Simply a question of
better measurement

SCHMIDT® Flow Sensor
SS 23.400 ATEX 3
Instructions for Use

SCHMIDT® Flow Sensor
SS 23.400 ATEX 3

Table of Contents

Imprint:

Version: 514622.02H
Subject to modifications

1 Important information

These instructions for use contain all required information for a fast commissioning and safe operation of **SCHMIDT® Flow sensor SS 23.400 ATEX 3:**

- These instructions for use must be read completely and observed carefully, before putting the unit into operation.
- Any claims under the manufacturer's liability for damage resulting from non-observance or non-compliance with these instructions will become void.
- Tampering with the device in any way whatsoever - with the exception of the designated use and the operations described in these instructions for use - will forfeit any warranty and exclude any liability.
- The unit is designed exclusively for the use described below (see *chapter 2*). In particular, it is not designed for direct or indirect protection of personal and machinery.
- **SCHMIDT Technology** cannot give any warranty as to its suitability for certain purpose and cannot be held liable for accidental or sequential damage in connection with the delivery, performance or use of this unit.

Symbols used in this manual

The symbols used in this manual are explained in the following section.

Danger warnings and safety instructions - read carefully!

Non-observance of these instructions may lead to personal injury or malfunction of the device.

Risk of explosion - read carefully!

Important instructions for use in areas subject to explosion hazards.

General information

Operate sensor only with original connecting cables from **SCHMIDT Technology** (see chapter *4 Electrical connection*).
Use of any other cable makes the ATEX approval null and void.

Only suitable for use in clean gases.
The medium to be measured must not contain oils, residue forming substances or abrasive particles.

When transporting the sensor or carrying out not approved cleaning operations, always place the yellow protective cap on the sensor tip.

All dimensions are given in mm.

2 Application range

The **SCHMIDT® Flow sensor SS 23.400 ATEX 3** (article no.: 513 970) is designed for stationary measurements of the flow velocity of air and gases at atmospheric pressure and under clean ambient conditions.

The sensor is based on the measuring principle of a thermal anemometer and measures the mass flow of the measuring medium as flow velocity which is output in a linear way as standard velocity[1] w_N (unit: m/s), based on standard conditions of 1013.25 hPa and 20 °C. Thus, the resulting output signal is independent from the pressure and temperature of the measuring medium.

The essential characteristics of the product are listed below:

- Measuring task
  - Measurement of flow velocity
  - Detection of flow direction
    (bidirectional measurement, optional)
- Application examples
  - Laminar-flow monitoring in cleanrooms
  - Monitoring of room cross-flow
  - Cooling air monitoring
  - Flow measurement in test benches
  - Draft monitoring
- Use in areas subject to explosion hazards

  The device can be installed only in hazardous areas with gases (G) and in Zone 2 according the following declaration:

  II 3G Ex nA IIC T4 Gc

Note:

Only suitable for use in clean gases.
The medium to be measured must not contain oils, residue forming substances or abrasive particles.

The **SCHMIDT® Flow sensor SS 23.400 ATEX 3** is designed for use inside closed rooms and is not suitable for outdoor use.

[1] Corresponds to the real velocity under standard conditions mentioned above.

3 Mounting instructions

For installation of the **SS 23.400 ATEX 3** the following accessories are available (see Table 1):

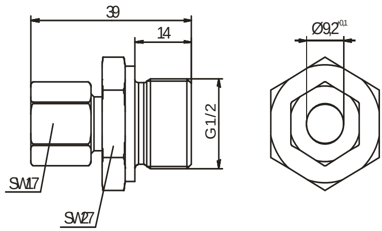
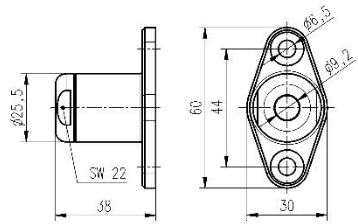
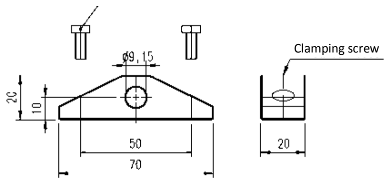
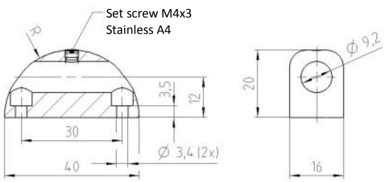
Type / art. no.	Drawing	Assembly
Compression fitting 532160		- Immersion sensor - Pipe (typ.) - Wall - Screwing into a clamp[2] - Material: Stainless steel 1.4571 Clamp collar PTFE
Wall mounting flange 520181		- Immersion sensor - Wall (plain surface) - Attachment with: 2 screws M5[3] - Material: Stainless steel 1.4404 Clamp collar PTFE O-ring Viton
Wall mounting bracket (an. aluminium) 503895		- Room-to-room overflow - Wall (plain surface) - Attachment with: 2 screws M5 x 12 - Material: Aluminium, anodised
Wall mounting bracket (stainless steel) 551740		- Room-to-room overflow - Wall (plain surface) - Attachment with: 2 screws M5 x 12 - Material: Stainless steel 1.4404

Table 1

All mounting fixtures fasten the sensor by means of frictional clamping on the sensor tube. This allows stepless positioning of the sensor in the holder both axially in direction of the longitudinal sensor axis (immersion depth) as well as in rotational direction around the same axis (tilting).

