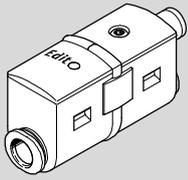


Pressure sensor SDE5



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Operating instructions
 Original instructions

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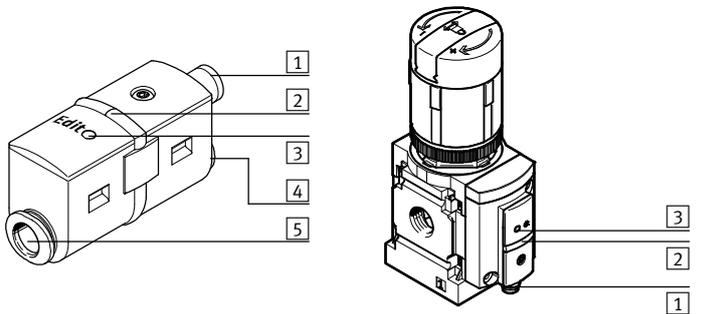


For all available product documentation → www.festo.com/pk

1 Product description

1.1 Overview

SDE5 installed on the MS series service unit



- 1 Electrical connection
- 2 LED indicator (continuous transmission of the LED indicator through fibre-optic cable)
- 3 Edit button (not on SDE5-...X)
- 4 Connection 2 for compressed air or vacuum
- 5 Connection 1 for compressed air or vacuum

Fig. 1

1.2 Characteristics

Key feature	Order code	Specification
Type	SDE5	Pressure sensor
Pressure measuring range	-V1/-B2/-D2/ -D6/-D10	→ Chapter 10 Technical data.
Supply port		Relative pressure
	-Z	Differential pressure
Output function ¹⁾	-FP	Freely programmable
	-O	Normally open contact (NO), fixed hysteresis, mode 0
	-C	Normally closed contact (NC), fixed hysteresis, mode 0
	-O1	Normally open contact (NO), fixed hysteresis, mode 1
	-C1	Normally closed contact (NC), fixed hysteresis, mode 1
	-O2	Normally open contact (NO), teachable hysteresis, mode 2
	-C2	Normally closed contact (NC), teachable hysteresis, mode 2
	-O3	Normally open contact (NO), fixed hysteresis, mode 3
-C3	Normally closed contact (NC), fixed hysteresis, mode 3	
	-NF	Analogue output 0 ... 10 V
Pneumatic connection	-Q4/-Q6/ -T532/-T14	At both ends for standard O.D. tubing $\varnothing 4 \text{ mm} / \varnothing 6 \text{ mm} / \varnothing \frac{3}{32} / \varnothing \frac{1}{4}''$
	-Q4E/-Q6E/ -T532E/-T14E	At one end for standard O.D. tubing $\varnothing 4 \text{ mm} / \varnothing 6 \text{ mm} / \varnothing \frac{3}{32}'' / \varnothing \frac{1}{4}''$
Electrical output	-P/-N	Switching output PNP/NPN
	-V	Pressure proportional voltage 0 ... 10 V
Electrical connection	-K	Cable, 2.5 metres long, 3-core
	-M8	Plug connector M8x1, 3-pin
Teach point	-X	X teach point permanently set
	-Y	Y teach point permanently set

1) Signal curves, switching functions and operating modes → Fig. 14 and Fig. 15

Fig. 2

2 Function and application

The pressure sensor SDE5 is intended for the proper monitoring of the pressure in the compressed air system. The SDE5 converts pneumatic pressure values into a pressure proportional voltage. Depending on the design of the pressure sensor, this signal is converted into a digital switching signal (SDE5-...-P-.../SDE5-...-N-...) or it is amplified for an analogue output (SDE5-...-NF-...-V). The monitored pressure values record either the relative pressure or the differential pressure (SDE5-...-Z-...). The pressure sensor with switching output closes or opens a circuit when the switching pressure is reached. The switching element function is preset at the plant and can only be modified with the SDE5-...-FP-.... The SDE5 is available with different switch/teach functions (→ Fig. 2).

