Operating Instructions

# ctrlX CORE
# X2, X3

## Controls

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# 1 About this documentation

## 1.1 Revision history

Table 1: Editions of this documentation

| Edition | Release date | Note |
|---|---|---|
| Edition 01 | 2020-10 | First edition |
| Edition 02 | 2020-12 | Revision |
| Edition 03 | 2021-07 | Variant X2 supplemented, UL notes supplemented |
| Edition 04 | 2022-04 | Revision, UK conformity |
| Edition 05 | 2022-05 | Variant X3+ supplemented |
| Edition 06 | 2023-06 | Variant X3+ now as separate manual, see ➡ R911420136 |

## 1.2 Overview on target groups and product phases

In the following illustration, the framed activities, product phases and target groups refer to the present documentation.

Example: In the product phase "Mounting (assembly/installation)", the target group "Mechanic/electrician" can execute the activity "install" using this documentation.
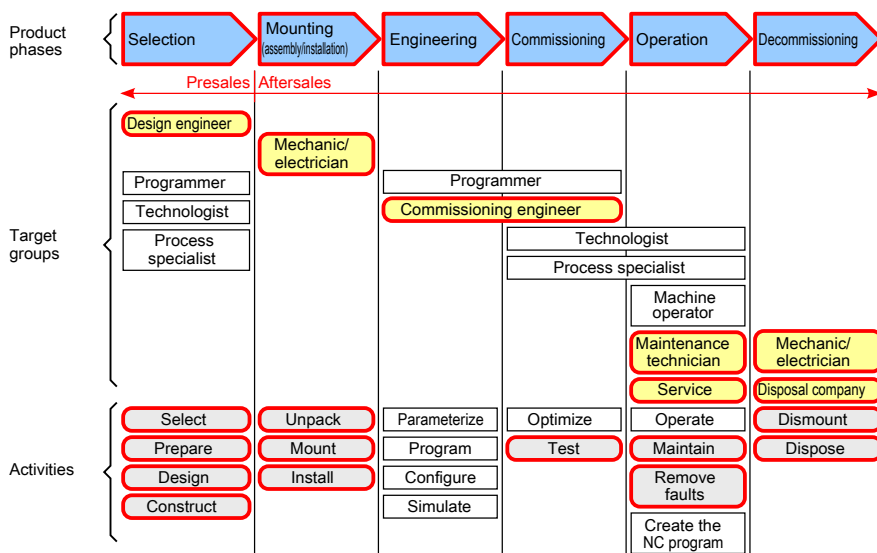


Fig. 1: Assigning the present documentation to the target groups, product phases and activities of the target group

This document instructs the technical staff of the machine manufacturer on how to safely perform the mechanical and electrical installation and on how to commission the device.

Required qualification: Individual who is able to assess the tasks assigned and to identify possible safety risks owing to qualification in the subject, knowledge and experience. The individual should also be familiar with the standards and regulations.

## 1.3 Scope

This operating instructions is valid for all variants of the control with a type code starting with:

COREX-C

The type code specifications are located on the type plate of the device. Also refer to → Chapter 2.1 "Product identification" on page 8.

## 1.4 Related documents

Table 2: Related documentation

| Title | Part number and document type |
|---|---|
| Security Manual<br>Electric Drives<br>and Controls | → R911342562<br>Project Planning Manual |
| Rexroth IndraControl<br>VAU 01.1<br>UPS with Communication Interface | → R911336867<br>Operating Instructions |

## 1.5 Customer feedback

Customer requests, comments or suggestions for improvement are of great importance. Please email your feedback on the documentations to → Feedback.Documentation@boschrexroth.de. Directly insert comments into the electronic PDF document and send the PDF file to Bosch Rexroth.

# 2 Product identification and scope of delivery

## 2.1 Product identification
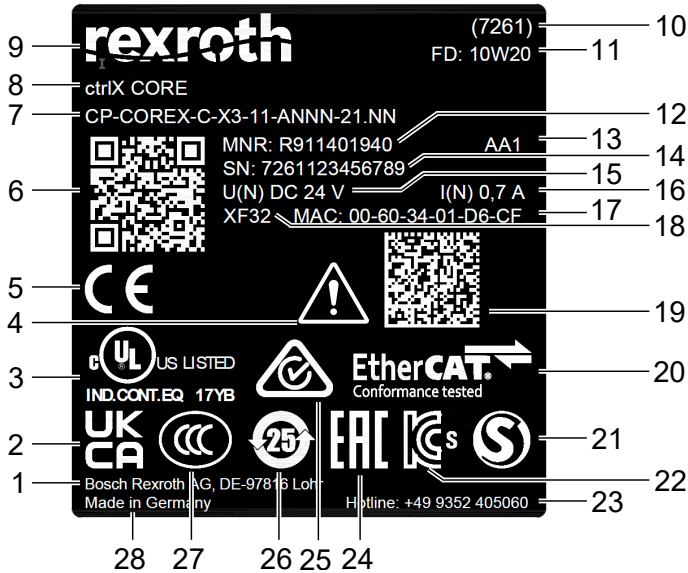


Fig. 2: Type plate (example)

1   Company address
2   UKCA marking
3   Underwriters Laboratories Inc. mark
4   Symbol for reference to the operating instructions
5   CE conformity mark
6   QR or data matrix code, Rexroth, 2D code
7   Type code
8   Product
9   Trademark
10  Plant number
11  Manufacturing date
12  Part number
13  State of revision
14  Serial number
15  Rated voltage
16  Rated current
17  MAC address (Ethernet ID)
18  Free text on the MAC address
19  MAC code (2D code), data matrix
20  EtherCAT
21  S-mark logo
22  KCs mark
23  Service hotline number
24  EAC conformity mark
25  Regulatory Compliance Mark (RCM)
26  China-RoHs 2 label
27  CCC marking
28  Name of origin

## 2.2 Scope of delivery

- ctrlX CORE control
- 24 V power connector, 2-pin

# 3 Using safety instructions

## 3.1 Structure of the safety instructions

The safety instructions are structured as follows:
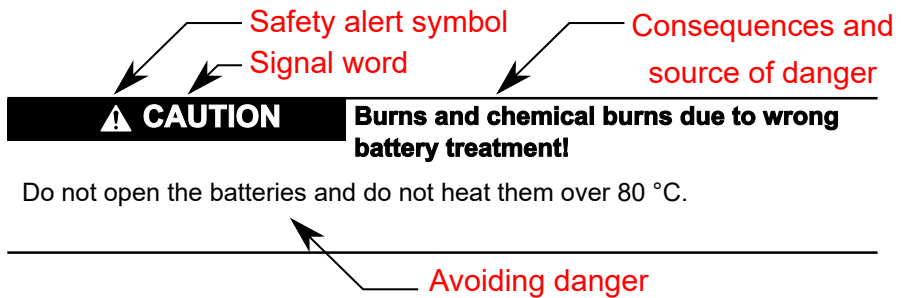


Fig. 3: Structure of the safety instructions

## 3.2 Explaining signal words and the safety alert symbol

The safety instructions in this documentation contain specific signal words (danger, warning, caution, notice) and, if necessary, a safety alert symbol (according to ANSI Z535.6).

