

System CPX-E

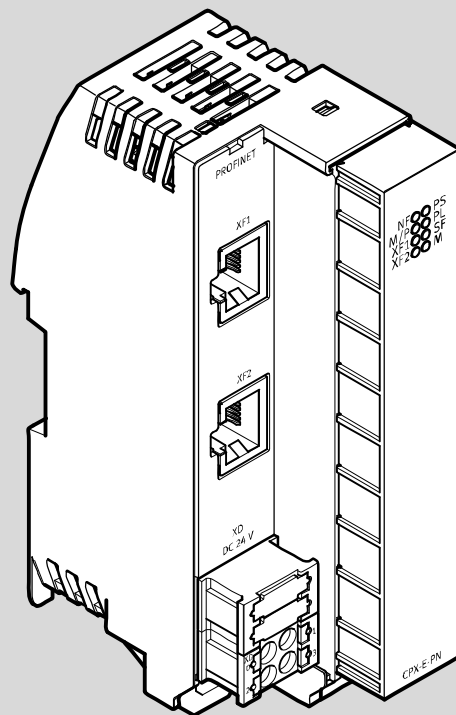
Bus module CPX-E-PN

FESTO

Description

Protocol
PROFINET

Function
Parameterisation



8071139
2017-07
[8071141]

Bus module CPX-E-PN

Original instructions
CPX-E-PN-EN

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Symbols used:



Note

Material damage or loss of function



Recommendations, tips, references to other documentation

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1 About this document

This document describes the function and parameterisation of the product stated in the title. Safe use of the product is described in a separate document → 1.1 Further applicable documents.

1.1 Further applicable documents

Document	Contents
Description of system CPX-E (CPX-E-SYS)	Detailed description of system CPX-E
Instructions for using system CPX-E (CPX-E-SYS)	Instructions and important notes on mounting, electrical installation and maintenance tasks for a system CPX-E
Instructions for using bus module CPX-E-EP (CPX-E-EP)	Instructions and important notes on the use and safe usage of the product
Documentation for the components in a system CPX-E and the connected peripherals	Information on using the components
Documentation for the higher-order controller and the additional participants in the network	Information on commissioning and parameterisation of the components

Tab. 1.1



For all available product documentation → www.festo.com/pk.

1.2 Target group

This document is intended for qualified personnel. Experience of a PROFINET IO network is required in order to understand this documentation.

1.3 Product version

This document refers to the following product versions:

Product	Version
CPX-E-PN	Bus module CPX-E-PN as of Revision 1

Tab. 1.2

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



Appropriate software for identifying the product version can be found in the Festo 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 these or later product versions.

- Check whether a corresponding version of this document is available → www.festo.com/sp.

1.4 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 calls up the Festo Support Portal, with 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.

- 1 Designation
- 2 Part number/serial number
- 3 Revision status
- 4 MAC ID
- 5 Data Matrix Code
- 6 Product Key
- 7 Approvals/warning symbols
- 8 Port assignment

