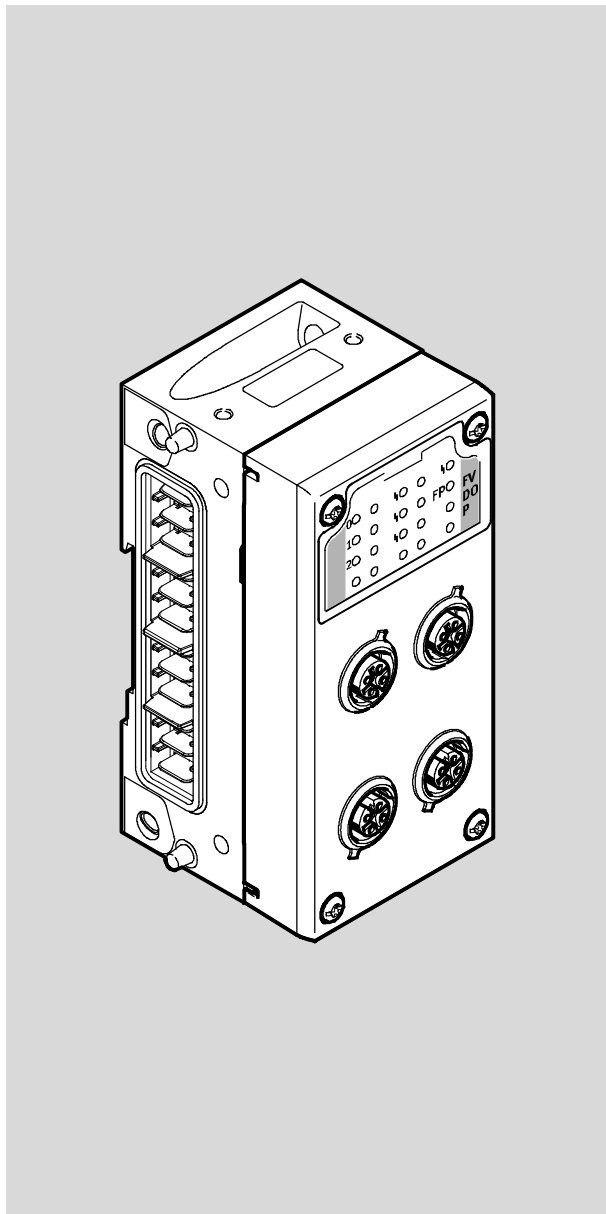


CPX terminal

Output module CPX-FVDA-P



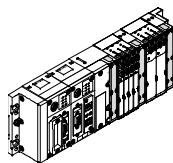
FESTO

Description

Output module
CPX-FVDA-P

with
connection block
CPX-M-AB-4-M12X2
-5POLE

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



570844
en 1303a
[8023314]

Contents and general instructions

Translation of the original instructions

Original de

Version en 1303a

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

Order number 570844

© (Festo AG & Co., 73726 Esslingen, Germany, 2013)

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Contents and general instructions

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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 devices.

Marking of special information

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

Pictograms



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



Accessories:
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. Numerals denote activities that must be carried out in the sequence specified.
- Arrowheads indicate general lists.

General safety instructions



Warning

Nonobservance of safety regulations can result in death, serious injuries or high material damage.

- Ensure to comply with the safety regulations.



Note

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

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



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

Intended use

The module can be used as intended to achieve the safety function

- Safe shut off of connected consumers

if in the off state the connected consumers go into the safe state.

This function is achieved through two-channel switch off of the following load voltage supplies of the CPX terminal:

- Load voltage supply line for valves U_{VAL} of the CPX terminal (channel 0 of the module). Through this, the right-side-mounted modules of the valve terminal pneumatics of the CPX terminal are supplied
- Two outputs (channel 1 and channel 2 of the module) provided through the connection technology of the module.

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

The output module CPX-FVDA-P 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 combination with the components of the CPX terminals mentioned here
- within the limits of the product defined by the technical data (→ appendix A.1)
- in an industrial environment



Observe that the safety engineering system limits of the output module are its physical limits.

Rules for product configuration

- The output module CPX FVDA-P must be used only within the standard version of the Festo CPX terminal. Operation of the module within a variant-P CPX terminal is impermissible.
- Operation is permissible only in combination with the following PROFI-safe-capable CPX bus nodes as from revision code Rev. 18 (→ bus node name plate):
 - CPX-FB33 (Network protocol PROFINET IO)
 - CPX-FB34 (Network protocol PROFINET IO)
 - CPX-FB35 (Network protocol PROFINET IO)
- The operation within CPX-terminals with integrated valve terminal is permitted only with VTSA-pneumatic type 44 and type 45.
- For each CPX terminal or per CPX terminal with integrated valve terminal, as maximum an output module CPX-FVDA-P may be used.
- Note that the output module must always be installed as the last electronics module right next to the right end plate and/or next to the pneumatic interface.
- For configuration of the module only the following components are permissible:
 - Interlinking block CPX-M-GE-EV-FVO
 - Manifold block CPX-M-AB-4-M12X2-5POL.



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

Possible incorrect application

Non-intended use includes the following foreseeable misuse:

- 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-P for formation of safety circuits is **not permissible**:

- in a CPX terminal equipped with a CPX-FEC
- in a CPX terminal, that is equipped with a CPX-CEC
- in a CPX terminal with connected valve terminal and valves that are not of type VTSA
- in a CPX terminal of variant P



Note

Repairs on the module are impermissible! This invalidates the certification of the module!



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-P, safety functions can be implemented up to:

- safety integrity level SIL 3 in accordance with IEC 61508
- Safety integrity level SIL CL 3 in accordance with EN 62061
- performance level e, cat. 3 in accordance with EN ISO 13849-1

The achievable safety level depends on the other components used to achieve a safety function.

The operational capability of the safety device is to be checked at adequate intervals. It is the responsibility of the operator to choose the type of check and time intervals in the specified time period. The check is to be conducted so the flawless functioning of the safety device in interaction with all the components can be verified.

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 location 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: close connection cover tightly, professionally install cable entry, seal unused connections with blind plugs.
- For emergency off applications, restart may take place only as intended under safety switching process.

Technical requirements

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

- Do not exceed the specified limit values (e.g. for operating medium, pressures, forces, torque, temperatures, voltages, currents).
Only compliance with the limit values or load limits permits operation of the product in accordance with the relevant safety regulations.
- When connecting standard ancillary components, also observe the specified limit values for temperatures, electrical data and torque, etc.
- Observe the instructions and warnings in this description.
- Use the product as described under “Intended use”.

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 occupational safety, and
- the documentation for the product.



Note

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

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

Common cause failures cause the loss of the safety function, since in this case both channels 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.

Service

Please consult your local Festo Service agent 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 section “Technical data”. The product-relevant EU directives can be found in the declaration of conformity at www.festo.com.

- Observe that compliance with the named standards is limited to the output module CPX-FVDA-P. From the perspective of the output module, all disconnectable parts of a CPX terminal and/or 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:

- Rules 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.

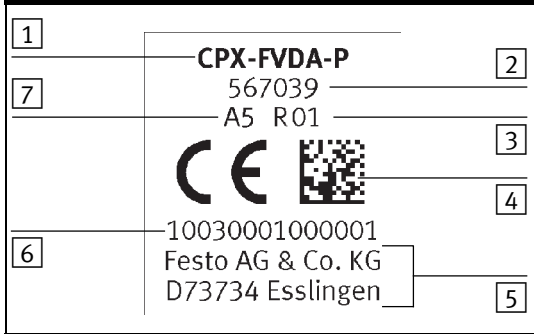
Product identification

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]; FVDOP (F=Safety; V=Valves; D=Digital; O=Outputs; P=PROFIsafe) - yellow background [2] for identification of the safety functionality

Tab. 0/1: Module identifier (FVDAP) of the output module CPX-FVDA-P

The name plate of the output module CPX-FVDA-P shows the following information:

Name plate (typical)	Significance
 <p>The name plate contains the following information:</p> <ul style="list-style-type: none"> 1: CPX-FVDA-P 2: 567039 3: A5 R01 4: CE mark and QR code 5: 10030001000001 6: Festo AG & Co. KG 7: D73734 Esslingen 	<p>Rating plate</p> <ul style="list-style-type: none"> - Type designation [1] - Part number [2]¹⁾ - Revision status (here R01) [3] - Serial number represented as data matrix code [4]²⁾ - Manufacturer and manufacturer's address [5] - 14-character serial number [6]²⁾ - Production time period (encoded, here A5 = May 2010) [7]³⁾
<p>1) Part number of the electronics module CPX-FVDA-P 2) Permits traceability of the product. 3) → Tab. 0/3 and Tab. 0/4.</p>	

Tab. 0/2: Name plate of the output module CPX-FVDA-P

Revision

You can determine the revision of a CPX module with:

- the handheld unit (→ [Module data][Revision])
- corresponding configuration software (→ module data, revision code).
- reading the name plate of the respective module (in the dismantled state, → Tab. 0/2).
- 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 on the name plate encoded in the form of a two-character abbreviation (→ Tab. 0/2). 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. 0/3: Manufacturing year (20-year cycle)

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

Tab. 0/4: Manufacturing month

Transport and storage conditions



Note

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

- Observe the handling specifications for electrostatically sensitive devices.
 - Discharge yourself from static discharges before installing or disassembling modules to protect the modules.
-
- Protect the product during transport and storage from impermissible burdens, such as:
 - mechanical loads
 - impermissible temperatures,
 - moisture and
 - aggressive atmospheres.
 - Store and transport the product in its original packaging. The original packaging offers sufficient protection from typical stresses.

Instructions on this description

This description contains general basic information on the mode of operation, assembly and installation of the switch-off module CPX-FVDA-P in combination with the CPX terminal and refers exclusively to the following revisions of the output module:

Range of validity of this description		
Type	Part number	Revision ¹⁾
CPX-FVDA-P	567039	R0x
1) x stands here for a single-digit number from 1 to 9 (→ Tab. 0/2)		

General basic information about the mode of operation, mounting, installation and commissioning of CPX terminals can be found in the CPX system description.

Special information about commissioning, parameterisation and diagnostics of a CPX terminal with the bus node you are using can be found in the corresponding description for the bus node. Information about additional CPX modules can be found in the description for the respective module.

