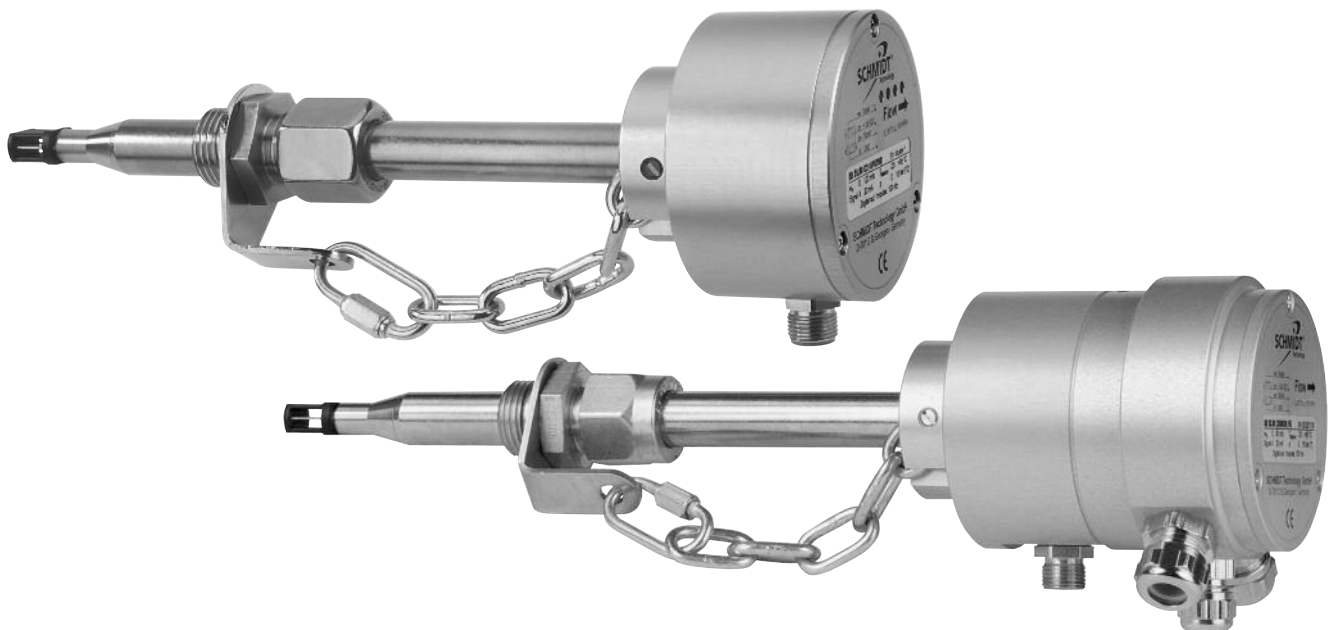


SCHMIDT® Flow Sensor

SS 20.60

SS 20.60 FB



Product description

Flow sensor with integrated microcontroller transducer for the measurement of air-flow velocity and for the determination of the flow rate and flow volume. The aerodynamically styled chamber head of the sensor provides optimized flow properties in respect of an extremely small flow resistance. This ensures that even an unclean mounting of the sensor (slight twisting, relative to the axis of flow, or tilting toward the sensor axis) will not have the slightest effect on the measurement result. Each sensor with an analog output, in addition, is equipped with a digital output enabling a direct consumption measurement of the air flow e.g. by means of a supply meter. In addition to that the **SS 20.60 FB** design is equipped with a bus interface for connecting to different field buses.

Product advantages

- High temperature gradient permissible
- Electronic temperature compensation active in the whole range of operating temperatures
- Large measuring-range dynamics of 1:800
- Easy, cost-saving mounting
- Pressure-proofed up to 16 bar
- Digital output for connection to supply meter or energy management systems
- Optionally with integrated field bus interface

Measuring principle

The principle of the flow measurement is based on the heat-transfer calorimetric method. An electrically heated thermo-resistor is kept at a constant higher temperature relative to the medium (CTD mode). The heat dissipation into the medium increases with the increasing mass flow. The heater voltage is thus a direct measure of the standard flow velocity. This measuring principle leads to the following, special properties:

