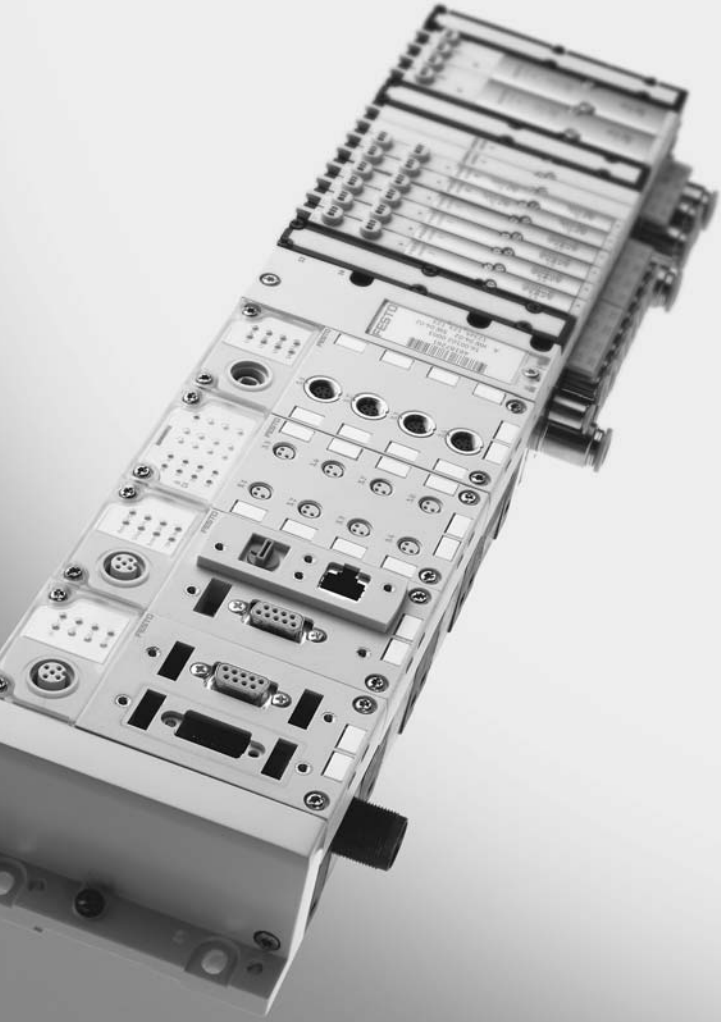
CPX terminal



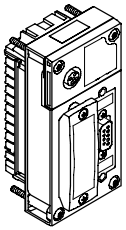
FESTO

Manual
Electronics

CPX field bus node

Type CPX-FB13

Field bus protocol
PROFIBUS-DP
according to
EN 50170



Manual
526 428
en 0811c
[740 270]

Original ..... de

Edition ..... en 0811c

Designation P.BE-CPX-FB13-EN

Order no. 526 428

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

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Contents

Intended use

The field bus node type CPX-FB13 described in this manual has been designed exclusively for use as a slave on the PROFIBUS-DP.

The CPX terminal must only be used as follows:

– as designated in industrial applications

– without any modifications by the user. Only the conversions or modifications described in the documentation supplied with the product are permitted.

– in faultless technical condition.

The maximum values specified for pressures, temperatures, electrical data, torques etc. must be observed.

If additional commercially available components such as sensors and actuators are connected, the specified limits for pressures, temperatures, electrical data, torques, etc. must not be exceeded.

Please comply with the safety regulations of the workers' compensation insurers, technical supervision authorities (TÜV), electrical association (VDE) or corresponding national regulations.

Target group

This manual is intended exclusively for technicians trained in control and automation technology who have experience in installing, commissioning, programming and diagnosing slaves on PROFIBUS-DP.

Service

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

Notes on this manual

This manual contains specific information on installing, configuring, parameterising, commissioning, programming and diagnosing with the CPX field bus node for PROFIBUS-DP as per EN 50170.

You will find an overview of the structure of user documentation on the CPX terminal in the CPX system description.

Further information on the PROFIBUS-DP can be found in:

– set-up guidelines for the PROFIBUS-DP

– manuals of the master manufacturer.

General basic information about the method of operation, fitting, installing and commissioning CPX terminals can be found in the CPX system manual.

Information about further CPX modules can be found in the manual for the relevant module.

Important user instructions

Danger categories

This manual contains instructions on the possible dangers which may occur if the product is not used correctly. These instructions are marked (Warning, Caution, etc.), printed on a shaded background and marked additionally with a pictogram. A distinction is made between the following danger warnings:

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

Caution
This means that failure to observe this instruction may result in personal injury or damage to property.

Note
This means that failure to observe this instruction may result in damage to property.

The following pictogram marks passages in the text which describe activities with electrostatically sensitive components.

Electrostatically sensitive components may be damaged if they are not handled correctly.

Marking special information

The following pictograms mark passages in the text containing special information.

Pictograms

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

Accessories:
Information on necessary or sensible accessories for the Festo product.

Environment:
Information on environment-friendly use of Festo products.

Text markings

- The bullet indicates activities which may be carried out in any order.

1. Figures denote activities which must be carried out in the numerical order specified.

– Hyphens indicate general activities.

The following product-specific terms and abbreviations are used in this manual:

Term/abbreviation	Meaning
AO, AI	Analogue output, analogue input
CPX modules	Collective term for the various modules which can be integrated in a CPX terminal
CPX terminal	Complete system consisting of CPX modules with or without pneumatics
DIL switches	Dual in-line switches consist of several switch elements with which settings can be made.
DPV1	PROFIBUS extension for acyclic access to system data during running time
$F0_h$	Hexadecimal numbers are marked by a low-set “h”
FEC	Front end controller
Field bus node	Provides the connection to specific field buses. Transmits control signals to the connected modules and monitors their ability to function
Handheld	Handheld programmer for commissioning and service purposes (CPX-MMI)
I/Os	Digital inputs and outputs
I/O diagnostic interface	The I/O diagnostic interface is a bus-independent diagnostic interface at I/O level, permitting access to internal data of the CPX terminal
I/O modules	Collective term for the CPX modules which provide digital inputs and outputs
O, I	Digital output, digital input
Octet	Number of address words assigned by the CPX terminal
PLC/IPC	Programmable logic controller/industrial PC
SCS, SCO, SCV	Short circuit/overload sensor supply, outuputs, valves
Status bits	Internal inputs which supply coded common diagnostic messages

Tab. 0/1: CPX-specific terms and abbreviations

Installation

Chapter 1

Contents

1.1 General instructions on installation

Warning
Before carrying out installation and maintenance work, switch off the following:

– the compressed air supply
– the operating voltage supply for the electronics/sensors
– the load voltage supply for the outputs/valves.

You can thereby avoid:

– uncontrolled movements of loose tubing
– unexpected movements of the connected actuators
– non-defined switching states of the electronic components.

Caution
The CPX field bus node contains electrostatically sensitive components.

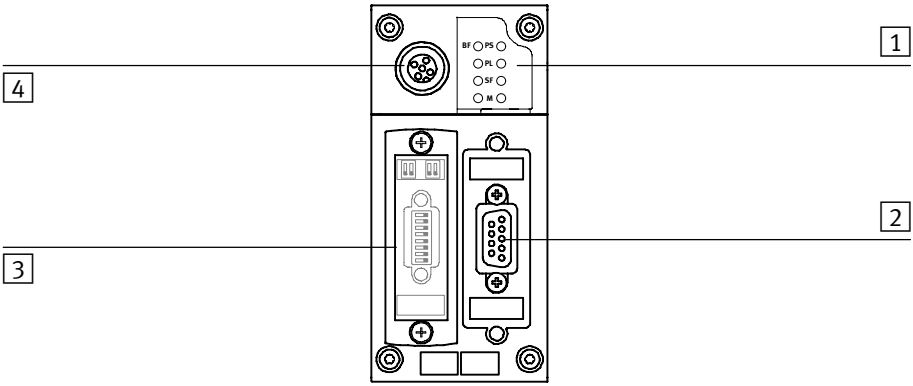
- Therefore, do not touch any contacts.
- Observe the handling specifications for electrostatically sensitive components.

You will then prevent the electronics from being damaged.

Information about fitting the CPX terminal can be found in the CPX system manual (P.BE-CPX-SYS-...).

Electrical connection and display elements

You will find the following electrical connection and display elements on the CPX field bus node for PROFIBUS-DP:



1 Bus-status-specific and CPX-specific LEDs

2 Field bus connection (9-pin sub-D socket)

3 Transparent cover for the DIL switches

4 Service interface for handheld (V24) und USB adapter (for CPX-FMT)

Fig. 1/1: Connecting and display elements on the CPX field bus node

Note
Use protective caps or blanking plugs to seal unused connections. You will then comply with protection class IP65/IP67 (see section 1.3.4).

Dismantling and fitting

The field bus node is fitted in a manifold base of the CPX terminal (see Fig. 1/2).

Dismantling

Dismantle the field bus node as follows:

1. Loosen the 4 screws in the field bus node with a TORX screwdriver size T10.
2. Pull the field bus node carefully and without tilting away from the contact rails of the manifold base.

1 Field bus node CPX-FB13
2 Manifold base
3 Contact rails
4 TORX T10 screws

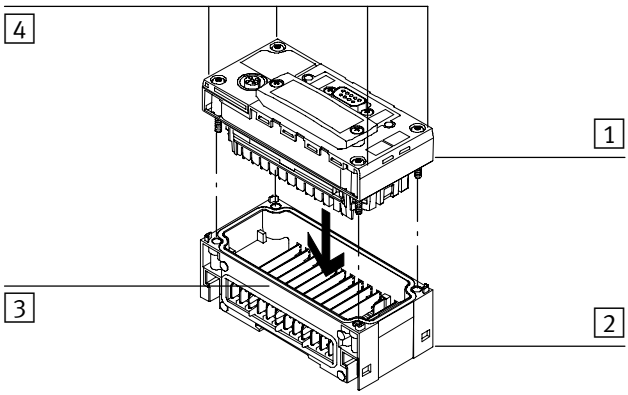


Fig. 1/2: Dismantling/fitting the field bus node

Note
Always use the correct screws for the manifold base, which depend on whether the base is made of metal or plastic:
- for **plastic** manifold bases: thread-cutting screws
- for **metal** manifold bases: screws with metric thread.

Fitting

Fit the field bus node as follows:

1. Place the field bus node in the manifold base. Make sure that the grooves with the power contact terminals on the bottom of the field bus node lie above the contact rails.
2. Push the field bus node carefully and without tilting as far as possible into the manifold base.
3. Tighten the screws at first only by hand. Place the screws so that the self-cutting threads can be used.
4. Tighten the screws with a TORX screwdriver size T10 with torque 0.9 ... 1.1 Nm.

1.2 Settings of the DIL switches on the field bus node

In order to set the CPX field bus node you must first remove the cover over the DIL switches.

Caution
The CPX field bus node contains electrostatically sensitive components.

- Do not touch any contacts.
- Observe the handling specifications for electrostatically sensitive components.

You will then prevent the electronics in the node from being damaged.

1.2.1 Removing and fitting the cover over the DIL switches

In order to set the CPX field bus node you must first remove the cover over the DIL switches.

Removing

1. Switch off the power supply.
2. Unscrew the two fastening screws in the switch cover.
3. Lift up the cover.

Fitting

1. Place the cover carefully on the node.

Note
- Make sure that the seal is seated correctly.

2. Tighten the two fastening screws at first by hand and then with a torque of 0.4 Nm.

1.2.2 Settingthe DIL switches

When you have removed the DIL-switch cover, you will see three DIL switches in the field bus node (see Fig. 1/3).

You can set the following parameters with the DIL switches:

– Operating mode

– PROFIBUS address

– Diagnostic mode

Proceed as follows:

1. Switch off the power supply.
2. Remove the cover over the DIL switches (section 1.2.1).
3. Set the desired operating mode (DIL switch 1, factory setting: Remote I/O).
4. Assign an unused station number to the CPX terminal. Set the desired station number (8-position DIL switch 3, switch elements 1 ... 7).
5. Set the diagnostic mode (8-position DIL switch 3, switch element 8).
6. Fit the cover again (section 1.2.1).

1 DIL switch 1: Operating mode

2 DIL switch 2: Reserved (must be set to OFF)

3 DIL switch 3: Diagnostic mode

4 DIL switch 4: Station number

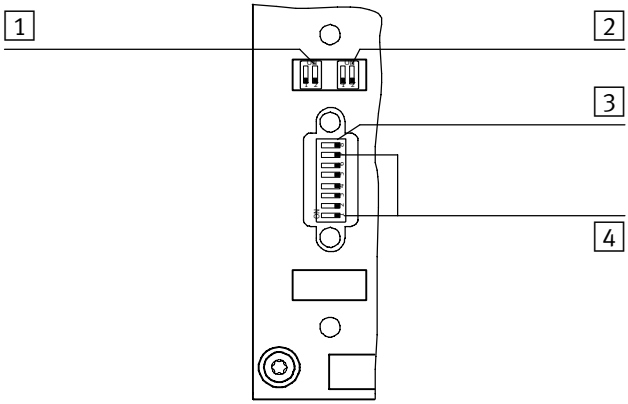


Fig. 1/3: DIL switch in the field bus node

Setting the operating mode with DIL switch 1

You can set the operating mode of the field bus node with switch element 1 of DIL switch 1:

Operating mode	Setting DIL switch 1	
Remote I/O operating mode All the functions of the CPX terminal are controlled directly by the PROFIBUS master. An FEC integrated in the CPX terminal works as a passive function module without controller.		DIL 1.1: OFF DIL 1.2: OFF (factory setting)
Operating mode Remote Controller An FEC integrated in the CPX terminal takes control of the I/Os. This operating mode is only useful if an FEC is integrated in the CPX terminal.		DIL 1.1: ON DIL 1.2: OFF

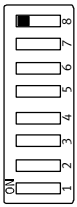
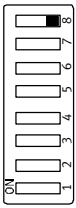
Tab. 1/1: Setting the operating mode with DIL switch 1

Reserved DIL switch 2

Leave the switch elements of DIL switch 2 at OFF.

Setting the diagnostic mode with DIL switch 3

With switch element 8 of DIL switch 3 you can deactivate the device-related diagnosis of the PROFIBUS-DP.
If the device-related diagnosis is deactivated, no device-related diagnostic information about the CPX terminal will be sent to the master system, e.g. short circuit of the outputs or undervoltage of the valves (see section 3.5).

Device-related diagnosis active	**Device-related diagnosis inactive**
	
DIL 3.8: ON	DIL 3.8: OFF

Tab. 1/2: Setting the diagnostic mode with DIL switch 3

Setting the station number with DIL switch 4

Note
Station numbers may only be assigned once per field bus master.

You can set the PROFIBUS address of the CPX terminal in binary coded form with the 8-element DIL switch 3:

1 Setting the station number (switch elements 1 ... 7)

Fig. 1/4: Setting the station number (8-element DIL switch 3)

The following station numbers are permitted:

Protocol	Address designation	Permitted station numbers
PROFIBUS-DP	PROFIBUS address	1; ...; 125

Recommendation:
Assign the station numbers in ascending order. Assign the station numbers to suit the machine structure of your system.

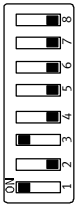
Example: **set station number: 5**	**Example:** **set station number: 38**
 $2^0 + 2^2 =$ $1 + 4 =$ 5	 $2^1 + 2^2 + 2^5 =$ $2 + 4 + 32 =$ 38

Fig. 1/5: Examples of set station numbers (binary coded)

The following pages contain a summary of the settings for the station numbers.

Station no.	1	2	3	4	5	6	7	8	Station no.	1	2	3	4	5	6	7	8
0	Reserved								**16**	OFF	OFF	OFF	OFF	ON	OFF	OFF	
1	ON	OFF	OFF	OFF	OFF	OFF	OFF		**17**	ON	OFF	OFF	OFF	ON	OFF	OFF	
2	OFF	ON	OFF	OFF	OFF	OFF	OFF		**18**	OFF	ON	OFF	OFF	ON	OFF	OFF	
3	ON	ON	OFF	OFF	OFF	OFF	OFF		**19**	ON	ON	OFF	OFF	ON	OFF	OFF	
4	OFF	OFF	ON	OFF	OFF	OFF	OFF		**20**	OFF	OFF	ON	OFF	ON	OFF	OFF	
5	ON	OFF	ON	OFF	OFF	OFF	OFF		**21**	ON	OFF	ON	OFF	ON	OFF	OFF	
6	OFF	ON	ON	OFF	OFF	OFF	OFF		**22**	OFF	ON	ON	OFF	ON	OFF	OFF	
7	ON	ON	ON	OFF	OFF	OFF	OFF		**23**	ON	ON	ON	OFF	ON	OFF	OFF	
8	OFF	OFF	OFF	ON	OFF	OFF	OFF		**24**	OFF	OFF	OFF	ON	ON	OFF	OFF	
9	ON	OFF	OFF	ON	OFF	OFF	OFF		**25**	ON	OFF	OFF	ON	ON	OFF	OFF	
10	OFF	ON	OFF	ON	OFF	OFF	OFF		**26**	OFF	ON	OFF	ON	ON	OFF	OFF	
11	ON	ON	OFF	ON	OFF	OFF	OFF		**27**	ON	ON	OFF	ON	ON	OFF	OFF	
12	OFF	OFF	ON	ON	OFF	OFF	OFF		**28**	OFF	OFF	ON	ON	ON	OFF	OFF	
13	ON	OFF	ON	ON	OFF	OFF	OFF		**29**	ON	OFF	ON	ON	ON	OFF	OFF	
14	OFF	ON	ON	ON	OFF	OFF	OFF		**30**	OFF	ON	ON	ON	ON	OFF	OFF	
15	ON	ON	ON	ON	OFF	OFF	OFF		**31**	ON	ON	ON	ON	ON	OFF	OFF	

Tab. 1/3: Setting station numbers 1 ... 31: Position of the DIL switch elements

Station no.	1	2	3	4	5	6	7	8	Station no.	1	2	3	4	5	6	7	8
32	OFF	OFF	OFF	OFF	OFF	ON	OFF		48	OFF	OFF	OFF	OFF	ON	ON	OFF	
33	ON	OFF	OFF	OFF	OFF	ON	OFF		49	ON	OFF	OFF	OFF	ON	ON	OFF	
34	OFF	ON	OFF	OFF	OFF	ON	OFF		50	OFF	ON	OFF	OFF	ON	ON	OFF	
35	ON	ON	OFF	OFF	OFF	ON	OFF		51	ON	ON	OFF	OFF	ON	ON	OFF	
36	OFF	OFF	ON	OFF	OFF	ON	OFF		52	OFF	OFF	ON	OFF	ON	ON	OFF	
37	ON	OFF	ON	OFF	OFF	ON	OFF		53	ON	OFF	ON	OFF	ON	ON	OFF	
38	OFF	ON	ON	OFF	OFF	ON	OFF		54	OFF	ON	ON	OFF	ON	ON	OFF	
39	ON	ON	ON	OFF	OFF	ON	OFF		55	ON	ON	ON	OFF	ON	ON	OFF	
40	OFF	OFF	OFF	ON	OFF	ON	OFF		56	OFF	OFF	OFF	ON	ON	ON	OFF	
41	ON	OFF	OFF	ON	OFF	ON	OFF		57	ON	OFF	OFF	ON	ON	ON	OFF	
42	OFF	ON	OFF	ON	OFF	ON	OFF		58	OFF	ON	OFF	ON	ON	ON	OFF	
43	ON	ON	OFF	ON	OFF	ON	OFF		59	ON	ON	OFF	ON	ON	ON	OFF	
44	OFF	OFF	ON	ON	OFF	ON	OFF		60	OFF	OFF	ON	ON	ON	ON	OFF	
45	ON	OFF	ON	ON	OFF	ON	OFF		61	ON	OFF	ON	ON	ON	ON	OFF	
46	OFF	ON	ON	ON	OFF	ON	OFF		62	OFF	ON	ON	ON	ON	ON	OFF	
47	ON	ON	ON	ON	OFF	ON	OFF		63	ON	ON	ON	ON	ON	ON	OFF	

Tab. 1/4: Setting station numbers 32 ... 63: Position of the DIL switch elements

Station no.	1	2	3	4	5	6	7	8	Station no.	1	2	3	4	5	6	7	8
64	OFF	OFF	OFF	OFF	OFF	OFF	ON		**80**	OFF	OFF	OFF	OFF	ON	OFF	ON	
65	ON	OFF	OFF	OFF	OFF	OFF	ON		**81**	ON	OFF	OFF	OFF	ON	OFF	ON	
66	OFF	ON	OFF	OFF	OFF	OFF	ON		**82**	OFF	ON	OFF	OFF	ON	OFF	ON	
67	ON	ON	OFF	OFF	OFF	OFF	ON		**83**	ON	ON	OFF	OFF	ON	OFF	ON	
68	OFF	OFF	ON	OFF	OFF	OFF	ON		**84**	OFF	OFF	ON	OFF	ON	OFF	ON	
69	ON	OFF	ON	OFF	OFF	OFF	ON		**85**	ON	OFF	ON	OFF	ON	OFF	ON	
70	OFF	ON	ON	OFF	OFF	OFF	ON		**86**	OFF	ON	ON	OFF	ON	OFF	ON	
71	ON	ON	ON	OFF	OFF	OFF	ON		**87**	ON	ON	ON	OFF	ON	OFF	ON	
72	OFF	OFF	OFF	ON	OFF	OFF	ON		**88**	OFF	OFF	OFF	ON	ON	OFF	ON	
73	ON	OFF	OFF	ON	OFF	OFF	ON		**89**	ON	OFF	OFF	ON	ON	OFF	ON	
74	OFF	ON	OFF	ON	OFF	OFF	ON		**90**	OFF	ON	OFF	ON	ON	OFF	ON	
75	ON	ON	OFF	ON	OFF	OFF	ON		**91**	ON	ON	OFF	ON	ON	OFF	ON	
76	OFF	OFF	ON	ON	OFF	OFF	ON		**92**	OFF	OFF	ON	ON	ON	OFF	ON	
77	ON	OFF	ON	ON	OFF	OFF	ON		**93**	ON	OFF	ON	ON	ON	OFF	ON	
78	OFF	ON	ON	ON	OFF	OFF	ON		**94**	OFF	ON	ON	ON	ON	OFF	ON	
79	ON	ON	ON	ON	OFF	OFF	ON		**95**	ON	ON	ON	ON	ON	OFF	ON	

Tab. 1/5: Setting station numbers 64 ... 95: Position of the DIL switch elements

Station no.	1	2	3	4	5	6	7	8	Station no.	1	2	3	4	5	6	7	8
96	OFF	OFF	OFF	OFF	OFF	ON	ON		**111**	ON	ON	ON	ON	OFF	ON	ON	
97	ON	OFF	OFF	OFF	OFF	ON	ON		**112**	OFF	OFF	OFF	OFF	ON	ON	ON	
98	OFF	ON	OFF	OFF	OFF	ON	ON		**113**	ON	OFF	OFF	OFF	ON	ON	ON	
99	ON	ON	OFF	OFF	OFF	ON	ON		**114**	OFF	ON	OFF	OFF	ON	ON	ON	
100	OFF	OFF	ON	OFF	OFF	ON	ON		**115**	ON	ON	OFF	OFF	ON	ON	ON	
101	ON	OFF	ON	OFF	OFF	ON	ON		**116**	OFF	OFF	ON	OFF	ON	ON	ON	
102	OFF	ON	ON	OFF	OFF	ON	ON		**117**	ON	OFF	ON	OFF	ON	ON	ON	
103	ON	ON	ON	OFF	OFF	ON	ON		**118**	OFF	ON	ON	OFF	ON	ON	ON	
104	OFF	OFF	OFF	ON	OFF	ON	ON		**119**	ON	ON	ON	OFF	ON	ON	ON	
105	ON	OFF	OFF	ON	OFF	ON	ON		**120**	OFF	OFF	OFF	ON	ON	ON	ON	
106	OFF	ON	OFF	ON	OFF	ON	ON		**121**	ON	OFF	OFF	ON	ON	ON	ON	
107	ON	ON	OFF	ON	OFF	ON	ON		**122**	OFF	ON	OFF	ON	ON	ON	ON	
108	OFF	OFF	ON	ON	OFF	ON	ON		**123**	ON	ON	OFF	ON	ON	ON	ON	
109	ON	OFF	ON	ON	OFF	ON	ON		**124**	OFF	OFF	ON	ON	ON	ON	ON	
110	OFF	ON	ON	ON	OFF	ON	ON		**125**	ON	OFF	ON	ON	ON	ON	ON	

Tab. 1/6: Setting station numbers 96 ... 125: Position of the DIL switch elements

1.3 Connecting the field bus

1.3.1 Field bus cable

Note
If installation has not been carried out correctly and if high baud rates are used, data transmission errors may occur as a result of signal reflections and attenuation.
Causes of the transmission faults can be:
- missing or incorrect terminating resistor
- incorrect screening/shield connection
- branches
- transmission over long distances
- unsuitable cables.

