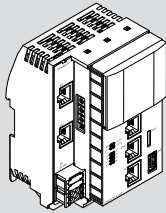


CPX-E-CEC-C1/-M1-EP
Controller



FESTO

Festo SE & Co. KG
Ruiter Straße 82
73734 Esslingen
Germany
+49 711 347-0

www.festo.com


8192769

Operating instruction
8192769
2023-09b
[8192771]

Translation of the original instructions

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1 About this document

This document describes the use of the above-mentioned product. Certain aspects of use are described in other documents and must be observed → 1.1 Applicable documents.

1.1 Applicable documents

All available documents for the product → www.festo.com/sp.

Document	Content
Automation system CPX-E Manual	Detailed description of the automation system CPX-E
Automation system CPX-E Operating instruction	Instruction manual and important information on assembly, electrical installation and maintenance tasks for an automation system CPX-E
Manual controller CPX-E-CEC-EP	Detailed description of product function and parameterisation options
Operating instructions and manuals for the other CPX-E modules in the automation system CPX-E	Information on using the CPX-E modules
Operator unit CDSB Operating instruction	General functions of the operator unit

Tab. 1: Applicable documents

1.2 Product version

This document refers to the following product versions:

Product	Programming	Version
CPX-E-CEC- C1 -EP	with CODESYS V3	Revision 1 and later
CPX-E-CEC- M1 -EP	with CODESYS V3 and SoftMotion	Revision 1 and later

Tab. 2: Product version

The product version can be identified from the product labelling or with the help of appropriate software from Festo.

Software suitable for determining the product version is available from Festo in the Support Portal → www.festo.com/sp. Information on using the software can be found in the integrated Help function.

There may be an updated version of this document for this or later product versions → www.festo.com/sp.

1.3 Product labelling

The product labelling is located on the left-hand side of the module. Scanning the printed Data Matrix Code with an appropriate device opens the Festo Support Portal with the information appropriate for the product. Alternatively, the Product Key (11-digit alphanumeric code on the product labelling) can be entered in the search field of the Support Portal.

Detailed information on the product labelling is included in the module manual → 1.1 Applicable documents.

1.4 Specified standards

Version		
EN 60529:2013-10	EN 61000-6-4:2007-01	IEC 60204-1:2014-10
EN 61000-6-2:2005-08		

Tab. 3: Standards specified in the document

1.5 UL certification

In combination with the UL inspection mark on the product, the information in this section must also be observed in order to comply with the certification conditions of Underwriters Laboratories Inc. (UL) for USA and Canada.

UL certification information	
Product category code	NRAQ/NRAQ7
File number	E239998
Considered standards	UL 61010-1, 3rd Edition, May 11, 2012, revised April 29, 2016 CAN/CSA-C22.2 No. 61010-1-12, 3rd Edition, Revision dated April 29, 2016 UL 61010-2-201, 1st Edition, Revised February 20, 2017 CSA-C22.2 No. 61010-2-201:14, 1st Edition, Issue date January 01, 2014
UL mark	

Tab. 4: UL certification information

- Technical data and environmental conditions may be subject to change in order to comply with Underwriters Laboratories Inc. (UL) certification requirements for the USA and Canada.
Note deviations → Technical data.
- The unit shall be supplied by a power source which fulfils the requirements on a limited-energy circuit in accordance to IEC/EN/UL/CSA 61010-1 or on a Limited Power Source (LPS) in accordance to IEC/EN/UL/CSA 60950-1 or IEC/EN/UL/CSA 62368-1 or a Class 2 circuit in accordance to NEC or CEC.

Unauthorised access to the device can cause damage or malfunctions. When connecting the device to a network: Protect the network against unauthorised access. Measures to protect the network include:

- Firewall
- Intrusion Prevention System (IPS)
- Network segmentation
- Virtual LAN (VLAN)
- Virtual private Network (VPN)
- Security at physical access level (port security)

For additional information → Guidelines and standards for security in information technology, e. g. IEC 62443, ISO/IEC 27001.

An access password only protects against unintentional modification.

NOTICE

Modules with Ethernet interfaces should only be operated in networks if all connected network components are supplied by PELV circuits or integrated circuits with equivalent protection.