MS series service unit with pressure sensor SDE5

The pressure sensor SDE5 on the series MS service unit is already permanently attached and pneumatically connected on delivery. Fig. 3 shows the allocation between the MS service unit and the attached pressure sensor.

MS series service unit	Attached pressure sensor
MS4/6-...-AD7	SDE5-D10-O-...-P-M8
MS4/6-...-AD8	SDE5-D10-C-...-P-M8
MS4/6-...-AD9	SDE5-D10-O3-...-P-M8
MS4/6-...-AD10	SDE5-D10-C3-...-P-M8

Fig. 3

3 Requirements for product use

- Use the product in its original status, without any unauthorised product modifications.
- Observe the specified limits (e.g. operating medium, pressures, forces, temperatures).
- Take into consideration the ambient conditions at the location of use.
- Observe the regulations which apply in your location (e.g. from trade associations or from national institutions).
- Remove everything used for protection during transport such as protective wax, films, caps and cardboard boxes. The material used in the packaging has been specifically chosen for its recyclability (exception: oil-impregnated paper = residual waste).
- The device is intended for use in an industrial environment. Measures may need to be implemented in residential areas for interference suppression.
- Remove dirt particles in the supply lines by blowing out the pipes and hoses. This protects the device from premature failure or heavy wear.

Range of applications 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:

This device is intended to be used with a Class 2 power source or Class 2 transformer in accordance with UL1310 or UL1585.

As an alternative a LV/C (Limited Voltage/Current) power source with one of the following properties can be used:

- This device shall be used with a suitable isolating source such that the maximum open circuit voltage potential available to the product is not more than 30 V DC and the current is limited to a value not exceeding 8 amperes measured after 1 minute of operation.
- This device shall be used with a suitable isolating source in conjunction with a fuse in accordance with UL248. The fuse shall be rated max. 3.3 A and be installed in the 30 V DC power supply to the device in order to limit the available current.

Note that, when more than one power supply or isolating device is used, connection in parallel is not permitted.

In determining the acceptability of the combination, the following details are to be examined:

- The suitability of the final mounting is to be determined.
- The devices are to be mounted in an enclosure with adequate strength and thickness.
- The devices have not been examined for field wiring. The suitability of the final application is to be determined.

UL approval information

Product category code	NRNT2 (USA) or NRNT8 (Canada)
File number	E253738
Considered standards	UL 508, 17th edition, C22.2 No. 14-95
UL mark	

Fig. 4

4 Installation



Note

The pressure sensor SDE5 on the series MS service unit is already permanently attached and pneumatically connected when delivered.

4.1 Mechanical system

- If several wall holders are used: push the dovetail of wall holder 1 into the connecting slot of the next wall holder (press out lug 2).

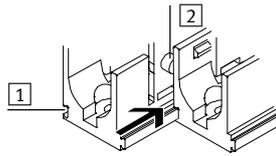


Fig. 5

- Mount the first and the last wall holder with 2 screws each (∅ 4 mm) at the designated positions.
- If more than 3 wall holders are being used: also mount every second wall holder with 2 screws each (∅ 4 mm).

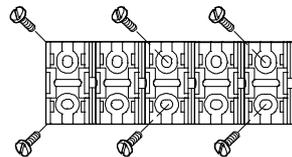


Fig. 6

- Press the SDE5 into the wall holders. If fitted correctly, all four spring clips 3 will latch audibly into place.

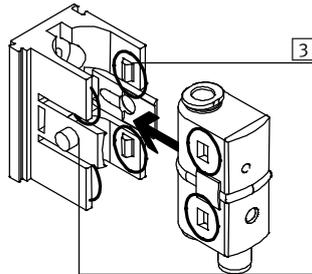


Fig. 7

The lug of wall holder 4 can be broken off in case of individual mounting. This gives an extended view of the all-round LED (→ Fig. 1).

4.2 Pneumatic system

Push-in connector at one end

- Connect the tubing to pneumatic connection 1.

