rexroth
A Bosch Company

Operating Manual

ctrlX CORE

Controls

R911405645, Edition 05

Liability

The specified data is intended for product description purposes only and shall not be deemed to be a guaranteed characteristic unless expressly stipulated in the contract. All rights are reserved with respect to the content of this documentation and the availability of the product.

Table of contents

1 About this documentation

1.1 Change record

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

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.

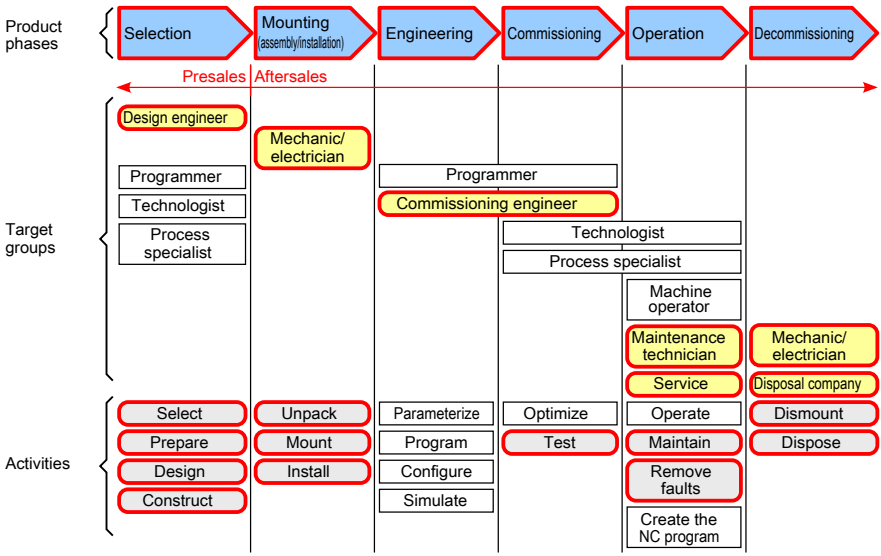


Fig. 1: Assigning the present documentation to the target groups, product phases and activities of the target group

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, whose type codes start with:

COREX-C

COREX-M

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	➦ R911342562
Electric Drives and Controls	Project Planning Manual
Rexroth IndraControl VAU 01.1 UPS with Communication Interface	➦ R911336867 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

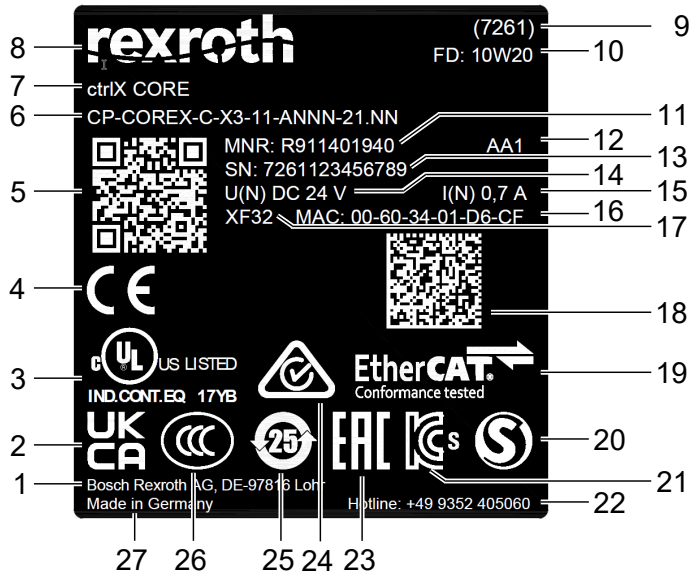


Fig. 2: Type plate (example)

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

2.2 Scope of delivery

- ctrlX CORE control
- 24 V power connector, 2-pin (ctrlX CORE X2 and ctrlX CORE X3)

- 24 V power connector, 4-pin (ctrlX CORE X3 PLUS)
- Endcover

3 Using safety instructions

3.1 Structure of the safety instructions

The safety instructions are structured as follows:

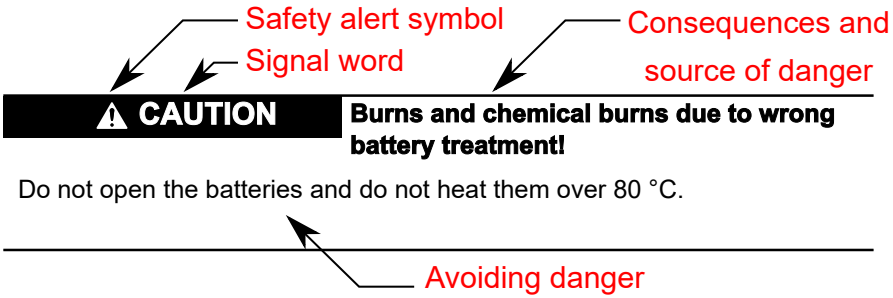


Fig. 3: Structure of the safety instructions

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 Z535.6-2006).

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 individuals.

⚠ 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
XACC-1-CSPWRM	R911416670	24 V plug for ctrlX CORE X3^{PLUS}

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 Endcover

Ordering code	Part number	Description
XACC-2-ENDCOVR	R911412178	

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 60068-2-6①	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 ➥ Chapter 10.2 “Installation notes” on page 24.