The signal word draws attention to the safety instruction and indicates the risk potential.

The signal graphics (warning triangle with exclamation mark), added in front of the signal words Danger, Warning and Caution refer to hazards to inidividuals.

| | |
|---|---|
| ⚠ DANGER | In case of non-compliance with this safety instruction, death or serious injury **will** occur. |
| ⚠ WARNING | In case of non-compliance with this safety instruction, death or serious injury **can** occur. |
| ⚠ CAUTION | In case of non-compliance with this safety instruction, minor or moderate injury can occur. |
| *NOTICE* | In case of non-compliance with this safety instruction, material damage can occur. |

## 3.3 Symbols used

This is a tip.

## 3.4 Explaining the signal alert symbol on the device

⚠️ If this symbol is on your device, you have to observe the documentation on the device. The respective documentation informs on the type of hazard as well as the steps required to avoid this hazard.

# 4 Intended use

## 4.1 General information on the intended use

| NOTICE | Risk of damaging the device if not expressly stated accessories, mounting parts and other components, cables, lines, software and firmware are used. |
|---|---|
| | The ctrlX CORE control may only be used with the accessories and mounting parts listed in this documentation. Components that are not expressly mentioned must neither be attached nor connected. The same applies to cables and lines. |
| | Only to be operated with the component configurations and combinations expressly defined and with the software and firmware specified in the corresponding functional description. |

Typical areas of application of the control:

- Handling and assembly systems
- Packaging and food processing machines
- Printing and paper converting machines
- Machine tools
- Wood working machines
- General mechanical engineering
- Building automation

| ⚠️ WARNING | Danger due to unintended use |
|---|---|
| | The protection specified by Bosch Rexroth cannot be ensured if not used as intended. |
| | – Use the product exclusively as intended by Bosch Rexroth. |
| | – Operate this device only under the mounting and installation conditions, in the position and under the ambient conditions (temperature, degree of protection, humidity, EMC etc.) specified in this documentation. |

# 5 Spare parts, accessories and wear parts

## 5.1 Power connector, 24 V

| Ordering code | Part number | Description |
|---|---|---|
| XACC-1-CSPWRC | R911410559 | 24 V plug for ctrlX CORE X2 and ctrlX CORE X3 |

## 5.2 SD card

| Ordering code | Part number | Description |
|---|---|---|
| XACC-0-SD016GB | R911404022 | Micro SD card, 16 GB |

## 5.3 RJ45 cable

| Ordering code | Part number | Description |
|---|---|---|
| RKB0020 | R911340676 | Bus cable |

## 5.4 End clamp

| Ordering code | Part number | Description |
|---|---|---|
| SUP-M01-ENDHALTER | R911170685 | 2 pieces of snap-on end brackets for 35 mm NS 35/7.5 support rail; width: 9.5 mm |

## 5.5 License dongle

The license dongle allows to easily transmit licenses between ctrlX controls. The license dongle is a micro SD card with a serial number. The user can assign licenses to the dongle instead of to the ctrlX controls.

| Ordering code | Part number | Description |
|---|---|---|
| XACC-1-SD*000L | R911416693 | License dongle |

## 5.6 Wear parts

The physical read-only memory (eMMC) of the control has a limited number of write cycles. Retrieve the current status of the read-only memory via the ctrlX CORE web interface: *"ctrlX CORE side navigation → Settings → Information → tab "Resources" → Sensors"*.

Notes on sensor values:

- "0 - 10% of eMMC life time used" means that up to 10 % of the maximum write cycles can be used.
- Create a backup if the value exceeds 80%.
- Replace the hardware if the value exceeds 80%.
- Use an external memory to extend the service life of the permanent memory.
- The frequency of the refresh cycle depends on the service life of the memory. If a refresh cycle is not possible anymore, data can be lost.

Notes on the temperature display:

- "Temperature (CPU)" shows the internal CPU temperature.
- "Temperature" shows the temperature on the PCB.

# 6 Ambient conditions

## 6.1 Ambient conditions of the ctrlX CORE

| | |
|---|---|
| Ambient temperature during operation | Up to 2,000 m: -25 °C to +55 °C |
| | 2,000 m to 3,000 m: -25 °C to +50 °C |
| | 3,000 m to 4,000 m: -25 °C to +45 °C |
| | 4,000 m to 5,000 m: -25 °C to +40 °C |
| Ambient temperature during storage and transport | -40 °C to +70 °C |
| Operating altitude acc. to DIN 60204 | Up to 5,000 m above sea level |
| Permitted air humidity according to DIN EN 61131-2 | 5% to 85%, no condensation |
| Protection class acc. to DIN EN 60 529 | IP 20 (not evaluated by UL) |
| Protection class acc. to DIN EN 61010-2-201 | III |
| Overvoltage category acc. to IEC 60664-1 | 2 |
| Contamination level acc. to EN 61010-1 | 2, no condensation allowed |
| **Mechanical tests** | |
| Vibration resistance acc. to DIN EN 60068-2-6[1] | Oscillations, sinusoidal in all three axes |
| | 5 Hz - 8.4 Hz with 3.5 mm amplitude |
| | 8.4 Hz -150 Hz with 1 g peak acceleration |
| Shock test acc. to DIN EN 60068-2-27 | Shock stress: Shock resistance in all three axes, 11 ms semi-sinusoidal 15 g |
| Broadband noise acc. to DIN EN 60068-2-64 | 5-20-150 Hz with 0.572 g, 5 h per axis |
| **Electrostatic discharge** | |
| ESD resistance acc. to DIN EN 61131-2 | Criterion B |
| • Test voltage | 8 kV for air discharge |
| | 4 kV for contact discharge |

[1] To avoid vibration, secure the cables at a short distance (< 20 cm).

| NOTICE | **Failure of the product due to contaminated air!** |
|---|---|
| | – The ambient air must not contain acids, alkaline solutions, corrosive agents, salts, metal vapors and other electrically conductive contaminants in high concentrations. |
| | – The devices to be installed into the housing and installation compartments must at least comply with the degree of protection IP 54 according to DIN EN 60529. |
| | – The device shall be provided in a suitable fire enclosure in the end-use application. |

| NOTICE | **Defective product due to gases jeopardizing functions** |
|---|---|
| | Due to the risk of corrosion, avoid sulphurous gases (e.g. sulphur dioxide ($SO_2$) and hydrogen sulphide ($H_2S$)). The product is not resistant against these gases. |

| NOTICE | **Failure of the product due to overheating** |
|---|---|
| | To avoid overheating and to ensure a smooth operation of the product, sufficient air has to circulate according to the minimum distances specified, see Fig. 9. |

This is a product that corresponds to the limit values of the emitted interference of class A (industrial environments). This is a product that does not correspond to the limit values of the emitted interference of class B (residential area and small enterprises.

When using the product in residential areas or small enterprises, the operator has to take actions to prevent radio interferences (also refer to DIN EN 55022).

