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SCHMIDT® Technology

# SCHMIDT® Flow Sensor

# SS 20.651

# Instructions for Use

# SCHMIDT® Flow Sensor
# SS 20.651

## Table of contents



Imprint:



Version: 547608.02B

Subject to modifications

# 1 Important information

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 device is designed exclusively for the use described below (see chapter 2). In particular, it is not designed for direct or indirect protection of personal or machinery.
- **SCHMIDT Technology** cannot give any warranty as to its suitability for a certain purpose and cannot be held liable for errors contained in these instructions for use or for accidental or sequential damage in connection with the delivery, performance or use of this device.
- The following symbol has to be observed:

**Danger warnings and safety instructions. Read carefully!**
Non-observance of these instructions may lead to injury of personal or malfunction of the device.

# 2 Application range

The **SCHMIDT® flow sensor SS 20.651** is designed for stationary measurement of the flow velocity as well as the temperature of air. The sensor measures standard velocity[1] $w_N$ (unit: m/s) based on standard conditions of 1013.25 hPa and 20 °C. The output signal is linear and independent of pressure and temperature of the measured medium.

The basic version (without coating) is suitable only for clean air. Especially the occurrence with aggressive components (e.g. sulfur, fluor, natrium, chlorine, phosphor, etc.) can be done only on the customer's own responsibility. With optional coating (Parylene) the sensor exhibits a higher tolerance concerning pollution and an increased media resistance. The respective suitability has to be considered in each case due to the different environmental conditions.

When using the sensor outdoors, it must be protected against direct exposure to the weather.

[1] Corresponds to actual velocity under standard conditions

# 3 Mounting

## Determination of the place of installation

Correct measurements require a flow low in turbulence. This can be achieved by providing sufficiently long and straight distances without disturbances in front of and behind the sensor.

The minimum inlet and outlet distances depend on the degree of disturbance of the flow obstacle upstream of the measuring distance and the inner pipe diameter[2] D (see Figure 1 and Table 1).

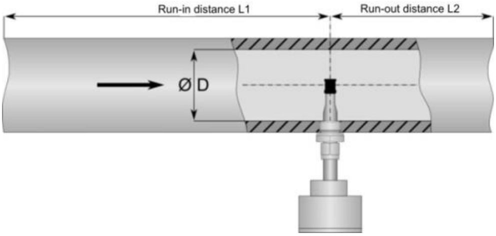



**Figure 1**

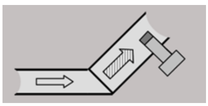
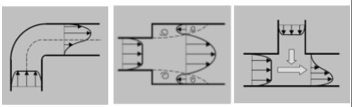
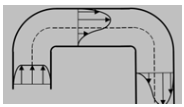
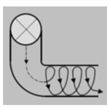
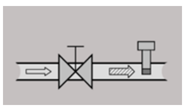
| Flow obstacle upstream of sensor position | | Minimum length inlet (L1) | Minimum length outlet (L2) |
|---|---|---|---|
| Light bend (< 90°) |  | **10 x D** | **5 x D** |
| Reduction, expansion, 90° bend or T-junction |  | **15 x D** | **5 x D** |
| Two 90° bends in one plane (2-dimensional) |  |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

**Table 1 Minimum measuring distances depending on the flow obstacles**

2 Minimum inner pipe diameter: 25 mm

## Mounting method

The **SS 20.651** is mounted by means of a through-bolt joint (included by delivery) which clamps the sensor probe frictionally. Due to the different operating conditions (temperature and pressure range), there are different types (see Table 2):

| Max. temperature | Max. pressure | fitting | seal | spare part no. |
|---|---|---|---|---|
| 200 / 350 °C | atmospheric | brass | no | 549311 |
| 200 °C | 16 bar | 1.4571 | FKM | 535092 |
| 350 °C | 16 bar | 1.4571 | clamping ring | 549312 |

**Table 2 Types of compression fittings**

## Systems with overpressure

The **SS 20.615** is designed for atmospheric conditions (standard), optionally for a working pressure up to 16 bar. As long as the medium is operated with overpressure, make sure that:

- There is no overpressure in the system during mounting.

  Mounting and dismounting of the sensor can be carried out only as long as the system is **in a depressurized state**.

- Only suitable pressure-tight mounting accessories are used.
- Appropriate safety devices are installed to avoid unintended discarding of the sensor due to overpressure.

  For measurements in media with overpressure, appropriate safety measures must be taken to prevent unintended discarding of the sensor.

If other accessories than the delivered pressure protection kit or alternative mounting solutions are used, the customer must ensure the corresponding safety measures.

Pressure-tight mounting, fastening of the screw pipe connection and discarding protection must be checked before pressure is applied. These tightness checks must be repeated at reasonable intervals.