- Direct measurement of a standard flow velocity or rather of a mass flow without any additional pressure and temperature sensors
- Smallest flow velocities can be measured
- No moving parts and thus no wear
- Measurement without additional pressure drop

Application example

- Compressed air consumption measurement
- Shielding gas flow measurement
- Control of volume flow
- Control of compressor
- Exhaust-air monitoring
- Control of combustion air for block-type thermal power plants and fuel cells
- Measurement of air mass flow in burners and combustion engines

SCHMIDT® Flow Sensor

SS 20.60

SS 20.60 FB



Product model types

SS 20.60



Standard sensor with analog + digital output

- Measuring ranges: up to 200 m/s
- Signal outputs: 1 analog, 1 digital

SS 20.60 FB



Field bus sensor with bus interface integrated in the electronic housing

- Measuring ranges: up to 160 m/s
- Signal outputs: 1 analog, 1 digital
- Field bus: **PROFIBUS DP (V0)** or **DeviceNet**
- Additional functions: calculation of volume flow, monitoring of threshold value

Design Remote Sensor

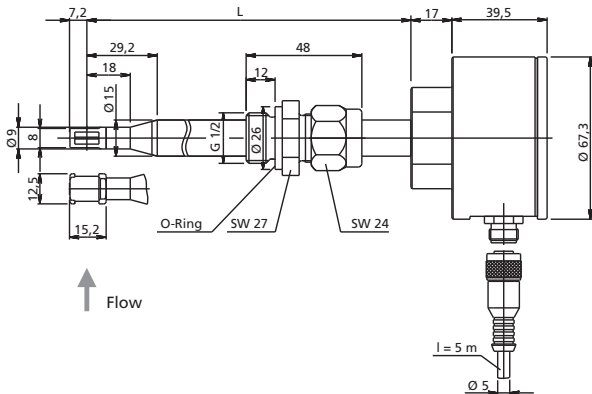


The above mentioned models can be delivered, as shown in the picture, as so-called **compact sensors** or as **remote sensors**.

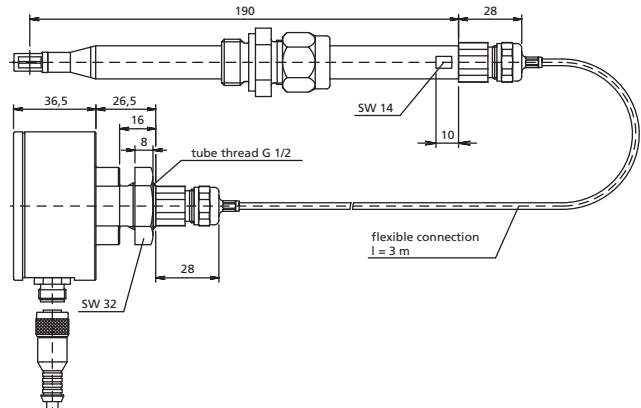
The remote sensor differs in the following characteristics:

- 3 m cable between sensor and electronics, firmly fixed on both sides
- Temperature of the medium up to 120 °C
- Only for operation under atmospheric pressure

