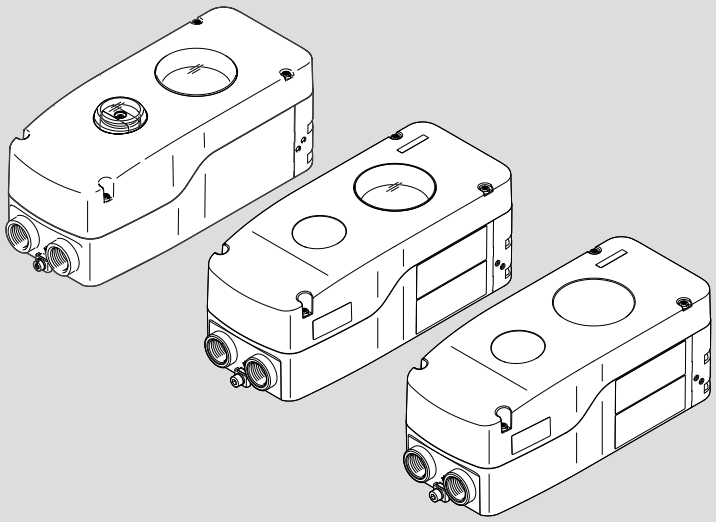
# CMSH
## Positioner



FESTO

Operating instruction

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Original instructions

# Table of contents

# 1 About this document

## 1.1 Applicable documents

All available documents for the product ➔ www.festo.com/sp.

## 1.2 Product version

This document refers to the following product versions:

| Product | Version |
|---|---|
| CMSH | from hardware revision 1.1.0<br>from software revision 1.2.0 |

Tab. 1: Product version

The product version can be determined from the product labelling or the local user interface.

There may be an updated version of this document for this or later product versions ➔ www.festo.com/sp.

### 1.2.1 Licences

This product uses open-source software. The following table lists the corresponding software packages as well as the licences that govern the software. The licensing conditions of the supplier apply.

| Package | Version | Copyright notice | SPDX | License conditions |
|---|---|---|---|---|
| Little File System | V2.0.1 | Copyright 2017 Arm Limited | BSD-3-Clause | https://opensource.org/licenses/BSD-3-Clause |
| STM32L4xx HAL Drivers | V1.10.0 | Copyright 2017 STMicroelectronics | BSD-3-Clause | https://opensource.org/licenses/BSD-3-Clause |
| STM32L4xx CMSIS | V5.4.0 | Copyright 2009-2018, Arm Limited | Apache 2.0 | Apache License, Version 2.0 |
| STM32L4xx CMSIS device | V1.5.1 | Copyright 2017 STMicroelectronics | BSD-3-Clause | https://opensource.org/licenses/BSD-3-Clause |
| STM32L0xx CMSIS | V1.9.0 | Copyright 2016 STMicroelectronics | BSD-3-Clause | https://opensource.org/licenses/BSD-3-Clause |
| STM32L0xx CMSIS device | V1.9.0 | Copyright 2017 STMicroelectronics | BSD-3-Clause | https://opensource.org/licenses/BSD-3-Clause |
| STM32L0xx HAL Drivers | V1.10.9.2 | Copyright 2017 STMicroelectronics | BSD-3-Clause | https://opensource.org/licenses/BSD-3-Clause |
| Embed OS, FileSystem | | Copyright 2006-2013, ARM Limited, Copyright 2015, ARM Limited | Apache License, Version 2.0 | https://www.apache.org/licenses/LICENSE-2.0 |

Tab. 2: Licences

# 2 Safety

## 2.1 General safety instructions

- Only use the product in its original condition without unauthorised modifications.
- Only use the product if it is in perfect technical condition.
- Observe the identifications on the product.
- Only use the product in an industrial environment.
- Do not open the product in a damp environment.
- Before carrying out assembly, installation and maintenance work: switch off the compressed air supply and secure it against being switched on again.
- After the compressed air supply is switched on, compressed air may be present directly at the pneumatic working ports.

**Return to Festo**

Hazardous substances can endanger the health and safety of persons and cause damage to the environment. To prevent hazards, the product should only be returned if explicitly requested by Festo.

- Consult your regional Festo contact.
- Complete the declaration of contamination and attach it to the outside of the packaging.
- Comply with all legal requirements for the handling of hazardous substances and the transport of dangerous goods.

## 2.2 Intended use

The positioner is intended for positioning pneumatic drives.
The positioner is intended for use in an industrial environment.
The product is suitable for attachment to single-acting or double-acting semi-rotary drives or linear drives.
The product is suitable for attachment to drives with a mechanical interface in accordance with VDI/VDE 3845-1 (IEC 60534-6-2) or VDI/VDE 3847-2.

## 2.3 Training of qualified personnel

Work on the product may only be carried out by qualified personnel who can evaluate the work and detect dangers. The qualified personnel have skills and experience in dealing with electropneumatic (open-loop) control technology.

# 3 Additional information

- Contact the regional Festo contact if you have technical problems
  ➔ www.festo.com.
- Accessories ➔ www.festo.com/catalogue.

# 4 Product overview

## 4.1 Design

### 4.1.1 Product design

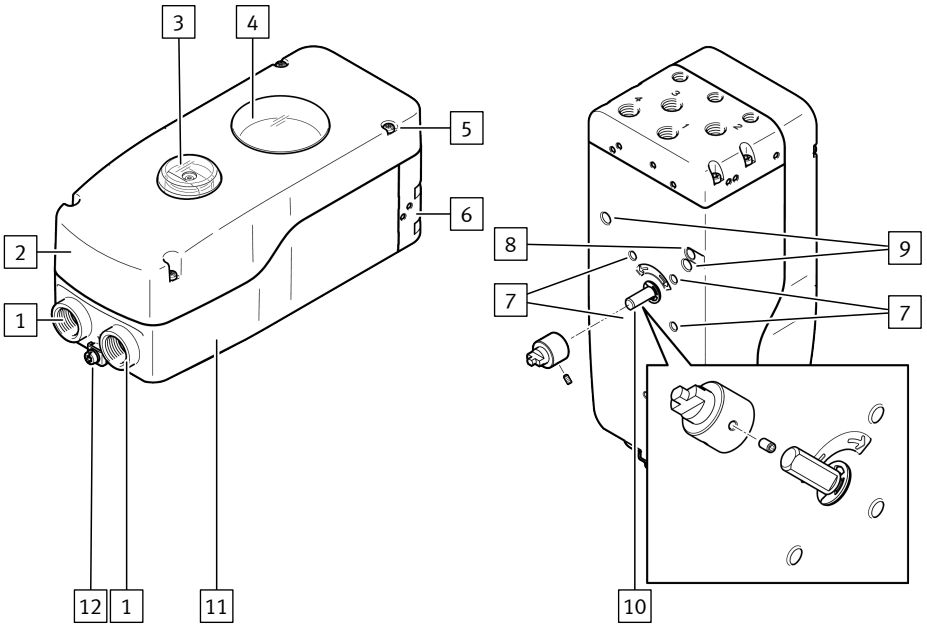



Fig. 1: Product design

1 Cable entry M20 or NPT ½, depending on product version
2 Housing cover
3 Position indicator, with product variant CMSH-S-..., CMSH-S-...
4 Inspection window for the display
5 4 housing cover screws
6 Pneumatic manifold block
7 Mounting thread for mounting kit for semi-rotary drives in accordance with VDI/VDE 3845-1
8 Check valve
9 Mounting thread for mounting kit for linear actuators in accordance with IEC 60534-6-1
10 Shaft of the integrated position sensor for displacement/angle measurement, for product variant CMSH-S-... , CMSH-SX1-...
11 Housing bottom part
12 Functional earth (FE), equipotential bonding

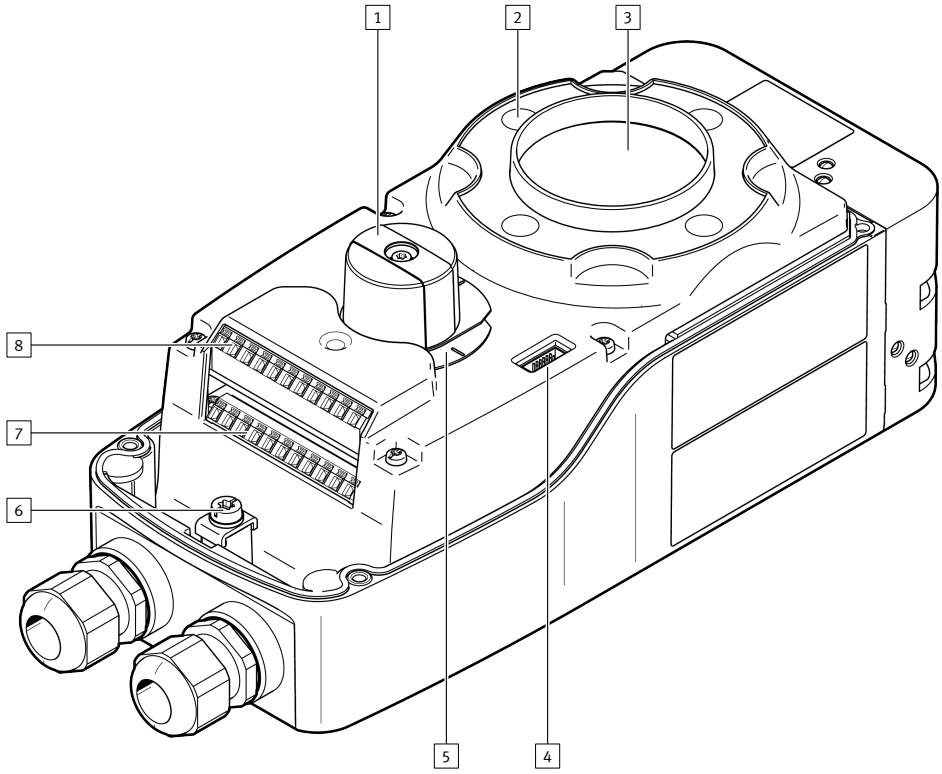



Fig. 2: Product design

1 Position indicator, for product variant CMSH-S-... , CMSH-SE-...
2 Operating button
3 Display
4 Service interface
5 Encoder disc for end position detection, for product variant CMSH-...-1W-... , CMSH-...-ZC-...
6 Functional earth (FE)
7 Electrical connection, option module I/O, only for product variant CMSH-...-V2-...
8 Electrical connection CMSH-...

**Electrical connection CMSH-...**

- 1 analogue input for power supply, setpoint specification and HART communication
- 1 digital input for triggering functions
- 1 input for an external position sensor

**Electrical connection, optional module CMSH-...-V2-...**

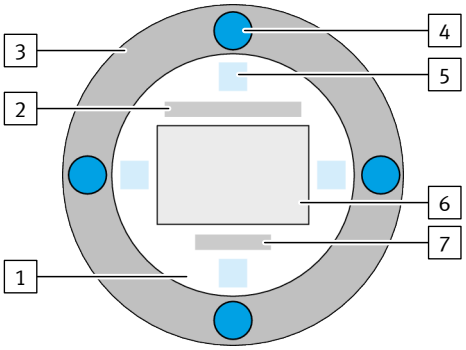
- 1 analogue output for position feedback
- 2 digital outputs for feedback of the device status and the position limit values
- 1 digital input for triggering functions

### 4.1.2 Product variant CMSH-...-V-SD-...

The same device can be used for single-acting and double-acting drives with the product variant CMSH-...-V-SD-....
The pneumatic manifold block CAPS determines the function type of the positioner.
The pneumatic manifold block CAPS required for operation is not pre-assembled and is not in scope of delivery.

### 4.1.3 Operation and display

#### 4.1.3.1 User interface




1 Display
2 Information area (optional)
3 Control ring
4 4 operating buttons
5 4 softkeys
6 Content area
7 Page indicator (optional)

Fig. 3: Structure of the user interface

| Range | Description |
|---|---|
| Information area | Information about the status of the device is displayed in the process views ➔ Status and information in the information area. |
| Operating buttons | The device is operated with 4 operating buttons. |
| Softkeys | A context-dependent function is displayed. This function can be triggered by the associated operating button. In the process views, the upper softkey displays the device status. |
| Content area | Process values, menus and parameters are displayed. |
| Page indicator | The total number of process views and the relative position of the current process view are displayed in the process views. |

Tab. 3: Elements in the user interface

#### 4.1.3.2 Process views

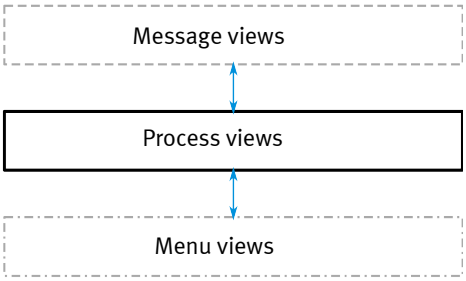



Fig. 4: Basic layout of the views

The process views show current process values as well as information on the operating status. The process views are automatically shown on the display when the device is switched on again or if there is no interaction on the user interface for a long time.
The default process view of the positioner shows the current values of the setpoint position and actual position. If the device is not initialised, the current actual position cannot be displayed.
Additional process views have been defined for automatic mode. Use the left and right keys for navigation between the process views.
The following 5 process views are available in automatic mode. These process views are not available in the manual operating modes ➔ 7.2.3 ‘Operation mode’ menu:

| Process view | Description |
|---|---|
| 1 | Setpoint position [%]/actual position [%] |
| 2 | Setpoint value input [mA], analogue position feedback [mA] |

| Process view | Description |
|---|---|
| 3 | Temperature [°C, °F] |
| 4 | Drive chamber pressures [bar, MPa, psi] |
| 5 | Supply pressure [bar, MPa, psi] |

Tab. 4: Process views

### Key functions

| Symbol | Function |
|---|---|
| Up key | – Device status according to NAMUR recommendation NE 107<br>– Switch to the message views |
| | Good |
| | Maintenance required |
| | Outside specification |
| | Functional check |
| | Failure |
| Down key | |
| | Switch to the menu views |
| Left key | |
| | Switch to the previous process view |
| Right key | |
| | Switch to the next process view |

Tab. 5: Key functions in the process views

### Status and information in the information area

The following status and information can be displayed in the information area of the process views:

| Symbol | Information/state |
|---|---|
| | Manual operation |
| DI | Active control signal at the digital input |
| | – No valid initialisation<br>– Control not possible |
| | Operation with substitute initialisation |
| | – Effective tight seal<br>– Current setpoint position specification is in the tight seal range |
| | Active blocking of local operation |

Tab. 6: Status and information in the information area

## 4.1.3.3 Message views

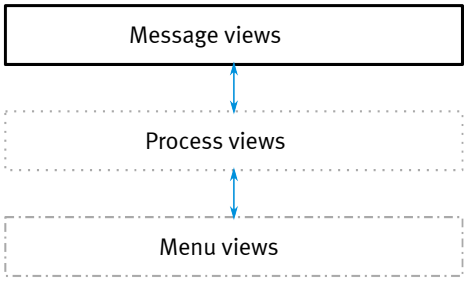
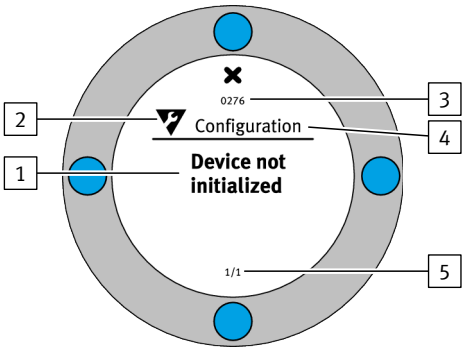



Fig. 5: Information structure

The following contents for a message are displayed in a message view:




1 Message
2 Status signal of the message corresponding to NAMUR recommendation NE 107
3 Unique message number
4 Message group
5 Page indicator

Fig. 6: Structure of the message views

Active messages are displayed in the message views. If no active message is pending, a corresponding message is displayed. If there are several messages pending, the highest priority message is displayed first.
The page indicator is used for orientation and displays the rank of the displayed message and the total number of all active messages. Active messages are called up when the upper key is pressed in the process views ➔ Key functions. The symbol belonging to the upper operating key indicates the current device status in accordance with NAMUR recommendation NE 107 ➔ Tab. 5 Key functions in the process views. Since this general device status is derived from the status signal of the highest priority active message, there is a direct connection between the device status and the associated message at any time.
The right-hand key can be used to switch from one message to the next lower-priority message. The left key can be used to switch from one message to the higher-priority message. After exit from the message views, the last visible process view is displayed ➔ Key functions.

**Status signals in accordance with NAMUR recommendation NE 107**

The messages are assigned to one of the following 4 status signals in accordance with NAMUR recommendation NE 107. This assignment can be changed via DTM or EDD for some diagnostic functions.

| Status signal | Function |
|---|---|
|  | Maintenance required |
|  | Outside specification |
|  | Functional check |
|  | Failure |

Tab. 7: Status signals

**Message groups**

The message groups facilitate classification in the evaluation and troubleshooting. The message groups are based on the possible error sources of the NAMUR recommendation NE 107.

| Message group | Description |
|---|---|
| Drive | Messages that refer to the pneumatic positioning system or the drive. |
| Configuration | Messages that refer to the missing or incorrect configuration of the positioner. |
| Electronics | Messages that are due to errors in the electronics. |
| Operating conditions | Messages that are the result of non-compliance with the specified operating conditions. |
| Process | Messages that affect the process. |

| Message group | Description |
|---|---|
| Sensor | Messages that affect the position sensor, pressure sensor or temperature sensor. |
| Other | Other messages |

Tab. 8: Message groups

A detailed description of the messages, possible causes and notes on error elimination can be found in chapter ➔ 8.2 Messages.

#### 4.1.3.4 Menu views

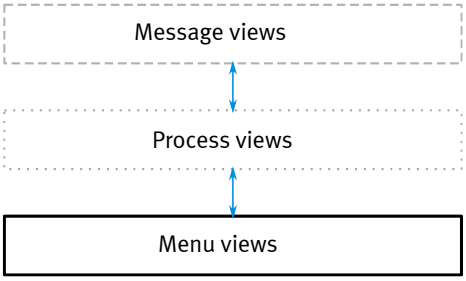



Fig. 7: Information structure

The menu views contain all the parameters, functions and information required for commissioning and configuration of the device. A detailed description of the individual menus and parameters can be found in chapter ➔ 7.2 Checking and setting parameters in the menu views.
The menu views become visible by pressing the lower key in the process views.

**Key functions**

The following key functions are available for navigation and settings in the menu views. The key functions are displayed context-dependent relevant to the current menu.

| Symbol | Function |
|---|---|
| Up key | |
| ✕ | – Exit menu: return from the top menu level to the last active process view.<br>– Cancel: exit the settings view without saving the changes. |
| ↰ | – Return to the next higher menu level. |
| Down key | |
| ☑ | – Select or deselect the focused parameter |
| ✓ | – Navigate to the next lower menu level.<br>– Apply: exit the settings view and apply changes. |
| ✎ | – Call a routine, action or wizard.<br>– Edit parameters: open settings view. |
| Left key | |
| ‹ | – Change selection: switch to the previous menu entry or selection option. |
| − | – Reduce parameter values. |
| Right key | |
| › | – Change selection: switch to the following menu entry or to the following selection option. |
| + | – Increase parameter values. |

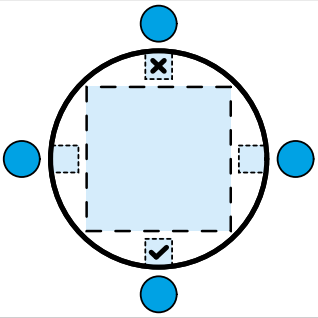
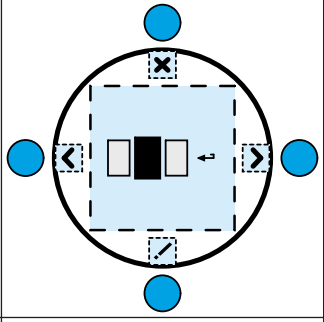
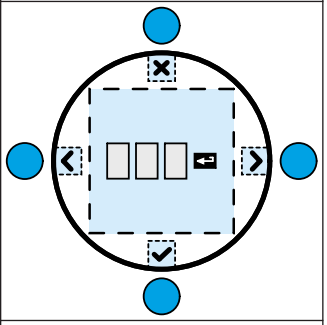
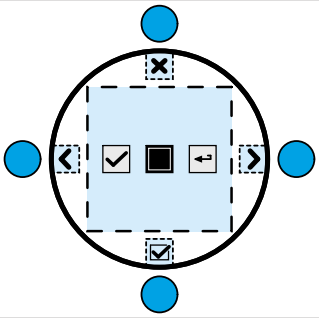
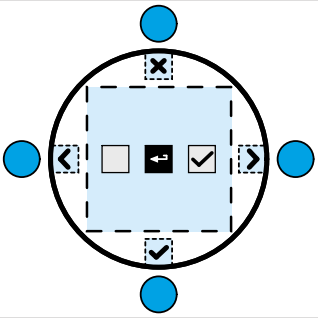
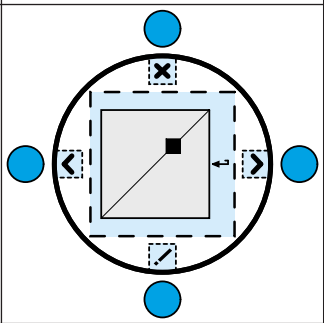
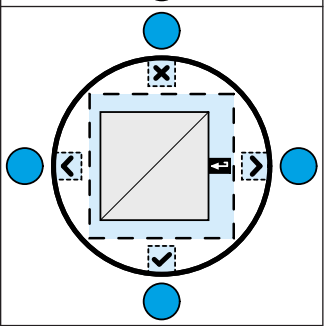
Tab. 9: Key functions in the menu view

## Settings

Parameters can be changed in the menu views. The parameters are selected or adjusted via a value input.

