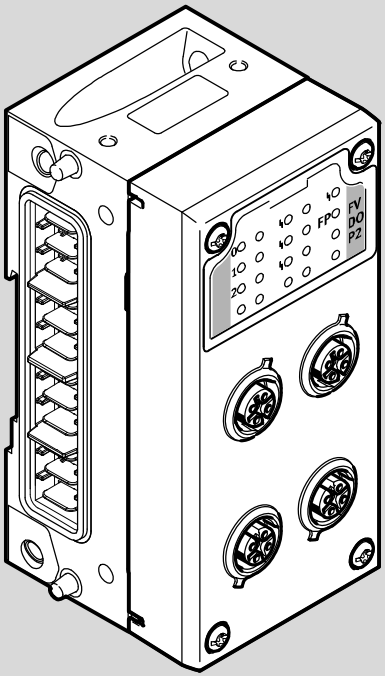
Terminal CPX

Output module CPX-FVDA-P2



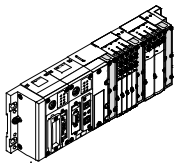
FESTO

Description

Output module
CPX-FVDA-P2

with
connection block
CPX-M-AB-4-M12X2
-5POL
or
CPX-AB-8-KL-4POL

and
interlinking block
CPX-M-GE-EV-FV



8022607
en 2018-02a
[8063230]

Translation of the original instructions

Original ..... de

Version ..... en 2018-02a

Designation P.BE-CPX-FVDA-P2-EN

Order no. 8022607

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

PROFINET IO®, PROFIBUS® are registered trademarks of the respective trademark owners in specific countries.

Contents

Important user information

Danger categories

This description includes instructions on the possible dangers that can occur if the product is used incorrectly. These notes are marked with a signal word (Warning, Caution, etc), printed on a shaded background and marked additionally with a pictogram. A distinction is made between the following danger warnings:

Warning
... means that non-observance can result in serious personal injury or damage to property.

Caution
... means that injury to people and damage to property can occur if this warning is not observed.

Note
... means that damage to property can occur if this warning is not observed.

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

Electrostatically sensitive devices: incorrect handling can cause damage to devices.

Marking of special information

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

Pictograms

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

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

Environment:
Information about environmentally friendly use of Festo products.

Text symbols and markers

- Bullet points denote activities that can be carried out in any order.

1. Numbers indicate activities that must be carried out in the specified sequence.

– Arrowheads indicate general lists.

General safety instructions

Warning
Disregarding the safety instructions can result in death, serious injuries or major material damage.

- The safety instructions must be observed.

Note
Electronics modules include electrostatically sensitive devices.

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

Note
To ensure compliance with the intended use:

- Each output channel that is in use must be switched at least once a week.
- If test pulses are switched off: each output that is in use must be switched at least once a day.

Note
To ensure compliance with the safety level:

- Each output channel that is in use must be switched on for more than 1 minute at least once every 8 operating hours.
  The operating time begins when the output module is first switched on.

Note
- Use a maximum of 2 output channels in a common safety pilot circuit.

Observe the regulations for providing voltage (protective extra-low voltage, PELV) to CPX terminals in the CPX system description P.BE-CPX-SYS-... .

Intended use

The output module CPX-FVDA-P2 is used correctly as a shut-off module for the safe shutdown of connected consumers (safety function) if the following condition is met:

– The connected consumers automatically go into a safe state during the safety shutdown.

The safety function is achieved through dual-channel, P- and M-side disconnection of the following load voltage supplies of the CPX terminal:

– Load voltage supply for U_{VAL} valves of the CPX terminal (output channel CH0 of the module). This is used to supply valve terminal pneumatic modules in the CPX terminal fitted on the right-hand side.

– Two outputs (output channels CH1 and CH2 of the module) provided through the connection technology of the module, also supplied via U_{VAL}.

In addition, the unswitched load voltage supply U_{VAL} is made available through the connection technology of the module as operating voltage for the external components (24 V DC auxiliary supply).

The output channels of the CPX-FVDA-P2 each form a safety circuit with their connected consumers.

The output module CPX-FVDA-P2 is a product with safety-relevant functions and is intended for installation in machines or automation systems and for use as follows:

– in excellent technical condition

– in its original state, without unauthorised modifications

– exclusively in the configurations named here (➔ chapter 1.3.2)

– within the product's limits as defined by the technical data (➔ appendix A.1)

– in an industrial environment

➔

Note
- Note that the safety limits of the output module are also its physical limits.

Rules for product configuration

– Operation of the output module CPX-FVDA-P2 is permissible only in CPX terminals from Festo of the variant CPX-M-....

– Comply with all technical operating limits (➔ Technical data).
Otherwise, operative malfunctions can occur.

– Operation of the CPX-FVDA-P2 is permissible only in combination with the following PROFIsafe-capable CPX bus nodes (➔ bus node rating plate):

CPX bus node	from revision	Network protocol
CPX-FB13[1]	30	PROFIBUS
CPX-FB33[2]	21	PROFINET IO
CPX-FB34[2]	21	PROFINET IO
CPX-FB35[2]	21	PROFINET IO
[1] ➔ Description P.BE-CPX-FB13... [2] ➔ Description P.BE-CPX-PNIO...		

Tab. 0/1: Permissible PROFIsafe-capable CPX bus nodes

– Operation of the CPX-FVDA-P2 within CPX valve terminals is only permissible with the following valve types:

Valve terminal	Type	Valve types
MPA-S-FB-VI	32	MPA1, MPA2 on VMPA...-FB-EMG-...[1]
MPA-F-FB-VI	33	MPAF1, MPAF2 on VMPA...-FB-EMG-...[1]
VTSA-FB-VI	44	All up to width of 52 mm[1]
VTSA-F-FB-VI	45	All up to width of 52 mm[1]
[1] Malfunctions may occur if the resultant current is exceeded.		

Tab. 0/2: Permissible valve types

– Operation of shut-off groups within CPX valve terminals is only allowed in conjunction with permissible pneumatics (➔ Description of the respective valve terminal).

– Operation of shut-off groups in CPX terminals in the Remote I/O operating mode is only allowed with the following approved output modules:

Output module
CPX-4DA[1]
CPX-8DA[1]
CPX-8DA-H[1]
CPX-8DE-8DA[1]
[1)] Malfunctions may occur if the resultant current is exceeded.

Tab. 0/3: Permissible output modules

– Only the following components are permitted when assembling the CPX-FVDA-P2:

Component	Type
Interlinking block	CPX-M-GE-EV-FVO
Connection block	CPX-M-AB-4-M12X2-5POL
	CPX-AB-8-KL-4POL

Tab. 0/4: Permissible components

Further information about the supported CPX product variants can be found in section 1.1.2.

Foreseeable misuse

The following examples of foreseeable misuse are among those not approved as intended use:

- use outdoors
- use in non-industrial areas
- use outside the limits of the product defined in the technical data
- unauthorised modifications
- use in combination with consumers where switching off can result in hazardous movements or conditions

Note
The use of connection and interlinking blocks that are not specified is not permissible.

Note
In the following cases, the use of the output module CPX-FVDA-P2 for formation of safety circuits is **not permissible**:

- in a CPX terminal equipped with CPX-FEC or CPX-CEC
- in a CPX terminal with shut-off groups containing output modules other than those permitted
- in a CPX terminal of variant P
- in a CPX terminal with a connected valve terminal which is equipped with valve types other than the following: VTSA, MPA-S, MPA-F (➔ Tab. 0/2)
- in a CPX terminal with a connected valve terminal where VPPM are located in switching groups with a safety shut-down function
- in impermissible switching configurations (➔ chapter1.3.2 Application examples)

Note
The output module does not contain any wearing parts. Repairs are not allowed on the output module CPX-FVDA-P2. This invalidates the certification of the output module.

Professional replacement of the electronics module by the user is permissible.

Note
In the event of damage caused by unauthorised manipulation or any use other than that intended, the guarantee is invalidated and the manufacturer is not liable for damages.

Attainable safety level

With the CPX-FVDA-P2, safety functions can be implemented up to:

– Safety integrity level SIL 3 in accordance with IEC 61508

– Performance level e, Cat. 3 in accordance with EN ISO 13849-1

– SIL Claim Limit SIL CL 3 in accordance with EN 62061.

The attainable safety level of the overall safety device depends on the other components used to implement a safety function.

To maintain the safety level:

- Test the functionality of the safety device at adequate intervals.

Failures due to a common cause (Common Cause Failure – CCF)

Common cause failures cause the loss of the safety function, since both channels (P and M) in a dual-channel system fail simultaneously.

The following measures ensure that common cause failures are avoided:

- Observe operating voltage limits
- Observe temperature range
- Use a maximum of 2 output channels in a common safety pilot circuit

Additional measures for avoidance of common cause failures may result from the application.

Requirements for product use

- Make this description available to the design engineer, installation technician and personnel responsible for commissioning the machine or system in which this product is used.
- Keep this description during the entire product lifecycle.
- Make sure that the specifications of the documentation are always complied with. Also comply with the documentation for the other components and modules (e.g. bus nodes, pneumatics, etc.).
- Take into consideration the legal regulations applicable for the location as well as:
  - Regulations and standards
  - Regulations of the testing organisations and insurers
  - National specifications
- Remove all transport packaging, such as foils, caps, cardboard. The material used in the packaging has been specifically chosen for its recyclability (exception: oiled paper = residual waste).
- Mounting must be performed in a professionally correct manner.
  To maintain the IP degree of protection:
  - Screw the connection block on tight
  - Install cable tips and seals professionally
  - Seal unused ports with cover caps
- If the system had to be shut down for safety reasons such as an emergency stop, make sure the safety controller monitors/controls all system restarts.

Technical prerequisites

General conditions for the correct and safe use of the product, which must be observed at all times:

- Comply with all technical operating limits (➔ Technical data).
  Only then is operation of the product ensured in accordance with the relevant safety regulations.
- When connecting standard auxiliary components, also observe the specified limit values for temperatures, electrical data and torques.

Training of qualified personnel

The device may only be commissioned by trained, qualified control and automation technology personnel, who are familiar with:

– installation and operation of control systems

– the applicable regulations for operating safety-related systems

– the applicable regulations for accident prevention and occupational safety

– the documentation for the product

➔

Note
Work on safety-related systems may only be carried out by qualified personnel trained in safety engineering.

Transport and storage conditions

- Protect the product during transport and storage from excessive stress factors, such as:
  - Mechanical loads
  - Excessive temperatures
  - Moisture
  - Aggressive atmospheres
- Store and transport the product in its original packaging. The original packaging offers sufficient protection from typical stresses.

Service

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

Range of applications and certifications

This product is a safety device as defined in the EU Machinery Directive and carries the CE marking.

CE

Standards and test values, which the product must comply with and fulfill, can be found in the section “Technical data”. The product-relevant EC directives can be found in the declaration of conformity. Certificates and the declaration of conformity for this product can be found at www.festo.com.

- Please note that compliance with the specified standards is limited to the output module CPX-FVDA-P2. From the perspective of the output module, all disconnectable

parts of a CPX terminal or a valve terminal are treated as an external load.

Certain configurations of the product have been certified by Underwriters Laboratories Inc. (UL) for the USA and Canada. These configurations bear the following mark:

UL Recognized Component Mark for Canada and the United States

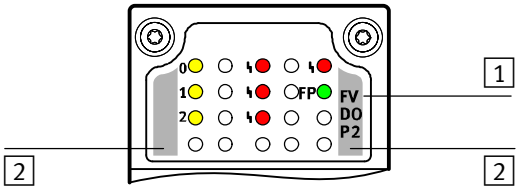
Only for connection to a NEC Class 2 supply.
Raccorder uniquement à un circuit de Classe 2.

Note
Observe the following if the UL requirements are to be complied with in your application:

- Regulations for complying with the UL certification can be found in the separate UL-specific special documentation. The relevant technical data in that documentation also apply with priority if they do not influence the safety characteristic values in an impermissible manner.
- The technical data in this documentation may show values deviating from this.

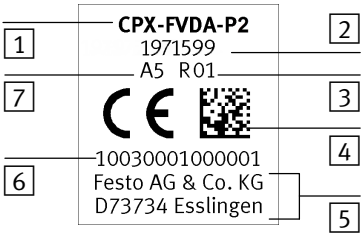
Product identification

The module identifier and product rating plate serve to identify the product. The module identifier can be seen through the transparent cover of the connection block.

Module identifier	Meaning
	– Module identifier [1]: FVDOP2 (F=Safety; V=Valves; D=Digital; O=Outputs; P=PROFIsafe; 2=variant) – Yellow background [2] to indicate the safety function

Tab. 0/5: Module identifier of the output module CPX-FVDA-P2

The rating plate of the electronics module CPX-FVDA-P2 shows the following information:

Rating plate (example)	Meaning
	Rating plate – Order reference [1] – Part number [2] 1) – Revision code (here R01) [3] – Serial number represented as data matrix code [4] 2) – Manufacturer and manufacturer's address [5] – 14-character serial number [6] 2) – Manufacturing period (encoded) [7] 3) (here A5 = May 2010)
1) Part number of the electronics module CPX-FVDA-P2 2) Permits traceability of the product. 3) ➔ Tab. 0/7 and Tab. 0/8	

Tab. 0/6: Rating plate of the electronics module CPX-FVDA-P2

You will find further information about this in the system description P.BE-CPX-SYS-...

Revision version

- Determine the revision of a CPX module:
  - With the operator unit CPX-MMI-1 (➔ [Module data] [Revision])
  - With the appropriate configuration software (➔ module data, revision code).
  - From the rating plate of the respective module (in dismounted state, ➔ Tab. 0/6).
- Before replacing a module, check whether the bus node revision code complies with the requirements of the module (➔ Tab. 3/1).

Manufacturing period

The manufacturing period is encoded on the rating plate in the form of a two-character ID code (➔ Tab. 0/6). The letter specifies the manufacturing year and the next character (number or letter) indicates the manufacturing month.

Manufacturing year					
X = 2009	A = 2010	B = 2011	C = 2012	D = 2013	E = 2014
F = 2015	H = 2016	J = 2017	K = 2018	L = 2019	M = 2020

Tab. 0/7: Manufacturing year (20-year cycle)

Manufacturing month				
1	January		2	February
3	March		4	April
5	May		6	June
7	July		8	August
9	September		O	October
N	November		D	December

Tab. 0/8: Manufacturing month

Information regarding this description

This description contains general basic information on operating, assembling and installing the output module CPX-FVDA-P2 in combination with the CPX terminal and refers exclusively to the following revisions of the output module:

This description applies to the following product		
Type code	**Part number**	**Revision**[1)]
CPX-FVDA-P2	1971599	R0x
[1)] x stands for a single digit from 1 to 9 (➔ Tab. 0/6)		

General basic information on operating, assembling, installing and commissioning CPX terminals can be found in the CPX system description.
Special information on commissioning, setting the parameters and performing diagnostics on a CPX terminal with the bus node which 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.

Information on the pneumatics can be found in the corresponding pneumatics descriptions.

An overview of the user documentation structure for the CPX terminal can be found in the CPX system description P.BE-CPX-SYS-... .

Conventions

The special parameters of the module appear on the operator unit CPX-MMI-1 in English. The data and parameters which appear in English on the operator unit 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].

Product-specific terms and abbreviations

Term/abbreviation	Definition
Switch-off group	Group of loads that can be controlled independently of each other and switched off together for safety reasons with the same output channel.
Output channel	An independently switchable output which is switched via two redundant switching elements in the outward and return path of the circuit. CH0, CH1 and CH2 are independent output channels that are switched internally via a 2-channel principle.
CRC signature	Test value in the PROFIsafe security telegram to check the integrity of telegram data (Cyclic Redundancy Check).
Depassivation	➔ Reintegration or passivation (the opposite)
Wire break detection	Function that detects and reports connection errors such as loads without contact and wire break. For CPX-FVDA-P2, this function can be activated or deactivated through parameterisation.
I/O image	➔ Process image
Replacement value	Preset safe value that replaces the real process value or the programmed value in the event of a malfunction or when booting safety-related systems. For CPX-FVDA-P2 (digital outputs), the output value is 0.
F-Device	Collective term for safety-related devices
F-Host	Safety controller for controlling safety-related devices
F-System	Safety-related system that restores a safe state in the event of dangerous system and device errors.
GSDML/GSD	Device master data file in XML format
i-parameters	Technology-specific individual parameters for a specific F-Device
Channel	➔ Output channel
Channel-wise passivation	A type of passivation during which only the defective output channel is passivated. The module remains integrated. For the CPX-FVDA-P2, the acknowledgment is carried out via the process image (➔ section 1.2.3).
Short circuit	Connection of switching points with normally different electrical potentials, e.g. of 0 V and 24 V of one voltage source.

Term/abbreviation	Definition
M-switch (low-side switch)	Switch in the 0 V current path of an output channel. Additional information (➔ P-switch).
Passivation	Safety function during which the output module CPX-FVDA-P2 switches off all output channels or only the defective output channels (channel-wise passivation), depending on the respective error. Instead of the programmed values, the so-called replacement values (0) are then effective. Module passivation takes place automatically in case of, e.g.: – Safety-related communication errors (PROFIsafe) – Self-test errors – Channel errors, but only if the “channel-wise passivation” function is switched off (➔ Channel-wise passivation). Once the module has been passivated, regular reintegration is required (standard PROFIsafe acknowledgment process). If “channel-wise passivation” is switched on, only the affected output channel is passivated in the event of a channel error. In order to depassivate the output channel, an acknowledgment signal via the process image is required (➔ section 1.2.3).
Performance level (PL ..., cat. ...)	Discrete level that specifies the capability of a controller’s safety-related parts to perform a safety function under defined conditions. Categories and 5 performance levels (PL a to PL e) are defined in DIN EN ISO 13849-1. – Category (cat.) is a measure of the resistance of a controller’s safety-related parts against errors and of their subsequent behaviour in case of error, which is achieved through the structure of the parts’ layout, error detection and reliability. – PL a is the lowest and PL e the highest level.
PROFIBUS	Standard for fieldbus communication between controllers (PLC/IPC) and devices in automation technology (PROcess Field BUS ➔www.profibus.-com).
PROFINET IO	Fieldbus standard based on industrial Ethernet for communication between controllers (PLC/IPC) and devices (➔ www.profibus.com/pn, www.profibus.de).

Term/abbreviation	Definition
PROFIsafe	Safety-related bus profile for PROFIBUS and PROFINET IO that, in conjunction with PROFIsafe-compliant devices (F-Host and F-Device) facilitates correct and reliable transmission of safety messages. Mechanisms for safe transmission and error detection: – CRC signatures (data integrity test), – Consecutive numbering of the safety messages, – Checking addresses (➔ PROFIsafe address) – Time monitoring. In the event of errors, the F-Device can automatically trigger predefined safety measures. Due to the consecutive numbering, the recipient can check whether they have received all the messages in the right order. For this purpose, the F-Host and the F-Device are equipped with their own state machines which are synchronised using a control and status byte. Correct synchronisation is monitored by including counter values in the CRC signature calculation.
PROFIsafe address	In order to identify the addressee of a message, each PROFIsafe-enabled device or module has its own unique PROFIsafe address. The PROFIsafe address is specified in the configuration program and set via the DIL switch on the PROFIsafe-enabled device or module. Configuration errors are automatically detected by comparing the target and actual configuration.
PROFIsafe monitoring time	Monitoring time for safety-related communication between F-Host and F-Device
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 assemblies are transferred to the process diagram for the inputs. At the end of the cyclical program, the process diagram for the outputs are transferred to the output assemblies as the signal state.
P-switch (high-side switch)	Switch in the 24 V current path of an output channel. Each output channel has a 24 V and a 0 V current path between which the load is switched. With the CPX-FVDA-P2, these current paths are switched together and at the same time, although independently of each other. The P-switch switches the 24 V current path and the M-switch switches the 0 V current path of the output channel. Both switches (P-switch and M-switch) must be closed in order for voltage to be applied to the load. For the CPX-FVDA-P2, the P- and M-switches of an output channel are controlled by different microcontrollers for safety reasons.

