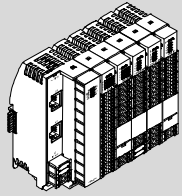


CPX-E System



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Instructions for use
 Original instructions

8070967
 2017-07
 [8070969]

CPX-E System English

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1 About this document

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

1.1 Further applicable documents


Document	Table of contents
Description of the CPX-E system (CPX-E-SYS)	Detailed description of the CPX-E system
Documentation of the components in a CPX-E system and the connected periphery	Information on use of the components
Special documentation on ATEX	Information on the use of the product in explosive gas atmospheres
Device description files	Definition of the modules of a CPX-E system for integration into the higher-order controller
Documentation of the higher-order controller and additional participants in the network	Information on commissioning and parameterisation of the components

Fig. 1

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

1.2 Product version

This document refers to the system consisting of CPX-E modules. The product version can be determined by the product labelling or using suitable Festo software.

 Suitable software for determining the product version is available on the support portal of Festo → www.festo.com/sp. Information for the use of the software is included in the integrated help function.

1.3 Product labelling

The CPX-E modules are labelled on the left lateral surface. The product labelling is described in the documentation supplied with the product.

1.4 Specified standards

Version status	
DIN 46228-1:1992-08	EN 60529:2013-10
DIN 46228-4:1990-09	EN 60715:2001-09
EN 60068-2-27:2010-02	IEC 60204-1:2014-10

Fig. 2

2 Safety

2.1 General safety information

- Take into consideration the legal regulations for the respective destination.
- Use the product only within the defined values → 15 Technical data.
- Take into account labelling on the product.
- Observe the further applicable documents → 1.1 Further applicable documents.
- Store the product in a cool, dry, UV-protected and corrosion-protected environment. Ensure storage times are short.
- Before working on the product: Switch off the power supply and secure it against being switched on again.
- Observe the handling specifications for electrostatically sensitive devices.

2.2 Intended use

The product family described in this document is intended only for use within a protected range in the vicinity of a machine and/or automated system.

The products must be used only as follows:

- Use only in an industrial environment. Outside of industrial environments, e.g. in commercial and mixed-residential areas, actions to suppress interference may have to be taken.
- Use only in combination with modules and components that are permissible for the respective product variant → www.festo.com/catalogue.
- Only use the product if it is in perfect technical condition.
- Only use the product in original status without unauthorised modifications. Only the conversions or modifications described in this and the other applicable documents are permitted.

2.3 Training of specialized personnel

Installation, commissioning, maintenance and disassembly should only be conducted by qualified personnel.

The qualified personnel must be familiar with installation and operation of electrical control systems.

3 Further information

- Accessories → www.festo.com/catalogue
- Spare parts → www.festo.com/spareparts

4 Service

- Contact your regional Festo contact person if you have technical questions → www.festo.com.

5 Product overview

5.1 Function


The CPX-E system is a modular system for the connection of electrical periphery. The individual modules in a CPX-E system are used, for example, to detect sensor signals and control actuators. Using a bus module or controller, the CPX-E system can be connected to a higher-order controller through a network or operated autonomously. Various interfaces and functions are available for diagnosis.

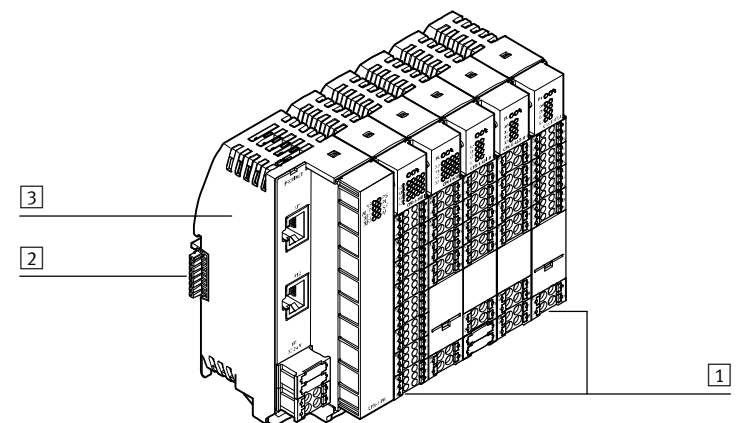
5.2 Product design

CPX-E system

A CPX-E system consists of a bus module or controller on the left side and at least one I/O module for signal processing.

