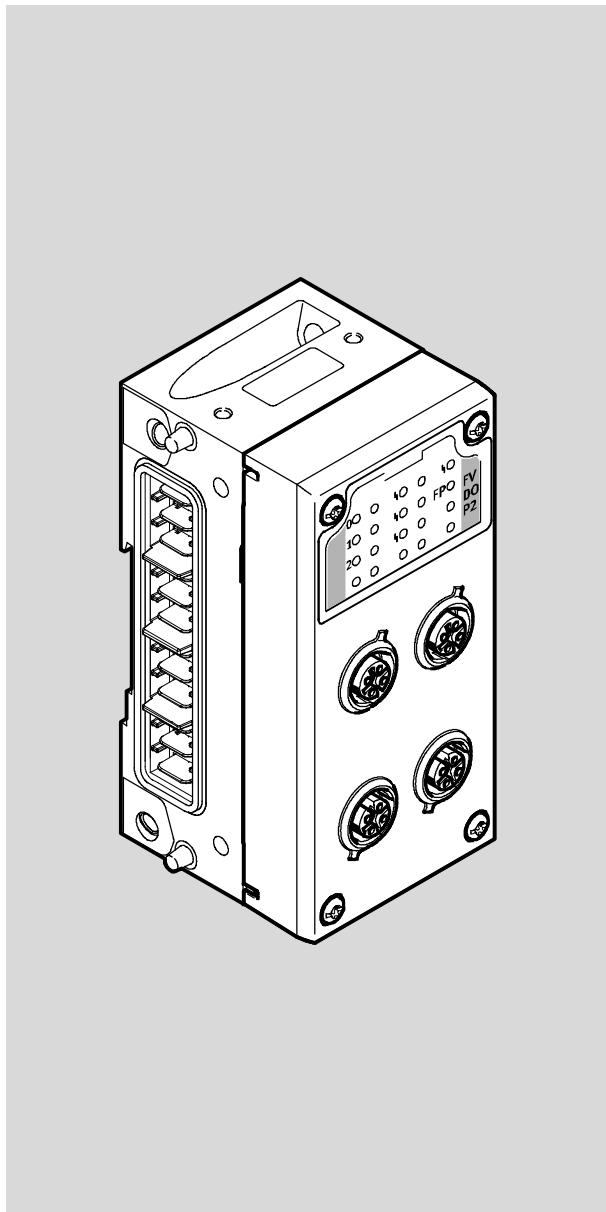


CPX terminal

Output module CPX-FVDA-P2



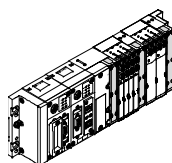
FESTO

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-FVO



8022607
en 1209NH
[8022613]

Contents and general instructions

Translation of the original instructions

Original de

Version en 1209NH

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

Order number 8022607

© (Festo AG & Co. KG, Postfach D-73726 Esslingen, 2012)

Internet: <http://www.festo.com>

E-Mail: service_international@festo.com

Reproduction, distribution or sale of this document or communication of its contents to others without express authorization is prohibited. Offenders will be liable for damages. All rights reserved in the event that a patent, utility model or design patent is registered.

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

Table of contents

Important user instructions	VI
General safety instructions	VIII
Intended use	IX
Rules for product configuration	X
Foreseeable misuse	XIII
Attainable safety level	XV
Failures due to common cause (common cause failure – CCF)	XV
Requirements for product use	XVI
Transport and storage conditions	XVIII
Service	XVIII
Range of application and certifications	XVIII
Product identification	XX
Instructions on this description	XXIII
Product-specific terms and abbreviations	XXIV
1. System overview CPX-FVDA-P2	1-1
1.1 CPX terminal with output module CPX-FVDA-P2	1-3
1.1.1 Design of the output module CPX-FVDA-P2	1-7
1.1.2 Supported product designs from CPX	1-11
1.1.3 Required bus topology (control loop system)	1-14
1.2 PROFIsafe	1-15
1.2.1 Safety profile PROFIsafe	1-15
1.2.2 Process image	1-16
1.2.3 Bit pattern of the output and input data (F-user data)	1-17
1.3 Mode of operation of the output module	1-22
1.3.1 Application ranges	1-23
1.3.2 Application examples	1-27
1.4 Requirements for actuators (CH0 ... CH2)	1-41
1.4.1 Electrical requirements	1-41
1.4.2 Safety-oriented requirements	1-43

2.	Installation	2-1
2.1	General instructions on installation	2-3
2.2	Connecting the cables and plugs to the connection block	2-5
2.3	Electrical connection and display components	2-7
2.3.1	Pin allocation with M12 connection block	2-8
2.3.2	Pin allocation with KL connection block	2-9
2.4	Set PROFIsafe address	2-10
2.5	Dismounting and mounting the electronics module	2-13
2.5.1	Dismantling the electronics module	2-14
2.5.2	Mounting the electronics module	2-15
3.	Commissioning	3-1
3.1	General instructions	3-3
3.1.1	Device master file (GSDML and GSD)	3-3
3.2	Preparing for commissioning	3-5
3.3	Commissioning steps	3-6
3.4	Set the PROFIsafe parameters	3-7
3.5	Setting the CPX module parameters	3-9
3.5.1	CPX module parameters CPX-FVDA-P2 in detail	3-10
3.5.2	Parameterisation and signal display with the operator unit CPX-MMI-1	3-14
3.6	Configuration with Siemens STEP 7 (example).	3-16
3.6.1	Addressing example	3-20
4.	Operation	4-1
4.1	Status display via LEDs	4-3
4.1.1	Behaviour during the switch-on phase (startup phase)	4-4
4.1.2	Normal operating status	4-4
5.	Diagnostics and error handling	5-1
5.1	Summary of diagnostics options	5-3
5.2	Possible error messages of the output module CPX-FVDA-P2	5-4

5.3	Diagnostics via LEDs	5-6
5.3.1	Error handling and parameterisation	5-9
5.3.2	Behaviour in the event of an error	5-11
5.4	Diagnostics via the CPX bus node	5-12
5.4.1	Diagnostics with the operator unit CPX-MMI	5-12
6.	Service, repair, disposal	6-1
6.1	Service	6-3
6.2	Repair	6-3
6.3	Disposal	6-4
A.	Technical appendix	A-1
A.1	Technical data of the output module CPX-FVDA-P2	A-3
A.2	Technical data of the connection blocks	A-9
A.3	Technical data of the interlinking block	A-10
B.	Index	B-1

Important user instructions

Danger categories

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



Warning

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



Caution

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



Note

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

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



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

Marking special information

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

Pictograms



Information:

Recommendations, tips and references to other information sources.



Accessories:

Specifications on necessary or useful accessories for the Festo product.



Environment:

Information on the environmentally friendly use of Festo products.

Text designations

- Bullets denote activities that may be carried out in any desired order.
- 1. Figures denote activities that must be carried out in the order specified.
- Arrowheads indicate general lists.

General safety instructions



Warning

Nonobservance of safety instructions can result in death, serious injuries or heavy material damage.

- Unconditionally observe the safety instructions.



Note

Electronic modules include electrostatically sensitive devices.

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



Note

To ensure intended use:

- Switch off each output channel used at least once per week.
- With test pulses switched off: Switch each output used at least once per day.



Note

To ensure the safety level:

- Switch on each output channel used at least once every 8 hours of operating time for longer than 1 minute. The operating time starts with the first switch-on of the output module.



Note

- Use max. 2 output channels in a shared safety-oriented control circuit.



Observe the regulations for the electrical supply .(Protective Extra-Low Voltage, PELV) of CPX terminals in the CPX system description P.BE-CPX-SYS-.... .

Intended use

The output module CPX-FVDA-P2 is intended as a switch-off module for securely switching off connected consumers (safety function) if the following conditions are met:

- The connected consumers go into a safe status in the event of safety switch-off.

The safety function is achieved through two-channel P- and M-side switch off of the following load voltage supplies of the CPX terminal:

- Load voltage supply for valves U_{VAL} of the CPX terminal (output channel CH0 of the module). Through this are supplied the right-side-mounted valve terminal pneumatics modules of the CPX terminal.
- Two outputs (output channel CH1 and CH2 of the module) available 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 (auxiliary supply DC 24 V).

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

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 original status, without unauthorised modifications
- exclusively in the configurations named here (→ chapter 1.3.2)
- within the limits of the product defined by the technical data (→ appendix A.1)
- in an industrial environment



Note

- Observe that the safety engineering system limits of the output module are 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-....
- All technical operating limits must be complied with (→ 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 node (→ bus node name 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 inside of 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⁾
MPA-L-FB-VI	34	All 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⁾ If the residual current is exceeded, operative malfunctions are possible.		

Tab. 0/2: Permissible valve types

- The operation of switch-off groups within CPX valve terminals is allowed only in combination with permissible pneumatics (→ description for the respective valve terminal).

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

Output module
CPX-4DO ¹⁾
CPX-8DO ¹⁾
CPX-8DO-H ¹⁾
CPX-8DI8DO ¹⁾
¹⁾ If the residual current is exceeded, operative malfunctions are possible.

Tab. 0/3: Permissible output modules

- For configuration of the CPX-FVDA-P2 only the following components are permissible:

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 product designs of CPX can be found in section 1.1.2.

Foreseeable misuse

The following foreseeable misuses 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 statuses



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 switch-off groups that include other output modules than the ones permitted
- in a CPX terminal of variant P
- in a CPX terminal with connected valve terminal that is equipped with valve types different from the following: VTSA, MPA-S, MPA-F, MPA-L (→ Tab. 0/2)
- in a CPX terminal with connected valve terminal that is equipped with VPPM
- in impermissible switching configurations (→ chapter 1.3.2 application examples)



Note

The output module includes no wearing parts. Repairs on the output module CPX-FVDA-P2 are impermissible. This invalidates the certification of the output module.

A professional replacement of the electronics module by the user is permissible.



Note

In the event of damage caused by unauthorised manipulation or other than intended use, 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.

The CPX-FVDA-P2 achieves an SIL performance limit of max. SIL CL3 in accordance with EN 62061.

The attainable safety level of the entire safety system depends on other components used to implement the safety function.

To maintain the safety level:

- Check the operational capability of the safety equipment at adequate intervals.

Failures due to common cause (common cause failure – CCF)

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

Through the following measures, you ensure that common cause failures are avoided:

- Observe operating voltage limits
- Comply with temperature range
- Use max. 2 output channels in a shared safety-oriented control circuit

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

Requirements for product use

- Make this description available to the design engineer, installer and personnel responsible for commissioning the machine or system in which this product is used.
- Store this description throughout the service life of the product.
- Make sure that the specifications of the documentation are always complied with. Also consider the documentation for the other components and modules (e.g. bus nodes, pneumatics, etc.).
- Take into consideration the legal regulations applicable for the destination as well as:
 - regulations and standards
 - regulations of the testing organizations and insurers
 - national specifications
- Remove all transport packing such as foils, caps, cardboard. The material used in the packaging has been specifically chosen for its recyclability (exception: oil paper = residual waste).
- Have mounting performed professionally.
To maintain the IP protection class:
 - Screw the connection block on tight
 - Mount cable entries and seals professionally
 - Seal unused connections with cover caps
- After a safety demand, such as emergency stop, make sure that the system restart takes place only under control of the safety controller.

Technical requirements

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 in accordance with the relevant safety regulations ensured.
- When connecting standard ancillary components, also observe the specified limit values for temperatures, electrical data and torques.

Qualification of trained personnel

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

- installation and operation of control systems
- the applicable regulations for operating safety-engineered systems
- the applicable regulations for accident protection and industrial safety
- the documentation for the product



Note

Work on safety-related systems should only be carried out by authorised specialists trained in safety engineering.

Transport and storage conditions

- Protect the product during transport and storage from impermissible burdens, such as:
 - mechanical loads
 - impermissible 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 repair service if you have any technical problems.

Range of application and certifications

The product is a safety component as defined in the Machinery Directive 2006/42/EC and carries the CE marking.



Standards and test values, which the product must comply with and fulfil, can be found in the Technical data section. The product-relevant EU 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.

- Observe that compliance with the named standards is limited to the output module CPX-FVDA-P2. From the perspective of the output module, all disconnectable parts of a CPX terminal 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 a un circuit de Classe 2.**



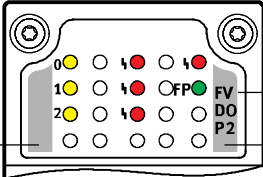
Note

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

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

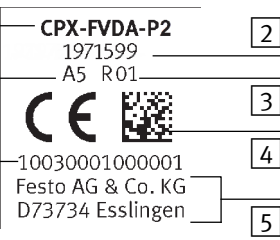
Product identification

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

Module identifier	Significance
	<ul style="list-style-type: none"> - Module identifier 1: FVDOP2 (F=safety; V=valves; D=digital; O=outputs; P=PROFIsafe; 2=variant) - Yellow background 2 for identification of the safety function

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

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

Name plate (typical)	Significance
	<p>Name plate</p> <ul style="list-style-type: none"> - Type designation 1 - Part number 2¹⁾ - Revision code (here R01) 3 - Serial number represented as data matrix code 4²⁾ - Manufacturer and manufacturer's address 5 - 14-character serial number 6²⁾ - Production time period (encoded) 7³⁾ (here A5 = May 2010)
<p>¹⁾ Part number of the electronics module CPX-FVDA-P2 ²⁾ Permits tracking of the product. ³⁾ → Tab. 0/7 and Tab. 0/8</p>	

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



Further information on this can be found in the system description P.BE-CPX-SYS-...

Revision

- Determine the revision of a CPX module:
 - with the operator unit CPX-MMI-1 (→ [Module data][Revision])
 - with corresponding configuration software (→ module data, revision code).
 - through the name plate of the respective module (in the dismantled status, → Tab. 0/6).
- Before replacing a module, check whether the revision code of the bus node corresponds to the requirements of the module (→ Tab. 3/1).

Production time period

The production time period is specified encoded on the name plate in the form of a two-character abbreviation (→ Tab. 0/6). The letter specifies the manufacturing year and the character behind it (number or letter) the month of production.

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	0	October
N	November	D	December

Tab. 0/8: Manufacturing month

Product-specific terms and abbreviations

Term/abbreviation	Significance
Acknowledgment	Signal or procedure for depassivation. Through acknowledgment, the user confirms that the module can be reentered or the output channel depassivated without danger. If the complete module is passivated, acknowledgment is made through regular reentry (standard process of PROFIsafe). If an output channel is passivated (channel-wise passivation), acknowledgment takes place through an acknowledgment signal of 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 have to be looked at more closely with regard to PROFIsafe and are therefore designated "black channels".
Channel	→ Output channel
Channel-wise passivation	Passivation type in which only the faulty output channel involved is passivated. The module remains integrated. Acknowledgment takes place in CPX-FVDA-P2 via the process image (→ section 1.2.3).
CRC signature	Check value in the safety telegram of PROFIsafe for checking the integrity of the telegram data (cyclic redundancy check).
Cross circuit	Accidental bypasses in switches, e.g. between 0 V and FE. These can be caused, for example, by cable squeezes and unallowed currents in switches. 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 thus becomes ineffective. In a similar way, a cross circuit can result in bypassing the P-switch.
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 status. This prevents undesired switching of the load due to impermissible cross currents.
Depassivation	→ Reentry or passivation (opposite)
F-Device	Collective name for safety-related devices
F-Host	Safety controller for control of safety-related devices
Forced dynamisation	Procedure for function checking of a device's switching capability. The effectiveness of the P- and M-switches of the output module CPX-FVDA-P2 are checked cyclically for their operational capability.

Term/abbreviation	Significance
F-System	Safety-related system that moves to a safe status when dangerous system and device errors occur.
GSDML/GSD	Equipment master file (Geräte-Stammdaten-Datei) in XML format
I/O illustration	➔ Process image
i-Parameter	Technology-specific individual parameters of a specific F-Device
M-switch (Low side switch)	Switch in the 0 V current path of an output channel. Further information (➔ P-switch).
Output channel	Independently switchable output that can be switched over two redundant switch elements in the forward and return path of the circuit. CH0, CH1 and CH2 are independent output channels that can be switched internally in 2 channels.
Passivation	<p>Safety function in which the output module CPX-FVDA-P2 switches off all output channels or only defective output channels (channel-wise passivation), dependent on the respective error. Instead of the programmed values, the so-called replacement values (0) are then effective.</p> <p>The passivation of the module takes place automatically, e.g.:</p> <ul style="list-style-type: none"> – with errors in the safety-oriented communication (PROFIsafe) – with self-test errors – with channel errors only if “channel-wise passivation” is switched off (➔ Channel-wise passivation). <p>After passivation of the module, a regular reentry is required (standard process of PROFIsafe for acknowledgment).</p> <p>If channel-wise passivation is switched on, in case of a channel error only the output channel involved is passivated. For depassivation of the output channel, an acknowledgment signal through the process image is required (➔ section 1.2.3).</p>
Performance Level (PL ..., cat. ...)	<p>Discrete level that specifies the capability of safety-related parts of a controller to fulfil a safety function under defined conditions. In DIN EN ISO 13849-1, categories and 5 performance levels (PL a to PL e) are defined.</p> <ul style="list-style-type: none"> – Category (cat.) is a measure of the capability of a safety-oriented part of a controller to resist errors and of their subsequent behaviour in case of error, which is achieved through the structure of the layout of the parts, error recognition and their reliability. – PL a is the lowest and PL e the highest level.