Term/abbreviation	Definition
Cross circuit	Accidental bypasses in switches, e.g. between 0 V and FE. These can be triggered, for example, by pinched cables and can cause unauthorised currents in circuits. If, for example, 0 V and FE are connected to each other in the system power supply, a cross circuit between the 0 V current path and FE behind the M-switch results in bypassing the switch. The switch is rendered ineffective. In a similar way, a cross circuit can also result in the P-switch being bypassed.
Cross-circuit monitoring	Function that detects possible cross currents in the device's own circuits and switches the device or the output channel into a safe state. This prevents undesired switching of the load due to impermissible cross currents.
Acknowledgment	Signal or procedure for depassivation. By acknowledging, the user confirms that the module can be reintegrated or the output channel can be depassivated without any risk. Once the complete module has been passivated, acknowledgment is carried out via regular reintegration (standard PROFIsafe process). If an output channel is passivated (channel-wise passivation), acknowledgment takes place via an acknowledgement signal from the process image (➔ section 1.2.3).
Black channel	The transmission channels of PROFIBUS and PROFINET IO are not influenced by PROFIsafe. They do not need to be considered in more detail with regard to PROFIsafe and are therefore called black channels.
Safe state	State in which the system is safe.
Safety-related communication	Exchange of safety-related messages between the F-Host and F-Device (e.g. via PROFIsafe)
Safety integrity	Effectiveness of safety functions in a safety-related system under requirement-based conditions.
Safety integrity level	Safety integrity level for safety-related systems in acc. with IEC 61508. There are 4 levels (SIL 1 to SIL 4). SIL 1 is the lowest level and SIL 4 is the highest level of safety integrity. The higher the level the less probable it is that the system will fail in a dangerous manner.
Safety circuit	Output module CPX-FVDA-P2 with all the connected consumers. A safety circuit is formed when the load to be operated safely is supplied from an output (CH0, CH1, CH2) of the CPX-FVDA-P2. A switched-on (supplied) load can either be safely switched off upon request (via PROFIsafe) or the module automatically switches off the load safely if it detects a safety-related error.
Safety pilot circuit	Safety circuit including safety-oriented control by the controller.

Term/abbreviation	Definition
Safety program	Safety-related user program in the F-Host
Safety controller	A safety controller is generally a programmable logic controller with specific design elements for processing safe input information into safe output information. It is used in safety-related systems in order to guarantee the required safety integrity level.
SIL	Safety Integrity Level
SIL CL	Claim limit for sub-systems of a safety-related electrical control system.
Test pulse	Fast switching impulse for monitoring switching capability and detecting cross circuits (➔ Forced switch on/off).
Reintegration	Switching from replacement values to programmed values or process values (depassivation) ➔ Passivation. Reintegration is a standard PROFIsafe process to depassivate a passivated module (➔ PROFIsafe standard).
Forced switch on/off	Functional test procedure to determine the switching capability of a device. The P- and M-switches of the output module CPX-FVDA-P2 are checked cyclically for effective functionality.

Tab. 0/9: Product-specific terms and abbreviations

Chapter 1

Contents

1.1 CPX terminal with output module CPX-FVDA-P2

Only the CPX-M-... variant of the terminal can be equipped with the output module CPX-FVDA-P2. The module has 3 digital output channels (CH0 ... CH2), which enable the following load voltages to be switched off safely:

– Load voltage supply for valves U_{VAL} of the CPX terminal via output channel 0 (CH0 of the module). This is used to supply valve terminal pneumatic modules in the CPX terminal fitted on the right-hand side.

– Two output channels (CH1 and CH2 of the module) provided through the connection technology.

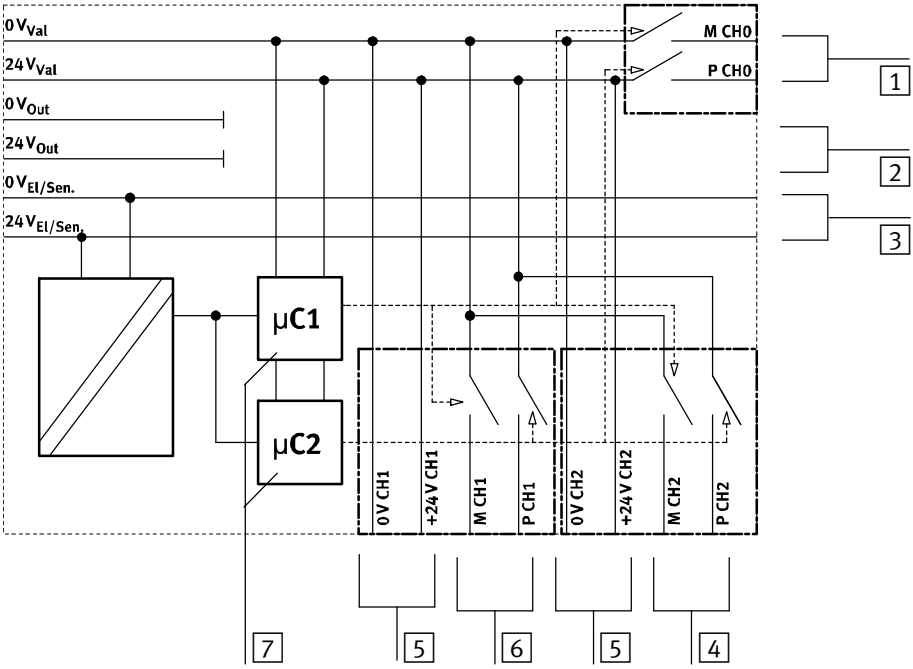
In addition, the unswitched load voltage supply U_{VAL} is made available for output channels 1 and 2 (CH1, CH2) as operating voltage for external components (24 V DC).

The load voltage supplies of the CPX terminal run on contact rails within the interlinking blocks for forwarding to subsequent modules.

A special interlinking block is required for operation of the output module CPX-FVDA-P2 (➔ Tab. 1/3). In this interlinking block, the contact rails of the load voltage supplies U_{VAL} and U_{OUT} are interrupted. The contact rails for U_{VAL} are bridged by switches of the CPX-FVDA-P2.

Therefore, the output module is able to switch off the load voltage supply U_{VAL} for the right-side pneumatics modules in two channels (P- and M-switching). Two channels mean that the 24 V line (P, high-side path) and the 0 V line (M, low-side path) are switched together but also independently of each other at the same time.

In addition, the output module offers two output channels (CH1 and CH2) that can also be switched off safely if required (P- and M-switching). These output channels are supplied from the load voltage supply for valves U_{VAL}.



1 CH0: output supplied by 24 V_{VAL} and 0 V_{VAL} for pneumatics modules mounted on the right side

2 24 V_{OUT} and 0 V_{OUT} is no longer available on the right side

3 Operating voltage for electronics and sensors (24 $V_{EL/SEN}$ and 0 $V_{EL/SEN}$) for pneumatics modules mounted on the right side

4 CH2: output supplied by 24 V_{VAL} and 0 V_{VAL}; available via the connection technology of the module CPX-FVDA-P2

5 Unswitched voltage U_{VAL} for the supply of intelligent load systems (auxiliary supply)

6 CH1: output supplied by 24 V_{VAL} and 0 V_{VAL}; available via the connection technology of the module CPX-FVDA-P2

7 Processors for controlling and monitoring the P-switch and M-switch

Fig. 1/1: Basic representation of the CPX power supply concept with CPX-FVDA-P2

Output channels CH0, CH1 and CH2 can be used to safely switch off up to 3 load groups independently of each other.

From the perspective of the output module CPX-FVDA-P2, the output channels (CH0 ... CH2) are channel pairs, since in each case two paths are always switched together and at the same time, although independently of each other. One channel forms the positive (P) path and another forms the negative (M) path for a potential-free load voltage supply.

All P- and M-switches of the module output channels are controlled by different processors that monitor each other continuously (safety concept).

Output channels 1 and 2 (CH1 and CH2) are suitable, for example, for the load voltage supply of components that must be switched off safely when required and that fulfil the respective requirements (➔ section 1.4 and technical data in the appendix).

Examples:

– Soft start/quick exhaust valves for external components or the internal valve terminal pneumatics.

– Valve groups within the CPX terminal that are supplied separately via electrical supply plates.

– Output signal groups that are supplied via additional electrical supplies.
  These can be arranged in both their own and a separate valve terminal.

– Integrated power supply of another valve terminal. The operating voltage for electronics and sensors $U_{EL/SEN}$ is supplied from the unswitched auxiliary power supply and the load voltage U_{VAL}/U_{OUT} from an output channel (CH1 or CH2). If required, (during operation), the load of the other valve terminal is then switched off without influencing the communication and input functions.

Note
- Use a maximum of 2 output channels in a common safety pilot circuit.

Information on the voltage supply concept of the CPX terminal can be found in the CPX system description.

1.1.1 Design of the output module CPX-FVDA-P2

The output module CPX-FVDA-P2 features a modular design and consists of the following components:

1. Connection block CPX-M-AB-4-M12X2-5POL
2. Alternative connection block CPX-AB-8-KL-4POL
3. Electronics module CPX-FVDA-P2
4. 10-way DIL switch for PROFIsafe address
5. Mechanical coding
6. Interlinking block CPX-M-GE-EV-FVO
7. Rating plate (underneath)
8. Electrical plug connector
9. LEDs of the module

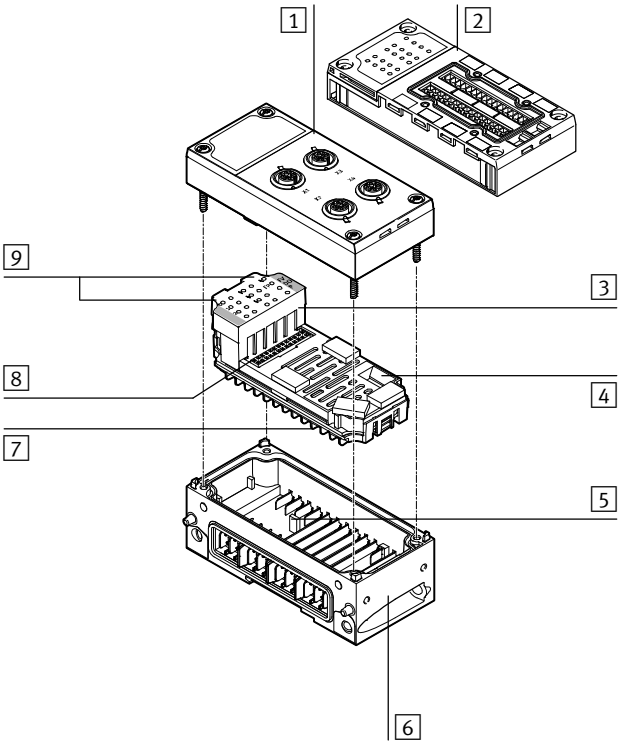


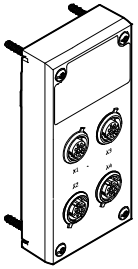
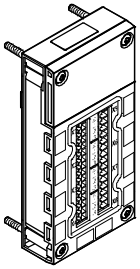
Fig. 1/2: Design of the output module CPX-FVDA-P2

To avoid errors in mounting, both the interlinking block CPX-M-GE-EV-FVO and the electronics module CPX-FVDA-P2 are mechanically coded. The coding prevents a different module from being plugged into the interlinking block or the electronics module from being plugged into an incorrect interlinking block.

Components

Connection block

The connection block provides the output module's electrical connection technology. The following connection blocks can be used for CPX-FVDA-P2:

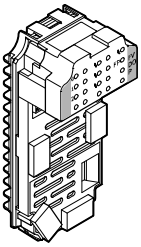
Connection block	Type code	Description
	CPX-M-AB-4-M12X2-5POL	M12 metal connection technology – 4 M12 socket contacts with metal thread, 5-pin – Degree of protection IP65/IP67 when using cover caps for unused connections – A functional earth connection for each socket contact – Possibility of shielding through metal thread – Enables the use of M12- and SPEEDCON connectors
	CPX-AB-8-KL-4POL	Terminal strip connection technology – 2 terminal strips, 16-pin (4 x 4-pin) – Degree of protection IP20 Degree of protection IP65/IP67 with cover AK-8KL and fittings kit VG-K-M9 – All cores can be placed individually in a spring-loaded terminal – Connections combined in groups of 4 with one functional earth connection for each group

Tab. 1/1: Permissible connection block

Connection blocks are not mechanically coded.
The use of a connection block other than those specified here is not permitted.

Electronics module

The electronics module contains the electronic components of the output module. It is connected to the interlinking block and the connection block by means of electrical plug connectors. The PROFIsafe address can be set directly on the electronics module using a DIL switch (➔ chapter 2.4).

Electronics module	Type	Description
	CPX-FVDA-P2	– One digital output channel CH0 for switching off the load voltage supply U_{VAL} in the linking of the CPX terminal[1)] – Two digital output channels CH1 and CH2[2)] – Control of the digital output channels with safety-related PLC via PROFIsafe – Status and error display per output channel – Module error display – Max. load current at CH0, CH1 and CH2 (➔ Technical data). – Electronic fuse as short-circuit protection – A mechanical coding prevents the electronics module from being plugged into impermissible interlinking blocks.

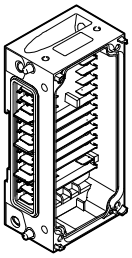
1) All the modules supplied via the load voltage supply U_{VAL} of the CPX terminal are switched off in two channels by means of P- and M-switching.

2) The connected external consumers are switched off in two channels by means of P- and M-switching.
Output channels 1 and 2 (CH1, CH2) are supplied from U_{VAL}.

Tab. 1/2: Electronics module

Interlinking block

The interlinking block CPX-M-GE-EV-FVO provides the mechanical and electrical link to the CPX terminal.

Interlinking block	Type code	Description
	CPX-M-GE-EV-FVO	Special metal interlinking block for CPX-FVDA-P2 (without supply) – Interrupts all contact rails for load voltage supplies (U_{VAL} and U_{OUT}) – The contact rails for the load voltage supply U_{VAL} are closed or interrupted via the output module – The contact rails for U_{OUT} remain interrupted[1)] – Mechanical coding prevents you from plugging in impermissible electronics modules
[1)] To the right of the output module, a U_{OUT} is no longer available via the contact rails.		

Tab. 1/3: Interlinking block

The use of different interlinking blocks for CPX-FVDA-P2 is not permitted.

1.1.2 Supported CPX product versions

A PROFIBUS or PROFINET-enabled bus node is required for controlling the output module CPX-FVDA-P2. The CPX terminal must be equipped with one of the following bus nodes (➔ rating plate):

Bus node	from revision	Network protocol
CPX-FB13	30	PROFIBUS
CPX-FB33	21	PROFINET IO
CPX-FB34	21	PROFINET IO
CPX-FB35	21	PROFINET IO

Tab. 1/4: Bus nodes for controlling the CPX-FVDA-P2

The following product versions of the CPX terminal in combination with the named bus nodes support the operation of the output module CPX-FVDA-P2:

Product version	Description
Electrical terminal CPX-M	Modular electrical terminal CPX (without pneumatic modules)
Valve terminal, type code 32 – MPA-S-FB-VI	Valve terminal MPA-S with modular electrical peripheral equipment CPX
Valve terminal, type code 33 – MPA-F-FB-VI	Valve terminal MPA-F with modular electrical peripheral equipment CPX
Valve terminal, type code 44 – VTSA-FB-VI – VTSA-FB-NPT-VI	Valve terminal VTSA with modular electrical peripheral equipment CPX
Valve terminal, type code 45 – VTSA-F-FB-VI – VTSA-F-FB-NPT-VI	Valve terminal VTSA-F with modular electrical peripheral equipment CPX

Tab. 1/5: Supported product versions in combination with above bus node

Product versions		
Valve terminal	**Type**	**Valve types**
MPA-S-FB-VI	32	MPA1, MPA2 on VMPA...-FB-EMG-...[1)]
MPA-F-FB-VI	33	MPAF1, MPAF2 on VMPA...-FB-EMG-...[1)]
VTSA-FB-VI	44	All up to width of 52 mm[1)]
VTSA-F-FB-VI	45	All up to width of 52 mm[1)]
[1)] Malfunctions may occur if the resultant current is exceeded.		

Tab. 1/6: Supported product versions of the CPX terminal

Other product versions are not supported by the output module CPX-FVDA-P2 at output channel CH0.

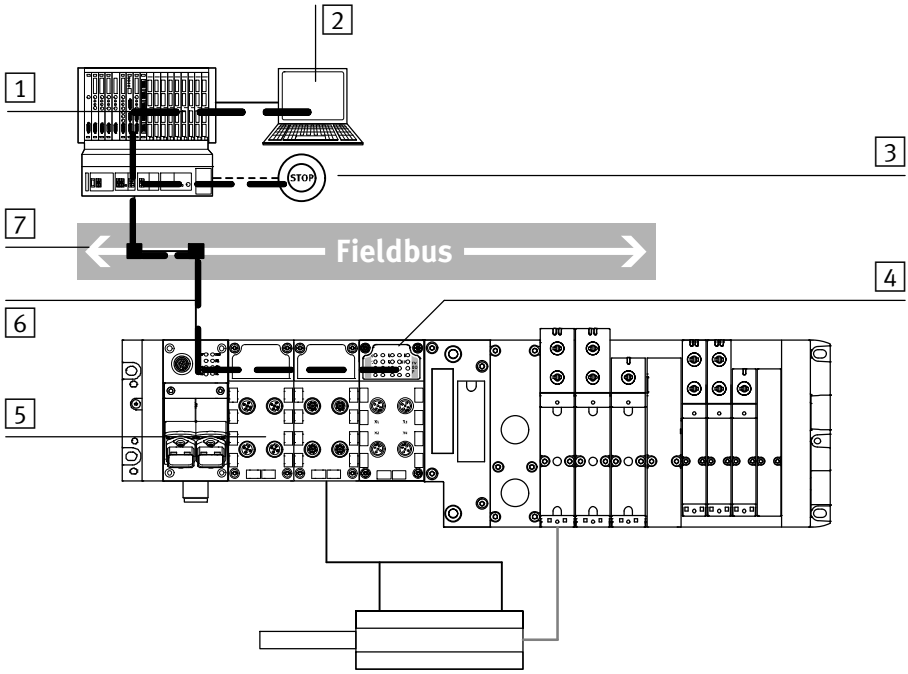
Note
When using the pneumatic interface VABA-S6-1-X2:
- Set the “Wire break monitoring” parameter of the pneumatic interface to inactive (➔ parameter description for the pneumatic interface).

Otherwise, the module’s self-monitoring function can trigger false diagnoses in certain cases.

