BECKHOFF New Automation Technology

Manual | EN

CX20x3

Embedded PC

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1   Notes on the documentation

This description is intended exclusively for trained specialists in control and automation technology who are familiar with the applicable national standards.
For installation and commissioning of the components, it is absolutely necessary to comply with the documentation and the following notes and explanations.
The qualified personnel is always obliged to use the currently valid documentation.

The responsible staff must ensure that the application or use of the products described satisfies all safety requirements, including all the relevant laws, regulations, guidelines, and standards.

Disclaimer

The documentation has been prepared with care. The products described are, however, constantly under development.
We reserve the right to revise and change the documentation at any time and without notice.
No claims to modify products that have already been supplied may be made on the basis of the data, diagrams, and descriptions in this documentation.

Trademarks

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Patents

The EtherCAT Technology is covered by the following patent applications and patents, without this constituting an exhaustive list:
EP1590927, EP1789857, EP1456722, EP2137893, DE102015105702
and similar applications and registrations in several other countries.

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1.1   Representation and structure of warnings

The following warnings are used in the documentation. Read and follow the warnings.

Warnings relating to personal injury:

⚠ **DANGER**
Hazard with high risk of death or serious injury.

⚠ **WARNING**
Hazard with medium risk of death or serious injury.

⚠ **CAUTION**
There is a low-risk hazard that can result in minor injury.

Warnings relating to damage to property or the environment:

NOTICE
There is a potential hazard to the environment and equipment.

Notes showing further information or tips:

i This notice provides important information that will be of assistance in dealing with the product or software. There is no immediate danger to product, people or environment.

1.2 Documentation issue status

Version	Modifications
1.0	First version
1.1	Chapter "Power supply" and "Technical data" reworked
1.2	Chapter "Replacing the fan cartridge" and "Selecting the appropriate CX2100 power supply unit" adapted

2   For your safety

Read the chapter on safety and follow the instructions in order to protect from personal injury and damage to equipment.

Limitation of liability

All the components are supplied in particular hardware and software configurations appropriate for the application. Unauthorized modifications and changes to the hardware or software configuration, which go beyond the documented options, are prohibited and nullify the liability of Beckhoff Automation GmbH & Co. KG.
In addition, the following actions are excluded from the liability of Beckhoff Automation GmbH & Co. KG:

- Failure to comply with this documentation.
- Improper use.
- Use of untrained personnel.
- Use of unauthorized replacement parts.

2.1   Intended use

The embedded PC is a modular control system for use in machine and system engineering for automation, visualization and communication. The system is scalable so that the basic PC modules, power supply units, system modules and extension modules can be plugged together as required.

The embedded PC is designed for installation in a control cabinet or terminal box and is used together with Bus or EtherCAT Terminals to receive digital and analog signals from sensors and output them to actuators or forward them to higher-level controllers.

The Embedded PC is designed for a working environment that meets the requirements of protection class IP20. This involves finger protection and protection against solid foreign objects up to 12.5 mm, but not protection against water. Operation of the devices in wet and dusty environments is not permitted, unless specified otherwise. The specified limits for electrical and technical data must be adhered to.

Improper use

The Embedded PC is not suitable for operation in the following areas:

- Potentially explosive atmospheres.
- Areas with an aggressive environment, e.g. aggressive gases or chemicals.
- Living areas. If the devices are to be used in living areas, the relevant standards and guidelines for interference emissions must be adhered to, and the devices must be installed in housings or control boxes with suitable shielding.

2.2   Staff qualification

All operations involving Beckhoff software and hardware may only be carried out by qualified personnel with knowledge of control and automation engineering. The qualified personnel must have knowledge of the administration of the Industrial PC and the associated network.

All interventions must be carried out with knowledge of control programming, and the qualified personnel must be familiar with the current standards and guidelines for the automation environment.

2.3   Safety instructions

The following safety instructions must be followed during installation and working with networks and the software.

Mounting

- Never work on live equipment. Always switch off the power supply for the device before installation, troubleshooting or maintenance. Protect the device against unintentional switching on.
- Observe the relevant accident prevention regulations for your machine (e.g. the BGV A 3, electrical systems and equipment).
- Ensure standard-compliant connection and avoid risks to personnel. Ensure that data and supply cables are laid in a standard-compliant manner and ensure correct connection.
- Observe the relevant EMC guidelines for your application.
- Avoid polarity reversal of the data and supply cables, as this may cause damage to the equipment.
- The devices contain electronic components, which may be destroyed by electrostatic discharge when touched. Observe the safety precautions against electrostatic discharge according to DIN EN 61340-5-1/-3.

Working with networks

- Restrict access to all devices to an authorized circle of persons.
- Change the default passwords to reduce the risk of unauthorized access.
- Protect the devices with a firewall.
- Apply the IT security precautions according to IEC 62443, in order to limit access to and control of devices and networks.

Working with the software

- The sensitivity of a PC against malicious software increases with the number of installed and active software.
- Uninstall or disable unnecessary software.

Further information on the safe handling of networks and software can be found in the Beckhoff Information System:
http://infosys.beckhoff.com

Document name
IPC Security Guideline

2.4   Notes on information security

The products of Beckhoff Automation GmbH & Co. KG (Beckhoff), insofar as they can be accessed online, are equipped with security functions that support the secure operation of plants, systems, machines and networks. Despite the security functions, the creation, implementation and constant updating of a holistic security concept for the operation are necessary to protect the respective plant, system, machine and networks against cyber threats. The products sold by Beckhoff are only part of the overall security concept. The customer is responsible for preventing unauthorized access by third parties to its equipment, systems, machines and networks. The latter should be connected to the corporate network or the Internet only if appropriate protective measures have been set up.

In addition, the recommendations from Beckhoff regarding appropriate protective measures should be observed. Further information regarding information security and industrial security can be found in our https://www.beckhoff.com/secguide.

Beckhoff products and solutions undergo continuous further development. This also applies to security functions. In light of this continuous further development, Beckhoff expressly recommends that the products are kept up to date at all times and that updates are installed for the products once they have been made available. Using outdated or unsupported product versions can increase the risk of cyber threats.

To stay informed about information security for Beckhoff products, subscribe to the RSS feed at https://www.beckhoff.com/secinfo.

3   Transport and storage

Transport

NOTICE
Short circuit due to moisture
Moisture can form during transport in cold weather or in the event of large temperature fluctuations.
Avoid moisture formation (condensation) in the embedded PC, and leave it to adjust to room temperature slowly. If condensation has occurred, wait at least 12 hours before switching on the embedded PC.

Despite the robust design of the unit, the components are sensitive to strong vibrations and impacts. During transport the embedded PC must be protected from

- high mechanical stress and
- use the original packaging for shipping.

Table 1: Dimensions and weight of the individual modules.

	CX2033	CX2043
Dimensions (W x H x D)	144 mm x 99 mm x 91 mm	
Weight	approx. 1165 g	approx. 1230 g

Storage

- Remove the battery from the Embedded PC if storage temperatures exceed 60 °C. The battery should be stored separate from the Embedded PC in a dry environment at a temperature between 0 °C and 30 °C.
  The preset date and time are lost if the battery is removed.

4   Product overview

The CX2000 product family consists of individual modules, which can be assembled to form a customized embedded PC.

The CX2000 product family consists of:

- basic CPU modules,
- CX2100 power supply units,
- system, fieldbus and extension modules.

Basic CPU module

The basic CPU module is a fully functional PC and can be used in conjunction with a CX2100 power supply unit as the smallest possible configuration. The basic configuration of the CX20x3 Embedded PC includes:

- a CFast card slot,
- two independent Gbit Ethernet interfaces,
- four USB 3.0 interfaces,
- and a DVI-D interface.

The basic CPU module features internal persistent data memory in the form of 128 kB NOVRAM. In the event of a power failure, important data are stored in the NOVRAM and are available again after a restart. Microsoft Windows 10 IoT Enterprise LTSC or TwinCAT/BSD can be used as the operating system.

Extension modules

The basic CPU module can be extended with additional interfaces or storage media, as required. Up to four modules of the type CX2500-xxxx can be connected on the left side of the basic CPU module. The connection order is irrelevant.

Modules of the type CX2550 (e.g. CFast or SSD modules) and a power supply unit of the type CX2100-xxxx can be connected on the right. In the CX20x3 Embedded PC either the internal CFast card slot can be used and a maximum of one memory module (CFast or SSD module) can be plugged in or a maximum of two memory modules can be plugged in on the right-hand side, in which case the internal CFast card slot is disabled and can no longer be used. In addition, a maximum of two USB extenders (CX2550-0179 or CX2550-0279) can be plugged in on the right-hand side between the power supply unit and the memory modules.

Table 2: Available extension modules for the CX20x3.

Module	Description
CX2500-0030	RS232 serial interface, 2 x D-sub connector, 9-pin
CX2500-0031	RS422/RS485 serial interface, 2 x D-sub socket, 9-pin
CX2500-0060	Ethernet module, 2 x Ethernet, 10/100/1000 Mbit/s
CX2500-0061	Power-over-Ethernet module (PoE), 1 x RJ45, 10/100/1000 Mbit/s
CX2500-0070	USB 3.0 module, 4 x USB 3.0, type A
CX2500-M310	PROFIBUS fieldbus master module, 1 x D-sub socket, 9-pin
CX2500-B310	PROFIBUS fieldbus slave module, 1 x D-sub socket, 9-pin
CX2500-M510	CANopen fieldbus master module, 1 x D-sub connector, 9-pin
CX2500-B510	CANopen fieldbus slave module, 1 x D-sub connector, 9-pin
CX2550-0010	Module for CFast slot
CX2550-0020	Module for 2½-inch HDD/SSD
CX2550-0179	1 x USB Extended 1.1
CX2550-0279	1 x USB Extended 2.0

Optional interface

The basic CPU module can be ordered ex factory with an optional interface. The optional interface cannot be retrofitted.

Table 3: Available optional interfaces for the CX20x3.

CX20x3-xxxx	Optional interfaces
CX20x3-N010	DVI-D, additional DVI-D socket for clone and extended display mode.
CX20x3-N011	DisplayPort, additional DisplayPort for clone and extended display mode
CX20x3-N030	RS232, D-sub connector, 9-pin.
CX20x3-N031	RS422/RS485, D-sub socket, 9-pin.
CX20x3-M112	2 x EtherCAT master, RJ45.
CX20x3-B110	EtherCAT slave, EtherCAT IN and OUT (2 x RJ45).
CX20x3-M310	PROFIBUS master, D-sub socket, 9-pin.
CX20x3-B310	PROFIBUS slave, D-sub socket, 9-pin.
CX20x3-M510	CANopen master, D-sub connector, 9-pin.
CX20x3-B510	CANopen slave, D-sub connector, 9-pin.
CX20x3-M930	PROFINET RT, controller, Ethernet (2 x RJ-45).
CX20x3-B930	PROFINET RT, device, Ethernet (2 x RJ-45 switch).

CX2100 power supply units

The CX2100 power supply units serve the basic CPU module and all additional modules. Bus terminals (K-bus) or EtherCAT Terminals (E-bus) can be attached on the right-hand side of the power supply units. The power supply units are available in two different versions:

- CX2100-0014: E-bus/K-bus power supply unit with automatic switchover and passive ventilation.
- CX2100-0914: E-bus/K-bus power supply unit with automatic switchover and integrated electronic charging unit for an external battery pack.
- CX2100-0024: E-bus/K-bus power supply unit with automatic switchover and active cooling. The power supply unit is electrically isolated and UPS-OCT-capable.

All power supply units feature an illuminated anti-glare LC display with two rows of 16 characters each for displaying status messages. Application-specific texts can be displayed with the aid of user programs.

Software

In combination with the TwinCAT automation software, the CX20x3 Embedded PC becomes a powerful IEC 61131-3 PLC with up to four user tasks. In conjunction with EtherCAT and TwinCAT, it is possible to implement very fast control processes in the microsecond range (XFC eXtreme Fast Control Technology). It is also possible to execute Motion Control tasks with potentially up to 256 axes. Depending on the required sampling time, several servo axes can be controlled. Even special functions such as Flying Saw, Electronic Gearing and Cam Plate can be realized.

In addition to handling real-time control tasks the TwinCAT real-time kernel leaves enough time for the user interface (HMI). The high performance of the graphics core integrated in the CPU enables demanding visualizations with advanced user interfaces to be realized.
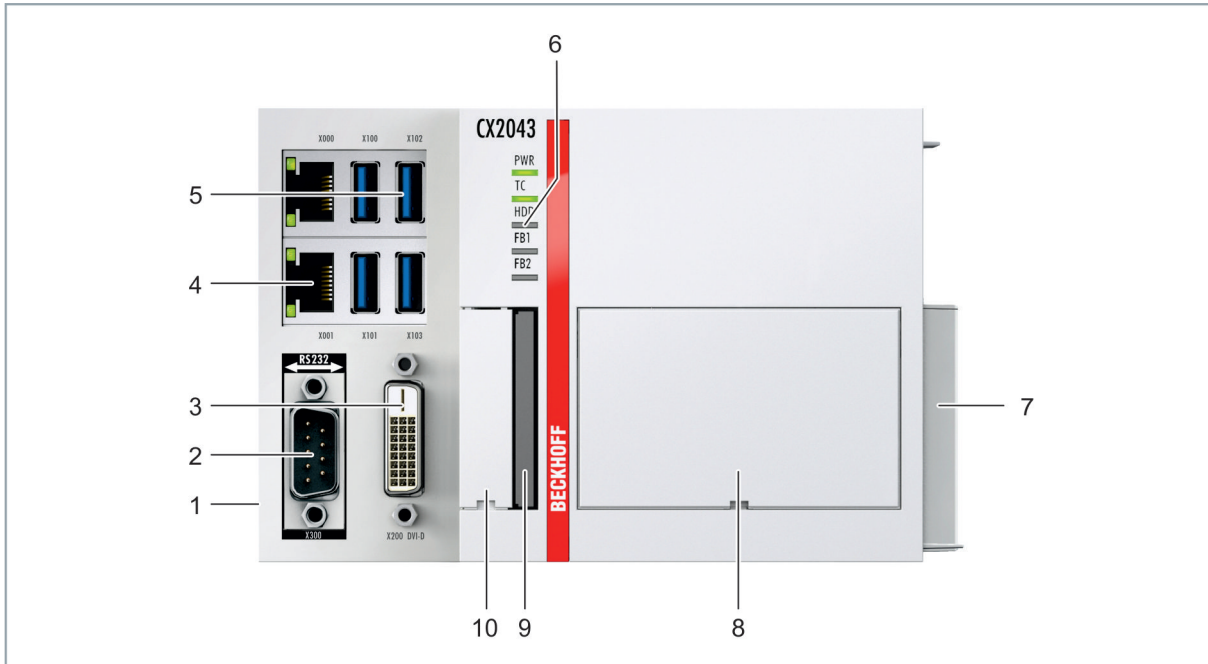
4.1 Structure

Fig. 1: Example: Embedded PCs CX2043 with active cooling.

Table 4: Legend for the configuration of the basic CPU module

| No.	Component	Description
1	Multi-pin connection (left)	Extension through system modules and fieldbus modules of type CX2500.
2	Optional interface (X300).	Space for interfaces such as RS232, EtherCAT, CANopen or others. The optional interface must be ordered ex factory and cannot be retrofitted retrospectively.
3	DVI-D interface (X200). [▶ 19]	Interface for a monitor or Panel.
4	RJ45 Ethernet interfaces (X000, X001).	For connecting to local networks, internet or EtherCAT.
5	USB interfaces (X100, X101, X102, X103).	Interfaces for peripheral devices such as mouse, keyboard or USB memory.
6	Diagnostic LEDs. [▶ 63]	Diagnostic LEDs for power supply, TwinCAT, CFast card and optional interface.
7	Multi-pin connection (right)	Connection for extension modules of type CX2550 and for power supply units of type CX2100.
8	Fan cartridge (under the front flap).	The fan cartridge is provided as standard for the CX2043. The CX2033 can be ordered ex factory with active cooling.
9	CFast card slot.	Slot for industrial CFast cards.
10	Battery compartment (under the front flap).	Power supply for the battery-backed clock for time and date.

4.2 Name plate
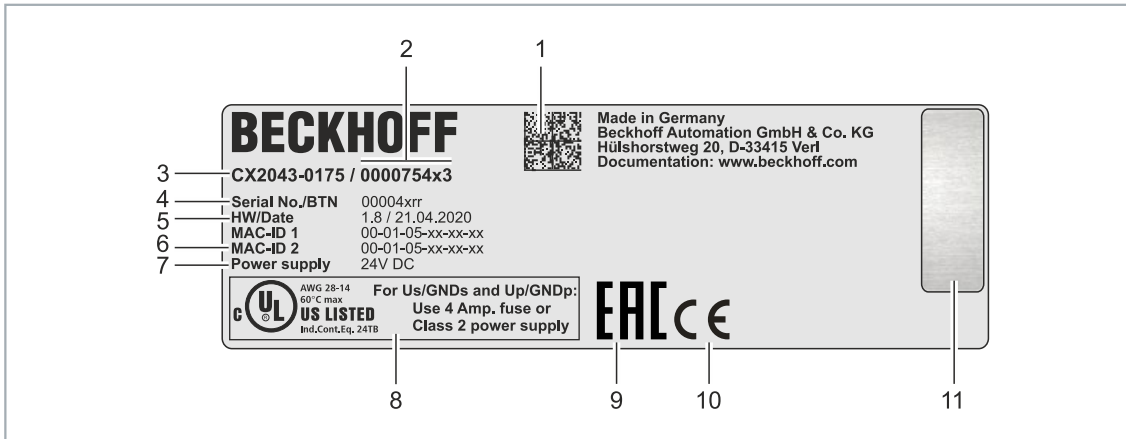
Fig. 2: Name plate example.

Table 5: Information on the name plate.

No.	Description
1	Machine-readable information in the form of a Data Matrix Code (DMC, code scheme ECC200) that you can use for better identification and management.
2	Variant number for identification of the Embedded PC configuration. With this number, the exact configuration of Embedded PC, operating system, options and TwinCAT can be reordered.
3	Product designation for identification of the Embedded PC.
4	Serial number/ Beckhoff Traceability Number (BTN) for the unambiguous identification of the product.
5	Hardware version and date of manufacture.
6	MAC addresses of the built-in Ethernet interfaces. The host name is made up of CX and the last three bytes of the MAC address. Example: the MAC address: 00-01-05-aa-bb-cc results in the host name **CX-aabbcc**.
7	Power supply 24 V DC
8	UL marking with prescribed information on power supply, fuse, temperature and cable cross-sections.
9	EAC marking
10	CE marking
11	License sticker for operating system (optional).

4.3   Types

The basic CPU module can be ordered with different hardware and software options. Use this overview in conjunction with the information on the name plate to ascertain the hardware, operating system and TwinCAT version of the basic CPU module.
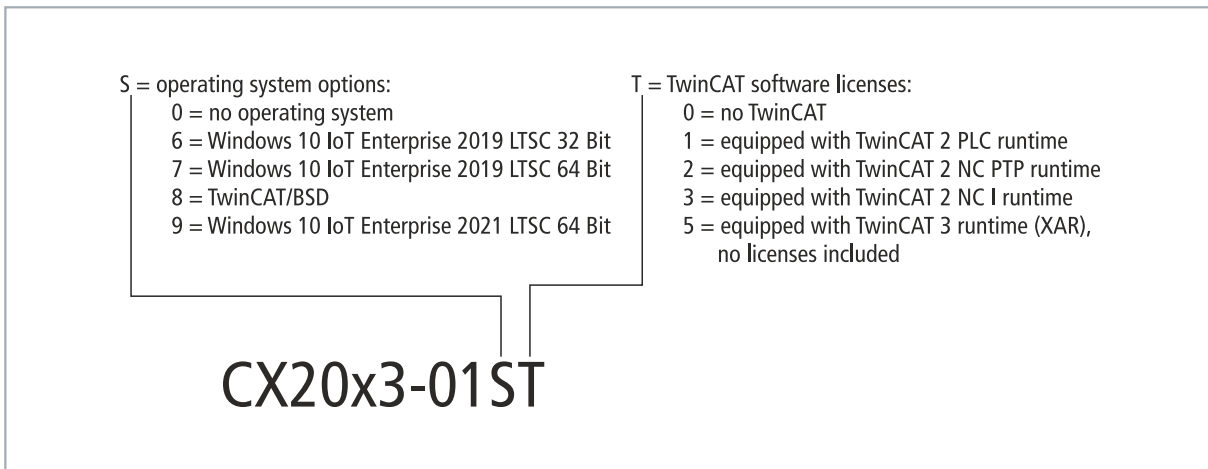
S = operating system options:
  0 = no operating system
  6 = Windows 10 IoT Enterprise 2019 LTSC 32 Bit
  7 = Windows 10 IoT Enterprise 2019 LTSC 64 Bit
  8 = TwinCAT/BSD
  9 = Windows 10 IoT Enterprise 2021 LTSC 64 Bit

T = TwinCAT software licenses:
  0 = no TwinCAT
  1 = equipped with TwinCAT 2 PLC runtime
  2 = equipped with TwinCAT 2 NC PTP runtime
  3 = equipped with TwinCAT 2 NC I runtime
  5 = equipped with TwinCAT 3 runtime (XAR),
    no licenses included

CX20x3-01ST

Fig. 3: Nomenclature for the basic CPU module.

The CX2033 and CX2043 basic CPU modules are available with the following software options:

Table 6: CX20x3, ordering information for software.

Ordering information	Description
CX20x3-0100	no operating system, no TwinCAT
CX20x3-0160	Windows 10 IoT Enterprise 2019 LTSC 32-bit, no TwinCAT
CX20x3-0161	Windows 10 IoT Enterprise 2019 LTSC 32-bit, TwinCAT 2 PLC runtime
CX20x3-0162	Windows 10 IoT Enterprise 2019 LTSC 32-bit, TwinCAT 2 NC PTP runtime
CX20x3-0163	Windows 10 IoT Enterprise 2019 LTSC 32-bit, TwinCAT 2 NC I runtime
CX20x3-0170	Windows 10 IoT Enterprise 2019 LTSC 64-bit, no TwinCAT
CX20x3-0175	Windows 10 IoT Enterprise 2019 LTSC 64-bit, TwinCAT 3 runtime (XAR)
CX20x3-0185	TwinCAT/BSD, TwinCAT 3 runtime (XAR)
CX20x3-0190	Windows 10 IoT Enterprise 2021 LTSC 64-bit, no TwinCAT
CX20x3-0195	Windows 10 IoT Enterprise 2021 LTSC 64-bit, TwinCAT 3 runtime (XAR)

A CX20x3 Embedded PC with TwinCAT/BSD requires a CFast card with a capacity of at least 20 GB. A CFast card with a capacity of at least 40 GB is required for Microsoft Windows 10 IoT Enterprise.

