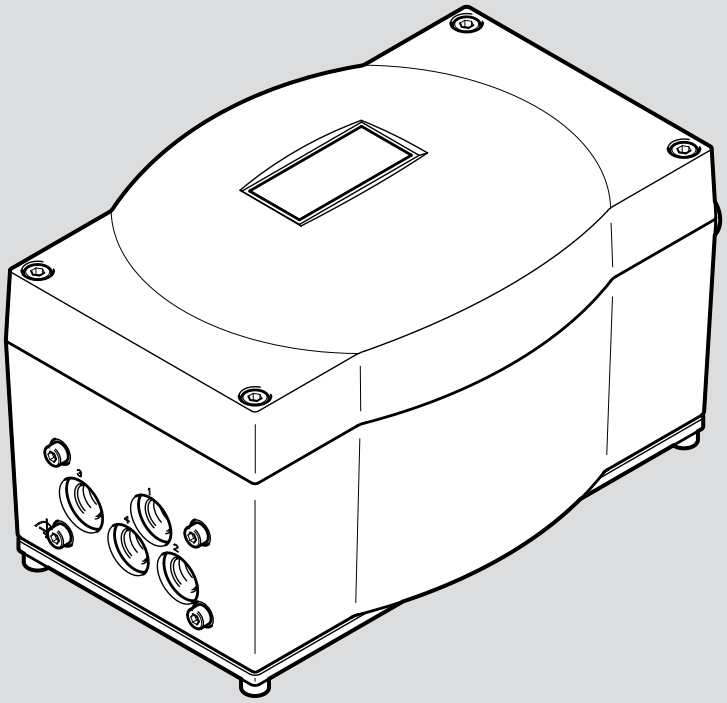
CMSX-...-C-U-F1
Positioner



FESTO

Operating instruction

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2024-09g
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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

Product version

This document refers to the following product versions:

Product	Version
CMSX	Revision 06 and above from software version 1.0.19

Tab. 1: Product version

The revision of the device is shown on the product label.
The software version can be found in the "IDENT" menu of the local user interface.

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

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
STM32H7xx HAL	V1.9.0	Copyright 2017 STMicroelectronics	BSD-3-Clause	https://opensource.org/licenses/BSD-3-Clause
Cortex-M CMSIS	V5.4.0	Copyright 2009-2017, Arm Limited	Apache License, Version 2.0	https://www.apache.org/licenses/LICENSE-2.0
STM32H7xx CMSIS	V1.9.0	Copyright 2017 STMicroelectronics	Apache License, Version 2.0	https://www.apache.org/licenses/LICENSE-2.0
Embed OS, FileSystem	V5.6.2	Copyright 2006-2012, 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 controls the positioning behaviour of pneumatic actuators in process engineering systems.
The product is suitable for attachment to single-acting or double-acting semi-rotary drives or linear drives with a standardised mechanical interface ➔ 11 Technical data.
The positioner is intended for use in an industrial environment.

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 and spare parts ➔ www.festo.com/catalogue.

4 Product overview

4.1 Design

4.1.1 Product design

CMSX-P-S-...

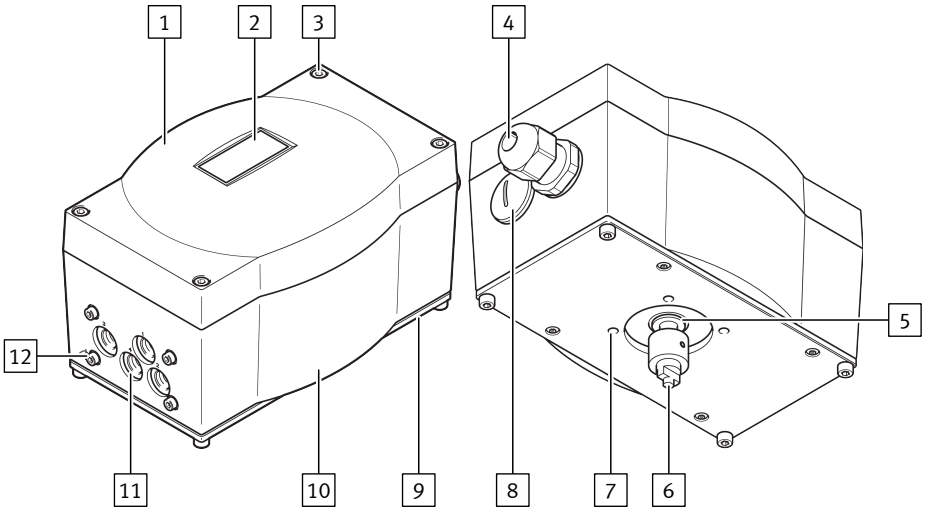


Fig. 1: Product design CMSX-P-S-...

1 Housing cover
2 Inspection window for display
3 Housing screws
4 Cable entry with cable fitting for electrical connecting cable
5 Shaft
6 Mechanical coupling
7 Mounting thread for mounting adapter
8 Blanking plug
9 Base plate
10 Housing
11 Pneumatic ports (G1/8)
12 Earth terminal

CMSX-P-SE-...

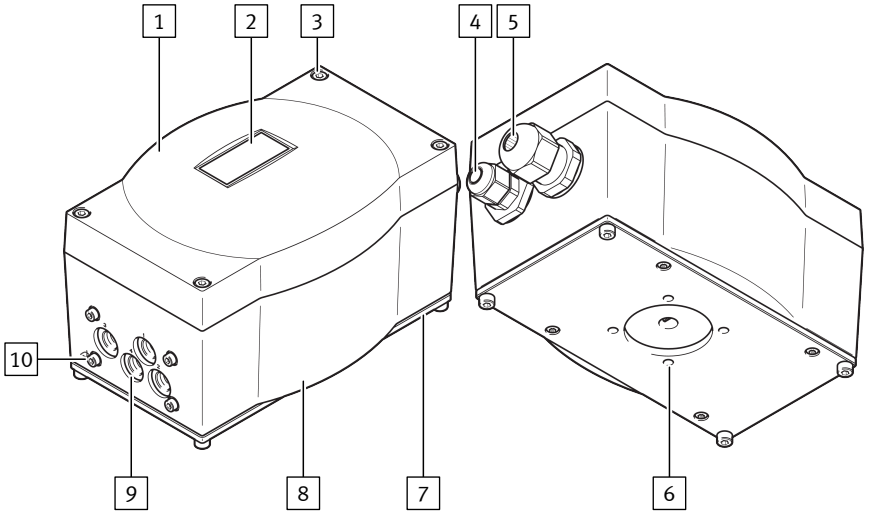


Fig. 2: Product design CMSX-P-SE-...

1 Housing cover
2 Inspection window for display
3 Housing screws
4 Cable entry with cable fitting for external path/angle sensor
5 Cable entry with cable fitting for electrical connecting cable
6 Mounting thread for mounting adapter
7 Base plate
8 Housing
9 Pneumatic ports (G1/8)
10 Earth terminal

4.1.2 Controls and display elements

Operating elements and connections on the device – example: CMSX-P-SE-...

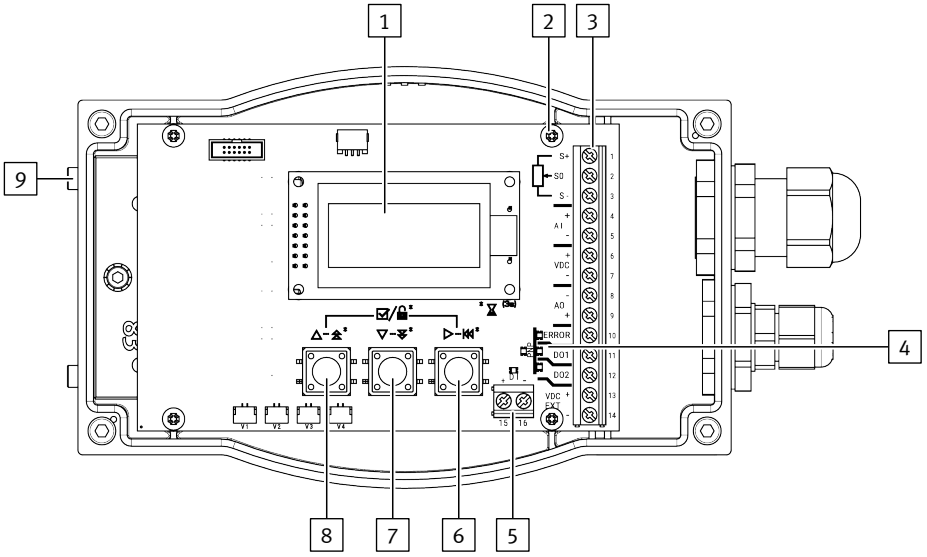


Fig. 3: Controls, display elements and connections

1 Display
2 Connection of shield of external displacement encoder
3 Terminal strip 1 (pin 1 ... 14)
4 Digital output LEDs
5 Terminal strip 2 (pin 15 ... 16)
6 Set button
7 Sub button
8 Add button
9 Earth terminal

LED display for the digital outputs

LED		Meaning
Right LED		ON: digital output switched
		OFF: digital output not switched
Left LED		ON: PNP, positive switching
		OFF: NPN, negative switching

Tab. 3: Meaning of the LEDs

4.2 Function

The CMSX digital electropneumatic positioner enables simple and efficient position control based on the PID control algorithm. Positions are specified via an analogue setpoint signal. The current position of the actuator is detected as follows:

– CMSX-P-S-... : through an integrated potentiometer
– CMSX-P-SE-... : through an external path/angle sensor

The PID controller compares the measurement value with the specified analogue setpoint value and controls the solenoid valves.

4.3 Safety functions

If the electrical power supply fails, the positioner will react differently depending on the product variants and drive system (failure of the operating voltage supply or the setpoint specification) ➔ Tab. 4 Threshold values for safety function and ➔ Tab. 5 Overview of safety position (pneumatic initial position).
If the operating voltage supply is switched back on, the last operating status is immediately effective.

Type of analogue input	Threshold value
0 … 10 V	10.5 V
0 … 20 mA	21 mA
4 … 20 mA	3.6 mA or 21 mA

Tab. 4: Threshold values for safety function

Drive	Safety position in case of electrical power failure, pneumatic compressed air supply present	Safety position in case of failure of the pneumatic compressed air supply, electric power present	Safety position in case of failure of both pneumatic compressed air supply and electrical power
Single-acting	CMSX-...-A: Regulating action opening or closing, dependent on the initial position of the drive	not defined	CMSX-...-A: Regulating action opening or closing, dependent on the initial position of the drive
Double-acting	CMSX-...-A: Regulating action opening or closing, dependent on the connection of working ports 2 and 4		CMSX-...-A: not defined Bring drive into the safety position as needed with an emergency pneumatic supply.
	CMSX-...-C: Regulating effect blocking		CMSX-...-C: regulating effect blocking

Tab. 5: Overview of safety position (pneumatic initial position)

4.3.1 CMSX-P-...-...-D-...-A (double-acting)

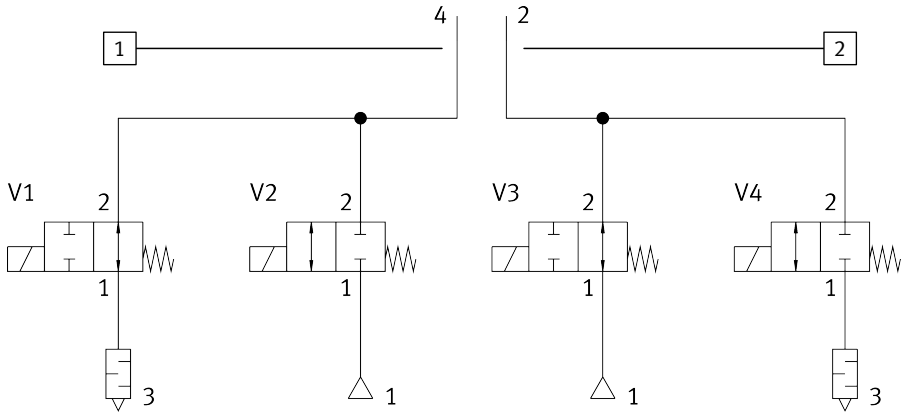


Fig. 4: Safety position CMSX-P-S-...-D-...-A

[1] Working port (4) [2] Working port (2)

– Working port (2) is pressurised.
– Working port (4) is exhausted.

