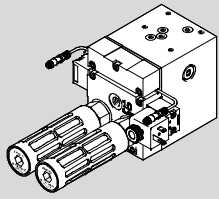


# PAHL-SM-RE



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(en) Operating instructions (Original instructions) 8027936 1310NH [8027938]

Original: de

## Shut-off valve PAHL-SM-RE ..... English

### 1 Safety

#### 1.1 General safety information



**Note**

##### Loss of the safety function

If measures to handle “common cause failures” (CCF) are not complied with, the safety function of the shut-off valve can be impaired.

- Make sure that the described measures for handling “common cause failures” (CCF) are complied with (➔ chap. 2.4 and chap. 11.1).



**Note**

##### Loss of the safety function

Non-compliance with the technical data can lead to loss of the safety function.

- Comply with the technical data.

#### 1.2 Intended use

The shut-off valve is intended exclusively for shutting off the pilot air of the pneumatically piloted pressure regulator PREL-186-HP3.

The valve is designed with two channels. It is equipped with two 2/2-poppet valves for this purpose, which are actuated through pilot solenoid valves.

Proximity switches are integrated for monitoring the switching position of the poppet valves. The safety function is achieved through a two-channel venting of the pilot pressure.

The switch-off valve can be used in combination with the pressure-reducing valve PREL-186-...-40CFX2 to implement the “safe venting” safeguarding. The safety function can only be achieved through appropriate activation and evaluation of the sensor signals.

In combination with connecting plates, the switch-off valve can also be used for other applications, such as between the pilot valve and control chamber of a pressure regulator. A safety function can only be achieved through appropriate activation and evaluation of the sensor signals and must be checked by the operator. In no application is it appropriate for safe switch-off of an input pressure.

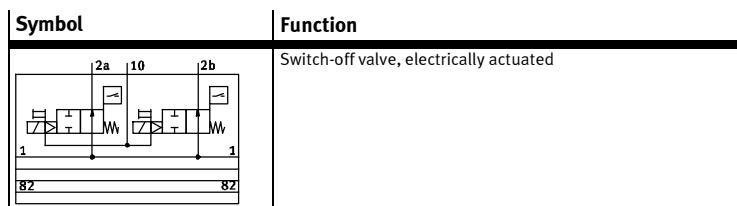


Fig. 1

The product is intended for installation in machines or automated systems and may be used only in the following ways:

- in an industrial environment
- within the limits of the product defined through the technical data (➔ 11 Technical data)
- in original status, without unauthorised modifications
- in perfect technical condition

### 1.3 Foreseeable misuse

The following foreseeable misuses are among those not approved as intended use:

- use outdoors
- use in a non-industrial area/residential area
- use outside the limits of the product defined in the technical data
- unauthorised modifications
- bypassing of the safety function
- use in reversible operation (reversal of supply and exhaust air)
- “low demand mode” in accordance with EN 61511 or vacuum operation



**Note**

In the event of damage caused by unauthorised manipulation or use other than that intended, the guarantee is invalidated and the manufacturer is not liable for damages.

### 1.4 Safety function in accordance with EN ISO 13849

For the safety function, the shut-off valve has control attributes of the control block enable, with which Performance Level d can be achieved.

The product has been developed and produced in accordance with the fundamental and reliable safety principles of EN ISO 13849-2.

The following requirements apply for the operator:

- Specifications on mounting and operating conditions in these operating instructions must be observed.
- For use in higher categories (2 to 4), the requirements of EN ISO 13849 (e.g. CCF) must be considered.
- The basic and proven safety principles of EN ISO 13849-2 relating to implementation and operation of the component must be satisfied.
- When using this product in machines or systems subject to specific C standards, the requirements specified in these standards must be observed.
- Before using the product, a risk evaluation corresponding to EN ISO 12100 in accordance with Machinery Directive 2006/42/EC, appendix I, paragraph 1 and 1.1.2 is necessary.
- The user is responsible for coordinating all applicable safety regulations and rules with the responsible authority and for complying with them.

### 2 Requirements for product use

- Make these operating instructions available to the design engineer and installer of the machine or system in which this product will be used.
- Keep these operating instructions during the entire product life cycle.
- Take into consideration the legal regulations applicable for the destination as well as:
  - regulations and standards,
  - regulations of the testing organizations and insurers,
  - national specifications.
- Connect the device in an appropriate way into the system control to integrate the “safe venting” safety function.

