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SCHMIDT® Technology

SCHMIDT® Flow Sensor
SS 20.515 LED
Instructions for Use

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1 Important Information

These instructions for use contain all required information for a fast commissioning and a safe operation of **SCHMIDT®** flow sensors of the **SS 20.515 LED** type:

- 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 and machinery.
- **SCHMIDT Technology** cannot give any warranty as to its suitability for certain purpose and cannot be held liable for accidental or sequential damage in connection with the delivery, performance or use of this unit.

Symbols used in this manual

The symbols used in this manual are explained below.

Danger warnings and safety instructions - please read them!

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

General information

All dimensions are given in mm.

2 Application Range

The **SCHMIDT® Flow Sensor SS 20.515 LED** (551550) is designed for stationary use in cleanrooms under atmospheric pressure and clean environmental conditions.

The sensor measures the flow velocity of the gaseous medium (reference: air) as standard velocity[1] (unit: m/s), relative to standard conditions of 1013.25 hPa and 20 °C.
Thus, the resulting output signal is independent of pressure and temperature of the medium to be measured.

The sensor is designed for the use inside closed rooms and is not suitable for outdoor use.

3 Mounting Instructions

General information on handling

The **SCHMIDT® Flow Sensor SS 20.515 LED** is a sensitive measuring instrument. Applying mechanical force to the sensor tip should be avoided.

The sensor tip can be damaged irreversibly due to mechanical stress.
Leave the protective cap as long as possible attached during mounting and handle the sensor with care.

For applications with an uncontrollable risk of touch, two special safety bars can be mounted on the sensor (optional accessory). One bracket consists of a single, very robust spring steel strip (531026) and the other one comprises two parallel, relatively flexible spring steel wires (559124). For details, see:

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

Flow characteristics

To avoid false measurement results, appropriate installation conditions must be guaranteed to ensure that the gas flow is supplied to the sensor in a quiet (low in turbulence) state.

Correct measurements requires laminar[2] flow with as low turbulence as possible.

[1] Corresponds to the real velocity under standard conditions.
[2] The term “laminar” means here an airflow low in turbulence (not according to its physical definition saying that the Reynolds number is < 2300).

Mounting sequence

For the assembly of the **SCHMIDT® Flow Sensor SS 20.515 LED**, five different assembly versions optimized for use in cleanrooms are available, in order to cover all the different applications (see Table 1).

First, the required holes, depending on the assembly version, must be drilled, and the corresponding fixing socket must be mounted in that hole. Then the connecting cable is introduced with its open into the fixing socket from the cleanroom side until the cable bushing protrudes from the fixture by only about 5 cm. Please note that after assembling the sensor, there must still be room for this protruding cable length in the void behind the assembly bushing. Now connect the sensor to the connecting cable (plug in and screw down spigot nut), insert it into the fixture bushing and tighten the holding fixture screw by hand. Now the sensor can still be aligned accurately by hand, if required. Finally, the holding fixture screw must be tightened with a key wrench (wrench size 22) until the sensor is sufficiently secured against twisting.

Prior to commissioning the sensor, remove the protective cap.

Mounting beneath a ceiling

The angled sensor is designed for mounting beneath a ceiling.

After screwing the sensor into the ceiling sleeve, its tip is automatically in the correct position to measure a vertical downdraft flow from the filter outlet. Only the torsional angle of the sensor arm in parallel to the ceiling must still be aligned. Then tighten assembly screw using the key wrench until the sensor is secured against twisting (hold sensor, if necessary).

Mounting at a wall

The straight sensor is designed for assembly at a wall.

Insert sensor into the fixture bushing and thoroughly tighten the assembly screw. No alignment to the flow is required, due to the omnidirectional measurement characteristic of the sensor head.