– The regulating effect is opening or closing.
– The process valve is opened or closed, dependent on the tubing connection of the positioner to the drive.

4.3.2 CMSX-P-...-...-D-...-C (double-acting)

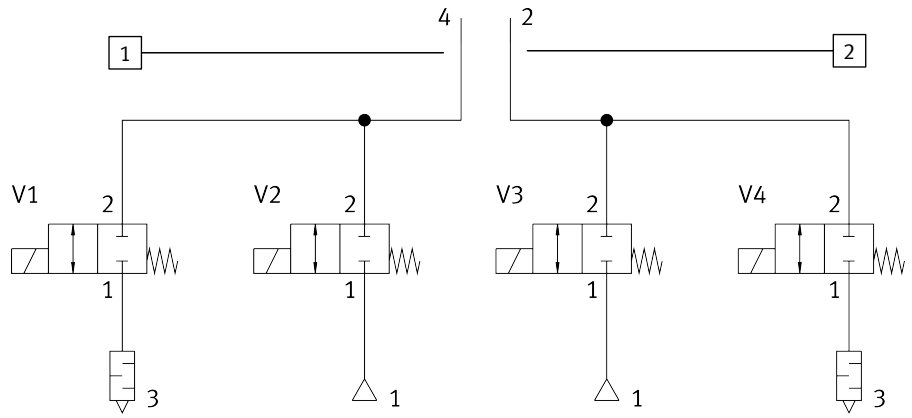


Fig. 5: Fail-safe position CMSX-P-S-...-D-...-C

[1] Working port (4)

[2] Working port (2)

– Working port (2) is blocked.
– Working port (4) is blocked.
– Compressed air is trapped in the drive.
– The regulating effect is blocking.
– The current position of the drive is blocked.

4.3.3 CMSX-P-...-...-S-...-A (single-acting)

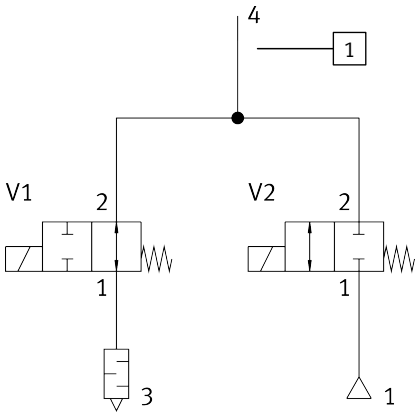


Fig. 6: Safety position CMSX-P-S-...-S-...-A

[1] Working port (4)

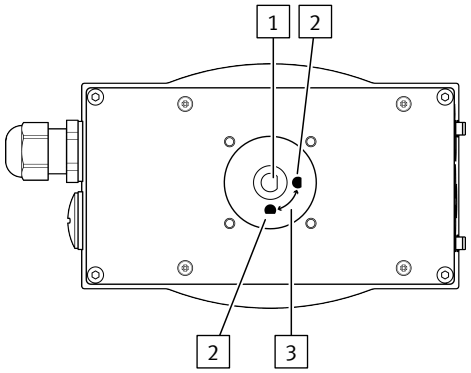
– Working port (4) is exhausted.
– The process valve is opened or closed depending on the drive.

5 Mounting

5.1 Mounting CMSX-PS-... on a semi-rotary drive

5.1.1 Positioning mechanical coupling

The angular position of the semi-rotary drive is detected by the shaft of the positioner. The shaft can be rotated as desired. It does not have a mechanical stop. The permissible sensing range is 100°. The mounting position of the mechanical coupling on the shaft determines the detectable swivel range of the drive.



1 Positioner shaft with flat spot
2 Identification of the alignment of the flat spot
3 Identification of the detection range

Fig. 7: Detection range of the positioner

Position of the mechanical coupling upon delivery

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 mechanical coupling must be positioned on the shaft of the positioner depending on the alignment.

The mechanical coupling is preassembled in the delivery status:
– For an anticlockwise direction of motion of the drive during exhaust.
– For aligning the positioner parallel to the drive.
If the direction of motion of the drive or the orientation of the positioner is to be changed, the position of the mechanical coupling on the positioner shaft must be changed.

Checking correct mounting of the mechanical coupling

Requirement: the semi-rotary drive is in the neutral position.

1. Determine the direction of rotation of the drive.
2. Place the positioner with the mounted mechanical coupling on the drive and align it parallel.
3. Remove the positioner with the mounted mechanical coupling and check the position of the mechanical coupling underneath the positioner.
   ⇨ The threaded pin for mounting the mechanical coupling must be located at the start of the marked detection range.
   ⇨ The threaded pin must move within the identified range for the determined direction of rotation of the drive.

Changing position of the mechanical coupling

Requirement: the semi-rotary drive is in the neutral position.

1. Remove the threaded pin of the mechanical coupling. Rotate the mechanical coupling on the shaft in the desired direction so the alternative threaded hole is above the flat section of the shaft.
2. Lock the mechanical coupling with the threaded pin.
   – Tightening torque: 0.5 Nm ± 15%

5.1.2 Installing positioner

- Select the mounting position so the underside of the device is protected from spray and moisture.
- Use only mounting adapters DARQ-K-P-A1-F05 or DADG-AK-F6-A2
  ➔ www.festo.com/sp.

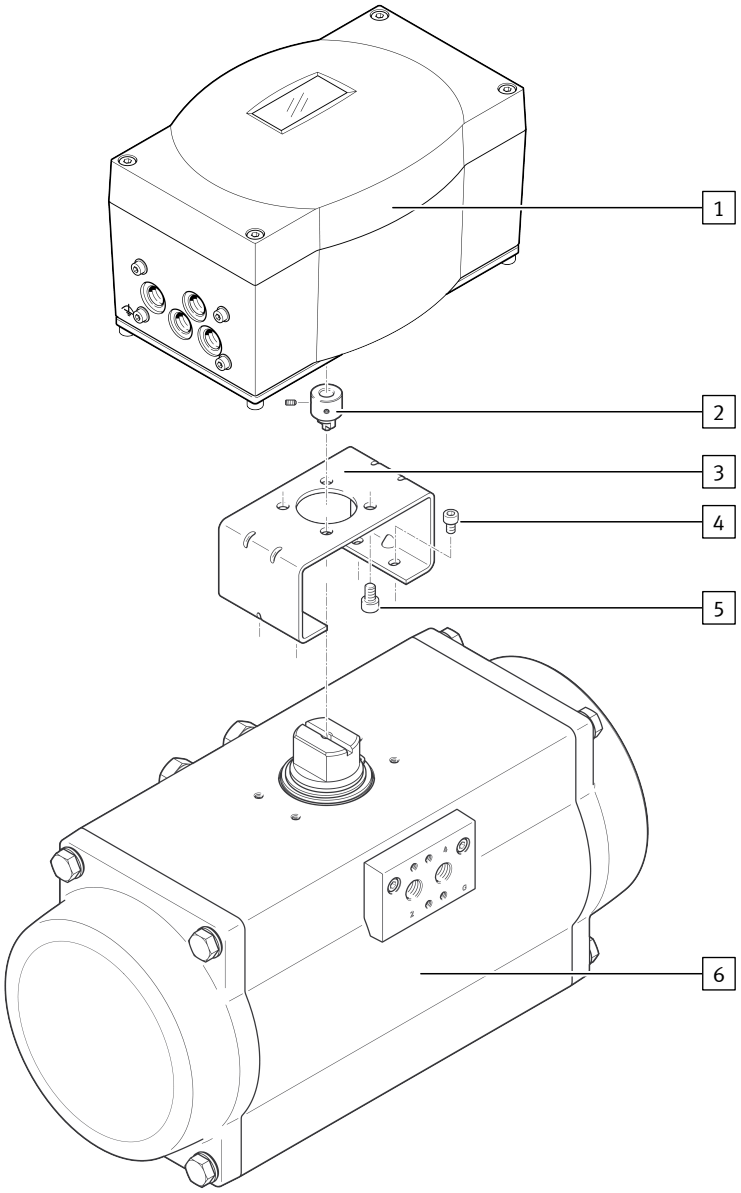


Fig. 8: Mount CMSX-PS-... on a semi-rotary drive DFPD

1	Positioner	4	4 M5 retaining screws
2	Mechanical coupling, preassembled	5	4 M4 retaining screws
3	Mounting adapter	6	Semi-rotary drive

1. Switch off compressed air and power supply to the drive.

2. Check that the mechanical coupling is correctly installed ➔ 5.1.1 Positioning mechanical coupling.
3. Fasten the mounting adapter to the positioner.
   – 4 M4 retaining screws
   – Tightening torque 1.5 Nm ± 20%
4. Place the positioner with mounting adapter and mechanical coupling on the drive and align it. Make sure that transverse forces do not act on the shaft of the positioner during alignment.
5. Fasten the mounting adapter to the drive.
   – 4 M5 retaining screws
   – Tightening torque: 3 Nm ± 10%

5.2 Mounting CMSX-P-SE-... in the linear drive DFPI-...-E-NB3

This chapter describes the attachment of the positioner to the linear drive DFPI-...-E-NB3 with the adapter kit DADG-AK-F6-A2.

- Select the mounting position so the underside of the device is protected from spray and moisture.
- Use adapter kit DADG-AK-F6-A2 ➔ www.festo.com/sp.

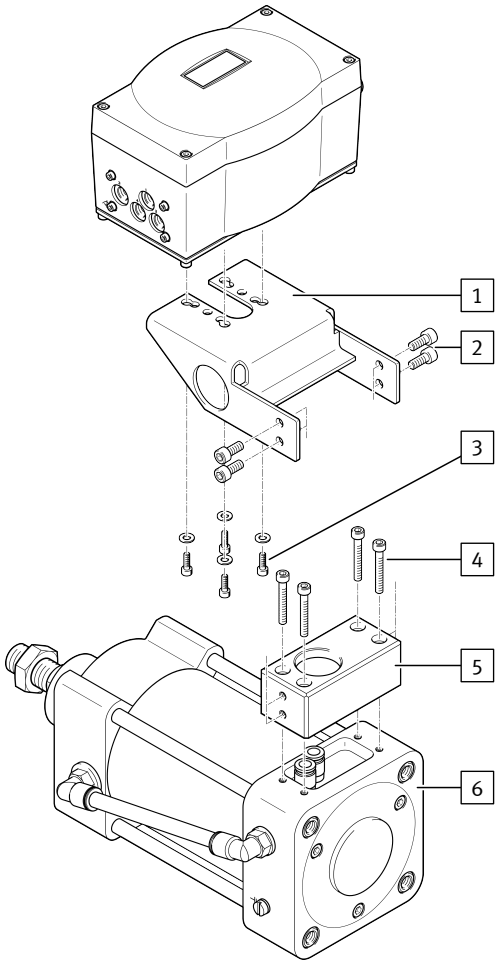


Fig. 9: Mount CMSX-P-SE-... on the drive DFPI-...-E-NB3-...

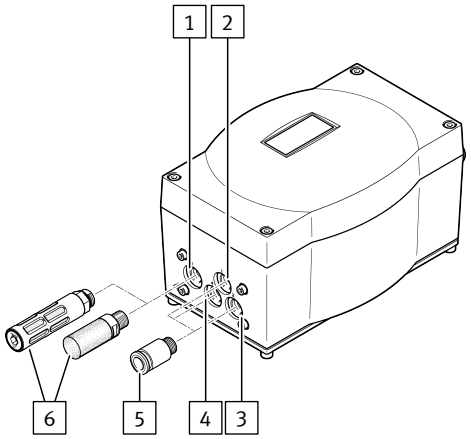
1	Mounting adapter	4	4 M5 retaining screws
2	4 M6 retaining screws	5	Flange receptacle
3	4 M4 retaining screws	6	Linear drive

1. Switch off compressed air and power supply to the drive.

2. Fasten the mounting adapter to the positioner.
   – 4 M4 retaining screws
   – Tightening torque 1.5 Nm ± 20%
3. Fasten the flange receptacle to the linear drive:
   – 4 M5 retaining screws
   – Tightening torque 2.7 Nm ± 10%
4. Fasten the positioner with the mounting adapter to the flange receptacle.
   – 4 M6 retaining screws
   – Tightening torque 3 Nm ± 20%

6 Installation

6.1 Pneumatic installation



1 Exhaust port (3)
2 Supply port (1)
3 Working port (2)
4 Working port (4)
5 QS-1/8-...-I push-in fitting (accessory)
6 Silencer (accessory)

Fig. 10: Pneumatic installation

Recommendation: use push-in fittings type QS-1/8-...-I and tubing type PUN. Keep tubing short.