All components of the pressure protection kit (bolt, chain and bracket) have to be checked regularly for integrity.

## Thermal boundary conditions

With medium temperatures exceeding the permitted ambient temperature of the electronic components, a free cooling section of the probe of at least 50 mm must be provided (see Figure 2) to prevent the electronic components located in the electronic housing from being influenced by the temperature.

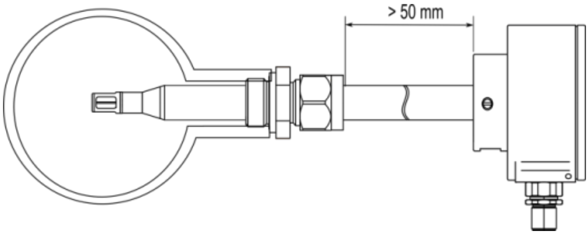



**Figure 2**

Make sure that the transmission of the medium temperature does not cause the temperature to exceed the permitted operating temperature of the electronics.
On the housing side, the sensor tube should project out of the measuring tube in the air (without insulation) at a length of at least 50 mm (if ambient air is cold enough to cool it down).

## Alignment of the sensor

The sensor head must be placed in the middle of the pipe (see Figure 1) and adjusted correctly relative to the flow direction. A sensor mounted in the wrong direction rotated by 180° leads to wrong (too high) measuring values. As installation aid, a flow arrow is located on the enclosure cover. It must corresponds to the flow direction.
The tilting of the measurement direction relative to the flow must not exceed ± 3°, otherwise it can lead to major measurement deviations[3].

The sensor measures unidirectionally and must be adjusted correctly relative to the flow direction.
The axial tilting of the sensor head relative to the flow direction should not exceed ± 3°.

General note:

Do not use the aligning surface of the housing for mechanical alignment, such as locking. There is a risk of damage to the sensor.

---

[3] Deviations > 1% of the measured value

# 4 Electrical connection

Make sure that no operating voltage is active during electrical installation and that the operating voltage cannot be switched on inadvertently.

Specification of the plug-in connector (firmly integrated in the housing):

| | |
|---|---|
| Number of connection pins: | 8 (plus shield connection at the metallic housing) |
| Type: | male |
| Fixation of connecting cable: | M12 thread (spigot nut at the cable) |
| Type of protection: | IP67 (with screwed cable) |
| Model: | Binder, series 763 |
| Pin numbering: | View of plug-in connector of the sensor |

**Figure 3**

Pin assignment of the connector can be seen in the following Table 3.

| Pin | Designation | Function | Wire color |
|---|---|---|---|
| 1 | Pulse 1 | Output signal flow / volume (digital: impulse) | White |
| 2 | $U_B$ | Operating voltage: 24 $V_{DC}$ ± 20% | Brown |
| 3 | Analog $T_M$ | Output signal temperature of medium (analog: U / I) | Green |
| 4 | Analog $w_N$ | Output signal flow (analog: U / I) | Yellow |
| 5 | AGND | Reference potential for analog outputs | Gray |
| 6 | Pulse 2 | Output signal flow / volume (digital: relay) | Pink |
| 7 | GND | Operating voltage: Ground | Blue |
| 8 | Pulse 2 | Output signal flow / volume (digital: relay) | Red |
| | Shield | Electromechanical shielding | Meshwork |

**Table 3**

The analog signals have an own AGND reference potential which is directly connected to GND of the operating voltage within the sensor.

The specified wire colors are valid using a connecting cable delivered by **SCHMIDT**®.

The appropriate protection class III (SELV) respective PELV (EN 50178) has to be considered.

## Operating voltage

For proper operation, the sensor requires DC voltage with a nominal value of 24 $V_{DC}$ with a permitted tolerance of ± 20 %.

Deviating values can lead to measurement errors or even defects and, therefore, should be avoided.

Only operate the sensor in the defined range of operating voltage (24 $V_{DC}$ ± 20 %).
Undervoltage may result in malfunction, overvoltage may lead to irreversible damage.

The operating current of the sensor (including analog signal currents) is normally approx. 50 mA (max. 250 mA).

The specifications for the operating voltage are valid for the connection to the sensor. Voltage drops generated due to line resistances must be taken into account by the customer.

## Wiring of analog outputs

Both analog outputs, for flow and temperature, are designed as high-side drivers with "Auto-U/I" characteristic which are short circuit protected against both rails of the operating voltage.

The loading resistance $R_L$ must be connected between the corresponding signal output and the electronic reference potential AGND or GND of the sensor.

Depending on the resistance value $R_L$, the signal electronics switches automatically between its operation as voltage interface (mode: U) or current interface (mode: I), hence the designation "Auto-U/I". The switching threshold is in range between 500 and 550 Ω (for details, refer to the next subchapter *Signaling of analog outputs*).