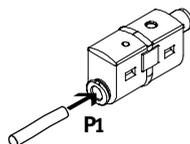


Fig. 8

Push-in connector at both ends

- Check the pressure ratios. With the pressure sensor for differential pressure (SDE5-...-Z-...), the higher pressure must be present at connection 1. The following is valid: Differential pressure = $p_1 - p_2$.
- Connect tubing to pneumatic connections 1 and 2.

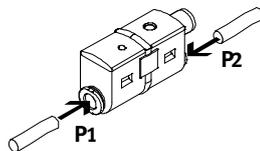


Fig. 9

4.3 Electrical system



Warning

Only use power sources which guarantee reliable electrical isolation of the operating voltage according to IEC/DIN EN 60204-1. Also observe the general requirements for PELV power circuits according to IEC/EN 60204-1.



Note

- Long signal lines reduce the immunity to interference.
- Make sure that the length of the signal line is always shorter than 30 metres.

The tightening torque for the cap nut at the plug connector is max. 0.3 Nm.

Pin allocation and circuit diagrams

Pin	Allocation	Core colours ¹⁾	Plug connector
1	Operating voltage +24 V DC	Brown (BN)	
2/4	Switching output A (Out A) or analogue output	Black (BK)	
3	0 V	Blue (BU)	

1) When using the connecting cable from the electrical accessories

Fig. 10

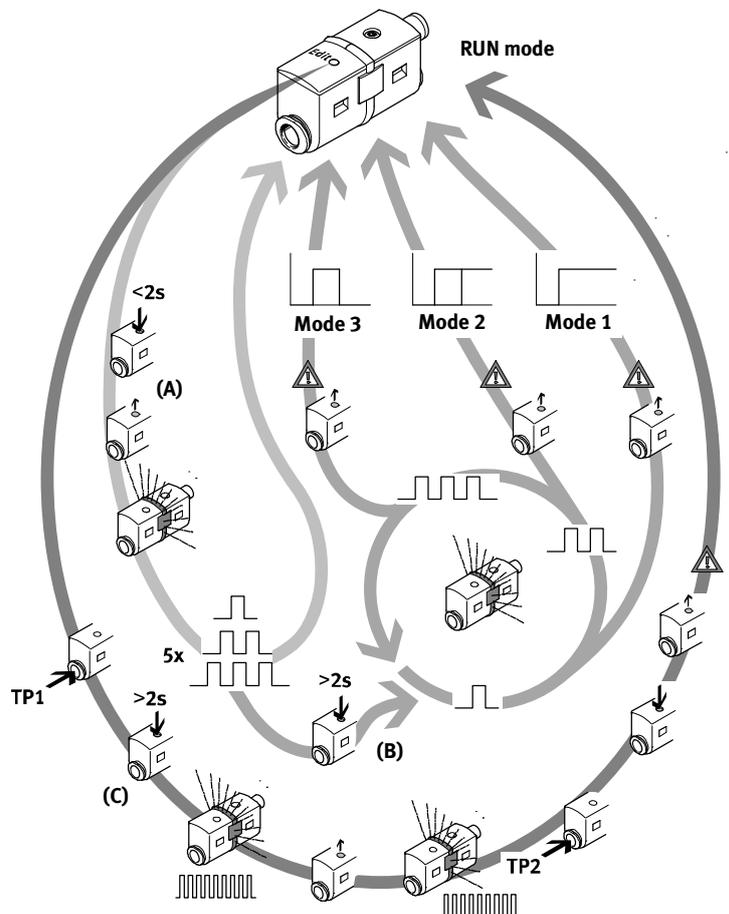
Circuit diagrams

<p>SDE5-...-P-...-K Switching output cable connection</p>	<p>SDE5-...-P-...-M8 Switching output plug connection</p>
<p>SDE5-...-N-...-K Switching output cable connection</p>	<p>SDE5-...-N-...-M8 Switching output plug connection</p>
<p>SDE5-...-V-...-K Analogue output cable connection</p>	<p>SDE5-...-V-...-M8 Analogue output plug connection</p>

Fig. 11

5 Commissioning

Fig. 12 shows an overview of the possible settings and displays. The activities are described in the subsequent sections.



