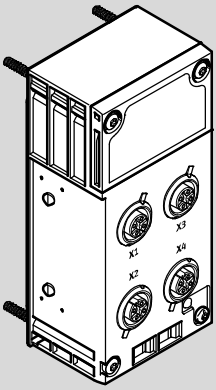
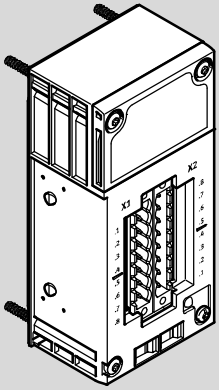
Terminal CPX-P

Input modules CPX-P-8-DE-N...





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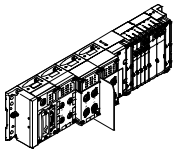
Description

Input modules
CPX-P-8DE-N...

Connection blocks
CPX-P-AB-4XM12-...
CPX-P-AB-2XKL-...



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Translation of the original instructions
P.BE-CPX-P-EA-EN

Identification of hazards and instructions on how to prevent them:

Danger
Immediate dangers which can lead to death or serious injuries

Warning
Hazards that can cause death or serious injuries

Caution
Hazards that can cause minor injuries

Other symbols:

Note
Material damage or loss of function

Recommendations, tips, references to other documentation

Essential or useful accessories

Information on environmentally sound usage

Text designations:
- Activities that may be carried out in any order

1. Activities that should be carried out in the order stated

– General lists

➔ Result of an action/References to more detailed information

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1 About this document

This description contains general basic information on the mode of operation, mounting and installation of CPX modules and CPX-P connection blocks.

For product versions with corresponding approvals and certificates (➔ Product labels) in connection with potentially explosive areas, observe the specifications in the related special documentation.

General basic information about the mode of operation, mounting, installation and commissioning of CPX terminals can be found in the CPX system description (P.BE-CPX-SYS-...).
Special information on commissioning, parameterisation and diagnostics of a CPX terminal with the bus node you are using can be found in the corresponding description for your bus node.
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...).

Conventions

The special parameters are described in the individual chapters. These appear in English on the handheld of type CPX-MMI-1.

[.....]	The data and parameters which appear in English on the Handheld are shown in square brackets in this description, e.g. [Debounce time]. Next to this in the text follows the translation, e.g.: Input debounce time [Debounce time].

2 Safety

2.1 General safety information

Note

Electronic modules include electrostatically sensitive devices. Incorrect handling can cause damage to the electronics modules.

- Observe the handling specifications for electrostatically sensitive devices.
- Discharge yourself from static discharges before assembling or disassembling modules to protect the modules.

Observe the regulations for electrical power supply to CPX terminals in the CPX system description (Protective Extra-Low Voltage, PELV).

2.2 Intended use

The CPX-P modules documented in this description have been designed for use in P variant CPX terminals from Festo.
The input module CPX-P-8DE-N can also be used in the Festo CPX terminal under the following conditions:

– When combined with interlinking blocks in metal design
– Use for **non**-intrinsically safe wiring

The CPX-P modules may only be used as follows:

– as intended
– in excellent technical condition
– in its original condition, without unauthorised modifications
– within the limits of the product defined by the technical data (➔ Technical data)
– in the process industry and in an industrial environment.

For product versions with corresponding approvals and certificates (➔ Product labels) in connection with potentially explosive areas, observe the specifications in the related special documentation (➔ www.festo.com/sp).

When conventional accessory components, such as sensors and contacts, are connected, the specified limits for torques, temperatures, electrical data, etc. must be observed.
Take into consideration the legal regulations applicable for the installation site as well as:

– Regulations and standards,
– Regulations of the testing organisations and insurers,
– National specifications.

2.2.1 Rules for product configuration

Current and comprehensive information about which components and modules are permitted for setting up Variant P CPX terminals can be found in our catalogue (➔ www.festo.com/catalogue).
Information on which components were considered in connection with certain certifications can be found in the related special documentation (➔ www.festo.com/sp).

CPX-P modules may be operated only with the CPX I/O modules and bus nodes intended for Variant P CPX terminals.

Not all available connection blocks are permitted for Variant P CPX terminals. To set up Variant P CPX terminals, select only the connection blocks approved for this product variant from our catalogue (➔ www.festo.com/catalogue).

The following CPX bus nodes and controllers with the revisions named here are required for operation of CPX-P modules:

Bus nodes/controllers	Required revision[1)]
CPX–CEC–C1–V3 (Modbus/TCP, EasyIP, TCP/IP)	From Rev 5
CPX–CEC–M1–V3 (Modbus/TCP, EasyIP, TCP/IP)	From Rev 5
CPX–CEC–S1–V3 (Modbus/TCP, EasyIP, TCP/IP)	From Rev 5
CPX–FB11 (DeviceNet)	From Rev 23
CPX–FB13 (PROFIBUS)	From Rev 28
CPX–FB14 (CANopen)	From Rev 29
CPX–FB32 (EtherNet/IP)	From Rev 18
CPX–FB33 (PROFINET IO)	From Rev 20
CPX–FB36 (EtherNet/IP)	From Rev 12
CPX–FB37 (EtherCAT)	From Rev 5
CPX–FEC[2)] (Modbus/TCP)	From Rev 21
CPX–M–FB34 (PROFINET IO)	From Rev 20
CPX–M–FB35 (PROFINET IO)	From Rev 20

1) Revision (Rev) see product label
2) Only in the remote I/O Ethernet operating mode

Tab. 1 Revisions of bus nodes/controllers

Current information about permissible components, modules and bus nodes for Variant P CPX terminals can be found in our catalogue (➔ www.festo.com/catalogue).

2.3 Foreseeable misuse

– Operation of CPX-P modules in combination with incompatible interlinking blocks (e.g. interlinking blocks in plastic version CPX-GE-EV-...) is not permitted.
– Operation of CPX-P modules in combination with pneumatic modules, CPX I/O modules and bus nodes not approved for use with CPX-P modules is not permitted (➔ www.festo.com/catalogue).
– Operation of CPX-P modules in the design for intrinsically safe circuits with connection blocks is not permitted for **non**-intrinsically safe circuits.
– Operation of CPX-P modules in the design for **non**-intrinsically safe circuits with connection blocks is not permitted for intrinsically safe circuits.

2.4 Requirements for product use

- Compare the limit values in this description with those of your application (e.g. forces, torques, temperatures, voltages, etc.).
- Take into consideration the ambient conditions at the location of use.
- Comply with the regulations of the workers' compensation trade association, the German Technical Control Board (TÜV), of the VDE or relevant national regulations.
- The material used in the packaging has been specifically chosen for its recyclability (exception: oiled paper = residual waste).
- Use the product in its original status. Unauthorised modification is not permitted.
- Before carrying out mounting, installation and maintenance work, always switch off the operating and, if applicable, load voltage supplies.

2.5 Training of skilled personnel

This description is directed exclusively to technicians trained in control and automation technology who are familiar with the installation and operation of control systems.

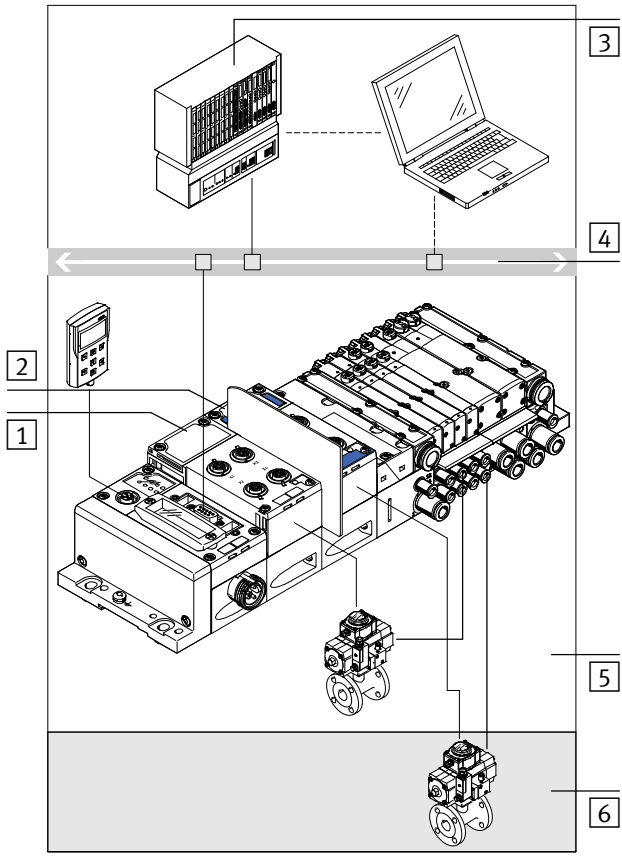
3 Service

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

4 Product overview

4.1 CPX-P modules and Variant P CPX terminals

Depending on the design, CPX-P modules are suitable for building intrinsically safe or **non**-intrinsically safe circuits. And so field devices can be operated with the Variant P CPX terminal in both safe areas and potentially explosive areas.



1 I/O module for **non**-intrinsically safe circuits
2 I/O module for intrinsically safe circuits
3 Higher-order system
4 Industrial Ethernet / bus
5 For example, not ATEX zone; permitted for **non**-intrinsically safe circuits
6 Zone 0/20 or 1/21 in accordance with ATEX; intrinsically safe circuits or equivalent ignition protection measures required

Fig. 1 Build-up of intrinsically safe and non-intrinsically safe circuits with the Variant P CPX terminal (example 1 – CPX bus node for Ethernet/IP)

Variant P CPX terminals are equipped with various electric modules and pneumatic modules (valves) on customer request.
Representations of CPX terminals in this description can therefore deviate from the equipment you use.

The electric and pneumatic side of the CPX terminal can be adapted to numerous requirements.
The electric side can be equipped with various electric CPX modules, such as CPX bus nodes, digital and analogue I/O modules, etc.

Detailed information about permitted components can be found in
➔ www.festo.com/catalogue.

4.2 Overview of CPX-P modules and CPX-P connection blocks

Type	Module identifier[1)]	Description
CPX-P-8DE-N	P8DI-N	Input module with 8 digital NAMUR inputs for **non**-intrinsically safe wiring
CPX-P-8DE-N-IS	P8DI-N	Input module with 8 digital NAMUR inputs for intrinsically safe wiring

1) In the mounted status, the module identifier and, in the ...-IS version, the blue identification is visible in the display window of the connection block (➔ Fig. 3).

Tab. 2 CPX-P modules

Type code	Manual
CPX-P-AB-4XM12-4POL	M12 connection block for non-intrinsically safe wiring of CPX-P modules[1)]
CPX-P-AB-2XKL-8POL	Terminal connection block for non-intrinsically safe wiring of CPX-P modules[1)]
CPX-P-AB-4XM12-4POL-**8DE-N-IS**	M12 connection block for intrinsically safe wiring of the input module CPX-P-8DE-N-IS[1)]
CPX-P-AB-2XKL-8POL-**8DE-N-IS**	Terminal connection block for intrinsically safe wiring of the input module CPX-P-8DE-N-IS[1)]

1) Combination rules ➔ Section 4.3

Tab. 3 CPX-P connection blocks

Additional CPX-P modules and connection blocks are planned. CPX-I/O modules that are permitted for Variant P CPX terminals can be found at ➔ www.festo.com/catalogue.

For the ...-IS version in connection with potentially explosive areas, observe the special documentation valid for your application (➔ www.festo.com/sp).

4.3 Combination of CPX-P modules and CPX-P connection blocks

The following table shows the permitted combinations of the CPX-P I/O modules with the CPX-P connection blocks.

Connection block	**CPX-P modules**	
Type code	**CPX-P-8DE-N** (8 digital NAMUR inputs – coding pin type B)	**CPX-P-8DE-N-IS** (8 digital NAMUR inputs – coding pin type A)
CPX-P-AB-4XM12-4POL[1)] (4 M12 sockets, 4-pin)	•	–
CPX-P-AB-4XM12-4POL-**8DE-N-IS** (4 M12-sockets, 4-pin, mechanically coded for type code A[2)])	–	•
CPX-P-AB-2XKL-8POL[1)] (2 x COMBICON pin headers, 8-pin)	•	–
CPX-P-AB-2XKL-8POL-**8DE-N-IS** (2 x COMBICON pin headers, 8-pin, mechanically coded for type code A[2)])	–	•
• Combinable – Not permitted (must not be combined!)		

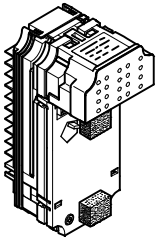
1) For CPX terminals delivered pre-assembled, coded mechanically at the factory (coding piece for coding pin of type code B)
2) Mechanically coded at the factory (coding piece for coding pin of type code A)

Tab. 4 Permissible combinations

To avoid allocation errors, CPX-P connection blocks of CPX-P terminals pre-assembled at the factory are always equipped with a coding piece and thus mechanically coded. CPX-P connection blocks and CPX-P modules for intrinsically safe circuits are also marked in blue. For further information on mechanical coding ➔ Section 5.3.

4.4 Functions of the input module CPX-P-8DE-N..

The input module CPX-P-8DE-N... provides 8 digital inputs in accordance with specification EN 60947-5-6 (NAMUR). It determines the switching status (logic 0 or logic 1) of each channel through internal current measurement in accordance with specification EN 60947-5-6. When NAMUR sensors are connected or mechanical contacts are wired, short circuits and wire fractures can be detected.

P8DI-N	Type code	Manual
	CPX-P-8DE-N	Functions: – 8 digital inputs in accordance with EN 60947-5-6 – Short circuit and wire fracture monitoring – Module characteristics can be parameterised – Channel 0 ... 3 usable as counter inputs or for frequency measurement; limit monitoring; control possible through process image (start, stop, reset)[1)] Suitable for connection of: – NAMUR sensors in accordance with EN 60947-5-6 – Switched mechanical contacts – Unswitched mechanical contacts (the diagnostic functions “monitoring of wire fracture” and “monitoring of short circuit” must be deactivated). Area of application: – Only for **non**-intrinsically safe circuits.[2)]
	CPX-P-8DE-N-**IS**	as CPX-P-8DE-N**,** but for intrinsically safe circuits[3)]

1) Only if miniature switch is in the ON position (expanded process image, ➔ Section 6.1)

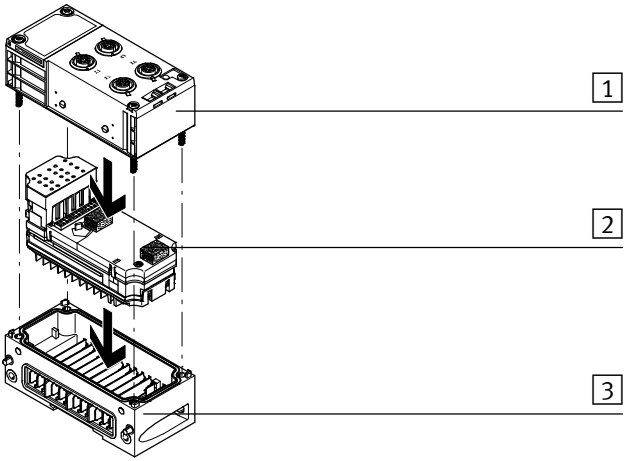
2) For non-intrinsically safe circuits (e.g. for sensors and actuators in the non-ATEX zone).

3) Design with blue identification; only for connection of suitable intrinsically safe field devices. Observe certification-specific special documentation!

Tab. 5 Input module CPX-P-8DE-N...

4.5 Construction of the CPX-P module

Electric CPX-P modules are modularly constructed and comprise the following components:



1 Connection block; here M12- connection block
2 Electronics module CPX-P-...
3 Interlinking block with contact rails; metal design

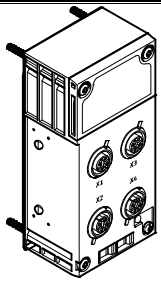
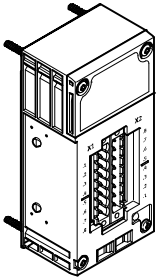
Fig. 2 Construction of the electric CPX-P modules – example

Module components	Description
Connection block	Selectable housing top part, which provides the required connections for field devices.
Electronics module	Contains the electronic components of the module. It is connected to the Manifold block and the connection block by means of electric plug connectors.
Interlinking block in metal design	Housing bottom part for electrical and mechanical linkage of the modules. The interlinking blocks carry the operating and load voltage to the adjacent modules. Certain variants offer a connection for supply of the operating and/or load voltage. In addition, interlinking blocks offer opportunities for fastening the entire CPX terminal (-P) (see CPX system description).