#### 2.1 Technical prerequisites

General conditions for the correct and safe use of the product, which must be observed at all times:

- Maintain the specified limits (e.g. for pressures, temperatures and electric voltages).
- Make sure there is a supply of correctly prepared compressed air in accordance with the specifications on the medium.
- Before mounting, remove particles in the supply lines through appropriate measures. In this way, you protect the product from premature failure and higher wear.
- Pressurize your entire system slowly. This allows avoidance of abrupt movements.
- Observe the warnings and notes in these operating instructions.
- Use the product in its original status, without any unauthorised product modifications.

#### 2.2 Qualification of trained personnel

Installation, mounting, commissioning, maintenance, repair and removal from operation may only be performed by qualified personnel with knowledge and experience with electrical and pneumatic control technology.

#### 2.3 Diagnostic coverage (DC)

Through switching position sensing of the poppet valve piston rest position, a dangerous failure can be detected in every channel. With conforming design of the test set-up in the control, a DC = 99% is achievable for switch-off. To achieve this, the signal sequence of the coil voltage and sensors must be evaluated.

## 2.4 Failures due to common cause (common cause failure – CCF)

Common cause failures cause the loss of the safety function, since in this case both channels in a two-channel system fail simultaneously.

Through the following measures, you ensure that common cause failures are avoided:

- Compliance with operating pressure limits
- Compliance with the maximum pilot pressure, if necessary through use of a pressure-relief valve
- Compliance with the permissible values for vibration and shock stress
- Compliance with the temperature range
- Compliance with compressed air quality conforming to the technical data, in particular avoidance of flash rust particles (for example, caused by servicing work) as well as compliance with the residual oil content of max. 0.1 mg/m<sup>3</sup> when using ester-containing oils (which may, for example, be contained in the compressor oil)
- Compliance with the maximum permissible pulse patterns with use in timed safety outputs
- Compliance with the permissible magnetic fields specified in data (keeping magnetic fields away)
- Compliance with the permissible operating voltages
- Exclusive use of the permitted silencers
- Check the silencer at regular intervals for contamination and replace it if necessary.

## 2.5 Range of application and approval certificates

The product is a safety device as defined in the Machinery Directive 2006/42/EC and carries the CE marking.



Safety-oriented standards and test values, which the product must comply with and fulfil, can be found in the section “Technical data”. The product-relevant EU directives and standards can be found in the declaration of conformity.

## 2.6 Standards

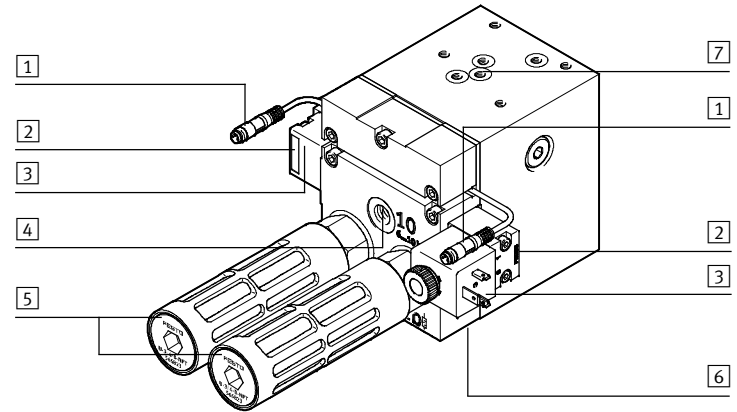
Standard	Title
EN ISO 13849-1	Safety of machinery - safety-related parts of control systems Part 1: General principles for design
EN ISO 13849-2	Safety of machinery - safety-related parts of control systems Part 2: Validation

Fig. 2

## 2.7 Service

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

## 3 Control sections and connections



- |   |   |
|---|---|
| 1 Electrical connection for proximity switch (M8, 3-pin)              | 5 Silencers – connections G $\frac{3}{4}$ [2a/2b] (in delivery) |
| 2 Manual override (MO)  | 6 Interface for pressure regulator PREL                         |
| 3 Solenoid valve  | 7 Interface for proportional pressure regulator VPPL            |
| 4 Pneumatic connection for auxiliary pilot air G $\frac{3}{4}$ – [10] |   |

