

FlowJam S Ex

Bulk Flow Detection



Operating Instructions

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1. Function

The radar flow detector FlowJam S Ex indicates the flow of bulk materials which moves through the detection range (fig. 1) at a minimal required speed of 0.1 m/s.

The detection is executed by evaluating the Doppler's effect, thus independent of the flow direction.

The material flow, which can be in metallic or non-metallic tubes, ducts, free fall distances and discharge points, is indicated by relays.

The sensor distinguishes between two conditions:

- material flow
- material jam or standstill.

FlowJam S Ex is adapted to extreme process conditions like high temperature and high pressure by a separating flange equipped with a window especially for microwaves.

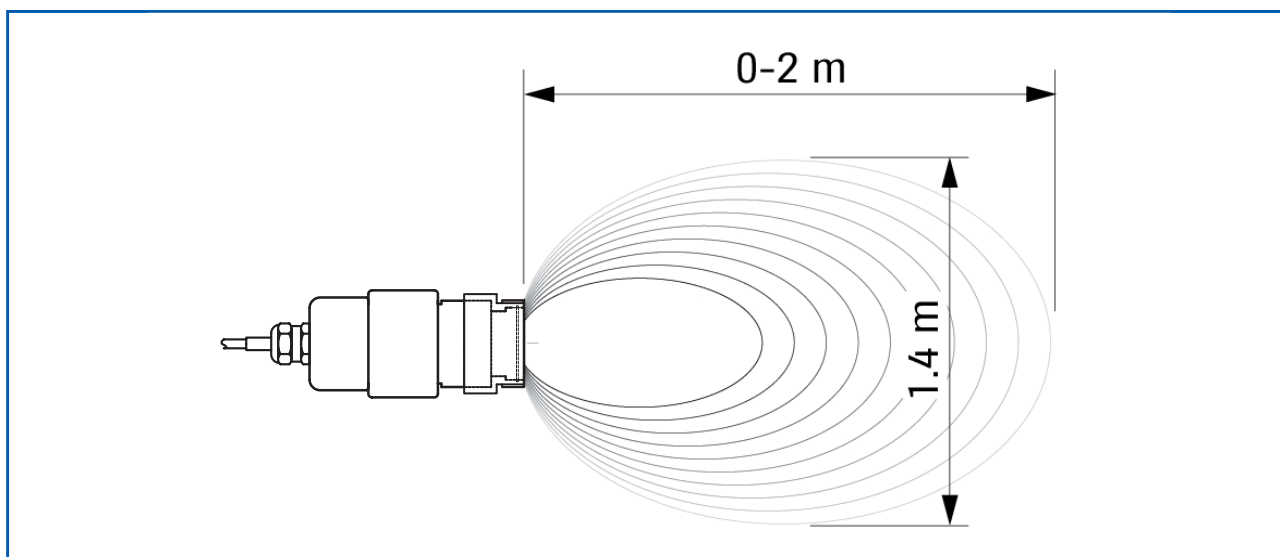


Fig. 1: Detection range

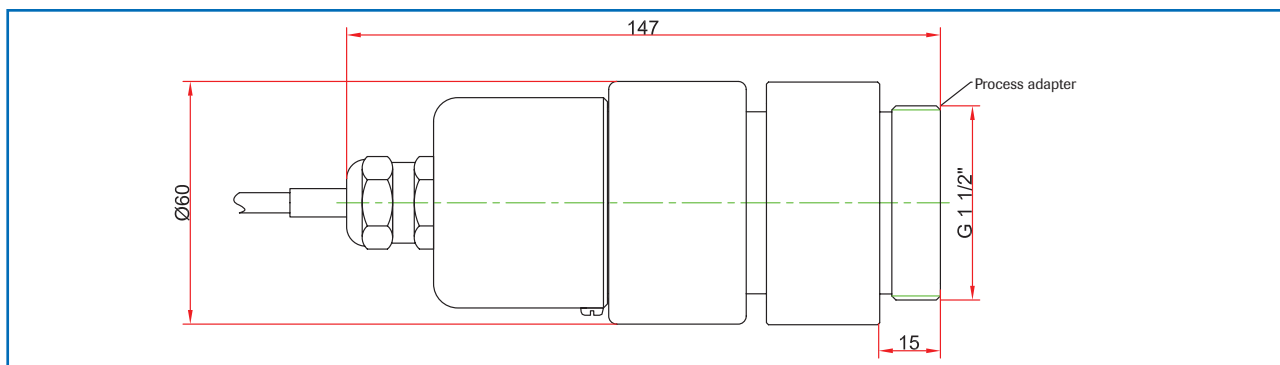


Fig. 2: Dimensional drawing

2. Safety

The sensor FlowJam S Ex was designed, built and tested to be safe and was shipped in safe condition. Nevertheless persons or objects may be endangered by components of the system if these are operated in an inexpert manner. Therefore the operational instructions must be read completely and the safety notes must be followed.

