BECKHOFF New Automation Technology

Manual | EN

CX51x0

Embedded-PC



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EUROTEC
TECNOLOGIE IMPIANTISTICHE - AUTOMAZIONE - TELECONTROLLO

Table of contents

1 Notes on the documentation 7
1.1 Representation and structure of warnings 8
1.2 Related documents 9
1.3 Documentation issue status 9
2 For your safety 10
2.1 Intended use 10
2.2 Staff qualification 11
2.3 Safety instructions 11
3 Transport and storage 13
4 Product overview 14
4.1 Configuration of the CX51x0 Embedded PC 15
4.2 Name plate 16
4.3 Types 17
4.4 Architecture overview 19
5 Description of the interfaces 21
5.1 USB (X100, X101, X102, X103) 21
5.2 Ethernet RJ45 (X000, X001) 22
5.3 DVI-I (X200) 23
5.4 Optional interfaces 24
5.4.1 DVI-D (N010) 24
5.4.2 DisplayPort (N011) 25
5.4.3 Audio interface (N020) 26
5.4.4 RS232 (N030) 27
5.4.5 RS422/RS485 (N031) 28
5.4.6 EtherCAT slave (B110) 30
5.4.7 PROFIBUS (x310) 31
5.4.8 CANopen (x510) 32
5.4.9 PROFINET RT (x930) 33
6 Commissioning 34
6.1 Assembly 34
6.1.1 Note the permissible installation positions 34
6.1.2 Attaching on mounting rail 36
6.1.3 MicroSD card installation and removal 37
6.1.4 CFast card installation and removal 38
6.1.5 Installing passive EtherCAT Terminals 39
6.2 Connecting the power supply 40
6.3 Switching on 42
6.4 Switching off 42
7 Configuration 43
7.1 Windows Embedded Compact 7 43
7.1.1 Setting up the audio interface (N020) 43
7.2 Windows Embedded Standard 7 P 44
7.2.1 Identification of the Ethernet interfaces (X000, X001) 44

7.2.2 Enabling jumbo frames ... 45
7.2.3 Set NIC Teaming ... 46
7.2.4 Restoring the Beckhoff real-time driver. ... 48
7.3 Windows 10 IoT Enterprise LTSB ... 49
7.3.1 Identification of the Ethernet interfaces (X000, X001) ... 49
7.3.2 Enabling jumbo frames ... 50
7.3.3 Set NIC Teaming ... 51
7.3.4 Restoring the Beckhoff real-time driver ... 53
7.3.5 Using serial interfaces N030/N031 ... 54
7.4 Beckhoff Device Manager ... 55
7.4.1 Starting the Beckhoff Device Manager ... 55
7.4.2 Enabling a remote display ... 56
7.4.3 Starting a remote connection ... 57
7.5 TwinCAT ... 58
7.5.1 Tree view ... 58
7.5.2 Searching for target systems ... 59
7.5.3 Scanning an Embedded PC ... 61
7.5.4 Configure the serial interface (N03x) ... 62
7.5.5 Configuring EtherCAT cable redundancy. ... 64
7.5.6 Using a hardware watchdog ... 66

8 1-second UPS (persistent data) ... 68
8.1 BIOS settings ... 69
8.2 Windows write filter ... 71
8.3 FB_S_UPS_CX51x0 ... 72
8.4 Mode and status of the function block ... 74
8.5 Checking the validity of the variables ... 75
8.5.1 SYSTEMINFOTYPE ... 75
8.5.2 PlcAppSystemInfo ... 77

9 Error handling and diagnostics ... 78
9.1 Diagnostic LEDs ... 78
9.2 Power supply terminal LEDs in K-bus mode ... 79
9.3 Power supply terminal LEDs in E-bus mode ... 82
9.4 Faults ... 83

10 Care and maintenance ... 84
10.1 Replace the battery ... 84

11 Decommissioning ... 85
11.1 Removing cables ... 85
11.2 Dismantling the Embedded PC ... 86

12 Technical data ... 87

13 Appendix ... 89
13.1 Accessories ... 89
13.2 Certifications ... 90
13.3 Support and Service ... 91

List of tables ... 92

List of figures **94**

1 Notes on the documentation

This description is only intended for the use of trained specialists in control and automation engineering who are familiar with the applicable national standards.
It is essential that the documentation and the following notes and explanations are followed when installing and commissioning the components.
It is the duty of the technical personnel to use the documentation published at the respective time of each installation and commissioning.

The responsible staff must ensure that the application or use of the products described satisfy all the requirements for safety, 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 prior announcement.
No claims for the modification of products that have already been supplied may be made on the basis of the data, diagrams and descriptions in this documentation.

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Patent Pending

The EtherCAT Technology is covered, including but not limited to the following patent applications and patents:
EP1590927, EP1789857, EP1456722, EP2137893, DE102015105702
with corresponding applications or registrations in various 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

Serious risk of injury

Hazard with high risk of death or serious injury.

⚠ WARNING

Risk of injury

Hazard with medium risk of death or serious injury.

⚠ CAUTION

Slight risk of injury

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

Warnings relating to damage to property or the environment:

NOTE

Damage to the environment or devices

There is a potential hazard to the environment and equipment.

Notes showing further information or tips:

Tip or pointer

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 Related documents

Information on operation in potentially explosive atmospheres

Please refer to the corresponding documentation for important information and notes regarding operation of the CX51x0 Embedded PCs in potentially explosive atmospheres. In particular, read and follow the sections on safety contained in this document:

http://www.beckhoff.de

Document name
Notes on using the CX51x0 in potentially explosive atmospheres.

Retaining the documentation

This documentation is part of the Embedded PC. Keep the documentation in the immediate vicinity of the device throughout its entire service life. Ensure that personnel have access to the documentation at all times. Pass on the documentation to subsequent users, and in addition ensure that all supplementary information is included in the documentation.

1.3 Documentation issue status

Version	Modifications
0.1	Provisional version (original version)
1.0	First release
1.1	UL note expanded
1.2	Values changed in chapter 1-second UPS
1.3	Architecture overview added
1.4	Description of the diagnostic LEDs revised
1.5	Notes on driver support for serial interfaces added
1.6	Chapter Versions revised
1.7	Chapter 1-second UPS revised
1.8	Documentation restructured and revised
1.9	Notes on operation in potentially explosive atmospheres added.
2.0	Technical data, graphic card specifications adapted.
2.1	Chapter on serial interfaces N030/N031 added.
2.2	Chapter Beckhoff Device Manager revised
2.3	Chapter "RS232 (N030)" adapted.
2.4	Chapter "Power supply" adapted.
2.5	Chapter Technical data adapted.
2.6	Chapter “Types” and “Device Manager” revised.
2.7	Chapter “Connecting the power supply” revised.

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 CX51x0 Embedded PC is a control system and is intended for mounting on a DIN rail in a control cabinet or terminal box. The Embedded PC series is used in conjunction with Bus Terminals for recording digital or analog signals from sensors and transferring them to actuators or 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.

Potentially explosive atmospheres

Device modification CX2900-0107 is mandatory for operation of the Embedded PC in potentially explosive atmospheres, zone 2/22. The device modification includes a factory-installed retainer bracket for mechanically securing the plug connectors.

The device modification is mandatory for operating the Embedded PC in the following potentially explosive atmospheres:

1. For Zone 2 atmospheres in which gas is present as a combustible material. Zone 2 means that an explosive atmosphere does usually not occur during normal operation, or only for a short time.
2. For Zone 22 atmospheres in which dust is present as a combustible material. Zone 22 means that an explosive atmosphere in the form of a cloud does usually not occur during normal operation, or only for a short time.

The Embedded PC must be installed in a housing, which ensures protection class IP 54 for gas according to EN 60079-15. A housing with protection class IP 54 is required for non-conductive dust. IP 6X is required for conductive dust according to EN 60079-31.

Improper use

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

- In potentially explosive atmospheres, the Embedded PC may not be used in other zones except for 2/22 and not without a suitable housing.
- Areas with an aggressive environment, e.g. aggressive gases or chemicals.
- Living areas. 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 attenuation of 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.

Explosion protection

Device modification CX2900-0107 is mandatory for operation of the Embedded PC in potentially explosive atmospheres, zone 2/22. The device modification entails the modification and relocation of the device label and a factory-fitted retainer bracket for mechanically securing the connectors.

⚠ WARNING

Operation without device modification

Without the CX2900-0107 device modification, the USB plug connectors may slip out of the USB ports due to vibration, which may trigger a deflagration or explosion.

The Embedded PC must only be used with the device modification, and the USB plug connectors must be secured to the retainer brackets with cable ties.

Tighten the screws of the DVI plug connector and, if present, also the screws of the fieldbus plug connectors, in order to prevent the plug connectors slipping out. Only use RJ45 connectors with an intact latch. Use cable ties to secure the USB plug connectors and RJ45 connectors to the retainer brackets.

The CXxxxx-N020 optional interface (audio interface) may not be used in potentially explosive atmospheres.

The Embedded PC must be installed in a housing, which ensures protection class IP54 for gas according to EN 60079-15. A housing with protection class IP54 is required for non-conductive dust. IP6X is required for conductive dust according to EN 60079-31.

Observe the temperature at the cable entry points into the housing. If the temperature during nominal operation is higher than 70 °C at the entry points or higher than 80 °C at the wire branching points, cables must be selected that are designed for these high temperatures and operation in potentially explosive atmospheres.

Maintain the prescribed ambient temperature during operation. The permissible ambient temperature lies within the range from 0 °C ... +60 °C.

Take measures to prevent the rated operating voltage exceeding 119 V through short-term interference voltages.

Switch off the power supply and ensure that no explosive atmosphere occurs when:

- Bus Terminals are connected or removed,
- the Embedded PC is wired or cables are connected,
- the front flap is opened,
- the CFast card, MicroSD card or battery is replaced.

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 pin assignment.
- 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. Regularly change the passwords.
- 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

- Use up-to-date security software. The safe function of the PC can be compromised by malicious software such as viruses or Trojans.
- The sensitivity of a PC against malicious software increases with the number of installed and active software.
- Uninstall or disable unnecessary software.

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

Document name
Documentation about IPC Security

3 Transport and storage

Transport

NOTE

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

- mechanical stress and
- use the original packaging.

Table 1: Dimensions and weight of the individual modules.

	CX5120	CX5130	CX5140
Dimensions (W x H x D)	123 mm x 100 mm x 91 mm	142 mm x 100 mm x 91 mm	
Weight	approx. 975 g	approx. 1095 g	approx. 1095 g

Storage

- The battery should be removed if the Embedded PC is stored at temperatures above 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.
- Store the Embedded PC in the original packaging.

4 Product overview

The CX5100 product family comprises three Embedded PCs, which differ in terms of processor type, RAM and housing size. The CX51x0 Embedded PC is a full-fledged PC with the following basic configuration:

- CFast card slot,
- MicroSD card slot,
- two independent Gbit Ethernet interfaces,
- four USB 2.0 interfaces,
- and a DVI-I interface.

Suitable operating systems are Microsoft Windows 10 IoT Enterprise LTSB, Microsoft Windows Embedded Standard 7 P or Microsoft Windows Embedded Compact 7.

The Embedded PC features an internal 1-second UPS as persistent data memory. In the event of a power failure the 1-second UPS can store up to 1 MB of persistent data on the CFast card or MicroSD card.

The Embedded PC can be ordered ex factory with an optional interface. The optional interface cannot be retrofitted.

Table 2: Available optional interfaces for the CX51x0.

CX51x0-xxxx	Optional interfaces
CX51x0-N010	DVI-D, additional DVI-D socket for clone and extended display mode.[1)]
CX51x0-N011	DisplayPort, additional DisplayPort for clone and extended display mode.[1)]
CX51x0-N020	Audio interface, 3 x 3.5 mm jack plug, Line-In, Mic-In, Line-Out
CX51x0-N030	RS232, D-sub connector, 9-pin.
CX51x0-N031	RS422/RS485, D-sub socket, 9-pin.
CX51x0-B110	EtherCAT slave, EtherCAT IN and OUT (2 x RJ45).
CX51x0-M310	PROFIBUS master, D-sub socket, 9-pin.
CX51x0-B310	PROFIBUS slave, D-sub socket, 9-pin.
CX51x0-M510	CANopen master, D-sub connector, 9-pin.
CX51x0-B510	CANopen slave, D-sub connector, 9-pin.
CX51x0-M930	PROFINET RT, controller, Ethernet (2 x RJ-45).
CX51x0-B930	PROFINET RT, device, Ethernet (2 x RJ-45 switch).

[1)] Only available for CX5130 and CX5140.

Power supply terminal

The power supply terminal for the Embedded PC is located on the right-hand side. Bus Terminals (K-bus) or EtherCAT Terminals (E-bus) can be attached on the right-hand side of the power supply unit. The power supply terminal automatically recognizes the respective bus system (K-bus or E-bus).

Software

In combination with the TwinCAT automation software, the CX51x0 Embedded PC becomes a powerful IEC 61131-3 PLC with up to four user tasks.

Additionally, Motion Control tasks can also be executed. It may be possible to control several servo axes, depending on the required sampling time. In addition to simple point-to-point movements, it is possible to execute more complex multi-axis functions such as electronic gear unit, cam plate and flying saw.

In addition to real-time execution of control tasks, the TwinCAT real-time kernel ensures that enough time remains for the user interface (HMI), to communicate with the real-time components via software interfaces such as ADS or OPC.

4.1 Configuration of the CX51x0 Embedded PC

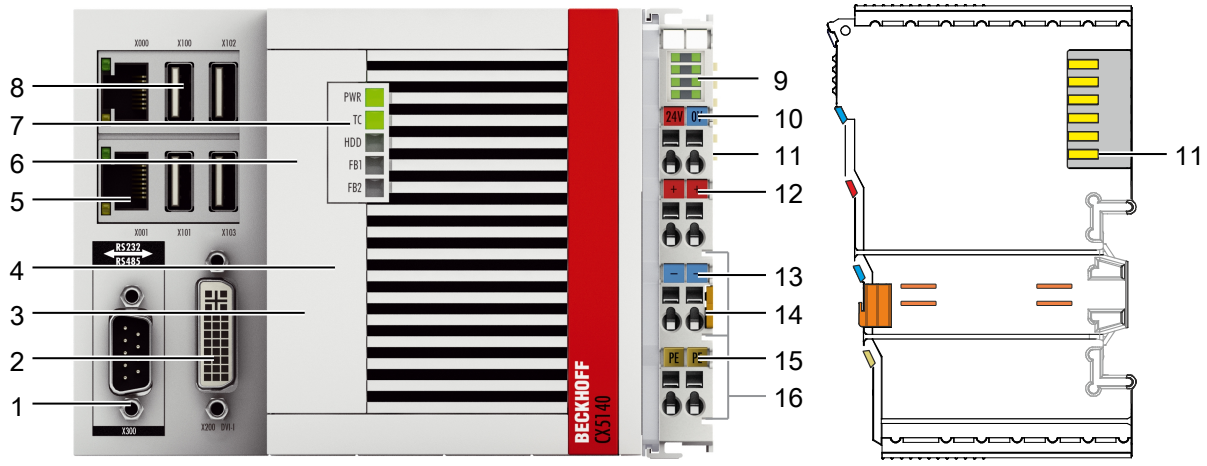


Fig. 1: Example: CX5140 Embedded PC.

Table 3: Legend for the configuration.

No.	Component	Description
1	Optional interface [▶ 24] (X300).	Space for interfaces such as RS232, EtherCAT, CANopen or others. The optional interface must be ordered ex factory and cannot be retrofitted retrospectively.
2	DVI-I interface [▶ 23] (X200).	Interface for a monitor or Panel.
3	CFast card slot [▶ 38] (under the front flap).	Slot for industrial CFast cards.
4	MicroSD card slot [▶ 37] (under the front flap).	Slot for industrial MicroSD cards.
5	RJ45 Ethernet interfaces [▶ 22] (X000, X001).	For connecting to local networks or the internet.
6	Battery compartment [▶ 84] (under the front flap).	Power supply for the battery-backed clock for time and date.
7	Diagnostic LEDs. [▶ 78]	Diagnostic LEDs for power supply, TwinCAT and the optional interface.
8	USB interfaces [▶ 21] (X100, X101, X102, X103).	Interfaces for peripherals such as mouse, keyboard or USB memory.
9	Diagnostic LEDs, power supply terminal. [▶ 79]	Diagnosis of the power supply for the Embedded PC and the Terminal Bus. Status of the E-bus and K-bus communication.
10	Spring-loaded terminals, +24 V and 0 V	Power supply for Embedded PC.
11	Terminal bus (K- or E-bus)	Interface for EtherCAT Terminals or Bus Terminals. Data exchange and supply.
12	Spring-loaded terminal, +24 V	Power supply for Bus Terminals via power contact.
13	Spring-loaded terminal, 0 V	Power supply for Bus Terminals via power contact.
14	Terminal release	Releases the power supply terminal and therefore the Embedded PC from the mounting rail.
15	Spring-loaded terminal, PE	Spring-loaded terminal for power contact PE.
16	Power contacts, +24 V, 0 V, PE	Power contacts for Bus Terminals.

4.2 Name plate

The CX51x0 Embedded PC features a name plate on the left-hand side of the housing.

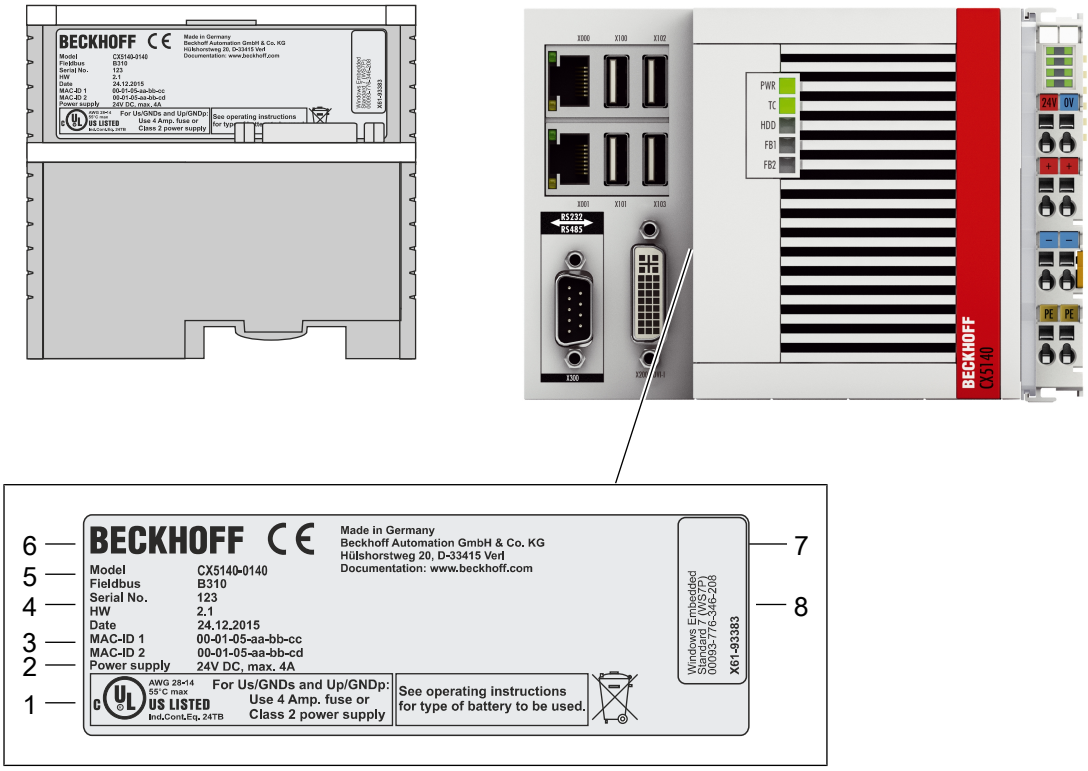


Fig. 2: CX51x0 name plate.

Table 4: Legend for the name plate.

No.	Description
1	UL approval with prescribed information on power supply, fuse, temperature and cable cross-sections.
2	Information on the power supply unit. 24 V DC, 4 A max.
3	MAC addresses of the integrated Ethernet ports. By default, the host name is formed from "CX-" plus the last 3 bytes of the MAC address: Example: the host name **CX-aabbcc** is formed from the MAC address 00-01-05-aa-bb-cc.
4	Information on: • serial number, • hardware version • and date of manufacture.
5	Information on the model. The last four numerals relate to the configuration of Embedded PC.
6	Manufacturer information including address.
7	CE compliant.
8	Windows license sticker (optional).

4.3 Types

The CX51x0 Embedded PC can be ordered with different software options. Use this overview in conjunction with the information on the name plate to ascertain the operating system and the TwinCAT version of the Embedded PC.

