SCHMIDT® Flow Sensor
SS 20.400

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Product description

Thermal flow sensor for the measurement in one or two directions of the flow velocity of air and gases with simultaneous detection of the flow direction.

Extremely compact because electronics are integrated in the sensor tube. Sensor element located in the chamber head and protected against mechanical load. Linear analog output to indicate the measurement values, two switching outputs to output the flow direction and the signal of the threshold value. An optional programming kit (RS232 with Windows PC) allows on-site the configuration of the sensor, with additional indication of temperature and flow quality (degree of turbulence) of the medium.

When installed in a measuring tube, it is suitable for the measurement of the standard volumetric flow or the mass flow.

Application examples

■ Laminar-flow monitoring in cleanrooms

■ Monitoring of room cross-flow

■ Cooling air monitoring

■ Flow measurement in test benches

■ Mass and volume flow measurement

Product advantages

■ Bidirectional measurement

■ Precise detection of direction

■ Very low beginning of measuring range

■ Very fast response

■ Easy single-hole mounting

■ Switching outputs

■ Self-monitoring
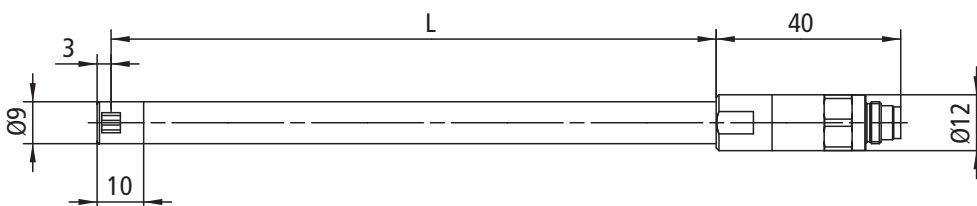
■ Assessment of flow quality

Self-monitoring

The sensor permanently monitors its function. If a fault, causing a measurement error, is detected, it will be signalled as follows:
+ Analog: current interface (4 ... 20 mA) drops to 2 mA
+ RS232:   error diagnosis by programming kit

Detectable faults at the sensor element:
+ Humidity: reversible error is signalled until sensor element has become dry
+ Soiling: requires cleaning
+ Defective: send for repair

Dimensional drawing

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Technical data

| Measuring quantity	standard velocity w_N of air relative to standard conditions 20 °C and 1013.25 hPa
Medium to be measured	clean air or nitrogen, other gases on request
Measuring range w_N	0 ... 1 m/s 0 ... 2.5 m/s 0 ... 5 m/s 0 ... 10 m/s 0 ... 20 m/s unidirectional or bidirectional
Lower detection limit	0.05 m/s
Measuring inaccuracy	± (3 % of measuring value + 0.4 % of final value) min. ± 0.05 m/s
Repeatability	± 2 % of measuring value
Response time (t_{90})	0.01 ... 10 s (configurable)
Storage temperature	-20 ... +85 °C
Operating temperature	0 ... +60 °C
Humidity range	0 ... 95 % rel. humidity (RH)
Pressure range	700 ... 1300 hPa
Supply voltage U_B	7,5 ... 24 V DC + 10 % [1]
Current consumption	typ. < 10 mA (without electrical load)
Analog output	current ($R_L \leq$ 300 Ω): • 0 ... 20 mA • 4 ... 20 mA [2] voltage ($R_L \geq$ 10 kΩ): • 0 ... 10 V • 0 ... 5 V • 0 ... 2 V
Switching outputs • Signal • Model • Electrical data • Adjustment threshold value • Switching hysteresis • Configuration	OC1 and OC2 OC1: direction or threshold value OC2: threshold value open-collector, current-limited and short-circuit protected $U_{S, max}$ = 26.4 V DC $I_{S, max}$ = 65 mA 0 ... 100 % of end value; min. ± 0.05 m/s 5 % of switch threshold; min. 0.05 m/s via RS232 (programming kit)
Electrical connection	plug-in connection M9, 7-pin type: male connector
Line length	15 m max. (voltage output) 100 m max. (current output)
Protection type	IP 67 (housing) IP 67 (connector)
Mounting	by means of a mounting flange (see accessories)
Dimensions / material - Sensor head um anodised - Sensor tube - Sensor length L - Plug-in connector	 Ø 9 mm x 10 mm alumini- Ø 9 mm stainless steel 1.4571 130 / 200 / 300 mm Ø 14 mm x 40 mm stainless steel 1.4571
Weight	about 60 g (with 300 mm sensor length)