Note
When using individual pneumatic modules of types VMPA-..., VTSA-... or VMPAL-..., the “wire break” diagnostic message may be triggered as the detection limit is undershot.
- In this case, deactivate the “wire break” diagnostic message for output channel CH0.

1.1.3 Required bus topology (control chain)

Hardware and software components are required to set up safety-related systems. For example, a safety controller (F-Host) with corresponding planning and programming tools is required.



1 Safety controller (F-Host)

2 Safety Configuration Tool (for safety controller)

3 Emergency stop button (example)

4 Output module CPX-FVDA-P2

5 CPX terminal with bus node for PROFIBUS or PROFINET IO

6 Embedded PROFIsafe data (black channel)

7 PROFIBUS or PROFINET IO

Fig. 1/3: Communication between safety controller and safety module via PROFIsafe

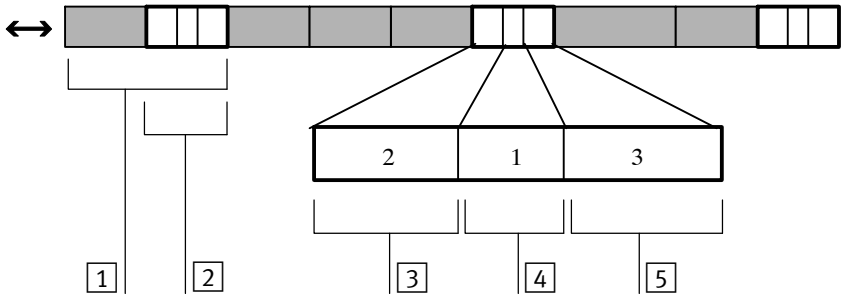
1.2 PROFIsafe

The data exchange between the output module and the safety controller occurs via the safety-related PROFIsafe bus profile from PROFIBUS or PROFINET.

1.2.1 PROFIsafe safety profile

The PROFIsafe telegrams are embedded in standard telegrams and transmitted via the black channel from the safety PLC to the output module. The black channel extends from the field bus connection on the safety controller via the CPX bus node to the output module CPX-FVDA-P2 (➔ Fig. 1/3). The PROFIsafe telegrams are processed there by the output module.

In addition to process data, the PROFIsafe telegrams also transmit safety information. Therefore, the output module CPX-FVDA-P2 is allocated 6 bytes in the CPX terminal's process image (➔ Fig. 1/4; 3, 4, 5).



1 Standard telegram with embedded PROFIsafe data

2 Embedded PROFIsafe telegram

3 2 bytes for the module's F-user data

4 1 byte status or control byte

5 3 bytes CRC signature (CRC2)

Fig. 1/4: Telegram structure of the output module CPX-FVDA-P2

Data are transmitted on the same physical basis as the transfer of process data to a standard module. There is a distinction to be made between the kind of data and the interpretation of that data by the F-Device (PROFIsafe slave).

The following applies for PROFIsafe communication in combination with the output module CPX-FVDA-P2:

– The module supports the PROFIsafe bus profile in the V2 mode

– Parametrisation on V1 mode is rejected

1.2.2 Process image

Due to the PROFIsafe safety mechanisms, the output module CPX-FVDA-P2 occupies 6 bytes for inputs and 6 bytes for outputs in the process image of the CPX terminal. Of these, 4 bytes each are used exclusively for PROFIsafe communication.

The 6 bytes for outputs are made up as follows:

– 2 bytes output data (F-user data, ➔ Tab. 1/7)

– 1 status byte (for PROFIsafe communication)

– 3 CRC bytes (for PROFIsafe communication)

The 6 bytes for inputs are made up as follows:

– 2 bytes input data (F-user data, ➔ Tab. 1/8)

– 1 control byte (for PROFIsafe communication)

– 3 CRC bytes (for PROFIsafe communication)

1.2.3 Bit pattern of the output and input data (F-user data)

Bit pattern of the output data: byte 0 and byte 1

Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Byte 0	Re-served	Test pulse activated		Reserved		Target status		
		CH2	CH1			CH2	CH1	CH0
	0	0 = Activate 1 = Deactivate		0		0 = Off 1 = On		
Byte 1	Channel-wise passiva-tion	Reserved		Data direc-tion	Re-served	Acknowledgment		
						CH2	CH1	CH0
	0 = Off 1 = On	0		0 = Device to Host (fixed value)	0	– Low → High change = user acknowledgment or – permanent 1 = auto acknow-ledgment		

Tab. 1/7: Bit pattern of the output data (F-user data, byte 0 and byte 1)

- Make sure that all the output data bits are set according to their definition.

Bits 0 ... 2 control the switches at output channels 0 ... 2.

- Make sure that the controlled switching frequency is not exceeded.

Switching commands are only executed by an integrated (de-passivated) module. Failsafe values are output if the module or channel is passivated.

Cross-circuit monitoring

The test pulses of the relevant output channel can be deac-tivated in a targeted manner via bit 5 and bit 6 of byte 0. This reduces the interference potential for the connected load. The other diagnostics measures remain active.
The switch-off paths are checked cyclically during active mon-itoring. The function of the electronic switches and lack of

cross-circuiting of the lines are checked. The cyclical check results in a momentary potential shift of the output voltage, which simultaneously takes place on the P- and M-sides. As a result, the output voltage remains largely unchanged. Potential-free consumers are not affected by this test.

The actual status of the operating mode is returned at the same position in the input data.

Note
The safety-related characteristic values change if the cross-circuit monitoring test pulses are deactivated (➔ appendix Tab. A/11).

Note
The cross-circuit monitoring function only monitors the device's own circuits.

- Ensure that cross-circuiting to other circuits is not possible using appropriate installation measures.

Channel-wise passivation

The "channel-wise passivation" can be switched on or off via bit 7 of byte 1.

As long as the function is inactive (0 = Off), the output module safely switches off all output channels even in the case of an individual channel error (in accordance with the PROFIsafe specification) and signals this error to the F-Host via the "FV_activated" and "Device Fault" flags. The F-Host then passivates the output channels of the module (F-Slave), isolates the module and sets the "Activate_FV" control bit.

Caution
If the module determines that the cause of an error is no longer present, it will withdraw the “Device_Fault” flag. The F-Host must evaluate this and can only withdraw the “Activate_FV” control bit when a safe restart is possible or the hazard can be contained through other measures. The technical possibilities can be found in the documentation of the relevant F-Host.

If a channel error occurs when the function is active (1 = On), the output module safely switches off only the output channel in which the error occurred. Uninvolved output channels remain uninfluenced and the module remains integrated.

In addition to the current status, the module signals the channel error status to the controller via the input image (➔ Tab. 1/8, channel error status).

Input data

In byte 0, the output module returns the logical current states as well as the statuses of the monitoring flags to the F-Host as input data (➔ Tab. 1/8). This makes it possible to check the status of the monitoring flags.

The setting of the “channel-wise passivation” parameter is returned in byte 1. If channel-wise passivation is switched on, the channel errors detected by the module are signalled through the bits “Channel error status of channel ... ”. These errors can be evaluated by the F-Host.

Bit pattern of the input data: byte 0 and byte 1

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Re-served	Test pulse activated		Reserved		Logical current state[1)]		
		CH2	CH1			CH2	CH1	CH0
	0	0 = Activated 1 = Deactivated		0		0 = Off 1 = On		
Byte 1	Channel-wise passiva-tion	Reserved		Data direc-tion	Re-served	Channel error status		
						CH2	CH1	CH0
	0 = Off 1 = On	0		1 = Host to Device (fixed value)	0	0 = No error 1 = Error		

1) These bits reflect the logical current states. The states are **not** determined through measure-ments. No external voltages are evaluated at passivated or switched-off outputs. If the complete module is passivated, these bits deliver logic 0 signals. If an output channel is passivated, the corresponding bit delivers a logic 0 signal.

Tab. 1/8: Bit pattern of the input data (F-user data, byte 0 and byte 1)

Acknowledgment sequence

If channel-wise passivation is used, acknowledgement must be ensured via the user program.

The following sequence description (➔ Tab. 1/9) shows the relevant bits for channel-wise passivation in the input and output images of the module.

No.	Sequence	Channel-wise passivation[1)]	Target status of the output channel[1)]	Actual status of the output channel[2)]	Channel error status[2)]	Acknowledgment of channel error[1)]
1	Module is not passivated	1 (active)	x	x	0	0
	Channel error occurs					
2	Module has detected the error	1 (active)	x	0	1	0
	F-Host detects the error in the module					
3	F-Host passivates the output	1 (active)	0	0	1	0
	Error is rectified					
	User acknowledges the error (at least 1 F-I/O cycle)	1 (active)	0	0	1	1
4	Channel is no longer passivated	1 (active)	x	x	0	0

The cells highlighted in grey indicate the bits that are relevant for the respective table row.
1) Bit in the output image (➔ Tab. 1/7)
2) Bit in the input image (➔ Tab. 1/8)
X = Signal irrelevant; 1 = Logic 1; 0 = Logic 0

Tab. 1/9: Channel error acknowledgment – example

The detection of a short circuit is not possible in the passivated status. Therefore, the short circuit is reported until it is acknowledged.

Automatic acknowledgment is possible by holding the acknowledgment bit permanently at “1”. Reintegration is delayed in the event of a short circuit.

In case of acknowledgment despite the presence of an error, the output channel is automatically passivated again within the detection time. If automatic acknowledgment is not desired, the user program must be used to ensure that the F-Host resets the acknowledgment.

Data direction

In the supported version, the PROFIsafe protocol does not have a sufficient indication of the transmission direction of a telegram. As a result, it is possible that a telegram from the F-Host will be sent back to it and misinterpreted.
This is extremely rare and occurs only if an unsafe participant malfunctions in the black channel.

To safely avoid this exception:

- Make sure that bit 4 of byte 1 (in the F-Host) of the F-user data’s input image is regularly checked for “1”.
- Also ensure that when a “0” is read in, the relevant module is immediately passivated in the controller.

1.3 Mode of operation of the output module

The switches of the output channels are each controlled by different processors in accordance with the safety concept. For this purpose, the output module is equipped with 2 processors that monitor each other constantly and check the switching capability. In addition, they can monitor the output channels for short circuits and cross circuits (➔ Fig. 1/1).

Each high-side path (P, 24 V current path) of an output channel is coupled with a current measurement device. This is able to measure current from about 50 mA and detect load and short-circuit current.

The entire module is designed to ensure that the output channels are also switched off in case of an error, e.g.:

– Overvoltage, undervoltage, overload, short circuit and cross circuit

– PROFIsafe communication failure or malfunction

– Failure or defect of individual safety-determining components of the module.

➔

Note
When operating a load with constantly high momentum (e.g. fast-switching valves), the diagnostic function cannot be completely executed. In this case, the output channel is switched off safely.

- Ensure that a load with sufficiently low momentum is operated at the relevant output channel.

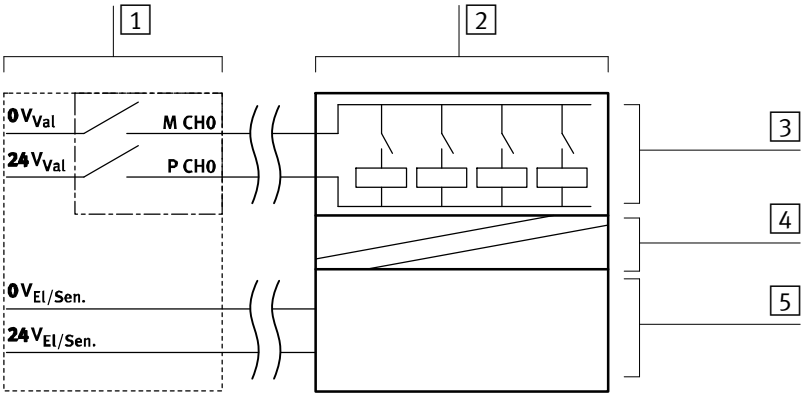
1.3.1 Application ranges

The module can only be used in machines and systems with increased safety requirements if a safe state is achieved by switching off circuits. The following table lists possible applications:

Case	Safely switching off ...	Output channel used	Safe function
1	... the load voltage supply for the internal valves of the valve terminal with galvanic isolation	CH0	Safe switch-off of the load voltage with cyclical checking of the switch-off paths for function and cross circuit
2	... potential-free individual consumers (e.g. valves, contactors, relays)	CH1 + CH2	
3	... the load voltage of external electronic consumers with safe galvanic isolation of the load voltage		

Tab. 1/10: Possible applications for the output module CPX-FVDA-P2

Case 1: Safely switching off the load voltage supply for the internal valves of the valve terminal with galvanic isolation via CH0.



1 Output module CPX-FVDA-P2 with interlinking block CPX-M-GE-EV-FVO

2 Valve terminal MPA or VTSA

3 Solenoid coils of the internal pneumatics

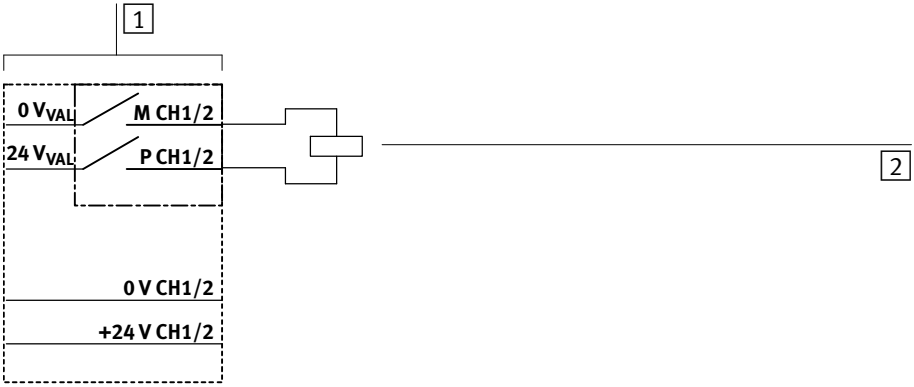
4 Galvanic isolation

5 Electronics side

Fig. 1/5: Switching off the load voltage supply of CPX-internal solenoid coils

Case 2: Safely switching off potential-free individual consumers via CH1 or CH2 (e.g. valves, contactors, relays).

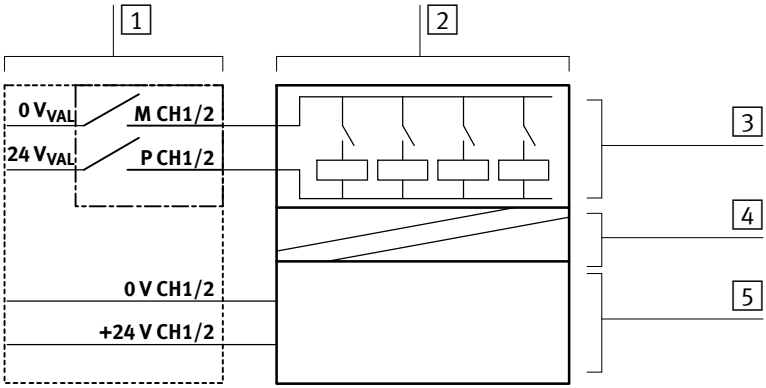
For example, an internal or external valve group can be exhausted via an external venting valve.



1 Output module CPX-FVDA-P2 2 Potential-free passive load

Fig. 1/6: Safely switching off potential-free individual consumers

Case 3: Safely switching off the load voltage of external electronic consumers with safe galvanic isolation of the load voltage via CH1 or CH2.



1 Output module CPX-FVDA-P2

2 External consumer (e.g. valve terminal, switch-off group of the CPX terminal or switch-off group of a valve terminal)

3 Load side of the consumer, galvanically isolated

4 Galvanic isolation

5 Electronics side of the consumer can optionally be connected to the 24 V supply provided by the module

Fig. 1/7: Safely switching off the load voltage of external electronic consumers with safe galvanic isolation of the load voltage

1.3.2 Application examples

A safety function is created by safely switching off connected consumers. The following application examples show you the different potential options for the intended use of the CPX-FVDA-P2.

Note
The output channels of the CPX-FVDA-P2 do not provide isolated potentials which may be used independently from a safety perspective. For this reason, the P- and M-connections of an output channel must always be used together.

- Make sure that the current path is always routed from P to M of the **same** output channel.

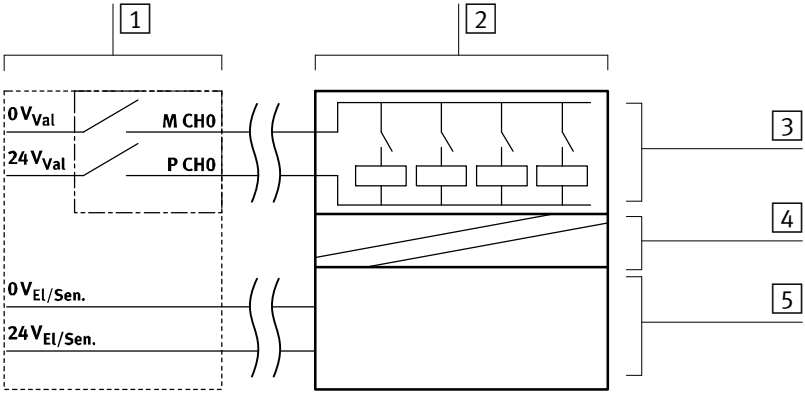
The following pages contain various application examples that illustrate the switching of permissible and impermissible safety circuits.

Caution

- Make sure that the application examples which are designated as impermissible are not used under any circumstances.
  They merely represent an example of foreseeable misuse.

Example 1 – permissible use of the CPX-FVDA-P2

Internal connection of the CPX valve terminal, which is mounted on the CPX terminal, to CH0.



1 Output module CPX-FVDA-P2 with interlinking block CPX-M-GE-EV-FVO

2 CPX valve terminal MPA or VTSA

3 Solenoid coils of the internal pneumatics

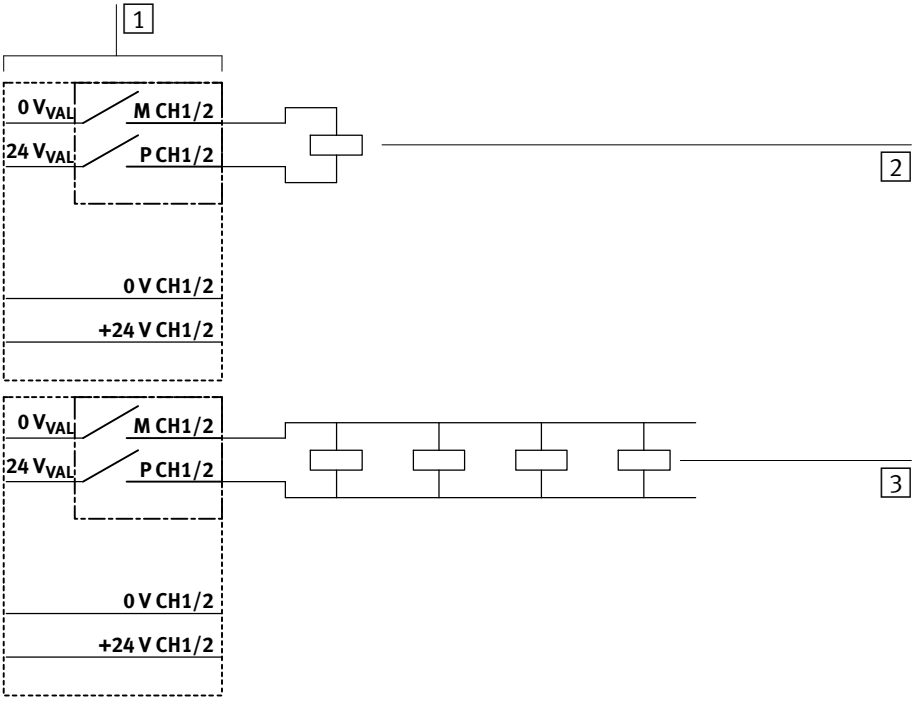
4 Galvanic isolation

5 Electronics side

Fig. 1/8: Connecting the load voltage supply of CPX-internal solenoid coils

Example 2 – permissible use of the CPX-FVDA-P2

Connecting potential-free passive loads to one of the two output channels CH1 or CH2.