1. Switch off compressed air and power supply.
2. Connect working port (2) and working port (4) to the working ports of the pneumatic drive with tubing.
   For single-acting drives: only connect working port (4), seal working port (2) with a blanking plug.
3. Connect the supply port (1) to the compressed air source.
4. Screw a suitable silencer into the exhaust port (3).

6.2 Electrical installation

6.2.1 Establish electrical connection

⚠ WARNING

Risk of injury due to electric shock.

- For the electric power supply, use only PELV or SELV circuits that guarantee a reliable electric disconnection from the mains network.
- Observe IEC 60204-1/EN 60204-1.
- Connect all circuits for operating and load voltage supplies.

⚠ 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

The IP65 degree of protection depends on the type of electrical connection. Unsuitable cables or incorrect installation reduce the degree of protection of the product.

1. Switch off compressed air and power supply.
2. Unscrew the housing screws and remove the housing cover.
3. Run the electrical connecting cable through the cable fitting to the terminal strips.
   – Length of the connecting cable: max. 30 m
   – Outside diameter of the connecting cable: 7 … 13 mm
   – Cable cross-section: max. 1.5 mm²
   – Use wire end sleeves.
4. Additionally with CMSX-SE-...: run connecting cable for external displacement/angle sensor to the terminal strip through the cable fitting.
   – Outside diameter of the connecting cable: 3 … 6.5 mm
   – Cable cross-section: max. 1.5 mm²
   – Use wire end sleeves.
5. Wire the electrical connections ➔ Tab. 6 Pin allocation of terminal strips.
   – Tightening torque: max. 0.6 Nm
6. Connect the earth terminal to the earth potential with low impedance (short cable with large cross-section).
   – Tightening torque: 0.7 Nm
7. Optional: fasten the shield of an external displacement encoder to the circuit board ➔ Fig. 3.
   – Tightening torque: 0.7 Nm
8. Tighten the union nut on the cable connector.
   – Tightening torque: 1.5 Nm
9. Place the housing cover in position and tighten the 4 housing screws.
   – Make sure that the seal is positioned correctly.
   – Tightening torque: 1.5 Nm

6.2.2 Wiring diagram

Pin allocation of terminal strips

Pin	Identifier	Description	Function
Terminal strip 1			
1	S+	Operating voltage of sensor +5 V DC	Connection of an external displacement/angle sensor with a total resistance of at least 5 kΩ
2	SO	Sensor signal actual value (0 … 5 V DC)	
3	S–	Operating voltage of sensor 0 V galvanically connected to 0 V DC	

Pin	Identifier	Description	Function
4	AI+	Isp+/Usp+	Setpoint input 4 … 20 mA, 0… 20 mA 0 … 10 V
5	AI–	Isp–/Usp– galvanically connected to 0 V	
6	VDC+	Operating voltage +24 V DC	System supply
7	VDC–	Operating voltage 0 V	
8	AO–	Current output signal – galvanically connected to 0 V DC	Analogue output for position feedback 4 … 20 mA
9	AO+	Current output signal +	
10	ERROR	ALARM digital output	Alarm output
11	DO1	Digital output OUT 1	Status output
12	DO2	Digital output OUT 2	
13	EXT VDC+	Load voltage +24 V DC	Supply to the digital outputs
14	EXT VDC–	Load voltage 0 V	
Terminal strip 2			
15	DI+	Digital input +	Digital input for triggering functions
16	DI–	Digital input –	

Tab. 6: Pin allocation of terminal strips

6.2.3 Connection, digital outputs

The digital outputs ALARM, OUT 1 and OUT 2 can be connected as either PNP or NPN outputs. The positioner must be parameterised according to the electrical connection of the digital outputs ➔ 7.4.3.14 DO-Mod – switching mode of digital outputs.

Connection as PNP outputs

– The PNP outputs are positive switching.
– Connect negative load pole to pin 14.

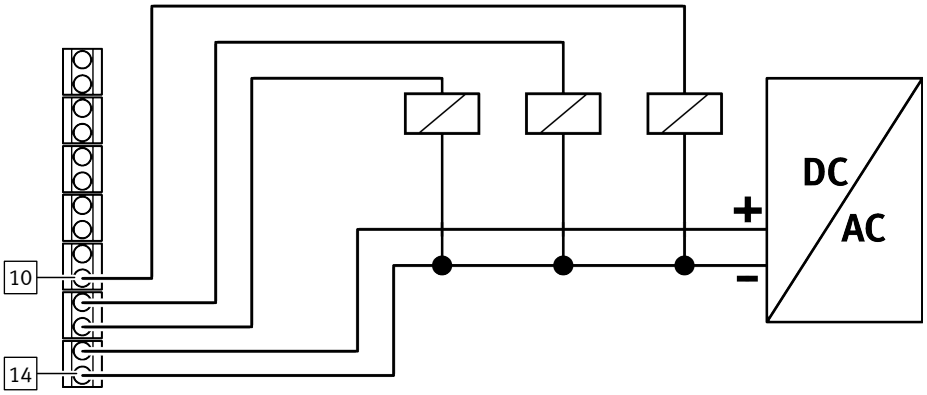


Fig. 11: PNP connection for the digital outputs ALARM, OUT 1, OUT 2

Connection as NPN outputs

– The NPN outputs are negative switching.
– Connect positive load pole to pin 13.

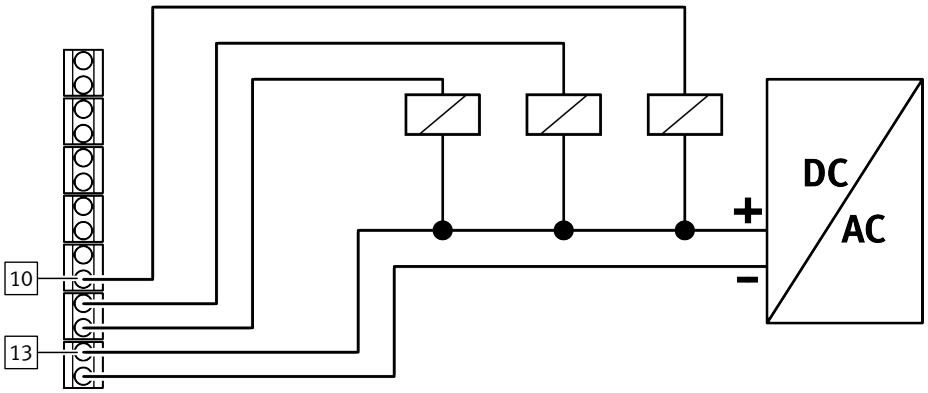


Fig. 12: NPN output for the digital outputs ALARM, OUT 1, OUT 2

6.2.4 Digital input connection

The digital input can be connected as PNP or NPN input.

Connection as PNP input

– The PNP input is positive switching.
– Switch is located between 24 V DC and digital input.

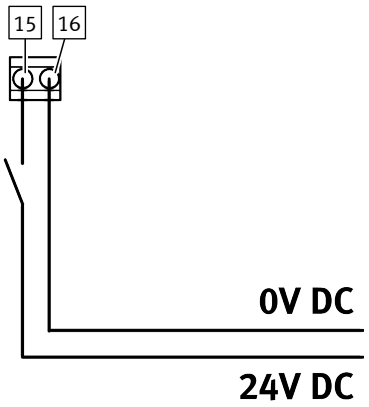


Fig. 13: PNP connection for the digital input

Connection as NPN input:

– The NPN input is negative reading.
– Switch is located between digital input and 0 V DC.

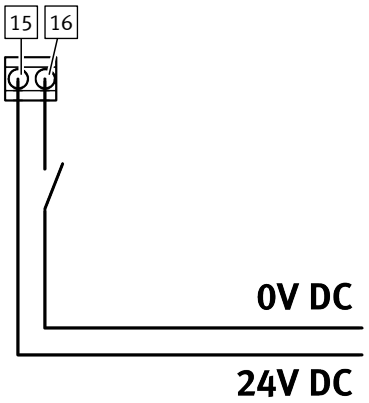


Fig. 14: NPN connection for the digital input

7 Commissioning

7.1 Operation and display

The settings on the device are made with the "Add", "Sub" and "Set" buttons ➔ 4.1.2 Controls and display elements. The housing cover must be removed to operate the buttons.

7.1.1 Function of the operating buttons

Symbol	Operation	Function
△	Press Add	– Switch to next menu item – Increment parameter values – In manual positioning mode: manual pressurisation
▽	Press Sub	– Switch to previous menu item – Decrement parameter values – In manual positioning mode: manual exhaust
▷	Press Set	– Selection of a parameter or menu item – Acceptance of the set value
△*	Press and hold Add for 3 seconds	– Fast incrementing of parameter values
▽*	Press and hold Sub for 3 seconds	– Fast decrementing of parameter values
⏮*	Press and hold Set for 3 seconds	– Switch between basic and main menu – Exit submenus
☑/🔓*	Press and hold Add and Set for 3 seconds	– Selection of an option – Acceptance of the set value – Switch mode of operation

Tab. 7: Key symbols and functions

7.1.2 Critical interactions

Interactions with far-reaching effects are specially protected as critical interactions through an additional query.
Critical interactions include:
– Calling an initialisation routine (A-Init in INIT submenu)
– Calling the sensor test (Sensor in INIT submenu)
– Resetting parameters to factory settings (FReset in DEVICE submenu)
– Saving a user-defined configuration (SaveCf in DEVICE submenu)
– Loading the last saved user-defined configuration (LoadCf in DEVICE submenu)

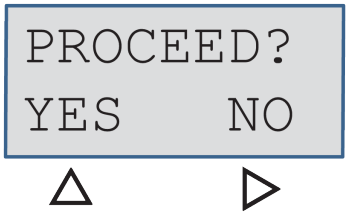


Fig. 15: Additional query in case of a critical interaction

– "Add" calls the function.
– "Set" skips back without calling the function.

7.1.3 Input of numerical values

Default

Numerical values are entered incrementally with the "Add" and "Sub" buttons.
- Briefly pressing the "Add" button increments the current numerical value.
- Briefly pressing the "Sub" button decrements the current numerical value.
- Press and hold the "Add" or "Sub" button to make greater changes to the numerical value.

Control parameters

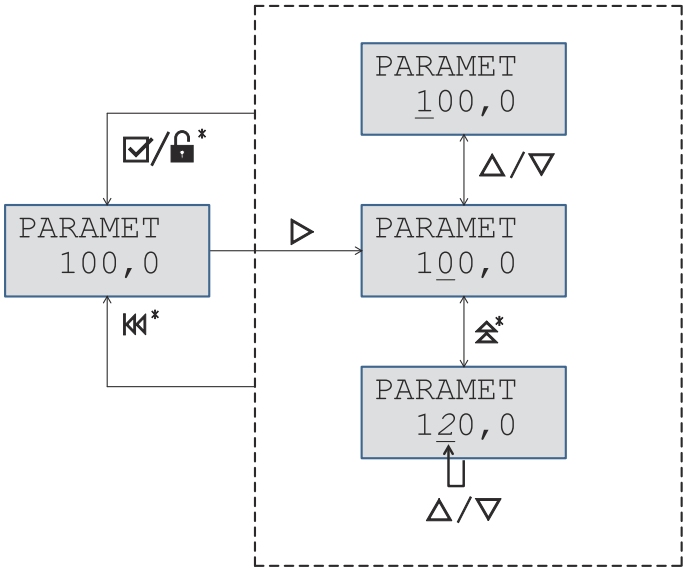


Fig. 16: Entering numerical values one digit at a time

The values of the control parameters (P, I, D) are entered digit by digit.