2 Safety

2.1 Safety instructions

- Take into consideration the legal regulations for the installation location.
- Use the product only within the defined values → 11 Technical data.
- Observe the identifications on the product.
- Observe further applicable documents.
- Store the product in a cool, dry environment protected from UV and corrosion. Keep storage times short.
- Before working on the product: switch off the power supply and secure it against being switched on again.
- Comply with the handling specifications for electrostatically sensitive devices.
- Do not activate the load voltage until the system is properly installed, configured and parameterised.

2.2 Intended use

The product described in this document is intended as an autonomous CODESYS controller for an Automation system CPX-E. Interfaces for EtherNet/IP or Modbus TCP are available for communication with a higher-order controller. An EtherCAT master interface enables connection to lower-order devices. Use the product only as follows:

- Use only in an industrial environment. Outside industrial environments, e.g. in commercial and residential/mixed-use areas, it may be necessary to take measures to suppress radio interference.
- Use only in combination with modules and components that are approved for the applicable product variant → www.festo.com/catalogue.

- Only use the product if it is in perfect technical condition.
- Only use the product in its original condition without unauthorised modifications. Only the conversions or modifications described in this and the further applicable documents are permitted.

2.3 Training of qualified personnel

Work on the product should only be conducted by qualified personnel. The qualified personnel must be familiar with installation of electrical control systems. Experience of an EtherCAT- and EtherNet/IP-network and with the CODESYS V3 development kit is required in order to understand this documentation.

3 Additional information

- Contact the regional Festo contact if you have technical problems
➔ www.festo.com.
- Accessories and spare parts ➔ www.festo.com/catalogue.

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Firmware, software or configuration files ➔ www.festo.com/sp.

More information	Content
CODESYS Installation and getting started.pdf	Working with CODESYS ➔ installation directory for the software
CODESYS_OPC_Server_V3_Benutzerhandbuch.pdf	
Online help for CODESYS V3	Detailed information on using the product with CODESYS V3 and the Festo extensions
Online help for CODESYS libraries	Description of the function blocks for an extended function range of the controller

Tab. 5: More information

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Including the following information will make it easier to process support queries:

- CODESYS project as project archive ➔ menu command in CODESYS V3: [File][Project archive][Save/send archive...]
- Version of the programming environment ➔ menu command in CODESYS V3 [Help][Information...][Show detailed version information]
- Controller data ➔ Copy data properties using suitable software from Festo, e.g. Festo Field Device Tool (FFT).

4 Product overview

4.1 Function

Together with additional CPX-E modules, the product forms an Automation system CPX-E that can be commissioned using CODESYS V3.

Network Connection

The product can be integrated directly into a higher-order network. Communication takes place via EtherNet/IP. Modbus TCP and standard Ethernet (TCP/IP) are also supported.

EtherCAT-Master

EtherCAT slave devices can be connected to the product.

CODESYS libraries and plug-ins

Various libraries and plug-ins for CODESYS V3 are available for the easy actuation and visualisation of CPX-E modules.

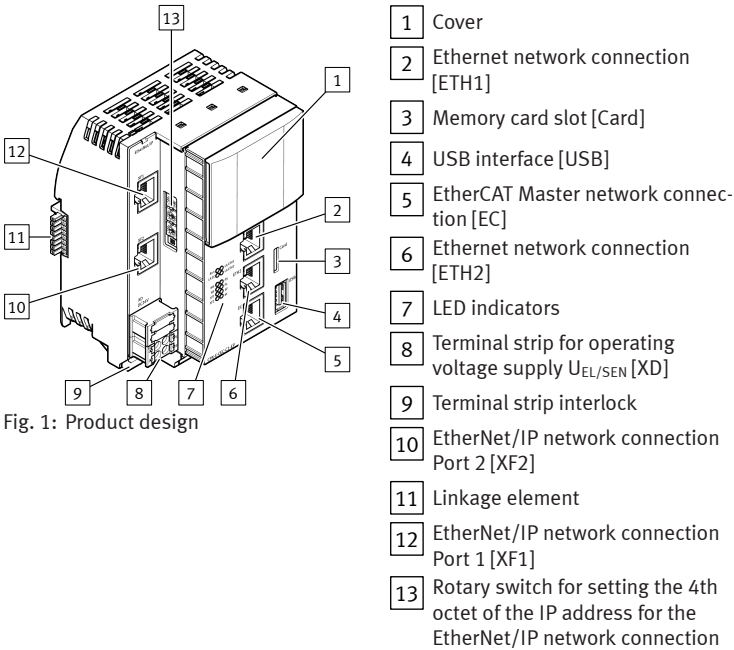
Web server

The integrated web server provides read access to the key parameters and diagnostic functions of the automation system CPX-E. The web server can be accessed by entering the IP address in the address bar of a web browser.