Term/abbreviation	Significance
Process image	The process image is part of a controller's system memory. At the start of the cyclical program, the signal statuses of the input assemblies are transferred to the process diagram for the inputs. At the end of the cyclical program, the process image of the outputs is transmitted to the output assemblies as a signal status.
PROFIBUS	Standard for the fieldbus communication between controllers (PLC/IPC) and automation technology devices (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).
PROFIsafe	<p>Safety-oriented bus profile for PROFIBUS and PROFINET, which, in combination with PROFIsafe-capable devices (F-Host and F-Device), permits the correct and reliable transmission of safety-related messages. Serving as mechanisms for safe transmission and error detection are:</p> <ul style="list-style-type: none"> – CRC signatures (data integrity check), – Consecutive numbering of safety-related messages, – Address checking (→ PROFIsafe address) – Time monitoring. <p>In case of errors, the F-Device can automatically trigger predefined safety measures. Based on the continuous numbering, receivers can tell whether they have received the messages in the correct sequence and completely. For this purpose, F-Host and F-Device have their own finite state machines that are synchronised with the help of a control and status byte. Correct synchronisation is monitored through inclusion of counter values in the CRC signature calculation.</p>
PROFIsafe address	For identification of the addressee of a message, each PROFIsafe-capable device or module has a unique PROFIsafe address. The PROFIsafe address is specified in the configuration program and set at the PROFIsafe-capable device or module through DIL switches. Configuration errors can be determined automatically through comparison between the set and actual configuration.
PROFIsafe monitoring time	Monitoring time for the safety-oriented communication between F-HOST and F-Device

Term/abbreviation	Significance
P-switch (High side switch)	Switch in the 24 V current path of an output channel. For each output channel, there is 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 in common and simultaneously but independently of each other. The P-switch switches the 24 V current path and the M-switch the 0 V current path of the output channel. For voltage to be present at the load, both switches (P- and M-switches) must be closed. For CPX-FVDA-P2, the control of P- and M-switches of an output channel is taken over by different microcontrollers for safety reasons.
Reentry	Switching of replacement values to programmed values or process values (depassivation) → Passivation. Reentry is a standard process of PROFIsafe to depassivate a passivated module (→ PROFIsafe standard).
Replacement value	Preset safe value which replaces the real process value or the programmed value in case of error or when safety-related systems are run up. For CPX-FVDA-P2 (digital outputs), the output value is 0.
Safe status	Status in which the safety of a system is achieved.
Safety circuit	Output module CPX-FVDA-P2 with all connected consumers. A safety circuit is formed by supplying the load to be operated for safety engineering from one output (CH0, CH1, CH2) of the CPX-FVDA-P2. A switched-on (supplied) load can either be switched off on request (via PROFIsafe) in a safety-oriented manner or the module automatically switches off the load for safety reasons upon detection of a safety-engineering-relevant error.
Safety controller	A safety controller is usually a programmable logic controller with special design elements for processing safe input information into safe output information in order to guarantee the required amount of safety integrity when used in safety-critical systems.
Safety integrity	Effectiveness of the safety functions of a safety-related system under request-conforming conditions.
Safety integrity level	Level of safety integrity (Safety integrity level) for safety-related systems in accordance with IEC 61508. There are 4 levels (SIL1 to SIL 4). SIL 1 is the lowest level and SIL 4 the highest level of safety integrity. The higher the level, the less likely is an endangering failure of the system.
Safety-oriented communication	Exchange of safety-related messages between F-Host and F-Device (e.g. via PROFIsafe)
Safety-oriented control circuit	Safety circuit including safety-oriented activation through the controller.

Term/abbreviation	Significance
Safety program	Safety-oriented user program in the F-Host
Short circuit	Connection of switching points with normally different electrical potentials, e.g. of 0 V and 24 V of one voltage source.
SIL	Safety integrity level
SIL CL	Requirements limit for partial systems of a safety-related control system.
Switch-off group	Group of loads that can be functionally triggered independently of each other and switched off together for safety reasons with the same output channel.
Test pulse	Fast switch impulse for monitoring the switch capability and detection of cross circuits (→ Forced dynamisation).
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.

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

System overview CPX-FVDA-P2

Chapter 1

Table of contents

1.	System overview CPX-FVDA-P2	1-1
1.1	CPX terminal with output module CPX-FVDA-P2	1-3
1.1.1	Design of the output module CPX-FVDA-P2	1-7
1.1.2	Supported product designs from CPX	1-11
1.1.3	Required bus topology (control loop system)	1-14
1.2	PROFIsafe	1-15
1.2.1	Safety profile PROFIsafe	1-15
1.2.2	Process image	1-16
1.2.3	Bit pattern of the output and input data (F-user data)	1-17
1.3	Mode of operation of the output module	1-22
1.3.1	Application ranges	1-23
1.3.2	Application examples	1-27
1.4	Requirements for actuators (CH0 ... CH2)	1-41
1.4.1	Electrical requirements	1-41
1.4.2	Safety-oriented requirements	1-43

1.1 CPX terminal with output module CPX-FVDA-P2

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

- Load voltage supply for valves U_{VAL} of the CPX terminal via output channel 0 (CH0 of the module). Through this are supplied the right-side-mounted valve terminal pneumatics modules of the CPX terminal.
- Two output channels (CH1 and CH2 of the module) available through the connection technology.

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

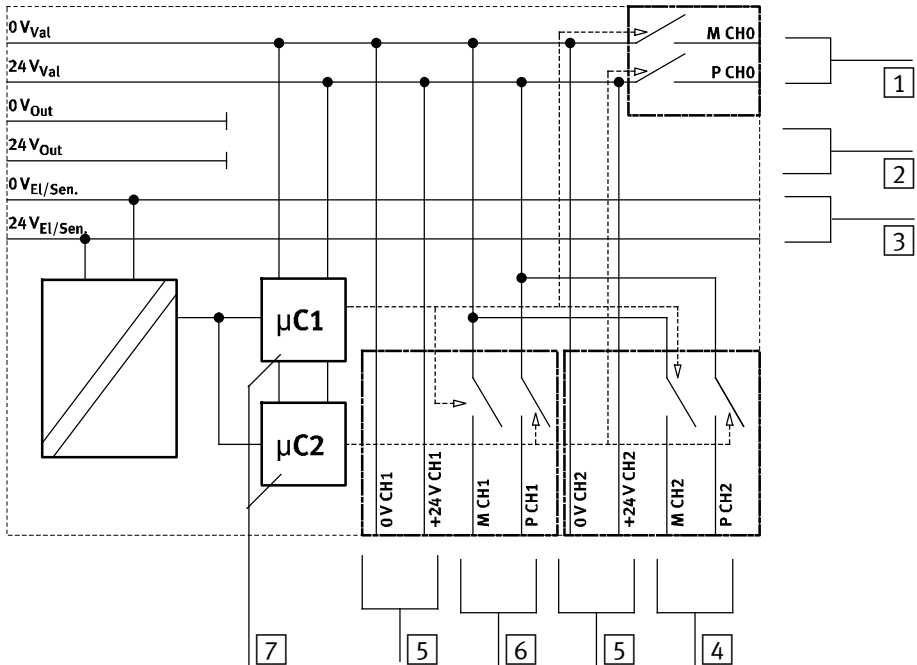
The load voltage supplies of the CPX terminal run on contact rails within the interlinking block for transmission to subsequent modules.

For operation of the output module CPX-FVDA-P2, a special interlinking block is required (➔ Tab. 1/3). In this interlinking block, the contact rails of the load voltage supply U_{VAL} and U_{OUT} are interrupted. The contact rails for U_{VAL} are bridged through 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 string (P, high-side path) and the 0 V string (M, low-side path) are switched commonly and simultaneously but independently of each other.

In addition, the output module offers two output channels (CH1 and CH2) that, on request, can also be switched off in a safety-oriented manner (P- and M-switching). These output channels are supplied from the load voltage supply for valves U_{VAL} .

1. System overview CPX-FVDA-P2



- 1** CH0: output supplied through $24V_{VAL}$ and $0V_{VAL}$ for right-side-mounted pneumatics modules
- 4** CH2: output supplied through $24V_{VAL}$ and $0V_{VAL}$; available through the connection technology of the module CPX-FVDA-P2
- 2** Load voltage $24V_{OUT}$ and $0V_{OUT}$ is no longer available on the right side
- 5** Unswitched voltage U_{VAL} for supply of intelligent load systems (auxiliary supply)
- 3** Operating voltage for electronics and sensors ($24V_{EL/SEN}$ and $0V_{EL/SEN}$) for right-side-mounted pneumatics modules
- 6** CH1: output supplied through $24V_{VAL}$ and $0V_{VAL}$; available through the connection technology of the module CPX-FVDA-P2
- 7** Processors for control and monitoring of the P- and M-switches

Fig. 1/1: Circuit diagram of the CPX power supply concept with CPX-FVDA-P2



With the output channels CH0, CH1 and CH2, up to 3 load groups can be switched in a safety-oriented manner 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 commonly and simultaneously but independently of each other. One channel forms the positive (P) and one the negative (M) path for a potential-free load voltage supply.

All P- and M-switches of the module's output channels are each controlled by different processors, which permanently monitor each other (safety concept).

The output channels 1 and 2 (CH1 and CH2) are suitable, for example, for load voltage supply of components that must be switched off safely, as needed, and that fulfil the corresponding requirements (→ section 1.4 and technical data in the appendix).

Examples:

- Soft-start/quick exhaust valves for external components or internal valve terminal pneumatics.
- Valve groups within the CPX terminal, which are separately supplied through electrical supply plates.
- Output signal groups, which are supplied through an additional electrical power supply. These can be arranged in both their own and a separate valve terminal.
- Integrated voltage supply of an additional valve terminal. The operating voltage for electronics and sensors $U_{EL/SEN}$ is supplied from the unswitched auxiliary voltage supply and the load voltage U_{VAL}/U_{OUT} from an output channel (CH1 or CH2). If requested (in the functioning case), the load of the additional valve terminal is switched off without influencing the communication and input function.

1. System overview CPX-FVDA-P2



Note

- Use max. 2 output channels in a shared safety-oriented control circuit.



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

1. System overview CPX-FVDA-P2

1.1.1 Design of the output module CPX-FVDA-P2

The output module CPX-FVDA-P2 is modularly constructed and consists of the following components:

- 1 Manifold block
CPX-M-AB-4-
M12X2-5POL
- 2 Alternative
manifold block
CPX-AB-8-KL-4POL
- 3 Electronics
module
CPX-FVDA-P2
- 4 10-element DIL
switch for
PROFIsafe
address
- 5 Mechanical
coding
- 6 Interlinking block
CPX-M-GE-EV-FVO
- 7 Name plate (on
the bottom)
- 8 Electrical plug
connector
- 9 LEDs of the
module

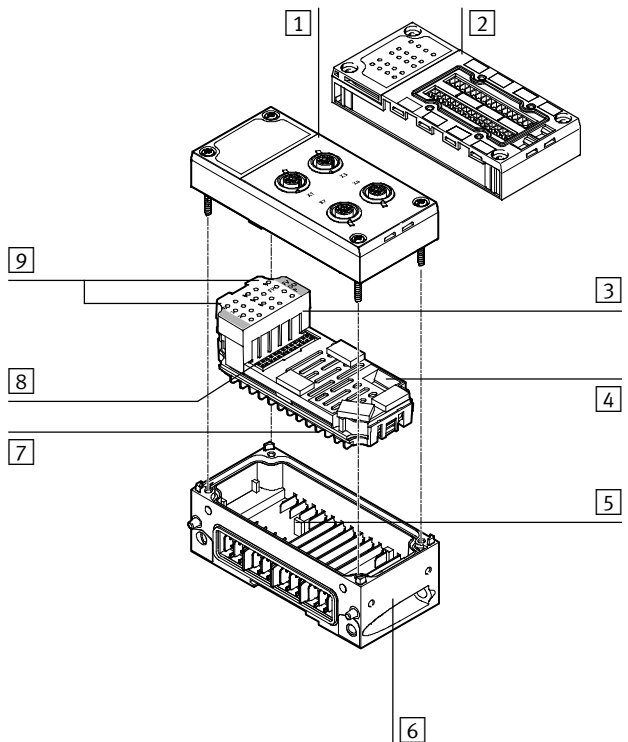


Fig. 1/2: Design of the output module CPX-FVDA-P2

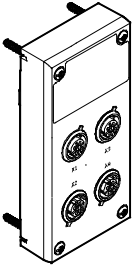
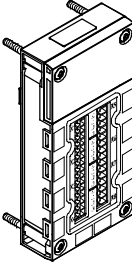
To avoid errors in mounting, both the interlinking block CPX-M-GE-EV-FVO and the electronics module CPX-FVDA-P2 are mechanically coded. The coding prevents a different module from being plugged into the interlinking block or the electronics module from being plugged into an incorrect interlinking block.

1. System overview CPX-FVDA-P2

Components

Connection block

The connection block makes available the electrical connection technology of the output module. The following connection blocks can be used for CPX-FVDA-P2:

Connection block	Type	Description
	CPX-M-AB-4-M12X2-5POL	<p>M12 metal connection technology</p> <ul style="list-style-type: none"> – 4 M12 sockets with metal thread, 5-pin – Protection class IP65/IP67 using cover caps for unused connections – One functional earth connection per socket – Shielding possibility via metal thread – enables the use of M12- and SPEEDCON plug connectors
	CPX-AB-8-KL-4POL	<p>Terminal strip connection technology</p> <ul style="list-style-type: none"> – 2 terminal strips, 16-pin (4 x 4-pin) – Protection class IP20 – Protection class IP65/IP67 with cover AK-8KL and screw connector set VG-K-M9 – All cores can be laid individually in spring-clip terminals – Connections are arranged in groups of 4, one functional-earth connection per group

Tab. 1/1: Permissible connection block

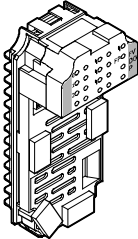


Connection blocks are not mechanically coded. Use of a different connection block than the ones named here is impermissible.

1. System overview CPX-FVDA-P2

Electronics module

The electronics module includes the electronic components of the output module. It is connected to the interlinking block and the connection block by means of electric plug connectors. The PROFIsafe address can be set directly at the electronics module through a DIL switch (→ chapter 2.4).

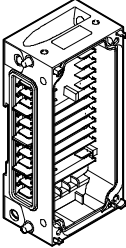
Electronics module	Type	Description
	CPX-FVDA-P2	<ul style="list-style-type: none"> – A digital output channel CH0 for switching off the load voltage supply U_{VAL} in the linking of the CPX terminals ¹⁾ – Two digital output channels CH1 and CH2 ²⁾ – Control of the digital output channels with safety-oriented 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 – Mechanical coding prevents the electronics module from being plugged into invalid interlinking blocks.
<p>¹⁾ All modules supplied via the load voltage supply U_{VAL} of the CPX terminal are switched off in two channels, P and M-sided.</p> <p>²⁾ The connected external consumers are switched off in two channels, P- and M-sided. The output channels 1 und 2 (CH1, CH2) are supplied from U_{VAL}.</p>		

Tab. 1/2: Electronics module

1. System overview CPX-FVDA-P2

Interlinking block

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

Interlinking block	Type	Description
	CPX-M-GE-EV-FVO	<p>Special metal interlinking block for CPX-FVDA-P2 (without supply)</p> <ul style="list-style-type: none"> – Interruption of all contact rails for load voltage supplies (U_{VAL} and U_{OUT}) – Contact rails for load voltage supply U_{VAL} are closed or interrupted through the output module – Contact rails for U_{OUT} remain interrupted ¹⁾ – Mechanical coding prevents plugging in of impermissible modules
<p>¹⁾ To the right of the output module, a U_{OUT} is no longer available above the contact rails.</p>		

Tab. 1/3: Interlinking block



Use of a different interlinking block for CPX-FVDA-P2 is impermissible.

1. System overview CPX-FVDA-P2

1.1.2 Supported product designs from CPX

To control the output module CPX-FVDA-P2, a PROFIBUS- or PROFINET-capable bus node is required. The CPX terminal must be equipped with one of the following bus nodes (→ name plate):

Bus nodes	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 node for control of the CPX-FVDA-P2

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

Product version	Description
Electrical terminal CPX-M	Modular electrical terminal CPX (without pneumatics modules)
Valve terminal type 32 – MPA-S-FB-VI	Valve terminal MPA-S with CPX modular electrical peripherals
Valve terminal type 33 – MPA-FB-VI	Valve terminal MPA-F with CPX modular electrical peripherals
Valve terminal type 34 – MPA-L-FB-VI	Valve terminal MPA-L with CPX modular electrical peripherals

1. System overview CPX-FVDA-P2

Product version	Description
Valve terminal type 44 – VTSA-FB-VI – VTSA-FB-NPT-VI	Valve terminal VTSA with CPX modular electrical peripherals
Valve terminal type 45 – VTSA-F-FB-VI – VTSA-F-FB-NPT-VI	Valve terminal VTSA-F with CPX modular electrical peripherals

Tab. 1/5: Supported product designs 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⁾
MPA-L-FB-VI	34	All 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⁾ If the residual current is exceeded, operative malfunctions are possible.		

