

SCHMIDT® Flow Sensor

SS 25.60

SS 25.60 FB



Product description

The flow sensor **SS 25.60** is a mass flow sensor (thermal anemometer), designed for use in oxygen. Due to a careful cleaning during production and packaging of the sensor according to the standard IEC/TR 60877:1999, the sensor can be used in gas mixtures with an oxygen percentage of at least 21 % or in pure oxygen.

Application examples

- Consumption measurement
- Process control
- Burner control
- Welding and cutting technology

Danger warning



Danger warning: **RISK of FIRE and EXPLOSION**

Read and observe the following information!

It is explicitly pointed out that the customer, when opening the packaging assumes full responsibility for the cleanliness of the sensor and its accessories according to the standard IEC/TR 60877:1999.

Product advantages

- High temperature gradient permissible
- Electronic temperature compensation active in the whole range of operating temperatures
- Very high turn down ratio of up to 1 : 1000
- Easy, cost-saving mounting
- Pressure-proofed up to 16 bar
- Digital output for connection to supply meter or energy management systems
- Signaling of sensor state (flow velocity in 6 stages or fault) via 4 double LED's
- Optionally with integrated field bus interface

Information concerning the handling

The general rule applies that a soiling of sensor parts that come into contact with oxygen must be absolutely avoided:

- The installation site must be carefully cleaned before mounting the sensor.
- Make sure to use only clean tools and material for the installation.
- Before opening the packaging film, remove the dirt such as dust from the film, if necessary.
- If possible, open the packaging film and take out the sensor directly at the installation site.
- Otherwise open the packaging film at an appropriate and clean workplace and store the sensor in an appropriate, cleaned and dust and humidity tight container.
- Do not touch the oxygen contacting sensor parts with bare hands.
- Use clean and non-fluffy gloves or cloths or similar to handle the sensor.

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Technical data		
Measuring quantity	standard flow velocity w_N normalized to $\vartheta_N = 20\text{ °C}$ and $p_N = 1013.25\text{ hPa}$	
Measuring fluid	air or nitrogen other gases on request	
Measuring range (w_N)	0 ... 200 m/s / 656.2 ft/s 0 ... 160 m/s / 524.9 ft/s 0 ... 120 m/s / 393.7 ft/s 0 ... 60 m/s / 196.9 ft/s 0 ... 40 m/s / 131.2 ft/s 0 ... 20 m/s / 65.6 ft/s 0 ... 10 m/s / 32.8 ft/s 0 ... 2.5 m/s / 8.2 ft/s	
Lower range limit	0.2 m/s	0.66 ft/s
Lower detection limit	0.1 m/s	0.33 ft/s
Measuring inaccuracy	$\pm (3\text{ \% of measurement value} + 0.4\text{ \% of measuring range})$	
Repeatability	$\pm 0.5\text{ \% of measurement value}$	
Response time (t_{90})	3 s (0 to 5 m/s transient)	
Operating temperature		
- Compact sensor	-20 ... +85 °C	
- Remote sensor	-20 ... +120 °C	
- Electronics	0 ... +60 °C	
Storage temperature	-20 ... +85 °C	
Humidity range	0 ... 95 % RF	
Pressure range		
- Atmospheric	700 ... 1300 hPa	
- Overpressure	0 ... 16 bar (only compact sensor)	
Temperature gradient	8 K/min @ $w_N = 5\text{ m/s}$	
Recovery time constant	6 s at temperature jump $\Delta\vartheta_{\text{air}} = 40\text{ K}$, $w_N = 5\text{ m/s}$	
Temperature dependence	compensated within the operating temperature range	
Pressure dependence	independent of medium pressure within pressure range	
Zero offset compensation	pressure dependent adaptation of characteristic line	
Supply voltage U_B	24 V DC $\pm 20\text{ \%}$	
Current consumption		
• Standard	75 mA typ. @ $w_N = 0\text{ m/s}$ 140 mA typ. @ $w_N = 200\text{ m/s}$	
• Fieldbus	250 mA typ. @ $w_N = 160\text{ m/s}$	
Switch-on current		
• Standard	160 mA for max. 5 s	
• Fieldbus	270 mA for max. 5 s	
Stabilization time	approx. 10 s after switch-on	

