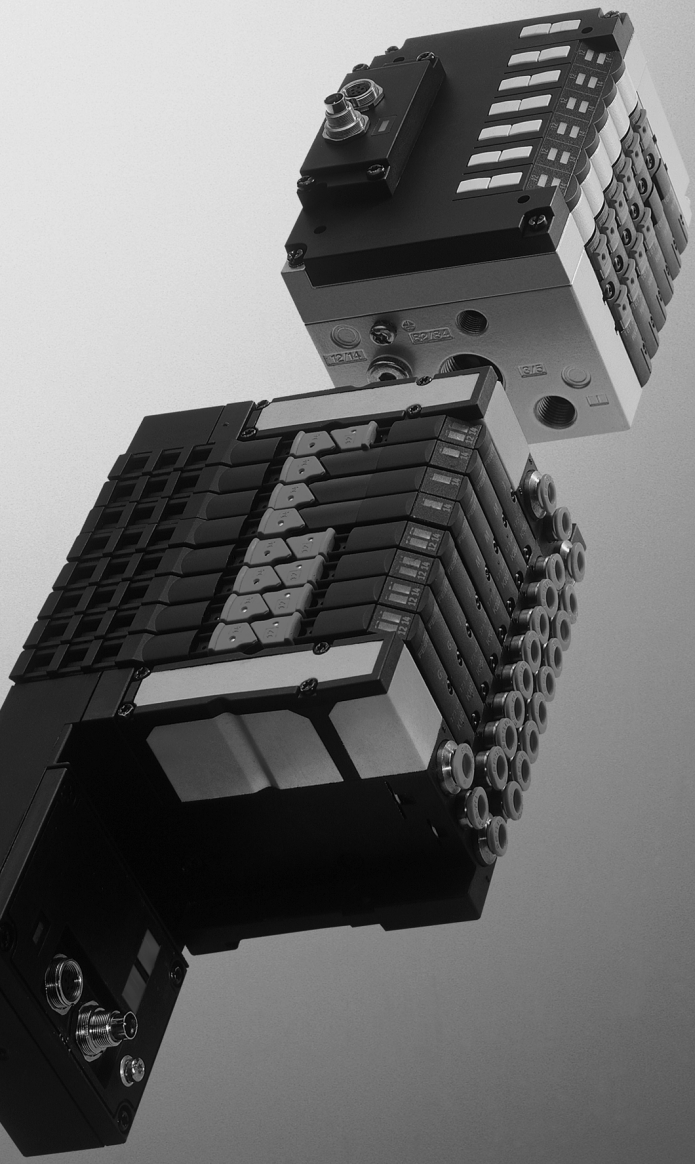
Compact Performance



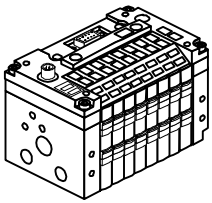
FESTO

Electronics manual

CPV valve terminal
with direct
connection

Type CPV..-DI01

Field bus protocols:
- PROFIBUS-DP
- Festo field bus
- ABB CS31
- SUCOnet K



Manual
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en 0503d

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Contents

Designated use

The CPV valve terminal type CPV-DI01 with field bus direct connection (CPV direct) described in this documentation is designed exclusively for use as a slave on the following field buses:

- PROFIBUS-DP
- Festo field bus
- ABB CS31
- Moeller SUCOnet K

The valve terminal may only be used as follows:

- as specified 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 specifiedlimits for pressures, temperatures, electrical data, torques, etc. must not be exceeded.

Please comply with national and local safety laws and regulations.

If you wish to implement an emergency stop function, please observe the measures listed in section 1.6.3.

Warning
If the terminal is to be used as an explosion-protected operating medium, make sure that:

- the electrical connections are **not** disconnected when power is still applied.
- the completely fitted product with all plugs, adapters and protective caps used complies at least with protection class IP64.

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 the field busesnamed above.

Service

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

Notes on the use of this manual

Please note
This manual describes the functionality of the software version as from 1.x and the hardware version as from 04/98 of the CPV valve terminal with direct connection for PROFIBUS-DP, Festo field bus, ABB CS31, Moeller SUCOnet K.

This manual contains specific information on installing, commissioning, programming and diagnosing CPV valve terminals with direct connection for the field buses named.

Information on pneumatics can be found in the “Pneumatics manual, P.BE-CPV-... .”

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

– the setting up guidelines for the PROFIBUS-DP

– the manuals of the master manufacturer.

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.

Please 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
CP	Compact Performance
CP cable	Special cable for coupling the various CP modules
CP connection	Plug or socket on the CP modules which enables the modules to be connected with the CP cable
CPV Direct	CPV valve terminal with field bus direct connection
CP modules	Common term for various modules which can be incorporated in a CP system
CP system	Complete system consisting of CPV Direct and CP modules
I	Digital input
I/O modules	Common term for the CP modules which provide digital inputs and outputs (CP input modules and CP output modules)
I/Os	Digital inputs and outputs
O	Digital output
OB	Output byte
Octet	Number of address words assigned by the CP system
PLC/IPC	Programmable logic controller/industrial PC

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

Installation

Chapter 1

Contents

1.1 General instructions on installation

Information on using the CPV Direct in **explosion-protected areas** can be found in section 1.8.

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

- the compressed air supply
- the operating voltage for the internal logic
- the load voltage for the valves.

You can thereby avoid:

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

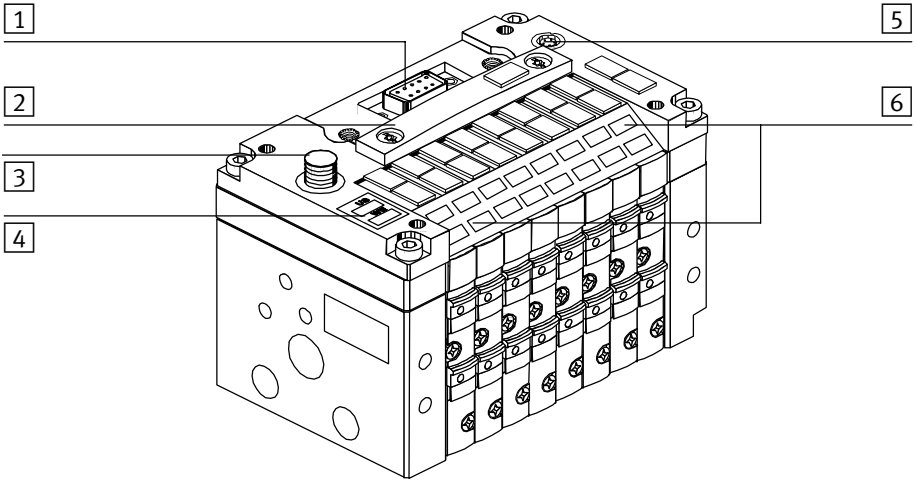
Caution
The CPV valve terminal with field bus direct connection (CPV Direct) contains electrostatically sensitive components.

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

You will then prevent the electronics from being damaged.

Electrical connecting and display elements

The following connecting and display elements can be found on the CPV valve terminal with field bus direct connection (CPV Direct):



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

2 Switch module (can be removed)

3 Operating voltage connection for electronics/load voltage connection for CP valves (4-pin M12 plug)

4 Bus status and power LEDs (red or green)

5 CP extension connection

6 Switching status displays of the CP valve coils (yellow LEDs)

Fig. 1/1: Connecting and display elements of the CPV Direct

1.2 Configuring the CPV Direct

1.2.1 Fitting and removing the switch module

Caution
The switch module contains electrostatically sensitive components.
- Do not therefore touch any contacts.
- Observe the regulations for handling electrostatically sensitive components.

The switch module must be removed before the CPV Direct can be set.

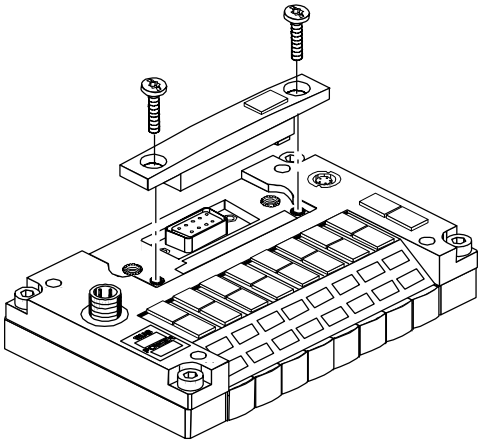


Fig. 1/2: Fitting/removing the switch module

Removing:

1. Switch off the operating voltage.
2. Unscrew the two fastening screws on the switch module.
3. Lift up and remove the switch module.

Fitting:

1. Place the switch module carefully in the recess.
2. Tighten the two fastening screws alternately.

Please note
- Do not tilt the switch module when fitting it. The fitting position is clearly marked by a groove in the housing.
- Make sure that the seal is seated correctly.

1.2.2 Setting the CPV Direct

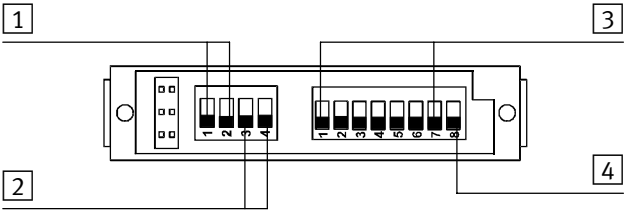
When the switch module is opened, you will see two DIL switches (Fig. 1/3).

You can set the following parameters with the DIL switches:

- Field bus protocol
- Extension to the CP system
- Station number
- Diagnostic mode

Proceed as follows:

1. Switch off the operating voltage.
2. Remove the switch module (chapter 1.2.1).
3. Set the field bus protocol (4-position DIL switch, elements 1...2).
4. Set the extension to the CP system (4-position DIL switch, elements 3...4).
5. Assign an unused station number to the CPV Direct. Set the desired station number (8-position DIL switch, elements 1...7).
6. Set the diagnostic mode (8-position DIL switch, element 8).
7. Fit the switch module (see chapter 1.2.1).



4-position DIL switch:

[1] Setting the field bus protocol

[2] Setting the extension to the CP system

8-position DIL switch:

[3] Address selector switch for station number

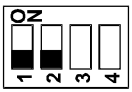
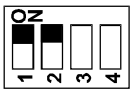
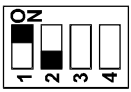
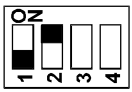
[4] Setting the diagnostic mode

Fig. 1/3: DIL switch in the switch module (further information on [1] ... [4] see next pages)

Setting the field bus protocol [1]

The CPV Direct can be operated with one of four field bus protocols. The desired protocol can be selected with switch elements 1 and 2 of the 4-position DIL switch.

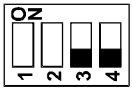
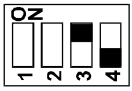
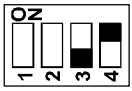
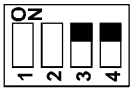
Set the field bus protocol you wish to use as follows:

PROFIBUS-DP	**Festo field bus**	**ABB CS31**	**SUCOnet K**
			
DIL 1: OFF, DIL 2: OFF	DIL 1: ON, DIL 2: ON	DIL 1: ON, DIL 2: OFF	DIL 1: OFF, DIL 2: ON

Tab. 1/1: Setting the field bus protocol with the 4-position DIL switch

Setting: Extension to the CP system 2

Further CP modules can be connected to the CPV Direct. You can set the extension to the CP system with switch elements 3 and 4 of the 4-position DIL switch as shown in the table below.

Extension to the CP system	Number of inputs/outputs		Setting the DIL switches	
CPV Direct without extension	16 O			DIL 3: OFF DIL 4: OFF
CPV valve terminal with extension with: – CP input module	16 O	+ 16 I		DIL 3: ON DIL 4: OFF
CPV valve terminal with extension with: – a CP valve terminal or CP output module	16 O + 16 O			DIL 3: OFF DIL 4: ON
CPV valve terminal with extension with: – a CP valve terminal/CP output module and – CP input module	16 O + 16 O	+ 16 I		DIL 3: ON DIL 4: ON

Tab. 1/2: Setting: Extension of the CP system with 4-position DIL switch

Please note
Depending on the extension set, the CP system occupies a different number of inputs and outputs or station numbers. Further information can be found in chapter 1.7.

Setting the station number 3

You can set the field bus station number with 8-position DIL switch.

Please note
Station numbers may only be assigned once per field bus line.

The following station numbers are permitted:

Protocol	Address designation	Permitted station numbers
PROFIBUS-DP	PROFIBUS address	1; ...; 125
Festo field bus	Field bus address	1; ...; 63
ABB CS31	CS31 module address	0; ...; 60
Moeller SUCOnet K	–	2; ...; 98

Tab. 1/3: Permitted station numbers for the different field buses

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

[1] Setting the station number for
– PROFIBUS-DP
– ABB CS31
– SUCOnet K
(8-position DIL switch, elements 1...7)

[2] Setting the station number for
– Festo field bus
(8-position DIL switch, elements 1...6)

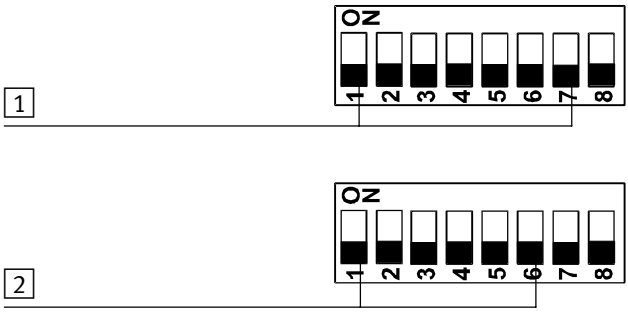
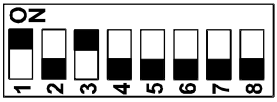
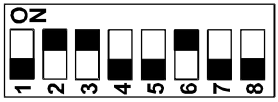


Fig. 1/4: Setting the station number (8-element DIL switch)

The station number is entered coded with the 8-position DIL switch.

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

Tab. 1/4: Examples of set station numbers (binary coded)

The following pages contain a summary of the settings for the station numbers. You can use the tables for all protocols with which the valve terminal can be used.

Please note
With protocols ABB CS31 and Festo field bus, the DIL switch elements 1...6 suffice for setting the station number.

With protocol ABB CS31, switch element 7 must be set to OFF.

With the Festo field bus, switch elements 7 and 8 are used for setting the baud rate.

Stat. no.	1	2	3	4	5	6	7	8	Stat. 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. 1/5: Setting station numbers 0...31: Position of the DIL switch elements

Stat. no.	1	2	3	4	5	6	7	8	Stat. 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. 1/6: Setting station numbers 32...63: Position of the DIL switch elements

Stat. no.	1	2	3	4	5	6	7	8	Stat. 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. 1/7: Setting station numbers 64...95: Position of the DIL switch elements

Stat. no.	1	2	3	4	5	6	7	8	Stat. 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	ON	OFF	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. 1/8: Setting station numbers 96...125: Position of the DIL switch elements

Setting the diagnostic mode [4]
(only for PROFIBUS-DP and ABB CS31)

The following diagnosis can be deactivated with switch element 8 of the 8-position DIL switch:

– PROFIBUS-DP: Device-related diagnosis

– ABB CS31: Load voltage monitoring

[1] DIL 8 OFF:
Diagnosis deactivated

[2] DIL 8 ON:
Diagnosis activated

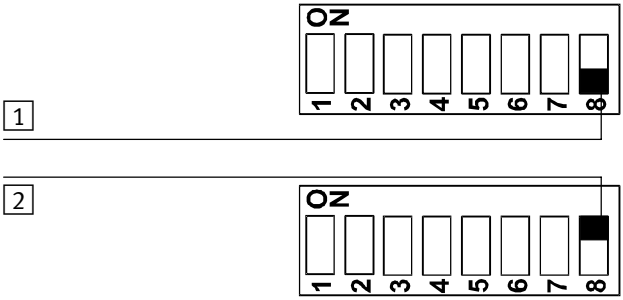


Fig. 1/5: Setting the diagnostic mode

For PROFIBUS-DP:
If the device-related diagnosis is deactivated (switch element 8 to OFF), no device-related diagnostic information will be sent from the valve terminal to the master system, e.g. short circuit at the outputs or undervoltage of the valves (see section 3.3).

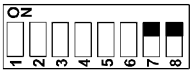
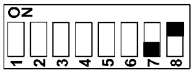
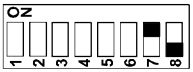
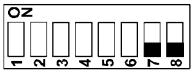
1.3 Setting the field bus baud rate

Please note
It is only necessary to set the baud rate with the Festo field bus protocol.

The CPV Direct automatically recognizes the baud rate for the PROFIBUS-DP (9.2 kBd ... 12 MBd) and the SUCOnet K (187.5 kBd ... 375 kBd) protocols.
The baud rate 187.5 kBd is used constantly for the ABB CS31 protocol.

With the Festo field bus protocol, DIL switch elements 7 and 8 of the 8-position DIL switch are used for setting the baud rate.