In case of inexpert or irregular use, the manufacturer will refuse any liability or guarantee.

2.1 Regular Use

- Only original spare parts and accessories of SWR engineering must be used.

2.2 Identification of Dangers

- Possible dangers when using the sensor are marked in the operating instructions.

2.3 Operational Safety

- The sensor must be installed by trained and authorised personnel only.
- In case of maintenance-work on the pipe or on components of the FlowJam S Ex-sensor, make sure that the piping is in unpressurized condition.
- Switch off the power supply for all maintenance, cleaning or inspection works on the tubes or on components of the FlowJam S Ex.
- Before hot work the sensor must be removed from the installation place.
- The components and electrical connections must be checked for damages regularly. If a damage is found, it is to be repaired before further operation of the instruments.

2.4 Technical Progress

- The manufacturer reserves the right to adapt technical data to the technical progress without particular advance notice. If you have any questions, SWR engineering will be pleased to inform you on possible changes and extensions of the operating instructions.

3. Mounting and Installation

3.1 Basic remarks

FlowJam S Ex has to be mounted at an angle between 45° and 90° to the flow direction of the bulk material.

Be careful to mount the sensor in an absolutely vibration-free area and that no parts within the detection range are moving, because this might be detected as a material flow.

Moving parts within the area of detection have to be screened.

3.2 Installation of the sensor in general

The installation of the sensor depends on the conditions of the site, thus the sensor can be

- screwed directly into an existing thread type G 1 1/2" (fig. 3)
- fixed by a flange (fig. 4)
- mounted by means of a pipe clamp (fig. 5)

Before installation, make sure that neither the medium temperature nor the pressure within the piping or the container require additional measures like e. g. the mounting of a separating flange previous for microwaves (fig. 6).

When used with non-conductive tubes, detection is carried out via the side of the tube. It is not necessary to make a separate hole into the tube.