1) Output with error indication according to NAMUR NE43
(error signaling current 2 mA)

2) Tube throughpassage and safety chain are included in delivery of compact sen-

Electrical connection standard sensor	
Electrical connection	plug-in connector M12, 4-pin including connection cable with plug, 4 x 0.34 mm², pigtail with wire end sleeve
Cable length (standard)	5 m
Cable length (adm.)	
• Voltage output	15 m
• Current output	100 m
• Digital output	100 m
Analog output	selectable when ordering
• Type voltage	0 ... 10 V
• Type current	0 / 4 ¹⁾ ... 20 mA
Load resistance (adm.)	
• Voltage output	$\geq 10\text{ k}\Omega$
• Current output	$\leq 400\text{ }\Omega$
Digital output	pulse output high level: $\geq U_B - 3\text{ V}$ low level: $< 0.7\text{ V}$ load resistance: $\geq 2\text{ k}\Omega$
Digital output frequency	0 ... 100 Hz 0 ... 40 Hz 0 ... 20 Hz 0 ... 16 Hz 0 ... 10 Hz (selectable when ordering)
Digital pulse duration	min. 1 / (2 x f_{max})

Other features

Housing

Probe tube

Sensor head

Sensor element

aluminium anodised

stainless steel 1.4571

thermoplast PPO/PA

platinum resistor element, glass passivated

Mounting

tube throughpassage, stainless steel 1.4571,
pressure-proofed, probe tube adjustable,
mounting thread G 1/2 x 12

Mounting tolerance

$\pm 5^\circ$ relative to flow direction

Installation position

as desired, for vertical downdraft flow lower
range limit approx. 2m/s

Dimensions

• Standard housing

• Housing field bus

• Sensor head

• Probe tube

67.3 mm x 56.5 mm (Ø x H)

67.3 mm x 103.5 mm (Ø x H)

8 mm x 15.2 mm x 12.5 mm (W x H x D)

15 mm (Ø)

Mounting length (L)

• Compact probe

• Remote probe

120 / 180 / 250 / 400 mm optionally

190 mm, remote from housing,
with 3 m connection cable firmly fixed

Weight

450 g max. (without cable)

800 g (SS 25.60 FB)

Protection type

IP 65 (housing)

IP 67 (sensor head + tube)

¹⁾ Output with error indication according to NAMUR NE43
(error signaling current 2 mA)

²⁾ Tube throughpassage and safety chain are included in delivery of compact sensors. Remote sensors will solely be delivered with tube throughpassage.

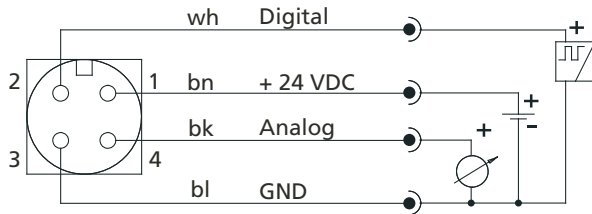
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Pin assignment SS 25.60 and SS 25.60 FB

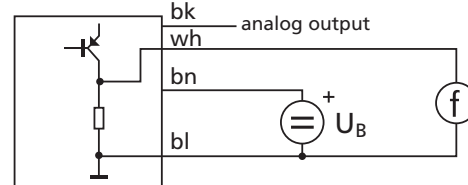


View on sensor plug pins.

Color assignment of connection cable 300 722:
wh = white, bn = brown, bk = black, bl = blue

Minus pole of supply voltage (GND) is also reference potential for analog signal.