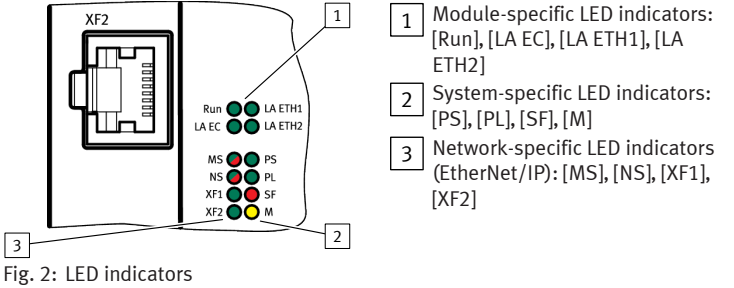
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Factory settings for the web server:
IP address: 192.168.0.1, subnet mask: 255.255.255.0

4.2 Structure

4.2.1 Product design



4.2.2 Display components



Module-specific LED indicators:

- Operation [Run] (green)
- Connection/data traffic EtherCAT [LA EC] (green)
- Connection/data traffic Ethernet [LA ETH1], [LA ETH2] (green)

System-specific LED indicators:

- Operating voltage supply $U_{EL/SEN}$ [PS] (green)
- Load voltage supply U_{OUT} [PL] (green)
- System Fault [SF] (red)
- Force mode [M] (yellow)

Network-specific LED indicators (EtherNet/IP):

- Module status [MS] (green, red, orange)
- Network status [NS] (green, red, orange)
- Connection/data traffic [XF1], [XF2] (green)

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The module- and network-specific LED displays are described below ➔ 10.3 LED indicators.
The system-specific LED indicators are described in the documents for the automation system CPX-E ➔ 1.1 Applicable documents.

4.2.3 Control elements

4.2.3.1 Run/stop switch

The run/stop switch (DIL switch) is located under the covering.

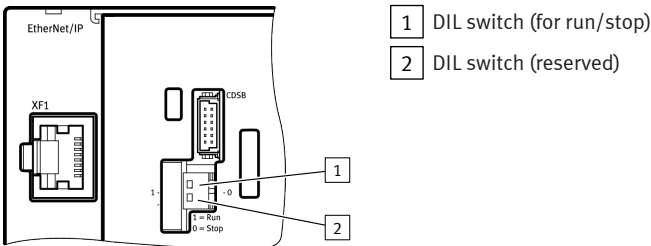


Fig. 3: Run/stop switch

NOTICE

Damage to internal electronics.

Damage to at-risk components due to electrostatic discharge.

- Ensure your body is electrostatically discharged before activating the run/stop switch.

- Activate run/stop switch as required.

Switch status	Function
Run (standard setting)	A project can be started using CODESYS (run mode active). A CODESYS boot application can be started.
Stop	A project cannot be started using CODESYS. A CODESYS boot application cannot be started.
Run → Stop	A project that is running will be stopped.
Stop → Run	A project that was stopped using the run/stop switch will be continued.

Tab. 6: Run/stop switch

4.2.3.2 Rotary switch

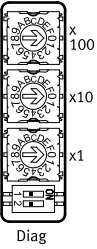
NOTICE

Damage to internal electronics.

Damage to at-risk components due to electrostatic discharge.

- Ensure your body is electrostatically discharged before activating the rotary switch.

- Activate rotary switch as required.

Rotary switch	Function
Address  x100 x10 x1 Diag	The 3 rotary switches are used to set the 4th octet of the IP address for the EtherNet/IP network connection: 192.168.1.XXX. Possible settings 0 = use the internal configuration (factory setting) 1 ... 254 = Permissible address range 999 = reset to factory setting For invalid values, the internal configuration is used. Factory setting 192.168.1.1 (DHCP active) The DIL switches are reserved and have no function.

Tab. 7: Rotary switch

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Changes to the rotary switches only take effect following a restart of the module.

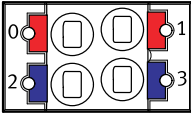
4.2.3.3 Operator unit CDSB (optional)

The operator unit CDSB is available as an accessory → www.festo.com/catalogue.