1. Press the "Add" or "Sub" button until the digit you want to change is underlined.
2. Press the "Set" button.
   ⇨ The digit that is to be changed flashes and can now be changed with the "Add" and "Sub" buttons.
3. To save the numerical value, press and hold the "Add" and "Set" buttons,
   ⇨ The "saved" message appears briefly. The numerical value is saved.
4. To exit the menu without saving the numerical value, press and hold the "Set" button for 3 seconds.

7.1.4 Applying changes

Value input or selection of an option

Applying changes requires a confirmation. If the change is not confirmed, any changes will be discarded when you exit the screen.

- To confirm the change: press and hold the "Add" and "Set" pushbuttons for 3 seconds.
  ⇨ The change is saved. The display shows "saved" momentarily.

Input of interpolation points

The setpoint characteristic curve is defined by interpolation points to which a freely selectable setpoint position can be assigned. Input of the interpolation points effects a change as soon as you switch to the next interpolation point with the "Set" button. The change cannot be discarded here.

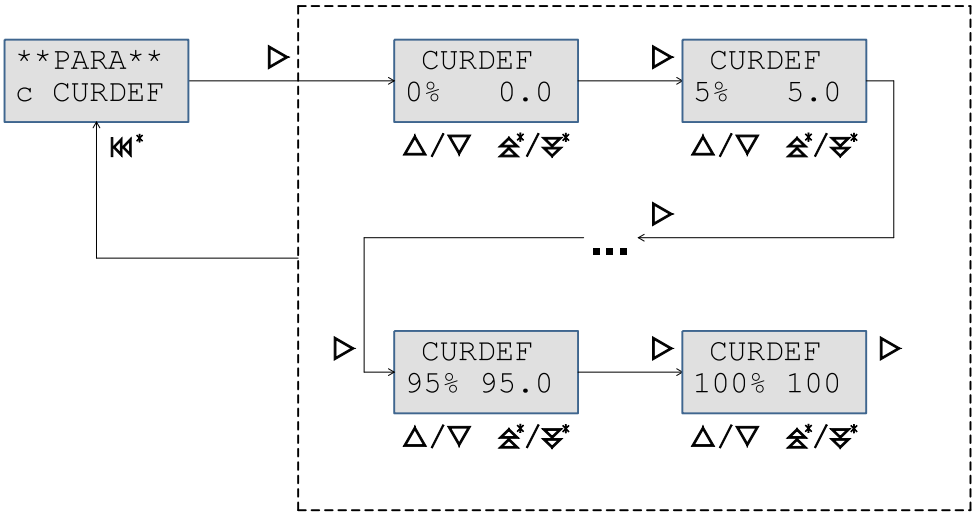


Fig. 17: Change of grid points

1. To confirm the change of the interpolation point, press the "Set" pushbutton.
   ⇨ The change is saved. The next interpolation point is called. After the last interpolation point, the display returns to the first interpolation point.
2. To exit the menu, press and hold the "Set" button for 3 seconds.

7.2 Menu structure

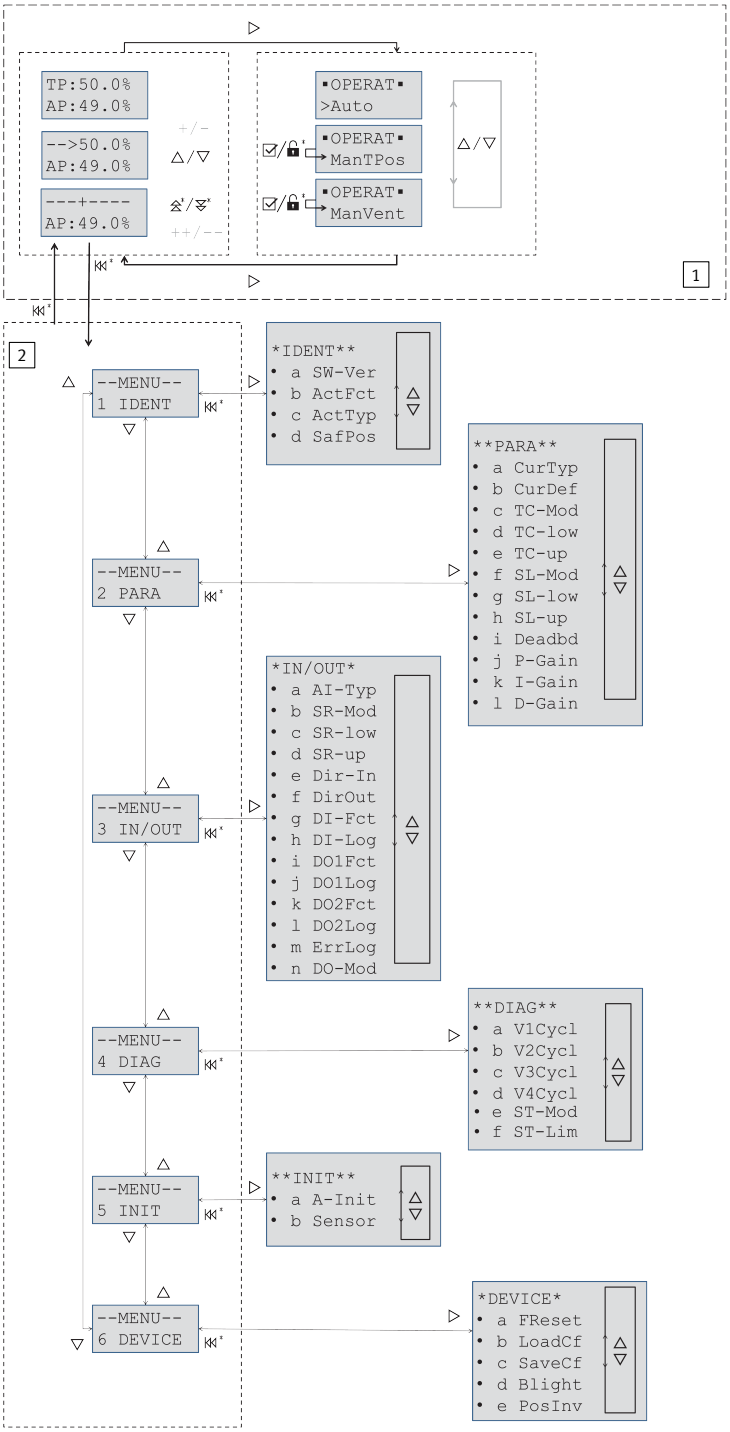


Fig. 18: Menu structure

1 Base menu

2 Main menu

7.3 Base menu

After switching on the operating voltage supply, the display shows the default view in the basic menu. The default view displays information about the current operating mode or system messages. The operating mode can be changed in a submenu.

To switch between the basic menu and the main menu, press and hold the "Set" button for 3 seconds.
After 30 minutes without input, the device automatically switches to the default view.

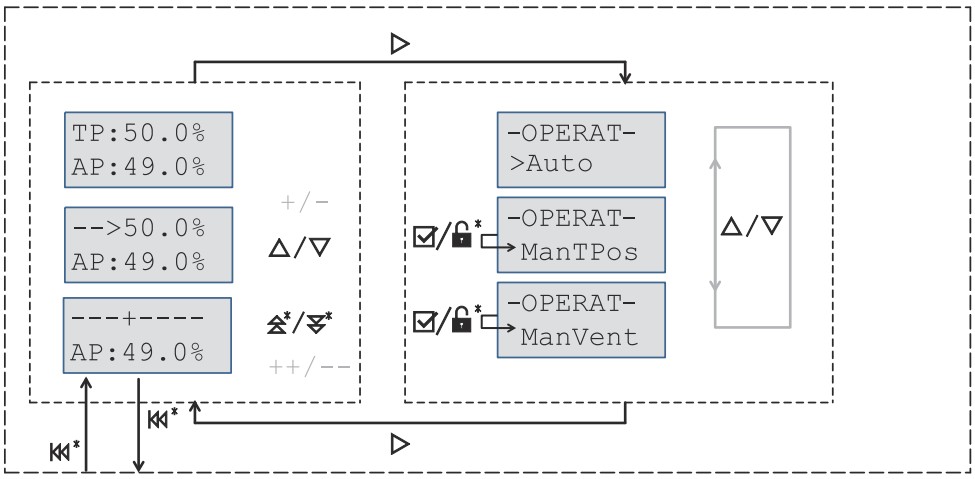


Fig. 19: Base menu

7.3.1 Default view - operating mode

The default view shows the setpoint position and the actual position of the current operating mode. The positions can be changed in the manual operating modes.

Example	Operating mode	Description
TP:50.0% AP:49.0%	Automatic mode (preset)	TP: specified setpoint position at the analogue input (target position) AP: actual position
-->50.0% AP:49.0%	Manual setpoint position mode The setpoint position can be manually input by pressing the "Add" or "Sub" buttons. The selected position is approached at the analogue input independently of the setpoint specification.	TP: manually specified setpoint position (target position) AP: actual position
---+---- AP:49.0%	Manual manipulated variable mode Manual pressurisation and exhaust of the outlets by pressing the "Add" or "Sub" buttons. The selected position is approached at the analogue input independently of the specified setpoint position (closed-loop controller inactive).	1st line: signal from the displacement/angle sensor as a plus sign. The plus sign moves in accordance with the movement of the drive AP: actual position[1)]

1) only if the positioner is initialised

Tab. 8: Operating modes on the display in the default view

Selecting operating mode

Prerequisite: the default view is shown on the display.

1. Press "Set" button.
   ⇨ The current operating mode is displayed.
2. Select the desired operating mode with the "Add" or "Sub" buttons. The selection is indicated by a leading character "›".
3. Press and hold the "Add" and "Set" buttons for 3 seconds.
   ⇨ The display switches to the default view.

7.3.2 Manual operation

Changing setpoint position

1. Select the manual setpoint position operating mode ‘ManTPos’ and confirm the selection.
2. Press and hold the "Add" or "Sub" button.
   ⇨ The specified setpoint position is shown in the display but is not yet applied.
3. Release the "Add" or "Sub" button.
   ⇨ The positioner approaches the setpoint position.

Executing manual positioning mode

1. Select the positioning operating mode ‘ManVent’ and confirm the selection.
2. Press the "Add" or "Sub" button.
   ⇨ The positioner moves directly in the desired direction during input.

7.3.3 Default view - system messages

Deviations from normal operation are shown in the default view. In addition to the display, the flashing backlight also indicates pending errors.

Apart from the default view, additional system messages may appear as information during specific routines.

View in display[1)]	Flashing backlighting	Description	Example
TP: --.-%	yes	Setpoint signal invalid or outside specification	TP:--.-% AP:18.3%
NO INIT	no	Positioner not yet initialised	TP:50.0% NO INIT
AP:--.-%	yes	Initialisation not successful	TP:50.0% AP:--.-%
DI*	no	Signal at the digital input	DI*50.0% AP:49.0%
Default view in automatic mode	yes	Settling time exceeded	TP:50.0% AP:37.7%

1) combinations of error messages possible

Tab. 9: System messages in the default view

7.4 Main menu

Parameters can be displayed and changed in the main menu.

To switch between the basic menu and the main menu, press and hold the "Set" button for 3 seconds.
After 30 minutes without input, the device automatically switches to the default view.

7.4.1 Parameter overview - 1 IDENT

Parameters for identification of the specific product variant are displayed in the ‘IDENT’ menu. The ‘TP-Mod’ parameter can be changed.

Index	Parameters	Description	Reference
a	SW-Ver	Software version	➔ 7.4.1.1 SW-Ver – software version
b	ActFct	Drive function	➔ 7.4.1.2 ActFct – drive function
c	TP-Mod	Target position mode	➔ 7.4.1.3 TP-Mod - setpoint position mode
d	SafPos	Safety position of the positioner	➔ 7.4.1.4 SafPos – fail-safe position of the positioner

Tab. 10: ‘IDENT’ menu: identification of the positioner

7.4.1.1 SW-Ver – software version

This parameter displays the software version of the positioner.
The identification is classified into three levels XX.YY.ZZ according to NAMUR recommendation NE53.