Tab. 6 Components of CPX-P modules

4.6 Connection blocks of the CPX-P modules

The following connection blocks are available for CPX-P modules for electrical connection of field devices:

Connection block	Type/description[1)]
	CPX-P-AB-4XM12-4POL M12 connection block: – Suitable only for non-intrinsically safe wiring (without blue identification) – 4 M12 sockets, 4-pin – Possibility of shielding through metal thread – Permits use of standard M12X1 round plug connectors and SPEEDCON M12 round plug connectors
	CPX-P-AB-4XM12- 4POL-**8DE-N-IS** like CPX-P-AB-4xM12-4pol, but: – Only combinable with CPX-P-8DE-N-IS – Only connectors in accordance with ATEX special documentation permitted – Suitable only for intrinsically safe wiring (with blue identification)[2)] – Insulating plate required[3)]
	CPX-P-AB-2XKL-8POL Terminal connection block: – Suitable only for non-intrinsically safe wiring (without blue identification) – With 2 x COMBICON pin headers, 8-pin (2 x 8-pin) – Plugs possible in spring-loaded and screw terminal design
	CPX-P-AB-2XKL- 8POL-**8DE-N-IS** like CPX-P-AB-2xKL-8pol, but: – Only combinable with CPX-P-8DE-N-IS – Only connectors in accordance with ATEX special documentation permitted – Suitable only for intrinsically safe wiring (with blue identification)[2)] – Insulating plate required[3)]

1) Technical data in detail ➔ Section 9.1

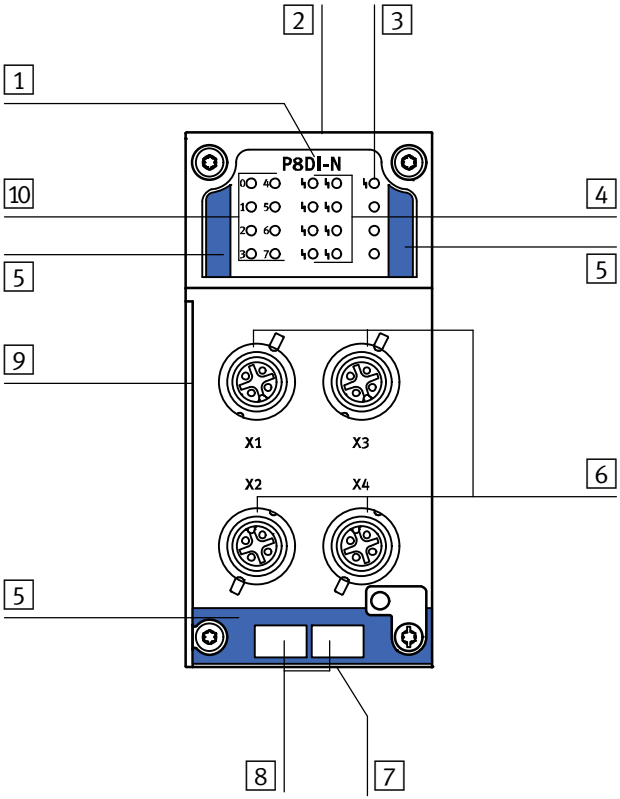
2) For building intrinsically safe circuits

3) For maintenance of the required distance (50 mm) between conducting elements of non-intrinsically safe circuits and the connection area of intrinsically safe circuits (IS) (➔ accessories)

Tab. 7 Connection equipment of the CPX-P modules

4.6.1 Display and connecting elements

For all CPX-P modules, the LEDs and the module identifier can be seen through the transparent cover of the connection block. The CPX-P modules have the following display and connecting elements:



1 Identification of the module (e.g. P8DI-N = 8 digital inputs, NAMUR – type code CPX-P-8DE-N-...)
2 Product label of the connection block
3 Module error LED (red)
4 Channel error LEDs (red)
5 Only for intrinsically safe design (-IS): blue identification
6 Electrical connections (here M12 connection)
7 Only version ...-IS: approval label
8 Inscription fields
9 Slot for insulating plate
10 Channel status LEDs (green)

Fig. 3 Display and connecting elements (example M12 connection block)

Use the inscription labels IBS 6x10 for labelling the addresses.

4.7 Product label of the CPX-P connection blocks and the CPX-P modules

Depending on the type, CPX-P modules and CPX-P connection blocks are only suitable either for building intrinsically safe or **non**-intrinsically safe circuits.
All product variants are labelled with a standard product label.
Product variants for building intrinsically safe circuits (version ...-IS) also have:
– A product label that describes the approval
– A blue colour code
– A mechanical coding with coding piece premounted at the factory.

For product versions with corresponding approvals and certificates in connection with potentially explosive areas, observe the specifications in the related special documentation.

4.8 Product-specific terms and abbreviations

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

Term/abbreviation	Significance
A	Output
ATEX zone	Potentially explosive area
Bus node	Provide the connection to specific buses. Transmit control signals to the connected modules and monitor their ability to function.
CP	Compact Performance
CPX bus	Data bus through which the CPX modules communicate with each other and are supplied with the necessary operating voltage.
CPX I/O modules	Collective term for CPX modules which provide digital inputs and outputs and can be integrated into a CPX terminal.
CPX-P modules	Collective term for modules that have been especially developed for Variant P CPX terminals.
DIL switch	Dual-in-line switches consist of several switch elements with which settings can be made.
E	Input
I-module	CPX input module
Interlinking block	Housing bottom part of a module or block for electrical linkage of the module to the terminal.
Intrinsically safe circuits	Circuits that release as little energy as possible in operation or in certain error cases under established test conditions, so ignition of a specific explosive atmosphere cannot take place.

Term/abbreviation	Significance
I/O modules	Collective term for the CPX modules which provide digital inputs and outputs (CPX input modules and CPX output modules).
I/Os	Inputs and outputs
Mechanically switched contacts	With a mechanically switched contact, a resistor is wired parallel to the contact. This avoids a wire fracture signal when the contact is open.
MPA..valve terminal	Modular valve terminal connecting plates (Variants MPA-S, MPA-F and MPA-L)
NAMUR sensors	Sensor in accordance with specifications by NAMUR (formerly Standards Working Group for Measurement and Control Technology in the chemical industry)
O module	CPX output module
PII	Process image of inputs (➔ Process image)
PIO	Process image of outputs (➔ Process image)
Pneumatic interface	The pneumatic interface is the interface between the modular electrical peripherals and the pneumatics.
Process image	The process image is part of a controller's system memory. At the start of the cyclical program, the signal states of the input modules are transferred to the process image for the inputs (PII). At the end of the cyclical program, the process image for the outputs (PIO) is transferred to the output modules as a signal status.
Variant P CPX terminal, CPX terminal (-P)	Modular electrical terminal which is particularly suitable for use in the process industry (intrinsically safe electronics modules available).

Tab. 8 Product-specific terms and abbreviations

5 Mounting

5.1 General instructions on mounting and dismounting

Note

Incorrect handling can cause damage to the electronics modules.

- Switch off the supply voltage before conducting any mounting or installation work.
- Only switch on the electrical power supply when the product has been completely assembled and all installation work is complete.

Note

Electronic modules include electrostatically sensitive devices.

- Observe the handling specifications for electrostatically sensitive devices.
- Discharge yourself from static discharges before assembling or disassembling modules to protect the modules.

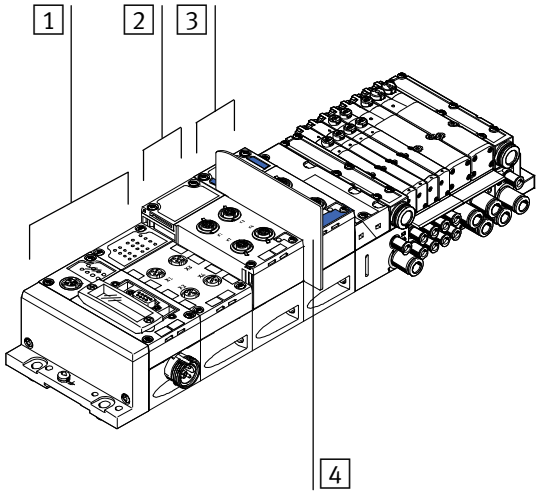
5.2 Build-up of the electric side of the CPX terminal (-P)

When building up a CPX terminal (-P), the following sequence must be complied with on the electric side (➔ Also image Fig. 4):

Sequence from left to right		Brief description	Connection area
Left end plate		Left housing end	
Module m[2]	Module block 1: Bus node or controller mounted on interlinking block1) or CPX I/O modules mounted on interlinking blocks[1] – as needed	Bus nodes, controllers and CPX I/O modules must be brought together by blocks and mounted on the left side	For **non**-intrinsically safe circuits
Module m[2]			
Module m[2]	Module block 2: CPX-P modules for **non**-intrinsically safe wiring mounted on interlinking blocks[1] – as needed	CPX-P modules for **non**-intrinsically safe wiring must be brought together by blocks and mounted directly to the right of the module block with bus node (1).	
Module m[2]			
Insulating plate[3]		Insulating plate between the connecting area of intrinsically safe and non-intrinsically safe circuits – if a connection area is present for intrinsically safe circuits	
Module m[2]	Module block 3: CPX-P modules for intrinsically safe wiring mounted on interlinking blocks[1] – as needed	CPX-P modules of the version ...-IS must be brought together on the right side by block	For intrinsically safe circuits
Module m[2]			
Right end plate or pneumatic interface		Housing end or pneumatic interface for connection with additional pneumatic modules – as needed	

1) Only interlocking blocks in metal design permitted. Interlinking blocks with additional supply can be placed only to the right of the system supply.
2) m = module number (counting mode from left to right – max. 10 modules including bus nodes)
3) To maintain the required distance in connection with potentially explosive areas

Tab. 9 Build-up of the electric side of the CPX terminal (-P)



1 Module block 1: bus nodes and CPX I/O modules (**non**-intrinsically safe wiring)
2 Module block 2: CPX-P modules for **non**-intrinsically safe wiring – here only 1 module
3 Module block 3: CPX-P modules for intrinsically safe wiring (...-IS – here only 1 module)
4 Insulating plate

Fig. 4 Arrangement of the electronics modules of a CPX terminal (-P)

– For CPX-P modules, only the metal interlinking blocks named in the technical data section are permitted (➔ Section 9.2; Mechanical characteristic values).
  Current information ➔ www.festo.com/catalogue.
– The CPX terminal (-P) supports a maximum address volume of 64 bytes of inputs and 64 bytes of outputs.

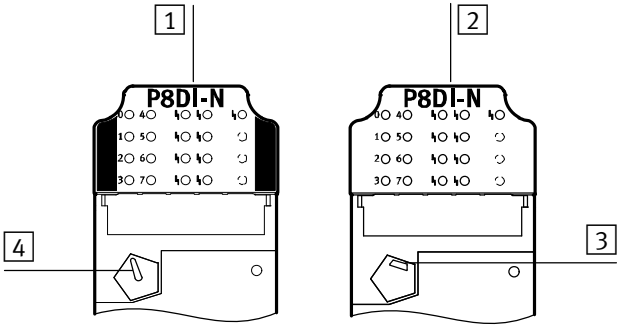
Make sure that the maximum resultant address volume is not exceeded if the product is extended. For certain bus nodes, additional limitations can apply. If applicable, consider the rules specified in the description for the bus node.

5.3 Mechanically code the connection block

Warning
Incorrect allocation of connection blocks and I/O modules during installation and maintenance work can cause severe damages in operation.
- To avoid incorrect allocations, make sure that mechanical coding of the connection blocks is correct when mounting.

Approval is cancelled in case of faulty mechanical coding.

Connection blocks and CPX-P modules are equipped with a mechanical coding system. The coding system makes it possible to mechanically code connection blocs so that, during later maintenance work, inserting a module into a different product design (for intrinsically safe or for non-intrinsically safe wiring) or into a different type of module can be avoided.
Each electronics module of type CPX-B has a permanently attached coding pin on the top. Arrangement and shape of the coding pin depend on the module type and product version.
The following table gives an overview of the possible codings:



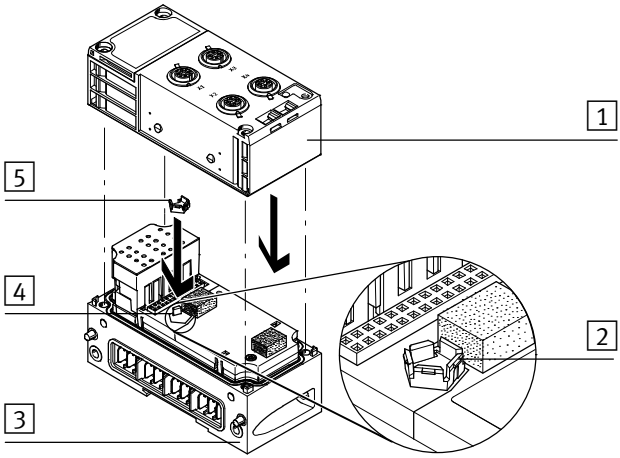
1 Input module CPX-P-8DE-N-**IS** (NAMUR) – marked blue
2 Input module CPX-P-8DE-N (NAMUR)
3 Coding pin type B
4 Coding pin type A

Fig. 5 Codings

Codings are available for connection blocks. To code a connection block, the corresponding coding piece (type A or type B) must be plugged into the bottom of the connecting block in a fixed-defined alignment (➔ Fig. 6).
CPX-P connection blocks of CPX terminals shipped pre-assembled and individually shipped CPX-P connection blocks in the design ...-IS are already mechanically coded at the factory. Individually shipped CPX-P connection blocks for non-intrinsically safe circuits can be equipped with a coding piece, if needed.

Perform mechanical coding as follows prior to initial mounting of uncoded connection blocks:

1. Make sure that no coding element is still plugged into the connection block.
2. Lay the interlinking block with electronics module (➔ Fig. 6, [3]) horizontally on a flat surface.
3. With the latching hooks facing upward, place the coding piece on the coding pin ([5]) of the electronics module ([4]) so it fits, as depicted in Fig. 6. This ensures correct orientation of the coding piece.



[1] Connection block
[2] Latching hook on coding piece
[3] Interlinking block with electronics module
[4] Coding pin on the electronics module
[5] Coding piece

Fig. 6 Mechanical coding of a connection block – example

4. Align the connection block ([1]) via the interlinking block on the electronics module. Make sure that the plug connectors of the connection block and electronics module are exactly opposite each other.
5. Push the connection block carefully and without tilting onto the electronics module until the coding piece catches in the intended cut-out on the bottom of the connection block.

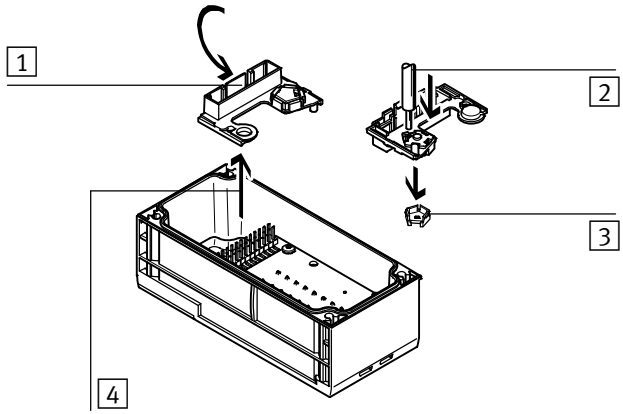
Removing coding piece from the connection block

To change the device configuration, it might be necessary to recode connection blocks for non-intrinsically safe wiring. To do this, you must first remove the corresponding coding piece from the respective connection blocks.

Removing the coding piece is not permitted in the case of connection blocks for intrinsically safe wiring, as they may only be combined with the assigned module!

To remove a coding piece from a connection block:

1. Remove cover on the bottom of the connection block. To do this, carefully unlock the locking lever (1) and pull off the cover (4).
2. Carefully press out the coding piece (3) using a suitable tool (2) – e.g. a pin.
3. Carefully put the cover back on the bottom of the connection block.



1 Locking lever
2 Tool (e.g. pin)
3 Coding piece
4 Pull off cover on the underside

Fig. 7 Remove coding piece

5.4 Mounting and dismounting of the modules and connection blocks

Note

Incorrect handling can damage the device.

- Handle all modules and components with great care. Pay particular attention to the following:
  - Correct mechanical coding of the connection blocks
  - The metal interlinking block must be clean and free of foreign matter, especially around the area of the contact rails.
  - Use only screws with metric thread.
  - Position screws exactly before tightening (otherwise their threads may be damaged). Screw in screws only by hand.
  - Compliance with the specified torques
  - Threaded fittings must be free of distortion and mechanical tension
  - Undamaged seals and threads (to ensure the specified IP degree of protection)
  - Clean contact surfaces (sealing effect, avoidance of leakage and contact errors)
- For subsequently ordered modules and components, observe the mounting instructions that come with the product.
- In case of damage to the thread, replace the interlinking block.