2 Commercially available welding stud (not included in delivery), must be welded.
3 Countersunk head (not included in the delivery)

The following points must be observed:

- The angle of tilt[4] to the flow direction should not exceed ±5° in order to avoid significant measuring errors (> 1 %).
- In inhomogeneous, laminar flow fields (e.g. a quasi-parabolic speed profile in a pipe), the sensor tip should be positioned at a place at which the highest speed occurs (adjustment of the immersion depth) because this position normally has the largest distance to interfering elements such as boundary surfaces.
- Both the compression fitting as well as the wall mounting flange are pressure-tight up to an overpressure of 500 mbar provided the installation has been carried out properly[5].

The customer bears the responsibility for securing the sensor against unintended discarding due to overpressure.

Flow with medium separation

To ensure the enclosures type of protection (IP54) observe the following mounting drawing for media-separated installation using the compression fitting or wall mounting flange (see for example Figure 3-1).

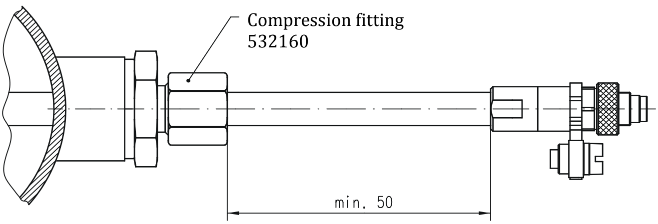


Figure 3-1

[4] Deviation between measurement direction of sensor head and flow direction.

[5] The screw-in thread of the compression fitting must be sealed for this purpose, e.g. by means of a copper seal or teflon tape.

Tube-related flow

Installation in a flow-guiding tube is carried out by means of a compression fitting (532160, see also Figure 3-1):

- Screw the threaded part of the compression fitting into the pipe union (hexagon with AF27).
  - ➢ If pressure tightness is required, first, seal the thread (e.g. wrap it with a teflon tape).
- Unscrew the spigot nut (AF17) to such an extent that the sensor can be inserted without jamming.
- Remove the protective cap from the sensor tip and insert the sensor into the bore of the fitting so that its tip is in the middle of the pipe.
- Tighten the spigot nut slightly by hand or with a fork wrench (AF17) to fasten the sensor.
- Align sensor to nominal flow direction (direction of arrow) considering that immersion depth must be maintained.

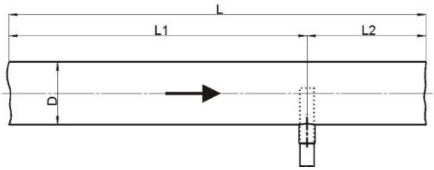
  The angular deviation should not exceed ±5° referenced to the ideal direction of the gaseous flow. Otherwise, the measurement accuracy may be impaired.
- Tighten spigot nut by turning the fork wrench (AF17) by a quarter while maintaining the sensor in position.

To achieve the accuracy specified in the data sheets, the sensor has to be positioned in a straight pipe section with undisturbed flow profile. An undisturbed flow profile can be achieved if a sufficiently long distance in front of the sensor (run-in distance) and behind the sensor (run-out distance) is held absolutely straight without disturbances (such as edges, seams, bends etc.; see Figure 3-2).

Correct measurements require laminar[6] flow with turbulences as low as possible.

The design of the run-out distance is also important, since disturbances do not only act in the direction of the air flow but also lead to turbulences against the flow direction.

[6] The term "laminar" means here an air flow low in turbulence (not according to its physical definition saying that the Reynolds number is < 2300).



L = Length of entire measuring section

L1 = Length of run-in distance

L2 = Length of run-out distance

D = Diameter of measuring section

Figure 3-2

The following Table 2 specifies the required straight lengths of the pipe sections depending on pipe diameter and different disturbances.