However, a low load resistance value in voltage mode may cause significant voltage losses via line resistances $R_{W,S}$, which can lead to measuring errors.

For the voltage mode, a measuring resistance of at least 10 kΩ is recommended.

The maximum load capacity $C_L$ is 10 nF.

The following points must be also taken into account:

- Use of only one analog output

  It is recommended to terminate both analog outputs with the same resistance value, even if only one of the two analog outputs is used.

- Unused analog outputs

  In this case, both outputs can remain disconnected or should be terminated with high impedance against A/GND (with the same resistance value).

- Short circuit mode

  In case of a short circuit against the positive rail of the operating voltage (+$U_B$), the signal output is switched off.

  In case of a short circuit against the negative rail (A/GND) of the operating voltage, the output switches to current mode ($R_L$ is calculated to 0 Ω) and provides the required signal current.

  If the signal output is connected to +$U_B$ via a resistance, the value $R_L$ is calculated incorrectly and false signal values are caused.

## Signaling of analog outputs

- Switching characteristic “Auto-U/I”

| Range of resistance value $R_L$ | Signaling mode | Signaling range |
|---|---|---|
| ≤ 500 (550) Ω | Current (I) | 4 ... 20 mA |
| > 500 (550) Ω | Voltage (U) | 0 ... 10 V |

**Table 4 Switching characteristic “Auto-U/I”**

A hysteresis of approx. 50 Ω ensures a stable transition behavior which is shown in Figure 4 below.

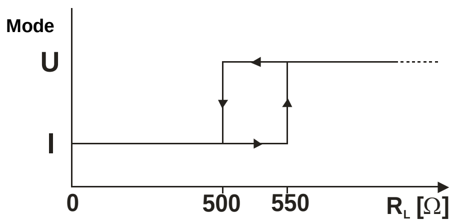



**Figure 4**

Depending on the set output signal, accuracy of the switching point detection can be reduced. Therefore, it is recommended to select the load resistance $R_L$ in such a way that a secure detection can be maintained (< 300 Ω for current mode and > 1 kΩ for voltage mode).

For measuring of $R_L$ in an actual zero signal (voltage mode), the electronics generates test pulses that correspond to an effective value of approx. 1 mV. However, the latest measuring devices may trigger in response to such a pulse in the DC voltage measuring mode and display short-term measuring values of up to 20 mV. In this case, it is recommended to install an RC filter before the measuring input with a time constant of 20 … 100 ms.

Severe interferences on the connection cable may shift the switching threshold outside specification. In this case the use of isolated amplifiers for the measuring signals is recommended.

- Error signaling

  In current mode, the interface outputs 2 mA[4].
  In voltage mode, the output switches to 0 V.

- Representation of measuring range

  The measuring range of the corresponding measuring value is mapped in a linear way to the signaling range of its associated analog output, depending on signal type.

  For flow velocity measurement, it ranges from zero flow to the end of the measuring range $w_{N,max}$ (see Table 5).

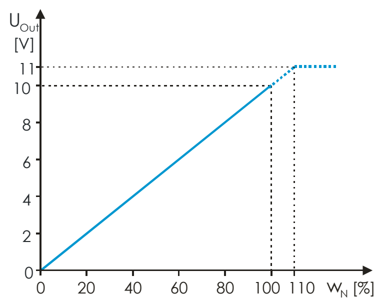
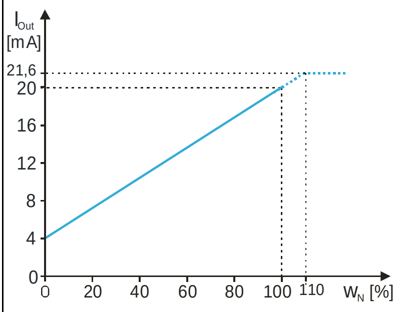
| **Voltage mode (U)** | **Current mode (I)** |
|---|---|
|  |  |
| $w_N = \frac{w_{N,\max}}{10V} \cdot U_{Out,wN}$ | $w_N = \frac{w_{N,\max}}{16mA} \cdot (I_{Out,wN} - 4mA)$ |

**Table 5 Representation specification for flow measurement**

The measuring range of the medium temperature $T_M$ starts at 0 °C and reaches up to $T_{M,max}$ = 200 / 350 °C (see Table 6).