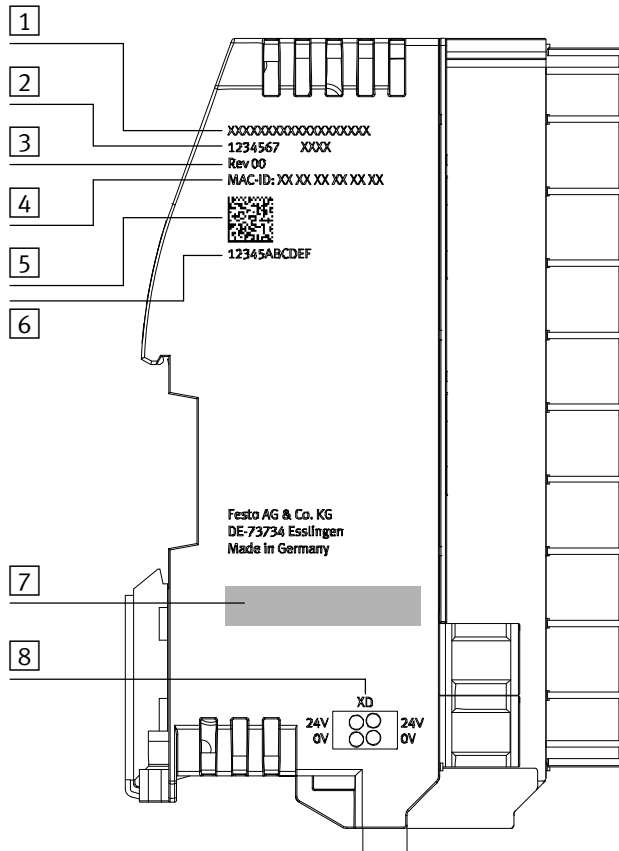


Fig. 1.1

1.5 Specified standards

Version status	
EN 60529:2013-10	IEC 61784:2014-08
EN 61000-6-2:2009-04	IEC 61918:2013-08
EN 61000-6-4:2011-09	IEEE 802.3:2014-00
IEC 60204-1:2014-10	NE 21:2012-05
IEC 61158:2014-07	

Tab. 1.3

2 Function

2.1 General

The product is intended for operating a system CPX-E in a PROFINET IO network. Data is transmitted on the basis of Industrial Ethernet following the IEEE 802.3 protocol. Communication takes place in real time, using the Real-Time Protocol (RT) or the Isochronous Real-Time Protocol (IRT).

The product has two equivalent Ethernet interfaces (RJ45) with integrated switch, and therefore supports both star and line topology. The network can be divided into segments using additional switches and routers. This makes it possible to structure the network and extend it further.

2.1.1 Web server

The integrated web server provides read access to the key parameters and diagnostic functions of the system CPX-E.

The web server can be accessed by entering the IP address in the address bar of a web browser.



Factory settings of the bus module:
IP address: 192.168.10.3, subnet mask: 255.255.255.0

2.1.2 Device description file

A device description file (GSDML file) is used for configuring the bus module in the higher-order controller software. This file contains all the information required for parameterising the system CPX-E using controller software (such as Siemens STEP 7).



The device description file is available on the Festo Support Portal (→ www.festo.com/sp).

2.1.3 PROFlenergy

The product supports the PROFlenergy profile for energy management. This makes it possible to switch off specific consumers that are not required in order to reduce energy demand.

2.1.4 Crossover detection (auto MDI/MDI-X)

The product supports crossover detection (auto MDI/MDI-X), which means that there is the option of using patch cables or crossover cables.



When using patch cables and crossover cables in the same network, crossover detection must be activated in the higher-order controller.

When using the “Priority start-up” function (Fast Start-Up), crossover detection (auto MDI/MDI-X) must be deactivated.

2.1.5 Priority start-up (Fast Start-Up)

The “Priority start-up” function (Fast Start-Up) ensures that the system CPX-E is able to start up quickly.



When using the “Priority start-up” function (Fast Start-Up), crossover detection (auto MDI/MDI-X) must be deactivated and the bus module must be parameterised as a slave.

2.1.6 Identification & Maintenance (I&M)

The “Identification & Maintenance” (I&M) function acts as an electronic product label for the bus module and provides standardised, non-proprietary access to device-related information about the network.