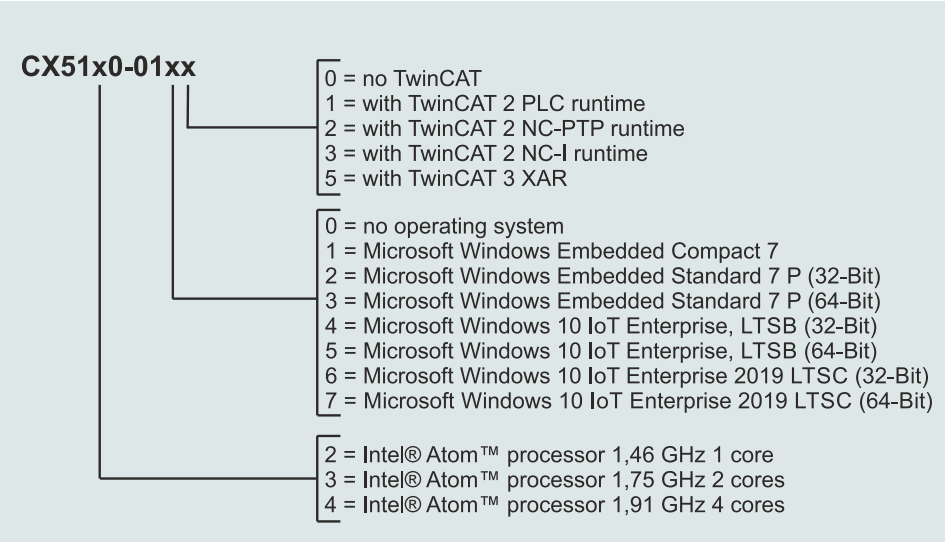


Fig. 3: Nomenclature for the CX51x0 Embedded PC.

The Embedded PCs CX5120, CX5130 and CX5140 are available with the following software options:

Table 5: Order details, CX51x0 with Windows Embedded Compact 7.

Module	no operating system	Windows Embedded Compact 7	no TwinCAT	TwinCAT 2 PLC-Runtime	TwinCAT 2 NC-PTP-Runtime	TwinCAT 2 NC-I-Runtime	TwinCAT 3 XAR
CX51x0-0100	X	-	X	-	-	-	-
CX51x0-0110	-	X[1)]	X	-	-	-	-
CX51x0-0111	-	X[1)]	-	X	-	-	-
CX51x0-0112	-	X[1)]	-	-	X	-	-
CX51x0-0113	-	X[1)]	-	-	-	X	-
CX51x0-0115	-	X[1)]	-	-	-	-	X

[1)] Only one CPU core is supported with Microsoft Windows Embedded Compact 7.

Table 6: Order details, CX51x0 with Windows Embedded Standard 7 P.

Module	Windows Embedded Standard 7 P (32-bit)	Windows Embedded Standard 7 P (64-bit)	no TwinCAT	TwinCAT 2 PLC-Runtime	TwinCAT 2 NC-PTP-Runtime	TwinCAT 2 NC-I-Runtime	TwinCAT 3 XAR
CX51x0-0120	X	-	X	-	-	-	-
CX51x0-0121	X	-	-	X	-	-	-
CX51x0-0122	X	-	-	-	X	-	-
CX51x0-0123	X	-	-	-	-	X	-
CX51x0-0125	X	-	-	-	-	-	X
CX51x0-0130	-	X	X	-	-	-	-
CX51x0-0135	-	X	-	-	-	-	X

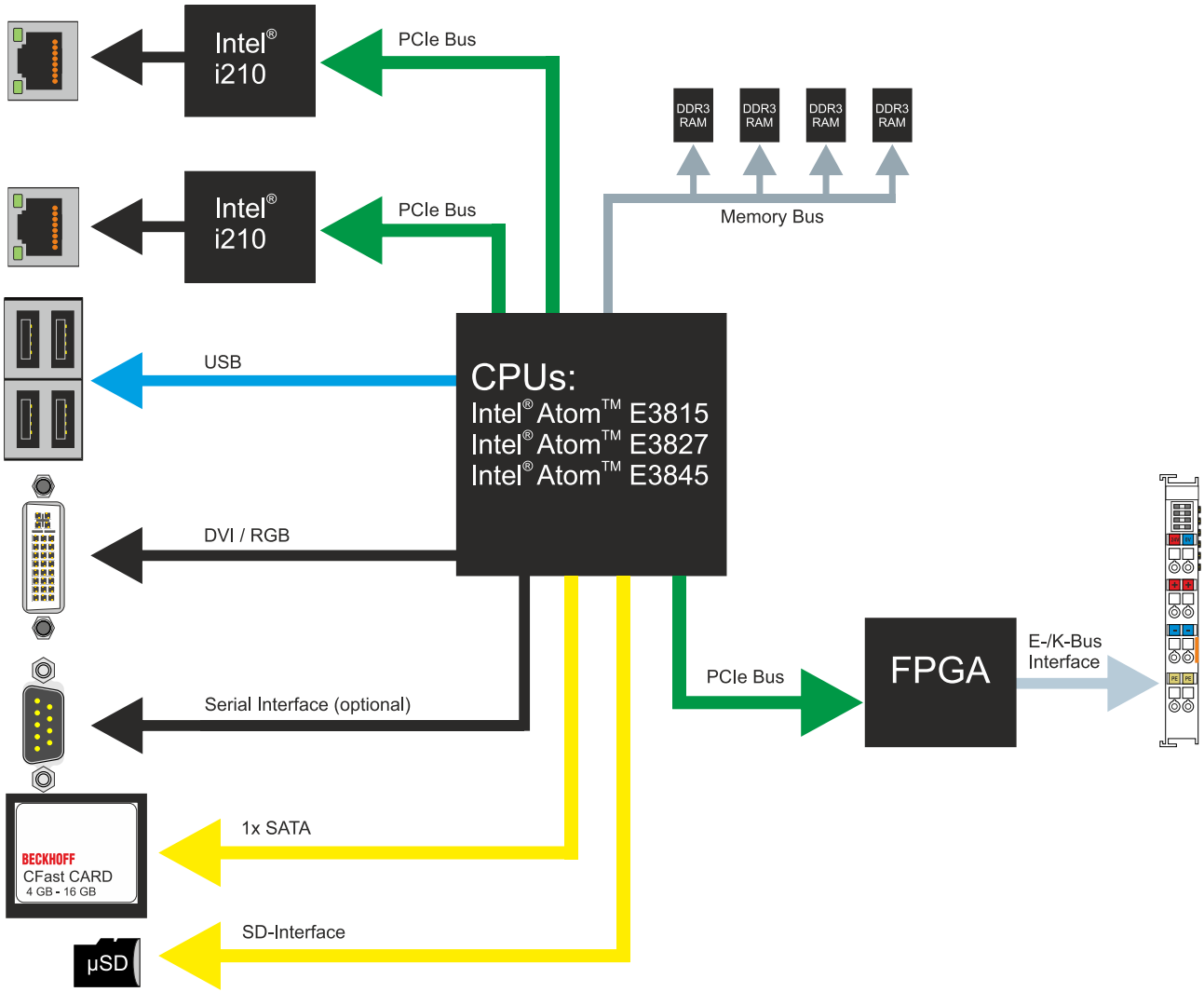
Table 7: Order details, CX51x0 with Windows 10 IoT Enterprise.

Module	Windows 10 IoT Enterprise 2016 LTSB 32-bit	Windows 10 IoT Enterprise 2016 LTSB 64-bit	Windows 10 IoT Enterprise 2019 LTSC 32-bit	Windows 10 IoT Enterprise 2019 LTSC 64-bit	no TwinCAT	TwinCAT 2 PLC-Runtime	TwinCAT 2 NC-PTP-Runtime	TwinCAT 2 NC-I-Runtime	TwinCAT 3 XAR
CX51x0-0140	X	-	-	-	X	-	-	-	-
CX51x0-0141	X	-	-	-	-	X	-	-	-
CX51x0-0142	X	-	-	-	-	-	X	-	-
CX51x0-0143	X	-	-	-	-	-	-	X	-
CX51x0-0150	-	X	-	-	X	-	-	-	-
CX51x0-0155	-	X	-	-	-	-	-	-	X
CX51x0-0160	-	-	X	-	X	-	-	-	-
CX51x0-0161	-	-	X	-	-	X	-	-	-
CX51x0-0162	-	-	X	-	-	-	X	-	-
CX51x0-0163	-	-	X	-	-	-	-	X	-
CX51x0-0170	-	-	-	X	X	-	-	-	-
CX51x0-0175	-	-	-	X	-	-	-	-	X

A CX51x0 Embedded PC with Windows Embedded Compact 7 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 Embedded Standard 7 P and Microsoft Windows 10 IoT Enterprise.

4.4 Architecture overview

The Embedded PCs of the CX51x0 family all have the same architecture. This is described below.



The CX51x0 Embedded PCs are based on the Intel Atom microarchitecture, which was developed by Intel. The following CPUs are used:

- Intel®Atom™ E3815 (Singlecore)
- Intel®Atom™ E3827 (Dualcore)
- Intel®Atom™ E3845 (Quadcore)

In addition to the arithmetic unit, the CPU also contains the memory controller and the graphics controller. The processors use the Intel® HD Graphics core. For details on the CPUs please refer to Intel. The memory is connected directly to the CPU. The Embedded PCs are available in two memory configurations: 2GB or 4GB DDR3 RAM. The memory is not extendable and must be ordered ex factory.

The CPU provides all required interfaces:

- 1 PCI lane for each of the two Intel® i210 Gigabit Ethernet controllers
- 4x USB 2.0 (interfaces)
- DVI-I and DVI-D interface (2nd interface optional in CX51x0-N010)
- Serial interface (CX51x0-N03x)
- 1 PCIe for FPGA for K-/E-bus and NOV-RAM
- 1 SATA for CFast card interface
- 1 IDE for MicroSD card interface

The interfaces (USB, DVI, and LAN) are standard interfaces. Devices that meet the corresponding standard can be connected to and operated at these interfaces. A VGA monitor can be connected to the DVI-I interface with an adapter.

Intel® i210 Gigabit Ethernet controllers are used as network controllers. There are two independent Ethernet interfaces. Both LAN interfaces are gigabit-capable.

5 Description of the interfaces

5.1 USB (X100, X101, X102, X103)

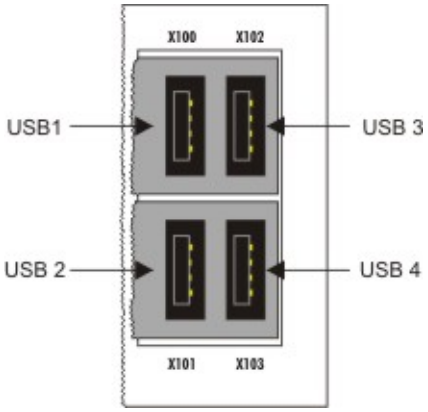


Fig. 4: USB interfaces (X100, X101, X102, X103).

The Embedded PC has four independent USB interfaces for connecting keyboards, mice, touchscreens and other input or data storage devices.

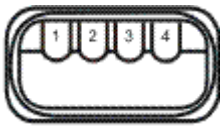


Fig. 5: USB interface, pin numbering.

Note the power consumption of the individual devices. Each interface is limited to 500 mA. The USB interface is of type A and corresponds to the USB 2.0 specification.

Table 8: USB interfaces (X100, X101, X102, X103), pin assignment.

Pin	Assignment	Typical assignment
1	VBUS	Red
2	D-	White
3	D+	Green
4	GND	Black
Shell	Shield	Drain Wire

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 delivery state the Ethernet interfaces (X000, X001) are configured for EtherCAT communication.

Note that an additional switch is required for a line topology.

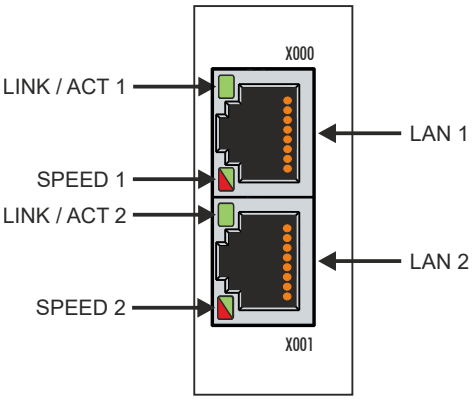


Fig. 6: Ethernet interface X000, X001.

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 is green. The LED flashes when data transfer is in progress.

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



Fig. 7: Ethernet interface, pin numbering.

Table 9: 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-I (X200)

The DVI-I interface (X200) transfers digital data and is suitable for connection to digital or analog monitors. 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.

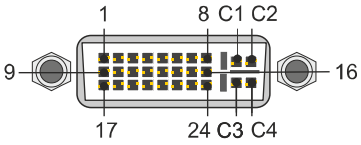


Fig. 8: DVI-I interface X200.

Table 10: DVI-I interface X200, pin assignment.

Pin	Assignment	Pin	Assignment	Pin	Assignment
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 11: DVI-I cross, pin assignment.

Pin	Assignment
C1	Analog Red Video Out
C2	Analog Green Video Out
C3	Analog Blue Video Out
C4	Analog Horizontal Sync

Table 12: DVI-I 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 2560 x 1440 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

5.4.1 DVI-D (N010)

The DVI-D interface (X300) transfers digital data and is suitable for connection to digital displays. If the optional N010 interface (DVI-D interface) is used, the first DVI-I interface can be operated either in VGA mode or in DVI mode. 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.

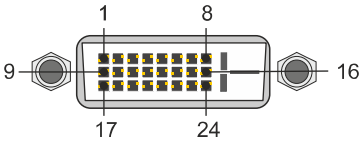


Fig. 9: DVI-D interface X300.

Table 13: DVI-D interface X300, pin assignment.

Pin	Assignment	Pin	Assignment	Pin	Assignment
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 14: 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 2560 x 1440 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.

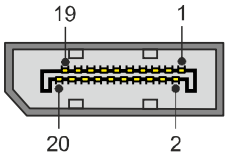


Fig. 10: DisplayPort X300.

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 15: DisplayPort, pin assignment.

Pin	Assignment	Pin	Assignment
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 16: DisplayPort X300, resolution at the monitor.

Interface	Resolution in pixels
DisplayPort	max. 2560 x 1600 @ 60 Hz
DisplayPort with adapter, DisplayPort to DVI-D	max. 1600 x 1200 @ 60 Hz

5.4.3 Audio interface (N020)

Two inputs are available: "LINE IN" (X300) and "MIC IN" (X301). The "LINE OUT" interface (X302) is intended for audio signal output. The 3.5 mm sockets are designed for jack plugs. It can also be used for connecting headphones with a maximum output of 200 mW.

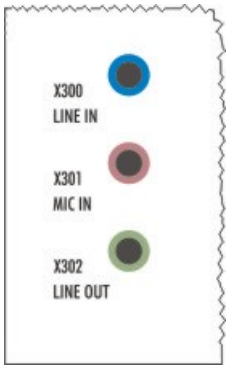


Fig. 11: Audio interface X300, X301, X302.

The audio interfaces are accessed via the operating system.

The audio interface operates in stereo mode as standard, using stereo outputs/inputs and a single-channel input for the microphone. The inputs should be connected as indicated.

Line In / Line Out jack plugs

The left channel is transferred via the tip of the jack plug, the right channel via the first ring. The remainder of the sleeve is used for earthing.

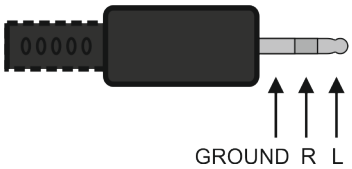


Fig. 12: Line In / Line Out X300, X302 jack plugs.

Table 17: Line In /Line Out jack plugs, pin assignment.

Signal	Description
L	Left channel
R	Right channel
Ground	Ground

Mic In jack plug

The only existing channel is transferred via the tip, the remainder of the sleeve is used for earthing.

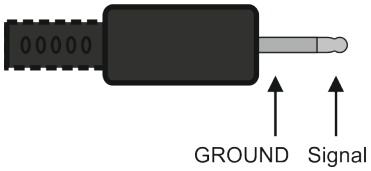


Fig. 13: Mic In X301 jack plug.

5.4.4 RS232 (N030)

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

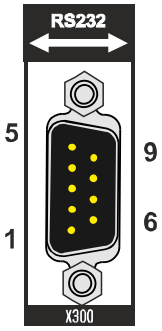


Fig. 14: RS232 interface X300 with pin numbering.

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 18: 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	-	-	-
7	RTS	Signal out	Request to Send
8	CTS	Signal in	Clear to Send
9	RI	Signal in	Ring Indicator

Limited driver support

The driver manufacturer does not support all standard functions for the interface. As a result, some applications may not run properly under Windows.

The following API and IOCTLs are not supported:

- SetupComm
- SetCommBreak
- ClearCommBreak
- EscapeCommFunction (no support for parameters SETBREAK and CLR-BREAK)

- IOCTL_SERIAL_XOFF_COUNTER
- IOCTL_SERIAL_LSRMST_INSERT
- IOCTL_SERIAL_SET_BREAK_ON
- IOCTL_SERIAL_SET_BREAK_OFF

5.4.5 RS422/RS485 (N031)

The optional N031 interface provides an RS422 or RS485 interface (X300). The interface is implemented on a 9-pin D-sub connector.

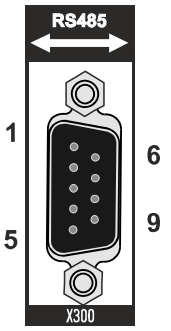


Fig. 15: RS485 interface X300 with pin numbering.

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 19: 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 RS485 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 20: 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.

Limited driver support

The driver manufacturer does not support all standard functions for the interface. As a result, some applications may not run properly under Windows.

The following API and IOCTLs are not supported:

- SetupComm
- SetCommBreak
- ClearCommBreak
- EscapeCommFunction (no support for parameters SETBREAK and CLR-BREAK)

- IOCTL_SERIAL_XOFF_COUNTER
- IOCTL_SERIAL_LSRMST_INSERT
- IOCTL_SERIAL_SET_BREAK_ON
- IOCTL_SERIAL_SET_BREAK_OFF

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.

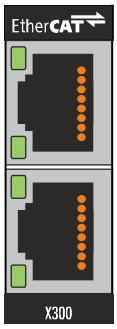


Fig. 16: EtherCAT slave interface X300.

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



Fig. 17: EtherCAT slave LAN interface, pin numbering.

Table 21: 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 optional EtherCAT slave interface (B110), documentation with further information is available for download from the Beckhoff website:
https://www.beckhoff.de/german/download/epc.htm?id=71003127100362

Document name
CXxxx0-B110 optional interface EtherCAT slave.

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.

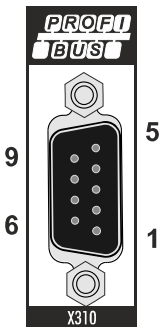


Fig. 18: PROFIBUS interface X310 with pin numbering.

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

Table 22: PROFIBUS interface X310, pin assignment.

Pin	Assignment
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 23: Wire colors of the PROFIBUS line.

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

For the optional PROFIBUS interface (x310), documentation with further information is available for download from the Beckhoff website:
https://www.beckhoff.de/german/download/epc.htm?id=71003127100362

Document name
CXxxx0-x310 optional Profibus interface.

5.4.8 CANopen (x510)

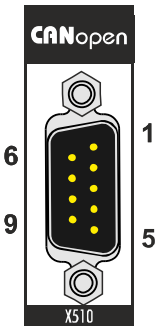


Fig. 19: CANopen interface X510 with pin numbering.

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

Table 24: CANopen interface X510, pin assignment.

Pin	Assignment
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 optional CANopen interface (x510), documentation with further information is available for download from the Beckhoff website:
https://www.beckhoff.de/german/download/epc.htm?id=71003127100362

Document name
CXxxx0-x510 optional CANopen interface.

5.4.9 PROFINET RT (x930)

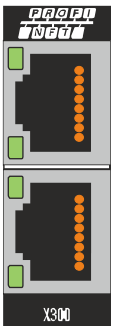


Fig. 20: PROFINET RT interface X300.



Fig. 21: *PROFINET RT LAN interface, pin numbering.*

Table 25: 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		

6 Commissioning

6.1 Assembly

6.1.1 Note the permissible installation positions

Increased heat generation

The Embedded PC may overheat if the installation position is incorrect or the minimum distances are not adhered to.

The Embedded PC may only be operated at ambient temperatures of up to 60 °C. Ensure adequate ventilation. Select a horizontal installation position. Leave at least 30 mm clearance above and below the Embedded PC.

Install the Embedded PC horizontally in the control cabinet on a mounting rail, in order to ensure optimum heat dissipation.

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 PCs.
- 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.

Correct installation position

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 PCs required, in order to ensure adequate ventilation.

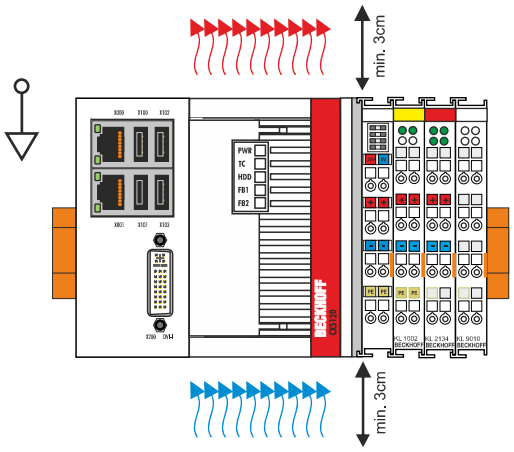


Fig. 22: CX51x0 Embedded PC, permitted installation position.