The connection between the modules is implemented using linking elements. The contacts of both external linking elements are protected by end supports.

 2 end supports are included with a bus module or controller.

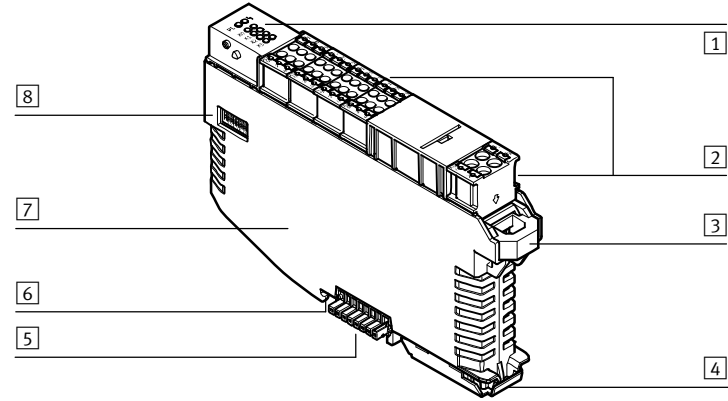


-  Input and output modules
-  Linking element
-  Bus module (here: CPX-E-PN)

Fig. 3

CPX-E modules

The CPX-E modules are designed in such a way that an exchange of individual components is possible without dismantling the CPX-E system. By disengaging the interlock of the terminal strips, you can remove them from the module. By disengaging the interlock of the module, you can remove an individual module from the system. The link remains on the H-rail.



- 1 LED display components
- 2 Terminal strips
- 3 Interlock of terminal strips
- 4 Interlock of module
- 5 Linking element
- 6 Contact of functional earth (FE)
- 7 Housing
- 8 DIL switch¹⁾

1) Module-dependent

Fig. 4

5.3 Display components

The CPX-E modules have LED indicators specific to the module, network or system:

- LED indicators specific to the module or network are described in the documentation for the respective module.
- An overview of the system-specific LED displays is displayed in the following table → Fig. 5.
- The behaviour of the system-specific LED indicators is described in “Description of the CPX-E system” (→ 1.1 Further applicable documents) and further below → 11 Diagnostics and fault clearance.

LED	Significance	
PS (green)	Power System	Monitoring of the operating voltage supply U_{EL}/SEN
PL (green)	Power Load	Monitoring of the logic and load voltage supply U_{OUT}
SF (red)	System Failure	System fault ¹⁾
M (yellow)	Modify	Force mode active or system start with saved parameterisation and saved CPX expansion have been set.

1) Display of 3 error classes through different flashing behaviours.

Fig. 5

Detailed information on the error classes can be found in “Description of the CPX-E system” → 1.1 Further applicable documents.

5.4 Control elements

A CPX-E module has interlocks for engaging and disengaging the module terminal strips and connected conductors.

- 1 Interlock of spring-loaded terminal
- 2 Interlock of terminal strips
- 3 Interlock of module

