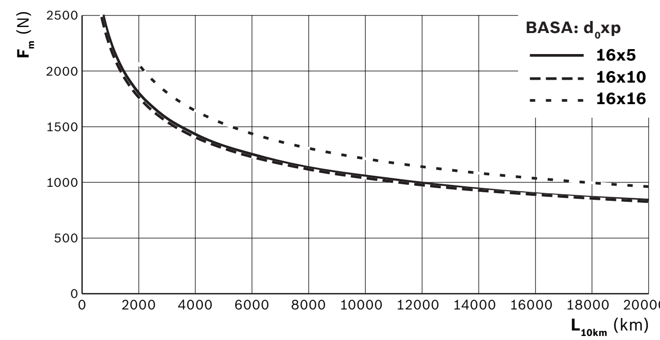
Piston rod in swivel bearings	Piston rod linear-guided	Piston rod free	Fastener swiveling	Fastener fixed
				

Service life

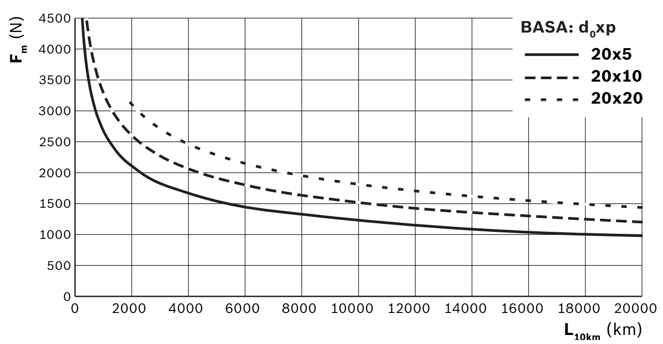
EMC-32



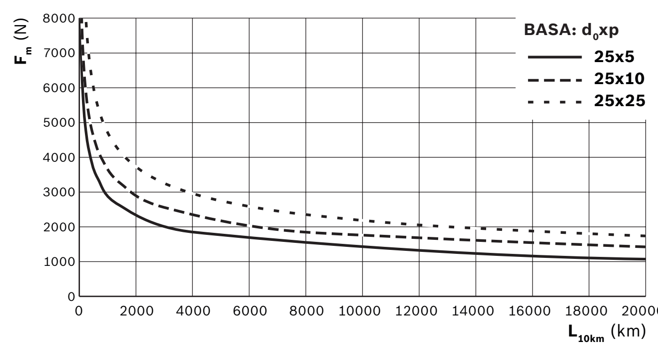
EMC-40



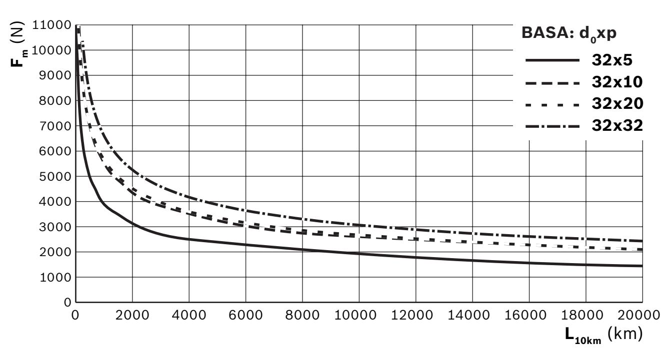
EMC-50



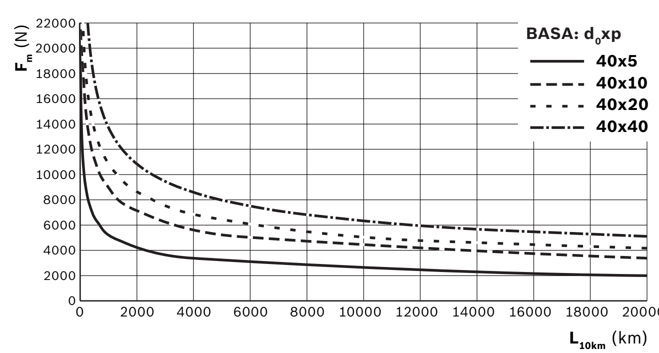
EMC-63



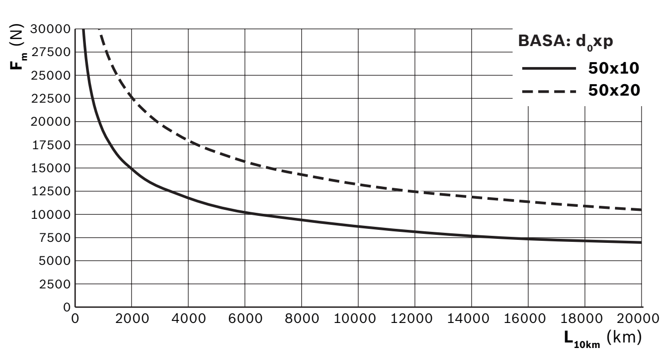
EMC-80



EMC-100



EMC-100XC

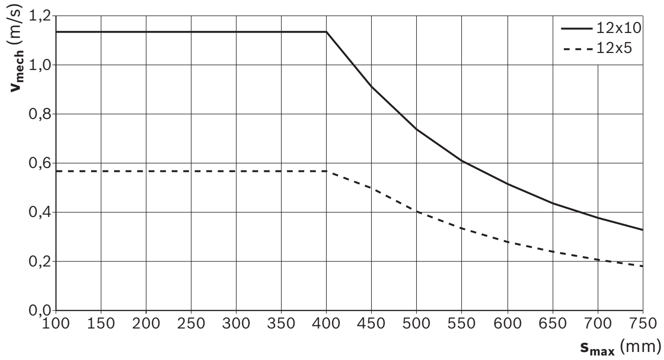


The stated values comply with the specified relubrication intervals (see chapter "Service and information").
For calculation of the equivalent dynamic axial load F_m see chapter "Calculation principles".

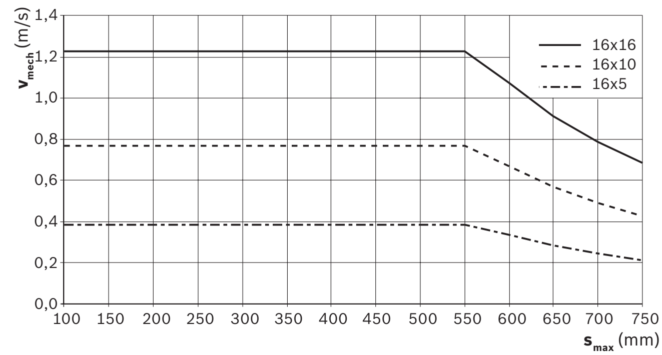
F_m = Equivalent dynamic axial load (N)
$L_{10\,km}$ = Nominal service life (km)

Permissible speeds

EMC-32



EMC-40



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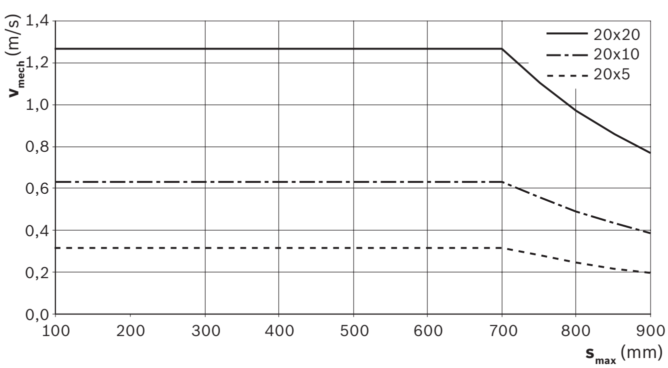
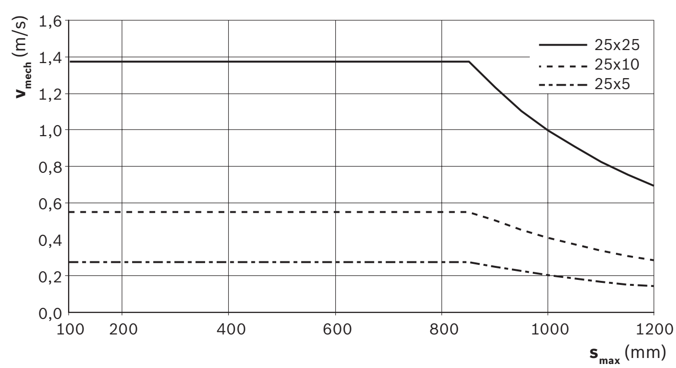
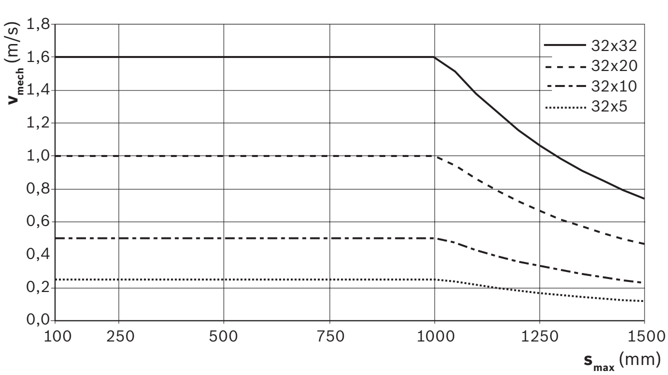


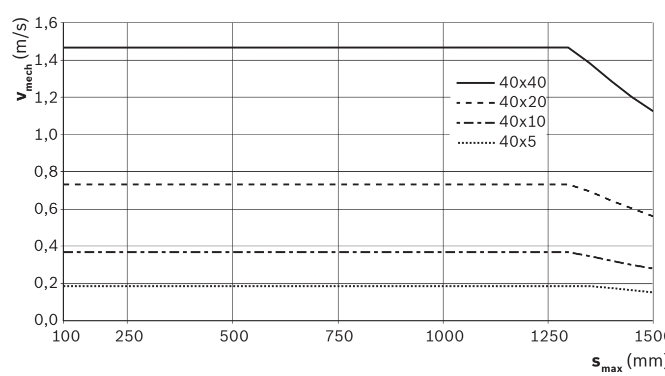
EMC-63



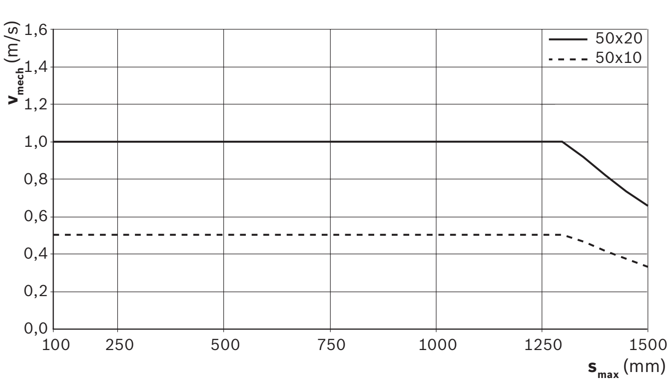
EMC-80



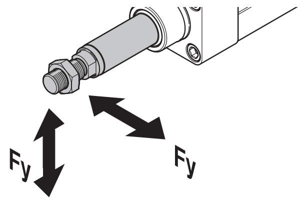
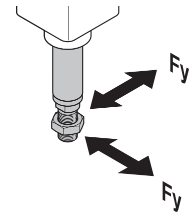
EMC-100



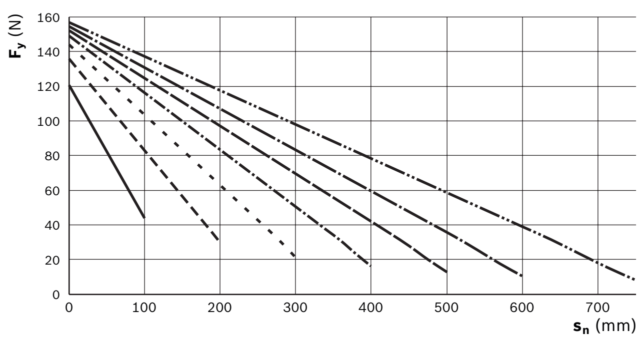
EMC-100XC

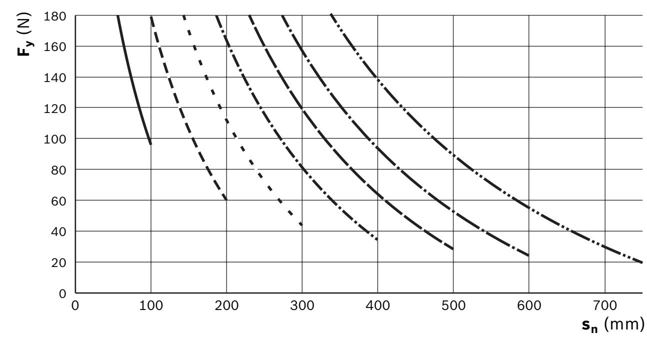


Load on the piston rod

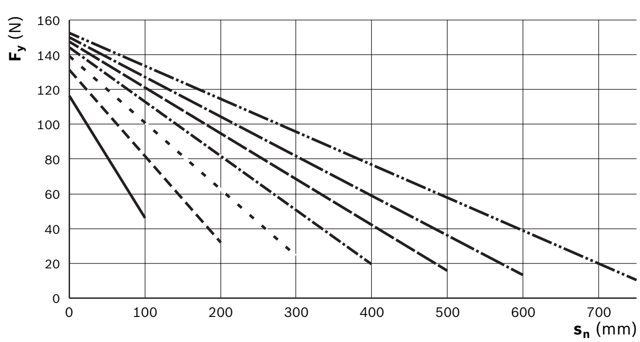
Horizontal mounting	Vertical mounting
	

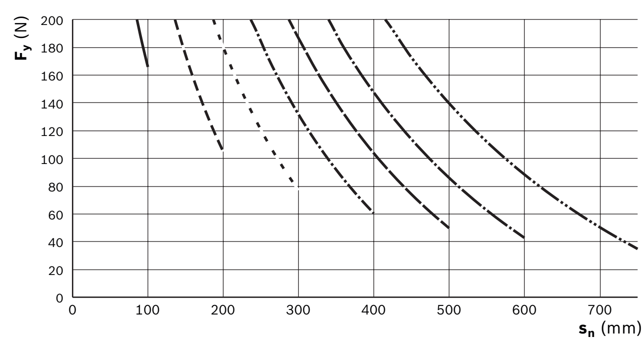
EMC-32



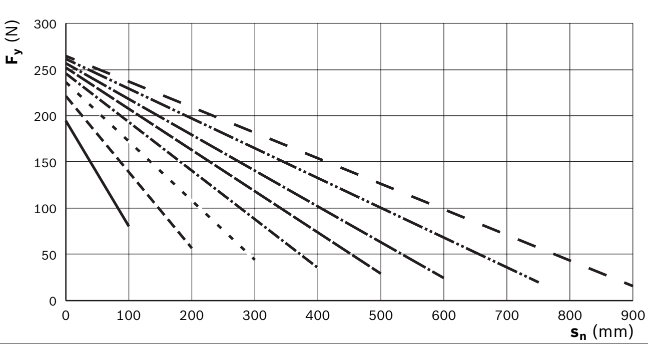


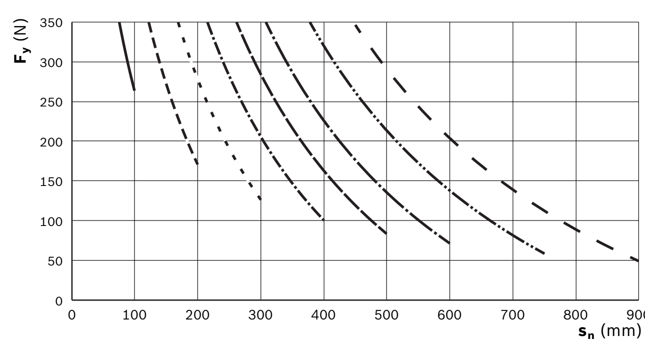
EMC-40



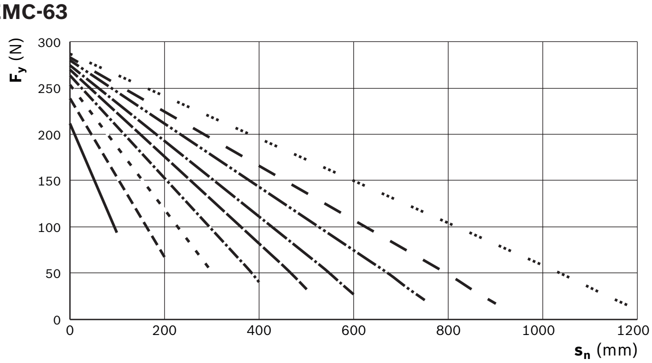


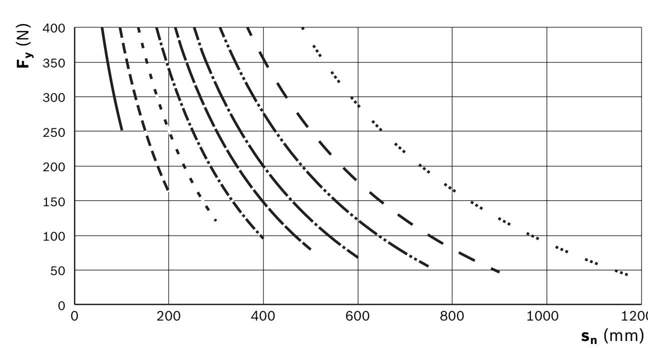
EMC-50

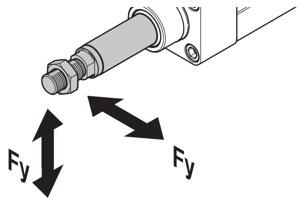
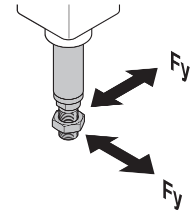




EMC-63





Horizontal mounting	**Vertical mounting**
	

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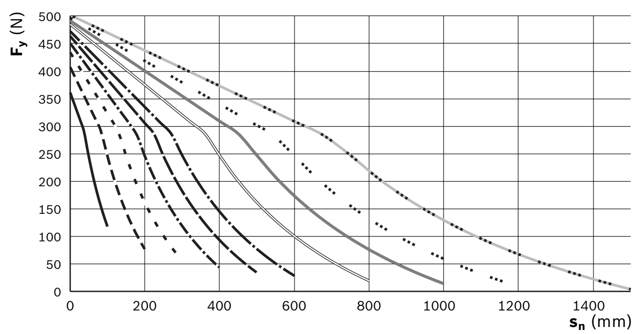
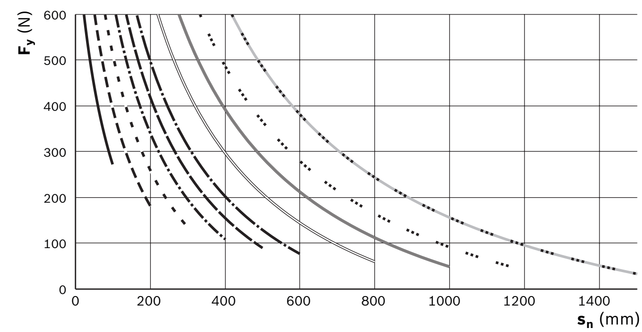
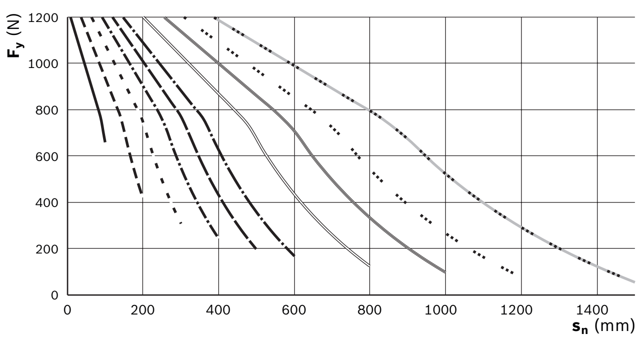
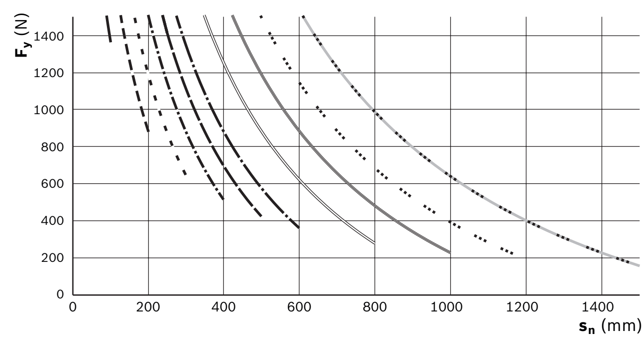


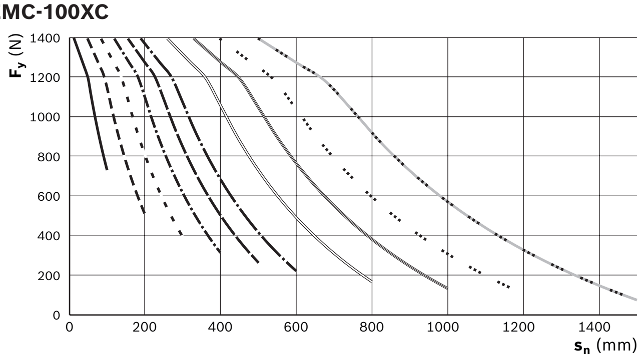


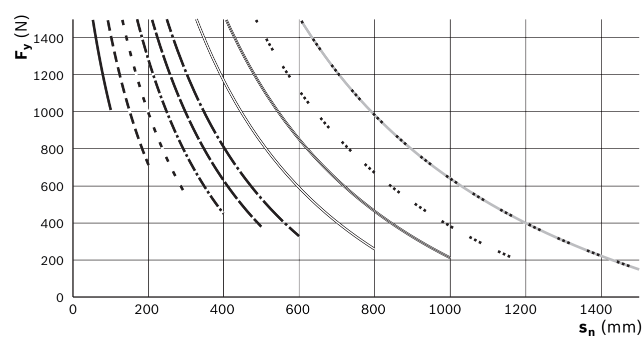
EMC-100





EMC-100XC





Characteristic curves for s_{max}

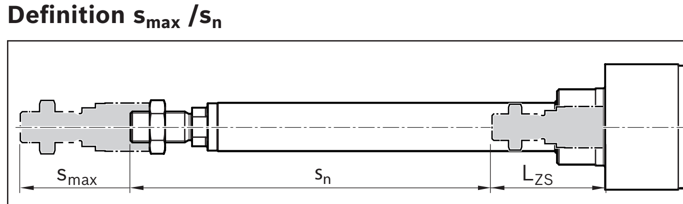
100 mm	750 mm
200 mm	800 mm
300 mm	900 mm
400 mm	1000 mm
500 mm	1200 mm
600 mm	1500 mm

F_y	=	Lateral force	(N)
s_n	=	Position of the piston rod	(mm)
s_{max}	=	Maximum travel range	(mm)
L_{ZS}	=	Position of the piston rod retracted	(mm)

Diagrams are valid for:

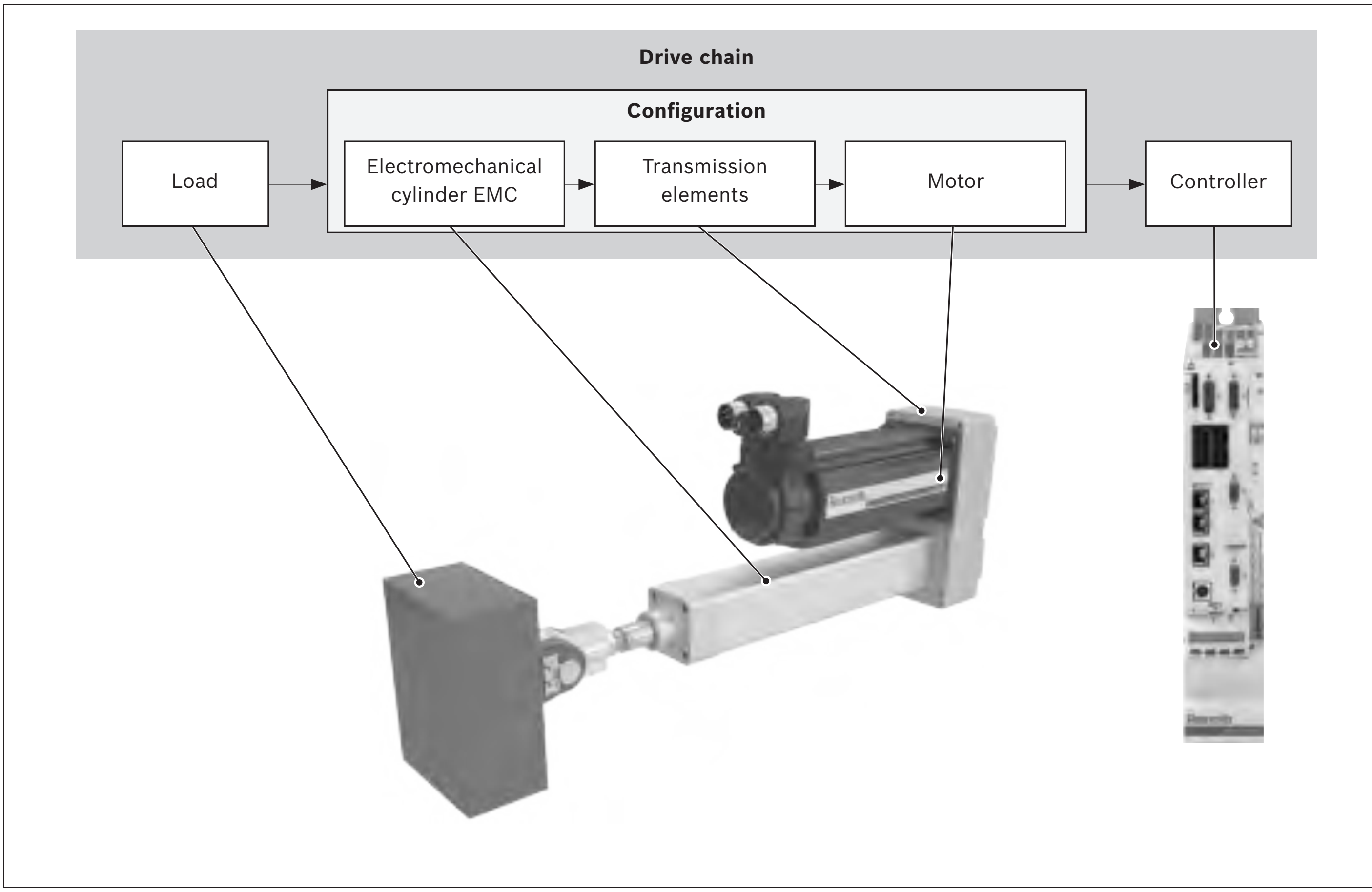
- 25% of F_{max}
- a speed of 0.5 m/s

Definition s_{max} /s_n



Calculation principles

Drive chain

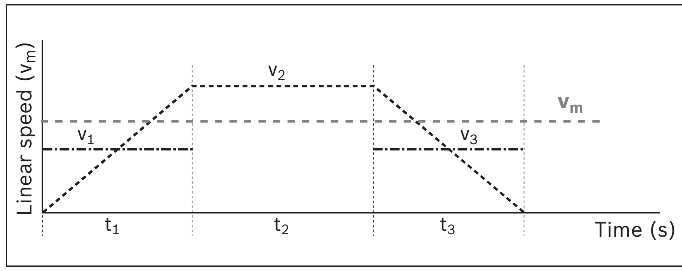


The correct dimensioning and assessment of an application requires structured consideration of the entire drive chain. The basic element of the drive chain is the configuration – comprising the electromechanical cylinder EMC, the transmission element (coupling or belt side drive) and the motor, which can be ordered in this constellation as per the catalog.

Maximum permissible loads
When selecting electromechanical cylinders EMC, maximum limits for permissible loads and forces must be taken into account. These limits can be found in chapter "Product description and technical data".
The values in this chapter are system-based, i.e. the limits are based not only on the load rating of the bearings, but also on design/material limits.

Mechanical calculation

Service life of electromechanical cylinder EMC
Where the operating conditions vary (fluctuating linear speed and load), the service life must be calculated using the average values for F_m and v_m.

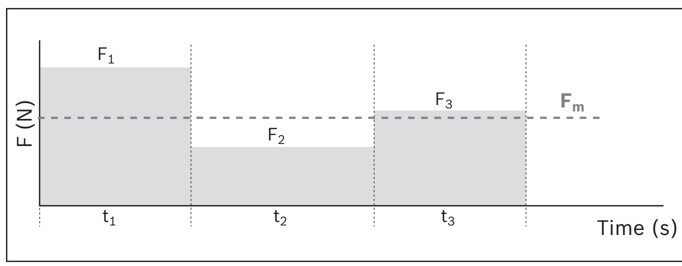


When the linear speed varies, the average speed v_m is calculated as follows:

$$v_m = \frac{1}{t_{ges}} \cdot (\,|v_1| \cdot t_1 + |v_2| \cdot t_2 + \dots + |v_n| \cdot t_n\,)$$

$$t_{ges} = t_1 + t_2 + \dots + t_n$$

When both the load and the rotary speed vary, the average load F_m is calculated as follows:



$$F_m = \sqrt[3]{|F_1|^3 \cdot \frac{|v_1|}{v_m} \cdot \frac{t_1}{t_{ges}} + |F_2|^3 \cdot \frac{|v_2|}{v_m} \cdot \frac{t_2}{t_{ges}} + \dots + |F_n|^3 \cdot \frac{|v_n|}{v_m} \cdot \frac{t_n}{t_{ges}}}$$

Nominal service life

– in revolutions L

$$L = \left(\frac{C}{F_m}\right)^3 \cdot 10^6$$

– in hours L_h

$$L_h = \frac{L}{n_m \cdot 60}$$

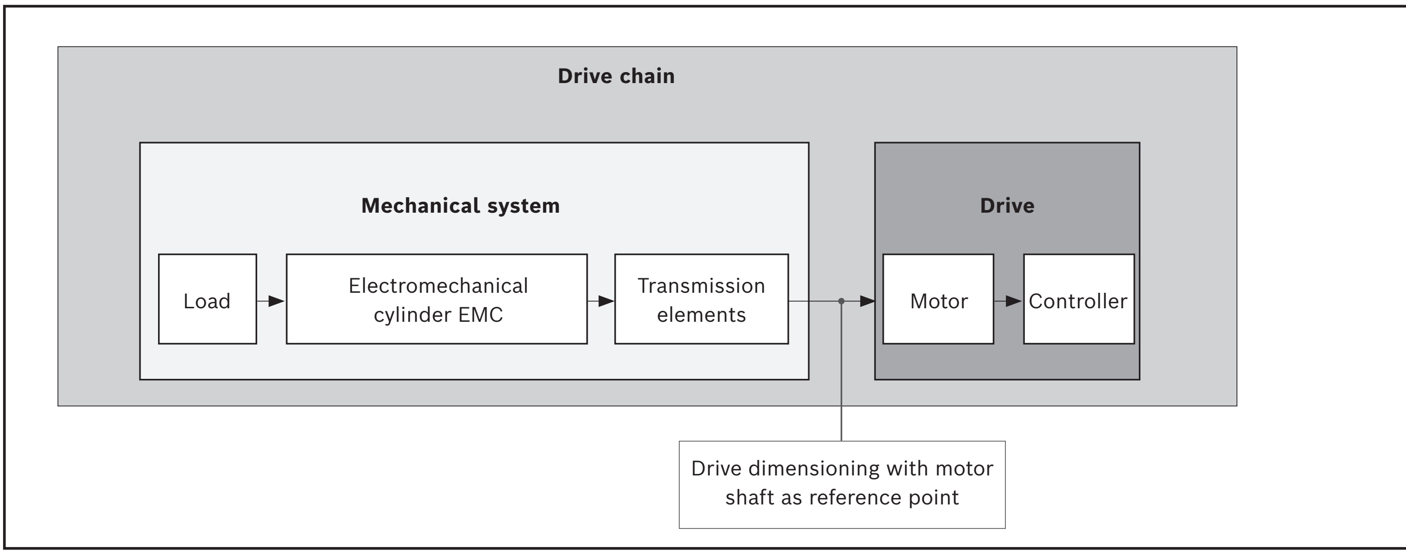
Drive torque M:

$$M = \frac{F \cdot P}{2{,}000 \cdot \pi \cdot \eta}$$

Drive dimensioning

Basic principles

For drive dimensioning, the drive chain can be divided into the **mechanical system** and **drive system**.
The **mechanical system** includes the physical components – electromechanical cylinder EMC (including gear unit transmission element) – and the load to be carried.
The electric **drive** is a motor-controller combination with corresponding performance data.
The dimensioning of the electric drive is done taking the motor shaft as a reference point.
For drive dimensioning, limits must be taken into account as well as base values. The limits must not be exceeded in order to avoid damaging the mechanical components.



Technical data and formula symbols for the mechanical system

The relevant data for flange / coupling or belt side drive is already included in the specifications for the electromechanical cylinder EMC. In other words, the corresponding maximum permissible limits for drive torque and speed, as well as the underlying friction torque and mass moment of inertia with respect to the motor shaft are reduced, and can be taken directly from the tables (see "Drive data").
The following technical data with the associated symbols are used when considering the basic mechanical system requirements in the design calculations for drive dimensioning. The data listed in the table below can be found in chapter "Technical Data" or is determined using formulas based on the descriptions on the following pages.

		Mechanical system	
		Load	**EMC**
Weight moment	(Nm)	M_g[4]	–
Equivalent dynamic torque	(Nm)	M_m[1]	–
Friction torque	(Nm)	–	M_{Rs}[3]
Mass moment of inertia	(kgm²)	J_t[1]	J_s[2]
Max. permissible travel speed	(m/s)	–	v_{max}[3]
Max. permissible rotary speed	(min⁻¹)		n_P [3]
Max. permissible drive torque	(Nm)	–	M_p[3], M_{pl}[1]

1) Determine the value using the appropriate formula
2) Length-dependent value, determined using the appropriate formula
3) Use the value from the table
4) For vertical installation position: Determine the value using the appropriate formula

Drive dimensioning with motor shaft as reference point

When dimensioning the drive, all relevant design calculation values for the mechanical components in the drive chain have to be determined and be expressed/reduced to the motor shaft. In other words, for a combination of mechanical components within the drive chain, this will result in one value for each of the following:

- Friction torque M_R
- Mass moment of inertia J_{ex}
- Max. permissible speed v_{mech} (maximum permissible rotary speed n_{mech})
- Max. permissible drive torque M_{mech}

Determination of the values for each mechanical component in the drive chain based on the motor shaft as a reference point

Friction torque M_R

With the value for friction torque of the EMC, friction is already reduced to the motor shaft.

$$M_R = M_{Rs}$$

Mass moment of inertia J_{ex}

The constants $k_{J\,fix}$, $k_{J\,var}$ and $k_{J\,m}$ used in the formulas already contain the mass moment of inertia and gear ratios for any incorporated transmission elements, and can therefore be taken from the "Drive data" table.

$$J_{ex} = J_s + J_t$$

Determining the mass moment of inertia of the EMC component (including transmission elements, if used)

$$J_s = (k_{J\,fix} + k_{J\,var} \cdot s_{max}) \cdot 10^{-6}$$

Determination of the translative mass moment of inertia of the external load (reduced to motor shaft)

$$J_t = m_{ex} \cdot k_{J\,m} \cdot 10^{-6}$$

Maximum permissible speed and maximum permissible rotary speed

The value for the maximum permissible speed of the EMC already includes the permissible rotary speed for any incorporated transmission elements.

Maximum permissible speed v_{mech}

$$v_{mech} = v_{max}$$

Maximum permissible rotary speed n_{mech}

$$n_{mech} = n_p$$

When considering the complete drive chain (mechanical system + motor/controller) the rotary speed of the motor can lie below the maximum value for the mechanical system (M_{mech}) and thus limit the maximum permissible rotary speed of the overall drive chain.

Drive dimensioning

Maximum permissible drive torque M_p, M_{mech}

The lower value of the permissible drive torque of all mechanical components contained in the drive chain (M_p) and allowable axial load from the user-defined installation case determines the maximum permissible drive torque of the mechanical system which needs to be taken into account as a limitation in the drive dimensioning.
The smaller value from the drive data table or that calculated from the F_{max} value from the permissible axial load on the cylinder mechanism diagram is valid.

$$M_{pl} = \frac{F_{max} \cdot P}{2{,}000 \cdot \pi \cdot \eta}$$

$$M_{mech} = \text{Minimum}\ (M_{p;}\ M_{pl})$$

When considering the complete drive chain (mechanical system + motor/controller) the maximum torque of the motor can lie below the maximum value for the mechanical system (M_{mech}) and thus limit the maximum permissible drive torque of the overall drive chain.
If the maximum torque of the motor lies above the upper limit for the mechanical system (M_{mech}), the maximum motor torque must be limited to the permissible value for the mechanical system.

Pre-selecting the motor

The motor can be generally preselected using the following conditions.

Condition 1:

The rotary speed of the motor must be greater than or equal to the rotary speed required for the mechanical system (but not exceeding the maximum permissible limit value).

$$n_{max} \geq n_{mech}$$

Condition 2:

Consideration of the ratio of mass moments of inertia of the mechanical system and the motor. The ratio of the mass moments of inertia serves as an indicator for the control performance of a motor-controller combination.
The mass moment of inertia of the motor is directly related to the motor size.

Mass moment of inertia ratio

$$V = \frac{J_{ex}}{J_m + J_{br}}$$

For preselection, experience has shown that the following ratios will result in high control performance.
These are not rigid limits, but values exceeding them will require closer consideration of the specific application.

Application area	V
Handling	≤ 6.0
Machining	≤ 1.5

Condition 3:
Estimation of the ratio of the static load moment to the continuous torque of the motor. The torque ratio must be less than or equal to an empirical value of 0.6. This condition roughly factors in the missing dynamic characteristics of an exact motion profile with the required motor torques.

Torque ratio:

$$\frac{M_{stat}}{M_0} \leq 0.6$$

Static load moment:

$$M_{stat} = M_R + M_g + M_m$$

Weight moment:
For vertical installation position only!
For motor attachment via flange and coupling: i = 1

$$M_g = \frac{P \cdot (m_{ex} + m_{ca}) \cdot g}{2\,000 \cdot \pi \cdot i \cdot \eta}$$

Equivalent dynamic torque:

$$M_m = \frac{F_m \cdot P}{2\,000 \cdot \pi \cdot i \cdot \eta}$$

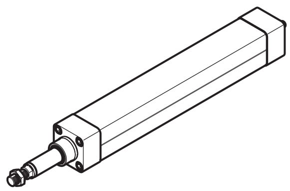
The equivalent dynamic torque can be calculated approximately via the average load F_m.
The appropriate mechanical efficiency must be used depending on the drive element BASA.

In chapter "Configuration and ordering", users can put together standard configurations including gear reducer and motor, for the various EMC sizes by selecting the appropriate options. By checking the three conditions stated above, it is possible to see whether a standard motor selected in a particular configuration will generally be of a suitable size for the specific application.

Precise drive dimensioning

Preselecting the motor according to this rough guide is no substitute for the required precise design calculations for the drive, taking all moments/torques and rotary speed levels into account. For precise calculation of the electric drive, including consideration of the specific motion profile, please refer to the performance data in the catalog "Rexroth drive technology". When dimensioning the drive, the maximum permissible values for speed, drive torque and acceleration must not be exceeded, in order to avoid damaging the mechanical system!