Setting the baud rate with the Festo field bus protocol

31.25 kBd	62.5 kBd	187.5 kBd	375 kBd
			
DIL 7: ON, DIL 8: ON	DIL 7: OFF, DIL 8: ON	DIL 7: ON, DIL 8: OFF	DIL 7: OFF, DIL 8: OFF

Tab. 1/9: Setting the baud rate for the Festo field bus

1.4 Connecting the field bus

1.4.1 Field bus cable

Please note
With incorrect installation and high baud rates, data transmission errors may occur as a result of signal reflections and attenuations.
Causes of the transmission errors may be:
– missing or incorrect terminating resistor
– incorrect screening/shield connection
– branches
– transmission over long distances
– unsuitable cables.
Observe the cable specifications. Refer to the manual for your controller for information on the type of cable to be used.

Please note
If the valve 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 observe also the relevant regulations in IEC/DIN EN 60204-1.

PROFIBUS-DP

Use a twisted, screened 2-wire cable for the field bus.

Cable specification as per EN 50170 (cable type A):

Surge impedance:	135...165 ohm (3...20 MHz)
Capacitance per unit length:	‹ 30 nF/km
Loop resistance:	‹ 110 ohm/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.

Festo field bus / ABB CS31 / Moeller SUCOnet K

Refer to the PLC manual for your controller for the type of cable to be used. Also take into account here the distances and the field bus baud rate.

1.4.2 Field bus baud rate and field bus length for PROFIBUS-DP

Please note
The maximum permitted field bus length and branch line length depend on the baud rate used.

- Please observe the maximum permitted length of the field bus cable, if you connect the valve terminal via a branch line.
- Take into account also the sum of the branch line lengths when calculating the maximum permitted length of the field bus cable.

The CPV Direct sets itself automatically to one of the following baud rates:

Baud rate (in kBaud)	Field bus length (max.)	Max. permitted branch line length
9.6	1200 m	500 m
19.2	1200 m	500 m
93.75	1200 m	100 m
187.5	1000 m	33.3 m
500	400 m	20 m
1500	200 m	6.6 m
3000...12000	100 m	–

Tab. 1/10: Max. field bus length and branch line length for PROFIBUS-DP depending on the baud rate

1.4.3 Field bus interface

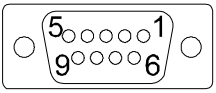
There is a 9-pin sub-D socket on the CPV Direct for connecting it to the field bus.
This connection serves for the incoming and continuing field bus cable. You can connect the CPV valve terminal with the field bus plug from Festo type FBS-SUB-9-GS-DP-B.

Please note
Only the Festo field bus plug complies with IP65. Before connecting field bus plugs from other manufacturers:

- replace the two flat screws by bolts (part no. 340960).

PROFIBUS-DP

Pin	Field bus plug IP65 from Festo [1]	PROFIBUS-DP	Designation
1		n.c.	not connected
2		n.c.	not connected
3	B	**RxD/TxD-P**	**Receive/send 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**	**Receive/send data N**
9		n.c.	not connected
Housing	Clamp strap	Screening/shield	Connection to functional earth



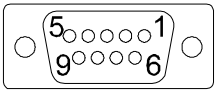
(view of socket of the CPV Direct)

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

Tab. 1/11: Pin assignment of the field bus interface for PROFIBUS-DP

Festo field bus / ABB CS31 / Moeller SUCOnet K

Pin	Field bus plug IP65 from Festo [1]	Festo field bus	ABB CS31	SUCOnet K sub-D 9-pin	SUCOnet K DIN (round) 5-pin
1					
2					
3	B	S+	Bus 1	3 (T_A/R_A)[2]	4 (T_A/R_A)[2]
4					
5					
6					
7					
8	A	S-	Bus 2	7 (T_B/R_B)[2]	1 (T_B/R_B)[2]
9					
Housing	Clamp strap	Screening/ shield	Screening/ shield	4 (screening/ shield) [2]	Housing



(View of socket of the CPV Direct)

1) Type FBS-SUB-9-GS-DP-B (part no. 532216)
2) Pin numbers of the SUCOnet K interface

Tab. 1/12: Pin assignment of the field bus interface for Festo field bus, ABB CS13 and SUCOnet K

1.4.4 Connection possibilities

Please note
Use a protective cap or blanking plug 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.

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

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

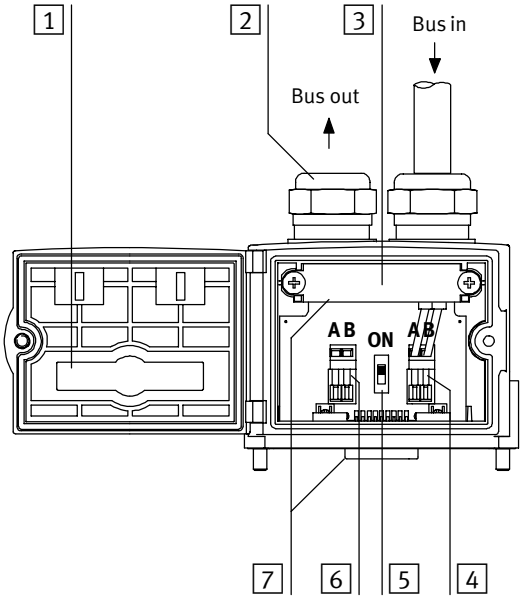


Fig. 1/6: Field bus plug from Festo, type FBS-SUB-9-GS-DP-B

Please 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 equalizing currents flowing through the screening of the field bus cable.

DIL switch

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

– Switch position OFF: The bus termination is switched off and the continuing field bus cable is switched in.

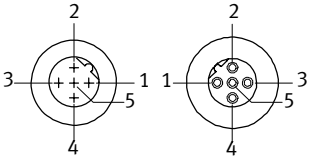
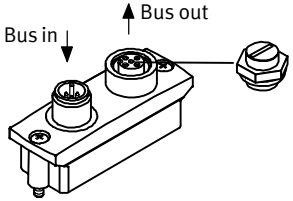
– Switch position ON: The bus termination is switched on and the continuing field bus cable is **switched off** (see Fig. 1/7).

Please 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 adapter (reverse key coded)

With adapter (type FBA-2-M12-5POL-RK, part no. 533118), you can connect the CPV Direct to the field bus via an M12 plug connector. The plug connectors have an inverted mechanical coding (reverse key or B-coded), to avoid confusion between incoming and continuing connections.
You can disconnect the M12 adapter from the CPV Direct without interrupting the bus cable (T-TAP function).

Connection to the 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.**
	1. VP: Power supply positive (P5V) 2. **RxD/TxD-N: Receive/Send data N** 3. DGND: Data reference potential (M5V) 4. **RxD/TxD-P: Receive/Send data P** 5. FE: Functional earth Housing/thread: Screening/shield
 Protective cap or plug with bus termination resistor if connection is not used.	

Tab. 1/13: Pin assignment of the field bus interface with adapter for M12 connection, 5-pin

Connection with optical-fibre waveguide

The PROFIBUS-DP interface of the CPV Direct 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 (OLM) for PROFIBUS (IP20)

– Harting Han-InduNet® Media converter IP65 in combination with adapter cable for Festo products (optical data transmission in DESINA installation concept).

1.5 Bus termination with terminating resistors

Please note
If the valve terminal is at the beginning or the end of the field bus system, 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).

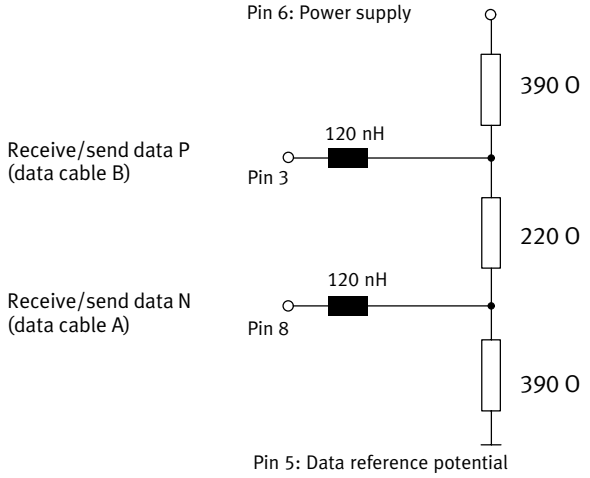


Fig. 1/7: Circuit diagram for bus termination network
(switch in Festo field bus plug set to ON)
(PROFIBUS-DP: for cable type A as per EN 50170)

1.6 Connecting the power supply

1.6.1 Cable for power supply

- Use a power supply cable with sufficient cross-sectional area.
- Avoid long distances between the power unit and the CPV valve terminal. Long cables reduce the voltage supplied by the power unit.
- If necessary, ascertain the suitable cross-sectional area and the maximum permitted cable length.

The connection for the power supply is in the form of a plug. The pin assignment of the plug can be found on the following pages.

For connecting the power supply, use plugs from the Festo range which correspond to the outer diameter of the cable used (see Appendix A.3).

1 Cable
2 Strain relief
3 Housing
4 Connecting part

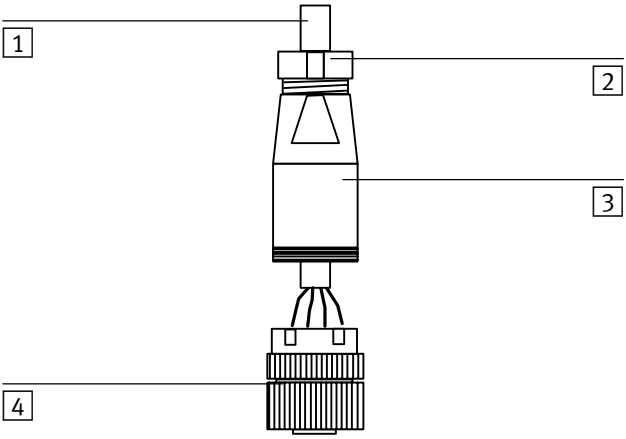


Fig. 1/8: Individual parts of socket and cable exit

Preparing

When you have selected suitable cables connect them as follows (Fig. 1/8):

1. Open the socket: Loosen the centre knurled nut.
2. Open the strain relief on the rear of the housing. Pass the cable through.
3. Remove 5 mm of the insulation from the end of the cable and fit core end sleeves.
4. Connect the conductors.
5. Replace the connecting part on the housing of the socket and screw it tight. Pull the cable back so that there are no loops inside the housing.
6. Tighten the strain relief.

1.6.2 Selecting the power unit

Warning

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

By the use of PELV circuits, protection against electric shock (protection against direct and indirect contact) is guaranteed in accordance with IEC/EN 60204-1 (Electrical equipment for machines, General requirements).

The current consumption of a CP system depends on the number of CP modules and valve coils. Recommendation:

- Used closed-loop power units.
- When selecting the power units, check that they provide sufficient output. Ascertain here the total current consumption according to the following table.

Total current consumption

The table below shows how to calculate the total current consumption for a CP system. The values specified have been rounded up.

Current consumption of CP electronics (pin 1)		**Sums**
CPV Direct	Max. 100 mA	
CPV valve terminal	Max. 40 mA	
CPA valve terminal	20 mA	
CP input module	Max. 40 mA	
Sensors	See manufacturer's specifications	
CP output module	Max. 40 mA	
Carry forward		=_____mA
Current consumption of valve supply (pin 2)		
Current consumption of all simultaneously energized valve coils [1)]	__x_____mA	=_____mA
[1)] Current consumption depends on the valve type (see Technical specifications for the valves in the relevant pneumatics manuals).		

Tab. 1/14: Calculating the total current consumption

1.6.3 Connecting the power supply

Warning
If the valve terminal is supplied with load voltage via an output of a “safety I/O module,” switch-on test pulses of the “safety I/O module” can cause unexpected reactions of the valve terminal.

- Make sure that switch-on test pulses are reliably suppressed or switched off.

Power is supplied via a 4-pin M12 plug (see Fig. 1/1).

The current consumption depends on the type of valve terminal. Please refer to the “Pneumatics manual, P.BE-CPV-..” and the previous section for the values.

- When connecting the 24 V load voltage at pin 2, observe the tolerance: 20.4 ... 26 V DC. Check the 24 V load voltage of the valves while your system is operating.

Caution
Protect the load voltage of the CPV valve coils with an external fuse max. 2 A.

In this way you can avoid functional damage to the CPV Direct in the event of a short circuit.

Please note

Check within the framework of your EMERGENCY STOP circuit, to ascertain the measures necessary for putting your machine/system into a safe state in the event of an EMERGENCY STOP.

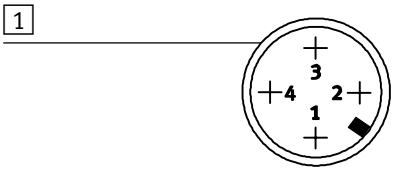
– Switching off the load voltage of the valves and output modules in the secondary circuit of the power unit.
– Switching off the compressed air supply to the valve terminal.

When the load voltage is switched off, there may be a delay before the valves are switched off, due to energy being stored in the input circuit of the valve terminals.

Take this into consideration, e.g. as follows:

– Register the fact that the load voltage is switched off by means of an input signal in the controller.
– Block the control signal of the valves by locking the output signal with the input signal “load voltage.”

Pin assignment of the power supply connection



1 Pin assignment
- 1: 24 V DC operating voltage for electronics (and inputs; in the case of connected modules on the extension connection) (max. 2 A)
- 2: 24 V DC load voltage for valves (max. 2 A)
- 3: 0 V
- 4: Earth/ground connection

Fig. 1/9: Pin assignment of power supply connection

Potential equalization

The CPV valve terminal has two earth connections for potential equalization:

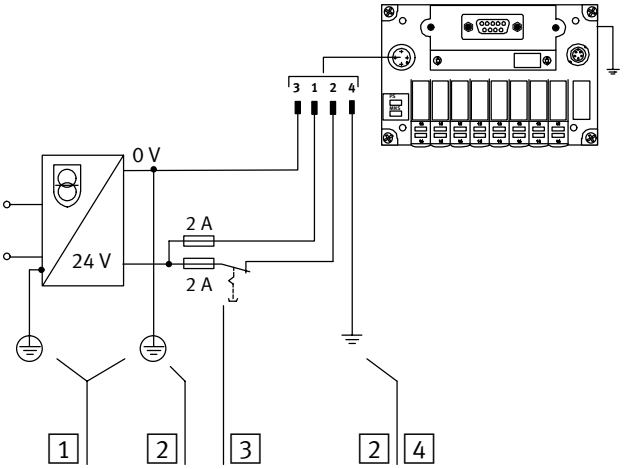
– on the power supply connection

– on the end plate.

Please note

- Always connect the earth potential to pin 4 of the power supply connection.
- Connect the earth connection of the end plate with low impedance (short cable with large cross-sectional area) to the earth potential.
- With low-impedance connections you can ensure that the housing of the valve terminal and the earth connection at pin 4 have the same potential and that there are no equalizing currents.

In this way, you will avoid interference caused by electromagnetic influences.



1 PE

2 Potential equalization

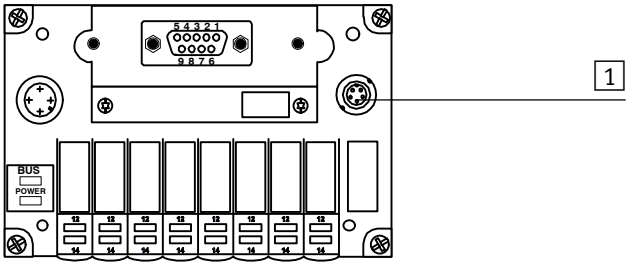
3 Load voltage can be switched off separately

4 The earth connection at pin 4 is designed for 3 A

Fig. 1/10: Example of connection with PELV power unit and potential equalization

1.7 Extending the CPV Direct

You can connect further modules of the CP system to the CPV Direct via the CP extension connection.



1 CP extension connection

Fig. 1/11: CP extension connection

Caution
Set the exact extension of your CP system on the 4-position DIL switch on the switch module. You can then avoid malfunctioning of your CP system.

Modules which you connect to the CP extension connection will be recognized only if the DIL switch is set correctly.

Information on setting the DIL switches can be found in chapter 1.2.2.

You can connect the following to the CP extension connection:

– CP input module with 16 inputs

– CP output module with 8 outputs

– CPV valve terminals

– CPA valve terminals (max. 8 double-solenoid or 16 single-solenoid valve plates in conjunction with a CPV Direct)

Please note
The CPV Direct can be extended by maximum:
– **one** CP input module
– **one** CP valve terminal or **one** CP output module.

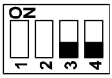
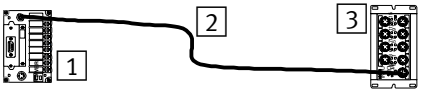
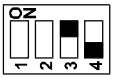
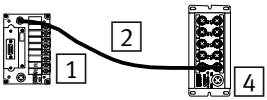
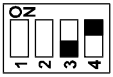
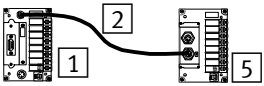
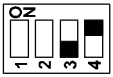
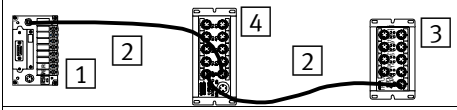
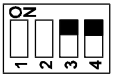
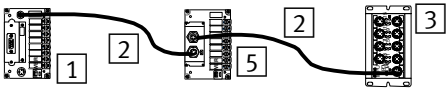
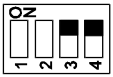
Caution
The maximum cable length between the CPV Direct and the last CP module must not exceed 10 m.

