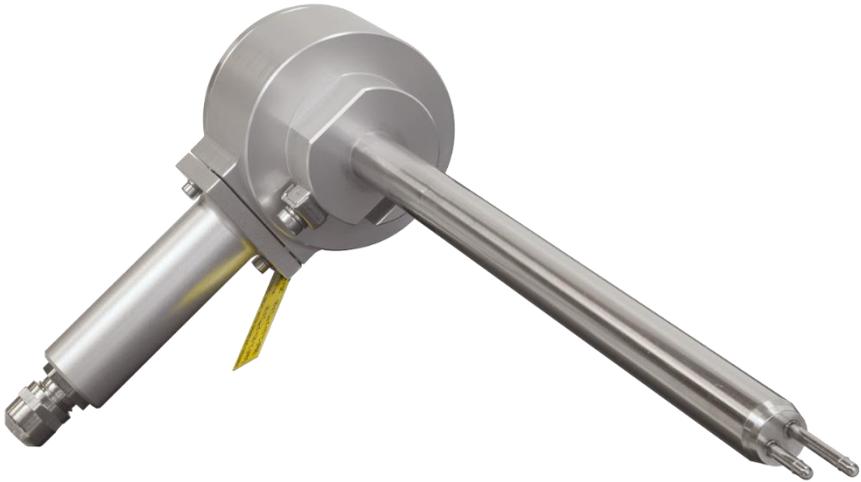


Simply a question of  
**better measurement**



**SCHMIDT<sup>®</sup> Flow Sensor  
SS 23.700 Ex  
Instructions for Use**

# SCHMIDT® Flow Sensor SS 23.700 Ex

## Table of Contents

1	Important information.....	3
2	Application range - General.....	4
3	Application range - ATEX .....	6
4	Mounting instructions - General .....	7
5	Mounting instructions - ATEX.....	17
6	Electrical connection - General .....	19
7	ATEX - Electrical connection and protective sleeve assembly .....	24
8	ATEX type plate - Labelling.....	26
9	Signaling.....	27
10	Commissioning.....	32
11	Information concerning operation.....	32
12	Service information.....	33
13	Dimensions.....	36
14	Technical data .....	37
15	Declarations of conformity.....	39
16	Type Examination Certificate .....	41

Imprint:

Copyright 2023 **SCHMIDT Technology GmbH**

All rights reserved

Version: 570454.02

Subject to modifications

# 1 Important information

The instructions for use contain all required information for a fast commissioning and a safe operation of **SCHMIDT®** flow sensors.

- 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 (refer to 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 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 injury of the personal or malfunction of the device.



### **Risk of explosion - Read carefully!**

Important instructions for use in areas subject to explosion hazards.

## General note

All dimensions are given in mm.

## 2 Application range - General

The **SCHMIDT® Flow Sensor SS 23.700 Ex** (art. no.: 569700) is designed for the stationary measurement of flow velocity as well as the temperature of air and gas with operating temperature from -20 ... +120 °C and working pressure<sup>1</sup> up to 16 bar.

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<sup>2</sup>  $w_N$  (unit: m/s), based on standard conditions of 1013.25 hPa and 20 °C. Thus, the resulting output signal is independent of the pressure and temperature of the medium to be measured.



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

### Version “PWIS-compliant”

It differs from the standard version in the following points:

- Use of a special PWIS-compliant compression fitting (abbr.: DGV), completely made of stainless steel, which seals by means of a cutting ring (i.e. there is no O-ring or other plastic in contact with the medium). The cutting ring is designed relatively "soft" so that it does not bite too much when tightened and can therefore be easily loosened again, making it unnecessary to use a lubricant. The internal thread of the compression nut is finished with a coating (DURNI-COAT®) which prevents jamming.
- The packaging (foil pouch) of the sensor is also PWIS-compliant.
- In addition, the sensor, together with its supplied mounting accessories (pressure safety kit) and optional accessories, is specially cleaned in accordance with the IEC/TR 60877:1999 standard.

The PWIS-compliant zone is limited to the actual sensor probe part only!



**Only the tube-shaped probe itself (incl. its DGV and pressure protection components) is PWIS-compliant.**



By opening the shipping package, the customer assumes responsibility for maintaining or restoring the PWIS-compliance of the probe as well as the cleanliness of the rest of the sensor and its accessories in accordance with IEC/TR 60877:1999.

---

<sup>1</sup> Overpressure

<sup>2</sup> Corresponds to the actual velocity under standard conditions

## Information concerning PWIS-compliant handling

In general, it is essential to avoid contamination, especially of the PWIS-compliant sensor component:

- Before installing the sensor, carefully clean its mounting location.
- Make sure to use only clean tools and material for the installation.
- Before opening the packaging foil, remove dirt such as dust from its surface, if necessary.
- If possible, open the packaging film and take out the sensor directly at the installation site.
- Otherwise open the package foil at an appropriate and clean workplace and store the sensor in an appropriate, PWIS-compliant container.
- Don't touch the PWIS-compliant sensor parts with bare hands.
- Use clean and non-fluffy gloves or cloths or similar to handle the sensor, preferably in PWIS-compliant models.

## Version for "special gases"

The version of the **SS 23.700 Ex** for "special gases" receives a gas-specific adaption for the measurement of certain gases and gas mixtures.

The sensor is adjusted and calibrated in air. Then a special correction function for the medium to be measured is applied to the sensor. This correction has been determined for many gases in real gas ducts. For gas mixtures, the correction adaption is calculated according to the volume based mixing ratio.



The customer is responsible for observing all relevant statutory provisions, standards and directives relating to the use of gases.

## Mechanical versions

The sensor **SS 23.700 Ex** is available in two mechanical versions:

- Compact sensor:  
The sensor probe is fixed to the main enclosure.
- Remote sensor:  
The sensor probe is mechanically separated from the main enclosure. Connection is realized by an electrical signal cable that cannot be detached on either side.

The different construction types and their dimensions can be found in the dimensional drawings in chapter 13.

### 3 Application range - ATEX

As a category 3 device, the **SCHMIDT® Flow Sensor SS 23.700 Ex** is equipped with the following types of protection:

- o Gases (Zone 2): **II 3G Ex ec ic IIC T4 Gc**
- o Dusts (Zone 22): **II 3D Ex ic tc IIIC T135°C Dc**



The sensor is only suitable for use in combustible, conductive dusts with a smoldering temperature higher than 210 °C.

Special conditions for use ("X"):

- o The internal intrinsically safe circuit is isolated<sup>3</sup> from the enclosure only up to 30 V.
- o A power supply with protection class III is required (PELV).
- o The permissible pulling force at the connecting cable of the remote version is limited to 20 N (25 % of the nominal value of the standard according to Annex A, chapter A.2.3.2).

The permissible operating temperatures are:

- o Electronics: -20 ... +70 °C
- o Sensor probe (medium): -20 ... +120 °C

Electrical data:

- o Rated voltage: 24 V<sub>DC</sub> ± 20 %
- o Rated current: 250 mA
- o Measurement outputs: 0 ... 10 V / 4 ... 20 mA
- o Impulse output:
  - f = 0 ... 100 Hz
  - U<sub>max</sub> = 28.8 V<sub>DC</sub>
  - I<sub>max</sub> = 100 mA
- o Relay output:
  - f = 0 ... 100 Hz
  - U<sub>max</sub> = 30 V<sub>DC</sub>
  - I<sub>max</sub> = 50 mA

Enclosure:

- o Degree of protection: IP66 (main enclosure)  
IP67 (sensor probe)

---

<sup>3</sup> Limitation by varistor inside the sensor between GND and enclosure (ESD-protection).

## 4 Mounting instructions - General

### Handling

The flow sensor **SS 23.700 Ex** is a precision instrument with high measuring sensitivity. In spite of the robust construction of the sensor head, soiling of the sensor elements can lead to distortion of measurement results (see also chapter 12).

During procedures such as transport, installation or dismantling of the sensor that facilitates soiling as well as represent a mechanical load on the sensor head, the protective cap supplied by **SCHMIDT Technology** should generally be attached to the sensor head and only removed during installation.



To avoid soiling and mechanical stress on the sensor head, the protective cap should be placed over it during transport or installation.

### Mounting method

The sensor **SS 23.700 Ex** can be mounted only by means of a compression fitting which supports the sensor tube and ensures frictional clamping. The compression fitting as well as a pressure protection kit is included in the scope of delivery.

Due to the variety of applications the compression fitting exists in different versions. On the one hand they are determined by the design of the external thread (order option: G $\frac{1}{2}$  or R $\frac{1}{2}$ ), on the other hand by the materials and properties of the sealing:

- Standard: Sealing with O-Ring (NBR)
- PWIS-compliant: Sealing with clamping ring (stainless steel), only G $\frac{1}{2}$

### Systems with overpressure

The **SS 23.700 EX** is designed for a maximum working pressure of 16 bar. As long as the medium to be measured is operated with overpressure, make sure that:

- There is no overpressure in the system during mounting.