The screw connection between connection block and interlinking block is designed for at least 10 mounting/dismounting cycles, if the instructions are followed.

CPX terminals (-P) are supplied from the factory completely mounted. It may be necessary to fit or remove the connection blocks for the following reasons:

- Replacement of the connection equipment
- Simpler mounting of the sensor plugs or cables.

It may be necessary to dismount and mount modules for the following reasons:

- Replacement of a module
- Setting of a miniature switch (dependent on the module)
- Replacement of defective electronics modules.

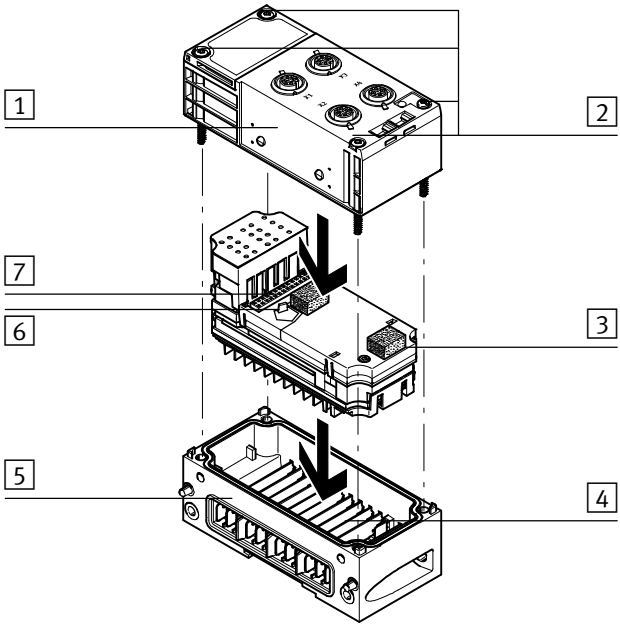
After extension or modification, the device is no longer in the status at delivery. As a result, the responsibility for conforming part status and conforming configuration passes to whomever extended, modified or operates the product.

Warning
If threads are damaged or seals are defective, the device may lose its specified IP degree of protection. Through this, the ignition protection of the device can be invalidated.
- When replacing modules, check the seal and thread of the interlinking blocks and, if damaged, replace the interlocking block.

5.4.1 Mounting

Mount the modules as follows (➔ Fig. 8):

Note
Incorrect handling can cause damage to the electronics modules.
- Switch off the supply voltage before conducting any mounting or installation work.
- Only switch on the electrical power supply when the product has been completely assembled and all installation work is complete.



1 Connection block
2 Screws (Torx PLUS)
3 Electronics module
4 Contact rails
5 Interlinking block in metal design
6 Coding pin for mechanical coding
7 Internal electrical interface

Fig. 8 Mounting of connection block and electronics module – example

Note

- Observe the notes for the combination of electronics modules and connection blocks in Section 4.3.
- When combining and arranging modules in the CPX terminal (-P), observe the construction rules in Section 5.2.

This is how you mount an electronics module:

1. Insert the electronics module in the proper position (3) into the interlinking block (4) (➔ Fig. 8).
2. Align the electronics module so that the appropriate slots with the terminals for electrical contact on the bottom of the electronics module lie directly above the contact rails.
3. Then press the electronics module (3) carefully and without tilting into the interlinking block up to the stop (4).

This is how to mount a connection block:

1. Check whether the connection block (1) is mechanically coded correctly. If necessary, perform a new mechanical coding (➔ Section 5.3).

2. Align the connection block (1) via the interlinking block (4) on the electronics module (3). Make sure that the plug connectors of the connection block and electronics module are exactly opposite each other. Then carefully press the connection block (1) onto the interlinking block without tilting.
3. Screw in the four screws only by hand. Tighten all four screws diagonally with a Torx screwdriver of size T10 – tightening torque 1 Nm ± 10 %.

The lower right screw is used internally as an earth terminal between the interlinking block and connection block.

5.4.2 Dismantling

Dismantle the connection block as follows (➔ Fig. 8):

1. Loosen the 4 screws (2) of the respective connection block or module with a Torx screwdriver of size T10.
2. Without tilting, carefully disconnect the connection block (1) from the electrical plug connector of the electronics module (3).

Only if the electronics module should be dismounted:

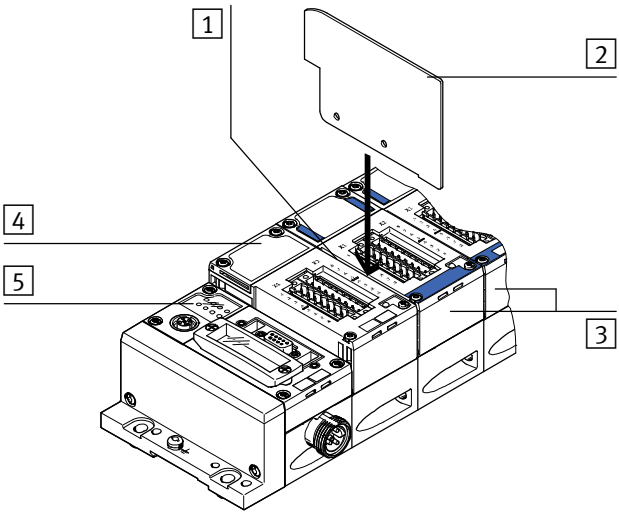
- Pull the electronics module (3) carefully and without tilting away from the contact rails of the interlinking block (4).

5.5 Mounting and dismounting the insulating plate

To safeguard intrinsic safety, an insulating plate must be used to separate the connecting areas of intrinsically safe and non-intrinsically safe circuits (➔ Tab. 9).

5.5.1 Mounting the insulating plate

- Press the insulating plate (2) in the depicted alignment (➔ Fig. 9) with light pressure into the insulating plate slot (1) until the insulating plate catches.



1 Insulating plate slot
2 Insulating plate CPX-P-AB
3 Module for intrinsically safe circuits (version -IS ; marked blue)
4 Module for **non**-intrinsically safe circuits (**without** blue identification)
5 Bus node

Fig. 9 Mounting of the insulating plate CPX-P-AB

5.5.2 Dismounting the insulating plate

To dismount the insulating plate (2), you must dismount the adjacent connection block. Proceed as described in Section 5.4.

6 Installation

Recommendation: For tension spring and screw terminal connections, take advantage of mechanical coding to avoid connection errors during later installation work (➔ Fig. 16 and Section 10).

6.1 Setting the miniature switch

Through miniature switches, the function range and address space (process image) of the module can be extended. With extended function range, the channels 0 ... 3 can be used as counter inputs or for frequency monitoring.
With extended function range, the module provides current counter readings and frequency measurements in the process image for input (PII). Therefore, 8 additional bytes are occupied in the PII. In the PIO, too, 1 additional byte is occupied. Further, additional parameterisation options are available for extended functions.

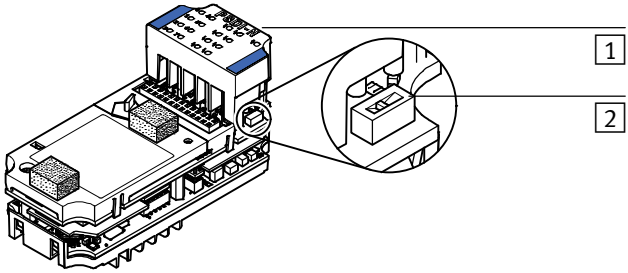
Miniature switch position		PII and PIO	Brief description
	OFF[1)]	– 2 bytes PII – 1 byte PIO	– Standard function range (8 digital inputs) – Standard process image – Standard parameters
	ON	– 10 bytes PII – 2 bytes PIO	– Extended function range for channels 0 ... 3 (counter inputs, frequency monitoring) – Extended process image (current counter readings and frequencies are depicted in the PII) – Additional parameterisation options for counter inputs and frequency monitoring

1) Factory setting (miniature switch = OFF)

Tab. 10 Miniature switch settings and size of the process image

Note
Exceeding of the maximum address range of the CPX terminal (-P) leads to configuration errors.
- Before activating the function, check the address range of the CPX terminal (-P).
- Make sure that the maximum address range of the CPX terminal (-P) of 64 bytes for inputs and 64 bytes for outputs is **not** exceeded.

The miniature switch is located on the side below the light guide of the electronics module.



[1] Light guides for LED indicator

[2] Miniature switch for setting the function range and process image

Fig. 10 Position of the miniature switch

Caution

Electronic modules include electrostatically sensitive devices. Incorrect handling can cause damage to the electronics modules. The effectiveness of internal protective measures can be so impaired that modules lose their suitability for constructing intrinsically safe circuits.

- Observe the handling specifications for electrostatically sensitive devices.
- Discharge yourself electrostatically before assembling or disassembling modules in order to protect them.

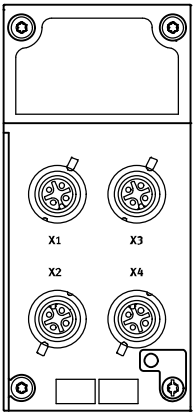
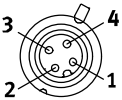
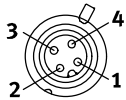
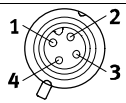
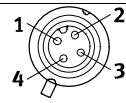
Here is how you set the miniature switch:

1. Switch off the power supplies of the CPX terminal (-P).
2. Remove the mounted connection block (➔ Section 5.4).
3. Carefully set the DIL switch as desired by using a suitable tool, e.g. a very small screwdriver (➔ Tab. 10).
4. Remount the connection block (➔ Section 5.4; pay attention to tightening torque!).

The set process image becomes effective after the power supply is switched on again.

6.2 Pin assignment CPX-P-8DE-N...

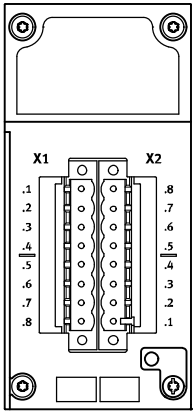
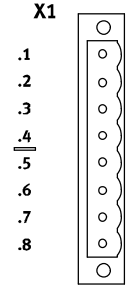
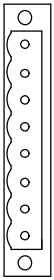
CPX-P-8DE-N.. with connection block CPX-P-AB-4xM12-4POL..

Connection block	Pin allocation X1, X2		LED	Pin allocation X3, X4		LED
		Socket X1: 1: BN+ [0] 2: BU– [0] 3: BN+ [1] 4: BU– [1] – : S[1]	0 1		Socket X3: 1: BN+ [4] 2: BU– [4] 3: BN+ [5] 4: BU– [5] – : S[1]	4 5
		Socket X2: 1: BN+ [2] 2: BU– [2] 3: BN+ [3] 4: BU– [3] – : S[1]	2 3		Socket X4: 1: BN+ [6] 2: BU– [6] 3: BN+ [7] 4: BU– [7] – : S[1]	6 7
	[...] = Channel number ([0] = channel 0, [1] = channel 1, etc.) BN+ = input + (brown) BU– = input – (blue) S = shield					

1) The shield (S) can be connected through the metal thread of the plug connector.

Tab. 11 CPX-P-8DE-N.. with connection block CPX-P-AB-4xM12x-4POL..

Use suitable push-in T-connectors or duo plug connectors (plug connectors with the possibility of connecting two cables) to be able to connect two NAMUR sensors or contacts to a socket at low cost. Please select the corresponding accessories from our catalogue (➔ www.festo.com/catalogue).

E-module CPX-P-8DE-N.. with connection block CPX-P-AB-2xKL-8POL..					
Connection block	**Pin allocation X1**		**LED**	**Pin allocation X2**		**LED**
		Terminal X1: 1: BN+ [0] 2: BU– [0] 3: BN+ [1] 4: BU– [1] 5: BN+ [2] 6: BU– [2] 7: BN+ [3] 8: BU– [3]	 0 1 2 3		Terminal X2 8: BU– [7] 7: BN+ [7] 6: BU– [6] 5: BN+ [6] 4: BU– [5] 3: BN+ [5] 2: BU– [4] 1: BN+ [4]	 7 6 5 4
[...] = Channel number ([0] = channel 0, [1] = channel 1, etc.) BN+ = Input + (brown) BU– = Input – (blue)						

Tab. 12 CPX-P-8DE-N.. with connection block CPX-P-AB-2xKL-8POL..

The respective pin numberings are attached on the terminal connection block, directly next to the connections X1 and X2. Observe that the sequence of the numbering for connection X2 is in reverse sequence (see also assigned LEDs).

Note

Notes on the line connection as well as for shield support and shield earthing can be found in Section 6.3.

6.3 Notes on the cable connection

6.3.1 I/O lines for digital signals

For wiring the field devices, select suitably screened cables – dependent on the conditions at the location of use. The possible cable length depends on various factors. Note among others:

– The cable resistance
– The transfer resistance at connection locations
– The electric characteristic values of the modules and the connected sensors.

The max. permissible sensor ling length is 200 m (at min. 0.1424 mm², resistance ‹ 50 Ω for the entire line length). Use of twisted cable pairs increases EMC resistance of the sensor cables.

6.3.2 Shield support and shield earthing

– Terminal connection block CPX-P-AB-2xKL-8POL-...
  These connection blocks have no connection for the cable screening. A shield support or earthing (potential equalisation) must be built up separately.
– M12 connection block CPX-P-AB-4xM12-4POL-...
  With these connection blocks, the metal thread can be used as a screening support if the corresponding plug connectors is used. The shield support is capacitively separated from the potential equalisation.
  If the screen should be earthed on the module side, a separate precaution must be made.

If national regulations in combination with the potential equalisation concept at the installation location permit, cable screening should be earthed on only one side.

6.3.3 Mounting and dismounting of the cable

Observe the maximum permissible number of plug cycles and mounting procedures of the components used (➔ Technical data).

– M12 connection block CPX-P-AB-4xM12-4POL-...
  To achieve protection class IP 65 for completely mounted modules with M12 connection blocks:
- Use only suitable plug connectors for the connection. The plug connectors from the Festo range of accessories are suitable (➔ www.festo.com/catalogue).
- Tighten the union nuts of the plug connectors – tightening torque 0.5 Nm.
- Seal unused bushings with protective caps of type ISK-M12 (accessories) – tightening torque ≥ 0.5 Nm.

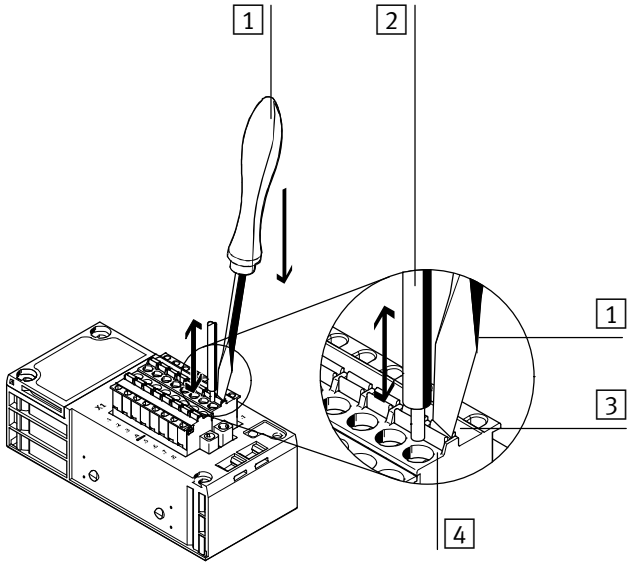
– Terminal connection block CPX-P-AB-2xKL-8POL-...
  To ensure a reliable contact with these connection blocks:
- Use only suitable terminal strips for the connection. The plug connectors and terminal strips from the Festo range of accessories are suitable (➔ www.festo.com/catalogue).
- For plug connectors in screw terminal components: Use only suitable cable end sleeves for the connection.
- Connect only one conductor per spring-loaded terminal or screw terminal.

Spring-loaded terminal NECU-L3G8-C1-...		
Conductor cross section with wire end sleeve	[mm²]	0.25 to 2.5
2 conductors of the same cross section	[mm²]	0.5 to 1.5
Strip length	[mm]	10

Tab. 13 Specifications for spring-loaded terminal

For connecting and disconnecting the conductors with spring-loaded terminal blocks:

Note
The terminal will be damaged if a screwdriver is inserted into the opening. Only insert conductors into the terminal opening.