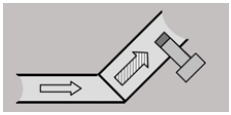
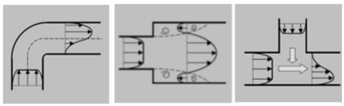
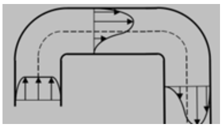
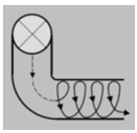
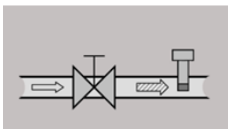
Flow obstacle upstream of measuring distance		Minimum distance length of	
		Run-in (L1)	**Run-out (L2)**
Light bend (< 90°)		**10 x D**	**5 x D**
Reduction, expansion, 90° bend or T-junction		**15 x D**	**5 x D**
Two 90° bends in one plane (2-dimensional)		**20 x D**	**5 x D**
Two 90° bends with 3-dimensional change in direction		**35 x D**	**5 x D**
Shut-off valve		**45 x D**	**5 x D**

Table 2

This table lists the minimum values required in each case. If the listed straight conduit lengths cannot be achieved, measurement accuracy may be impaired or additional actions are required like the use of flow rectifiers[7].

Under laminar conditions a quasi-parabolic speed profile emerges over the pipe cross-section, whereas the flow velocity at the pipe walls remains almost zero while reaching its maximum w_N in the pipe center (the opti-

[7] E.g. honeycombs made of plastics or ceramics; profile factor may change there-fore.

mum measuring point). This measuring value can be converted to an average speed $\overline{w_N}$ which is constant over the pipe cross-section by using a correction factor, the so-called profile factor PF. This profile factor depends on the pipe's inner diameter[8] (details see flow calculator).

Thus, it is possible to calculate the standard volumetric flow of the medium using the measured standard flow velocity in a pipe with known inner diameter:

$$A = \frac{\pi}{4} \cdot D^2$$

$$\overline{w}_N = PF \cdot w_N$$

$$\dot{V}_N = \overline{w}_N \cdot A \cdot EF$$

D	Inner diameter of pipe [m]
A	Cross section area of pipe [m^2]
w_N	Peak flow velocity in the middle of pipe [m/s]
$\overline{w}_N$	Average flow velocity in pipe [m/s]
PF	Profile factor (for pipes with circular cross-section)
EF	Measuring unit factor (conversion to non-SI units)
$\dot{V}_N$	Standard volumetric flow [m^3/s]

SCHMIDT Technology provides a convenient calculation tool to compute flow velocity or volume flow in pipes (circular or rectangle) for all its sensor types and measuring ranges on its homepage:

www.schmidt-sensors.com or www.schmidttechnology.de

Wall mounting

The wall mounting flange (520181) is designed for the installation of the flow sensor **SS 23.400 ATEX 3** as an immersion sensor through a (locally plane) wall (e.g. wall of a flow box). In general, the flange differs from the compression fitting only by the type of fastening on the wall. The threaded bush included in the delivery has a broadened base provided with a planar contact surface and two holes that allow a fast and easy installation by means of two screws.

Otherwise, all advantages, requirements and installation instructions for the compression fitting regarding the stepless sensor installation apply here as well (see subchapter *Tube-related flow*).

[8] Both inner air friction as well as obstruction caused by the sensor is responsible.

Mounting for measuring room-to-room overflow

A room-to-room overflow sensor is fixed by means of a wall mounting bracket (503895, made of anodized aluminium or 551740, in stainless steel). The sensor should be placed in flow direction behind the wall opening, whereas the sensor tip must be located in the middle of the opening.

To ensure the type of protection (IP54), the following mounting drawing must be observed (see Figure 3-3 for exemplary use of 503895).

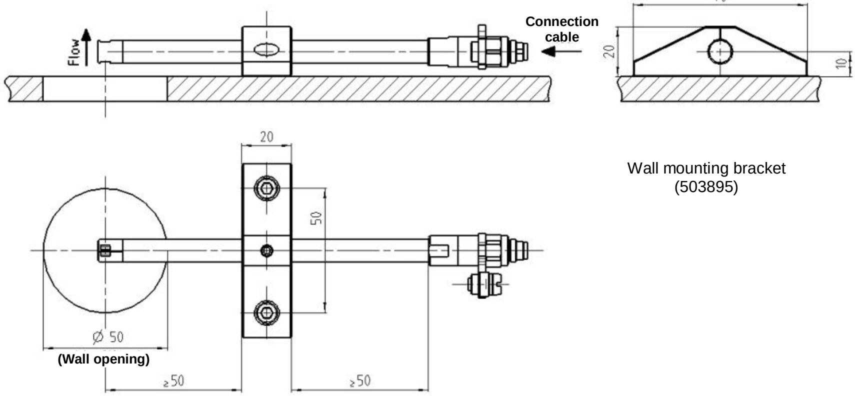


Figure 3-3

The application of a **SS 23.400 ATEX 3** with bidirectional measurement capability allows the detection of backflow and is therefore able to signalize critical operating conditions.

ATEX Installation regulation

The sensor must be installed properly in the following order:

- Mechanical installation
  See previous subchapter
- Connection of the equipotential bonding

  The metallic enclosure of the sensor must have electrical connection to a ground conductor or an equipotential bonding conductor according to EN 60079-0 chapter 15. The expression „electrical connection“ does not always require a conductor; for example, the equipotential bonding can also be implemented by means of a grounded holder which is in permanent electric, low-resistance contact with the sensors enclosure[9].