Observe the cable specifications. Refer to your controller manual for information on the type of cable to be used.

Note
If the CPX terminal is fitted onto the moving part of a machine, the field bus cable on the moving part must be provided with strain relief. Please also observe the relevant regulations in EN 60204 part 1.

Use a twisted screened 2-core cable for the field bus in accordance with PROFIBUS specifications (EN 50170, cable type A):

surge impedance:	135 ... 165 Ω (3 ... 20 MHz)
capacitance per unit length:	‹ 30 nF/km
loop resistance:	‹ 110 Ω/km
core diameter:	› 0.64 mm
core cross-sectional area:	≥ 0.34 mm^2

Bus length

Exact specifications on the bus length can be found in the next section and in the manuals for your control system.

1.3.2 Field bus baud rate and field bus length

Note
The maximum permitted field bus segment lengths depend on the baud rate used.

- Note the maximum permitted segment length (cable length without repeater), if you connect the CPX terminal to a field bus segment.
- Avoid branch lines.

The CPX terminal sets itself automatically to one of the following baud rates:

Baud rate	Maximum segment length
9.6; 19.2; 93.75 kBaud	1200 m
187.5 kBaud	1000 m
500 kBaud	400 m
1500 kBaud	200 m
3000 ... 12000 kBaud	100 m

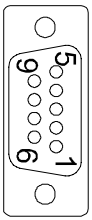
Tab. 1/7: Maximum field bus segment lengthsfor PROFIBUS-DP depending on the baud rate

1.3.3 Field bus interface

There is a 9-pin sub-D socket on the CPX terminal for connecting it to the field bus.
This connection serves for the incoming and continuing field bus cable. You can connect the CPX terminal with the field bus plug from Festo type FBS-SUB-9-GS-DP-B.

Note
Only the Festo field bus plug complies with IP65.
Before connecting sub-D plugs from other manufacturers:

- Replace the two flat screws with bolts (type UNC 4-40/M3x5).

Socket on CPX terminal	Pin	Field bus plug IP65 from Festo [1]	PROFIBUS-DP	Description
	1	–	Screen	Connection to (FE) functional earth
	2	–	n.c.	not connected
	3	B	**RxD/TxD-P**	**Received/transmitted data P**
	4	–	CNTR-P [2]	Repeater control signal [2]
	5	–	DGND	Data reference potential (M5V)
	6	–	VP	Power supply positive (P5V)
	7	–	n.c.	not connected
	8	A	**RxD/TxD-N**	**Received/transmitted data N**
	9	–	n.c.	not connected
	Housing	Clamp strap	Screen	Connection to functional earth

[1] Type FBS-SUB-9-GS-DP-B (part no. 532216)
[2] The repeater control signal CNTR-P is in the form of a TTL signal.

Tab. 1/8: Pin assignment of the field bus interface of the CPX field bus node

1.3.4 Connection options

Note
Use protective caps or blanking plugs to seal unused connections. You will then comply with protection class IP65.

Connection with field bus plugs from Festo

- Observe the fitting instructions for the field bus plug. Tighten the two fastening screws at first by hand and then with max. 0.4 Nm.

You can connect the CPX terminal easily to the field bus with the field bus plug from Festo (type FBS-SUB-9-GS-DP-B, part no. 532216). You can disconnect the plug from the node without interrupting the bus cable (T-TAP function).

Note
The clamp strap in the field bus plug from Festo is connected internally only capacitively with the metallic housing of the Sub-D plug. This is to prevent equalising currents flowing through the screening of the field bus cable.

1 Hinged cover with display window

2 Blanking plug if connection is not used

3 Clamp strap for screening/shield connection

4 Field bus incoming (IN)

5 Switch for bus termination and continuing field bus

6 Field bus continuing (OUT)

7 Only connected capacitively

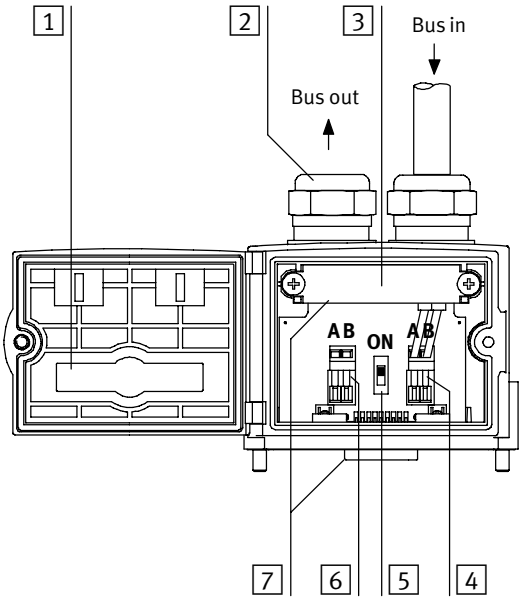


Fig. 1/6: Field bus plug from Festo, type FBS-SUB-9-GS-DP-B

DIL switches

With the switch in the field bus plug you can switch the following:

Switch position	Bus terminal	Continuing field bus cable
OFF	not switched	switched on
ON	switched	switched off

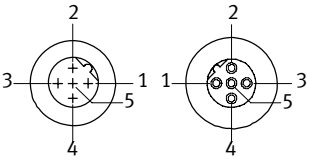
Note
Note the type designation of your field bus plug. The new plug type FBS-SUB-9-GS-DP-B switches the continuing field bus cable off when the bus termination is switched on.

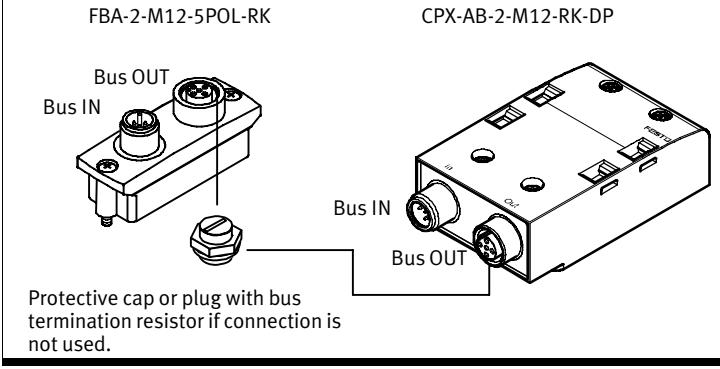
Connection with M12 adapters (reverse key coded)

Two different adapters are available for connecting the CPX-FB13 to the field bus via M12 plug connectors. You can disconnect the M12 adapters from the CPX terminal without interrupting the bus cable (T-TAP function).

– Type: FBA-2-M12-5POL-RK (part no. 533118)
– Type: CPX-AB-2-M12-RK-DP (part no. 541519)

Connection to the field bus is made with a 5-pin M12 plug with PG9 screw connector. Use the second connection socket for the continuation of the field bus.

M12 adapter Reverse key coded	**Pin no. Bus IN**	**Pin no. Bus OUT**
	1. n.c. 2. **RxD/TxD-N** 3. n.c. 4. **RxD/TxD-P** 5. PE M12 thread: Functional earth, shield	1. VP (P5V) 2. **RxD/TxD-N** 3. DGND (M5V) 4. **RxD/TxD-P** 5. PE M12 thread: Functional earth, shield



Tab. 1/9: Pin assignment of the M12 adapters for the field bus interface

Connection with optical-fibre waveguide

The PROFIBUS-DP interface of the node complies with specification EN 50170-2 and supports the control of network components for optical fibre waveguides.

Use optical-fibre waveguides when transmission is affected by heavy interference, as well as for extending the transmission range when high baud rates are used.

Example of optical-fibre waveguide network components:

– Siemens Optical Link Module (OLM) for PROFIBUS plus

– Siemens Optical Link Plug (OLP) for PROFIBUS (IP20)

– Harting Han-InduNet® media converter IP65 (optical data transmission in the DESINA installation concept).

1.4 Bus connection with terminating resistors

Note
If the CPX terminal is at the beginning or end of the field bus segment, a bus termination will be required.

- Fit a bus termination to both ends of a bus segment.

Recommendation:
Use the ready-to-use field bus plugs from Festo for the bus termination. A suitable resistor network is incorporated in the housing of this plug (see Fig. 1/7).

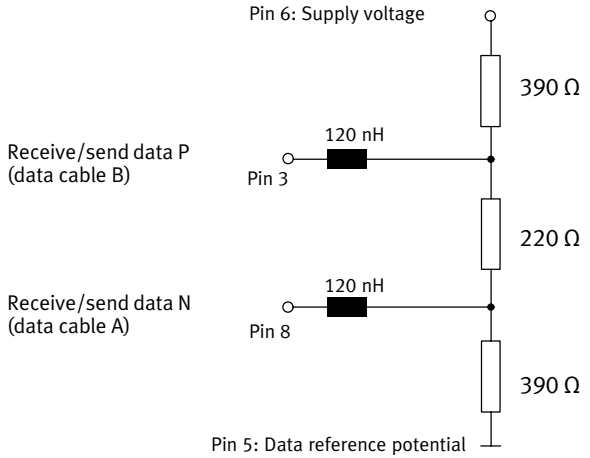


Fig. 1/7: Circuit diagram for bus termination network for cable type A as per EN 50170 (switch in Festo field bus plug set to ON)

1.5 Pin assignment of power supply

Warning

- Use only PELV **circuits** as per IEC/DIN EN 60204-1 (Protective Extra-Low Voltage, PELV) for the power supply. Take into account also the general requirements for PELV circuits as per IEC/DIN EN 60204-1.
- Use only **power sources** which guarantee reliable electrical isolation of the operating voltage as per IEC/DIN EN 60204-1.

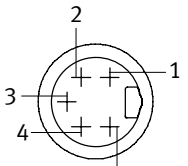
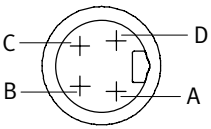
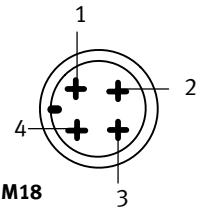
Use of PELV power circuts grarantees protection against electric shock (protection against direct and indirect contact) in accordance with IEC/DIN EN 60204-1 (electrical equipment of machines, general requirements).

The current consumption of a CPX terminal depends on the number and type of integrated modules and components.

Read the information on power supply as well as on the earthing measures to be carried out in the CPX system manual.

System supply, additional supply and valve supply

The CPX terminal is supplied with operating and load power via the manifold base with system, additional and valve supply. Further manifold bases are in preparation.

Plugs	**Pin assignment of manifold base with**		
	system power supply type CPX-GE-EV-S... type CPX-M-GE-EV-S...	**additional power supply type CPX-GE-EV-Z... type CPX-M-GE-EV-Z...**	**valve power supply type CPX-GE-EV-V...**
 **7/8"-5PIN**	1: 0 V_{VAL} / 0 V_{OUT} 2: 0 $V_{EL/SEN}$ 3: Earth terminal (incoming) 4: 24 $V_{EL/SEN}$ 5: 24 V_{VAL} / 24 V_{OUT}	1: 0 V_{OUT} 2: free (not connected) 3: Earth terminal (incoming) 4: free (not connected) 5: 24 V_{OUT}	–
 **7/8"-4PIN** [1]	A: 24 $V_{EL/SEN}$ B: 24 V_{VAL} / 24 V_{OUT} C: Earth connection D: 0 $V_{EL/SEN}$ / 0 V_{VAL} / 0 V_{OUT} (incoming)	A: not connected B: 24 V_{OUT} C: Earth connection D: 0 V_{OUT} (incoming)	A: free (not connected) B: 24 V_{VAL} C: Earth connection D: 0 V_{VAL} (incoming)
 **M18**	1: 24 $V_{EL/SEN}$ 2: 24 V_{VAL} / 24 V_{OUT} 3: 0 $V_{EL/SEN}$ / 0 V_{VAL} / 0 V_{OUT} 4: Earth terminal	1: free (not connected) 2: 24 V_{OUT} 3: 0 V_{OUT} 4: Earth terminal	1: free (not connected) 2: 24 V_{VAL} 3: 0 V_{VAL} 4: Earth terminal
[1] Note the specifications on the plug $V_{EL/SEN}$: Operating voltage for electronics/sensors V_{OUT}: Load voltage for outputs V_{VAL}: Load voltage for valves			

Tab. 1/10: Pin assignment for system supply, additional supply and valve supply

Commissioning

Chapter 2

Contents

2.1 Configuration

2.1.1 General information

Control commands

The operating modes FREEZE, SYNC and CLEAR_DATA are supported by the CPX terminal in accordance with EN 50170.

The method of accessing these commands depends on the controller used. Please refer here to the documentation for your field bus module.
Information on DPV1 commands can be found in section A.3 in appendix A.

Caution
The operating mode FREEZE or SYNC will be reset automatically:

– the CPX terminal is switched on or off

– when the field bus module stops.

Only the operating mode FREEZE will be reset automatically:

– The bus connection to the CPX terminal is interrupted (response monitoring active).

FREEZE command

All the inputs of the CPX terminal will be “frozen”.
The CP terminal now sends a constant image of all the inputs to the master. With each further FREEZE command, the input image is updated and sent again to the master.
Return to normal operation: UNFREEZE command

SYNC command

All the outputs of the CP terminal will be “frozen”.
The CP terminal now no longer reacts to modifications to the output image in the master. With each further SYNC command, the updated output image will be transmitted.
Return to normal operation: UNFREEZE command

Command CLEAR_DATA

All the outputs of the CP terminal will be reset.

2.1.2 Preparing the CPX terminal for the configuration

Addressing the CPX terminal

The CPX terminal has an address range of up to 64 bytes inputs and 64 bytes outputs: Max_Data_Len = 128 (80_h).

Inputs

– Counting is module-orientated, irrespective of the position of the field bus node.

– Counting from left to right.

– Depending on the configuration, the field bus node can occupy status information as logical inputs.

Outputs

– Counting is module-oriented, irrespective of the position of the field bus node.

– Counting from left to right.

Electric modules

Configuration in the Remote I/O operating mode

In the Remote I/O operating mode, the identifiers of the field bus node (including diagnosis mode), the CPX modules and, if present, the pneumatics are configured (see the following tables and sections 2.1.4 or B.1):

Enter the identifiers corresponding to the physical sequence of the modules from left to right in your configuration program.

Electric modules **Description**	**Module identifier** [1]	**Identifier Siemens/EN 50170**	**Assigned address space**	
			Inputs	**Outputs**
Field bus node CPX-FB13 In Remote I/O operating mode: **without diagnostics access**	FB13-RIO...	0 / 00_h	–	–
Field bus node CPX-FB13 In Remote I/O operating mode: **with status bits [Status]**	FB13-RIO...	64 / 40_h, 00_h	2 byte/ 8 I	–
Field bus node CPX-FB13 In Remote I/O operating mode: **with I/O diagnostic interface [System Table Interface, STI]**	FB13-RIO...	192 / $C0_h$, 81_h, 81_h	2 byte/ 16 I	2 byte/ 16 O
[1] Module identifier in the handheld unit or in the hardware configuration of the programming software				

Tab. 2/1: Module overview and address assignment part 1: field bus nodes and diagnosis mode

Electric modules Description	Module identifier [1]	Identifier Siemens/EN 50170	Assigned address space Inputs	 Outputs
Digital 4-input module: **CPX-4DE**	4DI	8DI / 10_h	1 byte/ 8 I	–
		0 / 00_h [2]	4 bit I [2]	
Digital 8-input module: **CPX-8DE**	8DI	8DI / 10_h	1 byte/ 8 I	–
Digital 8-input module with channel diagnostics: **CPX-8DE-D**	8DI-D	8DI / 10_h	1 byte/ 8 I	–
Digital 8-input module, n-switching: **CPX-8NDE**	8NDI	8DI / 10_h	1 byte/ 8 I	–
Digital 16-input module: **CPX-16DE**	16DI	8DI / 11_h	2 byte/ 16 I	–
Digital 16-input module with channel diagnostics: **CPX-M-16DE-D**	16DI-D	8DI / 11_h	2 byte/ 16 I	–
Digital 4-way output module: **CPX-4DA**	4DO	8DO / 20_h	–	1 byte/ 8 O
		0 / 00_h [2]	–	4 bit O [2]
Digital 8-output module: **CPX-8DA**	8DO	8DO / 20_h	–	1 byte/ 8 O
Digital 8-output high current output module: **CPX-8DA-H**	8DO-H	8DO / 20_h	–	1 byte/ 8 O
Digital multi I/O module: **CPX-8DE-8DA**	8DI/8DO	8DX / 30_h	1 byte/ 8 I	1 byte/ 8 O

[1] Module identifier in the handheld unit or in the hardware configuration of the programming software
[2] Identifiers can be grouped together

Tab. 2/2: Module overview and address assignment part 2: Digital input and output modules

Electric modules Description	Module identifier [1]	Identifier Siemens/EN 50170	Assigned address space Inputs	 Outputs
Analogue 2-input module: **CPX-2AE-U-I**	2AI	2AI / 51_h	2 words/ 32 I	–
Analogue 4-way input module: **CPX-4AE-I**	4AI-I	4AI / 53_h	4 words/ 64 I	–
Analogue 4-way input module (temperature module for RTD sensors): **CPX-4AE-T**	4AI-T	2AI / 51_h 4AI / 53_h	2 words or 4 words/ 32/64 I [2]	–
Analogue 4-way input module (temperature module for TC sensors): **CPX-4AE-TC**	4AI-TC	4AI / 53_h	4 words/ 64 I	–
Analogue 2-way output module: **CPX-2AA-U-I**	2AO	2AO / 61_h	–	2 words/ 32 O

[1] Module identifier in the handheld unit or in the hardware configuration of the programming software
[2] Number of inputs which can be switched between 2 and 4

Tab. 2/3: Module overview and address assignment part 3: Digital input and output modules

Electric modules Description	Module identifier [1]	Identifier Siemens/EN 50170	Assigned address space Inputs	 Outputs
CPX-CP interface: **CPX-CP-4-FB**	CPI	192 / $C0_h$, $0F_h$, $0F_h$ [2]	max. 4 bytes per string/ 128 I	max. 4 bytes per string/ 128 O
Soft-stop end-position controller: **CPX-CMPX**	CMPX-C-1-H1	53 / 35_h	3 words/ 48 I	3 words/ 48 O
Multi-axis interface: **CPX-CMXX**	CPX-CMXX	192 / $C0_h$, $0F_h$, $0F_h$	16 byte/ 128 I	16 byte/ 128 O
[1] Module identifier in the handheld unit or in the hardware configuration of the programming software [2] Dependent on the last CP string used, example for maximum assignment				

Tab. 2/4: Module overview and address assignment part 4: Technology modules

Operating mode Remote Controller

In the Remote Controller operating mode, only the identifier of the field bus node will be configured (see section 2.1.5):

Electric modules Description	Module identifier [1]	Identifier Siemens/EN 50170	Assigned address space Inputs	 Outputs
Field bus node **(Remote controller)** (FB13: CPX-8 bytes I/8 bytes O)	FB13-RC	192 / $C0_h$, 07_h, 07_h	8 byte/ 64 I	8 byte/ 64 O
[1] Module identifier in the handheld unit or in the hardware configuration of the programming software				

Tab. 2/5: Configuration of the field bus node for the operating mode Remote Controller

Pneumatic interfaces and pneumatic modules

The Tab. 2/6 to Tab. 2/9 give an overview of the assigned address spaces of different pneumatic interfaces and modules.

