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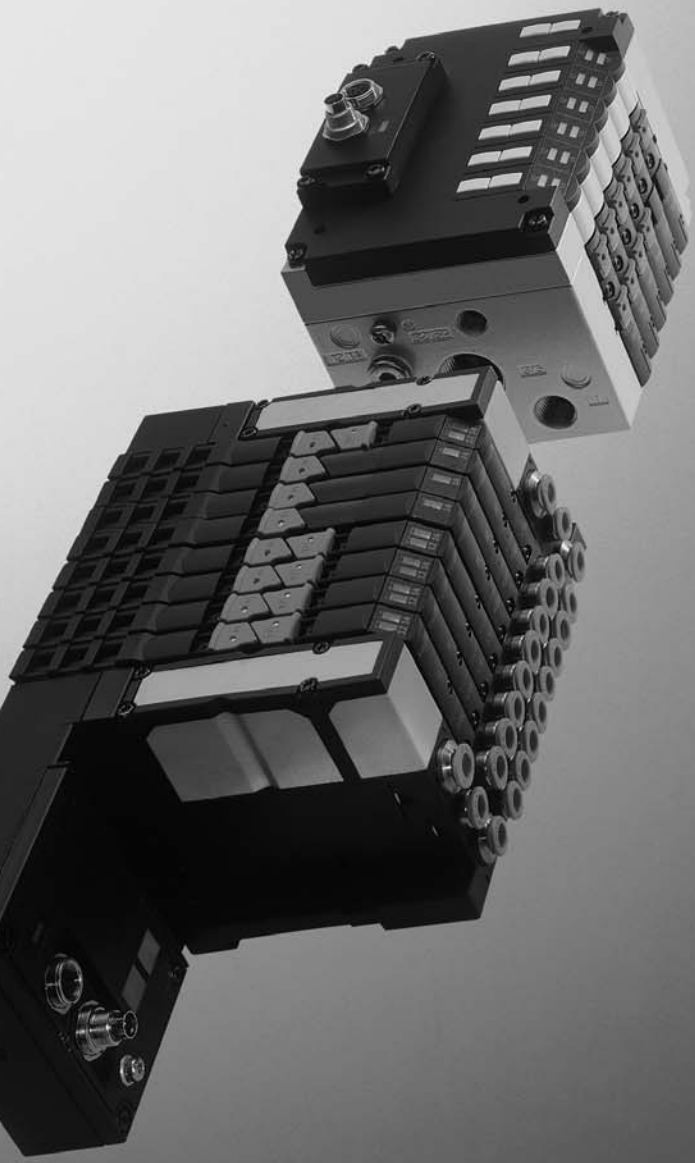


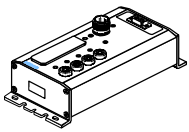
FESTO

**Manual**
**Programming and diagnosing**

CP field bus
node 13

Type CP-FB13-E

Field bus
connection
PROFIBUS-DP
as per EN 50170



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# Contents

Designated use ..... IV
Target group ..... V
Service ..... V
Notes on the use of this manual ..... V
Important user instructions ..... VI

**1. Installation ..... 1-1**

1.1 General instructions on installation ..... 1-3
1.2 Configuring the field bus node ..... 1-5
1.2.1 Setting the field bus node ..... 1-5
1.3 Connecting the field bus ..... 1-9
1.3.1 Field bus cable ..... 1-9
1.3.2 Field bus baud rate and field bus length ..... 1-11
1.3.3 Field bus interface ..... 1-12
1.3.4 Connection possibilities ..... 1-13
1.4 Bus termination with terminating resistors ..... 1-17
1.5 Connecting the CP modules ..... 1-18
1.6 Connecting the power supply ..... 1-19

**2. Commissioning ..... 2-1**

2.1 Preparing the CP system for commissioning ..... 2-3
2.1.1 Saving the string assignment ..... 2-3
2.1.2 Information on commissioning ..... 2-5
2.2 Device master file (GSD) and icon files ..... 2-12
2.3 Configuration with a Siemens master ..... 2-13
2.3.1 STEP 7 – HW Config (up to V 5.2) ..... 2-14
2.3.2 Examples of addressing ..... 2-20
2.3.3 Commissioning the CP system on the PROFIBUS-DP ..... 2-24

**3. Diagnosis and error treatment ..... 3-1**

3.1 LED displays on the bus node ..... 3-3
3.1.1 Normal operating status ..... 3-4

| | | | |
|---|---|---|---|
| | 3.1.2 | Fault display of the POWER LEDs | 3-5 |
| | 3.1.3 | Fault messages of the LED BUS ERROR | 3-6 |
| 3.2 | Testing the valves | | 3-7 |
| 3.3 | Diagnosis via PROFIBUS-DP | | 3-9 |
| | 3.3.1 | Diagnostic words | 3-9 |
| | 3.3.2 | Diagnostic steps | 3-10 |
| | 3.3.3 | Overview of diagnostic bytes | 3-11 |
| | 3.3.4 | Details for standard diagnostic information | 3-12 |
| 3.4 | Fault treatment | | 3-17 |
| | 3.4.1 | Siemens SIMATIC S5/S7 | 3-18 |
| 3.5 | Online diagnosis with STEP 7 | | 3-20 |
| | 3.5.1 | Read diagnostic buffer with STEP 7 (up to V 5.2) | 3-20 |
| 3.6 | Short circuit/overload | | 3-22 |
| | 3.6.1 | Output module | 3-22 |
| | 3.6.2 | Input module | 3-24 |
| **A.** | **Technical appendix** | | **A-1** |
| A.1 | Technical specifications Field bus node CP FB13-E | | A-3 |
| A.2 | Commissioning with the general DP master | | A-5 |
| | A.2.1 | Bus start | A-5 |
| | A.2.2 | Send parametriziung data | A-6 |
| | A.2.3 | Check the configuration data | A-7 |
| | A.2.4 | Transferring input and output data | A-9 |
| | A.2.5 | Read diagnostic information | A-11 |
| | A.2.6 | Implemented functions and service access points (SAP) | A-11 |
| | A.2.7 | Bus parameters/reaction times | A-12 |
| | A.2.8 | Transmission times on the PROFIBUS-DP | A-12 |
| **B.** | **Index** | | **B-1** |

## Designated use

The CP field bus node type CP-FB13-E described in this manual has been designed exclusively for use as a slave on the PROFIBUS-DP. CP modules from Festo can be connected to CP field bus node CP-FB13-E.

The CP node 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.

## Target group

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

## Service

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

## Notes on the use of this manual

This manual contains specific information on installing, commissioning, programming and diagnosingCP field bus node FB13 for PROFIBUS-DP in accordance with EN 50170.

Information on further CP modules can be found in the manual for the relevant module. An overview is provided in Tab. 0/1.

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.

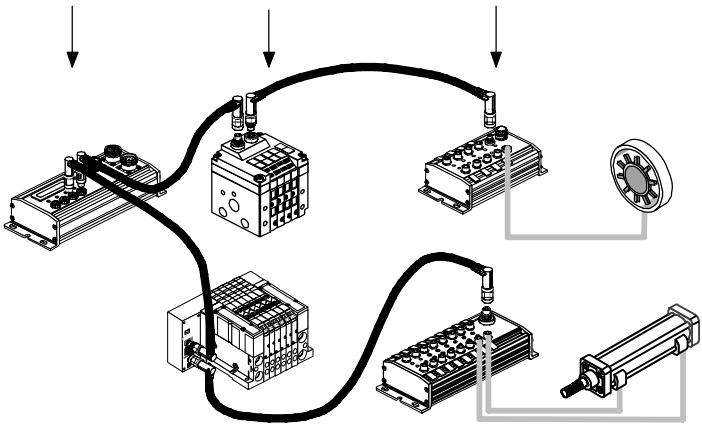
**Text markings**

- 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.

| **Manuals on the CP system** | | | | **Peri-pherals** |
|---|---|---|---|---|
| Manual | “CP system, installation and commissioning” type P.BE-CPSYS-... | | | |
| Contents | General basic information on the method of operation, fitting, installation and commissioning of CP systems | | | |
| Manual | “CP field bus node, programming and diagnosis” type P.BE-CP-FB... or P.BE-VIFB...-10... | “CPV valve terminal, pneumatics” or “CPA valve terminal, pneumatics” type P.BE-CPV-... or P.BE-CPA-... | “CP modules, electronics” type P.BE-CPEA-... | |
| Contents | Special information on commissioning, programming and diagnosing related to the node used | Information on fitting, installing and commissioning CPA or CPV valve terminals | Information on fitting, installing and commissioning CP I/O modules | |