# 7 Technical data

## 7.1 General technical data

| | COREX-C-X2 | COREX-C-X3 |
|---|---|---|
| Processor | Zync Ultrascale+, 64 bit, 4 × ARM A53 | Zync Ultrascale+, 64 bit, 4 × ARM A53 |
| RAM | 2 GByte DRAM | 2 GByte DRAM |
| Internal physical read-only memory (eMMC) | 4 GByte, also refer to ➡ Chapter 5.6 "Wear parts" on page 11 | 4 GByte, also refer to ➡ Chapter 5.6 "Wear parts" on page 11 |
| Internal non-volatile random-access memory (NVRAM) | 128 Kbyte | 128 Kbyte |
| Extensions | None | None |
| Communication interfaces | RJ-45 <br><br>• 2 × Ethernet connection (10 Mbit, 100 Mbit, 1 Gbit) | RJ-45 <br><br>• 3 × Ethernet connection (10 Mbit, 100 Mbit, 1 Gbit) |
| USB | Not enabled | 1 × USB host, TYPE C (USB2.0), maximum cable length of 3 m |
| SD card | Slot for SD card | Slot for SD card |
| Battery | CR1025 | CR1025 |
| Weight | 370 g | 370 g |
| Dimensions | Refer to ➡ Chapter 10.1 "Housing dimensions" on page 18 | Refer to ➡ Chapter 10.1 "Housing dimensions" on page 18 |

## 7.2 Voltage supply and current consumption

| | |
|---|---|
| Nominal voltage at $U_L$ | DC 24 V SELV/PELV |
| Maximum permitted voltage range of the supply voltage $U_L$ | DC 18 V to DC 31.2 V (incl. all tolerances and ripple) |
| Max. current consumption of the control from $U_L$ at a nominal voltage of 24 V | 320 mA |

Technical data

| | |
|---|---|
| Max. power consumption of the control from $U_L$ at a nominal voltage of 24 V | 7.68 W |
| Reverse polarity protection of the supply voltage $U_L$ | Present |
| Fuse protection $U_L$ | Internal with eFuse, 1.5 A |
| Overvoltage protection $U_L$ | Available; the protective fuse can trigger in case of overvoltage |
| Transient protection $U_L$ | Present, suppressor diodes |
| | Pulse load up to 1,500 W |
| Voltage dips at current supply interfaces | PS1 < 1 ms, evaluation criterion A |
| Electrical isolation | DC 707 V |
| 24 V supply ($U_L$/$U_L$ GND) to the functional earth | |
| 24 V supply voltage ($U_L$/$U_L$ GND) to XF10, XF50, XF51 | DC 1200 V |

| NOTICE | **Electronic damage due to polarity reversal or due to a nominal current that is too low** |
|---|---|
| | The power supply unit has to be able to deliver the quadruple nominal current of the internal and external fuses to ensure that the fuse reliably triggers in case of error. |

# 8 Standards

## 8.1 Standards used

Table 3: Angewandte Normen – Standards used – Normes appliquées

| Norm<br>Standard<br>Norme | Bedeutung<br>Meaning<br>Signification | Ausgabe<br>Edition<br>Édition |
|---|---|---|
| DIN EN 60204-1 | Sicherheit von Maschinen | 2019 |
| | Elektrische Ausrüstung von Maschinen | |
| | – | |
| | Safety of machinery | |
| | Electrical equipment of machines | |
| | – | |
| | Sécurité des machines | |
| | Equipement électrique des machines | |

| Norm | Bedeutung | Ausgabe |
|---|---|---|
| Standard | Meaning | Edition |
| Norme | Signification | Édition |
| DIN EN 61131-2 | Speicherprogrammierbare Steuerungen | 2008 |
| | Teil 2: Betriebsmittelanforderungen und Prüfungen | |
| | – | |
| | Programmable controllers | |
| | Part 2: Equipment requirements and tests | |
| | – | |
| | Automates programmables | |
| | Partie 2: Spécifications et essais des équipements | |
| DIN EN 60529 | Schutzarten durch Gehäuse (IP-Code) | 2014 |
| | – | |
| | Degrees of protection provided by enclosures (IP Code) | |
| | – | |
| | Degrés de protection procurés par les enveloppes (Code IP) | |
| DIN EN 61010-2-201 | Sicherheitsbestimmungen für elektrische Mess-, Steuer-, Regel- und Laborgeräte | 2014 |
| | Teil 2-201: Besondere Anforderungen für Steuer- und Regelgeräte | |
| | – | |
| | Safety requirements for electrical equipment for measurement, control and laboratory use | |
| | Part 2-201: Particular requirements for control equipment | |
| | – | |
| | Règles de sécurité pour appareils électriques de mesurage, de régulation et de laboratoire | |
| | Partie 2-201: Exigences particulières pour les équipements de commande | |
| UL 61010-2-201 | UL Standard for Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use | 2014 |
| | Part 2-201: Particular Requirements for Control Equipment | |

Standards

## 8.2 CE marking

### 8.2.1 Declaration of conformity

C E

The electronic products described in the present operating instructions comply with the requirements and the target of the following EU directive and with the following harmonized European standards:

Table 4: Normen zur elektromagnetischen Verträglichkeit (EMV) − Standards for electromagnetic compatibility (EMC) − Normes sur la compatibilité électromagnétique (CEM)

| Norm<br>Standard<br>Norme | Bedeutung<br>Meaning<br>Signification | Ausgabe<br>Edition<br>Édition |
|---|---|---|
| DIN EN 61000-6-2 | Elektromagnetische Verträglichkeit (EMV) | November 2019 |
| | Teil: 6-2: Fachgrundnormen − Störfestigkeit für Industrieber-eiche | |
| | Normes génériques − Immunité pour les environnements industriels | |
| DIN EN 61000-6-4 | Elektromagnetische Verträglichkeit (EMV) | September 2011 |
| | Teil: 6-4: Fachgrundnormen − Störaussendung für Industrie-bereiche | |
| | Normes génériques − Norme sur l'émission pour les environ-nements industriels | |

> Loss of EU conformity due to modifications at the device
>
> EU marking applies only to the device upon delivery. After modifying the device, verify the EU conformity.

> For the CE declaration of conformity, go to the Bosch Rexroth media directory: ➡ www.boschrexroth.com/MediaDirectory, search term ➡ "DCTC-30455-001".

## 8.3 UL/CSA certified

c (UL) us LISTED

The devices "ctrlX CORE" are certified according to:

- **UL 61010-2-201** (Industrial Control Equipment) and
- **CSA22.2 No. 61010-2-201** (CSA)

However, there can be combinations or extension stages with a limited or missing certification. Thus, verify the registration according to the UL marking on the device.

> Loss of UL/CSA conformity due to modifications at the device.
>
> UL and CSA marking applies only to the device upon delivery. After modifying the device, verify the UL and the CSA conformity.

> To guarantee a UL/CSA-compliant operation, the following conditions have to be met:
> - Use only insulated copper wires suitable for at least 60 °C

## 8.4 UK declaration of conformity

The products comply with the UK directive acc. to S.I. 2016/1091 (electromagnetic compatibility).

