



## 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.



Technical data		Electrical connection standard sensor	
Measuring quantity	standard flow velocity $w_N$ normalized to $\vartheta_N = 20\text{ °C}$ and $p_N = 1013.25\text{ hPa}$	Electrical connection	plug-in connector M12, 4-pin including connection cable with plug, 4 x 0.34 mm <sup>2</sup> , pigtail with wire end sleeve
Measuring fluid	air or nitrogen other gases on request	Cable length (standard)	5 m
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	Cable length (adm.)	5 m
Lower range limit	0.2 m/s 0.66 ft/s	• Voltage output	15 m
Lower detection limit	0.1 m/s 0.33 ft/s	• Current output	100 m
Measuring inaccuracy	± (3 % of measurement value + 0.4 % of measuring range)	• Digital output	100 m
Repeatability	± 0.5 % of measurement value	Analog output	selectable when ordering
Response time ( $t_{90}$ )	3 s (0 to 5 m/s transient)	• Type voltage	0 ... 10 V
Operating temperature		• Type current	0 / 4 <sup>1)</sup> ... 20 mA
- Compact sensor	-20 ... +60 °C	Load resistance (adm.)	
- Remote sensor	-20 ... +60 °C	• Voltage output	≥ 10 kΩ
- Electronics	0 ... +60 °C	• Current output	≤ 400 Ω
Storage temperature	-20 ... +85 °C	Digital output	pulse output high level: ≥ $U_B - 3\text{ V}$ low level: < 0.7 V load resistance: ≥ 2 kΩ
Humidity range	0 ... 95 % RF	Digital output frequency	0 ... 100 Hz 0 ... 40 Hz 0 ... 20 Hz 0 ... 16 Hz 0 ... 10 Hz (selectable when ordering)
Pressure range		Digital pulse duration	min. 1 / (2 x $f_{max}$ )
- Atmospheric	700 ... 1300 hPa	<b>Other features</b>	
- Overpressure	0 ... 16 bar (only compact sensor)	Housing	aluminium anodised
Temperature gradient	8 K/min @ $w_N = 5\text{ m/s}$	Probe tube	stainless steel 1.4571
Recovery time constant	6 s at temperature jump $\Delta\vartheta_{air} = 40\text{ K}$ , $w_N = 5\text{ m/s}$	Sensor head	thermoplast PPO/PA
Temperature dependence	compensated within the operating temperature range	Sensor element	platinum resistor element, glass passivated
Pressure dependence	independent of medium pressure within pressure range	Mounting	tube throughpassage, stainless steel 1.4571, pressure-proofed, probe tube adjustable, mounting thread G 1/2 x 12
Zero offset compensation	pressure dependent adaptation of characteristic line	Mounting tolerance	± 5° relative to flow direction
Supply voltage $U_B$	24 V DC ± 20 %	Installation position	as desired, for vertical downdraft flow lower range limit approx. 2m/s
Current consumption		Dimensions	
• Standard	75 mA typ. @ $w_N = 0\text{ m/s}$ 140 mA typ. @ $w_N = 200\text{ m/s}$	• Standard housing	67.3 mm x 56.5 mm (Ø x H)
• Fieldbus	250 mA typ. @ $w_N = 160\text{ m/s}$	• Housing field bus	67.3 mm x 103.5 mm (Ø x H)
Switch-on current		• Sensor head	8 mm x 15.2 mm x 12.5 mm (W x H x D)
• Standard	160 mA for max. 5 s	• Probe tube	15 mm (Ø)
• Fieldbus	270 mA for max. 5 s	Mounting length (L)	
Stabilization time	approx. 10 s after switch-on	• Compact probe	120 / 180 / 250 / 400 mm optionally
		• Remote probe	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)

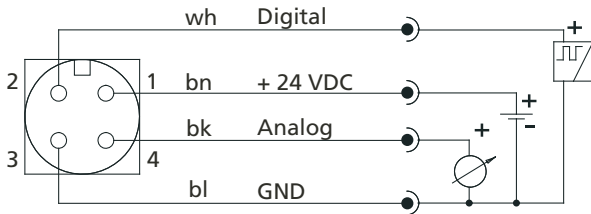
<sup>1)</sup> Output with error indication according to NAMUR NE43  
(error signaling current 2 mA)

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

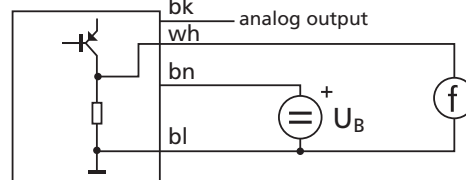
# SCHMIDT® Flow Sensor SS 25.60



## Pin assignment SS 25.60 and SS 25.60 FB



## Digital output



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.

