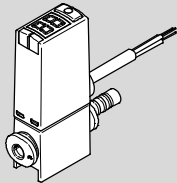


Pressure sensor SPAE



FESTO

Festo SE & Co. KG
Ruiter Straße 82
73734 Esslingen
Germany
+49 711 347-0
www.festo.com

Operating instructions
Original instructions

8058480
2017-03b
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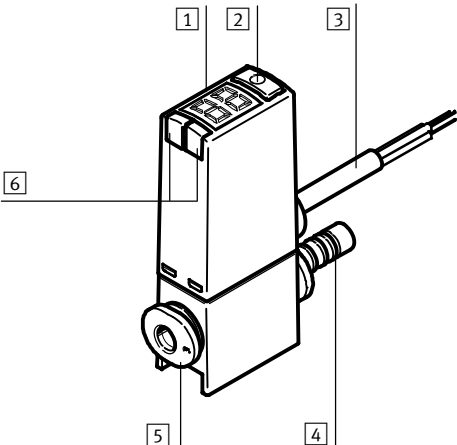
For all available product documentation → www.festo.com/pk

1 Product description

→ **Note**

You can find detailed specifications for the product, the device description file (IODD) with a description of the IO-Link parameters and the declaration of conformity at: → www.festo.com/sp

1.1 Overview



1 Display

2 Operating key

3 Electrical connection

4 Blanking plug (dependent on type)

5 Pneumatic port (design dependent on type)

6 LED

Fig. 1

1.2 Characteristics

Feature	Order code	Specification
Function	SPAE	Pressure sensor
Pressure measuring range	-B2, -B11, -P025, -P05, -P1, -P2, -P6, -P10, -V025, -V05, -V1	→ Technical data
Supply port	R	Relative pressure
Pneumatic port	-S4	Push-in sleeve 4 mm (insertable)
	-S6	Push-in sleeve 6 mm (insertable)
	-Q3	Push-in connector 3 mm
	-Q4	Push-in connector 4 mm
	-F	Flange (with through-hole and screw)
	-PC10	Cartridge 10 mm
Electrical output	-PNLK	PNP or NPN or IO-Link
Electrical connection	-2.5 K	Connecting cable 2.5 m, open end

Fig. 2

2 Function and application

The SPAE pressure sensor is intended for measuring the relative pressure in pneumatic applications. The SPAE converts pneumatic pressure values into a pressure proportional voltage. The measurement result is shown on the display. Available output signals include:

- Programmable switching output (24 V)
- IO-Link communication mode

2.1 Operating states

Operating status	Function
RUN mode	<ul style="list-style-type: none">– Initial status after switching on the operating voltage– Display of the current measured value– Display of the current switching status
SHOW mode	<ul style="list-style-type: none">– Display of the current settings
EDIT mode	<ul style="list-style-type: none">– Setting or modification of parameters
TEACH mode	<ul style="list-style-type: none">– Application of the current value as the switching point

Fig. 3

2.2 Switching functions

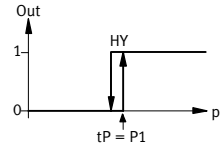
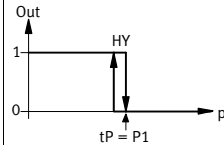
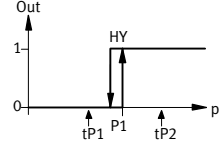
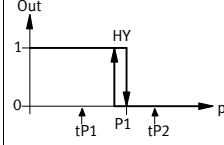
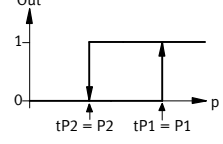
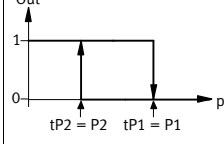
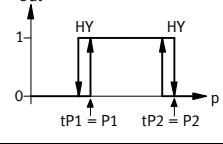
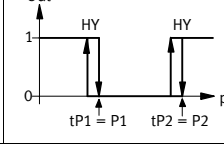
Function	NO (normally open)	NC (normally closed)
F0: Switching function: – Threshold value comparator – 1 switching point (P1) TEACH mode: – 1 teach-in point (tP) – tP = P1		
F1: Switching function: – Threshold value comparator – 1 switching point (P1) TEACH mode: – 2 teach-in points (tP1, tP2) – P1 = 1/2 (tP1 + tP2)		
F2: Switching function: – Threshold value comparator – 2 switching points (P1, P2) TEACH mode: – 2 teach-in points (tP1, tP2) – tP1 = P1, tP2 = P2		
F3: Switching function: – Window comparator – 2 switching points (P1, P2) TEACH mode: – 2 teach-in points (tP1, tP2) – tP1 = P1, tP2 = P2		

Fig. 4

2.3 Replicating parameters

An integrated IO-Link master function enables the settings of the sensor to be transferred to another sensor with the same pressure measuring range.