Value	Description
XX	Identification level 1 in accordance with NE53. Versioning due to lack of backward compatibility with the previous software version, the functionality or technical specification of the product or a security vulnerability. The operating instructions are changing.
YY	Identification level 2 in accordance with NE53. Versioning for additional functionality of the product. Compatibility with the previous software version is maintained. The operating instructions are changing.
ZZ	Identification level 3 in accordance with NE53. Versioning for minor bug fixes and scope of operation. Compatibility with the previous software version is maintained. The operating instructions do not change.

Tab. 11: SW-Ver parameter – software version

7.4.1.2 ActFct – drive function

This parameter displays the drive function supported by the positioner.

Value	Description
single	single-acting drives (CMSX-P-...-S-...)
double	double-acting drives (CMSX-P-...-D-...)

Tab. 12: ActFct parameter - drive function

7.4.1.3 TP-Mod - setpoint position mode

This parameter can be used to specify the response for double-acting drives when the setpoint position is reached. This parameter has no effect on a single-acting drive.

Value	Description
cls-out	Closing the pneumatic outputs – Suitable primarily for double-acting linear drives and very small drives (linear or rotary). – The air is trapped in the drive to retain the position.
prs-out	Pressurisation of the pneumatic outputs – Suitable primarily for double-acting rotary drives. This mode provides improved stability against external influences. – Both chambers of the drive are pressurised to retain the position.

Tab. 13: TP-Mod parameter - setpoint position mode

7.4.1.4 SafPos – fail-safe position of the positioner

This parameter displays the fail-safe position of the positioner.

Value	Description
safe	Regulating effect opening or closing (CMSX-P-...-A)
freeze	Regulating effect holding (CMSX-P-...-C)

Tab. 14: SafPos parameter – fail-safe position of the positioner

7.4.2 Overview of parameters - 2 PARA

Parameters for the control response of the positioner can be modified the ‘PARA’ menu.

Index	Parameters	Description	Reference
a	CurTyp	Type of setpoint characteristic curve	➔ 7.4.2.1 CurTyp – type of setpoint characteristic curve
b	CurDef	User-defined characteristic curve	➔ 7.4.2.2 CurDef – user-defined characteristic curve
c	TC-Mod	Tight-closing mode	➔ 7.4.2.3 TC-Mod – tight-closing mode
d	TC-low	Value for the lower tight-closing limit	➔ 7.4.2.4 TC-low – value for lower tight-closing limit
e	TC-up	Value for the upper tight-closing limit	➔ 7.4.2.5 TC-up – value for upper tight-closing mode
f	SL-Mod	Stroke-limitation mode	➔ 7.4.2.6 SL-Mod – stroke-limitation mode
g	SL-low	Lower stroke limitation value	➔ 7.4.2.7 SL-low – lower stroke limitation value
h	SL-up	Upper stroke limitation value[1)]	➔ 7.4.2.8 SL-up – upper stroke limitation value
i	Deadbd	Deadband	➔ 7.4.2.9 Deadbd – Deadband
j	P-Gain	P-proportion of the PID controller	➔ 7.4.2.10 P-Gain – P-proportion of the PID controller

Index	Parameters	Description	Reference
k	I-Gain	I-proportion of the PID controller	➔ 7.4.2.11 I-Gain – I-proportion of the PID controller
l	D-Gain	D-proportion of the PID controller	➔ 7.4.2.12 D-Gain – D-proportion of the PID controller

1) The value for the upper stroke limitation must be greater than the value for the lower stroke limitation.

Tab. 15: PARA menu: parameterisation of setpoint functions

7.4.2.1 CurTyp – type of setpoint characteristic curve

This 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
inactiv	Linear characteristic curve (factory setting)
1:25	Equal-percentage characteristic curve
1:33	
1:50	
25:1	Inverse equal-percentage characteristic curve
33:1	
50:1	
userdef	User-defined characteristic curve

Tab. 16: CurTyp parameter - type of setpoint characteristic curve

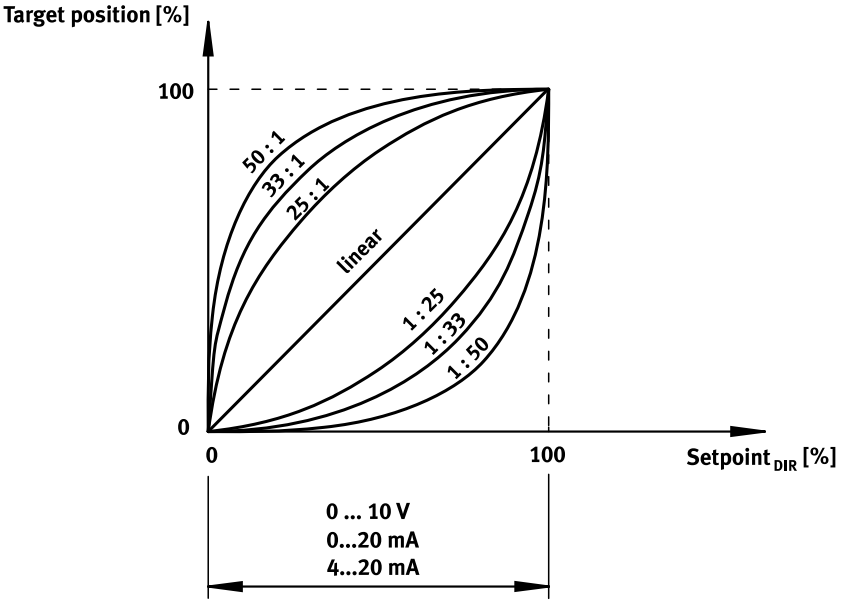


Fig. 20: Setpoint characteristic curves

7.4.2.2 CurDef – user-defined characteristic curve

This parameter enables the user-defined setpoint characteristic curve to be defined over 21 interpolation points. The interpolation points are distributed equidistantly over the setpoint range from 0 to 100%. The distance between the

individual interpolation points is 5%. Every interpolation point can be assigned a setpoint position in the setting range of 0...100%. The setpoint positions of the interpolation points can only be selected in ascending order.

Interpolation point	Setting range	Description
0.0 %	0.0 ... 98.0 %	Interpolation point with standardised setpoint value 0% Factory setting: 0%
5.0 %	0.1 ... 98.1 %	Interpolation point with standardised setpoint value 5% Factory setting: 5%
...		
95.0 %	1.9 ... 99.9 %	Interpolation point with standardised setpoint value 95% Factory setting: 95%
100.0 %	2.0 ... 100.0 %	Interpolation point with standardised setpoint value 100% Factory setting: 100%

Tab. 17: CurDef parameter - support points

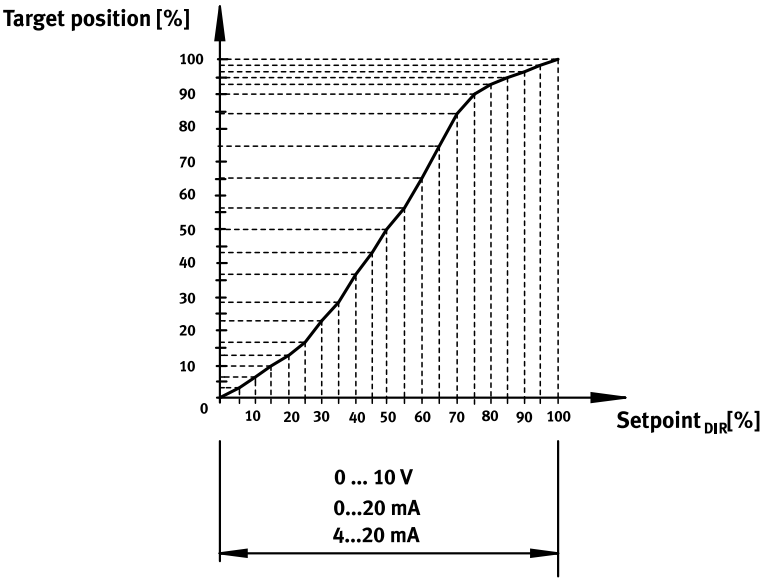


Fig. 21: Interpolation points

7.4.2.3 TC-Mod – tight-closing mode

Tight-closing mode can be activated with this parameter. During tight-closing the valve moves to the end position with the maximum actuating force of the drive. The tight-closing mode can be activated on one side or for both end positions. The tight-closing mode becomes effective when the setpoint value reaches the lower or upper value for tight-closing.

Value range	Description
inactiv	Tight-closing mode deactivated (factory setting)
bothact	Tight-closing mode for the lower and upper value of tight-closing limit active
up_act	Tight-closing mode for the upper value of tight-closing limit active
low_act	Tight-closing mode for the lower value of tight-closing limit active

Tab. 18: TC-Mod parameter - tight-closing mode

Stroke limitation and tight closing cannot be active simultaneously in one end position. If it is not possible to change the mode, a message appears on the display.

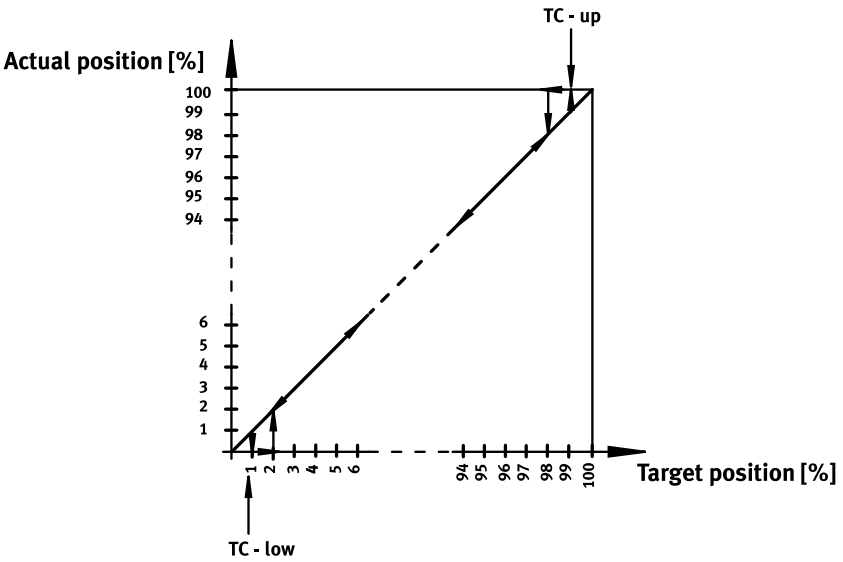


Fig. 22: Tight-closing mode

7.4.2.4 TC-low – value for lower tight-closing limit

This parameter defines the lower value of the tight-closing limit. If the setpoint position of the positioner is below the set value, the valve is moved to the lower end position at maximum positioning force.

Value range	Description
0.0 ... 45.0 %	Factory setting: 2.0%

Tab. 19: TC-low parameter - value for tight closing limit below

7.4.2.5 TC-up – value for upper tight-closing mode

This parameter defines the upper value of the tight-closing limit. If the setpoint position of the positioner is above the set value, the valve is moved to the upper end position at maximum positioning force.

Value range	Description
55.0 ... 100.0 %	Factory setting: 98.0%

Tab. 20: TC-up parameter - value for upper tight-closing limit

7.4.2.6 SL-Mod – stroke-limitation mode

This parameter can be used to restrict the working range of the positioner. The restriction is independent of the type of setpoint characteristic. The setpoint position of the setpoint value characteristic curve corresponds to the setpoint position of the stroke limitation.

Value range	Description
inactiv	Stroke-limitation mode deactivated (factory setting)
bothact	Stroke-limitation mode for the lower and the upper stroke-limitation value active
up_act	Stroke-limitation mode for the upper stroke limitation value active
low_act	Stroke limitation mode for the lower stroke limitation value active

Tab. 21: SL-Mod parameter - stroke limiting mode

Stroke limitation and tight closing cannot be active simultaneously in one end position. If it is not possible to change the mode, a message appears on the display.