1 Output module CPX-FVDA-P2

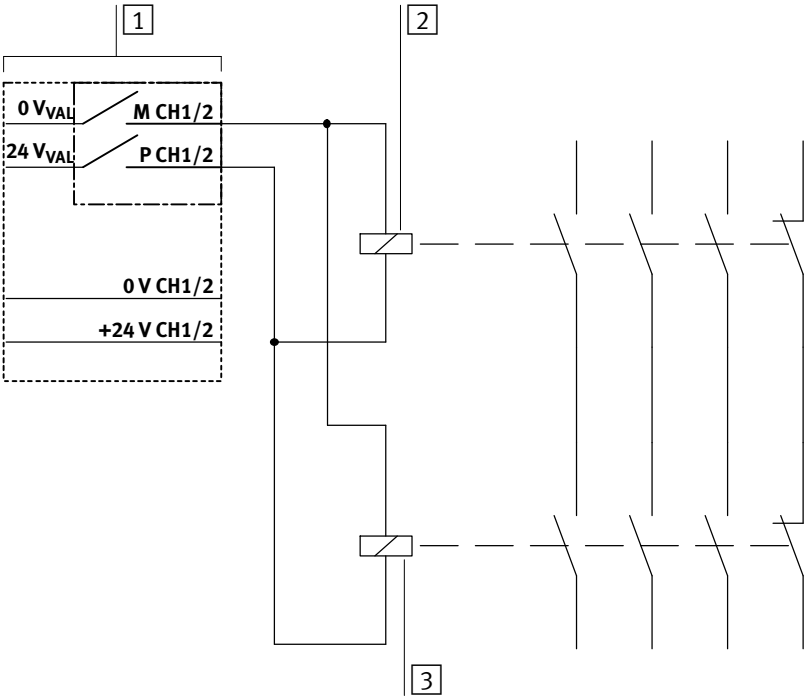
2 Potential-free passive load

3 Potential-free parallel passive loads

Fig. 1/9: Safely connecting potential-free individual consumers

Example 3 – permissible use of the CPX-FVDA-P2

Connecting safety relays to one of the two output channels CH1 or CH2.



1 Output channel CH1 or CH2 of output module CPX-FVDA-P2

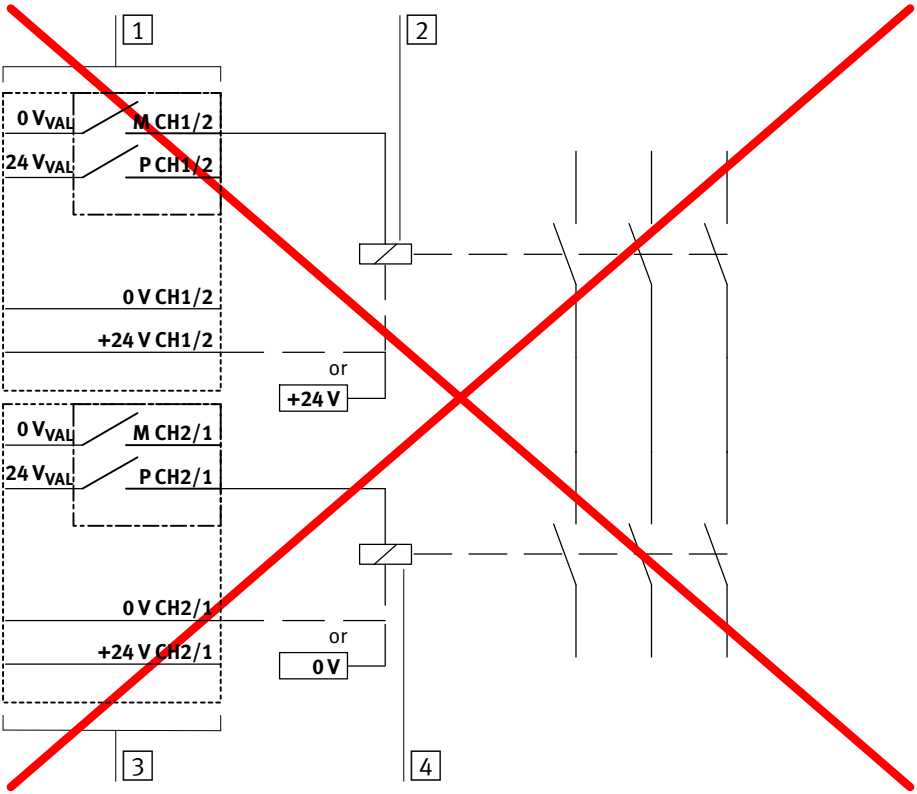
2 Safety relay 1 with forcibly actuated acknowledgment contact

3 Safety relay 2 with forcibly actuated acknowledgment contact

Fig. 1/10: Safely connecting safety relays

Example 4 – impermissible use of the CPX-FVDA-P2

Caution
This connection of potential-free loads **must not be used** to create a safety circuit.



1 Output channel CH1 or CH2 of output module CPX-FVDA-P2

2 Safety relay 1

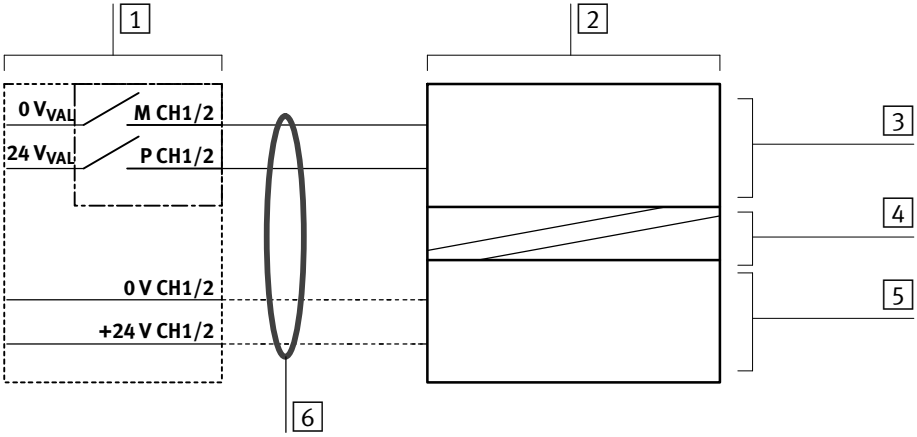
3 Output channel CH2 or CH1 of output module CPX-FVDA-P2

4 Safety relay 2

Fig. 1/11: Impermissible connection of potential-free individual consumers, using safety relays as an example

Example 5 – permissible use of the CPX-FVDA-P2

Connecting general active loads to one of the two output channels CH1 or CH2.



1 Output module CPX-FVDA-P2

2 General active load

3 Safety load circuit

4 Galvanic isolation

5 Supply of the general active load

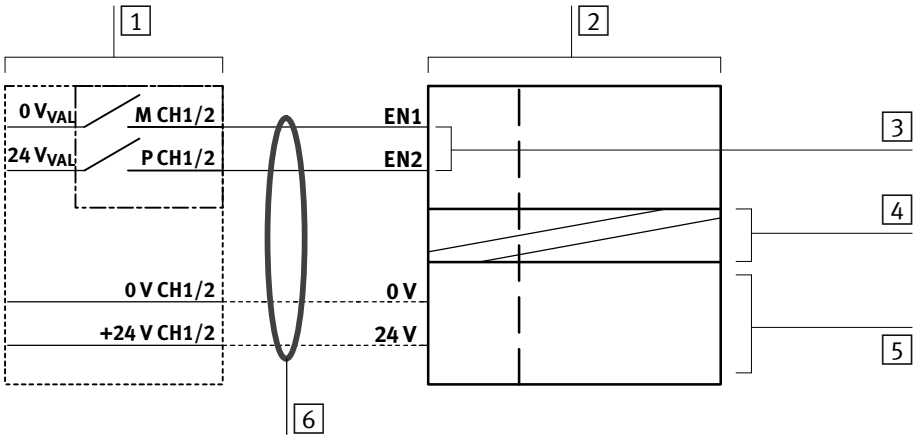
6 The signals may be routed together via the same cable

Fig. 1/12: Connecting general active loads

If the supply comes from the output module, a functional galvanic isolation is sufficient.

Example 6 – permissible use of the CPX-FVDA-P2

Connecting a MS6-SV-..-E-10V24-... via NECA-S1G9-P9- MP5 to one of the two output channels CH1 or CH2.



1 Output module CPX-FVDA-P2

2 NECA-S1G9-P9-MP5 with MS6-SV-..-E-10V24-...

3 Antivalent control inputs EN1, EN2

4 Galvanic isolation

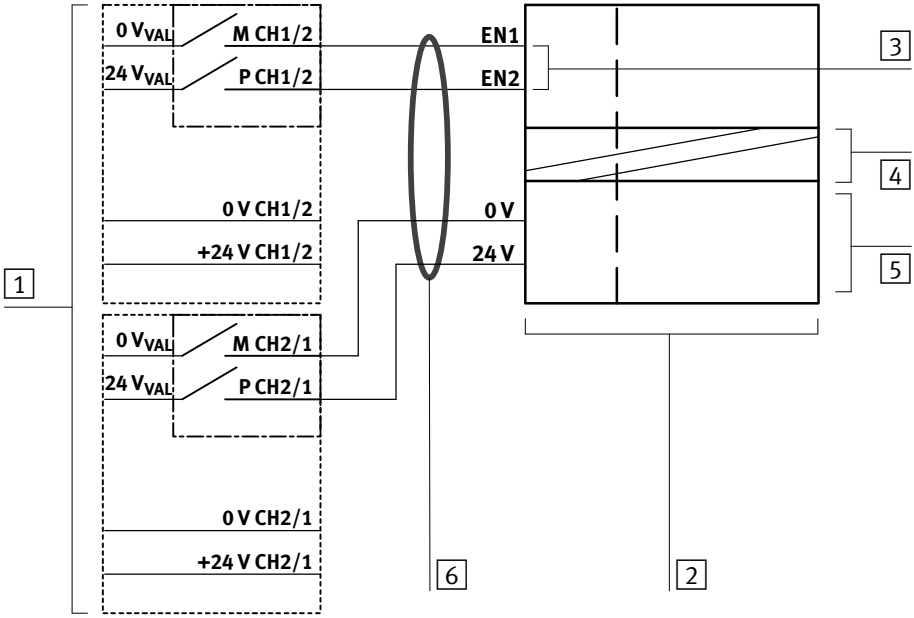
5 Supply of the MS6-SV-..-E-10V24-... via NECA-S1G9-P9-MP5

6 The signals may be routed together via the same cable

Fig. 1/13: Connecting a MS6-SV-..-E-10V24-... via NECA-S1G9-P9-MP5

Example 7 – permissible use of the CPX-FVDA-P2

Connecting a MS6-SV-..-E-10V24-... to both output channels CH1 and CH2.



1 2 x output module CPX-FVDA-P2 with interlinking block CPX-M-GE-EV-FVO

2 NECA-S1G9-P9-MP5 with MS6-SV-..-E-10V24-...

3 Antivalent control inputs EN1, EN2

4 Galvanic isolation

5 Supply of the MS6-SV-..-E10V24-... via NECA-S1G9-P9-MP5

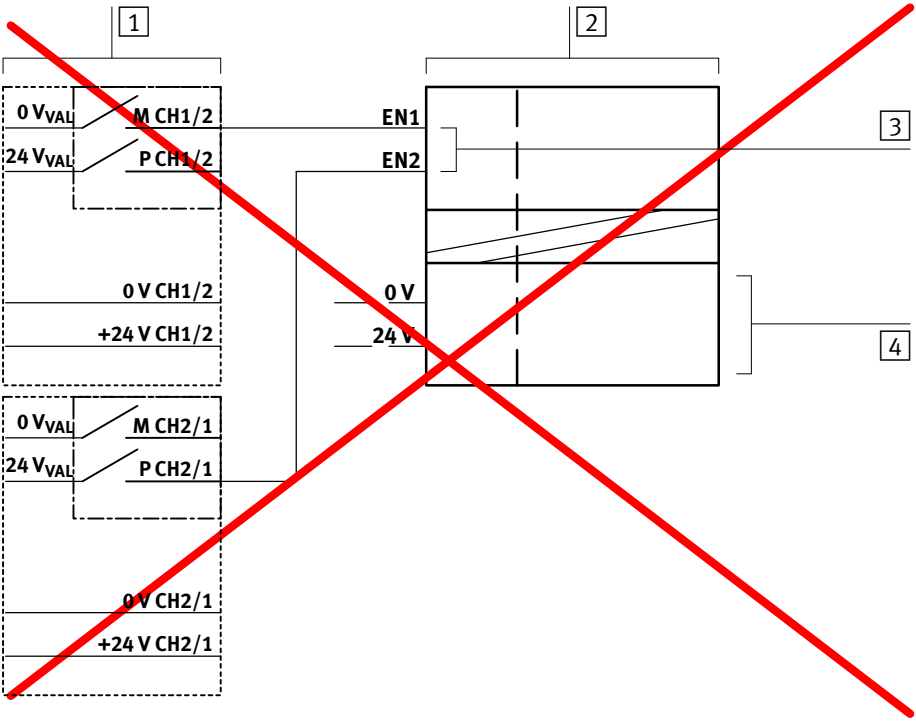
6 The signals may be routed together via the same cable (with a Y distributor if required)

Fig. 1/14: Connecting a MS6-SV-..-E-10V24-... via NECA-S1G9-P9-MP5to both output channels CH1 and CH2.

The second output channel can be used to briefly switch off the supply to MS6, which triggers a reset and the acknowledgment of an internal MS6 error shutdown.

Example 8 – impermissible use of the CPX-FVDA-P2

Caution
This connection of a MS6-SV-..-E-10V24- **must not be used** to create a safety circuit.



1 2 x output module CPX-FVDA-P2

2 NECA-S1G9-P9-MP5 with MS6-SV-..-E-10V24-...

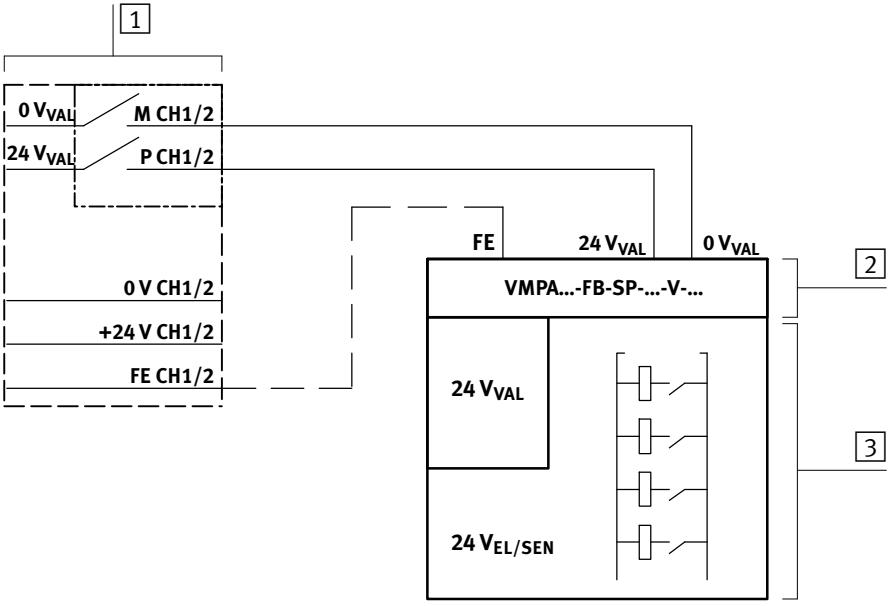
3 Antivalent control inputs EN1, EN2

4 Supply of the MS6-SV-..-E10V24-... via NECA-S1G9-P9-MP5

Fig. 1/15: Impermissible connection of a MS6-SV-..-E-10V24-...

Example 9 – permissible use of the CPX-FVDA-P2

Connecting a separate safety circuit of a valve terminal via an additional supply to one of the two output channels CH1 or CH2.



1 Output channel CH1 or CH2 of output module CPX-FVDA-P2

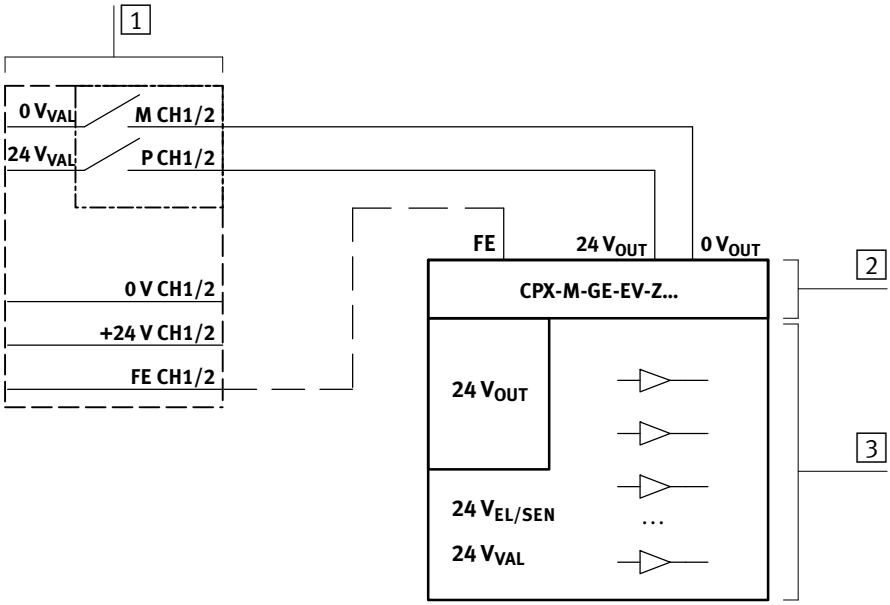
2 Additional supply VMPA...-FB-SP-...-V-...

3 Part of the valve terminal with the valves that must be switched off for safety

Fig. 1/16: Connecting a valve terminal via an additional supply

Example 10 – permissible use of the CPX-FVDA-P2

Connecting output modules of a separate supply circuit via an additional supply to one of the two output channels CH1 or CH2.