EMC 32 – EMC 50

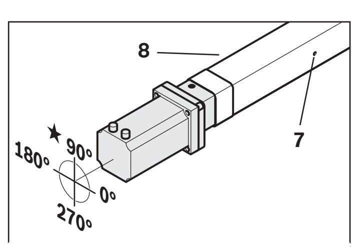


Size short product name	Max. travel range mm	Housing: Standard	Housing: IP65 enclosure protection class	Housing: IP65 enclosure protection class +R	Drive: BASA d_0 x P (mm)	Drive	Lubrication[1]: LSS	LCF	LPG	LHG	LFL[9]	Switch[6]: without switch and sensor profile	Sensor profile	Switches 1, 2, 3, 4		Version	
EMC-032-NN-2		01	02	03	12 x 5	01	01	02	03	04	05	00	80	PNP NC contact	120	OF01	without motor attachment
																MF01	with flange
					12 x 10	02										RV01 RV02 RV03	with belt side drive
EMC-040-NN-2					16 x 5	01								NPN NC contact	121	OF01	without motor attachment
																MF01	with flange
					16 x 10	02										RV01 RV02 RV03	with belt side drive
					16 x 16	03											
EMC-050-NN-2					20 x 5	01								PNP NO contact	122	OF01	without motor attachment
																MF01	with flange
					20 x 10	02								NPN NO contact	123	RV01 RV02 RV03	with belt side drive
					20 x 20	04											

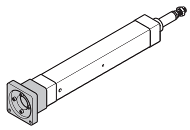
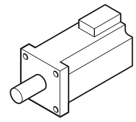
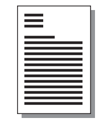
1) LSS: Standard lubrication; LCF: prepared for central lubrication system for fluid grease; LPG: preserved version; LHG: initial lubrication with NSF-H1 grease; LFL: lifelong lubrication:
2) Attachment kit also available without motor (when ordering: enter "00" for motor); for motor attachment kit for customer motor see chapter "Motor attachment".
3) For motor types see chapter "IndraDyn S - servo motors"
4) Measurement of frictional torque
5) Lead deviation
6) Sensor profile and switch not possible in combination with version RV03
7) Lube connection for LSS, LCF, LPG, LHG; for LFL lubrication: Housing without lube connection
8) Slot for sensor profile
9) Application conditions, see page 5

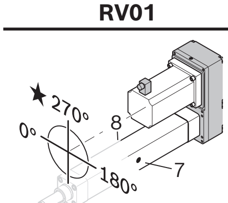
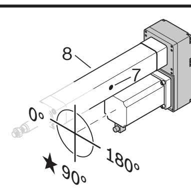
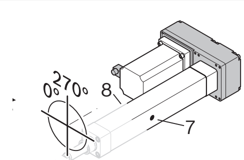
Flange (F)	Motor connector position 0°	90°	180°	270°
MF01	000	090 ★	180	270

★ standard delivery



Example:
Flange MF01
Motor connector position 90°

Motor attachment		Motor						Documentation		
										
		Motor code[3]	Cables							
			2 cables, Brake		1 cable, Brake		Motor connector position			
Gear ratio	Attachment kit[2]		without	with	without	with		Standard report	Measurement reports	
	00	without		00						
	01	MSM019B-0300	134	135	–					
	02	MSM031B-0300	136	137	–					
	03	MS2N03-B0BYN	201	202	203	204	000			
i = 1	41	MSM019B-0300	134	135	–					
	42	MSM031B-0300	136	137	–					
	43	MS2N03-B0BYN	201	202	203	204				
	00	without		00						
	05	MSM031C-0300	138	139	–					
	06	MS2N03-B0BYN	201	202	203	204				
	200	MS2N03-D0BYN	205	206	207	208				
	07	MS2N04-B0BTN	209	210	211	212	090			
i = 1	45	MSM031C-0300	138	139	–					
	46	MS2N03-B0BYN	201	202	203	204				
	47	MS2N04-B0BTN	209	210	211	212				
		MS2N04-C0BTN	213	214	215	216				
i = 1.5	49	MSM031C-0300	138	139	–			01	02[4]	03[5]
	50	MS2N03-B0BYN	201	202	203	204				
	51	MS2N04-B0BTN	209	210	211	212				
	00	without		00			180			
	09	MSM031C-0300	138	139	–					
	10	MSM041B-0300	140	141	–					
	11	MS2N04-B0BTN	209	210	211	212				
		MS2N04-C0BTN	213	214	215	216				
	12	MS2N05-B0BTN	221	222	223	224				
i = 1	53	MSM031C-0300	138	139	–					
	54	MSM041B-0300	140	141	–					
	55	MS2N04-C0BTN	213	214	215	216	270			
	56	MS2N05-C0BTN	225	226	227	228				
i = 1.5	58	MSM031C-0300	138	139	–					
	59	MSM041B-0300	140	141	–					
	60	MS2N04-B0BTN	209	210	211	212				

RV01	RV02	RV03
		

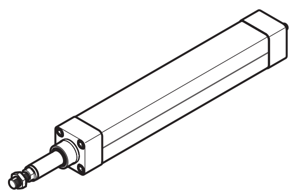
Example:
Belt side drive RV02
Motor connector position 90°

Belt side drive	Motor connector position			
	0°	**90°**	**180°**	**270°**
RV01	000	–	180	270 ★
RV02	000	090 ★	180	–
RV03	000 ★	090	–	270

★ standard delivery

Explanation of the order parameters and ordering example
➠ Chapter "Ordering example".

EMC 63 – EMC 80

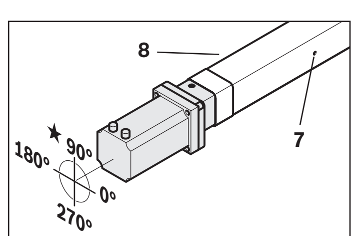


Size short product name	Max. travel range mm	Housing: Standard	Housing: IP65 enclosure protection class	Housing: IP65 enclosure protection class +R	Drive: BASA d_0 x P (mm)	Drive	Lubrication[1]: LSS	LCF	LPG	LHG	LFL[9]	Switch[6]: without switch and sensor profile	Sensor profile	Switches 1, 2, 3, 4		Version	
EMC-063-NN-2					25 x 5	01								PNP NC contact	120	OF01	without motor attachment
																MF01	with flange
					25 x 10	02										RV01 RV02 RV03	with belt side drive
					25 x 25	05								NPN NC contact	121		
EMC-080-NN-2		01	02	03	32 x 5	01	01	02	03	04	05	00	80			OF01	without motor attachment
														PNP NO contact	122	MF01	with flange
					32 x 10	02											
					32 x 20	04										RV01 RV02 RV03	with belt side drive
					32 x 32	06								NPN NO contact	123		

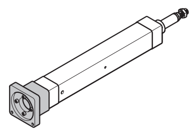
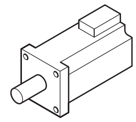
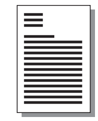
1) LSS: Standard lubrication; LCF: prepared for central lubrication system for fluid grease; LPG: preserved version; LHG: initial lubrication with NSF-H1 grease; LFL: lifelong lubrication:
2) Attachment kit also available without motor (when ordering: enter "00" for motor); for motor attachment kit for customer motor see chapter "Motor attachment".
3) For motor types see chapter "IndraDyn S - servo motors"
4) Measurement of frictional torque
5) Lead deviation
6) Sensor profile and switch not possible in combination with version RV03
7) Lube connection for LSS, LCF, LPG, LHG; for LFL lubrication: Housing without lube connection
8) Slot for sensor profile
9) Application conditions must be observed, see page 5

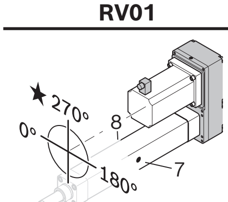
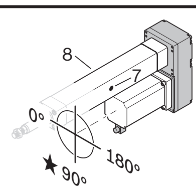
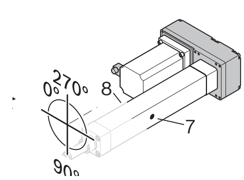
Flange (F)	Motor connector position			
	0°	90°	180°	270°
MF01	000	090 ★	180	270

★ standard delivery



Example:
Flange MF01
Motor connector position 90°

	Motor attachment		**Motor**						**Documentation**		
											
			Motor code[3]	Cables				Motor connector position			
				2 cables Brake		1 cable Brake					
	Gear ratio	Attachment kit[2]		without	with	without	with		Standard report	Measurement reports	
		00	without	00				00	01	02[4]	03[5]
		14	MSM041B-0300	140	141	–					
		15	MS2N04-D0BQN	217	218	219	220				
		16	MS2N05-D0BRN	229	230	231	232				
		17	MS2N06-C0BTN	237	238	239	240				
			MS2N06-D0BRN	241	242	243	244				
	i = 1	62	MSM041B-0300	140	141	–		090			
		63	MS2N04-D0BQN	217	218	219	220				
		64	MS2N05-D0BRN	229	230	231	232				
		65	MS2N06-C0BTN	237	238	239	240				
			MS2N06-D1BNN	245	246	247	248				
	i = 2	67	MSM041B-0300	140	141	–					
		68	MS2N04-C0BTN	213	214	215	216				
		69	MS2N05-B0BTN	221	222	223	224				
		00	without	00				180			
		19	MS2N05-D0BRN	229	230	231	232				
		20	MS2N06-C0BTN	237	238	239	240				
			MS2N06-D0BRN	241	242	243	244				
			MS2N06-E0BRN	249	250	251	252				
		201	MS2N07-C0BQN	257	258	259	260				
			MS2N07-D0BRN	265	266	–					
	i = 1	71	MS2N05-D0BRN	229	230	231	232	270			
		72	MS2N06-D1BNN	245	246	247	248				
		202	MS2N07-B1BNN	253	254	255	256				
			MS2N07-C1BRN	261	262	263	264				
	i = 2	75	MS2N05-B0BTN	221	222	223	224				
			MS2N05-C0BTN	225	226	227	228				
		76	MS2N06-C0BTN	237	238	239	240				
			MS2N06-D0BRN	241	242	243	244				

RV01	**RV02**	**RV03**
		

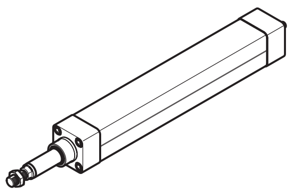
Example:
Belt side drive RV02
Motor connector position 90°

Belt side drive	**Motor connector position**			
	0°	**90°**	**180°**	**270°**
RV01	000	–	180	270 ★
RV02	000	090 ★	180	–
RV03	000 ★	090	–	270

★ standard delivery

Explanation of the order parameters and ordering example
➠ **Chapter "Ordering example".**

EMC 100 – EMC 100XC

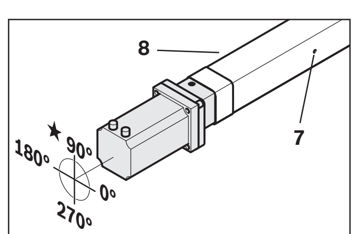


Size short product name	Max. travel range mm	Housing: Standard	Housing: IP65 enclosure protection class	Housing: IP65 enclosure protection class +R	Drive: BASA d_0 x P (mm)	Drive	Lubrication[1)]: LSS	LCF	LPG	LHG	LFL[9)]	Switch[6)]: without switch and sensor profile	Sensor profile	Switches 1, 2, 3, 4		Version	
EMC-100-NN-2		01	02	03	40 x 5	01	01	02	03	04	05	00	80	PNP NC contact	120	OF01	without motor attachment
					40 x 10	02								NPN NC contact	121	MF01	with flange
					40 x 20	04								PNP NO contact	122	RV01 RV02 RV03	with belt side drive
					40 x 40	07								NPN NO contact	123		
EMC-100-XC-2					50 x 10	02										OF01	without motor attachment
					50 x 20	04										MF01	with flange
																RV01 RV02 RV03	with belt side drive

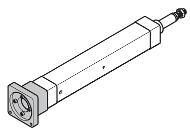
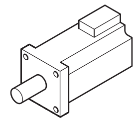
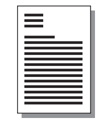
1) LSS: Standard lubrication; LCF: prepared for central lubrication system for fluid grease; LPG: preserved version; LHG: initial lubrication with NSF-H1 grease; LFL: lifelong lubrication:
2) Attachment kit also available without motor (when ordering: enter "00" for motor); for motor attachment kit for customer motor see chapter "Motor attachment".
3) For motor types see chapter "IndraDyn S - servo motors"
4) Measurement of frictional torque
5) Lead deviation
6) Sensor profile and switch not possible in combination with version RV03
7) Lube connection for LSS, LCF, LPG, LHG; for LFL lubrication: Housing without lube connection
8) Slot for sensor profile
9) Application conditions must be observed, see page 5

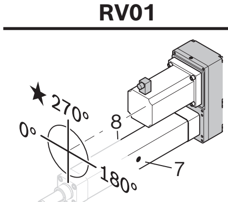
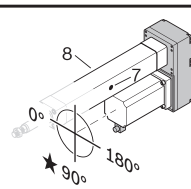
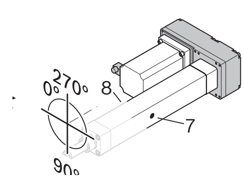
Flange (F)	Motor connector position 0°	90°	180°	270°
MF01	000	090 ★	180	270

★ standard delivery



Example:
Flange MF01
Motor connector position 90°

Motor attachment		Motor						Documentation		
										
		Motor code[3]	Cables 2 cables		1 cable		Motor connector position			
Gear ratio	Attachment kit[2]		without brake	with brake	without brake	with brake		Standard report	Measurement reports	
	00	without	00							
	23	MS2N06-D0BRN	241	242	243	244				
		MS2N06-E0BRN	249	250	251	252	00			
	24	MS2N07-C0BQN	257	258	259	260				
		MS2N07-D0BRN	265	266	–					
		MS2N07-E0BQN	271	272						
i = 1	203	MS2N06-D1BNN	245	246	247	248				
	79	MS2N07-C1BRN	261	262	263	264				
		MS2N07-D0BRN	265	266	–					
		MS2N07-E0BQN	271	272			090			
i = 2	204	MS2N06-C0BTN	237	238	239	240				
		MS2N06-D0BRN	241	242	243	244				
		MS2N06-E0BRN	249	250	251	252				
	205	MS2N07-B1BNN	253	254	255	256		01	02[4]	03[5]
		MS2N07-C0BQN	257	258	259	260				
		MS2N07-D0BRN	265	266	–					
	00	without	00				180			
	27	MS2N07-E0BQN	271	272						
	28	MS2N10-D0BNN	277	278						
		MS2N10-E0BNN	279	280	–					
i = 1	85	MS2N07-E1BNN	273	274						
	86	MS2N10-D0BNN	277	278						
i = 1.5	88	MS2N07-D1BNN	267	268	269	270				
		MS2N07-E1BNN	273	274	–		270			
	89	MS2N10-C0BNN	275	276	–					
		MS2N10-D0BNN	277	278						

RV01	RV02	RV03
		

Example:
Belt side drive RV02
Motor connector position 90°

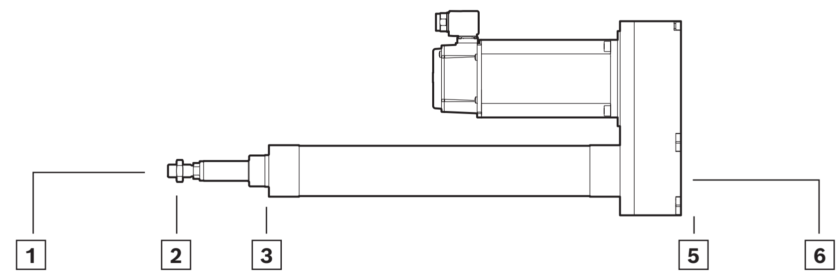
Belt side drive	Motor connector position			
	0°	90°	180°	270°
RV01	000	–	180	270 ★
RV02	000	090 ★	180	–
RV03	000 ★	090	–	270

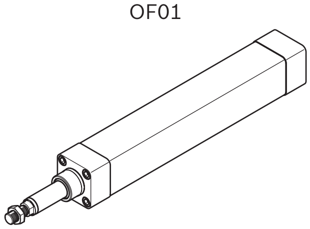
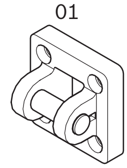
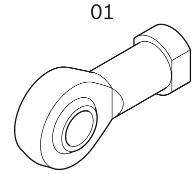
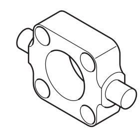
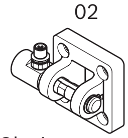
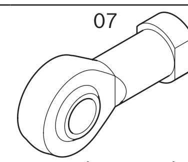
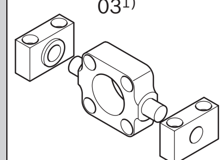
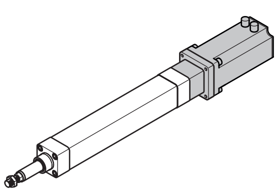
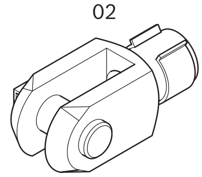
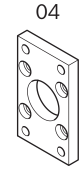
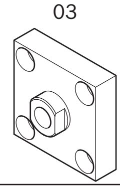
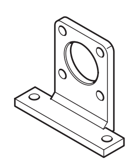
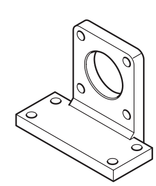
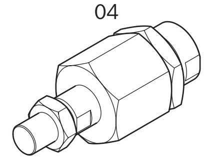
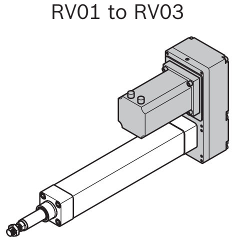
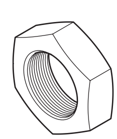
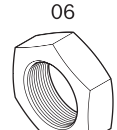
★ standard delivery

Explanation of the order parameters and ordering example
➟ **Chapter "Ordering example".**

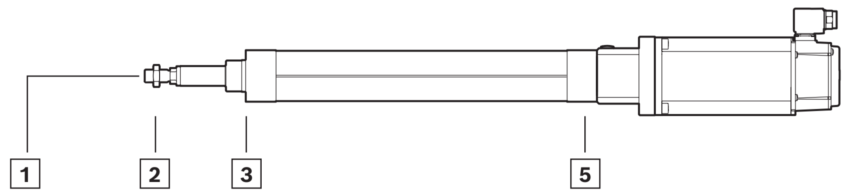
Fastening elements

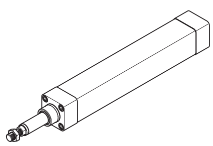
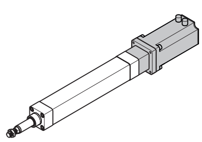
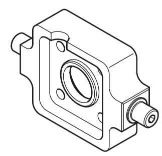
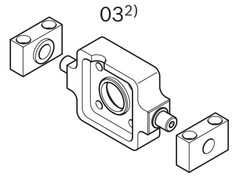
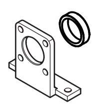
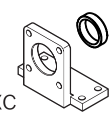
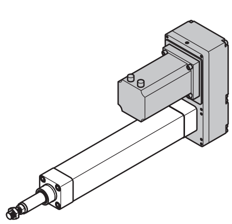
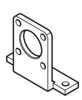
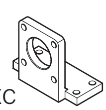
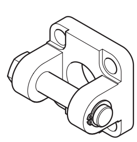
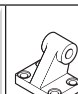
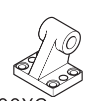
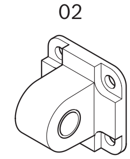
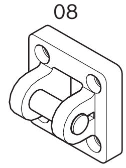
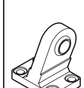
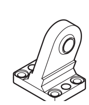
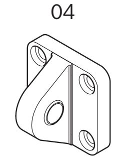
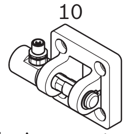
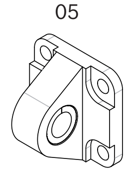
Fastening element



Version	**Group 1**	**Group 2**	**Group 3**	**Group 4**
	00 without	00 without	00 without	00 without
without motor attachment OF01 	01 	01 	01[1)] 	
	02  Clevis mount with force measuring bolt	07  Stainless steel	03[1)] 	
with flange and coupling MF01 		02 	04 	
		03 	06 EMC-32 - EMC-50  EMC-63 - EMC-100XC 	
		04 		
with belt side drive RV01 to RV03 		05 		
		06  Stainless steel		

[1)] Only permissible vertically
[2)] Fastening elements are supplied assembled when version with flange and coupling is selected

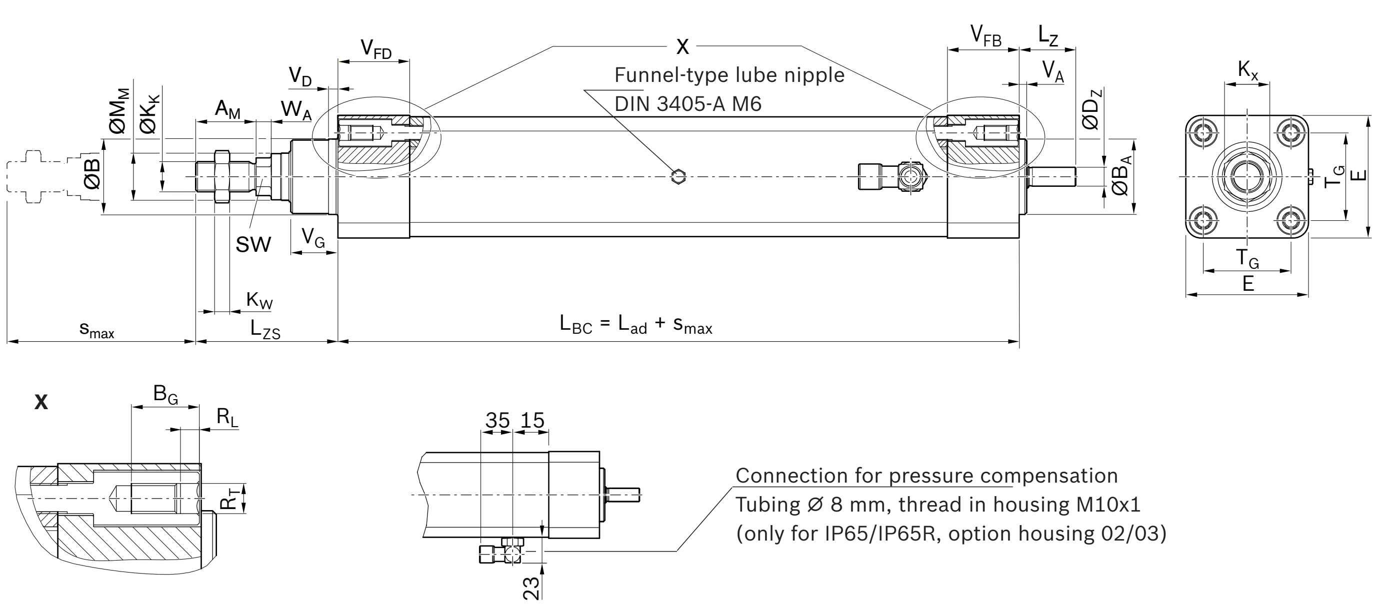


Version	Group 5		Group 6		
	00	without	00	without	
without motor attachment OF01  with flange and coupling MF01 	01[2] 				
	03[2] 				
	05[2] EMC-32 - EMC-50  EMC-63 - EMC-100XC 				
with belt side drive RV01 to RV03 	06 EMC-32 - EMC-50  EMC-63 - EMC-100XC 				
	07 		01 EMC-32 - EMC-50  EMC-63 - EMC-100XC 	02 	
	08 		03 EMC-32 - EMC-50  EMC-63 - EMC-100XC 	04 	
	10  Clevis mount with force measuring bolt		05 		

Note: Fastening elements are included

Dimension drawing EMC

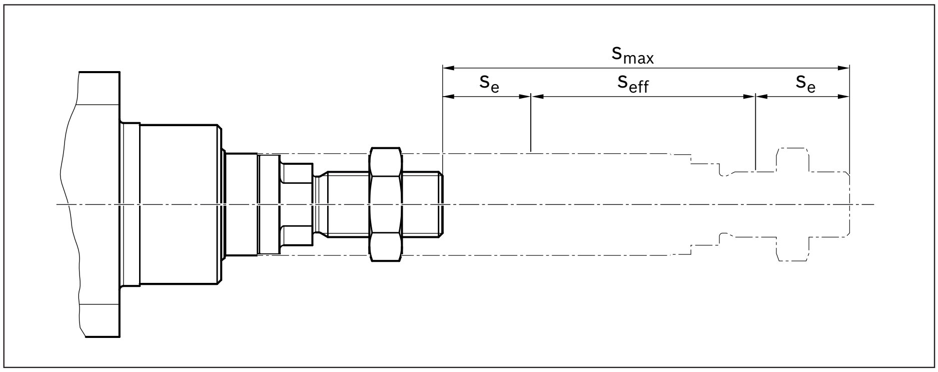
OF01



EMC	BASA	Dimensions (mm)							
	d_0 x P	A_M −0.1	B_{d11} / $B_{A\ h7}$	$D^{Z\ h7}$	E ±0.1	K_K	K_W	K_X	L_{ZS}
32	12 x 5	22	30	5	47	M10x1.25	6	17	55.00
	12 x 10								
40	16 x 5	24	35	8	53	M12x1.25	7	19	61.50
	16 x 10								
	16 x 16								
50	20 x 5	32	40	10	65	M16x1.5	8	24	76.75
	20 x 10								
	20 x 20								
63	25 x 5	32	45	15	75	M16x1.5	8	24	76.50
	25 x 10								
	25 x 25								
80	32 x 5	40	55	18	95	M20x1.5	10	30	94.50
	32 x 10								
	32 x 20								
	32 x 32								
100	40 x 5	40	65	25	115	M20x1.5	10	30	99.25
	40 x 10								
	40 x 20								
	40 x 40								
100XC	50 x 10	72	75	32	115	M36x2	18	55	144.00
	50 x 20								

Effective stroke

Excess travel must be greater than braking distance. The acceleration travel can be taken as a guideline value for braking distance.



$$s_{eff} = s_{max} - 2 \cdot s_e$$

s_e	=	Excess travel	(mm)
s_{eff}	=	Effective stroke	(mm)
s_{max}	=	Maximum travel	(mm)

Length calculation:

Overall length of EMC for motor attachment with flange and coupling = $L_{zs} + s_{max} + L_{ad} + L_f + L_m$

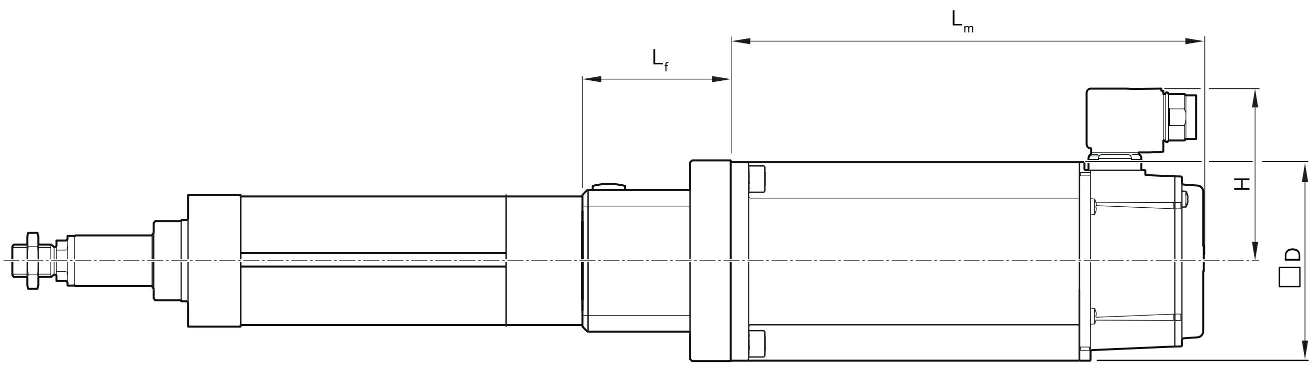
Overall length of EMC for motor attachment with belt side drive = $L_{zs} + s_{max} + L_{ad} + G$

(for L_f, L_m and G, see following page)

L_{ad}	L_Z	$M_{M\ f8}$	R_T	B_G	R_L	SW	T_G	V_A ±0.1	V_D	V_{FB}	V_{FD}	V_G ±0.1	W_A
132	18	18	M6	18	4	10	32.5	4	5	30	30	16	6
136													
134	25	20	M6		4	13	38.0			33		20	6
143													
159													
142	30	25	M8		5	17	46.5			38	38	25	8
161													
180													
148	35	30	M8		5	17	56.5			40			
167													
199													
163	46	38	M10	22	6	22	72.0			44	45	33	10
187													
195													
230													
171	57	50	M10		6	22	89.0			54		38	10
185													
203													
258													
316	62	60	M12	28	7	36	89.0			121	62	38	18
338													

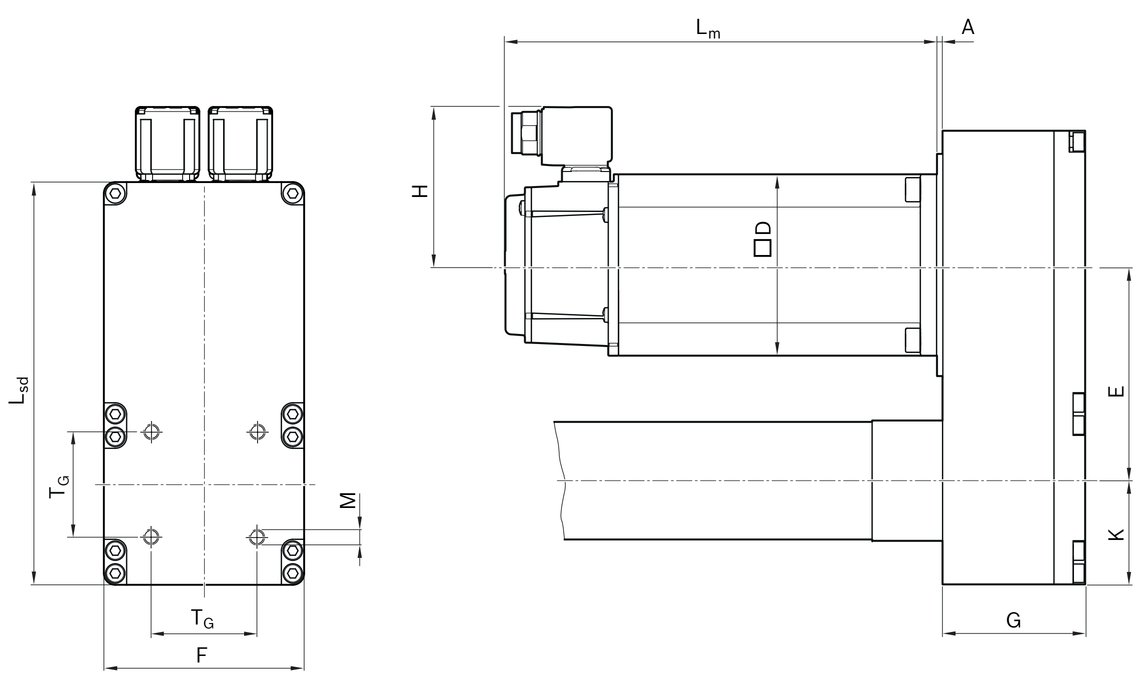
Dimension drawing for motor attachment with flange and coupling

MF01



Dimension drawing motor attachment with belt side drive

RV01, RV02, RV03



EMC	for motor	i	Dimensions (mm) A	E	K	G	□D	H	L_m without brake	L_m with brake	L_{sd}	L_f	F	T_G	M	Max. permissible screw-in depth[1)]
32	MSM019B	1	2.0	67.3	30.5	37.0	38	32.0	92.0	122.0	130	55	54.0	32.5	M6	10.5
	MSM031B	1	2.0	62.8	33.0	45.5	60	43.0	79.0	115.5	138		64.5			16.0
	MS2N03B	1	–				54	71.5	188.0	213.0						
40	MSM031C	1	2.0	62.8	33.0	45.5	60	42.0	98.5	135.0	138	61	64.5	38.0	M6	16.0
		1.5	2.0	65.3												
	MS2N03B	1	–	62.8			54	71.5	188.0	213.0						
		1.5	–	65.3												
	MS2N04	1	–	82.2	44.0	55.5	82	83.5	185.5	215.5	177		88.0			
		1.5	–	81.5												
50	MSM031C	1	0.5	82.2	44.0	55.5	60	43.0	99.0	135.0	177	73	88.0	46.5	M8	16.0
		1.5	0.5	81.5												
	MSM041B	1	3.0	82.2			80	53.0	112.0	149.0						
		1.5	3.0	81.5												
	MS2N04	1	–	82.2			82	83.5	185.5	215.5						
		1.5	–	81.5												
	MS2N05	1	3.0	117.2	56.0	77.0	96	85.5	203.0	233.0	245		116.0			
63	MSM041B	1	3.0	117.2	56.0	77.0	80	53.0	112.0	149.0	245	95	116.0	56.5	M8	16.0
		2	3.0	116.2												
	MS2N04	1	3.0	117.2			82	83.5	185.5	215.5		88				
		2	3.0	116.2												
	MS2N05	1	3.0	117.2			98	85.5	203.0	233.0		95				
		2	3.0	116.2												
	MS2N06	1	–	117.2			116	98.5	226.0	259.0						
80	MS2N05	1	3.0	116.2	56.0	77.0	98	85.5	203.0	233.0	245	100	116.0	72.0	M10	16.0
		2	3.0	117.2												
	MS2N06	1	2.5	149.7	77.0	102.0	116	98.5	226.0	259.0	324		160.0			
		2	2.5	151.4												
	MS2N07	1	6.0	149.7			140	110.0	292.5	292.5		110				
100	MS2N06	1	2.5	149.7	77.0	102.0	116	98.5	226.0	259.0	324	119	160.0	89.0	M10	16.0
		2	2.5	151.4												
	MS2N07	1	3.0	149.7			140	110.0	292.5	292.5						
		2	3.0	151.4												
100XC	MS2N07	1	3.0	174.7	89.0	113.5	140	132.0	352.0	387.0	375	143	197.0	89.0/ 140.0	M12/ M16	24.0
		1.5	3.0	175.6												
	MS2N10	1	4.0	174.7			192	166.0	410.0	410.0		145				
		1.5	4.0	175.6												

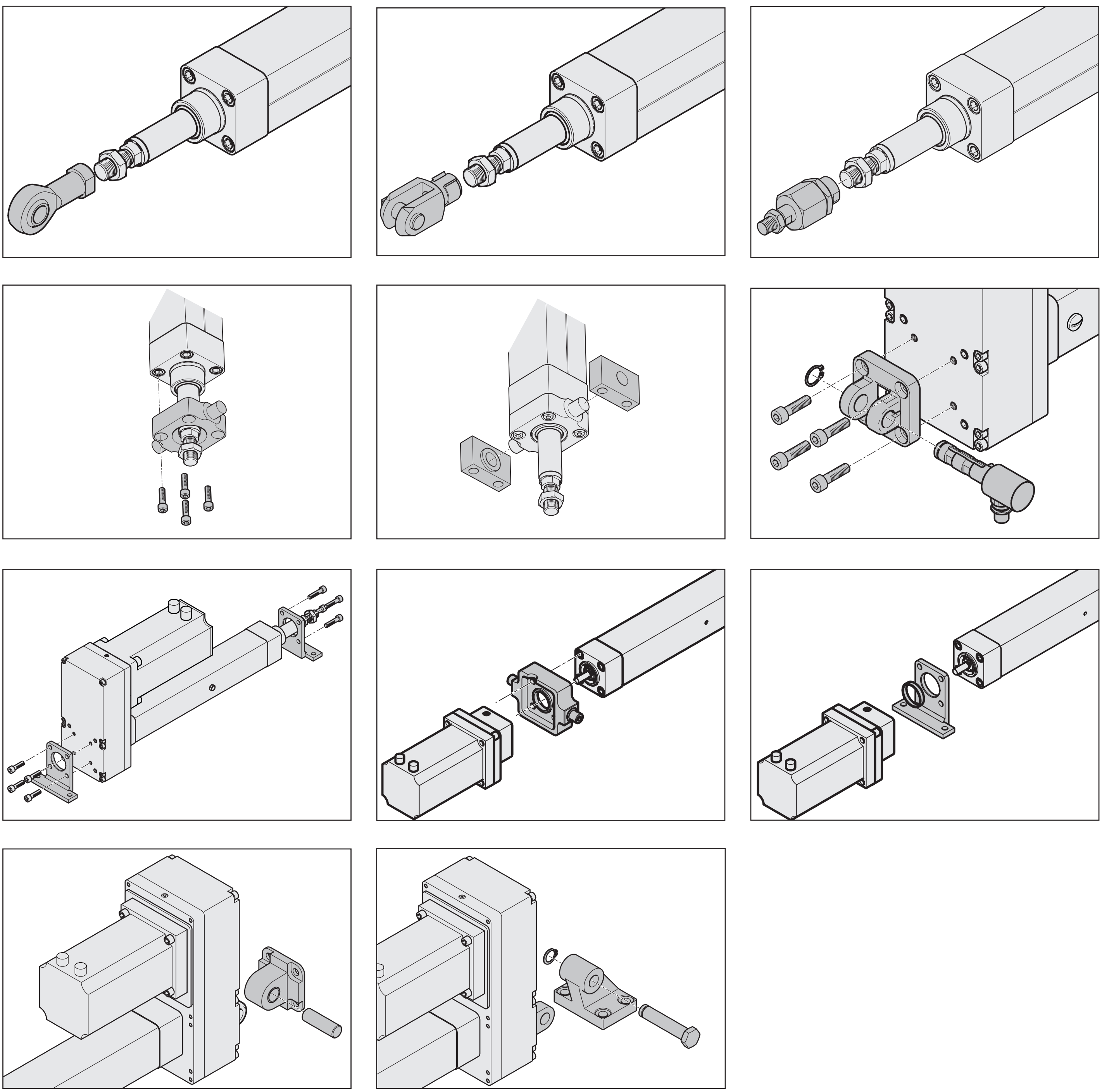
1) Do not exceed max. permissible screw-in depth for "M" threads

Fastener

⚠ When you order an EMC with flange, motor and foot mounting or trunnion on the bottom, the unit is delivered fully assembled. When assembling these fastening elements retrospectively to the cylinder base, the flange first needs to be disassembled.
The "Instructions EMC", R320103102 that are part of the product must be observed.

The fastening elements are mounted on the rear of the belt side drive. The screws are included with the fastening elements.
Before mounting the fastening elements, remove the set screws on the belt side drive.