For the UK declaration of conformity, go to the Bosch Rexroth media directory: ➡ www.boschrexroth.com/mediadirectory, search term: ➡ "DCTC-30455-031".
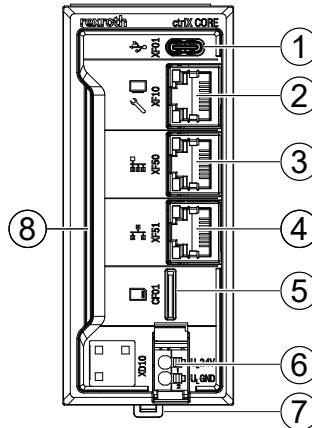
UK CA

# 9 Interfaces

## 9.1 Interface description



Fig. 4: Interfaces

| NOTICE | **Damage of the device by plug mounting under voltage!** |
|---|---|
| | – Before mounting or dismounting components, disconnect the control - including its components - from voltage. |
| | – Connect the voltage only after the control and its components have been set up. |

Table 5: Control interfaces

| No. | Name | Connection type | Connector type (integrated) | Mating connector and cable (From outside) | X2 | X3 |
|---|---|---|---|---|---|---|
| ① | XF01 | USB host<br>USB 2.0 | USB socket,<br>Type C | USB plug,<br>Type C | – | ✓ |
| ② | XF10 | Ethernet<br>10/100/1000 MBit<br>HMI and engineering port | RJ45 socket<br>8-pin | RJ45 plug<br>(twisted pair, 8-wire) | ✓ | ✓ |
| ③ | XF50 | Ethernet<br>10/100/1000 MBit<br>Field bus master (Ethercat) | RJ45 socket<br>8-pin | RJ45 plug<br>(twisted pair, 8-wire) | ✓ | ✓ |

| No. | Name | Connection type | Connector type (integrated) | Mating connector and cable (From outside) | X2 | X3 |
|---|---|---|---|---|---|---|
| ④ | XF51 | Ethernet 10/100/1000 MBit 1G Bit/s Ethernet (configurable) TSN-capable (Time-Sensitive Networking) | RJ45 socket 8-pin | RJ45 plug (twisted pair, 8-wire) | – | ✓ |
| ⑤ | CF01 | Slot for SD card | – | SD card | ✓ | ✓ |
| ⑥ | XD10 | 24 V plug, $U_L$ with status display | 2-pin | 2-pin | ✓ | ✓ |
| ⑦ | GB01 | Battery case | – | – | ✓ | ✓ |
| ⑧ | | ctrlX CORE status LED | – | – | ✓ | ✓ |

# 10 Mounting, dismounting and electric installation

## 10.1 Housing dimensions



Fig. 5: Front view

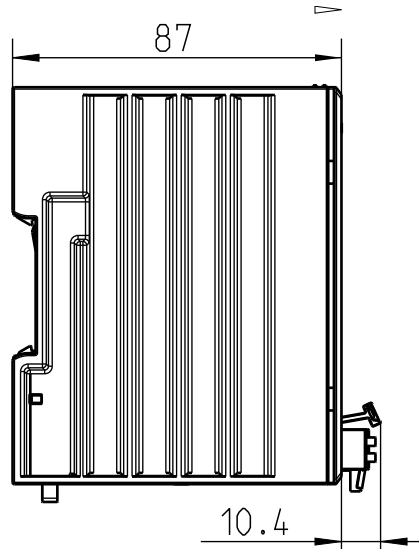Mounting, dismounting and electric installation
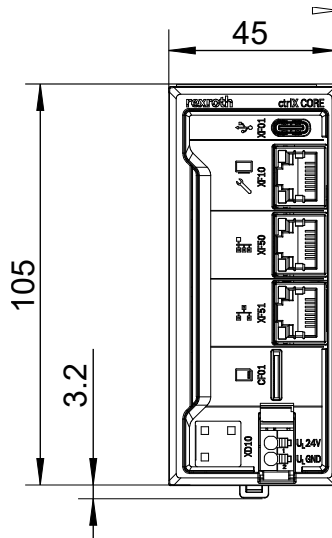


Fig. 6: Side view

## 10.2  Installation notes

| NOTICE | Destruction of the device due to electrostatic discharge |
|---|---|
| | The device contains components that can be damaged or destroyed by electrostatic discharge. Comply with the required safety measures against electrostatic discharge (ESD) acc. to EN 61340-5-1 when operating the control. |

* Mounting location

  The control has the degree of protection IP 20 and is thus intended for use in a closed control cabinet or control box (terminal box) of the degree of protection IP 54 or higher. The control cabinet has to be provided with sufficient stability and rigidity and has to comply with the requirement to impede fire spreading (acc. to UL 61010-1, 61010-2-201).

* Support rail

  Mount the control on an electrically conductive 35 mm standard support rail. Its connection to the functional earth is sufficient. Only use a support rail with an design height of 7.5 mm (corresponds to TH 35-7.5 acc. to EN 60715).

  The fastening distance of the support rails may not exceed 200 mm. This distance is required to ensure stability while mounting and dismounting the control.

Fig. 7: Support rail fastening (in mm)

• Mounting position

  To ensure air cooling in the device by convection, mount the control only vertically on a horizontal support rail as shown in the following figure.

  In the shown mounting position, the natural convection supports the forced cooling air flow. Heat pockets can thus not be caused in the device.
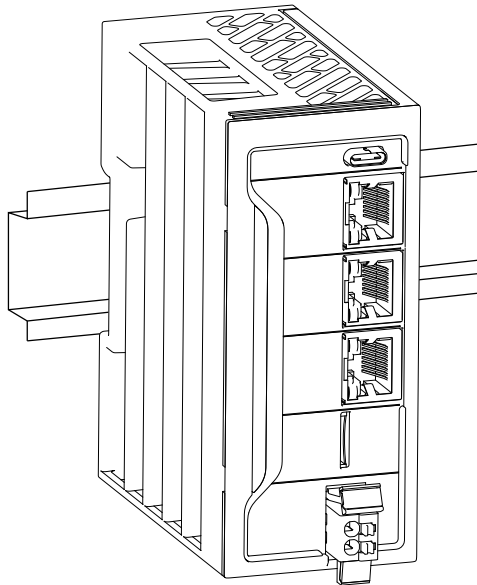


Fig. 8: Permitted mounting position for all ctrlX CORE controls

• End clamps

  Fasten end clamps of the type SUP-M01-ENDHALTER on both sides of the control.

  End clamps ensure a correct fastening of the control connected to them on the support rail and they are used as lateral end elements.

  Always fasten one end clamp of the station before mounting the control. This ensures the following:

  – It impedes the shifting of the control.

  – The installation place for the end clamps is secured.

• Do not route cables parallel to motor cables or other strong interference sources to avoid the coupling of interferences.

• Observe the bending radii of the cables when routing.