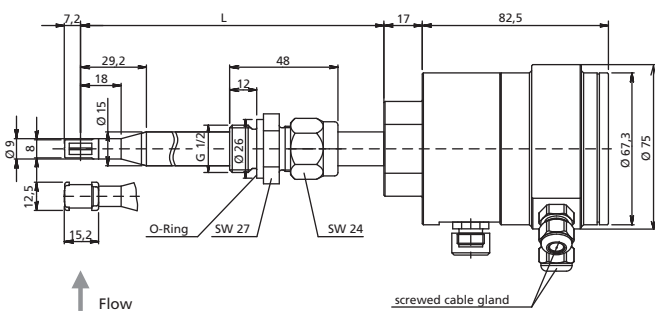
Dimensions Compact Sensor



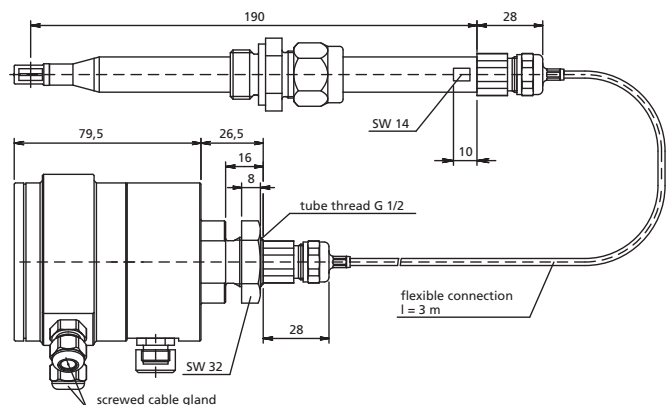
Dimensions Remote Sensor



Dimensions Compact Sensor SS 20.60 FB



Dimensions Remote Sensor SS 20.60 FB



All dimensions in mm (if not otherwise noted)

SCHMIDT® Flow Sensor

SS 20.60

SS 20.60 FB



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 ² , 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.)	• Voltage output 15 m • Current output 100 m • Digital output 100 m
Lower range limit	0.2 m/s 0.66 ft/s	Analog output	selectable when ordering
Lower detection limit	0.1 m/s 0.33 ft/s	• Type voltage	0 ... 10 V
Measuring inaccuracy	± (3 % of measurement value + 0.4 % of measuring range)	• Type current	0 / 4 ¹⁾ ... 20 mA
Repeatability	± 0.5 % of measurement value	Load resistance (adm.)	• Voltage output ≥ 10 kΩ • Current output ≤ 400 Ω
Response time (t_{90})	3 s (0 to 5 m/s transient)	Digital output	pulse output high level: ≥ $U_B - 3\text{ V}$ low level: < 0.7 V load resistance: ≥ 2 kΩ
Operating temperature	-20 ... +85 °C	Digital output frequency	0 ... 100 Hz 0 ... 40 Hz 0 ... 20 Hz 0 ... 16 Hz 0 ... 10 Hz (selectable when ordering)
- Compact sensor	-20 ... +85 °C	Digital pulse duration	min. 1 / (2 x f_{max})
- Remote sensor	-20 ... +120 °C	Other features	
- Electronics	0 ... +60 °C	Housing	aluminium anodised
Storage temperature	-20 ... +85 °C	Probe tube	stainless steel X6 CrNiMoTi 1.4571
Humidity range	0 ... 95 % RF	Sensor head	thermoplast PPO/PA
Pressure range	700 ... 1300 hPa	Sensor element	platinum resistor element, glass passivated
- Atmospheric	700 ... 1300 hPa	Mounting	tube throughpassage, brass, pressure-proofed, probe tube adjustable, mounting thread G 1/2 x 12
- Overpressure	0 ... 16 bar (only compact sensor)	Mounting tolerance	± 5° relative to flow direction
Temperature gradient	8 K/min @ $w_N = 5\text{ m/s}$	Installation position	as desired, for vertical downdraft flow lower range limit approx. 2m/s
Recovery time constant	6 s at temperature jump $\Delta\vartheta_{air} = 40\text{ K}$, $w_N = 5\text{ m/s}$	Dimensions	• Standard housing 67.3 mm x 56.5 mm (Ø x H) • Housing field bus 67.3 mm x 103.5 mm (Ø x H) • Sensor head 8 mm x 15.2 mm x 12.5 mm (W x H x D) • Probe tube 15 mm (Ø)
Temperature dependence	compensated within the operating temperature range	Mounting length (L)	• Compact probe 120 / 180 / 250 / 400 mm optionally • Remote probe 190 mm, remote from housing, with 3 m connection cable firmly fixed
Pressure dependence	independent of medium pressure within pressure range	Weight	450 g max. (without cable) 800 g (SS 20.60 FB)
Zero offset compensation	pressure dependent adaptation of characteristic line	Protection type	IP 65 (housing) IP 67 (sensor head + tube)
Supply voltage U_B	24 V DC ± 20 %		
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 sensors. Remote sensors will solely be delivered with tube throughpassage.