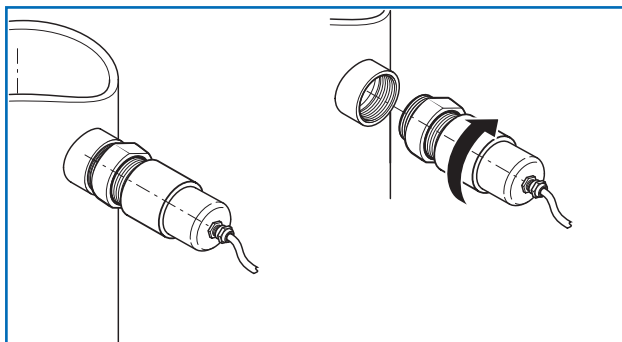


Fig. 3: Thread mounting

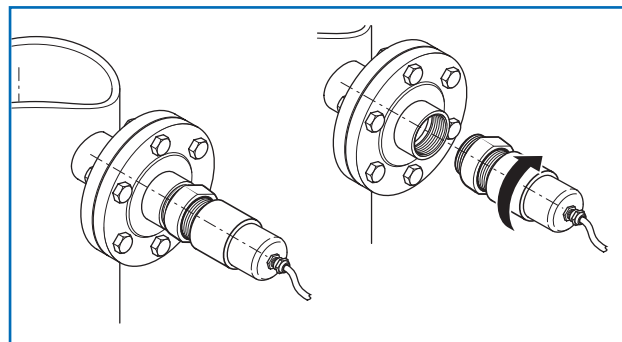


Fig. 4: Flange mounting

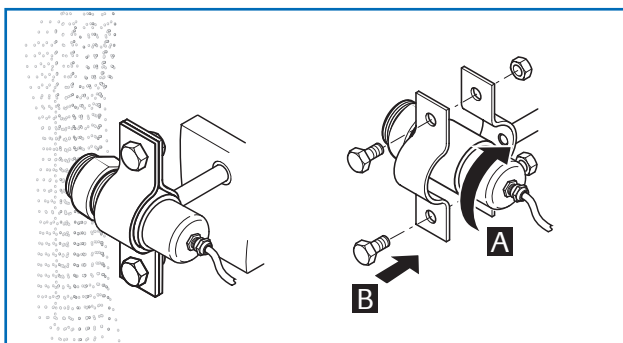


Fig. 5: Mounting with pipe clamp

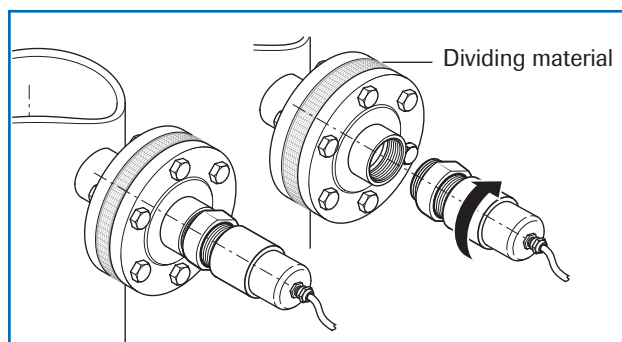


Fig. 6: Mounting with separating flange

3.3 Installation of the sensor on conveyor belts

If possible, the installation on conveyor belts is to be executed in the area of the discharge point.

If the installation is above a conveyor belt, then the FlowJam S Ex has to be installed at an angle of approx. 70 - 80° (fig. 7), in order to use the changing surface profile of the bulk material flow.

Based on the formula for the doppler frequency, the following relation can be pointed on:

$$\Delta f = 2 (V^* \cos \alpha / C) f_0$$

V = resulting speed

Δf = frequency shift

f_0 = transmitted frequency

α = angle of the sensor to flow direction at the bulk material

Angle approx. 90°; mainly the speed of the change of the damping height is measured.

Angle approx. 0°; mainly the material speed is measured.

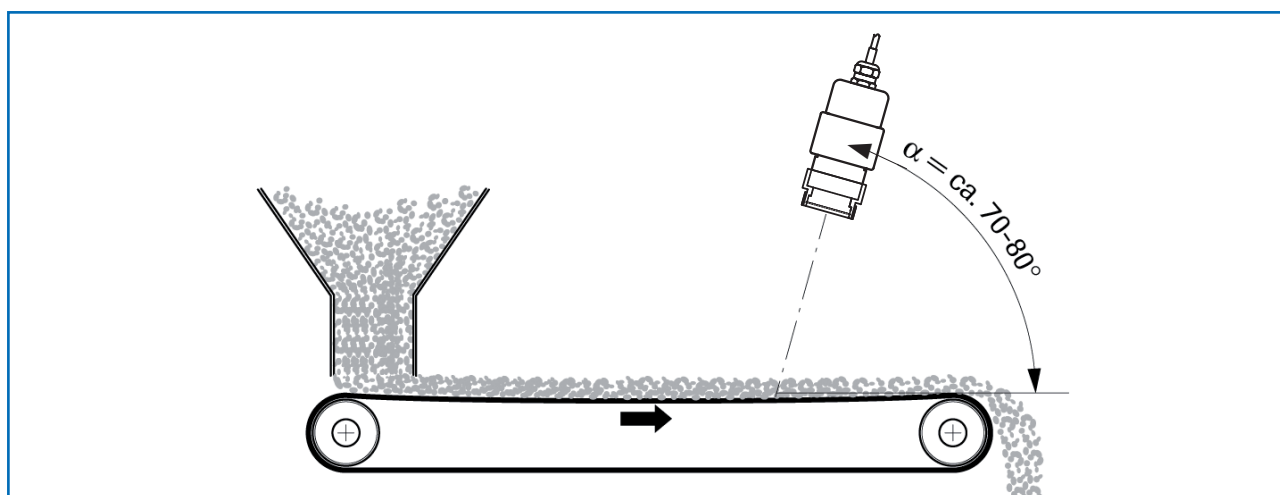


Fig. 7: Installation above conveyor belt

3.4 Safety instructions

Marking according directive 94/9/EEC:



II 3 G/D IP 65 T 85 °C

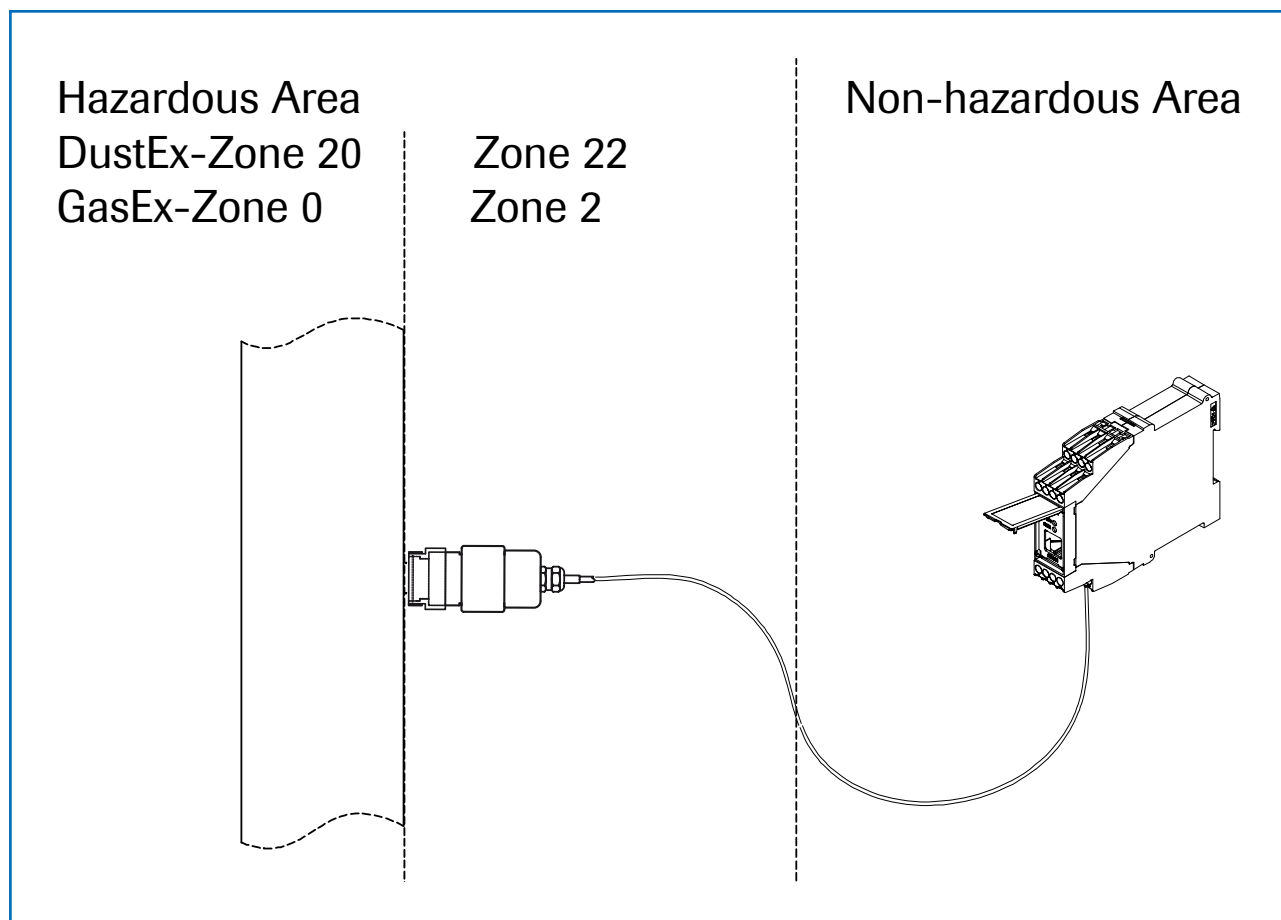
Equipment group _____

Equipment category _____

For explosive mixtures of air and combustible dusts such as gases _____

Degree of protection _____

Maximum surface temperature at maximum ambient temperature $T_a = 60\text{ °C}$ _____



Equipment Category	Explosive dust/air-mixtures (D)	Explosive gas-mixtures (G)
Category 1	Zone 20, 21 or 22	Zone 0, 1 or 2
Category 2	Zone 21 or 22	Zone 1 or 2
Category 3	Zone 22	Zone 2