The valves are configured according to the pneumatic interface used:

- Valves of type 44 (VTSA, ISO), type 03 (Midi/Maxi) or type 12 (CPA):
  When extensions are added to the valve side, only **one** identifier is used for the pneumatic interface. In the pneumatic interface the number of valve coils is set with a DIL switch (grid pattern 1 byte).

- Valves of type 32 and 33 (MPA, MPA-F and MPA-P or VPPM pneumatic modules):
  From the technical point of view, the individual MPA pneumatic modules each represent an electric module for controlling the attached valves.

  A configuration is required for **each** pneumatic module of type MPA:

  - Pneumatic modules of type **MPA1** each occupy 1 byte of address space or 8 outputs (an identifier), regardless of how many valves are attached to the pneumatic module.

  - Pneumatic modules of type **MPA2** each occupy 1 byte of address space or 8 outputs, but only 4 bits are used. The identifiers can be grouped together with modules of the same type (see Fig. 2/1).

  - Pneumatic modules of type **MPA-P** each occupy 1 byte of address space or 16 inputs.

  - Pneumatic modules of type **VPPM** each occupy 1 byte of address space (inputs/outputs) or 16 inputs and 16 outputs.

Additional information on the pneumatics can be found in the corresponding Pneumatics descriptions (see document overview “Descriptions of the CPX terminal” in the CPX manual P.BE-CPX-SYS-...).

The manuals for the pneumatic valve cluster (Midi/Maxi, CPA, MPA and VTSA/VTSA-F or ISO) contain the address assignment within the pneumatic modules.

For further information on MPA pneumatic modules and the pneumatic interfaces: see manual for the CPX I/O modules (P.BE-CPX-EA-...).

CPX pneumatic interfaces for MPA and MPA pneumatics modules	**Module identifier** [1]	**Identifier Siemens/EN 50170**	**Assigned address space**	
			Inputs	**Outputs**
Pneumatic interface for MPA or MPA-F valves (type 32/33): VMPA-FB-EPL-...	–	–	–	–
MPA1 pneumatic module **without** separate circuits: VMPA1-FB-EMS-8 [2]	MPA1S	8DO / 20_h	–	1 byte/8 O
MPA1 pneumatic module **with** separate circuits: VMPA1-FB-EMG-8 [2]	MPA1G	8DO / 20_h	–	1 byte/8 O
MPA2 pneumatic module **without** separate circuits: VMPA2-FB-EMS-4 [2]	MPA2S	8DO / 20_h	–	1 byte/8 O
		0 / 00_h	–	4 bit O [3]
MPA2 pneumatic module **with** separate circuits: VMPA2-FB-EMG-4 [2]	MPA2G	8DO / 20_h	–	1 byte/8 O
		0 / 00_h	–	4 bit O [3]

[1] Module identifier in the handheld unit or in the hardware configuration of the programming software
[2] Type of MPA electronic module used
[3] Identifiers can be grouped together

Tab. 2/6: Identifiers and address assignment part 1: MPA pneumatics

MPA pneumatic module with diagnosis function D2	Module identifier [1]	Identifier Siemens/EN 50170	Assigned address space	
			Inputs	Outputs
MPA1 pneumatic module **without** separate circuits, **with** diagnostic function D2 VMPA1-FB-EMS-D2-8 [2]	MPA1S-D	8DO / 20_h	–	1 byte/8 O
MPA1 pneumatic module **with** separate circuits, **with** diagnostic function D2 VMPA1-FB-EMG-D2-8 [2]	MPA1G-D	8DO / 20_h	–	1 byte/8 O
MPA2 pneumatic module **without** separate circuits, **with** diagnostic function D2 VMPA2-FB-EMS-D2-4 [2]	MPA2S-D	8DO / 20_h	–	1 byte/8 O
		0 / 00_h	–	4 bit O [3]
MPA2 pneumatic module **with** separate circuits, **with** diagnostic function D2 VMPA2-FB-EMG-D2-4 [2]	MPA2G-D	8DO / 20_h	–	1 byte/8 O
		0 / 00_h	–	4 bit O [3]

[1] Module identifier in the handheld unit or in the hardware configuration of the programming software
[2] Type of MPA electronic module used
[3] Identifiers can be grouped together

Tab. 2/7: Identifiers and address assignment part 2: MPA pneumatic module with diagnosis function D2

CPX pneumatic interfaces for VTSA (ISO), Midi/Maxi, CPA	Module identifier [1]	Identifier Siemens/EN 50170	Assigned address space	
			Inputs	Outputs
Pneumatic interface for **VTSA** or **VTSA-F** pneumatic (ISO, type 44/45): [2] – 1 ... 8 valve coils – 1 ... 16 valve coils – 1 ... 24 valve coils – 1 ... 32 valve coils	ISO PlugIn or type 44 or type 45 [3]	 8DO / 20_h 16DO / 21_h 24DO / 22_h 32DO / 23_h	 – 	 1 byte/8 O 2 bytes/16 O 3 bytes/24 O 4 bytes/32 O
Pneumatic interface for **Midi/Maxi** valves (type 03): [2] – 1 ... 8 valve coils – 1 ... 16 valve coils – 1 ... 24 valve coils – 1 ... 32 valve coils (26 can be used)	TYP3	 8DO / 20_h 16DO / 21_h 24DO / 22_h 32DO / 23_h	 – 	 1 byte/8 O 2 bytes/16 O 3 bytes/24 O 4 bytes/32 O
Pneumatic interface for **CPA** valves (type 12): [2] – 1 ... 8 valve coils – 1 ... 16 valve coils – 1 ... 24 valve coils (22 can be used)	CPA10/14	 8DO / 20_h 16DO / 21_h 24DO / 22_h	 – 	 1 byte/8 O 2 bytes/16 O 3 bytes/24 O
[1] Module identifier in the handheld unit or in the hardware configuration of the programming software [2] Setting with DIL switch in the pneumatic interface [3] Display text (module identifier) dependent on the version of the handheld unit				

Tab. 2/8: Identifiers and address assignment of the pneumatic interface part 3:

MPA pressure sensor and VPPM/MPA	Module identifier	Identifier Siemens/EN 50170	Assigned address space	
			Inputs	Outputs
MPAP pressure sensor module **VMPA-FB-PS-...**	MPA-P	1AI / 50_h	1 word/ 16 I	–
VPPM proportional pressure-regulating valve (type 32) **VPPM-6TA-...**	VPPM	112 / 70_h	1 word/ 16 I	1 word/ 16 O

Tab. 2/9: Identifiers and address assignment of the pneumatics part 4

Special identifier format and groupable identifiers

Configuration is made PROFIBUS-specific byte-by-byte.
By means of a special identifier format, you can group some modules together within a byte. The data volume will then be reduced.

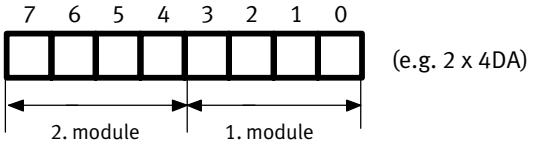


Fig. 2/1: 2 modules grouped together in an identifier byte

You can only group together modules of the same type:

– input modules with input modules

– output modules with output modules

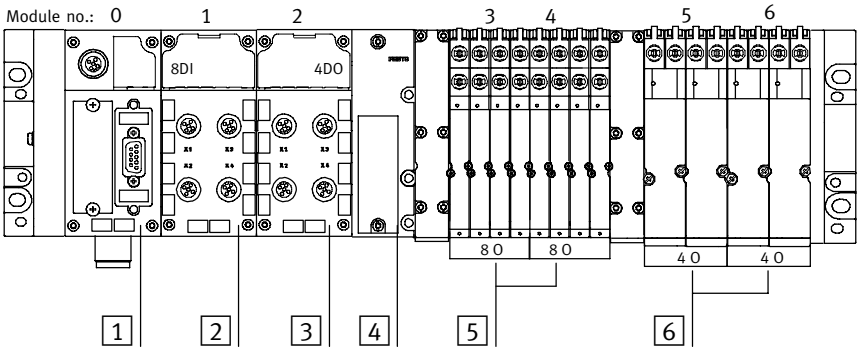
– pneumatic modules of type MPA2 with modules of type MPA2

Between the grouped **electric** modules there may be any other **electric** module types. Further information can be found in the following configuration examples:

Note
Make sure that the modules are correctly grouped together. The project planning software does not make a check.

Configuration examples

Example 1: CPX valve terminal with MPA pneumatics



1 Field bus node CPX-FB13

2 8-input module

3 4-output module

4 Pneumatic interface for MPA pneumatics

5 Valves/MPA1 pneumatic modules

6 Valves/MPA2 pneumatic modules

Fig. 2/2: Example terminal 1 (with MPA1 and MPA2 pneumatics)

Configure the CPX terminal module-by-module from left to right. The following table shows the configuration of the above terminal example:

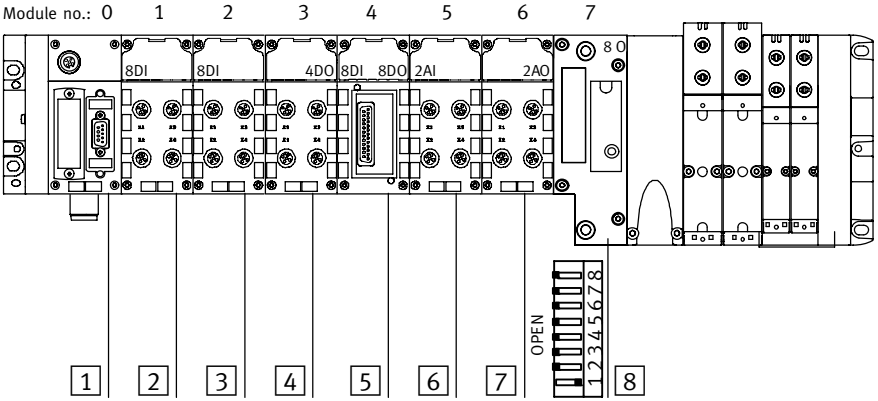
Mod. no.	Module Siemens order number	DP identifier Siemens	DP identifier EN 50170	Explanation
0	Field bus node CPX-FB13: DP slave [status]	64_d	40_h, 00_h	Configured with status bits
1	Digital 8-input module CPX-8DE [8DI]	8DI	10_h	Identifier byte used completely
2	Digital 4-output module CPX-4DA [4DO]x2	8DO	20_h	Only the first 4 bits of the identifier byte are used [1)]
–	MPA pneumatic interface VMPA-FB-EPL-...	–	–	Passive module
3	MPA1 pneumatic module MPA1S: VMPA1-FB-EMS-8 [8DO]	8DO	20_h	MPA1 pneumatic modules without separate power supply circuits. Identifier bytes are used completely.
4	MPA1 pneumatic module MPA1S: VMPA1-FB-EMS-8 [8DO]	8DO	20_h	
5	MPA2 pneumatic module MPA2S: VMPA2-FB-EMS-4 [4DO]x2	8DO	20_h	MPA2 pneumatic module (without separate circuits) Only the first 4 bits are used.
6	MPA2 pneumatic module *MPA2S: VMPA2-FB-EMS-4 [4DO]x0	0	00_h	MPA2 pneumatic module (without separate circuits). The remaining 4 bits of module no. 5 are used.

1) As no output module with groupable identifier is used in the subsequent locations, 8 bits are assigned here, but only 4 are used.

Tab. 2/10: Configuration for example terminal 1

The identifier bytes of locations 5 and 6 are grouped together. The identifier with the star symbol is used in location 6.

Example 2: CPX terminal with VTSA pneumatics



1 Field bus node CPX-FB13

2 Digital 8-input module

3 Digital 8-input module

4 Digital 4-output module

5 Digital multi I/O module

6 Analogue 2-input module

7 Analogue 2-output module

8 Pneumatic interface for CPA pneumatics (with DIL switch set to 1 ... 8 valve coils)

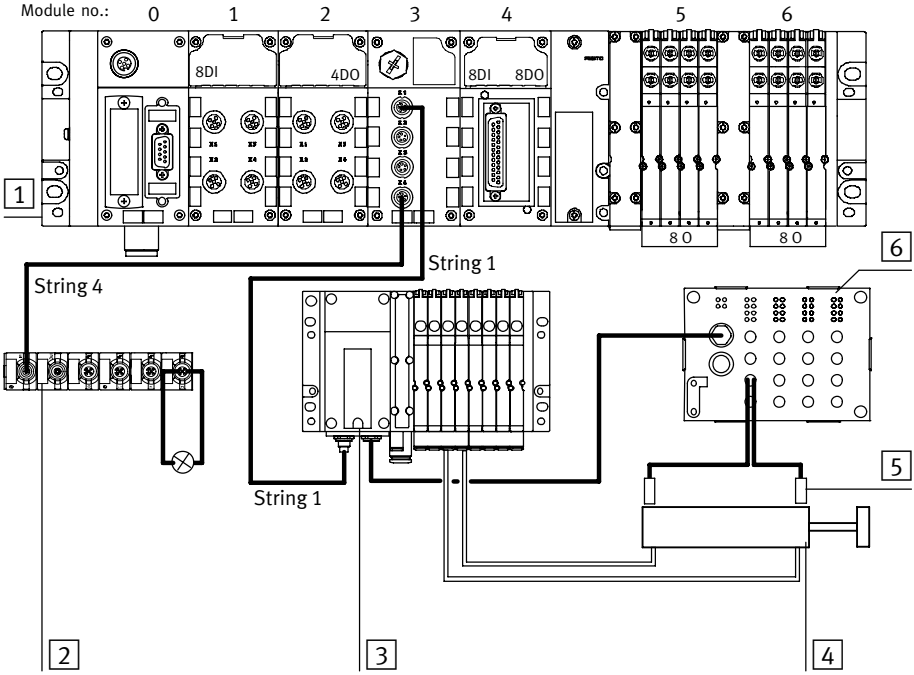
Fig. 2/3: Example terminal 2 (with VTSA pneumatics)

Configure the CPX terminal module-by-module from left to right. The following table shows the configuration of the above terminal example:

Mod. no.	**Module** Siemens order number	**DP identifier Siemens**	**DP identifier EN 50170**	**Explanation**
0	Field bus node CPX-FB13: DP slave [status]	64_d	40_h, 00_h	Configured with status bits
1	Digital 8-input module CPX-8DE [8DI]	8DI	10_h	Identifier byte used completely
2	Digital 8-input module CPX-8DE [8DI]	8DI	10_h	Identifier byte used completely
3	Digital 4-output module CPX-4DA [4DO]x2	8DO	20_h	Only the first 4 bits of the identifier byte are used [1)]
4	Digital multi I/O module CPX-8DE-8DA [8DI/8DO]	8DX	30_h	Identifier byte used completely
5	Analogue 2-input module CPX-2AE-U/I [2AI]	2AI	51_h	–
6	Analogue 2-output module CPX-2AA-U/I [2AO]	2AO	61_h	–
7	VTSA pneumatic interface (DIL switch set to 1 ... 8 valve coils) ISO PlugIn DIL1 [8DO]	8DO	20_h	The pneumatic interface must be configured according to the DIL-switch setting.
1) As no output module with groupable identifier is used in the subsequent locations, 8 bits are assigned here, but only 4 are used.				

Tab. 2/11: Configuration for example terminal 2

Example 3: CPX terminal with CP interface



1 CPX terminal with CP interface (module no. 3)

2 CP-CL output module on CP string 4

3 MPA-CPI valve terminal on CP string 1

4 Cylinder

5 Sensor

6 CP-EL input module

Fig. 2/4: Example terminal 3 (with CP interface)

In the example, the CP interface occupies 4 input bytes and 16 output bytes (see manual for CPX-CP interface, chapter “System overview of CP system”).

Mod. no.	**Module** Siemens order number	**DP identifier Siemens**	**DP identifier EN 50170**	**Explanation**
0	Field bus node CPX-FB13: DP slave [status]	64_d	40_h, 00_h	Configured with status bits
1	Digital 8-input module CPX-8DE [8DI]	8DI	10_h	Identifier byte used completely
2	Digital 4-output module CPX-4DA [4DO]x2	8DO	20_h	Only the first 4 bits of the identifier byte are used [1)]
3	CP interface CPI: 4 bytes I/16 bytes O	192	$C0_h$, $0F_h$, 03_h	CP interface with assignment of 4 input bytes and 16 output bytes
4	Digital multi I/O module CPX-8DE-8DA [8DI/8DO]	8DX	30_h	Identifier byte used completely
5	MPA1 pneumatic module MPA1S: VMPA1-FB-EMS-8 [8DO]	8DO	20_h	MPA1 pneumatic modules without separate power supply circuits. Identifier bytes are used completely.
6	MPA1 pneumatic module MPA1S: VMPA1-FB-EMS-8 [8DO]	8DO	20_h	
1) As no output module with groupable identifier is used in the subsequent locations, 8 bits are assigned here, but only 4 are used.				

Tab. 2/12: Configuration for example terminal 3

2.1.3 Device master file (GSD) and icon files

A Device Master File (GSD) is needed for the configuration and programming of the CPX terminal with a programming device or PC. The GSD contains all the required information for the configuration and adjustment of the CPC terminal using configuration and programming software, e.g. Siemens STEP 7.

Reference sources

Current GSD files can be found on the Festo Internet pages under: www.festo.com/fieldbus

GSD files

You will require one of the following files for the CPX terminal:

- CPX_059E.GSD (German version)
- CPX_059E.GSE (international version)

For some older controllers, the GSD can be too large for the available storage. In this case, you will receive support through the Festo technical hotline. You can reach them by e-mail at: tshq@de.festo.com.

Symbol files

To represent the CPX terminal in your configuration software, you will find symbol files for Festo CPX terminals at www.festo.com/fieldbus: Integration of these symbol files is explained on the following pages:

Normal operating status	**Diagnostic case**	**Special operating status**
		
File: Pb_cpx_n.dib	File: Pb_cpx_d.dib	File: Pb_cpx_s.dib

Tab. 2/13: Icon files for configuration software

Publication date	Support from
December 2008	Identification and maintenance (see section 2.1.6)
July 2008	– Soft-stop end-position controller CPX-CMPX-... – Multi-axis interface CPX-CMXX
May 2008	Pressure sensor VMPA-FB-PS-... and parameters of analogue process value presentation (see section 2.2.4)
April 2007	Analogue input module CPX-4AE-TC
March 2007	Proportional pressure regulator valve VPPM-6TA-...
December 2006	– Digital output module CPX-8DA-H – Digital input module CPX-M-16DE-D
July 2006	– MPA1 and MPA2 electronic modules with diagnosis function D2 – Digital input module CPX-16DE and CPX-8DE-N

Tab. 2/14: History of the GSDs

Note
GSDs are downward compatible. Always use the latest GSD to ensure support of all functions of the CPX-FB13. For some functions, the latest update of the CPX-FB13 is required. You can find information on this in the corresponding sections of this manual.

2.1.4 Configuration with a Siemens master

The following sections describe the basic configuration steps with the Siemens STEP 7 configuration and programming software.

Other controller systems may require other settings or a different procedure. Information on operation with general DP masters can be found in appendix B.1.

The configuration examples shown in this chapter are based on the use of a Siemens SPS SIMATIC S7-300 and the Siemens STEP 7 Version 5.3 configuration and programming software. Operation of the STEP 7 software is assumed to be known in the following.

Note
Various configuration programs are available for use in conjunction with a Siemens master. Observe the corresponding procedure for your configuration program.

Caution
Danger of malfunctions, damage or injuries to people

A valve terminal with defective configuration will also be put into operation. However, only the modules which have been correctly configured for type and position will be activated.

Before commissioning, ensure that the connected elements (e.g. actuators) do not perform any undesired or uncontrollable movements.

If necessary, disconnect the load power supply and compressed air supply.

See also section 2.3, checklist for commissioning

Preparations

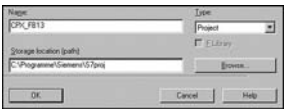
Creating automation project

1. Start the Siemens SIMATIC controller: Start › Programs › SIMATIC › **SIMATIC Manager**.
   (The program path of your SIMATIC controller can be different from the example shown here).

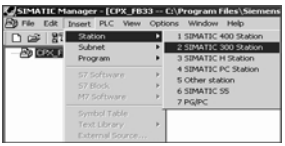
Note
These instructions refer to the English language version of the Siemens SIMATIC controller and the STEP 7 configuration and programming software.

Other language versions usually use other designations for the program and function calls and menu items mentioned here.

2. Create a new project in the SIMATIC Manager:
   [File] – [New] – [New...]



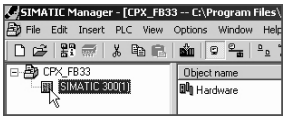
3. Enter a project name (e.g. CPX_FB13) and confirm the input with OK.



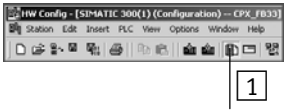
4. Select the controller used (PLC/Master):
   [Insert] – [Station] ... (e.g. SIMATIC 300 Station).

5. Open the project by clicking on the plus symbol (on the left next to the project symbol and the project name).

Setting up the controller system (PLC/Master)



1. Click once on the station symbol (on the left next to the station name) and afterwards double click on the hardware symbol in the “Object name” column.
   The hardware configuration window **HW Config** (Station Configuration) is displayed.



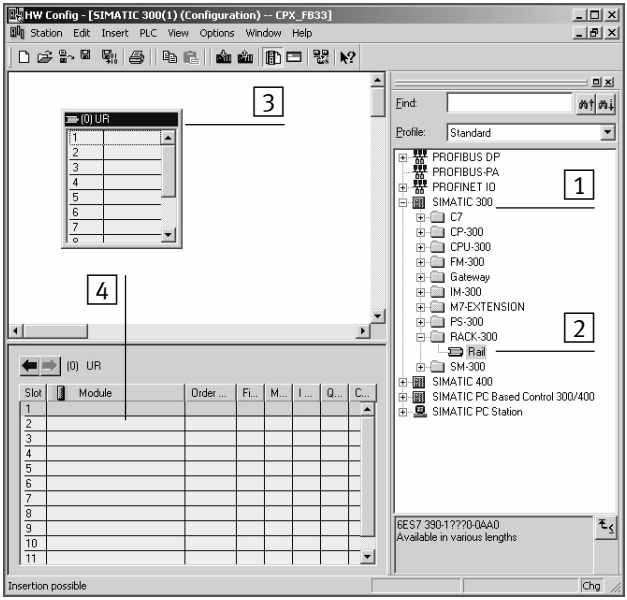
2. Open the Hardware catalogue
   (Catalogue View, 1 in the adjacent screenshot).