Tab. 0/1: Manuals on the CP system

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

| Term/abbreviation | Meaning |
|---|---|
| Busy bit | Enable bit, for analysing data exchange with the CP system |
| 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 |
| CP modules | Common term for various modules which can be incorporated in a CP system |
| CP system | Complete system consisting of CP field bus node and P 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 |
| Node | CP field bus node with/without field bus connection to which the I/O modules are connected |
| O | Digital output |
| Octet | Number of address bytes assigned by the CP system |
| PLC/IPC | Programmable logic controller/industrial PC |
| SAVE button | Save the current string assignment (connected I/Os); when the CP system is restarted, the last saved string assignment will be compared with thecurrent string assignment. Deviations will be indicated by flashing LEDs. |
| String | Total number of I/O modules connected together on **one** CP connection of the field bus node |
| String assignment | Total number of **all** I/O modules connected via strings to a CP field bus node (0...3) |

# Installation

## Chapter 1

# Contents


| | | |
|---|---|---|
| **1.** | **Installation** | **1-1** |
| 1.1 | General instructions on installation | 1-3 |
| 1.2 | Configuring the field bus node | 1-5 |
| 1.2.1 | Setting the field bus node | 1-5 |
| 1.3 | Connecting the field bus | 1-9 |
| 1.3.1 | Field bus cable | 1-9 |
| 1.3.2 | Field bus baud rate and field bus length | 1-11 |
| 1.3.3 | Field bus interface | 1-12 |
| 1.3.4 | Connection possibilities | 1-13 |
| 1.4 | Bus termination with terminating resistors | 1-17 |
| 1.5 | Connecting the CP modules | 1-18 |
| 1.6 | Connecting the power supply | 1-19 |

## 1.1 General instructions on installation

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

– the compressed air supply,

– the operating voltage on the field bus node (pins 1 and 2),

– the load voltage supply to 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 node of the CP system contains electrostatically sensitive components.

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

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

General information on installing the CP modules can be found in the manual “Installing and commissioning CP systems.”

## Electrical connecting and display elements

1 Field bus interface

2 LED BUS ERROR

3 LEDs POWER and POWER V

4 CP connections for 4 strings (0...3)

5 String fault LEDs

6 Identification fields

7 Rotary and DIL switches

8 Cover of the rotary/DIL switches

9 SAVE button

10 Connection for power supply

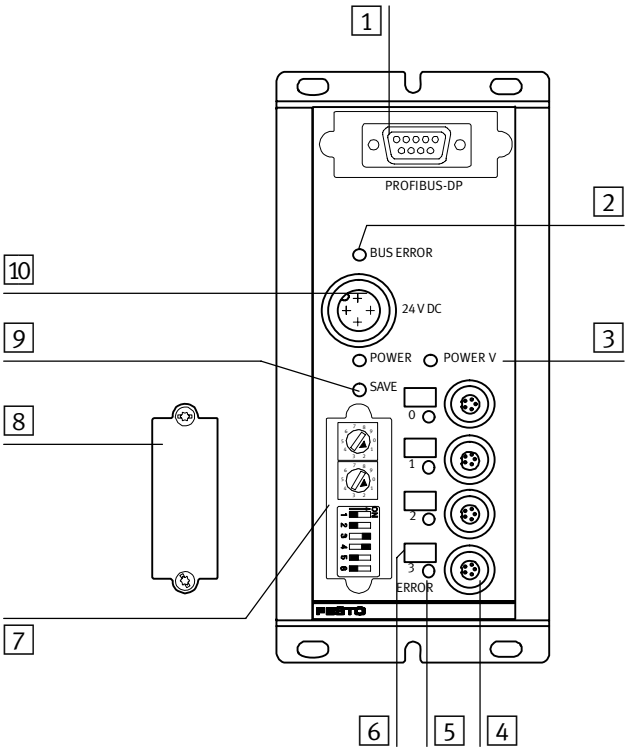



Fig. 1/1: Connecting and display elements of the CP field bus node

## 1.2 Configuring the field bus node

Rotary and DIL switches can be found under the cover on the field bus node (see Fig. 1/1).

Open and close the cover as follows:

- Opening: Remove the 2 screws in the cover. Lift up the cover.
- Closing: Place the cover in position and tighten the screws by hand.

**Caution**
Tighten the screws of the switch cover only by hand.

### 1.2.1 Setting the field bus node

With the rotary and DIL switches you can set the following functions:

– the station number

– the voltage monitoring

– the field bus protocol PROFIBUS-DP:
Switch elements 3...6 are reserved and must be set to the positions specified below.

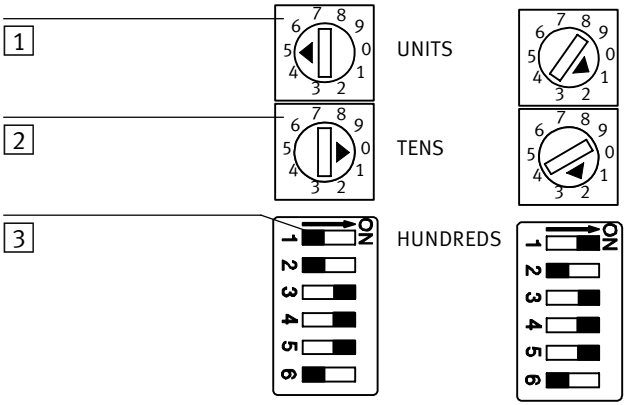
**Setting the station number**

You can set the station number with the rotary switches and element 1 of the DIL-switch.

1 Rotary switch for the UNITS figure

2 Rotary switch for the TENS figure

3 DIL switch for the HUNDREDS figure




Examples of set station numbers: 005 121

Fig. 1/2: Setting the station number and examples

Proceed as follows:

1. Switch off the operating voltage.
2. Assign an unused PROFIBUS address to the field bus node.
3. Use a screwdriver to set the arrow of the relevant rotary switch or element 1 of the DIL switch to the units, tens or hundreds figure of the desired station number.

The following station numbers are permitted:

| Protocol | Address designation | Permitted station numbers |
|---|---|---|
| PROFIBUS-DP | Station number | 1; ...; 125 |

Tab. 1/1: Permitted station numbers

**Please note**
The station number (DP slave address) of the valve terminal cannot be modified by the DP master. The valve terminal can only be addressed by the station number set on the rotary/DIL switches.

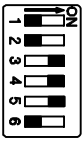
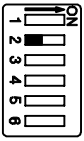
Station numbers may only be assigned once per field bus module/PROFIBUS-DP interface.

Observe any possible limitations as regards the assignment of station addresses by your DP master.

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

### Setting the voltage monitoring

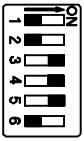
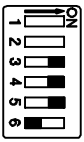
With switch element 2 of the DIL switch, you can specify whether or not the load voltage of the valves and the output modules is to be monitored (see chapter 3 “Diagnosis and fault treatment”).

| DIL switch | Voltage monitoring active | Voltage monitoring inactive |
|---|---|---|
|  |  |  |
| | DIL 2: ON | DIL 2: OFF |

Tab. 1/2: Setting the voltage monitoring, DIL switch element 2

### Reserved DIL switch elements 3...6

Leave switch elements 3...6 set as follows:

| DIL switch | Setting reserved |
|---|---|
|  |  |
| | DIL 3...5: ON<br>DIL 6: OFF |

Tab. 1/3: Reserved DIL switch elements 3...6

## 1.3 Connecting the field bus

### 1.3.1 Field bus cable

**Please note**
With incorrect installation and high baud rates, data transmission faults may occur as a result of signal reflections and attenuations.
Causes of the transmission faults 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 CP system 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 the relevant regulations in IEC/DIN EN 60204-1.

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

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

| | |
|---|---|
| Surge impedance: | 135...165 ohms (3...20 MHz) |
| Capacitance per unit length: | ‹ 30 nF/km |
| Loop resistance: | ‹ 110 ohms/km |
| Core diameter: | › 0.64 mm |
| Core cross-sectional area: | › 0.34 $mm^2$ |

Bus length

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

## 1.3.2 Field bus baud rate and field bus length

**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 CP system 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.

Field bus node FB13 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. 1/4: Max. field bus length and branch line length for PROFIBUS-DP depending on the baud rate

## 1.3.3 Field bus interface

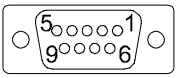
There is a 9-pin sub-D socket on the node for connecting the valve terminal to the field bus.
This connection is used for the incoming cable as well as for the continuing field bus cable. You can connect the valve terminal with the field bus plug from Festo type FBS-SUB-9-GS-DP-B.