Mounting and dismantling 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 measures are installed to avoid unintended discarding of the sensor due to overpressure. If other accessories than the delivered pressure protection kit or alternative mounting solutions are used, the customer must ensure the corresponding safety measures.



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



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



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

## Thermal boundary conditions

In the case of medium temperatures that don't correspond to the permissible operating temperature of the electronics, cross-talk of the temperature into the electronics housing must be prevented by a thermal decoupling section of the sensor tube having a free-standing length of at least 50 mm (see Figure 4-1) or by means of other suitable measures.

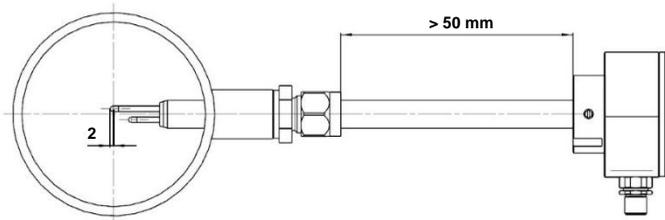


Figure 4-1



The permissible operating temperature range of the electronics must not be exceeded by crosstalk of the medium temperature on the sensor housing.

## Flow characteristics

Local turbulences of the medium can cause distortion of measurement results. Therefore, appropriate mounting conditions must be guaranteed to ensure that the gas flow is supplied to the sensor in a laminar<sup>4</sup> state, i.e. quiet and low in turbulence. The corresponding measures depend on the system properties (pipe, chamber, etc.) which are described in the following subchapters for different mounting variants.



Correct measurements require a (laminar) flow, low in turbulence.

---

<sup>4</sup> The term "laminar" means here an air flow, low in turbulence (not according to its physical definition saying that the Reynolds number is < 2300).

## Installation conditions

The sensor head of the **SS 23.700 Ex** consists of two basic elements:

- Heater

The longer of the two sensor tubes at the tip of the sensor head is the so-called heater. It consists of a heated, temperature-dependent resistor that is used to measure flow velocity.

The end of the heater element, to which the length specification (L) of the sensor also refers, represents the actual measuring point of the flow measurement and should be placed as favourably as possible in the flow, e.g. in the middle of the pipe.

- Temperature sensing element

The shorter of the two sensor tubes at the tip of the sensor head is the temperature sensor. It consists of an unheated, temperature-dependent resistor, which measures the temperature of the medium.

The aerodynamically optimized design allows tilting around the longitudinal axis of the sensor up to  $\pm 3^\circ$  relative to the ideal measuring direction (see Figure 4-2) without significant impact on the measurement result<sup>5</sup>.



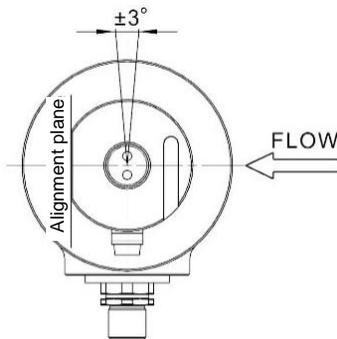
The axial tilting of the sensor head relative to flow direction should not exceed  $\pm 3^\circ$ .



Position the sensor head always at the most advantageous position for flow measurement.



The sensor measures unidirectional (see “flow arrow” in Figure 4-2) and must be adjusted correctly relative to the flow direction.



View on probe head



View on enclosure cover

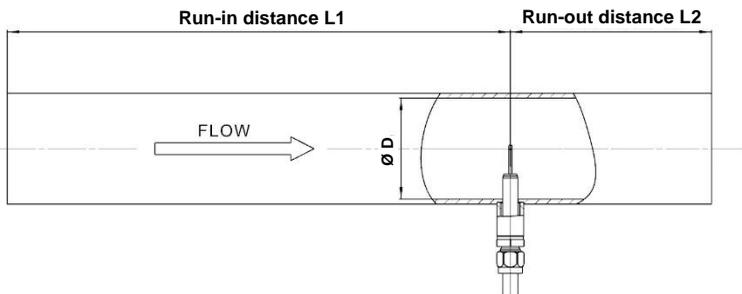
**Figure 4-2 Alignment of sensor relative to flow direction**

<sup>5</sup> Deviation < 1 % of measured value

## Mounting in pipes with circular cross-section

Typical applications for this type are compressed air networks or burner gas supply lines. They are characterized by long thin pipes with a typically quasi-parabolic flow profile.

The easiest method to achieve a low-turbulence flow is to provide a sufficiently long and absolutely straight distance without disturbances (such as edges, seams, bends etc.) in front (inlet) and behind the sensor (outlet) (see installation drawing Figure 4-3). It is also necessary to pay attention to the design of the outlet distance because the flow is also influenced by disturbances generating turbulences against the flow direction.



**Figure 4-3**

- L1 Length of run-in distance
- L2 Length of run-out distance
- D Inner diameter of measuring distance

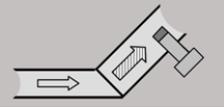
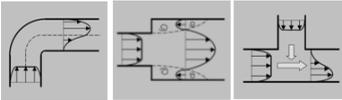
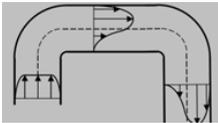
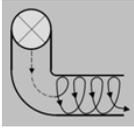
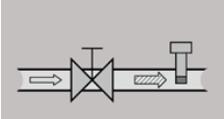
The absolute length of the respective distances are determined by the inner diameter  $D$  of the pipe because the flow abatement effect depends directly on the aspect ratio of measuring distances to the diameter. Therefore, the required abatement distances are specified as a multiple of the inner pipe diameter  $D$ . Besides, the degree of turbulence generation by the corresponding disturbing object plays an important role. A slightly curved bend directs the air with a relative low-disturbance level, whereas a valve generates massive turbulences with its abrupt change of the flow-guiding cross-section, requiring a relatively long distance for abatement.

The following Table 1 shows the required straight pipe lengths depending on the inner tube diameter  $D$  and different causes of disturbances.

This table lists the minimum values required in each case. If the listed straight pipe lengths cannot be achieved, measurement accuracy may be impaired or additional actions are required like the use of flow rectifiers<sup>6</sup>.

---

<sup>6</sup> E.g., honeycombs made of plastic or ceramics.

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 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 1 Run-in and run-out distances**

The profile factors specified in Table 2 may become void by the use of flow rectifiers.

## Calculation of volume flow

Under the conditions described previously, a quasi-parabolic velocity profile forms over the pipe cross-section, whereby the flow velocity at the pipe walls remains practically zero and reaches its maximum  $w_N$  in the center of the pipe (the optimum measuring point). This measured variable can be converted into an average flow velocity  $\overline{w_N}$  that is constant over the pipe's cross-section using the so-called profile factor PF.

The profile factor depends on the inner pipe diameter<sup>7</sup> (see Table 2).

<sup>7</sup> Both inner air friction and sensor locking are responsible.

PF	Pipe Ø		Volume flow [m³/h]						
	Inner [mm]	Outer [mm]	Min. @ 0.2 m/s	@ Sensor measuring range					
				10 m/s	20 m/s	60 m/s	90 m/s	140 m/s	220 m/s
0.748	39.3	44.5	0.7	32.7	65.3	196.0	294.0	457.3	718.6
0.772	51.2	57.0	1.1	57.2	114.4	343.3	515.0	801.1	1258
0.786	70.3	76.1	2.2	109.8	219.7	659.0	988.5	1537	2416
0.797	82.5	88.9	3.1	153.4	306.8	920.3	1380	2147	3374
0.804	100.8	108.0	4.6	231.0	462.0	1385	2078	3233	5081
0.812	125.0	133.0	7.2	358.7	717.5	2152	3228	5022	7892
0.817	150.0	159.0	10.4	519.8	1039	3118	4677	7276	11434
0.829	206.5	219.1	20.0	999.5	1999	5997	8995	13993	21989
0.835	260.4	273.0	32.0	1700	3201	9605	14408	22412	35219
0.840	309.7	323.9	45.6	2278	4556	13668	20502	31892	50116
0.841	339.6	345.6	54.8	2742	5484	16454	24681	38393	60331
0.845	388.8	406.4	72.2	3611	7223	21669	32504	50562	79455
0.847	437.0	457.0	91.5	4573	9146	27440	41160	64027	100614
0.850	486.0	508.0	113.5	5676	11353	34059	51088	79471	124883
0.852	534.0	559.0	137.4	6869	13738	41216	61824	96170	151125
0.854	585.0	610.0	165.3	8263	16526	49580	74371	115688	181796
0.860	800.0		311.2	15562	31124	93373	140059	217870	342368
0.864	1000		488.6	24429	48858	146574	219861	342006	537438
0.872	1500		1109	55474	110948	332845	499268	776639	1220433
0.877	2000		1983	99186	198372	595118	892677	1388609	2182100