## Discard or apply changes

Parameter changes are discarded when the upper key is pressed.
Parameter changes are applied when the lower key is pressed. The input symbol must be selected in order to apply the change for numerical value entry, multiple selection and the user characteristic curve. A curved arrow is visible on the input symbol. The input symbol is selected if it is highlighted in black.
Actions with far-reaching consequences, such as calling the initialisation routine and resetting the device, are protected by upstream queries. The critical action is not executed until the question is confirmed.

| Pattern | Lower key for changing the focused parameter | Lower key for applying the change |
|---|---|---|
| General principle | — |  |
| Numerical value entry |  |  |
| Multiple selection |  |  |
| User characteristic curve |  |  |

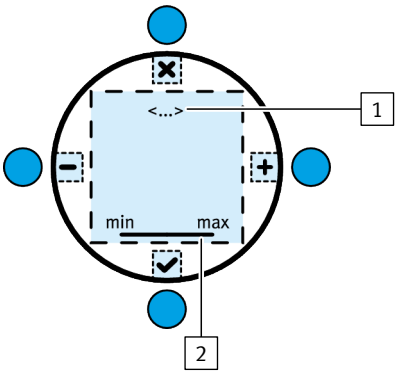
Tab. 10: Applying changes

### Selection

During selection one or more options are selected from a list. There is a distinction between whether just one or more options are permissible. After a single selection the value currently stored in the system is displayed in the upper area.

### Step-by-step value entry

With step-by-step value entry, a parameter value can be changed with the left and right keys. The value currently stored in the system is displayed in the upper area and the permitted value range in the lower area of the view.




1 Currently valid system value
2 Permissible range of values

Fig. 8: Value input

### Numerical value entry

In the case of numerical value entry, a value is set by entering the individual decimal places. First, the number to be edited is selected using the left and right keys. Then, the digit can be changed analogously to the pattern for step-by-step value entry ➔ Step-by-step value entry.

## 4.2 Function

The CMSH is a digital, electropneumatic positioner. It controls the position of a process valve that is actuated by a pneumatic drive.
The CMSH is a 4 … 20 mA loop powered 2-wire device. An additional power supply is therefore not required.
The CMSH has a local user interface (LUI) for configuration and operation. A HART interface permits remote access and integration into higher-level systems.
The product variants CMSH-S-... and CMSH-SX1-... have an internal position sensor for path/angular detection. The angular position of the shaft is detected by the internal position sensor.
Alternatively, an external potentiometric position sensor can be connected to the positioner on all product variants.

## 4.3 Fail-safe position

The safety position defines the pneumatic initial position of the positioner.
Depending on the product variant and the type of drive, the positioner reacts differently to the failure of the electrical power supply, the failure of the compressed air supply or an impermissible setpoint specification.
In the product variant CMSH-...-V-SD-... the pneumatic manifold block CAPS determines the function type of the positioner and thus the safety position.

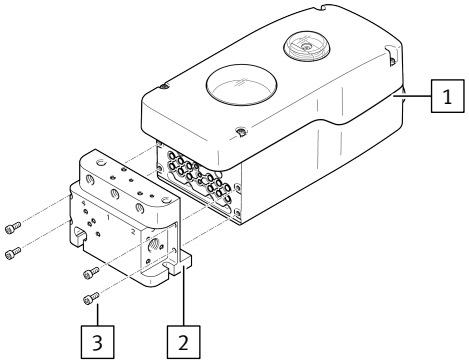
| | Single-acting drives | Double-acting drives |
|---|---|---|
| Safety position in case of electrical power failure, pneumatic compressed air supply present | CMSH-...-S-A-..., CAPS-...-S-A-... :<br>– Working port (2) on the positioner is exhausted.<br>– Drive moves to the initial position. | CMSH-...-D-A-..., CAPS-...-D-A-... :<br>– Working port (2) on the positioner is exhausted, working port (4) on the positioner is pressurised.<br>– Drive moves to end position.<br>CMSH-...-D-C-..., CAPS-...-D-C-... :<br>– Working port (2) and (4) on the positioner are closed.<br>– Drive holds last position. |
| Safety position in case of failure of the compressed air supply, electric power present | CMSH-...-S-A-..., CAPS-...-S-A-... :<br>– Working port (2) on the positioner is exhausted.<br>– Drive moves to the initial position. | CMSH-...-D-A-..., CAPS-...-D-A-... :<br>– Working port (2) on the positioner is exhausted, working port (4) on the positioner is open.<br>– Drive position not defined.<br>CMSH-...-D-C-..., CAPS-...-D-C-... :<br>– Working port (2) and (4) on the positioner are closed.<br>– Drive holds last position. |
| Safety position in case of failure of electrical power and compressed air supply | CMSH-...-S-A-..., CAPS-...-S-A-... :<br>– Working port (2) on the positioner is exhausted.<br>– Drive moves to the initial position. | CMSH-...-D-A-..., CAPS-...-D-A-... :<br>– Working port (2) on the positioner is exhausted, working port (4) on the positioner is open.<br>– Drive position not defined.<br>CMSH-...-D-C-..., CAPS-...-D-C-... :<br>– Working port (2) and (4) on the positioner are closed.<br>– Drive holds last position. |

Tab. 11: System response to fault

If the power supply is switched on again, the last operating status is effective immediately.

# 5 Assembly

## 5.1 Mounting the pneumatic manifold block CAPS on the CMSH-...-V-SD-...




1 Positioner CMSH-...-V-SD-...
2 Pneumatic manifold block CAPS
3 4 retaining screws

Fig. 9: Mounting pneumatic manifold block CAPS

- Fasten the pneumatic manifold block CAPS to the positioner with 4 retaining screws.
  – M4x20 retaining screws for CAPS-M1-VDE1-..., M4x10 retaining screws for CAPS-M1-VDE2-...
  – Tightening torque: 2.7 Nm ± 10%

Select the ‘Device’ menu to configure the assembly-related ‘Actuator function’ and ‘Safety position’ parameters based on the type of the selected pneumatic manifold block CAPS ➔ 7.2.4.4 Device.

| CAPS type | Actuator function | Safety position |
|---|---|---|
| CAPS-...-SA-... | Single-acting | Fail safe |
| CAPS-...-DA-... | Double-acting | Fail safe |
| CAPS-...-DC-... | Double-acting | Fail in place |

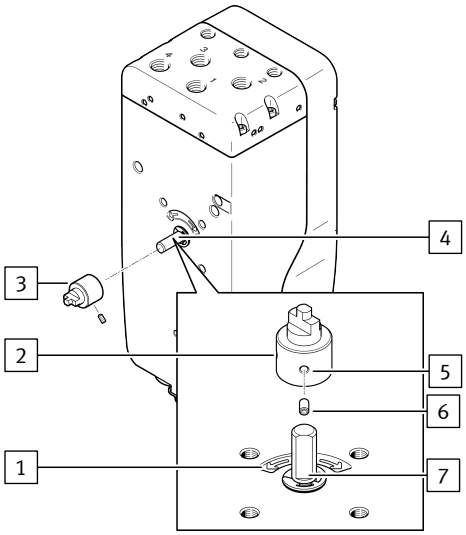
Tab. 12: Parameter settings for CMSH-...-V-SD-...

## 5.2 Mounting on semi-rotary drives

### 5.2.1 Mounting shaft adapter on the positioner

The alignment of the positioner to the semi-rotary drive and the direction of motion of the drive must be determined for the position sensor to work within its detection range. The shaft adapter must be positioned on the shaft of the positioner based on this.

The shaft of the internal position sensor can be rotated as desired and does not have a mechanical stop for the sensing range. The permissible sensing range of the position sensor is 115°.
The sensing range of the position sensor can be checked in Operation mode ‘Manual venting’ ➔ 7.2.3.2 ‘Manual venting’ manual manipulated variable mode. When moving over the entire swivel angle of the drive, the flattened area of the shaft on the positioner [7] must be opposite the sensing range of the position sensor [1].



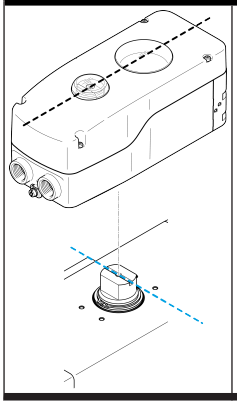
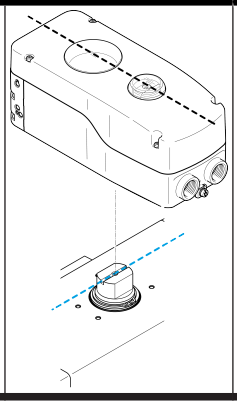
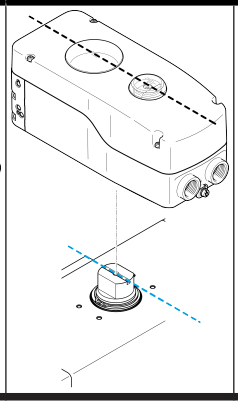
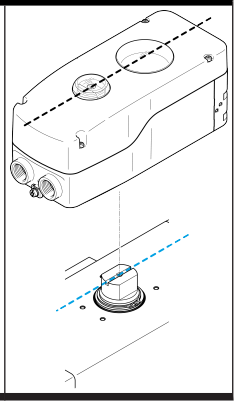

1 Sensing range of the position sensor for travel/angular detection
2 Alternative threaded hole
3 Shaft adapter
4 Position sensor shaft
5 Threaded hole
6 Threaded pin
7 Flat section of the shaft

Fig. 10: Shaft of the positioner

Requirement: the drive is in the neutral position:
– For single-acting drives: exhaust working port 2.
– For double-acting drives: exhaust working port 2 and pressurise working port 4.

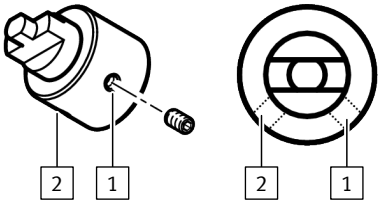
1. Adjust the shaft of the position sensor by hand so the flat section of the shaft is opposite the sensing range of the position sensor.
2. Determine the direction of movement of the drive when exhausting working port 2.

3. Determine the alignment of the positioner to the slot of the drive shaft.

| Vertical | | Parallel | |
|---|---|---|---|
|  |  |  |  |

4. Locate the threaded hole of the shaft adapter that is to be used.

| **Direction of movement of the drive during exhaust** | **Alignment of the positioner** | |
|---|---|---|
| | Vertical | Parallel |
| Direction of movement clockwise, right rotation | Threaded hole 1 | Threaded hole 2 |
| Direction of movement anticlockwise, left rotation | Threaded hole 2 | Threaded hole 1 |



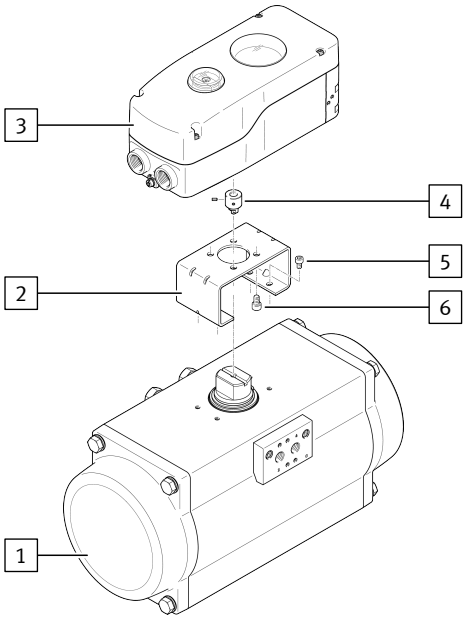

1 Threaded hole 1
2 Threaded hole 1

5. Fix the shaft adapter with a threaded pin through the selected threaded hole to the flat section of the positioner shaft.
   – Tightening torque: 0.5 Nm ± 15%

### 5.2.2 Mounting CMSH-S/SX1-VDE1-... on a semi-rotary drive

This chapter describes the installation of the product variant CMSH-S-... on a semi-rotary drive in accordance with the VDI/VDE 3845-1, IEC 60534-6-2 standard. This description also applies to the product variant CMSH-SX1-....

Use a mounting kit for semi-rotary drives in accordance with VDI/VDE 3845-1, IEC 60534-6-2, accessories ➔ 3 Additional information.




1 Semi-rotary drive
2 Mounting adapter
3 Positioner CMSH-S-VDE1-...
4 Shaft adapter
5 4 M5x8 retaining screws
6 4 M6x10 retaining screws

Fig. 11: Mounting CMSH-S-VDE1-... on semi-rotary drive

Requirement: the shaft adapter is mounted according to the direction of movement and alignment so the range of movement of the drive is within the sensing range of the position sensor.

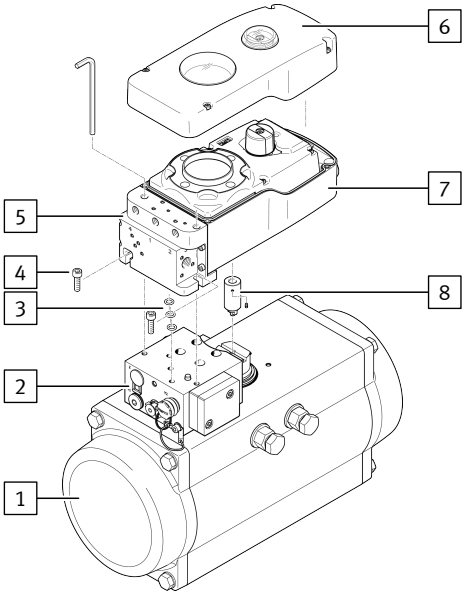
1. Fasten the mounting adapter to the semi-rotary drive with 4 M6x10 retaining screws.
   – Tightening torque: 5 Nm ± 10%
2. Place the positioner with the pre-assembled mounting adapter on the drive and align it. This requires alignment of the shaft adapter to the drive shaft
   ➔ 5.2.1 Mounting shaft adapter on the positioner.
3. Fasten the mounting adapter to the positioner with 4 M5x8 retaining screws.
   – Tightening torque: 3 Nm ± 10%

Make sure that transverse loads of the shaft do not act on the shaft of the positioner during alignment of the mounting adapter. This requires tightening the retaining screws on the positioner only at the end of the process.

### 5.2.3 Mounting CMSH-S/SX1-VDE2-... on a semi-rotary drive

This chapter describes the installation of the product variant CMSH-S-... on a semi-rotary drive in accordance with the VDI/VDE 3847-2 standard. This description also applies to the product variant CMSH-SX1-....

### 5.2.3.1 Mounting CMSH-S-VDE2-... on control plate DADG-FM-F9-VDE2




1 Semi-rotary drive DFPD-...C-VDE2
2 Control plate DADG-FM-F9-VDE2
3 Seals
4 2 M6x20 retaining screws
5 Pneumatic manifold block
6 Housing cover
7 Positioner CMSH-S-VDE2-...
8 Shaft adapter

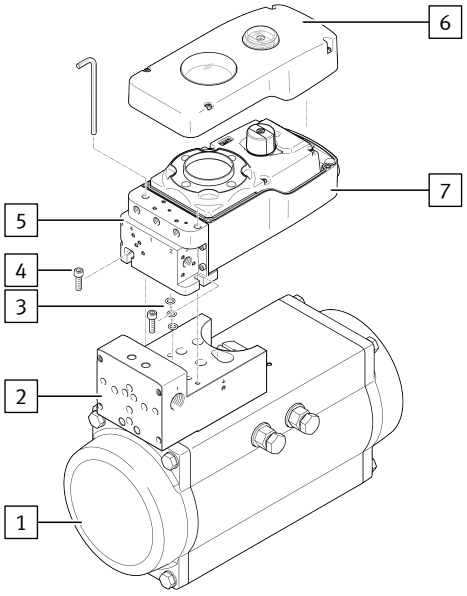
Fig. 12: Mounting CMSH-S-VDE2-... on control plate DADG-FM-F9-VDE2

1. Make sure that the control plate is mounted on the semi-rotary drive.
2. Unscrew the 4 housing cover screws and remove the housing cover.
3. Insert the included seals into the specified slots on the bottom of the pneumatic manifold block.
   – Ensure that the seals are correctly positioned.
4. Insert 2 M6x20 retaining screws into the cut-outs on the pneumatic manifold block.
5. Place the positioner with the pre-assembled shaft adapter on the control plate and align it. This requires alignment of the shaft adapter to the drive shaft ➔ 5.2.1 Mounting shaft adapter on the positioner.

   Make sure that transverse loads do not act on the shaft of the positioner during alignment.

6. Fasten the positioner to the control plate with 2 M6x20 retaining screws.
   – Tightening torque: 3 Nm ± 10%
7. Place the housing cover on the positioner and tighten the 4 housing cover screws.
   – Make sure that the seal is positioned correctly.
   – Tightening torque: 3 Nm ± 20%

### 5.2.3.2 Mounting CMSH-S-VDE2-... on adapter plate VABA of valve terminal VTOP




1 Semi-rotary drive DFPD-...C-VDE2
2 Adapter plate VABA
3 Seals
4 2 M6x20 retaining screws
5 Pneumatic manifold block
6 Housing cover
7 Positioner CMSH-S-VDE2-...

Fig. 13: Mounting CMSH-S-VDE2-... on adapter plate VABA of valve terminal VTOP

1. Ensure that the adapter plate is mounted on the semi-rotary drive.
2. Unscrew the 4 housing cover screws and remove the housing cover.
3. Insert the included seals into the specified slots on the bottom of the pneumatic manifold block.
   – Ensure that the seals are correctly positioned.
4. Insert 2 M6x20 retaining screws into the cut-outs on the pneumatic manifold block.
5. Place the positioner with the pre-assembled shaft adapter on the adapter plate and align it. This requires alignment of the shaft adapter to the drive shaft ➔ 5.2.1 Mounting shaft adapter on the positioner.
   Place the positioner with the shaft adapter on the adapter plate and align it. The swivel angle must be within the sensing range of the position sensor ➔ 5.2.1 Mounting shaft adapter on the positioner.

Make sure that transverse loads do not act on the shaft of the positioner during alignment.

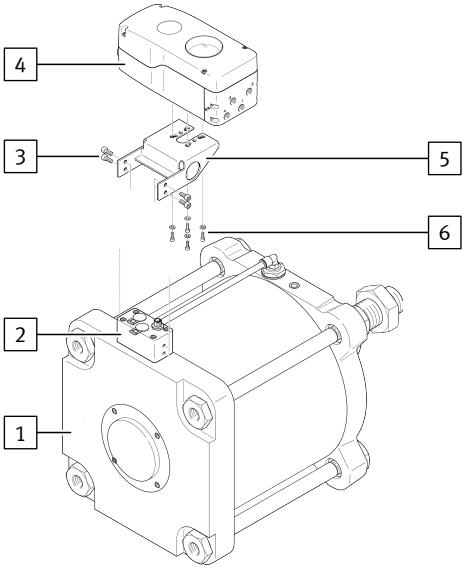
6. Fasten the positioner to the adapter plate with 2 M6x20 retaining screws.
   – Tightening torque: 3 Nm ± 10%
7. Place the housing cover on the positioner and tighten the 4 housing cover screws.
   – Make sure that the seal is positioned correctly.
   – Tightening torque: 3 Nm ± 20%

## 5.3 Mounting on linear drives

### 5.3.1 Mounting CMSH-SE/SE1-VDE1-D-... on a linear drive

This chapter described the attachment of the positioner CMSH-SE-VDE1-D-... on a linear drive DFPI-...-E-NB3 with the adapter kit DADG-AK-F6-A2. This description also applies to the product variant CMSH-SE1-VDE1-D-....

Use adapter kit DADG-AK-F6-A2 for linear drive DFPI-...-E-NB3, accessories
➔ 3 Additional information.



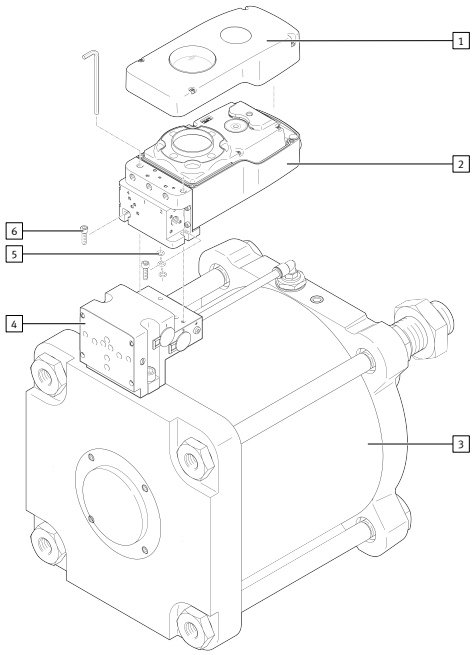

1 Linear drive DFPI-...-E-NB3
2 Housing (flange-type socket)
3 4 M6x10 retaining screws
4 Positioner CMSH-SE-VDE1-D-...
5 Adapter kit DADG-AK-F6-A2
6 4 M6x10 retaining screws

Fig. 14: Mounting CMSH-SE-VDE1-D-...
on linear drive DFPI-...-E-NB3

1. Fasten the adapter kit to the positioner with 4 M6x10 retaining screws.
   – Tightening torque: 5 Nm ± 10%
2. Fasten the positioner to the housing (flange type socket) with the adapter kit using 4 M6x10 retaining screws.
   – Tightening torque: 10 Nm ± 10%

### 5.3.2 Mounting CMSH-SE/SE1-VDE2-D-... on a linear drive

This chapter describes the attachment of the positioner CMSH-SE-VDE2-D-... to a linear drive DFPI-...-E-NB3VM12, based on the VDI/VDE 3847-2 standard. This description also applies to the product variant CMSH-SE1-VDE1-D-....