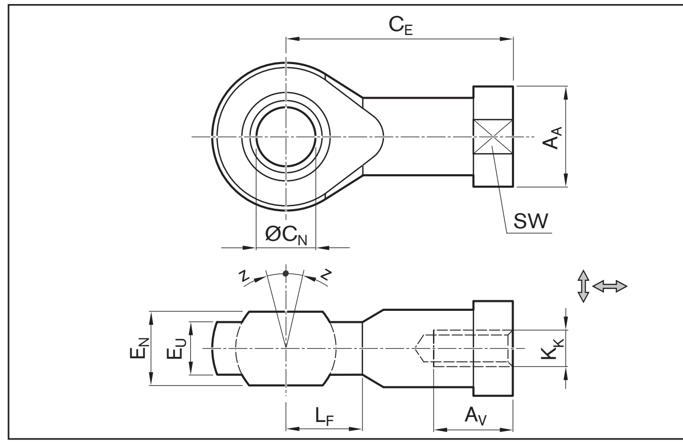
Examples



Fastening elements

Female spherical rod end bearing

Group 2 Option 01 Galvanized steel	Group 2 Option 07 Stainless steel



EMC	Material number		Dimensions (mm)										m
	Steel galvanized	Stainless steel	A_A	A_V min.	C_E	$ØC_N$ H7	E_N −0.1	E_U max.	K_K	L_F	SW	Z (°)	(kg)
32	R349938500	R349951600	19	15	43	10	14	11.5 (10.5)	M10x1.25	14	17	4 (7)	0.070 (0.10)
40	R349938600	R349951700	22	18 (16)	50	12	16	12.5 (12)	M12x1.25	16	19	4 (7)	0.105 (0.12)
50 **63**	R349938700	R349951800	29	24	64	16	21	15.5 (15)	M16x1.5	21	24	4 (8)	0.210 (0.23)
80 **100**	R349938900	R349951900	34	30 (33)	77	20	25	18.5 (18)	M20x1.5	25	30 (32)	4 (8)	0.380 (0.42)
100XC	R349951500	R349952000	60 (53)	56 (53)	125	35	43 (35)	32 (24)	M36x2	40 (37)	50 (–)	4 (6)	2.000 (1.40)

Bracketed values for "stainless steel" version

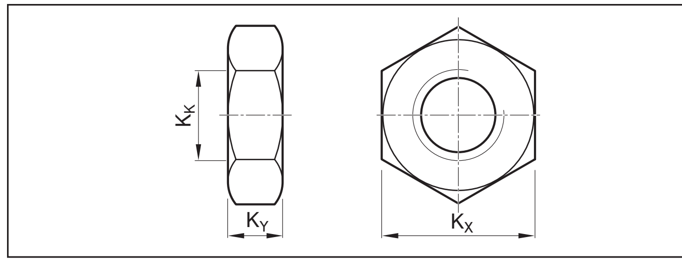
Fastening elements

Hexagon nut

One included with the EMC

Group 2 Option 05 Galvanized steel

Group 2 Option 06 Stainless steel



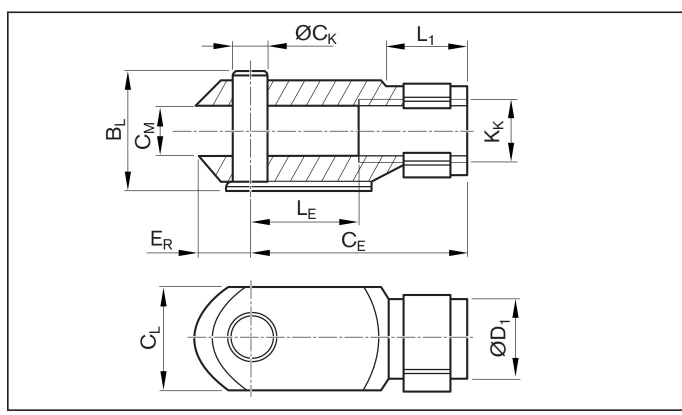
EMC	Material number		Dimensions (mm)			m
	Galvanized steel	**Stainless steel**	**K_K**	**K_X**	**K_Y**	**(kg)**
32	1823A00020	2990600303	M10x1.25	17	6 (5)	0.010
40	1823A00021	2990600304	M12x1.25	19	6	0.012
50 / **63**	1823300030	2990600305	M16x1.5	24	8	0.017
80 / **100**	1823300031	2990600308	M20x1.5	30	10	0.030
100XC	8103190414	2990600316	M36x2	55 (50)	18 (16)	0.175 (0.15)

Bracketed values for "stainless steel" version

Fork clevis with internal thread

Material: Galvanized steel

Group 2 Option 02

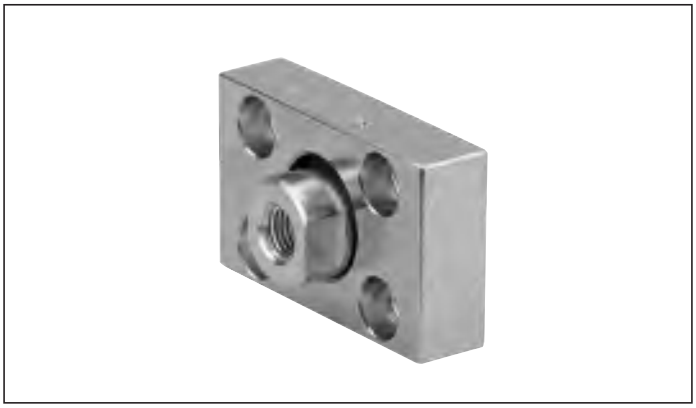


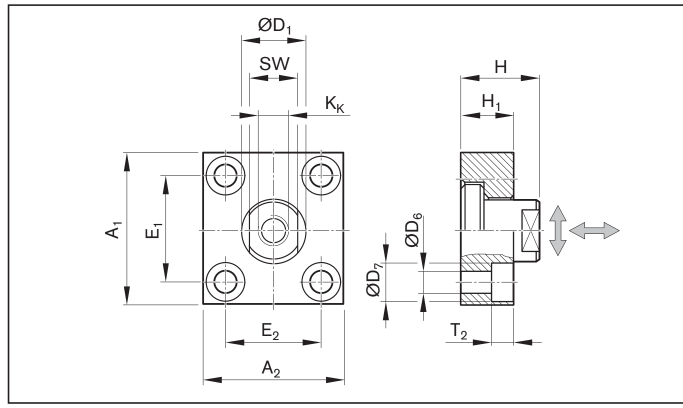
EMC	Material number	Dimensions (mm)										m
		B_L	**C_E**	**$ØC_K$ e11**	**C_L**	**C_M**	**$ØD_1$**	**E_R**	**K_K**	**L_1**	**L_E**	**(kg)**
32	R349939100	26	40	10	20	10	18	12	M10x1.25	15.0	20	0.10
40	R349939200	31	48	12	24	12	20	14	M12x1.25	18.0	24	0.15
50 / **63**	R349939300	39	64	16	32	16	26	19	M16x1.5	24.0	32	0.35
80 / **100**	R349939500	50	80	20	40	20	34	20	M20x1.5	30.0	40	0.70
100XC	R349951000	80	144	35	70	35	60	57	M36x2	54.5	72	1.40

Flexible coupling with fastening plate

Material: Galvanized steel

Group 2 Option 03



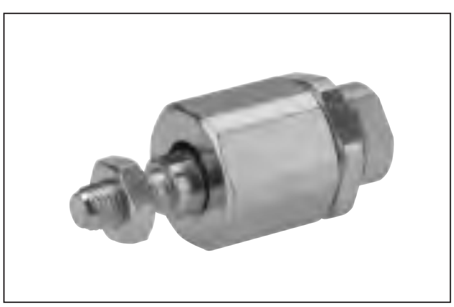


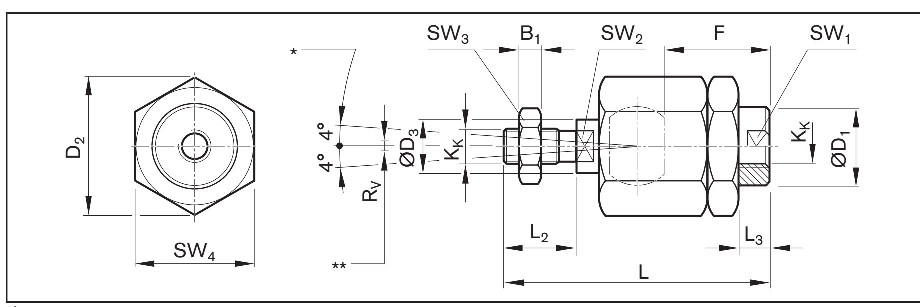
EMC	Material number	Dimensions (mm)														m	Fmax
		A_1	A_2	$ØD_1$ H11	$ØD_6$ H13	$ØD_7$ H13	E_1	E_2	H_1	H	K_K	SW	T_2	Clearance (min./max) ⇔ axial	radial ⇕	(kg)	(N)
32	R349939700	60	37	20	6.6	11	36±0.15	23±0.15	15	24	M10x1.25	17	7			0.30	$F_{max\ EMC}$
40	R349939800	60	56	25	9.0	15	42±0.20	38±0.20	20	30	M12x1.25	19	9			0.40	$F_{max\ EMC}$
50	R349939900	80	80	30	11.0	18	58±0.20	58±0.20	20	32	M16x1.5	24	11	0.4 – 0.8	1.9 – 2.3	0.90	$F_{max\ EMC}$
63																	$F_{max\ EMC}$
80	R349940100	90	90	40	14.0	20	65±0.30	65±0.30	20	35	M20x1.5	36	13			1.15	$F_{max\ EMC}$
100																	28 000
100XC	R349951100	125	125	60	18.0	26	90±0.30	90±0.30	30	55	M36x2	50	17	0.4 – 0.95	2.8 – 3.4	3.40	44 000

Flexible coupling

Material: Galvanized steel

Group 2 Option 04





*) Axial angle equalization **) Radial compensation

EMC	Material number	Dimensions (mm)														m	Fmax
		B_1	$ØD_1$	D_2	$ØD_3$	F	K_K	L ±2	L_2	L_3 ±1	SW_1	SW_2	SW_3	SW_4	R_V	Axial backlash	(kg)	(N)
32	R349937900	6	22	32	14	23	M10x1.25	74.5	23	7.5	19	12	17	30	0.7	0.05 – 0.5	0.21	$F_{max\ EMC}$
40	R349938000	7	22	32	14	22	M12x1.25	75.0	24	13.0	19	12	19	30	0.7	0.05 – 0.5	0.21	$F_{max\ EMC}$
50	R349938100	8	32	45	22	30	M16x1.5	103.0	30	9.0	30	20	24	41	1.0	0.05 – 0.5	0.65	$F_{max\ EMC}$
63																		10 300
80	R349938300	10	32	45	22	40	M20x1.5	119.0	40	19.0	30	20	30	41	1.0	0.05 – 0.5	0.68	10 300
100																		
100XC	R349950900	18	80	80	38	86	M36x2	241	72	18.2	50	36	55	75	1.5	0.05 – 0.2	5.40	15 000

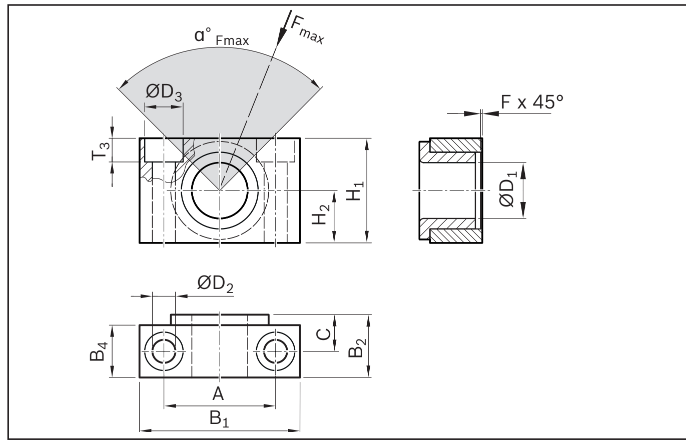
Radial clearance 0 – 2 mm

Fastening elements

Bearing for trunnion

Material: Galvanized steel, with female connectors made of sintered bronze. Delivered in pairs

Group 3 Option 03 **Group 5 Option 03**



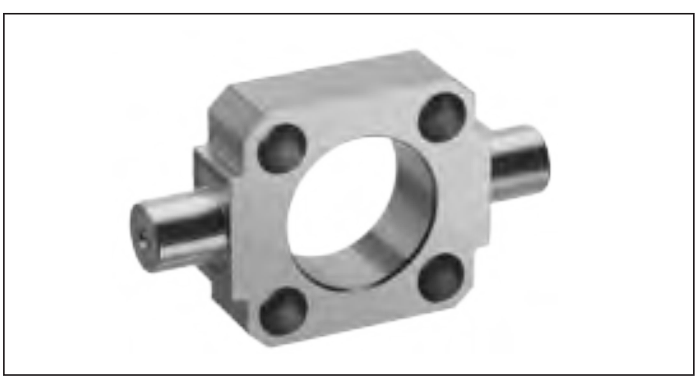
Note: Bearing for trunnion for vertical load; if α F_{max} is not complied with, a positive lock must be added

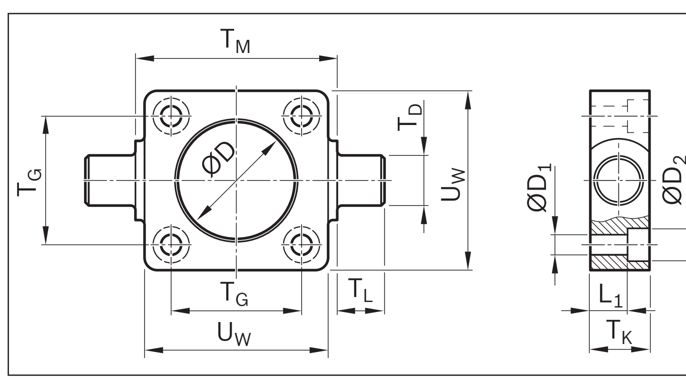
EMC	Material number	Dimensions (mm)												α°F_{max}
		A ±0.2	B_1 f8	B_2	B_4	C	ØD_1 H7	ØD_2 H12	ØD_3 H13	F x 45°	H_1	H_2 ±0.1	T_3 −0.4	
32	R349940900	32	46	18.0	15	10.5	12	6.6	11	1.0	30	15	6.8	180
40	R349941000	36	55	21.0	18	12.0	16	9.0	15	1.6	36	18	9.0	180
50														180
63	R349941200	42	65	23.0	20	13.0	20	11.0	18	1.6	40	20	11.0	110
80														70
100	R349941400	50	75	28.5	25	16.0	25	14.0	20	2.0	50	25	13.0	80
100XC														30

Trunnion for cover (only for vertical installation of EMC)

Material: Galvanized cast iron with spheroidal graphite. Fastening screws included in scope of delivery.

Group 3 Option 01 **Group 3 Option 03**



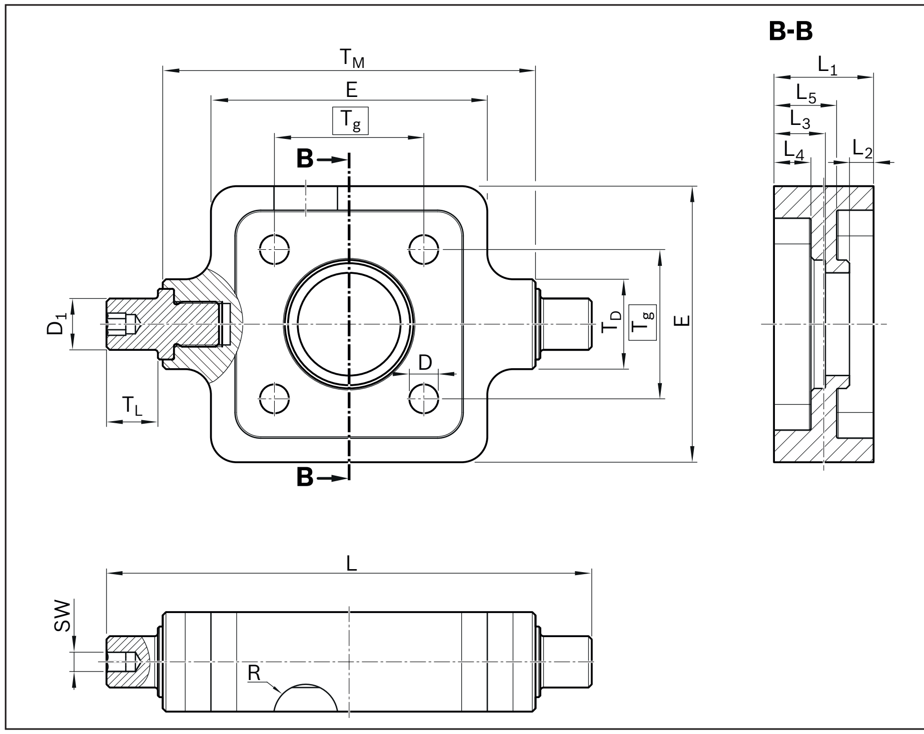


EMC	Material number	Dimensions (mm)										m
		ØD H11	ØD_1	ØD_2	L_1	T_D e9	T_G ±0.2	T_K	T_L h14	T_M h14	U_W	(kg)
32	R349940300	30	6.6	11	7.5	12	32.5	16	12	50	48	0.29
40	R349940400	35	6.6	11	7.5	16	38.0	20	16	63	56	0.50
50	R349940500	40	9.0	15	10.0	16	46.5	24	16	75	65	0.70
63	R349940600	45	9.0	15	10.0	20	56.5	24	20	90	75	1.10
80	R15615A001	55	11.0	18	16.0	20	72.0	28	20	110	100	1.50
100	R15616A001	65	11.0	18	25.5	25	89.0	38	25	132	120	2.70
100XC	R15617A001	75	13.5	20	25.5	25	89.0	38	25	132	120	3.88

Trunnion, for base

Group 5 Option 01 | Group 5 Option 03

Material: Galvanized steel. Fastening screws included in scope of delivery.



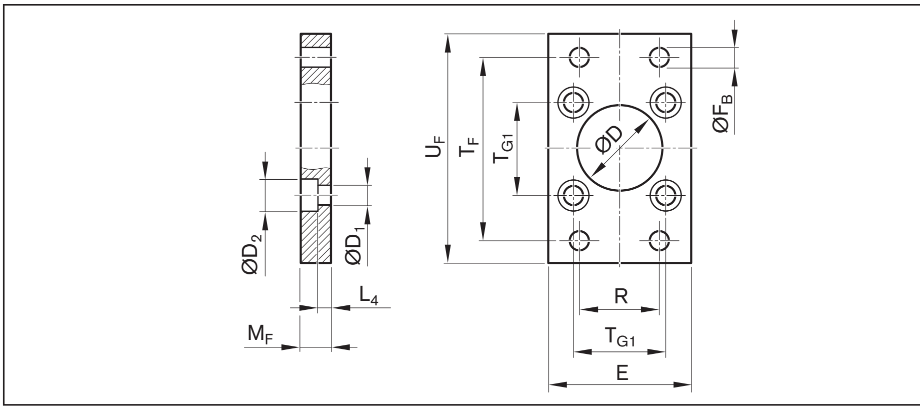
EMC	Material number	Dimensions (mm)															m
		ØD	ØD₁	L	L_1	L_2	L_3	L_4	L_5	T_D	T_g	T_M	T_L	E	R	SW	
		H13	h7		±0.5	±0.2	±0.2	±0.5	±0.5	±0.5		±0.3	±0.2	±0.5			(kg)
32	R15611B013	6.6	12	115	25	5.5	14.0	9.5	15.5	22	32.5	90	12	60	10	6	0.472
40	R15612B013	6.6	16	135	28	6.5	15.0	10.5	17.5	28	38.0	100	16	65	10	6	0.657
50	R15613B013	9.0		151	31	7.5	16.0	11.5	19.5	28	46.5	116		86	10		1.141
63	R15614B013	9.0	20	173	35	7.5	16.5	11.5	23.5	35	56.5	130	20	90	10	8	1.468
80	R15615B013	11.0		193	36	7.5	16.5	11.5	24.5	38	72.0	150		105	10		2.079
100	R15616B013	11.0	25	233	38	7.5	16.5	11.5	26.5	38	89.0	180	25	125	10	12	2.725
100XC	R15617B013	13.5	25	253	44	7.5	16.5	11.5	32.5	45	89.0	200	25	140	11	12	4.480

Fastening elements

Flange fastening

Material: Galvanized steel. Fastening screws included in scope of delivery.

Group 3
Option 04



EMC	Material number	Dimensions (mm)											m
		ØD	$ØD_1$	$ØD_2$	E	$ØF_B$	L_4	M_F	R	T_F	T_{G1}	U_F	
		H11	H13	H13	max.			±0.1	±0.2	±0.2	±0.2	±0.2	(kg)
32	R349942100	30	6.6	11	50	7.0	4.5	10	32	64	32.5	80	0.3
40	R349942200	35	6.6	11	55	9.0	4.5	10	36	72	38.0	90	0.4
50	R349942300	40	9.0	15	65	9.0	6.0	12	45	90	46.5	110	0.8
63	R349942400	45	9.0	15	75	9.0	6.0	12	50	100	56.5	125	1.0
80	R15615A002	55	11.0	18	100	12.0	9.0	16	63	126	72.0	154	1.7
100	R15616A002	65	11.0	18	120	14.0	9.0	16	75	150	89.0	186	2.4
100XC	R15617A002	75	13.5	20	120	17.5	12.6	24	75	150	89.0	186	3.0

Foot mounting for assembly on the cover or belt side drive

Material: Galvanized steel
Fastening screws included in scope of delivery

Group 3 Option 06 **Group 5 Option 06**

EMC 32 - EMC 50 **EMC 63 - EMC 100XC**

EMC	Material number	m (kg)
32	R15611B105	0.166
40	R15612B105	0.246
50	R15613B105	0.459
63	R15614B105	1.038
80	R15615B105	1.952
100	R15616B105	2.793
100XC	R15617B105	4.147

Foot mounting with centering ring for mounting on the base

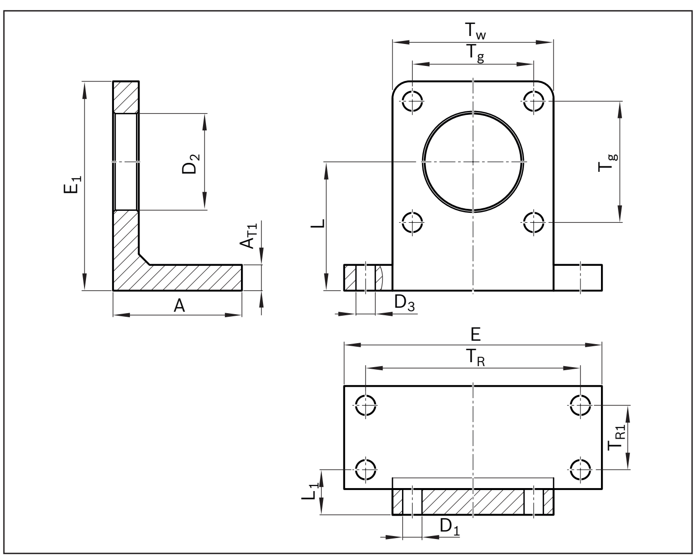
Material: Galvanized steel
Fastening screws included in scope of delivery

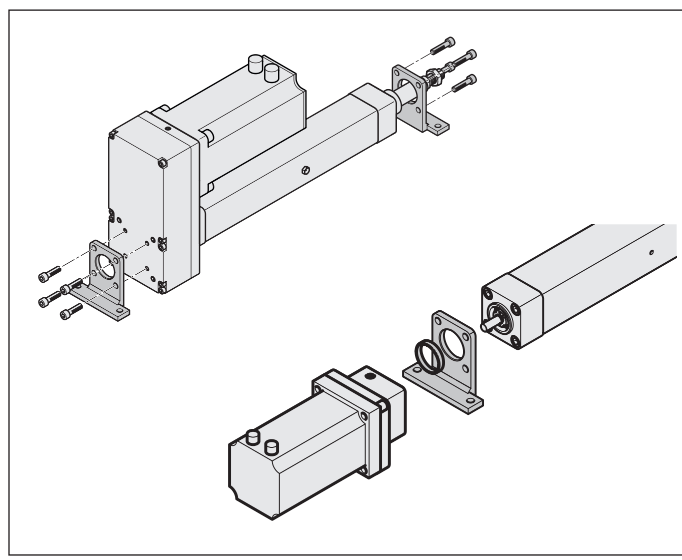
Group 5 Option 05

EMC 32 - EMC 50 **EMC 63 - EMC 100XC**

EMC	Material number	m[1] (kg)
32	R15611B104	0.172
40	R15612B104	0.252
50	R15613B104	0.465
63	R15614B104	1.047
80	R15615B104	1.962
100	R15616B104	2.805
100XC	R15617B104	4.165

1) including the weight of the centering ring





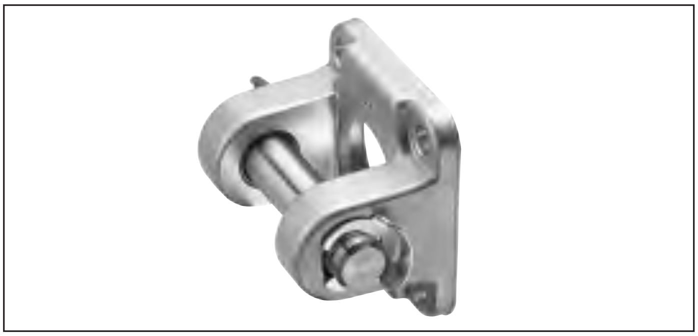
EMC	Dimensions (mm)												
	A	A_{T1}	ØD1	ØD2	ØD3	E	E_1	L	L_1	T_R	T_{R1}	T_g	TW
	±0.5	±0.5	H13	H7	H13	±0.5	±0.5	±0.1					±0.5
32	30	6	6.6	30	6.6	79	57.5	34	18	65	–	32.5	47
40	30	7	6.6	35	9.0	90	71.5	45	18	75	–	38.0	53
50	35	8	9.0	40	9.0	110	93.5	60	21	90	–	46.5	65
63	50	12	9.0	45	9.0	120	98.5	60	21	100	20	56.5	75
80	62	13	11.0	55	11.0	153	129.5	82	27	128	25	72.0	95
100	72	15	11.0	65	14.0	178	140.5	82	27	148	30	89.0	115
100XC	90	21	13.5	75	17.5	188	156.5	99	33	158	45	89.0	115

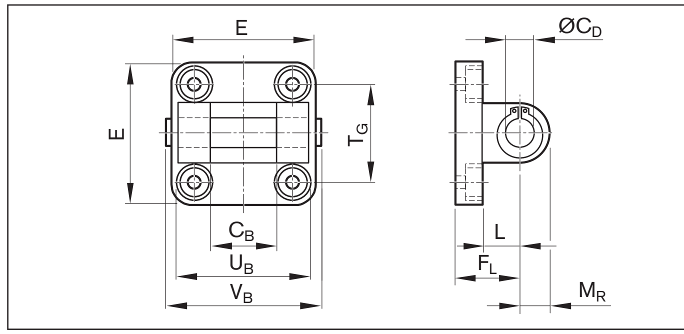
Fastening elements

Clevis mount

Group 5
Option 07

Bolts and fastening screws included in scope of delivery





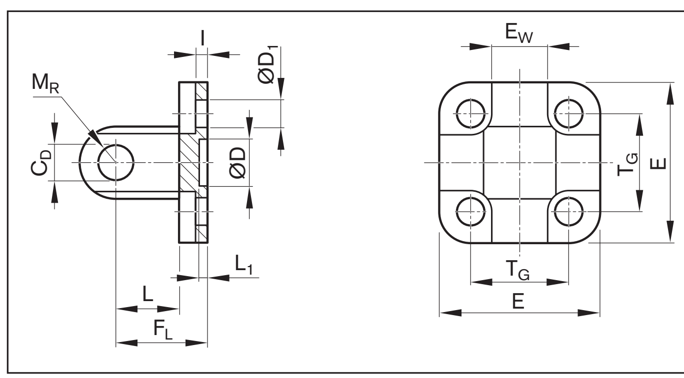
EMC	Material number	Dimensions (mm)									m	F_{max}
		C_B	$ØC_D$	E	F_L	L	M_R	T_G	U_B	V_B		
		H14	H9	max.	±0.2	min.		±0.2	h14		(kg)	(N)
32	R349945700[1)]	26	10	49	22	12	10	32.5	45	50.0	0.09	$F_{max\ EMC}$
40	R349945800[1)]	28	12	53	25	15	13	38.0	52	57.0	0.11	$F_{max\ EMC}$
50	R349945900[1)]	32	12	63	27	15	13	46.5	60	65.0	0.18	$F_{max\ EMC}$
63	R349946000[1)]	40	16	73	32	18	17	56.5	70	76.0	0.25	10 900
80	R349946100[1)]	50	16	98	36	20	17	72.0	90	96.0	0.51	13 100
100	R349946200[1)]	60	20	115	41	25	18	89.0	110	117.0	0.70	16 400
100XC	R15617B026[2)]	90	30	177	55	35	31	140.0	170	180.5	2.14	$F_{max\ EMC}$

1) Material: Aluminum
2) Material: Galvanized cast iron with spheroidal graphite

Swivel mount

Group 6
Option 02

Fastening screws included in scope of delivery



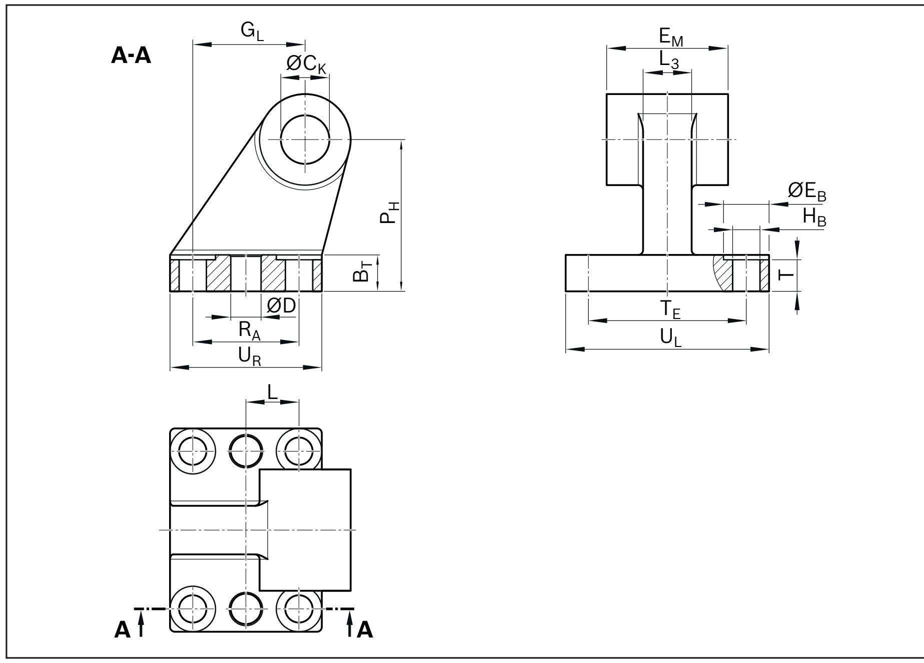
EMC	Material number	Dimensions (mm)												m	F_{max}
		C_D	ØD	D_1	E	E_W	F_L	I	L	L_1	M_R	T_G	DIN 912		
		H9	H11	H13		−0.2/−0.6	±0.2	±0.5	min.	min.	max.	±0.2		(kg)	(N)
32	R349948100[1)]	10	30	6.6	48	26	22	5.5	12	4.5	10	32.5	M6x18	0.08	$F_{max\ EMC}$
40	R349948200[1)]	12	35	6.6	53	28	25	5.5	15	4.5	12	38.0	M6x18	0.11	$F_{max\ EMC}$
50	R349948300[1)]	12	40	9.0	63	32	27	6.5	15	4.5	12	46.5	M8x20	0.17	$F_{max\ EMC}$
63	R349948400[1)]	16	45	9.0	73	40	32	6.5	20	4.5	16	56.5	M8x20	0.27	10 900
80	R349948500[1)]	16	45	11.0	98	50	36	10.0	20	4.5	16	72.0	M10x20	0.50	13 100
100	R349948600[1)]	20	55	11.0	115	60	41	10.0	25	4.5	20	89.0	M10x20	0.77	16 400
100XC	1827004867[2)]	30	65	13.5	180	90	55	10.0	35	7.0	31	140±0.3	M16x50	2.60	$F_{max\ EMC}$

1) Material: Aluminum
2) Material: Galvanized cast iron with spheroidal graphite

Bearing block

Group 6
Option 01

Material: Galvanized cast iron with spheroidal graphite. Without fastening screws



EMC	Material number	Dimensions (mm)																m
		B_R	B_T	$ØC_K$ H9	ØD H11	$ØE_B$ H13	E_M −0.2 −0.6	G_L	$ØH_B$ H13	L ±0.2	L_3	P_H JS15	R_A JS14	T	T_E JS14	U_L	U_R	(kg)
32	R349947500	10.0	8	10	–	10	26	21	6.6	–	10	32	18	4	38	51	31	0.20
40	R349947600	11.0	10	12	–	10	28	24	6.6	–	12	36	22	4	41	54	35	0.30
50	R349947700	13.0	12	12	–	11	32	33	9.0	–	16	45	30	6	50	65	45	0.50
63	R15614A017	15.0	12	16	10	11	40	37	9.0	17.5	16	50	35	6	52	67	50	0.85
80	R15615A017	15.0	14	16	10	15	50	47	9.0	20.0	20	63	40	6	66	86	60	1.40
100	R15616A017	19.0	15	20	10	15	60	55	11.0	25.0	20	71	50	6	76	96	70	1.90
100XC	R15617A017	31.5	25	25	12	26	90	97	14.0	44.0	36	115	88	17	118	156	126	1.90

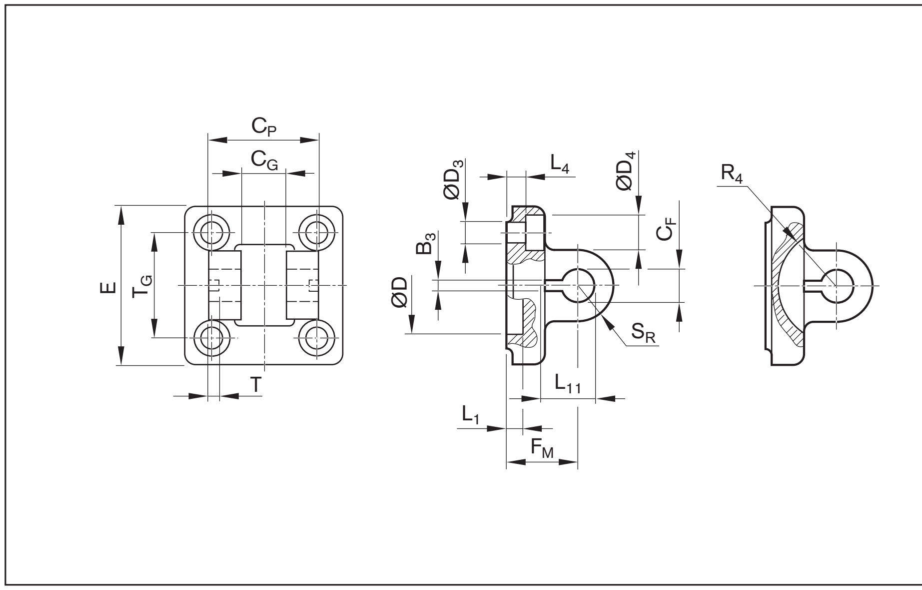
Fastening elements

Clevis mount

Bolts and fastening screws included in scope of delivery

Group 1 Option 01

Group 5 Option 08



EMC	Material number	Dimensions (mm)																	m	F_{max}
		B_3	C_F	C_G	C_P	$ØD_3$	$ØD_4$	$ØD$	E	F_M	L_1	L_4	L_{11}	R_4	S_R	T	T_G	DIN 912		
		±0.2	F7	D10	d12					±0.2	±0.5	±0.5	−0.5			±0.2	±0.2		(kg)	(N)
32	R349945100[1)]	3.3	10	14	34	6.6	11	30	49	22	4.5	5.5	16.5	17	11	3	32.5	M6x18	0.22	$F_{max\ EMC}$
40	R349945200[1)]	4.3	12	16	40	6.6	11	35	55	25	4.5	5.5	18.0	20	12	4	38.0	M6x18	0.29	$F_{max\ EMC}$
50	R349945300[1)]	4.3	16	21	45	9.0	15	40	67	27	4.5	6.5	23.0	22	15	4	46.5	M8x20	0.49	$F_{max\ EMC}$
63	R349945400[1)]	4.3	16	21	51	9.0	15	45	77	32	4.5	6.5	23.0	25	15	4	56.5	M8x20	0.68	14 500
80	R349945500[1)]	4.3	20	25	65	11.0	18	45	97	36	4.5	10.0	27.0	30	20	4	72.0	M10x20	1.39	17 800
100	R349945600[1)]	4.3	20	25	75	11.0	18	55	117	41	4.5	10.0	27.0	32	20	4	89.0	M10x20	2.04	22 900
100XC	1827001600[2)]	6.3	35	43	122	18.0	26	65	180	55	10.0	10.0	45.0	46	26	6	140.0	M16x50	2.13	$F_{max\ EMC}$

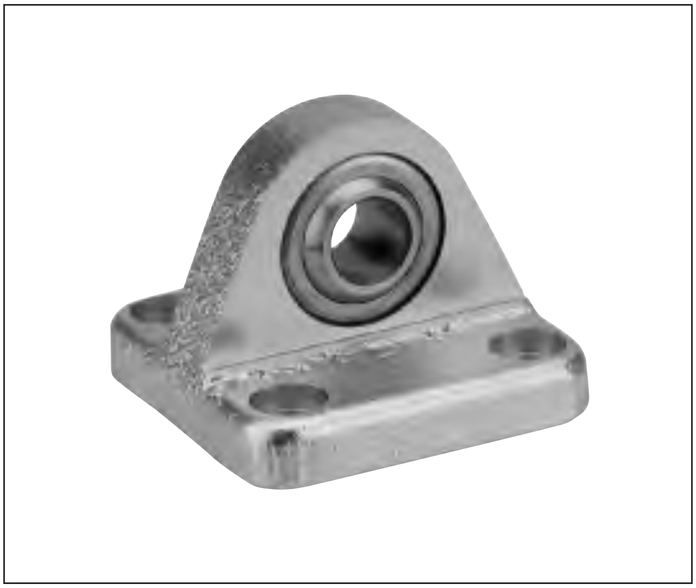
1) Material: Aluminum (forged)

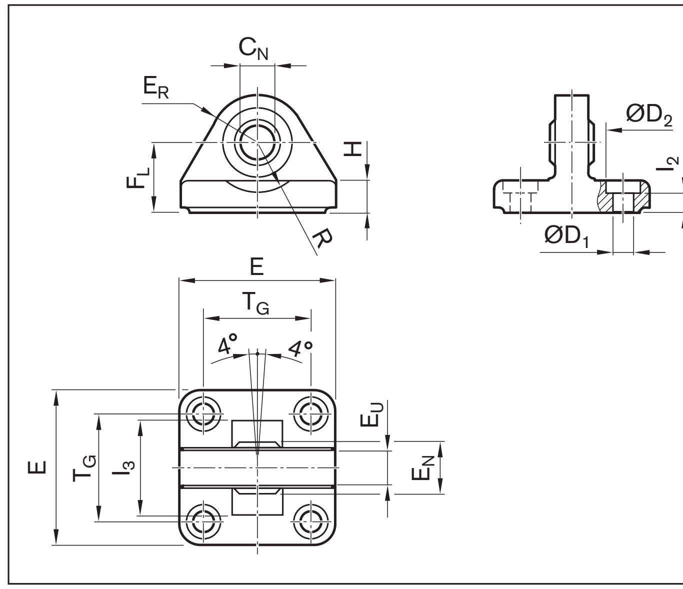
2) Material: Galvanized spheroidal graphite iron

Swivel bearing

Fastening screws included in scope of delivery

Group 6
Option 04





EMC	Material number	Dimensions (mm)													DIN 912	m	F_{max}
		ØC_N	ØD_1	ØD_2	E	E_N	E_R	E_U	F_L	H	l_2	l_3	R	T_G			
		H7	H13	H13		–0.1			–0.2			min.		±0.2		(kg)	(N)
32	R349946900[1)]	10	6.6	11	47	14	15	10.5	22	9.0	5.5	36	12	32.5	M6x18	0.21	$F_{max\ EMC}$
40	R349947000[1)]	12	6.6	11	53	16	18	12.0	25	9.0	5.5	42	15	38.0	M6x18	0.28	$F_{max\ EMC}$
50	R349947100[1)]	16	9.0	15	65	21	20	15.0	27	10.5	6.5	48	19	46.5	M8x20	0.43	$F_{max\ EMC}$
63	R349947200[1)]	16	9.0	15	75	21	23	15.0	32	10.5	6.5	55	21	56.5	M8x20	0.68	14 500
80	R349947300[1)]	20	11.0	18	95	25	27	18.0	36	14.0	10.0	70	24	72.0	M10x20	1.21	17 800
100	R349947400[1)]	20	11.0	18	115	25	30	18.0	41	15.0	10.0	80	25	89.0	M10x20	2.03	22 900
100XC	1827001626[2)]	35	18.0	26	176	43	44	30.0	55	17.0	10.0	130	39	140.0	M16x30	6.10	$F_{max\ EMC}$

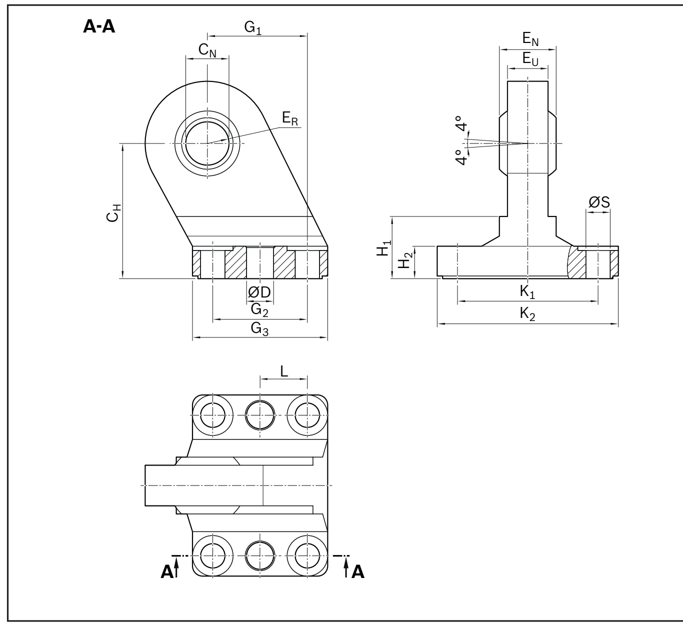
1) Material: Aluminum
2) Material: Galvanized cast iron with spheroidal graphite

Fastening elements

Swivel bearing, high

Group 6
Option 03

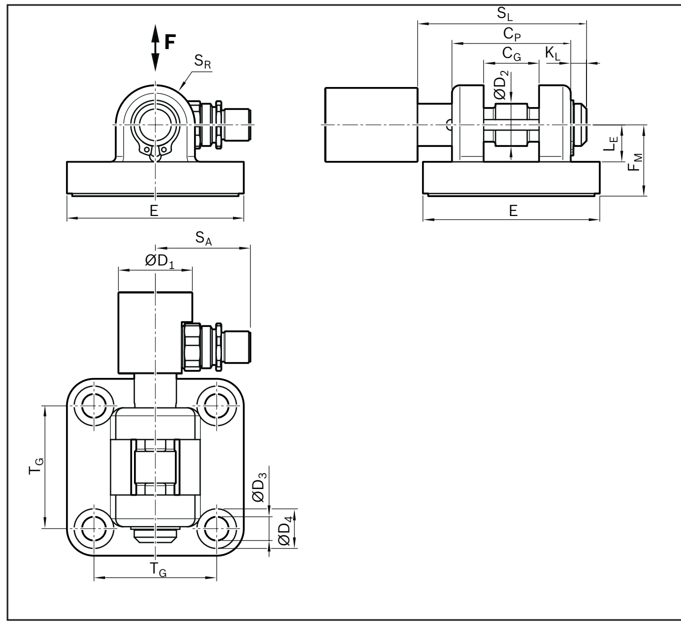
Material: Galvanized cast iron with spheroidal graphite. Without fastening screws



EMC	Material number	Dimensions (mm)															m
		C_H	C_N	ØD	E_N	E_R	E_U	G_1	G_2	G_3	H_1	H_2	K_1	K_2	L	ØS	
		JS15	H7	H11	−1.0	max.		JS14	JS14	max.			JS14	max.	±0.2	H13	(kg)
32	R349946300	32	10	–	14	16	10.5	21	18	31	16	$9^{\pm1.0}$	38	51	–	6.6	0.21
40	R349946400	36	12	–	16	18	12.0	24	22	35	16	$9^{\pm1.0}$	41	54	–	6.6	0.27
50	R349946500	45	16	–	21	21	15.0	33	30	45	23	$11^{\pm1.0}$	50	65	–	9.0	0.50
63	R15614A018	50	16	10	21	23	15.0	37	35	50	23	$11^{\pm1.0}$	52	67	17.5	9.0	0.61
80	R15615A018	63	20	10	25	28	18.0	47	40	60	32	$12^{\pm1.5}$	66	86	20.0	11.0	1.14
100	R15616A018	71	20	10	25	30	18.0	55	50	70	33	$13^{\pm1.5}$	76	96	25.0	11.0	1.56
100XC	R15617A018	115	35	12	43	44	28.0	97	88	126	70	$17^{\pm1.5}$	118	156	44.0	14.0	6.64

Clevis mount with force measuring bolt

Group 1 Option 02 **Group 5 Option 10**



EMC	Material number	Dimensions (mm)																m	F_{max}
		C_G	C_P	$ØD_1$	$ØD_2$	$ØD_3$	$ØD_4$	E	F_M	K_L	L_E	S_A	S_L	S_R	T	T_G	DIN 912		
		D10	d12		f8				±0.2		min.				±0.2	±0.2		(kg)	(N)
32	R15611B021[1)]	14	34	28	10	6.6	11	49	22	4.5	11.5	31.5	48	11	3	32.5	M6x18	0.372	$F_{max\ EMC}$
40	R15612B021[1)]	16	40	28	12	6.6	11	55	25	4.5	12.0	31.5	54	12	4	38.0	M6x18	0.485	$F_{max\ EMC}$
50	R15613B021[1)]	21	45	28	16	9.0	15	67	27	6.0	14.0	31.5	64	15	4	46.5	M8x20	0.721	$F_{max\ EMC}$
63	R15614B021[1)]	21	51	28	16	9.0	15	77	32	6.0	14.0	31.5	72	15	4	56.5	M8x20	1.025	14 500
80	R15615B021[1)]	25	65	28	20	11.0	18	97	36	6.5	16.0	31.5	74	20	4	72.0	M10x20	1.829	17 800
100	R15616B021[1)]	25	75	28	20	11.0	18	117	41	6.5	16.0	31.5	84	20	4	89.0	M10x20	2.866	22 900
100XC	R15617B021[2)]	43	122	35	35	18.0	26	180	55	10.5	35.0	35.5	135	26	6	140.0	M16x50	2.994	$F_{max\ EMC}$

1) Material: Aluminum (forged)
2) Material: Galvanized spheroidal graphite iron

Instruction for mounting

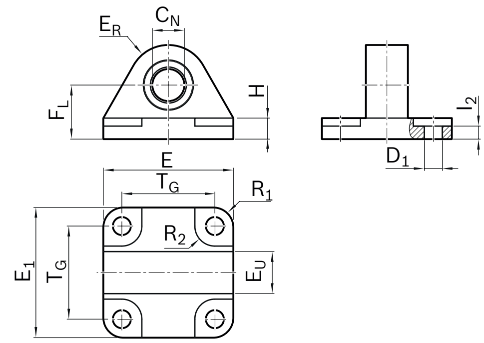
Pay attention to the direction of force, see also force sensor

Fastening elements

Swivel mount for force measuring bolt

Material: Aluminum

Group 6
Option 05

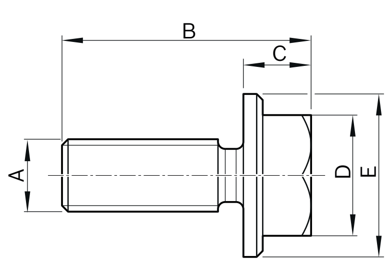


EMC	Material number	Dimensions (mm)											m
		$⌀C_N$	$⌀D_1$	F_L	H	E_R	E_U	I_2	E/E_1	T_G	R_1/R_2	DIN 912	
		H7	H13	±0.2	±0.5	±0.2	±0.2	±0.5	±0.5				(kg)
32	R15611B025	10	6.6	22	9.0	15	14	5.5	47	32.5	8	M6x18	0.074
40	R15612B025	12	6.6	25	9.0	18	16	5.5	53	38.0	8	M6x18	0.109
50	R15613B025	16	9.0	27	10.5	20	21	6.5	65	46.5	10	M8x20	0.181
63	R15614B025	16	9.0	32	10.5	23	21	6.5	80	56.5	10	M8x20	0.257
80	R15615B025	20	11.0	36	14.0	27	25	10.0	95	72.0	13	M10x20	0.493
100	R15616B025	20	11.0	41	15.0	30	25	10.0	115	89.0	13	M10x20	0.747
100XC	R15617B025	35	18.0	55	17.0	44	43	10.0	176	140.0	20	M16x40	2.238

Accessories

Screw plug for cover

Material: corrosion-resistant

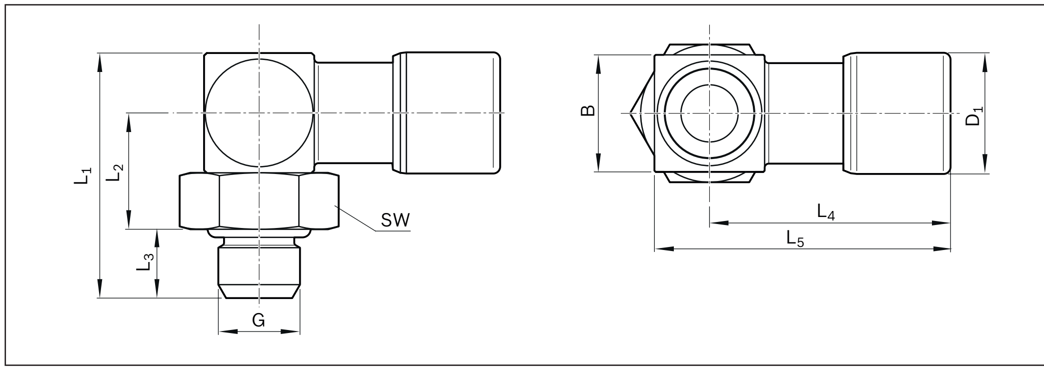


EMC	Material number	Dimensions (mm)				
		A	B	C	D	E
32/40	R15610A015	M6	20.6	5.6	SW 10	13.5
50/63	R15610A016	M8	24.0	8.0	SW 13	18.0
80/100	R15610A017	M10	29.0	8.5	SW 16	22.0
100XC	R15610A018	M12	36.0	10.0	SW 18	25.0

Accessories

Connection for central lubrication system

Is supplied once as part of the delivery if the lubrication option LCF has been chosen (prepared for central lubrication system for liquid grease).