**Table 2 Profile factors and volume flows of different pipe diameters**

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

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

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

$$\dot{V}_N = \bar{w}_N \cdot A$$

$D$  Inner diameter of pipe [m]  
 $A$  Cross-section area of pipe [m<sup>2</sup>]  
 $w_N$  Flow velocity in the middle of pipe [m/s]  
 $\bar{w}_N$  Average flow velocity in pipe [m/s]  
 $PF$  Profile factor (for pipes with a circular cross-section)  
 $\dot{V}_N$  Standard volume flow [m<sup>3</sup>/s]

**SCHMIDT Technology** provides a "flow calculator" on its homepage for the calculation of flow velocity or volume flow in (circular) pipes or (rectangular) ducts for the different sensor types:

[www.schmidt-sensors.com](http://www.schmidt-sensors.com)

or

[www.schmidttechnology.de](http://www.schmidttechnology.de)

## Installation in systems with square cross-section

For most applications, two limit cases can be distinguished with regard to flow conditions:

- Quasi-uniform flow field

The lateral dimensions of the flow-guiding system are approximately as large as its length in the flow direction and the flow velocity is small so that a stable trapezoidal<sup>8</sup> speed profile of the flow is formed. The width of the flow gradient zone at the wall is negligible in relation to the chamber width so that a constant flow velocity can be expected over the whole chamber cross-section (in this case the profile factor is 1). The sensor must be mounted here so that its sensor head, located at a sufficient distance from the wall, measures in the area with the constant flow field.

Typical applications are:

- Exhaust ventilation ducts for drying processes
  - Chimneys
  - Open spaces (e. g. clean room)
- Quasi-parabolic flow profile

The system length is large compared to the cross-section surface and the flow velocity is so high that the ratios correspond to that of the circular pipe. This means that the same requirements apply here to the installation conditions.

Since the situation is similar to that in a pipe<sup>9</sup>, the volume flow in a square chamber can be calculated by equating the hydraulic diameters of both cross-section forms.

A rectangular duct (see Figure 4-4) has a hydraulic “pipe diameter”  $D_H$ :

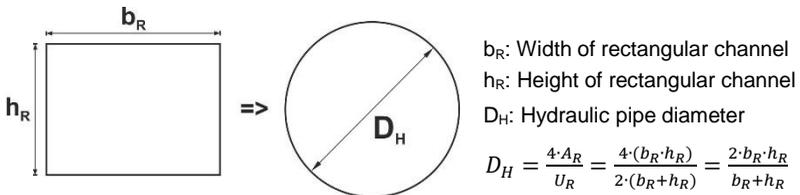


Figure 4-4

<sup>8</sup> A uniform flow field prevails in the largest part of the space cross-section.

<sup>9</sup> The profile factors are equal for both cross-section forms.

According to this, the volume flow in this duct is calculated as:

$$A_H = \frac{\pi}{4} \cdot D_H^2 = \frac{\pi}{4} \cdot \left( \frac{2 \cdot b_R \cdot h_R}{b_R + h_R} \right)^2 = \pi \cdot \left( \frac{b_R \cdot h_R}{b_R + h_R} \right)^2$$

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

$$\dot{V}_N = \bar{w}_N \cdot A_H = PF \cdot \pi \cdot \left( \frac{b_R \cdot h_R}{b_R + h_R} \right)^2 \cdot w_N$$

$b_R / h_R$	Width / height of square duct [m]
$D_H$	Hydraulic inner diameter of duct [m]
$A_H$	Cross-section area of equivalent pipe [m <sup>2</sup> ]
$w_N$	Maximum flow velocity in the middle of duct / pipe [m/s]
$\bar{w}_N$	Average flow velocity in pipe [m/s]
PF	Pipe profile factor
$\dot{V}_N$	Standard volume flow [m <sup>3</sup> /s]

Typical applications are:

- Ventilation ducts
- Exhaust air ducts

## Mounting with compression fitting

The compression fitting is mounted using its external thread (G½ or R½). Typically, a bushing (sleeve) is welded as a fitting onto a bore in the medium-guiding system wall. In most applications, latter are pipes which are taken as an example for describing the mounting procedure below (details see Figure 4-5).

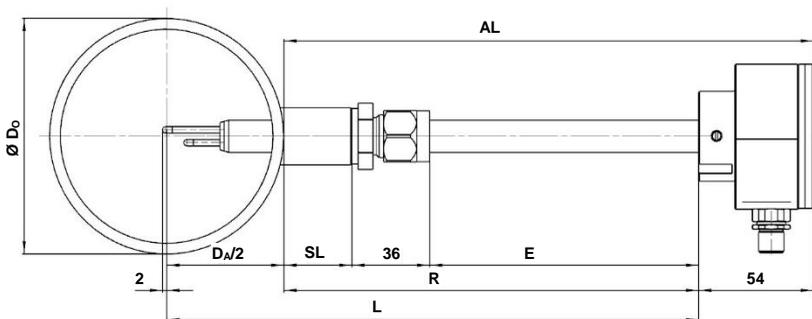


Figure 4-5

$L$	Probe length [mm]	$D_O$	Outer diameter of pipe [mm]
$SL$	Length of weld-in sleeve [mm]	$E$	Sensor tube setting length [mm]
$AL$	Projecting length [mm]	$R$	Reference length [mm]

## Installation process:



Depressurize the system for measurements with overpressure media and mount the pressure protection kit.

- Drill a mounting bore in pipe wall.
- Weld pipe sleeve with an internal thread G $\frac{1}{2}$  or R $\frac{1}{2}$  on to the pipe, in the center above the mounting bore.  
Recommended length of sleeve: 15 ... 40 mm
- Plug holding bracket of pressure protection chain into thread of the compression fitting.
- Screw threaded part of compression fitting tightly into the pipe sleeve (hexagon AF27).
  - Observe correct seat and alignment of chain bracket.
  - Check if there is an O-ring seal available and if it is fitted tightly.
- Unscrew spigot nut of compression fitting so that the sensor probe can be inserted without jamming.
- Remove protective cap from sensor head. Carefully insert sensor into the duct of the compression fitting so that the end of the heater (longer tube) is positioned in the middle of the pipe.
- Adjust sensor manually at sensor enclosure by turning it counterclockwise by approx. 80° to flow direction (observe flow arrow on enclosure cover). Make sure that immersion depth is maintained.
- Tighten spigot nut slightly by means of a key wrench (AF24) to fasten the sensor.
- Apply a key wrench (AF27) to hexagon bolt of the compression fitting to lock it. Use another key wrench (AF24) to tighten spigot nut of the compression fitting until the arrow on the sensor enclosure complies with the direction of the pipe flow.
- Check the set angular position carefully, for example by placing a bubble level on resp. at the alignment plane of the sensor enclosure.



The angular deviation should not be more than  $\pm 3^\circ$ , related to the ideal measuring direction. Otherwise, measurement accuracy may be affected.

- In case of wrong adjustment, the compression fitting has to be loosened and the alignment procedure must be repeated.
- Shorten safety chain by removing superfluous chain links so that the chain is slightly tensioned after being locked at the enclosure. Finally, secure chain with a its padlock.

### General note:



Do not use the alignment plane of the enclosure for mechanical adjustment, e.g. for locking. There is risk of damage to the sensor.

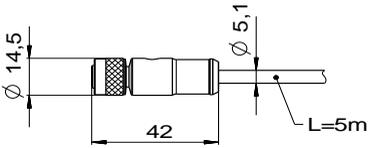
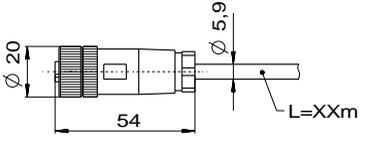
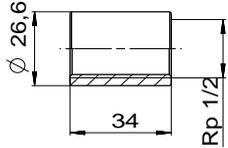
## Mounting of remote version

The sensor probe of the remote version is mounted with a compression fitting in the same way as the compact sensor.

A wall mounting bracket is provided for fastening the sensor enclosure.

## Accessories

The accessories required for mounting and operation of the **SCHMIDT®** Flow Sensor **SS 23.700 Ex** are listed in Table 3 below.