- The cabling of the Ethernet wires may not be outside the building.
- Use strain reliefs for all cables and place them the closest possible to the connection of the control.
- Install the control only horizontally on a support rail attached to a wall.
- Keep the maximum possible distance from interference sources.
- Provide the following minimum distances for sufficient cooling:
  In case of a several line design, the supply air has to be measured under each line and its limit value may not be exceeded. For information on ambient temperatures, refer to ➡ Chapter 6.1 "Ambient conditions of the ctrlX CORE" on page 12.
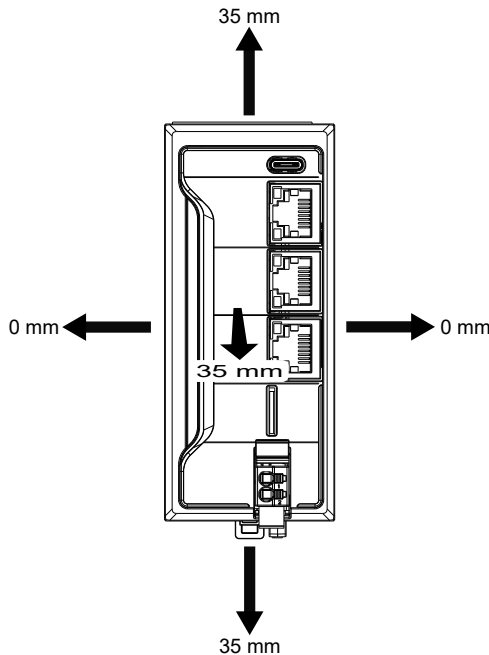


Fig. 9: Minimum distances for the circulation of ambient air

- Additionally, provide sufficient distance for mounting, dismounting, plugs and cables.

## 10.3 Mounting the control

| NOTICE | Damage of the device by plug mounting under voltage! |
|---|---|
| | – Before mounting or dismounting components, disconnect the control - including its components - from voltage. |
| | – Connect the voltage only after the control and its components have been set up. |

| NOTICE | Possible damage to property due to unintended mounting of the support rail |
|---|---|
| | – Fasten the support rail adequately. |
| | – Connect the support rail to a functional ground. |
| | – Mount the control on the support rail, as the support rail is also used for heat dissipation and grounding. |
| | – Install the control in a control cabinet or an appropriate housing. |

| NOTICE | Control not fixed due to clamped support arm mounting! |
|---|---|
| | Before mounting, ensure that the support arm mounting of the control is not in open position. If required, release the clamping of the open position using the locking lever, see Fig. 10. |
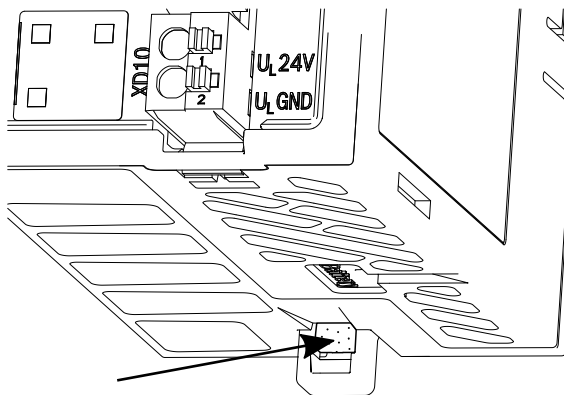


Fig. 10: Locking lever to release the clamping of the open position

**Mounting steps**

1. ▷ Mounting the control
2. ▷ Fastening end clamp

The control has up to 50 mounting cycles.

## 10.3.1 Mounting the ctrlX I/O module

| NOTICE | Damage of the device by plug mounting under voltage! |
|---|---|
| | Disconnect the module and all connected module components from voltage before mounting or dismounting. |

| NOTICE | Possible damage to property due to unintended mounting of the support rail |
|---|---|
| | – Connect the support rail to a functional ground. |
| | – Mount the module on a support rail. |
| | – Install the module in a control cabinet or an appropriate housing. |

| **NOTICE** | **Module is not fixed correctly due to engaged support arm mounting!** |
|---|---|
| | Before mounting, ensure that the support arm mounting of the control is not in open position. If required, release the clamping of the open position using the locking lever, refer to the following figure 11. |
| **NOTICE** | **Damage of the device by short circuit of patch connectors** |
| | There is an endcover on the right upon delivery. Remove this endcover to connect the modules in series. Position the endcover on the last module of the station to protect it against short circuit and contamination. |
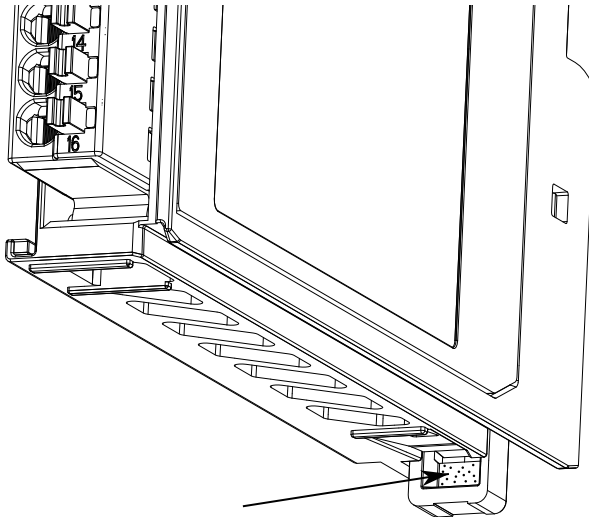
Fig. 11: Locking lever to release the clamping of the open position

Each module has to be snapped separately.

## 10.4    Dismounting the control

For dismounting, use a common tool such as a slotted screwdriver with a 2.5 mm blade.

## 10.4.1    Dismounting steps

| NOTICE | Destruction of components and devices due to mounting and dismounting under voltage! |
|---|---|
| | − Before mounting or dismounting, disconnect the control - including its components - from voltage. |
| | − Connect the voltage only after the control and its components have been set up. |

For a secure decommissioning with regard to IT security, refer to ➡ Chapter 11.2.1 "Notes on safe decommissioning" on page 29.

### Removing the control from the support rail

1. ▷ Remove the left or the right end clamp.

2. ▷ Use a suitable tool (e.g. slotted screwdriver) and put it into the lower disengaging mechanism (base latch) of the control and disengage the control (see (A) in the following figure). The base latch is locked in the open position.

3. ▷ Remove the control vertically to the support rail [see (B) in the following figure].
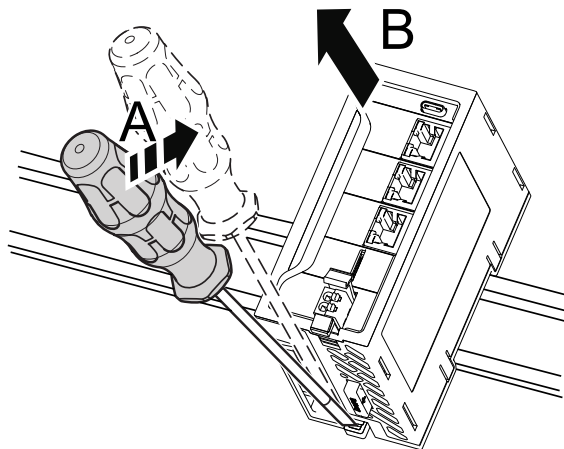


Fig. 12: Removing the control from the support rail

ⓘ Before mounting the control on the support rail again, release the clamping of the open position again. Press the locking lever, see chapter 10.4 "Mounting the control".