Information about the pneumatics can be found in the corresponding description of pneumatics.



An overview of the structure of the CPX terminal user documentation is contained in the CPX system description.

Conventions

The special parameters of the module appear on the handheld unit type CPX-MMI-1 in English. The data and parameters which appear in English on the Handheld are shown in square brackets in this description, e.g. [Debounce time]. Next to this in the text follows the translation, e.g.:

Input debounce time [Debounce time].

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 channel depassivated without danger. If the complete module is passivated, acknowledgment is made through regular reentry (standard process of PROFIsafe). If a channel is passivated (channel-wise passivation), acknowledgment takes place through an acknowledgment signal of the image table (→ section 1.2.1).
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-wise passivation	Passivation type in which only the faulty channel involved is passivated. The module remains integrated. Acknowledgment takes place in CPX-FVDA-P via the image table (→ section 1.2.1).
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 channel into a safe status. This prevents undesired switching of the load due to impermissible cross currents.
Depassivation	→ Passivation (opposite) or under reclassification
F-Device	Collective name for safety-related devices
F-Host	Safety controller (control computer) for control of safety-related equipment

Term/abbreviation	Significance
Forced dynamisation	<p>Procedure for function checking of a device's switching capability of the shut-off module.</p> <p>The effectiveness of the P- and M-switches of the shut-off module are checked cyclically for their operational capability. For this purpose, the outputs are briefly switched on changing potential, and the state is read back. The determined value is evaluated by the controller.</p>
F-System	<p>Safety-related system that moves to a safe status when dangerous system and device errors occur.</p>
GSDML	<p>Equipment master file (Geräte-Stammdaten-Datei) in XML format</p>
I/O illustration	<p>➔ Image table</p>
i-Parameter	<p>Technology-specific individual parameters of a specific F-Device</p>
M-switch (Low side switch)	<p>Switch in the 0 V current path of a channel ➔ P-switch</p>
Passivation	<p>Safety function in which the module CPX-FVDA-P switches off all channels or only defective 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 channel involved is passivated. For depassivation of the channel, an acknowledgment signal through the image table is required (➔ section 1.2.1).</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. 5 Performance Levels (PL a to PL e) are distinguished. PL a is the lowest and PL e the highest level.</p> <p>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.</p>

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 states of the input assemblies are transferred to the process diagram for the inputs. At the end of the cyclical program, the process diagram for the outputs are transferred to the output assemblies as the signal state.
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-Adresse) – 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
P-switch (High side switch)	Switch in the 24 V current path of a channel → M-switch; For each channel, there is a 24 V- and a 0 V-current path between which the load is switched. With the shut-off module, these current paths are switched in common and simultaneously but independently of each other. A P-switch switches the 24 V current path and the M-switch the 0 V current path of the channel. For voltage to be present at the load, both switches (P- and M-switches) must be closed. For shut-off module, the control of the P- and M-switches of a channel is taken over by different microcontrollers for safety reasons.

Term/abbreviation	Significance
Reentry	Switching from 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 shut-off module (digital outputs), the output value is 0.
Safe state	Status in which the safety of a system is achieved.
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 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; → Safety Integrity Level
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 shut-off module this function can be activated or deactivated through parameterisation.

Tab. 0/5: Product-specific terms and abbreviations

Contents and general instructions

System overview CPX-FVDA-P

Chapter 1

1. System overview CPX-FVDA-P

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1.1 CPX terminal with output module CPX-FVDA-P

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

- Load voltage supply line for valves U_{VAL} of the CPX terminal (channel 0 of the module). Through this are supplied the right-side-mounted valve terminal pneumatics modules of the CPX terminal.
- Two outputs (channel 1 and channel 2 of the module) provided through the connection technology of the module.

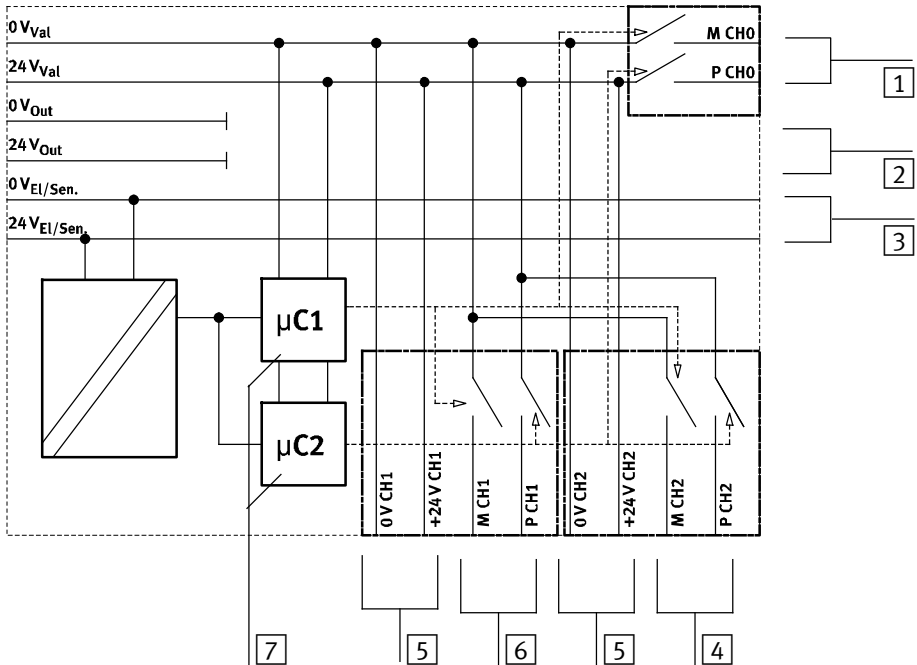
In addition, unswitched voltage supply U_{VAL} is made available to the channels 1 and 2 (CH1, CH2) as operating voltage for external components (24 V).

The load voltage supply lines of the CPX terminal run within the interlinking blocks on contact rails. This conduct supply voltages further to subsequent modules. For operation of the output module, a special interlinking block is required (→ Tab. 1/3). In this interlinking block, the contact rails of the load voltage supply lines U_{VAL} and U_{OUT} are interrupted. The contact rails for U_{VAL} are bridged by switches of the output module CPX-FVDA-P.

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

In addition, the 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 channels are supplied from the load voltage supply line for valves U_{VAL} .

1. System overview CPX-FVDA-P



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

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

1. System overview CPX-FVDA-P



From the perspective of the output module CPX-FVDA-P, the output channels (CH0 ... CH2) are quasi channel pairs, since in each case two paths are always switched together but independently of each other. One channel forms the positive (P) and one the negative (N) 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 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 requirements (→ section 1.4 and technical data in the appendix). For example:

- 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. With the channels CH0, CH1 and CH2, up to 3 valve groups can be switched in a safety-oriented manner independently of each other.



Note that the output module must always be installed as the last electronics module right next to the right end plate and/or next to the pneumatic interface.

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

1. System overview CPX-FVDA-P

1.1.1 Design of the output module CPX-FVDA-P

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

- 1 Connection block
- here type
CPX-M-4-M12X2-
5POL
- 2 Electronics
module
CPX-FVDA-P
- 3 DIL switch for
PROFIsafe
address
- 4 Mechanical
coding
- 5 Interlinking block
CPX-M-GE-EV-FVO
- 6 Name plate (on
the bottom)
- 7 Electrical plug
connector
- 8 LEDs of the
module
- 9 Screws,
tightening torque
0.9 ...1.1 Nm

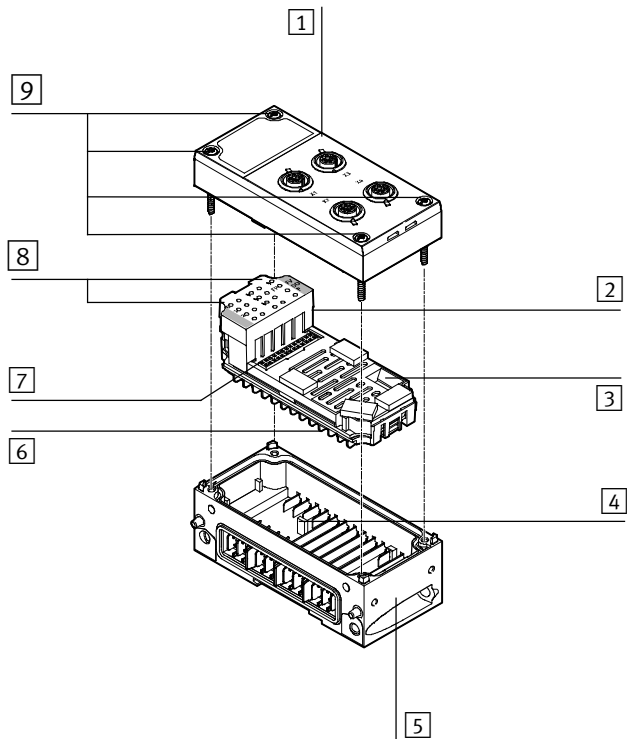


Fig. 1/2: Design of the output module CPX-FVDA-P

To avoid errors in mounting, both the interlinking block CPX-M-GE-EV-FVO and the electronics module CPX-FVDA-P 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.

1. System overview CPX-FVDA-P

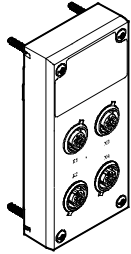
Components

Connection block

The connection block makes available the electrical connection technology of the module. The following connection block is usable for CPX-FVDA-P:



Connection blocks are not mechanically coded. The use of a different connection block than the one named here is impermissible.

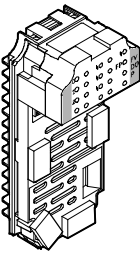
Connection block	Type	Description
	CPX-M-AB-4-M12X2-5POL	M12 metal connection technology – 4 M12 sockets with metal thread, 5-pin – Protection class IP65/IP67 – One functional earth connection per socket – Screening possibility via metal thread – enables the use of M12- and SPEEDCON plug connectors

Tab. 1/1: Permissible connection block

1. System overview CPX-FVDA-P

Electronic module

The electronic module contains the electronic components of the 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 on the electronics module using a DIL switch.