Type / Art. no.	Drawing	Assembly
Connecting cable Standard with fixed length:  5 m 524921		<ul style="list-style-type: none"> <li>- Threaded ring, knurl</li> <li>- Plug injection-moulded</li> <li>- Material: Brass, nickel-plated PUR, PVC</li> </ul>
Connecting cable Standard <sup>10</sup> with optional length:  x m 524942		<ul style="list-style-type: none"> <li>- Threaded ring, knurl</li> <li>- Material: Brass, nickel-plated Polyamide, PUR, PP Halogen-free<sup>11</sup></li> </ul>
Sleeve <sup>12</sup>  a.) 524916 b.) 524882		<ul style="list-style-type: none"> <li>- Internal thread G½, R½</li> <li>- Material: a.) Steel, black b.) Stainless steel 1.4571</li> </ul>

**Table 3 Accessories**

Information about further accessories for mounting and display are available on the **SCHMIDT®** homepage:

[www.schmidt-sensors.com](http://www.schmidt-sensors.com)

OR

[www.schmidttechnology.de](http://www.schmidttechnology.de)

<sup>10</sup> Shielded, but shield not connected to cable socket.

<sup>11</sup> According to IEC 60754

<sup>12</sup> According to EN 10241; must be welded.

## 5 Mounting instructions - ATEX

Prior to installation in potentially explosive atmospheres, the following safety measures must be observed:

- Check if the device category corresponds to the specified zones.
- 
- Check if the operation approval of the operator is available.
  - Check if there is no explosive atmosphere during assembly, maintenance or other activities.
  - Compliance with the applicable regulations and the entire relevant documentation for this device.

### ATEX-relevant operating conditions

#### Pressure-tight accessories



Only use suitable, pressure-tight accessories if media separation is required.

Observe pressure safety measures.

#### Opening of enclosure



It is not allowed to open the enclosure (sealed housing screws). Unauthorized opening of the enclosure renders the explosion protection null and void!

#### Remote version



The connecting cable between sensor probe and main enclosure comprises intrinsically safe circuits. It is connected by the factory and must not be disconnected or modified in any way.

### Mounting of earth or equipotential bonding conductor

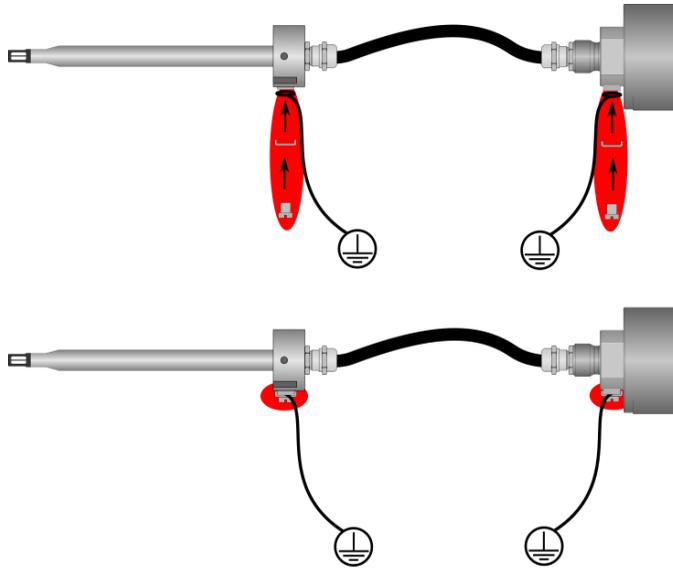
The metallic enclosure of the sensor must be connected electrically to earth or an equipotential bonding according to EN 60079-0.

The cable required for this must be fastened at the terminal screw of the enclosure, for the remote version at the sensor probe additionally.

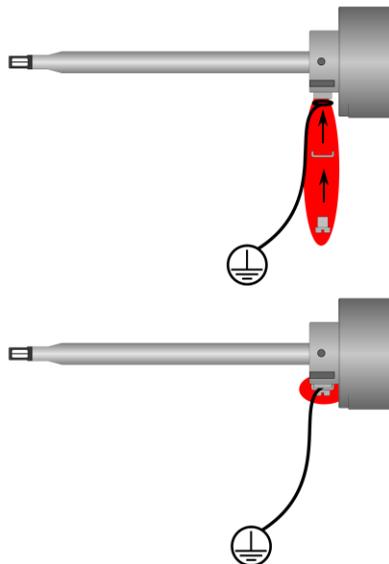
In general the following applies to grounding:

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

- The potential difference between the GND of the operating voltage and the earth potential<sup>13</sup> must be  $\leq 30 \text{ V}_{\text{Peak}}$ .



**Figure 5-1 Grounding contacts (red), remote version**



**Figure 5-2 Grounding contacts (red), compact sensor**

<sup>13</sup> Limitation by varistor inside the sensor between GND and enclosure (ESD-protection).

## 6 Electrical connection - General

The sensor is operated via a plug connector which is integrated in the enclosure (pin assignment see Table 4), with the following data:

Number of connection pins:	8 (plus shield connection at the metallic enclosure)
Type:	M12, A-coded, male
Fixation of connecting cable:	M12 thread (spigot nut at connecting cable)
Type of protection:	IP67 (with screwed cable)
Model:	Binder, series 763
Pin numbering:	



View on connector of sensor

Figure 6-1

Pin	Name	Function	Wire color
1	Pulse 1	Output signal: Flow / volume (digital: PNP)	White
2	U <sub>B</sub>	Operating voltage: +24 V <sub>DC</sub> ± 20 %	Brown
3	Analog T <sub>M</sub>	Output signal: Temperature of medium (Auto-U/I)	Green
4	Analog w <sub>N</sub>	Output signal: Flow velocity (Auto-U/I)	Yellow
5	AGND	Reference potential for analog outputs	Gray
6	Pulse 2	Output signal: Flow / volume (digital: relay <sup>14</sup> )	Pink
7	GND	Operating voltage: Ground	Blue
8	Pulse 2	Output signal: Flow / volume (digital: relay <sup>13</sup> )	Red
	Shield <sup>15</sup>	Electromechanical shielding	Meshwork

Table 4

The specified wire colors are valid when one of the **SCHMIDT**<sup>®</sup> connecting cables is used (see subchapter *Accessories*, Table 3).

The analog signals have an own reference potential "AGND".



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

The metallic sensor enclosure is indirectly coupled to GND (varistor<sup>16</sup>, in parallel to 100 nF) and has to be grounded, as well as the sensor probe of the remote version (for details refer to chapter 7).



The appropriate protection class III / PELV (acc. to EN 50178) has to be considered.

<sup>14</sup> Galvanically decoupled

<sup>15</sup> For cable with mat. no. 524942, the shield is not connected to the cable socket.

<sup>16</sup> Voltage-dependent resistor (VDR); breakthrough voltage 30 V @ 1 mA

## Operating voltage

The **SCHMIDT® Flow Sensor SS 23.700 Ex** is protected against reverse polarity of the operating voltage. It requires a DC voltage of 24 V<sub>DC</sub> with a tolerance of ±20 % for the intended operation.



Operate the sensor only within the specified voltage range and type of 24 V<sub>DC</sub> ± 20 %.

Undervoltage may result in malfunction; overvoltage may lead to irreversible damage.

Specifications of the supply voltage apply to the connector of the sensor. Voltage drops generated due to line resistances (especially “mass offset”) must be taken into account by the customer.

The operating current of the sensor (analog signal currents included, without any of the pulse outputs) is normally approx. 80 mA. With pulse output<sup>17</sup>, the required current consumption increases to max. 200 mA<sup>18</sup>.

## Wiring of analog outputs

Both analog outputs (flow velocity and temperature of medium) are designed as high-side driver with “Auto-U/I” feature and are permanently short-circuit protected against both rails of the operating voltage.

- Nominal operation

The measuring resistance  $R_L$  must be connected between the corresponding signal output and the electronic reference potential of the sensor (see Figure 6-2).

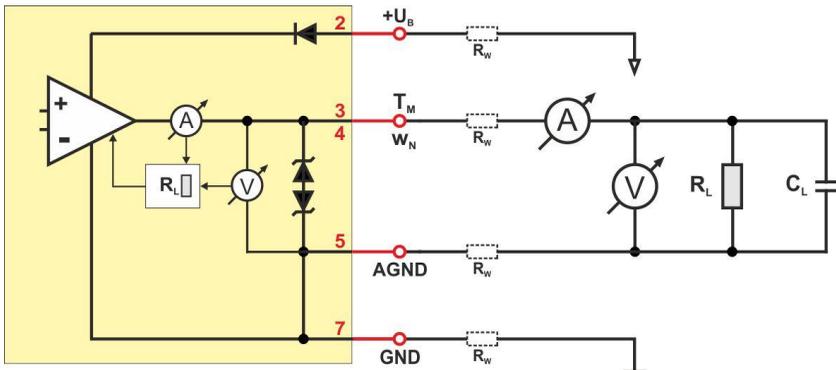


Figure 6-2

<sup>17</sup> Without signal current of the semiconductor relay

<sup>18</sup> Both signal outputs with 22 mA (maximum measurement values); supply voltage minimal

Typically, AGND should be selected as measuring reference potential for both analog signal outputs.

