

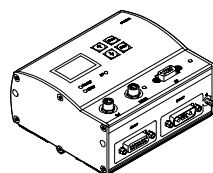
# Motor controller SFC-DC

**FESTO**

## Manual

Motor controller  
with fieldbus  
interface PROFIBUS

Type  
SFC-DC-VC-...-PB



**Manual**  
540 412  
en 1005c  
[753 245]



## Contents and general instructions

Original ..... de

Edition ..... en 1005c

Designation ..... P.BE-SFC-DC-PB-EN

Order -no. .... 540 412

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## Intended use

The motor controller (Single Field Controller, single axis field controller) type SFC-DC-...-PB serves as a position controller and position servo for the electric mini slide type SLTE or the electric gripper HGPLE and the gripper and rotary modules GEH and DEF of Sommer Co. with activation via the PROFIBUS fieldbus.

It is absolutely necessary to observe the “Safety instructions” as well as the designated use of the relevant components and modules. Please also observe the safety instructions specified in the operating instructions for the components used.

The SFC-DC and the connectable modules and lines may only be used as follows:

- as intended
- only in an industrial environment
- in its original condition without unauthorised modifications. Only the conversions or modifications described in the documentation supplied with the product are permitted,
- in perfect technical condition.

If conventional accessory components such as sensors and actuators are connected, the specified limits for pressures, temperatures, electrical data, torques etc. should be observed.

Please observe the standards specified in the relevant chapters and comply with the regulations of the trade association and the German Technical Control Board (TÜV), the VDE conditions as well as the relevant national regulations.

## Safety instructions

When commissioning and programming positioning systems, the safety regulations in this manual as well as those in the operating instructions for the other components used should be observed unconditionally.

The user must make sure that nobody is within the sphere of influence of the connected actuators or axis system. Access to the potential danger area must be prevented by suitable measures, such as barriers and warning signs.



### Warning

Electric axes can move suddenly with high force and at high speed. Collisions can lead to serious injury to people and damage to components.

Make sure that nobody can reach into the sphere of influence of the axes or other connected actuators and that no items are within the positioning range while the system is connected to energy sources.

If used in safety-relevant applications, additional measures are necessary, e.g. in Europe, the standards listed under the EU machine guidelines must be observed. Without additional measures in accordance with statutory minimum requirements, the product is not suitable for use in safety-related sections of control systems.



### Warning

Errors in parametrisation can cause injury to people and damage to property.

Enable the controller only if the axis system has been correctly installed and parametrised.

## Target group

This description is intended exclusively for technicians trained in control and automation technology, who have experience in installing, commissioning, programming and diagnosing positioning systems.

## Service

Please consult your local Festo Service or write to the following e-mail address if you have any technical problems:

[service\\_international@festo.com](mailto:service_international@festo.com)

## Scope of delivery

The scope of delivery of the motor controller type SFC-DC includes the following:

- Motor controller, optionally with control panel
- Operating package on CD ROM:
  - User documentation (descriptions)
  - Festo Configuration Tool with SFC-DC plug-in
- User documentation (descriptions)

The following are available as accessories (see appendix A.2):

- Connecting cables and fieldbus plugs
- Mounting attachments
- User documentation in paper form

## Important user instructions

### Danger categories

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



#### **Warning**

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



#### **Caution**

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



#### **Note**

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

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



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

## Marking special information

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

### Pictograms



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



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



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

### Text markings

- The bullet indicates activities which may be carried out in any order.
- 1. Figures denote activities which must be carried out in the numerical order specified.
- Hyphens indicate general activities.

## Descriptions for motor controller type SFC-DC

This manual contains information on the method of operation, as well as on fitting, installing, commissioning and diagnosing electric positioning drives with motor controller type SFC-DC-...-PB with PROFIBUS field bus interface.

Information on components, such as the electric mini-slide, the grippers, or the reference switch can be found in the operating instructions supplied with the relevant product.

| Type                                                                                            | Designation                                                                                                                  | Contents                                                                                                                                                                                             |
|-------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operator package with short description and<br>– Manual<br>– FCT with SFC-DC PlugIn<br>on CDROM | P.BE-SFC-DC-UDOK                                                                                                             | Brief description: Important commissioning instructions and preliminary information.<br>Manuals: Contents as described below.<br>FCT with SFC-DC PlugIn: Festo Configuration Tool with SFC-DC PlugIn |
| Description                                                                                     | <b>Motor controller type SFC-DC with PROFIBUS interface</b><br>P.BE-SFC-DC-PB-...                                            | Installation, commissioning and diagnosis of electric axes with motor controller type SFC-DC with communication via PROFIBUS.                                                                        |
| Help system for software                                                                        | Festo Configuration Tool help (contained in FCT software)                                                                    | Functional descriptions for the Festo Configuration Tool configuration software.                                                                                                                     |
| Operating instructions                                                                          | Type HGPLe-... / HGPPe-...<br>Mini slide type SLTE-..., gripper type HGPLe-..., drives of the Sommer Co.                     | Mounting and commissioning of the electric drive.                                                                                                                                                    |
| Additional descriptions                                                                         | <b>Motor controller type SFC-DC with other interfaces</b><br>P.BE-SFC-DC-IO-...,<br>P.BE-SFC-DC-CO-...,<br>P.BE-SFC-DC-DN... | Installing, commissioning and diagnosing electric axes with motor controller type SFC-DC with communication via I/O interface or via the relevant field bus.                                         |
| Manual for S7 module                                                                            | <b>S7 module for the SFC-DC</b><br>P.BE-SFC-DC-PB-S7-...                                                                     | Using the S7 module for motor controller type SFC-DC with PROFIBUS interface.                                                                                                                        |

Tab. 0/1: Documentation on the SFC-DC

## Information on the version

The hardware version specifies the version status of the mechanical and electronic components of the SFC-DC. The firmware version specifies the version status of the operating system of the SFC-DC.

You can find the specifications on the version status as follows:

- Hardware version and firmware version in the Festo Configuration Tool with active device connection to the SFC-DC under “Device data”
- Firmware version on the control panel under [Diagnostic] [Software information].

| Firmware version from                                                                                                                                                                                                         | What is new?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Which FCT PlugIn?  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| V4.02                                                                                                                                                                                                                         | Motor controller with PROFIBUS interface type SFC-DC-...-PB <b>from hardware version 2.0</b> , supports <sup>1)</sup> <ul style="list-style-type: none"> <li>– electric mini-slides e.g. type SLTE-10-.../SLTE-16-...</li> <li>– electric grippers, e.g. type HGPLE-25-40</li> <li>– electric grippers and rotary modules of Sommer Co.</li> </ul> In addition, user-defined axis lengths, gear variants and spindle pitches are supported for customized solutions. Extended parameters, see appendix B. | From SFC-DC V3.0.0 |
| V2.00                                                                                                                                                                                                                         | Motor controller with PROFIBUS interface type SFC-DC-...-PB, supports <sup>1)</sup> <ul style="list-style-type: none"> <li>– electric mini-slides e.g. type SLTE-10-.../SLTE-16-...</li> <li>– electric grippers, e.g. type HGPLE-25-40</li> </ul> Support of force control for the gripper with additional parameters.<br>Changed objects: 2040h, 2041h (previously 6067h, 6068h).<br>Firmware download possible via FCT.                                                                                | From SFC-DC V2.3.0 |
| V1.10                                                                                                                                                                                                                         | Motor controller with PROFIBUS interface type SFC-DC-...-PB, supports <ul style="list-style-type: none"> <li>– electric mini-slide type e.g. type SLTE-10-.../SLTE-16-...</li> </ul>                                                                                                                                                                                                                                                                                                                      | From SFC-DC V2.0.0 |
| <sup>1)</sup> Support for other drives in preparation. Currently supported drives as per [Axis type] listing on control panel (see chapter 4.5, Tab. 4/15 and Tab. 4/16) or FCT PlugIn (settings for “Axis type” and “Size”). |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                    |

Tab. 0/2: Firmware designs

## Product-specific terms and abbreviations

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

For fieldbus specific abbreviations see following Tab. 0/4.

| Term / abbreviation                           | Significance                                                                                                                                                                                                                    |
|-----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Axis                                          | Mechanical component of a drive that transfers the drive force for the motion. An axis enables the attachment and guiding of the work load and, if necessary, the attachment of a reference switch.                             |
| Axis zero point (AZ)                          | Reference point for the software end positions and the project zero point PZ. The axis zero point AZ is defined by a preset distance (offset) from the reference point REF.                                                     |
| Controller                                    | Contains power electronics + regulator + position controller, evaluates sensor signals, calculates movements and forces and provides the power supply for the motor via the power electronics.                                  |
| Drive                                         | Complete actuator, consisting of motor, encoder and axis, optionally with a gearbox, if applicable with controller. The electric mini slide type SLTE is an integrated unit consisting of a motor, encoder, gear unit and axis. |
| EMC                                           | Electromagnetic compatibility (EMC).                                                                                                                                                                                            |
| Encoder                                       | With the SFC-DC: magnetic pulse generator (rotor position transducer). The electric signals generated are sent to the controller, which then calculates the position and speed on the basis of the signals received.            |
| Festo Configuration Tool (FCT)                | Software with uniform project and data management for all supported device types. The special requirements of a device type are supported with the necessary descriptions and dialogues by means of plug-ins.                   |
| Festo Handling and Positioning Profile (FHPP) | Uniform fieldbus data profile for positioning controllers from Festo.                                                                                                                                                           |
| Festo Parameter Channel (FPC)                 | Parameter access according to the “Festo Handling and Positioning Profile” (I/O messaging, optionally additional 8 bytes I/O)                                                                                                   |
| FHPP standard                                 | Defines the sequence control as per the “Festo Handling and Positioning Profile” (I/O Messaging 8 Byte I/O)                                                                                                                     |

| Term / abbreviation                         | Significance                                                                                                                                                                                                                                                    |
|---------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Force control<br>(Profile Torque Mode)      | Operating mode for executing a direct positioning task with power operation (open loop transmission control) with motor current regulation.                                                                                                                     |
| HGPLe...                                    | Type designation, electric gripper.                                                                                                                                                                                                                             |
| HMI                                         | Human-Machine Interface (MMI), e.g. control panel with LC display and operating buttons.                                                                                                                                                                        |
| Homing                                      | Positioning procedure in which the reference point and therefore the origin of the measuring reference system of the axis are defined.                                                                                                                          |
| Homing<br>(Homing mode)                     | Defining the measuring reference system of the axis                                                                                                                                                                                                             |
| Homing method                               | Method for defining the reference position: Against a fixed stop (overload current evaluation/speed evaluation) or with reference switch.                                                                                                                       |
| I<br>O<br>I/O                               | Input.<br>Output.<br>Input and/or output.                                                                                                                                                                                                                       |
| Jog mode                                    | Manual positioning in positive or negative direction (only on fieldbus variants of the SFC-DC via the fieldbus or only with FCT or control panel).                                                                                                              |
| Load voltage, logic voltage                 | The load voltage supplies the power electronics of the controller and thereby the motor. The logic voltage supplies the evaluation and control logic of the controller.                                                                                         |
| Logic 0                                     | 0 V present at input or output (positive logic, corresponds to LOW).                                                                                                                                                                                            |
| Logic 1                                     | 24 V present at input or output (positive logic, corresponds to HIGH).                                                                                                                                                                                          |
| MMI                                         | Human-Machine-Interface, see "HMI".                                                                                                                                                                                                                             |
| Operating mode                              | Type of controller or internal operating mode of the controller.<br>– Type of control: Record Select, Direct Mode<br>– Operation mode of the controller: Position Profile Mode, Profile Torque Mode ...<br>– Predefined sequences: Homing Mode, Demo Mode, etc. |
| PLC                                         | Programmable logic controller; controller (also IPC: industrial PC).                                                                                                                                                                                            |
| Positioning mode<br>(Profile Position mode) | Operating mode for executing a position set or a direct positioning task with position control (closed loop position control)                                                                                                                                   |

| Term / abbreviation     | Significance                                                                                                                                                                                                                                                                                                                                                                                                |
|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Positioning record      | Positioning command defined in the position set table, consisting of target position, positioning mode, positioning speed and accelerations.                                                                                                                                                                                                                                                                |
| Project zero point (PZ) | Reference point for all positions in positioning tasks. The project zero point PZ forms the basis for all absolute position specifications (e.g. in the position set table or with direct control via the controller or diagnostic interface). The project zero point PZ is defined by a preset distance (offset) from the axis zero point.                                                                 |
| Reference point (REF)   | Point of reference for the incremental measuring system. The reference point defines a known orientation or position within the positioning path of the drive.                                                                                                                                                                                                                                              |
| Reference switch        | External sensor used for ascertaining the reference position and connected directly to the controller.                                                                                                                                                                                                                                                                                                      |
| SLTE...                 | Type designation, electric slide.                                                                                                                                                                                                                                                                                                                                                                           |
| Software end position   | <p>Programmable stroke limitation (basis point = axis zero point)</p> <ul style="list-style-type: none"> <li>– Software end position, positive:<br/>max. limit position of the stroke in positive direction; must not be exceeded during positioning.</li> <li>– Software end position, negative:<br/>min. limit position in negative direction; must not be fallen short of during positioning.</li> </ul> |
| Teach mode              | Operating mode for setting positions by moving to the target position, e.g. when creating position sets.                                                                                                                                                                                                                                                                                                    |

Tab. 0/3: Index of terms and abbreviations for the SFC-DC

## PROFIBUS specific terms and abbreviations

| Term / abbreviation        | Significance                                                                                                                                                                                                                                               |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0x1234 or 1234h            | Hexadecimal numbers are marked by a prefixed “0x” or by a suffixed “h”.                                                                                                                                                                                    |
| AK                         | See under response identifier or task identifier                                                                                                                                                                                                           |
| BCD                        | Binary coded decimal                                                                                                                                                                                                                                       |
| Bus segment                | Bus cable between two terminating resistors. A bus segment contains a maximum of 32 slaves. A PROFIBUS system consists of at least one bus segment with at least 2 stations. Further bus segments can be connected with the aid of repeaters.              |
| Consistency                | A data range, which is defined as consistent, is transmitted complete, i.e. in a bus cycle.                                                                                                                                                                |
| GSD file                   | Device master file in which all specific features of the slave are saved (e.g. number of I/Os, number of diagnostic bytes etc.).                                                                                                                           |
| Job identifier (AK)        | Integral part of the parameter channel in task telegrams specifying the type of task of a parameter processing.                                                                                                                                            |
| LSB                        | Least significant bit (lower-value bit)                                                                                                                                                                                                                    |
| MSB                        | Most significant bit (higher-value bit)                                                                                                                                                                                                                    |
| Octet                      | Byte (8 bits); basis type for PROFIBUS telegrams                                                                                                                                                                                                           |
| Parameter channel (PKW)    | Telegram part used for transmitting parameters (PKW = parameter identifier value). See also “Festo Parameter Channel (FPC)” under “Product-specific abbreviations” (Tab. 0/3).                                                                             |
| Parameter identifier (PKE) | Integral part of the parameter channel (PKW) which contains the task and reply identifiers (AK) and the parameter number (PNU).                                                                                                                            |
| Parameter number (PNU)     | Parameters which can be transmitted via the parameter channel are addressed with the parameter number (PNU). The parameter number is an integral part of the parameter identifier (PKE) and serves for identifying or addressing the individual parameter. |
| PKE                        | See under parameter identifier                                                                                                                                                                                                                             |
| PKW                        | See under parameter channel                                                                                                                                                                                                                                |
| PNU                        | See under parameter number                                                                                                                                                                                                                                 |

| Term / abbreviation      | Significance                                                                                                                         |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| PROFIBUS                 | PROcess FieldBUS; German processing and Fieldbus standard defined in IEC 61158 type 3.                                               |
| PROFIBUS address         | Provides unique identification of a bus slave on the PROFIBUS                                                                        |
| Repeater                 | Device for amplifying bus signals and for coupling segments over long distances.                                                     |
| Reply telegram           | Telegram sent from the slave to the master (slave reply)                                                                             |
| Response identifier (AK) | Integral part of the parameter channel in reply telegrams specifying the type of reply of a parameter processing.                    |
| Subindex (IND)           | Integral part of the parameter channel (PKW) which addresses an element of an array parameter (sub-parameter number).                |
| Task telegram            | Telegram sent from the master to the slave (task of master)                                                                          |
| Terminating resistor     | Resistor for minimising signal reflections. Terminating resistors must be installed or switched in at the end of bus segment cables. |
| User data                | Telegram data without protocol frame data. The length of the user data is defined in the configuration of the Fieldbus slave.        |

Tab. 0/4: Index of terms and abbreviations for PROFIBUS

# **System summary**

## **Chapter 1**

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1.1      Positioning with electric drives ..... 1-3

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### 1.1 Positioning with electric drives

The motor controller type SFC-DC-...-PB with PROFIBUS fieldbus interface enables positioning of the connected electric drive in accordance with the Festo Handling and Positioning Profile:

- Via record selection:  
in max. 31 position sets (+ homing) with separately adjustable speeds, accelerations and decelerations.
- Via Direct mode:  
The positioning task is transmitted directly in the I/O telegram via the Fieldbus with the appropriate setpoint values.

The permitted positioning range can be limited by means of software end positions.

You can parametrise and commission the SFC-DC as follows:

- Directly via the control panel (only type SFC-DC-...H2-...).
- Via the RS232 interface (with FCT software).
- Via fieldbus (see chapter 5.4 ff).

Coupling to a higher-order PLC/IPC in operation takes place via the PROFIBUS Fieldbus.

### Control panel (only type SFC-DC-...-H2-...)

The control panel offers all functions necessary for commissioning, parametrisation, diagnostics and operation directly at the SFC-DC-...

The control panel provides the necessary input masks via menus for editing positioning records and parameters. If your positioning system is set up completely, you can use the Teach functions to move easily to positions and transfer them to the position record table.

You will find information on the control panel's operating elements and menu structure in Chapter 4, and instructions for commissioning using the control panel starting at chapter 5.2.



### Festo Configuration Tool (FCT)

The Festo Configuration Tool (abbreviated as FCT) is the software platform for configuring and commissioning different components and devices from Festo.

The FCT consists of the following components:

- A framework providing a program starting and entry point with uniform project and data management for all supported device types.
- A PlugIn for each of the special demands of a device type (e.g. SFC-DC) with the necessary descriptions and dialogues. The PlugIns are managed and started from within the framework.

PlugIn SFC-DC for the FCT supports all the steps necessary for commissioning an SFC-DC.

An overview of commissioning with the FCT can be found in chapter 5.3.2.

The help for the FCT contains the complete information on operating the Festo Configuration Tool. The device-specific PlugIns each have their own help files.



## 1. System summary

| Functions             |                                                                                                                                                                   | Control panel | FCT | Fieldbus |
|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-----|----------|
| Parametrisation       | – Selecting the axis type and the associated axis parameters                                                                                                      | x             | x   | x        |
|                       | – Uploading/downloading of configuration data                                                                                                                     | –             | x   | x        |
|                       | – Saving different configurations in projects                                                                                                                     | –             | x   | –        |
| Commissioning         | – Homing                                                                                                                                                          | x             | x   | x        |
|                       | – Jog mode                                                                                                                                                        | (x)           | x   | x        |
|                       | – Teaching of positions                                                                                                                                           | x             | x   | x        |
|                       | – Travel in individual steps                                                                                                                                      | –             | x   | x        |
|                       | – Starting and stopping positioning procedures during commissioning                                                                                               | x             | x   | x        |
|                       | – Extended test functions e.g status displays                                                                                                                     | (x)           | x   | x        |
|                       | – Testing or demonstrating the positioning records                                                                                                                | x             | x   | x        |
| Record selection      | – Creation of a positioning record table for positioning operation with record number, target position, positioning mode, positioning speed, acceleration, delay. | x             | x   | x        |
|                       | – Executing a positioning record                                                                                                                                  | x             | x   | x        |
| Direct mode           | – Parametrising the direct job for positioning and force mode                                                                                                     | –             | x   | x        |
|                       | – Executing a direct job                                                                                                                                          | –             | x   | x        |
| Diagnostics / Service | – Reading and displaying diagnostic data                                                                                                                          | x             | x   | x        |
|                       | – Read and display fault buffer                                                                                                                                   | –             | x   | x        |

Tab. 1/1: Commissioning options – Functions

## 1. System summary

All values are entered or displayed according to the measuring units set for either the Festo Configuration Tool or the control panel.

| Units of measurement                                               |                      |                                                                       | Access via:   |     |          |
|--------------------------------------------------------------------|----------------------|-----------------------------------------------------------------------|---------------|-----|----------|
|                                                                    |                      |                                                                       | Control panel | FCT | Fieldbus |
| Electric mini slide, gripper                                       | Metric               | Metric units of measurement, e.g. mm, mm/s, mm/s <sup>2</sup>         | x             | x   | –        |
|                                                                    | Inches <sup>1)</sup> | Imperial units of measurement, e.g. inch, inch/s, inch/s <sup>2</sup> | –             | x   | –        |
|                                                                    | Increments           | Increment-based units, e.g. inc, inc/s, inc/s <sup>2</sup>            | –             | –   | x        |
| Rotary module                                                      | ° (degrees)          | Units of measurement in degrees, e.g. °, °/s, °/s <sup>2</sup>        | x             | x   | –        |
|                                                                    | Increments           | Increment-based units, e.g. inc, inc/s, inc/s <sup>2</sup>            | –             | –   | x        |
| 1) Only with FCT; must be established when setting up the project. |                      |                                                                       |               |     |          |



The setting of the units of measurement influences only the display in the Festo Configuration Tool. All parameters are saved in the SFC-DC in increments (inc, inc/s, inc/s<sup>2</sup>...) and are not converted until they are written or read.

Measurements transmitted directly via fieldbus or RS232 refer to an increment basis (conversion see appendix A.3).

## 1. System summary

### 1.2 Components

- 1 Higher-order controller / PROFIBUS master
- 2 Software level: Festo Configuration Tool
- 3 Controller level: SFC-DC
- 4 Motor drive level (e.g. SLTE)

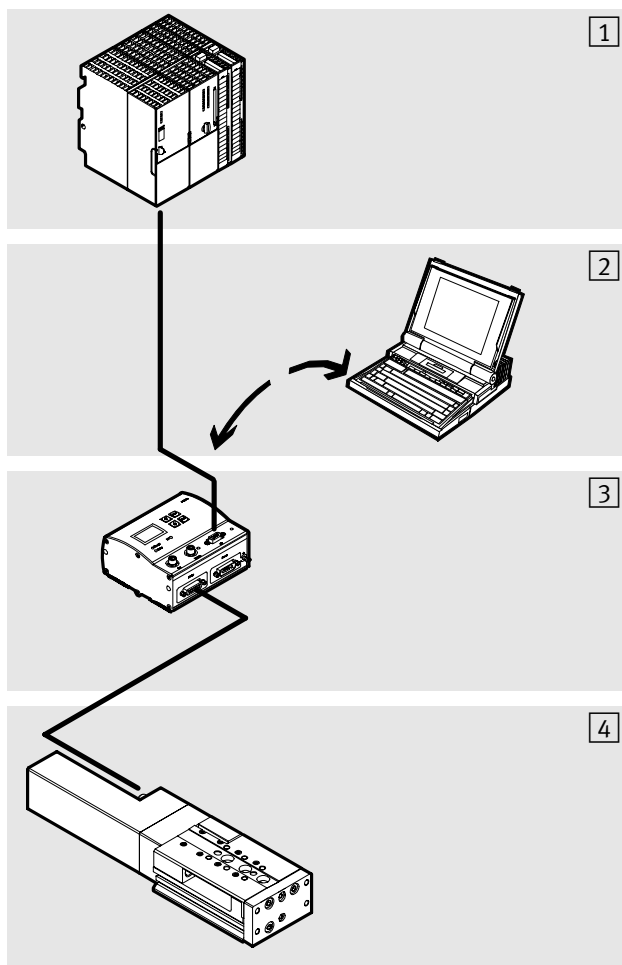


Fig. 1/1: Principle of an electric positioning system with the SFC-DC....-PB

## 1. System summary

In order to set up an electric axis with the SFC-DC you will require the following components:

Controller

SFC-DC, optionally with control panel.

Drive

Electric drive with motor, accessories and, if necessary, further components for the drive, e.g. mounting attachments, etc.

The SFC-DC supports the following drives  
(see also “Version information”, Tab. 0/2).:

| Supported drives | Description                                       | Permissible mounting position |
|------------------|---------------------------------------------------|-------------------------------|
| SLTE-...         | Electric mini-slide type SLTE-...                 | Any                           |
| HGPLE-...        | Electric gripper.                                 | Any                           |
| GEH6..., DEF...  | Electric gripper and rotary modules of Sommer Co. | Any                           |
| Other            | only after consultation with Festo.               |                               |

Power supply unit

For logic and load voltage supply: 24 VDC

Power supply line

For supplying the SFC-DC with operating and load voltage  
(see accessories, Appendix A.2)

Motor cable

For connecting the drive to the SFC-DC  
(see Accessories, Appendix A.2)

Fieldbus plug with fieldbus cable

For information transfer between the higher-order controller and the SFC-DC (see accessories, Appendix A.2)

Programming cable

For transfer of information between the PC and the SFC-DC-... (see Accessories, Appendix A.2)

Reference switch

Optional: Suitable sensor (normally open) as reference switch, e.g. type SMT-10.



For positioning systems, Festo offers accessories suited to the drive packages (see Festo delivery program or catalogue).

### 1.3 Control and regulating functions

In the positioning mode, a certain position is specified to which the motor must move. The current position is obtained from the information supplied by the internal increment sensor (magnetic encoder). The position is derived from the gear reduction and the shaft pitch.

The deviation of the position is processed in the position controller and passed on to the speed regulator.

- 1 Controller SFC-DC
- 2 controller
- 3 Nominal value generator
- 4 Position controller
- 5 Speed regulator
- 6 Current Control
- 7 Output stage
- 8 Signal converter

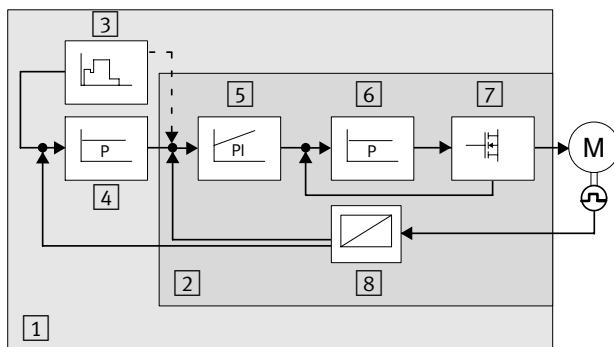


Fig. 1/2: Simplified technical representation of the cascade regulator function

The controller takes over the following tasks:

- Control via FHPP.
- Specification of the nominal values.
- Control of the following variables: position, speed, acceleration, current (power).

## 1. System summary

### Profile Position Mode

#### Positioning mode

Operating mode for executing a position set or a direct positioning task with position control (closed loop position control)

The target position defines the position to which the drive controller is to move. The target position is interpreted either as an absolute or relative specification. The set target position is transferred to the nominal value generator. This generates a nominal position value for the position controller. For position control, the current settings for speed, acceleration, braking deceleration, etc. are taken into account.

### Profile Torque Mode

#### Force control

Force control (open loop transmission control) with motor current regulation. This operating mode enables an external nominal torque value (relative to the rated motor current) to be specified to the controller. Power control takes place indirectly via the regulation of the motor current. All specifications on forces/torques refer to the rated motor torque or current.

### Homing mode

Positioning travel for referencing the mechanical basis system.



For commissioning, testing or demonstration, the following functions are also available via the control panel of the SFC-DC-...H2-...:

- Positioning travel for defining the target position of a position set (Teach mode).
- Positioning travel for testing all position sets in the position set table (Demo posit. tab.).
- Positioning travel for testing a certain positioning set in the positioning set table (Move posit. set).

### 1.4 Operational safety

A complex system of sensors and monitoring functions ensures operational reliability:

- Temperature monitoring (measurement of the power end stage temperature),
- Voltage monitoring, detection of:
  - Faults in the logic voltage supply,
  - Undervoltages in the load voltage supply,
- $I^2t$  monitoring / overload protection
- Drag fault monitoring,
- Software end position recognition.



#### **Note**

Check within the framework of your emergency stop concept to ascertain which measures are required to put your machine/system into a safe status in the event of EMERGENCY-STOP (e.g. switching off the operating voltage).

The SFC-DC has a separate logic voltage supply.

- Use additional separate safety limit switches if an EMERGENCY STOP circuit is required for your application (e.g. as normally closed contact in series connection).
- Use software end positions and, if necessary, external safety limit switches as well as additional appropriate mechanical stops in order to make sure that the axis always lies within the permitted positioning range.

## 1. System summary

### 1.5 Structure of the SFC-DC

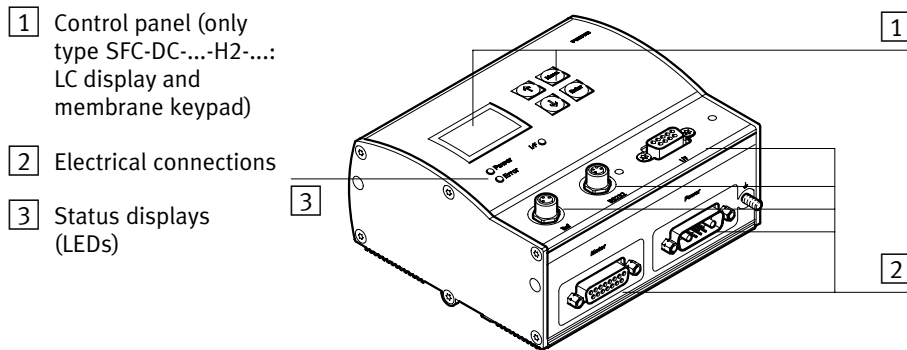


Fig. 1/3: Single field controller SFC-DC

#### Control panel

The control panel possesses an LCD graphics display (128 x 64 dots). It is operated using a touch-sensitive keypad with 4 keys, allowing access to all functions by means of menus.



Remove the protective foil from the display before commissioning.

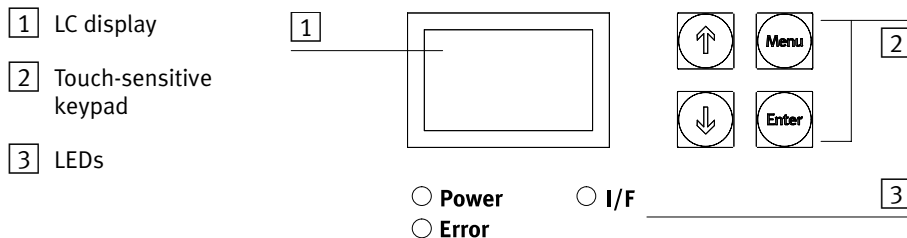


Fig. 1/4: Control panel and status display on the SFC-DC-...-H2-...

## 1. System summary

### Status indicators

The operating statuses are visually indicated by 3 LEDs:

- Operating voltage (“Power”)
- Positioning status / bus status “I/F”  
(= interface / fieldbus)
- “Error”

### Connections

The SFC-DC has the following connections:

- 1 Reference switch
- 2 RS232 interface to PC
- 3 PROFIBUS interface
- 4 Drive  
(Motor connection)
- 5 Power supply

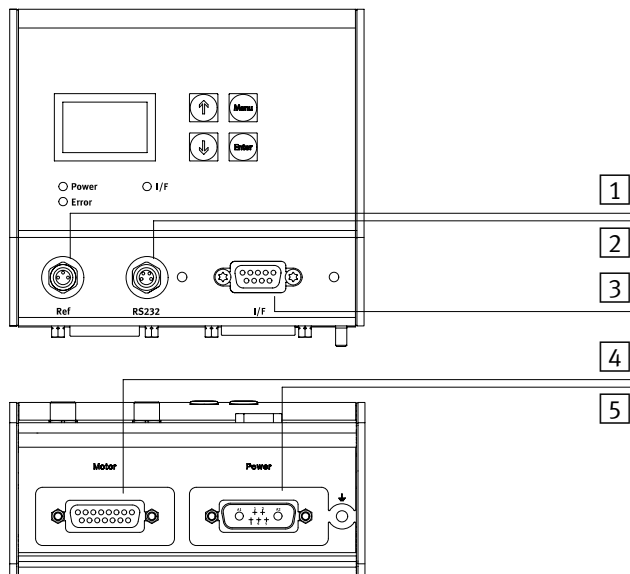


Fig. 1/5: Connections of the SFC-DC

### 1.6 Dimension reference system

The measuring reference system defines all reference points and limits the working area.

The measuring reference system of the SFC-DC is based on the axis zero point which is defined via the offset to the reference point. The position of the reference point is ascertained during the reference run. The referencing method defines the way in which the axis ascertains the reference point.

#### 1.6.1 Basis points and work range

|                        |                                                                                                                                                                                                                                                                                                                                               |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Reference point REF    | forms the mechanical basis point of the axis coordinate system and is defined during homing travel by a reference switch or a fixed stop, depending on the homing method. It is the basis point of the axis zero point.                                                                                                                       |
| Axis zero point AZ     | Is offset by a defined distance from the reference point (offset axis zero point) and is the point of reference of the software end positions and of the project zero point.                                                                                                                                                                  |
| Project zero PZ        | is a reference point freely selectable by the user to which the actual position and the target positions from the positioning set table relate. The basis point for the project zero point is the axis zero point.                                                                                                                            |
| Software end positions | The permitted positioning range (effective stroke) is limited by the settings of the software end positions. The software end positions refer to the axis zero point. If the target position of a positioning command lies outside the software end positions, the positioning command will not be processed and an error status will be set. |

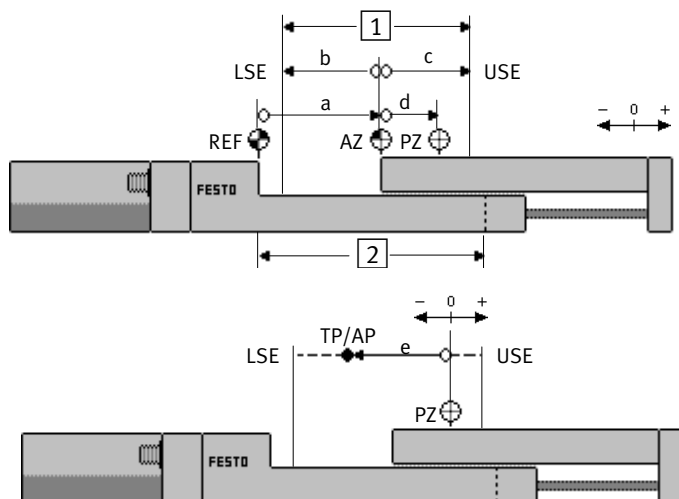


All values are entered or displayed according to the measuring system set either for the Festo Configuration Tool or the control panel (see appendix A.3)

## 1. System summary

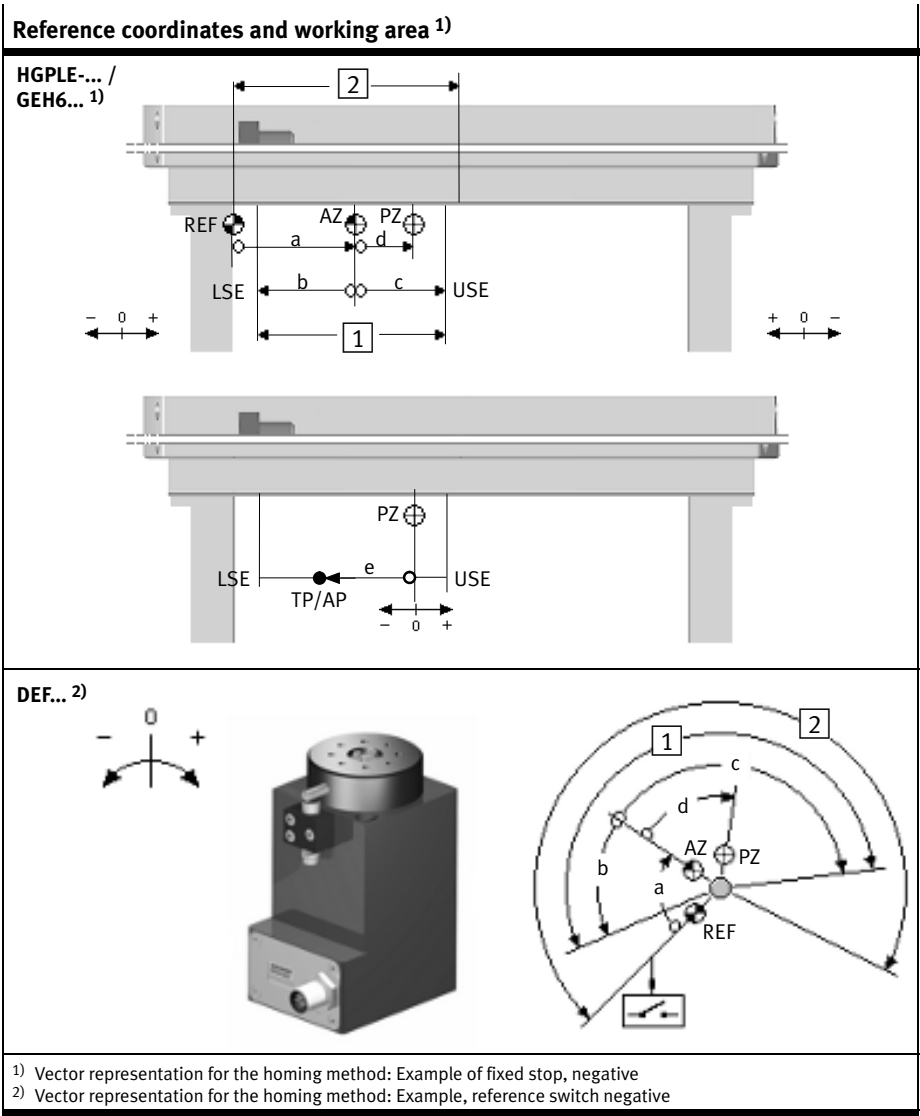
### Reference coordinates and working area <sup>1)</sup>

SLTE...



|                                                                                            |                                                                                                                                                                                                                                                                     |
|--------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| REF                                                                                        | Reference point: The measuring reference point to which movement is made during reference travel and to which the axis zero point refers.                                                                                                                           |
| AZ                                                                                         | Axis zero point: Dimension reference point for the project zero point and the software end positions. The basis point for the axis zero point is the reference point.                                                                                               |
| PZ                                                                                         | Project zero point: Dimension reference point for all absolute position specifications (e.g. in the position set table or with direct control via the controller or diagnostic interface). The basis point for the project zero point is the axis zero point.       |
| USE                                                                                        | Upper software end position                                                                                                                                                                                                                                         |
| LSE                                                                                        | Lower software end position                                                                                                                                                                                                                                         |
| TP/AP                                                                                      | Target/actual position                                                                                                                                                                                                                                              |
| a                                                                                          | Offset axis zero point: Defined distance of the axis zero point from the reference point.                                                                                                                                                                           |
| b, c                                                                                       | Software end positions: Limits for the permitted positioning range (effective stroke). If the target position of a positioning command lies outside the software end positions, the positioning command will not be processed and a fault status will be displayed. |
| d                                                                                          | Offset project zero point: Defined distance of the project zero point from the axis zero point.                                                                                                                                                                     |
| e                                                                                          | Offset of the (current) position to the project zero point                                                                                                                                                                                                          |
| 1                                                                                          | Effective stroke: permitted positioning range. The work range of the axis is thereby defined.                                                                                                                                                                       |
| 2                                                                                          | Nominal stroke: Nominal stroke of the drive in use; see technical data for the drive (for the SLTE the stroke specified in the order).                                                                                                                              |
| <sup>1)</sup> Vector representation for the homing method: Example of fixed stop, negative |                                                                                                                                                                                                                                                                     |

1. System summary



Tab. 1/2: Dimension reference system

## 1. System summary

| Reference point             | Calculation rule                                 |
|-----------------------------|--------------------------------------------------|
| Axis zero point             | $AZ = REF + a$                                   |
| Project zero point          | $PZ = AZ + d = REF + a + d$                      |
| Lower software end position | $LSE = AZ + b = REF + a + b$                     |
| Upper software end position | $USE = AZ + c = REF + a + c$                     |
| Target/actual position      | $TP, AP = PZ + e = AZ + d + e = REF + a + d + e$ |

Tab. 1/3: Calculating specifications for the dimension reference system

### 1.6.2 Signs and directions

All offsets and position values are (signed) vectors and must be adjusted to match the position of the respective reference point.



The direction in which the work load moves depends on the gearbox, the spindle type (left/right-hand turning), the sign for the position specifications (+/-) and the setting of the “Direction reversal” parameter.

The +/- active direction of the vectors can be assigned to the direction of rotation of the motor shaft (view on the motor shaft). The factory setting is “+” for motor rotation in a clockwise direction; “-” for motor rotation in an anti-clockwise direction.

| Value <sup>1)</sup>                                                                                                                                                     | SLTE-...                                                                        | HGPLE-... / GEH6...                                                                        | DEF...                                           |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|--------------------------------------------------|
| +                                                                                                                                                                       | Positive values face from the basis point in the direction away from the motor. | Positive values face from the reference point in the direction of the closed gripper jaws. | Clockwise, looking towards the motor shaft.      |
| —                                                                                                                                                                       | Negative values face from the basis point in the direction towards the motor.   | Negative values face from the reference point in the direction of the open gripper jaws.   | Anti-clockwise, looking towards the motor shaft. |
| <sup>1)</sup> With factory setting. The assignment can be reversed (see also appendix B.2.15, PNU 1000, Object 607E). After reversal a new homing run is then required. |                                                                                 |                                                                                            |                                                  |

## 1. System summary

### 1.6.3 Homing

In the case of drives with an incremental measuring system, homing must always be carried out when the device is switched on positions. This is defined drive-specifically with the parameter “Homing required” (PNU 1014, CI 23F6h).

The following homing methods are permitted:

- Search for stop in a negative direction
- Search for stop in a positive direction
- Search for reference switch in a positive direction
- Search for reference switch in a negative direction

In order to search for the reference point and for positioning the drive in the axis zero point, you can set two different speeds.

Homing sequence:

1. Search for the reference point in accordance with the configured method at speed  $v_{rp}$
2. Move from reference point to axis zero point AZ (offset axis zero point) at speed  $v_{zp}$
3. Set at axis zero point current position =  
0 – offset project zero point PZ



After successful homing the drive stands at the axis zero point AZ. On initial commissioning or following a change of homing method the axis zero offset is = 0; after homing the drive is then positioned at the reference point (REF).

#### Search for stop

With this method the drive moves at first at search speed in a negative or positive direction until it reaches the fixed stop. A rise in the motor current signals that the stop has been reached.

1. System summary



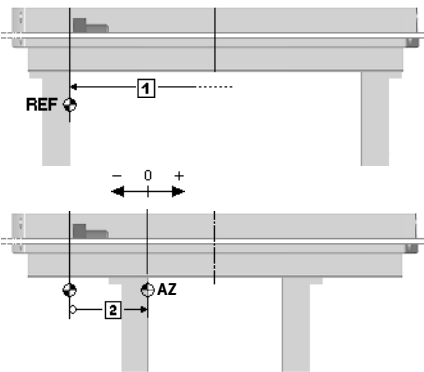
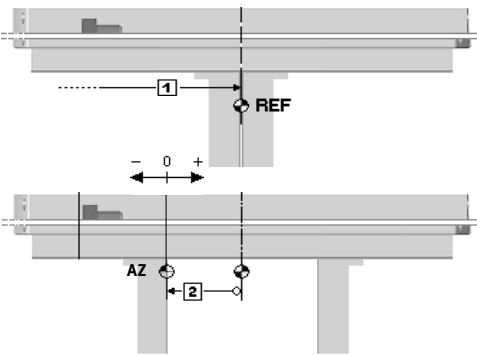
When the maximum motor current is reached at the same time as the motor is at a standstill, the SFC-DC recognises that the stop, and therefore the reference position, has been reached.

As the axis must not stand still at the stop, the offset axis zero point must be  $\neq 0$  (min. 0.25 mm).

| “Fixed stop” homing method                                                                                                                                                                                         |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| – Negative fixed stop                                                                                                                                                                                              |  |
|                                                                                                                                                                                                                    |  |
| – Positive fixed stop                                                                                                                                                                                              |  |
|                                                                                                                                                                                                                    |  |
| <div><div>1</div> Slide moves at search speed <math>v_{rp}</math> to the mechanical fixed stop.</div> <div><div>2</div> Slide moves at speed <math>v_{zp}</math> from reference point to axis zero point AZ.</div> |  |

Tab. 1/4:     Referencing to fixed stop (mini slide)

## 1. System summary

| <b>“Fixed stop” homing method</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| – Negative mechanical stop (= gripper jaws open)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|  <p>The diagram illustrates the homing process for a gripper with a negative mechanical stop. It consists of two cross-sectional views of the gripper assembly. The top view shows the gripper moving to the left, indicated by a dashed line and an arrow labeled '1'. A reference point 'REF' is marked on the left. Below this, a coordinate system shows '0' at the center, with '-' to the left and '+' to the right. The bottom view shows the gripper at its leftmost position, where the jaws are open. A point 'AZ' is marked on the right side of the gripper body, and an arrow labeled '2' points from the 'REF' position to 'AZ'.</p>      |
| – Positive mechanical stop (= gripper jaws closed)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|  <p>The diagram illustrates the homing process for a gripper with a positive mechanical stop. It consists of two cross-sectional views of the gripper assembly. The top view shows the gripper moving to the right, indicated by a dashed line and an arrow labeled '1'. A reference point 'REF' is marked on the right. Below this, a coordinate system shows '0' at the center, with '-' to the left and '+' to the right. The bottom view shows the gripper at its rightmost position, where the jaws are closed. A point 'AZ' is marked on the left side of the gripper body, and an arrow labeled '2' points from the 'REF' position to 'AZ'.</p> |
| <p>1 Gripper moves at search speed <math>v_{rp}</math> to the mechanical fixed stop.</p> <p>2 Gripper moves at speed <math>v_{zp}</math> from reference point to axis zero point AZ.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

Tab. 1/5: Referencing to fixed stop (gripper)

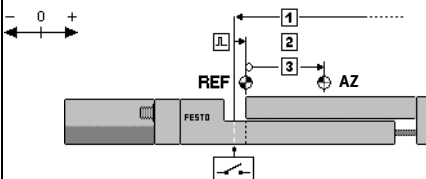
## 1. System summary

Search for reference switch

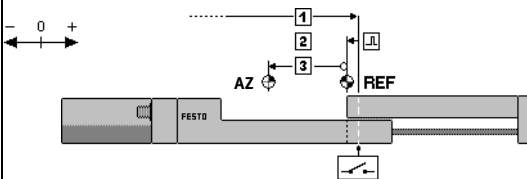
With this method the drive moves at first at search speed in a negative or positive direction until it reaches the limit switch. It then moves back at creep speed: The reference position lies at the point at which the reference switch becomes inactive again when the drive moves back.

### “Reference switch” referencing method

– Reference switch, negative (near motor)



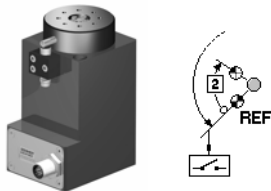
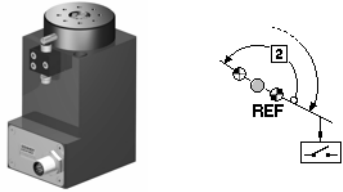
– Reference switch, positive (remote from motor)



- 1 Slide moves at search speed  $v_{rp}$  to the reference switch and reverses.
- 2 After leaving the switching range of the reference switch, the slide moves to the next index signal of the encoder for determining the reference point.
- 3 The slide then moves at speed  $v_{zp}$  from the reference point to the axis zero point.

Tab. 1/6: Referencing to reference switch (mini slide)

## 1. System summary

| <b>“Reference switch” referencing method</b>                                                                                                                                                                                       |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| – Reference switch, negative (anti-clockwise)                                                                                                                                                                                      |  |
|                                                                                                                                                   |  |
| – Reference switch, positive (clockwise)                                                                                                                                                                                           |  |
|                                                                                                                                                   |  |
| <div><div>1</div> Rotary module moves at search speed <math>v_{rp}</math> to the reference switch and reverses.</div> <div>2</div> The rotary module then moves at speed $v_{zp}$ from the reference point to the axis zero point. |  |

Tab. 1/7: Referencing to reference switch (rotary module)

### 1.7 Fieldbus communication

#### 1.7.1 PROFIBUS data exchange

##### DPV0

###### Control

Control with DPV0 takes place via the 8 cyclic control and status bytes, see chapter 5.5.2.

###### Parametrisation

Parametrizing with DPV0 takes place via the Festo parameter channel (FPC, further 8 I/O bytes), see appendix B.1.1.

##### DPV1

###### Parametrisation

Parameterising with DPV1 takes place via the parameter channel as per PROFIdrive V3.1. This protocol is a compatible extension of the PKW protocol within the DPV1 work data. This means that the parameters can be addressed with PNU, subindex etc.



The method of functioning of the parameterising with DPV1 depends on the DP master system used.

Please refer here to the documentation of your controller manufacturer.

As an example of parameterising with DPV1, you will find a functional description in the documentation for the S7 modules for the SFC-DC, type P.BE-SFC-DC-S7-...

## 1. System summary

### 1.7.2 Festo Handling and Positioning Profile (FHPP)

Festo has developed an optimised data profile, the “Festo Handling and Positioning Profile (FHPP)” tailored to handling and positioning tasks. The FHPP enables uniform sequence control and programming for the various fieldbus systems and controllers from Festo. Parameter values, control and status bytes required during operation can be written and read via the object directory and a structure description.

Communication over the Fieldbus can occur cyclically (DPV0) or acyclically (DPV1). Mixed operation is typical:

- Commissioning and application parameters can be transferred via DPV1.
- Time-critical process control occurs via **FHPP Standard** (DPV0, 8 Byte I/O).
- Parameter access during normal operation occurs via DPV1 or optionally via **FHPP-FPC** (DPV0, further 8 Byte I/O).

#### FHPP Standard

The operating modes differ in the content and the meaning of the cyclic I/O data and in the functions which can be accessed in the SFC-DC.

#### **Direct mode**

Positioning tasks in positioning or force mode can be executed as direct tasks. The task is transferred directly in the cyclic I/O data (FHPP standard). This defines the most important setpoint values (position, velocity, force/torque...).

## 1. System summary

### Record selection

Record selection allows jobs to be executed in positioning mode. The positioning data (target position, speed...) are set indirectly via positioning records which are taught via FCT, the control panel or fieldbus and saved in the controller. 31 positioning records can be saved in the SFC-DC. A record contains all the parameters specified for a positioning task (positioning mode). The record number is transferred to the cyclic I/O data as the nominal or actual value (FHPP standard).

#### FHPP-FPC

Optionally, an additional 8 Bytes of I/O can be used for parameter access via FPC (Festo Parameter Channel ). The additional bytes are defined via the configuration program with the GSD file, see chapter 5.4.

If the FPC is not needed in normal operation, the data length can be reduced to 8 bytes in order to optimise the PLC access in cyclic data transfers. Parameter changes via the acyclic data channel can still be performed using DPV1.



Detailed information on the FHPP can be found starting at chapter 5.5.

1. System summary

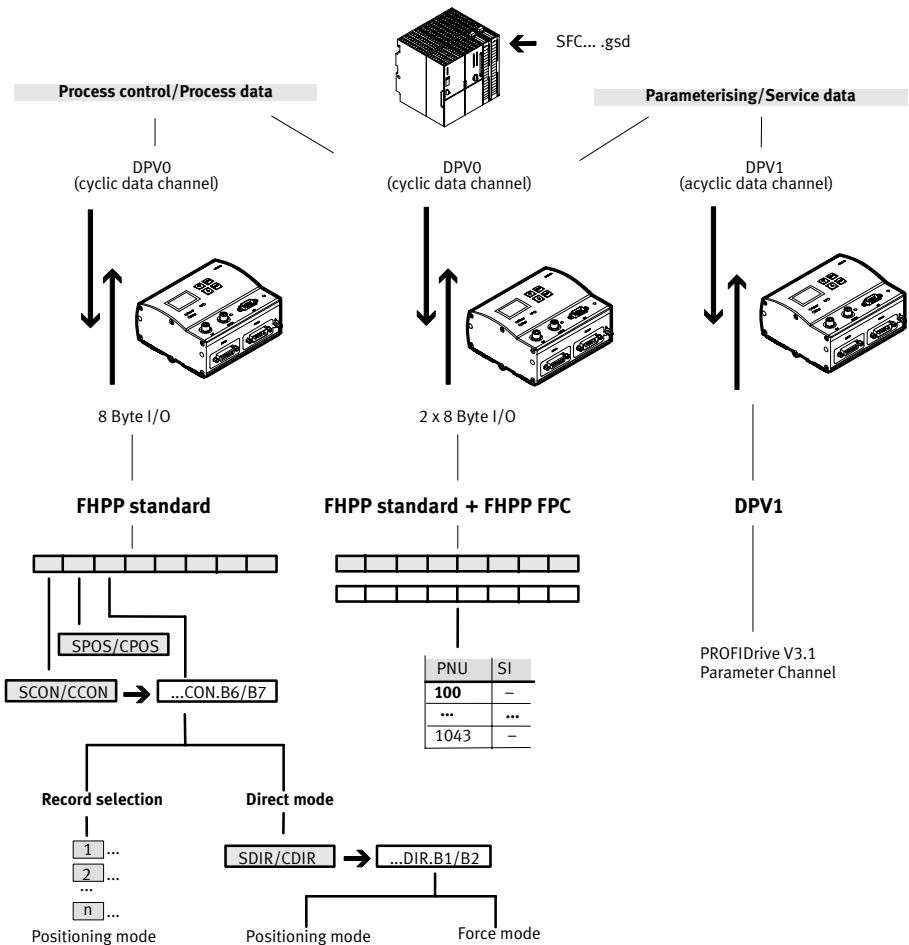


Fig. 1/6: Festo Handling and Positioning Profile (FHPP)

# Fitting

## Chapter 2

Contents

2.1 General Information ..... 2-3

2.2 Dimensions of the controller ..... 2-3

2.3 Mounting the controller ..... 2-4

2.4 Notes on mounting electrical axes ..... 2-6

## 2. Fitting

### 2.1 General Information



#### Caution

Damage to components

- Before carrying out mounting, installation and/or maintenance work, always switch off the power supply.



#### Note

Handle all modules and components with great care.

Note especially the following:

- Screw connections must be fitted without distortion and mechanical tension. Screws must be fitted exactly (otherwise threads will be damaged).
- Compliance with the specified torques.
- The modules must not be offset.
- Contact surfaces must be clean (avoid contact errors).

### 2.2 Dimensions of the controller

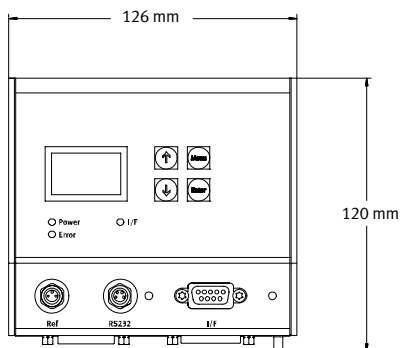


Fig. 2/1: Dimensions of the controller

### 2.3 Mounting the controller

You can mount the SFC-DC in one of two ways:

- Wall mounting on a flat surface.
- H-rail mounting.



#### Note

Mount the SFC-DC or the H-rail so that there is sufficient space for heat dissipation (above and below at least 40 mm).

#### Wall mounting

You will need:

- A mounting surface of approximately 120 x 160 mm.
- 2 sets of central supports, type MUP-18/25 (accessories). The 4 brackets are clipped into the edge of the housing (see Fig. 2/2).
- 4 tapped holes for screw size M3 (for dimensions see Fig. 2/2) with matching screws.

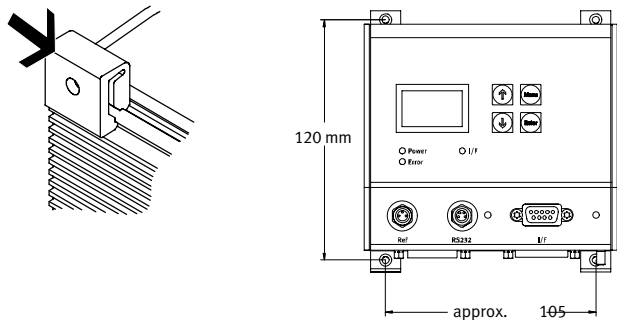


Fig. 2/2: Mounting with fixed screws

## 2. Fitting

### H-rail mounting

When mounting onto an H-rail, proceed as follows:

1. Make sure the mounting area is able to take the weight of the SFC-DC.
2. Mount an H-rail  
(DIN mounting rail EN 60715 - 35x7.5 or 35x15).

With 35 x 7.5 H-rail only: Maintain a max. distance of 3.3 mm between the housing web and the H-rail:

- If possible, use a part of the H-rail where there are no mounting screws.
  - If you need to insert a screw underneath the SFC-DC: use e.g. an M6 screw as per ISO-7380ULF.
3. Hang the SFC-DC on the H-rail as follows:
    - first from below, pressing against the clamping element, then
    - swing upwards against the H-rail.

When you let go, the clamping element presses the SFC-DC into the groove at the top.

- 1 H-rail
- 2 Dovetail clamp
- 3 Distance between housing web and H-rail: 3.3 mm

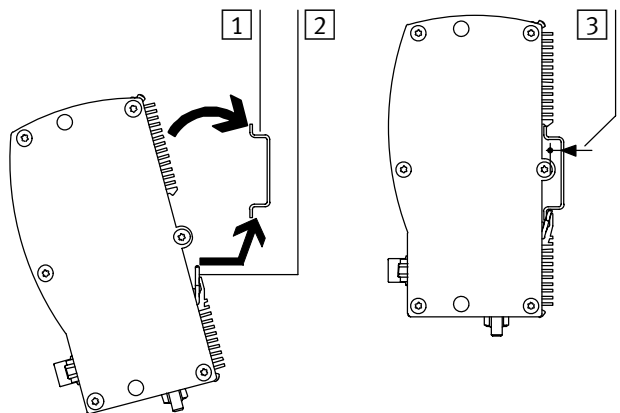


Fig. 2/3: Mounting the SFC-DC onto an H-rail

### 2.4 Notes on mounting electrical axes



Refer to the following documentation when mounting the electric axis:

- Operating instructions for the electric drive used.
- Instructions for the components used.



#### **Warning**

If a drive is mounted in a sloping or vertical position, loads may fall down and cause injury to persons.

- Check whether additional external safety measures are necessary (e.g. toothed latches or moveable bolts)

This prevents the work load sliding down suddenly if there is a power failure.

Make sure that:

- the drive is fitted securely and is correctly aligned,
- the working space in which the drive and effective load will move is of sufficient size for operation with a useful load,
- the useful load does not collide with any axis component when the slide moves to its end position.