➔

**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).

| 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 on field bus node)

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. 1/5: Pin assignment of the field bus interface

## 1.3.4 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 valve terminal 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 node 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

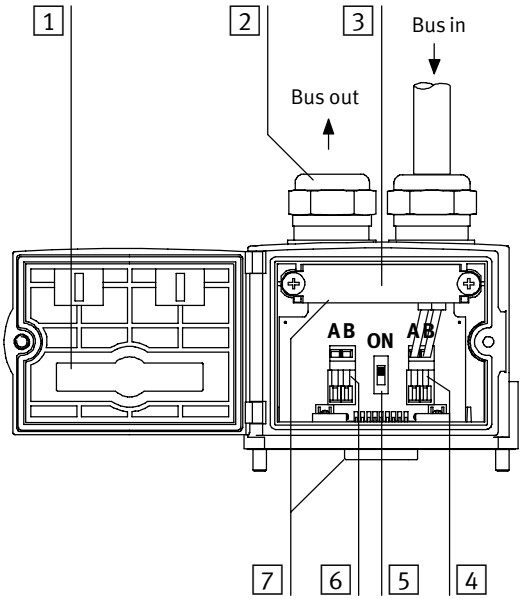



Fig. 1/3: Field bus plug from Festo type FBS-SUB-9-GS-DP-B

**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:

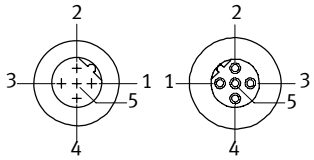
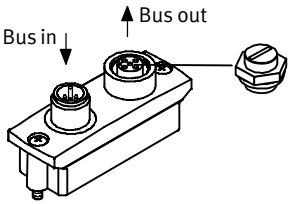
- Switch position OFF: The bus termination is switched off and the continuing field bus cable is switched in.
- Switch position ON: The bus termination is switched on and the continuing field bus cable is **switched off** (see Fig. 1/4).

**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 valve terminal 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 node without interrupting the bus cable (T-TAP function).

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

| **M12 adapter (reverse key coded)** | **Pin no.** |
|---|---|
|  | 1. VP: Power supply positive (P5V)<br>2. **RxD/TxD-N: Receive/Send data N**<br>3. DGND: Data reference potential (M5V)<br>4. **RxD/TxD-P: Receive/Send data P**<br>5. FE: Functional earth<br>Housing/thread: Screening/shield |
|  Protective cap or plug with bus termination resistor if connection is not used. | |

Tab. 1/6: 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 node complies with specification EN 50170-2 and supports the control of network components for optical fibre waveguides.

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

Example of optical-fibre waveguide network components:

- Siemens Optical Link Module (OLM) for PROFIBUS plus
- Siemens Optical Link Plug (OLP) for PROFIBUS (IP20)
- Harting Han-InduNet® Media converter IP65 in combination with adapter cable for Festo products (optical data transmission in DESINA installation concept)

## 1.4 Bus termination with terminating resistors

**Please note**
If the CP system is at the beginning or 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. 1/4).

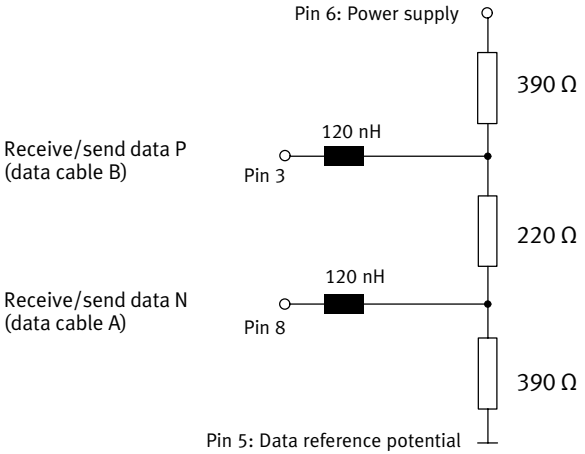



Fig. 1/4: Circuit diagram for bus connection network for cable type A as per EN 50170 (switch in Festo field bus plug set to ON)

## 1.5 Connecting the CP modules

**Warning**
- For connecting the CP modules to a string, use the special CP cable from Festo (type KVI-CP-1-...).
- Please note that the total length of cable on a string must not exceed 10 m.

You can thereby avoid:

– faults in data exchange between the node and the connected CP modules.

Information on the connection procedure can be found in the manual “Installing and commissioning CP systems.”

## 1.6 Connecting the power supply

**Please note**
Use a suitable power unit to supply the CP field bus node separately with operating voltage.

Information on the procedure as well as on connecting cables and current requirements can be found in the manual "Installing and commissioning CP systems."

**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).

**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 (e.g. switching off the operating voltage for the valves and output modules, switching off the compressed air).

# Commissioning

## Chapter 2

# Contents

**2. Commissioning ..... 2-1**

2.1 Preparing the CP system for commissioning ..... 2-3
2.1.1 Saving the string assignment ..... 2-3
2.1.2 Information on commissioning ..... 2-5
2.2 Device master file (GSD) and icon files ..... 2-12
2.3 Configuration with a Siemens master ..... 2-13
2.3.1 STEP 7 – HW Config (up to V 5.2) ..... 2-14
2.3.2 Examples of addressing ..... 2-20
2.3.3 Commissioning the CP system on the PROFIBUS-DP ..... 2-24

## 2.1 Preparing the CP system for commissioning

**Warning**
Before commissioning:

- Make sure that the setting of switch elements 3...6 on the DIL switch is correct (see section 1.2.1).

During operation:

- Do not modify the settings of the DIL switch.

You will thereby avoid undesired movements of the connected actuators.

### 2.1.1 Saving the string assignment

**Please note**
Before commissioning the CP system

- Prepare the CP system for commissioning (see manual “Installing and commissioning CP systems”).

Prepare commissioning of the CP system on the PROFIBUS-DP as follows:

1. Connect the power supply of the node (see manual “Installing and commissioning CP systems”).
2. Connect the CP modules.
3. Switch on the power supply.
4. Save the current string assignment by pressing the SAVE button.

1 SAVE button

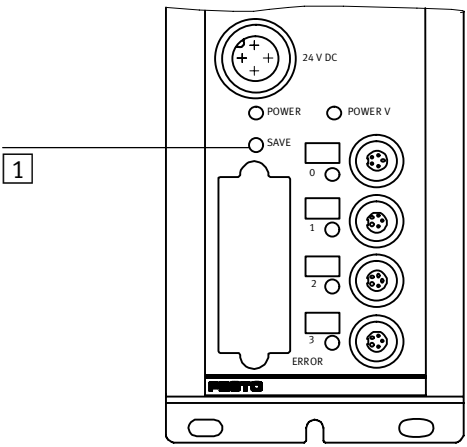



Fig. 2/1: The SAVE button saves the current string assignment of the CP system as the NOMINAL configuration

## 2.1.2 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 stops.

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 outputs of the CP system will be “frozen.” The CP system 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 complete structure of the CP system

– over the selected format (byte).

## Sequence of configuration entries

**Caution**
The number of inputs/outputs must correspond to the equipment fitted on the CP system. The configuring of additional inputs and outputs as a later reserve is not permitted.

## Configuration with DP identifiers

**Please note**
DP identifier 049 or 16DX (standard mode) is used for the examples.

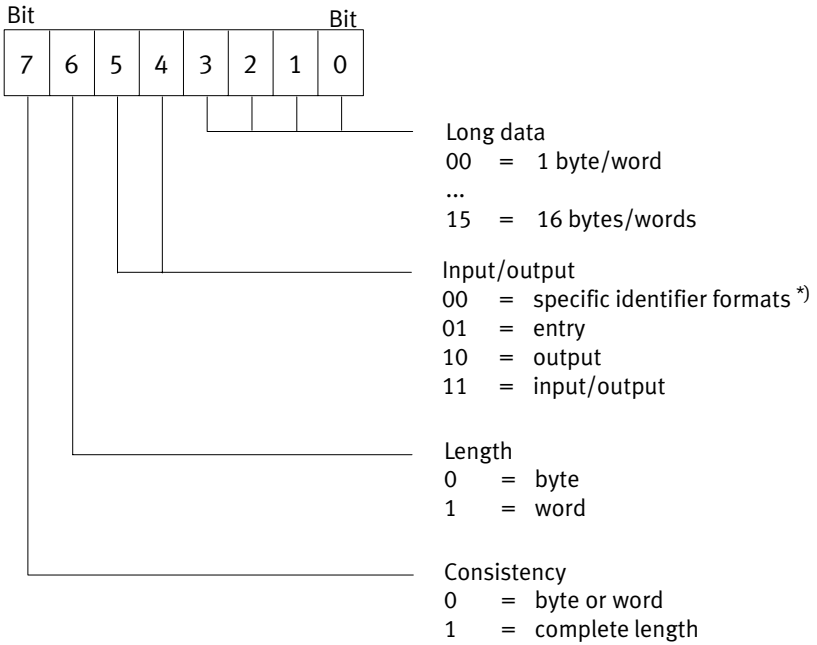
The configuration data must be known or ascertained for each bus slave. There are two possibilities of configuring the CP system:

– standard mode

– compact mode

The CP system recognises automatically the mode in which you wish to operate the CP system, on the basis of the DP identifier sent by the master.