Though GND (mass of supply voltage) can also be used as reference potential<sup>19</sup>, the ground offset in the GND line may cause significant signal errors in signal mode "voltage".



AGND should generally be selected as reference potential for the analog signal outputs.

- Auto-U/I-Characteristic

Depending on the load resistance  $R_L$ , 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 the range between 500 ... 550  $\Omega$  (for details refer to chapter 9 *Signaling*). However, in voltage mode a low resistance value may cause significant voltage losses via the line resistances  $R_W$  of the connection wires which can lead to measuring errors.



For voltage mode, a load resistance of at least 10 k $\Omega$  is recommended.

The maximum load capacitance  $C_L$  is 10 nF.

- Use of only one analog output

It is recommended to connect the same load resistance value to both analog outputs, even if only one of them is used. E.g., if only the analog output "flow velocity" is operated as current output with a load of a few ohms, it is recommended to connect the other analog output ("medium temperature") with the same resistance value or at least to AGND.

- Short circuit mode

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

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.

In case of a short circuit against the negative rail (GND) of the supply voltage, the output switches to current mode ( $R_L$  is calculated to 0  $\Omega$ ) and provides the corresponding signal current.

---

<sup>19</sup> „GND“ and „AGND“ are shorted internally

## Wiring of pulse output 1 (highside driver, PNP)

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

Design:	Highside driver, open collector (PNP)
Minimum high level $U_{S,H,min}$ :	$U_B - 3\text{ V}$ (with maximum switching current)
Maximum low level $U_{S,L,max}$ :	0 V
Short circuit current limitation:	Approx. 100 mA
Maximum leakage current $I_{Off,max}$ :	10 $\mu\text{A}$
Minimum load resistance $R_{L,min}$ :	Depending on switching voltage $U_B$ (see below)
Maximum load capacitance $C_L$ :	10 nF
Maximum cable length:	100 m

Wiring:

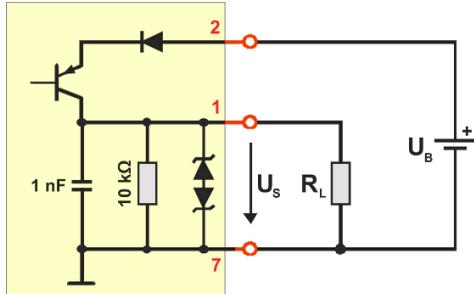


Figure 6-3

This pulse output can be used for direct driving of low-impedance loads (e.g. optocoupler, coil of relay etc.) with a maximum current consumption of approx.  $I_{L,max} = 100\text{ mA}$ .

This allows calculating the minimum permitted (static<sup>20</sup>) load resistance  $R_{L,min}$  depending on the operating voltage  $U_B$ :

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

Example:

In case of the maximum operating voltage of  $U_{B,max} = 28.8\text{ V}$  the minimal load is  $R_{L,min} = 258\ \Omega$ .

Here the excessive heating power of the load has to be considered.

This pulse output is protected by means of different mechanisms:

- Current limiting:

The current is limited to approx. 100 mA (analog).

If the resistance value is too low, the length of the interconnection phases are limited to 100  $\mu\text{s}$  (period duration: 1 s).

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

<sup>20</sup> Overcurrent peaks are absorbed by the short circuit limiter.



In case of a high capacitive load  $C_L$ , the inrush current peak 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 surge) of both polarities by means of a TVS diode<sup>21</sup>. Long-term overvoltage destroys the electronics.



Overvoltage can destroy the pulse output.

## Wiring of pulse output 2 (relay)

This output is realized by a semiconductor relay (SSR):

Maximum leakage current $I_{Off,max}$ :	2 $\mu$ A
Maximum resistance $R_{ON}$ :	16 $\Omega$ (typ. 8 $\Omega$ )
Maximum switching current $I_S$ :	50 mA
Maximum switching voltage $U_S$ :	30 V <sub>DC</sub> / 21 V <sub>AC,eff</sub>

Wiring:

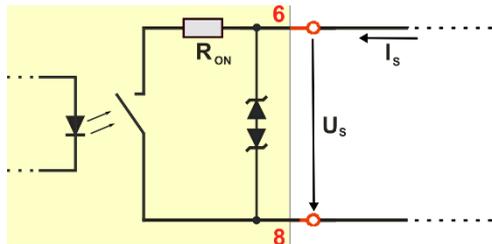


Figure 6-4

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



The output has no protective measures, exceeding the specified electrical operating values leads to irreversible damage.

<sup>21</sup> Transient Voltage Suppressor Diode, breakdown voltage approx. 30 V

## 7 ATEX - Electrical connection and protective sleeve assembly

The electrical connection is established by use of special connection cables that are only available from **SCHMIDT Technology** and which must be purchased additionally as optional accessories:

Material numbers: 524921 or 524942

### Connecting cable



The sensor must be operated only with an original connecting cable from **SCHMIDT Technology** (optional accessory).

Otherwise, the ATEX compliance is null and void.

Connecting the sensor is done via a plug-in connection which has to be protected against impact and UV radiation using a protective sleeve<sup>22</sup>. This sleeve has an ATEX-certified cable entry (M12) and has to be subsequently mounted (mounting procedure see Figure 7-1).

### Protective sleeve for plug-in connector



Must absolutely be mounted!

If the protective sleeve is not mounted professionally, the explosion protection becomes null and void!

It is recommended to connect, first, the connecting cable on the field side (before, fit protective sleeve on cable, see Figure 7-1).

Other electrical accessories, such as Zener barriers or intrinsically safe power supplies, are not required for ATEX operation.

In general the following applies:



During electrical installation ensure that no voltage is applied and inadvertent activation is not possible.

This applies in particular when disassembling the sensor.



### WARNING!

DO NOT DISCONNECT CONNECTING CABLE AND SENSOR UNDER VOLTAGE!

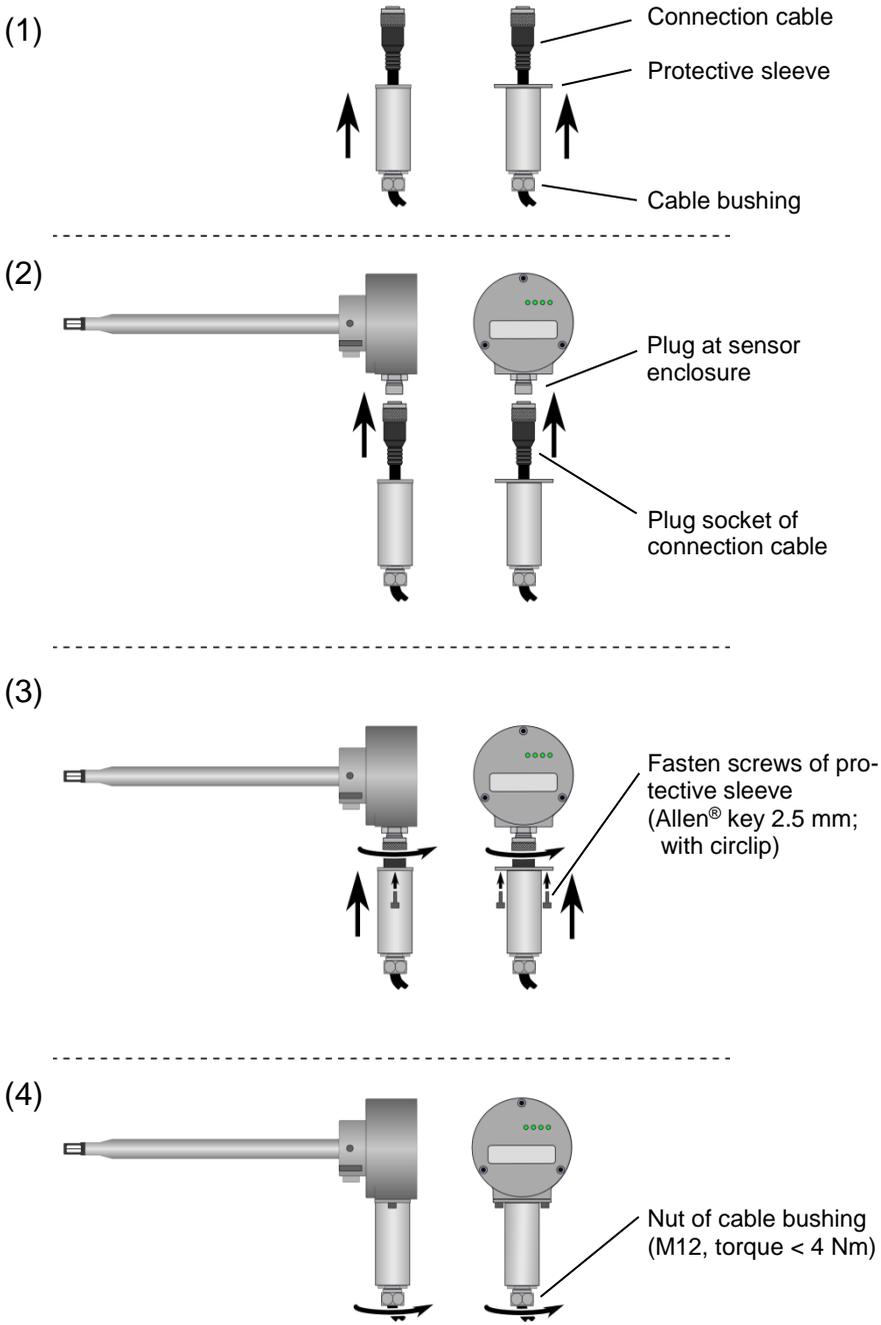


### WARNING!

DO NOT OPEN PROTECTIVE SLEEVE UNDER VOLTAGE!