2.1.7 Product design

- 1 LED indicators
- 2 Terminal strip for operating voltage supply $U_{EL/SEN}$ [XD]
- 3 Terminal strip interlock
- 4 Network connection [XF2]
- 5 Linking
- 6 Network connection [XF1]

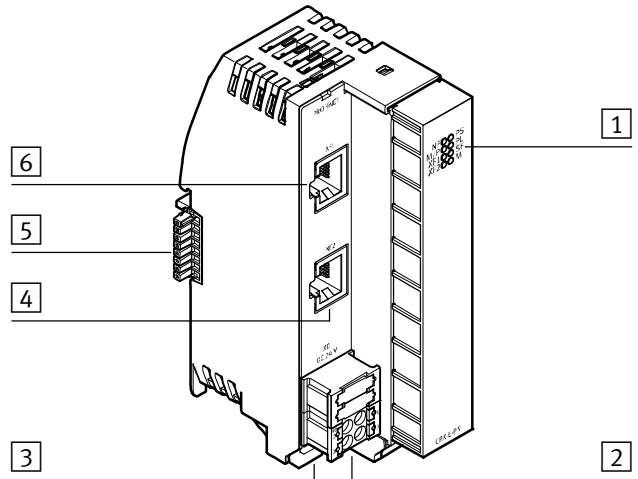


Fig. 2.1

2.1.8 Display components

- 1 Network-specific LED indicators:
 - Network fault [NF] (red)
 - Maintenance [M/P] (yellow/green)
 - Connection/data traffic [XF1]/[XF2] (green)
- 2 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)

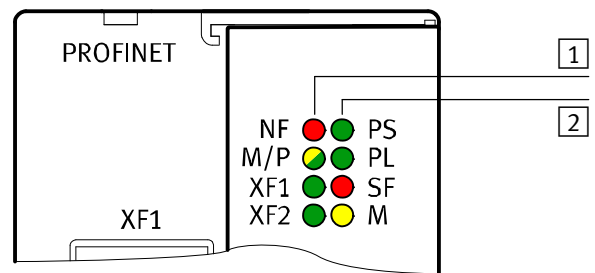


Fig. 2.2

2.1.9 Connecting components

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

1) Housing

Tab. 2.1

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

1) The ports XD.0 and XD.1 and also XD.2 and XD.3 are interconnected in the terminal strip.

Tab. 2.2

2.2 Address assignment

The system CPX-E is composed of a different number of inputs and outputs, depending on the number and type of modules CPX-E used and the parameterisation of the bus module. The inputs and outputs are assigned automatically within the system CPX-E.

The address assignment (number of allocated inputs and outputs) on the system CPX-E must be determined prior to commissioning.

- i** – A maximum of 10 I/O modules + bus module is permitted in one system CPX-E.
- The address space of a system CPX-E is limited. The bus module provides the system CPX-E with a maximum address space of 64 bytes for inputs and 64 bytes for outputs.
- Activated diagnostic functions as well as status bits or the I/O diagnostic interface reduce the size of the available address space.

2.3 Addressing

2.3.1 Basic rules for addressing

- The address assignment of the inputs is independent of the address assignment of the outputs.
- The bus module counts as a module with 0 inputs and 0 outputs when the status bits and the I/O diagnostic interface are deactivated.
 - Activated status bits occupy 8 inputs.
 - An activated I/O diagnostic interface occupies 16 inputs and 16 outputs.
- The inputs and outputs of different module types are assigned separately from each other.

i Addressing is generally carried out by the higher-order controller (in cases where a Siemens higher-order controller is being used).

2.3.2 Addressing example

- 1 Bus module CPX-E-PN (with status bits)
 - Status bits activated
 - I/O diagnostic interface deactivated
- 2 Digital input module CPX-E-16DI
- 3 Digital output module CPX-E-8DO
- 4 Digital output module CPX-E-8DO
- 5 Analogue input module CPX-E-4AI-U-I
- 6 Analogue output module CPX-E-4AO-U-I

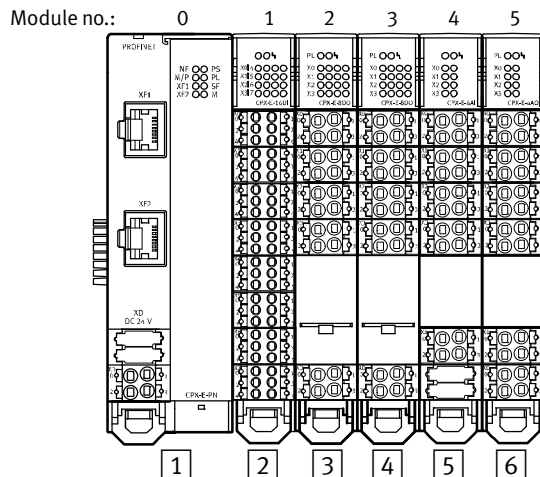


Fig. 2.3

Tab. 2.3 shows the address assignment for the system CPX-E pictured here, in a TIA portal with a Siemens PLC.