⚠ Ensure there is a power supply for at least 10 s.

- | | |
|--------------------------------|---|
| (A) Mode display | Display of the set mode (only with ...-FP) |
| (B) Mode selection | Selection of modes 1 to 3 (only with ...-FP) |
| (C) Switching pressure setting | Teaching the switching pressures TP1 and TP2 (mode 0...3) |

Fig. 12



Caution

After teaching, the values are written to the internal memory. If the saving process is unexpectedly aborted (e.g. from a power interruption), the transfer process to the memory can not be completely carried out and the device becomes unusable.

- Ensure that there is power supply to the device for at least 10 seconds after teaching.



Note

Unintended pressing of the Edit button can cause an accidental alteration of the preset switching pressure (e.g. setting the SDE5 to a switching pressure of 0 bar/0 MPa when the operating pressure is missing).

Definitions:

- Pressure p: relative pressure or differential pressure (also vacuum with SDE5-V1/B2).
- Switching pressure SP: pressure p at which the SDE5 switches.
- Teach pressure TP1, TP2: pressure p at time of programming.

5.1 SDE5-...X without Edit button

The SDE5-...X without Edit button is preset at the factory with fixed switching pressures. The SDE5-...X does not require further setting for commissioning.

5.2 SDE5-...-NF-...-V with analogue output

1. Switch on the operating voltage.
 - ➔ The LED illuminates green.
2. Pressurise the SDE5 with the desired pressure p.
 - ➔ The pressure measurement value at the analogue output is an electrical pressure-proportional signal in the range 0 ... 10 V depending on the pressure measuring range (➔ Fig. 13).

Signal range of analogue output		0 V		...		5 V		...		10 V	
		bar	MPa	bar	MPa	bar	MPa	bar	MPa		
Pressure measuring range [bar, MPa]	SDE5-V1	0	0	...	-0.5	-0.05	...	-1	-0.1		
	SDE5-B2	-1	-0.1	...	0	0	...	1	0.1		
	SDE5-D2	0	0	...	1	0.1	...	2	0.2		
	SDE5-D6	0	0	...	3	0.3	...	6	0.6		
	SDE5-D10	0	0	...	5	0.5	...	10	1		

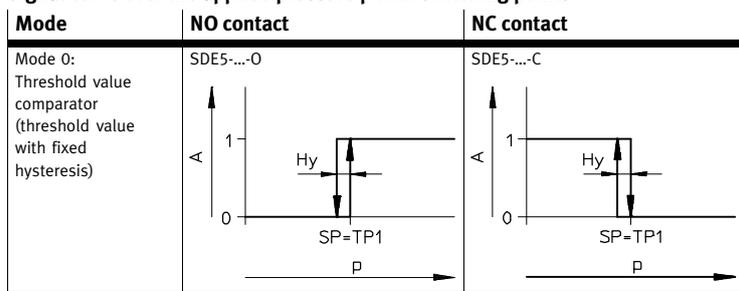
Fig. 13

5.3 SDE5-...-O/C-...-P/N with switching output

Set the switching pressure SP with one teach pressure TP1

1. Switch on the operating voltage.
2. Pressurise the SDE5 with the desired teach pressure TP1.
3. Press the Edit button (> 2 s) until the LED flashes.
4. Let go of the Edit button.
 - ➔ The current teach pressure TP1 is saved as the switching pressure SP.
5. Ensure that there is power supply for at least 10 seconds.
6. Carry out a test run with various pressures to ascertain whether the SDE5 switches as desired. When the switching signal is emitted, the LED also illuminates.

Signal curve over the applied pressure p with switching points



TP1 = teach pressure, SP = switching pressure, Hy = hysteresis, A = switching output (Out A)

Fig. 14



Note

The switching output behaviour of the SDE5-B2 and of the SDE5-V1 differ from each other in the vacuum range 0 ... -1 bar/0 ... -0.1 MPa¹⁾.