The functions of the operator unit are described in the "CPX-E-CEC-...-EP controller manual" → 1.1 Applicable documents.

4.2.4 Connecting elements

4.2.4.1 Operating voltage supply

Connection [XD1], [XD2] ¹⁾	Signal
	0
	1
	2
	3
	+24 V DC operating voltage supply U_{EL/SEN} 0 V DC operating voltage supply U_{EL/SEN}

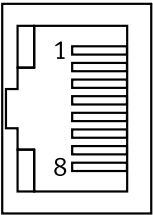
1) Connections XDx.0 and XDx.1 and also XDx.2 and XDx.3 are each connected to each other in the terminal strip.

Tab. 8: Connection [XD1], [XD2]

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To comply with the certification requirements of Underwriters Laboratories Inc. (UL) for the USA and Canada, within the scope of UL/CSA, depending on the current consumption, the parallel connection of the operating voltage supply to [XD1] and [XD2] is required → 11.3 Technical data for UL certification.

4.2.4.2 Network connections

Port [XF1], [XF2], [ETH1], [ETH2], [EC]	Signal
	1
	2
	3
	4
	5
	6
	7
	8
	¹⁾ Shield
	TD+ Transmitted data + TD– Transmitted data – RD+ Received data + n.c. – RD– Received data – n.c. – n.c. – Functional earth

1) Housing

Tab. 9: Port [XF1], [XF2], [ETH1], [ETH2], [EC]

Connection	Function
[XF1]	EtherNet/IP Port 1
[XF2]	EtherNet/IP Port 2

Connection	Function
[ETH1]	Ethernet interfaces for the connection of a programming device, PC or operator unit CDPX
[ETH2]	
[EC]	EtherCAT master

Tab. 10: Network connections

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The network connections ETH1 and ETH2 are connected to the controller via a switch.

4.2.4.3 Memory card slot [Card]

The slot is used to save data and results to a memory card CAMC-M-MS-G32-G2.

- The data are saved in the directory /mnt/sdcard.
- The data are accessed through SysFile and CAA.File → CODESYS libraries.

Requirements:

- Maximum memory size: 32 GB
- Formatting: FAT32 (one partition only)

i

When using a memory card, please note the direction and orientation.

i

Use only memory cards that are sold by Festo as accessories for the product → www.festo.com/catalogue.

Festo does not provide any warranty for the use of other memory cards.

i

The memory card slot is only intended for user-monitored operation.

- Do not use memory cards for continuous data recording.

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Memory cards cannot be used to execute CODESYS boot projects.

4.2.4.4 USB interface [USB]

The USB interface (A-coded socket, USB specification 2.0) is used to save data and results to external storage media.

- The data from the USB memory are saved in the directory /mnt/usb.
- The data are accessed through SysFile and CAA.File → CODESYS libraries.

Requirements:

- Maximum memory size: 32 GB
- Formatting: FAT32 (one partition only)

NOTICE

Impermissible operating states of the controller result from high current consumption at the USB interface.

- Use only storage media with a current consumption of ≤ 0.5 A.

i

The USB interface is only intended for user-monitored operation.

- Do not use storage media for continuous data recording.

i

USB storage devices cannot be used to execute CODESYS boot projects.

5 Transport and storage

- Observe specifications for environmental and storage conditions → 11 Technical data.

6 Mounting

- Assemble the module following the "Automation system CPX-E operating instructions" → 1.1 Applicable documents.

7 Installation

7.1 Network

NOTICE

Unauthorised Access to the Device Can Cause Damage or Malfunction.

- When connecting the device to a network, protect the network from unauthorised access.
Standards for security in information technology can be used for network protection measures, e.g. IEC 62443, ISO/IEC 27001.

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Network

An access password only protects against unintentional modification.

NOTICE

Transmission errors due to faulty installation or excessive transmission rates.

- Please note the line specifications in the documentation of the controller.

7.2 Operating power supply U_{EL}/SEN

NOTICE

Malfunction due to faulty installation.

- Please note the information regarding the line specification, power supply and earthing measures.

1. Observe the information in the "Automation system CPX-E operating instructions" → 1.1 Applicable documents.
2. Ensure the power supply is switched off.
3. Connect the cables to the terminal strip as directed by the "Automation system CPX-E operating instructions" → 1.1 Applicable documents.