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	COREX-M-C3
Processor	Zync Ultrascale+, 64 bit, 4 × ARM A53	Zync Ultrascale+, 64 bit, 4 × ARM A53	Zync Ultrascale+, 64 bit, 4 × ARM A53
RAM	2 GByte DRAM	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	4 GByte, also refer to ➥ Chapter 5.6 “Wear parts” on page 11
Internal non-volatile random-access memory (NVRAM)	1 Mbyte	1 Mbyte	1 Mbyte
Extensions	None	None	Multi-Ethernet and ctrlX I/O
Communication interfaces	RJ-45 • 2 × Ethernet connection (10 Mbit, 100 Mbit, 1 Gbit)	RJ-45 • 3 × Ethernet connection (10 Mbit, 100 Mbit, 1 Gbit)	RJ-45 • 3 × Ethernet connection (10 Mbit, 100 Mbit, 1 Gbit) • 2 × Ethernet connection (10 Mbit, 100 Mbit)
USB	Not enabled	1 × USB host, TYPE C (USB2.0), maximum cable length of 3 m	1 × USB host, TYPE C (USB2.0), maximum cable length of 3 m
SD card	Slot for SD card	Slot for SD card	Slot for SD card
Battery	CR1025	CR1025	CR1025
Weight	314 g	314 g	346 g
Dimensions	Refer to ➥ Chapter 10.1 “Housing dimensions” on page 23	Refer to ➥ Chapter 10.1 “Housing dimensions” on page 23	Refer to ➥ Chapter 10.1 “Housing dimensions” on page 23

7.2 Voltage supply and current consumption

Table 3: ctrlX CORE X2 and ctrlX CORE X3

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
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 24 V supply (U_L/U_L GND) to the functional earth	DC 707 V
24 V supply voltage (U_L/U_L GND) to XF10, XF50, XF51	DC 1200 V

Table 4: Setup of the voltage supply ctrlX CORE^{PLUS} X3

Nominal voltage at U_L and U_P	DC 24 V SELV/PELV
Maximum permitted voltage range of the supply voltage U_L and U_P	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	Typ. 400 mA (without I/O modules if U_L = 24 V), 3.4 A max. (with 3 A for I/O modules if U_L = 24 V)
Max. power consumption of the control from U_L at a nominal voltage of 24 V	Typ. 9.6 W (without I/O modules if U_L = 24 V), 81.6 W max. (with 3 A for I/O modules if U_L =24 V)
Current consumption U_P	Typ. 5 mA (without I/O modules), 8 A max., at U_P = 24 V
Power consumption from U_P	Typ. 0.12 W (without I/O modules), 192 W max., at U_P = 24 V
Reverse polarity protection of the supply voltage U_L and U_P	Present
Fuse protection U_L	Internal with a protective fuse of 10 A
Fuse protection U_P	No internal fuse protection. The operator has to provide protection against overload by an external fuse.
Overvoltage protection U_L and U_P	Present, fuses can trigger in case of overvoltage.
Transient protection U_L and U_P	Present, suppressor diodes Pulse load up to 1,500 W

Voltage dips at current supply interfaces	PS1 < 1 ms, evaluation criterion A
Electrical isolation 24 V supply (U_L/U_L GND) to the functional earth 24 V supply (U_P/U_P GND) to the functional earth	DC 707 V
24 V supply voltage (U_L/U_L GND and U_P/U_P GND) to XF10, XF50, XF51 und XF23, XF24 at ctrlX CORE^{PLUS} X3	DC 1200 V
U^L/U^L GND to U^P/U_P GND	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 5: Angewandte Normen – Standards used – Normes appliquées

Norm Standard Norme	Bedeutung Meaning Signification	Ausgabe Edition Édition
DIN EN 60204-1	Sicherheit von Maschinen Elektrische Ausrüstung von Maschinen – Safety of machinery Electrical equipment of machines – Sécurité des machines Equipement électrique des machines	2019
DIN EN 61131-2	Speicherprogrammierbare Steuerungen Teil 2: Betriebsmittelanforderungen und Prüfungen – Programmable controllers Part 2: Equipment requirements and tests – Automates programmables Partie 2: Spécifications et essais des équipements	2008

Norm Standard Norme	Bedeutung Meaning Signification	Ausgabe Edition Édition
DIN EN 60529	Schutzarten durch Gehäuse (IP-Code) – Degrees of protection provided by enclosures (IP Code) – Degrés de protection procurés par les enveloppes (Code IP)	2014
DIN EN 61010-2-201	Sicherheitsbestimmungen für elektrische Mess-, Steuer-, Regel- und Laborgeräte 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	2014
UL 61010-2-201	UL Standard for Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use Part 2-201: Particular Requirements for Control Equipment	2014

8.2 CE marking

8.2.1 Declaration of conformity

CE

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 6: Normen zur elektromagnetischen Verträglichkeit (EMV) – Standards for electromagnetic compatibility (EMC) – Normes sur la compatibilité électromagnétique (CEM)

Norm Standard Norme	Bedeutung Meaning Signification	Ausgabe Edition Édition
DIN EN 61000-6-2	Elektromagnetische Verträglichkeit (EMV) Teil: 6-2: Fachgrundnormen – Störfestigkeit für Industriebereiche Normes génériques – Immunité pour les environnements industriels	November 2019

Norm Standard Norme	Bedeutung Meaning Signification	Ausgabe Edition Édition
DIN EN 61000-6-4	Elektromagnetische Verträglichkeit (EMV) Teil: 6-4: Fachgrundnormen – Störaussendung für Industriebereiche Normes génériques – Norme sur l'émission pour les environnements industriels	September 2011

Loss of CE conformity due to modifications at the device.

