# ctrlX AUTOMATION
## Технические характеристики

X I/O

rexroth

ctrlX CORE

X4

SD

# TWO STEPS AHEAD

rexroth

ctrl**X** CORE

X4

SD

XF54

XF59

# A NEW WORLD
# OF AUTOMATION

The production world is changing and along with it the challenges it faces. Rigid, complex automation systems are no longer a right fit in a world where markets are characterized by ever shorter product life cycles and increasingly tougher competition.

## The answer to the new challenges that industry is facing: ctrlX AUTOMATION.

More agile systems are needed to keep pace with the global speed of innovation. This is precisely where Bosch Rexroth's vision of the "Factory of the Future" was born: only the walls, the floor and the ceiling of the factory remain in place—everything else is flexible. The Factory of the Future dynamically reacts to demands and always provides the ideal solution.

This vision marks the beginning of a new world of automation with a user-focused automation platform. Our developers left no stone unturned in their quest to discover the ultimate solution: a flexible, scalable automation platform designed with maximum openness at all levels and interfaces.

# NO GOOD REASONS.
# JUST PERFECT SOLUTIONS.

10 arguments for ctrlX AUTOMATION

# A 360° SOLUTION. FOR STRAIGHT-FORWARD DECISIONS.

# 1

# A COMPLETE AUTOMATION SOLUTION

ctrlX AUTOMATION provides all the elements required for any complete automation solution. The system is extremely scalable and meets the requirements for nearly every application.

The system functionality is perfectly coordinated and can be expanded via apps and third-party hardware and software, thanks to the complete openness of the system.

Offering the best possible networking capability, the automation system can also be connected with virtually any relevant automation interface and protocol, providing complete flexibility of development environment and programming language.

**Systematic flexibility:**
▶ Maximum scalability and expandability
▶ Perfectly coordinated system functionality
▶ Virtually any common interface and programming language supported

**ctrlX IOT**
Built-in security

**ctrlX PLC**
IEC and non-IEC

**ctrlX WORKS**
Runtime and engineering

**ctrlX MOTION**
Motion, Robotics and CNC

**ctrlX SAFETY**
SafeLogic and SafeMotion

**ctrlX DRIVE**
Drives and motors

**ctrlX I/O**
EtherCAT and Gigabit Ethernet

**ctrlX CORE**
CPU and power

**ctrlX IPC**
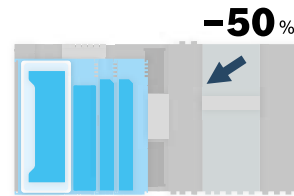Box and panel
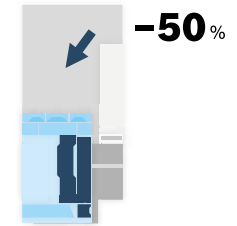
**ctrlX HMI**
Hardware and software

# 2
# LESS IS MORE

More compact machines and systems, less hardware, faster installation, and significantly fewer software installations—all of this is possible thanks to ctrlX AUTOMATION. That's because the developers focused on reducing components, complexity, and footprint whenever possible for all components and functionality. Right down to the smallest detail. The space required is reduced significantly since the installation size of all automation components is up to 50% smaller on average. Many individual components that were previously required could be eliminated thanks to the dramatic reduction in component diversity and functional integration. This simplifies order and delivery logistics as well as procurement of replacement parts. The systematic use of web technology reduces the number of required software installations and enables maximum flexibility in the hardware used for engineering, diagnostics, and service.

**ctrlX AUTOMATION reduces:**
▶ Space requirements
▶ Installation times
▶ Control cabinet sizes
▶ Service and spare parts requirements
▶ Logistics work
▶ Transaction costs
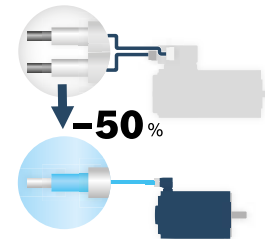
**−50**% **CPU AND I/O**

**−50**% **DRIVES**

**−50**% **HARDWARE INSTALLATION**
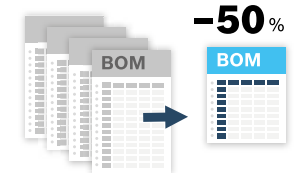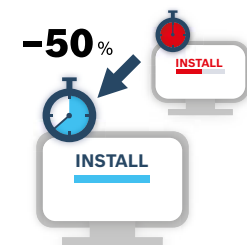
**−50**% **BOM POSITIONS**

**−30**% **MOTORS**

**−50**% **SOFTWARE INSTALLATIONS**

LIKE SCIENCE FICTION.
JUST WITH LESS SPACE.

# NON-STOP PERFORMANCE. REAL-TIME CONTROL.

# 3

## CONSISTENT PERFORMANCE

ctrlX CORE is the powerful heart that beats inside ctrlX AUTOMATION. A high-performance 64-bit multicore CPU forms the basis for all automation topologies—regardless of whether PC-based, as an embedded controller or integrated in the drive. It therefore transcends the typical boundaries between device platforms. The performance of a ctrlX CORE CPU is more than adequate for practically all automation tasks and, for example, enables synchronization of more than 200 servo drives. Future CPU upgrades are guaranteed to require no software adaptations.

**ctrlX CORE provides**
▶ Maximum performance
▶ Universal use in all devices and topologies
▶ Long-term avail-ability, thanks to full upgrade compatibility
▶ Service support over the long-term with guaranteed availability

**ctrlX DRIVE**          **ctrlX CORE**          **ctrlX IPC**

# 4

## CONNECTIVITY AT ITS BEST

Flexible automation solutions demand connectivity. And as the system boasting the best possible connectivity, ctrlX AUTOMATION focuses uncompromisingly on standardized as well as sector and manufacturer-neutral interfaces. In addition to EtherCAT, the system also supports PROFINET and IO-Link. More than 30 interfaces to IT systems such as OPC UA and MQTT ensure seamless communication within the entire Factory of the Future.

ctrlX I/O provides a virtually unlimited portfolio of powerful interfaces. Analog and digital I/Os or encoder interfaces are used to connect additional components or for system enhancements and communication with external infrastructures. They enable direct control of small and stepper motors.