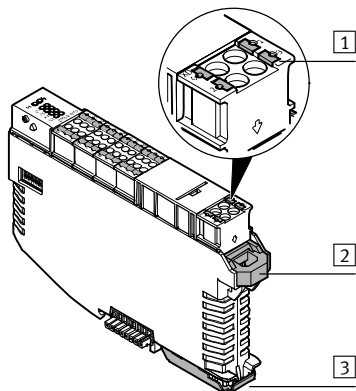


Fig. 6

5.5 Connecting components

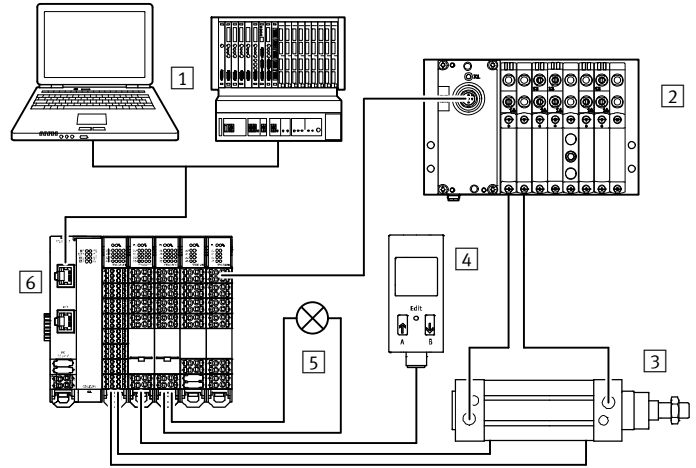
Connection of the CPX-E system

The individual modules of a CPX-E system are connected to each other through the link. The contact is established when the modules are hung into the H-rail → 7 Mounting. If a module is removed, the connection to the other modules is interrupted.

Connecting peripheral equipment

For the connection of the peripheral equipment, the modules have terminal strips with spring-loaded terminals → 8 Installation.

6 Function examples



- 1 Higher-order controller
- 2 valve terminal VTUG
- 3 Standards-based cylinder with proximity sensors for position sensing
- 4 Flow sensor
- 5 Signal lamp
- 6 CPX-E system with bus module and I/O modules

Fig. 7

7 Mounting

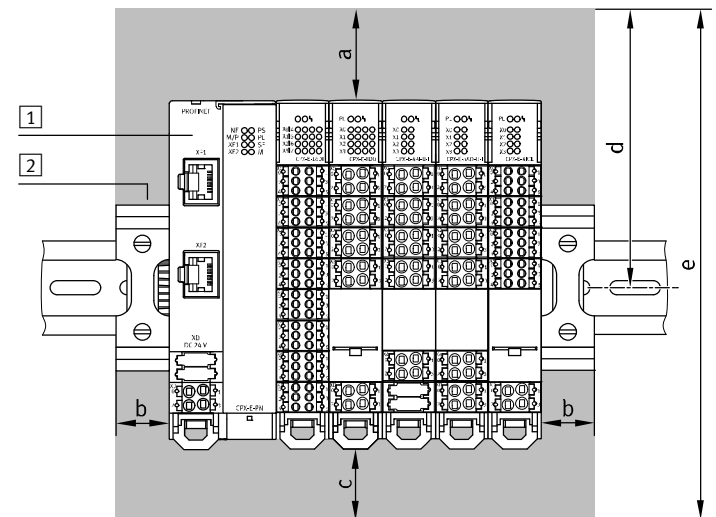
7.1 H-rail mounting

The modules can be mounted to an H-rail 35 × 7.5 mm according to EN 60715.

When selecting screws for H-rail mounting, a distance between the H-rail and the linking elements of 3 mm must be observed. The distance between the mounting screws of the H-rail may be a maximum of 50 mm.

7.2 Mounting clearances

To guarantee a sufficient pressurisation of the modules, the following minimum distances must be observed for the mounting of the CPX-E system → Fig. 8.



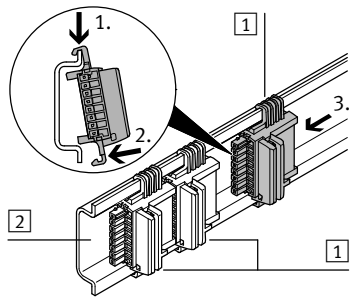
- 1 CPX-E system
 - 2 End supports
- Dimensions [mm]:
- a = 40
 - b = 20
 - c = 30
 - d = 106
 - e = 195

Fig. 8

7.3 Link

Hanging the linking element into place

1. Place the linking element into the correct position on the H-rail.
2. Clip the linking element to the H-rail.
3. Push together the linking elements until they engage.