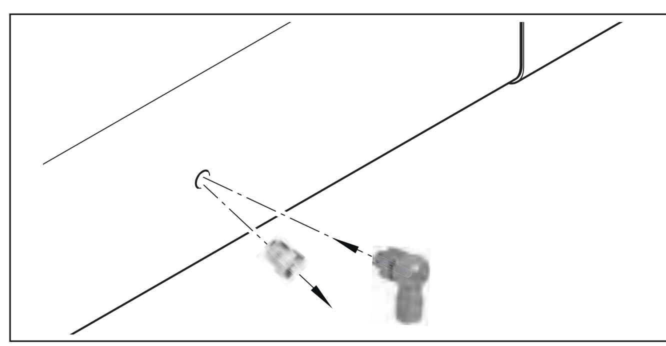
Material number	Material	G	for tubing	Dimensions (mm)								m
				SW	L_1	L_2	L_3	L_4	L_5	B	D_1	(g)
R913031697	Nickel-plated brass (for housing option (standard and IP65)	M6	AD4(4/2)	10	17.8	8.5	5	17.5	21.5	8.5	8.8	10
R913031717	Corrosion-resistant steel 1.430/1.4307 (for housing option IP65+R)											

Features

- Enclosed O-ring
- Seals FPM
- Temperature range –20 to +120 °C
- Operating pressure range –0.95 to 24 bar

Instruction for mounting

In order to connect the EMC to a central lubrication system, remove the standard lube nipple from the housing and replace it with the port for the central lubrication system.



Force sensor

Force measuring bolt

Clevis mount with force measuring bolt

If your application requires precise load sensing, there is a clevis bearing block version with force measuring bolt available for this purpose. This option can be selected both at the piston rod end connected to the spherical rod end bearing, and at the belt side drive.
Thanks to the thin-film technology used, the load cells are very robust and stable over the long term. The load cells are compliant with the EN 61326 standard for electromagnetic compatibility (EMC) and are designed to sense both tensile and compressive forces.

Note
The use of a hammer or press to fit the bolt is not permissible. It may only be inserted by hand.
The bolt is not suitable to handle torques. It is secured axially and against rotation, like the standard bolt, on one side of the clevis mount using the included retaining ring and clamping pin.
For force control at the controller level, a control component with an analog input is required.

Output signal 4 - 20 mA, reduced measurement range and test certificate on request.

Technical data, force measuring bolts
Metrological specifications

Material	Stainless steel
Enclosure protection class	IP65
Hardness (load range)	38 HRC
Mechanical system	
Operating load	150% of MB
Breaking load	300% of MB
Accuracy	
Non-linearity	±0.5% of MB
Repeatability	±0.25% of MB
Hysteresis	±0.2% of MB
Temperature drift at zero point	±0.05% of MB/K.
Temperature drift over measurement range	±0.05% of MB/K.
Compensated temperature	+10 ... +40 °C
Operating temperature	−20 ... +60 °C

Electrical specifications

Output signal	0kN	0±0.03 V
Output signal	MB	−10 ... 10 V ±0.2 V
Power supply voltage		24 V ±2 V
Tare (zero setting function)		7.2 ... 24 V
Current consumption		25 mA (24 V)
Bandwidth		2.5 ±0.2 KHz
Connection		Plug M12x1

Technical data, connection cable

Length	5 m
Rated voltage	250 V
Rated current	4 A
Plug outlet	angled
Connection type 1	Female connector, M12, 4-pin
Connection type 2	Flying leads
Type of cable	PUR black, shielded
Suitable for drag chains	yes
Cable cross-section	4x0.34 mm^2
Cable diameter D	5.9 ±0.2 mm
Static bending radius	>10xD
Dynamic bending radius	>5xD
Bending cycles	> 2 Mio
Ambient temperature, stationary	−25 ... +80 °C
Ambient temperature, in motion	−40 ... +80 °C
Enclosure protection class	IP65

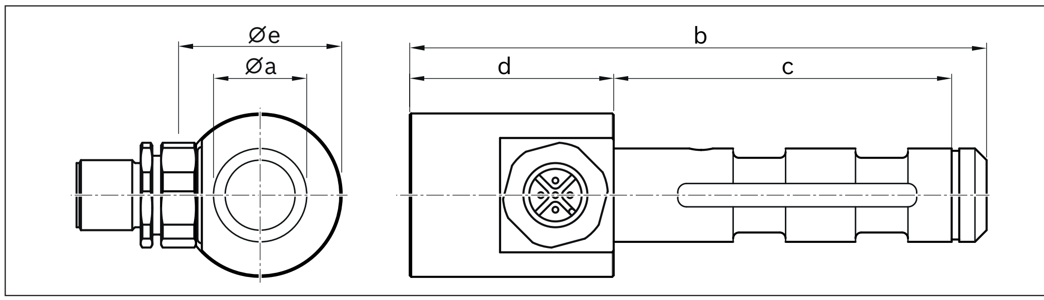
Connection cable in the scope of delivery

MB = Measurement range
MB/K. = Measurement range per Kelvin

Features

- For tensile and compressive forces
- Corrosion-resistant
  Stainless steel version
- Integrated amplifier
- Low temperature coefficient
- High long term stability
- High shock and vibration resistance
- For dynamic or static measurements
- Good reproducibility
- Easy mounting

Dimensions/material numbers



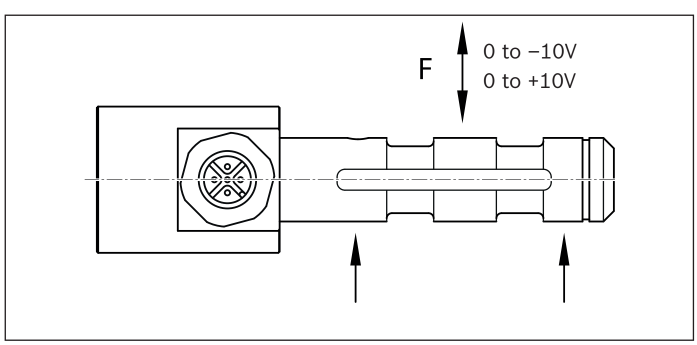
EMC	Material number (force measuring bolt)[1]	Dimensions (mm)					Measurement range	Measurement inaccuracy
		Øa f8	b	c	d	Øe	(kN)	(kN)
32	R15611A007	10	83	43.5	35	28	1.3	± 0.007
40	R15612A007	12	89	49.5	35	28	5.0	± 0.025
50	R15613A007	16	99	58.0	35	28	8.0	± 0.04
63	R15614A007	16	107	66.0	35	28	16.0	± 0.08
80	R15615A007	20	109	67.5	35	28	22.0	± 0.11
100	R15616A007	20	119	77.5	35	28	45.0	± 0.23
100XC	R15617A007	35	170	124.5	35	35	56.0	± 0.28

[1] with connection cable

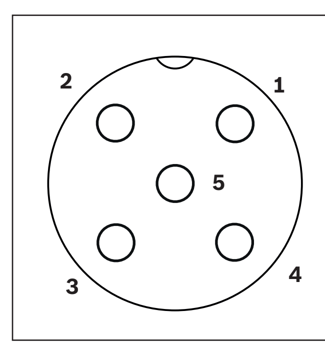
Connection diagram

Force measuring bolt
1 Supply (+)
2 Tare
3 GND
4 Output
5 Internal assignment

Connection cable
1 brn = brown, supply (+)
2 wht = white, tare
3 blu = blue, GND
4 blk = black, output



Output signal depending on direction of loading

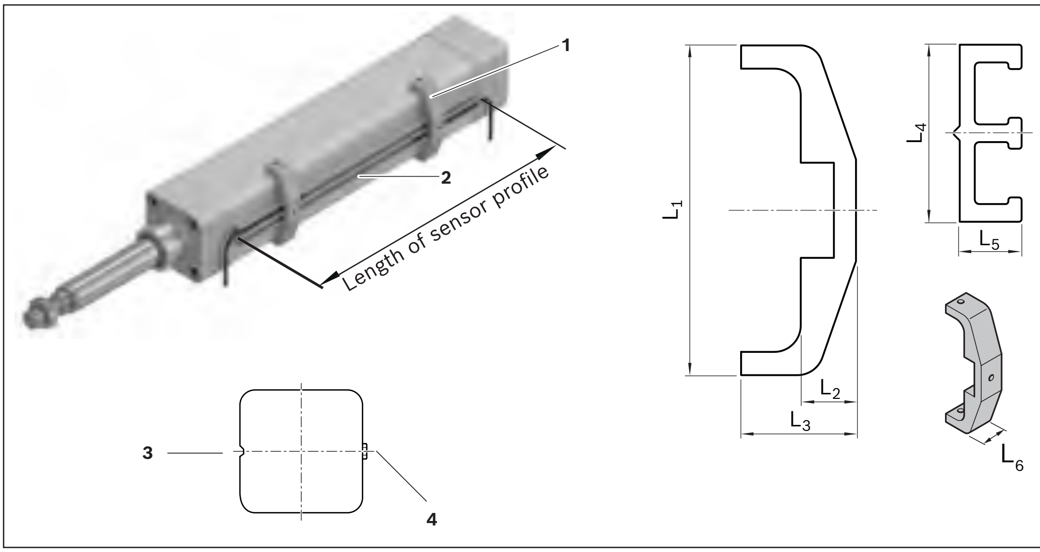


Connection diagram for measuring bolt

Switching system

Sensor profile

1 Retaining bracket
2 Sensor profile
3 Slot for sensor profile (opposite the lube nipple)
4 Lube nipple



EMC	Material number		BASA size d_0 x P (mm)	Dimensions (mm)						
	Retaining bracket	Sensor profile		L_{SL}	L_1	L_2	L_3	L_4	L_5	L_6
32	R15611B022		12 x 5	68	56.5	12.5	25			
			12 x 10	72						
40	R15612B022		16 x 5	67	62.5	12.5	25			
			16 x 10	76						
			16 x 16	92						
50	R15613B022		20 x 5	62	74.5	12.5	26			
			20 x 10	81						
			20 x 20	100						
63	R15614B022		25 x 5	66	84.5	12.5	26			
			25 x 10	85						
		R15610A009	25 x 25	117				20	7	15
80	R15615B022		32 x 5	70	104.5	12.5	26			
			32 x 10	94						
			32 x 20	102						
			32 x 32	137						
100	R15616B022		40 x 5	68	124.0	12.5	31			
			40 x 10	82						
			40 x 20	100						
			40 x 40	155						
100XC	R15616B022		50 x 10	129	124.0	12.5	31			
			50 x 20	151						

Number of retaining brackets

Length of sensor profile (mm)	Number of retaining brackets
≤500	2
≤900	3
≤1 200	4
≤1 500	5

Length calculation Sensor profile

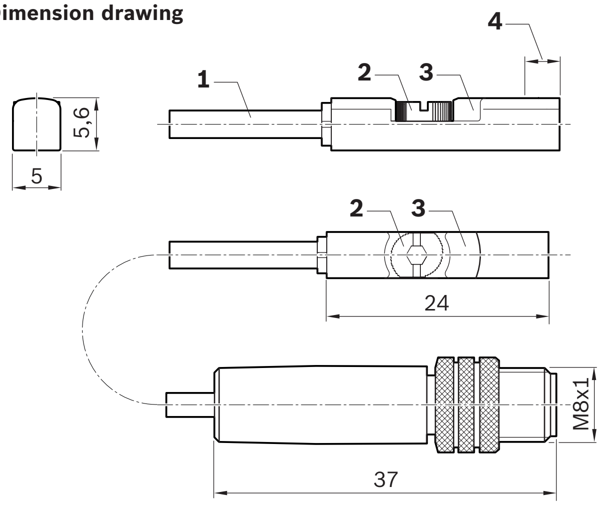
Length of sensor profile = $s_{max} + L_{SL}$

s_{max} = Maximum travel range (mm)

Switching system

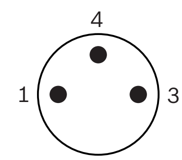
Magnetic switches

Dimension drawing



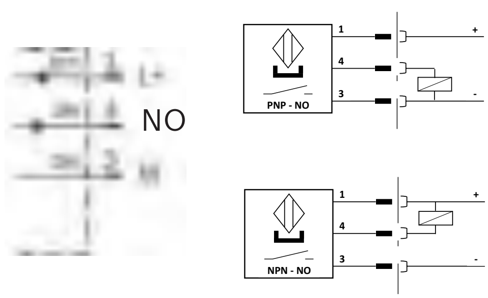
1) Connection
2) Fastening screw
3) LED display
4) Position of sensor element: 2 mm

1 brown (+)
3 blue (–)
4 black (signal)

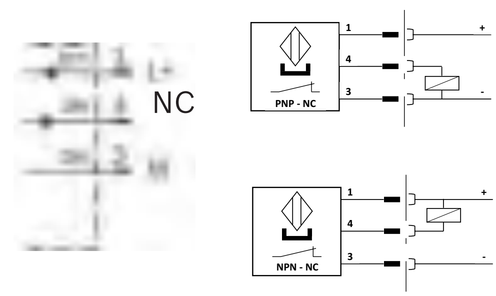


Connection diagram

R913037444
R913037446



R913037443
R913037445



Material numbers/technical data

Use	Limit switch	Reference switch	Limit switch	Reference switch
Material number	R913037445	R913037444	R913037443	R913037446
Name	MZT8-03VPO-KRDS14	MZT8-03VPS-KRDS13	MZT8-03VNO-KRDS16	MZT8-03VNS-KRDS15
Functional principle	magnetic			
Operating voltage	10 - 30 VDC			
Load current	≦ 200 mA			
Switching function	PNP/NC	PNP/NO	NPN/NC	NPN/NO
Connection type	0.5 m cable and M8x1 plug, 3-pin with knurled screw connection			
Function indicator	✓			
Short-circuit protection	✓			
Reverse polarity protection	✓			
Switch-on suppression	✓			
Switching frequency	3 kHz			
Pulse elongation (off delay)	20 ms			
Max. permissible starting speed	5 m/s			
Suitable for drag chains*	✓			
Torsion-resistant*	✓			
Welding spark-resistant*	–			
Cable cross-section*	3x0.14 mm^2			
Cable diameter D*	2.9 ±0.15 mm			
Static bending radius*	≧ 5xD			
Dynamic bending radius*	≧ 10xD			
Bending cycles*	> 2 Mio.			
Max. permissible travel speed*	5 m/s			
Max. permissible acceleration*	≦ 5 m/s^2			
Ambient temperature	–30 °C to +80 °C			
Enclosure protection class	IP68			
MTTFd (per EN ISO 13849-1)	MTTFd = 2,339.0 years			
Certifications and approvals**	CE cULus LISTED RoHS			

*) Technical data for connection line (0.5 m) cast on magnetic sensor only. Available extension cables offer even more performance, e.g. for use in a cable drag chain (see below).

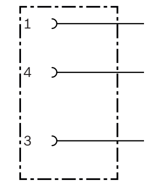
** No CCC certificate for import to the Chinese market required for these products. Document "Sales information CCC" available on request.

Switching system

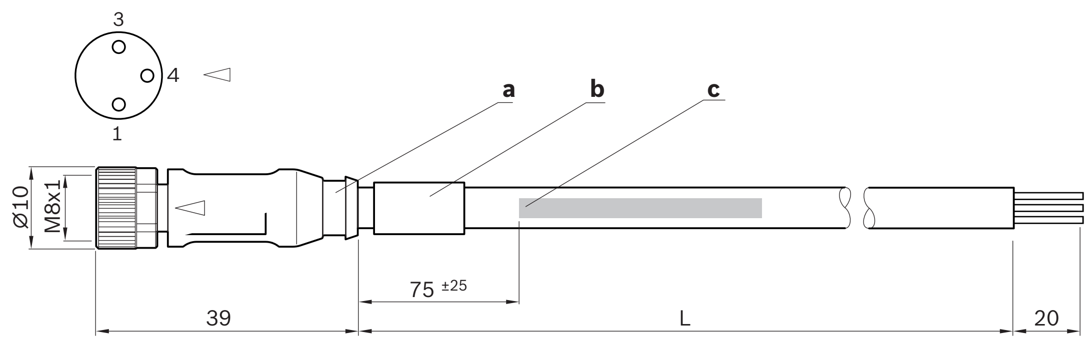
Extensions
Assembled on one end

Connection diagram

1 brown (+)
3 blue (–)
4 black (signal)



Dimension drawing



Material numbers

Use	Extension cable		
Material number	R911344602	R911344619	R911344620
Name	7000-08041-6500500	7000-08041-6501000	7000-08041-6501500
Length (L)	5.0 m	10.0 m	15.0 m
Connection type 1	Female connector, straight, M8x1, 3-pin		
Connection type 2	Unassembled cable end		

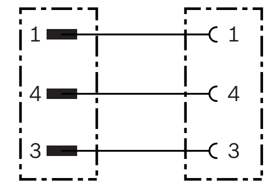
a) Contour for 6.5 mm corrugated tube (inner diameter)
b) Cable grommet
c) Cable printing per printing specification

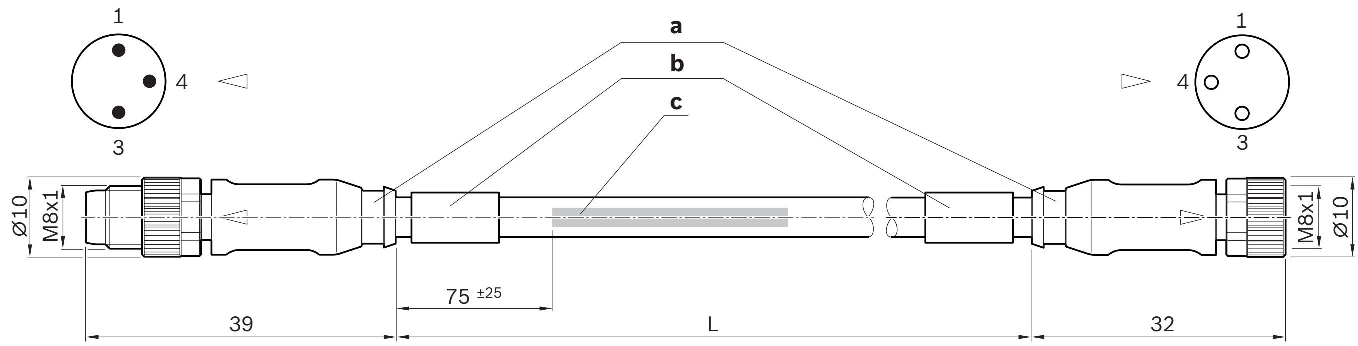
Assembled on two sides

Dimension drawing

Connection diagram

1 brown (+)
3 blue (–)
4 black (signal)





Material numbers

Use	Extension cable				
Material number	R911344621	R911344622	R911344623	R911344624	R911344625
Name	7000-88001-6500050	7000-88001-6500100	7000-88001-6500200	7000-88001-6500500	7000-88001-6501000
Length (L)	0.5 m	1.0 m	2.0 m	5.0	10.0
Connection type 1	Female connector, straight, M8x1, 3-pin				
Connection type 2	Plug, straight, M8x1, 3-pin				

Technical data for extensions pre-assembled on one or two sides

Function indicator	–
Operating voltage indicator	–
Operating voltage	10 - 30 VDC
Type of cable	PUR black
Suitable for drag chains	✓
Torsion-resistant	✓
Weld spark-resistant	✓
Cable cross-section	3x0.25 mm²
Cable diameter D	4.1 ±0.2 mm
Static bending radius	≧ 5xD
Dynamic bending radius	≧ 10xD
Bending cycles	> 10 Mio.
Max. permissible travel speed	3.3 m/s for 5 m travel range (typ.), up to 5 m/s for 0.9 m travel range
Max. permissible acceleration	≦ 30 m/s²
Ambient temperature fixed ext.	–40 °C to +85 °C
Ambient temperature flexible ext.	–25 °C to +85 °C
Enclosure protection class	IP68
Certifications and approvals	CE, cULus LISTED, CSA C US, PCT, RoHS

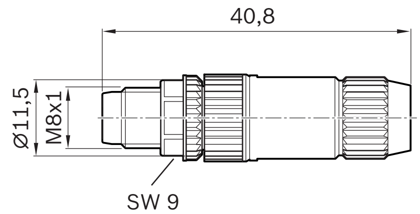
a) Contour for 6.5 mm corrugated tube (inner diameter)
b) Cable grommet
c) Cable printing per printing specification

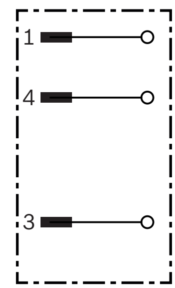
Switching system

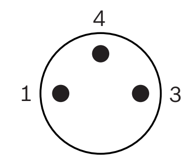
Plugs

Dimension drawing | **Connection diagram** | **View Plug side**

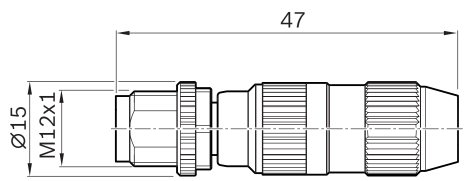
R901388333

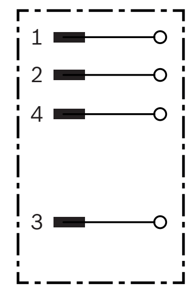


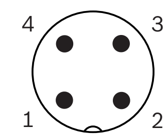




R901388352



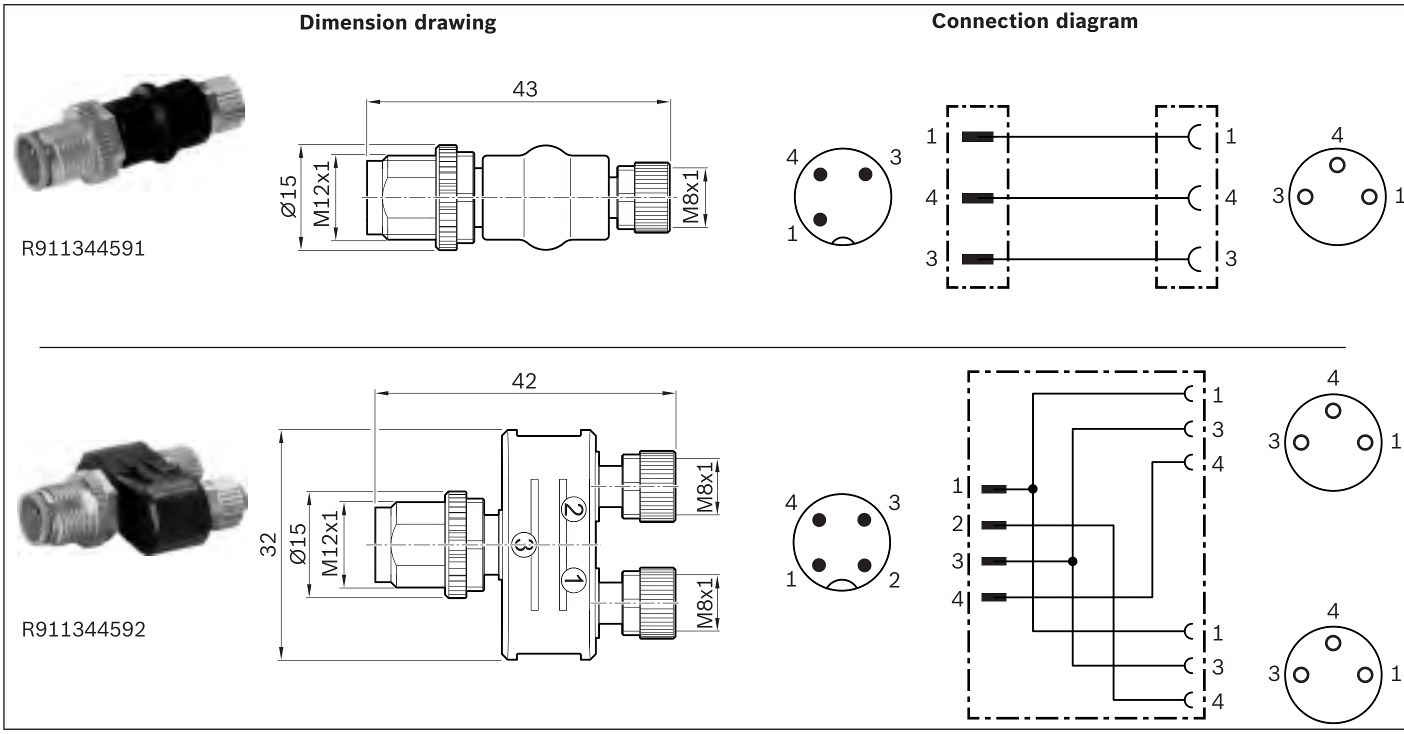




Material numbers / technical data

Use	Plug, single	
Material number	R901388333	R901388352
Name	7000-08331-0000000	7000-12491-0000000
Version	straight	
Operating current per contact	max. 4 A	
Operating voltage	max. 32 V AC/DC	
Connection type	Plug, straight, M8x1, 3-pin Insulation displacement, self-locking screw thread	Plug, straight, M12x1, 4-pin Insulation displacement, self-locking screw thread
Function indicator	–	
Operating voltage indicator	–	
Connection cross-section	0.14...0.34 mm²	
Ambient temperature	–25 °C to +85 °C	
Enclosure protection class	IP67 (inserted and locked)	
Certifications and approvals	c UL us, PCT, RoHS	

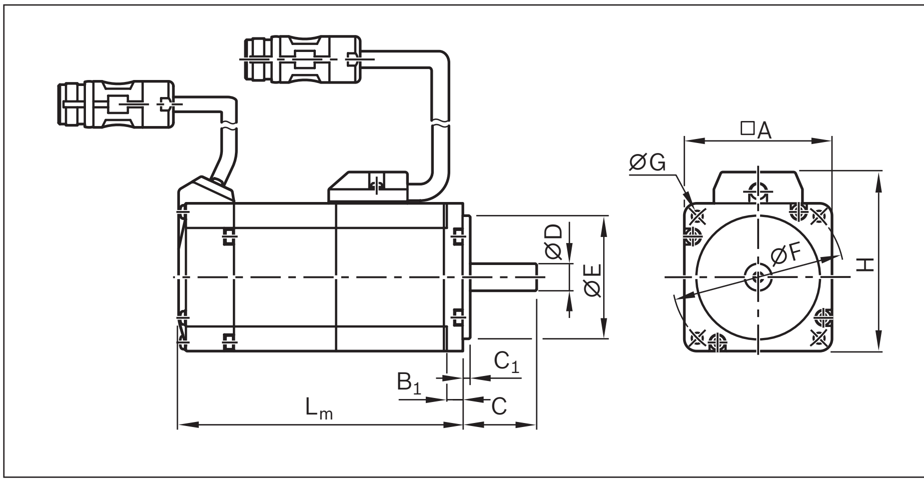
Adapters



Material numbers / technical data

Use	Adapters	
Material number	R911344591	R911344592
Name	7000-42201-0000000	7000-41211-0000000
Version	straight	
Operating current per contact	max. 4 A	
Operating voltage	max. 32 V AC/DC	
Connection type 1	Female connector, straight, M8x1, 3-pin self-locking screw thread	2 X Female connector, straight, M8x1, 3-pin self-locking screw thread
Connection type 2	Plug, straight, M12x1, 3-pin, self-locking screw thread	Plug, straight, M12x1, 4-pin self-locking screw thread
Function indicator	–	
Operating voltage indicator	–	
Connection cross-section	–	
Ambient temperature	–25 °C to +85 °C	
Enclosure protection class	IP67 (inserted and locked)	
Certifications and approvals	RoHS	c UL us LISTED, PCT, RoHS

IndraDyn S – servo motors MSM



Motor schematic

Motor code	Dimensions (mm) A	B$_1$	C	C$_1$	Ø D h6	Ø E h7	Ø F	Ø G	L$_m$ Brake without	L$_m$ Brake with
MSM 019B-0300	38	6.0	25	3	8	30	45	3.4	92.0	122.0
MSM 031B-0300	60	6.5	30	3	11	50	70	4.5	79.0	115.5
MSM 031C-0300	60	6.5	30	3	14	50	70	4.5	98.5	135.0
MSM 041B-0300	80	6.0	35	3	19	70	90	6.0	112.0	149.0

Version:

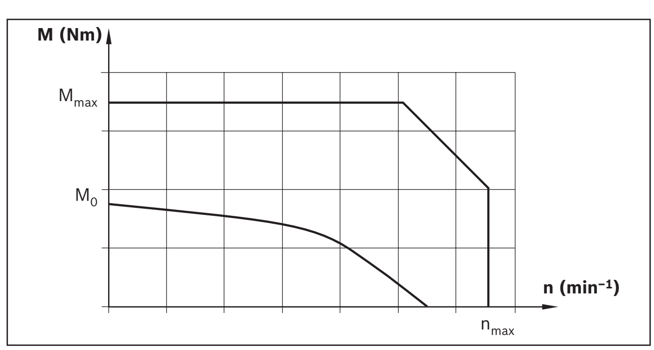
- Plain shaft without shaft seal
- M5 multi-turn absolute encoder (20-bit, absolute encoder function only available with backup battery)
- Cooling system: natural convection
- IP54 enclosure protection class (shaft: IP40)
- With and without brake
- M17 metal round connector

Motor data								Motor connection	Brake	Type code	Material number
n_{max} (min⁻¹)	M_0 (Nm)	M_{max} (Nm)	M_{br} (Nm)	J_m (kgm²)	J_{br} (kgm²)	m_m (kg)	m_{br} (kg)				
5 000	0.32	0.95	0.29	0.0000051	0.0000002	0.47	0.21	2	N	MSM 019B-0300-NN-M5-MH0	R911344211
									Y	MSM 019B-0300-NN-M5-MH1	R911344212
5 000	0.64	1.91	1.27	0.0000140	0.0000018	0.82	0.48	2	N	MSM 031B-0300-NN-M5-MH0	R911344213
									Y	MSM 031B-0300-NN-M5-MH1	R911344214
5 000	1.30	3.80	1.27	0.0000260	0.0000018	1.20	0.50	2	N	MSM 031C-0300-NN-M5-MH0	R911344215
									Y	MSM 031C-0300-NN-M5-MH1	R911344216
4 500	2.40	7.10	2.45	0.0000870	0.0000075	2.30	0.80	2	N	MSM 041B-0300-NN-M5-MH0	R911344217
									Y	MSM 041B-0300-NN-M5-MH1	R911344218

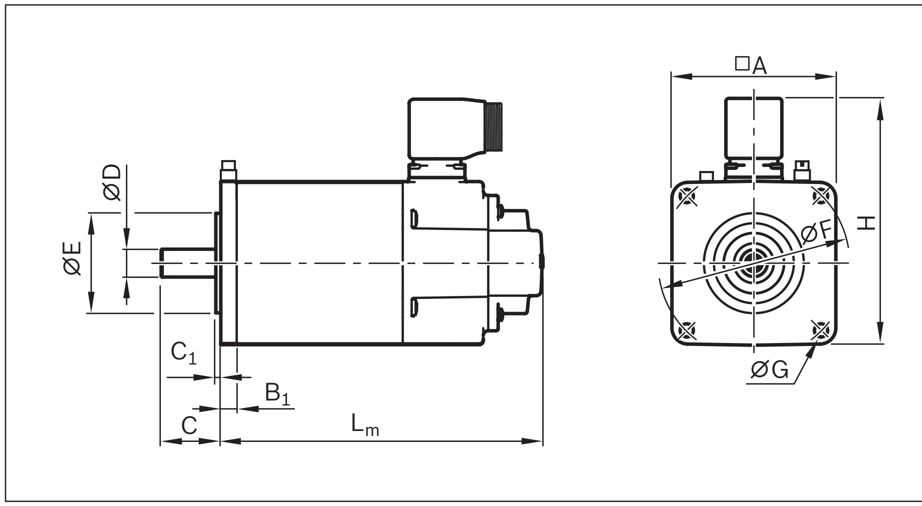
Recommended motor-controller combination

Motor	Controller
MSM 019B-0300	HCS 01.1E-W0003
MSM 031B-0300	HCS 01.1E-W0006
MSM 031C-0300	HCS 01.1E-W0009
MSM 041B-0300	HCS 01.1E-W0013

Motor characteristic
(schematic)



IndraDyn S – servo motors MS2N



Motor schematic

Dimensions / motor data

Motor code	Dimensions (mm) □ A	B_1	C	C_1	ø D k6	ø E j7	ø F	ø G	H Cables 2	H Cables 1	L_m Brake without	L_m Brake with
MS2N03-B0BYN	58	7.5	20	2.5	9	40	63	4.5	84	99	163	192
MS2N03-D0BYN	58	7.5	23	2.5	11	40	63	4.5	84	99	203	232
MS2N04-B0BTN	82	8	30	2.5	14	50	95	6.6	108	123	162	194.5
MS2N04-C0BTN	82	8	30	2.5	14	50	95	6.6	108	123	194	226.5
MS2N04-D0BQN	82	8	30	2.5	14	50	95	6.6	108	123	226	258.5
MS2N05-B0BTN	98	9	40	3	19	95	115	9	124	139	188	218
MS2N05-C0BTN	98	9	40	3	19	95	115	9	124	139	224	254
MS2N05-D0BRN	98	9	40	3	19	95	115	9	124	139	260	290

Version

- Plain shaft without shaft seal ring
- Multi-turn encoder
- Standard encoder (B) in conjunction with 2-cable connection (Hiperface interface)
- Advanced encoder (C) in conjunction with 1-cable connection (AcuroLink interface)
- IP64 enclosure protection class
- With and without brake
- Special ground connection terminal near motor flange (used as needed)

Motor data n_{max} (min^{-1})	M_0 (Nm)	M_{max} (Nm)	M_{br} (Nm)	J_m (kgm^2)	J_{br} (kgm^2)	m_m (kg)	m_{br} (kg)	Motor connection	Brake	Type code	Material number
9 000	0.73	3.46	1.8	0.000023	0.000007	2.0	0.4	2	N	MS2N03-B0BYN-BMDH0-NNNNE-NN	R911384765
								2	Y	MS2N03-B0BYN-BMDH1-NNNNE-NN	R911384766
								1	N	MS2N03-B0BYN-CMSH0-NNNNE-NN	R911384767
								1	Y	MS2N03-B0BYN-CMSH1-NNNNE-NN	R911384769
9 000	1.15	6.8	1.8	0.000037	0.000007	2.0	0.4	2	N	MS2N03-D0BYN-BMDH0-NNNNE-NN	R911384770
								2	Y	MS2N03-D0BYN-BMDH1-NNNNE-NN	R911384771
								1	N	MS2N03-D0BYN-CMSH0-NNNNE-NN	R911384772
								1	Y	MS2N03-D0BYN-CMSH1-NNNNE-NN	R911384773
6 000	1.75	5.9	5.0	0.000070	0.000040	2.7	0.7	2	N	MS2N04-B0BTN-BMDH0-NNNNE-NN	R911384525
								2	Y	MS2N04-B0BTN-BMDH1-NNNNE-NN	R911384526
								1	N	MS2N04-B0BTN-CMSH0-NNNNE-NN	R911384527
								1	Y	MS2N04-B0BTN-CMSH1-NNNNE-NN	R911384528
6 000	2.80	12.0	5.0	0.000110	0.000050	3.7	0.7	2	N	MS2N04-C0BTN-BMDH0-NNNNE-NN	R911384529
								2	Y	MS2N04-C0BTN-BMDH1-NNNNE-NN	R911384530
								1	N	MS2N04-C0BTN-CMSH0-NNNNE-NN	R911384531
								1	Y	MS2N04-C0BTN-CMSH1-NNNNE-NN	R911384532
6 000	3.85	18.1	5.0	0.000160	0.000040	4.7	0.7	2	N	MS2N04-D0BQN-BMDH0-NNNNE-NN	R911384533
								2	Y	MS2N04-D0BQN-BMDH1-NNNNE-NN	R911384534
								1	N	MS2N04-D0BQN-CMSH0-NNNNE-NN	R911384535
								1	Y	MS2N04-D0BQN-CMSH1-NNNNE-NN	R911384536
6 000	3.75	10.6	10.0	0.000170	0.000110	4.0	1.1	2	N	MS2N05-B0BTN-BMDH0-NNNNE-NN	R911384539
								2	Y	MS2N05-B0BTN-BMDH1-NNNNE-NN	R911384540
								1	N	MS2N05-B0BTN-CMSH0-NNNNE-NN	R911384542
								1	Y	MS2N05-B0BTN-CMSH1-NNNNE-NN	R911384543
6 000	6.10	20.8	10.0	0.000290	0.000110	5.9	1.1	2	N	MS2N05-C0BTN-BMDH0-NNNNE-NN	R911384544
								2	Y	MS2N05-C0BTN-BMDH1-NNNNE-NN	R911384545
								1	N	MS2N05-C0BTN-CMSH0-NNNNE-NN	R911384546
								1	Y	MS2N05-C0BTN-CMSH1-NNNNE-NN	R911384547
6 000	7.90	31.3	10.0	0.000400	0.000110	7.3	1.1	2	N	MS2N05-D0BRN-BMDH0-NNNNE-NN	R911384548
								2	Y	MS2N05-D0BRN-BMDH1-NNNNE-NN	R911384549
								1	N	MS2N05-D0BRN-CMSH0-NNNNE-NN	R911384550
								1	Y	MS2N05-D0BRN-CMSH1-NNNNE-NN	R911384551