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

Incorrect installation positions

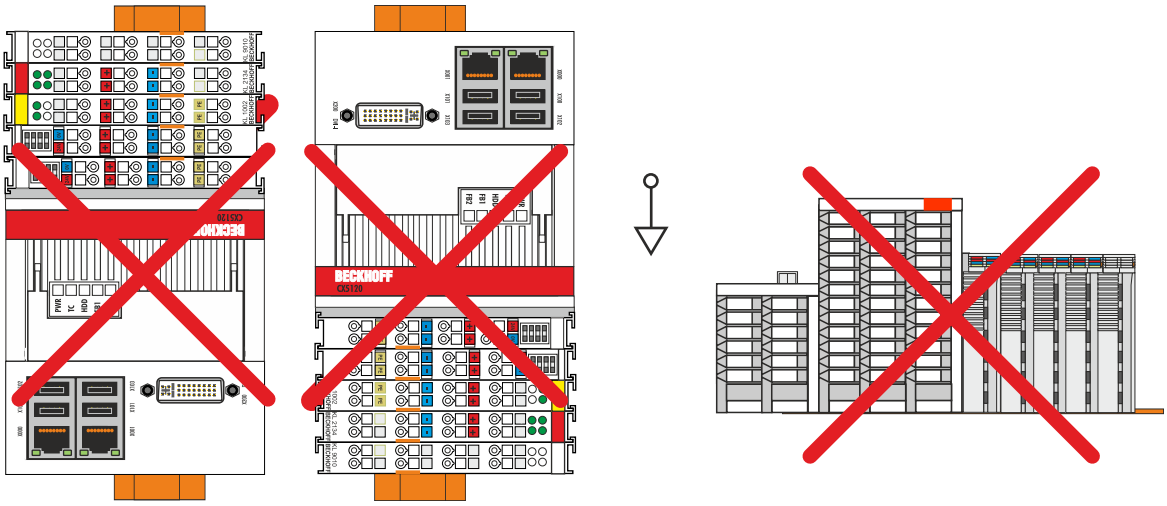


Fig. 23: CX51x0 Embedded PC, invalid installation positions.

6.1.2 Attaching on mounting rail

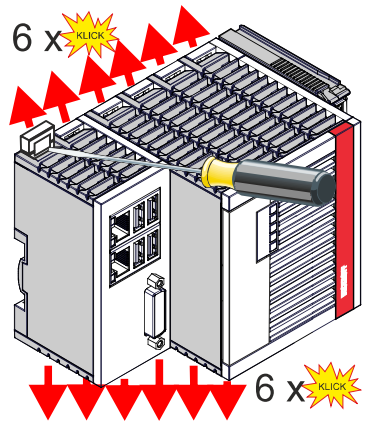
The housing is designed such that the Embedded PC can be pushed against the mounting rail and latched onto it.

Requirements:

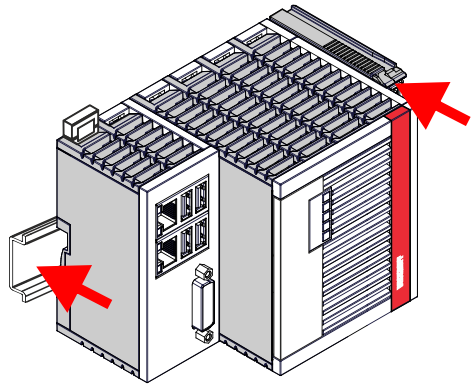
- Mounting rail of type TS35/7.5 or TS35/15 according to DIN EN 60715.

Secure the Embedded PC on the mounting rail as follows:

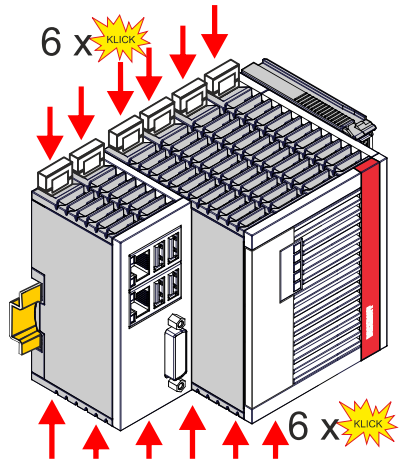
1. Unlock the latches at the top and bottom.



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.

6.1.3 MicroSD card installation and removal

Loss of data

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

Only use industrial MicroSD cards provided by Beckhoff.

The MicroSD card slot is intended for a MicroSD card. Data and further programs can be stored here, or Windows Embedded Compact 7 can be installed instead.

The eject mechanism is based on the push/push principle. The installation and removal of a MicroSD card is described below.

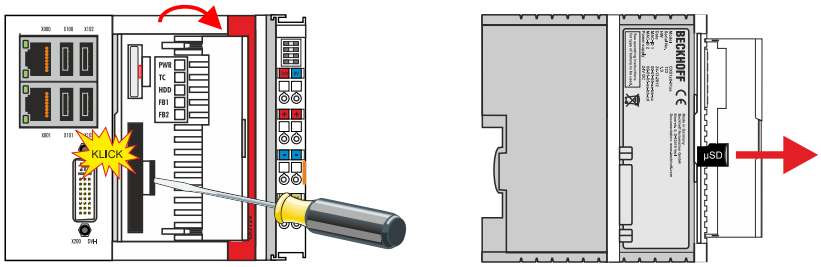
Requirements:

- The Embedded PC must be switched off. The MicroSD card may only be installed or removed in switched-off state.

Removing the MicroSD card

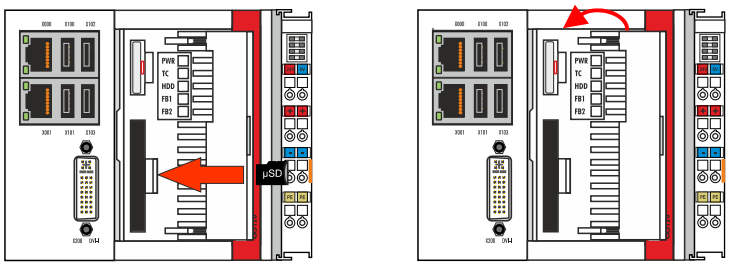
1. Gently push the MicroSD card.
   A soft click can be heard when the card is released.

2. The card is lifted by approx. 2-3 mm from the housing. Pull out the card.



Installing a MicroSD card

1. Push the MicroSD card into the Micro SD card slot.



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

⇨ The card is positioned correctly, if it is located approx. 1 mm lower than the front of the housing.

6.1.4 CFast card installation and removal

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.

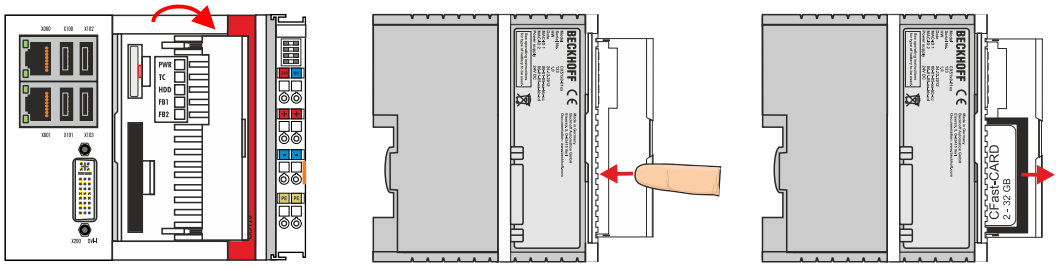
Requirements:

- The Embedded PC must be switched off. The CFast cards may only be installed or removed in switched off state.

Removing a CFast card

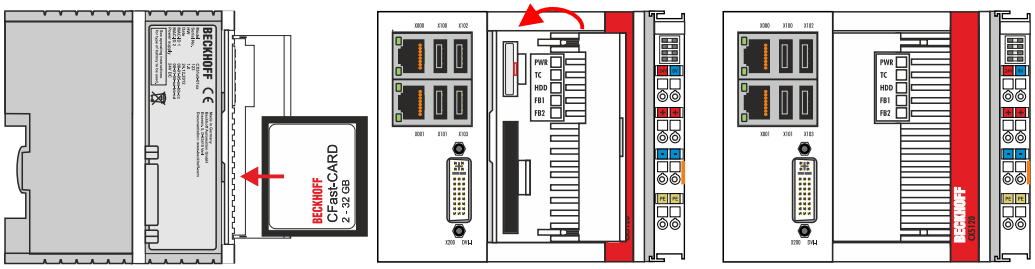
1. Gently push the CFast card.
   A soft click can be heard when the card is released.

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.

6.1.5 Installing passive EtherCAT Terminals

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.

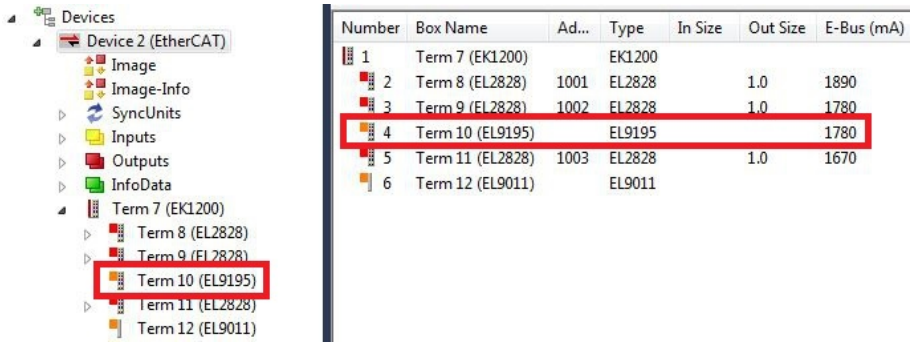


Fig. 24: Identifying a passive EtherCAT Terminal in TwinCAT.

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.

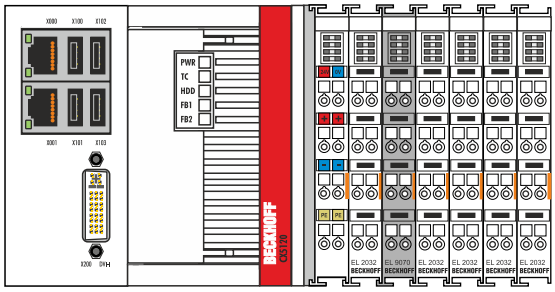


Fig. 25: Passive EtherCAT Terminals, permissible installation.

The following diagram shows the invalid installation of a passive EtherCAT Terminal.

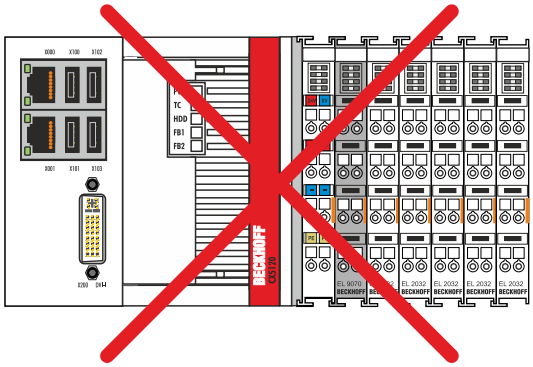


Fig. 26: Passive EtherCAT Terminals, invalid installation.

6.2 Connecting the power supply

NOTE

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 terminals require an external voltage source, which provides 24 V DC (-15% / +20%). The power supply terminal must provide 4 A at 24 V, in order to ensure the operation of the Embedded PCs in all situations.

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 a point of the energy source for this circuit must be connected to the protective earth conductor system.

Connection example

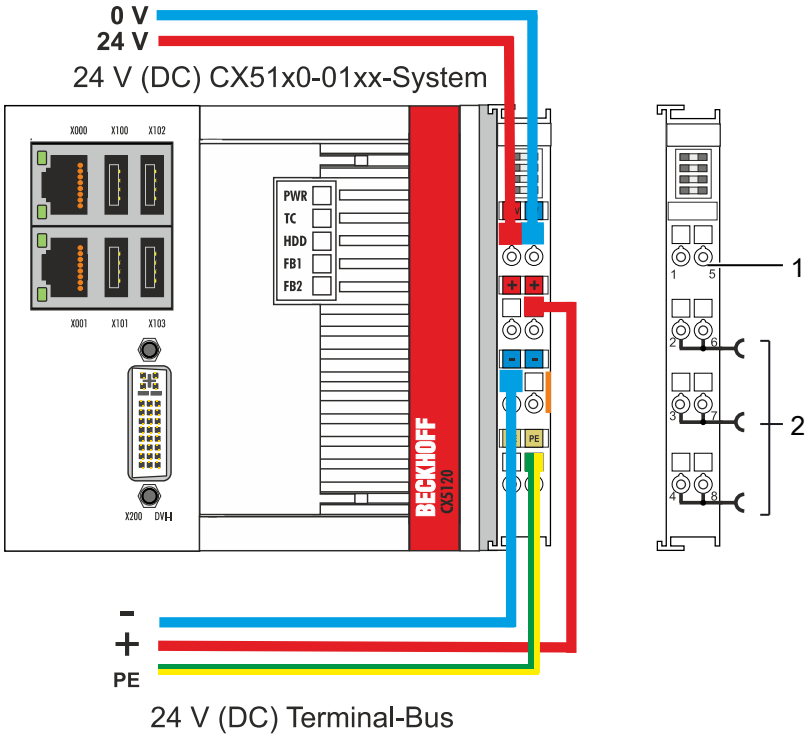


Table 26: Legend for the connection example

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

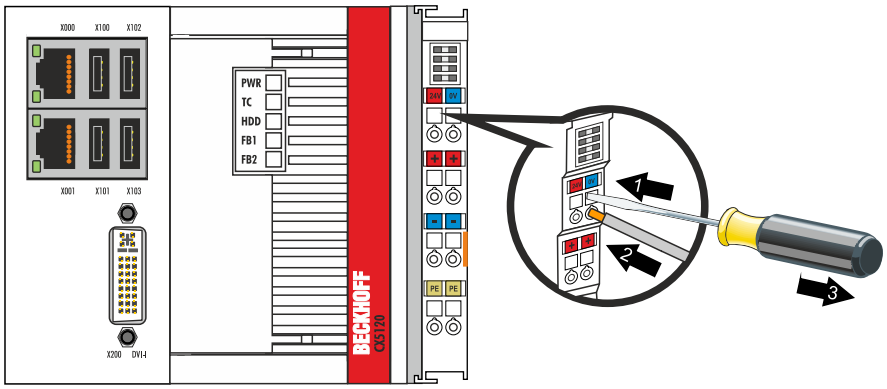
Fuse protection

- When dimensioning the fuse for the system voltage (Us), observe the max. power consumption of the Embedded PC (see: Technical Data [▶ 87]).
- Protect power contacts (Up) with a fuse of max. 10 A (slow blow).

The cables of an external voltage source are connected to the power supply unit with spring-loaded terminals.

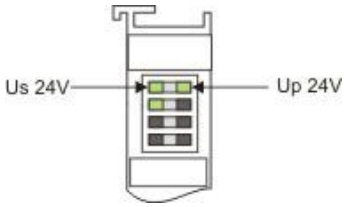
Table 27: Required wire cross-sections and strip lengths.

Conductor cross-section	0,5 ... 2,5 mm²	AWG 20 ... AWG 14
Strip length	8 ... 9 mm	0.33 inch



The voltage source has been connected to the power supply unit successfully when the two upper power supply terminal LEDs light up in green.

- The left LED (Us) indicates the supply of the basic CPU module and terminal bus.
- The red LED (Up) indicates the Bus Terminal supply via the power contacts.



NOTE

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 have (no potential difference).

Observe the UL requirements

The CX51x0 Embedded PCs are UL certified. The corresponding UL label can be found on the type plate.

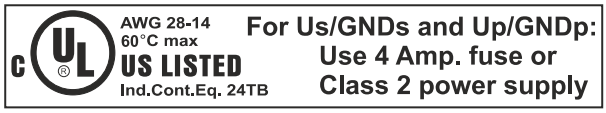


Fig. 27: UL label for CX51x0 Embedded PC.

The CX51x0 Embedded PCs can thus be used in areas in which special UL requirements have to be met. These requirements apply to the system voltage (Us) and to the power contacts (Up). Application areas 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.

6.3 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 installation position was 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.

6.4 Switching off

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 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 Windows Embedded Compact 7

7.1.1 Setting up the audio interface (N020)

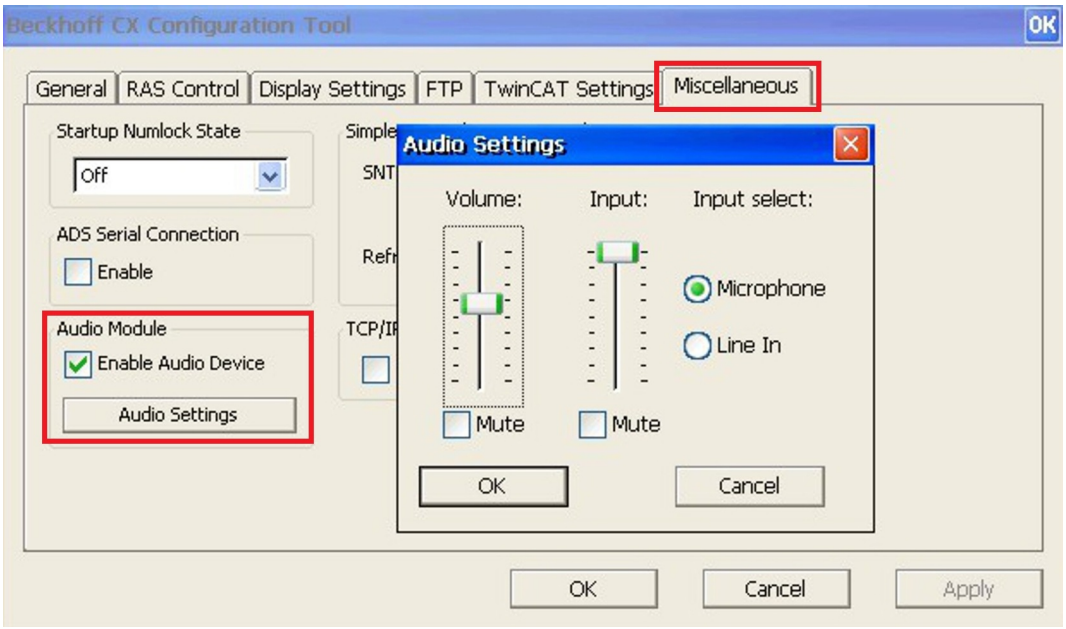
Under Windows Embedded Compact 7, the Beckhoff CX configuration tool can be used for the audio settings.

Requirements:

- Embedded PC with audio interface.
- Windows Embedded Compact 7.

Proceed as follows:

1. Open the Beckhoff CX configuration tool under **Start > Control Panel > CX Configuration**. The Beckhoff CX configuration tool window opens.
2. Click on the **Miscellaneous** tab.



3. Tick the **Enable Audio Device** checkbox.
4. Click on **Audio Settings** and set the volume for input and output via the sliders.
5. Select the input source under **Input Select**. Only one input source can be active at any one time.

⇨ Confirm the settings with OK, once you have set up the audio interface.

7.2 Windows Embedded Standard 7 P

7.2.1 Identification of the Ethernet interfaces (X000, X001)

Network and Sharing Center

In the Network and Sharing Center the Ethernet interfaces (X000, X001) of the CX51x0 Embedded PC are identified as follows as standard:

- Local Area Connection corresponds to Ethernet interface X000.
- Local Area Connection 2 corresponds to Ethernet interface X001.

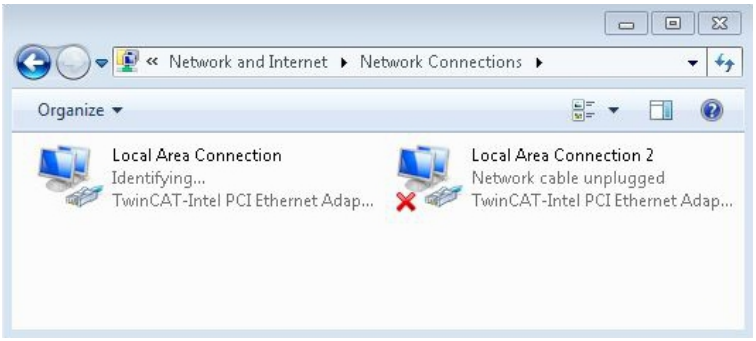


Fig. 28: Windows 7, Identification of the Ethernet interfaces (X000, X001) in the Network and Sharing Center.

Device Manager

In the Device Manager the Ethernet interfaces (X000, X001) of the CX51x0 Embedded PC are identified as follows as standard:

- TwinCAT Intel PCI Ethernet adapter (gigabit) corresponds to the Ethernet interface X000.
- TwinCAT Intel PCI Ethernet adapter (gigabit) #2 corresponds to the Ethernet interface X001.

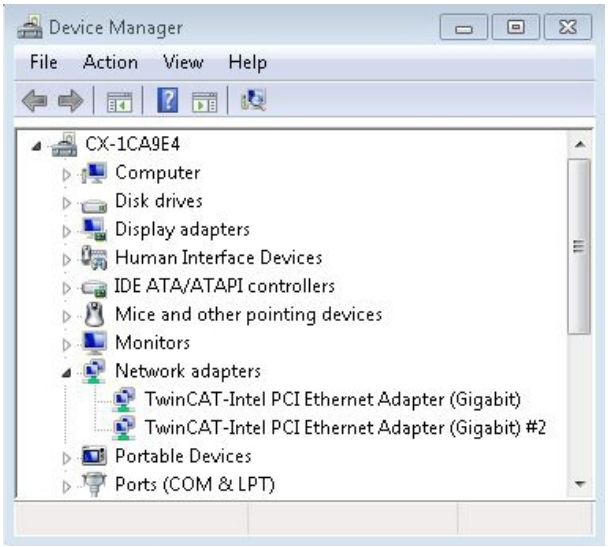


Fig. 29: Windows 7, identification of the Ethernet interfaces (X000, X001) in the device manager.