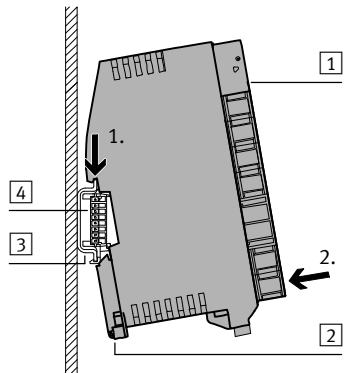
- 1 Linking element
- 2 H-rail

Fig. 9

7.4 Clamping and drilling

Hanging the module into place and engaging it

1. Place the module above the linking element(s) on the H-rail.
2. Press the module onto the H-rail until the module interlock engages.



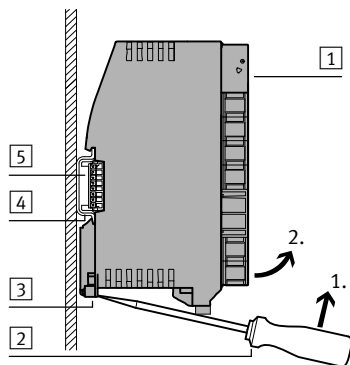
- 1 Module
- 2 Interlock of module
- 3 H-rail
- 4 Linking element

1) In the case of bus modules, 2 linking elements are required. In the case of controllers, 4 linking elements are required.

Fig. 10

Disengaging and removing the module

1. Disengage the module interlock (e.g., with a slotted screwdriver).
2. Tilt up the module and remove it from the H-rail.



- 1 Module
- 2 Slotted head screwdriver
- 3 Interlock of module
- 4 H-rail
- 5 Linking element

Fig. 11

8 Installation



Note

Malfunction due to electromagnetic interference.

- Connect screening to the connection for functional earth FE.
- Connect the H-rail to the earth potential with low impedance.

8.1 Power supply concept

A CPX-E system uses separate voltages to supply the electronic and sensors ($U_{EL/SEN}$) and to supply outputs (U_{OUT}). The voltage potentials (+24 V DC and 0 V DC) are respectively connected to each other in the terminal strips. It respective voltage can be conducted from one module to another.



Warning

Risk of injury due to uncontrolled movements of the connected actuators. A feedback loop through the sensor and/or actuator supply of the modules can supply the CPX-E system and lead to unwanted functions.

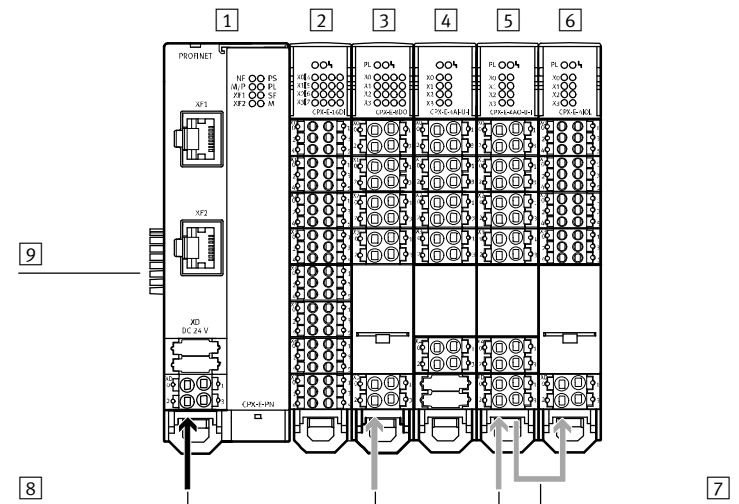
- Keep the range of movement of the connected actuators unobstructed.

Operating voltage supply $U_{EL/SEN}$

The operating voltage supply $U_{EL/SEN}$ to supply the electronics and sensors is fed at the bus module or controller and distributed internally to the entire CPX-E system through the link.

Load voltage supply U_{OUT}

The load voltage supply U_{OUT} to supply the outputs is fed separately directly at every module with outputs.