1 Output channel CH1 or CH2 of output module CPX-FVDA-P2

2 Additional supply CPX-M-GE-EV-Z...

3 Part of the CPX terminal with the output modules that must be switched off for safety

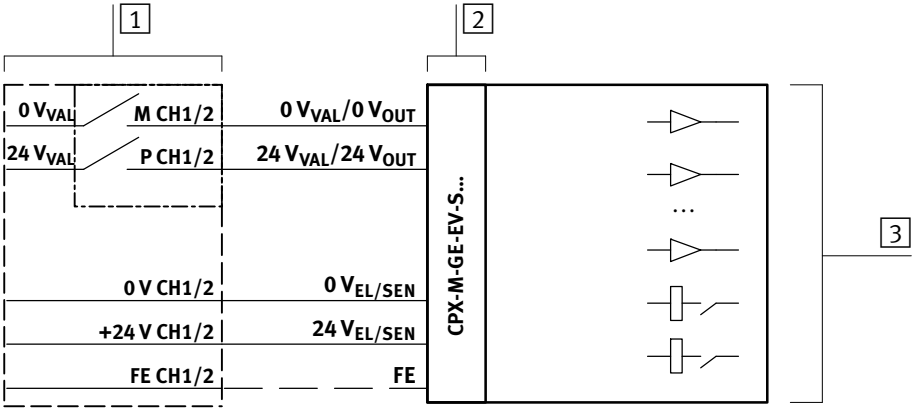
Fig. 1/17: Connecting a separate supply circuit via an additional supply

Note

- Only use the released output modules in the safety circuit.
- Observe the specifications for connecting loads to an output module in the safety circuit (➔ chapter 1.4.2 and example 12).

Example 11 – permissible use of the CPX-FVDA-P2

Connecting an external valve terminal via the system supply to one of the output channels CH1 or CH2. Outputs and valves are operated in the same safety circuit.



1 Output channel CH1 or CH2 of output module CPX-FVDA-P2

2 System supply CPX-M-GE-EV-S...

3 CPX valve terminal with the output modules and valves that must be switched off for safety

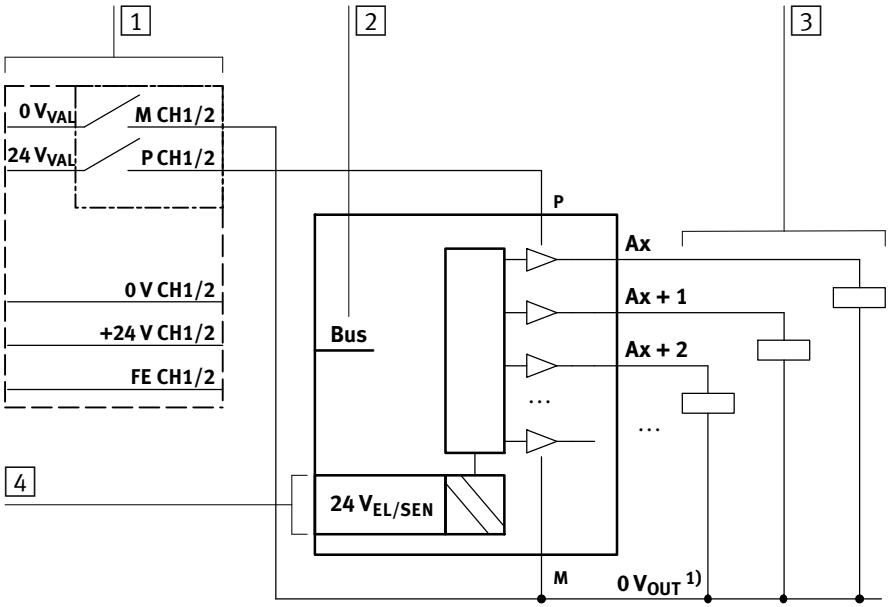
Fig. 1/18: Connecting an external valve terminal via the system supply

Note

- Only use one of the following system supplies:
  - CPX-M-GE-EV-S-7/8-5POL
  - CPX-M-GE-EV-S-PP-5POL
  - CPX-M-GE-EV-S-7/8-CIP-4POL
- Only use the released output modules and valve terminals in the safety circuit.
- Observe the specifications for connecting loads to an output module in the safety circuit (➔ chapter 1.4.2 and example 12).

Example 12 – permissible use of the CPX-FVDA-P2

Connecting further loads to an output module in the safety circuit.



1 Output channel CH1 or CH2 of output module CPX-FVDA-P2

2 Internal system bus for functional control of the loads

3 Functionally switched loads that can be switched off for safety

4 Operating voltage supply, galvanically isolated

1) Signal names from P.BE-CPX-EA-...

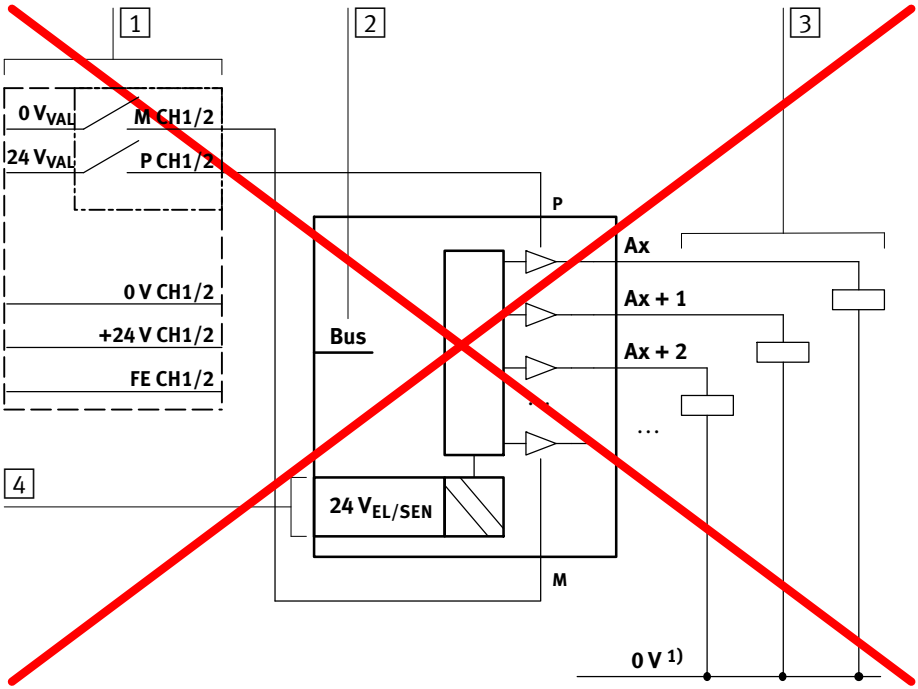
Fig. 1/19: Connecting further loads via an output module

Note

- Use only the existing connections for supplying the additional loads.
- Connect the additional loads in a potential-free manner (not related to FE or PE).

Example 13 – impermissible use of the CPX-FVDA-P2

Caution
This connection of loads via a 0-potential without connection to the M-channel **must not be used** to create a safety circuit.



1 Output channel CH1 or CH2 of output module CPX-FVDA-P2

2 Internal system bus for functional control of the loads

3 Functionally switched loads that can be switched off for safety

4 Operating voltage supply, galvanically isolated

1) 0 V potential that is not provided by M, e.g. V_{SEN}

1.4 Requirements for actuators (CH0 ... CH2)

Observe the following instructions when using the output module CPX-FVDA-P2 for safety purposes (➔ appendix A.1 Technical data)

1.4.1 Electrical requirements

All output channels ensure that loads are switched off safely. The number of loads to be switched off is limited by the maximum current load.

If the max. load current is exceeded, the output module sends an “Overload” diagnostic message for the relevant output channel and reacts with a channel or module orientation in a safety-oriented manner corresponding to the operating mode.

- Make sure that the loads used in the safety circuit are insensitive to test pulses of the cross-circuit monitoring function.
  If necessary, it may be helpful to deactivate the test pulses of the cross-circuit monitoring function. In this regard, please note the deviating safety characteristic values (➔ appendix A.1 Tab. A/11).
- Only use externally supplied loads if their supply voltage:
  - comes from safely galvanically isolated protective extra-low voltage (PELV)
  - comes from the load voltage supply for valves (U_{VAL}).

Note
If electronic loads are connected to CH1 and CH2, a cross circuit may be detected incorrectly under certain unfavourable operating conditions.

- Pay particular attention to the maximum values for the following characteristics (➔ appendix A.1 Technical data):
  - Cable length for external loads
  - Permanent current (load current) per output channel
  - Permanent current of the unswitched load voltage U_{VAL} (auxiliary supply) per output channel

Auxiliary supply connections (0 V, +24 V) for CH1 and CH2 are available on the front connections.

Further technical data ➔ appendix A.1.
Maximum permissible load inductivity at the output channels CH1 and CH2 (➔ Fig. A/5).

Note
When additional valves are added to a valve terminal, the load current at CH0 increases.

- When operating the valve terminal, make sure that the maximum permissible load current is **not** exceeded.
  To this end, limit the number of valves that are switched on at the same time.

Otherwise, the respective safety circuit will be switched off for safety reasons.

1.4.2 Safety-related requirements

When connecting loads:

- Observe the requirements of the safety standards that apply to the respective load and system type. This applies in particular to loads that have another energy supply or storage in addition to the electrical connection to the P and M channels.
- Make sure that the safe state of the loads is maintained under each of the following conditions:
  - Switching off the P and M channels (normal operation).
  - Switching off only the P channel or the M channel (error).

When controlling loads connected to additional voltage sources:

- Make sure that one of the following options applies:
  - The additional voltages come from the same source as the load voltage supply U_{VAL}.
  - The loads are galvanically isolated from the potential of the output channels of the CPX-FVDA-P2 in accordance with the required safety level.

When operating loads that are switched via another output module (➔ table Tab. 0/3):

- Take measures to prevent or detect cross circuits between the other output module and the load.
- Operate the load in a potential-free manner.
- Make sure that the power supplies used are from the same source to guarantee the cross circuit monitoring function.
- Always connect the load to the corresponding 0 V connection on the output module.

Note
- Make sure that CH1 and CH2 are not connected in an electrically parallel manner.

Note
- Make sure that all voltages in the system (for CPX and its loads that are switched for safety purposes) are based on the same functional earth (FE).

Chapter 2

Contents

2.1 General installation instructions

Warning

- For the electrical power supply, use only PELV circuits in accordance with EN 60204-1 (protective extra-low voltage, PELV).
  Also take into account the general requirements for PELV circuits in accordance with EN 60204-1.
- Only use power sources which guarantee reliable electrical isolation of the operating voltage from the mains in accordance with EN 60204-1.
- Ensure that defective cables are replaced immediately.

Through the use of PELV circuits, protection from electric shock (protection from direct and indirect contact) is ensured in accordance with EN 60204-1 (refer to Electrical Equipment of Machines. General Requirements).

Compliance with the input voltage limits of the module is also ensured.

Module-related rules for configuration

- Only plug the output module CPX-FVDA-P2 into the interlinking block CPX-M-GE-EV-FVO.

A mechanical coding prevents the output module from being plugged into an incorrect interlinking block.

- Note that the connection blocks are not mechanically coded.
- Only operate the output module with connection blocks CPX-M-AB-4-M12X2-5POL or CPX-AB-8-KL-4POL.
- When placing the output module, ensure that the voltage 24 V_{VAL}/0 V_{VAL} is switched to the right of it through output channel CH0 and that the voltage 24 V_{OUT}/0 V_{OUT} is no longer available.
- Use the output module only in combination with permissible product designs of the CPX terminal (➔ section 1.1.2).

Note
The power supply U_{OUT} is no longer available on the right side of interlinking block CPX-M-GE-EV-FVO.

- If required, use an intermediate supply (additional supply) with the aid of a CPX-M-GE-EV-Z.

Note
The safety function of output channel CH0 is disabled when the intermediate supply CPX-M-GE-EV-Z is assembled on the right side of interlinking block CPX-M-GE-EV-FVO.

2.2 Connecting the cables and plugs to the connection block

Note
Incorrect handling can cause damage to the electronics modules.

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

Actuators are connected to the connection block. This means that the plugs and cables can remain on the connection block when, for example, the electronics module is replaced.

The degree of protection of the module depends on the connection block as well as on the plugs and cover caps used. Notes can be found on the following pages and in the appendix A.2.

Use plugs from the Festo product range (➔ www.festo.com/catalogue).

The max. permitted cable length is 200 m.

Note
In order for output modules with connection block CPX-M-AB-4-M12X2-5POL to comply with degree of protection IP65/IP67:

- Use the specified plugs from the accessories (➔ www.festo.com/catalogue) to connect the actuators.
- Tighten the union nuts of the plugs by hand.
- Use cover caps ISK-M12 to seal unused socket contacts (accessories).

Note
In order for output modules with connection block CPX-AB-8-KL-4POL to comply with degree of protection IP65/IP67:

- Use the specified cover from the accessories (➔ www.festo.com/catalogue) for sealing.

Note
The cross-circuit monitoring function only monitors the device's own circuits.

- Ensure that cross-circuiting to other circuits is not possible using appropriate installation measures.

2.3 Electrical connection and display components

The LEDs and the module identifier can be seen through the transparent cover of the connection block (example ➔ Fig. 2/1).

1 Rating plates on connection and interlinking blocks

2 Status LED (yellow) per output

3 Channel error LED (red) per output channel

4 Module error LED (red)

5 FP LED (green)

6 Module identifier FVDOP2 (for CPX-FVDA-P2)

7 Area for electrical connections

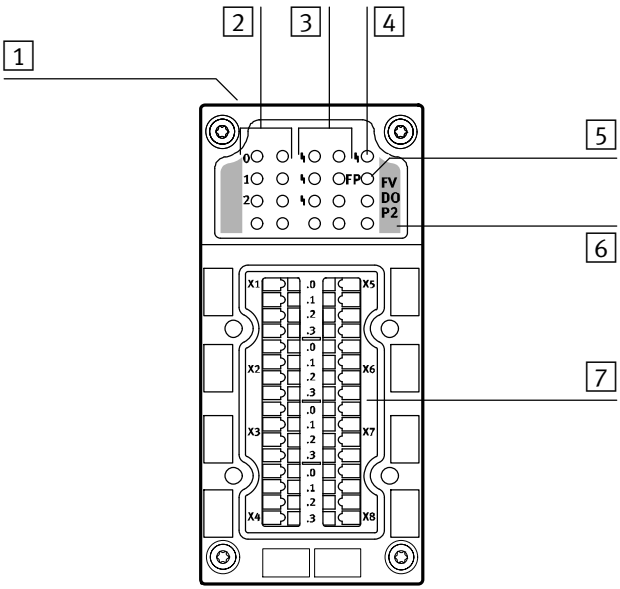


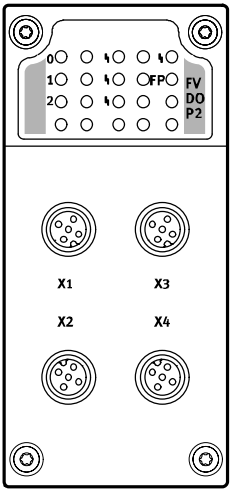
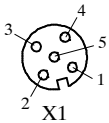
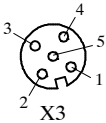
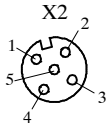
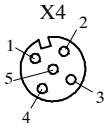
Fig. 2/1: Display and connecting components CPX-FVDA-P2

Detailed information on LEDs ➔ section 5.3.

2.3.1 Pin allocation with M12 connection block

Note
The socket contacts X1 to X4 on the connection block are labelled correspondingly. The numbering of the sockets here corresponds to the output addresses.

CPX-FVDA-P2 with connection block CPX-M-AB-4-M12X2-5POL

Connection block	Pin allocation X1, X2		Pin allocation X3, X4	
		Socket contact X1 1: 0 V CH1[1)] 2: +24 V CH1[1)] 3: F–DO(M) CH1[2)] 4: F–DO(P) CH1[2)] 5: FE		Socket contact X3 1: n.c. 2: n.c. 3: n.c. 4: n.c. 5: FE
		Socket contact X2 1: 0 V CH2[1)] 2: +24 V CH2[1)] 3: F–DO(M) CH2[2)] 4: F–DO(P) CH2[2)] 5: FE		Socket contact X4 1: n.c. 2: n.c. 3: n.c. 4: n.c. 5: FE

FE = functional earth
n.c. = free (not connected)
1) Unswitched voltage U_{VAL} usable for supply of intelligent load systems (auxiliary supply)
2) All output voltages are likewise derived from the internal contact rail U_{VAL}

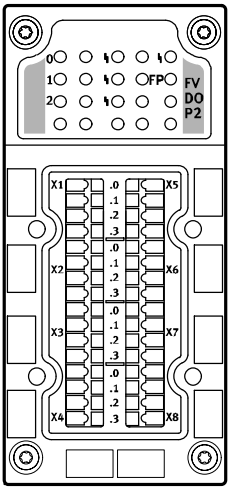
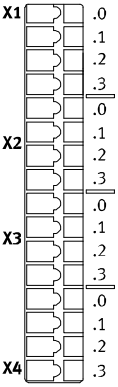
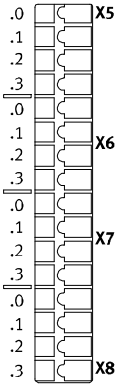
Tab. 2/1: Pin allocation with M12 connection block

The metal thread of the connection block CPX-M-AB-4-M12X2-5POL is connected internally with pin 5 (functional earth FE).

2.3.2 Pin allocation with terminal strip connection block

Note
The terminal strips on the connection block are labelled correspondingly. The numbering of the terminals corresponds to the output addresses.

CPX-FVDA-P2 with connection block CPX-AB-8-KL-4POL

Connection block	Left terminal strip allocation		Right terminal strip allocation	
		**X1** 0: 0 V CH1[1)] 1: F–DO (M) CH1[2)] 2: F–DO (P) CH1[2)] 3: FE **X2** 0: n.c. 1: n.c. 2: +24 V CH1[1)] 3: FE **X3** 0: 0 V CH2[1)] 1: F–DO (M) CH2[2)] 2: F–DO (P) CH2[2)] 3: FE **X4** 0: n.c. 1: n.c. 2: +24 V CH2[1)] 3: FE		**X5** 0: n.c. 1: n.c. 2: n.c. 3: FE **X6** 0: n.c. 1: n.c. 2: n.c. 3: FE **X7** 0: n.c. 1: n.c. 2: n.c. 3: FE **X8** 0: n.c. 1: n.c. 2: n.c. 3: FE

FE = functional earth
n.c. = free (not connected)
1) Unswitched voltage U_{VAL} usable for supply of intelligent load systems (auxiliary supply)
2) All output voltages are likewise derived from the internal contact rail U_{VAL}

Tab. 2/2: Pin allocation with TS connection block

2.4 Set PROFIsafe address

The output module is controlled by an F-Host via PROFIsafe and needs a PROFIsafe address for unique identification. The PROFIsafe address is defined via configuration software and is set directly at the output module using binary coding via the 10-way DIL switch. Both settings must match.
The 10-way DIL switch is located directly on the electronics module and can be set while the connection block is not mounted (➔ Fig. 1/2).
PROFIsafe addresses in the range from 1 to 1023 are permissible.

The DIL switch setting is evaluated during the run-up phase of the firmware. For that reason, the output module must be restarted by switching on the load voltage U_{VAL} again in order to accept the changed address. Information on address allocation via configuration software can be found in the software documentation.

Note
Incorrect handling can cause damage to the electronics modules.

- Never pull/push the electronics module from/into the interlinking block when powered.

Electronics modules include electrostatically sensitive devices.

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

Note
The DIL switch is a mechanically sensitive component due to its size.

- To set it, use an appropriate, small blunt tool (e.g. watchmaker's screwdriver) and proceed very carefully.

PROFIsafe address 0 is preset at the factory. The following image shows the 10-way DIL switch with an addressing example.