7.2.2 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.

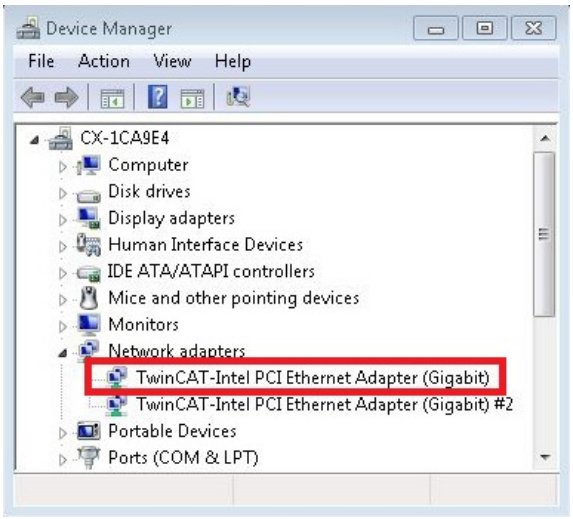
Requirements:

- 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.

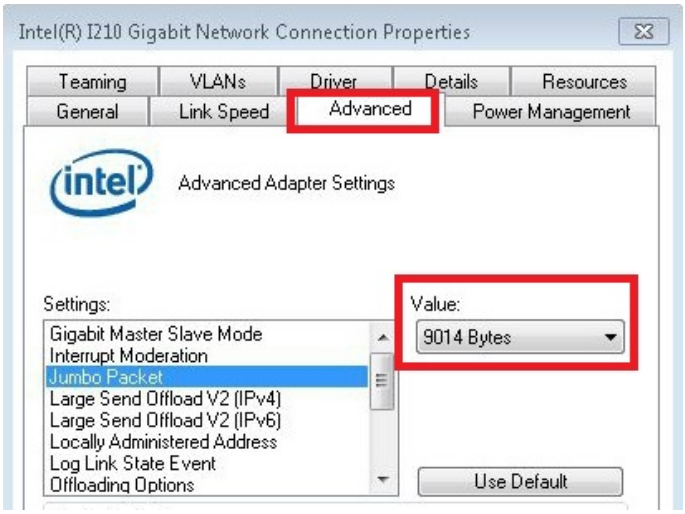
Jumbo frames are activated as follows:

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.

7.2.3 Set NIC Teaming

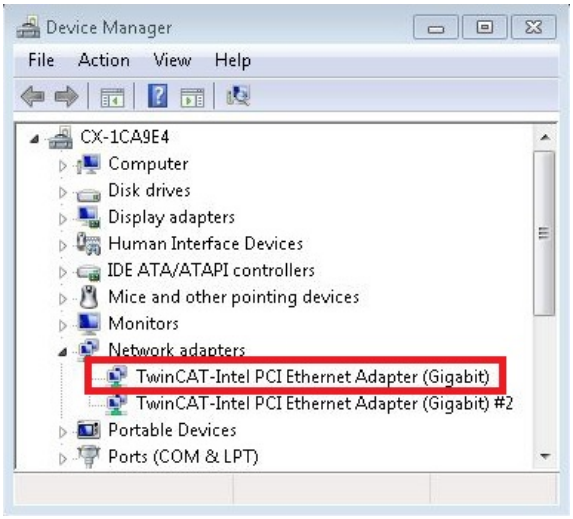
NIC Teaming consolidates several physical network cards to group, thereby creating redundancy. Redundancy can help intercept interference in network cards or in the cabling by assigning the data transfer to other devices in the group.

Requirements:

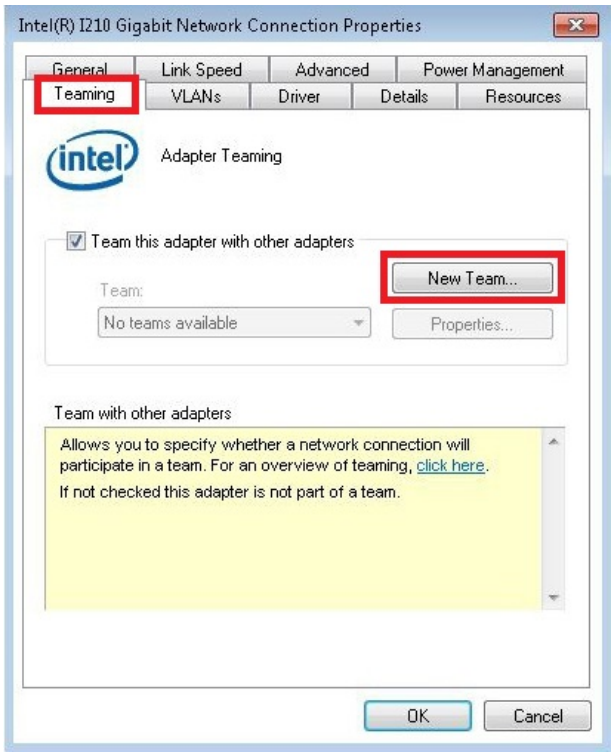
- The original Intel® driver can be downloaded from https://downloadcenter.intel.com.
- Install the original Intel® driver for the Network Interface Card. Note that this will delete the real-time capable driver from Beckhoff.

NIC Teaming is set as follows:

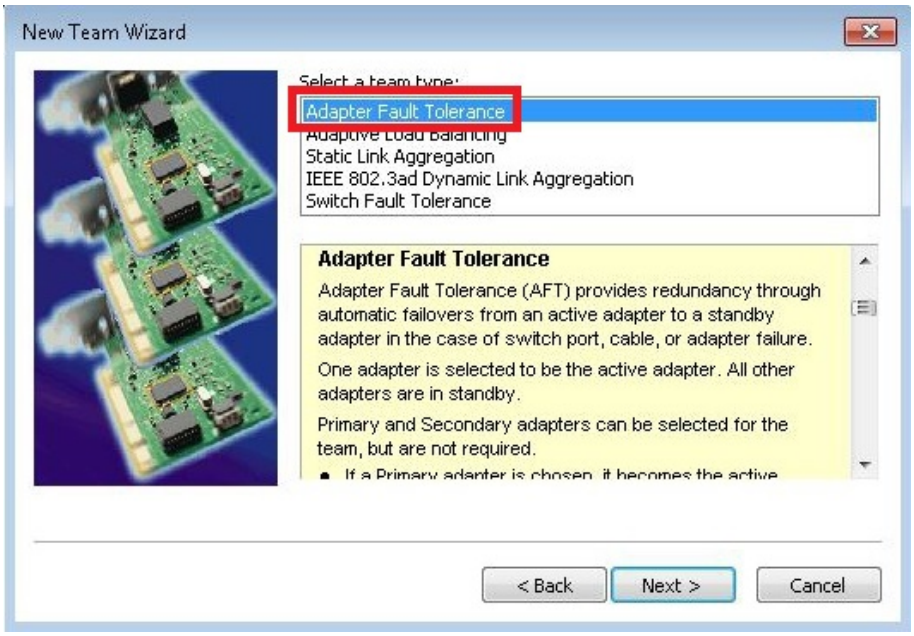
1. Under **Start > Control Panel > Hardware and Sound** click on **Device Manager**.
2. Double-click on the interface.



3. Click on the **Teaming** tab.
4. Click on **New Team** and follow the installation instructions.

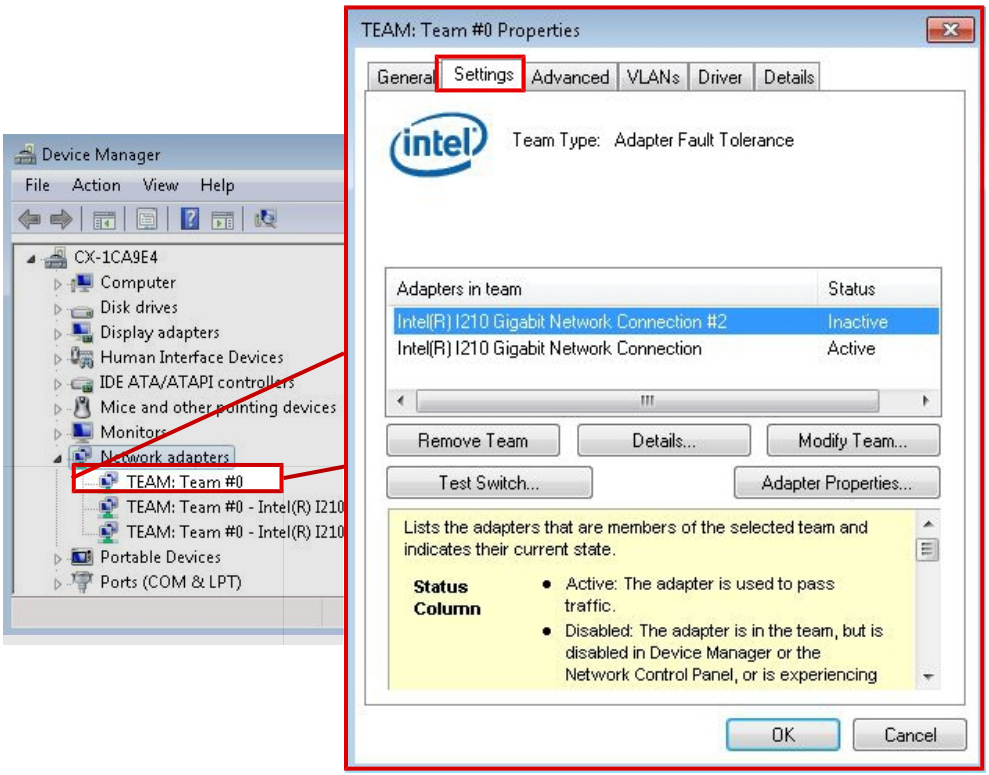


5. Under **Select a team type** select the option **Adapter Fault Tolerance**



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.



7.2.4 Restoring the Beckhoff real-time driver.

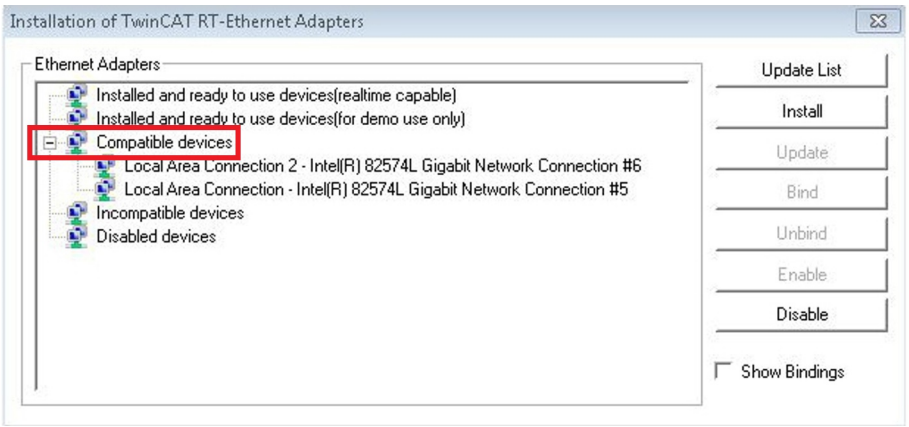
The Beckhoff real-time driver can be restored if the real-time driver was uninstalled or the original Intel® driver for jumbo frames or NIC Teaming was installed, for example. This chapter shows you how to use *TcRteInstall.exe* to restore the Beckhoff real-time driver. The file is in the TwinCAT directory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

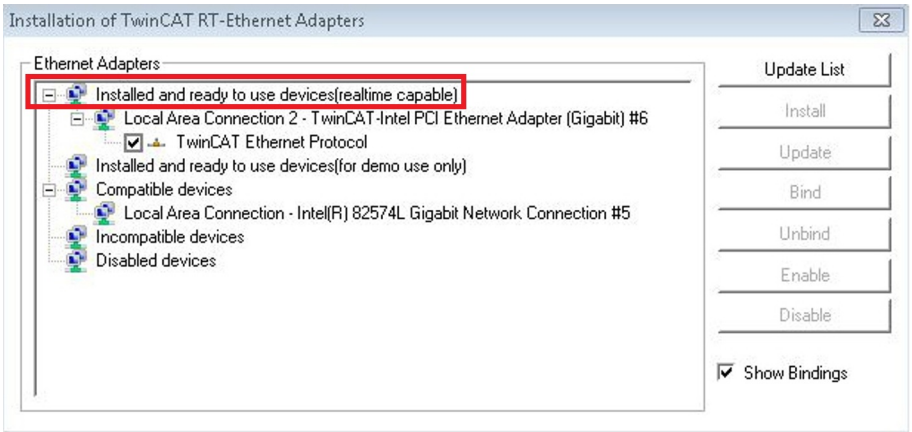
Proceed as follows:

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)**.



7.3 Windows 10 IoT Enterprise LTSB

7.3.1 Identification of the Ethernet interfaces (X000, X001)

Network and Sharing Center

In the Network and Sharing Center the Ethernet interfaces (X000, X001) of the CX51x0 Embedded PC are identified as follows as standard:

- Ethernet corresponds to the Ethernet interface X000.
- Ethernet 2 corresponds to the Ethernet interface X001.

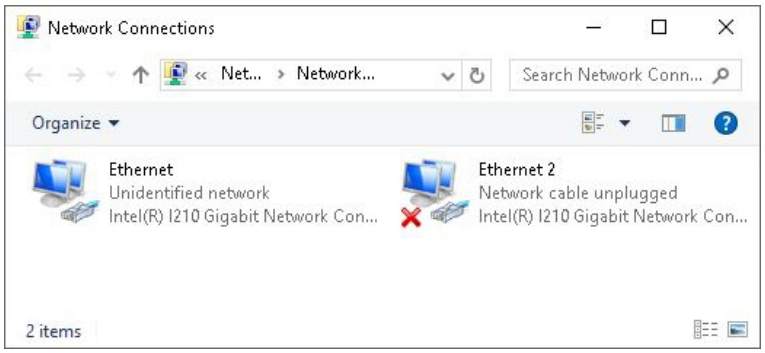


Fig. 30: Windows 10, Identification of the Ethernet interfaces (X000, X001) in the Network and Sharing Center.

Device Manager

In the Device Manager the Ethernet interfaces (X000, X001) of the CX20x0 Embedded PC are identified as follows as standard:

- Intel(R) I210 Gigabit Network Connection corresponds to the Ethernet interface X000.
- Intel(R) I210 Gigabit Network Connection #2 corresponds to the Ethernet interface X001.

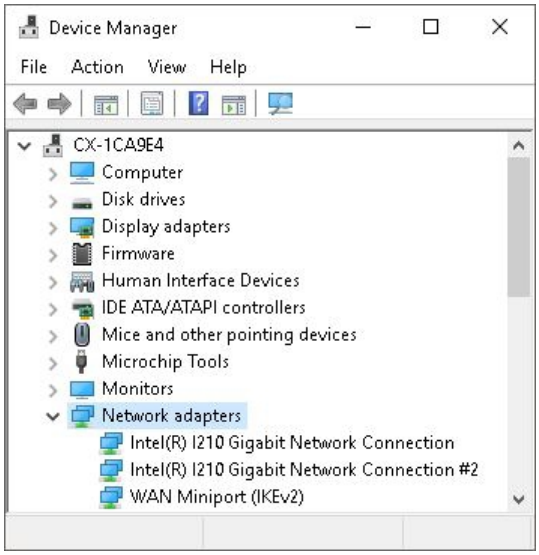


Fig. 31: Windows 10, identification of the Ethernet interfaces (X000, X001) in the device manager.

7.3.2 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.

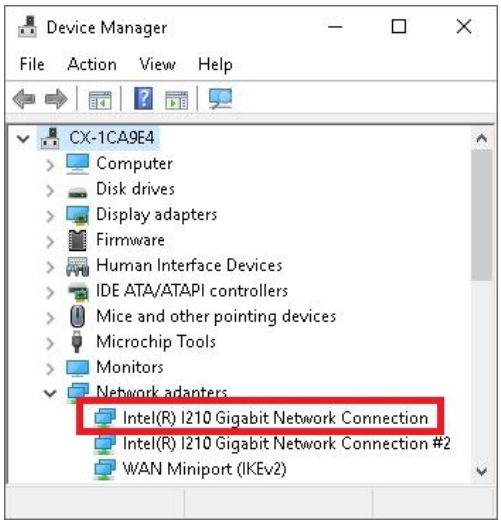
Requirements:

- 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.

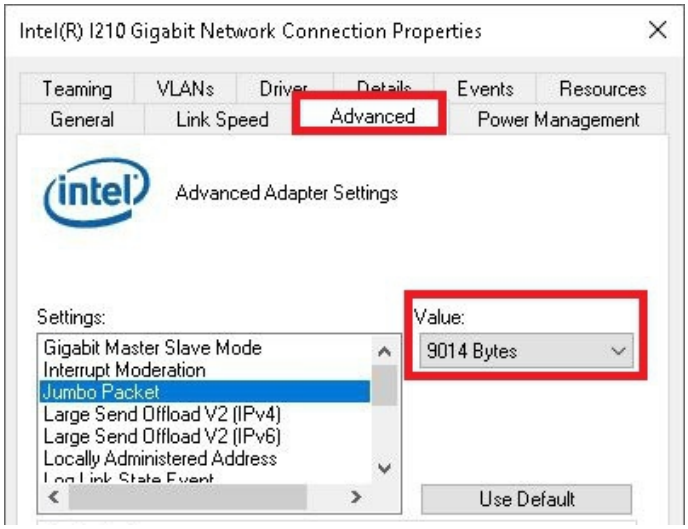
Jumbo frames are activated as follows:

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.

7.3.3 Set NIC Teaming

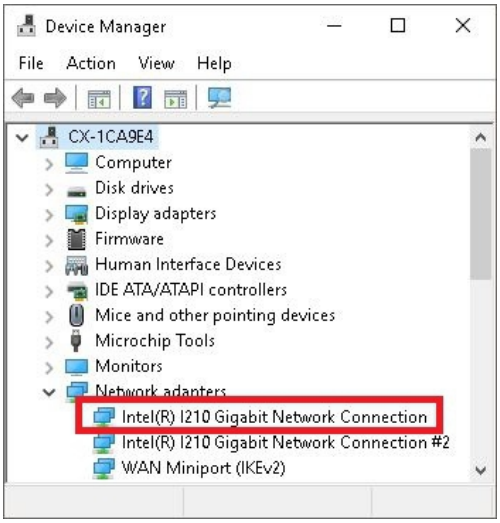
NIC Teaming consolidates several physical network cards to group, thereby creating redundancy. Redundancy can help intercept interference in network cards or in the cabling by assigning the data transfer to other devices in the group.

Requirements:

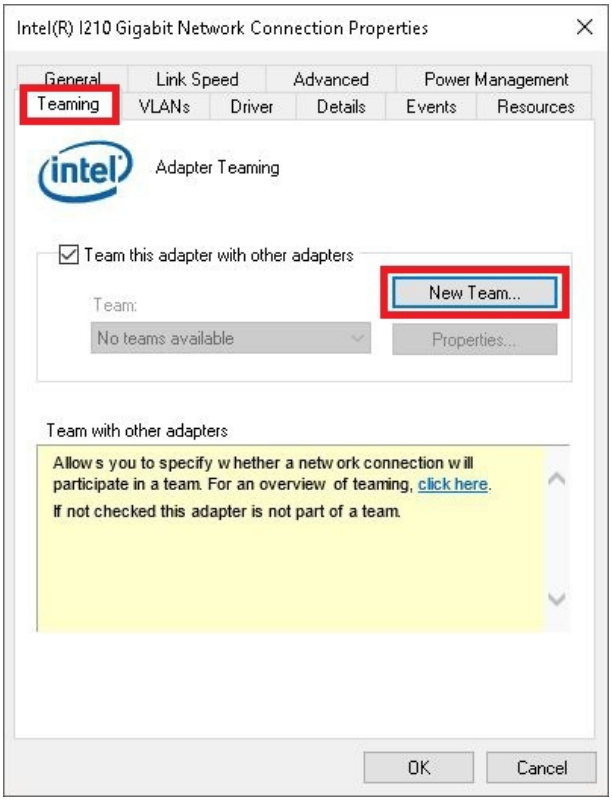
- The original Intel® driver can be downloaded from https://downloadcenter.intel.com.
- Install the original Intel® driver for the Network Interface Card. Note that this will delete the real-time capable driver from Beckhoff.

NIC Teaming is set as follows:

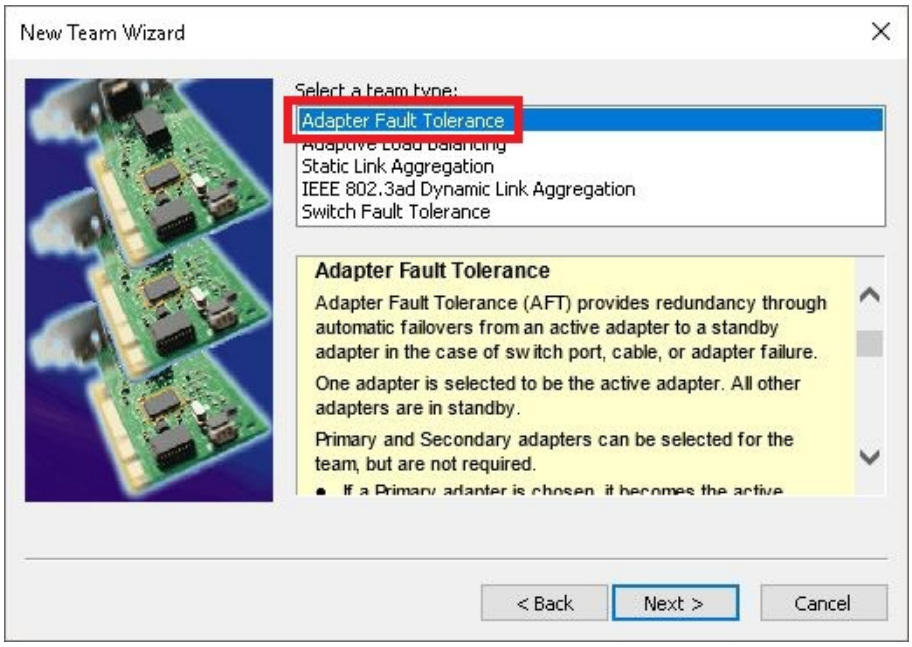
1. Under **Start > Control Panel > Hardware and Sound** click on **Device Manager**.
2. Double-click on the interface.