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4.4 Architekture overview

The Embedded PCs of the CX20x3 family all have the same architecture.
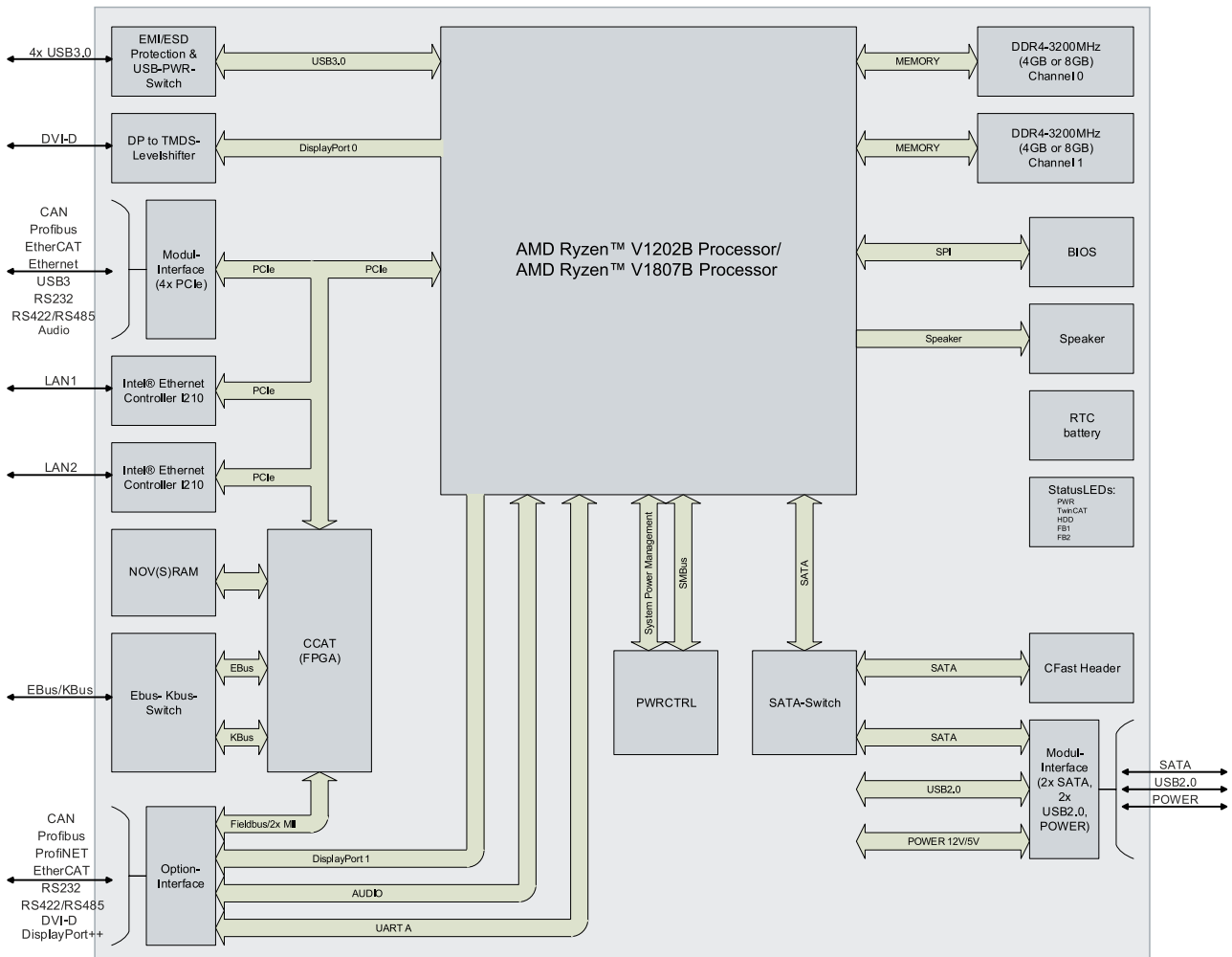
The CX20x3 Embedded PCs are based on the AMD Zen microarchitecture. The following CPUs are used:

- AMD Ryzen™ V1202B (dual core),
- AMD Ryzen™ V1807B (quad core),

In addition to the arithmetic unit, the CPU also contains the memory controller and the graphics controller. The AMD Radeon™ Vega 3 graphics are used in the dual core processor and the AMD Radeon™ Vega 11 graphics in the quad core processor. The memory is connected directly to the memory controller. The Embedded PCs are available in two memory configurations: 8 GB and 16 GB DDR4 RAM. The memory extension must be ordered ex factory.

The CPU provides all required interfaces:

- 1 PCIe lane for each of the two Intel® i210 Gigabit Ethernet controllers
- 4x USB 3.0
- DVI-D interface (second interface optional with CX20x3-N010).
- 1 PCIe to FPGA for K-/E-bus and NOVRAM.
- 4 PCIe lanes via the multi-pin connection (left).
- 2x SATA internal via the multi-pin connection (right).
- 2x USB internal via the multi-pin connection (right).

The interfaces (USB, DVI, and LAN) are standard interfaces. Devices that meet the corresponding standard can be connected to and operated at these interfaces.

5   Interface description

5.1   USB 3.0 (X100, X101, X102, X103)

The embedded PC has four independent USB interfaces for connecting keyboards, mice, touch screens and other input or data storage devices.
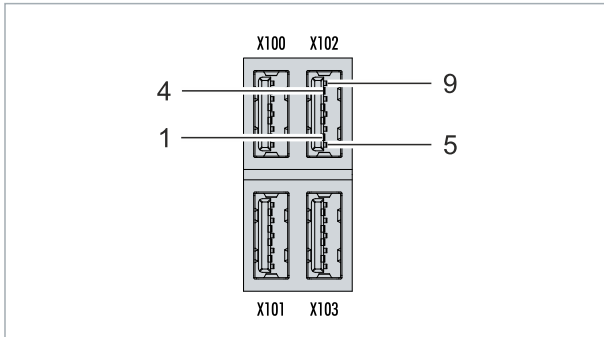
Fig. 4: USB interfaces X100, X101, X102, X103.

The USB interfaces are type A and comply with the USB 3.0 specification.

Table 7: USB interfaces (X100, X101, X102, X103), pin assignment.

Pin	Assignment	Typical assignment
1	VBUS	Red
2	D-	White
3	D+	Green
4	GND	Black
5	StdA_SSRX−	Blue
6	StdA_SSRX+	Yellow
7	GND_DRAIN	N/A
8	StdA_SSTX−	Purple
9	StdA_SSTX+	Orange
Shell	Shield	Drain Wire

Pay attention to the power consumption of the connected devices. No more than 900 mA and 4.5 W of power can be output per interface. The USB interfaces support data rates of up to 5 Gbit/s.

5.2   Ethernet RJ45 (X000, X001)

The two Ethernet interfaces are independent; no switch is integrated. The independent Ethernet interfaces can be configured in different ways. In the delivery state, the Ethernet interfaces (X000, X001) are configured for EtherCAT communication.

Note that an additional switch is required for a line topology.
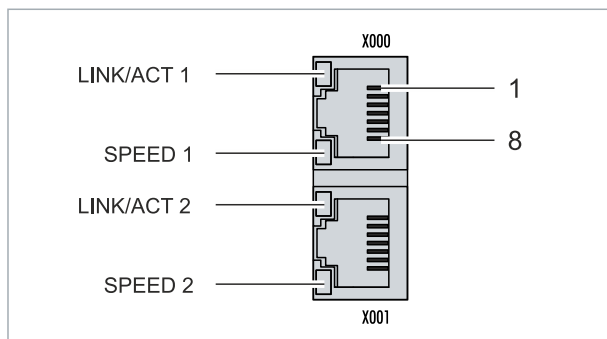
Fig. 5: Ethernet interfaces X000, X001.

Both Ethernet interfaces reach speeds of 10 / 100 / 1000 Mbit. The LEDs on the left of the interfaces indicate the connection status. The upper LED (LINK/ACT) indicates whether the interface is connected to a network. If this is the case, the LED lights up green. The LED flashes when data transfer on the interface is in progress.

The lower LED (SPEED) indicates the connection speed. At a speed of 10 Mbit, the LED does not light up. If the speed is 100 Mbit, the LED lights up green. The LED lights up red if the speed is 1000 Mbit (gigabit).

Table 8: Ethernet interface X000 and X001, pin assignment.

PIN	Signal	Description
1	T2 +	Pair 2
2	T2 -	
3	T3 +	Pair 3
4	T1 +	Pair 1
5	T1 -	
6	T3 -	Pair 3
7	T4 +	Pair 4
8	T4 -	

5.3   DVI-D (X200)

The DVI-D interface (X200) transfers digital data and is suitable for connection to digital displays. The resolution on the display or the Beckhoff Control Panel depends on the distance from the display device. The maximum distance is 5 m. Beckhoff offers various panels with an integrated DVI extension. A cable length of up to 50 meters is therefore possible.
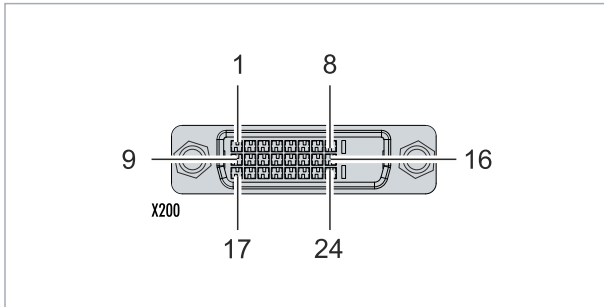

Fig. 6: DVI-D interface X200.

Table 9: DVI-D interface X200, pin assignment.

Pin	Connection	Pin	Connection	Pin	Connection
1	TMDS Data 2-	9	TMDS Data 1-	17	TMDS Data 0-
2	TMDS Data 2+	10	TMDS Data 1+	18	TMDS Data 0+
3	TMDS Data 2/4 Shield	11	TMDS Data 1/3 Shield	19	TMDS Data 0/5 Shield
4	not connected	12	not connected	20	not connected
5	not connected	13	not connected	21	not connected
6	DDC Clock	14	+ 5V Power	22	TMDS Clock Shield
7	DDC Data	15	Ground (+5V, Analog H/ V Sync)	23	TMDS Clock +
8	Analog Vertical Sync	16	Hot Plug Detect	24	TMDA Clock -

Table 10: DVI-D interface X200, resolution at the monitor.

Resolution in pixels	Distance of the interface from the monitor
1920 x 1200	5 m
1920 x 1080	5 m
1600 x 1200	5 m
1280 x 1024	5 m
1024 x 768	5 m
800 x 600	5 m
640 x 480	5 m

The embedded PC also supports higher resolutions, based on the DVI standard. A maximum resolution of 1920 x 1200 pixels can be set on the embedded PC. Whether this resolution is achieved depends on the monitor, the cable quality, and the cable length.

5.4   Optional interfaces

An optional interface is an additional interface that can be equipped with a wide range of signal types ex factory and extends the Embedded PC beyond the basic equipment. The optional interface must be ordered in advance and cannot be retrofitted to the device.

5.4.1   DVI-D (N010)

The DVI-D interface (X300) transfers digital data and is suitable for connection to digital displays. The resolution at the display or the Beckhoff Control Panel depends on the distance from the display device. The maximum distance is 5 m. Beckhoff offers various Panels with an integrated "DVI extension". These make a cable length of up to 50 meters possible.
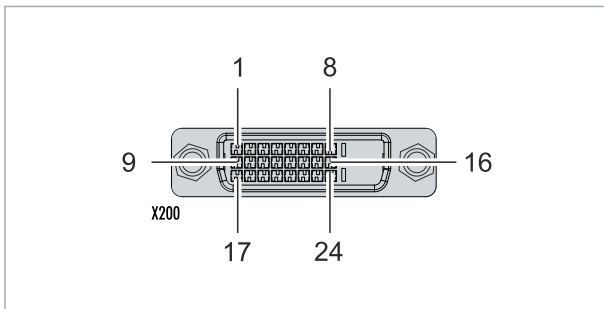

Fig. 7: DVI-D interface X300.

Table 11: DVI-D interface X300, pin assignment.

Pin	Connection	Pin	Connection	Pin	Connection
1	TMDS Data 2-	9	TMDS Data 1-	17	TMDS Data 0-
2	TMDS Data 2+	10	TMDS Data 1+	18	TMDS Data 0+
3	TMDS Data 2/4 Shield	11	TMDS Data 1/3 Shield	19	TMDS Data 0/5 Shield
4	not connected	12	not connected	20	not connected
5	not connected	13	not connected	21	not connected
6	DDC Clock	14	+ 5V Power	22	TMDS Clock Shield
7	DDC Data	15	Ground (+5V, Analog H/ V Sync)	23	TMDS Clock +
8	Analog Vertical Sync	16	Hot Plug Detect	24	TMDA Clock -

Table 12: DVI-D interface X300, resolution at the monitor.

Resolution in pixels	Distance of the interface from the monitor
1920 x 1200	5 m
1920 x 1080	5 m
1600 x 1200	5 m
1280 x 1024	5 m
1024 x 768	5 m
800 x 600	5 m
640 x 480	5 m

The Embedded PC also supports higher resolutions, based on the DVI standard. A maximum resolution of 1920 x 1200 pixels can be set on the Embedded PC. Whether this resolution is achieved depends on the monitor, the cable quality and the cable length.

5.4.2   DisplayPort (N011)

The DisplayPort transfers image and audio signal at the same time and is therefore suitable for connecting panels or monitors to the Embedded PC.
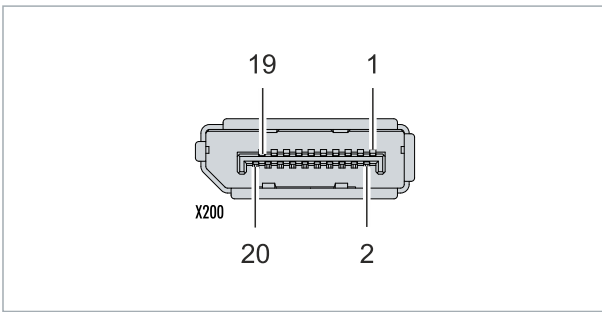
Fig. 8: DisplayPort X300.

Version 1.1a of the DisplayPort (DisplayPort++) is installed on the Embedded PC. Adapters from DisplayPort to DVI-D or DisplayPort to HDMI can be used to connect monitors without DisplayPort to the Embedded PC.

Table 13: DisplayPort, pin assignment.

Pin	Connection	Pin	Connection
1	LVDS lane 0+	2	Ground
3	LVDS lane 0-	4	LVDS lane 1+
5	Ground	6	LVDS lane 1-
7	LVDS lane 2+	8	Ground
9	LVDS lane 2-	10	LVDS lane 3+
11	Ground	12	LVDS lane 3-
13	Config 1	14	Config 2
15	AUX channel+	16	Ground
17	AUX channel-	18	Hot-plug detection
19	Power supply: Ground	20	Power supply: 3.3 V / 500 mA

Table 14: DisplayPort X300, resolution at the monitor.

Interface	Resolution in pixels
DisplayPort	max. 2560x1600@60Hz
DisplayPort with adapter, DisplayPort to DVI-D	max. 1600x1200@60Hz

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5.4.3 RS232 (N030)

The optional N030 interface provides an RS232 interface (X300). The RS232 interface is implemented on a 9-pin D-sub connector.
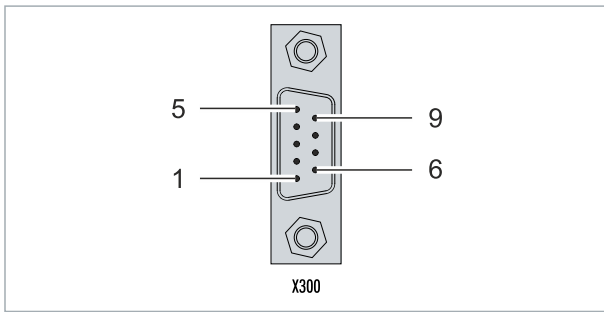
Fig. 9: RS232 interface X300.

The maximum baud rate on both channels is 115 kbit. The interface parameters are set via the operating system or from the PLC program.

Table 15: RS232 interface X300, pin assignment.

PIN	Signal	Type	Description
1	-	-	-
2	RxD	Signal in	Receive Data
3	TxD	Signal out	Transmit Data
4	-	-	-
5	GND	Ground	Ground
6	DSR	Signal in	Dataset Ready
7	RTS	Signal out	Request to Send
8	CTS	Signal in	Clear to Send
9	-	-	-

5.4.4 RS422/RS485 (N031)

The optional N031 interface provides an RS422 or RS485 interface (X300). The interface is executed on a 9-pin D-sub socket.
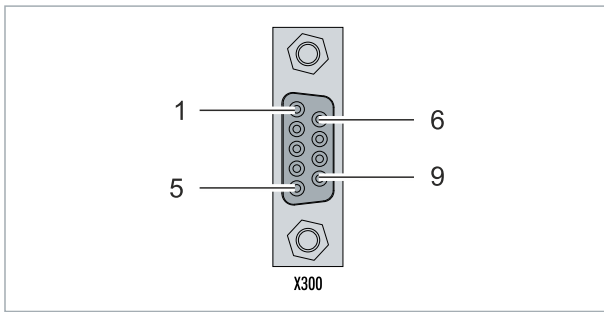
Fig. 10: RS485 interface X300.

The maximum baud rate on both channels is 115 kbit. The interface parameters are set via the operating system or from the PLC program.

Table 16: RS422/485 interface, pin assignment.

PIN	Signal	Type	Description
2	TxD+	Data-Out +	Transmit 422
3	RxD+	Data-In +	Receive 422
5	GND	Ground	Ground
6	VCC	VCC	+5 V
7	TxD-	Data-Out -	Transmit 422
8	RxD-	Data-In -	Receive 422

For RS 485 pins 2 and 3 (data +) must be connected, and pins 7 and 8 (data -).

By default the interface is parameterized as follows on delivery:

Table 17: Default setting, RS485 without echo with end point (terminated).

Function	Status
Echo on	off
Echo off	on
Auto send on	on
Always send on	off
Auto receive on	on
Always receive on	off
Term on	on
Term on	On

Other configurations for the RS485 interface

Other configurations for the RS485 interface can be ordered ex factory. The following options are available:

- N031-0001 RS485 with echo, end point (terminated).
- N031-0002 RS485 without echo, stub (without termination).
- N031-0003 RS485 with echo, stub (without termination).
- N031-0004 RS422 full duplex end point (terminated).

An RS485 interface cannot be configured retrospectively and must always be ordered ex factory as required.

5.4.5   EtherCAT master (M112)

The latest generation of embedded PCs can be ordered ex factory with an EtherCAT master interface (M112). On the devices the optional M112 interface is referred to as X300. With this option a total of three EtherCAT masters are available, whereby two EtherCAT masters are fed out from the front of the device and one EtherCAT master from the right side of the terminal segment.

The EtherCAT masters are fully DC-synchronous due to the direct FPGA connection. External synchronization is not necessary in order to synchronize the EtherCAT masters or EtherCAT rings with one another. This function is particularly interesting for smaller XTS systems that require synchronously running EtherCAT masters. The optional interface can additionally be used for EtherCAT redundancy, while the two upper Ethernet interfaces are available for other applications.
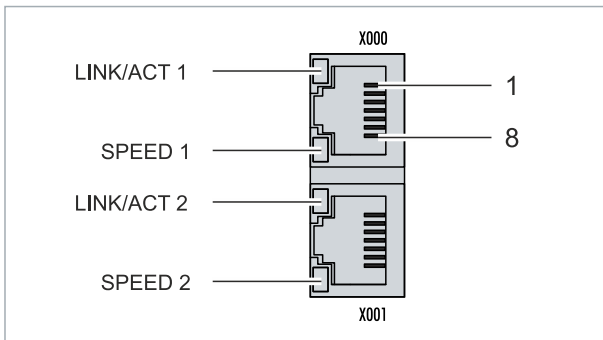
Fig. 11: EtherCAT master interface X300.

The incoming EtherCAT signal is connected to the upper LAN interface. The lower LAN interface relays the signal to other EtherCAT master devices.

Table 18: EtherCAT master interface X300, pin assignment.

PIN	Signal	Description
1	TD +	Transmit +
2	TD -	Transmit -
3	RD +	Receive +
4	connected	reserved
5		
6	RD -	Receive -
7	connected	reserved
8		

5.4.6 EtherCAT slave (B110)

The latest generation of Embedded PCs can be ordered ex factory with an EtherCAT slave interface (B110). On the devices the optional B110 interface is referred to as X300.
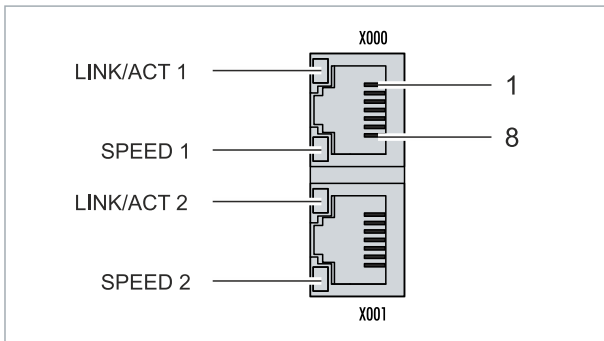
Fig. 12: EtherCAT slave interface X300.

The incoming EtherCAT signal is connected to the upper LAN interface. The lower LAN interface relays the signal to other EtherCAT slave devices.

Table 19: EtherCAT slave interface X300, pin assignment.

PIN	Signal	Description
1	TD +	Transmit +
2	TD -	Transmit -
3	RD +	Receive +
4	connected	reserved
5		
6	RD -	Receive -
7	connected	reserved
8		

For the EtherCAT slave optional interface (B110), documentation with further information is available: https://infosys.beckhoff.com/content/1033/b110_ethercat_optioninterface/index.html?id=2623834056269338700

Document name
CXxxxx-B110	EtherCAT Slave Optional Interface.

5.4.7 PROFIBUS (x310)

Pin 6 transfers 5 V_{DC}, pin 5 transfers GND for the active termination resistor. These must never be used for other functions, as this can lead to destruction of the device.

Pins 3 and 8 transfer the PROFIBUS signals. These must never be swapped over, as this will prevent communication.
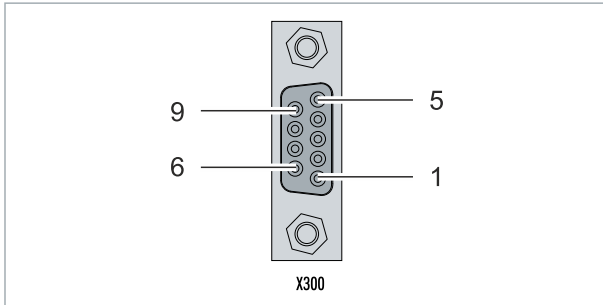
Fig. 13: PROFIBUS interface X310.