1 Addressing example – PROFIsafe address 578

2 Decimal value when set to ON

3 Calculation example – DIL switch element 2, 7 and 0 (10) set ON

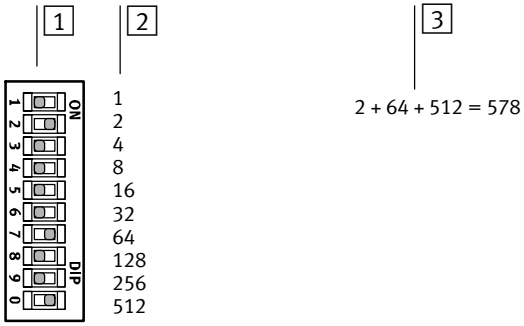


Fig. 2/2: 10-way DIL switch for setting the PROFIsafe address – binary coded

Note

- Before commissioning the automated system, ensure that the PROFIsafe address has been set according to the installation planning.

To set the PROFIsafe address on the DIL switch:

Note
Incorrect handling can cause damage to the electronics modules.

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

1. Switch off the power supplies of the CPX terminal.
2. Remove the mounted connection block (➔ section 2.5.1).
3. Carefully set the desired PROFIsafe address on the DIL switch by using a suitable tool, e.g. a small watchmaker's screwdriver.

During assembly, observe the instructions in section 2.5.2 (threaded connector without distortion, clean connection surfaces, etc.).

4. Reinstall the connection block. Tightening torque ➔ Technical data (appendix A.1).

2.5 Dismounting and mounting the electronics module

Note
Incorrect handling can cause damage to the electronics modules.

- Never pull/push the electronics module from/into the interlinking block when powered.

Electronics modules include electrostatically sensitive devices.

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

- Switch off the supply voltage before assembly or installation.
- Switch on the electrical supply voltage only when the module is completely assembled and installed.

To avoid errors in mounting, both the interlinking block CPX-M-GE-EV-FVO and the electronics module CPX-FVDA-P2 are mechanically coded. The coding prevents a different module from being plugged into the interlinking block or the module from being plugged into an incorrect interlinking block.

The plugs connected to the connection block on the CPX-M-AB-4-M12X2-5POL or cables on the CPX-AB-8-KL-4POL can remain attached whilst dismounting the connection block.

Before the CPX terminal can be extended or converted, it must first be unscrewed and dismounted. Instructions can be found in the CPX system description.

CPX terminals are supplied from the factory completely assembled. It may be necessary to dismount and mount the connection blocks for the following reasons:

– Replacement of the connection technology.

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

– Change to the DIL switch setting (PROFIsafe address)

– Replacement of a defective electronics module.

2.5.1 Dismounting the electronics module

To dismount the electronics module (➔ Fig. 1/2 in section 1.1.1):

1. Switch off the operating and supply voltages.
2. Unscrew the screws [9] and carefully lift off the connection block [1].
3. If necessary: pull the electronics module [2] carefully off the contact rails.

2.5.2 Mounting the electronics module

Note
- Handle the components with care.
- Ensure that the metal interlinking block is clean and free of foreign bodies, especially on and near the contact rails.
- Check the seals for damage.
- Make sure that connecting surfaces are clean in order to optimise the sealing effect and prevent contact errors.

Note
- Use only screws with metric threads for the metal interlinking block CPX-M-GE-EV-FVO.
- To avoid damaging the threads, make sure the screws are inserted precisely.
- Tighten the screws using a hand-held screwdriver only.
- Make sure that threaded fittings are free of any distortion or mechanical tension.
- Observe the specified tightening torques.
- For subsequently ordered modules and components, also observe the mounting instructions that come with the product.

- Before mounting, make sure that the PROFIsafe address is correctly set at the electronics module (➔ section 2.4).

To mount the electronics module and connection block (➔ Fig. 1/2 in section 1.1.1):

1. Switch off the operating and supply voltages.

2. Align the electronics module [2] correctly and press it carefully into the interlinking block [5].
3. Check the seal and the sealing surfaces, align the connection block [1] and place it on the electronics module [2].
4. Set the screws so that the self-cutting threads can be used. Tighten the screws by hand in diagonally opposite sequence; tightening torque: 0.9 ... 1.1 Nm.

Chapter 3

Contents

3.1 General instructions

The following software versions as well as a CPX bus node with a corresponding revision code are required to operate the output module:

Device master file	**Bus node** Revision code[1)]	**Control software** (PLC software version)
– PROFIBUS: from CPX_059E.gsd dated 04.02.2013 – PROFINET: from GSDML-V2.25-Festo-CPX-20121203.xml dated 03.12.2012	– CPX-FB13 from Rev. 30 – CPX-FB33 from Rev. 21 – CPX-FB34 from Rev. 21 – CPX-FB35 from Rev. 21	Manufacturer: Siemens – STEP 7: from Version 5.4 with Service Pack SP5 or higher – S7-Distributed Safety: from Version 5.4 with Service Pack SP4 or higher
		Manufacturer: Phoenix Contact – AUTOMATIONWORX Software Suite 2009 with service pack SP3 or higher – SafetyProg 2.4 (Build 356) or higher
1) Revision code ➔ bus node rating plate		

Tab. 3/1: Required versions

The configuration depends on the control system used. The basic approach and required configuration data are presented in the following pages.

3.1.1 Device master file (GSD/GSDML)

In combination with the output module CPX-FVDA-P2, a current device master file GSD/GSDML is required for configuration and programming.

Reference source

Current versions of the GSDML/GSD files for CPX terminals can be found on the Festo website (➔ www.festo.com/pk).

Import the GSDML/GSD file into the project of the configuration program. After importing, you can select the CPX terminal with the output module CPX-FVDA-P2 in the configuration program and edit it (e.g. set F-Parameters).

Configuration, parametrisation and commissioning of the CPX terminal with CPX-FVDA-P2 depend on the control system used.
You will find detailed information in the documentation of the control system used and the online help of the configuration software.

Module identification

Each module has its own identifier (module identifier).

Add the module identifiers – from left to right, corresponding to the physical order as installed in the CPX terminal – in your configuration program.

Module (order code)	Module identifier[1)]	Assigned I/O bytes[2)]
CPX-FVDA-P2	FVDO-P2	6 bytes O + 6 bytes I

1) Module identifier in the operator unit or in the hardware configuration of the programming software
2) 4 Bytes each are used exclusively for PROFIsafe communication

Tab. 3/2: Module identifier of the output module CPX-FVDA-P2

3.2 Preparing for commissioning

1. Ensure that the CPX terminal is mounted correctly (➔ CPX system description).
2. Check the wiring (connecting cables, contact assignment) (➔ chapter 2.3.1).
3. Dismount the connection block of the output module (➔ section 2.5.1).
4. Check that the module functions perfectly.
5. Set the PROFIsafe address using the DIL switch on the module and mount the connection block (➔ section 2.5.2).

3.3 Commissioning steps

Detailed information on configuring, programming and commissioning in combination with the relevant F-Host can be found in the F-Host manufacturer's documentation.
Instructions for configuring and commissioning the CPX terminal can be found in the CPX bus node description.

1. Integrate the GSDML/GSD file into the configuration software of the F-Host (➔ CPX bus node description).
2. Configure and parameterise the output module with the F-Host configuration software.
   - Add the CPX terminal to the configuration (➔ description of the corresponding CPX bus node)
   - Add the output module to the CPX configuration
   - Set the start address for the inputs and outputs
   - Set the PROFIsafe parameters of the output module (➔ section 3.4)
   - If required, set the standard parameters of the output module (➔ sections 3.5 and 3.5.1)
3. Create and load the safety program.
4. Commission the CPX terminal on the fieldbus (PROFIBUS or PROFINET IO) and test the characteristics in a trial run.

3.4 Setting the PROFIsafe parameters

PROFIsafe-specific parameters can be viewed or set with the configuration device of the F-Host (e.g. HW Config). They are marked in accordance with the PROFIsafe profile in the GSDML/GSD file. They can only be accessed by entering the password in the F-Host.

PROFIsafe parameters	General description	For CPX-FVDA-P2, the following apply:	Value
F_CHECK_IPAR	Determines whether the individual device parameters (CPX module parameters) are to be taken into account when checking the consistency (CRC calculation) of the F-user data telegram.	CPX-FVDA-P2 does not provide any individual device parameters.	No check (cannot be altered)
F_CHECK_SEQNR	Determines whether the sequence number is to be taken into account when checking the consistency (CRC calculation) of the F-user data telegram.	CPX-FVDA-P2 supports only the V2 mode. The sequence number is always encapsulated in the CRC2 test in the V2 mode	Check (cannot be altered)
F_SIL	The expected safety integrity level (SIL) of the module.	CPX-FVDA-P2 supports requirements up to SIL 3	– SIL 1 – SIL 2 – SIL 3
F_CRC_LENGTH	Communicates the expected length of CRC2 key to the F-Host in the safety telegram.	This parameter cannot be changed for CPX-FVDA-P2 because the CRC2 key is always allocated 3 bytes.	3 -byte CRC (cannot be altered)
F_BLOCK_ID	Shows if the record for the F_iPar_CRC value has been extended by 4 bytes. The parameter F_Block_ID has a value of 1 if the parameter F_iPar_CRC is present, otherwise it has a value of 0.	CPX-FVDA-P2 does not provide any individual device parameters.	0 (cannot be altered)
F_PAR_VERSION	Displays the PROFIsafe operating mode of the device. The setting 1 corresponds to PROFIsafe V2-MODE.	CPX-FVDA-P2 works exclusively in PROFIsafe V2-MODE.	1 (cannot be altered)

PROFIsafe parameters	General description	For CPX-FVDA-P2, the following apply:	Value
F_SOURCE_ADD (PROFIsafe source address)	Unique PROFIsafe source address of the F-Host.	Unique PROFIsafe source address of the F-Host.	Specified by the F-Host
F_DEST-ADD (PROFIsafe target address)	Unique PROFIsafe target address of the F-Device within the PROFIsafe network. The address set via the configuration software must match the PROFIsafe address set on the output module using the DIL switch.	CPX-FVDA-P2 compares both settings in order to check the authenticity of the connection (➔ section 2.4)	1 ... 1023 (0 is not permitted)
F_WD_Time	Time period (**W**atch**d**og Time) within which a valid current safety telegram must arrive from the F-Host. Otherwise the F-Device switches into a safe state.	The time period must be short enough that the system can react fast enough to communication failures or malfunctions. On the other hand, the time period must be long enough to tolerate typical delays in transmission. The clock time for calling the safety program must be less than the time period set here.	50 ... 65535 [ms]
F_iPAR_CRC	CRC via the individual device parameters (i-parameters).	CPX-FVDA-P2 does not provide any individual device parameters.	0 (cannot be altered)

Tab. 3/3: PROFIsafe parameters

3.5 Setting the CPX module parameters

The characteristics of the output module CPX-FVDA-P2 can be parametrised. Parameters that influence diagnostic or error messages refer only to the diagnostic system of CPX and not to the diagnostic channels of the safety protocol.

Additional information on parameterisation can be found in the CPX system description P.BE-CPX-SYS-... or in the CPX bus node description.

The following table provides an overview of the existing CPX module parameters of the output module.

Overview of module parameters CPX-FVDA-P2

Function number[1)]	bit	Module parameters	Presetting
4828 + m * 64 + **0**	0, 1 2 3 ... 7	Reserved Monitoring supply voltage U_{VAL} Reserved	– Active –
4828 + m * 64 + **1 ... 5**	0 ... 7	reserved	–
4828 + m * 64 + **6**	0 1 2 3 4 5 6, 7	General diagnostics – output channel 0 General diagnostics – output channel 1 General diagnostics – output channel 2 Reserved General diagnostics – module General diagnostics – failsafe protocol Reserved	active active active – active active –
4828 + m * 64 + **7**	0 1 2 3 ... 7	Wire break monitoring – output channel 0 Wire break monitoring – output channel 1 Wire break monitoring – output channel 2 Reserved	inactive inactive inactive –
4828 + m * 64 + **8 ... 21**	0 ... 7	Reserved for PROFIsafe	–

Function number[1)]	bit	Module parameters	Presetting
4828 + m * 64 + **22** 4828 + m * 64 + **23**	0 ... 7 0, 1	Setting of the DIL switch 0 ... 7 Setting of the DIL switch 8, 9	0[1)]
1) Parameters read-only via operator unit and command interpreter (CI).			

Tab. 3/4: Overview – module parameters CPX-FVDA-P2

3.5.1 CPX module parameters CPX-FVDA-P2 in detail

Module parameters: monitoring supply voltage U_{VAL}		**Operator unit**
Function no.	4828 + m * 64 + **0** m = module number (0 ... 47)	
Description	This parameter influences the diagnostic behaviour of the module when detecting undervoltage and overvoltage on U_{VAL} (➔ Technical data, monitoring supply voltage). The parameter is used to activate or deactivate the diagnostic message when undervoltage or overvoltage is detected. Active diagnostic message in case of undervoltage and overvoltage detection U_{VAL} causes the following. The error is: – sent to the CPX bus node – displayed via the module error LED.	
Bit	Diagnostic message – supply voltage monitoring Bit 0, 1 reserved Bit 2 Monitoring supply voltage U_{VAL} Bit 3 ... 7: reserved	[Monitor Vout/Vval]
Values	0 = Inactive 1 = Active (presetting)	[Inactive] [Active]
Comment	The monitoring function itself is not affected and is always active. It makes sense to switch off the diagnostics in the case of undervoltage detection U_{VAL} if another module that is connected to the switched voltage (e.g. a pneumatic interface) features its own undervoltage detection function and can issue a corresponding error message.	

Tab. 3/5: Monitoring supply voltage U_{VAL}

Module parameters: general diagnostics		**Operator unit**
Function no.	4828 + m * 64 + **6** m = module number (0 ... 47)	
Description	This parameter influences the module's general diagnostic behaviour. It determines whether channel-, module- or protocol-specific error messages are to be suppressed or reported. Active diagnostics cause the following. The relevant error is: – sent to the CPX bus node – displayed via the module error LED. Note the exceptions specified under Comments.	
Bit	General diagnostics Bit 0: output channel 0 Bit 1: output channel 1 Bit 2: output channel 2 Bit 3: reserved Bit 4: module Bit 5: Failsafe protocol Bit 6, 7: reserved	[General diagnosis] [Channel 0] [Channel 1] [Channel 2] [Module] [Failsafe protocol]
Values	0 = inactive – suppress error message 1 = active – report error (presetting)	[Inactive] [Active]
Comment	Exceptions: – Error messages regarding wire breaks **cannot** be influenced with this parameter. However, the wire break monitoring function can be activated or deactivated with the wire break monitoring parameter (➔ Tab. 3/7). – In the case of module-specific error messages, diagnostic messages from the failsafe protocol are **not** suppressed.	

Tab. 3/6: General diagnostics

Module parameter: Wire break monitoring	**Operator unit**
Function no.	4828 + m * 64 + **7** m = module number (0 ... 47)
Description	Determines whether the respective output channel should be monitored for wire break. It is necessary to deactivate the wire break monitoring function if: – a load smaller than the specified minimum load is to be switched or – the electrical signal is guided additionally through external relays which themselves disconnect the circuit.

Module parameter: Wire break monitoring		**Operator unit**
Bit	Wire break monitoring Bit 0: output channel 0 Bit 1: output channel 1 Bit 2: output channel 2 Bit 3 ... 7: Reserved	[Monitor wire break] [Channel 0] [Channel 1] [Channel 2]
Values	0 = Inactive 1 = Active Presettings: – Output channel 0: inactive – Output channel 1: inactive – Output channel 2: inactive	[Inactive] [Active]
Comment	Wire break monitoring is only possible when the output channel is switched on. If there is a wire break during active monitoring, the error LED of the respective output channel flashes. Any pending diagnostic messages are reset if the monitoring function is switched off. A wire break diagnosis does not switch off the output channel.	

Tab. 3/7: Wire break monitoring (channel-specific)

Module parameter: DIL switch setting		**Operator unit**
Function no.	4828 + m * 64 + **22** m = module number (0 ... 47) 4828 + m * 64 + **23**	
Description	Indicates the setting of the PROFIsafe address selector switch on the module. In addition to the PROFIsafe parameter F_DEST_ADD (➔ section 3.4), the address selector switch setting can be read out via CPX parameters for diagnostic purposes – e.g. with the operator unit (read only).	
Bit	Low byte (4828 + m * 64 + **22)** Bit 0: SW 0 Bit 1: SW 1 ... Bit 7: SW 7 High byte 4828 + m * 64 + **23)** Bit 0: SW 8 Bit 1: SW 9 Bit 2 ... 7: reserved or 0	[PROFIsafe Addr]

Module parameter: DIL switch setting		**Operator unit**
Values	bit 7 bit 6 bit 5 bit 4 bit 3 bit 2 bit 1 bit 0 SW 7 SW 6 SW 5 SW 4 SW 3 SW 2 SW 1 SW 0 Low byte 0 0 0 0 0 0 SW 9 SW 8 High byte	
	0: Switch is set to OFF 1: Switch is set to ON	[0] [1]
Comment	This parameter can only be changed by changing the DIL switch setting (read only).	

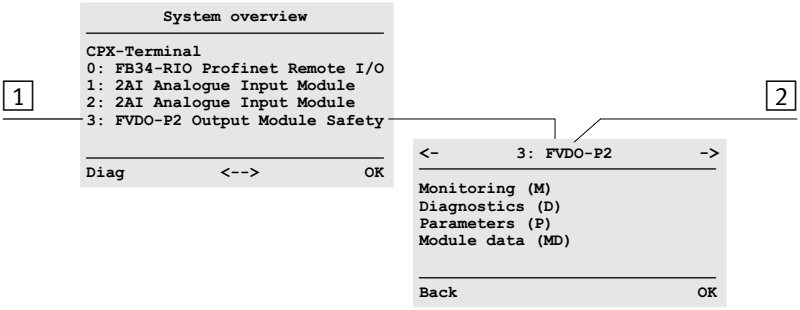
Tab. 3/8: DIL switch setting

3.5.2 Parameterisation and signal display with the operator unit CPX-MMI-1

The universal operator unit CPX-MMI-1 offers convenient functions that support you during the commissioning process. With the operator unit, you can view and change the CPX module parameters if necessary. The PROFIsafe parameters of the module cannot be influenced using the operator unit. This is for technical safety reasons.

General information on the operator unit and on commissioning the CPX terminal using the operator unit can be found in the description P.BE-CPX-MMI1-... .
The following section requires knowledge about the basic functions of the operator unit.