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



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



Note

If the pneumatics interface VABA-S6-1-X2 is used:

- Set the parameter “Wire break monitoring” of the pneumatics interface to inactive (→ parameter description for the pneumatics interface).

Otherwise, diagnostic errors can be triggered in certain cases by the module’s self-monitoring.

1. System overview CPX-FVDA-P2



Note

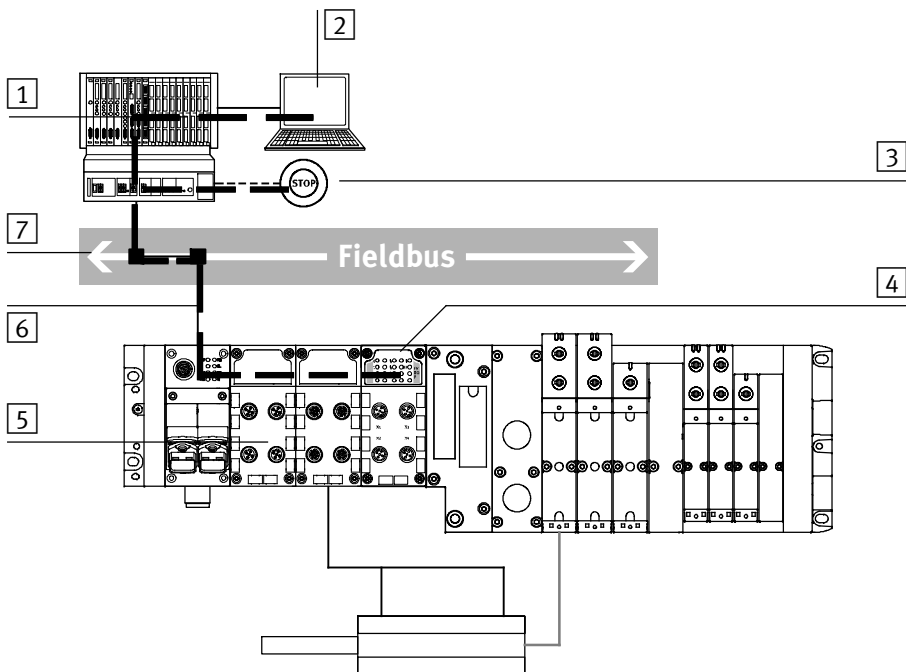
If individual pneumatics modules of the types VMPA-... , VTSA-... or VMPAL-... are used, the diagnostic message “wire break” can be triggered, since the detection limit has been fallen below.

- In this case, deactivate the “wire break” diagnostic message for the output channel CH0.

1. System overview CPX-FVDA-P2

1.1.3 Required bus topology (control loop system)

For construction of the safety-related systems, hardware and software components are required. Needed, for example, is a safety controller (F-Host) with corresponding design and programming tools.



- | | |
|---|--|
| 1 Safety controller (F-Host) | 5 CPX terminal with bus node for PROFIBUS or PROFINET IO |
| 2 Safety Configuration Tool (for safety controller) | 6 Embedded PROFIsafe data (black channel) |
| 3 EMERGENCY STOP pushbutton (example) | 7 PROFIBUS or PROFINET IO |
| 4 Output module CPX-FVDA-P2 | |

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

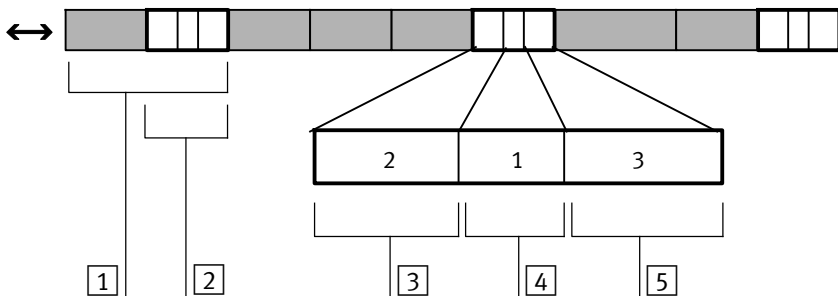
1.2 PROFIsafe

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

1.2.1 Safety profile PROFIsafe

The PROFIsafe telegrams are embedded in standard telegrams and guided over the so-called black channel from the safety SSPS to the output module. The black channel stretches from the fieldbus connection of the safety controller through the CPX bus node to the output module CPX-FVDA-P2 (→ Fig. 1/3). There, the PROFIsafe telegrams are processed by the output module.

In addition to the process data, safety information is transmitted in the PROFIsafe telegram. Therefore, the output module CPX-FVDA-P2 occupies 6 bytes each in the process image of the CPX terminal (→ Fig. 1/4; 3, 4, 5).



- | | |
|---|--|
| 1 Standard telegram with embedded PROFIsafe data | 3 2 bytes for F user data of the module |
| 2 Embedded PROFIsafe telegram | 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

1. System overview CPX-FVDA-P2

Data are transmitted on the same physical basis as the transfer of process data to a standard module. The type of data and their interpretation through the F-device (PROFIsafe slave) differ.

For PROFIsafe communication in combination with the output module CPX-FVDA-P2, the following apply:

- 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 safety mechanisms of PROFIsafe, 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 of the following:

- 2 bytes of output data (F-user data, ➔ Tab. 1/7)
- 1 byte status (for PROFIsafe communication)
- 3 bytes CRC (for PROFIsafe communication)

The 6 bytes for inputs are made up of the following:

- 2 bytes of input data (F-user data, ➔ Tab. 1/8)
- 1 byte control byte (for PROFIsafe communication)
- 3 bytes CRC (for PROFIsafe communication)

1. System overview CPX-FVDA-P2

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	Reserved	Test pulse activated		Reserved		Nominal status		
		CH2	CH1			CH2	CH1	CH0
	0	0 = activate 1 = deactivate		0		0 = off 1 = on		
Byte 1	Channel-wise passivation	Reserved		Data direction	Reserved	Acknowledgment		
	0 = off 1 = On	0		0 = Device to host (fixed value)	0	– Change Low → High = user acknowledgment or – Permanent 1 = auto-acknowledgment		

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

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

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

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

Switching commands are carried out only by an integrated (depassivated) module. If the module or channel is passivated, failsafe values are output.

Cross-circuit monitoring

Through bit 5 and bit 6 of byte 0, the test pulses of the relevant output channel can be specifically deactivated. This reduces the error potential for the connected load. The other diagnostic measures remain active.

With active monitoring, a cyclical check of the switch-off paths takes place. The function of the electronic switches and

1. System overview CPX-FVDA-P2

the lack of cross-circuiting of the lines are checked. The cyclical check results in a momentary potential shift of the output voltage, which takes place simultaneously on the P- and M-side. As a result, the output voltage remains largely unchanged. Potential-free consuming devices are not influenced through this.

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



Note

If the test pulses of cross-circuit monitoring are deactivated, the safety-engineering characteristic values change (→ appendix Tab. A/4).



Note

Cross-circuit monitoring supervises only the device's own circuits.

- Make sure that cross-circuiting to other circuits are prevented through 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 also safely switches all channels off in case of a single channel error in accordance with PROFIsafe specification and signals errors to the F-Host through the flags “FV_activated” and “Device fault”. The F-Host then passivates the output channels of the module (F-Slaves), phases out the module and sets the control bit “Activate_FV”.

If the function is active (1 = on), in case of a channel error, 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.

1. System overview CPX-FVDA-P2

Through the input image, in addition to the current status, the module signals the channel error status to the controller (→ Tab. 1/8, channel error status).

Input data

The output module in byte 0 returns the logical actual statuses as well as the statuses of the monitoring flags as input data to the F-Host (→ Tab. 1/8). This enables control of the status of the monitoring flag.

In byte 1, setting of the parameter “channel-wise passivation” can be returned. If channel-wise passivation is switched on, through the bits “Channel fault status channel ...” are signaled the channel errors detected by the module. These 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	Reserved	Test pulse activated		Reserved		Logical actual status ¹⁾		
		CH2	CH1			CH2	CH1	CH0
	0	0 = activated 1 = deactivated		0		0 = off 1 = on		
Byte 1	Channel-wise passivation	Reserved		Data direction	Reserved	Channel error status		
		CH2	CH1	CH0				
	0 = off 1 = On	0		1 = Host to service (fixed value)	0	0 = No fault 1 = Fault		
1) These bits return the logical actual statuses. The statuses are not determined through measurements. No external voltages are evaluated at passivated or switched-off outputs. In case of passivation of the complete module, these bits supply 0-signals. In case of passivation of an output channel, the corresponding bit supplies a logic 0.								

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

1. System overview CPX-FVDA-P2

Acknowledgment sequence

If channel-wise passivation is used, acknowledgment through user program must be ensured.

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

No.	Process	Channel-wise passivation ¹⁾	Setpoint status of the output channel ¹⁾	Actual status of the output channel ²⁾	Channel fault status ²⁾	Acknowledgment of the channel fault ¹⁾
1	Module is not passivated	1 (active)	X	X	0	0
	Channel fault appears					
2	Module detected the fault	1 (active)	X	0	1	0
	F-Host detects the fault of the module					
3	F-Host passivates the output	1 (active)	0	0	1	0
	Fault is eliminated					
	User acknowledged the fault (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
<p>The grey-marked cells emphasise the bits relevant for the respective table line. 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</p>						

Tab. 1/9: Sequence description of channel fault acknowledgment – example

1. System overview CPX-FVDA-P2

The detection of a short circuit is not possible in the passivated status. Therefore, the short circuit is reported up to acknowledgment.

Automatic acknowledgment is possible by holding the acknowledgment bit permanently at “1”. In case of short circuit, reentry is delayed.

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 ensure that the F-Host takes the acknowledgment back again.

Data direction

The PROFIsafe protocol in the supported version does not have an adequate marking of the transmission direction of a telegram. As a result, it may occur that a telegram from the F-Host is returned to it and incorrectly interpreted there. This case is extremely rare and occurs only in the case of malfunction of a non-reliable slave in the “black channel”.

For reliable avoidance of this exception:

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

1.3 Mode of operation of the output module

The switches of the output channels are 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 for switching capability and 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 facility. This is able to measure current from about 50 mA and detect load and short-circuit current.

The design of the entire module ensures that the output channels are also switched off in case of error, such as:

- overvoltage, undervoltage, overload, short circuit and cross circuit
- Failure or malfunction of communication via PROFIsafe
- Failure or defect of individual safety-determining components of the module.



Note

If a load is operated with own dynamics that are constantly high (e.g. rapidly switching valves), the diagnostic function cannot be carried out completely. In this case, the output channel is switched off for safety.

- Make sure that a load is operated with sufficiently low own dynamics at the output channel involved.

1. System overview CPX-FVDA-P2

1.3.1 Application ranges

Use in machines and systems with increased safety requirements is possible only if the safe status is achieved by switching off circuits. The following application ranges are intended:

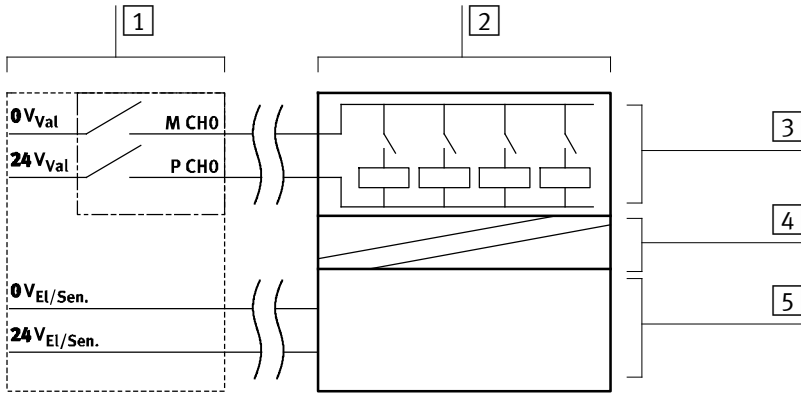
Case	Safe switch off ...	Output channel used	Reliable function
1	... the load voltage supply for the internal valves of the valve terminal with galvanic isolation	CH0	Safe switch-off of the load voltage with cyclical checking of the switch-off paths for function and cross circuits
2	... of potential-free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

1. System overview CPX-FVDA-P2

Case 1:

Safe switch off of the load voltage supply for the internal valves of the valve terminal with galvanic isolation via CHO.



- 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

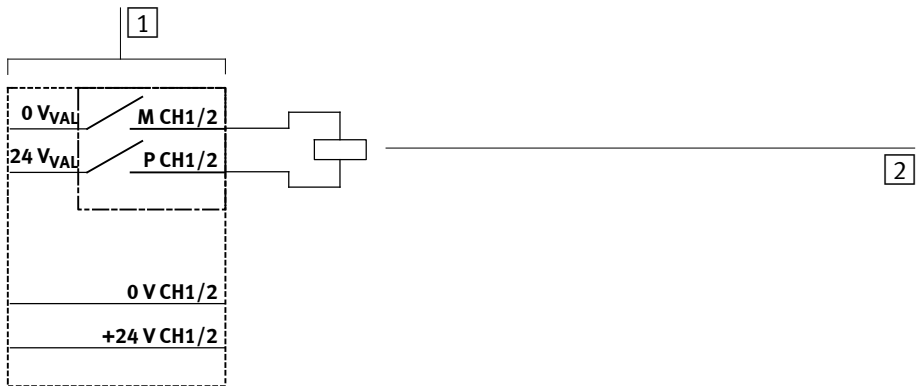
Fig. 1/5: Switch-off of the load voltage supply of CPX-internal solenoid coils

1. System overview CPX-FVDA-P2

Case 2:

Safe switch-off of potential-free individual consumers via CH1 or CH2 (e.g. valves, contactors, relays).

An internal or external valve group can, for example, be exhausted through an external exhaust valve.



1 Output module CPX-FVDA-P2

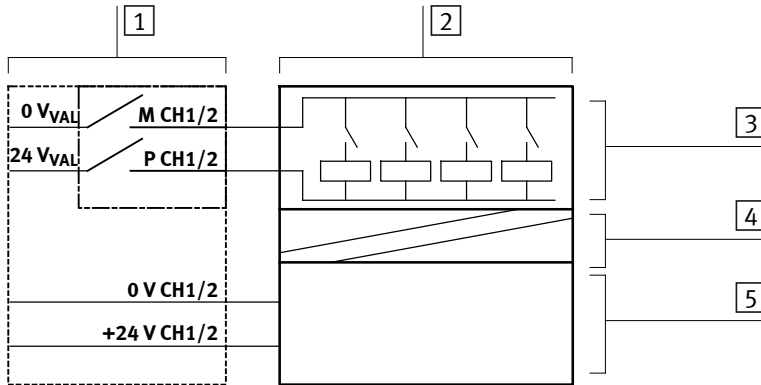
2 Potential-free passive load

Fig. 1/6: Safe switch-off of potential-free individual consumers

1. System overview CPX-FVDA-P2

Case 3:

Safe switch-off of the load voltage of external electronic consumers with safe galvanic isolation of the load 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 Electronic side of the consumer can optionally be connected to the 24 V supply available from the module

Fig. 1/7: Safe switch-off of 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 through the safe switch-off of connected consumers. The following application examples show you the various possible applications for intended use of the CPX-FVDA-P2.



Note

The output channels of the CPX-FVDA-P2 do not make available separate potentials that may be used independently of each other from a safety engineering perspective. For this reason, the P and M connections of an output channel must always be used in common.

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

On the following pages, you will find various application examples representing the switching of permissible and impermissible safety circuits.



Caution

- Make sure that the application examples designated impermissible are not used under any condition. They merely represent a foreseeable misuse.