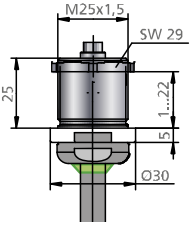
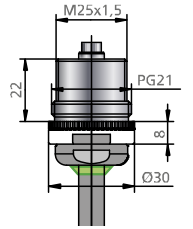
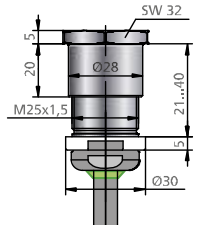
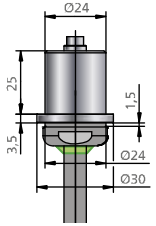
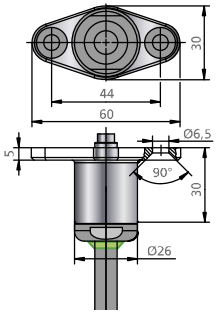
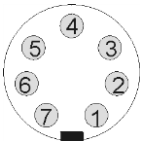
Mounting	Drawing	Assembly
Type 1		Threaded bush M25 with lock nut: - For installation in ceilings, walls or frames with a thickness from 1… 22 mm - Opening with Ø of 26 mm required for fixing with lock nut - Or insert a thread M25 x 1.5 into ceiling
Type 2		Threaded bush M25 with threaded adapter M25 x 1.5 for PG: - For installation in frames featuring an existing opening with PG21 thread (e.g. sprinkler openings in profiles)
Type 3		Threaded bush M25 with shank nut: - For installation in frames with a height of 21 … 40 mm, especially for ceiling frames made of hollow profiles - Openings with Ø of 26 mm and 28.5 mm are required
Type 4		Welding bush: - For welding to ceilings or walls made of stainless steel
Type 5		Flanged bushing: - For mounting under the ceiling or at a wall with two screws M6 - Opening in ceiling / wall required with a Ø of 15 mm for cable plus 2 threads M6 - Pressure-tight till 300 mbar

Table 1

4 Electrical Connection

The **SCHMIDT® Flow Sensor SS 20.515 LED** is equipped with a plug-in connector firmly integrated into the enclosure with the following data:

Number of connection pins:	7 (plus shield connection of metallic housing)
Type:	Male
Locking of connecting cable:	M9 spigot nut (on cable)
Model:	Binder, series 712
Pin numbering:	



View on connector of sensor

Figure 4-1

The pin assignment of the plug-in connector can be found in Table 2.

Pin	Designation	Function	Wire colour
1	Power	Supply voltage: $+U_B$	White
2	A_{out} Temp	Medium temperature signal T_M	Brown
3	Internal	-	Green
4	Internal	-	Yellow
5	Internal	-	Grey
6	A_{out} Flow	Flow velocity signal w_N	Pink
7	GND	Supply voltage: Mass	Blue
	Shield	Electromechanical shielding	Shield meshwork

Table 2

All signals use GND as electrical reference potential.

The wire colours mentioned in Table 2 are applicable for the use of a **SCHMIDT®** cable (article numbers: 505911-4, 535279, 535281, 565072, 561972, 561973).

The cable shield is electrically connected to the metallic housings of connector and sensor which are coupled to GND indirectly (VDR[3], in parallel with 100 nF). The shield should be connected to an anti-interference potential, e.g. ground (depending on the shielding concept).

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

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

[3] Voltage dependent resistor; breakdown voltage 27 V @ 1 mA

Operating voltage

The **SCHMIDT® Flow Sensor SS 20.515 LED** is protected against a polarity reversal of the operating voltage.
It has a nominal operating voltage range of U_B = 24 V_{DC} ± 10 %.

Only operate the sensor within the defined operating voltage range (21.6 … 26.4 V_{DC}).
Undervoltage may result in malfunction, overvoltage may lead to irreversible damage.

The specifications for the operating voltage are valid for the connection at the sensor. Voltage drops generated due to line resistances must be considered by the customer.
Current consumption of the sensor is typically 60 mA and at maximum 100 mA.