**ctrlX I/O provides:**
▶ Maximum freedom of design in automation
▶ The most connectible system
▶ Long-term availability thanks to systematic openness

# ALWAYS CONNECTED. TO ALMOST EVERYTHING.

# 5

# UNIFORM ARCHITECTURE

**Fully adaptable systems:**
▶ User-developed software can be run without limitation
▶ Custom apps and open-source software can be created and integrated
▶ Functionality can be added at any time, even during run time
▶ Apps exchange data in real time and non-real time
▶ Security is assured, thanks to configurable user administration

ctrlX AUTOMATION uses Linux, the most stable and reliable real-time operating system in the world. The ctrlX Data Layer is the central element of the architecture. It enables simple and central access to all available system data and parameters in real time, including authorization management. With 8 million potential accesses per second, maximum performance is assured. In addition, the system architecture allows developers to effortlessly implement additional system functions at any time, such as apps and open-source software. The automation platform is therefore available to a vast global community of programmers who create new functions in the programming languages of their choice. This accelerates the development of innovations and process improvements.

**RUNTIME APPS**

| PLC | MOTION | ROBOTICS | CNC |
| SAFETY | OPC UA | WEB HMI | USER APP |
| IOT GATEWAY | VPN-FIREWALL | IOT INSIGHTS | ... |

**ENGINEERING APPS**

| PLC | HMI | DRIVE | I/O |
| SAFETY | DEVICE ADMIN | VIRTUAL | ... |

**ctrlX Data Layer**

**LINUX REAL-TIME**

**HIGH-PERFORMANCE MULTICORE CPU**

ctrlX CORE

**RUNTIME APPS**

ctrlX I/O    ctrlX HMI

ctrlX CORE    ctrlX IPC    ctrlX DRIVE

**EDGE DEVICE, CLOUD, VIRTUAL**
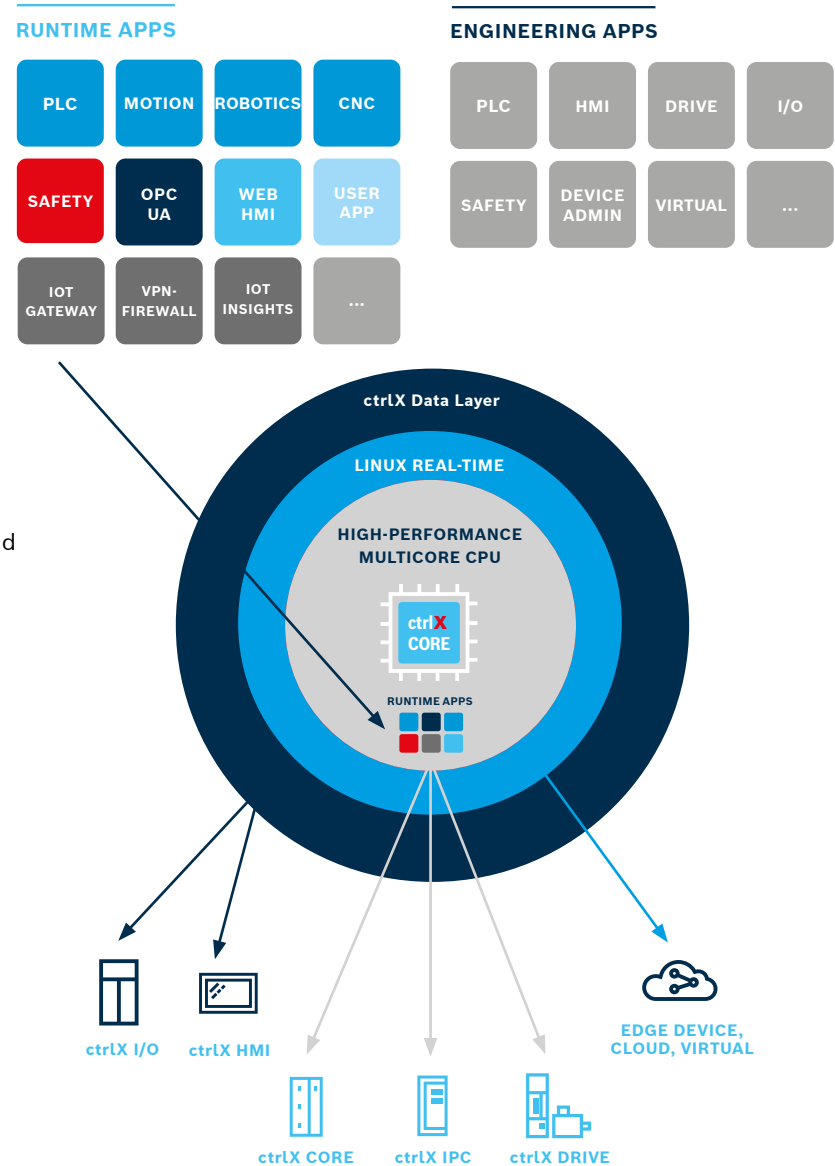
# TODAY'S TECHNOLOGY. READY FOR FUTURE STANDARDS.

# ONE OPEN SYSTEM. OPEN-END OPPORTUNITIES.

# 6

## THE MOST OPEN AUTOMATION SYSTEM ON THE MARKET

As a universal automation system, ctrlX AUTOMATION speaks many languages. The system software can be selected, configured, and programmed across all popular programming languages by means of the flexible and modular software and engineering solution, ctrlX WORKS. Developers are therefore free in their choice of the development environment and can simultaneously use different programming languages in their projects. The constantly growing demands with respect to Industry 4.0 / Internet of Things (IoT) applications can therefore be fulfilled with minimum effort, backed by the integrated OPC UA server with its unrivaled range of functions and MQTT protocol support. ctrlX CORE uses EtherCAT as the standard for a real-time Ethernet master. The ctrlX DRIVE servo drives support the most common real-time Ethernet protocols as a slave connection.

**Ultimate technological advantage:**
▶ Free choice of programming language
▶ Key industry standards can be used immediately
▶ System functionality can be expanded
▶ Structured and secure access to data with the ctrlX Data Layer
▶ Savings in terms of line control systems because data is available centrally

# CONNECT TO THE WORLD WILD WEB. SECURE.

# 7

# UNIVERSAL IOT INTEGRATION

Integration of the automation world and the Internet of Things in the Factory of the Future is an absolute prerequisite for improving competitiveness in the digital age. ctrlX AUTOMATION offers better connectivity than any other system and can be integrated into all IT, edge, and cloud systems.

Security updates, backups, and upgrades of new software features are performed centrally, simultaneously, and efficiently by means of the ctrlX Device Portal. Future standards such as 5G and OPC UA over TSN are already prepared. A security solution certified according to IEC 62443 ensures the secure exchange of data. A VPN expansion or firewall installation can also be implemented optionally via app.

**Device management:**
▸ Cloud-based device management via the ctrlX Device Portal
▸ Security updates and bug fixing, new function upgrades
▸ Backup and recovery of automation projects

**IoT integration:**
▸ IoT Connector for IT systems via OPC UA Client and Server, MQTT
▸ Expansion via customer-specific IoT apps
▸ Ready for new standards: 5G, OPC UA over TSN ...