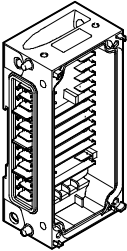
FVDA-P	Type	Description
	CPX-FVDA-P	<ul style="list-style-type: none"> – A digital output channel for switching off the load voltage supply line U_{VAL} in the link of the CPX terminals(channel 0) ¹⁾ – Two digital output channels (channel 1 and 2) ²⁾. – Control of the digital output channels with safety-oriented PLC via PROFIsafe – Status and error display per output channel – Module error display – Max. output current channel 0 (load current): 1.5 A – Max. output current channel 1, 2 (load current per channel): 0.5 A – Microcontroller-independent, separate, fast short circuit protection with common reset and short circuit feedback. – A mechanical coding prevents the module from being plugged into impermissible interlinking blocks.
<p>1) All right-mounted modules that are powered by the load supply line U_{VAL} of the CPX terminal, are separated by P and M switching.</p> <p>2) The connected external consumers are switched off by means of P- and M-switching. The channels 1 and 2 (CH1, CH2) are supplied from U_{VAL}.</p>		

Tab. 1/2: Electronics module CPX-FVDA-P

1. System overview CPX-FVDA-P

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	Special metal interlinking block for CPX-FVDA-P (without supply) <ul style="list-style-type: none">– Interrupts 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
1) To the right of the output module, a U_{OUT} is no longer available via the contact rails.		

Tab. 1/3: Interlinking block



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

1. System overview CPX-FVDA-P

1.1.2 Supported product designs from CPX

To control of the output module CPX-FVDA-P, a PROFINET-capable bus node is required. The CPX terminal must be equipped with one of the following bus nodes:

- CPX-FB33 (Network protocol PROFINET IO)
- CPX-FB34 (Network protocol PROFINET IO)
- CPX-FB35 (Network protocol PROFINET IO).

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

Product version	Description
Electrical terminal CPX-M	Modular electrical terminal CPX (without pneumatics modules)
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. 1/4: Product versions of the CPX-Terminals supported by CPX-FVDA-P



Other product versions or bus nodes are not supported by the output module CPX-FVDA-P.



Note

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

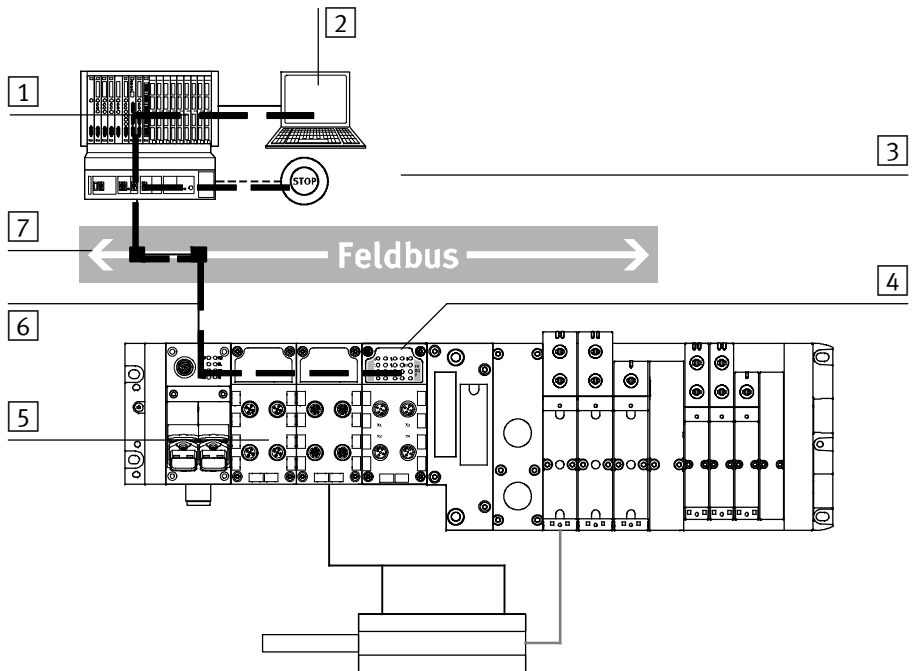
- Set the parameter “Wire break monitoring” of the pneumatics interface to inactive (→ parameter description for the pneumatics interface).

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

1. System overview CPX-FVDA-P

1.1.3 Required bus topology (control loop system)

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



- | | |
|---|--|
| 1 Safety control (F-host) | 5 CPX terminal with bus node for PROFIBUS or PROFINET IO |
| 2 Safety Configuration Tool (for F-SPS) | 6 Embedded PROFIsafe data (black channel) |
| 3 Emergency off switch | 7 PROFINET IO |
| 4 Output module CPX-FVDA-P | |

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

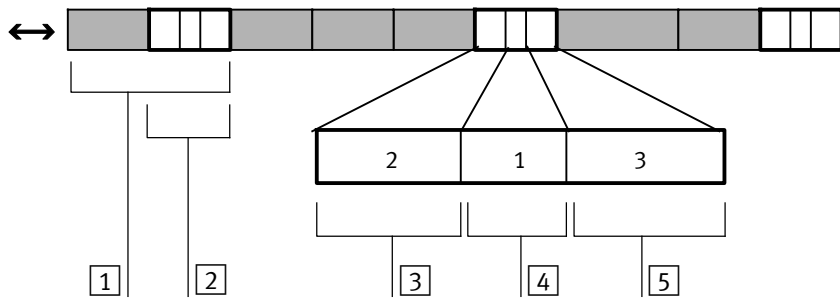
1. System overview CPX-FVDA-P

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

Safety profile PROFIsafe

The PROFIsafe telegrams are embedded quasi in standard telegrams and fed via the so-called black channel from the safety control to the output module. The black channel stretches from the PROFINET link of the safety controller through the CPX bus node to the output module CPX-FVDA-P (→ Fig. 1/3). Only there are the PROFIsafe telegrams 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-P occupies 6 bytes each in the image table 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-P

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.

1. System overview CPX-FVDA-P

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

- The module supports the PROFIsafe bus profile in the V2 mode.
- Parametrisation on V1 mode is rejected.

1.2 Addressing

Address occupation

Due to the safety mechanisms of PROFIsafe, the output module CPX-FVDA-P occupies 6 bytes for inputs and outputs respectively in the image table 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. 1/5)
- 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. 1/6)
- 1 byte control byte (for PROFIsafe communication)
- 3 bytes CRC (for PROFIsafe communication).

1. System overview CPX-FVDA-P

1.2.1 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	Monitoring cross circuit		Reserved		Nominal status		
		Channel 2 (CH2)	Channel 1 (CH1)			Channel 2 (CH2)	Channel 1 (CH1)	Channel 0 (CH0)
	0	0 = on 1 = off		0		0 = off 1 = on		
Byte 1	Channel-wise passivation	Reserved				Acknowledgment		
	0 = off 1 = On	0					Channel 2 (CH2)	Channel 1 (CH1)
						<ul style="list-style-type: none"> - Change Low → High = user acknowledgment or - Permanent 1 = auto-acknowledgment 		

Tab. 1/5: Bit pattern of the output data (F-user data, byte 0 and byte 1)

Cross-circuit monitoring

Via bit 5 and bit 6 of byte 0 the cross-circuit monitoring of the said channel can be directly overridden. With active monitoring, a cyclical check of the switch-off paths takes place. The function of the electronic switches and lack of cross-circuiting of the lines are checked. The cyclical check results in a momentary potential shift of the output voltage, which takes place uniformly on the P- and M-side. As a result, the output voltage remains largely unchanged. Potential-free consuming devices are not influenced through this.

1. System overview CPX-FVDA-P



Note

The cross circuit monitoring may only be turned off when cross-circuit fault can be ruled out safely by other means.



Note

Cross-circuit monitoring supervises only the device's own circuits. Cross-circuiting to other circuits must be prevented otherwise, e.g. 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 module switches all channels off in case of a channel error in accordance with PROFIsafe specification and signals through the flags “FV_activated” and “Device fault” the failure of the module to the F-Host. The F-Host then passivates the output channels of the module (F-Slaves), phases out the module and sets the control bit “Activate_FV”.

For an active function (1 = on), in case of a channel error, the output module safely switches off only the channel in which the error occurred. Uninvolved channels remain uninfluenced and the module remains integrated.

Through the input image, in addition to the current status, the module signals the channel error status to the controller (→ Tab. 1/6, channel error status).

1. System overview CPX-FVDA-P

Input data

The 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. 1/6). Thus, additional safety can be achieved with respect to the status of the monitoring flag.

In byte 1, the setting of the parameter “channel-wise passivation” can be returned. If channel-wise passivation is switched on through the bits “Channel fault status of channel ...” the errors detected by the module are signalled. 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	Monitoring cross circuit		Reserved		Logical actual status ¹⁾		
		Channel 2 (CH2)	Channel 1 (CH1)			Channel 2 (CH2)	Channel 1 (CH1)	Channel 0 (CH0)
	0	0 = active 1 = off		0		0 = off 1 = on		
Byte 1	Channel-wise passivation	Reserved				Channel error status		
						Channel 2 (CH2)	Channel 1 (CH1)	Channel 0 (CH0)
	0 = off 1 = On	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 detected at passivated or switched-off outputs. In case of passivation of the complete module, these bits deliver 0-signals. In case of passivation of a channel, the corresponding bit supplies 0 signal.								

Tab. 1/6: Bit pattern of the input data (F-user data, byte 0 and byte 1)

1. System overview CPX-FVDA-P

Acknowledgment sequence

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

The following sequence description (→ Tab. 1/7) shows the relevant bits for the channel-wise passivation in the input and output image of the module.

No.	Process	Channel-wise passivation ¹⁾	Target status of the channel ¹⁾	Actual status of the channel ²⁾	Channel fault status ²⁾	Acknowledgment of 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. 1/5) 2) Bit in the input image (→ Tab. 1/6) X = Signal irrelevant; 1 = 1-Signal; 0 = 0-Signal</p>						

Tab. 1/7: Sequence description of channel fault acknowledgment – example

The detection of a short circuit is not possible in the passivated status. That is, a present short circuit is no longer reported after passivation.

1. System overview CPX-FVDA-P

Automatic acknowledgment is possible by holding the acknowledgment bit permanently at “1”. An automatic acknowledgment against a present error triggers a wait time of 5 seconds. If the error is corrected only after the expiry of the waiting period, the output will be depassivated only in the following “F protocol cycle”. The module behaves in the same way in case of module-wise passivation and automatic or manual reintegration.

