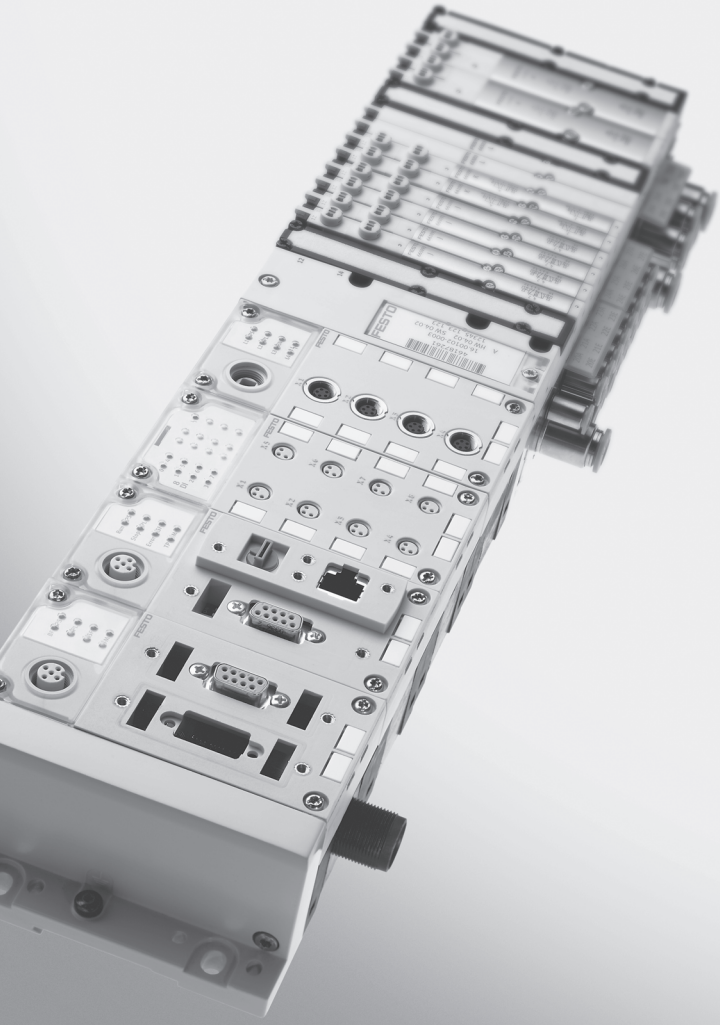
CPX terminal



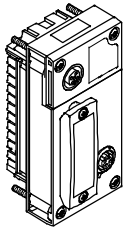
FESTO

Manual
Electronics

CPX field bus node

Type CPX-FB32

Fieldbus protocol
EtherNet/IP



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Internet: http://www.festo.com
E-Mail: service_international@festo.com

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Use for intended purpose

The fieldbus node documented in this descriptionCPX-FB32 is intended solely for use as a station on the EtherNet/IP.

The CPX terminal must only be used as follows:

– as intended in an industrial environment

– in original status without unauthorised alterations. Only the conversions or modifications described in the documentation supplied with the product are permitted.

– in perfect technical condition.

The limit values specified for pressures, temperatures, electrical data, torques etc. must be observed.

If additional commercially available components such as sensors and actuators are connected, the specified limits for pressures, temperatures, electrical data, torques, etc. must not be exceeded.

Observe the regulations of the trade associations, German Technical Control Board (TÜV), VDE stipulations or corresponding national laws and regulations.

Target group

This description is intended exclusively for technicians trained in control and automation technology who have experience in installing, commissioning, programming and diagnosing stations on the EtherNet/IP.

Service

Please consult your local Festo Service agent if you have any technical problems.

Instructions on this description

Further information on the EtherNet/IP can be found in:

– www.odva.org

General basic information about the method of operation, mounting, installation and commissioning of CPX terminals can be found in the CPX system description.

An overview of the structure of the CPX terminal user documentation is contained in the CPX system description.

Important user instructions

Danger categories

This description contains instructions on the possible dangers which can occur if the product is not used correctly.
These instructions are marked with a signal word (Warning, Caution, etc.), printed on a shaded background and marked additionally with a pictogram. A distinction is made between the following danger warnings:

Warning
... means that failure to observe this instruction may result in serious personal injury or material damage.

Caution
... means that failure to observe this instruction may result in personal injury or material damage.

Note
... means that failure to observe this instruction may result in material damage.

The following pictogram marks passages in the text which describe activities with electrostatically sensitive components:

Electrostatically sensitive components may be damaged if they are not handled correctly.

Identification of specific information

The following pictograms mark passages in the text which contain special information.

Pictograms

Information:
Recommendations, tips and references to other information sources.

Accessories:
Specifications on necessary or useful accessories for the Festo product.

Environment:
Information on the environmentally friendly use of Festo products.

Text designations

- Bullet points indicate activities which may be carried out in any order.

1. Numerals denote activities which must be carried out in the numerical order specified.

– Arrowheads indicate general lists.

The following **product-specific** terms and abbreviations are used in this description:

Term/abbreviation	Meaning
$A0_h$	Hexadecimal numbers are marked by a low-set “h”.
AA, AO	Analogue output
AB, AW	Output byte, output word
AE, AI	Analogue input
CP modules	Collective term for the various modules which can be integrated in a CPX terminal.
CPX terminal	Complete system consisting of CPX modules with or without pneumatics.
DA, DO, A	Digital output
DE, DI, O	Digital input
DIL switch	Dual-in-line switches consist of several logic elements with which settings can be made.
EB, EW	Input byte, input word
FEC	Front End Controller
Fieldbus nodes	Provide the connection to specific fieldbuses. Transmit control signals to the connected modules and monitor their ability to function.
Handheld / MMI	Handheld programmer for commissioning and service purposes
I/O modules	Collective term for the CPX modules which provide digital inputs and outputs.
I/Os	Digital inputs and outputs
Pneumatic interface	The pneumatic interface is the interface between the modular electrical peripherals and the pneumatics.

Tab. 0/1: CPX-specific terms and abbreviations

Installation

Chapter 1

Table of contents

1.1 General installation instructions

Warning
Before carrying out installation and maintenance work, switch off the following:
- Compressed air supply
- Operating voltage supply for the electronics/sensors
- Load voltage supply for the outputs/valves

In this way, you can avoid:

- uncontrolled movements of loose tubing
- unexpected movements of the connected actuators
- non-defined switching states of the electronic components

Caution
The CPX fieldbus node contains electrostatically sensitive components.
- Therefore, do not touch any components.
- Observe the handling specifications for electrostatically sensitive devices.

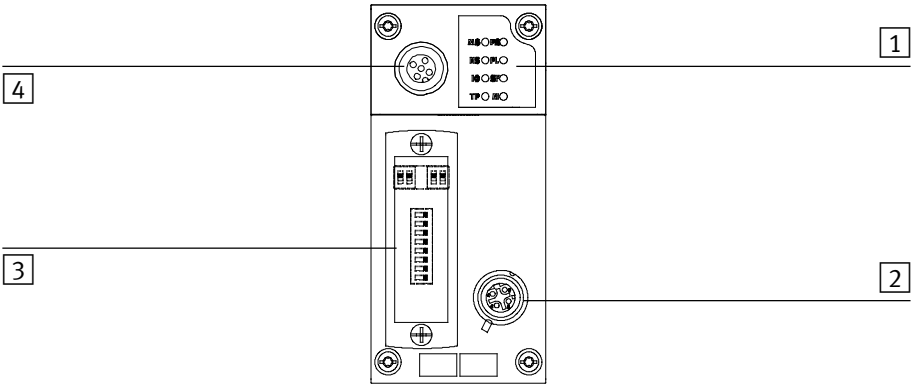
They will help you avoid damage to the electronics.

Note
Use protective caps or blanking plugs to seal unused connections. This is how you achieve protection class IP65/IP67.

Information about mounting of the CPX terminal can be found in the CPX system description (P.BE-CPX-SYS-...).

Electrical connection and display elements

On the fieldbus node CPX-FB32 you will find the following connection and display elements:



1 Bus-status-specific and CPX-specific LEDs

2 Fieldbus interface: Ethernet connection (4-pin M12 socket, D-coded)

3 Transparent cover for the DIL switches

4 Service interface for the Hand-held (V24)

Fig. 1/1: Connecting and display elements on the CPX fieldbus node

Dismantling and mounting

The fieldbus node is fitted in an interlinking block of the CPX terminal (see Fig. 1/2).

Dismantling

Dismantle the fieldbus node as follows:

1. Loosen the 4 screws in the field bus node with a Torx screwdriver size T10.
2. Pull the fieldbus node carefully and without tilting away from the contact rails of the manifold base.

1 Fieldbus node CPX-FB32

2 Interlinking block with contact rails

3 Torx T10 screws

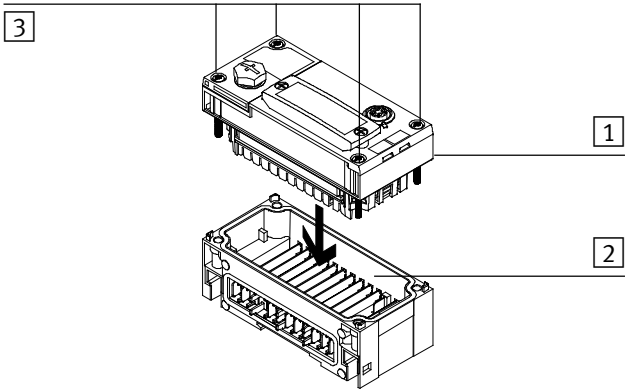


Fig. 1/2: Dismantling/mounting the fieldbus node

Mounting

Mount the fieldbus node as follows:

1. Place the fieldbus node in the interlocking block.
   Make sure that the grooves with the power contact terminals on the bottom of the fieldbus node lie above the contact rails.
2. Push the field bus node carefully and without tilting into the interlocking block up to the stop.
3. Only tighten the screws by hand. Place the screws so that the self-cutting threads can be used.
4. Tighten the screws with a Torx screwdriver size T10 with torque 0.9 ... 1.1 Nm.

1.2 Settings of the DIL switches on the fieldbus node

In order to set the CPX fieldbus node, you must first remove the cover over the DIL switches.

Caution
The CPX fieldbus node contains electrostatically sensitive components.

- Do not therefore touch any contacts.
- Observe the handling specifications for electrostatically sensitive devices.

You will then prevent the electronics in the node from being damaged.

1.2.1 Removing and mounting the cover for the DIL switches

In order to set the CPX fieldbus node, you must first remove the cover over the DIL switches.

Removing

1. Switch off the power supply.
2. Unscrew the two mounting screws in the switch cover.
3. Lift off the cover.

Mounting

1. Place the cover carefully on the node.

Note
- Make sure that the seal is seated correctly.

2. Tighten the two fastening screws at first by hand and then with a torque of 0.4 Nm.

1.2.2 Settingthe DIL switches

You can set the following parameters with the DIL switches under the cover (see Fig. 1/3):

– Operating mode

– Diagnostic mode or number of I/O bytes

– IP addressing

Procedure:

1. Switch off the power supply.
2. Remove the cover over the DIL switches (section 1.2.1).
3. Carry out the setting as described on the following pages.
4. Mount the cover again (section 1.2.1).

1 DIL switch 1: Operating mode

2 DIL switch 2: Diagnostic mode or number of I/O bytes for Remote Controller

3 DIL switch 3: IP addressing

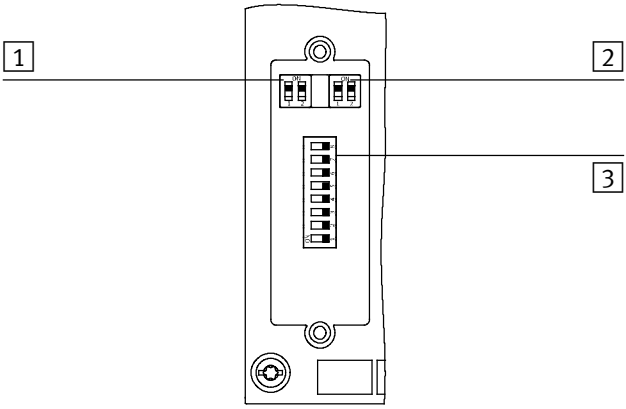


Fig. 1/3: DIL switch in the fieldbus node

Setting the operating mode with DIL switch 1

You can set the operating mode of the fieldbus node with switch element 1 of DIL switch 1:

Operating mode	Setting DIL switch 1	
Remote I/O operating mode All functions of the CPX terminal are controlled directly by the master. An FEC integrated in the CPX terminal works as a passive function module without controller.		DIL 1.1: OFF DIL 1.2: OFF (factory setting)
Operating mode Remote Controller An FEC integrated in the CPX terminal takes control of the I/Os. This operating mode is only useful if an FEC is integrated in the CPX terminal.		DIL 1.1: ON DIL 1.2: OFF

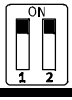
Tab. 1/1: Setting the operating mode with DIL switch 1

Setting the diagnostic mode or the data size for Remote Controller with DIL switch 2

The function of this DIL switch is dependent on the set operating mode of the CPX terminal (see Tab. 1/1):
The diagnostic mode is set In the Remote I/O operating mode; the number of I/O bytes is set in the Remote Controller operating mode.

Diagnostic mode (Remote I/O operating mode)	**Setting DIL switch 2**	
The I/O diagnostic interface and the status bits are switched off (+ 0 I/O bits)		2.1: OFF 2.2: OFF (default)
The I/O diagnostic interface is switched on [1] (+ 16 I/O bits)		2.1: ON 2.2: OFF
Status bits are switched on (+ +16 E-bits (8 used))		2.1: OFF 2.2: ON
Reserved for future extensions		2.1: ON 2.2: ON
[1] The I/O diagnostic interface occupies an additional 16 I/O bits.		

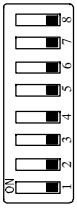
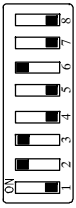
Tab. 1/2: Setting the diagnostic mode with DIL switch 2 (Remote I/O operating mode)

Number of I/O bytes (Remote Controller operating mode)	**Setting DIL switch** 2	
8 byte I/8 byte O for communication of the fieldbus node with the CPX-FEC or CPX-CEC.		2.1: OFF 2.2: OFF (default)
Reserved		2.1: ON 2.2: OFF
16 byte I/16 byte O for communication of the fieldbus node with the CPX-FEC or CPX-CEC.		2.1: OFF 2.2: ON
Reserved		2.1: ON 2.2: ON

Tab. 1/3: Setting the number of I/O bytes with DIL switch 2 (operating mode Remote Controller)

Setting the IP addressing with DIL switch 3

With DIL switch 3 you can set the type of addressing or the IP address of the fieldbus node.

Dynamic addressing via BOOTP/DHCP or saved addressing	Fixed addressing via DIL switch
 Setting: All switches OFF (factory setting)	 Setting: Host ID of the IP address

Tab. 1/4: Settings of DIL switch 3 for different types of addressing

The factory setting is the dynamic addressing.
Observe the detailed information on addressing in section 1.3.3.