The CP connecting cables must have special electrical characteristics. Always use, therefore, Festo CP connecting cables.

You can obtain ready-to-use CP connecting cables from Festo. These are available in various lengths and types. You will find a summary in Appendix A.

Seal unused CP connections of your CP system with the relevant seal provided. You will then comply with protection class IP65.

The following table gives an overview of the possible extensions:

Extension to the CP system			Position of the switch elements in 4-position DIL switch
CPV Direct	**Output module or CP valve terminal**	**Input module**	
			
			
			
			
			
			
Total cable length of the CP system: maximum 10 m			
1 CPV Direct 2 CP connecting cable 0.5 m, 2 m, 5 m, 8 m 3 CP input module 16 inputs (8 x M12 plug, 16 x M8 plug) 4 CP output module with 8 outputs (8 x M12 plug) 5 CPV or CPA valve terminal			

Tab. 1/15: Extension possibilities for the CPV Direct

1.8 Use in an explosion-protected environment

Warning
If the terminal is to be used as an explosion-protected operating medium, make sure that:

- the electrical connections are **not** disconnected when power is still applied.
- the completely fitted product with all plugs, adapters and protective caps used complies at least with protection class IP64.

Explanations of the explosion protection marking on the product can be found in the Appendix "Technical specifications."

Overview of the installation steps:

1. Set the DIL switches and close the switch covers again. Make sure that the seals are seated correctly.
2. Install the product. CP cables and CP plugs from Festo are regarded as accessories within the framework of the conformity test as per 94/9/EG and may be used in potentially explosive environments, in accordance with the Ex-marking of the CP system.
3. Connect the field bus cable. Use only plugs which comply at least with protection class IP64. Close the cover of the plug if one is fitted.
4. Seal unused connections of the product with protective caps and blanking plugs which comply at least with protection class IP64.
5. Connect a power supply with PELV power units, as described in the chapter "Installation."

The conformity declaration as per EU directive 94/9/EG can be obtained from Festo.

Commissioning PROFIBUS-DP

Chapter 2

Contents

2.1 Preparing the CPV Direct for commissioning

2.1.1 Switching on the power supply

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

When the controller is switched on, it will automatically carry out a comparison between the NOMINAL and the ACTUAL configurations. For this configuration procedure it is important that:

– the specifications for the field bus configuration are complete and correct.

– the power supplies for the programmable logic controller and for the field bus slaves are switched on eithersimultaneously or in the sequence indicated below.

Please note the following when switching on the power supply:

Common supply

If there is a common supply for the control system and for all the field bus slaves, the power should be switched on via a central power unit or central switch.

Separate supply

If there is a separate supply for the control system and for the field bus slaves, the power should be switched on in the following sequence:

1. the power supply for all the field bus slaves.

2. the power supply for the controller.

2.1.2 Address assignment of the CPV Direct

The CPV Direct always occupies 16 output addresses, irrespective of the number of valve solenoid coils fitted on it. This enables the CPV Direct to be extended at a later stage without the need to shift the addresses.

The following diagram shows the addressing sequence of the individual CPV valve plates.

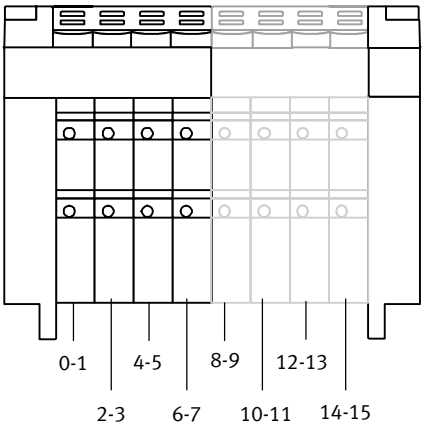


Fig. 2/1: Address assignment of the CPV Direct

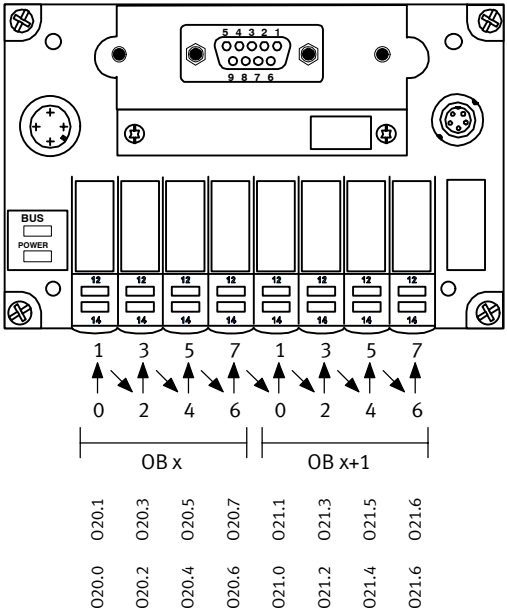
– A valve location on the CPV Direct always occupies 2 addresses, even if it is fitted with a blanking plate or pressure-separator plate. If a valve location is fitted with a double-solenoid valve, the following assignment applies:

  – pilot solenoid 14 occupies the lower-value address

  – pilot solenoid 12 occupies the higher-value address.

  With single-solenoid valves the higher-value address remains unused.

– Addresses are assigned from left to right on the CPV Direct and from the front to the rear on the individual valve locations.



OB: Output byte

Fig. 2/2: Address assignment of the CPV Direct (outputs) with examples for OB20 and OB21

2.1.3 Information on commissioning

FREEZE and SYNC

The operating modes FREEZE and SYNC are supported by the CP system in accordance with EN 50170.

The method of accessing the commands FREEZE and SYNC depends on the controller used. Please refer here to the documentation for your field bus module.

Caution
The operating modes FREEZE or SYNC will be reset automatically if:

– the CP system is switched on/off
– the field bus module is stopped.

Only the operating mode FREEZE will be reset automatically if:

– the bus connection to the CP system is interrupted (response monitoring active).

FREEZE command

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

SYNC command

All the inputs of the CP system will be “frozen.” The valve 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

Module consistency

The CP system supports the following variants of module consistency:

– over the selected format (word)

Configuration with DP identifiers

The position of the DIL switch for the extension of the CP system is relevant for the required DP identifiers (see sections 1.2.2 and 1.7).

Please note
Make sure that the DIL switches are set according to the extension of your CP system.

The following table provides an overview of the possible DP identifiers for the CP system:

Extending the CPV Direct	DP identifier		Comment
	Siemens	EN 50170	
Only CPV Direct (no extension)	ID1: 16DO	ID1: 033_d	16 digital outputs
Extension with one input module	ID1: 16DO	ID1: 033_d	16 digital outputs
	ID2: 16DI	ID2: 017_d	16 digital inputs
Extension with one CP valve terminal or one CP output module	ID1: 16DO	ID1: 033_d	16 digital outputs
	ID2: 16DO	ID2: 033_d	16 digital outputs
Extension with one CP valve terminal or one CP output module and one input module	ID1: 16DO	ID1: 033_d	16 digital outputs
	ID2: 16DO	ID2: 033_d	16 digital outputs
	ID3: 16DI	ID3: 017_d	16 digital inputs

Tab. 2/1: Overview of DP identifiers for various extensions to the CPV Direct

Please note
Enter the identifiers corresponding to the physical sequence of the modules, starting with the CPV Direct.

Example:

	DP identifier	Comment
1	16DO	16 digital outputs (CPV Direct)
2	16DI	16 digital inputs (input module)

Tab. 2/2: CPV Direct extended with one input module

2.2 Device master file (GSD) and icon files

In order to configure the CPV Direct with a PC/programmer, you will require the appropriate GSD file. In addition to slave-typical entries (Ident. number, Revision, etc.), the device master file (GSD) also contains a selection of identifiers.

Reference sources

Current GSD files can be found on the Festo Internet pages under:

– www.festo.com/fieldbus

You can obtain the GSD files and further configuration aids with the CD ROM “Utilities” from Festo:
type P.CD-VI-UTILITIES-2, part no. 533500
The most up-to-date GSD files are always available via the Internet.

GSD files

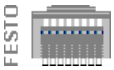
You will require one of the following files for the CPV Direct:

– VI1000C9.GSD (german version) or

– VI1000C9.GSE (international version)

Symbol files

In order to represent the valve terminal in your configuration software, you will find icon files under the above-mentioned Internet address:

Normal operating status	Diagnostic case	Special operating status
		
File: Pb_dicpn.dib	File: Pb_dicpd.dib	File: Pb_dicps.dib

Tab. 2/3: Icon files for configuration software

2.3 Configuration with a Siemens master

Please note
Various configuration programs are available for use in conjunction with a Siemens master. Please observe the relevant procedure for your configuration program.

The following sections describe as an example the main configuration steps with the STEP 7 software. It is assumed that the reader is already familiar with the information in the manual for the STEP 7 software.
Information on operation with general DP masters can be found in A.2.

2.3.1 STEP 7 – HW Config (up to V 5.2)

Preparations

GSD

1. Copy the GSD of the valve terminal into the directory ...\STEP7\S7DATA\GSD on your PC/programmer.
   File: VI1000C9.GS*
   (Reference sources for the GSD see section 2.2)

   The GSDs can either be:

   – copied manually into the above mentioned directory (e. g. with Windows Explorer) or

   – loaded via the menu [Options] – [Install new GSD].

Please note
Update the hardware catalogue, if you copy the GSD during work with STEP 7.
Menu HW Config: [Options] [Update catalogue]

Please note
As from STEP 7 V4.02, GSDs are stored within the STEP 7 project (station GSD). This can cause the updating/reading of new GSD files to appear as if incorrect. Please inform yourself about handling the station GSD files in the STEP 7 help.

2. Process the dialogue window “Properties PROFIBUS”
   – Baud rate
   – Profile

Icons

3. Copy the icon files (see section 2.2) for the CPV Direct into directory ...\STEP7\S7DATA\NSBMP on your PC or programmer.

   The icon files can either be copied

   – manually into the above named directory or

   – loaded via the menu [Options] [Install new GSD] – file type “Bitmap files” in HW Config.

4. Insert a DP master system:
   – Right-hand mouse click on “DP” under “CPU” in the rack
   – Click on [Add master system] in the context menu.
   The line of the DP master system will be displayed.

Station selection with STEP 7

1. If the hardware catalogue is not open: click on the catalogue icon (see Fig. 2/3 [1]).
   The hardware catalogue will be displayed.

2. Open the following folder in the hardware catalogue:
   "\PROFIBUS-DP\Additional Field Devices\Valves."
   The folder VALVES is displayed when you copy the GSD (see step 1 of the preparations).
   Pull the station type "FESTO CPV DO01" onto the line of the DP master system [2].
   The dialogue window "Properties – PROFIBUS interface" will be displayed [3].

3. Select the PROFIBUS address identical to the selected setting on the DIL/rotary switch in the switch module (see section 1.2.2) and close with OK.
   The dialogue window "Properties – DP slave" appears [4].

4. Process the dialogue window, if necessary, and close it.
   The icon of the valve terminal will be displayed on the line of the DP master system.

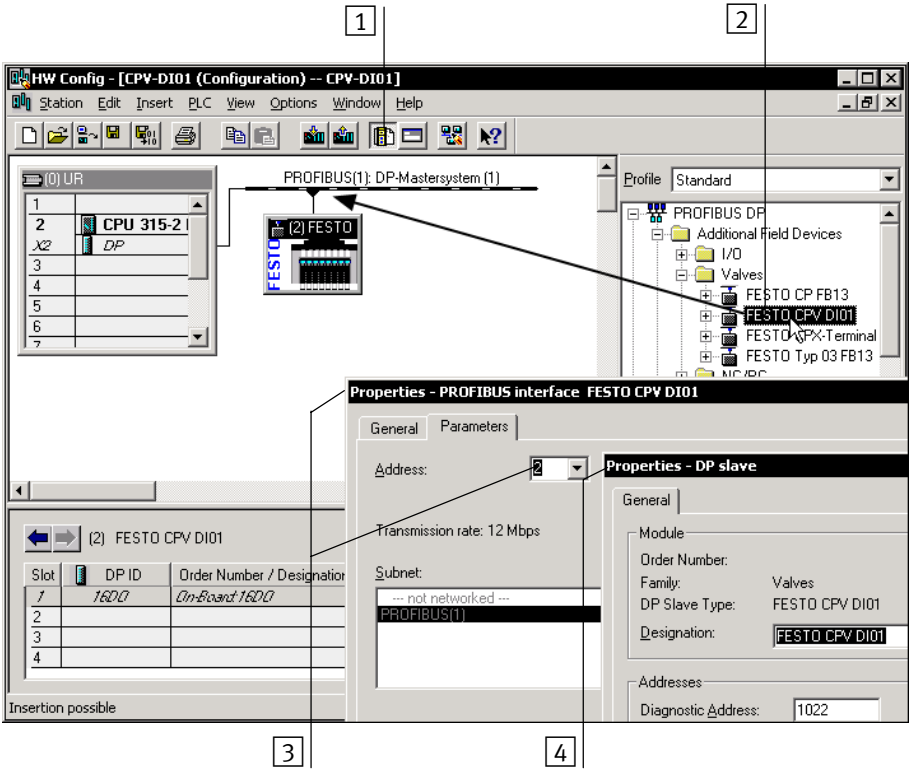


Fig. 2/3: Station selection with STEP 7 – HW Config
(The windows displayed are not all visible at the same time, see text.)

Configuration with STEP 7

The outputs of the CPV Direct valve locations are entered automatically in the configuration table. If you have connected modules to the extension connection of the CPV Direct, you must assign the configuration table as follows:

1. Click on the icon of the valve terminal to be configured in HW Config [1]. The configuration table will be displayed under the rack [2].
2. Open the module “FESTO CPV DI01” (Folder\PROFIBUS-DP\Additional Field Devices\Valves\...) in the hardware catalogue [3].
3. Pull the modules onto the next free line in the configuration table according to the extension of your CPV Direct. Assign the starting address in the window “Properties – DP slave” [4].

Please note
Pull the modules into the configuration table according to the physical sequence of the extensions of your CP system.

Modifying the address

- Double click the appropriate line in the configuration table and modify the starting address of the inputs or outputs in the window “Properties – DP slave.”

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

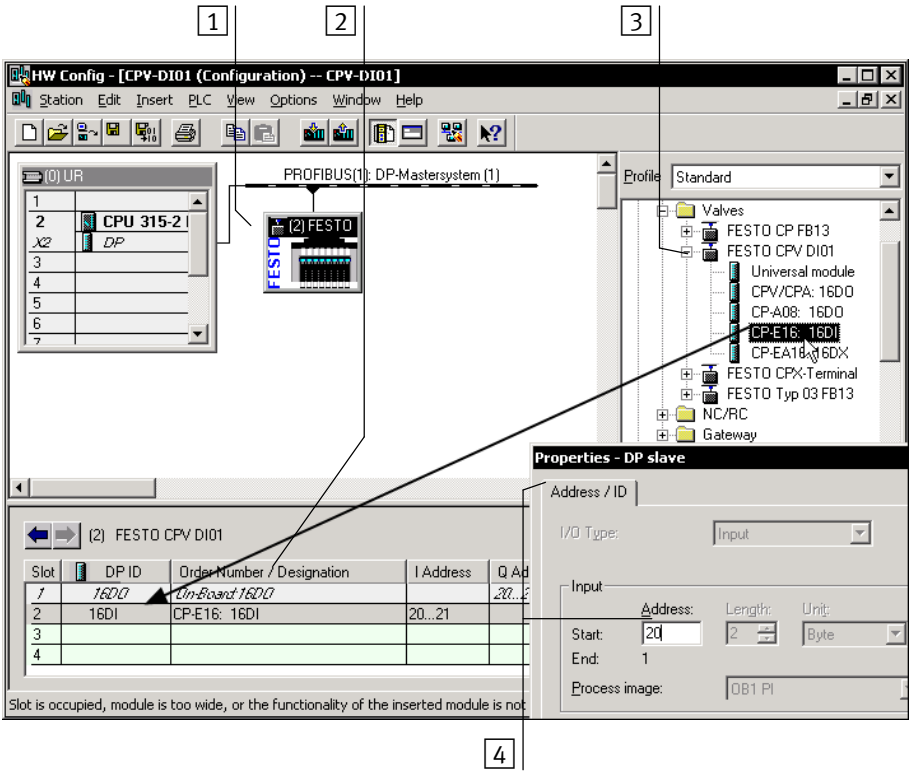


Fig. 2/4: Configuration with STEP 7 V – HW Config
(Example for extension with one CP input module, explanations see text.)

This concludes the station selection and configuration.