**Security:**
▸ Security by default
▸ Security by design
▸ Certified IT security according to IEC 62443
▸ Secure production mode

**Reliable connectivity:**
▸ Automated software updates
▸ Simple backup and restore
▸ Effective protection against cyber attacks

# 8

# THE REVOLUTION IN ENGINEERING

With its future-oriented software architecture, ctrlX AUTOMATION offers a previously unrivaled degree of freedom and efficiency, allowing developers to overcome the challenges of contemporary software development quickly and creatively. In addition to classic PLC and motion functions, they can flexibly design additional functions in numerous programming languages and combine them with one another.

The modular ctrlX WORKS software solution increases engineering efficiency in this regard by 30 to 50 %. Web-based system configuration therefore allows fast and simple start-up without the need to install software. A completely virtual development environment is available for engineering without the use of hardware. Furthermore, the online services of the ctrlX Device Portal and the ctrlX Developer Community are linked with the GitHub software platform that offers forums and how-to videos.

**Future-oriented development:**
▶ Faster engineering times
▶ Rapid implementation of innovations
▶ Shorter commissioning times
▶ Expertise and security of investment

## All options at a glance

**STRAIGHTFORWARD START-UP**
Web-based access to program code in just a few minutes without software installation

**FREE CHOICE OF PROGRAMMING LANGUAGE**
IEC61131, PLCopen, G-Code, C/C#, Python, Java, Node-RED, Blockly...

**STRAIGHTFORWARD INDIVIDUALIZATION**
▶ Custom software/IP
▶ Third-party providers
▶ Open source

**UNLIMITED FUNCTIONALITY**
Unrestricted expandability through apps

**VIRTUAL CONTROL**
Unrestricted virtual availability of control and software environment

**ONLINE SERVICES**
▶ ctrlX Device Portal
▶ ctrlX Developer Community
▶ GitHub

# 9

# LONG-TERM AVAILABILITY
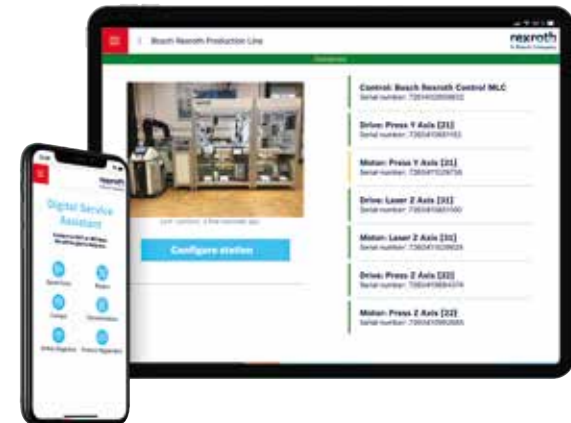# AND DIGITAL SERVICES

ctrlX AUTOMATION sets the market standard for the longest product availability. Bosch Rexroth ensures additional availability of all components for at least ten years after the end of active production and therefore secures service capability for the long term. This period can even be extended to a total of 25 years, thanks to an optional add-on service.

All service activities for ctrlX AUTOMATION can be initiated directly via the ctrlX Service App. The ctrlX Device Portal manages all connected IoT devices via the cloud and also enables security updates, parameter backups, secure remote access, etc.

Bosch Rexroth supports machine manufacturers and end users worldwide with a 24/7 service hotline, rapid availability of spare parts at any location, as well as repairs. Application specialists provide advice and support during engineering, commissioning, and maintenance.

**ctrlX AUTOMATION Service:**
▶ 24/7 global service, spare parts, and repairs
▶ Product availability up to 25 years beyond active production
▶ ctrlX Service App enables direct service activities
▶ ctrlX Device Portal allows cloud-based device management

**LIVES LONG AND PROSPERS. THANKS TO LIGHT-SPEED SERVICE.**

# INVEST IN CHANGE.
# IT'S THE ONLY
# CONSTANT.

# 10

# THE MOST FUTURE-PROOF AUTOMATION SYSTEM

In every sector, the decision in favor of an automation system and its provider is pivotal in terms of sustained competitiveness. Foundational prerequisites are: maximum future-proofing, protection of investment, and a wholly reliable automation partner.

Bosch Rexroth embraces this responsibility with ctrlX AUTOMATION. Future standards, trends, and expansion options have therefore always been at the forefront and continue to play a vital role in its development activities. Thanks to the uncompromisingly open and platform-neutral system architecture at all levels, even now ctrlX AUTOMATION offers the possibility to use future standards such as 5G, OPC UA over TSN, or programming languages yet under development as soon as they are ready for market. In the future, it will therefore also be possible for machine manufacturers and users to implement new types of automation concepts, whether intelligent AI systems, central server-based solutions or distributed systems. This ensures full protection of investment and creates trust.

**Developed with vision:**
▶ Uncompromisingly open, no proprietary systems or interfaces
▶ Free choice of programming language
▶ Software compatible with any hardware
▶ Extremely long-term availability of all components
▶ Ready for future standards such as 5G, TSN, AI etc.

# NO PORTFOLIO.
# JUST OPTIMIZED
# SERVICE.

ctrlX AUTOMATION: always the right solution

# ctrlX WORKS

## The software and engineering toolbox

ctrlX WORKS is the central nervous system of the platform and reduces the engineering time for new concepts by 30 to 50 %. In addition to classic PLC languages in compliance with to IEC 61131, PLCopen, and G-Code, developers can implement functions without restriction in the form of apps or open source software. Individual functions can be simply installed, removed, and tested virtually without affecting existing apps. The central ctrlX Data Layer guarantees continual access to all real-time and non-real time data of the installed apps. It makes no difference whether the apps are installed as runtime apps on a ctrlX CORE or are executed as engineering apps and services on a PC, smart device, or the cloud.

ctrlX WORKS already includes an extensive portfolio of high-performance apps for typical tasks in the area of factory automation. In addition, users can develop their own programs in any programming language or integrate third-party apps.