1.3 Connecting the Ethernet fieldbus

1.3.1 Ethernet cable

Note
Faulty installation or high transmission rates may cause data transmission errors as a result of signal reflections and attenuations.
Causes of the transmission errors can be:
– incorrect screened connection
– branches
– transmission over long distances
– inappropriate cables
Observe the cable specifications. Refer to the manual for your control system for information on the type of cable to be used.

Cable specification

Screened, flexible Ethernet round cable of category 5

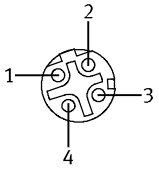
Max. exterior diameter:	5.4 mm
Wire diameter:	0.89 ... 1.0 mm AWG24-26
Pre-assembly:	Plug screwed on, Type NECU-M-S-D12G4-C2-ET, Part no. 543109

Note
If the CPX terminal is mounted movably into a machine, the fieldbus cable on the movable part must be provided with strain relief. Also observe the corresponding regulations in EN 60204 Part 1.

Applicable for the fieldbus length are the specifications for Ethernet networks according to ANSI/TIA/EIA-568-B.1

1.3.2 Fieldbusinterface of the CPX-FB32

There is a 4-pin M12 socket with D-code on the fieldbus node for connecting the valve terminal to the fieldbus.
The socket is compatible with SPEEDCON® plugs.

M12 socket EtherNet/IP	Pin allocation	Explanation	Pin equivalent with RJ45 plug
	1. TX+ 2. RX+ 3. TX– 4. RX– Housing: screen	Transmitted data+ Received data+ Transmitted data– Received data–	1 3 2 6

Tab. 1/5: Pin assignment of the fieldbus interface of the CPX-FB32 (M12 4pin)

Connection with fieldbus plugs from Festo

With the fieldbus plug from Festo (type NECU-M-S-D12G4-C2-ET, TN 543109), you connect the CPX terminal to the fieldbus.

1.3.3 Setting the IP address

For setting the IP address, CPX-FB32 four options are available to you.

Note
When changes are made to the network settings of the CPX-FB32, the Modify LED “M” flashes yellow:

- In this case, restart the CPX-FB32 with Power OFF/ON.

Dynamic addressing via BOOTP/DHCP

Factory setting

In the factory setting, all switch elements of the DIL switch 3 are set to OFF and BOOTP/DHCP is activated in the CPX-FB32. The dynamic addressing via BOOTP/DHCP is then set (see Tab. 1/4).
For dynamic addressing, a BOOTP/DHCP server must be located in the network.

If you wish to change from another type of addressing back to dynamic addressing:

1. Set all switch elements of DIL switch 3 to OFF (see Tab. 1/4).
2. Activate DHCP with the Handheld (CPX-MMI) or the program “BOOTP-DHCP Server” from Rockwell Automation.

Use network settings stored in the CPX-FB32

The CPX-FB32 offers the option to save the network settings in a non-volatile memory. DHCP/BOOTP is thereby deactivated.

1. If necessary, set all switch elements of the DIL switch to OFF (see Tab. 1/4).

2. Set the network settings with the Handheld (CPX-MMI) or the program “BOOTP-DHCP Server” from Rockwell Automation. This activates saving of the network settings.

Fixed addressing via DIL switch

Tip

The fixed setting of the IP address is to be recommended for test purposes during commissioning or for small networks.

Settings

If a (binary coded) number not equal to 0 or 255 is set with the switch elements of DIL switch 3, the IP address is assigned fixed. The set number specifies the host ID of the address “192.168.1.xxx” (see Fig. 1/4).

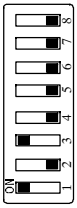
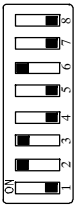
Example: Set IP address: 192.168.1.**005**	**Example: Set IP address:** 192.168.1.**038**
 $2^0 + 2^2 =$ 1 + 4 = 5	 $2^1 + 2^2 + 2^5 =$ 2 + 4 + 32 = 38

Fig. 1/4: Examples of set IP addresses (binary coded) with fixed addressing

In case of fixed addressing, the setting of the network mask and the gateway are set unchangeably to:
Network mask: 255.255.255.0
Gateway: 0.0.0.0

Network setting stored in the CPX-FB32 and setting with DIL switches

Analogously to the section **“Fixed addressing via DIL switches”**, the last octet of the IP address is set with the DIL switch 3.

But the first 3 octets are not necessarily “192.168.1”, but can be freely selected via the IP address parameter. The settings can be changed with the Handheld (CPX-MMI) or via the CPX Festo Maintenance Tool (CPX-FMT).

This addressing option is available to you from Revision 18.

1.3.4 Extended Ethernet settings

Via the "Ethernet Link Object" (see appendix B.2.3), you can undertake additional settings for the Ethernet connection. Configure the Ethernet Link Object via your EtherNet/IP Master or scanner. The extended Ethernet settings are described in the following.

Automatic setting (factory setting)

It is standard for the fieldbus baud rate and the Duplex mode to be recognised automatically by the CPX-FB32.

Baud rate

The field bus baud rate can be switched via EtherNet/IP and is set via Attribute no. 6 (Interface Speed) of the Ethernet Link Object. The following settings are possible:

– 10 MBd

– 100 MBd

Duplex mode

The full Duplex mode can be activated/deactivated.

1.3.5 Use Webserver functions of the CPX-FB32

A Webserver is integrated in the CPX-FB32. The Webserver makes available read access to the most important parameters and diagnostic functions.

1.4 Pin assignment of power supply

Warning

- Use for the electrical power supply only PELV circuits in accordance with EN 60204-1 (Protective Extra-Low Voltage, PELV).
- Also consider the general requirements for PELV circuits in accordance with EN 60204-1.
- Use only voltage sources that ensure a reliable electric separation of operating voltage in accordance with EN 60204-1.

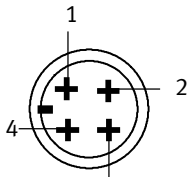
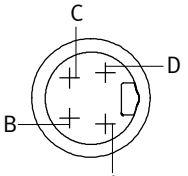
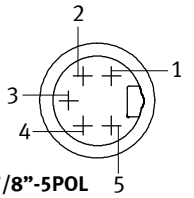
Through the use of PELV circuits, protection from electric shock (protection from direct and indirect contact) in accordance with EN 60204-1 is ensured (Electrical equipment of machines. General requirements).

The current consumption of a CPX terminal depends on the number and type of integrated modules and components.

Read the information on power supply as well as on the earthing measures to be carried out in the CPX system manual.

System power supply, additional power supply and valve power supply

Through the interlinking blocks with system, additional and valve power supply of type CPX-GE-EV-S..., CPX-GE-EV-Z... or CPX-GE-EV-V..., the CPX terminal is supplied with operating and load voltage.

Plug	**Pin assignment of interlinking block with**		
	system supply type CPX-GE-EV-S...	**additional supply type CPX-GE-EV-Z...**	**valve supply type CPX-GE-EV-V...**
 **M18**	1: 24 $V_{EL/SEN}$ 2: 24 V_{VAL} / 24 V_{OUT} 3: 0 $V_{EL/SEN}$ / 0 V_{VAL} / 0 V_{OUT} 4: Earth connection	1: Free (not connected) 2: 24 V_{OUT} 3: 0 V_{OUT} 4: Earth connection	1: Free (not connected) 2: 24 V_{VAL} 3: 0 V_{VAL} 4: Earth connection
 **7/8"-4POL**	A: 24 $V_{EL/SEN}$ B: 24 V_{VAL} / 24 V_{OUT} C: Earth connection D: 0 $V_{EL/SEN}$ / 0 V_{VAL} / 0 V_{OUT} (leading)	A: Free (not connected) B: 24 V_{OUT} C: Earth connection D: 0 V_{OUT} (leading)	A: Free (not connected) B: 24 V_{VAL} C: Earth connection D: 0 V_{VAL} (leading)
	Pin designation: Pay attention to the specifications on the plug.		
 **7/8"-5POL**	1: 0 V_{VAL} / 0 V_{OUT} 2: 0 $V_{EL/SEN}$ 3: Earth connection (leading) 4: 24 $V_{EL/SEN}$ 5: 24 V_{VAL} / 24 V_{OUT}	1: 0 V_{OUT} 2: Free (not connected) 3: Earth connection (leading) 4: Free (not connected) 5: 24 V_{OUT}	–
$V_{EL/SEN}$: Operating voltage electronics/sensors V_{OUT}: Load voltage outputs V_{VAL}: Load voltage valves			

Tab. 1/6: Pin assignment for system supply, additional supply and valve supply

Commissioning

Chapter 2

Table of contents

2.1 Addressing

Before configuring, ascertain the exact number of available inputs/outputs. A CPX terminal consists of a different number of I/Os, depending on what you have ordered and on the configuration of the field bus node. The I/Os will be assigned automatically within the CPX terminal.

Note

- Maximum 10 electric modules including the fieldbus node plus a pneumatic interface or MPA pneumatic modules are permitted on a CPX terminal.
- If you configure the CPX terminal with an EDS file, the field bus node in the **first** location must be installed as module 0.
- The CPX terminal has an address range of up to 64 bytes of inputs and 64 bytes of outputs.

2.1.1 Ascertaining the address range

Address assignment of the modules

Electric modules

The individual modules are displayed with their identifier on the handheld. In the case of the I/O modules, the identifier is also shown in the LED viewing window. With the aid of this identifier, you can read the type of module and therefore the number of inputs and outputs occupied by the module.

Electric modules	Type	Module identifier 1)	Assigned addresses	
			Inputs	Outputs
Fieldbus node FB32	CPX-FB32	FB32-...	–	–
Digital 4-input module	CPX-4DE	4DI	4 E 2)	–
Digital 8-input module	CPX-8DE	8DI	8 I	–
Digital 8-input module with channel diagnostics	CPX-8DE-D	8DI-D	8 I	–
Digital 16-input module	CPX-16DE	16DI	16 I	–
Digital 16-input module with channel diagnostics	CPX-16DE-D	16DI-D	16 I	–
Digital 8-input module n-switching	CPX-8NDE	8NDI	8 I	–
Digital 4-output module	CPX-4DA	4DO	–	4 O 2)
Digital 8-output module	CPX-8DA	8DO	–	8 O
Digital 8-output module, high-current variant	CPX-8DA-H	8DO-H	–	8 O

1) Module identification in Handheld
2) 8 bits are always occupied

Tab. 2/1: Overview of electric CPX modules (part 1)

Electric modules [1]	Type	Module identifier	Assigned addresses	
			Inputs	Outputs
Digital multi I/O module	CPX-8DE-8DA	8DI/8DO	8 I	8 O
Analogue 2-input module	CPX-2AE-U-I	2AI	32 I	–
Analogue 4-input module	CPX-4AE-U-I	4AI	64 I	–
Analogue 4-input module	CPX-4AE-I	4AI-I	64 I	–
Analogue 4-input module (temperature module)	CPX-4AE-T	4AI-T	32/64 I [2]	–
Analogue 2-output module	CPX-2AA-U-I	2AO	–	32 O
CP interface	CPX-CP-4-FB	CPI	128 I [3]	128 O [3]
Front End Controller	CPX-FEC	FEC	64/128 I [4]	64/128 O [4]

[1] Additional modules in preparation
[2] Number of inputs switchable between 2 and 4
[3] Maximum number (actual allocation depends on the string allocation)
[4] With the CPX-FB32, switchable via DIL switches (see 1.2.2)

Tab. 2/2: Overview of electric CPX modules (part 2)

The address assignment within the individual I/O modules can be found in the manual for the I/O modules.
Details on the CP interface can be found in the manual for the CP interface.

Pneumatic modules and pneumatic interfaces

The following table shows the number of output addresses occupied by the pneumatic modules:

Pneumatic interfaces [1]	Type	Module identification [2]	Assigned addresses	
			Inputs	Outputs
Pneumatic interface for MPA-S valves (type 32)	VMPA-FB-EPL-...	–	–	–
Pneumatic interface for MPA-F valves (Type 33)	VMPAF-FB-EPL-...	–	–	–
Pneumatic interface for MPA-L valves (Type 34)	VMPAL-EPL-CPX	–	–	–
Pneumatic interface for CPA valves (type 12) with setting: [3] – 1 ... 8 valve coils – 1 ... 16 valve coils – 1 ... 2 4 valve coils (22 can be used)	CPX-GP-CPA-10 CPX-GP-CPA-14	CPA10/14	–	8 O 16 O 24 O
Pneumatic interface for Midi/Maxi valves (type 03) with setting: [2] – 1 ... 8 valve coils – 1 ... 16 valve coils – 1 ... 24 valve coils – 1 ... 32 valve coils (26 can be used)	CPX-GP-03-4.0	TYPE3	–	8 O 16 O 24 O 32 O
Pneumatic interface for VTSA pneumatic (ISO, Type44) [2] and VTSA-F pneumatic – 1 ... 8 valve coils – 1 ... 16 valve coils – 1 ... 24 valve coils – 1 ... 32 valve coils	VABA-10S6-x1	ISO plug-in or type 44 [3]	–	8 O 16 O 24 O 32 O

[1] Additional interfaces in preparation
[2] Module identification in Handheld
[3] Setting with DIL switches in the pneumatic interface (see description, CPX-EA modules).

Tab. 2/3: Overview of pneumatic interfaces

Pneumatic modules [1]	Type of electronic module	Module identification [2]	Assigned addresses	
			Inputs	Outputs
MPA1 pneumatic module (type 32, 33) without galvanic isolation	VMPA1-FB-EMS-8	MPA1S	–	8 O
MPA1 pneumatic module (type 32, 33) with galvanic isolation	VMPA1-FB-EMG-8	MPA1G	–	8 O
MPA2 pneumatic module (type 32, 33) without galvanic isolation	VMPA2-FB-EMS-4	MPA2S	–	4 O [3]
MPA2 pneumatic module (type 32, 33) with galvanic isolation	VMPA2-FB-EMG-4	MPA2G	–	4 O [3]
MPA1 pneumatic module (type 32, 33) without galvanic isolation with diagnostic function D2	VMPA1-FB-EMS-D2-8	MPA1S-D	–	8 O
MPA1 pneumatic module (type 32, 33) with galvanic isolation with diagnostic function D2	VMPA1-FB-EMG-D2-8	MPA1G-D	–	8 O
MPA2 pneumatic module (type 32, 33) without galvanic isolation with diagnostic function D2	VMPA2-FB-EMS-D2-4	MPA2S-D	–	4 O [3]
MPA2 pneumatic module (type 32, 33) with galvanic isolation with diagnostic function D2	VMPA2-FB-EMG-D2-4	MPA2G-D	–	4 O [3]

[1] Additional modules in preparation
[2] Module identification in Handheld
[3] 8 bits are always assigned

Tab. 2/4: Overview of pneumatic modules MPA-S and MPA-F

Pneumatic modules [1]	Type of electrical interlinking	Module identification [2]	Assigned addresses	
			Inputs	Outputs
MPA-L pneumatic module (type 34) for one solenoid valve, one solenoid coil	VMPAL-EVAP-10-1	MPAL	–	1 A
MPA-L pneumatic module (type 34) for one solenoid valve, 2 solenoid coils	VMPAL-EVAP-10-2	MPAL	–	2 A
MPA-L pneumatic module (type 34) for 4 solenoid valves, 4 solenoid coils	VMPAL-EVAP-10-1-4	MPAL	–	4 O
MPA-L pneumatic module (type 34) for 4 solenoid valves, 8 solenoid coils	VMPAL-EVAP-10-2-4	MPAL	–	8 O

[1] Additional modules in preparation
[2] Module identification in Handheld

Tab. 2/5: Overview of pneumatic modules MPA-L

The address assignment within the pneumatic modules can be found in the manual for the valve terminal pneumatics. Additional information on MPA pneumatic modules can be found in the description CPX-EA modules (P.BE-CPX-EA-...).

