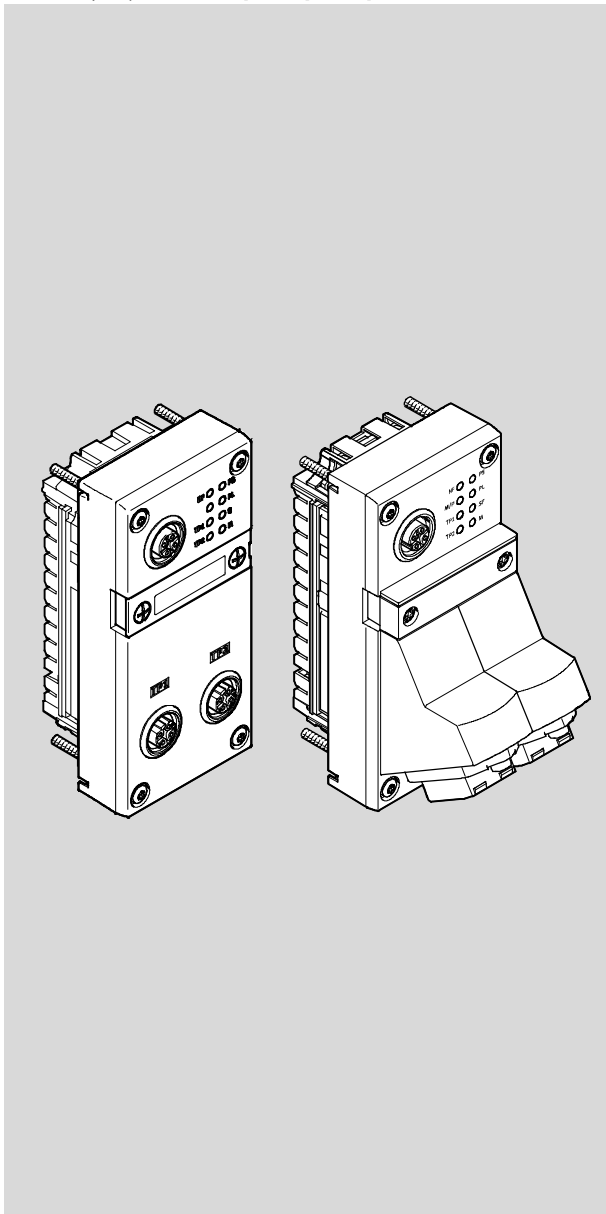


# Terminal CPX

## Bus node

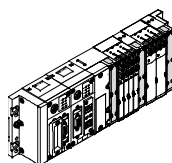
CPX-(M)-FB33/34/35/41



# FESTO

## Description

Network protocol  
PROFINET IO



548760  
en 1410d  
[8041494]



## Contents and general safety instructions

Original ..... de

Version ..... en 1410d

Designation ..... P.BE-CPX-PNIO-EN

Order no. .... 548760

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## Intended use

The CPX-FB33, CPX-M-FB34, CPX-M-FB35 and CPX-M-FB41 bus nodes documented in this description are intended only for use as participants (“I/O device”) on the Industrial Ethernet system PROFINET IO.

The bus nodes can be used in three different operating modes:

- Remote I/O
- Remote controller
- Remote I/O with additional function “**Prioritized Start-up**”, also designated “Fast Start-up” (FSU) or “Fast re-start”.

“Fast Start-up” ensures a faster running up of the CPX terminal.

But this additional function has restrictions regarding commissioning and parameterisation → Section B.1.3.

The CPX terminal must only be used as follows:

- as intended in industrial environments;  
outside of industrial environments, e.g. in commercial and mixed-residential areas, actions to suppress interference may have to be taken
- exclusively in combination with modules and components that are permissible for the respective product variant of the CPX terminals → [www.festo.com/catalogue](http://www.festo.com/catalogue)
- in original status without unauthorised modifications;  
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.

When connected with commercially available components, such as sensors and actuators, the specified limits for pressures, temperatures, electrical data, torques etc. must be observed.

Comply with the legal rules and regulations and standards, rules of the testing organisations and insurance companies and national specifications applicable for the location.



### **Warning**

Electric shock.

Injury to people, damage to the machine and system.

- Use for the electrical power supply only PELV circuits in accordance with IEC 60204-1 (Protective Extra-Low Voltage, PELV).
- Observe the general requirements in accordance with IEC 60204-1 for PELV circuits.
- Use only voltage sources that guarantee a reliable electric disconnection of operating and load voltage in accordance with IEC 60204-1.
- Always connect the circuits for operating and load voltage supplies  $U_{EL/SEN}$ ,  $U_{VAL}$  and  $U_{OUT}$ .

Through the use of PELV circuits, protection against electric shock (protection against direct and indirect contact) is ensured in accordance with IEC 60204-1.

Observe the measures in section 2.11 and section 3.1 when implementing an emergency off or emergency stop function.

## **Target group**


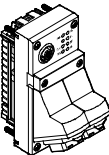
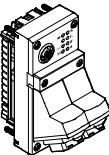
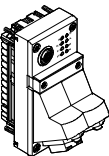
This description is intended exclusively for technicians trained in control and automation technology, who have experience in installation, commissioning, programming and diagnostics of programmable logic controllers (PLC) and field-bus systems.

## **Service**

Please consult your local Festo repair service if you have any technical problems.

## Notes regarding this description

This description contains information about the following modules:

Bus node	Type code	Brief description	Connection technology
	CPX-FB33	Bus node for PROFINET IO  The PROFINET fieldbus technology uses the Ethernet standard and TCP/IP protocol for real-time communication in an industrial environment.	2 x M12 socket, D-coded, 4-pin, corresponding to IEC 61076-2
	CPX-M-FB34	Data transmission:  – PROFINET, on the basis of Industrial Ethernet, based on the Ethernet protocol (IEEE 802.3), real-time-capable	2 x RJ45 socket, push-pull, AIDA-compliant, corresponding to IEC 60603, IEC 61076-3
	CPX-M-FB35	– Switched Fast Ethernet, 100 Mbit/s.  Selection of directives, standards and norms regarding PROFINET:	2 x SCRJ socket, push-pull, 650 nm wavelength, suitable for POF fibre-optic cable, AIDA-compliant, corresponding to IEC 61754-24
	CPX-M-FB41	– PROFINET installation guidelines – IEC 61158 – IEC 61784 – IEC 61918.  Additional information: ➔ <a href="http://www.profinet.com">www.profinet.com</a>	1 x SCRJ socket, push-pull, 650 nm wavelength, suitable for POF fibre-optic cable, AIDA-conforming, conforming to IEC 61754-24

Tab. 0/1: Bus node for PROFINET – overview



This description includes information about installation and configuration of the bus node for PROFINET as well as PROFINET-specific information regarding parameterisation, commissioning, programming and diagnostics of a CPX terminal in a PROFINET network.

Further information about PROFINET can be obtained in the Internet:

→ [www.profinet.com](http://www.profinet.com)

→ [www.profibus.com/download/](http://www.profibus.com/download/)

Observe in particular the following document:

- PROFINET installation guidelines (“PROFINET Installation Guide”, “Installation Guideline PROFINET Part 2...”).

General, basic information on PROFINET can be found in the following document:

- PROFINET system description, Technology and Application (“PROFINET System Description, Technology and Application”).

General basic information about the mode of operation, assembly, installation and commissioning of CPX terminals can be found in the CPX system description (P.BE-CPX-SYS...).

Information about additional CPX modules can be found in the description for the respective module.



**An overview of the structure of the CPX terminal User Documentation can be found in the CPX system description (P.BE-CPX-SYS...).**

Product-specific information about the control system (IPC, PLC or I/O controller) can be found in the manufacturer’s product documentation accompanying the product.

## Important user instructions

### Danger categories

This description includes instructions on the possible dangers which can occur if the product is used incorrectly. 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.

In addition, the following pictogram marks passages in the text which describe activities with electrostatically sensitive devices:



Electrostatically sensitive devices: Incorrect handling may cause damage to components.

## Identification of special information

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

### Pictograms



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



**Accessories:**  
Information about necessary or useful accessories for the product from Festo.



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

### Text designations

- Bullet points denote activities that may be carried out in any sequence.
- 1. Numerals label activities that must be carried out in the sequence specified.
- Arrowheads indicate general lists.

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

<b>Term/abbreviation</b>	<b>Significance</b>
A	Digital output
A0 <sub>h</sub>	Hexadecimal numbers are identified by a subscript “h”
AB	Output byte
AIDA	Automation Initiative of German Domestic Automobile Manufacturers (Automatisierungsinitiative Deutscher Automobilhersteller)
Auto-MDI	Auto-MDI designates the capability of automatically recognising the circuitry of the transmitting and receiving lines or of the connected device and to adjust to it (also designated “Crossover detection” or “Auto-crossover”)
Bus node	Create the connection to certain networks or fieldbuses; pass on control signals to the connected modules and monitor their functioning
CEC	Control block, e.g. CPX-CEC/CPX-CEC..., usable for configuration, commissioning and programming of various components and equipment from Festo
CoDeSys	Controller Development System
CP	Compact Performance
CPX modules	Collective term for the electrical modules which can be integrated into a CPX terminal; CPX modules form the “electric” side of the CPX terminal
CPX terminal	Installation system comprising CPX modules with or without valve terminal (pneumatics modules)
DIL	dual in-line
DIL switches	Miniature switch that consists of several switching elements, with which, for example, basic settings can be made

Tab. 0/2: Specific terms and abbreviations – part 1



<b>Term/abbreviation</b>	<b>Significance</b>
FEC	Control block, e.g. CPX-FEC, usable as: <ul style="list-style-type: none"> <li>– stand-alone system controller (PLC, Stand Alone operating mode)</li> <li>– system controller (PLC, Remote Controller operating mode)</li> <li>– fieldbus slave (Remote I/O operating mode)</li> </ul>
FMT	Festo Maintenance Tool (CPX-FMT); configuration and programming software for CPX modules for commissioning and service purposes
FO	Fibre-optic cable (FOC, fibre optics)
FOC	Fibre-optic cable
FSU	“Fast Start-up”, also designated “Prioritized Start-up” or “Fast Restart”; further information can be found in section B.1.3
I	Digital input
IB	Input byte
I/O modules	Collective term for the CPX modules which provide digital inputs and outputs
I/Os	Digital inputs and outputs
IPC	Industrial PC
MAC address	Permanently assigned hardware address (“physical address”) for Ethernet network devices or network adapters – for unique identification in the worldwide computer network (Media Access Control address)
MDI	Medium Dependent Interface
MMI	User interface (Man-Machine Interface)
Operator unit (CPX-MMI)	Operator unit (CPX-MMI) for CPX modules for commissioning and service purposes, also designated as “Handheld”
PLC	Programmable logic controller, also designated system controller or controller for short (see also SPS)
PLC	Programmable Logic Controller (German: Speicherprogrammierbare Steuerung (SPS))

Tab. 0/3: Specific terms and abbreviations – part 2

<b>Term/abbreviation</b>	<b>Significance</b>
Pneumatic interface	The pneumatic interface (port pattern) is the interface between the CPX modules and the pneumatics modules (→ Valve terminal); the pneumatic interface serves to connect the valve terminal pneumatics to the CPX terminal; it creates the mechanical connection between the electric and pneumatic side and ensures transmission of the electric signals; the pneumatic interface counts functionally as on the “electric” side of the CPX terminal
Pneumatic modules	Collective term for the pneumatic modules which can be integrated into a CPX terminal (→ Valve terminal); pneumatic modules form the “pneumatic” side of the CPX terminal
POF	Polymeric Optical Fibre (also called Plastic Optical Fibre)
Prioritized Start-up	“Prioritized Start-up”, also designated “Fast Start-up” (FSU) or “Fast Restart”; further information can be found in section B.1.3
PROFenergy	PROFenergy makes energy management settings possible; for more extensive information → <a href="http://www.profinet.com">www.profinet.com</a>
PROFINET IO	Fieldbus system based on Industrial Ethernet for data exchange between system controller (PLC/IPC), system controller (e.g. CPX-FEC) and field devices (“I/O devices”) or drives and valve terminals; for more extensive information → <a href="http://www.profinet.com">www.profinet.com</a>
PROFINET IO RT	PROFINET IO in the design with real-time protocol (cycle time: typ. 10 ms; application: e.g. production control)
PROFINET IO IRT	PROFINET IO in the design with isochronous real-time protocol (cycle time: typ. < 1 ms; application: e.g. drive control)
PROFIsafe	PROFIsafe makes possible shared transmission of operating components of a reliable control and process control on the same network; for more extensive information → <a href="http://www.profinet.com">www.profinet.com</a>
STI	I/O diagnostic interface (System Table Interface)
Valve terminal	Electromagnetic valves with shared power supply, air supply and control; the valves and pneumatic components on the right side of the pneumatic interface together form the valve terminal pneumatics

Tab. 0/4: Specific terms and abbreviations – part 3

# Installation

## Chapter 1

# 1. Installation

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## 1. Installation

### 1.1 General instructions on installation



#### **Warning**

Before installation and maintenance work, switch off the following:

- compressed air supply
- power supply to the electronics/sensors
- load voltage supply to valves/outputs.

In this way, you can avoid:

- uncontrolled movements of loose tubing
- accidental movements of the connected actuator technology
- undefined switching states of the electronics.



#### **Caution**

The bus node includes electrostatically sensitive devices.

- Therefore, do not touch any components.
- Observe the handling specifications for electrostatically sensitive devices.

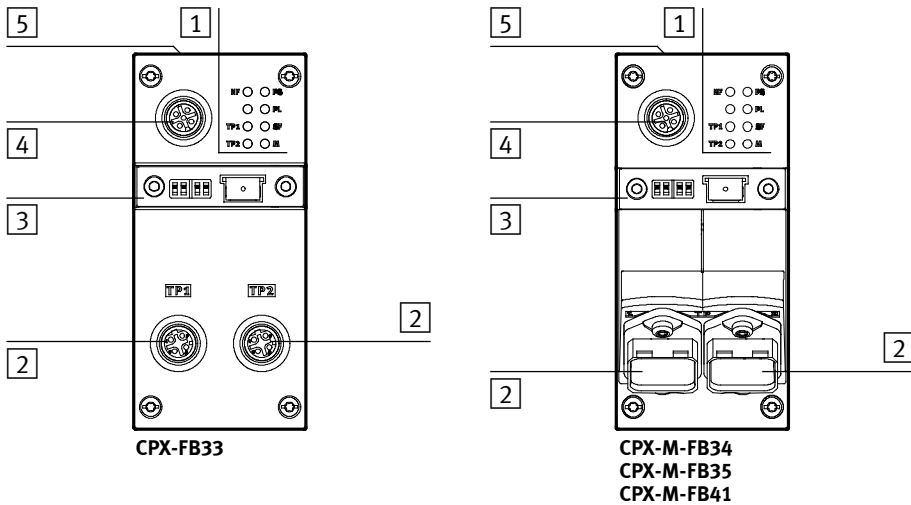
By doing so, you avoid malfunctions of and damage to the electronics.



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

## 1. Installation

### 1.2 Connection and display components



- |   |  |
|---|--|
| <p>1 PROFINET-specific network/bus status LEDs and CPX-specific LEDs</p> <p>2 Network connection<br/>CPX-FB33: 2 x M12-socket, D-coded, 4-pin<br/>CPX-M-FB34: 2 x RJ45-socket, push-pull, AIDA-conforming<br/>CPX-M-FB35: 2 x SCRJ-socket, push-pull, AIDA-conforming<br/>CPX-M-FB41: 1 x SCRJ-socket, push-pull, AIDA-conforming</p> | <p>3 Cover for DIL-switches and memory card</p> <p>4 Service interface for operator unit (CPX-MMI; V.24-interface) and USB adapter (for CPX-FMT)</p> <p>5 Rating plate with MAC-ID and CPX revision code ("Rev ...")</p> |
|---|--|

Fig. 1/1: Connection and display components on the bus node for PROFINET



#### Note

Use cover caps to seal unused connections (→ Section 1.7).

### 1.3 Mounting and dismounting of the bus node



#### **Warning**

Electric shock

Injury to people, damage to the machine and system

- Switch supply power off before assembly work.



#### **Note**

Material damage due to incorrect mounting

- Select screws that are suitable for the material of the interlinking block:
  - plastic: thread-cutting tapping screws
  - metal: screws with metric thread.



When ordering a single bus node, all required screws are supplied.

#### Mounting

Mount the bus node as follows:

1. Check seal and seal surfaces. Replace damaged parts.
2. Push the bus node carefully and without tilting into the interlinking block up to the stop (→ Fig. 1/2).
3. Turn the screws into the existing thread.
4. Tighten the screws in diagonally opposite sequence.  
Tightening torque: 0.9 ... 1.1 Nm.

## 1. Installation

- 1 Bus node  
(example CPX-FB33)
- 2 Interlinking block
- 3 Screws

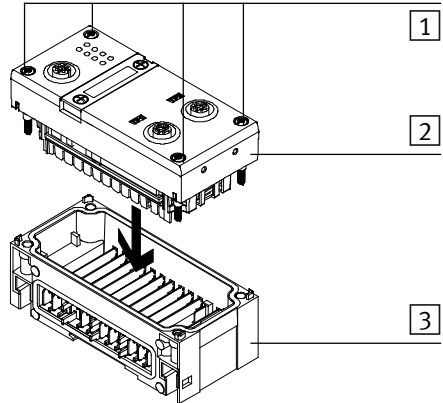


Fig. 1/2: Mounting/dismounting the bus node

### Dismounting

Dismount the bus node as follows:

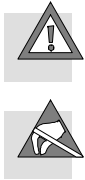
1. Unscrew screws.
2. Pull the bus node without tilting out of the interlinking block.



## 1. Installation

### 1.4 Setting the DIL switches, use of the memory card

In order to make the settings for the bus node and to change the memory card, you must first remove the cover for the DIL switches.



#### Caution

The bus node includes electrostatically sensitive devices.

- Therefore, do not touch any components.
- Observe the handling specifications for electrostatically sensitive devices.

By doing so, you avoid malfunctions of and damage to the electronics.

#### 1.4.1 Removing and attaching the cover for DIL switches and memory card

You need a screwdriver in order to remove or attach the cover.



#### Note

Observe the following notes when removing or attaching the cover:

- Switch off the power supply before removing the cover.
- Make sure that the seal is seated correctly when attaching the cover!
- Tighten the two fastening screws at first by hand and then with max. 0.4 Nm.

## 1. Installation

### 1.4.2 Setting the DIL switches

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

- bus node operating mode
- diagnostics mode (remote I/O operating mode only)
- data field size (only in remote controller operating mode).

#### Approach:

1. Switch off the power supply.
2. Remove the cover (see section 1.4.1).
3. Carry out the required settings (see Tab. 1/1, Tab. 1/2 and Tab. 1/4).
4. Install the cover again (see section 1.4.1).



#### Note

- Make sure that the seal is seated correctly.

- 1 DIL switch 1.1 + 1.2:  
bus node operating mode
- 2 DIL switches 2.1 + 2.2:  
diagnostics mode (only in remote I/O operating mode);  
data field size (only in remote controller operating mode)
- 3 Memory card  
(see section 1.4.3, 1.5 as well as 2.6.3 and 2.8.1)

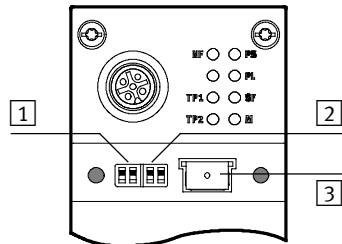




Fig. 1/3: Settings of the DIL switches in the bus node

## 1. Installation

### Setting the operating mode with DIL switch 1

You can set the operating mode of the bus node with switch element 1.1 of DIL switch 1 (see Tab. 1/1):

- remote I/O operating mode
- remote controller operating mode.

DIL switch <span style="border: 1px solid black; padding: 0 2px;">1</span>	Set bus node operating mode
 <p>DIL 1.1: OFF DIL 1.2: OFF (Factory setting)</p>	<p><b>Remote I/O operating mode</b></p> <p>All functions of the CPX terminal are controlled directly by the PROFINET-I/O controller or a higher-level PLC.</p> <p>The bus node undertakes the <b>required</b> connection to PROFINET.</p>
 <p>DIL 1.1: ON DIL 1.2: OFF</p>	<p><b>Operating mode Remote Controller</b></p> <p><b>Requirement:</b> A control block CPX-FEC or CPX-CEC is a component of the CPX terminal.</p> <p>The CPX-FEC or CPX-CEC control block integrated into the terminal controls all functions of the CPX terminal, i.e. the control block takes on the I/O control.</p> <p>The bus node takes over the <b>additional</b> connection to PROFINET.</p>

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

Further explanations of the bus node operating mode can be found in section B.1:





- remote I/O operating mode → Section B.1.1
- remote controller operating mode → Section B.1.2
- additional function “Fast Start-up” (FSU) → Section B.1.3.