---

<sup>22</sup> Included in delivery



**Figure 7-1 Assembly of connecting cable with protective sleeve**

## Assembly

For this, see also Figure 7-1:

- (1) Insert open end of the connection cable into the protective sleeve, unscrew the screw of the cable bushing if necessary.  
Push sleeve right up to the cable connector.
- (2) Insert cable socket connector into the plug of the sensor enclosure and tighten the spigot nut hand-tight.
- (3) Put protective sleeve on the plug-in connector and fasten it to the enclosure (hand-tight) with the enclosed screws (Allen® key 2.5 mm; do not forget the circlips).
- (4) Tighten nut of the cable bushing (M12, max. 4 Nm).

## 8 ATEX type plate - Labelling

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

If required, the customer can attach this label, on his own responsibility, elsewhere on or at the sensor, provided that the assignment to the sensor remains unmistakable, it is easily legible and mounted so that it cannot be lost.

Examples are:



- Mounting it directly at the sensor, e.g. by means of machine screws through the fixing hole.
- Attaching on the adjacent wall next to the sensor or similar according to EN 60079-0, chapter 29.6.
- The side with the warning note  
„**WARNUNG - NICHT UNTER SPANNUNG TRENNEN**“  
(*Meaning: "WARNING - Do not disconnect under voltage"*)  
must remain visible.

# 9 Signaling

## LED bar

The **Flow Sensor SS 23.700 EX** has four Duo-LEDs<sup>23</sup> (see Figure 9-1) in the enclosure cover. They either indicate the flow velocity in fault-free operation in a quantitative way (bar graph mode) or they signal the cause of a problem (see Table 5).



Figure 9-1

No.	State	LED 1	LED 2	LED 3	LED 4
1	Ready for operation & flow < 5 % <sup>24</sup>	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	Electronic temperature too low	Off	Flashes Red	Flashes Red	Off
11	Electronic temperature too high	Flashes Red	Off	Off	Flashes Red
12	Medium temperature too low	Orange	Flashes Red	Flashes Red	Orange
13	Medium temperature too high	Flashes Red	Orange	Orange	Flashes Red

Table 5

- LED off
- LED on: Green
- LED on: Orange
- LED flashes<sup>25</sup>: Red

<sup>23</sup> Component with two integrated LEDs (red and green).

<sup>24</sup> „%“ of measurement range

<sup>25</sup> Approx. 1 Hz

## Analog outputs

- Switching characteristic Auto-U/I

The switching of the signal characteristic of an analog signal output is determined by the value of the applied measuring load  $R_L$  (see Table 6):

Interval of load value $R_L$	Signaling mode	Signaling range
$\leq 500$ (550) $\Omega$	Current (I)	4 ... 20 mA
$> 500$ (550) $\Omega$	Voltage (U)	0 ... 10 V

Table 6

A hysteresis of approx. 50  $\Omega$  ensures a stable transition behavior (see Figure 9-2 as well as Table 6).

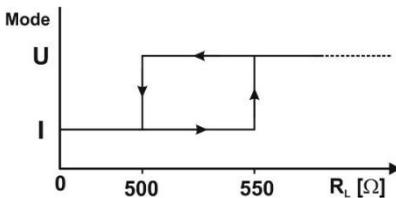


Figure 9-2

Depending on the provided output signal characteristic the accuracy of detection of the switching point can be reduced. Therefore, it is recommended to select the load resistance such that a safe detection can be maintained ( $\leq 300 \Omega$  for current mode and  $\geq 10 \text{ k}\Omega$  for voltage mode).

To detect possible alternating load 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 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 at the measuring input with a time constant of 20 ... 100 ms.

- Error signaling

In current mode, the interface outputs 2 mA<sup>26</sup>.

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 mode-specific signal range of its associated analog output.

<sup>26</sup> In accordance with the Namur specification.

For flow velocity, the measuring range extends from zero to the selectable end of the measuring range  $w_{N,max}$  (see Table 7).

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

**Table 7 Representation specification for flow velocity measurement**

The measuring range of medium temperature starts at  $T_{Min} = -20\text{ °C}$  and ends at  $+120\text{ °C}$  (see Table 8).

Voltage mode (U)	Current mode (I)
$T_M = \frac{140\text{ °C}}{10 V} \cdot U_{Out,T_M} - 20\text{ °C}$	$T_M = \frac{140\text{ °C}}{16 mA} \cdot (I_{Out,T_M} - 4 mA) - 20\text{ °C}$

**Table 8 Representation specification for measurement of medium temperature**

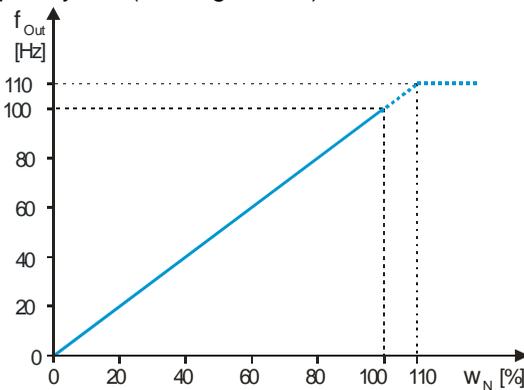
- Exceeding measuring range of flow velocity  $w_N$   
 Measuring values larger than  $w_{N,max}$  are output in linearly up to 110 % of the signaling range (this corresponds to 11 V resp. 21.6 mA, see graphics in Table 7). At higher values of  $w_N$ , the output signal remains constant. Error signaling does not take place because damaging of the sensor is unlikely.

- Medium temperature  $T_M$  outside of specification range  
Operation beyond the specified limits can damage the sensor and, therefore, is seen as a critical error. This leads to the following reaction depending on the temperature limit (also refer to graphics in Table 8):
  - Medium temperature below  $T_{M,min} = -20\text{ °C}$ :  
The analog output for  $T_M$  switches to error (0 V or 2 mA)<sup>27</sup>.  
The measuring function for flow velocity is switched off, its analog output also signals an error (0 V resp. 2 mA).
  - Medium temperature above  $T_{M,max} = +120\text{ °C}$ :  
 $T_M$  is output in a linear way up to at least  $+125\text{ °C}$ , flow velocity is measured and displayed further on.  
Above this critical limit, flow measurement is switched off and the analog output  $w_N$  switches to error signaling (0 V or 2 mA).  
The signal output for  $T_M$ , on the other hand, jumps to the maximum values of 11 V resp. 22 mA, in contrast to normal error signaling.  
This is to avoid a catastrophic feedback if a heating control uses the medium temperature sensor of the **SS 23.700 EX**. The standard error signal (0 V or 2 mA) could be interpreted by the control as a very low temperature of the medium which would consequently lead to further heating.

## Pulse outputs

The pulse outputs represent the flow velocity  $w_N$  as an alternative to the analog output.

- The basic version of the **SS 23.700 EX** maps the flow velocity  $w_N$  proportional to a frequency range  $[0 \dots f_{max}]$  with selectable maximum frequency  $f_{max}$  (see Figure 9-3).



$$f_{max} = 10 \dots 100 \text{ Hz}$$

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

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

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

Figure 9-3 Example for  $f_{max} = 100\text{ Hz}$

<sup>27</sup> The switching hysteresis for the threshold is approx. 5 K.

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

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

Exceeding the measuring range is also output linearly up to 110 % of the measuring range. Higher values of flow velocity or volume flow are limited to 110 % of the measuring range.

- Optional the sensor can be configured by ordering to supply pulses with a predefined pulse valency (e.g. 1 m<sup>3</sup>/pulse).

For this, the inner pipe diameter must be specified when ordering (at minimum DN40).

If an error occurs,  $f = 0$  Hz resp. no pulses will be output, the actual signal level remains unchanged.