### Highlights

**More productivity**
▶ Free choice of programming language
▶ Limitless functionality that can be implemented with ease
▶ Virtual testing without hardware
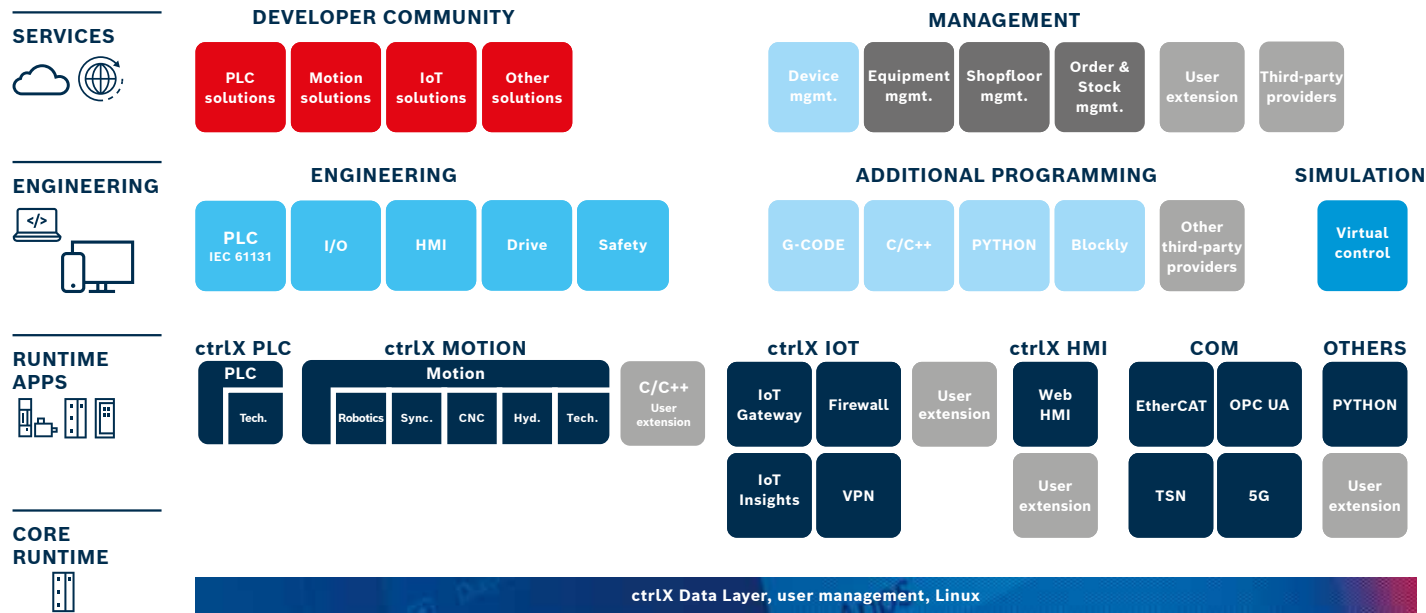▶ Simple integration of custom and third-party software

**Less engineering**
▶ Web-based engineering
▶ Pre-programmed functions and intuitive programming tools
▶ Developer communities and services

**At a glance:**
- ▶ Engineering is up to 50% faster
- ▶ Rapid adaptation to changes in the market

## SERVICES

### DEVELOPER COMMUNITY

| PLC solutions | Motion solutions | IoT solutions | Other solutions |
|---|---|---|---|

### MANAGEMENT

| Device mgmt. | Equipment mgmt. | Shopfloor mgmt. | Order & Stock mgmt. | User extension | Third-party providers |
|---|---|---|---|---|---|

## ENGINEERING

### ENGINEERING

| PLC IEC 61131 | I/O | HMI | Drive | Safety |
|---|---|---|---|---|

### ADDITIONAL PROGRAMMING

| G-CODE | C/C++ | PYTHON | Blockly | Other third-party providers |
|---|---|---|---|---|

### SIMULATION

| Virtual control |
|---|

## RUNTIME APPS

**ctrlX PLC**

| PLC | Tech. |
|---|---|

**ctrlX MOTION**

| Motion | | | | | C/C++ User extension |
|---|---|---|---|---|---|
| Robotics | Sync. | CNC | Hyd. | Tech. | |

**ctrlX IOT**

| IoT Gateway | Firewall | User extension |
|---|---|---|
| IoT Insights | VPN | |

**ctrlX HMI**

| Web HMI |
|---|
| User extension |

**COM**

| EtherCAT | OPC UA |
|---|---|
| TSN | 5G |

**OTHERS**

| PYTHON |
|---|
| User extension |

## CORE RUNTIME

**ctrlX Data Layer, user management, Linux**

# ctrlX PLC

## The future-oriented PLC software

ctrlX PLC offers a high-performance PLC control solution and combines the advantages of classic PLC automation with the communication and functional requirements of the Internet of Things—a perfect combination for the Factory of the Future.

## Modular principle for targeted application

The flexible ctrlX PLC guarantees cost-efficient solutions, even for applications with distributed architectures. Ready-made function blocks and automatic code generation increase effectiveness and efficiency in engineering. In order to define motion sequences and target positions in drives, the corresponding function modules simply need to be called up and combined. The programming process is streamlined by using wizards and the enhanced Generic Application Template with automatic PLC code generation. The open infrastructure enables protected integration of in-house expertise.
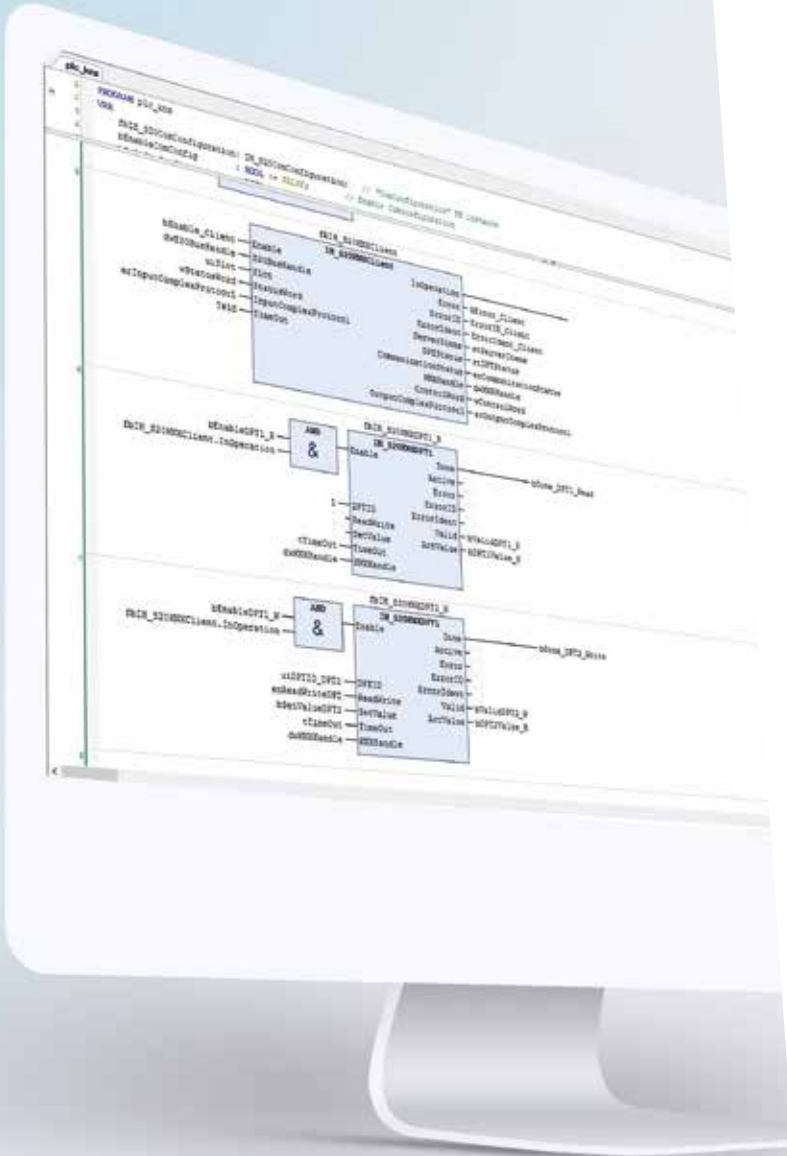
## Open for networking