1 Housing cover
2 Positioner
3 Linear drive
4 Control plate
5 Seals
6 2 M6x20 retaining screws

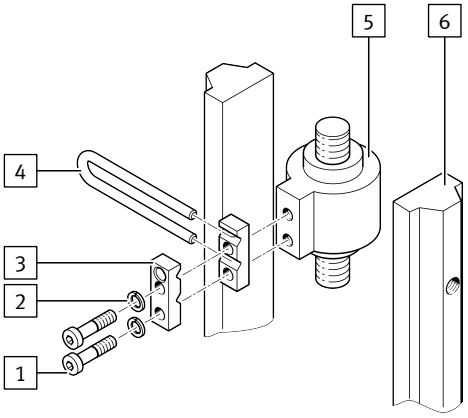
Fig. 15: Mounting CMSH-SE-VDE2-D-... on linear drive DFPI-...-E-NB3VM12

1. Make sure that the control plate is mounted on the linear drive.
2. Unscrew the 4 housing cover screws and remove the housing cover.
3. Insert the included seals into the specified slots on the bottom of the pneumatic manifold block.
   – Ensure that the seals are correctly positioned.
4. Insert 2 M6x20 retaining screws into the cut-outs on the pneumatic manifold block.
5. Place the positioner on the adapter plate of the linear drive and align it.
6. Fasten the positioner to the adapter plate with 2 M6x20 retaining screws.
   – Tightening torque: 3 Nm ± 10%
7. Place the housing cover on the positioner and tighten the 4 housing cover screws.
   – Make sure that the seal is positioned correctly.
   – Tightening torque: 3 Nm ± 20%

## 5.4 Mounting on thrust drives

The chapter describes the attachment of the positioner to a thrust drive in accordance with IEC 60534-6-1, NAMUR Recommendation NE004.

### 5.4.1 Mounting pick-up bracket on drive spindle




1 M6x25 retaining screw
2 A6 spring washer
3 Clamping piece
4 Pick-up bracket
5 Drive spindle
6 Intermediate bracket

Fig. 16: Mounting pick-up bracket

1. Mount the clamping pieces on the drive spindle with 2 M6x25 retaining screws and 2 A6 spring washers.
2. Slide the pick-up bracket into the milled slots of the clamping pieces.
3. Adjust the length of the pick-up bracket.
4. Tighten the retaining screws so that the pick-up bracket can still be moved.

### 5.4.2 Adjusting lever arm to drive stroke

- Short lever arm at strokes of 2 … 35 mm.
- Long lever arm with strokes of 35 … 130 mm.

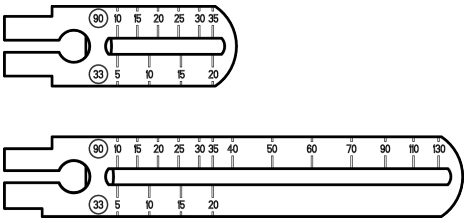
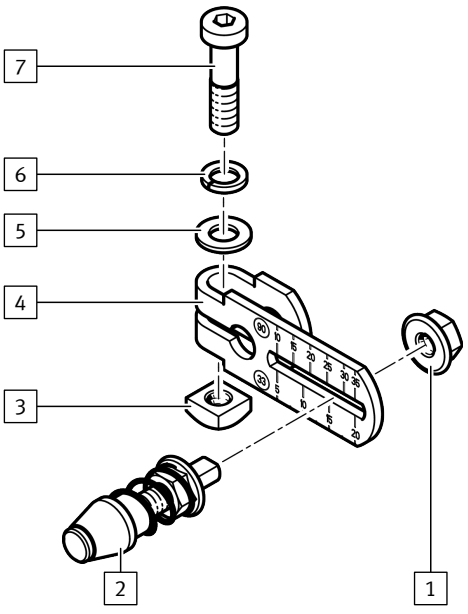


Fig. 17: Short and long lever arm, not mounted




1 M6 hex nut
2 Driving pin
3 M6 square nut
4 Lever arm
5 B6.4 washer
6 A6 spring washer
7 M6x25 retaining screw

Fig. 18: Mounting lever arm

The driving pin and the retaining screw are pre-installed on the short lever arm.
If the long lever arm is used, the driving pin and the retaining screw must be transferred from the short lever arm to the long lever arm.

1. Measure the stroke range of the drive.
2. Locate this value on the scale marked 90 on the lever arm.

If this scale value is not available or if there is uncertainty regarding the actual drive stroke, select the next larger scale value.

3. Mount the driving pin on the lever arm in the middle of the scale line.

### 5.4.3 Mounting lever arm and mounting bracket on the positioner

This chapter describes the attachment of the lever arm and mounting bracket on the positioner CMSH-S-VDE1-.... This description also applies to attachment to the product variant CMSH-SX1-....

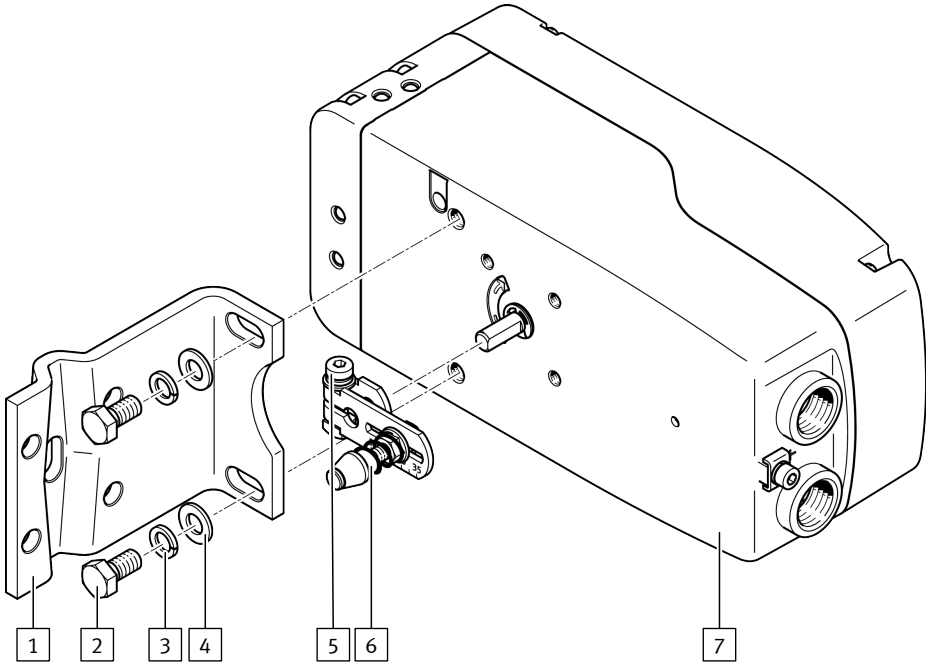



Fig. 19: Mounting lever arm and mounting bracket on the CMSH-S-VDE1-...

1. Mounting bracket in accordance with IEC 60534-6-1, NAMUR recommendation NE004
2. M8x16 retaining screw
3. A8 spring washer
4. B8.4 washer
5. M6x25 retaining screw
6. Driving pin
7. Positioner

1. Slide the lever arm onto the positioner axis to the stop and clamp it with an M6x25 retaining screw.
2. Mount the mounting bracket on the back of the positioner with 2 M8x16 retaining screws, lock washers and washers.

### 5.4.4 Mounting positioner on a drive lantern

This chapter describes the attachment of the positioner CMSH-S-VDE1-... on a drive lantern. This description also applies to the product variant CMSH-SX1-....

1. Hold the positioner with the mounting bracket on the actuator in such a way that the driving pin is guided within the pick-up bracket.
2. Tighten the pick-up bracket.
3. Fasten the positioner to the bracket of the valve actuator.
   Use the correct assembly parts depending on the type of connection point on the drive:
   – Drive with rib: retaining screw, washer and spring washer.
   – Drive with flat surface: 4 hexagon head screws with washer and spring washer.
   – Drive with columns: 2 U-bolts, 4 hex nuts with washer and spring washer.

Set the height of the positioner so the horizontal lever position is passed through and it is reached as close to the middle of the stroke as possible. Use the stroke scale of the drive as a guide.

The driving pin should engage in the pick-up bracket as close as possible to the drive spindle, but it must not touch the clamping pieces. The positioning of the mounting bracket on the positioner may need to be adjusted.

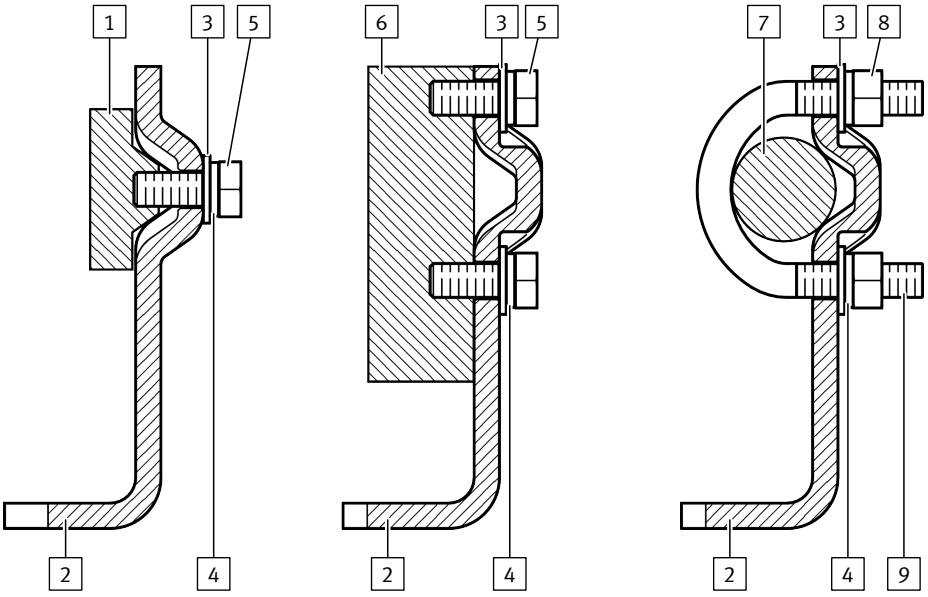



Fig. 20: Mounting brackets on various intermediate brackets

1 Drive with rib
2 Mounting bracket in accordance with IEC 60534-6-1
3 B8.4 washer
4 A8 spring washer
5 M8x20 retaining screw
6 Drive with flat surface
7 Drive with columns
8 M8 hex nut
9 U-bolt

# 6 Installation

## 6.1 Pneumatic installation

- The fittings, pressure gauge and silencer are not in scope of delivery.

- Pressure gauge connections are only available with product variant CMSH-...-V-....
- The working port (4) is only available for product variant CMSH-...-D-... and, depending on the version, for product variant CMSH-...-SD-....
- Ensure protection against icing at an ambient temperature of ≤ 0 °C.

### 6.1.1 Installing pneumatics of the CMSH-...-VDE1-...

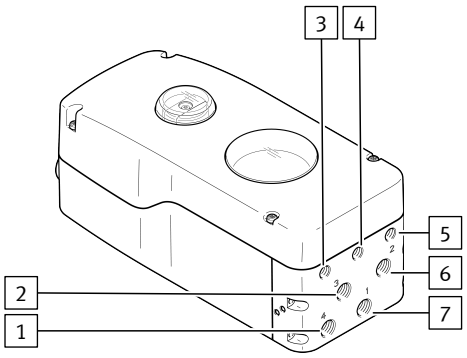



Fig. 21: Positioner CMSH-...-VDE1-...

1. Working port (4)
2. Exhaust port (3)
3. Pressure gauge connection for working port (4)
4. Pressure gauge connection for supply port (1)
5. Pressure gauge connection for working port (2)
6. Working port (2)
7. Compressed air connection (1)

1. Make sure that energy is not connected to the device.
2. Select suitable fittings and silencers. Select pressure gauges suitable for the CMSH-...-V-... product variant ➔ 3 Additional information.
3. Screw the fittings, silencer and pressure gauge into the corresponding pneumatic ports.
4. Connect the compressed air lines to the fittings.
5. Seal unused connections with blanking plugs.

### 6.1.2 Installing pneumatics of the CMSH-...-VDE2-...

The air supply is integrated between the positioner and the drive. The supply port (1), working port (2) and working port (4) are connected to the drive via a control plate, chapter ➔ 5.2 Mounting on semi-rotary drives and chapter ➔ 5.3 Mounting on linear drives. Additional tubing is not required.

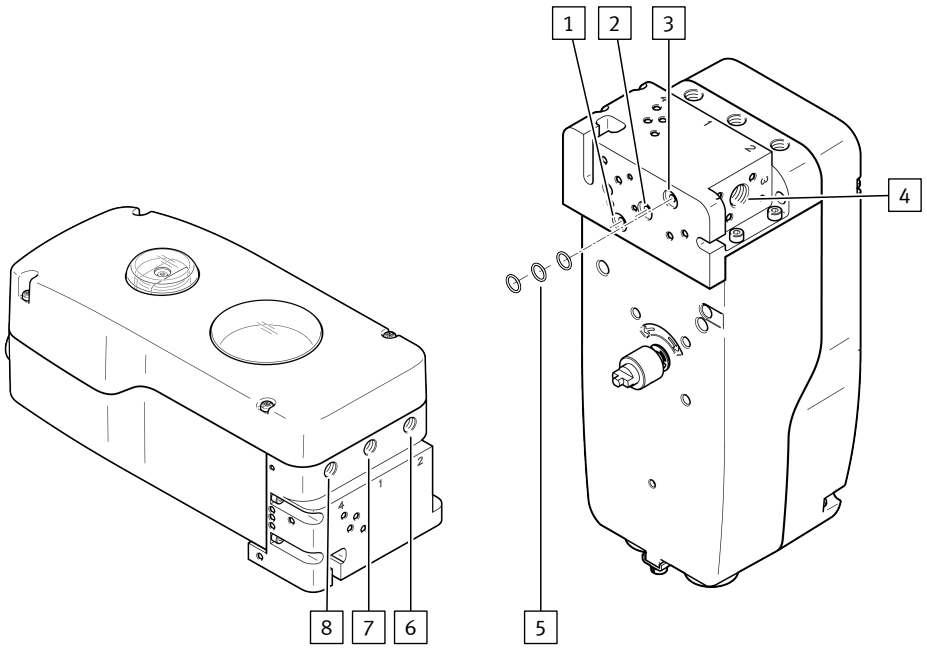



Fig. 22: Positioner CMSH-...-VDE2-...

1 Working port (4)
2 Compressed air connection (1)
3 Working port (2)
4 Exhaust port (3)
5 Seals
6 Pressure gauge connection for working port (2)
7 Pressure gauge connection for supply port (1)
8 Pressure gauge connection for working port (4)

1. Make sure that energy is not connected to the device.
2. Insert seals.
   – Ensure that the seals are correctly positioned.
3. Select suitable fittings and silencers. Select pressure gauges suitable for the CMSH-...-V-... product variant ➔ 3 Additional information.
4. Screw the fittings, silencer and pressure gauge into the corresponding pneumatic ports.
5. Connect the compressed air lines to the fittings.
6. Seal unused connections with blanking plugs.

## 6.2 Electrical installation

### 6.2.1 Establish electrical connection

**⚠ WARNING**

**Risk of injury due to electric shock.**

- For the electric power supply, use SELV or PELV circuits that guarantee a reliable electric disconnection from the mains network.
- Observe IEC 60204-1/EN 60204-1.

**⚠ WARNING**

**Fire risk from overheating.**
Injury resulting from fire.
- The device must have a limited power supply in accordance with the following standard.
  - IEC/EN/UL/CSA 61010-1 Safety of measuring, control and laboratory equipment

**NOTICE**

The connection of a voltage source to the current input will destroy the device.
- Never connect the analogue current input AI to a voltage source.
- Observe the specifications of the electrical connections ➔ 10.3 Electrical data.

The cable fitting and the blanking plugs are not in scope of delivery.

1. Make sure that energy is not connected to the device.
2. Select a suitable cable fitting or insert a blanking plug.
   – Observe the temperature range.
   – The cable fitting must comply with protection class IP67.
   – Connecting thread: M20x1.5 for CMSH-...-M20-..., 1/2 NPT for CMSH-...-N12-...
3. Unscrew the housing cover screws.
4. Remove the housing cover.
5. Screw the cable connector into the threaded hole.
6. Guide the electrical connecting cable through the cable fitting and connect the electrical connection.
   – Select the electrical connecting cable suitable for the cable fitting.
   – Conductor cross section ➔ Tab. 105 Electrical connection.
7. Wire the electrical connections ➔ 6.2.2 Wiring diagram.
8. Tighten the union nut of the cable fitting to seal the cable tightly.
9. Seal unused cable entry with a blanking plug.
10. Connect the functional earth (FE) with low impedance ➔ Fig. 1, [12].
    – Tightening torque: 1 Nm ± 15%
11. If required, attach the cable shield connection to the functional earth (FE) inside the housing.
    – Tightening torque: 1 Nm ± 15%
12. Replace the housing cover and tighten the 4 housing cover screws.
    – Ensure that the seal is correctly positioned.
    – Tightening torque: 3 Nm ± 20%

### 6.2.2 Wiring diagram

For the electrical characteristic values of the connections ➔ 10.3 Electrical data.

**Electrical connection CMSH**

| +11 AI | -12 AI | +81 DI1 | -82 DI1 | POS + | POS W | POS - | +51 DO3 | -52 DO3 | +53 DO4 | -54 DO4 |
|---|---|---|---|---|---|---|---|---|---|---|

Fig. 23: Terminal strip CMSH circuit diagram

| Terminal | Designation | Function |
|---|---|---|
| +11/-12 | AI | Analogue input 4 ... 20 mA for power supply, setpoint specification and HART communication |
| +81/-82 | DI1 | Digital input for triggering functions |
| POS | +<br>W<br>- | Analogue input for external position sensor |
| +51/-52 | DO3 | Digital output for the switching contact of the end position detection only for product variants with limit switch encoder CMSH-...-1W-... and CMSH-...-ZC-... |
| +53/-54 | DO4 | |

Tab. 13: Terminal strip CMSH assignment

**Electrical connection, optional module I/O**

The optional product feature CMSH-...-V2 provides an additional analogue output, two additional digital inputs and digital outputs on a second terminal strip.

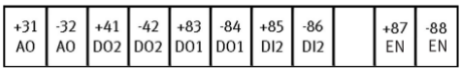



Fig. 24: Terminal strip option module I/O circuit diagram

| Terminal | Designation | Function |
|---|---|---|
| +31/-32 | AO | Analogue output for position feedback |
| +41/-42 | DO2 | Digital output for feedback of the device status and the position limit values |
| +83/-84 | DO1 | Digital output for feedback of the device status and the position limit values |
| +85/-86 | DI2 | Digital input for triggering functions |
| +87/-88 | EN | No function |

Tab. 14: Terminal strip option module I/O assignment

# 7 Commissioning

## 7.1 Commissioning positioner

**Initial commissioning**

During initial commissioning:
- The operating mode is set to automatic mode.
- The positioner is not initialised.
- The positioner does not respond to external setpoint specifications.

Requirements:
- The positioner is fully mounted and connected.
- Ensure that the compressed air supply is stable during commissioning.

1. Switch on the operating voltage.
2. Switch on the compressed air supply.
   ⇨ The compressed air is immediately available at the pneumatic working ports.
3. Check the sensing range of the position sensor ➔ Checking mounting situation and sensing range of the position sensor.
4. Check and adjust the parameters relevant for operation ➔ 7.2 Checking and setting parameters in the menu views.

> The most important parameters can also be set with the setup wizard ➔ 7.2.2 ‘Guided setup’ menu.

5. For the product variants CMSH-...-1W-... and CMSH-...-ZC-...: set end position detection ➔ 7.3 Setting end position detection on the CMSH-...-1W/ZC-....

6. For product variants CMSH-S-...: setting position indicator ➔ 7.4 Adjusting position indicator on the CMSH-S-...
7. Run the initialisation.
   – The automatic initialisation can be started from the ‘Initialization’ menu or within the setup wizard ➔ 7.2.5 Initialization menu, ➔ 7.2.2 ‘Guided setup’ menu.
   – Initialisation from a middle starting position is recommended for larger drives. The middle starting position is implemented by manual movement ➔ 7.2.3.2 ‘Manual venting’ manual manipulated variable mode.

If the control signal is active at the digital input, the initialisation routine may not be executable.

8. On completion of initialisation, replace the housing cover. Make sure that the seal is positioned correctly.
9. Tighten the 4 housing screws.
   – Tightening torque: 3 Nm ±20%.

**Restarting after power failure**

After an interruption of the electrical power supply of an initialised positioner, the positioner restarts with the last effective operating mode. The current setpoint value takes effect immediately.

**Recommissioning in a changed installation situation**

If the system configuration has been changed, the positioner must be reinitialised.

## 7.2 Checking and setting parameters in the menu views

### 7.2.1 Menu structure

The following overview shows all the menus and parameters available in the device in the menu views.

Not all menus and parameters are available for all product variants.