[9] The types of holders supplied by **SCHMIDT®** are not suitable for this purpose.

When using a cable the locking screw at the plug-in connector of the sensor is designed for this purpose.

In general the following applies for the grounding:

- The external ground connection of the enclosure must be connected to the equipotential bonding of the Ex-area with low resistance.
- No equipotential current must flow between Ex-areas and non-hazardous areas.
- Minimum cable cross-section: 1 x 4 mm^2
- The screw must be tightened firmly at the terminal so that the conductor cannot be loosened or twisted.

- Connecting the cable
    - Connect the shield meshwork (in the non-hazardous area) to the ground potential on a large surface.
    - No equipotential current must flow between Ex-areas and non-hazardous areas.
- Labeling

  The rating plate for labeling according to the standards is fixed at the sensor by means of a wire loop.

  If required, the customer can attach this plate at another place provided that it can be clearly assigned to the sensor and is legible and undetachably. Examples are:
    - Direct attachment to the sensor by means of a machine screw through the loop hole.
    - Mounting it undetachably onto a wall according to EN 60079-0, chapter 29.6.

      The side with the warning note "Do not disconnect under voltage" must remain visible.

4 Electrical connection

Plug-in connector

The sensor features a firmly integrated plug-in connector:

Number of connection pins:	7 (plus shield connection on the metallic housing)
Type:	Male
Fixation of connecting cable:	Screw M9 (spigot nut on cable)
Protection type:	IP67 (with properly attached cable)
Model:	Binder, series 712

View at plug-in connector
of sensor

Figure 4-1

WARNING!
DO NOT DISCONNECT CONNECTING CABLE AND SENSOR WHEN THEY ARE UNDER VOLTAGE!

For pin assignment of the plug-in connector see Table 3.

Pin	Designation	Function	Wire color
1	Power	Operating voltage : $+U_B$	White
2	TXD	Do not connect	Brown
3	RXD	Do not connect	Green
4	OC1	Switching output 1: Direction / threshold	Yellow
5	OC2	Switching output 2: Switch threshold	Gray
6	Analog	Signal of flow velocity	Pink
7	GND	Operating voltage : Mass	Blue
	Shield	Electromechanical shielding	Shield meshwork

Table 3

All signals use GND as electric reference potential.
The cable shield is connected to the metallic housings of the plug-in connector and the sensor enclosure and must be connected to an anti-interference potential, e.g. ground (depending on the shielding concept).
The wire colors mentioned in Table 3 are applicable for the use of **SCHMIDT®** cables with material nos. 535279[10], 535281 and 565072.

The ATEX approval is valid only when using the cables of **SCHMIDT®** mentioned above with material numbers 535279[10], 535281 and 565072.

[10] Also allowed are the formerly orderable cable with material no. 505911-x (x = 1 / 2 / 3).

Electrical assembly

Prior to carry out operations such as assembly, electrical connection, repair work or loosening a plug-in connector, make sure that:

- The system is disconnected from the mains.
- The system cannot be switched on inadvertently.

The appropriate protection class PELV has to be considered.

In potentially explosive atmospheres, the following precautions must be observed:

- Check if the device category corresponds to the specified zones.
- Check if the operation approval from the operator is available.
- Check if there is no explosive atmosphere.
- Compliance with the applicable regulations and the entire relevant documentation for this device.

Operating voltage

The flow sensor **SS 23.400 ATEX 3** is protected against polarity reversal of the operating voltage.

The nominal voltage range is U_B = 12 ... 26.4 V_{DC}.

Only operate sensor within the defined range of operating voltage (12 ... 26.4 V_{DC}).
Undervoltage may result in malfunction. Overvoltage may lead to irreversible damage to the sensor.

Specifications for the operating voltage apply for the connection of the sensor. Voltage drops generated due to line resistances must be considered by the customer.

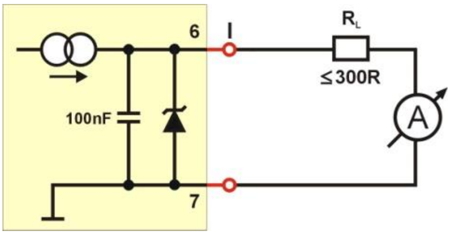
The current consumption of the sensor is 35 mA typically, peak current is 150 mA (incl. all signal output currents at their maximum).