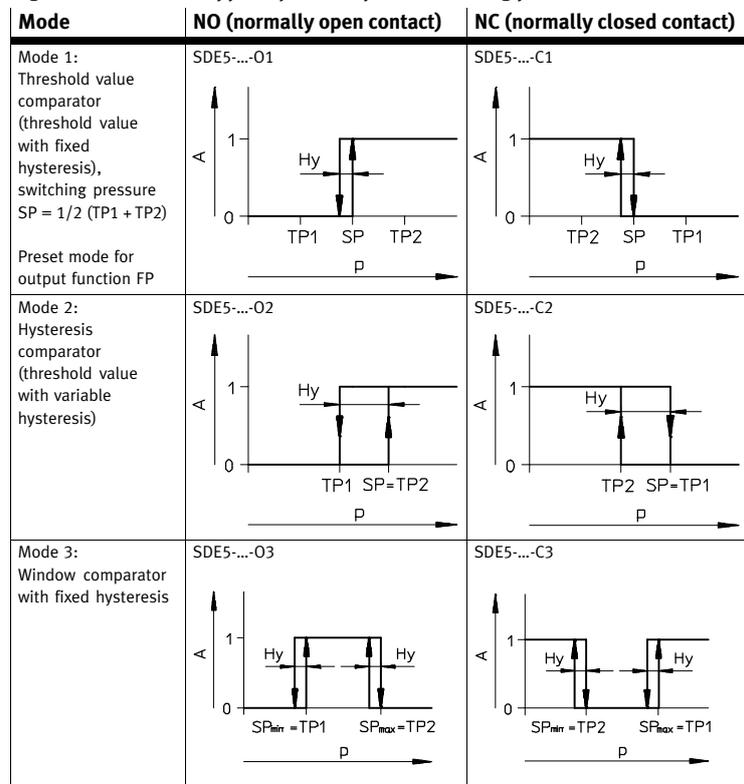
1) Example for switching point at -0.5 bar/-0.05 MPa, inlet pressure = 0 bar/0 MPa: switching status SDE5-V1-0-...: output open, switching status SDE5-B2-0-...: output closed.

5.4 SDE5-...-O1/O2/O3/C1/C2/C3-...-P/N with switching output

Set the switching pressure SP with two teach pressures TP1/TP2

1. Switch on the operating voltage.
2. Pressurise the SDE5 with one teach pressure, e.g. for TP1 (you could also start with TP2, since the functions of the normally closed contact and/or normally open contact are specified).
3. Press the Edit button (> 2 s) until the LED flashes.
4. Release the Edit button.
 - ➔ The current teach pressure TP1 is saved.
 - ➔ The LED flashes.
5. Pressurise the SDE5 with the other teach pressure, e.g. TP2.
6. Press the Edit button until the LED stops flashing.
7. Release the Edit button.
 - ➔ The current teach pressure TP2 is saved.
8. Ensure that there is power supply for at least 10 seconds.
9. Carry out a test run with various pressures to ascertain whether the SDE5 switches as desired. When the switching signal is emitted, the LED also illuminates.

Signal curve over the applied pressure p with switching points



TP1 = teach pressure, SP = switching pressure, Hy = hysteresis, A = switching output (Out A)
 Presettings: TP1 = 20 % FS; TP2 = 80 % FS TP1 = 80 % FS; TP2 = 20 % FS
 Fig. 15

5.5 SDE5-...-FP-...-P/N with switching output

Mode display

The LEDs indicate the current mode by flashing (e.g. 3 x flashes for mode 3). The mode is displayed a total of 5 times in succession before the SDE5 returns to RUN mode.