Power Supply (observe typeplate)	Voltage range Power supply 12 V DC powered by DIN Rail electronic	Max. Power consumption 1,5 W
Category	II 3 D Sensor in Zone 22 / II 3 G Sensor in zone 2	
Type of protection	Sensor = IP 65 / DIN Rail electronic = IP 44	

Safety notes for installation in explosion hazardous areas

1. Comply with the installation and safety instructions in the operating instructions.
2. Install the device according to the manufacture's instructions and any other valid standards and regulations.
3. The device may not be operated outside the electrical and thermal parameters.
4. To maintain the ingress protection IP 65 of the housing, install the housing cover and cable glands correctly.
5. Cable glands and cable entries must be used, which are suited for the category II 3 D and II 3 G.
6. To install the FlowJam S Ex in a Ex zone you **need** a process adapter.

Thermal Data	Category 3 (Zone 2 / Zone 22)
Permissible range of ambient temperature	- 20 °C . . . + 80 °C
Maximum surface temperature at an ambient temperature of 80 °C	+ 100 °C

4. Electrical Connection

The connection of the sensor and transmitter has to be carried out according to fig. 9 and 10. A maximum length of 300 m cable between sensor and transmitter should not be exceeded.

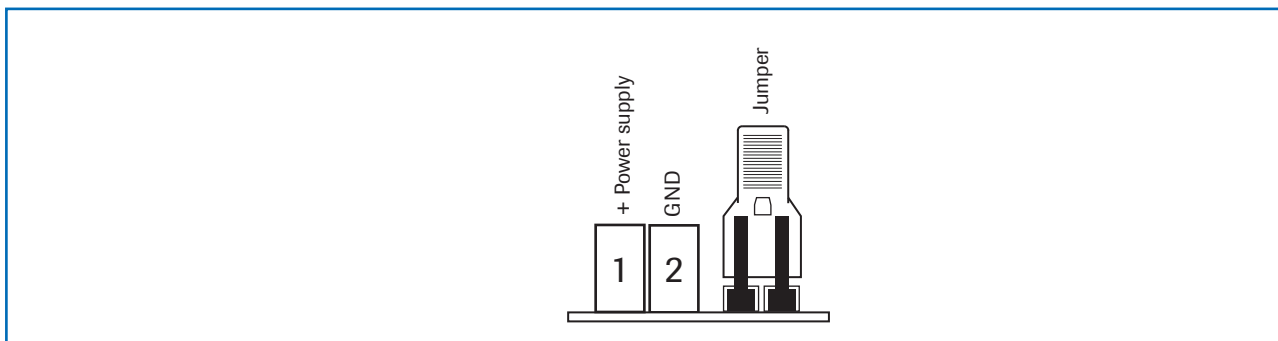


Fig. 9: Wiring diagram for sensor (standard-version: with jumper / high-version: without jumper)