IndraDyn S – servo motors MS2N

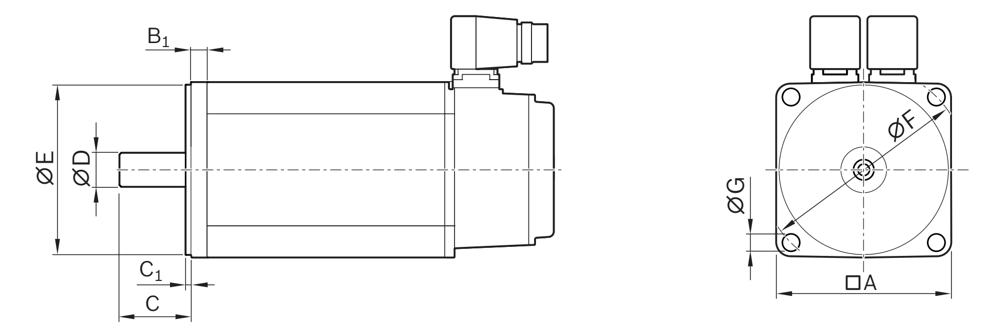
Dimensions / motor data

Motor code	Dimensions (mm)											
	☐ A	B_1	C	C_1	Ø D k6	Ø E j7	Ø F	Ø G	H		L_m	
									Cables		Brake	
									2	1	without	with
MS2N06-C0BTN	116	14	50	3	24	95	130	9	156	156	184	202
MS2N06-D0BRN	116	14	50	3	24	95	130	9	156	156	224	261
MS2N06-D1BNN	116	14	50	3	24	95	130	9	156	156	224	261
MS2N06-E0BRN	116	14	50	3	24	95	130	9	156	156	264	301
MS2N07-B1BNN	140	18	58	4	32	130	165	11	180	180	176	230
MS2N07-C0BQN	140	18	58	4	32	130	165	11	180	180	205	259
MS2N07-C1BRN	140	18	58	4	32	130	165	11	180	180	205	259
MS2N07-D0BRN	140	18	58	4	32	130	165	11	180	180	263	317
MS2N07-D1BNN	140	18	58	4	32	130	165	11	180	180	263	317
MS2N07-E0BQN	140	18	58	4	32	130	165	11	180	180	321	375
MS2N07-E1BNN	140	18	58	4	32	130	165	11	180	180	321	375
MS2N10-C0BNN	196	20	80	4	38	180	215	14	270	270	238	298
MS2N10-D0BNN	196	20	80	4	38	180	215	14	270	270	296	356
MS2N10-E0BNN	196	20	80	4	38	180	215	14	270	270	354	414

Motor data											
n_{max} (min⁻¹)	M_0 (Nm)	M_{max} (Nm)	M_{br} (Nm)	J_m (kgm²)	J_{br} (kgm²)	m_m (kg)	m_{br} (kg)	Motor connection	Brake	Type code	Material number
6 000	6.00	16.0	10.0	0.000390	0.000110	6.4	1.0	2	N	MS2N06-C0BTN-BMUH0-NNNNE-NN	R911384931
								2	Y	MS2N06-C0BTN-BMUH1-NNNNE-NN	R911384932
								1	N	MS2N06-C0BTN-CMSH0-NNNNE-NN	R911384933
								1	Y	MS2N06-C0BTN-CMSH1-NNNNE-NN	R911384934
6 000	9.70	32.0	15.0	0.000650	0.000140	9.0	1.5	2	N	MS2N06-D0BRN-BMUH0-NNNNE-NN	R911384935
								2	Y	MS2N06-D0BRN-BMUH2-NNNNE-NN	R911384936
								1	N	MS2N06-D0BRN-CMSH0-NNNNE-NN	R911384937
								1	Y	MS2N06-D0BRN-CMSH2-NNNNE-NN	R911384938
6 000	9.00	38.4	15.0	0.001400	0.000140	9.0	1.5	2	N	MS2N06-D1BNN-BMUH0-NNNNE-NN	R911384939
								2	Y	MS2N06-D1BNN-BMUH2-NNNNE-NN	R911384940
								1	N	MS2N06-D1BNN-CMSH0-NNNNE-NN	R911384941
								1	Y	MS2N06-D1BNN-CMSH2-NNNNE-NN	R911384942
6 000	13.0	49.0	15.0	0.000890	0.000140	11.5	1.5	2	N	MS2N06-E0BRN-BMUH0-NNNNE-NN	R911384943
								2	Y	MS2N06-E0BRN-BMUH2-NNNNE-NN	R911384944
								1	N	MS2N06-E0BRN-CMSH0-NNNNE-NN	R911384945
								1	Y	MS2N06-E0BRN-CMSH2-NNNNE-NN	R911384946
6 000	7.40	21.0	20.0	0.001970	0.000260	9.5	2.0	2	N	MS2N07-B1BNN-BMUH0-NNNNE-NN	R911384949
								2	Y	MS2N07-B1BNN-BMUH1-NNNNE-NN	R911384950
								1	N	MS2N07-B1BNN-CMSH0-NNNNE-NN	R911384951
								1	Y	MS2N07-B1BNN-CMSH1-NNNNE-NN	R911384952
6 000	12.8	35.7	20.0	0.001200	0.000260	12.0	2.0	2	N	MS2N07-C0BQN-BMUH0-NNNNE-NN	R911384953
								2	Y	MS2N07-C0BQN-BMUH1-NNNNE-NN	R911384954
								1	N	MS2N07-C0BQN-CMSH0-NNNNE-NN	R911384955
								1	Y	MS2N07-C0BQN-CMSH1-NNNNE-NN	R911384956
6 000	11.50	42.2	20.0	0.003050	0.000260	12.0	2.0	2	N	MS2N07-C1BRN-BMUH0-NNNNE-NN	R911384957
								2	Y	MS2N07-C1BRN-BMUH1-NNNNE-NN	R911384958
								1	N	MS2N07-C1BRN-CMSH0-NNNNE-NN	R911384959
								1	Y	MS2N07-C1BRN-CMSH1-NNNNE-NN	R911384960
6 000	22.0	73.2	36.0	0.00210	0.000410	17.5	2.5	2	N	MS2N07-D0BRN-BMVH0-NNNNE-NN	R911384961
								2	Y	MS2N07-D0BRN-BMVH2-NNNNE-NN	R911384962
6 000	18.90	84.8	36.0	0.005290	0.000410	17.5	2.5	2	N	MS2N07-D1BNN-BMUH0-NNNNE-NN	R911384963
								2	Y	MS2N07-D1BNN-BMUH2-NNNNE-NN	R911384964
								1	N	MS2N07-D1BNN-CMSH0-NNNNE-NN	R911384965
								1	Y	MS2N07-D1BNN-CMSH2-NNNNE-NN	R911384966
6 000	29.2	109.5	36.0	0.00300	0.0000410	23.0	3.0	2	N	MS2N07-E0BQN-BMVH0-NNNNE-NN	R911384967
								2	Y	MS2N07-E0BQN-BMVH2-NNNNE-NN	R911384968
6 000	25.8	128.5	36.0	0.00752	0.0000410	23.0	3.0	2	N	MS2N07-E1BNN-BMVH0-NNNNE-NN	R911384969
								2	Y	MS2N07-E1BNN-BMVH2-NNNNE-NN	R911384970
6 000	30.2	70.5	53.0	0.00480	0.001470	23.5	5.0	2	N	MS2N10-C0BNN-BMVH0-NNNNE-NN	R911384875
								2	Y	MS2N10-C0BNN-BMVH2-NNNNE-NN	R911384876
6 000	51.0	142.0	53.0	0.00810	0.001470	34.0	5.0	2	N	MS2N10-D0BNN-BMVH0-NNNNE-NN	R911384877
								2	Y	MS2N10-D0BNN-BMVH2-NNNNE-NN	R911384878
6 000	67.7	214.0	90.0	0.01140	0.002700	45.0	7.0	2	N	MS2N10-E0BNA-BMAH0-NNNNE-NN	R911384881
								2	Y	MS2N10-E0BNA-BMAH3-NNNNE-NN	R911384882
								2	N	MS2N10-E0BNN-BMAH0-NNNNE-NN	R911384879
								2	Y	MS2N10-E0BNN-BMAH3-NNNNE-NN	R911384880

Motor attachment kits according to customer specification

The motor attachment for linear motion systems with Rexroth ball screw assembly consists of either an attachment kit with flange and coupling (MF) or a belt side drive (SD).
The available combinations are shown in the "Configuration and ordering" selection tables for each size. In addition to attachment kits for Rexroth motors, attachment kits for motors according to customer specification are also available. In order to determine the appropriate attachment kit, the connection geometry of the motor is crucial. Characteristics required to clearly determine motor geometry are shown below.

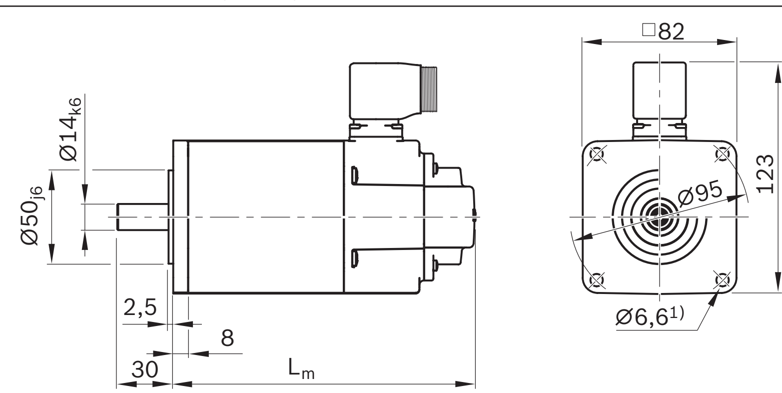


The dimensions queried result in a unique "motor geometry code":

□□ – □□ – □□□ – □□□ – □□□ – M□□ – □□□ – □□□

ØD	=	Shaft diameter
C	=	Shaft length
ØE	=	Centering diameter
C_1	=	Centering depth
ØF	=	Pitch diameter
ØG	=	Drill hole for mounting screw (specify thread diameter)
B_1	=	Flange thickness
A	=	Flange edge dimension

Example illustration of servo motor IndraDyn S type MS2N04



1 4 – 3 0 – 0 5 0 – 2 . 5 – 0 9 5 – M 0 6 – 0 0 8 – 0 8 2

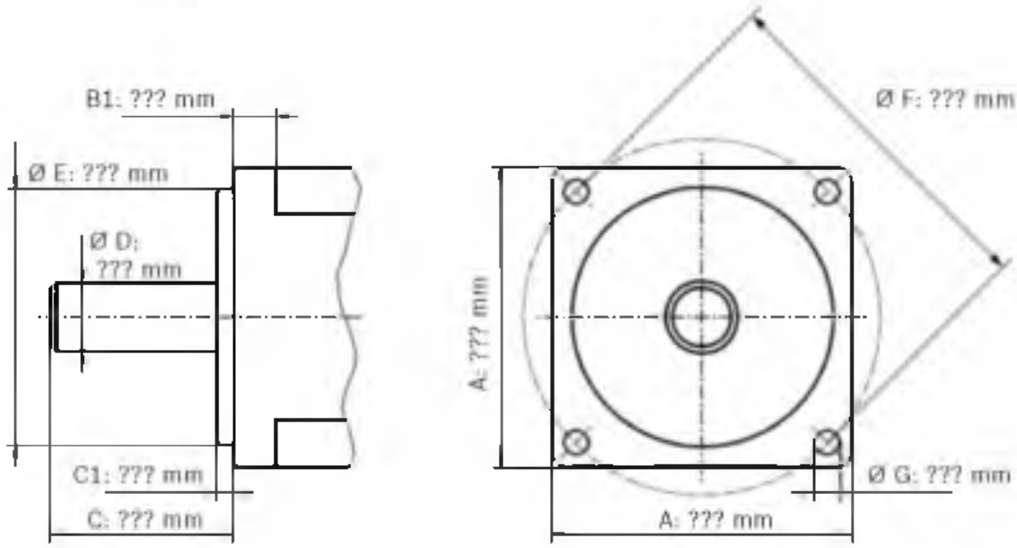
1) The drill hole Ø 6.6 mm results in the type designation M06 for the geometry motor code (nominal thread diameter mounting screw M6).

Motor attachment kits for motors according to customer specification can be selected using the online configurator in the eShop. To do this, select the "mechanical interface" and "motor according to customer specification" option.

Size customer motor

Motor manufacturer [▼]

Motor type [▼]

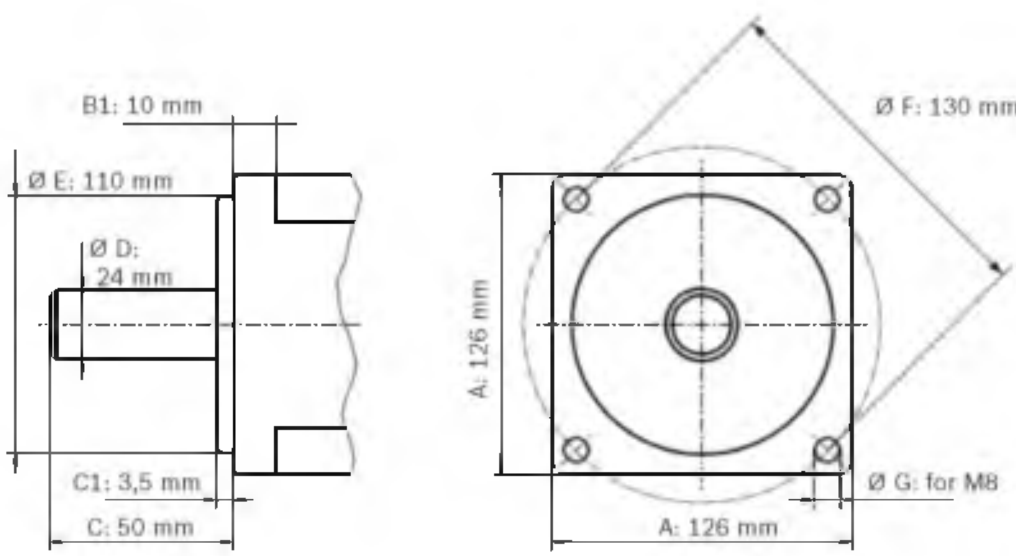


Example

Size customer motor

Motor manufacturer [Siemens ▼]

Motor type [1FK706 ▼]

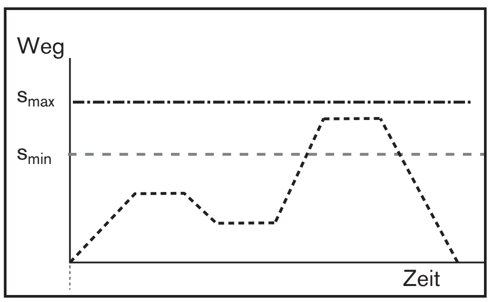


Operating conditions and usage

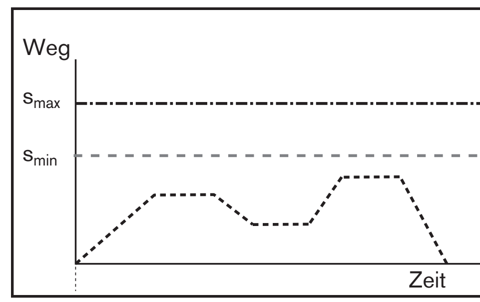
Normal operating conditions

Ambient temperature with Bosch Rexroth servo motor	0 °C ... 40 °C, above 40 °C loss of performance
Ambient temperature Mechanical system (no dropping below dew point)	−10 °C ... 50 °C
Enclosure protection class	IP54, IP65 as an option
Duty cycle	100%
Normal stroke	The distance traveled per cycle is ≥ s_{min} (see diagram)

Stroke definition



Normal stroke



Short stroke

Short stroke: The distance traveled per cycle is **<** s_{min} (see diagram).

Short stroke case 1:
Distance traveled in the cycle < s_{min} and > 2 x screw lead:
- Perform the service life calculation with 69% of the dynamic load rating
- Halve the maintenance interval (see "Instructions EMC R320103102")

Short stroke case 2:
Distance traveled in the cycle < s_{min} and ≤ 2 x screw lead:
- Only permissible with regular lubricating strokes
- Perform the service life calculation with reduction to the dynamic load capacity
- Adapt maintenance interval

Contact Bosch Rexroth for further details.

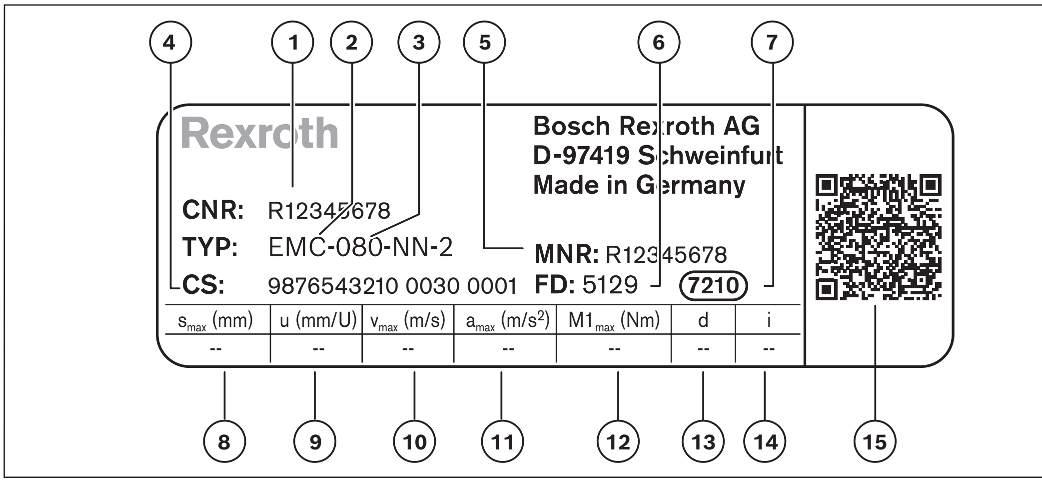
Notes

For more information about intended use and safety, see "Safety instructions for linear motion systems R320103152".

For more information on assembly/start-up see "Instructions EMC R320103102".

Parameterization (start-up)

The nameplate contains reference information on the production of the linear motion system as well as technical start-up parameters.



1	CNR	Customer's material number
2	TYP	Short product name
3	080	Size
4	CS	Customer information
5	MNR	Material number
6	FD	Date of manufacture
7	7210	Manufacturing location
8	s_{max}	Maximum travel range
9	u	Feed constant without motor attachment
10	v_{max}	Maximum travel speed
11	a_{max}	Maximum acceleration rate
12	$M1_{max}$	Maximum drive torque at motor journal
13	d	Direction of motor rotation to travel in positive (+) direction CW = clockwise CCW = counterclockwise
14	i	Gear ratio
15		QR-Code

Note

The values given describe the mechanical limit values of the axle.
Limit values for the included fastening elements and application-related installation cases are not taken into account here.

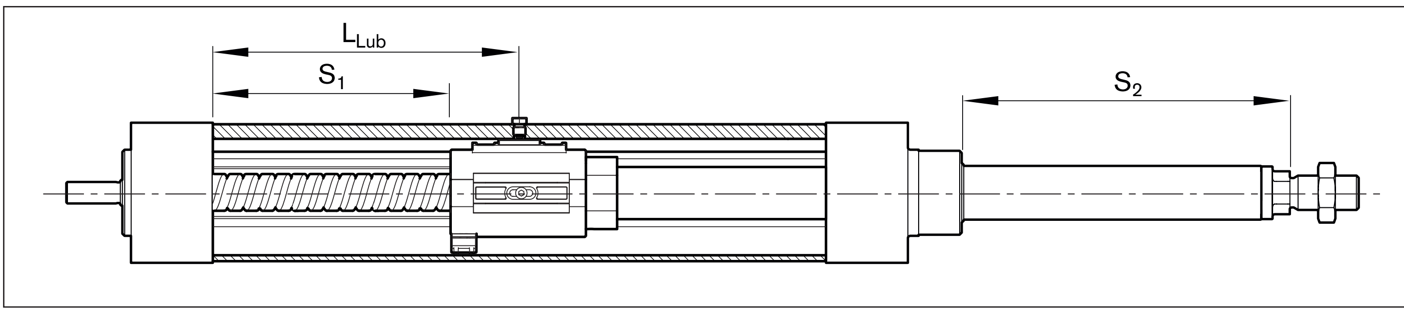
Lubrication and maintenance

Grease lubrication

The advantage of grease lubrication is that Rexroth ball screw assemblies can run for prolonged periods without needing relubrication.
All high-quality ball bearing lubricating greases can be used. Follow the lubricant manufacturer's instructions!
Greases in accordance with DIN 51825-K2K and, for higher loads, KP2K of grade NLGI 2 in accordance with DIN 51818 are recommended for the longest possible lubrication intervals. Tests have shown that grade NLGI 00 greases achieve only about 75% of the travel life of grade 2 at higher loads.

Lubrication position and notes on lubrication

Basic lubrication is applied in-factory before shipment. When selecting the LPG option (preserved version), initial lubrication by the customer is necessary prior to start-up.
The electromechanical cylinders are designed for grease lubrication using a manual grease gun with a lubricating pin, or for connecting to a central lubrication system (with liquid grease). Maintenance is limited to relubrication of the Rexroth ball screw assembly. In order to reach lubrication position L_{Lub}, move the piston rod to stroke position S_2. For this purpose, move S_1 from the rear end position according to the table. For more information, see "Instructions EMC, R320103102".



EMC	P[1) (mm)]	L_{Lub} (mm)	S_1 (mm)	S_2 (mm)
32	5	36.0 + $s_{max}/2$[2)]	21.5 + $s_{max}/2$[2)]	33.0 + $s_{max}/2$[2)]
	10	38.0 + $s_{max}/2$[2)]	18.5 + $s_{max}/2$[2)]	30.0 + $s_{max}/2$[2)]
40	5	35.5 + $s_{max}/2$[2)]	16.1 + $s_{max}/2$[2)]	28.1 + $s_{max}/2$[2)]
	10	40.0 + $s_{max}/2$[2)]	17.5 + $s_{max}/2$[2)]	29.5 + $s_{max}/2$[2)]
	16	48.0 + $s_{max}/2$[2)]	15.0 + $s_{max}/2$[2)]	27.0 + $s_{max}/2$[2)]
50	5	33.0 + $s_{max}/2$[2)]	10.0 + $s_{max}/2$[2)]	24.0 + $s_{max}/2$[2)]
	10	42.5 + $s_{max}/2$[2)]	10.0 + $s_{max}/2$[2)]	24.0 + $s_{max}/2$[2)]
	20	52.0 + $s_{max}/2$[2)]	10.0 + $s_{max}/2$[2)]	24.0 + $s_{max}/2$[2)]
63	5	35.0 + $s_{max}/2$[2)]	10.0 + $s_{max}/2$[2)]	24.0 + $s_{max}/2$[2)]
	10	44.5 + $s_{max}/2$[2)]	10.0 + $s_{max}/2$[2)]	24.0 + $s_{max}/2$[2)]
	25	60.5 + $s_{max}/2$[2)]	10.0 + $s_{max}/2$[2)]	24.0 + $s_{max}/2$[2)]
80	5	37.0 + $s_{max}/2$[2)]	10.0 + $s_{max}/2$[2)]	26.0 + $s_{max}/2$[2)]
	10	49.0 + $s_{max}/2$[2)]	7.5 + $s_{max}/2$[2)]	24.5 + $s_{max}/2$[2)]
	20	53.0 + $s_{max}/2$[2)]	7.5 + $s_{max}/2$[2)]	24.5 + $s_{max}/2$[2)]
	32	70.5 + $s_{max}/2$[2)]	7.5 + $s_{max}/2$[2)]	24.5 + $s_{max}/2$[2)]
100	5	36.0 + $s_{max}/2$[2)]	7.9 + $s_{max}/2$[2)]	23.9 + $s_{max}/2$[2)]
	10	43.0 + $s_{max}/2$[2)]	10.5 + $s_{max}/2$[2)]	27.5 + $s_{max}/2$[2)]
	20	52.0 + $s_{max}/2$[2)]	4.5 + $s_{max}/2$[2)]	21.5 + $s_{max}/2$[2)]
	40	79.5 + $s_{max}/2$[2)]	4.5 + $s_{max}/2$[2)]	21.5 + $s_{max}/2$[2)]
100XC	10	66.5 + $s_{max}/2$[2)]	15.3 + $s_{max}/2$[2)]	43.4 + $s_{max}/2$[2)]
	20	77.5 + $s_{max}/2$[2)]	18.4 + $s_{max}/2$[2)]	46.5 + $s_{max}/2$[2)]

[1)] BASA lead
[2)] s_{max}: maximum travel range of the EMC (see name plate)

Recommended lubricants

Note

Do not use lubricants with solid particles (e.g. graphite or MoS_2 additives).
For central lubrication systems we recommend using Dynalub 520.

Grease	
Consistency class NLGI 2 per DIN 51818	**Consistency class NLGI 00 per DIN 51818**
- **Dynalub 510** (Bosch Rexroth) Cartridge (400 g) R341603700 Bucket (5 kg) R341603500 - **Berulub FG H2 SL** (Bechem) NSF-H1 grease Cartridge (400 g) R341604600	- **Dynalub 520** (Bosch Rexroth) Cartridge (400 g) R341604300 Bucket (5 kg) R341604200
Can also be used	**Can also be used**
Elkalub GLS 135 / N2 (Chemie-Technik) Tribol GR 100-2 PD (Castrol)	Elkalub GLS 135 / N00 (Chemie-Technik) Tribol GR 100-00 PD (Castrol)

Initial lubrication with NSF-H1 lubricant:

Ball screw assembly and other components are pre-lubricated with NSF-H1 lubricant.

Even when using an H1 lubricant, the EMC is only conditionally suitable for use in the foodstuff industry.

H1 lubricants or separating agents (anti-corrosion agents) only have H1 approval if they are available with grade purity in an unmixed state. A blend of two H1 approval lubricants or separating agents does not have H1 approval. Owing to the preservation used for the ball screw assembly, the H1 lubricant in the EMC does not have grade purity.

Information on the materials used is available upon request.
In case of any doubt, please consult Bosch Rexroth.

Connection for central lubrication system

For additional information, please refer to chapter "Attachments and accessories".

Documentation

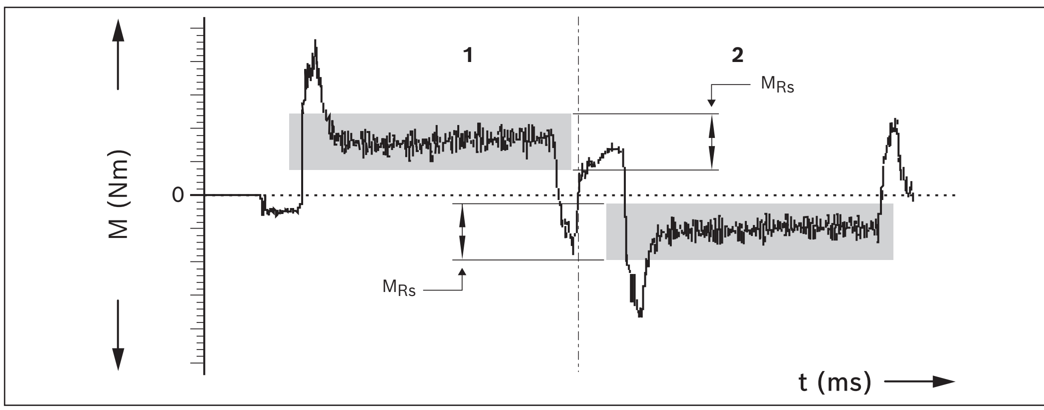
Standard report
Option 01

The standard report serves to confirm that the checks listed in the report have been carried out and that the measured values lie within the permissible tolerances.
Checks listed in the standard report:

- Functional checks of mechanical components
- Functional checks of electrical components
- Design as per order confirmation

Measurement of frictional torque of complete system
Option 02
All items as per the standard report.
The friction torque M is measured over the entire travel range.

Example diagram

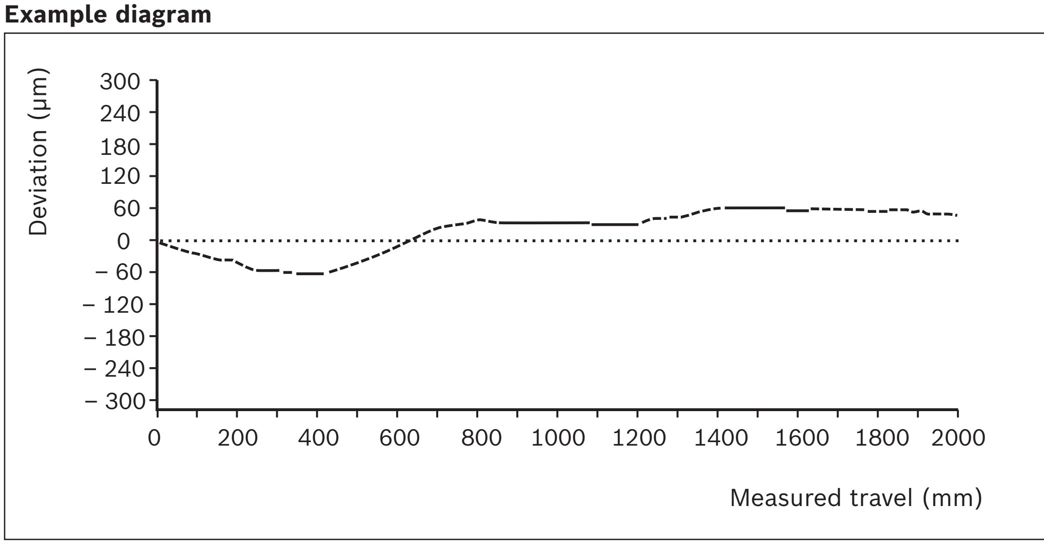


1 Advance
2 Return

M_{Rs} = Friction torque (N)
t = Travel time (ms)

Lead deviation of screw drive
Option 03
All items as per the standard report.
In addition to the graphical illustration (see figure), a measurement report is included in tabular form.

Example diagram



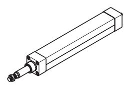
Abbreviations

Abbreviation/ index	Name	Unit
a	Acceleration	(m/s²)
a_{max}	Maximum acceleration rate	(m/s²)
BASA	Ball screw assembly	(–)
C	Dynamic load capacity, guideway	(N)
d_0	Nominal diameter of ball screw assembly	(mm)
F_1, F_2, ... F_n	Axial load during phases 1 ... n	(N)
F_m	Equivalent dynamic axial load	(N)
i	Gear ratio	(–)
J_{br}	Mass moment of inertia of the motor brake	(kgm²)
J_{ex}	Mass moment of inertia of the mechanical system	(kgm²)
J_{ge}	Mass moment of inertia of the gear at motor journal	(kgm²)
J_m	Mass moment of inertia of motor	(kgm²)
J_s	Mass moment of inertia	(kgm²)
J_t	Translative mass moment of inertia of external load based on the linear motion system screw journal	(kgm²)
$k_{g\ fix}$	Constant for fixed portion of mass	(kg)
$k_{g\ var}$	Constant for variable-length portion of mass	(kg/mm)
$k_{J\ fix}$	Constant for fixed portion of mass moment of inertia	(kgmm²)
$k_{J\ m}$	Constant for mass-specific portion of mass moment of inertia	(mm²)
$k_{J\ var}$	Constant for variable-length portion of mass moment of inertia	(kgmm)
L	Nominal service life – in revolutions – in meters	 (min⁻¹) (m)
L_{ad}	Additional length	(mm)
L_h	Nominal service life	(h)
L_m	Length of the motor	(mm)
m_{br}	Mass of the brake	(kg)
m_{ex}	Moved external load	(kg)
m_{fc}	Mass of flange and coupling	(kg)
m_m	Mass of the motor	(kg)
m_s	Mass of the linear system (without attachments)	(kg)
m_{sd}	Mass of the timing belt side drive	(kg)
M_0	Continuous motor torque	(Nm)
M_m	Equivalent dynamic torque	(Nm)
M_{max}	Max. possible motor torque	(Nm)
M_{mech}	Maximum permissible drive torque for mechanical system	(Nm)
M_p	Maximum permissible drive torque (at drive journal)	(Nm)
M_R	Frictional torque at motor journal	(Nm)
M_{Rs}	Friction torque of system	(Nm)

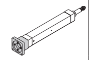
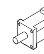
Abbreviation/ index	Name	Unit
M_{stat}	Static load moment	(Nm)
n_1, n_2, ... n_n	Rotary speed in acceleration and braking phases	(min⁻¹)
n_{mech}	Maximum permissible rotary speed for mechanical system	(min⁻¹)
n_{max}	Max. motor speed	(min⁻¹)
n_p	Maximum permissible rotary speed	(min⁻¹)
P	Screw lead	(mm)
s_e	Excess travel (excess travel s_e should be greater than braking distance. The acceleration travel can be used as a guideline value for braking distance.)	(mm)
s_{eff}	Effective stroke	(mm)
s_{min}	Min. travel range	(mm)
s_{max}	Maximum travel	(mm)
t_1, t_2, ... t_n	Time for phase 1 ... n	(s)
u	Feed constant	(mm/U)
v_1, v_2, ... v_n	Speed in phase 1 ... n	(m/s)
v_{max}	Maximum permissible speed	(m/s)
v_{mech}	Maximum permissible speed of mechanical system	(m/s)
v_m	Average linear speed	(m/s)
V	Ratio of mass moments of inertia of drive chain and motor	(–)
π	Pi	(–)

Ordering example

EMC 32 – EMC 50



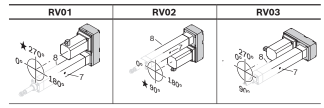
Gehäuse: Standard	Gehäuse: Schutzart IP65	Gehäuse: Schutzart IP65 + R	Schmierung[1]: LSS	LCF	LPG	LHG	LFL[9]	Schalter[6]: ohne Schalter und Sensorprofil	Sensorprofil	Dokumentation: Standardprotokoll	Messprotokolle	
01	02	03	01	02	03	04	05	00	80	01	02[4]	03[5]

Motoranbau  Motor  Dokumentation 

Größe Kurzbezeichnung	Max. Verfahrweg mm	Antrieb BASA d_0 x P (mm)		Schalter 1, 2, 3, 4		Ausführung		Motoranbau: Übersetzung	Anbausatz[2]	Motorcode[3]	Kabel 2 Kabel Bremse ohne	2 Kabel Bremse mit	1 Kabel Bremse ohne	1 Kabel Bremse mit	Motorsteckerlage
EMC-032-NN-2		12 x 5	01	PNP-Öffner	120	OF01	ohne Motoranbau		00	ohne	00				000
						MF01	mit Flansch		01	MSM019B-0300	134	135	–		
									02	MSM031B-0300	136	137	–		
									03	MS2N03-B0BYN	201	202	203	204	
		12 x 10	02			RV01 RV02 RV03	mit Riemenvorgelege	i = 1	41	MSM019B-0300	134	135	–		
									42	MSM031B-0300	136	137	–		
									43	MS2N03-B0BYN	201	202	203	204	
EMC-040-NN-2		16 x 5	01	NPN-Öffner	121	OF01	ohne Motoranbau		00	ohne	00				090
						MF01	mit Flansch		05	MSM031C-0300	138	139	–		
									06	MS2N03-B0BYN	201	202	203	204	
									200	MS2N03-D0BYN	205	206	207	208	
									07	MS2N04-B0BTN	209	210	211	212	
		16 x 10	02			RV01 RV02 RV03	mit Riemenvorgelege	i = 1	45	MSM031C-0300	138	139	–		
									46	MS2N03-B0BYN	201	202	203	204	
									47	MS2N04-B0BTN	209	210	211	212	
										MS2N04-C0BTN	213	214	215	216	
		16 x 16	03					i = 1,5	49	MSM031C-0300	138	139	–		
									50	MS2N03-B0BYN	201	202	203	204	
									51	MS2N04-B0BTN	209	210	211	212	
EMC-050-NN-2		20 x 5	01	PNP-Schlie-ßer	122	OF01	ohne Motoranbau		00	ohne	00				180
						MF01	mit Flansch		09	MSM031C-0300	138	139	–		
									10	MSM041B-0300	140	141	–		
									11	MS2N04-B0BTN	209	210	211	212	
										MS2N04-C0BTN	213	214	215	216	
									12	MS2N05-B0BTN	221	222	223	224	
		20 x 10	02	NPN-Schlie-ßer	123	RV01 RV02 RV03	mit Riemenvorgelege	i = 1	53	MSM031C-0300	138	139	–		270
									54	MSM041B-0300	140	141	–		
									55	MS2N04-C0BTN	213	214	215	216	
									56	MS2N05-C0BTN	225	226	227	228	
		20 x 20	04					i = 1,5	58	MSM031C-0300	138	139	–		
									59	MSM041B-0300	140	141	–		
									60	MS2N04-B0BTN	209	210	211	212	

1) LSS: Standardbefettung; LCF: Vorbereitet für Zentralschmieranlage für Fließfett; LPG: Konservierte Ausführung; LHG: Erstbefettung mit NSF-H1 Fett; LFL: Lebensdauerschmierung
2) Anbausatz auch ohne Motor lieferbar (bei Bestellung: für Motor „00" eintragen) Motor-Anbausatz für Kundenmotor siehe Kapitel Motoranbau.
3) Motortypenschlüssel siehe Kapitel IndraDyn S - Servomotore
4) Reibmomentmessung
5) Steigungsabweichung
6) Sensorprofil und Schalter nicht in Kombination mit Ausführung RV03 möglich
7) Schmieranschluss für LSS, LCF, LPG, LHG; bei LFL Schmierung: Gehäuse ohne Schmieranschluss
8) Nut für Sensorprofil
9) Anwendungsbedingungen beachten siehe Seite 5

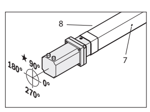
RV01	RV02	RV03



Beispiel:
Riemenvorgelege RV02
Motorsteckerlage 90°

Flansch	Motorsteckerlage 0°	90°	180°	270°
MF01	000	090 ★	180	270

★ Standardauslieferung



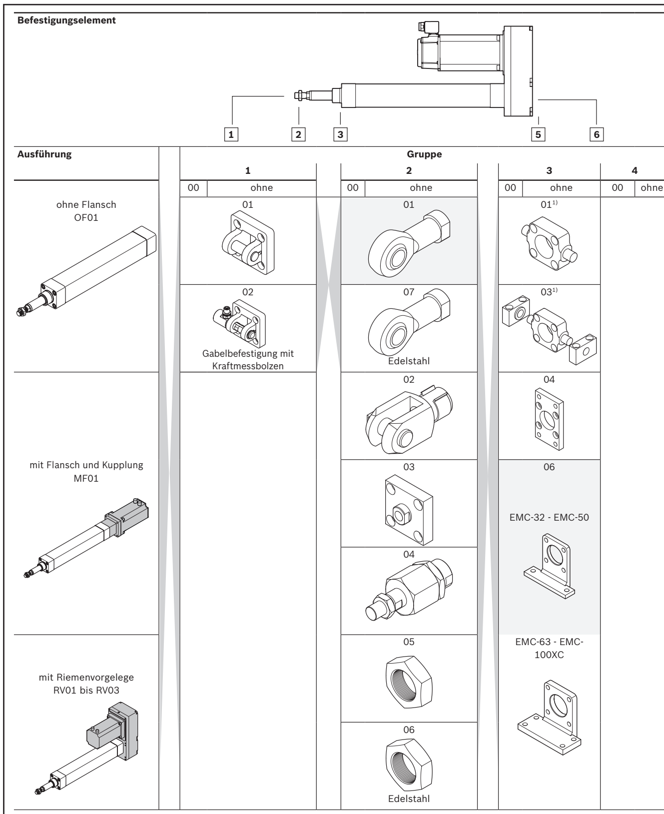
Beispiel:
Flansch MF01
Motorsteckerlage 90°

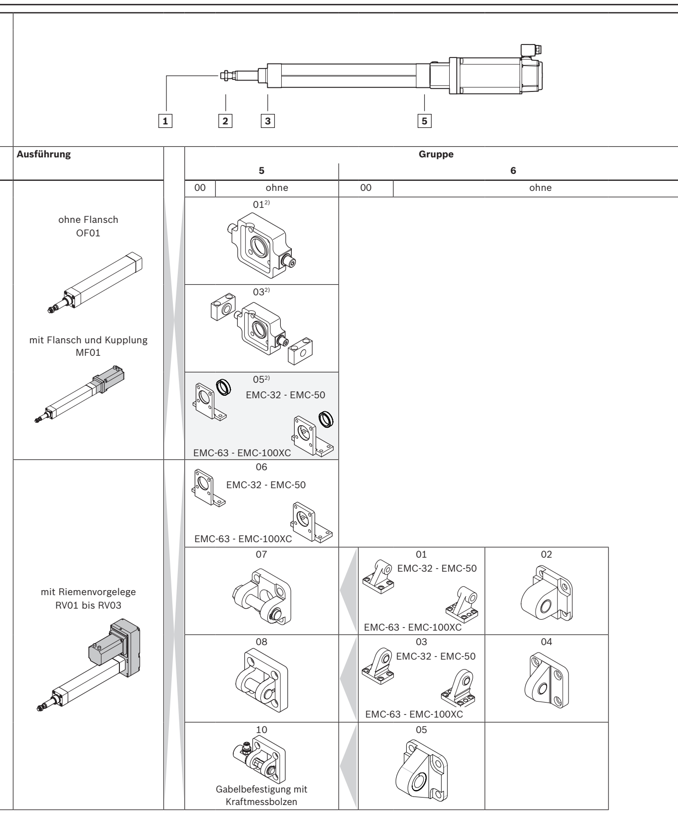
Riemen-vorgelege	Motorsteckerlage 0°	90°	180°	270°
RV01	000	–	180	270 ★
RV02	000	090 ★	180	–
RV03	000 ★	090	–	270

★ Standardauslieferung

Erläuterung der Bestellparameter und Bestellbeispiel
➠ Kapitel „Bestellbeispiel".