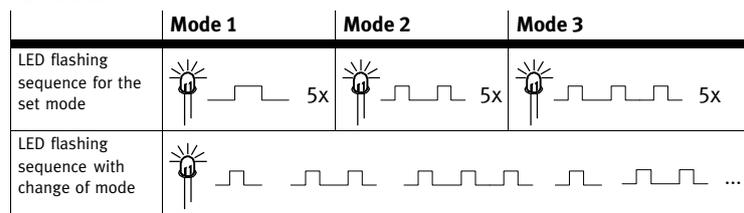


Fig. 16

Set mode

1. Switch on the operating voltage.
2. First briefly press the Edit button 1 time (≤ 2 s) and then release it.
 - ➔ The LED indicates the mode currently set (➔ Fig. 16).
3. While the mode is displayed, press the Edit button again until the desired mode is displayed for the operation.
4. Release the Edit button.
 - ➔ The current mode is saved.
5. Ensure that there is power supply for at least 10 seconds.



Note

The switching pressure SP must be reset after the mode is selected or changed.

Set the switching pressure SP with two teach pressures TP1/TP2



Note

The sequence of the teach pressures for the switching pressure setting affects the switching element function (normally closed contact/normally open contact) of the SDE5.

- Take the following relationship into account:
 TP1 < TP2: Programming as NO contact
 TP1 > (TP2 + 2 % full-scale): Programming as NC contact

- Note down the teach pressures TP1 and TP2.
- Pressurize the SDE5 with the first teach pressure TP1.
- Press the Edit button (> 2 s) until the LED flashes.
- Release the Edit button.
 - The current teach pressure TP1 is saved.
 - The LED flashes.
- Pressurize the SDE5 with the second teach pressure TP2.
- Press the Edit button until the LED stops flashing.
- Release the Edit button.
 - The current teach pressure TP2 is saved.
- Ensure that there is power supply for at least 10 seconds.
- Carry out a test run with various pressures to ascertain whether the SDE5 switches as desired. When the switching signal is emitted, the LED also illuminates.

Signal curve over the applied pressure p with switching points

The diagrams for NO (normally open contact, TP1 < TP2) and NC (normally closed contact, TP1 > (TP2 + 2 % full-scale)) show the relationship between teach pressure, switching pressure and hysteresis (→ Fig. 15).

6 Operation



Warning

Risk of injury from high temperatures.

Extreme pneumatic conditions (high cycle rate with large pressure amplitude) can heat the device over 80 °C.

- Select the operating conditions (in particular the ambient temperature, pressure amplitude, cycle rate, current consumption) such that the device does not heat up above the maximum permitted operating temperature.

- Observe the operating conditions.
- Switch on the operating voltage.
 - The device is working in RUN mode (basic status).

LED indicator	Meaning
LED illuminates yellow	SDE5-...-P/-N-...(switching output): pressure p > switching pressure
LED does not illuminate	SDE5-...-P/-N-...(switching output): pressure p < switching pressure
LED flashes quickly	Teach procedure (→ Fig. 12)
LED flashes slowly	Only SDE5-...-FP: display and setting of the switching function
LED illuminates green	Only SDE5-...-V (analogue output): ready status (RUN mode)

Fig. 17

7 Maintenance and care

Clean the SDE5 on the outside

- Switch off the operating voltage.
- Switch off the compressed air.
- Clean the outside of the SDE5 with a soft cloth.
 Permissible cleaning agents are soap suds (max. +50 °C) and all non-abrasive agents.

8 Disassembly

- Switch off the operating voltage.
- Switch off the compressed air.
- Disconnect the electrical and pneumatic connections from the SDE5.
- Release the SDE5 from the wall holder.
 For this, slide a screwdriver into the slot 1 and prise the SDE5 out of the wall holder.