1 Screwdriver, blade 2.5 × 0.4 mm
2 Cable
3 Unlocking
4 Terminal opening for inserting the conductors

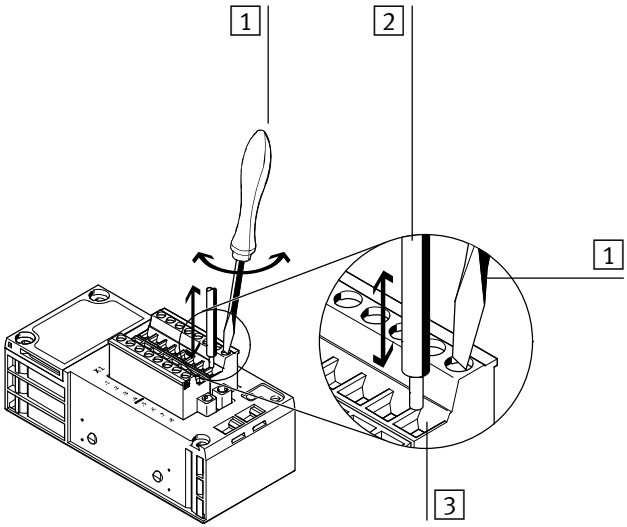
Fig. 11 Mounting and dismounting of the connection cables

1. With a screwdriver 1, hold down the unlocking pin 3 (➔ Fig. 11). This unlocks the terminal.
2. Plug the wires of the cable into the terminal opening 4 up to the stop.
3. Remove the pressure from the unlocking pin. This clamps the wires securely.

For connecting and disconnecting the conductors with screw terminal blocks:

Screw terminal NECU-L3G8-C2-...		
Conductor cross section with wire end sleeve	[mm²]	0.25 to 2.5
2 conductors of the same cross section	[mm²]	0.25 to 1.0
Strip length	[mm]	10

Tab. 14 Specifications for screw terminal



1 Screwdriver, blade 2.5 × 0.4 mm
2 Cable
3 Terminal opening for inserting the conductors

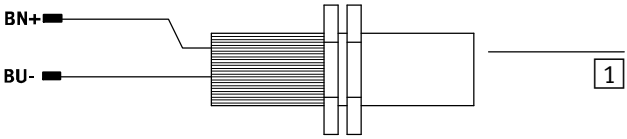
Fig. 12 Connecting and disconnecting the conductors

1. Loosen the corresponding screw terminal with a screwdriver. This unlocks the terminal.
2. With unlocked terminal, you can insert the conductor into the terminal opening or pull it out.
3. Tighten the terminal with a screwdriver – tightening torque 0.5 ... 0.6 Nm. This clamps the conductor securely.

6.4 Examples of circuits CPX-P-8DE-N..

6.4.1 Connection of NAMUR sensors

NAMUR sensors are supplied through the module and provide a logical low or high signal – dependent on the sensor's switching status. A possible wire fracture or short circuit is detected through an internal current measurement. A corresponding error message is generated, dependent on the parameterisation.

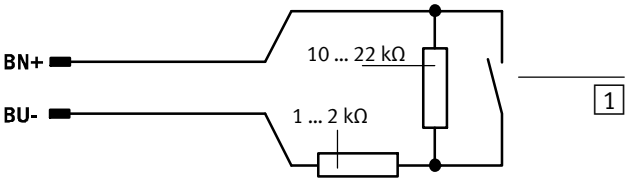


[1] NAMUR sensor

Fig. 13 Connection of NAMUR sensors

6.4.2 Connection of switched mechanical contacts

Switched mechanical contacts likewise permit monitoring of wire fractures and short circuits. The two resistors cause the current to be in the valid work range in both switching statuses.



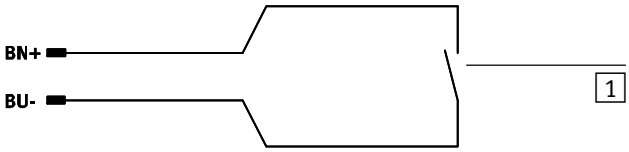
[1] Switched mechanical contact

Fig. 14 Connection of switched mechanical contacts

6.4.3 Connection of unswitched mechanical contacts

During connection of unswitched mechanical contacts, monitoring of wire fractures and short circuits is not possible. With active wire fracture and short circuit monitoring, an open contact is identified as a wire fracture and a closed contact as a short circuit.
If you use unswitched mechanical contacts:

- Deactivate short-circuit and wire-fracture monitoring of the respective channels (➔ Tab. 32 and Tab. 33).



1 Unswitched mechanical contact
Fig. 15 Connection of unswitched mechanical contacts

6.5 Mechanical coding system for terminal connection

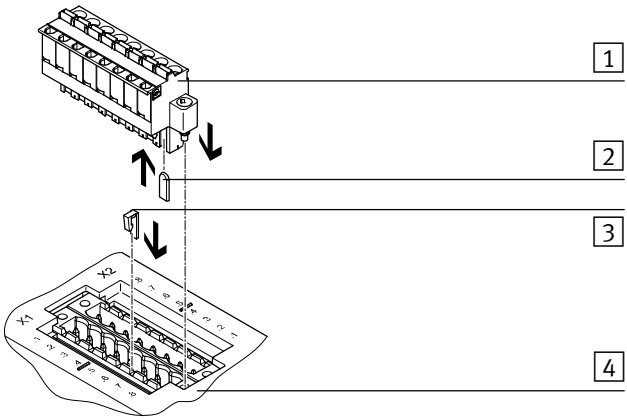
To make connection errors more difficult during later installation and maintenance work, you can mechanically code the terminal plugs with the help of a coding system.

Note
Despite mechanical coding, it is still possible to plug them in incorrectly with improper handling.

- Identify connections and cables of the device (colour identifications and inscriptions) to prevent mixing up connections, in particular of intrinsically safe circuits.

The coding system is optionally available (➔ www.festo.com/catalogue).

The coding system consists of coding tabs and coding profiles. For each contact, you can:
– Plug a coding profile into the slot of the plug-in block and
– A coding tab into the recess on the box header.
If two coding elements come together at a contact point, the plug connector is mechanically prevented from being inserted at this point.



1 Plug-in block
2 Coding profile
3 Coding tab
4 Box header

Fig. 16 Plugging in a coding tab and a coding profile

Contacts that are not equipped with a coding element (coding profile or coding tab) do **not** contribute to plug-in security.

Recommendation: Equip all contact points with a coding element – either a coding profile in the plug-in block or a coding tab in the box header. As a result, you increase security against mixing them up.
A suitable approach for coding can be found in Section 10.

7 Commissioning

The function range of the module and the size of the process image inputs (PII) is dependent on the setting of the miniature switch (➔ Tab. 10).

7.1 Processing of the I/O signals – standard process image

If the miniature switch of the module is set to OFF, the module provides 8 digital inputs.

Operating mode (input function)		Supported by channel	Brief description
A	Digital input (NAMUR)	0 ... 7	Digital value of the input status

Tab. 15 Operating mode – standard process image (miniature switch = OFF)

7.1.1 Configuration of process image inputs (PII)

PII Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Description
0	State[1]: For operating mode digital input (A) – channel 0 ... 7 (CH0 ... 7)								
	CH7	CH6	CH5	CH4	CH3	CH2	CH1	CH0	– 0-/1 signal in accordance with characteristic curve; – In the diagnostic case: replacement value[2]
1	Diag.[1]: Diagnostic status – channel 0 ... 7 (CH0 ... 7)								
	CH7	CH6	CH5	CH4	CH3	CH2	CH1	CH0	0: Input signal in the operating area 1: Channel error[3]

1) Display text for process value representation on the handheld [monitoring/forcing (M)]

2) Replacement value in accordance with parameterisation (➔ Tab. 38 and Tab. 39)

3) Short circuit or wire fracture

Tab. 16 Process image of inputs (PII) – standard-process image

Byte 0 in the PII

The signal statuses (0/1) of the digitalised input signals are represented in byte 0 (➔ Tab. 16). In case of short circuit or wire fracture, the parameterised replacement value is output (➔ Tab. 38 and Tab. 39).

Byte 1 in the PII

In byte 1 of the PII, the module represents the diagnostic status of the 8 input channels (➔ Tab. 16). A logic 1 signal specifies that there is a channel error (short circuit or wire fracture) at the corresponding input. With a logic 0 signal, the input signal is in a signal range permissible for NAMUR sensors.

7.1.2 Configuration of process image outputs (PIO)

The process image outputs (PIO) has 1 byte. In the standard process image, this area is reserved for future extensions.

PIO Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Description
0	For operating mode digital input channel (A) – channel 0 ... 7 (CH0 ... 7)								
	–	–	–	–	–	–	–	–	– Reserved

Tab. 17 Process image of outputs (PIO) – standard process image

7.2 Processing of the I/O signals – extended process image

If the miniature switch of the module is set to ON, the module provides four operating modes for processing the input signals. The desired operating mode can be set through parameterisation for each input separately if the corresponding input supports the operating mode.

Operating mode (input function)		Supported by channel	Brief description
A	Digital input (NAMUR)	0 ... 7	Digital value of the input status
B	Counter	0 ... 3	Possible are upward and decremental counters that count rising or trailing edges of the input signal (➔ Section 7.3.2).[1)] Depending on the counter type, counting begins at the lower or upper limit value and continues until the end of the counting range. When the relevant limit value is reached, a bit is set in the PII (limit value reached).
C	Frequency measurement up to 1 kHz	0 ... 3	Pulses of the digitalised input signal are counted within a parameterised gate time (➔ Section 7.3.3). The frequency is calculated at the end of the gate time. If the lower limit value (LLV) is dropped below or the upper limit value (ULV) is exceeded, a bit is set in the PII (limit value fallen below / exceeded).[1)]
D	Frequency measurement up to 10 kHz	0	Only possible for input channel 0: Like operating mode C, but with a frequency range up to 10 kHz[1)]

1) Current counter readings and frequencies can be represented in the process image inputs (PII) (➔ Tab. 19).

Tab. 18 Possible operating modes – extended process image (miniature switch = ON)

The inputs 4 ... 7 can be used solely as digital inputs. The inputs 0 ...3 also support the counter operating mode and the frequency measurement operating mode, whereby only the input 0 supports the frequency measurement up to 10 kHz (➔ Operating mode D in Tab. 18).

7.2.1 Configuration of process image inputs (PII)

Byte 0 in the PII
For inputs that are configured as digital inputs, the signal statuses (0/1) of the digitalised input signals are represented in byte 0.
For inputs that work in the counter or frequency measurement operating mode, the alarm signals (e.g. limit value reached or limit value fallen below/exceeded) are represented in byte 0 (➔ Tab. 19).
In case of short circuit or wire fracture, the parameterised replacement value is output (➔ Tab. 38 and Tab. 39).

Byte 1 in the PII
In byte 1 of the PII, the module represents the diagnostic status of the 8 input channels (➔ Tab. 19).
A logic 1 signal specifies that there is a channel error (short circuit or wire fracture) at the corresponding input. In the “counter” operating mode, a 1 signal also specified a detected undervoltage less than or equal to 20 ms. The diagnostics are taken back only through new parameterisation or resetting of the respective counter. This should ensure that the user checks and evaluates the validity of the counter value.
With a logic 0 signal, the input signal is in a signal range permissible for NAMUR sensors.

Byte 2 to 9 in the PII
If the miniature switch of the module is set to ON, bytes 2 to 9 in the PII represent the current counter readings or frequency measurement values. Two bytes in the PII are occupied per counter or frequency measurement value (➔ Tab. 19).
In configuration, these two bytes (low byte, high byte) are combined in the control system into one word (16 bit). The position of low byte and high byte must be arrayed differently for different control systems.

Some CPX bus nodes offer a parameter through which the process value representation can be set globally for analogue values (➔ Description for the bus node, analogue process value representation parameter).

- Set the parameter corresponding to the operating method of the control system used (➔ Description for the bus node).

You can find further information on configuration and address allocation in the description for the bus node. Further information on counters and on frequency measurement can be found in Section 7.3.2 and 7.3.3.

PII Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Description
0	State[1]: For operating mode digital input (A) – channel 0 ... 7 (CH0 ... 7)								
	CH7	CH6	CH5	CH4	CH3	CH2	CH1	CH0	– 0-/1 signal in accordance with characteristic curve; – In the diagnostic case: replacement value[2]
	State[1]: For operating mode counter (B) – only channel 0 ... 3 (CH0 ... 3)								
	–				CH3	CH2	CH1	CH0	– 0: Limit value not reached – 1: Limit value reached – In the diagnostic case: replacement value[2]
	State[1]: For frequency measurement (C) – only channel 0 ... 3 (CH0 ... 3); (D) – only channel 0								
	–				CH3	CH2	CH1	CH0	– 0: Frequency (f) in the permissible range (lower limit ≤ f ≤ upper limit) – 1: Limit value fallen below / exceeded – In the diagnostic case: replacement value[2]
1	Diag.[1]: Diagnostic status – channel 0 ... 7 (CH0 ... 7)								
	CH7	CH6	CH5	CH4	CH3	CH2	CH1	CH0	0: Input signal in the operating area 1: Channel error[3]
2 3	CH0[1]: channel 0; byte 0 CH0[1]: channel 0; byte 1								Counter reading or frequency value (in Hz)[4]
4 5	CH0[1]: channel 0; byte 0 CH0[1]: channel 0; byte 1								Counter reading or frequency value (in Hz)[4]
6 7	CH0[1]: channel 0; byte 0 CH0[1]: channel 0; byte 1								Counter reading or frequency value (in Hz)[4]
8 9	CH0[1]: channel 0; byte 0 CH0[1]: channel 0; byte 1								Counter reading or frequency value (in Hz)[4]

1) Display text for process value representation on the handheld [monitoring/forcing (M)]

2) Replacement value in accordance with parameterisation (➔ Tab. 38 and Tab. 39)

3) Short circuit, wire fracture; for the counter function, also undervoltage

4) Byte 0 = low byte; byte 1 = high byte; process value representation can be parameterised through CPX bus node, if necessary (➔ Description of CPX bus node)

Tab. 19 Process image of inputs (PII) – extended process image

7.2.2 Configuration of process image outputs (PIO)

The process image outputs (PIO) has 2 bytes. Through byte 0, the respective counter or frequency measurement of the designated channel (CH..) can be activated or deactivated. For the input operating mode digital input (A), the output byte has no meaning. Byte 1 is reserved.

PIO Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Description
0	Control[1]: For operating mode digital input channel (A) – channel 0 ... 7 (CH0 ... 7)								
	–	–	–	–	–	–	–	–	– Reserved
	Control[1]: For operating mode counter (B) – only channel 0 ... 3 (CH0 ... 3)								
	CH3 Reset	CH3 Start/ stop	CH2 Reset	CH2 Start/ stop	CH1 Reset	CH1 Start/ stop	CH0 Reset	CH0 Start/ stop	Bit Start/stop – 0: Stop counter – 1: Start counter Bit Reset – 0: Counter active – 1: Counter passive/ reset[2]
	Control[1]: For frequency measurement (C) – only channel 0 ... 3 (CH0 ... 3); (D) – only channel 0								
	–	CH3 Start/ stop	–	CH2 Start/ stop	–	CH1 Start/ stop	–	CH0 Start/ stop	– 0: Switch off frequency measurement[3] – 1: Switch on frequency measurement
1	–	–	–	–	–	–	–	–	– Reserved

1) Display text for process value representation on the handheld [monitoring/forcing (M)]
2) Counter reading is set to the lower limit value for upward counters and to the upper limit value for decremental counters and held until the Reset bit is reset to 0 (➔ Section 7.3.2)
3) The current value is set to 0 (➔ Section 7.3.3).

Tab. 20 Process image of outputs (PIO) – extended process image

7.3 Selection of the operating mode

If the miniature switch (➔ Section 6.1) of the module is set to OFF, the module provides all 8 channels as digital inputs. in accordance with EN 60947-5-6 (operating mode A).
If the miniature switches are set to ON, the desired operating mode must be activated by parameterisation for the input channels 0 ... 3 (➔ Tab. 30).
The input channels 4 ... 7 can be used solely as digital inputs – independent of the setting of the miniature switch.

7.3.1 Operating mode A – digital input

Certain parameter changes cause initialisation of the respective channel. (➔ Section 7.4.1).
In the digital input operating mode, the present signal in accordance with specification EN 60947-5-6 (NAMUR) is converted into a digital signal (0/1) and stored in the corresponding bit in byte 0 of the PII.
In case of error (e.g. short circuit, overload, wire fracture), the last valid value or the parameterised replacement value is valid, depending on the parameterisation (Tab. 38 and Tab. 39).
Through parameterisation, a signal extension time (➔ Tab. 34 and Tab. 35) as well as an input debounce time (➔ Tab. 36 and Tab. 37) can be activated.