[4] In accordance with the Namur specification

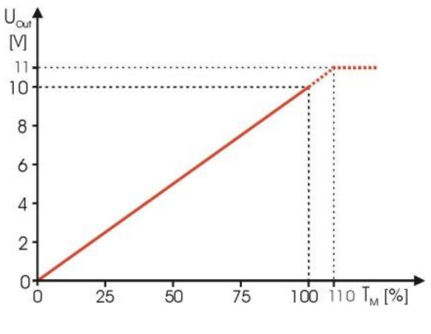
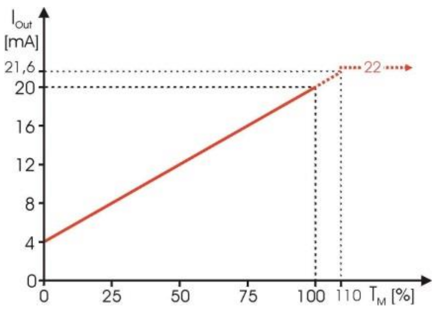
<table>
<tr><th>Voltage mode (U)</th><th>Current mode (I)</th></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td>$T_M = \frac{T_{M,\max}}{10V} \cdot U_{Out,TM}$</td><td>$T_M = \frac{T_{M,\max}}{16mA} \cdot (I_{Out,TM} - 4mA)$</td></tr>
</table>

**Table 6 Representation specification for measurement of medium temperature**

- Exceeding measuring range of flow velocity

  Measuring values bigger than $w_{N,max}$ are output in a linear way up to 110 % of the signaling range (this corresponds to maximum 11 V or 21.6 mA, see images in Table 5). In case of even higher values of $w_N$, the output signal remains constant.

  Error signaling does not take place.

- Medium temperature outside specification range

  An operation beyond the specified limits can lead to damage to the sensor and, therefore, is considered as a critical error. Depending on the temperature limit[5], this leads to the following reaction (see also images in Table 6):

  - Medium temperature below 0 °C:
    The analog output for $T_M$ switches to error (0 V or 2 mA).
    The measuring function for flow velocity is switched off; its analog output also signals an error (0 V resp. 2 mA).
  - Medium temperature above 200 / 350 °C:
    $T_M$ is output in a linear way up to 200 / 350 °C + 10 %.
    Above this critical limit flow measurement is switched off and its analog output switches to error (0 V or 2 mA). The signal output for $T_M$ switches, contrary to standard error signaling, directly to the maximum values of 11 V resp. 22 mA.

[5] The switching hysteresis for decision threshold is approx. 5 K.

## Wiring of pulse output (high-side driver)

The pulse output is current-limited, short-circuit protected and exhibits the following technical characteristics:

| | |
|---|---|
| Design: | High-side driver, open collector |
| Minimum high level $U_{S,H,min}$: | $U_B$ – 3 V (with maximum switching current) |
| Maximum low level $U_{S,L,max}$: | 0 V (load resistance $R_L$ to GND required) |
| Short circuit current limit: | approx. 100 mA |
| Maximum leakage current $I_{Off,max}$: | 10 µA |
| Minimum load resistance $R_{L,min}$: | depending on supply voltage $U_B$ (see below) |
| Maximum load capacitance $C_L$: | 10 nF |
| Maximum cable length: | 100 m |
| Wiring: | |

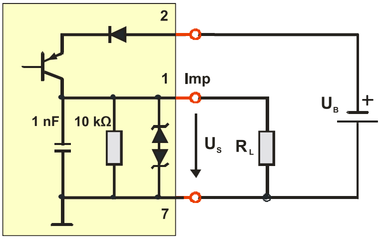



**Figure 5**

The pulse output can be used as follows:

- Direct driving of low-impedance loads (e.g. optocoupler, relays, etc.) with a maximum current consumption of approx. 100 mA.

  This allows calculating the minimum permitted (static) load resistance $R_{L,min}$ depending on the operating voltage $U_B$ [6]:

$$R_{L,\min} = \frac{U_B - 3V}{0.1A}$$

  Example:

  In case of the maximum permissible operating voltage of $U_{B,max}$ = 28.8 V the minimal load is $R_{L,min}$ = 258 Ω.
  Here the excessive heating power of the load has to be considered.

The pulse output is protected by means of different mechanisms:

- Current limiting:

  The analog current is limited to approx. 100 mA.

  If the load values are too low, the output switches to chopping (cycle of 300 ms with interconnection phases of approx. 100 µs).

  The maximum load capacitance $C_L$ is 10 nF. A higher capacitance reduces the limit of the current limiter.

[6] Overcurrent peaks are absorbed by the short circuit limiter.

In case of a high capacitive load $C_L$, the inrush current impulse may trigger the quick-reacting short-circuit protection (permanently) although the static current requirement is below the maximum current $I_{S,max}$. An additional resistor connected in series to $C_L$ can eliminate the problem.

- Protection against overvoltage.

  The pulse output is protected against short-term overvoltage peaks (e.g. due to ESD or burst) of both polarities by means of a TVS diode[7]. Long-term overvoltage destroys the electronics.

Overvoltage can destroy the pulse output.