3. Click on the **Teaming** tab.
4. Click on **New Team** and follow the installation instructions.

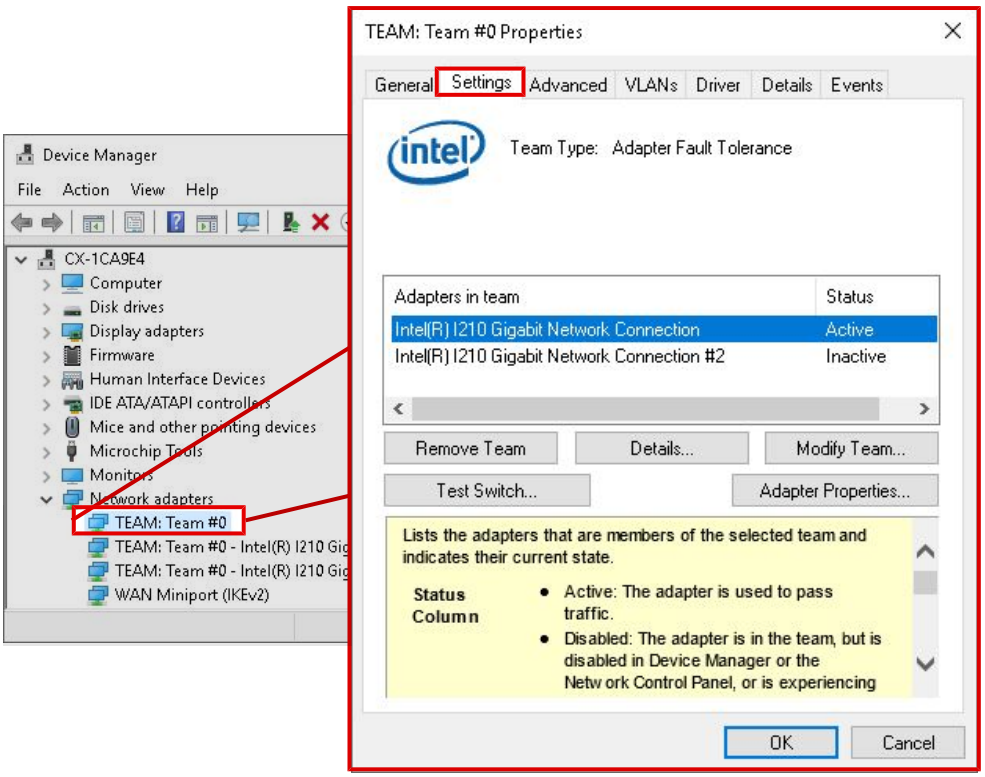


5. Under **Select a team type** select the option **Adapter Fault Tolerance**



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.



7.3.4 Restoring the Beckhoff real-time driver

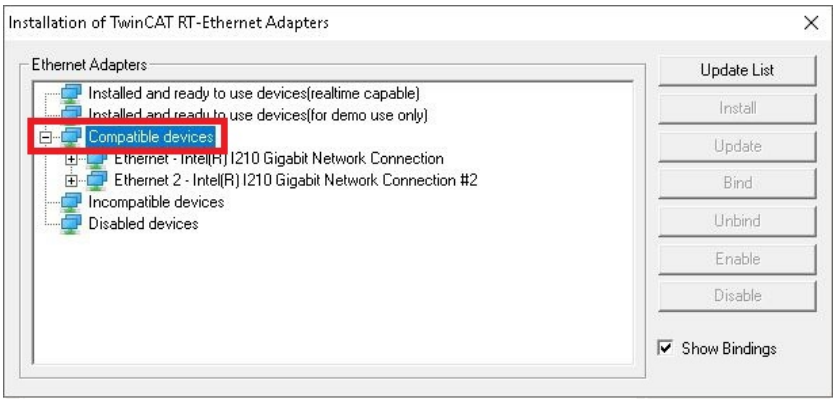
The Beckhoff real-time driver can be restored if the real-time driver was uninstalled or the original Intel® driver for jumbo frames or NIC Teaming was installed, for example. This chapter shows you how to use *TcRteInstall.exe* to restore the Beckhoff real-time driver. The file is in the TwinCAT directory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

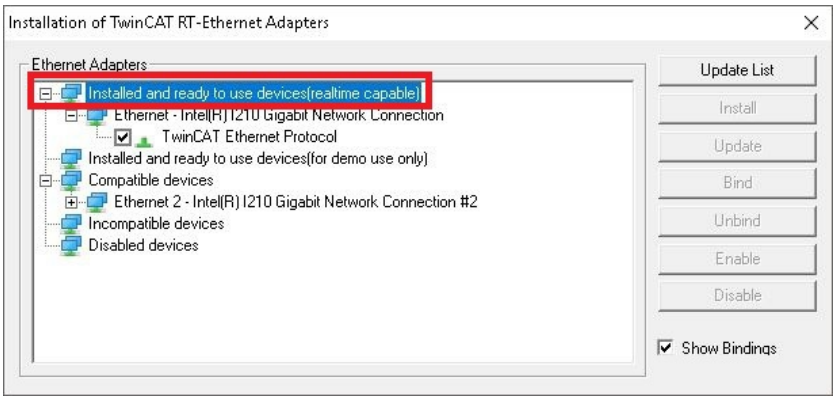
Proceed as follows:

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)**.



7.3.5 Using serial interfaces N030/N031

With the Embedded PC from the CX5100 series with Windows 10 Image, the serial interfaces are only supported from a certain BIOS, Image and TwinCAT version onwards.

Table 28: System requirements for the operation of the serial interfaces N030 and N031.

Order Option	BIOS version	Image version	TwinCAT version
CX51x0-N030	0.79	CX1800-0501-0011v2.0 CX1800-0511-1011v2.0	2.11.2302 3.1.4022.27
CX51x0-N031			

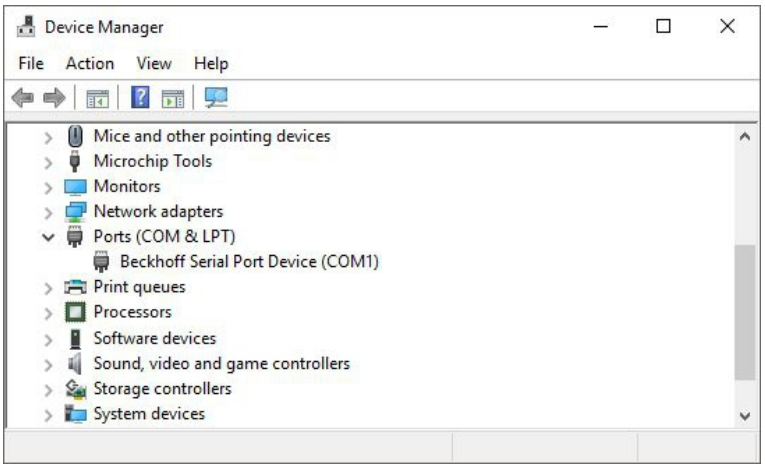
The serial interfaces CX51x0-N030 and CX51x0-N031 of the Embedded PC CX51x0 are configured as standard for operation under TwinCAT. The drivers are not loaded under Windows and you cannot use the interfaces for custom installed application software.

You can use the interfaces either under Windows 10 or TwinCAT. A mixture of both operating modes is not possible. The configuration and switching of the operating modes takes place in the BIOS.

Set the BIOS as follows to operate the serial interfaces under Windows 10:

1. Restart the Embedded PC and press **[Del]** to start the BIOS setup.
   The BIOS Setup window appears.
2. Set the option **LPSS & SCC Devices Mode** to **ACPI mode** under **Advanced > LPSS & SCC Configuration**.
3. Set the option **OS Selection** to **Windows 8.x** under **Advanced > Miscellaneous Configuration**.
4. Press **[F4]** to save the settings and exit the BIOS setup.
   The device is restarted.

⇨ After the reboot, the drivers for the serial interfaces are loaded and displayed in the device manager under Windows 10. The serial interfaces are now ready for operation under Windows 10.



The serial interfaces no longer function under TwinCAT with immediate effect. To operate the serial interfaces under TwinCAT again, you must restore the default settings in the BIOS setup. Set the options **LPSS & SCC Devices Mode** to **PCI mode** and **OS Selection** to **Windows 7**.

7.4 Beckhoff Device Manager

7.4.1 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:

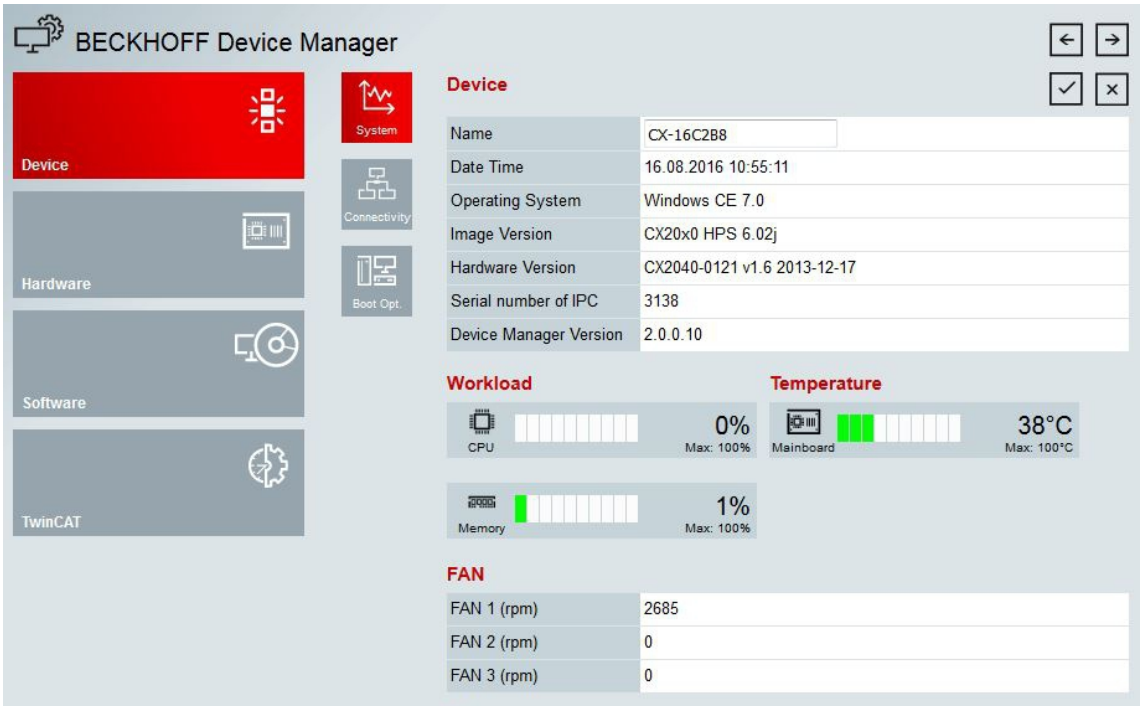
- Host PC and Embedded PC must be located in the same network. Depending on the operating system version, the network firewall must allow access via port 80 (HTTP) or port 443 (HTTPS).
- IP address or host name of the Embedded PC.

Table 29: Access data for the Beckhoff Device Manager on delivery.

Operating system	Access data
Windows Embedded Standard 7, Windows 10 IoT Enterprise LTSB Windows Embedded Compact 7	User name: Administrator Password: 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.

7.4.2 Enabling a remote display

So that you can remotely access an Industrial PC with CE operating system, you must first activate Remote Display in the Beckhoff Device Manager. The remote display is disabled by default.

Requirements:

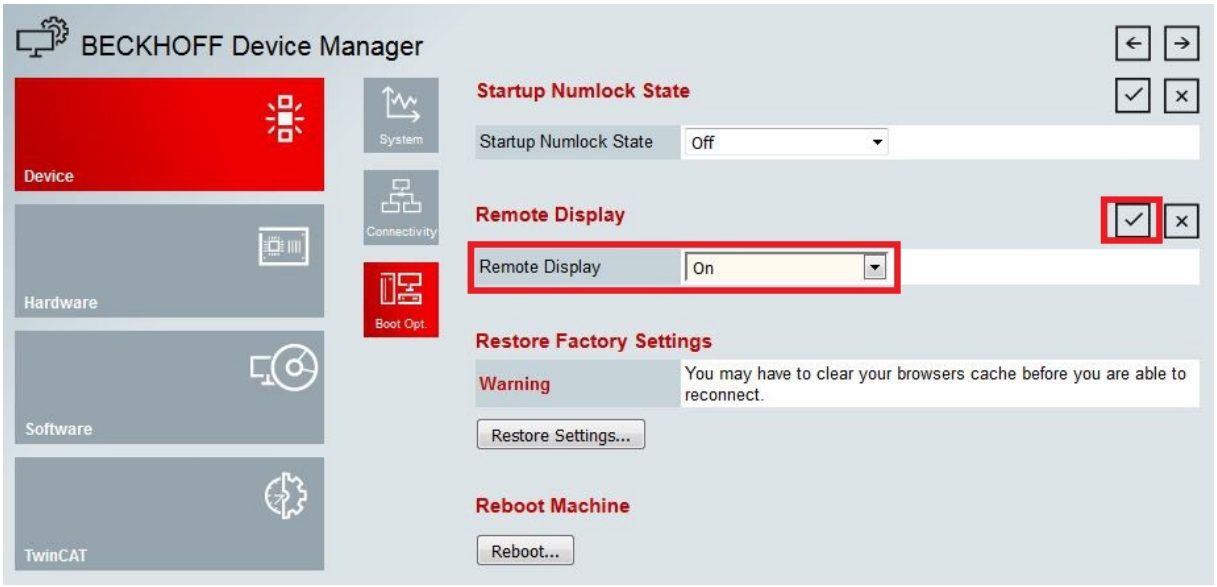
- Host PC and Embedded PC must be located in the same network. Depending on the operating system version, the network firewall must allow access via port 80 (HTTP) or port 443 (HTTPS).
- The IP address or the host name of the Embedded PC must be known.

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

Operating system	Access data
Windows Embedded Compact 7	User name: Administrator Password: 1

Enable the remote display 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.
4. In the menu under **Device** click on **Boot Opt**.



5. Under **Remote Display** select the option **On** and confirm the settings.
6. In the information window click **OK** to accept the settings.

⇨ You have successfully activated Remote Display on the Industrial PC. After restarting, you can remotely access your Industrial PC.

7.4.3 Starting a remote connection

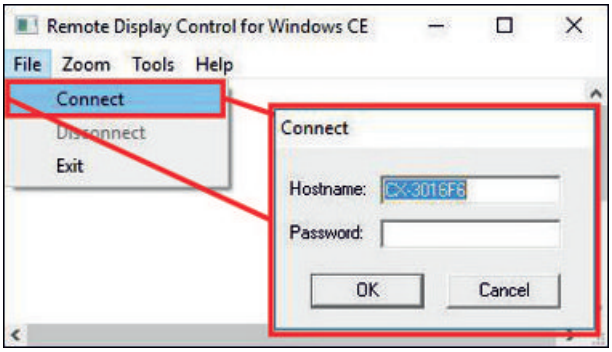
With the aid of the Remote Display Control program (CERHOST), a remote connection can be established and an Industrial PC with CE operating system can be remotely controlled from a host PC.

Requirements:

- Remote Display is active. See: Enabling a remote display.
- Host name of the Embedded PC.
- Remote Display Control (CERHOST). Download under: https://infosys.beckhoff.com/content/1033/CX51x0_HW/Resources/zip/5047075211.zip

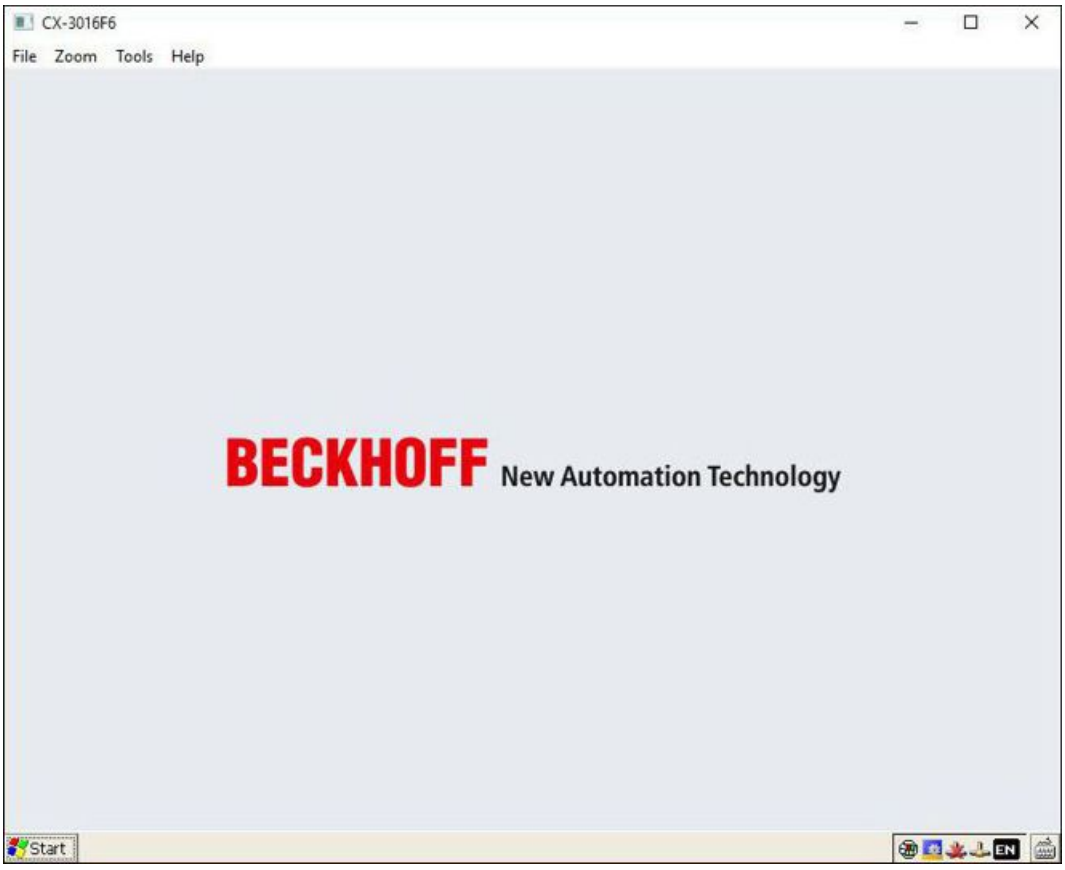
Start the remote connection as follows:

1. Unpack the zip file on the host PC and run *cerhost.exe*.
2. Click on **File** in the menu bar and then on **Connect**.



3. Enter the host name of the Embedded PC in the **Hostname** field.

⇨ The remote connection is started and the Windows Embedded CE 7 start screen appears.



7.5 TwinCAT

7.5.1 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 PCs must be added manually in TwinCAT 3.

The smallest possible configuration of the CX51x0 Embedded PC is created as follows in the tree view under TwinCAT 3:

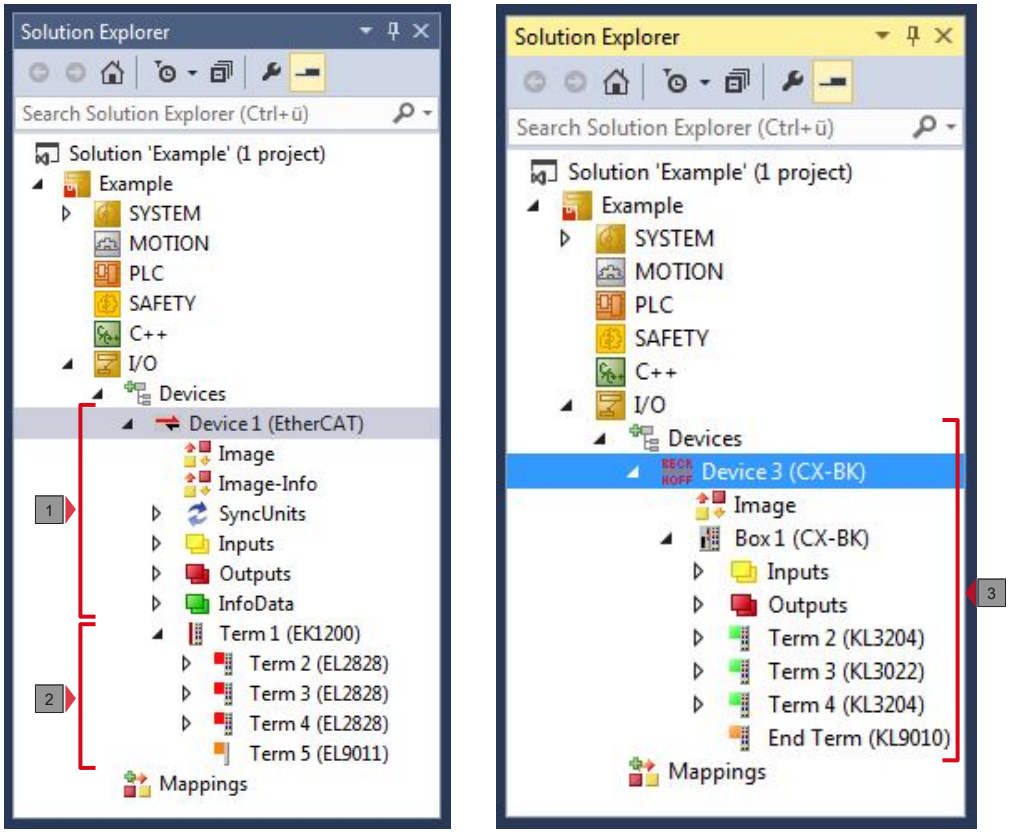


Fig. 32: CX51x0 Embedded PC in the tree view of TwinCAT 3, with attached EtherCAT Terminals (left) or Bus Terminals (right).