Detailed information on the operating method of the signal extension time parameters and debounce time can be found in the CPX system description. But for CPX-P-8DE-N-..., these parameters are channel-specific and influence the behaviour of an individual channel.

7.3.2 Operating mode B – counter

Depending on the parameterisation, counters count rising or trailing edges of the digitalised input signal upward or downward.

Certain parameter changes cause initialisation of the respective channel. Counters are reset to the start value (lower or upper limit value) (➔ Section 7.4.1).

Channel	Counter characteristics
0 ... 3	Control options – Start, stop, reset through byte 0 of the PIO – Current counter reading in byte 2 ...9 of the PII[1)] – Alarm signal in byte 0 of the PII Parameterisable characteristics: – Limit values within the value range freely selectable – Upward or decremental counters – Counting of trailing or rising signal edges[2)] – Input debounce times are taken into account[2)] (signal extension time is ignored) – Diagnostic reaction when the limit value is reached can be influenced Maximum values: – Max. counting rate: 1250 Hz – Min. impulse length: 400 µs – Min. signal pause: 400 µs – Max. counting range: -32768 to 32767

1) Only for extended process image (➔ Tab. 20)

2) The edges of the debounced signal are counted. The debounce time limits the max. counting rate. At 3 ms debounce time, this is, for example, approx. 166 Hz.

Tab. 21 Counter characteristics (operating mode B)

The “counter input” operating mode is set through the parameter “operating mode of the input channel” (➔ Tab. 30). Control of the counter (start, stop, reset) takes place through the process image of outputs (➔ Tab. 20).

The limit values of the counter are set by parameterisation within the value range are set freely (➔ Tab. 42 and Tab. 43). The corresponding bit in byte 0 of the PII provides the alarm signal (limit value reached/not reached). The current counter reading is represented in the PII (byte 2 ... 9) (➔ Section 6.1).

Counter inputs can be configured as upward or decremental counters with the help of the counter configuration parameter. In addition, the edge polarity can be established (➔ Tab. 40).

Upward counter

For upward counters, counting begins at the parameterised **lower** limit value and continues upward maximally until the upper end of the counting range (32767).

When the parameterised **upper** limit value is reached, the bit assigned to the related channel in byte 0 of the PII is set.

When the counting range limit is reached, the counter is stopped (maximum value = stop value).

Counter value	Upward counter
Lower limit value (example)	0
	
Upper limit value (example)	10000[1)]
	
End of the counting range	32767[2)]

1) When the upper limit value is reached, the corresponding bit in byte 0 of the PII is set (➔ Tab. 19).

2) Upper end of the counting range (maximum value = stop value)

Tab. 22 Operating method of an upward counters

Decremental counter

For decremental counters, counting begins at the parameterised **upper** limit value and continues downward until the lower end of the counting range (-32768).

When the parameterised **lower** limit value is reached, the bit assigned to the related channel in byte 0 of the PII is set.

When the counting range limit is reached, the counter is stopped (minimum value = stop value).

Counter value	Decremental counter
Upper limit value (example)	10000
	
Lower limit value (example)	0[1)]
	
End of the counting range	-32768[2)]

1) When the lower limit value is reached, the corresponding bit in byte 0 of the PII is set (➔ Tab. 19).

2) Lower end of the counting range (minimum value = stop value)

Tab. 23 Possible operating methods of a counter

Steps	Description	Status
1. Reset start/stop bit in the PIO	Stop current function to avoid undefined statuses	Counter is stopped
2. Parameterise counter	• Establish limit values (➔ Tab. 42 and Tab. 43) • Set counter type (upward/decremental counter) and edge polarity (➔ Tab. 40) • Select input operating mode “counter” (➔ Tab. 30)	Input channel is initialised automatically (➔ Section 7.4.1): – Limit values are loaded – Counter is stopped – Signal bit for limit value = 0 – Status LED is not illuminated (off)
3. Use counter • Start counter	• Set start/stop bit in the PIO (start/stop = 1)	– Signal edges are counted until the stop value is reached. – Status LED flashes (2 Hz)[1)] – When the limit value is reached, bit in byte 0 of the PII is set
• Stop counter	• Reset start/stop bit in the PIO (start/stop = 0)	– Input signal edges are no longer counted. – Counter remains at the current value. – Status LED is off
• Reset counter	• Reset signal via the PIO: a) Reset bit = 1 (min. 1 cycle) b) Bit reset = 0	– Limit value is loaded – Signal bit for limit value = 0 – Counter remains in the current status (started or stopped) – Status LED is not illuminated (off)
– Counter value reaches end of the counting range (stop value)	– Counter value = stop value	Counter is stopped (restart through reset and start via PIO) – Signal bit for limit value = 1 – Status LED illuminated

1) Status LED flashes as long as the counter is active and the stop value has not been reached yet.

Tab. 24 Approach with meters

7.3.3 Operating mode C, D – Frequency measurement

With frequency measurement, rising edges of the digitalised signal are counted within a parameterised gate time and then the frequency is calculated (f = n/t). When the set limit values are exceeded or fallen below, the bit assigned to the related channel in byte 0 of the PII is set (➔ Tab. 19).

Certain parameter changes cause initialisation of the respective channel. The ongoing frequency measurement is then stopped (➔ Section 7.4.1).

Channel	Measure frequency
0 ... 3	Control options – Start and stop through byte 0 of the PIO – Current frequency in byte 2 ... 9 of the PII[1)] – Alarm signal in byte 0 of the PII Parameterisable characteristics: – Gate time – Lower and upper limit value – Input debounce times[2)] (Signal extension times are ignored) – Diagnostic reaction when limit values are reached Maximum values of the operating mode C: – Max. signal frequency (f_{max}): 1250 Hz – Min. impulse length: 400 µs – Min. signal pause: 400 µs – Value range of lower limit value: 0 ... 999 – Value range of upper limit value: 1 ... 1000 Maximum values of the operating mode – only channel 0: – Max. signal frequency (f_{max}): 12500 Hz – Min. impulse length: 40 µs – Min. signal pause: 40 µs – Value range of lower limit value: 0 ... 9999 – Value range of upper limit value: 1 ... 10000

1) Only for extended process image (➔ Tab. 20)

2) Only effective in operating mode C: The edges of the debounced signal are counted. The debounce time limits the max. measurable frequency. At 3 ms debounce time, this is, for example, approx. 166 Hz.

Tab. 25 Frequency measurement (operating mode C and D)

The “frequency measurement” operating mode is set through the parameter “operating mode of the input channel” (➔ Tab. 30). Through the outputs process image (➔ Tab. 20), the frequency measurement can be switched on and off.

The frequency measured in the last gate period is represented in the PII (byte 2 ... 9). The update always takes place at the end of the respective gate period. The length of the gate time thus determines the resolu-

tion accuracy of the frequency measurement and the speed of the measurement value update (➔ Tab. 41).
Information on resolution accuracy ➔ Technical data.
The corresponding bit in byte 0 of the PII provides the alarm signal (frequency in the permissible range or limit value fallen below/exceeded).

Hysteresis for alarms
To prevent undesired toggling of the alarm bit, it is only reset if the following measurement shows a difference of at least 2 signal edges. For example, with a gate time of 10 ms, this corresponds to a difference of 200 Hz (difference of 2 signal edges within the gate time of 10 ms).
For the limit values, the following apply:
– Lower limit value (LLV) ‹ upper limit value (ULV)
– Difference between LLV and ULV: › $2/T_{Gate}$

Gate time [ms]	Difference between LLV and ULV [Hz]
10	≥ 200
100	≥ 20
1000	≥ 2
5000	≥ 2

Tab. 26 Required difference between LLV and ULV

Steps	Description	Status
1. Reset start/stop bit in the PIO	• Stop current function to avoid undefined statuses	Frequency measurement is stopped
2. Parameterise frequency measurement	• Set lower and upper cut-off frequency (➔ Tab. 42 and Tab. 43) • Set gate time for frequency measurement (➔ Tab. 41) • Select “frequency measurement” input operating mode (➔ Tab. 30)	Input channel is initialised automatically (➔ Section 7.4.1): – Current frequency value = 0 – Signal bit for limit value = 0 – Status LED is off
3. Measure frequency • Start frequency measurement	• Set start/stop bit in the PIO (start/stop = 1)	– Signal edges are calculated within the gate time, and the frequency is calculated at the end of the gate time ($f = n/t$).
– Frequency within area		– Signal bit for “limit value fallen below/exceeded” = 0 – Status LED flashes (2 Hz) [1)]
– Frequency outside area		– Signal bit for “limit value fallen below/exceeded” = 1 – Status LED flashes and error LED illuminated – Frequency value in the PII remains stopped at the last value
• Stop frequency measurement	• Reset start/stop bit in the PIO (start/stop = 0)	– Signal edges are no longer counted. – Frequency value in the PII = 0 – Status LED is off

Tab. 27 Procedure for frequency measurement

7.4 Module parameters CPX-P-8DE-N..

Overview of module parameters CPX-P-8DE-N..

Function number[1)]	bit	Module parameters		Default
4828 + m * 64 + **0**	0 ... 6	Reserved		–
	7	Monitoring of parameters		Active
4828 + m * 64 + **1 ... 5**	0 ... 7	reserved		–
4828 + m * 64 + **6**	0 ... 7	Operating mode input channel 0 ... 3	2)3)	Digital input
4828 + m * 64 + **7**	0 ... 3	Monitoring of limit values	3)	Inactive
4828 + m * 64 + **8**	0 ... 7	Monitoring of short circuit	2)	Active
4828 + m * 64 + **9**	0 ... 7	Monitoring of wire break	2)	Inactive
4828 + m * 64 + **10**	0 ... 7	Signal extension time channel 0 ... 3	2)	Inactive
4828 + m * 64 + **11**	0 ... 7	Signal extension time channel 4 ... 7	2)	
4828 + m * 64 + **12**	0 ... 7	Input debounce time channel 0 ... 3	2)	3 ms
4828 + m * 64 + **13**	0 ... 7	Input debounce time channel 4 ... 7	2)	
4828 + m * 64 + **14**	0 ... 7	Replacement value channel 0 ... 3	2)	0
4828 + m * 64 + **15**		Replacement value channel 4 ... 7	2)	
4828 + m * 64 + **16**	0 ... 7	Counter configuration (channel 0 ... 3)	2)3)	Positive edge; Count upwards
4828 + m * 64 + **17**	0 ... 7	Gate time	2)3)	1000 ms
4828 + m * 64 + **18 ... 25**	0 ... 7	Lower limit value	2)3)	0
4828 + m * 64 + **26 ... 33**	0 ... 7	Upper limit value	2)3)	1000
- [4)]	0 ... 7	Fail safe channel x		–
- [4)]	0 ... 7	Idle mode channel x		–
- [4)]	0 ... 7	Force channel x		–

1) m = module number (counting mode from left to right, beginning with 0)
2) Changing the parameter causes the respective channel to be initialised again.
3) This parameter is available only in the extended process image (miniature switch = ON).
4) Access is protocol-specific (➔ Description of bus node)

Tab. 28 Overview – module parameters CPX-P-8DE-N..

7.4.1 Notes on avoiding parameterisation errors

Note
Observe that changes of certain parameters can have undesired effects on signal statuses, function statuses and diagnostic statuses.

Changing certain parameters causes initialisation of the respective channel (➔ Tab. 28). During the initialisation phase, signal statuses in the PII of the respective channel **cannot** be evaluated meaningfully!

Initialisation of a channel causes the following:

– The signal bit for limit value monitoring (➔ byte 0, PII), debounce time and signal extension time of the channel are reset.
– If the channel is working in the frequency measurement operating mode or in the counter operating mode, the following apply:
  – Counters are set to the relevant limit value (lower limit value for upward counters, upper limit value for decremental counters)
  – Frequency measurement values are reset.

In connection with the counter and frequency measurement operating modes, the function should be stopped before parameterisation by resetting the respective start/stop bit in the PIO. This avoids undefined statuses during parameterisation.
Perform parameterisation in the following sequence:
1. Stop counter and frequency measurement via PIO.
2. Carry out parameterisation. Initialisation of the channel takes place automatically.
3. If no error is reported, the respective function can be used with the loaded parameters (start, stop and reset, if necessary).

With invalid parameters, the values valid until then remain effective.

7.4.2 CPX module parameters of the e-module CPX-P-8DE-N in detail

Module parameter: Monitoring of parameters		**Handheld**
Function no.	4828 + m * 64 + **0** m = module number (0 ... 47)	
Description	Sets the diagnostic reaction that should take place when implausible parameters are detected. The following are checked: – Operating mode permitted for the channel? – Upper limit value permitted for the channel? – Lower limit value ‹ upper limit value? – For operating mode C, D: difference between LLV and ULV: › $2/T_{Gate}$ With active monitoring, a diagnostic message is sent to the bus node and the channel error LED is illuminated if an error occurs.	
Bit	Monitoring of parameters Bit 0 ... 6: Reserved Bit 7: Monitoring of parameters	[Monitor parameters]
Values	0 = Inactive 1 = Active (presetting)	[Inactive] [Active]
Comment	Implausible parameters are faulty and thus invalid. With invalid parameters, the parameters valid until then remain effective.	

Tab. 29 Monitoring of parameters

Module parameter: Operating mode of the input channel		**Handheld**
This parameter is available only in the extended process image (miniature switch = ON).		
Function no.	4828 + m * 64 + **6** m = module number (0 ... 47)	
Description	Sets the operating mode for the first 4 input channels (0 ... 3) of the module. – Operating mode A: digital input – Operating mode B: counter – Operating mode C: frequency measurement up to 1 kHz – Operating mode D: frequency measurement up to 10 kHz (only possible for channel 0) Changing the parameter causes an initialisation of the respective channel.	
Bit	Operating mode of the input channel (input function) Bit: 1, 0 Channel 0 3, 2 Duct 1 5, 4 Duct 2 7, 6 Duct 3	[Input function] [Ch 0] [Ch 1] [Ch 2] [Ch 3]
Values	0 0 Digital input (A) (presetting) 0 1 Counter input (B) 1 0 Frequency measurement up to 1 kHz (C) 1 1 Only channel 0: frequency measurement up to 10 kHz (D)	[Digital input] [Counter] [Frequency 1 kHz] [Frequency 10 kHz]
Comment	Current counter values and frequencies are represented in the PII (byte 2 ... 9). The inputs 4 ... 7 can be used solely as digital inputs in accordance with specification EN 60947-5-6 (NAMUR).	

Tab. 30 Operating mode of the input channel (channel-specific, channel 0 ... 3)

Module parameter: Monitoring of limit values		**Handheld**
This parameter is available only in the extended process image (miniature switch = ON).		
Function no.	4828 + m * 64 + **7** m = module number (0 ... 47)	
Description	Sets the diagnostic reaction when limit values are reached (operating mode B) or fallen below/exceeded (operating mode C, D). With active monitoring, a diagnostic message is sent to the bus node and the channel error LED is illuminated in the corresponding case.	
Bit	Monitoring of limit values channel 0 ... 3 Bit 0: channel 0 Bit 1: channel 1 Bit 2: channel 2 Bit 3: channel 3 Bit 4 .. 7: reserved (0)	[Monitor limits] [Ch 0] [Ch 1] [Ch 2] [Ch 3]
Values	0 = Inactive (presetting) 1 = Active	[Inactive] [Active]
Comment	Reaching of the limit value (operating mode B) or falling below/exceeding the limit value (operating mode C, D) is signaled in the PII (➔ Tab. 19).	

Tab. 31 Monitoring of limit values (channel-specific, channel 0 ... 3)

Module parameter: Monitoring of short-circuits		**Handheld**
Function no.	4828 + m * 64 + **8** m = module number (0 ... 47)	
Description	Sets the diagnostic reaction in case of short circuit. With active monitoring and occurrence of a short circuit, a diagnostic message is sent to the bus node and the error LED of the corresponding channel is illuminated. Changing the parameter causes an initialisation of the respective channel.	
Bit	Monitoring of short circuit Bit 0: channel 0 Bit 1: channel 1 ... Bit 7: channel 7	[Monitor short circuit] [Ch 0] [Ch 1] ... [Ch 7]
Values	0 = Inactive 1 = Active (presetting)	[Inactive] [Active]
Comment	Signal behaviour in case of a short circuit is set with the parameter “replacement value” (➔ Tab. 38 and Tab. 39).	