**Caution**
Configure a CP system only in one of these two ways:
– standard mode (max. 4 x 049)
– compact mode (sum identifiers).
The identifiers must not be mixed.




*) Not supported

Fig. 2/2: Structure of the identifier byte

Example:
$00010000_b = 016_d$ ($010_h$): 8DI = 8 digital inputs

## Standard mode

Configure in standard mode 16 outputs and 16 inputs per assigned string. DP identifier: 049 or 16DX for each assigned string.
The following table shows an overview of the possible entries for the valve terminal in standard mode:

| Last used string number | Number of bytes for input/outputs | Individual identifier |
|---|---|---|
| 0 | 2 | 16DX |
| 1 | 4 | 16DX, 16DX |
| 2 | 6 | 16DX, 16DX, 16DX |
| 3 | 8 | 16DX, 16DX, 16DX, 16DX |

Tab. 2/1: Standard mode: possible configuration of the inputs and outputs

The last **used** string is decisive for the number of DP identifiers, even if numerically lower strings are not assigned physically (see manual “Installing and commissioning CP systems”).

**Example:**

CP system with 3 strings, a total of 3 input modules and 3 output modules, highest assigned string number = 2.

| | DP identifier | Comment |
|---|---|---|
| 0 | 16DX | Input module and output module of string 0 |
| 1 | 16DX | Input module and output module of string 1 |
| 2 | 16DX | Input module and output module of string 2 |

Tab. 2/2: Example of configuration in standard mode

## Compact mode

In compact mode configure the **sum** of the input bytes and the **sum** of the output bytes **separately and independently of each other** (see Tab. 2/3). The following applies here:

**Please note**
Observe the sequence “inputs before outputs” in compact mode, if both inputs and outputs areinstalled in a CP system.

CP valve terminals occupy **two** output bytes irrespective of the number of valve coils.

– Assign the DP identifiers in ascending order without gaps. No field must remain unused (inputs before outputs).

– If only output modules or CP valve terminals are fitted: enter their DP identifiers in line 0.

– The string assigned with the highest number of inputs or outputs defines the sum of input or output bytes.

– Non-existent CP valve terminals occupy input or output bytes if a **higher** string is assigned with inputs or outputs.

Maximum configuration in compact mode:
$023_d$ $039_d$ 8 input bytes and 8 output bytes

The following table shows an overview of the possible entries for the valve terminal in compact mode.

| **With input modules** | | | |
|---|---|---|---|
| Last used string number | Number of input bytes | Sum identifier (decimal) | |
| 0 | 2 | $017_d$ | 16DI |
| 1 | 4 | $019_d$ | 32DI |
| 2 | 6 | $021_d$ | – |
| 3 | 8 | $023_d$ | – |
| **With output modules or valve terminals** | | | |
| Last used string number | Number of output bytes | Sum identifier (decimal) | |
| 0 | 2 | $033_d$ | 16DO |
| 1 | 4 | $035_d$ | 32DO |
| 2 | 6 | $037_d$ | – |
| 3 | 8 | $039_d$ | – |

Tab. 2/3: Compact mode: possible configuration of the inputs and outputs

**Example 1:**

CP system with 3 strings, a total of 3 input modules and 3 output modules, highest assigned string number = 2.

| | DP identifier | Comment |
|---|---|---|
| 0 | $021_d$ | 6 bytes inputs |
| 1 | $037_d$ | 6 bytes outputs |

**Example 2:**

CP system with 3 strings, only 3 output modules, highest assigned string number = 2.

| | DP identifier | Comment |
|---|---|---|
| 0 | $037_d$ | 6 bytes outputs |

## 2.2 Device master file (GSD) and icon files

In order to configure the valve terminal 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

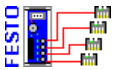
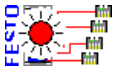
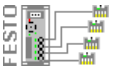
You will require one of the following files for the CP field bus node 13:

– VI10F13C.GSD (German version) or

– VI10F13C.GSE (International version)

Icon files

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

| Normal operating status | Diagnostic case | Special operating status |
|---|---|---|
|  |  |  |
| File: Pbfb13en.dib | File: Pbfb13ed.dib | File: Pbfb13cs.dib |

Tab. 2/4: 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 appendix A.2.

Before commissioning or programming, compile a configuration list of all connected field bus slaves. On the basis of this list you can:

– carry out a comparison between the NOMINAL and the ACTUAL configurations to ascertain if there are any connection faults.

– access these specifications during the syntax check of a program, in order to avoid addressing faults.

The configuration of the CP system requires a very accurate procedure, as different configuration specifications are sometimes required for each system, due to the modular structure. Please observe here the specifications in the following sections.

## 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: VI10F13C.GS*
   (Reference sources for the GSD see section 2.2)

   The GSDs can be either:

   – 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 CPX terminal 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 CP FB13" 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 node (see section 1.2.1) and confirm this 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.

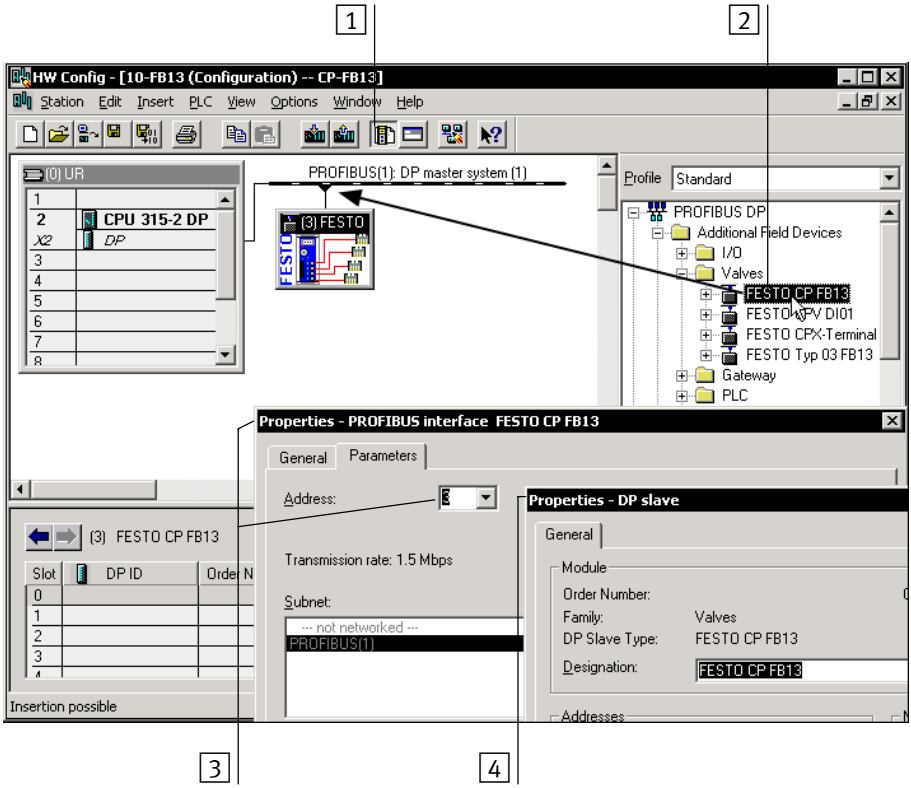



Fig. 2/3: Station selection with STEP 7 – HW Config
(the windows displayed are not all visible at the same time, see text)

## Configuration with STEP 7

You can configure the CP system in “standard mode” or in “compact mode.” Assign the configuration table as follows:

1. Click on the icon of the valve terminal to be configured in Hardware config. (see Fig. 2/4 [1]). The configuration table will be displayed under the rack [2].

2. Open the module “FESTO CP FB13” (folder\PROFIBUS-DP\Additional Field Devices\Valves\...) in the hardware catalogue [3].