1. System overview CPX-FVDA-P2

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

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

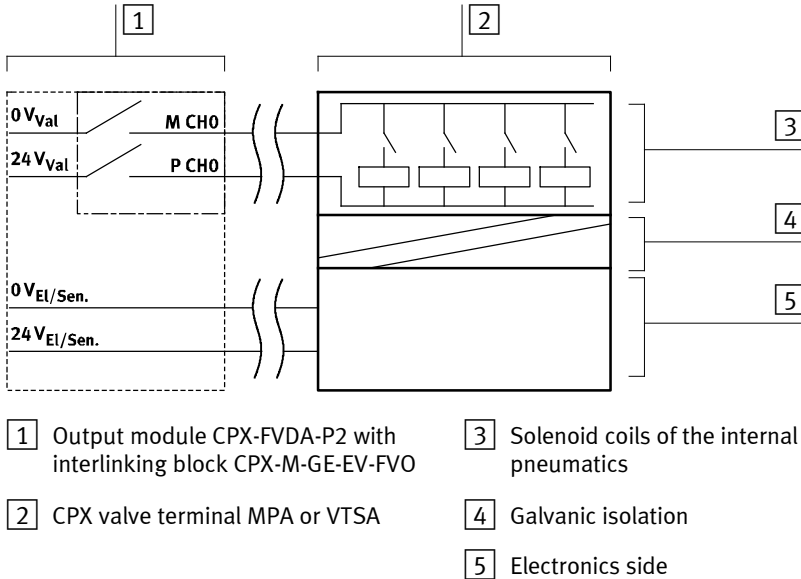
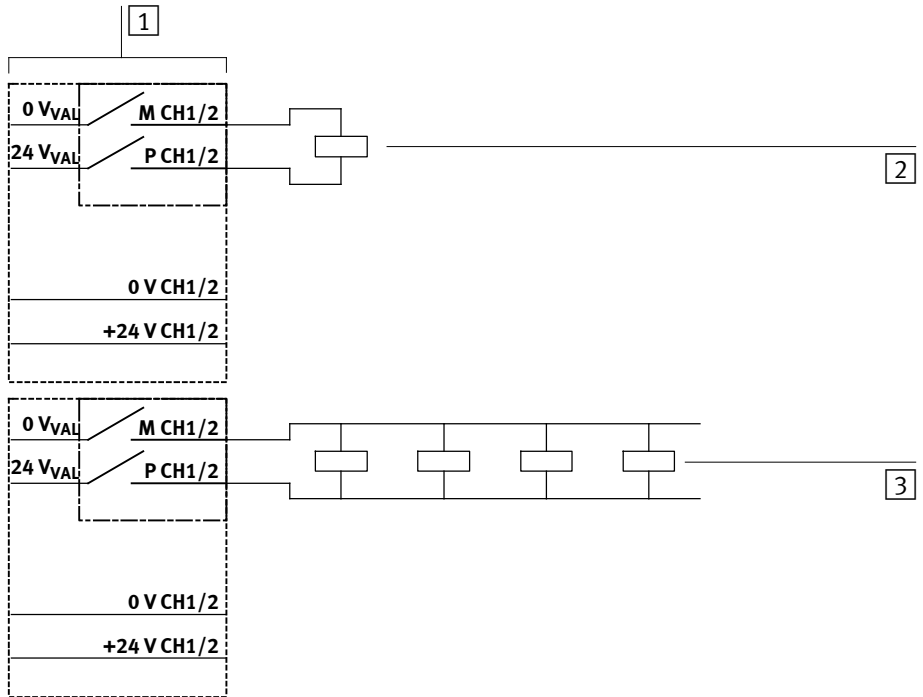


Fig. 1/8: Connection of the load voltage supply of CPX-internal solenoid coils

1. System overview CPX-FVDA-P2

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

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



1 Output module CPX-FVDA-P2

3 Potential-free parallel passive loads

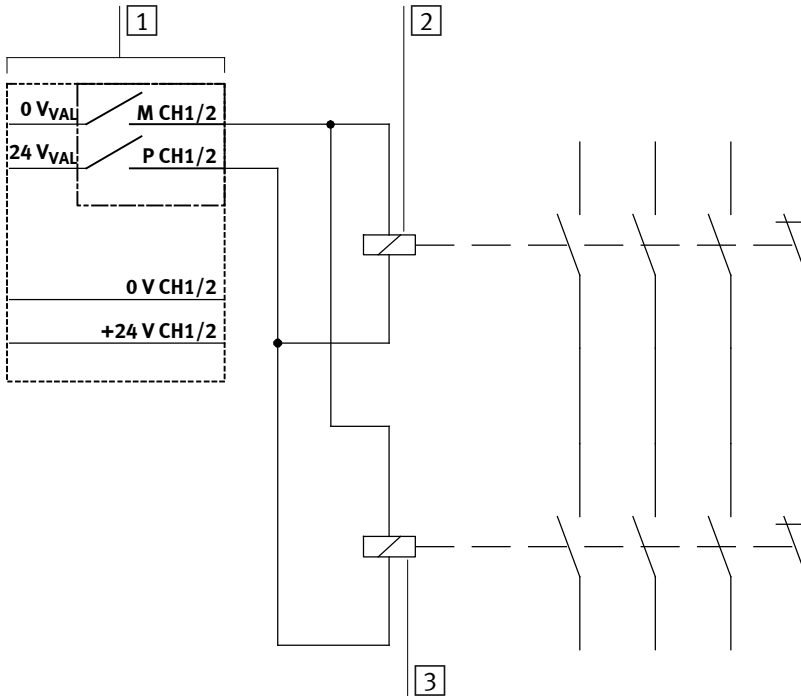
2 Potential-free passive load

Fig. 1/9: Safe connection of potential-free individual consumers

1. System overview CPX-FVDA-P2

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

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



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

3 Safety relay 2 with forced feedback contact

2 Safety relay 1 with forced feedback contact

Fig. 1/10: Safe connection of safety relays

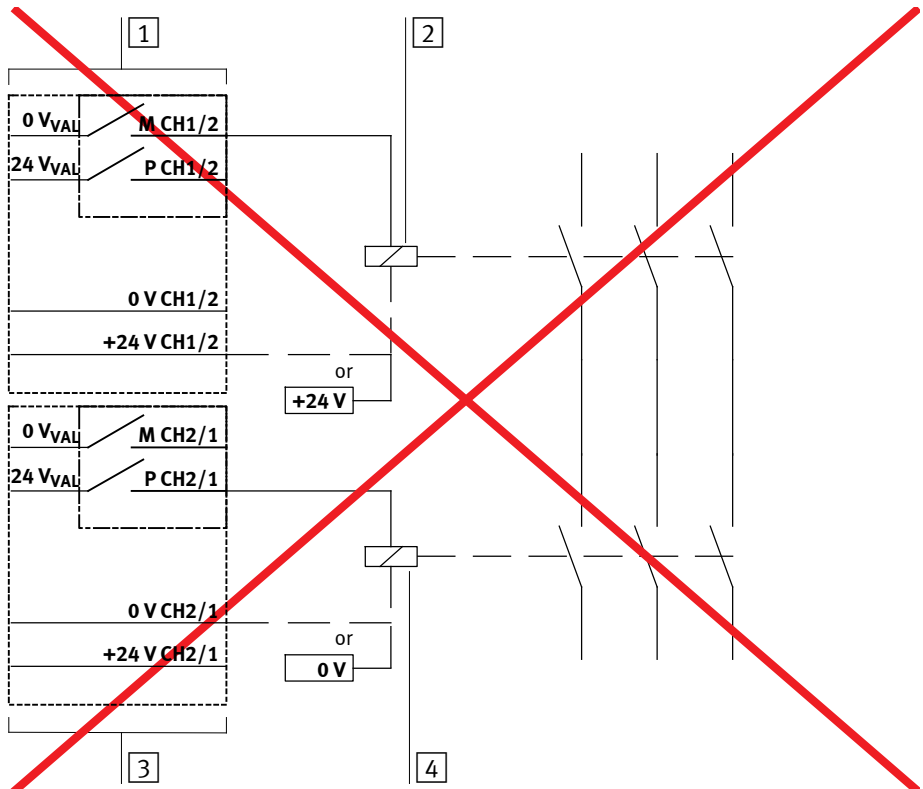
1. System overview CPX-FVDA-P2

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



Caution

This connection of potential-free loads is **not permissible** for the formation of a safety circuit.



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

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

2 Safety relay 1

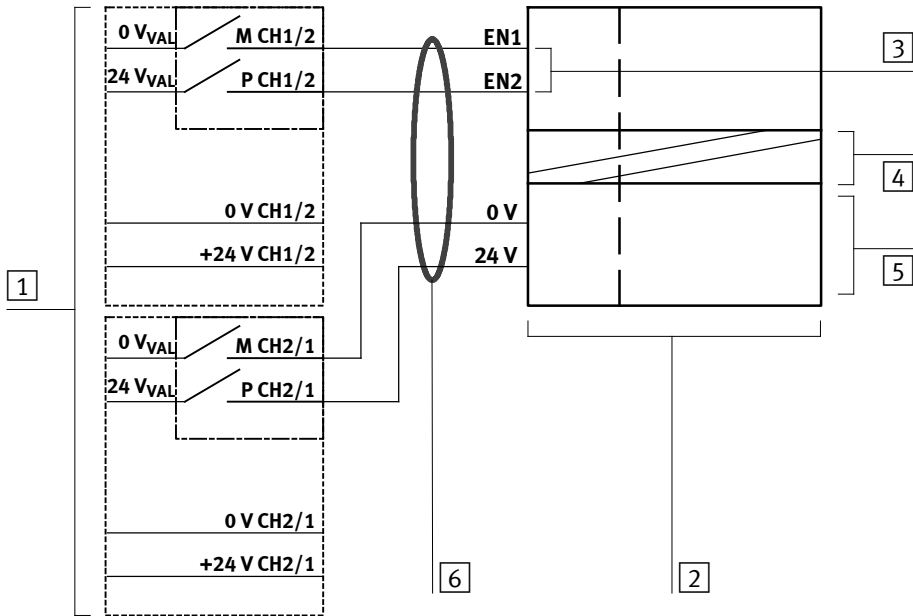
4 Safety relay 2

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

1. System overview CPX-FVDA-P2

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

Connection of an 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 ports EN1, EN2
- 4 Galvanic isolation
- 5 Supply of the MS6-SV...-E-10V24... via NECA-S1G9-P9-MP5
- 6 Shared guiding of the signals over the same cable permissible (if necessary with Y-distributor)

Fig. 1/14: Connection of an MS6-SV...-E-10V24... via NECA-S1G9-P9-MP5 to both output channels CH1 and CH2.



With the second output channel, a reset and thus acknowledgment of an MS6-internal error switch-off can be triggered by briefly switching off the MS6-supply.

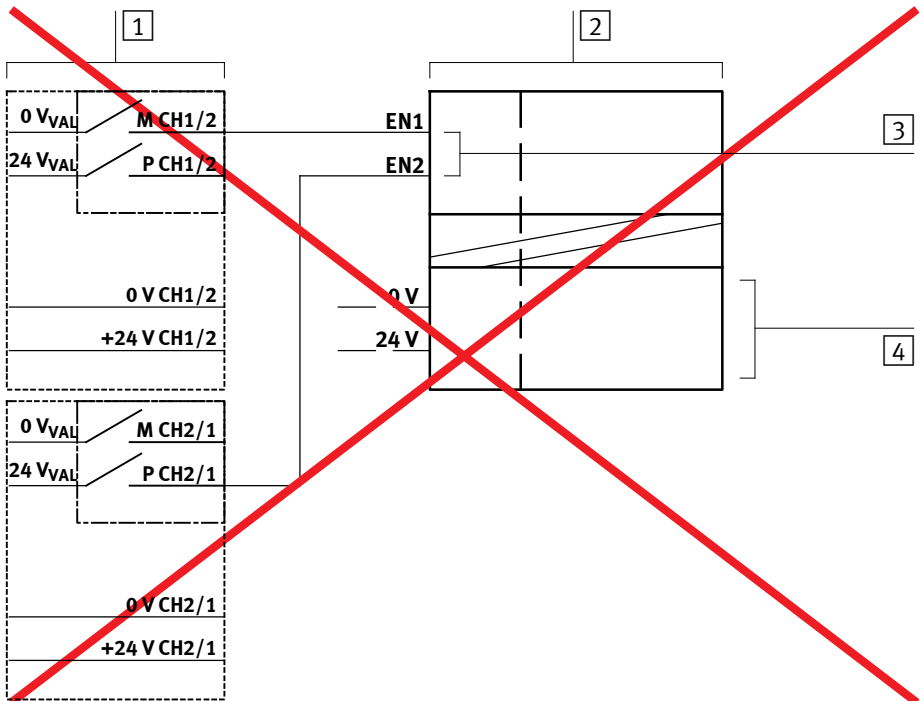
1. System overview CPX-FVDA-P2

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



Caution

This connection of an MS6-SV-...-E-10V24-... is **not permissible** for the formation of a safety circuit.



1 2 x output module CPX-FVDA-P2

3 Antivalent control ports EN1, EN2

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

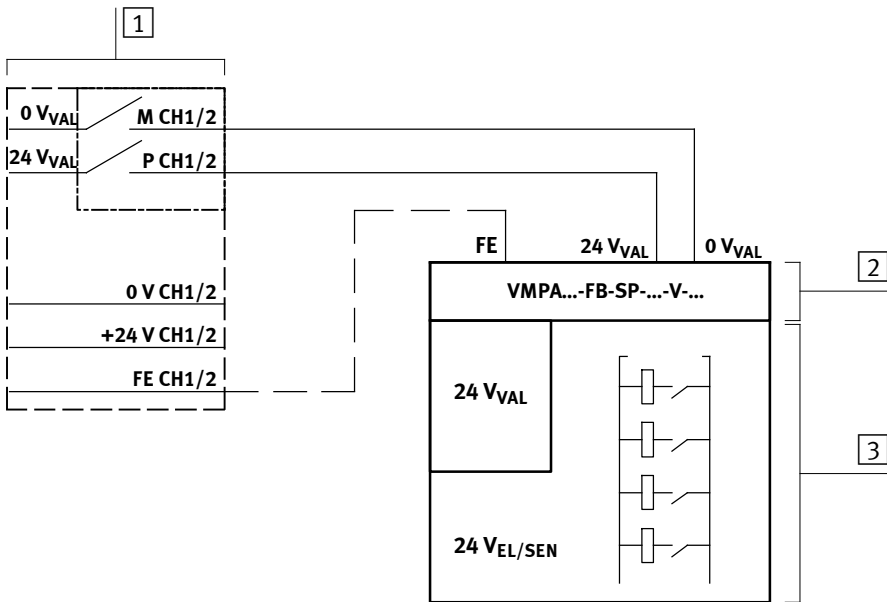
4 Supply of the MS6-SV-...-E-10V24-... via NECA-S1G9-P9-MP5

Fig. 1/15: Impermissible connection of an MS6-SV-...-E10V24-...

1. System overview CPX-FVDA-P2

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

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



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

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

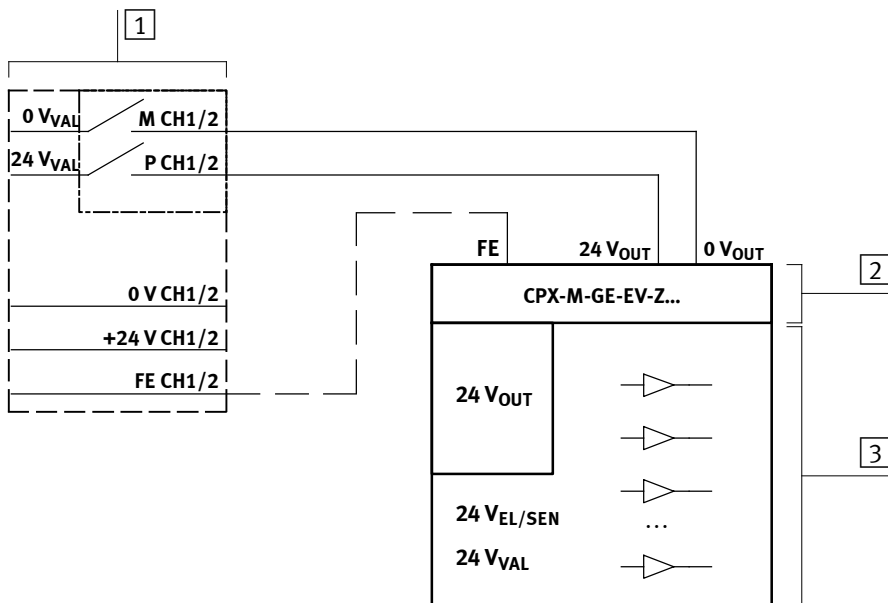
3 Part of the valve terminal with the valves to be switched off for safety engineering reasons

Fig. 1/16: Connection of a valve terminal via additional power supply

1. System overview CPX-FVDA-P2

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

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



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

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

3 Part of the CPX terminal with the output modules to be switched off for safety engineering reasons

Fig. 1/17: Connection of a separate supply circuit via additional power supply



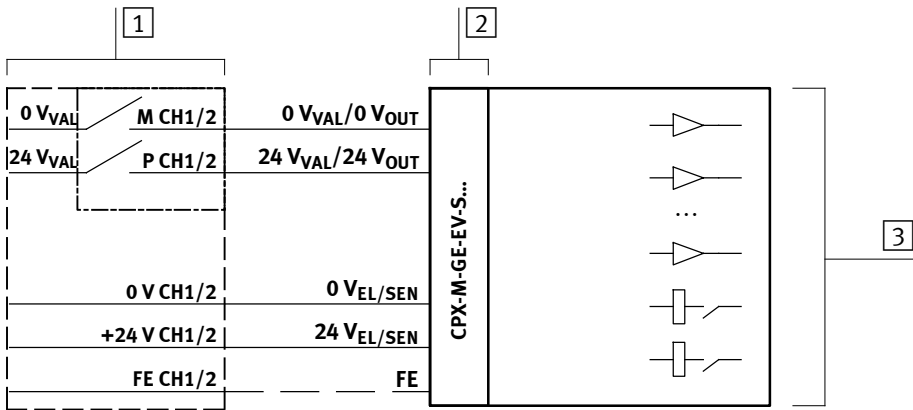
Note

- Use only the approved output modules in the safety circuit.
- Observe the specifications for connection of loads to an output module within the safety circuit (→ chapter 1.4.2 and example 12).