Analog signal outputs

The analog outputs of the sensor (flow velocity and temperature of the medium) are protected against a short circuit towards both rails.
There are two output versions (selected by ordering):

Current interface:

Signal range[4]:	4 ... 20 mA
Type:	High side driver, load resistance against GND
Maximum load resistance R_L:	300 Ω
Maximum load capacitance C_L:	10 nF
Maximum cable length:	100 m (recommended)
Wiring:	

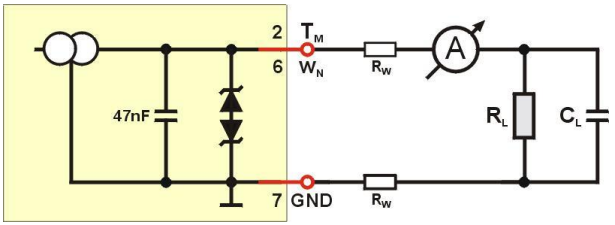


Figure 4-2

Voltage interface:

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

[4] Error signaling 2 mA as specified in NAMUR NE 43

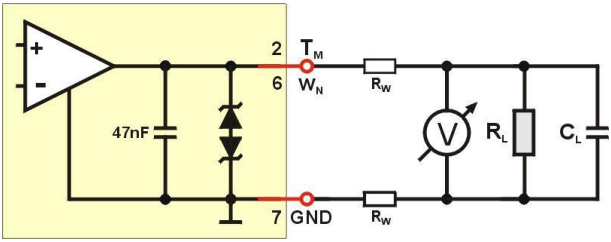


Figure 4-3

Due to the resistance[5] R_W of the connecting cable, the operating current causes a voltage drop in each wire of the operating voltage, which may adopt interfering values especially as so-called "mass offset" in the GND wire.

This is why you have to make sure during installation that the original lead of the sensor is kept as short as possible. Reconnection to cables with wider cross-sections near the sensor is recommended.

The voltage drop in the GND wire of the connecting cable during operation can substantially falsify the analog signal at the voltage output.

5 Signalizing

The **SCHMIDT® Flow Sensor SS 20.515 LED** maps the respective measuring quantity linearly to the corresponding analog output. The representation specification depends both on the measuring quantity and the output characteristics (see figures in the following tables).

- Representation of measuring range:

  The measuring range of the flow velocity w_N extends from zero flow to the selectable maximum value $w_{N,max}$ (see Table 3).

  The measuring range of the temperature of the medium T_M is fixed between -20 °C and +70 °C (see Table 4).

  Note regarding commissioning:

  Normally the temperature output provides approx. 5 V resp. 12 mA because the typically prevailing room temperature of approx. 25 °C corresponds to half of the measuring range.

- Overflow:

  Flow speeds which exceed the measuring range are furthermore output in a linear way up to 110 % of measuring range (11 V or 21.6 mA). For higher values of flow velocity the output signal remains constant.

[5] The specific resistance of the lead of the nominal cable (0.14 mm^2) is 0.138 Ω/m (20 °C); at L = 10 m a current of $I_{B,max}$ = 100 mA can cause a voltage drop up to 166 mV.

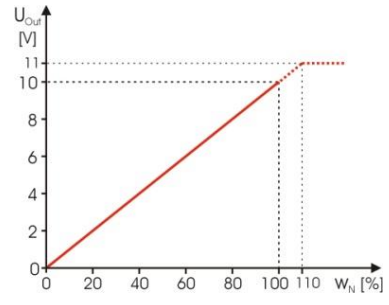
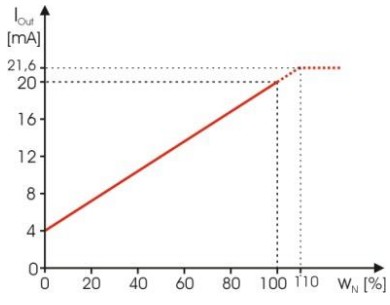
w_N: Voltage interface (U)	w_N: Current interface (I)
	
$w_N = \frac{w_{N,max}}{10\ V} \cdot U_{Out}$	$w_N = \frac{w_{N,max}}{16\ mA} \cdot (I_{Out} - 4\ mA)$