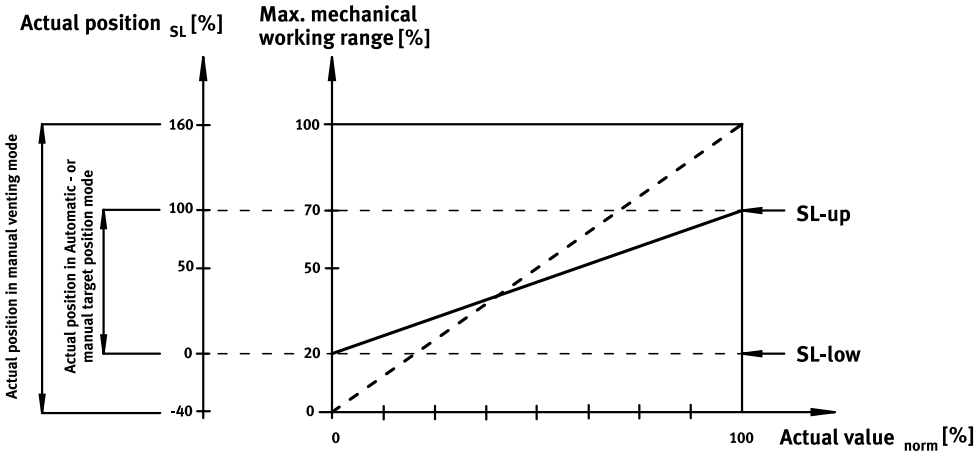


Fig. 23: Stroke limitation

7.4.2.7 SL-low – lower stroke limitation value

This parameter defines the lower value of the stroke limitation. The value must be less than the value of the SL-up parameter.

Value range	Description
0.0 ... 90.0 %	Permissible setting range, factory setting:0.0 %

Tab. 22: SL-low parameter - lower stroke limitation value

7.4.2.8 SL-up – upper stroke limitation value

This parameter defines the value of the upper stroke limit. The value must be greater than the value of the SL-low parameter.

Value range	Description
10.0 ... 100.0 %	Permissible setting range, factory setting:100.0 %

Tab. 23: SL-up parameter - upper stroke limitation value

7.4.2.9 Deadbd – Deadband

The deadband of the PID controller can be set with this parameter. The deadband defines a range around the setpoint position within which the closed-loop controller does not react to deviations.

The size of the deadband influences the reaction of the positioner to a deviation:

– A deadband that is too small results in oscillations around the setpoint position up to permanent oscillations (instability). The process valve, drive and solenoid valves of the positioner are subjected to unnecessary loads.
– A deadband that is too large results in low positioning accuracy.

Value range	Description
0.5 ... 10.0 %	Permissible setting range, factory setting:1.0 %

Tab. 24: Deadbd parameter - deadband

If the deadband < 1% is selected: activate tight-closing mode at both end positions ➔ 7.4.2.3 TC-Mod – tight-closing mode.
Recommended values:

- Lower tight-closing limit TC-low: ≤ 1%
- Upper tight-closing limit TC-up: ≥ 99%

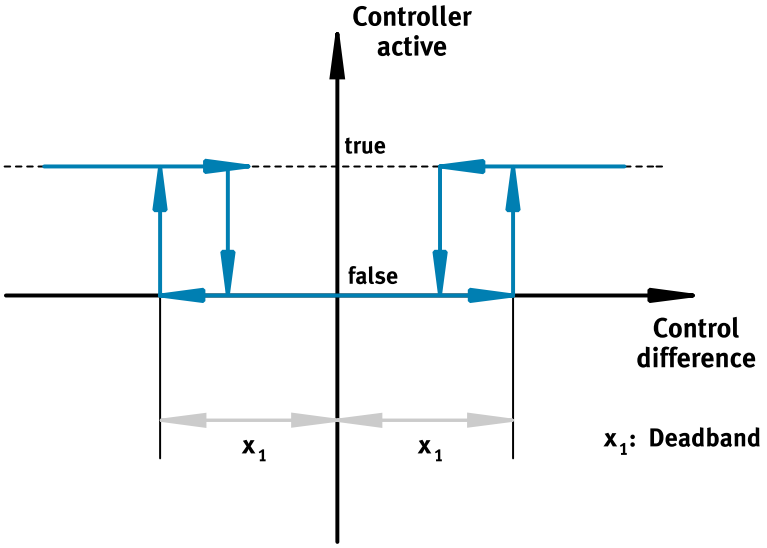


Fig. 24: Deadband

7.4.2.10 P-Gain – P-proportion of the PID controller

For most drives, the controller parameters are optimally determined during automatic initialisation. The parameters should only be changed if the automatic initialisation does not result in a satisfactory control response.

This parameter defines the proportional gain factor of a PID controller. The P-proportion influences the speed and stability of the closed-loop control.
– The greater the value the greater the positioning change in the case of a deviation.
– A P-proportion that is too high results in overshoots.
– A P-proportion that is too low slows the closed-loop control.

Value range	Description
0 … 25000	P-proportion of the PID controller

Tab. 25: P-Gain parameter - P-share of the PID controller

7.4.2.11 I-Gain – I-proportion of the PID controller

For most drives, the controller parameters are optimally determined during automatic initialisation. The parameters should only be changed if the automatic initialisation does not result in a satisfactory control response.

This parameter defines the integral gain factor of a PID controller. The I-proportion dynamically counteracts the D-proportion of a PID controller. This influences the speed and stability of the closed-loop control.
– As the I-proportion increases, the speed of the closed-loop control decreases.

Value range	Description
0 … 25000	I-proportion of the PID controller

Tab. 26: I-Gain parameter - I-proportion of the PID controller

7.4.2.12 D-Gain – D-proportion of the PID controller

For most drives, the controller parameters are optimally determined during automatic initialisation. The parameters should only be changed if the automatic initialisation does not result in a satisfactory control response.

This parameter defines the differential gain factor of a PID controller.
- The greater the value the greater the setpoint specification change in the case of a deviation.
- A D-proportion that is too high makes the closed-loop control more dynamic.
- A D-proportion that is too low slows the closed-loop control.

Value range	Description
0 … 25000	D-proportion of the PID controller

Tab. 27: D-Gain parameter - D-proportion of the PID controller

7.4.3 Parameter overview - 3 IN/OUT

Parameters that determine the response of the analogue and digital inputs and outputs are configured in the ‘IN/OUT’ menu.

Index	Parameters	Description	Reference
a	AI-Typ	Type of analogue input	➔ 7.4.3.1 AI type – type of analogue input
b	SR-Mod	Split range mode (restriction of the setpoint range)	➔ 7.4.3.2 SR-Mod – split-range mode
c	SR-low	Value for lower split range limit	➔ 7.4.3.3 SR-low – value for lower split-range limit
d	SR-up	Value for upper split range limit	➔ 7.4.3.4 SR-up – value for upper slip-range limit
e	Dir-In	Setpoint value direction	➔ 7.4.3.5 Dir-In – set-point value direction
f	DirOut	Position feedback direction	➔ 7.4.3.6 DirOut – position feedback direction
g	DI-Fct	Digital input function	➔ 7.4.3.7 DI-Fct – digital input function
h	DI-Log	Digital input logic	➔ 7.4.3.8 DI-Log – digital input logic
i	DO1Fct	Digital output 1 function	➔ 7.4.3.9 DO1Fct – digital output 1 function
j	DO1Log	Digital output 1 logic	➔ 7.4.3.10 DO1Log – digital output 1 logic
k	DO2Fct	Digital output 2 function	➔ 7.4.3.11 DO2Fct – digital output 2 function
l	DO2Log	Digital output 2 logic	➔ 7.4.3.12 DO2Log – digital output 2 logic

Index	Parameters	Description	Reference
m	ErrLog	Switching logic of digital alarm output	➔ 7.4.3.13 ErrLog – digital alarm output logic
n	DO-Mod	Switching mode of digital outputs	➔ 7.4.3.14 DO-Mod – switching mode of digital outputs

Tab. 28: ‘IN/OUT’ menu: configuration of the analogue and digital inputs and outputs

7.4.3.1 AI type – type of analogue input

This parameter defines the analogue input as a voltage or current input.

Value	Description
0 … 10 V	Voltage input 0 … 10 V
0 … 20 mA	Current input 0 … 20 mA
4 … 20 mA	Current input 4 … 20 mA (factory setting)

Tab. 29: AI type parameter – type of analogue input

7.4.3.2 SR-Mod – split-range mode

This parameter can be used to activate a restriction of the setpoint range. The limits are set with the SR-low and SR-up parameters ➔ 7.4.3.3 SR-low – value for lower split-range limit, ➔ 7.4.3.4 SR-up – value for upper slip-range limit.

Value	Description
inactiv	Split-range mode deactivated (factory setting)
bothact	Split-range mode for lower and upper limit active
up_act	Split-range mode for upper limit active
low_act	Split-range mode for lower limit active

Tab. 30: SR-Mod parameter - split-range mode

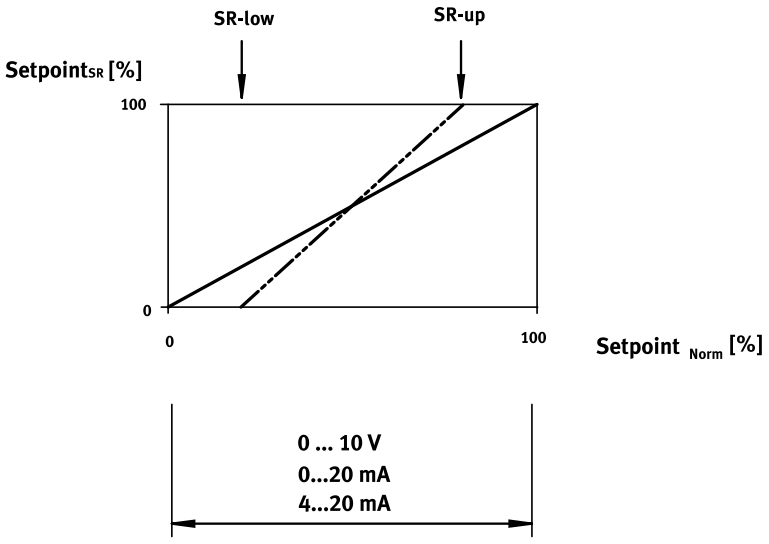


Fig. 25: Split range

7.4.3.3 SR-low – value for lower split-range limit

This parameter defines the lower limit value of the split range.

Value	Description
0 … 99 %	Factory setting: 0%

Tab. 31: SR-low parameter - value for split-range lower limit

7.4.3.4 SR-up – value for upper slip-range limit

This parameter defines the upper limit value of the split range.

Value	Description
0 ... 100 %	Factory setting: 100%

Tab. 32: SR-up parameter - value for upper split-range limit

7.4.3.5 Dir-In – setpoint value direction

This parameter defines the effective direction between the setpoint value and the setpoint position. The setting is made independently of the setpoint characteristic curve.

Value	Description
rising	The setpoint position is incremented with a rising setpoint value (factory setting).
falling	The setpoint position is incremented with a falling setpoint value.

Tab. 33: Dir-In parameter - setpoint value direction

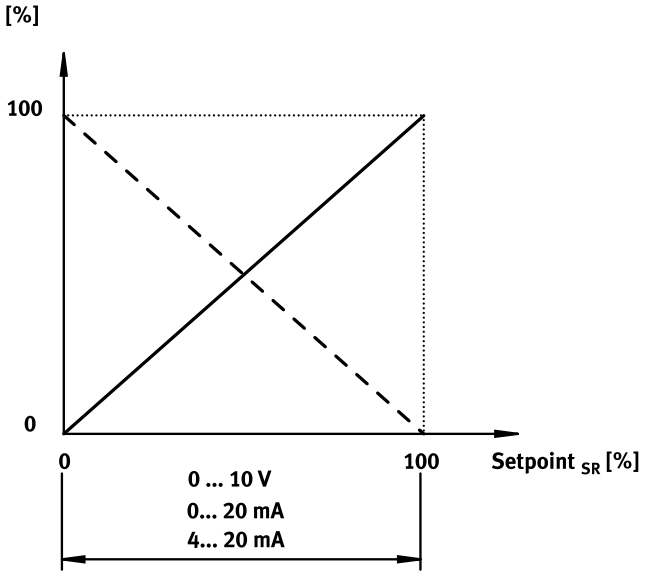


Fig. 26: Setpoint value direction

7.4.3.6 DirOut – position feedback direction

This parameter defines the effective direction between actual value and actual position.