## 1. Installation

### In the remote I/O operating mode: setting the diagnostics mode with DIL switch 2

The function of the DIL switch 2 depends on the setting of the DIL switch 1 or the set operating mode of the CPX terminal (→ Tab. 1/1):

The diagnostics mode is set with DIL switch 2 in the remote I/O operating mode (→ Tab. 1/2).

DIL switch <span style="border: 1px solid black; padding: 0 2px;">2</span>	<b>Set diagnostics mode:</b> (in the remote I/O operating mode)	
	DIL 2.1: OFF DIL 2.2: OFF (factory setting)	<b>I/O diagnostics interface and status bits are switched off or diagnostics mode is set via the hardware configuration of the configuration software<sup>3)</sup></b> (+ 0 byte I / 0 byte O)
	DIL 2.1: OFF DIL 2.2: ON	<b>Status bits are switched on</b> (+ 1 Byte E / 0 Byte A) <sup>1)</sup>
	DIL 2.1: ON DIL 2.2: OFF	<b>I/O diagnostics interface is switched on</b> (+ 2 bytes I / 2 bytes O) <sup>2)</sup>
	DIL 2.1: ON DIL 2.2: ON	Reserved for future extensions

<sup>1)</sup> Diagnostics mode status bits occupy 1 byte of address space (8 I bits)  
<sup>2)</sup> Diagnostics mode I/O diagnostics interface occupies 4 bytes of address space (16 I and 16 O bits)  
<sup>3)</sup> From Revision 21

Tab. 1/2: Setting the diagnostics mode with DIL switch 2



### Note

#### (1) Diagnostics mode reduces the available address space

Use of the diagnostics mode (status bits or I/O diagnostics interface) occupies **8 I** or **16 I/O** bits and thus reduces the number of I/O bits which are available for module communication. In this way, the number of addressable modules is reduced in favour of additional status or diagnostic information.

Take account of this fact for the planning of your CPX terminal.

#### (2) Subsequent activation changes configuration

During subsequent activation of the diagnostics mode (status bits or I/O diagnostics interface), the CPX-internal I/O illustration or address allocation can be shifted.

The system controller carries out this adjustment **automatically**. Manual manipulation, e.g. a reconfiguration of the CPX terminal or manual adaptation of the hardware and network configuration, are not required.

Assignment of the I/O addresses and diagnostics addresses can be changed as needed.

To do this, repeat the hardware and network configuration in your configuration and programming software (e.g. Siemens SIMATIC STEP 7), especially the assignment of the inputs and outputs (see section 2.7.1 and section 2.7.2).

#### (3) Setting the diagnostics mode via the hardware configuration

Starting with Revision 21, the diagnostics mode can be set via the hardware configuration. The available address space thereby remains intact: The number of I/O bits is not reduced; the I/O bits are available for module communication without restriction.

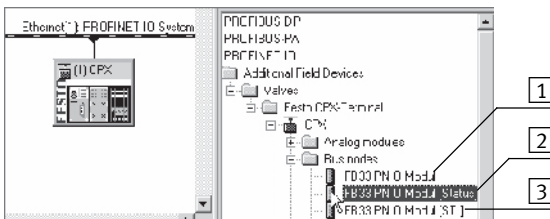
Set the DIL switch  to the factory setting for this purpose (see Tab. 1/2). Parameterise the diagnostics mode via the hardware configuration.

# 1. Installation



### Note

The DIL switch settings for operating mode and diagnostics mode must match the bus node selection in the context of a PLC hardware and network configuration (see Tab. 1/3 and section 2.6.2).



Operating mode of the bus node	Diagnostics mode [Mode identification]	Additional function Fast start-up (FSU)	Field device group (station symbol)	
			FB33 (M12), FB34 (RJ45)	FB35 (SCR), FB41 (SCR)
Remote I/O	Without diagnostics [1]	No	CPX <sup>1)</sup>	CPX-FO <sup>1)2)</sup>
		Yes, with FSU	CPX FSU <sup>1)</sup>	CPX-FO FSU <sup>1)2)</sup>
	Status bits [Status] [2]	No	CPX <sup>1)</sup>	CPX-FO <sup>1)2)</sup>
		Yes, with FSU	CPX FSU <sup>1)</sup>	CPX-FO FSU <sup>1)2)</sup>
	I/O diagnostics interface [STI] [3]	No	CPX <sup>1)</sup>	CPX-FO <sup>1)2)</sup>
		Yes, with FSU	CPX FSU <sup>1)</sup>	CPX-FO FSU <sup>1)2)</sup>
Remote controller	–	–	CPX RC	CPX-RC-FO <sup>2)</sup>
1) CPX Rev 18, CPX-FO Rev 18, CPX FSU Rev 18 or CPX-FO FSU Rev 18 for bus node with CPX revision code Rev 12 ... Rev 18 2) FB41 (SCR): CPX-FO-1P, CPX-FO-1P FSU, CPX-RC-FO-1P				

Tab. 1/3: Bus node selection (station symbol or field device group) dependent on operating mode, diagnostics mode and additional function FSU

## 1. Installation

### In the remote controller operating mode: setting the data field size with DIL switch 2

The function of the DIL switch 2 depends on the setting of the DIL switch 1 or the set operating mode of the CPX terminal (→ Tab. 1/1):

The required data field size is set with DIL switch 2 in the remote controller operating mode (→ Tab. 1/4).







#### Note

Observe that the data field size set with the DIL switch 2 (→ Tab. 1/4) must be the same size or larger than the data field size, which you set in your control system.



Further explanations about the remote controller operating mode can be found in section 2.10 and B.1.2.

DIL switch <span style="border: 1px solid black; padding: 0 2px;">2</span>	<b>Set data field size</b> (in the remote controller operating mode)	
	DIL 2.1: OFF DIL 2.2: OFF (factory setting)	Maximum data field size: 8 bytes I/8 bytes O
	DIL 2.1: OFF DIL 2.2: ON	Maximum data field size: 16 bytes I/16 bytes O
	DIL 2.1: ON DIL 2.2: OFF	Reserved for future extensions
	DIL 2.1: ON DIL 2.2: ON	Reserved for future extensions

Tab. 1/4: Setting the data field size with DIL switch 2

## 1. Installation

### 1.4.3 Using the memory card

The memory card is used as a carrier of configuration data for PROFINET addressing and thus simplifies bus node replacement:

- PROFINET I/O device name
- IP address.



#### Note

Data stored on the card have priority over other configuration data which are stored, e.g. in the bus node memory or in the controller system (see also section 2.8.1, sequence of the start parameterisation with memory card).



#### Caution

Risk of malfunctions or damage.

Inserting or removing the memory card while the power supply is switched on can result in malfunctions or damage to the memory card.

- Disconnect the power supply before you insert or remove the memory card.

Replacing  
the memory card

The memory card is under a cover (see Fig. 1/1). You need a screwdriver in order to remove or attach this cover.



### 1.5 Replacement of the bus node

#### Easy replacement using memory card

The memory card is used as a carrier of configuration data, e.g. of the fieldbus device name, i.e. of the PROFINET I/O device name. Thus, a bus node can be conveniently replaced.



#### Note

**Check the start behaviour** of the CPX terminal **before replacing** the bus node.

If the **Modify** LED (M) lights up or flashes permanently after the system start, “System start with saved parameterisation and saved CPX expansion” is set or “Force” is active.

For CPX terminals with a permanently lit or flashing M-LED, the **parameterisation at replacement** of the bus node or CPX terminal during servicing is not automatically created by the higher-level system.

In this case, verify which settings are required before replacement and restore these settings after replacement.



#### Caution

Risk of malfunctions or damage.

Inserting or removing the memory card while the power supply is switched on can result in malfunctions or damage to the memory card.

- Disconnect the power supply before you insert or remove the memory card.

### **Bus node replacement with memory card:**

1. Switch off the power supply.
2. Remove the cover  
(see section 1.4.1).
3. Remove the memory card from the bus node.
4. Replace the bus node (mounting/dismounting: see section 1.1).
5. Insert the memory card in the new bus node.
6. Install the cover again  
(see section 1.4.1).
7. Switch the power supply back on.
8. Start the automation program if necessary.
9. The controller recognises the bus node using the device name on the memory card and loads all required data.

### **Bus node replacement without memory card:**

1. Switch off the power supply.
2. Replace the bus node (mounting/dismounting: see section 1.1).
3. Switch the power supply back on.
4. Start your configuration and programming software (e.g. Siemens STEP 7).
5. Perform a new configuration (hardware configuration, in STEP 7 using HW Config).
6. The controller loads all required data into the bus node.

### 1.6 Connecting to the network

#### 1.6.1 General information about PROFINET networks

**Note**

Subassemblies with PROFINET interfaces may only be operated in networks where all connected network components are supplied with PELV power supplies or integrated power supplies with similar protection.



#### Installation guidelines

Observe the installation guidelines of the PROFINET user organisation (PNO):

→ [www.profibus.com/download/](http://www.profibus.com/download/)

**Note**

Unauthorised access to the device can cause damage or malfunctions.

When connecting the device to a network:

- Protect your network from unauthorised access.

Measures for protecting the network include:

- firewall
- Intrusion Prevention System (IPS)
- network segmentation
- virtual LAN (VLAN)
- virtual private network (VPN)
- security at physical access level (Port Security).

For further information, please refer to the guidelines and standards for security in information technology, e.g. IEC 62443, ISO/IEC 27001.

## 1. Installation



An access password protects only against accidental changes.

## 1. Installation

### Use of switches and routers

The switch integrated in the bus node permits division of the network into several segments.

With use of additional switches and routers, the network can be divided into additional segments. Thus, it is possible to structure the PROFINET network and realize greater network expansions.

Independent of the network structure, the expansion of a PROFINET segment must not exceed certain connection lengths:

- Copper connecting cable:  
(Ethernet twisted pair cable, 22 AWG):  
max. 100 m between network participants  
(PROFINET-End-to-end-Link)
- Optical connecting cable  
(POF fibre-optic cable, max. 12.5 dB signal attenuation  
over the entire connection length):  
max. 50 m PROFINET-End-to-end-Link.

Switches and routers for Industrial EtherCat are available on the market from various companies. There are many IP20, IP65 or IP67 components.

- Unmanaged Switches:  
for small network solutions with a low network load or minimal requirements for deterministics
- Managed switches:  
for comprehensive network solutions, with diagnostics and control functions.



#### Note

Make sure that any intermediate switches and routers support the PROFINET function “Fast Start-up” (FSU) when you use this additional function. Further information on FSU can be found in section B.1.3.

## 1. Installation



### Note

PROFINET devices (“IO devices”) which are connected via industrial wireless LAN (“**IWLAN Access Points**”) do **not** support the additional function FSU.

### 1.6.2 Overview of connections, network connectors and cables



### Note

Faulty installation and high transmission rates may cause data transmission errors as a result of signal reflections and attenuations.

Transmission errors can be caused by:

- faulty screened connection
- branches
- transmission over distances which are too long
- unsuitable cables.

Observe the cable specification.

Refer to the manual of your controller for information about the required type of line or cable.

Bus node	Connection technology	Network connectors
CPX-FB33	2 x M12 socket, D-coded, 4-pin, corresponding to IEC 61076-2	Plug connector NECU-M-S-D12G4-C2-ET
CPX-M-FB34	2 x Push-pull RJ45 copper, AIDA-compliant, corresponding to IEC 60603, IEC 61076-3	Plug connector FBS-RJ45-PP-GS
CPX-M-FB35	2 x SCRJ sockets, push-pull, AIDA-compliant, corresponding to IEC 61754-24, 650 nm wavelength, suitable for POF fibre-optic cable	Plug FBS-SCRJ-PP-GS
CPX-M-FB41	1 x SCRJ socket, push-pull, AIDA-conforming, corresponding to IEC 61754-24, 650 nm wavelength, suitable for POF fibre-optic cable	Plug connector FBS-SCRJ-PP-GS

Tab. 1/5: Overview of connection technology and network plugs  
(➔ [www.festo.com/catalogue/](http://www.festo.com/catalogue/))

## 1. Installation

### RJ45 to M12 converter

For PROFINET installations, it may be necessary to change between RJ45- and M12 connection technology.

Example for use: connections between devices in the switch cabinet with RJ45 connection and IP65/IP67 devices with M12 connection.

### Cable specification

Use shielded Industrial Ethernet cables of category Cat 5 or higher. You can find details regarding cable specification in Tab. 1/6.

### Crossover detection

The bus nodes for PROFINET support crossover detection (“Auto-MDI”): You can either use patch cables or crossover cables for connecting your bus node to a network or PC.

Make sure that the function “Autonegotiation/Autocrossover” is activated in your controller software if you use patch and crossover cables in the same system. You will find additional instructions on this function in section 2.6.4.

Crossover detection is not available in the remote I/O operating mode with additional function “Fast start-up” (FSU):

- Use only suitable lines.
- Observe the following note regarding pin allocation of port TP2.

## 1. Installation

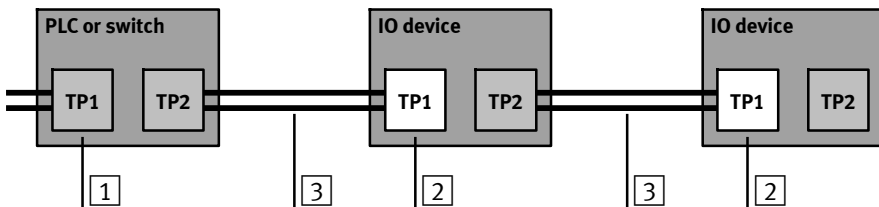


### Note – Pin-allocation port TP2

Deactivation of crossover detection changes the pin allocation of the continuation port TP2 to “crossover”.

Choose the network line (patch cable or crossover cable) depending on the pin allocation of the devices connected to TP2 (“I/O devices”) → Fig. 1/4:

- crossover cables with the same allocation of the ports
  - patch cable with different allocation of the ports.
- Make sure that the function “Autonegotiation/Autocrossover” is **deactivated** in your control software before placing the system in operation (see section 2.6.4).
  - If necessary, the function “Autonegotiation/Autocrossover” must also be **deactivated** on the hardware-side, in the basic setting of your controller (PLC) or in switches or routers in between: check the port settings for this purpose.



- 1 Switch port, e.g. the PLC (“crossover” pin allocation)
- 2 Terminal port of a PROFINET I/O device (“IO device”)
- 3 Patch cable

Fig. 1/4: Wiring of the network participants for “fast start-up” with **deactivated** “crossover” detection and “autonegotiation” (configuration example)



## 1. Installation

<b>Bus node + network plug</b>	<b>Cable specification<sup>1)</sup></b>
CPX-FB33 + ...D12G4...	<ul style="list-style-type: none"> <li>– Cable type: Ethernet twisted-pair cable, shielded (shielded twisted pair, STP)</li> <li>– Transmission class (link class): category Cat 5</li> <li>– Cable diameter: 6 ... 8 mm</li> <li>– Wire cross section: 0.14 ... 0.75 mm<sup>2</sup>; 22 AWG required for max. connection length between network participants (end-to-end link)</li> <li>– Connection length: max. 100 m PROFINET end-to-end link</li> </ul>
CPX-M-FB34 + ...R]45...	<ul style="list-style-type: none"> <li>– Cable type: Ethernet twisted-pair cable, shielded (shielded twisted pair, STP)</li> <li>– Transmission class (link class): category Cat 5</li> <li>– Cable diameter: 5 ... 8 mm</li> <li>– Wire cross section: 0.13 ... 0.36 mm<sup>2</sup> (≙ approx. 26 ... 22 AWG); 22 AWG required for max. connection length between network participants (end-to-end link)</li> <li>– Wire/conductor configuration: 1-wire or 7-wire</li> <li>– Connection length: max. 100 m PROFINET end-to-end link</li> </ul>
CPX-M-FB35/41 + ...SCRJ...	<ul style="list-style-type: none"> <li>– Cable type: fibre-optic cable, polymer-optic fibre (polymeric/plastic optical fibre, POF)</li> <li>– Cable composition (core/sheath diameter): 980/1000 µm</li> <li>– Cable diameter: 6.5 ... 9.5 mm</li> <li>– Connection length: max. 50 m PROFINET end-to-end link</li> <li>– Signal attenuation: ≤ 12.5 dB (over the entire connection length)</li> </ul>
<p>1) Length corresponding to specification for PROFINET networks (PROFINET Installation Guide) based on ISO/IEC 11801, ANSI/TIA/EIA-568 (see also section 1.6.1)  → <a href="http://www.profinet.com">www.profinet.com</a>, <a href="http://www.profibus.com/download/">www.profibus.com/download/</a></p>	

Tab. 1/6: Overview of line specification (in combination with Festo bus node and Festo network plug)

## 1. Installation

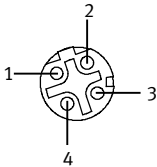


### Note – strain relief

If the CPX terminal is fitted onto the moving part of a machine, the network cable on the moving part must be provided with strain relief. Also observe the corresponding regulations in EN 60204 Part 1.

### 1.6.3 Network interface of the bus node CPX-FB33

For connection to the network, there are two 4-pin M12 sockets with D coding on the bus node CPX-FB33.

Socket	Pin	Signal	Explanation
<b>M12, D-coded</b> 	1 2 3 4 Housing	<b>TD+</b> <b>RD+</b> <b>TD-</b> <b>RD-</b> Shield/FE	Transmission data (transmit data, TD) + Receive data (receive data, RD) + Transmitted data – Received data – Shield/functional earth (FE)

Tab. 1/7: Pin allocation of the network interfaces of the bus node CPX-FB33 (M12)

### Connection with plug from Festo

Connect the CPX terminal to the network with a Festo plug NECU-M-S-D12G4-C2-ET. The plug is designed for Ethernet cable with cable diameters of 6 ... .. 8 mm.

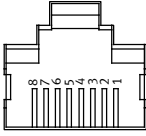
To achieve the required degree of protection, e.g. IP65/IP67:

- Use Festo plugs.
- Seal unused connections (see section 1.7).

## 1. Installation

### 1.6.4 Network interface of the bus node CPX-M-FB34

There are two RJ45 push-pull sockets (AIDA-compliant) on the CPX-M-FB34 for the network connection:

Socket	Pin	Signal	Explanation
<b>RJ45, push-pull</b> 	1	<b>TD+</b>	Transmission data (transmit data, TD) +
	2	<b>TD-</b>	Transmitted data –
	3	<b>RD+</b>	Receive data (receive data, RD) +
	4	n.c.	Not connected
	5	n.c.	Not connected
	6	<b>RD-</b>	Received data –
	7	n.c.	Not connected
	8	n.c.	Not connected
	Housing	Shield/FE	Shield/functional earth (FE)

Tab. 1/8: Pin allocation of the network interfaces of the bus node CPX-M-FB34 (RJ45)

#### Connection with plug from Festo



Connect the CPX terminal to the network with a Festo plug FBS-RJ45-PP-GS. The plug is designed for Ethernet cable with cable diameter of 5 ... .. 8 mm.

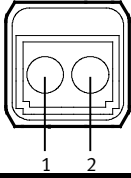
To achieve the required degree of protection, e.g. IP65/IP67:

- Use Festo plugs.
- Seal unused connections (see section 1.7).

## 1. Installation

### 1.6.5 Network interface of the bus nodes CPX-M-FB35 and CPX-M-FB41

There are two SCRJ push-pull sockets (AIDA-compliant) on the CPX-M-FB35 for the network connection:

Socket	Connection	Signal	Explanation
<b>SCRJ, push-pull</b>			
	1 2	<b>TX</b> <b>RX</b>	Transmitted data Received data

Tab. 1/9: Connection allocation of the network interfaces of the bus nodes CPX-M-FB35 and CPX-M-FB41 (SCRJ)

#### Connection with plug from Festo

Connect the CPX terminal to the network with a Festo plug, FBS-SCRJ-PP-GS. The plug is designed for POF fibre-optic cable with cable diameter of 6.5 ... 9.5 mm.

To achieve the required degree of protection, e.g. IP65/IP67:

- Use Festo plugs.
- Seal unused connections (see section 1.7).

## 1. Installation

### 1.7 Ensuring the protection class

- Use connection technology with the required degree of protection (→ [www.festo.com/catalogue](http://www.festo.com/catalogue), examples in Tab. 1/10).
- Use cover caps to seal unused connections.