- 1 Bus module CPX-E-PN
- 2 Input module CPX-E-16DI
- 3 Output module CPX-E-8DO
- 4 Input module CPX-E-4AI-U-I
- 5 Output module CPX-E-4AO-U-I
- 6 IO-Link® master module CPX-E-4IOL
- 7 Load voltage supply U_{OUT}
- 8 Operating voltage supply $U_{EL/SEN}$
- 9 Link

Fig. 12

i The operating voltage supply $U_{EL/SEN}$ and load voltage supply U_{OUT} are implemented separately from each other within the CPX-E system. If this separation is not required for the respective use case, both voltages can also be supplied from a common voltage source. In this case, the load voltage supply must be able to be disconnected separately.

8.2 Connect lines



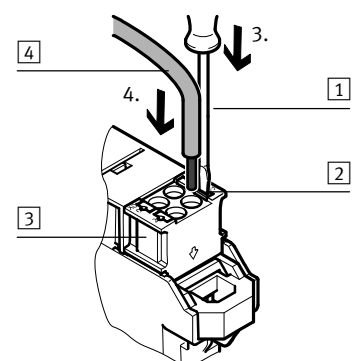
Warning

Electric voltage

Injury caused by electric shock, damage to machine and to system

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

1. Make sure the module and line are de-energised.
2. Strip the end of the line and fit wire end sleeves if required.
3. Disengage the spring-loaded terminal interlock (e.g., with a slotted screwdriver).
4. Insert the end of the line into the terminal strip to the limit stop.
5. Engage the spring-loaded terminal interlock.

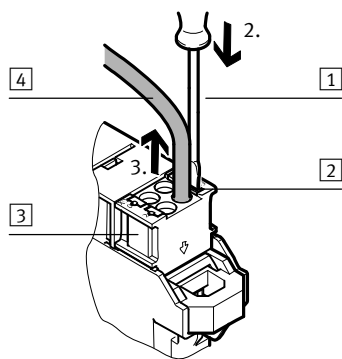


- 1 Slotted head screwdriver
- 2 Interlock of spring-loaded terminal
- 3 Terminal strip
- 4 Cable

Fig. 13

8.3 Disconnecting cables

1. Make sure the module and line are de-energised.
2. Disengage the spring-loaded terminal interlock (e.g., with a slotted screwdriver).
3. Pull the line from the terminal strip.



- 1 Slotted head screwdriver
- 2 Interlock of spring-loaded terminal
- 3 Terminal strip
- 4 Cable

Fig. 14

9 Commissioning

The behaviour of the CPX-E system during commissioning is largely determined by the parameterisation of the bus module.

- Observe information on parameterisation in the description of the bus node → 1.1 Further applicable documents.



Warning

Risk of injury due to uncontrolled movements of the connected actuators. The CPX-E system starts even if the parameterisation process is incomplete.

- Keep the range of movement of the connected actuators unobstructed.
- Check the parameterisation and address allocation of the inputs and/or outputs (e.g., using Force mode).

In order to avoid connecting and addressing errors, you must carry out the commissioning steps as follows.

1. Check the mounting and electrical connections → 9.1.
2. Make settings on the bus module or controller → 9.2.
3. Functional test (without higher-order controller) → 9.3.
4. Commissioning in network (with higher-order controller) → 9.4.
5. Parameterisation → 9.5.



Note

Addressing errors caused by changing address ranges during operation.

- Do not connect the bus module/controller to the network until after the functional test (→ 9.3).

9.1 Checking the mounting and electrical connections

1. Check the mounting of the CPX-E system.
 - Make sure the linking elements are clipped onto the H-rail and engaged in each other.
 - Make sure all module interlocks are engaged to the H-rail.
 - Make sure all terminal strip interlocks are engaged to the H-rail.
2. Check the electrical installation of the CPX-E system.
 - Check the connections of the functional earth.
 - Check the connected lines for a firm seat.
 - Check the feed of the voltage supplies.
 - Check the allocation of the sensors and actuators to the modules.

9.2 Make settings on the bus module or controller

Settings are made on the bus module or controller independently of the module using rotary and/or DIL switches.



The functions and factor settings of the rotary and DIL switches (if existent on the module) are described in the respective documentation accompanying the product.

- Make the desired settings on the bus module or controller if they deviate from the factory setting.