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

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 channels for short circuits and cross circuits (→ Fig. 1/1).

Each high-side path (24 V current path) of a 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.

1. System overview CPX-FVDA-P

1.3.1 Application ranges (examples)

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:

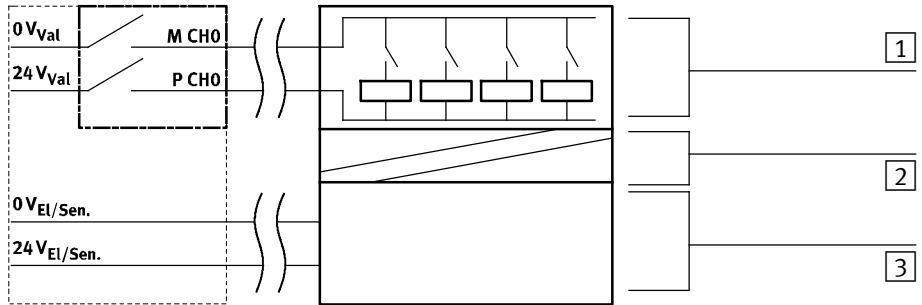
Case	Safe switch off ...	Channel	Reliable function
1	– ... of the load voltage supply for the internal valves of the valve terminal with galvanic isolation	CH0	Safe switch-off of the load voltage (Performance Level PL e, Cat. 3; SIL 3) – with cyclical checking of the switch-off paths for function and cross circuits ¹⁾
2	– ... 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.		
1) Only for active cross-circuit detection			

Tab. 1/8: Possible applications for the output module CPX-FVDA-P

1. System overview CPX-FVDA-P

Case 1:

Safe switch off of the load voltage supply for the internal valves of the valve terminal with galvanic isolation via CH0;

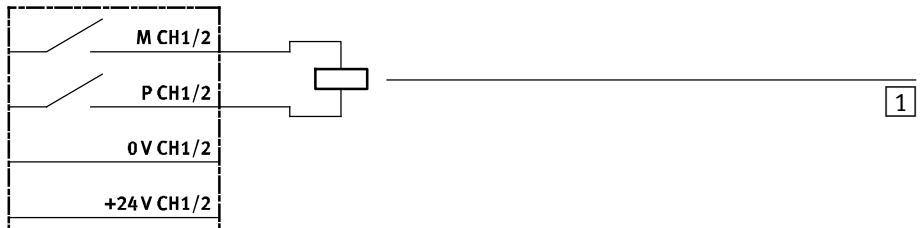


- 1 Solenoid coils of the internal pneumatics
- 2 Galvanic isolation
- 3 Electronics side

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

Case 2:

Safe switch off of potential-free single consumers via CH1 or CH2 (e.g. valves, contactors, relays);
For instance an internal or external valve group can be deaerated through an external venting valve.



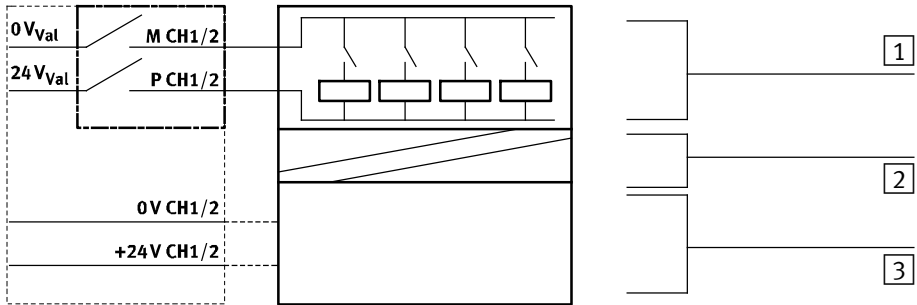
- 1 Potential-free load

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

1. System overview CPX-FVDA-P

Case 3:

Safe switch-off of the load voltage of external electronic consumers with safe galvanic isolation of the load voltage;



- 1 Load side of the consumer, galvanically isolated
- 2 Galvanic isolation
- 3 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

1.4 Requirements for actuators (CH0 ... CH2)

Observe the following instructions for the safety-oriented use (→ Technical data in appendix A.1):

Power rating per channel 0 (CH0) The channel 0 ensures safe shutdown with minimal equipment (1 valve) and maximum equipment as follows.

Acceptable current load:

- Permanent current (load current): max. 1.5 A

Max. permissible equipment in combination with CPX-FVDA-P:

- max. 16 VTSA valves:
VSVA-B-...-A1-1T1L
VSVA-B-...-A2-1T1L
VSVA-B-...-D1-1T1L

Power rating per channel 1 and 2 (CH1 and CH2) Actuators must be insensitive to the cross-circuit monitoring. Otherwise, the cross-circuit monitoring must be disabled and replaced by another suitable method.

Note that externally powered actuators can be connected provided the power supply comes from a safe function low voltage.



Note

If electronic loads are connected to channel 1 and 2, under certain unfavourable operating conditions, incorrect detection of a cross circuit may occur.

1. System overview CPX-FVDA-P

Not the maximum values:

- Cable length: max. 200 m
- Permanent current (load current): per channel max. 0.5 A
- Supply voltage connection (0 V, +24 V) for CH1 and CH2 are available on the front connections
 - Permanent current per unswitched voltage U_{VAL} (auxiliary supply) 2.5 A



Further technical data → Appendix A.1. Maximum permissible load inductivity at the output channels CH1 and CH2 → Fig. A/1.

Installation

Chapter 2

2. Installation

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2.2	Connecting the cables and plugs to the connection block	2-3
2.3	Electrical connection and display components	2-5
2.3.1	Pin allocation with M12 connection block	2-6

2. Installation

2.1 General instructions on installation



Warning

- Use only power sources which guarantee reliable electrical isolation of the operating voltage as per IEC/EN 60204-1. Observe also the general requirements for PELV power circuits 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).

2.2 Connecting the cables and plugs to the connection block



Note

Incorrect handling can cause damage to the electronics modules.

- Switch off the supply voltage before 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.

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.

2. Installation



The protection class of the module depends on the connection block used as well as on 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 for connection (→ www.festo.com/catalogue).

The max. permissible line length is 200 m.

Connection block CPX-M-AB-4-M12X2-5POL



Note

In order that the completely fitted modules with connection block CPX-M-AB-4-M12x2-5POL comply with protection class IP65/IP67:

- 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 protective caps type ISK-M12 (Accessories).



Note

Cross-circuit monitoring supervises only the device's own circuits. Cross-circuiting to other circuits must be prevented otherwise, e.g. 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 for each channel (red)
- 4 Module error LED (red)
- 5 FP-LED (green)
- 6 Module identifier FVDOP (for type CPX-FVDA-P)
- 7 Electrical connections X1 ... 4

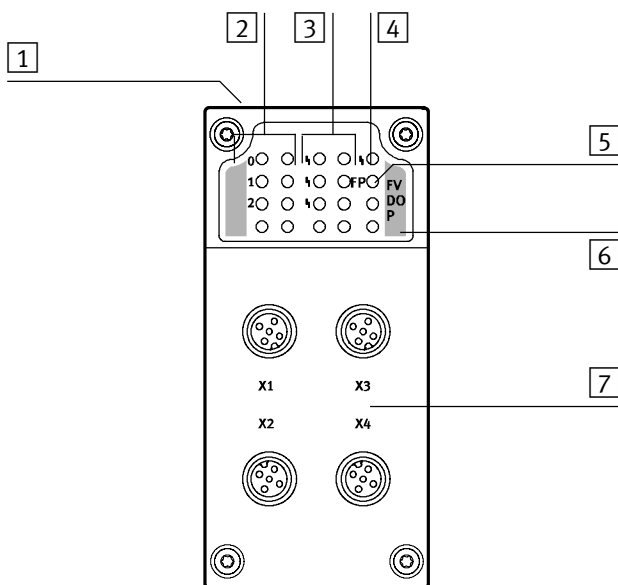


Fig. 2/1: Display and connecting elements CPX-FVDA-P



Detailed information on the LEDs → section 4.3.

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 here corresponds to the output addresses.

CPX-FVDA-P with connection block CPX-M-AB-4-M12X2-5POL			
Connection block	Pin allocation X1, X2		Pin allocation X3, X4
 	 	<p>Socket X1</p> <ol style="list-style-type: none"> 1: 0V CH1 ¹⁾ 2: +24V CH1 ¹⁾ 3: F-DO(M) CH1 ²⁾ 4: F-DO(P) CH1 ²⁾ 5: FE <p>Socket X2</p> <ol style="list-style-type: none"> 1: 0V CH2 ¹⁾ 2: +24V CH2 ¹⁾ 3: F-DO(M) CH2 ²⁾ 4: F-DO(P) CH2 ²⁾ 5: FE 	<p>Socket X3</p> <ol style="list-style-type: none"> 1: n.c. 2: n.c. 3: n.c. 4: n.c. 5: FE <p>Socket X4</p> <ol style="list-style-type: none"> 1: n.c. 2: n.c. 3: n.c. 4: n.c. 5: FE
<p>FE = functional earth n.c. = free (not connected)</p> <p>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}</p>			

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).

Commissioning

Chapter 3

3. Commissioning

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3. Commissioning

3.1 General instructions

Required software versions

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

GSDML file (Version)	Bus nodes ¹⁾ Revision code ²⁾	Controller software (PLC software status)
from GSDML file V 2.2	from Rev. 18	Manufacturer: Siemens – STEP 7: from Version 5.4 with Service Pack SP5 or higher – S7-Distributed Safety: from Version 5.4 with Service Pack SP5 or higher
		Manufacturer: Phoenix Contact – AUTOMATIONWORX Software Suite 2009 with Service Pack SP3 or higher – SafetyProg 2.4 (Build 356) or higher
1) CPX-FB33, CPX-FB34 or CPX-FB35 2) revision code of the bus node → rating plate on the bus nodes (Rev. ...)		

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.

Device master file (GSDML)

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

3. Commissioning

Source

The current version for CPX terminals can be found on the Festo website at:

- www.festo.com/fieldbus



If you have questions or technical problems, please contact your local Festo service or the Festo telephone hotline.