3. **Configuration in standard mode**
   Pull the module corresponding to the highest assigned string number of your CP system onto location 0 in the configuration table.
   Assign the starting address in the window “Properties – DP slave” [4].

   **Configuration in compact mode**
   Pull the “Universal module” onto location 0 in the configuration table (see Fig. 2/5).
   Select the I/O type, the starting address and the number of I or O-bytes in the window “Properties – DP slave.” Information on this can be found in Tab. 2/3. Repeat the last steps for further modules.

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.

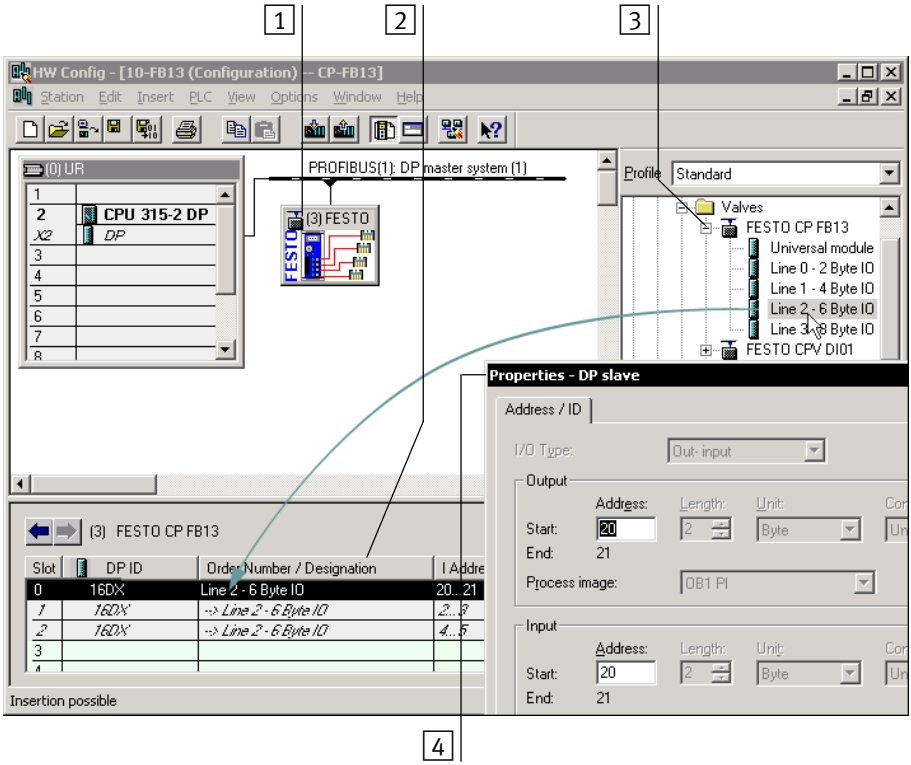



Fig. 2/4: Configuration in standard mode with STEP 7 – HW Config

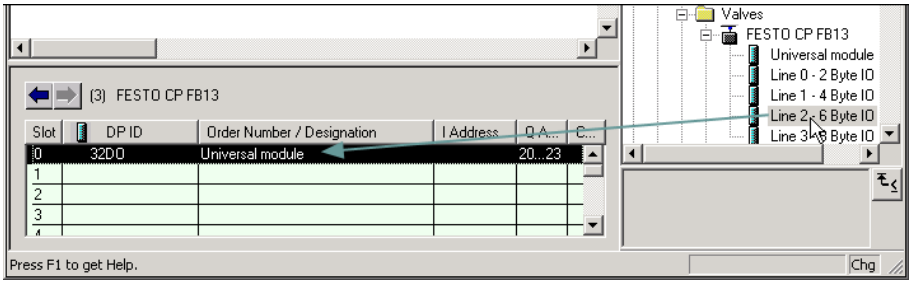


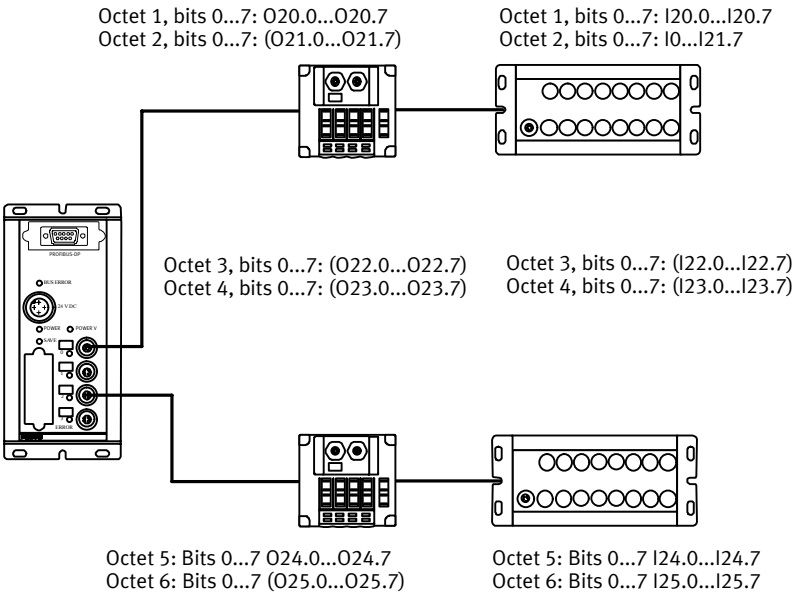

Fig. 2/5: Configuration in compact mode with STEP 7 – HW Config

## 2.3.2 Examples of addressing

**Example 1: Standard mode**

| String assignment of the CP system | DP identifier | I/O address (IN/OUT) |
|---|---|---|
| String 0:<br>16 outputs and<br>16 electrical inputs | 049 | <br>O20.0...21.7<br>I20.0...21.7 |
| String 1:<br>not assigned | 049 | (O22.0...23.7, (unused)<br>(I22.0...23.7, (unused) |
| String 2:<br>16 outputs and<br>16 electrical inputs | 049 | <br>O24.0...25.7<br>I24.0...25.7 |
| String 3:<br>not assigned | – | Address range can be used for other bus slaves |

Tab. 2/5: Addressing the CP system shown in Fig. 2/6



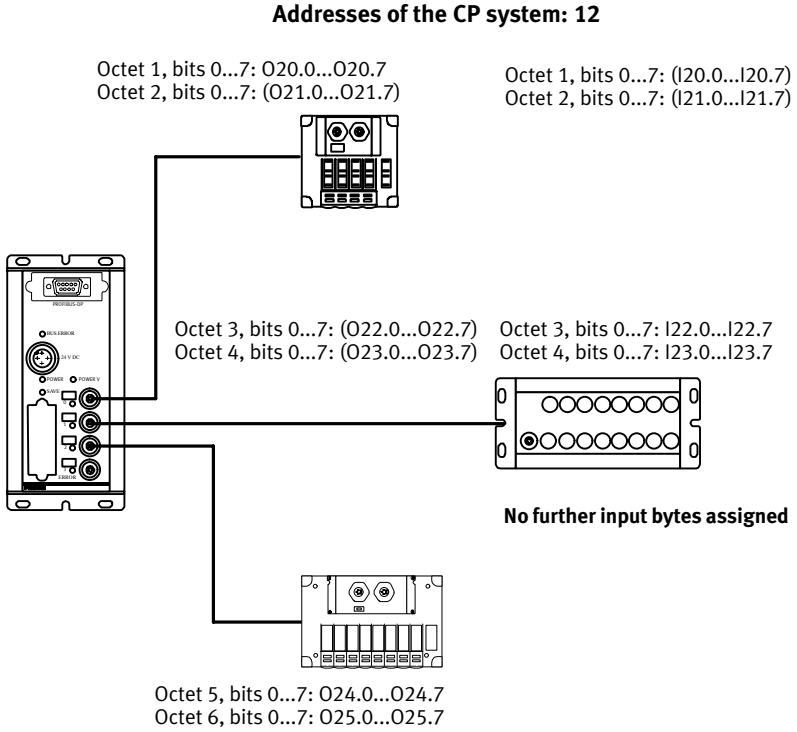

I = Input
O = Output
( ) = Assigned, but not used

Fig. 2/6: Examples of addressing the inputs and outputs of a CP system on the PROFIBUS-DP in standard mode

**Example 2: Compact mode**

| String assignment of the CP system | DP identifier | I/O address (IN/OUT) |
|---|---|---|
| String 0:<br>8 outputs | 017<br>037 | O20.0...21.7<br>(I20.0...21.7, unused) |
| String 1:<br>16 inputs | | (O22.0...23.7, unused)<br>I22.0...23.7 |
| String 2:<br>16 outputs | | O24.0...25.7 |
| String 3: not assigned | | Address range can be used for other bus slaves |

Tab. 2/6: Addressing the CP system shown in Fig. 2/7




I = Input
I = Output
( ) = Assigned, but not used
Sum of the assigned bytes: 6 output bytes; 4 input bytes

Fig. 2/7: Addressing the inputs and outputs of a CP system on the PROFIBUS-DP in compact mode

## 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 field bus node.
2. Switch on the operating voltages:
   - of all field bus slaves
   - of the CP system.
3. Switch on the operating voltage for the master module.