3. Select your controller system (PLC/Master) in the Hardware Catalogue (e.g. SIMATIC 300, 1 in Fig. 2/5): Click on the plus symbol in order to expand the selection.

4. Open the rack directory (e.g. RACK-300, 2 in Fig. 2/5).

5. Double click on the rack rail symbol (e.g. RAIL, 2 in Fig. 2/5).
   A child window (with rack rail symbol in the header) opens in the left-hand area of the HW Config window (3 or 4 in Fig. 2/5).

   The child window symbolises the rack rail (profile rail) of your controller system. You compile the individual elements of your controller in this child window and thus form the basis for your PROFIBUS automation system.



1 Select controller system

2 Insert rack rail

3 Set up controller system in the rack rail window

Fig. 2/5: Setting up the controller system (PLC/Master) - inserting rack rail (Rail)

6. Add your CPU and a PROFIBUS system to the hardware configuration:

   – Drag the corresponding catalogue element (symbol) into the Rack Rail window (3 or 4 in Fig. 2/5). Row 1/slot 1 is reserved and cannot be used for the configuration.

– The dialogue window “Properties – PROFIBUS interface” opens: With “New...”, create a PROFIBUS system and, if necessary, edit the “Transmission rate” and “Profile” entries (transmission rate/baud rate and profile) in the “Network Settings” tab.

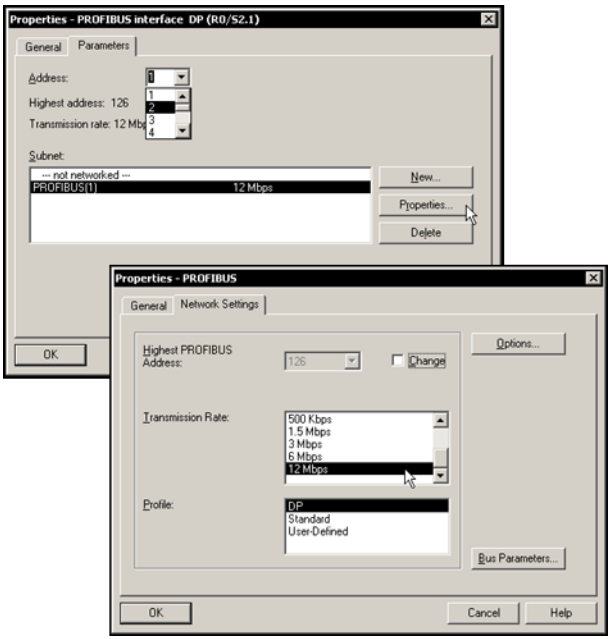


Fig. 2/6: Edit the PROFIBUS properties dialogue window

Install GSD and symbol files

Install the GSD and symbol files in the following steps:

– CPX_059E.GS*

Source and remarks for the selection:
see section 2.1.3.

1. Start the installation function from the STEP 7 menu:
   [Options] – [Install GSD File ...]

2. Update the hardware catalogue from the STEP 7 menu:
   [Options] – [Update Catalog].

All available CPX modules in the hardware catalogue are displayed under PROFIBUS-DP › Additional Field Devices › Valves › Festo CPX Terminal. You can start the selection and configuration of your modules.

Station selection with STEP 7

1. If the hardware catalogue is not open:
   Click on the catalogue icon (see Fig. 2/7 [1]).
   The hardware catalogue will be displayed.

2. In the hardware catalogue, open the folder:
   “PROFIBUS DP › Additional Field Devices › Valves”.
   The Valves folder is displayed when you have installed the GSD (see above).
   Pull the station type “Festo CPX terminal” onto the line of the DP master system [2].
   The “Properties – PROFIBUS interface” dialogue window is displayed [3].

3. Select the PROFIBUS address identical to the selected setting on the DIL switch in the switch module (see section 1.2.2) and close with OK.
   The icon of the valve terminal will be displayed on the line of the DP master system.

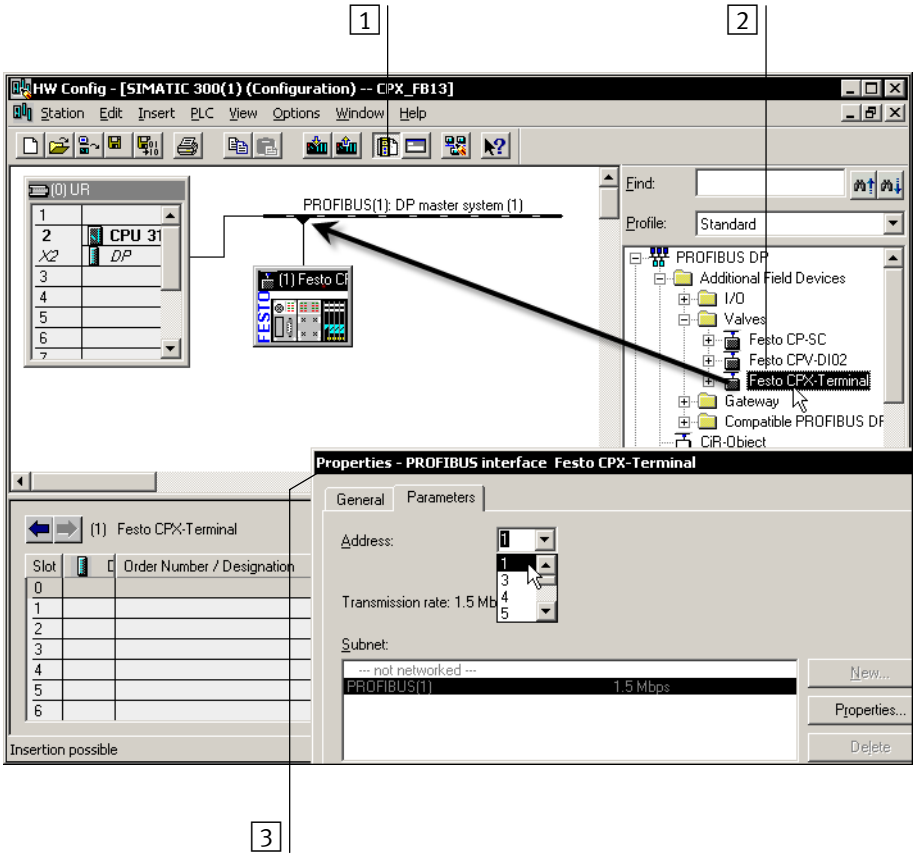


Fig. 2/7: Station selection with STEP 7 – HW Config

Configuration with STEP 7

Assign the configuration table with the modules of your CPX system (see Fig. 2/8):

1. Click on the icon of the valve terminal to be configured in the HW Config [1]. The configuration table will be displayed under the rack [2].
2. In the hardware catalogue, open the module "Festo CPX terminal" (folder in the English version: "PROFIBUS-DP › Additional Field Devices › Valves ›...") [3].
3. Pull the first (left-hand) module of your CPX terminal onto line 0 in the configuration table. Repeat this step with further modules of your CPX terminal. Drag each next module onto the next free line in the configuration table. Assign the starting address in the window "Properties – DP slave" [4].

Note
Drag the modules into the configuration table according to the physical sequence (from left to right) of your CPX terminal.

Modifying the address

1. Double-click on the appropriate line in the configuration table.
2. Modify the starting address of the inputs/outputs in the "Properties – DP slave" window.

Note
With S7-400 controllers, up to 4 bytes of addresses are reserved for each DP identifier, depending on the version status.

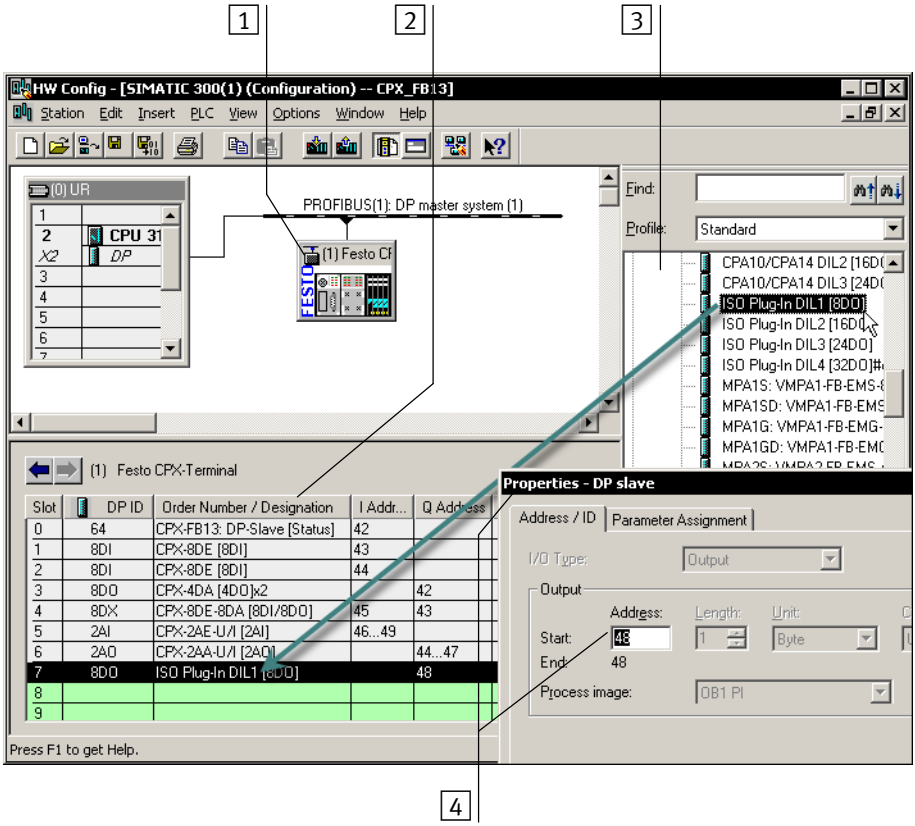


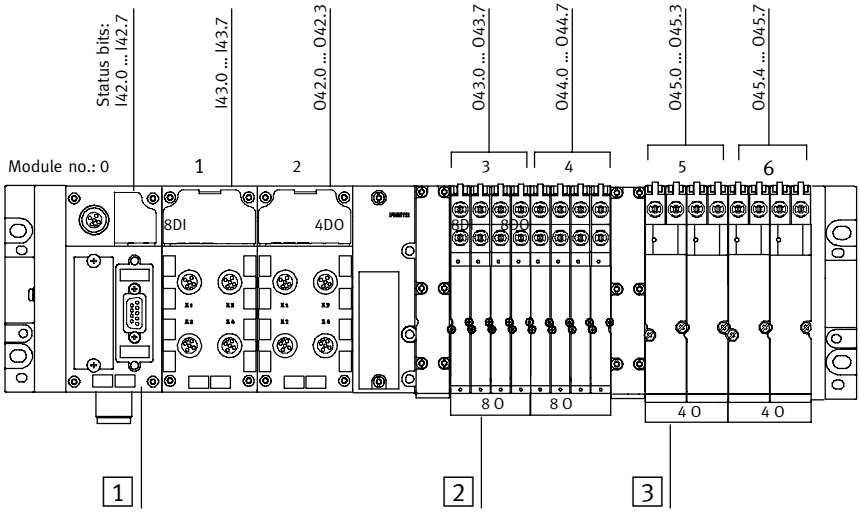
Fig. 2/8: Configuration with STEP7 – Hardware catalogue

This concludes the station selection and configuration.

Examples of addressing

Addressing example 1: CPX valve terminal with MPA pneumatics

Addresses used as from input/output word 42:



1 Field bus node CPX-FB13

2 MPA1 pneumatic modules

3 MPA2 pneumatic modules

Fig. 2/9: Addressing the example terminal 1 (see also Fig. 2/2)

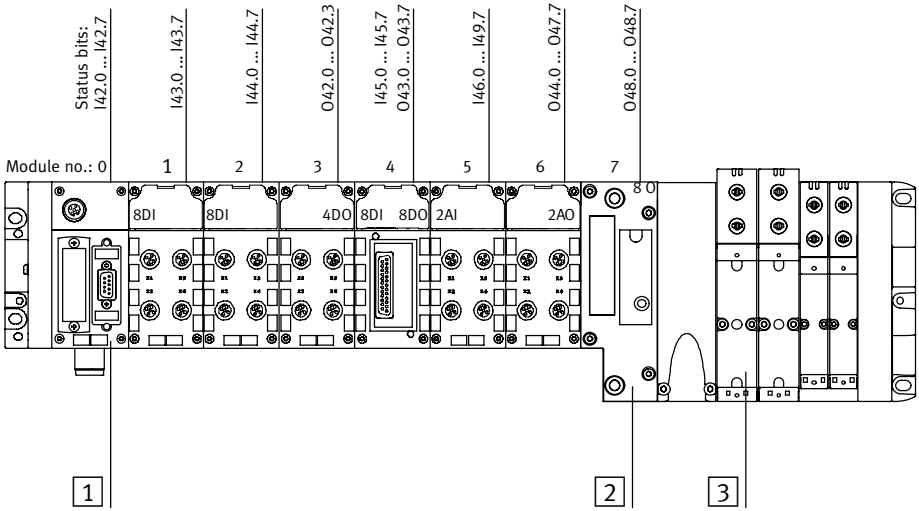
Location	Module	DP identifier Siemens	Input address	Output address
0	Field bus node CPX-FB13: DP slave [status]	64	42	–
1	Digital 8-input module CPX-8DE [8DI]	8DI	43	–
2	Digital 4-output module CPX-4DA [4DO]x2	8DO	–	42
–	MPA pneumatic interface [1] VMPA-FB-EPL-...	–	–	–
3	MPA1 pneumatic module MPA1S: VMPA1-FB-EMS-8 [8DO]	8DO	–	43
4	MPA1 pneumatic module MPA1S: VMPA1-FB-EMS-8 [8DO]	8DO	–	44
5	MPA2 pneumatic module MPA2S: VMPA2-FB-EMS-4 [4DO]x2	8DO	–	45
6	MPA2 pneumatic module *MPA2S: VMPA2-FB-EMS-4 [4DO]x0	0	–	(45) [2]

[1] Passive module
[2] Occupies bits 4 ... 7 of output byte 45 automatically

Tab. 2/15: Input and output addresses for example terminal 1 (see Fig. 2/9)

Addressing example 2: CPX terminal with VTSA pneumatics

Addresses used as from input/output word 42:



1 Field bus node CPX-FB13

2 Pneumatic interface

3 VTSA pneumatics

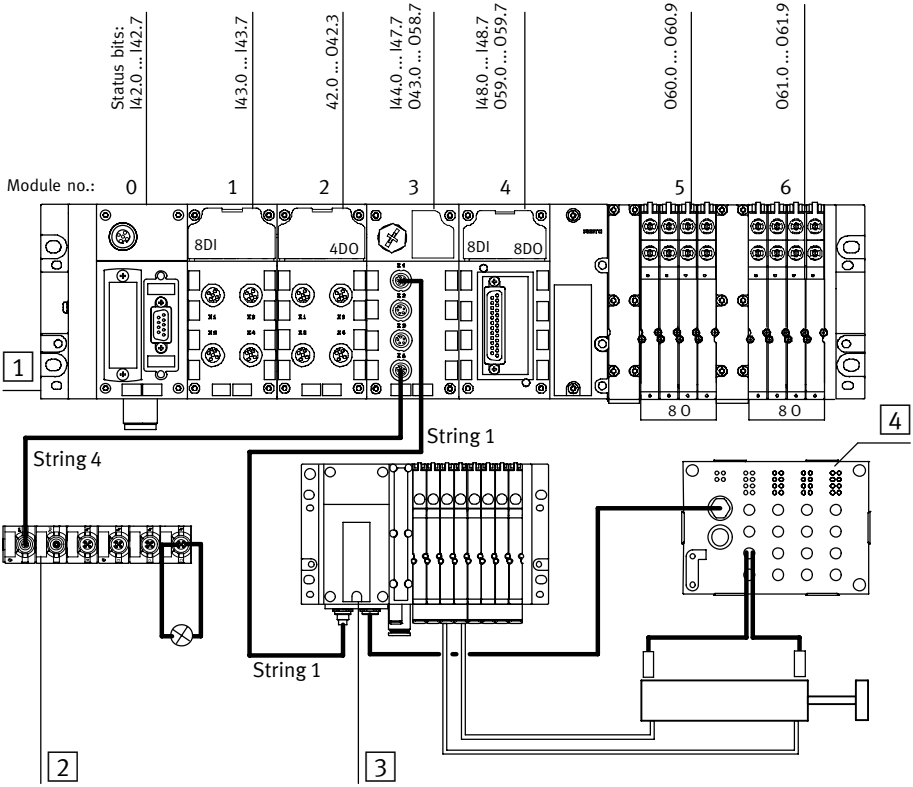
Fig. 2/10: Addressing the example terminal 2 (see also Fig. 2/3)

Location	Module	DP identifier Siemens	Input address	Output address
0	Field bus node CPX-FB13: DP slave [status]	64	42	–
1	Digital 8-input module CPX-8DE [8DI]	8DI	43	–
2	Digital 8-input module CPX-8DE [8DI]	8DI	44	–
3	Digital 4-output module CPX-4DA [4DO]x2	8DO	–	42 [1)]
4	Digital multi I/O module CPX-8DE-8DA [8DI/8DO]	8DX	45	43
5	Analogue 2-input module CPX-2AE-U/I [2AI]	2AI	46 ... 49	–
6	Analogue 2-output module CPX-2AA-U/I [2AO]	2AO	–	44 ... 47
7	VTSA pneumatic interface ISO PlugIn DIL1 [8DO]	16DO	–	48
[1)] Bit 4 ... 7 occupied, but not used				

Tab. 2/16: Input and output addresses for example terminal 2 (see Fig. 2/10)

Addressing example 3: CPX terminal with CP interface

Addresses used as from input/output word 42:



1 CPX terminal with CP interface (module no. 3) and MPA pneumatics

2 CP-CL output module at CP string 4 (last string used for outputs; therefore 16 byte outputs)

3 MPA-CPI valve terminal on CP string 1

4 CP-CL input module at CP string 1 (last string used for inputs; therefore 4 byte inputs)

Fig. 2/11: Addressing the example terminal 3 (see also Fig. 2/4)

Location	Module	DP identifier Siemens	Input address	Output address
0	Field bus node CPX-FB13: DP slave [status]	64	42	–
1	Digital 8-input module CPX-8DE [8DI]	8DI	43	–
2	Digital 4-output module CPX-4DA [4DO]x2	8DO	–	42
3	CP interface CPI: 4 bytes I/16 bytes O	192	44 ... 47	43 ... 58
4	Digital multi I/O module CPX-8DE-8DA [8DI/8DO]	8DO	48	59
–	MPA pneumatic interface [1)] VMPA-FB-EPL-...	8DO	–	–
5	MPA1 pneumatic module MPA1S: VMPA1-FB-EMS-8 [8DO]	8DO	–	60
6	MPA1 pneumatic module MPA1S: VMPA1-FB-EMS-8 [8DO]	8DO	–	61
[1)] Passive module				

Tab. 2/17: Input and output addresses for example terminal 3 (see Fig. 2/11)

2.1.5 Configuration in the Remote Controller operating mode

If there is an FEC in your CPX terminal, you can operate the field bus node in the “Remote Controller” operating mode. The field bus node occupies 8 bytes of inputs and 8 bytes of outputs. These are available for the control program in the FEC.

Configuration in the Remote Controller bus node operating mode

1. Make sure that DIL switch DIL 1.1 of the bus node is in the remote controller position (DIL 1.1 = ON, DIL 1.2 = OFF; see Tab. 1/1).
2. Carry out the station selection (see section 2.1.4).
3. Drag module “CPX-FB13: Remote Controller Mode” onto line 0 of the configuration table (see diagram below).

   The field bus node is thus configured as Remote Controller.

   Use of Festo Software Tools Version 4 (FST 4) is required (see step 4.) to configure the CPX-FEC and CPX terminal.
4. Configure the CPX terminal with the Festo Software Tools FST 4 via the CPX-FEC.

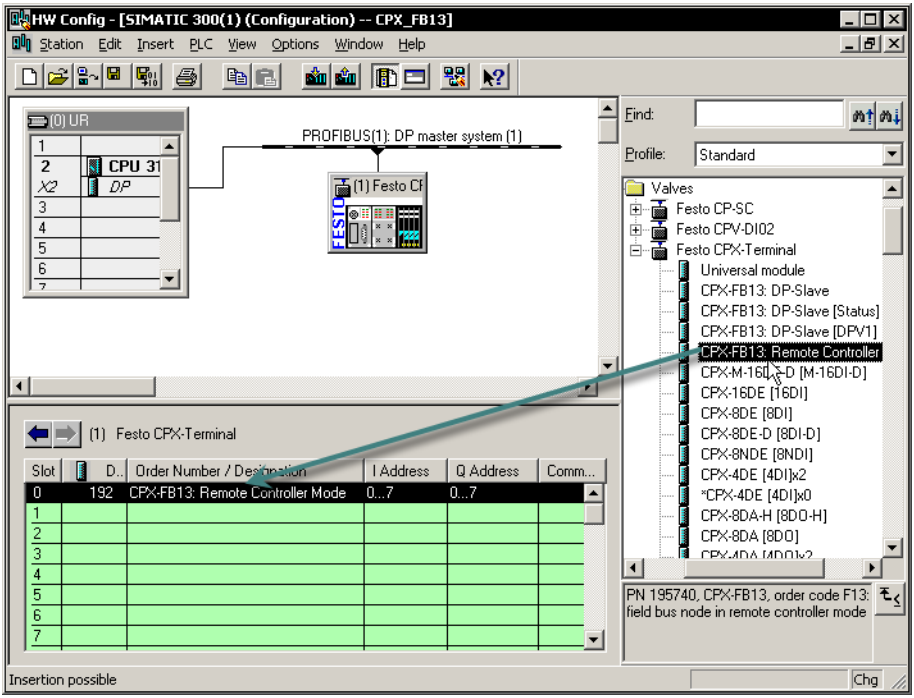


Fig. 2/12: “Remote Controller” operating mode: Configuration with STEP 7 – Hardware catalogue

2.1.6 Identification and Maintainance

The I&M function (Identification and Maintenance) serves as an electronic nameplate of the CPX-FB13 and offers uniform, manufacturer-independent access to device-specific online information via the internet.