Module no.	Module	Input address	Output address
0	Bus module CPX-E-PN (with status bits)	Byte 68	–
1	Digital input module CPX-E-16DI	Byte 1 ... 2	–
2	Digital output module CPX-E-8DO	–	Byte 1
3	Digital output module CPX-E-8DO	–	Byte 2
4	Analogue input module CPX-E-4AI-U-I	Byte 69 ... 76	–
5	Analogue output module CPX-E-4AO-U-I	–	Byte 64 ... 71

Tab. 2.3

2.4 Diagnostics options

The module supports various diagnostics options, depending on the configuration and parameterisation of the system CPX-E.

Diagnostics option	Description	Detailed information
LED display components		
System-specific	The system status and errors are displayed directly on the module via LED indicators.	<ul style="list-style-type: none"> ➔ Instructions for using system CPX-E ➔ Description of system CPX-E
Network-specific	The network status and errors are displayed directly on the module via LED indicators.	<ul style="list-style-type: none"> ➔ 2.4.1 ➔ Instructions for using CPX-E-PN
Status bits	Common diagnostic messages are transmitted cyclically to the interface as internal inputs. Access is via the control software, independently of the interface and master.	<ul style="list-style-type: none"> ➔ 2.4.2 ➔ Description of system CPX-E
I/O diagnostic interface	Network-independent diagnostic interface with read access to the internal data of the system CPX-E at the I/O level.	<ul style="list-style-type: none"> ➔ 2.4.3 ➔ Description of system CPX-E
Festo software	Malfunctions or errors are displayed directly on a PC, meaning that diagnostics is also possible from a higher automation level.	➔ Online help for software
PROFINET IO	Diagnostics as part of PROFINET IO functions via the network. Detailed module-related and channel-related error detection by means of control software.	➔ 2.5

Tab. 2.4

2.4.1 LED indicators



This document describes the network-specific LED indicators. The system-specific LED indicators are described in the documentation for the system CPX-E → 1.1 Further applicable documents.

Network fault [NF]		
LED (red)	Significance	Remedy
 Flashes	Network connection not OK Possible causes: Device name not correct IO controller defective Network connection interrupted, short-circuited or disturbed	<ul style="list-style-type: none"> • Check device name. • Repair IO controller. • Check network connection.
 Off	No fault (if PS LED lights up green)	–

Tab. 2.5

Maintenance/PROFenergy [M/P]		
LED (yellow/ green)	Significance	Remedy
 Lights up yellow	Maintenance measure required	<ul style="list-style-type: none"> • Check plug connectors.
 Flashes green	PROFenergy activated	–
 Off	No maintenance measures required, PROFenergy not activated	–

Tab. 2.6

Connection status [XF1], [XF2]		
LED (green)	Significance	Remedy
 Lights up	Network connection OK	–
 Flashes	Module positioning if both LEDs (XF1 and XF2) flash synchronously, e.g. for troubleshooting purposes or during configuration	–
 Off	No network connection	<ul style="list-style-type: none"> • Check network connection.

Tab. 2.7

2.4.2 Status bits

The system CPX-E provides 8 status bits for displaying global common diagnostic messages.

The status bits are configured like inputs and supply coded diagnostic information in the form of 0 or 1 signals. If all status bits are supplying a 0 signal, there is no error. If, in contrast, a status bit supplies a 1 signal, there is an error. In order to make use of the status bits function, the bus module of the system CPX-E must be configured accordingly.