The Profibus bus line is connected via a 9-pin D-sub with the following pin assignment:

Table 20: PROFIBUS interface X310, pin assignment.

Pin	Connection
1	Shielding
2	not used
3	RxD/TxD-P
4	not used
5	GND
6	+5 V_{DC}
7	not used
8	RxD/TxD-N
9	not used

Table 21: Wire colors of the PROFIBUS line.

PROFIBUS line	D-sub
B red	Pin 3
A green	Pin 8

For the PROFIBUS optional interface (x310), documentation with further information is available:
https://infosys.beckhoff.com/content/1033/m310_b310_profibus_optioninterface/index.html?id=2233561431434830097

Document name
CXxxxx-M310/B310	Profibus Optional Interface

5.4.8   CANopen (x510)
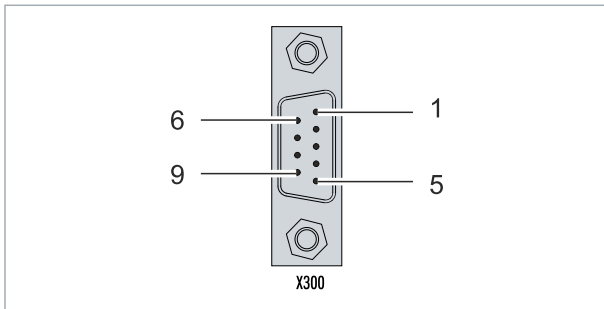
Fig. 14: CANopen interface X510.

The CAN bus line is connected via a 9-pin D-sub connector with the following pin assignment:

Table 22: CANopen interface X510, pin assignment.

Pin	Connection
1	not used
2	CAN low (CAN-)
3	CAN Ground (internally connected to pin 6)
4	not used
5	Shield
6	CAN Ground (internally connected to pin 3)
7	CAN high (CAN+)
8	not used
9	not used

For the CANopen optional interface (x510), documentation with further information is available:
https://infosys.beckhoff.com/content/1033/m510_b510_canopen_optioninterface/index.html?id=1404127979601372947

Document name
CXxxxx-M510/B510	CANopen Optional Interface

5.4.9 PROFINET RT (x930)
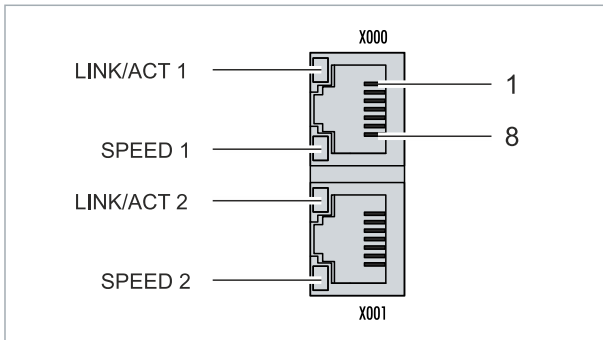
Fig. 15: PROFINET RT interface X300.

Table 23: PROFINET RT interface, pin assignment.

PIN	Signal	Description
1	TD +	Transmit +
2	TD -	Transmit -
3	RD +	Receive +
4	connected	reserved
5		
6	RD -	Receive -
7	connected	reserved
8		

For the PROFINET RT optional interface (x930), documentation with further information is available: https://infosys.beckhoff.com/content/1033/m930_b930_profinet_optioninterface/index.html?id=3617310193267164961

Document name
CXxxxx-M930/B930	Profinet Optional Interface

6   Commissioning

6.1   Selecting the appropriate CX2100 power supply unit

The basic CPU module requires a power supply unit of type CX2100-0xxx. Connect the power supply unit to the multi-pin port on the right of the basic CPU module.

When selecting a CX2100-0xxx power supply unit, always check whether the peak power consumption of the overall system with all connected USB devices, expansion, system and fieldbus modules can be covered by the selected power supply unit.

Table 24: Suitable power supply unit for the CX20x3 Embedded PC.

Basic CPU module	Power supply units
CX2033	• CX2100-0004 (45 W)* • CX2100-0904 (45 W, capacitive UPS)* • CX2100-0914 (100 W) • CX2100-0014 (130 W, from HW version: 2.4) • CX2100-0024 (240 W)
CX2043	• CX2100-0914 (100 W) • CX2100-0014 (130 W, from HW version: 2.4) • CX2100-0024 (240 W)

* Can be used if the total load does not exceed 45 W, e.g. due to USB devices or CX25xx modules.

The CX2033 Embedded PC can be ordered ex factory with active cooling (CX2900-0301) so that it can be operated in an upright or horizontal installation position. The CX2043 Embedded PC is actively cooled as standard and can therefore be operated in an upright or horizontal installation position.

Table 25: Power supply units for vertical or horizontal installation position.

Basic CPU module	Accessories	Power supply units
CX2033	CX2900-0301 fan option required	• CX2100-0014 (130 W)
CX2043	Fan ex factory	• CX2100-0914 (100 W, external battery pack can be used) • CX2100-0024 (240 W)

Configuration of the power supply terminal

Fig. 16: Embedded PC CX20x3 with power supply unit CX2100-0014, configuration of the power supply terminal.

Table 26: Legend for configuration of the power supply terminal.

No.	Description	No.	Description
1	Diagnostic LEDs	5	0 V, Bus Terminal supply
2	Terminal bus (K-bus or E-bus)	6	Terminal release
3	+24 V and 0 V, for basic CPU module	7	PE, spring-loaded terminal
4	+24 V, Bus Terminal supply	8	+24 V, 0 V, PE, for power contacts

6.2   Mounting
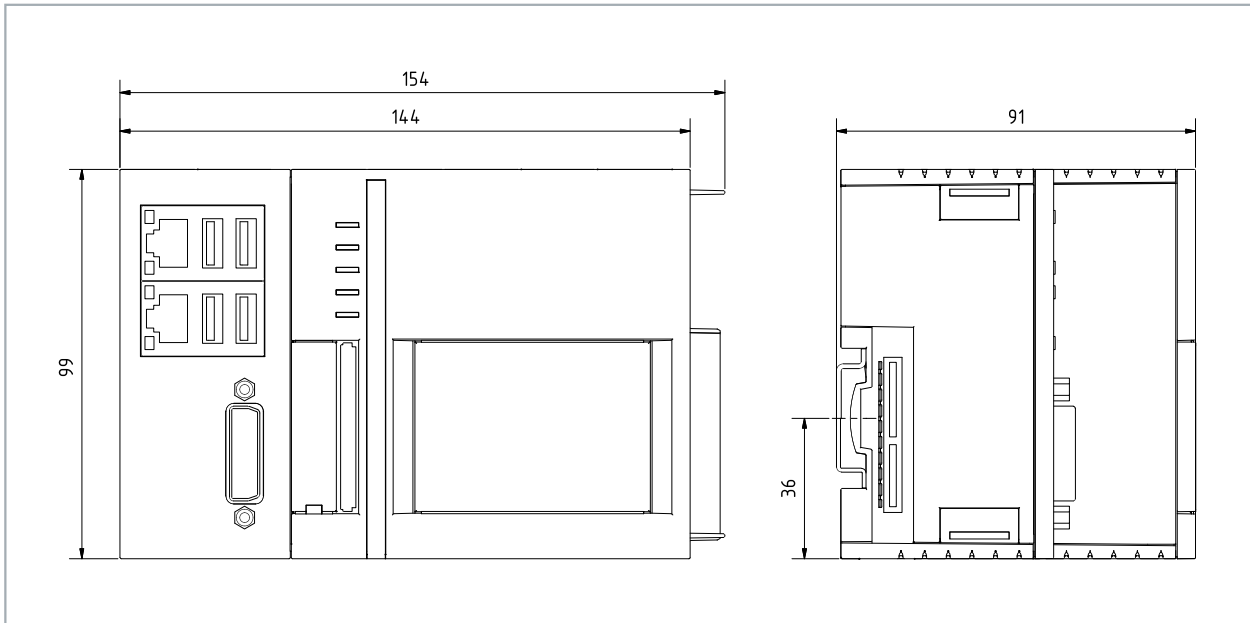
Fig. 17: CX2033 Embedded PC, dimensions.
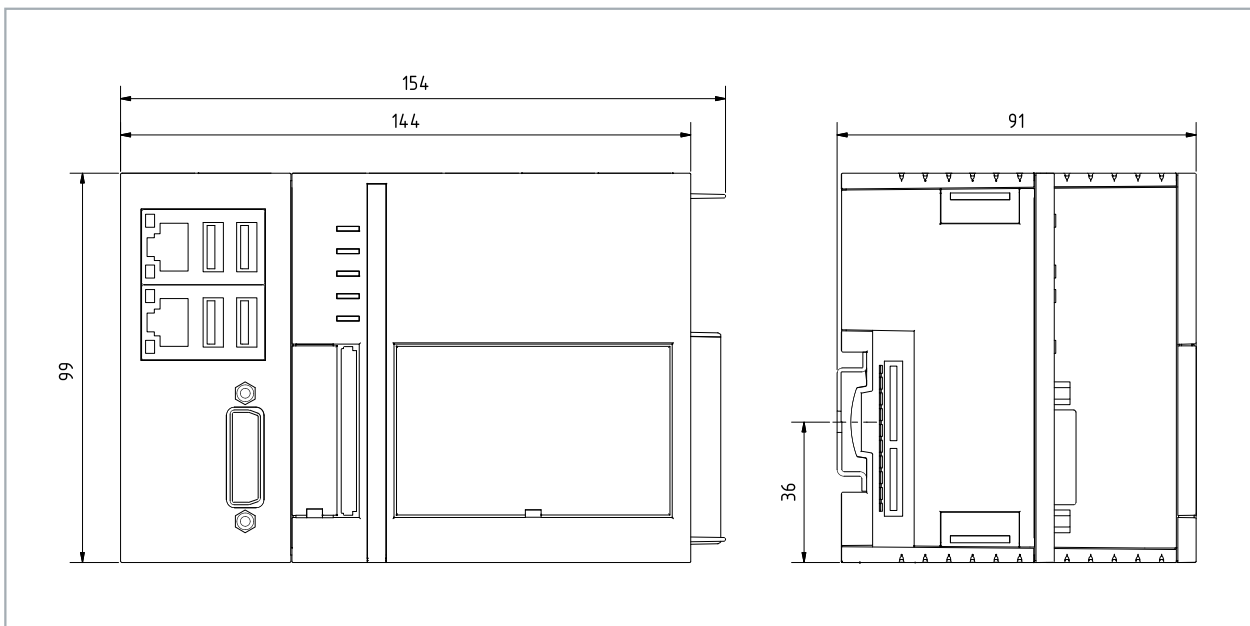
Fig. 18: CX2043 Embedded PC, dimensions.

6.2.1 Attaching the power supply unit

The basic CPU module requires a power supply unit of type CX2100-0xxx. Connect the power supply unit to the multi-pin port on the right of the basic CPU module.

Proceed as follows:

1. Select the appropriate power supply unit, as described in chapter <u>Selecting the appropriate CX2100 power supply unit [▶ 29]</u>.

2. Attach the power supply unit on the right of the basic CPU module.
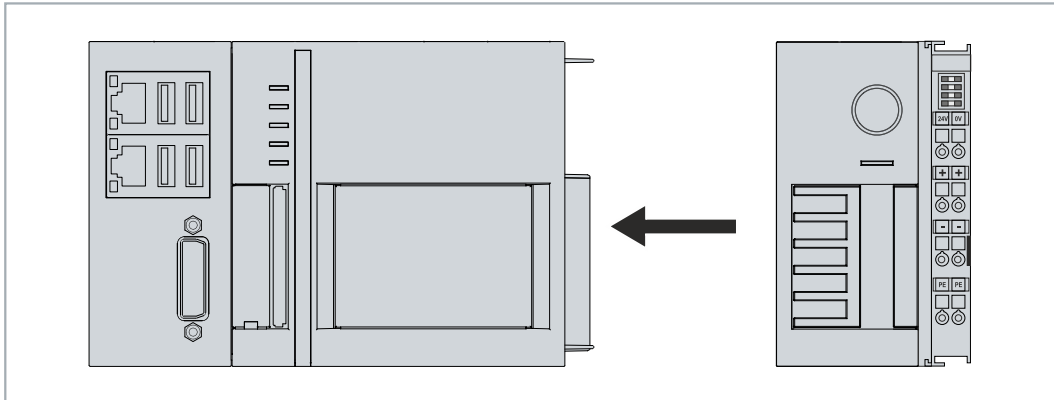
⇨ Next you can install the bar clips.

6.2.2 Installing the bar clips

Usually, the connection between the modules is strong enough. However, the basic CPU module and the attached modules may be subjected to shocks, vibrations or other impacts. The modules can be securely connected to one another with the aid of bar clips.

Install the bar clips as follows:

1. Attach the bar clips at the top and bottom between the cooling fins.

2. Push the bar clips between the cooling fins of your devices, as shown in the image below.
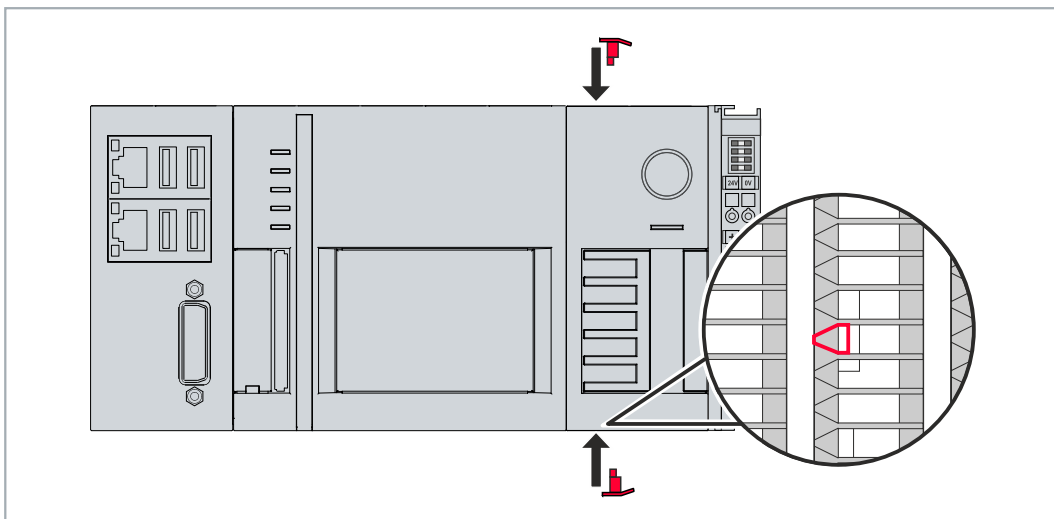
⇨ The bar clips have been installed successfully, if they don't protrude and are level with the cooling fins of your modules.
Once all modules are latched, the devices can be installed on the mounting rail.

6.2.3   Note the permissible installation positions

NOTICE
Overheating
The Embedded PC may overheat if the installation position is incorrect or the minimum distances are not adhered to. Adhere to the maximum ambient temperature of 60°C and the mounting instructions.

Install the Embedded PC horizontally in the control cabinet on a mounting rail, in order to ensure optimum heat dissipation. Only Embedded PCs with active cooling can be operated vertically or horizontally.

Table 27: Embedded PC CX20x3, installation position depending on the cooling option.

Embedded PCs	Horizontal installation position	Vertical and horizontal installation position
CX2033	X	-
CX2043 with active cooling	X	X
CX2033 with CX2900-0301 fan option	X	X

Note the following specifications for the control cabinet:

- The Embedded PC should only be operated at ambient temperatures between -25 °C and 60 °C. Measure the temperature below the Embedded PC at a distance of 30 mm to the cooling fins, in order to determine the ambient temperature correctly.

- Adhere to the minimum distances of 30 mm above and below the Embedded PC.

- Additional electrical equipment affects the heat generation in the control cabinet. Select a suitable control cabinet enclosure depending on the application, or ensure that excess heat is dissipated from the control cabinet.

Permitted installation position without fan

The Embedded PC must be installed horizontally on the mounting rail. Ventilation openings are located at the top and bottom of the housing. This ensures an optimum airflow through the Embedded PC in vertical direction. In addition, a minimum clearance of 30 mm above and below the Embedded PC is required, in order to ensure adequate ventilation.
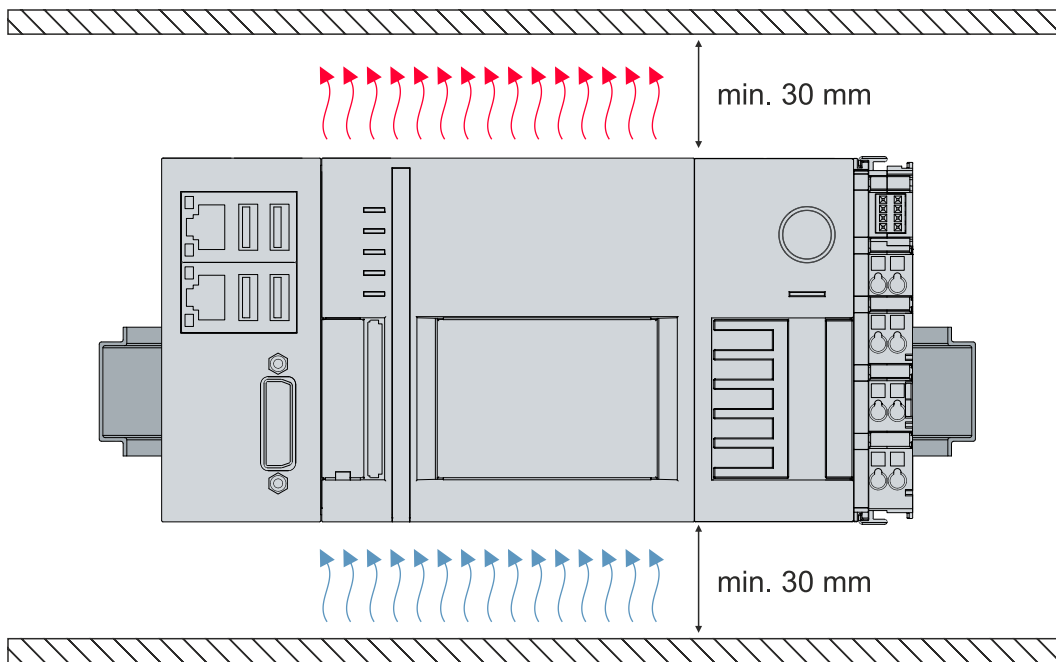
Fig. 19: Embedded PC CX20x3, horizontal installation position.

If vibrations and impact occur in the same direction as the mounting rail, the Embedded PC must be secured with an additional bracket, in order to prevent it slipping.

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Permitted installation positions with fan

Only Embedded PCs with an active cooling can be installed vertically or horizontally on the mounting rail. Without active cooling the Embedded PC is not ventilated adequately in vertical or horizontal position.

Even with active cooling, the ambient temperature range between -25 and 60 °C and the minimum distances of 30 mm above and below the Embedded PC should be adhered to. Secure the Embedded PC with an additional bracket, in order to prevent it slipping from the DIN rail.

Ensure that Bus Terminals that are connected to the Embedded PC are designed for operation in vertical or horizontal position.

6.2.4 Attaching on mounting rail

The housing is designed such that the Embedded PC can be pushed against the mounting rail and latched onto it.

Requirements:

- Mounting rail of type TS35/7.5 or TS35/15 according to DIN EN 60715.

Secure the Embedded PC on the mounting rail as follows:

1. Unlock the latches on the top side and underside using a screwdriver.

2. Place the Embedded PC at the front of the mounting rail. Slightly press the Embedded PC onto the mounting rail until a soft click can be heard and the Embedded PC has latched.
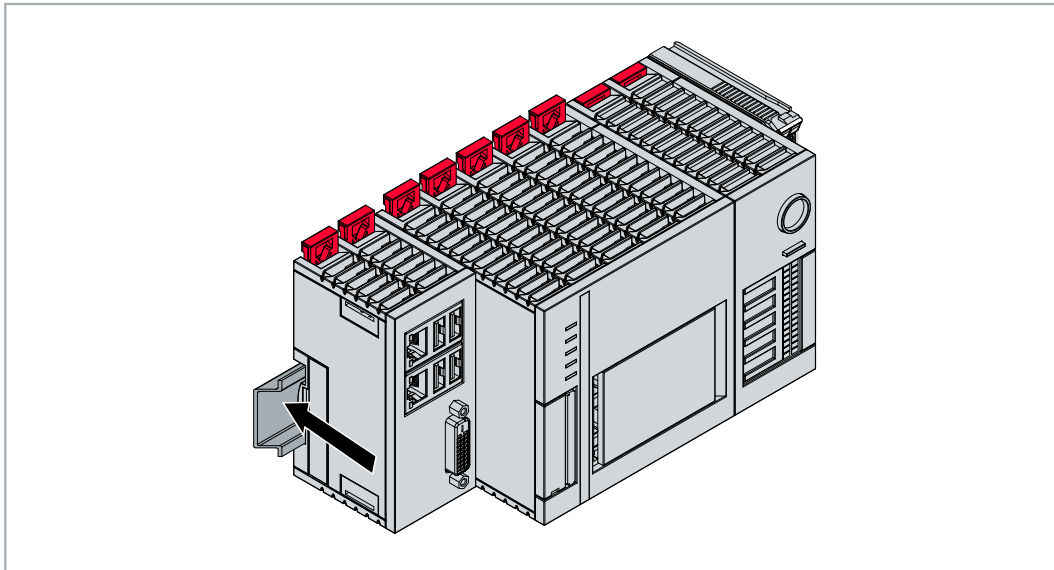
3. Then lock the latches again.
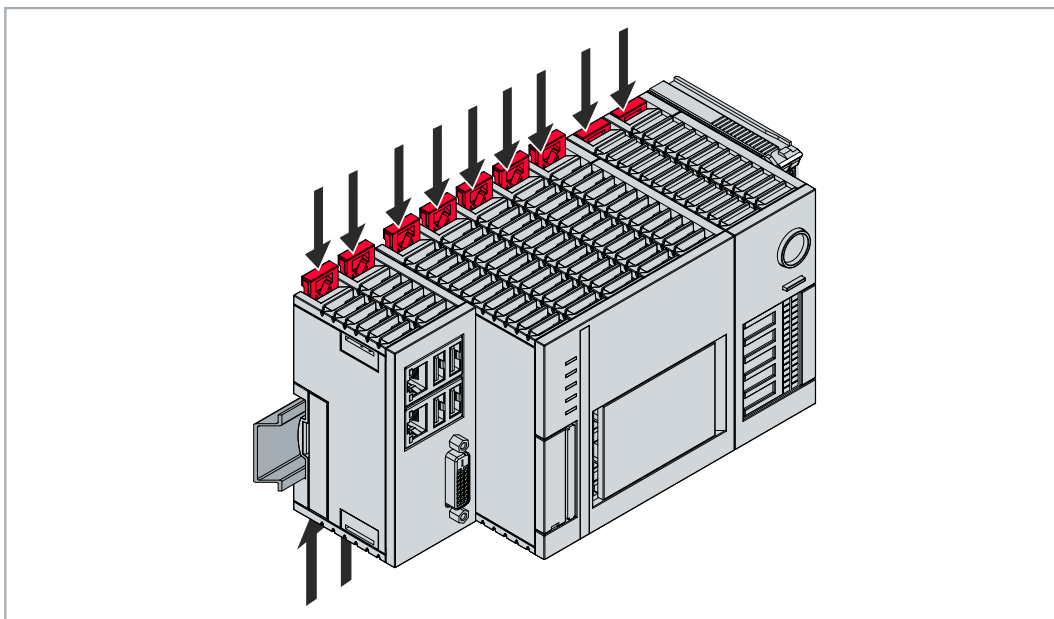
⇨ You have installed the Embedded PC successfully. Double-check the correct installation and latching of the Embedded PC on the mounting rail.