The ctrlX Data Layer provides all process and machine data centrally, replacing PLC line control systems. At the field level, ctrlX PLC provides a master function for numerous fieldbuses such as EtherCAT, PROFINET, and EtherNet/IP. The data and information collected is forwarded on the basis of established standards such as OPC UA and MQTT. This means that ctrlX PLC can be integrated in the most diverse automation environments.
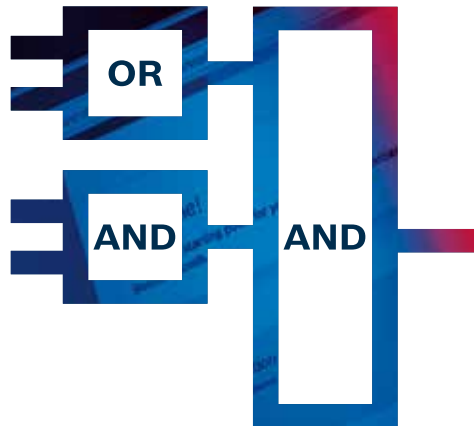


## Highlights

**More productivity**
▶ Openness and standards eliminate hardware dependencies
▶ Future orientation by design
▶ New degree of freedom with the ctrlX Data Layer
▶ Increased efficiency thanks to unrestricted choice of programming language

**Fewer components**
▶ Ultra-compact control platform with optimum performance and minimum variance
▶ Ultimate functionality and flexibility
▶ Savings on logistics, hardware, and assembly costs

**Less engineering**
▶ Development of expertise through integration of custom applications
▶ Free choice of programming language

**At a glance:**
▶ Highest performance, smallest hardware variance
▶ Reduced logistics costs
▶ Less time needed for training and engineering
▶ The ctrlX Data Layer provides all process and machine data centrally, making PLC line control systems redundant

# ctrlX IOT

## The most modern IoT software

Industry 4.0, the industrial Internet of Things (IIoT) or the Factory of the Future: The greatest productivity potential for industrial users lies in networking. That's why ctrlX IOT is always included as part of ctrlX AUTOMATION. Thanks to full integration of IoT solutions in the hardware, users have boundless possibilities and can start implementation immediately.

### Ready to run in less than five minutes

Guided configuration dialogs are used to configure quickly and intuitively—without the need for programming. End-users, too, can configure or change data connections quickly at the click of a mouse. With more than 30 direct connection options and communication standards, ctrlX IOT offers optimum flexibility for connecting different devices and seamless integration into existing or even future systems. Non-reactive updates ensure an optimum level of machine availability during the production process, even when loading updates. A firewall and VPN access provide continuous control in order to protect machine availability. IT security standards compliant with IEC 62443 provide enhanced protection against

viruses and trojans. At the same time, the solution enables encrypted transmission of data and secure remote services.

## Transparency unleashes optimum potential

Whether online or offline: Machine data can be transparently displayed retrospectively for up to six months with IoT Insights. This ranges from production KPIs to notifications for the shift manager to a fault history for service.

By integrating ctrlX IOT in Bosch's Nexeed industrial application system, a universal solution is created ranging from sensors to cloud applications. Among other features, Nexeed therefore enables central monitoring from the individual machines to entire global plant networks.

## Highlights

**More productivity**
▶ Maximum production capacity and long-term availability, thanks to non-reactive updates during the production process
▶ Local storage of machine data for maintenance
▶ Fully integrated IT security standards for access control and remote maintenance
▶ Seamless integration in the Bosch Nexeed industrial application system

**Fewer components**
▶ IPC and VPN router hardware is reduced to one control platform
▶ Cost savings and lower risk of failure thanks to hardware reduction and IT security standards
▶ Machine is "Bosch IoT ready"

**Less engineering**
▶ Integration of data into existing IT production systems is easy and doesn't require programming
▶ Simplest handling for machine manufacturers and end-users

**At a glance:**
▶ Increased system efficiency, thanks to faster exchange of data with the IoT
▶ Full integration of automation components
▶ Cost savings via reduced engineering effort for data connectivity

# ctrlX MOTION

## The motion, robotics, and CNC software

ctrlX MOTION sets new standards for openness and scalability. Users can perform the most varied automation tasks with this software: from simple handling tasks to complex robot applications to highly dynamic machines, such as those used in the packaging and print industry. In this environment, they control multi-axis applications with strict requirements with respect to coordinated movements and synchronicity.

ctrlX MOTION forms the perfect basis for the intelligent automation of production machines. It implements both fast I/O signal processing and highly dynamic motion control tasks—with more than 100 axes per control system. ctrlX MOTION is executable on all ctrlX AUTOMATION hardware, adapts flexibly to the respective requirements and can be expanded at any time.

ctrlX MOTION connects the previously separate worlds of automation and IT with the ctrlX Data Layer. Users can create functions as apps in any programming language, even if graphics-based, and combine them freely. This allows an unprecedented degree of freedom, flexibility, and efficiency.

Guided dialogs for visualization and engineering tasks optimize the project workflow during development and increase productivity through simple integration of innovative functions. Web-based engineering supports fast commissioning and shortens time-to-market.