# Installation

## Chapter 3

Contents

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3.3 Earthing ..... 3-9

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## 3. Installation

### 3.1 Installation overview



#### **Warning**

Before carrying out mounting, installation and/or maintenance work, always switch off the power supply.

In this way, you can avoid:

- uncontrolled movements of the connected actuators,
- non-defined switching states of the electronic components.



#### **Caution**

Faulty pre-assembled lines may destroy the electronics and trigger unexpected movements of the motor.

- Use only lines specified as accessories for the installation of the system (see Tab. 3/2). Only in this way can you be sure that the system will work properly.



#### **Note**

- Lay all flexible lines so that they are free of kinks and free of mechanical stress; if necessary use an energy chain.
- Keep to the maximum specified cable lengths.

3. Installation

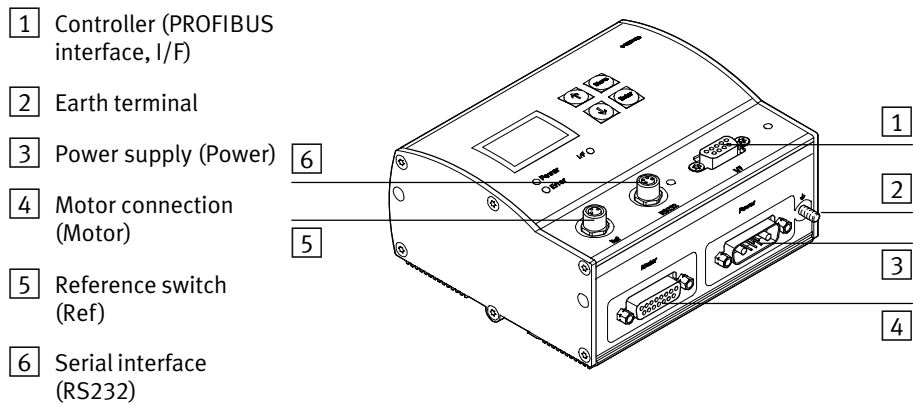


Fig. 3/1: Connections of the SFC-DC

| Connections on the SFC-DC |                                                          | Description                                                                                                                 |
|---------------------------|----------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| Controller/Fiel<br>dbus   | With type<br>SFC-DC-...-PB:<br>– Sub-D 9-pin<br>– Socket | Interface for connection to<br>PROFIBUS                                                                                     |
| Earth terminal            | – Stud bolt, M4                                          | Functional earthing<br>connection (optionally via<br>power supply cable)                                                    |
| Power supply              | – D-Sub 7W2<br>– Plug                                    | Power connection with<br>2 high-current contacts<br>and 5 low-current contacts<br>(separate load and logic<br>power supply) |
| Motor<br>connection       | – Sub-D 15-pin<br>– Socket                               | Motor activation with<br>encoder signals                                                                                    |
| Reference<br>switch       | – M8, 3-pin<br>– Socket                                  | Sensor input for reference<br>switch                                                                                        |
| Serial<br>interface       | – M8, 4-pin<br>– Socket                                  | RS232 interface for<br>parametrising,<br>commissioning and<br>diagnosing                                                    |

Tab. 3/1: Overview of connections

### 3. Installation



If unoccupied connectors are touched, there is a risk that ESD (electrostatic discharge) may cause damage to the SFC-DC or other system components. Place protective caps on unused terminal connections in order to prevent such discharges.



The plug connectors on the Festo cables listed in the following are designed to conform to protection class IP54 when connectors are plugged in and secured, or when the connections on the SFC-DC are fitted with caps.

| Connection         | Cable/plug                                             | Type                   | Length [m]   |
|--------------------|--------------------------------------------------------|------------------------|--------------|
| Power supply       | Power supply cable                                     | KPWR-MC-1-SUB-15HC-... | 2,5 / 5 / 10 |
| Motor connection   | Motor cable                                            | KMTR-DC-SUB-15-M12-... | 2,5 / 5 / 10 |
| Control            | Control line                                           | KES-MC-1-SUB-15-...    | 2,5 / 5 / 10 |
| Reference switch   | E.g. type SMT-10... or extension cable type KM8-M8-... |                        |              |
| PROFIBUS interface | Fieldbus plug for open fieldbus cable end              | FBS-SUB-9-GS-DP-B      | –            |
|                    | Fieldbus plug for M12 adapter                          | FBA-2-M12-5POL-RK      | –            |

Tab. 3/2: Overview of cables and plugs (accessories)

To ensure the IP protection class is complied with:

- Seal unused M8 connections with type ISK-M8 protective caps (accessories).
- Hand-tighten the union nuts/locking screws of the plugs.



Observe the permissible tightening torques specified in the documentation for the lines and plugs used

## 3.2 Power supply



### Warning

- Use only **PELV circuits** as per IEC/DIN EN 60204-1 for the electric power supply (protective extra-low voltage, PELV).  
Also observe the general requirements for PELV circuits in accordance with IEC/DIN EN 60204-1.
- Use only **power sources** that guarantee reliable electrical isolation of the operating voltage as per IEC/DIN EN 60204-1.

Protection against electric shock (protection against direct and indirect contact) is guaranteed in accordance with IEC/DIN EN 60204-1 by using PELV circuits (electrical equipment of machines, general requirements).

The internal power and controller electronics are supplied with DC voltage by way of the power supply connection.



### Note

Be sure to keep to the voltage supply tolerances; see Tab. 3/4. The tolerance must be maintained even directly at the power supply connection of the SFC-DC.

- For power supply, use only one of the following cables from the Festo accessory list:
  - Power supply cable KPWR-MC-1-SUB-15HC-...
  - Max. cable length 10 m.
- Use a regulated power supply unit with
  - at least 5 A peak current

3. Installation



Caution

Damage to the device

The 24 VDC power supplies of the SFC-DC have no special protection against voltage overload.

- Make sure the permissible voltage tolerance is never exceeded; see Tab. 3/4.

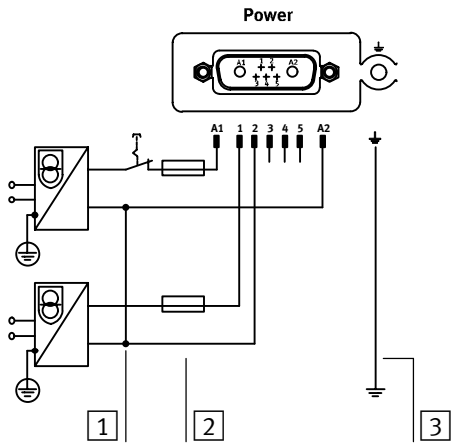
| Connection                                                                                                                                                                                                                                                                                                                                                                                 | Pin | Designation     | Function                               | Core colour <sup>1)</sup>        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----------------|----------------------------------------|----------------------------------|
| <div><p><b>Power</b></p></div>                                                                                                                                                                                                                                                                                                                                                             | A1  | Load power      | + +24 VDC load                         | Black, 1                         |
|                                                                                                                                                                                                                                                                                                                                                                                            | A2  | Load power      | GND load <sup>2)</sup>                 | Black, 2                         |
|                                                                                                                                                                                                                                                                                                                                                                                            | 1   | Logic power VCC | +24VDC logic                           | White                            |
|                                                                                                                                                                                                                                                                                                                                                                                            | 2   | Logic power GND | GND logic <sup>2)</sup>                | Brown                            |
|                                                                                                                                                                                                                                                                                                                                                                                            | 3   | n.c.            | Reserved                               | Green                            |
|                                                                                                                                                                                                                                                                                                                                                                                            | 4   | FE              | Earth terminal (housing) <sup>3)</sup> | – <sup>4)</sup>                  |
|                                                                                                                                                                                                                                                                                                                                                                                            | 5   | n.c.            | Reserved                               | Yellow                           |
|                                                                                                                                                                                                                                                                                                                                                                                            | –   | Plug housing    | Earth terminal (housing) <sup>3)</sup> | Earthing strap with cable lug M4 |
|                                                                                                                                                                                                                                                                                                                                                                                            |     | FE              | Earth terminal (housing) <sup>3)</sup> | –                                |
| <p><sup>1)</sup> Wire colours with power supply cable of type KPWR-MC-1-SUB-15HC-...</p> <p><sup>2)</sup> The GND terminals of the power supplies must not be connected to the housing, screen or functional earth (FE)!</p> <p><sup>3)</sup> Functional earth; use only one terminal; see chapter 3.3.</p> <p><sup>4)</sup> With cables of type KPWR-MC-1-SUB-15HC-... not connected.</p> |     |                 |                                        |                                  |

Tab. 3/3: “Power” connection on SFC-DC

The power supply must meet the following requirements:

| Power supply                                                                                                                              | Value                                                                          |
|-------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| Load supply (pin A1, A2) <ul style="list-style-type: none"><li>– Nominal current</li><li>– Peak current</li><li>– Internal fuse</li></ul> | 24 VDC $\pm$ 10 %<br>3 A $\pm$ 30 %<br>5 A $\pm$ 30 %<br>7 A very quick acting |
| Logic supply (pin 1, 2) <ul style="list-style-type: none"><li>– Nominal current</li><li>– Peak current</li><li>– Internal fuse</li></ul>  | 24 VDC $\pm$ 10 %<br>0.1 A $\pm$ 30 %<br>0.8 A $\pm$ 30 %<br>2 A slow-blow     |

Tab. 3/4: Power supply specification



- 1 Potential equalisation is essential!**
- 2 External fuses**  
(optional, to protect the internal fuses)
- 3 Earth connection** (alternative; see chapter 3.3)

Fig. 3/2: Power supply connection example

### 3.3 Earthing



#### Note

- Connect one of the earth terminals of the SFC-DC at low impedance (short cable with wide cross-section) to the earth potential.

You can thereby avoid interference from electromagnetic sources and ensure electromagnetic compatibility in accordance with EMC directives.

To connect the SFC-DC to the earth potential use **one** of the following earthing connections:

- Earthing strap on free end of the power supply cable; see assembly instructions for cable type KPWR-MC-1-SUB-15HC-..., or
- earth connection on the housing of the SFC-DC, see Tab. 3/3.



#### Note

Note that only one of the two earthing connections can be used at any one time (so as to avoid earth loops).

When using the earth terminal on the SFC-DC housing:

- Use a suitable earthing cable with an M4 cable lug together with the accompanying nut and toothed washer.
- Tighten the nut with max. 1.7 Nm.

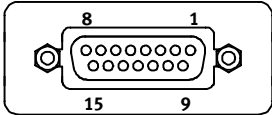
3.4 Motor connection

The motor connection is used to control the motor of the connected electric drive and to transfer the encoder signals.



**Note**  
To connect the electric drive, use exclusively one of the following cables from the Festo accessories:

- motor cable KMTR-DC-SUB-15-M12-...
- max length 10 m.

| Connection                                                                                                     | Pin | Designation | Function                  |
|----------------------------------------------------------------------------------------------------------------|-----|-------------|---------------------------|
| <div><p><b>Motor</b></p></div> | 1   | +5VDC       | VCC logic                 |
|                                                                                                                | 2   | A           | Encoder channel A (RS485) |
|                                                                                                                | 3   | A/          | Encoder channel A/        |
|                                                                                                                | 4   | B           | Encoder channel B (RS485) |
|                                                                                                                | 5   | B/          | Encoder channel B/        |
|                                                                                                                | 6   | C           | Encoder channel C (RS485) |
|                                                                                                                | 7   | C/          | Encoder channel C/        |
|                                                                                                                | 8   | GND logic   | GND logic                 |
|                                                                                                                | 9   | GND         | GND                       |
|                                                                                                                | 10  | GND         | GND                       |
|                                                                                                                | 11  | GND         | GND                       |
|                                                                                                                | 12  | Motor +     | Motor +                   |
|                                                                                                                | 13  | Motor -     | Motor -                   |
|                                                                                                                | 14  | GND         | GND                       |
|                                                                                                                | 15  | GND         | GND                       |
|                                                                                                                | –   | Plughousing | Cable shield              |

Tab. 3/5: “Motor” connection on the SFC-DC

3.5 Serial interface

Serial interface for parametrising, commissioning and diagnosing.



**Note**  
To connect a PC to the SFC-DC, use exclusively one of the following cables from the Festo accessories list:

- programming cable KDI-MC-M8-SUB-9-...
- length 2.5 m.

- Remove the cap from the serial port on the SFC-DC, if fitted.
- Connect the following terminals with the programming cable:
  - the connection socket on the SFC-DC
  - a serial interface COMx on the PC

| M8 socket                                                 |   | Description |                                                    |
|-----------------------------------------------------------|---|-------------|----------------------------------------------------|
|                                                           | 1 | GND         | Ground                                             |
|                                                           | 2 | RXD         | RS232 receiving line of the PC <sup>1)</sup>       |
|                                                           | 3 | TXD         | RS232 transmission line of the PC <sup>1)</sup>    |
|                                                           | 4 | ---         | Reserved for servicing personnel – do not connect! |
| <sup>1)</sup> The levels correspond to the RS232 standard |   |             |                                                    |

Tab. 3/6: RS232 (serial) port on SFC-DC

### 3. Installation



Information on commissioning and parameterising the SFC-DC via the serial interface can be found in chapter 5.3.2 and in the help system for the Festo Configuration Tool software package.

You will find information on transmitting CI commands via the serial interface in appendix C.1.

**Note**

The RS232 interface is not electrically isolated. It is not suitable for permanent connection to PC systems, nor for use as a control interface.

- Use this terminal only for commissioning.
- Remove the programming cable in continuous operation.
- Close off the port with the supplied cap (type ISK-M8),

#### 3.6 Input for external reference switch



If you are not using a reference switch:

- Seal the terminal with the protective cap supplied (type ISK-M8).

Use the following Festo proximity sensors for example:

- Electric proximity switch type SMT-10F...  
(can be installed in sensor grooves of the drive profile).

Use an extension cable type KM8-M8-... as necessary.

To connect the reference switch:

- For the reference switch use the correct switch type (N.O. = normally open), in PNP design.
- For connecting the reference switch use a cable with rotating thread sleeve on the end, e.g. type SMT-10F... or extension cable type KM8-M8-...
- When selecting the sensor, note that the accuracy of the sensor switching point may affect the accuracy of the reference point.
- During installation, observe the position of the sensor relative to the index pulse; shift the sensor if necessary (see warning “INDEX PULSE WARNING”, chapter 6.3).

3. Installation

The power supply for the reference switch (24 V DC / Ground) is provided via pin 1/3.



**Caution**

Damage to the device

The 24 VDC direct voltage at pin 1 has no special protection against overload; the voltage is tapped by the main power supply after the ESD and reverse polarity protection.

- Use the terminal only for the reference switch (sensor supply).

Use of this connection as a power supply for other devices is not permitted.

The input for sensor signal REF complies in its electrical features with the input specification in the appendix “Technical specifications”.

| M8 socket |   | Description |                                             |
|-----------|---|-------------|---------------------------------------------|
|           | 1 | +24VDC      | +24 VDC voltage output for reference switch |
|           | 4 | K           | Reference switch contact                    |
|           | 3 | GND         | Ground                                      |

Tab. 3/7: “Ref” (reference switch) connection on SFC-DC

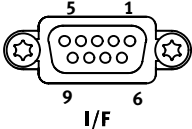
3.7 Control

The controller connection of the SFC-DC-...-PB is used for communication with the higher-level controller.

There is a 9-pin sub-D socket on the SFC-DC for connecting it to the Fieldbus. This connection is used for the incoming and continuing fieldbus cable.



**Note**  
Only the Fieldbus plugs type FBS-SUB-9-GS-DP-B or FBA-2-M12-5POL-RK from Festo comply with IP54.  
Note the instructions in chapter 3.8.4 if other sub-D plugs are used.

| Connection                                                                                                                                                                   | Pin | Designation           | Function                              | Fieldbus plug <sup>1)</sup> |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----------------------|---------------------------------------|-----------------------------|
| <br>I/F                                                                                     | 1   | n.c.                  | Not connected                         | –                           |
|                                                                                                                                                                              | 2   | n.c.                  | Not connected                         | –                           |
|                                                                                                                                                                              | 3   | <b>RxD/TxD-P</b>      | <b>Received/transmitted data P</b>    | B                           |
|                                                                                                                                                                              | 4   | CNTR-P <sup>2)</sup>  | Repeater control signal <sup>2)</sup> | –                           |
|                                                                                                                                                                              | 5   | DGND                  | Data reference potential (M5V)        | –                           |
|                                                                                                                                                                              | 6   | VP                    | Supply voltage positive (P5V)         | –                           |
|                                                                                                                                                                              | 7   | n.c.                  | Not connected                         | –                           |
|                                                                                                                                                                              | 8   | <b>RxD/TxD-N</b>      | <b>Received/transmitted data N</b>    | A                           |
|                                                                                                                                                                              | 9   | n.c.                  | Not connected                         | –                           |
|                                                                                                                                                                              | –   | Screening/<br>housing | Connection to functional earth        | Clamping<br>strap           |
| <p><sup>1)</sup> Pin assignment in Fieldbus plug type FBS-SUB-9-GS-DP-B from Festo.<br/><sup>2)</sup> The repeater control signal CNTR-P is in the form of a TTL signal.</p> |     |                       |                                       |                             |

Tab. 3/8: Connection “I/F” (controller connection) on the SFC-DC-...-PB

## 3.8 Connecting the fieldbus

### 3.8.1 Fieldbus cable



#### Note

In case of faulty installation or high transmission rates, data transmission errors can occur as a result of signal reflections and attenuations.

Transmission errors can be caused by:

- Missing or incorrect terminating resistor
- Incorrect screened connection
- Branches
- Transmission over long distances
- Inappropriate cables

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



#### Note

If the SFC-DC is installed in a machine on a movable mounting, the fieldbus cable must be provided with strain relief on the moving part of the machine. Also observe the relevant regulations in EN 60204 part 1.



Use a twisted screened 2-core cable for the Fieldbus in accordance with PROFIBUS specifications (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              |
| Wire cross section:          | > 0.34 mm <sup>2</sup> |

Bus length

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

3.8.2    Fieldbus baud rate and Fieldbus length



**Note**  
The maximum permitted fieldbus segment lengths depend on the baud rate used.

- Note the maximum permitted segment length (cable length without repeater), if you connect the SFC-DC to a Fieldbus segment.
- Avoid branch lines.

The baud rate is defined by the master and is recognized automatically by the SFC-DC.

| Baud rate                     | Maximum segment length |
|-------------------------------|------------------------|
| 9.6; 19.2; 45.45; 93.75 kBaud | 1200 m                 |
| 187.5 kBaud                   | 1000 m                 |
| 500 kBaud                     | 400 m                  |
| 1500 kBaud                    | 200 m                  |
| 1,5 ... 12 MBaud              | 100 m                  |

Tab. 3/9:    Maximum fieldbus segment lengths for PROFIBUS-DP depending on the baud rate

#### 3.8.3 Connection with fieldbus plugs from Festo

##### Connection with fieldbus plugs from Festo

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



You can connect the SFC-DC easily to the Fieldbus with the Fieldbus plug from Festo (type FBS-SUB-9-GS-DP-B). You can disconnect the plug from the SFC-DC without breaking the bus connection (T-tap function).



##### **Note**

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

3. Installation

- 1 Folding cover with inspection window
- 2 Blanking plug if connection unused
- 3 Clamp strap for screen connection
- 4 Fieldbus incoming (IN)
- 5 Switch for bus termination and continuing fieldbus
- 6 Fieldbus continuing (OUT)
- 7 Only capacitively connected

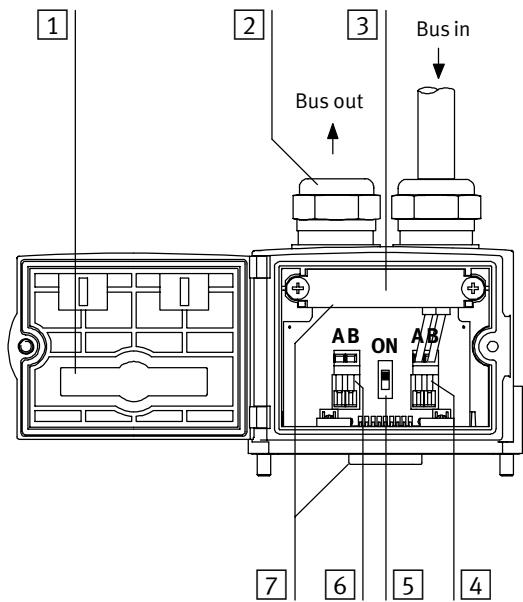


Fig. 3/3: Fieldbus plug from Festo, type FBS-SUB-9-GS-DP-B

DIL switch

With the switch in the Fieldbus plug you can switch the following:

| Switch position | Bus terminal | The continuing fieldbus cable |
|-----------------|--------------|-------------------------------|
| OFF             | Not switched | Switched on                   |
| ON              | Switched     | Switched off                  |



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

3. Installation



Connection with M12 adapter (reverse key coded)

With the adaptor (type FBA-2-M12-5POL-RK) you can connect the SFC-DC to the Fieldbus with an M12 plug connector. You can disconnect the M12 adapter from the SFC-DC without interrupting the bus cable (T-tap function).

Connection to the Fieldbus is made with a 5-pin M12 plug with PG 9 screw connector. Use the second connection socket for the continuation of the Fieldbus.

| M12 adapter (reverse key coded) | Pin no.                                                                                                                                                                                                                                     |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                 | <p>1. VP: Supply voltage positive (P5V)<br/>2. <b>RxD/TxD-N: Receive/Send data N</b><br/>3. DGND: Data reference potential (M5V)<br/>4. <b>RxD/TxD-P: Receive/Send data P</b><br/>5. FE: Functional earth<br/>Housing/thread: Screening</p> |
|                                 |                                                                                                                                                                                                                                             |

Tab. 3/10: Pin assignment of the Fieldbus interface with adapter for M12 connection, 5-pin

### 3. Installation

#### 3.8.4 Connection by other Sub-D plugs

If plug type FBS-SUB-9-WS-PB-K from Festo or Sub-D plugs of other manufacturers are used, you must replace the two flat screws, with which the Fieldbus plug is fastened in the SFC-DC, by a bolt type UNC 4-40/M3x5 (included in delivery).



##### **Note**

If both screws or stud bolts are removed simultaneously, there is a risk that the plug may be pressed into the SFC-DC housing with the internal circuit board.

- Always leave one of the screws or stud bolts mounted while changing over.

Proceed as follows:

1. First slacken just one of the mounting screws and remove it.
2. Screw one of the mounting bolts into the vacant tapped hole and tighten it.  
Maximum tightening torque: 0.48 Nm
3. Repeat steps 1 and 2 for the other screw.



##### **Note**

Note that when using Sub-D plugs from other manufacturers only IP20 protection is attained.

## 3.9 Bus termination with terminating resistors



### Note

If the SFC-DC is at the beginning or end of the Fieldbus segment, a bus termination will be required.

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



### Recommendation:

Use the ready-to-use Fieldbus plugs from Festo for the bus termination. A suitable resistor network is incorporated in the housing of this plug (see Fig. 3/4).

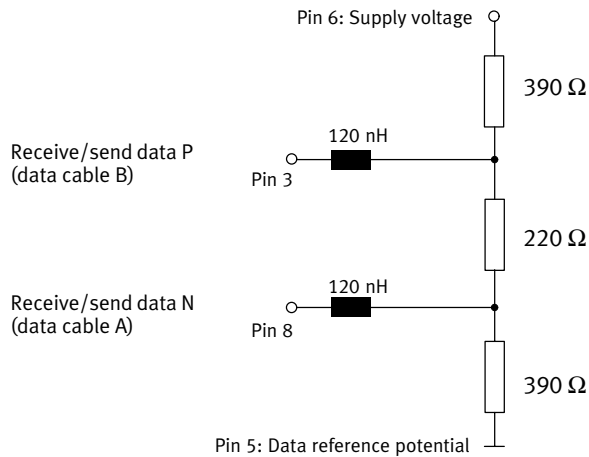


Fig. 3/4: Circuit diagram for bus termination network for cable type A as per EN 50 170 (switch in Festo Fieldbus plug set to ON)

# **The control panel (only type SFC-DC-...-H2-...)**

## **Chapter 4**

## 4. The control panel (only type SFC-DC-...-H2-...)

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#### 4. The control panel (only type SFC-DC-...-H2-...)



Motor controller type SFC-DC-...-H2-... offers on the control panel all functions necessary for commissioning, programming and diagnosing. An overview of the button and menu functions can be found in this chapter. Commissioning with the control panel is described starting from chapter 5.2.

With the SFC-DC-...-H0-... (without control panel) you can carry out commissioning of the SFC-DC via the RS232 interface with the Festo Configuration Tool. Instructions on this can be found in chapter 5.3.2.



##### **Caution**

Errors may occur if you attempt to access control and operating functions via the FCT and the control panel at the same time.

- Make sure that the FCT, the control panel and the control interface of the SFC-DC are not used at the same time.
- If necessary, use the possibility of blocking parametrisation and positioning functions via the control panel (HMI access, see chapter 5.5.2)



##### **Note**

If applicable, remove any protective foil on the display before commissioning.

#### 4. The control panel (only type SFC-DC-...-H2-...)

### 4.1 Design and function of the control panel

The control panel enables commissioning directly on the SFC-DC with the following functions:

- parametrisation and referencing the axis,
- entering position sets,
- test functions e.g. for moving to individual position sets.

- 1 LC display
- 2 Operating buttons
- 3 LEDs
  - Power (green)
  - I/F (green/red)
  - Error (red)

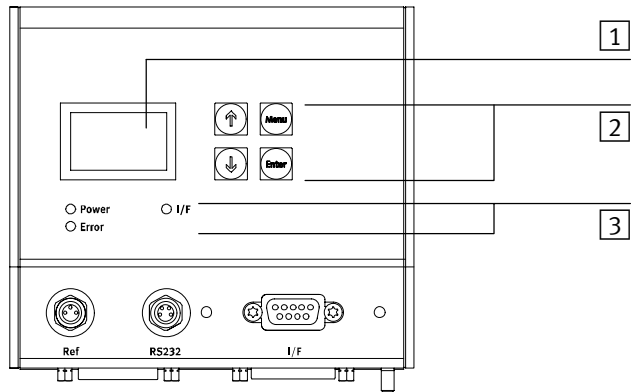


Fig. 4/1: Control panel of the SFC-DC-...-H2-...

With the 4 buttons on the control panel you can carry out all operating functions and settings by means of menus. The graphic LCD display shows all texts in English. The display can be turned in 180° steps, see menu command [LCD adjustment].

#### 4. The control panel (only type SFC-DC-...-H2-...)

The visual display of the operating states is shown via 3 LEDs (see also chapter 6.2).

- Power: Indicates ready status
- I/F: Bus status, positioning status
- Error: Error

| Function   |                                                                                                                                                            | Key                                                                                  |
|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| MENU       | Activated by the status display from the main menu                                                                                                         |    |
| ESC        | Rejects the current entry and switches back step by step to the higher-order menu level or status display                                                  |                                                                                      |
| EMERG.STOP | Interrupts the current positioning procedure (→ Error mode; confirm with <Enter>, then automatic return to the status display)                             |                                                                                      |
| OK         | Confirms the current selection or entry                                                                                                                    |    |
| SAVE       | Saves parameter settings permanently in the EEPROM                                                                                                         |                                                                                      |
| START/STOP | Starts or stops a positioning procedure (only in Demo mode). After stop: Display of current position; use <Menu> to return to the higher-order menu level. |                                                                                      |
| ← →        | Scrolls within a menu level in order to select a menu command                                                                                              |  |
| EDIT       | Sets parameters                                                                                                                                            |  |

Tab. 4/1: Button function (overview)

4. The control panel (only type SFC-DC-...-H2-...)

4.2 The menu system

4.2.1 Calling up the main menu and selecting a menu command

```
SFC-DC-VC-3-E-PB
SLTE...
Xa = 0.00 mm
HMI: off      PB: 5
<Menu>
```

When the power supply is switched on, the SFC-DC automatically carries out an internal check. At first the display briefly shows the Festo logo and then switches to the status display. The status display shows the following information:

- the type designation of your SFC-DC
- the type designation/type of the parametrised drive
- the current position of the drive  $x_a = \dots$
- the current setting of the device control (HMI = human machine interface) and the current PROFIBUS address.

The main menu is accessed from the status display using the <Menu> button. The current button function will be displayed in the lower lines of the LCD display.

4.2.2 Selection of a menu command

```
→ Diagnostic
  Positioning
  Settings
  ↓          ESC <Menu>
<-->       OK <Enter>
```

```
→ HMI control
  LCD adjustment
  ↓          ESC <Menu>
<-->       OK <Enter>
```

| Function |                                                                                                                                                                                                                                    | Key                                                                                                                                                                        |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ← →      | You can use the arrow keys on the control panel to select a menu item from the list. The current selection is marked with an arrow (→ Diagnostic). Select the menu item ↓ in order to display further menu items (HMI control...). | <br> |
| ESC      | With <Menu> you can interrupt the current entry and return step by step to the higher-order menu level or status display                                                                                                           |                                                                                         |
| OK       | With <Enter> you can confirm the current selection or entry.                                                                                                                                                                       |                                                                                         |

Tab. 4/2: Button function (menu selection)

#### 4. The control panel (only type SFC-DC-...-H2-...)

| Menu command |                                     | Description                                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| →            | <b>Diagnostic</b>                   | Displays the system data and the currently effective settings (see chapter 4.3)                                                                                                                                                                                                                                                                                                                                            |
|              | → Pos. set table                    | Displays the position set table                                                                                                                                                                                                                                                                                                                                                                                            |
|              | → Axis parameters                   | Displays axis parameters and data                                                                                                                                                                                                                                                                                                                                                                                          |
|              | → System paramet.                   | Displays system parameters and data                                                                                                                                                                                                                                                                                                                                                                                        |
|              | → PROFIBUS Diag                     | Displays status and diagnostic information on the bus communication                                                                                                                                                                                                                                                                                                                                                        |
|              | → SW information                    | Displays the operating system version (firmware)                                                                                                                                                                                                                                                                                                                                                                           |
| →            | <b>Positioning <sup>1) 2)</sup></b> | Homing and positioning runs for testing the positioning records (see chapter 4.4)                                                                                                                                                                                                                                                                                                                                          |
|              | → Homing                            | Starts reference run <sup>1)</sup>                                                                                                                                                                                                                                                                                                                                                                                         |
|              | → Move posit. set                   | Start positioning run "Position set"                                                                                                                                                                                                                                                                                                                                                                                       |
|              | → Demo posit. tab                   | Start positioning run "Position set table"                                                                                                                                                                                                                                                                                                                                                                                 |
| →            | <b>Settings <sup>1) 2)</sup></b>    | Select the drive, parametrisation, programming the position sets, etc. (see chapter 4.5)                                                                                                                                                                                                                                                                                                                                   |
|              | → Axis type                         | → Festo<br>→ Sommer<br>Selection of the manufacturer. Subsequently, selection of the axis, see chapter 4.5.                                                                                                                                                                                                                                                                                                                |
|              | → Axis parameter                    | → Zero point <sup>3)</sup><br>→ SW-limit-neg <sup>3)</sup><br>→ SW-limit-pos <sup>3)</sup><br>→ SAVE...<br>Offset axis zero point<br>Stroke limitation: Software end position, negative<br>Stroke limitation: Software end position, positive<br>Saves parameters to the EEPROM                                                                                                                                            |
|              | → Homing paramet.                   | → Homing method<br>→ Velocity v_rp<br>→ Velocity v_zp<br>→ SAVE...<br>Select referencing method (stop, reference switch, etc.)<br>Positioning speed for searching for the reference point<br>Positioning speed for moving to the axis zero point<br>Saves parameters to the EEPROM                                                                                                                                         |
|              | → Position set                      | → Position no.<br>→ Pos set mode<br>→ Position <sup>3)</sup><br>→ Velocity<br>→ Acceleration<br>→ Deceleration<br>→ SAVE...<br>Number of the positioning record (1 ... 31)<br>Set status: Absolute or relative positioning<br>Target position of the position set<br>Positioning speed of the position set<br>Start acceleration of the position set<br>Deceleration of the position set<br>Saves parameters to the EEPROM |
|              | → Password edit                     | Set up a local password with 3 digits for the control panel (see chapter 4.5).                                                                                                                                                                                                                                                                                                                                             |
|              | → PB parameters                     | Set PROFIBUS parameters                                                                                                                                                                                                                                                                                                                                                                                                    |
| →            | <b>HMI control <sup>1)</sup></b>    | Presetting the device control via the control panel (see chapter 4.2.3)                                                                                                                                                                                                                                                                                                                                                    |
| →            | <b>LCD adjustment</b>               | Rotate the display in steps of 180°                                                                                                                                                                                                                                                                                                                                                                                        |

<sup>1)</sup> If necessary password protection  
<sup>2)</sup> Control interface must be deactivated, see [HMI control]: HMI=on  
<sup>3)</sup> Teach mode

Tab. 4/3: Menu commands

4. The control panel (only type SFC-DC-...-H2-...)

4.2.3 Enable device control [HMI control]

To select the menu commands [Positioning] and [Settings], the “HMI: on” setting is required. Only then is the SFC-DC ready to process user entries on the control panel.

When selecting the menu commands, you are requested to modify the HMI setting.

[HMI control]

You can also modify the setting directly with the [HMI control] menu command.

```
HMI control
[on/off] off?
HMIAccessFree
          ESC <Menu>
EDIT <->  OK  <Enter>
```

| HMI 1)                     | Device control                                                                                                                                                                                                                                                                                           |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| on                         | The device is controlled manually via the control panel. The control interface of the SFC-DC is deactivated and Control Enable is set. The actual status of the FHPP control byte then has no effect.<br><b>With active control via the control panel the drive cannot be stopped with the STOP bit.</b> |
| off                        | Device control is carried out via the control interface of the SFC-DC.                                                                                                                                                                                                                                   |
| 1) Human Machine Interface |                                                                                                                                                                                                                                                                                                          |

Tab. 4/4: States [HMI control]



The device control “HMI Control” can be blocked via the fieldbus:

- FHPP: Bit CCON.B5, “HMI Access locked” (see also HMI Access, chapter 5.5.2).

4. The control panel (only type SFC-DC-...-H2-...)

4.3 [Diagnostic] menu

Displays the system data and the settings currently in effect.

→ Diagnostic

→ Pos. set table  
Axis parameter  
System paramet.  
PROFIBUS Diag  
SW information

- 1. Use the arrow keys in the main menu to select [Diagnostic] and press the <Enter> button.
- 2. Select one of the following menu commands:
  - Position record table [Pos. set table]
  - Axis parameter [Axis parameter]
  - System parameters [System paramet.]
  - Displays status and diagnostic information on the bus communication [PROFIBUS-Diag]
  - Version of the firmware of the SFC-DC e.g. V4.02 [SW information]

| Function |                                                                | Key                                                                                                                                                                  |
|----------|----------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ← →      | You can scroll through the diagnostic data with the arrow keys |   |
| ESC      | With <Menu> you can return to the higher-order menu level      |                                                                                    |

Tab. 4/5: Button function [Diagnostic] menu

4. The control panel (only type SFC-DC-...-H2-...)

[Pos. set table]

|   | N   | a/r | Pos     | Vel       |
|---|-----|-----|---------|-----------|
| → | 1   | a   | 0.00mm  | 20.00mm/s |
|   | 2   | r   | 10.00mm | 1.50mm/s  |
|   | 3   | a   | -5.00mm | 5.00mm/s  |
|   | ... |     |         |           |

Menu command for displaying the entries in the position set table.

When the menu command is accessed a table of position sets will be displayed. Select a position set and press the «Enter» button in order to display details of this position set.

| [Pos. set table] | Description                                 |
|------------------|---------------------------------------------|
| No.              | Number of the positioning record (1 ... 31) |
| a/r              | Absolute (a) or relative (r) positioning    |
| Pos              | Target position                             |
| Vel              | Travel speed                                |
| Acc              | Start acceleration (acceleration ramp)      |
| Dec              | Deceleration (braking ramp)                 |

Tab. 4/6: Elements [Pos. set table]

[Axis parameter]

Menu command for displaying the following axis parameters and data:

| [Axis parameter] | Description                                           |
|------------------|-------------------------------------------------------|
| Vmax             | Maximum speed of travel                               |
| Xpos             | Stroke limitation:<br>software end position, negative |
| Xneg             | Stroke limitation:<br>Software end position, positive |
| Xzp              | Axis zero point offset                                |
| Feed             | Feed constant (e.g. thread pitch)                     |

Tab. 4/7: Elements [Axis parameter]

#### 4. The control panel (only type SFC-DC-...-H2-...)

[System paramet.]

Menu command for displaying the following system parameters and data:

| [System paramet.] |                                                                                                                  | Description                                                                                                                                          |
|-------------------|------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| VRef              | [V]                                                                                                              | Internal reference voltage                                                                                                                           |
| VDig              | [V]                                                                                                              | Digital voltage                                                                                                                                      |
| Imax              | [A]                                                                                                              | Maximum possible motor current<br>(e.g. power limitation / motor protection)                                                                         |
| Iact              | [A]                                                                                                              | Current motor current                                                                                                                                |
| Temp              | [°C]                                                                                                             | Operating temperature, power end stage                                                                                                               |
| Cycle             | Number of positioning cycles                                                                                     |                                                                                                                                                      |
| Ref. switch       | on/off                                                                                                           | Signal at reference switch input                                                                                                                     |
| Mode              | mm                                                                                                               | System of measurement (millimetres)                                                                                                                  |
| Hom.meth.         | <ul style="list-style-type: none"> <li>– bl.pos</li> <li>– bl.neg</li> <li>– sw.pos</li> <li>– sw.neg</li> </ul> | Fixed stop in positive direction<br>Fixed stop in negative direction<br>Reference switch in positive direction<br>Reference switch in neg. direction |
| Gear              | e.g. 4.38                                                                                                        | Gear ratio of the drive                                                                                                                              |

Tab. 4/8: Elements [System paramet.]

4. The control panel (only type SFC-DC-...-H2-...)

[PROFIBUS Diag]

Menu commands for displaying status and diagnostic information on the bus communication:

| [PROFIBUS Diag] | Description                                                                                                                                                                                                                                                                                                 |
|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ConState        | Configuration status <ul style="list-style-type: none"><li>– WaitPrm: Wait for parameterising</li><li>– WaitCfg: Waiting for configuration</li><li>– DataEx: Data exchange</li></ul>                                                                                                                        |
| Baud rate       | Recognized baud rate of the bus communication.                                                                                                                                                                                                                                                              |
| MasterAdr       | Field bus address of the field bus master.                                                                                                                                                                                                                                                                  |
| SlaveAdr        | Fieldbus address of the SFC-DC.                                                                                                                                                                                                                                                                             |
| ActCFG          | Current bus configuration. <ul style="list-style-type: none"><li>– Invalid:<br/>No or incorrect configuration by master (e.g. by invalid GSD file)</li><li>– FHPP Std.:<br/>Control via control bytes</li><li>– FHPP FPC:<br/>Control via control bytes, parameterising via the parameter channel</li></ul> |
| GbDiagnosis     | Device-related diagnosis. <ul style="list-style-type: none"><li>– ON: If there is a fault, request for diagnosis will be sent.</li><li>– OFF: If there is a fault, request for diagnosis will not be sent.</li></ul>                                                                                        |

Tab. 4/9: Elements [PROFIBUS Diag]

## 4.4 [Positioning] menu

Starting a reference run or a positioning run to test the position records.



### Note

- Before starting homing, make sure that:
  - The positioning system is set up and wired completely, and is supplied with power.
  - The parametrisation is completed.
- Do not start a positioning run until the reference system has been defined by means of homing.



### Warning

Danger of injury.

With all positioning procedures the motor turns or the connected axis starts to move.

- Make sure that nobody can reach into the positioning range of the moveable load and that there are no objects in its path.



### Note

Please note that position records with speed  $v = 0$  or invalid target positions (-> error "TARGET POSITION OUT OF LIMIT) cannot be executed.

4. The control panel (only type SFC-DC-...-H2-...)

4.4.1 Reference travel [Positioning] [Homing].

→ Positioning

1. Use the arrow keys to select [Positioning] from the main menu and press the <Enter>button.

→ Homing  
Move posit. set  
Demo posit. tab

2. Select the menu command:  
– Reference run [Homing]

| [Positioning] | Description                                            | Note                                                                                                                              |
|---------------|--------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| [Homing]      | Homing for determining the mechanical reference system | First set the parameter in the menu [Settings] [Homing parameter].<br>Factory setting: Referencing to stop in negative direction. |

Tab. 4/10: Menu command [Homing]

Homing  
Attention!  
Motor moves...  
ESC <Menu>  
START <Enter>

3. Make sure that nobody can reach into the positioning range of the moveable load and that there are no objects in its path.  
Start the homing run with START <Enter>

HOMING  
v\_rp = 10.0 mm/s  
v\_zp = 5.0 mm/s  
STOP<Menu>

The following information is displayed:

- The search speed to the reference point v\_rp,
- The travel speed v\_zp to the axis zero point

| Function |                                                                                                 |                                                                                     |
|----------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| STOP     | With <Menu> you can abort the homing run; this automatically returns you to the status display. |  |

Tab. 4/11: Button function [Homing]

#### 4. The control panel (only type SFC-DC-...-H2-...)

#### 4.4.2 Positioning records [Positioning] [Move posit. set] / [Demo posit. tab]



##### Note

Do not start a positioning run until the reference system has been defined by means of a reference run.

For testing a particular positioning record in the positioning record table.

→ Positioning

Homing  
→ Move posit. set  
Demo posit. tab

1. Use the arrow keys to select [Positioning] from the main menu and press the <Enter>button.
2. Select the menu command:
  - Positioning run “Positioning record” [Move posit. set] – or
  - Positioning run “Position record table” [Demo posit. tab]

| [Positioning]     | Description                                                                                                 | Note                                                                                                                 |
|-------------------|-------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| [Move posit. set] | Positioning run for testing a particular position record in the position record table.                      | Parametrisation and referencing must have been completed.                                                            |
| [Demo posit. tab] | Positioning run (continuous loop) for testing all position records (1 ... 31) in the position record table. | Parametrisation and referencing must have been completed.<br>There must be at least two position sets in the memory. |

Tab. 4/12: Elements [Positioning]

In the [Demo posit tab] positioning run, all position records 1 ... 31 in the position record table will be executed one after the other. If the position set table contains a position set with speed  $v = 0$ , this position set and all the following sets will not be processed; the positioning run will be continued with position set 1.

4. The control panel (only type SFC-DC-...-H2-...)

```
...
Attention!
Motor moves...
      ESC <Menu>
      START <Enter>
```

```
...
Pos 1
Xt = 100.00 mm
v = 20 mm/s
Xa = 90.00 mm
EMERG.STOP<Menu>
```

3. Make sure that nobody can reach into the positioning range of the moveable load and that there are no objects in its path.  
Start the positioning procedure with START <Enter>.

During the positioning run the following information is displayed:

- the active position set Pos...
- the target position xt
- the positioning speed, v
- the current position xa.

| Function       |                                                                                                                                                                                                                                     |                                                                                   |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| EMERG.<br>STOP | With<Menu>you can interrupt the positioning procedure (→ Error mode EMERG.STOP; confirm with <Enter>, then automatic return to the status display).                                                                                 |  |
| DEMO<br>STOP   | With<Enter> you can interrupt the “positioning record table” positioning run [Demo posit tab]. The current positioning record will be executed before the axis stops. If you restart, the run will begin with positioning record 1. |  |

Tab. 4/13: Button function [Positioning]

#### 4. The control panel (only type SFC-DC-...-H2-...)

### 4.5 [Settings] menu

For parametrising the axis system and programming the position records:

→ Settings

→ Axis type  
Axis parameter  
Homing paramet.  
Position set  
Password edit  
PB parameters

1. Use the arrow keys to select [Settings] from the main menu and press the <Enter> button.
2. Select
  - the axis type [Axis type]
  - the axis parameters [Axis parameter]
  - the referencing parameters [Homing paramet.]
  - the position set table [Position set]
  - the password setting [Password edit]
  - the PROFIBUS setting [PB parameter]

#### 4.5.1 Axis type [Settings][Axis type]

[Axis type]

Design of axis driven by the SFC-DC.

Selection of the axis type determines feed constant, encoder resolution, gear ratio and motor type, for example (dependent on the size: nominal current, default controller parameters).

A summary of all axis parameters changed when the axis type is changed is provided in appendix B.2.15 (PNU 1005).



#### Note

After the axis type or size is changed, a reset is absolutely necessary for adaptation of the internal regulator settings.

- After changing the axis type, switch the power supply off and then on again (Power off/on).

#### 4. The control panel (only type SFC-DC-...-H2-...)

1. First select the manufacturer of the drive.

| <b>[Axis type]</b> | <b>Parameter</b>                                                           |
|--------------------|----------------------------------------------------------------------------|
| [Festo]            | Drives from Festo.<br>Select the type used corresponding to Tab. 4/15:     |
| [Sommer]           | Drives from Sommer Co.<br>Select the type used corresponding to Tab. 4/16: |

Tab. 4/14: Elements [Axis type] – Manufacturer selection

2. Subsequently select the product family and then the type of drive.

| <b>[Festo]</b>                                | <b>Parameter</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [SLTE]                                        | Electric mini-slide from Festo. Select the type used: <ul style="list-style-type: none"> <li>– SLTE10-50-G04: Type SLTE-10-50-LS5,0-DC-VCSC-G04</li> <li>– SLTE10-80-G04: Type SLTE-10-80-LS5,0-DC-VCSC-G04</li> <li>– SLTE10-xx: Mini slide SLTE size 10, stroke and gear ratio user-defined, see Tab. 4/17.</li> <li>– SLTE16-50-G04: Type SLTE-16-50-LS7,5-DC-VCSC-G04</li> <li>– SLTE16-80-G04: Type SLTE-16-80-LS7,5-DC-VCSC-G04</li> <li>– SLTE16-100-G04: Type SLTE-16-100-LS7,5-DC-VCSC-G04</li> <li>– SLTE16-150-G04: Type SLTE-16-150-LS7,5-DC-VCSC-G04</li> <li>– SLTE16-xx: Mini slide SLTE size 16, stroke and gear ratio user-defined, see Tab. 4/17.</li> </ul> |
| [HGP]                                         | Electric gripper from Festo. Select the type used: <ul style="list-style-type: none"> <li>– HGPLE-14-30: Type HGPLE-14-30, in preparation</li> <li>– HGPLE-14-60: Type HGPLE-14-60, in preparation</li> <li>– HGPLE-14-xx: Gripper HGPLE size 14, stroke and gear ratio user-defined, see Tab. 4/17.</li> <li>– HGPLE-25-40: Type HGPLE-25-40-2,8-DC-VCSC-G85, Stroke per gripper jaw 40 mm, total 80 mm.</li> <li>– HGPLE-25-80: Type HGPLE-25-80, in preparation</li> <li>– HGPLE-25-xx: Gripper HGPLE size 25, stroke and gear ratio user-defined, see Tab. 4/17.</li> </ul>                                                                                                |
| Support for further drives is in preparation. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

Tab. 4/15: Selection of axis type – Manufacturer Festo

#### 4. The control panel (only type SFC-DC-...-H2-...)

| [Sommer] | Parameter                                                                                                                                                                                                                                                                                                                                                                                                              |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [GEH]    | <p>Electric gripper from Sommer Co. Select the type used:</p> <ul style="list-style-type: none"> <li>– GEH6030: Type GEH6030</li> <li>– GEH6060: Type GEH6060</li> <li>– GEH60xx: Gripper GEH60, stroke and gear ratio user-defined, see Tab. 4/17.</li> <li>– GEH6140: Type GEH6140</li> <li>– GEH6180: Type GEH6180</li> <li>– GEH61xx: Gripper GEH61, stroke and gear ratio user-defined, see Tab. 4/17.</li> </ul> |
| [DEF]    | <p>Electric rotary module from Sommer Co. Select the type used:</p> <ul style="list-style-type: none"> <li>– DEF60: Type DEF60</li> <li>– DEFxx: Rotary module DEF, stroke and gear ratio user-defined, see Tab. 4/17.</li> </ul>                                                                                                                                                                                      |

Tab. 4/16: Selection of axis type – Manufacturer Sommer Co.

```
SLTE10-xx-G04
→ MotorRev: ...
  ShaftRev: ...
    Feed: ...
      Length: ...
        SAVE
```

3. Only with selection of a user-defined type:  
Enter the values one after the other conforming to Tab. 4/17.  
The specified PNUs can be found in appendix B.2.15.

| [Axis Values] | Parameter                                                                       |
|---------------|---------------------------------------------------------------------------------|
| [MotorRev]    | Gear ratio – Numerator (refer to PNU 1002:01)                                   |
| [ShaftRev]    | Gear ratio – Denominator (refer to PNU 1002:02)                                 |
| [Feed]        | Gear ratio – Numerator in mm/rev. (refer to PNU 1003:01, fixed denominator = 1) |
| [Length]      | Axis length in mm or degrees (refer to PNU 1005:01)                             |

Tab. 4/17: Input of the axis values for user-defined axes

```
SLTE10-xx-G04
MotorRev: 57
ShaftRev: 13
Feed: 5.000
Length: 26
  ESC <Menu>
  SAVE <Enter>
```

4. Finally, the values of the selected drive are displayed and can be saved with <Enter>.  
After changing the axis type, switch the power supply off and then on again (Power off/on).

4. The control panel (only type SFC-DC-...-H2-...)

4.5.2 Axis parameter [Settings] [Axis parameter]

[Axis parameter]

Teach mode for setting the axis parameters



**Warning**

During the teach procedure for specifying the axis zero point and the stroke limitation, the motor turns or the connected drive starts to move.

- Make sure that nobody can reach into the positioning range of the moveable load and that there are no objects in its path.

| [Axis parameter] | Description                                           |
|------------------|-------------------------------------------------------|
| [Zero point]     | Offset axis zero point                                |
| [SW-limit-neg]   | Stroke limitation:<br>software end position, negative |
| [SW-limit-pos]   | Stroke limitation:<br>software end position, positive |
| [SAVE...]        | Save parameters in EEPROM                             |

Tab. 4/18: Elements [Axis parameter]



**Note**

The set parameters take effect immediately after confirmation with OK <ENTER>. The settings are saved permanently in EEPROM with the [SAVE...] menu command:

- Save the parameter settings with the menu command [SAVE]. Only then will the settings be retained even after switching off the power supply or in the event of a power failure.

#### 4. The control panel (only type SFC-DC-...-H2-...)

##### 4.5.3 Homing parameters [Settings] [Homing paramet.]

[Homing paramet.]

Sets the referencing method and the speeds during the reference run.

The maximum speed during the reference run is limited to 10 mm/s.

| [Hom. paramet.] | Param.                    | Description                                            |
|-----------------|---------------------------|--------------------------------------------------------|
| [Homing method] | block negative            | Homing to fixed stop, negative = factory setting       |
|                 | block positive            | Homing to fixed stop, positive                         |
|                 | switch negative           | Homing to reference switch, negative with index search |
|                 | switch positive           | Homing to reference switch, positive with index search |
| [Velocity v_rp] | v_rp                      | Speed for searching for the reference point            |
| [Velocity v_zp] | v_zp                      | Speed for moving to the axis zero point                |
| [SAVE...]       | Save parameters in EEPROM |                                                        |

Tab. 4/19: Elements [Homing paramet.]



##### Note

The set parameters take effect immediately after confirmation with OK <ENTER>. The settings are saved permanently in EEPROM with the [SAVE...] menu command:

- Save the parameter settings with [SAVE]. Only then will the settings be retained even after switching off the power supply or in the event of a power failure.

4. The control panel (only type SFC-DC-...-H2-...)

4.5.4 Positioning record table [Settings][Position set]

[Position set]

Teach mode for programming the position set table.



**Warning**

During the teach procedure the motor turns or the connected axis starts to move.

- Make sure that nobody can reach into the positioning range of the moveable load and that there are no objects in its path.

| [Position set] | Param.                    | Description                                                                                                                                                                                  |
|----------------|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [Position no.] | No.                       | Number of the positioning record<br>[1 ... 31]                                                                                                                                               |
| [Pos set mode] | [absolute/<br>relative]   | Positioning mode<br>absolute = absolute position<br>specification, related to the<br>project zero point<br>relative = relative position<br>specification, related to the<br>current position |
| [Position]     | xt                        | Target position in [mm]                                                                                                                                                                      |
| [Velocity]     | v                         | Positioning speed in [mm/s]                                                                                                                                                                  |
| [Acceleration] | a                         | Acceleration in [mm/s <sup>2</sup> ]                                                                                                                                                         |
| [Deceleration] | d                         | Deceleration in [mm/s <sup>2</sup> ]                                                                                                                                                         |
| [SAVE...]      | Save parameters in EEPROM |                                                                                                                                                                                              |

Tab. 4/20: Elements [Position set.]

#### 4. The control panel (only type SFC-DC-...-H2-...)



##### **Note**

The set parameters take effect immediately after confirmation with OK <ENTER>. The settings are saved permanently in EEPROM with the [SAVE...] menu command:

- Save the parameter settings with [SAVE]. Only then will the settings be retained even after switching off the power supply or in the event of a power failure.

#### 4.5.5 Password [Settings] [Password edit]

Access via the control panel can be protected by a (local) password in order to prevent unauthorized or unintentional overwriting or modification of parameters in the device. No password has been preset at the factory (presetting = 000).

- Keep the password for the SFC-DC in a safe place, e.g. with the internal documentation for your system.



If the active password in the SFC-DC should be lost in spite of care being taken:

The password can be deleted by entering a master password if necessary. In this case please contact your Festo service partner.

#### 4. The control panel (only type SFC-DC-...-H2-...)

### Activating a password

[Password edit]

Select [Password edit] from the [Settings] menu:

```
New Password:
[ ? x x ] = 0

                ESC <Menu>
EDIT <-->      OK <Enter>
```

Enter a password with 3 digits. The current input position is marked with a question mark.

1. Use the arrow buttons to select a digit 0 ... 9.
2. Confirm your input with <Enter>. The next entry position = “?” will be displayed.
3. Set a digit for the next input position.
4. After entering the third digit, save your setting with SAVE <Enter>.

Access to all parameter and control functions of the control panel is only possible with the password after saving it.

### Enter password

```
Enter Password:
[ ? x x ] = 0

                ESC <Menu>
EDIT <-->      OK <Enter>
```

As soon as a password is active, it will be scanned automatically when the menu commands [Positioning], [Settings] or [HMI control] are accessed. When the correct password is entered, all parametrisation and control functions of the control panel are enabled until the power supply is switched off.

The current input position is marked with a question mark.

1. Use the arrow buttons to select a digit 0 ... 9.
2. Confirm your input with <Enter>. The next entry position will be displayed.
3. Repeat the entry for the remaining entry positions.

When the correct password is entered, all parametrisation and control functions of the control panel are enabled until the power supply is switched off.

#### 4. The control panel (only type SFC-DC-...-H2-...)

### Changing/deactivating the password

#### [Password edit]

Select [Password edit] in the [Settings] menu:

```
Enter Password:
[ ? x x ] = 0

                                ESC <Menu>
EDIT <-->      OK <Enter>
```

Enter the existing password with 3 digits. The current input position is marked with a question mark.

1. Use the arrow keys to select a digit 0 ... 9.
2. Confirm your entry with OK <Enter>. The next entry position will be displayed.
3. Repeat the entry for the remaining entry positions.
4. Enter the new password with 3 digits. If you wish to deactivate the password, enter "000".
5. Save your setting after entering the last digit by pressing [SAVE...] <Enter>.

```
New Password:
[ ? x x ] = 0

                                ESC <Menu>
EDIT <-->      OK <Enter>
```

### 4.5.6 PROFIBUS address [Settings] [PB parameter]

#### [PB parameter]

Setting of the field bus address.

```
PROFIBUS ADR
```

```
                                ESC <Menu>
                                OK <Enter>
```

Procedure see chapter 5.2.8.

#### 4. The control panel (only type SFC-DC-...-H2-...)

# Commissioning

## Chapter 5

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### 5.1 Preparations for commissioning

#### 5.1.1 Check the connection to the mains power supply

**Note**

Make sure that the tolerances for the supply voltage are observed. The tolerances must also be observed directly at the logic and operating voltage connection of the SFC-DC.

The correct values can be found in chapter 3.2 and in the technical specifications in the appendix.

#### 5.1.2 Checking the drive

**Warning**

Danger of injury.

Electric axes can move suddenly with high force and at high speed. Collisions can lead to serious injury to people and damage to components.

- Make sure that nobody can gain access to the operating range of the axis or of other connected actuators and that no objects lie in the path of the axes while the system is still connected to a power supply (voltage).

**Note**

During operation, the drive must not strike a stop without shock absorption (exceptions: homing, force mode).

Recommendation: Use shock absorbers or other suitable buffer elements on all stops where no reference run is being carried out.

## 5. Commissioning

- Before commissioning the positioning drive, make sure that:
  - the work space is of sufficient size for operation with a work load,
  - the work load does not collide with the motor or the gearbox of the drive when the slide moves into the end position,
  - that the positioning drive is within the permitted positioning range when it is switched on.
- Observe the notes in the operating instructions for your positioning drive.

### 5.1.3 General instructions on commissioning



#### **Warning**

Danger of injury.

Errors in parametrisation can cause injury to people and damage to property. In the following cases reference travel is absolutely essential in order that the reference coordinates and the working range can be set correctly:

- during initial commissioning,
- When the referencing method is changed
- **each** time the logic voltage supply is switched on.



#### **Caution**

Faults may occur if you attempt to access control and operating functions with the Festo Configuration Tool and the control panel at the same time.

- Make sure that the Festo Configuration Tool, the control panel and the control interface of the SFC-DC are not used at the same time.



### Note

In the following cases it is not permitted to write-access the SFC-DC with the Festo Configuration Tool (e.g. downloading parameters) or controlling (e.g. with “Move manually” or when starting homing):

- When the SFC-DC is currently performing a positioning movement or when a movement is started during access (e.g. via the control interface or via the control panel).
- When parametrisation or operation with the control panel takes place on the SFC-DC.

Observe the following:

- The device connection in the Festo Configuration Tool must not be activated when the control panel is being used for control (“HMI control = on”).
- Control with the control panel (“HMI control = on”) must not be activated when the device connection in the Festo Configuration Tool is activated.
- Control by the Festo Configuration Tool must not be activated while the drive is in motion or when control is being carried out via the controller interface.

### First steps in commissioning

- Switch on the power supply for the SFC-DC.
- Check (if your drive has been configured at the factory) the settings in the menu [Diagnostic].
- Carry out parameterising and commissioning with the control panel or the Festo Configuration Tool, as described in the following sections and in the Festo Configuration Tool/PlugIn help.  
For commissioning, the mechanical structure must be configured and a measuring system must be defined for referencing the reference coordinates. By means of the measuring system all positions are defined and movement can be made to them. Explanations of reference coordinates and the working area can be found in chapter 1.6.
- In order to complete commissioning note the instructions for operation in the Festo Configuration Tool/PlugIn help and in chapter 5.8.