Fig. 3

## 4 Installation



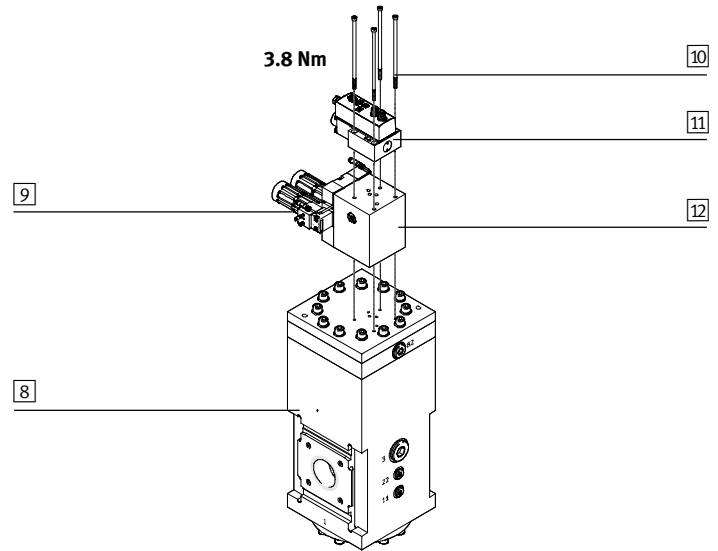
### Note

- Installation only by qualified personnel and only in accordance with the operating instructions.

• Check the system conditions on site before installation:

- The piping system is unpressurized and no medium flows in it.
- The supply lines are clean and free of wear-causing particles.
- Shut-off valves for venting the system are mounted in the compressed air supply line.

## 4.1 Assembly with pressure regulator PREL

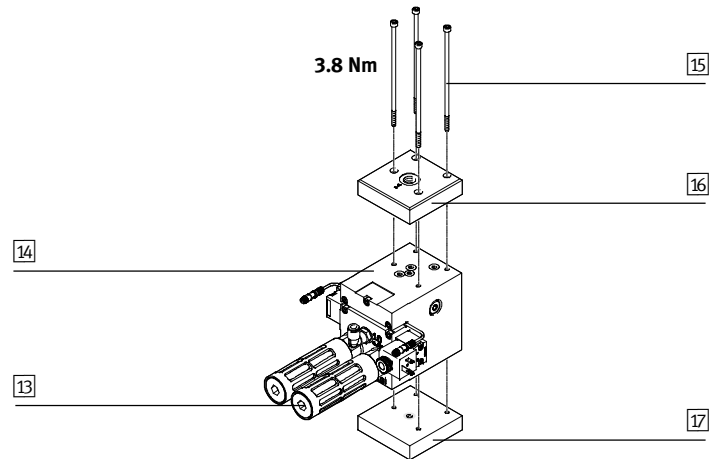


- |                           |   |
|---------------------------|---|
| 8 Pressure regulator PREL | 11 Proportional pressure regulator VPPL |
| 9 Silencer                | 12 Shut-off valve PAHL                  |
| 10 Mounting screws        |   |

Fig. 4

1. Mount the two silencers 9 (U-3/4-B – scope of delivery).
2. Flange-mount the proportional pressure regulator VPPL 11 onto the shut-off valve PAHL 12.
  - Make sure the O-rings are inserted between the shut-off valve PAHL and the proportional pressure regulator VPPL.
3. Flange-mount the combination of VPPL 11 and PAHL 12 onto the pressure regulator PREL 8.
  - Provide a mounting clearance for cable connection and tube couplings.
  - Tightening torques of the four mounting screws, 3.8 Nm.
  - Make sure the O-rings are inserted between the shut-off valve PAHL and the proportional pressure regulator PREL.

## 4.2 Assembly with connecting plates



- |                        |                            |
|------------------------|----------------------------|
| 13 Silencer            | 16 Connecting plate input  |
| 14 Shut-off valve PAHL | 17 Connecting plate output |
| 15 Mounting screws     |                            |

Fig. 5

1. Mount the two silencers 13 (U-3/4-B – scope of delivery).
2. Mount the two connecting plates 16 and 17 with 4 fastening screws 15, tightening torques 3.8 Nm.
  - Make sure the O-rings are inserted between the shut-off valve and the connecting plate.
  - Connecting plate input 16 and connecting plate output 17 must not be exchanged.
3. Connect the ports at the input (e.g. pilot valve output) and output (e.g. pressure regulator control chamber).

## 5 Electrical connection



### Warning

- Electrical connection may be made only by qualified personnel.
- Use only power sources which guarantee reliable electrical isolation of the operating voltage in accordance with IEC/DIN EN 60204-1.
- Observe the requirements for PELV power circuits as per IEC/DIN EN 60204-1.