## Wiring relay

The output is realized by a semiconductor relay with following technical characteristics:

| | |
|---|---|
| Type: | SSR (PhotoMOS relay) |
| Maximum leakage current $I_{Off,max}$: | 2 µA |
| Maximum resistance $R_{ON}$: | 16 Ω (typ. 8 Ω) |
| Maximum switching current $I_S$: | 50 mA |
| Maximum switching voltage $U_S$: | 30 $V_{DC}$ / 21 $V_{AC,eff}$ |
| Wiring: | |

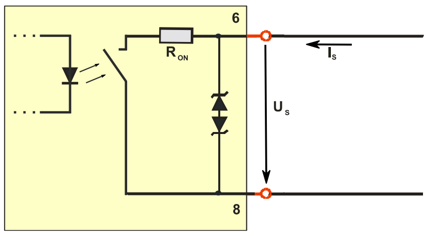



**Figure 6**

The relay output is protected against short-term overvoltage peaks (e.g. due to ESD or burst) of both polarities by means of a TVS diode. Long-term overvoltage destroys the electronics.

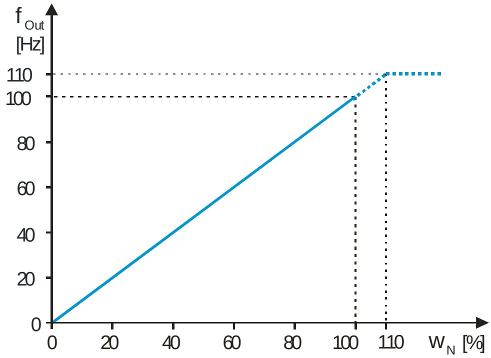
Exceeding the specified electrical operating values lead to irreversible damage.
Protective measures for incorrect wiring or overload are not taken for this output.

[7] Transient Voltage Suppressor Diode, breakdown voltage approx. 30 V, peak pulse capacity 4 kW (8 / 20 µs)

## Signaling of pulse outputs

Both pulse outputs represent the same information synchronously whereas two measurands are selectable:

- The actual flow velocity $w_N = 0 \dots w_{N,max}$ is mapped proportionally to the frequency range $f = 0 \dots f_{max}$ (see Figure 7):
  - Standard version: $f_{max}$ = 100 Hz
  - Optional selectable maximum frequency ($f_{max}$ = 10 … 99 Hz)




$$f_{max} = 10 \ldots 100\,Hz$$

$$w_N = \frac{f}{f_{max}} \cdot w_{N,max}$$

$$\dot{V}_N = \frac{f}{f_{max}} \cdot \dot{V}_{N,max}$$

$\dot{V}_N$ : Standard volume flow

**Figure 7 Example for $f_{max}$ = 100 Hz**

The volume flow and the pulse valence $V_{N,Imp}$ (= volume per pulse) can be determined on base of output frequency, measuring range of the sensor and inner pipe diameter D:

$$\dot{V}_N = w_N \cdot PF \cdot A_D = w_N \cdot PF \cdot \frac{\pi}{4} \cdot D^2 \;; \qquad V_{N,Imp} = \frac{\dot{V}_{N,max}}{f_{max}}$$

- Another option supplies pulses with a fixed pulse valance of 1 $m^3$/pulse.

  To do this, the pipe diameter must be specified when ordering (minimum inner pipe diameter: $D_{min}$ = 20 mm).

Exceeding measuring range of the flow $w_N$ is also output up to 110 % of the measuring range. The output of higher flow values is limited to 110 % of the measuring range.

If an error occurs, 0 Hz or no pulses will be output. The current initial state remains unchanged.

Note:

The relay can be used as a S0-Interface according DIN 43 864.

# 5 Commissioning

The valid measuring ranges are specified on the rating plate.

After applying the supply voltage, the sensor signals the initialization of the measuring operation by means of all four LEDs (sequence: red, orange and green).

If the sensor detects a problem during initialization, it signals the problem according to Table 7. An extensive overview of errors and their causes as well as troubleshooting measures are listed in Table 8.

If the sensor is in the correct operational state, it switches to the measuring mode after initialization. Flow velocity indication (both LEDs and signal outputs) switches for a short period to maximum and levels off at the correct measuring value after about 10 seconds, if the sensor probe already has the medium temperature. Otherwise, the process will last longer until the sensor has reached the medium temperature.