9.3 Functional test (without higher-order controller)

1. Switch on the power supplies ($U_{EL/SEN}$, U_{OUT}).
2. Check the behaviour of the CPX-E system:
 - LED displays
 - Connected actuators

9.4 Commissioning in network (with higher-order controller)



Note

Malfunction due to the activation of the higher-order controller and CPX-E system in the incorrect order.

- Switch on the higher-order controller and CPX-E system according to the pre-set order of the network used.



Information on commissioning can be found in the “Instructions for use” for the respective bus module → 1.1 Further applicable documents.

9.5 Parameterisation

With the aid of parameterisation, the behaviour of the CPX-E system the individual modules and channels can be adapted to each particular application. Parameterisation can be performed using suitable software from Festo or using the higher-order controller. The parameters are preset at the factory.



The possibilities of parameterisation depend on the bus module or controller used (→ Description of the respective bus module/controller). A list and description of the general parameters can be found in the “Description of the CPX-E system” → 1.1 Further applicable documents.

Parameterisation using Festo software



Suitable software for parameterisation can be found on the support portal of Festo → www.festo.com/sp. Information for the use of the software is included in the integrated help function.

Parameterisation using the higher-order controller



Information on parameterisation using the higher-order controller can be found in the description of the respective bus module or controller.

Start-up behaviour of the CPX-E system

The “System start” system parameter fundamentally influences the start-up behaviour of the CPX-E system.

- “Standard parameters” setting (presetting):

The CPX-E system starts with the factory setting.

The desired parameterisation can be established by the higher-order controller.

- “Stored parameters” setting

The CPX-E system starts with the parameters saved in the bus module.

The setting is signaled by the lighting of the “Modify” LED indicator [M]

→ 5.3 Display components.



If the “Modify” LED indicator [M] is lit continuously, the parameterization of the system is not restored automatically by the higher-level controller after a replacement.

- Before replacement, note the required parameters and re-establish them again after replacement.

10 Operation

The behaviour of the system in case of an error with the following malfunctions is dependent on the parameterisation of the higher-order controller and the setting of the system parameters “Fail safe”:

- Telegram failure

- Network interruption

Depending on the parameterisation, the electrical outputs are switched off (factory setting), switched on or retain their status.



Detailed information on the “Fail safe” can be found in the “Description of the CPX-E system” → 1.1 Further applicable documents.

11 Diagnostics and fault clearance

11.1 Diagnostics options

For the diagnosis of errors, various possibilities are available depending on the parameterisation and network protocol used:

- Internal system diagnosis
- LED indicators on the product

11.2 Internal system diagnosis



The internal system diagnosis is described in the “Description of the CPX-E system” and the module descriptions

→ 1.1 Further applicable documents.

11.3 LED indicators

Various LED indicators are available on every module for the visualisation of the statuses and errors. In the process, LED indicators specific to the system and module or network are differentiated.

i The system-specific LED indicators of the controllers and bus modules are described in this document.

LED indicators specific to the module or network are described in the documentation for the respective module.

Power System [PS] – Operating voltage supply $U_{EL/SEN}$			
LED (green)	Significance	Remedy	
Lights up	ON OFF	Voltage supply present. No error.	–
Flashes	ON OFF	Voltage supply present, but outside of the tolerance range.	• Eliminate undervoltage.
Flashes	ON OFF	The link on the bus module is missing or incomplete.	• Check the link.
Flashes	ON OFF	The internal fuse of the voltage supply has responded.	• Eliminate short circuit/overload. Depending on the parameterisation, the voltage supply is then switched on automatically again (factory setting) or it must be switched off and then on again.
Off	ON OFF	Voltage supply not present.	• Check connection of the power supply.

Fig. 15

Power Load [PL] – Load voltage supply U_{OUT}			
LED (green)	Significance	Remedy	
Lights up	ON OFF	Voltage supply present. No error.	–
Flashes	ON OFF	Voltage supply present, but outside of the tolerance range.	• Eliminate undervoltage.
Off	ON OFF	Voltage supply not present.	• Check connection of the power supply.