3 Requirements for product use

- Only use the product in original status, without any unauthorised modifications.
- The product is intended for use in industrial environments. Measures may need to be implemented in residential areas for radio interference suppression.
- Take into consideration the ambient conditions at the location of use.
- Remove all transport packaging. The material used in the packaging has been specifically chosen for its recyclability.

3.1 Range of application and certifications

The information in this section, in combination with the UL marking on the product, must be observed in order for there to be compliance with the certification conditions of Underwriters Laboratories Inc. (UL) for USA and Canada. Observe the following English-language remarks from UL:

Conditions of Acceptability

- For use only in or with complete equipment where the acceptability of the combination is determined by UL LLC. When installed in an end-product, consideration must be given to the following:
- This component has been judged on the basis of the creepage and clearances required in the indicated Standards, which would cover the component itself if submitted for Listing: CAN/CSA 22.2 No. 61010-1-12 3rd Ed., UL 61010-1 3rd Ed.
 - The end-product shall consider that: The enclosure does not serve as a fire/ electrical/mechanical enclosure.
 - The output connectors are: Not investigated for field wiring.
 - The unit is considered acceptable for use in a max ambient of: 50 °C.



UL approval information	
Product category code	QUYX2 (USA) or QUXY8 (Canada)
File number	E322346
Considered Standards	UL 61010-1 CAN/CSA 22.2 No. 61010-1
UL mark	

Fig. 5

Technical Considerations	
Pollution degree	2
Operating temperature	0° to 50° C / 32° to 122° F
Relative humidity	0 to 100%
For use in wet locations	No


Fig. 6

4 Installation


Note

Installation and commissioning are to be carried out only by qualified personnel in accordance with the operating instructions.

4.1 Mechanical and pneumatic


Note

Mount the sensor so that no condensation from the compressed air lines can gather in the device.

SPAE-...-Q

- Attachment with mounting clip possible. Hole pattern → Fig. 19.
- Slide the sensor into the mounting clip with the cable outlet at the top or with the cable outlet at the bottom.
- If there is a tubing connection at one end, seal the unused pneumatic port with the blanking plug.

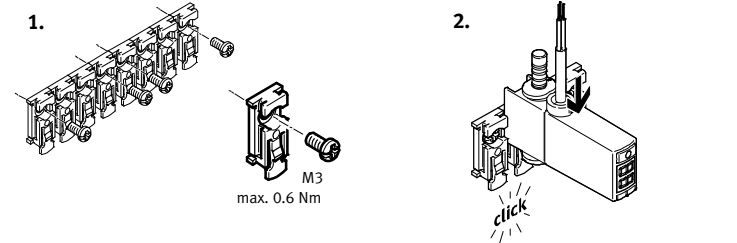


Fig. 7

SPAE-...-S

- Insert into the QS push-in connector as far as it will go.

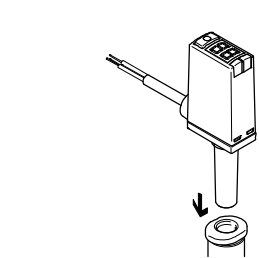


Fig. 8

SPAE-...-F

- Hole pattern → Fig. 19
- Check the correct seating of the sealing ring.

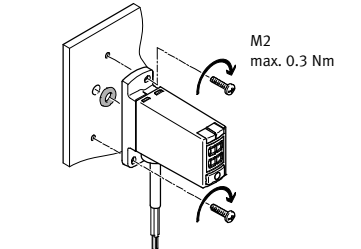



Fig. 9

4.2 Electric


Warning

Use only power sources which guarantee reliable electrical isolation of the operating voltage in accordance with IEC/EN 60204-1. Consider also the general requirements for PELV circuits in accordance with IEC/EN 60204-1.