## LED display

| No. | State | LED 1 | LED 2 | LED 3 | LED 4 |
|---|---|---|---|---|---|
| 1 | Ready for operation & flow < 5% | orange | off | off | off |
| 2 | Flow > 5% | green | off | off | off |
| 3 | Flow > 20% | green | green | off | off |
| 4 | Flow > 50% | green | green | green | off |
| 5 | Flow > 80% | green | green | green | green |
| 6 | Flow > 100% = overflow | green | green | green | orange |
| 7 | Sensor element defective | flashes red | flashes red | flashes red | flashes red |
| 8 | Operating voltage too low | flashes red | flashes red | off | off |
| 9 | Operating voltage too high | off | off | flashes red | flashes red |
| 10 | Electronics temperature too high | flashes red | off | off | flashes red |
| 11 | Electronics temperature too low | off | flashes red | flashes red | off |
| 12 | Medium temperature too low | orange | flashes red | flashes red | orange |
| 13 | Medium temperature too high | flashes red | orange | orange | flashes red |

**List of abbreviations**

LED off

LED on: green

LED on: orange

LED flashes (approx. 2Hz): red

**Table 7 LED signals of sensory functions**

# 6 Service information

## Maintenance

Contaminations of the sensor head lead to distortion of the measured value and can damage the sensor chip.
Therefore, the sensor head must be checked for contamination at least every six months. If contaminations are visible, the sensor must be cleaned as described below and examined with respect to flow at a certain volume flow (calibration). Ideally, the entire characteristic line of the sensors should be calibrated by **SCHMIDT Technology**.

If the maintenance is performed not properly or not at the required intervals, the warranty will be rendered.

## Cleaning of the sensor head

If the sensor head is dusty or contaminated, it can be <u>carefully</u> cleaned by means of compressed air.

The sensor head is a sensitive measuring system.
During manual cleaning proceed with great care.

In case of persistent deposits, the sensor chip and the inside of the chamber head can be carefully cleaned with the help of alcohol that dries out without leaving residues (e.g. isopropyl alcohol) or soap water with special cotton buds.

Cotton buds of the mark "CONSTIX Swabs" type "SP4" manufactured by "CONTEC" with small, gentle cotton pads are approved for this purpose (see Figure 8). The narrow side of these pads fits exactly between chamber head wall and sensor chip and exerts thus a controlled, minimum pressure on the chip. Conventional cotton pads are too large and can break the chip.

Do not try to apply great force to the chip (e.g. using cotton pads with too thick head or making levering movements with the pad).
Mechanical overload of the sensor element may lead to irreversible damage.

Move the cotton pad with great care back and forth parallel to the surface of the chip to rub off the contamination.  Use several cotton pads if required.


**Figure 8 Approved cotton pads with narrow cleaning pads**

For washing off the sensor element, a short rinsing with liquid (preferably using cleaning agents or alcohol that dry out without leaving residues) is allowed. Immersion of the sensor head into liquids is not permitted.

Immersion into liquids is not permitted and can irreversibly damage the sensor head.

Before putting the sensor head into operation again, wait until it is completely dry. The drying process can be accelerated by careful blowing off.

If this procedure does not help, the sensor must be sent to **SCHMIDT Technology** for cleaning or repair.

## Eliminating malfunctions

The following Table 8 lists possible errors (error images). A description of the way to detect errors is given. Furthermore, possible causes and measures to be taken to eliminate errors are listed.

Causes of any error signaling have to be eliminated immediately. Significant exceeding or falling below the permitted operating parameters can result in permanent damage to the sensor.

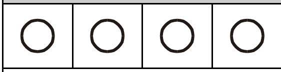
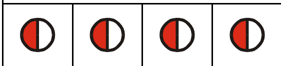
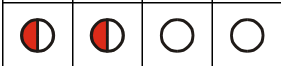
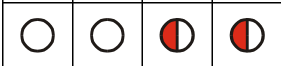
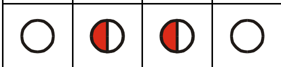
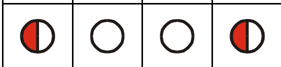
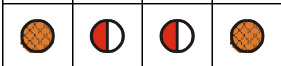
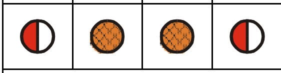
| Error image | Possible causes | Troubleshooting |
|---|---|---|
| <br>No LED is lit<br>All signal outputs at zero | Problems with the supply voltage $U_B$:<br>➢ No $U_B$ present<br>➢ $U_B$ has wrong polarity<br>➢ $U_B$ < 15 V<br>Sensor defective | ➢ Is the plug-in connector screwed on correctly?<br>➢ Is supply voltage connected to sensor (cable break, field connect)?<br>➢ Is the power supply unit large enough? |
| Start sequence is repeated continuously (all LEDs red - yellow - green) | $U_B$ unstable:<br>➢ Power supply unit unable to supply the switch-on current<br>➢ Other consumers overload $U_B$<br>➢ Cable resistance too high | ➢ Is the supply voltage at the sensor stable?<br>➢ Is the power supply unit large enough?<br>➢ Are the voltage losses over cable negligible? |
|  | Sensor element defective | Return the sensor for repair |
|  | Supply voltage too low | Increase supply voltage |
|  | Supply voltage too high | Reduce supply voltage |
|  | Electronic temperature too low | Increase operating temperature of the environment |
|  | Electronic temperature too high | Lower operating temperature of the environment |
|  | Medium temperature too low | Increase medium temperature |
|  | Medium temperature too high | Lower medium temperature |
| Low signal $w_N$ is too large / small | Measuring range too small / large<br>I-mode instead of U-mode or vice versa<br>Sensor element soiled | Check sensor configuration<br><br>Check type or measuring resistance<br>Clean sensor head |
| Flow signal $w_N$ is fluctuating | $U_B$ unstable<br>Mounting conditions:<br>➢ Sensor head is not in the optimum position<br>➢ Inlet or outlet is too short<br>Strong fluctuations of pressure or temperature | Check the voltage supply<br>Check mounting conditions<br><br><br><br>Check operating parameters |
| Analog signal voltage permanently at maximum | Load resistance of signal output connected to $+U_B$ | Connect load resistance to AGND |
| Analog signal voltage permanently at zero | Error signaling<br>Short circuit against (A)GND | Eliminate errors<br>Eliminate short circuit |