Calculating the number of inputs/outputs

Use the following table for calculating the number of inputs and outputs on your CPX terminal.

Input/output modules and system diagnostics		**Inputs**	**Outputs**
1. I/O diagnostic interface, if set	+ 16 I/O	+ _____ I	+ _____ O
2. Number of input modules CPX-4DE	+ __ x 8I [1)]	+ _____ I	
3. Number of input modules CPX-8DE, -8NDE, 8DE-D	+ __ x 8 I	+ _____ I	
4. Number of input modules CPX-16DE	+ __ x 16I	+ _____ I	
5. Number of output modules CPX-4DA	+ __ x 8O [1)]		+ _____ O
6. Number of output modules CPX-8DA	+ __ x 8 O		+ _____ O
7. Number of Multi I/O modules CPX-8DE-8DA	+ __ x 8 I/O	+ _____ I	+ _____ O
8. Number of analogue input modules CPX-2AE-U-I	+ __ x 32 I	+ _____ I	
9. Number of analogue input modules CPX-4AE-I	+ __ x 64 E/ x 32 I	+ _____ I	
10. Number of analogue input modules CPX-4AE-T	+ __ x 64 I	+ _____ I	
11. Number of analogue output modules CPX-2AA-U-I	+ __ x 32 O		+ _____ O
12. Number of inputs and outputs of other modules (e.g. CP interface)	+ __ I/O	+ _____ I	+ _____ O
13. Midi/Maxi, CPA or VTSA pneumatic interface: Number of configured valve solenoid coils (+8 O, 16 O, 24 O, 32 O) Configured at the factory is 32 O (Midi/Maxi, VTSA) or 24 O (CPA)!			+ _____ O
14. Number of MPA1 or MPA2 pneumatic modules	+ __ x 8 O [1)]		+ _____ O
15. Total number of Inputs/Outputs to be configured Total of 1. to 14.:		= Σ _____ I	= Σ _____ O

[1)] 8 bits are always assigned (4 remain unused).

Tab. 2/6: Ascertaining the number of inputs and outputs

2.1.2 Address assignment of the CPX terminal

Note
If necessary, status bits or an I/O diagnostic interface can be activated by DIL switch (see Tab. 1/2):

– If the 8 status bits are activated, they will occupy the first 16 inputs in the address range (8 used).
– If the I/O diagnostic interface is activated, it will occupy the first 16 inputs and outputs in the address range.

If you configure the CPX terminal with an EDS file, the field bus node must be installed in the **first** location as module 0.

Basic rules for addressing

– The address assignment of the inputs does not depend on the address assignment of the outputs.

– Counting from left to right, addressing **bytewise**: Modules with less than 8 bits occupy an 8-bit address space, but do not use it completely.

– The fieldbus node counts as a module with 0 inputs and 0 outputs if the status bits and the I/O diagnostic interface are deactivated.

– The I/Os of different module types are assigned separately from each other.
The sequence in the following table applies:

Sequence of addressing		Description
1.	I/O diagnostic interface [1)]	Can be activated by DIL switch. If the interface is activated, it will occupy the first 16 inputs and outputs in the address range.
2.	Analogue modules	Modules with analogue inputs/outputs
3.	Technology modules	e.g. CP interface, Front End Controller CPX-FEC
4.	Digital modules	Modules with digital inputs/outputs
[1)] Depending on the setting, this address range can also be occupied by status bits (see note above and Tab. 1/2).		

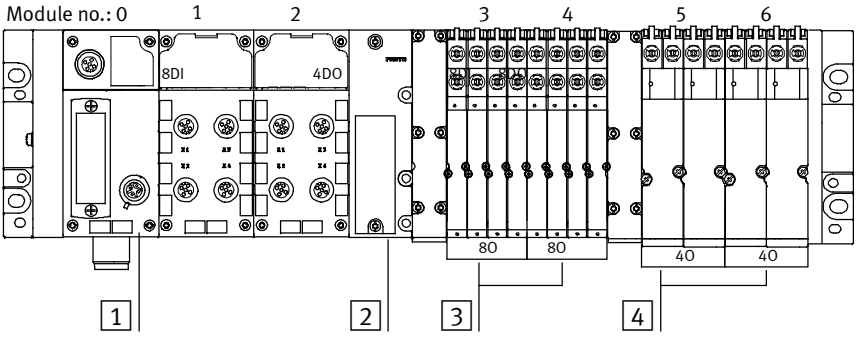
Tab. 2/7: Sequence of addressing

Configuration examples

Example 1: CPX terminal with MPA1- and MPA2 pneumatic

The following diagram shows as an example a CPX terminal with MPA pneumatics and the following setting:

– Status bits and I/O diagnostic interface deactivated



1 Fieldbus node CPX-FB32

2 MPA pneumatic interface

3 MPA1 pneumatic modules (8 DO each)

4 MPA2 pneumatic modules (4 DO each)

Fig. 2/1: Example terminal 1: (with MPA1- and MPA2 pneumatic)

The following table shows the address assignment for the CPX terminal in Fig. 2/1:

Module no.	Module	Input address	Output address
0	Fieldbus node CPX-FB32	–	–
1	Digital 8-input module CPX-8DE	I0 ... I7	–
2	Digital 4-output module CPX-4DA	–	O0 ... O7*)
3	MPA1 pneumatic module (8 DO)	–	O8 ... O15
4	MPA1 pneumatic module (8 DO)	–	O16 ... O23
5	MPA2 pneumatic module (4DO)	–	O24 ... O31*)
6	MPA2 pneumatic module (4DO)	–	O32 ... O39*)
*) 8 bits occupied, 4 bits used			

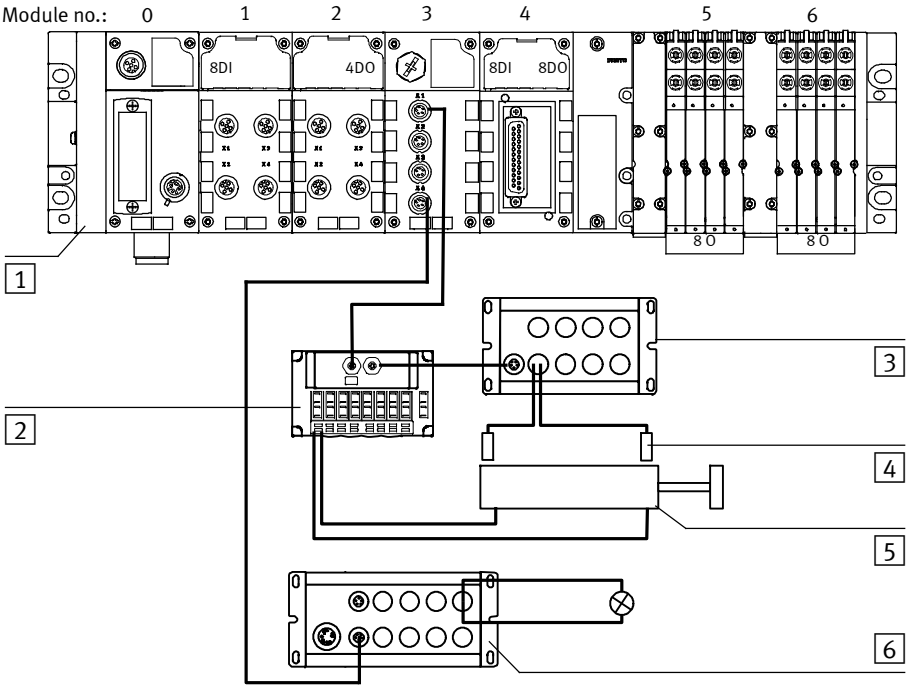
Tab. 2/8: Addressing the example terminal 1 (see Fig. 2/1)

If modular EDS is used, the addresses will be assigned in bytes. In the example above, the output addresses therefore change as from modules 2, 5 and 6.

Example 2: CPX terminal with CP interface

The address assignment for this CPX terminal can be found on the next page in Tab. 2/9. The settings are:

– Status bits and I/O diagnostic interface deactivated



1 Fieldbus node CPX-FB32

2 CPV valve terminal (16DO) on the CP interface (string 1)

3 CP input module (16 DI)

4 Sensor

5 Cylinder

6 CP output module (16DO) on the CP interface (string 4)

Fig. 2/2: Example terminal 2 (with CP interface)

Module no.	Module	Input address	Output address
0	Fieldbus node CPX-FB32	–	–
1	Digital 8-input module CPX-8DE	I32 ... I39	–
2	Digital 4-output module CPX-4DA	–	O128 ... O135*)
3	CP interface CP-I, here: 4 byte I, 16 byte O	I0 ... I32	O0 ... O127
4	Digital multi I/O module CPX-8DE-8DA	I40 ... I47	O136 ... O143
5	MPA1 pneumatic module (8 DO)	–	O144 ... O151
6	MPA1 pneumatic module (8 DO)	–	O152 ... O159
*) 8 bits occupied, 4 bits used			

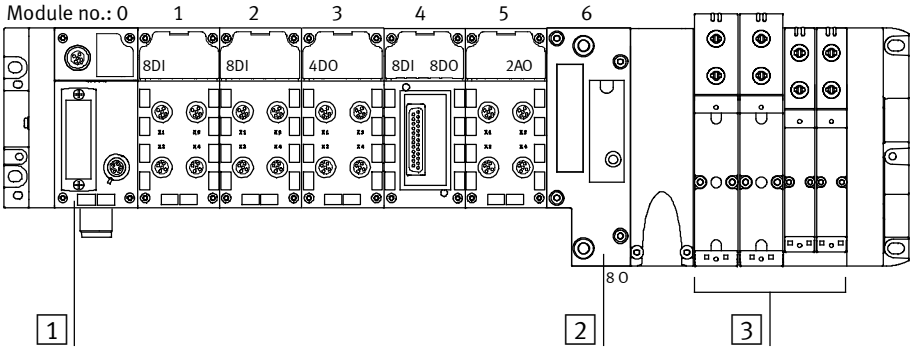
Tab. 2/9: Addressing the example terminal 2 (see Fig. 2/2)

Example 3: CPX terminal with analogue module and VTSA pneumatic

The address assignment for this CPX terminal can be found on the next page in Tab. 2/10. The settings are:

– Status bits activated and I/O diagnostic interface deactivated

– On the pneumatic interface set with DIL switch to 1 ... 8 valve coils (8 DO).



1 Fieldbus node CPX-FB32 (with DIL 3.2 at ON for status bits)

2 Pneumatic interface (set with DIL switch to 1 ... 8 valve coils)

3 VTSA pneumatics (type 44)

Fig. 2/3: Example terminal 3 (with analogue module and VTSA pneumatics)

Module no.	Module	Input address	Output address
0	Fieldbus node CPX-FB32 with status bits	I0 ... I15 [1]	–
1	Digital 8-input module CPX-8DE	I16 ... I23	–
2	Digital 8-input module CPX-8DE	I24 ... I31	–
3	Digital 4-output module CPX-4DA	–	O32 ... O39 [2]
4	Digital multi I/O module CPX-8DE-8DA	I32 ... I39	O40 ... O47
5	Analogue 2-output module CPX-2AA	–	O0 ... O31
6	VTSA pneumatic interface set with DIL switch to 1 ... 8 valve coils	–	O48 ... O55

[1] 16 bits occupied, 8 bits used
[2] 8 bits occupied, 4 bits used

Tab. 2/10: Addressing the example terminal 3 (see Fig. 2/3)

2.1.3 Address assignment after extension/conversion

A speciality of the CPX terminal is its flexibility. If the demands placed on the machine change, the equipment fitted on the CPX terminal can also be modified.

Caution
If the CPX terminal is extended or converted at a later stage, the input/output addresses may be shifted.
This applies in the following cases:

- Additional modules are inserted between existing modules.
- Existing modules are removed or replaced by other modules which have more or fewer input/output addresses.
- Interlinking blocks (CPA) or pneumatic manifold blocks (Midi/Maxi) for single-solenoid valves are replaced by interlinking blocks/manifold blocks for double-solenoid valves or vice versa (see Pneumatics description).
- Additional interlinking blocks (CPA) of manifold blocks (Midi/Maxi) are inserted between existing ones.
- Status bits or the I/O diagnostic interface are activated/deactivated.

Example terminal 3 modified

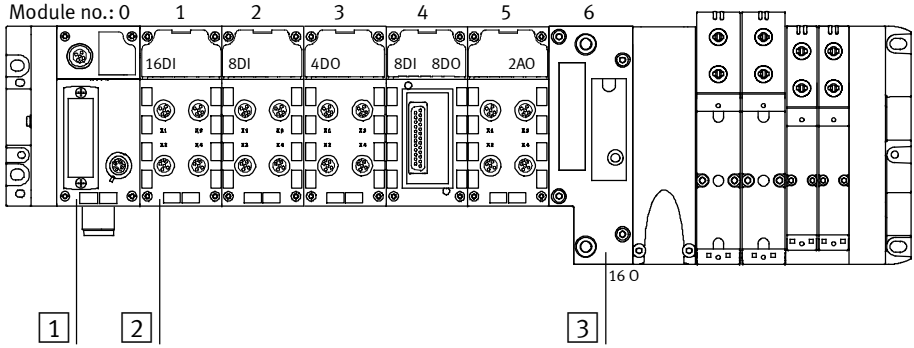
The next diagram shows with terminal 3 as an example (see Fig. 2/3) the effects of modifications to the address assignment.

The following has been changed:

– The status bits have been deactivated.

– In the case of module no. 1 an 8-input module has been replaced by a 16-input module.

– The pneumatic interface has been set to 16 O in order to reserve addresses for an extension to the pneumatics.