Fig. 16

System Failure [SF] – System failure			
LED (red) ¹⁾	Significance	Remedy	
Flashes	ON OFF	Simple error/information (error class 1)	→ Description of the CPX-E system
Flashes	ON OFF	Error (Error class 2)	
Flashes	ON OFF	Serious error (Error class 3)	
Off	ON OFF	No error	–

1) The LED indicator “System Failure” [SF] flashes depending on the error class.

Fig. 17

Modify [M] – Parameterisation modified or “Force” active.			
LED (yellow)	Significance	Remedy	
Lights up	ON OFF	System start with saved parameterisation and saved CPX expansion set; parameters and CPX expansion are saved permanently; external parameterisation is blocked ¹⁾	Caution when replacing systems with saved parameterisation. In the case of these systems, parameterisation is not carried out automatically by the higher-order controller on replacement.
Flashes	ON OFF	The Forcen function is enabled. ¹⁾	• Before replacement, note required settings and restore them after replacement, if required.
Off	ON OFF	System start with default parameterisation (factory setting) and current CPX expansion set; external parameterisation is possible (presetting).	

1) The indication of the “Forcen” function (LED flashing) has priority over indication of the setting for the system start with the saved parameterisation and saved extension (LED lights up).

Fig. 18

12 Maintenance

→ Note

Accumulation of heat due to reduced air supply to electronics.

- Keep the ventilation slots free and regularly remove contamination.

13 Conversion

13.1 Replacing the module

→ Note

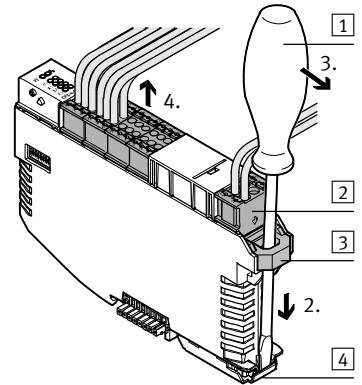
When a bus module, controller or complete system is replaced, a different parameterisation will result in deviating behaviour.

- Before replacement, check which settings are required and restore them after the replacement.

Removing the terminal strips

If a module is exchanged within the course of a conversion or repair, the conductor remains in the terminal strip and the terminal strips are removed from the module.

1. Ensure that the module is de-energised.
2. Insert the screwdriver through the recess of the terminal strip interlock and into the module interlock.
3. Pull the screwdriver in the direction of the arrow to disengage the terminal strips.
4. Remove the terminal strips.



- 1 Screwdriver
- 2 Terminal strip
- 3 Interlock of terminal strips
- 4 Interlock of module

Fig. 19

i After the terminal is disengaged, it remains in a stopped position. The terminal strips that are not removed must be pushed back in to the limit stop.

Disengaging and removing the module

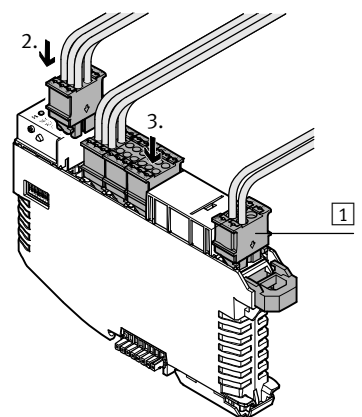
- → Fig. 11

Hanging the module into place and engaging it

- → Fig. 10

Inserting terminal strips

1. Ensure that the module is de-energised.
2. Place the terminal strips in the appropriate positions on the module.
3. Press in the terminal strips to the limit stop.



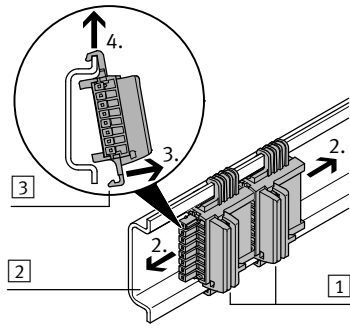
- 1 Terminal strip

Fig. 20

i To prevent connection faults, the terminal strips of the signals and terminal strips of the voltage supply have matching codes.

13.2 Replacing the linking element

1. Disengage and remove the module → Fig. 11.
2. Disconnect the linking elements by pulling them apart.
3. Release the lower lock of linking element from the H-rail.
4. Remove the linking element from the H-rail.
5. Hang the new linking element into place → Fig. 9.