#### Note

In order to restore the default settings you can, if necessary, delete the EEPROM directly via the serial interface with the CI command 20F1 (Data memory control) (see Chapter 7). User-specific settings will then be lost.

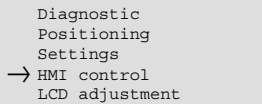
- Use CI commands only if you already have experience of Service Data Objects.
- If necessary, consult Festo.

### 5.2 Commissioning with the control panel (only type SFC-DC-...-H2-...)

#### Working with the control panel

Information on the button functions and on the menu composition of the control panel can be found in Chapter 4.

#### Device control



Diagnostic  
Positioning  
Settings  
→ HMI control  
LCD adjustment

In order for the control panel to control the connected SFC-DC, the control interface of the SFC-DC must be deactivated and the controller enable must be set. [HMI = on]. The actual status of the FHPP control bytes then has no effect.



Instructions on control enable can be found in chapter 4.2.3.

### Procedure for parametrisation and commissioning

When first commissioning the SFC-DC with the control panel, carry out the following steps. Observe the detailed description in the specified chapters.

| <b>Commissioning (overview)</b>                                                                                                                                                                                                                                                                                                  | <b>Chap.</b>    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| 1. Select the drive type and, if necessary, adapt the parameterising to suit your axis.                                                                                                                                                                                                                                          | 5.2.1           |
| 2. Set the following parameters for homing: <ul style="list-style-type: none"> <li>– Referencing method,</li> <li>– search speed to reference point,</li> <li>– positioning speed to axis zero point,</li> <li>– With referencing method “Fixed stop ...”: Teach an axis zero point <math>\neq 0</math> if necessary.</li> </ul> | 5.2.2           |
| 3. Carry out a homing run.                                                                                                                                                                                                                                                                                                       | 5.2.3           |
| 4. Teach the following axis parameters for defining the axis zero point and the working area: <ul style="list-style-type: none"> <li>– Offset of the axis zero point to the reference point,</li> <li>– Positive and negative software end positions.</li> </ul>                                                                 | 5.2.4           |
| 5. Enter several positioning records (target position, positioning mode, positioning speed and accelerations).                                                                                                                                                                                                                   | 5.2.5 and 5.2.6 |
| 6. Carry out a test run to check the positioning reaction of the axis, as well as the basis coordinates and the working area.                                                                                                                                                                                                    | 5.2.7           |
| 7. If necessary, optimize the settings for positioning records as well as for the basis coordinates and the working area.                                                                                                                                                                                                        | 5.2.6           |
| 8. Commission the PROFIBUS interface of the SFC-DC. This step can be the first one.                                                                                                                                                                                                                                              | 5.2.8 and 5.4   |
| 9. Before completing commissioning, observe the instructions for operation.                                                                                                                                                                                                                                                      | 5.8             |

Tab. 5/1: Commissioning steps

## 5. Commissioning

### 5.2.1 Setting the axis type

1. Select the axis used in the menu [Settings][Axis type], as described in chapter 4.5.1.
2. Check the displayed values of the drive and save the setting with SAVE <Enter>.

```
SLTE10-xx-G04  
MotorRev: 57  
ShaftRev: 13  
Feed: 5.000  
Length: 26  
      ESC <Menu>  
      SAVE <Enter>
```



#### Note

After the axis type or size is changed, a reset is absolutely necessary for adaptation of the internal regulator settings.

- After changing the size, switch the power supply off and then on again (Power off/on).

### 5.2.2 Setting the reference run parameters

In order to search for the reference point and for positioning the drive in the axis zero point, you can set two different speeds. The maximum possible speed is limited at the factory.

Depending on the referencing method, the reference point is defined by means of a reference switch or fixed stop.

### Notes on referencing to the fixed stop



#### Note

Reference travel may only be carried out directly against the fixed stop if the permitted impact pulse is not exceeded.

- Operate the positioning drive only with the permitted mass.



#### Caution

Damage to components

The drive with positioning controller SFC-DC moves during homing to a mechanical stop with adjustable nominal motor torque (default: 100 % of nominal current).

- Limit the maximum current during the reference run by means of
  - the Festo Configuration Tool, see help for PlugIn SFC-DC,
  - PNU 1034 / Object 6073h “Max. current (maximum current)”, see appendix B.2.18.



#### Caution

Damage to components

During operation it is not permitted to move to the mechanical end positions (stops). If movement is made to the end positions with a heavy load, jamming may occur in the end positions.

- Set the offset of the axis zero point  $\neq 0$ , e.g. +1.00 mm when referencing to a negative mechanical stop or -1.00 mm when referencing to a positive mechanical stop, for grippers set to +0.50 mm or -0.50 mm correspondingly.
- Limit the positioning range by defining valid software end positions during commissioning (see chapter 1.6).
- Specify target positions only within the permitted positioning range.

### Notes on referencing to the reference switch

If homing to a mechanical end position in the application or with rotary drives is not possible, an external sensor (reference switch) can be used as reference signal (see also chapter 1.6).

#### **Special case 1: At the start of homing, the axis stands on the reference switch**

If the axis stands on the reference switch at the start of homing it will move in the opposite direction to the reference switch (see [2](#) in Tab. 1/6).

The axis then moves as usual to the axis zero point (compare [2](#) in Tab. 1/6).

#### **Special case 2: The axis cannot find a reference switch during homing**

If the axis cannot find a reference switch during homing, it will move until it strikes a stop. It will then remain at the stop until the fault HOMING ERROR is displayed (see chapter 6.3).

The reasons for this can be:

- At the start of homing, the axis already stands behind the reference switch.
- The reference switch is defective.
- the axis is defective or fitted incorrectly, e.g. the coupling “does not grip”.

## 5. Commissioning

Homing must be repeated after the error message has been acknowledged:

- Acknowledge the error message with <Enter>.
- If necessary, check the function of the reference switch.
- Check the settings of the parameters.
- If necessary, position the drive in Teach mode so that at the start it stands in the search direction **in front of** the stop or reference switch.
- Repeat the homing run.

## 5. Commissioning

### Setting parameters

```
→ Settings
  Homing paramet.
  └─ Homing method
  └─ Velocity v_rp
  └─ Velocity v_zp
    SAVE...
```

1. Set the following homing parameters one after the other:
  - The referencing method [Homing method]
  - The search speed for ascertaining the reference point [Velocity v\_rp]
  - The positioning speed to the axis zero point. [Velocity v\_zp].
2. With referencing method “Fixed stop”:  
Make sure that the axis zero point is  $\neq 0$ .  
If necessary, teach the axis zero point (see chapter 5.2.4).



#### Caution

If the referencing method is changed, the offset of the axis zero point will be reset to zero. Existing settings of the software end positions and of the target positions of the positioning record table will be retained. Note that these values refer to the previous axis zero point.

- Always carry out homing after changing the referencing method.
- Then teach the offset of the axis zero point.

If the axis zero point is modified:

- Teach the software end positions and the target positions again.

3. Accept each setting with OK <Enter>. The setting will then take effect in the drive.
4. Save the parameter settings with the menu command [SAVE]. Only then will the settings be retained even after switching off the power supply or in the event of a power failure.
5. Finally, carry out homing, otherwise the previous reference system of the SFC-DC will remain unmodified.

### 5.2.3 Starting a homing run

The following conditions must be fulfilled for homing:

- The drive must be set up completely, wired and supplied with power.
- The SFC-DC must be correctly parameterised.



#### Note

When carrying out homing note that:

- The drive must be in the permitted positioning range,
- the axis moves in the search direction according to the selected referencing method and at the start must stand **in front of** the stop or reference switch.

1. If necessary, position the axis in Teach mode so that at the start it stands in the search direction **in front of** the stop or reference switch.
  - Select e.g. [Settings][Position set][Position] (see also settings 5.2.6).
  - Move the axis to the desired position manually with the arrow buttons.
  - Interrupt the procedure with ESC <menu>, in order that the position is not included in the positioning record table.
2. Select [Positioning][Homing].
3. Start the homing run with START <Enter>.

→ Positioning  
├ Homing  
├ Move posit. set  
└ Demo posit. tab



After successful homing the axis stands at the axis zero point. With first commissioning or after a change of referencing method the offset of the axis zero point = 0; after homing the axis then stands at the reference point (= axis zero point).

## 5. Commissioning

### Interrupting the reference run

If necessary, homing can be interrupted with the <Menu> button (STOP).

### 5.2.4 Teach the axis zero point and the software end positions

Prerequisites for teaching the axis zero point and the software end positions:

- The axis has been completely set up and wired and supplied with power.
- The SFC-DC must be correctly parameterised.
- Homing was successful.



#### Note

With referencing to the stop, set the offset of the axis zero point to  $\neq 0$ . You will then prevent movement to the mechanical end positions during operation.

Teach the axis zero point:

```
→ Settings
  Axis parameter
    Zero point
    SW-limit-neg
    SW-limit-pos
  SAVE
```

1. Select [Settings] [Axis parameter] [Zero point].
2. Move the drive to the desired axis zero point manually with the arrow buttons.
3. Accept the position reached with OK <Enter>. The setting will then take effect in the drive. The current position  $x_a$  becomes the axis zero point. ( $x_a = 0$ )

**Note**

If the axis zero point is modified:

Check existing settings of the software end positions and of target positions in the position table. Note that these values refer to the previous axis zero point.

- Teach the software end positions and the target positions again.

Teach the negative and the positive software end positions:

1. Select [Settings][Axis parameter][SW-limit-neg] or [SW-limit-pos].
2. Move the drive manually with the arrow buttons.
3. Accept the position reached with OK <Enter>. The setting will then take effect in the drive.
4. Save the parameter settings with [SAVE]. Only then will the settings be retained even after switching off the power supply or in the event of a power failure.

### 5.2.5 Positioning with positioning records

The following conditions must be fulfilled:

- The axis has been completely set up and wired and supplied with power.
- The SFC-DC must be correctly parameterised.
- Homing has been carried out successfully.
- The axis zero point and the software end positions have been set correctly.



#### Note

Please note that position records with speed  $v = 0$  or invalid target positions (-> error "TARGET POSITION OUT OF LIMIT) cannot be executed.

- After successful homing, carry out a test run, if necessary, without an effective load (see chapter 5.2.7).
- If necessary, optimise the settings for positioning records as well as for the reference coordinates and the working area (see chapter 1.6).
- After a successful test run you can teach the positions in the positioning record table to which movement must be made (see chapter 5.2.6).



#### Warning

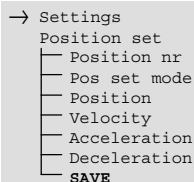
During the teach procedure the motor turns or the connected axis starts to move.

- Make sure that nobody can place his/her hand in the positioning range of the moveable mass and that no objects lie in its path.

## 5. Commissioning

### 5.2.6 Teach position records

Enter the positioning records as follows:



→ Settings  
Position set  
Position nr  
Pos set mode  
Position  
Velocity  
Acceleration  
Deceleration  
**SAVE**

1. Activate the desired position set (1...31) with [Settings] [Position set] [Position no.].
2. Complete or correct the positioning mode of the positioning record:
  - Select [Pos set mode].
  - Set the positioning mode with the arrow keys:  
absolute = absolute position specification,  
relative to the project zero point  
relative = relative position specification,  
relative to the current position.
  - Accept the value with OK <Enter>.



#### Note

If you modify the positioning mode, you must then teach again the target position of the positioning record, otherwise the modification of the positioning mode will not be accepted.

3. Teach the target position of the position record:
  - Select [Position].
  - Move the drive manually to the desired target position with the arrow keys.
  - Accept the position reached with OK <Enter>.  
The setting of the target position and the positioning mode will then take effect in the drive.



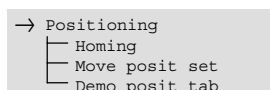
Only positioning jobs can be executed with positioning records. Force mode is not possible.

## 5. Commissioning

4. Complete or correct the speed.
  - Select [Velocity].
  - Set the nominal speed with the arrow keys.
  - Accept the setting with OK <Enter>. The setting will then take effect in the drive.
5. Complete or correct the acceleration value of the acceleration ramp of the positioning record.
  - Select [Acceleration].
  - Set the nominal acceleration with the arrow keys.
  - Accept the setting with OK <Enter>. The setting will then take effect in the drive.
6. Complete or correct the deceleration value of the braking ramp of the positioning record.
  - Select [Deceleration].
  - Set the nominal acceleration with the arrow keys.
  - Accept the setting with OK <Enter>. The setting will then take effect in the drive.
7. Save the positioning record table with [SAVE].  
Only then will the settings be retained even after switching off the power supply or in the event of a power failure.
8. Enter the next positioning record.

## 5. Commissioning

### 5.2.7 Test run



1. Enter several positioning records in order to check the positioning behaviour (see chapter 5.2.6).
  - Set the target positions at the limits of the positioning range, for example, in order to check the software end positions.
  - Set different speeds, for example.

2. Select [Positioning][Move posit. set] in order to execute a particular position record.

– or –

3. Select [Positioning][Demo posit. tab] in order to execute all position records. At least two positioning records must be entered in the positioning record table in order that this function can be used.

In the [Demo posit tab] positioning run, all position records 1 ... 31 in the position record table will be executed one after the other. If the positioning record table contains a positioning record with speed  $v = 0$ , this positioning record and all the following sets will not be processed; positioning travel will be continued with position set 1.

With DEMO STOP <Enter> you can interrupt the [Demo posit tab] positioning run. The current positioning record will be executed before the drive stops.

4. Start the test run.
  - Check the positioning behaviour.
  - Check the displayed coordinates of the axis.

With EMERG.STOP <Menu> you can interrupt the current positioning procedure.

5. If necessary, optimize the settings for positioning records as well as for the basis coordinates and the working area.

## 5. Commissioning

### 5.2.8 Set station number (PROFIBUS address)

Before commissioning on the PROFIBUS, you must set a valid station number.

- Permitted station numbers: 0 ... 125.
- The **invalid station number 255** is preset.  
This is to make sure that a correct address is set during commissioning or exchange.
- Addresses cannot be assigned by the master  
(the service Set\_Slave\_Address is not supported).



#### Note

Station numbers may only be assigned once per Fieldbus master.

Set the station number as follows:

```
→ Settings
  PB parameters
    └ PROFIBUS ADR
```

PROFIBUS address

```
7
                                ESC <Menu>
EDIT <-->                      OK <Enter>
```

1. Select [Settings][PB parameter][PROFIBUS ADR]  
(see also chapter 4.5).
2. The current address is displayed with <Enter>.
3. Set the desired address with the arrow buttons.
4. Accept the address with OK <Enter>.  
The set address becomes effective immediately and is saved against network failure.

### 5.3 Commissioning with the Festo Configuration Tool

#### 5.3.1 Installing and starting the Festo Configuration Tool

The Festo Configuration Tool (FCT) and the plug-in SFC-DC are installed on your PC with an installation program.

**Note**

For the controller type SFC-DC-...-PB with

- hardware version from V2.00
- firmware version from V4.0x

you need the PlugIn SFC-DC version V3.0.0.

Check with later versions of the SFC-DC, whether an updated PlugIn is available. If necessary, consult Festo.

**Note**

Administrator rights are required for installing the Festo Configuration Tool.

You can install the Festo Configuration Tool from the CD ROM as follows:

1. Close all programs.
2. Insert the Festo Configuration Tool CD in your CD ROM drive. If Auto-Run is activated on your system, the installation starts automatically and you can skip steps 3 and 4.
3. Select [Execute] in the Start menu.
4. Enter D:\setup (if necessary replace D by the letter of your CD ROM drive).
5. Follow the instructions on the screen.

### 5.3.2 Procedure for commissioning with the Festo Configuration Tool

#### Starting the Festo Configuration Tool

In order to commission the SFC-DC with the Festo Configuration Tool, carry out the following steps:

1. Connect the SFC-DC to your PC via the RS232 interface. Observe here the instructions in chapter 3.5.
2. Start the Festo Configuration Tool: Double-click on the Festo Configuration Tool icon on the desktop, – or switch to the Windows menu [Start] and select the entry [Festo Software][Festo Configuration Tool].
3. Create a project in the Festo Configuration Tool or open an existing project. Add a device to the project with the plug-in SFC-DC.
4. Create the device connection (online connection) between the PC and the SFC-DC via the tool bar of the Festo Configuration Tool.  
It may be necessary here to adapt the controller type, the device name or the axis type.

#### Device control

In order that the Festo Configuration Tool can control the connected SFC-DC, the control interface of the SFC-DC must be deactivated and the controller enable must be set. The actual status of the FHPP control bytes then has no effect.

- Access the window “General output,” tab “Operate,” then under “Device control” activate first the box “FCT control” and then the box “Enable”. The control interface of the SFC-DC will then be deactivated and the control enable of the Festo Configuration Tool will be set.

Access to the SFC-DC by means of the Festo Configuration Tool can be blocked via the PROFIBUS interface (see chapter 5.5.2, control byte CCON, bit 5). In this case, the check boxes “FCT controller” and “enable” are blocked (inactive).



### Instructions on parametrisation and commissioning

Further information can be found in the help for the Festo Configuration Tool with the command [Help] [Contents FCT general] e.g.

- for working with projects and for adding a device to a project,
- for help on defining the measuring system (referencing and reference coordinates),
- for setting the fieldbus address.

The plug-in SFC-DC for the Festo Configuration Tool supports all the steps necessary for commissioning an SFC-DC.



With the PlugIn SFC-DC for the Festo Configuration Tool the necessary parametrisation can be carried out offline, i.e. without the SFC-DC being connected to the PC. This enables the actual commissioning to be prepared, e.g. in the design office when a new system is being planned.

Further information can be found in the plug-in help: Command [Help] [Contents of installed PlugIns] [Festo (manufacturer name)] [SFC-DC (PlugIn name)], e.g.:

- for a description of the dialogues of the PlugIn SFC-DC,
- for a description of the work steps for commissioning,
- for the basic functions: device connection, device names, device control and for password protection.

### 5.4 Commissioning at the PROFIBUS

The following sections detail the configuration and addressing of the SFC-DC on a PROFIBUS master.

#### 5.4.1 Overview of commissioning on the PROFIBUS

The following steps are required for commissioning the SFC-DC as a fieldbus station:

1. Set the PROFIBUS address on the SFC-DC:

| Settings                                                           | Description                                      |
|--------------------------------------------------------------------|--------------------------------------------------|
| PROFIBUS address                                                   | Permitted address range: 0 ... 125 <sup>1)</sup> |
| <sup>1)</sup> under circumstances is limited by the DP master used |                                                  |

- on the control panel (only with type SFC-DC-...-H2-..., see chapter 5.2.8), or
- with the Festo Configuration Tool (see help for the Festo Configuration Tool).

Modification by a DP master is not possible.

2. Install the GSD file and icon file, see chapter 5.4.2.
3. Configure the PROFIBUS master with the relevant configuration software (e.g. with STEP 7 Hardware Configurator), see chapter 5.4.4.
4. Test the fieldbus connection in online mode.

Details can be found in the following sections.



## 5. Commissioning

### 5.4.2 Install device master file (GSD file) and icon files

If a new hitherto unknown device is to be incorporated in a configuration program when configuring a PROFIBUS-DP system, an appropriate device master file (GSD file) must be installed for this device. The device master file contains all the necessary information for the configuration program. You will require the appropriate icon files for representing the device graphically.

#### Obtainable from

This documentation CD contains GSD files and icon files for the SFC-DC in the folder "PROFIBUS". Current GSD files and icon files can be found on the Festo Internet pages at:

➔ [www.festo.com](http://www.festo.com) ➔ Downloads ➔ Download Area: Software, Drivers and firmware ➔ Enter search term  
Enter search term: SFC-DC

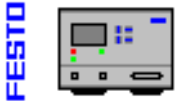
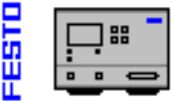
#### GSD file

You will require one of the following GSD files for the SFC-DC:

- SFC\_0973.gsd – English  
SFC\_0973.gsg – German  
(with support for DPV0 and DPV1)
- SFC00973.gsd – English  
SFC00973.gsg – German  
(only for older controllers/without DPV1)

#### Icon files

In order to represent the SFC-DC in your configuration software use the following icon files:

| Normal operating status                                                           | Diagnostic case                                                                   | Special operating status                                                          |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
|  |  |  |
| File: sfc-dc_n.dib or<br>sfc-dc_n.bmp                                             | File: sfc-dc_d.dib or<br>sfc-dc_d.bmp                                             | File: sfc-dc_s.dib or<br>sfc-dc_s.bmp                                             |

Tab. 5/2: Icon files

### Install GSD file and icon files

Depending on the configuration program used, install the GSD file and the icon files with the aid of the appropriate menu command or copy the files manually into a particular directory of your peripheral/PC.

#### 5.4.3 I/O configuration

Two configurations are supported by the GSD files:

- “Festo handling and positioning profile standard”  
GSD entry as “FHPP Standard”,  
8 bytes of I/O data, consistent transmission
- “Festo handling and positioning profile with parameter channel” GSD entry as “FHPP Standard + FPC”,  
2 x 8 bytes of I/O data, consistent transmission

5.4.4 Configuration with STEP 7

General Information

The Simatic Manager software package provides project planning and commissioning in conjunction with PROFIBUS masters from Siemens or compatible masters. In order to understand this chapter, you should be sure of how to handle your configuration program. If necessary, refer to the documentation for the Simatic Manager. This description refers to software version V 5.3.



An appropriate device master file (GSD file) for the SFC-DC must be installed for configuration.  
With the STEP 7 Hardware Configurator you can load the files via the menu command [Options][Install GSD file] ([Extras][Install GSD files]) in the dialogue window “HW Config.” Read (“HW Config.”).

| Configuration program                                                                                                                                                                        | File type    | Directory              |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|------------------------|
| STEP 7 Hardware Configurator <sup>1)</sup>                                                                                                                                                   | GSD file     | ...\STEP7\S7DATA\GSD   |
|                                                                                                                                                                                              | Bitmap files | ...\STEP7\S7DATA\NSBMP |
| 1) If you copy the GSD files when the SIMATIC Manager has already been started, you can update the hardware catalogue with the command [Options][Update Catalog] ([Extras][Update Catalog]). |              |                        |

Tab. 5/3: Folder for GSD and icon files STEP 7

### Insert SFC-DC as slave

The hardware configuration window graphically represents the structure of the master system. When the GSD file has been installed, the SFC-DC can be selected in the hardware catalogue. It can be found in the group [PROFIBUS-DP][Further field devices][Drives][Festo], (see Fig. 5/1).

In order to insert the SFC-DC:

1. Pull the station type “Festo SFC-DC DP-V0” or “Festo SFC-DC DP-V1” ([3], see 5.4.2) from the hardware catalogue onto the Profibus line ([1]) of the DP master system (Drag & Drop).
2. Enter the PROFIBUS address, which you have set using the Festo Configuration Tool or the control panel, into the “Properties PROFIBUS interface” dialog and confirm the value with OK.
3. If necessary, enter other settings in the dialogue window “Properties DP slave” (e.g. the response monitoring, see chapter 5.4.6 or the startup parameterising, see chapter 5.4.5) and confirm with OK.  
The icon of the SFC-DC is displayed on the line of the DP master system ([2]).

## 5. Commissioning

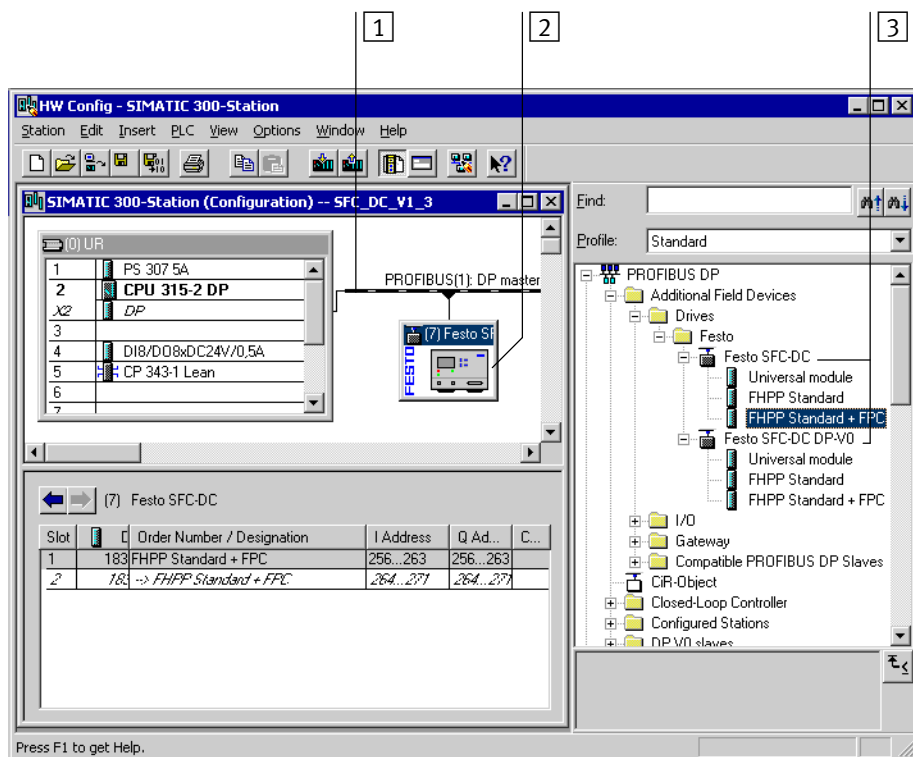


Fig. 5/1: Station selection STEP 7

### Configuring the slave features

After clicking the icon for the SFC-DC, you can configure the “Slave features” in the lower part of the screen. Here you can determine the number and size of the I/O ranges of the slave and assign them with address ranges of the master.

In order to configure the slave features of the SFC-DC:

1. Open the available modules (configurations) in the hardware catalogue under [Festo SFC-DC ...].
2. Then pull the desired configuration (see chapter 5.4.3) with the mouse into the appropriate line under Component/DP identifier.

With STEP 7 a “universal module” is also offered for compatibility reasons. This must not be used.

The SFC-DC is a modular slave, but with only **one permitted** module. The configuration is defined only by the master.



5. Commissioning

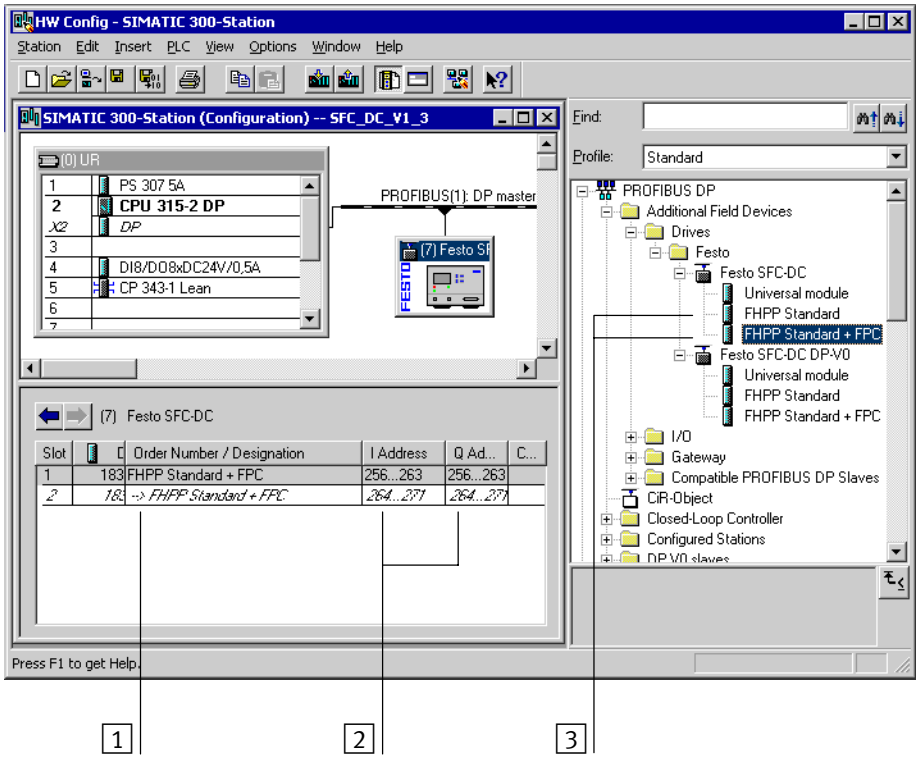


Fig. 5/2: Configuring the slave features

When the configuration is concluded, transfer the data to the master.

5. Commissioning

5.4.5 Start parameterising

When the connection is built up, parameters are automatically transferred to the slave by the master. These are parameters for the extended configuration of the data exchange. These serve to guarantee improved compatibility with various masters.

- Configuration of the data exchange (connection settings).

| Parameter                                  | Type | Values                                                                                                                                                           |
|--------------------------------------------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Diagnostic behaviour (GbD switched on/off) | Bool | = 0: In the case of an error, diagnosis will be requested by the master (Default)<br>= 1: In the case of an error, diagnosis will not be requested by the master |

Tab. 5/4: Configuration of the data exchange (connection settings)

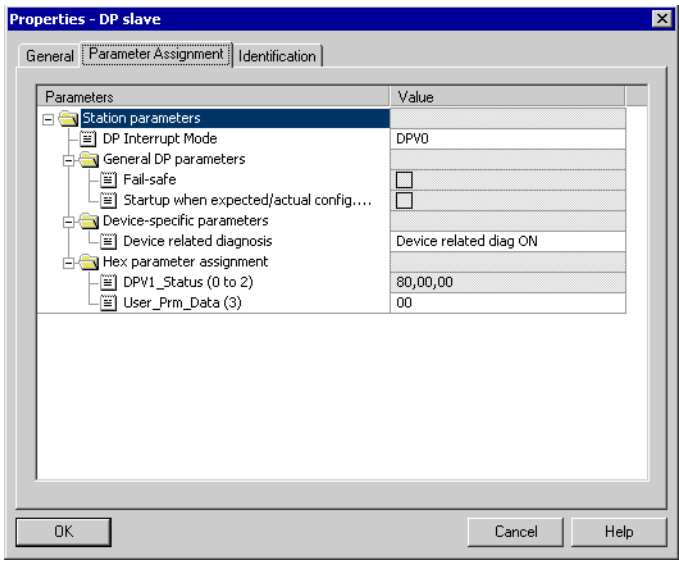


Fig. 5/3: Properties of DP slave – Parametrisation

### 5.4.6 Response monitoring

The response monitoring influences the reaction when Fieldbus communication fails, e.g. due to cable fracture. The SFC-DC can be operated with active or inactive response monitoring.

With active response monitoring, the drive is stopped with the emergency stop ramp and remains still under control when the response monitoring time has expired.

With inactive response monitoring, the current drive function is still carried out if Fieldbus communication fails.

### 5.4.7 Control commands

FREEZE, SYNC and CLEAR\_DATA are supported by the SFC-DC as per EN 50170.



The method of accessing these commands depends on the controller used. Please refer here to the documentation for your Fieldbus module.



#### **Caution**

The operating mode FREEZE or SYNC will be reset automatically:

- When the SFC-DC is switched on or off,
- or when the Fieldbus interface stops.

Only the operating mode FREEZE will be reset automatically when:

- The bus connection to the SFC-DC is interrupted (response monitoring active).

5.5 Festo handling and positioning profile (FHPP)

5.5.1 Supported operation modes

The operating modes differ as regards their contents and the meaning of the cyclic I/O data and in the functions which can be accessed in the SFC-DC.

| Operating mode                | Description                                                                                                                                                                                                                                                                      |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Record Selection<br>(Default) | 31 positioning records can be saved in the SFC-DC. A record contains all the parameters which are specified for a positioning job.<br>The record number is transferred in the cyclic I/O data as the nominal or actual value (FHPP standard).                                    |
| Direct mode                   | The positioning job is transferred directly in the I/O telegram (FHPP standard). The most important setpoint values (position, velocity, force/torque ...) are thereby transferred. Supplementary parameters (e.g. acceleration ...) are defined via parametrisation (FHPP-FPC). |

Tab. 5/5: Overview of operating modes

The operating mode is switched by the control byte CCON (see below) and indicated in the status byte SCON.  
Definition by means of parametrisation is not possible.  
Switching between modes is only permitted in the “Drive disabled” or “Drive enabled” status.

Record selection

Positioning mode

The SFC-DC has 31 records (1 ... 31) that contain all the information necessary for a positioning job  
(+ record 0 = homing).

The record number, which the SFC-DC is to process at the next start, is transferred to the output data of the master.  
The input data contains the record number that was processed last. The positioning job itself does not need to be active.

## 5. Commissioning



The SFC-DC cannot function autonomously, i.e. it does not have its own user program. Records cannot be processed automatically with a programmable logic. The drive cannot accomplish any tasks sensibly with Stand Alone; close coupling to the PLC is necessary.

There are also 3 records with special functions (which cannot be executed in Record Selection mode):

- Record 32 contains the parameters for the Jog mode.
- Record 33 contains the parameters for Direct mode.
- Record 34 is the direct set for the FCT software.

### Direct mode

In the direct mode, positioning jobs are formulated directly in the output data of the master.

### Positioning mode

The typical application dynamically calculates the nominal target values for each job or just for some jobs. Adaptation to different workpiece sizes is therefore possible. It is not sensible here to parameterise the record list again each time. The positioning data is managed entirely in the PLC and sent to the SFC-DC. Here also, close coupling between the PLC and the SFC-DC is necessary.

### Force mode

Alternatively, setpoint values relative to the nominal motor current can be specified as direct mode. This results in a rotary torque and with linear drives in a force (force control).

5.5.2 Composition of the cyclic I/O data (FHPP standard)

The FHPP standard protocol always contains 8 bytes input and 8 bytes output data.



Further 8 bytes I/O as per FHPP-FPC  
In the cyclic data a further 8 bytes input data and 8 bytes output data are permitted for transmitting parameters in accordance with the FPC protocol (Festo Parameter Channel). The I/O data and the parameters are described in appendix B.1.

| Data   | Byte 1                                                                                                                                                                             | Byte 2 | Byte 3                                                                                                                                                                                                                                                                                                                                                                                                   | Byte 4 | Byte 5 | Byte 6 | Byte 7 | Byte 8 |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|
| O data | Bytes 1 and 2 (fixed) are retained in each operation mode and transmit control and status bytes (e.g. CCON, SCON, ...) for enabling the SFC-DC and for setting the operating modes |        | Bytes 3 to 8 depend on the selected operating mode (Direct mode, Record selection) and transmit further control and status bytes (e.g. CDIR, SDIR, ...), as well as nominal and actual values:<br>– Record number or setpoint position in the output data.<br>– Feedback of actual position and record number in the input data.<br>– Further nominal and actual values depending on the operating mode. |        |        |        |        |        |
| I data |                                                                                                                                                                                    |        |                                                                                                                                                                                                                                                                                                                                                                                                          |        |        |        |        |        |

| I/O data: Record selection |        |        |            |          |                 |        |        |        |
|----------------------------|--------|--------|------------|----------|-----------------|--------|--------|--------|
| Data                       | Byte 1 | Byte 2 | Byte 3     | Byte 4   | Byte 5          | Byte 6 | Byte 7 | Byte 8 |
| O data                     | CCON   | CPOS   | Record no. | Reserved | Reserved        |        |        |        |
| I data                     | SCON   | SPOS   | Record no. | RSB      | Actual position |        |        |        |

| I/O data: Direct mode |        |        |        |                                              |                                               |        |        |        |
|-----------------------|--------|--------|--------|----------------------------------------------|-----------------------------------------------|--------|--------|--------|
| Data                  | Byte 1 | Byte 2 | Byte 3 | Byte 4                                       | Byte 5                                        | Byte 6 | Byte 7 | Byte 8 |
| O data                | CCON   | CPOS   | CDIR   | Setpoint value 1 (velocity)                  | Setpoint value 2 (position, force/torque ...) |        |        |        |
| I data                | SCON   | SPOS   | SDIR   | Actual value 1 (velocity, force/torque, ...) | Actual value 2 (actual position)              |        |        |        |

## 5. Commissioning

### Assignment of the control bytes (overview) <sup>1)</sup>

| <b>CCON</b>                       | <b>B7<br/>OPM2</b>       | <b>B6<br/>OPM1</b>    | <b>B5<br/>LOCK</b>      | <b>B4<br/>–</b>    | <b>B3<br/>RESET</b>     | <b>B2<br/>BRAKE</b>                         | <b>B1<br/>STOP</b>    | <b>B0<br/>ENABLE</b> |
|-----------------------------------|--------------------------|-----------------------|-------------------------|--------------------|-------------------------|---------------------------------------------|-----------------------|----------------------|
|                                   | Operating mode selection |                       | MMI Access blockage     | –                  | Acknowledge malfunction | –                                           | Stop                  | Enable drive         |
| <b>CPOS</b>                       | <b>B7<br/>–</b>          | <b>B6<br/>CLEAR</b>   | <b>B5<br/>TEACH</b>     | <b>B4<br/>JOGN</b> | <b>B3<br/>JOGP</b>      | <b>B2<br/>HOM</b>                           | <b>B1<br/>START</b>   | <b>B0<br/>HALT</b>   |
|                                   | –                        | Delete remaining path | Teach value             | Jog negative       | Jog positive            | Start reference travel                      | Positioning job Start | Halt                 |
| <b>CDIR</b><br>(only Direct mode) | <b>B7<br/>FUNC</b>       | <b>B6<br/>FAST</b>    | <b>B5<br/>XLIM</b>      | <b>B4<br/>VLIM</b> | <b>B3<br/>CONT</b>      | <b>B2<br/>COM2</b>                          | <b>B1<br/>COM1</b>    | <b>B0<br/>ABS</b>    |
|                                   | –                        | –                     | Deactivate stroke limit | –                  | –                       | Control mode (Position, force/ Torque, ...) |                       | Absolute/ relative   |

<sup>1)</sup> – : Reserved

### Assignment of the status bytes (overview) <sup>1)</sup>

| <b>SCON</b>                       | <b>B7<br/>OPM2</b>             | <b>B6<br/>OPM1</b>  | <b>B5<br/>FCT/MMI</b>     | <b>B4<br/>VLOAD</b>  | <b>B3<br/>FAULT</b> | <b>B2<br/>WARN</b>                                      | <b>B1<br/>OPEN</b> | <b>B0<br/>ENABLED</b> |
|-----------------------------------|--------------------------------|---------------------|---------------------------|----------------------|---------------------|---------------------------------------------------------|--------------------|-----------------------|
|                                   | Acknowledgement Operating mode |                     | Device controller FCT/MMI | Load voltage applied | Malfunction         | Warning                                                 | Operation enabled  | Drive enabled         |
| <b>SPOS</b>                       | <b>B7<br/>REF</b>              | <b>B6<br/>STILL</b> | <b>B5<br/>DEV</b>         | <b>B4<br/>MOV</b>    | <b>B3<br/>TEACH</b> | <b>B2<br/>MC</b>                                        | <b>B1<br/>ACK</b>  | <b>B0<br/>HALT</b>    |
|                                   | Drive referenced               | Downtime monitoring | Following error           | Axis moves           | Acknowledge teach   | Motion complete                                         | Acknowledge start  | Halt                  |
| <b>SDIR</b><br>(only Direct mode) | <b>B7<br/>FUNC</b>             | <b>B6<br/>FAST</b>  | <b>B5<br/>XLIM</b>        | <b>B4<br/>VLIM</b>   | <b>B3<br/>CONT</b>  | <b>B2<br/>COM2</b>                                      | <b>B1<br/>COM1</b> | <b>B0<br/>ABS</b>     |
|                                   | –                              | –                   | Stroke limit reached      | Speed limit reached  | –                   | Feedback of control mode (position, force/ torque, ...) |                    | Absolute/ relative    |

<sup>1)</sup> – : Reserved

## 5. Commissioning

### 5.5.3 Description of the I/O data (Record select)

| <b>O data – Record selection</b> |            |               |                                                               |
|----------------------------------|------------|---------------|---------------------------------------------------------------|
| Byte                             | Bit        | EN            | Description                                                   |
| 1                                | B0 ... B7  | CCON          | Control bytes, see chapter 5.5.5                              |
| 2                                | B0 ... B7  | CPOS          |                                                               |
| 3                                | B0 ... B7  | Record number | Preselection of record number for record selection (0 ... 31) |
| 4                                | B0 ... B7  | –             | Reserved (= 0)                                                |
| 5 ... 8                          | B0 ... B31 | –             | Reserved (= 0)                                                |

| <b>I data – Record selection</b> |            |                          |                                                                                                           |
|----------------------------------|------------|--------------------------|-----------------------------------------------------------------------------------------------------------|
| Byte                             | Bit        | EN                       | Description                                                                                               |
| 1                                | B0 ... B7  | SCON                     | Status bytes, see chapter 5.5.6                                                                           |
| 2                                | B0 ... B7  | SPOS                     |                                                                                                           |
| 3                                | B0 ... B7  | Record number            | Feedback of record number for record selection (0 ... 31)                                                 |
| 4                                | B0 ... B7  | Record status byte (RSB) | See SDIR with Direct mode, chapter 5.5.6                                                                  |
| 5 ... 8                          | B0 ... B31 | Position, ...            | Feedback of position for record selection:<br>– position in increments<br>(32-bit number, low byte first) |

## 5. Commissioning

### 5.5.4 Description of the I/O data (Direct mode)

| <b>O data – Direct mode</b> |            |                        |                                                                                                                                                                                                                                                                         |
|-----------------------------|------------|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Byte                        | Bit        | EN                     | Description                                                                                                                                                                                                                                                             |
| 1                           | B0 ... B7  | CCON                   | Control bytes, see chapter 5.5.5                                                                                                                                                                                                                                        |
| 2                           | B0 ... B7  | CPOS                   |                                                                                                                                                                                                                                                                         |
| 3                           | B0 ... B7  | CDIR                   |                                                                                                                                                                                                                                                                         |
| 4                           | B0 ... B7  | Velocity               | Setpoint value 1: Specification depends on the controller operating mode (see control byte 3 CDIR) <ul style="list-style-type: none"><li>– Positioning mode: Velocity in % of the maximum speed</li><li>– Force mode: Reserved (not relevant)</li></ul>                 |
| 5 ... 8                     | B0 ... B31 | Position<br>Force, ... | Setpoint value 2: Specification depends on the controller operating mode (see control byte 3 CDIR) <ul style="list-style-type: none"><li>– Positioning mode: Position in increments</li><li>– Force mode: Force/Torque in % of the nominal current (PNU 1035)</li></ul> |

| <b>Idata – Direct mode</b> |            |                          |                                                                                                                                                                                                                                                                              |
|----------------------------|------------|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Byte                       | Bit        | EN                       | Description                                                                                                                                                                                                                                                                  |
| 1                          | B0 ... B7  | SCON                     | Status bytes, see chapter 5.5.6                                                                                                                                                                                                                                              |
| 2                          | B0 ... B7  | SPOS                     |                                                                                                                                                                                                                                                                              |
| 3                          | B0 ... B7  | SDIR                     |                                                                                                                                                                                                                                                                              |
| 4                          | B0 ... B7  | Velocity<br>Force/torque | Actual value 1: Feedback depends on the controller operating mode (see control byte 3 CDIR) <ul style="list-style-type: none"><li>– Positioning mode: Velocity in % of the maximum speed</li><li>– Force mode: Force/Torque in % of the nominal current (PNU 1035)</li></ul> |
| 5 ... 8                    | B0 ... B31 | Position                 | Actual value 2: Feedback of the position in increments                                                                                                                                                                                                                       |

5.5.5 Description of the control bytes CCON, CPOS, CDIR

CCON

With control byte 1 (CCON) all the states are controlled which must be available in all operating modes. The cooperation of the control bits can be found under the description of the drive functions in chapter 5.6.

| Control byte 1 (CCON)                                                                                     |                                            |                                                                                                                                                                                                                                                                                          |
|-----------------------------------------------------------------------------------------------------------|--------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit                                                                                                       | EN                                         | Description                                                                                                                                                                                                                                                                              |
| <b>B0<br/>ENABLE</b>                                                                                      | Drive <b>Enable</b>                        | = 1: Drive (controller) enabled<br>= 0: Drive (controller) blocked                                                                                                                                                                                                                       |
| <b>B1<br/>STOP</b>                                                                                        | <b>Stop</b>                                | = 1: Operation enabled.<br>= 0: Stop 1 active (cancel emergency ramp + positioning job).<br>The axis stops with maximum braking ramp, the positioning job is reset.                                                                                                                      |
| <b>B2<br/>BRAKE</b>                                                                                       | –                                          | Reserved<br>:= 0                                                                                                                                                                                                                                                                         |
| <b>B3<br/>RESET</b>                                                                                       | <b>Reset</b> Fault                         | With a rising edge a fault is acknowledged and the fault value is deleted.                                                                                                                                                                                                               |
| <b>B4<br/>–</b>                                                                                           | –                                          | Reserved<br>:= 0                                                                                                                                                                                                                                                                         |
| <b>B5<br/>LOCK</b>                                                                                        | HMI Access <b>Lock</b>                     | Controls access to the diagnostic interface of the drive.<br>= 1: MMI and FCT may only observe the drive, the device control (HMI control) cannot be taken over by MMI and FCT.<br>= 0: MMI or FCT may take over the device control (in order to modify parameters or to control inputs) |
| <b>B6<br/>OPM1</b>                                                                                        | Select <b>Operating Mode</b> <sup>1)</sup> | = 00: Record selection<br>= 01: Direct mode<br>= 10: Reserved<br>= 11: Reserved                                                                                                                                                                                                          |
| <b>B7<br/>OPM2</b>                                                                                        |                                            |                                                                                                                                                                                                                                                                                          |
| <sup>1)</sup> Switching between Record selection and Direct mode is also permitted in the status “Ready”. |                                            |                                                                                                                                                                                                                                                                                          |

## 5. Commissioning

CPOS

Control byte 2 (CPOS) controls the positioning sequences as soon as the drive is enabled.

| Control byte 2 (CPOS) – Record selection and direct mode |                                         |                                                                                                                                                                                                                               |
|----------------------------------------------------------|-----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit                                                      | EN                                      | Description                                                                                                                                                                                                                   |
| <b>B0<br/>HALT</b>                                       | <b>Halt</b>                             | = 1: Halt is not active<br>= 0: Halt activated (do not cancel braking ramp + positioning job).<br>The axis stops with a defined braking ramp, the positioning job remains active (with B6 the remaining path can be deleted). |
| <b>B1<br/>START</b>                                      | <b>Start<br/>Positioning<br/>Task</b>   | With a <b>rising edge</b> the current setpoint values will be transferred and positioning started (record 0 = homing travel).                                                                                                 |
| <b>B2<br/>HOM</b>                                        | Start <b>Homing</b>                     | With a <b>rising edge</b> homing is started with the set parameters.                                                                                                                                                          |
| <b>B3<br/>JOGP</b>                                       | <b>Jog positive</b>                     | The drive moves at the specified velocity or rotational speed in the direction of larger actual values, providing the bit is set. The movement begins with the rising edge and ends with the falling edge.                    |
| <b>B4<br/>JOGN</b>                                       | <b>Jog negative</b>                     | The drive moves at the specified velocity or rotational speed in the direction of smaller actual values, see bit 3.                                                                                                           |
| <b>B5<br/>TEACH</b>                                      | <b>Teach Actual<br/>Value</b>           | At a <b>falling edge</b> the current actual position is imported into the setpoint register of the currently addressed positioning record; see chapter 5.6.3.<br>The teach target is defined with PNU 520.                    |
| <b>B6<br/>CLEAR</b>                                      | <b>Clear<br/>Remaining<br/>Position</b> | In the “Halt” status a <b>rising edge</b> causes the positioning job to be deleted and transfer to the status “Ready”.                                                                                                        |
| <b>B7<br/>–</b>                                          | –                                       | Reserved<br>:=0                                                                                                                                                                                                               |

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CDIR

Control byte CDIR is a special control byte for the operating mode “Direct job”.

| Control byte 3 (CDIR) – Only direct mode |                                     |                                                                                                                                                  |
|------------------------------------------|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit                                      | EN                                  | Description                                                                                                                                      |
| <b>B0<br/>ABS</b>                        | <b>Absolute /<br/>Relative</b>      | = 0: Setpoint value is absolute<br>= 1: Setpoint value is relative to last setpoint value                                                        |
| <b>B1<br/>COM1</b>                       | <b>Control Mode</b>                 | = 00: Positioning mode (see also chapter 5.5.7 point 6)<br>= 01: Force mode (see also chapter 5.5.7 point 7)<br>= 10: Reserved<br>= 11: Reserved |
| <b>B2<br/>COM2</b>                       |                                     |                                                                                                                                                  |
| <b>B3<br/>CONT</b>                       | –                                   | Reserved<br>:= 0                                                                                                                                 |
| <b>B4<br/>VLIM</b>                       | –                                   | Reserved<br>:= 0                                                                                                                                 |
| <b>B5<br/>XLIM</b>                       | Stroke (X-) <b>Limit</b> not active | Force control:<br>= 0: Stroke monitoring active<br>= 1: Stroke monitoring not active                                                             |
| <b>B6<br/>FAST</b>                       | –                                   | Reserved<br>:= 0                                                                                                                                 |
| <b>B7<br/>FUNC</b>                       | –                                   | Reserved<br>:= 0                                                                                                                                 |

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### 5.5.6 Description of the status bytes SCON, SPOS, SDIR (RSB)

| <b>Status byte 1 (SCON)</b> |                                      |                                                                                                            |
|-----------------------------|--------------------------------------|------------------------------------------------------------------------------------------------------------|
| <b>Bit</b>                  | <b>EN</b>                            | <b>Description</b>                                                                                         |
| <b>B0<br/>ENABLED</b>       | Drive <b>Enabled</b>                 | = 0: Drive blocked, controller not active<br>= 1: Drive (controller) enabled                               |
| <b>B1<br/>OPEN</b>          | <b>Operation<br/>Enabled</b>         | = 0: Stop active<br>= 1: Operation enabled, positioning possible                                           |
| <b>B2<br/>WARN</b>          | <b>Warning</b>                       | = 0: Warning not registered<br>= 1: Warning registered                                                     |
| <b>B3<br/>FAULT</b>         | <b>Fault</b>                         | = 0: No fault<br>= 1: There is a fault or fault reaction is active.<br>Fault code in the diagnostic memory |
| <b>B4<br/>VLOAD</b>         | <b>Load Voltage is<br/>applied</b>   | = 0: No load voltage<br>= 1: Load voltage applied                                                          |
| <b>B5<br/>FCT/MMI</b>       | Drive Control<br>by <b>FCT/MMI</b>   | = 0: Device control by PLC/Fieldbus<br>= 1: Device control by FCT/MMI                                      |
| <b>B6<br/>OPM1</b>          | Display<br><b>Operating<br/>Mode</b> | = 00: Record selection<br>= 01: Direct mode<br>= 10: Reserved<br>= 11: Reserved                            |
| <b>B7<br/>OPM2</b>          |                                      |                                                                                                            |

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| <b>Status byte 2 (SPOS)</b> |                               |                                                                                                                                                                         |
|-----------------------------|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Bit</b>                  | <b>EN</b>                     | <b>Description</b>                                                                                                                                                      |
| <b>B0<br/>HALT</b>          | <b>Halt</b>                   | = 0: Halt is active<br>= 1: Halt is not active, axis can be moved                                                                                                       |
| <b>B1<br/>ACK</b>           | <b>Acknowledge<br/>Start</b>  | = 0: Ready for start (positioning, homing)<br>= 1: Start executed (positioning, homing)                                                                                 |
| <b>B2<br/>MC</b>            | <b>Motion<br/>Complete</b>    | = 0: Positioning task active<br>= 1: Positioning job completed, where applicable with error<br>Note:<br>MC is set after device is switched on (status "Drive blocked"). |
| <b>B3<br/>TEACH</b>         | <b>Acknowledge<br/>Teach</b>  | = 0: Ready for teaching<br>= 1: Teaching carried out, actual value is transferred                                                                                       |
| <b>B4<br/>MOV</b>           | <b>Axis is moving</b>         | = 0: Speed of the axis < limit value<br>= 1: Speed of the axis >= limit value                                                                                           |
| <b>B5<br/>DEV</b>           | <b>Drag Error</b>             | = 0: No following error<br>= 1: Following error active                                                                                                                  |
| <b>B6<br/>STILL</b>         | <b>Standstill<br/>control</b> | = 0: After MC, axis remains in tolerance window<br>= 1: After MC, axis remains outside tolerance window                                                                 |
| <b>B7<br/>REF</b>           | <b>Axis is<br/>referenced</b> | = 0: Referencing must be carried out<br>= 1: Reference information present, homing not necessary                                                                        |

## 5. Commissioning

| <b>Status byte 3 (SDIR) – Direct mode</b> |                                      |                                                                                                                |
|-------------------------------------------|--------------------------------------|----------------------------------------------------------------------------------------------------------------|
| <b>Bit</b>                                | <b>EN</b>                            | <b>Description</b>                                                                                             |
| <b>B0<br/>ABS</b>                         | <b>Absolute /<br/>Relative</b>       | Positioning mode:<br>= 0: Setpoint value is absolute<br>= 1: Setpoint value is relative to last setpoint value |
| <b>B1<br/>COM1</b>                        | <b>Control Mode<br/>feedback</b>     | = 00: Positioning mode<br>= 01: Force mode<br>= 10: Reserved<br>= 11: Reserved                                 |
| <b>B2<br/>COM2</b>                        |                                      |                                                                                                                |
| <b>B3<br/>CONT</b>                        | –                                    | Reserved                                                                                                       |
| <b>B4<br/>VLIM</b>                        | <b>Speed (V-)<br/>LIMit reached</b>  | Force mode:<br>= 1: Speed limit reached<br>= 0: Speed limit not reached                                        |
| <b>B5<br/>XLIM</b>                        | <b>Stroke (X-)<br/>LIMit reached</b> | Force mode:<br>= 1: Stroke limit value reached<br>= 0: Stroke limit not reached                                |
| <b>B6<br/>FAST</b>                        | –                                    | Reserved                                                                                                       |
| <b>B7<br/>FUNC</b>                        | –                                    | Reserved                                                                                                       |

5.5.7 Examples of the I/O data

On the following pages you will find typical examples of the I/O data as per the FHPP Standard.:

- 1. Record selection: Create ready status
- 2. Direct mode: Create ready status
- 3. Fault handling
- 4. Homing
- 5. Record selection: Positioning mode
- 6. Direct mode: Positioning mode
- 7. Direct mode: Force mode



A description of the finite state machine of the SFC-DC can be found in chapter 5.7.

Safeguard device control

| Step/<br>description                                    | O data |      |       |       |      |       |       |       |       | I data |      |       |         |      |       |      |      |       |
|---------------------------------------------------------|--------|------|-------|-------|------|-------|-------|-------|-------|--------|------|-------|---------|------|-------|------|------|-------|
|                                                         | Byte   | B7   | B6    | B5    | B4   | B3    | B2    | B1    | B0    | Byte   | B7   | B6    | B5      | B4   | B3    | B2   | B1   | B0    |
| 0.1 Device control<br>HMI = on                          | Byte 1 | OPM2 | OPM1  | LOCK  | –    | RESET | BRAKE | STOP  | ENABL | Byte 1 | OPM2 | OPM1  | FCT/... | VLOA | FAULT | WARN | OPEN | ENABL |
|                                                         | CCON   | 0    | 0     | 0     | 0    | 0     | x     | 0     | 0     | SCON   | 0    | 0     | 1       | 1    | 0     | 0    | 0    | 0     |
|                                                         | Byte 2 | –    | CLEAR | TEACH | JOGN | JOGP  | HOM   | START | HALT  | Byte 2 | REF  | STILL | DEV     | MOV  | TEACH | MC   | ACK  | HALT  |
|                                                         | CPOS   | 0    | 0     | 0     | 0    | 0     | 0     | 0     | 0     | SPOS   | 0    | 0     | 0       | 0    | 0     | 1    | 0    | 0     |
| 0: Logic 0<br>1: 1 Signal<br>x: Not relevant (optional) |        |      |       |       |      |       |       |       |       |        |      |       |         |      |       |      |      |       |

Tab. 5/6: I/O data “Device control active”

Device control via the control panel or the Festo Configuration Tool is activated. To control the SFC-DC via the fieldbus interface, device control by the FCT/MMI must first be deactivated.