Note
At least a CPX-FB13 with “Rev 24” update is necessary to use the Identification and Maintenance function. If a field bus node with an earlier version is used, the following fault message is displayed.

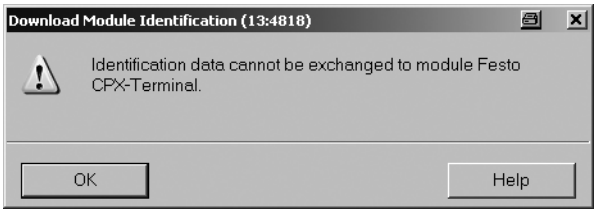
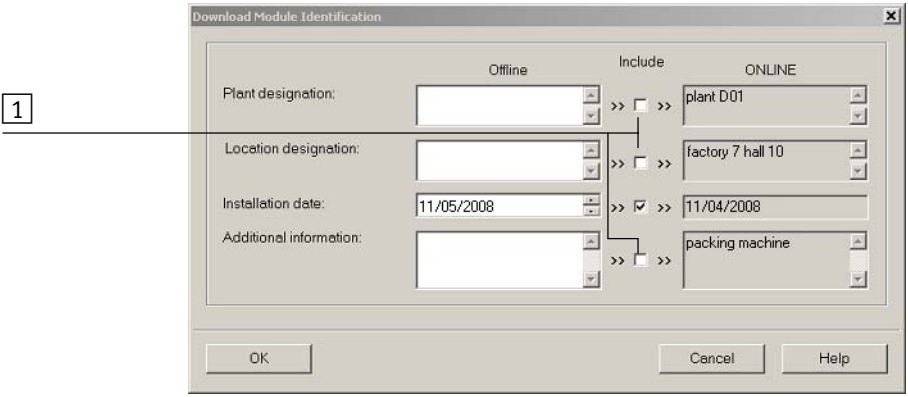


Fig. 2/13: Fault message with field bus nodes with versions earlier than Rev 24

Load identification properties in the field bus nodes

1. Click on [Download Module Identification...] in the [PLC] menu (Target system – Load module identification) The window “Download Module Identification” is displayed.
2. Enter your identification properties in the fields under “Offline” (examples, see Fig. 2/14).
3. Activate the checks under “Include” (Consider) only where you wish to load data into the field bus node. Deactivate checks where the “ONLINE” filed already contains correct data; otherwise, they will be overwritten!
4. Confirm with OK.



1 Deactivate checks so that ONLINE fields that have already been filled out are not overwritten

Fig. 2/14: Load identification data in the field bus nodes

Look at identification properties

1. Click on [Module Information...] in the [PLC] menu (Target system – Module status).
   The window “Module Information” (component status) is displayed.

2. In the “General” tab, you will find the hardware version and the software/firmware status of the field bus node (see Fig. 2/15).

3. You will find further information, such as manufacturer’s specification, in the “Identification” tab (see Fig. 2/16).

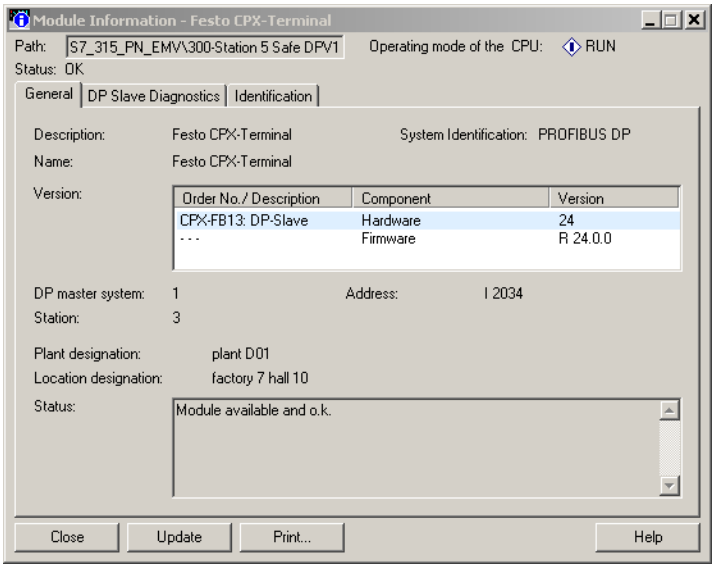


Fig. 2/15: Look at identification data ansehen, “General” tab

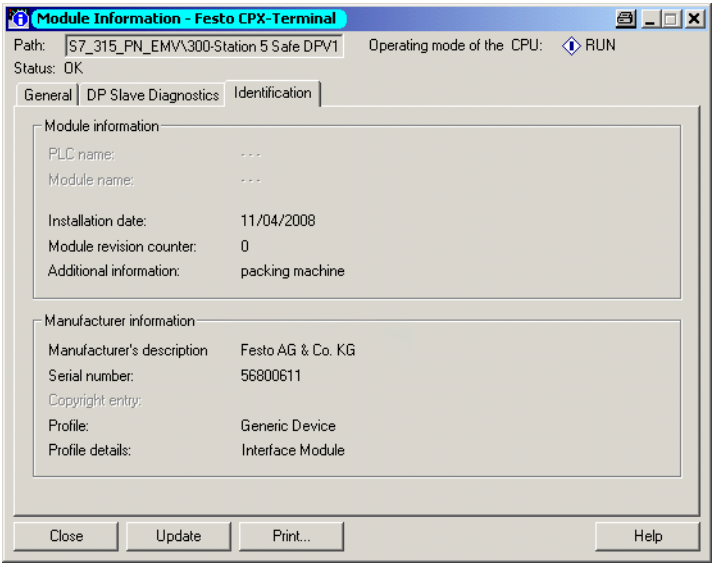


Fig. 2/16: Look at identification data, “Identification” tab

2.2 Parameterisation

You can set the reaction of the CPX terminal individually by parameterisation. A distinction is made between the following parameterisations:

– System parameterisation, e.g.: switching off fault messages, etc.

– Parameterisation of the diagnostics memory

– Module parameterisation (module and channel-specific), e.g.: monitoring, settings in the event of faults, settings for the debounce times of the inputs.

A detailed description of the individual parameters as well as basic information about application can be found in the CPX system manual (P.BE-CPX-SYS-...).
Parameter lists for CPX I/O modules and CPX pneumatic interfaces can be found in the manual for the CPX I/O modules (P.BE-CPX-EA-...).

2.2.1 Parameterisation when switching on

1 Master loads parameter set into the node

2 Node distributes parameter set to the modules

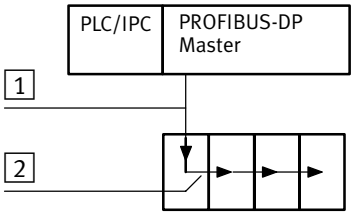


Fig. 2/17: Sequence of the start parameterisation

When the field bus system is switched on, the CPX terminal is parameterised as “Start parameterisation” by parameter set 1 saved in the PROFIBUS master. The field bus node then distributes the parameters by module to the CPX modules 2.

Note

The number of start parameters is limited, depending on the software version of the CPX-FB13.
Pay attention to the behaviour of the CPX-FB13:

– Up to and including software version 15:
  A maximum of 172 start parameters are possible. If the maximum number is exceeded, **no** fault message will be issued. The CPX terminal does **not** start and the BF LED flashes. Therefore, check the Start parameterisation before commissioning.
– Starting with software version 22:
  A maximum of 224 start parameters are possible. If the maximum number is exceeded, the configuration cannot be loaded into the field bus node. A fault message is output (see Fig. 2/18).

A list of the possible Start parameters can be found in appendix A.2.

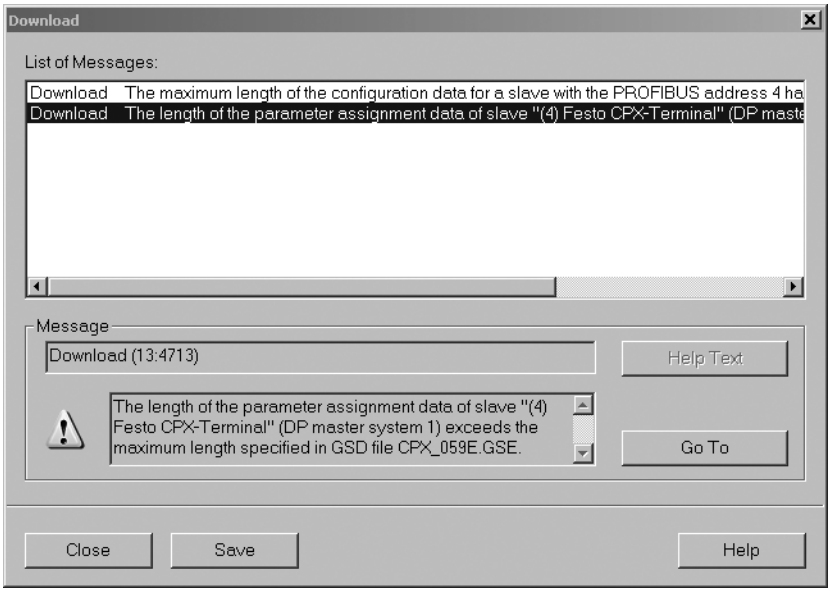


Fig. 2/18: Fault message when the maximum number of Start parameters is exceeded (CPX-FB13 from version 22), note the appendix A.2 “Start parameters”

➔

Note
After each interruption of the field bus system (e.g. after interruption of the power supply to the field bus node), the parameter set will be sent again by the PROFIBUS master to the field bus node.

An exchange of individual CPX modules is therefore possible, without the need for new manual parameterisation.

2.2.2 Parameterising the CPX terminal with STEP 7

System parameters

1. Double click on the icon of the CPX terminal on the line of the DP master system (see Fig. 2/19 [1]). The dialogue window “Properties – DP slave” is displayed [2].
2. Select the “Parameter Assignment” tab [3]. The list with the parameters and the currently active values is shown.
3. Click on the parameter value which you wish to modify. A list with the possible values is opened [4].
4. Modify the value by clicking it and confirm this with OK.

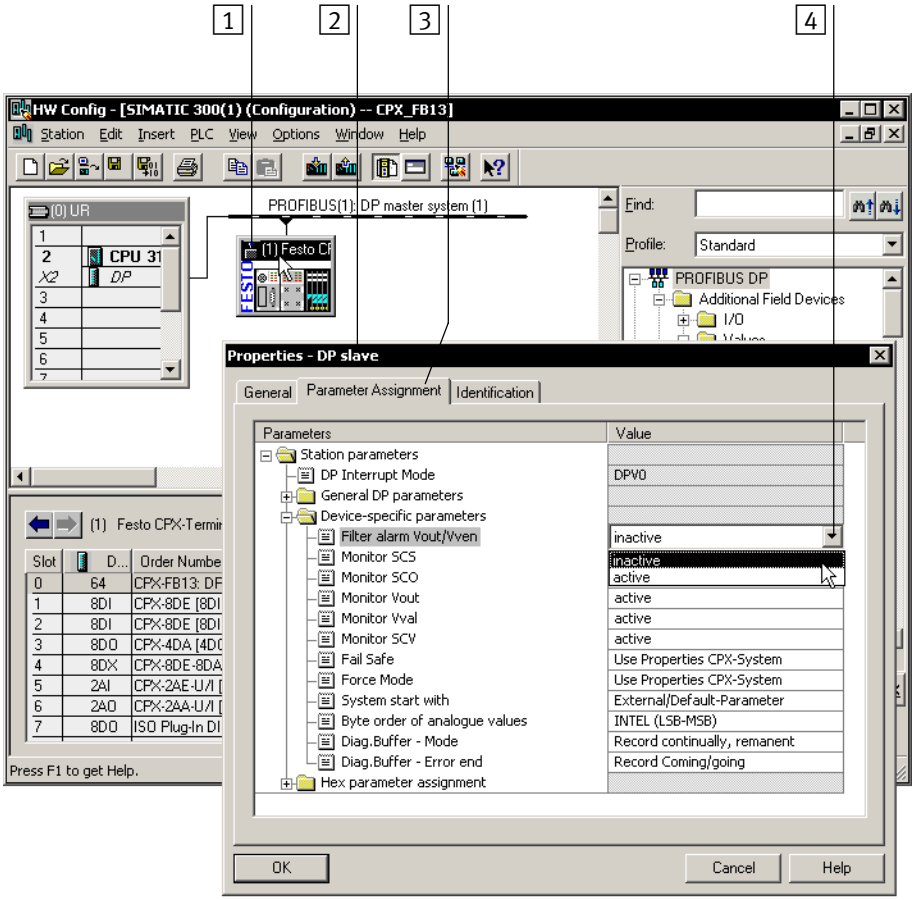


Fig. 2/19: Setting system parameters with STEP 7

Parameterising the diagnostic memory

A maximum of 40 diagnostic messages can be saved in the diagnostic memory. With the HW Config, DPV1 or the handheld, you can parameterise the way in which the messages are to be saved.

1. Click on the value of the parameter “Diag.Buffer – Mode” or “Diag.Buffer – Error End”
   A list with the possible values will be opened.

2. Modify the value as follows and confirm this with OK.

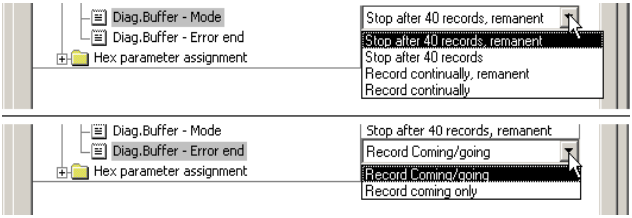


Fig. 2/20: Parameterising the diagnostic memory with STEP 7

Possibilities for parameterising the diagnostic memory mode

– “Stop after 40 records...”:
  The first 40 diagnostic messages are saved, but after that no further messages are saved.

– “Record continually...”:
  Continuous saving of the diagnostic messages. After the 40th message, the oldest message will be overwritten.

There are two ways in which the diagnostic messages can be saved:

– “... remanent”:
  The diagnostic messages remain saved when the operating voltage is switched off or after a power failure.

– without “remanent”:
  The diagnostic messages will be lost when the operating voltage is switched off or after a power failure.

Possibilities for parameterising the fault end filter of the diagnostic memory

You can parameterise whether a rectified fault (“Outgoing fault”) is to be recorded in the diagnostic memory.

– “Record Coming/going”:
  When a fault occurs and is eliminated, the fault number and the time of the event are recorded.

– “Record coming only”:
  Only when a fault occurs, the fault number and the time of the event are recorded. If the fault is eliminated, the time of the event will not be recorded.

Module parameters

1. Double click in the configuration table on the line of the module which you wish to parameterise [1]. The dialogue window “Properties – DP slave” is displayed.

2. Proceed further as described above under “System parameters” in steps 3 and 4.

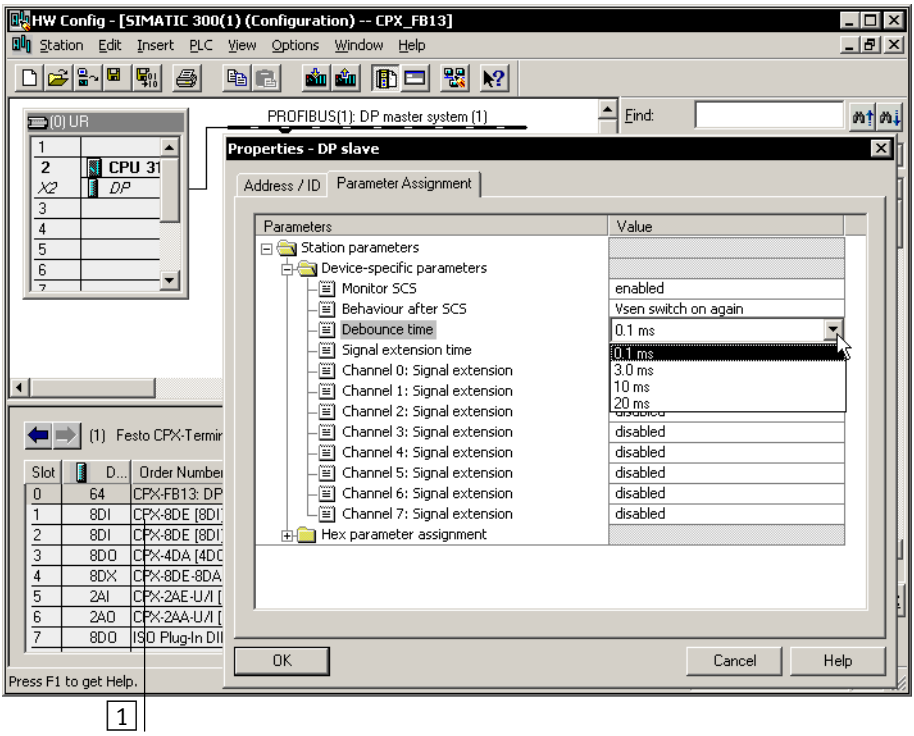


Fig. 2/21: Module parameterisation with STEP 7

Note
Module parameters can refer to:
– properties of the complete module
– properties of an individual channel of a module.

2.2.3 Parameterisation with the handheld

The handheld provides menu-guided access to the parameterisation of the CPX terminal without configuration software.

If the handheld has write access to the parameters, you can no longer parameterise via the bus:

– System parameters

– Module parameters

Diagnostic memory parameters can still be parameterised via the bus.

The value “Use CPX system settings” with the system parameters for Fail Safe or Force Mode (see Fig. 2/19) means: The value of these parameters will not be modified when the field bus system is switched on. Values already set with the handheld or via DPV1 are retained.

Information about operating the handheld can be found in the manual for the handheld P.BE-CPX-MMI-1-...

2.2.4 Field bus node CPX-FB13

Device-specific parameters	Description/setting possibilities
– Monitor SCS – Monitor SCO – Monitor V_{OUT} – Monitor V_{VAL} – Monitor SCV – Fail Safe – Force Mode – Diag.Buffer – Mode – Diag.Buffer – Error End – System start with external default parameters or saved parameters	Standard CPX parameter; for further information, see CPX system manual
Filter diagnosis message V_{OUT}/V_{VAL}	Special parameter for the CPX-FB13 Setting options: – inactive: Undervoltage is reported over the field bus – active: Undervoltage is filtered and **not** reported over the field bus; the undervoltage is merely displayed through flasing of the SF LED on the CPX-FB13.
Analogue process value presentation	Special parameter for the CPX-FB13 for setting the presentation of process values of the analogue modules. Setting options: – Byte sequence INTEL (LSB-MSB, factory setting): Process values are presented in the Intel format (lowest value bit to the left, highest value bit to the right) – Byte sequence MOTOROLA (MSB-LSB): Process values are presented in the Motorola format (highest value bit to the left, lowest value bit to the right) If your control system has to use this byte sequence, you must take this into account accordingly, e.g. in your user programs. This parameter can also be set via the I/O diagnostic interface with the function number 4402 bit 7.

Tab. 2/18: Device-specific parameters of the CPX-FB13

Note
When using the “Filter diagnosis message V_{OUT}/V_{VAL}” and “Analogue process value presentation” parameters, pay attention to the required modification of the CPX-FB13 in the following table.

If you use a field bus node with a version earlier than required together with a current GSD, the parameters are displayed in STEP 7, but they have no effect.

Parameters	**Required version CPX-FB13**
Filter diagnosis message V_{OUT}/V_{VAL}	Rev 24
Analogue process value presentation	Rev 23

Tab. 2/19: Required version of the CPX-FB13 for use of parameters

2.2.5 Application example for parameterisation

1 Input for 1st sensor (with default parameterisation)

2 Parameterised input for 2nd sensor (see text)

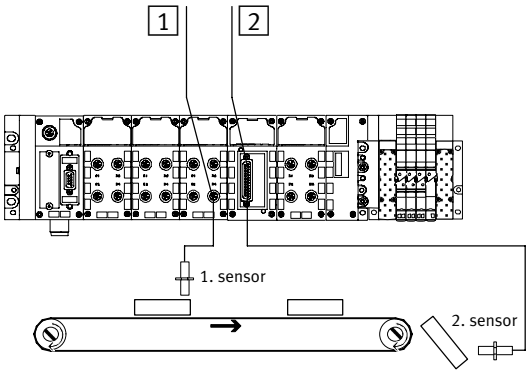


Fig. 2/22: Application example for parameterisation of input debounce time and signal extension time on the 2nd sensor

In the above application, packages are transported on a fast-moving conveyor belt.

For improvement of signal recording and processing, the input for the 2nd sensor is parameterised as follows:

– Reduction of the input debounce time from 3 ms (factory setting) to 0.1 ms: Recording shorter signals is possible. This parameter is set for the complete module.

– Signal extension time set to 50 ms: Reliable recording of the signals by the controller.
The value of this parameter is set for the complete module, but must be activated/deactivated separately for each input channel.

2.3 Checklist for commissioning the CPX terminal with FB13

Recommendation:
If the safety concept of your machine/system permits, commission the CPX terminal with all operating voltages – but without compressed air. You can then test the CPX terminal without triggering undesired reactions.

Caution
The CPX terminal with field bus node for PROFIBUS-DP also starts with incomplete configuration.

- Check the configuration and address assignment of the I/Os on the CPX terminal. In order to do this, you can, if necessary, force the I/Os (see CPX system manual P.BE-CPX-SYS-...).
- An incomplete configuration will be displayed with the diagnostics LED of the controller and in the online diagnostics of your configuration software.