2.3.2 Example of addressing

	Extension to the CP system	DP identifier	I/O address (IN/OUT)
1	CPV Direct (without extension)	16DO	O20.0...O21.7
2	CPV valve terminal with 8 double-solenoid valves	16DO	O22.0...O23.7
3	CP input module, 16 inputs	16DI	I20.0...I21.7

Tab. 2/4: Example: Input and output address (see Fig. 2/5)

1 CPV Direct

2 CPV valve terminal with 8 valve plates

3 CP input module with 16 inputs

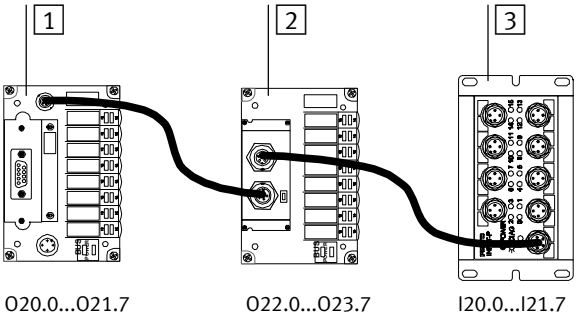


Fig. 2/5: Example – addressing the inputs and outputs of a CP system with CPV Direct and maximum extension

2.3.3 Commissioning the CP system on the PROFIBUS-DP

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

Proceed as follows:

1. Connect the field bus cable to the CPV Direct.
2. Switch on the operating voltage:
   - of all field bus slaves
   - of the CP system.
3. Switch on the operating voltage for the master module.

Configuration run

Some master systems carry out a comparison between the NOMINAL and the ACTUAL configurations (= DIL switch setting) automatically when the system is switched on. For this configuration run it is important that:

- the specifications for the NOMINAL configuration are complete and correct (see also section 2.1.2).
- the power supply for the programmable logic controller and for the field bus slaves is switched on eithersimultaneously or in the sequence indicated above.

Recommendation:
Providing the safety concept of your machine/system permits this, commission the CP system with both operating voltages (pins 1 and 2), but without compressed air. A suitable test function is therefore available which does not trigger undesired reactions.

Please note
A CP valve location occupies two addresses.
The following assignment applies:
– lower value address: pilot solenoid 14
– higher-value address: pilot solenoid 12

Diagnosis PROFIBUS-DP

Chapter 3

Contents

3.1 Diagnosis by means of LEDs

The LEDs on the cover indicate the operating status of the CPV Direct.

1 Red LED:
Bus status/fault (BUS)

2 Green LED:
Operating voltage display (POWER)

3 Yellow LED row for pilot solenoid 12

4 Yellow LED row for pilot solenoid 14

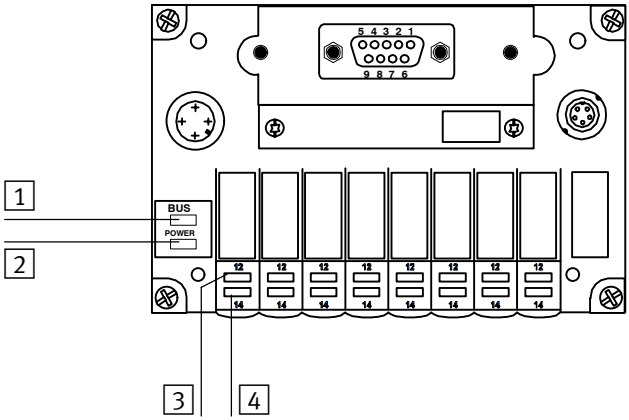


Fig. 3/1: LEDs of the CPV Direct

3.1.1 Normal operating status

In normal operating status the green power LED lights up.

lights up; flashes; ◯ out

LED	Colour	Operating status	Fault treatment
BUS ◯	out	Normal	None
POWER	green lights up	Normal	None

Tab. 3/1: Normal operating status

3.1.2 Fault displays of the BUS/POWER LEDs

Fault diagnosis with the green LED (POWER)

LED	Colour	Operating status	Fault treatment
POWER 	out	Operating voltage for electronics not applied	• Check the operating voltage (pin 1)
POWER 	green flashes fast	Load voltage of the CP valves < 20.4 V	• Check the load voltage supply (pin 2)
POWER 	green flashes slowly	Load voltage of the CP valves < 10 V	• Check the load voltage supply (pin 2)

Tab. 3/2: Fault diagnosis with the green POWER LED

Load voltage faults are always displayed with the green LED (irrespective of the diagnostic mode set).

If the device-related diagnosis is active, faults will also be passed on to the master PLC via the field bus.

Fault diagnosis with the red LED (BUS):

LED	Colour	Operating status	Fault treatment
BUS 	red lights up	Hardware fault	• Servicing required
BUS 	red flashes fast	PROFIBUS address not valid	• Correct address setting (1, ..., 125)
BUS 	red flashes slowly (1-second intervals)	Field bus connection not OK. Possible causes: – Station number not correct (e.g. address assigned twice) – Field bus module switched off or defective – Interrupted, short-circuited or faulty field bus connection – Configuration faulty, master configuration setting in the switch module	Check the ... • address setting • field bus module • field bus connection • configuration of the master and the setting in the switch module
BUS 	flashes red briefly out	Switch module is missing Switch module defective	• Install switch module • Replace switch module

Tab. 3/3: Fault diagnosis with the red BUS LED

3.1.3 LEDs for status display of the valve solenoid coils

There is a yellow LED for every valve solenoid coil (see Fig. 3/1). The LED indicates the switching status of the valve solenoid coil.

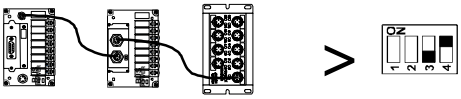
LED	Colour	Switch position Valve solenoid coil	Meaning
○	out	Basic position	Logical 0 (no signal)
	yellow lights up	– Switch position or – Basic position	Logical 1 (signal present) Logical 1 but: – load voltage of the valves lies below the permitted tolerance range (< 20.4 V DC) or – compressed air supply not OK or – pilot exhaust blocked or – servicing required

Tab. 3/4: LEDs for status display of the valve solenoid coils

Please note
If there is no valve solenoid coil, the assigned LED will **not** show control of the output.

3.2 Eliminating faults

A deviation in the actual extension of your CP system from the extension set in the switch module can lead to problems when the system is started (see section 1.7 “Extending the CPV Direct”). The following table shows the reaction:

Extension to the CP system (examples)	Deviation	Behaviour
	Extension **greater** than the setting in the switch module.	System starts. A redundant non-configured module will be ignored.
	Extension **greater** than the setting in the switch module.	System starts. Carry out device-related diagnosis (see section 3.3).

Tab. 3/5: Behaviour if the system extension differs from the setting of the DIL switch

3.3 Diagnosis via PROFIBUS-DP

The CP system supports diagnostic possibilities via the PROFIBUS as per EN 50170. The device-specific diagnosis is supported.

Please note
The identifier-related or channel-related diagnosis listed in EN 50170 is not supported.

3.3.1 Diagnostic words

The following fault states of the CP system are grouped into diagnostic words and passed on to the DP master:

- Failure of the load voltage supply for the valves (pin 2)
- Short circuit in sensor power supply
- Failure of load voltage at the output modules
- Short circuit/overload at the output modules
- Interruption of the CP connection on various CP modules
- Lower voltage tolerance limit of CP valves exceeded (< 20.4 V)

3.3.2 Diagnostic steps

The CP system offers extensive diagnostic possibilities via the PROFIBUS-DP. The diagram below shows you the steps required for diagnosing the CP system. Only the diagnostic bits, which require a further diagnostic step, are represented.

Please note
The diagnostic information is only sent to the master system if the device-related diagnosis is activated in the switch module. In order to do this, set switch element 8 of the 8-element DIL switch to “ON.”

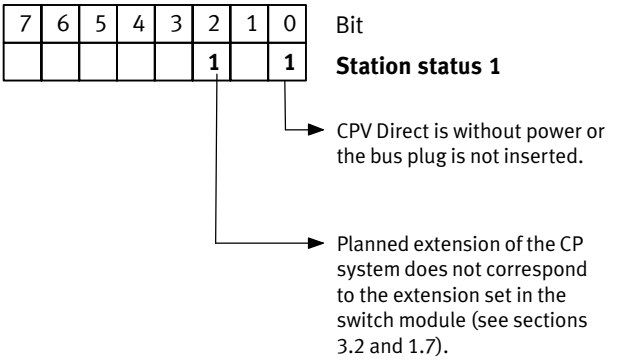


Fig. 3/2: First diagnostic step

In the following only those diagnostic bits, which require further diagnostic steps, are represented.

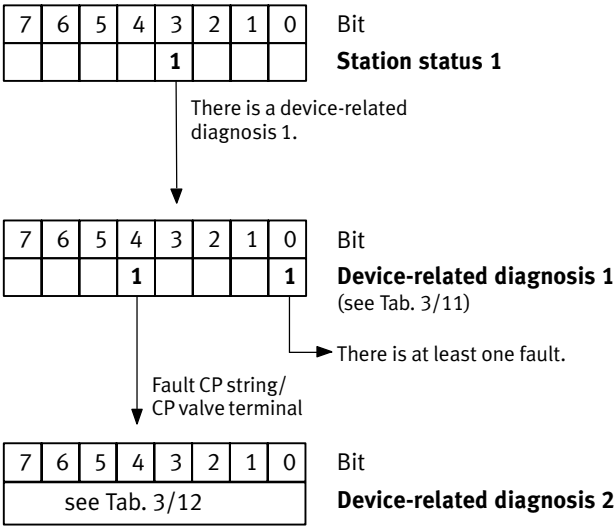


Fig. 3/3: Further diagnostic steps

It can in some cases be helpful if you switch off the device-related diagnosis when commissioning your system. If your controller does not start, try at first with the setting “Device-related diagnosis inactive” in the switch module (see section 1.2.2).

3.3.3 Overview of diagnostic bytes

Diagnostic words

Several diagnostic words are provided for each bus slave. The diagnostic words and their meaning for CP systems from Festo are shown in the following table:

Byte *	**Octet ****	**Diagnostic address**	**Diagnostic address + 1**	**Octet ****	**Byte ***
0	**1**	**Station status 1**	**Station status 2**	**2**	**1**
2	**3**	**Station status 3**	Master address (Diag.Master_Add)	4	3
4	5	Manufacturer identifier (Ident_number High byte 00_h)	Manufacturer identifier (Ident_number Low byte $C9_h$)	6	5
6	7	Header	**Device-related diagnosis 1 (overview of faults)**	**8**	**7**
8	**9**	**Device-related diagnosis 2 (fault byte CPV Direct)**	always logical “0”	10	9
bold = Contents modified by the CP system * = Siemens ** = EN 50170					

Tab. 3/6: Overview of diagnostic bytes: Standard diagnostic information

3.3.4 Details of standard diagnostic information

The following diagnostic information can be requested by the DP master from the CP system via the function **Slave_Diag**. The CP system replies with an octet string of length 10. The procedure for reading out this diagnostic information with a SIMATIC S5/S7 system is described in section 3.4.1.

Octet 1: Station status_1

Bit	Meaning	Explanation
0	**Diag.Station_Non_Existent**	CP system no longer/not yet addressable. Possible causes: – operating voltage not applied – data cable interrupted – fault in data cable
1	**Diag.Station_Not_Ready**	CP system not yet ready for data exchange
2	**Diag.Cfg_Fault**	The configuration data received from the master do not agree with those ascertained by the CP system.
3	**Diag.Ext_Diag**	There is a device-related diagnosis. Possible causes: – cable fracture on input/output module – short circuit/overload at electric outputs or sensor supply for inputs – V_{valves} < 20.4 V – $V_{outputs}$ < 10 V – V_{sensor} < 10 V
4	Diag.Not_Supported	1 = CP system does not support the function requested
5	Diag.Invalid_Slave_Response	Always 0 (set by CP system)
6	Diag.Prm_Fault	Last parametrizing telegram faulty
7	Diag.Master_Lock	Always 0 (set by CP system)
bold = Valve terminal related bits		

Tab. 3/7: Diagnostic bits station status1

Octet 2: Station status_2		
Bit	**Meaning**	**Explanation**
0	**Diag.Prm_Req**	1 = The master must configure the CP system again
1	Diag.Stat_Diag	1 = The master must request diagnostic data until this bit is set to 0
2	–	Always 1 (set by CP system)
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 CP system)
bold = Valve terminal related bits		

Tab. 3/8: Diagnostic bits of station status 2

Octet 3: Station status_3		
Bit	**Meaning**	**Explanation**
0...6	–	Reserved
7	Diag.Ext_Diag_Overflow	Always 0 (set by CP system)

Tab. 3/9: Diagnostic bits of station status 3

Further octets

Octets 4...7: Overview

Octet	Designation	Explanation
4	Diag.Master_Add	Master address: The address of the master, which parametrized the CP system, is entered in this octet.
5...6	Ident_number	Manufacturer identification: These octets contain the manufacturer identification: $009C_h$ for the CPV Direct.
7	Ext_Diag_Data (device-related diagnosis)	Header device-related diagnosis: The CP system enters the fixed value 8 in this octet, i.e. 4 octets “Device-related diagnosis” incl. the header octet, are made available/transferred, irrespective of the equipment fitted on the CP system. 3 of the 4 octets are used.

Tab. 3/10: Overview of the octets 4...7

Structure of device-related diagnosis

Octet 8: Device-related diagnosis 1 *)		
Bit	**Meaning**	**Explanation**
0	Common fault in CP system	1 = There is at least one fault
1	–	Not used
2	–	Not used
3	–	Not used
4	Common fault	1 = Fault CP string/CP valve terminal
5	–	Not used
6	–	Not used
7	–	Not used
*) Is sent to the master controller only if the device-related diagnosis is activated in the switch module.		

Tab. 3/11: Diagnostic bits device-related diagnosis 1

Octet 8: Device-related diagnosis 2		
Bit	**Meaning**	**Explanation**
0	$Error_{Output}$	1 = CP connection interrupted at output module
1	$Error_{Input}$	1 = CP connection interrupted at input module
2	Short circuit/overload	1 = Short circuit/overload at output module
3	V_{out}	1 = Load voltage failure at output module
4	V_{sen}	1 = Short circuit/overload in sensor supply < 10 V
5	V_{val}	1 = Load voltage of valve coils < 20.4 V
6	V_{load}	1 = Load voltage of valve coils < 10 V
7	Ix	Not used

Tab. 3/12: Diagnostic bits device-related diagnosis 2

3.4 Fault treatment

With the following faults, the behaviour of the CP system depends on the configured behaviour of the master module:

– telegram failure

– master stopped

– interruption in the bus cable.

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

Warning
- Make sure that valves and outputs are put into a safe state when the faults named occur.

An incorrect status of the valves and outputs may lead to dangerous situations.

Please note
Please observe the following if the outputs are reset in the event of a PLC stop, field bus interruption or field bus 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: pressurized, exhausted or blocked).

3.4.1 Siemens SIMATIC S5/S7

With these controllers, you can determine the reaction of the CP system to the faults named above.

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

There are two ways in which you can set the control system to react to faults:

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

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

Control system	Module	Meaning	STOP	RUN
SIMATIC S5 with IM 308C	OM23	Reaction to QVZ with direct periphery access	Default	OM is programmed
	OM24	Reaction to QVZ with periphery access via process image	Default	OM is programmed
	OM35	Reaction to PEU (periphery not clear)	Default	OM is programmed
SIMATIC S7/M7	OM82	Reaction to a device-specific diagnosis	Default	OM is programmed
	OM86	Reaction to failure of a DP slave	Default	OM is programmed
QVZ: Quitting delay, OM: Organisation module, PEU: Periphery not clear				

Tab. 3/13: Fault reactions STOP and RUN with S5/S7

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

Possibilities for reading out the diagnosis for S5/S7

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

Control system	Function module	See ...	Manufacturer
SIMATIC S5 with IM 308C	FB 192 “IM 308C”	Manual “ET 200 decentral periphery system”	Siemens
SIMATIC S5 with S5-95U/DP master	FB 230 “S_DIAG”	Manual “ET 200 decentral periphery system”	Siemens
SIMATIC S5 with SF 50/DP master	FB 230 “S_DIAG”	Manual “Programmable valve terminal with SB/SF 50”	Festo
SIMATIC S7/M7	SFC 13 “DP NRM_DG”	Reference manual “System functions and standard functions”	Siemens

Tab. 3/14: Possibilities for reading out the diagnosis for S5/S7

Example for a STEP 7 user program:

STL	Explanation
`CALL SFC 13`	
`REQ:=TRUE`	Request to read
`LADDR:=W#16#03FE`	Pointer at diagnostic address, e.g. $1022_d = 03FE_h$ (see window “Properties – DP slave” in HW Config)
`RET_VAL:=MW100`	If fault occurs, output fault code
`RECORD:=P#M110.0 WORD 5`	Pointer at start of data range for diagnosis and length of diagnostic data
`BUSY:=M10.0`	Reading concluded

Fig. 3/4: Example

3.5 Online diagnosis with STEP 7

Direct diagnostic events in conjunction with the CP valve terminal can be:

- Decentral periphery: station failure
  - communication between slave and master interrupted.
- Module faulty (see device-related diagnosis Tab. 3/11 and Tab. 3/12).
- Transition of the operating status from START to RUN (nominal/actual difference exists)
  - the configuration data of the valve terminal do not agree with the periphery.
  - valve terminal has incorrect DIL switch setting.

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

The diagnostic buffer of STEP 7 offers the possibility of displaying diagnostic events of the S7 systemin the sequence in which they occur.

Prerequisites:
- HW Config has been accessed.