- Connecting the sensor.
 - Take into consideration the maximum permissible line length → Technical data.
 - Only route the signal line and power supply in a common line.

Circuit diagram and wire assignment

Circuit diagram	Core colour	Allocation
	Brown (BN)	Operating voltage +24 V DC
	Black (BK)	Switching output or IO-Link (C/Q line)
	Blue (BU)	0 V

Fig. 10

5 Commissioning

5.1 Control elements and displays

Operating key

The operating key is used to select switching functions and set parameters. The function of the operating key is time and context-dependent.

If the operating key is not actuated for approx. 12 seconds during the setting procedure, the sensor will automatically switch to the RUN mode. Revised setting values are applied (exceptions: TEACH mode and display min./max. measured values).

LED	Display	Significance
Both LEDs on	Permanently illuminated	RUN mode: Switching output switched
Both LEDs off	Permanently illuminated	RUN mode: Switching output not switched
One LED flashes	Permanently illuminated	RUN mode: IO-Link communication active
Both LEDs off	[Function] and <Value> flash alternately	SHOW mode
Both LEDs flash alternately	Permanently illuminated or flashing.	EDIT mode: First menu option
Both LEDs flash simultaneously	Permanently illuminated or flashing.	EDIT mode: Second menu option or TEACH mode

Fig. 11

Display	Significance
<Value>	In RUN mode: Current measured value (in % FS - Full Scale). Single-digit pressure display values are displayed with a preceding underscore (e.g. _1).
[F0]	Switching function F0 (→ Switching functions)
[F1]	Switching function F1 (→ Switching functions)
[F2]	Switching function F2 (→ Switching functions)
[F3]	Switching function F3 (→ Switching functions)
_J	Threshold value comparator
_JL	Window comparator
[P1]	Switching point P1 (in % FS)
[P2]	Switching point P2 (in % FS); not with switching function [F0] and [F1]
[HY]	Hysteresis (in % FS): Adjustable from [0] to [99] (corresponds to 0 to 9.9 % FS); not with switching function [F2]
[Lo]	Minimum measured value (in % FS)
[Hi]	Maximum measured value (in % FS)
[Pn]	PNP switching output
[nP]	NPN switching output
[nc]	Switching logic normally closed contact
[no]	Switching logic normally open contact
[di]	Switch the display on/off: [On] = always switched on; [1] ... [20] = switch off after 1 to 20 min
[do]	Alignment of the numerical display: [do] = default alignment, [op] = rotated 180°
[LC]	Switch the security code on/off: [OF] = Security code disabled; [On] = Security code enabled; [1] ... [99] = Security code (selectable up to 99)
[rP]	IO-Link master function to replicate parameters: [On] = Replicate on; [OF] = Replicate off

Fig. 12

5.2 Displaying parameters (SHOW mode)

- Requirement: The sensor is ready for operation (RUN mode).
- Press the operating key briefly.
 - The first parameter is displayed.

The subsequent parameters can be displayed by repeatedly pressing the operating key (→ Fig. 13).

5.3 Setting the sensor (EDIT mode)

Requirement: The sensor is ready for operation (RUN mode).

Entering the security code

- If the security code is enabled, the parameter entry option is blocked: [LC] flashes briefly, then <1> appears.
- Briefly press the operating key repeatedly until the security code is set.

- Press and hold the operating key.
→ The parameter entry option is unblocked.

Setting the switching function

1. Press the operating key 1 x briefly.
→ The display alternates between the designation and the symbol of the current set switching function (e.g. [F1] and [J⁺], significance → Fig. 12).
2. Press and hold the operating key.
→ Switch to the EDIT mode. LEDs flash alternately.
3. Repeatedly press the operating key briefly until the desired switching function appears in the display.
4. Press and hold the operating key.
→ The setting is saved. Switch to the RUN mode.

Setting switching points and hysteresis



Note

The hysteresis display value corresponds to 10 times the actual value (e.g. <10> corresponds to a hysteresis of 1.0 % FS).

Parameters [P2] and [HY] are only displayed if they are intended for the set switching function (→ Fig. 4).

The values can be adjusted in two stages, namely with a coarse adjustment (in steps of ten) and a precision adjustment (in steps of one).