8 Commissioning



You can find information on commissioning the automation system CPX-E in the "Automation system CPX-E operating instructions".
You can find information on the parameters in the "Automation system CPX-E manual" and in the descriptions of the installed modules → 1.1 Applicable documents.

8.1 Response of the display components after error-free commissioning

[MS] (green)	[NS] (green)	[XF1], [XF2] (green)
 on	 on	 Lights up or flashes

Tab. 11: Display components after error-free commissioning

[PS] (green)	[PL] (green)	[SF] (red)	[M] (yellow)
 on	 on	 off	 off

Tab. 12: Display components after error-free commissioning



Information on troubleshooting in the event of deviating response can be found in the "Automation system CPX-E manual" and in the manuals for the installed modules → 1.1 Applicable documents.

8.2 Commissioning with CODESYS

CAUTION

Risk of injury due to uncontrolled movements of the connected actuators.

- Perform test runs of projects and applications without active actuators first.



- Use CODESYS V3 for configuration, parameterisation and programming of the product.

Requirements

- PC (WINDOWS 7 and later) with Ethernet interface
- Components for network connection
- Programming software CODESYS V3
- Package CPX-E-CEC conforming to the firmware of the product

Preparations



The user requires administrator rights to install and operate programming softwareCODESYS V3.

1. Install CODESYS V3.
2. Start CODESYS V3 with administrator rights.
3. Open Package Manager → menu command [Tools][Package Manager].
4. Install the current package for CPX-E-CEC → online help for CODESYS V3 → Package Manager.
5. CODESYS Restart V3.
6. Connect the controller to the network connection [ETH 1] or [ETH 2] through a switch/hub or directly to the PC → 7.1 Network.
7. Configure the network settings → menu command [Online][Scan Festo devices] → online help for CODESYS V3 → Scan Festo Devices.



The current version of the package CPX-E-CEC for CODESYS V3 is available in the Festo Support Portal → www.festo.com/sp.
Further information is available in the product-specific Help
→ Online help for CODESYS V3 → Getting started.

Procedure for unwanted program states

If a program with real-time priority is not responding:

1. Set run/stop switch to stop.
 - ↳ The boot application cannot be started.
2. Restart the controller.
3. Establish connection to CPX-E-CEC.
4. Delete boot application using "Reset device to original state"
→ General help for CODESYS V3.

9 Service

NOTICE

Accumulation of heat due to reduced air supply to electronics.

- Keep the ventilation slots free and regularly remove contamination.

9.1 Firmware service (update)

- Update the controller firmware with suitable software from Festo
→ www.festo.com/sp.

10 Diagnostics and fault clearance

10.1 Diagnostics options

Various options are available for diagnosing errors:

- Internal system diagnostics
- LED indicators on the product

10.2 Internal system diagnostics



The internal system diagnostics is described in the "Automation system CPX-E manual" → 1.1 Applicable documents.

10.3 LED indicators



The module- and network-specific LED displays are described below.
The system-specific LED indicators are described in the documents for the automation system CPX-E → 1.1 Applicable documents.

Module-specific LED indicators

Operation [Run]		
LED (green)	Meaning	Remedy
 Lit	CODESYS application is running	–
 Off	CODESYS application is not available or has stopped	–

Tab. 13: Operation [Run]

Ethernet interfaces [LA ETH 1][LA ETH 2]		
LED (green)	Meaning	Remedy
 Lit	Network connection established Status "Link"	–
 Flashing	Network connection established Status "Activity"	–
 Off	No network connection	Check network connection.

Tab. 14: Ethernet interfaces [LA ETH 1][LA ETH 2]

EtherCAT interface [LA EC]		
LED (green)	Meaning	Remedy
 Lit	Network connection established Status “Link”	–
 Flashing	Network connection established Status “Activity”	–
 Off	No network connection	Check network connection.

Tab. 15: EtherCAT interface [LA EC]

Network-specific LED indicators

Connection status [XF1], [XF2]		
LED (green)	Meaning	Remedy
 on	Network connection established Status “Link”	–
 flashes	Network connection established Status “Activity”	–
 off	no network connection	Check network connection.