CE marking applies only to the device upon delivery. After modifying the device, verify the CE 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 X2 and ctrlX CORE X3 are certified acc. 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 an 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-30455-030".

UK CA

9 Interfaces

9.1 Interface description

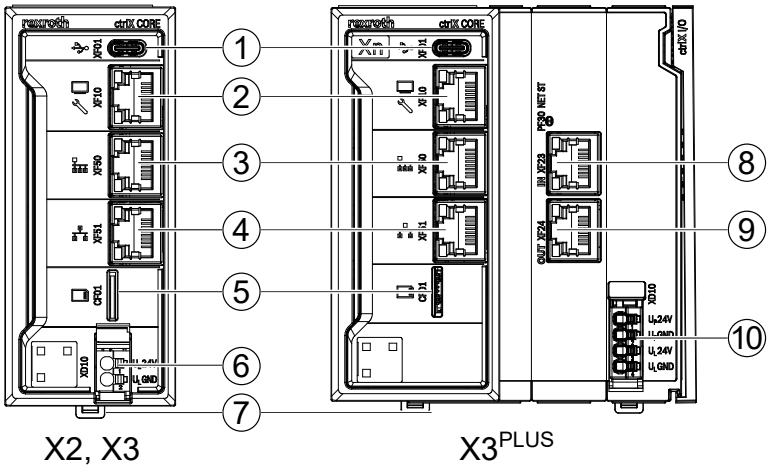


Fig. 4: Interfaces

① and ④ are not enabled for the COREX-C-X2 variant.

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 7: Control interfaces

No.	Name	Connection type	Connector type (integrated)	Mating connector and cable (From outside)	X2	X3	X3PLUS
①	XF01	USB host USB 2.0	USB socket, Type C	USB plug, Type C	–	✓	✓
②	XF10	Ethernet 10/100/1000 MBit HMI and engineering port	RJ45 socket 8-pin	RJ45 plug (twisted pair, 8-wire)	✓	✓	✓
③	XF50	Ethernet 10/100/1000 MBit Field bus master (Ethercat)	RJ45 socket 8-pin	RJ45 plug (twisted pair, 8-wire)	✓	✓	✓

No.	Name	Connection type	Connector type (integrated)	Mating connector and cable (From outside)	X2	X3	X3PLUS
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	2-pin	2-pin	✓	✓	✓
⑦	GB01	Battery case	–	–	✓	✓	✓
⑧	XF23	Ethernet 10/100 MBit Ethernet (configurable)	RJ45 socket 8-pin	RJ45 plug (twisted pair, 4-wire)	–	–	✓
⑨	XF24	Ethernet 10/100 MBit Ethernet (configurable)	RJ45 socket 8-pin	RJ45 plug (twisted pair, 4-wire)	–	–	✓
⑩	XD10	24 V plug U_L, U_P	4-pin	4-pin	–	–	✓

9.1.1 Local bus interface Ethercat of ctrlX CORE^{PLUS} X3

The local bus connected to the ctrlX CORE^{PLUS} at the right is a 100 MBit/s LVDS Ethercat bus and the cycle time between 2 ms and 10 ms. The ctrlX CORE^{PLUS} can be extended with up to 20 ctrlX I/O modules. The number of connectable modules depends on the total current consumption of the ctrlX IO modules. The ctrlX CORE^{PLUS} can provide up to 3 A for the current supply of the modules. The ctrlX CORE^{PLUS} supplies the connected I/O modules with the logic voltage U_L and the periphery voltage U_P. The voltages and currents fed in are measured internally and applied to the process data. For U_L, only the current consumption of the infeed terminal and the I/O modules. For the integration into the parent system, the respective ESI files are available. For the ESI files, go to ➦ http://www.boschrexroth.com/electrics.

Synchronizing the application

The application is synchronized in the "SM synchronous" mode.

Object directory

The object directory of the bus coupler contains objects that can be triggered via SDO services. These are defined in the ETG standards:

Table 8: CoE standard objects

Index (hex)	Name
1000	Device type
1001	Error register
1008	Device name
1009	Hardware version
100A	Software version
1018	Identify
10F1	Error settings
10F3	Diagnosis history
10F8	Timestamp object
1Ann	PDO Mapping TxPDO
1C00	Sync manager type
1C12	Sync manager 2 assignment
1C13	Sync manager 3 assignment
1C33	SM input parameter
F000	Modular device profile

Table 9: Module-specific CoE objects

Index (hex)	Object name	Data type	Error, warning	Diagnostic number	Unit
6000	**UP Supply periphery**				
6000:01	U_P Voltage	Uint16		-	mV
6000:02	U_P Current	Uint16		-	mA
6010	**UP Supply logic**				
6010:01	U_L Voltage	Uint16		-	mV
6010:02	U_L Current	Uint16		-	mA
6020	**State**				
6020:01	U_P Undervoltage	Bit	W	0x3420	
6020:02	U_P Overvoltage	Bit	W	0x3410	
6020:03	U_P Overcurrent	Bit	E	0x2316	
6020:04	U_L Undervoltage	Bit	W	0x3421	
6020:05	U_L Overvoltage	Bit	W	0x3411	
6020:06	U_L Overcurrent	Bit	E	0x2315	
8000	**System info**				
8000:01	Temperature	Int16	W	0x4210 0x4220	1/100 °C
8000:02	Power logic used	Uint16		-	W
8000:03	Power logic available	Uint16			W
A000:0	**Material number**	String(20)		-	
A010:0	**Full serial number**	String(20)		-	

Process data of the bus coupler

The bus coupler has data that is inserted into the cyclic process image. This data length is 5 words in total. According to the Ethercat standard, this data before the input process data is shown in the process image.