Connection	Connection technology	Cover cap
CPX-FB33: Network connection (M12)	Plug connector NECU-M-S-D12G4-C2-ET	ISK-M12 <sup>2)</sup>
CPX-M-FB34: Network connection (RJ45)	Plug connector FBS-RJ45-PP-GS	CPX-M-AK-C CPX-M-AK-C
CPX-M-FB35: Network connection (SCRJ)	Plug FBS-SCRJ-PP-GS	
CPX-M-FB41: Network connection (SCRJ)		
Service interface	Connecting cable KV-M12-M12-... <sup>1)</sup>	ISK-M12 <sup>2)</sup>
1) Connecting cable for the operator unit (CPX-MMI)		
2) Included in scope of delivery		

Tab. 1/10: Connection technology and cover caps for degree of protection IP65/IP67 (examples)

## 1.8 Power supply



### Warning

Electric shock.

Injury to people, damage to the machine and system.

- Use for the electrical power supply only PELV circuits in accordance with IEC 60204-1 (Protective Extra-Low Voltage, PELV).
- Observe the general requirements in accordance with IEC 60204-1 for PELV circuits.
- Use only voltage sources that guarantee a reliable electric disconnection of operating and load voltage in accordance with IEC 60204-1.
- Always connect the circuits for operating and load voltage supplies  $U_{EL/SEN}$ ,  $U_{VAL}$  and  $U_{OUT}$ .

Through the use of PELV circuits, protection against electric shock (protection against direct and indirect contact) is ensured in accordance with IEC 60204-1.

CPX terminals are supplied with operating and load voltage through interlinking blocks, end plates or bus nodes.



### Note

Observe the notes on installation and power supply as well as potential equalisation (earthing measures) in the CPX system description (P.BE-CPX-SYS-... → Electrical connection) and in the descriptions for the valve terminal used.

## 1. Installation



### **Note**

The current consumption of a CPX terminal depends on the number and type of modules and connected components. Observe the instructions on the maximum permissible current load in the CPX system description (→ Calculation of current consumption) and in the appendix for the product “Pin allocation, power supply” (CPX-PIN-BEL- ... → Load rating per pin).

When implementing an emergency off or emergency stop function, observe the measures in sections 2.11 and 3.1.

## 1. Installation



# Commissioning

## Chapter 2

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## 2. Commissioning

### 2.1 General instructions

Configuration of the bus nodes for PROFINET depends on the control system used.

The basic approach and required configuration data are presented in the following pages.

#### Switching on the power supply



##### **Caution**

Danger of malfunctions, damage or injuries to people

Before commissioning, make sure that the connected components (e.g. actuators) do not perform any unexpected or uncontrollable movements.



##### **Note**

Please observe the switch-on instructions in the manual of your control system (PLC/IPC).

#### Separate supply

If the control system and fieldbus station have separate voltage supplies, the devices must be switched on in the following sequence:

1. Switch on the operating voltage supply of all network participants (“I/O devices”).
2. Switch on the operating voltage supply for the controller.

## 2. Commissioning

### Addressing, configuration and parameterisation

#### Addressing

The address space of a CPX terminal in the PROFINET network is limited. Determine the number of assigned inputs and outputs before commissioning or configuring the CPX terminal (see section 2.2 regarding address assignment and section 2.3 regarding addressing).

Addressing of the individual modules is done by the higher-order controller: PROFINET uses module-oriented addressing, i.e. each module is addressed separately (in contrast to block-oriented addressing of other fieldbus systems).

The controller uses the following for addressing:

- IP addresses and MAC-IDs
- Fieldbus device names, “device names” for short.

#### Configuration

Configuration of a CPX terminal and the related bus node depends on the control system used. The fundamental procedure, PROFINET-specific preparations and the main configuration steps are depicted on the following pages (see section 2.6).

#### Parameterisation

A CPX terminal in the PROFINET network can be parameterised through the control system (PLC/IPC), an operator unit (CPX-MMI) or the Festo Maintenance Tool (CPX-FMT) (see section 2.8).

### 2.2 Address assignment



#### Note

The address space of a CPX terminal in the PROFINET network is limited.

The bus node for PROFINET provides the CPX terminal with an address space of up to **64 bytes for inputs (I)** and **64 bytes for outputs (O)**.

Each module of the CPX terminal occupies a certain number of I/O bits, I/O bytes or I/O words in the context of module communication.

The number of occupied I/O bytes (of the respective module) can be found in the following tables (Tab. 2/2 to Tab. 2/7).

Take account of this fact for the planning of your CPX terminal.

Determine the number of assigned inputs and outputs prior to commissioning or configuring the CPX terminal. Tab. 2/8 provides help with this.

Use the configuration documents, the operator unit (CPX-MMI) or the Festo Maintenance Tool (CPX-FMT) to determine address assignment or terminal configuration.

In the operator unit, the individual modules of the CPX terminal are displayed with the respective module identifiers. Using the module identifier and the following tables, you can determine the module type and, with it, the number of inputs and outputs occupied by the module.

## 2. Commissioning

### Module identifiers

Each module, including the bus node, has its own identifier, the so-called module identifier. It serves to determine and localise the module type, for example as part of configuration. Apply the module identifiers – from left to right, corresponding to the physical order as installed in the CPX terminal – in your configuration program (e.g. Siemens SIMATIC STEP 7, see section 2.7).



In graphically oriented configuration programs, the module identifiers are typically found in a separate listing of all available hardware modules or field devices, e.g. in a module folder or module catalogue.

### Electric modules

Tab. 2/1 shows the assigned address space of the bus node in the Remote Controller operating mode.

Tab. 2/2 to Tab. 2/4 give an overview of the assigned address spaces of different electric modules and of the bus node in the remote I/O operating mode.



The address assignment within the individual CPX modules can be found in the associated descriptions, e.g. P.BE-CPX-EA-... and P.BE-CPX-AX-...

Details on the CP interface can be found in the description for the CP interface (P.BE-CPX-CP-...).

### Configuration of the bus node

In the **Remote Controller** (RC) operating mode, only the identifier of the bus node will be configured (see Tab. 2/1).

In the **Remote I/O** (RIO) operating mode, the identifiers of the bus node (including diagnostics mode), the CPX modules and, if present, the pneumatics modules are configured (see Tab. 2/2).

## 2. Commissioning

Electrical modules (Designation)	Module type (Type code)	Module identifier <sup>1)</sup>	Allocated address space	
			Inputs	Outputs
<b>Bus nodes</b> Remote controller operating mode				
with setting of datafield variable <b>8 bytes I / 8 bytes O</b> (→ Tab. 1/4)	CPX-FB33 CPX-M-FB34 CPX-M-FB35	e.g. <b>FB33-RC</b> PROFINET I/O bus node <sup>2) 3)</sup>	8 bytes/ 32 I	8 bytes/ 32 O
	CPX-M-FB41		16 bytes/ 64 I	16 bytes/ 64 O
with setting of datafield variable <b>16 bytes I / 16 bytes O</b> (→ Tab. 1/4)				
<sup>1)</sup> Module identifier in the operator unit or in the hardware configuration of the programming software <sup>2)</sup> Display in the operator unit: “ <b>FB33-RC</b> PROFINET I/O bus node”, “ <b>FB34-RC</b> PROFINET RJ45 bus node”, “ <b>FB35-RC</b> PROFINET FOC bus node” or “ <b>FB41-RC</b> PROFINET FO-1P bus node” <sup>3)</sup> Display in the hardware configuration of the programming software: e.g. “ <b>FB33</b> PNIO module”				

Tab. 2/1: Address assignment of the bus node for the Remote Controller operating mode

Electric modules (Designation)	Module type (Type code)	Module identifier <sup>1)</sup>	Allocated address space		
			Inputs	Outputs	
<b>Bus nodes</b> Remote I/O operating mode					
Without diagnostic access or when setting the diagnostic mode via the hardware configuration (from Revision 21 → Tab. 1/2)	CPX-FB33 CPX-M-FB34 CPX-M-FB35 CPX-M-FB41	e.g. <b>FB33</b> PNIO module <sup>2) 3)</sup>	–	–	
	With status bits		e.g. <b>FB33</b> PNIO module [Status] <sup>2) 3)</sup>	2 bytes/ 8 (16 I <sup>4)</sup>	–
	With I/O diagnostic interface (system table interface, STI)		e.g. <b>FB33</b> PNIO module [STI] <sup>2) 3)</sup>	2 bytes/ 16 I	2 bytes/ 16 O
<sup>1)</sup> Module identifier in the operator unit or in the hardware configuration of the programming software <sup>2)</sup> Display in the operator unit without specification of the diagnostic mode: e.g. “ <b>FB33-RIO</b> PROFINET remote I/O” <sup>3)</sup> Display in the hardware configuration of the programming software with specification of the diagnostic mode: e.g. “ <b>FB33</b> PNIO module [Status]” <sup>4)</sup> Diagnostic mode status bits occupy 16 I or 2 bytes of address space (8 I or 8 bits remain unused)					

Tab. 2/2: Address assignment of the bus nodes for the Remote I/O operating mode

## 2. Commissioning

Electric modules (Designation)	Module type (Type code)	Module indicator <sup>1)</sup>	Allocated address space	
			Inputs	Outputs
Digital 4-off input module	CPX-4DE	4DI Input module	1 byte/ 4 (8) I <sup>3)</sup>	–
Digital 8-off input module	CPX-8DE	8DI Input module	1 byte/ 8 I	–
Digital 8-off input module with channel diagnostics	CPX-8DE-D	8DI-D Input module	1 byte/ 8 I	–
Digital 8-off input module, n-switching:	CPX-8NDE	8NDI Input module	1 byte/ 8 I	–
Digital 16-off input module	CPX-16DE	16DI Input module	2 byte/ 16 I	–
Digital 16-off input module with channel diagnostics	CPX-M-16DE-D	16DI-D Input module	2 byte/ 16 I	–
Digital 4-off output module	CPX-4DA	4DO Output module	–	1 byte/ 4 (8) O <sup>2)</sup>
Digital 8-off output module	CPX-8DA	8DO Output module	–	1 byte/ 8 O
Digital 8-off high-current output module	CPX-8DA-H	8DO-H Output module	–	1 byte/ 8 O
Digital multi I/O module	CPX-8DE-8DA	8DI/8DO Multi I/O module	1 byte/ 8 I	1 byte/ 8 O
Analogue 2-off input module	CPX-2AE-U-I	2AI Analogue input	2 words/ 32 I	–
Analogue 2-off output module	CPX-2AA-U-I	2AO Analogue output	–	2 words/ 32 O

<sup>1)</sup> Module identifier in the operator unit or in the hardware configuration of the programming software  
<sup>2)</sup> 4-off modules (CPX-4DE and CPX-4DA) occupy 8 I or 8 O or 1 byte of address space (4 I/O or 8 bits of address space remain unused)

Tab. 2/3: Example of address assignment of electric CPX modules (overview; bus node in Remote I/O operating mode) – Part 1



## 2. Commissioning

Electric modules (Designation)	Module type (Type code)	Module indicator <sup>1)</sup>	Allocated address space	
			Inputs	Outputs
Analogue 4-off input module <sup>2)</sup>	CPX-4AE-I	4AI-I Analogue input	4 words/ 64 I	–
Analogue 4-off input module <sup>2)</sup> (temperature module for RTD sensors)	CPX-4AE-T	4AI-T Analogue input temp.	2 words or 4 words/ 32/64 I <sup>3)</sup>	–
Analogue 4-off input module <sup>2)</sup> (temperature module for TC sensors)	CPX-4AE-TC	4AI-TC Analogue input temp.	4 words/ 64 I	–
Analogue 4-way input module with pressure sensors <sup>2)</sup> (measuring range –1 ... +1 bar)	CPX-4AE- P-B2	4AI-P-B2 Analogue input press.	4 words/ 64 I	–
Analogue 4-way input module with pressure sensors <sup>2)</sup> (measuring range 0 ... 10 bar)	CPX-4AE- P-D10	4AI-P-D10 Analogue input press.	4 words/ 64 I	–
CP interface <sup>2)</sup>	CPX-CP-4-FB	CPI CP interface	Max. 8 words/ 128 I <sup>4)</sup>	Max. 8 words/ 128 O <sup>4)</sup>
<sup>1)</sup> Module identifier in the operator unit or in the hardware configuration of the programming software <sup>2)</sup> No support for the additional function FSU <b>Note</b> When using the module in FSU operation, fast running up of the CPX terminal and compliance of the PROFINET specification with regard to FSU are not guaranteed. <sup>3)</sup> Number of inputs switchable between 2 and 4 <sup>4)</sup> Address space assignment dependent on the string allocation (4 byte I or 4 byte O per string)				

Tab. 2/4: Example of address assignment of electric CPX modules (overview; bus node in Remote I/O operating mode) – Part 2

## 2. Commissioning

### Pneumatic interfaces and pneumatic modules

Tab. 2/5 ... Tab. 2/7 provide an overview of the assigned address spaces of various pneumatic interfaces and modules.

#### Configuration of the pneumatics (valves)

The valves are configured according to the pneumatic interface used:

- Valves of type 03 (Midi/Maxi), type 12 (CPA) and type 44/45 (VTSA/VTSA-F or ISO):

For expansion of the valve side, only **one** configuration process is required for the pneumatics interface. In the pneumatic interface, the number of solenoid coils is set using a DIL switch.

- Valves of type 32 and 33 (MPA-, MPA-F-, MPA-P- and MPAF-P- or VPPM pneumatic modules):

From a technical point of view, the individual MPA pneumatic modules each represent an electric module for controlling the attached valves.

A configuration process is required for **each** pneumatic module of type MPA... or VPPM:

➔ Pneumatic modules of type **MPA1** each occupy 1 byte A or 8 outputs regardless of how many valves are attached to the pneumatic module.

➔ Pneumatic modules of type **MPA2** each occupy 1 byte 0 or 8 outputs, but only 4 bits are used.

➔ Pneumatic modules of type **MPA-P** or **MPAF-P** each occupy 2 byte I or 16 inputs.

➔ Pneumatic modules of type **VPPM** each occupy 4 bytes of address space, i.e. 2 bytes I / 2 bytes 0 or 16 inputs and 16 outputs.

## 2. Commissioning

Pneumatic modules of type MPA-P or MPAF-P and VPPM are among the analogue modules. Observe the sequence of the modules in addressing or I/O mapping (see Tab. 2/9).



Additional information on the pneumatics can be found in the corresponding pneumatics descriptions → Document overview “Descriptions of the CPX terminal” in the CPX system description (P.BE-CPX-SYS...).

The descriptions for the pneumatic valve terminal (Midi/Maxi, CPA, MPA and VTSA/VTSA-F or ISO) contain the address assignment within the pneumatic modules.

Information about pneumatic interfaces and pneumatic modules can be found in the descriptions of the input/output modules → P.BE-CPX-EA-... and P.BE-CPX-AX-...

## 2. Commissioning

Pneumatic interface for MPA/ MPA-F and related modules	Module type (Type code of the electronics module)	Module indicator <sup>1)</sup>	Allocated address space	
			Inputs	Outputs
Pneumatic interface for MPA or MPA-F valves (type 32/33)	VMPA-FB-EPL...	–	–	–
MPA1 pneumatic module (type 32, 33): <b>1-8V..</b> ) <b>without</b> galvanic isolation	VMPA1-FB-EMS-8 [8DO]	MPA1S Valve module	–	1 byte/ 8 O
MPA1 pneumatic module (type 32, 33): <b>1-8V..</b> ) <b>with</b> galvanic isolation	VMPA1-FB-EMG-8 [8DO]	MPA1G Valve module	–	1 byte/ 8 O
MPA2 pneumatic module (type 32/33): <b>1-4V..</b> ) <b>without</b> galvanic isolation	VMPA2-FB-EMS-4 [4DO]	MPA2S Valve module	–	1 byte/ 4 (8) O <sup>2)</sup>
MPA2 pneumatic module (type 32, 33): <b>1-4V..</b> ) <b>with</b> galvanic isolation	VMPA2-FB-EMG-4 [4DO]	MPA2G Valve module	–	1 byte/ 4 (8) O <sup>2)</sup>
MPA1 pneumatic module (type 32, 33): <b>1-8V..</b> ) <b>without</b> galvanic isolation, with diagnostic function D2	VMPA1-FB-EMS- D2-8 [8DO]	MPA1S-D Valve module	–	1 byte/ 8 O
MPA1 pneumatic module (type 32, 33): <b>1-8V..</b> ) <b>with</b> galvanic isolation, with diagnostic function D2	VMPA1-FB-EMG- D2-8 [8DO]	MPA1G-D Valve module	–	1 byte/ 8 O
MPA2 pneumatic module (type 32/33): <b>1-4V..</b> ) <b>without</b> galvanic isolation, with diagnostic function D2	VMPA2-FB-EMS- D2-4 [4DO]	MPA2S-D Valve module	–	1 byte/ 4 (8) O <sup>2)</sup>
MPA2 pneumatic module (type 32, 33): <b>1-4V..</b> ) <b>with</b> galvanic isolation, with diagnostic function D2	VMPA2-FB-EMG- D2-4 [4DO]	MPA2G-D Valve module	–	1 byte/ 4 (8) O <sup>2)</sup>
<sup>1)</sup> Module identifier in the operator unit or in the hardware configuration of the programming software <sup>2)</sup> 4-off modules MPA2 always occupy 8 O (1 byte) of address space (4 O or 8 bits remain unused)				

Tab. 2/5: Overview of CPX pneumatic interfaces and pneumatic modules (part 1)

## 2. Commissioning

Pneumatic interface for MPA/ MPA-F and related modules	Module type (Type code)	Module indicator <sup>1)</sup>	Allocated address space	
			Inputs	Outputs
VPPM proportional-pressure regulation valve (type 32; 2 bar, 6 bar, 10 bar, “not equipped” or vacant position) <sup>2) 3)</sup>	VPPM-6...-1-... [2AI/2AO]	VPPM Proportional valve ...	1 word/ 16 I	1 word/ 16 O
MPA-P Pressure sensor module <sup>2) 3)</sup> (measuring range 0 ... 10 bar)	VMPA...-FB-PS-... [2AI-P]	MPA-P Analogue in- put press.	1 word/ 16 I	–
MPAF-P pneumatic interface with pressure sensor <sup>2) 3) 4)</sup> Measurement range 0 ... 10 bar)	VMPAF-FB-EPL-PS [1AI-P]	MPAF-P Analogue in- put press.	1 word/ 16 I	–
<sup>1)</sup> Module identifier in the operator unit or in the hardware configuration of the programming software <sup>2)</sup> No support for the additional function FSU <b>Note</b> When using the module in FSU operation, fast running up of the CPX terminal and compliance of the PROFINET specification with regard to FSU are not guaranteed. <sup>3)</sup> Pneumatic modules of type MPA-P or MPAF-P and VPPM are among the analogue modules: Observe the sequence of the modules as part of addressing or in I/O mapping (see Tab. 2/9) <sup>4)</sup> MPAF-P is also called “end plate” with pressure sensor or pressure sensor plate				

Tab. 2/6: Overview of CPX pneumatic interfaces and pneumatic modules (part 2)

## 2. Commissioning

Pneumatic interfaces for Midi/Maxi, CPA, VTSA/VTSA-F (ISO)	Module type (Type code)	Module indicator <sup>1)</sup>	Allocated address space	
			Inputs	Outputs
Pneumatics interface for Midi/Maxi valves (type 03) 1-...-.) with setting: <sup>2)</sup> <ul style="list-style-type: none"> <li>- 1...8 solenoid coils</li> <li>- 1...16 solenoid coils</li> <li>- 1...24 solenoid coils</li> <li>- 1...32 solenoid coils (26 effective)</li> </ul>	CPX-GP-03-4.0	TYPE 3 Pneumatic interface	–	1 byte/8 O 2 byte/16 O 3 byte/24 O 4 byte/32 O
Pneumatics interface for CPA valves (type 12: 1-...-.) with setting: <sup>2)</sup> <ul style="list-style-type: none"> <li>- 1...8 solenoid coils</li> <li>- 1...16 solenoid coils</li> <li>- 1...24 solenoid coils (22 effective)</li> </ul>	CPX-GP-CPA-10 CPX-GP-CPA-14	CPA 10/14 Pneumatic interface	–	1 byte/8 O 2 byte/16 O 3 byte/24 O
Pneumatic interface for VTSA or VTSA-F pneumatics (ISO, type 44/45: 1-...-.) with setting: <sup>2)</sup> <ul style="list-style-type: none"> <li>- 1...8 solenoid coils</li> <li>- 1...16 solenoid coils</li> <li>- 1...24 solenoid coils</li> <li>- 1...32 solenoid coils</li> </ul>	VABA-10S6-x1	VTSA pneumatic interface, ISO plug-in or TYPE 44 or TYPE 45 <sup>3)</sup>	–	1 byte/8 O 2 byte/16 O 3 byte/24 O 4 byte/32 O
<sup>1)</sup> Module identifier in the operator unit or in the hardware configuration of the programming software <sup>2)</sup> Setting with DIL switch in the pneumatic interface <sup>3)</sup> Display text (module identifier) dependent on the version of the operator unit				

Tab. 2/7: Overview of CPX pneumatic interfaces and pneumatic modules (part 3)

## 2. Commissioning

### Calculation of the address allocation

Use Tab. 2/8 to calculate the address assignment or number of inputs and outputs of your CPX terminal.