**Table 8**

## Transport / Shipment of the sensor

Before transport or shipment of the sensor, the delivered protective cap must be placed onto the sensor head. Avoid contaminations 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.

**A completed declaration of decontamination must be attached.**

The “Declaration of decontamination” form is attached to the sensor and can also be downloaded from

www.schmidttechnology.com

under “Downloads” in “Service returns”.

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.

# 7 Dimensions

## Compact sensor

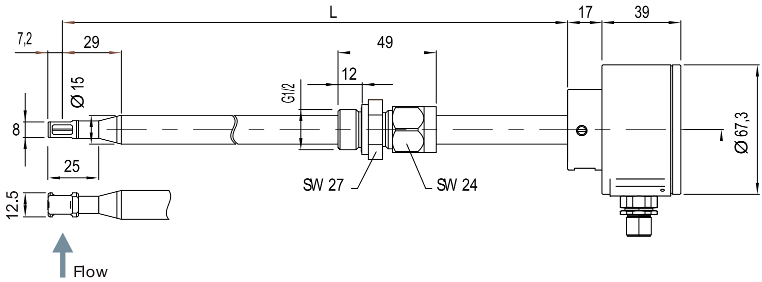



**Figure 9**

## Remote sensor (including wall mounting bracket)

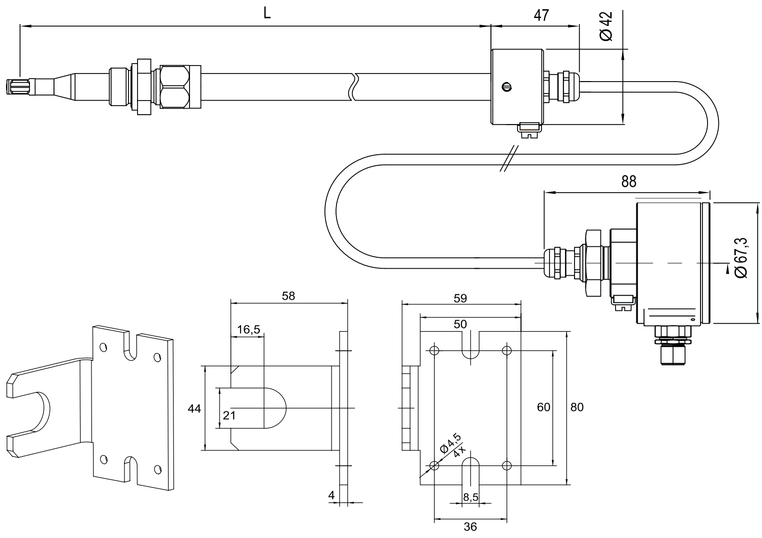



**Figure 10**

# 8 Technical table

| **Measuring quantities** | |
|---|---|
| Measured quantities | Standard velocity $w_N$ based on standard conditions of 20°C and 1013.25 hPa<br>Medium temperature |
| Medium to be measured | clean air (without chemically aggressive parts)<br>with optional coating (Parylene) increased soiling and media resistance |
| Measuring range $w_N$ | 0 ... 2.5 / 10 / 20 / 40 / 60 m/s |
| Lower detection limit $w_N$ | 0.2 m/s @ 20 °C |
| Measuring range $T_M$ | 0 ... + 200 / 350 °C |
| **Process data** | |
| Measuring accuracy $w_N$ | ± 3 % of m. v. + (0.4 % of final value; min. 0.08 m/s)*<br>± 1 % of m. v. + (0.4 % of final value; min. 0.08 m/s)* |
| Reproducibility $w_N$ | ± 1 % of m. v. |
| Response time ($t_{90}$) $w_N$ | 3 s (jump from 0 to 5 m/s in air) |
| Temperature gradient $w_N$ | < 8 K/min (at $w_N$ = 5 m/s) |
| Recovery time constant | < 10 s at temperature jump $\Delta\vartheta$ = 40 K @ $w_N$ = 5 m/s |
| Measuring accuracy $T_M$ ($w_N$ > 2 m/s) | ± 2 K ($T_M$ = 10 ... 30 °C)<br>± 4 K (remaining measuring range) |
| **Operating temperature** | |
| Sensor | 0 … + 200 / 350 °C |
| Electronics | - 20 … + 70 °C |
| Storage temperature | - 20 … + 85 °C |
| **Operating conditions** | |
| Humidity range | up to 95 % rel. humidity, non-condensing.<br>High humidity and high temperature at the same time can cause some deviations |
| Operating pressure | atmospheric / max. 16 bar (over pressure) |
| **Mounting** | |
| Installation position | arbitrary (under pressure horizontal preferred) |
| Mounting tolerance | ± 3° to flow direction (unidirectional) |
| Minimum pipe diameter | 25 mm (depending on media temperature) |
| **Construction** | |
| Version | Compact / remote probe |
| Weight | approx. 750 g |
| Type of protection | Probe: IP54, housing: IP65 |
| Probe length L | 250 / 400 / 600 / 1000 mm (both versions) |
| Cable (remote connection) | Selectable: 1 … 10 m (in steps of 10 cm) |

* Under reference conditions

| **Material** | |
|---|---|