1. System overview CPX-FVDA-P2

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

Connection of an external valve terminal over the system supply to one of the two output channels CH1 or CH2. Outputs and valves are operated in the common safety circuit.



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

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

3 CPX valve terminal with the output modules and valves to be switched off for safety engineering reasons

Fig. 1/18: Connection of an external valve terminal over the system supply

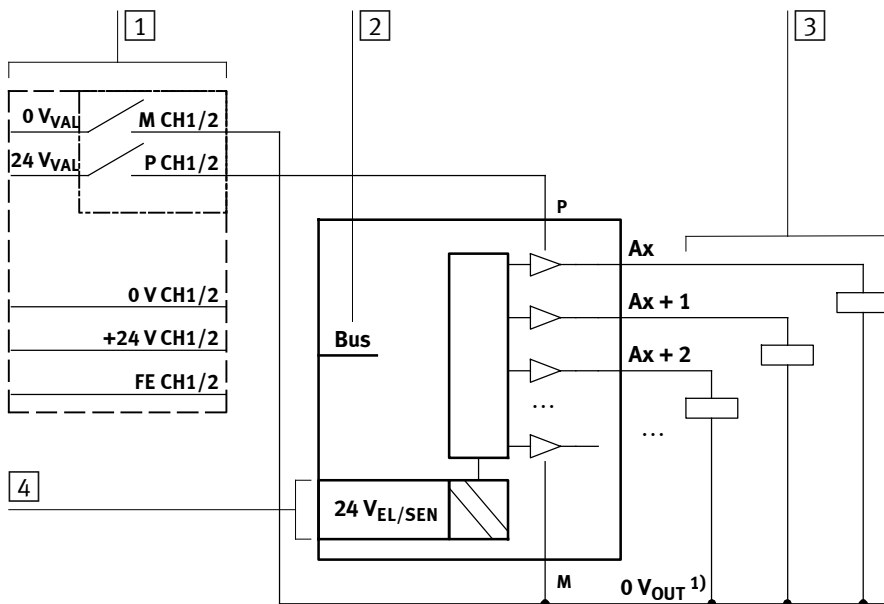


Note

- Use only 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
- Use only the approved output modules and valve terminals in the safety circuit.
- Observe the specifications for connection of loads to an output module within the safety circuit (➔ chapter 1.4.2 and example 12).

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

Connection of additional loads to an output module within the safety circuit.



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

2) Internal system bus for functional control of the loads

3) Functionally switched loads that are disconnectable for safety engineering reasons

4) Operating voltage supply, galvanically isolated

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

Fig. 1/19: Connection of additional loads via an output module



Note

- Use only the existing connections for supply of the additional loads.
- Connect the additional loads in a potential-free manner (no reference to FE or PE).

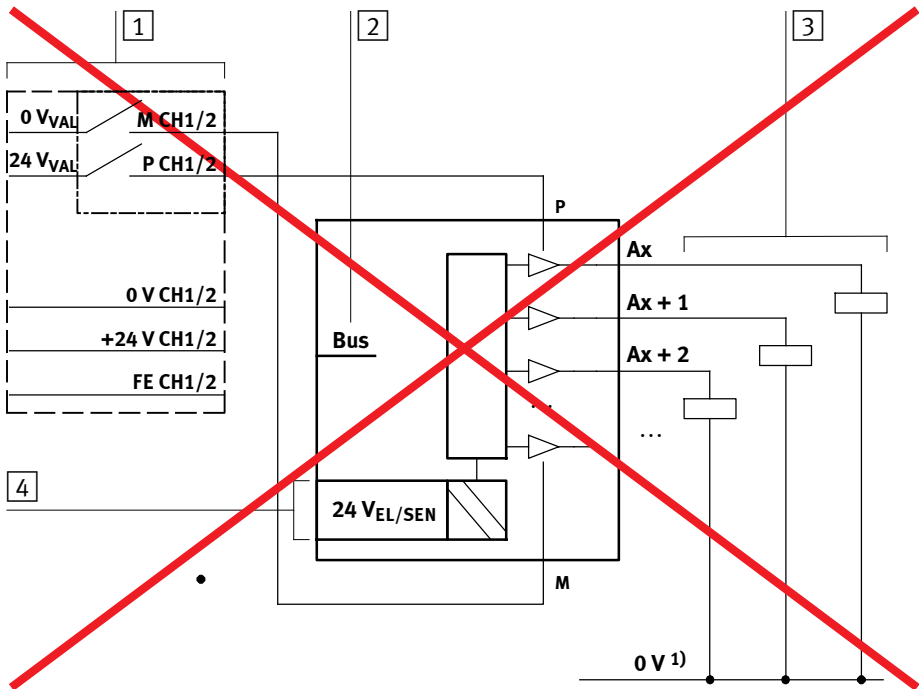
1. System overview CPX-FVDA-P2

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



Caution

This connection of loads through a 0-potential without connection to the M-channel is **not permissible** for the formation of a safety circuit.



- 1 Output channel CH1 or CH2 of the output module CPX-FVDA-P2
- 2 Internal system bus for functional control of the loads
- 3 Functionally switched loads that are disconnectable for safety engineering reasons
- 4 Operating voltage supply, galvanically isolated

1) 0V-potential, which does not come from M, e.g. V_{SEN}

1.4 Requirements for actuators (CH0 ... CH2)

Observe the following instructions for the safety-oriented use of the output module CPX-FVDA-P2 (→ appendix A.1 Technical data):

1.4.1 Electrical requirements

All output channels ensure the secure switch-off of loads. The number of disconnectable loads 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 loads used in the safety circuit are not sensitive to test pulses of the cross-circuit monitoring. If necessary, it can be helpful to deactivate the test pulses of the cross-circuit monitoring. In this regard, observe the deviating safety characteristics (→ appendix A.1 Tab. A/4).
- Use the outside-supplied loads only if their supply alternatively:
 - results from a reliably galvanically isolated functional low voltage (PELV)
 - from the load voltage supply for valves (U_{VAL}).



Note

If electronic loads are connected to CH1 and CH2, under unfavourable operating conditions, the result may be incorrect detection of a cross circuit.

1. System overview CPX-FVDA-P2

- Observe in particular the maximum values of 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/1).



Note

If a valve terminal is extended with additional valves, the load current at CH0 increases.

- For operation of the valve terminal, make sure that the maximum permissible load current is **not** exceeded. Therefore, limit the number of simultaneously switched-on valves.

Otherwise, the safety-oriented switch-off of the relevant safety circuit will take place.

1.4.2 Safety-oriented requirements

When loads are connected:

- Comply with the requirements of the safety standards valid for the respective load and system type. This applies particularly for loads that have no further energy supply or storage besides the electrical connection to the P- and M-channel.
- Make sure that the safe status of the loads is taken under each of the following conditions:
 - Switch-off of P-channel and M-channel (normal operation).
 - Switch-off only of P-channel and M-channel (error case).

If loads connected to additional voltage sources are controlled:

- Ensure one of the two following options:
 - The additional voltages come from the same source as the load voltage supply U_{VAL} .
 - The loads have a galvanic isolation, corresponding to the required safety level, from the potential of the output channels of the CPX-FVDA-P2.

If loads are operated that are switched via an additional output module (→ table Tab. 0/3):

- Take measures to avoid or uncover cross circuits between the additional output module and the load.
- Operate the load potential-free.
- Make sure that the voltage supplies used come from the same source to ensure functioning of the cross circuit detection.
- Always connect the load to the related 0V port located on the output module.

1. System overview CPX-FVDA-P2



Note

- Make sure that CH1 and CH2 are not switched electrically parallel.



Note

- Make sure that all voltages in the system (for CPX and its loads switched for safety engineering reasons) refer to the same functional earth (FE).

Installation

Chapter 2

2. Installation

Table of contents

2.	Installation	2-1
2.1	General instructions on installation	2-3
2.2	Connecting the cables and plugs to the connection block	2-5
2.3	Electrical connection and display components	2-7
2.3.1	Pin allocation with M12 connection block	2-8
2.3.2	Pin allocation with KL connection block	2-9
2.4	Set PROFI-safe address	2-10
2.5	Dismounting and mounting the electronics module	2-13
2.5.1	Dismantling the electronics module	2-14
2.5.2	Mounting the electronics module	2-15

2. Installation

2.1 General instructions on installation



Warning

- Only use PELV **circuits** in accordance with IEC/EN 60204-1 (protective extra-low voltage, PELV) for the electrical power supply. Also observe the general requirements for PELV circuits in accordance with IEC/EN 60204-1.
- Use only power **sources** which guarantee reliable electrical isolation of the operating voltage as per IEC/EN 60204-1.
- Make sure that defective cables are replaced immediately.

The use of PELV circuits ensures protection from electric shock (protection from direct and indirect contact) in accordance with IEC/EN 60204-1 (Electrical equipment of machines, general requirements).

In addition, compliance with the input voltage limits of the module is ensured.

Module-related rules for configuration

- Plug the output module CPX-FVDA-P2 only into the interlinking block CPX-M-GE-EV-FVO.



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

- Observe that the connection blocks are not mechanically coded.
- Operate the output module exclusively with the connection blocks CPX-M-AB-4-M12X2- 5POL or CPX-AB-8-KL-4POL.
- When placing the output module, make sure that to the right the voltage $24 V_{VAL}/0 V_{VAL}$ is switched through output channel CH0 and 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 voltage supply U_{OUT} is no longer available on the right side of the interlinking block CPX-M-GE-EV-FVO.

- Use, if necessary, an intermediate power supply (additional power supply) with the help of a CPX-M-GE-EV-Z.



Note

When the intermediate power supply CPX-M-GE-EV-Z is mounted on the right side of the interlinking block CPX-M-GE-EV-FVO, the safety function of output channel CH0 is ineffective.

2.2 Connecting the cables and plugs to the connection block

**Note**

Incorrect handling can cause damage to the electronics modules.

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

Connection of actuators to the connection block. In this way, e.g. when the electronics module is replaced, the plugs and cables remain mounted in the connection block.



The protection class of the module is dependent on the connection block used as well as the plugs and protective caps used. Instructions can be found on the following pages and in the appendix A.2.



Use plugs from the Festo assortment (→ www.festo.com/catalogue).

The max. permissible line length is 200 m.

**Note**

To achieve the protection class IP65/IP67 for output modules with the connection block CPX-M-AB-4-M12X2-5POL:

- For connecting the actuators, use the specified plugs from the accessories (→ www.festo.com/catalogue).
- Tighten the union nuts of the plugs by hand.
- Seal unused sockets with cover caps ISK-M12 (accessories).

2. Installation



Note

To achieve the protection class IP65/IP67 for output modules with the connection block CPX-AB-8-KL-4POL:

- For sealing, use the specified cover from the accessories (→ www.festo.com/catalogue).



Note

Cross-circuit monitoring is only for the device's own circuits.

- Make sure that cross-circuiting to other circuits is prevented through appropriate installation measures.

2. Installation

2.3 Electrical connection and display components

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

- 1 Name plates of the connection and interlinking block
- 2 Status LED per output (yellow)
- 3 Channel error LED per output channel (red)
- 4 Module error LED (red)
- 5 FP-LED (green)
- 6 Module identifier FVDOP2 (for CPX-FVDA-P2)
- 7 Area for electrical connections

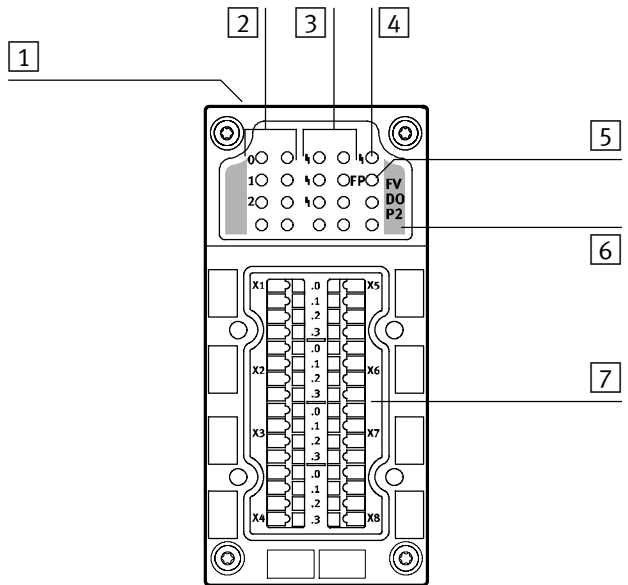


Fig. 2/1: Display and connecting elements CPX-FVDA-P2



Detailed information on the LEDs → section 5.3.

2. Installation

2.3.1 Pin allocation with M12 connection block



Note

Sockets X1 to X4 on the connection block are marked accordingly. The numbering of the sockets correspond here 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 X1 1: 0V CH1 ¹⁾ 2: +24V CH1 ¹⁾ 3: F-DO(M) CH1 ²⁾ 4: F-DO(P) CH1 ²⁾ 5: FE		Socket X3 1: n.c. 2: n.c. 3: n.c. 4: n.c. 5: FE
		Socket X2 1: 0V CH2 ¹⁾ 2: +24V CH2 ¹⁾ 3: F-DO(M) CH2 ²⁾ 4: F-DO(P) CH2 ²⁾ 5: FE		Socket 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).

2.4 Set PROFIsafe address

The output module is controlled by an F-Host via PROFIsafe and requires a PROFIsafe address for unique identification. The PROFIsafe address is determined through configuration software and also set binary coded directly at the output module with the 10-element DIL switch. Both settings must match.

The 10-element DIL switch is located directly on the electronics module and can be set with a dismantled connection block (→ Fig. 1/2).

Permissible are PROFIsafe addresses from 1 to 1023.

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



Note

Incorrect handling can cause damage to the electronics modules.

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

Electronics modules include electrostatically sensitive devices.

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

2. Installation



Note

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

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

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

1 Addressing example – PROFIsafe address 578

2 Decimal value at setting to ON

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

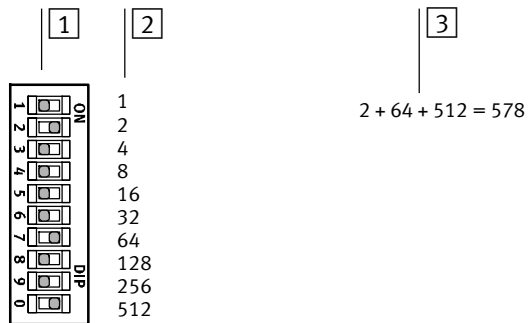


Fig. 2/2: 10-element DIL switch for setting the PROFIsafe address – binary coded



Note

- Before commissioning of the automatic system, make sure that the PROFIsafe address is set in accordance with the installation planning.

This is how you set the PROFIsafe address at the DIL switch:



Note

Incorrect handling can cause damage to the electronics modules.

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

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



When mounting, observe the instruction in section 2.5.2 (threaded connector without distortion, clean connection surfaces, etc.).

4. Remount 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 push/pull the electronics module into/out of the interlinking block when powered.

Electronics modules include electrostatically sensitive devices.

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

- First switch off the supply voltage before conducting any mounting or installation work.
- Switch on the electrical supply voltage only when mounting and installation work are completely finished.

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 at the CPX-M-AB-4-M12X2-5POL or cable at the CPX-AB-8-KL-4POL can remain attached while dismounting the connection block.



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

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

- replacing the connections.

It may be necessary to mount or dismantle electronics modules for the following reasons:

- changing the DIL switch setting (PROFIsafe address)
- replacement of a defective electronics module.

2.5.1 Dismantling the electronics module

For dismantling of the electronics module (→ Fig. 1/2 in section 1.1.1):

1. Switch off the operating and supply voltage.
2. Unscrew the screws 9 and carefully lift off the connection block 1.
3. If required: Pull the electronics module 2 carefully off the contact rails.

2.5.2 Mounting the electronics module



Note

- Handle the components with care.
- Make sure that the metal interlinking block is clean and free from foreign matter, especially in the area of the contact rails.
- Check seals for damage.
- Ensure clean connecting surfaces to optimise the sealing effect and avoid contact errors.



Note

- Use only screws with metric threads for the metal interlinking block CPX-M-GE-EV-FVO.
 - Set screws exactly to avoid damage to thread.
 - Tighten the screws only by hand with a screwdriver.
 - In the threaded connector, avoid any distortion and mechanical stresses.
 - Comply with the specified tightening torques.
 - Also observe the mounting instructions in the package insert supplied with modules and components subsequently ordered.
- 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 voltage.