- Before establishing the electrical connection, check the connecting cable:
  - The signal lines should not be longer than 30 m.
  - Use the pre-assembled cables from Festo.
  - The cables are installed free of crimping, kinking and stretching.

### 5.1 Proximity sensor

- Screw the signal cable to the terminal 1.
- Max. tightening torque 0.5 Nm.
- Pin allocation for M8 plug:

Pin	Cable colour <sup>1)</sup>	Allocation	M8 plug
1	Brown (BN)	+	
3	Blue (BU)	-	
4	Black (BK)	Output	

1) When using the pre-assembled Festo cables  
Fig. 6

### 5.2 Solenoid valves

- Plug the signal cable into the connection of the solenoid valve 3.
- Pin allocation for plug connection in accordance with EN 175301-803

## 6 Commissioning



### Note

The “safe venting” safety function is lost through actuation of the manual override.

- After commissioning, protect the solenoid valve from manipulation (e.g. paste over manual override).

### Linking to the machine control system

For error detection, the sensor signals of the proximity switches and the statuses of the output signals for the solenoid valves must be evaluated.

A logic test of the signals must be performed before commissioning.



### Note

The time span from solenoid valve activation to signal change of both sensors can last up to 500 ms, dependent on the control and operating pressure.

### 6.1 With pressure regulator PREL

1. Prior to commissioning, check the requirements:
  - The VPPL and PAHL are flange-mounted to the PREL.
  - The PREL is completely connected and ready for operation (→ operating instruction PREL-186).
  - Any necessary safety equipment is present and active.
2. Apply pilot pressure p10.
3. Check the signal change of the proximity switch (press manual override of the related solenoid valve).
4. Switch on the supply voltage.
5. Switch both solenoid valves of the PAHL to close the exhaust function. A signal change of the sensor signals must also take place.
6. Switch on the supply pressure.
7. Switch on the analogue setpoint signal (0 ... 10 V / 4 ... 20 mA).
8. Commission the entire device, consisting of VPPL, PAHL and PREL.

### 6.2 With connecting plates

1. Prior to commissioning, check the requirements:
  - For example, the PAHL is installed between the pilot valve and control chamber of the regulator.
  - The PAHL is completely connected and ready for operation.
  - Input and output side are not exchanged.
  - Any necessary safety equipment is present and active.
  - Depending on the configuration, residual pressures can remain, such as in the control chamber. These have to be determined and evaluated for the selected configuration.
2. Apply pilot pressure at p10.
3. Check the signal change of the proximity switch (press manual override of the related solenoid valve).

4. Switch both solenoid valves of the PAHL to close the exhaust function. A signal change of the sensor signals must also take place.
5. If necessary, switch on the supply voltage, supply pressure and setpoint signal.
6. Commission the entire device (e.g. consisting of PAHL, pilot valve and pressure regulator).

## 7 Operation



### Warning

Danger of injury from compressed air.

If one of the two solenoid valves fails, it is possible that the system will not be completely exhausted. Residual pressure can occur, → 11 Technical data.

- Exhaust the system completely before you remedy the error.

- Observe the operating conditions.
- Always observe the permissible limit values.
- Keep sources of high-frequency electromagnetic radiation (e.g. radios, mobile phones, other interfering transmitters) away from the unit. Electromagnetic disturbance sources can impair the switching function of the valves. This prevents interference with the setpoint signal.
- Keep the magnetic fields away from the device. Magnetic fields can impair the switching function of the valves. This prevents interference with the setpoint signal.
- In case of an emergency off, make sure that voltage is switched off to all conducting parts.

## 8 Maintenance and care



### Warning

Danger of injury from compressed air.

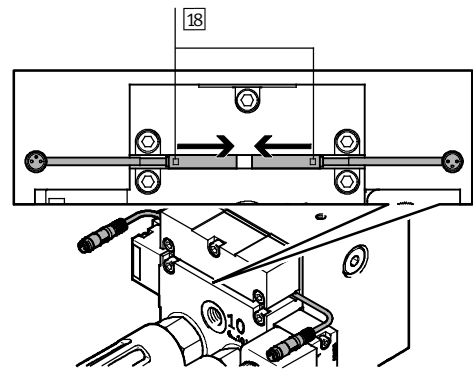
Products under pressure can cause personal injury and material damage.

- Maintenance only by qualified personnel.
- Before any maintenance work, depressurize the valve, service unit string and tubing.

### Before all maintenance work:

1. Switch off the analogue setpoint signal.
2. Disconnect pressure to the device and adjacent pneumatic devices.
3. Let the device cool off.
4. Switch off the supply voltage.