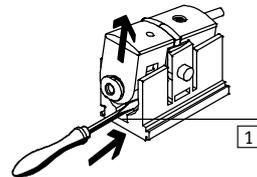


Fig. 18

9 Fault clearance

Malfunction	Possible cause	Remedy
No LED indicator	Pressure p < switching pressure SP	Regular operating status (→ Fig. 17)
	No power supply or no permissible operating voltage	Switch on power supply/adhere to the permitted operating voltage range
	Connections mixed up (reverse polarity)	Wire the SDE5 in accordance with the pin allocation
	Pressure failure	Eliminate pressure failure
	SDE5 defective	Replace device
LED indicator or switching output does not react in accordance with the settings made	Short circuit or overload at the output	Eliminate short circuit/overload
	Incorrect switching point taught (e.g. at 0 bar/0 MPa)	Repeat teach procedure
	SDE5 defective	Replace device

Fig. 19

10 Technical data

Type SDE5	-V1	-B2	-D2	-D6	-D10	
General information						
Certification	RCM, c UL us – Recognized (OL)					
CE marking (→ Declaration of conformity)	In accordance with EU EMC Directive					
Note on materials	RoHS-compliant					
Input signal/measuring element						
Pressure measuring range ¹⁾	[bar]	0 ... -1	-1 ... 1	0 ... 2	0 ... 6	0 ... 10
Pressure measuring range ¹⁾	[MPa]	0 ... -0.1	-0.1 ... 0.1	0 ... 0.2	0 ... 0.6	0 ... 1
Max. overload pressure	[bar]	5	5	6	15	15
Max. overload pressure	[MPa]	0.5	0.5	0.6	1.5	1.5
Operating medium	Compressed air in accordance with ISO 8573-1:2010[7:4:4], lubricated operation possible					
Temperature of medium	[°C]	0 ... +50				
Ambient temperature	[°C]	0 ... +50				
Output, general						
Repetition accuracy	[% FS]	±0.3 (short time)				
Temperature coefficient	[% FS/K]	Max. ±0.05				
Short circuit protection		Yes				
Overload protection		Available				
Switching output						
Accuracy	[% FS]	Max. ±0.5				
Switching time (on/off)	[ms]	2 (typical)/4 (max.) ²⁾				
Max. output current	[mA]	100				
Capacitive load maximum DC	[nF]	100				
Voltage drop	[V]	Max. 1.8				
Inductive protective circuit		Adapted to MZ, MY, ME coils				
Analogue output						
Output characteristic curve ¹⁾	[V]	0 ... 10				
Accuracy	[% FS]	±3 (room temperature: 20 ... 25 °C)				
	[% FS]	Max. ±4 (room temperature: 0 ... 50 °C)				
Rise time	[ms]	5 (typical) with resistive load				
Min. load resistance	[kΩ]	2				
Electronics						
Operating voltage range	[V DC]	15 ... 30				
No-load supply current	[mA]	Max. 34				
Ready-state delay	[ms]	≤ 10				
Reverse polarity protection		For all electrical connections				
Electromechanics						
Max. cable length	[m]	30				
Information on materials – cable sheath		PUR				
Information on materials – plug connector housing		Brass (nickel-plated, chrome-plated)				
Cable diameter	[mm]	2.9				
Nominal conductor cross section	[mm ²]	0.14				
Mechanical						
Mounting position		As desired, preferably vertical ³⁾				
Information on materials – housing/keypad		Polyamide (POM) reinforced				
Information on material – fibre-optic cable		PA				
Display/operation						
Threshold value setting range:						
– Switching pressure	[% FS]	0 ... 100 (recommended work range 1 ... 99)				
– Hysteresis (mode 2)	[% FS]	0 ... 100 (recommended work range 1 ... 99)				
– Hysteresis (mode 0, 1, 3)	[% FS]	2 (permanently set)				
Immission/emission						
Storage temperature	[°C]	-20 ... +80				
Degree of protection (in accordance with EN 60529)		IP40				
Protection class (in accordance with DIN VDE 0106-1)		III				
Shock resistance (in accordance with EN 60068-2)		30 g acceleration with 11 ms duration (half-sine)				
Vibration resistance (in accordance with EN 60068-2)		0.35 mm travel, 5 g acceleration at 10 ... 150 Hz				
Corrosion resistance class CRC		2				

1) Starting value...End value.

2) Switching times do not apply with additional function activated ...- TF (filter function).

3) No condensed water should be allowed to accumulate in the pressure measuring cell.