<b>Input/output modules and system diagnostics</b>	<b>Inputs</b>	<b>Outputs</b>
1. Status bits or I/O diagnostics interface <sup>1)</sup>	+ ____ I	+ ____ O
2. Number of input modules CPX-4DE + __ x 8I <sup>2)</sup>	+ ____ I	
3. Number of input modules CPX-8DE, 8DE-D, -8NDE + __ x 8 I	+ ____ I	
4. Number of input modules CPX-16DE, (M-)16DE-D + __ x 16I	+ ____ I	
5. Number of output modules CPX-4DA + __ x 8O <sup>2)</sup>		+ ____ O
6. Number of output modules CPX-8DA, 8DA-H + __ 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 I	+ ____ I	
10. Number of analogue output modules CPX-2AA-U-I + __ x 32 O		+ ____ O
11. Number of analogue input modules CPX-4AE-T + __ x 32 I/ x 64 I	+ ____ I	
12. Number of analogue input modules CPX-4AE-TC + __ x 64 I	+ ____ I	
13. Number of analogue input modules CPX-4AE-P-... + __ x 64 I	+ ____ I	
14. Number of inputs and outputs of other modules + __ I/O (e.g. CP interface, VPPM/MPA-P/MPAF-P pneumatics module)	+ ____ I	+ ____ O
15. Midi/Maxi, CPA and VTSA/VTSA-F pneumatics interfaces: Number of configured valve solenoid coils + 8 ... 32 O (from factory: Midi/Maxi, VTSA/VTSA-F: 32 O; CPA: 24 O)		+ ____ O
16. Number of MPA1- or MPA2 pneumatics modules + __ x 8O <sup>2)</sup>		+ ____ O
<b>Sum total of inputs/outputs to be configured</b> Total from 1. to 15 (max. 512 I and 512 O)	= Σ ____ I	= Σ ____ O
<sup>1)</sup> Number of occupied inputs/outputs: see Tab. 2/2 <sup>2)</sup> 4-off modules CPX-4DE and CPX-4DA as well as MPA2 pneumatic modules generally occupy 8 inputs or outputs (1 byte; available address space remains partially unused)		

Tab. 2/8: Determination of the assigned address space (total of inputs and outputs)

### 2.3 Addressing

#### 2.3.1 Basic rules for addressing

- The bus node counts as a module with 0 inputs and 0 outputs when the status bits and the I/O diagnostic interface are deactivated.
- Observe the instructions regarding address assignment in section 2.2.
- The address assignment of the inputs does **not depend** on the address assignment of the outputs.
- Counting **module-oriented, from left to right** (corresponding to the physical sequence)
- Addressing **byte-by-byte**: Modules with less than 8 bits occupy 8 bits or 1 byte of address space, but do not use this space completely.
- The I/Os of different module types are assigned separately from each other. Observe the sequence of addressing: see Tab. 2/9.



## 2. Commissioning

Sequence of addressing	Description
1. Status bits or I/O diagnostics interface <sup>1)</sup>	Delivers status and diagnostic information; activate through DIL switches; occupies the <b>first</b> 16 inputs or inputs and outputs <sup>2)</sup>
2. Analogue modules	Modules with analogue inputs/outputs
3. Technology modules	e.g. CP interface, control block (CPX-FEC, CPX-CEC...)
4. Digital modules	Modules with digital inputs/outputs
<sup>1)</sup> See also note above as well as Tab. 1/2 and Tab. 2/2. <sup>2)</sup> Depending on the setting, you can also occupy this address space <b>with modules</b> (see also the following information).	

Tab. 2/9: Sequence of addressing



If the status bits or I/O diagnostic interface are activated subsequently, that is, after initial commissioning, via the DIL switches, the module configuration for the **first** 16 inputs and outputs must be adjusted.

Move the modules originally **configured in this address range** into another area. Configuration of these modules must be repeated, if necessary (see also section 2.7 regarding configuration with PROFINET configuration and programming software, e.g. Siemens SIMATIC STEP 7).

## 2. Commissioning

### 2.3.2 Address assignment and addressing after expansion or conversion

A special feature of the CPX terminal is its flexibility. If the demands placed on the machine or system change, the equipment fitted on the CPX terminal can also be revised.



#### **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 fewer or more input/output addresses.
- Interlinking blocks (CPA) or pneumatic manifold blocks (Midi/Maxi) for monostable valves are replaced by interlinking blocks/manifold blocks for bistable valves – or vice versa (see Pneumatics description).
- Additional interlinking blocks (CPA) or manifold blocks (Midi/Maxi) are inserted between existing ones.
- The diagnostics mode (status bits or the I/O diagnostics interface) is activated/deactivated.

### 2.4 Instructions for commissioning with Siemens SIMATIC STEP 7

The following sections describe commissioning of a CPX terminal with a SIEMENS PLC SIMATIC S7 and the Siemens SIMATIC STEP 7 configuration and programming software.

Other control systems may require other settings or a different approach.

Knowledge of the operation of the Siemens SIMATIC STEP 7 software is required.



#### Note

Pay attention to the commissioning instructions in the control system manual.



The illustrations and specifications in this description refer to the following variants:

- Controller (PLC/CPU) Siemens SIMATIC S7-317 with firmware version 3.2.x
- Controller software Siemens STEP 7 version 5.5 with service pack SP 3
- GSDML file version 2.31.

Information on other variants can be obtained from the technical documentation of the controller and of the related software.

In case of technical problems, please contact the respective manufacturer first. In case of doubt, your local Festo Service is happy to help you further.

## 2. Commissioning



### **Caution**

Danger of malfunctions, damage or injuries to people

A valve terminal will be put into operation even if it is incorrectly configured. However, only the modules which have been correctly configured for type and position will be activated.

Before commissioning, make sure that the connected components (e.g. actuators) do not perform any unexpected or uncontrollable movements.

If necessary, disconnect the load power supply and compressed air supply.

See also section 2.11: Check list for commissioning the CPX terminal.

## 2. Commissioning

### 2.5 Preparing for commissioning

The following sections describe the PROFINET-specific preparation of commissioning with the SIEMENS PLC SIMATIC S7 and the Siemens SIMATIC STEP 7 configuration and programming software.

Other control systems may require other settings or a different approach.

#### 2.5.1 Import device master file (GSDML) and symbol files

A device master file (GSD) in XML format (GSDML) is needed for configuration and programming of the CPX terminal. The GSDML includes all the required information for the configuration and adjustment of the CPX terminal using configuration and programming software, e.g. STEP 7.

##### Source

The current GSDML file for CPX terminals can be found in the Festo Support Portal:

- ➔ [www.festo.com/sp](http://www.festo.com/sp)
- ➔ Enter search term: “GSDML”
- ➔ Click on “Firmware and drivers” tab.

##### File download

Download the current GSDML file for PROFINET to your controller system:

- Click on “File and language versions”.
- Click on the filenames:  
“GSDML-V...-Festo-CPX-...zip”.
- Save the file on your control system.

## 2. Commissioning

- Double click on the saved file to unpack the contents:
  - one or several GSDML files:  
GSDML-V...-Festo-CPX-... .xml  
(→ Tab. 2/10)
  - a symbol file for CPX terminals:  
e.g. GSDML-014D-0101-CPX.bmp
  - optionally a “Read Me” file with notes on the current GSDML versions.
- Observe the notes in the “Read Me” file as well as the instructions in section 2.5.2 before installing the GSDML file.
- Installation of the GSDML file is explained in section 2.5.5.

## 2. Commissioning

### 2.5.2 Select GSDML file (compatibility table)

Using the subsequent compatibility table, select the required GSDML file for your system and application purpose.

<b>GSDML file</b> (Version)	<b>Bus nodes</b> (CPX revision code; see rating plate) <sup>1)</sup>	<b>Controller software</b> (PLC software status)	<b>Function range</b> (Extract)
GSDML file version 2.2 <sup>2)</sup>	<b>Rev 12 ... Rev 18<sup>3)</sup></b>	Siemens STEP 7, <b>from version 5.4</b> , service pack <b>SP4</b>	<b>“Fast start-up” (FSU)<sup>4)</sup></b> , extension of the module support and diagnostic function, in particular regarding FOC diagnostics
GSDML file version 2.31	<b>Rev 20 ... Rev 24</b>	Siemens STEP 7, <b>from Version 5.5</b> , or “TIA portal” <b>from version 13</b>	PROFlenergy, PROFIsafe, media redundancy (MRP), shared device
<p>1) <b>The CPX revision code</b> is located on the rating plate (see section 1.2).</p> <p>2) <b>The GSDML file version 2.2</b> also supports bus nodes with <b>Rev 07 ... Rev 11</b>: The additional function FSU is not supported by these bus nodes (with Rev 07 ... Rev 11).</p> <p>3) Individual bus nodes with <b>Rev 13</b> do <b>not</b> have the required hardware for support of the additional function FSU. Required hardware revision: &gt; 8. Check the hardware revision status using the controller software or the Festo Field Device Tools (FFT).</p> <p>4) <b>The additional function FSU</b> is supported only by bus nodes from Rev 12.</p>			

Tab. 2/10: Compatibility of GSDML file, bus nodes and controller



The current GSDML file for CPX terminals can be found in the Festo Support Portal:

➔ [www.festo.com/sp](http://www.festo.com/sp)

Additional information:

➔ section 2.5.1.

Consult your local Festo repair service if you have any questions or technical problems.

## 2. Commissioning

### 2.5.3 Setting up automation project

1. Start the Siemens SIMATIC controller: Start › Programs › SIMATIC › **SIMATIC Manager**.  
(The program path of your SIMATIC controller can be different from the example shown here)

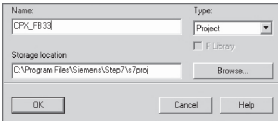


#### Note

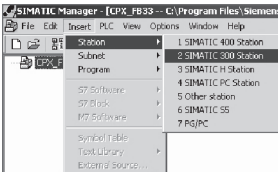
These instructions refer to the English language version of the Siemens SIMATIC controller and the STEP 7 configuration and programming software.

Other language versions usually use other designations for the program and function calls and menu items mentioned here.

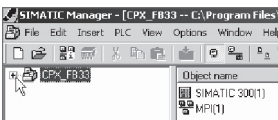
2. Create a new project in the SIMATIC Manager: File › New › New...



3. Enter a project name (e.g. CPX\_FB33) and confirm the input with OK.



4. Select the controller used (PLC/Master): Insert › Station › ... (e.g. SIMATIC 300 Station).

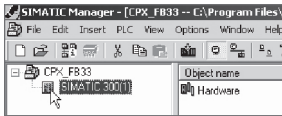


5. Open the project by clicking on the plus symbol (on the left next to the project symbol and the project name).

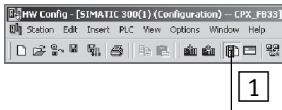


## 2. Commissioning

### 2.5.4 Setting up the controller system (PLC/Master)



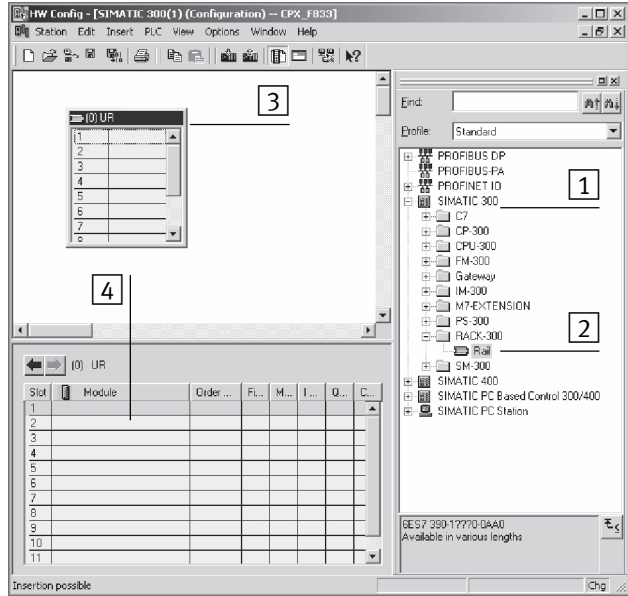
1. Click once on the station symbol (on the left next to the station name) and afterwards double click on the hardware symbol in the “Object name” column.  
The hardware configuration window **HW Config** (station configuration) opens.



2. Open the Hardware Catalogue (Catalogue View, **1** in the adjacent figure).
3. Select your control system (PLC/Master) in the Hardware Catalogue (e.g. “SIMATIC 300”, **1** in Fig. 2/1):  
Click on the Plus symbol to expand the selection.
4. Open the rack folder (e.g. RACK-300, **2** in Fig. 2/1).
5. Double click on the rack rail symbol (e.g. RAIL, **2** in Fig. 2/1).  
A sub-window (with rack rail symbol in the header) opens in the left area of the HW Config window (**3** or **4** in Fig. 2/1).

The sub-window symbolises the rack rail (profile rail) of your control system. You compile the individual elements of your controller in this child window and thus form the basis for your PROFINET automation system.

## 2. Commissioning



- 1 Select control system
- 2 Insert rack rail
- 3 Set up control system in the rack rail window

Fig. 2/1: Setting up the control system (PLC/Master) – insert rack rail (Rail)

6. Insert your CPU and a PROFINET-IO system into the hardware configuration: Drag the corresponding catalogue elements (symbols) into the Rack Rail window (3) or (4) in Fig. 2/1).

## 2. Commissioning

- Alternatively, you can execute a double click on the catalogue element: Select the next free line (insert position, slot) in the rack rail window before you make the double click.
- Line 1 (slot 1) is reserved and cannot be used for the configuration.

### 2.5.5 Install GSDML file

Install the GSDML file in the course of the following steps:

- GSDML-V...-Festo-CPX-...xml

Source and notes for the selection:  
see section 2.5.1.

1. Start the installation function via the Step-7 menu:  
Options > **Install GSD File ...**
2. Update the hardware catalogue through the STEP-7 menu: Options > Update Catalog.

All available CPX modules appear in the hardware catalogue under PROFINET IO > Additional Field Devices > Valves > Festo CPX Terminal.

You can start the selection and configuration of your modules (see section 2.6).

### 2.6 Basic hardware configuration

The following sections describe hardware configuration with the SIEMENS PLC SIMATIC S7 and the Siemens SIMATIC STEP 7 configuration and programming software.

Other control systems may require other settings or a different approach.

#### 2.6.1 Localise and identify CPX terminal in the network

Use the “Node flashing test” function (flashing) in order to localise your CPX terminal in the network: The LEDs TP1 and TP2 flash simultaneously. This function helps you with the assignment of the Device Name. You can also use this function to test whether there is a logical data connection to the CPX terminal.

1. Start the PROFINET hardware configuration in your configuration and programming software (e.g. HW Config in Siemens STEP 7).
2. Start the “Assign Device Name” function through the STEP-7 menu: PLC › Ethernet › Assign Device Name. The Assign device name window is displayed.
3. If the CPX terminal is not displayed, start updating of the display: To do this, click on “Update”. The network is searched and the network participants found are listed (under “Available devices”).
4. Mark your searched-for CPX terminal in the list (recognisable e.g. through the MAC-ID) and click on “Flashing on”. The LEDs TP1 and TP2 of the bus node at the searched-for CPX terminal flash for unique identification.

You can assign a device name to the CPX terminal in the next step. This device name is also stored on the memory card of the bus node (if inserted).

## 2. Commissioning

5. Enter a device name in the “Device name” field (e.g. CPX or CPX-01) and confirm the entry by clicking on “Assign name”.

## 2. Commissioning

### 2.6.2 Select CPX terminal (station selection)

1. Start the PROFINET hardware configuration in your configuration and programming software (e.g. HW Config in Siemens STEP 7).

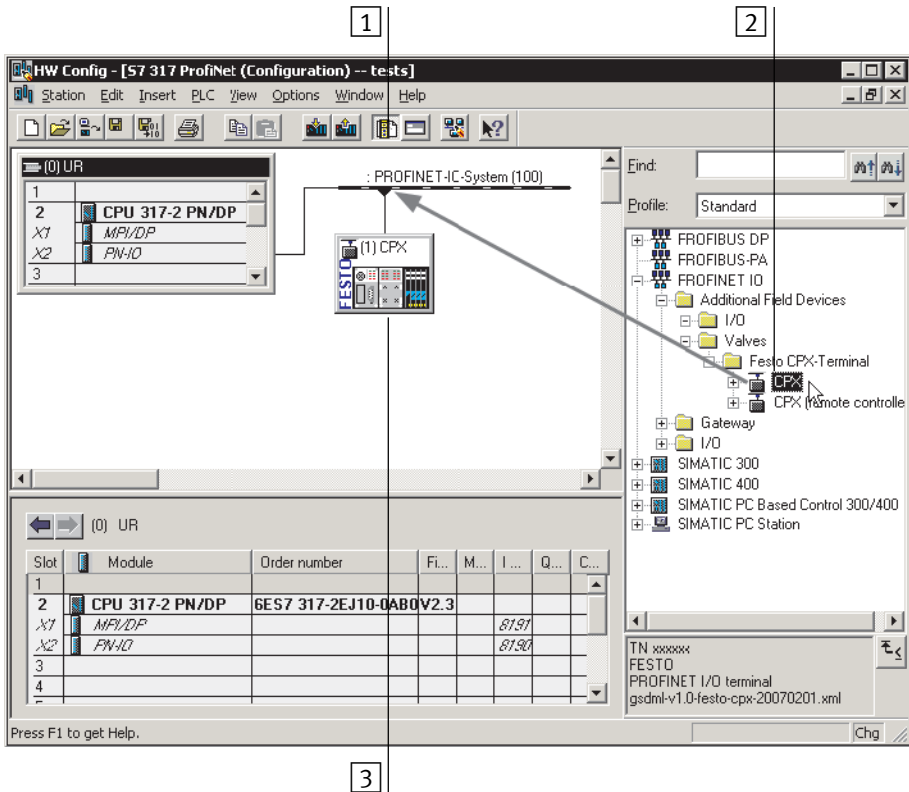


Fig. 2/2: Station selection using Siemens STEP 7 - HW Config

2. If the hardware catalogue is not opened:  
Click on the catalogue symbol (1 in Fig. 2/2) or use the keyboard combination [Ctrl] + [K].

The hardware catalogue is displayed.

## 2. Commissioning

Select “Station”  
(station symbol)

3. In the Hardware Catalogue (HW Config), open the folder:
  - \PROFINET-IO\Weitere Feldgeräte\Ventile\Festo CPX-Terminal (German language version of the software)
  - “\PROFINET-IO\Additional Field Devices\Valves\Festo CPX-Terminal” (English language version of the software)



### Note

If the folder “Valves\Festo CPX-Terminal” is not displayed (see Fig. 2/3), repeat installation of the device master file (GSDML, see section 2.5.5).

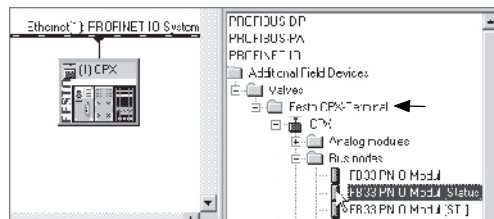
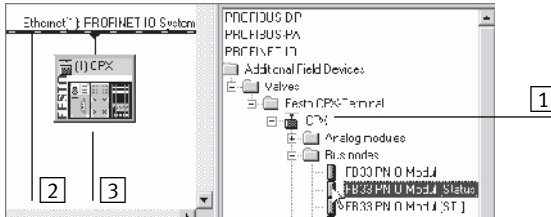


Fig. 2/3: Station selection – selection of the station symbol (Festo CPX terminals)

4. Choose the station symbol corresponding to your application using the following Tab. 2/11 – dependent on:
  - **CPX revision code** of the bus node (see section 2.5.2 or Tab. 2/10)
  - **operating mode** of the bus node (see section 1.4.2 or Tab. 1/1)
  - additional function “Fast Start-up” (**FSU**) see section B.1.3)
  - **Connection technology** (M12 or RJ45 or SCR)).

## 2. Commissioning

**Example:** With use of a bus node CPX-FB33 – with **Rev 14** – in the Remote I/O operating mode, without the additional function “Fast Start-up”, open the **station symbol** CPX (**1**) in Tab. 2/11).