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

Table 31: Legend for the tree view.

No.	Description
1	The CX51x0 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 an Embedded PC, the Bus Coupler (CX-BK) is added together with the Bus Terminals.

7.5.2 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:

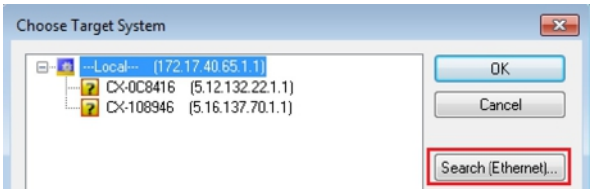
- TwinCAT 3 must be in Config mode.
- IP address or host name of the device.

Search for the devices as follows:

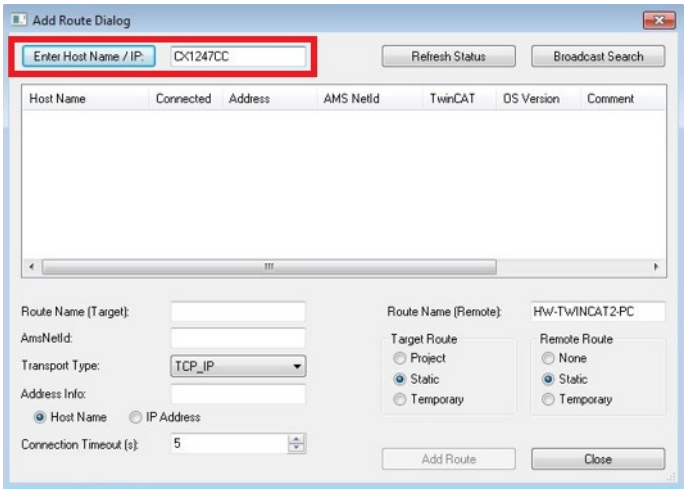
1. In the menu at the top click on **File > New > Project** and create a new TwinCAT XAE project.
2. In the tree view on the left click on **SYSTEM**, and then **Choose Target**.



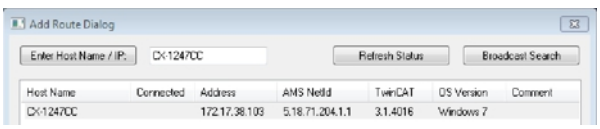
3. Click on **Search (Ethernet)**.



4. Type the host name or the IP address of the device into the **Enter Host Name / IP** box and press **[Enter]**.

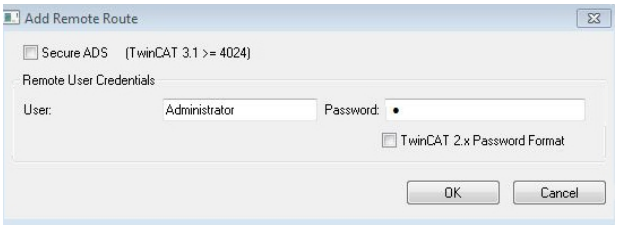


5. Mark the device found and click on **Add Route**.



The Logon Information window appears.

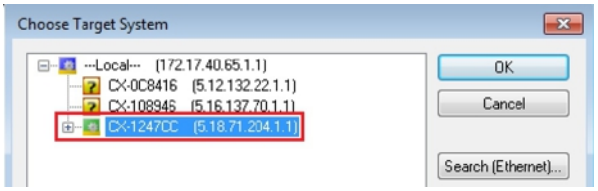
Enter the user name and password for the CX in the **User Name** and **Password** fields and click **OK**.



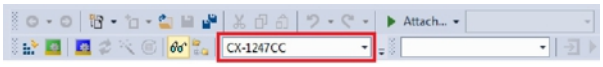
The following information is set as standard in CX devices:
User name: Administrator **Password:** 1

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.

7.5.3 Scanning an Embedded PC

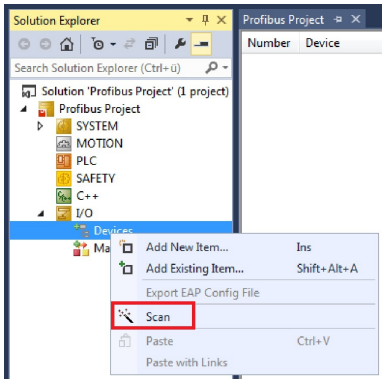
This step shows how to scan an Embedded PC in TwinCAT and then further configure it.

Prerequisites for this step:

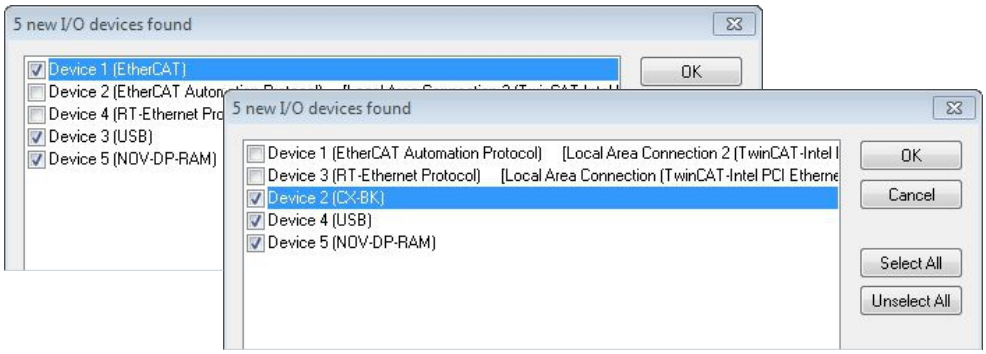
- Selected target device.

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.

7.5.4 Configure the serial interface (N03x)

This chapter explains how to configure a CX51x0 with serial interface (N03x) in TwinCAT.

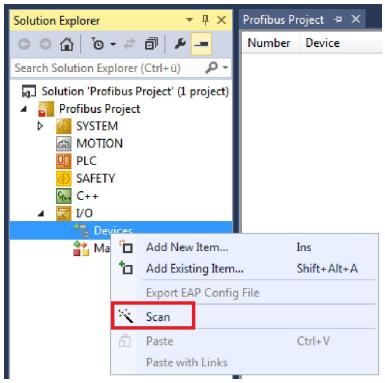
The procedure for commissioning the CX51x0-N03x with serial interface under TwinCAT differs from that for other Embedded PCs. In order to avoid configuration errors, the procedure for adding and configuring the CX51x0 in TwinCAT is described below.

Prerequisites for this step:

- A scanned and selected target system.
- The description applies to TwinCAT2 from TC2.11.2248 and TwinCAT 3 from TC3.1.4018

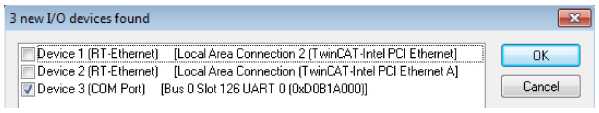
Configure the CX51x0-N03x as follows:

1. In the tree view on the left, right-click on **Devices**.
2. In the context menu click on **Scan**.



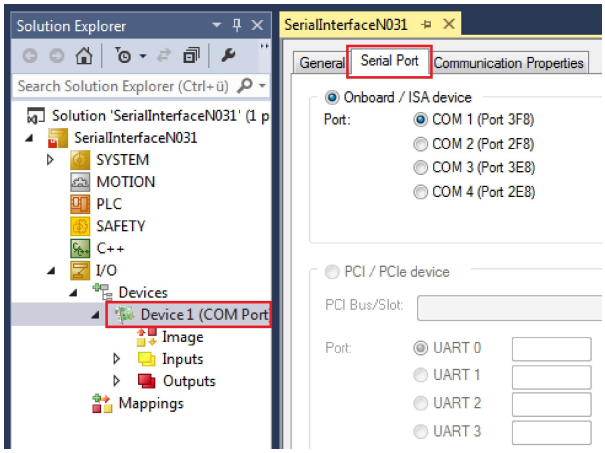
The window **new I/O devices found** appears.

3. Select the device with a COM port and confirm the selection with **OK**.

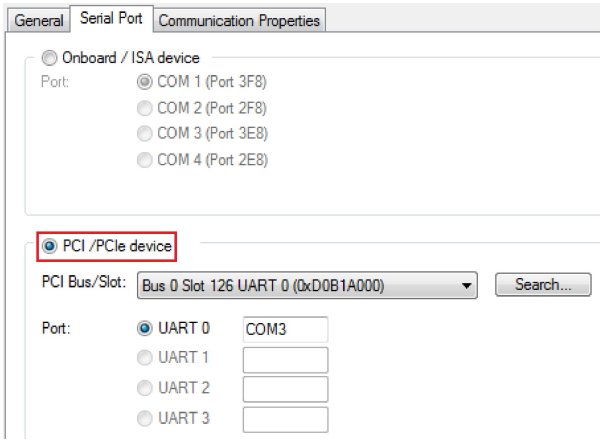


The CX51x0-N03x is added in TwinCAT as **Device (COM Port)** in the tree view on the left.

4. Click on **Device (COM Port)** and then on the **Serial Port** tab.



5. Under the **Serial Port** tab, select the option **PCI/PCIe Device**.



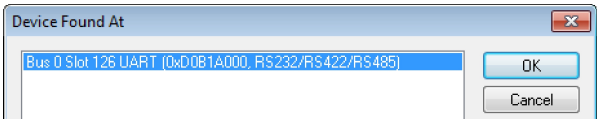
The serial interface of the CX51x0 is shown under **Port:**.

If the option Onboard/ISA device is already selected, the option PCI/PCIe device is grayed out and cannot be selected.



The option PCI/PCIe device can be re-enabled as follows:

6. Click on **Search**.
   The window **Device Found At** appears.



7. Click on the COM port, then on **OK**.
   The option PCI/PCIe device is enabled again.

⇨ You have successfully added and configured the CX51x0 with serial interface (N031x) in TwinCAT. You can now add further devices to the device and continue with the configuration as usual.

7.5.5 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 broken wires or unplugged LAN cables are avoided.

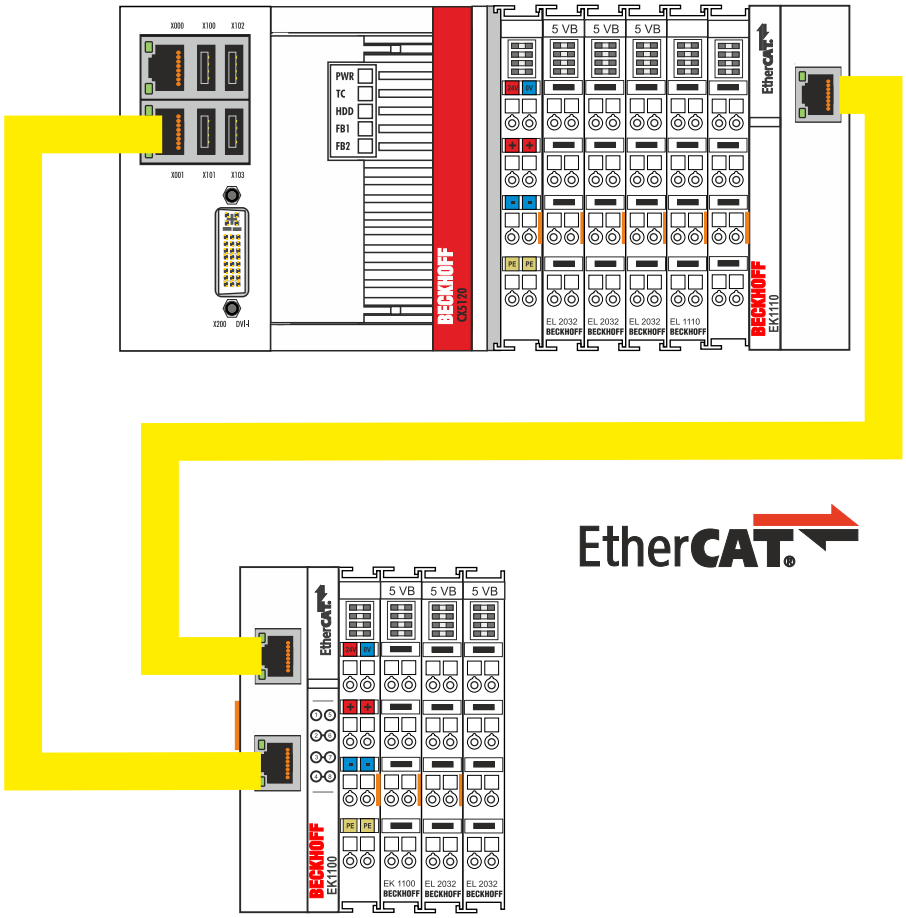


Fig. 33: Smallest possible configuration for EtherCAT cable redundancy.

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

Table 32: Cable redundancy, hardware for sample configuration.

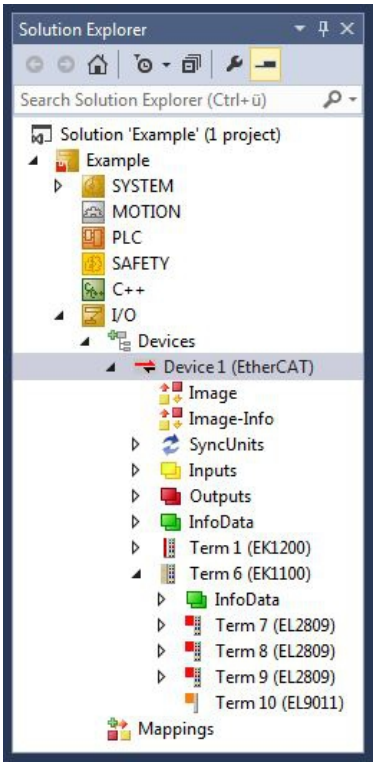
Type	Description
CX51x0 Embedded PC	Is the EtherCAT master in the example.
Bus Coupler EK1110	EtherCAT extension can be used to extend an EtherCAT segment by up to 100 m.
EK1100 Bus Coupler	The Bus Coupler relays the EtherCAT signal to connected EtherCAT Terminals.
EtherCAT Terminals	Any number of EtherCAT Terminals can be connected to the CX51x0 Embedded PC and the Bus Coupler.

Requirements:

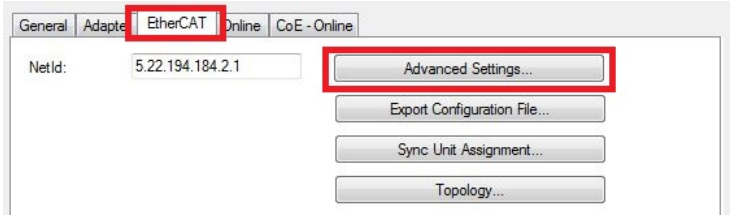
- For TwinCAT 2 you have to install and license the supplement TS622x | TwinCAT EtherCAT Redundancy on the Embedded PC: http://www.beckhoff.de/forms/twincat3/warenkorb.aspx?lg=de&title=TS622x-EtherCAT-Redundancy&version=1.0.2
- In TwinCAT 3 the supplement is already included and only has to be licensed.
- Hardware wired as EtherCAT ring (see Fig.: Smallest possible configuration for EtherCAT cable redundancy) and added in TwinCAT.

Configure EtherCAT cable redundancy as follows:

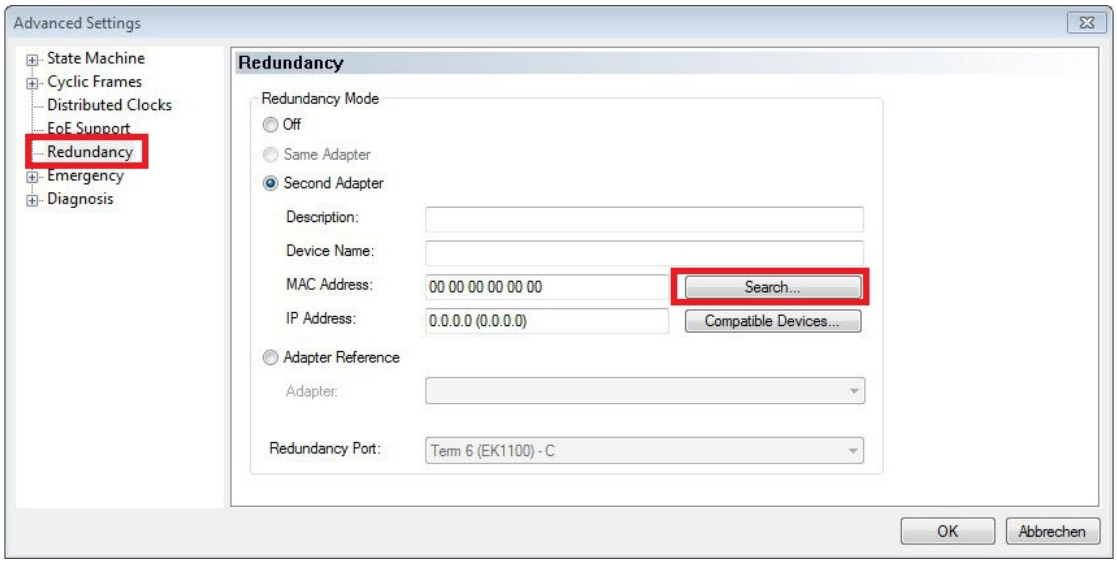
1. In the tree view click on the EtherCAT master.



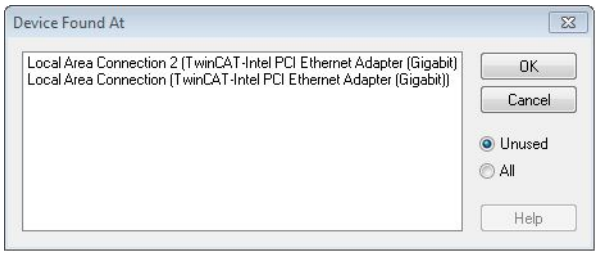
2. Click on the **EtherCAT** tab, then **Advanced Settings**.



3. Click on **Redundancy** in the tree structure on the left.
4. Click on the option **Second adapter**, followed by the **Search** button.



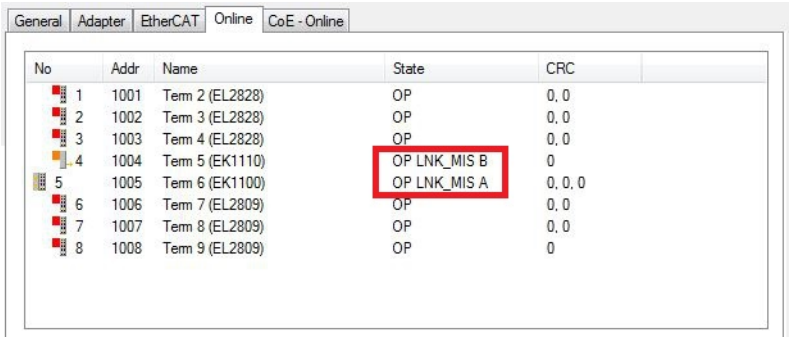
5. Select the appropriate LAN connection according to your cabling at the Embedded PC.



6. Confirm the settings with **OK**.

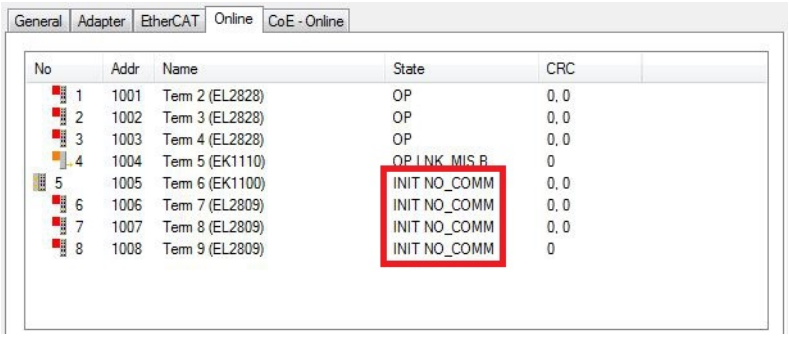
⇨ You have successfully configured cable redundancy. Under the **Online** tab the EtherCAT slaves are displayed, for which cable redundancy was configured.