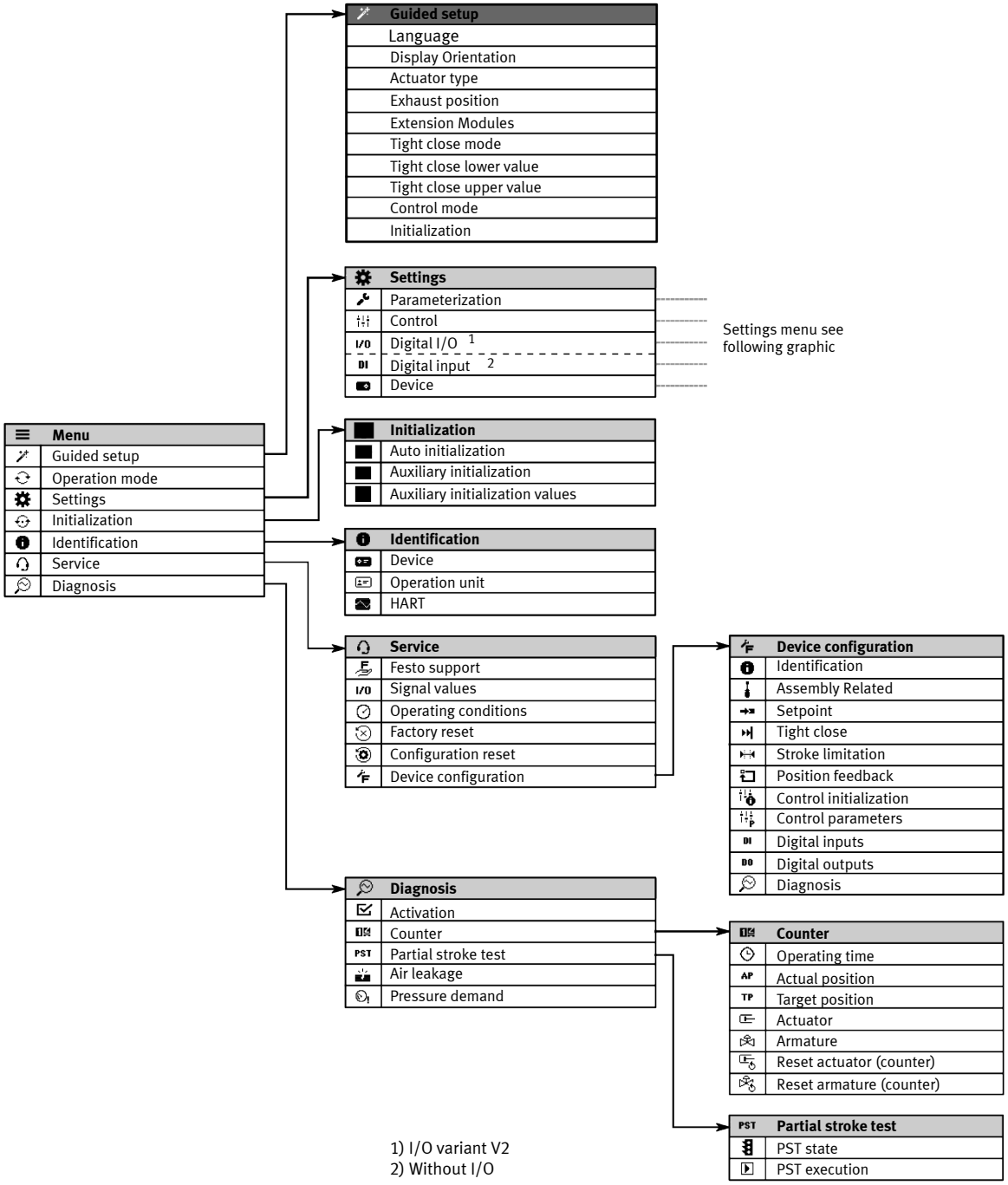



Fig. 25: Structure of the menu views

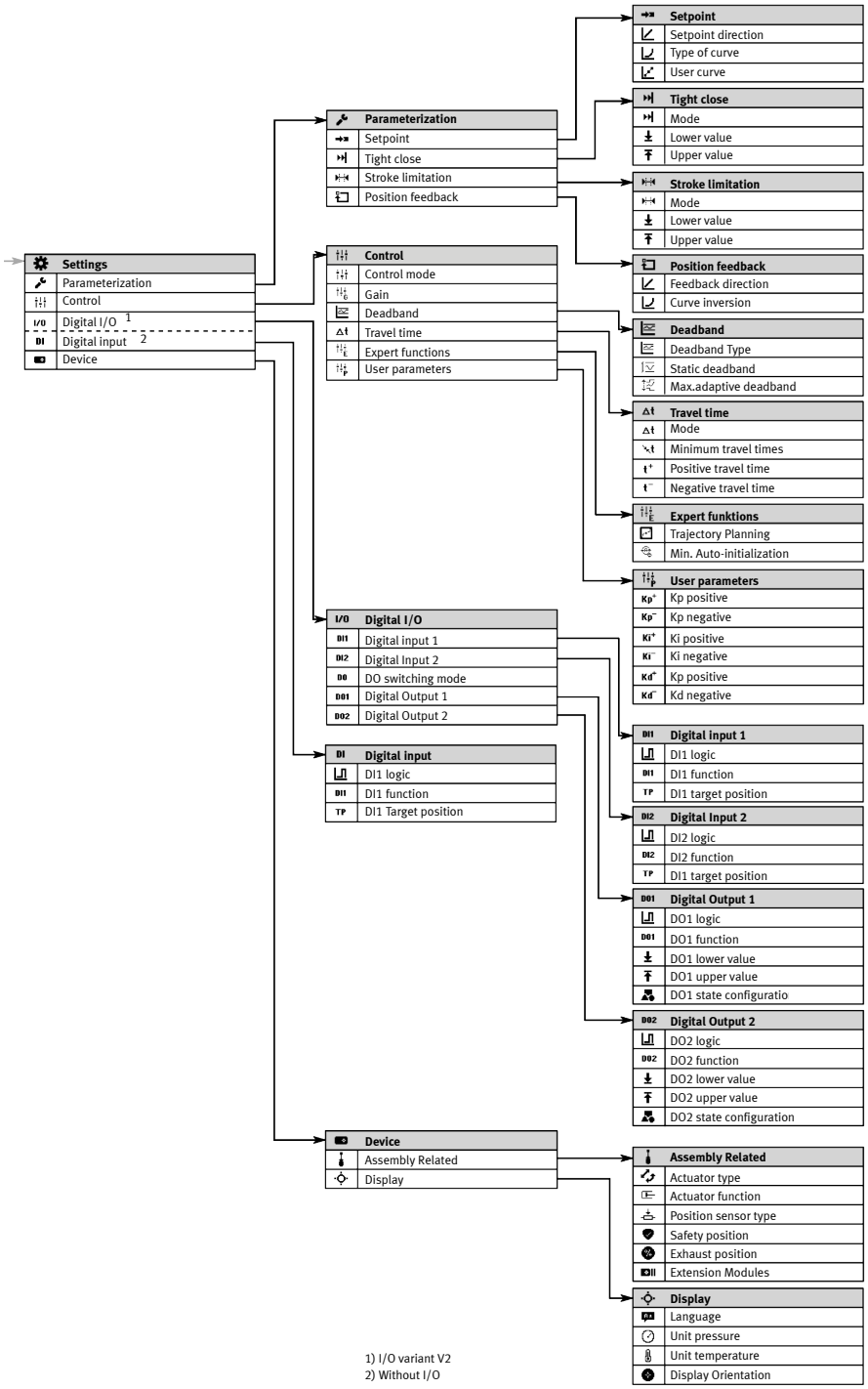



Fig. 26: Structure of the menu views

| Menu item | Description |
|---|---|
| Guided setup | The setup wizard can be started in this area. The setup wizard offers the most important parameters for the initial commissioning of the device.<br>➔ 7.2.2 ‘Guided setup’ menu |
| Operation mode | The operating mode can be defined in this area.<br>The following selection options are available:<br>– Automatic mode<br>– Manual setpoint position mode<br>– Manual pressurisation and exhausting<br>➔ 7.2.3 ‘Operation mode’ menu |

| Menu item | | Description |
|---|---|---|
| | Settings | Basic settings can be made in this area. This includes parameterisation, settings for control, configuration of the digital inputs and digital outputs as well as device-specific settings.<br>➔ 7.2.4 ‘Settings’ menu |
| | Initialization | The device can be initialised in this area. In addition to automatic initialisation, replacement initialisation is also possible.<br>➔ 7.2.5 Initialization menu |
| | Identification | Basic information about the device and the operating unit is displayed in this area.<br>➔ 7.2.6 ‘Identification’ menu |
| | Service | Service-related information is displayed in this section. This includes operating conditions as well as signal values at the inputs and outputs. In addition, reset functions can be executed.<br>➔ 7.2.7 ‘Service’ menu |
| | Diagnosis | Diagnostic functions can be activated, diagnostic results displayed and counter readings retrieved and reset in this area. In addition, the Partial Stroke Test can be executed and its status retrieved.<br>➔ 7.2.8 Diagnosis menu |

Tab. 15: Menu views

### 7.2.2 ‘Guided setup’ menu

A setup wizard is available for guided commissioning. The essential parameters are set in the setup wizard. These parameters and other parameters can also be opened and edited via the ‘Settings’ menu ➔ 7.2.4 ‘Settings’ menu.

| Menu item | | Reference |
|---|---|---|
| | Language | ➔ Language |
| | Display Orientation | ➔ Display Orientation |
| | Actuator type | ➔ Actuator type |
| | Exhaust position | ➔ Exhaust position |
| | Extension Modules | ➔ Extension Modules |
| | Tight close mode | ➔ Tight close mode |
| | Tight close lower value | ➔ Tight close lower value |
| | Tight close upper value | ➔ Tight close upper value |
| | Control mode | ➔ Control mode |
| | Initialization | ➔ Initialization |

Tab. 16: ‘Guided setup’ menu

**Language**

The ‘Language’ parameter defines the display language of the device.

| Value | Description |
|---|---|
| ENGLISH | Factory setting |
| DEUTSCH | — |

Tab. 17: Language

**Display Orientation**

The ‘Display Orientation’ parameter defines the display direction of the device. The display can be adjusted in 90° steps by pressing the left or right key.

| Value | Description |
|---|---|
| 0° | Factory setting |
| 90° | — |

| Value | Description |
|---|---|
| 180° | — |
| 270° | — |

Tab. 18: Display Orientation

**Actuator type**

The ‘Actuator type’ parameter defines the drive type to which the positioner is attached. Sine correction can be activated for linear drives with lever kinematics for position detection.

| Value | Description |
|---|---|
| rotary | Factory setting |
| linear | — |
| linear with lever | — |

Tab. 19: Actuator type

**Exhaust position**

The ‘Exhaust position’ parameter defines which position is displayed for a completely exhausted working port (2). The effective direction of the drive can be changed with this parameter.

| Value | Description |
|---|---|
| 0 % | Factory setting: exhausted at setpoint position 0% |
| 100 % | Exhausted at setpoint position 100% |

Tab. 20: Exhaust position

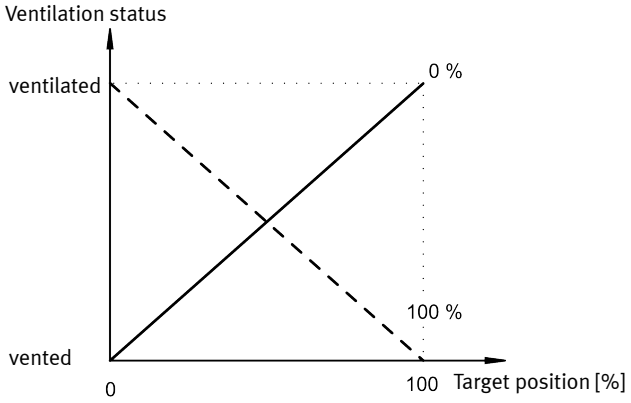



Fig. 27: Exhaust position

**Extension Modules**

The ‘Extension Modules’ parameter defines the installed extension modules. This parameter enables activation of an optimised control response for the extension module.

| Value | Description |
|---|---|
| NONE | Factory setting |
| FLOW BOOSTER | — |

Tab. 21: Extension Modules

**Tight close mode**

The ‘Tight close mode’ parameter defines the tight closing behaviour. For tight closing the valve moves into the seat with the maximum control force of the drive. The closing function can be activated at one or both end positions. The tight closing function becomes effective when the setpoint position specification reaches the lower value or the upper value for the tight closing.
Stroke limitation and tight closing cannot be active simultaneously at one end position.

| Value | Description |
|---|---|
| inactive | Factory setting: tight closing inactive. |
| Lower value active | Tight closing for upper value of the tight closing limit active. |
| Upper value active | Tight closing for lower value of the tight closed limit active. |
| Both values active | Tight closing active for lower and upper value of the tight closing limit. |

Tab. 22: Tight close mode

**Tight close lower value**

The ‘Tight close lower value’ parameter defines the lower value of the tight closing. If the setpoint position falls below this value, the valve is moved to the lower end position with maximum drive force.

| Value range | Description |
|---|---|
| 0.0 ... 45.0 % | Permissible setting range, factory setting 2.0% |

Tab. 23: Tight close lower value

**Tight close upper value**

The ‘Tight close upper value’ parameter defines the upper value of the tight closing. If the setpoint position exceeds this value, the valve is moved to the upper end position with maximum drive force.

| Value range | Description |
|---|---|
| 55.0 ... 100.0 % | Permissible setting range, factory setting 98.0% |

Tab. 24: Tight close upper value

**Control mode**

The ‘Control mode’ parameter defines the currently effective control mode.

| Value | Description |
|---|---|
| robust | Factory setting: the positioner approaches the setpoint position slowly and accurately. |
| fast | The positioner approaches the setpoint position quickly. It may overshoot. |
| user defined | The positioner regulates according to parameters specified by the user. User-defined controller parameters: direction-dependent P, I and D components. |

Tab. 25: Control mode

**Initialization**

The positioner is not initialised in delivery status.
It must be initialised in the following cases:
– During commissioning
– After changes in the system structure
– After reset to factory settings
The permissible stroke range and the controller parameters are determined during initialisation. This involves both end positions being approached in succession independently of the pending setpoint value.
The progress of the initialisation is shown on the display during the initialisation process. A running initialisation can be cancelled with the upper key.
After successful initialisation, the display briefly shows the ‘Initialisization successful’ message. The symbol for a missing initialisation in the process views then disappears ➔ Tab. 6 Status and information in the information area.
The control parameters can be adapted and, if necessary, optimised in the ‘Control’ › ‘User parameters’ menu ➔ 7.2.4.2 Control.

### 7.2.3 ‘Operation mode’ menu

The operating mode is displayed and changed in the Operation mode menu. There is a view for the two ‘Manual TPOS’ and ‘Manual venting’ operating modes.

| Menu item | Description |
|---|---|
| Automatic | Automatic mode |
| Manual TPOS | Manual setpoint position mode. The closed-loop controller remains active. The setpoint value applied externally to the analogue input is ignored in this operating mode. |
| Manual venting | Manual manipulated variable mode for manual pressurisation and exhausting. The closed-loop controller is deactivated. The setpoint value applied externally to the analogue input is ignored in this operating mode. |

Tab. 26: ‘Operation mode’ menu

#### 7.2.3.1 ‘Manual TPOS’ manual setpoint position mode

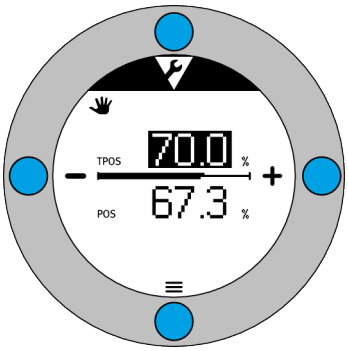



Fig. 28: Manual setpoint position mode

In this operating mode, the setpoint position is entered manually. The selected position is approached at the analogue input independently of the setpoint specification.
If the left key is actuated, the setpoint position specification is reduced. If the right key is actuated, the setpoint position specification is increased.
The positioner must already be initialised for this operating mode. A change in the position becomes visible via the feedback of the actual position.

#### 7.2.3.2 ‘Manual venting’ manual manipulated variable mode

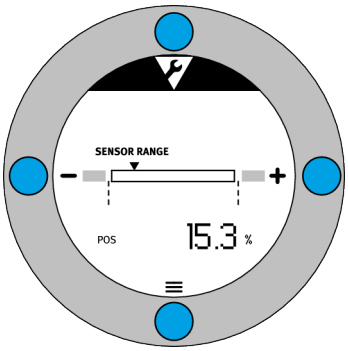



Fig. 29: Manual manipulated variable mode

In this operating mode, the position of the drive can be changed by manual pressurisation and exhausting when the left or right button is actuated. A changed position of the actuator is returned by the bar graph in the middle of the view and, if the positioner has been initialised, also by the display of the actual position.
The view does not distinguish whether the type of path detection is an external or internal path detection system.
The ‘Manual control value operation’ operating mode is relevant for two applications:

- ➔ Manual movement of the drive
- ➔ Checking mounting situation and sensing range of the position sensor

### Manual movement of the drive

In this application, the actuator can be pressurised or exhausted in open-loop operation and independently of a successful initialisation of the positioner. Settings that apply to the control and target position specifications are ignored in this context. There is a pressurise button and an exhaust button. When one of the buttons is pressed, the working ports are pressurised or exhausted to the maximum. If neither button is pressed, the working ports (2) and (4) are closed.

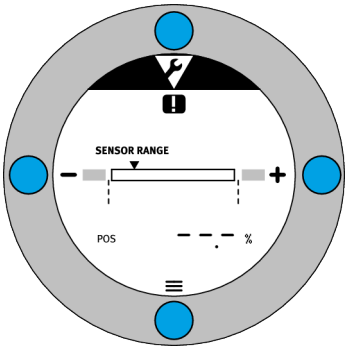
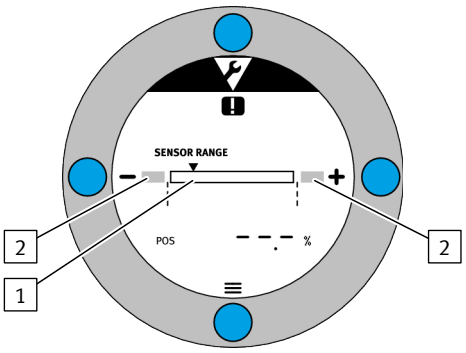



Fig. 30: Manual control value operation in non-initialised state

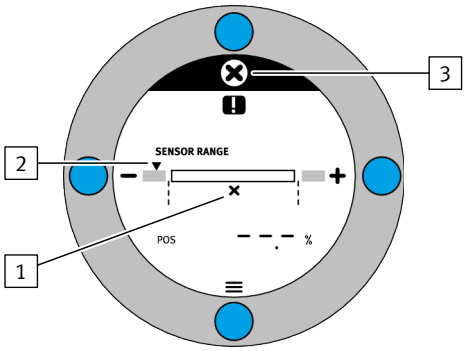
### Checking mounting situation and sensing range of the position sensor

This application enables a check of whether the positioner has been mounted correctly on the actuator.
The light area of the bar graph shows the permissible sensing range of the position sensor. The area must not be exited over the entire traversing range of the drive.
If the position sensor exits the permissible sensing range, the display symbol points to the dark area of the bar graph and a special symbol is displayed below the bar graph. A message is also output ➔ 8.2 Messages. If the position sensor exceeds the permissible sensing range, the mounting of the positioner on the drive must be corrected ➔ 5 Assembly.




1 Permissible range
2 Impermissible range

Fig. 31: Position value in the permissible range




1 Special symbol when leaving the permissible area
2 Position value in the impermissible range
3 Related message

Fig. 32: Position value in the impermissible range

1. Approach both end positions with the left and right buttons.
   ⇨ The bar graph shows the position change.
2. If one of the end positions lies outside the sensing range, correct the attachment of the positioner on the drive or the alignment of the shaft adapter ➔ 5 Assembly.