## 10.5    Electric installation

### 10.5.1    External power supply unit

| ⚠ WARNING | **Danger of lethal injury due to hazardous electric voltage** |
|---|---|
| | – Connect power supply units generating protective extra-low voltage (24 V) only to supply voltages designed for these power supply units. Note the overvoltage categories (refer to the documentation of the power supply unit). |
| | – Do not apply the supply voltage to the protective extra-low voltage. |

All control components are supplied from 24 V voltage supplies (SELV/PELV, NEC class 2).

The power supply units used have to be able to deliver the quadruple nominal current of the internal and external fuses to ensure that the fuse reliably triggers in case of an error.

All lines of the 24 V voltage supply have to be routed separately from lines carrying higher voltages.

All peripherals, such as digital sensors or actuators connected to the interfaces of the control, also have to comply with the criteria of safety-separated circuits.

ℹ The 24 V voltage supply can be grounded. For more detailed information, refer to the documentation of the power supply unit.

ℹ Use only power supply units that can bridge a half-wave failure (10 ms).

### 10.5.2    Power connector XD10

The control is supplied via the XD10 power connector.

ℹ Use only copper wires to connect the connection terminals.

ℹ Only the power connector is permitted to connect the 24 V supply voltage for the control (see ➡ Chapter 5.1 "Power connector, 24 V" on page 10).

ℹ The power connector has a maximum number of 50 mating cycles. The mating cycles of the cables in the XD10 power connectors are limited to 50.
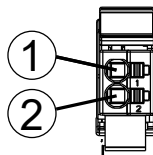


Fig. 13: Power connector XD10

Table 6: Pin assignment

| Plug contact | Signal | Function | Color |
|---|---|---|---|
| 1 | 24 V | DC +24 V supply voltage ($U_L$) | Red |
| 2 | 0 V | GND ($U_L$) (ground supply voltage) | Blue |

Mounting notes:

- For the power connector XD10, one-wire cables and stranded cables can be used with or without wire end ferrule (acc. to DIN 46228). These wire end ferrules can be with or without plastic collar. The contact surface has to be 8 mm.
- The cable cross-section allowed is between 0.75 and 1.5 mm$^2$ (AWG 19 to AWG 16).
- Use only cables approved for temperatures of at least 60°C.
- Use freely routed 1-wire cables. The wire distance has to be at least the wire diameter.
- The stripping length is 8 mm.
- To use stranded cables without wire end ferrules, twist the strand between 180° and 360°. The stripped area has to be 8 mm after twisting. If stranded cables are introduced, keep the pushbutton of the push-in terminal pressed.
- To remove the cables, press the pushbutton of the push-in terminal.

**Positioning the power connector**

1. ▸ Position the connector on the connector holder.
2. ▸ Engage the connector on top.

## 10.5.3 24 V voltage supply

The voltage supply (SELV) for the device has to be equipped with a UL-approved overcurrent protection acc. to UL 61010-1, table 18.

For the voltage supply, use a power supply unit as described in the following chapter: ➡ Chapter 10.5.1 "External power supply unit " on page 25.

The GND ($U_L$) is not grounded to the device!

**Mounting, dismounting and electric installation**

## Setup without electrical isolation
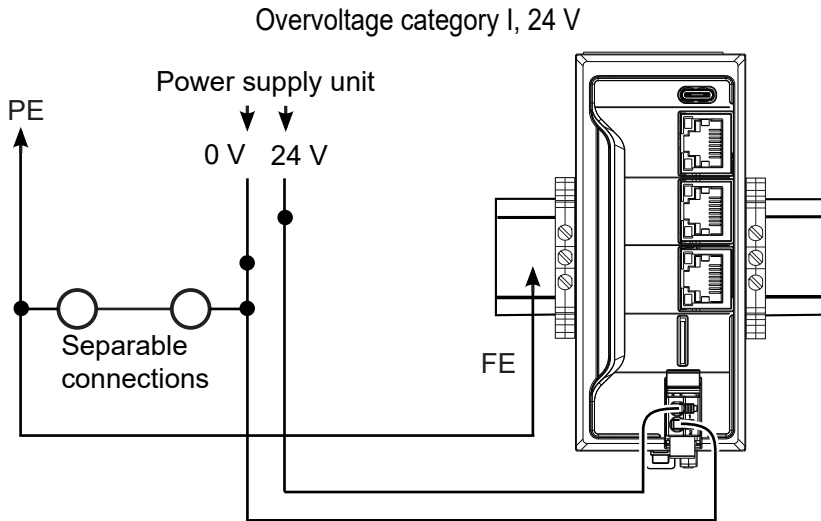
### Overvoltage category I, 24 V



Fig. 14: Setup of the voltage supply ctrlX CORE X2 and ctrlX CORE X3

Control does not start in case of reverse input voltage

The 24 V feeding $U_L$ at the XD10 connector is protected against polarity reversal. A polarity reversal of $U_L$ and GND $U_L$ feeding does not damage the device. However, the control does not start and the status displays are not on.

## Dimensioning the voltage infeed

Observe the maximum currents when dimensioning the voltage supply. The operating voltage allowed has to be applied directly to the device.

The voltage must also not be exceeded if:

- there are variations in line voltage, e.g. caused by different loads of the mains
- there are varying load states, such as short-circuit, normal load, lamp load or no load

## Connecting the reference conductor to the protective conductor

If the reference conductor 0 V ($U_L$) is connected to the protective conductor system, this connection has to be arranged at a central place (e.g. at the load power supply unit). Hence, the supply current circuit is a PELV circuit.

### 10.5.4 Grounding

| NOTICE | Failure due to insufficient grounding |
|---|---|
| | An optimum grounding is required to impede possible interferences from the control and to discharge them to the ground. |

**Functional earth**

Only the functional earth (FE) is used for the device. The functional earth is only used to discharge disturbances. For individuals, the functional earth is not intended as protection against electric shock.

The control is grounded via the support rail. The support rail, on which the control is mounted, has to be mounted to a grounded metal carrier, e. g. the rear panel of the control cabinet.

The control is provided with FE springs (metal clips) at its bottom side creating an electric connection to the support rail while mounting.

If necessary, provide the support rail with a separate ground connection.

**Potential equalization**

Potential equalization acc. to DIN VDE 0100 part 540 has to be provided between the system parts and the voltage supply.

### 10.5.5 Shielding

| NOTICE | Failure due to insufficient shielding |
|---|---|
| | Provide sufficient shielding. |

The shielding reduces any effects of interferences on the system.

Observe the following when shielding:

- Fasten the shielding as extensively as possible
- Ensure proper contact between connector and terminal
- Avoid damaging or squeezing conductors
- Note the wire specifications when connecting the shielding
- Shield the closest possible to the signal terminal points

Route all power cables and data cables in separate cable channels.