- Please observe the general commissioning instructions in the CPX system manual.
- Make sure that the desired parameterisation of the CPX terminal in the initialization phase or after field bus interruptions is carried out by the module. This is to ensure that if the CPX terminal is replaced, the new terminal will also be operated with the desired parameter settings.
- Use spot checks if necessary to check the parameterisation, e.g. with the configuration program or with the handheld.
- Check the DIL switch settings and the field bus configuration before using and replacing CPX terminals.

Please also observe the switching-on instructions in the manual for your controller.

Faultless commissioning, normal operating status

After faultless commissioning, the LEDs PS (Power System) and PL (Power Load) light up green.
nformation on the other LEDs for diagnosis and fault treatment can be found in chapter 3 of this manual and in the CPX system manual (P.BE-CPX-SYS-...).

LED	Colour	Operating status	Fault treatment
PS 	green lights up	normal	none
PL 	green lights up	normal	none
BF 	LED is off	normal	none

Tab. 2/20: Normal operating status of the CPX terminal

Diagnosis

Chapter 3

Contents

3.1 Overview of diagnostic possibilities

The following possibilities for diagnosis and error handling are available, depending on the configuration:

Diagnostic option	Brief description	Advantages	Detailed description
LED display	The LEDs directly show configuration faults, hardware faults, bus faults, etc.	Fast “on-the-spot” recognition of faults	Section 3.2
Status bits	Internal inputs which supply coded common diagnostic messages. The 8 status bits are transmitted to the module as “inputs” cyclically with the normal inputs.	Fast access to fault messages in the PLC user program, irrespective of the module and master	Section 3.3
I/O diagnostic interface	Bus-independent diagnostic interface at I/O level which enables access to the internal data of the CPX terminal (16 inputs and 16 outputs)	Read access to internal parameters and data at I/O level	CPX system description
Diagnostics via the handheld unit	Diagnostic information can be shown on the handheld unit in a user-friendly manner by means of menus.	Fast “on-the-spot” recognition of faults without programming in clear text	Manual for the handheld unit (P.BE-CPX-MMI-1-...)
Diagnosis via PROFIBUS-DP	Diagnosis as per PROFIBUS standard	Detailed module-related and channel-related fault recognition in the online mode of the programming/ configuration software and in the PLC user program	Section 3.5
Diagnosis via PROFIBUS DPV1	Access to all system data of the CPX terminal via the field bus	Extended access to diagnostic data in the PLC user program (e.g. diagnostic memory)	Appendix A.3

Tab. 3/1: Overview of the diagnostic options of the CPX terminal

Note
Note that the diagnostic information shown can depend on the settings (see section 1.2.2) as well as on the parameterisation (see section 2.2) of the CPX terminal.

3.2 Diagnostics via LEDs

The LEDs on the cover indicate the operating status of the CPX field bus node.

1 LED BF:
Bus fault/status
(red)

2 LEDs for system diagnosis:
PS: Power system (green)
PL: Power load (green)
SF: System fault (red)
M: Modify (yellow)

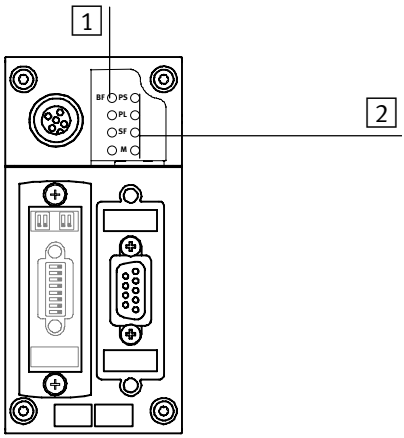


Fig. 3/1: LEDs of the CPX node

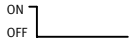
3.2.1 Fault displays of the bus fault/status LED BF

If the device-related diagnosis is activated, faults will also be sent to the master PLC via the field bus.

The LEDs are shown in their various states as follows:

 lights up;  flashes; ◯ out

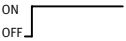
BF (Bus fault)

LED (red)	Process	Status	Fault treatment
◯ LED is off		No fault (if the green PS LED lights up)	–
 LED flashes		Field bus connection not OK. Possible causes: – Station number not correct (e.g. address assigned twice) – Defective field bus module – Interrupted, short-circuited or faulty field bus connection – Faulty configuration	Check the ... • address setting of the DIL switches in the field bus node • field bus module/master • field bus connection • configuration of the master with regard to the modules of the CPX terminal

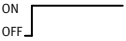
Tab. 3/2: Fault diagnosis with the red LED “BF”

3.2.2 Fault displays of the LEDs for system diagnosis PS, PL, SF, M

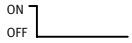
PS (power system) – power sensor/logic supply

LED (green)	Process	Status	Fault treatment
 LED lights up		No error. Operating voltage/sensor supply applied	–
 LED flashes		Operating voltage/sensor supply outside the tolerance range	1. Eliminate short circuit/overload 2. Dependent on the parameterisation: • The sensor supply voltage will be switched on again **automatically** after the short circuit has been eliminated (default) • Power Off/On is necessary
 LED is off		The operating voltage/ sensor supply is not applied	Check the operating voltage connection of the electronics

PL (Power Load) – power load supply (outputs/valves)

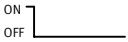
LED (green)	Process	Status	Fault treatment
 LED lights up		No error. Load voltage applied	None
 LED flashes		Load voltage outside the tolerance range.	1. Eliminate undervoltage 2. Dependent on the parameterisation: • The load voltage supply will be switched on again **automatically** after the undervoltage has been eliminated (default) • Power Off/On is necessary

Tab. 3/3: Fault diagnostics using the LEDs PS and PL

SF (System Fail) – system fault			
LED (red)	**Process**	**Status**	**Meaning / error handling**
LED is off		No error	–
LED flashes once		Simple fault/information (error class 1)	See description of fault numbers in the CPX system manual
LED flashes twice		Error (error class 2)	
LED flashes three times		Serious fault (error class 3)	
The system error LED flashes depending on the class of error which has occurred. Error class 1 (minor error): 1 * flash, pause Error class 2 (error): 2 * flash, pause Error class 3 (serious error): 3 * flash, pause			

Tab. 3/4: Fault diagnostics using the SF LED

M (modify) – parameterisation modified or Force active

LED (yellow)	Process	Status	Meaning / error handling
○ LED is off		System start with default parametrizing (factory setting) and current CPX equipment status is set; external parameterisation is possible (pre-setting).	None
 LED lights up		System start with saved parameterisation and saved CPX expansion has been set; parameters and CPX equipment status are saved remanently; external parameterisation is blocked [1]	Be careful when replacing CPX valve terminals with saved parameterisation. With these CPX valve terminals, parameterisation is not carried out automatically by the higher-order PLC/IPC when the terminal is replaced. In these cases, check before replacing to see which settings are required and, if necessary, carry out these settings.
 LED flashes		Force is active [1]	The Force function is enabled (see system parameter Force mode; function no. 4402, Tab. A/8 in the appendix).

[1] The display of the Force function (LED flashes) has priority over the display of the setting for the system start (LED lights).

Tab. 3/5: Messages of the LED M

3.3 Diagnostics via status bits

The CPX terminal provides 8 status bits if you have configured it with the option “FB13: DP slave system status”.
The status bits are used for displaying common diagnostics messages (global error messages). The status bits are configured like inputs; you can select the address freely during the configuration.
If all status bits supply a 0-signal, no fault will be registered.

Bit	Diagnostic information with 1-signal	Description
0	Fault at valve	Module type in which a fault has occurred.
1	Fault at output	
2	Fault at input	
3	Fault on analogue module/ technology module	
4	Undervoltage	Type of error
5	Short circuit/overload	
6	Wire fracture	
7	Other error	

Tab. 3/6: Status bits of the CPX FB13 (optional)

3.4 Diagnostics via the I/O diagnostic interface (STI)

The CPX terminal provides a 16-bit I/O diagnostic interface if you have configured it with the option “FB13: DP slave system diagnosis”. Further information can be found here:

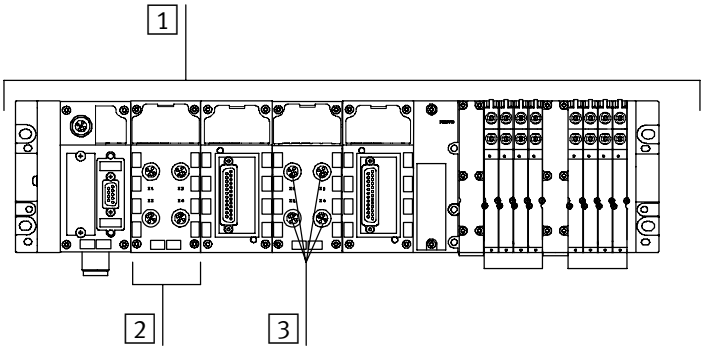
– in the appendix A.3 “Access to the CPX terminal via DPV1”

– in the CPX system manual P.BE-CPX-SYS-... in the chapter “Diagnosis and eliminating faults”.

3.5 Diagnosis via PROFIBUS-DP

The CPX terminal supports the following diagnostic possibilities via PROFIBUS as per EN 50170:

- Device-related diagnosis:
  Status message (see section 3.7.2)
- Module-related diagnosis (see section 3.5.4):
  One bit is reserved per module for displaying a diagnosis.
- Channel-related diagnosis (see section 3.5.5):
  - module number
  - channel number and type
  - type of diagnosis (fault number).



1 Device-related diagnosis

2 Module-related diagnosis

3 Channel-related diagnosis

Fig. 3/2: Diagnosis possibilities

3.5.1 Diagnosis steps

The following diagram shows the necessary steps which are useful for diagnosing the CPX terminal.

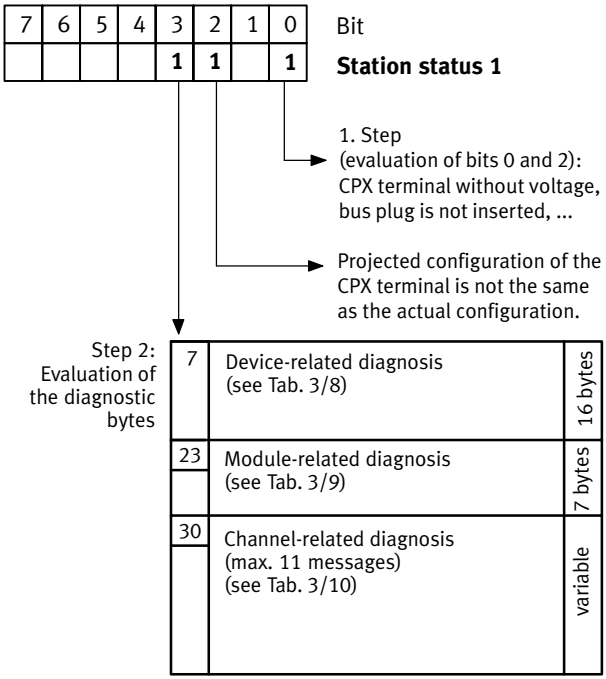


Fig. 3/3: Diagnosis steps

Note
The diagnostic information is sent to the master system only if the device-related diagnosis has been activated with the DIL switch.
In order to do this, set switch element 8 of the 8-element DIL switch to “ON”.

In order to commission your system, it may be useful in some cases to switch off the device-related diagnosis. If your controller does not start, try with the setting “Device-related diagnosis inactive” on the 8-element DIL switch (see section 1.2.2).

3.5.2 Overview of the diagnostic bytes

In the following the diagnostic bytes are represented in four tables.

Standard diagnostic information		
Byte	**Contents**	**Explanation**
1	**Station status 1**	see Tab. 3/11
2	**Station status 2**	see Tab. 3/12
3	**Station status 3**	see Tab. 3/13
4	Diag.Master_add	Master address: The address of the master that parameterised the CPX terminal is entered in this byte
5	Ident_number high byte	Manufacturer identifier high byte (05_h)
6	Ident_number low byte	Manufacturer identifier low byte ($9E_h$)

Tab. 3/7: Diagnostic bytes 1 ... 6: Standard diagnostic information

Device-related diagnosis (16 bytes), (module status DPV1)		
Byte	**Contents**	**Explanation**
7	Header	With CPX terminal fixed 10_h
8	Type	With CPX terminal fixed 82_h
9	Slot	With CPX terminal fixed 0_h
10	Slot	With CPX terminal fixed 0_h
11	Module 0 (bits 1 and 2) ... Module 3 (bits 6 and 7)	2 bits per module: 00 = no fault (valid useful data) 01 = module fault (invalid useful data) 10 = incorrect module (invalid useful data) 11 = module failed or does not exist (invalid useful data)
12	Module 4 ... 7	Like byte 11
13	Module 8 ... 10 (bits 6 and 7 are reserved)	Like byte 11
14 ... 22	Reserved	–

Tab. 3/8: Diagnostic bytes 7 ... 22: Device-related diagnosis (fixed at length of 16 bytes)

Module-related diagnosis (7 bytes)		
Byte	**Contents**	**Explanation**
23	Header	With CPX terminal fixed 47_h
24	Module-related diagnosis module 0 ... 7	Relative module has diagnostic message
25	Module-related diagnosis module 8 ... 10	Relative module has diagnostic message
26 ... 29	Reserved	–

Tab. 3/9: Diagnostic bytes 23 ... 29: Module-related diagnosis (details in section 3.5.4)

Channel-related diagnosis (variable length)		
Byte	**Contents**	**Explanation**
30	Channel-related diagnostic module x byte 1	Contains module number
31	Channel-related diagnostic module x byte 2	Channel number and input/output
32	Channel-related diagnostic module x byte 3	Fault type and channel type
33	Channel-related diagnostic module x byte 1	Contains module number
34	Channel-related diagnostic module x byte 2	Channel number and input/output
35	Channel-related diagnostic module x byte 3	Fault type and channel type
...	...	...
60	Channel-related diagnostic module x byte 1	Contains module number
61	Channel-related diagnostic module x byte 2	Channel number and input/output
62	Channel-related diagnostic module x byte 3	Fault type and channel type
x, y, z: See explanation in the following text.		

Tab. 3/10: Diagnostic bytes 30 ... 62: Channel-related diagnosis (details in section 3.5.5)

The following applies to entries in the diagnostic bytes 30 ... 62 (channel-related diagnosis):

- Entries must be in ascending order by module number without gaps: The entries must always be in the same sequence as the module numbers, irrespective of the time sequence of the diagnostic messages (if necessary, the entries with large module numbers will be shifted).
- In the case of module-oriented and channel-oriented faults on a module, only the module-oriented diagnostic message will be entered.
- If there are several channel-oriented faults on a module, **only** the diagnostic message of the channel **with the lowest channel number** will be entered.
- A maximum of 11 diagnostic messages can be processed.

3.5.3 Details on standard diagnostic information

The following diagnostic information can be requested by the DP master from the CPX terminal with the function **Slave_Diag**. The procedure for reading out this diagnostic information with a SIMATIC S5/S7 system is described in section 3.6.1.

Station status_1		
Bit	**Meaning**	**Explanation**
0	**Diag.Station_Non_Existent**	CPX terminal no longer/not yet addressable. Possible causes: – Operating voltage not applied – Data cable interrupted – Fault in data cable
1	**Diag.Station_Not_Ready**	CPX terminal not yet ready for data transmission.
2	**Diag.Cfg_Fault**	The configuration data received from the master are not the same as that ascertained by the CPX terminal.
3	**Diag.Ext_Diag**	There is a diagnosis. Possible causes: – Cable fracture on input/output module – Short circuit/overload at electrical outputs, ...
4	Diag.Not_Supported	1 = CPX terminal does not support the function requested
5	Diag.Invalid_Slave_Response	Always 0 (set by the CPX terminal)
6	Diag.Prm_Fault	Last parameterisation telegram faulty
7	Diag.Master_Lock	Always 0 (set by the CPX terminal)
bold = CPX terminal related bits		

Tab. 3/11: Diagnostic bits station status_1

Station status_2		
Bit	**Meaning**	**Explanation**
0	**Diag.Prm_Req**	1 = The master must configure the CPX terminal again
1	Diag.Stat_Diag	1 = The master must request diagnostic data until this bit is set to 0
2	–	Always 1 (set by the CPX terminal)
3	**Diag.WD_On**	1 = Response monitoring/watchdog activated
4	Diag.Freeze_Mode	1 = Freeze activated
5	Diag.Sync_Mode	1 = Sync activated
6	–	Reserved
7	Diag.Deactivated	Always 0 (set by the CPX terminal)
bold = CPX terminal related bits		

Tab. 3/12: Diagnostic bits station status_2

Station status_3		
Bit	**Meaning**	**Explanation**
0 ... 6	–	Reserved
7	Diag.Ext_Diag_Overflow	1 = The CPX terminal has more diagnostic messages than can be buffered or the master receives more diagnostic messages than it can buffer.

Tab. 3/13: Diagnostic bits station status_3

3.5.4 Details of the module-related diagnosis

One bit is reserved for every module (identifier byte) assigned during configuration. A set bit means that there is a diagnostic message in this I/O range.

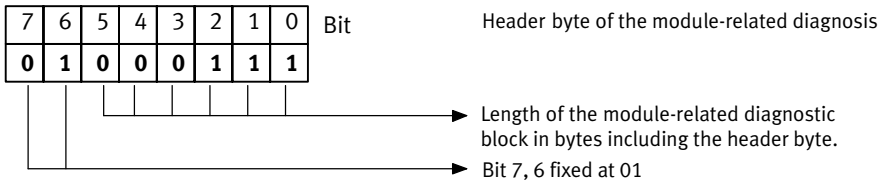


Fig. 3/4: Header byte of the module-related diagnosis

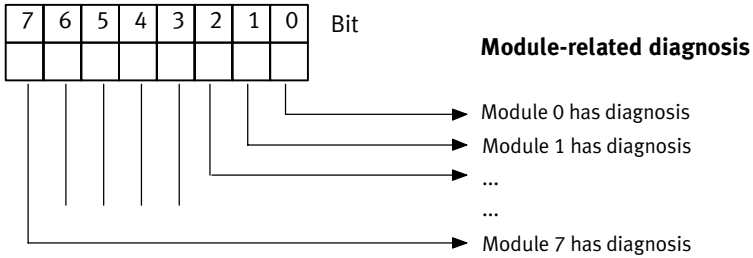


Fig. 3/5: Module-related diagnosis

3.5.5 Details of the canal-related diagnosis

3 bytes of diagnostic data are available for each channel:

- Byte 1: Module number
- Byte 2: Channel number
- Byte 3: Type of diagnosis

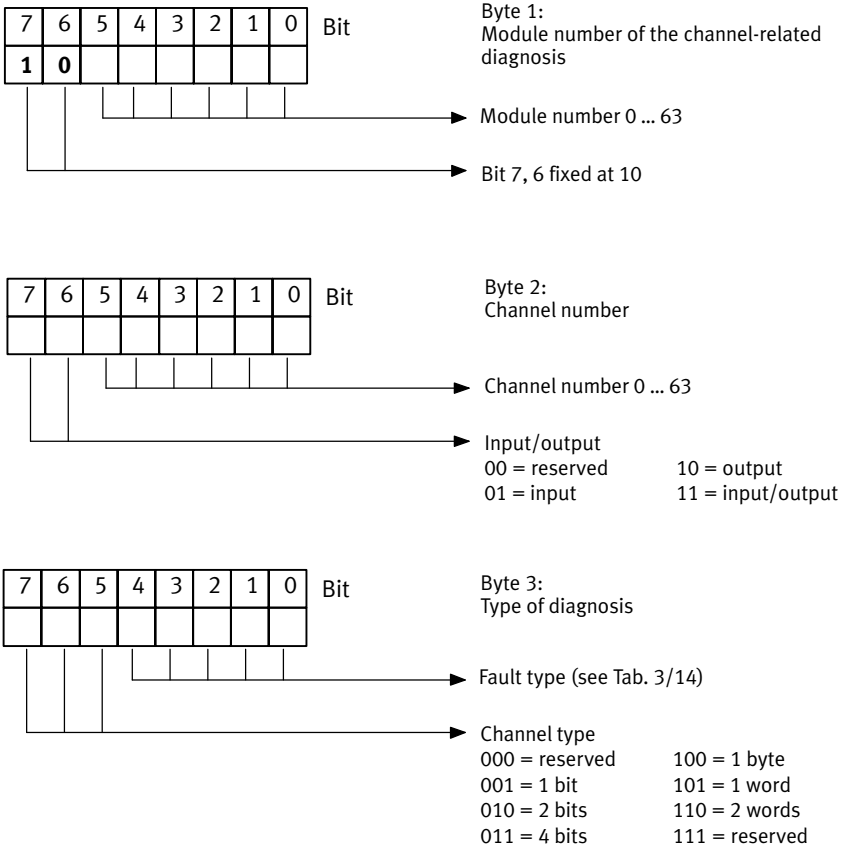


Fig. 3/6: Channel-related diagnostic byte 1 ... 3

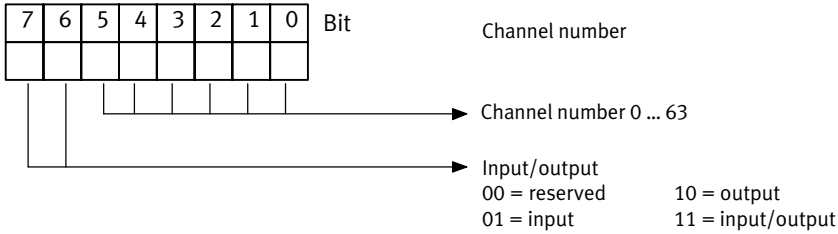


Fig. 3/7: Channel-related diagnostic byte 2

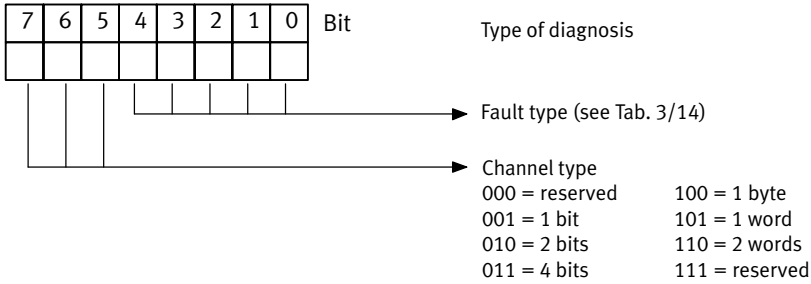


Fig. 3/8: Channel-related diagnostic byte 1 ... 3

Value	Fault type (standard)	Value	Fault type (Festo)
0	Reserved	16	Incorrect valve setting
1	**Short circuit**	17	Valve: Switching counter, limit value exceeded
2	**Undervoltage**	18	Reserved
3	Overvoltage	19	Reserved
4	**Overload**	**20**	**Parameterisation fault (configurable)**
5	Overheating	**21**	**Parameterisation fault (data format)**
6	**Cable break**	**22**	**Parameterisation fault (linear scaling)**
7	**Upper limit value exceeded**	**23**	**Parameterisation error (digital filter)**
8	**Lower limit value exceeded**	**24**	**Parameterisation error (lower limit value)**
9	Reserved	**25**	**Parameterisation error (upper limit value)**
10	Reserved	**26**	**Defective actuator supply**
11	Reserved	**27**	**CP module failure**
12	Reserved	**28**	**Defective CP configuration**
13	Reserved	**29**	**Short circuit in the CP string (CP line)**
14	Reserved	**30**	**Slave has no bus connection**
15	Reserved	**31**	**Channel failed**
bold = relevant for CPX-FB13			

Tab. 3/14: Fault types (byte 3 of the channel-related diagnosis)

3.6 Fault treatment (“Fail safe”)

Parameterisation

The reaction of the CPX terminal to the following faults depends on the configured reaction of the master module and the parameterised fail-safe setting:

– Telegram failure

– The master has stopped

– Interruption in the bus cable

Depending on parameterisation, the outputs (valves and electric outputs) will be switched off (factory setting), switched on or retain their status.