2. Installation

2. Orient the electronics module **[2]** in the correct position and push it carefully into the interlinking block **[5]**.
3. Check the seal and sealing surfaces, align the connection block **[1]** in the right position and place it onto 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.

Commissioning

Chapter 3

3. Commissioning

Table of contents

3.	Commissioning	3-1
3.1	General instructions	3-3
	3.1.1 Device master file (GSDML and GSD)	3-3
3.2	Preparing for commissioning	3-5
3.3	Commissioning steps	3-6
3.4	Set the PROFIsafe parameters	3-7
3.5	Setting the CPX module parameters	3-9
	3.5.1 CPX module parameters CPX-FVDA-P2 in detail	3-10
	3.5.2 Parameterisation and signal display with the operator unit CPX-MMI-1	3-14
3.6	Configuration with Siemens STEP 7 (example).	3-16
	3.6.1 Addressing example	3-20

3. Commissioning

3.1 General instructions

To operate the output module, the following software versions and a CPX bus node with corresponding revision code are required:

Device master file	Bus nodes Revision code ¹⁾	Controller software (PLC software version)
– PROFIBUS: from CPX_059E.gsd from 04 Feb. 2013 – PROFINET: from GSDML-V2.25- Festo-CPX-20121203. xml from 03 Dec. 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 → name plate bus node		

Tab. 3/1: Required versions

The configuration is dependent on the control system used. The basic procedure and the required configuration data are presented in the following pages.

3.1.1 Device master file (GSDML and GSD)

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

3. Commissioning

Source

Current versions of the GSDML/GSD files for CPX terminals can be found on the Festo website at:

- www.festo.com/fieldbus

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



Configuration, parametrisation and commissioning of the CPX terminal with CPX-FVDA-P2 are dependent on the control system used.

Detailed information can be found in the documentation of the control system used and in the online help of the configuration software used.

Module identifiers

Each module has its own identifier (module identifier).

Apply 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 indicator ¹⁾	Assigned IO 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) Four bytes each are used exclusively for PROFI-safe communication		

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

3. Commissioning

3.2 Preparing for commissioning

1. Make sure that the CPX terminal is correctly mounted (→ CPX system description).
2. Check the wiring (connecting cable, pin allocation) (→ chapter 2.3.1).
3. Dismantle the connection block of the output module (→ section 2.5.1).
4. Check the module for excellent status.
5. Set the PROFIsafe address through the DIL switches on the module and mount the connection block (→ section 2.5.2).

3.3 Commissioning steps



Detailed information on configuration, programming and commissioning in combination with the F-Host used can be found in the documentation of the F-Host manufacturer. Instructions on configuration and commissioning of the CPX terminal can be found in the description of the CPX bus node.

1. Integrate the GSDML/GSD file into the configuration software of the F-Host (→ description of the CPX bus node).
2. Configure and parameterise the output module with the configuration software of the F-Host.
 - Add CPX terminal to the configuration (→ description of the corresponding CPX bus node)
 - Add output module to the CPX configuration
 - Set start address of the inputs and outputs
 - Set PROFIsafe parameter of the output module (→ section 3.4)
 - If necessary, set standard parameters of the output module (→ section 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 trial mode.

3. Commissioning

3.4 Set the PROFIsafe parameters

PROFIsafe-specific parameters can be viewed or set with the configurator of the F-Host (e.g. HW Config). They are marked in accordance with the PROFIsafe profile in the GSDML/GSD file. As a result, access is possible only after the password is entered in the F-Host.

PROFIsafe parameters	General description	For CPX-FVDA-P2, the following apply:	Value
F_CHECK_IPAR	Establishes whether the individual device parameters (CPX module parameter) should be taken into account in the consistency check (CRC calculation) of the F-user data telegram.	– CPX-FVDA-P2 makes no individual device parameters available.	– No check (not changeable)
F_CHECK_SEQNR	Establishes whether the sequence number should be taken into account in the consistency check (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 (not changeable)
F_SIL	Safety integrity level (SIL), which is expected by the module.	– CPX-FVDA-P2 supports requirements up to SIL 3	– SIL 1 – SIL 2 – SIL 3
F_CRC_LENGTH	Informs the F-HOST of the expected length of the CRC2 key in the safety telegram.	– This parameter cannot be changed with CPX-FVDA-P2, since the CRC2 key always occupies 3 bytes.	– 3 byte CRC (not changeable)
F_BLOCK_ID	Displays whether the data record for the value of F_iPar_CRC has been extended by 4 bytes. The parameter F_Block_ID has the value 1 if the parameter F_iPar_CRC is on hand; otherwise it has the value 0.	– CPX-FVDA-P2 makes no individual device parameters available.	– 0 (not changeable)

3. Commissioning

PROFIsafe parameters	General description	For CPX-FVDA-P2, the following apply:	Value
F_PAR_VERSION	Specifies 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 (not changeable)
F_SOURCE_ADD (PROFIsafe source address)	Unique PROFIsafe source address of the F-Host.	– Unique PROFIsafe source address of the F-Host.	Specified through F-Host
F_DEST-ADD (PROFIsafe target address)	Unique PROFIsafe target address of the F-Device within the PROFIsafe network. The address set through configuration software must agree with the PROFIsafe address set by DIL switch on the output module.	– CPX-FVDA-P2 compares both settings in order to check the authenticity of the connection (→ section 2.4)	– 1 ... 1023 (0 is invalid)
F_WD_Time	Time period (Watchdog Time) within which a valid current safety telegram must arrive from the F-Host. Otherwise, the F-Device goes into the safe status.	– The time period must be short enough that the system can react quickly enough to communication failures or malfunctions. On the other hand, the time period must be long enough to tolerate typical delays in transmission. The cycle time for calling the safety program must be less than the time period set here.	– 50 ... 65535 [ms]
F_iPAR_CRC	CRC through the individual device parameters (i-parameter).	– CPX-FVDA-P2 makes no individual device parameters available.	– 0 (not changeable)

Tab. 3/3: PROFIsafe parameters

3. Commissioning

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 on the diagnostic channels of the safety protocol.



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

The following table provides an overview of the available 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 of 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	Monitoring wire fracture output channel 0 Monitoring wire fracture output channel 1 Monitoring wire fracture output channel 2 Reserved	Inactive Inactive Inactive –
4828 + m * 64 + 8 ... 21	0 ... 7	Reserved for PROFIsafe	–

3. Commissioning

Function number ¹⁾	Bit	Module parameters	Presetting
4828 + m * 64 + 22	0 ...7	Position of the DIL switch 0 ... 7	0 ¹⁾
4828 + m * 64 + 23	0, 1	Position of the DIL switch 8, 9	
1) Parameters only readable through 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 parameter: monitoring of supply voltage U_{VAL}		Operator unit
Function no.	4828 + m * 64 + 0	m = Module number (0 ... 47)
Description	<p>This parameter influences the diagnostic behaviour of the module in detection of undervoltage and overvoltage at U_{VAL} (→ Technical data, monitoring of supply voltage). The parameter activates or deactivates the diagnostic message in case of undervoltage and overvoltage detection.</p> <p>Active diagnostic message in case of undervoltage and overvoltage detection U_{VAL} causes the following. The error is:</p> <ul style="list-style-type: none"> – sent to the CPX bus node – displayed using the module error LED. 	
Bit	Diagnostic message supply voltage monitoring Bit 0, 1 reserved Bit 2 monitoring of supply voltage U_{VAL} Bit 3 ... 7 reserved	[Monitor Vout/Vval]
Values	0 = inactive 1 = active (presetting)	[Inactive] [Active]
Note	The monitoring function itself is not influenced and is always active. Switching off of the diagnostics in case of undervoltage identification U_{VAL} makes sense if another module connected to the switched voltage (e.g. a pneumatics interface) has its own undervoltage detection and can initiate a corresponding error message.	

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

3. Commissioning

Module parameters: general diagnostics		Operator unit
Function no.	4828 + m * 64 + 6 m = module number (0 ... 47)	
Description	<p>This parameter influences the general diagnostic behaviour of the module. It determines whether channel-, module- or protocol-specific error messages should be suppressed or reported.</p> <p>Active diagnostics cause the following. The corresponding error is:</p> <ul style="list-style-type: none"> – sent to the CPX bus node – displayed using the module error LED. <p>Observe the exceptions named under the note.</p>	
Bit	<p>General diagnostics</p> <p>Bit 0: output channel 0</p> <p>Bit 1: output channel 1</p> <p>Bit 2: output channel 2</p> <p>Bit 3: reserved</p> <p>Bit 4: module</p> <p>Bit 5: failsafe protocol</p> <p>Bit 6, 7: reserved</p>	<p>[General diagnosis]</p> <p>[Channel 0]</p> <p>[Channel 1]</p> <p>[Channel 2]</p> <p>[Module]</p> <p>[Failsafe protocol]</p>
Values	<p>0 = inactive – suppress error message</p> <p>1 = active – report error (presetting)</p>	<p>[Inactive]</p> <p>[Active]</p>
Note	<p>Exceptions:</p> <ul style="list-style-type: none"> – Error messages regarding wire break can not be influenced with this parameter. But the wire break monitoring function can be activated or deactivated with the monitoring wire break parameter (➔ Tab. 3/7). – With module-specific error messages, diagnostic messages from the failsafe protocol are not suppressed. 	

Tab. 3/6: General diagnostics

Module parameter: Monitoring wire break		Operator unit
Function no.	4828 + m * 64 + 7 m = module number (0 ... 47)	
Description	<p>Establishes whether the respective output channel should be monitored for wire break.</p> <p>Deactivating the wire break monitoring is necessary if:</p> <ul style="list-style-type: none"> – a load smaller than the minimum-specified load is to be switched or – the electrical signal is guided additionally through external relays that themselves disconnect the circuit. 	

3. Commissioning

Module parameter: Monitoring wire break		Operator unit
Bit	Monitor wire break 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]
Note	Wire break monitoring is possible only with a switched-on output channel. If monitoring is active and a wire break occurs, the error LED of the corresponding channel flashes. If monitoring is switched off, any diagnostic message present is reset. A wire break diagnostic does not switch off the output channel.	

Tab. 3/7: Monitoring of wire fracture (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	Specifies the switch setting of the PROFIsafe address selection switch on the module. In addition to the PROFIsafe parameter F_DEST_ADD (→ section 3.4), the setting of the address selection switch can be read out through 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]

3. Commissioning

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
	0	0	0	0	0	0	SW 9	SW 8
	0: switch element is OFF 1: switch element is ON							[0] [1]
Note	This parameter can only be changed by changing the DIL switch setting (read only).							

Tab. 3/8: DIL switch setting

3. Commissioning

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

The universal operator unit CPX-MMI-1 offers convenient functions which will support you in commissioning. With the operator unit, you can view the CPX module parameters of the module and change them, if necessary. For safety engineering reasons, the PROFIsafe parameters of the module cannot be influenced with the operator unit.



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-MMI-1-...

Knowledge of the basic functions of the operator unit are assumed in the following.

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

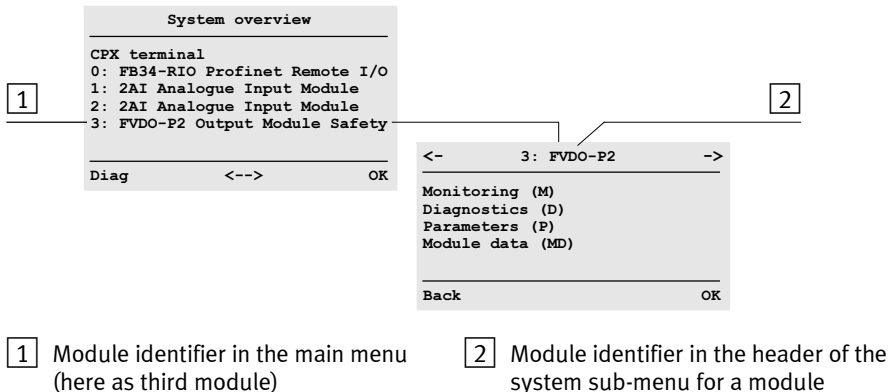


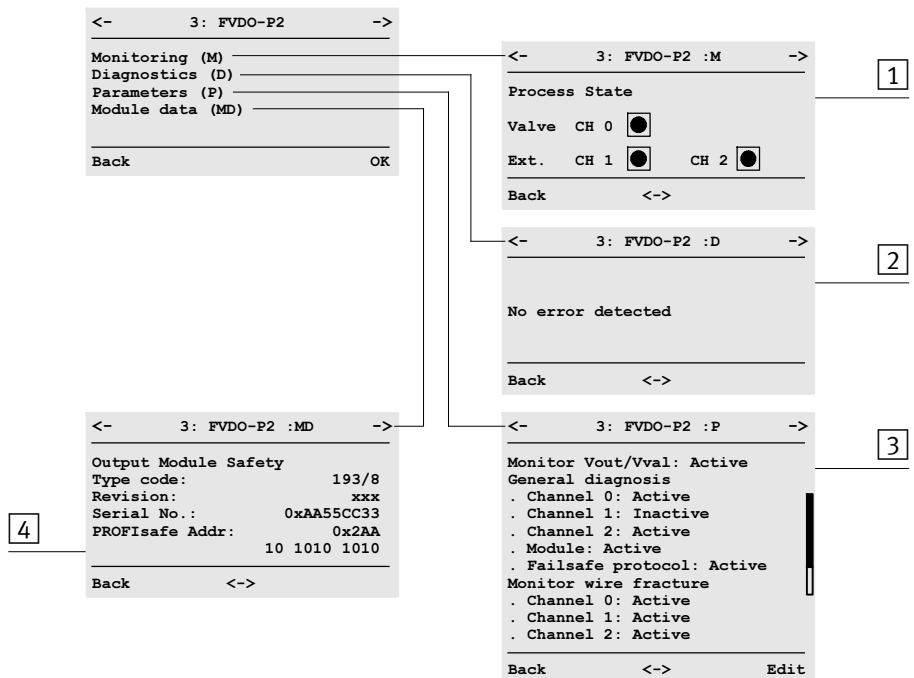
Fig. 3/1: Module identifier of the output module CPX-FVDA-P2 at the operator unit

3. Commissioning

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



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



1 Monitoring (M)

3 Parameters (P) – basic representation

2 Diagnostics (D)

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 the bus system. Knowledge of how to operate the STEP 7 software is assumed in the following.



Please inform yourself first in the description for your CPX bus node about the fundamental procedure for configuration of a CPX terminal. The information in the following sections refers exclusively to the output module CPX-FVDA-P2.

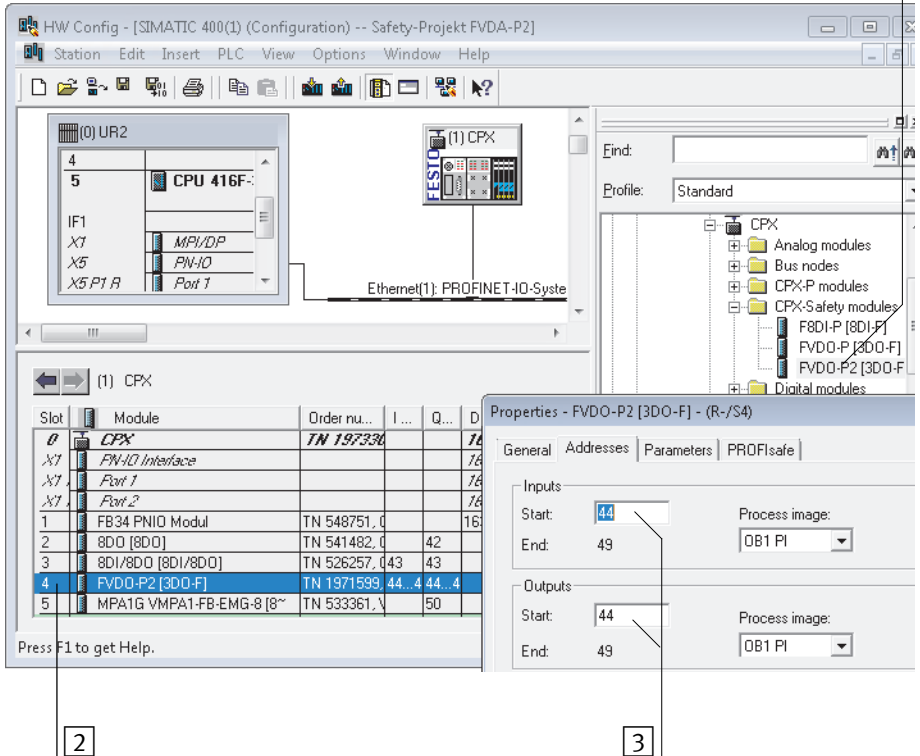
After you have installed the GSDML/GSD file and added the CPX terminal with the configuration software (HW Config) to the project's network, you can add the output module to the configuration table of the CPX terminal (➔ description of the CPX bus node).

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

- In the configuration table, click on the line of the output module CPX-FVDA-P2. Then the dialogue window “Properties – FVDA-P2” appears.
- Now set the desired start addresses of the inputs and outputs in the [Addresses] tab of the dialogue window (➔ Fig. 3/3).