[1] For the analog output with 0 … 10 V and for the current interface, the minimum voltage is $U_{B,min}$ = 12 V.
[2] Current output according to NAMUR NE43: Overflow ≤ 22 mA, error = 2 mA
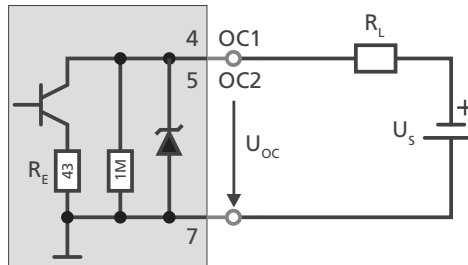
Output wiring
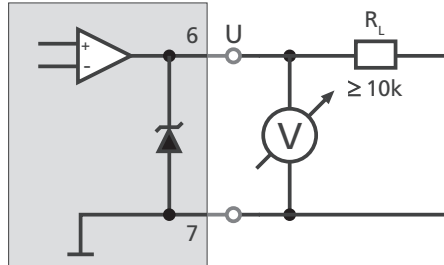
Analog output: 0 ... 2 / 5 / 10 V, $R_L \geq$ 10 kΩ
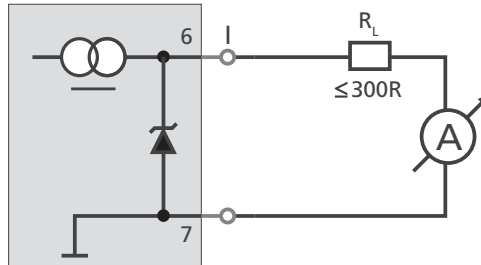
Analog output: 0 / 4 ... 20 mA, $R_L \leq$ 300 Ω

Switching outputs OC1, OC2

Switching outputs

The individual switching outputs can be used as follows:
a.) Direct activation of digital inputs with integrated pull-up resistor (e. g. PLC input).
b.) Direct driving of ohmic or inductive loads (e. g. LED or relay) with a maximum power consumption of 65 mA.
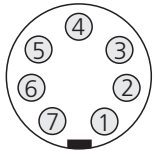
Note:
The internal resistance R_L under load may not fall below a minimum value, which can be calculated as follows:

$$R_L \geq \frac{U_S \, [V] - 2.6 \, V}{0.065 \, A} \, \Omega$$

Example: $R_{L, min}$ = 366 Ω for $U_{S, max}$ = 26.4 V

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Pin assignment

View on sensor plug pins

| Pin	Designation	Function	Wire color connecting cable
1	power	operating voltage U_B	white
2	TXD	RS232	brown
3	RXD	RS232	green
4	OC1	switching output 1: direction or switch threshold	yellow
5	OC2	switching output 2: switch threshold	grey
6	analog	velocity signal	pink
7	ground	ground connection	blue
	shield [1]	electromagnetic screening	shielding braid

[1] The braiding shield which is connected electrically to the metallic housings of connector and sensor has to be coupled to protective potential, e. g. earth (depending on the shielding scheme).

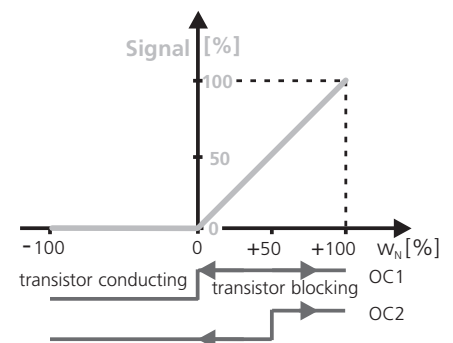## Display of analog and digital signals

Bidirectional
direction display: swiching output OC1
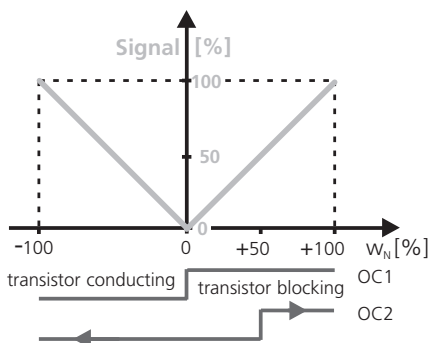
Bidirectional
direction display: 0 m/s = 50 % signal
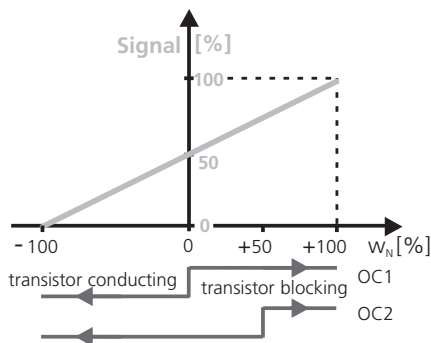
Unidirectional
direction display: none