Digital output



LED display

The standard version of SS 25.60 (not version FB) has a 4-fold double LED status display. The following states are indicated:

No.	state	LED 1	LED 2	LED 3	LED 4
1	operational & flow < 5 %				
2	operational > 5 %				
3	operational > 20 %				
4	operational > 50 %				
5	operational > 80 %				
6	operational > 100 % = Overflow				
7	sensor element defective				

No.	state	LED 1	LED 2	LED 3	LED 4
8	supply voltage too low				
9	supply voltage too high				
10	temperature of electronics too high				
11	temperature of electronics too low				

Legende

- LED off
- LED on: green
- LED on: orange
- LED flashes (approx. 2 Hz): red

Field bus interface DeviceNet

Standardization	ISO / DIS 11 898 DeviceNet specification volume I + II release 2.0
Electrical connection	8-pin screw-type terminal inside the housing cable feed via 3 cable bushings
Terminal resistor	The terminal resistor (120 Ohm, 0.25 W) is dis- abled on delivery and can be switched in by a single-pole DIP switch.
Baud rate	125 / 250 / 500 kbit/s, default value 125 kbit/s, adjustable via DIP switches or by software
Address	0 .. 63, default value of address 63 (MAC ID 63), can be configured via rotary switch or by software
Operating modes	poll mode, Change of State (COS), cyclic
Process data	32 bit; volume flow, alternatively flow velocity selectable
Switch thresholds	upper and lower switch threshold adjustable for flow velocity and volume flow
Warning flag	signal when exceeding measuring range
Alarm flag	signal of a defective sensor
Status display	two-color LED indicates status of field bus com- munication

Field bus interface PROFIBUS DP

Standardization	PROFIBUS standard EN 50 170
Electrical connection	8-pin screw-type terminal inside the housing cable feed via 3 cable bushings
Terminal resistor	The activated network terminal resistor (390-220- 390 Ohm) is disabled on delivery and can be switched in by a two-pole DIP switch.
Baud rate	9600 Bd – 12 MBd, automatic adjustment by PROFIBUS master
Address	00 ... 99, adjustable via BCD rotary switch
Operating modes	"Data Exchange" to PROFIBUS DP-V0
Process data	32 bit; volume flow, alternatively flow velocity selectable
Switch thresholds	upper and lower switch threshold adjustable for flow velocity and volume flow
Warning flag	signal when exceeding measuring range
Alarm flag	signal of a defective sensor
Status display	two-color LED indicates status of field bus com- munication

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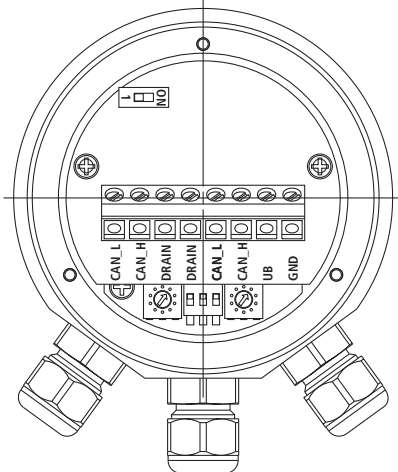
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Pin assignment DeviceNet interface

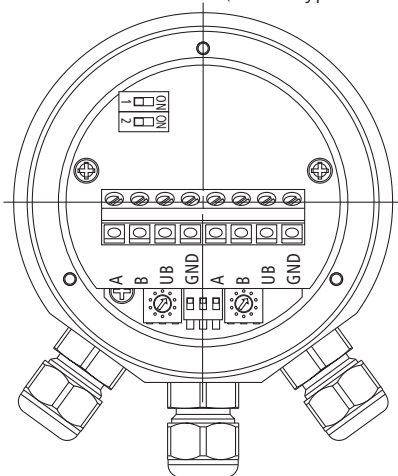
Electrical connections (screw-type terminals)



Pos.	Cable color	Solder pin/terminal	Explanation
1	blue	CAN_L	CAN negative data line (dominant low)
2	white	CAN_H	CAN positive data line (dominant high)
3	without	drain (CAN_SHLD)	shield connections
4	without	drain (CAN_SHLD)	shield connections
5	blue	CAN_L	CAN negative data line (dominant low)
6	white	CAN_H	CAN positive data line (dominant high)
7	red	U _B (24 V ± 20 %)	supply voltage
8	black	GND	connection to earth

Pin assignment PROFIBUS interface

Electrical connections (screw-type terminals)



Pos.	Solder	Explanation
1	A	negative serial data line
2	B	positive serial data line
3	U _B	supply voltage (24 V ± 20 %)
4	GND	connection to earth
5	A	negative serial data line
6	B	positive serial data line
7	U _B	supply voltage (24 V ± 20 %)
8	GND	connection to earth

Process data field bus modules

The process data are transmitted to the bus master via the the field bus. According to the adjusted function, you will obtain the flow velocity or the volume flow in a 32-bit representation of integers (only positive values). Optionally, a further byte can be transmitted which is transmitting the limit value, the alarm flags and the warning flags.