6.2.5   CFast card installation and removal

ℹ Loss of data

CFast cards are subjected to heavy load during operation and have to withstand many write cycles and extreme ambient conditions. CFast cards from other manufacturer may fail, resulting in data loss.

Only use industrial CFast cards provided by Beckhoff.

A CFast card is a non-volatile memory. Data to be retained in the event of a power failure should be saved on the CFast card. The CFast cards supplied by Beckhoff are industrial cards with an increased number of write cycles and an extended temperature range (+85 °C).

The eject mechanism is based on the push/push principle. The installation and removal of CFast cards is described below.

Requirements:

- The basic CPU module must be switched off. The CFast cards may only be installed or removed in switched off state.

Removing a CFast card

1. Gently push the CFast card.
   A soft click can be heard when the card is released.

2. The card is lifted by approx. 4 mm from the housing. Pull out the card.
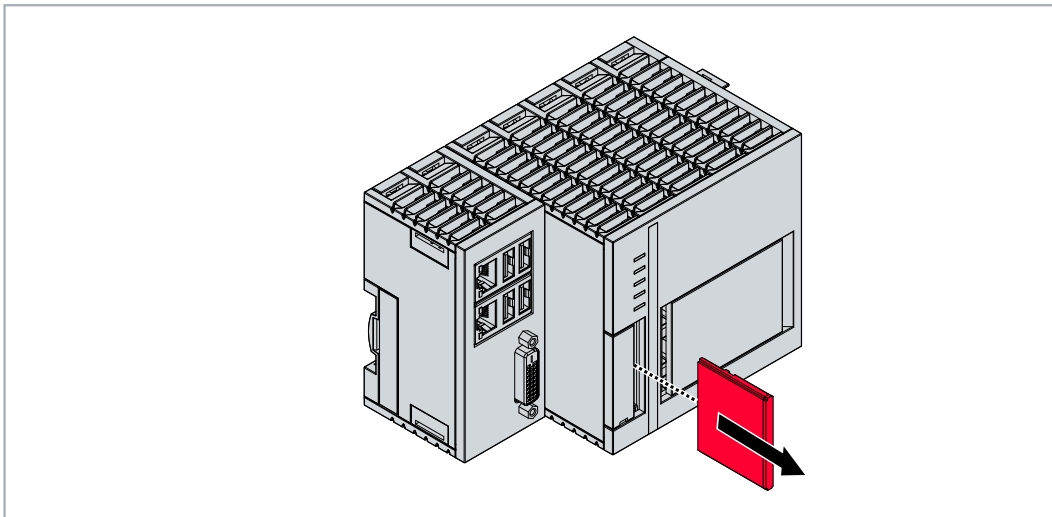
Installing a CFast card

1. Push the CFast card into the CFast card slot.

2. A soft click can be heard when the CFast card engages.

⇨ The card is seated correctly if it is flush with the front side of the device housing.

6.2.6   Installing passive EtherCAT Terminals

i   **Incorrectly installed passive EtherCAT Terminals**

The E-bus signal between an Embedded PC and the EtherCAT Terminals can be impaired due to incorrectly installed passive EtherCAT Terminals.

Passive EtherCAT Terminals should not be installed directly on the power supply unit.

EtherCAT Terminals that do not take part in active data exchange are referred to as passive terminals. Passive EtherCAT Terminals have no process image and do not require current from the terminal bus (E-bus).

Passive EtherCAT Terminals (e.g. EL9195) can be detected in TwinCAT. In the tree structure the EtherCAT Terminal is displayed without process image, and the value in column "E-bus (mA)" does not change, compared to the preceding EtherCAT Terminal.

Fig. 20: Identifying a passive EtherCAT Terminal in TwinCAT.

The entry "Current consumption via E-Bus" in the technical data of an EtherCAT Terminal indicates whether a particular EtherCAT Terminal requires power from the terminal bus (E-bus).

The following diagram shows the permissible installation of a passive EtherCAT Terminal. The passive EtherCAT Terminal was not directly attached to the power supply unit.
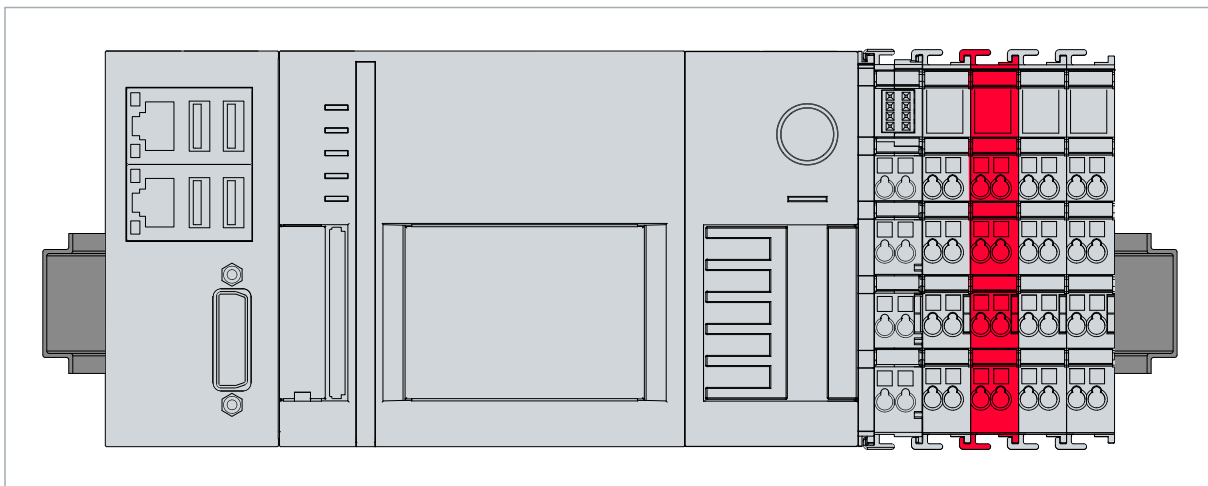
Fig. 21: Passive EtherCAT Terminals, permissible installation.

6.3   Power supply

NOTICE
Damage to the Embedded PCs
The Embedded PCs may be damaged during wiring. The cables for the power supply should only be connected in de-energized state.

The power supply units require an external voltage source, which provides 24 V DC (-15% / +20%).

The cabling of the Embedded PC in the control cabinet must be done in accordance with the standard EN 60204-1:2006 (PELV = Protective Extra Low Voltage):

- The "PE" and "0 V" conductors of the voltage source for a basic CPU module must be on the same potential (connected in the control cabinet).
- Standard EN 60204-1:2006, section 6.4.1:b stipulates that one side of the circuit, or one point of the energy source for this circuit must be connected to the protective earth conductor system.

Connection example with basic CPU moduleCX20x3 and CX2100-0014 power supply unit:
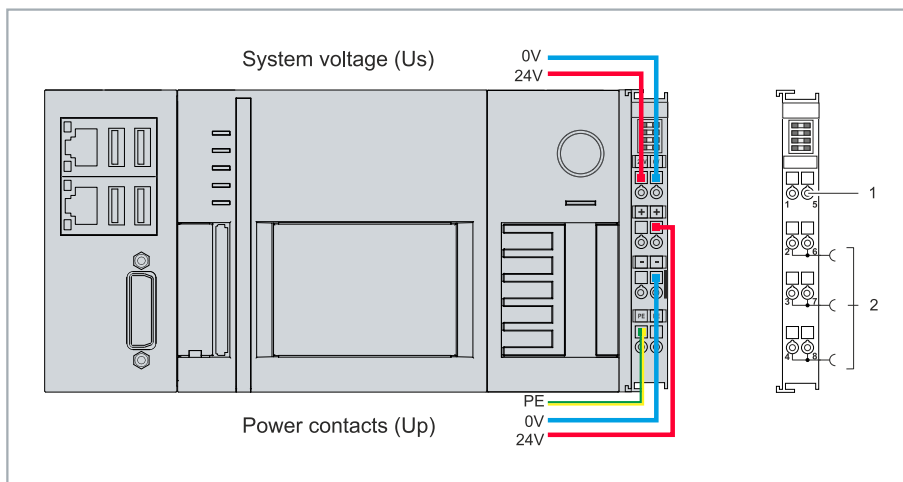
Fig. 22: Connections for system voltage (Us) and power contacts (Up).

Table 28: Legend for the connection example.

No.	Description
1	The upper spring-loaded terminals identified with "24 V" and "0 V" supply the basic CPU module and the terminal bus (data transfer via K- or E-bus).
2	The spring-loaded terminals identified as "+", "-" and "PE" supply the Bus Terminals via the power contacts and the sensors or actuators connected to the Bus Terminals.

Fuse

- When dimensioning the fuse for the system voltage (Us), observe the maximum power consumption of the Embedded PC (see: Technical data [▶ 74]).
- Protect the power contacts (Up) with a fuse with a max. rating of 10 A (slow-blow).

Interrupting/switching off the power supply

To switch off the Embedded PC, do not disconnect the ground (0 V), because otherwise current may continue to flow via the shielding, depending on the device, and damage the Embedded PC or peripheral devices.

Always disconnect the 24 V line. Devices connected to the Embedded PC, which have their own power supply (e.g. a panel) must have the same potential for "PE" and "0 V" as the Embedded PC has (no potential difference).

6.3.1 Connect Embedded PC

The cables of an external voltage source are connected to the power supply unit with spring-loaded terminals. Observe the required conductor cross-sections and strip lengths.

Table 29: Required conductor cross-sections and strip lengths.

Conductor cross-section	0.5 ... 2.5 mm^2	AWG 20 ... AWG 14
Strip length	8 ... 9 mm	0.33 inch
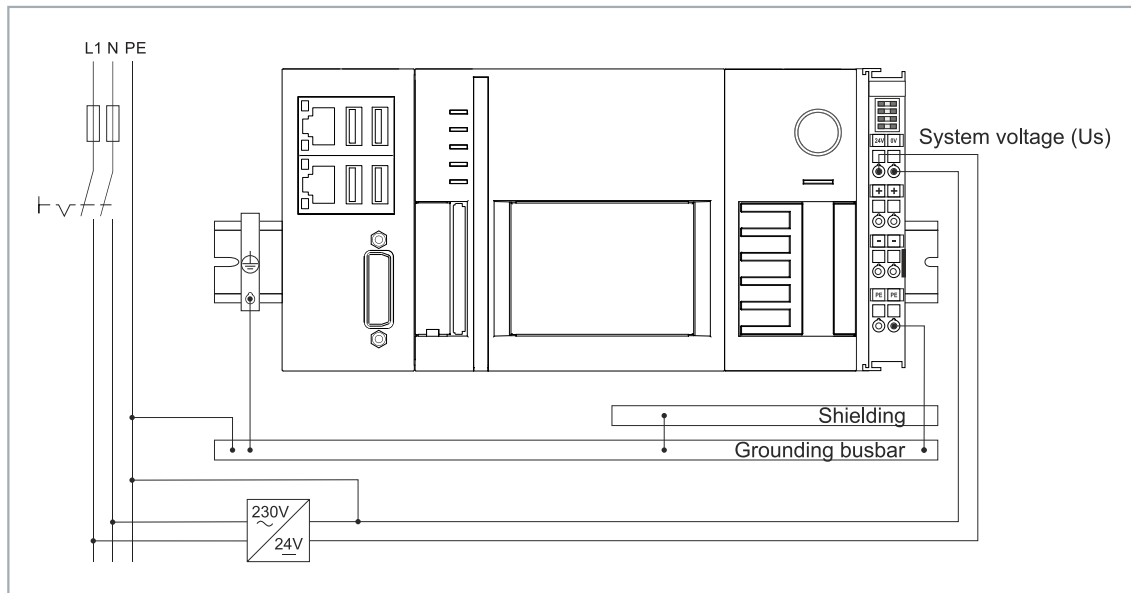
Fig. 23: Connection example with a CX20x3.

Connect the Embedded PC as follows:

1. Open a spring-loaded terminal by slightly pushing with a screwdriver or a rod into the square opening above the terminal.
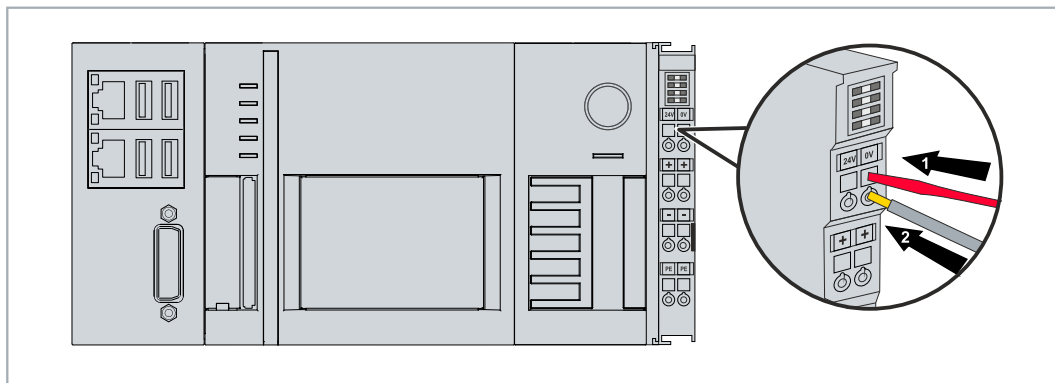
2. The wire can now be inserted into the round terminal opening without any force.

3. The terminal closes automatically when the pressure is released, holding the wire safely and permanently.

⇨ You have successfully connected the voltage source to the power supply terminal when the two upper LEDs of the power supply terminal light up green.

The left LED (Us 24V) indicates the supply of the basic CPU module and the terminal bus. The right LED (Up 24V) indicates the bus terminal supply via the power contacts.

6.3.2 UL requirements

The CX20x3 Embedded PCs are UL-certified. The corresponding UL label can be found on the name plate.

Fig. 24: UL label for CX20x3.

The Embedded PCs CX20x3 can thus be used in areas in which special UL requirements have to be met. These requirements apply to the system voltage (Us) and the power contacts (Up). Applications without special UL requirements are not affected by UL regulations.

UL requirements:

- The Embedded PCs must not be connected to unlimited voltage sources.
- Embedded PCs may only be supplied from a 24 V DC voltage source. The voltage source must be insulated and protected with a fuse of maximum 4 A (corresponding to UL248).
- Or the power supply must originate from a voltage source that corresponds to NEC class 2. An NEC class 2 voltage source must not be connected in series or parallel with another NEC class 2 voltage source.
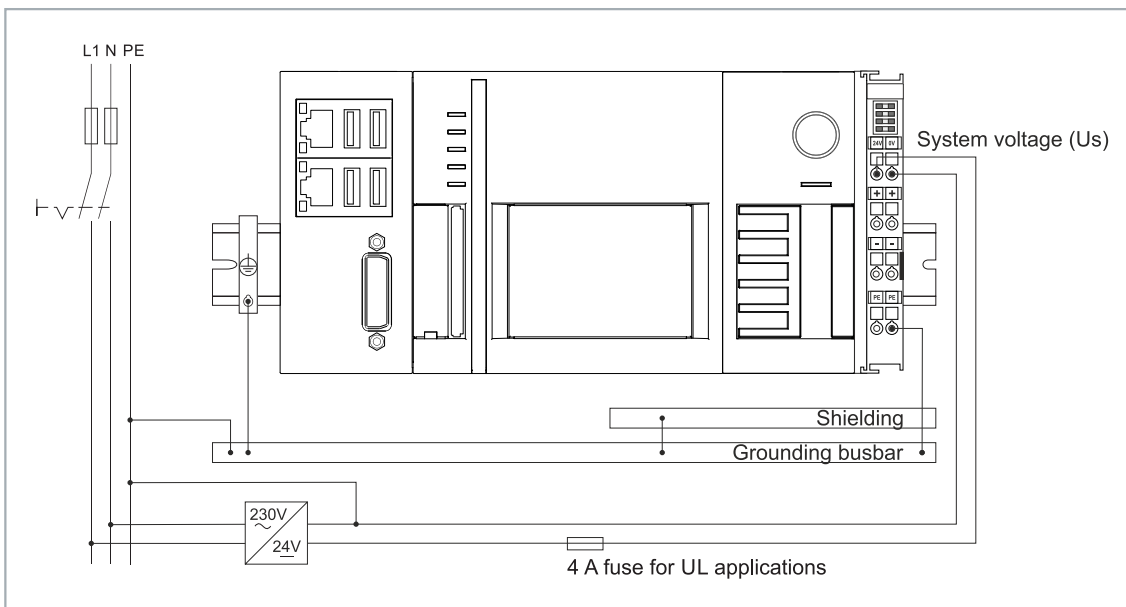
Fig. 25: Connection example for areas with special UL requirements.

6.4 Switching on

Please ensure that the Embedded PC is fully configured before switching on the Embedded PC.

Switch on the Embedded PC as follows:

1. Ensure that all extension, system and fieldbus modules are connected correctly.
2. Check whether the right CX2100 power supply unit and the right installation position were selected.
3. Check whether the Embedded PC is mounted securely on the DIN rail and all required Bus Terminals are connected.
4. Only then switch on the power supply for the power supply unit.
   ⇨ The Embedded PC starts automatically when the external power supply is switched on. The pre-installed operating system is started and all connected extension, system and fieldbus modules are configured.

6.5   Switching off

NOTICE
Loss of data
If the Embedded PC is switched off during operation, data on the CFast card or other hard disks may be lost. Do not disconnect the Embedded PC from the power supply during operation.

Switch off the Embedded PC as follows:

1. Stop all running programs properly, e.g. the control software on the Embedded PC.
2. Shut down the operating system.
3. Do not switch off the external power supply until all other tasks have been completed, in order to switch off the Embedded PC.

7 Configuration

7.1 Starting the Beckhoff Device Manager

Using the Beckhoff Device Manager, an industrial PC can be configured by remote access with the aid of a web browser. Depending on the image version, access takes place via different protocols and requires different open ports. For older image versions access takes place via the HTTP protocol and Port 80 (TCP). More up-to-date image versions use HTTPS and Port 443 (TCP).

Requirements:

- Host PC and embedded PC must be located in the same network. Depending on the operating system version, the network firewall must allow access via port 80 (HTTP) or port 443 (HTTPS).
- IP address or host name of the embedded PC.

Table 30: Access data for the Beckhoff Device Manager on delivery.

User name	Password
Administrator	1

Start the Beckhoff Device Manager as follows:

1. Open a web browser on the host PC.
2. Enter the IP address or the host name of the industrial PC in the web browser to start the Beckhoff Device Manager.
   - Example with IP address: https://169.254.136.237/config
   - Example with host name: https://CX-16C2B8/config
3. Enter the user name and password. The start page appears:
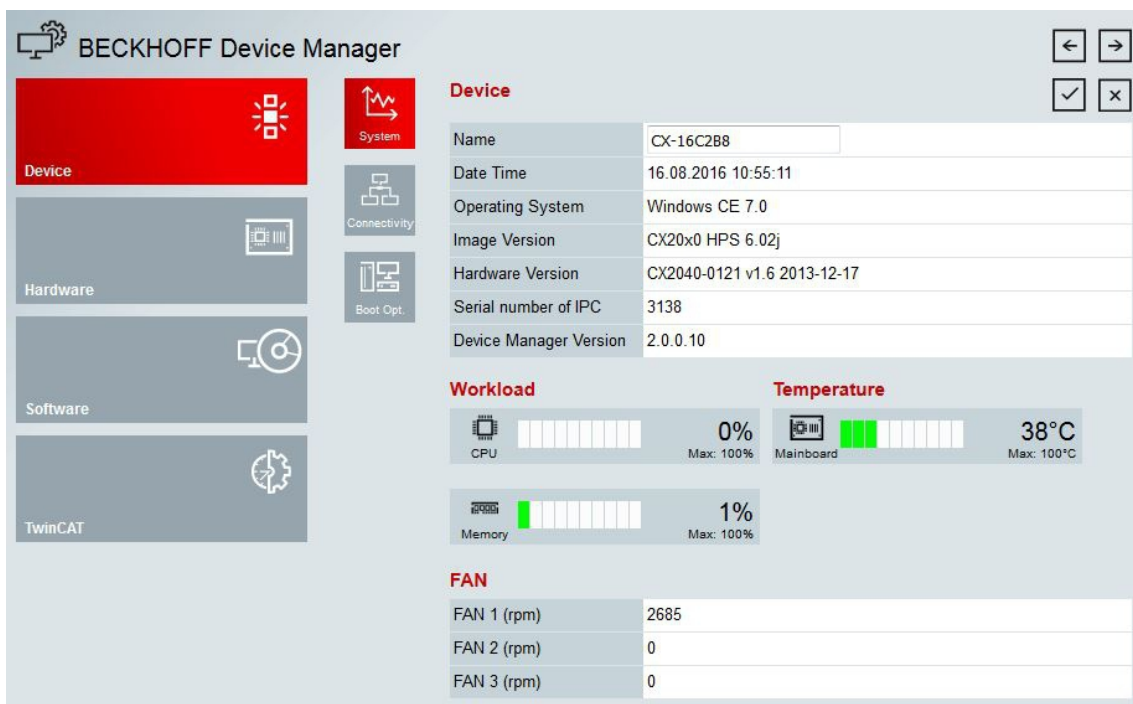
⇨ Navigate forward in the menu and configure the industrial PC. Note that modifications only become active once they have been confirmed. It may be necessary to restart the industrial PC.

7.2   Enable TPM

The CX20x3 is extended with a TPM (Trusted Platform Module) for basic safety functions. Among other features, this enables encryption of the user data and thus prevents unauthorized read access when the device is switched off. Unauthorized manipulation of the software is also prevented. On the CX20x3 the firmware TPM solution (fTPM) is implemented, where the main CPU has a microcode to represent the function of a TPM (see: Technical data).

The TMP is disabled by default and has to be enabled in the BIOS before it can be used. Further information about the use of a TPM on a Beckhoff Industrial PC can be found at: TPM on Beckhoff IPC

Requirements:

- UEFI BIOS.