Note: In an unidirectional design, the switching output OC1 is used as a flow indicator by default (configurable). It indicates a flow greater than 0 m/s by blocking and switches through in case flow is smaller or equal 0 m/s. The arrows in the figure of the switching outputs signify that the threshold value is configurable.
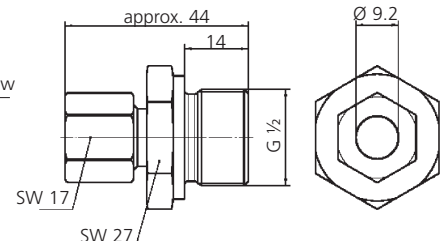
Mounting accessories
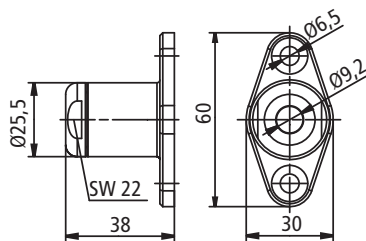
Wall-mounting flange 520 181
For mounting on walls through wall openings
Material: stainless steel 1.4571, PTFE
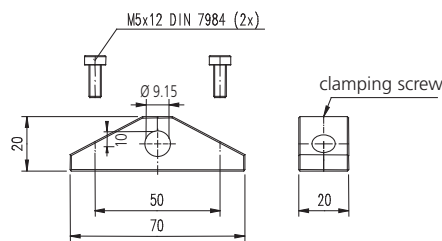
Wall-fixture 503 895
For mounting in front of wall openings
Material: anodised aluminium

Through bolt joint 301 082
For gas-tight mounting in tubes and channels
Material: stainless steel 1.4571, clamping ring PTFE

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Accessories

Wall-mounting flange	520 181
Wall-fixture	503 895
Through bolt joint	301 082
Coupler socket M9, 7-pin, with soldering sleeves for cable 0.14 mm²	507 150
Connecting cable (shielded), with coupler socket M9, 7-pin cable length: 2 m / 5 m / 10 m	505 911 -1 / -2 / -3
Programming kit, suitable for PC's with Windows 2000 or XP and with RS232 interface	505 960
Extension cable between programming kit and sensor	506 944
ISO Calibration Certificate	506 247 -xx

Programming kit

Ordering information

Article no. 518 210 -XYDZR-P	Mounting length X | L		Measuring range Y | w_N		Measuring direction D |		Output Z |		Indication of direction R |		Programming P |	
	1	130 mm	1	0 ... 1 m/s	1	unidirectional	1	0 ... 10 V	1	OC1 = direction signal	S	standard
	2	200 mm	2	0 ... 2.5 m/s	2	bidirectional	2	0 ... 5 V	2	analog signal contains direction 0 m/s = 50 % signal	K	customized
	3	300 mm	3	0 ... 5 m/s			3	0 ... 2 V				
			4	0 ... 10 m/s			4	0 ... 20 mA[1]	3	unidirectional		
			5	0 ... 20 m/s			5	4 ... 20 mA[1]				

[1] Current output versions are not available with L = 130 mm.

Programming kit

The following default settings can be changed using the programming kit or preprogrammed by factory (P = K):

Parameter	Factory setting	Setting range	Note
Response time	1 s	0.01 ... 10 s	
Threshold value OC1	0 m/s	(-100 …) 0 … +100 %	set to 0 m/s for bidirectional version with indication of direction via OC1
Threshold value OC2	50 % of measuring range	(-100 …) 0 … +100 %	
Switching polarity OC1/2	see graphics page 3	polarity reversible	

The user interface displays the values of flow, temperature of the medium and status of switching outputs continuously, combined with the calculated degree of flow turbulence (operating manual art. no. 505 959.02).
This kind of measurement transmission and evaluation is intended for configuration or testing purposes only and not suitable for continuous operating.