The process data words 0...3 contain the voltage and current values of U_P and U_L (only the current consumption of the infeed terminal and the I/O modules) as well as their bits for the supply voltage diagnostics of the bus coupler. This information can also be retrieved via acyclic services using CoE. These are shown as the indices 6000, 6010 and 6020 hex.

Word 0	U_P Voltage
Word 1	U_P Current
Word 2	U_L Voltage
Word 3	U_L Current (Only the current consumption of the infeed terminal (typ. 50 mA) and the I/O modules (3 A max.) is measured. In addition to the transferred measured value (typ. 350 mA), the ctrlX CORE and the multi-Ethernet unit consume more than shown here.
Word 4	
0	U_P Undervoltage
1	U_P Overvoltage
2	U_P Overcurrent
3	U_L Undervoltage
4	U_L Overvoltage
5	U_L Overcurrent
6-15	Reserved

Diagnostic strategy

Mechanisms

Different mechanisms are used for the diagnostics of the bus coupler.

Mechanism	Diagnostics
Ethercat state machine	Ethercat system diagnostics
Ethercat hardware watchdog	
Diagnostic objects in the CoE object directory	Extended diagnostics, e.g. periphery errors
10F1	Error settings
Diagnosis history object	20 diagnostic messages can be stored
10F3	Diagnosis history

For the status codes of the "Ethercat state machine" and the diagnostic codes across all modules, refer to .

Diagnosis history 10F3hex

The object 10F3hex is implemented as ring memory in the "Overwrite mode". The latest 20 diagnostic messages are stored. Older messages are deleted.

The following table shows the structure of a diagnostic message of the bus coupler for Ethercat.

Index (hex)	Subindex	Object name	Data type	Length	Rights	Meaning
10F3		Diagnosis history				Diagnostic statistics
	01	Maximum messages	UINT8	1	R	Maximum number of messages
	02	Newest message	UINT8	1	R	Latest message
	03	Newest acknowledged message	UINT8	1	R/W	Latest confirmed message. Writing "0" deletes the messages in the ring memory.
	04	New messages available	Boolean	0.1	R	New message available
	05	Flags	UINT8	2	R/W	Setting of the object response. Refer to ETG.1020

In case of overvoltage or undervoltage of U_L, all modules connected to the segment circuit are switched off.

10 Mounting, dismounting and electric installation

10.1 Housing dimensions

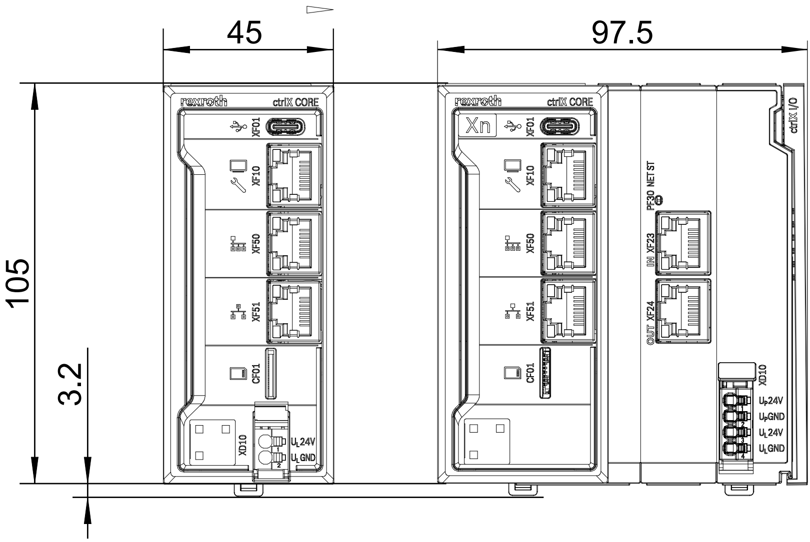


Fig. 5: Front view

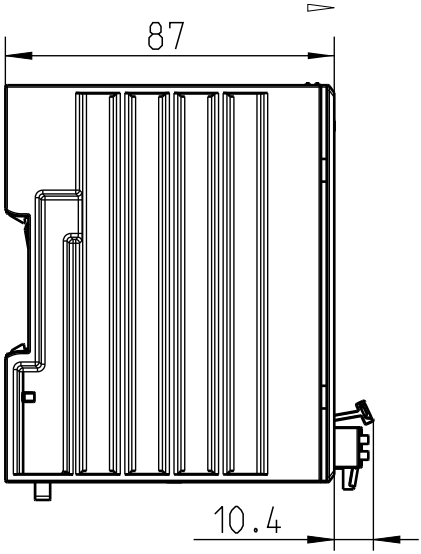


Fig. 6: Side view

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 (acc. to UL 61010-1, 61010-2-201) 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.

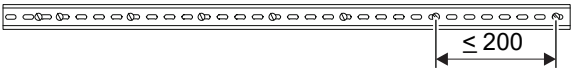


Fig. 7: Support rail fastening (in mm)

- 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.