Analog output

The analog output is protected against a short circuit towards the operating voltage or the mass.
It is available in two basic versions which differ in the representation range (measurement range, directionality):

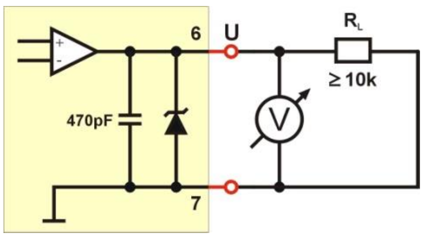
Current interface:

Signal range:	4 ... 20 mA (error signal: 2 mA)
Type:	High side driver, load resistance against GND
Maximum load resistance RL:	300 Ω
Maximum load capacity CL:	100 nF
Maximum cable length:	100 m
Wiring:	



Voltage output:

Signal range:	0 ... 10 V
Type:	High side driver, load resistance against GND
Minimum load resistance RL:	10 kΩ
Maximum load capacity CL:	10 nF
Maximum short-circuit current:	25 mA
Maximum cable length:	10 m (recommended)
Wiring:	



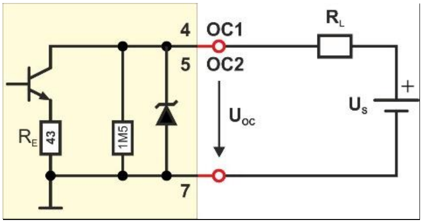
⚠ The voltage drop in the GND wire of the connecting cable (mass offset[11]) can significantly affect the analog signal at the voltage output.

[11] The specific resistance of the lead of the nominal cable (0.14 mm^2) is 0.138 Ω/m (20 °C); at L = 10 m a current of $I_{B,max}$ = 150 mA can cause a voltage drop of up to 240 mV.

Switching outputs

The sensor is equipped with two current limited and short-circuit resistant switching outputs with the following technical data:

Type:	Low side driver, open collector
Maximum switching voltage $U_{S,max}$:	26.4 V_{DC}
Maximum switching current $I_{S,max}$:	55 mA (typ. 50 mA)
Maximum off-state resistance R_{Off}:	1.5 MΩ [12]
Minimum load resistance $R_{L,\,min}$:	Depending on switching voltage U_S (see below)
Maximum load capacity C_L:	Depending on switching current I_S (see below)
Maximum cable length:	100 m (recommended)
Wiring:	



The individual switching outputs can be used as follows:

- Direct driving of a resistive or inductive load (e.g. LED or relays) with a maximum current consumption of 50 mA.
- Direct activation of digital inputs with integrated pull-up resistor R_L (e.g. PLC input).

Due to the internal measuring resistor, which is connected in parallel to the transistor, the switching stage has a comparatively low off-state resistance of 1.5 MΩ. This should be taken into account in case of a (high resistance) pull-up resistor R_L. For a digital evaluation, it is recommended to choose a value of R_L < 167 kΩ so as to achieve an active high level (locked transistor) which is 10 % below switching voltage U_S or higher.

Because of its open collector design, the switching voltage U_S is independent of the operating voltage U_B of the sensor. Thereby it does not behave like an ideal switch (in particular in combination with the protective mechanism) but exhibits in conductive condition a drop voltage U_{OC} with following behaviour:

- Below the limiting current, the voltage U_{OC} results from the voltage drop via the emitter resistance R_E plus the saturation voltage across the collector emitter path of the switching transistor:

$$U_{OC} \approx 47\ \Omega \cdot I_S + 0.2\ V$$

[12] Measuring resistor and switching transistor; additional leakage current of the TVS diode connected in parallel ($U_{OC} \approx U_{S,max}$): < 100 µA

- If the current limit is almost reached, the emitter resistance generates an inverse feedback holding the current I_S virtually constant while the voltage drop over the switching transistor (from $U_{OC} \approx 2.6$ V) rises significantly (analog current limiting).
- Regarding this limit case, the minimum allowed (static) load resistance $R_{L,min}$ at an actually active switching voltage U_S can be calculated[13]:

  $$R_{L,min} = \frac{U_S - 2.6\,V}{0.05\,A}$$

  Example:

  At maximum switching voltage $U_{S,max}$ = 26.4 V, $R_{L,min}$ is 476 Ω.
- If the load resistance is too low (e.g. a short circuit), a digital short-circuit protection comes in effect. It switches the output on and off (impulse length of switching through is approx. 1 ms, switch-off break approx. 300 ms) until the cause of the faulty switching is eliminated.

  An inrush current due to a high capacitive load can trigger the quick-reacting short-circuit protection (permanent) although the static current requirement would be below the maximum current $I_{S,max}$.
  An additional resistance connected in series to the load capacity can eliminate the problem.
- Each switching output is protected against voltage peaks by an unipolar TVS diode[14]. Positive voltage impulses, e.g. due to ESD sparks or an inductive load, are limited to approx. 30 V at the connecting pin, negative impulses are short-circuited against GND (conducting-state voltage of a diode).