Tab. 32 Monitoring of short circuit (channel-specific)

Module parameter: Monitoring of wire fracture		**Handheld**
Function no.	4828 + m * 64 + **9** m = module number (0 ... 47)	
Description	Sets the diagnostic reaction in case of a wire fracture. With active monitoring and occurrence of a wire fracture circuit, a diagnostic message is sent to the bus node and the error LED of the corresponding channel flashes. Changing the parameter causes an initialisation of the respective channel.	
Bit	Monitoring of wire break Bit 0: channel 0 Bit 1: channel 1 ... Bit 7: channel 7	[Monitor open circuit] [Ch 0] [Ch 1] ... [Ch 7]
Values	0 = Inactive (presetting) 1 = Active	[Inactive] [Active]
Comment	Signal behaviour in case of a wire fracture is set with the parameter “replacement value” (➔ Tab. 38 and Tab. 39).	

Tab. 33 Monitoring of wire fracture (channel-specific)

Module parameter: Signal extension time channel 0 ... 3		**Handheld**
Function no.	4828 + m * 64 + **10** m = module number (0 ... 47)	
Description	Specifies the signal extension time for the respective channel. Signal statuses accepted as logical input signals usually remain valid at least until the specified signal extension time (minimum signal duration) has expired. Changes of edge within the extension time are ignored. This parameter is effective only for inputs that are operated in the “digital input” (A) operating mode. Changing the parameter causes an initialisation of the respective channel.	
Bit	Signal extension time channel 0 ... 3	[Signal extension time]
	Bit: 1, 0 Channel 0	[Ch 0]
	3, 2 Duct 1	[Ch 1]
	5, 4 Duct 2	[Ch 2]
	7, 6 Duct 3	[Ch 3]
Values	0 0 Deactivated (presetting)	[Inactive]
	0 1 15 ms	[15 ms]
	1 0 150 ms	[150 ms]
	1 1 1500 ms	[1500 ms]
Comment	If a higher-order controller has long cycle times, there is the danger that short signals cannot be “detected” by this controller. So that such signals can be taken into consideration in the control sequence, a signal extension time can be set. For this module, the signal extension time can be specified individually for each channel.	

Tab. 34 Signal extension time channel 0 ... 3 (channel-specific)

Detailed information on the operating method of the signal extension time can be found in the CPX system description. But for many other input modules, the parameter is module-specific and influences the behaviour of the entire module. With the CPX-P-8DE-N-... it is a channel-specific parameter that sets the behaviour of an individual channel.

Module parameter: Signal extension time channel 4 ... 7		**Handheld**
Function no.	4828 + m * 64 + **11** m = module number (0 ... 47)	
Description	➔ Tab. 34	
Bit	Signal extension time channel 4 ... 7	[Signal extension time]
	Bit: 1, 0 Channel 4	[Ch 4]
	3, 2 Duct 5	[Ch 5]
	5, 4 Duct 6	[Ch 6]
	7, 6 Duct 7	[Ch 7]
Values	0 0 Deactivated (presetting)	[Inactive]
	0 1 15 ms	[15 ms]
	1 0 150 ms	[150 ms]
	1 1 1500 ms	[1500 ms]
Comment	➔ Tab. 34	

Tab. 35 Signal extension time channel 4 ... 7 (channel-specific)

Module parameter: Input debounce time channel 0 ... 3		**Handheld**
Function no.	4828 + m * 64 + **12** m = module number (0 ... 47)	
Description	Specifies when a change of edge of the sensor signal is accepted as a logical input signal. Changing the parameter causes an initialisation of the respective channel.	
Bit	Input debounce time channel 0 ... 3	[Input debounce time]
	Bit: 1, 0 Channel 0	[Ch 0]
	3, 2 Duct 1	[Ch 1]
	5, 4 Duct 2	[Ch 2]
	7, 6 Duct 3	[Ch 3]
Values	0 0 Deactivated	[Inactive]
	0 1 3 ms (presetting)	[3 ms]
	1 0 10 ms	[10 ms]
	1 1 20 ms	[20 ms]
Comment	Input debounce times are set to eliminate disturbing signal edge changes during switching operations (bouncing of the input signal).	

Tab. 36 Input debounce time channel 0 ... 3 (channel-specific)

Detailed information on the operating method of the signal debounce time can be found in the CPX system description. But for many other input modules, the parameter is module-specific and influences the behaviour of the entire module. With the CPX-P-8DE-N-... it is a channel-specific parameter that sets the behaviour of an individual channel.

Module parameter: Input debounce time channel 4 ... 7				**Handheld**
Function no.	4828 + m * 64 + **13** m = module number (0 ... 47)			
Description	➔ Tab. 36			
Bit	Input debounce time channel 4 ... 7			[Input debounce time]
	Bit:	1,	0	Channel 4	[Ch 4]
		3,	2	Duct 5	[Ch 5]
		5,	4	Duct 6	[Ch 6]
		7,	6	Duct 7	[Ch 7]
Values		0	0	Deactivated	[Inactive]
		0	1	3 ms (presetting)	[3 ms]
		1	0	10 ms	[10 ms]
		1	1	20 ms	[20 ms]
Comment	➔ Tab. 36				

Tab. 37 Input debounce time channel 4 ... 7 (channel-specific)

Module parameter: Replacement value channel 0 ... 3				**Handheld**
Function no.	4828 + m * 64 + **14** m = module number (0 ... 47)			
Description	Sets the replacement value for the status bit of the respective channel that should be entered in the PII in case of an error (short circuit or wire fracture) (➔ Tab. 19, bit in byte 0). Changing the parameter causes an initialisation of the respective channel.			
Bit	Replacement value channel 0 ... 3			[Fault mode value]
	Bit:	1,	0	Channel 0	[Ch 0]
		3,	2	Duct 1	[Ch 1]
		5,	4	Duct 2	[Ch 2]
		7,	6	Duct 3	[Ch 3]
Values		0	0	Replacement value = 0 (presetting)	[0]
		0	1	Replacement value = 1	[1]
		1	0	Last value of the status bit valid	[last value]
		1	1	Reserved	
Comment	Replacement value channel 4 ... 7 ➔ Tab. 39				

Tab. 38 Replacement value channel 0 ... 3 (channel-specific)

Module parameter: Replacement value channel 4 ... 7		**Handheld**
Function no.	4828 + m * 64 + **15** m = module number (0 ... 47)	
Description	➔ Tab. 38	
Bit	Replacement value channel 4 ... 7	[Fault mode value]
	Bit: 1, 0 Channel 4	[Ch 4]
	3, 2 Duct 5	[Ch 5]
	5, 4 Duct 6	[Ch 6]
	7, 6 Duct 7	[Ch 7]
Values	0 0 Replacement value = 0 (presetting)	[0]
	0 1 Replacement value = 1	[1]
	1 0 Last value of the status bit valid	[last value]
	1 1 Reserved	
Comment	Replacement value channel 0 ... 3 ➔ Tab. 38	

Tab. 39 Replacement value channel 4 ... 7 (channel-specific)

Module parameter: Counter configuration channel 0 ... 3		**Handheld**
This parameter is available only in the extended process image (miniature switch = ON).		
Function no.	4828 + m * 64 + **16** m = module number (0 ... 47)	
Description	Only effective in operating mode B (counter): sets the counting direction and edge polarity for the respective input channel (only channel 0 ... 3). Changing the parameter causes an initialisation of the respective channel.	
Bit	Counter configuration	[Counter control]
	Bit 0: edge polarity channel 0	[Ch 0 edge]
	Bit 1: edge polarity channel 1	[Ch 1 edge]
	Bit 2: edge polarity channel 2	[Ch 2 edge]
	Bit 3: edge polarity channel 3	[Ch 3 edge]
	Bit 4: counting direction channel 0	[Ch 0 direction]
	Bit 5: counting direction channel 1	[Ch 1 direction]
	Bit 6: counting direction channel 2	[Ch 2 direction]
	Bit 7: counting direction channel 3	[Ch 3 direction]
Values	Edge polarity (bit 0 ... 3)	
	0 Positive edge (presetting)	[rising]
	1 Negative edge	[falling]
	Counting direction (bit 4 ... 7)	
	0 Count upwards (presetting)	[up]
	1 Count downwards	[down]
Comment	If the counter configuration is changed, the counter is initialised! If the debounce time is active, counting takes place on the edge of the debounced signal.	

Tab. 40 Counter configuration (channel-specific, channel 0 ... 3)

Module parameter: Gate time		**Handheld**
This parameter is available only in the extended process image (miniature switch = ON).		
Function no.	4828 + m * 64 + **17** m = module number (0 ... 47)	
Description	Sets the period for the frequency measurement (operating mode C, D). The longer the gate time is, the more exact the measurement result also is, as a rule. But as the frequency is calculated after the gate time has passed, more time is needed until the measurement result is available. Changing the parameter causes an initialisation of the respective channel.	
Bit	Gate time (channel 0 ... 3)	[Gate time]
	Bit: 1, 0 Channel 0	[Ch 0]
	3, 2 Duct 1	[Ch 1]
	5, 4 Duct 2	[Ch 2]
	7, 6 Duct 3	[Ch 3]
Values	Gate time; Resolution[1)]	
	0 0 10 ms; 100 Hz	[10 ms]
	0 1 100 ms; 10 Hz	[100 ms]
	1 0 1000 ms; 1 Hz (presetting)	[1000 ms]
	1 1 5000 ms; 1 Hz[2)]	[5000 ms]
Comment	The gate time influences the resolution and speed of availability of the measurement value. With short gate times, frequency changes can be recorded faster.	

1) Smallest detectable frequency

2) Improved accuracy of measurement

Tab. 41 Gate time (channel-specific, channel 0 ... 3)

Module parameter: Lower limit value (B, C, D)			**Handheld**
This parameter is available only in the extended process image (miniature switch = ON).			
Function no.	4828 + m * 64 + **18** 4828 + m * 64 + **19** 4828 + m * 64 + **20** 4828 + m * 64 + **21** 4828 + m * 64 + **22** 4828 + m * 64 + **23** 4828 + m * 64 + **24** 4828 + m * 64 + **25**	(channel 0, low byte) (channel 0, high byte) (channel 1, low byte) (channel 1, high byte) (channel 2, low byte) (channel 2, high byte) (channel 3, low byte) (channel 3, high byte)	m = module number (0 ... 47)
Description	Sets the lower limit value (only channel 0 ... 3). – Operating mode B: For upward counters, counting begins at the lower limit value. For decremental counters, when the lower limit value is reached, the bit assigned to the related channel in byte 0 of the PII is set. – Operating mode C, D: Falling below the lower limit value is signaled by setting the corresponding bit in byte 0 of the PII (➔ Tab. 19). The smallest detectable frequency depends on the gate time (➔ Tab. 41).		
Bit	Bit 0 ... 7: High byte or low byte of the value for the respective channel		
Values	Lower limit value Permissible range of values – Operating mode B: -32768 ... 32767 – Operating mode C: 0 ... *999* – Operating mode D: 0 ... *9999* Bit 0 ... 7: high byte (presetting = 0) Bit 0 ... 7: low byte (presetting = 0)		[Lower limit] [Ch 0] ... [Ch 3]
Comment	Changing the parameter causes an initialisation of the respective channel. – Operating mode B: further information ➔ Section 7.3.2. – Operating mode C, D: further information ➔ Section 7.3.3.		

Tab. 42 Lower limit value (channel-specific, channel 0 ... 3)

For the limit values, the following apply:
– Lower limit value (LLV) ‹ upper limit value (ULV)
– For operating mode C, D: difference between LLV and ULV: › $2/T_{Gate}$

Example: With a gate time of 10 ms, the upper and lower cut-off frequencies must differ by more than 2 x 100 Hz (200 Hz).

Module parameter: Upper limit value (B, C, D)			**Handheld**
This parameter is available only in the extended process image (miniature switch = ON).			
Function no.	4828 + m * 64 + **26**	(channel 0, low byte)	m = module number (0 ... 47)
	4828 + m * 64 + **27**	(channel 0, high byte)	
	4828 + m * 64 + **28**	(channel 1, low byte)	
	4828 + m * 64 + **29**	(channel 1, high byte)	
	4828 + m * 64 + **30**	(channel 2, low byte)	
	4828 + m * 64 + **31**	(channel 2, high byte)	
	4828 + m * 64 + **32**	(channel 3, low byte)	
	4828 + m * 64 + **33**	(channel 3, high byte)	
Description	An upper limit value can be set for each of the channels 0 ... 3 of the input module. – Operating mode B: For upward counters, when the upper limit value is reached, the bit assigned to the related channel in byte 0 of the PII is set. For decremental counters, counting begins at the upper limit value. Permissible range of values: -32768 ... 32767. – Operating mode C, D: Exceeding the upper limit value is signaled by setting the corresponding bit in byte 0 of the PII (➔ Tab. 19). Permissible range of values operating mode C: 1 ... 1000 Hz for channel 0 ...3 (f_{max} – 20 %) operating mode D: 1 ... 10000 Hz for channel 0 (f_{max} – 20 %)		
Bit	Bit 0 ... 7: High byte or low byte of the value for the respective channel		
Values	Upper limit value (Presetting channel 0 ... 3 = 1000) Bit 0 ... 7: low byte (presetting = 0xE8) Bit 0 ... 7: high byte (presetting = 0x03)		[Upper limit] [Ch 0] ... [Ch 3]
Comment	Changing the parameter causes an initialisation of the respective channel. – Operating mode B: further information ➔ Section 7.3.2. – Operating mode C, D: further information ➔ Section 7.3.3.		

Tab. 43 Upper limit value (channel-specific, channel 0 ... 3)

Modul parameter: fail safe channel x		
Function no.	This module parameter is accessed via protocol-specific functions (see description for the bus node).	
Description	Fault mode channel x:	Hold last state Fault state (presetting)
	Fault state channel x:	Set value[1)] Reset value[1)] (presetting)
Comment	With the so-called fail-safe parameterisation, the signal status is determined that the bits in the control byte assume in case of fieldbus communication errors (see also CPX system description).	

1) For the input module CPX-P-8DE-N-...: bit in the outputs process image (➔ Tab. 20)

Tab. 44 Fail safe channel x (channel-specific)

If the miniature switch of the module is set to ON, the module makes available a byte in the process image outputs (PIO) (➔ Tab. 20).

Module parameter: Idle mode channel x		
Function no.	This module parameter is accessed via protocol-specific functions (see description for the bus node).	
Description	Only relevant for certain fieldbus protocols (e.g. CPX-FB11, CPX-FB32).	
	Idle mode channel x:	Hold last state Idle state (presetting)
	Idle state channel x:	Set value[1)] Reset value[1)] (presetting)
Comment	With the so-called idle mode parameterisation, the signal status is determined that the bits in the control byte assume during a change into the idle status (see also CPX system description). This parameter is not available for all fieldbus protocols.	

1) For the input module CPX-P-8DE-N-...: bit in the outputs process image (➔ Tab. 20)

Tab. 45 Idle mode channel x (channel-specific)

Module parameter: Force channel x	
Function no.	This module parameter is accessed via protocol-specific functions (see description for the bus node).
Description	The Force function permits manipulation of signal statuses (➔ Also CPX system description). The following parameters are available for this: – Force mode inputs channel x – Force state inputs channel x
Values	– Force mode inputs channel x: 0 = blocked (presetting) 1 = Force state – Force state inputs channel x: 0 = reset value (presetting) 1 = set value
Comment	For parameterisation of the Force state, the desired input word must be represented accordingly in the parameter bits “Force state inputs channel x”. Enabling of forcing is set for the entire CPX terminal through the “Force mode” system parameter (➔ CPX system description).

Tab. 46 Force channel x (channel-specific)

7.5 Parameterisation and signal indicator with the handheld (MMI)

General information regarding operation of the handheld and commissioning of the CPX terminal with the handheld is found in the description of the handheld device, type P.BE.CPX-MMI-1-... . Knowledge about the basic logic function of the handheld is assumed in the following.

With the handheld, you can access all module data and parameters. The module identifier of a module is shown in the handheld. For CPX-P-8DE-N.. the module identifier depends on the setting of the miniature switch on the module.