Configuration run

When the system is switched on, some master systems automatically carry out a comparison between the NOMINAL and the ACTUAL configurations. For this configuration run it is important that:

- the specifications for the NOMINAL configuration are complete and correct (see also section 2.1.1).
- 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 and error treatment

## Chapter 3

# Contents


**3. Diagnosis and error treatment ..... 3-1**

3.1 LED displays on the bus node ..... 3-3
3.1.1 Normal operating status ..... 3-4
3.1.2 Fault display of the POWER LEDs ..... 3-5
3.1.3 Fault messages of the LED BUS ERROR ..... 3-6
3.2 Testing the valves ..... 3-7
3.3 Diagnosis via PROFIBUS-DP ..... 3-9
3.3.1 Diagnostic words ..... 3-9
3.3.2 Diagnostic steps ..... 3-10
3.3.3 Overview of diagnostic bytes ..... 3-11
3.3.4 Details for standard diagnostic information ..... 3-12
3.4 Fault treatment ..... 3-17
3.4.1 Siemens SIMATIC S5/S7 ..... 3-18
3.5 Online diagnosis with STEP 7 ..... 3-20
3.5.1 Read diagnostic buffer with STEP 7 (up to V 5.2) ..... 3-20
3.6 Short circuit/overload ..... 3-22
3.6.1 Output module ..... 3-22
3.6.2 Input module ..... 3-24

## 3.1 LED displays on the bus node

The LEDs on the node enable a speedy on-the-spot diagnosis to be made of the operating status of the CP system.

1 LED BUS ERROR

2 LED POWER

3 LED POWER V

4 String fault LEDs

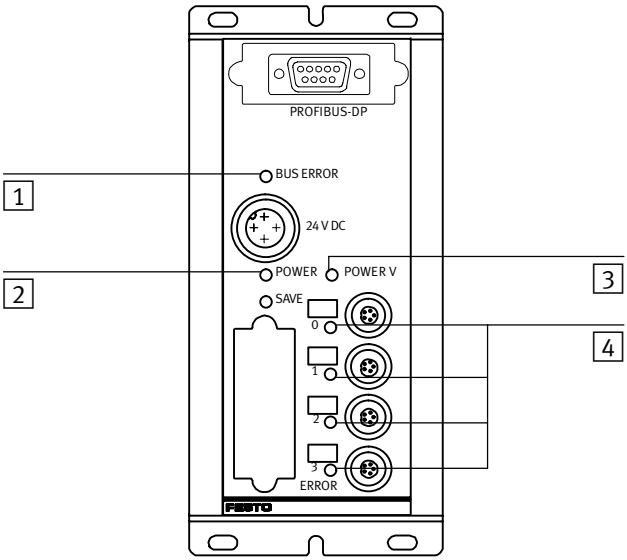



Fig. 3/1: LEDs of CP field bus node FB13

| LED designation | Function | Meaning |
|---|---|---|
| BUS ERROR | Bus communication | Flashes when there is a fault in conjunction with the field bus or when there is an address fault. |
| POWER | Operating voltage display of internal electronics | Lights up when the operating voltage is applied to pin 1; the node is ready to operate. |
| POWER V | Load voltage display for valves | Lights up when the load voltage of the valves is OK (pin 2);<br>flashes if load voltage < 20.4 V and >10 V |
| 0...3 | CP string LED | In the starting phase:<br>Flashes if the string assignment has been modified since the previous operation.<br>During operation:<br>Lights up if a CP connection is interrupted |

Tab. 3/1: Overview of the function of the LEDs of the field bus node

### 3.1.1 Normal operating status

In the normal operating status only the green LEDs POWER and POWER V light up.

 lights up  LED flashes ○ out

| LED | Colour | Operating status | Fault treatment |
|---|---|---|---|
| BUS ○ | Out | Normal | None |
| POWER  | Green lights up | Normal | None |
| POWER V  | Green lights up | Normal | None |

Tab. 3/2: Normal operating status

## 3.1.2 Fault display of the POWER LEDs

| LED | Colour | Operating status | Fault treatment |
|---|---|---|---|
| POWER<br>  <br>POWER V<br>  | Green<br>lights up | Operating status normal<br>or<br>Operating status normal, but valves do not switch.<br>– Compressed air supply not OK<br>– Pilot exhaust blocked<br><br>or<br>Operating status normal, but PROFIBUS fault message of the LED BUS ERROR | None<br><br>**Check the ...**<br><br>• Compressed air supply<br>• Pilot exhaust channels<br><br>See fault messages of the LED BUS ERROR |
| POWER<br>  <br>POWER V<br>  | Green<br>lights up<br><br>Out | Load voltage of the outputs (pin 2) not applied.<br>or<br>CP valve terminal or output module defective. | • Check load voltage of the outputs (pin 2)<br><br>• Replace the CP module |
| POWER<br>  <br>POWER V<br>  | Green<br>lights up<br><br>Green<br>flashes | Load voltage of the outputs (pin 2) not in the tolerance range. | • Check load voltage of the outputs (pin 2). |
| POWER<br>  | Out | Operating voltage of the electronics (pin 1) not applied.<br>or<br>Hardware fault | • Check the operating voltage connection<br><br>Servicing required |

### 3.1.3 Fault messages of the LED BUS ERROR

Possible PROFIBUS-specific LED displays of the operating status of the CP node are shown in the following table:

| LED | Colour | Operating status | Fault treatment |
|---|---|---|---|
| BUS ERROR  | Red flashes fast | Station number not permitted | • Correct station number (1; ...; 125) |
| BUS ERROR  | Red flashes slowly (1-second intervals) | Field bus connection not OK.<br>Possible causes:<br>– Station number not correct (e.g. address assigned twice)<br>– Field bus module switched off or defective<br>– Interrupted, short-circuited or faulty field bus connection<br>– Configuration not correct: nominal ≠ actual status | Check the ...<br>• Setting of the address selector switch<br>• Field bus module<br>• Field bus connection<br>• Configuration |
| BUS ERROR  | Out | Valve test | –<br>(Conclude valve test) |

## 3.2 Testing the valves

**Warning**
Before the test:

- Switch off the compressed air supply for the valves.
- In the case of a non-saved string assignment:
  Save the current string assignment with the SAVE key
  (see section 2.1.1).

You can then avoid undesired or dangerous movements of the actuators.

**Caution**
– This test function runs automatically in the CP terminals.
  **All valves** are switched on/off cyclically.
– None of the programmed lockings or further switching conditions will be taken into account.

Test routine

During the test routine of the CP terminal all the valves are switched on/off at 1-second intervals.

## Starting the test routine

1. Switch off the power supplies (pins 1 and 2) on the node.
2. Switch off the load voltage supply to the output modules.
3. Remove the cover of the rotary/DIL switches.
4. Note the setting of the rotary and DIL switch elements.
5. Set station number 199.
6. Switch on the power supplies (pins 1 and 2).
7. Starting the test routine: Set DIL switch element 1 to OFF.

If faults occur when the test routine is started, the red LED on the node will flash quickly. The procedure must then be repeated.

## Concluding the test routine

1. Switch off the power supplies (pins 1 and 2) on the node.
2. Set the address selector switch and the DIL switch elements to their original positions again.

When the test routine is finished, switch on the power supplies again:

– on the node

– on the output modules.

## 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 controller:

- Load voltage failure on the output modules
- Short circuit/overload at the output modules
- Interruption of the CP connection on various CP modules

Additional fault messages when DIL switch element 2 = ON:

- Load voltage failure in the CP connection
- Lower voltage tolerance limit of CP valves exceeded (< 20.4 V)

### Busy bit

With device-related diagnosis 1, the CP system supplies status information as bit 1:

– Busy bit = CP system in starting phase and therefore not ready for date exchange

If the busy bit is set (= “log. 1”), the diagnostic bits in bytes 2...5 contain “log. 0.” Only device-related diagnosis 1 is supported.