The status bits are shown in the process image if this has been specified by selecting the catalogue entry “E-PN [Status]” in the hardware configurator.



If different errors occur simultaneously on different types of modules, errors cannot be distinguished. The I/O diagnostic interface can be used to distinguish errors clearly → 2.4.3 I/O diagnostic interface. You can find detailed information about status bits in the “Description of system CPX-E” → 1.1 Further applicable documents.

2.4.3 I/O diagnostic interface

The system CPX-E provides an I/O diagnostic interface in the form of 16 input bits and 16 output bits for reading detailed diagnostic information. The I/O diagnostic interface can be used, for example, to precisely determine the module and channel on which an error has occurred. In order to make use of the I/O diagnostic interface, the bus module of the system CPX-E must be configured accordingly.

The I/O diagnostic interface is shown in the process image if this has been specified by selecting the catalogue entry “E-PN [STI]” in the hardware configurator.



You can find detailed information about the I/O diagnostic interface in the “Description of system CPX-E” → 1.1 Further applicable documents.

2.5 Diagnostics via PROFINET IO

The system CPX-E supports diagnostics options via PROFINET IO in accordance with IEC 61158; for example, module-related and channel-related status information as well as error detection in the online mode of the control software and in the PLC user program.

2.5.1 Error numbers



With the exception of the CPX-E error numbers listed in Tab. 2.8, the CPX-E error numbers in the PROFINET IO network are transferred with an offset of 1000:

→ CPX-E error number + 1000 = PROFINET IO error number

Error number		Significance
CPX-E	PROFINET IO	
2	1	Short circuit
3	6	Wire break
4	2	Undervoltage
5		
9	8	Lower limit undershot
10	7	Upper limit exceeded
11	1	Short circuit at valve
13	6	Wire break at valve
65	64	PROFIsafe addresses (F_Dest_Add) different
69	72	Parameterisation error (error in “safe parameterisation”)
75	5	Over-temperature
254	2	Electronics and sensors undervoltage

Tab. 2.8



You can find a list of all CPX-E-specific error numbers in the “Description of system CPX-E”

→ 1.1 Further applicable documents.

3 Parameterisation

The behaviour of the system CPX-E can be parameterised with the aid of suitable software from Festo or using a higher-order controller. Here, a distinction is made between the following variants:

- System parameters
- Module parameters (module-specific and channel-specific)
- Parameterisation of the diagnostic memory



You can find a detailed description of the individual parameters in the “Description of system CPX-E” and in the descriptions of the individual modules → 1.1 Further applicable documents.

System parameters		Description/setting options
System parameters (CPX-E-specific)		
SCS monitoring		You can find detailed information in the “Description of system CPX-E” → 1.1 Further applicable documents.
SCO monitoring		
U _{OUT} monitoring		
Fail-safe		
Force mode		
Diagnostic memory		
System parameters (CPX-E-PN-specific)		
Filter for diagnostic message, undervoltage U _{OUT}	Inactive	Undervoltage is reported via the network.
	Active	Undervoltage messages are filtered and not reported via the network. The undervoltage is only indicated by the “SF” LED flashing on the bus module.
Filter for channel alarms, undervoltage U _{OUT}	Inactive	Undervoltage is reported via the network.
	Active	Undervoltage messages are filtered; a maximum of one message per module is sent via the network. The undervoltage is also indicated by the “SF” LED flashing on the bus module.
Filter for combining channel alarms (channel bundling)	Inactive	Channel alarms are reported individually via the network.
	Active	Channel alarms (e.g. short circuit or undervoltage) are combined and sent as a common message via the network. The error is also indicated by the relevant LED flashing on the bus module.
Analogue process value display (Intel/Motorola format)		<p>Defines how the process values of the analogue modules are displayed.</p> <p>Setting options:</p> <ul style="list-style-type: none"> – Intel byte order (LSB-MSB, little endian):¹⁾ Process values are displayed in Intel format (least significant bit on the left, most significant bit on the right) – Motorola byte order (MSB-LSB, big Endian): Process values are displayed in Motorola format (most significant bit on the left, least significant bit on the right) <p>This parameter can also be set via the I/O diagnostic interface, using function number 4402 in bit 7:</p> <ul style="list-style-type: none"> – Value “0”: Intel (LSB-MSB)¹⁾ – Value “1”: Motorola (MSB-LSB) <p>The settings for the byte order and process value display depend on the higher-order controller and the associated user programs.</p>