Single Axis Motion

CNC

Synchronized Motion

Hydraulic Motion

## Highlights

### More productivity
▶ Shortest PLC and motion cycle times
▶ A control system coordinates
  more than 100 axes
▶ Ultimate precision, thanks to axis
  synchronization at microsecond speed
  and at a nanometer level of precision

### Fewer components
▶ All applications on one platform
  (synchronized motion, coordinated
  motion and hydraulic motion)
▶ Maximum scalability ensures the best
  possible solution in terms of space
  requirements and functionality

### Less engineering
▶ The engineering time is reduced by
  up to 50% thanks to wizard-based
  development of application software
  and ultimate ease of programming
▶ Can be used for all applications

**At a glance:**
▶ Control system
  for universal and
  modern machine
  automation
▶ Cross-platform
  performance
  and openness
▶ Time-to-market is
  at least 30% faster
▶ Complete and open
  automation system

# ctrlX CORE

## The ultra-compact control platform

Nowadays mechanical engineering means software development. The high-performance and communication-ready ctrlX CORE forms the basis for this. It breaks down the boundaries between the IPC, embedded system, and drive-based platforms. The 64-bit multicore CPUs distribute the applications optimally to the different processor cores. They offer significantly higher computing power than previous control platforms in the same space. ctrlX CORE offers scalable control for systems requiring anything from single-axis movements to highly complex multiple axis movements. It implements different technology functions with complex arithmetic operations in parallel with a high control quality and communicates with higher-level systems. Process data can be processed comprehensively by the control system when ctrlX I/O is activated. Optional I/O modules for additional functions and communication protocols in the same form factor simplify scaling.

## Quality down to the tiniest screw

ctrlX CORE is expressly designed
for demanding environments and
withstands vibrations and impact in a
wide temperature window with high EMC
resistance. The hardware is designed for
maximum maintenance-free operation
and long-term availability based on a
fanless and design free of wear parts.

## At the heart of open communication

Thanks to its open and flexible architecture,
ctrlX CORE is ready to meet whatever the
Factory of the Future may bring. In addition to
EtherCAT, the hardware supports many other
common automation protocols. For example,
the gigabit Ethernet interface is ideal for use
in networked environments, supporting the
data-intensive exchange of information with
higher-level IT systems, HMI devices and
cloud-based applications. The control system
supports more than 30 IT and IoT standards,
including OPC UA as server and client as
well as the widely used MQTT protocol.

## Highlights

**More productivity**
▶ Unlimited performance, thanks to
  64-bit multicore processors
▶ Optimum distribution of
  applications to the CPU cores

**Fewer components**
▶ Flexible expandability of
  performance and I/O functions
▶ Robust hardware design

**Less engineering**
▶ One control system for all platforms

**At a glance:**
▶ Multicore tech-
  nology for optimum
  performance
▶ The system that
  offers the best
  possible connectivity
  on the market
▶ Open and flexible
  architecture for
  new freedom in
  developing functions

# ctrlX I/O

## The powerful ctrlX CORE enhancement

With ctrlX I/O, Bosch Rexroth provides the ideal add-on for holistic automation solutions. This add-on connects the EtherCAT ecosystem to the machine control level.

### Intuitive use at a new level

The compact I/O portfolio allows simple installation and cabling as well as rapid exchange of individual modules or expansions. Configuration is not required because automatic recognition integrates each module independently. Additional communication standards and interfaces can be integrated via the I/O Performance Line for enabling future-oriented concepts. Based on EtherCAT, ctrlX I/O supports real-time capable data processing. Simple configuration and commissioning shorten engineering times by up to 30 %.

### Durable and diagnostic-friendly

ctrlX I/O is designed for use in industrial environments and fulfills the strictest requirements in terms of vibrations, temperature rating, and protection class. Clever diagnostic concepts, on-board sensor systems, or smart module diagnostics via NFC increase machine up-time and expedite diagnostics in the event of errors.

## Highlights

**More productivity**
▶ Clever diagnostic concept at module and channel level reduces standstill times
▶ Robust design in IP20 protection class for maintenance- and fault-free operation in the control cabinet

**Fewer components**
▶ Up to 20 I/O points on 12 mm installation width
▶ Flexible expandability with performance functions

**Less engineering**
▶ Tool-free assembly thanks to ergonomic mechanical design and PUSH-IN technology
▶ Supports the IO-Link standard for integrating intelligent sensors

**At a glance:**
▶ Expandable for holistic automation solutions
▶ Intuitive and ergonomic
▶ Simple installation and rapid exchange of modules
▶ Engineering times are reduced by up to 30 %
▶ Strictest mechanical requirements
▶ Real-time-enabled data processing

# ctrlX IPC

## The PC-based automation solution

Sophisticated process control systems often require high performance reserves, which ctrlX IPC provides flexibly and scalably. Thanks to low power loss, the hardware design needs neither a cooling concept nor fans, thus facilitating a long and fault-free operating time. The modular ctrlX CORE control platform can be integrated in the open ctrlX IPC portfolio via the PCIe interface. This means that the system can be expanded by standard components or open source software. Numerous wired and wireless interfaces are available for communication. ctrlX IPC forms the ideal interface between field level and cloud and ensures reliable and secure transmission of large quantities of data.

## Security intelligence for large volumes of data

The integrated hardware and software security infrastructure safeguards the application and machine availability at the same time. The hardware robustly withstands impact and vibrations and offers high EMC stability. It is therefore ideal for use in practically any application and environment. The use of high-performance and robust SSD memories from upwards of 64 GB allows future-proof machine designs and offers reliable protection against data loss in the RAID system. All IPCs are delivered with standard data backup and recovery software.

Trusted platform modules (TPM 2.0) use encryption software to protect the computer from bootup until the application is running (security by design). This chip also stores certificates and serves as a hardware key for further protection mechanisms. Windows 10 IoT Enterprise LTSC (Long-Term Servicing Channel) as the operating system is a key component of ctrlX IPC; it was developed specially by Microsoft for networking intelligent devices on the most varied platforms. Linux can likewise be used as the operating system.

## Highlights

**More productivity**
▶ Scalable performance from entry-level to high-end applications
▶ The latest hardware with security-by-design integrated TPM chip
▶ High long-term availability, thanks to maintenance-free hardware without batteries and fans

**Fewer components**
▶ Integration of the ctrlX CORE industrial control platform
▶ Space-saving design with low installation depth

**Less engineering**
▶ Maximum flexibility and modularity
▶ Flexible topologies
▶ High performance and openness with Windows 10 IoT or Linux
▶ ctrlX IPC components are designed strategically for one-person installation

**At a glance:**
▶ Scalable IPC portfolio from entry-level solution to high-end application
▶ Maximum flexibility across all performance ranges

# ctrlX HMI

## The perfect user experience combination

The right information at the right time: ease of use is an increasingly important factor when deciding to purchase a machine. ctrlX HMI offers machine builders optimum freedom when it comes to implementing the user experience with intuitive user guidance.