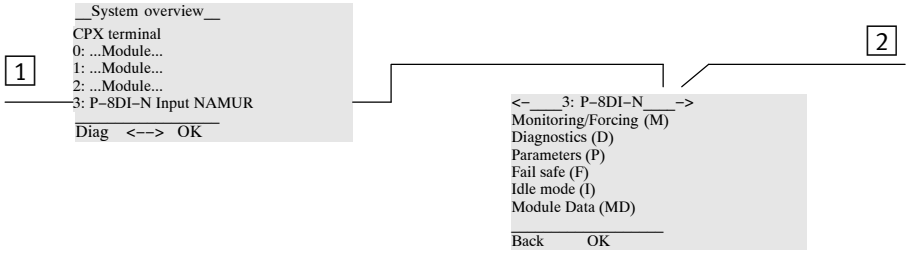
Type code	**Miniature switch setting**	**Module identifier on the handheld**		**Module code**	**Sub-code**
		Short text	**Long text**		
CPX-P-8DE-N	OFF[1)]	P-8DI-N	Input NAMUR	32	10
CPX-P-8DE-N-IS		P-8DI-N-IS	Input NAMUR IS		110
CPX-P-8DE-N	ON[2)]	P-8DI-N-X	Input NAMUR X	184	10
CPX-P-8DE-N-IS		P-8DI-N-IS-X	Input NAMUR IS X		110

1) Standard process image (factory setting)

2) Extended process image

Tab. 47 Module identifier on the MMI, module code and sub-module code

The main menu of the handheld unit displays the name [... Input NAMUR ...] for the input module. The header displays the module identifier e.g. [P-8DI-N]. The following image shows an example:



1 Module identifier in the main menu (here as module 3)

2 Module identifier in the header of the system sub-menu for a module

Fig. 17 Module identifier of the input module on the handheld

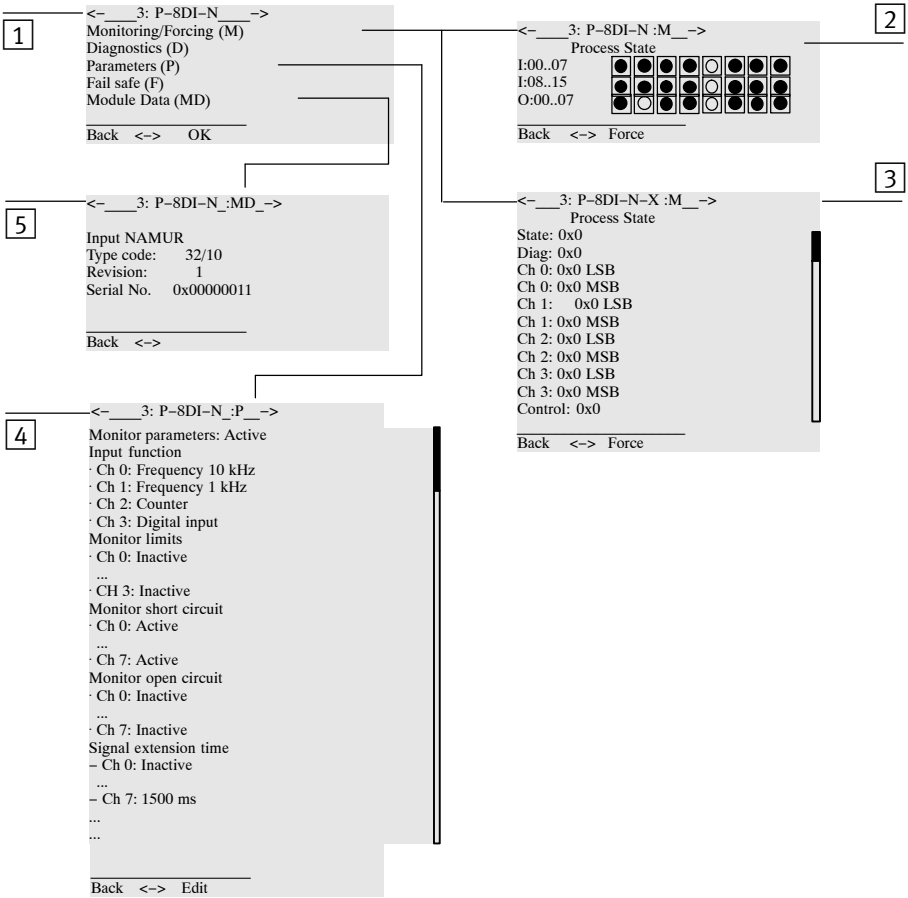
Note that the menu [Idle mode] is only available if the bus node supports the Parameterisation idle mode (➔ Description of bus node). The functions [Force], [Fail safe], [Idle mode] and [Diagnostics] work as is customary with CPX.

For the extended process image:
Note that the output bits in byte 0 of the PIO represent the control byte of the module. Manipulation of these bits has an influence on the control of counters and frequency measurement.

The process image shown under [Monitoring] and the parameters presented under [Parameter] depend on the miniature switch setting (➔ Section 7.1).

Additional information on the handheld can be found in the description of the handheld type P.BE.CPX-MMI-1-... .

The following image shows an example of the representations for an input module CPX-8DE-N... .



1 System submenu for the module
2 Monitoring (M) in the standard process image (miniature switch set to OFF)
3 Monitoring (M) in the extended process image (miniature switch set to ON)
4 Parameters (P) – basic representation (Details ➔ Section 7.4)
5 Module Data (MD)

Fig. 18 Special representations for CPX-P-8DE-N on the handheld – example

In the extended process image, the handheld shows special display texts under [Monitoring] (➔ Fig. 18, 3). The following table shows the bytes of the process image to which the related values are allocated:

Process image		Display text on the handheld[3]	Description
PII[1]	Byte 0	State	Status depending on operating mode – channel 0 ... 7
	Byte 1	Diag	Diagnostic status – channel 0 ... 7
	Byte 2 Byte 3	Ch 0: LSB Ch 0: MSB	Counter reading or frequency value CH0
	Byte 4 Byte 5	Ch 1: LSB Ch 1: MSB	Counter reading or frequency value CH1
	Byte 6 Byte 7	Ch 2: LSB Ch 2: MSB	Counter reading or frequency value CH2
	Byte 8 Byte 9	Ch 3: LSB Ch 3: MSB	Counter reading or frequency value CH3
PIO[2]	Byte 0	Control	Control byte for counter and frequency monitoring
	Byte 1	Control	Reserved

1) Process image inputs ➔ Tab. 19

2) Process image outputs ➔ Tab. 20

3) Value in hexadecimal representation; MSB = most significant byte; LSB = least significant byte

Tab. 48 Representation of the extended process image on the handheld

Further information on the extended process image ➔ Section 7.2.

8 Diagnostics

Specific errors of the input module are reported or suppressed dependent on the module parameterisation.
The errors are shown in location via the Error LED and, if necessary, can be evaluated with the handheld.
The errors are reported to the bus node, dependent on the module parameterisation, and can be evaluated in the higher-order controller according to the fieldbus protocol used.

8.1 Relevant bit in the status byte

With use of the status byte (➔ Description of the bus node or the controller), the following bit is relevant for group diagnostics:

Process image	bit	Diagnostic information
Standard process image	2	Error at input
Extended process image	3	Error at analogue module/technology module

Tab. 49 Relevant bit in the status byte

The representation of the errors in the various bus nodes depends on the protocol (➔ Description of the bus node or the controller).

8.2 Error messages of the input module CPX-P-8DE-N..

Error No.	Handheld display	Error description	Error elimination
2	[Short circuit]	**Short circuit/overload**[1)] Input current › max. permissible value	• Eliminate short circuit/overload, check connected sensors, if necessary; • If you use an unswitched contact instead of a NAMUR sensor or a switched contact, you must switch off short-circuit monitoring (➔ Tab. 32).
3	[Wire fracture]	**Wire fracture**[1)] Input current ‹ min. permissible value	• Check cable and connected sensors and replace, if necessary. • If you use an unswitched contact instead of a NAMUR sensor or a switched contact, you must switch off wire-fracture monitoring (➔ Tab. 33).
9	[Lower limit exceeded]	**Lower limit fallen below**[1)2)] The parameterised lower limit value was reached[3)] or fallen below; informative (not an error)	• None; error message for information
10	[Upper limit exceeded]	**Upper limit value exceeded** [1)2)] The parameterised upper limit value was reached[3)] or exceeded; informative (not an error)	• None; error message for information

1) The module displays the relevant error, depending on the parameterisation.

2) Standard CPX error with product-specific error description

3) In operating mode B (counter), this message is already output when the respective limit value is reached (see also parameter description in Tab. 42 and Tab. 43).

Error No.	Handheld display	Error description	Error elimination
29	[Fault in parametrizing]	**Error in parameterisation**[1)] Parameterisation implausible; the channel continues to work with the old parameter setting; the process status refers to this status of the parameters	• Check the parameterisation undertaken and, if necessary, undertake the parameterisation again with the correct parameters (valid parameters ➔ Section 7.4.2).
55	[Invalid process value]	**Invalid process value**[1)2)] End of the counting range was reached; informative (not an error)	• None; error message for information

1) The module displays the relevant error, depending on the parameterisation.
2) Standard CPX error with product-specific error description
3) In operating mode B (counter), this message is already output when the respective limit value is reached (see also parameter description in Tab. 42 and Tab. 43).

Tab. 50 Error elimination

8.3 LED indicator

The following LEDs for on-site diagnostics are located under the transparent cover of the modules:

1 Module error LED (red); one per module (also called module common error LED)
2 Channel error LED (red); one for each channel (here 8 channels)
3 Status LED (green); one per channel; allocation to the inputs ➔ Pin allocation of the module in Tab. 11 and Tab. 12.

Fig. 19 LED display of the input module CPX-P-8DE-N..

Display of errors can be suppressed through module parameters (➔ Tab. 31, Tab. 32, Tab. 33).

Module error LED			
LED (red)	**Sequence**	**Status**	**Significance/error handling**
LED not illuminated	ON OFF	Error-free operation	None
LED flashes	Error-specific	Minor error (e.g. parameterisation error)	Check the parameterisation undertaken and, if necessary, undertake the parameterisation again with the correct parameters[1)]
LED illuminated	ON OFF	Serious error (e.g. module/channel failed)	Check supply voltage; power off/on required; if repeated occurrence, service needed

1) Details ➔ Section 7.4.2.

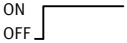
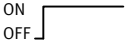
Tab. 51 Module error LED

Channel error LED			
LED (red)	**Sequence**	**Status**	**Significance/error handling**
LED not illuminated	ON OFF	Error-free operation	None
LED flashes	Error-specific	Wire break	Eliminate wire fracture
LED illuminated	ON OFF	Error at the corresponding channel (e.g. short circuit or limit value reached)	Eliminate error at the corresponding channel; check connected field device, if applicable

Tab. 52 Channel error LED

Status LED

The meaning of the status LED depends on the operating mode of the input.

Operating mode of the input	Status LED (green)	Sequence	Status
Operating mode A; Digital input (presetting)	 LED illuminated	 ON OFF	Logic 1[1)]
	 LED not illuminated	 ON OFF	Logic 0[1)]
Operating mode B; Counter input	 LED flashes	 ON OFF	Counter is started
	 LED illuminated	 ON OFF	The minimum or maximum value (limit of the counting range) has been reached, depending on the counting direction; counter was automatically stopped
	 LED not illuminated	 ON OFF	– Counter stopped or – Input signal outside the permitted range ➔ Diagnostic messages
Operating mode C, D; frequency monitoring	 LED flashes	 ON OFF	Frequency measurement is active
	 LED not illuminated	 ON OFF	Frequency measurement is stopped, or input signal is outside the permitted range ➔ Diagnostic messages

1) In error-free operation, the signal status present at the respective input is displayed. In case of short circuit or wire fracture, the parameterised value (last signal status or replacement value) is displayed (➔ Tab. 38 and Tab. 39).

Tab. 53 Function of the status LED

8.4 Notes on parameterisation of the e-module CPX-P-8DE-N..

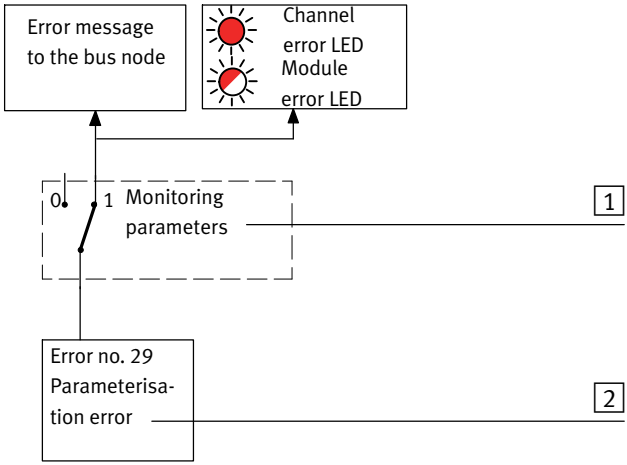
Note that some parameters are available only in the extended process image (➔ Tab. 28).

Parameterisation of diagnostic behaviour

The following parameters influence forwarding and display of errors:

– Monitoring of parameters
– Monitoring of short circuit (s.c.)
– Monitoring of wire break
– Limit value monitoring

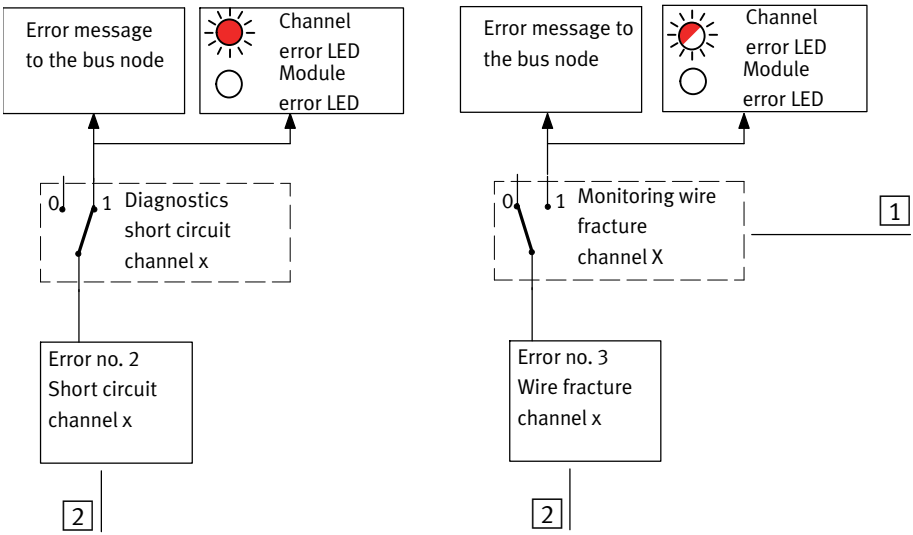
The following images show the method of operation of the possible parameter settings – represented as switches in the image.



1 Module-specific parameter (represented switch setting = presetting)

2 Module-specific error

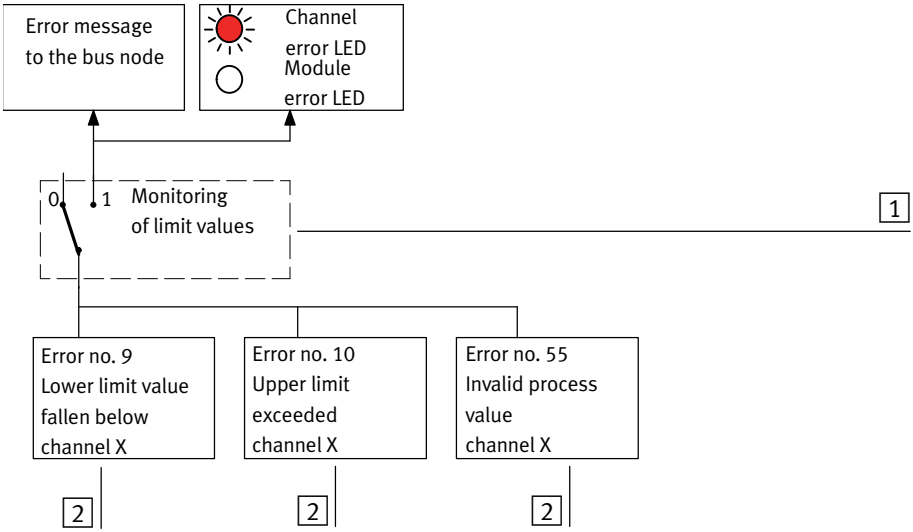
Fig. 20 Principle of error handling and parameterisation CPX-P-8DE-N.. – Part 1



[1] Channel-specific module parameters (switch setting shows the presetting)

[2] Channel-specific errors

Fig. 21 Principle of error handling and parameterisation CPX-P-8DE-N.. – Part 2



[1] Channel-specific module parameters (switch setting shows the presetting)

[2] Channel-specific errors

Fig. 22 Principle of error handling and parameterisation CPX-P-8DE-N.. – Part 3

Errors are reported or the message suppressed, depending on the module parameterisation. Errors from higher-order systems can be evaluated if forwarded to the bus node – depending on the bus protocol used.