### 7.2.4 ‘Settings’ menu

| Menu item | Description |
|---|---|
| Parameterization | Basic parameterisation can be carried out in this area.<br>➔ 7.2.4.1 Parameterization |
| Control | The parameters relevant for the control can be configured in this area.<br>➔ 7.2.4.2 Control |
| I/O Digital input or Digital I/O | The digital inputs can be configured in this area.<br>The digital inputs and digital outputs can be configured with additional inputs and outputs with device variant CMSH-...-V2.<br>➔ 7.2.4.3 Digital I/O |
| Device | The device-specific parameters can be configured in this section.<br>➔ 7.2.4.4 Device |

Tab. 27: ‘Settings’ menu

#### 7.2.4.1 Parameterization

| Menu item | Description |
|---|---|
| Setpoint | The parameters that define the properties of the setpoint value can be configured in this area.<br>➔ ‘Setpoint’ menu |
| Setpoint direction | |
| Type of curve | |
| User curve | |
| Tight close | Tight closing can be activated and configured in this area.<br>➔ ‘Tight close’ menu |
| Mode | |
| Lower value | |
| Upper value | |
| Stroke limitation | Stroke limitation can be activated and configured in this area.<br>➔ ‘Stroke limitation’ menu |
| Mode | |
| Lower value | |
| Upper value | |
| Position feedback | The parameters that define the properties of the position feedback at the analogue output can be configured in this area.<br>➔ ‘Position feedback’ menu |

| Menu item | Description |
|---|---|
| Feedback direction | The parameters that define the properties of the position feedback at the analogue output can be configured in this area.<br>➔ ‘Position feedback’ menu |
| Curve inversion | |

Tab. 28: Parameterization

## ‘Setpoint’ menu

### Setpoint direction

The ‘Setpoint direction’ parameter defines the relationship between the externally applied setpoint value and the setpoint position. The direction of action is determined independently of the setpoint characteristic curve.

| Value | Description |
|---|---|
| RISING | Factory setting: the setpoint position is increased with a rising setpoint value. |
| FALLING | The setpoint position is incremented with a falling setpoint value. |

Tab. 29: Setpoint direction

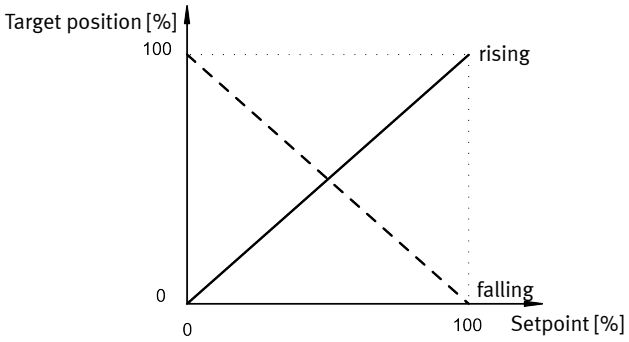



Fig. 33: Setpoint direction

### Type of curve

The ‘Type of curve’ parameter defines the characteristic of the transmission characteristic curve between setpoint value and setpoint position. The transmission characteristic curve is used to correct the operating characteristic curve in order to guarantee a proportional flow relationship between the setpoint value and the setpoint position.

| Value | Description |
|---|---|
| linear | Factory setting: linear characteristic curve |
| 1:25 | Equal-percentage characteristic curve |
| 1:33 | |
| 1:50 | |
| 25:1 | |
| 33:1 | |
| 50:1 | |
| user defined | User-defined characteristic curve |

Tab. 30: Type of curve

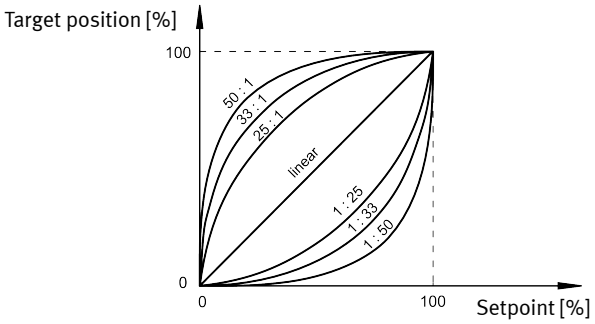



Fig. 34: Setpoint value characteristic curves

**User curve**

The user-defined characteristic curve can be configured in this area. The parameters named in the following table are used to define a user-defined characteristic curve over 21 support points distributed at fixed intervals over the setpoint value range of ... 100%. The distance between the individual interpolation points is 5%. Every sampling point can be assigned a setpoint position. Only strictly monotone rising values may be entered, i.e. the entered setpoint position must be greater than the previous setpoint position value.

| Interpolation point with standardised setpoint value | Value range | Description |
|---|---|---|
| 0.0 % | 0.0 ... 98.0 % | Factory setting: 0.0% |
| 5.0 % | 0.1 ... 98.1 % | Factory setting: 5.0% |
| ... | ... | ... |
| 95.0 % | 1.9 ... 99.9 % | Factory setting: 98.0% |
| 100.0 % | 2.0 ... 100.0 % | Factory setting: 100.0% |

Tab. 31: Interpolation points

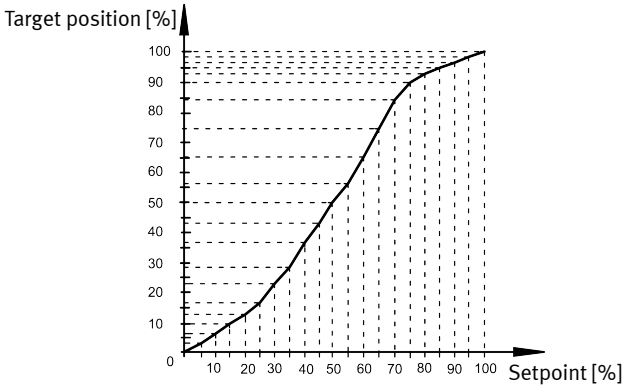



Fig. 35: User curve

**'Tight close' menu**

**Mode**

The 'Mode' parameter defines the tight closing behaviour. For tight closing the valve moves into the seat with the maximum control force of the drive. The closing function can be activated at one or both end positions. The tight closing function becomes effective when the setpoint position specification reaches the lower value or the upper value for the tight closing.

| Value | Description |
|---|---|
| inactive | Factory setting: tight closing inactive. |
| Lower value active | Tight closing for upper value of the tight closing limit active. |

| Value | Description |
|---|---|
| Upper value active | Tight closing for lower value of the tight closed limit active. |
| Both values active | Tight closing active for lower and upper value of the tight closing limit. |

Tab. 32: Mode

If stroke limitation is active in an end position, the tight-closing function can no longer be activated there. If it is not possible to change the mode, a message appears on the display.

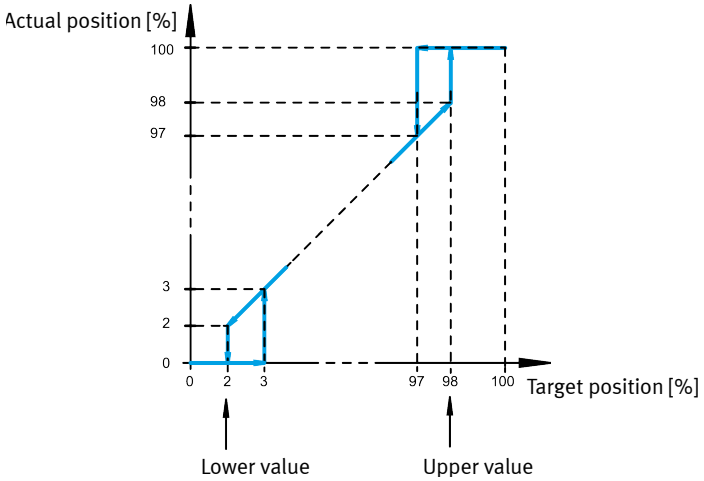



Fig. 36: Tight closing

**Lower value**

The ‘Lower value’ parameter defines the lower value of the tight closing. If the setpoint position falls below this value, the valve is moved to the lower end position with maximum drive force.

| Value range | Description |
|---|---|
| 0.0 ... 45.0 % | Permissible setting range, factory setting: 2.0% |

Tab. 33: Lower value

**Upper value**

The ‘Upper value’ parameter defines the upper value of the tight closing. If the setpoint position exceeds this value, the valve is moved to the upper end position with maximum drive force.

| Value range | Description |
|---|---|
| 55.0 ... 100.0 % | Permissible setting range, factory setting: 98.0% |

Tab. 34: Upper value

**‘Stroke limitation’ menu**

The stroke limitation permits restriction of the working range of the positioner. This is independent of the characteristics of the setpoint characteristic curve (linear, equal percentage, user-defined). The setpoint characteristic curve is adjusted in accordance with the values for the lower and upper stroke limitation.

**Mode**

The ‘Mode’ parameter defines the stroke limitation mode. Stroke limitation can be activated at one or both end positions.

| Value | Description |
|---|---|
| inactive | Factory setting: stroke limitation inactive. |
| Lower value active | Stroke limitation active at the lower end of the working range. |

| Value | Description |
|---|---|
| Upper value active | Stroke limitation active at the upper end of the working range. |
| Both values active | Stroke limitation active at the lower and upper end of the working range |

Tab. 35: Mode

If the tight-closing function is active in an end position, the stroke limitation can no longer be activated there. If it is not possible to change the mode, a message appears on the display.

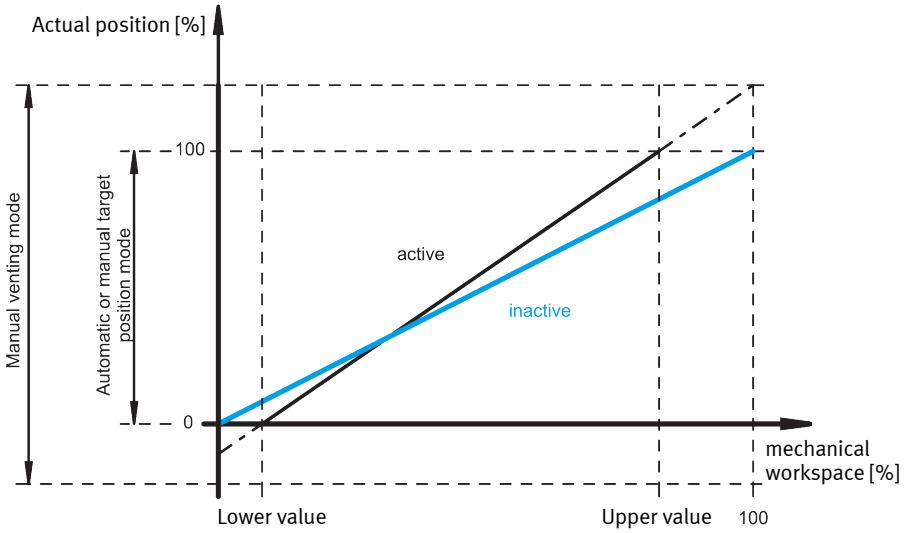



Fig. 37: Stroke limitation

**Lower value**

The ‘Lower value’ parameter defines the lower value of the stroke limit. This value must be at least 10.0% below the upper stroke limit.

| Value range | Description |
|---|---|
| 0.0 … 90.0 % | Permissible setting range, factory setting: 0.0% |

Tab. 36: Lower value

**Upper value**

The ‘Upper value’ parameter defines the value of the upper stroke limit. This value must be at least 10.0% above the lower stroke limit.

| Value range | Description |
|---|---|
| 10.0 … 100.0 % | Permissible setting range, factory setting: 100.0% |

Tab. 37: Upper value

**‘Position feedback’ menu**

**Feedback direction**

The ‘Feedback direction’ parameter defines the relationship between the actual position and the position feedback at the analogue output.

| Value | Description |
|---|---|
| RISING | Factory setting: the position feedback is incremented as the actual position rises. |
| FALLING | The position feedback is increased as the actual position falls. |

Tab. 38: Feedback direction

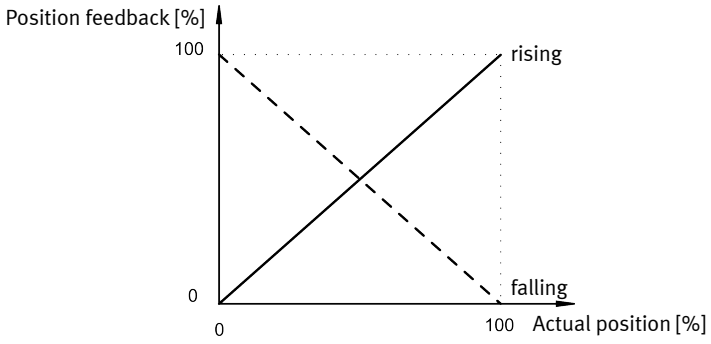



Fig. 38: Feedback direction

**Curve inversion**

The ‘Curve inversion’ parameter can be used to undo the correction of the operating characteristic curve made by the ‘Type of curve’ parameter for the position feedback ➔ ‘Setpoint’ menu.

| Value | Description |
|---|---|
| INAKTIVE | Factory setting: no inversion of the position feedback. |
| AKTIVE | Inversion of the position feedback. |

Tab. 39: Curve inversion

### 7.2.4.2 Control

| Menu item | | Description |
|---|---|---|
| Control mode | | Parameter description ➔ Control mode |
| Gain | | Parameter description ➔ Gain |
| Deadband | | Parameter description ➔ ‘Deadband’ menu |
| | Deadband Type | |
| | Static deadband | |
| | Max.adaptive deadband | |
| Travel time | | The positioning time extension can be configured in this area. The minimum positioning times determined during initialisation are also displayed here. ➔ ‘Travel time’ menu |
| | Mode | |
| | Minimum travel times | |
| | Positive travel time | |
| | Negative travel time | |
| Expert functions | | Parameter description ➔ ‘Expert functions’ menu |
| | Trajectory Planning | |
| | Min. Auto-initialization | |
| User parameters | | The controller parameters that are effective in the user-defined control mode can be defined in this area. ➔ ‘User parameters’ menu |
| | Kp positive | |
| | Kp negative | |
| | Ki positive | |
| | Ki negative | |
| | Kp positive | |
| | Kd negative | |

Tab. 40: Control

### Control mode

The ‘Control mode’ parameter defines the currently effective control mode.

| Value | Description |
|---|---|
| robust | Factory setting: the positioner approaches the setpoint position slowly and accurately. |
| fast | The positioner approaches the setpoint position quickly. It may overshoot. |
| user defined | The positioner regulates according to parameters specified by the user.<br>The direction-dependent P, I and D components can be adjusted in the ‘User parameters’ menu ➔ 7.2.4.2 Control. |

Tab. 41: Control mode

### Gain

The ‘Gain’ parameter defines the factor for modifying the control response. A small factor results in a conservative control response. A large factor results in a more aggressive control response.
This parameter only applies to the ‘robust’ and ‘fast’ control modes.

| Value range | Description |
|---|---|
| 0.1 … 10.0 | Permissible setting range, factory setting: 1.0 |

Tab. 42: Gain

### ‘Deadband’ menu

The Deadband defines a range around the setpoint position within which the closed-loop controller does not react to deviations.

### Deadband Type

The ‘Deadband Type’ parameter defines the response of the deadband.

| Value | Description |
|---|---|
| static | Factory setting: the deadband remains fixed at the set value. The value is specified by the ‘Static deadband’ parameter. |
| adaptive +/– | The deadband is automatically enlarged and reduced. The maximum size is specified by the ‘Max.adaptive deadband’ parameter. An initialisation resets the effective adaptive deadband to the factory setting. |
| adaptive + | The deadband is automatically enlarged but not reduced. The maximum size is specified by the ‘Max.adaptive deadband’ parameter. An initialisation resets the effective adaptive deadband to the factory setting. |

Tab. 43: Deadband Type

### Static deadband

The ‘Static deadband’ parameter defines the value for the size of the static deadband.

| Value range | Description |
|---|---|
| 0.1 … 10.0 % | Permissible setting range, factory setting: 1.0% |

Tab. 44: Static deadband

### Max.adaptive deadband

The ‘Max.adaptive deadband’ parameter defines the maximum size of the adaptive deadband.

| Value range | Description |
|---|---|
| 1.0 … 25.0 % | Permissible setting range, factory setting:10 % |

Tab. 45: Max.adaptive deadband

### ‘Travel time’ menu

The positioning speed can be limited by extending the initially determined positive and negative positioning times for the entire stroke. The extension is only effective for target position changes ≤ 5%.

**Mode**

The ‘Mode’ parameter defines the positioning time mode. This parameter can be used to activate a manual extension of the positioning time for one or both directions of travel.

| Value | Description |
|---|---|
| inactive | Factory setting: response time extension inactive. |
| pos. time active | Positive positioning time extension active. |
| neg. time active | Negative positioning time extension active. |
| both times active | Positive and negative positioning time extensions active. |

Tab. 46: Mode

If trajectory planning is deactivated, an active extension of the positioning time has no influence on the positioning speed.

**Minimum travel times**

The minimum positioning times in both directions of movement are displayed in this area. They are determined during initialisation.

**Positive travel time**

The ‘Positive travel time’ parameter defines the value for the extension of the positive positioning time. The value must lie between the minimum positive positioning time and 1000 seconds.

**Negative travel time**

The ‘Negative travel time’ parameter defines the value for the extension of the negative positioning time. The value must lie between the minimum negative positioning time and 1000 seconds.

### ‘Expert functions’ menu

**Trajectory Planning**

The trajectory planning can be activated with the ‘Trajectory Planning’ parameter. This calculates a position specification that can be mapped by the positioner from a sudden change in the setpoint value. This smoothing is particularly useful for preventing overshooting behaviour. It can lead to an improved settling time for very large drives if trajectory planning is deactivated.

| Value | Description |
|---|---|
| INAKTIVE | Trajectory planning inactive. |
| AKTIVE | Factory setting: trajectory planning active. |

Tab. 47: Trajectory Planning

**Min. Auto-initialization**

The ‘Min. Auto-initialization’ parameter starts a simplified automatic initialisation routine. This can be used as an alternative if the comprehensive automatic initialisation routine fails.

### ‘User parameters’ menu

The controller parameters that are used in the user-defined control mode can be defined in this area.

| Value | Value range | Description |
|---|---|---|
| Kp positive | 0 … *9999* | The ‘Kp positive’ parameter defines the proportional amplification gain of the PID controller for the positive direction of travel. |
| Kp negative | 0 … *9999* | The ‘Kp negative’ parameter defines the proportional amplification gain of the PID controller for the negative travel direction. |
| Ki positive | 0 … *9999* | The ‘Ki positive’ parameter defines the integral amplification gain of the PID controller for the positive direction of travel. |
| Ki negative | 0 … *9999* | The ‘Ki negative’ parameter defines the integral amplification gain of the PID controller for the negative direction of travel. |
| Kp positive | 0 … *9999* | The ‘Kp positive’ parameter defines the differential gain of the PID controller for the positive direction of travel. |
| Kd negative | 0 … *9999* | The ‘Kd negative’ parameter defines the differential gain of the PID controller for the negative travel direction. |

Tab. 48: ‘User parameters’ menu

### 7.2.4.3 Digital I/O

| Menu option | | Description |
|---|---|---|
| DI1 | Digital input 1 | The parameters that define the behaviour of digital input 1 can be configured in this area.<br>➔ ‘Digital input 1’ menu |
| | DI1 logic | |
| | DI1 function | |
| | DI1 target position | |
| DI2 | Digital Input 2[1)] | The parameters that define the behaviour of digital input 2 can be configured in this area.<br>➔ ‘Digital Input 2’ menu |
| | DI2 logic | |
| | DI2 function | |
| | DI2 target position | |
| DO | DO switching mode[1)] | The switching characteristics of digital outputs 1 and 2 can be defined in this area.<br>➔ DO switching mode |
| DO1 | Digital Output 1[1)] | The parameters that define the behaviour of digital output 1 can be configured in this area.<br>➔ ‘Digital Output 1’ menu |
| | DO1 logic | |
| | DO1 function | |
| | DO1 lower value | |
| | DO1 upper value | |
| | DO1 state configuration | |
| DO2 | Digital Output 2[1)] | The parameters that define the behaviour of digital output 2 can be configured in this area.<br>➔ ‘Digital Output 2’ menu |
| | DO2 logic | |
| | DO2 function | |
| | DO2 lower value | |
| | DO2 upper value | |
| | DO2 state configuration | |

1) Optional availability. Depending on the product variant.

Tab. 49: Digital I/O

#### ‘Digital input 1’ menu

**DI1 logic**

The ‘DI1 logic’ parameter defines the switching logic for activating the function of the digital input 1.

| Value | Description |
|---|---|
| ACTIVE LOW | Switching logic ‘ACTIVE LOW’<br>The set function is activated at a low level. |
| ACTIVE HIGH | Factory setting: switching logic ‘ACTIVE HIGH’<br>The set function is activated at a high level. |

Tab. 50: DI1 logic

**DI1 function**

The ‘DI1 function’ parameter defines the behaviour of the positioner when digital input 1 has been activated.

| Value | Description |
|---|---|
| inactive | Factory setting: inactive |
| Execute init | Initialisation is being executed. |
| Hold last TPOS | Last setpoint position is held. |
| Hold user TPOS | User-defined setpoint position is maintained ➔ ‘Digital input 1’ menu. |
| Close outputs | Working port (2) and working port (4) are closed. |
| Exhaust output 2 | Working port (2) is exhausted. Working port (4) is pressurised. |
| Pressurize out 2 | Working port (2) is pressurised. Working port (4) is exhausted. |
| Lower end pos. | Controlled movement to the lower end position. |
| Upper end pos. | Controlled movement to the upper end position. |
| Execute PST | Partial Stroke Test is executed. |
| Lock interface | Local operation is blocked. |

Tab. 51: DI1 function

**DI1 target position**

The ‘DI1 target position’ parameter shows the user-defined setpoint position that is approached when the function at digital input 1 has been set to ‘Hold user TPOS’.

| Value range | Description |
|---|---|
| 0.0 ... 100.0% | Permissible setting range, factory setting 0.0% |

Tab. 52: DI1 target position

**‘Digital Input 2’ menu**

**DI2 logic**

The ‘DI2 logic’ parameter defines the switching logic for activating the function of the digital input 2.

| Value | Description |
|---|---|
| ACTIVE LOW | Switching logic ‘ACTIVE LOW’<br>The set function is activated at a low level. |
| ACTIVE HIGH | Factory setting: switching logic ‘ACTIVE HIGH’<br>The set function is activated at a high level. |

Tab. 53: DI2 logic

**DI2 function**

The ‘DI2 function’ parameter defines the behaviour of the positioner when digital input 2 has been activated.

| Value | Description |
|---|---|
| inactive | Factory setting: inactive |
| Execute init | Initialisation is being executed. |
| Hold last TPOS | Last setpoint position is held. |
| Hold user TPOS | User-defined setpoint position is maintained ➔ ‘Digital Input 2’ menu. |
| Close outputs | Working port (2) and working port (4) are closed. |
| Exhaust output 2 | Working port (2) is exhausted. Working port (4) is pressurised. |

| Value | Description |
|---|---|
| Pressurize out 2 | Working port (2) is pressurised. Working port (4) is exhausted. |
| Lower end pos. | Controlled movement to the lower end position. |
| Upper end pos. | Controlled procedure for the upper end position. |
| Execute PST | Partial Stroke Test is executed. |
| Lock interface | Local operation is blocked. |

Tab. 54: DI2 function

**DI2 target position**

The ‘DI2 target position’ parameter defines the setpoint position that is approached when the function at digital input 2 has been set to ‘Hold user TPOS’.

| Value range | Description |
|---|---|
| 0.0 ... 100.0% | Permissible setting range, factory setting 0.0% |

Tab. 55: DI2 target position

**DO switching mode**

The ‘DO switching mode’ parameter defines the switching behaviour of the digital outputs.

| Value | Description |
|---|---|
| NAMUR | Factory setting: NAMUR output (current-switching) |
| PLC | PLC output (voltage switching) |

Tab. 56: ‘DO switching mode’ menu

**‘Digital Output 1’ menu**

**DO1 logic**

The ‘DO1 logic’ parameter defines the switching logic of the function of the digital output 1.