The output module name [FVDO-P2 Output Module Safety] is displayed in the main menu of the operator unit.
The short text [FVDO-P2] is displayed in the header of the operator unit. An example is shown in the diagram below:



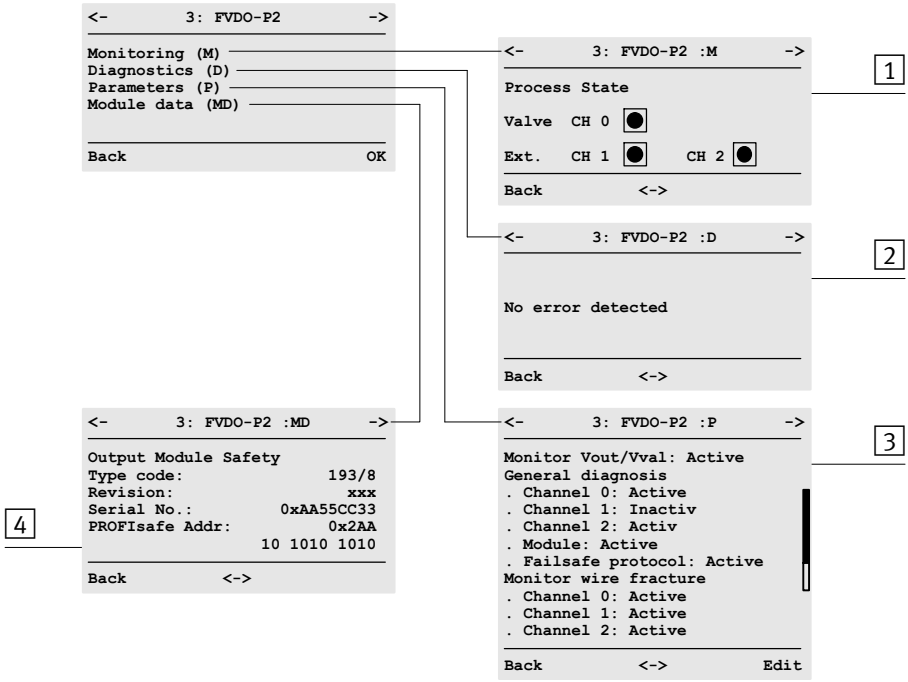
1 Module identifier in the main menu (here as module 3)

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

Fig. 3/1: Module identifier of the output module CPX-FVDA-P2 on the operator unit

The following image shows an example of the representations for the output module CPX-FVDA-P2.

Note that the menus [Forcing], [Fail safe] and [Idle mode] are not supported for the output module CPX-FVDA-P2.



1 Monitoring (M)

2 Diagnostics (D)

3 Parameters (P) – basic representation

4 Module Data (MD)

Fig. 3/2: Special representations for CPX-FVDA-P2 on the operator unit

When the command [Monitoring/Forcing (M)] is called up, the statuses of the 3 output channels are displayed.

3.6 Configuration with Siemens STEP 7 (example)

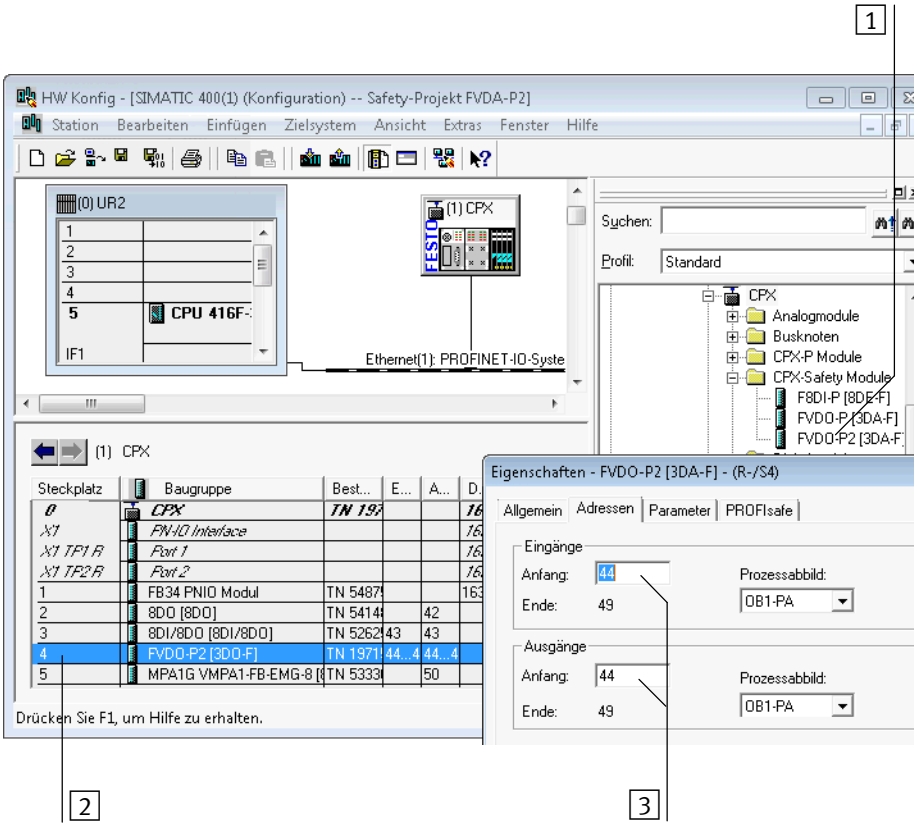
The configuration examples shown in this chapter are based on the use of a Siemens PLC and the Siemens STEP_7 Version 5.4 configuration and programming software with Distributed Safety Version 5.4. PROFINET is used as a bus system. The following section requires knowledge on how to operate the STEP 7 software.

Please first read the description of your CPX bus node to learn the basic approach for configuring a CPX terminal. The information in the following sections refers exclusively to the output module CPX-FVDA-P2.

After you have installed the GSDML/GSD file and added the CPX terminal with the configuration software (HW Config) to the project's network, you can add the output module to the configuration table of the CPX terminal (➔ CPX bus node description).

You can then set the start addresses for inputs and outputs as well as the PROFIsafe parameters and the standard module parameters.

- In the configuration table, double-click the row of the output module CPX-FVDA-P2. The "Properties – FVDA-P2" dialogue window is displayed.
- Now set the desired start addresses of the inputs and outputs in the [Addresses] tab of the dialogue window (➔ Fig. 3/3).



1 Output module CPX-FVDA-P2 in the hardware catalogue

2 Output module CPX-FVDA-P2 in the configuration table of the CPX terminal

3 Start addresses of the output module for inputs and outputs (here 44)

Fig. 3/3: CPX terminal configuration with Siemens STEP 7 – HW Config

The third tab of the dialogue window “Properties – FVDA-P2” offers access to the standard parameters of the output module.

Please note that not all of the PROFIsafe parameters that are represented here are relevant for the output module. You can find detailed information about the individual parameters in section 3.5.1.

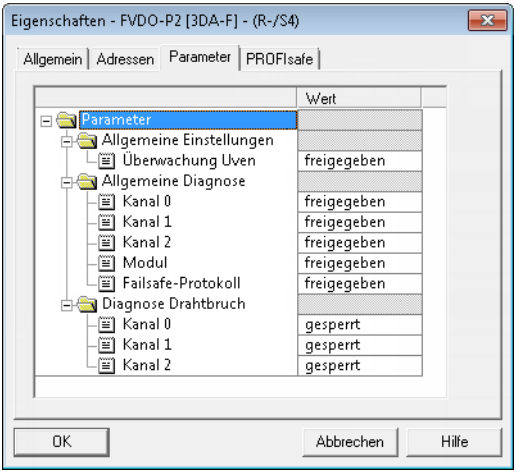


Fig. 3/4: Standard parameters of the output module CPX-FVDA-P2

The fourth tab of the dialogue window “Properties – FVDA-P2” offers access to the PROFIsafe parameters of the output module.

- Set the correct PROFIsafe target address under [F_Dest_Add] (➔ Fig. 3/5). The setting must match the DIL switch setting on the module (➔ Fig. 2/2).

You can find detailed information about the individual parameters in section 3.4.

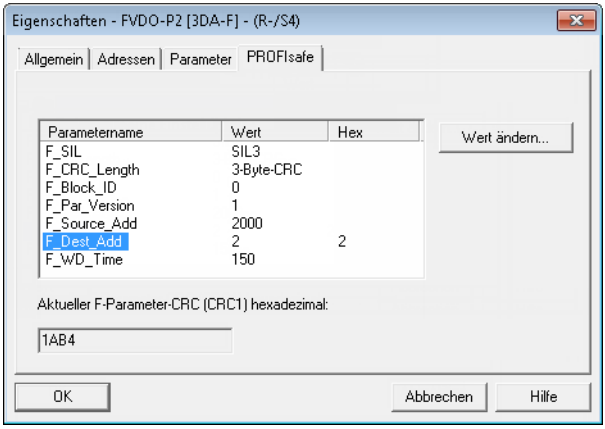
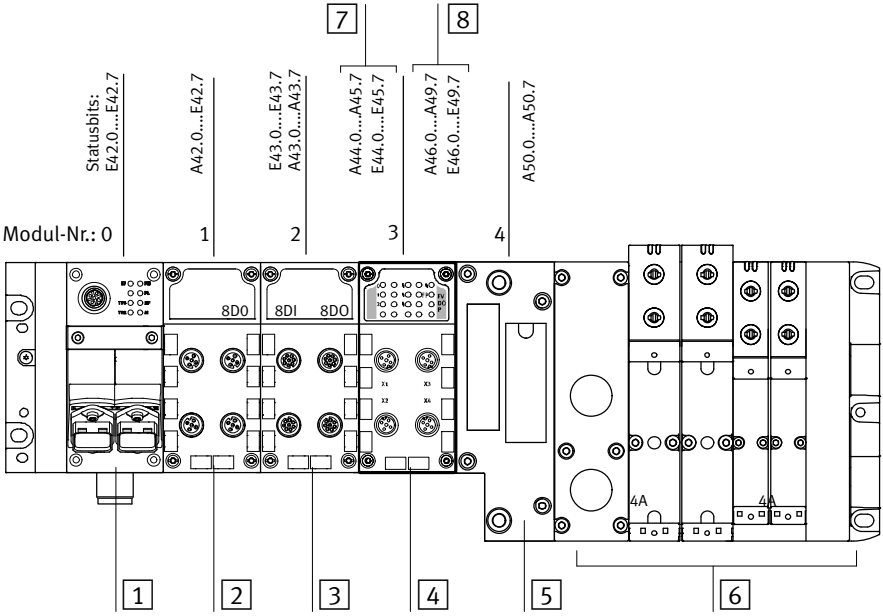


Fig. 3/5: PROFIsafe parameters

3.6.1 Addressing example

Addressing example: CPX terminal with VTSA pneumatics

Addresses used as of input/output byte 42:



1 Bus node CPX-FB34

2 Output module with 8 digital outputs

3 Input/output module with 8 digital inputs and 8 digital outputs

4 Output module CPX-FVDA-P2 (6 bytes for inputs and 6 bytes for outputs)

5 Pneumatic interface (DIL switch set to 8 digital outputs)

6 VTSA pneumatics

7 F-user data (2 bytes for inputs and 2 bytes for outputs)

8 Unusable range (1 byte each for status/control and 3 bytes for CRC)

Fig. 3/6: Addressing example

Module no.	Module	I address	O address
0	Bus node CPX-FB34 CPX-FB34 PNIO module [status]	42	–
1	Digital output module CPX-8DA [8DO]	–	42
2	Digital input/output module CPX-8DE-8DA [8DI/8DO]	43	43
3	Output module CPX-FVDA-P2 CPX-FVDA-P2	44 ... 49	44 ... 49
4	VTSA: pneumatic interface[1)] VABA-S6-1-X2 [8DO]	–	50
–	VTSA: pneumatics module VABV-S4-1-T2...	–	–
–	VTSA: pneumatics module VABV-S4-2-T2...	–	–
[1)] The number of allocated output addresses is specified for each DIL switch (here 8DO)			

Tab. 3/9: Input and output addresses for the example (➔ Fig. 3/6)

Chapter 4

Contents

4.1 LED status indication

1 Module error LED (red)

2 FP-LED (green) - **F**ailsafe **P**rotocol

3 Channel error LED (red); one for each output channel

4 Status LED (yellow); one for each output channel

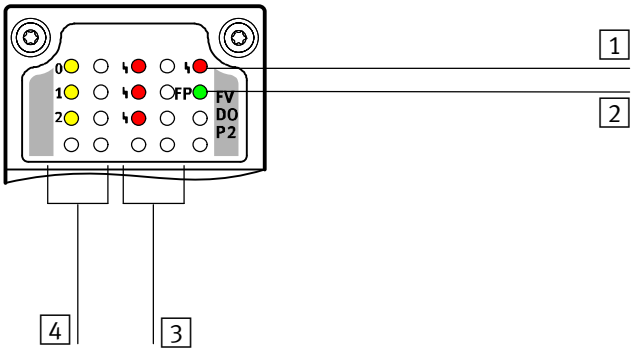


Fig. 4/1: LED indicator of the output module CPX-FVDA-P2

During normal operation, the following LEDs light up:

– FP LED – **F**ailsafe **P**rotocol (green)

– Status LED (yellow) of the active output channels

The status LEDs of inactive output channels and the module and channel error LEDs do not light up.

Note
The LED indicator of the module was not designed for safety purposes.

- Do not evaluate these LEDs during safety-related activities.

Detailed information on error characteristics can be found in sections .5.2 and 5.3.2.

4.1.1 Behaviour during the start-up phase

No.	Status LED	FP LED	Channel error LED	Module error LED	I/O image	Event/status
1a *)	○	○	○	 500ms	0 *)	Start-up – starting up the operating voltage supply $U_{EL/SEN}$
1b *)	○	○	 500ms	○	0 *)	Start-up – starting up the load voltage supply for valves U_{VAL}
2	○		○	○	0	Waiting for safety parameters
*) The sequence depends on the order in which the operating and load voltage supply are started up. If both power supplies are switched on simultaneously, 1a and 1b occur together.						

Tab. 4/1: Behaviour during the start-up phase

4.1.2 Normal operating status

No.	Status LED	FP LED	Channel error LED	Module error LED	I/O image	Event/status
3			○	○	1 **)	Output channel is switched on
4	○		○	○	0 **)	Output channel is switched off
**) Refers to the output channel to which the respective status LED is assigned.						

Tab. 4/2: Normal operating status

Chapter 5

Contents

5.1 Summary of diagnostics options

The CPX terminal offers extensive possibilities of diagnosis and error treatment. The output module supports the following options for diagnostics and error handling:

Diagnostics option		Brief description	reference
On the spot diagnostics	LED	The module LEDs display output channel and module errors.	➔ Section 5.3
	Operator unit (MMI)	On the operator unit, diagnostic information from the module can be displayed conveniently with menu navigation.	➔ Section 5.4.1 as well as the operator unit description
Diagnostics via bus node	System status scanning (status bit scanning)	8 status bits of the CPX terminal display common diagnostics messages (global error messages)	➔ Section 5.2 as well as the CPX system description and CPX bus node description
	I/O diagnostics interface	CPX-FVDA-P2 reports specific malfunctions as error numbers to the CPX bus node. These data can be read via the I/O diagnostic interface.	➔ CPX system description
	Fieldbus-specific diagnostics	Depends on the bus node (e.g. DPV1)	➔ CPX bus node description

Tab. 5/1: Diagnostics options

Specific errors of the output module CPX-FVDA-P2 are reported or suppressed depending on the module parameterisation. Reported errors can be evaluated, depending on the bus protocol used. The errors are indicated on-site via the Error LED and, if necessary, can be evaluated with the operator unit.

Information about the diagnostics options for the complete CPX terminal or all modules can be found in the CPX system description or in the description of the CPX bus node employed.

5.2 Possible error messages of the output module CPX-FVDA-P2

Error no.	Display on the operator unit:	Description	Error handling
2 [2]	[Short circuit]	Short circuit/overload at output.	• Eliminate short circuit. • Acknowledge and reintegrate the module or output channel.
3 [3]	[Wire break/idling current I/O]	Wire break.	• Check and, if required, replace the connected actuators.
5 [1]	[Undervoltage in power supply]	Undervoltage in supply voltage U_{VAL}.	• Eliminate undervoltage • Acknowledge and reintegrate the module.
61 [1]	[Overvoltage in power supply]	Overvoltage in supply voltage U_{VAL}.	• Eliminate overvoltage • Acknowledge and reintegrate the module.
65 [1]	[F_DEST_ADD mismatch]	The PROFIsafe address set by the DIL switch does not correlate with the setting on the PROFIsafe master (F_DEST_ADD).	• Check the set address or F_DEST_ADD parameter. Correct address or send new parameters.
66 [1]	[F-Communication fault]	Error in safe communication.	• Check F-Host. • Acknowledge and reintegrate the module.
67 [1]	[F-Communication timeout]	Timeout during PROFIsafe transmission. The chronological sequence of the PROFIsafe communication is malfunctioning.	• Check program in F-Host. • Check the communication paths. • Check timeout (parameter F_WD_Time). • Acknowledge and reintegrate the module.
68 [2]	[Leakage current]	Cross circuit error (shunt error) at output.	• Eliminate cross circuit • Acknowledge and reintegrate the module or output channel.

Error no.	Display on the operator unit:	Description	Error handling
69 [1]	[F-Parameter fault]	Error in safe parameterisation (safety parameterisation invalid). The PROFIsafe communication cannot be established.	• Check PROFIsafe parameters. • Send corrected parameters.
80	[Function failure]	Switching frequency is too high.	• Reduce the switching frequency.
145 [1]	[Built-in self-test failed]	Self-test error; module has detected an error during the self-test.	• Switch on the supply voltage U_{VAL} again. This restarts the module. If error persists, replace the module.

[1] All output channels of the module are passivated (CH0 ... CH2 are switched off).
[2] If “channel-wise passivation” is active, only the affected output channel is passivated. Otherwise, footnote 1) is valid.
[3] Does not lead to safety switch-off.

Tab. 5/2: Possible error messages

When using PROFIBUS, all error messages without a standardised error type are mapped to error type 9.

When using PROFINET, error message 69 is transmitted as diagnostic message 72 and error message 65 is transmitted as diagnostic message 64.

5.3 Diagnostics via LEDs

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

1 Module error LED (red)

2 FP-LED (green) - **F**ailsafe **P**rotocol

3 Channel error LED (red); one for each output channel

4 Status LED (yellow); one for each output channel

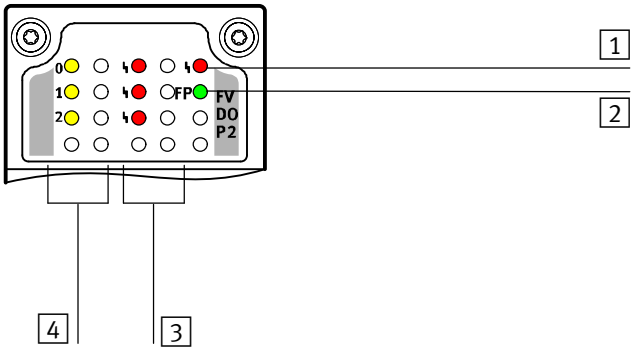


Fig. 5/1: LED indicator of the output module CPX-FVDA-P2

In the run-up phase, error LEDs 1 and 3 light up for approx. 500 ms.

During normal operation, the following LEDs light up:

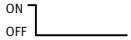
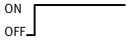
– FP-LED – **F**ailsafe **P**rotocol (green) 2

– Status LED 4 (yellow) of the active output channels

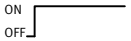
The status LEDs of inactive output channels and the module 1 and channel error LEDs 2 do not light up.

Note
The LED indicator of the module was not designed for safety purposes.

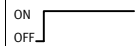
- Do not evaluate these LEDs during safety-related activities.

Module error LED			
LED (red)	**Sequence**	**Status**	**Significance/error handling**
 LED not illuminated		Error-free operation	None
 LED flashes	Error-specific	Self-test error or internal communication problem	To delete the error, switch the operating voltage off and on again (Power Off/On).[1)]
 LED illuminated		Module error (e.g. module supply undervoltage, missing safety parameterisation or error in safe communication)	Eliminate undervoltage or correct parameterisation.
1) If self-test errors persist, replace the module.			