Parameters	Meaning	Value range	Default value
Flow velocity	measured flow velocity w_N of medium	0.00 ... 160.00 (16 bit)	0
Volume flow	volume flow calculated from flow velocity	0.00 ... 5773265.96 (32 bit)	0
Lower flag	lower switch threshold L_U not reached	0: $w_N \geq L_U$ 1: $w_N < L_U$	0
Upper flag	upper switch threshold L_O exceeded	0: $w_N \leq L_O$ 1: $w_N > L_O$	0
Warning flag	measuring range M_N exceeded	0: $w_N \leq M_N$ 1: $w_N > M_N$	0
Alarm flag	sensor defective	0: OK 1: Error	0

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Calculation of volume flow in the field bus module

The sensor with field bus interface can convert the measured flow velocity w_N in a standard volume flow V_N , if the correct inside diameter ID has been communicated to the sensor before. The necessary profile factors PF for the conversion are permanently stored in the sensor.

For this the following information is required: bore diameter of measuring tube (profile factor is deposited in the sensor), in order to find out the volume flow rate in m^3/s (conversion factor: CF). In order to convert into other measurements a unit factor is required (unit factor see adjoining scale).

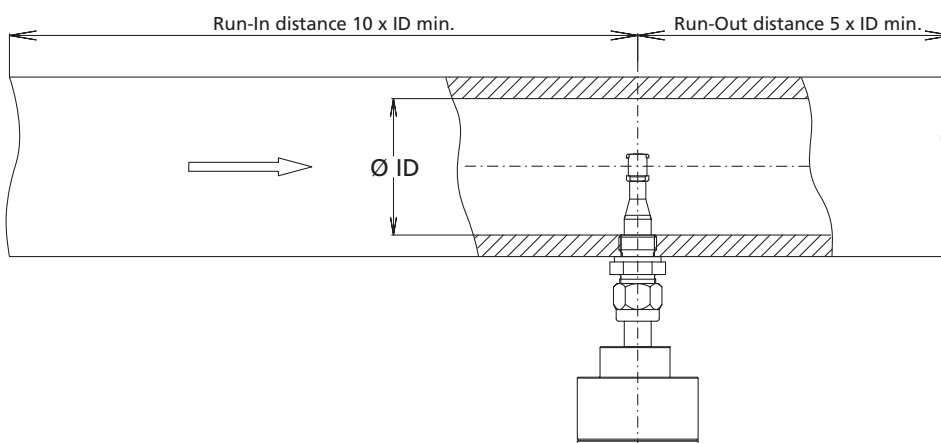
Supported unit factors:

position	unit factor
1	[m^3/min]
2	[m^3/h]
3	[l/s]
4	[ft^3/min]
5	[ft^3/h]