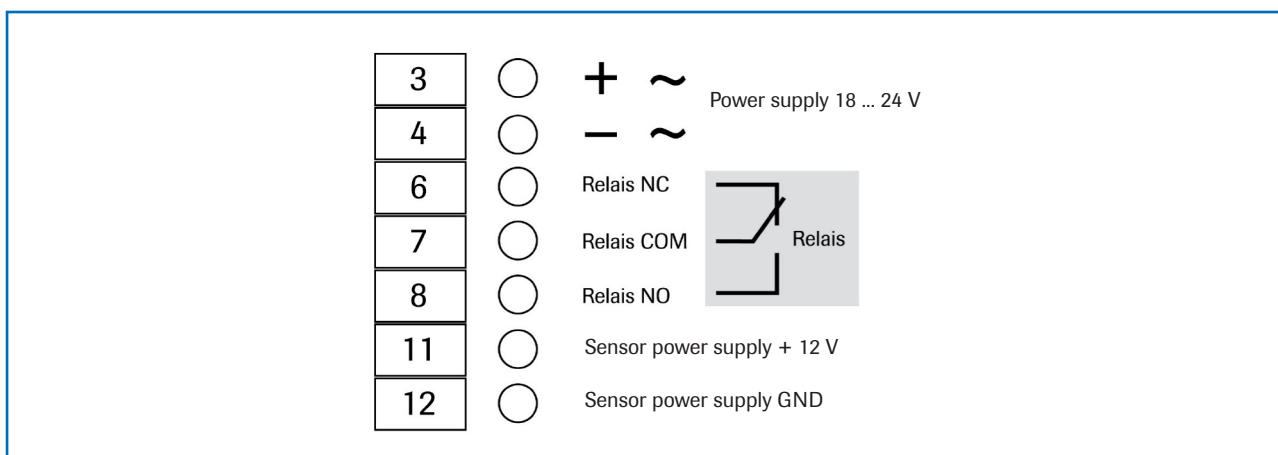


Fig. 10: Wiring diagram for DIN Rail electronic

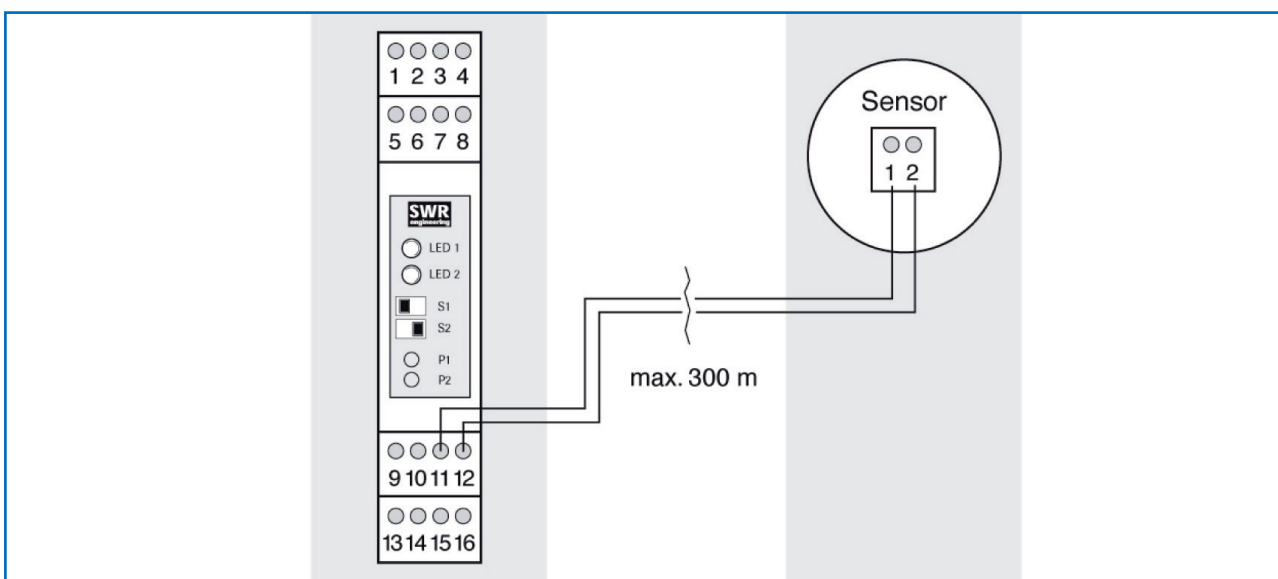


Fig. 11: Wiring of sensor and DIN Rail electronic

5. Commissioning

All operational controls required for the alignment are shown in fig. 12.

Control elements:

- LED 1: Signal strength
- LED 2: Material flow
- S1: Switching between working current / closed current
- S2: Coarse adjustment of sensitivity
- P1: Threshold level
- P2: Delay time

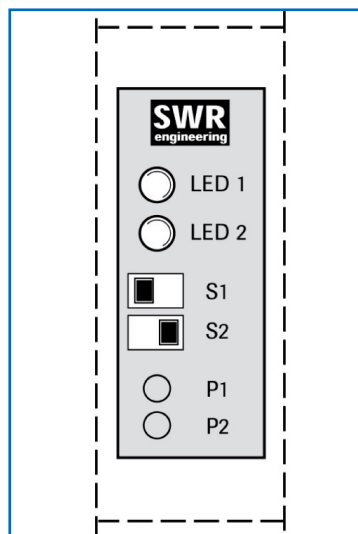


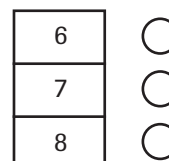
Fig. 12: Position of control elements

Switch S1

The position of switch S1 determines, whether the relay is attracted up or released at material flow.