Further information about the fail-safe setting can be found in the CPX system manual P.BE-CPX-SYS-...

Warning
- Ensure that valves and outputs are put into a safe state if the faults named occur.

An incorrect status of the valves and outputs can lead to dangerous situations!

Note
Please note the following if the outputs are reset after PLC stop, field bus interruption or fault:
– Single-solenoid valves move to the basic position.
– Double-solenoid valves remain in the current position.
– Mid-position valves move to the mid-position (depending on valve type: vented, purged or blocked).

3.6.1 Siemens SIMATIC S5/S7

With these faults you have the possibility of specifying the reaction of the CPX terminal to the faults named (details see controller manual).

Almost all configuration programs contain the function “Response monitoring”. For the operating modes named, the specified time corresponds to the drop-out time of the valves and electric outputs.

Further details on response monitoring can be found in the relevant controller manuals.

You can set two types of fault reactions of the control system:

– Hard fault reaction: The controller switches to the operating mode “STOP” when a fault occurs.

– Soft fault reaction: The controller remains in the operating mode “RUN” when a fault occurs.

Control system	Module	Meaning	STOP	RUN
SIMATIC S5 with IM 308C	OM23	Reaction to AKD with direct access to peripherals	default	OM is programmed
	OM24	Reaction to AKD with access to peripherals via process image	default	OM is programmed
	OM35	Reaction to PEU (periphery unclear)	default	OM is programmed
SIMATIC S7/M7	OM82	Reaction to a device-related diagnosis	default	OM is programmed
	OM86	Reaction to failure of a DP slave	default	OM is programmed
AKD: acknowledgement delay		OM: organisation module		PEU: periphery unclear

Tab. 3/15: Fault reactions STOP and RUN with S5/S7

Possibilities for downloading the diagnosis for S5/S7

The diagnosis for PROFIBUS-DP is supported in the different control systems by means of function modules. These download the slave diagnosis and write it into a data range of the user program.

Control system	Functional module	See ...	Manufacturer
SIMATIC S5 with IM 308C	FB192 “IM 308C”	“ET 200 Decentral Periphery System” manual	Siemens
SIMATIC S5 with S5-95U/DP master	FB230 “S_DIAG”	“ET 200 Decentral Periphery System” manual	Siemens
SIMATIC S5 with SF 50/DP master	FB230 “S_DIAG”	“Programmable valve terminal with SB/SF 50” manual	Festo
SIMATIC S7/M7	SFC13 “DP NRM_DG”	“System and Standard Functions” reference manual	Siemens
SIMATIC S7/M7	FB125	Siemens download in Internet	Siemens

Tab. 3/16: Possibilities for downloading the diagnosis for S5/S7

Example for a STEP 7 user program

STL	Explanation
`CALL SFC 13`	
`REQ:=TRUE`	Read request
`LADDR:=W#16#03FE`	Pointer at diagnostic address, e.g. $1022_d = 03FE_h$ (see mask “Properties – DP slave” in HW Config)
`RET_VAL:=MW100`	When faults occur, output fault code
`RECORD:=P#M110.0 BYTE 64`	Pointer at start of data range for diagnosis and maximum length of the diagnostic data
`BUSY:=M10.0`	Read procedure finished

Fig. 3/9: Programming example in STL

3.7 Online diagnosis with STEP 7

Direct diagnostic events in conjunction with the CPX terminal can be:

- Decentral periphery station failure
  - communication between slave and master interrupted
- Module faulty (see device-related diagnosis Tab. 3/8)
- Change of operating status from START to RUN (nominal/actual difference exists)
  - configuration data of the CPX node do not agree with the periphery
  - CPX node has incorrect DIL setting

3.7.1 Read out diagnostic buffer with STEP 7 (up to V 5.2)

Requirements:

- HW Config must be accessed.

Proceed as follows (Fig. 3/10):

1. Switch from offline to online [1].
2. Click with the right-hand mouse button on the CPU in rack [2].
3. Click on [Module Information...] in the displayed context menu (Module status). The “Module Information” window is displayed [3].
4. Click on the register “Diagnostic Buffer” [4].
5. Click on the event and read the details [5]. Here you will find more detailed information on proceding further, depending on the S7 controller used.

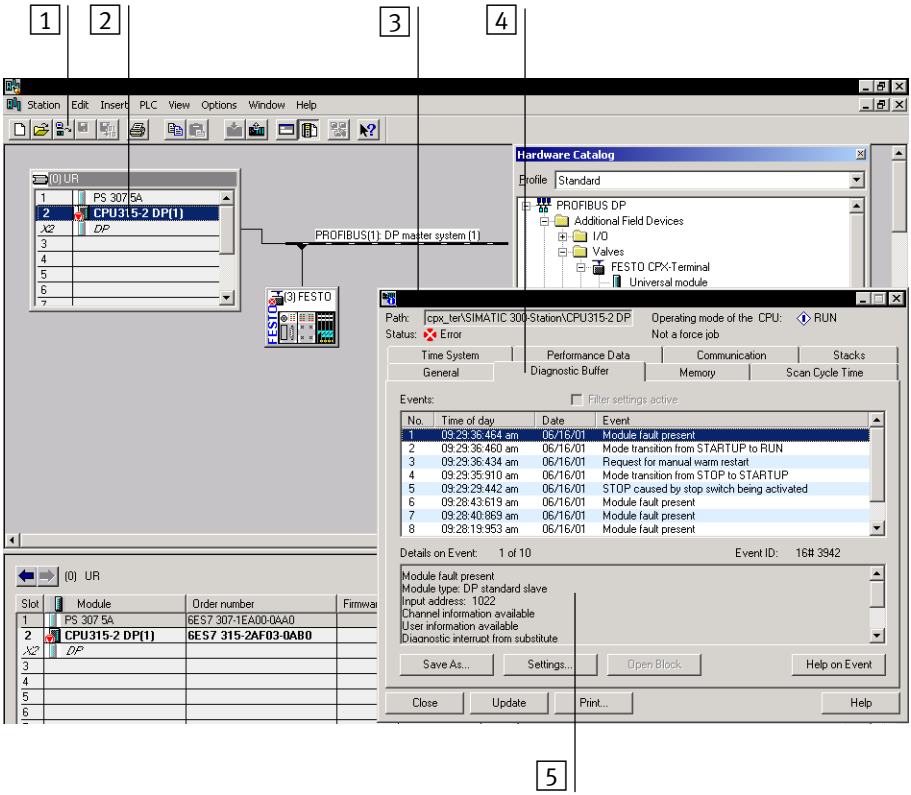


Fig. 3/10: Online diagnosis via the diagnostic buffer (explanation see text)

3.7.2 Device-related diagnosis with STEP 7 (up to V 5.3)

You can display fault messages of the device-related diagnosis with STEP 7 HW Config V5.1, if you mark the CPX terminal instead of the CPU. Proceed as follows (see Fig. 3/11):

Requirement:
– HW Config has been accessed.

1. Switch from offline to online.
2. Click with the right-hand mouse button on the icon of the CPX terminal [1]. Click on “Module Information” (component status) in the displayed context menu. The dialogue window “Module Information” now appears.
3. Select the “DP Slave Diagnostics” tab.
4. Read the diagnostic information [2].

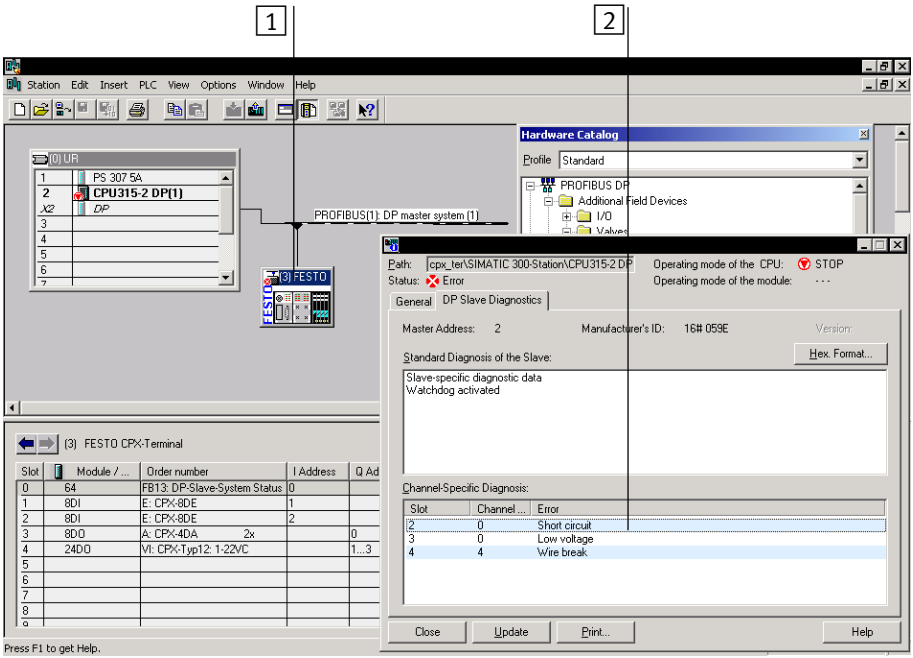


Fig. 3/11: Device-related diagnosis with STEP 7 (explanation see text)

Technical appendix

Appendix A

Contents

A.1 Technical specifications of field bus node CPX-FB13

General information	
General technical specifications	see CPX system manual P.BE-CPX-SYS-...
Protection class as per EN 60529, CPX-FB13 fitted completely, plug connector plugged in or fitted with protective cap	IP65 / IP67
Protection against electric shock (protection against direct and indirect contact as per IEC/DIN EN 60204-1)	by means of a PELV circuit (Protected Extra-Low Voltage)
Module code (CPX-specific)	Remote I/O: 202 Remote controller: 153
Module identifier (in the handheld unit)	Remote I/O: – FB13-RIO PROFIBUS remote I/O Remote controller: – FB13-RC PROFIBUS bus node

Voltage supply	
Operating voltage / load voltage	see CPX system manual P.BE-CPX-SYS-...
Current consumption of field bus node CPX-FB13 – from operating voltage supply for electronics/ sensors ($V_{EL/SEN}$)	max. 200 mA (only CPX-FB13)
Electrical isolation	bus interface opto-decoupled

Field bus	
PROFIBUS chip	SPC 3 with DPV1
Version	RS485, floating
Type of transmission	serial asynchronous, half duplex
Protocol	PROFIBUS DP
Transmission speed	9.6 ... 12000 kBaud, automatic baud rate recognition
Cable type	depends on the cable length and on the set field bus baud rate: see the manual for your controller

A.2 Start parameters

This section informs you about the number of start parameters of the CPX modules. Use of the newest GSD is a requirement.

Further information on start parameterisation can be found in section 2.2.1.

Sample calculation

The following table shows a sample calculation to determine the number of start parameters for the sample terminal 3 (see Fig. 2/11). The result is below the upper limits for the start parameters named in section 2.2.1.

Location	Module	Start parameters
0	Field bus node CPX-FB13: DP slave [status]	5
1	Digital 8-input module CPX-8DE [8DI]	5
2	Digital 4-output module CPX-4DA [4DO]x2	5
3	CP interface CPI: 4 bytes I/16 bytes O	42
4	Digital multi-I/O module CPX-8DE-8DA [8DI/8DO]	7
5	MPA1 pneumatic module MPA1S: VMPA1-FB-EMS-8 [8DO]	5
6	MPA1 pneumatic module MPA1S: VMPA1-FB-EMS-8 [8DO]	5
Total		**74**

Tab. A/1: Number of start parameters for example terminal 3 (see Fig. 2/11)

In the following tables,

– maximum number in a CPX terminal: specifies the maximum possible number of the respective module in a CPX terminal.

Field bus node, digital input and output modules	**Maximum number in a CPX terminal**		**Start parameters per module**
	≤ Rev. 15	**≥ Rev. 20**	
Field bus node CPX-FB13, Remote I/O and Remote controller: **CPX-FB13**	1	1	5
Digital 4-input module: **CPX-4DE**	9	9	5
Digital 8-input modules: **CPX-8DE, CPX-8DE-D, CPX-8NDE**	9	9	5
Digital 16-input modules: **CPX-16DE, CPX-M-16DE-D**	9	9	6
Digital 4-way output module: **CPX-4DA**	9	9	5
Digital 8-output modules: **CPX-8DA, CPX-8DA-H**	9	9	6
Digital multi I/O module: **CPX-8DE-8DA**	9	9	7

Tab. A/2: Number of start parameters, part 1: Field bus node, digital input and output modules

Analogue input and output modules	Maximum number in a CPX terminal		Start parameters per module
	≤ Rev. 15	≥ Rev. 20	
Analogue 2-input module: **CPX-2AE-U-I**	9	9	17
Analogue 4-input module: **CPX-4AE-I**	6	8	27
Analogue 4-input module (temp. module for RTD sensors): **CPX-4AE-T**	8	9	20
Analogue 4-input module (temp. module for TC sensors): **CPX-4AE-TC**	8	9	19
Analogue 2-output module: **CPX-2AA-U-I**	7	9	21

Tab. A/3: Number of start parameters, part 2: Analogue input and output modules

Technology modules	Maximum number in a CPX terminal		Start parameters per module
	≤ Rev. 15	≥ Rev. 20	
Soft stop end-position controller **CMPX without fail-safe**	8	9	19
Soft stop end-position controller **CMPX with fail-safe**	6	8	27
Multi-axis interface **CPX-CMXX**	9	9	0
CPX-CP interface **CPX-CP-4-FB**	see Tab. A/5		

Tab. A/4: Number of start parameters, part 3: Technology modules

CPX-CP interface	Maximum number in a CPX terminal		Start parameters per module
	≤ Rev. 15	≥ Rev. 20	
CPX-CP interface: **CPX-CP-4-FB** Dependent on the CP-string assignment, as follows:			
– 0I/0O – 0I/4O – 0I/8O – 0I/12O – 0I/16O	4 4 4 4 4	4 4 4 4 4	3 15 24 33 42
– 4I/0O – 4I/4O – 4I/8O – 4I/12O – 4I/16O	4 4 4 4 4	4 4 4 4 4	10 15 24 33 42
– 8I/0O – 8I/4O – 8I/8O – 8I/12O – 8I/16O	4 4 4 4 4	4 4 4 4 4	14 19 24 33 42
– 12I/0O – 12I/4O – 12I/8O – 12I/12O – 12I/16O	4 4 4 4 4	4 4 4 4 4	18 23 28 33 42
– 16I/0O – 16I/4O – 16I/8O – 16I/12O – 16I/16O	4 4 4 4 3	4 4 4 4 4	22 27 32 37 42

Tab. A/5: Number of start parameters, part 4: Technology module CPX-CP interface

Pneumatics	**Maximum number in a CPX terminal**		**Start parameters per module**
	≤ Rev. 15	**≥ Rev. 20**	
Pneumatic interface for **VTSA** or **VTSA-F** pneumatic (ISO, type 44/45): [1]			
– 1 ... 8 valve coils	1	1	6
– 1 ... 16 valve coils	1	1	9
– 1 ... 24 valve coils	1	1	12
– 1 ... 32 valve coils	1	1	15
Pneumatic interface for **Midi**/**Maxi** valves (type 03): [1]			
– 1 ... 8 valve coils	1	1	5
– 1 ... 16 valve coils	1	1	7
– 1 ... 24 valve coils	1	1	9
– 1 ... 32 valve coils (26 can be used)	1	1	10
Pneumatic interface for **CPA** valves (type 12): [1]			
– 1 ... 8 valve coils	1	1	6
– 1 ... 16 valve coils	1	1	9
– 1 ... 24 valve coils (22 can be used)	1	1	12
MPA1 pneumatic module VMPA1-FB-EM...-8 [2]	8	8	5
MPA1 pneumatic module with diagnostic function D2: VMPA1-FB-EM...-D2-8 [2]	8	8	7
MPA2 pneumatic module VMPA2-FB-EM...-4 [2]	9	9	4
MPA2 pneumatic module with diagnostic function D2: VMPA2-FB-EM...-D2-4 [2]	9	9	6
MPAP pressure sensor module **VMPA-FB-PS-...**	4	9	12
VPPM proportional pressure-regulating valve (type 32) **VPPM-6TA-L-1-F...**	9	9	18

[1] Setting with DIL switch in the pneumatic interface
[2] Type of MPA electronic module used

Tab. A/6: Number of start parameters, part 5: Pneumatics

A.3 Access to the CPX terminal via DPV1

By means of DPV1 commands, you can access all the data and parameters which the CPX terminal provides:

- Parameter and status information
- System data

DPV1 commands are **only** available if you configure the field bus node with the following possibility:

- FB13: DP slave system diagnosis

You can easily access the system data via the PROFIBUS configuration software. Background information can be found in the CPX system manual P.BE-CPX-SYS-...

A.3.1 Reading and writing data records

Various function modules are available for reading and writing data. The following table provides an overview:

Function	Function module Siemens S7 (former)	Function module Siemens S7 (new)	Functional module DP standard
Read data	SFC 59 RD_REC	SFB 52 RDREC	DP_RDREC
Write data	SFC 58 WR_REC	SFB 53 WRREC	DP_WRREC
DPV1 compatibility *)	“S7 compatible”	“S7 compatible” IEC 61131-3	“Standard” EN 50170
*) Parameterisation of the field bus node as in the following section			

Tab. A/7: Overview of function modules for reading and writing data records

You can still use the function modules SFC 58 and SFC 59 in your existing S7 projects.
Recommendation: When creating new projects, use the new function modules SFB 52 and SFB 53, in order to make use of the full DPV1 functionality.

Before accessing the data, set the DPV1 compatibility to “S7 compatible” as follows:

Setting the DPV1 compatibility

Parameterise the field bus node S7-conform if you are working with a Siemens master:

1. Proceed as described in section 2.2.2, double-click in step 1 but on the line of the field bus node in the configuration table. The dialogue window “Properties – DP slave” will be displayed.

2. Select the “Parameter Assignment” tab and modify the value of the “DPV1 – Services” to “S7 compatible” (see following diagram).

3. Confirm with OK.

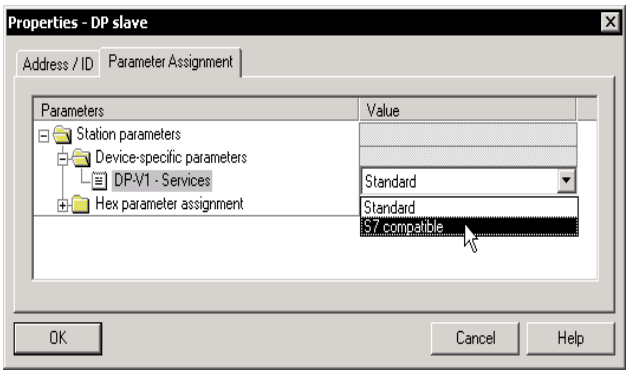


Fig. A/1: Setting the compatibility for accessing the DPV1

Siemens S7 – SFC 59 and 58

Function module SFC 59 in STL for reading a data record:

STL	Explanation
`CALL SFC 59"RD_REC"`	
`REQ :=TRUE`	Request to read
`IOID :=B#16#54`	Identifier of the address range (here always 54)
`LADDR :=W#16#6`	Logical address of the field bus node (see mask "Properties – DP slave" in HW Config)
`RECNUM :=B#16#14`	Data record number 20 (see Tab. A/8)
`RET_VAL :=MW100`	If faults occur, output fault code
`RECORD :=P#M110.0 BYTE 8`	Target range for data record read and length of data record
`BUSY :=M10.0`	Reading in process

Fig. A/2: Example program for reading out the diagnostic memory status

Function module SFC 58 in STL for writing a data record:

STL	Explanation
`CALL SFC 58"WR_REC"`	
`REQ :=TRUE`	Request to write
`IOID :=B#16#54`	Identifier of the address range (here always 54)
`LADDR :=W#16#6`	Logical address of the field bus node (see mask "Properties – DP slave" in HW Config)
`RECNUM :=B#16#14`	Data record number 20 (see Tab. A/8)
`RECORD :=P#M130.0 BYTE 8`	Pointer at start of data range for diagnosis and length of diagnostic data
`RET_VAL :=MW102`	If faults occur, output fault code
`BUSY :=M10.1`	Writing in process

Fig. A/3: Example program for transmitting the diagnostic memory status

Siemens S7 – SFB 52 and 53

New function module SFB 52 in STL for writing a data record:

STL		Explanation
CALL "RDREC" , DB100		
REQ	:=TRUE	Request to read
ID	:=B#16#256	Logical address of the field bus node (see mask "Properties – DP slave" in HW Config)
INDEX	:=17	Data record number
MLEN	:=10	max. length of the data record information to be read in byte
VALID	:=M200.0	1 = new data record received and valid
BUSY	:=M200.1	1 = reading in process
ERROR	:=M200.2	1 = fault in reading
STATUS	:=MD202	Access identifier or fault code
LEN	:=MW220	Length of the read data record information
RECORD	:=P#M230.0 BYTE 10	Target range for the read data record and max. data record length

Fig. A/4: Example program for reading out the diagnostic memory status

New function module SFB 53 in STL for writing a data record:

STL		Explanation
CALL "WRREC" , DB101		
REQ	:=TRUE	Request to write
ID	:=B#16#256	Logical address of the field bus node (see mask "Properties – DP slave" in HW Config)
INDEX	:=17	Data record number
LEN	:=8	max. length of the data record information to be transferred in bytes
DONE	:=M200.0	1 = data record has been transferred
BUSY	:=M200.4	1 = reading in process
ERROR	:=M200.5	1 = fault in reading
STATUS	:=MD206	Access identifier or fault code
RECORD	:=P#M230.0 BYTE 10	Source range for the data record and max. data record length to be written

Fig. A/5: Example program for transmitting the diagnostic memory status

Compliant with the standard

For standard-conform access to the data records, set the DPV1 compatibility to “Standard” (see above under “Setting the DPV1 compatibility”).
Use function module DP_RDREC for reading and DP_WRREC for writing data.