1 Modified status bits deactivated

2 Modified: 8DI module replaced by 16DI module

3 Modified: Pneumatic interface (set with DIL switch to 1 ... 16 valve coils)

Fig. 2/4: Example terminal 3 after extension/modification(compare with Fig. 2/3)

Module no.	Module	Input address	Output address
0	**Fieldbus node** CPX-FB32 with deactivated status bits	Dependent on DIL switch settings (see Tab. 1/2)	
1	**Digital 16-input module CPX-16DE**	I0 ... I15	–
2	Digital 8-input module CPX-8DE	I16 ... I23	–
3	Digital 4-output module CPX-4DA	–	O32 ... O39 [1)]
4	Digital multi I/O module CPX-8DE-8DA	I24 ... I31	O40 ... O47
5	Analogue 2-output module CPX-2AA	–	O0 ... O31
6	**VTSA pneumatic interface set with DIL switch to 1 ... 16 valve coils**	–	O48 ... O63
bold = modified module [1)] 8 bits occupied, 4 bits used			

Tab. 2/11: Addressing the example terminal 3 after extension/modification (see Fig. 2/4)

2.2 Bus configuration

General instructions on commissioning

Configuration of the CPX terminal demands a very accurate procedure, as different configuration specifications are sometimes necessary for each station on the EtherNet/IP due to the modular structure. Note here the specifications in the sections which follow.

2.2.1 Registering station properties in the configuration program

When you place a new EtherNet/IP station into operation for the first time, you must inform your configuration program about certain features of the station.

The properties of the various stations are managed by the configuration program usually in a list or library, e.g. “EDS library” (EDS for electronic data sheets).

The following options are available for expanding an EDS library:

– Installing EDS files The EDS file is used only for identification of the CPX-FB32 in the network.

– Enter station properties manually (only by using the parameter settings set at the factory).

Source of supply for EDS files

Source of supply

Current EDS files, icon files and information on the EDS files can be found at the following internet address:

– www.festo.com/fieldbus

Installing EDS files

You will require the following files for the CPX terminal:

File type	Filename	Language	Description
EDS	cpx_fb32.eds	English	Provides the communication adapter in the configuration program.
ICO	cpx_fb32.ico	–	Icon file for representing the CPX terminal or mode in the configuration program.

Tab. 2/12: Configuration files (EDS) for CPX terminal for EtherNet/IP

Installing EDS files

- Install the files with your configuration program.

Icon files

Depending on the configuration program used, you can assign icon files (.ico format) to the CPX terminal or the CPX modules. The CPX terminal or the modules will then be represented accordingly in the configuration program.

Instructions on installing the EDS files and the icon files can be found in the documentation for your configuration program.

Entering station properties manually

When an EDS file is installed, the following information about the EtherNet/IP station is added to the EDS library.
This information can also be entered manually if the CPX terminal is to be operated with the parameter settings preset at the factory.

Information	Description
Vendor name	Festo Corporation
Vendor ID	26_D $1A_H$
Device type	12_D C_H
Product code (depends on operating mode) – Remote I/O – Remote Controller	 13002_D $32CA_H$ 13003_D $32CB_H$
Major Revision	2[1)]
Input size / output size	Depends on CPX equipment
Product name	CPX-FB32
Catalogue number	541302
Extended Ethernet/IP station features	
Request Packet Interval (RPI)	≥ 10 ms
Connections: – Total of all connections – Exclusive Owner – Input only – Listen only	 Max. 32 Max. 1 Max. 32 Max. 31 (There has to be simultaneously at least 1 Excl.Owner or input only connection)
[1)] From CPX-FB32 Revision 17	

Tab. 2/13: Station features

Note
From CPX-FB32 Revision 17, the “Major Revision” was raised from 1 to 2. For “Major Revision” 2, a new EDS file must be used or the corresponding setting made in the controller.

Nodes with “Major Revision” 2 are downward compatible with “Major Revision” 1

The EDS file suitable to your CPX-FB32 can be determined and downloaded at www.festo.com in the Festo Support Portal.

Note
If the station features are entered manually, individual parameterisation of the CPX terminal is not possible.

When the EDS library has been expanded, the CPX terminal is entered in the station list as a possible EtherNet/IP station. It can now be added to a network.

2.2.2 Overview of configuration on the EtherNet/IP

When the station features have been configured (e.g. by installation of the EDS file), the following steps are required for parameterisation (depending on the configuration program):

1. Install your CPX terminal and set the network addressing according to section 1.3.3.

2. Create a connection to an EtherNet/IP station. With RSLogix, use for this the profile **“Generic Ethernet Device”**.

3. Assign the instances of the Assembly Object:
   Instance 101: Inputs
   Instance 100: Outputs
   Instance 102: Configuration data, if used
   (“Configuration Assembly”)

4. Select the **data format SINT**.

5. Enter the IP address, if necessary.

2.2.3 Set up a listen-only connection

When the station features have been configured (e.g. by installation of the EDS file), the following steps are required for parameterisation (depending on the configuration program):

1. Install your CPX terminal and set the network addressing according to section 1.3.3.

2. Create a connection to an EtherNet/IP station.
   With RSLogix, use for this the profile
   “Generic Ethernet Device”.

3. Assign the instances of the Assembly Object:
   Instance 101: Inputs
   Instance 1 Outputs
   Instance 102: Configuration data, if used
   (“Configuration Assembly”)

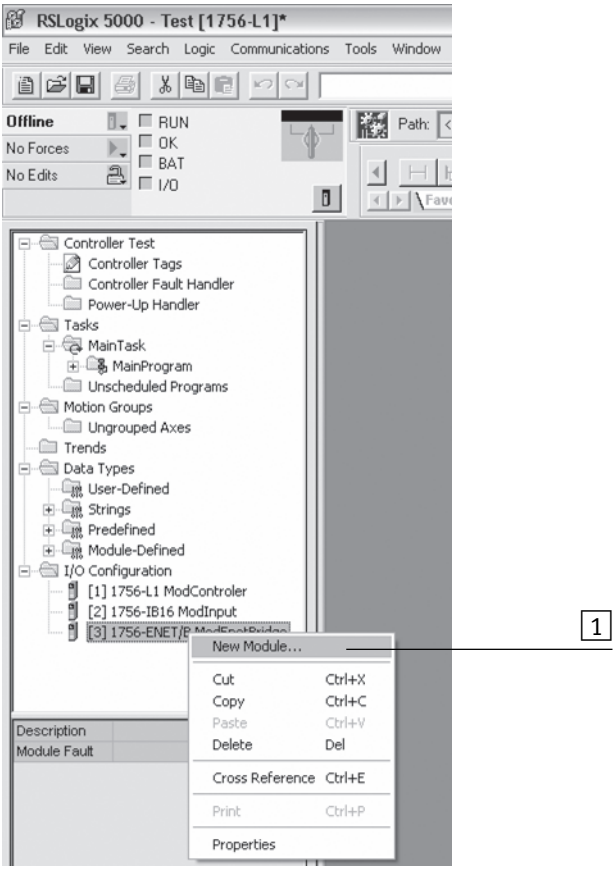
4. Select the **data format Input Data – SINT**.

5. Enter the IP address, if necessary.

2.2.4 Configuration with RSLogix5000

With the help of the CPX Festo Maintenance Tool (CPX-FMT), it is also possible to export the configuration of a CPX terminal with EtherNet/IP bus node into an RSLogix5000 project (see section 2.3.2).

1. Click in RSLogix5000 in the “I/O Configuration” on the right on the Ethernet/IP bridge and select “New Module”:



1 CPX-FB32 – adding as new module in Ethernet/IP

Fig. 2/5: Configuration with RSLogix5000

2. Select “ETHERNET MODULE – Generic Ethernet Module” in the window “Select Module Type” and confirm with “OK”:

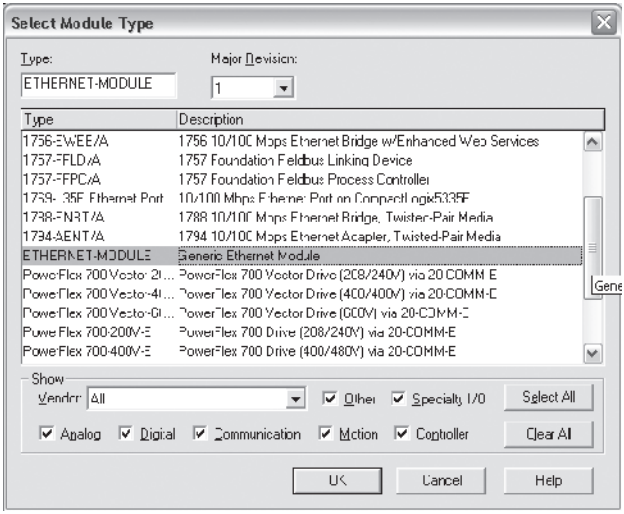


Fig. 2/6: CPX-FB32 – adding as generic module

3. Enter in the window “Module Properties” (Fig. 2/7):

   – the name for the fieldbus node (freely selectable)

   – Instances for inputs: 101
     outputs: 100

   – Instance for Configuration Assembly: 102
     The standard setting is “0”
     (Configuration Assembly not used).
     Operating mode Remote I/O: If you undertake parameterisation via the Configuration Assembly:
     Enter the total of the assigned bytes
     (see section 2.3.1).
     Operating mode Remote Controller:
     Leave the standard setting “0” unchanged.

   – Data format SINT

   – IP address

   Confirm the entry.

1 Name (freely selectable)

2 Assembly instances

3 Size of the “Configuration Assembly” (see explanation in the text)

4 IP address

5 Data format

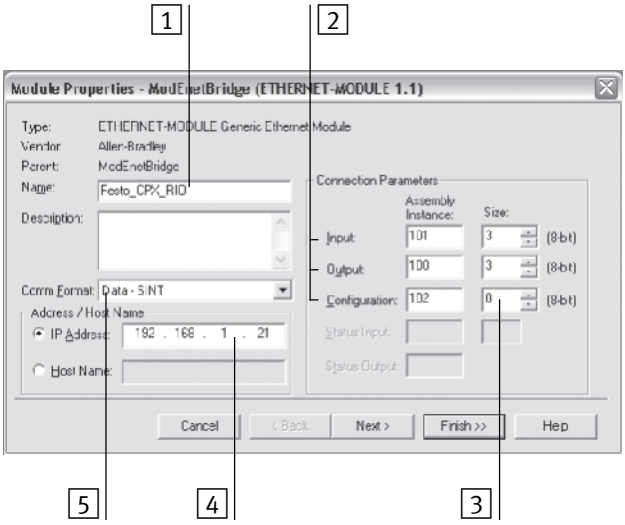


Fig. 2/7: Enter values for “Module Properties”

Note

For the configuration with RSLogix5000 at least one input must be assigned:

- Enter at least 1 for the instances for inputs (2 in Fig. 2/7) or
- if your CPX terminal does not contain any input modules, activate the status bits with the DIL switches (see Tab. 1/2).

2.3 Parameterisation

Caution
A different parameterisation will result in different characteristics. Check especially when replacing CPX terminals to see which settings are necessary and make sure that these are restored (e.g. in the start-up phase by the higher-order PLC/IPC).

The CPX terminal is supplied from the factory with preset parameters.

The system reaction of the CPX terminal can be adapted to the relevant application. You can set the reaction of the CPX terminal as well as the reaction of individual modules and channels through parameterisation. A distinction is made between the following parameterisations:

– System parameterisation, e.g.: switching off of malfunction messages, setting of reaction times, etc.

– Module parameterisation (module- and channel-specific), e.g.: monitoring, settings in case of error, settings for Forcing.

– Parameterisation of the diagnostic memory.

A detailed description of the individual parameters as well as fundamentals for application can be found in the CPX system description (P.BE-CPX-SYS-...) The module parameters that are available for the various modules can be found in the description of the relevant module (e.g. Description of the CPX pneumatic interfaces and CPX I/O modules (P.BE-CPX-EA-...).

Requirements for parameterisation

You can influence the start characteristics with the system parameter “System start”. If possible, select the setting “System start with default parameterisation and current CPX expansion”. The desired parameterisation can then be carried out in the initialisation phase or user-controlled (depending on the fieldbus used).

Note
The CPX terminal can only be parameterised if the system parameter “System start” has the setting “System start with default parameterisation and current CPX expansion”.

If the M LED lights up permanently after the system start, then “System start with saved parameterisation and saved CPX expansion” is set. In this case, no other parameterisation can be carried out.

Caution
In the case of CPX terminals on which the M LED lights up permanently, parameterisation will not be restored automatically by the higher-order system if the CPX terminal is replaced during servicing. In these cases, check before replacement to see which settings are required and carry out these settings.

2.3.1 Methods of parameterisation

You can parameterise a CPX terminal with CPX-FB32 various methods. The following table and the following sections provide an overview of the methods.

Methods and description	Advantages	Disadvantages
1. Parameterisation via configuration data ("Configuration Assembly") Depending on the control software, parameters can be entered manually or conveniently via the menus.	– Parameters are loaded automatically after Power On and are therefore retained if the CPX terminal is replaced	– Parameters must be entered individually [1)]
2a. Parameterisation via software **2b. Parameterisation with the Handheld** Parameterisation is carried out with entries via the menus	– User-friendly parameterisation via the menus (plain text)	– Parameterisation is saved locally in the CPX terminal and is lost if the terminal is replaced. [1)]
3. Parameterisation via the PLC application program Parameterisation is carried out within the user program in the PLC/IPC via "Explicit Message".	– Parameterisation is saved in the PLC – Parameters are loaded automatically after Power On and are therefore retained if the CPX terminal is replaced	– Explicit Message programming required
4. Parameterisation with EDS files via configuration program The parameters are set via the configuration program and transmitted directly to the EtherNet/IP station.	– Fast, simple parameterisation during commissioning for testing the parameters	– Not available with all Ethernet/IP masters – Parameterisation is saved locally in the CPX terminal and is lost if the terminal is replaced. [2)]

1) With the help of the CPX-FMT and the function L5K Export, the complete configuration of a CPX terminal for RSLogix5000 can also be prepared automatically.
2) The current parameter settings can be copied with the help of the Handheld.

Tab. 2/14: Methods of parameterisation

2.3.2 Parameterisation via Configuration Assembly (method 1)

With parameterisation via the Configuration Assembly, the parameters must be entered individually in the control program or generated via software.

Parameterisation via the Configuration Assembly is available only for revision statuses later than Rev. 1.10.
Further information on creation of the Configuration Assembly can be found at **www.festo.com/fieldbus**.

Simplified parameterisation in RSLogix5000

With the help of the CPX Festo Maintenance Tool (CPX-FMT), it is possible to export the configuration of a CPX terminal with EtherNet/IP bus node into an RSLogix5000 project.

The CPX-FMT is available in the internet at **www.festo.com/fieldbus**.

1. Establish a connection between CPX-FMT and the CPX terminal through the Ethernet.
2. Manually configure the CPX terminal with the CPX-FMT or use the online function to download the configuration automatically.
3. Change the parameters to the extent needed (all parameters can also still be changed after export/import into RSLogix).