3. Commissioning

1



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

3. Commissioning

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



Observe that not all PROFIsafe parameters shown here are relevant for the output module. Detailed information on the individual parameters can be found in section 3.5.1.

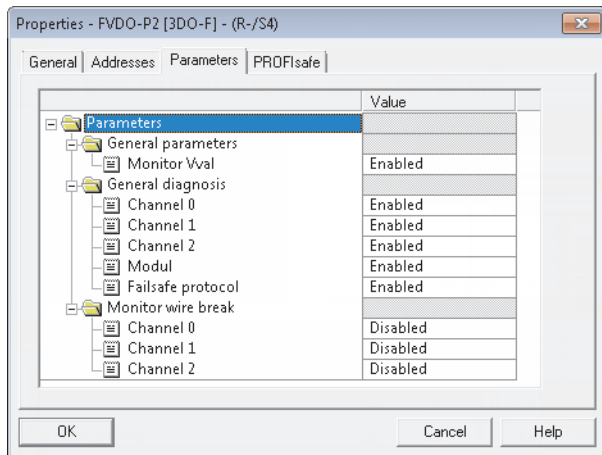


Fig. 3/4: Standard parameters of the output module CPX-FVDA-P2

3. Commissioning

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).



Detailed information on the individual parameters can be found in section 3.4.

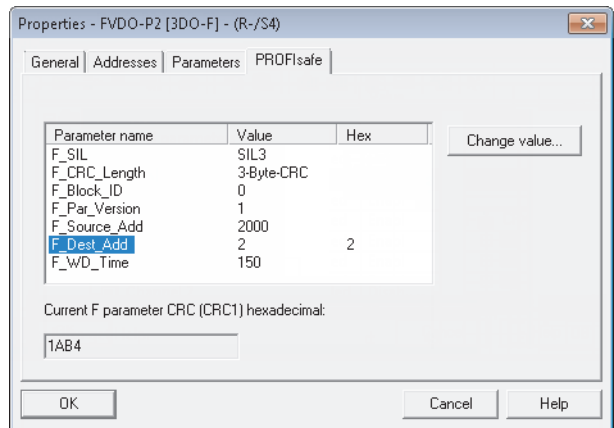


Fig. 3/5: PROFIsafe parameters

3. Commissioning

3.6.1 Addressing example

Addressing example: CPX terminal with VTSA pneumatics

Addresses from input/output byte 42 used:

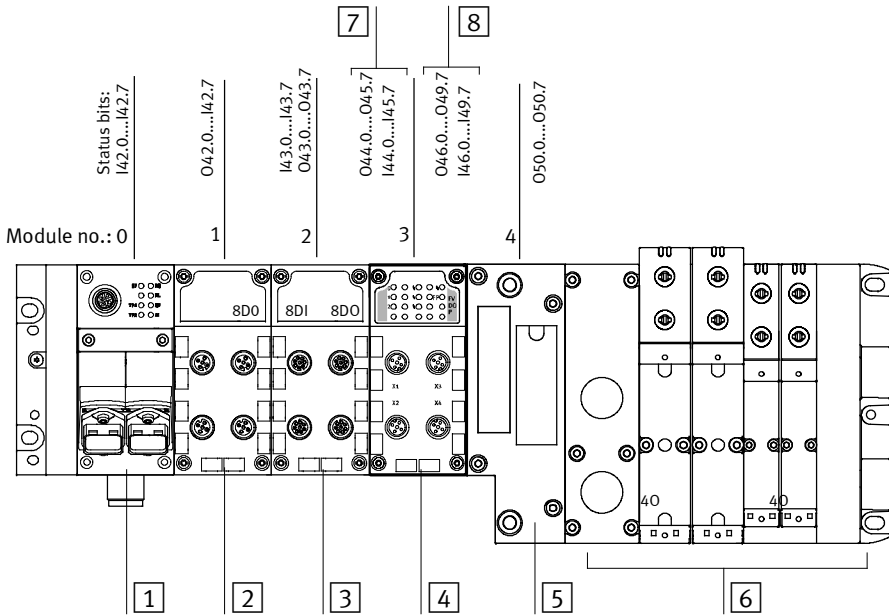


Fig. 3/6: Addressing example

3. Commissioning

Module No.	Module	Input address	Output address
0	Bus node CPX-FB34 CPX-FB34 PNIO module [Status]	42	–
1	Digital 8-fold output module CPX-8DA [8DO]	–	42
2	Digital multi I/O module CPX-8DE-8DA [8DI/8DO]	43	43
3	Output module CPX-FVDA-P2 CPX-FVDA-P2	44 ... 49	44 ... 49
4	VTSA: pneumatics 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 by DIL switches (here 8DO)			

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

3. Commissioning

Operation

Chapter 4

4. Operation

Table of contents

4.	Operation	4-1
4.1	Status display via LEDs	4-3
4.1.1	Behaviour during the switch-on phase (startup phase)	4-4
4.1.2	Normal operating status	4-4

4. Operation

4.1 Status display via LEDs

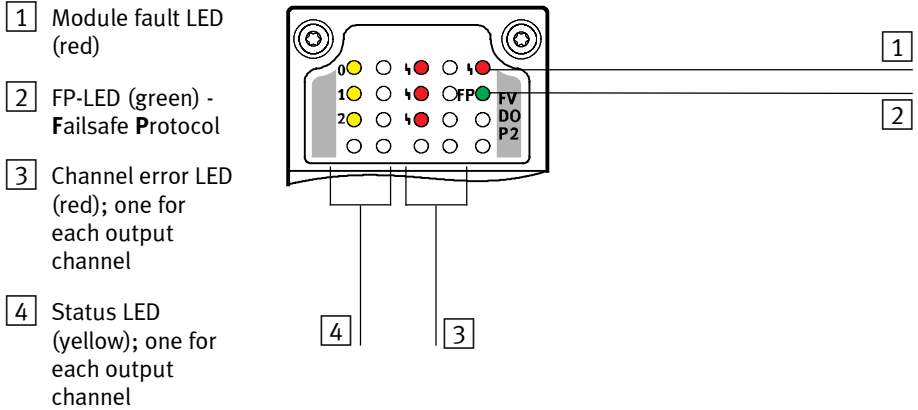


Fig. 4/1: LED display of the output module CPX-FVDA-P2

In normal operating status, the following LEDs light up:

- FP-LED – Failsafe Protocol (green)
- Status LED (yellow) of the active output channels

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



Note

The LED display of the module is not designed in a safety-oriented way.













- Observe that the LEDs must not be evaluated for safety-oriented measures.



Detailed information on this error response can be found in section 5.2 and 5.3.2.









4. Operation

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

Number	Status LED	FP-LED	Channel error LED	Module error LED	I/O illustration	Event/ status
1a *)				 500 ms	0 *)	Startup – Switch on the operating voltage supply $U_{EL/SEN}$
1b *)			 500 ms		0 *)	Startup – Switch on the load voltage supply for valves U_{VAL}
2					0	Waiting for safety parameters
*) The sequence is dependent on the sequence in which operating and load voltage supply is switched on. If switched on simultaneously, 1a and 1b light up together.						

Tab. 4/1: Behaviour during the switch-on phase

4.1.2 Normal operating status

Number	Status LED	FP-LED	Channel error LED	Module error LED	I/O illustration	Event/ status
3					1 **)	Output channel is switched on
4					0 **)	Output channel is switched off
**) Refers to the output channel that is assigned to the respective status LED.						

Tab. 4/2: Normal operating status

Diagnostics and error handling

Chapter 5

5. Diagnostics and error handling

Table of contents

5.	Diagnostics and error handling	5-1
5.1	Summary of diagnostics options	5-3
5.2	Possible error messages of the output module CPX-FVDA-P2	5-4
5.3	Diagnostics via LEDs	5-6
5.3.1	Error handling and parameterisation	5-9
5.3.2	Behaviour in the event of an error	5-11
5.4	Diagnostics via the CPX bus node	5-12
5.4.1	Diagnostics with the operator unit CPX-MMI	5-12

5. Diagnostics and error handling

5.1 Summary of diagnostics options

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

Diagnostics option		Brief description	Reference
On-site diagnostics	LED	The LEDs of the module display output channel and module errors.	→ section 5.3
	Operator unit (MMI)	Diagnostic information of the module can be displayed on the operator unit in a convenient and menu-driven manner.	→ section 5.4.1 and description for the operator unit
Diagnostics via bus node	System status interrogation (status bits interrogation)	8 status bits of the CPX terminal display common diagnostics messages (global error messages)	→ section 5.2 as well as CPX system description and description for the CPX bus node
	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	dependent on the bus node (e.g. DPV1)	→ description of CPX node

Tab. 5/1: Diagnostics options

Specific errors of the output module CPX-FVDA-P2 are reported or suppressed dependent 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 on diagnostics options of the complete CPX terminal or all modules can be found in the CPX system description or in the description for the CPX bus node used.

5. Diagnostics and error handling

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

Error no.	Operator unit display	Description	Error handling
2 ²⁾	[Short circuit]	Short circuit/overload at the output	<ul style="list-style-type: none"> • Remedy short circuit • Acknowledgment and reentry of the module or output channel
3 ³⁾	[Wire break/idling current I/O]	Wire break	<ul style="list-style-type: none"> • Check and, if necessary, replace the cable and connected actuators.
5 ¹⁾	[Undervoltage in power supply]	Undervoltage of the supply voltage U_{VAL}	<ul style="list-style-type: none"> • Eliminate undervoltage • Acknowledgment and reentry of the module
61 ¹⁾	[Overvoltage in power supply]	Overvoltage of the supply voltage U_{VAL}	<ul style="list-style-type: none"> • Eliminate overvoltage • Acknowledgment and reentry of the module
65 ¹⁾	[F_DEST_ADD mismatch]	The PROFIsafe address set by the DIL switches does not agree with the setting on the PROFIsafe master (F_DEST_ADD).	<ul style="list-style-type: none"> • Check set address or parameter F_DEST_ADD. Correct address or send new parameters.
66 ¹⁾	[F-Communication fault]	Error in safe communication	<ul style="list-style-type: none"> • Check F-Host • Acknowledgment and reentry of the module
67 ¹⁾	[F-Communication timeout]	Timeout in the PROFIsafe transmission. The time sequence of the PROFIsafe communication is malfunctioning.	<ul style="list-style-type: none"> • Check program in the F-Host • Check communication paths • Check timeout (parameter F_WD_Time) • Acknowledgment and reentry of the module
68 ²⁾	[Leakage current]	Cross circuit error (bypass circuit error) at the output	<ul style="list-style-type: none"> • Eliminate cross circuit • Acknowledgment and reentry of the module or output channel

5. Diagnostics and error handling

Error no.	Operator unit display	Description	Error handling
69 ¹⁾	[F-Parameter fault]	Error in safe parameterisation (safety parameterisation invalid). The PROFIsafe communication cannot be constructed.	<ul style="list-style-type: none"> • Check PROFIsafe parameters • Send corrected parameters
80	[Function failure]	Switching frequency too high	<ul style="list-style-type: none"> • Switch more slowly
145 ¹⁾	[Built-in self test failed]	Error in self-test; module has established an error in the self-test	<ul style="list-style-type: none"> • Switch on the supply voltage U_{VAL} again. This causes the module to restart. If the error persists, replace the module.
<p>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) applies. ³⁾ Does not result in safety switch-off.</p>			

Tab. 5/2: Possible error messages



When PROFIBUS is used, all error messages without standardised error type are mapped to error type 9.

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

5.3 Diagnostics via LEDs

For the on-site diagnostics, the following LEDs 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

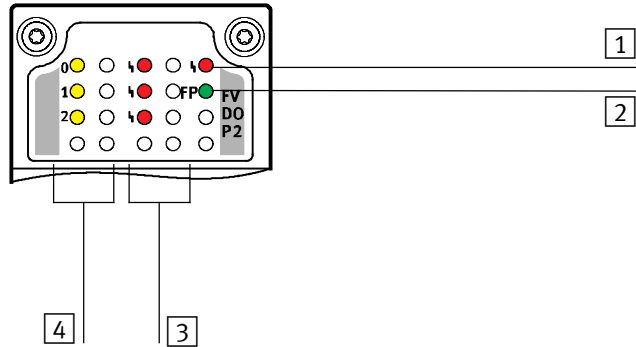


Fig. 5/1: LED display of the output module CPX-FVDA-P2



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

In normal operating status, the following LEDs light up:

- FP-LED – **F**ailsafe **P**rotocol (green) 2
- Status LED (yellow) 4 of the active output channels

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


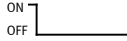


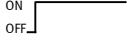


Note





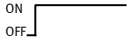
The LED display of the module is not designed in a safety-oriented way.

- Observe that the LEDs must not be evaluated for safety-oriented measures.

5. Diagnostics and error handling





Module error LED			
LED (red)	Process	Status	Significance / error handling
 LED not illuminated		Trouble-free operation	None
 LED flashing	Error-specific	Self-test error or internal communication problem	To delete the error, switch operating voltage off and on again (Power Off/On). ¹⁾
 LED illuminated		Module error (e.g. undervoltage in module supply, lack of safety parameterisation or errors in safe communication)	Eliminate undervoltage or correct parameterisation.
1) If self-test errors occur again, replace module!			

Tab. 5/3: Module error LED









Channel error LED			
LED (red)	Process	Status	Significance / error handling
 LED not illuminated		Trouble-free operation	None
 LED flashing	Error-specific	Wire break	Replace affected cable
 LED illuminated		Cross circuit at the output or short circuit/overload error at the output (dependent on error number)	Eliminate error

Tab. 5/4: Channel error LED

5. Diagnostics and error handling

Status LED			
LED (yellow)	Process	Status	Significance / error handling
 LED not illuminated		Output channel inactive (logical 0)	The corresponding load voltage supply is switched off.
 LED illuminated		Output channel active (logical 1)	The corresponding load voltage supply is switched on.

Tab. 5/5: Status LED

FP-LED (FP for Failsafe protocol)			
LED (green)	Process	Status	Significance / error handling
 LED flashing double		– Waiting for safety parameters	– Module waiting for parameterisation through the F-Host
 LED flashes slowly		– Address error PROFIsafe or – CRC error PROFIsafe parameter	– Set PROFIsafe address does not match safety parameterisation. – Safety parameterisation invalid. The PROFIsafe communication cannot be constructed.
 LED flashing quickly		– Operator Acknowledge possible	– PROFIsafe: 0A-Req
 LED illuminated		– Failsafe protocol active	– Module communicates with an F-Host via PROFIsafe protocol.

Tab. 5/6: FP-LED

5. Diagnostics and error handling

5.3.1 Error handling and parameterisation

The following figure shows error handling of the output module. Further reporting and display of the errors can be suppressed as desired with the corresponding module parameters, represented in the figure as switches (description of parameters → section 3.5.1).