Table 3

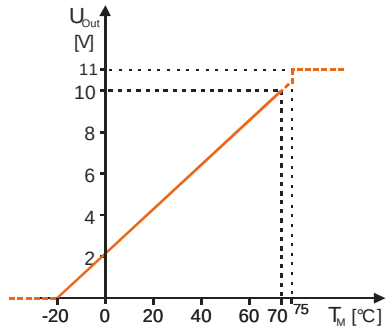
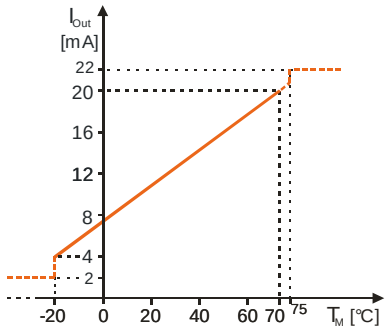
T_M: Voltage interface (U)	T_M: Current interface (I)
	
$T_M = \left(\frac{90}{10\ V} \cdot U_{Out} - 20\right) °C$	$T_M = \left[\frac{90}{16\ mA} \cdot (I_{Out} - 4\ mA) - 20\right] °C$

Table 4

- Temperature of medium outside of specification range:
  Operation outside the specified limits may damage the sensor and is displayed as follows (see also graphics in Table 4):
  - Temperature of medium below -20 °C
    The analog output for T_M switches to error (0 V or 2 mA).
    The analog output for w_N switches to error (0 V or 2 mA).
  - Temperature of medium above +70 °C
    Measuring values above $T_{M,max}$ are output in a linear way up to approx. 75 °C (10.6 V or 20.9 mA).

- Temperature of medium above[6] +75 °C
  The analog output for w_N signals an error (0 V or 2 mA).
  The analog output of T_M switches directly to the maximum possible output values of 11 V or 22 mA.

- Error signaling:
  The voltage interface is set to 0 V.
  The current interface outputs 2 mA.

LED light ring

The **SCHMIDT® Flow Sensor 20.515 LED** indicates its current operating state via a light ring in the holder using coloured light code:

Colour signal	Function / failure
None	Supply voltage: None / reversed / too low
Green pulsing (2 Hz)	Supply voltage: Too high
Red pulsing (2 Hz)	Sensor defective
Red blazing	Only with current interface: Load too big (> 350 Ω)
Green blazing	Sensor operational
Orange flashing (2 Hz)	LF-Status indicator: w_N out of permitted range (option)

Table 5

The function "**LF-Status indicator**" signals a drop out of the admissible flow velocity range of 0.45 m/s ± 20 % (w_N < 0.36 m/s or w_N > 0.54 m/s).

6 Startup

The **SCHMIDT® Flow Sensor SS 20.515 LED** is ready within 20 s after switch-on.

If the sensor has a temperature different from that of the place of use, this time will increase until the sensor has acclimatised.

[6] The switching hysteresis for the threshold is approx. 2 K.

7 Information concerning Operation

Ambient condition temperature

The **SCHMIDT® Flow Sensor SS 20.515 LED** monitors the temperature of both medium and electronics. As soon as one of the measured temperatures leaves its specified operating range, the sensor switches off flow measurement and reports the corresponding error. As soon as proper operational conditions are restored, the sensor resumes the measuring mode.

Even leaving the specified operating temperature range for a short period can cause irreversible sensor damage.

Ambient condition medium

The **SCHMIDT® Flow Sensor SS 20.515 LED** is designed for use in clean to slightly contaminated media.

Dirt or other deposits on the head of the sensor cause false measurement results.
Therefore, the sensor must be checked for contamination at regular intervals and cleaned if necessary.

The coated version has particularly high chemical media resistance to organic solvents, acids and bases in liquid or gaseous state, for example:
Acetone, ethyl acetate, methyl ethyl ketone, perchloroethylene, peracetic acid, xylene, alcohols, ammonia, gasoline, motor oil (50 °C), cutting oil (50 °C), sodium hydroxide, acetic acid, hydrochloric acid, sulfuric acid.