4. Export the configuration via
   File → Export → RSLogix (.L5K) and select a storage location for the L5K file.

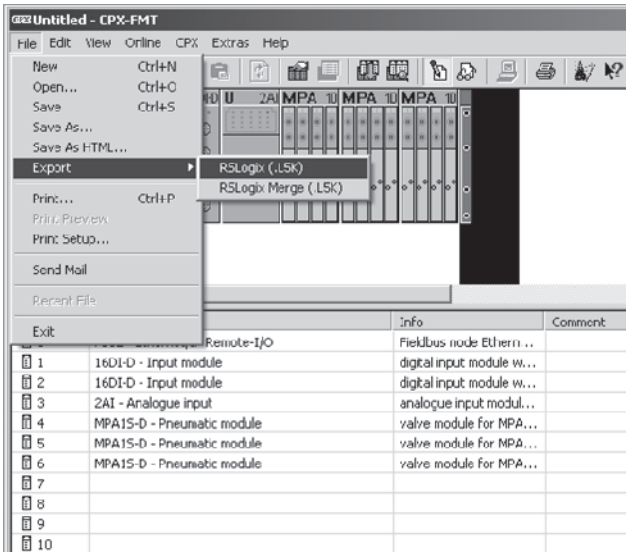


Fig. 2/8: Export of the L5K file

5. Open the L5K file as a new project in RSLogix5000.
   This project contains the just configured CPX terminal.

6. To integrate the CPX terminal into existing RSLogix projects, copy the module with a right click → Copy.

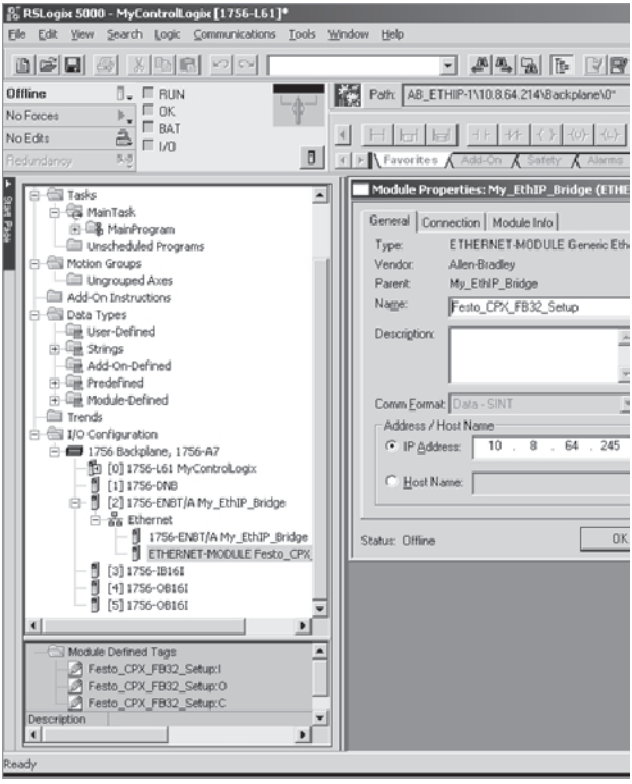


Fig. 2/9: Copying the CPX module

7. Insert the module with a right click ⟶ Paste onto the Ethernet connection in the existing RSLogix project.

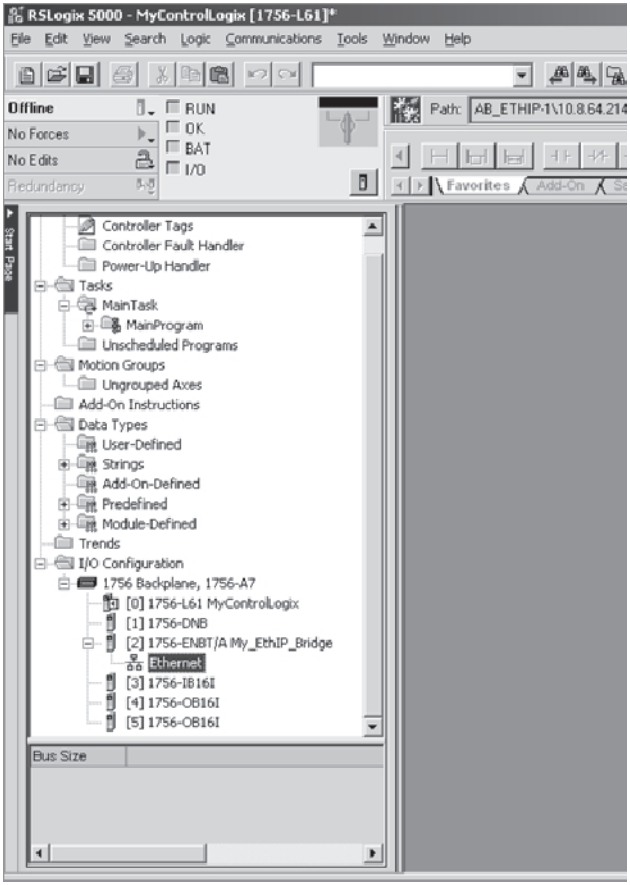


Fig. 2/10: Inserting the CPX module

All necessary settings from CPX-FMT are taken over into the RSLogix project. This includes, among others, the I/O data lengths, the IP configuration and all module and system parameters.

2.3.3 Parameterisation via software (method 2a)

With the CPX Maintenance Tool (CPX-FMT), you can parameterise the CPX terminal with a PC via Ethernet.

The CPX-FMT is available in the internet at:

– www.festo.com/fieldbus.

2.3.4 Parameterisation with the Handheld (method 2b)

The Handheld offers menu-orientated access to parameterisation without configuration software.

Information on operating the Handheld can be found in the relevant description.

Note
The last parameterisation received in the CPX terminal is always valid.

The CPX terminal can only be parameterised if the system parameter “System start” has the setting “System start with default parameterisation and current CPX expansion”.
In this case, the standard parameter settings are valid in the CPX terminal after Power On.

Note
If the system parameter “System start” has the setting “System start with saved parameterisation and saved CPX expansion”, modified parameter settings in the CPX terminal will become valid immediately after Power On.

2.3.5 Parameterisation via the PLC user program (method 3)

Program-controlled access to parameters is made via the "Explicit Message" programming. The addresses of the EtherNet/IP Object Model required for this can be found in Appendix B. Information on programming this data transmission can be found in the manual for your controller.

In order to address the CPX terminal with FB32 you will require the following Object descriptions:

Detailed Object descriptions can be found in Appendix B.1.

Object classes	**Instances (dec.)**	**Attri-butes (dec.)**	**Name**
4_d	100 ... 102	-	Assembly Object
102_d	1 ... 48	1, 2	Modification digital inputs, Object
103_d	1 ... 48	1 ... 6	Modification digital outputs, Object
104_d	1 ... 48	1, 2	Modification analogue inputs, Object
105_d	1 ... 48	1 ... 6	Modification analogue outputs, Object
106_d	1 ... 48	1, 2	Modification input words of technology module, Object
107_d	1 ... 48	1 ... 6	Modification output words of technology module, Object
132_d	1	1 ... 37	System Object (Global System Object)
133_d	1	1 ... 3	Status and Diagnostic Object
134_d	1 ... 40	1 ... 12	Diagnostic Trace Object
135_d	1	1 ... 13	Diagnostic Trace Status Object

Tab. 2/15: Overview of Object classes for EtherNet/IP (operating mode Remote I/O)

Object classes	Instances (dec.)	Attri-butes (dec.)	Name	Type
136_d	1	1, 2	Slave Size Object (only Remote Controller)	SINT

Tab. 2/16: Object class for EtherNet/IP in operating mode Remote Controller

2.3.6 Parameterisation with EDS files (method 4)

This method of parameterisation is only possible if your configuration program supports parameterisation via EDS.
The EDS files of the CPX terminal must be contained in the EDS library.
The CPX-EDS Version 1.2 is used only for identification of the CPX-FB32 in the network.

2.4 Notes on parameters for Idle mode and Fault mode

Reaction of the outputs in Idle mode or Fault mode

The Idle mode is assumed by the stations after request by the master.
The Fault mode defines the status the relevant channel is to assume in the event of fieldbus communication faults.
In this status, the following applies:

– Inputs are transmitted.

– Output channels of the stations are no longer updated.

In the Idle mode or Fault mode, outputs can assume one of the following states:

Digital outputs/valves	Analogue outputs
Freeze current status	Freeze current status
Reset output	Desired analogue value
Set output	

Tab. 2/17: Possible states in the Idle or Fault mode

You can determine the status to be assumed for each output channel (output or solenoid coil) separately.
The standard setting is “Reset of the output channel”.

Further information can be found in the CPX system description.

2.5 Check list for commissioning the CPX terminal with FB32

- Please observe the general commissioning instructions in the CPX system description.
- Check the DIL switch settings and the network configuration before using and replacing CPX terminals.
- Check the configured address range. If necessary, test the I/Os.
- Check the address assignment of the I/Os on the CPX terminal. For this purpose you can, if necessary, force the I/Os (see CPX system description).
- Make sure that the desired parameterisation of the CPX terminal in the start-up phase or after fieldbus interruptions is restored by the plug-in module. This is to ensure that if the CPX terminal is replaced, the new terminal will also be operated with the desired parameter settings.
- Use spot checks if necessary to check the parameterisation, e.g. with the configuration program or with the Handheld.

Diagnostics

Chapter 3

Table of contents

3.1 Overview of diagnostics options

The CPX terminal provides extensive and user-friendly possibilities for diagnostics and error handling.
The following possibilities are available depending on the configuration:

Diagnostics option	Brief description	Advantages	Detailed description
LED display	The LEDs show directly configuration errors, hardware errors, bus errors, etc.	Fast “on-the-spot” recognition of errors	Section 3.2
Status bits	Internal inputs that supply coded common diagnostic messages.	Fast access to error messages, irrespective of the module and master.	Section 3.3 and CPX system description
I/O diagnostic interface	The I/O diagnostic interface is a bus-independent diagnostic interface at I/O level which permits access to internal data of the CPX terminal (16 inputs and 16 outputs).	Detailed error recognition irrespective of the fieldbus type used.	Section 3.4 and CPX system manual
Diagnostics via EtherNet/IP	Access to all system data of the CPX terminal via the fieldbus.	Detailed module-related and channel-related error recognition as well as access to the diagnostic memory in the online mode of the programming/configuration software and in the PLC user program.	Appendix B (Ethernet/IP Objects)
Diagnostics via the Handheld	Diagnostic information can be shown on the CPX Handheld in a user-friendly manner by means of menus.	Fast “on site” error detection	Description for the Handheld

Tab. 3/1: Diagnostics options

Note
Observe that the diagnostic information displayed depends on the parameterisation of the CPX terminal.

3.2 Diagnostics via LEDs

LEDs for diagnosing the CPX terminal are available on the fieldbus node as well as on the individual modules.

The meaning of the LEDs on the electric modules can be found in the description for the relevant module.

LEDs on the fieldbus node CPX-FB32

The LEDs on the cover indicate the operating status of the CPX fieldbus node.

1 CPX-specific LEDs

PS: Power System

PL: Power Load

SF: System Fault

M: Modify

2 EtherNet/ IP-specific LEDs

MS: Module Status

NS: Network Status

IO: I/O Status

TP: Link/Traffic

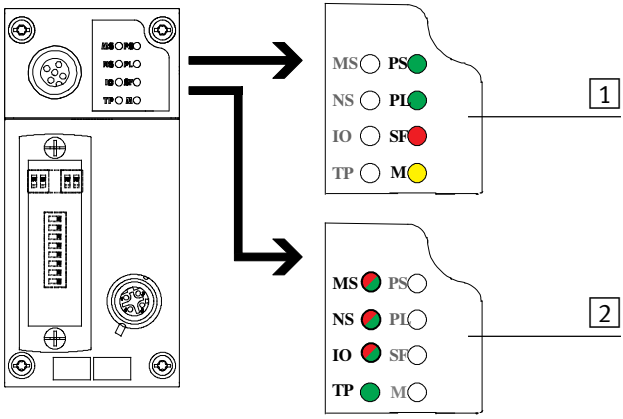
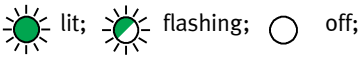


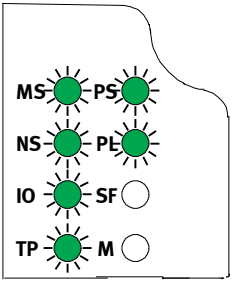
Fig. 3/1: LEDs on the CPX fieldbus node

The LEDs are shown in their various states as follows:

 lit; flashing; off;

Normal operating status

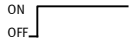
In normal operating status the following LEDs light up green. The SF LED does not light up. The M-LED lights up only with the setting “System start with stored parameterisation and stored CPX expansion” (see function number 4402).

LED display		Operating status
	The following LEDs light green: – PS – PL – MS – NS – IO [1] – TP [2] The SF LED does not light up. – SF M LED see function number 4402	Standard
[1] Lights up only when inputs/outputs are controlled via EtherNet/IP. [2] Steady light: Ready for data transmission Flashing: Data transmission ongoing		

Tab. 3/2: Normal operating status

3.2.1 CPX-specific LEDs

PS (power system) – power sensor/logic supply

LED (green)	Sequence	Status	Meaning / error handling
 LED lights up		No error. Operating voltage/sensor supply applied	–
 LED flashes		Operating voltage/sensor supply outside the tolerance range	Eliminate undervoltage
		Internal fuse for the operating voltage/sensor supply has responded.	1. Eliminate short circuit/overload on module side. 2. Depends on the parameterisation of the module (module parameter): • The sensor supply voltage will be switched on again **automatically** after the short circuit has been eliminated (default) • Power Off/On is necessary
 LED is off		The operating voltage/ sensor supply is not applied	Check the operating voltage connection of the electronics

PL (power load) – power load supply (outputs/valves)

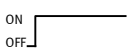
LED (green)	Sequence	Status	Meaning / error handling
 LED lights up		No error. Load voltage applied	None
 LED flashes		Load voltage at the system supply or additional supply outside the tolerance range	Eliminate undervoltage

SF (system failure) – system fault

LED (red)	Sequence [1]	Status	Meaning / error handling
LED is off		No error.	–
LED flashes		Simple error/information (error class 1)	See description of error numbers in the CPX system manual
LED flashes		Error (error class 2)	
LED flashes		Serious error (error class 3)	

[1] The System Failure LED flashes dependent on the applicable error class.
Error class 1 (simple error): 1 * flashing, pause time
Error class 2 (error): 2 * flashing, pause time
Error class 3 (serious error): 3 * flashing, pause time

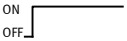
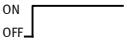
M (modify) – parameterisation modified or forcing active

LED (yellow)	Sequence	Status	Meaning / error handling
LED is off		System start with default parameterisation (factory setting) and current CPX expansion set; external parameterisation is possible (pre-setting)	None
LED lights up		System start with saved parameterisation and saved CPX expansion has been set; Parameters and CPX expansion are saved remanently; external parameterisation is blocked [1]	Be careful when replacing CPX valve terminals with saved parameterisation. With these CPX valve terminals, parameterisation is not carried out automatically by the higher-order PLC/IPC when the terminal is replaced. In these cases, check which settings are required before the replacement and make these settings if necessary.
LED flashes		– Force is active [1] – Network settings have been modified	– The Force function is enabled (see system parameter Force mode; function no. 4402). – CPX-FB32 Restart (Power OFF/ON), see also section 1.3.3)

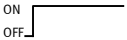
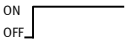
[1] The display of the Force function (LED flashes) has precedence over the display of the setting for System start (LED lights up).