Under **State** the state of the individual EtherCAT slaves is displayed. 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" appears under status.



Although the connection between the Bus Couplers is interrupted, the EtherCAT Terminals connected to the EK1100 Bus Coupler show no fault.

If the cable connection is interrupted without cable redundancy at the same location, the terminals show a fault under status.



7.5.6 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.

NOTE

Unwanted restart

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

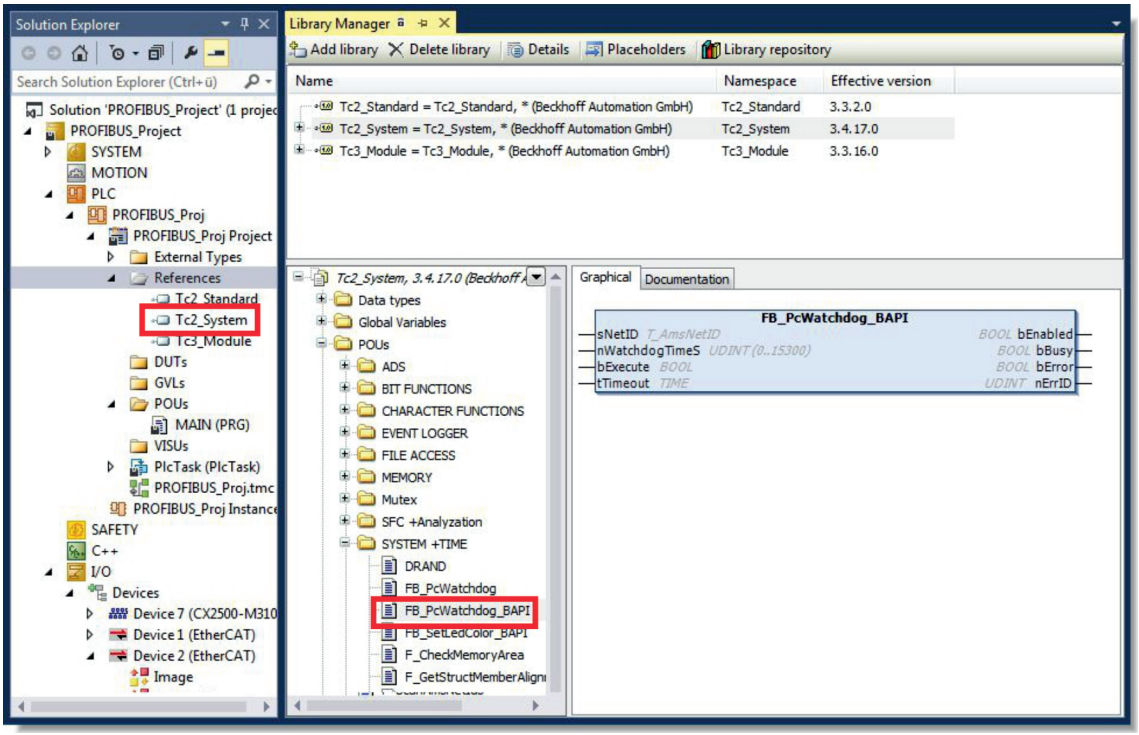
Be aware of this behavior and disable the watchdog if you use breakpoints, carry out a PLC reset or an overall reset, stop TwinCAT, switch to config mode or activate the configuration.

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.



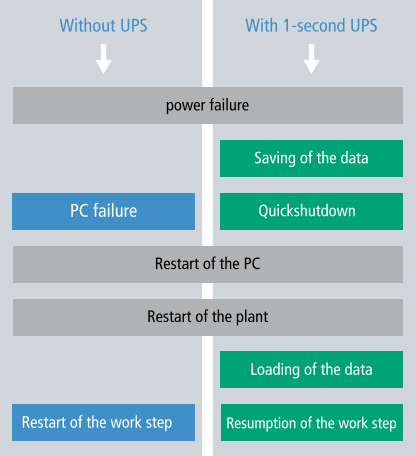
2. Under **Tc2_System > POUs > SYSTEM +TIME** click on the function block **FB_PcWatchdog_BAPI**.

⇨ 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 1-second UPS (persistent data)

Loss of data

The use of the 1-second UPS outside of the documented possibilities can lead to loss or corruption of data.
Use only TwinCAT to control the 1-second UPS and save only persistent data with a maximum size of 1 MB.



The 1-second UPS is an UltraCap capacitor that continues to supply the processor with power in the event of a power failure.

During this period persistent data can be saved, which are available on switching on again.

Since the 1-second UPS is designed for the entire service life, the holding time is considerably longer with new devices. The capacitors age over the course of time and the holding time decreases. Therefore a maximum of 1 MB persistent data can be reliably saved over the entire service life.

Do not save any other data and do not use any other applications to control the 1-second UPS.

Please note that the 1-second UPS does not supply power to the K-bus or the E-bus and that their data may already be invalid when the 1-second UPS is activated. Also, the fieldbus system (or Ethernet) may not work or not work properly once the 1-second UPS was activated.

Storage location and names of the files:
The persistent data are saved by default in the TwinCAT boot directory:

Development environment	File path	File name
TwinCAT 2	\\TwinCat\Boot\	TCPLC_T_x.wbp TCPLC_T_x.wb~ (backup) The x in the file name stands for the number of the runtime system.
TwinCAT 3	\\TwinCat\3.1\Boot\Plc	Port_85x.bootdata Port_85x.bootdata-old (backup) The x in the file name stands for the number of the runtime system.

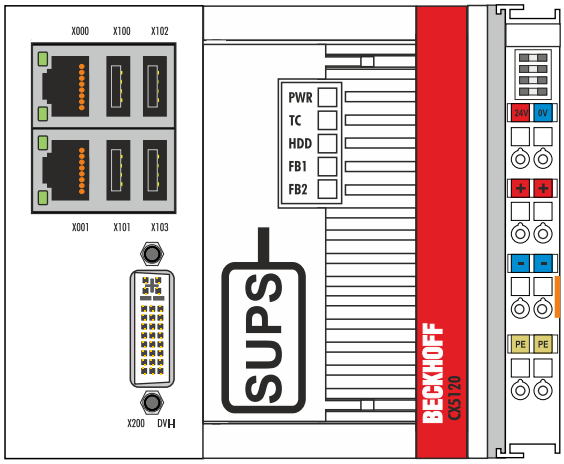
Configure the 1-second UPS as follows in order to save persistent data:

- In the case of the CX51x0, check whether the 1-second UPS is activated or deactivated in the BIOS (see: BIOS settings [▶ 69]). Configure the Windows write filter and issue the corresponding write permissions in order to be able to save persistent data (see: Windows write filter).
- Declare important data such as counter values in the PLC as VAR PERSISTENT. Then call the function block FB_S_UPS_CX51x0 cyclically in TwinCAT in order to control the 1-second UPS (see: FB_S_UPS_CX51x0 [▶ 72]).
- Select the mode in the function block in order to specify what should happen in the case of a voltage failure. Specify, for example, whether persistent data are saved and a quick shutdown is executed (see: Mode and status of the function block [▶ 74]).
- Subsequently you can check the validity of the variables and monitor whether the persistent variables are loaded without error (see: Checking the validity of the variables [▶ 75]).

Sample project:
https://infosys.beckhoff.com/content/1033/CX51x0_HW/Resources/pro/1937303563.pro.

Components	Version
TwinCAT on the development PC and on the control system	TwinCAT 2.11R3 Build 2047 (or higher) TwinCAT 3.1 Build 4018 (or higher)

8.1 BIOS settings



The CX51x0 family features a built-in capacitive one-second UPS. It ensures a safe storage of the persistent application data on the Compact Flash card.

Up to 1 MB of persistent data can be saved. The UPS can be switched on and off via the BIOS. Under the menu:

Advanced -> Power Controller Options

the parameter of the S-UPS are displayed and can be modified, if required.

Aptio Setup Utility - Copyright (C) American Megatrends, Inc.		
Bootloader version	1.00-23	WatchDogTimer mode
Firmware version	1.00-77	
Mainboard serial no	120003414250178	
Mainboard Prod. date (Week.Year)	44.14	
Mainboard BootCount	4711	
Mainboard operation time	1224min (20h)	
Voltage (Min/Max)	5.00V / 5.20V	
Temperature (Min/Max)	15°C / 63°C	
USB-Port voltage	[Off in S3-5]	
WatchDogTimerMode	[Compatibility mode]	
1-second Uninterruptable Power Supply (SUPS)		→←: Select Screen ↑↓: Select Item Enter: Select +/-: Change Options F1: General Help F2: Previous Values F3: Optimized Defaults F4: Save & Exit ESC: Quit
SUPS Enable	[Enable]	
Hold Usb	[Enable]	
Delay	0	
SUPS Firmware version	1.09	
Current Power source	On Line	
Battery load level	100%	
Powerfail counter	42	
Version 2.17.1246. Copyright (C) 2014 American Megatrends, Inc.		

SUPS Enable
Options: Enable / Disable
Switches the SUPS on or off.

Hold USB
Options: Enable / Disable
Switches off the power supply for the USB ports in UPS mode.

Delay
Options: 0…255 seconds
Start delay with which the SUPS is loaded.

SUPS Firmware Version
Firmware version

Current Power Source
Power supply status: Online / Battery

Battery Load Level
Charge state in percent (n% Cap. (n={0...100}) describes the UPS capacity)

Powerfail Counter
Number of power failures

Integration into a PLC

TwinCAT offers special function blocks for integrating the S-UPS into a PLC program. These are described below. From TwinCAT 2.11R3 Build 2247 or TwinCAT 3.1 Build 4018 the required library is integrated in the installation. For older versions the library:
https://infosys.beckhoff.com/content/1033/CX51x0_HW/Resources/rar/1941420683.rar
has to be copied into the TwinCAT library directory.

8.2 Windows write filter

Since the persistent data are stored on a storage medium, the file and the path must be writeable. If you use the Windows write filter, the Windows partition is protected against write access operations, and the persistent data are not saved.

- Switch off the EWF, if you want to save persistent data.
- The FBWF and UWF do not have to be switched off, because an exception can be defined for the directory \Boot.

For Windows CE and Windows Embedded Compact 7 no Windows write filters are used.

FBWF exception list

By default an exception list is automatically created when the FBWF is switched on. The \Boot directory is already entered in this list. Check the configuration of the FBWF if you have made changes to the exception list.

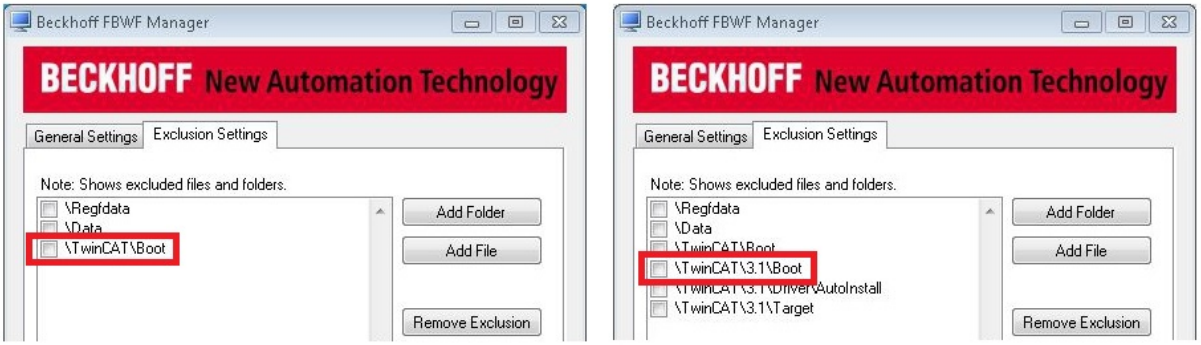


Fig. 34: FBWF exception list, under TwinCAT 2 (left) and TwinCAT 3.

The persistent data are saved by default under \TwinCAT\Boot in TwinCAT 2 and under \TwinCAT\3.1\Boot in TwinCAT 3.

The FBWF can be configured via the Beckhoff FBWF manager.

UWF exception list

By default an exception list is automatically created when the UWF is switched on. The \Boot directory is already entered in this list. Check the configuration of the UWF if you have made changes to the exception list.

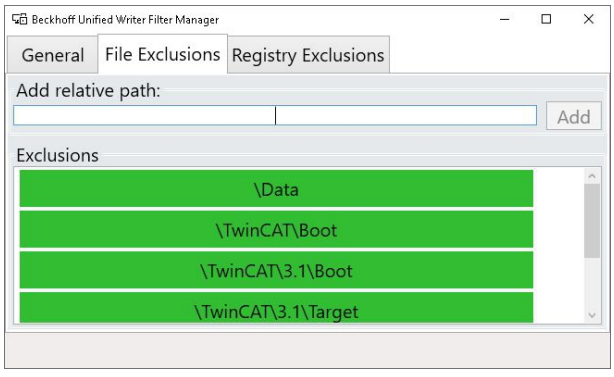


Fig. 35: UWF exception list under TwinCAT 3

By default, the persistent data are stored under \TwinCAT\3.1\Boot in TwinCAT 3.

The UWF can be configured via the Beckhoff Unified Write Filter Manager.

8.3 FB_S_UPS_CX51x0

Loss of data

The 1-second UPS switches the mainboard off as soon as the capacitors have discharged. If other applications or the PLC are keeping other data open or are writing to them, data may be corrupted or lost.

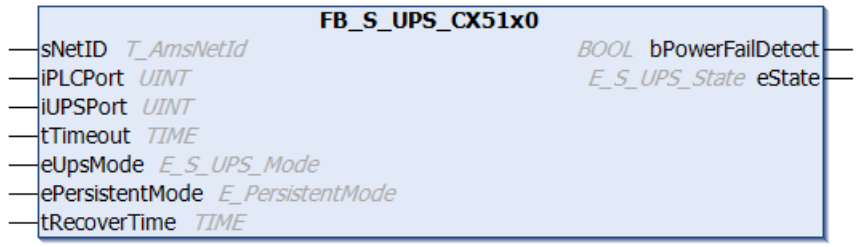
In the case of the CX51x0 the function block FB_S_UPS_CX51x0 is used to control the 1-second UPS from the PLC. If possible, use the standard values of the FB_S_UPS_CX51x0 and call the function block cyclically in the PLC.

The function block has various modes that control the behavior of the Embedded PC when the 1-second UPS is triggered:

Table 33: Block modes.

Mode	Function
eSUPS_WrPersistData_Shutdown	Writing of the persistent data, followed by quick shutdown.
eSUPS_WrPersistData_NoShutdown	Only writing of the persistent data (no quick shutdown)
eSUPS_ImmediateShutdown	Quick shutdown only (no writing of persistent data)
eSUPS_CheckPowerStatus	Monitoring only (neither writing of the persistent data nor quick shutdown); data handling is entirely up to the user.

Regardless of the mode and therefore irrespective of whether data were saved or quick shutdown was performed, the 1-second UPS switches off the mainboard after discharging of the capacitors, even if the voltage has returned in the meantime.



VAR_INPUT

```
VAR_INPUT
    sNetID          : T_AmsNetId:= ''; (* '' = local netid *)
    iPLCPort        : UINT := 0; (* PLC Runtime System for writing persistent data *)
    iUPSPort        : UINT := 16#588; (* Port for reading Power State of UPS *)
    tTimeout        : TIME := DEFAULT_ADS_TIMEOUT; (* ADS Timeout *)
    eUpsMode        : E_S_UPS_Mode := eSUPS_WrPersistData_Shutdown; (* UPS mode (w/
wo writing persistent data, w/wo shutdown) *)
    ePersistentMode : E_PersistentMode := SPDM_2PASS; (* mode for writing persistent data *)
    tRecoverTime    : TIME := T#10s; (* ON time to recover from short power failure in mode eSUPS_Wr
PersistData_NoShutdown/eSUPS_CheckPowerStatus *)
END_VAR
```

sNetID: AmsNetID of the controller. (Type: T_AmsNetId)

iPLCPort: Port number of the PLC runtime system.

iUPSPort: Port number via which the UPS status is read (standard value is 16#588).

tTimeout: Timeout for the execution of the quick shutdown.

eUpsMode: The eUpsMode defines whether persistent data are to be written and whether a quick shutdown is to be performed. Standard value is eSUPS_WrPersistData_Shutdown, i.e. with writing of the persistent data and then quick shutdown. (Type: E_S_UPS_Mode [▶ 74])

ePersistentMode: Mode for the writing of the persistent data. Standard value is SPDM_2PASS.

tRecoverTime: Time after which the UPS reverts to the PowerOK status in the case of UPS modes without shutdown. The tRecoverTime must be somewhat longer than the maximum holding time of the UPS, since the UPS switches off even when the voltage returns

VAR_OUTPUT

```
VAR_OUTPUT
    bPowerFailDetect  : BOOL; (* TRUE while powerfailure is detected *)
    eState            : E_S_UPS_State; (* current ups state *)
END_VAR
```

bPowerFailDetect: TRUE during power failure. FALSE if the supply voltage is present.

eState: Internal state of the function block (type: E_S_UPS_State [▶ 74])

VAR_GLOBAL

```
VAR_GLOBAL
   eGlobalSUpsState  :  E_S_UPS_State; (*current ups state*)
END_VAR
```

eGlobalSUpsState: Internal state of the function block as global copy of VAR_OUTPUT

eState: For values see E_S_UPS_State [▶ 74].

Development environment	Target platform	Hardware	PLC libraries to include
TwinCAT v2.11 R3 B2246 TwinCAT v3.1 B4016	CX51x0	1-Second UPS	For TwinCAT 2: TcSUPS_51x0.lib For TwinCAT 3: Tc2_SUPS

8.4 Mode and status of the function block

E_S_UPS_Mode

With the mode selected in the function block you can specify what should happen in the case of a power failure.

```
eSUPS_WrPersistData_Shutdown: Writing of persistent data and then a QuickShutdown

eSUPS_WrPersistData_NoShutdown: Only writing of the persistent data (no QuickShutdown)

eSUPS_ImmediateShutdown: Only QuickShutdown (no writing of persistent data)

eSUPS_CheckPowerStatus: Only check status (neither writing of persistent data nor a QuickShutdown)
```

E_S_UPS_State

The internal state of the function block can be read with E_S_UPS_State.

```
eSUPS_PowerOK:
in all modes: Power supply is OK

eSUPS_PowerFailure:
in all modes: Power supply is faulty (only shown for one PLC cycle)

eSUPS_WritePersistentData:
in mode eSUPS_WrPersistData_Shutdown: Writing of persistent data is active
in mode eSUPS_WrPersistData_NoShutdown: Writing of persistent data is active

eSUPS_QuickShutdown:
in mode eSUPS_WrPersistData_Shutdown: QuickShutdown ist active
in Mode eSUPS_ImmediateShutdown: QuickShutdown is active

eSUPS_WaitForRecover:
in mode eSUPS_WrPersistData_NoShutdown: Wait for the reestablishment of the power supply
in mode eSUPS_CheckPowerStatus: Wait for the reestablishment of the power supply

eSUPS_WaitForPowerOFF:
in mode eSUPS_WrPersistData_Shutdown: Wait for switching off of the PC by the UPS
in mode eSUPS_ImmediateShutdown: Wait for switching off of the PC by the UPS
```

8.5 Checking the validity of the variables

For TwinCAT 2 the implicit structure Systeminfotype.bootDataFlags can be read in order to determine the validity of the persistent data (see: SYSTEMINFOTYPE [▶ 75]).

For TwinCAT 3 the implicit variables PlcAppSystemInfo.BootDataLoaded and PlcAppSystemInfo.OldBootData are available for determining the validity of the persistent data (see: PlcAppSystemInfo [▶ 77]).

8.5.1 SYSTEMINFOTYPE

```
TYPE SYSTEMINFOTYPE
STRUCT
runTimeNo :BYTE;
projectName :STRING(32);
numberOfTasks :BYTE;
onlineChangeCount :UINT;
bootDataFlags :BYTE;
systemStateFlags  :WORD;
END_STRUCT
END_TYPE
```

runTimeNo: specifies the number of the runtime system (1..4).

projectName: project name as STRING.

numberOfTasks: number of tasks contained in the runtime system (max. 4).

onlineChangeCount: number of online changes since the last complete download.

bootDataFlags: State of the boot data (RETAIN and PERSISTENT) after loading. The upper four bits indicate the state of the persistent data, while the lower four bits indicate the state of the retain data.

Bit number	Description
0	RETAIN variables: LOADED (without error)
1	RETAIN variables: INVALID (the back-up copy was loaded, since no valid data was present)
2	RETAIN variables: REQUESTED (RETAIN variables should be loaded, a setting in TwinCAT System Control)
3	reserved
4	PERSISTENT variables: LOADED (without error)
5	PERSISTENT variables: INVALID (the back-up copy was loaded, since no valid data was present)
6	reserved
7	reserved

systemStateFlags : Reserved.