A.3.2 Data records

Access to the parameters and data is made via a slot number and an index number. Tab. A/8 to Tab. A/11 show the address assignment.
The slot number for the module-related data results from:
slot number = module number + 100.

Data model of the DPV1 access

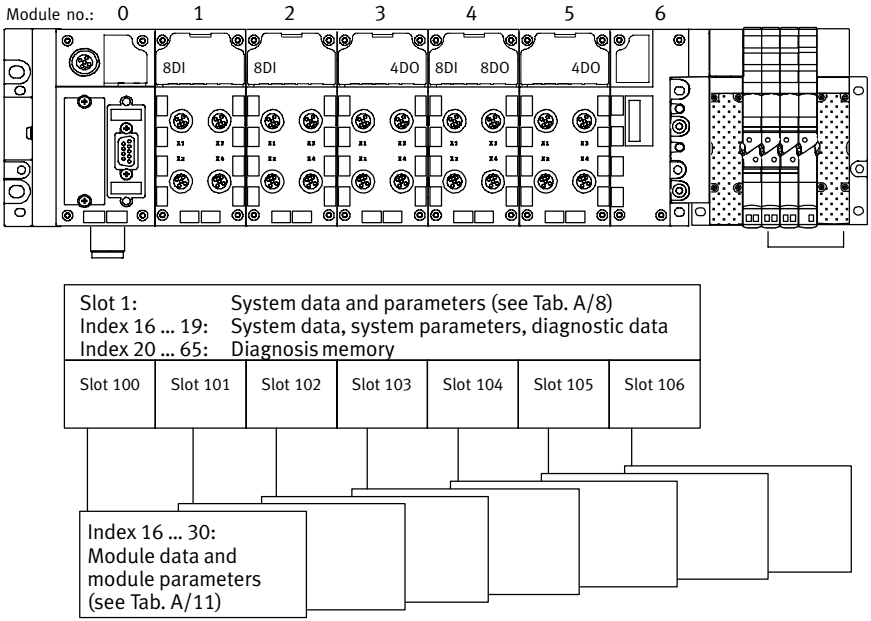


Fig. A/6: Data model of the DPV1 access with the CPX-FB13

The following tables show the relationship between access to parameters and data via DPV1 and via the function numbers. Further information on the function numbers can be found in the Appendix to the CPX system manual P.BE-CPX-SYS-...

Slot 1: System parameters

Index	Name	Length [byte]	Access	Data record number *)	Function no.
16	System data	16	r	16	0 ... 2 3 ... 15 (reserved)
17	System parameters	8	r/w	17	4400 (reserved) 4401 ... 4407
18	Reserve	64	r/w	18	3416
19	System diagnostic data	8	r	19	1936 ... 1938 1939 ... 1943 (reserved)
20	Diagnosis memory parameters	8	r/w	20	3480 ... 3487
21	Diagnosis memory Entry 0	10	r	21	3488 ... 3497
22	Diagnosis memory Entry 1	10	r	22	3498.... 3507
...	Diagnosis memory Entry ...	10	r	...	...
60	Diagnosis memory Entry 39	10	r	60	3878 ... 3887
65	Delete diagnosis memory	1	w	65	–

*) Siemens S7

Tab. A/8: Slot 1: System parameters

Slot 2: Channel-specific module parameters					
Index	**Name**	**Length [byte]**	**Access**	**Data record number** *)	**Function no.**
16	Fault mode	64	r	2	3888
17	Fault state	64	r	3	3952
18	Force mode outputs	64	r	4	4016
19	Force state outputs	64	r	5	4080
20	Force mode inputs	64	r	6	4144
21	Force state inputs	64	r	7	4208
22	Global operating system data	40	r	8	4792
*) Siemens S7					

Tab. A/9: Slot 2: Channel-specific module parameters

With slot 3 you have indirect reading and writing access to the data records (system parameters, module data and module parameters). In order to do this, assign the 4 bytes of the command box with: the slot number, the index number and an offset (byte 4 is reserved). You can then carry out the read or write process with the Read Box and the Write Box.

Slot 3: Indexed addressing of the objects					
Index	**Name**	**Length [byte]**	**Access**	**Data record number** *)	**Function no.**
16	Command box	4	r/w	9	–
17	Read Box	64	r	10	–
18	Write Box	64	w	11	–
*) Siemens S7					

Tab. A/10: Slot 3: Indexed addressing of the objects

Slot 100 ... 147: Module data and module parameters					
Index	**Name**	**Length [byte]**	**Access**	**Data record number** *)	**Function no.**
16	Module configuration	16	r	72	16 + 16 • m
17	Module series number	4	r	73	784 + 4 • m
18	Module diagnostic data	4	r	74	2008 + 4 • m
19	Reserve	4	r/w	75	3224 + 4 • m
20	Module nominal configuration	8	r/w	76	4408 + 8 • m
21	Module parameters	64	r/w	77	4828 + 64 • m
22	Module parameter records	16	r	78	976 + 16 • m
23	Diagnosis of all input channels	64	r	79	–
24	Diagnosis of all output channels	64	r	80	–
25	Module fault mode	64	r/w	81	–
26	Module fault state	64	r/w	82	–
27	Module force: outputs	64	r/w	83	–
28	Module force: outputs	64	r/w	84	–
29	Module force: inputs	64	r/w	85	–
30	Module force: inputs	64	r/w	86	–
m = module number (counting from left to right, beginning with 0) *) Siemens S7					

Tab. A/11: Module data and parameters

A.3.3 Examples for DPV1 access

Example of access to data records

In the following, the module parameter “Reaction after short circuit/overload of the load voltage supply” is modified on module no. 3 from Fig. 2/3 in the configuration example. Since slot number = module number + 100 (see above), slot 103 should be used for module no. 3 in the following.

As an initial setting, bit 1 of parameter 1 has the value “1” = “Switch voltage on again”.

1. Assign the command box as follows:

Byte	**1**	**2**	**3**	**4**
Contents	Slot no.	Index no.	Offset	–
Example	103	21	1	–

2. Then transfer the value “0” with the Write Box.
   The module is now parameterised to “Leave voltage switched off” in the event of a short circuit/overload.

Example of access to the diagnostic memory

In the following, entry 0 of the diagnosis memory will be read out indirectly via the command box.

1. Assign the command box as follows:

Byte	**1**	**2**	**3**	**4**
Contents	Slot no.	Index no.	Offset	–
Example	1	21	0	–

2. Read out the diagnostic memory with the Read Box.

Example for forcing of outputs

In the following, the output channels are forced in a CPX 4-output module (Fig. 2/3, module no. 3). In steps 1 ... 4, the forcing function is first released for the CPX terminal.

1. Read out the currently set system parameters via slot 1 index 17.

2. Release the “Force mode” system parameter: Set byte 2 bit 2 to “1”. (See CPX system manual Tab. B/6 “System parameter: Force mode”.)

3. Write the system parameters changed in step 2 via slot 1 index 17.

This releases the Force function for the entire CPX terminal. Since slot number = module number + 100 (see above), slot 103 should be used for module no. 3 in the following

4. For the “Force State outputs” module parameter for channels 0 ... 3, via slot 103 set index 28 to “$0F_h$” (see Tab. A/11)

5. For the “Force Mode outputs” module parameter for channels 0 ... 3, via slot 103 set index 27 to “$0F_h$” (see Tab. A/11)

This sets the outputs 0 ... 3 of the module through forcing.

See also CPX system manual Tab. B/21 “Module parameter: Forcing channel x”.
Basics of forcing can be found in the CPX system manual in appendix C “General principles for parameterisation” in the “Forcing” section.

General DP master

Appendix B

Contents

B.1 Operation with the general DP master

The Festo CPX terminal can be controlled from any PLC, PC or industrial PC with a PROFIBUS-DP module in accordance with EN 50170.

Further information

Read the information on the following themes in the appropriate sections:

- GSD: section 2.1.3
- Module consistency, FREEZE and SYNC, identifiers: section 2.1.1
- Status bits: section 3.3

B.1.1 Bus start

In order to commission the CPX terminal correctly, the DP master must carry out the following functions in the sequence specified:

1. Request diagnosis.
2. Send parameterisation data (Set_Prm)
   For the start parameterisation, the parameter set will be loaded into the field bus node by the master. The node distributes the parameters amongst the modules.
3. Check configuration data (Chk_Cfg).
4. Transfer input and output data (cyclic data exchange, Data_Exchange).
5. Read diagnostic information (Slave_Diag).

The composition and contents of the individual telegrams are described in the following sections.

Note
After each interruption of the field bus system (e.g. after interruption of the power supply to the field bus node), the parameter set will be sent again by the PROFIBUS master to the field bus node.

An exchange of individual CPX modules is therefore possible without the need for manual parameterisation.

B.1.2 Send parameterisation data

Set_Prm — The parameterisation data are sent to the CPX terminal by the DP master via the function Set_Prm.

Octet 1: Station status

Bit	Meaning	Explanation		
0	—	Reserved		
1	—			
2	—			
3	WD_On	Response monitoring of the CPX terminal on/off: 0 = Off 1 = On		
4	Freeze_Req	0 = FREEZE mode not requested by the master 1 = FREEZE mode set by the master		
5	Sync_Req	0 = SYNC mode not requested by the master 1 = SYNC mode set by the master		
6	Unlock_Req	**Bit 7**	**Bit 6**	**Explanation**
7	Lock_Req	0	0	min T_{SDR} + slave parameters may be overwritten
		0	1	CPX terminal released for other masters
		1	0	CPX terminal blocked for other masters
		1	1	CPX terminal released for other masters

Tab. B/1: Octet 1: Station status

Further octets

Octet	Description	Explanation
2 and 3	WD_Fact_1 WD_Fact_2	Range 1 ... 255: The response monitoring time of the CPX terminal is transmitted with these two octets: TWD [s] = 10 ms x WD_Fact_1 x WD_Fact_2
4	Minimum Station Delay Responder (min T_{SDR})	The minimum time the CPX terminal must wait, before the reply telegram may be sent to the DP master.
5 and 6	Ident_number	Transmits the Ident. number (= $059E_h$) of the CPX terminal; parametrizing telegrams to the CPX terminal are only accepted if the transmitted and the programmed Ident. numbers are the same.
7	Group_Ident	Not supported by the CPX terminal
8 ... 198	User_Prm_Data	Information on the slave-specific parameters can be found in section 2.2 and the CPX system manual P.BE-CPX-SYS-... as well as in the manual for the I/O modules P.BE-CPX-EA-...

Tab. B/2: Octets 2 ... 198

B.1.3 Check the configuration data

Chk_Cfg

The configuration data are transferred to the CPX terminal by the DP master with the function Chk_Cfg.

Permitted identifiers for the CPX terminal:

Identifiers according to EN 50170 and the assigned address space of the CPX modules can be found in the tables in section 2.1.2:

- Field bus nodes and diagnosis mode: Tab. 2/1
- Digital input and output modules: Tab. 2/2
- Analogue input and output modules: Tab. 2/3
- Technology modules Tab. 2/4
- CPX-FB13 as remote controller Tab. 2/5
- MPA pneumatics Tab. 2/6
- MPA pneumatic module with diagnosis function D2: Tab. 2/7
- Pneumatic interfaces and other pneumatics: Tab. 2/8 and Tab. 2/9

Example: Configuring a CPX terminal

Mod. no.	Module	DP identifier EN 50170	Comment
0	Field bus node (FB13: DP slave system status)	40_h, 00_h	Configured with status bits
1	Digital 8-input module (I: CPX-8DE)	10_h	Identifier byte used completely
2	Digital 8-input module (I: CPX-8DE)	10_h	Identifier byte used completely
3	Digital 4-output module (O: CPX-4DA 2x)	20_h	Only 4 bits of the identifier byte are used
4	Digital multi I/O module (Y: CPX-8DE-8DA)	30_h	Identifier byte used completely
5	Digital 4-output module (*O: CPX-4DA)	00_h	The identifier byte from location 3 is filled with the remaining 4 bits
6	CPA pneumatic interface, set with DIL switch to 1 ... 16 valve coils (VI: CPX type 12: 1-16VS)	21_h	The interface to the pneumatics must be configured correctly to correspond to the pneumatic equipment fitted

Tab. B/3: Example of the configuration of a CPX terminal (see Fig. 2/3) with different modules and MPA pneumatics

Mod. no.	Module	DP identifier EN 50170	Explanation
0	Field bus node FB13: DP slave system status	40_h, 00_h	Configured with status bits
1	Digital 8-input module E: CPX-8DE	10_h	Identifier byte used completely
2	Digital 4-output module O: CPX-4DA 2x	20_h	Only the first 4 bits of the identifier byte are used [1)]
–	MPA pneumatic interface VMPA-FB-EPL-...	–	Passive module
3	MPA1 pneumatic module VI: MPA1S: VMPA1-FB-EMS-8 [8DO]	20_h	MPA1 pneumatic modules without separate power supply circuits. Identifier bytes are used completely
4	MPA1 pneumatic module VI: MPA1S: VMPA1-FB-EMS-8 [8DO]	20_h	
5	MPA2 pneumatic module VI: MPA2S: VMPA2-FB-EMS-4 [4DO]x2	20_h	MPA2 pneumatic module (without separate circuits) Only the first 4 bits are used.
6	MPA2 pneumatic module VI: *MPA2S: VMPA2-FB-EMS-4 [4DO]x0	00_h	MPA2 pneumatic module (without separate circuits). The remaining 4 bits of module no. 5 are used.

1) As no output module with groupable identifier is used in the subsequent locations, 8 bits are assigned here, but only 4 are used.

Tab. B/4: Example of the configuration of a CPX terminal (see Fig. 2/2) with different modules and MPA pneumatics

B.1.4 Transferring input and output data

Data_Exchange

The cyclic exchange of data is accomplished with the function Data_Exchange.

With this function the output data for CPX terminals are transmitted as an octet string of length x. The octet string length depends on the number of identifier bytes.

Note
With the function Data_Exchange, the CPX terminal expects the **output information** for the valves and electric outputs.

The **input data** are sent to the master as a reply telegram.

Overview of the work data (Data_Exchange) for the example CPX terminal 1 (CPX terminal with MPA1 and MPA2 pneumatics):

Output data (Outp_Data)	**Input data (Inp_Data)**
Octet 1: O-data byte_0 *) (4DO module, mod. no. 2, 8DO) Bit 0: Output x.0 Bit 1: Output x.1 ... Bit 6: Output x.6 Bit 7: Output x.7 Octet 2: O-data byte_1 (MPA1 pneumatic module, mod. no. 3, 8DO) Bit 0: Output y.0 ... Bit 7: Output y.7 Octet 3: O-data byte_2 (MPA1 pneumatic module, mod. no. 4, 8DO) Bit 0: Output z.0 ... Bit 7: Output z. 7 Octet 4: O-data byte_3 (MPA2 pneumatic modules, mod. nos. 5 and 6, 8DO) Bit 0: Output s.0 ... Bit 7: Output s.7	Octet 1: I-data byte_0 (Status bits CPX-FB13, mod. no. 0) Bit 0: Diagnostic message ... (see section 3.3) Bit 7: Diagnostic message Octet 2: I-data byte_1 (8DI module, mod. no. 1, 8DI) Bit 0: Input t.0 Bit 1: Input t.1 Bit 2: Input t.2 Bit 3: Input t.3 Bit 4: Input t.4 Bit 5: Input t.5 Bit 6: Input t.6 Bit 7: Input t.7
*) Only the first 4 bits in this byte are used. x, y, z, s, t = address offset of master module	

Tab. B/5: Cyclical data exchange for example terminal 1 (see Fig. 2/9)

Overview of the work data (Data_Exchange) for the example terminal 3 (CPX terminal with CP interface):

Output data (Outp_Data)	**Input data (Inp_Data)**
Octet 1: O-data byte_0 *) (4DO module, mod. no. 2, 8DO) Bit 0: Output x.0 ... Bit 7: Output x.7 Octet 2: O-data byte_1 (CP interface 4 bytes I/16 bytes O, mod. no. 3, CPV valve terminal on string 1) Bit 0: Output y.0 ... Bit 7: Output y.7 Octet 3: O-data byte_2 (CP interface continued, CPV valve terminal on string 1) Bit 0: Output (y+1).0 ... Bit 7: Output (y+1).7 Octet 4: O-data byte_3 (CP interface cont., assigned but unused) Bit 0: Output (y+2).0 ... Bit 7: Output (y+2).7 ... Octet 14: O-data byte_13 (CP interface continued, output module on string 4) Bit 0: Output (y+12).0 ... Bit 7: Output (y+12).7	Octet 1: I-data byte_0 (Status bits CPX-FB13, mod. no. 0) Bit 0: Diagnostic message ... (see section 3.3) Bit 7: Diagnostic message Octet 2: I-data byte_1 (8DI module, mod. no. 1, 8DI) Bit 0: Input u.0 ... Bit 7: Input u.7 Octet 3: I-data byte_2 (CP interface 4 bytes I/16 bytes O, mod. no. 3, input module on string 1) Bit 0: Input v.0 ... Bit 7: Input v.7 Octet 4: I-data byte_3 (CP interface continued, input module on string 1) Bit 0: Input (v+1).0 ... Bit 7: Input (v+1).7 Octet 5: I-data byte_4 (CP interface continued, assigned but unused) Bit 0: Input (v+2).0 ... Bit 7: Input (v+2).7
*) Only the first 4 bits in this byte are used. x, y, u, v = address offset of master module	

Tab. B/6: Cyclical data exchange for example terminal 3 (see Fig. 2/11) – part 1

Output data (Outp_Data)	**Input data (Inp_Data)**
Octet 15: O-data byte_14 (CP interface continued, output module on string 4) Bit 0: Output (y+13).0 ... Bit 7: Output (y+13).7 Octet 16: O-data byte_15 (CP interface continued, assigned but unused) Bit 0: Output (y+14).0 ... Bit 7: Output (y+14).7 ... Octet 18 O-data byte_17 (8DI/8DO module, mod. no. 4, 8DX) Bit 0: Output z.0 ... Bit 7: Output z. 7 Octet 19: O-data byte_18 (MPA1 pneumatic module, mod. no. 5, 8DO) Bit 0: Output s.0 ... Bit 7: Output s.7 Octet 20: O-data byte_19 (MPA1 pneumatic module, mod. no. 6, 8DO) Bit 0: Output t.0 ... Bit 7: Output t.7	Octet 6: I-data byte_5 (CP interface continued, assigned but unused) Bit 0: Input (v+3).0 ... Bit 7: Input (v+3).7 Octet 7: I-data byte_6 (8DI/8DO module, mod. no. 4, 8DX) Bit 0: Input w.0 ... Bit 7: Input w.7
x, y, z, ... = address offset	

Tab. B/7: Cyclic data exchange for example terminal 3 – part 2

B.1.5 Read diagnostic information

Slave_Diag	The diagnostic data are requested by the CPX terminal via the function Slave_Diag (see section 3.5.3, Diagnosis via PROFIBUS-DP).
Set_Prm	With the function Set_Prm you can determine the watchdog time (WD_Fact_1, Octet 2, WD_Fact_2, Octet 3). The reaction of the CPX terminal in the event of a fault (e. g. a bus failure) depends on the parameterisation (see section 3.6.)

B.1.6 Implemented functions and service access points (SAP)

Function	Available	Destination SAP (DSAP)
Data_Exchange	Yes	NIL
RD_Inp	Yes	56
RD_Outp	Yes	57
Slave_Diag	Yes	60
Set_Prm *)	Yes	61
Chk_Cfg	Yes	62
Get_Cfg	Yes	59
Global_Control	Yes	58
Set_Slave_Add	No	55
MSAC_C1	Yes	50, 51
MSAC_C2	Yes	0 ... 48
*) The CPX parameters are also sent with Set_Prm during the initialisation phase.		

Tab. B/8: Overview of functions and service access points

DPV1

You can access the DPV1 services with the following functions:

- MSAC_C1:
  For masters of class 1 (e.g. PLC), fixed service access points.
- MSAC_C2:
  For masters of class 2 (e.g. PC/PG), dynamic use, service access points are specified when connections are set up.

B.1.7 Bus parameters/reaction times

Baud rate (kBaud)	max T_{SDR} (T_{Bit})	min T_{SDR} (T_{Bit})
.. 187.5	60	11
500	100	
1500	150	
3000	250	
6000	450	
12000	800	

Tab. B/9: Bus parameters and reaction times

B.1.8 Transmission times on the PROFIBUS-DP

Note
Observe here the cycle time of your PLC and the update time of the PROFIBUS-DP.

The delay time within the CPX terminal is very brief. It is considerably less than 1 ms, irrespective of the equipment fitted on your CPX terminal.

Please refer to the manual for your controller for ascertaining the total time required for transmission.

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Appendix C

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