1. Press the operating key repeatedly until the parameter to be set is displayed (e.g. [P1]).
→ The display alternates between the designation and value (in % FS) of the current set switching point (e.g. [P1] and <40>).
2. Press and hold the operating key.
→ Switch to the EDIT mode for coarse adjustment. LEDs flash alternately.
3. Press the operating key repeatedly until a value is displayed that is equal to, or slightly less than, the desired value.
4. Press and hold the operating key.
→ Switch to the EDIT mode for precision adjustment. LEDs flash simultaneously.
5. Press the operating key repeatedly until the desired value is displayed.
6. Press and hold the operating key.
→ The setting is saved. Switch to the RUN mode.

Additional settings → Fig. 12 and Fig. 13.



Note

If the NPN switching output is set, the IO-Link mode is not possible.

5.4 Teaching a switching point (TEACH mode)

Requirement: The sensor is ready for operation (RUN mode).

Entering the security code

If the security code is enabled, the teach function is blocked.

- Enable parameter entry (→ Chapter 5.3).

Setting the switching point with a teach pressure (F0)

1. Pressurize the sensor with the teach pressure.
2. Press and hold the operating key.
→ The teach pressure is applied as the switching point.
The display alternates between [P1] and the value of the taught switching point for as long as the operating key is depressed.
3. Release the operating key.
→ Switch to the RUN mode.

Setting the switching point with two teach pressures

1. Pressurize the sensor with the first teach pressure.
2. Press and hold the operating key.
→ The teach pressure is applied as the switching point.
The display alternates between [tP] and the value of the taught switching point for as long as the operating key is depressed.
3. Release the operating key.
5. Pressurize the sensor with the second teach pressure.
5. Press and hold the operating key.
→ The teach pressure is applied as the switching point.
The display alternates between [tP] and the value of the taught switching point for as long as the operating key is depressed.
6. Release the operating key.
→ Switching function F1 only: [P1] and the value of the switching point [P1] briefly appear.
→ Switch to the RUN mode.