Note:

The relay can be used as a S0-Interface<sup>28</sup> according EN 62053-31.

---

<sup>28</sup> Former standard: DIN 43 864

# 10 Commissioning

Prior to switching on the **SCHMIDT® Flow Sensor SS 23.700 EX**, the following checks have to be carried out:

- Mechanical installation:
  - Correct immersion depth and alignment of the sensor probe according to flow direction
  - Tightening of fastening screw or spigot nut
  - Installation of pressure safety measures



For measurements in media with overpressure, check if the fastening screw is tightened properly and pressure safety devices are installed.

- Connecting cable:
  - Correct connection in the field (switch cabinet or similar)
  - Tightness of sensor connector and connecting cable (flat seal must be inserted correctly into the female cable connector)
  - Tight fit of spigot nut of cable connector at the sensor enclosure

After switching on the supply voltage, the sensor signals its initialization by switching all four LEDs in the enclosure cover sequentially to red, orange and green.

If the sensor detects a problem during initialization, it signals the problem with those LEDs according to Table 5 and Table 9.

If the sensor is operating as intended after the initialisation, it switches into regular measuring mode. For a short period the flow velocity indication (both LEDs and signal outputs) goes to maximum and settles to the correct measuring value after about 10 seconds, provided the sensor probe was already at medium temperature. Otherwise, the process will last longer until the sensor has reached the medium temperature.

# 11 Information concerning operation

## Environmental condition Temperature

The **SCHMIDT® Flow Sensor SS 23.700 EX** monitors both the medium and the electronics temperature. As soon as one of the specified operating ranges is left, the sensor switches off both measuring functions associated with the medium and signals the error via its LEDs (according to Table 5). As soon as proper operational conditions are restored, the sensor resumes measuring mode.



Even short-term exceeding or undershooting the operating temperatures can cause irreversible damage to the sensor.

## Environmental conditions of medium

The **SCHMIDT® Flow Sensor SS 23.700 EX** is also suitable for relatively impure gases. Dust or non-abrasive particles can be tolerated as long as they do not form any deposits on the sensor elements.

Deposits or other soiling must be detected during regular inspections and removed during cleaning because they can lead to distortion of the measurement result (see chapter *12 Service information*).



Dirt or other deposits on the sensor elements may cause false measurement results.

Therefore, the sensor must be checked for contamination at regular intervals and cleaned if necessary.

Condensing liquids or even immersion in a liquid lead to a strong falsification of the measured values. After drying, correct measured values are provided again.



Avoid liquids on the sensoric elements during operation because it leads to serious measurement distortions.

## 12 Service information

### Maintenance and cleaning of sensor head

Heavy soiling of the sensor elements may lead to measurement distortion. The sensor head can be cleaned carefully if it is soiled or dusty.



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

### Eliminating malfunctions

The following Table 9 lists possible errors (images), depicted by the LED bar in the sensor enclosure.

A description of the way to detect errors is given. Furthermore, possible causes and measures to be taken to eliminate errors are listed.



The cause of any error signal must be remedied immediately. Significantly exceeding or falling below the permitted operating parameters can permanently damage the sensor.

Error image	Possible causes	Troubleshooting
 No LED is lit All signal outputs at zero	Problems with supply voltage $U_B$ : ➤ No $U_B$ present ➤ $U_B$ has wrong polarity ➤ $U_B < 15\text{ V}$  Sensor defective	➤ Is cable connector screwed on correctly? ➤ Is supply voltage connected to the control? ➤ Is voltage at the sensor plug (cable break)? ➤ Is power supply unit large enough?
Start sequence is repeated continuously (all LEDs red - yellow - green)	$U_B$ unstable: ➤ Power supply unit unable to supply switch-on current ➤ Other consumers overload $U_B$ ➤ Cable resistance too high	➤ Is supply voltage at sensor stable? ➤ Is power supply unit large enough? ➤ Are voltage losses over cable negligible?
	Sensor element defective	Return sensor for repair
	Supply voltage too low	Increase supply voltage
	Supply voltage too high	Reduce supply voltage
	Electronic temperature too low	Increase temperature of environment
	Electronic temperature too high	Lower temperature of environment
	Medium temperature too low	Increase medium temperature
	Medium temperature too high	Lower medium temperature
Flow signal $w_N$ is too large / small	Measuring range too small / large I-mode instead of U-mode or vice versa Medium to be measured does not correspond to adjustment medium Sensor element soiled	Check sensor configuration  Check type or measuring resistance Is foreign gas correction considered?  Clean sensor head
Flow signal $w_N$ is fluctuating	$U_B$ unstable Mounting conditions: ➤ Sensor head is not in optimum position ➤ Inlet or outlet is too short Strong fluctuations of pressure or temperature	Check voltage supply Check mounting conditions  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 Short circuit against (A)GND	Eliminate errors Eliminate short circuit

**Table 9**

## 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 appropriate form "Declaration of decontamination" is enclosed with the sensor and can also be downloaded from

[www.schmidt-sensors.com](http://www.schmidt-sensors.com)

under the heading "Service & Support for Sensors".

Alternatively it can be downloaded from

[www.schmidttechnology.de](http://www.schmidttechnology.de)

under the heading "Service & Support für Sensorik".

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.



# 14 Technical data

Measurement-specific data	
Measuring values	Standard velocity $w_N$ of air, based on standard conditions of 20 °C and 1,013.25 hPa Temperature of medium $T_M$
Medium to be measured	Standard: Air or nitrogen Optional: Natural gas, biogas, CO <sub>2</sub> and special gases resp. gas mixtures
Measuring range $w_N$	Standard: 0 ... 10 / 20 / 60 / 90 / 140 / 220 m/s Special: 10 ... 220 m/s (steps: 1 m/s)
Lower detection limit $w_N$	0.1 m/s
Measuring range $T_M$	-20 ... +120 °C
Measuring accuracy <sup>29</sup>	
Standard $w_N$	±3 % o. m. v. + (0.4 % o. f. v.; min. 0.08 m/s) <sup>30</sup>
Response time ( $t_{90}$ ) $w_N$	10 s (jump of $w_N$ from 0 to 5 m/s in air)
Temperature gradient $w_N$	< 8 K/min (at $w_N = 5$ m/s)
Measuring accuracy <sup>31</sup> $T_M$	±1 K ( $T_M = 10 ... 30$ °C) ±2 K (remaining measuring range of $T_M$ )
Operating temperature	
Sensor probe	-20 ... +120 °C
Electronics	-20 ... +70 °C
Storage temperature	-20 ... +85 °C
Material	
Sensor head	Stainless steel 1.4404
Sensor tube	Stainless steel 1.4571
Enclosure	Anodized aluminum, Makrolon, NBR (sealing)
Protection sleeve	Anodized aluminum, NBR (sealing)
End piece (remote sensor)	Anodized aluminum, FKM 70A (sealing)
Sensor cable (remote sensor)	Sheathing TPE, halogen-free
Compression fittings: - Standard: - PWIS conform:	Stainless steel 1.4571, FKM 70A (O-ring) Stainless steel 1.4571, nickel phosphite (DURNI-COAT®)

<sup>29</sup> Under reference conditions

<sup>30</sup> „o. m. v.“: of measured value; „o. f. v.“: of final value

<sup>31</sup>  $w_N > 2$  m/s

General data	
Humidity range	Measuring mode: Non-condensing (< 95 % RH)
Operating overpressure (max.)	16 bar
Display	Stripe of 4 dual LEDs (green / red / orange)
Supply voltage $U_B$	24 V <sub>DC</sub> ± 20 %
Current consumption	Approx. 80 mA (without pulse outputs); max. 200 mA <sup>32</sup>
Analog outputs - Type: Auto U / I Switching Auto-U/I: - Voltage output - Current output - Switching hysteresis Maximum load capacitance	Flow velocity, temperature of medium Automatic switching of signal mode based on load $R_L$  0 ... 10 V for $R_L \geq 550 \Omega$ 4 ... 20 mA for $R_L \leq 500 \Omega$ 50 $\Omega$ 10 nF
Pulse outputs - Signaling:  - Pulse output 1:  - Pulse output 2:	$f \sim w_N$ : 0 m/s ... $w_{N,max}$ → 0 Hz ... $f_{max}$ Standard: $f_{max} = 100$ Hz Option : $f_{max} = 10 \dots 99$ Hz Option: 1 pulse / 1 m <sup>3</sup>   1 pulse / 0.1 m <sup>3</sup>   1 pulse / 0.01 m <sup>3</sup> (max. 100 Hz)  High-side driver connected to $U_B$ (without galvanic separation) High level: > $U_B - 3$ V Short circuit current limitation: 100 mA Leakage current: $I_{off} < 10 \mu A$  Semiconductor relay (output galvanically separated) Max. 30 V <sub>DC</sub> / 21 V <sub>AC,eff</sub> / 50 mA
Electrical connection	Connector: M12, A-coded, male, 8-pin, screwed
Maximum cable length	Voltage signal: 15 m, current signal / pulse: 100 m
Installation position	Arbitrary
Direction / mounting tolerance	Unidirectional / ±3° relative to flow direction
Minimum pipe diameter	DN40
Type of protection	IP66 (enclosure), IP67 (sensor probe)
Protection class	III / PELV (according to EN 50178)
Probe length L - Compact sensor - Remote sensor	Standard: 250 / 600 mm Probe: 250 / 600 mm Cable: 1 ... 10 m (steps: 1 m)
Weight	Approx. 500 g max. (without connecting cable)