# 11 Commissioning

## 11.1 Commissioning steps

### 11.1.1 General information

To commission the device, proceed as follows:

1. ▷ Mount the control.

   For details, refer to .

2. ▷ Connect the voltage supply to the XD10 connection of the control.

   Refer to .

## 11.2 Safe decommissioning

### 11.2.1 Notes on safe decommissioning

To securely decommission the ctrlX CORE control with regard to IT security, delete all user data on the control. There are two options to delete user data:

1. ▷ Deleting configurations and apps

   First, delete all configurations created on the control and then all installed apps. All user data belonging to the apps is also deleted.

2. ▷ Loading a new image to the control using an SD card

   An SD card can be used to load an image to the control. All existing data is deleted when loading a new image. Please contact the Bosch Rexroth Service.

   🛈 Please back up the user data before you delete it if you want to restore it on another control.

# 12 Device description

## 12.1 ctrlX CORE control

The ctrlX CORE compact control in embedded format is suitable for the support rail mounting and for its use in a control cabinet.

With the 64 bit Quad Core ARM CPU, the ctrlX CORE has sufficient computing performance for complex control tasks. The Linux-based operating system is open for the integration of all ctrlX CORE Runtime and ctrlX CORE engineering apps from the ctrlX WORKS function module kit and other further customized apps. A central ctrlX Data Layer is used to exchange the communication between the apps in realtime and non-realtime.

The onboard EtherCAT master is used to connect and control the drives, I/O modules and other devices from the open EtherCAT ecosystem.

## 12.2 Status displays

For error diagnostics, the ctrlX CORE status LED is located on the front of the controls and the voltage status LED is located on the XD10 plug.

### 12.2.1 Status display on the ctrlX CORE

The following functions are assigned to the ctlrX CORE status LED when the system firmware is running:

Device description

Table 7: Status LED

| State | Color | |
|---|---|---|
| Control in "Run" state | Green | `GN` |
| Control in "Stop" state | Blue | `BU` |
| Warning in the ctrlX CORE Runtime | Flashing yellow | `YE YE YE YE YE -- -- -- -- --` ↵ |
| Errors (F0 – F7[①]) in the ctrlX CORE Runtime | Flashing red | `RD RD RD RD RD -- -- -- -- --` ↵ |
| App execution faulty | Flashing red | `RD RD RD RD RD -- -- -- -- --` ↵ |
| Service mode active | Flashing blue | `BU BU BU BU BU -- -- -- -- --` ↵ |
| Identification | Flashing white | `WH WH WH WH WH -- -- -- -- --` ↵ |
| The ctrlX CORE Rescue system is active | Flashing red and blue | `RD RD RD RD RD BU BU BU BU BU` ↵ |
| Booting active or shut down | Flashing blue | `BU BU BU BU BU -- -- -- -- --` ↵ |
| System error (F8 and F9[①]) in the ctrlX CORE Runtime | Red | `RD` |

① For the error codes, refer to:

➥ https://docs.automation.boschrexroth.com/doc/2331677038/main-diagnostics/latest/en/

- − One square corresponds to a period of 200 ms.
- − The arrow represents the end of a cycle.
- − --: LED is not on.
- − BU: LED is blue.
- − GN: LED is green.
- − RD: LED is red.
- − WH: LED is white.
- − YE: LED is yellow.

A new status is only displayed after the previous flashing cycle has elapsed. A change in status can thus be delayed up to two seconds.

### 12.2.2 Status display at the power connector XD10

The voltage $U_L$ applied at the connecting points is signaled via a green LED next to the respective red pusher.

Off = Voltage not present

On = Voltage present

## 12.3 Initial firmware

Upon delivery, the ctrlX CORE is provided with the operating system (Linux) including all system-relevant apps and optionally selected apps. The operating system provides commissioning and maintenance functions.

## 12.4    Booting

The ctrlX CORE control starts booting after switching on the 24 V voltage supply. Booting can be monitored and checked using the status display.

The status display is red briefly after switching on the 24 V voltage supply. In the initialization phase, the operating system (Linux) is started, the respective hardware drivers are loaded and the ctrlX CORE application is then started. The status display of the control is flashing blue during that time. If the initialization phase is completed, the control is in "Run" mode and the status display is permanently green.

### 12.4.1    Secure Boot

Booting is secured by "Secure Boot". Thus, it can only be loaded by a runtime system released by Bosch Rexroth. For the kernel development, this mechanism can be unlocked using an app and the respective license.

If the system is unlocked, the status display of the control flashes yellow during each booting. The warning "080E0305 Bootloader enabled!" is entered into the logbook.

To purchase the app and the license for unlocking purposes, please contact the Bosch Rexroth Service.

| **NOTICE** | **Limitation of the security functions and the loss of the device warranty by unlocking the "Secure Boot" mechanism** |
|---|---|
| | Unlocking the "Secure Boot mechanism" is at own risk. The productive device use is not supported anymore. The certification according to IEC 62443 is lost. |

## 12.5    Backing up remanent data

At runtime, remanent data is saved to an internal remanent NVRAM. It is immediately available after booting.

## 12.6    Real-time clock

The real-time clock of the control is buffered in the switched-off state using the inserted battery. If no voltage is applied, the battery buffers the real-time clock for at least 3 years. For notes on changing the battery, see ➡ Chapter 14.3 "Battery change " on page 34.

It is recommended to set the time via SNTP.

## 12.7    SD card

There is a slot (CF01) for the micro SD card on the front of the control.

Use only SD cards available as accessories, see ➡ Chapter 5.2 "SD card" on page 11. These SD cards are formatted and tested for the control.

A correct functioning of other SD cards cannot be ensured.

## 12.8 USB interface

There is a USB interface (XF01) (type C, USB 2.0) on the front side of the control. The USB interface can be used to connect USB storage media (only FAT16 and FAT32), scanners and similar USB devices.

The USB interface provides a voltage supply with DC 5 V and 0.5 A for external devices. The USB interface is switched off up to the next voltage cycle if the current is exceeded.

The USB interface is not enabled for the COREX-C-X2 variant.

The maximum cable length allowed is 3 m.

| **NOTICE** | **Device damage due to external supply via the USB interface** |
|---|---|
| | The grounding at the 24 V power connector XD10 always has to be connected. |

## 12.9 RJ45 interface

| X10 | HMI and engineering port |
|---|---|
| X50 | Field bus master (EtherCAT) |
| X51 | GBit/s Ethernet (configurable), not enabled for COREX-C-X2 |

## 12.10 Battery

A battery with battery holder (GB01) is included and working in the device upon delivery. Battery designation: Lithium battery 3.0 V CR1025 (30 mAH).

The battery is used to buffer the real-time clock if the control is disconnected from voltage. A circuit monitors the battery state.

For notes on changing the battery, see ➡ Chapter 14.3 "Battery change " on page 34.

A discharged battery causes an incorrect system time.

## 12.11 License information

### 12.11.1 General information

This product contains software components that are licensed by the holder of the rights under GNU General Public License (GPL), GNU Lesser General Public License (LGPL) or any other Open Source Software license, which requires a provided source code.