Proceed as follows (see Fig. 3/5):

1. Switch from offline to online [1].
2. Click with the right-hand mouse button on the CPU in the rack [2].
3. Click on [Module Information ...] in the context menu which now appears. The window “Module Information” will be shown [3].
4. Select the register “Diagnostic Buffer” [4].
5. Click on the event and read the details [5]. These supply more detailed information on further procedures and depend on the S7 controller used.

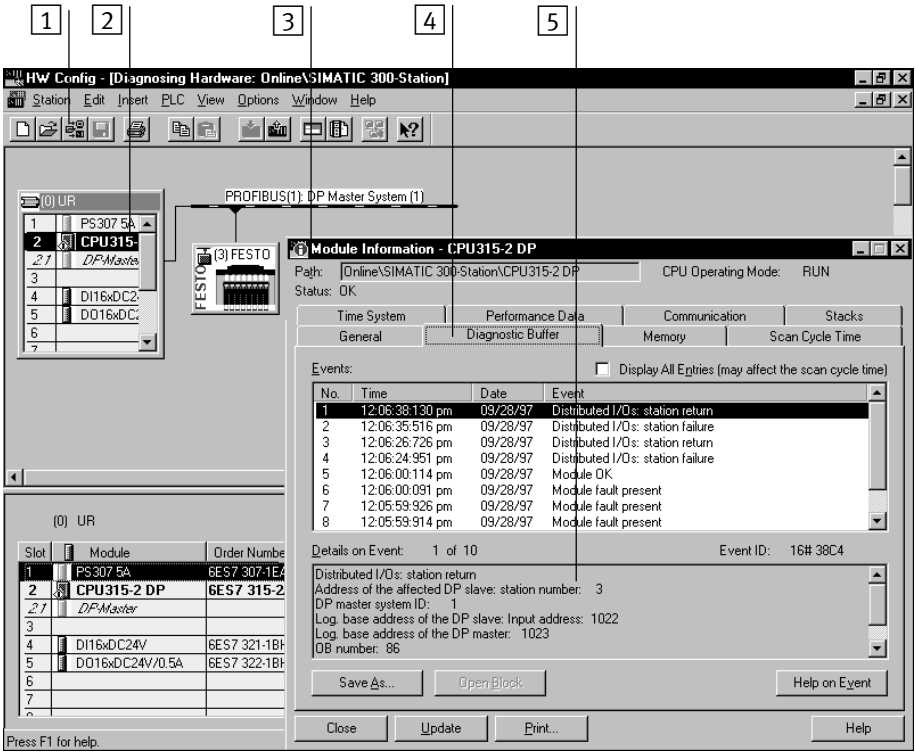


Fig. 3/5: Online diagnosis via diagnostic buffer (explanation see text)

3.5.2 Device-related diagnosis with STEP 7 (up to V 5.2)

You can display fault messages of the device-related diagnosis via the window “Module Information” (see Fig. 3/6):

1. Click with the right-hand mouse key on the icon of the valve terminal 1.
2. Click on [Module Information ...] in the context menu which now appears. The window “Module Information” will be shown.
3. Read the diagnostic information 2.

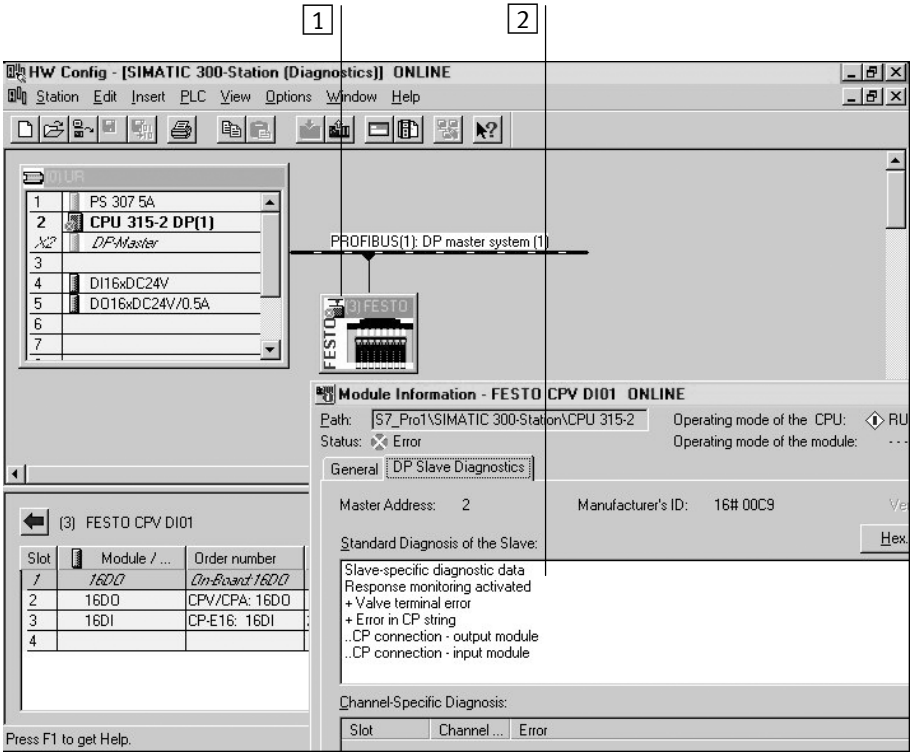


Fig. 3/6: Device-related diagnosis with STEP 7 (explanation see text)

3.6 Short circuit/overload

Detailed information on input and output modules can be found in the manual “CP modules electronics.”

3.6.1 Output module

In the event of a short circuit or overload

- all the digital outputs of an output module will be switched off.
- the green LED “Diag” on the output module will flash quickly.
- the bit short circuit/overload in octet 9 “Device-related diagnosis 2” will be set to logical 1.

Please note
The outputs cannot be used again until the short circuit or overload has been eliminated and the fault deleted.

Deleting the fault

You can delete the fault by resetting all eight outputs. You can do this in one of the following ways:

Possibilities	**Explanation**
• Set all the outputs of the output module to logical “0” (RESET) or	– Manually or automatically in the program
• Briefly interrupt the CP connection at the CP output module or	– Outputs on the output module will be reset automatically
• Briefly interrupt the operating voltage for the CP system	– All outputs of the CP system will be reset automatically

Tab. 3/15: Deleting the fault – possibilities

The outputs can then be used again. If the short circuit/overload still exists, the outputs will be switched off again.

3.6.2 Sensor supply at an input module

If there is a short circuit, overload or voltage fault in the sensor supply:

– the sensor supply for all inputs of the module will be switched off.

– the green LED “Diag” on the input module will flash quickly.

– the fault bit V_{sen} in octet 9 “Device-related diagnosis 2” will be set to logical 1.

Please note
The outputs cannot be used again until the short circuit or overload has been eliminated and the fault deleted.

Deleting the fault

You can delete the fault in one of the following ways:

– Briefly interrupt the CP connection at the CP input module

or

– Briefly interrupt the operating voltage of the CP system on the CPV Direct

The inputs can then be scanned again. If the short circuit/ overload still exists, the fault will be shown again.

Module CP-E16-M8-Z:
The short circuit/overload will be reset automatically and the voltage will be switched on again.

Commissioning Festo field bus

Chapter 4

Contents

4.1 Preparing the CPV Direct for commissioning

4.1.1 Switching on the operating voltages

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

When the controller is switched on, it automatically carries out a comparison between the NOMINAL and the ACTUAL configurations. For this configuration run it is important that:

– the specifications for the field bus configuration are complete and correct.

– the power supplies for the programmable logic controller and for the field bus slaves are switched on eithersimultaneously or in the sequence indicated below.

Please observe the following points when switching on the power supply:

Common supply

If there is a common supply for the control system and for all the field bus slaves, the power should be switched on via a central power unit or central switch.

Separate supply

If there is a separate supply for the control system and for the field bus slaves, the power should be switched on in the following sequence:

1. the power supply for all the field bus slaves

2. the power supply for the controller.

4.1.2 Address assignment of the CPV Direct

The CPV Direct always occupies 16 output addresses, irrespective of the number of valve solenoid coils fitted on it. This enables the CPV Direct to be extended at a later stage without the need to shift the addresses.

The following diagram shows the addressing sequence of the individual CPV valve plates.

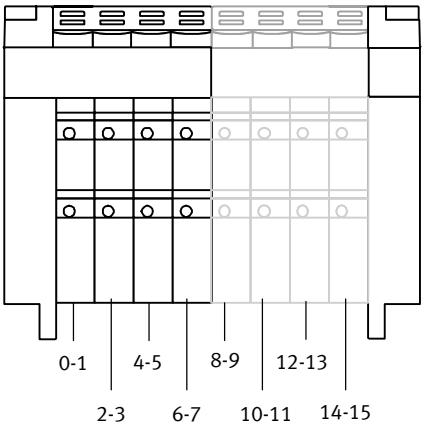


Fig. 4/1: Address assignment of the CPV Direct

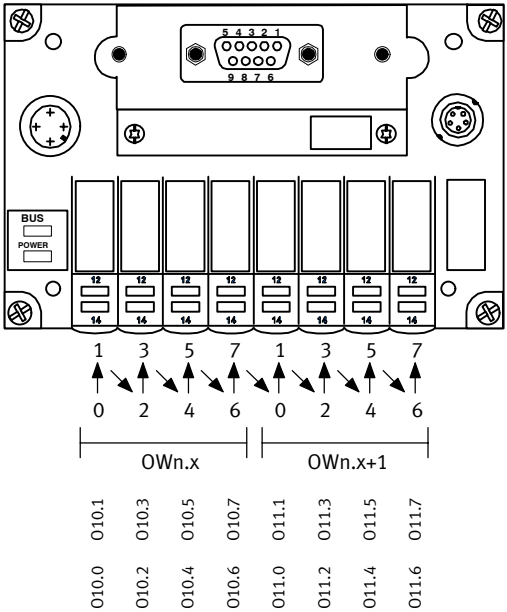
– A valve location on the CPV Direct always occupies 2 addresses, even if it is fitted with a blanking plate or pressure-separator plate. If a valve location is fitted with a double-solenoid valve, the following assignment applies:

  – pilot solenoid 14 occupies the lower-value address

  – pilot solenoid 12 occupies the higher-value address.

  With single-solenoid valves the higher-value address remains unused.

– Addresses are assigned from left to right on the CPV Direct and from the front to the rear on the individual valve locations.



OW: Output word
n: Slave number
x: Word (8 bits)

Fig. 4/2: Address assignment of the CPV Direct (outputs) with example for slave no. 1

4.2 Configuration

Please note
The CP modules occupy constantly 16 outputs or 16 inputs, irrespective of the system extension and the type of module (inputs, outputs, valves).

The position of the DIL switch for the extension of the CP system is relevant for the number of assigned I/O addresses and station numbers (see sections 1.2.2 and 1.7).

Please note
Make sure that the DIL switches in the switch module are set according to the extension of the CP system.

If the set extension is greater than the actual extension, a fault message (ACP) will be displayed.

4.2.1 Configuration with field bus configurator

The field bus configurator in the FST software will assist you in creating the NOMINAL configuration. Operation of the menu and the FST software is described in the relevant FST manual for your controller.

Procedure

1. Enter the field bus address of the field bus slave (CP system).
2. Select the type of field bus slave (“Valve term. 10” for CP system).
3. Enter the number of assigned inputs/outputs in bytes under IW and OW.

Please note
The entry mask of the field bus configurator displays IW and OW on the screen. This stands for input and output words each with 8 bits.

Enter two IW or two OW for each module (16 inputs or 16 outputs).

Please note
With a Festo field bus master you can also configure the CP system with an actual-nominal comparison. An existing field bus configuration will then be loaded into the master.

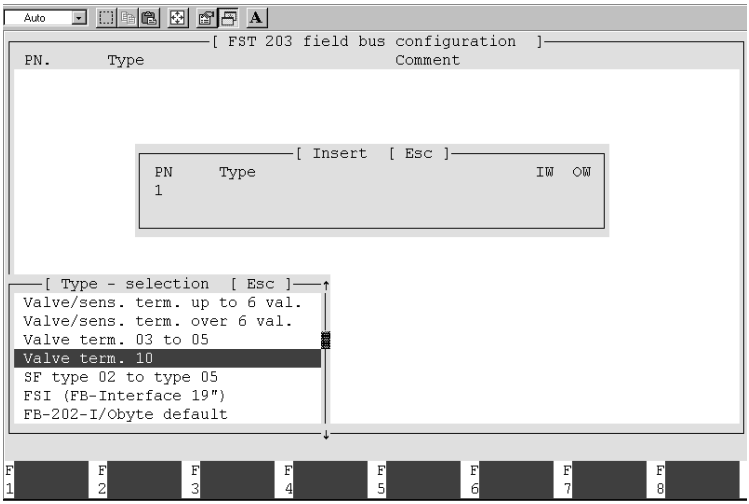


Fig. 4/3: Example – configuring with FST 200; select CP system from slave list

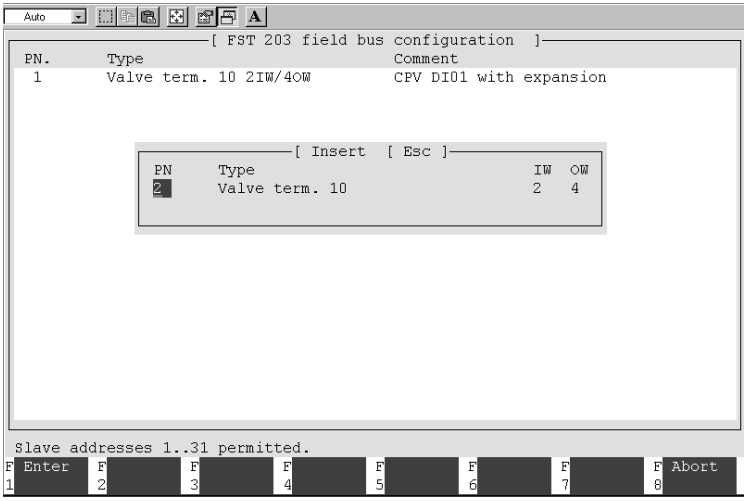


Fig. 4/4: Example – configuring with FST 200; enter number of IW or OW

Addressing

Please note
Addressing the CP system via the Festo field bus is carried out in bytes.

Note the differences from the word-by-word addressing of other field bus slaves.

Addressing the inputs/outputs

The following example shows the addressing of the inputs/outputs when the CPV Direct is extended by one valve terminal and one output module.

Example

Master:	Festo SF3
Configuration with FST 200:	2 IW and 4 OW
Field bus address of CP system:	3

1 CPV Direct

2 CPV valve terminal with 8 valve plates

3 CP input module with 16 inputs

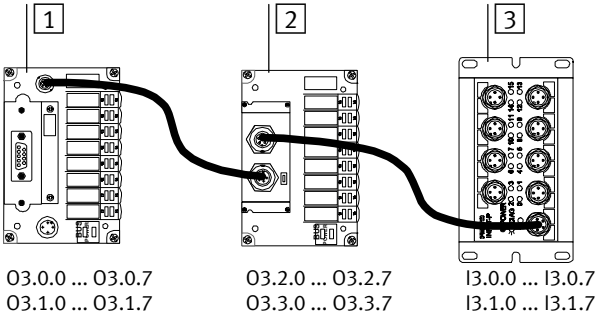


Fig. 4/5: Example – addressing with the Festo field bus

Diagnosis Festo field bus

Chapter 5

Contents

5.1 Diagnosis with LEDs

The LEDs on the cover indicate the operating status of the CPV Direct.

1 Red LED: Bus status/fault (BUS)

2 Green LED: Operating voltage display (POWER)

3 Yellow LED row for pilot solenoid 12

4 Yellow LED row for pilot solenoid 14

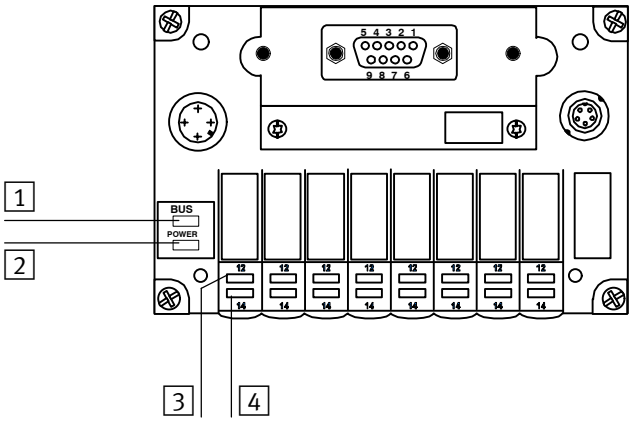


Fig. 5/1: LEDs of the CPV Direct

5.1.1 Normal operating status

In normal operating status only the green power LED lights up.

lights up; flashes; out

LED	Colour	Operating status	Fault treatment
BUS ○	out	Normal	None
POWER ☀	green lights up	Normal	None

Tab. 5/1: Normal operating status

5.1.2 Fault displays of the BUS/POWER LEDs

Fault diagnosis with the green LED (POWER)

LED	Colour	Operating status	Fault treatment
POWER 	out	Operating voltage for electronics not applied	• Check the operating voltage supply (pin 1)
POWER 	green flashes fast	Load voltage of the CP valves < 20.4 V	• Check the load voltage supply (pin 2)
POWER 	green flashes slowly	Load voltage of the CP valves < 10 V	• Check the load voltage supply (pin 2)

Tab. 5/2: Fault diagnosis with the green POWER LED

Load voltage faults are always displayed with the green LED.