---

[13] The basic current of the switching transistor is negligible.
[14] Transient Voltage Suppressor Diode

5 Signaling

Analog output

The following is applicable for all output versions:

- Representation of the measuring range:

  The measuring range of the flow velocity (0 … $w_{N,max}$ or $\pm w_{N,max}$) is mapped in a linear way to the signaling range of the associated analog output (see Table 4).

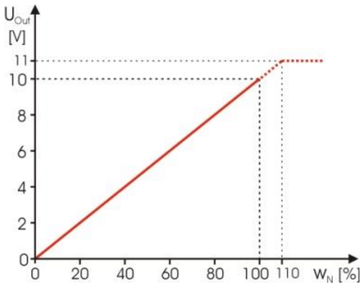
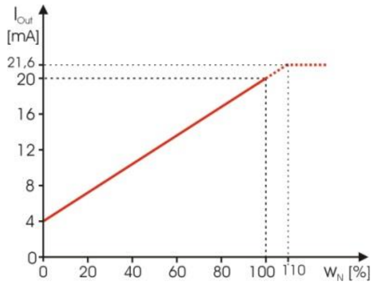
<table>
<tr><th>Voltage mode (U)</th><th>Current mode (I)</th></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td>$w_N = \frac{w_{N,max}}{10\,V} \cdot U_{Out}$</td><td>$w_N = \frac{w_{N,max}}{16\,mA} \cdot (I_{Out} - 4\,mA)$</td></tr>
</table>

Table 4

- Overflow:

  Flow speeds which exceed the measuring range are furthermore output in a linear way up to 110 % of the measuring range (end value + 10 %), to signalize clearly that there is an overflow. For higher values of flow the output signal remains constant.

- Indication of flow direction[15]:

  Depending on its type, the sensor measures flow only in one (unidirectional) or in both directions (bidirectional). For indication of direction, there are different possibilities mostly in combination with switching output OC1 (see also next subchapter *Switching outputs*).

  In an unidirectional version (see Figure 5-1), the switching output OC1 is used to signalize clearly a zero flow (factory setting[16]). The output transistor locks if the flow is higher than 0 m/s and conducts if it is lower or equal to 0 m/s.

---

[15] Related to the nominal measuring direction (defined as positive) of the sensor head.

[16] OC1 can be configured optionally to any threshold value within measuring range.

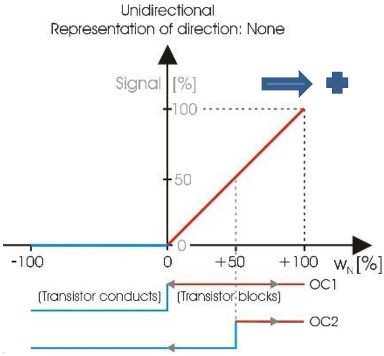


Figure 5-1

To distinguish between positive and negative flow direction, bidirectional versions use either the switching output OC1 (see Figure 5-2) or the representation area of the analog signal output is halved, that means that zero flow is located at 50 % of the signaling range (see Figure 5-3).

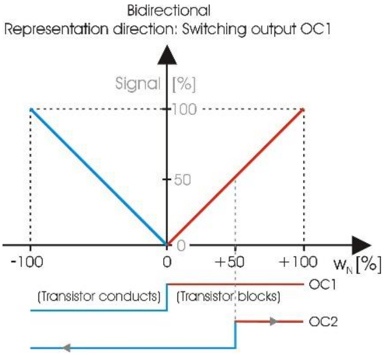


Figure 5-2

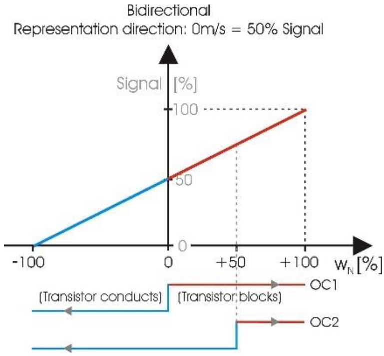


Figure 5-3

- Error signaling:
  The voltage interface (0 ... 10 V) is set to 0 V.
  The current interface (4 … 20 mA) signalizes 2 mA.
- Response time (damping of measured values):
  By default the response time of flow measurement is 1 s.
  Optionally it could be configured in the range of 0.01 … 10 s by order.

Switching outputs

The switching outputs are used as threshold value switches, i.e. they change their switching condition while in normal measuring operation as soon as the measured flow velocity exceeds or falls below the respective threshold value.

- Switching hysteresis:

  The threshold value is symmetrically superimposed by a fixed hysteresis. The hysteresis width is 5 % of the threshold value but at least 0.05 m/s and is not configurable.

- Switching polarity:

  The switching polarity is defined as the change in direction of the switching state during a defined procedure (from "locked" to "conductive" or vice versa).

  Both switching outputs are configured in factory to a positive polarity that means that the previously conductive transistor locks if the switching threshold is exceeded (and, in connection with the switching load R_L, switches to a positive voltage level of U_S).