1) Factory setting

Tab. 3.1

A Technical Data

General		
Key feature		Specification/value
General technical data, system CPX-E		Description of system CPX-E ➔ 1.1 Further applicable documents
Dimensions (length x width x height)	[mm]	125.8 x 37.8 x 76.5
Product weight ¹⁾	[g]	145
Mounting position		Vertical/horizontal
Ambient temperature	[°C]	-5 ... +60 (-5 ... +50) ²⁾
Storage temperature	[°C]	-20 ... +70
Air humidity (non-condensing)	[%]	0 ... 95
Assigned address space (inputs/outputs)		
Without diagnostics	[bit]	-/-
With status bits	[bit]	8/-
With I/O diagnostic interface	[bit]	16/16
Module code/submodule code (CPX-E-specific)		222/34
Module identification		E-PN
Degree of protection in accordance with EN 60529		IP20
Protection against electric shock (protection against direct and indirect contact to IEC 60204-1)		Through the use of PELV circuits (Protected extra-low voltage)
Electromagnetic compatibility		To EN 61000-6-2/-4 and NE 21

1) Including linking

2) With horizontal mounting position

Tab. A.1

Power supply		
Key feature		Specification/value
Operating voltage supply for electronics/sensors (U _{EL/SEN})	[V DC]	24 ± 25 %
Intrinsic current consumption at nominal operating voltage 24 V from U _{EL/SEN}	[mA]	73
Reverse polarity protection 24 V U _{EL/SEN} against 0 V U _{EL/SEN}		Yes
Mains buffering time	[ms]	20

Tab. A.2

Network-specific		
Key feature		Specification/value
Protocol		PROFINET IO ¹⁾
Conformity class		CC-C
Specification ²⁾		IEC 61158, IEC 61784, IEC 61918
Transmission rate	[Mbps]	100
Crossover detection		Auto-MDI/MDI-X
Maximum cable length per segment	[m]	100
Cable specification		
Cable type		Ethernet twisted pair cable, screened
Transmission class		Category Cat 5 or higher
Cable diameter	[mm]	6 ... 8
Wire cross section	[mm ²]	0.14 ... 0.75; 22 AWG ³⁾

1) Based on the Ethernet protocol IEEE 802.3

2) Standards with reference to PROFINET

3) Required for maximum connection length between network participants

Tab. A.3

B Terminology

Term/abbreviation	Description
Bus module	Connects a system CPX-E to the network; transmits control signals to the connected modules CPX-E and monitors their functionality.
Device description file	Protocol-specific file for configuring the bus module in the control software for the higher-order controller. This contains all the information required to parameterise the system CPX-E via control software.
DIL switch	Switch consisting of several switch elements with which settings can be made (dual in-line).
GSDML file	Device description file for PROFINET (Generic Station Description Markup Language)
I/O	Input and output
I/O diagnostic interface	Network-independent diagnostic interface at I/O level, which enables access to the internal data of the system CPX-E.
I/O module	Collective term for modules that provide analogue or digital inputs and/or outputs.
Modules CPX-E	Collective term for modules that can be integrated in a system CPX-E.
PLC	Programmable logic controller
Status bits	Internal status information (common diagnostic messages) of the system CPX-E, provided as input signals via the network.
System CPX-E	Complete system consisting of modules CPX-E.

Tab. B.1

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