CPX revision code of the bus node	Operating mode of the bus node	Additional function Fast Start-up (FSU)	Station symbol <b>1</b> (field device group)	
			FB33 (M12), FB34 (RJ45)	FB35 (SCRJ), FB41 (SCRJ)
Rev 12 ... Rev 18	Remote I/O	No	<b>CPX Rev 18</b>	<b>CPX-FO Rev 18</b>
		Yes, with FSU	<b>CPX FSU Rev 18</b>	<b>CPX-FO FSU Rev 18</b>
Rev 20 ... Rev 24	Remote I/O	No	<b>CPX</b>	<b>CPX-FO<sup>1)</sup></b>
		Yes, with FSU	<b>CPX FSU</b>	<b>CPX-FO FSU<sup>1)</sup></b>
Rev 12 ... Rev 24	Remote controller	–	<b>CPX RC</b>	<b>CPX-RC-FO<sup>1)</sup></b>
1) FB41 (SCRJ): CPX-FO-1P, CPX-FO-1P FSU, CPX-RC-FO-1P				

Tab. 2/11: Station symbol selection as part of CPX-terminal configuration with Siemens SIMATIC STEP 7

5. Drag the selected station symbol **1** onto the bus line of the PROFINET-IO system (**2**) in Tab. 2/11).

The CPX terminal is displayed as a symbol (**3**) and connected to the bus of the PROFINET-IO system.



## 2. Commissioning

### 2.6.3 Assign “Device Name”



The subsequent steps and related illustrations differ by controller, firmware and software used.

#### Use of the device name

You can assign or change a device name for the CPX terminal in the next step. This device name is also stored on the memory card of the bus node.

Using this device name, you can also directly address the CPX terminal, e.g. in your automation programs. Alternatively, you can also use the IP address or the MAC-ID for addressing purposes → Information about addressing can be found in the sections 2.6.5 and 2.6.6.

If you have allocated a device name in the course of localising and identifying the CPX terminal (see section 2.6.1), you can skip the steps 6. and 7..

#### Assign device name

6. Double click on the symbol of the CPX terminal 3.

The “Properties – CPX” window is displayed (see Fig. 2/4).

## 2. Commissioning

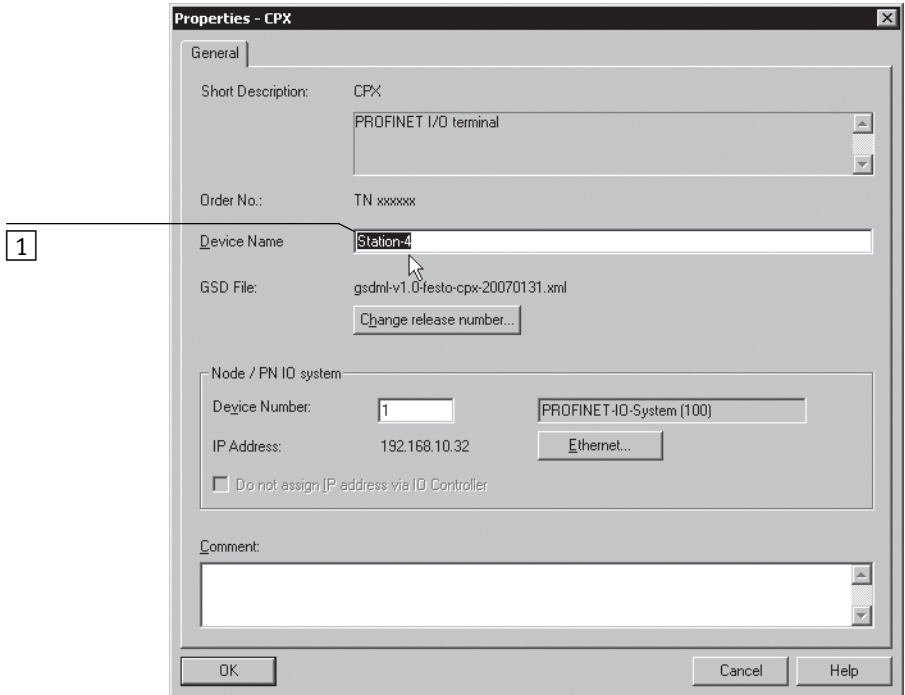


Fig. 2/4: CPX terminal characteristics – device name

7. Enter a unique device name for the CPX terminal in the “Device Name” field (1 in Fig. 2/4) or “Name” (1 in Fig. 2/5), e.g. CPX-01, Station-xy or an application-specific designation.

## 2. Commissioning

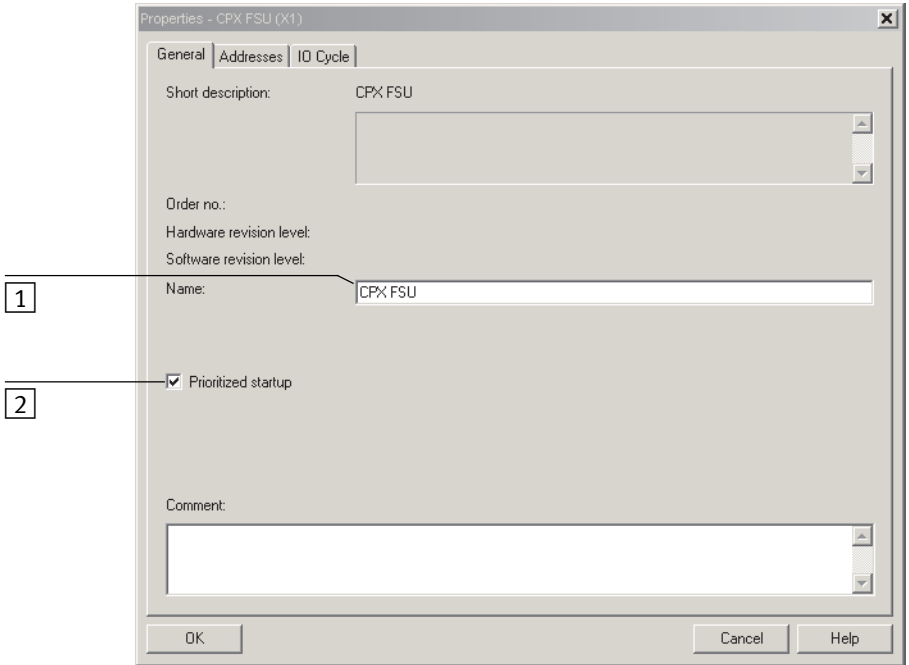


Fig. 2/5: CPX terminal properties – device name and activation of the “Prioritized Start-up” (“Fast Start-up”)

### 2.6.4 Set up Prioritized Start-up (“Fast Start-up”)

In the next steps, you can set up the “Prioritized Start-up” additional function.



The additional function “Prioritized Start-up” is also designated “Fast Start-up” (FSU).

If you do not want to use this additional function, you can omit steps 8. to 20..

## 2. Commissioning



### Note

The “Fast Start-up” operating mode has restrictions regarding commissioning and parameterisation. Detailed information can be found in the corresponding chapters. Also observe the notes in section 2.8 and section B.1.3 regarding “Fast Start-up”.

- Activate “Fast Start-up”
- Place a check in front of “Prioritized Startup” **2** in the window “Properties – CPX” (see Fig. 2/5).
  - Select the tab “IO Cycle” **1** in Fig. 2/6).

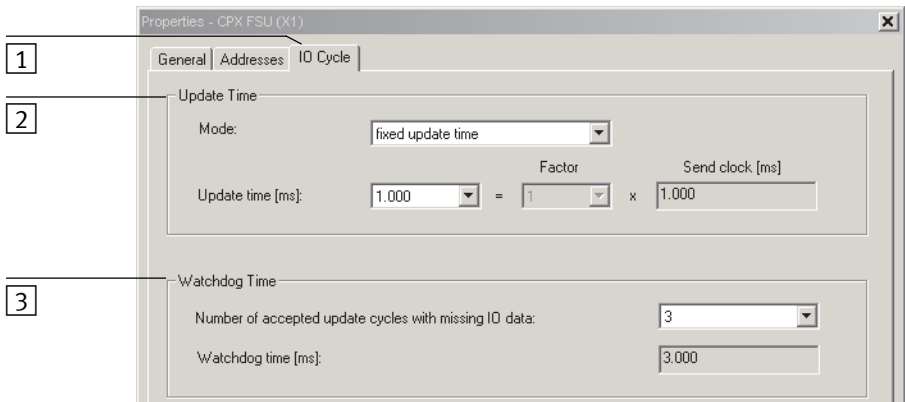


Fig. 2/6: “Fast-Start-up” settings – adaptation of the I/O cycle time (update time)

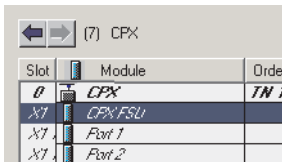
## 2. Commissioning

10. Make sure that the following values are set for “IO Cycle”:

- Update time 2:
  - Mode: fixed
  - Update time
  - Update time: 1,000 ms
- Address monitoring time 3:
  - Number of update cycles: 3
  - Address monitoring time: 3,000 ms

11. Confirm your inputs by clicking on “OK”.

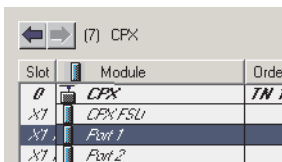
12. Click on the symbol of the CPX terminal to be configured in the PROFINET Hardware Configuration (HW Config, 3 in Fig. 2/2).



Slot	Module	Order
0	CPX	IN 1
X7	CPX FSU	
X7	Port 1	
X7	Port 2	

13. The configuration table is displayed:

You will find the configuration table below the schematic representation of the PROFINET-IO system. If necessary, increase the size of this area of the HW Config window (see Fig. 2/2 or 2 in Fig. 2/11).



Slot	Module	Order
0	CPX	IN 1
X7	CPX FSU	
X7	Port 1	
X7	Port 2	

14. Double click in the configuration line of the connection (port) “X1 TP1”.

The window “Properties – CPX FSU Port 1” (X1 TP1) is displayed (see Fig. 2/7).

## 2. Commissioning

15. Select the “Options” tab (1) in Fig. 2/7).

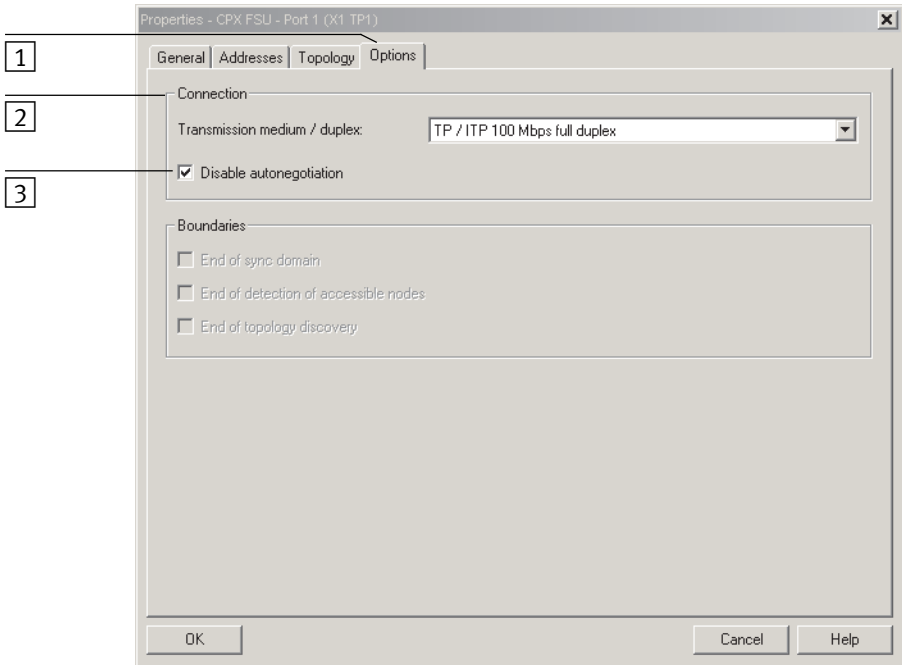
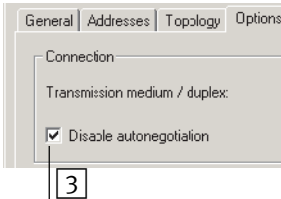


Fig. 2/7: “Fast-Start-up” settings – deactivation of the crossover detection (Disable Autonegotiation)

16. Make sure that the following “Transmission medium” is set for “Connection” (2):

- “TP / ITP with 100 Mbit/s full duplex”

## 2. Commissioning



17. Deactivate crossover detection 3:

Place a check in front of “Deactivate Autonegotiation/ Autocrossover” (Disable Autonegotiation).

18. Also deactivate crossover detection in the counterpart station, e.g. in the control system (PLC/Master).



Deactivation of crossover detection is required for “Fast start-up”. These additional functions are possible only with crossover detection deactivated.

19. Use a suitable network cable for this connection, in this case a crossed line, for example (if the crossover detection is deactivated on both sides of the connection and a connection between PLC or master and slave is created).

20. Repeat the steps 14. to 19. for port X2 TP2.

### 2.6.5 Assigning or changing IP address

You can manually assign or change the IP address of the CPX terminal in the next steps. The controller usually takes over the allocation of an IP address (automatic addressing using the DHCP server integrated in the controller).

If you would like to accept the specified IP address, you can skip the steps 21. to 23..

#### Assigning or changing IP address

21. For IP addressing, choose the tab “Addresses” (1 in Fig. 2/8).

The “Addresses” tab is displayed (see Fig. 2/9).

## 2. Commissioning

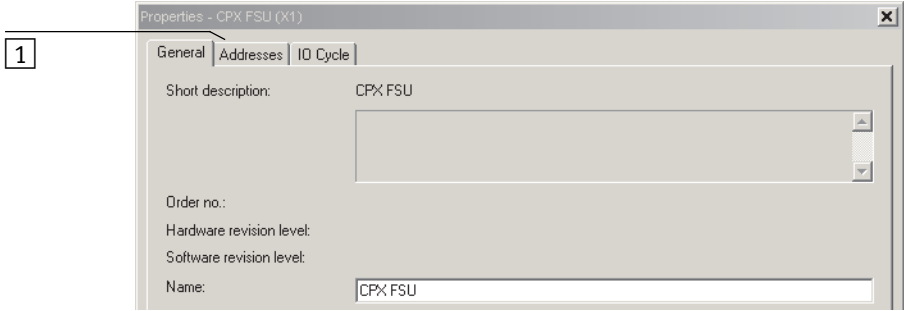


Fig. 2/8: CPX terminal characteristics – addressing (part 2)

### 22. Manual addressing (if required):

Enter the IP address of the bus node (**1** in Fig. 2/9).

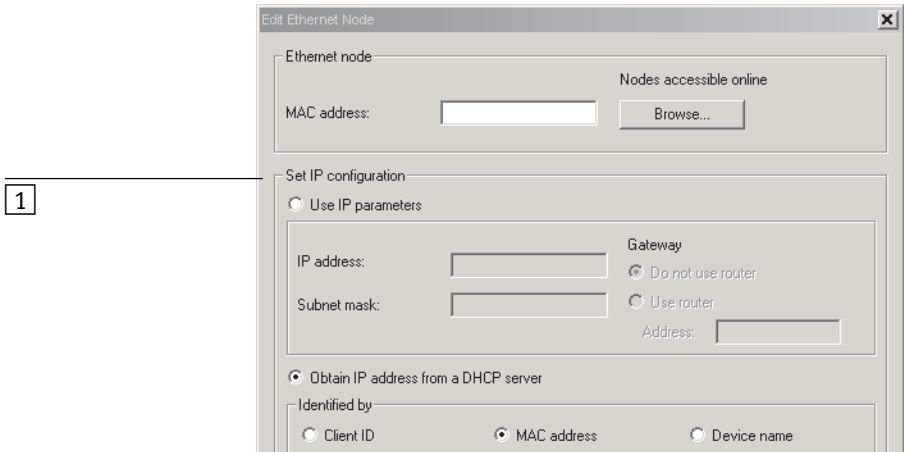


Fig. 2/9: CPX terminal characteristics – addressing (part 4)

### 23. Confirm your inputs by clicking on “OK” (twice if necessary).



## 2. Commissioning



Observe the basic addressing rules for the allocation of the IP address, e.g. with respect to the use of private or public address ranges. Also check that the IP address can be used in your automation network (no duplicate address assignment etc.).

The following IP address variants are available for addressing the bus node or CPX terminal:

- factory-specified (“remanent”) IP address (192.168.10.2)
- host system IP address
- dynamic IP address, assigned through DHCP
- static, customer-specific or user-changeable IP address.

The dynamic IP address assigned through DCHP can be fixed, if needed, and so becomes a customer-specific static IP address.

## 2. Commissioning

### 2.6.6 Use MAC addressing

#### Use **MAC addressing**

Besides the IP addresses, the MAC-ID of the bus node is also available for addressing purposes (see 1 in Fig. 2/10). The MAC-ID is located on the rating plate.

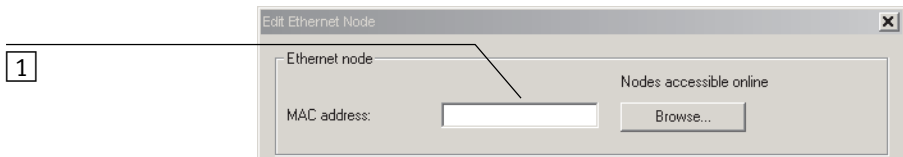


Fig. 2/10: CPX terminal characteristics – MAC addressing

The MAC-ID is a uniform worldwide identification of each individual Ethernet device. The identification consists of a “Manufacturer ID” and a continuous identification of the Ethernet device, e.g. **00-0E-F0**-12-3A-BC. The highlighted designation represents the “Manufacturer ID”, here Festo AG & Co. KG.

### 2.6.7 Determine port addresses

#### Determine **port addresses**

Addresses of the input and output ports TP1 and TP2 can be determined through the configuration table of the HW Config window, for example.

### 2.7 CPX-terminal configuration

#### 2.7.1 Allocate configuration table (insert bus nodes and modules)

In the subsequent steps, you take the bus node and individual modules of your CPX terminal ([1] in Fig. 2/11) from the hardware catalogue into the configuration table ([2]).



The CPX modules are subdivided within the hardware catalogue into field-device groups ([4] in Fig. 2/11): analogue modules, digital modules, pneumatic interfaces, pneumatic interfaces and technology modules. In this environment, the bus nodes CPX-FB33, CPX-M-FB34, CPX-M-FB35 and CPX-M-FB41 form their own group (“Bus nodes”).

The field-device groups or “Bus node and module folder” are located under the station symbols ([3]).

1. Start the PROFINET hardware configuration in your configuration and programming software (e.g. HW Config in Siemens STEP 7).

2. If the Hardware Catalogue has not been opened:

Click on the catalogue symbol or use the keyboard combination [Ctrl] + [K].

The hardware catalogue is displayed.

3. In the Hardware Catalogue, open the folder:

- “\PROFINET-IO\Additional Field Devices\Valves\Festo CPX-Terminal” (English language version of the software)

or

- \PROFINET-IO\Weitere Feldgeräte\Ventile\Festo CPX-Terminal.

## 2. Commissioning

If the folder “Valves\Festo CPX-Terminal” is not displayed, repeat installation of the device master file (GSDML, see section 2.5.5).

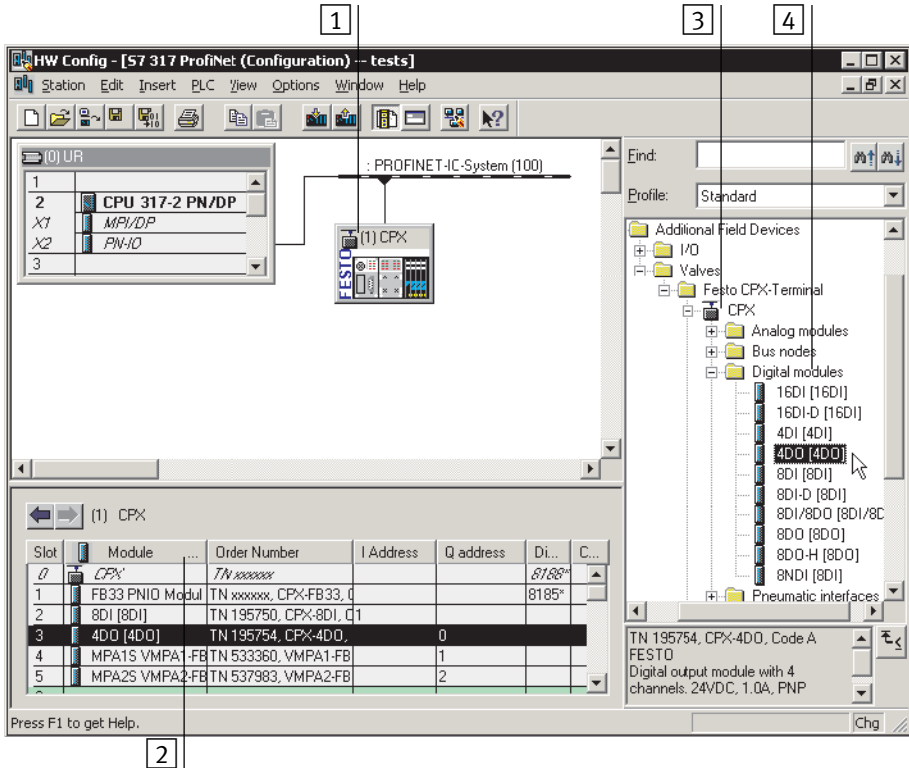


Fig. 2/11: CPX terminal configuration with Siemens STEP 7 – HW Config

4. Click on the symbol of the CPX terminal to be configured in the PROFINET Hardware Configuration (HW Config, [1](#) in Fig. 2/11).