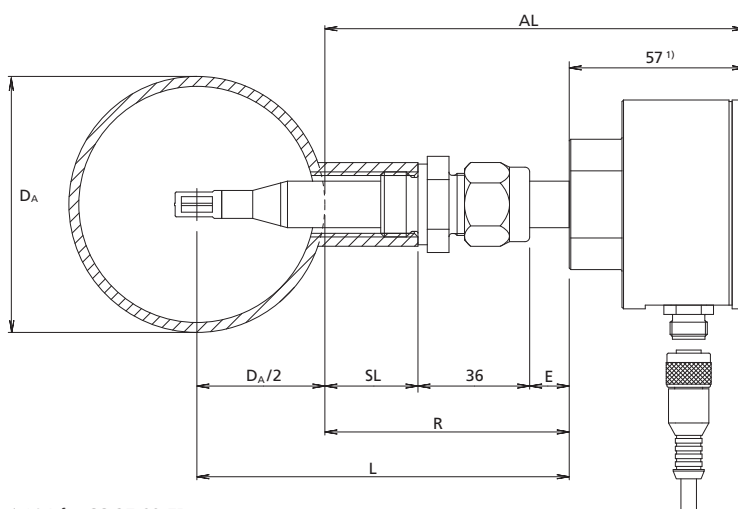
$$CF = \Pi \cdot (ID/2)^2 \cdot PF$$

$$V_n = w_N \cdot UF \cdot CF$$

Mounting instructions



Mounting parameters



D_A = tube outside diameter
 SL = welding stud length
 E = probe tube setting length
 AL = compact sensor projecting length
 R = reference length
 L = probe tube mounting length
 Recommended welding stud length:
 min. 10 mm, max. 30 mm

Formula for calculation:

Which probe length is at least necessary?

$$L > D_A/2 + SL + 36 \text{ mm}$$

Where must the immersion mark be placed at the probe tube?

$$E = L - D_A/2 - SL - 36 \text{ mm}$$

How much does the sensor projects out of the tube?

$$AL = L - D_A/2 + 57 \text{ mm}$$

For SS 25.60 FB:

$$AL = L - D_A/2 + 100 \text{ mm}$$

¹⁾ 104 for SS 25.60 FB

All dimensions in mm

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Selection table probe length

Probe length	Recommended for tubes from diameter	Suitable for tubes up to	When installing through ball valve for tubes up to
120 mm	DN 25 / 1"	DN 65 / 2½"	–
180 mm	DN 50 / 2"	DN 150 / 6"	DN 25 ¹⁾ / 1"
250 mm	DN 100 / 4"	DN 300 / 12"	DN 125 / 5"
400 mm	DN 250 / 10"	DN 800 / 32"	DN 450 / 18"

¹⁾ only if welding stud length = 10 mm

Mounting measurements and measuring ranges for measuring tubes

Tube diameters + corresponding PF				Mounting measurements				Measuring range of volume flow in m³/h for sensor measuring range			
DN	Inside	Outside	PF	L	AL	E	R	60 m/s	120 m/s	160 m/s	200 m/s
25	26.0	31.2	0.796	120.00	160.9	38.4	104.4	91.3	183	243	304
	28.5	33.7	0.796	120.00	159.7	37.2	103.2	110	219	292	366
	32.8	32.8	0.796	120.00	160.1	37.6	103.6	145	291	387	484
	36.3		0.770	120.00	176.5	54.0	120.0	172	344	459	574
40	39.3	44.5	0.748	120.00	154.3	31.8	97.8	196	392	523	653
	43.1	48.3	0.757	120.00	152.4	29.9	95.9	239	477	636	795
	45.8	51.0	0.763	120.00	151.0	28.5	94.5	272	543	724	905
50	51.2	57.0	0.772	120.00	148.0	25.5	91.5	343	687	916	1.144
	54.5	60.3	0.775	120.00	146.4	23.9	89.9	391	781	1041	1.302
	57.5	63.5	0.777	120.00	144.8	22.3	88.3	436	872	1162	1.453
	64.2	70.0	0.782	120.00	141.5	19.0	85.0	547	1094	1458	1.823
65	70.3	76.1	0.786	120.00	138.5	16.0	82.0	659	1318	1757	2.197
	76.1	82.5	0.792	120.00	135.3	12.8	78.8	778	1556	2075	2.594
80	82.5	88.9	0.797	180.00	192.1	69.6	135.6	920	1841	2454	3.068
100	100.8	108.0	0.804	180.00	182.5	60.0	126.0	1386	2772	3696	4.620
	107.1	114.3	0.806	180.00	179.4	56.9	122.9	1568	3137	4182	5.228
125	125.0	133.0	0.812	180.00	170.0	47.5	113.5	2152	4305	5740	7.175
	131.7	139.7	0.814	180.00	166.7	44.2	110.2	2395	4790	6387	7.984
150	150.0	159.0	0.817	180.00	157.0	34.5	100.5	3119	6237	8316	10.395
	159.3	168.3	0.820	180.00	152.4	29.9	95.9	3530	7060	9414	11.767
	182.5	193.7	0.825	180.00	139.7	17.2	83.2	4661	9323	12431	15.538
200	206.5	219.1	0.829	250.0	197.0	74.5	140.5	5997	11,994	15,992	19.990
250	260.4	273.0	0.835	250.0	170.0	47.5	113.5	9602	19,205	25,606	32.018
300	309.7	323.9	0.840	250.0	144.6	22.1	88.1	13,668	27,336	36,448	45.560
350	339.6	355.6	0.842	400.0	278.7	156.2	222.2	16,474	32,947	43,930	54.912
400	388.8	406.4	0.845	400.0	253.3	130.8	196.8	21,670	43,339	57,786	72.232
450	437.0	457.0	0.847	400.0	228.0	105.5	171.5	27,440	54,881	73,174	91.468
500	486.0	508.0	0.850	400.0	202.5	80.0	146.0	34,059	68,119	90,825	113.531
550	534.0	559.0	0.852	400.0	177.0	54.5	120.5	41,216	82,432	109,909	137.387
600	585.0	610.0	0.854	400.0	151.5	29.0	95.0	49,581	99,162	132,215	165.269