## 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.

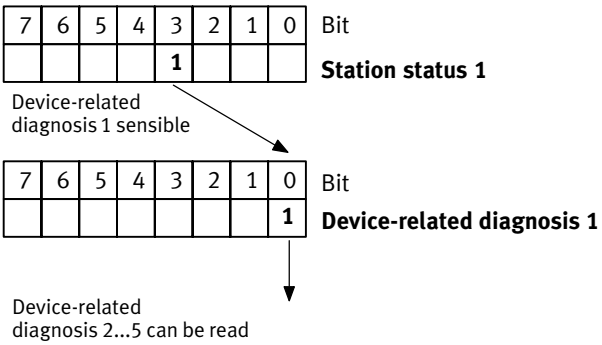



Fig. 3/2: Diagnostic steps

### 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 $F1_h$) | Manufacturer identifier (Ident_number Low byte $3C_h$) | 6 | 5 |
| 6 | 7 | Header | **Device-related diagnosis 1 (overview of faults)** | **8** | **7** |
| **8** | **9** | **Device-related diagnosis 2 (fault byte CP string 0)** | **Device-related diagnosis 3 (fault byte CP string 1)** | **10** | **9** |
| **10** | **11** | **Device-related diagnosis 4 (fault byte CP string 2)** | **Device-related diagnosis 5 (fault byte CP string 3)** | **12** | **11** |
| 12 | 13 | Device-related diagnosis 6 (not used) | Device-related diagnosis 7 (not used) | 14 | 13 |
| **bold** = Contents modified by the CP system<br>* = Siemens<br>** = EN 50170 | | | | | |

Tab. 3/3: Diagnostic words

## 3.3.4 Details for 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 15. The procedure for reading out this diagnostic information with a SIMATIC S5/S7 system is described in chapter 3.4.2.

| **Octet 1: Station status_1** | | |
|---|---|---|
| **Bit** | **Meaning** | **Explanation** |
| **0** | **Diag.Station_Non_Existent** | CP system no longer/not yet addressable.<br>Possible causes:<br>– Operating voltage not applied<br>– Data cable interrupted<br>– 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:<br>– Cable fracture on input/output module<br>– Short circuit/overload at electric outputs or sensor supply for inputs<br>– $V_{valves}$ < 20.4 V<br>– $V_{outputs}$ < 10 V<br>– $V_{sensor}$ < 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. 3/4: Diagnostic bits station status 1

| **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. 3/5: 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. 3/6: Diagnostic bits of station status 3

## Further octets

| **Octets 4...7: Overview** | | |
|---|---|---|
| **Octet** | **Designation** | **Explanation** |
| 4 | Diag.Master_Add | Master address:<br>The address of the master, which parametrized the CP system, is entered in this octet. |
| 5...6 | Ident_number | Manufacturer identification:<br>These octets contain the manufacturer identification: $F13C_h$ for the Festo CP system. |
| 7 | Ext_Diag_Data<br>(device-related diagnosis) | Header device-related diagnosis:<br>The CP system enters the fixed value 8 in this octet, i.e. 8 Octets “Device-related diagnosis” incl. the header octet, are made available/transferred, irrespective of the equipment fitted on the CP system.<br>6 of the 8 octets are used. |

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

## Structure of device-related diagnosis

| **Octet 8: Device-related diagnosis 1** | | |
|---|---|---|
| **Bit** | **Meaning** | **Explanation** |
| 0 | Common fault in CP system | 1 = Fault in one or several CP strings (bits 4...7) |
| 1 | Busy bit | 1 = During the starting phase: CP system not yet ready for data exchange |
| 2 | – | Not used |
| 3 | – | Not used |
| 4 | Common fault 0 | 1 = Fault in string 0 |
| 5 | Common fault 1 | 1 = Fault in string 1 |
| 6 | Common fault 2 | 1 = Fault in string 2 |
| 7 | Common fault 3 | 1 = Fault in string 3 |

Tab. 3/8: Diagnostic bits of device-related diagnosis 1

| Overview octets 9...12: Device-related diagnosis 2...5 | |
|---|---|
| **Octet** | **Explanation** |
| 9 | Device-related diagnosis 2: String 0 |
| 10 | Device-related diagnosis 3: String 1 |
| 11 | Device-related diagnosis 4: String 2 |
| 12 | Device-related diagnosis 5: String 3 |

Tab. 3/9: Overview of device-related diagnosis 2...5

| Octets 9..12: Device-related diagnosis 2...5 | | |
|---|---|---|
| **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 the output module |
| 3 | $V_{off}$ | 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 | Ex | Not used |
| *) Only with setting DIL switch element 2 at ON | | |

Tab. 3/10: Diagnostic bits device-related diagnosis 2...5

## 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. 3/11: Fault reactions STOP and RUN with S5/S7

Further details 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. 3/12: Possibilities for reading out the diagnosis for S5/S7

## Example for a STEP 7 user program

| STL | Explanation |
|---|---|
| `CALL SFC 13` | Reading request |
| `REQ:=TRUE` | |
| `LADDR:=W#16#03FE` | Pointer at diagnostic address, e.g. $1022_d = 03FE_h$ (see mask “Properties – DP slave” in HW Config) |
| `RET_VAL:=MW100` | If fault occurs, output fault code |
| `RECORD:=P#M110.0 WORD 7` | Pointer at start of data range for diagnosis and length of diagnostic data |
| `BUSY:=M10.0` | Reading concluded |

## 3.5 Online diagnosis with STEP 7

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

- Decentral periphery: station failure
  - Communication between slave and master interrupted
- Faulty component (see device-specific diagnosis)
- 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/rotary 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 (Fig. 3/3):

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 [Component status...] in the context menu which now appears. The window “Component status” will be shown [3].
4. Click on the register “Diagnostic Buffer” [4].
5. Click on the event and read the details. These supply more detailed information on the further procedure and depend on the S7 controller [5] used.

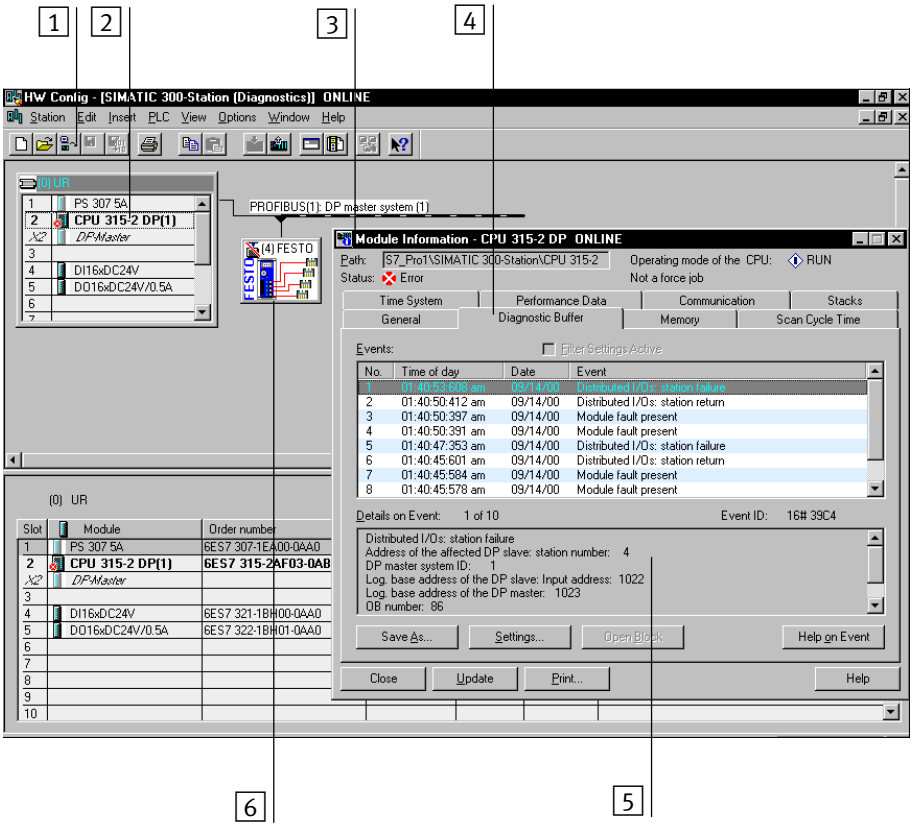



Fig. 3/3: Online diagnosis via diagnostic buffer (explanation see text)

## Device-related diagnosis

- Instead of the CPU, click on the CP valve terminal 6. Read further information on the device-related diagnosis of the CP system via the window “Component status.”