- 1 Linking element
- 2 H-rail
- 3 Lower lock of linking element

Fig. 21

14 Disposal

- Dispose of the packaging and the product at the end of its useful life through environmentally friendly recycling in accordance with applicable specifications.

15 Technical data

General information

Characteristic	Specification/value
Assembly position	Vertical/horizontal
Ambient temperature [°C]	-5 ... +60 (-5 ... +50) ¹⁾
Storage temperature [°C]	-20 ... +70
Air humidity (non-condensing) [%]	0 ... 95
Max. permissible setup altitude above sea level [m]	2000
Max. number of modules per CPX-E system, including the bus module or controller	11
Address volume of the inputs/outputs [byte]	64/64 (maximum)
Degree of protection in accordance with EN 60529	IP20
Protection against electric shock (protection against direct and indirect contact to IEC 60204-1)	Through the use of PELV circuits (protected extra-low voltage)
CE marking (see declaration of conformity) → www.festo.com	To EU EMC Directive
Explosion prevention and protection (IECEX/ATEX)	→ Special documentation on ATEX
Certification certificate	RCM compliance mark
Contamination level	2
Vibration and shock resistance in accordance with EN 60068 ²⁾	
Vibration (part 2-6)	H-rail SG1
Shock (part 2 - 27)	H-rail SG1
Continuous shock (part 2-27)	H-rail SG1

- 1) In case of horizontal mounting position
- 2) Explanation of the severity level → Fig. 23 ... Fig. 25

Fig. 22

Vibration load

Frequency range [Hz]		Acceleration [m/s ²]		Deflection [mm]	
SL1	SL2	SL1	SL2	SL1	SL2
2 ... 8	2 ... 8	–	–	±3.5	±3.5
8 ... 27	8 ... 27	10	10	–	–
27 ... 58	27 ... 60	–	–	±0.15	±0.35
58 ... 160	60 ... 160	20	50	–	–
160 ... 200	160 ... 200	10	10	–	–

Fig. 23

Shock load

Acceleration [m/s ²]		Duration [ms]		Shocks per direction	
SL1	SL2	SL1	SL2	SL1	SL2
±150	±300	11	11	5	5

Fig. 24

Continuous shock load

Acceleration [m/s ²]	Duration [ms]	Shocks per direction
±150	6	1000

Fig. 25

Power supply

Characteristic	Specification/value	
Operating voltage supply U _{EL/SEN}		
Nominal operating voltage	[V DC]	24 ± 25 %
Trigger level, undervoltage identification	[V DC]	17.5
Max. current load of terminal strip	[A]	8
Mains buffering time		Module-dependent ¹⁾
Load voltage supply U _{OUT}		
Nominal operating voltage	[V DC]	24 ± 25 % ²⁾
Trigger level, undervoltage identification		Module-dependent ¹⁾
Max. current load of terminal strip	[A]	8

- 1) → Documentation of the modules
- 2) The indication of tolerance deviates in case of some modules.

Fig. 26

Connection data of the terminal strips

Key feature	Specification/value	
	4-pin	6-pin
Conductor cross-section		
Massive	[mm ²]	0.14 ... 1.5
Flexible	[mm ²]	0.14 ... 2.5
Flexible with wire end sleeve		
Without plastic sleeve	[mm ²]	0.14 ... 1.5
With plastic sleeve	[mm ²]	0.14 ... 1.5
Length of the wire end sleeve without plastic sleeve ¹⁾		
Conductor cross section 0.14 ... 1.0 mm ²	[mm]	8 ... 10
Conductor cross-section 1.5 mm ²	[mm]	8 ... 10
Length of the wire end sleeve with plastic sleeve ²⁾		
Conductor cross-section 0.14 ... 0.34 mm ²	[mm]	8 ... 10
Conductor cross-section 0.5 ... 1.0 mm ²	[mm]	8 ... 10

- 1) in accordance with DIN 46228-1
- 2) in accordance with DIN 46228-4

Fig. 27