| Value | Description |
|---|---|
| ACTIVE LOW | Switching logic ‘ACTIVE LOW’<br>The low level is output at digital output 1 if the assigned function or the status to be acknowledged is active. |
| ACTIVE HIGH | Factory setting: switching logic ‘ACTIVE HIGH’<br>The high level is output at digital output 1 if the assigned function or the status to be acknowledged is active. |

Tab. 57: DO1 logic

**DO1 function**

The ‘DO1 function’ parameter defines the statuses that are returned via the digital output.

| Value | Description |
|---|---|
| inactive | Factory setting: inactive. There is no feedback via the digital input. |
| Lower value active | Feedback is returned when the lower user-defined position limit value is reached. |
| Upper value active | Feedback is returned when the upper user-defined position limit value is reached. |
| Both values active | Feedback is returned when the upper or lower user-defined position limit value is reached. |
| Diagnosis state | The diagnostic status is acknowledged. |
| No auto operat. | The deviation from automatic operation is returned.<br>Deviation from automatic operation: manual operation, not initialised, active initialisation routine |
| PST running | An active Partial Stroke Test is returned. |

Tab. 58: DO1 function

**DO1 lower value**

The ‘DO1 lower value’ parameter defines the lower limit value for monitoring the actual position. This must be reached or undershot in order to generate feedback at digital output 1.

| Value range | Description |
|---|---|
| 0.0 ... 100.0% | Permissible setting range, factory setting: 2.0% |

Tab. 59: DO1 lower value

**DO1 upper value**

The ‘DO1 upper value’ parameter defines the upper limit value for monitoring the actual position. This must be reached or exceeded in order to generate feedback at digital output 1.

| Value range | Description |
|---|---|
| 0.0 ... 100.0% | Permissible setting range, factory setting: 98.0% |

Tab. 60: DO1 upper value

**DO1 state configuration**

The ‘DO1 state configuration’ parameter defines which active status group is output at digital output 1 ➔ Fig. 6. The allocation of the NAMUR classification can only be changed via DTM or EDD. If a value is activated, a signal for the selected status group is output at digital output 1. Multiple selections are possible.

| Option | Value range | Description |
|---|---|---|
| Maintenance req. | active, inactive | Maintenance required<br>Factory setting: inactive |
| Out of spec. | active, inactive | Outside the specification<br>Factory setting: inactive |
| Check function | active, inactive | Functional check<br>Factory setting: inactive |
| Failure | active, inactive | Error<br>Factory setting: inactive |

Tab. 61: DO1 state configuration

**‘Digital Output 2’ menu**

**DO2 logic**

The ‘DO2 logic’ parameter defines the switching logic of the function of the digital output 2.

| Value | Description |
|---|---|
| ACTIVE LOW | Switching logic ‘ACTIVE LOW’<br>The low level is output at digital output 2 if the assigned function or the status to be acknowledged is active. |
| ACTIVE HIGH | Factory setting: switching logic ‘ACTIVE HIGH’<br>The high level is output at digital output 2 if the assigned function or the status to be acknowledged is active. |

Tab. 62: DO2 logic

**DO2 function**

The ‘DO2 function’ parameter defines the statuses that are returned via the digital output.

| Value | Description |
|---|---|
| inactive | Factory setting: inactive. There is no feedback via the digital input. |
| Lower value active | Feedback is returned when the lower user-defined position limit value is reached. |
| Upper value active | Feedback is returned when the upper user-defined position limit value is reached. |
| Both values active | Feedback is returned when the upper or lower user-defined position limit value is reached. |

| Value | Description |
|---|---|
| Diagnosis state | The diagnostic status is acknowledged. |
| No auto operat. | The deviation from automatic operation is returned.<br>Deviation from automatic operation: manual operation, not initialised, active initialisation routine |
| PST running | An active Partial Stroke Test is returned. |

Tab. 63: DO2 function

**DO2 lower value**

The ‘DO2 lower value’ parameter defines the lower limit value for monitoring the actual position. This value must be reached or undershot in order to generate feedback at digital output 2.

| Value range | Description |
|---|---|
| 0.0 ... 100.0% | Permissible setting range, factory setting: 2.0% |

Tab. 64: DO2 lower value

**DO2 upper value**

The ‘DO2 upper value’ parameter defines the upper limit value for monitoring the actual position. This value must be reached or exceeded in order to generate feedback at digital output 2.

| Value range | Description |
|---|---|
| 0.0 ... 100.0% | Permissible setting range, factory setting: 98.0% |

Tab. 65: DO2 upper value

**DO2 state configuration**

The ‘DO2 state configuration’ parameter defines which active status group is output at digital output 2 ➔ Fig. 6. The allocation of the NAMUR classification can only be changed via DTM or EDD. If a value is activated, a signal for the selected status group is output at digital output 2. Multiple selections are possible.

| Option | Value range | Description |
|---|---|---|
| Maintenance req. | active, inactive | Maintenance required<br>Factory setting: inactive |
| Out of spec. | active, inactive | Outside the specification<br>Factory setting: inactive |
| Check function | active, inactive | Functional check<br>Factory setting: inactive |
| Failure | active, inactive | Error<br>Factory setting: inactive |

Tab. 66: DO2 state configuration

### 7.2.4.4 Device

| Menu item | Description |
|---|---|
| Assembly Related | The assembly-related parameters can be configured in this area.<br>➔ Assembly Related menu |
| Actuator type | |
| Actuator function | |
| Position sensor type | |
| Safety position | |
| Exhaust position | |
| Extension Modules | |
| Display | The parameters that define the properties of the display can be configured in this area.<br>➔ Display menu |
| Language | |
| Unit pressure | |

| Menu item | Description |
|---|---|
| Unit temperature | The parameters that define the properties of the display can be configured in this area.<br>➔ Display menu |
| Display Orientation | |

Tab. 67: Device

### Assembly Related menu

**Actuator type**

The ‘Actuator type’ parameter defines the drive type to which the positioner is attached. Sine correction can be activated for linear drives with lever kinematics for position detection.

| Value | Description |
|---|---|
| rotary | Factory setting |
| linear | — |
| linear with lever | — |

Tab. 68: Actuator type

**Actuator function**

The ‘Actuator function’ parameter defines the function of the attached drive.

| Value | Description |
|---|---|
| SINGLEACTING | Factory setting for CMSH-...-S-..., cannot be changed |
| DOUBLEACTING | Factory setting for CMSH-...-D-..., cannot be changed |
| SINGLEACTING<br>DOUBLEACTING | CMSH-...-SD-... :<br>Both SINGLEACTING and DOUBLEACTING can be selected in this variant.<br>Factory setting: SINGLEACTING |

Tab. 69: Actuator function

**Position sensor type**

The ‘Position sensor type’ parameter defines the potentiometer in use.

| Value | Description |
|---|---|
| INTERNAL | Internal potentiometer<br>Factory setting for CMSH-S-..., CMSH-SX1-... |
| EXTERNAL | External potentiometer<br>Factory setting for CMSH-SE-..., CMSH-SE1-..., cannot be changed |

Tab. 70: Position sensor type

A change to the parameter requires a renewed initialisation ➔ 7.2.5 Initialization menu.

**Safety position**

The ‘Safety position’ parameter defines the pneumatic initial position of the positioner in the event of electrical power failure.

| Value | Description |
|---|---|
| FAIL SAFE | Working port (2) is exhausted. The working port (4) is also pressurised with double-acting drives. |
| FAIL IN PLACE | Working port (2) and working port (4) are closed. |

Tab. 71: Safety position

**Exhaust position**

The ‘Exhaust position’ parameter defines which position is displayed for a completely exhausted working port (2). The effective direction of the drive can be changed with this parameter.

| Value | Description |
|---|---|
| 0 % | Factory setting |
| 100 % | — |

Tab. 72: Exhaust position

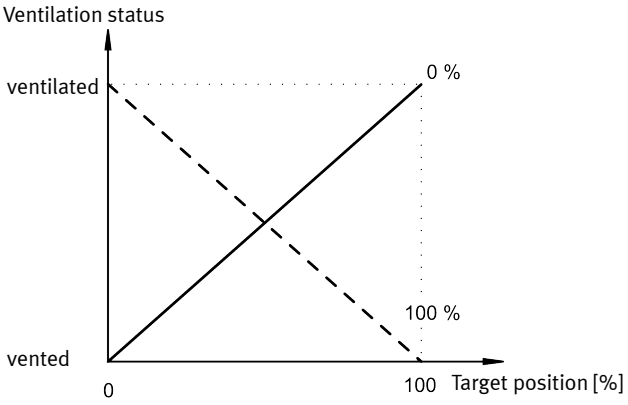



Fig. 39: Exhaust position

**Extension Modules**

The ‘Extension Modules’ parameter defines the installed extension modules. This parameter enables activation of an optimised control response for the extension module.
A change to the parameter requires a renewed initialisation ➔ 7.2.5 Initialization menu.

| Value | Description |
|---|---|
| NONE | Factory setting |
| FLOW BOOSTER | Volumetric flow amplifier |

Tab. 73: Extension Modules

**Display menu**

**Language**

The ‘Language’ parameter defines the display language on the device.

| Value | Description |
|---|---|
| ENGLISH | Factory setting |
| DEUTSCH | — |

Tab. 74: Language

**Unit pressure**

The ‘Unit pressure’ parameter defines the unit of pressure shown on the display.

| Value | Description |
|---|---|
| bar | Factory setting |
| MPa | — |
| psi | — |

Tab. 75: Unit pressure

**Unit temperature**

The ‘Unit temperature’ parameter defines the temperature unit shown on the display.

| Value | Description |
|---|---|
| CELSIUS | Factory setting |
| FAHRENHEIT | — |

Tab. 76: Unit temperature

**Display Orientation**

The ‘Display Orientation’ parameter defines the display direction of the device.
The display can be adjusted in 90° steps.

| Value | Description |
|---|---|
| 0° | Factory setting |
| 90° | — |
| 180° | — |
| 270° | — |

Tab. 77: Display Orientation

### 7.2.5 Initialization menu

The positioner is not initialised in delivery status.
It must be initialised in the following cases:
– During commissioning
– After changes in the system structure
– After reset to factory settings

If the control signal is active at the digital input, the initialisation routine may not be executable.

| Menu item | | Description |
|---|---|---|
|  | Auto initialization | The automatic initialisation can be started in this area. |
|  | Auxiliary init. | The values for the replacement initialisation can be entered in this area. This is relevant for the target device. |
|  | Aux. init. values | The values for the replacement initialisation can be read out in this area. This is relevant for the source device. |

Tab. 78: ‘Initialization’ menu

#### 7.2.5.1 Automatic initialisation

The permissible stroke range and the controller parameters are determined during initialisation. This involves both end positions being approached in succession independently of the pending setpoint value.
The progress of the initialisation is shown on the display during the initialisation process. A running initialisation can be cancelled with the upper key.
After successful initialisation, the display briefly shows the ‘Initialisization successful’ message. The symbol for a missing initialisation in the process views then disappears ➔ Tab. 6 Status and information in the information area.
The control parameters can be adapted and, if necessary, optimised in the ‘Control’ › ‘User parameters’ menu ➔ 7.2.4.2 Control.

#### 7.2.5.2 Auxiliary initalization

The replacement initialisation allows a positioner to be exchanged for a replacement device during operation.
A replacement initialisation can be run in the current position. It is not necessary to approach the end positions and move through the entire stroke range.
In order to obtain the best possible result with the least possible impact on the ongoing process, the processes described in the following chapters must be observed:
– ➔ Source device
– ➔ Target device

Replacement initialisation is only intended to bridge the time when a device replacement is absolutely necessary and an automatic initialisation must be run in the near future ➔ 7.2.5.1 Automatic initialisation.

If the device is operated in the replacement-initialised state, the device state changes and a message is displayed ➔ 8.2 Messages. This message can be deactivated in the 'Activation' menu ➔ 7.2.8.1 Activation.
The following values are relevant for replacement initialisation:

| Value | Description |
|---|---|
| Act. sensor value | Current value of the position sensor |
| Min. sensor value | Minimum value of the position sensor |
| Max. sensor value | Maximum value of the position sensor |
| Kp aux. | Controller parameters for replacement initialisation |
| Ki aux. | Controller parameters for replacement initialisation |
| Velocity aux. | Speed of replacement initialisation |
| Travel direction | Direction of travel of the drive |

Tab. 79: Auxiliary initialization values

**Source device**

The positioner that is to be replaced is referred to as the source device. During replacement the parameters and settings of the source device must be transferred to the target device.

**Reading parameters and settings of the source device**

Requirement: the drive is blocked pneumatically or mechanically in its current position.

1. Open the 'Auxiliary initialization values' menu.
2. Record the replacement initialisation values that will be transferred to the target device.
3. Remove the positioner from the drive ➔ 9 Demontage.

**Target device**

The replacement device is called the target device. The target device must be configured with the settings of the source device.
Requirement: before the parameters are transferred from the source device to the target device, ensure that the assembly-related configuration parameters in the target device match the parameters in the source device:
– Actuator type
– Actuator function
– Safety position
– Position sensor type
– Exhaust position
– Extension Modules

All settings must be imported from the source device to the target device to ensure that it behaves like the source device.

**Starting replacement initialisation**

1. Mount the target device on the drive ➔ 5 Assembly.

Ensure that the positioner shaft is in the identical alignment as the source device and is within the sensing range of the position sensor.

2. Connect the target device pneumatically and electrically ➔ 6 Installation.
3. Check that the assembly-related configuration parameters and settings in the target device match the assembly-related configuration parameters and settings in the source device.
4. Open the ‘Auxiliary initialization values’ menu.
5. Transfer the replacement initialisation values from the source device to the target device.
6. Confirm the replacement initialisation at the end of the setup wizard.
7. After successful transfer, release the blocking of the drive.

### 7.2.6 ‘Identification’ menu

| Menu option | | Description |
|---|---|---|
| | Device | Device-specific information is displayed in this area ➔ 7.2.6.1 Device. |
| | Operation unit | The description of the operating unit is displayed in this area ➔ 7.2.6.2 Operation unit. |
| | HART | HART-specific information is displayed in this area ➔ 7.2.6.3 HART. |

Tab. 80: ‘Identification’ menu

#### 7.2.6.1 Device

Device-specific information is displayed in this area. These parameters cannot be changed.

| Value | Description |
|---|---|
| ProductKeyFesto | This parameter shows the Festo Product Key. This is an individual code on the product that uniquely identifies the product. The Festo Product Key enables all documents belonging to the product to be opened in the Festo Support Portal. |
| HardwareVersion | This parameter shows the current version status of the hardware. The identification corresponds to the NAMUR recommendation NE 53. |
| SoftwareVersion | This parameter shows the current version status of the software. The identification corresponds to the NAMUR recommendation NE 53. |

Tab. 81: Device

#### 7.2.6.2 Operation unit

The description of the operating unit is displayed in this area. The parameters are not completed in delivery status. The contents can only be changed via DTM or EDD.

| Value | Description |
|---|---|
| Tag | This parameter shows an application-related device identifier. |
| LongTag | This parameter shows an application-related device identifier. |
| Descriptor | This parameter shows a description of the positioner. |
| Date | This parameter shows a date assigned to the device, e.g. the installation date of the field device. The date corresponds to the format ‘dd.mm.yyyy’. |
| ProcessUnitTag | This parameter shows the allocation of the positioner to the process system. |

Tab. 82: Operation unit

#### 7.2.6.3 HART

HART-specific information is displayed in this area. These parameters cannot be changed.

| Value | Description |
|---|---|
| HART revision | This parameter shows the major revision number of the HART protocol supported by the device. |
| Device revision | This parameter shows the revision number of the device. |
| Software revision | This parameter shows the software revision number of the device. |
| Hardware revision | This parameter shows the hardware revision number of the device. |

Tab. 83: HART

### 7.2.7 'Service' menu

| Menu option | | Description |
|---|---|---|
| | Festo support | The link to the Festo Support Portal is displayed in this area in the form of a data matrix code. |
| I/O | Signal values | The current values/statuses at the analogue inputs, analogue outputs, digital inputs and digital outputs are displayed in this area. |
| | Operating conditions | The current pressure and temperature values are displayed in this area. |
| | Factory reset | This function irrevocably resets the device settings to the delivery status. |
| | Configuration reset | This function irrevocably resets the device settings to the delivery status. It does not reset counter readings. |
| | Device configuration | A summary of the current device configuration is displayed in this area. |

Tab. 84: 'Service' menu

### 7.2.8 Diagnosis menu

The configuration of diagnostic functions and the assignment of an NAMUR status signal to a monitoring function can only be performed via EDD and DTM.

| Menu item | | Description |
|---|---|---|
| | Activation | Functions for extended monitoring and diagnostics can be activated in this area. Corresponding messages are not generated until after activation.<br>Monitoring can be activated for the following variables. Multiple selections are possible:<br>– Air leakage<br>– Dist. actuator<br>– Direct. actuator<br>– Moves actuator<br>– Supply pressure<br>– Dist. armature<br>– Direct. armature<br>– Moves armature<br>– Aux. init. operation<br>– Pressure demand<br>– Settling time<br>– DI triggered ctrl.<br>➔ 7.2.8.1 Activation |
| | Counter | The current counter readings are displayed in this area. In addition, resettable counters can be reset here.<br>If a counter reaches its threshold value and the associated monitoring function is activated, a message is output.<br>➔ 7.2.8.2 'Counter' menu |
| PST | Partial stroke test | The Partial Stroke Test can be executed and its status called up in this area.<br>➔ 7.2.8.3 'Partial stroke test' menu |

| Menu item | | Description |
|---|---|---|
| | Air leakage | The results of the leakage monitoring are displayed in this area. |
| | Pressure demand | The results of the monitoring of the drive pressures with refence to break-away behaviour are displayed in this area. |

Tab. 85: ‘Diagnosis’ menu

### 7.2.8.1 Activation

| Option | Value range | Description | Related Message |
|---|---|---|---|
| Air leakage | active, inactive | The ‘Air leakage’ option activates monitoring of the drive pressures to detect compressed air leakage. If the rate of change of a drive pressure signal exceeds the associated threshold while the drive is stationary, a message is generated. Factory setting: inactive | Message ID: 80 ... 87, factory setting: pressure drop threshold: 0.2 bar/min |
| Dist. actuator | active, inactive | Application-specific monitoring of the total travel counters, changes in direction and movements for the drive and the process valve is activated with these options. If a counter exceeds the threshold assigned to it, a message is generated. The current values of the counters are displayed under the ‘Counter’ menu item and can also be reset there ➔ 7.2.8.2 ‘Counter’ menu. Factory setting: inactive | Message ID: 0153, factory setting: total drive travel threshold: 50,000,000 % |
| Direct. actuator | active, inactive | | Message ID: 0150, factory setting: threshold number of changes in direction of drive: 500,000 |
| Moves actuator | active, inactive | | Message ID: 0156, factory setting: threshold number of movements of drive: 500,000 |
| Dist. armature | active, inactive | | Message ID: 1174, factory setting: total process valve travel threshold: 50,000,000 % |
| Direct. armature | active, inactive | | Message ID: 1187, factory setting: threshold number of direction changes for process valve: 500,000 |
| Moves armature | active, inactive | | Message ID: 1184, factory setting: threshold number of movements of process valve: 500,000 |

| Option | Value range | Description | Related Message |
|---|---|---|---|
| Supply pressure | active, inactive | The ‘Supply pressure’ option activates application-specific monitoring of the supply pressure.<br>If the supply pressure is above the upper threshold or below the lower threshold, a message is generated.<br>The current value of the supply pressure is displayed in the process display and in the ‘Service’ area under the Operating conditions ➔ 7.2.7 ‘Service’ menu.<br>Application-specific monitoring of the supply pressure is only active after initialisation.<br>Factory setting: inactive | Message ID: 919, factory setting: lower threshold: 1.4 bar<br>Message ID: 918, factory setting: upper threshold: 8 bar |
| Adaptive deadband | active, inactive | The ‘Adaptive deadband’ option activates the monitoring of the currently effective adaptive deadband. If the currently effective value exceeds 80% of the set value of ‘Max.adaptive deadband’, a message is generated.<br>Factory setting: active | Message ID: 1074 |
| Aux. init. operation | active, inactive | The ‘Aux. init. operation’ option activates monitoring of the initialisation type. If the device was configured with a replacement initialisation, a message is generated.<br>Factory setting: inactive | Message ID: 1212 |
| Pressure demand | active, inactive | The ‘Pressure demand’ option activates monitoring of drive pressure signals to detect break-away behaviour. If the compressed air demand ratio at break-away exceeds its allocated threshold, a message is generated.<br>The current values are displayed in the ‘Compressed air requirement’ menu ➔ 7.2.8.5 ‘Pressure demand’ menu.<br>Factory setting: inactive | Message ID: 1114, factory setting: compressed air requirement threshold ratio: 95% |
| Settling time | active, inactive | The ‘Settling time’ option activates monitoring of the settling time. If the target position is not reached within the allocated threshold after a setpoint value change, a message is generated.<br>Factory setting: active | Message ID: 1034, factory setting: settling time threshold: recommended value from the results of the automatic initialisation. |
| DI triggered ctrl. | active, inactive | Digital input monitoring is activated in this area. If control is requested via the digital input via an active function, a message is generated. Since the externally applied setpoint value is ignored in this case, there is usually a deviation between the external setpoint position specification and the actual position.<br>Factory setting: inactive | Message ID: 1557, factory setting: substitute value for the setpoint position<br>Message ID: 1558, factory setting: request for end positions |

Tab. 86: Activation

### 7.2.8.2 ‘Counter’ menu

| Menu option | | Description |
|---|---|---|
|  | Operating time | The current value of the operating hours counter is displayed in this area. This counter cannot be reset. |
| AP | Actual position | The current values of the counters for movements, changes in direction and the total distance of the actual position are displayed in this area. These counters cannot be reset. |

| Menu option | | Description |
|---|---|---|
| TP | Target position | The current values of the counters for movements, changes in direction and the total travel of the setpoint position are displayed in this area. These counters cannot be reset. |
| | Actuator | The current values of the counters for movements, changes in direction and the total distance of the actual position of the drive are displayed in this area. These counters can be reset. |
| | Armature | The current values of the counters for movements, changes in direction and the total distance of the actual position of the process valve are displayed in this area. These counters can be reset. |
| | Reset actuator (counter) | The counters of the drive are irrevocably reset with this function. |
| | Reset armature (counter) | This function is used to irrevocably reset the numerators of the process valve. |

Tab. 87: ‘Counter’ menu

### 7.2.8.3 ‘Partial stroke test’ menu

The Partial Stroke Test (PST) can be used to check the mobility of a safety-related process valve. This can reduce the probability of failure in an emergency and the required maintenance intervals can be extended.
With the Partial Stroke Test the process valve is moved from a specified position start value to a defined position end value. The process valve then returns to its initial position. The characteristics of the movements (times, pressures) are recorded and compared with the characteristics of a reference manoeuvre.
If the movements between position start value and position end value are not completed within the expected times, a message is output. If the movement times are too long and the permissible ranges for position and pressure are exited, the Partial Stroke Test is terminated prematurely with a message.
The following settings can only be made via EDD and DTM:
– Configure and activate the time-controlled trigger.
– Adjust the parameters for execution of the movement.
– Adjust the limit values for the result evaluation and assign them according to the NAMUR status groups.
– Execute the reference manoeuvre. A valid reference manoeuvre is a prerequisite for executing a PST.