Position "2" (off) causes alarm in case of material flow:

- material flow - relay is attracted
- contacts 7 + 8 closed
- no material flow - relay is released
- contacts 6 + 7 closed



Position "1" (on) causes alarm when there is no material flow:

- material flow - relay is released
- contacts 6 + 7 closed
- no material flow - relay is attracted
- contacts 7 + 8 closed

LED 1

The LED 1 (red) lightning shows the signal strength by its luminosity; that is, no lightning if no reception signal (no material flow, no vibrations, etc.), weak lightning if low and strong lightning if intense reception signal.

LED 2

The LED 2 (green) lights always up, if material flow is detected; this display is independent of the position of the switch S1.

Adjustment of sensitivity

Hereto use switch S2, potentiometer P1 and potentiometer P2.

The control elements are in the following positions at the delivery (this basis is crucial for the commissioning):

- P1 (fine adjustment of sensitivity): at the left lay, thus insensitive
- S2 (coarse adjustment of sensitivity): switch at (on), thus relatively insensitive
- Jumper on sensor electronic (coarse adjustment of sensitivity): put on, thus relatively insensitive
- P2 (delay time): at the left lay, thus minimal delay of 1 s

Now start your machine in order to guarantee material flow. In consequence the LED 1 must glow. If the LED 1 doesn't glow, then the switch S2 has to be set on (off). If there is still no lightning, then either the sensor has to be aligned differently, and/or the jumper has to be pulled out.

Now choose the position of the switch S1 accordingly, if the relay has to be turned (on) or (off) at material flow.

Enhance the sensitivity so long until the LED 2 glows and the relay switches (off) or (on).

If you interrupt the material flow, both LED lightning must go out, whereas the LED 2 goes out at the latest if the delay time ends.

Finally, you can adjust the delay time according to your requirements with potentiometer P2 in the range of 1 ... 15 s.

6. Troubleshooting

If LED 1 does not light up even at the largest possible amplification, the following points must be checked:

- properties of the material flow
- positioning of the installation
- distance between the sensor and the material flow

If LED 1 lights up without an existing material flow and with minimal amplification adjusted on S2 and P1, it is very likely that the sensor detects the motion of something else or vibrations.

Attention: Does the LED 1 lights up continuously, then either there is no connection between sensor and DIN Rail electronic, or the sensor is broken!

7. Notice

- Avoidance of reflection by vibration or moving line parts
- Setting of the amplification by potentiometer P1 until just of the switching threshold (LED 2 glows)

8. Declaration of conformity

Conforms to the following Product Specifications:

Number: 2004/108/EEC

Text: Electromagnetic Compatibility

The product herewith complies to requirements of the EMC directive 2004/108/EEC:

Reference No.	Date	Reference No.	Date
DIN EN 55011	2009 + A1 : 2010	DIN EN 61000-4-3	2011
DIN EN 61000-1	2009	DIN EN 61000-6-1	2007
DIN EN 61000-3-2	2006 + A1 +A2 : 2009	DIN EN 61000-6-2	2011
DIN EN 61000-3-3	2014	DIN EN 61000-6-3	2012

9. Technical Data

Sensor	
Power supply	12 V DC powered by transmitter
Power consumption	approx. 1.5 W
Housing	Stainless steel 1.4571
Protection system	IP 65
Using in EX-Zones	Cat. 3 G/D Cat. 1/3 G and Cat. 1/3 D (with process-adapter)
Process temperature	- 20 ... + 80 °C (standard) - 20 ... + 220 °C (with process-adapter) - 20 ... + 1000 °C (with ceramic-flange)
Ambient temperature	- 20 ... + 80 °C
Working pressure	max. 20 bar (with process-adapter)
Detection range	0 ... 2 m (dependent on application)
Required material speed for detection	min. 0.1 m/s
Measuring frequency	K-Band 24.125 GHz / ± 100 MHz
Transmitting power	max. 5 mW
Dimensions	Housing: L 147 mm / Ø 60 mm / Thread: L 15 mm / Ø G 1½
Weight	approx. 850 g

Transmitter	
Power supply	24 V DC ± 10 %
Power consumption	approx. 3.5 W
Relay	max. 110 V AC max. 1 A 60 W
Fall-delay time	1 ... 15 s (continuously adjustable)
Weight	approx. 172 g