### Innovative and mobile HMI solution

The portfolio includes small operating panels, tablets, panel PCs, or large stationary displays with a screen diagonal of up to 24". Anti-glare and chemically hardened front glass make display and operating panels ideal for use in harsh everyday production environments. The 16:9 screen size supports multi-touch operation with ten fingers.

The web-based software solution ctrlX HMI adapts every representation automatically to different display sizes and prepares important information clearly at all times. Third-party provider tools can be used additionally, which communicate via standard interfaces such as OPC UA. ctrlX HMI covers all applications reliably—from the simplest process controls to demanding and dynamic simulations.
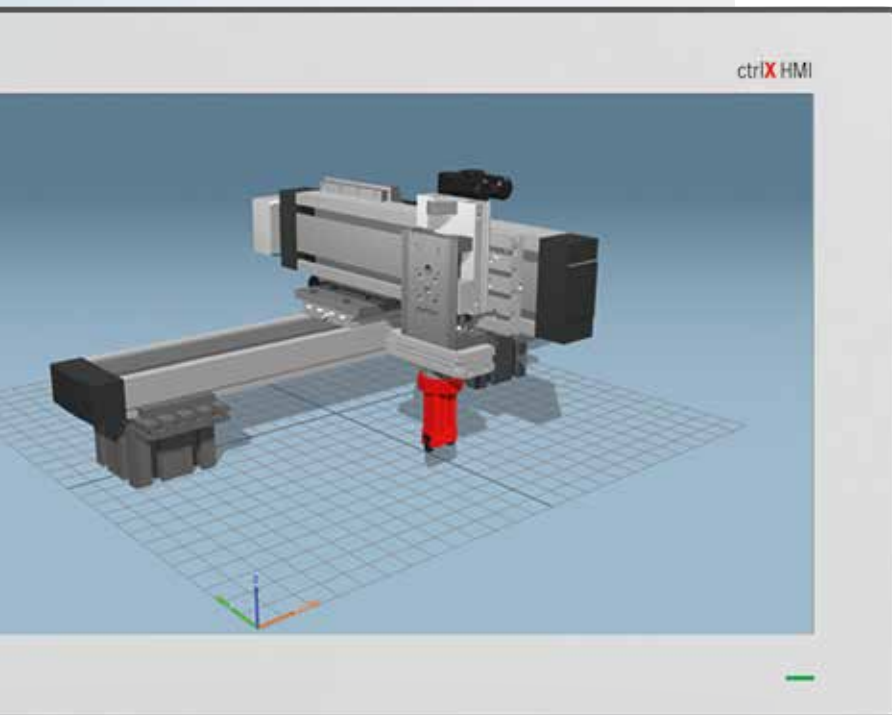
## Highlights

**More productivity**
▶ Scalable portfolio from small operating
   panels to 24" displays

**Fewer components**
▶ Web-based HMI with integrated web server

**Less engineering**
▶ Integrated web-based HMI engineering
   and simple integration of third-
   party provider HMI tools
▶ Integration of 10" smart devices
   for the mobile HMI solution

**At a glance:**
▶ Perfectly harmonized
   hardware and software
   for intuitive visualization
▶ Robust hardware
▶ Long life cycle

# ctrlX DRIVE

## The most compact drive system

Bosch Rexroth has developed the most compact modular drive system in the world for its customers with ctrlX DRIVE. Apart from space-saving dimensions and maximum scalability, ctrlX DRIVE boasts advantages such as virtually unlimited combination options for users, sophisticated engineering tools, and high energy efficiency.

### Flexible supplier concept

The new drive generation offers both simple single-axis applications and complex multi-axis machine systems. The scalable drive portfolio includes converters, single and dual-axis inverters, DC/DC converters, and power and regenerative supply units. ctrlX DRIVE therefore offers tailored solutions with peak currents of 6 A to 375 A. Sufficient power is always available even for extensive machine designs with output of up to 260 kW.

### Space requirements are halved

The powerful ctrlX CORE control hardware can be integrated in the drive housing without needing additional space. Overall, users save up to 50 % in the control cabinet. Further space savings are possible in combination  with the modern MS2N motors, since they offer a power density that is up to 30 % higher.

### Complete performance package

All components in the ctrlX DRIVE system can be combined freely with one another. Users can expand the drives with additional hardware and software functions with the ctrlX DRIVE[plus] option. Add-on boards for additional encoders, I/O expansions, and the integrated ctrlX CORE control system offer previously unattainable degrees of freedom.
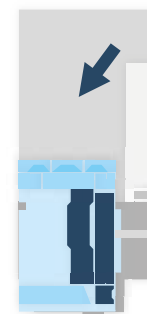
**−50**%

## Secure and energy-efficient

With a reaction time of around 4 ms, ctrlX DRIVE offers one of the fastest SafeMotion solutions on the market. The energy management functions enable energy to be exchanged in the link connection and central network access components. The patented Smart Energy Mode reduces peak power of the drives by up to 70 %. The converters can be used at the same time as supply units and inverters. In addition, classic power and regenerative supply units are also available. The continuous DC bus optimizes the power requirement and reduces power loss.

**At a glance:**
▶ Most consistent drive
system on the market
▶ Space savings of up to 50 %
▶ From cost-efficient
entry-level solution to
high-end solution with
integrated motion control

## Robust design

ctrlX DRIVE has a robust EMC design. The new power connector with integrated grounding concept allows even better interference resistance. The integrated DC bus connection eliminates accessory sets and is designed for high current-carrying capacity (up to 375 A).

## Highlights

**More productivity**
- ▶ Peak currents of 6 A to 375 A
- ▶ Converters, power and regenerative supply units with peak power of up to 260 kW
- ▶ Flexible power supplier concept – space saving, flexible, and energy-efficient

**Fewer components**
- ▶ Up to 50 % less space is required in the control cabinet
- ▶ Perfect for 300 mm control cabinets owing to modular multi-axis concept
- ▶ Integrating ctrlX CORE totally eliminates the space required for the control system fully

**Less engineering**
- ▶ Intelligent functions such as multi-Ethernet, multi-encoders, and integrated web servers allow for simple diagnostics
- ▶ Less wiring and faster engineering
- ▶ Single-cable technology

# The high-performance servo motors

Bosch Rexroth servo motors are the perfect team player in the ctrlX DRIVE portfolio. Boasting compact dimensions, they combine optimum dynamics with maximum precision of position, speed, and torque values.