Fault diagnosis with the red LED (BUS)

LED	Colour	Operating status	Fault treatment
BUS 	red lights up	Hardware fault	• Servicing required
BUS 	red flashes fast	Field bus address not permitted	• Correct address setting (0, ..., 63)
BUS 	red flashes slowly (1-second intervals)	Field bus connection not OK. Possible causes: – Station number not correct (e.g. address assigned twice) – Field bus module switched off or defective – Interrupted, short-circuited or faulty field bus connection – Configuration not correct Master configuration ? Setting in the switch module	Check the ... • address setting • field bus module • field bus connection • configuration of the master and the setting in the switch module
BUS 	flashes red briefly out	Switch module is missing Switch module defective	• Install switch module • Replace switch module

Tab. 5/3: Fault diagnosis with the red BUS LED

5.1.3 LEDs for status display of the valve solenoid coils

There is a yellow LED for every valve solenoid coil (see Fig. 5/1). This LED indicates the switching status of the valve solenoid coil.

LED	Colour	Switch position valve solenoid coil	Fault treatment
○	out	Basic position	Logical 0 (no signal)
☀	yellow lights up	– Switch position or – Basic position	Logical 1 (signal present) Logical 1 but: – operating voltage of the valves lies below the permitted tolerance range (< 20.4 V DC) or – compressed air supply not OK or – pilot exhaust blocked or – servicing required

Tab. 5/4: LEDs for status display of the valve solenoid coil

→

Please note
If there is no valve solenoid coil, the assigned LED will **not** show control of the output.

5.2 Diagnosis via the field bus

All diagnostic information can be evaluated directly with a Festo PLC. For this purpose a fault list is created in the master. All diagnostic bits are included in this fault list and are continually updated.

The following faults are recognized by the CP system:

Diagnostic bit	Meaning
KCP	CP system not yet ready (during start-up phase) Configuration fault in the field bus master
V_{val}	Load voltage failure of the CP valves < 10.4 V – CPV Direct – CP valve terminal in the extension
V_{tol}	Undervoltage of the CP valves < 20.4 V – CPV Direct – CP valve terminal in the extension
V_{sen}	Short circuit in sensor supply to CP input module
V_{off}	Load voltage failure at CP output module
Short circuit/ overload	Short circuit/overload at CP output module
ACP	Connection to a CP module interrupted in the extension – CP input module – CP output module – CP valve terminal

Tab. 5/5: Overview of diagnostic bits

The diagnostic byte is scanned via function module 44 or in the command interpreter (CI).

Refer to the manual for your controller for further information.

5.3 Fault treatment

5.3.1 Reaction of the CPV Direct to faults

Reaction to faults in the control system:

The CP valves and any electric outputs will be switched off in the event of faults after the following times:

Baud rate (kBaud)	Switch-off time
31.25	2 s
62.5	1 s
187.5	500 ms
375	250 ms

Tab. 5/6: Switch-off times of CP valves and outputs in the event of faults (depending on the baud rate)

Please note
Please observe the following if the outputs are reset in the event of a PLC stop, field bus interruption or field bus 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: pressurized, exhausted or blocked).

5.3.2 Short circuit/overload at an output module

In the event of a short circuit or overload:

– all the digital outputs of the module will be switched off.

– the green LED “Diag” on the output module will flash quickly.

– the short circuit/overload bit of the diagnostic byte will be set to “logical 1.”

Please note
The outputs cannot be used again until the short circuit or overload has been eliminated and the fault deleted.

Deleting the fault

You can delete the fault by resetting all eight outputs. You can do this in one of the following ways:

Possibilities	Explanation
• Set all the outputs of the output module to logical “0” (RESET) or	– Manually or automatically in the program
• Briefly interrupt the CP connection at the CP output module or	– Outputs on the output module will be reset automatically
• Briefly interrupt the operating voltage for the CPV Direct	– All outputs of the CP system will be reset automatically

Tab. 5/7: Deleting the fault – possibilities

The outputs can then be set again to “logical 1.”

If the short circuit/overload still exists, the outputs will be switched off again.

5.3.3 Short circuit in the sensor supply at an input module

If there is a short circuit, overload or voltage fault in the sensor supply:

– the sensor supply for all inputs of the module will be switched off.

– the green LED “Diag” on the input module will flash quickly.

– the fault bit in the diagnostic byte will be set to “logical 1.”

Please note
The outputs cannot be used again until the short circuit or overload has been eliminated and the fault deleted.

Deleting the fault / short circuit/overload

You can delete the fault in one of the following ways:

- Briefly interrupt the CP connection at the CP input module

or

- Briefly interrupt the operating voltage for the CPV Direct

The inputs can then be scanned again.

If the short circuit/overload still exists, the fault will be shown again.

Commissioning ABB CS31

Chapter 6

Contents

6.1 Preparing the CPV Direct for commissioning

6.1.1 Switching on the operating voltages

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

When the controller is switched on, it automatically carries out a comparison between the NOMINAL and the ACTUAL configurations. For this configuration run it is important that:

– the specifications for the field bus configuration are complete and correct.

– the power supplies for the programmable logic controller and for the field bus slaves are switched on eithersimultaneously or in the sequence indicated below.

Please observe the following points when switching on the power supply:

Common supply

If there is a common supply for the control system and for all the field bus slaves, the power should be switched on via a central power unit or central switch.

Separate supply

If there is a separate supply for the control system and for the field bus slaves, the power should be switched on in the following sequence:

1. the power supply for all the field bus slaves

2. the power supply for the controller.

6.1.2 Address assignment of the CPV Direct

The CPV Direct always occupies 16 output addresses, irrespective of the number of valve solenoid coils fitted on it. This enables the CPV Direct to be extended at a later stage without the need to shift the addresses.

The following diagram shows the addressing sequence of the individual CPV valve plates.

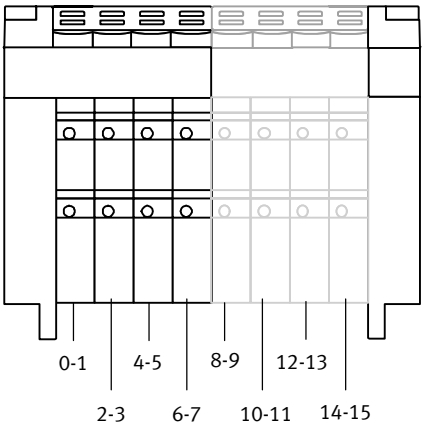


Fig. 6/1: Address assignment of the CPV Direct

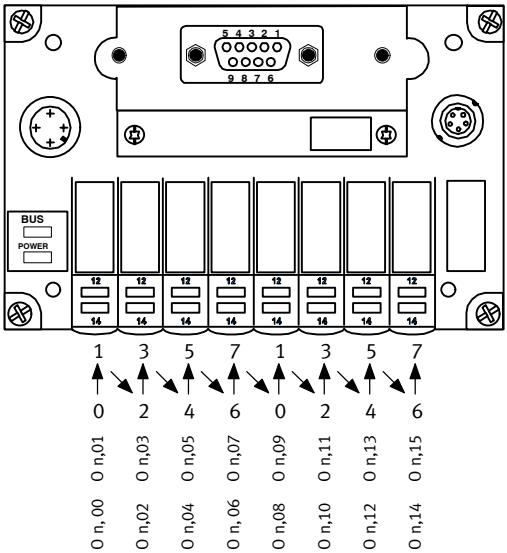
– A valve location on the CPV Direct always occupies 2 addresses, even if it is fitted with a blanking plate or pressure-separator plate. If a valve location is fitted with a double-solenoid valve, the following assignment applies:

  – pilot solenoid 14 occupies the lower-value address

  – pilot solenoid 12 occupies the higher-value address.

  With single-solenoid valves the higher-value address remains unused.

– Addresses are assigned from left to right on the CPV Direct and from the front to the rear on the individual valve locations.



n = Station number

Fig. 6/2: Address assignment of the CPV Direct (outputs)

6.1.3 General information

A CP system can be fitted with a different number of inputs and outputs. The addressing of the CPV Direct is based on the specifications of the CS31 system bus.

The following applies for the CP system: 16 inputs or 16 outputs each occupy one CS31 bus address. A 16-group which has been started also occupies a full CS31 bus address.

The following applies if the CP system is connected to an ABB Procontic T200:

– The address designation of the inputs and outputs is different from that of a CS31 CPU.

– The relevant module identifiers must be entered in the configuration table of the T200.

Please note
Select the range n = 0...60 for the address to be set in the CPV Direct. In this way a CP valve terminal or CP output module connected to the extension connection can then also be addressed.

Please note
Note that the CP system occuies one or two station numbers depending on the extension.

6.2 Configuration

Please note
The CP modules occupy constantly 16 outputs or 16 inputs, irrespective of the system extension and the type of module (inputs, outputs, valves).

The position of the DIL switch for the extension of the CP system is relevant for the number of assigned I/O addresses and station numbers (see sections 1.2.2 and 1.7)

Please note
Make sure that the DIL switches in the switch module are set according to the extension of the CP system.

If the set extension is greater than the actual extension, the fault message “BE” will be displayed.

6.2.1 CS31 CPU as bus master

The CPV Direct offers the following on the ABB CS31:

– max. 32 outputs (valves and digital outputs) and

– max. 16 inputs.

The following diagram provides an overview of the addresses:

CP system		**Signal designation when a CS31 CPU is used**	
Extension	**Inputs/outputs**	**Outputs**	**Inputs**
CPV Direct (without extension)	16O	O n,00 ... O n,15	—
CP extension modules: CP valve terminal or CP output module	32O	O n+1,00 ... O n+1,15	—
CP input module	16I	—	I n,00 ... I n,15
n = Set station number			

Tab. 6/1: Configuration possibilities and addresses for a CS31 CPU

The CS31 CPU ascertains the configuration of the CS31 system when it is switched on and does not require any settings.

Please note
With system flag 00,09 the processing of the programcan be blocked until the specified number of I/O modules (including the CP system) exists on the CS31 system bus.

Example: Addressing with a CS31 CPU

The station number 20 is set in the CPV Direct. The CPV Direct has been extended with one CPV valve terminal and one CP input module and occupies two CS31 bus addresses (station numbers).

1 CPV Direct

2 CPV valve terminal with 8 valve plates

3 CP input module with 16 inputs

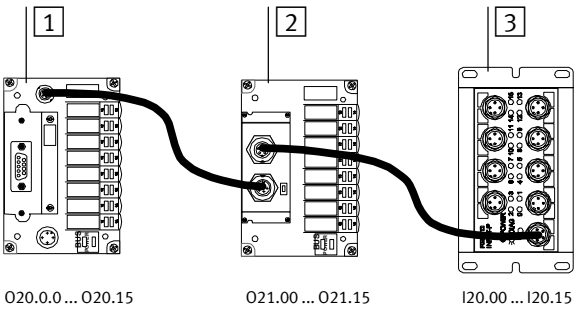


Fig. 6/3: Example – addressing with a CS31 CPU

6.2.2 T200 / 07CS61 as bus master

Four CS31 system buses can be connected to the T200 station. The coupler type 07CS61 plugged in nearest to the T200 CPU has line number 1, the subsequent buses have line numbers 2, 3 and 4.

Example:
Signal designation O 1.20,05 means:
line 1, CS31 bus address 20, output 05.

Within the framework of program creation, the CPU must be informed of the configuration on the relevant lines. In order to do this, use the programming system (e.g. 07 PC 332) to enter the appropriate module identifiers in the configuration table. The following table provides an overview.

Extension to the CP system	**Module identifier with coupler 07CS61**	**Signal designation**	
		Outputs	**Inputs**
CPV Direct (without extension)	O16	O l.n,00 ... O l.n,15	
CPV Direct + CP input module	IO16	O l.n,16 ... O l.n,31	I l.n,00 ... I l.n,15
CPV Direct + CP valve terminal or CP output module	O16 O16	O l.n,00 ... O l.n,15 O l.n+1,00 ... O l.n+1,15	
CPV Direct + CP input module + CP valve terminal or CP output module	 IO16 O16	 O l.n,16 ... O l.n,31 O l.n+1,00 ... O l.n+1,15	I l.n,00 ... I l.n,15
l = Line number n = Set station number			

Tab. 6/2: Overview of module identifiers

Example: Addressing on a T200 CPU with coupler 07CS61 (line 1):

The station number 12 is set in the CPV Direct. The CPV Direct has been extended with one CPV valve terminal and one CP input module and occupies two CS31 bus addresses (station numbers).

1 CPV Direct

2 CPV valve terminal with 8 valve plates

3 CP input module with 16 inputs

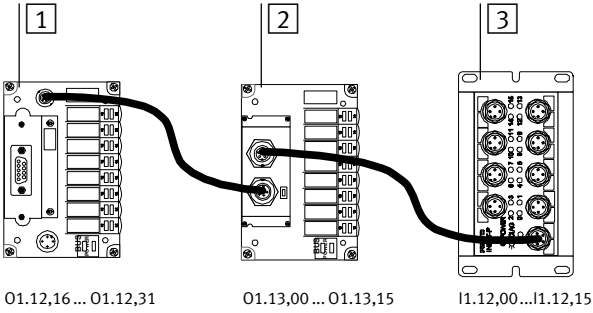


Fig. 6/4: Example – addressing with a T200 CPU

Diagnosis ABB CS31

Chapter 7

Contents

7.1 Diagnosis with LEDs

The LEDs on the cover indicate the operating status of the CPV Direct.

1 Red LED: Bus status/fault (BUS)

2 Green LED: Operating voltage display (POWER)

3 Yellow LED row for pilot solenoid 12

4 Yellow LED row for pilot solenoid 14

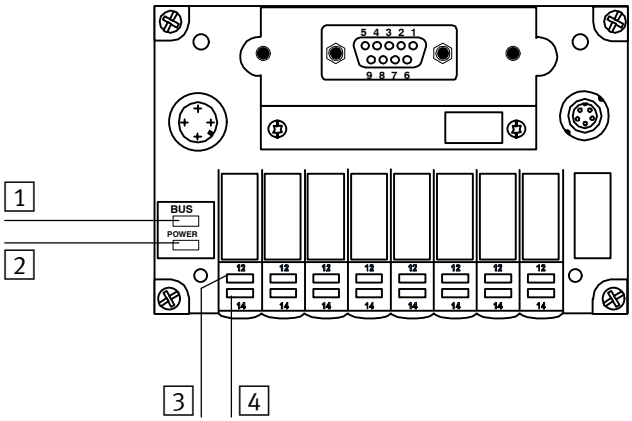


Fig. 7/1: LEDs of the CPV Direct

7.1.1 Normal operating status

In normal operating status only the green power LED lights up.

lights up; flashes; ◯ out

LED	Colour	Operating status	Fault treatment
BUS ◯	out	Normal	None
POWER ☀	green lights up	Normal	None

Tab. 7/1: Normal operating status

7.1.2 Fault displays of the BUS/POWER LEDs

Fault diagnosis with the green LED (POWER)

LED	Colour	Operating status	Fault treatment
POWER 	out	Operating voltage for electronics not applied	• Check the operating voltage connection (pin 1)
POWER  BUS 	green flashes fast red lights up	Load voltage of the CP valves < 20.4 V	• Check the load voltage supply (pin 2)
POWER  BUS 	green flashes slowly red lights up	Load voltage of the CP valves < 10 V	• Check the load voltage supply (pin 2)

Tab. 7/2: Fault diagnosis with the green POWER LED

Load voltage faults are always displayed with the green LED (irrespective of the diagnostic mode set).

If the device-related diagnosis is active, faults will also be passed on to the master PLC via the field bus.

Fault diagnosis with the red LED (BUS)

LED	Colour	Operating status	Fault treatment
BUS 	red flashes fast	– Station number incorrectly (> 60) set	• Correct station number (0, ..., 60)
BUS 	red flashes slowly (1-second intervals)	– Address setting is not correct, e.g. assigned twice – CPV Direct is not yet initialized	• Correct station number • Start the bus
BUS 	red lights up	– Load voltage failure on the CPV Direct [1)] – Load voltage failure on the CP valve terminal in the extension [1)] – Load voltage failure on CP output module [1)]	• Check power supply • Check power supply • Check power supply

		– Undervoltage on the valves of the CPV Direct[1)]
		– Undervoltage on the CP valves < 20.4 V (in the extension) [1)]
		– Short circuit/overload at CP output module
		– Short circuit in sensor supply of CP input module
		– Connection to a CP module interrupted
		  – CP input module
		  – CP output module
		  – CP valve terminal
			• Check power supply
			• Check power supply
			• Eliminate short circuit/overload
			• Eliminate short circuit/overload
			• Restore connection

[1)] These fault displays can be switched off by means of the diagnostic mode setting. They will then no longer be passed onto the CS31 master (see section 1.2.2).			

Tab. 7/3: Fault diagnosis with the red BUS LED

7.1.3 LEDs for status display of the valve solenoid coils

There is a yellow LED for every valve solenoid coil (see Fig. 7/1). This LED indicates the switching status of the valve solenoid coil.