## 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):

## Field bus interface DeviceNet

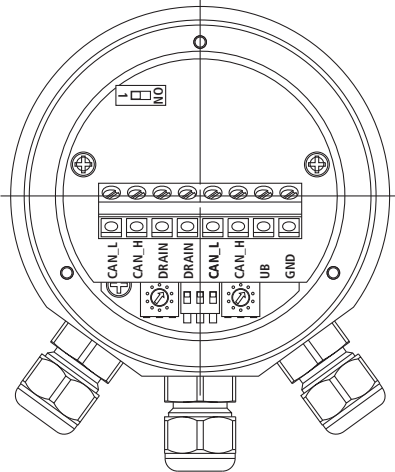
Standardization	ISO / DIS 11 898 DeviceNet specification volume I + II release 2.0
Electrical connection	8-pin screw-type terminal inside the housing cable feed via 3 cable bushings
Terminal resistor	The terminal resistor (120 Ohm, 0.25 W) is disabled on delivery and can be switched in by a single-pole 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-

## 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

## Pin assignment DeviceNet interface

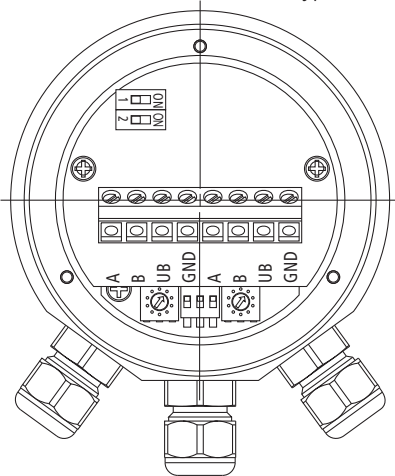
Electrical connections (screw-type terminals)



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 <sub>B</sub> (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 <sub>B</sub>	supply voltage (24 V ±20 %)
4	GND	connection to earth
5	A	negative serial data line
6	B	positive serial data line
7	U <sub>B</sub>	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 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

## 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).

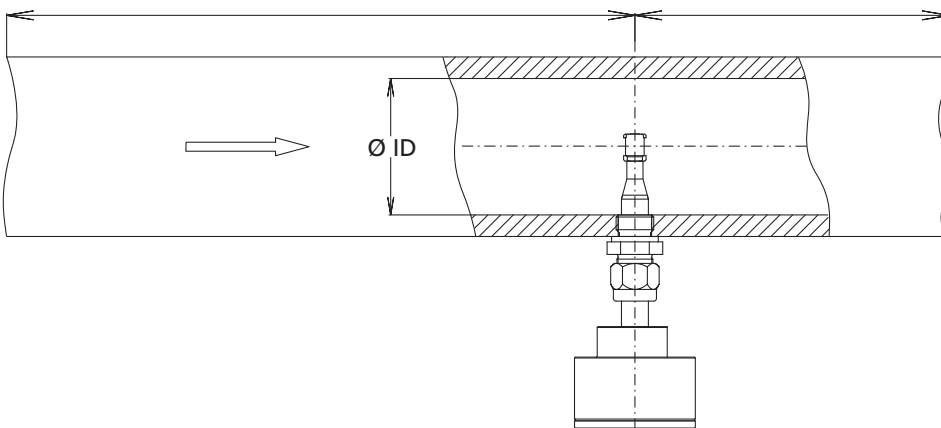
### Supported unit factors:

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

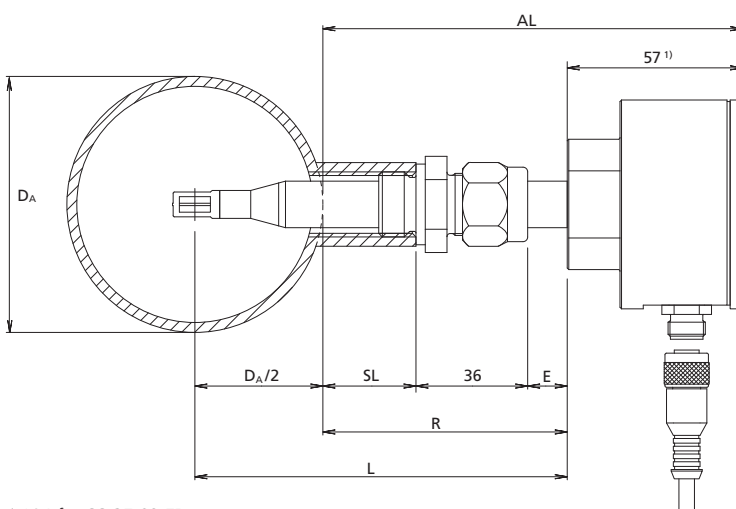
$$CF = \pi \cdot (ID/2)^2 \cdot PF$$

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

## 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:

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

<sup>1)</sup> 104 for SS 25.60 FB

All dimensions in mm

## 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 <sup>1)</sup> / 1"
250 mm	DN 100 / 4"	DN 300 / 12"	DN 125 / 5"
400 mm	DN 250 / 10"	DN 800 / 32"	DN 450 / 18"

<sup>1)</sup> 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