The configuration table ([2](#) in Fig. 2/11) is displayed (below the schematic representation of the PROFINET-I/O system). If necessary, increase the size of this area of the HW Config window.

## 2. Commissioning



The configuration table represents your CPX terminal.

This area of the HW Config window as well as the higher-level graphic representation is also designated as the Rack Rail window. In the documentation for your control system, the designation profile rail, mounting rack, or rail may be found instead of “rack rail”.

Open station symbol

5. In the hardware catalogue, open the station symbol (3) corresponding to your application and the related field device groups (“Bus node and module folder”, 4 in Fig. 2/11).



### Note

Open the same station symbol as with the station selection in section 2.6.2.

Select and insert bus node, insert modules

6. Pull the required catalogue elements, i.e. first the bus node and then the modules of your CPX terminal corresponding to the “physical” sequence (as mounted, from left to right) into the configuration table.



### Note

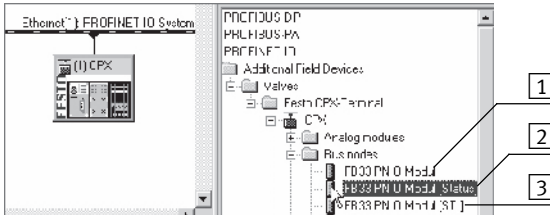
Various catalogue elements are available for linking the bus node: Observe the subsequent sections.

Choose the required bus node catalogue element based on the following Tab. 2/12 – dependent on:

- **operating mode** of the bus node (see section 1.4.2 or Tab. 1/1)
- **Diagnostic mode** of the bus node (see section 1.4.2 or Tab. 1/3)

## 2. Commissioning

- additional function Fast Start-up (FSU, see appendix B.1.3)
- **Connection technology** (M12, RJ45 or SCR)).



Operating mode of the bus node	Diagnostics mode [Mode identification]	Additional function Fast start-up (FSU)	Field device group (station symbol)	
Remote I/O	Without diagnostics [1]	No	CPX <sup>1)</sup>	CPX-FO <sup>1)2)</sup>
		Yes, with FSU	CPX FSU <sup>1)</sup>	CPX-FO FSU <sup>1)2)</sup>
	Status bits [Status] [2]	No	CPX <sup>1)</sup>	CPX-FO <sup>1)2)</sup>
		Yes, with FSU	CPX FSU <sup>1)</sup>	CPX-FO FSU <sup>1)2)</sup>
	I/O diagnostics interface [STI] [3]	No	CPX <sup>1)</sup>	CPX-FO <sup>1)2)</sup>
		Yes, with FSU	CPX FSU <sup>1)</sup>	CPX-FO FSU <sup>1)2)</sup>
Remote controller	–	–	CPX RC	CPX-RC-FO <sup>2)</sup>
1) CPX Rev 18, CPX-FO Rev 18, CPX FSU Rev 18 or CPX-FO FSU Rev 18 for bus node with CPX revision code Rev 12 ... Rev 18 2) FB41 (SCR): CPX-FO-1P, CPX-FO-1P FSU, CPX-RC-FO-1P				

Tab. 2/12: Bus node selection as part of CPX terminal configuration (PLC hardware configuration)

## 2. Commissioning



### Note

The DIL switch settings for operating mode and diagnostics mode must match the bus node selection in the context of a PLC hardware and network configuration (see Tab. 1/3 and section 2.6.2).

- Check the setting of the DIL switches for operating mode and diagnostics mode (see section 1.4.2): Make sure that the setting for operating mode and diagnostics mode selected on the bus node via DIL switch agrees with the function of the catalogue element.

### 2.7.2 Modify I/O address

1. Double click on the module name in the configuration table.

The “Properties – ...” window is displayed.

2. Select the “Addresses” tab.
3. Change the start address (“Start”) of the inputs or outputs.
4. Confirm the input with “OK”.

The modified address is displayed in the configuration table.

### 2.7.3 Modify diagnostics address

The diagnostics address is automatically assigned by the Siemens STEP 7 configuration and programming software - HW Config. A change is rarely required.

1. Double-click on “Slot 0” in the configuration table.

The “Properties – CPX” window is displayed (see Fig. 2/12).

## 2. Commissioning



Fig. 2/12: Changing the diagnostics address with Siemens STEP 7 – HW Config

2. Select the “Addresses” tab.
3. Enter the desired “Diagnostic Address”.  
(The available address range depends on the controller used - see manufacturer documentation.)
4. Confirm the input with “OK”.  
The modified address is displayed in the configuration table.



Further information about diagnostics:

- Section 3.1, “Overview of diagnostics options”
- Section 3.5, “Diagnostics via PROFINET”.



### 2.8 Parameterisation

You can set the reaction of the CPX terminal individually through parameterisation. The following parameterisation variants are distinguished:

- System parameterisation, e.g. deactivation of error messages, etc.
- Module parameterisation (module-specific and channel-specific), e.g. module monitoring, settings for errors, adjustment of debouncing times for the inputs, etc.
- Parameterisation of the diagnostic memory.



A detailed description of the individual parameters as well as basic principles of application can be found in the CPX system description (P.BE-CPX-SYS-..).

Parameter lists for the various CPX modules can be found in the corresponding descriptions for the modules (P.BE-CPX-EA-..., P.BE-CPX-AX-..., P.BE-CPX-CP-..., etc.).



#### **Note – Module parameter in the operating mode FSU**

In the “Fast Start-up” (FSU) operating mode, not all module parameters can be set through the control software.

Use the Festo Maintenance Tool (CPX-FMT) or the operator unit (CPX-MMI) to make the required settings.

System parameters can be set in all operating modes, also in the FSU operating mode, using the control software.



### Note – System start in the operating mode FSU

For the system start, the function “System Start with Saved Parameters” (“Saved” or “Stored” parameters) must be activated to ensure that the parameters entered using FMT or MMI are used.

This setting must be made at two positions:

- in the bus node system parameters (using FMT or MMI)
- in the system parameters of the control software (e.g. Siemens STEP 7, see 1 in Fig. 2/13).

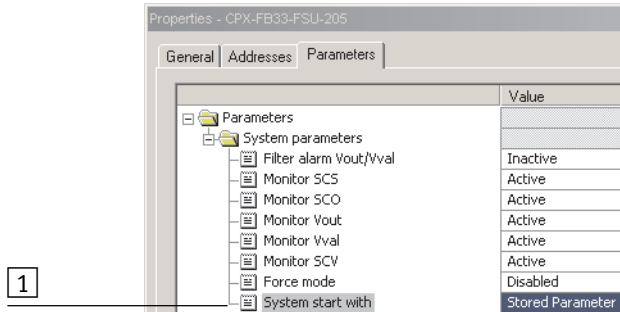


Fig. 2/13: System start in the operating mode FSU – “System Start with Saved Parameters” (“Saved” or “Stored Parameters”)

### 2.8.1 Start parameterisation during switch-on (system start)

Parameterisation during system start of the CPX terminal is initially dependent on the setting of the system start parameter. This parameter specifies whether Start parameterisation will be loaded from the PROFINET-I/O Controller or from the bus node.



#### **Note**

The Start parameter set is loaded again (according to the rules described above) after every interruption of the network connection or of the power supply.

An exchange of individual CPX modules is therefore possible, without the need for new manual parameterisation.

Sequence of Start parameterisation when the CPX terminal is switched on

#### **Sequence with system start parameter “Default Parameters”:**

- The PROFINET-I/O controller loads the Start parameter set into the bus node.
- The bus node then distributes the parameter set to the modules.

It does not matter whether there is a memory card in the bus node or not.

#### **Sequence with system start parameter “Saved Parameters”:**

- The bus node distributes the saved (in the bus node) Start parameter set to the modules.

## 2. Commissioning

### 2.8.2 Parameterisation of the CPX terminal with Siemens STEP 7

#### Setting system parameters

1. Start the PROFINET hardware configuration in your configuration and programming software (e.g. HW Config in Siemens STEP 7).

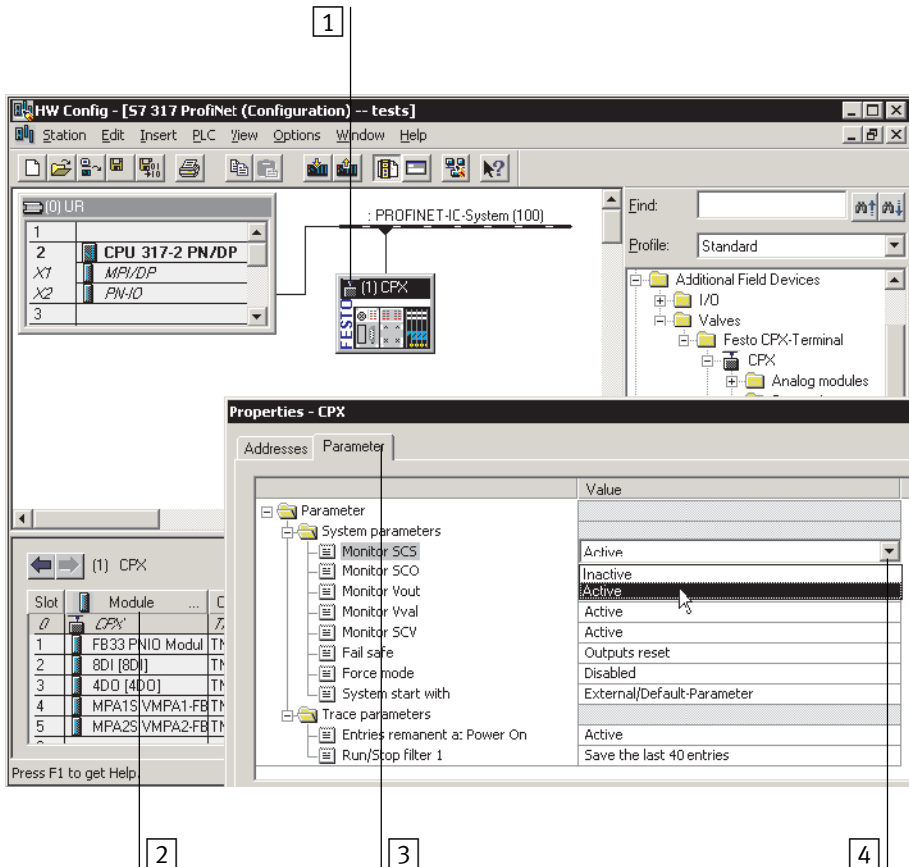


Fig. 2/14: Setting system parameters with Siemens STEP 7

## 2. Commissioning

2. Mark the symbol of the CPX terminal on the PROFINET-IO system (see [1](#) Fig. 2/14). The configuration table now shows the configuration of the CPX terminal.
3. Double click on line 0 of the configuration table [2](#). The “Properties CPX” dialogue window is displayed.
4. Choose the “Parameter” tab [3](#).  
The list with the parameters and the currently active values will be shown.
5. Click on the parameter value (“Value”) which you wish to modify.  
A list field with the possible values is opened [4](#).
6. Change the parameter by clicking on the desired value (“Value”).
7. Confirm the change to close.



### Note

System parameter monitoring KZS/KZA/KZV, U<sub>VAL/OUT</sub>

The short-circuit /overload and undervoltage diagnostic messages for the complete CPX terminal can be suppressed using the monitoring system parameter (function no. 4401).

The settings made separately for each module with the CPX **module** parameter monitoring are not affected by the setting of the monitoring **system** parameters.

Additional information on parameterisation can be found in the CPX system description (P.BE-CPX-SYS-..) in Appendix B.

## 2. Commissioning

### Setting module parameters

1. Start the PROFINET hardware configuration in your configuration and programming software (e.g. HW Config in Siemens STEP 7).

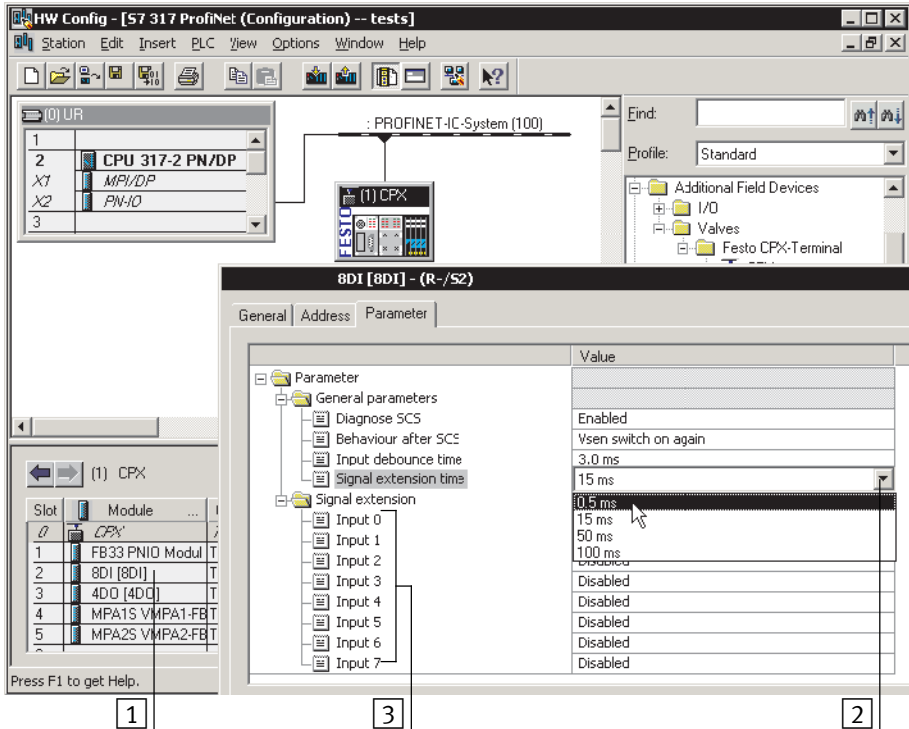


Fig. 2/15: Setting module parameters with Siemens STEP 7

2. Double click in the configuration table on the description of the module you would like to parameterise (1 in Fig. 2/15). The “Properties ...” dialogue window is displayed.
3. Click on the parameter value (“Value”) which you wish to modify. A list with the possible values will be opened (2).

## 2. Commissioning

4. Change the parameter by clicking on the desired value (“Value”).
5. Confirm the change to close.



### **Note**

Module parameters can refer to:

- properties of the complete module
- properties of an individual channel of a module.

### 2.8.3 Parameterisation with the operator unit

The operator unit (CPX-MMI) offers menu-driven access to parameterise the CPX terminal without configuration software.

If the operator unit has write access to the parameters, you cannot parameterise the following parameters via the bus:

- system parameters
- module parameters.



Information on operation of the operator unit can be found in the description for the operator unit P.BE-CPX-MMI-...

### 2.8.4 Parameterisation through the Festo Maintenance Tool

With the PC software Festo Maintenance Tool (CPX-FMT), you can easily parameterise the CPX terminal over a USB connection.

You receive the required USB adapter with the software for the CPX-FMT.



#### **Note**

The last parameterisation set or received is always valid until restart of the bus node or CPX terminal.

After a restart, settings chosen through MMI or FMT must be recreated, if necessary. See also section 2.8.1 (Start parameterisation) and the notes on system start in the operating mode FSU (Fig. 2/13). Notes on parameterisation after replacement of a bus node can be found in section 1.5.



## 2. Commissioning

### 2.8.5 Bus node parameters

Bus node parameters	Description/setting options
<b>Standard CPX parameter</b>	
<ul style="list-style-type: none"> <li>– Monitoring of short circuit at sensors</li> <li>– Monitoring of short circuit at outputs</li> <li>– Monitoring of <math>U_{OUT}</math></li> <li>– Monitoring of <math>U_{VAL}</math></li> <li>– Monitoring of short circuit at valves</li> <li>– Fail-safe</li> <li>– Force mode</li> <li>– System start with external parameters or default parameters or with saved parameters</li> <li>– Diagnostic memory → Note</li> </ul>	<p>Standard CPX parameter – for further information: see CPX system description (P.BE-CPX-SYS...)</p> <p><b>Note</b> The parameters of the diagnostic memory can only be set via the CPX-MMI or CPX-FMT.</p>
<b>Device-specific parameters</b>	
Diagnostic message filter Undervoltage $U_{OUT}/U_{VAL}$ <sup>1)</sup>	<ul style="list-style-type: none"> <li>– Inactive: Undervoltage is reported over the network</li> <li>– Active: Undervoltage messages are filtered and <b>not</b> reported over the network → The undervoltage is displayed only through flashing of the SF LED on the bus node</li> </ul>
Channel alarm filter Undervoltage $U_{OUT}/U_{VAL}$ <sup>2)3)</sup>	<ul style="list-style-type: none"> <li>– Inactive: Undervoltage is reported over the network</li> <li>– Active: Undervoltage messages are filtered → A maximum of one message per module is sent over the network; the undervoltage is additionally displayed through flashing of the SF LED on the bus node</li> </ul>
<p>1) Displayed in the hardware configuration (HW Config) as “Filter Alarm <math>U_{off}/U_{val}</math>”; only available for bus nodes from CPX revision code 14 (“Rev 14”).</p> <p>2) Displayed in the hardware configuration (HW Config) as “Filter channel alarm <math>U_{off}/U_{val}</math>”.</p> <p>3) Only available for bus nodes from CPX revisions code 20 (“Rev 20”).</p>	

Tab. 2/13: Bus node parameters – part 1

## 2. Commissioning

Device-specific parameters	Description/setting options
Summarise channel alarm filters (“channel bundling”) <sup>1)</sup>	<ul style="list-style-type: none"> <li>– Inactive: Channel alarms are reported individually over the network</li> <li>– Active: Channel alarms (e.g. short circuit or undervoltage) are summarised and transmitted as a common message over the network; the error is also displayed through flashing of the corresponding LED on the bus node</li> </ul>
Analogue process value representation (Intel/Motorola format)	<p>Special bus node parameter – defines the representation of process values of the analogue modules – setting options:</p> <ul style="list-style-type: none"> <li>– Intel byte sequence (LSB-MSB, “Little Endian”; factory setting): Process values are displayed in the Intel format (least significant bit on the left, most significant bit)</li> <li>– Motorola byte sequence (MSB-LSB, “Big Endian”): Process values are displayed in the Motorola format (most significant bit on the left, least significant bit on the right)</li> </ul> <p>This parameter can also be set via the I/O diagnostic interface with the function number 4402 in bit 7:</p> <ul style="list-style-type: none"> <li>– Value “0”: Intel (LSB-MSB; factory setting)</li> <li>– Value “1”: Motorola (MSB-LSB)</li> </ul> <p><b>The setting of the byte sequence</b> or of the process value representation is dependent on your control system and the related user programs: Select the byte sequence used in your control system.</p>
1) Only available for bus nodes from CPX revisions code 20 (“Rev 20”).	

Tab. 2/14: Bus node parameters – part 2



### Note

Take into account the set bus node parameters in your user programs also, in particular the “analogue process value representation” (byte sequence).

## 2. Commissioning



### **Note**

Note that individual parameters are available only from a specific revision of the bus node → Tab. 2/13 and Tab. 2/14.

If you use a bus node with an earlier revision, although the parameters are displayed in Siemens STEP 7, they cannot be set.

## 2. Commissioning

### 2.8.6 Application example for the parameterisation

- 1 Input for 1st sensor (with default parameterisation)
- 2 Parameterised input for 2nd sensor (see text)

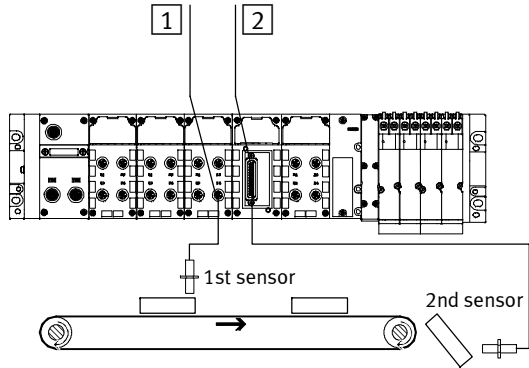


Fig. 2/16: Application example for parameterisation of input debounce time and signal extension time on the 2nd sensor

In the above application, packets are transported on a fast-moving conveyor belt.