## 1. Record selection: Create ready status

- 1.1 Basic status of the drive when the supply voltage has been switched on.  
→ Step 1.2 or 1.3
- 1.2 Disable device control by FCT/MMI.  
Optionally, assuming of device control by the FCT/MMI can be disabled with CCON.B5 = 1 (LOCK).  
→ Step 1.3
- 1.3 Enable drive (Record select)  
→ Homing: Example 4, Tab. 5/10

| Step/<br>description                                            | O data |      |       |       |      |       |       |       |       | I data |      |       |         |      |       |      |      |       |
|-----------------------------------------------------------------|--------|------|-------|-------|------|-------|-------|-------|-------|--------|------|-------|---------|------|-------|------|------|-------|
|                                                                 | Byte   | B7   | B6    | B5    | B4   | B3    | B2    | B1    | B0    | Byte   | B7   | B6    | B5      | B4   | B3    | B2   | B1   | B0    |
| 1.1 Basic status<br><br>(Device control<br>HMI = off)           | Byte 1 | OPM2 | OPM1  | LOCK  | –    | RESET | BRAKE | STOP  | ENABL | Byte 1 | OPM2 | OPM1  | FCT/... | VLOA | FAULT | WARN | OPEN | ENABL |
|                                                                 | CCON   | 0    | 0     | 0     | 0    | 0     | x     | 0     | 0     | SCON   | 0    | 0     | 0       | 1    | 0     | 0    | 0    | 0     |
|                                                                 | Byte 2 | –    | CLEAR | TEACH | JOGN | JOGP  | HOM   | START | HALT  | Byte 2 | REF  | STILL | DEV     | MOV  | TEACH | MC   | ACK  | HALT  |
|                                                                 | CPOS   | 0    | 0     | 0     | 0    | 0     | 0     | 0     | 0     | SPOS   | 0    | 0     | 0       | 0    | 0     | 1    | 0    | 0     |
| 1.2 Disable device<br>control by FCT/MMI                        | Byte 1 | OPM2 | OPM1  | LOCK  | –    | RESET | BRAKE | STOP  | ENABL | Byte 1 | OPM2 | OPM1  | FCT/... | VLOA | FAULT | WARN | OPEN | ENABL |
|                                                                 | CCON   | x    | x     | 1     | 0    | x     | x     | x     | x     | SCON   | x    | x     | 0       | x    | x     | x    | x    | x     |
|                                                                 | Byte 2 | –    | CLEAR | TEACH | JOGN | JOGP  | HOM   | START | HALT  | Byte 2 | REF  | STILL | DEV     | MOV  | TEACH | MC   | ACK  | HALT  |
|                                                                 | CPOS   | 0    | x     | x     | x    | x     | x     | x     | x     | SPOS   | x    | x     | x       | x    | x     | x    | x    | x     |
| 1.3 Enable drive,<br>enable operation<br><br>(Record selection) | Byte 1 | OPM2 | OPM1  | LOCK  | –    | RESET | BRAKE | STOP  | ENABL | Byte 1 | OPM2 | OPM1  | FCT/... | VLOA | FAULT | WARN | OPEN | ENABL |
|                                                                 | CCON   | 0    | 0     | x     | 0    | 0     | x     | 1     | 1     | SCON   | 0    | 0     | 0       | 1    | 0     | 0    | 1    | 1     |
|                                                                 | Byte 2 | –    | CLEAR | TEACH | JOGN | JOGP  | HOM   | START | HALT  | Byte 2 | REF  | STILL | DEV     | MOV  | TEACH | MC   | ACK  | HALT  |
|                                                                 | CPOS   | 0    | 0     | 0     | 0    | 0     | 0     | 0     | 1     | SPOS   | 0    | 0     | 0       | 0    | 0     | 1    | 0    | 1     |
| 0: Logic 0<br>1: 1 Signal<br>x: Not relevant (optional)         |        |      |       |       |      |       |       |       |       |        |      |       |         |      |       |      |      |       |

Tab. 5/7: I/O data “Record selection: Establish readiness to operate”



If there are malfunctions after switching on or after setting CCON.B0 (ENABLE):

→ Fault handling: see example 3, Tab. 5/9

## 5. Commissioning

### 2. Direct mode: Create ready status

- 2.1 Basic status of the drive when the supply voltage has been switched on.  
→ Step 2.2 or 2.3
- 2.2 Disable device control by FCT/MMI.  
Optionally, assuming of device control by the FCT/MMI can be disabled with CCON.B5 = 1 (LOCK).  
→ Step 2.3
- 2.3 Enable drive. (Direct mode)  
→ Homing: Example 4, Tab. 5/10

| Step/<br>description                                       | O data |      |       |       |      |       |       |       |       | I data |      |       |         |      |       |      |      |       |
|------------------------------------------------------------|--------|------|-------|-------|------|-------|-------|-------|-------|--------|------|-------|---------|------|-------|------|------|-------|
|                                                            | Byte   | B7   | B6    | B5    | B4   | B3    | B2    | B1    | B0    | Byte   | B7   | B6    | B5      | B4   | B3    | B2   | B1   | B0    |
| 2.1 Basic status<br><br>(Device control<br>HMI = off)      | Byte 1 | OPM2 | OPM1  | LOCK  | –    | RESET | BRAKE | STOP  | ENABL | Byte 1 | OPM2 | OPM1  | FCT/... | VLOA | FAULT | WARN | OPEN | ENABL |
|                                                            | CCON   | 0    | 0     | 0     | 0    | 0     | x     | 0     | 0     | SCON   | 0    | 0     | 0       | 1    | 0     | 0    | 0    | 0     |
|                                                            | Byte 2 | –    | CLEAR | TEACH | JOGN | JOGP  | HOM   | START | HALT  | Byte 2 | REF  | STILL | DEV     | MOV  | TEACH | MC   | ACK  | HALT  |
|                                                            | CPOS   | 0    | 0     | 0     | 0    | 0     | 0     | 0     | 0     | SPOS   | 0    | 0     | 0       | 0    | 0     | 1    | 0    | 0     |
| 2.2 Disable device<br>control by FCT/MMI                   | Byte 1 | OPM2 | OPM1  | LOCK  | –    | RESET | BRAKE | STOP  | ENABL | Byte 1 | OPM2 | OPM1  | FCT/... | VLOA | FAULT | WARN | OPEN | ENABL |
|                                                            | CCON   | x    | x     | 1     | 0    | x     | x     | x     | x     | SCON   | x    | x     | 0       | x    | x     | x    | x    | x     |
|                                                            | Byte 2 | –    | CLEAR | TEACH | JOGN | JOGP  | HOM   | START | HALT  | Byte 2 | REF  | STILL | DEV     | MOV  | TEACH | MC   | ACK  | HALT  |
|                                                            | CPOS   | 0    | x     | x     | x    | x     | x     | x     | x     | SPOS   | x    | x     | x       | x    | x     | x    | x    | x     |
| 2.3 Enable drive,<br>enable operation<br><br>(Direct mode) | Byte 1 | OPM2 | OPM1  | LOCK  | –    | RESET | BRAKE | STOP  | ENABL | Byte 1 | OPM2 | OPM1  | FCT/... | VLOA | FAULT | WARN | OPEN | ENABL |
|                                                            | CCON   | 0    | 1     | x     | 0    | 0     | x     | 1     | 1     | SCON   | 0    | 1     | 0       | 1    | 0     | 0    | 1    | 1     |
|                                                            | Byte 2 | –    | CLEAR | TEACH | JOGN | JOGP  | HOM   | START | HALT  | Byte 2 | REF  | STILL | DEV     | MOV  | TEACH | MC   | ACK  | HALT  |
|                                                            | CPOS   | 0    | 0     | 0     | 0    | 0     | 0     | 0     | 1     | SPOS   | 0    | 0     | 0       | 0    | 0     | 1    | 0    | 1     |
| 0: Logic 0<br>1: 1 Signal<br>x: Not relevant (optional)    |        |      |       |       |      |       |       |       |       |        |      |       |         |      |       |      |      |       |

Tab. 5/8: Control and status bytes “Create readiness to operate – Direct mode”



If there are malfunctions after switching on or after setting CCON.B0 (ENABLE):  
→ Fault handling: see example 3, Tab. 5/9



### 3. Fault handling

Description of errors and warnings see chapter 6.5.

- 3.1 An error is shown with SCON.B3 (FAULT).  
→ Positioning can no longer be undertaken.
- 3.2 A warning is shown with SCON.B2 (WARN).  
→ Positioning can still be undertaken.
- 3.3 Acknowledge fault with positive edge at CCON.B3 (RESET).
  - Fault bit SCON.B3 (FAULT) or SCON.B2 (WARN) is reset.
  - SPOS.B2 (MC) will be set.
  - Drive is ready to operate.
- 3.4 Quit fault with negative edge at CCON.B0 (ENABLE).
  - Fault bit SCON.B3 (FAULT) or SCON.B2 (WARN) is reset.
  - SPOS.B2 (MC) will be set.
  - Establish readiness to operate again  
(see examples 1, Tab. 5/7 and 2, Tab. 5/8)

5. Commissioning

| Step/<br>description                                                                            | O data |      |       |       |      |       |       |       |       | I data |      |       |         |      |       |      |      |       |
|-------------------------------------------------------------------------------------------------|--------|------|-------|-------|------|-------|-------|-------|-------|--------|------|-------|---------|------|-------|------|------|-------|
|                                                                                                 | Byte   | B7   | B6    | B5    | B4   | B3    | B2    | B1    | B0    | Byte   | B7   | B6    | B5      | B4   | B3    | B2   | B1   | B0    |
| 3.1 Error                                                                                       | Byte 1 | OPM2 | OPM1  | LOCK  | –    | RESET | BRAKE | STOP  | ENABL | Byte 1 | OPM2 | OPM1  | FCT/... | VLOA | FAULT | WARN | OPEN | ENABL |
|                                                                                                 | CCON   | x    | x     | x     | 0    | x     | x     | x     | x     | SCON   | x    | x     | x       | x    | 1     | x    | x    | x     |
|                                                                                                 | Byte 2 | –    | CLEAR | TEACH | JOGN | JOGP  | HOM   | START | HALT  | Byte 2 | REF  | STILL | DEV     | MOV  | TEACH | MC   | ACK  | HALT  |
|                                                                                                 | CPOS   | 0    | x     | x     | x    | x     | x     | x     | x     | SPOS   | x    | x     | x       | x    | x     | 0    | x    | x     |
| 3.2 Warning                                                                                     | Byte 1 | OPM2 | OPM1  | LOCK  | –    | RESET | BRAKE | STOP  | ENABL | Byte 1 | OPM2 | OPM1  | FCT/... | VLOA | FAULT | WARN | OPEN | ENABL |
|                                                                                                 | CCON   | x    | x     | x     | 0    | x     | x     | x     | x     | SCON   | x    | x     | x       | x    | x     | 1    | x    | x     |
|                                                                                                 | Byte 2 | –    | CLEAR | TEACH | JOGN | JOGP  | HOM   | START | HALT  | Byte 2 | REF  | STILL | DEV     | MOV  | TEACH | MC   | ACK  | HALT  |
|                                                                                                 | CPOS   | 0    | x     | x     | x    | x     | x     | x     | x     | SPOS   | x    | x     | x       | x    | x     | 0    | x    | x     |
| 3.3 Acknowledge<br>fault                                                                        | Byte 1 | OPM2 | OPM1  | LOCK  | –    | RESET | BRAKE | STOP  | ENABL | Byte 1 | OPM2 | OPM1  | FCT/... | VLOA | FAULT | WARN | OPEN | ENABL |
|                                                                                                 | CCON   | 0    | x     | x     | 0    | F     | x     | x     | 1     | SCON   | 0    | x     | 0       | 1    | 0     | 0    | 0    | 0     |
|                                                                                                 | Byte 2 | –    | CLEAR | TEACH | JOGN | JOGP  | HOM   | START | HALT  | Byte 2 | REF  | STILL | DEV     | MOV  | TEACH | MC   | ACK  | HALT  |
| with CCON.B3<br>(RESET)                                                                         | CPOS   | 0    | 0     | 0     | 0    | 0     | 0     | x     | x     | SPOS   | x    | 0     | 0       | 0    | 0     | 1    | 0    | 1     |
| 3.4 Acknowledge<br>fault                                                                        | Byte 1 | OPM2 | OPM1  | LOCK  | –    | RESET | BRAKE | STOP  | ENABL | Byte 1 | OPM2 | OPM1  | FCT/... | VLOA | FAULT | WARN | OPEN | ENABL |
|                                                                                                 | CCON   | 0    | x     | x     | 0    | 0     | x     | x     | N     | SCON   | 0    | x     | 0       | 1    | 0     | 0    | x    | 0     |
|                                                                                                 | Byte 2 | –    | CLEAR | TEACH | JOGN | JOGP  | HOM   | START | HALT  | Byte 2 | REF  | STILL | DEV     | MOV  | TEACH | MC   | ACK  | HALT  |
| with CCON.B0<br>(ENABLE)                                                                        | CPOS   | 0    | 0     | 0     | 0    | 0     | 0     | x     | x     | SPOS   | x    | 0     | 0       | 0    | 0     | 1    | x    | x     |
| 0: Logic 0<br>1: 1 Signal<br>x: Not relevant (optional)<br>F: Positive edge<br>N: Negative edge |        |      |       |       |      |       |       |       |       |        |      |       |         |      |       |      |      |       |

Tab. 5/9: I/O data “Fault handling”

## 5. Commissioning

### 4. Homing (requires status 1.4 or 1.5)

- 4.1 A positive edge at CPOS.B2 (HOM, Start homing) starts the homing. The start is confirmed with SPOS.B1 (Quit Start) as long as CPOS.B2 (HOM) is set.
- 4.2 Movement of the axis is shown with SPOS.B4 (MOV, Axis moves).
- 4.3 After a successful homing run, SPOS.B2 (MC, Motion Complete) and SPOS.B7 (REF) are set.

| Step/<br>description                                                        | O data |      |       |       |      |       |          |       |       | I data |          |       |         |      |       |          |          |       |
|-----------------------------------------------------------------------------|--------|------|-------|-------|------|-------|----------|-------|-------|--------|----------|-------|---------|------|-------|----------|----------|-------|
|                                                                             | Byte   | B7   | B6    | B5    | B4   | B3    | B2       | B1    | B0    | Byte   | B7       | B6    | B5      | B4   | B3    | B2       | B1       | B0    |
| 4.1 Start homing                                                            | Byte 1 | OPM2 | OPM1  | LOCK  | –    | RESET | BRAKE    | STOP  | ENABL | Byte 1 | OPM2     | OPM1  | FCT/... | VLOA | FAULT | WARN     | OPEN     | ENABL |
|                                                                             | CCON   | 0    | x     | x     | 0    | 0     | x        | 1     | 1     | SCON   | 0        | x     | 0       | 1    | 0     | 0        | 1        | 1     |
| 4.2 Homing is running                                                       | Byte 2 | –    | CLEAR | TEACH | JOGN | JOGP  | HOM      | START | HALT  | Byte 2 | REF      | STILL | DEV     | MOV  | TEACH | MC       | ACK      | HALT  |
|                                                                             | CPOS   | 0    | 0     | 0     | 0    | 0     | <b>F</b> | 0     | 1     | SPOS   | 0        | 0     | 0       | 0    | 0     | <b>0</b> | <b>1</b> | 1     |
| 4.3 Homing is finished                                                      | Byte 1 | OPM2 | OPM1  | LOCK  | –    | RESET | BRAKE    | STOP  | ENABL | Byte 1 | OPM2     | OPM1  | FCT/... | VLOA | FAULT | WARN     | OPEN     | ENABL |
|                                                                             | CCON   | 0    | x     | x     | 0    | 0     | x        | 1     | 1     | SCON   | 0        | x     | 0       | 1    | 0     | 0        | 1        | 1     |
| 4.3 Homing is finished                                                      | Byte 2 | –    | CLEAR | TEACH | JOGN | JOGP  | HOM      | START | HALT  | Byte 2 | REF      | STILL | DEV     | MOV  | TEACH | MC       | ACK      | HALT  |
|                                                                             | CPOS   | 0    | 0     | 0     | 0    | 0     | <b>0</b> | 0     | 1     | SPOS   | <b>1</b> | 0     | 0       | 0    | 0     | <b>1</b> | 0        | 1     |
| 0: Logic 0<br>1: 1 Signal<br>x: Not relevant (optional)<br>F: Positive edge |        |      |       |       |      |       |          |       |       |        |          |       |         |      |       |          |          |       |

Tab. 5/10: I/O data “homing”



If there are faults during homing:  
 → Fault handling: see example 3, Tab. 5/9

### 5. Record selection: Positioning mode (requires status 1.3/2.3 and 4.)

When the readiness to operate is established and the homing has been carried out, a positioning job can be started (sequence defined by steps 5.1 ... 5.4):

- 5.1 Preselect record number: Byte 3 of the output data
  - 0 = Reference travel
  - 1 ... 31 = Programmable positioning records
- 5.2 With CPOS.B1 (START, Start job) the preselected positioning job will be started. The start is confirmed with SPOS.B1 (Quit Start) as long as CPOS.B1 (START) is set.
- 5.3 Movement of the axis is shown with SPOS.B4 (MOV, Axis moves).
- 5.4 At the end of the positioning job, SPOS.B2 (MC, Motion Complete) will be set.

If there are faults during positioning:  
→ Fault handling: see example 3, Tab. 5/9



## 5. Commissioning

| Step/<br>description                                                        | O data        |                       |       |       |      |       |       |       |       | I data        |                                |       |         |      |       |      |      |       |
|-----------------------------------------------------------------------------|---------------|-----------------------|-------|-------|------|-------|-------|-------|-------|---------------|--------------------------------|-------|---------|------|-------|------|------|-------|
|                                                                             | Byte          | B7                    | B6    | B5    | B4   | B3    | B2    | B1    | B0    | Byte          | B7                             | B6    | B5      | B4   | B3    | B2   | B1   | B0    |
| 5.1 Preselect<br>record number<br>(byte 3)                                  | Byte 3        | Record number         |       |       |      |       |       |       |       | Byte 3        | Record number                  |       |         |      |       |      |      |       |
|                                                                             | Record<br>no. | Record no. (0 ... 31) |       |       |      |       |       |       |       | Record<br>no. | Previous record no. (0 ... 31) |       |         |      |       |      |      |       |
| 5.2 Start task                                                              | Byte 1        | OPM2                  | OPM1  | LOCK  | –    | RESET | BRAKE | STOP  | ENABL | Byte 1        | OPM2                           | OPM1  | FCT/... | VLOA | FAULT | WARN | OPEN | ENABL |
|                                                                             | CCON          | 0                     | 0     | x     | 0    | 0     | x     | 1     | 1     | SCON          | 0                              | 0     | 0       | 1    | 0     | 0    | 1    | 1     |
|                                                                             | Byte 2        | –                     | CLEAR | TEACH | JOGN | JOGP  | HOM   | START | HALT  | Byte 2        | REF                            | STILL | DEV     | MOV  | TEACH | MC   | ACK  | HALT  |
|                                                                             | CPOS          | 0                     | 0     | 0     | 0    | 0     | 0     | F     | 1     | SPOS          | 1                              | 0     | 0       | 0    | 0     | 0    | 1    | 1     |
| 5.3 Taskrunning                                                             | Byte 1        | OPM2                  | OPM1  | LOCK  | –    | RESET | BRAKE | STOP  | ENABL | Byte 1        | OPM2                           | OPM1  | FCT/... | VLOA | FAULT | WARN | OPEN | ENABL |
|                                                                             | CCON          | 0                     | 0     | x     | 0    | 0     | x     | 1     | 1     | SCON          | 0                              | 0     | 0       | 1    | 0     | 0    | 1    | 1     |
|                                                                             | Byte 2        | –                     | CLEAR | TEACH | JOGN | JOGP  | HOM   | START | HALT  | Byte 2        | REF                            | STILL | DEV     | MOV  | TEACH | MC   | ACK  | HALT  |
|                                                                             | CPOS          | 0                     | 0     | 0     | 0    | 0     | 0     | 1     | 1     | SPOS          | 1                              | 0     | 0       | 1    | 0     | 0    | 1    | 1     |
| 5.4 Task finished                                                           | Byte 3        | Record number         |       |       |      |       |       |       |       | Byte 3        | Record number                  |       |         |      |       |      |      |       |
|                                                                             | Record<br>no. | Record no. (0 ... 31) |       |       |      |       |       |       |       | Record<br>no. | Current record no. (0 ... 31)  |       |         |      |       |      |      |       |
|                                                                             | Byte 1        | OPM2                  | OPM1  | LOCK  | –    | RESET | BRAKE | STOP  | ENABL | Byte 1        | OPM2                           | OPM1  | FCT/... | VLOA | FAULT | WARN | OPEN | ENABL |
|                                                                             | CCON          | 0                     | 0     | x     | 0    | 0     | x     | 1     | 1     | SCON          | 0                              | 0     | 0       | 1    | 0     | 0    | 1    | 1     |
| 5.4 Task finished                                                           | Byte 2        | –                     | CLEAR | TEACH | JOGN | JOGP  | HOM   | START | HALT  | Byte 2        | REF                            | STILL | DEV     | MOV  | TEACH | MC   | ACK  | HALT  |
|                                                                             | CPOS          | 0                     | 0     | 0     | 0    | 0     | 0     | 0     | 1     | SPOS          | 1                              | 0     | 0       | 0    | 0     | 1    | 0    | 1     |
|                                                                             | Byte 5 ... 8  | Reserved              |       |       |      |       |       |       |       | Byte 5 ... 8  | Position                       |       |         |      |       |      |      |       |
|                                                                             | –             | Reserved              |       |       |      |       |       |       |       | Act.<br>pos.  | Actual position (increments)   |       |         |      |       |      |      |       |
| 0: Logic 0<br>1: 1 Signal<br>x: Not relevant (optional)<br>F: Positive edge |               |                       |       |       |      |       |       |       |       |               |                                |       |         |      |       |      |      |       |

Tab. 5/11: I/O data “Record selection: Positioning mode”

### 6. Direct mode: Positioning mode (requires status 1.3/2.3 and 4.)

When the readiness to operate is established and the homing has been carried out, a setpoint position must be preselected (sequence defined by steps 6.1 ... 6.4)

- 6.1 The setpoint position is transferred in increments in bytes 5 ... 8 of the output word.  
The nominal speed is transferred in % in byte 3  
(0 = no speed; 100 = max. speed).
- 6.2 With CPOS.B1 START (Start positioning job) the preselected positioning job will be started.  
The start is confirmed with SPOS.B1 (Quit Start) as long as CPOS.B1 (START) is set.
- 6.3 Movement of the axis is shown with SPOS.B4 (MOV, Axis moves).
- 6.4 At the end of the positioning job, SPOS.B2 (MC, Motion Complete) will be set.

If there are faults during positioning:  
→ Fault handling: see example 3, Tab. 5/9



## 5. Commissioning

| Step/<br>description                                                                                                                       | O data                         |                                                             |       |       |      |       |       |       |       | I data                    |                                                             |       |         |      |       |      |      |       |
|--------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|-------------------------------------------------------------|-------|-------|------|-------|-------|-------|-------|---------------------------|-------------------------------------------------------------|-------|---------|------|-------|------|------|-------|
|                                                                                                                                            | Byte                           | B7                                                          | B6    | B5    | B4   | B3    | B2    | B1    | B0    | Byte                      | B7                                                          | B6    | B5      | B4   | B3    | B2   | B1   | B0    |
| 6.1 Preselect position and speed (bytes 4 and 5 ... 8)                                                                                     | Byte 4<br>Speed                | Velocity<br>Speed preselection (0 ... 100 %)                |       |       |      |       |       |       |       | Byte 4<br>Speed           | Velocity<br>Speed feedback (0 ... 100 %)                    |       |         |      |       |      |      |       |
|                                                                                                                                            | Byte 5 ... 8<br>Set-point pos. | Position<br>Target position (increments), see chapter 5.5.2 |       |       |      |       |       |       |       | Byte 5 ... 8<br>Act. pos. | Position<br>Actual position (increments), see chapter 5.5.2 |       |         |      |       |      |      |       |
| 6.2 Start task                                                                                                                             | Byte 1<br>CCON                 | OPM2                                                        | OPM1  | LOCK  | –    | RESET | BRAKE | STOP  | ENABL | Byte 1<br>SCON            | OPM2                                                        | OPM1  | FCT/... | VLOA | FAULT | WARN | OPEN | ENABL |
|                                                                                                                                            | Byte 2<br>CPOS                 | –                                                           | CLEAR | TEACH | JOGN | JOGP  | HOM   | START | HALT  | Byte 2<br>SPOS            | REF                                                         | STILL | DEV     | MOV  | TEACH | MC   | ACK  | HALT  |
|                                                                                                                                            | Byte 3<br>CDIR                 | FUNC                                                        | FAST  | XLIM  | VLIM | CONT  | COM2  | COM1  | ABS   | Byte 3<br>SDIR            | FUNC                                                        | FAST  | XLIM    | VLIM | CONT  | COM2 | COM1 | ABS   |
| 6.3. Taskrunning                                                                                                                           | Byte 1<br>CCON                 | OPM2                                                        | OPM1  | LOCK  | –    | RESET | BRAKE | STOP  | ENABL | Byte 1<br>SCON            | OPM2                                                        | OPM1  | FCT/... | VLOA | FAULT | WARN | OPEN | ENABL |
|                                                                                                                                            | Byte 2<br>CPOS                 | –                                                           | CLEAR | TEACH | JOGN | JOGP  | HOM   | START | HALT  | Byte 2<br>SPOS            | REF                                                         | STILL | DEV     | MOV  | TEACH | MC   | ACK  | HALT  |
| 6.4 Task finished                                                                                                                          | Byte 1<br>CCON                 | OPM2                                                        | OPM1  | LOCK  | –    | RESET | BRAKE | STOP  | ENABL | Byte 1<br>SCON            | OPM2                                                        | OPM1  | FCT/... | VLOA | FAULT | WARN | OPEN | ENABL |
|                                                                                                                                            | Byte 2<br>CPOS                 | –                                                           | CLEAR | TEACH | JOGN | JOGP  | HOM   | START | HALT  | Byte 2<br>SPOS            | REF                                                         | STILL | DEV     | MOV  | TEACH | MC   | ACK  | HALT  |
| 0: Logic 0<br>1: 1 Signal<br>x: Not relevant (optional)<br>F: Positive edge<br>S: Positioning condition:      0 = absolute<br>1 = relative |                                |                                                             |       |       |      |       |       |       |       |                           |                                                             |       |         |      |       |      |      |       |

Tab. 5/12: I/O data “Direct mode: Positioning mode”

### 7. Direct mode: Force mode (requires status 1.3/2.3 and 4.)

When the readiness to operate is established and the homing has been carried out, a setpoint must be specified and the force mode must be prepared (only for axis type gripper HGPLE, GEH).

The resulting force is heavily dependent on the speed used to position the workpiece (clearance to the workpiece, parametrisation of speed limits).

- 7.1 Specify the setpoint value in % of the nominal motor current. (Note frictional influences of the connected axis).
- 7.2 Prepare force mode Set bit CDIR.B1 (COM1, Control mode) and if desired set bit CDIR.B5 (XLIM, deactivate stroke limit) for the stroke limitation.
- 7.3 Start the job with CPOS.B1 START. The start is confirmed with SPOS.B1 (Quit Start) as long as CPOS.B1 (START) is set.
- 7.4 or 7.5  
Depending on whether the setpoint value is reached or not, the relevant bits in the status will be set.
- 7.6 The job will be finished automatically when the stroke limit or software end position is reached. Switching is made again to position control.
- 7.7 The job can be discontinued by the controller e.g. B. with CCON.B1 (STOP).

#### **Note**

A change of the setpoint value for force mode is possible only after the last specification (MC) is reached by a new starting edge!

If there are faults during force mode:  
see example 3, Tab. 5/9 Fault handling.

## 5. Commissioning

[illegible]

## 5. Commissioning

| Step/<br>description                                                                                                                                                        | O data |      |       |       |      |       |       |       |       | I data |      |       |         |      |       |      |      |       |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|-------|-------|------|-------|-------|-------|-------|--------|------|-------|---------|------|-------|------|------|-------|
|                                                                                                                                                                             | Byte   | B7   | B6    | B5    | B4   | B3    | B2    | B1    | B0    | Byte   | B7   | B6    | B5      | B4   | B3    | B2   | B1   | B0    |
| 7.5 Task running<br>(setpoint value reached)                                                                                                                                | Byte 1 | OPM2 | OPM1  | LOCK  | –    | RESET | BREAK | STOP  | ENABL | Byte 1 | OPM2 | OPM1  | FCT/... | VLOA | FAULT | WARN | OPEN | ENABL |
|                                                                                                                                                                             | CCON   | 0    | 1     | x     | x    | 0     | x     | 1     | 1     | SCON   | 0    | 1     | 0       | 1    | 0     | 0    | 1    | 1     |
|                                                                                                                                                                             | Byte 2 | –    | CLEAR | TEACH | JOGN | JOGP  | HOM   | START | HALT  | Byte 2 | REF  | STILL | DEV     | MOV  | TEACH | MC   | ACK  | HALT  |
|                                                                                                                                                                             | CPOS   | 0    | 0     | 0     | 0    | 0     | 0     | x     | 1     | SPOS   | 1    | 0     | 0       | 0    | 0     | 1    | x    | 1     |
|                                                                                                                                                                             | Byte 3 | FUNC | FAST  | XUM   | –    | CONT  | COM2  | COM1  | ABS   | Byte 3 | FUNC | FAST  | XUM     | VUM  | CONT  | COM2 | COM1 | ABS   |
|                                                                                                                                                                             | CDIR   | 0    | 0     | S     | x    | 0     | 0     | 1     | 0     | SDIR   | 0    | 0     | 0       | 0    | 0     | 0    | 1    | 0     |
| 7.6 Job discontinued<br>(stroke limit or software end position reached)                                                                                                     | Byte 1 | OPM2 | OPM1  | LOCK  | –    | RESET | BREAK | STOP  | ENABL | Byte 1 | OPM2 | OPM1  | FCT/... | VLOA | FAULT | WARN | OPEN | ENABL |
|                                                                                                                                                                             | CCON   | 0    | 1     | x     | x    | 0     | x     | 1     | 1     | SCON   | 0    | 1     | 0       | 1    | 0     | 0    | 1    | 1     |
|                                                                                                                                                                             | Byte 2 | –    | CLEAR | TEACH | JOGN | JOGP  | HOM   | START | HALT  | Byte 2 | REF  | STILL | DEV     | MOV  | TEACH | MC   | ACK  | HALT  |
|                                                                                                                                                                             | CPOS   | 0    | 0     | 0     | 0    | 0     | 0     | x     | 1     | SPOS   | 1    | 0     | 0       | 0    | 0     | 1    | x    | 1     |
|                                                                                                                                                                             | Byte 3 | FUNC | FAST  | XUM   | –    | CONT  | COM2  | COM1  | ABS   | Byte 3 | FUNC | FAST  | XUM     | VUM  | CONT  | COM2 | COM1 | ABS   |
|                                                                                                                                                                             | CDIR   | 0    | 0     | S     | x    | 0     | 0     | 1     | 0     | SDIR   | 0    | 0     | 1       | 0    | 0     | 0    | 0    | 0     |
| 7.7 Stop job<br>(e.g. with STOP)                                                                                                                                            | Byte 1 | OPM2 | OPM1  | LOCK  | –    | RESET | BREAK | STOP  | ENABL | Byte 1 | OPM2 | OPM1  | FCT/... | VLOA | FAULT | WARN | OPEN | ENABL |
|                                                                                                                                                                             | CCON   | 0    | 1     | x     | x    | 0     | x     | 0     | 1     | SCON   | 0    | 1     | 0       | 1    | 0     | 0    | 0    | 1     |
|                                                                                                                                                                             | Byte 2 | –    | CLEAR | TEACH | JOGN | JOGP  | HOM   | START | HALT  | Byte 2 | REF  | STILL | DEV     | MOV  | TEACH | MC   | ACK  | HALT  |
|                                                                                                                                                                             | CPOS   | 0    | 0     | 0     | 0    | 0     | 0     | x     | 1     | SPOS   | 1    | 0     | 0       | 0    | 0     | 1    | x    | 1     |
|                                                                                                                                                                             | Byte 3 | FUNC | FAST  | XUM   | –    | CONT  | COM2  | COM1  | ABS   | Byte 3 | FUNC | FAST  | XUM     | VUM  | CONT  | COM2 | COM1 | ABS   |
|                                                                                                                                                                             | CDIR   | 0    | 0     | S     | x    | 0     | 0     | 1     | 0     | SDIR   | 0    | 0     | 0       | 0    | 0     | 0    | 0    | 0     |
| O: Logic 0<br>1: 1 Signal<br>x: Not relevant (optional)<br>F: Positive edge<br>S: Path limitation (stroke limit):    0 = Stroke limit active<br>1 = Stroke limit not active |        |      |       |       |      |       |       |       |       |        |      |       |         |      |       |      |      |       |

Tab. 5/13: I/O data Direct mode: Force mode

### 5.6 Sequence control as per FHPP standard

#### 5.6.1 Homing



Information on homing, reference coordinates and calculation rules for the reference system are provided in chapter 1.6.

In the case of electric drives with the SFC-DC, after the operating voltage is switched on, it is a requirement that a homing run is completed before a positioning job can be carried out (the parameter “homing required” – PNU 1014 – must = 1).

The drive homes against a stop or a reference switch. An increase in the motor current indicates that a stop has been reached. As the drive must not continuously reference against the stop, it must move at least one millimetre back into the stroke range.

#### **Sequence:**

1. Search for the reference point in accordance with the configured method.
2. Move relative to the reference point around the “Offset axis zero point”.
3. Set at axis zero point:  
Current position = 0 – project zero offset.

## 5. Commissioning

| Overview of parameters involved (see also appendix B.2.15) |                                                                                                                                 |     |      |       |
|------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|-----|------|-------|
| Parameters involved                                        | Description                                                                                                                     | FCT | PNU  | CI    |
|                                                            | Axis zero point offset                                                                                                          | x   | 1010 | 607Ch |
|                                                            | Homing method (permitted: 7, 11, -18, -17)                                                                                      | x   | 1011 | 6098h |
|                                                            | Homing speeds                                                                                                                   | x   | 1012 | 6099h |
|                                                            | Reference travel required                                                                                                       | –   | 1014 | 23F6h |
|                                                            | Homing maximum torque                                                                                                           | x   | 1015 | 23F7h |
| <b>Start (FHPP)</b>                                        | CPOS.B2 = Positive edge: Start homing                                                                                           |     |      |       |
| <b>Acknowledgement (FHPP)</b>                              | SPOS.B1 = Positive edge: Acknowledge start<br>SPOS.B7 = Drive referenced                                                        |     |      |       |
| <b>Prerequisites</b>                                       | Device control by PLC/fieldbus<br>Controller must be in status “Operation enabled”<br>There must not be any command for jogging |     |      |       |

Tab. 5/14: Parameters involved in homing

| Homing methods <sup>1)</sup>                                                |     |                                                                                                                                                                              |
|-----------------------------------------------------------------------------|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Hex                                                                         | Dec | Description                                                                                                                                                                  |
| 07h                                                                         | 7   | Search for reference switch in positive direction. The reference position lies at the first index pulse in the negative direction; the reference switch supplies a 0-signal. |
| 08h                                                                         | 11  | Search for reference switch in negative direction. The reference position lies at the first index pulse in the positive direction; the reference switch supplies a 0-signal. |
| EFh                                                                         | -17 | Search for negative stop. The point found is the reference position. As the axis must not stand still at the stop, the offset axis zero point must be ≠ 0.                   |
| EEh                                                                         | -18 | Search for positive stop. The point found is the reference position. As the axis must not stand still at the stop, the offset axis zero point must be ≠ 0.                   |
| <sup>1)</sup> Detailed description of the homing methods see chapter 5.2.2. |     |                                                                                                                                                                              |

Tab. 5/15: Overview of homing methods

### 5.6.2 Jog mode

In the status “Operation enabled” the drive can be moved to the left/right by jogging. This function is usually used for:

- Moving to teach positions.
- Moving the drive out of the way (e.g. after a system fault).
- Manual motion as a normal operating mode (manual feed).

#### **Sequence**

1. When one of the signals “Jog left / Jog right” is set, the drive starts to move slowly. Due to the slow speed, a position can be defined very accurately.
2. If the signal remains set for longer than the configured “phase 1 duration”, the speed is increased until the configured maximum speed is reached. In this way large strokes can be traversed quickly
3. If the signal changes to 0, the drive is braked with the pre-set maximum deceleration.
4. The drive stops automatically if it reaches a software end position. The software end position is not exceeded, the path for stopping depends on the ramp set. The jog mode can be exited here with Jogging = 0.

5. Commissioning

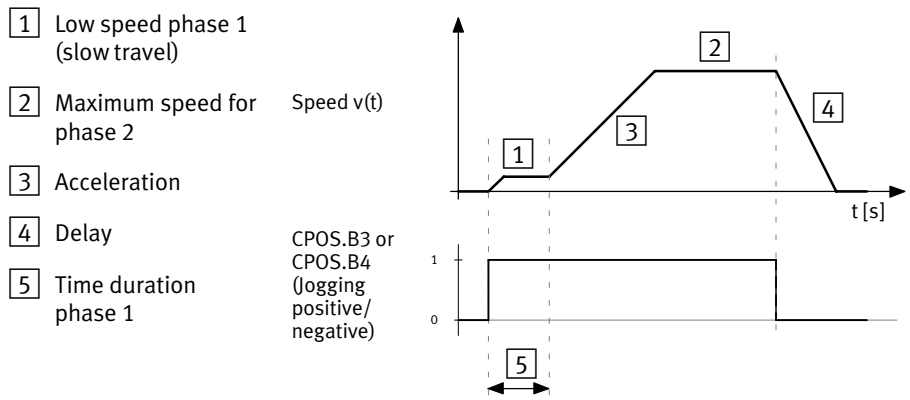


Fig. 5/4: Sequence diagram for jog mode

| Overview of parameters involved (see appendix B.2.9) |                                                                                                       |     |     |         |
|------------------------------------------------------|-------------------------------------------------------------------------------------------------------|-----|-----|---------|
| Parameters involved                                  | Description                                                                                           | FCT | PNU | CI      |
|                                                      | Jog mode speed phase 2 in speed unit (inc/s)                                                          | x   | 531 | 20ED/21 |
|                                                      | Jog mode acceleration in acceleration unit (inc/s <sup>2</sup> )                                      | x   | 532 | 20EE/21 |
|                                                      | Jog mode deceleration in deceleration unit (inc/s <sup>2</sup> )                                      | x   | 533 | 20EF/21 |
|                                                      | Jog mode duration phase 1 (T1) in ms                                                                  | x   | 534 | 20E9/21 |
| Start (FHPP)                                         | CPOS.B3 = Positive edge: Jog positive (forwards)<br>CPOS.B4 = Positive edge: Jog negative (backwards) |     |     |         |
| Acknowledgement (FHPP)                               | SPOS.B4 = 1: Drive moving<br>SPOS.B2 = 0: (Motion Complete)                                           |     |     |         |
| Prerequisites                                        | Device control by PLC/fieldbus<br>Controller must be in status “Operation enabled”                    |     |     |         |

Tab. 5/16: Parameters involved in jogging mode

### 5.6.3 Teaching via fieldbus

Position values can be taught via the fieldbus.  
Previously taught position values will then be overwritten.

#### Sequence

1. The drive will be moved to the desired position by the jogging mode or manually. This can be accomplished in jog mode by positioning or by moving by hand in the status “Drive blocked”.
2. The user must make sure that the desired parameter is selected. For this the parameter “Teach target” and, if applicable, the correct record address must be entered.

| Teach target<br>(PNU 520) | Is taught                                                                                                                                                              |
|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| = 1 (specification)       | Setpoint position in the positioning record.<br>– Record selection:<br>Positioning record after control byte 3<br>– Direct mode:<br>Positioning record after PNU = 400 |
| = 2                       | Axis zero point                                                                                                                                                        |
| = 3                       | Project zero point                                                                                                                                                     |
| = 4                       | Lower software end position                                                                                                                                            |
| = 5                       | Upper software end position                                                                                                                                            |

Tab. 5/17: Overview of teach targets

3. Teaching takes place via the handshake of the bits in the control and status bytes CPOS/SPOS:

5. Commissioning

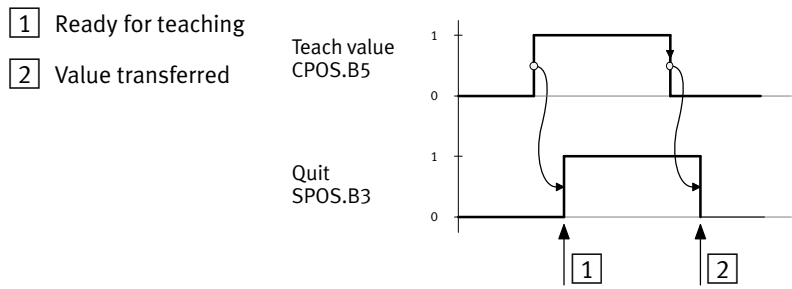


Fig. 5/5: Handshake during teaching



**Note:**  
The drive must not stand still for teaching. However, a speed of 1 m/s means that the actual position changes by 1 mm every millisecond. With the usual cycle times of the PLC + fieldbus + motor controller there will be inaccuracies of several millimetres even at a speed of only 100 mm/s.

| Overview of parameters involved (see appendix B.2.8 and B.2.9)                              |                                                                                    |      |     |       |
|---------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|------|-----|-------|
| Parameters involved                                                                         | Description                                                                        | FCT  | PNU | CI    |
|                                                                                             | Teach target                                                                       | – 1) | 520 | 21FEh |
|                                                                                             | Record number                                                                      | – 1) | 400 | 2190h |
| Start (FHPP)                                                                                | SPOS.B5 = Falling edge: Teach value                                                |      |     |       |
| Acknowledgement (FHPP)                                                                      | SPOS.B2 = 1: Value transferred                                                     |      |     |       |
| Prerequisites                                                                               | Device control by PLC/fieldbus<br>Controller must be in status “Operation enabled” |      |     |       |
| 1) Teaching is made possible in the Festo Configuration Tool by means of special functions. |                                                                                    |      |     |       |

Tab. 5/18: Teach parameters involved

### 5.6.4 Record selection (positioning mode)

A record can be started in the status “Operation enabled.”  
This function is usually used for:

- Moving to any position in the record list by the PLC,
- processing a positioning profile by linking records
- known target positions that seldom change (recipe change).

#### **Sequence**

1. Set the desired record number in the output data of the master. Until the start, the controller replies with the number of the record last processed.
2. With a rising edge at START (CPOS.B1) the controller accepts the record number and starts the positioning job.
3. The controller signals with the rising edge at Quit Start that the PLC output data has been accepted and that the positioning job is now active. The positioning command will be processed irrespective of whether Start (CPOS.B1) has been reset to zero or not.
4. When the record is concluded, MC (SPOS.B2) is set.

5. Commissioning

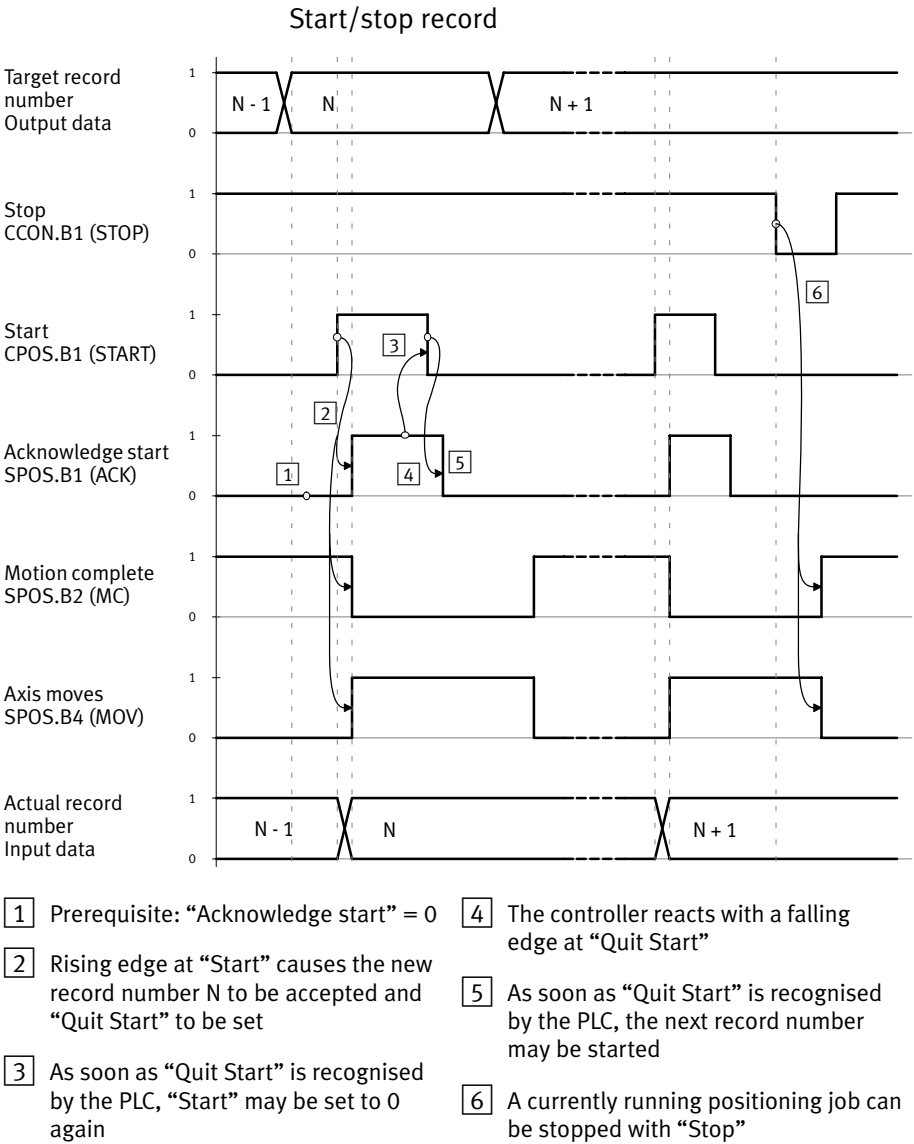


Fig. 5/6: Sequence diagram Start/Stop record

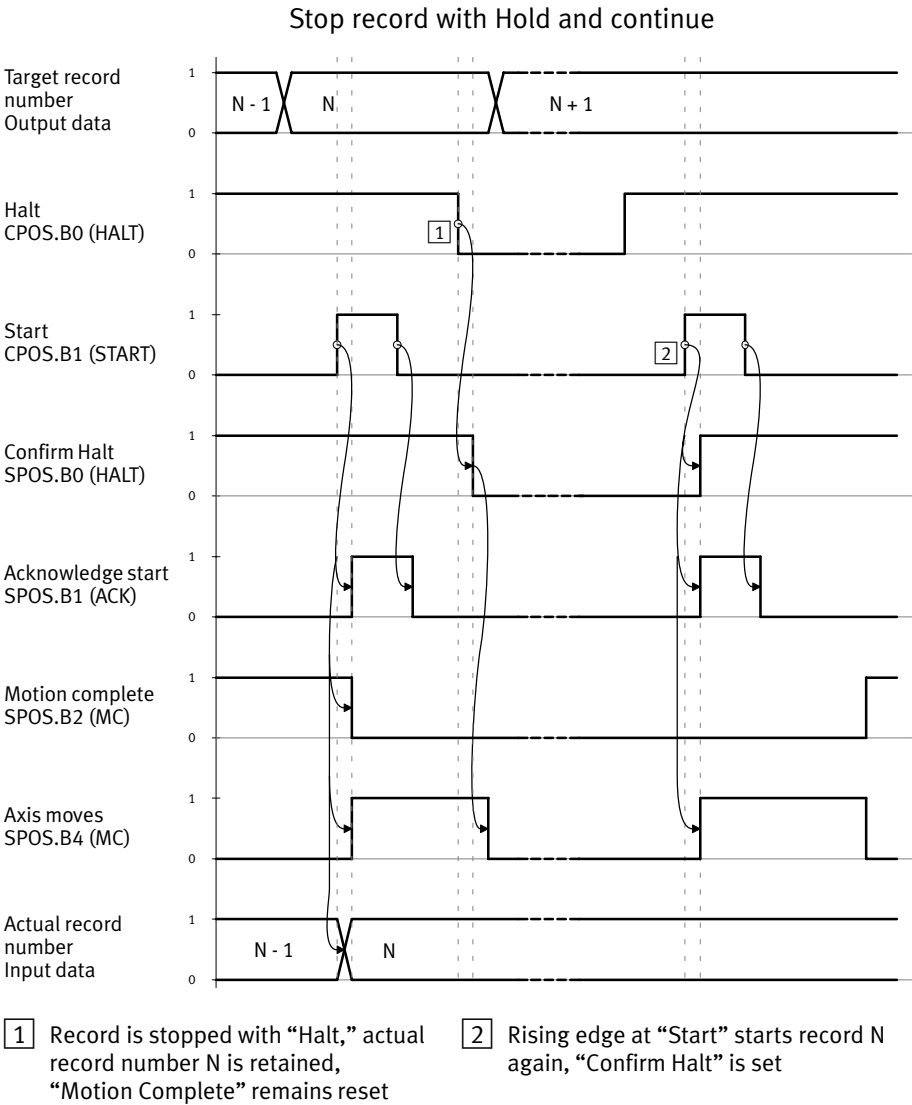


Fig. 5/7: Sequence diagram for Stop record with Halt and Continue

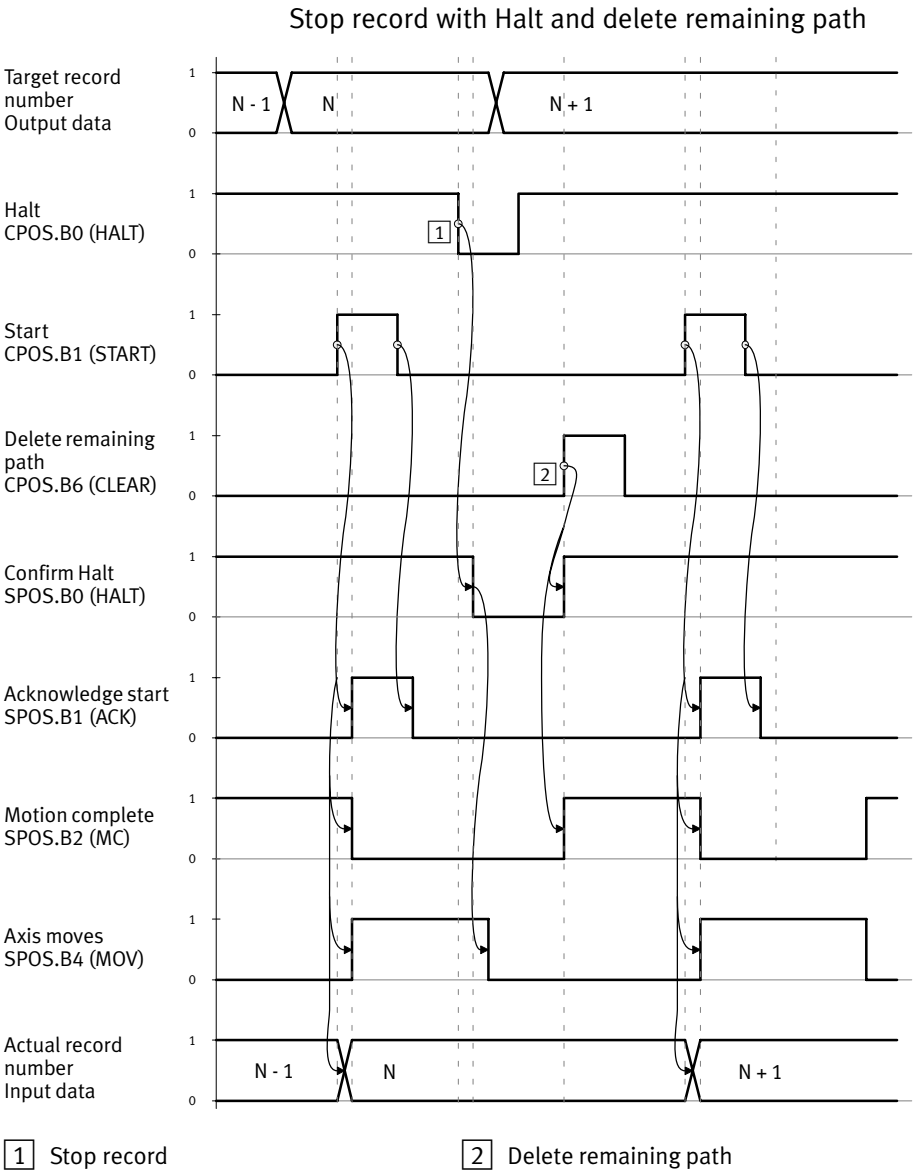


Fig. 5/8: Sequence diagram for Stop record with Halt and delete remaining path

Record structure

A positioning task in record select mode is described by a record made up of setpoint values. Every setpoint value is addressed by its own PNU. A record consists of the setpoint values with the same subindex.

Causes of errors in application:

- Referencing has not been carried out.
- The target position and/or the preselect position cannot be reached.
- Invalid record number.
- Record not initialised.

| Overview of parameters involved (see appendix B.2.8) |                                                                                                                   |     |     |       |
|------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|-----|-----|-------|
| Parameters involved                                  | Description                                                                                                       | FCT | PNU | CI    |
|                                                      | Record control byte 1                                                                                             | x   | 401 | 20EAh |
|                                                      | Positioning record target position                                                                                | x   | 404 | 20ECh |
|                                                      | Record velocity                                                                                                   | x   | 406 | 20EDh |
|                                                      | Positioning record acceleration                                                                                   | x   | 407 | 20EEh |
|                                                      | Positioning record deceleration                                                                                   | x   | 408 | 20EFh |
| Start (FHPP)                                         | CPOS.B1 = Positive edge: Start<br>Jogging and referencing have priority.                                          |     |     |       |
| Acknowledgement (FHPP)                               | SPOS.B2 = 0: Motion complete<br>SPOS.B1 = Positive edge: Acknowledge start<br>SPOS.B4 = 1: Drive moving           |     |     |       |
| Prerequisites                                        | Device control by PLC/fieldbus<br>Controller must be in status “Operation enabled”<br>Record number must be valid |     |     |       |

Tab. 5/19: Record selection parameters involved

### 5.6.5 Direct mode (positioning mode, power operation)

#### Positioning mode

In the status “Operation enabled” (Direct mode) a positioning job is formulated directly in the I/O data which are transmitted via the Fieldbus. The setpoint values for the position are therefore held in the PLC. The function is used in the following situations:

- Moving to any position within the work stroke.
- the target positions are unknown during planning or change frequently (several different work item positions).

A positioning profile formed by linking records can be implemented externally controlled by the master.

#### Sequence of discrete setpoint value

1. Set the desired setpoint (position) and the positioning conditions (absolute/relative) in the output data.
2. With a rising edge at START (CPOS.B1) the controller accepts the setpoint position and starts the positioning job.
3. After the start you must wait for MC before a new start can be made.
4. When the setpoint position is reached, MC (SPOS.B2) is set.

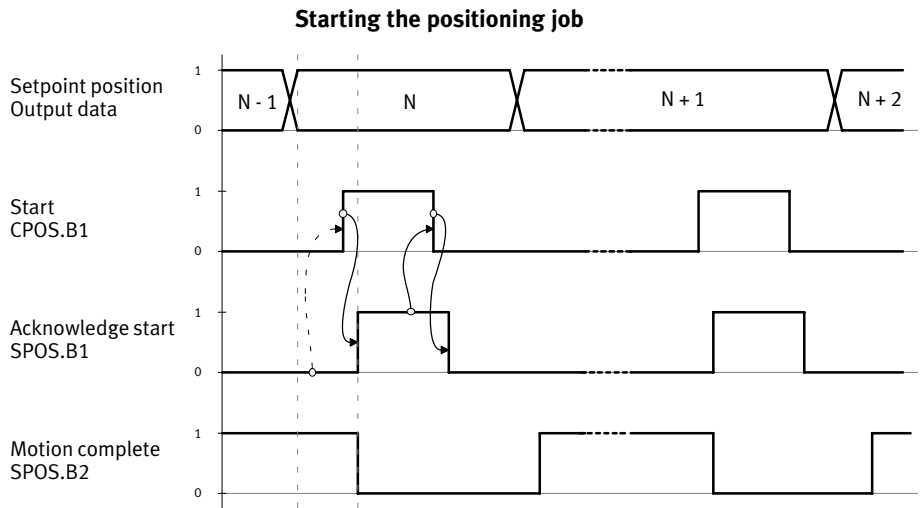


Fig. 5/9: Start the positioning task



The sequence of the remaining control and status bits as well as the functions Hold and Stop react as with the function Record select, see Fig. 5/6, Fig. 5/7 and Fig. 5/8.

### Causes of errors in application

- No referencing carried out.
- Target position cannot be reached or lies outside the software end positions.

| Overview of parameters involved (see appendix B.2.9)                                                                                                                     |                                                                                                         |     |     |          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|-----|-----|----------|
| Parameters involved                                                                                                                                                      | Description                                                                                             | FCT | PNU | CI       |
| Position specifications                                                                                                                                                  | Max. permitted speed <sup>1)</sup>                                                                      | x   | 502 | 21F6/00h |
|                                                                                                                                                                          | Direct mode acceleration in acceleration unit (inc/s²)                                                  | x   | 541 | 20EE/22h |
|                                                                                                                                                                          | Direct mode deceleration in deceleration unit (inc/s²)                                                  | x   | 542 | 20EE/22h |
| Start (FHPP)                                                                                                                                                             | CPOS.B1 = Positive edge: Start<br>(CDIR.B0 = Setpoint position absolute/relative)                       |     |     |          |
| Acknowledgement (FHPP)                                                                                                                                                   | SPOS.B2 = 0: Motion complete<br>SPOS.B1 = Positive edge: Acknowledge start<br>SPOS.B4 = 1: Drive moving |     |     |          |
| Prerequisites                                                                                                                                                            | Device control by PLC/fieldbus<br>Controller must be in status “Operation enabled”                      |     |     |          |
| <sup>1)</sup> In the control bytes the master transfers a percent value which is multiplied by the maximum permitted speed, in order to achieve the final nominal speed. |                                                                                                         |     |     |          |

Tab. 5/20: Parameters involved in Direct mode (positioning mode)

Force mode

Force mode is used in the following situations:  
(only for axis type gripper HGPLE, GEH, supported from FW V2.00):

- For clamping and holding workpieces as well as for procedures in which work items must be orientated (e.g. to a fixed stop).
- Pressing and inserting procedures.
- Special functions in which e.g. workpieces must be touched in order to receive position values.



### Notes on force mode

Control of the motor torque takes place indirectly by means of the current regulation. All specifications on forces/torques refer to the nominal motor current (relative to the rated motor torque). The actual force at the axis should be calculated/checked and then set with external measuring devices during commissioning.

Not that the gripper force resulting from the motor current is also heavily dependent on the positioning speed used to move to the workpiece.



### Note

The following settings are required for parametrising the force mode (see Tab. 5/21):

- Force window (permitted deviation from the setpoint value ascertained by the Fieldbus).
- Speed limitation (maximum speed that the drive should reach).
- Rest time (time during which the setpoint force must be applied, before “Motion complete” is triggered).
- Extend the rest time if the setpoint force is already achieved briefly due to the increased torque when starting (before reaching the work item).

Force mode is prepared when the control mode is switched over. The drive stands with the position controlled.

### Sequence

1. Set the desired setpoint (in % of nominal motor torque) in the output data.
2. With the rising edge at Start (CPOS.B1) the controller accepts the setpoint torque and builds up the force/torque in the direction of the sign of the setpoint value.
  - When this speed has been reached, the bit “Speed limit reached” is set (status byte SDIR).
  - When the setpoint value has been reached, taking into account the target window and the time window, the “MC” signal is set. The motor current will still be controlled.
  - If there is a resistance e.g. from a workpiece in the positioning range, the drive will press against the obstruction with a defined force (see Fig. 5/10).
  - If the path set in the path/stroke monitoring (relative to the starting position) is exceeded, the bit “Stroke limit reached” is set in the status byte SDIR. The drive is braked with the emergency stop ramp, held with the position controlled at the current position, and the “MC signal” is set.

Recommendation: Procedure for gripping a workpiece quickly and with good repeatability of the force:

1. Position just before the workpiece.
2. Switch from positioning mode to force mode.
3. Grip the workpiece in force mode.

### Causes of errors

- No referencing carried out.
- Axis stands at the software end position at the start of the positioning job.