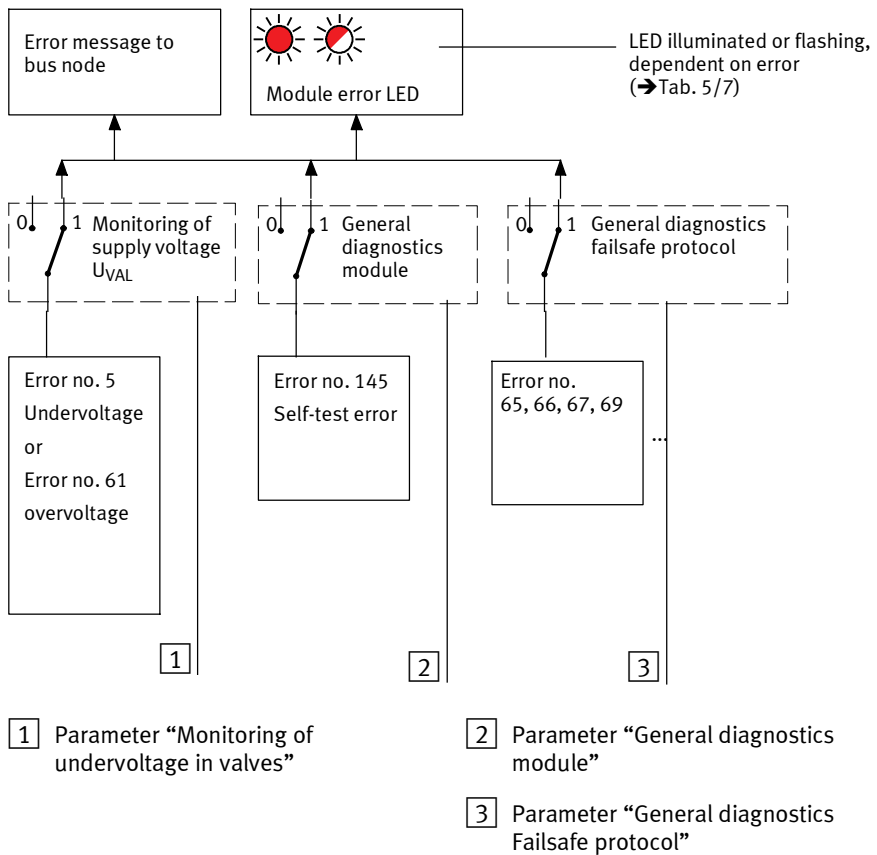
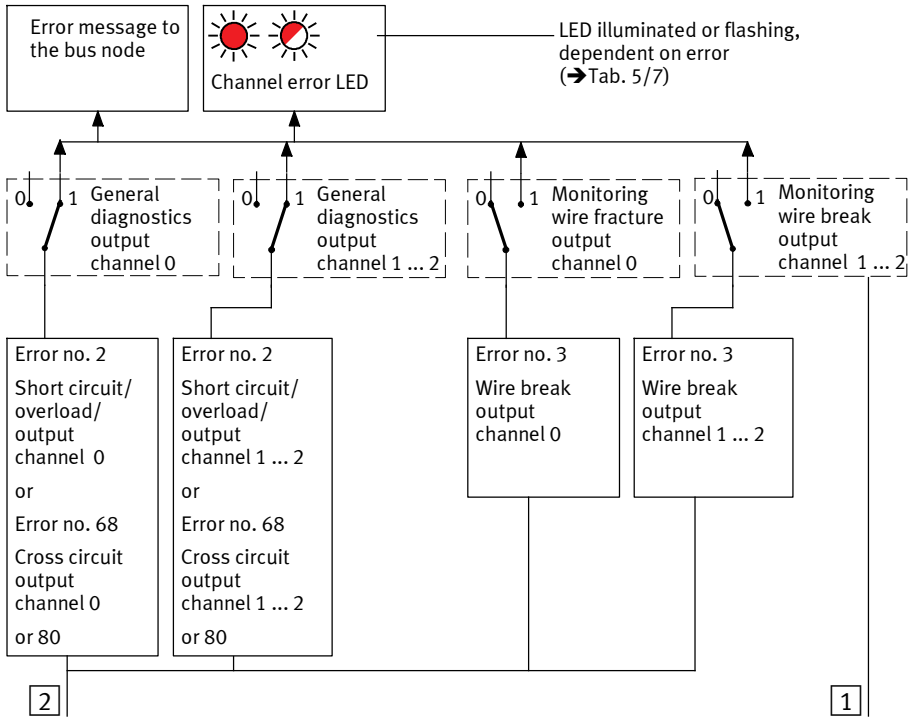


Fig. 5/2: Principle of error handling and parameterisation – part 1

5. Diagnostics and error handling

















1 Module parameters (switch position represented = default setting)

2 Channel-specific error

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

5. Diagnostics and error handling

5.3.2 Behaviour in the event of an error

Status LED	FP-LED	Channel error LED	Module error LED	Error no.	Error description
				2 ²⁾	Short circuit/overload at the output
				3 ³⁾	Wire break
				5 ¹⁾	Undervoltage in the supply voltage
				61 ¹⁾	Overvoltage of the supply voltage
				65 ¹⁾	The PROFIsafe address set by the DIL switch does not agree with the setting on the PROFIsafe master (F_DEST_ADD).
				66 ¹⁾	Error in safe communication.
				67 ¹⁾	Timeout in the PROFIsafe transmission.
				68 ²⁾	Cross circuit error (bypass circuit error) at the output
				69 ¹⁾	Error in safe parameterisation (safety parameterisation invalid). The PROFIsafe communication cannot be constructed.
		⁴⁾		145 ¹⁾	Module has established an error in the self-test.
<p>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 result in safety switch-off. ⁴⁾ In many cases, channel-error LEDs are also illuminated.</p>					

Tab. 5/7: Behaviour in the event of an error

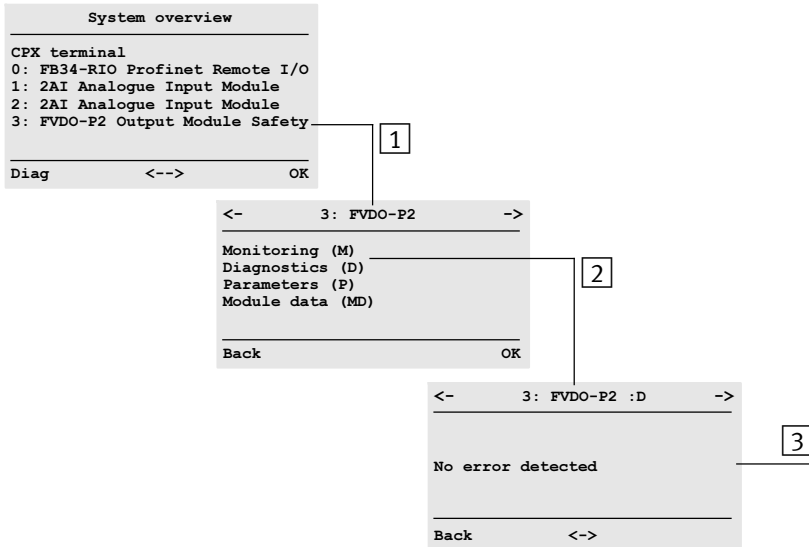
5.4 Diagnostics via the CPX bus node



Information on the CPX bus node used can be found in the description for 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



In addition, the operator unit offers access to the diagnostic memory (→ description P.BE-CPX-MMI-1-...).

Service, repair, disposal

Chapter 6

6. Service, repair, disposal

Table of contents

6.	Service, repair, disposal	6-1
6.1	Service	6-3
6.2	Repair	6-3
6.3	Disposal	6-4

6. Service, repair, disposal

6.1 Service

The output module includes no parts requiring service.

6.2 Repair



Note

The output module CPX-FVDA-P2 includes no wearing parts.

Repairs are impermissible. This invalidates the certification of the output module.

A professional replacement of the electronics module is permissible.



Note

- Always replace the output module in case of an internal defect.
- Send the unchanged defective output module, including a description of the error and the application, back to Festo for analysis.
- Please contact your technical consultant to clarify the modalities of the return. In case of complaint or repair, please name the following specifications: claim type 2 in accordance with Festo VA 19.02.



For dismantling and mounting of the electronics module
→ section 2.5.

6.3 Disposal

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

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

Technical appendix

Appendix A

Table of contents

A.	Technical appendix	A-1
A.1	Technical data of the output module CPX-FVDA-P2	A-3
A.2	Technical data of the connection blocks	A-9
A.3	Technical data of the interlinking block	A-10

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...

Electric characteristic values		CPX-FVDA-P2
Nominal operating voltage DC	[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.)	[V _{ss}]	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 of output channel (CH0, CH1, CH2) - internal bus		Yes, for intermediate supply
Electrical isolation of output channel - output channel		No
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

A. Technical appendix

Electric characteristic values		CPX-FVDA-P2
Max. residual current per module	[A]	5
Max. switching frequency of the output channels	[Hz]	1
Max. voltage drop per output channel with permanent load	[V]	0.6
Wire break detection (CH0, CH1, CH2)		Parameterisable, detection threshold I_L approx. 50 mA
Max. cable length (CH1, CH2)	[m]	200
Max. load capacity to FE	[nF]	400
Max. load capacity P-M	[μ F]	22
Max. load inductivity	[mH]	1000 at 150 mA, 100 at 600 mA; → characteristic curve Fig. A/1
Fuse protection (short circuit)		Integrated electronic fuse
Max. test pulse duration	[μ s]	300
Max. voltage drop during test pulse	[V]	6

Tab. A/1: Electric characteristic values

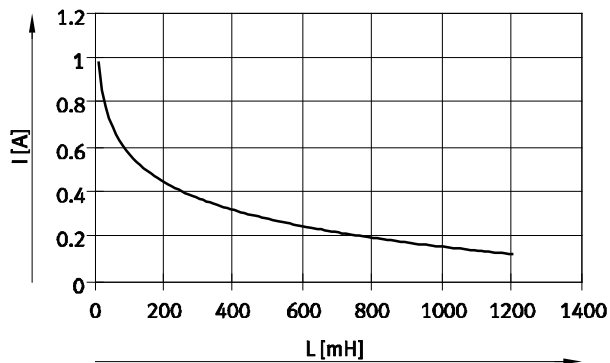


Fig. A/1: Maximum permissible load inductivity at the output channels

A. Technical appendix

Functional characteristics	CPX-FVDA-P2
Module code	193d (C1h)
Sub-module code	8d (08h)
Compatible with Fast Startup (FSU)	Yes
Startup time until module is ready	< 2 s
Diagnostics of external channel fault	<ul style="list-style-type: none"> – Cyclic check for function – Cyclic check for external supply – Cyclic check 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/2: Functional characteristics

Safety characteristics ¹⁾	
Safety function	Safe switch off of the output channels <ul style="list-style-type: none"> – 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
Switch off diagram per output channel	P- and M-switching
Internal response time to shut-off command (T_{WCDT}) at the output channel CH0 [ms]	< 23
Internal response time to shut-off command (T_{WCDT}) at the output channels CH1 and CH2 dependent on the minimum load	➔ Load diagrams Fig. A/2 and Fig. A/3
PROFIsafe watchdog time	F_WD_TIME
Max. response time of the safety function [ms]	F_WD_TIME + T_{WCDT}
Max. cyclical request rate [1/min]	1

A. Technical appendix

Safety characteristics ¹⁾		
Mean time to endangering failure (MTTF _d)	[Years]	> 750
Probability of an endangering failure per hour (PFH _D)	[1/h]	< 1.0 x 10 ⁻⁹
Max. duration of use	[Years]	20
Min. request rate for each output channel (CH0, CH1, CH2)	[1/week]	1
Measures for avoidance of common cause failures (CCF)		<ul style="list-style-type: none"> – Maintain operating voltage limits – Comply with temperature range – Combine max. 2 output channels in a shared safety-oriented control circuit
Safety protocol		PROFIsafe Profile Version 2.4 ²⁾
Product type testing		The functional safety engineering of the product has been certified by an independent testing body, see EC-type examination certificate → www.festo.com .
CE certification (→ declaration of conformity)		In accordance with EU Machinery Directive 2006/42/EC
Certificate issuing authority		TÜV Rheinland 01/205/5294/13
¹⁾ To guarantee the safety level, a minimum switch-on duration of 1 minute for every 8 operating hours must be planned for each output channel used. ²⁾ Profile for Safety Technology on PROFIBUS DP and PROFINET IO; Version 2.4, March 2007		

Tab. A/3: Safety characteristics



Note

- Use the following diagram if load current is known.

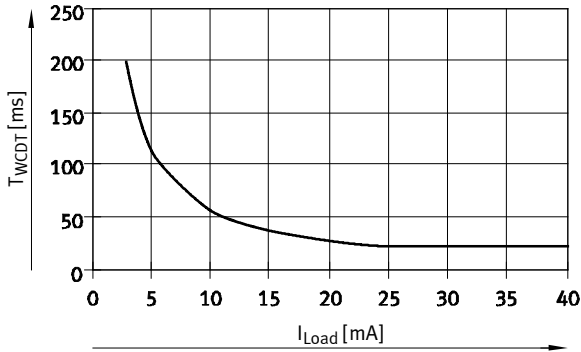


Fig. A/2: Internal response time dependent on the minimum load current



Note

- Use the following diagram if load resistance is known.

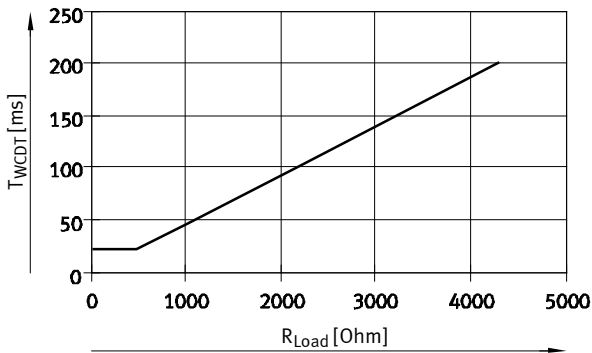


Fig. A/3: Internal response time dependent on the Ohmic minimum load

A. Technical appendix

Deviating safety characteristics with switched off test pulses ¹⁾		
Min. request rate for each output channel (CH0, CH1, CH2)	[1/day]	1
¹⁾ Except for the values specified here, the safety characteristics maintain their validity.		

Tab. A/4: Deviating safety characteristics with switched off test pulses

Other characteristic values		
Operating ambient temperature	[°C]	-5 ... +50
Ambient temperature in storage	[°C]	-20 ... +70
Relative air humidity (non-condensing)	[%]	5 ... 90
Protection class in accordance with EN 60 529		Dependent on the connection block ¹⁾
Electromagnetic compatibility – Emitted interference – Resistance 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/5: Other 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
Protection class in accordance with EN 60 529 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 M12 sockets, metal thread, 5-pin
– Contact load capacity	4 A
¹⁾ Degree of protection is determined through a combination of interlinking block and connection block	

Tab. A/6: Technical data for connection block CPX-M-AB-4-M12X2-5POL

Technical data	CPX-AB-8-KL-4POL
Protection class in accordance with EN 60 529 ¹⁾	IP20, completely mounted, cable connected to terminal strip
Information on housing materials	Reinforced polyamide, polycarbonate
Ports	
– Design	2 terminal strips
– Contact load capacity	4 A
¹⁾ Degree of protection is determined through a combination of interlinking block and connection block	

Tab. A/7: Technical data for 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 all contact rails for load voltage supplies (U_{VAL} switchable, U_{OUT} permanent)
Special feature	Mechanical coding prevents plugging in of impermissible electronics modules

Tab. A/8: Technical data for interlinking block CPX-M-GE-EV-FVO

Index

Appendix B

B. Index

Table of contents

B.	Index	B-1
-----------	--------------------	------------

Index

A

Abbreviations, Product-specific	XXIV
Addressing examples	3-20
Assembly	2-13, 2-15

B

Behaviour in the event of an error	5-11
--	------

C

Category	XXVI
CCF	XV
Channel error LED	5-7
Channel-wise passivation	1-18
Commissioning	3-6
Components	1-8
Connection block	1-8
Connecting the cables and plugs	2-5
CPX-AB-8-KL-4POL	
Merkmale	1-8
Port	2-6
CPX-FVDA-P2, Merkmale	1-9
CPX-M-AB-4-M12X2-5POL	
Merkmale	1-8
Port	2-5
CPX-M-GE-EV-FVO, Features	1-10
CRC signature	XXIV
Cross circuit	XXIV
Cross-circuit monitoring	XXIV, 1-17

D

Diagnostics	
on the operator unit (MMI)	3-15
via LED	5-6
Diagnostics option	5-3
DIL switch setting	3-12
DIL switches	2-11
Dismantling	2-14

E

Electronics module	1-9
Error handling	5-9
Error messages	5-4

F

F_BLOCK_ID	3-7
F_CHECK_IPAR	3-7
F_CHECK_SEQNR	3-7
F_CRC_LENGTH	3-7
F_DEST-ADD	3-8
F_iPAR_CRC	3-8
F_PAR_VERSION	3-8
F_SIL	3-7
F_SOURCE_ADD	3-8
F_WD_Time	3-8
F-user data	1-16, 3-20
FP-LED	5-8
Functional characteristics, Output module CPX-FVDA-P2	A-5

G

GSDML 3-3

I

Input data 1-19

Intended use IX

Interlinking block 1-10

L

LED

Channel error LED 5-7

FP-LED 5-8

Module error LED 5-7

Status LED 5-8

M

M-switch XXV

Misuse XIII

Module error LED 5-7

Module identifiers 3-4

Module parameters

DIL switch setting 3-12

General diagnostics 3-11

Overview 3-9

Supply voltage monitoring 3-10

Wire break monitoring 3-11, 3-12

Monitoring

Cross circuit 1-17

Supply voltage 3-9, 3-10

Wire break 3-9, 3-12

O

On-site diagnostics	5-6
Operating status	4-4
Operator unit	3-14, 5-12
Output data	1-17

P

P-switch	XXVII
Parameterisation	5-9
Parameters	
CPX module parameters	3-9, 3-18
on the operator unit (MMI)	3-15
PROFIsafe parameters	3-7, 3-19
Passivation	XXV, 1-18
Channel-wise	XXIV
PELV	2-3
Performance level	XXVI
Pictograms	VII
Presetting	3-9
Process image	1-16
Product design	X
Product version	1-11
PROFIsafe	1-15
PROFIsafe address	2-10, 2-12
PROFIsafe parameters	3-7, 3-19
Protection class	2-5

R

Repair	6-3
Replacement	6-3

S

Safety characteristics	A-5
Safety circuit	XXVII
Safety instructions	VIII
Safety integrity	XXVII
Safety integrity level	XXVII
Safety level	XV
Service	XVIII
Signal display	
on the operator unit (MMI)	3-15
through status LED	4-3, 5-6
Starting phase	4-4
Status LED	5-8

T

Technical data	
Connection block	A-9
CPX-FVDA-P2	A-3
Interlinking block	A-10
Interlinking block CPX-M-GE-EV-FVO	A-10
Output module CPX-FVDA-P2	A-3
Test pulse	XXVIII
Text markings	VII
Transport and storage conditions	XVIII

U

User instructions	VI
-------------------------	----

W

Wire break 3-12, 5-4