For improvement of the signal detection and processing, the input for the 2nd sensor is parameterised as follows:

- Input debounce time reduced from 3 ms (factory setting) to 0.1 ms: detection of shorter signals is possible. This parameter is set for the total module.
- Signal extension time set for 50 ms: Secure detection of the signals through the controller. The value of this parameter is set for the complete module, but must be activated/deactivated separately for each input channel.

### 2.9 Identification & Maintenance

The “Identification and Maintenance” (I&M) function serves as an electronic rating plate of the bus node and offers uniform, manufacturer-independent access to device-specific online information via the Internet.



#### Note

To use the I&M function, at least revision status 14 (“Rev 14”) is required (see rating plate of the bus node). If a bus node with an earlier version is used, the following error message is displayed:

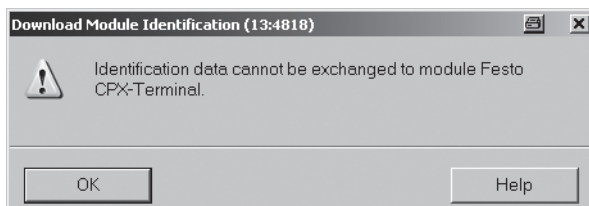


Fig. 2/17: I&M error message for bus nodes with revision status (CPX revisions code) earlier than “Rev 14”

## 2. Commissioning

### Load identification properties into the bus node

1. In the “PLC” menu, click on “Download Module Identification...” (Target System > Download Module Identification).

The window “Download Module Identification” is displayed.

2. Enter the new identification properties in the fields under “Offline” (examples: see Fig. 2/18).
3. Make sure that, a check is entered in the check boxes under “Include” only if you want to load new I&M data into the bus node.



#### Note

Remove the check under “Include” if **correct data** are already in the “ONLINE” field; otherwise, these data will be overwritten!

4. Confirm the inputs with OK.

	Offline	Include	ONLINE
Plant designation:	<input type="text"/>	<input type="checkbox"/>	plant D01
Location designation:	<input type="text"/>	<input type="checkbox"/>	factory 7 hall 10
Installation date:	11/05/2008	<input checked="" type="checkbox"/>	11/04/2008
Additional information:	<input type="text"/>	<input type="checkbox"/>	packing machine

- 1 Deactivate checks, if applicable, so that correctly filled-in ONLINE fields are not overwritten.

Fig. 2/18: Selection of the I&M identification data for transfer to the bus node

## 2. Commissioning

### Look at identification properties

1. Click on “Module Information...” in the “PLC” menu (Target System > Module Information).

The window “Module Information” is displayed.

2. In the “General” tab, you will find the hardware revision and the software/firmware status of the bus node.



#### Note

The detailed and possibly updated I&M specifications for the hardware revision and for the firmware and software status of the bus node might **not be identical** to the higher-level CPX revision code (“Rev xy”) located on the rating plate.

3. You will find further information, such as manufacturer’s specifications, in the “Identification” tab.

### 2.10 Configuration in the Remote Controller operating mode

If there is a control block in your CPX terminal, you must operate the bus node in the Remote Controller operating mode. The bus node then occupies 8 or 16 input bytes and 8 or 16 output bytes (dependent on the switch position DIL 2.2 → Tab. 1/4). These are available to the control program in the control block CPX-FEC or CPX-CEC and to the PROFINET Master.

Configuration of the Remote Controller operating mode bus node

1. Ensure that DIL switches of the control block are in the “Remote Controller” position (→ Description P.BE-CPX-FEC or P.BE-CPX-CEC).
2. Ensure that DIL switch 1 of the bus node is in the “Remote Controller” position (→ Section 1.4.2, Tab. 1/1).
  - DIL 1.1: ON
  - DIL 1.2: OFF
3. Set the required data field size with DIL switch 2, (see Tab. 1/4).
4. Start the configuration and programming software of your control system, e.g. Siemens STEP 7.
5. Open the hardware configuration, e.g. “HW Config”.
6. If you change an existing configuration: If necessary, remove the existing bus nodes and all other (subordinate) modules from this CPX terminal configuration.
7. Carry out the bus node selection (station selection) with the station type **CPX RC** or **CPX-RC-FO** (see section 2.7.1).
8. Select the required data field size in the configuration and programming software:  
8 bytes I / 8 bytes O ... 16 bytes I / 16 bytes O.



## 2. Commissioning



### **Note**

Observe that the data field size set with the DIL switch 2 (→ Tab. 1/4) must be the same size or larger than the data field size that you set in your control system.

The bus node is thus configured as remote controller.

Additional settings, such as change of the PROFINET device name or IP address, can be made just as in the Remote I/O operating mode.

### 2.11 Checklist for commissioning the CPX terminal



If the safety concept of your machine/system permits, commission the CPX terminal at first with both operating voltages – but without compressed air. You can then test the CPX terminal without triggering undesired reactions.



#### Note

Observe the general commissioning instructions in the CPX system description and in the manual of your controller.



#### Caution

The CPX terminal with bus node for PROFINET will also start with incomplete configuration.

- Check the configuration and address assignment of the I/Os on the CPX terminal. You can force the I/Os for this purpose → CPX system description P.BE-CPX-SYS...
- An incomplete configuration will normally be displayed with the diagnostics LED of the controller and in the on-line diagnostics of your configuration software.

#### Approach:









- Check the DIL switch settings and the network configuration before using and replacing CPX terminals.
- Ensure that the desired start parameterisation of the CPX terminal will be recreated after a network interruption.
- Make sure that, after replacement of individual modules or of the entire CPX terminal, the new terminal is also operated with the required parameter settings. (See also section 2.8.1 for the start parameterisation and the note on parameterisation using CPX-MMI or CPX-FMT in section 2.8.4.)

## 2. Commissioning

- Check the parameterisation on a sample basis, if necessary, e.g. with the CPX-MMI, the CPX-FMT or the configuration program.

### Faultless commissioning, normal operating status

After an error-free commissioning (normal operating status), the following LEDs light green: “Power System” (PS) and “Power Load” (PL), if necessary also “Link 1” (TP 1) as well as TP2 (if port used).

LED display	Operating status
<p> <b>NF</b>   <b>PS</b>  <b>M/P</b>   <b>PL</b>  <b>TP1</b>   <b>SF</b>  <b>TP2</b>   <b>M</b> </p>	<p>The following LEDs light green:</p> <ul style="list-style-type: none"> <li>– PS</li> <li>– PL</li> <li>– TP1<sup>1)</sup></li> <li>– TP2<sup>1)</sup>.</li> </ul> <p>The following LEDs do not light:</p> <ul style="list-style-type: none"> <li>– NF</li> <li>– M/P</li> <li>– SF.</li> </ul> <p>The M LED lights or flashes if parameterisation is changed or forcing is active.</p>
<p>1) Only if port used: – Continuous light: network connection OK</p>	

Tab. 2/15: Normal operating status of the CPX terminal or bus node

## 2. Commissioning

The LEDs “Network Failure” (NF), “Maintenance/PROFten-ergy” (M/P) and “System Failure” (SF) do not light.

The “Modify” (M) LED only lights or flashes for the “changed parameterisation” setting (system start with saved parameterisation and saved CPX expansion) or “force active” → CPX system description (P.BE-CPX-SYS...), on the spot diagnostics, “force mode”, function no. 4402.

Detailed information about the significance of the individual LEDs and information on diagnostics and error handling can be found in section 3.2 of this description and in the CPX system description (P.BE-CPX-SYS-...).

# Diagnostics

## Chapter 3

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### 3. Diagnostics

#### 3.1 Overview of Diagnostic Functions

The CPX terminal provides comprehensive and user-friendly options for diagnostics and error handling. Depending on the configuration, the following functions are available as part of PROFINET:

<b>Diagnostic function</b>	<b>Brief description</b>	<b>Benefits</b>	<b>Detailed description</b>
LED display	Status LEDs, for display of hardware errors, configuration errors, bus errors, etc.	Fast “on-site” error detection	Section 3.2
Status bits	Internal inputs, which supply coded common diagnostic messages: 8 status bits are cyclically transmitted to the interface as “inputs” along with all other inputs	Fast access to fault messages in the PLC user program, independently of the module and IO-Controller	Section 3.3
I/O diagnostics interface	Bus-independent diagnostic interface at I/O level, which enables access to the internal data of the CPX terminal (16 I and 16 O)	Read access to internal parameters and data at I/O level	CPX system description, section on diagnostics and error elimination (P.BE-CPX-SYS...), notes in section 3.4 (P.BE-CPX-PNIO...)

Tab. 3/1: Overview of the diagnostic options of the CPX terminal – Part 1

### 3. Diagnostics

<b>Diagnostic function</b>	<b>Brief description</b>	<b>Benefits</b>	<b>Detailed description</b>
Diagnostics via CPX-MMI	Operator unit, for menu-driven, convenient display of diagnostic information	Fast “on-site” error detection, without programming, in clear text	Operator unit description (P.BE-CPX-MMI-...)
Diagnostics via CPX-FMT	Festo Maintenance Tool (FMT), for PC-based diagnostic functions	Graphic representation of the CPX terminal, additional functions, e.g. status display, parameterisation	Online documentation for the CPX-FMT
Diagnostics via PROFINET	Diagnostics as part of the PROFINET function	Diagnostics through the network: detailed module-related and channel-related error detection in the online mode of the configuration software and in the PLC user program	Section 3.5

Tab. 3/2: Overview of the diagnostic options of the CPX terminal – Part 2



#### **Note**

Note that the diagnostic information shown can depend on the settings (see section 1.4.2) as well as on parameterisation (see section 2.8) of the CPX terminal.



### 3. Diagnostics

## 3.2 Diagnostics via LEDs

LEDs for the diagnostics of the CPX terminal are available on the bus node as well as on the individual modules.



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

### LEDs on the bus node for PROFINET

The light emitting diodes on the cover indicate the operating status of the bus node.

#### 1 CPX-specific LEDs

PS: Power system

PL: Power Load

SF: System Failure

M: Modify

#### 2 PROFINET-specific LEDs

NF: Network Failure

M/P:  
Maintenance/  
PROFenergy

TP1: Link 1

TP2: Link 2

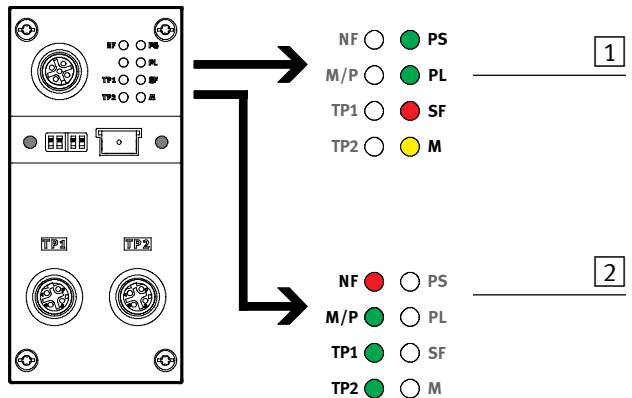


Fig. 3/1: LEDs on the bus node (here CPX-FB33)

### 3. Diagnostics

The LEDs are shown in their various statuses as follows:









 lit;       flashing;       dark;

#### Normal operating status

In normal operating status the following LEDs illuminate green: **PS**, **PL** and possibly also **TP1**, **TP2** (if port used).

The SF and NF LEDs do not light up.





The **M** LED only lights or flashes for the “Changed parameterisation” setting (system start with saved parameterisation and saved CPX expansion) or “Force active” (force mode, function no. 4402 → CPX system description, P.BE-CPX-SYS... → “On the spot diagnostics”).




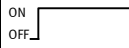


LED display	Operating status	
<p> <b>NF</b>  <b>PS</b>   <b>M/P</b>  <b>PL</b>   <b>TP1</b>  <b>SF</b>   <b>TP2</b>  <b>M</b>  </p>	<p>The following LEDs illuminate green:</p> <ul style="list-style-type: none"> <li>– PS</li> <li>– PL</li> <li>– TP1<sup>1)</sup></li> <li>– TP2<sup>1)</sup>.</li> </ul> <p>The following LEDs do not light:</p> <ul style="list-style-type: none"> <li>– SF</li> <li>– NF.</li> </ul> <p>The M LED lights or flashes if parameterisation is changed or forcing is active.</p>	<p>Normal, no error</p>
<p>1) Only if port used: – Continuous light: network connection OK.</p>		

Tab. 3/3: Normal operating status – LED display




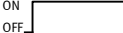


### 3. Diagnostics

#### 3.2.1 Network status/network error – LED NF, Maintenance/PROFenergy – LED M/P, connection status – LEDs TP1, TP2

<b>NF – Network status/network failure</b>			
<b>LED (red)</b>	<b>Sequence</b>	<b>Status</b>	<b>Error handling</b>
 LED not illuminated		No error (if the PS LED lights up green)	–
 LED flashing		Network connection not OK - possible causes: – only before commissioning: configuration defective, e.g. MAC-ID not configured – device name or device number not correct – IO-controller defective – network connection interrupted, short-circuited or disturbed	Check: <ul style="list-style-type: none"> <li>• Configuration</li> <li>• Device name</li> <li>• Device number</li> <li>• IO controller</li> <li>• Network connection</li> </ul>

<b>M/P – Maintenance/PROFenergy</b>			
<b>LED (green)</b>	<b>Sequence</b>	<b>Status</b>	<b>Error handling</b>
 LED not illuminated		No maintenance measure required, no PROFenergy function available	–
 LED illuminated yellow		Maintenance measure required	Check: <ul style="list-style-type: none"> <li>• plug connector</li> <li>• fibre optic cable.</li> </ul>
 LED flashing green		PROFenergy activated	–


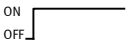



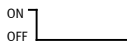
### 3. Diagnostics





<b>TP1, TP2 – connection status (Link 1, 2)</b>			
<b>LED (green)</b>	<b>Sequence</b>	<b>Status</b>	<b>Error handling</b>
 LED not illuminated		No physical network connection	Check network connection/network cable
 LED illuminated		Network connection OK	–
 LED flashing		– Flashing, both LEDs at the same rate: locating module	Locating module: e.g. for fault finding or during configuration ➔ Section 2.6.1

Tab. 3/4: Network status/network error – LED NF, Maintenance/PROFlenergy – LED M/P, connection status – LEDs TP1, TP2

### 3. Diagnostics









#### 3.2.2 CPX terminal status – LEDs PS, PL, SF, M

<b>PS – status of operating voltage supply for electronics/sensors (power system)</b>			
<b>LED (green)</b>	<b>Sequence</b>	<b>Status</b>	<b>Error handling</b>
 LED illuminated		No error, operating voltage for electronics and sensors is present	–
 LED flashing		Operating voltage for electronics and sensors outside the tolerance range	1. Eliminate short circuit/overload 2. Depending on the parameterisation: <ul style="list-style-type: none"> <li>• The sensor supply voltage will be switched on again <b>automatically</b> after the short circuit has been eliminated (default)</li> <li>• Switch the power supply off/on (Power off/on)</li> </ul>
 LED not illuminated		Operating voltage for electronics and sensors not applied	Check the operating voltage connection of the electronics

<b>PL – load voltage supply valves/outputs (power load)</b>			
<b>LED (green)</b>	<b>Sequence</b>	<b>Status</b>	<b>Error handling</b>
 LED illuminated		No fault, load voltage applied	None
 LED flashing		Load voltage outside tolerance range	1. Eliminate undervoltage 2. Depending on the parameterisation: <ul style="list-style-type: none"> <li>• The load voltage supply will be switched on again <b>automatically</b> after the undervoltage has been eliminated (default)</li> <li>• Switch the power supply off/on (Power off/on)</li> </ul>




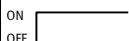


Tab. 3/5: CPX terminal status (part 1) – LEDs PS and PL

### 3. Diagnostics

<b>SF – system failure</b>			
<b>LED (red)</b>	<b>Sequence</b>	<b>Status <sup>1)</sup></b>	<b>Significance/error handling</b>
 LED not illuminated		No error	–
 LED flashes 1x		Information or minor error (error class 1)	See description of error numbers in the CPX system description (P.BE-CPX-SYS...)
 LED flashes 2x		Error (error class 2)	
 LED flashes 3x		Serious error (error class 3)	
<sup>1)</sup> The system error LED flashes dependent on the applicable error class: Error class 1 (minor error): 1x flash, interval Error class 2 (error): 2x flash, interval Error class 3 (serious error): 3x flash, interval			

Tab. 3/6: CPX terminal status (part 2) – LED SF

### 3. Diagnostics

<b>M – parametrisation revised or forcing active (modify)</b>			
<b>LED (yellow)</b>	<b>Sequence</b>	<b>Status</b>	<b>Significance/error handling</b>
 LED not illuminated		<ul style="list-style-type: none"> <li>– System start with factory settings (default parameterisation) and current CPX expansion</li> <li>– External parameterisation possible (default)</li> </ul>	None
 LED illuminated		<ul style="list-style-type: none"> <li>– System start with saved parameterisation and saved CPX expansion</li> <li>– Parameters and CPX expansion are saved permanently; external parameterisation is blocked <sup>1)</sup></li> </ul>	<b>Caution</b> when replacing a CPX terminal with saved parameterisation (LED M lights up): In case of servicing, such as with replacement of the CPX terminal, parameterisation is <b>not</b> created automatically by the PLC or the higher-order system. In this case, check which settings are required before replacement and make these settings if necessary.
 LED flashes		<ul style="list-style-type: none"> <li>– Forcing active <sup>1)</sup></li> </ul>	The forcing function is enabled (force mode; function no. 4402 → CPX system description P.BE-CPX-SYS...).
<sup>1)</sup> The display of the Force function (LED flashing) has precedence over the display of the setting for system start (LED illuminated).			

Tab. 3/7: CPX terminal status (part 3) – LED M

### 3.3 Diagnostics via status bits

The CPX terminal provides 8 status bits if you activate this function using DIL switches (see section 1.4.2) – assuming the corresponding PLC hardware configuration (see Tab. 1/3). Observe also the continued explanations for configuration in section 2.6.2.

The status bits are used for displaying common diagnostics messages (global error messages). The status bits are configured like inputs; you can select the address freely during the configuration.

If all status bits supply a logic 0, no error will be registered.

Bit	Diagnostic information with logic 1	Description
0	Error at 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	Error type
5	Short circuit/overload	
6	Wire break	
7	Other error	

Tab. 3/8: Status bits of the bus node (optional)



### 3. Diagnostics

#### **3.4 Diagnostics via the I/O diagnostic interface (STI)**

The CPX terminal provides a 16-bit I/O diagnostics interface (system table interface, STI) if you activate this function using DIL switches (see section 1.4.2) – assuming the corresponding PLC hardware configuration (see Tab. 1/3). Observe also the continued explanations for configuration in section 2.6.2.

Further information can be found in the CPX system description (P.BE-CPX-SYS-...) in the section Diagnostics and error handling.

### 3.5 Diagnostics via PROFINET

#### 3.5.1 Basic information

PROFINET forms the basis for comprehensive diagnostics functions and information over your automation network, e.g. detailed module-related and channel-related status information and error recognition in the online mode of the configuration software and in the PLC user program.

The following sections provide an initial view of the use of the online diagnostics using the configuration and programming software (see section 3.5.2) and the user-specific diagnostics using function modules (see section 3.5.3).

#### Error characteristics

The behaviour of the CPX terminal for the following errors is dependent on the configured behaviour of the controller (the Master), i.e. of the PLC or IPC and the parameterised fail-safe setting:

- telegram failure
- stop of the controller (of the master)
- network interruption.

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

Further information about the fail-safe setting can be found in the CPX system description P.BE-CPX-SYS-...



### 3. Diagnostics

You can set two types of controller error characteristics:

- Hard error characteristic: When an error occurs, the controller switches to the operating mode “STOP”
- Soft error characteristic: When an error occurs, the controller remains in the operating mode “RUN”.



#### **Warning**

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

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



#### **Note**

Please note the following if the outputs are reset after PLC stop, network interruption or malfunction:

- Monostable valves move to the basic position
- Bistable valves remain in the current position
- Mid-position valves go into mid-position (pressurized, exhausted or closed, depending on valve type).

### Error numbers and types

Table Tab. 3/9 shows PROFINET-specific error numbers and types.



A list of all CPX-specific error numbers and types can be found in the CPX system description (P.BE-CPX-SYS...).

Further diagnostic information about the error types can be obtained. The sections 3.5.2 and 3.5.3 describe access to these error types (based on Siemens STEP 7).