5.5 Menu structure

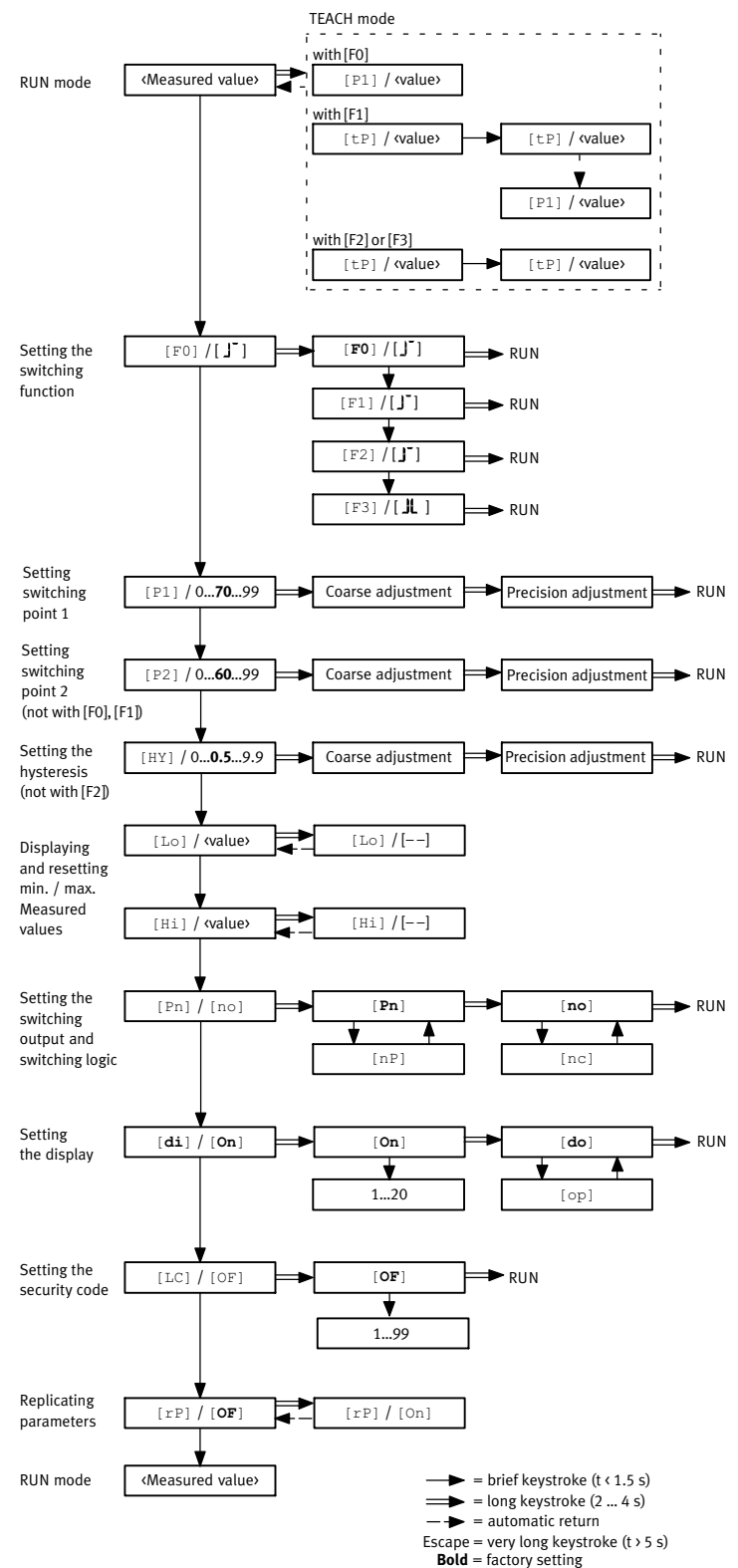


Fig. 13

6 Operation

Replicating parameters

Requirement:

- The pre-configured sensor (master) is ready for operation (RUN mode).
- The second sensor (device) is in an unswitched status (switching output PNP, LED off).
- Master sensor and device sensor have the same design (same device ID).
- Parameterisation of the device sensor must not be blocked via IO-Link®.

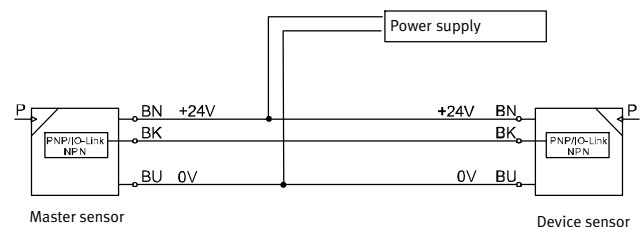


Fig. 14

1. Connect the sensors to each other and connect to the power supply (➔ Fig. 14).
On the pre-configured sensor (master):
2. Press the operating key repeatedly until [rP] / [OF] appears.
3. Press and hold the operating key (can be repeated any number of times for additional device sensors).
➔ [rP] / [On] briefly appears.
➔ If replication has been successful, [rP] / [OF] will then appear. If an error occurs, an error message will appear briefly (➔ Fig. 15).
4. Press the operating key briefly.
➔ Switch to the RUN mode.

Restoring factory settings (restore)

1. Press the operating key.
2. Switch on the operating voltage and keep the operating key depressed.
➔ <Value> appears.
➔ [-.] appears.
➔ [rS] appears.
3. Release the operating key.

7 Disassembly

1. Switch off the energy sources (operating voltage, compressed air).
2. Disconnect the connections from the device.
3. Loosen the mountings.
When using mounting clips release the detent.

8 Fault clearance

Malfunction	Possible cause	Remedy
No display	No operating voltage or impermissible operating voltage	• Apply permissible operating voltage
	Electrical connections swapped	• Connect the device in accordance with the circuit diagram
	Device defective	• Replace device
No measured value indicator in the RUN mode	Display switch-off activated	• Press the operating key • Adjust the display option [On]
Display flashes in the RUN mode	Measuring range exceeded	• Stay within measuring range
Implausible measured value	Incorrect alignment of the display	• Check the alignment of the display
Display or switching output does not react in accordance with the settings	Short circuit or overload at the output	• Eliminate short circuit/overload
	Incorrect switching point taught (e.g. at 0 bar / 0 MPa)	• Repeat teaching procedure
	Device defective	• Replace device
Display [Er] / [LC]	Incorrect security code	• Enter the security code
Display [Er] / [Co]	IO-Link® communication error	• Check setting of the device sensor (Pn). • Check line.
Display [Er] / [Id]	Devices do not have the same design.	• When replicating, use sensors with the same pressure range (same device ID)
Display [Er] / [bY]	Switching output is active.	• Check device settings.
Display [Er] / [01]	Device errors	• Replace device
Display [Er] / [17]	Undervoltage	• Apply permissible operating voltage
Display [Er] / [20]	Temperature error	• Check operating conditions • Replace device
Display [Er] / [21]	Short circuit	• Eliminate short circuit

Fig. 15

9 Accessories

Accessories ➔ www.festo.com/catalogue.