EtherNet/IP-specific LEDs

MS – module status

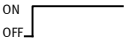
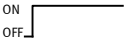
LED	Sequence	Status	Meaning / error handling
 Is off		Logic supply for bus interface not applied	• Check logic supply
 Lights up green		Operating status normal	None
 Flashes green		CPX terminal must be placed in operation as the configuration is missing, incomplete or incorrect.	Carry out, complete or correct the configuration
 Flashes red		Error can be rectified	Complete or correct the configuration
 Lights up red		Error cannot be rectified	Check CPX expansion as well as other LEDs and, if necessary, request service
 Flashes red-green		CPX terminal is in self-test	None

NS – network status

LED	Sequence	Status	Meaning / error handling
 Is off		The CPX terminal is not online – Logic supply for bus interface not applied	• Check logic supply
 Flashes green		CPX terminal is online and has received an IP address, but the CPX terminal does not have a configured connection.	• Check configuration; it is possible that the CPX terminal is not assigned to a master/scanner or • Check the status of the master, it is possible that the master is not in the RUN mode.
 Lights up green		The CPX terminal is online and has a connection to the fieldbus	None (normal operating status)
 Flashes red		One or more “I/O connections” are in the time-out status	Check the physical connection to the master/scanner (EtherNet cable).
 Lights up red		Communication has failed. – Non-permitted IP address set and already used in the network	• Correct IP address
 Flashes red/green		CPX terminal is in self-test	None

*) Test algorithm which ensures that no station numbers are assigned double in the network. The test is usually carried out automatically when the network connection is set up.

I/O (I/O status)

LED	Sequence	Status	Meaning / error handling
 Is off		– Logic supply for bus interface not applied – Outputs are inactive	• Check logic supply
 Lights up		One or more outputs are controlled via EtherNet/IP. No output is faulty.	None
 Flashes green		One or more outputs are in the idle state and none of the outputs is active or faulty.	I/O control via EtherNet/IP, but device is allocated by the master and the master is in idle mode, e.g. programming mode.
 Flashes red		One or more outputs are defective, possibly in a faulty status.	Check the inputs/outputs and the communication connection to the master.
 Lights up red		One or more outputs are forcibly switched off (perhaps an error which cannot be corrected); one or more inputs have an error which cannot be corrected	Check the other LEDs, if necessary request servicing
 Flashes red/green		CPX terminal is in self-test	None

TP (Link/Traffic)

LED (green)	Sequence	Status	Error handling
 LED is off		No Ethernet connection or Ethernet cable not connected	If necessary check Ethernet connection
 LED lights up		Network connection OK (Link)	–
 LED flashes		Data traffic (traffic) Illumination intensity is dependent on the traffic.	–

3.3 Diagnostics via status bits

Status bits are internal inputs (1 input byte), which serve to display common diagnostic messages (global error messages).

Note
If status bits are to be transmitted via a “polled” or “change of state” connection, you have to set the DIL switch at the fieldbus node correspondingly (see Tab. 1/2).

If all status bits supply a 0-signal, no fault will be registered. The following table shows the diagnostic information when there is a 1-signal:

Bit	Diagnostic information with 1-signal	Description
0	Error in valve	Module type in which an error has occurred
1	Error at output	
2	Error at input	
3	Error at analogue module/technology module	
4	Undervoltage	Type of error
5	Short circuit/overload	
6	Wire break	
7	Other error	

Tab. 3/3: Overview of status bits

If various errors occur simultaneously on different types of modules, these errors cannot be assigned via the status bits. Errors may be uniquely determined through the I/O diagnostics interface or diagnostics via EtherNet/IP access.

Further instructions on the function and content of the status bits can be found in the CPX system description.

3.4 Diagnosis via I/O diagnostic interface

For the fieldbus node CPX-FB32,access to the EtherNet/IP Objects through Explicit Message programming is in principle more appropriate than the use of the I/O diagnostic interface (see Appendix B.1).

Detailed diagnostic information can be accessed via the I/O diagnostic interface. You can ascertain exactly, for example, on which module and on which channel an error has occurred. 16 input bits and 16 output bits, through which all diagnostic data can be read, are available for accessing the system diagnosis.

Note
In order to use the I/O diagnostic interface, it must be activated with the DIL switch on the fieldbus node (see Tab. 1/2).

If the I/O diagnostic interface is active, it will occupy the first 16 inputs and outputs in the address range (see Tab. 2/7).

Information on the I/O diagnostic interface (diagnostic information, function numbers) can be found in the CPX system description.

Overview of diagnostic data

Diagnostic data	Contents / description
Global diagnostic data	– General overview of errors
Module diagnostic data	– Detail diagnosis per module
Status of diagnostic memory	– Number of entries in the diagnostic memory – Operating mode
Diagnostic memory data	– Long-term memory – Detail diagnosis + relative time stamp per error event

Tab. 3/4: Diagnostic data

3.5 Diagnosis via EtherNet/IP

The CPX system enables diagnosis via EtherNet/IP.
The following diagnostic options are supported here:

– Explicit Messaging via Ethernet/IP Master

– Diagnosis via user program The I/O diagnostic interface can also be read out here.

Overview of diagnostic data with Explicit Messaging

The following EtherNet/IP Objects offer detailed diagnostic information:

Object classes	Name	Diagnostic data
101_d	General Module Parameter Object	– Faulty channel type – Number of the faulty channel – Module error number
133_d	Status and Diagnostic Object	– Number of the module in which an error has occurred – Diagnostic status (specifies whether there are diagnostic data). – System error number
134_d	Diagnostic Trace Object	– Long-term memory (max. 40 entries) – Detail diagnosis + relative time stamp per error event
135_d	Diagnostic Trace Status Object	– Number of entries in the diagnostic memory – Trace status

Tab. 3/5: Diagnostic data with Explicit Messaging

Possible sequence of diagnosis

Possible sequence of diagnosis	**Diagnostic data**	**Object which supplies the diagnostic data**
1. Check to see if there are diagnostic data available	Diagnostic status	Status and Diagnostic Object (133_d)
2. Ascertain the number of the module in which an error has occurred	Number of the module	Status and Diagnostic Object (133_d)
3. Ascertain relevant module diagnostic data	Error number, channel type and number of the faulty channel	General Parameter Object Module (101_d)

Tab. 3/6: Possible sequence of diagnosis

3.6 Error handling

With the following malfunctions, the reaction of the CPX terminal depends on the configured reaction of the master module and on the parameterised Fail Safe setting:

– Telegram failure

– The master has stopped

– Interruption in the bus cable

Depending on the parameterisation, the outputs (valves and electric outputs) will be switched off (factory setting), switched on or retain their status (see CPX system manual).

Warning

- Ensure that valves and outputs are put into a safe state if the stated malfunctions occur.

An incorrect status of the valves and outputs can lead to dangerous situations!

Note

Please observe the following if the outputs are reset in the event of a PLC stop or fieldbus interruption or malfunction:

– Single-solenoid valves move to the basic position.

– Double-solenoid valves remain in the current position.

– Mid-position valves go into mid-position (pressurized, exhausted or closed, depending on valve type).

Technical appendix

Appendix A

Table of contents

A.1 Technical data fieldbus node type CPX-FB32

General information	
General technical data	See CPX system description: – Description P.BE-CPX-SYS-...
Protection class according to EN 60 529, CPX-FB32 completely mounted, plug connector, like accessories, plugged in or equipped with protective cap	IP65 / IP67
Protection against electric shock	Through use of PELV circuits (Protection against direct and indirect contact in accordance with EN 60204-1)
Current consumption fieldbus node CPX-FB32 Internal current consumption at 24 V (internal electronics): – from operating voltage supply for electronics/ sensors ($V_{EL/SEN}$)	type 65 mA
Galvanic isolation – Ethernet/IP interface	electrically isolated (optocoupler)
Module code (CPX-specific)	Remote I/O: 212 Remote Controller: 160
Module identification (Handheld)	Remote I/O: – “CPX-FB32 Remote/IO” Remote Controller: – “CPX-FB32 Remote Controller”

Fieldbus	
Protocols	– IEEE 802.3 (Ethernet) according to RFC 894 – Internet Protocol (RFC 791) – User Datagram Protocol (UDP) (RFC 768) – Transmission Control Protocol (TCP) (RFC 793) – Address Resolution Protocol (ARP) (RFC 826) – Internet Control Messaging Protocol (ICMP) (RFC 792) – Internet Group Management Protocol (IGMP) (RFC 1112 & 2236) – HTTP – FTP – DHCP
Baud rate	10/100 MBd, full/half duplex
Cable type and length	see Ethernet specification according to IEEE 802.3

A.2 Accessories

Accessories	Type	Part No.
M12 plug for connection to the fieldbus	NECU-M-S-D12G4-C2-ET	543109

Tab. A/1: Accessories

Ethernet/IP Objects of the CPX-FB32

Appendix B

Table of contents

B.1 Overview of Ethernet/IP objects of the CPX-FB32

This chapter describes the representation of the CPX terminal within the Ethernet/IP object model. Some of the information is in English even in the documentation in other languages, so that the original terms of the Ethernet/IP specification can be used uniquely.

Ethernet/IP Class Services

The CPX terminal supports various services, depending on the Object:

Service Code	Service Name
05_d (05_h)	Reset
01_d (01_h)	Get Attribute All
14_d ($0E_h$)	Get Attribute Single
16_d (10_h)	Set Attribute Single

Tab. B/1: Class services and instance services

Ethernet/IP object classes

The following objects are supported:

Object class	Instances	Name	Type
1_d	1	Identity object	CIP general
2_d	1	Message Router Object	
4_d	100 ... 102	Assembly Object	
6_d	1 ... 10	Connection Manager Object	
244_d	1	Port Object	
245_d	1	TCP/IP Interface Object	Ethernet/IP specific
246_d	1	Ethernet Link Object	
132_d	1	System Object (Global System Object)	CPX specific
133_d	1	Status and Diagnostic Object	
134_d	1 ... 40	Diagnostic Trace Object	
135_d	1	Diagnostic Trace Status Object	
199_d	1	Configuration Array Object	

Tab. B/2: Overview of EtherNet/IP objects of the CPX-FB32 – Part 1

Object class	Instances	Name	Type
101_d	1 ... 48	General module parameter object (Generic Parameter Object)	CPX specific: parameter
102_d	1 ... 48	Discrete Input Object	CPX specific: inputs/outputs
103_d	1 ... 48	Discrete Output Object	
104_d	1 ... 48	Analogue Input Object	
105_d	1 ... 48	Analogue Output Object	
106_d	1 ... 48	Function Input Object	
107_d	1 ... 48	Function Output Object	
108_d	1 ... 48	Discrete Input Force State Object	CPX specific: force, fault, idle mode
109_d	1 ... 48	Discrete Input Force Mode Object	
110_d	1 ... 48	Discrete Output Force State Object	
111_d	1 ... 48	Discrete Output Force Mode Object	
112_d	1 ... 48	Discrete Output Fault State Object	
113_d	1 ... 48	Discrete Output Fault Mode Object	
114_d	1 ... 48	Discrete Output Idle State Object	
115_d	1 ... 48	Discrete Output Idle Mode Object	

Tab. B/3: Overview of EtherNet/IP objects of the CPX-FB32 – Part 2

Object class	Instances	Name	Type
116_d	1 ... 48	Analogue Input Force State Object	CPX specific: force, fault, idle mode
117_d	1 ... 48	Analogue Input Force Mode Object	
118_d	1 ... 48	Analogue Output Force State Object	
119_d	1 ... 48	Analogue Output Force Mode Object	
120_d	1 ... 48	Analogue Output Fault State Object	
121_d	1 ... 48	Analogue Output Fault Mode Object	
122_d	1 ... 48	Analogue Output Idle State Object	
123_d	1 ... 48	Analogue Output Idle Mode Object	
124_d	1 ... 48	Function Input Force State Object	
125_d	1 ... 48	Function Input Force Mode Object	
126_d	1 ... 48	Function Output Force State Object	
127_d	1 ... 48	Function Output Force Mode Object	
128_d	1 ... 48	Function Output Fault State Object	
129_d	1 ... 48	Function Output Fault Mode Object	
130_d	1 ... 48	Function Output Idle State Object	
131_d	1 ... 48	Function Output Idle Mode Object	

Tab. B/4: Overview of EtherNet/IP objects of the CPX-FB32 – Part 3

Object class	Instances	Name	Type
136_d	1	Slave Size Object	CPX specific

Tab. B/5: Special EtherNet/IP object for the remote controller operating mode

Counting mode

Applicable for the module-oriented objects in Tab. B/3 and Tab. B/4 is: **Instance number = Module number + 1**
Explanation: Counting of the modules begins with 0 for the fieldbus node; counting of the instances begins with 1 for the fieldbus node.

An overview of the available data and parameters, their function numbers as well as their assignment to the objects can be found in the following sections.

A description of the functions of the individual parameters and data as well as basic information on parametrizing can be found in the CPX system manual.

B.2 Objects for network settings

B.2.1 Port Object

Object class: 244
Instances: 1

The Port Object lists the CIP ports available on the device. The Port Object of the CPX-FB32 supports an instance with the ID 2.

Attr. No.	Access	Description	Type
1	Get	Revision	WORD
2	Get	Max Instances	WORD
3	Get	Number of Instances	ARRAY
8	Get	Entry Port	ARRAY
9	Get	All Ports	ARRAY

B.2.2 TCP/IP Interface Object

Object class: 245
Instances: 1

With the TCP/IP Interface Object you can configure the network settings of a device.

Attr. No.	Access	Description	Type
1	Get	Status	DOUBLE
2	Get	Configuration Capability	DOUBLE
3	Get/Set	Configuration Control	DOUBLE
4	Get	Physical Link Object Path Size Path	ARRAY
5	Get/Set	Interface Configuration IP Address Network Mask Gateway Address Name Server Name Server 2 Domain Name	ARRAY
6	Get/Set	Host Name	ARRAY

B.2.3 Ethernet Link Object

Object class: 246
Instances: 1

Via the Ethernet Link Object you can undertake extended settings for the Ethernet connection (see also section 1.3.4):

Attr. No.	Access	Description	Type
1	Get	Interface Speed	DOUBLE
2	Get	Interface Flags	DOUBLE
3	Get	Physical MAC address	ARRAY
6	Get/Set	Interface Control	DOUBLE
		Control Bits	DOUBLE
		Forced Interface Speed	DOUBLE

Further details can be found in the Ethernet/IP specification.