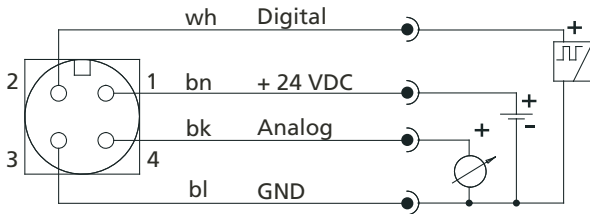
SCHMIDT® Flow Sensor

SS 20.60

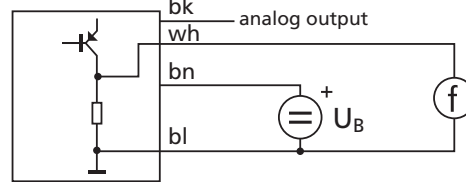
SS 20.60 FB



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 20.60 (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 %	LED on: orange	LED off	LED off	LED off
2	operational > 5 %	LED on: green	LED off	LED off	LED off
3	operational > 20 %	LED on: green	LED on: green	LED off	LED off
4	operational > 50 %	LED on: green	LED on: green	LED on: green	LED off
5	operational > 80 %	LED on: green	LED on: green	LED on: green	LED on: green
6	operational > 100 % = Overflow	LED on: green	LED on: green	LED on: green	LED on: orange
7	sensor element defective	LED flashes (approx. 2 Hz): red	LED flashes (approx. 2 Hz): red	LED flashes (approx. 2 Hz): red	LED flashes (approx. 2 Hz): red

No.	state	LED 1	LED 2	LED 3	LED 4
8	supply voltage too low	LED flashes (approx. 2 Hz): red	LED flashes (approx. 2 Hz): red	LED off	LED off
9	supply voltage too high	LED off	LED off	LED flashes (approx. 2 Hz): red	LED flashes (approx. 2 Hz): red
10	temperature of electronics too high	LED flashes (approx. 2 Hz): red	LED off	LED off	LED flashes (approx. 2 Hz): red
11	temperature of electronics too low	LED off	LED flashes (approx. 2 Hz): red	LED flashes (approx. 2 Hz): red	LED off

Legende

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

Field bus interface DeviceNet

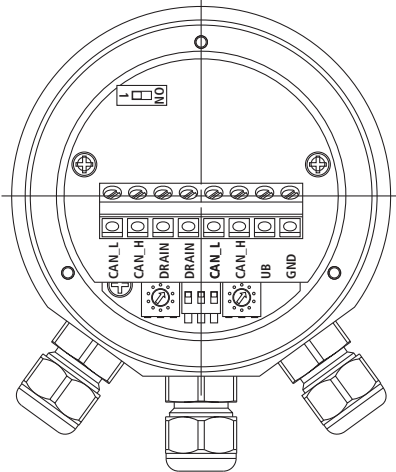
Standardization	ISO / DIS 11 898 DeviceNet specification volume I + II release 2.0
Electrical connection	8-pin screw-type terminal inside the housing cable feed via 3 cable bushings
Terminal resistor	The terminal resistor (120 Ohm, 0.25 W) is disabled on delivery and can be switched in by a single-pole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

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 communication

Pin assignment DeviceNet Interface

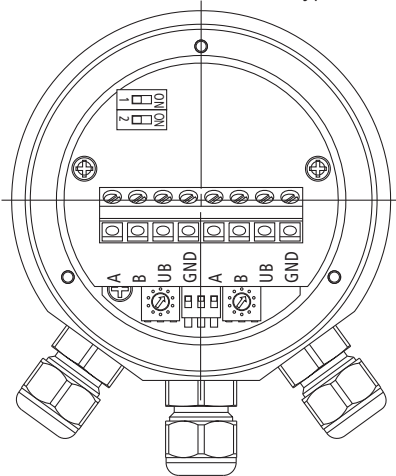
Electrical connections (screw-type terminals)



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 connection
4	without	drain (CAN_SHLD)	shield connection
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 pin/terminal	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 of field bus module

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 flag, 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

SCHMIDT® Flow Sensor

SS 20.60

SS 20.60 FB



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.