Value	Description
rising	The position feedback is incremented as the actual position rises (factory setting)
falling	The position feedback is incremented as the actual position falls

Tab. 34: DirOut parameter - position feedback direction

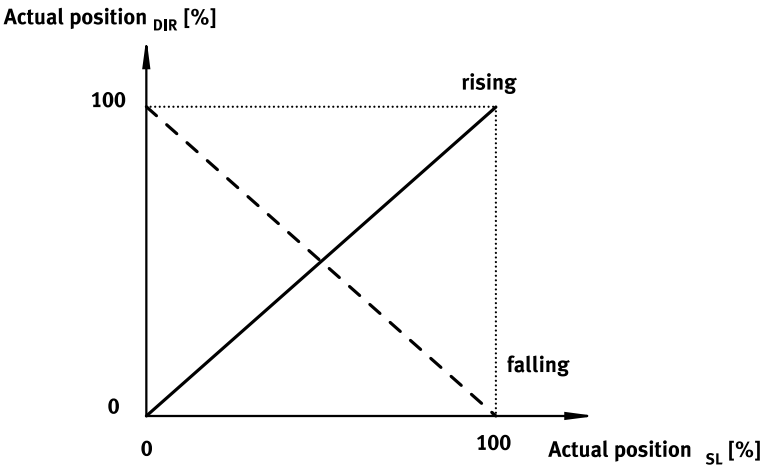


Fig. 27: Position feedback direction

7.4.3.7 DI-Fct – digital input function

This parameter defines the function of the digital input.

Value	Description
inactiv	No function at the digital input (factory setting)
stop	Pneumatic outputs 2 and 4 are closed.
exhaust	Exhausting pneumatic output 2 and pressurising pneumatic input 4
pressur	Pressurising pneumatic output 2 and exhausting pneumatic input 4
a-init	automatic initialisation

Tab. 35: DI-Fct parameter - digital input function

7.4.3.8 DI-Log – digital input logic

This parameter defines the switching logic at the digital input.

Value	Description
lowact	Switching logic active low: the set function is activated at low level
highact	Switching logic active high: the set function is activated at high level (factory setting)

Tab. 36: DI-Log parameter - digital input logic

7.4.3.9 DO1Fct – digital output 1 function

This parameter defines the action that activates digital output 1.

Value	Description
inactiv	Digital output 1 deactivated (factory setting)
lowlmt	Activation when the lower position limit is reached (2%)
uplmt	Activation when the upper position limit is reached (98%)
bothlmt	Activation when the upper position limit (98%) or the lower position limit (2%) is reached

Tab. 37: DO1Fct parameter - digital output 1 function

7.4.3.10 DO1Log – digital output 1 logic

This parameter defines the switching logic at digital output 1.

Value	Description
lowact	Switching logic active low: low level is output when digital output 1 is activated.
highact	Switching logic active high: high level is output when digital output 1 is activated (factory setting)

Tab. 38: DO1Log parameter - digital output 1 logic

7.4.3.11 DO2Fct – digital output 2 function

This parameter defines the action that activates digital output 2.

Value	Description
inactiv	Digital output 2 deactivated (factory setting)
lowlmt	Activation when the lower position limit is reached (2%)
uplmt	Activation when the upper position limit is reached (98%)
bothlmt	Activation when the upper position limit (98%) or the lower position limit (2%) is reached

Tab. 39: DO2Fct parameter - digital output 2 function

7.4.3.12 DO2Log – digital output 2 logic

This parameter defines the switching logic at digital output 2.

Value	Description
lowact	Switching logic active low: low level is output when digital output 2 is activated.
highact	Switching logic active high: high level is output when digital output 2 is activated (factory setting)

Tab. 40: DO2Log parameter - digital output 2 logic

7.4.3.13 ErrLog – digital alarm output logic

This parameter defines the switching logic at the digital alarm output.
The digital alarm output is activated in the following cases:
– Initialisation not successful
– Setpoint value outside the specification
– Actuator cannot reach required target position

Value	Description
lowact	Switching logic active low: low level is output when the alarm output is activated.
highact	Switching logic active high: high level is output when the alarm output is activated (factory setting)

Tab. 41: Parameter ErrLog – logic digital alarm output

7.4.3.14 DO-Mod – switching mode of digital outputs

This parameter defines the switching mode of the D-OUT-1, D-OUT-2, ALARM digital outputs. The positioner must be connected in accordance with the selected parameter value ➔ 6.2.3 Connection, digital outputs.

Value	Description
PNP	PNP polarity, positive switching (factory setting)
NPN	NPN polarity, negative switching

Tab. 42: DO-Mod parameter - switching mode of digital outputs

7.4.4 Parameter overview – 4 DIAG

Diagnostic functions can be configured in the ‘DIAG’ menu.

Index	Parameters	Description	Reference
a	V1CYCL	Number of switching cycles solenoid valve 1	➔ 7.4.4.1 V1CYCL, V2CYCL, V3CYCL, V4CYCL - number of switching cycles solenoid valve
b	V2CYCL	Number of switching cycles solenoid valve 2	
c	V3CYCL	Number of switching cycles solenoid valve 3	
d	V4CYCL	Number of switching cycles solenoid valve 4	
e	ST-MOD	Effective threshold of the settling time	➔ 7.4.4.2 ST-MOD - effective threshold of the settling time
f	ST-LIM	User defined threshold settling time	➔ 7.4.4.2 ST-MOD - effective threshold of the settling time

Tab. 43: DIAG menu: diagnostic functions

7.4.4.1 V1CYCL, V2CYCL, V3CYCL, V4CYCL - number of switching cycles solenoid valve

The counters sum up the control processes of the solenoid valves and serve to evaluate the switching frequency. The characteristic service life value of the individual solenoid valves is load-dependent and averages about 10 million switching cycles.

Value	Description
0 … 1^{10}	Number of actuation processes per solenoid valve

Tab. 44: V1CYCL, V2CYCL, V3CYCL, V4CYCL diagnostics – number of switching cycles of solenoid valve

7.4.4.2 ST-MOD - effective threshold of the settling time

The settling time of the positioner is monitored as soon as the device is in control operation. If, after a setpoint change, the controller deadband is not reached within the time defined as the threshold, an error message is issued.
This parameter defines how the threshold for monitoring the settling time is set.

Value	Description
system	A threshold determined by the system during initialisation is used to monitor the settling time (factory setting)
userdef	A user-defined threshold is used to monitor the settling time

Tab. 45: ST-MOD diagnostics – effective threshold of the settling time

7.4.4.3 ST-LIM - user-defined settling time threshold

This parameter sets the value for the user-defined settling time threshold. Once set, this value cannot be overwritten by the system, except by Factory Reset.

Factory Reset resets the value to the default value (recommended when changing the system configuration).

Value	Description
1 … 6000 s	User-defined threshold for monitoring the settling time

Tab. 46: ST-LIM diagnostics – user-defined settling time threshold

7.4.5 Parameter overview – 5 INIT

Routines for commissioning can be started in the ‘INIT’ menu.

Index	Parameters	Description	Reference
a	A-Init	Start automatic initialisation	➔ 7.4.5.1 A-Init – start automatic initialisation
b	Sensor	Start sensor test	➔ 7.4.5.2 Sensor – start sensor test

Tab. 47: INIT menu: commissioning

7.4.5.1 A-Init – start automatic initialisation

This function starts the automatic initialisation of the positioner ➔ 7.8 Perform initialisation.

7.4.5.2 Sensor – start sensor test

This function starts the sensor test to check that the working range of the drive is within the detection range of the displacement/angle sensor ➔ 7.7 Checking sensing range of the displacement/angle sensor.

After the sensor test the device remains in the "ManVent" mode regardless of the prior operating status.

7.4.6 Parameter overview - 6 DEVICE

Configuration and display settings can be made in the ‘DEVICE’ menu.

Index	Parameters	Description	Reference
a	FReset	Reset the parameters to factory settings. The device is finally in the non-initialised state	➔ 7.4.6.1 FReset – reset parameters to factory setting
b	LoadCf	Loading the last saved user-defined configuration	➔ 7.4.6.2 LoadCf – load the last saved user-defined configuration
c	SaveCf	Saving the user-defined configuration	➔ 7.4.6.3 SaveCf – saving the user-defined configuration
d	BLight	Configuration of the backlight of the display	➔ 7.4.6.4 BLight – configuration of the display backlight
e	PosInv	Inversion of the position indicator on the display	➔ 7.4.6.5 PosInv - inversion of the position indicator on the display

Tab. 48: ‘DEVICE’ menu: device configuration

7.4.6.1 FReset – reset parameters to factory setting

This function resets all parameters to the factory settings. A user-defined configuration saved with SaveCf will be overwritten. The device is finally in the non-initialised state.
Recommendation: after a change in the system structure, reset the positioner to factory settings with FReset and reinitialise it.

7.4.6.2 LoadCf – load the last saved user-defined configuration

This function can be used to load the last saved user-defined configuration.

7.4.6.3 SaveCf – saving the user-defined configuration

This function saves the currently set user-defined configuration. The previously saved user-defined configuration will be overwritten.

Recommendation: after successful commissioning, save the user-defined configuration as individual defaults.

7.4.6.4 BLight – configuration of the display backlight

This parameter defines when the display backlight is active.

Value	Description
on press	The backlight of the display is switched on for 10 s when the operating buttons are pressed.
always	The backlight of the display is always switched on.

Tab. 49: BLight parameter – backlight of the display

7.4.6.5 PosInv - inversion of the position indicator on the display

This parameter can be used to invert the position shown in the display in %. The direction of action of the setpoint value and the direction of action of the position feedback are not influenced by this parameter ➔ 7.4.3.5 Dir-In – setpoint value direction, ➔ 7.4.3.6 DirOut – position feedback direction.

Value	Description
inactive	The inversion of the position indicator on the display is inactive.
active	The inversion of the position indicator on the display is active. 0% becomes 100% and 100% becomes 0%.

Tab. 50: PosInv parameter - inversion of the position indicator on the display

7.5 Schematic view of the mode of action of the parameters

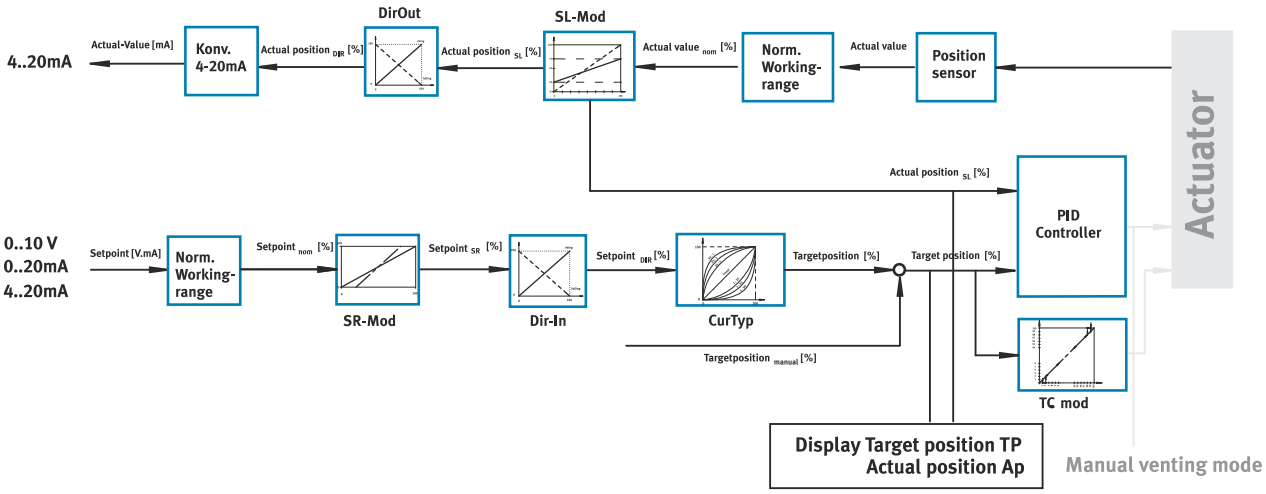


Fig. 28: Signal processing

7.6 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.
   ⇨ "NO INIT" display.
3. Check the sensing range of the displacement/angle sensor ➔ 7.7 Checking sensing range of the displacement/angle sensor.
4. Run the initialisation ➔ 7.8 Perform initialisation
5. On completion of initialisation, replace the housing cover. Make sure that the seal is positioned correctly.
6. Tighten the 4 housing screws.
   – Tightening torque: 1.5 Nm.