During the test, the valve no longer follows the external setpoint value. Changing the valve’s position can impair the process.

| Menu item | | Description |
|---|---|---|
| | PST state | Information about PST state is displayed in this area ➔ Information on the PST state. |
| | PST execution | The Partial Stroke Test can be started in this area. |

Tab. 88: ‘Partial stroke test’ menu

**Information on the PST state**

| PST state | Description |
|---|---|
| PST Initialization | Initialised, not initialised<br>Successful initialisation is a prerequisite for executing the Partial Stroke Test. |
| Time since last PST | Time since last Partial Stroke Test in hours. |
| Last PST result | Result of the last Partial Stroke Test: not initialised, running, successfully completed, abort with cause. |

Tab. 89: Information on the PST state

**Messages in connection with PST abort**

The following graph shows the relationship between the target position and the waiting time (T_wait) during PST execution:
– Continuous line: current position
– Dashed line: target position

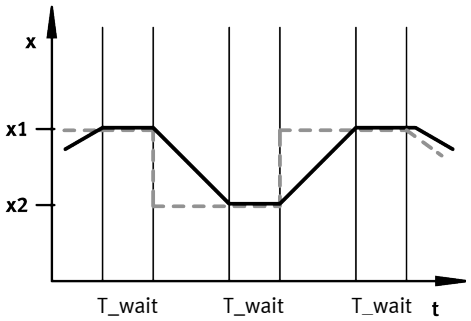
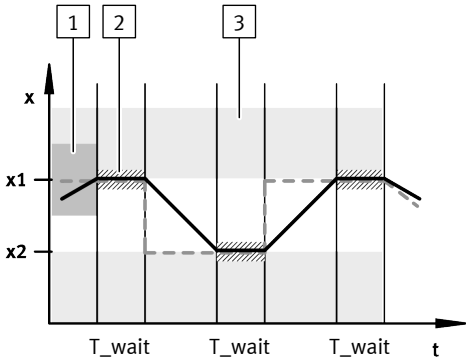



Fig. 40: Movement with PST execution

If the characteristics lie above or below the user-defined thresholds, a message is generated and the Partial Stroke Test is aborted.
The following graph shows the tolerance range of the position limitation:




1 Tol_start
2 Tol_target
3 Tol_ext

Fig. 41: Position limitation

**Partial Stroke Test configuration parameters**

The configuration parameters can only be adjusted via EDD and DTM.

| Abbreviation | Description | Value[1)] |
|---|---|---|
| x1 | Target position 1 | 100 % |
| x2 | Target position 2 | 90 % |
| Tol_start | Tolerance start position | 100 % |
| Tol_ext | Tolerance setpoint position | 100 % |
| Tol_target | Permitted deviation from x1 or x2 during PST | 5 % |
| T_wait | Waiting time | 5 s |
| Fact_duration | Factor for movement times for determining the message threshold | 5 |
| P_low | Minimum permissible pressure difference | -10 bar |
| P_high | Maximum permissible pressure difference | 10 bar |
| T_total | Absolute upper limit for total duration | 180 s |
| T_interval | Test interval | 8760 h |
| Tol_interval | Tolerance for test interval | 1 h |

1) factory setting

Tab. 90: Partial Stroke Test configuration parameters

**Messages about a PST abort**

Every message is displayed in a separate message view ➔ 4.1.3.3 Message views.

The message text is shown in abbreviated form on the display.

| Message | Termination criterion | NAMUR status[1] | ID |
|---|---|---|---|
| PST stopped: Tolerated deviation of starting position exceeded | Deviation > Tol_start | ◆ | 1082 |
| PST stopped: Tolerated deviation of external target position exceeded | Deviation > Tol_ext | ◆ | 1083 |
| PST stopped: Too long duration of movement from x2 to x1 compared to reference | Relative duration > 2 * Fact_duration | ◆ | 1084 |
| PST stopped: Total duration too long compared to reference | Relative duration > 2 * Fact_duration | ◆ | 1085 |
| PST stopped: Too long duration compared to absolute upper limit | Duration > T_total | ◆ | 1086 |
| PST stopped: Out of valid position range at starting position x1 | Deviation > Tol_target | ◆ | 1087 |
| PST stopped: Out of valid position range during movement from x1 to x2 | Deviation > Tol_target | ◆ | 1088 |
| PST stopped: Out of valid position range at position x2 | Deviation > Tol_target | ◆ | 1089 |
| PST stopped: Out of valid position range during movement from x2 to x1 | Deviation > Tol_target | ◆ | 1090 |
| PST stopped: Out of valid position range at starting position x1 | Deviation > Tol_target | ◆ | 1091 |
| PST stopped: Too long duration of movement from x1 to x2 compared to reference | Relative duration > 2 * Fact_duration | ◆ | 1099 |
| PST stopped: Below lower pressure limit | Differential pressure < P_low | ◆ | 1102 |
| PST stopped: Above upper pressure limit | Differential pressure > P_high | ◆ | 1103 |

1) factory setting

Tab. 91: Messages about a PST abort

**Additional messages for Partial Stroke Test**

If the following criteria are met, a message is generated. The Partial Stroke Test is not aborted.

| Message | Criterion | NAMUR status[1] | Message ID |
|---|---|---|---|
| Test interval exceeded | Time since last PST > T_interval + Tol_interval | ◆ | 1095 |
| Motion or manoeuvre duration is too long in relation to the reference PST | Fact_duration < ratio < 2 * Fact_duration | ◆ | 1096 |

1) factory setting

Tab. 92: Additional messages for Partial Stroke Test

### 7.2.8.4 'Air leakage' menu

The results of the leakage monitoring are displayed in the 'Air leakage' menu.
The function for detecting pneumatic leakage starts evaluating the drive pressures as soon as the drive is at a standstill and the positioner is not actively changing the drive pressures. If this condition persists for a sufficiently long time, the function determines the rate of change of the drive pressures over time. The pressure drops are used to assess the extent of pneumatic leakage.
The configuration of the diagnostic function for pneumatic leakage can only be changed via EDD and DTM.

| Value | Description |
|---|---|
| Time since last eval. | This parameter shows the operating time of the positioner since the last evaluation. |
| Leakage type | This parameter is derived from the values of the calculated pressure drop from several consecutive evaluations.<br>– undefined<br>– No leakage: observed pressure changes at port 2 and port 4 are generally below the user-defined pressure change rate threshold.<br>– unspecific: pressure drops and pressure increases that exceed the user-defined pressure change rate threshold are observed.<br>– Pressure drop: pressure drops that mostly exceed the user-defined pressure change rate threshold are observed.<br>– Pressure equalization between port 2 and port 4: the difference in pressures at port 2 and port 4 is steadily decreasing by an amount that exceeds the user-defined rate of pressure change threshold.<br>– Pressure rise: pressure rises that generally exceed the user-defined pressure change rate threshold are observed. |
| Pressure slope port 2 | These parameters show the most recent rate of change in pressure measured at the supply ports of the positioner drive.<br>– Without sign: pressure rise<br>– Negative sign: pressure drop |
| Pressure slope port 4 | |
| Position | This parameter shows the drive deflection measured during the last evaluation. |
| Pressure port 2 | These parameters show the drive pressures measured at the beginning of the last evaluation. |
| Pressure port 4 | |

Tab. 93: ‘Air leakage’ menu

### 7.2.8.5 ‘Pressure demand’ menu

The ‘Pressure demand’ menu shows the results of monitoring drive pressures with refence to break-away behaviour.
The function for recording the compressed air requirement starts evaluating the drive pressures if, after the connected drive has come to a standstill, a new movement is requested due to a change in the setpoint value. The break-away pressure is determined when the movement starts. If the break-away pressure can be recorded sufficiently well, it is used as a basis for assessing the compressed air requirement.
The configuration of the air pressure demand diagnostic function can only be changed via EDD and DTM.

| Value | Description |
|---|---|
| Time since last eval. | This parameter shows the time since the air pressure demand was last evaluated. |
| Pressure demand ratio | This parameter shows the proportion of the available pressure difference that was required to initiate the movement. The parameter is calculated:<br>– for double-acting drives from the ratio of the break-away pressure pLB to the supply pressure pV,<br>– for single-acting drives for movements with increasing drive pressure from the ratio of the break-away pressure pLB to the supply pressure pV,<br>– for single-acting drives for movements with decreasing drive pressure from (pV - pLB)/pV. |
| Limit ratio | This parameter shows the amount by which the air pressure demand ratio determined during a break-away event must be exceeded for a message to be generated. |

| Value | Description |
|---|---|
| Breakaway pressure | This parameter shows the recorded drive pressure just before the start of the movement. The parameter is calculated:<br>– for double-acting drives from the difference (p2 - p4) of the pressures measured at the drive-side supply ports (2) and (4) of the positioner,<br>– for single-acting drives from the pressure p2. |
| Position | This parameter shows the drive deflection before the start of the movement. |
| Movement direction | This parameter shows whether a movement with increasing position values (positive) or decreasing position values (negative) has taken place. |
| Min. pos. change | This parameter shows the minimum change that the detected drive deflection must have when a position change is requested so the break-away pressure can be evaluated. |

Tab. 94

## 7.3 Setting end position detection on the CMSH-...-1W/ZC-...

This chapter describes how to set the end position detection for the product variants with limit switch encoder CMSH-...-1W-... (mechanical microswitch) and CMSH-...-ZC-... (inductive switch).

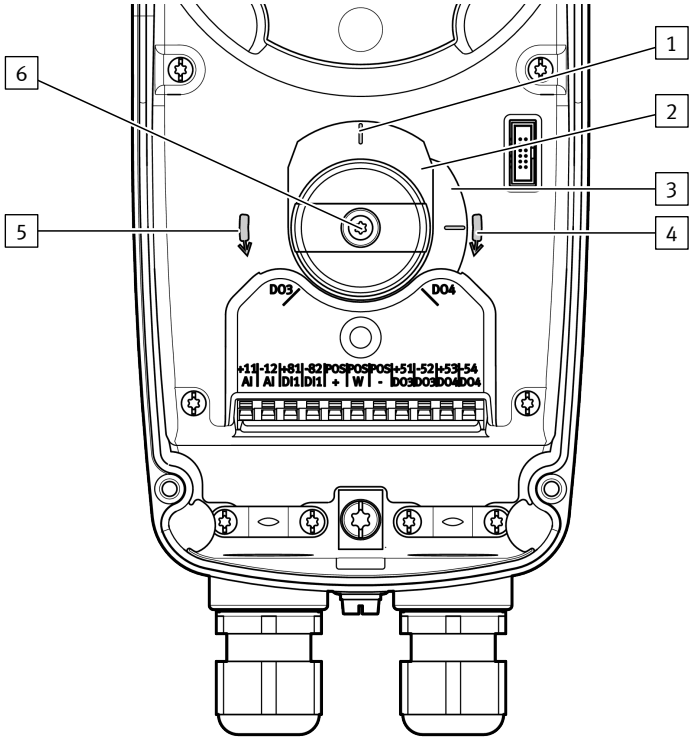



Fig. 42: Setting end position detection

1 Marking for the switching point
2 Switch lug 1
3 Switch lug 2
4 Range in which the switching point for DO4 is to be expected
5 Range in which the switching point for DO3 is to be expected
6 Screw for mounting the position indicator

1. To determine the first switching contact, connect a measuring device to the digital outputs DO4.
2. Move the actuator by setting the manual control value mode ➔ 7.2.3.2 ‘Manual venting’ manual manipulated variable mode. Move the drive to the first switching position.

3. Loosen the screw of the position indicator until the switch lugs can be rotated easily. Do not unscrew the screw completely.
4. Move the lower switch lug in the direction of the arrow to the range in which the switching point for DO4 is to be expected. Use the measuring device to find the exact switching point.
5. Adjust the position indicator to the desired position. Make sure that the position of the first switch lug does not change.
6. Tighten the screw of the position indicator lightly so the switch lug and position indicator are locked to prevent torsion.
7. To determine the second switching contact, connect a measuring device to the digital outputs DO3.
8. Move the drive to the second switching position.
9. Loosen the screw of the position indicator until the upper switch lug can rotate. Make sure that the positions of the lower switch lug and the position indicator do not change.
10. Move the upper switch lug in the direction of the arrow to the range in which the switching point for DO3 is to be expected. Use the measuring device to find the exact switching point.
11. Tighten the position indicator screw.
    – Tightening torque 0.4 Nm ± 10%
12. Test run: move the drive to both switching positions and check that the switching positions and the position indicator are correctly adjusted.

### 7.4 Adjusting position indicator on the CMSH-S-...

1. Unscrew the 4 housing cover screws and remove the housing cover.
2. Adjust the position indicator by turning it.
3. Place the housing cover on the positioner and tighten the 4 housing cover screws.
   – Make sure that the seal is positioned correctly.
   – Tightening torque: 3 Nm ± 20%

## 8 Malfunctions

### 8.1 Fault description

The error messages are shown on the display according to priority ➔ 4.1.3.3 Message views.
Every message has a unique number (ID) and is permanently allocated to a pre-defined message group. This facilitates troubleshooting and classification in the evaluation.
The message groups are based on the possible sources of error of the NAMUR recommendation NE 107.

| Message group | ID | Context |
|---|---|---|
| Drive | 1 ... 255 | Drive, volumetric flow amplifier |
| Configuration | 257 ... 511 | Mounting and commissioning |
| Electronics | 513 ... 767 | Electronics |
| Operating conditions | 769 ... 1023 | Specified operating conditions |
| Process | 1025 ... 1279 | Control, Partial Stroke Test |

| Message group | ID | Context |
|---|---|---|
| Sensor | 1281 ... 1535 | Position sensor, position signal |
| Other | 1537 ... 1791 | Manual operation and other messages |

Tab. 95: Allocation of message numbers to message groups

## 8.2 Messages

### Representation of messages on the display

The message text is shown in abbreviated form on the display.

| ID | Message | NAMUR[1)] | Possible cause | Notes/remedy |
|---|---|---|---|---|
| 30 | No movement detectable | ⊗ | – Blocked drive<br>– Increased friction with drive or process valve | – Service drive or process valve. |
| 60 | Initialization failed: control parameters | ⊗ | – Increased friction of drive or process valve<br>– Fluctuations in supply pressure<br>– External potentiometer outside specification<br>– Operation of drive or process valve out of specification<br>– Active control signal is applied at the digital input. | – Repeat initialisation. If the initialisation repeatedly fails, contact Festo support ➔ www.festo.com/sp.<br>– Service drive or process valve.<br>– Check supply pressure.<br>– Check specification of the external potentiometer.<br>– Check digital input. |
| 62 | Initialization failed: control parameters | ⊗ | – Increased friction of drive or process valve<br>– Fluctuations in supply pressure<br>– External potentiometer outside specification<br>– Operation of drive or process valve out of specification | – Repeat initialisation. If the initialisation repeatedly fails, contact Festo support ➔ www.festo.com/sp.<br>– Service drive or process valve.<br>– Check supply pressure.<br>– Check specification of the external potentiometer. |
| 64 | Initialization failed: end positions | ⊗ | – Defective seal in process valve<br>– Mechanical blockage of the process valve<br>– Fluctuations in supply pressure<br>– Drive outside the operating range of the potentiometer<br>– Incorrect configuration of the fail-safe position | – Service process valve.<br>– Check supply pressure.<br>– Check that the positioner is correctly mounted on the drive.<br>– With external potentiometer: check attachment position of the potentiometer.<br>– Adjust configuration of fail-safe position. |
| 66 | Initializiation failed: No movement Control parameters | ⊗ | – Automatic initialisation cannot be successfully implemented | – Run Min. Auto-initialization ➔ ‘Expert functions’ menu. |
| 80 | Leakage detected: limit exceeded | ◆ | – Leak in drive or supply connection<br>– Specified threshold exceeded | – Check drive for leakage.<br>– Check pneumatic connections.<br>– Check positioner for leakage and replace if necessary. |

| ID | Message | NAMUR[1)] | Possible cause | Notes/remedy |
|---|---|---|---|---|
| 81 | Leakage detected: pressure equalization between port 2 and port 4 | | – Drive piston seal worn<br>– Supply connection between port 2 and port 4 outside the drive<br>– Specified threshold exceeded | – Check drive for internal leakage and replace if necessary.<br>– Check pneumatic connections. |
| 82 | Leakage detected: pressure drop | | – Leak in drive<br>– Leak in supply connection<br>– Internal exhaust valve cannot be fully closed<br>– Specified threshold exceeded | – Check drive for leakage.<br>– Check pneumatic connections.<br>– Check positioner for leakage and replace if necessary. |
| 83 | Leakage detected: pressure drop port 2 | | – Leak in drive<br>– Leak in supply connection at port 2<br>– Internal exhaust valve at port 2 cannot be fully closed<br>– Specified threshold exceeded | – Check drive for leakage.<br>– Check pneumatic connections.<br>– Check positioner for leakage and replace if necessary. |
| 84 | Leakage detected: pressure drop port 4 | | – Leak in drive<br>– Leak in supply connection at port 4<br>– Internal exhaust valve at port 4 cannot be fully closed<br>– Specified threshold exceeded | – Check drive for leakage.<br>– Check pneumatic connections.<br>– Check positioner for leakage and replace if necessary. |
| 85 | Leakage detected: pressure rise | | – Connection between supply line and drive chamber<br>– Internal pressurisation valve cannot be fully closed<br>– Specified threshold exceeded | – Check pneumatic connections.<br>– Check the positioner for defects in the internal valve and replace the positioner if necessary. |
| 86 | Leakage detected: pressure rise port 2 | | – Connection between supply line and drive chamber at port 2<br>– Internal pressurisation valve at port 2 cannot be fully closed<br>– Specified threshold exceeded | – Check pneumatic connections.<br>– Check the positioner for defects in the internal valve and replace the positioner if necessary. |
| 87 | Leakage detected: pressure rise port 4 | | – Connection between supply line and drive chamber at port 4<br>– Internal pressurisation valve at port 4 cannot be fully closed<br>– Specified threshold exceeded | – Check pneumatic connections.<br>– Check the positioner for defects in the internal valve and replace the positioner if necessary. |
| 150 | Number of direction changes actuator exceeded | [2)] | – Set threshold value exceeded<br>– Service life of the drive reached<br>– Oscillating behaviour<br>– Repeated position drift and readjustment due to severe compressed air leakage | – Service drive and replace if necessary.<br>– Optimise control parameters. |

| ID | Message | NAMUR[1] | Possible cause | Notes/remedy |
|---|---|---|---|---|
| 153 | Covered distance limit actuator exceeded | 2) | – Set threshold value exceeded<br>– Service life of the drive reached<br>– Oscillating behaviour<br>– Repeated position drift and readjustment due to severe compressed air leakage | – Service drive and replace if necessary.<br>– Optimise control parameters. |
| 156 | Number of movements actuator exceeded | 2) | – Set threshold value exceeded<br>– Service life of the drive reached<br>– Stick-Slip behaviour<br>– Repeated position drift and readjustment due to severe compressed air leakage | – Service drive and replace if necessary.<br>– Check drive and/or process valve for changes in friction. |
| 276 | Device not initialized | 2) | – Initialisation failed<br>– Device not yet initialised | – Perform initialisation. |
| 356 | PST reference test running | | – Ongoing PST reference manoeuvre | – Wait until the PST is finished.<br>– Cancel PST reference manoeuvre manually. |
| 361 | PST: Reference test run necessary | | – Faulty PST reference manoeuvre | – Start PST reference manoeuvre. Only possible via EDD and DTM. |
| 416 | Initialization failed: Timeout control parameter | | – Increased friction with drive or process valve<br>– Fluctuations in supply pressure<br>– External potentiometer outside specification<br>– Operation of drive or process valve out of specification | – Repeat initialisation. If the initialisation repeatedly fails, contact Festo support ➔ www.festo.com/sp.<br>– Service drive or process valve.<br>– Check supply pressure.<br>– Check specification of the external potentiometer. |
| 790 | Setpoint signal below valid range | | – Setpoint signal below 3.8 mA | – Check analogue input signal. |
| 791 | Setpoint signal above valid range | | – Setpoint signal above 20.5 mA | – Check analogue input signal. |
| 798 | Supply pressure too high | | – Supply pressure above 8 bar | – Check supply pressure. |
| 799 | Supply pressure too low | | – Supply pressure below 1.4 bar<br>– Clogged filter | – Check supply pressure.<br>– Check filters. |
| 828 | Temperature in device too high | | – Temperature above 80 °C<br>– Media influences or environmental influences | – Check operating conditions. |
| 829 | Temperature in device too low | | – Temperature below -40 °C<br>– Media influences or environmental influences | – Check operating conditions. |
| 918 | Above defined supply pressure limit | 2) | – Set threshold value exceeded | – Check supply pressure.<br>– Adjust threshold value if necessary. |