## Motors for every requirement

The broad model portfolio includes the right solutions to meet all requirements. An ATEX-compliant series is therefore available for environments with explosive gases and dust. The rotary and linear direct drives in the  MS2N motors dispense with mechanical transmission components like coupling and gears. The innovative single-cable technology with cable length of up to 75 m reduces cabling by 50 %.

**−30**%
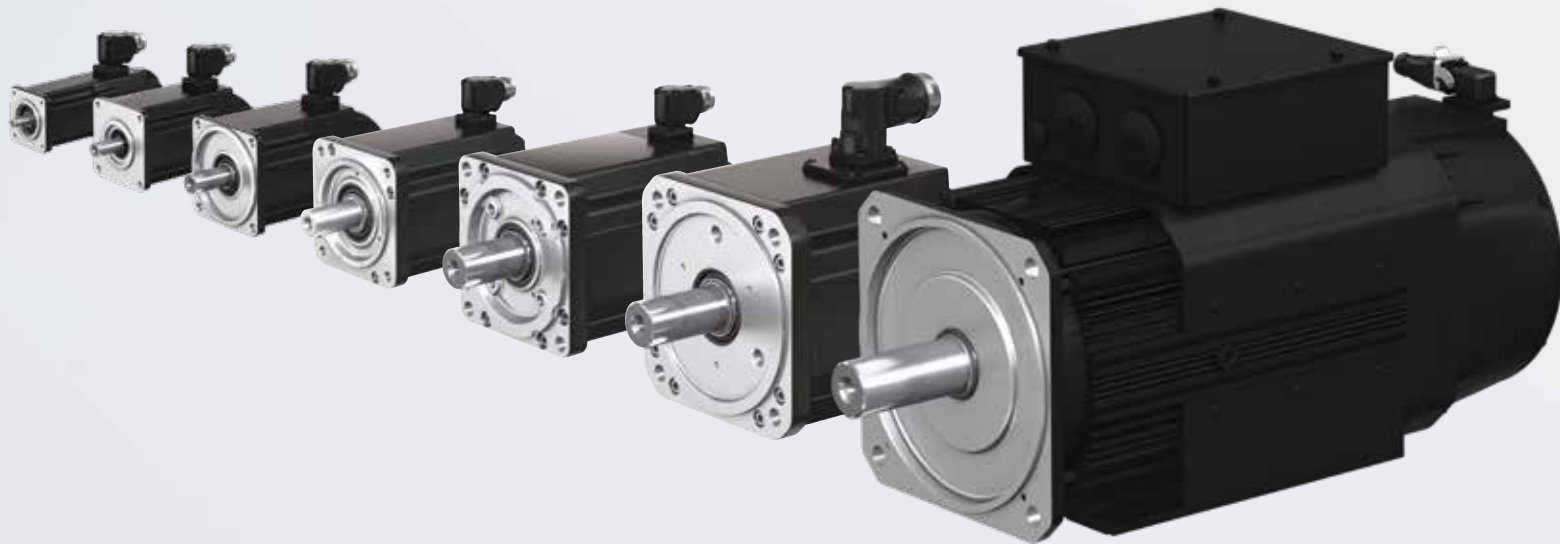
## Engineering for experts

Developers have access to the digital twin of the motor, which is stored in a design tool and in the ctrlX DRIVE controller. Planning and design of even complex drive systems can therefore be virtualized quickly and reliably. A new torque model transforms each motor into a data source for intelligent machines or Industry 4.0 applications.

## Highlights

**More productivity**
▶ High torque density for greater power
▶ 7 frame sizes with maximum torque of up to 692 Nm
▶ Maximum dynamics of the servo axes due to low motor inertia and high overload capacity

**Fewer components**
▶ Robust single-cable connection with a cable length of up to 75 m
▶ MS2N with integrated SafeMotion encoder – no further safety components are required
▶ Motor as torque sensor makes external sensors redundant

**Less engineering**
▶ Plug-and-play expanded encoder data memory for faster commissioning
▶ Digital twin of the thermal motor model

# ctrlX SAFETY

## The most comprehensive SafeMotion and SafeLogic solution

Safety first: standardized safety is an absolute prerequisite for machine manufacturers and users. ctrlX SAFETY simplifies implementation of standardized safety while ensuring maximum productivity during usage.

### Certified safety as standard

The new ctrlX DRIVE drive generation is systematically fitted with expandable safety functions. SafeMotion implements safety functions precisely where motion occurs and responds within 4 ms. Of particular interest for modular concepts is that manufacturers can use SafeMotion to implement a purely drive-based safety solution in their assemblies, which operates independently of the higher-level control system.

SafeLogic safety control is an optional and compact expansion of the standard control system. Graphic programming simplifies engineering and reduces the familiarization time.

## SafeMotion and SafeLogic as a package solution

SafeMotion and SafeLogic together communicate via Bosch Rexroth's own safety bus at a speed that is 10 to 15 times faster than via classic fieldbuses. Safety equipment can therefore be designed more compactly, thanks to the fast reaction times.

ctrlX SAFETY covers the full range from entry-level solutions to highly complex applications with different packages. Once they have been created, safety solutions can be integrated into different machine designs without any major adaptations. ctrlX SAFETY also simplifies engineering in the process via dialog-based acceptance tests. Intelligent software modules simplify parameterization in this context. The unrestricted choice of bus systems ensures perfect communication between components.

## Highlights

**More productivity**
▶ Fastest safety solution on the market with reaction times of 4 ms
▶ Optimum integration into machine concepts

**Fewer components**
▶ Less hardware thanks to software-based scaling
▶ Space savings due to faster reaction times by the system

**Less engineering**
▶ Simplified creation of application programs through graphic programming of the safety logic and dialog-based support for the acceptance test

**At a glance:**
▶ Fast and adaptable, can be used individually or as an overall system
▶ The reaction time of the safety solutions enables a more compact design
▶ Maximum safety in production

# ctrl**X** Configurator

## The intuitive tool for a systemic automation solution

The ctrlX Configurator supports the complete ctrlX AUTOMATION portfolio and enables individual configuration of automation solutions—simply, quickly, and reliably. Users create the desired system topologies graphically without product knowledge. Support or availability can be queried directly from the configuration tool. Round the clock—worldwide.

▶ Graphic configuration of components and complete automation solutions
▶ Intuitive handling via modern operating concept with dynamic 3D product view
▶ Individual problem-solving without product expertise using manufacturer-independent product library
▶ Faster configuration via solution templates and 24/7 availability of the online platform
▶ System-wide consistency of the solution configuration via automatic verification of product relationships
▶ Support for processing in project teams and for support and availability queries