## 5. Commissioning

| Overview of parameters involved (see appendix B.2.9)                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                         |     |      |          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|-----|------|----------|
| Parameter                                                                                                                                                                                                                                                                                                                                                                                                                          | Description                                                                                             | FCT | PNU  | CI       |
| Force mode <sup>1)</sup>                                                                                                                                                                                                                                                                                                                                                                                                           | Stroke limitation                                                                                       | x   | 510  | 60F6/01h |
|                                                                                                                                                                                                                                                                                                                                                                                                                                    | Minimum torque                                                                                          | x   | 511  | 60F6/05h |
|                                                                                                                                                                                                                                                                                                                                                                                                                                    | Maximum torque                                                                                          | x   | 512  | 6072h    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                    | Force message window reached                                                                            | x   | 552  | 60F6/03h |
|                                                                                                                                                                                                                                                                                                                                                                                                                                    | Force damping time reached                                                                              | x   | 553  | 60F6/04h |
|                                                                                                                                                                                                                                                                                                                                                                                                                                    | Max. permitted speed                                                                                    | x   | 554  | 60F6/02h |
|                                                                                                                                                                                                                                                                                                                                                                                                                                    | Nominal motor current <sup>2)</sup>                                                                     | –   | 1035 | 6075h    |
| <b>Start</b>                                                                                                                                                                                                                                                                                                                                                                                                                       | CPOS.B1 = Positive edge<br>(CDIR.B0 = Setpoint position absolute/relative)                              |     |      |          |
| <b>Acknowledgement</b>                                                                                                                                                                                                                                                                                                                                                                                                             | SPOS.B2 = 0: Motion complete<br>SPOS.B1 = Positive edge: Acknowledge start<br>SPOS.B4 = 1: Drive moving |     |      |          |
| <b>Prerequisites</b>                                                                                                                                                                                                                                                                                                                                                                                                               | Device control by PLC/fieldbus<br>Controller must be in status “Operation enabled”                      |     |      |          |
| <sup>1)</sup> Force specifications are only supported for axis type HGPLE, GEH starting with Firmware V2.00.<br>Further parameters:<br>6071h Target torque                      6088h Torque profile type<br>6076h Motor rated torque                6087h Torque slope<br>6077h Actual torque                        CDIR.B5 Stroke limiting active/inactive<br><sup>2)</sup> Fixed value set, defined depending on the axis type |                                                                                                         |     |      |          |

Tab. 5/21: Parameters involved in Direct mode (Force mode)

## 5. Commissioning

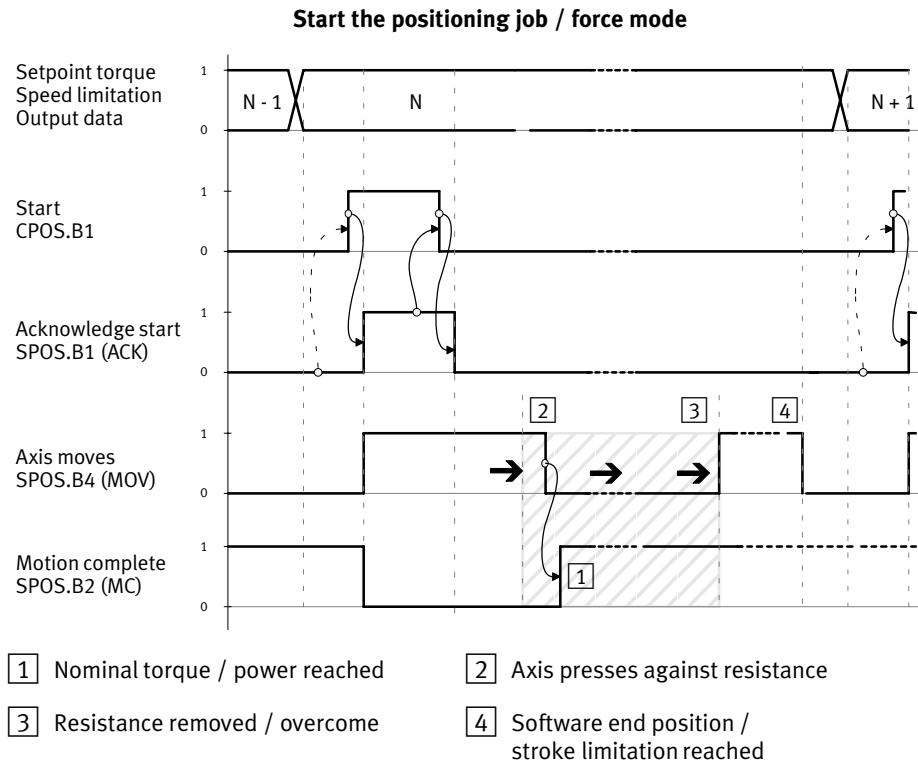


Fig. 5/10: Start the positioning job / force mode



The signal “MC” (Motion Complete) is used in this control mode to mean “Nominal value/stroke limitation reached”. The sequence of the remaining control and status bits as well as the functions Hold and Stop behave in the same way as the Record selection function, see Fig. 5/6, Fig. 5/7 and Fig. 5/8.

### 5.6.6 Standstill monitoring

With the standstill monitoring it is clear that the target position window is exited at a standstill.

When the target position has been reached and MC signaled in the status word, the drive switches to the “standstill” state, bit SPOS.B6 (standstill monitor) is reset. If, in this status, the drive is removed from the standstill position window for a minimum defined time due to external forces or other influences, the bit SPOS.B6 will be set.

As soon as the drive is in the standstill position window again for the standstill monitoring time, the bit SPOS.B6 will be reset.

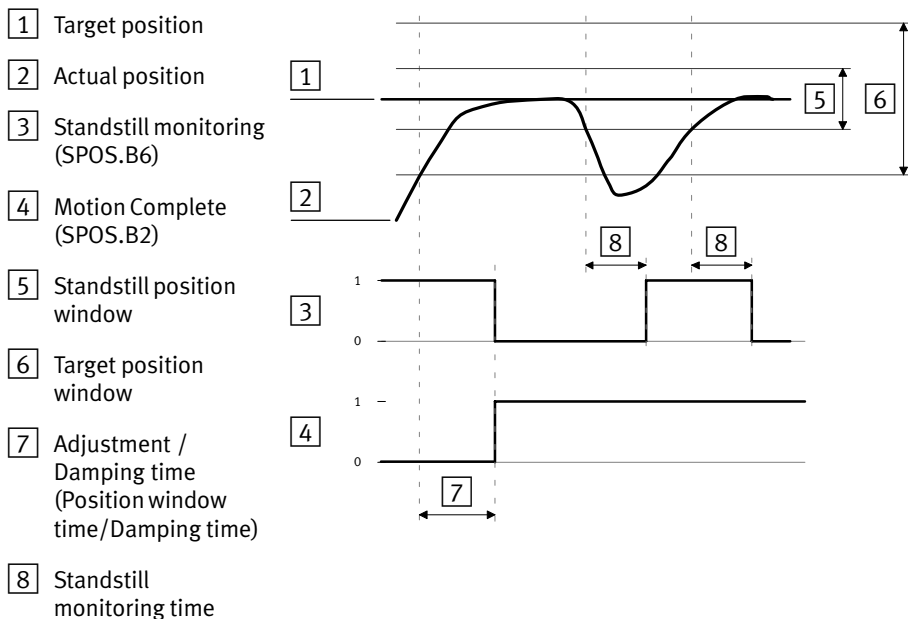


Fig. 5/11: Standstill monitoring

5. Commissioning

The standstill monitoring cannot be switched on or off explicitly. It becomes inactive when the standstill position window is set to “0”.

| Overview of parameters involved (see appendix B.2.15)                               |                                                                                    |     |      |                     |
|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-----|------|---------------------|
| Parameters involved                                                                 | Description                                                                        | FCT | PNU  | CI                  |
|                                                                                     | Setpoint position                                                                  | –   | 1040 | 6062h               |
|                                                                                     | Current position                                                                   | –   | 1041 | 6064h               |
|                                                                                     | Standstill message window                                                          | –   | 1042 | 2040h <sup>1)</sup> |
|                                                                                     | Standstill delay time                                                              | –   | 1043 | 2041h <sup>1)</sup> |
|                                                                                     | Adjustment time (Positioning mode)                                                 | –   | 1023 | 6068h               |
| Start (FHPP)                                                                        | SPOS.B2 = Positive edge: Motion complete                                           |     |      |                     |
| Acknowledgement (FHPP)                                                              | SPOS.B6 = 1: Drive has moved out of standstill position window                     |     |      |                     |
| Prerequisites                                                                       | Device control by PLC/fieldbus<br>Controller must be in status “Operation enabled” |     |      |                     |
| <sup>1)</sup> Starting at firmware version V1.38, earlier versions CI 6065h / 6066h |                                                                                    |     |      |                     |

Tab. 5/22: Parameters involved in standstill monitoring

### 5.7 FHPP finite state machine

#### Notes on the “Operation enabled” state

The transition T3 changes to state S4, which itself contains its own sub-state machine, the states of which are marked with “SAx” and the transitions of which are marked with “TAx” Fig. 5/13. This enables an equivalent circuit diagram (Fig. 5/12) to be used, in which the internal states SAx are omitted.

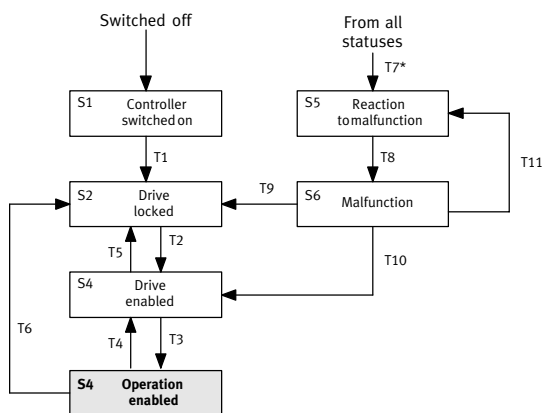


Fig. 5/12: Finite state machine equivalent circuit diagram

Transitions T4, T6 and T7\* are executed from every sub-state SAx and automatically have a higher priority than any transition TAx.

#### Reaction to malfunctions

T7 (“Malfunction recognised”) has the highest priority (and receives the asterisk “\*”).

T7 is then derived from S5+S6 when an error of higher priority occurs. This means that a serious error can suppress a simple error.

5. Commissioning

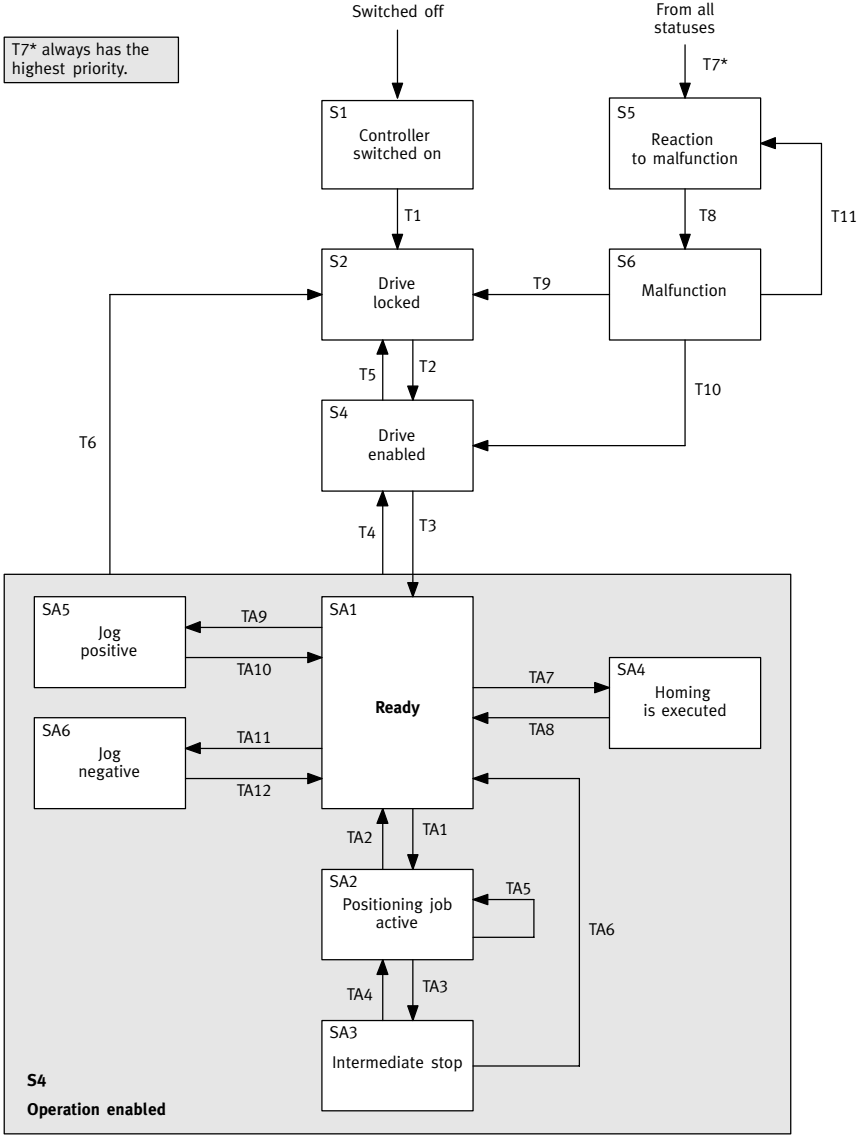


Fig. 5/13: Finite state machine

## 5. Commissioning

### 5.7.1 Create ready status

| T                                                  | Internal conditions                                                       | Actions of the user                                   |
|----------------------------------------------------|---------------------------------------------------------------------------|-------------------------------------------------------|
| T1                                                 | Drive is switched on.<br>An error cannot be ascertained.                  |                                                       |
| T2                                                 | Load voltage applied.<br>Fieldbus master must be higher-order controller. | “Enable drive” = 1<br>CCON = xxx0.xxx1                |
| T3                                                 |                                                                           | “Stop” = 1<br>CCON = xxx0.xx11                        |
| T4                                                 |                                                                           | “Stop” = 0<br>CCON = xxx0.xx01                        |
| T5                                                 |                                                                           | “Enable drive” = 0<br>CCON = xxx0.xxx0                |
| T6                                                 |                                                                           | “Enable drive” = 0<br>CCON = xxx0.xxx0                |
| T7*                                                | Malfunction recognised.                                                   |                                                       |
| T8                                                 | Reaction to malfunction completed, drive stopped.                         |                                                       |
| T9                                                 | There is no longer a malfunction.<br>It was a serious error.              | “Acknowledge malfunction” = 0 → 1<br>CCON = xxx0.Pxxx |
| T10                                                | There is no longer a malfunction.<br>It was a simple error.               | “Acknowledge malfunction” = 0 → 1<br>CCON = xxx0.Pxx1 |
| T11                                                | Malfunction still exists.                                                 | “Acknowledge malfunction” = 0 → 1<br>CCON = xxx0.Pxx1 |
| Key: P = positive edge, N = negative edge, x = any |                                                                           |                                                       |

## 5. Commissioning

### 5.7.2 Positioning

Fundamentally, the following applies:  
Transitions T4, T6 and T7\* always have priority.

| TA                                                 | Internal conditions                                                                                            | Actions of the user                                                                                              |
|----------------------------------------------------|----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|
| TA1                                                | Referencing is running.                                                                                        | Start positioning task = 0→1<br>Halt = 1<br>CCON = xxx0.xx11<br>CPOS = 0xx0.00P1                                 |
| TA2                                                | Motion Complete = 1<br>The current record is completed. The next record is not to be carried out automatically | “Halt” status is any<br>CCON = xxx0.xx11<br>CPOS = 0xxx.xxx0                                                     |
| TA3                                                | Motion Complete = 0                                                                                            | Halt = 1 → 0<br>CCON = xxx0.xx11<br>CPOS = 0xxx.xxx0                                                             |
| TA4                                                |                                                                                                                | Halt = 1<br>Start positioning task = 0→1<br>Clear remaining position = 0<br>CCON = xxx0.xx11<br>CPOS = 00xx.xxP1 |
| TA5                                                | Record selection:<br>– A single record is finished.<br>– The next record is processed automatically.           | CCON = xxx0.xx11<br>CPOS = 0xxx.xxx1                                                                             |
|                                                    | Direct mode:<br>– A new positioning task has arrived.                                                          | CCON = xxx0.xx11<br>CPOS = 0xxx.xx11                                                                             |
| TA6                                                |                                                                                                                | Clear remaining position = 0 → 1<br>CCON = xxx0.xx11<br>CPOS = 01xx.xxxx                                         |
| TA7                                                |                                                                                                                | Start homing = 0→1<br>Halt = 1<br>CCON = xxx0.xx11<br>CPOS = 0xx0.0Px1                                           |
| TA8                                                | Referencing finished or stopped.                                                                               | Only for halt:<br>Halt = 1 → 0<br>CCON = xxx0.xx11<br>CPOS = 0xxx.xxxN                                           |
| Key: P = positive edge, N = negative edge, x = any |                                                                                                                |                                                                                                                  |

## 5. Commissioning

| TA                                                 | Internal conditions | Actions of the user                                                                                                                              |
|----------------------------------------------------|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| TA9                                                |                     | Jog positive = 0 → 1<br>Halt = 1<br>CCON = xxx0.xx11<br>CPOS = 0xx0.Pxx1                                                                         |
| TA10                                               |                     | Either<br>– Jog positive = 1 → 0<br>– CCON = xxx0.xx11<br>– CPOS = 0xxx.0xx1<br>or<br>– Halt = 1 → 0<br>– CCON = xxx0.xx11<br>– CPOS = 0xxx.xxxN |
| TA11                                               |                     | Jog negative = 0 → 1<br>Halt = 1<br>CCON = xxx0.xx11<br>CPOS = 0xxP.xxx1                                                                         |
| TA12                                               |                     | Either<br>– Jog negative = 1 → 0<br>– CCON = xxx0.xx11<br>– CPOS = 0xxN.xxx1<br>or<br>– Halt = 1 → 0<br>– CCON = xxx0.xx11<br>– CPOS = 0xxx.xxxN |
| Key: P = positive edge, N = negative edge, x = any |                     |                                                                                                                                                  |

### Special features dependent on operating mode

| Operating mode   | Notes on specific features                                                                                                 |
|------------------|----------------------------------------------------------------------------------------------------------------------------|
| Record selection | No restrictions.                                                                                                           |
| Direct mode      | TA2: The condition that no new record may be processed no longer applies.<br>TA5: A new record can be started at any time. |

### 5.8 Instructions on operation

Take the following instructions and recommendations into account when programming positioning systems with electric axes:

#### Password protection

Protection by means of a password is not set when the product is supplied from the factory. In order to prevent unauthorized or unintentional overwriting or modification of parameters in the device, all download and control functions can be blocked.

- Recommendation:  
Protect the settings of your axis against undesired modifications with a password:
  - FCT password protection  
(8 characters, see plug-in help SFC-DC)
  - HMI password protection for SFC-DC-...-H2-...  
(3 characters, see section 4.5).



#### **Warning**

Danger of injury.

Errors in parametrisation can cause injury to people and material damage. In the following cases reference travel is absolutely essential in order that the reference coordinates and the working range can be set correctly:

- when commissioning the first time,
- when the referencing method is changed,
- after **each time** the logic voltage supply is switched on.

## 5. Commissioning



### Note

Make sure that:

- it is located within the permissible positioning range when switching on and before the start of homing,
- homing is carried out when the higher-order controller or motor controller is switched on or, if applicable, after malfunctions

## Device connection



### Caution

The RS232 interface is not electrically isolated. It is not intended for permanent connection to PC systems, nor as a control interface.

- Use the connection only for parametrisation and diagnosis.

## Control during operation



### Warning

Danger of injury.

Errors in parametrisation can cause injury to people and damage to property when the controller is enabled.

- Enable the controller only if the axis system has been correctly installed and parametrised.



### Caution

Note the manufacturer's specifications for the permitted operating conditions of the motors and drives used, e.g. in respect of the permitted positioning speeds.

## 5. Commissioning



### **Caution**

Damage to components

Movement to the mechanical end positions is not permitted during operation. If movement is made to the end positions with a heavy load, jamming may occur in the end positions.



### **Note**

Any functions implemented for the purposes of your EMERGENCY STOP procedures must be accommodated in the control programs.

## Service and maintenance

The motor units do not require maintenance during their specified service life. Follow the maintenance instructions for the components used.

# Diagnosis and error display

## Chapter 6

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## 6. Diagnosis and error display

### 6.1 Diagnostics options

The SFC-DC offers the following possibilities for diagnosis and error display:

| <b>Diagnostics option</b>                         | <b>Brief description</b>                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Advantages/ Properties</b>                       | <b>Detailed description</b> |
|---------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|-----------------------------|
| LED display                                       | LEDs indicate readiness to operate, positioning status, errors and bus status.                                                                                                                                                                                                                                                                                                                                                | Fast “on-site” error detection.                     | Chapter 6.2                 |
| Control panel with LC display on SFC-DC-...-H2-PB | Warnings, messages and errors are displayed directly on the LC display                                                                                                                                                                                                                                                                                                                                                        | Fast “on-site” error diagnosis.                     | Chapter 6.3                 |
|                                                   | Diagnostic data, operating mode, the current positioning set, target and actual positions, speed as well as information on bus communication can be accessed on the control panel.                                                                                                                                                                                                                                            | Detailed diagnostic possibility “on-site”.          | Chapter 6.3                 |
| Festo Configuration Tool                          | With active device connection: <ul style="list-style-type: none"><li>– Display of the current position set, target and actual positions as well as speed.</li><li>– Display of the operating mode, special outputs and operating states as well as error messages of the connected SFC-DC.</li><li>– Display of the device status.</li><li>– Display of the diagnostic memory.</li><li>– Display of the bus status.</li></ul> | Detailed diagnosis during commissioning.            | Help on PlugIn SFC-DC       |
| PROFIBUS DP                                       | <ul style="list-style-type: none"><li>– Standard diagnosis</li><li>– Device-related diagnosis.</li><li>– Diagnosis via FHPP status bytes SCON and SPOS.</li></ul>                                                                                                                                                                                                                                                             | Simple diagnosis via the field bus.                 | Chapter 6.5                 |
| PROFIBUS via parameter channel                    | <ul style="list-style-type: none"><li>– Extended access to diagnostic data, e.g. diagnostic memory.</li></ul>                                                                                                                                                                                                                                                                                                                 | If necessary, detailed diagnosis via the field bus. | Chapter 6.5.2               |

Tab. 6/1: Summary of diagnostics options

### 6.2 LED status displays

- 1 LEDs
- Power (green)
  - I/F (green/red)
  - Error (red)

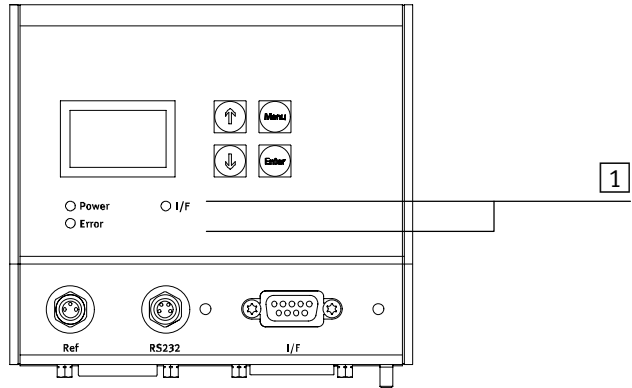


Fig. 6/1: LEDs of the SFC-DC-...-H2-PB

The visual display of the operating states is shown via 3 LEDs

- Operating voltage LED (POWER)
- Bus status, positioning status (I/F)
- Error LED (ERROR)

## 6. Diagnosis and error display

### Operating and logic voltage

| Power                                                                                        | Status                                                                                                       |
|----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| <br>Green   | Logic and operating voltage present.                                                                         |
| <br>Flashes | Logic voltage is present.<br>Operating voltage <b>not</b> present.<br>Check voltage connection if necessary. |
| <br>Off     | Logic voltage is <b>not</b> present.<br>Check voltage connection if necessary.                               |

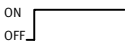
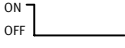
Tab. 6/2: LED “Power”

### Error display

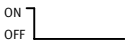
| Error                                                                                          | Status                                                                  |
|------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| <br>Red      | Error.<br>The SFC-DC is not ready for operation.                        |
| <br>Flashes | Warning.<br>Check cause and rectify if necessary, see also chapter 6.3. |
| <br>Off     | – No internal error indicated.<br>The SFC-DC is ready to operate.       |

Tab. 6/3: LED “Error”

Bus status, positioning status and controller enable

| I/F 1)<br>MC (green)                                                                                                                                                                                                      | Status                                                                                                                                                                                      |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <div>ON OFF</div> <div>  </div> <p>Lights up green</p> | <b>Motion Complete 2)</b> <ul style="list-style-type: none"> <li>Positioning procedure is completed or stopped (Motion Complete).</li> </ul>                                                |
|  <div>ON OFF</div> <div>  </div> <p>Off</p>             | <b>No Motion Complete or fault/warning</b> <ul style="list-style-type: none"> <li>Target position not yet reached (positioning procedure running) 2)</li> <li>or</li> <li>Error.</li> </ul> |
| 1) Two-colour LED<br>2) If there is no fault, i.e. LED ERROR = out                                                                                                                                                        |                                                                                                                                                                                             |

Tab. 6/4: LED “I/F” – Green Motion Complete LED

| I/F 1)<br>PROFIBUS (red)                                                                                                                                                                                                                | Status                                                                                                      |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
|  <div>ON OFF</div> <div>  </div> <p>Off</p>                         | <b>Data exchange active</b> <ul style="list-style-type: none"> <li>Normal operating status.</li> </ul>      |
|  <div>ON OFF</div> <div>  </div> <p>Flashes red fast (5 Hz)</p>   | <b>Address not parameterised</b> <ul style="list-style-type: none"> <li>Invalid bus address set.</li> </ul> |
|  <div>ON OFF</div> <div>  </div> <p>Flashes red slowly (1 Hz)</p> | <b>Waiting for connection</b>                                                                               |
| 1) Two-colour LED                                                                                                                                                                                                                       |                                                                                                             |

Tab. 6/5: LED “I/F” – Red PROFIBUS LED

## 6. Diagnosis and error display

### 6.3 Malfunction messages

#### 6.3.1 Overview

| Category        | Name, display                | Description                                              | Device error <sup>1)</sup> | Fault Number | Error LED | Status bytes <sup>2)</sup> |
|-----------------|------------------------------|----------------------------------------------------------|----------------------------|--------------|-----------|----------------------------|
| Error           | POSITION ERROR               | Following error                                          | 0x0001                     | 31           | ON        | FAULT, DEV                 |
| Error (message) | MOTOR-STOP                   | Motor stop (Emergency stop)                              | 0x0002                     | 106          | ON        | FAULT                      |
| Error           | HOMING ERROR                 | homing error                                             | 0x0004                     | 32           | ON        | FAULT                      |
| Error           | OVERHEATING                  | Overtemperature (ActTemp > 80)                           | 0x0008                     | 101          | ON        | FAULT                      |
| Error           | LOAD-POWER-DOWN              | Load voltage monitoring (undervoltage at the controller) | 0x0010                     | 70           | ON        | FAULT                      |
| Error           | I <sup>2</sup> t-ERROR       | Current monitoring (I <sup>2</sup> t monitoring)         | 0x0020                     | 100          | ON        | FAULT                      |
| Error           | HARDWARE ERROR               | Hardware device error (user data destroyed, check sum)   | 0x0040                     | 52           | ON        | FAULT                      |
| Error           | TARGET POSITION OUT OF LIMIT | Target position cannot be reached                        | 0x0080                     | 2            | ON        | FAULT                      |
| Warning         | ILLEGAL RECORD               | Invalid record number                                    | 0x0100                     | 3            | FLASHES   | WARN                       |
| Error           | PLEASE ENFORCE HOMING RUN    | Reference travel required                                | 0x0200                     | 1            | ON        | FAULT                      |
| Error           | POSITION PLAUS. ERROR        | Position plausibility error (max. speed exceeded)        | 0x0400                     | 35           | ON        | FAULT                      |

<sup>1)</sup> See PNU 205 / object 2FF1/00

<sup>2)</sup> FHPP status bytes, see chapter 5.5.2

## 6. Diagnosis and error display

| Category                                                                                         | Name, display       | Description                                               | Device error <sup>1)</sup> | Fault Number | Error LED | Status bytes <sup>2)</sup> |
|--------------------------------------------------------------------------------------------------|---------------------|-----------------------------------------------------------|----------------------------|--------------|-----------|----------------------------|
| Error                                                                                            | DIGITAL-POWER-DOWN  | Logic voltage monitoring (undervoltage at the controller) | 0x0800                     | 71           | ON        | FAULT                      |
| Warning                                                                                          | INDEX PULSE WARNING | Index Pulse Warning                                       | 0x1000                     | –            | FLASHES   | WARN                       |
| Error                                                                                            | MOTOR ERROR         | Motor error Phase failure (no motor current)              | 0x2000                     | 103          | ON        | FAULT                      |
| Warning                                                                                          | STANDSTILL          | Standstill monitoring warning                             | 0x4000                     | 36           | FLASHES   | WARN, STILL                |
| Error                                                                                            | PROFIBUS-INIT-ERROR | PROFIBUS initialisation fault                             | 0x8000                     | 51           | ON        | FAULT                      |
| Warning                                                                                          | HOT TEMPERATURE     | Overheating                                               | –                          | –            | FLASHES   | WARN                       |
| Warning                                                                                          | COLD TEMPERATURE    | Under-temperature                                         | –                          | –            | FLASHES   | WARN                       |
| <sup>1)</sup> See PNU 205 / object 2FF1/00<br><sup>2)</sup> FHPP status bytes, see chapter 5.5.2 |                     |                                                           |                            |              |           |                            |

Tab. 6/6: Errors and warnings with malfunction numbers and error bits

### 6.3.2 Description of errors and warnings

#### Messages

The following message is displayed if a positioning procedure is aborted manually or cannot be carried out.

- Acknowledge the message on the control panel with **⟨Enter⟩** or start a new positioning procedure with the FCT or via the control interface.

| message    | Cause                                                                                        |
|------------|----------------------------------------------------------------------------------------------|
| MOTOR-STOP | A positioning procedure has been stopped with the <b>⟨Menu⟩</b> button (EMERG. STOP [Menu]). |

Tab. 6/7: Messages

#### Warnings [WARNING MODE]

For states that do not prevent functioning, the SFC-DC displays a warning. If a positioning task is running, it is not interrupted. The error LED flashes, the output WARNING (FHPP status bits, SCON.B2) is set.

| Warning             | Cause                                                                                                                                                                                                                                                                |
|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| COLD TEMPERATURE    | Operating temperature $T < -10\text{ °C}$ .<br>Increase ambient temperature if necessary.                                                                                                                                                                            |
| HOT TEMPERATURE     | Operating temperature $T > 75\text{ °C}$ , check for possible overloading of the drive; check the mechanical system, e.g. for sluggishness; reduce ambient temperature.                                                                                              |
| ILLEGAL RECORD      | Non-permitted record number. The transmitted record number is outside the permissible range.                                                                                                                                                                         |
| INDEX PULSE WARNING | During homing:<br>The reference switch signal is too close to the index pulse. Therefore it may be impossible to determine a reproducible reference position. <ul style="list-style-type: none"> <li>• Shift the reference switch (a few tenths of a mm).</li> </ul> |
| STANDSTILL          | The axis has moved outside the standstill tolerance window.                                                                                                                                                                                                          |

Tab. 6/8: Warnings

## 6. Diagnosis and error display

Error  
[ERROR-MODE]                      If there is an error, the drive will be stopped. The error LED flashes, the FAULT output (FHPP status bits, SCON.B3) is set.

- Eliminate the cause of the error.
- Acknowledge the error message:
  - Using <Enter> on the control panel.
  - via a falling edge at the RESET input (FHPP control bits, CCON.B3),
  - via a falling edge at the ENABLE input (FHPP control bits, CCON.B0, the axis can move once the enable is switched off),
  - with the “Acknowledge error” button in the Festo Configuration Tool.

| Error                  | Possible cause                                                                                                                                                          | Remedy                                                                                                                                                                                                      |
|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DIGITAL-POWER-DOWN     | Voltage monitoring.<br>Possible causes: <ul style="list-style-type: none"> <li>– Digital voltage supply too low.</li> <li>– Voltage drops under load.</li> </ul>        | <ul style="list-style-type: none"> <li>• Check the power supply:               <ul style="list-style-type: none"> <li>– Power supply unit too weak?</li> <li>– Supply line too long?</li> </ul> </li> </ul> |
| HARDWARE ERROR         | Device fault e.g. EEPROM defective.                                                                                                                                     | <ul style="list-style-type: none"> <li>• Please contact your Festo Service.</li> </ul>                                                                                                                      |
| HOMING ERROR           | Error during the reference run.<br>Possible causes: <ul style="list-style-type: none"> <li>– Reference switch defective.</li> </ul>                                     | <ul style="list-style-type: none"> <li>• If necessary, check the functioning of the reference switch.</li> <li>• Make sure homing is repeated.</li> </ul>                                                   |
| I <sup>2</sup> t-ERROR | Current monitoring I <sup>2</sup> t.<br>Possible causes: <ul style="list-style-type: none"> <li>– The drive is blocked</li> </ul>                                       | <ul style="list-style-type: none"> <li>• Check the mechanical system of the drive.</li> </ul>                                                                                                               |
| LOAD-POWER-DOWN        | Voltage monitoring.<br>Possible causes: <ul style="list-style-type: none"> <li>– Load voltage supply lacking or too low.</li> <li>– Voltage drops under load</li> </ul> | <ul style="list-style-type: none"> <li>• Check the power supply:               <ul style="list-style-type: none"> <li>– Power supply unit too weak?</li> <li>– Supply line too long?</li> </ul> </li> </ul> |
| MOTOR ERROR            | Motor not connected or cable fracture.                                                                                                                                  | <ul style="list-style-type: none"> <li>• Check connection to motor, replace cable if necessary.</li> </ul>                                                                                                  |

## 6. Diagnosis and error display

| Error                        | Possible cause                                                                                                                                                               | Remedy                                                                                                                                                                                                                                                                                        |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| OVERHEATING                  | Overheating<br>(operating temperature > 80 °C).<br>– Too high temperature in the power end stage.                                                                            | <ul style="list-style-type: none"> <li>• Check: <ul style="list-style-type: none"> <li>– That the limits are complied with (motor characteristic curves).</li> <li>– The mechanical parts e.g. for stiffness.</li> </ul> </li> <li>• If necessary, reduce the ambient temperature.</li> </ul> |
| PLEASE ENFORCE HOMING RUN    | When starting a positioning job:<br>– After the power supply was switched on, no reference run was carried out or a reference run was stopped.                               | <ul style="list-style-type: none"> <li>• Carry out a homing run.</li> </ul>                                                                                                                                                                                                                   |
| POSITION ERROR               | Position fault (drag fault).<br>Possible causes:<br>– The drive is blocked.<br>– sluggish mechanics or too much mass (acceleration).<br>– The positioning speed is too high. | <ul style="list-style-type: none"> <li>• Check: <ul style="list-style-type: none"> <li>– The mechanics of the drive.</li> <li>– The speed of the positioning job.</li> </ul> </li> </ul>                                                                                                      |
| POSITION PLAUSIBILITY ERROR  | Plausibility error.<br>Possible causes:<br>– Actual speed has exceeded the predefined limit value.                                                                           | <p>May be possible with vertical mounting and large moving mass.</p> <ul style="list-style-type: none"> <li>• Reduce: <ul style="list-style-type: none"> <li>– The moving mass.</li> <li>– The acceleration.</li> </ul> </li> </ul>                                                           |
| PROFIBUS-INIT                | PROFIBUS initialisation fault.<br>– hardware error                                                                                                                           | <ul style="list-style-type: none"> <li>• Servicing required.</li> </ul>                                                                                                                                                                                                                       |
| TARGET POSITION OUT OF LIMIT | Target position fault<br>– The specified target position is outside the permitted positioning range.                                                                         | <ul style="list-style-type: none"> <li>• Check the software end positions and the target position.</li> </ul>                                                                                                                                                                                 |

Tab. 6/9: Error

6.4 Diagnostic memory

The diagnostic memory contains the codes of the last 16 diagnostic messages and is saved if possible when the power fails. If the diagnostic memory is full, the oldest element will be overwritten (FIFO principle).

| Structure of the diagnostic memory |                                     |              |        |
|------------------------------------|-------------------------------------|--------------|--------|
| Parameters <sup>1)</sup>           | 200                                 | 201          | 202    |
| Format                             | uint8                               | uint16       | uint32 |
| Significance                       | Diagnostic event                    | Fault Number | Time   |
| Subindex 1                         | Latest / current diagnostic message |              |        |
| Subindex 2                         | Last diagnostic message             |              |        |
| ...                                | ...                                 |              |        |
| Subindex 16                        | Oldest diagnostic message           |              |        |
| <sup>1)</sup> (See appendix B.2.6) |                                     |              |        |

Tab. 6/10: Structure of diagnostic memory

| Configuration of the diagnostic memory with parameter 204 (see appendix B.2.6) |                                                                                                                                            |         |     |     |
|--------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|---------|-----|-----|
| SI                                                                             | Description                                                                                                                                | Default | Min | Max |
| 1                                                                              | = 1: Record incoming and outgoing <sup>1)</sup> faults<br>= 2: Record only incoming faults                                                 | 1       | 1   | 2   |
| 2                                                                              | = 1: Resolution time stamp 10 ms<br>= 2: Resolution time stamp 1 ms                                                                        | 1       | 1   | 2   |
| 3                                                                              | Deleting the diagnostic memory<br>– Writing with value = 1 deletes the diagnostic memory<br>– Read will always be answered with value = 0. | 0       | 0   | 1   |
| 4                                                                              | Number of valid entries in the diagnostic memory.                                                                                          | 0       | 0   | 16  |
| <sup>1)</sup> Outgoing fault = time point when the fault was acknowledged.     |                                                                                                                                            |         |     |     |

Tab. 6/11: Structure of diagnostic memory

## 6. Diagnosis and error display

The faults are divided into logical groups according to the fault numbers. There are both simple and serious faults within a group.

| Range       | Name                   | Comment                                                                                                                                                                                                                                                                                                                                                                                              |
|-------------|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0           | –                      | No fault active                                                                                                                                                                                                                                                                                                                                                                                      |
| 1 ... 19    | Execution error        | Examples: No homing run, setpoint position outside software end positions, setpoint value calculation not possible. Although the system is OK, a user command cannot be processed. In most cases there is an error in operation. Source: sequence control, controller                                                                                                                                |
| 20 ... 29   | Parameter fault        | Example: Software end positions outside the working stroke. A parameter lies within the limit values so that it can be written by the user. During the new calculation of the controller, it was ascertained that it is not permitted in the context of the other parameters.<br>Note: Non-permitted parameters are rejected by the parameter protocol and do not generate a fault in the controller |
| 30 ... 49   | Controller             | Examples: Positioning timeout, homing run not successful, drag error too large, ...<br>The task could not be processed correctly. No hardware fault is recognised here. Source: controller                                                                                                                                                                                                           |
| 50 ... 69   | Initialisation         | Fault in initialising the controller                                                                                                                                                                                                                                                                                                                                                                 |
| 70 ... 79   | Run time of controller | Error in controller run time: undervoltage, checksum                                                                                                                                                                                                                                                                                                                                                 |
| 80 ... 89   | –                      | Reserved                                                                                                                                                                                                                                                                                                                                                                                             |
| 90 ... 99   | –                      | Reserved                                                                                                                                                                                                                                                                                                                                                                                             |
| 100 ... 109 | Run time of motor      | Run time of motor: undervoltage, overtemperature, etc.                                                                                                                                                                                                                                                                                                                                               |
| 110 ... 119 | –                      | Reserved                                                                                                                                                                                                                                                                                                                                                                                             |

Tab. 6/12: Overview of fault numbers



A detailed description of the warnings and faults can be found in chapter 6.3.

6.5 Diagnosis via PROFIBUS-DP

The SFC-DC supports the following diagnostic possibilities via PROFIBUS-DP:

- FHPP status bytes (see chapter 5.5.2):
  - SCON.B2: WARN – Warning
  - SCON.B3: FAULT – Disturbance
  - SPOS.B5: DEV – Following error
  - SPOS.B6: STILL – Standstill monitoring.
- DP diagnosis (see chapter 6.5.1):  
PROFIBUS service “GetDiag” with device-related diagnosis (GbD) when activated.

The alarm model as per DPV1 is not supported.

6.5.1 Structure of the DP diagnosis

Structure of the DP diagnosis

The DP diagnosis of the SFC-DC reacts as per IEC 61158-6 type 3. 16 bytes are reserved in the SFC-DC for DP diagnosis, see Tab. 6/13.

| Byte | Octet | Diagnostic address                             | Description                                                                                                        |
|------|-------|------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| 0    | 1     | Station status 1                               | Gives an overview of the communication status and the general status of the SFC-DC.                                |
| 1    | 2     | Station status 2                               |                                                                                                                    |
| 2    | 3     | Station status 3                               |                                                                                                                    |
| 3    | 4     | Master PROFIBUS address                        | PROFIBUS address of the DP master via which the SFC-DC was parameterised and which has both read and write access. |
| 4    | 5     | ID number<br>(for SFC-DC = 0973 <sub>H</sub> ) | Describes the type of the DP slave (here 0973 <sub>H</sub> ).                                                      |
| 5    | 6     |                                                |                                                                                                                    |

## 6. Diagnosis and error display

| Byte | Octet | Diagnostic address                                     | Description                                                                                                         |
|------|-------|--------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| 6    | 7     | Header (for the device-related diagnosis)              | Specifies the length of the device-related diagnosis incl. header. <sup>1)</sup>                                    |
| 7    | 8     | Status type                                            | With the SFC-DC always 0xA0 (for “manufacturer-specific status”).                                                   |
| 8    | 9     | Slot number                                            | With the SFC-DC always 0x00 (slot is ignored).                                                                      |
| 9    | 10    | Specifier                                              | With the SFC-DC always 0x00 (no specification of the fault).                                                        |
| 10   | 11    | Device-related diagnosis 1:<br>Firmware version number | Version number of the firmware of the SFC-DC: <sup>2)</sup><br>Byte 11: Main version<br>Byte 10: Subsidiary version |
| 11   | 12    |                                                        |                                                                                                                     |
| 12   | 13    | Device-related diagnosis 2:<br>Hardware version number | Version number of the hardware of the SFC-DC: <sup>2)</sup><br>Byte 13: Main version<br>Byte 12: Subsidiary version |
| 13   | 14    |                                                        |                                                                                                                     |
| 14   | 15    | Device-related diagnosis 3:<br>Fault number            | Fault number, see chapter 6.3, Tab. 6/9.                                                                            |
| 15   | 16    |                                                        |                                                                                                                     |

<sup>1)</sup> The SFC-DC enters the value “10” fixed in this octet.

<sup>2)</sup> E.g. “0x02 0x01” ≙ V1.02

Tab. 6/13: DP diagnosis



The method of requesting the slave diagnosis can be found in the manual for the DP master.

### Diagnosis via general DP master



#### Note

The identifier-related or channel-related diagnosis listed in IEC 61158-6 type 3 is not supported.

**Station status 1**

Bit 3 is especially of interest with station status 1. If this bit is set, it is sensible to evaluate the device-related diagnosis.

| Station status 1                                                                                   |                             |                                                                                                                                                   |
|----------------------------------------------------------------------------------------------------|-----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit                                                                                                | Significance                | Explanation                                                                                                                                       |
| 0                                                                                                  | Diag.Station_Non_Existent   | SFC-DC 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      | SFC-DC not yet ready for data exchange                                                                                                            |
| 2                                                                                                  | Diag.Cfg_Fault              | The configuration data received from the master are not the same as those ascertained by the SFC-DC.                                              |
| 3                                                                                                  | Diag.Ext_Diag               | There is a device-related diagnosis. <sup>1)</sup>                                                                                                |
| 4                                                                                                  | Diag.Not_Supported          | 1 = The SFC-DC does not support the function requested.                                                                                           |
| 5                                                                                                  | Diag.Invalid_Slave_Response | Always 0 (always reset to 0 by the SFC-DC) <sup>2)</sup>                                                                                          |
| 6                                                                                                  | Diag.Prm_Fault              | Last parameterising telegram faulty                                                                                                               |
| 7                                                                                                  | Diag.Master_Lock            | Access by a different master (set by the master)                                                                                                  |
| <sup>1)</sup> Is set by the SFC-DC when a new fault occurs (new fault message).                    |                             |                                                                                                                                                   |
| <sup>2)</sup> Is set to 1 in the DP master when the reply sent by the slave cannot be interpreted. |                             |                                                                                                                                                   |

Tab. 6/14: Structure of station status 1

## 6. Diagnosis and error display

### Station status 2 (only SFC-DC related bits)

| Station status 2                                 |                  |                                                                        |
|--------------------------------------------------|------------------|------------------------------------------------------------------------|
| Bit                                              | Significance     | Explanation                                                            |
| 0                                                | Diag.Prm_Req     | 1 = The master must configure the SFC-DC again                         |
| 1                                                | Diag.Stat_Diag   | 1 = The master must request diagnostic data until this bit is set to 0 |
| 2                                                | –                | Always 1 (set to logical 1 by the SFC-DC)                              |
| 3                                                | Diag.WD_On       | 1 = Response monitoring/watchdog activated                             |
| 4                                                | Diag.Freeze_Mode | 1 = Freeze activated <sup>1)</sup>                                     |
| 5                                                | Diag.Sync_Mode   | 1 = Sync activated <sup>1)</sup>                                       |
| 6                                                | –                | Reserved                                                               |
| 7                                                | Diag.Deactivated | Always 0 (always reset to 0 by the SFC-DC)                             |
| 1) Only in conjunction with a diagnostic message |                  |                                                                        |

Tab. 6/15: Diagnostic bits of station status 2

### Station status 3

| Station status_3 |                        |                                         |
|------------------|------------------------|-----------------------------------------|
| Bit              | Significance           | Explanation                             |
| 0 ... 6          | –                      | Reserved                                |
| 7                | Diag.Ext_Diag_Overflow | Is always logical 0 (set by the SFC-DC) |

Tab. 6/16: Diagnostic bits of station status 3

## 6. Diagnosis and error display

### 6.5.2 Diagnosis via parameter channel

The Festo parameter channel or the parameter channel as per PROFIdrive (see chapter 1.7.1) offers the following methods of access to diagnostic information (see PNU 201 to 206, appendix B.2.6):

- Current device fault (compare faults and warnings see chapter 6.3),
- diagnostic memory (PNU 200, PNU 201, PNU 202),
- PROFIBUS diagnosis (PNU 206).

# Technical appendix

## Appendix A

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A.2      Accessories ..... A-5

A.3      Converting the units of measurement ..... A-7

## A.1 Technical Data

| <b>General</b>                                                                                                                                                                                                                                      |                                                                                                            |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| <b>Protection class</b> as per EN 60529<br>(plug connector inserted or fitted with protective cap)                                                                                                                                                  | IP54                                                                                                       |
| <b>Relative air humidity</b>                                                                                                                                                                                                                        | 0 to 95 %, non condensing                                                                                  |
| <b>Temperature range</b><br>– Operation<br>– Storage/transport                                                                                                                                                                                      | 0 °C ... +40 °C<br>-25 °C ... +60 °C                                                                       |
| <b>Protection against electric shock</b><br>(protection against direct and indirect contact as per IEC/DIN EN 60204-1)                                                                                                                              | By means of PELV power circuit<br>(Protected Extra-Low Voltage)                                            |
| <b>CE symbol (declaration of conformity)</b><br>→ <a href="http://www.festo.com">www.festo.com</a>                                                                                                                                                  | In accordance with EU EMC Directive <sup>1)</sup>                                                          |
| <b>Vibration</b>                                                                                                                                                                                                                                    | As per DIN/IEC68/EN 60068 part 2-6:<br>0.35 mm travel at 10 ... 60 Hz<br>5 g acceleration at 60 ... 150 Hz |
| <b>Shock</b>                                                                                                                                                                                                                                        | As per DIN/IEC68/EN 60068 part 2-27:<br>±30 g at 11 ms duration;<br>5 shocks per direction                 |
| Temperature monitoring                                                                                                                                                                                                                              | Shut-down at temperature > 80 °C                                                                           |
| Display resolution                                                                                                                                                                                                                                  | 128 x 64 pixels                                                                                            |
| Serial interface                                                                                                                                                                                                                                    | RS232, 9600 baud                                                                                           |
| Mounting                                                                                                                                                                                                                                            | Wall or DIN H-rail mounting                                                                                |
| <sup>1)</sup> The component is intended for use in industrial environments.<br>In residential areas, measures for radio interference suppression may have to be taken.<br>The maximum permitted I/O signal cable length is 30 m (reference switch). |                                                                                                            |

### Mechanical data

|                |                           |
|----------------|---------------------------|
| Dimensions     | Approx. 126 x 120 x 62 mm |
| Product weight | approx. 0.6 kg            |

### Electrical data

|                                                                                                                            |                                                           |
|----------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|
| Load voltage supply<br>(power connection, pins A1, A2)<br>– Nominal voltage<br>– Nominal current (motor)<br>– Peak current | See chapter 3.2<br><br>24 VDC $\pm$ 10%<br>3 A<br>5 A     |
| Logic voltage supply<br>(power connection, pins 1, 2)<br>– Nominal voltage<br>– Nominal current<br>– Peak current          | See chapter 3.2<br><br>24 VDC $\pm$ 10%<br>0.1 A<br>0.8 A |
| Specifications for serial interface                                                                                        | See chapter 3.5                                           |
| Specifications for reference switch input                                                                                  | To DIN/EN 61131 part 2 (IEC 1131-2),<br>see chapter 3.6   |

### PROFIBUS data

|                                                                                           |                                                                             |
|-------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| Protocol                                                                                  | PROFIBUS-DP (DPV0, DPV1)                                                    |
| Baud raten                                                                                | 9.6 kBd ... 12 MBd,<br>Automatic baud rate recognition                      |
| Interface<br>– Plug<br>– Design<br>– Type of transmission<br>– Integrated bus termination | D-Sub, 9-pin<br>RS485, floating<br>Serial asynchronous, half duplex<br>None |
| Cable type                                                                                | Depends on length of cable and fieldbus baud<br>rate, see controller manual |

## A.2 Accessories

| Connection                         | Cable/plug                                                       | Type                   | Length [m]   |
|------------------------------------|------------------------------------------------------------------|------------------------|--------------|
| Power supply                       | Power supply cable                                               | KPWR-MC-1-SUB-15HC-... | 2,5 / 5 / 10 |
| Motor connection                   | Motor cable                                                      | KMTR-DC-SUB-15-M12-... | 2,5 / 5 / 10 |
| Reference switch                   | E.g. type SME-10.../SMT-10... or extension cable type KM8-M8-... |                        |              |
| Serial interface                   | Programming cable                                                | KDI-MC-M8-SUB-9-...    | 2,5          |
| Controller<br>(PROFIBUS interface) | Fieldbus plug for open fieldbus cable end                        | FBS-SUB-9-GS-DP-B      | –            |
|                                    | Fieldbus plug for M12 adapter                                    | FBA-2-M12-5POL-RK      | –            |

| Protective caps                                                        | Type   | Comment          |
|------------------------------------------------------------------------|--------|------------------|
| 1 protective cap for the serial interface                              | ISK-M8 | 10 items per bag |
| 1 protective cap for the connection<br>“Reference switch,” if not used |        |                  |

| Wall mounting                                                                           | Type      | Comment         |
|-----------------------------------------------------------------------------------------|-----------|-----------------|
| 2 sets of central supports (4 brackets)                                                 | MUP-18/25 | 2 items per bag |
| For wall mounting, additionally 4 suitable M3 screws with cylindrical head are required |           |                 |

| H-rail mounting                                                                                                              |
|------------------------------------------------------------------------------------------------------------------------------|
| For H-rail mounting, you will require a DIN mounting rail EN 60715 - 35x7.5 or 35x15;<br>width 35 mm, height 7.5 mm or 15 mm |

| Manual in paper form |                   |
|----------------------|-------------------|
| German               | P.BE-SFC-DC-PB-DE |
| English              | P.BE-SFC-DC-PB-EN |
| French               | P.BE-SFC-DC-PB-FR |
| Italian              | P.BE-SFC-DC-PB-IT |
| Spanish              | P.BE-SFC-DC-PB-ES |
| Swedish              | P.BE-SFC-DC-PB-SV |

### A.3 Converting the units of measurement

In the SFC-DC all parameters are always saved in increment specifications (inc, inc/s, inc/s<sup>2</sup>) and not converted until they are written or read. For the display, conversion from the internal basis system into the (pre)set measuring system takes place within the firmware; for representation on the PC monitor within the FCT software. In this way, the user does not need to carry out conversion when entering values or when reading on the control panel or in the FCT. The direct transfer of values via the field bus interface or the serial interface with CI commands always takes place in the basis system and it is assumed that conversion into increments has already taken place.

Conversion is carried out via the parameters:

- feed constant, depending on the drive,
- gear reduction,
- encoder resolution = physical measuring steps per motor revolution.

| Parameter                                                                                                                                                                        |                                  | SLTE-10                       | SLTE-16                       |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|-------------------------------|-------------------------------|
| feed                                                                                                                                                                             | Feed constant                    | SLTE-...-BS5.0: 5000 [μm/rot] | SLTE-...-LS7.5: 7500 [μm/rot] |
| gear                                                                                                                                                                             | Gear reduction <sup>1)</sup>     | SLTE-...-G04 (57:13)          |                               |
| enc                                                                                                                                                                              | Encoder resolution <sup>2)</sup> | 512 x 4 = 2048 [incr/rot]     | 1,000 x 4 = 4000 [incr/rot]   |
|                                                                                                                                                                                  |                                  | <b>HGPLE-14 / GEH60</b>       | <b>HGPLE-25 / GEH61</b>       |
| feed                                                                                                                                                                             | Feed constant                    | 31.416 [μm/rot]               | 62.832 [μm/rot]               |
| gear                                                                                                                                                                             | Gear reduction <sup>1)</sup>     | 385 : 4                       | 84 : 1                        |
| enc                                                                                                                                                                              | Encoder resolution <sup>2)</sup> | 1,000 x 4 = 4000 [incr/rot]   | 1,000 x 4 = 4000 [incr/rot]   |
| <sup>1)</sup> Specification in two natural numbers for numerator or denominator of the fraction<br><sup>2)</sup> With the SFC-DC: Pulse quadruplication by digital interpolation |                                  |                               |                               |

Tab. A/1: Basic parameters for the system of measurement units for linear drives

| Parameter                                                                                       |                                  | DEF            |  |
|-------------------------------------------------------------------------------------------------|----------------------------------|----------------|--|
| feed                                                                                            | Feed constant                    | 100.000        |  |
| gear                                                                                            | Gear reduction <sup>1)</sup>     | 100 : 1        |  |
| enc                                                                                             | Encoder resolution <sup>2)</sup> | 500 x 4 = 2000 |  |
| <sup>1)</sup> Specification in two natural numbers for numerator or denominator of the fraction |                                  |                |  |
| <sup>2)</sup> With the SFC-DC: Pulse quadruplication by digital interpolation                   |                                  |                |  |

Tab. A/2: Basic parameter for the system of measurement units for rotary drives

Special conversion factors

| Unit of length           | SLTE-10                 | SLTE-16                 | HGPLE-16/<br>GEH60      | HGPLE-25/<br>GEH61      |
|--------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| Increments → millimetres | Increments / 1,795.938  | Increments / 2,338.461  | Increments / 12,254.901 | Increments / 5,347.593  |
| Millimetre → increments  | Millimetres * 1,795.938 | Millimetres * 2,338.461 | mm * 12,254.901         | mm * 5,347.593          |
| Increments → inch        | Increments / 45,616.83  | Increments / 59,396.92  | Increments / 311,274.48 | Increments / 135,828.86 |
| Inch → increments        | Inch * 45,616.83        | Inch * 59,396.92        | Inch * 311,274.48       | Inch * 135,828.86       |

Tab. A/3: Conversion factors for the system of measurement units for linear drives

| Unit                     | DEF                                                  |
|--------------------------|------------------------------------------------------|
| Increments → degrees     | Increments / 555.555556 (555.555556 = 200,000 / 360) |
| Degrees → increments     | Degree * 555.555556 (555.555556 = 200,000 / 360)     |
| Increments → revolutions | Increments / 200,000                                 |
| Revolutions → increments | Revolutions * 200,000                                |

Tab. A/4: Conversion factors for system of measurement units for rotary drives

### General conversion factors UF

$$1 [\text{inch}] = 25,4 [\text{mm}]$$

$$1 [\mu\text{inch}] = 0,0254 [\mu\text{m}]$$

$$1 [^\circ] = \frac{1}{360} [\text{rot}]$$

$$[\mu\text{m}] \longrightarrow [\text{inc}]$$

$$UF_{\mu\text{m}} \left[ \frac{\text{inc}}{\mu\text{m}} \right] = \frac{\text{enc} \times \text{gear}}{\text{feed}_{\mu\text{m}}} \left[ \frac{\frac{\text{inc}}{\text{rot}} \times \frac{\text{rot}}{\text{rot}}}{\frac{\mu\text{m}}{\text{rot}}} \right]$$

$$[\mu\text{inch}] \longrightarrow [\text{inc}]$$

$$UF_{\mu\text{inch}} \left[ \frac{\text{inc}}{\mu\text{inch}} \right] = \frac{\text{enc} \times \text{gear}}{\text{feed}_{\mu\text{inch}}} \left[ \frac{\frac{\text{inc}}{\text{rot}} \times \frac{\text{rot}}{\text{rot}}}{\frac{\mu\text{inch}}{\text{rot}}} \right]$$

$$= \frac{\text{enc} \times \text{gear}}{\text{feed}_{\mu\text{m}} \times \frac{1}{0,0254}} \left[ \frac{\frac{\text{inc}}{\text{rot}} \times \frac{\text{rot}}{\text{rot}}}{\frac{\mu\text{m}}{\text{rot}} \times \frac{\mu\text{inch}}{\mu\text{m}}} \right]$$

$$= UF_{\mu\text{m}} \times 0,0254 \left[ \frac{\text{inc}}{\mu\text{m}} \times \frac{\mu\text{m}}{\mu\text{inch}} \right]$$

$$[\text{rot}] \longrightarrow [\text{inc}]$$

$$UF_{\text{rot}} \left[ \frac{\text{inc}}{\text{rot}} \right] = \text{enc} \times \text{gear} \left[ \frac{\text{inc}}{\text{rot}} \times \frac{\text{rot}}{\text{rot}} \right]$$

## A. Technical appendix

| Physical values                                                                                                                                                                                                      | Conversion into increments |                                                                                                   |                                                              |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|---------------------------------------------------------------------------------------------------|--------------------------------------------------------------|
| Position                                                                                                                                                                                                             | POS [inc]                  |                                                                                                   |                                                              |
| <ul style="list-style-type: none"> <li>– Target position</li> <li>– Reference point</li> <li>– Project zero point</li> <li>– Software end position, positive</li> <li>– Software end position, negative</li> </ul>   | [μm] → [inc]               | $= POS_{\mu m} \times UF_{\mu m}$                                                                 | [μm] x [inc/μm]                                              |
|                                                                                                                                                                                                                      | [μinch] → [inc]            | $= POS_{\mu inch} \times (0.0254 \times UF_{\mu m}) *$<br>$= POS_{\mu inch} \times UF_{\mu inch}$ | [μinch] x [μm/μinch] x [inc/μm]<br>[μinch] x [inc/μinch]     |
|                                                                                                                                                                                                                      | [rot] → [inc]              | $= POS_{rot} \times UF_{rot}$                                                                     | [rot] x [inc/rot]                                            |
| Speed                                                                                                                                                                                                                | V [inc/s] =                |                                                                                                   |                                                              |
| <ul style="list-style-type: none"> <li>– Positioning speed to target position</li> <li>– Search speed during reference travel</li> <li>– Positioning speed to the axis zero point during reference travel</li> </ul> | [μm] → [inc]               | $= V_{\mu m} \times UF_{\mu m}$                                                                   | [μm/s] x [inc/μm]                                            |
|                                                                                                                                                                                                                      | [μinch] → [inc]            | $= V_{\mu inch} \times (0.0254 * \times UF_{\mu m}) *$<br>$= V_{\mu inch} \times UF_{\mu inch}$   | [μinch/s] x [μm/μinch] x [inc/μm]<br>[μinch/s] x [inc/μinch] |
|                                                                                                                                                                                                                      | [rot] → [inc]              | $= V_{rot} \times UF_{rot}$                                                                       | [rot/s] x [inc/rot]                                          |
| Acceleration                                                                                                                                                                                                         | a [inc/s²] =               |                                                                                                   |                                                              |
| <ul style="list-style-type: none"> <li>– Nominal acceleration</li> </ul>                                                                                                                                             | [μm] → [inc]               | $= a_{\mu m} \times UF_{\mu m}$                                                                   | [μm/s²] x [inc/μm]                                           |
|                                                                                                                                                                                                                      | [μinch] → [inc]            | $= a_{\mu inch} \times (0.0254 * \times UF_{\mu m}) *$<br>$= a_{\mu inch} \times UF_{\mu inch}$   | [μm/s²] x [μm/μinch] x [inc/μm]<br>[μinch/s²] x [inc/μinch]  |
|                                                                                                                                                                                                                      | [rot] → [inc]              | $= a_{rot} \times UF_{rot}$                                                                       | [rot/s²] x [inc/rot]                                         |
| * conversion [μm] → [μinch]: 1μinch = 0.0254 μm                                                                                                                                                                      |                            |                                                                                                   |                                                              |

Tab. A/5: General formulae for conversion

# **Reference: DeviceNet and FHPP**

## **Appendix B**

## Contents

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B.1 Festo Parameter Channel (FPC)

B.1.1 Structure of the cyclic I/O data (FHPP-FPC)

The parameter channel is used for transmitting parameters.  
The parameter channel comprises the following:

| Components                   | Description                                                                                                                                                                                                                                                                                                                      |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Parameter identifier (ParID) | Component of the parameter channel, which contains the request or response identifier (ResID) and the parameter number (PNU). The parameter number serves for identifying or addressing the individual parameter. The request or response identifier (ResID) describes the job or the reply in the form of an identifier number. |
| Subindex (IND)               | Addresses an element of an array parameter (sub-parameter number)                                                                                                                                                                                                                                                                |
| Parameter value (PV)         | Value of the parameter.<br>If a parameter processing task cannot be carried out, a fault number will be shown instead of the value in the reply telegram. The error number describes the cause of the error.                                                                                                                     |

Tab. B/1: Components of the parameter channel (PKW)

The parameter channel consists of 8 octets. The following table shows the structure of the parameter channel.