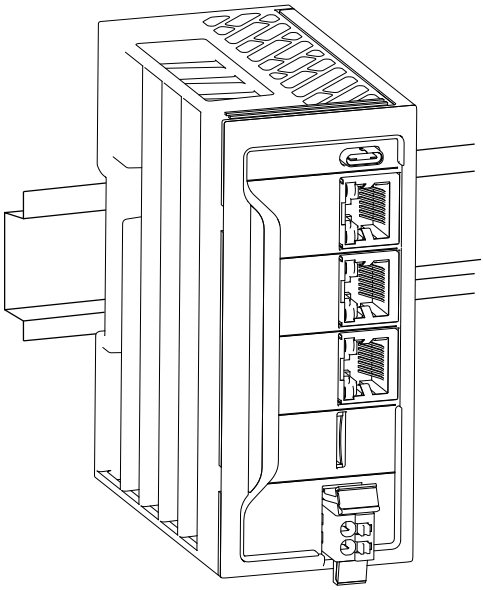


Fig. 8: Permitted mounting position for all ctrlX CORE controls

- End clamps

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

  End clamps ensure the 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 leave 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 has to be observed. For information on ambient temperatures, refer to ➦ Chapter 6.1 “Ambient conditions of the ctrlX CORE” on page 12.

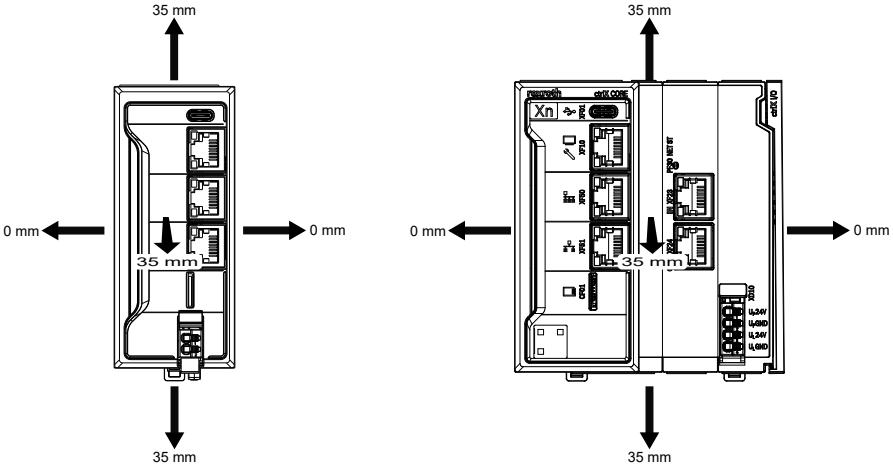


Fig. 9: Minimum distances for the circulation of ambient air

- 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.

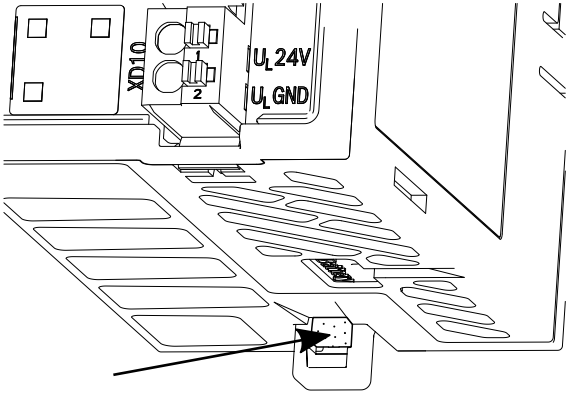


Fig. 10: Locking lever to release the clamping of the open position

Mounting steps

1. Mounting the control
2. Connecting ctrlX I/O modules in series (optional)
3. Fastening endcover
4. 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	**Material damage due to contamination**
	There is an endcover on the right of the bus coupler upon delivery. Remove this endcover to connect the modules in series at the bus coupler. Position the endcover on the last module to protect it against contamination.

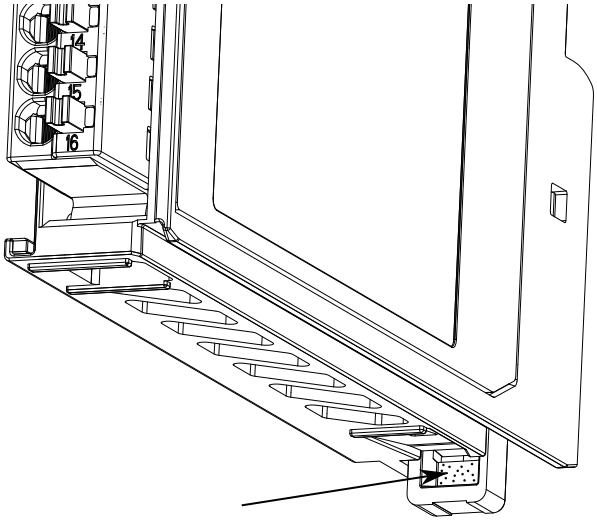


Fig. 11: Locking lever to release the clamping of the open position

Each module has to be snapped separately.

10.4 Dismounting the control

For dismounting, use a common tool such 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 the IT security, refer to ➦ Chapter 11.3.1 “Notes on safe decommissioning” on page 35.

Removing the control from the top-hat rail

1. Remove the left or the right end clamp.
2. Remove the first ctrlX IO terminal from the ctrlX CORE^{PLUS} if required.
3. 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.
4. Remove the control vertically to the support rail [see (B)] in the following figure).

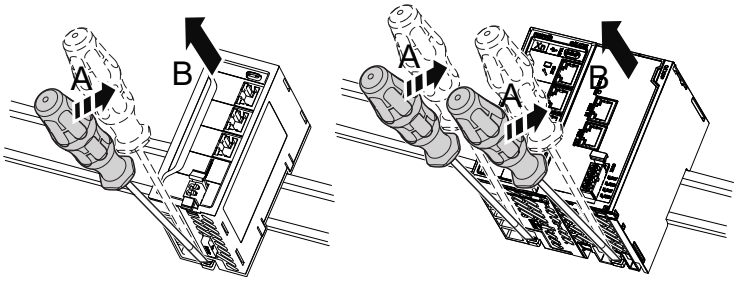


Fig. 12: Removing the control from the support rail

Before mounting the control on the support rail again, release the clamping of the open position again. Press the locking lever, see Fig. 10.