B.3 Objects for the I/O connection

B.3.1 Assembly Object

Object class: 4
Instances: 3

The Assembly Object bundles together Attributes of various Objects, so that the exchange of data with the Objects can take place via **one** connection.

The following Object instances are saved in the Assembly Object:

Instance	Description
101	Input data
100	Output data
102	Configuration data

Remote I/O operating mode

Each data range begins on the LSB (least significant bit) of a word.

Instance 101: Input

Within the instance “Input Assembly Object” all inputs of the CPX system are transmitted cyclically over the network by means of a communication connection.
The following sequence applies during transmission:

Sequence of transmission	
1.	I/O diagnostic interface, if active (16-bit orientated)
2.	Object instances of the analogue channels (16-bit orientated)
3.	Instances of the technology modules (16 or 8-bit orientated)
4.	Object instances of the digital inputs (8-bit orientated)

Instance 101 (input) possesses the following member list in the operating mode Remote I/O:

Obj.	Instances (= Module no. + 1)	Attributes (channel)	Entries in member list	Type
133	1 ... 48	0/1	I/O diagnostic interface data, if active	WORD
104	1 ... 48	1 ... 32	Analogue channel data	WORD
106	1 ... 48	1 ... 64 / 65 ... 96	Technology module	BYTE/ WORD
102	1 ... 48	1 ... 64	Digital Data	BOOL

Instance 100: Output

Within the Instance Output in the Assembly Object all outputs of the CPX system will be transmitted over the network by means of **one** communication connection.
The following sequence applies during transmission:

Sequence of transmission	
1.	I/O diagnostic interface/status byte, if active (16-bit orientated)
2.	Object instances of the analogue channels (16-bit orientated)
3.	Instances of the technology modules (16 or 8-bit orientated)
4.	Object instances of the digital outputs (8-bit orientated)

Instance 100 (Output) possesses the following member list in the operating mode Remote I/O:

Obj.	Instances (= Module no. + 1)	Attributes (channel)	Entries in member list	Type
133	1 ... 48	0/1	I/O diagnostic interface data, if active	WORD
105	1 ... 48	1 ... 32	Analogue channel data	WORD
107	1 ... 48	1 ... 64 / 65 ... 96	Technology module	BYTE/ WORD
103	1 ... 48	1 ... 64	Digital Data	BOOL

Instance 102: Configuration

Instance 102 (Configuration) possesses the following member list:

Obj.	Number of	Entries in member list	Type
199	1	Configuration Array data	ARRAY

The I/O Objects 102 ... 107 also possess the following attributes:

Attribute	Entries ...	Type
100	Number of data of the module in BYTE or WORD	BYTE
101	Data type: – $D1_h$: BYTE – $D2_h$: WORD	BYTE
102	All data values	ARRAY

Remote controller operating mode

Each data range begins on the LSB (least significant bit) of a word.

Instance 100: Output

Instance 100 (Output) possesses the following member list in the operating mode Remote Controller:

Obj.	Number of	Entries in member list	Type
107	1 ... 64 / 65 ... 96	Technology module	BYTE/ WORD

Instance 101: Input

Instance 101 (input) possesses the following member list:

Obj.	Number of	Entries in member list	Type
106	1 ... 64 / 65 ... 96	Technology module	BYTE/ WORD

Transmission by communication types Polled I/O or COS/Cyclic.

Instance 102: Configuration

Instance 102 (Configuration) must have the value “0” in the operating mode Remote Controller.

B.4 Objects for system data and diagnosis

B.4.1 Identity Object

Object class: 01
Instances: 1

The Identity Object contains the identification and general information on the CPX-FB32.

Attr. No.	Access	Description	Type
1	Get	Vendor ID	WORD
2	Get	Device type	WORD
3	Get	Product code	WORD
4	Get	Revision (major/minor)	WORD
5	Get	Status	WORD
6	Get	Serial number	DOUBLE
7	Get	Product name	ARRAY
14	Get/Set	Semaphore	ARRAY
100	Get	Operating Mode	BOOL
101	Get	External Module Identifiers	ARRAY

B.4.2 System Object (for operating mode Remote I/O)

Object class: 132
Instances: 1

This Object is only available in the operating mode Remote I/O.

Attr. No.	Access	Description	Type	Function no.
1	Get	CPX operating mode (bit 0 ... 3) 0: Remote I/O without FEC/CEC 1: Remote I/O with FEC or CEC 2: Remote controller without bus node 3: Remote controller with bus node	BYTE	0 (bit 0 ... 3)
		CPX equipment status (bit 4) Specifies whether the current equipment fitted to the CPX corresponds to the saved CPX equipment status. 0: equal 1: unequal		0 (bit 4)
		Handheld (bit 5) Specifies whether or not a handheld is connected. 0: No handheld connected 1: Handheld connected		0 (bit 5)
		Force mode (bit 6) Specifies whether Force is blocked or enabled. 0: blocked 1: enabled		0 (bit 6)
		Bit 7: reserved		0 (bit 7)

Attr. No.	Access	Description	Type	Function no.
2	Get	Fail safe Specifies whether Fail Safe is active or inactive. 0: inactive 1: active	BYTE	1 (bit 0, 1)
		System Idle mode Specifies whether Idle mode is active or inactive. 0: inactive 1: active		1 (bit 2, 3)
3	Get	Monitoring CPX terminal (bit 0 ... 7) Specifies whether the monitoring of short circuit/overload and undervoltage is active or inactive. Bit 0: Monitoring SCS (short circuit/ overload sensor supply) Bit 1: Monitoring SCO (short circuit/ overload outputs) Bit 2: Monitoring V_{Out} (Undervoltage outputs) Bit 3: Monitoring V_{Val} (Undervoltage valves) Bit 4: Monitoring SCV (short circuit valves) Bits 5 ... 7: reserved 0: inactive 1: active	BYTE	2 (bit 0 ... 7)
4	Get	Number of input bytes (Rx size) Specifies the number of input bytes of the CPX terminal.	BYTE	-
5	Get	Number of output bytes (Tx size) Specifies the number of output bytes of the CPX terminal.	BYTE	-

Attr. No.	Access	Description	Type	Function no.
9	Get/Set	Monitoring (bit 0 ... 7) Bit 0: Monitoring SCS (short circuit/ overload sensor supply) Bit 1: Monitoring SCO (short circuit/ overload outputs) Bit 2: Monitoring Uout (Undervoltage outputs) Bit 3: Monitoring Uval (Undervoltage valves) Bit 4: Monitoring SCV (short circuit valves) Bits 5 ... 7:reserved 1: active (presetting) 0: inactive	BYTE	4401 (bit 0 ... 7)
10	Get/Set	Fail safe 0: Reset all outputs (presetting) 1: Hold last state (Retain signal status) 2: Assume Fault mode	BYTE	4402 (bit 0, 1)
11	Get/Set	Force mode 0: blocked 1: enabled	BYTE	4402 (bit 2, 3)
12	Get/Set	System Idle mode 0: Reset all outputs (presetting) 1: Hold last state (Retain signal status) 2: Assume Idle mode	BYTE	4402 (bit 4, 5)
13	Get/Set	System start 0: System start with default parameterisation (factory setting) and current CPX disassembly; external parameterisation possible (presetting) 1: System start with stored parameterisation and stored CPX expansion; Parameter and CPX-expansion are stored remanently; external parameterisation is blocked; the M-LED on the fieldbus node is lit	BYTE	4402 (bit 6)

B.4.3 Status and Diagnostic Object

Object class: 133
Instances: 1

The status bits and the I/O diagnostic interface are mapped here.

Attr. No.	Access	Description	Type	Function no.
1	Get	Status bits (8 bit) Source of error: Bit 0: Valve Bit 1: Output Bit 2: Input Bit 3: Analogue/ technology module Error type: Bit 4: Undervoltage Bit 5: Short circuit/overload Bit 6: Wire break Bit 7: Other error	BYTE	1936
2	Get	Number of the first module in which a fault has occurred	BYTE	1937
3	Get	Diagnostic status	BYTE	
4	Get	Error number	BYTE	1938
5	Get/Set	Address I/O diagnostic interface 16 output bits (task data) of the I/O diagnostic interface	WORD	
6	Get	Data I/O diagnostic interface 16 input bits (reply data) of the I/O diagnostic interface	WORD	

B.4.4 Diagnostic Trace Object

Object class: 134
Instances: 1 ... 40

An instance is created for each diagnostic entry.

Attr. No.	Access	Designation	Description	Type	Function no. 3488 + n [1]
1	Get		Marking the first entry after Power on Supplies 1 if it is the first entry after Power on.	BYTE	n = 10 * d + 4 (bit 7)
2	Get	Days	Number of days [2]	BYTE	n = 10 * d + 0
3	Get	Hours	Number of hours [2]	BYTE	n = 10 * d + 1
4	Get	Minutes	Number of minutes [2]	BYTE	n = 10 * d + 2
5	Get	Seconds	Number of seconds [2]	BYTE	n = 10 * d + 3
6	Get	Milliseconds	Number of 10 msec [2]	BYTE	n = 10 * d + 4 (bits 0 ... 6)
7	Get	Module code [3]	Module code of the module which registered the error	BYTE	n = 10 * d + 5
8	Get	Module number	Module position of the module which registered the error; 63 = error not module-related	BYTE	n = 10 * d + 6 (bits 6, 7)
9	Get	Channel number [3]	Number of the first faulty channel	BYTE	n = 10 * d + 7 (bits 0 ... 5)

[1] d (diagnostic event) = 0 ... 39; most current diagnostic event = 0;
[2] Measured from the time the power supply was switched on
[3] If the error number = 0, the content is also 0. If the error number is between 128 ... 199 (error class 3), the content is not relevant (service case).

Attr. No.	Access	Designation	Description	Type	Function no. 3488 + n [1]
10	Get	Error number	Possible error messages see System Manual chapter 5	BYTE	n = 10 * d + 8
11	Get	Subsequent channels [3]	Number of subsequent channels with the same error	BYTE	n = 10 * d + 9

[1] d (diagnostic event) = 0 ... 39; most current diagnostic event = 0;
[2] Measured from the time the power supply was switched on
[3] If the error number = 0, the content is also 0. If the error number is between 128 ... 199 (error class 3), the content is not relevant (service case).

B.4.5 Diagnostic Trace Status Object

Object class: 135
Instances: 1

Attr. No.	Access	Name	Type	Function no.
1	Get	Number of trace entries in the diagnostic memory	BYTE	3482 (bits 0 ... 7)
2	Get	Status of diagnostic memory 0: Recording active 1: Recording inactive	BYTE	3483 (bits 0, 1)
3	Get/Set	Clear_trace1, access via EDS	BYTE	-
4	Get/Set	Clear_trace2, access via explicit messaging; Confirms activity carried out by resetting (0) the attribute value	BYTE	-
5	Get/Set	Entries remanent with Power on 0: active (presetting) 1: inactive	BYTE	3480 (bit 0)
6	Get/Set	Run/stop filter 1 0: Stop after 40 entries (store the first 40 entries) 1: Overwrite old entries (store the last 40 entries), presetting)	BYTE	3480 (bit 1)
7	Get/Set	Run/stop filter 2 0: Run/stop filter 2 inactive (presetting) 1: Record up to the defined FN 2: Record up to the defined FN + MN 3: Record up to the defined FN + MN + KN 4: Record from the defined FN 5: Record from the defined FN + MN 6: Record from the defined FN + MN + KN 7: reserved	BYTE	3484 (bits 0 ... 2)
8	Get/Set	End of error filter 0: Record going errors (end of error) (filter inactive, presetting) 1: Do not record going errors (end of error) (filter active)	BYTE	3484 (bit 3)

Attr. No.	Access	Name	Type	Function no.
9	Get/Set	Error number filter FN = error number 0: Error number filter inactive (presetting) 1: Record only defined FN 2: Do not record defined FN 3: reserved	BYTE	3484 (bits 4, 5)
10	Get/Set	Module/channel filter With this diagnostic memory filter, the registering of errors of other modules or channels can be suppressed in order that errors in a particular module or channel can be analysed. FN = error number 0: Module/channel filter inactive (presetting) 1: Record only FN of a module 2: Record only FN of a channel 3: reserved	BYTE	3484 (bits 6, 7)
11	Get/Set	Module number Module number for the diagnostic memory filter	BYTE	3485 (bits 0 ... 7)
12	Get/Set	Channel number Channel number for the diagnostic memory filter	BYTE	3486 (bits 0 ... 7)
13	Get/Set	Error number Fault number for the diagnostic memory filter	BYTE	3487 (bits 0 ... 7)

B.4.6 General Module Parameter Object

Object class: 101
Instances: 1 ... 48

Applicable is: Instance number = Module number + 1

This Object enables general access to the module parameters of all existing and future CPX modules.

Use the general parameter Module Object for parameterising modules with word or double-word parameters.
Examples for modules with word or double-word parameters are: the analogue 4-way input module CPX-4AE-I,
the temperature module CPX-4AE-T or the CPX-CP interface.

You can access three types of parameters via the Attributes of the general Module Parameter Object:

- byte parameters through the Attribute 1 ... 64
- word parameters through the Attribute 65 ... 127
- double-word parameters through the Attribute 129 ... 189

Procedure for parameterisation

1. Refer to the module manual for the function number of the parameter which you wish to set.
2. Search for this function number in the last column of Tab. B/6 (byte and word parameter) or Tab. B/7 (double-word parameter)
3. Read the appropriate Attribute number from the table.

Examples for parameterisation with the general Module Parameter Object can be found in Appendix B.5.2.

Attribute no.			Parameters	Function no.
Byte	**Word**	**Word**		
1	65	–	See relevant module manual for the parameter	4828 + m * 64 + **0**
2		66		4828 + m * 64 + **1**
3	67			4828 + m * 64 + **2**
4		68		4828 + m * 64 + **3**
5	69			4828 + m * 64 + **4**
6		70		4828 + m * 64 + **5**
7	71			4828 + m * 64 + **6**
8		72		4828 + m * 64 + **7**
9	73			4828 + m * 64 + **8**
10		74		4828 + m * 64 + **9**
11	75			4828 + m * 64 + **10**
12		76		4828 + m * 64 + **11**
...	...			4828 + m * 64 + ...
...		...		4828 + m * 64 + ...
...	...			4828 + m * 64 + ...
...		124		4828 + m * 64 + **59**
61	125			4828 + m * 64 + **60**
62		126		4828 + m * 64 + **61**
63	127			4828 + m * 64 + **62**
64		–		4828 + m * 64 + **63**

Tab. B/6: General module parameter object: Assignment of the Attributes for word parameters to the function numbers

Attribute no.					Parameters	Function no.
Byte	**DWord**	**DWord**	**DWord**	**DWord**		
1	129	–	–	–	See relevant module manual for the parameter	4828 + m * 64 + **0**
2		130				4828 + m * 64 + **1**
3			131			4828 + m * 64 + **2**
4				132		4828 + m * 64 + **3**
5	133					4828 + m * 64 + **4**
6		134				4828 + m * 64 + **5**
7			135			4828 + m * 64 + **6**
8				136		4828 + m * 64 + **7**
9	...					4828 + m * 64 + **8**
10		...				4828 + m * 64 + **9**
11			...			4828 + m * 64 + **10**
12				...		4828 + m * 64 + **11**
...	185					4828 + m * 64 + ...
...		186				4828 + m * 64 + ...
...			187			4828 + m * 64 + ...
...				188		4828 + m * 64 + **59**
61	189					4828 + m * 64 + **60**
62		–				4828 + m * 64 + **61**
63			–			4828 + m * 64 + **62**
64				–		4828 + m * 64 + **63**

Tab. B/7: General module parameter object: Assignment of the Attributes for double-word parameters to the function numbers

B.4.7 Force parameter

The first word receives the lowest instance number of the relevant Object. The second word receives the second lowest instance number, etc.