The source code of these software components is not delivered together with this product. You can obtain the source code for these software components on a physical medium (CD or DVD) by submitting a written request to our Open Source Office address listed below or by sending an email to ➡ open.source@boschrexroth.de. When sending such a request, please name the relevant product and its date of purchase.

Bosch Rexroth AG

We may charge you a fee (up to max. 20,- €) to cover the cost of the source code provision.

You may send your request (i) within three (3) years from the date you received the product that includes the binary file that is subject of your request or (ii) in case of code licensed under the GPL v3 for as long as Bosch Rexroth offers spare parts or customer support for that product.

# 13 Error causes and troubleshooting

## 13.1 General information

Table 8: Error causes and troubleshooting XF 10

| Error | Troubleshooting actions |
|---|---|
| The engineering PC cannot reach the control via the Ethernet interface "XF10" | • Check whether the device driver was correctly installed in the "Device manager" of the system control.<br>• Check whether the operating system assigned a valid IP address and a subnet mask to the network adapter (e.g. via the command "ipconfig"). If this is not the case, configure the IP address and the subnet mask manually. |

ⓘ The customer may not repair the device. Exceptions are maintenance works listed in the chapter "Maintenance".

For further information in the event of repair, please contact the Bosch Rexroth Service.

# 14 Maintenance

## 14.1 General maintenance information

| NOTICE | **Maintenance work in the device is only permitted by trained staff!** |
|---|---|
| | If hardware or software components have to be exchanged, please contact the Bosch Rexroth Service or ensure that only skilled staff changes the respective components. |

| NOTICE | **Loss of IP degree of protection due to incorrect maintenance.** |
|---|---|
| | Ensure that the IP degree of protection remains unchanged during mainte-nance! |

ⓘ Only the maintenance works at the device listed in this chapter are permitted.

For further information in the event of repair, please contact the Bosch Rexroth Service.

## 14.2 Scheduled maintenance tasks

Include the following tasks into the maintenance schedule:

- Check all plug and terminal connections of the components for proper tightness and possible damage at least annually.
- Ensure that cables are not broken or crushed.
- Replace damaged parts immediately.
- The device may not be opened.

## 14.3 Battery change

| ⚠ WARNING | Risk of injury due to fire or explosions caused by batteries. Risk of chemical burns due to battery contact. |
|---|---|
| | − Ensure that the batteries and accumulators are not short-circuited. |
| | − Do not charge batteries and accumulators externally. Do not dismantle, destroy or burn them or do not heat them above 80 °C. |
| | − Recycle old batteries and accumulators immediately and as intended. |
| | − Use only the battery specified in this documentation. |

It is recommended to change the battery of the control ctrlX CORE every three years.

The battery holder GB01 is located on the bottom side of the control (on the front side of the ctrlX CORE X7). Insert a common CR1025 lithium battery into a drawer of this battery holder. The design of the battery drawer ensures that inserting the battery is reverse polarity-protected. In order not to loose the time when changing the battery, a capacitor buffers the time for approximately 60 minutes.

Battery designation: Lithium battery 3.0 V CR1025 (30 mAH), manufacturer: Renata, part number: CR1025.IB.

# 15 Ordering information

## 15.1 General information on the ordering information

Function packages are also provided with the ctrlX CORE controls. The function packages are implemented into the control according to the system functions required in the application. Thus, variants with individual ordering information result from the required functional scope. Please contact the corresponding marketing organization and ask for the ordering information of the control variant optimized for your application.

## 15.2   Type code

| Type short description | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 1 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 2 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 3 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 4 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Example: | C | O | R | E | X | - | C | - | X | 3 | - | 1 | 1 | - | A | N | N | N | - | 2 | 1 | - | N | N | - | 0 | 1 | R | S | - | N | N | - | N | N | | | | | |

**01 Product**
ctrlX CORE ........ = COREX

**02 Design**
Compact ...................................... = C
Modular ...................................... = M

**03 Performance class**
CPU version X2 ................................ = X2
CPU version X3 ................................ = X3

**04 Device configuration**
Device configuration 11................................ = 11
CPU basic device (2 GB RAM, 4 GB hard drive,
1 MBit retentive memory)

**05 Basic interface**
Standard configuration ......................................... = A
1 x HMI, Engineering, 1 x fieldbus master,
1 x configurable
Standard configuration ......................................... = B
1 x HMI, Engineering, 1 x fieldbus master,
1 x configurable, 1 x IO connection

**06 Extension option 1**
None ......................................................................... = N
MultiEthernet ...........................................................  = 1

**07 Extension option 2**
None .........................................................................  = N

**08 Extension option 3**
None .................................................................................  = N

**09 Protection class**
IP 20 .........................................................................................  = 2

**10 Reserve**
Reserve ...................................................................................  = 1

**11 Device version**
01 ..........................................................................................  = 01

**12 Runtime version**
Version 01 .................................................................................................. = 01

**13 Runtime release**
Current release ............................................................................................... = RS

**14 Extended certification**
None..................................................................................................................  = N

**15 Subject to export control (EU)**
No export license required ................................................................................................  = N

**16 Special variante**
None ...................................................................................................................................... = NN
Robert Bosch ....................................................................................................................... = B1

Fig. 15: Type code

## 15.3   Accessories and spare parts

For ordering information on accessories and spare parts, refer to the chapter "Spare parts, accessories and wear parts".

Ordering information

# 16 Disposal

## 16.1 General information

Dispose the products according to the respective valid national standards.

## 16.2 Return

For disposal, our products can be returned free of charge. However, the products must be free from remains such as oil, grease or other impurities.

Furthermore, the products returned for disposal must not contain any undue foreign substances or external components.

Send the products free of charge to the following address:

Bosch Rexroth AG
Bürgermeister-Dr.-Nebel-Straße 2
97816 Lohr a.Main
Germany

## 16.3 Packaging

The packaging material consists of cardboard, plastics, wood or styrofoam. Packaging material can be recycled anywhere. For ecological reasons, please do not return empty packages.

# 17      Service and support

Our worldwide service network provides an optimized and efficient support. Our experts provide you with advice and assistance. You can contact us **24/7**.

## Service Germany

Our technology-oriented Competence Center in Lohr, Germany, is responsible for all your service-related queries for electric drive and controls.

Contact the **Service Hotline** and **Service Helpdesk** under:

| | |
|---|---|
| Phone: | **+49 9352 40 5060** |
| Fax: | **+49 9352 18 4941** |
| Email: | → service.svc@boschrexroth.de |
| Internet: | → http://www.boschrexroth.com |

Additional information on service, repair (e.g. delivery addresses) and training can be found on our internet sites.

## Service worldwide

Outside Germany, please contact your local service office first. For hotline numbers, refer to the sales office addresses on the internet.

## Preparing information

To be able to help you more quickly and efficiently, please have the following information ready:

- Detailed description of malfunction and circumstances
- Type plate specifications of the affected products, in particular type codes and serial numbers
- Your contact data (phone and fax number as well as your e-mail address)

**Service and support**

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