### 3. Diagnostics



With the exception of the CPX error numbers in table Tab. 3/9, CPX error numbers are transmitted in the PROFINET network with the offset 1000:

CPX error number + **1000** = PROFINET error number.

**Example:**

Error on the measuring system → CPX error number 108 + 1000 = PROFINET error number 1108.

CPX error number	PROFINET error number	Error type
2	1	Short circuit
3	6	Wire break
4	2	Undervoltage
5	2	Undervoltage
9	8	Lower limit fallen below
10	7	Upper limit exceeded
11	1	Short circuit at valve
13	6	Wire break at valve
65	64	PROFIsafe addresses (F_Dest_Add) different
69	72	Parameterisation error → Error in “safe paramterisation”
List of all CPX-specific error types → CPX system description (P.BE-CPX-SYS...)		

Tab. 3/9: PROFINET-specific error numbers and types

### 3. Diagnostics

#### 3.5.2 Online diagnostics with Siemens STEP 7

1. Start the PROFINET hardware configuration in your configuration and programming software (e.g. HW Config in Siemens STEP 7).

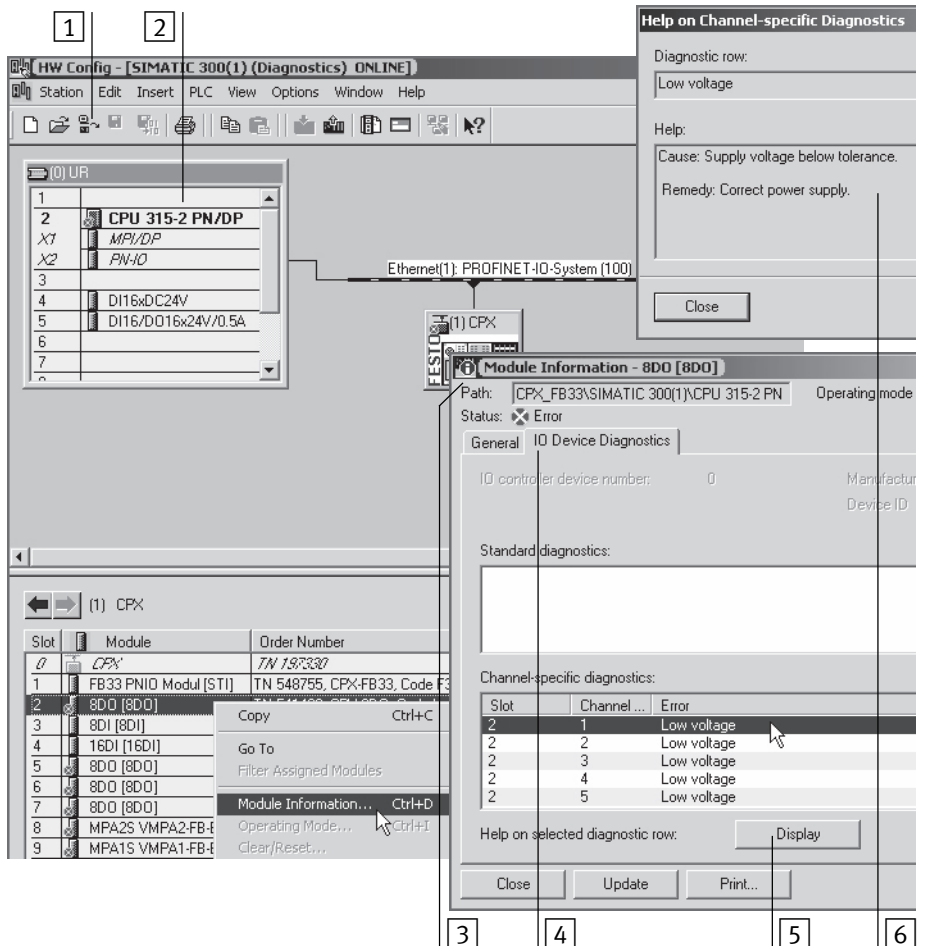


Fig. 3/2: Online diagnostics with Siemens STEP 7

### 3. Diagnostics

2. Switch from offline to online (see Fig. 3/2 **1**).
3. Click with the right mouse button on the CPU in rack **2**.
4. Click on “Module information...” (component status) in the displayed context menu.

The window “Module Information” (component status) is displayed **3**.

5. Click on the “IO device diagnostics” tab (IO device diagnostics) **4**.
6. Click on the event and then on “Display” **5**.

In a new window, details of the diagnostics are displayed **6**. They provide you with more precise information on the further approach. The information is independent of the controller used.

### 3. Diagnostics

#### 3.5.3 User-specific diagnostics with Siemens STEP 7

The diagnostics for PROFINET are supported in STEP 7 by organisation blocks (OBs) and function blocks (FBs). OBs and FBs consist of individual function instructions and thus form special program modules, so-called Instruction Lists (IL) which can be integrated into user-specific programs.

Organisation blocks start in response to a malfunction or a device-related diagnosis and are used thereby for localisation of the source of the error, while function blocks read the diagnostics of the bus node and write to a data range of the user program (see example in Fig. 3/3).

In this way, the system-specific diagnostics are individually integrated in comprehensive, higher-order diagnostics systems.

The following OBs and FBs can typically be used for diagnostics purposes: OB 82, OB 86 and SFB 54 (see Tab. 3/10).

Control system	Module	Meaning	Detail information
Siemens STEP 7	OB 82	Starts as a reaction to device-related diagnostics	– Siemens reference manual “System and standard functions for S7-300/400” – “PROFIBUS/PROFINET Guidelines” regarding “function blocks”
	OB 86	Starts as a reaction to failure of the network or of a network participant	
	SFB 54 RALRM	Receives an alarm and the related information from a network participant (“I/O device”) and makes this information available as an output parameter	

Tab. 3/10: Intended use (significance) of the organisation blocks OB 82 and OB 86 as well as the function block SFB 54

### 3. Diagnostics

#### Basic approaches – Diagnostics with user programs

Call the function block SFB54 RALRM within the error OB that was started by the controller, e.g. OB 82 or OB 86. A program example can be found in Fig. 3/3.

1. Call up SFB 54 initially with the operating mode `MODE = 0` in order to determine the logical address of the network participant triggering the diagnostics.
2. For determining the diagnostics details:
  - Call up SFB 54 with the operating mode `MODE = 2`.
  - Enter the diagnostics address of the bus node in the parameter `F_ID` (accept diagnostics address from step 1.).
3. SFB 54 writes the diagnostics information to the `AINFO` output parameter.

#### Instruction list

```
CALL "RALRM", DB54  
MODE :=2
```

```
F_ID :=DW#16#7F3
```

```
MLEN :=255
```

```
NEW :=M54.0
```

```
STATUS:="DB_ALARM".STATUS
```

```
ID :="DB_ALARM".ID
```

```
LEN :="DB_ALARM".LEN
```

```
TINFO:="DB_ALARM".TINFO
```

```
AINFO:="DB_ALARM".AINFO
```

#### Explanation

Call of SFB 54

Check of the network participant operating mode with the network address in `F_ID`

Logical address of the bus node (diagnostics address)

Max. length in bytes

New alarm received

Error code of the SFB

Start address of the module with alarm

Alarm information length

Target range OB start information ("Task Information")

Target range header/additional information ("Alarm Information")

Fig. 3/3: Program example in instruction list for reading diagnostics information



# Technical appendix

## Appendix A

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## A.1 Technical data, bus node CPX-FB33

<b>General characteristics CPX-FB33</b>	
<b>General technical data</b>	See CPX system description P.BE-CPX-SYS-...
<b>Degree of protection through housing</b> in accordance with IEC 60529, completely mounted, plug connector plugged in or equipped with cover cap	IP65/IP67
<b>Protection against electrical shock</b> Protection against direct and indirect contact in accordance with IEC 60204-1	through PELV circuits (Protected Extra-Low Voltage)
<b>Module code (CPX-specific)</b> – Remote I/O – Remote controller	215 164
<b>Module identifier (in the PLC, in the CPX-FMT or in the CPX-MMI)</b> – Remote I/O – Remote controller	FB33-RIO PROFINET remote I/O FB33-RC PROFINET I/O bus node

<b>Power supply CPX-FB33</b>	
<b>Operating voltage/load voltage</b>	see CPX system description P.BE-CPX-SYS-...
<b>Intrinsic current consumption at nominal operating voltage 24 V DC</b> from operating voltage supply for electronics/sensors ( $U_{EL/SEN}$ )	typ. 120 mA (internal electronics)
<b>Separation</b> PROFINET interfaces to $U_{EL/SEN}$	Galvanically separated through transformer (up to 1500 V)
<b>Mains buffering time</b>	10 ms

## A.2 Technical data, bus node CPX-M-FB34

<b>General characteristics CPX-M-FB34</b>	
<b>General technical data</b>	See CPX system description P.BE-CPX-SYS-...
<b>Degree of protection through housing</b> in accordance with IEC 60529, completely mounted, plug connector plugged in or equipped with cover cap	IP65/IP67
<b>Protection against electrical shock</b> Protection against direct and indirect contact in accordance with IEC 60204-1	through PELV circuits (Protected Extra-Low Voltage)
<b>Module code (CPX-specific)</b> – Remote I/O – Remote controller	216 165
<b>Module identifier (in the PLC, in the CPX-FMT or in the CPX-MMI)</b> – Remote I/O – Remote controller	FB34-RIO PROFINET RJ45 remote I/O FB34-RC PROFINET RJ45 bus node

<b>Power supply CPX-M-FB34</b>	
<b>Operating voltage/load voltage</b>	see CPX system description P.BE-CPX-SYS-...
<b>Intrinsic current consumption at nominal operating voltage 24 V DC</b> from operating voltage supply for electronics/sensors ( $U_{EL/SEN}$ )	typ. 120 mA (internal electronics)
<b>Separation</b> PROFINET interfaces to $U_{EL/SEN}$	Galvanically separated through transformer (up to 1500 V)
<b>Mains buffering time</b>	10 ms

### A.3 Technical data, bus node CPX-M-FB35

<b>General characteristics CPX-M-FB35</b>	
<b>General technical data</b>	See CPX system description P.BE-CPX-SYS-...
<b>Degree of protection through housing</b> in accordance with IEC 60529, completely mounted, plug connector plugged in or equipped with cover cap	IP65/IP67
<b>Protection against electrical shock</b> Protection against direct and indirect contact in accordance with IEC 60204-1	through PELV circuits (Protected Extra-Low Voltage)
<b>Module code (CPX-specific)</b> – Remote I/O – Remote controller	217 166
<b>Module identifier (in the PLC, in the CPX-FMT or in the CPX-MMI)</b> – Remote I/O – Remote controller	FB35-RIO PROFINET FOC remote I/O FB35-RC PROFINET FOC bus node

<b>Power supply CPX-M-FB35</b>	
<b>Operating voltage/load voltage</b>	see CPX system description P.BE-CPX-SYS-...
<b>Intrinsic current consumption at nominal operating voltage 24 V DC</b> from operating voltage supply for electronics/sensors ( $U_{EL/SEN}$ )	typ. 150 mA (internal electronics)
<b>Separation</b> PROFINET interfaces to $U_{EL/SEN}$	Galvanically separated through fibre-optic cable
<b>Mains buffering time</b>	10 ms

## A.4 Technical data for bus node CPX-M-FB41

<b>General characteristics CPX-M-FB41</b>	
<b>General technical data</b>	see CPX system description P.BE-CPX-SYS-...
<b>Degree of protection through housing</b> in accordance with IEC 60529, completely mounted, plug connector plugged in or equipped with cover cap	IP65/IP67
<b>Protection against electrical shock</b> Protection against direct and indirect contact in accordance with IEC 60204-1	through PELV circuits (Protected Extra-Low Voltage)
<b>Module code (CPX-specific)</b> – Remote I/O – Remote controller	217 (submodule code 8) 166 (submodule code 8)
<b>Module identifier (in the PLC, in the CPX-FMT or in the CPX-MMI)</b> – Remote I/O – Remote controller	FB41-RIO PROFINET FO-1P remote I/O FB41-RC PROFINET FO-1P bus node

<b>Power supply CPX-M-FB41</b>	
<b>Operating voltage/load voltage</b>	see CPX system description P.BE-CPX-SYS-...
<b>Intrinsic current consumption at nominal operating voltage 24 V DC</b> from operating voltage supply for electronics/sensors ( $U_{EL/SEN}$ )	typ. 125 mA (internal electronics)
<b>Disconnection</b> PROFINET interfaces to $U_{EL/SEN}$	galvanically separated through fibre-optic cable
<b>Mains buffering time</b>	10 ms

## A.5 Network-specific technical data

### Bus nodes CPX-FB33, CPX-M-FB34, CPX-M-FB35 and CPX-M-FB41

<b>Network-specific characteristics</b>	
<b>Network protocol</b>	PROFINET IO (“PN IO”): <ul style="list-style-type: none"> <li>– On the basis of Industrial Ethernet</li> <li>– based on the Standard Ethernet Protocol (IEEE 802.3)</li> </ul>
<b>Supported protocol characteristics and protocol functions (selection)</b>	<ul style="list-style-type: none"> <li>– Cyclical data exchange “in real-time”, without cycle synchronicity (real-time, RT) or with cycle synchronicity (isochronous real-time, IRT)<sup>1)2)</sup></li> <li>– Link Layer Discovery Protocol (LLDP)</li> <li>– Simple Network Management Protocol (SNMP)</li> <li>– Fast Start-up (FSU)</li> <li>– PROFINergy</li> <li>– PROFI-safe</li> <li>– Shared Device</li> <li>– Media Redundancy Protocol (MRP)<sup>2)</sup></li> </ul>
<b>Supported CPX-Characteristics and CPX functions (selection)</b>	<ul style="list-style-type: none"> <li>– CPX terminal configuration via CPX-FMT</li> <li>– Export/import of the CPX terminal configuration via CPX-FMT and control system (“export function”)</li> <li>– CPX terminal diagnostics via the fieldbus and control system</li> <li>– Webservice function: Representation of the PROFINET topology, CPX terminal configuration with diagnostic information, PROFINET-I&amp;M data, Ethernet statistics</li> </ul>
<sup>1)</sup> IRT is available only via LAN <sup>2)</sup> IRT and MRP are supported by the following bus nodes: CPX-FB33, CPX-M-FB34, CPX-M-FB35	

<b>Network-specific characteristics</b>	
<b>Specification</b>	<p>Selection of directives and standards with reference to PROFINET:</p> <ul style="list-style-type: none"> <li>– PROFINET installation guidelines (“PROFINET Installation Guide”, “Installation Guideline PROFINET Part 2...”)</li> <li>– IEC 61158</li> <li>– IEC 61784</li> <li>– IEC 61918</li> </ul> <p>Additional information:  → <a href="http://www.profinet.com">www.profinet.com</a>  → <a href="http://www.profibusb.com/download/">www.profibusb.com/download/</a></p>
<b>Transmission technology</b>	Switched Fast Ethernet; Version 100BaseTX in accordance with IEEE 802.3
<b>Transmission rate</b>	100 Mbit/s
<b>Wavelength</b> (only CPX-M-FB35 and CPX-M-FB41)	650 nm (suitable for POF fibre-optic cable)
<b>Network connections</b> (PROFINET interfaces, detailed information in section 1.6)	<ul style="list-style-type: none"> <li>– CPX-FB33</li> <li>– CPX-M-FB34</li> <li>– CPX-M-FB35</li> <li>– CPX-M-FB41</li> </ul> <ul style="list-style-type: none"> <li>– 2 x M12 socket, D-coded, 4-pin</li> <li>– 2 x RJ45 socket, push-pull, AIDA-conforming</li> <li>– 2 x SCRJ socket, push-pull, AIDA-conforming</li> <li>– 1 x SCRJ socket, push-pull, AIDA-conforming</li> </ul>
<b>Crossover detection, autonegotiation</b> (only CPX-FB33 and CPX-M-FB34)	Auto-MDI
<b>Max. address volume outputs/inputs</b> (PROFINET Input/Output Size)	64 bytes I, 64 bytes O, independent of operating mode



# Glossary

## Appendix B

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## B.1 Bus node operating modes

### B.1.1 Remote I/O operating mode

All functions of the CPX terminal are controlled directly by the PROFINET-IO controller or a higher-level PLC:

- control of the CPX terminal (or of the CPX valve terminal: also designated I/O control)
- Data exchange between controller and modules
- Parameterisation of the modules
- Diagnostics.

Controller and CPX terminal communicate via PROFINET. In doing so, the bus node takes over the connection to PROFINET and processing of the data exchange:

- protocol implementation
- forwarding of incoming and outgoing data.

PROFINET RT/IRT  
(in both operating modes)

The PROFINET real-time protocol (RT) or the PROFINET isochronous real-time protocol (IRT) is used.

A CPX-CEC control block or CPX-FEC possibly integrated into the CPX terminal works as a passive module, i.e. without control function. In this case, the control block may be used to **connect other networks**: The control block takes over forwarding of incoming and outgoing data and thus behaves like an I/O module.

## B.1.2 Remote Controller operating mode

A CPX-FEC or CPX-CEC integrated into the CPX terminal takes over control of the terminal (also designated “I/O controller”), e.g. as the local controller of a larger automation system.



Requirements for this operating mode:

- A control block CPX-FEC or CPX-CEC is a component of the CPX terminal.
- Make sure the DIL switches of the bus nodes and control block are set in accordance with the operating mode  
→ Section 1.4.2, Tab. 1/1 as well as Tab. 1/4 and description P.BE-CPX-FEC or P.BE-CPX-CEC.
- Observe the configuration notes in section 2.10.

The bus node takes over the connection to PROFINET, if necessary, that is not required for operation of the CPX terminal in the Remote Controller operating mode. The connection to PROFINET or the higher-level network provides supplementary functions in this operating mode:

- A higher-order controller can use this interface, for example, to call up status information of the valve terminal and to adjust or optimise the controller with other system parts correspondingly.
- The control block thereby communicates at the fieldbus level over a data field of 8 or 16 I/O bytes in size, such as with a PROFINET-IO controller or a higher-level controller.



**Note**

Observe that the data field size set with the DIL switch 2 (→ Tab. 1/4) must be the same size or larger than the data field size that you set in your control system.

### B.1.3 Additional function “Prioritized Start-up” (“Fast Start-up”)



The Remote I/O operating mode can be combined with the additional function **Prioritized Start-up**.

This additional function ensures a faster running up of the CPX terminal, also designated as “Fast Start-up”, (FSU) or “Fast restart”.

The subsequent sections summarise the specific information from the previous chapters to provide a comprehensive overview of this additional function.

The summary also simplifies conversion of an existing CPX system to “Fast Start-up”.

#### Requirements

The additional function “Fast Start-up” requires certain hardware, firmware and software versions as well as the current GSDML file, which must be installed as part of commissioning.

- Observe the wiring notes regarding FSU in section 1.6.2.
- Hardware, firmware and software requirements can be found in Tab. 2/10 (in section 2.5.2).
- Tab. 2/10 also includes information about the required GSDML file: For “Fast Start-up”, you need at least Version 2.2.
- Installation of the GSDML file is described in section 2.5.5.

### Restrictions

Crossover detection is not available in Remote I/O operating mode with additional function “Prioritized Start-up” (FSU):

- Use appropriate connecting cables (see section 1.6.2).
- Make sure that the function “Autonegotiation/Autocrossover” is **deactivated** in your control software before placing the system in operation (see section 2.6.4).
- If necessary, the function “Autonegotiation/Autocrossover” must also be **deactivated** on the hardware-side, in the basic setting of your controller (PLC) or in switches or routers in between: check the port settings for this purpose.

The additional function FSU has restrictions in parameterisation:

- Module parameters cannot be set over the controller software and must therefore be entered using CPX-FMT or CPX-MMI.
- For the system start, the function “System Start with Saved Parameters” (“Saved” or “Stored” parameters) must be activated to ensure that the parameters entered using FMT or MMI are used.

Additional information on parameterisation can be found in the corresponding sections, especially section 2.8.

Activation/shift

Shift of the operating mode to “Fast Start-up” is performed in the control software, e.g. Siemens STEP 7: Observe the following note.



**Note**

Activation of the additional function “Fast Start-up” (FSU). Observe that the shift to “Fast Start-up” in the control software must be made at two configuration levels:

- **Basic hardware configuration**  
CPX terminal characteristics → Section 2.6.4, “Set up Prioritized Start-up (FSU)”
- **CPX terminal configuration**  
Allocate configuration table → Section 2.7.1, “Open station symbol” and “Select bus node” – with additional function FSU.

Further information about the additional function FSU can be obtained in the Internet → [www.profinet.com](http://www.profinet.com), e.g. in the “PROFINET System Description”.

## B. Glossary



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## Appendix C

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