Befestigungselement





1) Nur vertikal zulässig
2) Befestigungselemente bei Ausführung mit Flansch und Kupplung bereits angebaut

Hinweis: Befestigungselemente liegen bei

Electromechanical cylinder EMC-040-NN-2

Ordering data		Option	Explanation
Short product name		EMC-040-NN-2	
Max. travel range		580	580 mm
Housing		01	Standard
Drive		02	Rexroth ball screw assembly 16 x 10
Lubrication		02	LCF
Sensor profile		80	With sensor profile
Switch 1		122	PNP NO contact
Version		MF01	With flange
Motor attachment		06	Attachment kit (flange and coupling) for MS2N03
Motor		203	MS2N03, without brake, 1 cable
Documentation		01	Standard
Fastening elements	**Group 1**	00	None
	Group 2	01	Female spherical rod end bearing
	Group 3	06	Foot mounting
	Group 4	00	None
	Group 5	05	Foot mounting
	Group 6	00	None

A Bosch Company

Electromechanical cylinder EMC-HP

Identification system for short product names

Short product name		Example:	**EMC**	–	**130**	–	**HP**	–	**1**
System	=	**E**lectro**M**echanical **C**ylinder							
Size		115 / **130** / 160							
Version	=	**H**igh **P**ower							
Generation	=	Product generation **1**							

Contents

Product description

For positioning loads weighing tons with absolute precision on micrometers, powerful pressing, joining or closing and unrestricted motion sequence variation: The new electromechanical cylinders EMC Heavy Power (EMC-HP) from Rexroth exploit the advantages of modern control technology even at high forces.
The high rigidity of the units allows precise positioning in addition to high performance and dynamics. Users can seamlessly integrate the cylinders into intelligent energy management and in this way reduce power consumption and carbon emissions.
Parameters for force, position and travel speed can be set as required and flexibly adapted to new tasks at any time via the drive system. The electromechanical cylinders EMC-HP for heavy loads transmit the motor movement via ball or planetary screw assemblies depending on the dynamics and force requirements. Available in various sizes and leads, the highly precise Rexroth screw drives cover a wide range of needs in a cost-effectively manner. Rexroth offers the EMC-HP as ready-to-install, purely mechanical axes and as a complete system with a choice of precisely matched gear units, servo motors and drive controllers.

Structural design

The mechanical system in the electromechanical cylinder EMC-HP is based on proven planetary screw assemblies in a wide range of diameter and lead combinations. A screw drive converts torque into linear motion with high mechanical efficiency. During this process, the piston rod fastened to the screw drive nut is extended and retracted. Both the nut and the piston rod are guided in the housing.
The piston rod-to-housing interface is optimally sealed to prevent dirt from working its way in.
The housing fulfills the requirements for protection class IP 65, the piston rod those for IP 54. The piston rod is protected against turning.
Integrated end position buffers protect the mechanical system during start-up. Switches are available as an option. Limit switches prevent damage to the cylinder in operation. A reference point switch is available for the use of incremental encoder systems. A load measuring pin is available for the exact measurement of forces.
Electromechanical Cylinders EMC-HP require only minimum maintenance effort. The advantage of grease lubrication is that the screw drive can run long distances on one supply of grease. The oil bath lubrication entails the advantage of longer maintenance intervals.

Advantages

- High energy efficiency and low negative environmental impact (no risk of leaks)
- Straightforward, compact and robust structural design for space-saving integration in machine concepts and usage even in harsh environmental conditions
- Complete building system with great variability for high flexibility in a broad range of applications
- Precise positioning, high dynamics, powerful drive and a long service life thanks to precision Rexroth planetary screw assemblies
- Smart, service-oriented, freely programmable drive system allows the realization of complex travel profiles (parameters for force, position and travel speed can be set as required over the complete working travel range)

Condition as delivered

- The electromechanical cylinder EMC-HP is delivered as a completely assembled unit. The only parts not pre-assembled are pillow blocks, clevis brackets and the switches.

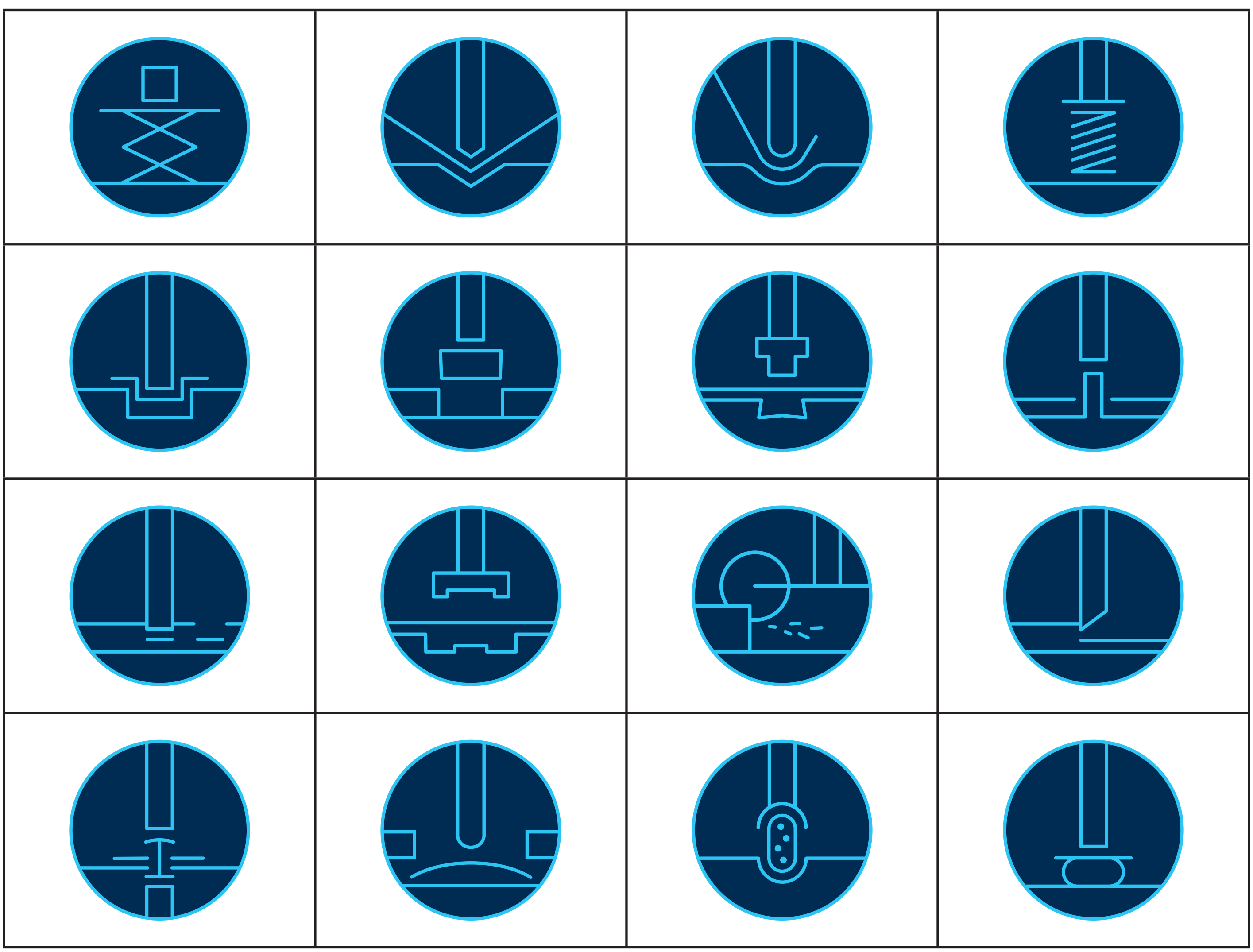
Application areas

Electromechanical cylinders EMC-HP can be used in many application areas. Due to their specific characteristics, they offer advantages in terms of accuracy, dynamics and controllability, and can therefore not only help to shorten cycle times but also to increase flexibility and quality in the manufacturing process. Their space-saving design makes them ideal for use in tightly confined spaces.

Possible application areas are:

- Servo presses and forming technology
- Joining technology
- Thermoforming
- Injection molding and blow molding machines
- Woodworking machines
- Machine tools
- Assembly and handling technology
- Packaging machines and conveyor systems
- Testing equipment and laboratory applications
- Simulators
- Special machines

Application examples: Bending, lifting, pressing, transporting, etc.



Structural design

1 Threaded bolt (galvanized steel)
2 Lock nut (galvanized steel)
3 Piston rod (stainless steel)
4 Thread (for mounting fastening elements)
5 Cover (aluminum, anodized)
6 Housing (aluminum, anodized)
7 Screw journal
8 Base (aluminum, anodized)
9 Lube connection (on two sides)
10 Cover for T-slot for switches
11 Service openings

Attachments
12 Motor
13 Gear (optional)
14 Flange (aluminum, anodized)
15 Belt side drive (aluminum, anodized)

Motor flange and coupling
The motor flange is used to fasten the motor to the EMC and as a closed housing unit for the coupling. With the coupling, the drive torque of the motor is transmitted free of distortive stresses on the screw journal of the EMC.

Belt side drive
This configuration results in the shortest overall length of the EMC possible.
The space-saving, closed housing serves as protection for the belt, motor bracket and to connect fastening elements.
Gear ratio i = 1 : 1.5

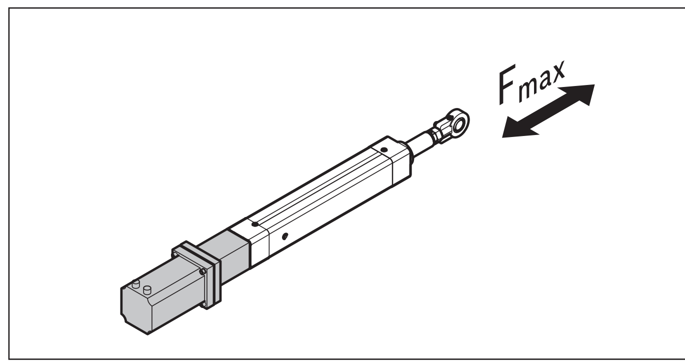
Mounting examples

Technical data

Dimensions, load ratings, maximum forces and masses

EMC-HP	PLSA								L_{ad} (mm)		
	d_0xP	C	F_{max}	M_p	v_{max}	a_{max}	s_{max}	s_{min}	Trunnion		n_P
	(mm)	(N)	(N)	(Nm)	(m/s)	(m/s^2)	(mm)	(mm)	without	with	(min^{-1})
115	30 x 5	82 000	44 000	43.8	0.42	30	1 200	85	332.0	374	5 000
	30 x 10	82 000	41 000	81.6	0.83	30	1 200	85	332.0	374	5 000
130	39 x 5	120 000	65 000	64.7	0.32	30	1 500	110	364.0	420	3 850
	39 x 10	120 000	70 000	139.3	0.64	30	1 500	110	364.0	420	3 850
160	48 x 5	179 000	95 000	94.5	0.26	30	1 500	130	418.5	482	3 125
	48 x 10	179 000	100 000	198.9	0.52	30	1 500	130	418.5	482	3 125

Note on dynamic load rating
In relation to the desired service life, an equivalent dynamic axial load of up to about 20% of the dynamic load rating (C) has generally proven effective.
Do not exceed the technical data.



Mass of the EMC-HP
Weight calculation without motor and without motor attachment*)

$$m_s = k_{g\ fix} + k_{g\ var} \cdot s_{max}$$

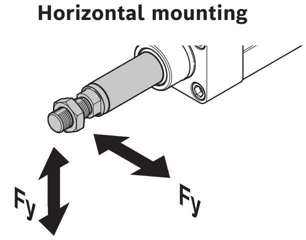
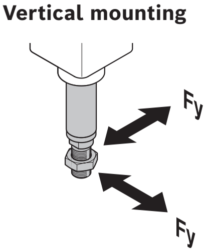
Moved mass of system*)

$$m_{ca} = m_{ca\ fix} + m_{ca\ var} \cdot s_{max}$$

*) When calculating the mass of the entire system, the masses of the attachments/fastening elements must also be taken into account.

The indicated values apply in case of compliance with the specified relubrication intervals and to standard operation.
For short stroke operation (stroke < s_{min}), reduction factors must be taken into consideration.
(see chapter "Operating conditions and application").

Load on the piston rod

Horizontal mounting	Vertical mounting
	

Loading the piston rod with transverse forces is not permissible

					m_s		m_{ca}	
η	**M_{Rs}** (Nm)	**$k_{J\ fix}$**	**$k_{J\ var}$**	**$k_{J\ m}$**	**$k_{g\ fix}$** (kg)	**$k_{g\ var}$** (kg/mm)	**$m_{ca\ fix}$** (kg)	**$m_{ca\ var}$** (kg/mm)
0.80	6.00	811.00	0.625	0.633	11.2	0.019	4.0	0.0055
0.80	6.00	819.00	0.629	2.533	11.2	0.019	4.0	0.0055
0.80	7.00	1947.00	1.768	0.633	17.0	0.026	5.8	0.0068
0.80	7.00	1958.00	1.781	2.533	17.0	0.026	5.8	0.0068
0.80	8.00	5598.00	4.095	0.633	28.6	0.035	10.7	0.0115
0.80	8.00	5618.00	4.091	2.533	28.6	0.035	10.7	0.0115

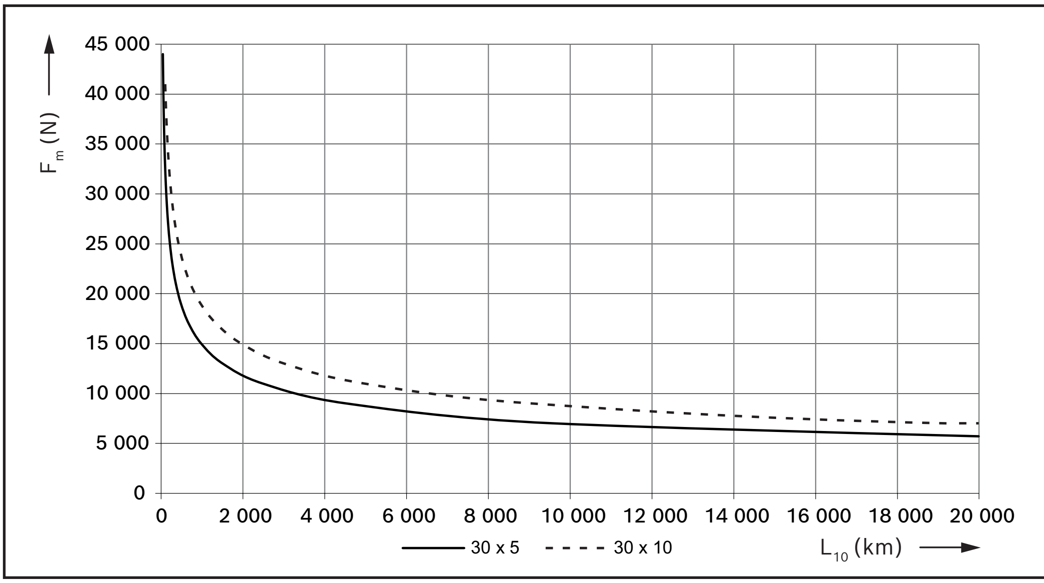
Length calculation

$$L = L_{ad} + S_{max}$$

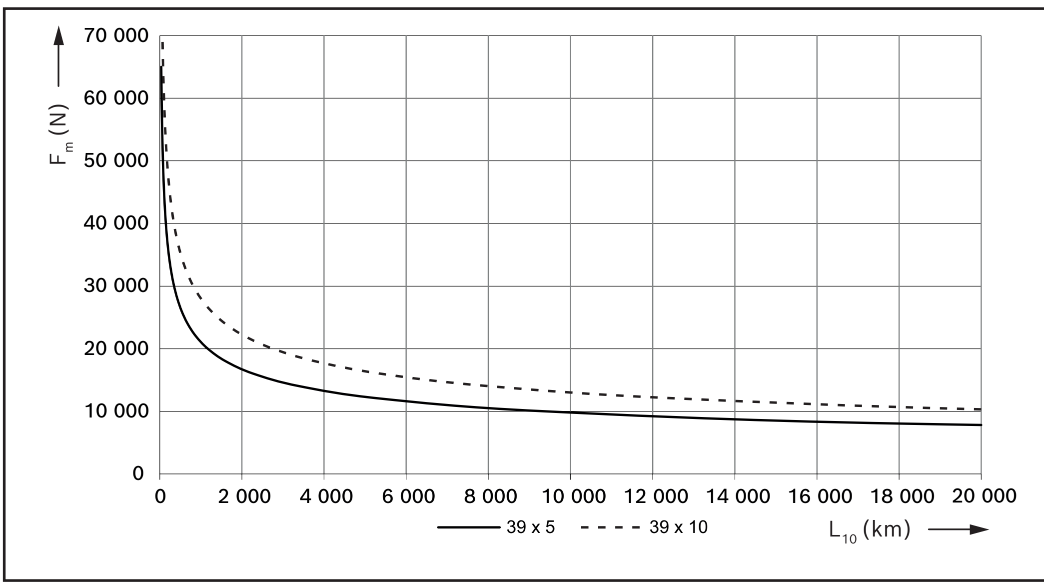
For abbreviations see chapter "Service and Information"

Service life

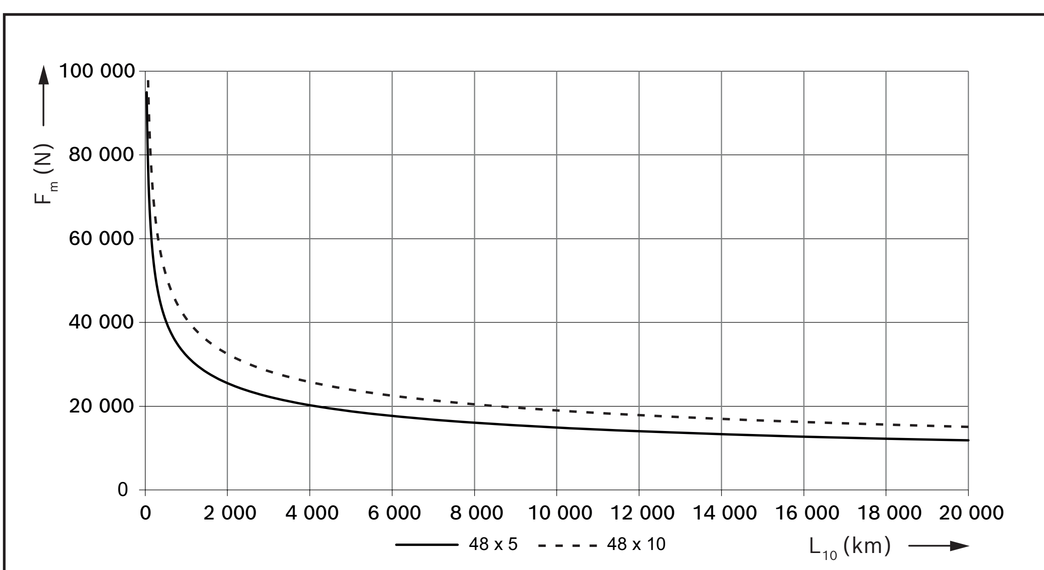
EMC-115-HP



EMC-130-HP

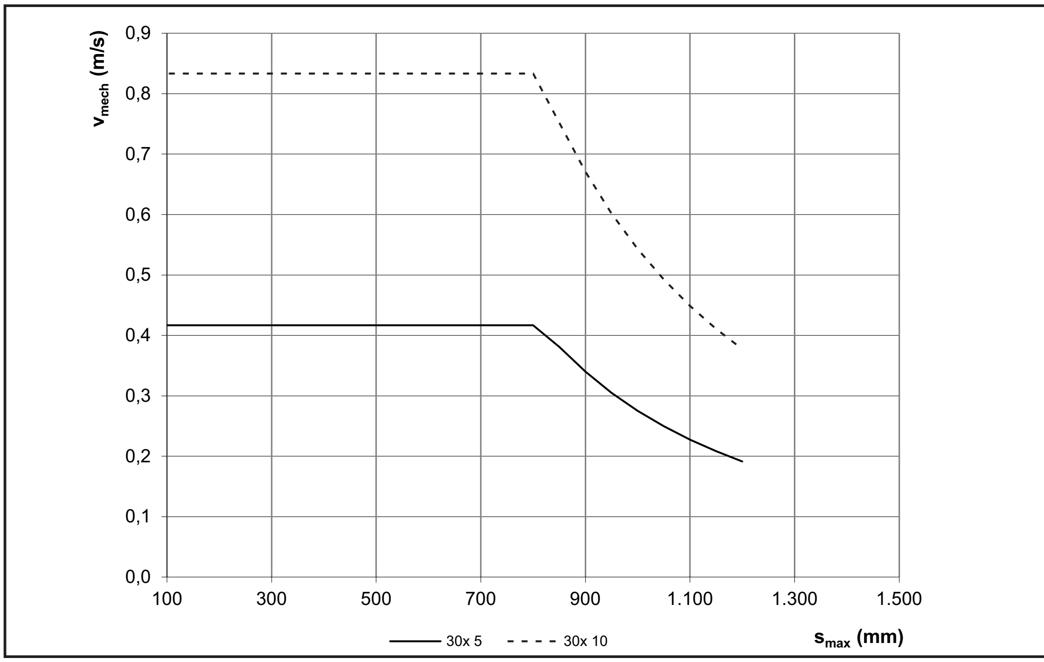


EMC-160-HP

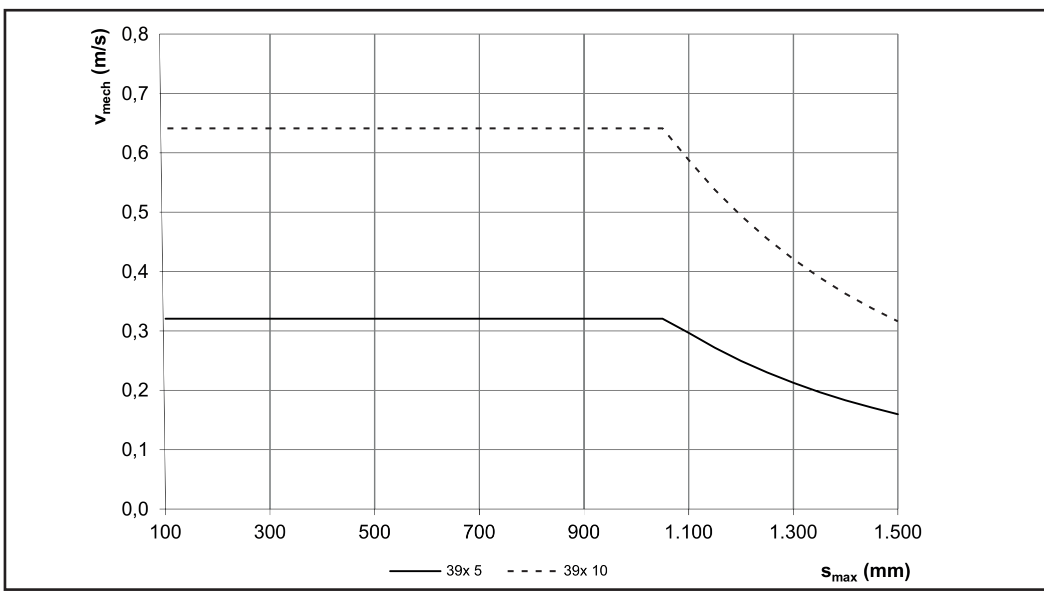


Travel speeds

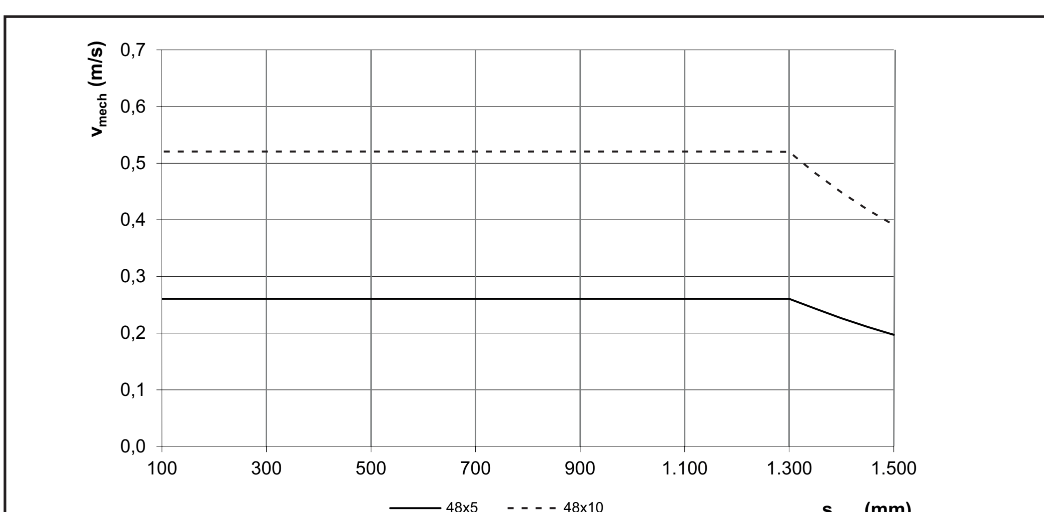
EMC-115-HP



EMC-130-HP



EMC-160-HP



Axial load on the cylinder mechanics

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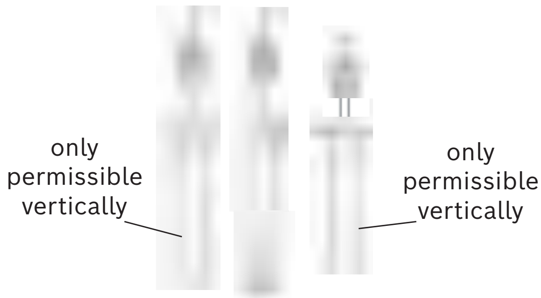
Size</th><th>Case I</th><th>Case II</th></tr>
<tr><td></td><td>
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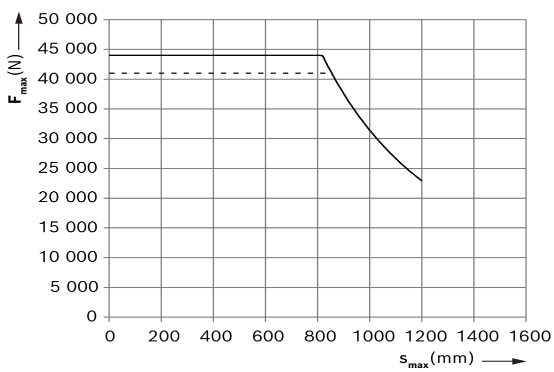
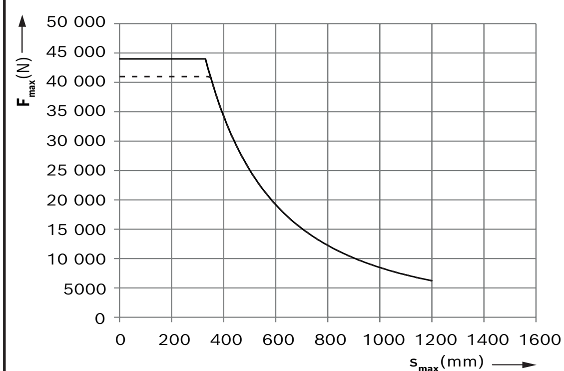
------ 30x10</td><td>
</td><td>
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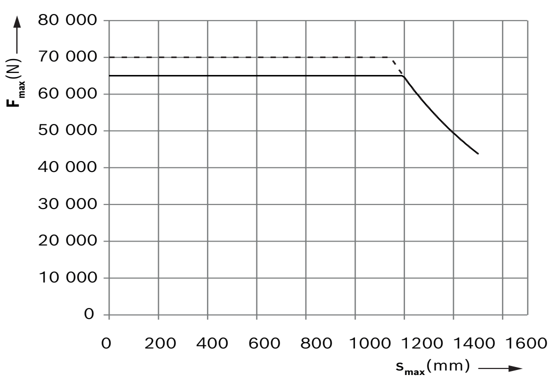
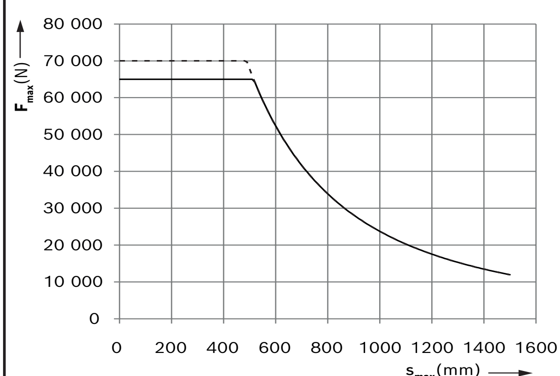
------ 39x10</td><td>
</td><td>
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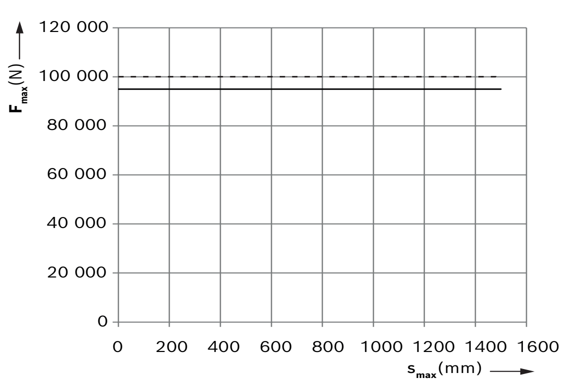
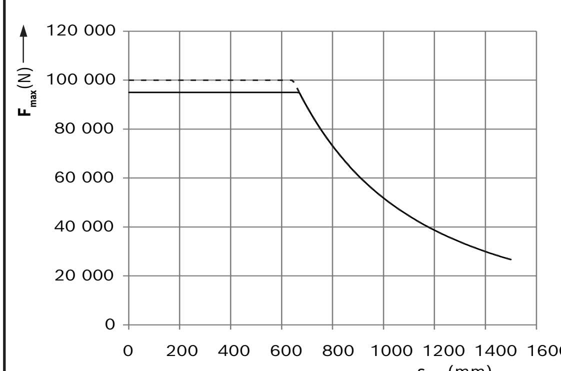
------ 48x10</td><td>
</td><td>
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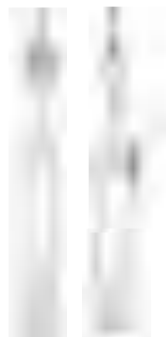
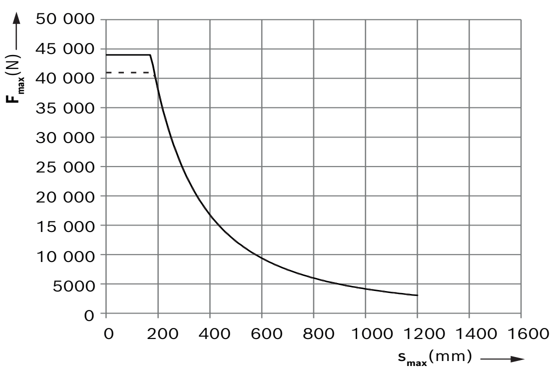
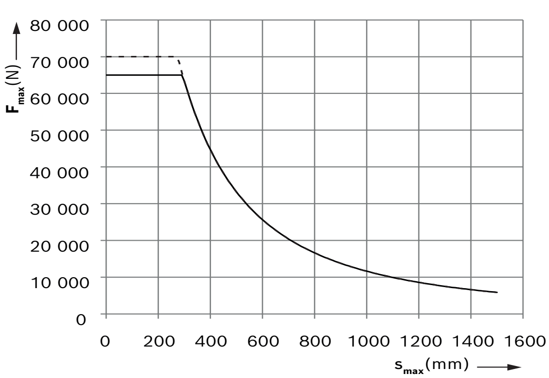
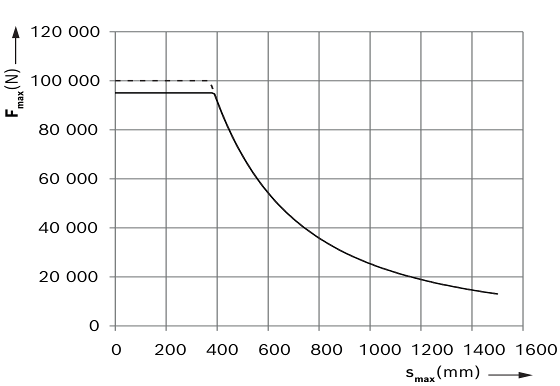
Case III

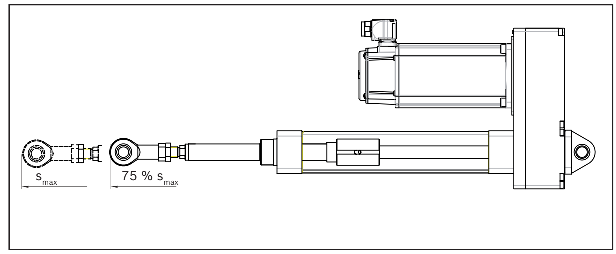






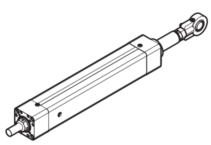


Installation case III

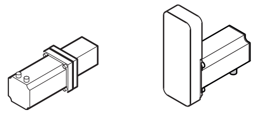
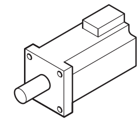


Note: In this installation case the cylinder mechanism of the EMC is loaded by its dead weight in a horizontal position.
Thus, the piston rod may be extended horizontally only up to 75% of s_{max}.

EMC-115-HP -1 Configuration and ordering

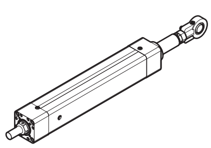
Short product name, s_{max} EMC-115-HP-1, ... mm	Housing	Drive	Lubrication				Switches					Cable duct	
		PLSA d_0xP		LSS standard lubrication[1]	LOB Oil bath lubrication	LLG low-temperature grease	Without sensor	PNP NC	NPN NC	PNP NO	NPN NO	Cover profile without	Cover profile with
	Standard	30 x 5	Grease lubrication	001	–	006	000	120	121	122	123	000	081
		30 x 10	Oil bath lubrication	–	011	–							

1) LSS: Standard lubrication with Dynalub 510 with manual grease gun
2) Measurement of frictional torque without motor attachment

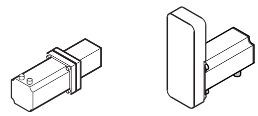
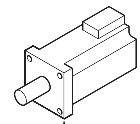
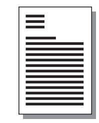
Version*		Mounting interface 			Motor 					Motor connector position*	Docu-mentation 
						Connection					
						1 cable		2 cables			
		Gear ratio	Mechanical interface		Motor code	without brake	with brake	without brake	with brake		
F000	flangeless		without	000	without	000	000	000	000	000 090 180 270	Standard report 001 Measurement of frictional torque[2] 002 Lead deviation 003
F001	with flange	i = 1	MS2N07	001	MS2N07-D1BNN	269	270	–	–		
					MS2N07-D0BHA	–	–	287	288		
			MS2N10	002	MS2N10-C0BNN	–	–	289	290		
					MS2N10-D0BHA	–	–	291	292		
S000 S090 S180 S270	with belt side drive	i = 1.5	MS2N07	040	MS2N07-D1BNN	269	270	–	–		
					MS2N07-D0BHA	–	–	287	288		
			MS2N10	041	MS2N10-C0BNN	–	–	289	290		

* see page Configuration and ordering, comprehensive information

EMC-130-HP -1 Configuration and ordering

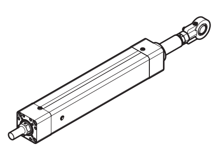
Short product name, s_{max} EMC-130-HP-1, ... mm	Housing	Drive	Lubrication				Switches					Cable duct	
												Cover profile	
		PLSA d_0xP		LSS standard lubrication[1]	LOB Oil bath lubrication	LLG low-temperature grease	Without sensor	PNP NC	NPN NC	PNP NO	NPN NO	without	with
	Standard	39 x 5	Grease lubrication	001	–	006	000	120	121	122	123	000	081
		39 x 10	Oil bath lubrication	–	011	–							

[1] LSS: Standard lubrication with Dynalub 510 with manual grease gun
[2] Measurement of frictional torque without motor attachment

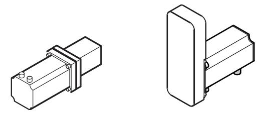
Version*		**Mounting interface**			**Motor**			**Motor connector position***	**Docu-mentation**
						Connection 2 cables			
		Gear ratio	Mechanical interface		Motor code	without brake	with brake		
F000	flangeless		without	000	without	000	000	000 090 180 270	Standard report 001 Measurement of frictional torque[2] 002 Lead deviation 003
F001	with flange	i = 1	MS2N07	001	MS2N07-D0BHA	287	288		
			MS2N10	002	MS2N10-D0BHA	291	292		
					MS2N10-E0BHA	293	294		
S000 S090 S180 S270	with belt side drive	i = 1.5	MS2N07	040	MS2N07-D0BHA	287	288		
			MS2N10	041	MS2N10-E0BHA	293	294		

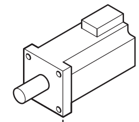
* see page Configuration and ordering, comprehensive information

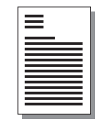
EMC-160-HP -1 Configuration and ordering

Short product name, s_{max} EMC-160-HP-1, ... mm	Housing	Drive	Lubrication				Switches					Cable duct	
		PLSA d_0xP		LSS standard lubrication[1]	LOB Oil bath lubrication	LLG low-temperature grease	Without sensor	PNP NC	NPN NC	PNP NO	NPN NO	Cover profile without	with
	Standard	48 x 5	Grease lubrication	001	–	006	000	120	121	122	123	000	081
		48 x 10	Oil bath lubrication	–	011	–							

1) LSS: Standard lubrication with Dynalub 510 with manual grease gun
2) Measurement of frictional torque without motor attachment





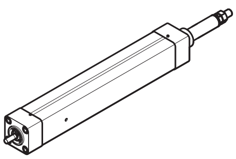
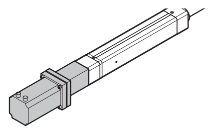
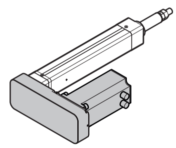
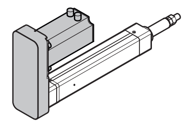
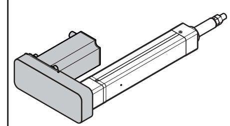
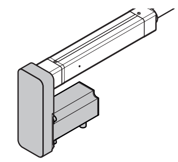


Version*			Mounting interface			Gearing	Motor			Motor connector position*	Documentation
								Connection 2 cables			
			Gear ratio	Mechanical interface		Gear ratio	Motor code	without brake	with brake		
	F000	flangeless		without	000		without	000	000	000 090 180 270	Standard report 001 Measurement of frictional torque[2] 002 Lead deviation 003
	F001	with flange	i = 1	MS2N10	001	–	MS2N10-D0BHA	291	292		
			i = 1	MS2N10 with gear unit	006	i = 3	MS2N10-E0BHA	293	294		
	S000 S090 S180 S270	with belt side drive	i = 1.5	MS2N10	041	–	MS2N10-C0BNN	289	290		
							MS2N10-D0BHA	291	292		
							MS2N10-E0BHA	293	294		
				MS2N10 with gear unit	051	i = 3	MS2N10-C0BNN	289	290		

* see page Configuration and ordering, comprehensive information

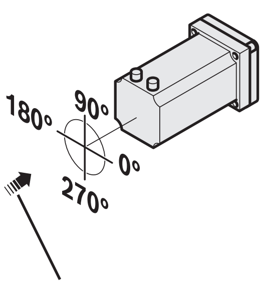
Configuration and ordering, comprehensive information

Motor attachment and motor connector position

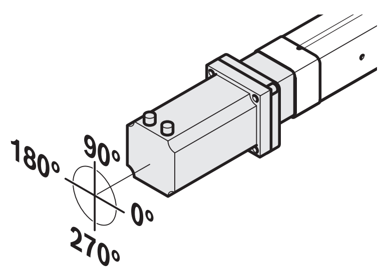
F000	F001	S000	S090	S180	S270
					

Version	Motor connector position			
	0 °	90 °	180 °	270 °
F001	000	090 ★	180	270
S000	–	090	180 ★	270
S090	000	090 ★	180	–
S180	000 ★	090	–	270
S270	000	–	180	270 ★

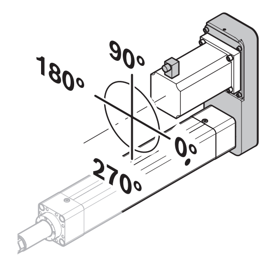
★ standard delivery



Direction of vision

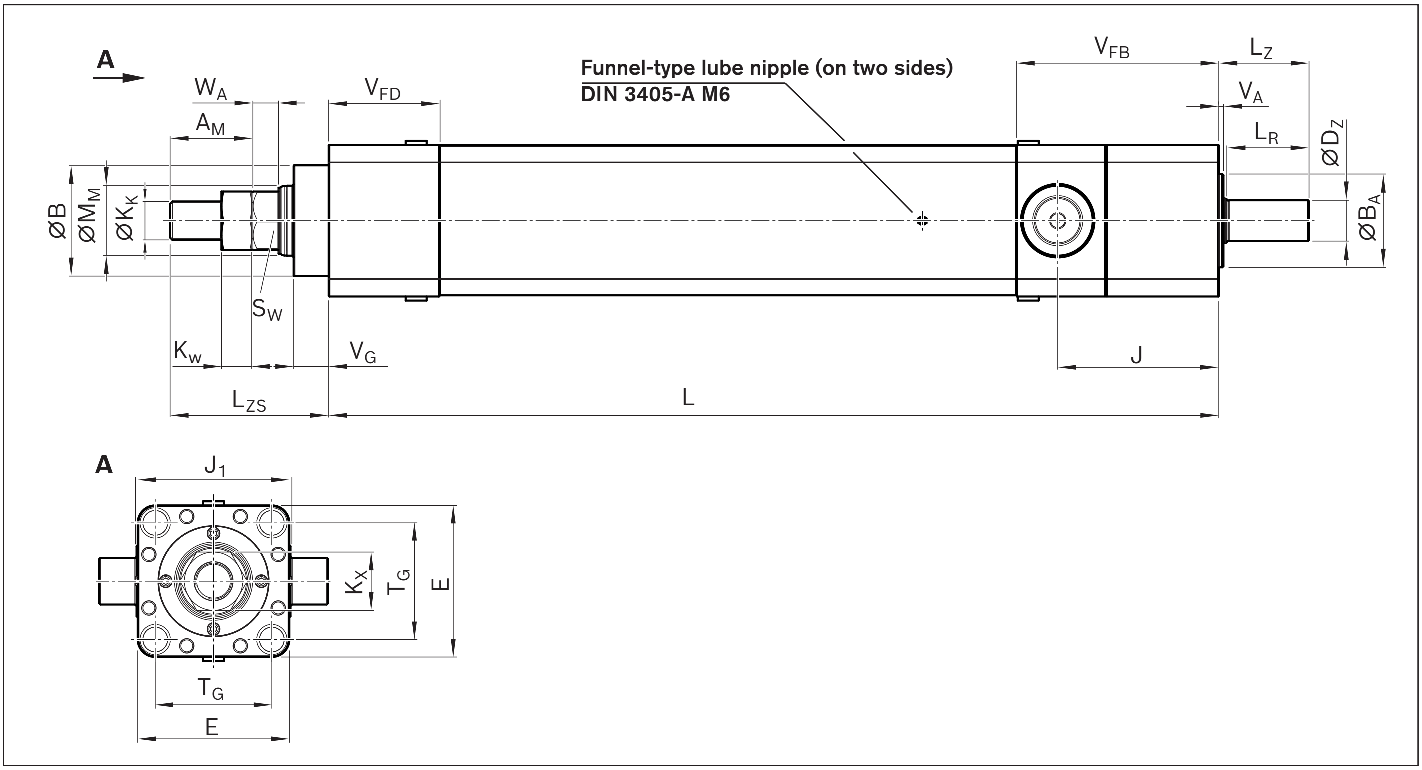


Example:
Flange F001
Motor connector position 90°



Example:
Belt side drive S090
Motor connector position 90°

Dimension drawings for electromechanical cylinder

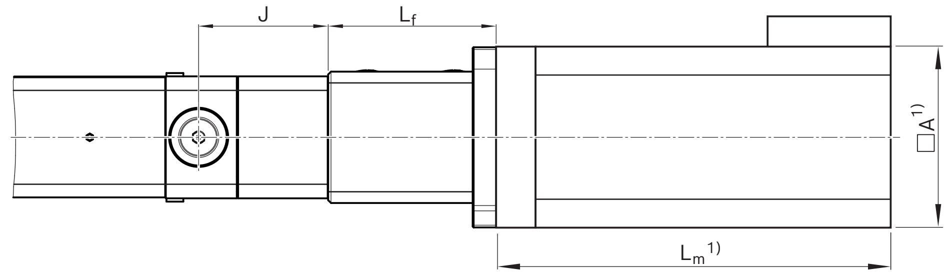


EMC-HP	**Dimensions** (mm)																				
	A_M	E	J	J_1	K_W	K_X	L_Z	L_{ZS}	L_R	S_W	T_G	V_A	V_{FB} Trunnion without	V_{FB} Trunnion with	V_{FD}	V_G	ØB	$ØB_A$	$ØD_Z$ h7	$ØM_M$ f8	$ØK_K$
115	59	115	117	117	22	41	78	139	70.5	41	87	4	105.5	147.5	90.5	30	85	70	25	50	M27x2
130	71	130	138	132	26	50	78	155	70.5	50	100	4	117.5	173.5	95.5	30	95	80	35	60	M33x2
160	89	160	160	162	34	65	82	176	71.5	60	125	4	135.0	198.5	105.5	30	106	93	40	70	M42x2

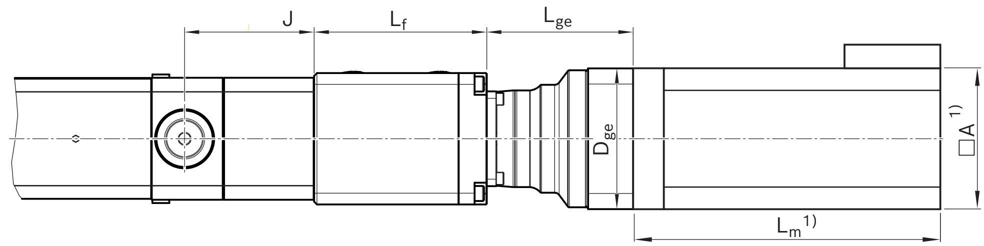
Length calculation L ➠ Technical data

Note: The presentations are schematic. Detailed contours can be found in the CAD model.