For PROFIBUS networks, 16-bit data (WORD) or 32-bit data (DWORD) are transmitted on the bus in “big endian” sequence, i.e. the highest-order byte (MSB) first.

B. Reference: DeviceNet and FHPP

| FPC     |                                                            |        |        |        |                     |                                   |        |        |
|---------|------------------------------------------------------------|--------|--------|--------|---------------------|-----------------------------------|--------|--------|
|         | Byte 1                                                     | Byte 2 | Byte 3 | Byte 4 | Byte 5              | Byte 6                            | Byte 7 | Byte 8 |
| MSB/LSB | –                                                          | –      | MSB    | LSB    | MSB                 | ...                               | ...    | LSB    |
| Format  | Byte                                                       | Byte   | WORD   |        | DWORD <sup>1)</sup> |                                   |        |        |
| O data  | 0                                                          | IND    | ParID  |        | Value (PV)          |                                   |        |        |
| I data  | 0                                                          | IND    | ParID  |        | Value (PV)          |                                   |        |        |
| MSB:    | Most significant byte                                      |        |        |        | <sup>1)</sup> Value | Parameter Value.                  |        |        |
| LSB:    | Least significant byte                                     |        |        |        | (PV)                | – With double word: Bytes 5 ... 8 |        |        |
| IND:    | Subindex – for addressing an array element                 |        |        |        |                     | – With word: bytes 7, 8           |        |        |
| ParID:  | Parameter Identifier – consisting of ReqID / ResID and PNU |        |        |        |                     | – With byte: Byte 8               |        |        |

Tab. B/2: Structure of parameter channel

Parameter identifier (ParID)

The parameter identifier contains the request (ReqID) or response identifier (ResID) and the parameter number (PNU). Spontaneous messages via bit 11 are not supported by the SFC-DC.

| ParID                                                                                                                                                                                                         |        |    |    |    |      |                        |   |   |        |   |   |   |   |   |   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|----|----|----|------|------------------------|---|---|--------|---|---|---|---|---|---|
| Bit                                                                                                                                                                                                           | Byte 3 |    |    |    |      |                        |   |   | Byte 4 |   |   |   |   |   |   |
|                                                                                                                                                                                                               | 15     | 14 | 13 | 12 | 11   | 10                     | 9 | 8 | 7      | 6 | 5 | 4 | 3 | 2 | 1 |
| Request                                                                                                                                                                                                       | ReqID  |    |    |    | res. | Parameter number (PNU) |   |   |        |   |   |   |   |   |   |
| Res-<br>ponse                                                                                                                                                                                                 | ResID  |    |    |    | res. | Parameter number (PNU) |   |   |        |   |   |   |   |   |   |
| ReqID Request Identifier – assignment identifier (read, write, ...)                                                                                                                                           |        |    |    |    |      |                        |   |   |        |   |   |   |   |   |   |
| ResID Response identifier – answer identifier (transfer value, fault, ...)                                                                                                                                    |        |    |    |    |      |                        |   |   |        |   |   |   |   |   |   |
| Value (PNU) Parameter Number – serves to identify or address the respective parameter (see appendix B.1). The request or response identifier identifies the type of request or response (see appendix B.1.2). |        |    |    |    |      |                        |   |   |        |   |   |   |   |   |   |

Tab. B/3: Structure of parameter identifier (ParID)

### B.1.2 Job identifiers, response identifiers and fault numbers

The job identifiers are shown in the following table:

| ReqID                                                                                                                                                                                                                                                                                                                                                                                   | Description                                                   | Response identifier |          |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|---------------------|----------|
|                                                                                                                                                                                                                                                                                                                                                                                         |                                                               | Positive            | Negative |
| 0                                                                                                                                                                                                                                                                                                                                                                                       | No request                                                    | 0                   | –        |
| 1                                                                                                                                                                                                                                                                                                                                                                                       | Request parameter <sup>1)</sup>                               | 1, 2                | 7        |
| 2                                                                                                                                                                                                                                                                                                                                                                                       | Modify parameter value (word) <sup>1)</sup>                   | 1                   | 7        |
| 3                                                                                                                                                                                                                                                                                                                                                                                       | Modify parameter value (double word) <sup>1)</sup>            | 2                   | 7        |
| (4)                                                                                                                                                                                                                                                                                                                                                                                     | – (Reserved – request describing element) <sup>2)</sup>       | –                   | –        |
| (5)                                                                                                                                                                                                                                                                                                                                                                                     | – (Reserved – modify describing element) <sup>2)</sup>        | –                   | –        |
| 6                                                                                                                                                                                                                                                                                                                                                                                       | Request parameter (array)                                     | 4, 5                | 7        |
| 7                                                                                                                                                                                                                                                                                                                                                                                       | Modify parameter value (array, word)                          | 4                   | 7        |
| 8                                                                                                                                                                                                                                                                                                                                                                                       | Modify parameter value (array, double word)                   | 5                   | 7        |
| (9)                                                                                                                                                                                                                                                                                                                                                                                     | – (Reserved – request number of array elements) <sup>2)</sup> | –                   | –        |
| (10)                                                                                                                                                                                                                                                                                                                                                                                    | – (Reserved) <sup>2)</sup>                                    | –                   | –        |
| 11                                                                                                                                                                                                                                                                                                                                                                                      | Modify parameter value (byte) <sup>1)</sup>                   | 11                  | 7        |
| 12                                                                                                                                                                                                                                                                                                                                                                                      | Modify parameter value (array, byte)                          | 12                  | 7        |
| (13)                                                                                                                                                                                                                                                                                                                                                                                    | – (Reserved – request lower limit value) <sup>2)</sup>        | –                   | –        |
| (14)                                                                                                                                                                                                                                                                                                                                                                                    | – (Reserved – request upper limit value) <sup>2)</sup>        | –                   | –        |
| (15)                                                                                                                                                                                                                                                                                                                                                                                    | Reserved <sup>2)</sup>                                        | –                   | –        |
| <sup>1)</sup> When access is made with order numbers for simple variables to parameters which are implemented as arrays, the subindex will be ignored or set to 0. This means that it is always the first element of an array which is addressed.<br><sup>2)</sup> Requests with non-supported request numbers (ReqID) will be answered with response identifier 7 and error number 22. |                                                               |                     |          |

Tab. B/4: Order and response identifiers

If the request cannot be carried out, response identifier 7 as well as the appropriate error number will be transmitted (negative reply).

The following table shows the reply identifiers:

| ResID                                | Description                                                               |
|--------------------------------------|---------------------------------------------------------------------------|
| 0                                    | No reply                                                                  |
| 1                                    | Parameter transferred (word)                                              |
| 2                                    | Parameter transferred (double word)                                       |
| (3)                                  | – (Reserved – describing element transferred) <sup>1)</sup>               |
| 4                                    | Parameter value transferred (array, word)                                 |
| 5                                    | Parameter value transferred (array, double word)                          |
| 6                                    | Number of array elements transferred                                      |
| 7                                    | Request cannot be carried out (with fault number) <sup>2)</sup>           |
| (8)                                  | – (Reserved – no higher order controller for PKW interface) <sup>1)</sup> |
| (9)                                  | – (Reserved – spontaneous message – word) <sup>1)</sup>                   |
| (10)                                 | – (Reserved – spontaneous message – double word) <sup>1)</sup>            |
| 11                                   | Parameter value transferred (byte)                                        |
| 12                                   | Parameter value transferred (array, byte)                                 |
| (13)                                 | – (Reserved – lower limit value transferred) <sup>1)</sup>                |
| (14)                                 | – (Reserved – upper limit value transferred) <sup>1)</sup>                |
| (15)                                 | – (Reserved) <sup>1)</sup>                                                |
| 1) Not used with the SFC-DC          |                                                                           |
| 2) Fault numbers see following table |                                                                           |

Tab. B/5: Order and response identifiers

If the job of the parameter processing cannot be carried out, an appropriate error number will be transmitted in the response telegram (octets 7 and 8 of the FPC range). The following table shows the possible error numbers:

## B. Reference: DeviceNet and FHPP

| Error numbers                                  |      | Description                                                                        |
|------------------------------------------------|------|------------------------------------------------------------------------------------|
| 0                                              | 0x00 | Impermissible PNU. The parameter does not exist.                                   |
| 1                                              | 0x01 | Parameter value cannot be modified (read only)                                     |
| (2)                                            | 0x02 | – (Reserved – lower or upper limit value exceeded) <sup>1)</sup>                   |
| 3                                              | 0x03 | Faulty subindex                                                                    |
| 4                                              | 0x04 | No array                                                                           |
| 5                                              | 0x05 | Incorrect data type                                                                |
| (6)                                            | 0x06 | – (Reserved – setting not permitted – can only be reset) <sup>1)</sup>             |
| (7)                                            | 0x07 | – (Reserved – describing element cannot be modified) <sup>1)</sup>                 |
| (8)                                            | 0x08 | – (Reserved – PPO-Write requested in IR does not exist) <sup>1)</sup>              |
| 9                                              | 0x09 | Description data do not exist                                                      |
| (10)                                           | 0x10 | – (Reserved – access group incorrect) <sup>1)</sup>                                |
| 11                                             | 0x0A | No control sovereignty                                                             |
| (12)                                           | 0x0B | – (Reserved – password incorrect) <sup>1)</sup>                                    |
| 13                                             | 0x0C | Text not legible in cyclic exchange                                                |
| (14)                                           | 0x0D | – (Reserved – name not legible in cyclic exchange) <sup>1)</sup>                   |
| (15)                                           | 0x0E | – (Reserved – text array does not exist) <sup>1)</sup>                             |
| (16)                                           | 0x10 | – (Reserved – PPO-Write missing) <sup>1)</sup>                                     |
| (17)                                           | 0x11 | – (Reserved – order cannot be processed because of operating status) <sup>1)</sup> |
| (18)                                           | 0x12 | – (Reserved – other faults) <sup>1)</sup>                                          |
| (19)                                           | 0x13 | – (Reserved – date not legible in cyclic exchange) <sup>1)</sup>                   |
| (20)                                           | 0x14 | – (Reserved – non-permitted value) <sup>1)</sup>                                   |
| (21)                                           | 0x15 | – (Reserved – reply too long) <sup>1)</sup>                                        |
| 22                                             | 0x16 | Impermissible: attributes, number of elements, PNU or IND                          |
| (23)                                           | 0x17 | – (Reserved – Write request: impermissible format) <sup>1)</sup>                   |
| 24                                             | 0x18 | Write request: number of values not permitted                                      |
| (...99)                                        | 0x64 | – (Reserved – PROFIBUS)                                                            |
| 100                                            | 0x65 | – (Reserved – Festo: ReqID is not supported) <sup>1)</sup>                         |
| (...255)                                       | 0xFF | – (Reserved – Festo)                                                               |
| <sup>1)</sup> These error numbers are not used |      |                                                                                    |

B.1.3 Rules for request-response processing

| Rules | Description                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | If the master sends the identifier for “No request”, the SFC-DC replies with the response identifier for “No reply”.                                                                                                                                                                                                                                                                                                                      |
| 2     | A request or response telegram always refers to a single parameter.                                                                                                                                                                                                                                                                                                                                                                       |
| 3     | The master must continue to send a job until it receives the appropriate response from the SFC-DC.                                                                                                                                                                                                                                                                                                                                        |
| 4     | The master recognises the response to the request placed: <ul style="list-style-type: none"><li>– By evaluating the response identifier.</li><li>– by evaluating the parameter number (PNU).</li><li>– If applicable, by evaluating the subindex (IND).</li><li>– If applicable, by evaluating the parameter value.</li></ul>                                                                                                             |
| 5     | The SFC-DC provides the response until the master sends a new request.                                                                                                                                                                                                                                                                                                                                                                    |
| 6     | a) A write request, even with cyclic repetition of the same request, will only be carried out once by the SFC-DC.<br>b) Between two consecutive requests with the same request identifier (ReqID), parameter number (PNU) and subindex (IND), the request identifier 0 (no request) must be sent and the response identifier 0 (no response) must be awaited. This ensures that an “old” response is not interpreted as a “new” response. |

Tab. B/6: Rules for request-response processing

## Sequence of parameter processing



### Caution

Observe the following when modifying parameters:  
An FHPP control signal, which is to refer to a modified parameter, may only follow when the response identifier “Parameter value transferred” is received for the relevant parameter and if applicable for the index.

If, for example, a position value in a position register is to be modified and if movement is then to be made to this position, the positioning command must not be given until the SFC-DC has completed and confirmed the modification of the position register.



### Caution

In order to be sure that an “old” response cannot be interpreted as a “new” response, the request identifier 0 (no job) must be sent and the response identifier 0 (no response) must be awaited between two consecutive requests with the same request identifier (ReqID), parameter number (PNU) and subindex (IND).

## Evaluating errors

In the case of jobs which cannot be carried out, the slave replies as follows:

- Output of response identifier = 7
- Output a fault number in bytes 7 and 8 of the parameter channel (FPC).

## B. Reference: DeviceNet and FHPP

### Example of parameterising via DPV0

The following tables show an example of parametrising a positioning task in the positioning record table via (FPC – Festo Parameter Channel).

#### Step 1

Output status of the 8 bytes of FPC data:

|        | Byte 1   | Byte 2   | Byte 3            | Byte 4 | Byte 5          | Byte 6 | Byte 7 | Byte 8 |
|--------|----------|----------|-------------------|--------|-----------------|--------|--------|--------|
|        | Reserved | Subindex | ReqID/ResID + PNU |        | Parameter value |        |        |        |
| O data | 0x00     | 0x00     | 0x00              | 0x00   | 0x00            | 0x00   | 0x00   | 0x00   |
| I data | 0x00     | 0x00     | 0x00              | 0x00   | 0x00            | 0x00   | 0x00   | 0x00   |

#### Step 2

Write record number 1 with absolute positioning:  
PNU 401, subindex 2 – Modify parameter value, array, byte:  
ReqID 12 (0xC) with value 0x00.

|        | Byte 1   | Byte 2   | Byte 3            | Byte 4 | Byte 5          | Byte 6 | Byte 7 | Byte 8 |
|--------|----------|----------|-------------------|--------|-----------------|--------|--------|--------|
|        | Reserved | Subindex | ReqID/ResID + PNU |        | Parameter value |        |        |        |
| O data | 0x00     | 0x02     | 0xC1              | 0x91   | unused          | unused | unused | 0x00   |
| I data | 0x00     | 0x02     | 0xC1              | 0x91   | 0x00            | 0x00   | 0x00   | 0x00   |

#### Step 3

After receiving the I data with ResID 0xC, send O data with  
ReqID = 0x0 and wait for I data with ResID = 0x0:

|        | Byte 1   | Byte 2   | Byte 3            | Byte 4 | Byte 5          | Byte 6 | Byte 7 | Byte 8 |
|--------|----------|----------|-------------------|--------|-----------------|--------|--------|--------|
|        | Reserved | Subindex | ReqID/ResID + PNU |        | Parameter value |        |        |        |
| O data | 0x00     | 0x02     | 0x01              | 0x91   | unused          | unused | unused | 0x00   |
| I data | 0x00     | 0x02     | 0x01              | 0x91   | 0x00            | 0x00   | 0x00   | 0x00   |

## B. Reference: DeviceNet and FHPP

### Step 4

Write record number 1 with target position 0x1234 (decimal 4660 increments):  
 PNU 404, subindex 2 – Modify parameter value, array,  
 double word: ReqID 8 (0x8) with value 0x00001234.

|        | Byte 1   | Byte 2   | Byte 3            | Byte 4 | Byte 5          | Byte 6 | Byte 7 | Byte 8 |
|--------|----------|----------|-------------------|--------|-----------------|--------|--------|--------|
|        | Reserved | Subindex | ReqID/ResID + PNU |        | Parameter value |        |        |        |
| O data | 0x00     | 0x02     | 0x81              | 0x94   | 0x00            | 0x00   | 0x12   | 0x34   |
| I data | 0x00     | 0x02     | 0x81              | 0x94   | 0x00            | 0x00   | 0x12   | 0x34   |

### Step 5

After receiving the I data with ResID 0x8 send O data with ReqID = 0x0 and wait for I data with ResID = 0x0:

|        | Byte 1   | Byte 2   | Byte 3            | Byte 4 | Byte 5          | Byte 6 | Byte 7 | Byte 8 |
|--------|----------|----------|-------------------|--------|-----------------|--------|--------|--------|
|        | Reserved | Subindex | ReqID/ResID + PNU |        | Parameter value |        |        |        |
| O data | 0x00     | 0x02     | 0x01              | 0x94   | 0x00            | 0x00   | 0x12   | 0x34   |
| I data | 0x00     | 0x02     | 0x01              | 0x94   | 0x00            | 0x00   | 0x12   | 0x34   |

### Step 6

Write record number 1 with speed 0x7743 (decimal 30531 increments/s):  
 PNU 406, subindex 2 – Modify parameter value, array,  
 double word: ReqID 8 (0x8) with value 0x00007743.

|        | Byte 1   | Byte 2   | Byte 3            | Byte 4 | Byte 5          | Byte 6 | Byte 7 | Byte 8 |
|--------|----------|----------|-------------------|--------|-----------------|--------|--------|--------|
|        | Reserved | Subindex | ReqID/ResID + PNU |        | Parameter value |        |        |        |
| O data | 0x00     | 0x02     | 0x81              | 0x96   | 0x00            | 0x00   | 0x77   | 0x43   |
| I data | 0x00     | 0x02     | 0x81              | 0x96   | 0x00            | 0x00   | 0x77   | 0x43   |

### Step 7

After receiving the I data with ResID 0x8 send O data with ReqID = 0x0 and wait for I data with ResID = 0x0:

|        | Byte 1   | Byte 2   | Byte 3            | Byte 4 | Byte 5          | Byte 6 | Byte 7 | Byte 8 |
|--------|----------|----------|-------------------|--------|-----------------|--------|--------|--------|
|        | Reserved | Subindex | ReqID/ResID + PNU |        | Parameter value |        |        |        |
| O data | 0x00     | 0x02     | 0x01              | 0x94   | 0x00            | 0x00   | 0x77   | 0x43   |
| I data | 0x00     | 0x02     | 0x01              | 0x94   | 0x00            | 0x00   | 0x77   | 0x43   |

## B.2 Reference parameters according to FHPP

### B.2.1 Parameter groups

| Group                                                                                                                                                              | PNU <sup>1)</sup> | Description                                                                                                                               |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| Device data                                                                                                                                                        | 100 ...           | Device identification and device-specific settings, version numbers, passwords, etc.                                                      |
| Diagnostics                                                                                                                                                        | 200 ...           | Memory for diagnostic events: error numbers, fault time, incoming/outgoing event; management of the diagnostic memory                     |
| Process data                                                                                                                                                       | 300 ...           | Current nominal and actual values, local I/Os, status data, operating panel queries etc.                                                  |
| Record list                                                                                                                                                        | 400 ...           | A record contains all the nominal value parameters required for a positioning procedure                                                   |
| Project data <ul style="list-style-type: none"> <li>– Force mode</li> <li>– Teach</li> <li>– Jog mode</li> <li>– Direct mode</li> </ul>                            | 500 ...           | Basic project settings. Maximum speed and acceleration, offset project zero point etc.<br>→ Parameters are the basis for the record list. |
| Factor group                                                                                                                                                       | 600 ...           | Reserved                                                                                                                                  |
| Axis data electric drives 1 <ul style="list-style-type: none"> <li>– Mechanics</li> <li>– Homing</li> <li>– Name plate</li> <li>– Standstill monitoring</li> </ul> | 1000 ...          | All axis-specific parameters for electric drives.<br>Gear factor, feed constant, reference parameter, etc.                                |
| <sup>1)</sup> Parameter number as per FHPP-FPC                                                                                                                     |                   |                                                                                                                                           |

Tab. B/7: Parameter groups (FHPP)

## B.2.2 Object overview (Parameter number (PNU))

The following overview shows all defined parameters of the FHPP, with the parameter number PNU for parametrisation as per FHPP-FPC (I/O Messaging).

The parameters are described in appendix B.2.4 to B.2.19.



You will find an overview of the available CI objects in appendix C.2.1.

| Name                                           | FHPP |          |
|------------------------------------------------|------|----------|
|                                                | PNU  | Subind.  |
| <b>B.2.4 Device data – Standard parameters</b> |      |          |
| Manufacturer Hardware Version                  | 100  | –        |
| Manufacturer Firmware Version                  | 101  | –        |
| Version FHPP                                   | 102  | –        |
| Controller Serial Number                       | 114  | 1 ... 12 |
| <b>B.2.5 Device data – Extended parameters</b> |      |          |
| Manufacturer Device Name                       | 120  | 1 ... 25 |
| User Device Name                               | 121  | 1 ... 25 |
| Drive Manufacturer                             | 122  | 1 ... 30 |
| HTTP Drive Catalog Address                     | 123  | 1 ... 30 |
| Festo Order Number                             | 124  | 1 ... 30 |
| Device Control                                 | 125  | –        |
| HMI parameters                                 | 126  | 1 ... 4  |
| Data Memory Control                            | 127  | 1, 2     |
| <b>B.2.6 Diagnostics</b>                       |      |          |
| Diagnostic Event                               | 200  | 1 ... 16 |
| Error Number                                   | 201  | 1 ... 16 |
| Time Stamp                                     | 202  | 1 ... 16 |
| Diagnosis Memory Parameter                     | 204  | 1 ... 4  |
| Device Errors                                  | 205  | –        |
| Fieldbus Diagnosis                             | 206  | 1 ... 6  |

## B. Reference: DeviceNet and FHPP

| Name                                                 | FHPP |          |
|------------------------------------------------------|------|----------|
|                                                      | PNU  | Subind.  |
| <b>B.2.7 Process data</b>                            |      |          |
| Local digital inputs                                 | 303  | –        |
| Local Digital Outputs                                | 304  | 1, 2     |
| Cycle Number                                         | 305  | –        |
| <b>B.2.8 Record list</b>                             |      |          |
| Record Number                                        | 400  | –        |
| Record Control Byte 1                                | 401  | 1 ... 32 |
| Record target position                               | 404  | 1 ... 32 |
| Record speed                                         | 406  | 1 ... 32 |
| Record Acceleration                                  | 407  | 1 ... 32 |
| Record Deceleration                                  | 408  | 1 ... 32 |
| <b>B.2.9 Project data – General project data</b>     |      |          |
| Project Zero Point                                   | 500  | –        |
| Software End Positions                               | 501  | 1, 2     |
| Max. speed                                           | 502  | –        |
| Max. Acceleration                                    | 503  | –        |
| <b>B.2.10 Project data – Force mode</b>              |      |          |
| Stroke Limit                                         | 510  | –        |
| Min. Torque/Force                                    | 511  | –        |
| Max Torque/Force                                     | 512  | –        |
| <b>B.2.11 Project data – Teach</b>                   |      |          |
| Teach Target                                         | 520  | –        |
| <b>B.2.12 Project data – Jog mode</b>                |      |          |
| Jog Mode Velocity Phase 2                            | 531  | –        |
| Jog Mode Acceleration                                | 532  | –        |
| Jog Mode Deceleration                                | 533  | –        |
| Jog Mode Time Phase 1                                | 534  | –        |
| <b>B.2.13 Project data – Direct positioning task</b> |      |          |
| Direct Mode Acceleration                             | 541  | –        |
| Direct Mode Deceleration                             | 542  | –        |

| Name                                                              | FHPP |               |
|-------------------------------------------------------------------|------|---------------|
|                                                                   | PNU  | Subind.       |
| <b>B.2.14 Project data – Direct task</b>                          |      |               |
| Force Target Window                                               | 552  | –             |
| Force Target Window Time                                          | 553  | –             |
| Force Mode Speed Limit                                            | 554  | –             |
| <b>B.2.15 Axis data electric drives 1 – Mechanical</b>            |      |               |
| Polarity                                                          | 1000 | –             |
| Encoder Resolution                                                | 1001 | 1, 2          |
| Gear Ratio                                                        | 1002 | 1, 2          |
| Feed Constant                                                     | 1003 | 1, 2          |
| Position Factor                                                   | 1004 | 1, 2          |
| Axis Parameter                                                    | 1005 | 1 ... 5       |
| <b>B.2.16 Axis data electric drives 1 – Homing</b>                |      |               |
| Offset Axis Zero Point                                            | 1010 | –             |
| Homing Method                                                     | 1011 | –             |
| Homing Velocities                                                 | 1012 | 1, 2          |
| Homing Required                                                   | 1014 | –             |
| Homing Max Torque                                                 | 1015 | –             |
| <b>B.2.17 Axis data electric drives 1 – Control parameters</b>    |      |               |
| Halt Option Code                                                  | 1020 | –             |
| Fault Reaction Option Code                                        | 1021 | –             |
| Target Position Window                                            | 1022 | –             |
| Position Window Time                                              | 1023 | –             |
| Position control parameter set                                    | 1024 | 18 ... 23, 32 |
| Motor Data                                                        | 1025 | 1, 3          |
| Drive Data                                                        | 1026 | 1 ... 8       |
| <b>B.2.18 Axis data electric drives 1 – Electronic type plate</b> |      |               |
| Motor Type                                                        | 1030 | –             |
| Max Current                                                       | 1034 | –             |
| Motor Rated Current                                               | 1035 | –             |
| Motor Rated Torque                                                | 1036 | –             |

| Name                                                       | FHPP |         |
|------------------------------------------------------------|------|---------|
|                                                            | PNU  | Subind. |
| B.2.19 Axis data electric drives 1 – Standstill monitoring |      |         |
| Position Target Value                                      | 1040 | –       |
| Position Actual Value                                      | 1041 | –       |
| Standstill Position Window                                 | 1042 | –       |
| Standstill Window Time                                     | 1043 | –       |

Tab. B/8: Overview of FHPP parameters

### B.2.3 Representation of the parameter entries

|   |                           |                                                                                                                                                                                                                      |                    |                |               |           |
|---|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|----------------|---------------|-----------|
|   | 1                         | 2                                                                                                                                                                                                                    | 3                  | 4              | 5             | 6         |
|   | <b>Encoder Resolution</b> |                                                                                                                                                                                                                      |                    |                |               |           |
| 7 | <b>FHPP</b>               | <b>1001</b>                                                                                                                                                                                                          | <b>1 ... 2</b>     | <b>0 ... 1</b> | <b>uint32</b> | <b>rw</b> |
|   | <b>Description</b>        | Encoder resolution in increments / revolutions<br>The encoder resolution is fixed and cannot be modified by the user.<br>The calculated value is derived from the fraction<br>(encoder increments/motor revolution). |                    |                |               |           |
| 8 | Encoder Increments        | 1001                                                                                                                                                                                                                 | 1                  | 0              | uint32        | rw        |
|   |                           | Range of values: 0 ... $2^{32} - 1$<br>Default: 500                                                                                                                                                                  |                    |                |               |           |
|   | Motor Revolutions         | 1001                                                                                                                                                                                                                 | 2                  | 1              | uint32        | rw        |
| 9 |                           | Fixed = 1                                                                                                                                                                                                            |                    |                |               |           |
|   | <b>CI</b>                 | <b>608Fh</b>                                                                                                                                                                                                         | <b>01h ... 02h</b> | <b>Array</b>   | <b>uint32</b> | <b>rw</b> |

- 1 Name of the parameter in English
- 2 Parameter number (PNU)
- 3 Subindices of the parameter for FHPP with DPV0
  - : The object has no subindex (simple variable)
  - 1 ... 30: The object has subindices from 1 ... 30
- 4 Subindices of the parameter for FHPP with DPV1
- 5 File type of the element.
- 6 Read/write permission: ro = read only,  
wo = write only,  
rw = read and write
- 7 Description of the parameter
- 8 If applicable: Explanation of the subindices
- 9 Corresponding CI object

Fig. B/1: Representation of the parameter entries

## B.2.4 Device data – Standard parameters

| Manufacturer Hardware Version |                                                                                                           |            |            |               |           |
|-------------------------------|-----------------------------------------------------------------------------------------------------------|------------|------------|---------------|-----------|
| <b>FHPP</b>                   | <b>100</b>                                                                                                | <b>–</b>   | <b>–</b>   | <b>uint16</b> | <b>ro</b> |
| <b>Description</b>            | Coding of the hardware version, specification in BCD: xxyy<br>(xx = main version, yy = secondary version) |            |            |               |           |
| <b>CI</b>                     | <b>2069h</b>                                                                                              | <b>00h</b> | <b>Var</b> | <b>uint16</b> | <b>ro</b> |

| Manufacturer Firmware Version |                                                                                                                |            |            |               |           |
|-------------------------------|----------------------------------------------------------------------------------------------------------------|------------|------------|---------------|-----------|
| <b>FHPP</b>                   | <b>101</b>                                                                                                     | <b>–</b>   | <b>–</b>   | <b>uint16</b> | <b>ro</b> |
| <b>Description</b>            | Firmware version, specified in BCD (binary coded decimal): xxyy<br>(xx = main version, yy = secondary version) |            |            |               |           |
| <b>CI</b>                     | <b>206Ah</b>                                                                                                   | <b>00h</b> | <b>Var</b> | <b>uint16</b> | <b>ro</b> |

| Version FHPP       |                                                                                                                      |            |            |               |           |
|--------------------|----------------------------------------------------------------------------------------------------------------------|------------|------------|---------------|-----------|
| <b>FHPP</b>        | <b>102</b>                                                                                                           | <b>–</b>   | <b>–</b>   | <b>uint16</b> | <b>ro</b> |
| <b>Description</b> | Version number of FHPP, specified in BCD (binary coded decimal): xxyy<br>(xx = main version, yy = secondary version) |            |            |               |           |
| <b>CI</b>          | <b>2066h</b>                                                                                                         | <b>00h</b> | <b>Var</b> | <b>uint16</b> | <b>ro</b> |

| Controller Serial Number |                                                                   |                 |                 |                 |           |
|--------------------------|-------------------------------------------------------------------|-----------------|-----------------|-----------------|-----------|
| <b>FHPP</b>              | <b>114</b>                                                        | <b>1 ... 12</b> | <b>0 ... 11</b> | <b>char</b>     | <b>ro</b> |
| <b>Description</b>       | 12-digit code for identifying the controller. e.g. "081007PN0636" |                 |                 |                 |           |
| <b>CI</b>                | <b>2072h</b>                                                      | <b>00h</b>      | <b>Var</b>      | <b>V-string</b> | <b>ro</b> |

## B.2.5 Device data – Extended parameters

| Manufacturer Device Name |                                                |          |          |          |    |
|--------------------------|------------------------------------------------|----------|----------|----------|----|
| FHPP                     | 120                                            | 1 ... 25 | 0 ... 24 | char     | ro |
| Description              | Drive designation, e.g.: "SFC-DC-VC-3-E-H2-PB" |          |          |          |    |
| CI                       | 1008h                                          | 00h      | Var      | V-string | ro |

| User Device Name |                                                                                                 |          |          |          |    |
|------------------|-------------------------------------------------------------------------------------------------|----------|----------|----------|----|
| FHPP             | 121                                                                                             | 1 ... 25 | 0 ... 24 | char     | ro |
| Description      | Designation of the drive by the user, max. 24 characters (ASCII, 7-bit).<br>Default: "motor001" |          |          |          |    |
| CI               | 20FDh                                                                                           | 00h      | Var      | V-string | rw |

| Drive Manufacturer |                                                 |          |          |          |    |
|--------------------|-------------------------------------------------|----------|----------|----------|----|
| FHPP               | 122                                             | 1 ... 30 | 0 ... 29 | char     | ro |
| Description        | Name of drive manufacturer: "Festo SE & Co. KG" |          |          |          |    |
| CI                 | 6504h                                           | 00h      | Var      | V-string | ro |

| HTTP Drive Catalog Address |                                                       |          |          |          |    |
|----------------------------|-------------------------------------------------------|----------|----------|----------|----|
| FHPP                       | 123                                                   | 1 ... 30 | 0 ... 29 | char     | ro |
| Description                | Internet address of the manufacturer: "www.festo.com" |          |          |          |    |
| CI                         | 6505h                                                 | 00h      | Var      | V-string | ro |

| Festo Order Number |                                               |          |          |          |    |
|--------------------|-----------------------------------------------|----------|----------|----------|----|
| FHPP               | 124                                           | 1 ... 30 | 0 ... 29 | char     | ro |
| Description        | Festo order number, e.g. "540366" or "540367" |          |          |          |    |
| CI                 | 6503h                                         | 00h      | Var      | V-string | ro |

### B. Reference: DeviceNet and FHPP

| <b>Device Control</b> |                                                                                                                                                                                                                                                                                                                                            |            |            |              |           |
|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------|--------------|-----------|
| <b>FHPP</b>           | <b>125</b>                                                                                                                                                                                                                                                                                                                                 | <b>-</b>   | <b>-</b>   | <b>uint8</b> | <b>rw</b> |
| <b>Description</b>    | <p>Activates/deactivates control via the SFC-DC interfaces.<br/>Corresponds to “HMI control” on the control panel and “FCT/HMI” on the FCT.</p> <p>0 (0x00): Control via control interface deactivated (fieldbus),<br/>via HMI (control panel) and FCT activated</p> <p>1 (0x01): Control via controller interface activated (default)</p> |            |            |              |           |
| <b>CI</b>             | <b>207Dh</b>                                                                                                                                                                                                                                                                                                                               | <b>00h</b> | <b>Var</b> | <b>uint8</b> | <b>rw</b> |

| HMI parameters |                                                                                                                                               |             |         |       |        |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------|-------------|---------|-------|--------|
| FHPP           | 126                                                                                                                                           | 1 ... 4     | 0 ... 3 | uint8 | ro     |
| Description    | Parametrisation of the HMI functions (only with SFC-DC-...-H2-...)                                                                            |             |         |       |        |
| LCD Current    | 126                                                                                                                                           | 1           | 0       | uint8 | Cl: rw |
|                | Range of values: 1 ... 5 (0x01 ... 0x05). Default: 5                                                                                          |             |         |       |        |
| LCD Contrast   | 126                                                                                                                                           | 2           | 1       | uint8 | Cl: rw |
|                | Range of values: 0 ... 63 (0x00 ... 0x3F). Default: 10                                                                                        |             |         |       |        |
| Measure        | 126                                                                                                                                           | 3           | 2       | uint8 | Cl: rw |
|                | Defining the measuring system for the LCD display. See object 20D0h.<br>Fixed: 1 (0x01): Metric measuring units - mm, mm/s, mm/s <sup>2</sup> |             |         |       |        |
| Scaling Factor | 126                                                                                                                                           | 4           | 3       | uint8 | Cl: rw |
|                | Number of post-decimal positions<br>Fixed: 2 (0x02): 2 post-decimal positions                                                                 |             |         |       |        |
| CI             | 20FFh                                                                                                                                         | 01h ... 04h | Array   | uint8 | rw     |

| Data Memory Control                                                                                        |                                                                                                                                                                                                            |          |       |       |                  |
|------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-------|-------|------------------|
| FHPP                                                                                                       | 127                                                                                                                                                                                                        | 1, 2     | 0, 1  | uint8 | rw <sup>1)</sup> |
| Description                                                                                                | Commands for the EEPROM (non-volatile data storage).                                                                                                                                                       |          |       |       |                  |
|                                                                                                            | Delete EEPROM                                                                                                                                                                                              | 127      | 1     | 0     | uint8 rw         |
|                                                                                                            | When the object is written and after Power Off/On the data in EEPROM is deleted. <b>Please note also the following instructions.</b><br>Fixed: 16 (0x10): Restore factory settings (delete data in EEPROM) |          |       |       |                  |
|                                                                                                            | Save Data                                                                                                                                                                                                  | 127      | 2     | 1     | uint8 rw         |
| The data in EEPROM will be overwritten with the current user-specific settings.<br>Fix 1 (0x01): Save data |                                                                                                                                                                                                            |          |       |       |                  |
| CI                                                                                                         | 20F1h                                                                                                                                                                                                      | 01h, 02h | Array | uint8 | rw <sup>1)</sup> |
| <sup>1)</sup> When reading the reply “0” always occurs                                                     |                                                                                                                                                                                                            |          |       |       |                  |



**Note**

All user-specific settings will be lost on deletion (except for cycle number). The status after deletion corresponds to the standard factory setting.

The gear factor is set to the standard factory setting for the SLTE.

- To set the gear factor: Consult Festo Service.
- Always carry out a first commissioning after deleting the EEPROM.
- When the EEPROM is deleted, the fieldbus parameters are also reset.

B.2.6 Diagnostics



Description of the method of operation of the diagnostic memory, see chapter 6.4.

| Diagnostic Event              |                                                                                                                                                                            |             |          |       |       |    |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|----------|-------|-------|----|
| FHPP                          | 200                                                                                                                                                                        | 1 ... 16    | 0 ... 15 | uint8 | ro    |    |
| Description                   | Type of fault or diagnostic information saved in the diagnostic memory.<br>Displays whether an incoming or outgoing fault is saved.<br>Value      Type of diagnostic event |             |          |       |       |    |
|                               | 0 (0x00)    No fault (or fault message deleted)                                                                                                                            |             |          |       |       |    |
|                               | 1 (0x01)    Incoming fault                                                                                                                                                 |             |          |       |       |    |
|                               | 2 (0x02)    Outgoing fault                                                                                                                                                 |             |          |       |       |    |
|                               | 3 (0x03)    Reserved                                                                                                                                                       |             |          |       |       |    |
|                               | 4 (0x04)    Overrun time stamp                                                                                                                                             |             |          |       |       |    |
|                               | Event 1                                                                                                                                                                    | 200         | 1        | 0     | uint8 | ro |
|                               | Active diagnostic event                                                                                                                                                    |             |          |       |       |    |
|                               | Event 2                                                                                                                                                                    | 200         | 2        | 1     | uint8 | ro |
|                               | Previous diagnostic event                                                                                                                                                  |             |          |       |       |    |
|                               | Event ...                                                                                                                                                                  | 200         | ...      | ...   | uint8 | ro |
|                               | ...                                                                                                                                                                        |             |          |       |       |    |
|                               | Event 16                                                                                                                                                                   | 200         | 16       | 15    | uint8 | ro |
| Oldest saved diagnostic event |                                                                                                                                                                            |             |          |       |       |    |
| CI                            | 20C8h                                                                                                                                                                      | 01h ... 10h | Array    | uint8 | ro    |    |

| Error Number |                                                                                                                     |             |          |        |        |    |
|--------------|---------------------------------------------------------------------------------------------------------------------|-------------|----------|--------|--------|----|
| FHPP         | 201                                                                                                                 | 1 ... 16    | 0 ... 15 | uint16 | ro     |    |
| Description  | Error number saved in the diagnostic memory, serves to identify the malfunction. See chapter 6.3 for error numbers. |             |          |        |        |    |
|              | Event ...                                                                                                           | 201         | ...      | ...    | uint16 | ro |
|              | See PNU 200                                                                                                         |             |          |        |        |    |
| CI           | 20C9h                                                                                                               | 01h ... 10h | Array    | uint16 | ro     |    |

| Time Stamp  |                                                                                                                                                                                                                             |             |          |        |        |    |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|----------|--------|--------|----|
| FHPP        | 202                                                                                                                                                                                                                         | 1 ... 16    | 0 ... 15 | uint32 | ro     |    |
| Description | Time of the diagnostic event in the unit after PNU 204/2 since being switched on. In the event of an overrun the time stamp jumps from 0xFFFFFFFF to 0, an entry: “Overrun time stamp” is created in the diagnostic memory. |             |          |        |        |    |
|             | Event ...                                                                                                                                                                                                                   | 202         | ...      | ...    | uint32 | ro |
|             | See PNU 200                                                                                                                                                                                                                 |             |          |        |        |    |
| CI          | 20CAh                                                                                                                                                                                                                       | 01h ... 10h | Array    | uint32 | ro     |    |

| Diagnosis Memory Parameter |                                                                                                                                                                                                                   |             |         |       |       |    |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|---------|-------|-------|----|
| FHPP                       | 204                                                                                                                                                                                                               | 1 ... 4     | 0 ... 3 | uint8 | rw/ro |    |
| Description                | Configuration of the diagnostic memory                                                                                                                                                                            |             |         |       |       |    |
|                            | Fault Type                                                                                                                                                                                                        | 204         | 1       | 0     | uint8 | rw |
|                            | Incoming and outgoing malfunctions.<br>1 (0x01): Log incoming and outgoing*) malfunctions (default)<br>2 (0x02) Log only incoming malfunctions<br>*) Outgoing malfunction = time when the fault was acknowledged. |             |         |       |       |    |
|                            | Resolution                                                                                                                                                                                                        | 204         | 2       | 1     | uint8 | rw |
|                            | 1 (0x01): Resolution time stamp 10 ms (default)<br>2 (0x02): Resolution time stamp 1 ms                                                                                                                           |             |         |       |       |    |
|                            | Clear Memory                                                                                                                                                                                                      | 204         | 3       | 2     | uint8 | rw |
|                            | Clear diagnostic memory by writing value = 1<br>Read is always answered with value = 0.                                                                                                                           |             |         |       |       |    |
|                            | Number of Entries                                                                                                                                                                                                 | 204         | 4       | 3     | uint8 | ro |
|                            | Number of entries in the diagnostic memory.<br>Range of values: 0 ... 15 (0x00 ... 0x0F)                                                                                                                          |             |         |       |       |    |
| CI                         | 20CCh                                                                                                                                                                                                             | 01h ... 04h | Array   | uint8 | rw/ro |    |

| Device Errors |       |                                                                                                                                                           |     |        |    |
|---------------|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|-----|--------|----|
| FHPP          | 205   | –                                                                                                                                                         | –   | uint16 | rw |
| Description   |       | Reading or deleting the active device malfunction.<br>Read [Bit 0 ... 15]: See chapter 6.3, Tab. 6/6.<br>Write 0 (0x0000): Delete all device malfunctions |     |        |    |
| CI            | 2FF1h | 00h                                                                                                                                                       | Var | uint16 | rw |

## B. Reference: DeviceNet and FHPP

| <b>Fieldbus Diagnosis</b> |                                                                                                                                                                                                                                                                                                                                                                                |                    |                |              |           |
|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|----------------|--------------|-----------|
| <b>FHPP</b>               | <b>206</b>                                                                                                                                                                                                                                                                                                                                                                     | <b>1 ... 6</b>     | <b>0 ... 5</b> | <b>uint8</b> | <b>ro</b> |
| <b>Description</b>        | Read out the PROFIBUS diagnostic data                                                                                                                                                                                                                                                                                                                                          |                    |                |              |           |
| Connection State          | 206                                                                                                                                                                                                                                                                                                                                                                            | 1                  | 0              |              |           |
|                           | Current connection state.<br>0 (0x00): Waiting for parameterising<br>16 (0x10): Waiting for configuration<br>32 (0x20): Data exchange                                                                                                                                                                                                                                          |                    |                |              |           |
| Baudrate                  | 206                                                                                                                                                                                                                                                                                                                                                                            | 2                  | 1              |              |           |
|                           | Current baud rate.<br>0 (0x00): 12 MBaud      6 (0x06): 93.75 kBaud<br>1 (0x01): 6 MBaud      7 (0x07): 45.45 kBaud<br>2 (0x02): 3 MBaud      8 (0x08): 19.2 kBaud<br>3 (0x03): 1.5 MBaud    9 (0x09): 9.6 kBaud<br>4 (0x04): 500 MBaud    15, 255 (0x0F, 0xFF): No baud rate (default),<br>5 (0x05): 187.5 kBaud                                      Baud rate search active |                    |                |              |           |
| Master Address            | 206                                                                                                                                                                                                                                                                                                                                                                            | 3                  | 2              |              |           |
|                           | Master address.<br>Range of values: 0 ... 125 (0x00 ... 0x7D)<br>Default: 255 (0xFF)                                                                                                                                                                                                                                                                                           |                    |                |              |           |
| Slave Address             | 206                                                                                                                                                                                                                                                                                                                                                                            | 4                  | 3              |              |           |
|                           | Slave address ("this station").<br>Range of values: 0 ... 125 (0x00 ... 0x7D)<br>Default: 255 (0xFF)                                                                                                                                                                                                                                                                           |                    |                |              |           |
| Configuration             | 206                                                                                                                                                                                                                                                                                                                                                                            | 5                  | 4              |              |           |
|                           | Current configuration.<br>0 (0x00): Invalid configuration<br>1 (0x01): Festo FHPP standard (8 bytes I/O)<br>2 (0x02): Festo FHPP standard + FPC (2 x 8 bytes I/O)                                                                                                                                                                                                              |                    |                |              |           |
| Settings                  | 206                                                                                                                                                                                                                                                                                                                                                                            | 6                  | 5              |              |           |
|                           | Connection settings<br>0 (0x00): Device-related diagnosis ON (GbD ON, default)<br>1 (0x01): Device-related diagnosis OFF (GbD OFF)                                                                                                                                                                                                                                             |                    |                |              |           |
| <b>CI</b>                 | <b>2FF2h</b>                                                                                                                                                                                                                                                                                                                                                                   | <b>01h ... 06h</b> | <b>Array</b>   | <b>uint8</b> | <b>ro</b> |

## B.2.7 Process data

| Local digital inputs |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |     |     |        |    |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|--------|----|
| FHPP                 | 303                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | –   | –   | uint32 | ro |
| <b>Description</b>   | Map of the digital inputs. Provides the status of special inputs.<br>Bit 0, 1: Reserved (= 0)<br>Bit 2: Reference switch (1 = reference input supplies 0-signal)<br>Bit 3 ... 15: Reserved (= 0)<br>Bit 16 ... 20: Current record number (compare to control byte 3)<br>Bit 21: STOP (CCON.B1) or internal status "Stop"<br>Bit 22: ENABLE (CCON.B0) or internal status "Drive enabled"<br>Bit 23: START (CPOS.B1) or internal status "Job started"<br>Bit 24 ... 31: Reserved (= 0) |     |     |        |    |
| CI                   | 60FDh                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 00h | Var | uint32 | ro |

| Local Digital Outputs |                                                                                                                                                                                                                                                                                                                                                                                           |          |       |        |    |
|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-------|--------|----|
| FHPP                  | 304                                                                                                                                                                                                                                                                                                                                                                                       | 1, 2     | 0, 1  | uint32 | rw |
| <b>Description</b>    | Map of the digital outputs.                                                                                                                                                                                                                                                                                                                                                               |          |       |        |    |
| Digital Outputs       | 304                                                                                                                                                                                                                                                                                                                                                                                       | 1        | 0     | uint32 | rw |
|                       | Status of special outputs (written values are not adopted).<br>Bit 0 ... 15: Reserved (= 0)<br>Bit 16: MC (SPOS.B2) or internal status "Motion Complete"<br>Bit 17: ENABLED (SCON.B0) or internal status "Ready for operation"<br>Bit 18: ACK (SPOS.B1) or internal status "Start signal accepted"<br>Bit 19: FAULT (SCON.B3) or internal status "Fault"<br>Bit 20 ... 31: Reserved (= 0) |          |       |        |    |
| Mask                  | 304                                                                                                                                                                                                                                                                                                                                                                                       | 2        | 1     | uint32 | rw |
|                       | Fixed = 0 (written values are not adopted).                                                                                                                                                                                                                                                                                                                                               |          |       |        |    |
| CI                    | 60FEh                                                                                                                                                                                                                                                                                                                                                                                     | 01h, 02h | Array | uint32 | rw |

| Cycle Number       |                                                                                                   |     |     |        |    |
|--------------------|---------------------------------------------------------------------------------------------------|-----|-----|--------|----|
| FHPP               | 305                                                                                               | –   | –   | uint32 | ro |
| <b>Description</b> | Number of positioning records executed, homing runs etc.<br>Range of values: 0 ... $(2^{32} - 1)$ |     |     |        |    |
| CI                 | 2FFFh                                                                                             | 00h | Var | uint32 | ro |

## B.2.8 Record list

|                 | Record no.    | RCB1                              | Setpoint position            | Speed                        | Acc. Move-ment to            | Acc. Brake                   |
|-----------------|---------------|-----------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| <b>FHPP PNU</b> | <b>400</b>    | <b>401</b>                        | <b>404</b>                   | <b>406</b>                   | <b>407</b>                   | <b>408</b>                   |
| <b>Type</b>     | uint8         | uint8                             | int32                        | uint32                       | uint32                       | uint32                       |
| <b>Data</b>     | Record no. 0  | Homing                            |                              |                              |                              |                              |
|                 | Record no. 1  | Record control byte for record 1  | Setpoint value for record 1  | Setpoint value for record 1  | Setpoint value for record 1  | Setpoint value for record 1  |
|                 | ...           | ...                               | Setpoint value for record 2  | Setpoint value for record 2  | Setpoint value for record 2  | Setpoint value for record 2  |
|                 | ...           | ...                               | ...                          | ...                          | ...                          | ...                          |
|                 | Record no. 31 | Record control byte for record 31 | Setpoint value for record 31 | Setpoint value for record 31 | Setpoint value for record 31 | Setpoint value for record 31 |
|                 | 32            | Reserved (data for Jog mode)      |                              |                              |                              |                              |
|                 | 33            | Reserved (data for Direct mode)   |                              |                              |                              |                              |

Tab. B/9: Structure of FHPP record list

FHPP

In FHPP, record selection for reading and writing is made via the subindex of the PNUs 401 ... 408

The record to be executed is selected via the record number in PDO1. PNU 400 is needed only for teaching records in direct operation.

| Record Number      |                                                                                                                                                                                                                                                 |   |            |              |           |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|------------|--------------|-----------|
| <b>FHPP</b>        | <b>400</b>                                                                                                                                                                                                                                      | – | –          | <b>uint8</b> | <b>rw</b> |
| <b>Description</b> | The active / selected record. It is also valid when the drive is not in Record Select mode (e. g. during teaching). In Record selection mode this parameter is transferred in the cyclic I/O data.<br>Range of values: 0 ... 31 (0x00 ... 0x1F) |   |            |              |           |
| <b>CI</b>          | <b>2033h</b>                                                                                                                                                                                                                                    | – | <b>Var</b> | <b>uint8</b> | <b>rw</b> |

| Record Control Byte 1                         |                                                                                                                                                                                                                                                                                                                                                                                                                    |             |          |       |       |    |
|-----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|----------|-------|-------|----|
| FHPP                                          | 401                                                                                                                                                                                                                                                                                                                                                                                                                | 1 ... 32    | 0 ... 31 | uint8 | rw    |    |
| Description                                   | Record control byte 1 (RCB1) controls important settings for the positioning job in Record selection mode.<br>The record control byte is bit-orientated:<br>Bit 0:           Setpoint value absolute/relative<br>Bit 1 ... 7:    Reserved (=0)<br>Values:<br>0 (0x00):       Nominal value is absolute (default)<br>1 (0x01):       Setpoint value is relative to the last setpoint value/<br>switch further value |             |          |       |       |    |
|                                               | Record 0                                                                                                                                                                                                                                                                                                                                                                                                           | 401         | 1        | 0     | uint8 | rw |
|                                               | Do not use (homing)                                                                                                                                                                                                                                                                                                                                                                                                |             |          |       |       |    |
|                                               | Record ...                                                                                                                                                                                                                                                                                                                                                                                                         | 401         | ...      | ...   | uint8 | rw |
|                                               | Record control byte for positioning records 1 ... 30                                                                                                                                                                                                                                                                                                                                                               |             |          |       |       |    |
|                                               | Record 31<br>(positioning record 31)                                                                                                                                                                                                                                                                                                                                                                               | 401         | 32       | 31    | uint8 | rw |
| Record control byte for positioning record 31 |                                                                                                                                                                                                                                                                                                                                                                                                                    |             |          |       |       |    |
| CI                                            | 20EAh                                                                                                                                                                                                                                                                                                                                                                                                              | 01h ... 20h | Array    | uint8 | rw    |    |

| Record target position |                                                                                                                                                                                              |             |          |       |       |    |
|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|----------|-------|-------|----|
| FHPP                   | 404                                                                                                                                                                                          | 1 ... 32    | 0 ... 31 | int32 | rw    |    |
| Description            | Target positions of the positioning record table.<br>Absolute or relative in increments as per PNU 401 / RCB1.<br>Range of values: -2 <sup>31</sup> ... +(2 <sup>31</sup> - 1)<br>Default: 0 |             |          |       |       |    |
|                        | Record 0                                                                                                                                                                                     | 404         | 1        | 0     | int32 | rw |
|                        | Do not use (homing)                                                                                                                                                                          |             |          |       |       |    |
|                        | Record ...                                                                                                                                                                                   | 404         | ...      | ...   | int32 | rw |
|                        | Target position of positioning records 1 ... 30                                                                                                                                              |             |          |       |       |    |
|                        | Record 31                                                                                                                                                                                    | 404         | 32       | 31    | int32 | rw |
|                        | Target position of positioning record 31                                                                                                                                                     |             |          |       |       |    |
| CI                     | 20ECh                                                                                                                                                                                        | 01h ... 20h | Array    | int32 | rw    |    |