All dimensions in mm

Calculation volume flow

$$\dot{V}_N \left[\frac{m^3}{h} \right] = w_N \left[\frac{m}{s} \right] \cdot PF \cdot \pi \cdot \left(\frac{ID[mm]}{2} \right)^2 \cdot 0,0036$$

\dot{V}_N : standard volume flow
 w_N : standard flow velocity
 PF: profile factor
 ID: tube diameter inside

Unit conversion factors

1 m³/h	35.315 ft³/h
1 mm	0.03937 inch
1000 ft³/h	28.317 m³/h
1 inch	25.4 mm

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Accessories

ISO Calibration Certificate	300 815
SS 20.031 air consumption-display module	300 838
Power supply unit 24 V DC supply 115 / 230 V AC	300 640
Coupler socket 4-pin, with screw terminals	511 957

Spare parts

Connection cable, 4 pins, length 5 m	511 956 -1
length 10 m	511 956 -2
Through bolt joint G ½ x 12, stainless steel 1.4571, with Viton sealing, multi-removable	511 958

Order information

Article number: **510 799 – K X Y Z S F DD** Description: **Flow sensor SS 25.60**

Order key:

K	= type
X	= probe tube mounting length
Y	= measuring range
Z	= analog output type
S	= digital output type
F	= digital output frequency
DD	= operating overpressure

Note for scope of delivery:

Design of compact sensor:	with through bolt joint (511 958) and safety chain
Design remote sensor:	with through bolt joint (511 958)
SS 25.60	with connection cable (511 956-1), 4 pins, length 5 m
SS 25.60 FB:	with CD ROM with EDS- / GSD-file, without connection cable

Type	Mounting length		Measuring range	Analog output	Digital output	Digital output frequency	Operating overpressure ¹⁾
K	X	L	Y w _N	Z	S	F	DD
1 Standard	1	120 mm	1 0 ... 60 m/s	1 0 ... 10 V	1 Pulse output	2 0 ... 100 Hz	00 0 bar ²⁾
2 DeviceNet with cable bushing	2	180 mm	2 0 ... 40 m/s	2 0 ... 20 mA		3 0 ... 40 Hz	01 1 bar
	4	250 mm	3 0 ... 20 m/s	3 4 ... 20 mA ³⁾		4 0 ... 20 Hz	02 2 bar
3 PROFIBUS DP with cable bushing	5	400 mm	4 0 ... 10 m/s			5 0 ... 16 Hz
	3	190 mm / 3 m ⁴⁾	5 0 ... 2,5 m/s			6 0 ... 10 Hz
4 DeviceNet with plug connection			6 0 ... 120 m/s				16 16 bar
			7 0 ... 160 m/s				
5 PROFIBUS DP with plug connection			8 0 ... 200 m/s				

¹⁾ Operating overpressure of the medium to be measured at the installation place

²⁾ Atmospheric air pressure

³⁾ Option with field bus not possible

⁴⁾ Measuring range > 60 m/s not possible, only for operation under atmospheric pressure
Other configuration on request