Flange coupling

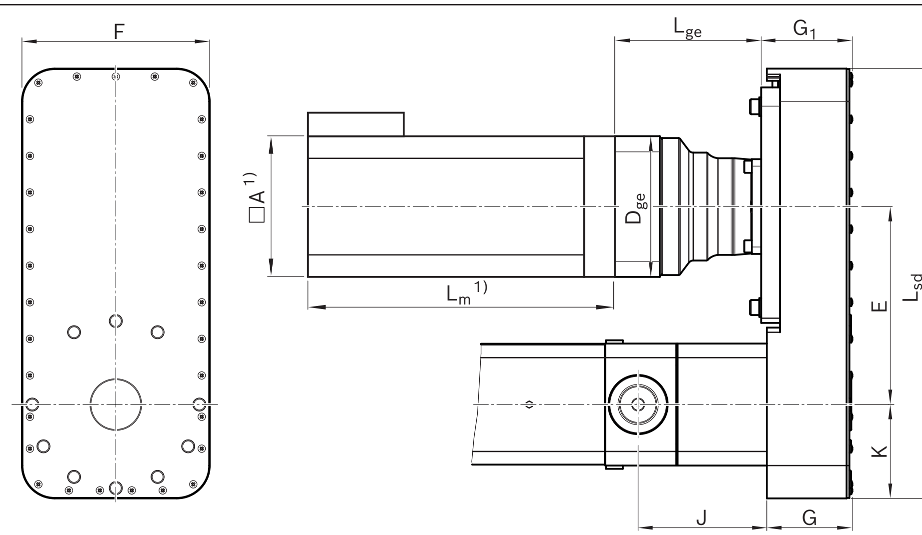


Gearing



EMC-HP	L_f			L_{ge}	D_{ge}	J
	Motor				Motor	
	MS2N07	MS2N10	Gearing		MS2N10	
115	154	179	–	–	–	117
130	154	179	–	–	–	138
160	–	188	193	156	190	160

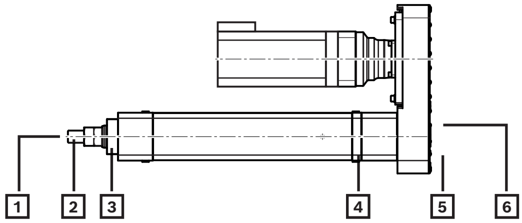
Belt side drive

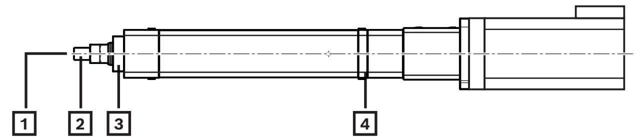


EMC-HP	E	F	G	G_1		J	K	L_{sd}	L_{ge}	D_{ge}
										Motor
				Motor	Gearing					MS2N10
115	211	200	91	87	–	116	100.0	458	–	–
130	211	200	91	87	–	137	100.0	458	–	–
160	248	255	96	87	97	159	127.5	504	156	190

1) Dimensions see chapter Motors

Fastening elements – Configuration and ordering





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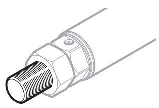
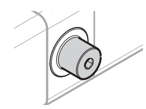
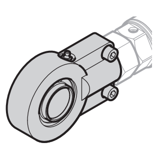
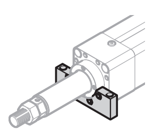
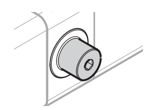
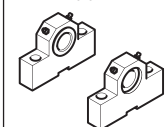
<tr><td rowspan="2">000</td><td rowspan="2">011
</td><td rowspan="2">000</td><td>F000
without flange</td><td rowspan="2">002
with trunnion
</td><td rowspan="3">000</td><td rowspan="2">000</td></tr>
<tr><td>F001
with flange</td></tr>
<tr><td rowspan="2">000</td><td rowspan="11">012
</td><td rowspan="7">011
Foot mounting
</td><td rowspan="7">S000
S090
S180
S270

with belt
side drive</td><td>002
with trunnion
</td><td>001
</td></tr>
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without
trunnion</td><td>000</td><td>000</td></tr>
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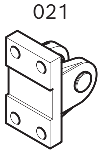
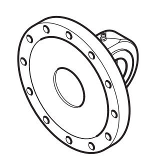
</td><td rowspan="5">011
(not with
screw cooling)
</td><td>000</td></tr>
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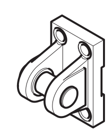</td></tr>
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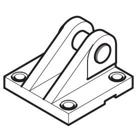</td></tr>
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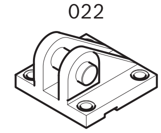</td></tr>
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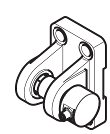</td></tr>
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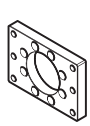
with flange
</td><td rowspan="2">F000
without flange</td><td rowspan="4">000
without
trunnion</td><td rowspan="4">000</td><td rowspan="4">000</td></tr>
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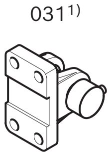</td></tr>
<tr><td>F001
with flange</td></tr>
<tr><td>S000, S090
S180, S270
with belt side drive</td></tr>
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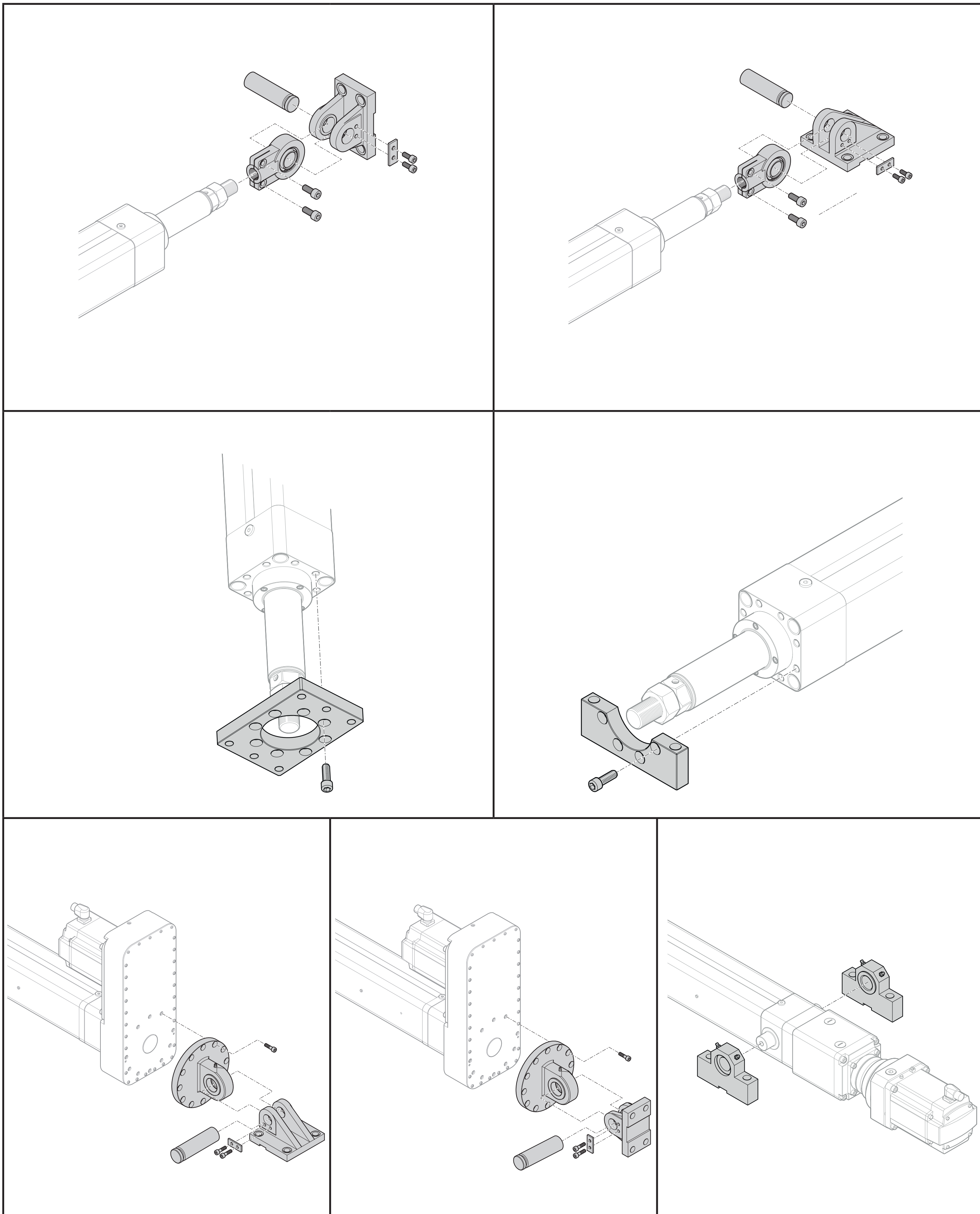
[1)] With load measuring pin

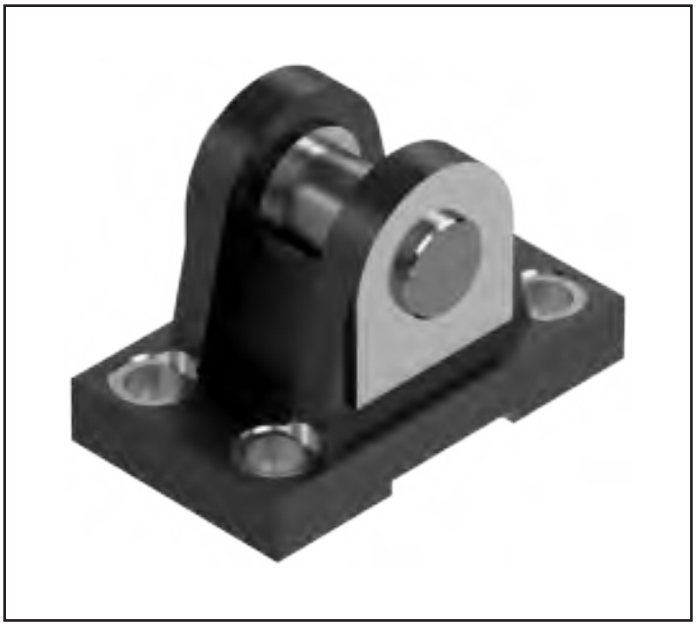
Examples

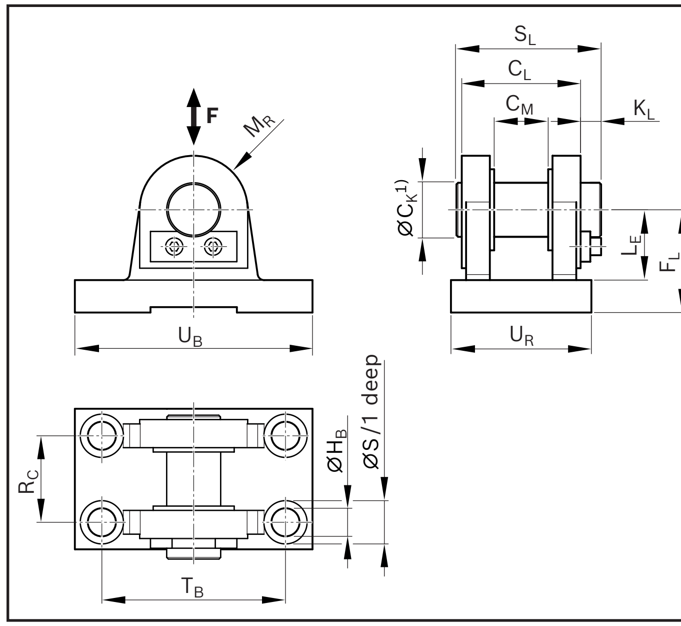


Fastening elements

Clevis bracket CLCD ISO 8132, form A

Group 1 / 6, option 021





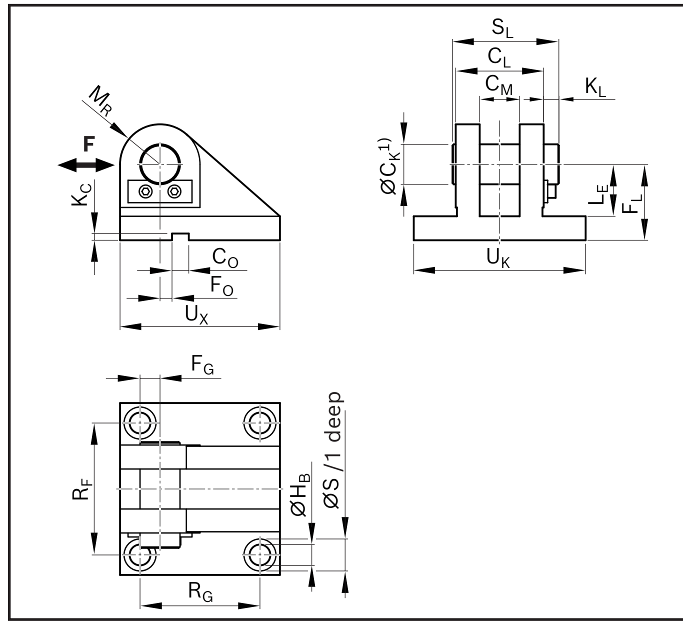
EMC-HP	Material number	**Dimensions** (mm)														**m**
		$ØC_K$ [1]	C_L	C_M	F_L	$ØH_B$	K_L	L_E	M_R	R_C	ØS	S_L	T_B	U_R	U_H	
		H9	h16	A12	js12	H13		min.	max.	js14			js14	max.	max.	(kg)
115	R156330101	32	70	32	65	17.5	13	43	32	50	26	87	110	85	143	3.0
130	R156340101	40	90	40	76	22.0	16	52	40	65	33	110	130	108	170	5.5
160	R156350101	50	110	50	95	26.0	19	65	50	80	40	133	170	130	220	10.6

[1] Matching bolt Ø m6 (bolt and bolt locking feature are included in the scope of supply and are not ready-mounted on delivery)

Material: Cast iron

Clevis bracket CLCA ISO 8132, form B

Group 1 / 6, option 022



EMC-HP	Material number	Dimensions (mm)																		m
		$ØC_K$ 1)	C_L	C_M	C_O	F_G	F_L	F_O	$ØH_B$	K_C	K_L	L_E	M_R	R_F	R_G	ØS	S_L	U_K	U_X	
		H9	h16	A12	N9	js14	js12	js14	H13	+0.3		min.	max.	js14	js14			max.	max.	(kg)
115	R156330102	32	70	32	25	14.5	65	6	17.5	5.4	13	43	32	110	110	26	87	145	145	4.5
130	R156340102	40	90	40	36	17.5	76	6	22.0	8.4	16	52	40	140	125	33	110	185	170	8.5
160	R156350102	50	110	50	36	25.0	95	0	26.0	8.4	19	65	50	165	150	40	133	215	200	13.5

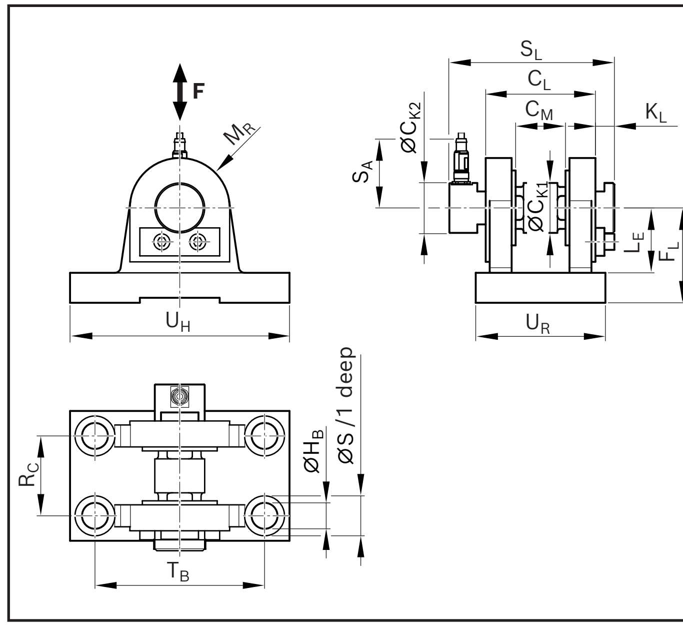
1) Matching bolt Ø m6 (bolt and bolt locking feature are included in the scope of supply and are not ready-mounted on delivery)

Material: Cast iron

Fastening elements

Clevis bracket CLCD (comparable with ISO 8132), form A, with load measuring pin

Group 1 / 6, option 031



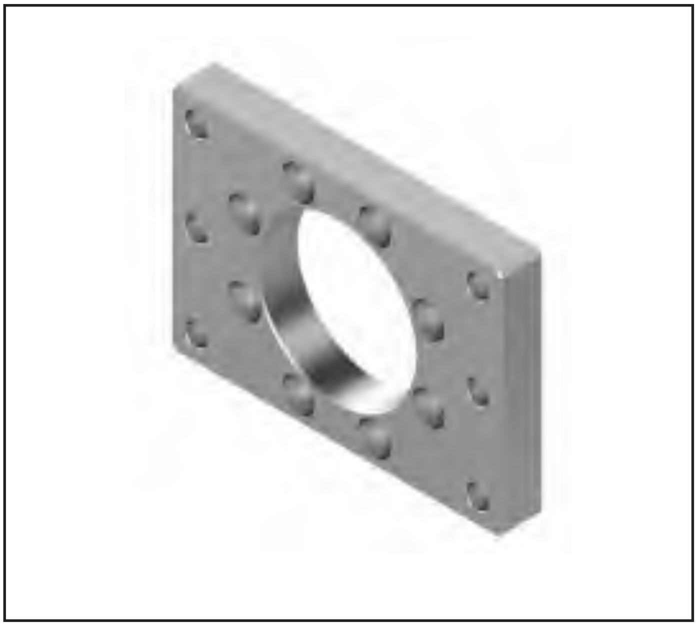
EMC-HP	Material number	Dimensions (mm)																m
		$ØC_{K1}$ 1)	$ØC_{K2}$	C_L	C_M	F_L	$ØH_B$	K_L 2)	L_E	M_R	R_C	ØS	S_L 2)	T_B	U_R	U_H	S_A 2)	
		H9		h16	A12	js12	H13		min.	max.	js14			js14	max.	max.		(kg)
115	R156330103	32	50	70	32	65	17.5	12	43	32	50	26	117.0	110	85	143	69.5	3.5
130	R156340103	40	40	90	40	76	22.0	13	52	40	65	33	135.0	130	108	170	61.0	6.8
160	R156350103	50	50	110	50	95	26.0	20	65	50	80	40	166.5	170	130	220	69.5	11.0

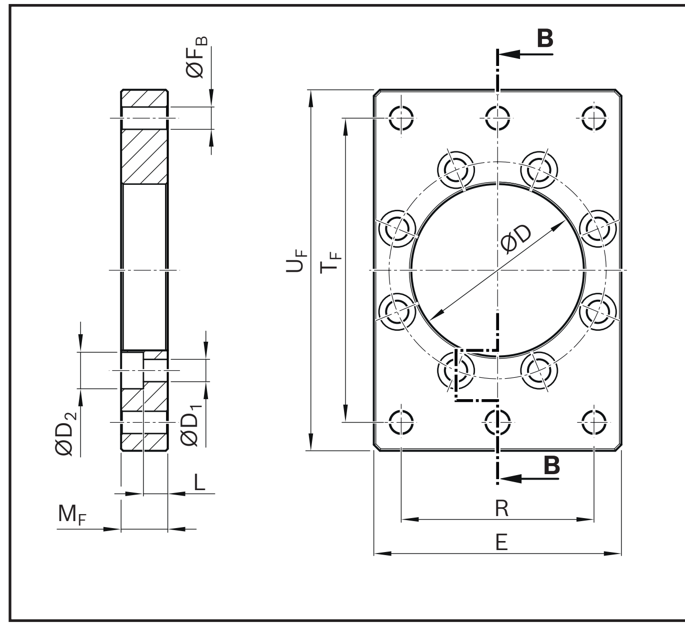
1) Matching bolt Ø f8. For detailed information on the load measuring pin see chapter "Force sensor".
2) Values deviate from ISO 8132 standard

Material: Cast iron

Flange fastening

Group 3, option 014





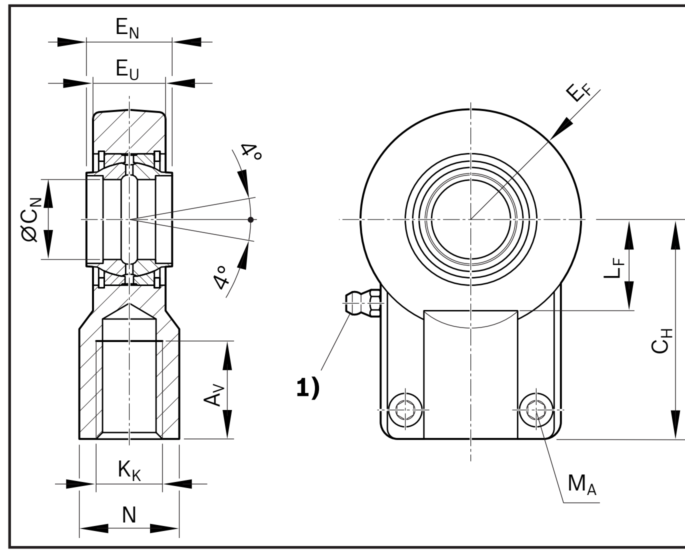
EMC-HP	Material number	Dimensions (mm)										m
		ØD H11	ØD1 H13	ØD2 H13	E	$ØF_B$	L	M_F	R ±0.2	T_F ±0.2	U_F	(kg)
115	R156530067	85	11	18	122	11	12	23	95	150	178	2.8
130	R156540067	96	13	20	140	13	12	25	110	170	200	4.0
160	R156550067	106	15	24	170	15	13	28	135	200	230	6.5

Material: Galvanized steel

Fastening elements

Spherical rod end bearing CGKD (clampable)

Group 2, option 012

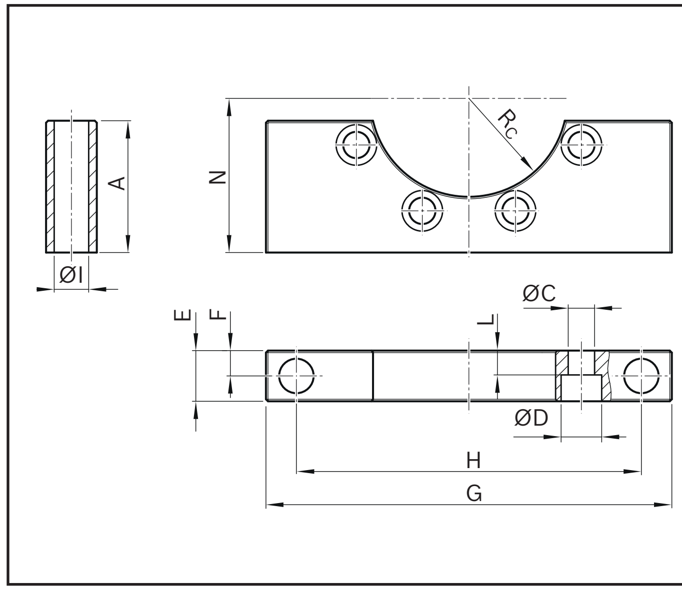


[1] Lube nipple, hydraulic type A as per DIN 71412

EMC-HP	Material number	Dimensions (mm)									Clamping screw		m[3]
		A_V min.	N max.	C_H js13	E_F max.	$ØC_N$[2] H7	E_N h12	E_U max.	K_K	L_F min.	ISO 4762-10.9	M_A (Nm)	(kg)
115	R900322049	37	38	80	40.0	32	32	28.0	M27x2	30	M10x25	59	1.15
130	R900322029	46	47	97	50.0	40	40	34.0	M33x2	39	M10x30	59	2.10
160	R900322719	57	58	120	63.0	50	50	42.0	M42x2	47	M12x35	100	4.00

[2] Matching bolt Ø m6
[3] Add mass for basis cylinder weight

Foot mounting
Group 3, option 011



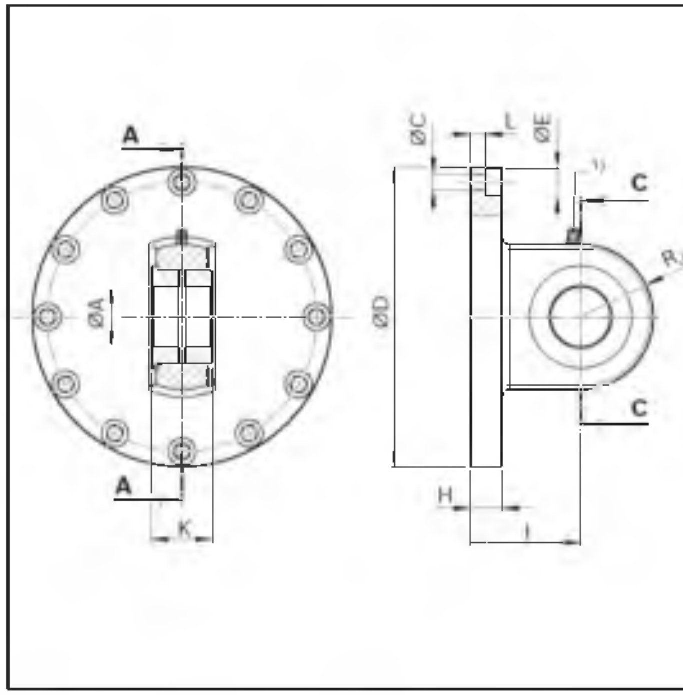
EMC-HP	Material number	Dimensions (mm)											
		A	ØC H13	ØD H13	E	F ±0.1	G	H ±0.2	ØI H13	L	N	R_C	m (kg)
115	R156530065	55	11	18	23	11.5	178	150	15	12	65	42.5	0.5
130	R156540065	65	13	20	25	12.5	200	170	17	12	76	48.0	0.8
160	R156550065	85	15	24	28	14.0	230	200	17	13	95	53.0	1.3

Material: Aluminum, anodized

Fastening elements

Swivel bearing

Group 5, option 011

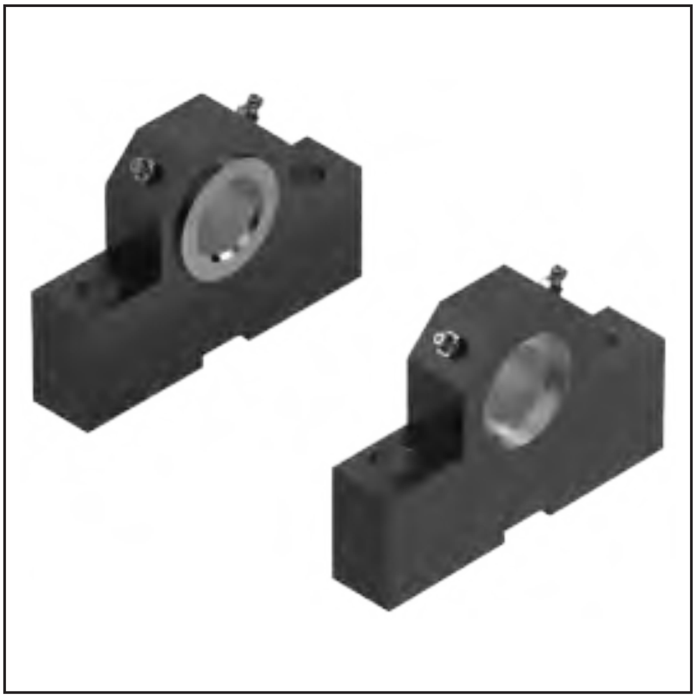


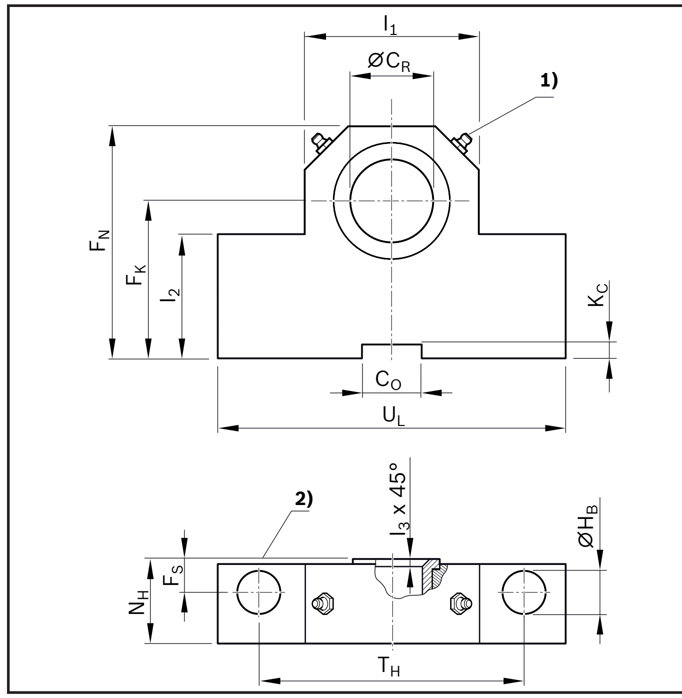
[1] Lube nipple, hydraulic type A as per DIN 71412

EMC-HP	Material number	Dimensions (mm)									
		ØA H9	ØC	ØD	ØE	H	I	K h12	L	R$_J$	m (kg)
115	R156530068	32	10.5	198	18	21	65	32	10	40	6.1
130	R156540068	40	10.5	198	18	21	73	40	10	48	7.0
160	R156550068	50	12.5	253	20	23	88	50	10	58	12.6

Material: Galvanized steel

Trunnion bearing block CLTB
Group 6, option 001





1) Lube nipple, hydraulic type A as per DIN 71412
2) Trunnion location face (inside)

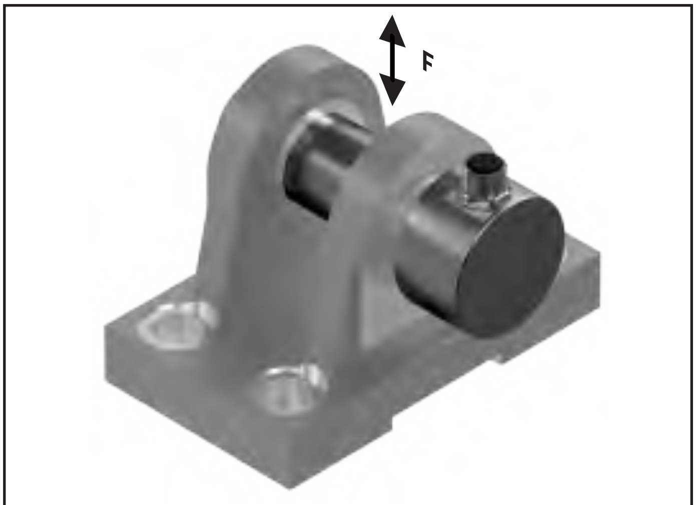
EMC-HP	Material number	Dimensions (mm)													m[3)]
		$ØC_R$	C_O	F_K	F_N	F_S	$ØH_B$	K_C	l_1	l_2	l_3	N_H	T_H	U_L	
		H7	N9	js12	max.	js14	H13	+0.3				max.	js14	max.	(kg)
115	R156330160	32	25	65	100	15	17.5	5.4	70	52	2.5	33	110	150	4.55
130	R156340160	40	36	76	120	16	22.0	8.4	88	60	2.5	41	125	170	7.30
160	R156350160	50	36	95	140	20	26.5	8.4	100	75	2.5	51	160	210	14.50

3) Add mass for basis cylinder weight, figure per pair

Note
Trunnion bearing blocks are always supplied in pairs.

Force sensor

Clevis bracket with load measuring pin



If your application requires precise load sensing, there is a clevis bearing block version with load measuring pin available for this purpose. This option can be selected both at the piston rod end connected to the spherical rod end bearing, and at the timing belt side drive connected to the swivel bearing.
Thanks to the thin-film technology used, the load cells are very robust and stable over the long term. The load cells are compliant with the EN 61326 standard for electromagnetic compatibility (EMC) and are designed to sense both tensile and compressive forces.

Note
The use of a hammer or press to fit the bolt is not permissible. It may only be inserted by hand.
The load measuring pin is not suitable for measuring torques and may therefore only be used with the cylinder option "Guideway with anti-twist feature".
It is secured axially and against rotation, like the standard bolt, on one side of the bearing block using the bolt locking feature included.
For force control at the controller level, a control component with an analog input is required.
Connection cable is included.

Output signal 4 - 20 mA, reduced measurement range and test certificate on request.