- 64-bit Windows 10 version 1809 or higher required.

Proceed as follows:

1. Restart your Industrial PC and press **[Del]** to start the BIOS setup.
   The BIOS setup window appears.

2. Under **Boot > Boot mode select**, select the option **UEFI**.

3. Under **Advanced > Trusted Computing** set the option **Security Device Support** to **Enable**.

```
 Aptio Setup Utility - Copyright (C) 2020 American Megatrends, Inc.
  Advanced

 Configuration                                      Enables or Disables
  Security Device        [Enable]                   BIOS support for
 Support                                            security device. O.S.
   Device Select         [TPM 2.0]                  will not show Security
                                                    Device. TCG EFI
                                                    protocol and INT1A
 Current Status Information                         interface will not be
   SUPPORT TURNED OFF                               available.


                                                    →←: Select Screen
                                                    ↑↓: Select Item
                                                    Enter: Select
                                                    +/-: Change Opt.
                                                    F1: General Help
                                                    F2: Previous Values
                                                    F3: Optimized Defaults
                                                    F4: Save & Reset
                                                    ESC: Exit

 Version 2.17.1249. Copyright (C) 2020 American Megatrends, Inc.
```

4. Press **[F4]** to save the settings and exit the BIOS setup.
   The device is restarted.

⇨ If you have previously stored keys in the TPM, we recommend resetting the TPM to factory defaults, which will delete any existing keys. The required options are available in the BIOS once the TPM has been enabled and the PC has been rebooted.

7.3   Windows 10 IoT Enterprise

7.3.1   Enabling jumbo frames

Standardized Ethernet frames have a size of 1518 bytes. Ethernet frames that are larger than 1518 bytes are referred to as jumbo frames. Jumbo frames are used for transferring large data quantities. Jumbo frames are useful for certain applications, e.g. video cameras.

The Ethernet interfaces (X000, X001) support jumbo frames only if the original Intel® driver is installed.

Requirements:

- The original Intel® driver can be downloaded from https://downloadcenter.intel.com.
- Install the original Intel® driver. Note that this will delete the real-time capable driver from Beckhoff.
- Check whether the peripheral devices support jumbo frames.

Jumbo frames are activated as follows:

1. Under **Start > Control Panel > Hardware and Sound** click on **Device Manager**.

2. Double-click on the interface and then on the **Advanced** tab.
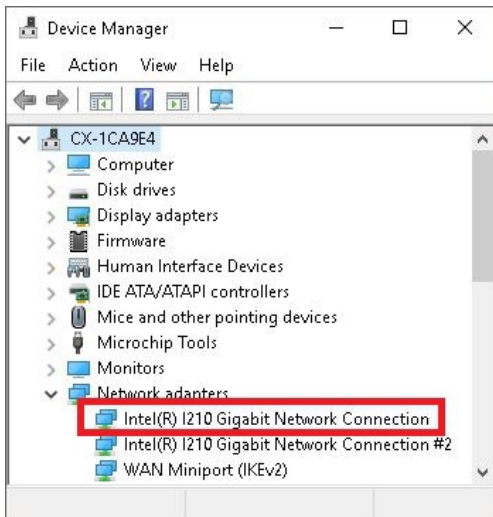
3. Under **Settings** click on Jumbo Packet, under **Value** select the option 4088 bytes or 9014 bytes.
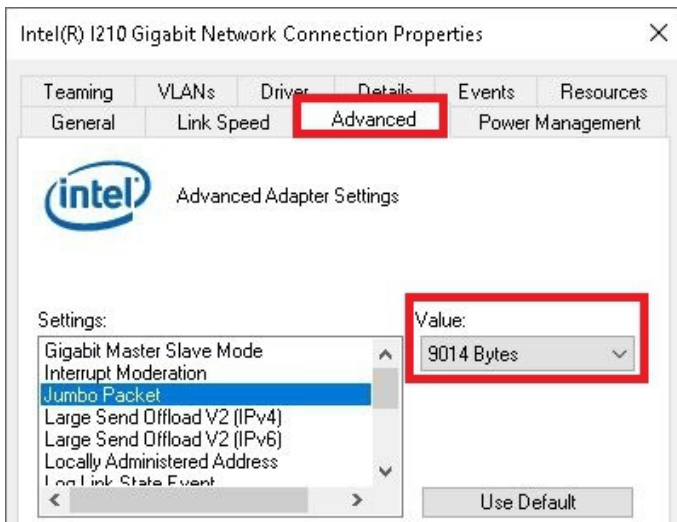
⇨ You have successfully activated jumbo frames, and you can now transfer larger data quantities.

7.3.2 Set NIC Teaming

NIC Teaming consolidates several physical network cards to group, thereby creating redundancy. Redundancy can help intercept interference in network cards or in the cabling by assigning the data transfer to other devices in the group.

Requirements:

- The original Intel® driver can be downloaded from https://downloadcenter.intel.com.
- Install the original Intel® driver for the Network Interface Card. Note that this will delete the real-time capable driver from Beckhoff.

NIC Teaming is set as follows:

1. Under **Start > Control Panel > Hardware and Sound** click on **Device Manager**.
2. Double-click on the interface.
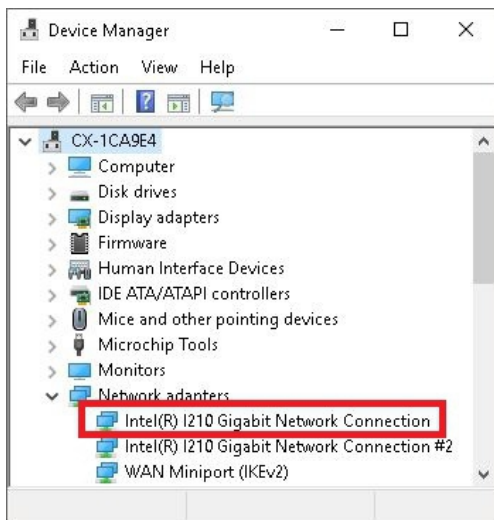
3. Click on the **Teaming** tab.
4. Click on **New Team** and follow the installation instructions.

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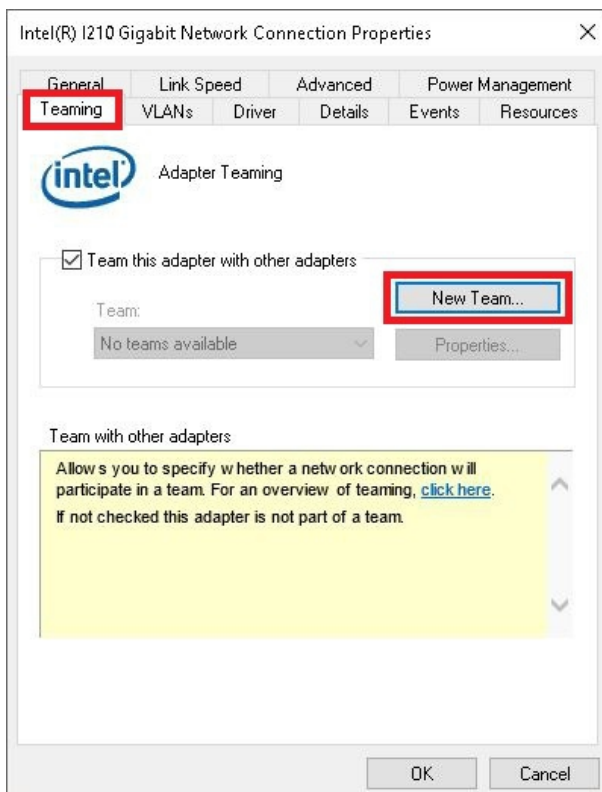
5. Under **Select a team type** select the option **Adapter Fault Tolerance**
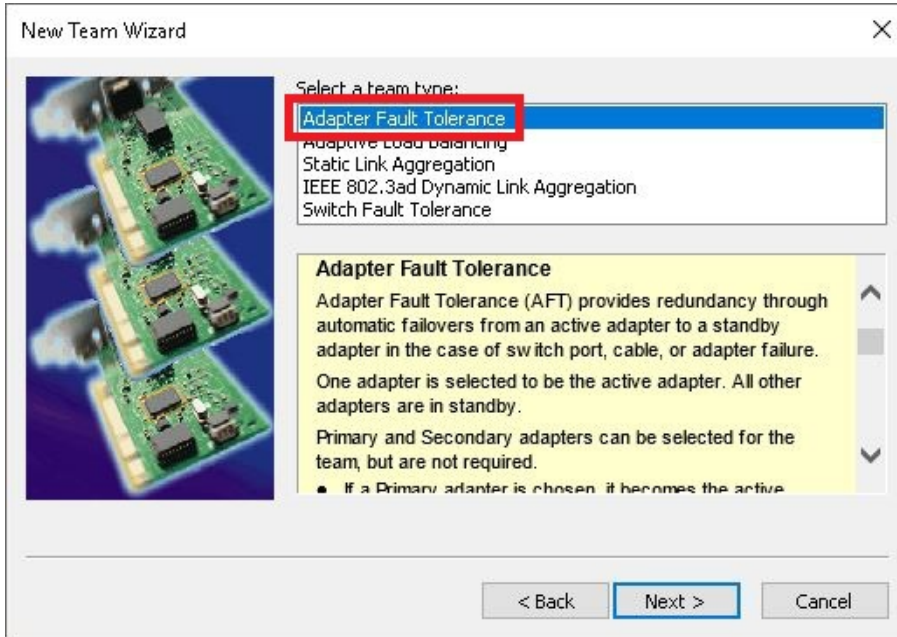
6. Click on **Next** to complete the installation.

⇨ You have successful set NIC Teaming for your Ethernet interfaces. Further settings can be specified or changed under the **Settings** tab.
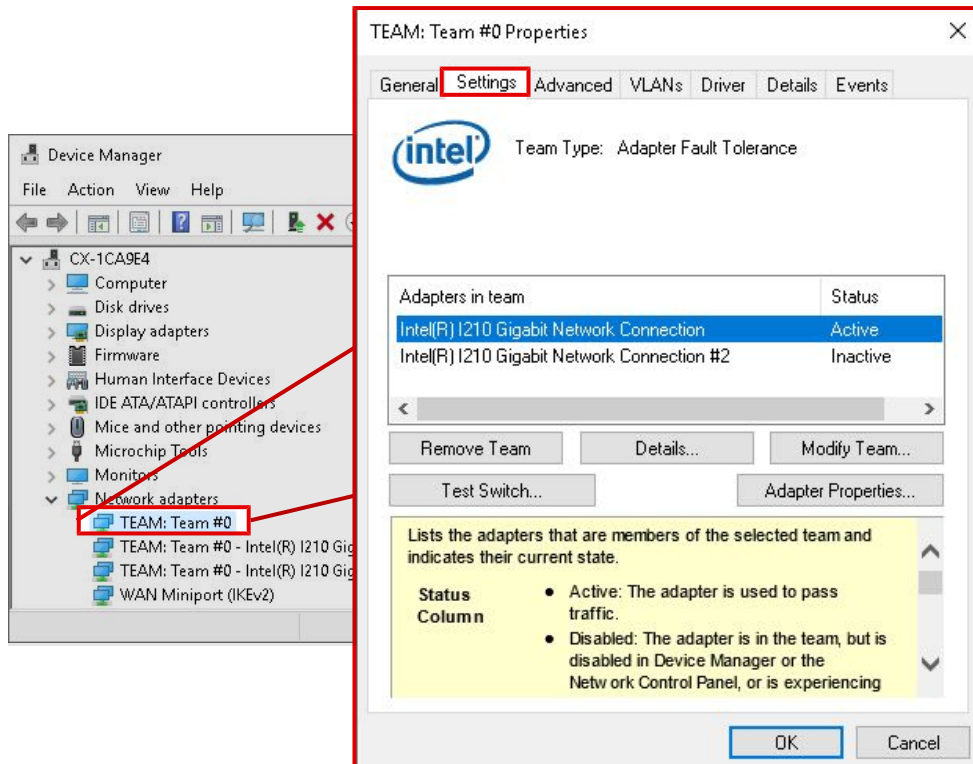
7.3.3 Restoring the Beckhoff real-time driver

The Beckhoff real-time driver can be restored if the real-time driver was uninstalled or the original Intel® driver for jumbo frames or NIC Teaming was installed, for example. This chapter shows you how to use *TcRteInstall.exe* to restore the Beckhoff real-time driver. The file is in the TwinCAT directory by default.

Requirements:

- You can find the *TcRteInstall.exe* in a TwinCAT 2 standard installation under: *C:\TwinCAT\Io\TcRteInstall.exe*
- And in a TwinCAT 3 standard installation under: *C:\TwinCAT\3.1\System\TcRteInstall.exe*

Proceed as follows:

1. Double-click the *TcRteInstall.exe* file.
   The installation dialog appears and shows the compatible Ethernet interfaces under **Compatible devices**.
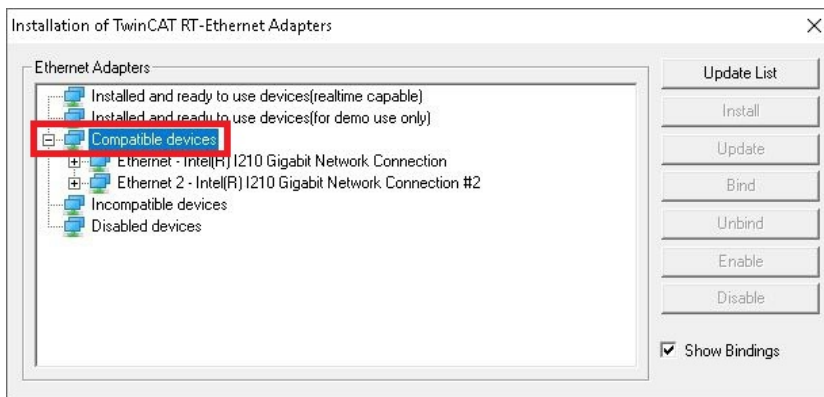
2. Select the Ethernet interfaces for which you wish to restore the Beckhoff real-time driver and click on **Install**.

⇨ The Beckhoff real-time driver is installed. The Ethernet interfaces with installed Beckhoff real-time driver are shown under **Installed and ready to use devices (real-time capable)**.
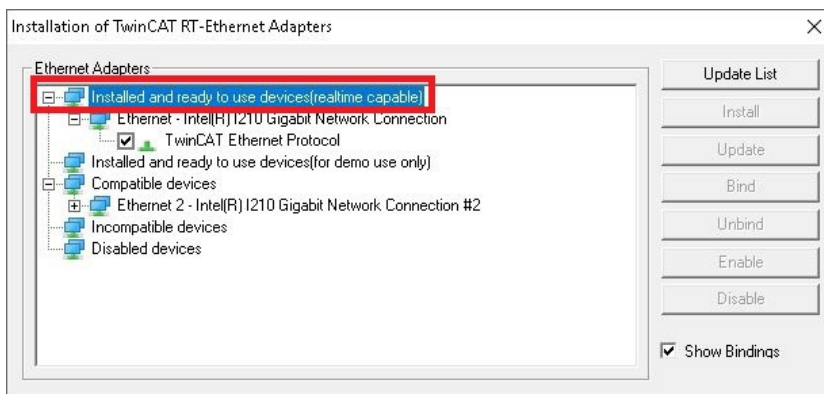
7.4 TwinCAT

7.4.1 Tree view

The Tree View chapter can be used as an example for creating a project without actual hardware. All devices and components of an embedded PC must be added manually in TwinCAT 3.

The smallest possible configuration of the CX20x3 Embedded PC is created as follows in the tree view under TwinCAT 3:
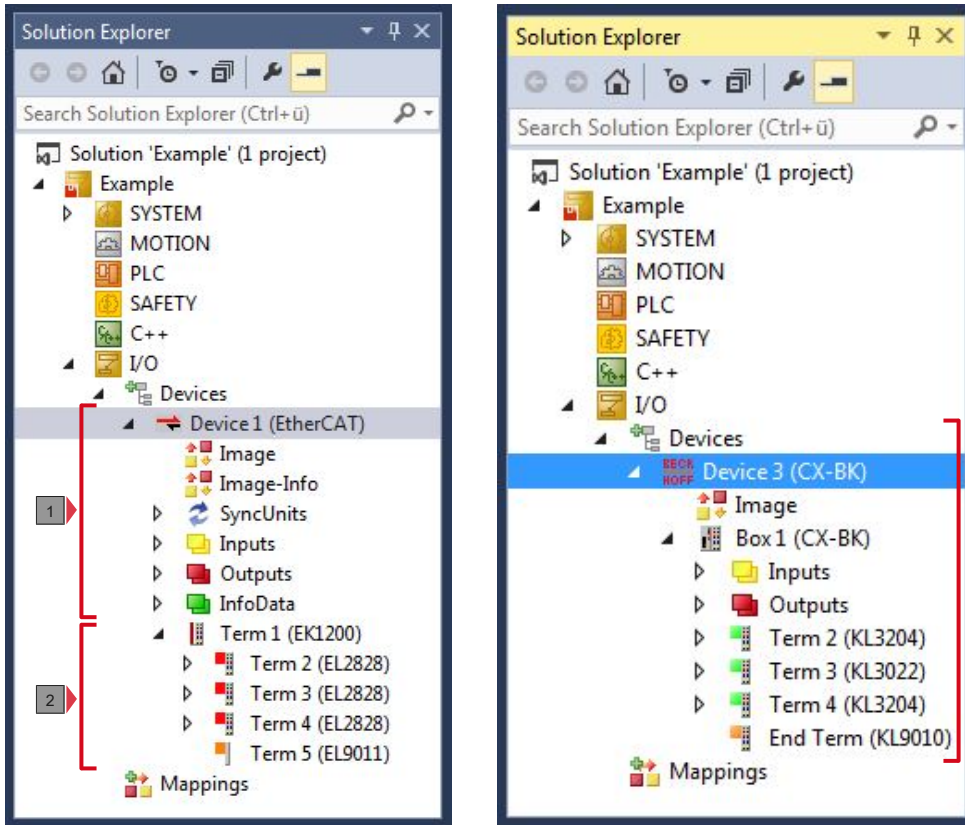
Fig. 26: CX20x3 Embedded PC in the tree view of TwinCAT 3, with attached EtherCAT Terminals (left) or Bus Terminals (right).

The configuration in the tree view differs depending on whether EtherCAT Terminals or Bus Terminals are connected to the Embedded PC.

Table 31: Key for the tree view.

No.	Description
1	The CX20x3 Embedded PC with EtherCAT Terminals is added as EtherCAT master. Variables for diagnostic purposes are listed under inputs or outputs.
2	EtherCAT Terminals (E-bus) are displayed under the EK1200 Bus Coupler in the tree view.
3	If Bus Terminals (K-bus) are used together with a CX20x3 Embedded PC, the Bus Coupler (CX-BK) is added together with the Bus Terminals.

7.4.2   Searching for target systems

Before you can work with the devices, you must connect your local computer to the target device. Then you can search for devices with the help of the IP address or the host name.

The local PC and the target devices must be connected to the same network or directly to each other via an Ethernet cable. In TwinCAT a search can be performed for all devices in this way and project planning subsequently carried out.

Prerequisites for this step:

- TwinCAT 3 must be in Config mode.
- IP address or host name of the device.

Search for the devices as follows:

1. In the menu at the top click on **File > New > Project** and create a new TwinCAT XAE project.
2. In the tree view on the left click on **SYSTEM**, and then **Choose Target**.

3. Click on **Search (Ethernet)**.
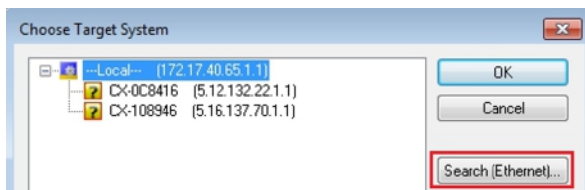
4. Type the host name or the IP address of the device into the **Enter Host Name / IP** box and press **[Enter]**.
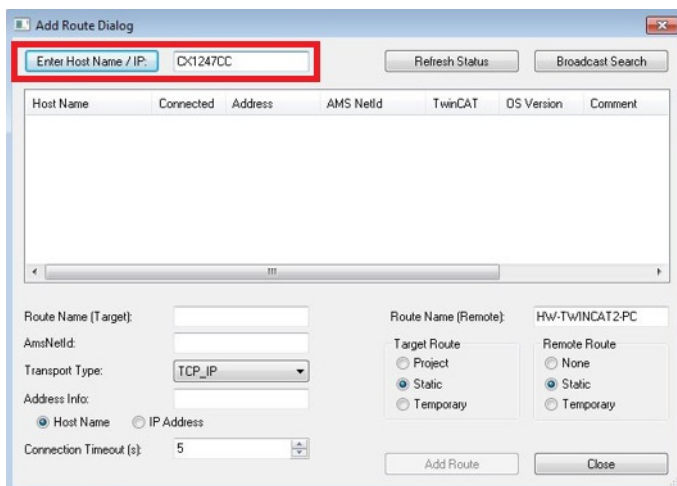
5. Mark the device found and click on **Add Route**.
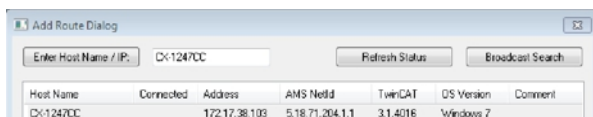
The Logon Information window appears.

Enter the user name and password for the CX in the **User Name** and **Password** fields and click **OK**.
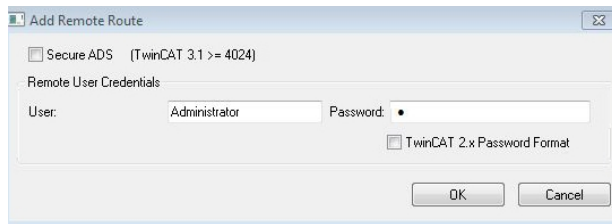
The following information is set as standard in CX devices:
User name: Administrator **Password:** 1

6. If you do not wish to search for any further devices, click on **Close** to close the Add Route Dialog.
   The new device is displayed in the Choose Target System window.

7. Select the device you want to specify as target system and click **OK**.
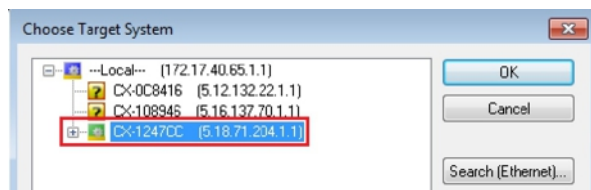
⇨ You have successfully searched for a device in TwinCAT and inserted the device as the target system.
   The new target system and the host name are displayed in the menu bar.

Using this procedure you can search for all available devices and also switch between the target systems at any time. Next, you can append the device to the tree view in TwinCAT.