  Switching polarity is configurable by ordering.

- Configuration OC1:

  If the analog indication area of the bidirectional version corresponds to the amount of the measuring range, OC 1 is used to signalize the direction (see Figure 5-2).

  Otherwise it is used as a freely programmable threshold switch that is set in factory to a threshold value of 0 m/s.

- Configuration OC2:

  OC2 can generally be used as a freely programmable threshold switch. Per default the middle of the positive measuring range is configured as threshold value.

- Error messaging:

  Both switching outputs are conducting independently of the configured switching polarity.

6 Startup

Prior to turn on the device the following checks have to be carried out:

- Check the tight seat of all screws:
  - Connection terminals, PE and equipotential bonding terminals
  - Plug-in connector
- Check plug-in connector:
  - Tight fit of spigot nut on the connecting cable connector.
  - Tightness between sensor connector and connecting cable (flat seal must be correctly inserted in the female cable connector).
- Check if the device is ready for operation:
  - The parameterization for this application case must be carried out.
  - All interfaces, for example inputs and outputs for control purposes must be connected and ready for operation.

5 seconds after switch-on the sensor is ready for operation. If the sensor has another temperature than the ambient, this time is prolonged until the sensor has reached ambient temperature.
In case of faults or other problems during installation, the fault table (Table 5) can help to resolve the problem. If the problems persist, please contact **SCHMIDT Technology**.

7 Information concerning operation

Sterilization

The **SS 23.400 ATEX 3** can be sterilized during operation.

Approved disinfectants are alcohol (drying without leaving residues) and hydrogen peroxide. If too much alcohol is applied to the sensor, the "soiling detection" can be activated and the analog signal is set to error state (0 V or 2 mA). As soon as the sensor element is dry, the sensor is automatically reset to its normal function.

Due to its capillarity, the chamber head gap in the sensor tip can be filled completely with cleaning agent.

In this case it may take **more than one hour** for the liquid to evaporate and the sensor to function properly again. To accelerate the drying process, the measuring gap can be cleaned by applying a short compressed air blast or similar methods.

Cleaning of the system

If it is necessary at any time to clean the system in which the sensor is integrated using another cleaning agent than mentioned above, protect the sensor tip against exposure to inappropriate cleaning agents by using the protective cap included in the scope of delivery. This applies especially to cleaning agents that do not dry without leaving residues and cleaning processes during which dirt may come in contact with the sensor tip.

Prior to carry out problematic cleaning measures (e.g. using inadmissible cleaning agents), the protective cap (yellow) included in the delivery must be placed on the sensor head to protect its sensor element.

See also chapter *8 Service information*, subchapter *Cleaning of the sensor tip*.

8 Service information

Maintenance

A soiled sensor tip may distort the measured value. Therefore, the sensor tip must be checked for soiling at regular intervals.

If the sensor tip is soiled or wetted by a liquid, the sensor sends an error signal via the analog output (0 V / 2 mA). In this case clean the sensor as described below.

If the error signal does not disappear after cleaning and drying, the sensor must be sent in to the manufacturer for repair.

Cleaning of the sensor tip

If the sensor tip is soiled or dusty, it must be carefully cleaned by means of compressed air (avoid strong pressure impulses!).

If this procedure is not successful, the sensor tip can be cleaned by immersing and washing it in alcohol which dries without leaving residues (e.g. isopropyl alcohol). As soon as the alcohol has evaporated, the sensor is again ready for operation.

- Do not shake or tap the wet sensor!
- Do not try to clean the sensor tip by any type of mechanical methods. Do not touch the sensor element located in the chamber head. This may irreversibly damage the sensor.
- Do not use strong cleaners, brushes or other objects like fluffy cloths etc. to clean the sensor tip!
- Inappropriate cleaning agents may leave residues or cake on the sensor element and, therefore, lead to faulty measurements or result in permanent damage to the sensor element.
- If the chamber head gap of the sensor tip is completely filled with cleaning agent, accelerate the drying process by blowing it out, if necessary.

Removing malfunctions

Possible errors (error images) are listed in the following Table 5. The way to detect an error is described. Furthermore, the possible causes and measures to be taken to eliminate the error are listed.