| Housing | Anodised aluminum |
| Sensor tube | Stainless steel 1.4571 |
| Through bolt joint | Stainless steel 1.4571 / brass |
| Sensor head | Platinum element (passivated glass), ceramics, glass |
| Remote cable | Sleeve PUR, without halogens, UL |
| Coating (optional) | Parylene |
| **Operation** | |
| Supply voltage | 24 VDC ± 20 % |
| Current consumption | typ. 50 mA (max. 250 mA) |
| Indication | 4 x dual LEDs (green / red / orange) |
| Stabilization time | About 10 s (after switch-on) |
| Protection class | III (SELV) or PELV (EN 50178) |
| **Analog outputs** | |
| Measuring quantities | Flow velocity, medium temperature |
| Short circuit protection | permanent (against both rails) |
| Signal type | Auto U / I (automatic switching based on load $R_L$) |
| Switching Auto-U/I<br>- Voltage output<br>- Current output<br>- Switching hysteresis | <br>0 … 10 V for $R_L \geq 550\ \Omega$<br>4 … 20 mA[8] for $R_L \leq 500\ \Omega$<br>50 Ω |
| Maximum load capacitance | 10 nF |
| **Pulse outputs** | |
| - Signaling:<br><br><br>- Pulse output 1:<br><br><br><br><br>- Pulse output 2: | Standard: $f \sim w_N$ (f = 0 Hz … 100 Hz)<br>Optional: $f \sim w_N$ (f = 0 Hz … $f_{max}$; $f_{max}$ = 10 … 99 Hz)<br>1 pulse/m³ (max 100 Hz)<br>High-side driver connected to supply voltage<br>(without galvanic separation)<br>High level: > supply voltage - 3 V<br>Short circuit current limitation: approx. 100 mA<br>Leakage current: $I_{Off}$ < 10 µA<br>Semiconductor relay (output galvanically separated)<br>max. 30 $V_{DC}$ / 21 $V_{AC,eff}$ / 50 mA |
| **Standard connection** | |
| Housing connector | Plug-in connector M12, 8-pin, male, screwed |
| Maximum cable length | Voltage signal: 15 m<br>Current/ impulse signal: 100 m |

**Table 9**

[8] Error signal: 2 mA

# 9 Declaration of conformity

## EU-Declaration of conformity

SCHMIDT® Technology

**SCHMIDT Technology GmbH** herewith declares that the product

**SCHMIDT® Flow Sensor SS 20.651**

Part-No. **546 650**

is in compliance with the following European guideline:

**No.:** **2014/30/EU**

**Text:** Directive 2014/30/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to **electromagnetic compatibility (EMC)**

The following European standards were used for assessment of the product therefore:

- Emission (residence): **EN 61000-6-3: 2007/A1:2011/AC:2012**
- Imission (industrial): **EN 61000-6-2: 2006+A1:2011**

This declaration certificates the compliance with the mentioned directive but comprises no confirmation of attributes. The security advices of the included product documentation have to be observed. The above mentioned product was tested in a typical configuration.

St. Georgen, 20.04.2016

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