When shutting TwinCAT down the PERSISTENT and RETAIN data is written into two files on the hard disk. The path can be specified in TwinCAT System Control by means of the TwinCAT system properties (PLC tab). The standard setting is "<Drive>:\TwinCAT\Boot". The files all have a fixed name with fixed extensions:

File name	Description
TCPLC_P_x.wbp	Boot project (x = number of the run-time system)
TCPLC_S_x.wbp	Packed source code (x = number of the runtime system)
TCPLC_R_x.wbp	RETAIN variables (x = number of the runtime system)
TCPLC_T_x.wbp	PERSISTENT variables (x = number of the runtime system)
TCPLC_R_x.wb~	Backup copy of the RETAIN variables (x = number of the runtime system)
TCPLC_T_x.wb~	Backup copy of the PERSISTENT variables (x = number of the runtime system)

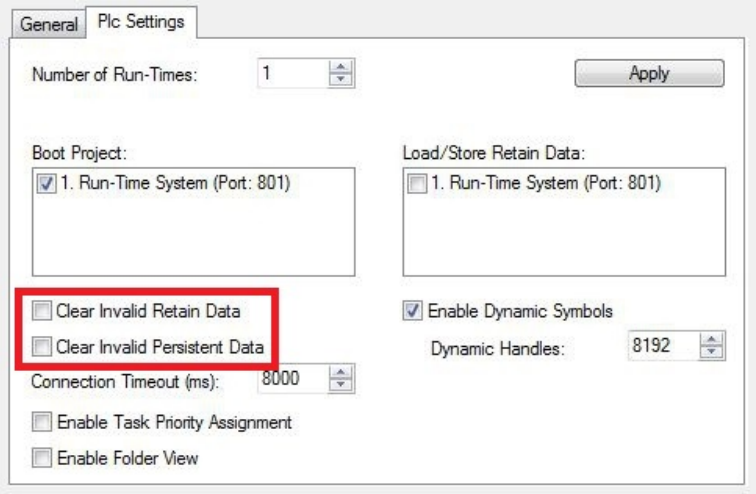
If the persistent or retain variables are not loaded, e.g. because they are invalid, the backup file is loaded by default. In that case bit 1 of the bootDataFlags (for the RETAIN variables) in the PLC and/or bit 5 (for the PERSISTENT variables) is set.

A registry setting can be used to determine whether the backup file is deleted or used. The backup file is used by default (setting 0). If the backup file is to be deleted, the value of "ClearInvalidRetainData" or "ClearInvalidPersistentData" must be set to 1 in the registry under:

```
[HKEY_LOCAL_MACHINE\SOFTWARE\Beckhoff\TwinCAT\Plc]
"ClearInvalidRetainData"=dword:00000000
"ClearInvalidPersistentData"=dword:00000000
```

the value of "ClearInvalidRetainData" or of "ClearInvalidPersistentData" must be set to 1.

Whether the backup file is to be used can also be set in the TwinCAT System Manager in the tree structure on the left under **PLC > PLC Settings**:



The backup files are deleted if the option **Clear Invalid Retain Data** or **Clear Invalid Persistent Data** is set in the System Manager. Corresponds to registry entry 1.

Development environment	Target platform	PLC libraries to be linked
TwinCAT v2.7.0	PC or CX (x86)	PLCSystem.Lib
TwinCAT v2.8.0	PC or CX (x86)	TcSystem.Lib
TwinCAT v2.10.0 Build >= 1301	CX (ARM)	TcSystem.Lib

8.5.2 PlcAppSystemInfo

Each PLC contains an instance of type 'PlcAppSystemInfo' with the name '_AppInfo'.

The corresponding namespace is 'TwinCAT_SystemInfoVarList'. This must be specified for use in a library, for example.

```
TYPE PlcAppSystemInfo
STRUCT
     ObjId              : OTCID;
     TaskCnt            : UDINT;
     OnlineChangeCnt    : UDINT;
     Flags              : DWORD;
     AdsPort            : UINT;
     BootDataLoaded     : BOOL;
     OldBootData        : BOOL;
     AppTimestamp       : DT;
     KeepOutputsOnBP    : BOOL;
     ShutdownInProgress : BOOL;
     LicensesPending    : BOOL;
     BSODOccured        : BOOL;

     TComSrvPtr         : ITComObjectServer;

     AppName            : STRING(63);
     ProjectName        : STRING(63);
END_STRUCT
END_TYPE
```

ObjId	Object ID of the PLC project instance
TaskCnt	Number of tasks in the runtime system
OnlineChangeCnt	Number of online changes since the last complete download
Flags	Reserved
AdsPort	ADS port of the PLC application
BootDataLoaded	PERSISTENT variables: LOADED (without error)
OldBootData	PERSISTENT variables: INVALID (the back-up copy was loaded, since no valid file was present)
AppTimestamp	Time at which the PLC application was compiled
KeepOutputsOnBP	The flag can be set and prevents that the outputs are zeroed when a breakpoint is reached. In this case the task continues to run. Only the execution of the PLC code is interrupted.
ShutdownInProgress	This variable has the value TRUE if a shutdown of the TwinCAT system is in progress. Some parts of the TwinCAT system may already have been shut down.
LicensesPending	This variable has the value TRUE if not all licenses that are provided by license dongles have been validated yet.
BSODOccured	This variable has the value TRUE if Windows is in a BSOD.
TComSrvPtr	Pointer to the TcCOM object server
AppName	Name generated by TwinCAT, which contains the port.
ProjectName	Name of the project

Differences compared with TwinCAT 2

If the variable runTimeNo was used under TwinCAT 2, the corresponding program code must be converted for application under TwinCAT 3.

Example:

- **Application under TwinCAT 2**: nPlcAdsPort := 801 + (SystemInfo.runTimeNo - 1) * 10;
- **Application under TwinCAT 3**: nPlcAdsPort := _AppInfo.AdsPort;

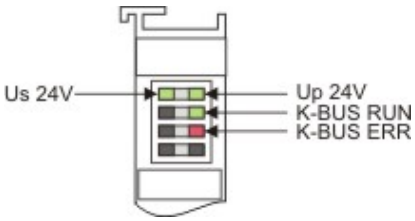
9 Error handling and diagnostics

9.1 Diagnostic LEDs

Display	LED	Meaning
	PWR	Power supply The power LED lights green if the device is connected to a power supply unit and the unit is switched on. The S-UPS is activated (violet). Bootloader is started and runs without errors (The colors red and yellow light up for one second).
	TC	TwinCAT status LED TwinCAT is in Run mode (green) TwinCAT is in Stop mode (red) TwinCAT is in Config mode (blue)
	HDD	Read/Write CFast card (red) indicates that access to the CFast card is in progress.
	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)

9.2 Power supply terminal LEDs in K-bus mode

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.

Display	LED	Meaning
	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.

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.

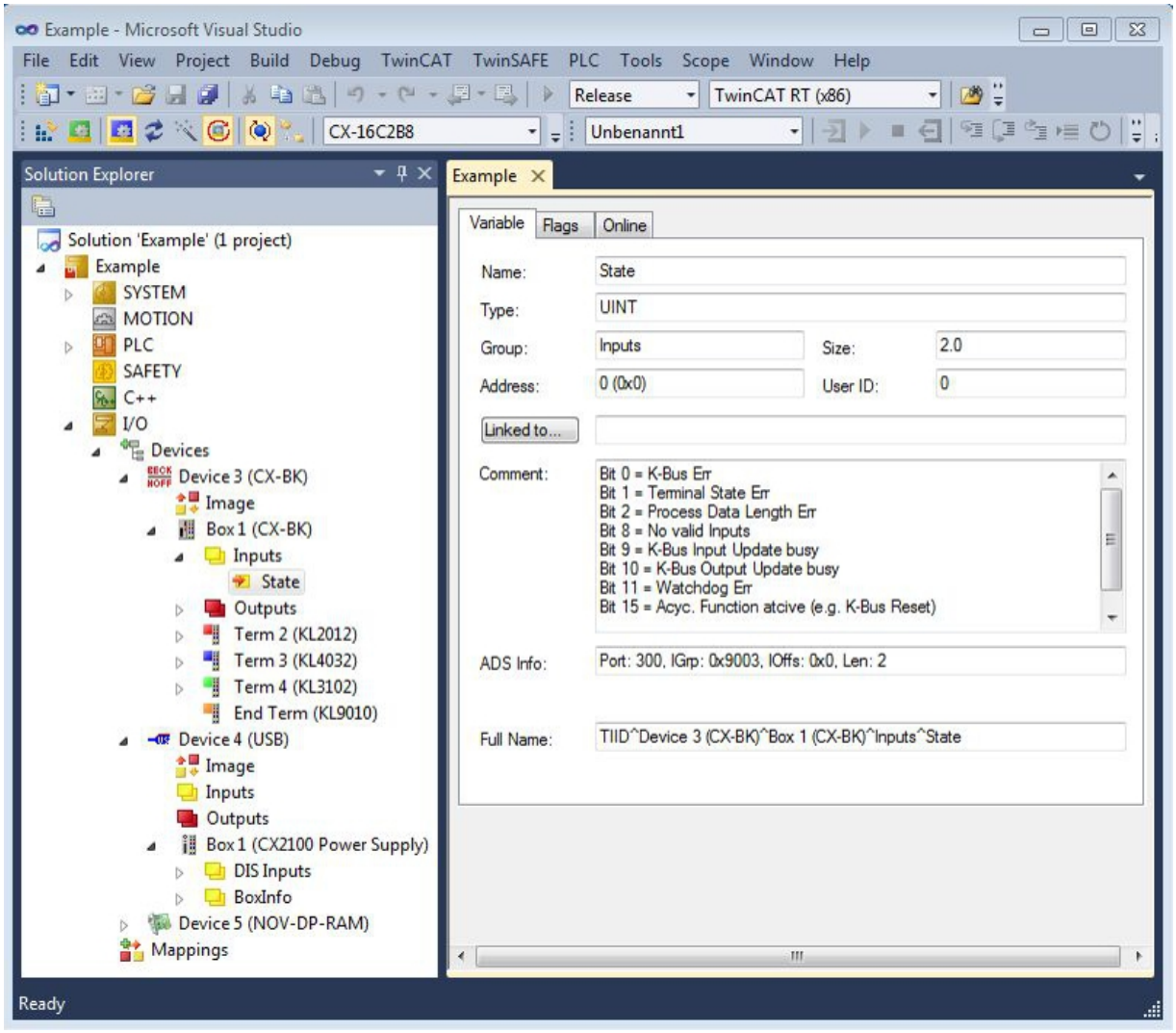


Fig. 36: Status variable for error handling and diagnostics under TwinCAT.

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.

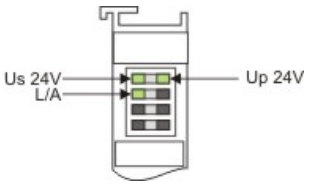
Table 36: Description of the State variable values.

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).

9.3 Power supply terminal LEDs in E-bus mode

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.

Display	LED		Meaning
	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.

9.4 Faults

Please also refer to the Safety instructions section.

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 fuse 2. Measure voltage at connection, check plug wiring 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	Check setup Call Beckhoff support
Computer boots, software starts, but control 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.
µSD card access error	Faulty µSD card, faulty card slot	Use a different µSD card to check the card slot Call Beckhoff support
Embedded PC only works partially or temporarily	Defective components in the Embedded PC	Call Beckhoff support

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. For details please refer to our website at www.beckhoff.de or ask your distribution partner.

10 Care and maintenance

10.1 Replace the battery

NOTE

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 battery of type CR2032 is used for the Embedded PC.

Table 37: Technical data of the battery.

Battery type	Electrical properties (at 20 °C)		Standard charge	Dimensions	
	nominal voltage	nominal capacity	continuous load	Diameter	Height
CR2032	3.0 V	225 mAh	0.20 mA	20.0 mm	3.20 mm

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.

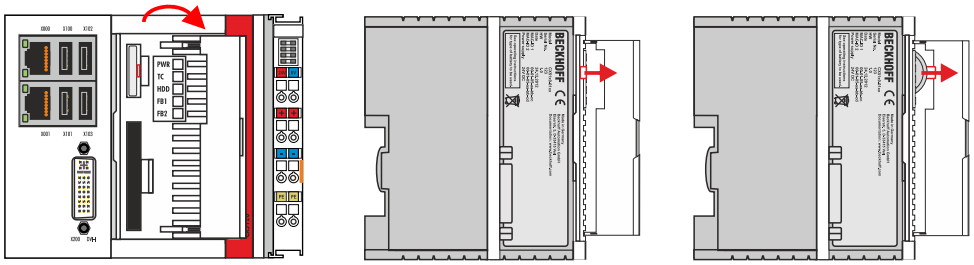
Be aware of this behavior for your hardware and software configuration and reset the time and date in the BIOS after a battery change. All other BIOS settings remain unchanged and are retained.

Requirements:

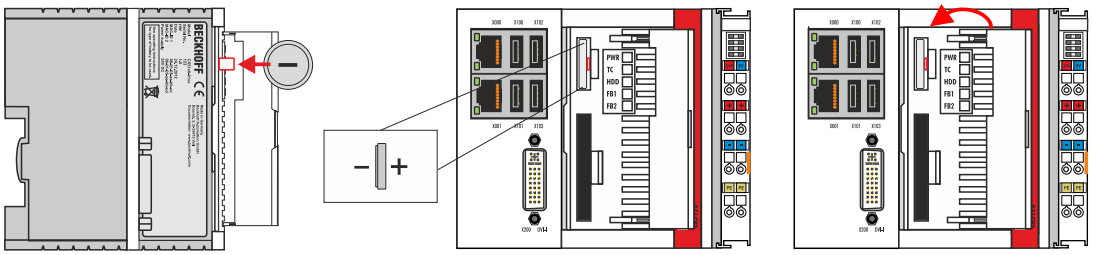
- The Embedded PC is switched off.

Replace the battery as follows:

1. Open the front flap.
2. Carefully pull the battery from the bracket.



3. Push the new battery into the battery compartment. The negative 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.

11 Decommissioning

11.1 Removing cables

NOTE

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.

Cabling

Make a note of the wiring configuration, if you wish to restore it with another device.

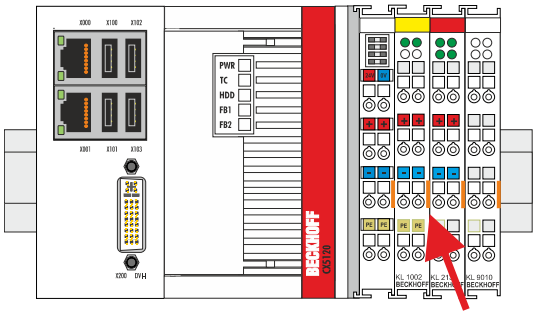
Before dismantling the Embedded PC, shut down the Embedded PC and switch off the power supply. Only then can you remove all the cables. Also remove all cables from the first terminal after the power supply terminal.

Requirements:

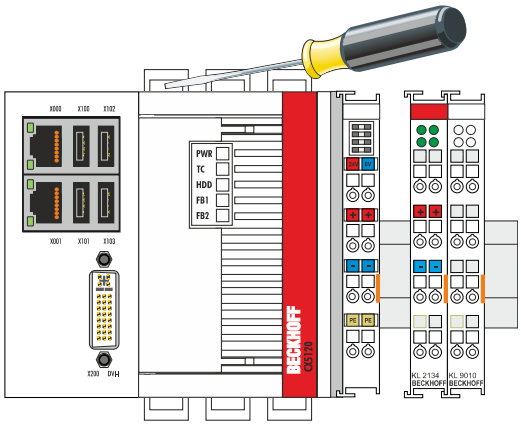
- Exit the software and shut down the Embedded PC.
- Switch off the power supply.

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

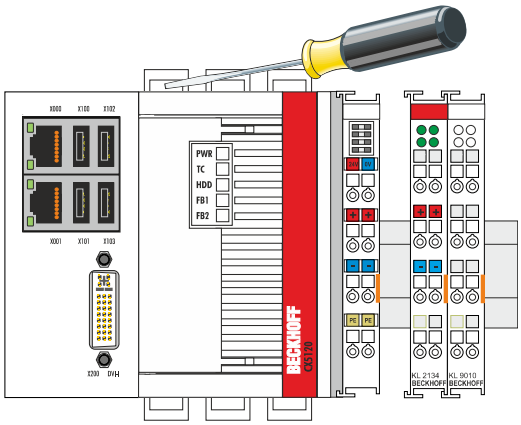
This chapter explains how to dismantle the Embedded PC and remove it from the mounting rail.

Requirements:

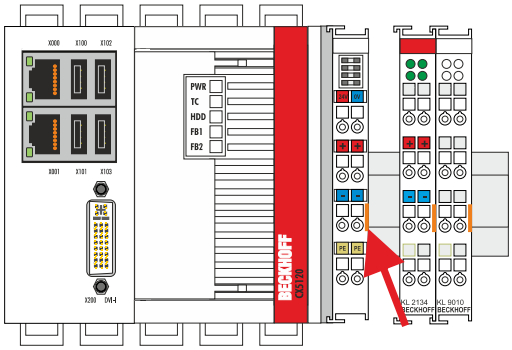
- All cables were removed from the Embedded PC.

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 38: Technical data, dimensions and weights.

	CX5120	CX5130	CX5140
Dimensions (W x H x D)	123 mm x 100 mm x 91 mm	142 mm x 100 mm x 91 mm	
Weight	approx. 975 g	approx. 1095 g	approx. 1095 g

Table 39: Technical data, general data.

Technical data	CX5120	CX5130	CX5140
Processor	Intel® Atom™ E3815 1.46 GHz, single-core	Intel® Atom™ E3827 1.75 GHz, dual-core	Intel® Atom™ E3845 1.91 GHz, single-core
Main memory	2 GB DDR3-RAM	4 GB DDR3-RAM	4 GB DDR3-RAM
Flash memory	Slot for CFast card (card not included), slot for MicroSD card		
Power supply	24 V DC (-15 %/+20 %)		
Max. power consumption	11 W	14 W	16 W
Max. power consumption (with UPS charging)	18 W	20 W	23 W
Dielectric strength	500 V (supply / internal electronics)		
Operating system	Microsoft Windows Embedded Compact 7 Microsoft Windows Embedded Standard 7 P Microsoft Windows 10 IoT Enterprise LTSB		
Control software	TwinCAT 2 PLC-runtime, NC-PTP runtime, NC-I runtime TwinCAT 3		
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, Ex, IECEx		

Table 40: Technical data, I/O terminals.

Technical data	Description
I/O connection	via power supply terminal (E-bus or K-bus, automatic recognition)
Power supply for I/O terminals	max. 2A
Power contacts current loading	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 41: Technical data, environmental conditions.

Technical data	Description
Ambient temperature during operation	-25 °C to +60 °C
Ambient temperature during storage	-40 °C ... +85 °C see notes under: Transport and storage [▶ 13]
Relative humidity	95% no condensation
Vibration resistance	10 frequency sweeps in 3 axes 6 Hz < f < 58.1 Hz displacement 0.15 mm, constant amplitude 58.1 Hz < f < 500 Hz acceleration 5 g, constant amplitude conforms to EN 60068-2-6
Shock resistance	1000 shocks in each direction, in 3 axes 15 g, 11 ms conforms to EN 60068-2-27
EMC immunity	conforms to EN 61000-6-2
EMC emission	conforms to EN 61000-6-4
Protection class	IP 20

Table 42: Technical data, graphic specifications.

Technical data	CX5120	CX5130	CX5140
Processor graphics	Intel® HD graphics	Intel® HD graphics	Intel® HD graphics
Graphic memory	256 MB (shared memory)		
Base clock frequency	400 MHz	542 MHz	542 MHz
max. burst frequency	400 MHz	792 MHz	792 MHz
Shader model	5.0		
DirectX	11		
OpenGL	4.0		

Table 43: Technical data, interfaces.

Technical data	Description
LAN	2 x RJ 45, 10/100/1000 Mbit/s
USB	4 x USB 2.0 each rated at 500 mA, type A
DVI-I	Resolution on the monitor in pixels: 640 x 480 to 1920 x 1200

Table 44: 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 plug, 9-pole Electrical isolation 500 V
RS422/RS485	D-Sub plug, 9-pole Electrical isolation 500 V
EtherCAT slave	2 x RJ 45, EtherCAT IN and OUT 100 Mbaud
PROFIBUS	D-Sub plug, 9-pole 9.6 kbaud to 12 Mbaud
CANopen	D-Sub plug, 9-pole 10 kbaud to 1,000 kbaud
PROFINET RT	2 x RJ-45 switches

13 Appendix

13.1 Accessories

Table 45: CFast cards

Order number	Description
CX2900-0026	20 GB CFast card, 3D flash, extended temperature range
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

larger capacities on request

Table 46: MicroSD cards.

Order number	Description
CX1900-0122	512 MByte microSD card
CX1900-0124	1 GByte microSD card
CX1900-0126	2 GByte microSD card
CX1900-0128	4 GByte microSD card
CX1900-0130	8 GByte microSD card

larger capacities on request

Table 47: Passive DVI-to-VGA adaptor.

Order number	Description
CX1900-0101	Passive DVI-to-VGA adaptor for the connection of standard VGA monitors to the CX system – feeds out the VGA signals of the DVI-I interface of the CX module – DVI-A plug, 29-pin (bottom), socket, 15-pin (top) – Weight: approx. 40 g – Dimensions (W x H x D): 40 x 42 x 15 mm

Table 48: Spare battery for CX systems.

Order number	Description
CX1900-0102	Battery for CX systems type CR2032 3V/225 mAh

13.2 Certifications

All products of the Embedded PC family are CE, UL and EAC certified. Since the product family is continuously developed further, we are unable to provide a full listing here. The current list of certified products can be found at www.beckhoff.com.

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.

Beckhoff's branch offices and representatives

Please contact your Beckhoff branch office or representative for local support and service on Beckhoff products!

The addresses of Beckhoff's branch offices and representatives round the world can be found on her internet pages:
http://www.beckhoff.com

You will also find further documentation for Beckhoff components there.



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