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



Configuration, parametrisation and commissioning of the CPX terminal with CPX-FVDA-P is dependent on the control system used. Basic information are listed below. 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-P	FVDO-P	6 bytes O + 6 bytes I
1) Module identifier in the handheld unit or in the hardware configuration of the programming software		
2) 4 bytes each are used exclusively for PROFIsafe communication		

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

3.2 Commissioning

3.2.1 Preparing for commissioning

Carry out the following steps in preparation for the initial start-up:

1. Make sure that the CPX terminal is correctly mounted (→ CPX system description).
2. Check the wiring (connecting cable, pin allocation) (→ chapter 2)
3. Dismantle the connection block of the output module (→ section 5.2)
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 3.2.2).

3.2.2 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 DIL switch. Both settings must match. The 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 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.

3. Commissioning



Note

Incorrect handling can cause damage to the electronics modules.

- Never push/pull the electronics module into/out of the interlinking block when under power!

Electronic modules include electrostatically sensitive devices.

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

Note

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

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

The PROFIsafe address 0 is preset at the factory. The following image shows the 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

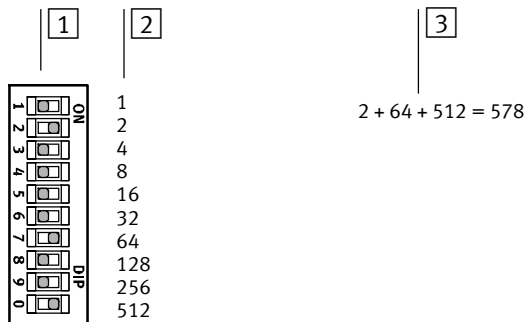


Fig. 3/1: 10-element DIL switch for setting the PROFIsafe address – binary coded

3. Commissioning

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



Note

Incorrect handling can cause damage to the electronics modules.

- Switch off the supply voltage before conducting any mounting or installation work.
- Only switch on the electrical 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 5.2).
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 5.2 (threaded connector without distortion, clean connection surfaces etc.).

4. Remount the connection block. Tightening torque 0.9 ... 1.1 Nm.

3. Commissioning

3.2.3 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.

The following steps must be executed during commissioning:

1. Integrate the GSDML 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 3.3)
 - If necessary, set standard parameters of the output module (→ section 3.4 and 3.4.1)
3. Create and load the safety program
4. Commission CPX terminal on fieldbus (PROFINET IO) and test performance in trial mode.

3. Commissioning

3.3 Set PROFIsafe parameter of the output module CPX-FVDA-P

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

PROFIsafe parameters	General description	For CPX-FVDA-P this applies:	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-P 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 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-P 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-P 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-P makes no individual device parameters available.	– 0 (not changeable)
F_PAR_VERSION	Specifies the PROFIsafe operating mode of the device. The setting 1 corresponds to PROFIsafe V2-MODE.	– CPX-FVDA-P works exclusively in PROFIsafe V2-MODE.	– 1 (not changeable)

3. Commissioning

PROFIsafe parameters	General description	For CPX-FVDA-P this applies:	Value
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.	– compares both settings in order to check the authenticity of the connection (→ section 3.2.2)	– 0 ... 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.	– 12 ... 65535 [ms]
F_iPAR_CRC	CRC through the individual device parameters (i-parameter).	– CPX-FVDA-P makes no individual device parameters available.	– 0 (not changeable)

Tab. 3/3: PROFIsafe parameters

3.4 CPX module parameter of the output module CPX-FVDA-P

The characteristics of the output module CPX-FVDA-P 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.

3. Commissioning



Additional information on parameterisation can be found in the CPX system description or the description of the bus node.

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

Overview of module parameters CPX-FVDA-P			
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 channel 0 General diagnostics channel 1 General diagnostics 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 channel 0 Monitoring wire fracture channel 1 Monitoring wire fracture channel 2 Reserved	inactive inactive inactive –
4828 + m * 64 + 8 ... 21	0 ... 7	Reserved for PROFIsafe	–
4828 + m * 64 + 22 4828 + m * 64 + 23	0 ... 7 0, 1	Position of the DIL switch 0 ... 7 Position of the DIL switch 8, 9	0 ¹⁾
1) Parameters only readable per handheld unit and command interpreter (CI).			

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

3. Commissioning

3.4.1 CPX module parameters CPX-FVDA-P in detail

Module parameter: monitoring of supply voltage U_{VAL}		Handheld
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 on U_{VAL} (→ Technical data, monitoring of supply voltage). With the parameter the diagnostic message in case of undervoltage and overvoltage detection can be activated or deactivated (suppressed). 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]
Comment	<p>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.</p>	

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

3. Commissioning

Module parameters: general diagnostics		Handheld
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: channel 0</p> <p>Bit 1: channel 1</p> <p>Bit 2: 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>
Comment	<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

3. Commissioning

Module parameter: Monitoring wire break		Handheld
Function no.	4828 + m * 64 + 7 m = module number (0 ... 47)	
Description	Establishes whether the respective channel should be monitored for wire break. Deactivating the wire break monitoring is necessary if: <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. 	
Bit	Monitor wire break Bit 0: channel 0 Bit 1: channel 1 Bit 2: channel 2 Bit 3 ... 7: reserved	[Monitor wire break] [Channel 0] [Channel 1] [Channel 2]
Values	0 = inactive 1 = active Presettings: – Channel 0: inactive – Channel 1: inactive – Channel 2: inactive	[Inactive] [Active]
Comment	Wire break monitoring is possible only with a switched-on 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.	

Tab. 3/7: Monitoring wire fracture (channel-specific)

3. Commissioning

Module parameter: DIL switch setting		Handheld																											
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 3.3), the setting of the address selection switch can be read out through CPX parameters for diagnostic purposes – e.g. with the handheld 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]																											
Values	<table border="1"> <thead> <tr> <th>Bit 7</th> <th>Bit 6</th> <th>Bit 5</th> <th>Bit 4</th> <th>Bit 3</th> <th>Bit 2</th> <th>Bit 1</th> <th>Bit 0</th> <th></th> </tr> </thead> <tbody> <tr> <td>SW 7</td> <td>SW 6</td> <td>SW 5</td> <td>SW 4</td> <td>SW 3</td> <td>SW 2</td> <td>SW 1</td> <td>SW 0</td> <td>low byte</td> </tr> <tr> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>SW 9</td> <td>SW 8</td> <td>high byte</td> </tr> </tbody> </table>	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0		SW 7	SW 6	SW 5	SW 4	SW 3	SW 2	SW 1	SW 0	low byte	0	0	0	0	0	0	SW 9	SW 8	high byte	
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0																					
SW 7	SW 6	SW 5	SW 4	SW 3	SW 2	SW 1	SW 0	low byte																					
0	0	0	0	0	0	SW 9	SW 8	high byte																					
	0: switch element is OFF 1: switch element is ON	[0] [1]																											
Comment	This parameter can only be changed by changing the DIL switch setting (read only).																												

Tab. 3/8: DIL switch setting

3. Commissioning

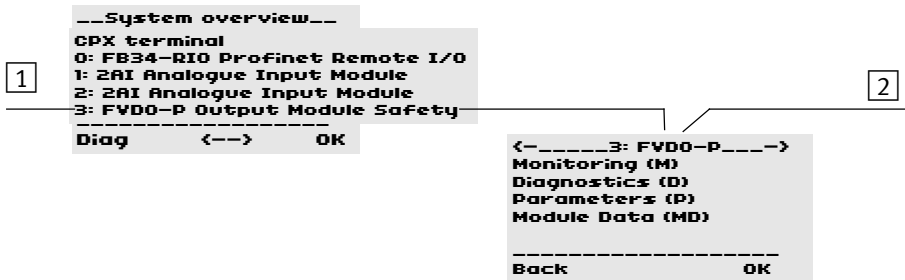
3.4.2 Parameterisation and signal display with the handheld (MMI)

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



General information regarding operation of the handheld as well as commissioning of the CPX terminal with the handheld can be found in the description for handheld type P.BE.CPX-MMI-1-... . Knowledge of the basic functions of the handheld are assumed in the following section.

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



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

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

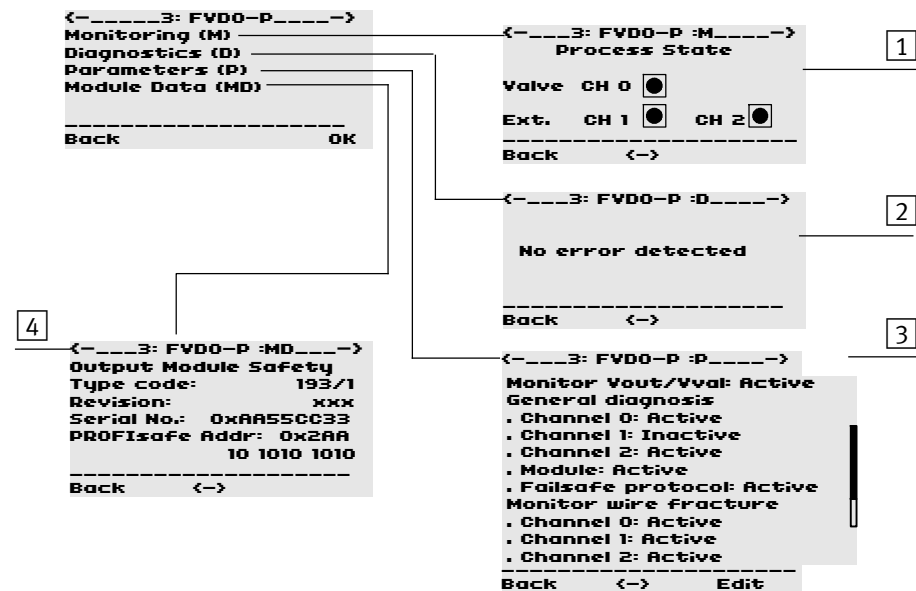
Fig. 3/2: Module identifier of the output module CPX-FVDA-P on the handheld unit

3. Commissioning

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



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



- 1 Monitoring (M)
- 2 Diagnostics (D)
- 3 Parameters (P) – basic representation
- 4 Module Data (MD)

Fig. 3/3: Special representations for CPX-FVDA-P on the handheld

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

3.5 Notes on operation



Note

Channel 1 and Channel 2 must be switched at least once per week to ensure their intended use.