Object	Description
108	Force state digital inputs
109	Force mode digital inputs
110	Force state digital outputs
111	Force mode digital outputs

Tab. B/8: Objects for Force Parameter of digital I/O modules

Object	Description
116	Force state analogue inputs
117	Force mode analogue inputs
118	Force state analogue outputs
119	Force mode analogue outputs

Tab. B/9: Objects for Force Parameter of analogue I/O modules

Object	Description
124	Force state inputs technology module
125	Force mode inputs technology module
126	Force state outputs technology module
127	Force mode outputs technology module

Tab. B/10: Objects for Force Parameter for technology module

Composition of the Objects for Force mode

Objects Force mode: 109, 111, 117, 119, 125, 127
(see Tab. B/8 ... Tab. B/10)
Instances: 1 ... 64, 100, 101

Attr. No.	Access	Description	Type
1	Get/Set	Value for Force mode: Channel 0: 0 = Force blocked 1 = Force enabled	BOOL
2	Get/Set	Channel 1: 0 = Force blocked 1 = Force enabled	BOOL
...	...	...	...
64	Get/Set	Channel 63: 0 = Force blocked 1 = Force enabled	BOOL
100	Get	Number of channels	BYTE
101	Get	All channels: values for Force mode	ARRAY

Tab. B/11: Basic composition of the Objects for Force mode

Composition of the Objects for Force state for digital I/O modules

Objects Force state: 108, 110 (see Tab. B/8)
Instances: 1 ... 64, 100, 101

Attr. No.	Access	Description	Type
1	Get/Set	Value for Force state: Channel 0: 0 = Reset signal 1 = Set signal	BOOL
2	Get/Set	Channel 1: 0 = Reset signal 1 = Set signal	BOOL
...	...	...	...
64	Get/Set	Channel 63: 0 = Reset signal 1 = Set signal	BOOL
100	Get	Number of channels	BYTE
101	Get	All channels: values for Force state	ARRAY

Tab. B/12: Composition of the Objects for Force state for digital I/O modules

Composition of the Objects for Force state for analogue I/O modules

Objects Force state: 116, 118 (see Tab. B/9)
Instances: 1 ... 32, 100, 101

Attr. No.	Access	Description	Type
1	Get/Set	Channel 0: Value for Forcing	WORD
2	Get/Set	Channel 1: Value for Forcing	WORD
...	...	...	...
32	Get/Set	Channel 31: Value for Forcing	WORD

Tab. B/13: Composition of the Objects for Force state for analogue I/O modules

Composition of the Objects for Force state for technology modules

Objects Force state: 124, 126
(see Tab. B/10)
Instances: 1 ... 64, 100, 101

Attr. No.	Access	Description	Type
1	Get/Set	Channel 0: Value for Forcing	BYTE
2	Get/Set	Channel 1: Value for Forcing	BYTE
...	...	...	...
64	Get/Set	Channel 63: Value for Forcing	BYTE
65	Get/Set	Channel 0: Value for Forcing	WORD
...	...	...	...
96	Get/Set	Channel 31: Value for Forcing	WORD
100	Get	Number of channels	BYTE
101	Get	Data type: – $D1_h$: BYTE – $D2_h$: WORD	BYTE
102	Get/Set	All channels: values for Force state	ARRAY

Tab. B/14: Composition of the Objects for Force state technology modules

B.4.8 Fail Safe and Idle parameters

The first word receives the lowest instance number of the relevant Object. The second word receives the second lowest instance number, etc.

Object	Description
112	Fault state digital outputs
113	Fault mode digital outputs
114	Idle state digital outputs
115	Idle mode digital outputs

Tab. B/15: Objects for Fail Safe and Idle parameters of digital output modules

Object	Description
120	Fault state analogue outputs
121	Fault mode analogue outputs
122	Idle state analogue outputs
123	Idle mode analogue outputs

Tab. B/16: Objects for Fail Safe and Idle parameters of analogue output modules

Object	Description
128	Fault state outputs technology module
129	Fault mode outputs technology module
130	Idle state outputs technology module
131	Idle mode outputs technology module

Tab. B/17: Objects for the Fail Safe and Idle parameters for technology modules

Composition of the Objects for Fault/Idle mode

Objects Fault state: 112, 120, 128
Objects Fault mode: 113, 121, 119
(see Tab. B/15 ... Tab. B/17)
Instances: 1 ... 64, 100, 101

Attr. No.	Access	Description	Type
1	Get/Set	Values for Fault/Idle mode: Channel 0: 0 = Hold last state 1 = Fault/Idle state	BOOL
2	Get/Set	Channel 1: 0 = Hold last state 1 = Fault/Idle state	BOOL
...	...	...	...
64	Get/Set	Channel 64: 0 = Hold last state 1 = Fault/Idle state	BOOL
100	Get	Number of channels	BYTE
101	Get	All channels: values for Fault/Idle mode	ARRAY

Tab. B/18: Composition of the Objects for Fault/Idle mode

Composition of the Objects for Fault/Idle state for digital output modules

Object Fault state: 112
Object Idle state: 114
(see Tab. B/15)
Instances: 1 ... 64, 100, 101

Attr. No.	Access	Description	Type
1	Get/Set	Channel 0: 0 = Hold last state 1 = Fault/Idle state	BOOL
2	Get/Set	Channel 1: 0 = Hold last state 1 = Fault/Idle state	BOOL
...	...	...	...
64	Get/Set	Channel 64: 0 = Hold last state 1 = Fault/Idle state	BOOL
100	Get	Number of channels	BYTE
101	Get	All channels: values for Fault/Idle state	ARRAY

Tab. B/19: Composition of the Objects for Fault/Idle state for digital output modules

Composition of the Objects for Fault/Idle state for analogue output modules

Object Fault state: 120
Object Idle state: 122
(see Tab. B/16)
Instances: 1 ... 64, 100, 101

Attr. No.	Access	Description	Type
1	Get/Set	Channel 0: Value for Fault/Idle state	WORD
2	Get/Set	Channel 1: Value for Fault/Idle state	WORD
...	...	...	...
32	Get/Set	Channel 31: Value for Fault/Idle state	WORD

Tab. B/20: Composition of the Objects for Fault/Idle state for analogue output modules and technology modules

Composition of the Objects for Fault/Idle state for technology modules

Object Fault state: 128
Object Idle state: 130
(see Tab. B/17)
Instances: 1 ... 64, 100, 101

Attr. No.	Access	Description	Type
1	Get/Set	Channel 0: Value for Fault/Idle state	BYTE
2	Get/Set	Channel 1: Value for Fault/Idle state	BYTE
...	...	...	...
64	Get/Set	Channel 63: Value for Fault/Idle state	BYTE
65	Get/Set	Channel 64: Value for Fault/Idle state	WORD
...	...	...	...
96	Get/Set	Channel 31: Value for Fault/Idle state	WORD
100	Get	Number of channels	BYTE
101	Get	Data type: – $D1_h$: BYTE – $D2_h$: WORD	BYTE
102	Get/Set	All channels: values for Fault/Idle state	ARRAY

Tab. B/21: Composition of the Objects for Fault/Idle state for analogue output modules and technology modules

B.4.9 Configuration Array Object

The Configuration Array Object is available only for revision statuses later than Rev. 1.2. Further information on this Object can be found under www.festo.com/fieldbus.

Instances: 1
Object class: 199

Attr. No.	Access	Description	Type	Function no.
1	Get/Set	Data field with all system and module parameters.	ARRAY	–

B.4.10 Slave Size Object (for operating mode Remote Controller)

Object class: 136
Instances: 1

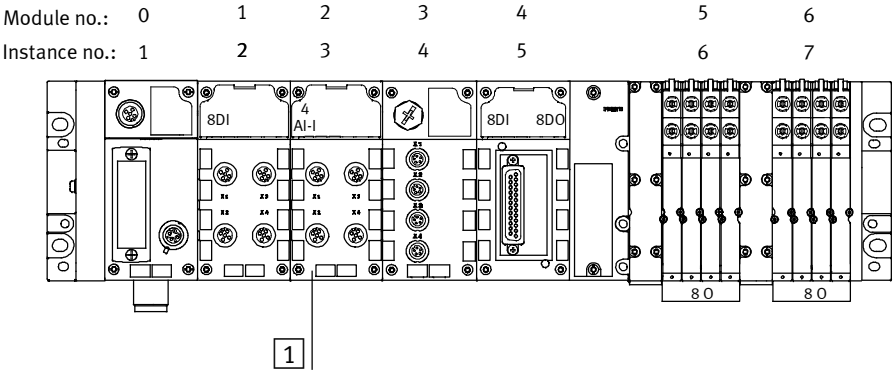
This Object is only available in the operating mode Remote Controller. It contains the number of I/O bytes for communication of theCPX-FB32 with the CPX-FEC or CPX-CEC. Setting is made through DIL switches on the CPX-FB32 (see Tab. 1/3).

Attr. No.	Access	Description	Type
1	Get	Number of input bytes for the operating mode Remote Controller	BYTE
2	Get	Number of output bytes for the operating mode Remote Controller	BYTE

B.5 Examples

B.5.1 Example: Forcing of inputs

In this example the Force mode of an analogue input module is parameterised.



1 Parameterisation: Module CPX-4AE-I, **Setting of Force mode for channel 2**:
Object class **117** (see Tab. B/9)
Instance 3 (= Module number + 1)
Attribute **3** (for channel 2, see Tab. B/11 and Tab. B/22)

Fig. B/1: Example of Forcing (sequence see text)

1. Enable Force mode

Enable the Force mode for the CPX terminal with the System Object 132 (see Tab. B/2 and Appendix B.4.2):

System Object:	132
Instance:	1
Attribute	11 (Force mode)

2. Define value for Force state for channel 2:

Objects Force state: 116 (see Tab. B/13)
Instance: 3

Attr. No.	Access	Parameters	Type
...	...	...	...
3	Get/Set	Channel 2: Value for Forcing	WORD
...	...	...	...
100	Get	Number of channels	BYTE
101	Get	All channels: values for Force mode	ARRAY

Tab. B/22: Example: Set Force state for module no. 2

3. Define Force mode for channel

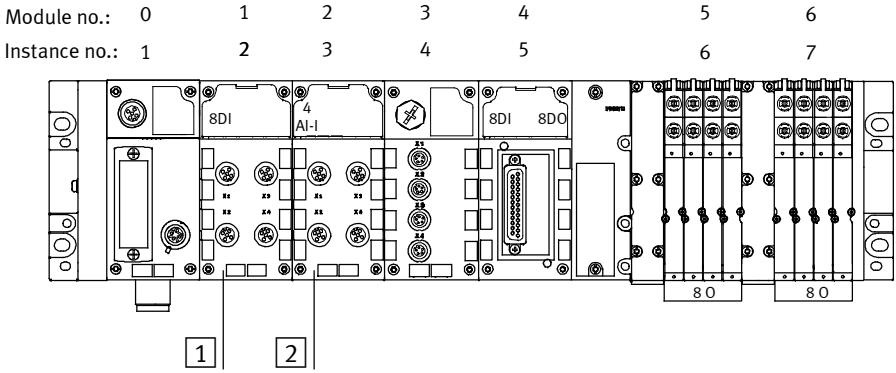
Objects Force state: 117 (see Tab. B/11)
Instance: 3

Attr. No.	Access	Parameters	Type
...	...	...	...
3	Get/Set	Value for Force mode, channel 2: 0 = Force blocked 1 = Force enabled	BOOL
...	...	...	...
100	Get	Number of channels	BYTE
101	Get	All channels: values for Force mode	ARRAY

Tab. B/23: Example: Set Force mode for module no. 2

B.5.2 Example: Parameterisation with the general Module Parameter Object

In this example a signal extension time with a digital input module and a lower limit value with an analogue input module are parameterised.



1 Parameterisation module CPX-8DE: **Enable signal extension channel 5**:
Object class **101** (see B.4.6)
Instance **1** (= module number)
Attribute **7** (see Tab. B/24)

2 Parameterisation module CPX-4AE-I: **Lower limit channel 2**
Object class **101**
Instance **2** (= module number)
Attribute **82** (see Tab. B/25)

Fig. B/2: Examples for parameterisation with the general Module Parameter Object

The following tables show you how to ascertain the Attributes for the parametrizing. The parameters of the relevant modules are entered in the tables.

Information on the parameters can be found in the description for the relevant module.

Attribute no.			Parameter (module no. 1 in Fig. B/2)	Function no.
byte	Word	Word		
1	65	–	Monitoring the CPX module	4828 + m * 64 + **0**
2		66	Bit 0: Behaviour after short circuit/overload Bit 4, 5: Input debouncing time Bit 6, 7: Signal extension time	4828 + m * 64 + **1**
3	67		–	4828 + m * 64 + **2**
4		68	–	4828 + m * 64 + **3**
5	69		–	4828 + m * 64 + **4**
6		70	–	4828 + m * 64 + **5**
7	71		Signal extension channel x	4828 + m * 64 + **6**
8		...	–	4828 + m * 64 + **7**

Tab. B/24: Example: parameterisation of signal extension for module no. 1

Attribute no.			Parameter (module no. 2 in Fig. B/2)	Function no.
byte	Word	Word		
1	65	–	Monitoring the CPX module	4828 + m * 64 + **0**
2		66	Bit 0: Behaviour after short circuit/overload	4828 + m * 64 + **1**
...	...		...	4828 + m * 64 + ...
...		...	...	4828 + m * 64 + ...
15	80		Lower limit channel 1	4828 + m * 64 + **14**
16		81	Lower limit channel 1	4828 + m * 64 + **15**
17	**82**		Lower limit channel 2	4828 + m * 64 + **16**
18		83	Lower limit channel 2	4828 + m * 64 + **17**
...	...		...	4828 + m * 64 + ...

Tab. B/25: Example: parameterisation of the lower limit value (module no. 2, channel 2)

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Appendix C

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