7.4.3 Scanning an Embedded PC

This step shows how to scan an Embedded PC in TwinCAT and then further configure it.

Prerequisites for this step:

- Selected target device.

Add the Embedded PC as follows:

1. Start TwinCAT and open an empty project.
2. In the tree view on the left, right-click on **I/O Devices**.
3. In the context menu click on **Scan**.
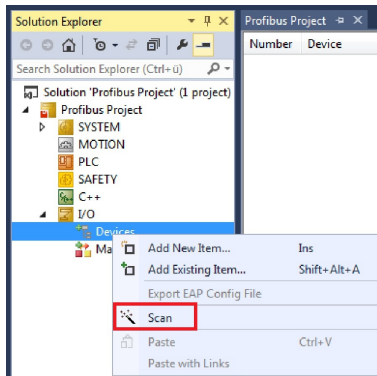
4. Select the devices you want to use and confirm the selection with **OK**.
   Only devices that are actual available are offered for selection.
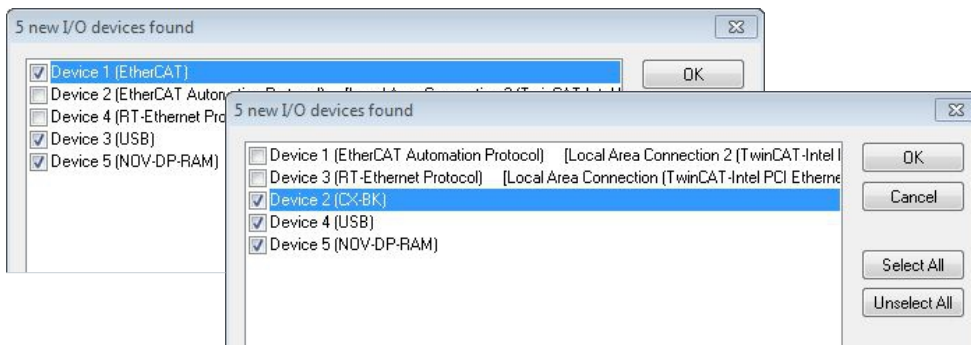
For Embedded PCs with connected Bus Terminals (K-bus) a Bus Coupler device (CX-BK) is displayed.
For EtherCAT Terminals (E-bus) the EtherCAT coupler is added automatically.

5. Confirm the request with **Yes**, in order to look for boxes.

6. Confirm the request whether to enable FreeRun with **Yes**.

⇨ The Embedded PC was successfully scanned in TwinCAT and is displayed in the tree view with the inputs and outputs.
   The Tree view chapter illustrates how Embedded PCs with connected Bus or EtherCAT Terminals are displayed.

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7.4.4   Configuring EtherCAT cable redundancy.

The embedded PC has two independent Ethernet interfaces, which can be used for EtherCAT cable redundancy. Cable redundancy offers resilience for the cabling. Interruptions of the EtherCAT communication due to wire break or unplugged LAN cables are avoided.
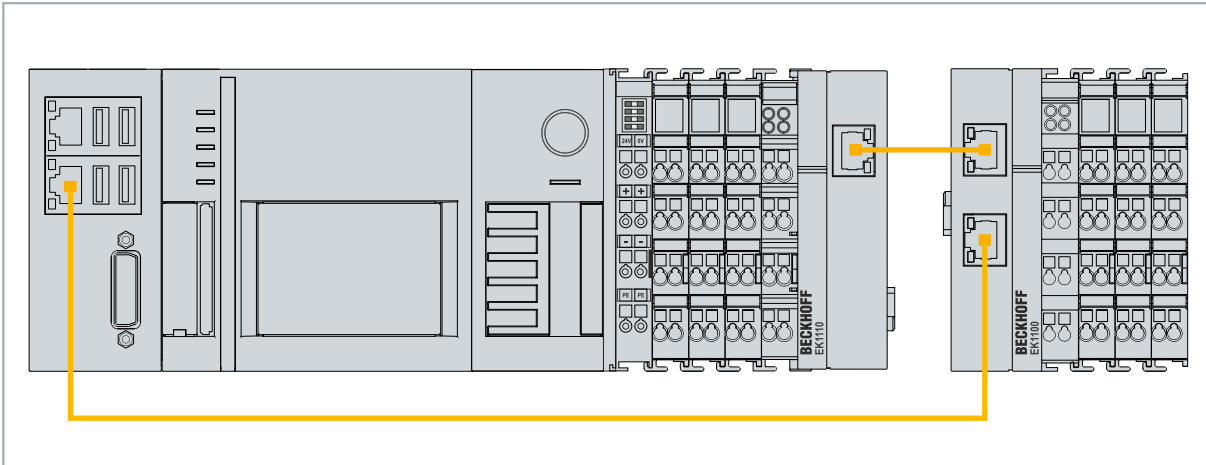
Fig. 27: Example configuration of a CX20x3 with EtherCAT cable redundancy.

Interference at the individual terminals is not intercepted by the cable redundancy.

Table 32: Cable redundancy, hardware for sample configuration.

Type	Description
Embedded PC	Is the EtherCAT master in the example.
EK1110 Bus Coupler	EtherCAT extension can be used to extend an EtherCAT segment by up to 100 m.
EK1100 Bus Coupler	The Bus Coupler relays the EtherCAT signal to connected EtherCAT Terminals.
EtherCAT Terminals	Any number of EtherCAT Terminals can be connected to the Embedded PC and the Bus Coupler.

Requirements:

- In TwinCAT 3 the supplement is already included and only has to be licensed.
- Hardware wired as EtherCAT ring (see Fig.: Smallest possible configuration for EtherCAT cable redundancy) and added in TwinCAT.

Configure EtherCAT cable redundancy as follows:

1. In the tree view click on the EtherCAT master.
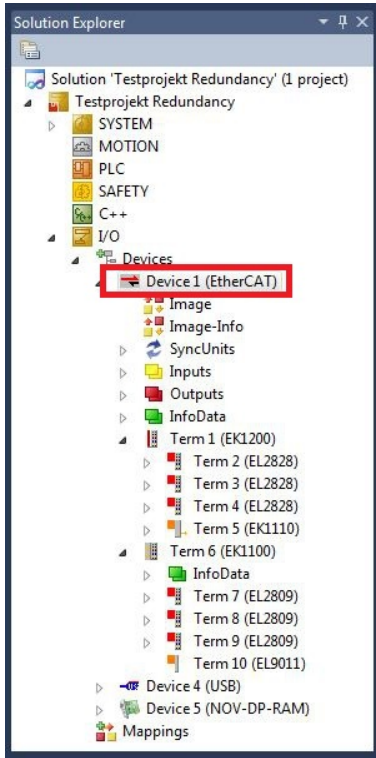
2. Click on the **EtherCAT** tab, then **Advanced Settings**.
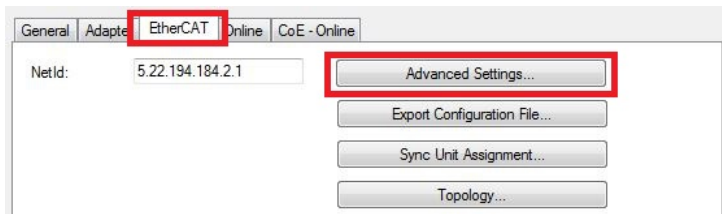
3. Click on **Redundancy** in the structure tree on the left.

4. Click the **Second Adapter** option and then the **Search** button.

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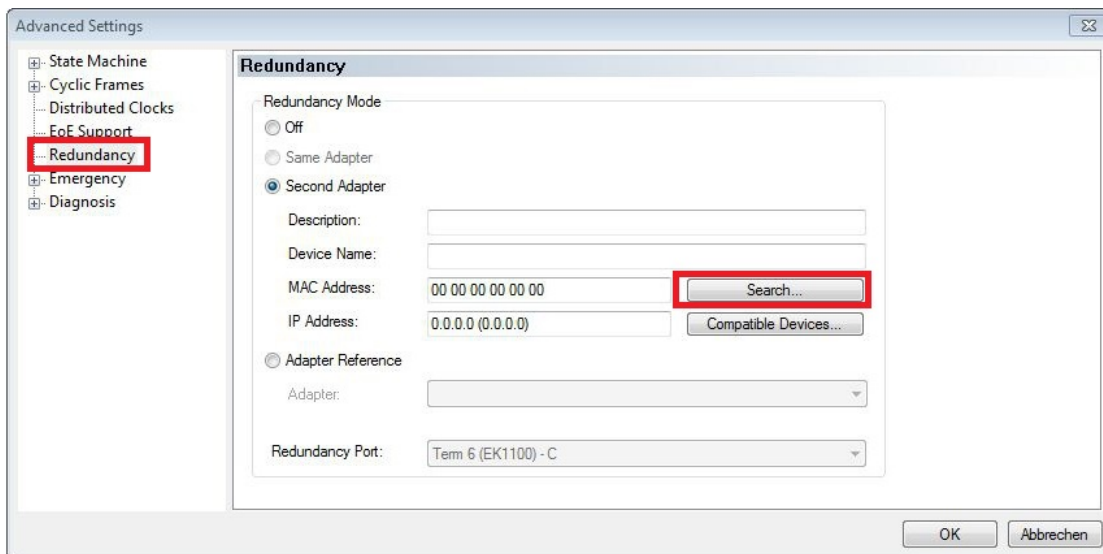
5. Select the appropriate LAN connection according to your cabling at the embedded PC.
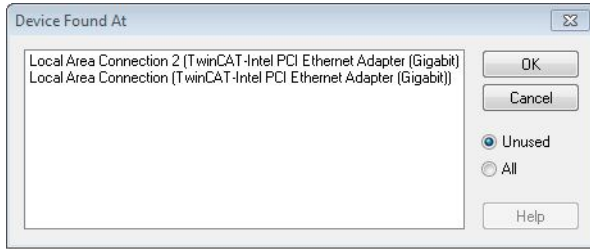
6. Confirm your settings with **Ok**.

⇨ You have successfully configured cable redundancy. The EtherCAT slaves configured for cable redundancy are displayed in the **Online** tab.

The state of the individual EtherCAT slaves can be found in the **State** column. If, for example, the cable connection between the EK1100 and EK1110 Bus Couplers is interrupted, the status of the Bus Coupler changes. The message "LINK_MIS B" and "LINK_MIS A" then appears in the State column.

Although the connection between the Bus Couplers is interrupted, the EtherCAT Terminals connected to the EK1100 Bus Coupler do not have a fault.

If the cable connection is interrupted at the same point without cable redundancy, a fault is displayed for the terminals in the State column.

7.4.5   Using a hardware watchdog

The function block **FB_PcWatchdog_BAPI** activates a hardware watchdog on the Embedded PC. The watchdog can be used to automatically restart systems that have entered an infinite loop or where the PLC has stopped.

The watchdog is activated with **bExecute** = TRUE and **nWatchdogTimeS** >= 1s.

Once the watchdog has been activated, the function block must be called cyclically and at shorter intervals than nWatchdogTimeS, because the Embedded PC automatically restarts if the set time is less than nWatchdogTimeS.

NOTICE

Unwanted restart

The watchdog restarts the Embedded PC as soon as the time set for nWatchdogTimeS elapses.

Be aware of this behavior and disable the watchdog if you use breakpoints, carry out a PLC reset or an overall reset, stop TwinCAT, switch to config mode or activate the configuration.

Requirements:

- Tc2_System library.
- TwinCAT v3.1.0
- A previously created PLC project in TwinCAT.

Locating the function block in TwinCAT:

1. Double-click on **Tc2_System** in the tree view under **PLC > PLC project > References**.
   The Library Manager appears.
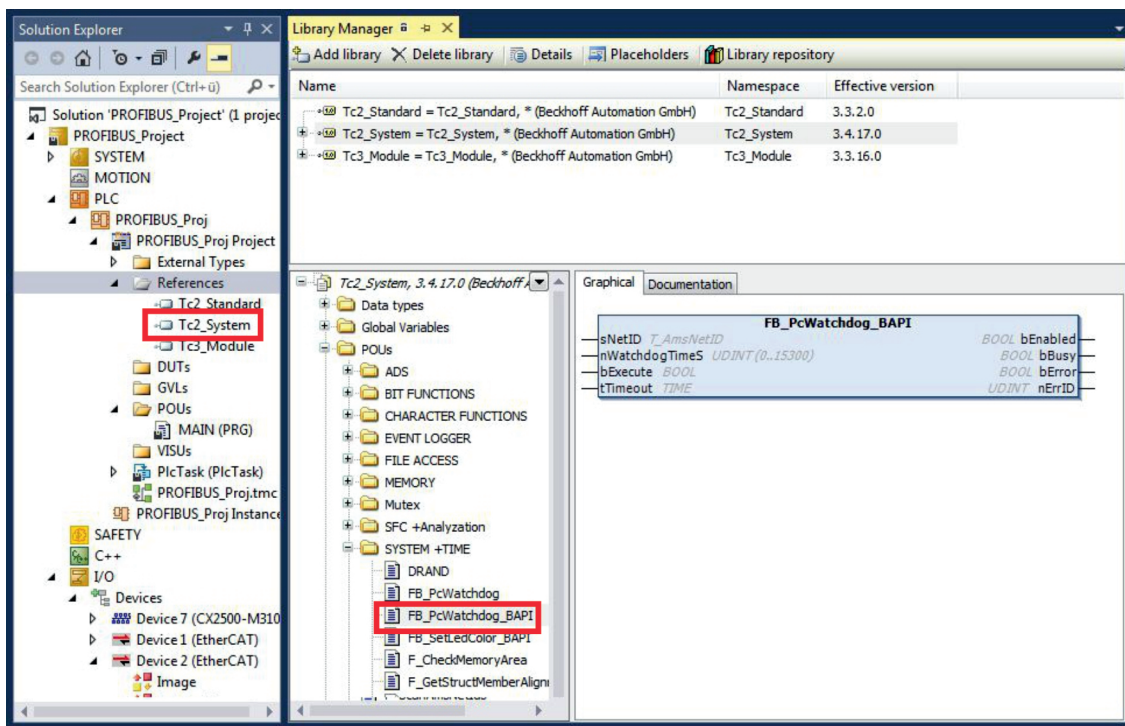
2. Under **Tc2_System > POUs > SYSTEM +TIME** click on the function block **FB_PcWatchdog_BAPI**.

   ⇒ The description of the function block can then be found under the **Documentation** tab or in the library description under: FB_PcWatchDog_BAPI. If necessary, you can install the **Tc2_System** library at a later stage via the **Add Library** button in the Library Manager.

8   NOVRAM

The NOVRAM can be used to reliably save important variable values, such as production data or counter values, in the event of a power failure. The memory size of the NOVRAM is limited and only suitable for smaller data quantities up to 63 kB.

In this chapter we show you how the NOVRAM is used in TwinCAT 3.

Functioning

The NOVRAM (Non-Volatile Random Access Memory) is a special memory component that is used to reliably save important data. The NOVRAM consists of two sections, a volatile memory and a non-volatile memory.

TwinCAT only writes to the volatile section of the NOVRAM. In the event of a power failure, the data are automatically copied from the volatile memory into the non-volatile memory. The energy required for this process is supplied by a capacitor. As soon as the power supply is restored, the data are automatically copied back into the volatile memory, so that TwinCAT can continue to use them.
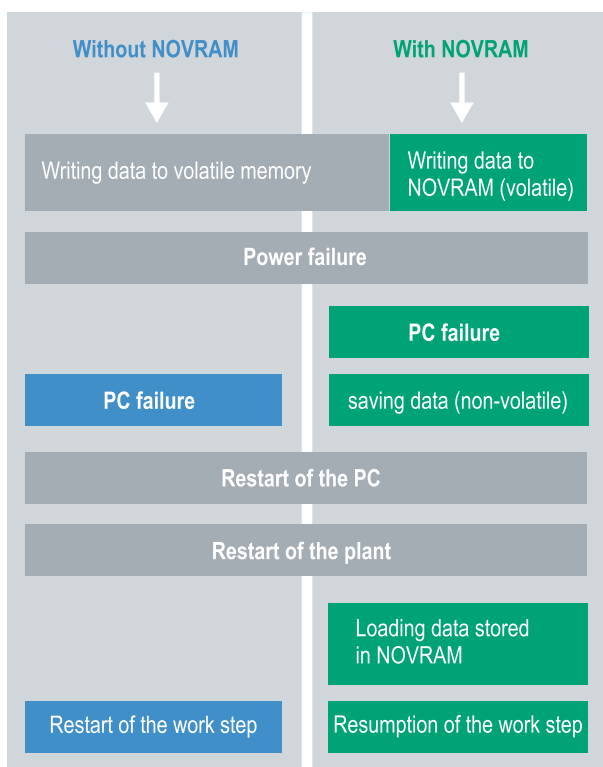
Fig. 28: Controller behavior with and without NOVRAM.

Memory size

The NOVRAM has a capacity of 128 kB. However, for reasons of data consistency, effectively less than 63 kB of data can be securely saved in the NOVRAM. The data are saved cyclically and alternately based on the dual buffer principle, in order to avoid the risk of data inconsistency.

Requirements

Development environ-ment	Target platforms	Hardware	PLC libraries to include
TwinCAT 3.1 Build: 4020	PC or CX (x86, x64, ARM)	CX70xx, CX9020, CX20x0, CX20x2, CX20x3	Tc2_IoFunctions

8.1 Creating a Retain Handler

Under TwinCAT 3 (from Build 4020) a delta algorithm is used to save data in the NOVRAM. The algorithm does not save all the variables in the NOVRAM. Instead, it searches for changes (delta function) compared to the previous cycle and only saves variables that have changed.

To use the delta algorithm, a Retain Handler must be created in TwinCAT 3, and the relevant variables must be declared in the PLC with the keyword VAR_RETAIN.

A new feature of this method is that no function blocks have to be used. The Retain Handler saves data in the NOVRAM in the event of a power failure and makes them available again once the power has been restored.

This chapter describes how to create a Retain Handler in TwinCAT 3. The Retain Handler saves data in the NOVRAM and makes them available again. In other words, important variable values such as production data or counter values are retained during a restart or power failure.

Requirements for this step:

- TwinCAT 3.1 Build: 4020.
- A target device selected in TwinCAT.

Create the Retain Handler as follows:

1. Right-click on **Devices** in the tree view on the left-hand side.
2. In the context menu click on **Scan**.
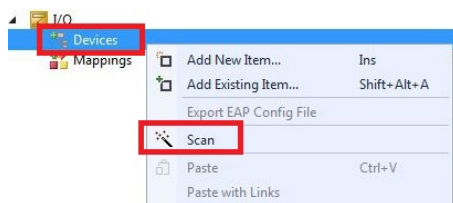
3. Select **Device (NOV-DP-RAM)** and confirm with **OK**.
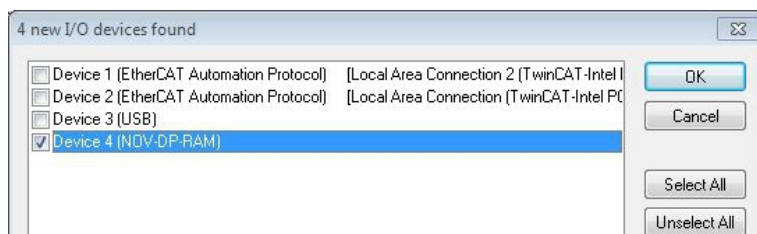
4. Click on **Yes** to search for boxes.

5. Click on **Device (NOV-DP-RAM)** in the tree view on the left-hand side and then on the tab **Generic NOV-DP-RAM Device**.
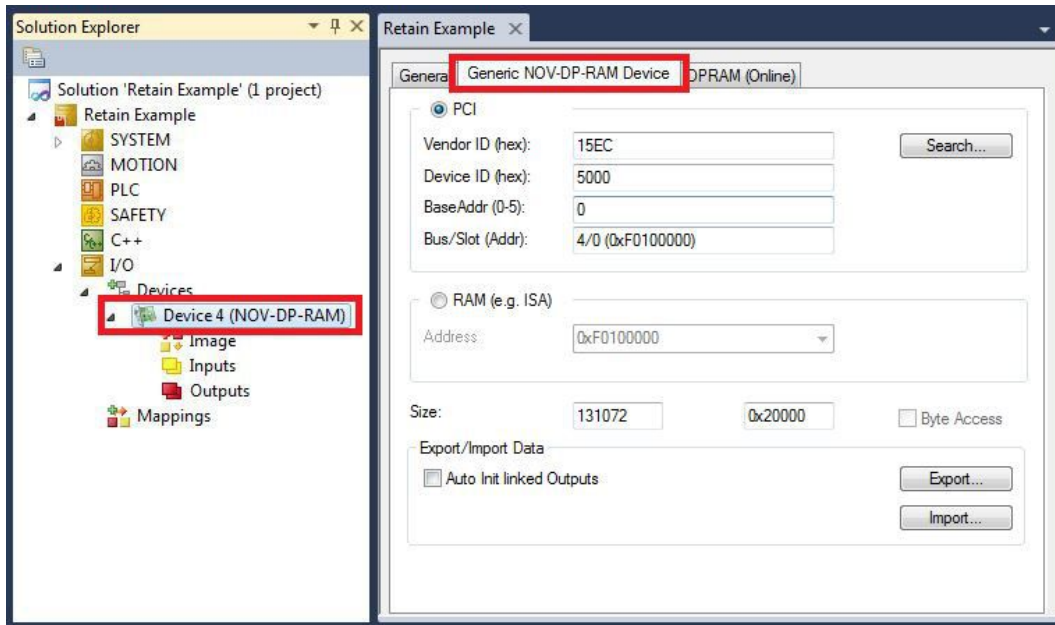
6. Click the option **PCI**.

7. Right-click on **Device (NOV-DP-RAM)** in the tree view and then on **Add New Item**.
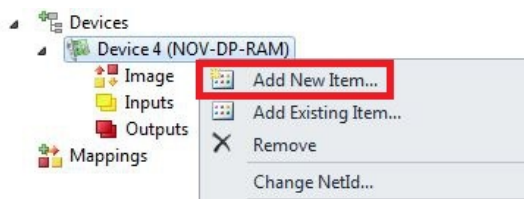
8. Select the **Retain Handler** and click on **OK**.
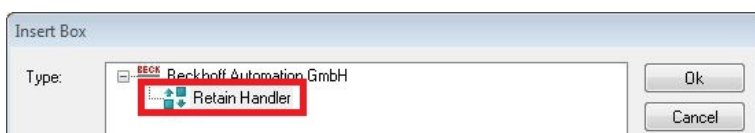
⇨ You have successfully created a Retain Handler in TwinCAT.
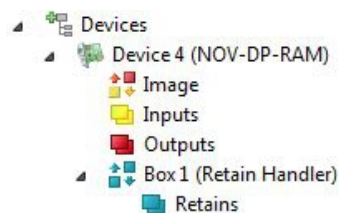
In the next step you can create retain variables in the PLC and link them with the Retain Handler.