3.5.1 Start behaviour of the output module

When the operating voltage supply $U_{EL/SEN}$ is switched on, the module error LED lights up for approx. 500 ms. When the load voltage supply U_{VAL} is switched on, the channel error LEDs light up for approx. 500 ms. From the perspective of the module, the order of switching is arbitrary. If both voltage supplies are switched on simultaneously, the specified LEDs light up in common (→ Tab. 4/7).

Until correct parameterisation through a PROFIsafe master, the FP-LED flashes. After correct parameterisation, the FP-LED lights up and the module is ready for operation (→ Tab. 4/8).

3.5.2 Reaction to faults

Safe state (Safety concept)

Basis of the safety concept is that a safe state exists for all process variables. For the digital output module the value is "0". In the following cases the default safe output values (0) for the output module are effective.

- Boot (start) the F-system
- Errors in the safety-oriented communication (PROFIsafe communication errors)
- internal faults that are detected by self-tests (e.g. under-voltage)
- detectable error situation outside the module (short circuit, cross circuit)

3. Commissioning



Detailed information on this error response can be found in section 4.2 and 4.3.4.

3.6 Configuration with Siemens STEP 7 (example).

The configuration examples shown in this chapter are based on the use of a Siemens SPS and the Siemens STEP_7 Version 5.4 configuration and programming software. Knowledge of how to operate the STEP 7 software is assumed in the following.



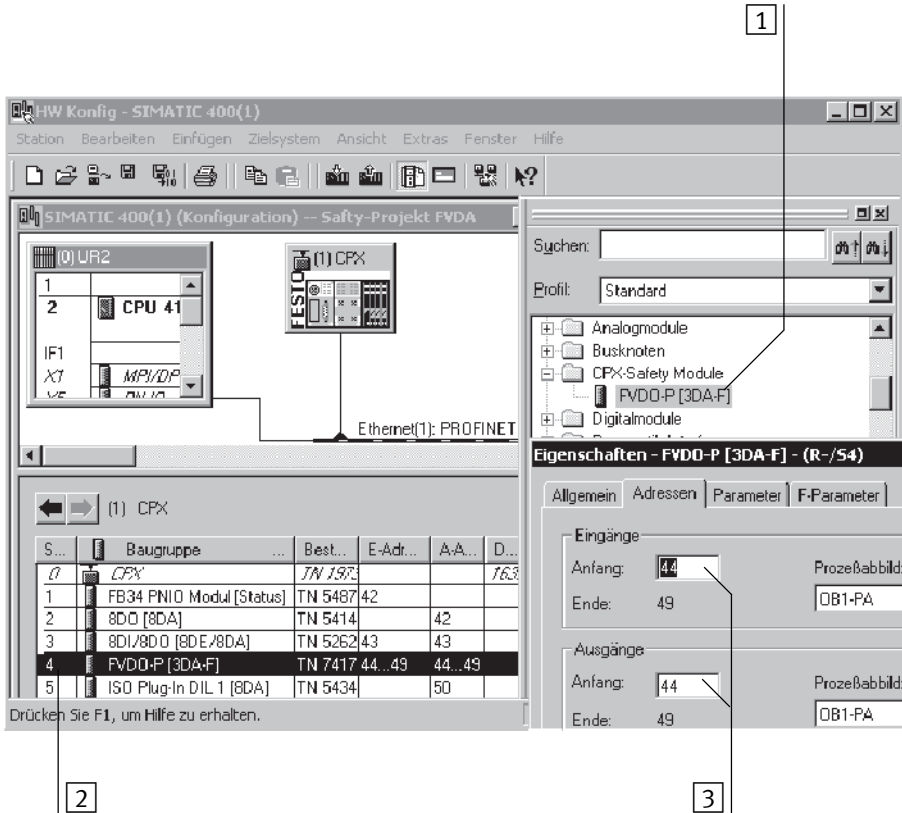
Please inform yourself first in the description for your CPX bus node about the fundamental procedure for configuration of a CPX terminal. The information in the following sections refers exclusively to the output module CPX-FVDA-P.

After you have installed the GSDML 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 systems (➔ 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-P. The dialog window “Features FVDA-P” appears.
- Now set the desired start addresses of the inputs and outputs in the [Addresses] tab of the dialogue window (➔ the following image).

3. Commissioning



- 1 Output module CPX-FVDA-P in the hardware catalogue
- 2 Output module CPX-FVDA-P in the configuration table of the CPX terminal
- 3 Start addresses of the output module for inputs and outputs (here 44)

Fig. 3/4: CPX terminal configuration with Siemens STEP 7 – HW Config

3. Commissioning

The second tab of the dialogue window “Features – FVDA-P” 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 3.4.1.

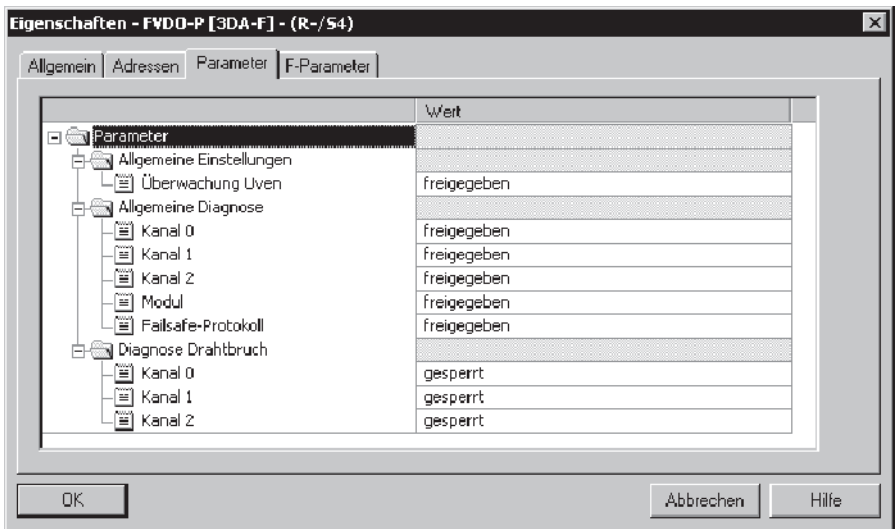


Fig. 3/5: Standard parameters of the output module CPX-FVDA-P

3. Commissioning

The third tab of the dialogue window “Features – FVDA-P” offers access to the PROFIsafe parameters of the output module.

- Set the correct PROFIsafe target address under [F_Dest_Add] (→ the following image). The setting must match the DIL switch setting on the module (→ Fig. 3/1).



Detailed information on the individual parameters can be found in section 3.3.

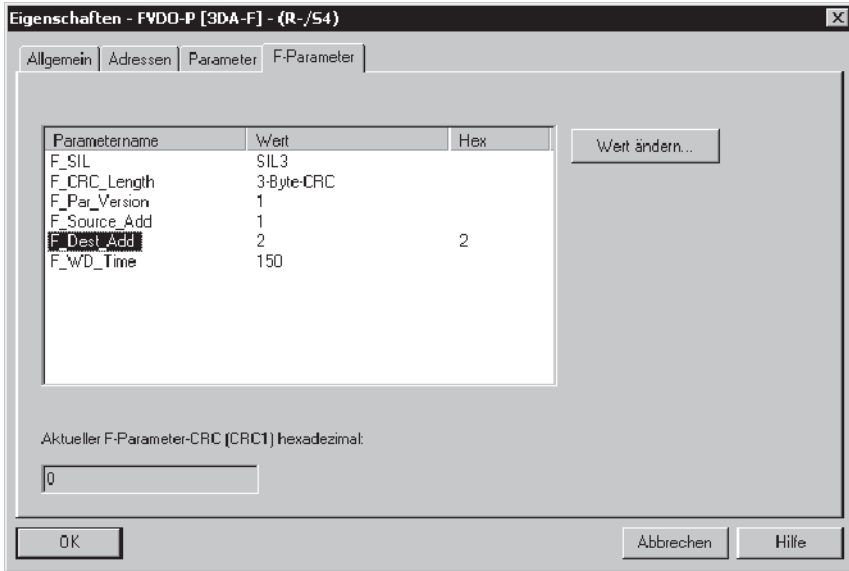


Fig. 3/6: PROFIsafe parameters

3. Commissioning

3.6.1 Addressing example

Addressing example: CPX terminal with VTSA pneumatics

Addresses from input/output byte 42 used:

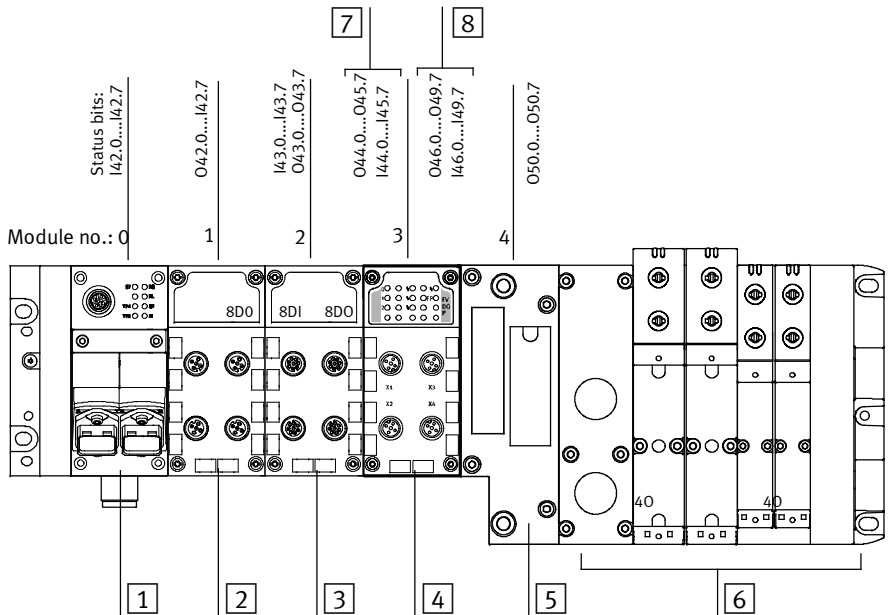


Fig. 3/7: Addressing example

3. Commissioning

Module No.	Module	Input address	Output address
0	Fieldbus 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-P CPX-FVDA-P	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. 3/7)

Diagnostics and error handling

Chapter 4

4. Diagnostics and error handling

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4. Diagnostics and error handling

4.1 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	see
On-site diagnostics	LED	The LEDs of the module display channel and module errors.	Section 4.3
	Handheld control unit (MMI)	Diagnostic information of the module can be shown on the handheld in a convenient and menu-driven manner.	Section 4.4.1 as well as description for the handheld
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 4.2 as well as CPX system description and description for the CPX bus node
	I/O diagnostics interface	CPX-FVDA-P 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 bus node

Tab. 4/1: Diagnostics options

Specific errors of the output module CPX-FVDA-P are reported or suppressed dependent on the module parameterisation. Reported errors can be evaluated, depending on the bus protocol used. The errors are shown on-site via the Error LEDs and, if necessary, can be evaluated with the Handheld.