Restarting after power failure

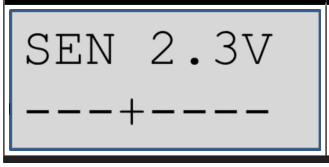
After an interruption of the electrical power supply of an initialised positioner, the positioner restarts with the last effective operating mode. The current setpoint value takes effect immediately.

Recommissioning in a changed installation situation

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

7.7 Checking sensing range of the displacement/angle sensor

The sensor test can be used to check that the working range of the drive is within the detection range of the displacement/angle sensor. During the test the outputs are pressurised and exhausted directly, as in manual positioning value operation.

Example	Description
	1st line: voltage value of the current position of the sensor (value range from 0 to 5.0 V) 2nd line: relative position of the sensor on an axis over the entire sensing range

Tab. 51: Display during sensor test

1. In the ‘5 INIT’ menu call the ‘Sensor’ function.
2. Use the "Add" and "Sub" buttons to approach the two end positions.
   ⇨ The signal from the position/angle sensor is shown as a plus sign in the lower line of the display.
   ⇨ If the movement of the drive from one end position to the other end position is shown as a continuous movement of the plus sign on the display, the working range of the drive is within the sensing range of the displacement/angle sensor. The positioner is correctly mounted on the drive.
   ⇨ If the plus sign on the display skips from the right side of the display to the left side or vice versa when the drive moves from one end position to the other end position, the working range of the drive is not within the sensing range of the displacement/angle sensor. The positioner is not correctly mounted on the drive. Correct the mounting of the positioner on the drive ➔ 5 Mounting. Then repeat the sensor test.
3. Press the "Set" button.
   ⇨ The positioner switches to the manual ‘ManVent’ positioning mode, regardless of the previous operating status.

7.8 Perform initialisation

The permissible stroke range and the controller parameters are determined during initialisation. Both end positions are approached in succession independently from the pending setpoint value. The positioner can only be initialised automatically.

It must be initialised in the following cases:

– during commissioning
– after changes in the system structure
– after reset to factory settings (Factory Reset)

Every initialisation overwrites the existing initialisation. If the initialisation fails, the positioner is in the non-initialised state.

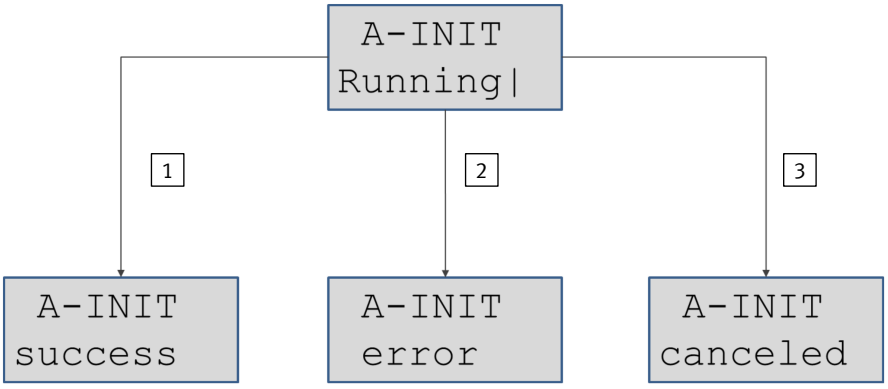


Fig. 29: Automatic initialisation messages

1 Initialisation successful
2 Initialisation aborted by system
3 Initialisation aborted by user

Starting initialisation

1. In the ‘5 INIT’ menu call the ‘A-Init’ function.
2. Press and hold the "Add" and "Set" pushbuttons for 3 seconds.
   ⇨ Automatic initialisation begins. The initialisation may take several minutes depending on the drive. During initialisation the display shows ‘running’.
   ⇨ After successful completion of the initialisation, the display shows ‘success’. The display returns to the ‘5 INIT’ menu.
   ⇨ If the system aborts the initialisation with the ‘error’ message, the initialisation was not successful. The positioner is in the non-initialised state. Clear the reason for the initialisation abort and restart the automatic initialisation.

Aborting initialisation

The initialisation can be aborted by the user by pressing and holding the "Set" button. Then the ‘cancelled’ message appears briefly and the positioner switches back to the ‘5 INIT’ menu.

8 Operation

- Observe the operating conditions.
- Observe limit values.

After the supply voltage is switched on, the positioner is in the same operating status and the same operating mode that was valid before the supply voltage was switched off.

9 Malfunctions

For possible error messages ➔ 7.3.3 Default view - system messages.

Malfunction	Cause	Remedy
Error in positioning	Initialisation was not performed	– Perform initialisation ➔ 7.8 Perform initialisation
	Solenoid valves of the positioner defective	– Replace device.
	mechanical connection between positioner and drive defective	– Check mechanical connection. – Ensure that the mechanical coupling is firmly seated. – Replace defective mechanical coupling
	no or unstable compressed air supply	– Ensure a stable compressed air supply.
Overshoot or continuous oscillation of the drive	Controller parameters set incorrectly	– Correct setting ➔ 7.4.2 Overview of parameters - 2 PARA
	Particularly with smaller drives: positioning speed on the drive too high	– Reduce the flow rate in the working line of the positioner, e.g. by installing a throttle valve.
	With double-acting drives: setpoint position mode for defining the response when the setpoint position is reached was incorrectly set	– Correct setting ➔ 7.4.1.3 TP-Mod - setpoint position mode
The drive does not move to the specified position if the operating voltage fails	Tubing connection between positioner and drive defective	– Correct the tubing connection.
The positioner does not respond to the analogue setpoint specification	Analogue input type incorrectly set	– Correct analogue input type ➔ 7.4.3 Parameter overview - 3 IN/OUT
	manual setpoint positioning mode (Man-Vent or ManTPos) active	– Activate automatic mode ➔ 7.3 Base menu
	Setpoint input defective	– Check setpoint value. – Replace device.
	Device not initialised	– Perform initialisation ➔ 7.8 Perform initialisation.
The drive travels to an end position, even though a different setpoint value is specified	Safety setting active or digital input active	– Deactivate digital input (DI-FCT) ➔ 7.4.3 Parameter overview - 3 IN/OUT. – Check the electrical connection (setpoint specification within the permissible range).

Tab. 52: Fault clearance

10 Disassembly

⚠ 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.

Dismantling CMSX-...

1. Switch off compressed air.
2. Activate in the manual operation base menu: ‘ManVent’.
3. Move drive until the working ports are completely exhausted.
4. Switch off power supply.
5. Unscrew housing screws and remove the housing cover.
6. Disconnect electrical and pneumatic connections.
7. Unscrew 4 retaining screws and remove the positioner with the mounting adapter.

11 Technical data

11.1 Technical data, general

CMSX		
Certificates, declaration of conformity		➔ www.festo.com/sp
Design		digital, electro-pneumatic positioner
Mounting position		any
Mode of operation of displacement encoder		Potentiometer
Sensing range	[°]	0 ... 100
Display		LCD, backlight
Deadband size	[%]	0.5 ... 10
Mode of operation		
CMSX-P-...-C-U-F1-S-...		single-acting
CMSX-P-...-C-U-F1-D-...		double-acting
Design features		
CMSX-P-...-C-U-F1-S-...-A		Fail-safe position – pneumatic output 4 exhausted
CMSX-P-S-C-U-F1-D-...-A		Fail-safe position – pneumatic output 4 exhausted, pneumatic outlet 2 pressurised
CMSX-P-...-C-U-F1-...-C		Fail-safe position - pneumatic outputs closed
Ambient conditions		
Ambient temperature	[°C]	–5 ... +60
Storage temperature	[°C]	–20 ... +60
Relative humidity	[%]	5 ... 95, non-condensing
Degree of protection		IP65
Shock resistance		Shock test with severity level 1 in accordance with FN 942017-5 and EN 60068-2-27 as per EN 60068-2-29
Vibration resistant		Transport application test with severity level 2 in accordance with FN 942017-4 and EN 60068-2-6 as per EN 60068-2-6
Contamination level		3

CMSX	
Materials	
Housing	PC reinforced
Inspection window material	PC
Base plate	Anodised wrought aluminium alloy
Shaft	high-alloy stainless steel
Coupling	high-alloy stainless steel
Screws	high-alloy stainless steel
Seals	NBR
Cable fitting	PA
Blanking plug	PA

Tab. 53: Technical data, general

11.2 Technical data, pneumatic

Pneumatic data		
Operating pressure	[MPa]	0.3 ... 0.8
	[bar]	3 ... 8
	[psi]	43.5 ... 116
Operating medium		Compressed air in accordance with ISO 8573-1:2010 [7:4:4]
Information on the operating medium		Lubricated operation not possible
Pneumatic connection		G1/8
Standard nominal flow rate		
CMSX-...-50	[l/min]	50
CMSX-...-130	[l/min]	130

Tab. 54: Technical data, pneumatic

11.3 Technical data, electrical

Electrical specifications		
Nominal operating voltage	[V]	24
Operating voltage range DC	[V]	21.6 ... 26.4
max. current consumption	[mA]	600
Reverse polarity protection		for operating voltage connection
Connection resistance	[kΩ]	≤ 80 for external potentiometer with CMSX-P-SE-...

Tab. 55: Electrical specifications

Analogue input		
Signal range	[mA]	4 ... 20 0 ... 20
	[V]	0 ... 10
Linearity error at 25 °C	[%]	‹ 0.5
Temperature coefficient	[%FS/K]	‹ 0.02
Resolution	[bit]	16
Overload protection		yes
Electrical isolation		no

Tab. 56: Analogue input

Analogue output		
Signal range	[mA]	4 ... 20
max. load resistance	[Ω]	≤ 600
Linearity error at 25 °C	[%]	‹ 0.5
Temperature coefficient	[%FS/K]	‹ 0.02
Resolution	[bit]	12
Reverse polarity protection		yes
Short circuit current rating		yes
Overload protection		yes
Electrical isolation		no

Tab. 57: Analogue output

Digital input	
Input characteristics	as per IEC 61131-2, type 3
Switching input	PNP (positive switching) NPN (negative switching)
Reverse polarity protection	yes
Electrical isolation	yes, optocoupler

Tab. 58: Digital input

Digital output		
Supply voltage	[V]	24
Switching output		3 x PNP or 3 x NPN switchable
max. output current	[mA]	100
Reverse polarity protection		yes
Short circuit current rating		yes
Overload protection		yes
Electrical isolation		yes, optocoupler

Tab. 59: Digital output

Electrical connection		
Electrical connection 1		
Function		Power supply Power supply load Analogue input Analogue output Digital output Digital input
Connection type		Terminal strip
Connection technology		Screw terminal
Number of pins/cores		14
Tightening torque	[Nm]	‹ 0.6
Conductor cross section	[mm²]	‹ 1.5
Cable fitting		M20 x 1.5
Approved cable diameter	[mm]	7 ... 13
Max. cable length	[m]	30
Electrical connection 2 (for CMSX-P-SE-CU-F1-...)		
Function		Connection of external path/angle sensor
Connection type		Terminal strip
Connection technology		Screw terminal

Electrical connection		
Number of pins/cores		3
Cable fitting		M12 x 1.5
Approved cable diameter	[mm]	3 ... 6.5
Max. cable length	[m]	3

Tab. 60: Electrical connection

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