### Adjust proximity sensor



18 LED at the proximity sensor

Fig. 7

1. Switch off both solenoid valves of the PAHL.
2. Loosen the fastening screw of the proximity switch.
3. Push the proximity switch in the direction of the arrow just until the LED 18 turns off.
4. Pull the proximity switch back far enough until the 18 lights up again.
5. Tighten the fastening screw of the proximity switch, tightening torque 0.2 Nm.
6. Carry out steps 2 to 5 for the second proximity switch.
7. Check the signal change of the proximity switch by actuating the manual override of the related solenoid valve.

### Cleaning:

- Regularly clean the outside of the device with a soft cloth. The permissible cleaning agent is water or soap suds (max. 50 °C).

## 9 Dismantling




### Warning

Danger of injury from compressed air.

Products under pressure can cause personal injury and material damage.

- Dismantling only by qualified personnel.
- Depressurise the valve, service unit string and tubing.

1. Switch off the analogue setpoint signal.
2. Switch off the supply voltage of the PREL.
3. Switch off both solenoid valves of the PAHL.
4. Depressurize the pneumatic system.
5. Let the device cool off.
6. Switch off the supply voltage.
7. Disconnect the electrical connections of the PAHL.

 The electrical connections at the VPPL do not necessarily have to be removed to dismantle the PAHL.

8. Remove the entire device, consisting of VPPL, PAHL and PREL, from operation.
9. Remove the existing service unit string.
  - If installing between VPPL and PREL: Loosen the 4 mounting screws.
  - In case of installation with connecting plates between the pilot valve and pressure regulator: Dismantle the compressed air lines at both connecting plates.

## 10 Accessories

Designation	Type
Electrical connecting cable	NEBU
Plug socket with cable	KMC
Silencers	U-¾-B

Fig. 8

## 11 Technical data

### 11.1 Safety characteristics

PAHL	-SM
Safety function	Exhausting
Performance Level (PL)	Exhausting: category 3, PL d <sup>1)</sup>
Service life characteristic B10 [Million Sp]	0.12
PFH <sub>d</sub>	2.5 E-8 <sup>2)</sup>
CCF measures	Observe operating pressure limits
	Observe pilot pressure limits
	Comply with vibration/shock limits
	Comply with temperature range
	Comply with compressed air quality
	Comply with pulse pattern of safety outputs
	Observe permissible magnetic fields
	Comply with operating voltage limits
Use of approved silencer	
Note on forced dynamization	Switching frequency min. 1/week
CE marking (→ declaration of conformity)	in accordance with EU Machinery Directive
Residual pressure at the output in the event of an error [bar]	max. 1.3

1) Only in combination with appropriate integration into the system control

2) with 4000 switchings per year

Fig. 9

## 11.2 General data

PAHL	-SM
Pneumatic port [10]	G¼
Pneumatic port 2a	G¾
Pneumatic port 2b	G¾
Mounting position	Any, preferably vertical
Design	Piloted piston poppet valve
Actuation type	Electric
Manual override (at the solenoid valve)	Detenting
	Non-detenting
Reset method	Mechanical spring
Type of control	Piloted
Valve function	2x 2/2-way, single solenoid, open
Piston position sensing	Normal position with sensor
Operating medium	Compressed air to ISO 8573-1:2010 [7:4:4]
	Inert gases
Pilot medium	Compressed air to ISO 8573-1:2010 [7:4:4]
	Inert gases
Operating pressure p1 [bar]	0 ... 50
Pilot pressure p10 [bar]	6 ... 10
Ambient temperature [°C]	5 ... 50
Temperature of medium [°C]	5 ... 50
Resistance to shocks	Shock test with severity level 2 in accordance with FN 942017-5 and EN 60068-2-27
Vibration resistance	Transport application test with severity level 2 in accordance with FN 942017-4 and EN 60068-2-6
Solenoid valve duty cycle	100%
Sensor switching element function	N/O contact
Switching status display sensor	Yellow LED
Nominal operating voltage DC [V]	24
Operating voltage range DC (sensor) [V]	10 ... 30
Operational voltage range DC (solenoid coil) [V]	21.6 ... 26.4
Electrical connection	Sensor: M8x1, cable with plug, 3-pin
	Solenoid valve: in accordance with EN175301-803, form A
Housing material information	Anodised aluminium
Product weight [g]	3300 <sup>1)</sup>

1) without silencer

Fig. 10