<sup>32</sup> Without signal current of pulse output 2 (relay)

# 15 Declarations of conformity



EU-Declaration of conformity



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

**SCHMIDT® Flow Sensor SS 23.700 Ex**

Part-No. **569 700**

is in compliance with the following European guidelines:

**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 designated standards were used for assessment of the product therefore:

- Emission (residence): **EN IEC 61000-6-3:2021**
- Immission (industrial): **EN IEC 61000-6-2:2019**

**No.: 2014/34/EU**

**Text:** Directive 2014/34/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 **equipment and protective systems intended for use in potentially explosive atmospheres (ATEX)**

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

- Equipment category „3G, 3D“: **EN IEC 60079-0:2018**
- Equipment category „3G“: **EN IEC 60079-7:2015/A1:2018**  
**EN 60079-11:2012**
- Equipment category „3D“: **EN 60079-31:2014**  
**EN 60079-11:2012**

- Marking:



**II 3G Ex ec ic IIC T4 Gc**  
**II 3D Ex ic tc IIIC T135°C Dc**

Further requirements of these directives apply for production and marketing of this device. This product will be produced using a quality assurance system according internal production control (attachment VIII).

This declaration certifies the compliance with the mentioned directives 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, 04.04.2023

Helmar Scholz  
Head of R&D Division Sensors

SCHMIDT Technology GmbH  
Feldbergstraße 1  
78112 St. Georgen  
Germany

Phone +49 (0) 77 24 / 89 90  
Fax +49 (0) 77 24 / 89 91 01  
Email [sensors@schmidttechnology.de](mailto:sensors@schmidttechnology.de)  
Internet [www.schmidt-sensors.com](http://www.schmidt-sensors.com)

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

**SCHMIDT® Flow Sensor SS 23.700 Ex**

Part-No. 569 700

is in compliance with the following UK statutory regulations:

**Title: Electromagnetic Compatibility Regulations 2016**

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

- Emission (residence): **BS EN IEC 61000-6-3:2021-03-30**
- Immision (industrial): **BS EN IEC 61000-6-2:2019-02-05**

**Title: Equipment and Protective Systems Intended for use in Potentially Explosive Atmospheres Regulations 2016**

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

- Equipment category „3G, 3D“: **BS EN IEC 60079-0:2018**
- Equipment category „3G“: **BS EN IEC 60079-7:2015/A1:2018**  
**BS EN 60079-11:2012**
- Equipment category „3D“: **BS EN 60079-31:2014**  
**BS EN 60079-11:2012**

- Marking:



**II 3G Ex ec ic IIC T4 Gc**  
**II 3D Ex ic tc IIC T135°C Dc**

Further requirements of this regulation apply for production and marketing of this device. This product will be produced using a quality assurance system according internal production control (attachment VIII).

This declaration certifies the compliance with the mentioned regulations 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, 04.04.2023

A handwritten signature in black ink, appearing to read "Helmut Scholz".

Helmut Scholz  
Head of R&D Division Sensors

# 16 Type Examination Certificate

Type Examination Certificate SS 23.700 Ex  
Manufacturer's self-declaration



Product: **Flow Sensor**  
Type: **SS 23.700 Ex**  
Mat.-Nr.: **569 700**

Producer: **SCHMIDT Technology GmbH**  
Address: **Feldbergstraße 1**  
**78112 St. Georgen / Schwarzwald**  
**Germany**

SCHMIDT Technology GmbH certifies that this product has been found to comply with the essential health and safety requirements relating to the design and construction of products intended for use in potentially explosive atmospheres given in Annex II to Directive 2014/34/EU of the European Parliament and of the Council, dated 26 February 2014.

The examination and test results are recorded in the confidential test report „Prüfbericht-SS23.700Ex“.

Compliance with the essential health and safety requirements has been assured in accordance with the following standards:

**EN IEC 60079-0:2018**  
**EN IEC 60079-7:2015/A1:2018**  
**EN 60079-11:2012**  
**EN 60079-31:2014**

The sign "X" after the marking indicates that this product is subject to specific conditions of use as stated on page 2 of this certificate.

This test certificate relates only to the design of the specified equipment and not to the specific items of equipment subsequently manufactured or supplied.

The marking of the product shall include the following:

 **II 3G Ex ec ic IIC T4 Gc X**  
**II 3D Ex ic tc IIIC T135°C Dc X**

SCHMIDT Technology GmbH  
Feldbergstraße 1  
78112 St. Georgen  
Germany

Phone +49 (0) 77 24 / 89 90  
Fax +49 (0) 77 24 / 89 91 01  
Email [sensors@schmidttechnology.de](mailto:sensors@schmidttechnology.de)  
Internet [www.schmidt-sensors.com](http://www.schmidt-sensors.com)

Page 1/2  
Type Examination Certificate SS 23.700 Ex

## Type Examination Certificate SS 23.700 Ex Manufacturer's self-declaration



### Description of product

The flow sensor is used for stationary measurement of flow velocity and temperature of gaseous media. The device is intended for use in potentially explosive atmospheres where equipment of category 3G or 3D is required. The sensor probe which is in contact with the medium is operated in an intrinsically safe circuit.

### Technical data

Ambient temperature of enclosure:	-20 °C up to +70 °C
Medium temperature of sensor probe:	-20 °C up to +120 °C
Degree of protection of enclosure:	IP66 acc. to EN 60529
Degree of protection of sensor probe:	IP67 acc. to EN 60529

### Electrical data

Rated voltage of sensor:	$U_N = 24 V_{DC} \pm 20\%$
Current consumption of sensor:	$I_N \leq 250 \text{ mA}$
Signal interface - current:	$I_{Out} = 4 \dots 20 \text{ mA}$
Signal interface - voltage:	$U_{Out} = 0 \dots 10 \text{ V}$
Signal interface - pulse:	$f_{Out} = 0 \dots 100 \text{ Hz}$ $U_{max} = 28,8 V_{DC}$ $I_{max} = 100 \text{ mA}$
Signal interface - relay:	$f_{Out} = 0 \dots 100 \text{ Hz}$ $U_{max} = 30 V_{DC} / 21,8 V_{AC}$ $I_{max} = 50 \text{ mA}$

### Summary of test results

The flow sensor SS 23.700 Ex fulfils the requirements of explosion protection for electrical equipment of equipment group II in:

- Equipment category 3G in type of protection increased safety "ec" with an internal circuit according to type of protection intrinsic safety "ic" for explosion group IIC and temperature class T4..
- Equipment category 3D in type of protection by enclosure "tc" with an internal circuit according to type of protection intrinsic safety "ic" for explosion group IIIC with maximum surface temperature of 135 °C.

### Specific conditions of use

- The internal intrinsically safe circuit is isolated up to 30 V from the enclosure.
- A power supply according to protection class III (PELV) is required.

Dipl. Ing. M. Schmitt  
Authorised representative ATEX

**SCHMIDT Technology GmbH**  
Feldbergstr. 1 · D-78112 St. Georgen/Schwarzwald  
Tel. +49 (0) 77 24 / 899-0 · Fax +49 (0) 77 24 / 899-101

- Stamp -

St. Georgen, 04.05.2023

SCHMIDT Technology GmbH  
Feldbergstraße 1  
78112 St. Georgen  
Germany

Phone +49 (0) 77 24 / 89 90  
Fax +49 (0) 77 24 / 89 91 01  
Email [sensors@schmidttechnology.de](mailto:sensors@schmidttechnology.de)  
Internet [www.schmidt-sensors.com](http://www.schmidt-sensors.com)

Page 2/2  
Type Examination Certificate SS 23.700 Ex





**SCHMIDT Technology GmbH**

Feldbergstr. 1  
78112 St. Georgen  
Germany

Phone +49 (0)7724 / 899-0

Fax +49 (0)7724 / 899-101

Email [sensors@schmidttechnology.de](mailto:sensors@schmidttechnology.de)

URL [www.schmidt-sensors.com](http://www.schmidt-sensors.com)  
[www.schmidttechnology.de](http://www.schmidttechnology.de)