Monitoring of wire fracture and monitoring of limit values are inactive from the factory.

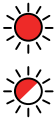
With the “Replacement value” module parameter, in diagnostic cases, you can determine whether the replacement value or the last signal status should be valid (➔ Tab. 38).

8.4.1 Behaviour during the switch-on phase (startup phase)

Status LED	Channel error LED	Module error LED	PII	Event/status
○	○	 500 ms	0	Startup phase, switch on electronic voltage

Tab. 54 Behaviour in the switch-on phase

8.4.2 Normal operating status

Normal operating status in operating mode A – digital input (NAMUR)						
Status LED	Channel error LED	Module error LED	PII, bit in ...			Event/status
			Byte 0	Byte 1	Byte 2 ... 9	
○	○	○	0	0	–	Input signal LOW
	○	○	0	0	–	Input signal HIGH
According to replacement value	 Depending on error [1]	○	Replacement value	1	–	Input signal outside the permitted range (e.g. short circuit or wire fracture)

1) LED illuminated or flashing, depending on the error (➔ Tab. 58). The display of errors can be suppressed through parameterisation (➔ Tab. 31 and Tab. 32).

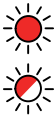
Tab. 55 Normal operating status – operating mode A

Normal operating status operating mode B – counter						
Status LED	**Channel error LED**	**Module error LED**	**PII, bit in ...**			**Event/status**
			Byte 0	**Byte 1**	**Byte 2 ... 9**	
○	Last value	○	Last value	0	Last value	Counter was stopped through Start/stop bit in the PIO (pause)
	○	○	0	0	Current value	Counter is counting – limit value not reached
			0	1	Current value	Signals a brief power failure (<20 ms); the current counter value might be incorrect[2]
		○	1	0	Current value	Counter is counting – limit value reached (if monitoring parameterised)
			1	1	Current value	Signals a brief power failure (<20 ms); the current counter value might be incorrect[2]
		○	1	0	-32768/ 32767	Counter has reached end of the counting range and is standing still (stop)
○	  Depending on error[1]	○	Replacement value	1	Last value	Input signal outside the permitted range (e.g. short circuit or wire fracture)

1) LED illuminated or flashing, depending on the error (➔ Also Tab. 58). The display of errors can be suppressed through parameterisation (➔ Tab. 29, Tab. 31, Tab. 32, Tab. 33)

2) The diagnostics are taken back only through new parameterisation or resetting of the respective counter.

Tab. 56 Normal operating status – operating mode B

Normal operating status operating mode C and D – frequency monitoring						
Status LED	**Channel error LED**	**Module error LED**	**PII, bit in ...**			**Event/status**
			Byte 0	**Byte 1**	**Byte 2 ... 9**	
○	○	○	0	0	0	Measurement was stopped through Start/stop bit in the PIO (pause)
	○	○	0	0	Current value	Frequency measurement is running within set limits
		○	1	0	Current value	Frequency measurement is running – lower or upper limit value fallen below or exceeded (if monitoring parameterised)
○	 Depending on error[1)]	○	Replacement value	1	0	Input signal outside the permitted range (e.g. short circuit or wire fracture)

1) LED illuminated or flashing, depending on the error (➔ Also Tab. 58). The display of errors can be suppressed through parameterisation (➔ Tab. 29, Tab. 31, Tab. 32, Tab. 33)

Tab. 57 Normal operating status – operating mode C and D

8.4.3 Behaviour in case of error

Status LED	Channel error LED	Module error LED	Error No.	Error description[1]
			2	Short circuit at the input (input current › max. permissible value)
			3	Wire fracture at the input (input current ‹ min. permissible value)
			9	Informative (not an error); the lower limit value was reached[2] or fallen below
			10	Informative (not an error); the upper limit value was reached[2] or exceeded
			29	General error; parameterisation implausible; the channel continues to work with the old parameter setting – the process status refers to this status of the parameters
			55	End of the counting range was reached; counter was stopped
			–	– Check supply voltage, or – Check mechanical connection of the interlinking blocks, or – Follow diagnostic message of the bus node, or – service required; replace module

1) Error elimination ➔ Tab. 50

2) In operating mode B (counter), this message is already output when the respective limit value is reached (see also parameter description in Tab. 42 and Tab. 43).

Tab. 58 Behaviour in case of error

8.5 Diagnostics via the fieldbus or a network

Depending on parameterisation, CPX I/O modules report specific errors over the fieldbus or your network.

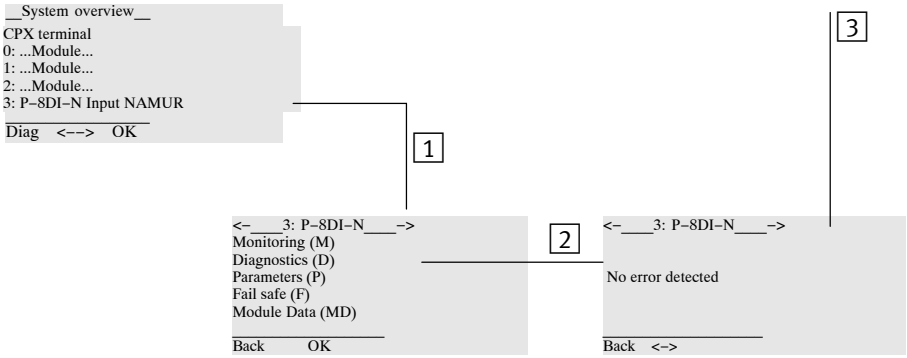
These can be evaluated through:

- Status bits (system status)
- I/O diagnostics interface (system diagnostics)
- Module diagnostics
- Error numbers.

Further information on diagnostics can be found in the CPX system description or in the description of the bus node.

8.5.1 Diagnostics with the handheld CPX-MMI

The handheld displays current error messages from the input module in clear text.



1 Select module in the main menu (here as module 3)
2 Select “Diagnostics” menu
3 Current module error (here: none)

Fig. 23 Diagnostics with the handheld

In addition, the handheld offers access to the diagnostics memory. Information on this can be found in the description of the handheld type P.BE.CPX-MMI-1-... .

9 Technical data

For product versions with corresponding approvals and certificates (➔ Product labelling) in connection with potentially explosive areas, observe the specifications in the related special documentation ➔ www.festo.com/sp.

9.1 Technical data of the CPX-P connection blocks

Technical data	**CPX-P-AB-...**			
	4XM12-4POL	**4XM12-4POL-8DE-N-IS**	**2XKL-8POL**	**2XKL-8POL-8DE-N-IS**
General technical data of the CPX terminal (-P)	➔ CPX system description (P.BE-CPX-SYS...)			
For intrinsically safe circuits	None	Yes[1)]	None	Yes[1)]
Characteristic values for explosion prevention and protection	– (Not permitted)	➔ Related special documentation for ATEX[1)]	– (Not permitted)	➔ Related special documentation for ATEX[1)]
Product weight [g]	120		100	
Degree of protection in accordance with EN 60529 [2)]	With mounted plug connectors or protective cap ISK- M12 mounted on interlinking block: IP65[2)]		At the terminal connection (2x pin header 8-pin), mounted on interlinking block: IP20	
Electrical connection	4 x socket, 4-pin, A-coded, M12X1 round plug connector		2 x COMBICON pin headers, 8-pin (grid = 5.00 mm)	
Permissible connectors	[3)]	[4)]	[5)]	[4)]
Max. permissible plug cycles	100			

1) Only if the related special documentation is complied with (➔ www.festo.com/sp)
2) To ensure the housing degree of protection (IP code), the tightening torque of the housing screws, plug connectors and protective caps must be checked semi-annually.
3) M12X1 round plug connectors or SPEEDCON M12 round plug connectors
4) Only connectors in accordance with ATEX special documentation permitted!
5) Plugs possible in spring-loaded and screw terminal design

Tab. 59 Technical data of the CPX-P connection blocks

9.2 Technical data CPX-P-8DE-N-...

Technical data		CPX-P-8DE-N	CPX-P-8DE-N-IS
General technical data of the CPX terminal (-P)		➔ CPX system description (P.BE-CPX-SYS...)	
Product weight	[g]	100	
Mechanical characteristic values			
Type of mounting		On interlinking block CPX-M-GE..	
Compatible with the CPX interlinking blocks		– CPX-M-GE-EV – CPX-M-GE-EV-S-7/8-5POL-VL – CPX-M-GE-EV-Z-7/8-5POL-VL Only in the non-ATEX zone: – CPX-M-GE-EV-S-7/8-5POL – CPX-M-GE-EV-Z-7/8-5POL	
Compatible with the connection blocks		– CPX-P-AB-2XKL-8POL – CPX-P-AB-4XM12-4POL	– CPX-P-AB-2XKL-8POL-8DE-N-IS; – CPX-P-AB-4XM12-4POL-8DE-N-IS
Electric characteristic values – power supply			
Nominal operating voltage DC	[V DC]	24	
DC operating voltage range	[V DC]	24 ± 25%	
Switch-on current limitation	[A]	Yes, › 3	
Reverse polarity protection		For operating voltage	
Intrinsic current consumption at nominal operating voltage	[mA]	Typ. 75	
Power failure buffering	[ms]	20 (without loss of the parameter data)	

Tab. 60 Mechanical and electrical characteristic values

Technical data		CPX-P-8DE-N	CPX-P-8DE-N-IS
Electrical characteristic values – sensors inputs			
Open circuit voltage	[V]	8.0 ± 10 % (within EN60947-5-6)	
Hysteresis		To EN 60947-5-6	
Internal resistance of the circuit amplifier			
Switching level		Within EN 60947-5-6	
Inputs characteristic curve			
Residual ripple	[Vpp]	0.4	
Maximum length of sensor supply lines	[m]	Max. 200 (at min. 0.1424 mm², resistance ‹ 50 ohms for the entire line length)	
Number of inputs		8	
Electrical isolation channel – channel		No	
Electrical isolation channel – internal bus		Yes, in accordance with EN 50178	
Electrical isolation between intrinsically safe and non-intrinsically safe circuit parts		–	Yes
Fuse protection (short circuit)		Per channel	

Tab. 61 Electric characteristic values – sensors inputs

Technical data		CPX-P-8DE-N	CPX-P-8DE-N-IS
Ambient characteristics			
Storage temperature	[°C]	-20 ... +70	
Ambient temperature		➔ CPX system description (P.BE-CPX-SYS...)	
Relative humidity			
Degree of protection to EN 60529		Dependent on the connection block ➔ Tab. 59	
Characteristic values for explosion prevention and protection		– (Not permitted)	Related ATEX special documentation ➔ www.festo.com/sp

Tab. 62 Ambient characteristics

Technical data		CPX-P-8DE-N	CPX-P-8DE-N-IS
Special functions channel 0 ... 3			
Operating mode A (digital input)			
– Minimum impulse length/pause	[µs]	400	
Operating mode B (counter)[1]			
– Max. counting rate	[Hz]	1250	
– Minimum impulse length/pause	[µs]	400	
Operating mode C[2]			
(frequency measurement channel 1 to 3)			
Max. signal frequency	[Hz]	1250	
Minimum impulse length/pause	[µs]	400	
Operating mode D[2]			
(frequency measurement channel 0)			
Max. signal frequency	[Hz]	12500	
Minimum impulse length/pause	[µs]	40	

1) Counter characteristics ➔ Tab. 21

2) Frequency measurement ➔ Tab. 25

Tab. 63 Special functions

Technical data	CPX-P-8DE-N	CPX-P-8DE-N-IS
Module code/submodule code and module identification on the handheld		
Module identification handheld		
(language English)		
– Miniature switch setting: OFF[1]	P-8DI-N	P-8DI-N-IS
– Miniature switch setting: ON[2]	P-8DI-N-X	P-8DI-N-IS-X
Module code/submodule code		
(CPX-specific)		
– Miniature switch setting: OFF[1]	32/10	32/110
– Miniature switch setting: ON[2]	184/10	184/110

1) Standard process image

2) Extended process image

Tab. 64 Codes and identification on the handheld

10 Coding recommendation for terminal connection of the CPX-P modules

In the following recommended coding, all contact points of a connection are provided a coding element to achieve plug reliability that is as high as possible. Here, for each contact, either a coding profile is plugged into the plug-in block or a code tab into the recess of the box header on the connection block (➔ Also Fig. 16).

For each of the 8-pin terminal connections, 4 coding tabs are used at the connection block for the box header and 4 coding profiles for the related plug-in block terminal. As a result, up to 70 different codings are available.

The following table specifies the codings for the box headers and, next to them, the coding of the related plug-in block terminal.

A contact point labelled with 1 must be equipped with the respective coding element, a contact point labelled with 0 not. In a modular system with up to 18 plug-in block terminals (max. 9 CPX-P modules permissible), a maximum of 72 coding profiles for plug-in block terminals and 72 coding tabs for box headers are needed.

No.	Coding of the box header								Coding of the plug-in block terminal							
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
1	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0
2	0	0	0	1	0	1	1	1	1	1	1	0	1	0	0	0
3					1	0	1	1					0	1	0	0
4						1	0	1						0	1	0
5						1	1	0						0	0	1
6	0	0	1	0	0	1	1	1	1	1	0	1	1	0	0	0
7					1	0	1	1					0	1	0	0
8						1	0	1						0	1	0
9						1	1	0						0	0	1
10	0	0	1	1	0	0	1	1	1	1	0	0	1	1	0	0
11						1	0	1						0	1	0
12						1	1	0						0	0	1
13					1	0	0	1					0	1	1	0
14						0	1	0						1	0	1
15						1	0	0						0	1	1
16	0	1	0	0	0	1	1	1	1	0	1	1	1	0	0	0
17					1	0	1	1					0	1	0	0
18						1	0	1						0	1	0
19						1	1	0						0	0	1
20	0	1	0	1	0	0	1	1	1	0	1	0	1	1	0	0
21						1	0	1						0	1	0
22						1	1	0						0	0	1
23					1	0	0	1					0	1	1	0
24						0	1	0						1	0	1
25						1	0	0						0	1	1
26	0	1	1	0	0	0	1	1	1	0	0	1	1	1	0	0
27						1	0	1						0	1	0
28						1	1	0						0	0	1
29					1	0	0	1					0	1	1	0
30						0	1	0						1	0	1
31						1	0	0						0	1	1
32	0	1	1	1	0	0	0	1	1	0	0	0	1	1	1	0
33						0	1	0						1	0	1
34						1	0	0						0	1	1
35					1	0	0	0					0	1	1	1
36	1	0	0	0	0	1	1	1	0	1	1	1	1	0	0	0
37					1	0	1	1					0	1	0	0
38						1	0	1						0	1	0
39						1	1	0						0	0	1
40	1	0	0	1	0	0	1	1	0	1	1	0	1	1	0	0

No.	Coding of the box header								Coding of the plug-in block terminal							
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
41	1	0	0	1	0	1	0	1	0	1	1	0	1	0	1	0
42	1	0	0	1	0	1	1	0	0	1	1	0	1	0	0	1
43					1	0	0	1					0	1	1	0
44						0	1	0						1	0	1
45						1	0	0						0	1	1
46	1	0	1	0	0	0	1	1	0	1	0	1	1	1	0	0
47						1	0	1						0	1	0
48						1	1	0						0	0	1
49					1	0	0	1					0	1	1	0
50						0	1	0						1	0	1
51						1	0	0						0	1	1
52	1	0	1	1	0	0	0	1	0	1	0	0	1	1	1	0
53						0	1	0						1	0	1
54						1	0	0						0	1	1
55					1	0	0	0					0	1	1	1
56	1	1	0	0	0	0	1	1	0	0	1	1	1	1	0	0
57						1	0	1						0	1	0
58						1	1	0						0	0	1
59					1	0	0	1					0	1	1	0
60						0	1	0						1	0	1
61						1	0	0						0	1	1
62	1	1	0	1	0	0	0	1	0	0	1	0	1	1	1	0
63						0	1	0						1	0	1
64						1	0	0						0	1	1
65					1	0	0	0					0	1	1	1
66	1	1	1	0	0	0	0	1	0	0	0	1	1	1	1	0
67						0	1	0						1	0	1
68						1	0	0						0	1	1
69					1	0	0	0					0	1	1	1
70	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1

Tab. 65 Coding recommendations for terminal connection of the CPX-P modules

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Copyright:
Festo AG & Co. KG
Ruiter Straße 82
73734 Esslingen
Germany

Phone:
+49 711 347-0

Fax:
+49 711 347-2144

E-mail:
service_international@festo.com

Internet:
www.festo.com