Technical data
Metrological specifications

Material	Stainless steel
Protection class	IP 65
Hardness (load range)	38 HRC
Mechanical system	
Operating load	150% of MB
Breaking load	300% of MB
Accuracy	
Non-linearity	±0.5% of MB
Repeatability	±0.25% of MB
Hysteresis	±0.2% of MB
Temperature drift at zero point	±0.05% of MB/K.
Temperature drift over measurement range	±0.05% of MB/K.
Compensated temperature	+10 ... +40 °C
Operating temperature	−20 ... +60 °C

MB = Measurement range
MB/K. = Measurement range per Kelvin

Electrical specifications

		EMC-HP
Output signal	0 kN	0 ±0.03 V
Output signal	MB	−10 ... 10 V ±0.2 V
Power supply voltage		24 ±2 V
Tare (zero setting function)		7.2 ... 24 V
Current consumption		max. 50 mA
Bandwidth		2.5 ±0.2 KHz
Connection		Connector M12x1

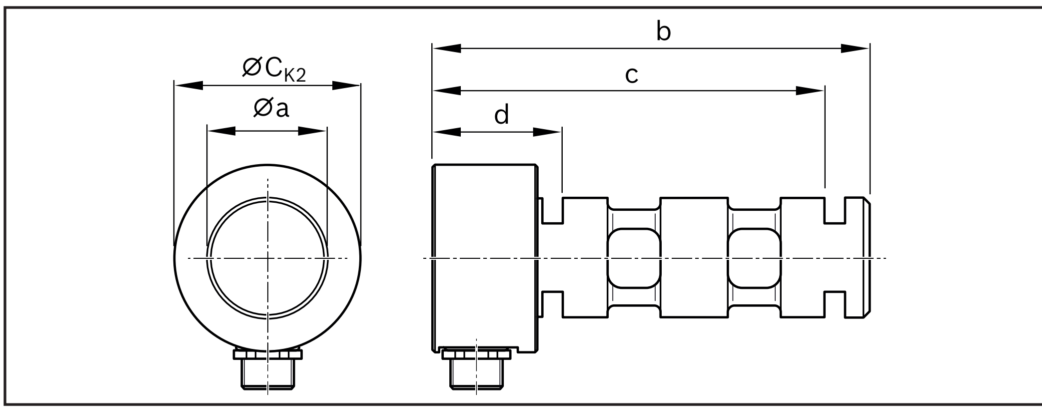
Technical data, connection cable

Length	5 m
Rated voltage	250 V
Rated current	4 A
Plug outlet	angled
Connection type 1	Female connector M12x1, 4-pin
Connection type 2	Flying leads
Type of cable	PUR black, shielded
Suitable for drag chains	ja
Cable cross-section	4x0,34 mm^2
Cable diameter D	5.9 ±0.2 mm
Static bending radius	>10 x D
Dynamic bending radius	>5 x D
Bending cycles	> 2 Mio
Ambient temperature, stationary	−25 ... +80 °C
Ambient temperature, in motion	−40 ... +80 °C
Protection class	IP 65

Features

- For tensile and compressive forces
- Corrosion-resistant stainless steel version
- Integrated amplifier
- Low temperature coefficient
- High long term stability
- High shock and vibration resistance
- For dynamic or static measurements
- Good reproducibility
- Easy mounting

Dimensions

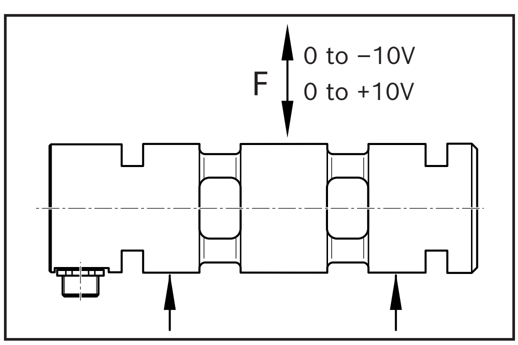


EMC-HP	Material number	Dimensions (mm)					Measurement range	Weight
		Øa f8	**ØC$_{K2}$**	**b**	**c**	**d**	(kN)	(kg)
115	R1563 370 80	32	32	131.0	119.0	49.0	50	0.9
130	R1563 470 80	40	40	135.0	122.0	32.0	80	1.3
160	R1563 570 80	50	50	166.5	146.5	36.5	110	2.2

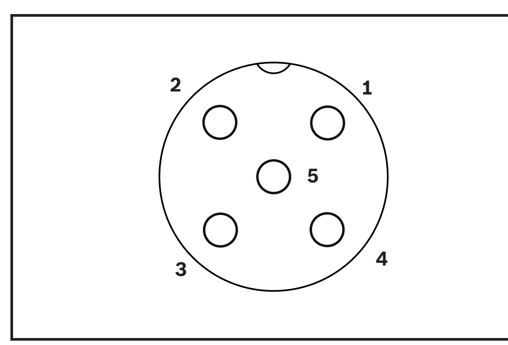
Connection diagram

Load measuring pin
1 Supply (V+)
2 Tare
3 GND (0 V)
4 Output
5 Internal assignment

Connection cable
1 brn = brown
Supply (V+)
2 wht = white, tare
3 blu = blue, GND (0 V)
4 blk = black, output



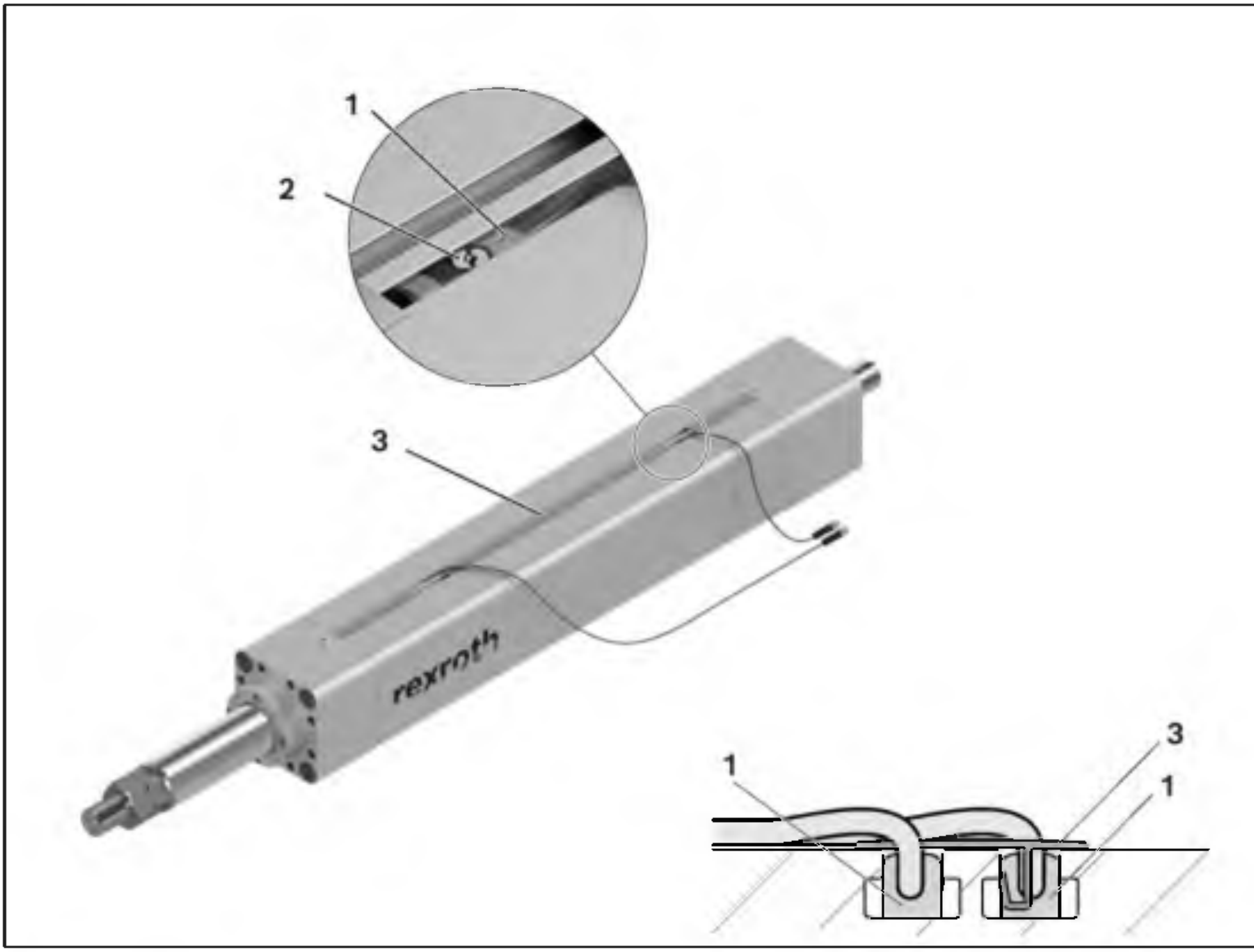
Output signal depending on direction of loading



Connection diagram for measuring pin

Switching system

Switching system



- The switches (magnetic field sensors (1)) can be used in both T-slots of the housing
- Insert the switch so that the clamping screw (2) shows outwards
- Cover profile (3) optionally available
- Further information see instructions EMC-HP R320103219

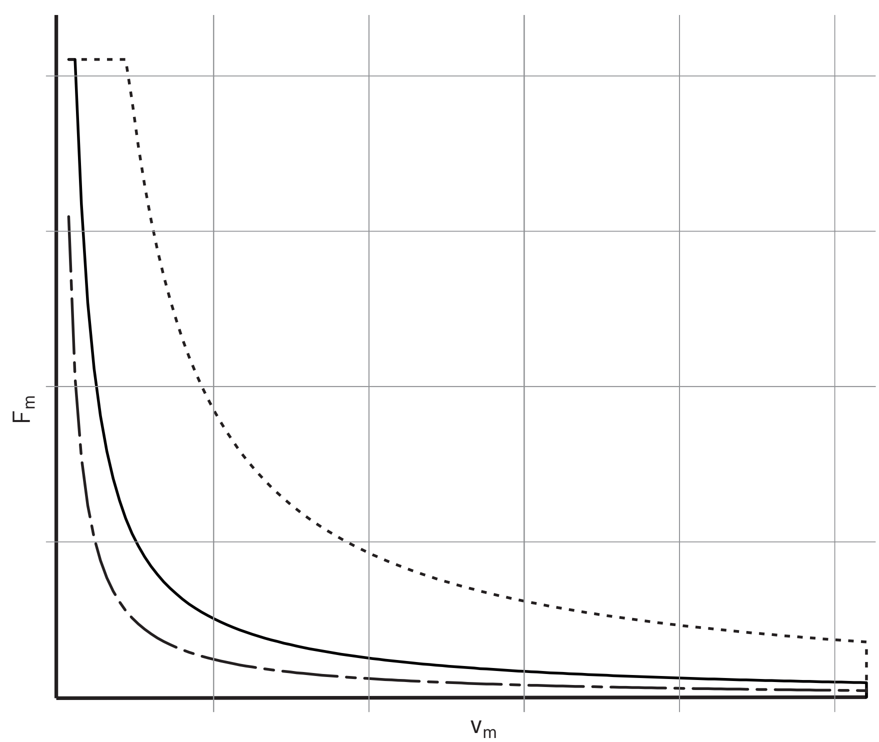
Cooling

The requirements of the application require an adaptation of the utility of the cylinder.
Various possibilities are offered for this purpose.

- The standard variant is the EMC-HP with grease lubrication. The cooling is carried out by the natural convection of the thermal energy to the environment. This inexpensive version covers the majority of applications. .
- Another variant is the EMC-HP with oil bath lubrication. This combination of a fluid inside and natural convection to the outside enables a more effective utilization of the cylinder.
- The most powerful option for demanding applications with high duty cycles or warm environments is spindle coo-ling. In this variant, a cooling medium is passed through the spindle.
  The resulting thermal energy is released into the environment through a separate cooler.
  For further details and support, please contact your local Bosch Rexroth sales office or your authorized dealer.

The selected option has an influence on the possible permanent power output of the cylinder.

Continuous power output
Performance curves



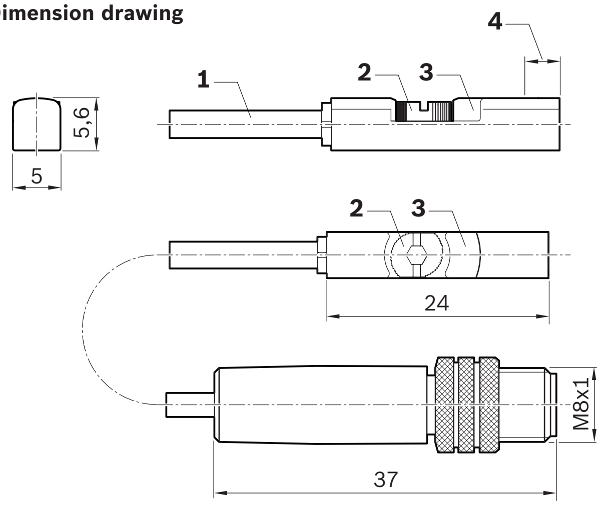
- - - - - - - LSW; screw cooling with grease lubrication
——— LOB; Oil bath lubrication
——- - - LSS; Grease lubrication

F_m = medium force
v_m = medium velocity

Switching system

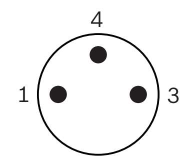
Magnetic switches

Dimension drawing



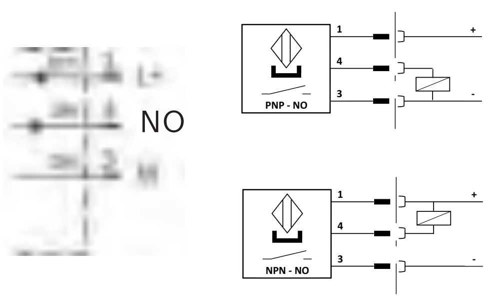
1) Connection
2) Fastening screw
3) LED display
4) Position of sensor element: 2 mm

1 brown (+)
3 blue (–)
4 black (signal)

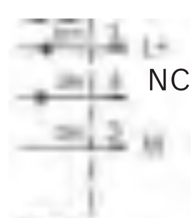


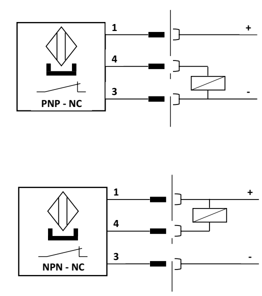
Connection diagram

R913037444
R913037446



R913037443
R913037445





Material numbers/technical data

Use	Limit switch	Reference switch	Limit switch	Reference switch
Material number	R913037445	R913037444	R913037443	R913037446
Name	MZT8-03VPO-KRDS14	MZT8-03VPS-KRDS13	MZT8-03VNO-KRDS16	MZT8-03VNS-KRDS15
Functional principle	magnetic			
Operating voltage	10 - 30 VDC			
Load current	≦ 200 mA			
Switching function	PNP/NC	PNP/NO	NPN/NC	NPN/NO
Connection type	0.5 m cable and M8x1 plug, 3-pin with knurled screw connection			
Function indicator	✓			
Short-circuit protection	✓			
Reverse polarity protection	✓			
Switch-on suppression	✓			
Switching frequency	3 kHz			
Pulse elongation (off delay)	20 ms			
Max. permissible starting speed	5 m/s			
Suitable for drag chains*	✓			
Torsion-resistant*	✓			
Welding spark-resistant*	–			
Cable cross-section*	3x0,14 mm^2			
Cable diameter D*	2.9 ±0.15 mm			
Static bending radius*	≧ 5xD			
Dynamic bending radius*	≧ 10xD			
Bending cycles*	> 2 Mio.			
Max. permissible travel speed*	5 m/s			
Max. permissible acceleration*	≦ 5 m/s^2			
Ambient temperature	–30 °C to +80 °C			
Protection class	IP68			
MTTFd (per EN ISO 13849-1)	MTTFd = 2,339.0 years			
Certifications and approvals**	CE, cULus LISTED, RoHS			

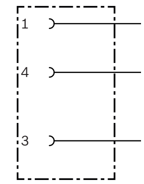
*) Technical data for connection line (0.5 m) cast on magnetic sensor only. Available extension cables offer even more performance, e.g. for use in a cable drag chain (see below).
**) No certificate for import to the CCC Chinese market required for these products. Document "Sales information CCC" available on request.

Switching system

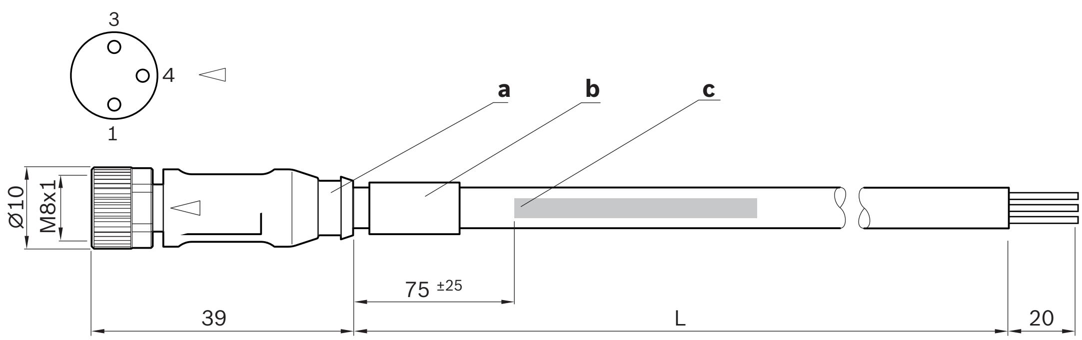
Extensions
Assembled on one end

Connection diagram

1 brown (+)
3 blue (–)
4 black (signal)



Dimension drawing



Material numbers

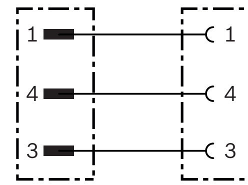
Use	Extension cable		
Material number	R911344602	R911344619	R911344620
Name	7000-08041-6500500	7000-08041-6501000	7000-08041-6501500
Length (L)	5.0 m	10.0 m	15.0 m
Connection type 1	Female connector, straight, M8x1, 3-pin		
Connection type 2	Unassembled cable end		

a) Contour for 6.5 mm corrugated tube (inner diameter)
b) Cable grommet
c) Cable printing per printing specification

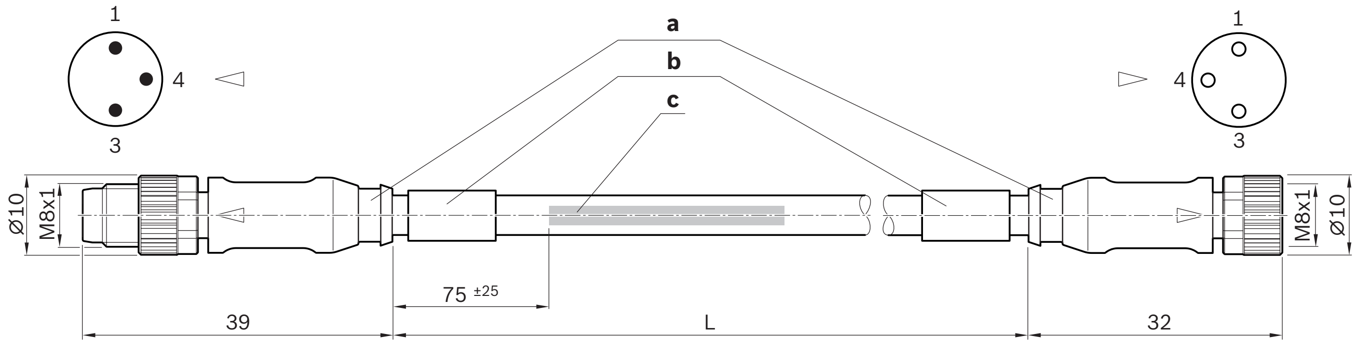
Assembled on two sides

Connection diagram

1 brown (+)
3 blue (–)
4 black (signal)



Dimension drawing



Material numbers

Use	Extension cable				
Material number	R911344621	R911344622	R911344623	R911344624	R911344625
Name	7000-88001-6500050	7000-88001-6500100	7000-88001-6500200	7000-88001-6500500	7000-88001-6501000
Length (L)	0.5 m	1.0 m	2.0 m	5.0	10.0
Connection type 1	Female connector, straight, M8x1, 3-pin				
Connection type 2	Connector, straight, M8x1, 3-pin				

Technical data for extensions pre-assembled on one or two sides

Function indicator	–
Operating voltage indicator	–
Operating voltage	10 - 30 VDC
Type of cable	PUR black
Suitable for drag chains	✓
Torsion-resistant	✓
Weld spark-resistant	✓
Cable cross-section	3x0,25 mm^2
Cable diameter D	4.1 ±0.2 mm
Static bending radius	≧ 5xD
Dynamic bending radius	≧ 10xD
Bending cycles	> 10 Mio.
Max. permissible travel speed	3.3 m/s for 5 m travel range (typ.), up to 5 m/s for 0.9 m travel range
Max. permissible acceleration	≦ 30 m/s^2
Ambient temperature fixed ext.	–40 °C to +85 °C
Ambient temperature flexible ext.	–25 °C to +85 °C
Protection class	IP68
Certifications and approvals	CE, cULus LISTED, CSA C US, PG, RoHS

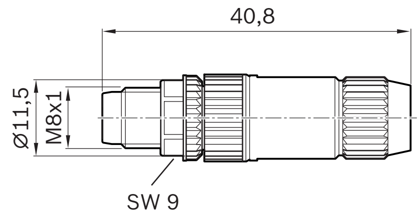
a) Contour for 6.5 mm corrugated tube (inner diameter)
b) Cable grommet
c) Cable printing per printing specification

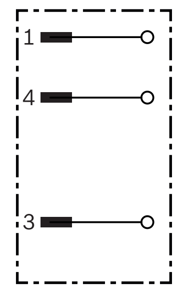
Switching system

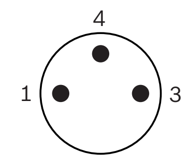
Connectors

Dimension drawing | **Connection diagram** | **View Connector side**

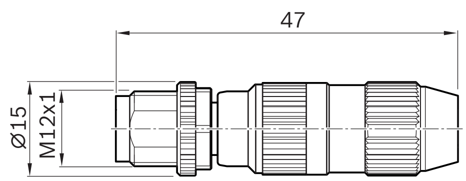
R901388333

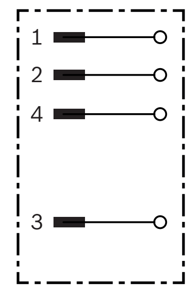


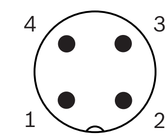




R901388352





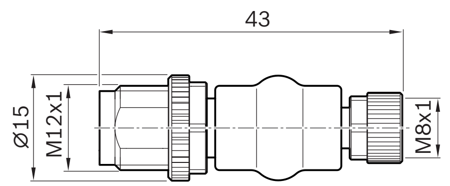


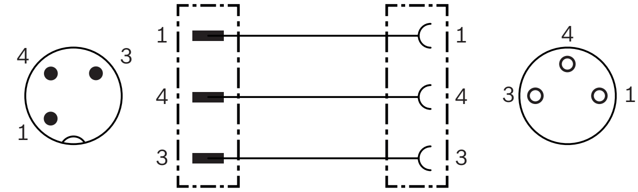
Material numbers/technical data

Use	Connector, single	
Material number	R901388333	R901388352
Name	7000-08331-0000000	7000-12491-0000000
Version	straight	
Operating current per contact	max. 4 A	
Operating voltage	max. 32 V AC/DC	
Connection type	Connector, straight, M8x1, 3-pin Insulation displacement, self-locking screw thread	Connector, straight, M12x1, 4-pin Insulation displacement, self-locking screw thread
Function indicator	–	
Operating voltage indicator	–	
Connection cross-section	0.14...0.34 mm²	
Ambient temperature	–25 °C to +85 °C	
Protection class	IP67 (inserted and screwed down)	
Certifications and approvals	c UL us, PC, RoHS	

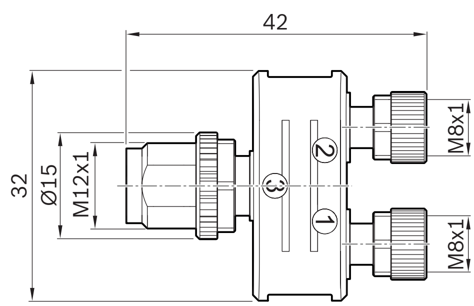
Adapters

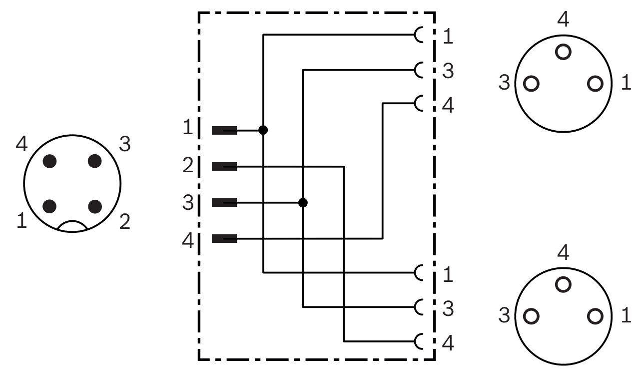
Dimension drawing | **Connection diagram**





R911344591





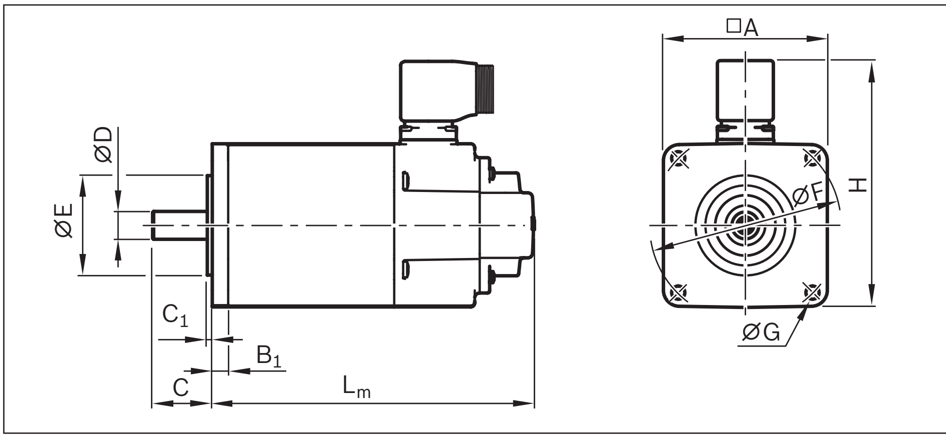
R911344592

Material numbers/technical data

Use	Adapters	
Material number	R911344591	R911344592
Name	7000-42201-0000000	7000-41211-0000000
Version	straight	
Operating current per contact	max. 4 A	
Operating voltage	max. 32 V AC/DC	
Connection type 1	Female connector, straight, M8x1, 3-pin self-locking screw thread	2 X Female connector, straight, M8x1, 3-pin self-locking screw thread
Connection type 2	Connector, straight, M12x1, 3-pin, self-locking screw thread	Connector, straight, M12x1, 4-pin self-locking screw thread
Function indicator	–	
Operating voltage indicator	–	
Connection cross-section	–	
Ambient temperature	−25 °C to +85 °C	
Protection class	IP67 (inserted and screwed down)	
Certifications and approvals	RoHS	c UL us LISTED, PCT, RoHS

IndraDyn S – servo motors MS2N

Motor schematic



Dimensions / motor data

	Dimensions (mm)										
	□ A	B_1	C	C_1	Ø D_{k6}	Ø E_{j7}	Ø F	Ø G	H	L_m	
									1	Brake without	with
MS2N07-D1BNN	140	18	58	4	32	130	165	11	180	263	317
MS2N07-D0BHA	140	18	58	4	32	130	165	11	203	384	438
MS2N10-C0BNN	196	20	80	4	38	180	215	14	270	238	298
MS2N10-D0BHA	196	20	80	4	38	180	215	14	270	394	454
MS2N10-E0BHA	196	20	80	4	38	180	215	14	270	452	512

1) Self-cooling
2) External cooling 230V

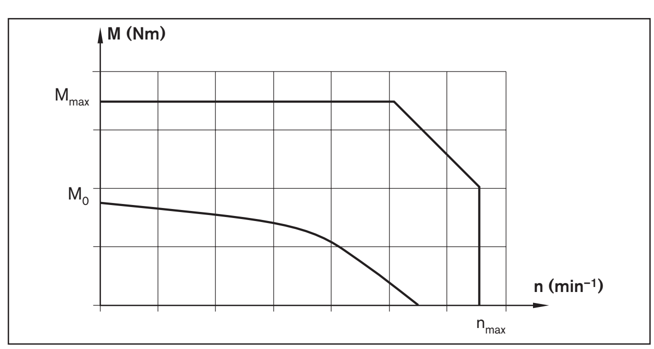
Version

- Plain shaft without shaft seal ring
- Multi-turn encoder
- Advanced encoder (C)
- Protection class IP64
- With or without holding brake
- Special ground connection terminal near motor flange (used as needed)

Motor data								Motor connection	Holding brake	Type code	Material number
n_{max} (min^{-1})	$M_{0\ 100K}$ (Nm)	M_{max} (Nm)	M_{br} (Nm)	J_m (kgm^2)	J_{br} (kgm^2)	m_m (kg)	m_{br} (kg)				
6000	24.0	84.4	36	0.0053	0.0004	17.5	2.5	1	N	MS2N07-D1BNN-CMSH0-NNNNE-NN	R911384965 1)
									Y	MS2N07-D1BNN-CMSH2-NNNNE-NN	R911384966 1)
4000	35.5	73.2	36	0.0021	0.0004	20.0	2.5	2	N	MS2N07-D0BHA-CMVH0-NNNNE-NN	R914503253 2)
									Y	MS2N07-D0BHA-CMVH2-NNNNE-NN	R914503254 2)
6000	34.0	70.5	53	0.0048	0.0015	23.5	5.0	2	N	MS2N10-C0BNN-CMVH0-NNNNE-NN	R914503255 1)
									Y	MS2N10-C0BNN-CMVH2-NNNNE-NN	R914503256 1)
4000	82.0	142.0	53	0.0081	0.0015	35.0	5.0	2	N	MS2N10-D0BHA-CMVH0-NNNNE-NN	R914503257 2)
									Y	MS2N10-D0BHA-CMVH2-NNNNE-NN	R914503258 2)
4000	119.0	214.0	90	0.0114	0.0027	46.0	7.0	2	N	MS2N10-E0BHA-CMAH0-NNNNE-NN	R914503270 2)
									Y	MS2N10-E0BHA-CMAH3-NNNNE-NN	R914503271 2)

For abbreviations see chapter "Service and Information"

Motor characteristic
(schematic)



Motor-controller combination

Several motor-controller combinations are available in order to provide the most cost-effective solution for every customer application. When sizing the drive, always consider the motor-controller combination.

IndraDrive drive family

The converters of the IndraDrive C series generate a DC link direct voltage from the mains voltage and from it a controlled AC output voltage with variable amplitude and frequency for operation of a servo motor.
The compact construction contains additional mains connection components, making it particularly suitable for single-axis applications.

Version

- Basic Universal or Basic Universal with Save Motion
- Multi-Ethernet for communication with a superior controller
- More interfaces or integrated controls available
- For the converter HCS01, a smart function kit for pressing and joining applications is available
- Brake resistor included
- Adapters included
- Separate mains filter included

IndraDrive Cs
HCS01.1E-W0054

IndraDrive C
HCS03.1E-W0100

Drive controller HSC

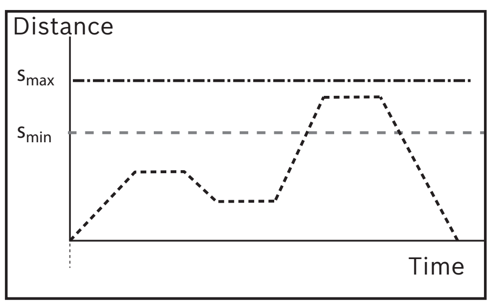
Motor	**Controller** **Designation**	**Option**		**Cable management connection cable**						
		BASIC UNIVERSAL-MultiEthernet (B-ET)	BASIC UNIVERSAL-MultiEthernet (B-ET) + S4 Safe Motion	without	1 cable Cable length 5 m	1 cable Cable length 10 m	1 cable Cable length 15 m	2 cables Cable length 5 m	2 cables Cable length 10 m	2 cables Cable length 15 m
EMC-HP-115										
without	000			000	--					
MS2N07-D1BNN	Indradrive HSC01-W054	500	501		105	110	115	--		
MS2N07-D0BHA					--			205	210	215
MS2N10-C0BNN										
MS2N10-D0BHA										
EMC-HP-130										
without		000			--					
MS2N07-D0BHA	Indradrive HSC01-W054	500	501		--			205	210	215
MS2N10-D0BHA										
MS2N10-E0BHA	Indradrive HSC03-W0100	700	701							
EMC-HP-160										
without		000			--					
MS2N10-C0BNN	Indradrive HSC01-W054	500	501		--			205	210	215
MS2N10-D0BHA										
MS2N10-E0BHA	Indradrive HSC03-W0100	700	701							

Operating conditions and usage

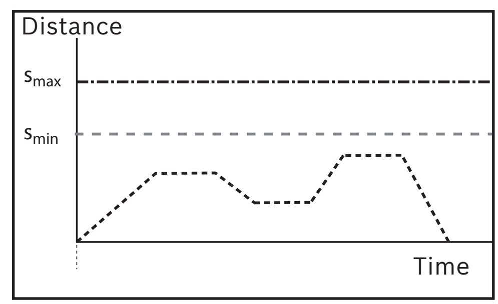
Normal operating conditions

Ambient temperature, cylinder with Rexroth servo motor	0 °C ... 40 °C, above 40 °C loss of performance
Ambient temperature Cylinder mechanics	−10 °C ... +50 °C (up to +70 °C with low duty cycle and power)
Ambient temperature Cylinder mechanics with PLSA and low-temperature grease	−30 °C ... +50 °C (up to +60 °C with low duty cycle and power)
Protection class	IP 54; housing IP 65
Duty cycle	100% (depending on power required, the permissible duty cycle may be limited due to heat generation)
Normal stroke	The distance traveled per cycle is ≥ s_{min} (see diagram)

Stroke definition



Normal stroke



Short stroke

Short stroke: The distance traveled per cycle is < s_{min} (see diagram).

Caution:
- Short stroke operation only permissible with regular lubrication strokes (larger s_{min})
- Perform service life expectancy calculation with reduction to the load rating
- Adapt maintenance interval

Contact Bosch Rexroth for further details.

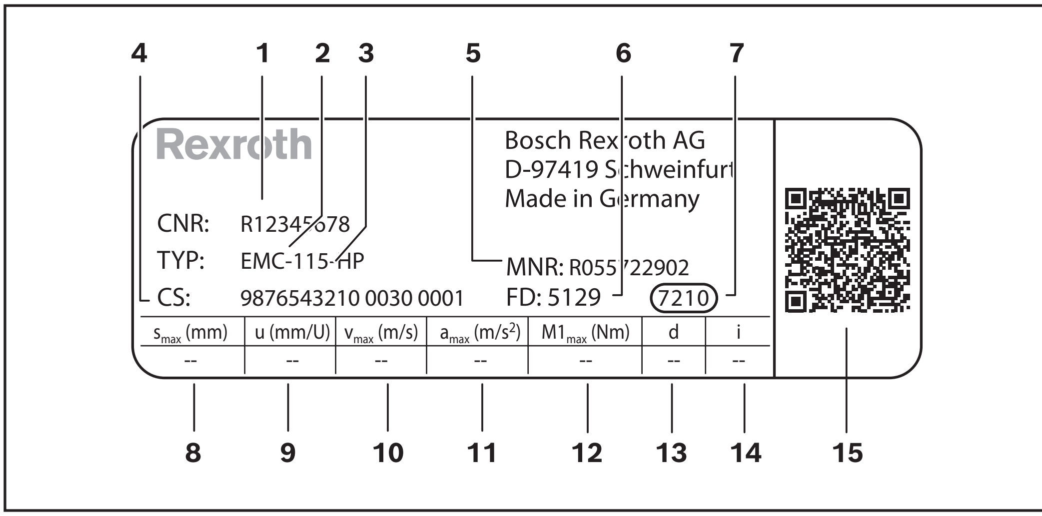
Notes

For more information about intended use and safety, see "Safety instructions for linear motion systems R320103152" and "Instructions EMC-HP R320103219".

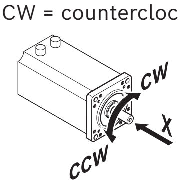
For more information on assembly/start-up see "Instructions EMC-HP R320103219".

Parameterization (start-up)

In addition to references for linear motion system production, the name plate contains technical parameters for start-up.



1	CNR	Customer's material number
2	TYP	Short product name
3	115	Size
4	CS	Customer information
5	MNR	Material number
6	FD	Date of manufacture
7	7210	Manufacturing location
8	s_{max}	Maximum travel range
9	u	Feed constant without motor attachment
10	v_{max}	Maximum speed
11	a_{max}	Maximum acceleration rate
12	$M1_{max}$	Maximum drive torque at motor journal
13	d	Direction of motor rotation to travel in positive (+) direction CW = clockwise CCW = counterclockwise
14	i	Gear ratio
15		QR code (for start-up)



Note
The values given describe the mechanical limit values of the axle.
Limit values for the included fastening elements and application-related installation cases are not taken into account here.

Lubrication and maintenance

Grease lubrication

The EMC-HP is designed for grease lubrication. Basic lubrication is applied in-factory before shipment.
The advantage of grease lubrication is that the planetary screw assembly can run long distances on one supply of grease.

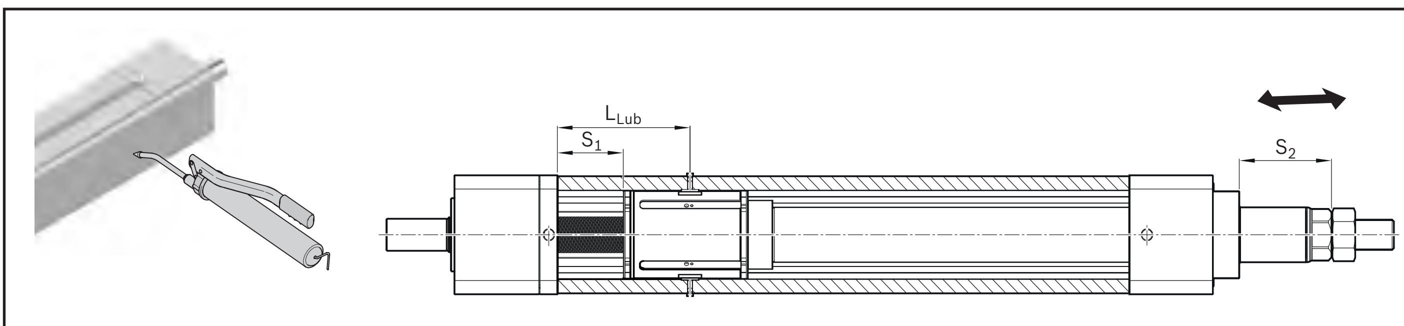
Recommended lubricants

Do not use lubricants with solid particles (e.g. graphite or MoS_2 additives). Dynalub 520 is recommended for central lubrication systems. For lubrication quantities and lubrication intervals see "Instructions EMC-HP R320103219".

Grease		**Low-temperature grease** (-30 ... +60 °C)
Consistency class NLGI 2 in accordance with DIN 51818 We recommend Dynalub 510 (Bosch Rexroth) Cartridge (400 g) R341603700 Bucket (5 kg) R341603500	**Consistency class NLGI 00 in accordance with DIN 51818** We recommend Dynalub 520 (Bosch Rexroth) Cartridge (400 g) R341604300 Bucket (5 kg) R341604200	Klüber BEM 34-132 R341603600
Can also be used	**Can also be used**	
Elkalub GLS 135 / N2 (Chemie-Technik) Tribol GR 100-2 PD (Castrol)	Elkalub GLS 135 / N00 (Chemie-Technik) Tribol GR 100-00 PD (Castrol)	

Lubrication position

a) Move the piston rod to stroke position S_2 (reference position) see figure
b) Without limit switch, extend from the rear end position by S_1 + 5 mm.
For more information, see "Instructions EMC-HP, R320103219".



EMC-HP	**Dimensions** (mm) L_{Lub}	S_1	S_2
115	143.5	75	101
130	151.0	75	105
160	164.5	75	108

Oil bath lubrication

For maintenance-free operation a oil bath lubrication can optionally selected.
The prerequisites for this are:

- normal operating conditions (see chapter operating conditions)
- F_m/C <= 0,05
- V_m >= 0,05 m/s
- Trafel life L up to 15 000 km
- T = -20 °C up to 50 °C

An oil with a viscosity of 220 is used as standard (e.g. Shell Tonna 220)

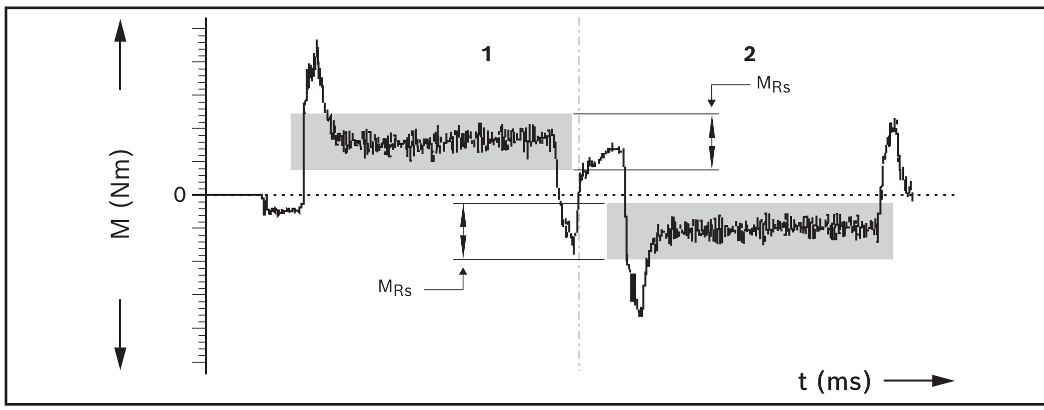
Documentation

Standard report
Option 01

The standard report serves to confirm that the checks listed in the report have been carried out and that the measured values lie within the permissible tolerances.
Checks listed in the standard report:
- Functional checks of mechanical components
- Functional checks of electrical components
- Design as per order confirmation

Measurement of frictional torque of complete system
Option 02
All items as per the standard report.
The friction torque M is measured over the entire travel range.

Example diagram

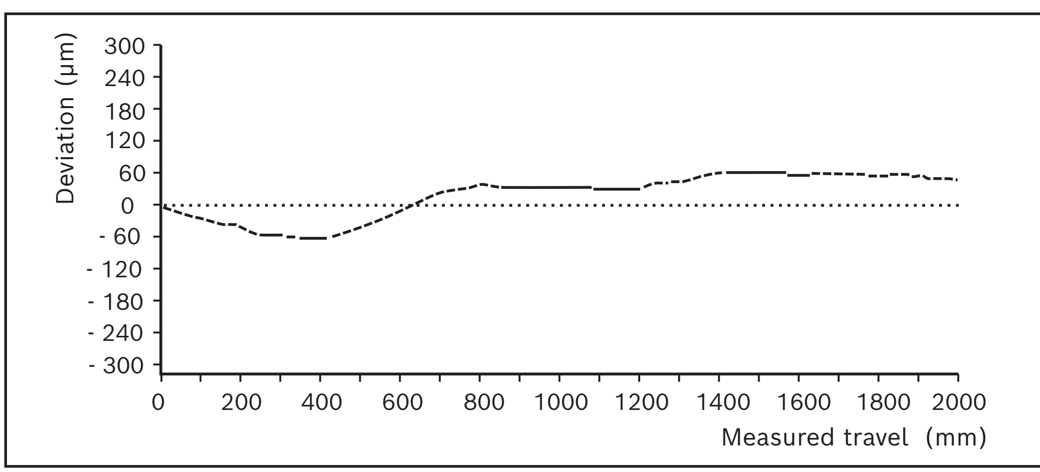


1) Advance
2) Return

M_{Rs} = Frictional torque (N)
t = Travel time (ms)

Lead deviation of screw drive
Option 03
All items as per the standard report.
In addition to the graphical illustration (see figure), a measurement report is included in tabular form.

Example diagram



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