8.2   Creating and linking variables

Once you have created a Retain Handler in TwinCAT, you can declare variables in the PLC and link them to the Retain Handler. The variables have to be identified in the PLC with the keyword VAR_RETAIN.

Prerequisite for this step:

- A PLC project created in TwinCAT.

Create variables as follows:

1. Create the variables in your PLC project in a VAR RETAIN area.

2. Click on **Build** in the toolbar at the top, then on **Build Solution**.
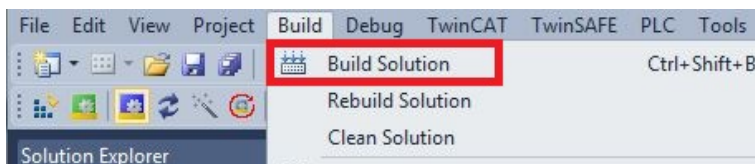
3. Click on **PLC Instance** in the tree view on the left and then on the tab **Data Area**.

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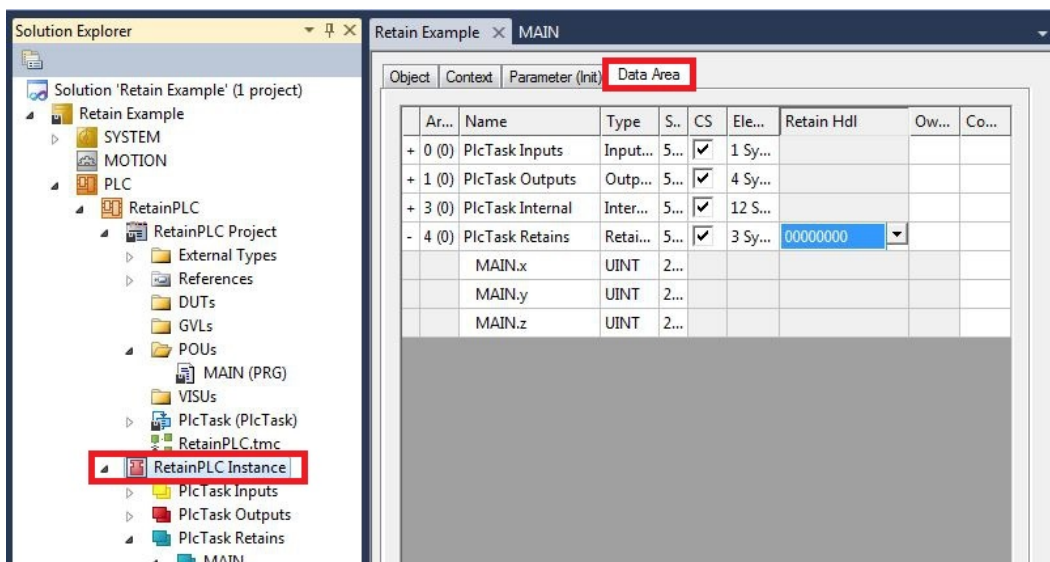
4. Under **Retain Hdl**, select the Retain Handler that you have created.

⇨ After selecting a Retain Handler as a target, the symbols in the tree view are linked and a mapping is created.
In the tree view the variables are created from the PLC under the Retain Handler and linked to the variables from the PLC instance.
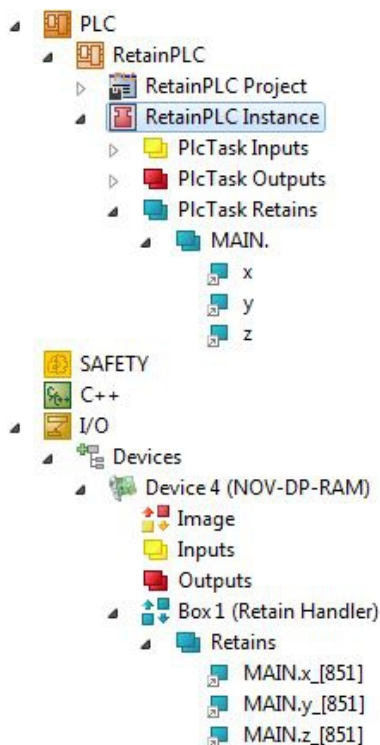
An existing link is displayed with an arrow symbol.

8.3   Writing speed of the Retain Handler

The Retain Handler takes a certain amount of time to search for changes (delta function) in the variables and save them in the NOVRAM.

The following diagrams provide an overview of how long the Retain Handler needs to save a particular data quantity in the NOVRAM. Use the diagrams to select your task cycle time such that a particular data quantity is saved in the NOVRAM within the selected task cycle time.
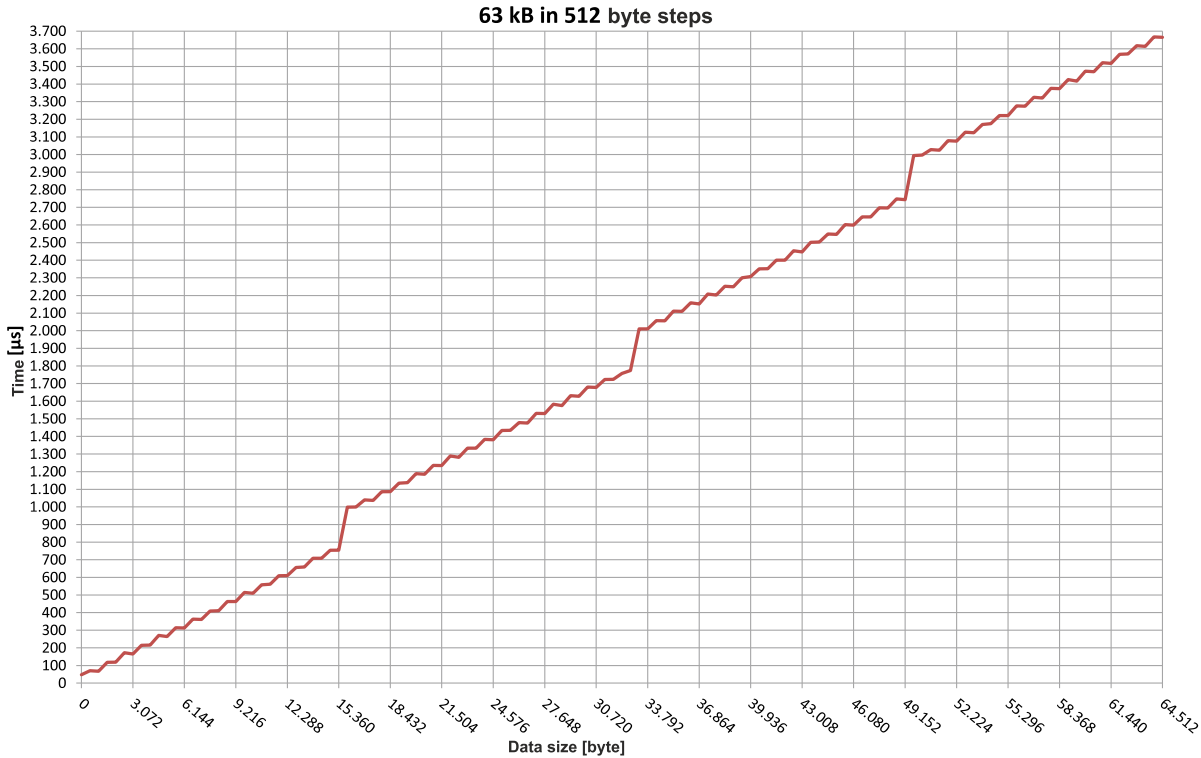
Fig. 29: Retain Handler write speed, up to 63 kB in 512 byte steps.
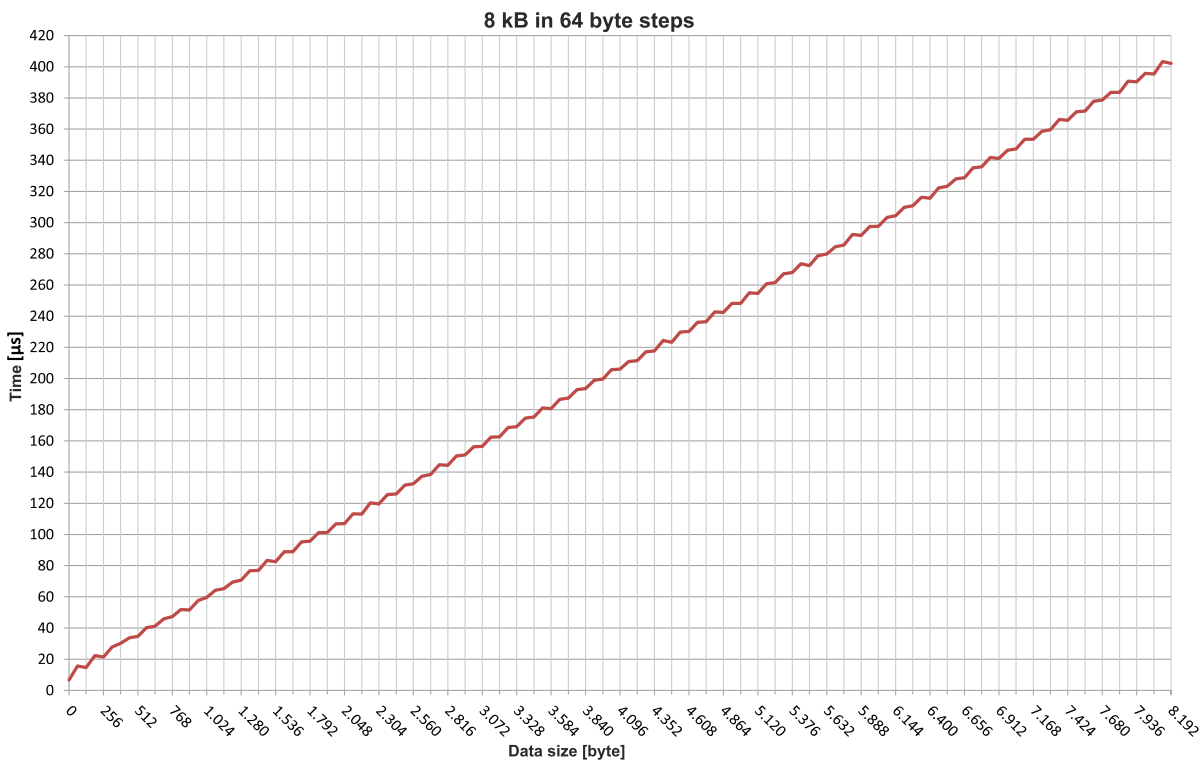
Fig. 30: Retain Handler write speed, up to 8 kB in 64 byte steps.

8.4 Deleting variables under the Retain Handler

If variables are deleted from the PLC, the link with the Retain Handler is cancelled. However, the variables continue to be shown under the Retain Handler and are not deleted automatically.

Under TwinCAT 3 the variables have to be deleted manually.

Prerequisites for this step:

- Variables declared with VAR_RATAIN were deleted from the PLC.

Delete the variables under the Retain Handler as follows:

1. The variable GVL_Retain.iNt under the Retain Handler is to be deleted.
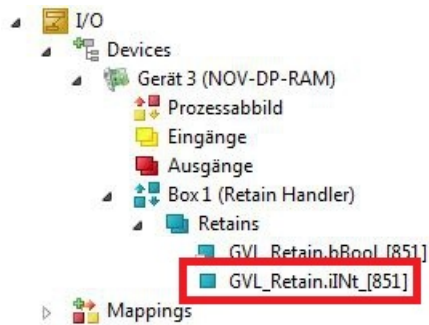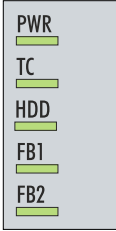
2. Right-click on the **Retain Handler** in the tree view on the left.
3. In the context menu click on **Optimize Retain Variables**.
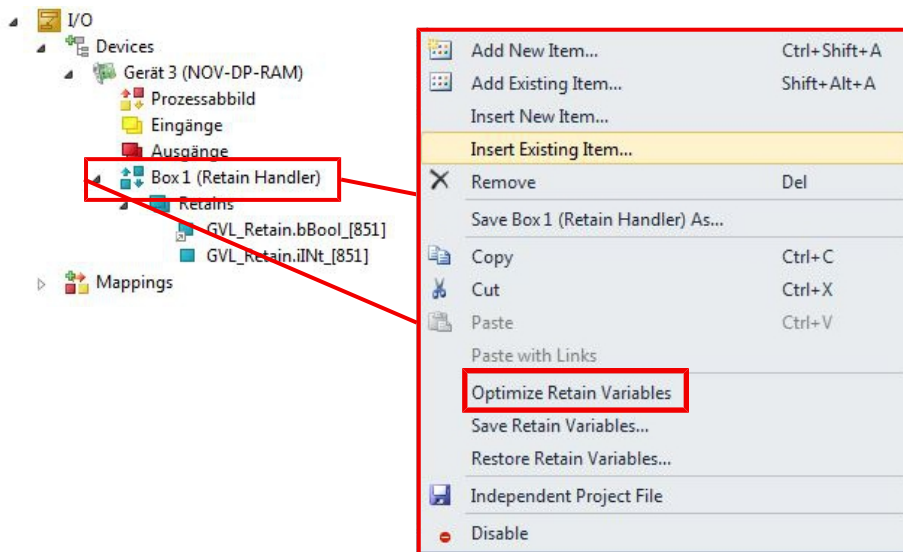
⇨ The variable under the Retain Handler is deleted.

9 Error handling and diagnostics
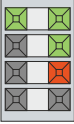
9.1 Diagnostic LEDs

Display	LED	Meaning
PWR TC HDD FB1 FB2	PWR	Power supply The power LED lights green if the device is connected to a power supply unit and the unit is switched on.
	TC	TwinCAT status LED TwinCAT is in Run mode (green) TwinCAT is in Stop mode (red) TwinCAT is in Config mode (blue) Error or crash of the PLC (yellow). Applies only to TwinCAT 3
	HDD	Read/Write storage medium (red) Indicates an access to the storage medium.
	FB1	Status LED1 for fieldbus (the function is described under the fieldbus interface)
	FB2	Status LED2 for fieldbus (the function is described under the fieldbus interface)

9.1.1 K-bus

The power supply unit checks the connected Bus Terminals for errors. The red LED "K-bus ERR" is off if no error is present. The red LED "K-bus ERR" flashes if Bus Terminal errors are present.

Table 33: Diagnostic LEDs in K-Bus mode.

Display	LED	Meaning
Us 24 V Up 24 V K-BUS RUN K-BUS ERR	Us 24 V	Power supply for basic CPU module. The LED lights green if the power supply is correct.
	Up 24V	Power supply for terminal bus. The LED lights green if the power supply is correct.
	K-BUS RUN	Diagnostic K-bus. The green LED lights up in order to indicate fault-free operation. "Error-free" means that the communication with the fieldbus system is also running.
	K-BUS ERR	Diagnostic K-bus. The red LED flashes to indicate an error. The red LED blinks with two different frequencies.

The frequency and number of the flashes can be used to determine the error code and the error argument. An error is indicated by the "K-bus ERR" LED in a particular order.

Table 34: K-bus ERR LED, fault indication sequence through the LED.

Order	Meaning
Fast blinking	Starting the sequence
First slow sequence	**Error code**
No display	Pause, the LED is off
Second slow sequence	**Error code argument**

Count how often the red LED K-bus ERR flashes, in order to determine the error code and the error argument. In the error argument the number of pulses shows the position of the last Bus Terminal before the error. Passive Bus Terminals, such as a power feed terminal, are not included in the count.

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Table 35: K-BUS ERR LED, fault description and troubleshooting.

Error code	Error code argument	Description	Remedy
Persistent, continuous flashing		EMC problems.	• Check power supply for undervoltage or overvoltage peaks. • Implement EMC measures. • If a K-bus error is present, it can be localized by a restart of the power supply (by switching it off and then on again)
3 pulses	0	K-bus command error.	• No Bus Terminal inserted. • One of the Bus Terminals is defective; halve the number of Bus Terminals attached and check whether the error is still present with the remaining Bus Terminals. Repeat this procedure until the faulty Bus Terminal has been found.
4 pulses	0	K-bus data error, break behind the power supply unit.	Check whether the Bus End Terminal 9010 is connected.
	n	Break behind Bus Terminal n	Check whether Bus Terminal n+1 after the power supply unit is connected correctly; replace if necessary.
5 pulses	n	K-bus error in register communication with Bus Terminal n.	Replace Bus Terminal at location n.
6 pulses	0	Error at initialization.	Replace Embedded PC.
	1	Internal data error.	Hardware reset of the Embedded PC (switch off and back on again).
	8	Internal data error.	Hardware reset of the Embedded PC (switch off and back on again).
7 pulses	0	Process data lengths of the set and actual configurations do not correspond.	Check the configuration and the Bus Terminals for consistency.

For some error the LED "K-BUS ERR" does not go out, even if the error was rectified. Switch the power supply for the power supply unit off and back on again to switch off the LED after the error has been rectified.

State variable

In TwinCAT there is a State variable under the Bus Coupler for K-bus diagnostics.
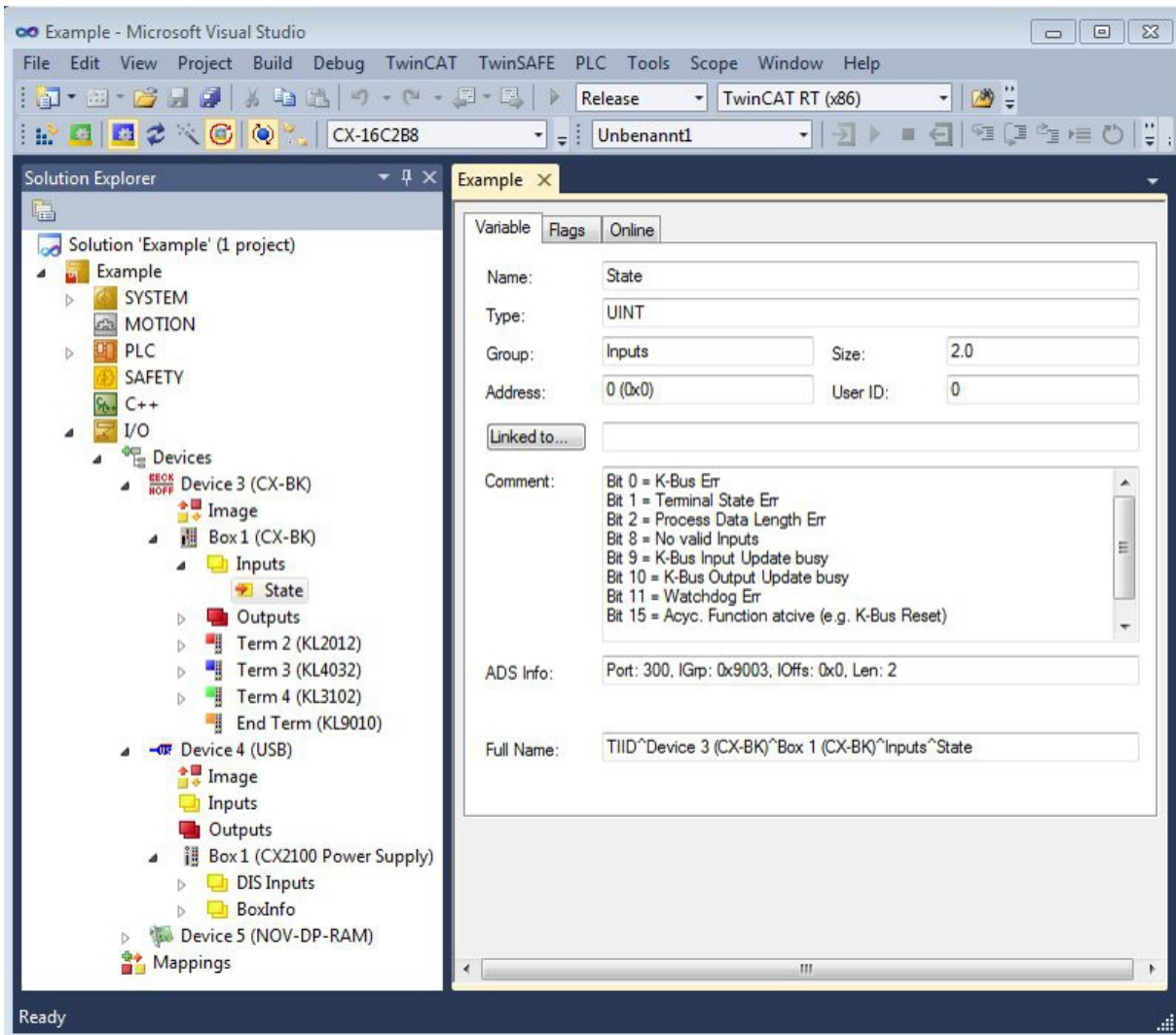
Fig. 31: Status variable for error handling and diagnostics under TwinCAT.

If the value is "0", the K-bus operates synchronous and without error. If the value is <> "0" there may be a fault, or it may only be an indication that the K-bus cycle is longer than the task. In which case it would no longer be synchronous with the task. The task time should be faster than 100 ms. We recommend a task time of less than 50 ms. The K-bus update time typically lies between one and five ms.

Table 36: Description of the State variable values.
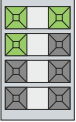
Bit	Description
Bit 0	K-bus error.
Bit 1	Terminal configuration has changed since the start.
Bit 2	Process image lengths do not match.
Bit 8	(still) no valid inputs.
Bit 9	K-bus input update not yet complete.
Bit 10	K-bus output update not yet complete.
Bit 11	Watchdog.
Bit 15	Acyclic K-bus function active (e.g. K-bus reset).

If there is a K-bus error, this can be reset via the IOF_DeviceReset function block (in the TcIoFunctions.lib).

9.1.2   E-bus

The power supply unit checks the connected EtherCAT Terminals. The "L/A" LED is lit in E-bus mode. The "L/A" LED flashes during data transfer.

Table 37: Diagnostic LEDs in K-Bus mode.

Display	LED		Meaning
Us 24 V ▨ ▨ Up 24 V L/A ▨ □ ▧ □ ▧ □	Us 24 V		Power supply for basic CPU module. The LED lights green if the power supply is correct.
	Up 24 V		Power supply for terminal bus. The LED lights green if the power supply is correct.
	L / A	off	E-bus not connected.
		on	E-bus connected / no data traffic.
		flashes	E-bus connected / data traffic on the E-bus.

9.2   Faults

Table 38: Possible faults and their correction.