Error image	Possible cause	Troubleshooting
No output signals OC1/2 locked A_{Out} = 0 V / 0 mA	Operating voltage (not / incorrectly connected)	Check operating voltage and wiring
	Sensor defective	Send in for repair
Error message of sensor OC1/2 conducting A_{Out} = 0 V / 2 mA although there is flow	Sensor element wetted	Wait until sensor element is dry
		Blow out sensor tip, if necessary
	Sensor element soiled	Clean sensor tip
	Sensor element defective	Send in for repair
Unexpected values of analog output Measured A_{Out} : Too high / small Strong noise / drift	Sensor configuration (measuring range / indication of direction / type of output)	Check order configuration and measurement settings
	Medium to be measured does not correspond to calibration medium (Standard medium: Air at 1013.25 hPa and 20 °C)	Check medium parameters
	Mounting conditions (tilting / immersion depth)	Check installation conditions
	Irregular flow conditions (turbulences / other disturbances)	Check run-in distance Increase damping of measured values
	Sensor element soiled	Clean sensor tip
	Operating voltage (stability / value)	Check operating voltage
	Large variations in pressure and temperature	Check medium parameters
Unexpected values of switching outputs	Configuration	Check configuration
	Faulty wiring	Check wiring
	Digital short-circuit protection active	Load resistance too small (Increase $R_L > R_{L,min}$) Reduce load capacity C_L Insert resistor in series to C_L

Table 5

Transport / Shipment of the sensor

Before transport or shipment of the sensor, the delivered protective cap must be placed onto the sensor tip. Avoid soiling or mechanical stress.

Calibration

If the customer has made no other provisions, we recommend repeating the calibration at a 12-month interval. To do so, the sensor must be sent in to the manufacturer.

Spare parts or repair

No spare parts are available, since a repair is only possible at the manufacturer's facilities. In case of defects the sensors must be sent in to the supplier for repair.
If the sensor is used in systems important for operation, we recommend you to keep a replacement sensor in stock.

Test certificates and material certificates

Every new sensor is accompanied by a certificate of compliance according to EN 10204-2.1. Material certificates are not available.
Upon request, we shall prepare, at a charge, a factory calibration certificate, traceable to national standards.

9 Type examination certificate ATEX

The type examination certificate can be downloaded from homepage of **SCHMIDT Technology**:

www.schmidt-sensors.com or www.schmidttechnology.de

10 Technical data

Measurement value	Normal velocity w_N of air, based on normal conditions of 20 °C and 1013.25 hPa
Medium to be measured	Clean air or nitrogen, more gases on request
Measuring range w_N	(±)0 ... 1 / 2.5 / 5 / 10 / 20 m/s Inidirectional or bidirectional
Lower detection limit	(±)0.05 m/s
Measuring accuracy[17] - Standard - High precision	 ±(3 % of reading + 2 % of end value); min. ±0.05 m/s ±(1 % of reading + 2 % of end value); min. ±0.04 m/s
Reproducibility	±1.5 % of reading
Response time t_{90}	1 s (configurable: 0.01 ... 10 s)
Storage temperature	-20 ... +85 °C
Operating temperature	0 ... +60 °C
Humidity range	Not condensing (≤ 95 % rel. humidity)
Operating pressure	Atmospheric (700 ... 1,300 hPa)
Operating voltage U_B	12 ... 26.4 V DC
Current consumption	Typical < 35 mA (max. 150 mA)[18]
Analog output - Current - Voltage	Type selectable on order; short circuit protected 4 ... 20 mA (R_L ≤ 300 Ω; C_L ≤ 100 nF) 0 ... 10 V (R_L ≥ 10 kΩ; C_L ≤ 10 nF)
Switching outputs	2 pcs., open-collector, current-limited, short-circuit-protected Switch 1 (OC1): Direction or threshold value Switch 2 (OC2): Threshold value Max. load: 26.4 V DC / 55 mA Threshold: 0 ... 100 % of end value; min. ±0.05 m/s Hysteresis: 5 % of switching threshold; min. 0.05 m/s Configuration: Polarity, threshold value (by ordering)
Electrical connection	Plug (male), M9, screwed, 7-pin (shielded)
Line length (max.)	Voltage output: 10 m / current output: 100 m
Protection type	Housing: IP66 / plug-in connector[19]: IP67
Protection class	PELV (EN 50178)
Dimensions / material - Sensor tip - Probe tube - Plug-in connector	 Ø 9 mm x 10 mm Stainless steel 1.4404 Ø 9 mm x 130 / 200 / 300 mm Stainless steel 1.4404 Ø 14 mm x 40 mm Stainless steel 1.4404
Weight	Approx. 60 g (with 300 mm probe length)

[17] Under reference conditions
[18] Including all signal output currents
[19] Only with correctly attached connecting cable

11 Declarations of conformity

SCHMIDT Technology GmbH herewith declares in its sole responsibility, that the product

SCHMIDT® Flow Sensor SS 23.400 ATEX 3

Part-No. **513 970**

is in compliance with the appropriate

CE European guidelines and standards

and

UKCA UK statutory requirements and designated standards.

The corresponding declarations of conformity can be download from **SCHMIDT®** homepage:

www.schmidt-sensors.com

www.schmidttechnology.de

SCHMIDT Technology GmbH
Feldbergstraße 1
78112 St. Georgen
Germany
Phone +49 (0)7724 / 899-0
Fax +49 (0)7724 / 899-101
Email sensors@schmidttechnology.de
URL www.schmidt-sensors.com
www.schmidttechnology.de