LED	Colour	Switch position Valve solenoid coil	Fault treatment
○	out	Basic position	Logical 0 (no signal)
☀	yellow lights up	– Switch position or – Basic position	Logical 1 (signal present) Logical 1 but: – operating voltage of the valves lies below the permitted tolerance range (< 20.4 V DC) or – compressed air supply not OK or – pilot exhaust blocked or – servicing required

Tab. 7/4: LEDs for status display of the valve solenoid coil

→

Please note
If there is no valve solenoid coil, the assigned LED will **not** show control of the output.

7.2 Diagnosis via the field bus

The CPV Direct reacts on the ABB CS31 system bus like a binary input/output module. All CPUs and couplers perform the general monitoring of the CS31 system bus, e.g. total failure of local modules.

The CPUs and couplers scan the diagnostic messages provided by the CPV Direct.

The appropriate ABB manuals are valid for all CPUs and couplers.

The following diagrams show as an example the diagnostic possibility in conjunction with:

– CPU 07KR91

– T200 wit coupler 07CS61

Please note
Several CP diagnostic messages are grouped together as common messages with protocol ABB CS31.

Example 1: CPU 07KR91

The entries of the CPV Direct in the fault flag words have the following meaning:

	FK3 = simple fault	FK4 = warning	
	Flag 255,10		
	Flag 255,13	Flag 255,14	
1	**Flag word 255,00**	**Flag word 255,08**	4
2	**Flag word 255,01**	**Flag word 255,09**	2
3	**Flag word 255,02**	**Flag word 255,10**	3
	Flag word 255,03	**Flag word 255,11**	5
	Flag word 255,04	Flag word 255,12	
	Flag word 255,05	Flag word 255,13	
	Flag word 255,06	Flag word 255,14	
	Flag word 255,07	Flag word 255,15	

Fault recognition/meaning with Festo CP systems	
1	15_D = CPV Direct not connected
2	Device type: 2_D = Binary outputs (CPV Direct without extension or extended by one CP valve terminal/ CP output module) 4_D = Binary inputs/outputs (CPV Direct extended by one input module)
3	Group no. (= set station number, decimal)
4	1_D = Internal module fault (in the CP system) – Undervoltage at valves 20.4 V – Load voltage failure (CP output module, CP valve terminal) – Short circuit in sensor supply 2_D = Wire fracture, connection interrupted to – CP output module / – CP input module / – CP valve terminal 4_D = Overload/short circuit of an electric output
5	Channel no.: Is always 0 in conjunction with CPV valve terminals

Tab. 7/5: Example 07KR91 – meaning of the ABB fault flag with Festo CP systems

Example 2: Coupler 07CS61

The diagnostic information of the CPV Direct is entered in the following fault flags:

- Line 1: Flag word 4104,04
- Line 2: Flag word 4105,12
- Line 3: Flag word 4107,04
- Line 4: Flag word 4108,12

They have the following meaning:

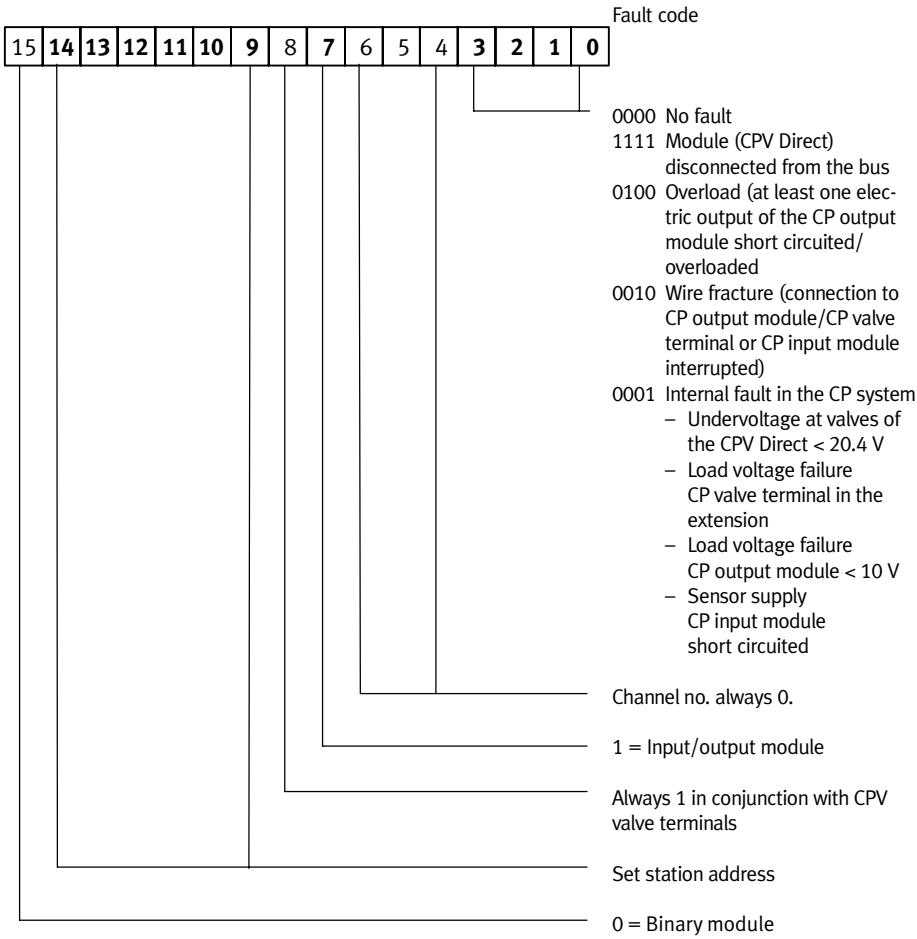


Fig. 7/2: Example 07CS61 – meaning of the ABB fault flags with Festo CP systems (see also Tab. 7/5)

7.3 Setting the diagnostic mode

The following fault messages can be switched off with element 8 of the 8-position DIL switch in the switch module (see section 1.2.2):

- Load voltage failure of the
  - CPV Direct
  - CP valve terminal in the extension
  - CP output module in the extension

The following table shows the reaction of the diagnostic LEDs or fault flags with active/inactive load voltage monitoring:

	Monitoring active	**Monitoring inactive**
BUS LED	lights up	out
POWER-LED	flashes [1)]	flashes [1)]
Fault flag	set	reset
[1)] Only with load voltage faults on the CPV Direct		

Tab. 7/6: Setting the diagnostic mode – reaction of LEDs and fault flags

7.4 Fault treatment

7.4.1 Reaction of the CPV Direct to faults

Reaction to faults in the control system:

The CP valves and any electric outputs will be switched off after 250 ms in the event of faults.

Please note
Please observe the following if the outputs are reset in the event of a PLC stop, field bus interruption or field bus 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: pressurized, exhausted or blocked).

7.4.2 Short circuit/overload at an output module

In the event of a short circuit or overload:

– all the digital outputs of the module will be switched off

– the green LED “Diag” on the output module will flash quickly

– the relevant diagnostic bit will be set.

Please note
The outputs cannot be used again until the short circuit or overload has been eliminated and the fault deleted.

Deleting the fault

You can delete the fault by resetting all eight outputs. You can do this in one of the following ways:

Possibilities	Explanation
• Set all the outputs of the output module to logical “0” (RESET) or • Briefly interrupt the CP connection at the CP output module or • Briefly interrupt the operating voltage for the CPV Direct	– Manually or automatically in the program – Outputs on the output module will be reset automatically – All outputs of the CP system will be reset automatically

Tab. 7/7: Deleting the fault – possibilities

The outputs can then be reset to “logical 1.”

If the short circuit/overload still exists, the outputs will be switched off again.

7.4.3 Short circuit in the sensor supply at an input module

If there is a short circuit, overload or voltage fault in the sensor supply:

– the sensor supply for all inputs of the module will be switched off

– the green LED “Diag” on the input module will flash quickly

– the fault bit in the diagnostic byte will be set to logical 1.

Please note
The outputs cannot be used again until the short circuit or overload has been eliminated and the fault deleted.

Deleting the fault/short circuit/overload

You can delete the fault in one of the following ways:

- briefly interrupt the CP connection at the CP input module

or

- briefly interrupt the operating voltage for the CPV Direct.

The inputs can then be scanned again.

If the short circuit/overload still exists, the fault will be shown again.

Commissioning Moeller SUCOnet K

Chapter 8

Contents

8.1 Preparing the CPV Direct for commissioning

8.1.1 Switching on the operating voltages

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

When the controller is switched on, it automatically carries out a comparison between the NOMINAL and the ACTUAL configurations. For this configuration run it is important that:

– the specifications for the field bus configuration are complete and correct.

– the power supplies for the programmable logic controller and for the field bus slaves are switched on eithersimultaneously or in the sequence indicated below.

Please observe the following points when switching on the power supply:

Common supply

If there is a common supply for the control system and for all the field bus slaves, the power should be switched on via a central power unit or central switch.

Separate supply

If there is a separate supply for the control system and for the field bus slaves, the power should be switched on in the following sequence:

1. the power supply for all the field bus slaves.

2. the power supply for the controller.

8.1.2 Address assignment of the CPV Direct

The CPV Direct always occupies 16 output addresses, irrespective of the number of valve solenoid coils fitted on it. This enables the CPV Direct to be extended at a later stage without the need to shift the addresses.

The following diagram shows the addressing sequence of the individual CPV valve plates.

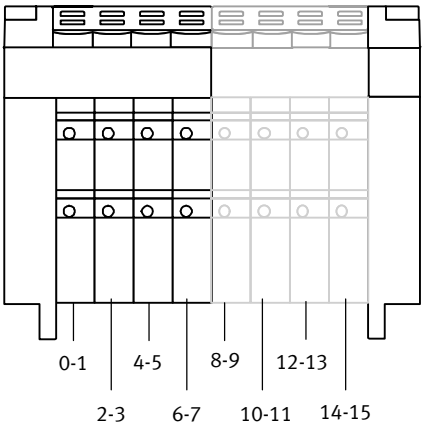


Fig. 8/1: Address assignment of the CPV Direct

– A valve location on the CPV Direct always occupies 2 addresses, even if it is fitted with a blanking plate or pressure-separator plate. If a valve location is fitted with a double-solenoid valve, the following assignment applies:

  – pilot solenoid 14 occupies the lower-value address

  – pilot solenoid 12 occupies the higher-value address.

  With single-solenoid valves the higher-value address remains unused.

Addresses are assigned from left to right on the CPV Direct and from the front to the rear on the individual valve locations.

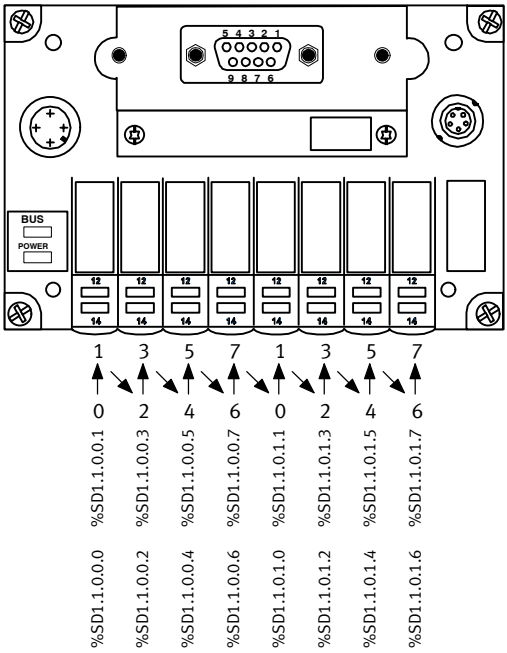


Fig. 8/2: Address assignment of the CPV Direct (outputs), example: Station number 2, unit 1

8.2 CP system extension and number of inputs/outputs

Please note
The CP system occupies constantly 32 inputs and 32 outputs in the PLC, irrespective of the system extension and the type of module (inputs, outputs, valves) and irrespective of the setting of the DIL switches for the extension of the CP system.

The setting of the CP system extension refers with the protocol SUCOnet K only to the check of the connected extension modules. For this purpose the position of the DIL switch for the extension of the CP system is relevant (see sections 1.2.2 and 1.7). The CP system itself always occupies 32 I/Os.

Please note
Make sure that the DIL switches in the switch module are set according to the extension of the CP system.

The following table shows the different variants:

Extension to the CP system	**Number of**	
	outputs	**inputs**
CPV Direct (without extension)	16 O	–
CPV Direct + CP input module	16 O	16 I
CPV Direct + CP valve terminal or CP output module	16 O 16 O	–
CPV Direct + CP input module + CP valve terminal or CP output module	16 O 16 O	16 I

Tab. 8/1: Number of inputs/outputs for the extension possibilities of the CPV Direct

8.3 Configuration for SUCOnet K

The following module type is required for the CPV Direct and any extensions:

– **SIS-K-06/07**
(SUCOnet K slave with max. 32 inputs and 32 outputs).

The topology configurator from Moeller is available for configuring bus slaves. The following diagram shows the configuration entry for a CP system with SUCOnet K direct connection in conjunction with a PS4-201 as master.

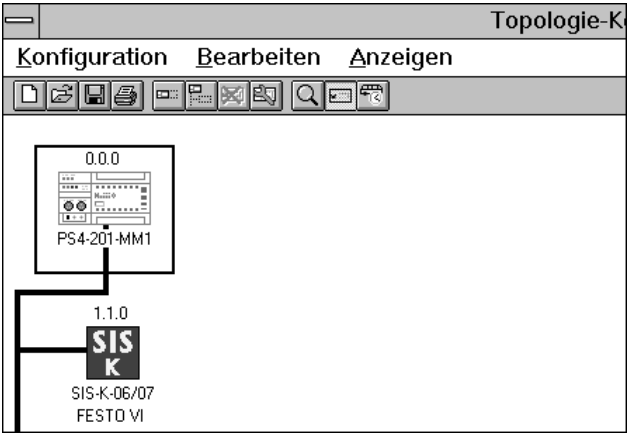


Fig. 8/3: Example – configuration PS4

8.4 Addressing the inputs/outputs

Note the following when addressing the inputs/outputs of a CP system with CPV Direct on the SUCOnet K:

The slave number or the number of the unitdiffers from the set station number by -1.

Example:

Set station number of the CP system	Number of the unit or slave number
2	1
3	2
4	3
...	...

Tab. 8/2: Difference between station number and slave number (-1)

Addressing the inputs and outputs with master PS4

Example of configuration

CPV Direct

- connected to PS4 string 1
- set station number: 2 (= unit 1)
- extension with one CP valve terminal or one CP input module

1 CPV Direct

2 CPV valve terminal with 8 valve plates

3 CP input module with 16 inputs

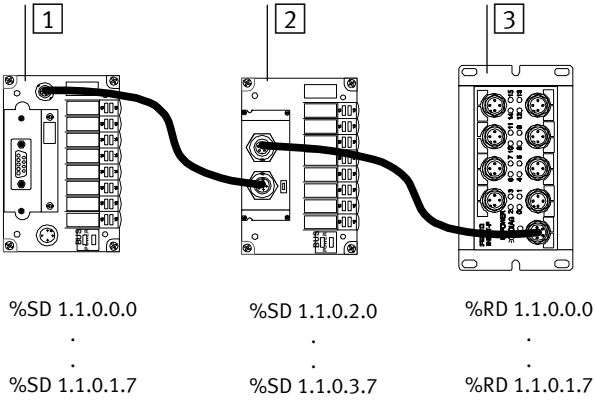


Fig. 8/4: Example – addressing with a PS4 master

Diagnosis Moeller SUCOnet K

Chapter 9

Contents

9.1 Diagnosis with LEDs

The LEDs on the cover indicate the operating status of the CPV Direct.

1 Red LED: Bus status/fault (BUS)

2 Green LED: Operating voltage display (POWER)

3 Yellow LED row for pilot solenoid 12

4 Yellow LED row for pilot solenoid 14

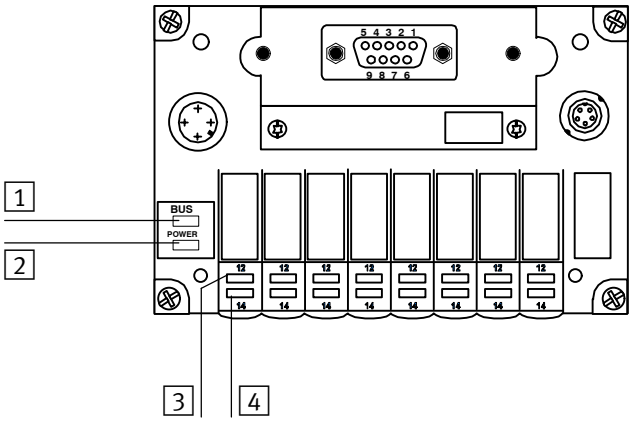


Fig. 9/1: LEDs of the CPV Direct

9.1.1 Normal operating status

In normal operating status only the green power LED lights up.

lights up; flashes; ◯ out

LED	Colour	Operating status	Fault treatment
BUS ◯	out	Normal	None
POWER	green lights up	Normal	None

Tab. 9/1: Normal operating status

9.1.2 Fault displays of the BUS/POWER LEDs

Fault diagnosis with the green LED (POWER)

LED	Colour	Operating status	Fault treatment
POWER 	out	Operating voltage for electronics not applied	• Check the operating voltage supply (pin 1)
POWER 	green flashes fast	Load voltage of the CP valves < 20.4 V	• Check the load voltage supply (pin 2)
POWER 	green flashes slowly	Load voltage of the CP valves < 10 V	• Check the load voltage supply (pin 2)

Tab. 9/2: Fault diagnosis with the green POWER LED

Load voltage faults are always displayed with the green LED.