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.

4. Diagnostics and error handling

4.2 Possible error messages of the output module CPX-FVDA-P



Note

- Always replace the module in case of an internal defect!
- Send defective modules to Festo (product monitoring). Ensure traceability of the device.

Error no.	Handheld display	Description	Error handling
2 ²⁾	[Short circuit]	Short circuit/overload at output	<ul style="list-style-type: none">• Remove short circuit• Acknowledgment and reentry of the module and/or channel
3 ³⁾	[Wire fracture/ 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 switch 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

4. Diagnostics and error handling

Error no.	Handheld display	Description	Error handling
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 and/or channel
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
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 channels of the module are passivated (CH0 ... CH2 are switched off) 2) If “channel-wise passivation” is active, only the affected channel is passivated. Otherwise footnote 1) applies. 3) Does not lead to safety switch-off</p>			

Tab. 4/2: Possible error messages

4.3 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) - Failsafe Protocol
- 3 Channel error LED (red); one for each channel
- 4 Status LED (yellow); one per channel

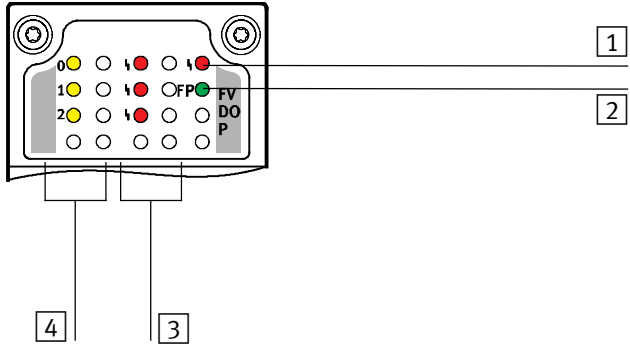


Fig. 4/1: LED display of the output module CPX-FVDA-P



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

In normal operating status, the following LEDs light up:

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

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


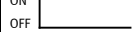


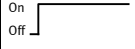


Note





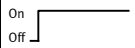
The LED display of the module is not designed in a safety-oriented way.

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

4. Diagnostics and error handling





Module error LED			
LED (red)	Process	Status	Significance / error handling
 LED not illuminated		Trouble-free operation	None
 LED flashes	error-specific	Self-test error	To delete the self-test 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. 4/3: Module error LED




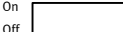
Channel error LED			
LED (red)	Process	Status	Significance / error handling
 LED not illuminated		Trouble-free operation	None
 LED flashes	error-specific	Wire break	Eliminate wire break
 LED illuminated		Cross circuit at the output or short circuit/overload error at the output (dependent on error number)	Remedy cross- and / or short circuit / overload

Tab. 4/4: Channel error LED

4. Diagnostics and error handling

Status LED 1)			
LED (yellow)	Process	Status	Significance / error handling
 LED not illuminated	ON OFF 	Channel inactive (logical 0)	The corresponding load voltage supply is switched off.
 LED illuminated	On Off 	Channel active (logical 1)	The corresponding load voltage supply is switched on.

Tab. 4/5: Status LED

FP-LED (FP for Failsafe protocol)			
LED (green)	Process	Status	Significance / error handling
 LED flashes	ON OFF 	<ul style="list-style-type: none"> - Waiting for safety parameters or - Address error PROFIsafe or - CRC error PROFIsafe parameter 	<ul style="list-style-type: none"> - Module waiting for parameterisation through the F-Host - Set PROFIsafe address does not match safety parameterisation. - Safety parameterisation invalid. The PROFIsafe communication cannot be constructed.
 LED illuminated	On Off 	<ul style="list-style-type: none"> - Failsafe protocol active 	<ul style="list-style-type: none"> - Module communicates with an F-Host via PROFIsafe protocol.

Tab. 4/6: FP-LED

4. Diagnostics and error handling

4.3.1 Error handling and parameterisation

The following figure shows error handling of the output module. Further registering and display of the errors can be suppressed as desired with the appropriate module parameters, represented in the diagram as switches. The parameters are described in section 3.4.1.

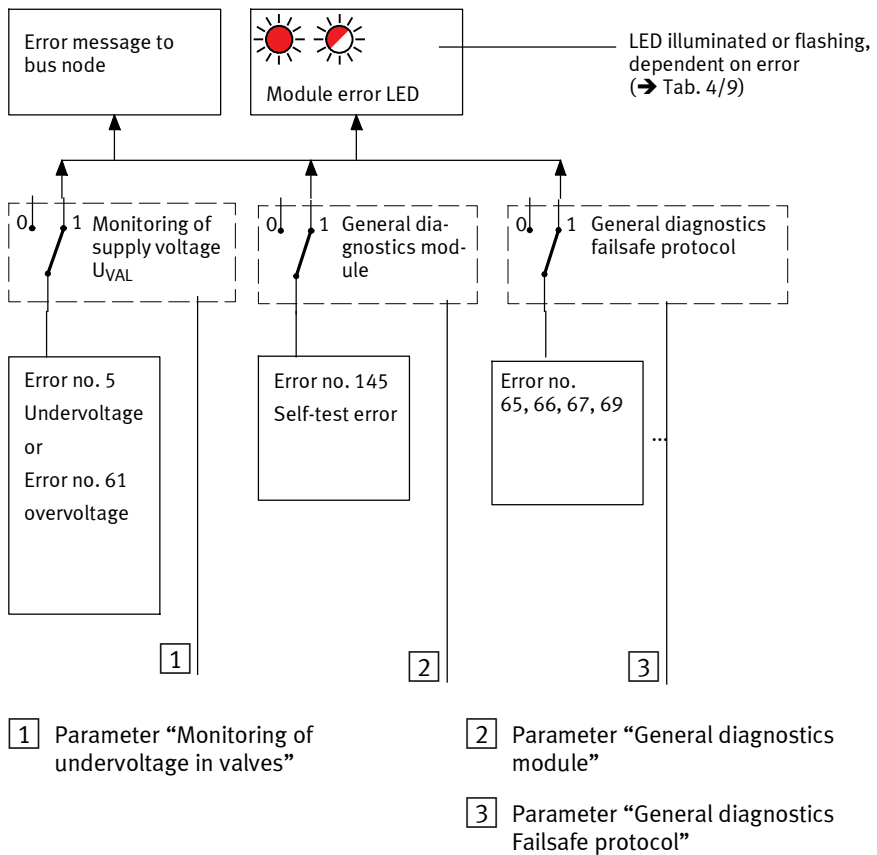
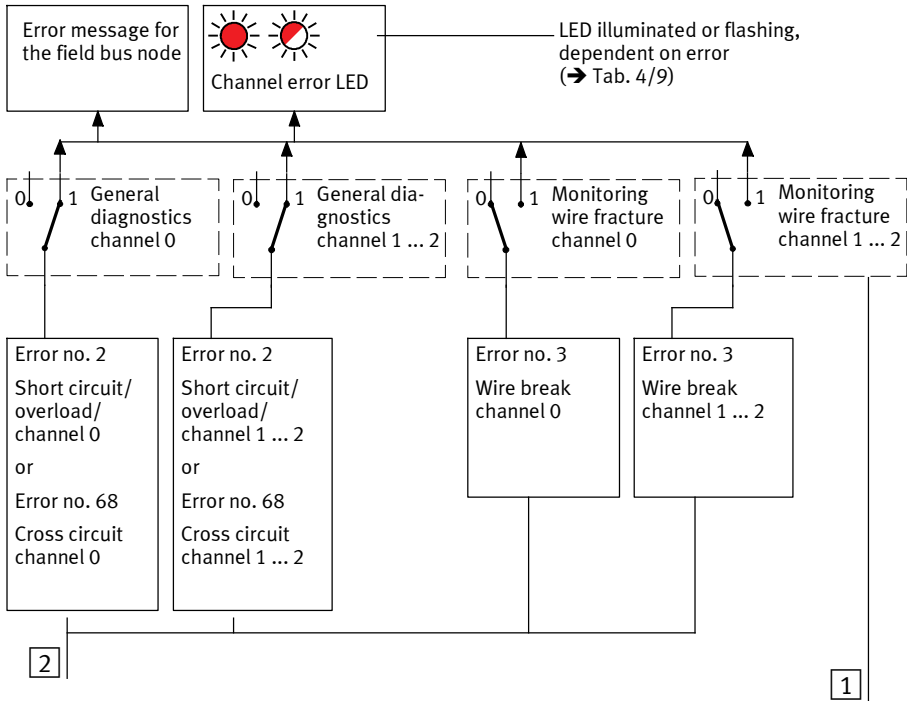


Fig. 4/2: Principle of error handling and parameterisation – part 1

4. Diagnostics and error handling















1 Module parameters (switch position represented = default setting)

2 Channel-specific error

Fig. 4/3: Principle of error handling and parameterisation – part 2









4. Diagnostics and error handling

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

No.	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. 4/7: Behaviour during the switch-on phase















4.3.3 Normal operating status

No.	Status LED	FP-LED	Channel error LED	Module error LED	I/O illustration	Event/ status
3					1 **)	Channel is switched on
4					0 **)	Channel is switched off
**) Refers to the channel that is assigned to the respective status LED.						