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.

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

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.

Use only copper wires to connect the connection terminals.

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).

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

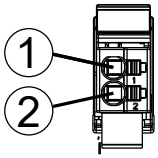


Fig. 13: Power connector XD10 of ctrlX CORE X2 and ctrlX CORE X3

Table 10: Pin assignment of the power connector XD10 of ctrlX CORE X2 and ctrlX CORE X3

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

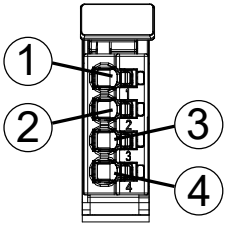


Fig. 14: Power connector XD10 of the ctrlX CORE^{PLUS}

Table 11: Pin assignment of the power connector XD10 of the ctrlX CORE^{PLUS}

Plug contact	Signal	Function	Color
1	24 V	DC +24 V supply voltage (U_P)	Red
2	0 V	GND (U_P) (supply voltage grounding)	Blue
3	24 V	DC +24 V supply voltage (U_L)	Red
4	0 V	GND (U_L) (supply voltage grounding)	Blue

Mounting notes:

- For the power connector, 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) for ctrlX CORE X2 and ctrlX CORE X3.
- The cable cross-section allowed is 1.5 mm^2 (AWG to 16) for the ctrlX $CORE^{PLUS}$.
- 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 29.

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

Setup without electrical isolation

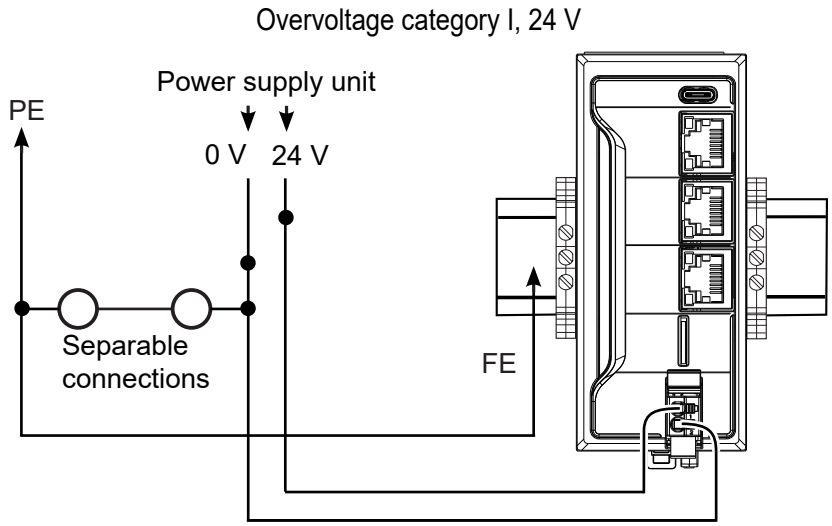


Fig. 15: Setup of the voltage supply ctrlX CORE X2 and ctrlX CORE X3

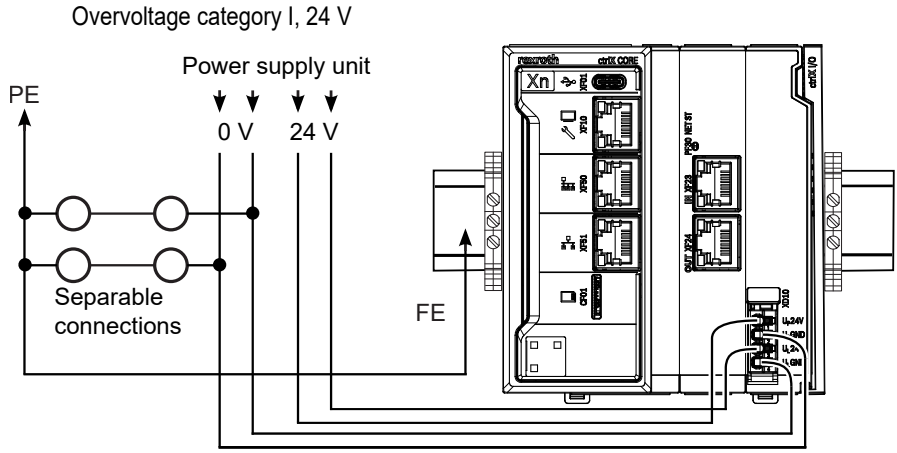


Fig. 16: Setup of the voltage supply ctrlX CORE^{PLUS} X3

Control does not start in case of reverse input voltage

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

Setup with electrical isolation

Provide electrical isolation between the logic supply U_L and the periphery supply U_P of the I/O terminals acc. to DIN EN 60204-1. Accordingly, the voltage U_L (24 V logic voltage) at the control is electrically isolated from the periphery voltages U_P (24 V segment voltage).