The suitability of the above-mentioned or other similar chemicals must be checked for every individual case due to different ambient conditions.

(Condensing) liquid on the sensor results in serious measurement errors.
After being dried, the sensor will work again correctly (provided the condensate has not caused any damage, e.g. by corrosion).

Sterilization

Both uncoated and coated sensors can be sterilized during operation.

Alcohols (drying without leaving residues) and hydrogen peroxide (uncoated version only) are approved and certified disinfectants.

Other disinfectants must be checked by the customer if necessary.

8 Service Information

Maintenance

Heavy contamination of the sensor head may lead to false measured values. Therefore, the sensor head must be checked for contamination at regular intervals. If contaminations are visible, the sensor can be cleaned as described below.

Cleaning of sensor head

The sensor head can be cleaned to remove dust or dirt by moving it carefully in warm water containing a dishwashing liquid or other allowed cleaning liquid (e.g. isopropanol)[7]. Persistent incrustations or deposits can be previously softened by prolonged immersion and then removed by means of a soft brush or cloth. Avoid applying force to the sensitive sensor tip.

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

Before putting it again into operation, wait until the sensor head is completely dry.

Transport / Shipment of the sensor

Before transport or dispatch of the sensor, the delivered protective cap must be put over the sensor head.
Avoid soiling or mechanical stress.

Calibration

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

Spare parts or repair

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

[7] Other cleaning agents upon request.

Test and material certificates

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

9 Technical Data

Measuring quantities	Standard velocity w_N of air, based on standard conditions of 20 °C and 1,013.25 hPa Temperature of the medium T_M
Measured medium	Air or nitrogen, other gases on request
Measuring range w_N	0 ... 1 / 2.5 / 10 m/s
Lower detection limit w_N	0.06 m/s
Measuring accuracy[8] w_N - Standard - Precision (optional)	 ±(3 % of measured value + 0.05 m/s) ±(1 % of measured value + 0.04 m/s)
Reproducibility w_N	±1.5 % of measured value
Response time (t_{90}) w_N	3 s (jump from 0 to 5 m/s)
Operating / measuring range T_M	-20 ... +70 °C
Measuring accuracy T_M (w_N > 1 m/s)	±1 K (10 ... 30 °C) ±2 K (remaining measuring range)
Air / gas humidity	Not condensing (≤ 95 % rH)
Operating pressure	Atmospheric (700 ... 1,300 hPa)
Supply voltage	24 V_{DC} ± 10 %
Current consumption	Typical < 60 mA (max. 100 mA, incl. signal currents)
Analog outputs - Current - Voltage	2 pcs., short-circuit protected (type by ordering) 4 ... 20 mA (R_L ≤ 300 Ω; C_L ≤ 10 nF) 0 ... 10 V (R_L ≥ 10 kΩ; C_L ≤ 10 nF)
Electrical connection	Plug M9 (male), 7-pin (shielded), screwed
Max. line length (rec.)	Voltage interface: 10 m / current interface: 100 m
Protection type[9]	IP65
Protection class	III (SELV) or PELV (EN 50178)
Dimensions / material: - Sensor head - Sensor tube: Straight (L) Angled (H x L) - Screw nut	 Ø max. 9 mm x 57 mm Stainless steel 1.4404, PBT Ø 9 mm Stainless steel 1.4404 300 / 301 … 1,000 mm 150 / 270 mm x 300 mm Stainless steel 1.4404
Weight	300 g max. (straight, 1,000 mm, type 3)

[8] Under reference condition; calibration is carried out in downfall wind tunnel
[9] Only with correctly attached connecting cable

10 Declarations of Conformity

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

SCHMIDT® Flow Sensor SS 20.515 LED

Part-No. **551 550**

is in compliance with the appropriate

CE European guidelines and standards

and

UKCA UK statutory requirements and designated standards.

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

www.schmidt-sensors.com

www.schmidttechnology.de

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