## 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 a string will be switched off.

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

– the short circuit/overload bit in the octets 9...12 “Device-related diagnosis 2...5” will be set to 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. 3/13: 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 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 the octets 9-12 “Device-related diagnosis 2...5” will be set to 1.

**Please note**
The inputs 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 for the CP system at the field bus node.

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.

# Technical appendix

## Appendix A

# Contents


**A. Technical appendix ..... A-1**

A.1 Technical specifications Field bus node CP FB13-E ..... A-3
A.2 Commissioning with the general DP master ..... A-5
A.2.1 Bus start ..... A-5
A.2.2 Send parametriziung data ..... A-6
A.2.3 Check the configuration data ..... A-7
A.2.4 Transferring input and output data ..... A-9
A.2.5 Read diagnostic information ..... A-11
A.2.6 Implemented functions and service access points (SAP) ..... A-11
A.2.7 Bus parameters/reaction times ..... A-12
A.2.8 Transmission times on the PROFIBUS-DP ..... A-12

## A.1 Technical specifications Field bus node CP FB13-E

| General information | |
|---|---|
| **Temperature range**<br>– Operation<br>– Storage/transport | <br>- 5 ... + 50 °C<br>- 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**<br>(protection against direct and indirect contact as per IEC/DIN EN 60204-1) | by means of PELV circuits<br>(Protective Extra-Low Voltage) |
| **Electromagnetic compatibility**<br>– Interference emitted<br>– Resistance to interference | <br>Tested as per EN 61000-6-4 (industry) *)<br>Tested as per EN 61000-6-2 (industry) |
| *) The CP system is intended for industrial usage. | |

| Operating voltage for the electronics and the input modules | |
|---|---|
| **Pin 1**<br>Power supply connection<br>– Rated value<br>– Tolerance | <br><br>24 V DC<br>20.4 ... 26.4 V |
| **Current consumption**<br>– Pin 1 node FB13-E<br>– Complete electronics of the CP system | <br>250 mA<br>See manual “CP system,” current consumption table |
| **Residual ripple** | 4 Vpp (within tolerance) |
| **Bridging time** during drop in logic voltage | 20 ms |

| Load voltage for solenoid valves of CP valve terminal | |
|---|---|
| **Pin 2**<br>Power supply connection<br>– Rated value<br>– Tolerance | <br><br>24 V DC<br>20.4 ... 26.4 V |
| **Current consumption**<br>– Pin 2 node FB13-E | <br>Sum of all switched-on CP solenoid valves;<br>see manual “CP pneumatics” |
| **Residual ripple** | 4 Vpp (within tolerance) |
| **Bridging time** during drop in logic voltage | 20 ms |

| 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,<br>automatic baud rate recognition |
| **Cable type** | Depending on cable length and baud rate:<br>see controller manual |

## A.2 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 2.1.2
- 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:<br>0 = off<br>1 = on | | |
| 4 | Freeze_Req | 0 = FREEZE mode not requested by the master<br>1 = FREEZE mode set by the master | | |
| 5 | Sync_Req | 0 = SYNC mode not requested by the master<br>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<br>WD_Fact_2 | Range 1...255: The response monitoring time of the CP system is transferred with these two octets:<br>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 CPV Direct (= $F13C_h$); 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.

**Please note**
The configuration of the CP system must be carried out as follows:

- per string: a DP identifier for inputs and outputs
- via sum identifier: sum of the input bytes and sum of the output bytes.

The composition of the identifier bytes can be found in section 2.1.2.

Summary of parameters (Chk_Cfg):

Octet 1-n: DP identifier
Permitted identifiers for CP systems from Festo in compact mode (see also Tab. 2/3):

| Number of I/Os | Decimal inputs | Decimal outputs |
|---|---|---|
| up to 16 | 017 | 033 |
| up to 32 | 019 | 035 |
| up to 48 | 021 | 037 |
| up to 64 | 023 | 039 |

Tab. A/3: Overview of DP identifiers for the CP system

**Example:**

Configuration: Function: Chk_Cfg

| String | Octet | DP identifier | |
|---|---|---|---|
| | | decimal | hex |
| 0 | 1 | 049 | 031 |
| 1 | 2 | 049 | 031 |

Tab. A/4: Configuring a CP system with 32 inputs/outputs in standard mode

## 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.

Overview of parameters (Data_Exchange):

| | |
|---|---|
| Octet 1: | I/O data byte_0<br>Bit 0: Input/output x *)<br>Bit 1: Input/output x+1<br>. . .<br>Bit 7: Input/output x+7 |
| Octet 2: | I/O data byte_1<br>Bit 0: Input/output x+8<br>Bit 1: Input/output x+9<br>. . .<br>Bit 7: Input/output x+15 |
| Octet 3: | I/O data byte_2<br>Bit 0: Input/output y *)<br>Bit 1: Input/output y+1<br>. . .<br>Bit 7: Input/output y+7 |
| . . . | |
| Octet 5: | I/O data byte_4<br>Bit 0: Input/output z *)<br>Bit 1: Input/output z+1<br>. . .<br>Bit 7: Input/output z+7 |
| . . . | |
| Octet 8: | I/O data byte_7<br>Bit 0: Input/output t+8<br>Bit 1: Input/output t+9<br>. . .<br>Bit 7: Input/output t+15 |

*) x, y, z, t = Address offset of the master module

## 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, 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/5: 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/6: Bus parameters and reaction times

## A.2.8 Transmission times on 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.

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

# Index

## Appendix B

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

B.1 Index ..... B-3

## A

Abbreviations, Product-specific ..... X

## B

Baud rate ..... 1-11
Branch line lengths ..... 1-11
BUS ERROR LED ..... 3-6
Bus termination ..... 1-17
Busy bit ..... 3-10

## C

Cable, Field bus ..... 1-9
Check the configuration data ..... A-7
Compact mode ..... 2-9
Configuration run ..... 2-24
Connecting
  CP modules ..... 1-18
  Field bus ..... 1-9
  Power supply ..... 1-19
Connection for optical-fibre waveguide ..... 1-16
Connections, Field bus ..... 1-12
CP system, Preparing for operation on the PROFIBUS-DP 2-3
Cyclic exchange of data ..... A-9

## D

Designated use ..... V
Device master file (GSD) ..... 2-12
Device-related diagnosis ..... 3-15
Device-related diagnosis 2...5 ..... 3-16

Diagnosis
BUS ERROR LED . . . . . 3-6
POWER LEDs . . . . . 3-5
Siemens master . . . . . 3-9
Diagnostic bytes . . . . . 3-11
Diagnostic steps . . . . . 3-10
Diagnostic words . . . . . 3-9
Overview . . . . . 3-11
DIL switch . . . . . 1-6

## E

Examples of addressing . . . . . 2-20

## F

Fault treatment . . . . . 3-17
Field bus baud rate . . . . . 1-11
Field bus cable . . . . . 1-9
Field bus interface . . . . . 1-12
Field bus length . . . . . 1-11
Field bus plug . . . . . 1-13
FREEZE . . . . . 2-5

## G

General DP master . . . . . A-5

## I

Identifiers . . . . . 2-6
Implemented functions . . . . . A-11
Important user instructions . . . . . VII

## L

LEDs . . . . . 3-3

## M

M12 adapter ..... 1-15

## N

Notes on the use of this manual ..... VI

## O

Octets 4...7, Overview ..... 3-14
Operating status ..... 3-4

## P

Pictograms ..... VIII
Pin assignment, Field bus interface ..... 1-12
POWER LEDs ..... 3-5
Power supply
  Connecting ..... 1-19
  Power unit ..... 1-19
Power unit ..... 1-19
PROFIBUS-DP
  Diagnostic information ..... 3-12
  STEP 7 ..... 2-14

## R

Reaction times ..... A-12
Reverse key ..... 1-15
Rotary switch ..... 1-6

## S

SAVE button ..... 2-4

Send parametrizing data ..... A-6
Service ..... VI
Service access points (SAP) ..... A-11
Setting
Station number ..... 1-6
Voltage monitoring ..... 1-8
Setting the address ..... 1-6
Setting the station number ..... 1-6
Short circuit, Short circuit/overload ..... 3-22
Siemens master, Configuration ..... 2-13
Standard mode ..... 2-8
Station status ..... 3-12
STEP 7, Online diagnosis ..... 3-20
Strain relief ..... 1-9
String assignment, Saving ..... 2-3
Icon files ..... 2-12
SYNC ..... 2-5

## T

Target group ..... VI
Technical specifications ..... A-3
Testing the valves ..... 3-7
Text markings ..... VIII