## B. Reference: DeviceNet and FHPP

| Record speed                                                                                       |                                                                                                                 |                     |          |        |        |    |
|----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|---------------------|----------|--------|--------|----|
| FHPP                                                                                               | 406                                                                                                             | 1 ... 32            | 0 ... 31 | uint32 | rw     |    |
| Description                                                                                        | Setpoint speed value in increments/s<br>Range of values: <sup>1)</sup><br>Axis type                      Values |                     |          |        |        |    |
|                                                                                                    | SLTE-10:                      0 ... 305309                      (± 0 ... 170 mm/s)                              |                     |          |        |        |    |
|                                                                                                    | SLTE-16:                      0 ... 491076                      (± 0 ... 210 mm/s)                              |                     |          |        |        |    |
|                                                                                                    | HGPLE-14/GEH60: 0 ... 674019                      (± 0 ... 55 mm/s)                                             |                     |          |        |        |    |
|                                                                                                    | HGPLE-25/GEH61: 0 ... 347593                      (± 0 ... 65 mm/s)                                             |                     |          |        |        |    |
|                                                                                                    | DEF:                      0 ... 216000                      (± 0 ... 388.8 °/s)                                 |                     |          |        |        |    |
|                                                                                                    | For user-defined axis length: 0 ... Max. speed (PNU 502)                                                        |                     |          |        |        |    |
|                                                                                                    | Default: dependent on the axis type                                                                             |                     |          |        |        |    |
|                                                                                                    | Record 0                                                                                                        | 406                 | 1        | 0      | uint32 | rw |
|                                                                                                    |                                                                                                                 | Do not use (homing) |          |        |        |    |
| Record ...                                                                                         | 406                                                                                                             | ...                 | ...      | uint32 | rw     |    |
|                                                                                                    | Speed of positioning record 1 ... 30                                                                            |                     |          |        |        |    |
| Record 31                                                                                          | 406                                                                                                             | 32                  | 31       | uint32 | rw     |    |
|                                                                                                    | Speed of positioning record 31                                                                                  |                     |          |        |        |    |
| CI                                                                                                 | 20EDh                                                                                                           | 01h ... 20h         | Array    | uint32 | rw     |    |
|                                                                                                    | Additional subindex of object 20EDh see PNU 531                                                                 |                     |          |        |        |    |
| <sup>1)</sup> Range of values dependent on the axis type (PNU 1005/4) and axis length (PNU 1005/5) |                                                                                                                 |                     |          |        |        |    |

| Record Acceleration                                                                                |                                                                                                                                                                                                         |             |          |        |    |
|----------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|----------|--------|----|
| FHPP                                                                                               | 407                                                                                                                                                                                                     | 1 ... 32    | 0 ... 31 | uint32 | rw |
| Description                                                                                        | Setpoint acceleration value for moving in increments/s <sup>2</sup><br>The acceleration can only be specified for Positioning mode.<br>Range of values: <sup>1)</sup><br><u>Axis type</u> <u>Values</u> |             |          |        |    |
|                                                                                                    | SLTE-10:                    897969 ... 4489845                    (Δ 500 ... 2500 mm/s <sup>2</sup> )                                                                                                   |             |          |        |    |
|                                                                                                    | SLTE-16:                    1169230 ... 5846154                    (Δ 500 ... 2500 mm/s <sup>2</sup> )                                                                                                  |             |          |        |    |
|                                                                                                    | HGPLE-14/GEH60: 1225490 ... 12254901                    (Δ 100 ... 1000 mm/s <sup>2</sup> )                                                                                                             |             |          |        |    |
|                                                                                                    | HGPLE-25/GEH61: 534759 ... 5347593                    (Δ 100 ... 1000 mm/s <sup>2</sup> )                                                                                                               |             |          |        |    |
|                                                                                                    | DEF:                    200000 ... 5000000                    (Δ 360 ... 9,000 °/s <sup>2</sup> )                                                                                                       |             |          |        |    |
|                                                                                                    | For user-defined axis length: 0 ... Max. acceleration (PNU 503)                                                                                                                                         |             |          |        |    |
|                                                                                                    | Default:                                                                                                                                                                                                |             |          |        |    |
|                                                                                                    | SLTE:                    500 mm/s <sup>2</sup>                                                                                                                                                          |             |          |        |    |
|                                                                                                    | HGPLE/GEH:          100 mm/s <sup>2</sup>                                                                                                                                                               |             |          |        |    |
|                                                                                                    | DEF:                    360 °/s <sup>2</sup>                                                                                                                                                            |             |          |        |    |
|                                                                                                    | Value is automatically entered when an axis type is selected (PNU 1005/4).                                                                                                                              |             |          |        |    |
| Record 0                                                                                           | 407                                                                                                                                                                                                     | 1           | 0        | uint32 | rw |
|                                                                                                    | Do not use (homing)                                                                                                                                                                                     |             |          |        |    |
| Record ...                                                                                         | 407                                                                                                                                                                                                     | ...         | ...      | uint32 | rw |
|                                                                                                    | Acceleration for positioning records 1 ... 30                                                                                                                                                           |             |          |        |    |
| Record 31                                                                                          | 407                                                                                                                                                                                                     | 32          | 31       | uint32 | rw |
|                                                                                                    | Acceleration for positioning record 31                                                                                                                                                                  |             |          |        |    |
| CI                                                                                                 | 20EEh                                                                                                                                                                                                   | 01h ... 20h | Array    | uint32 | rw |
|                                                                                                    | Additional subindices of object 20EEh see PNU 532 and 541                                                                                                                                               |             |          |        |    |
| <sup>1)</sup> Range of values dependent on the axis type (PNU 1005/4) and axis length (PNU 1005/5) |                                                                                                                                                                                                         |             |          |        |    |

| Record Deceleration                      |                                                                                                                                                                                                                                                        |             |          |        |        |    |
|------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|----------|--------|--------|----|
| FHPP                                     | 408                                                                                                                                                                                                                                                    | 1 ... 32    | 0 ... 31 | uint32 | rw     |    |
| Description                              | Setpoint for braking (deceleration) in increments/s <sup>2</sup><br>The deceleration can only be specified for Positioning mode.<br>Value is automatically entered when an axis type is selected (PNU 1005/4).<br>Value range and default: See PNU 407 |             |          |        |        |    |
|                                          | Record 0                                                                                                                                                                                                                                               | 408         | 1        | 0      | uint32 | rw |
|                                          | Do not use (homing)                                                                                                                                                                                                                                    |             |          |        |        |    |
|                                          | Record ...                                                                                                                                                                                                                                             | 408         | ...      | ...    | uint32 | rw |
|                                          | Deceleration for positioning records 1 ... 30                                                                                                                                                                                                          |             |          |        |        |    |
|                                          | Record 31                                                                                                                                                                                                                                              | 408         | 32       | 31     | uint32 | rw |
|                                          | Deceleration for positioning record 31                                                                                                                                                                                                                 |             |          |        |        |    |
| CI                                       | 20EFh                                                                                                                                                                                                                                                  | 01h ... 20h | Array    | uint32 | rw     |    |
|                                          | Additional subindices of object 20EFh see PNU 533 and 542                                                                                                                                                                                              |             |          |        |        |    |
| 1) Depends on axis type, see PNU 1005/04 |                                                                                                                                                                                                                                                        |             |          |        |        |    |

## B.2.9 Project data – General

| Project Zero Point |                                                                                                                                                                                                         |            |            |              |           |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------|--------------|-----------|
| <b>FHPP</b>        | <b>500</b>                                                                                                                                                                                              | <b>–</b>   | <b>–</b>   | <b>int32</b> | <b>rw</b> |
| <b>Description</b> | Offset of axis zero point to project zero point in increments.<br>Reference point for position values in the application (see PNU 404).<br>Range of values: $-2^{31} \dots +(2^{31} - 1)$<br>Default: 0 |            |            |              |           |
| <b>CI</b>          | <b>21F4h</b>                                                                                                                                                                                            | <b>00h</b> | <b>Var</b> | <b>int32</b> | <b>rw</b> |

| Software End Position |                                                                                                                                                                                                                                                                                                                                                                    |                 |              |              |           |
|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|--------------|--------------|-----------|
| <b>FHPP</b>           | <b>501</b>                                                                                                                                                                                                                                                                                                                                                         | <b>1, 2</b>     | <b>0, 1</b>  | <b>int32</b> | <b>rw</b> |
| <b>Description</b>    | Software end positions in increments.<br>The offset to the axis zero point is entered. Target positions outside the end positions are not permitted and will lead to a fault.<br>An entry of 0 for both end positions deactivates the software end positions.<br>Plausibility rule: Min. limit $\leq$ Max. limit<br>Range of values: $-2^{31} \dots +(2^{31} - 1)$ |                 |              |              |           |
| Lower Limit           | 501                                                                                                                                                                                                                                                                                                                                                                | 1               | 0            | int32        | rw        |
|                       | software end position, negative<br>Default:<br>SLTE-10: 0 ( $\triangleq 0$ mm)<br>SLTE-16: 0 ( $\triangleq 0$ mm)<br>HGPLE-14/GEH60: -50511 ( $\triangleq -29,5$ mm)<br>HGPLE-25/GEH61: -211230 ( $\triangleq -39,5$ mm)<br>DEF: 0 ( $\triangleq 0^\circ$ )<br>Value is automatically entered when an axis type is selected (PNU 1005/4).                          |                 |              |              |           |
| Upper Limit           | 501                                                                                                                                                                                                                                                                                                                                                                | 2               | 1            | int32        | rw        |
|                       | Software end position, positive<br>Default:<br>SLTE-10: 89797 ( $\triangleq 50$ mm)<br>SLTE-16: 116922 ( $\triangleq 50$ mm)<br>HGPLE-14/GEH60: 6127 ( $\triangleq 0,5$ mm)<br>HGPLE-25/GEH61: 2674 ( $\triangleq 0,5$ mm)<br>DEF: 200000 ( $\triangleq 360^\circ$ )<br>Value is automatically entered when an axis type is selected (PNU 1005/4).                 |                 |              |              |           |
| <b>CI</b>             | <b>607Bh</b>                                                                                                                                                                                                                                                                                                                                                       | <b>01h, 02h</b> | <b>Array</b> | <b>int32</b> | <b>rw</b> |

## B. Reference: DeviceNet and FHPP

| <b>Max. speed</b>  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            |            |               |           |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------|---------------|-----------|
| <b>FHPP</b>        | <b>502</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>–</b>   | <b>–</b>   | <b>uint32</b> | <b>rw</b> |
| <b>Description</b> | <p>Maximum permissible speed in increments/s. The specifications in Direct mode and in the record table refer to this value.</p> <p>Dependent on the axis type (PNU 1005/4) and axis length (PNU 1005/5):</p> <ul style="list-style-type: none"> <li>– The values are permanently set by selection of the axis type or automatically entered. Other values are not allowed.</li> <li>– For user-defined axis lengths, the values can be freely written.</li> </ul> <p>SLTE-10:                    305309    (Δ 170 mm/s)</p> <p>SLTE-16:                    491076    (Δ 210 mm/s)</p> <p>HGPLe-14/GEH60: 674019    (Δ 55 mm/s)</p> <p>HGPLe-25/GEH61: 347593    (Δ 65 mm/s)</p> <p>DEF:                        216000    (Δ 388.8 °/s)</p> <p>Value is automatically entered when an axis type is selected (PNU 1005/4).</p> |            |            |               |           |
| <b>CI</b>          | <b>21F6h</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>00h</b> | <b>Var</b> | <b>uint32</b> | <b>rw</b> |

| <b>Max. Acceleration</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |            |            |               |           |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------|---------------|-----------|
| <b>FHPP</b>              | <b>503</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>–</b>   | <b>–</b>   | <b>uint32</b> | <b>rw</b> |
| <b>Description</b>       | <p>Max. permitted acceleration in increments/s<sup>2</sup>. The specifications in Direct mode and in the record table refer to this value.</p> <p>Dependent on the axis type (PNU 1005/4) and axis length (PNU 1005/5):</p> <ul style="list-style-type: none"> <li>– The values are permanently set by selection of the axis type or automatically entered. Other values are not allowed.</li> <li>– For user-defined axis lengths, the values can be freely written.</li> </ul> <p>SLTE-10:                    4489845    (Δ 2500 mm/s<sup>2</sup>)</p> <p>SLTE-16:                    5846154    (Δ 2500 mm/s<sup>2</sup>)</p> <p>HGPLe-14/GEH60: 12254901    (Δ 1000 mm/s<sup>2</sup>)</p> <p>HGPLe-25/GEH61: 5347593    (Δ 1000 mm/s<sup>2</sup>)</p> <p>DEF:                        5000000    (Δ 9000 °/s<sup>2</sup>)</p> <p>Value is automatically entered when an axis type is selected (PNU 1005/4).</p> |            |            |               |           |
| <b>CI</b>                | <b>21F7h</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>00h</b> | <b>Var</b> | <b>uint32</b> | <b>rw</b> |

## B.2.10 Project data – Force mode

| Stroke Limit |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |     |   |        |    |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|---|--------|----|
| FHPP         | 510                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | –   | – | uint32 | rw |
| Description  | <p>Maximum permitted stroke with active Force mode.<br/>           With active force control, the actual position relative to the start position must not change by more than the amount specified in this parameter. In this way you can ensure that the axis will not perform an uncontrolled movement if Force mode is activated by mistake (e.g. missing workpiece). This parameter is taken into account in all control modes in which the position controller is not active in the status “Operation enabled”.<br/>           Monitoring can be deactivated when bit RCB1.B5 is set.<br/>           Range of values: 0 ... <math>+(2^{32} - 1)</math><br/>           Default:<br/>           SLTE-10: 17959 (<math>\triangleq 10</math> mm)<br/>           SLTE-16: 23384 (<math>\triangleq 10</math> mm)<br/>           HGPLE-14/GEH60: 112246 (<math>\triangleq 10</math> mm)<br/>           HGPLE-25/GEH61: 53475 (<math>\triangleq 10</math> mm)<br/>           DEF: 20000 (<math>\triangleq 36^\circ</math>)<br/>           Value is automatically entered when an axis type is selected (PNU 1005/4).</p> |     |   |        |    |
| CI           | 60F6h                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 01h |   | uint32 | rw |

| Min. Torque/Force |                                                                                                                                                                                                                           |     |   |        |    |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|---|--------|----|
| FHPP              | 511                                                                                                                                                                                                                       | –   | – | uint16 | rw |
| Description       | <p>The lowest permissible torque (force) of the motor.<br/>           Specified in 1/1000 of the rated torque (PNU 1036 / Object 6076h)<br/>           Range of values: 0 ... 1000 (0x03E8)<br/>           Default: 0</p> |     |   |        |    |
| CI                | 60F6h                                                                                                                                                                                                                     | 05h |   | uint16 | rw |

| Max Torque/Force |                                                                                                                                                                                                                        |     |     |        |    |
|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|--------|----|
| FHPP             | 512                                                                                                                                                                                                                    | –   | –   | uint16 | rw |
| Description      | <p>The highest permissible torque (force) of the motor.<br/>           Specified in 1/1000 of the rated torque (PNU 1036 / 6076h)<br/>           Range of values: 0 ... 1000 (0x03E8)<br/>           Default: 1000</p> |     |     |        |    |
| CI               | 6072h                                                                                                                                                                                                                  | 00h | Var | uint16 | rw |

B.2.11 Project data – Teaching

| Teach Target |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |     |     |       |    |
|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|-------|----|
| FHPP         | 520                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | –   | –   | uint8 | rw |
| Description  | <p>The parameter defined is the one written with the actual position by the next Teach command (see chapter 5.6.3).</p> <p>Values:</p> <p>1 (0x01): Setpoint position in positioning record (default).</p> <ul style="list-style-type: none"><li>– With Record selection: positioning record as per FHPP control bytes</li><li>– With Direct mode: Positioning record as per PNU 400</li></ul> <p>2 (0x02): Axis zero point</p> <p>3 (0x03): Project zero point</p> <p>4 (0x04): Lower software end position</p> <p>5 (0x05): Upper software end position</p> |     |     |       |    |
| CI           | 21FCh                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 00h | Var | uint8 | rw |

## B.2.12 Project data – Jog mode

| Jog Mode Velocity Phase 2                                                               |                                                                                    |     |       |        |    |
|-----------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-----|-------|--------|----|
| FHPP                                                                                    | 531                                                                                | –   | –     | uint32 | rw |
| Description                                                                             | Maximum speed for phase 2 in increments/s.<br>Range of values: 1)                  |     |       |        |    |
|                                                                                         | Axis type                      Values                                              |     |       |        |    |
|                                                                                         | SLTE-10:                      0 ... 305309                      (△ 0 ... 170 mm/s) |     |       |        |    |
|                                                                                         | SLTE-16:                      0 ... 491076                      (△ 0 ... 210 mm/s) |     |       |        |    |
|                                                                                         | HGPLE-14/GEH60: 0 ... 674019                      (△ 0 ... 55 mm/s)                |     |       |        |    |
|                                                                                         | HGPLE-25/GEH61: 0 ... 347593                      (△ 0 ... 65 mm/s)                |     |       |        |    |
|                                                                                         | DEF:                      0 ... 216000                      (△ 0 ... 388.8 °/s)    |     |       |        |    |
|                                                                                         | For user-defined axis length: 0 ... Max. speed (PNU 502)                           |     |       |        |    |
|                                                                                         | Default:                                                                           |     |       |        |    |
|                                                                                         | SLTE-10:                      30530                      (△ 17 mm/s)               |     |       |        |    |
|                                                                                         | SLTE-16:                      49107                      (△ 21 mm/s)               |     |       |        |    |
|                                                                                         | HGPLE-14/GEH60: 89460                      (△ 7.3 mm/s)                            |     |       |        |    |
|                                                                                         | HGPLE-25/GEH61: 39037                      (△ 7.3 mm/s)                            |     |       |        |    |
|                                                                                         | DEF:                      21666                      (△ 39 °/s)                    |     |       |        |    |
|                                                                                         | Value is automatically entered when an axis type is selected (PNU 1005/4).         |     |       |        |    |
| CI                                                                                      | 20EDh                                                                              | 21h | Array | uint32 | rw |
|                                                                                         | For additional subindices of object 20EDh see PNU 406                              |     |       |        |    |
| 1) Range of values dependent on the axis type (PNU 1005/4) and axis length (PNU 1005/5) |                                                                                    |     |       |        |    |

| Jog Mode Acceleration                                                                              |                                                                               |                       |                                     |        |    |
|----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|-----------------------|-------------------------------------|--------|----|
| FHPP                                                                                               | 532                                                                           | –                     | –                                   | uint32 | rw |
| Description                                                                                        | Acceleration in increments/s <sup>2</sup> .<br>Range of values: <sup>1)</sup> |                       |                                     |        |    |
|                                                                                                    | Axis type                                                                     |                       | Values                              |        |    |
|                                                                                                    | SLTE-10:                                                                      | 897969 ... 4489845    | (Δ 500 ... 2500 mm/s <sup>2</sup> ) |        |    |
|                                                                                                    | SLTE-16:                                                                      | 1169230 ... 5846154   | (Δ 500 ... 2500 mm/s <sup>2</sup> ) |        |    |
|                                                                                                    | HGPLE-14/GEH60:                                                               | 1225490 ... 12254901  | (Δ 100 ... 1000 mm/s <sup>2</sup> ) |        |    |
|                                                                                                    | HGPLE-25/GEH61:                                                               | 534759 ... 5347593    | (Δ 100 ... 1000 mm/s <sup>2</sup> ) |        |    |
|                                                                                                    | DEF:                                                                          | 200000 ... 5000000    | (Δ 360 ... 9,000 °/s <sup>2</sup> ) |        |    |
|                                                                                                    | For user-defined axis length: 0 ... Max. acceleration (PNU 503)               |                       |                                     |        |    |
|                                                                                                    | Default:                                                                      |                       |                                     |        |    |
|                                                                                                    | SLTE:                                                                         | 500 mm/s <sup>2</sup> |                                     |        |    |
| HGPLE/GEH:                                                                                         | 100 mm/s <sup>2</sup>                                                         |                       |                                     |        |    |
| DEF:                                                                                               | 360 °/s <sup>2</sup>                                                          |                       |                                     |        |    |
| Value is automatically entered when an axis type is selected (PNU 1005/4).                         |                                                                               |                       |                                     |        |    |
| CI                                                                                                 | 20EEh                                                                         | 21h                   | Array                               | uint32 | rw |
|                                                                                                    | Additional subindices of object 20EEh see PNU 407 and 541                     |                       |                                     |        |    |
| <sup>1)</sup> Range of values dependent on the axis type (PNU 1005/4) and axis length (PNU 1005/5) |                                                                               |                       |                                     |        |    |

| <b>Jog Mode Deceleration</b> |                                                                                     |            |              |               |           |
|------------------------------|-------------------------------------------------------------------------------------|------------|--------------|---------------|-----------|
| <b>FHPP</b>                  | <b>533</b>                                                                          | <b>–</b>   | <b>–</b>     | <b>uint32</b> | <b>rw</b> |
| <b>Description</b>           | Deceleration in increments/s <sup>2</sup> .<br>Value range and default: See PNU 532 |            |              |               |           |
| <b>CI</b>                    | <b>20EFh</b>                                                                        | <b>21h</b> | <b>Array</b> | <b>uint32</b> | <b>rw</b> |
|                              | Additional subindices of object 20EFh see PNU 408 and 542                           |            |              |               |           |

| <b>Jog Mode Time Phase 1</b> |                                                                                                                  |            |              |               |           |
|------------------------------|------------------------------------------------------------------------------------------------------------------|------------|--------------|---------------|-----------|
| <b>FHPP</b>                  | <b>534</b>                                                                                                       | <b>–</b>   | <b>–</b>     | <b>uint32</b> | <b>rw</b> |
| <b>Description</b>           | Time period of phase 1 (T1) in ms<br>Range of values: 0 ... +(2 <sup>32</sup> - 1)<br>Default: 2000 (0x000007D0) |            |              |               |           |
| <b>CI</b>                    | <b>20E9h</b>                                                                                                     | <b>21h</b> | <b>Array</b> | <b>uint32</b> | <b>rw</b> |

B.2.13 Project data – Direct mode (Positioning mode)

| Direct Mode Acceleration                                                                           |                                                                                              |                       |        |                                     |    |
|----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|-----------------------|--------|-------------------------------------|----|
| FHPP                                                                                               | 541                                                                                          | –                     | –      | uint32                              | rw |
| Description                                                                                        | Acceleration in direct mode in increments/s <sup>2</sup> .<br>Range of values: <sup>1)</sup> |                       |        |                                     |    |
|                                                                                                    | Axis type                                                                                    |                       | Values |                                     |    |
|                                                                                                    | SLTE-10:                                                                                     | 897969 ... 4489845    |        | (Δ 500 ... 2500 mm/s <sup>2</sup> ) |    |
|                                                                                                    | SLTE-16:                                                                                     | 1169230 ... 5846154   |        | (Δ 500 ... 2500 mm/s <sup>2</sup> ) |    |
|                                                                                                    | HGPLE-14/GEH60:                                                                              | 1225490 ... 12254901  |        | (Δ 100 ... 1000 mm/s <sup>2</sup> ) |    |
|                                                                                                    | HGPLE-25/GEH61:                                                                              | 534759 ... 5347593    |        | (Δ 100 ... 1000 mm/s <sup>2</sup> ) |    |
|                                                                                                    | DEF:                                                                                         | 200000 ... 5000000    |        | (Δ 360 ... 9,000 °/s <sup>2</sup> ) |    |
|                                                                                                    | For user-defined axis length: 0 ... Max. acceleration (PNU 503)                              |                       |        |                                     |    |
|                                                                                                    | Default:                                                                                     |                       |        |                                     |    |
|                                                                                                    | SLTE:                                                                                        | 500 mm/s <sup>2</sup> |        |                                     |    |
|                                                                                                    | HGPLE/GEH:                                                                                   | 100 mm/s <sup>2</sup> |        |                                     |    |
|                                                                                                    | DEF:                                                                                         | 360 °/s <sup>2</sup>  |        |                                     |    |
| Value is automatically entered when an axis type is selected (PNU 1005/4).                         |                                                                                              |                       |        |                                     |    |
| CI                                                                                                 | 20EEh                                                                                        | 22h                   | Array  | uint32                              | rw |
|                                                                                                    | Additional subindices of object 20EEh see PNU 407 and 532                                    |                       |        |                                     |    |
| <sup>1)</sup> Range of values dependent on the axis type (PNU 1005/4) and axis length (PNU 1005/5) |                                                                                              |                       |        |                                     |    |

| Direct Mode Deceleration |                                                                                                    |     |                     |        |    |
|--------------------------|----------------------------------------------------------------------------------------------------|-----|---------------------|--------|----|
| FHPP                     | 542                                                                                                | –   | –                   | uint32 | rw |
| Description              | Deceleration in direct mode in increments/s <sup>2</sup> .<br>Value range and default: See PNU 541 |     |                     |        |    |
| CI                       | 20EFh                                                                                              | 22h | Array <sup>1)</sup> | uint32 | rw |
|                          | Additional subindices of object 20EFh see PNU 408 and 533                                          |     |                     |        |    |

### B.2.14 Project data – Direct mode (Force mode)

| Force Target Window |                                                                                                                                                                                                                                                                                                                                                                                                                                                 |            |   |               |           |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|---|---------------|-----------|
| <b>FHPP</b>         | <b>552</b>                                                                                                                                                                                                                                                                                                                                                                                                                                      | –          | – | <b>uint16</b> | <b>rw</b> |
| <b>Description</b>  | <p>This is the amount by which the actual force (actual torque) may differ from the setpoint force (setpoint torque), in order to be interpreted as still being in the target window. The width of the window is twice the value transferred, with the target position in the centre of the window.</p> <p>The value is specified in 1/1000 of the rated torque (6076h / PNU 1036).</p> <p>Range of values: 0 ... 65535</p> <p>Default: 100</p> |            |   |               |           |
| <b>CI</b>           | <b>60F6h</b>                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>03h</b> | – | <b>uint16</b> | <b>rw</b> |

| Force Target Window Time |                                                                                                                                                                                                                                                                           |            |   |               |           |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|---|---------------|-----------|
| <b>FHPP</b>              | <b>553</b>                                                                                                                                                                                                                                                                | –          | – | <b>uint16</b> | <b>rw</b> |
| <b>Description</b>       | <p>Damping time in [ms]. If the actual force (actual torque) has been in the target window this amount of time, the “Target reached” bit will be set in the status word (Motion Complete).</p> <p>Range of values: 0 ... 30000 (Δ 30 s)</p> <p>Default: 100 (Δ 0.1 s)</p> |            |   |               |           |
| <b>CI</b>                | <b>60F6h</b>                                                                                                                                                                                                                                                              | <b>04h</b> | – | <b>uint16</b> | <b>rw</b> |

| Force Mode Speed Limit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                    |                            |   |        |    |           |        |  |          |              |                            |          |              |                            |                 |              |                           |                 |              |                           |      |                                                    |  |                                                          |  |  |          |  |  |          |       |                     |          |       |                     |                 |        |                     |                 |       |                     |      |       |                   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|----------------------------|---|--------|----|-----------|--------|--|----------|--------------|----------------------------|----------|--------------|----------------------------|-----------------|--------------|---------------------------|-----------------|--------------|---------------------------|------|----------------------------------------------------|--|----------------------------------------------------------|--|--|----------|--|--|----------|-------|---------------------|----------|-------|---------------------|-----------------|--------|---------------------|-----------------|-------|---------------------|------|-------|-------------------|
| FHPP                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 554                                                | –                          | – | uint32 | rw |           |        |  |          |              |                            |          |              |                            |                 |              |                           |                 |              |                           |      |                                                    |  |                                                          |  |  |          |  |  |          |       |                     |          |       |                     |                 |        |                     |                 |       |                     |      |       |                   |
| <p>Maximum permitted speed with active Force mode, in increments/s.<br/>In this way you can ensure that the axis will not undergo uncontrolled acceleration and move at high speed against a stop if force control is activated by mistake (e.g. workpiece missing). This parameter is taken into account in all control modes in which the position controller is <b>not</b> active in the status “Operation enabled”.</p> <p>Range of values: <sup>1)</sup></p> <table><thead><tr><th>Axis type</th><th colspan="2">Values</th></tr></thead><tbody><tr><td>SLTE-10:</td><td>0 ... 305309</td><td>(<math>\Delta</math> 0 ... 170 mm/s)</td></tr><tr><td>SLTE-16:</td><td>0 ... 491076</td><td>(<math>\Delta</math> 0 ... 210 mm/s)</td></tr><tr><td>HGPLE-14/GEH60:</td><td>2 ... 428921</td><td>(<math>\Delta</math> 0 ... 35 mm/s)</td></tr><tr><td>HGPLE-25/GEH61:</td><td>2 ... 267379</td><td>(<math>\Delta</math> 0 ... 50 mm/s)</td></tr><tr><td>DEF:</td><td colspan="2">0 ... Max. permitted speed (PNU 502, object 21F6h)</td></tr><tr><td colspan="3">For user-defined axis length: 0 ... Max. speed (PNU 502)</td></tr><tr><td colspan="3">Default:</td></tr><tr><td>SLTE-10:</td><td>17959</td><td>(<math>\Delta</math> 10 mm/s)</td></tr><tr><td>SLTE-16:</td><td>23384</td><td>(<math>\Delta</math> 10 mm/s)</td></tr><tr><td>HGPLE-14/GEH60:</td><td>122549</td><td>(<math>\Delta</math> 10 mm/s)</td></tr><tr><td>HGPLE-25/GEH61:</td><td>53475</td><td>(<math>\Delta</math> 10 mm/s)</td></tr><tr><td>DEF:</td><td>20000</td><td>(<math>\Delta</math> 36°/s)</td></tr></tbody></table> <p>Value is automatically entered when an axis type is selected (PNU 1005/4).</p> |                                                    |                            |   |        |    | Axis type | Values |  | SLTE-10: | 0 ... 305309 | ( $\Delta$ 0 ... 170 mm/s) | SLTE-16: | 0 ... 491076 | ( $\Delta$ 0 ... 210 mm/s) | HGPLE-14/GEH60: | 2 ... 428921 | ( $\Delta$ 0 ... 35 mm/s) | HGPLE-25/GEH61: | 2 ... 267379 | ( $\Delta$ 0 ... 50 mm/s) | DEF: | 0 ... Max. permitted speed (PNU 502, object 21F6h) |  | For user-defined axis length: 0 ... Max. speed (PNU 502) |  |  | Default: |  |  | SLTE-10: | 17959 | ( $\Delta$ 10 mm/s) | SLTE-16: | 23384 | ( $\Delta$ 10 mm/s) | HGPLE-14/GEH60: | 122549 | ( $\Delta$ 10 mm/s) | HGPLE-25/GEH61: | 53475 | ( $\Delta$ 10 mm/s) | DEF: | 20000 | ( $\Delta$ 36°/s) |
| Axis type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Values                                             |                            |   |        |    |           |        |  |          |              |                            |          |              |                            |                 |              |                           |                 |              |                           |      |                                                    |  |                                                          |  |  |          |  |  |          |       |                     |          |       |                     |                 |        |                     |                 |       |                     |      |       |                   |
| SLTE-10:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0 ... 305309                                       | ( $\Delta$ 0 ... 170 mm/s) |   |        |    |           |        |  |          |              |                            |          |              |                            |                 |              |                           |                 |              |                           |      |                                                    |  |                                                          |  |  |          |  |  |          |       |                     |          |       |                     |                 |        |                     |                 |       |                     |      |       |                   |
| SLTE-16:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0 ... 491076                                       | ( $\Delta$ 0 ... 210 mm/s) |   |        |    |           |        |  |          |              |                            |          |              |                            |                 |              |                           |                 |              |                           |      |                                                    |  |                                                          |  |  |          |  |  |          |       |                     |          |       |                     |                 |        |                     |                 |       |                     |      |       |                   |
| HGPLE-14/GEH60:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 2 ... 428921                                       | ( $\Delta$ 0 ... 35 mm/s)  |   |        |    |           |        |  |          |              |                            |          |              |                            |                 |              |                           |                 |              |                           |      |                                                    |  |                                                          |  |  |          |  |  |          |       |                     |          |       |                     |                 |        |                     |                 |       |                     |      |       |                   |
| HGPLE-25/GEH61:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 2 ... 267379                                       | ( $\Delta$ 0 ... 50 mm/s)  |   |        |    |           |        |  |          |              |                            |          |              |                            |                 |              |                           |                 |              |                           |      |                                                    |  |                                                          |  |  |          |  |  |          |       |                     |          |       |                     |                 |        |                     |                 |       |                     |      |       |                   |
| DEF:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0 ... Max. permitted speed (PNU 502, object 21F6h) |                            |   |        |    |           |        |  |          |              |                            |          |              |                            |                 |              |                           |                 |              |                           |      |                                                    |  |                                                          |  |  |          |  |  |          |       |                     |          |       |                     |                 |        |                     |                 |       |                     |      |       |                   |
| For user-defined axis length: 0 ... Max. speed (PNU 502)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                    |                            |   |        |    |           |        |  |          |              |                            |          |              |                            |                 |              |                           |                 |              |                           |      |                                                    |  |                                                          |  |  |          |  |  |          |       |                     |          |       |                     |                 |        |                     |                 |       |                     |      |       |                   |
| Default:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                    |                            |   |        |    |           |        |  |          |              |                            |          |              |                            |                 |              |                           |                 |              |                           |      |                                                    |  |                                                          |  |  |          |  |  |          |       |                     |          |       |                     |                 |        |                     |                 |       |                     |      |       |                   |
| SLTE-10:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 17959                                              | ( $\Delta$ 10 mm/s)        |   |        |    |           |        |  |          |              |                            |          |              |                            |                 |              |                           |                 |              |                           |      |                                                    |  |                                                          |  |  |          |  |  |          |       |                     |          |       |                     |                 |        |                     |                 |       |                     |      |       |                   |
| SLTE-16:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 23384                                              | ( $\Delta$ 10 mm/s)        |   |        |    |           |        |  |          |              |                            |          |              |                            |                 |              |                           |                 |              |                           |      |                                                    |  |                                                          |  |  |          |  |  |          |       |                     |          |       |                     |                 |        |                     |                 |       |                     |      |       |                   |
| HGPLE-14/GEH60:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 122549                                             | ( $\Delta$ 10 mm/s)        |   |        |    |           |        |  |          |              |                            |          |              |                            |                 |              |                           |                 |              |                           |      |                                                    |  |                                                          |  |  |          |  |  |          |       |                     |          |       |                     |                 |        |                     |                 |       |                     |      |       |                   |
| HGPLE-25/GEH61:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 53475                                              | ( $\Delta$ 10 mm/s)        |   |        |    |           |        |  |          |              |                            |          |              |                            |                 |              |                           |                 |              |                           |      |                                                    |  |                                                          |  |  |          |  |  |          |       |                     |          |       |                     |                 |        |                     |                 |       |                     |      |       |                   |
| DEF:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 20000                                              | ( $\Delta$ 36°/s)          |   |        |    |           |        |  |          |              |                            |          |              |                            |                 |              |                           |                 |              |                           |      |                                                    |  |                                                          |  |  |          |  |  |          |       |                     |          |       |                     |                 |        |                     |                 |       |                     |      |       |                   |
| CI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 60F6h                                              | 02h                        | – | uint32 | rw |           |        |  |          |              |                            |          |              |                            |                 |              |                           |                 |              |                           |      |                                                    |  |                                                          |  |  |          |  |  |          |       |                     |          |       |                     |                 |        |                     |                 |       |                     |      |       |                   |
| <p><sup>1)</sup> Range of values dependent on the axis type (PNU 1005/4) and axis length (PNU 1005/5).<br/>The force control is not approved for the mini slides and rotary modules; this can only be activated for user-defined axes via object 6502.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                    |                            |   |        |    |           |        |  |          |              |                            |          |              |                            |                 |              |                           |                 |              |                           |      |                                                    |  |                                                          |  |  |          |  |  |          |       |                     |          |       |                     |                 |        |                     |                 |       |                     |      |       |                   |

## B.2.15 Axis parameter electric drive 1 – Mechanical

| <b>Polarity</b>    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |            |            |              |           |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------|--------------|-----------|
| <b>FHPP</b>        | <b>1000</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>–</b>   | <b>–</b>   | <b>uint8</b> | <b>rw</b> |
| <b>Description</b> | <p>With this parameter the “+/-” direction of the position values (vectors) can be assigned to the direction of rotation of the motor shaft (see chapter 1.6).<br/>A new homing is then required.</p> <p>Values:</p> <p>0 (0x00) = Factory setting<br/>                  (“+” corresponds to rotational movement in a clockwise direction)</p> <p>128 (0x80) = Reverse direction<br/>                  (“+” corresponds to rotational movement in an anti-clockwise direction)</p> |            |            |              |           |
| <b>CI</b>          | <b>607Eh</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>00h</b> | <b>Var</b> | <b>uint8</b> | <b>rw</b> |

| <b>Encoder Resolution</b> |                                                                                                                                                                                                                                                    |                 |              |               |           |
|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|--------------|---------------|-----------|
| <b>FHPP</b>               | <b>1001</b>                                                                                                                                                                                                                                        | <b>1, 2</b>     | <b>0, 1</b>  | <b>uint32</b> | <b>rw</b> |
| <b>Description</b>        | Encoder resolution calculated from [encoder increments / motor revolutions]                                                                                                                                                                        |                 |              |               |           |
| Encoder Increments        | 1001                                                                                                                                                                                                                                               | 1               | 0            | uint32        | rw        |
| Motor Revolutions         | <p>Values (fixed, read-only):</p> <p>SLTE-10: 512</p> <p>SLTE-16: 1000</p> <p>HGPLE/GEH: 1000</p> <p>DEF: 500</p> <p>Value is automatically entered when an axis type is selected (PNU 1005/4).<br/>Other values are not adopted when written.</p> |                 |              |               |           |
|                           | 1001                                                                                                                                                                                                                                               | 2               | 1            | uint32        | rw        |
|                           | Fixed = 1                                                                                                                                                                                                                                          |                 |              |               |           |
|                           |                                                                                                                                                                                                                                                    |                 |              |               |           |
| <b>CI</b>                 | <b>608Fh</b>                                                                                                                                                                                                                                       | <b>01h, 02h</b> | <b>Array</b> | <b>uint32</b> | <b>rw</b> |

| <b>Gear Ratio</b>  |                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |              |               |           |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|--------------|---------------|-----------|
| <b>FHPP</b>        | <b>1002</b>                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>1, 2</b>     | <b>0, 1</b>  | <b>uint32</b> | <b>rw</b> |
| <b>Description</b> | Ratio of the internal motor revolutions to the external revolutions of the drive shaft of the motor.<br>Gear ratio = motor revolutions / spindle revolutions.<br>Dependent on the axis type (PNU 1005/4) and axis length (PNU 1005/5):<br>– The values are permanently set by selection of the axis type or automatically entered. Other values are not allowed.<br>– For user-defined axis lengths, the values can be freely written. |                 |              |               |           |
| Motor Revolutions  | 1002                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1               | 0            | uint32        | rw        |
| Shaft Revolutions  | Internal motor revolutions (gear ratio – numerator)<br>SLTE: 57<br>HGPLE-14/GEH60: 385<br>HGPLE-25/GEH61: 84<br>DEF...: 100                                                                                                                                                                                                                                                                                                            |                 |              |               |           |
|                    | 1002                                                                                                                                                                                                                                                                                                                                                                                                                                   | 2               | 1            | uint32        | rw        |
|                    | External revolutions of the motor drive shaft (gear ratio – denominator)<br>SLTE: 13<br>HGPLE-14/GEH60: 4<br>HGPLE-25/GEH61: 1<br>DEF: 1                                                                                                                                                                                                                                                                                               |                 |              |               |           |
| <b>CI</b>          | <b>6091h</b>                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>01h, 02h</b> | <b>Array</b> | <b>uint32</b> | <b>rw</b> |

## B. Reference: DeviceNet and FHPP

| Feed Constant     |                                                                                                                                                                                                                                                                                                                                                                                                                                                         |          |       |        |        |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-------|--------|--------|
| FHPP              | 1003                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1, 2     | 0, 1  | uint32 | rw     |
| Description       | The feed constant specifies the path (= feed) that the slide traverses when the drive shaft of the linear axis makes one revolution (feed constant = feed / shaft revolution).<br>Dependent on the axis type (PNU 1005/4) and axis length (PNU 1005/5):<br>– The values are permanently set by selection of the axis type or automatically entered. Other values are not allowed.<br>– For user-defined axis lengths, the values can be freely written. |          |       |        |        |
|                   | Feed                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1003     | 1     | 0      | uint32 |
| Shaft Revolutions | Specification of feed (feed constant - numerator) in [µm]<br>SLTE-10: 5000<br>SLTE-16: 7500<br>HGPLE-14/GEH60: 31416<br>HGPLE-25/GEH61: 62832<br>DEF60...: 100000<br>Value is automatically entered when an axis type is selected (PNU 1005/4).                                                                                                                                                                                                         |          |       |        |        |
|                   | 1003                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 2        | 1     | uint32 | rw     |
|                   | Feed constant - denominator. Fixed: 1 (0x00000001)                                                                                                                                                                                                                                                                                                                                                                                                      |          |       |        |        |
| CI                | 6092h                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 01h, 02h | Array | uint32 | rw     |

| Position Factor                                 |                                                                                                                                                                                                                                                                         |          |       |        |        |    |
|-------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-------|--------|--------|----|
| FHPP                                            | 1004                                                                                                                                                                                                                                                                    | 1, 2     | 0, 1  | uint32 | rw/ro  |    |
| Description                                     | Reading the conversion factor: Number of sensor increments per 1 measured unit of feed at the shaft.                                                                                                                                                                    |          |       |        |        |    |
|                                                 | Position faktor     = $\frac{\text{Encoder resolution} * \text{Gear ratio}}{\text{Feed constant linear axis}}$                                                                                                                                                          |          |       |        |        |    |
|                                                 | Numerator                                                                                                                                                                                                                                                               | 1004     | 1     | 0      | uint32 | rw |
|                                                 | Position factor – numerator<br>SLTE-10:               1795938<br>SLTE-16:               2338461<br>HGPLE-14/GEH60: 11224615<br>HGPLE-25/GEH61: 5347593<br>DEF:                    2000000<br>Value is automatically entered when an axis type is selected (PNU 1005/4). |          |       |        |        |    |
|                                                 | Denominator                                                                                                                                                                                                                                                             | 1004     | 2     | 1      | uint32 | ro |
| Position factor – denominator<br>Fixed: 1000000 |                                                                                                                                                                                                                                                                         |          |       |        |        |    |
| CI                                              | 6093h                                                                                                                                                                                                                                                                   | 01h, 02h | Array | uint32 | rw     |    |

| Axis Parameter   |                                                                                                                                                                                                                                                                                                                                                                                                                                                   |         |         |        |       |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|---------|--------|-------|
| FHPP             | 1005                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1 ... 5 | 0 ... 4 | uint32 | rw/ro |
| Description      | Specifying and reading the axis parameters, e.g. for diagnosis                                                                                                                                                                                                                                                                                                                                                                                    |         |         |        |       |
| Axis Length      | 1005                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1       | 0       | uint32 | rw    |
|                  | Axis length in increments (can be set as desired for user-defined axis lengths, for the specified drives – see subindex 4 – specifications for the axis lengths are entered by writing to subindex 05).<br>Range of values: $-2^{31} \dots +(2^{31} - 1)$<br>Default: 89796 ( $\hat{=}$ 50 mm for SLTE-10)<br>After changing the axis size (PNU 1005/5) the correct axis length is automatically entered according to the axis type (PNU 1005/4). |         |         |        |       |
| Gear Numerator   | 1005                                                                                                                                                                                                                                                                                                                                                                                                                                              | 2       | 1       | uint32 | ro    |
|                  | Gear ratio – numerator<br>Fixed: 1                                                                                                                                                                                                                                                                                                                                                                                                                |         |         |        |       |
| Gear Denominator | 1005                                                                                                                                                                                                                                                                                                                                                                                                                                              | 3       | 2       | uint32 | ro    |
|                  | Gear ratio – denominator<br>Fixed: 1                                                                                                                                                                                                                                                                                                                                                                                                              |         |         |        |       |

| Axis Parameter |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |   |   |        |    |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|--------|----|
| Axis Type      | 1005                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 4 | 3 | uint32 | rw |
|                | <p>Axis or gripper type</p> <p>Values:</p> <p>0 (0x00): SLTE-10-... (default)</p> <p>1 (0x01): SLTE-16-...</p> <p>16 (0x10): GEH61...</p> <p>17 (0x11): DEF...</p> <p>18 (0x12): GEH60...</p> <p>32 (0x20): reserved</p> <p>33 (0x21): HGPLE-25-...</p> <p>34 (0x22): HGPLE-14-...</p> <p>Modification of axis type influences the following parameters:</p> <ul style="list-style-type: none"> <li>– Modifies values and permitted value range of the following parameters: <ul style="list-style-type: none"> <li>407 Positioning record acceleration (object 20EEh)</li> <li>408 Positioning record deceleration (object 20EFh)</li> <li>501 Software end positions (Object 607Bh)</li> <li>531 Jog mode speed phase 2 (Object 20ED/21h)</li> <li>532 Jog mode acceleration (object 20EE/21h)</li> <li>533 Jog mode deceleration (object 20EF/21h)</li> <li>541 Direct mode acceleration (object 20EE/22h)</li> <li>542 Direct mode deceleration (object 20EF/22h)</li> <li>1011 Homing methode (Object 6098h)</li> <li>– (No PNU) Supported drive functions (Object 6502h)</li> </ul> </li> <li>– Modifies the values of the following parameters: <ul style="list-style-type: none"> <li>502 Max. permitted speed (Object 21F6h)</li> <li>503 Max. permitted acceleration (Object 21F7h)</li> <li>510 Stroke limitation (Object 60F6/01h)</li> <li>511 Minimum permissible force/torque (Object 60F6/05h)</li> <li>512 Maximum permissible force/torque (Object 6072h)</li> <li>554 Speed limitation (Object 60F6/02h)</li> <li>1001 Encoder resolution (Object 608Fh)</li> <li>1002 Gearbox ratio (Object 6091h)</li> <li>1003 Feed constant (Object 6092h)</li> <li>1004 Positioning factor (Object 6093h)</li> <li>1010 Offset axis zero point (Object 607Ch)</li> <li>1024/18 ... 23 Parameter of the positioning controller (object 60FB/12 ... 16h)</li> <li>1026/03 Axis param. – motor nominal current (object 6510/03/40h)</li> <li>1026/08 Axis param. – following error message window (object 6510/08/22h)</li> <li>1035 Rated motor current (Object 6075h)</li> <li>1036 Rated motor torque (Object 6076h)</li> </ul> </li> <li>– Modifies permitted value range of the following parameters: <ul style="list-style-type: none"> <li>406 Positioning record speed (object 20EDh)</li> <li>1012 Homing speed (Object 6099h)</li> </ul> </li> </ul> |   |   |        |    |

| Axis Parameter |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |             |        |        |      |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|--------|--------|------|
| Axis Size      | 1005                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 5           | 4      | uint32 | rw   |
|                | <p>For mini slides the slide length, for grippers the stroke (the “size”), for rotary modules a fixed value.</p> <p>0 (0x00): SLTE-...-50: 50 mm stroke</p> <p>1 (0x01): SLTE-...-80: 80 mm stroke</p> <p>2 (0x02): SLTE-...-100: 100 mm stroke</p> <p>3 (0x03): SLTE-...-150: 150 mm stroke</p> <p>16 (0x10): GEH6140: Stroke per gripper jaw 40, total stroke 80 mm</p> <p>17 (0x11): GEH6180: Stroke per gripper jaw 80, total stroke 160 mm</p> <p>18 (0x12): DEF60: Stroke 360° or unlimited</p> <p>19 (0x13): GEH6030: Stroke per gripper jaw 30, total stroke 60 mm</p> <p>20 (0x14): GEH6060: Stroke per gripper jaw 60, total stroke 120 mm</p> <p>32 (0x20): Reserved</p> <p>33 (0x21): HGPLE-25-40: Stroke per gripper jaw 40, total stroke 80 mm</p> <p>34 (0x22): HGPLE-25-80: Stroke per gripper jaw 80, total stroke 160 mm</p> <p>35 (0x23): HGPLE-14-30: Stroke per gripper jaw 30, total stroke 60 mm</p> <p>36 (0x24): HGPLE-14-60: Stroke per gripper jaw 60, total stroke 120 mm</p> <p>255 (0xFF): User-defined (any value in subindex 01).</p> <p>The relevant axis length in increments is entered in subindex 01 by writing subindex 05.</p> |             |        |        |      |
| CI             | 20E2h                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 01h ... 05h | Record | uint32 | r(w) |

## B.2.16 Axis parameter electric drive 1 – Homing

| Offset Axis Zero Point |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                     |     |       |    |          |      |                  |          |      |                  |                 |       |                     |                 |       |                     |      |   |                   |
|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-----|-------|----|----------|------|------------------|----------|------|------------------|-----------------|-------|---------------------|-----------------|-------|---------------------|------|---|-------------------|
| FHPP                   | 1010                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | –                   | –   | int32 | rw |          |      |                  |          |      |                  |                 |       |                     |                 |       |                     |      |   |                   |
| Description            | <p>Offset axis zero point in increments (distance from reference point).<br/>See chapter 1.6 for an explanation.<br/>Range of values: <math>-2^{31} \dots +(2^{31} - 1)</math><br/>Default: 1796 (axis type SLTE-10; referencing method “Block Negative”)<br/>The following values are automatically entered when the axis type is changed (PNU 1005/4):</p> <table><tr><td>SLTE-10:</td><td>1796</td><td>(<math>\Delta</math> 1 mm)</td></tr><tr><td>SLTE-16:</td><td>2338</td><td>(<math>\Delta</math> 1 mm)</td></tr><tr><td>HGPLE-14/GEH60:</td><td>-6127</td><td>(<math>\Delta</math> -0.5 mm)</td></tr><tr><td>HGPLE-25/GEH61:</td><td>-2674</td><td>(<math>\Delta</math> -0.5 mm)</td></tr><tr><td>DEF:</td><td>0</td><td>(<math>\Delta</math> -0 mm)</td></tr></table> <p>After every change of the referencing method (see PNU 1011 / object 6098h), the axis zero point is set to 0.<br/>The value for the SLTE-10 is set after the EEPROM is deleted (see PNU 127 / Object 20F1h).</p> |                     |     |       |    | SLTE-10: | 1796 | ( $\Delta$ 1 mm) | SLTE-16: | 2338 | ( $\Delta$ 1 mm) | HGPLE-14/GEH60: | -6127 | ( $\Delta$ -0.5 mm) | HGPLE-25/GEH61: | -2674 | ( $\Delta$ -0.5 mm) | DEF: | 0 | ( $\Delta$ -0 mm) |
| SLTE-10:               | 1796                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | ( $\Delta$ 1 mm)    |     |       |    |          |      |                  |          |      |                  |                 |       |                     |                 |       |                     |      |   |                   |
| SLTE-16:               | 2338                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | ( $\Delta$ 1 mm)    |     |       |    |          |      |                  |          |      |                  |                 |       |                     |                 |       |                     |      |   |                   |
| HGPLE-14/GEH60:        | -6127                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | ( $\Delta$ -0.5 mm) |     |       |    |          |      |                  |          |      |                  |                 |       |                     |                 |       |                     |      |   |                   |
| HGPLE-25/GEH61:        | -2674                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | ( $\Delta$ -0.5 mm) |     |       |    |          |      |                  |          |      |                  |                 |       |                     |                 |       |                     |      |   |                   |
| DEF:                   | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | ( $\Delta$ -0 mm)   |     |       |    |          |      |                  |          |      |                  |                 |       |                     |                 |       |                     |      |   |                   |
| CI                     | 607Ch                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 00h                 | Var | int32 | rw |          |      |                  |          |      |                  |                 |       |                     |                 |       |                     |      |   |                   |

| Homing Method |                                                                                |     |     |      |    |
|---------------|--------------------------------------------------------------------------------|-----|-----|------|----|
| FHPP          | 1011                                                                           | –   | –   | int8 | rw |
| Description   | Method that the drive uses to carry out Homing.                                |     |     |      |    |
|               | <div>ValuesFunction</div>                                                      |     |     |      |    |
|               | -17 (0xEF): Search for stop in negative direction (default with SLTE)          |     |     |      |    |
|               | -18 (0xEE): Search for stop in positive direction (default with HGPLE/GEH)     |     |     |      |    |
|               | 7 (07h): Search for reference switch in positive direction with index search   |     |     |      |    |
|               | 11 (0x0B): Search for reference switch in negative direction with index search |     |     |      |    |
|               | Change of homing method influences the following parameters:                   |     |     |      |    |
|               | – Modifies the values of the following parameters:                             |     |     |      |    |
|               | 1010 Axis zero point offset = 0 (Object 607Ch)                                 |     |     |      |    |
| CI            | 6098h                                                                          | 00h | Var | int8 | rw |

| Homing Velocities                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |          |       |        |           |
|----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-------|--------|-----------|
| FHPP                                                                                               | 1012                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1, 2     | 0, 1  | uint32 | rw        |
| Description                                                                                        | Speeds during homing, in inc/s                                                                                                                                                                                                                                                                                                                                                                                                                                           |          |       |        |           |
|                                                                                                    | Search REF                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1012     | 1     | 0      | uint32 rw |
|                                                                                                    | Speed when searching for the reference point REF<br>Range of values: <sup>1)</sup><br>Axis type      Values                                                                                                                                                                                                                                                                                                                                                              |          |       |        |           |
|                                                                                                    | SLTE-10:            1 ... 17959            ( $\triangleq$ 0 ... 10 mm/s)<br>SLTE-16:            1 ... 23384            ( $\triangleq$ 0 ... 10 mm/s)<br>HGPLE-14/GEH60: 1 ... 122549            ( $\triangleq$ 0 ... 10 mm/s)<br>HGPLE-25/GEH61: 1 ... 53475            ( $\triangleq$ 0 ... 10 mm/s)<br>DEF:                1 ... 20000            ( $\triangleq$ 0 ... 60 °/s)<br>Range of values for user-defined axis length: 0 ... $(2^{32} - 1)$<br>Default: 17959 |          |       |        |           |
| Search AZ                                                                                          | 1012                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 2        | 1     | uint32 | rw        |
|                                                                                                    | Speed of travel to the axis zero point AZ.<br>Range of values: as with "Search REF"<br>Default: 17959                                                                                                                                                                                                                                                                                                                                                                    |          |       |        |           |
| CI                                                                                                 | 6099h                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 01h, 02h | Array | uint32 | rw        |
| <sup>1)</sup> Range of values dependent on the axis type (PNU 1005/4) and axis length (PNU 1005/5) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |          |       |        |           |

| Homing Required |                                                                                                                                                                                                                                                                                                                                                                                                            |     |     |       |    |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|-------|----|
| FHPP            | 1014                                                                                                                                                                                                                                                                                                                                                                                                       | –   | –   | uint8 | rw |
| Description     | Defines whether or not homing must be carried out after switching on in order to carry out positioning tasks.<br>See also PNU 1024 / object 60FB/20h.<br><b>In the case of SFC-DC, homing must always be carried out after Power On.</b><br>See also the fault PLEASE ENFORCE HOMING RUN.<br>Values:<br>0 (0x00): Reserved (no homing run necessary)<br>1 (0x01): Homing run must be carried out (default) |     |     |       |    |
|                 |                                                                                                                                                                                                                                                                                                                                                                                                            |     |     |       |    |
| CI              | 23F6h                                                                                                                                                                                                                                                                                                                                                                                                      | 00h | Var | uint8 | rw |

| Homing Max Torque |                                                                                                                                                                                                                                                                                                                                                                                                                                |     |     |       |    |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|-------|----|
| FHPP              | 1015                                                                                                                                                                                                                                                                                                                                                                                                                           | –   | –   | uint8 | rw |
| Description       | <p>Maximum current consumption during homing.<br/>Specified as a multiple of the rated current in %<br/>(see PNU 1035 / object 6075h).<br/>The maximum permitted torque (via current limiting) during homing.<br/>If this value is reached, the drive will recognize the stop (REF) and move to the axis zero point (corresponds to 1/10 of PNU 1035).<br/>Range of values: 0 ... 255 (0 ... 0xFF)<br/>Default: 100 (0x64)</p> |     |     |       |    |
| CI                | 23F7h                                                                                                                                                                                                                                                                                                                                                                                                                          | 00h | Var | uint8 | rw |

### B.2.17 Axis parameters electric drives 1 –Controller



#### Note

The control parameters of the SFC-DC are preset.  
Modification is only permitted for servicing purposes.  
If necessary, consult Festo.

| Halt Option Code |                                                                                                                                                       |     |     |        |    |
|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|--------|----|
| FHPP             | 1020                                                                                                                                                  | –   | –   | uint16 | rw |
| Description      | <p>Describes the reaction to a Halt command.<br/>Values:<br/>0 (0x00): Reserved<br/>1 (0x01): Brake with stop ramp (fixed)<br/>2 (0x02): Reserved</p> |     |     |        |    |
| CI               | 605Dh                                                                                                                                                 | 00h | Var | uint16 | rw |

| Fault Reaction Option Code |                                                                                                                                                                           |     |     |        |    |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|--------|----|
| FHPP                       | 1021                                                                                                                                                                      | –   | –   | uint16 | rw |
| Description                | Describes the reaction to a malfunction.<br>Values:<br>0 (0x00): Reserved<br>1 (0x01): Reserved<br>2 (0x02): Brake with emergency stop ramp (fixed)<br>3 (0x03): Reserved |     |     |        |    |
| CI                         | 605Eh                                                                                                                                                                     | 00h | Var | uint16 | rw |

| Target Position Window |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |     |     |        |    |
|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|--------|----|
| FHPP                   | 1022                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | –   | –   | uint32 | rw |
| Description            | <p>Tolerance window in increments.<br/> Amount by which the current position may deviate from the target position, in order that it may still be regarded as being within the target window.<br/> The width of the window is twice the value transferred, with the target position in the centre of the window.<br/> Range of values: 0 ... <math>+(2^{32} - 1)</math><br/> Default: 750 (approx. SLTE-10: 0.42 mm HGPLe-14/GEH60: 0.06 mm<br/> SLTE-16: 0.32 mm HGPLe-25/GEH61: 0.14 mm<br/> DEF: 1,35°)</p> |     |     |        |    |
| CI                     | 6067h                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 00h | Var | uint32 | rw |

| Position Window Time |                                                                                                                                                                                                                                                                                  |     |     |        |    |
|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|--------|----|
| FHPP                 | 1023                                                                                                                                                                                                                                                                             | –   | –   | uint16 | rw |
| Description          | Adjustment time in milliseconds.<br>If the actual position has been in the target position window this amount of time, the “Target reached” bit will be set in the status word.<br>Range of values: 1 ... 30000 (Write only for service purposes)<br>Default: 100 (0x64 ± 0.1 s) |     |     |        |    |
| CI                   | 6068h                                                                                                                                                                                                                                                                            | 00h | Var | uint16 | rw |

## B. Reference: DeviceNet and FHPP

| Position control parameter set |                                                                                   |                                                                                                                                                                                                                                                                                                                                                 |               |        |           |
|--------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------|-----------|
| FHPP                           | 1024                                                                              | 18 ... 23, 32                                                                                                                                                                                                                                                                                                                                   | 17 ... 22, 31 | uint16 | rw        |
| Description                    |  | Technical control parameters.<br>Modification is only permitted for servicing purposes.<br>If necessary, consult Festo.                                                                                                                                                                                                                         |               |        |           |
| Gain Position                  |                                                                                   | 1024                                                                                                                                                                                                                                                                                                                                            | 18 (CI: 12h)  | 17     | uint16 rw |
|                                |                                                                                   | Gain position controller<br>Range of values: 1 ... 1000.                                                                                                                                                                                                                                                                                        |               |        |           |
| Gain Velocity                  | 1024                                                                              | 19 (CI: 13h)                                                                                                                                                                                                                                                                                                                                    | 18            | uint16 | rw        |
|                                |                                                                                   | Gain speed controller<br>Range of values: 1 ... 1000.                                                                                                                                                                                                                                                                                           |               |        |           |
| I-Fraction Velocity            | 1024                                                                              | 20 (CI: 14h)                                                                                                                                                                                                                                                                                                                                    | 19            | uint16 | rw        |
|                                |                                                                                   | I-proportion of speed controller<br>Range of values: 1 ... 2000.                                                                                                                                                                                                                                                                                |               |        |           |
| Gain Current                   | 1024                                                                              | 21 (CI: 15h)                                                                                                                                                                                                                                                                                                                                    | 20            | uint16 | rw        |
|                                |                                                                                   | Gain current controller<br>Range of values: 1 ... 800.                                                                                                                                                                                                                                                                                          |               |        |           |
| I-Fraction                     | 1024                                                                              | 22 (CI: 16h)                                                                                                                                                                                                                                                                                                                                    | 21            | uint16 | rw        |
|                                |                                                                                   | I-proportion current controller<br>Range of values: 0 ... 1000.                                                                                                                                                                                                                                                                                 |               |        |           |
| Gain Velocity Trajectory       | 1024                                                                              | 23 (CI: 17h)                                                                                                                                                                                                                                                                                                                                    | 22            | uint16 | rw        |
|                                |                                                                                   | Gain speed controller – path generator<br>Range of values: 1 ... 50.                                                                                                                                                                                                                                                                            |               |        |           |
| Save Position                  | 1024                                                                              | 32 (CI: 20h)                                                                                                                                                                                                                                                                                                                                    | 31            | uint16 | rw        |
|                                |                                                                                   | <b>In the case of SFC-DC, the position cannot be saved during switch off for technical reasons! Parameter is only included for compatibility reasons and is not evaluated.</b><br>Values:<br>15 (0x000F) = Reserved (current position is saved at power-off)<br>240 (0x00F0) = Current position will <b>not</b> be saved at power-off (default) |               |        |           |
| CI                             | 60FBh                                                                             | 12h ... 17h, 20h                                                                                                                                                                                                                                                                                                                                | Array         | uint16 | rw        |

| Motor Data                                                                                                                                                                                                                                                                                                 |                                                                          |          |        |        |           |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|----------|--------|--------|-----------|
| FHPP                                                                                                                                                                                                                                                                                                       | 1025                                                                     | 1, 3     | 0, 2   | uint32 | rw        |
| Description                                                                                                                                                                                                                                                                                                | Motor-specific data                                                      |          |        |        |           |
|                                                                                                                                                                                                                                                                                                            | Serial Number                                                            | 1025     | 1      | 0      | uint32 rw |
|                                                                                                                                                                                                                                                                                                            | Reserved<br>(Serial number of the motor, written values are not adopted) |          |        |        |           |
|                                                                                                                                                                                                                                                                                                            | Time Max Current                                                         | 1025     | 3      | 2      | uint32 rw |
| I <sup>2</sup> t-time in 20 ms (device-specific for SFC-DC). When the I <sup>2</sup> t time elapses, the current is limited automatically to the motor rated current in order to protect the motor (Motor Rated Current, PNU 1035 / Object 6075h).<br>Range of values: 1 ... 32767<br>Default: 100 (Δ 2 s) |                                                                          |          |        |        |           |
| CI                                                                                                                                                                                                                                                                                                         | 6410h                                                                    | 01h, 03h | Record | uint32 | rw        |



**Note**

The duration of the maximum motor current has been adjusted to the supported drives.