Tab. 4/8: Normal operating status

4. Diagnostics and error handling

4.3.4 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 output	Error elimination → section 4.2
				3 ³⁾	Wire break	
				5 ¹⁾	Undervoltage in the power supply	
				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 channels of the module are passivated (CH0 ... CH2 are switched off) 2) If “channel-wise passivation” is active, only the affected channel is passivated. Otherwise footnote 1) applies. 3) Does not lead to safety switch-off 4) In many cases, the 3 channel-error LEDs are also illuminated.</p>						

Tab. 4/9: Behaviour in the event of an error

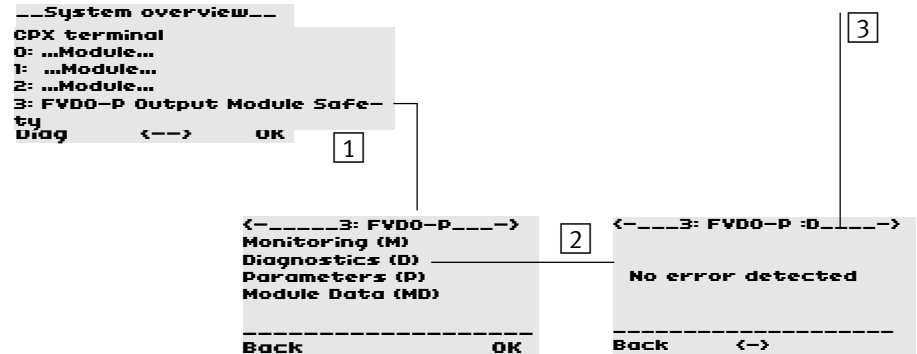
4.4 Diagnostics via the CPX bus node



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

4.4.1 Diagnostics with the handheld CPX-MMI

The handheld 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. 4/4: Module identifier of the output module CPX-FVDA-P on the handheld unit



In addition, the handheld also provides access to the diagnostic memory. Further information can be found in the description for handheld type P.BE.CPX-MMI-1-... .

4. Diagnostics and error handling

Dismantling, assembly, repair and disposal

Chapter 5

5. Dismantling, assembly, repair and disposal

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5.1 General instructions

To avoid errors in mounting, both the interlinking block CPX-M-GE-EV-FVO and the electronics module CPX-FVDA-P 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 may remain attached whilst dismantling 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 fitted. It may be necessary to fit or remove 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.

Module-related rules for configuration

Observe the following rules for the output module CPX-FVDA-P:

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



A mechanical coding prevents the module from being plugged into an incorrect interlinking block. Observe that the connection blocks are not mechanically coded.

- Operate module only with the connection block CPX-M-AB-4-M12X2- 5POL.
- Note that the module must always be installed as the last electronics I/O module next to the right end plate and/or next to a pneumatic interface.
- Use the module only in combination with permissible product designs of the CPX terminal (➔ section 1.1.2).

5.2 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 under power!

Electronic modules include electrostatically sensitive devices.

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



Note

Incorrect handling can cause damage to the electronics modules.

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

Dismantling the electronics module

How to dismantle the electronics module:

To the components → Fig. 1/2 in section 1.1.1.

1. Switch off the operating and load voltage supplies.
2. Unscrew the screws 9 and carefully lift off the sub-base 1.
3. If necessary, pull the electronic module 2 carefully out of the contact rails.

Mounting the electronics module




Note

Handle the components with care. Pay particular attention to the following:

- Use only screws with metric threads for the metal interlinking block CPX-M-GE-EV-FVO.
- The metal interlinking block must be clean and free of foreign matter, especially around the area of the contact rails.
- Position screws exactly before tightening (otherwise their threads will be damaged). Screws should only be secured by hand.
- The specified torques must be observed.
- Threaded fittings must be free of distortion and mechanical tension.
- Check the seals for damage (IP65/IP67).
- Connecting surfaces must be clean (ensure the sealing effect, contact errors).
- Also observe the mounting instructions in the package insert supplied with modules and components subsequently ordered.

Before mounting the electrical connection block:

- Before mounting, make sure that the PROFIsafe address is correctly set at the electronics module (➔ section 3.2.2).
1. Switch off the operating and load voltage supplies.
 2. Align the electronic module correctly and press it carefully into the interlinking block .
 3. Check the seal and sealing surfaces and align and refit the connection block.

5. Dismantling, assembly, repair and disposal

4. Screws must be set 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.

5.3 Repair



Note

The module includes no wearing parts. Repairs are impermissible! In case of impermissible repairs the certification of the module is invalidated!

A professional replacement of the electronics module is permissible.

- Please send defective electronic or output modules of type CPX FVDA-P to Festo.



For dismantling and mounting of the electronics module
→ section 5.2.

5.4 Disposal

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

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

5. Dismantling, assembly, repair and disposal

Technical appendix

Appendix A

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A.1 Technical data for output module CPX-FVDA-P

Technical data	CPX-FVDA-P
General technical data of the CPX terminal	→ CPX system description (P.BE-CPX-SYS...)
Electric characteristic values	
– 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 _{pp}]	2
– Voltage drop bypass time U _{VAL} [ms]	2
– Intrinsic current consumption at nominal operating voltage [mA]	for valves (from U _{VAL}): type. 65 for electronics (from U _{EL/SEN}): type. 25
– Undervoltage monitoring U _{VAL}	U < 20 V for t > 200 ms
– Overvoltage monitoring U _{VAL}	U > 29.5 V for t > 200 ms
– Operating voltage for contact on contact rail 5 V and 0 V [V]	5 ± 5%
– Electrical isolation between V _{EL,SEN} (or 5 V CBUS) and V _{VAL} [V rms]	Min. 500
– Electrical isolation channel – internal bus	Yes, for intermediate supply
– Electrical isolation channel - channel	No
– Potential reference of the channels	V _{VAL}
– Max. power supply CHO (load current) [A]	1.5
– Max. power supply CH1, CH2 (load current per channel) [A]	0.5 (12 W lamp load)
– Max. load current per unswitched voltage U _{VAL} (auxiliary supply) [A]	2.5

A. Technical appendix

Technical data		CPX-FVDA-P
– Peak current I _{max} per channel	[A]	5, for t < 50 ms
– Max. residual current per module	[A]	5
– Voltage drop per channel for permanent load	[V]	Max. 0.6
– Wire break detection (CH1, CH2)		can be parameterised, I _L < ca. 50 mA
– Cable length (CH1, CH2)	[m]	Max. 200
– Load capacity against FE	[nF]	Max. 100
– Load capacity	[μF]	Max. 2.2
– Load inductivity	[mH]	1000 at 150 mA, 100 at 600 mA; characteristic curve → Fig. A/1
– Fuse protection (short circuit)		Integrated electronic fuse per channel
– Switching logic at outputs		PM switching
Functional characteristics		
– Module code		193d (C1h)
– Sub-module code		1d (01h)
Safety characteristics		
– Safety function		Safe switch off of the output channels – in accordance with EN 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 channel		P- and M-switching
– Diagnostics of external channel fault		– Cyclic check for function – Cyclic check for external supply – Cyclic check for cross circuit
– Time for reaction to internal error	[ms]	< 100
– Response time for external channel errors	[ms]	< 220
– Response time to shut-off command (typ.)	[ms]	< 10

A. Technical appendix

Technical data		CPX-FVDA-P
– Max. reaction time to switch-off command	[ms]	F_WD_TIME + 16
– Max. request rate	[rpm]	1
– Min. load current (CH1, CH2) during operation	[mA]	30
– DCavg (average diagnostics degree of coverage) ¹⁾	[%]	91
– HFT (hardware failure tolerance)		1
– SFF (safe failure fraction)	[%]	97
– PFH _D (probability of an endangering failure per hour) ²⁾		$< 1.3 \times 10^{-10}$
– MTTF _d	[Years]	1709
– CCF measures ³⁾		<ul style="list-style-type: none"> – Observe operating voltage limits – Comply with temperature range
– Safety protocol		PROFIsafe Profile Version 2.4 ⁴⁾
– 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 01/205/5074/10
Ambient characteristics		
– Operating ambient temperature	[°C]	- 5... + 50
– Ambient temperature in storage	[°C]	-20...+ 70
– Relative air humidity (non-condensing)	[%]	5 ... 90
– Protection class to EN 60 529		Depending on connection block (→ Tab. A/2)

A. Technical appendix

Technical data	CPX-FVDA-P
Electromagnetic compatibility – Emitted interference – Resistance to interference	→ Declaration of conformity (www.festo.com)
UL certification	c UL us - Recognized (OL)
1) Average diagnostic coverage 2) PFH _D : Probability of failure per hour 3) Measures to avoid failures due to common cause (CCF: Common Cause Failure) 2) Profile for Safety Technology on PROFIBUS DP and PROFINET IO; Version 2.4, March 2007	

Tab. A/1: Technical data for output module CPX-FVDA-P

CPX-FVDA-P

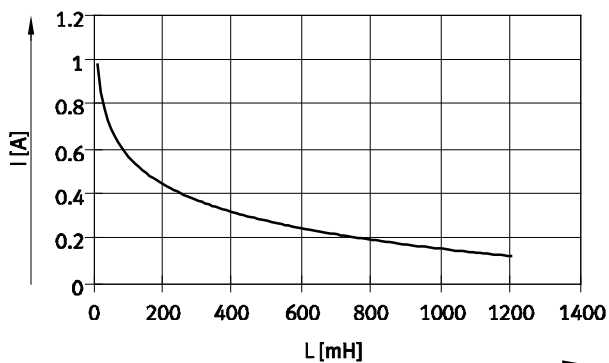


Fig. A/1: Maximum permissible load inductivity at the output channels CH1 and CH2

A.2 Technical data of the connection block

Technical data	CPX-M-AB-4-M12X2-5POL ¹⁾
General technical data of the CPX terminal	→ CPX system description ²⁾
Protection class in accordance with EN 60 529 ³⁾	IP 65/67, completely fitted, plug connector inserted or provided with protective cap ISK-M12
Information on housing materials	Reinforced polyamide, polycarbonate
Ports	
– Design	4 M12 sockets, metal thread, 5-pin
– Contact load capacity	4 A
¹⁾ Metal design ²⁾ General technical data of the CPX terminal: → CPX system description P.BE-CPX-SYS... ³⁾ Degree of protection is determined through a combination of interlinking block and connection block	

Tab. A/2: Technical data - connection block

A.3 Technical data - interlinking block

Technical data	CPX-M-GE-EV-FVO ¹⁾
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 modules
1) Metal design	

Tab. A/3: Technical data for interlinking block CPX-M-GE-EV-FVO

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