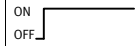
Tab. 5/3: Module error LED

Channel error LED			
LED (red)	**Sequence**	**Status**	**Significance/error handling**
 LED not illuminated		Error-free operation	None
 LED flashes	Error-specific	Wire break	Replace the affected cable
 LED illuminated		Cross circuit at output or short circuit/overload error at output (depends on error number)	Eliminate the cause

Tab. 5/4: Channel error LED

Status LED			
LED (yellow)	**Sequence**	**Status**	**Significance/error handling**
LED not illuminated		Output channel inactive (logic 0)	The respective load voltage supply is switched off.
LED illuminated		Output channel active (logic 1)	The respective load voltage supply is switched on.

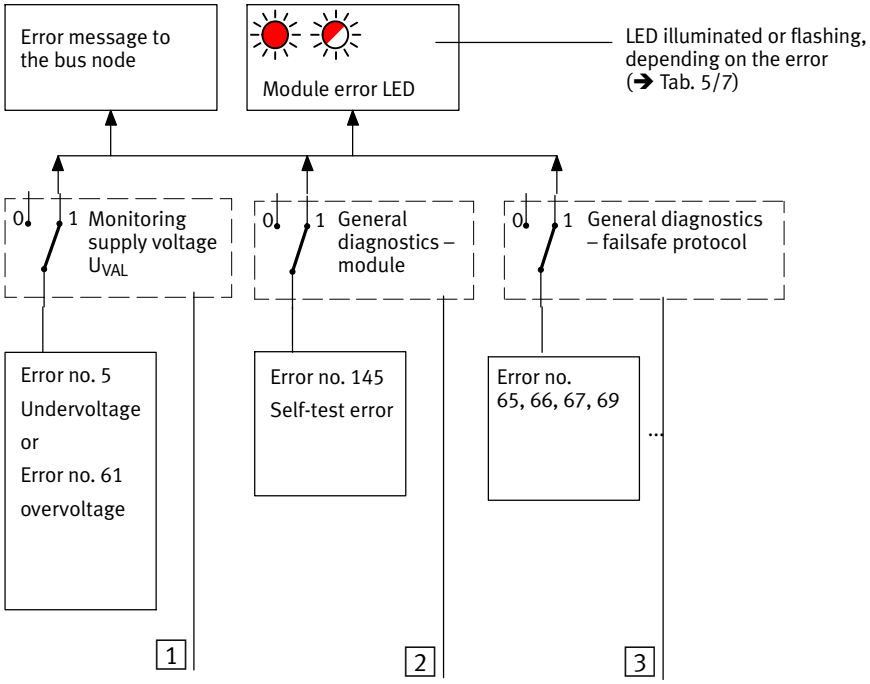
Tab. 5/5: Status LED

FP LED (FP for Failsafe Protocol)			
LED (green)	**Sequence**	**Status**	**Significance/error handling**
LED flashes twice		– Wait for Safety Parameter	– Module waits for parameterisation by the F-Host
LED flashes slowly		– PROFIsafe address error or – CRC error PROFIsafe parameter	– The set PROFIsafe address does not correlate with safety parameterisation. – Safety parameterisation invalid. The PROFIsafe communication cannot be established.
LED flashes quickly		– Operator Acknowledge possible	– PROFIsafe: 0A-Req
LED illuminated		– Failsafe protocol active	– Module communicates with an F-Host via a PROFIsafe protocol.

Tab. 5/6: FP LED

5.3.1 Error handling and parameterisation

The following diagram illustrates the error handling process for the output module. Using the appropriate module parameters (which are represented in the diagram as switches), you can suppress the further reporting and display of the errors as required (description of the parameters ➔ section 3.5.1).

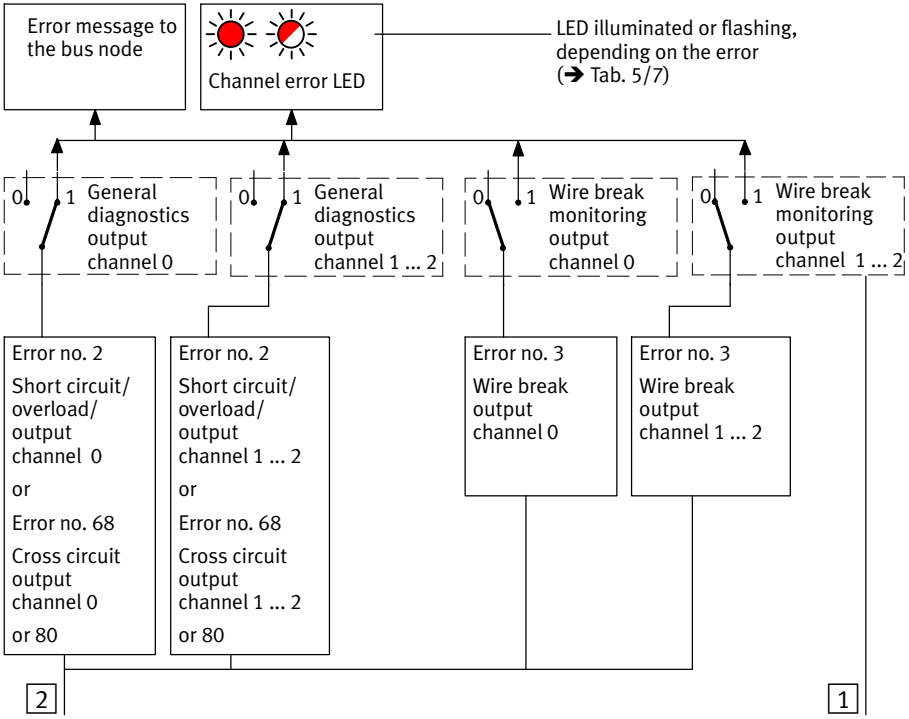


1 "Monitoring undervoltage valves" parameter

2 "General diagnostics – module" parameter

3 "General diagnostics – Failsafe Protocol" parameter

Fig. 5/2: Principle of error handling and parameterisation – part 1



[1] Module parameter (illustrated switch setting = default setting)

[2] Channel-specific errors

Fig. 5/3: Principle of error handling and parameterisation – part 2

5.3.2 Behaviour in case of error

Status LED	FP LED	Channel error LED	Module error LED	Error No.	Error description	
				2 [2]	Short circuit/overload at output	Error elimination ➔ section 5.2
				3 [3]	Wire break	
				5 [1]	Undervoltage in power supply	
				61 [1]	Overvoltage in supply voltage	
				65 [1]	The PROFIsafe address set on the DIL switch does not correlate with the setting on the PROFIsafe master (F_DEST_ADD).	
				66 [1]	Error in safe communication.	
				67 [1]	Timeout during PROFIsafe transmission.	
				68 [2]	Cross circuit error (shunt error) at output	
				69 [1]	Error in safe parameterisation (safety parameterisation invalid). The PROFIsafe communication cannot be established.	
		[4]		145 [1]	Module has detected an error during the self-test.	

[1] All output channels of the module are passivated (CH0 ... CH2 are switched off).
[2] If “channel-wise passivation” is active, only the affected output channel is passivated. Otherwise [1].
[3] Does not lead to safety switch-off.
[4] In many cases, the channel error LEDs are also illuminated.

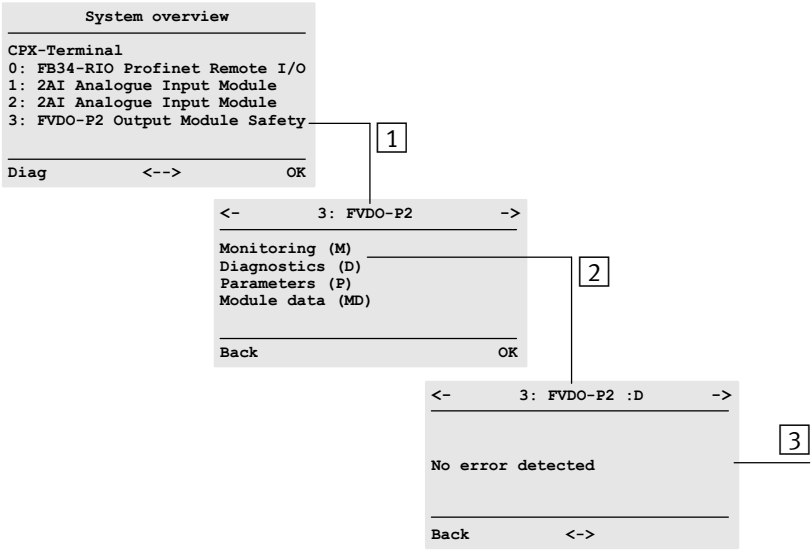
Tab. 5/7: Behaviour in case of error

5.4 Diagnostics via the CPX bus node

Information on diagnostics via the relevant CPX bus node can be found in the description of the corresponding bus node.

5.4.1 Diagnostics with the operator unit CPX-MMI

The operator unit displays current error messages of the output module in plain text.



1 Select module in the main menu (module 3 here)

2 Select “Diagnostics” menu

3 Current module error (here: none)

Fig. 5/4: Module identifier of the output module CPX-FVDA-P2 on the operator unit

Furthermore, the operator unit offers access to the diagnostic memory description (➔ description P.BE-CPX-MMI-1-...).

Service, repair, disposal

Chapter 6

Contents

6.1 Maintenance

The output module does not contain any components requiring maintenance.

6.2 Repair

Note
The output module CPX-FVDA-P2 does not contain any wearing parts.

Repairs are not allowed. This invalidates the certification of the output module.

The electronics module may be replaced by a duly trained technician.

Note
- Always replace the output module in case of an internal defect.
- Send the unmodified defective output module, including a description of the error and the application, back to Festo for analysis.

- Please contact your technical consultant to clarify how to return the module. In case of complaint or repair, please specify the following: complaint type 2 in accordance with Festo VA 19.02.

Dismounting and mounting the electronics module ➔ section 2.5.

6.3 Disposal

The material used in the packaging has been specifically chosen for its recyclability.

For final disposal of the output module, please contact a certified waste management company for electronic waste.

Appendix A

Contents

A.1 Technical data of the output module CPX-FVDA-P2

General technical data of the CPX terminal
➔ CPX system description P.BE-CPX-SYS-...

Electrical characteristic values		CPX-FVDA-P2
Nominal operating voltage	[V DC]	24
Permissible voltage fluctuations	[%]	–15 ... +20
Operating voltage in the case of a tap by the contact rail 24 V $_{VAL}$ and 0 V $_{VAL}$ (integrated polarity protection)	[V DC]	20.4 ... 28.8
Residual ripple (within tol.)	[Vss]	2
Voltage drop bypass time U_{VAL}	[ms]	2
Intrinsic current consumption at nominal operating voltage	[mA]	typ. 65 for valves (from U_{VAL}) typ. 25 for electronics (from $U_{EL/SEN}$)
Undervoltage monitoring U_{VAL}	[V]	‹ 19.5 for t › 250 ms
Overvoltage monitoring U_{VAL}	[V]	› 29.5 for t › 250 ms
Electrical isolation between $V_{EL,SEN}$ (or 5 V CBUS) and V_{VAL}	[V rms]	Min. 500
Electrical isolation between output channel (CH0, CH1, CH2) and internal bus		Yes, with intermediate supply
Electrical isolation between output channel and output channel		None
Potential reference of the output channels		V_{VAL}
Max. power supply CH0, CH1, CH2 (load current per output channel)	[A]	1.5
Max. load current per unswitched voltage U_{VAL} (auxiliary supply)	[A]	2.5
Max. peak current per output channel	[A]	5 for t ‹ 30 ms
Max. residual current per module	[A]	5

Electrical characteristic values		CPX-FVDA-P2
Max. switching frequency of the output channels	[Hz]	1
Max. voltage drop per output channel under continuous load	[V]	0.6
Wire break detection (CH0, CH1, CH2)		can be parameterised, detection point I_L approx. 50 mA
Max. cable length (CH1, CH2)	[m]	200
Max. load capacity against FE	[nF]	400
Max. load capacity P-M	[µF]	22
Max. load inductivity	[mH]	1000 at 150 mA, 100 at 600 mA; ➔ characteristic curve Fig. A/5
Fuse protection (short circuit)		Integrated electronic fuse
Max. test pulse duration	[µs]	300
Max. voltage drop during test pulse	[V]	6

Tab. A/8: Electrical characteristic values

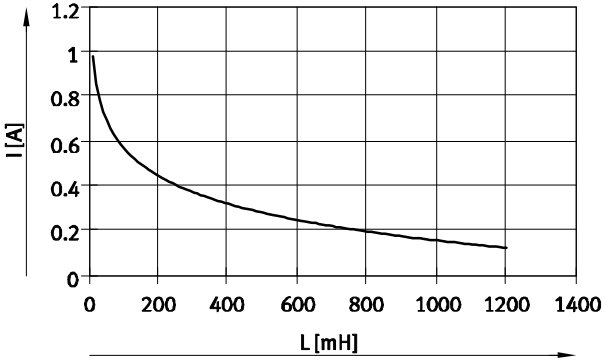


Fig. A/5: Maximum permissible load inductivity at the output channels

Functional characteristic values		CPX-FVDA-P2
Module code		193d (C1h)
Sub-module code		8d (08h)
Compatible with fast start-up (FSU)		Yes
Start-up time until module ready	[s]	‹ 2
Diagnostics of external channel fault		– Periodic inspection for function – Periodic inspection for external supply – Periodic inspection for cross circuit
Response time for external channel errors	[min]	‹ 1
Response time to shut-off command (typ.)	[ms]	‹ 10
Internal PROFIsafe processing time (T_{DAT})	[ms]	‹ 50

Tab. A/9: Functional characteristic values

Safety characteristic values[1)]		
Safety function		Safe shutdown of the output channels – in accordance with IEC 61508 with SIL 3 – in accordance with EN ISO 13849 with Cat. 3, PL e – in accordance with EN 62061 with SIL CL 3
Shutdown schema for each output channel		P- and M-switching
Internal response time to switch off command (T_{WCDT}) on output channel CH0	[ms]	‹ 23
Internal response time to switch off command (T_{WCDT}) on output channels CH1 and CH2 depending on minimum load		➔ Load diagrams Fig. A/6 and Fig. A/7
PROFIsafe watchdog time		F_WD_TIME
Max. response time of safety function	[ms]	F_WD_TIME + T_{WCDT}
Max. cyclical demand rate	[1/min]	1

Safety characteristic values[1)]		
Average time to dangerous failure ($MTTF_d$)	[years]	› 750
Probability of a dangerous failure per hour (PFH_d)	[1/h]	‹ 1.0×10^{-9}
Max. useful life	[years]	20
Min. demand rate for each output channel (CH0, CH1, CH2)	[1/week]	1
Measures to avoid common cause failures (CCF)		– Observe operating voltage limits – Observe temperature range – Combine a maximum of 2 output channels in a common safety pilot circuit
Safety protocol		PROFIsafe Profile Version 2.4 [2)]
Type test		The functional safety engineering of the product has been certified by an independent testing body, see EC-type examination certificate ➔ www.festo.com.
CE marking (➔ declaration of conformity)		In accordance with EU Machinery Directive
Certificate issuing authority		TÜV (German Technical Control Board) Rheinland 01/205/5294.01/18

1) In order to guarantee the safety level, a minimum switch-on period of 1 minute must be ensured every 8 operating hours for each output channel used.
2) Profile for Safety Technology on PROFIBUS DP and PROFINET IO; Version 2.4, March 2007

Tab. A/10: Safety characteristic values

Note
- Use the following graph if the load current is known.

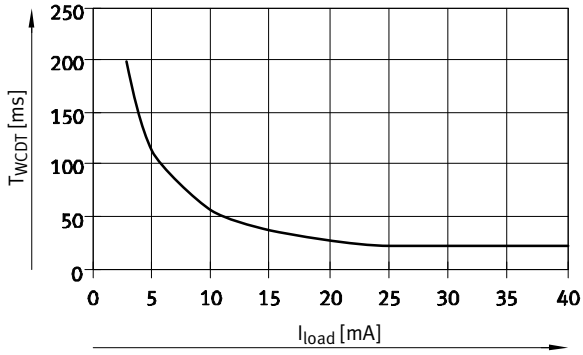


Fig. A/6: Internal response time as a function of the minimum load current

Note
- Use the following graph if the load resistance is known.

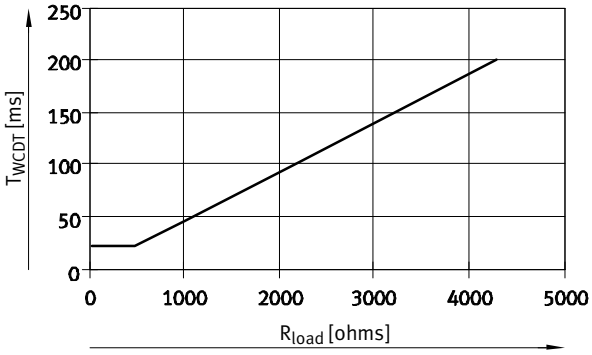


Fig. A/7: Internal response time as a function of the resistive minimum load

Deviating safety characteristic values when test pulses are switched off[1)]		
Min. demand rate for each output channel (CH0, CH1, CH2)	[1/day]	1
[1)] With the exception of the values specified here, the safety characteristic values retain their validity.		

Tab. A/11: Deviating safety characteristic values when test pulses are switched off

Further characteristic values		
Ambient operating temperature	[°C]	–5 ... +50
Ambient temperature in storage	[°C]	–20 ... +70
Relative humidity (non-condensing)	[%]	5 ... 90
Degree of protection to EN 60529		Dependent on the connection block[1)]
Electromagnetic compatibility – Interference emission – Immunity to interference		➔ Declaration of conformity (www.festo.com)
UL certification		c UL us - Recognized (OL)
[1)] ➔ Chapter A.2 “Technical data of the connection blocks“		

Tab. A/12: Further characteristic values

A.2 Technical data of the connection blocks

General technical data of the CPX terminal
➔ CPX system description P.BE-CPX-SYS-...

Technical data		CPX-M-AB-4-M12X2-5POL
Degree of protection to EN 60529[1)]		IP65/67, completely mounted, plug connector inserted or provided with protective cap ISK-M12
Information on housing materials		Die-cast aluminium
Ports		
Design		4 socket contacts M12, metal thread, 5-pin
Contact load	[A]	4
1) Degree of protection is determined through the combination of interlinking block and connection block		

Tab. A/13: Technical data – connection block CPX-M-AB-4-M12X2-5POL

Technical data		CPX-AB-8-KL-4POL
Degree of protection to EN 60529[1)]		IP20, completely mounted, cable connected to terminal strip
Information on housing materials		Polyamide reinforced, polycarbonate
Ports		
Design		2 terminal strips
Contact load	[A]	4
1) Degree of protection is determined through the combination of interlinking block and connection block		

Tab. A/14: Technical data – connection block CPX-AB-8-KL-4POL

A.3 Technical data of the interlinking block

Technical data	CPX-M-GE-EV-FVO
Type of mounting	Angled fitting
Information on housing materials	Die-cast aluminium
Function	Interrupts the contact rails for load voltage supplies (U_{VAL} switchable, U_{OUT} permanent)
Special feature	Mechanical coding prevents you from plugging in impermissible electronics modules

Tab. A/15: Technical data – interlinking block CPX-M-GE-EV-FVO

Index

Appendix B

Contents

B.1 Index

D

E

F

G

I

L

M

O

P

R

S

T

U

W