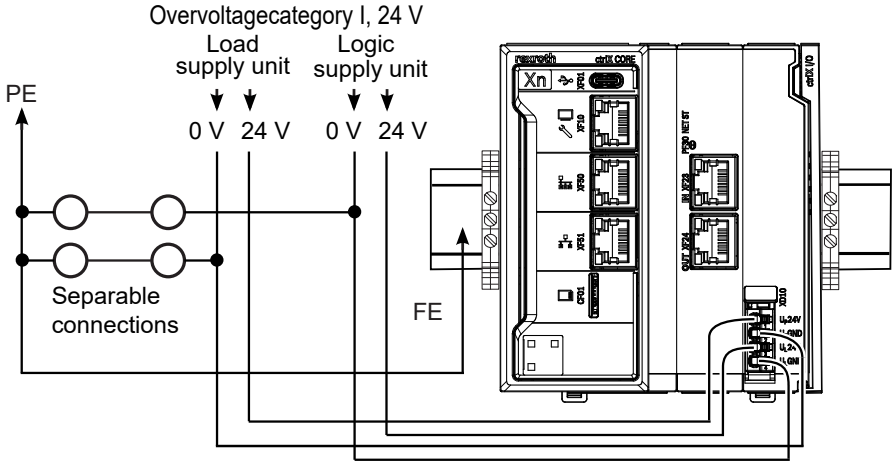


Fig. 17: Setup of the voltage supply ctrlX CORE^{PLUS} X3

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, U_P) 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 IT security

Operating systems and machines requires the implementation of a comprehensive concept for state-of-the-art IT security. Bosch Rexroth products are part of this comprehensive concept. The properties of the Bosch Rexroth products have to be considered for a comprehensive IT Security concept. For the required properties, refer to the IT Security Guideline (⮫ R911342562).

11.2 Commissioning steps

11.2.1 General information

To commission the device, proceed as follows:

1. Mount the control.
   For details, refer to ➦ Chapter 10.2 “Installation notes” on page 24.
2. Connect the voltage supply to the XD10 connection of the control.
   Refer to ➦ Chapter 10.5.2 “Power connector XD10 ” on page 30.

11.3 Safe decommissioning

11.3.1 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.

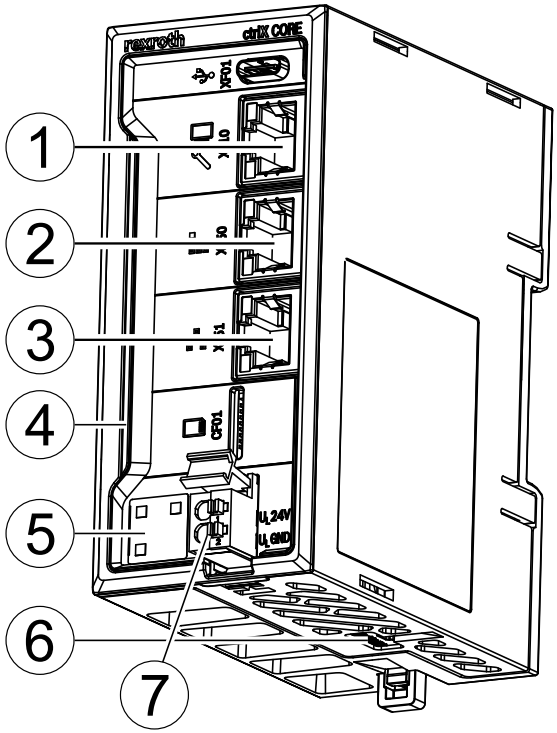


Fig. 18: Device view of the ctrlX CORE X2 and ctrlX CORE X3

① HMI and engineering port
② Field bus master (Ethercat)
③ 1 GBit/s Ethernet (configurable), not enabled for COREX-C-X2
④ ctrlX CORE status LED
⑤ QR code (references to the Bosch Rexroth product catalog)
⑥ Battery case
⑦ Voltage supply

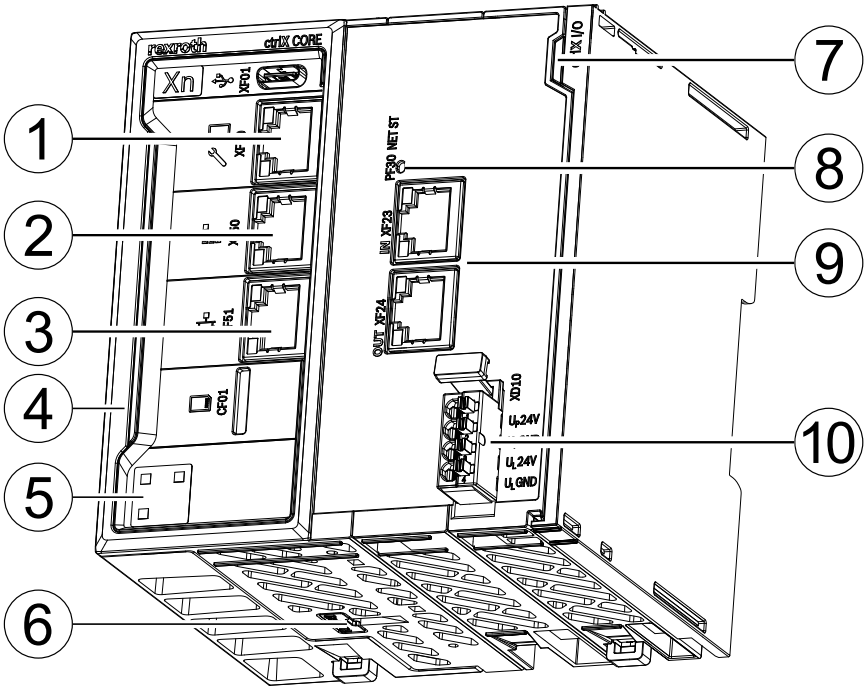


Fig. 19: Device view of the CORE[PLUS]