Tab. 16: Connection status [XF1], [XF2]

Module status [MS]		
LED (green, red, orange)	Meaning	Remedy
 green light	normal operating status	–
 flashing green	Configuration of the automation system CPX-E not complete or not correct	Complete or correct configuration of the automation system CPX-E.
 red light	error cannot be rectified	Contact Festo Service ➔ www.festo.com .
 flashing red	Error can be rectified	Check configuration of the automation system CPX-E.
 flashing alternately red/green	The automation system CPX-E is in self-test mode.	–
 orange light	Bootloader	–
 off	No logic power supply to the network interface	Check logic power supply.

Tab. 17: Module status [MS]

Network status [NS]		
LED (green, red, orange)	Meaning	Remedy
 green light	The automation system CPX-E is online and has a network connection (normal operating status).	–
 flashing green	The automation system CPX-E is online and has received an IP address but does not have a configured network connection.	Check configuration of the automation system CPX-E; it is possible that the automation system CPX-E is not assigned to a master/scanner.
 red light	Communication has failed. Non-permitted IP address set that is already used in the network.	Correct IP address.
 flashing red	One or more “I/O connections” are in the “time-out state”.	Check the physical connection to the master/scanner.
 flashing alternately red/green	The automation system CPX-E is in self-test mode.	–
 orange light	Bootloader, if the LED [MS] is also orange ➔ Network-specific LED indicators	–
 off	The automation system CPX-E is offline. No IP address assigned or no IP address received from DHCP server.	Check network connection. Check IP addressing settings.

Tab. 18: Network status [NS]

11 Technical data

11.1 Technical data, general

General technical data	CPX-E-CEC-C1-EP	CPX-E-CEC-M1-EP
Certificates, declaration of conformity	➔ www.festo.com/sp	
General technical data Automation system CPX-E	Automation system CPX-E Manual ➔ 1.1 Applicable documents	
Dimensions (length × width × height) ¹⁾	[mm]	124.3 × 75.9 × 82.5
Product weight ²⁾	[g]	288
Mounting position	Vertical/horizontal	
Ambient temperature with vertical mounting position	[°C]	–5 ... +60
Ambient temperature with horizontal mounting position	[°C]	–5 ... +50
Storage temperature	[°C]	–20 ... +70
Humidity (non-condensing)	[%]	0 ... 95
Degree of protection in accordance with EN 60529	IP20 The degree of protection is not UL-tested.	
Protection against electric shock (Protection against direct and indirect contact in accordance with IEC 60204-1)	By the use of PELV circuits (Protected extra-low voltage)	
Electromagnetic compatibility	In accordance with EN 61000-6-2/-4	
Module characteristic values	CPX-E-CEC-C1-EP	CPX-E-CEC-M1-EP
Module code/submodule code	222/102	222/103
Module identification	E-CEC-C1-EP	E-CEC-M1-EP

1) including cover, not including linkage element
2) including linkage element

Tab. 19: General technical data

11.2 Technical data, electrical

Power supply		
Operating power supply U _{EL/SEN}	[V DC]	24 ± 25%
Intrinsic current consumption at nominal operating voltage 24 V from U _{EL/SEN}	[mA]	Typically 150
Reverse polarity protection 24 V U _{EL/SEN} against 0 V U _{EL/SEN}		Yes
Mains buffering time	[ms]	20

Tab. 20: Power supply

Network-specific data		
Protocol		EtherNet/IP ¹⁾ , EtherCAT
Transmission rate	[Mbps]	10/100 (full duplex/half duplex)
Crossover detection		Auto-MDI/MDI-X
Maximum cable length per segment	[m]	100 ²⁾
Cable specification		
Cable type		Ethernet twisted pair cable, shielded
Transmission class		Category Cat 5/Cat 5e (link class)
Cable diameter	[mm]	6 ... 8
Wire cross section	[mm²]	0.14 ... 0.75; 22 AWG ³⁾

- 1) based on the Ethernet protocol IEEE 802.3
2) at a transmission rate of 100 Mbps
3) required for maximum connection length between network devices

Tab. 21: Network-specific data

11.3 Technical data for UL certification

Ambient conditions UL		
Pollution degree		3
Installation site		for indoor use only
Maximum installation height	[m]	2000

Tab. 22: Ambient conditions UL

Maximum current rating of operating voltage supply U _{EL/SEN} UL		
Supply via [XD1] connection	[A]	≤ 4
Supply via both [XD1] and [XD2] connections	[A]	> 4 ... 8 A

Tab. 23: Maximum current rating UL