The conversion takes place using the following formula:

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

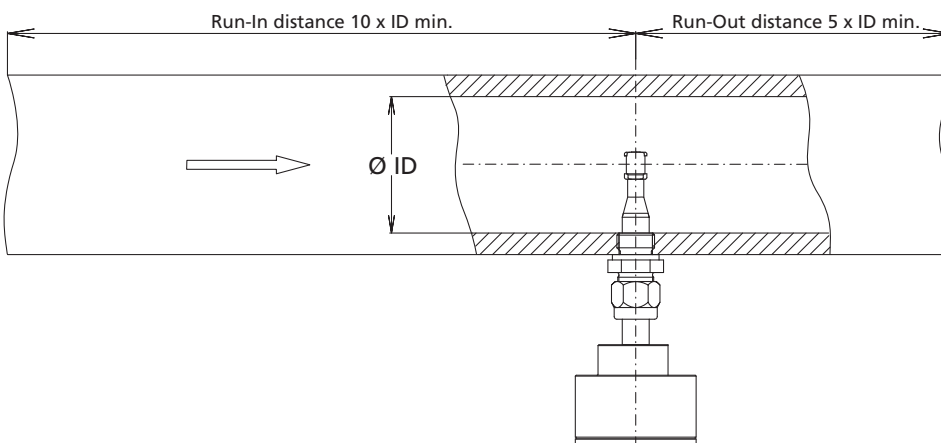
$$V_n = w_N \cdot UF \cdot CF$$

UF: unit factor
CF: conversion factor

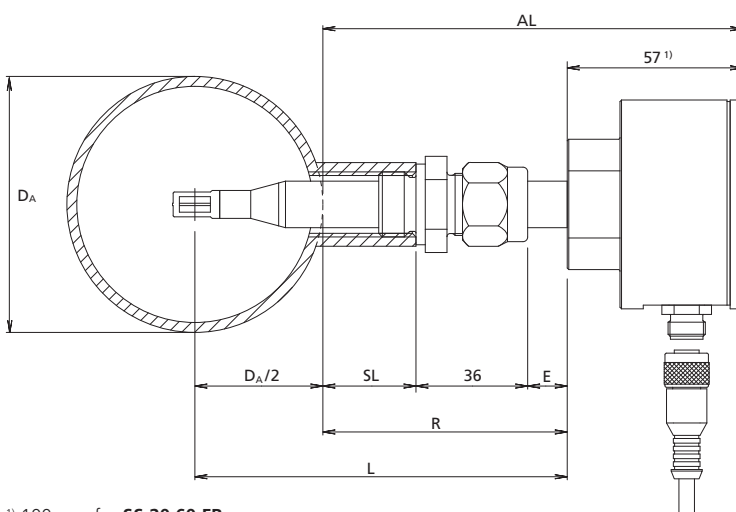
Unit factors (UF):

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

Mounting instructions



Mounting parameters



D_A = tube diameter outside
 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 20.60 FB:

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

¹⁾ 100 mm for SS 20.60 FB

SCHMIDT® Flow Sensor

SS 20.60

SS 20.60 FB



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

SCHMIDT® Flow Sensor

SS 20.60

SS 20.60 FB



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	301 008
Tube throughpassage G ½ x 12, stainless steel 1.4571, with Viton sealing, multi-removable	506 710

Spare parts

Connection cable, 4-pin, length 5 m	300 722
Tube throughpassage G ½ x 12, brass, multi-removable	300 730

Ordering information

Article number: **506 300 – K- X Y Z S F DD** Description: **Flow Sensor SS 20.60**

Ordering key:

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

Note on scope of delivery:

- Type compact sensor: with tube throughpassage (300 730) and safety chain with tube throughpassage (300 730)
- Type remote sensor: with connection cable, (300 722) 4-pin, length 5 m with CD Rom with EDS/GSD file, without connection cable
- SS 20.60:
- SS 20.60 FB:

Type	Mounting length		Measuring range	Analog output	Digital output	Digital output frequency	Operating overpressure ¹⁾	
	X	L					Y	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
3 PROFIBUS DP with cable bushing	4	250 mm	3 0 ... 20 m/s	3 4 ... 20 mA ³⁾		4 0 ... 20 Hz	02	2 bar
	5	400 mm	4 0 ... 10 m/s			5 0 ... 16 Hz
4 DeviceNet with plug connection	3	190 mm / 3 m ⁴⁾	5 0 ... 2,5 m/s			6 0 ... 10 Hz
			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