Values that are too high can damage the motor.

## B. Reference: DeviceNet and FHPP

| Drive Data                  |                                                                                                                                                                                                          |         |         |        |       |
|-----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|---------|--------|-------|
| FHPP                        | 1026                                                                                                                                                                                                     | 1 ... 8 | 0 ... 7 | uint32 | ro/rw |
| Description                 | General motor data                                                                                                                                                                                       |         |         |        |       |
| Output Stage Temp           | 1026                                                                                                                                                                                                     | 1       | 0       | uint32 | ro    |
|                             | Temperature of the output stage in °C<br>Range of values: 0 ... 85 (0x00 ... 0x55)                                                                                                                       |         |         |        |       |
| Output stage<br>Max. Temp   | 1026                                                                                                                                                                                                     | 2       | 1       | uint32 | ro    |
|                             | Maximum temperature of the output stage in °C<br>Fixed: 80 (0x0050)                                                                                                                                      |         |         |        |       |
| Motor Rated<br>Current      | 1026                                                                                                                                                                                                     | 3       | 2       | uint32 | ro    |
|                             | Rated motor current in mA<br>SLTE-10: 336<br>SLTE-16: 1440<br>HGPLE-14/GEH60: 1270<br>HGPLE-25/GEH61: 2250<br>DEF: 704<br>Value is automatically entered when an axis type is selected (PNU 1005/4).     |         |         |        |       |
| Current Limit               | 1026                                                                                                                                                                                                     | 4       | 3       | uint32 | ro    |
|                             | Maximum motor current, identical to PNU 1034                                                                                                                                                             |         |         |        |       |
| Lower Current Limit         | 1026                                                                                                                                                                                                     | 5       | 4       | uint32 | ro    |
|                             | Lower current limit value in 1/1000 of the rated motor current                                                                                                                                           |         |         |        |       |
| I/O Control                 | 1026                                                                                                                                                                                                     | 6       | 5       | uint32 | rw    |
|                             | Selection of the interface (see also PNU 125 / object 207Dh)<br>0: Control via HMI (control panel) or FCT, no control via fieldbus<br>1: Control via fieldbus – control interface (default)              |         |         |        |       |
| Controller Serial<br>Number | 1026                                                                                                                                                                                                     | 7       | 6       | uint32 | ro    |
|                             | Serial number of the controller in format 0xDDMYSSS:<br>TT (day): 8 bit: 0x01 ... 0x1F<br>M (month): 4 Bit: 0x1 ... 0xC<br>YY (year): 8 Bit: 0x00 ... 0x63<br>SSS (serial no.): 12 Bit: 0x001 ... 0xFFFF |         |         |        |       |
| Following Error<br>Window   | 1026                                                                                                                                                                                                     | 8       | 7       | uint32 | rw    |
|                             | Message window for following error monitoring. Values:<br>0: Following error monitoring switched off<br>1 ... +(2 <sup>32</sup> - 1): permitted following error in increments                            |         |         |        |       |

B. Reference: DeviceNet and FHPP

| Drive Data                                                                                                   |                                                                                                                                                                     |                                        |        |                                                               |                                      |
|--------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|--------|---------------------------------------------------------------|--------------------------------------|
| CI                                                                                                           | 6510h                                                                                                                                                               | 01h ...                                | Record |                                                               | ro/rw                                |
| Drive Data <sup>1)</sup>                                                                                     | 6510h                                                                                                                                                               | 01h ... 08h                            |        | uint32                                                        | ro/rw                                |
|                                                                                                              | 6510h                                                                                                                                                               | 31h, 32h, 40h, 41h, 42h, 43h, A0h, 22h |        | uint16, uint16, uint32, uint16, int16, uint16, uint32, uint32 | ro, ro<br>ro, ro<br>ro, rw<br>ro, ro |
| Current Actual Value                                                                                         | 6510h                                                                                                                                                               | 45h                                    |        | int 16                                                        | ro                                   |
|                                                                                                              | Actual value of the current.<br>Note: Not available via FHPP.                                                                                                       |                                        |        |                                                               |                                      |
| Firmware Number                                                                                              | 6510h                                                                                                                                                               | A1h                                    |        | uint32                                                        | ro                                   |
|                                                                                                              | Firmware version, specified in BCD (binary coded decimal): xxyy<br>(xx = main version, yy = secondary version)<br>Note: Identical to FHPP object PNU 101 (CI 206Ah) |                                        |        |                                                               |                                      |
| <sup>1)</sup> Description similar to FHPP 1026/1 ... 8.<br>Subindices 31h ... A0h are not available via FHPP |                                                                                                                                                                     |                                        |        |                                                               |                                      |

## B.2.18 Axis parameters electric drive 1 – Electronics Name plate

| Motor Type         |                                              |            |            |               |          |
|--------------------|----------------------------------------------|------------|------------|---------------|----------|
| <b>FHPP</b>        | <b>1030</b>                                  | –          | –          | <b>uint16</b> | <b>r</b> |
| <b>Description</b> | Classification of the motor<br>Fixed: 0x0000 |            |            |               |          |
| <b>CI</b>          | <b>6402h</b>                                 | <b>00h</b> | <b>Var</b> | <b>uint16</b> | <b>r</b> |

| Max Current        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |            |            |               |           |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------|---------------|-----------|
| <b>FHPP</b>        | <b>1034</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | –          | –          | <b>uint16</b> | <b>rw</b> |
| <b>Description</b> | <p>Maximum motor current during homing in 1/1000 of the specified nominal current (PNU 1035 / object 6075h).</p> <p>In homing (reference travel) mode: Setpoint value for the current regulator. Limits the motor force during homing to stops and, in the event of an error, protects the stops during homing to a reference switch.</p> <p>Note</p> <p>Observe that the current limitation also limits the maximum possible speed and that (higher) nominal speeds may not therefore be achieved.</p> <p>Range of values: 1 ... 3000</p> <p>Default: 1000</p> |            |            |               |           |
| <b>CI</b>          | <b>6073h</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>00h</b> | <b>Var</b> | <b>uint16</b> | <b>rw</b> |

| Motor Rated Current |                                                                                                                                                                                                                                                                                                       |            |            |               |           |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------|---------------|-----------|
| <b>FHPP</b>         | <b>1035</b>                                                                                                                                                                                                                                                                                           | –          | –          | <b>uint32</b> | <b>rw</b> |
| <b>Description</b>  | <p>Rated current of the motor in mA.</p> <p>Values (fixed, read-only):</p> <p>SLTE-10: 336</p> <p>SLTE-16: 1440</p> <p>HGPLE-14/GEH60: 1270</p> <p>HGPLE-25/GEH61: 2250</p> <p>DEF: 704</p> <p>Value is automatically entered when an axis type is selected (PNU 1005/4). Identical to PNU 1026/3</p> |            |            |               |           |
| <b>CI</b>           | <b>6075h</b>                                                                                                                                                                                                                                                                                          | <b>00h</b> | <b>Var</b> | <b>uint32</b> | <b>rw</b> |

| Motor Rated Torque |                                                                                                                                                                                                                                                                                                               |     |     |        |    |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|--------|----|
| FHPP               | 1036                                                                                                                                                                                                                                                                                                          | –   | –   | uint32 | rw |
| Description        | Nominal force of the drive in 0.001 N.<br>Information, is not used for control with SFC-DC.<br>Values (fixed, read-only):<br>SLTE-10: 13000<br>SLTE-16: 70000<br>HGPLE-14/GEH60: 120000<br>HGPLE-25/GEH61: 120000<br>DEF: 50000<br>Value is automatically entered when an axis type is selected (PNU 1005/4). |     |     |        |    |
| CI                 | 6076h                                                                                                                                                                                                                                                                                                         | 00h | Var | uint32 | rw |

## B.2.19 Axis parameters electric drive 1 – Standstill monitoring

| Position Target Value |                                                                                                              |            |            |              |           |
|-----------------------|--------------------------------------------------------------------------------------------------------------|------------|------------|--------------|-----------|
| <b>FHPP</b>           | <b>1040</b>                                                                                                  | –          | –          | <b>int32</b> | <b>ro</b> |
| <b>Description</b>    | Target position of the last positioning job, in increments<br>Range of values: $-2^{31} \dots +(2^{31} - 1)$ |            |            |              |           |
| <b>CI</b>             | <b>6062h</b>                                                                                                 | <b>00h</b> | <b>Var</b> | <b>int32</b> | <b>ro</b> |

| Position Actual Value |                                                                                              |            |            |              |           |
|-----------------------|----------------------------------------------------------------------------------------------|------------|------------|--------------|-----------|
| <b>FHPP</b>           | <b>1041</b>                                                                                  | –          | –          | <b>int32</b> | <b>ro</b> |
| <b>Description</b>    | Actual position of the drive in increments<br>Range of values: $-2^{31} \dots +(2^{31} - 1)$ |            |            |              |           |
| <b>CI</b>             | <b>6064h</b>                                                                                 | <b>00h</b> | <b>Var</b> | <b>int32</b> | <b>ro</b> |

| Standstill Position Window |                                                                                                                                                                                                                                                                                                           |            |            |               |           |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------|---------------|-----------|
| <b>FHPP</b>                | <b>1042</b>                                                                                                                                                                                                                                                                                               | –          | –          | <b>uint32</b> | <b>rw</b> |
| <b>Description</b>         | Standstill position window in increments: Amount by which the drive may move after MC, until the standstill monitoring responds.<br>Range of values: $0 \dots +(2^{32} - 1)$<br>Default: 750 (approx. SLTE-10: 0.42 mm HGPLE-14/GEH60: 0.06 mm<br>SLTE-16: 0.32 mm HGPLE-25/GEH61: 0.14 mm<br>DEF: 1,35°) |            |            |               |           |
| <b>CI</b>                  | <b>2040h</b>                                                                                                                                                                                                                                                                                              | <b>00h</b> | <b>Var</b> | <b>uint32</b> | <b>rw</b> |

| Standstill Window Time |                                                                                                                                                                                                                                                                              |            |            |               |           |
|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------|---------------|-----------|
| <b>FHPP</b>            | <b>1043</b>                                                                                                                                                                                                                                                                  | –          | –          | <b>uint16</b> | <b>rw</b> |
| <b>Description</b>     | Standstill monitoring time in [ms]: Time during which the drive must be outside the standstill position window before the standstill monitoring responds.<br>Range of values: $0 \dots 30000 (\triangle 0 \dots 30 \text{ s})$<br>Default: 200 ( $\triangle 0.2 \text{ s}$ ) |            |            |               |           |
| <b>CI</b>              | <b>2041h</b>                                                                                                                                                                                                                                                                 | <b>00h</b> | <b>Var</b> | <b>uint16</b> | <b>rw</b> |

# **Reference Festo Handling and Positioning Profile (FHPP)**

## **Appendice C**

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## C.1 Data transmission

### C.1.1 Procedure



#### Caution

In special application cases, access with CI commands enables parametrisation and commissioning of the SFC-DC directly via the RS232 interface, though it is not suitable for real-time capable communication, such as for control. Control of the SFC-DC via RS232 also requires:

- A risk estimation by the user
- ambient conditions free of interference,
- reliability of data transmission e.g. via the control program of the host.
- Use preferably the control panel or the FCT for commissioning and parametrisation.
- Note that control of the SFC-DC via the RS232 does not comply with designated use.



#### Warning

Injury to people and damage to property.

Full access to the internal variables of the controller is possible via CI commands. Incorrect operation can cause the controller to react unexpectedly and the motor may start in an uncontrolled manner.

- Use the CI commands only if you already have experience of Service Data Objects.
- Inform yourself about using the Objects in the CiA Draft Standard 402 before you use the CI commands of the Command Interpreter of the SFC-DC.



For data transmission you will require a commercially-available terminal program or the CI terminal of the SFC-DC plug-in in the Festo Configuration Tool.

C. Reference Festo Handling and Positioning Profile (FHPP)

Carry out the following steps:

- Connect the SFC-DC to your PC via the RS232 interface. Observe here the instructions in chapter 3.5.
- If necessary, adapt the PC interface to the following transmission protocol.

| Transmission protocol          |                                                                                                                                                                |
|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Transmission speed (baud rate) | 9600 Baud                                                                                                                                                      |
| Data format                    | Asynchronous character frame: <ul style="list-style-type: none"><li>– 1 start bit</li><li>– 8 data bits</li><li>– No parity bit</li><li>– 1 stop bit</li></ul> |

Tab. C/1: Specifications of the transmission protocol

- Initialise the data transmission with the following command:

| Command 310D <sub>h</sub> | Response 31310D <sub>h</sub> |
|---------------------------|------------------------------|
| 1 <CR>                    | 11 <CR>                      |

- Select the commands in accordance with the object list in appendix C.2.1, Tab. C/7.
- Use CI commands only if you already know their effects and if they are permitted for your SFC-DC.
- For the syntax of the commands, follow the information in appendix C.1.2.

### C.1.2 Composition of the CI commands

The contents of the commands implemented in the Command Interpreter of the SFC-DC are based on the objects standardised by CANopen (CiA Draft Standard 402):

|            |                         |
|------------|-------------------------|
| Group 1xxx | Device description      |
| Group 2xxx | Festo commands          |
| Group 6xxx | Commands as per CANopen |

The total of all parametrisation and control possibilities is referred to as the object directory. Every object is assigned a unique number (Index, Subindex) used for accessing the object.



#### **Caution**

Loss of data.

The Command Interpreter (CI) contains commands which reorganise or delete parts of the memory. Existing data is thereby destroyed:

- It is preferable to use the FCT or the control panel for commissioning and parametrisation.
- Use the CI commands only in special cases which require direct access to the controller.
- Use CI commands only if you already know their effects and if they are permitted for your SFC-DC.

Access procedure

The higher-order controller sends the controller either a write command (WRITE) to modify a parameter in the object directory, or a read command (READ) to read out a parameter.

For each command the higher-order controller receives a response which either contains the value read or, in the case of a write command, serves as an acknowledgement. The transmitted value (1, 2 or 4 data bytes) depends on the data type of the object to be read or written.

WRITE (W)

Write commands (W) transfer a value in the specified format to the SFC-DC. As a reply, Write commands will be reflected exactly character by character from the SFC-DC controller. A checksum <PS> is inserted in front of the <CR>.

READ (R)

Read commands (R) transfer a value from the SFC-DC. The reply from the SFC-DC controller contains the downloaded value. A checksum <PS> is inserted in front of the <CR>.



All commands are entered as a character sequence without any empty spaces. A hex character is a Char character in hex format.

| Acc <sup>1)</sup>                                                                                                               | Command                                        | Response                |
|---------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|-------------------------|
| W<br>W <sup>2)</sup>                                                                                                            | =IIIISS:<value><CR><br>=IIIISS:<Value><PS><CR> | =IIIISS:<Value><PS><CR> |
| R<br>R <sup>2)</sup>                                                                                                            | ?IIIISS<CR><br>?IIIISS<PS><CR>                 | =IIIISS:<Value><PS><CR> |
| <sup>1)</sup> Access: W = write, R = read<br><sup>2)</sup> With activated checksum comparison at the SFC-DC, see appendix C.1.3 |                                                |                         |

Tab. C/2: Syntax of a CI command/reply

## C. Reference Festo Handling and Positioning Profile (FHPP)

| Syntax   | Explanation                                                                                                               |
|----------|---------------------------------------------------------------------------------------------------------------------------|
| "=", "?" | Initial character for write or read commands                                                                              |
| IIII     | Index in 4 hexadecimal digits                                                                                             |
| SS       | Subindex in 2 hexadecimal digits<br>If the addressed object does not have indexed parameters, subindex <00> is specified. |
| “:”      | Separator                                                                                                                 |
| <Value>  | Data in a format depending on data type                                                                                   |
| <PS>     | Check sum in 2 hexadecimal digits<br>(see appendix C.1.3)                                                                 |
| <CR>     | End character <Carriage Return> (\$0D)                                                                                    |

Tab. C/3: Elements of syntax of a CI command/reply

### Data type

The transmitted value (1, 2 or 4 data bytes as hex number) depends on the data type of the object to be read or written. The following data types are supported:

| Type     | Hex | Format                                              |
|----------|-----|-----------------------------------------------------|
| UINT8    | 2H  | 8 bits without sign: 0 ... 255                      |
| INT8     |     | 8 bits with sign: -128 ... 127                      |
| UINT16   | 4H  | 16 bits without sign: 0 ... 65535                   |
| INT16    |     | 16 bits with sign: -32768 ... 32767                 |
| UINT32   | 8H  | 32 bits without sign: 0 ... ( $2^{32} - 1$ )        |
| INT32    |     | 32 bits without sign: $-2^{31} \dots +(2^{31} - 1)$ |
| V-string |     | Corresponds to the preset string                    |

Tab. C/4: Data types



**Note**  
Direct transfer of values via the serial interface with CI commands always takes place in the basis system and requires conversion into increments.  
All parameters are always saved in increments in the controller and are not converted into the relevant measuring system until they are written or downloaded.  
All physical variables (position, speed and acceleration) must be converted into increment values before they can be transferred.  
Further information on converting can be found in appendix A.3

All values are transferred in hexadecimal figures; one character represents 4 bits; and is known as a tetrad <Tn>. The first tetrad transferred contains the higher-value bits of the value.  
General information: Tetrad <Tn> contains the bits  $b_n \dots b_{n+3}$

Example: UINT8 (2H)

|     |              |       |       |       |              |       |       |       |
|-----|--------------|-------|-------|-------|--------------|-------|-------|-------|
| Dec | 26           |       |       |       |              |       |       |       |
| Hex | 1            |       |       |       | A            |       |       |       |
| Bin | 0            | 0     | 0     | 1     | 1            | 0     | 1     | 0     |
|     | $b_7$        | $b_6$ | $b_5$ | $b_4$ | $b_3$        | $b_2$ | $b_1$ | $b_0$ |
|     | Tetrad $T_4$ |       |       |       | Tetrad $T_0$ |       |       |       |

### C.1.3 Checking the data

#### Invalid values

Transferred parameters and values are checked by the SFC-DC before being accepted. In the case of invalid parameters or values, an error message will not appear in the response; rather, the transferred value will always be returned.



#### Note

The following applies when writing the objects:

- Discrete values (values from a value list):  
An invalid value will not be accepted, the previously valid value will be retained.
- Continuous values (values from a continuous interval):  
An invalid value will be limited up to the next permitted minimum or maximum value.



#### Recommendation

Check that values and parameters have been written correctly by downloading the current contents of the parameter or value with one of the following Read commands.

#### Transmission

In the case of a transmission error between the higher-level controller and the SFC-DC, instead of the usual response, the value <0x00FF> will be transferred (see Object 2FF0).

Possible causes:

- Incorrect initial character, separating character or empty character.
- Incorrect hex digit.
- Incorrect value type.

#### Check sum <CS>

The higher level controller must compare the sent command with the “Echo” from the SFC-DC and check the check sum. Additional check sum comparison at the SFC-DC for received commands can be optionally activated (CI Object 20F3h). The higher-level controller must then insert a check sum before the termination character (CR = Carriage return).

C. Reference Festo Handling and Positioning Profile (FHPP)

If the SFC-DC detects a deviation in the check sum then, instead of the usual response, the value <0xFFFF> will be transferred (see Object 2FF0h).

The check sum is calculated based on the case (upper/lower case) of the **command**; the check sum of the **response** is always based on upper case.

| Check sum <PS>                    | W/R | Command                 | Response                |
|-----------------------------------|-----|-------------------------|-------------------------|
| Default<br>(CI object 20F300:00)  | W   | =IIIISS:<value><CR>     | =IIIISS:<Value><PS><CR> |
|                                   | R   | ?IIIISS<CR>             | =IIIISS:<Value><PS><CR> |
| Optional<br>(CI object 20F300:01) | W   | =IIIISS:<Value><PS><CR> | =IIIISS:<Value><PS><CR> |
|                                   | R   | ?IIIISS:<PS><CR>        | =IIIISS:<Value><PS><CR> |
| W = write<br>R = read             |     |                         |                         |

Tab. C/5: Command/Response syntax (optionally with check sum comparison by the SFC-DC)

| Check sum <PS> |                                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Calculation    | <p>Sum of all ASCII characters sent, reduced to 1 byte.</p> <p>W: &lt;PS&gt; = “=IIIISS:&lt;Value&gt;” modulo 256</p> <p>R: &lt;PS&gt; = “?IIIISS” modulo 256</p> <p><b>Example</b></p> <p>Command =IIIISS:&lt;Value&gt;&lt;CR&gt;</p> <p>=20F300:00</p> <p>ASCII-&gt; = 2 0 F 3 0 0 : 0 0</p> <p>HEX 3D+32+30+46+33+30+30+3A+30+30</p> <p>Sum 212h</p> <p>Mod 256 212h mod 100h = 12h</p> <p>Response =20F300:00<b>12</b></p> |
| Format         | 2 Hexadecimal numbers, UINT8                                                                                                                                                                                                                                                                                                                                                                                                   |

Tab. C/6: Check sum

C.2 CI objects

C.2.1 Object overview (Index, Subindex)

The following overview shows all CI objects, where appropriate with the corresponding FHPP parameter numbers.



**Note**

The following table contains an overview of the CI objects. Some of the objects may be used only for certain product variants or only with limitations (e.g. writing only for service purposes). Note the detailed descriptions of the object.

You will find the descriptions of the CI objects in the following sections (see “See” column):

- Descriptions of the CI objects with the corresponding PNUs as per FHPP in appendix B.2.4 to B.2.19
- Descriptions of the additional CI objects beginning at appendix C.2.3.

| Name                          | CI<br>Object | SI  | FHPP<br>PNU | See   |
|-------------------------------|--------------|-----|-------------|-------|
| Group 1xxx                    |              |     |             |       |
| Device Type                   | 1000h        | 00h | –           | C.2.3 |
| Manufacturer Device Name      | 1008h        | 00h | 120         | B.2.5 |
| Manufacturer Hardware Version | 1009h        | 00h | –           | C.2.3 |
| Manufacturer software version | 100Ah        | 00h | –           | C.2.3 |

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| Name                          | CI     |             | FHPP | See    |
|-------------------------------|--------|-------------|------|--------|
|                               | Object | SI          | PNU  |        |
| Group 2xxx                    |        |             |      |        |
| Record Number                 | 2032h  | 01h         | –    | C.2.4  |
| Record Number                 | 2033h  | 00h         | 400  | B.2.8  |
| Standstill Position Window    | 2040h  | 00h         | 1042 | B.2.19 |
| Standstill Window Time        | 2041h  | 00h         | 1043 | B.2.19 |
| Version FHPP                  | 2066h  | 00h         | 102  | B.2.4  |
| Version FCT PlugIn Min        | 2067h  | 00h         | –    | C.2.4  |
| Version FCT PlugIn Opt        | 2068h  | 00h         | –    | C.2.4  |
| Manufacturer Hardware Version | 2069h  | 00h         | 100  | B.2.4  |
| Manufacturer Firmware Version | 206Ah  | 00h         | 101  | B.2.4  |
| Controller Serial Number      | 2072h  | 00h         | 114  | B.2.4  |
| Device Control                | 207Dh  | 00h         | 125  | B.2.5  |
| Diagnostic Event              | 20C8h  | 01h ... 10h | 200  | B.2.6  |
| Error Number                  | 20C9h  | 01h ... 10h | 201  | B.2.6  |
| Time Stamp                    | 20CAh  | 01h ... 10h | 202  | B.2.6  |
| Diagnosis Memory Parameter    | 20CCh  | 01h ... 04h | 204  | B.2.6  |
| Scaling                       | 20D0h  | 01h, 02h    | –    | C.2.4  |
| Record Table Element          | 20E0h  | 01h ... 05h | –    | C.2.4  |
| Axis Parameter                | 20E2h  | 01h ... 05h | 1005 | B.2.15 |
| Controller Type               | 20E3h  | 00h         | –    | C.2.4  |
| Jog Mode Time Phase 1         | 20E9h  | 00h / 21h   | 534  | B.2.12 |
| Record Control Byte 1         | 20EAh  | 01h ... 20h | 401  | B.2.8  |
| Record target position        | 20ECh  | 01h ... 20h | 404  | B.2.8  |
| ... Velocity (... speed)      | 20EDh  | 01h ... 20h | 406  | B.2.8  |
|                               |        | 21h         | 531  | B.2.12 |
| ... Acceleration              | 20EEh  | 01h ... 20h | 407  | B.2.8  |
|                               |        | 21h         | 532  | B.2.12 |
|                               |        | 22h         | 541  | B.2.13 |

## C. Reference Festo Handling and Positioning Profile (FHPP)

| Name                       | CI     |             | FHPP<br>PNU | See    |
|----------------------------|--------|-------------|-------------|--------|
|                            | Object | SI          |             |        |
| ... Deceleration           | 20EFh  | 01h ... 20h | <b>408</b>  | B.2.8  |
|                            |        | 21h         | <b>533</b>  | B.2.12 |
|                            |        | 22h         | <b>542</b>  | B.2.13 |
| Data Memory Control        | 20F1h  | 01h, 02h    | <b>127</b>  | B.2.5  |
| CI_ReceiveChecksumActive   | 20F3h  | 00h         | –           | C.2.4  |
| Password                   | 20FAh  | 01h, 02h    | –           | C.2.4  |
| Local Password             | 20FBh  | 00h         | –           | C.2.4  |
| User Device Name           | 20FDh  | 00h         | <b>121</b>  | B.2.5  |
| HMI parameters             | 20FFh  | 01h ... 04h | <b>126</b>  | B.2.5  |
| Project Zero Point         | 21F4h  | 00h         | <b>500</b>  | B.2.9  |
| Max. speed                 | 21F6h  | 00h         | <b>502</b>  | B.2.9  |
| Max. Acceleration          | 21F7h  | 00h         | <b>503</b>  | B.2.9  |
| Teach Target               | 21FCh  | 00h         | <b>520</b>  | B.2.11 |
| Homing Required            | 23F6h  | 00h         | <b>1014</b> | B.2.16 |
| Homing Max Torque          | 23F7h  | 00h         | <b>1015</b> | B.2.16 |
| Communication Error        | 2FF0h  | 00h         | –           | C.2.4  |
| Device Errors              | 2FF1h  | 00h         | <b>205</b>  | B.2.6  |
| Fieldbus Diagnosis         | 2FF2h  | 01h ... 06h | <b>206</b>  | B.2.6  |
| Fieldbus Address           | 2FF3h  | 00h         | –           | C.2.4  |
| Cycle Number               | 2FFFh  | 00h         | <b>305</b>  | B.2.7  |
| <b>Group 6xxx</b>          |        |             |             |        |
| Control Word               | 6040h  | 00h         | –           | C.2.5  |
| Status Word                | 6041h  | 00h         | –           | C.2.5  |
| Halt Option Code           | 605Dh  | 00h         | <b>1020</b> | B.2.17 |
| Fault Reaction Option Code | 605Eh  | 00h         | <b>1021</b> | B.2.17 |
| Operation Mode             | 6060h  | 00h         | –           | C.2.5  |
| Operation Mode Display     | 6061h  | 00h         | –           | C.2.5  |
| Position Target Value      | 6062h  | 00h         | <b>1040</b> | B.2.19 |
| Position Actual Value*     | 6063h  | 00h         | –           | C.2.5  |
| Position Actual Value      | 6064h  | 00h         | <b>1041</b> | B.2.19 |
| Target Position Window     | 6067h  | 00h         | <b>1022</b> | B.2.17 |

## C. Reference Festo Handling and Positioning Profile (FHPP)

| Name                        | CI     |          | FHPP<br>PNU | See    |
|-----------------------------|--------|----------|-------------|--------|
|                             | Object | SI       |             |        |
| Position Window Time        | 6068h  | 00h      | <b>1023</b> | B.2.17 |
| Velocity Demand Value       | 6068h  | 00h      | –           | C.2.5  |
| Velocity Actual Value       | 606Ch  | 00h      | –           | C.2.5  |
| Target Torque/Force         | 6071h  | 00h      | –           | C.2.5  |
| Max Torque/Force            | 6072h  | 00h      | <b>512</b>  | B.2.10 |
| Max Current                 | 6073h  | 00h      | <b>1034</b> | B.2.18 |
| Motor Rated Current         | 6075h  | 00h      | <b>1035</b> | B.2.18 |
| Motor Rated Torque          | 6076h  | 00h      | <b>1036</b> | B.2.18 |
| Torque Actual Value         | 6077h  | 00h      | –           | C.2.5  |
| Current Actual Value        | 6078h  | 00h      | –           | C.2.5  |
| Target Position             | 607Ah  | 00h      | –           | C.2.5  |
| Software End Position       | 607Bh  | 01h, 02h | <b>501</b>  | B.2.9  |
| Home Offset                 | 607Ch  | 00h      | <b>1010</b> | B.2.16 |
| Polarity                    | 607Eh  | 00h      | <b>1000</b> | B.2.15 |
| Profile Velocity            | 6081h  | 00h      | –           | C.2.5  |
| Profile Acceleration        | 6083h  | 00h      | –           | C.2.5  |
| Profile Deceleration        | 6084h  | 00h      | –           | C.2.5  |
| Motion Profile Type         | 6086h  | 00h      | –           | C.2.5  |
| Torque Slope                | 6087h  | 00h      | –           | C.2.5  |
| Torque Profile Type         | 6088h  | 00h      | –           | C.2.5  |
| Position Encoder Resolution | 608Fh  | 01h, 02h | <b>1001</b> | B.2.15 |
| Gear Ratio                  | 6091h  | 01h, 02h | <b>1002</b> | B.2.15 |
| Feed Constant               | 6092h  | 01h, 02h | <b>1003</b> | B.2.15 |
| Position Factor             | 6093h  | 01h, 02h | <b>1004</b> | B.2.15 |
| Homing Method               | 6098h  | 00h      | <b>1011</b> | B.2.16 |
| Homing Velocities           | 6099h  | 01h, 02h | <b>1012</b> | B.2.16 |
| Stroke Limit                | 60F6h  | 01h      | <b>510</b>  | B.2.10 |
| Force Mode Speed Limit      | 60F6h  | 02h      | <b>554</b>  | B.2.14 |
| Force Target Window         | 60F6h  | 03h      | <b>552</b>  | B.2.14 |
| Force Target Window Time    | 60F6h  | 04h      | <b>553</b>  | B.2.14 |
| Min. Torque/Force           | 60F6h  | 05h      | <b>511</b>  | B.2.10 |

## C. Reference Festo Handling and Positioning Profile (FHPP)

| Name                           | CI     |                                                                                                                          | FHPP<br>PNU | See    |
|--------------------------------|--------|--------------------------------------------------------------------------------------------------------------------------|-------------|--------|
|                                | Object | SI                                                                                                                       |             |        |
| Position Control Parameter Set | 60FBh  | 12h ... 17h,<br>20h                                                                                                      | <b>1024</b> | B.2.17 |
| Local digital inputs           | 60FDh  | 00h                                                                                                                      | <b>303</b>  | B.2.7  |
| Local Digital Outputs          | 60FEh  | 01h, 02h                                                                                                                 | <b>304</b>  | B.2.7  |
| Motor Type                     | 6402h  | 00h                                                                                                                      | <b>1030</b> | B.2.18 |
| Motor Data                     | 6410h  | 01h, 03h                                                                                                                 | <b>1025</b> | B.2.17 |
| Supported Drive Modes          | 6502h  | 00h                                                                                                                      | –           | C.2.5  |
| Drive Catalog Number           | 6503h  | 00h                                                                                                                      | <b>124</b>  | B.2.5  |
| Drive Manufacturer             | 6504h  | 00h                                                                                                                      | <b>122</b>  | B.2.5  |
| HTTP Drive Catalog Address     | 6505h  | 00h                                                                                                                      | <b>123</b>  | B.2.5  |
| Drive Data                     | 6510h  | 31h (01h),<br>32h (02h),<br>40h (03h),<br>41h (04h),<br>42h (05h),<br>43h (06h),<br>A0h (07h),<br>22h (08h),<br>44h, 45h | <b>1026</b> | B.2.17 |

Tab. C/7: Overview of CI objects

C.2.2 Representation of the parameter entries

1

2

3

4

5

6

|   |                    |                                                                                                                                                                |             |       |          |       |
|---|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------|----------|-------|
|   | Encoder Resolution |                                                                                                                                                                |             |       |          |       |
| 7 | CI                 | 20FAh                                                                                                                                                          | 01h ... 02h | Array | V-string | rw/ro |
| 8 | Description        | Managing the FCT password, entering the super password.                                                                                                        |             |       |          |       |
|   | FCT password       | 20FAh                                                                                                                                                          | 01h         |       | V-string | rw    |
|   | Super Password     | Password for the FCT software<br>Value: <.....> (fixed 8 characters, ASCII, 7-bit)<br>Default: <00000000> (status upon delivery and after resetting)           |             |       |          |       |
|   |                    | 20FAh                                                                                                                                                          | 02h         |       | V-string | ro    |
|   |                    | Entering the super password.<br>Resets all passwords (FCT password and HMI password, object 20FB).<br>Contact Festo Service if you require the super password. |             |       |          |       |

- 1
- Name of the parameter in English

2

 Object number

3

 Subindices of the parameter

4

 Element class

5

 Element variable type.

6

 Read/Write permission:    ro    = read only  
                                      wo    = write only  
                                      rw    = read and write

7

 Description of the parameter

8

 Name and description of subindices, if present

Fig. C/1: Representation of the parameter entries

## C. Reference Festo Handling and Positioning Profile (FHPP)

### C.2.3 Communication Profile Area (1xxxh)

| Device Type        |                                                                                                                                                                                                                                               |        |     |        |    |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----|--------|----|
| CI                 | 1000h                                                                                                                                                                                                                                         | –/ 00h | Var | uint32 | ro |
| <b>Description</b> | Classification of the device type and the function.<br>Bit: 31 ... 16                      15 ... 0<br>Additional information      Device profile number<br><br>Value: 0 (0x0000) – not used<br>Additional information: 0 (0x0000) – not used |        |     |        |    |

| Manufacturer Hardware Version  |                                                                                                  |        |     |          |    |
|--------------------------------|--------------------------------------------------------------------------------------------------|--------|-----|----------|----|
| CI                             | 1009h                                                                                            | –/ 00h | Var | V-string | ro |
| Description                    | Coding of the hardware version (xx = main version, yy = secondary version).<br>Format = “Vxx.yy” |        |     |          |    |
| Compare PNU 100 / object 2069h |                                                                                                  |        |     |          |    |

| Manufacturer Software Version  |                                                                                                  |        |     |          |    |
|--------------------------------|--------------------------------------------------------------------------------------------------|--------|-----|----------|----|
| CI                             | 100Ah                                                                                            | –/ 00h | Var | V-string | ro |
| Description                    | Coding of the firmware version (xx = main version, yy = secondary version).<br>Format = “Vxx.yy” |        |     |          |    |
| Compare PNU 101 / object 206Ah |                                                                                                  |        |     |          |    |

C.2.4 Manufacturer Specific Profile Area (2xxxh)

| Record Number                                |                                                                                                                                                                                                                                                                                                                                                                         |     |                     |       |    |
|----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|---------------------|-------|----|
| CI                                           | 2032h                                                                                                                                                                                                                                                                                                                                                                   | 01h | Array <sup>1)</sup> | uint8 | rw |
| <sup>1)</sup> Pseudo-array for compatibility |                                                                                                                                                                                                                                                                                                                                                                         |     |                     |       |    |
| Description                                  | Selection of a positioning record via the record number.<br>The record number is saved as the target for write and read operations on the following Objects: <ul style="list-style-type: none"><li>– Object 20E0/01h ... 05h: Record Table Element</li><li>– Or objects 607Ah, 6081h, 6083h, 6084h</li></ul> There is a direct correlation with object 2033h (PNU 401). |     |                     |       |    |
| Record Number number                         | 2032h                                                                                                                                                                                                                                                                                                                                                                   | 01h |                     | uint8 | rw |
|                                              | Read or write record number<br>Values:<br>0 (0x00): Direct position record, reserved, <b>do not</b> use<br>1 (0x00): RS232 position record (FCT record), reserved, <b>do not</b> use<br>2 (0x02): Homing (position record 0)<br>3 (0x03): Position record 1 (default)<br>4 (0x04): Position record 2<br>... Position record ...<br>33 (0x21): Position record 31        |     |                     |       |    |

| Version FCT PlugIn Min |                                                                                                                                                                                   |        |     |          |   |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----|----------|---|
| CI                     | 2067h                                                                                                                                                                             | –/ 00h | Var | V-string | r |
| Description            | Minimum version of FCT SFC-DC plug-in required for commissioning the SFC-DC with the firmware version being used.<br>Format = “xx.yy” (xx = main version, yy = secondary version) |        |     |          |   |

| Version FCT PlugIn Opt |                                                                                                                                                                                      |        |     |          |   |
|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----|----------|---|
| CI                     | 2068h                                                                                                                                                                                | –/ 00h | Var | V-string | r |
| Description            | Version of FCT SFC-DC plug-in optimally suited for commissioning of the SFC-DC with the firmware version being used.<br>Format = “xx.yy” (xx = main version, yy = secondary version) |        |     |          |   |

## C. Reference Festo Handling and Positioning Profile (FHPP)

| Scaling        |                                                                                                                                                                                                                                                                                                                                                   |          |       |       |       |    |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-------|-------|-------|----|
| CI             | 20D0h                                                                                                                                                                                                                                                                                                                                             | 01h, 02h | Array | uint8 | ro    |    |
| Description    | Units of measurement and decimal places on the control panel display                                                                                                                                                                                                                                                                              |          |       |       |       |    |
|                | Measuring Unit                                                                                                                                                                                                                                                                                                                                    | 20D0h    | 01h   |       | uint8 | ro |
| Scaling Factor | Definition of unit of measurement.<br>The setting for the system of measurement only affects the display.<br>All parameters are always saved in increments in the controller and are not converted into the relevant measuring system until they are written or downloaded.<br>Fixed = 1: Metric measuring units e.g. mm, mm/s, mm/s <sup>2</sup> |          |       |       |       |    |
|                |                                                                                                                                                                                                                                                                                                                                                   | 20D0h    | 02h   |       | uint8 | ro |
|                | Number of places after the decimal point<br>Fixed = 2                                                                                                                                                                                                                                                                                             |          |       |       |       |    |

| Record Table Element |                                                                                                                                                                                                                                                                                                                                   |               |              |                 |                  |              |              |
|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------------|-----------------|------------------|--------------|--------------|
| CI                   | 20E0h                                                                                                                                                                                                                                                                                                                             | 01h ... 05h   | Record       | uint16, int32   |                  |              | rw           |
| Description          | Editing the entries in the positioning record table:<br>1. Select line (= position number) with object 2032h.<br>2. Select column under subindex 20E0h: 01 ... 05                                                                                                                                                                 |               |              |                 |                  |              |              |
|                      |                                                                                                                                                                                                                                                                                                                                   |               | 20E0/01      | 20E0/02         | 20E0/03          | 20E0/04      | 20E0/05      |
|                      |                                                                                                                                                                                                                                                                                                                                   | Record Number | Pos-set Mode | Target Position | Profile Velocity | Profile Acc. | Profile Dec. |
|                      |                                                                                                                                                                                                                                                                                                                                   | 02            |              |                 |                  |              |              |
|                      | 2032h →                                                                                                                                                                                                                                                                                                                           | 03            | <1>          | <...>           | ...              | ...          | ...          |
|                      | ...                                                                                                                                                                                                                                                                                                                               |               |              |                 |                  |              |              |
|                      | This command only stores the values in the positioning table;<br>no movement takes place.<br>Via object 20E0 access is effected in part to the same parameters as with the corresponding objects 607Ah, 6081h, 6083h, 6084h or objects 20EAh to 20EFh. Different data types are converted accordingly during writing and reading. |               |              |                 |                  |              |              |
| Positioning Mode     | 20E0h                                                                                                                                                                                                                                                                                                                             | 01h           |              | uint16          |                  | rw           |              |
|                      | Positioning mode (record control word). Values:<br>0 (0x0000): Absolute positioning (default)<br>1 (0x0001): Relative positioning                                                                                                                                                                                                 |               |              |                 |                  |              |              |
| Target Position      | 20E0h                                                                                                                                                                                                                                                                                                                             | 02h           |              | int32           |                  | rw           |              |
|                      | Target position in increments (compare Target Position, object 607A).<br>Range of values and default values like PNU 404, object 20ECh                                                                                                                                                                                            |               |              |                 |                  |              |              |

## C. Reference Festo Handling and Positioning Profile (FHPP)

| Record Table Element |                                                                                                                                                         |     |  |       |    |
|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|-----|--|-------|----|
| Velocity             | 20E0h                                                                                                                                                   | 03h |  | int32 | rw |
|                      | Positioning speed in increments (compare Profile Velocity, object 6081).<br>Range of values and default values like PNU 406, object 20EDh               |     |  |       |    |
| Acceleration         | 20E0h                                                                                                                                                   | 04h |  | int32 | rw |
|                      | Acceleration in increments/s <sup>2</sup> (compare Profile acceleration, object 6083).<br>Range of values and default values like PNU 407, object 20EEh |     |  |       |    |
| Deceleration         | 20E0h                                                                                                                                                   | 05h |  | int32 | rw |
|                      | Deceleration in increments/s <sup>2</sup> (compare Profile deceleration, object 6084).<br>Range of values and default values like PNU 408, object 20EFh |     |  |       |    |

| Controller Type |                                                                                                                                                                                                                               |   |     |       |   |
|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-----|-------|---|
| CI              | 20E3h                                                                                                                                                                                                                         | – | Var | uint8 | r |
| Description     | Type of controller.<br>Values:<br>0 (0x00): Controller with display/keyboard (type ...-H2-...)<br>1 (0x01): Controller without display/keyboard (type ...-H0-...)<br>3 ... 15: Cannot be set (reserved for future extensions) |   |     |       |   |

| CI_ReceiveChecksumActive |                                                                                                                                                                                                                  |        |     |       |    |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----|-------|----|
| CI                       | 20F3h                                                                                                                                                                                                            | –/ 00h | Var | uint8 | rw |
| Description              | Enable checksum checking of received CI telegrams, see appendix C.1.3, Tab. C/6.<br>Values:<br>0 (0x00): Disabled (default)<br>1 (0x01): Enabled<br>Example: Deactivate checksum: “=20F300:0012” (12 = checksum) |        |     |       |    |

## C. Reference Festo Handling and Positioning Profile (FHPP)

| Password                                                                                                                                                       |                                                                                                                                                  |          |       |          |             |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|----------|-------|----------|-------------|
| CI                                                                                                                                                             | 20FAh                                                                                                                                            | 01h, 02h | Array | V-string | rw/ro       |
| Description                                                                                                                                                    | Managing the FCT password, entering the super password.                                                                                          |          |       |          |             |
|                                                                                                                                                                | FCT password                                                                                                                                     | 20FAh    | 01h   |          | V-string rw |
| Super Password                                                                                                                                                 | Password for the FCT software<br>Value: <.....> (fixed 8 characters, ASCII, 7-bit)<br>Default: <00000000> (status upon delivery and after reset) |          |       |          |             |
|                                                                                                                                                                |                                                                                                                                                  | 20FAh    | 02h   |          | V-string ro |
| Entering the super password.<br>Resets all passwords (FCT password and HMI password, object 20FB).<br>Contact Festo Service if you require the super password. |                                                                                                                                                  |          |       |          |             |

| Local Password                                                                                                                                                                                                                                                                     |       |        |     |          |    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------|-----|----------|----|
| CI                                                                                                                                                                                                                                                                                 | 20FBh | -/ 00h | Var | V-string | rw |
| Managing the (local) HMI password for enabling particular functions, which are carried out via the control panel.<br>Value: <.....> (fixed 8 characters, ASCII, 7-bit)<br>Only the first 3 characters are evaluated.<br>Default: <00000000> (status upon delivery and after reset) |       |        |     |          |    |

| Communication Error                                                                                                                             |       |        |     |        |    |
|-------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------|-----|--------|----|
| CI                                                                                                                                              | 2FF0h | -/ 00h | Var | uint16 | ro |
| Special object; see appendix C.1.3.<br>In the case of a transmission error, the value <0xFF> will be transferred instead of the usual response. |       |        |     |        |    |

| Fieldbus Address                                                                                             |       |        |     |       |    |
|--------------------------------------------------------------------------------------------------------------|-------|--------|-----|-------|----|
| CI                                                                                                           | 2FF3h | -/ 00h | Var | uint8 | rw |
| PROFIBUS address of the SFC-DC.<br>Values: 0 ... 125 (0x00 ... 0x7D)<br>Default: 255 (0xFF, invalid address) |       |        |     |       |    |

C.2.5 Standardised Device Profile Area (6xxxh)

| Control Word DS 402 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |        |     |        |    |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----|--------|----|
| CI                  | 6040h                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | –/ 00h | Var | uint16 | rw |
| Description         | <p>Modify the current controller status or trigger an activity.<br/>As status modifications require a certain amount of time, all status modifications triggered via the Control Word must be read back via the Status Word. Only when the requested status can be read in the status word may a further command be written via the control word. For a description of the finite state machine see chapter 5.7.<br/>Values see Tab. C/8.</p> <p><b>Specific features when accessing via CI:</b></p> <ul style="list-style-type: none"><li>– Reset Fault (Bit 7) as per DS 402 processing with positive edge, but via CI level evaluated.</li><li>– Start bit (Bit 4) when Homing and positioning according to DS 402, edge triggered for CI but level evaluated. 0-set interpreted as stop.</li><li>– HMI access locked (bit 14) only accessible via fieldbus.</li><li>– Switch to “Operation enable” may simultaneously contain action-triggering bits (Start, Jog, ...).</li><li>– Shortened status transitions:<ul style="list-style-type: none"><li>– Operation disable or Switch on command (same coding):<br/>State OPERATION ENABLE -&gt; READY TO SWITCH ON.<br/>State READY TO SWITCH ON -&gt; SWITCHED ON.</li><li>– Disable voltage command (bit 1 = 0, rest irrelevant)<br/>– all states -&gt; READY TO SWITCH ON.</li><li>– Operation enable command (all states) -&gt; OPERATION ENABLE.</li><li>– Voltage disable and Quick stop commands -&gt; READY TO SWITCH ON.</li></ul></li></ul> |        |     |        |    |

## C. Reference Festo Handling and Positioning Profile (FHPP)

| Bit | Value  | Description                                                                                                                                                                                  |                                                                     |
|-----|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|
| 0   | 0x0001 | Switch on                                                                                                                                                                                    | Control of state transitions.<br>These bits are evaluated together. |
| 1   | 0x0002 | Enable Voltage                                                                                                                                                                               |                                                                     |
| 2   | 0x0004 | Quick stop – low-active                                                                                                                                                                      |                                                                     |
| 3   | 0x0008 | Enable Operation                                                                                                                                                                             |                                                                     |
| 4   | 0x0010 | Depends on operating mode (object 6060h):<br>– Homing mode: Homing Operation Start (start reference travel)<br>– Profile Position Mode: New Setpoint (move to position)                      |                                                                     |
| 5   | 0x0020 | Depends on operating mode (object 6060h):<br>– Homing Mode: Reserved (set to 0)<br>– Profile Position Mode: Reserved (change_set_immediately not supported in record select and direct mode) |                                                                     |
| 6   | 0x0040 | Depends on operating mode (object 6060h):<br>– Profile Position Mode: absolute / relative<br>– Homing Mode: Reserved (set to 0)                                                              |                                                                     |
| 7   | 0x0080 | Reset fault                                                                                                                                                                                  |                                                                     |
| 8   | 0x0100 | Hold as per Hold option code – object 605Dh                                                                                                                                                  |                                                                     |
| 9   | 0x0200 | Reserved (= 0)                                                                                                                                                                               |                                                                     |
| 10  | 0x0400 | Reserved (= 0)                                                                                                                                                                               |                                                                     |
| 11  | 0x0800 | Jog positive: Run as long as set                                                                                                                                                             |                                                                     |
| 12  | 0x1000 | Jog negative: Run as long as set                                                                                                                                                             |                                                                     |
| 13  | 0x2000 | Teach: Apply current value                                                                                                                                                                   |                                                                     |
| 14  | 0x4000 | HMI Access locked                                                                                                                                                                            |                                                                     |
| 15  | 0x8000 | Reserved (= 0)                                                                                                                                                                               |                                                                     |

Tab. C/8: Description of control word

## C. Reference Festo Handling and Positioning Profile (FHPP)

| Status Word        |                                                                                                                                                                                                                                                                                                                                                                                                                                                         |        |     |        |    |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----|--------|----|
| CI                 | 6041h                                                                                                                                                                                                                                                                                                                                                                                                                                                   | –/ 00h | Var | uint16 | ro |
| <b>Description</b> | Reading the current controller or regulator status.<br>For a description of the finite state machine see chapter 5.7.<br>Values see Tab. C/9.<br><br><b>Specific features when accessing via CI:</b> <ul style="list-style-type: none"> <li>– Bit 4 in CI reversed polarity relative to DI402.</li> <li>– In the Fault state, when power is applied to the axis, the state is indicated not as xxx8, but xxxA, meaning “Switched on” is set.</li> </ul> |        |     |        |    |

| Bit | Value  | Description                                                                                                                                                                      |
|-----|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0   | 0x0001 | Ready to switch on                                                                                                                                                               |
| 1   | 0x0002 | Switched on                                                                                                                                                                      |
| 2   | 0x0004 | Operation enabled                                                                                                                                                                |
| 3   | 0x0008 | Fault                                                                                                                                                                            |
| 4   | 0x0010 | Voltage enabled                                                                                                                                                                  |
| 5   | 0x0020 | Quick Stop                                                                                                                                                                       |
| 6   | 0x0040 | Switch on disabled                                                                                                                                                               |
| 7   | 0x0080 | Warning (simple fault that does not require an emergency stop)                                                                                                                   |
| 8   | 0x0100 | Drive moves ( $\hat{=}$ bit 4 of SPOS in FHPP)                                                                                                                                   |
| 9   | 0x0200 | Control sovereignty (= device controller) ( $\hat{=}$ Bit 5 of SCON with FHPP)                                                                                                   |
| 10  | 0x0400 | Target position reached (see also PNU 1022 and 1023)                                                                                                                             |
| 11  | 0x0800 | Internal Limit active (I <sup>2</sup> t active)                                                                                                                                  |
| 12  | 0x1000 | Depends on operating mode (object 6060): <ul style="list-style-type: none"> <li>– Profile position mode: Setpoint acknowledge</li> <li>– Homing mode: Homing attained</li> </ul> |
| 13  | 0x2000 | Depends on operating mode (object 6060): <ul style="list-style-type: none"> <li>– Profile position mode: Following error</li> <li>– Homing mode: Homing error</li> </ul>         |
| 14  | 0x4000 | Confirmation of successful teachine ( $\hat{=}$ Bit 3 of SPOS with FHPP)                                                                                                         |
| 15  | 0x8000 | Drive is referenced ( $\hat{=}$ bit 7 of SPOS in FHPP)                                                                                                                           |

Tab. C/9: Description of status word

## C. Reference Festo Handling and Positioning Profile (FHPP)

| Operation Mode |                                                                                                                                                                                                                                                                     |        |     |      |    |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----|------|----|
| CI             | 6060h                                                                                                                                                                                                                                                               | –/ 00h | Var | int8 | rw |
| Description    | Set the controller operating mode.<br>Values:<br>-2 (0xFE): Demo mode (fixed sequence)<br>1 (0x01): Profile position mode (default, position controller with positioning mode)<br>3 (0x03): Reserved<br>4 (0x04): Torque Mode (force mode)<br>6 (0x06): Homing mode |        |     |      |    |

| Operation Mode Display |                                                                     |        |     |      |    |
|------------------------|---------------------------------------------------------------------|--------|-----|------|----|
| CI                     | 6061h                                                               | –/ 00h | Var | int8 | ro |
| Description            | Read current controller operating mode.<br>Values see object 6060h. |        |     |      |    |

| Position Actual Value* |                                                                                                                                  |        |     |       |    |
|------------------------|----------------------------------------------------------------------------------------------------------------------------------|--------|-----|-------|----|
| CI                     | 6063h                                                                                                                            | –/ 00h | Var | int32 | ro |
| Description            | Current position of the drive in increments (encoder increments)<br>Range of values: -2 <sup>31</sup> ... +(2 <sup>31</sup> - 1) |        |     |       |    |
| *: Normalised value    |                                                                                                                                  |        |     |       |    |

| Velocity Demand Value |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |        |     |       |    |
|-----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----|-------|----|
| CI                    | 606Bh                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | –/ 00h | Var | int32 | ro |
| Description           | Current setpoint velocity value of speed regulator in increments/s<br>Setpoint speed for the current positioning operation calculated by the trajectory generator. With this object the current setpoint speed of the speed regulator can be read. It is acted upon by the setpoint value of the ramp and curve generators. Because the position controller is active in Profile Position Mode, its correction speed is also added in.<br>Range of values: $-2^{31} \dots +(2^{31} - 1)$ |        |     |       |    |

| Velocity Actual Value |                                                                                                                    |        |     |       |    |
|-----------------------|--------------------------------------------------------------------------------------------------------------------|--------|-----|-------|----|
| CI                    | 606Ch                                                                                                              | –/ 00h | Var | int32 | ro |
| Description           | Current actual velocity value of speed regulator in increments/s<br>Range of values: $-2^{31} \dots +(2^{31} - 1)$ |        |     |       |    |

## C. Reference Festo Handling and Positioning Profile (FHPP)

| Target torque/force |                                                                                         |        |     |       |    |
|---------------------|-----------------------------------------------------------------------------------------|--------|-----|-------|----|
| CI                  | 6071h                                                                                   | –/ 00h | Var | int32 | ro |
| Description         | Setpoint value for force mode. Specified in 1/1000 of the nominal value (object 6076h). |        |     |       |    |

| Torque Actual Value |                                                                                      |        |     |       |    |
|---------------------|--------------------------------------------------------------------------------------|--------|-----|-------|----|
| CI                  | 6077h                                                                                | –/ 00h | Var | int32 | ro |
| Description         | Actual value in force mode. Specified in 1/1000 of the nominal value (object 6076h). |        |     |       |    |

| Target Position |                                                                                                                                                                                                                                                                                                                          |        |     |       |    |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----|-------|----|
| CI              | 607Ah                                                                                                                                                                                                                                                                                                                    | –/ 00h | Var | int32 | rw |
| Description     | <p>Target position in increments</p> <p>Writing the object does not yet trigger movement.</p> <p>The target position is stored in the position table in the column provided, at the line addressed by object 2032h or specified by the direct mode.</p> <p>Range of values: <math>-2^{31} \dots +(2^{31} - 1)</math></p> |        |     |       |    |

| Profile Velocity |                                                                                                                                                                                                                                                                                                                                                           |        |     |        |    |
|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----|--------|----|
| CI               | 6081h                                                                                                                                                                                                                                                                                                                                                     | –/ 00h | Var | uint32 | rw |
| Description      | <p>Final speed for a positioning procedure in increment/s</p> <p>The speed is stored in the position record table in the column provided, on the line addressed by object 2032h or specified by the direct job. Writing the object does not yet trigger movement.</p> <p>Range of values: 0 ... Max. permitted speed (Object 21F6h)</p> <p>Default: 0</p> |        |     |        |    |

## C. Reference Festo Handling and Positioning Profile (FHPP)

| Profile Acceleration |                     |        |     |        |    |
|----------------------|---------------------|--------|-----|--------|----|
| CI                   | 6083h               | –/ 00h | Var | uint32 | rw |
| Description          | See object 20E0:04. |        |     |        |    |

| Profile Deceleration |                     |        |     |        |    |
|----------------------|---------------------|--------|-----|--------|----|
| CI                   | 6084h               | –/ 00h | Var | uint32 | rw |
| Description          | See object 20E0:05. |        |     |        |    |

| Motion Profile Type |                                                                                        |        |     |       |    |
|---------------------|----------------------------------------------------------------------------------------|--------|-----|-------|----|
| CI                  | 6086h                                                                                  | –/ 00h | Var | int16 | rw |
| Description         | Type of acceleration ramp (linear, $\sin^2$ etc.).<br>Fixed = -1 (0xFFFF): Linear ramp |        |     |       |    |

| Torque Slope |                                                                                                                         |     |     |        |   |
|--------------|-------------------------------------------------------------------------------------------------------------------------|-----|-----|--------|---|
| CI           | 6087h                                                                                                                   | 00h | Var | uint32 | r |
| Description  | Modification speed of torque (or of force).<br>Unit: 1/000 of rated torque (6076h) per second.<br>Fixed: 18000 (0x4650) |     |     |        |   |

| Motion Profile Type |                                                                                                    |     |     |       |   |
|---------------------|----------------------------------------------------------------------------------------------------|-----|-----|-------|---|
| CI                  | 6088h                                                                                              | 00h | Var | int16 | r |
| Description         | Type of profile with which a torque modification is undertaken.<br>Fixed: 0 (0x0000) – linear ramp |     |     |       |   |

C. Reference Festo Handling and Positioning Profile (FHPP)

| Supported Drive Modes |                                                                                                                                                                                                                                                                                                                                                                                                    |        |     |        |    |
|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----|--------|----|
| CI                    | 6502h                                                                                                                                                                                                                                                                                                                                                                                              | –/ 00h | Var | uint32 | ro |
| Description           | Classification of the drive functions.<br>SLTE: 33 (0x21) = Without force mode<br>HGPLE/GEH/DEF: 41 (0x29) = With force mode<br><br>Bit 0: Profile Position Mode<br>Bit 1: Reserved (Velocity mode)<br>Bit 2: Reserved (Profile velocity mode)<br>Bit 3: Profile torque mode<br>Bit 4: Reserved<br>Bit 5: Homing mode<br>Bit 6: Reserved (Interpolated positioning mode)<br>Bit 7 ... 31: Reserved |        |     |        |    |

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## **Appendix D**

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