Fault	Cause	Measures
No function after the Embedded PC has been switched on.	• No power supply for the Embedded PC • Other causes.	1. Check the fuse. 2. Check the supply voltage and the pin assignment. 3. Call Beckhoff support.
Embedded PC does not boot fully.	Hard disk damaged (e.g. due to switching off while software is running), incorrect setup, other causes.	1. Check setup. 2. Call Beckhoff support.
Computer boots, software starts, but control system does not operate correctly.	Cause of the fault is either in the software or in parts of the plant outside the Embedded PC.	Call the manufacturer of the machine or the software.
Error during CFast card access.	Faulty CFast card, faulty card slot.	1. Use another CFast card to test the card slot. 2. Call Beckhoff support.
Embedded PC only works partially or temporarily.	Defective components in the Embedded PC.	Call Beckhoff support.
The time and date are no longer saved.	The service life of the battery is exceeded	Replace the battery.
Fan is not turning.	Fan faulty.	Replace the fan cartridge.
CX20x0 with Windows Embedded Compact 7 does not find new hardware (e.g. extension modules).	The Embedded PC only searches for new hardware at the PCI bus on first startup.	Delete the folder "Documents and Settings" on the CFast card. See: Scan for new hardware

Please make a note of the following information **before** contacting Beckhoff service or support:

1. Precise device ID: CXxxxx-xxxx.
2. Serial number.
3. Hardware version.
4. Any interfaces (N030, N031, B110, ...).
5. TwinCAT version used.
6. Any components / software used.

The quickest response will come from support / service in your country. Therefore please contact your regional contact. Check on our website at www.beckhoff.de or ask your distribution partner.

10 Care and maintenance

10.1 Replace the battery

NOTICE
Risk of explosion
An incorrectly inserted battery may explode and damage the Embedded PC.
Only use original batteries and ensure that the positive and negative poles are inserted correctly.

The battery must be replaced every 5 years. Spare batteries can be ordered from Beckhoff Service. A CR2032 battery (3 V, 225 mAh) is used in the Embedded PC.

The battery compartment is below the front flap. The battery stores the time and date. The time and date are reset if the battery is removed. Be aware of this behavior for your hardware and software configuration and reset the time and date in the BIOS after a battery change. All other BIOS settings remain unchanged and are retained.

Requirements:

• The Embedded PC is switched off.

Replace the battery as follows:

1. Lever the front flap open with a screwdriver and remove it.
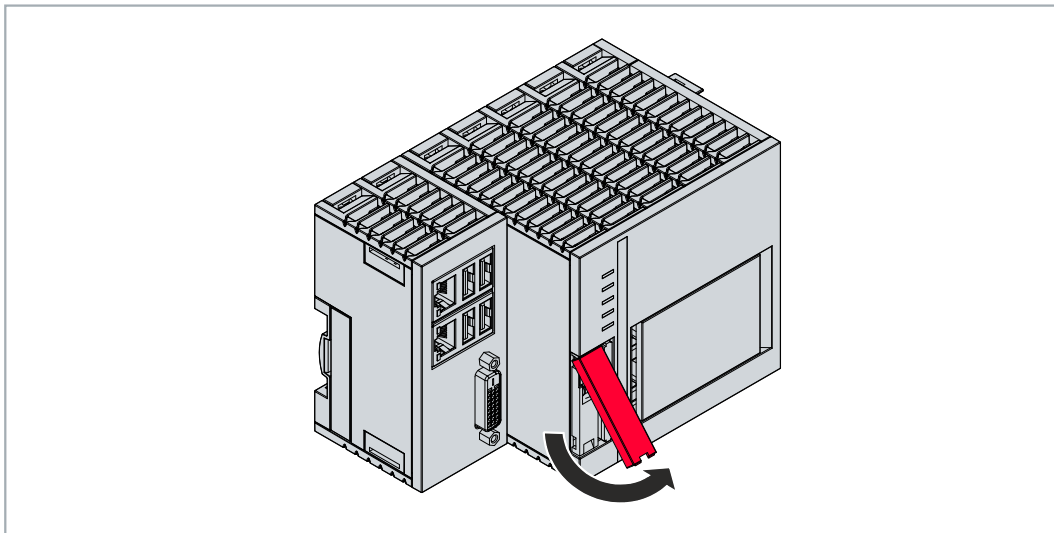
2. Carefully pull the battery from the bracket.
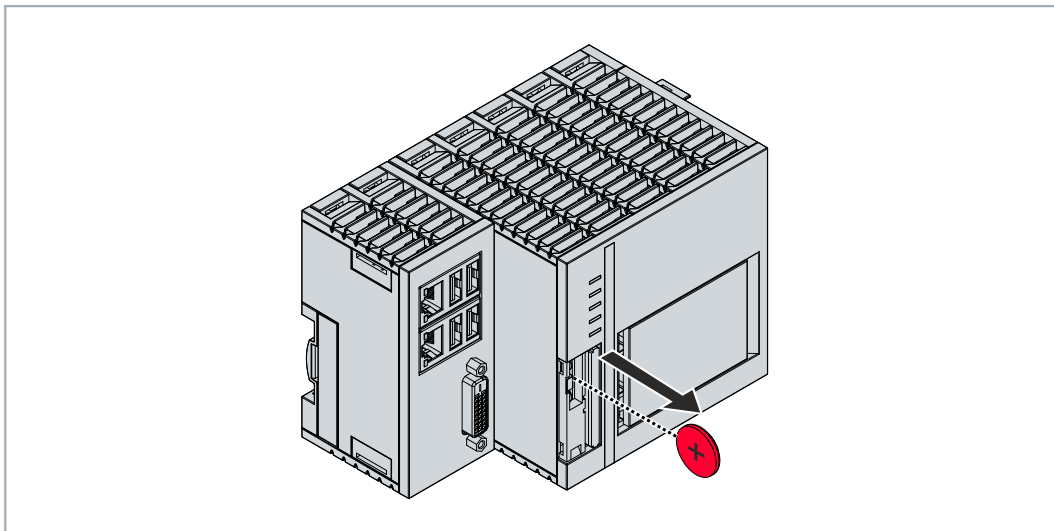
3. Push the new battery into the battery compartment. The positive pole points to the left towards the DVI-I interface.

⇨ The battery change is complete. Close the front flap and reset the date and time in the BIOS.

BECKHOFF

10.2   Replace the fan cartridge

ℹ **Service life**

The fan cartridge must be replaced every 5 years. Spare fan cartridges can be ordered from Beckhoff Service.

Replace the fan cartridge of the CX20x3 if:

- the fan cartridge has been in use for 5 years
- or the fan speed is less than 1000 rpm.

In a CX20x3 Embedded PC, the fan speed is controlled depending on the temperature.

Table 39: In the CX20x3, the fan control and speed depend on the temperature.

Temperature	Fan control	Fan speed
up to 40°C	0%	2400 rpm
40°C … 85°C	0% … 100%, controlled linearly	2400 rpm…5900 rpm, controlled linearly
above 85°C	100%	5900 rpm

Use the IPC diagnostics and monitor the fan speed to determine a fan fault.

Access to the fan status is described in the documentation for the Beckhoff Device Manager:https://infosys.beckhoff.com/content/1031/devicemanager/index.html?id=8733183011738041650

To replace the fan cartridge, follow these instructions:

1. Open the front flap using a screwdriver.
2. Pull the old fan cartridge out of the housing.
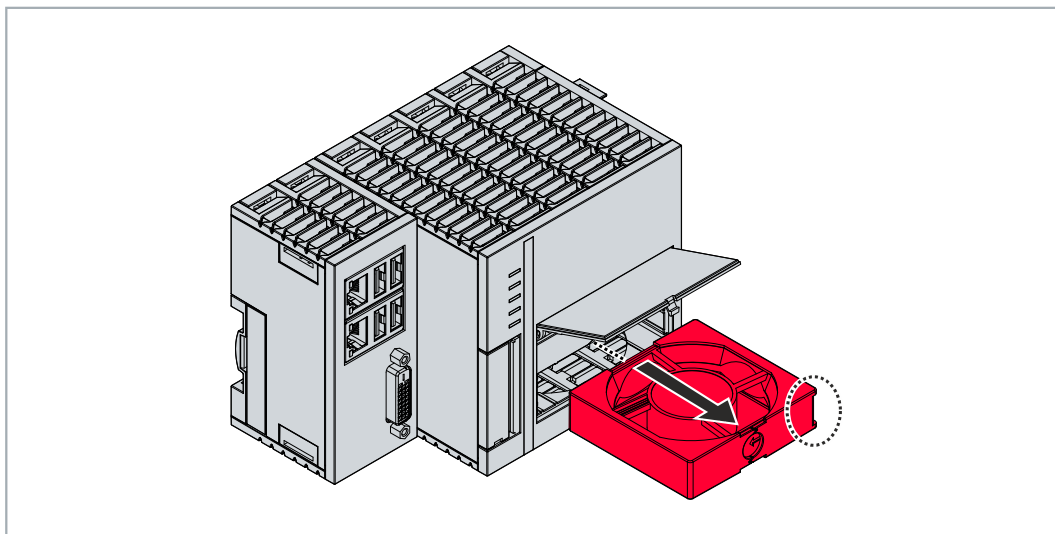
3. Push the new fan cartridge into the housing, leading with the contacts first. The guide rails on the fan match the guide rails in the housing.

⇨ Close the front flap. When the fan starts again, this means you have successfully changed the fan cartridge.

10.3   Cleaning the Embedded PC

⚠ CAUTION
Risk of electric shock
Live devices or parts can cause electric shocks. Disconnect the Embedded PC from the power supply before cleaning.

Clean only the housing of the Embedded PC. Use a soft, moist cleaning cloth for this. Make sure that the ventilation slots of the device are always free and do not clog up.

The following cleaning agents and materials are unsuitable and may cause damage:

- corrosive cleaning agents
- solvents
- scouring agents
- hard objects

11 Decommissioning

11.1   Removing cables

NOTICE
Electrical voltage
If the power supply is switched on during dismounting, this can lead to damage to the Embedded PCs. Switch off the power supply for the Embedded PCs during dismounting.

Before dismantling the Embedded PC, shut down the Embedded PC and switch off the power supply. Only then can you remove all the cables. Also remove all cables from the first terminal after the power supply terminal.

Requirements:

- Terminate your software and shut down the Embedded PC.
- Switch off the power supply.

Remove the cables as follows:

1. Remove the cabling from the Embedded PC.
2. Remove the wiring from the first terminal next to the power supply terminal.
3. Pull the orange strap to remove the first terminal after the power supply terminal by pulling it forward.
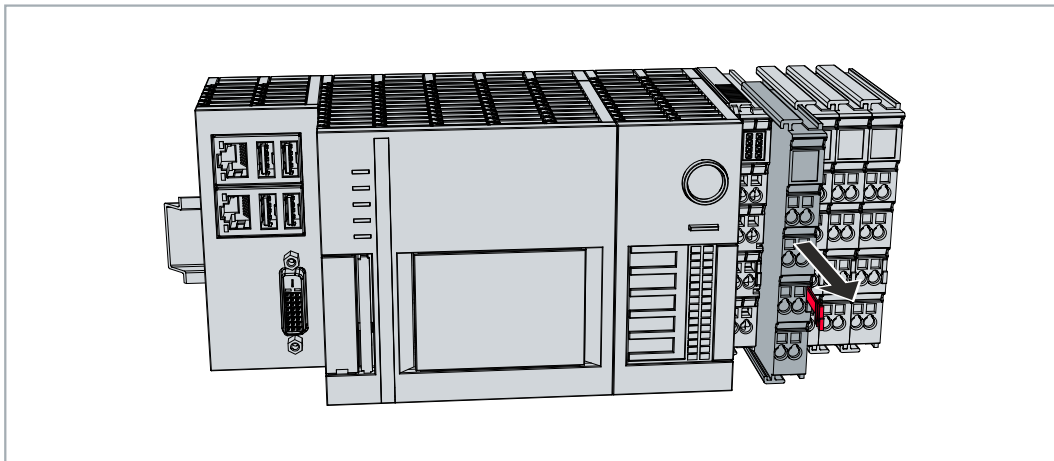
⇨ In the next step the Embedded PC can be removed from the DIN rail and dismantled.
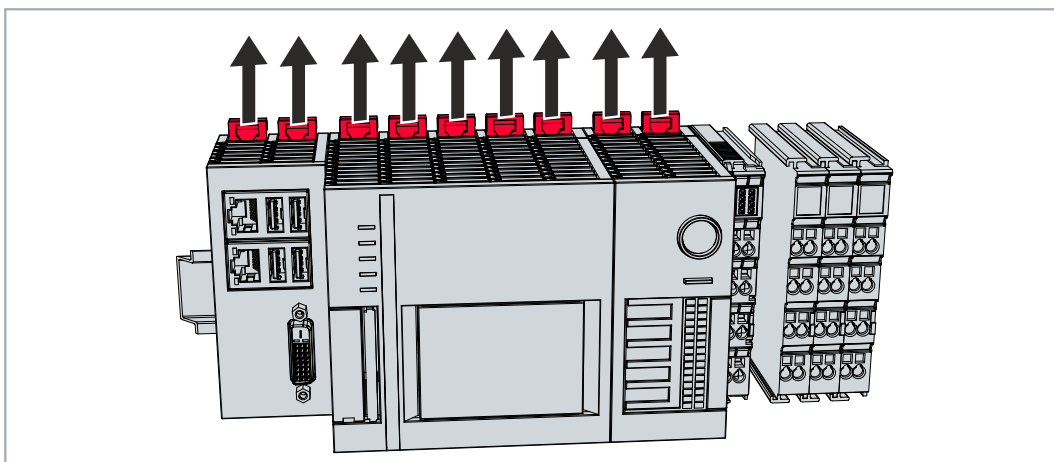
11.2   Dismantling the Embedded PC

This chapter explains how to dismantle the Embedded PC and remove it from the DIN rail.

Requirements:

- All cables were removed from the Embedded PC.

Dismantle the Embedded PC as follows:

1. Release the DIN rail mounting by pushing the latches outwards with a screwdriver.
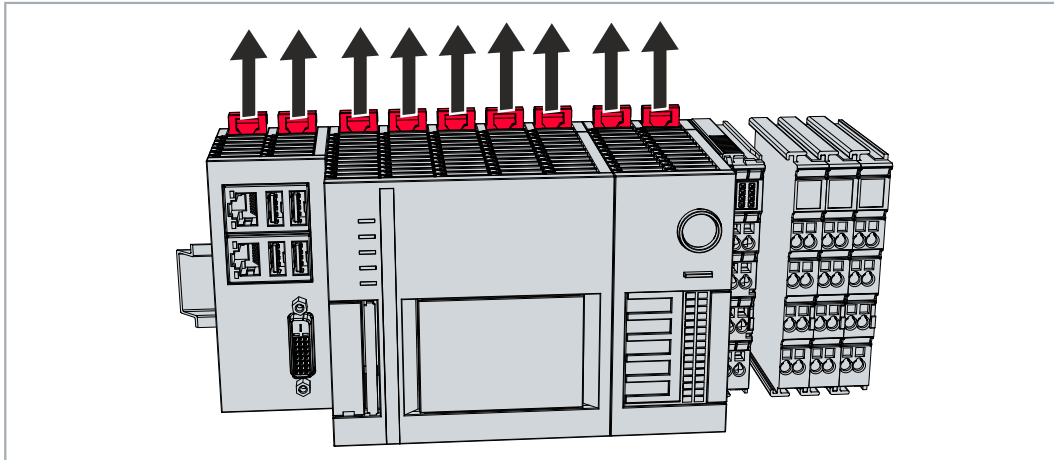
2. Pull the orange strap on the power supply terminal and gently remove the device from the DIN rail.
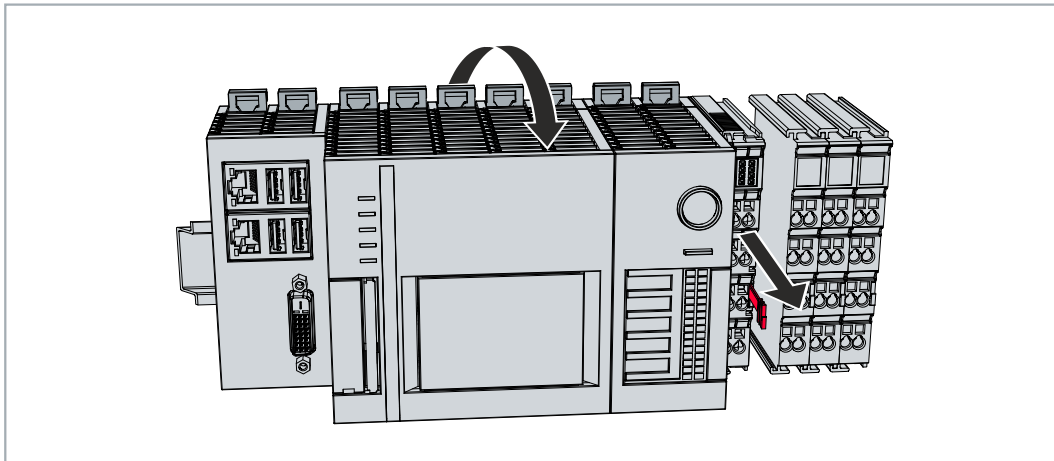
⇨ You have removed the Embedded PC successfully.

Disposal

The device must be fully dismantled in order to dispose of it. Electronic components must be disposed of according to national electronic waste regulations.

12 Technical data

Table 40: Technical data, dimensions and weights.

	CX2033	CX2043
Dimensions (W x H x D)	144 mm x 99 mm x 91 mm	
Weight	approx. 1165 g	approx. 1230 g

Table 41: Technical data, general data.

Technical data	CX2033	CX2043
Processor	AMD Ryzen™ V1202B 2.3 GHz, 2 cores	AMD Ryzen™ V1807B 3.35 GHz, 4 cores
Main memory	8 GB DDR4 RAM (optionally expandable)	
Flash memory	Plug-in for CFast card, card not included	
NOVRAM integrated	128 kB	
Power supply	24 V DC (-15 %/+20 %)	
Max. power consumption	42 W	70 W
Dielectric strength	500 V (supply / internal electronics)	
Operating system	Microsoft Windows 10 IoT Enterprise LTSC, TwinCAT/BSD	
Control software	TwinCAT 2 Runtime, TwinCAT 3 Runtime (XAR)	
Secure element	fTPM 2.0 (UEFI BIOS and 64-bit Windows 10 version 1809 or higher required)	
Diagnostics LED	1 x power, 1 x TC status, 1 x flash access, 2 x bus status	
Clock	Internal battery-backed clock for time and date (battery replaceable)	
Approvals	CE, UL	

Table 42: Technical data, I/O terminals.

Technical data	Description
I/O connection	via power supply unit (E-bus or K-bus, automatic recognition)
Power supply for I/O terminals	max. 2A
Power contacts current load	max. 10 A
Process data on the K-bus	max. 2048 bytes input and 2048 bytes output
max. number of terminals (K-bus)	64 (255 with K-bus extension)
max. number of terminals (E-bus)	up to 65534 terminals.

Table 43: Technical data, environmental conditions.

Technical data	Description
Ambient temperature during operation	-25° C ... +60° C
Ambient temperature during storage	-40° C ... +85° C see notes under: Transport and storage [▶ 10]
Relative humidity	95% no condensation
Vibration resistance	conforms to EN 60068-2-6
Shock resistance	conforms to EN 60068-2-27
EMC immunity	conforms to EN 61000-6-2
EMC emission	conforms to EN 61000-6-4
Protection rating	IP 20

Table 44: Technical data, graphic specifications.

Technical data	CX2033	CX2043
Graphic	AMD Radeon™ Vega 3 graphics	AMD Radeon™ Vega 11 graphics
Shader model	6.4	
DirectX	12	
OpenGL	4.6	

Table 45: Technical data, interfaces.

Technical data	Description
LAN	2 x RJ 45, 10/100/1000 Mbit/s
USB	4 x USB 3.0 each rated at 900 mA, type A
DVI-D	Resolution on the monitor in pixels: 640 x 480 to 1920 x 1200

Table 46: Technical data, optional interfaces.

Technical data	Description
DVI-D	Resolution on the monitor in pixels: 640 x 480 to 1920 x 1200
DisplayPort	Resolution on the monitor in pixels: max. 2560x1600
RS232	D-sub connector, 9-pin Electrical isolation 500 V
RS422/RS485	D-sub connector, 9-pin Electrical isolation 500 V
EtherCAT slave	2 x RJ 45, EtherCAT IN and OUT 100 Mbaud
PROFIBUS	D-sub connector, 9-pin 9.6 kbaud to 12 Mbaud
CANopen	D-sub connector, 9-pin 10 kbaud to 1,000 kbaud
PROFINET RT	2 x RJ-45 switches

13 Appendix

13.1 Accessories

Table 47: CFast cards

Order number	Description
CX2900-0038	40 GB CFast card, 3D flash, extended temperature range
CX2900-0040	80 GB CFast card, 3D flash, extended temperature range
CX2900-0042	160 GB CFast card, 3D flash, extended temperature range

Table 48: HDD/SSD

Order number	Description
CX2900-0401	Hard disk, SATA, 2½-inch, 1 TB
CX2900-0503	Solid-state disk SSD, SATA, 3D flash, 2½-inch, 240 GB
CX2900-0504	Solid-state disk SSD, SATA, 3D flash, 2½-inch, 480 GB
CX2900-0505	Solid-state disk SSD, SATA, 3D flash, 2½-inch, 960 GB

larger capacities on request

Table 49: Spare battery for CX systems.

Order number	Description
CX1900-0102	Replacement battery, suitable for CX10x0, CX50x0, CX51x0, CX5110-01xx-9020, CX52x0, CX56x0, CX90x0, CX20xx and CX8100 – Lithium button cell type CR2032, 3 V/225 mAh

Table 50: Further spare parts.

Order number	Description
CX2900-0101	Housing locking clips (black) for CX52x0, CX56x0 and CX20xx. 10 locking sets of two clips each.
CX2900-0102	Cover for left-side bus connector, 5 pieces
CX2900-0103	Replacement fan cartridge for CX2040, CX2042, CX2062, CX2072 and CX2020, CX2030 with fan option. – Tray consisting of chassis and 60 mm fan – simple exchange in the field due to wireless installation – Weight: approx. 30 g – Dimensions (W x H x D): 66 x 67 x 16 mm
CX2900-0104	Connector set (spare part) for connecting CX2100-0914 UPS module and CX2900-0192 battery pack
CX2900-0105	Replacement hood for CX2550-0020 2½-inch SSD/HDD module
CX2900-0106	Replacement frame for CX2550-0020 2½-inch SSD/HDD module

13.2   Certifications

FCC Approvals for the United States of America

FCC: Federal Communications Commission Radio Frequency Interference Statement

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Approval for Canada

FCC: Canadian Notice

This equipment does not exceed the Class A limits for radiated emissions as described in the Radio Interference Regulations of the Canadian Department of Communications.

13.3   Support and Service

Beckhoff and their partners around the world offer comprehensive support and service, making available fast and competent assistance with all questions related to Beckhoff products and system solutions.

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Our download finder contains all the files that we offer you for downloading. You will find application reports, technical documentation, technical drawings, configuration files and much more.

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