10 Technical data

SPAЕ-		
General		
Certification	RCM trademark, c UR us – Recognized	
CE marking (➔ Declaration of conformity)	in accordance with EU EMC Directive	
Note on materials	RoHS-compliant	
Input signal/measuring element		
Operating medium	Compressed air to ISO 8573-1:2010 [7:4:4] Lubricated operation possible	
Temperature of medium	[°C]	0 ... 50
Ambient temperature	[°C]	0 ... 50
Output, general		
Accuracy at room temperature	[% FS]	1.5
Accuracy in ambient temperature range	[% FS]	2.5
Repetition accuracy	[% FS]	±0.3
Temperature coefficient	[% FS/K]	±0.05

SPAЕ-		
Switching output		
Switch-on time	[ms]	max. 1, with filter time constant = Off (default)
Switch-off time	[ms]	max. 1, with filter time constant = Off (default)
Max. output current	[mA]	100
Capacitive load max. DC	[nF]	100
Voltage drop	[V]	max. 1.2
Inductive protective circuit		yes
Output, additional data		
Protection against short circuit		yes
Overload protection		yes
Electronic components		
Operating voltage range DC	[V]	18 ... 30
Idle current	[mA]	< 11
Ready-state delay	[ms]	< 30
Reverse polarity protection		all connections
Electromechanical components		
Electrical connection		Cable, 3-wire, open end
Max. permissible line length	[m]	30, with IO-Link 20
Cable sheath material		PVC
Mechanical system		
Mounting position		any, avoid condensation gathering in the sensor
Housing material		PA reinforced
Key material		POM
Immissions/emissions		
Storage temperature	[°C]	-20 ... 80
Protection class (as per EN 60529)		IP 40
Protection class (as per DIN VDE 0106-1)		III
Resistance to shocks (as per EN 60068-2)		30 g acceleration with 11 ms duration (half-sine)
Vibration resistance (as per EN 60068-2)		10 ... 60 Hz: 0.35 mm / 60 ... 150 HZ: 5 g
Pollution degree		3

Fig. 16

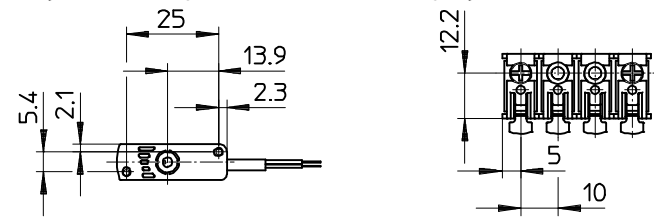
SPAЕ-	B2	B11	V025	V05	V1	P025	P05	P1	P2	P6	P10
Pressure measuring range											
Starting value	[bar]	-1						0			
	[MPa]	-0.1						0			
Final value	[bar]	1	10	-0.25	-0.5	-1	0.25	0.5	1	2	6
	[MPa]	0.1	1	-0.025	-0.05	-0.1	0.025	0.05	0.1	0.2	0.6
											10
											1
Overload range											
Starting value	[bar]						-1				
	[MPa]						-0.1				
Final value	[bar]	5	15	1	2	5	1	2	5	6	15
	[MPa]	0.5	1.5	0.1	0.2	0.5	0.1	0.2	0.5	0.6	1.5
											15

Fig. 17

IO-Link	
IO-Link protocol	V1.1
IO-Link profile	Smart Sensor profile Function classes:0x8000, 0x8001, 0x8002, 0x8003, 0x8004
Communication mode	COM2 (38.4 kbd)
Port type	A
Process data width	2 bytes
Process data content	Pressure monitoring BDC1 (BinaryDataChannel1) Pressure monitoring BDC2 (BinaryDataChannel2) Pressure measurement value PDV 14 bit (ProcessDataVariable)
IODD and IO-Link device description	➔ www.festo.com/sp

Fig. 18

Hole pattern for flange SPAЕ-...-F¹) and mounting clip SAMH



1) Pressure connection hole: Ø 2 mm max.

Fig. 19