① HMI and engineering port
② Field bus master (Ethercat)
③ 1 GBit/s Ethernet (configurable)
④ ctrlX CORE status LED
⑤ QR code (references to the Bosch Rexroth product catalog)
⑥ Battery case
⑦ Device status LED
⑧ PF30 NET ST LED
⑨ Field bus slaves
⑩ Voltage supply

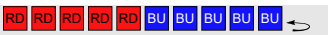
12.2 Status displays

A status display on the front panel of the controls ctrlX CORE X2 and ctrlX CORE X3 is used for error diagnostics. There are three status displays on the ctrlX CORE[PLUS]: The ctrlX CORE status LED, PF30-NET-ST-LED and device status LED

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

Table 12: 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 -- -- -- -- --

State	Color	
Errors (F0 – F7①) in the ctrlX CORE Runtime	Flashing red	
App execution faulty	Flashing red	
Service mode active	Flashing blue	
Identification	Flashing white	
The ctrlX CORE Rescue system is active	Flashing red and blue	
Booting active or shut down	Flashing blue	
System error (F8 and F9①) in the ctrlX CORE Runtime	Red	

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 when the previous flashing cycle elapsed. A change in status can thus be delayed up to two seconds.

12.2.1 Status display at the power connector XD10 ctrlX CORE X2 and ctrlX CORE X3

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

12.2.2 Status display at the power connector XD10 ctrlX CORE^{PLUS}

The voltages U_L and U_P applied at the connecting points are signaled via an own green LED next to the respective red pusher.

Off = Voltage not present

On = Voltage present

12.2.3 Status display PF30-NET-ST-LED

The status display PF30-NET-ST-LED is a field bus slave diagnostic LED. For a detailed description, refer to the documentation. See ➦ R911386579.

12.2.4 Status display of device status LED

For the status displays of the device status LED of the infeed terminal, refer to the bus coupler documentation, see ➦ R911416731.

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 42.

It is recommended to set the time via SNTP.

12.7 SD card

There is a slot 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 (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 Battery

A battery 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 42.

A discharged battery causes an incorrect system time.

12.10 License information

12.10.1 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 ➦ email>open.source@boschrexroth.de. When sending such a request, please name the relevant product and its date of purchase.

Bosch Rexroth AG

Open Source Office

Zum Eisengießer 1

97816 Lohr a.Main

Germany

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 13: 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. • 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.

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 once a year
- Ensure that cables are not broken or crushed
- Replace damaged parts immediately

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. 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

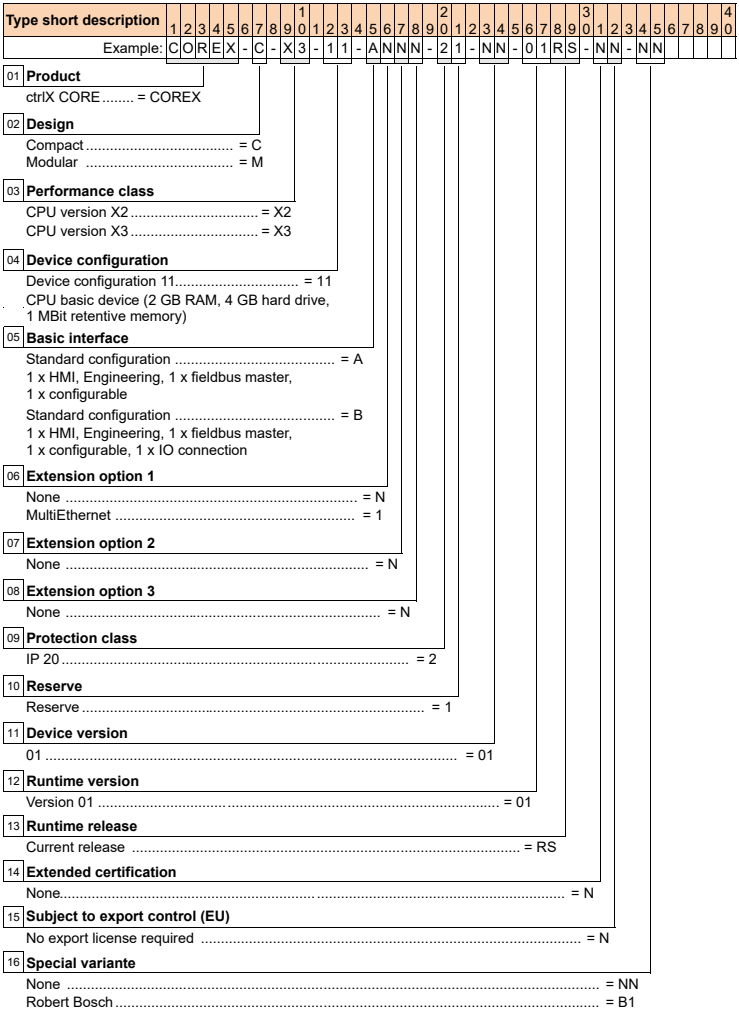


Fig. 20: Type code

15.3 Accessories and spare parts

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

16 Disposal

16.1 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
Electric Drives and Controls
Bürgermeister-Dr.-Nebel-Straße 2
97816 Lohr am Main, Germany

16.2 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)

Index

rexroth
A Bosch Company

Bosch Rexroth AG
Bgm.-Dr.-Nebel-Str. 2
97816 Lohr a.Main
Germany
Tel. +49 9352 18 0
Fax +49 9352 18 8400
www.boschrexroth.com/electrics

R911405645