| ID | Message | NAMUR[1] | Possible cause | Notes/remedy |
|---|---|---|---|---|
| 919 | Below defined supply pressure limit | [2] | – Set threshold value undershot<br>– Clogged filter<br>– Too many consumers on the compressed air line | – Check supply pressure.<br>– Adjust threshold value if necessary.<br>– Check filters.<br>– If necessary, install buffer volume. |
| 1034 | Settling time limit exceeded | [2] | – Set threshold value exceeded<br>– Increased friction due to wear on the drive or process valve<br>– Unsuitable threshold value | – Service the drive or process valve and replace if necessary.<br>– Adjust the threshold value and check the deadband of the closed-loop controller. |
| 1074 | Adaptive deadband limit exceeded | | – Increased friction with drive or process valve<br>– Malfunctions in the position detection or at the analogue input<br>– Drive travel speed too fast<br>– Specified threshold exceeded<br>– Fault in the positioner | – Service the drive or process valve and replace if necessary.<br>– Check analogue input signal.<br>– Check external position signal.<br>– Throttle drive.<br>– Adjust the threshold value and check the deadband of the closed-loop controller.<br>– Repeat initialisation. If the initialisation repeatedly fails, contact Festo support ➔ www.festo.com/sp. |
| 1082 | PST stopped: Tolerated deviation of starting position exceeded | [2] | – Drive outside the specified range at PST start | – Move drive into permitted position range before PST start.<br>– If necessary, adjust values of the start position tolerance (Tol_start). |
| 1083 | PST stopped: Tolerated deviation of external target position exceeded | [2] | – Setpoint position at PST start outside the specified range | – Move setpoint position into permitted range before PST start.<br>– If necessary, adjust values of tolerance of external setpoint position (Tol_ext). |
| 1084 | PST stopped: Too long duration of movement from x2 to x1 compared to reference | [2] | – Increased friction with drive or process valve<br>– Low supply pressure<br>– Increased resistance in the compressed air lines<br>– Wear of the positioner | – Service the drive or process valve and replace if necessary.<br>– Check supply pressure.<br>– Check compressed air lines.<br>– Replace positioner. |
| 1085 | PST stopped: Total duration too long compared to reference | [2] | – Increased friction with drive or process valve<br>– Low supply pressure<br>– Increased resistance in the compressed air lines<br>– Wear of the positioner | – Service the drive or process valve and replace if necessary.<br>– Check supply pressure.<br>– Check compressed air lines.<br>– Replace positioner. |
| 1086 | PST stopped: Too long duration compared to absolute upper limit | [2] | – Increased friction with drive or process valve<br>– Set threshold value exceeded<br>– Low supply pressure<br>– Increased resistance in the compressed air lines<br>– Wear of the positioner | – Service the drive or process valve and replace if necessary.<br>– Check supply pressure.<br>– Check compressed air lines.<br>– Replace positioner. |

| ID | Message | NAMUR[1)] | Possible cause | Notes/remedy |
|---|---|---|---|---|
| 1087 | PST stopped: Out of valid position range starting at x1 | 2) | – Position drift due to compressed air leakage<br>– Movement caused by external forces<br>– Increased noise of the position sensor | – Check for compressed air leakage.<br>– Check for external forces.<br>– If necessary, adjust values of the tolerance target position (Tol_target). |
| 1088 | PST stopped: Out of valid position range during movement from x1 to x2 | 2) | – Position drift due to compressed air leakage<br>– Movement caused by external forces<br>– Increased noise of the position sensor | – Check for compressed air leakage.<br>– Check for external forces.<br>– If necessary, adjust values of the tolerance target position (Tol_target). |
| 1089 | PST stopped: Out of valid position range at position x2 | 2) | – Position drift due to compressed air leakage<br>– Movement caused by external forces<br>– Increased noise of the position sensor | – Check for compressed air leakage.<br>– Check for external forces.<br>– If necessary, adjust values of the tolerance target position (Tol_target). |
| 1090 | PST stopped: Out of valid position range during movement from x2 to x1 | 2) | – Position drift due to compressed air leakage<br>– Movement caused by external forces<br>– Increased noise of the position sensor | – Check for compressed air leakage.<br>– Check for external forces.<br>– If necessary, adjust values of the tolerance target position (Tol_target). |
| 1091 | PST stopped: Out of valid position range at starting position x1 | 2) | – Position drift due to compressed air leakage<br>– Movement caused by external forces<br>– Increased noise of the position sensor | – Check for compressed air leakage.<br>– Check for external forces.<br>– If necessary, adjust values of the tolerance target position (Tol_target). |
| 1094 | PST running | | – Current PST | – Wait for completion of the test.<br>– Cancel PST manually if necessary. |
| 1095 | PST: Test interval exceeded | 2) | – Set tolerance for PST interval exceeded<br>– Start conditions for time-triggered PST not met for too long | – Ensure start conditions for PST at the desired time.<br>– Adjust start conditions for PST if necessary, e.g. increase tolerances. |
| 1096 | PST: Movement or test duration too long | 2) | – Increased friction with drive or process valve<br>– Low supply pressure<br>– Increased resistance in the compressed air lines<br>– Wear of the positioner | – Service the drive or process valve and replace if necessary.<br>– Check supply pressure.<br>– Check compressed air lines.<br>– Replace positioner. |
| 1099 | PST stopped: Too long duration of movement from x1 to x2 compared to reference | 2) | – Increased friction with drive or process valve<br>– Low supply pressure<br>– Increased resistance in the compressed air lines<br>– Wear of the positioner | – Service the drive or process valve and replace if necessary.<br>– Check supply pressure.<br>– Check compressed air lines.<br>– Replace positioner. |
| 1100 | PST: Canceled by external reset | | – PST aborted by user | — |
| 1102 | PST stopped: Below lower pressure limit | 2) | – Threshold value set for lower pressure limit undershot<br>– Difficult movement, e.g. due to increased friction<br>– Supply pressure too low | – Check the motion of the drive or process valve.<br>– Check supply pressure. |

| ID | Message | NAMUR[1] | Possible cause | Notes/remedy |
|---|---|---|---|---|
| 1103 | PST stopped: Above upper pressure limit | 2) | – Set threshold value for upper pressure limit exceeded<br>– Difficult movement, e.g. due to increased friction<br>– Supply pressure too low | – Check the motion of the drive or process valve.<br>– Check supply pressure. |
| 1114 | Pressure demand ratio limit exceeded | | – Excessive static friction on the process valve<br>– Excessive static friction on the drive<br>– Supply pressure too low<br>– Specified threshold exceeded | – Check drive and process valve.<br>– Check supply pressure. |
| 1174 | Covered distance limit armature exceeded | 2) | – Set threshold value exceeded<br>– Process valve service life reached<br>– Oscillating behaviour<br>– Repeated position drift and readjustment due to severe compressed air leakage | – Service the process valve and replace if necessary.<br>– Optimise control parameters. |
| 1184 | Number of movements armature exceeded | 2) | – Set threshold value exceeded<br>– Process valve service life reached<br>– Oscillating behaviour<br>– Repeated position drift and readjustment due to severe compressed air leakage | – Service the process valve and replace if necessary.<br>– Optimise control parameters. |
| 1187 | Number of direction changes armature exceeded | 2) | – Set threshold value exceeded<br>– Process valve service life reached<br>– Stick-Slip behaviour<br>– Repeated position drift and readjustment due to severe compressed air leakage | – Service the process valve and replace if necessary.<br>– Check drive and/or process valve for changes in friction. |
| 1212 | Operation with auxiliary init. / auto init. recommended! | | – Device initialised by replacement initialisation | – Run automatic initialisation. |
| 1298 | Initialization failed: Incorrect potentiometer value | | – Drive outside the operating range of the potentiometer | – Check that the positioner is correctly mounted on the drive.<br>– With external potentiometer: check attachment position of the potentiometer. |
| 1299 | Initialization failed: Incorrect potentiometer value | | – Drive outside the operating range of the potentiometer | – Check that the positioner is correctly mounted on the drive.<br>– With external potentiometer: check attachment position of the potentiometer. |
| 1300 | Short circuit: Potentiometer | | – Short-circuited potentiometer | – Check the connection of the external potentiometer. |

| ID | Message | NAMUR[1)] | Possible cause | Notes/remedy |
|---|---|---|---|---|
| 1301 | Incorrect value: Potentiometer | ⊗ | – Drive outside the operating range of the potentiometer | – Check that the positioner is correctly mounted on the drive.<br>– With external potentiometer: check attachment position of the potentiometer. |
| 1302 | Incorrect value: Potentiometer | ⊗ | – Drive outside the operating range of the potentiometer | – Check that the positioner is correctly mounted on the drive.<br>– With external potentiometer: check attachment position of the potentiometer. |
| 1310 | Initialization failed: Potentiometer failure | ⊗ | – Increased sensor noise<br>– Drive outside the operating range of the potentiometer<br>– Defective potentiometer<br>– External potentiometer outside specification<br>– Compressed air leakage at the drive or positioner<br>– Incorrect or missing pneumatic connection of the drive<br>– Incorrect configuration of the fail-safe position | – Repeat initialisation. If the initialisation fails repeatedly, contact Festo Support ➔ www.festo.com/sp.<br>– Check that the positioner is correctly mounted on the drive.<br>– With external potentiometer: check attachment position of the potentiometer.<br>– Check specification of the external potentiometer.<br>– Check pneumatic connection.<br>– Check configuration of the fail-safe position. |
| 1321 | Initialization failed: sensor noise | ⊗ | – Increased sensor noise<br>– Drive outside the operating range of the potentiometer<br>– Defective potentiometer<br>– External potentiometer outside specification<br>– Incorrect configuration of the fail-safe position | – Repeat initialisation. In case of repeated failure, contact Festo Support ➔ www.festo.com/sp.<br>– Check that the positioner is correctly mounted on the drive.<br>– With external potentiometer: check attachment position of the potentiometer.<br>– Check external potentiometer.<br>– Check configuration of the fail-safe position. |
| 1322 | Position drift during initialization | ◆ | – Drive outside the operating range of the potentiometer<br>– Defective potentiometer<br>– External potentiometer outside specification<br>– Compressed air leakage at the drive or positioner<br>– Incorrect or missing pneumatic connection of the drive<br>– Incorrect configuration of the fail-safe position | – Repeat initialisation. In case of repeated failure, contact Festo Support ➔ www.festo.com/sp.<br>– Check that the positioner is correctly mounted on the drive.<br>– With external potentiometer: check attachment position of the potentiometer.<br>– Check external potentiometer.<br>– Check pneumatic connection.<br>– Check configuration of the fail-safe position. |

| ID | Message | NAMUR[1)] | Possible cause | Notes/remedy |
|---|---|---|---|---|
| 1330 | Initialization failed: position sensing |  | – Increased sensor noise<br>– Drive outside the operating range of the potentiometer<br>– Defective potentiometer<br>– External potentiometer outside specification<br>– Compressed air leakage at the drive or positioner<br>– Incorrect or missing pneumatic connection of the drive<br>– Incorrect configuration of the fail-safe position | – Repeat initialisation. In case of repeated failure, contact Festo Support ➔ www.festo.com/sp.<br>– Check that the positioner is correctly mounted on the drive.<br>– With external potentiometer: check attachment position of the potentiometer.<br>– Check specification of the external potentiometer.<br>– Check pneumatic connection.<br>– Check configuration of the fail-safe position. |
| 1350 | Pressure sensor failure |  | – Defective electronics | – Contact Festo Support ➔ www.festo.com/sp. |
| 1556 | Initialization running |  | – Ongoing initialisation | – Wait for completion of initialisation.<br>– If necessary, cancel initialisation manually. |
| 1557 | Digital input active: Substitute target position |  2) | – Active signal at the digital input | — |
| 1558 | Digital input active: End position requested |  2) | – Active signal at the digital input | — |
| 1596 | Manual operation |  | – Operation of the positioner in manual mode | — |
| 1597 | Manual operation |  | – Operation of the positioner in manual mode | — |

1) Corresponds to NAMUR recommendation NE 107
2) Can be changed by the user

Tab. 96: Messages

# 9 Demontage

**⚠ CAUTION**

**Pressurised lines**

Even if the compressed air feed is shut off the pneumatic ports of the positioner may still be under pressure.

- Exhaust the pneumatic ports (working ports) before disconnecting the hose assemblies.

**Disassembling the positioner**

1. Switch off the compressed air supply.
2. Unscrew the 4 housing cover screws.
3. Remove the housing cover.
4. In the menu views, select manual operation ‘Manual venting’ ➔ 7.2.3.2 ‘Manual venting’ manual manipulated variable mode.
5. Move the drive until the working ports are completely exhausted.
6. Switch off the power supply.
7. Disconnect the electrical and pneumatic connections.
8. Remove the positioner ➔ 5 Assembly.

# 10 Technical data

## 10.1 General data

| General data | |
|---|---|
| Design | Digital, electropneumatic positioner |
| Mode of operation | |
| CMSH-...-S-... | Single-acting |
| CMSH-...-D-... | Double-acting |
| CMSH-...-SD-... | Single-acting/double-acting, switchable |
| Design features | |
| CMSH-...-SA-... | Safety position: Fail Safe - exhaust working port (2) |
| CMSH-...-DA-... | Safety position: Fail Safe - exhaust working port (2), pressurise working port (4) |
| CMSH-...-DC-... | Safety position: Fail in Place - close working port (2) and working port (4) |
| Mounting position | |
| CMSH-... | Any |
| Type of mounting | |
| CMSH-...-VDE1-... | With accessories in accordance with VDI/VDE 3845 |
| CMSH-...-VDE2-... | With accessories in accordance with VDI/VDE 3847-2 |
| Measuring principle of the displacement encoder | |
| CMSH-S-..., CMSH-SX1-... | Potentiometer |
| CMSH-SE-..., CMSH-SE1-... | External |
| Sensing range of the displacement encoder | |
| CMSH-S-..., CMSH-SX1-... | 0 ... 115° |
| Display | |
| CMSH-... | LC display, 90° rotatable via software |
| Setting options | |
| CMSH-... | Via LC display and operating buttons |

Tab. 97: General data

## 10.2 Pneumatic data

| Pneumatic data | |
|---|---|
| Operating pressure | |
| CMSH-... | 1.4 ... 8 bar |
| Operating medium | |
| CMSH-... | Compressed air in accordance with ISO 8573-1:2010 [7:4:4] |
| Note on operating and pilot medium | |
| CMSH-... | Lubricated operation not possible |
| Air output at $\Delta p = 6$ bar | |
| CMSH-...-VDE1-S-... | 380 l/min |
| CMSH-...-VDE1-D-... | 270 l/min |
| CMSH-...-VDE2-S-... | 320 l/min |
| CMSH-...-VDE2-D-... | 270 l/min |
| CMSH-...-V-SD-... | 270 – 380 l/min |
| Pneumatic port | |
| CMSH-...-G14-... | G 1/4 |
| CMSH-...-N14-... | 1/4 NPT |

| Pneumatic data | |
|---|---|
| Connection for pressure gauge | |
| CMSH-...-G14-...-V-... | G 1/8 |
| CMSH-...-N14-...-V-... | 1/8 NPT |

Tab. 98: Pneumatic data

## 10.3 Electrical data

| Analogue input AI | |
|---|---|
| Terminals | +11/-12 |
| Nominal signal range | 4 ... 20 mA with HART |
| Current to maintain communication | 3.4 mA |
| Current to maintain the pneumatic function | 3.8 mA |
| Input impedance | 480 Ω at 20 mA |
| Compliance voltage | 9.6 V at 20 mA |
| Overload-proof | ‹ 65 mA |
| Galvanic isolation | Yes, test voltage 1220 V, 1 min |

Tab. 99: Electrical data

| Analogue output AO | |
|---|---|
| Terminals | +31/-32 |
| Functional principle of the analogue output | Current source with external supply (passive output) |
| Nominal signal range | 4 ... 20 mA |
| Supply voltage | 24 V DC (12 V DC ... 30 V DC) |
| Reverse polarity protection | Yes |
| Short-circuit proof | Yes |
| Overload-proof | Yes |
| Galvanic isolation | Yes, test voltage 1220 V, 1 min |

Tab. 100: Electrical data

| Analogue input external position sensor | |
|---|---|
| Terminals | POS +/W/- |
| Functional principle of position measurement | External potentiometric position sensor with a total resistance of 3 ... 80 kΩ |
| Maximum cable length | 30 m, shielded |

Tab. 101: Electrical data

| Digital input DI1/DI2 | |
|---|---|
| Terminals | DI1 +81/-82<br>DI2 +85/-86 |
| Characteristics of inputs | IEC 61131-2, Type 3 (PLC) |
| Input ‘logic 0’ | -3 ... 5 VDC |
| Input ‘logic 1’ | 11 ... 30 VDC |
| Reverse polarity protection | Yes |
| Overload-proof | Yes, 33 V |
| Galvanic isolation | Yes, test voltage 1220 V, 1 min |

Tab. 102: Electrical data

| **Digital output DO1/DO2** | |
|---|---|
| Terminals | DO1 +41/-42<br>DO2 +83/-84 |
| Short-circuit proof | Yes |
| Overload-proof | Yes, 30 V DC |
| Galvanic isolation | Yes, test voltage 1220 V, 1 min |
| NAMUR output[1)] | |
| Connection to switching amplifier to IEC 60947-5-6 | UH = 8.2 V, Ri = 1 kΩ |
| Switching status ‘logical 0’ | I < 1.2 mA |
| Switching status ‘logical 1’ | I > 2.1 mA |
| PLC output[1)] | |
| Connection to PLC inputs in accordance with IEC 61131-2 | Ue 24 V DC, Type 2 |
| Supply voltage | 24 V DC (12 V DC ... 30 V DC) |
| Lowest operating current | ≤ 5 mA |
| Max. output current | ≤ 50 mA |
| Voltage drop | ≤ 8 V |
| Residual current | ≤ 1.5 mA |

1) selection of NAMUR output or PLC output can be configured by software.

Tab. 103: Electrical data

| **Digital output DO3/DO4** | |
|---|---|
| Terminals | DO3 +51/-52<br>DO4 +53/-54 |
| With CMSH-...-ZC | |
| Measurement principle | Inductive |
| Switching output | NAMUR |
| Switching element function | N/C (normally closed) |
| Operating voltage DC | 8.2 V |
| With CMSH-...-1W | |
| Measurement principle | mechanical/electrical |
| Switching output | conventional |
| Switching element function | N/C (normally closed) |
| Max. output current DC | 100 mA |
| Operating voltage range DC | 0 ... 30 V |

Tab. 104: Electrical data

| **Electrical connection** | |
|---|---|
| Conductor cross section, rigid | 0.2 ... 1.5 mm² |
| Conductor cross section, flexible | 0.2 ... 1.5 mm² |
| Conductor cross section AWG/kcmil | 24 ... 16 mm² |
| Flexible conductor cross section with wire end sleeve without plastic sleeve | 0.25 ... 1.5 mm² |
| Flexible conductor cross section with wire end sleeve with plastic sleeve | 0.25 ... 1.5 mm² |
| Strip length | 10 mm |

Tab. 105: Electrical connection

## 10.4 Operating and environmental conditions

| **CMSH-...**[1] | |
|---|---|
| Ambient temperature | -40 ... 80 °C |
| Note on ambient temperature | Indicated on display at operating temperature -30 ... 80 ° C |
| Climatic class during transport | Climate class 2K4 in accordance with DIN EN 60721-3-2, ambient temperature range -40 ... 80 °C |
| Climate class in operation | Climate class 4K3 in accordance with DIN EN 60721-3-4, ambient temperature range -40 ... 80 °C |
| Climatic class during storage | Climate class 1K5 in accordance with DIN EN 60721-3-1, ambient temperature range –40 ... 80 °C |
| Degree of protection | IP66/IP67 in accordance with IEC 60529 |
| Shock resistance | Shock test with severity level 2 in accordance with EN 60068-2-29 |
| Vibration resistance | Transport application test with severity level 2 in accordance with EN 60068-2-6 |
| Pollution degree | 3 |
| EMC conformity | NAMUR recommendation NE 21 |
| Maximum altitude for operation | < 2000 m |
| Overvoltage category | II in accordance with IEC/EN 61010-1 |
| CE marking | ➔ www.festo.com/sp |

1) All product variants

Tab. 106: Operating and environmental conditions

## 10.5 Materials

| **CMSH-...** | |
|---|---|
| Material housing | Die-cast aluminium, polyester coating |
| Material of the inspection window | PC |
| Material of the screws | High-alloy stainless steel |
| Material of the seals | NBR, EPDM, silicone |
| Note on materials | RoHS-compliant |

Tab. 107: Materials

| **CMSH-S-..., CMSH-SX1-...** | |
|---|---|
| Material of the shaft | High-alloy stainless steel |
| Material of the shaft adapter | High-alloy stainless steel |

Tab. 108: Materials

**Festo SE & Co. KG**
Ruiter Straße 82
73734 Esslingen
Germany

Phone: +49 711 347-0
www.festo.com