Fault diagnosis with the red LED (BUS)

LED	Colour	Operating status	Fault treatment
BUS 	red lights up	Hardware fault	• Servicing required
BUS 	red flashes fast	Station number set incorrectly	• Correct station number (0, ..., 98)
BUS 	red flashes slowly (1-second intervals)	Field bus connection not OK. Possible causes: – Station number not correct (e.g. address assigned twice) – Field bus module switched off or defective – Interrupted, short-circuited or faulty field bus connection – Configuration faulty, master configuration setting in the switch module	Check the ... • address setting • field bus module • field bus connection • configuration of the master and the setting in the switch module
BUS 	flashes red briefly out	Switch module is missing Switch module defective	• Install switch module • Replace switch module

Tab. 9/3: Fault diagnosis with the red BUS LED

9.1.3 LEDs for status display of the valve solenoid coils

There is a yellow LED for every valve solenoid coil (see Fig. 9/1). This LED indicates the switching status of the valve solenoid coil.

LED	Colour	Switch position Valve solenoid coil	Fault treatment
○	out	Basic position	Logical 0 (no signal)
	yellow lights up	– Switch position or – Basic position	Logical 1 (signal present) Logical 1 but: – operating voltage of the valves lies below the permitted tolerance range (< 20.4 V DC) or – compressed air supply not OK or – pilot exhaust blocked or – servicing required

Tab. 9/4: LEDs for status display of the valve solenoid coils

Please note
If there is no valve solenoid coil, the assigned LED will **not** show control of the output.

9.2 Diagnosis via the field bus

The following faults are recognized by the CP system:

Diagnostic bit	Meaning
V_{val}	Load voltage failure of the CP valves < 10.4 V – CPV Direct – CP valve terminal in the extension
V_{tol}	Undervoltage of the CP valves < 20.4 V – CPV Direct – CP valve terminal in the extension
V_{sen}	Short circuit in sensor supply to CP input module
V_{off}	Load voltage failure at CP output module
Short circuit/overload	Short circuit/overload at CP output module
ACP	Connection to a CP module interrupted in the extension – CP input module – CP output module – CP valve terminal

Tab. 9/5: Overview of diagnostic bits

The master receives the diagnostic byte from the SUCOnet K via the 5th. input byte.

The following diagram shows the composition of the diagnostic byte of the CP system:

Bit no.	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Diagnostic information	—	V_{val}	V_{tol}	V_{sen}	V_{off}	Short circuit/ overload	ACP	—
Signal status	0	0/1	0/1	0/1	0/1	0/1	0/1	0 *)
Meaning	Signal status “0”: No fault Signal status “1”: Faults							
*) As from software version 1.1 always 0, up to software version 1.1 always 1								

Tab. 9/6: Composition of diagnostic byte SUCOnet K

Example:
Load diagnostic byte
Master: PS4
Station number: 2 (= unit 1)

Program extract:

```
%RDB1.1.0.4
```

Fig. 9/2: Program example SUCOnet K

Refer to the PLC manual for your controller for further information.

9.3 Fault treatment

9.3.1 Reaction of the CPV Direct to faults

Reaction to faults in the control system:

The CP valves and any electric outputs will be switched off after 250 ms in the event of faults.

Please note
Please observe the following if the outputs are reset in the event of a PLC stop, field bus interruption or field bus 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: pressurized, exhausted or blocked).

9.3.2 Short circuit/overload at an output module

In the event of a short circuit or overload:

– all the digital outputs of the module will be switched off

– the green LED “Diag” on the output module will flash quickly

– the short circuit/overload bit of the diagnostic byte will be set to “logical 1.”

Please note
The outputs cannot be used again until the short circuit or overload has been eliminated and the fault deleted.

Deleting the fault

You can delete the fault by resetting all eight outputs. You can do this in one of the following ways:

Possibilities	Explanation
• Set all the outputs of the output module to logical “0” (RESET) or	– Manually or automatically in the program
• Briefly interrupt the CP connection at the CP output module or	– Outputs on the output module will be reset automatically
• Briefly interrupt the operating voltage for the CPV Direct	– All outputs of the CP system will be reset automatically

Tab. 9/7: Deleting the fault – possibilities

The outputs can then be reset to “logical 1.”

If the short circuit/overload still exists, the outputs will be switched off again.

9.3.3 Short circuit in the sensor supply at an input module

If there is a short circuit, overload or voltage fault in the sensor supply:

– the sensor supply for all inputs of the module will be switched off

– the green LED “Diag” on the input module will flash quickly

– the fault bit in the diagnostic byte will be set to“ logical 1.

Please note
The outputs cannot be used again until the short circuit or overload has been eliminated and the fault deleted.

Deleting the fault/short circuit/overload

You can delete the fault in one of the following ways:

- briefly interrupt the CP connection at the CP input module

or

- briefly interrupt the operating voltage for the CPV Direct

The inputs can then be scanned again.

If the short circuit/overload still exists, the fault will be shown again.

Technical appendix

Appendix A

Contents

A.1 Technical specifications

General information	
Temperature range – Operation – Storage/transport	 - 5 ... + 50 °C - 20 ... + 70 °C
Relative humidity	95 %, non-condensing
Protection class as per EN 60529 plug connector inserted or provided with protective cap	IP65
Protection against electric shock (protection against direct and indirect contact as per IEC/DIN EN 60204-1)	by means of PELV circuits (Protective Extra-Low Voltage)
Protection against explosion (as per EU guideline 94/9/EG, EN 50021 and EN 50281-1-1) Do not disconnect electrical connections which are under tension.	II 3 G/D EEx nA II T5 X -5 °C =Ta =+50 °C T 80° C IP65 (year of manufacture see Ex-identification on the product) X: Plugs or adapters of the electric connections must comply at least with protection class IP64.
Electromagnetic compatibility – Interference emitted – Resistance to interference	 Tested as per DIN EN 61000-6-4 (industry) *) Tested as per DIN EN 61000-6-2 (industry)
Vibration and shock – Vibration – Shock	 – Tested as per DIN/IEC 68/EN 60068 part 2-6; When fitted on a wall: (0.35 mm path at 10...60 Hz, 5 g acceleration at 60...150 Hz, – Tested as per DIN/IEC 68/EN 60068 part 2-27; When fitted on a wall: +/- 30 g at 11 ms duration; 15 cycles
Valves	See Pneumatics manual type P.BE-CPV-...
*) The CP system is intended for industrial usage.	

Operating voltage for bus interface and logic	
Pin 1 Power supply connection – Rated value – Tolerance	 24 V DC (protected against incorrect polarity) 20.4 ... 26.4 V
Current consumption – Rated value	 Max. 100 mA
Residual ripple	4 Vpp (within tolerance)
Electrical isolation	Bus interface opto-decoupled

Load voltage for solenoid valves of CP valve terminal	
Pin 2 Power supply connection – Rated value – Tolerance	 24 V DC (protected against incorrect polarity) 20.4 ... 26.4 V
Current consumption – Rated value – Tolerance	 Sum of all switched-on CP solenoid valves. See manual “CP pneumatics”
Residual ripple	4 Vpp (within tolerance)

Field bus	
Protocol	PROFIBUS-DP as per EN 50170
Design	RS 485, floating
Transmission type	Serial asynchronous, half-duplex
Baud rate	9.6 ... 12000 kBaud, automatic baud rate recognition
Cable type	Depending on cable length and baud rate: see controller manual

Technical specifications on the pneumatics can be found in the “Pneumatics manual, P.BE-CPV-... .”

Explanations of the explosion protection marking
II 3 G/D EEx nA II T5 X -5 °C =Ta =+50 °C T 80 °C IP65 jjjj

Identifier mark	Explanation	Standards
	Mark for preventing explosions	Directive 94/9/EG and others
II 3 G/D	II Device group II: for potentially-explosive environments except for mines and their surface installations 3 Device category 3: for use in zone 2 and zone 22 G/D G/D range: for gases and dusts	Directive 94/9/EG
EEx nA II T5 X	E Constructed in accordance with European standard Ex Explosion-protected operating medium n Ignition protection type n In normal operation, the operating medium is not able to ignite an ambient potentially-explosive atmosphere up to the ascertained temperature class (here T5). Further condition: It must be used in zone 2 (improbable occurrence of a potentially-explosive atmosphere of gas). A Operationally electric non-sparking operating medium II Device group II, see above T5 Temperature class T5, i.e. the maximum surface temperature in respect of gases, fumes or mist is 100 °C X Special condition for installation and use, here: plugs and adapters of the electric connections must comply at least with protection class IP64	DIN EN 50021
-5 °C =Ta =+ 50 °C	Limits of the permitted ambient temperatures	DIN EN 50021
T 80 °C	Maximum surface temperatures in respect of the ignition of dusts, fibres and fluff	DIN EN 50281-1-1
IP65	Protection class	DIN EN 50281-1-1
jjjj	Year of manufacture (see Ex-identification on the product)	DIN EN 50281-1-1

A.2 PROFIBUS-DP: Commissioning with the general DP master

The Festo CP system can be controlled from any PLC, PC or industrial PC with a PROFIBUS-DP modulein accordance with EN 50170.

Further information

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

- Module consistency, FREEZE and SYNC, identifiers: Section 2.1.3
- GSD: Section 2.2

A.2.1 Bus start

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

1. Send parametrizing data
2. Check the configuration data
3. Transfer input and output data (cyclic data exchange)
4. Read diagnostic information

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

A.2.2 Send parametriziung data

Set_Prm — The parametrizing data are transferred from the DP master to the valve terminal with the function Set_Prm.

Octet 1: Station status

Bit	Meaning	Explanation		
0	–	Reserved		
1	–			
2	–			
3	WD_On	Response monitoring of the CP system 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 parameter may be overwritten
		0	1	CP system released for other masters
		1	0	CP system blocked for other masters
		1	1	CP system released for other masters

Tab. A/1: Octet 1: Station status

Further octets

Octet	Designation	Explanation
2 and 3	WD_Fact_1 WD_Fact_2	Range 1 ... 255: The response monitoring time of the CP system is transferred 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 CP system must wait, before the reply telegram may be sent to the DP master.
5 and 6	Ident_number	Transmission of the manufacturer identifier of the valve terminal (= $009C_h$); parametrizing telegrams to the CP system are only accepted if the transmitted and the programmed manufacturer identifiers are the same.
7	Group_Ident	Not supported by the CP system
8 ... 32	User_Prm_Data	Not supported by the CP system

Tab. A/2: Octets 2 ... 32

A.2.3 Check the configuration data

Chk_Cfg

The configuration data are transferred from the DP master to the CP system with the function Chk_Cfg.

Summary of parameters (Chk_Cfg):

Octet 1-n: DP identifier
Permitted identifiers for the CPV Direct (see also Tab. 2/1):

Extension to the CP system	DP identifier		Comment
	decimal	hex	
CPV Direct (without extension)	Octet 1: 033	Octet 1: 021	16 digital outputs
Extension with one input module	Octet 1: 033 Octet 2: 017	Octet 1: 021 Octet 2: 011	16 digital outputs 16 digital inputs
Extension with one CP valve terminal or one CP output module	Octet 1: 033 Octet 2: 033	Octet 1: 021 Octet 2: 021	16 digital outputs 16 digital outputs
Extension with one CP valve terminal or one CP output module and one input module	Octet 1: 033 Octet 2: 033 Octet 3: 017	Octet 1: 021 Octet 2: 021 Octet 3: 011	16 digital outputs 16 digital outputs 16 digital inputs

Tab. A/3: Overview of DP identifiers for various extensions to the CPV Direct

Example:

Octet	DP identifier		Comment
	decimal	hex	
1	033	021	16 DO of the CPV Direct
2	017	011	16 DI of the input module

Tab. A/4: CPV Direct extended with one input module

A.2.4 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 CP systems is transmitted as an octet string of length x. The octet string length depends on the number of identifier bytes.

Please note
With the function Data_Exchange, the CP system expects the **output data** for the valves and electric outputs.

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

The following table provides a parameter overview (Data_Exchange) for the maximum extension to the CPV Direct.

Output data (Outp_Data)	**Input data (Inp_Data)**
Octet 1: O-data byte_1 (CPV Direct, 16 DO) Bit 0: Output x.0 Bit 1: Output x.1 ... Bit 7: Output x.7 Octet 2: O-data byte_2 (CPV Direct) Bit 0: Output (x+1).0 Bit 1: Output (x+1).1 ... Bit 7: Output (x+1).7 Octet 3: O-data byte_3 (CP valve terminal in the extension, 16 DO) Bit 0: Output y.0 Bit 1: Output y.1 ... Bit 7: Output y.7 Octet 4: O-data byte_4 (CP valve terminal in the extension) Bit 0: Output (y+1).0 Bit 1: Output (y+1).1 ... Bit 7: Output (y+1).7	Octet 1: I-data byte_1 CP input module, 16 DI) Bit 0: Input z.0 Bit 1: Input z.1 ... Bit 7: Input z.7 Octet 2: I-data byte_2 (CP input module) Bit 0: Input (z+1).0 Bit 1: Input (z+1).1 ... Bit 7: Input (z+1).8
x, y, z = Address offset of master module	

Tab. A/5: Example: Parameter overview for the maximum extension of the CPV Direct as in Fig. 2/5

A.2.5 Read diagnostic information

Slave_Diag

The diagnostic data are requested by the CP system via the function Slave_Diag (see section 3.3.4, Diagnosis via PROFIBUS-DP).

Set_Prm

With the function Set_Prm you have the possibility of determining the watchdog time (WD_Fact_1, Octet 2, WD_Fact_2, Octet 3). In the event of a fault, the CP system will switch off all the valves and electric outputs after the parametrized time (e.g. if there is a bus failure).

A.2.6 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

Tab. A/6: Overview of implemented functions and service access points

A.2.7 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. A/7: Bus parameters and reaction times

A.2.8 Transmission times on the PROFIBUS-DP

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

The time delay within the CP system depends on the amount of data and therefore on the extension to the CP system. It amounts to < 2 ms.

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

A.3 Accessories

This section provides an overview of necessary and useful accessories.

Power supply to CP valves

The power for the CP valves is supplied via a 4 -pin M12 socket with PG7 or PG9 screw connectors. You can order these screw connectors from Festo:

Plug	Type	Part no.
PG7 straight	FB-SD-GD7	18 497
PG9 straight	FB-SD-GD9	18 495
PG7 angled	FB-SD-WD7	18 524
PG9 angled	FB-SD-WD9	18 525

Bus connection

IP65 field bus plug from Festo (9-pin, sub-D):
type FBS-SUB-9-GS-DP-B, part no. 532216

M12 adapter reverse key coded:
type FBA-2-M12-5POL-RK, part no. 533518

If you wish to use field bus plugs of other manufacturers, you must replace the two flat screws on the plug by bolts (part no. 340960).

Overview of CP connecting cables

The following CP connecting cables are available for extending the CPV Direct:

Terminal connector	Type	Part no.
Angled plug – angled socket 0.5 m	KVI-CP-1-WS-WD-0.5	178 564
Angled plug – angled socket 2 m	KVI-CP-1-WS-WD-2	163 139
Angled plug – angled socket 5 m	KVI-CP-1-WS-WD-5	161 138
Straight plug – angled socket 5 m	KVI-CP-1-GS-WD-5	163 137
Straight plug – angled socket 8 m	KVI-CP-1-GS-WD-8	163 136
Straight plug – straight socket 2 m can be used as drag chain	KVI-CP-2-GS-GD-2	170 234
Straight plug – straight socket 5 m can be used as drag chain	KVI-CP-2-GS-GD-5	170 235
Straight plug – straight socket 8 m can be used as drag chain	KVI-CP-2-GS-GD-8	165 616

Overview of plugs for output module

Plug	Type	Part no.
Mains connector plug straight, PG9	NTSD-GD-9	18 493
Mains connector plug straight, PG13.5	NTSD-GD-13.5	18 526
Mains connector plug angled, PG9	NTSD-WD-9	18 527
Sensor plug straight, M12, PG7	SEA-GS-7	18 666

Overview of plugs for input module

Plug	Type	Part no.
Sensor plug straight, M12, PG7	SEA-GS-7	18 666
Sensor plug straight, M12, 5-pin, PG7	SEA-M12-5GS-7	175 487
Duo plug M12 (2 cable entries)	SEA-GS-11-DUO	18 779
Duo plug M12 (2 cable entries), 5-pin	SEA-5GS-11-DUO	192 010
Sensor plug straight, M8, 3-pin (can be soldered)	SEA-GS-M8	18 696
Sensor plug straight, M8, 3-pin (can be screwed)	SEA-3GS-M8-S	192 009
Connector set for CP-E16-KL-IP20-Z	SEA-KL-SAC10/30	526 256

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Appendix B

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