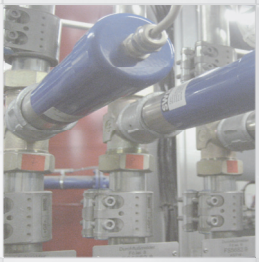
EN

Competence in Solids

SWR engineering

FlowJam

Bulk Flow Detection



Operating Instructions

SWR engineering Messtechnik GmbH

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1. Function

The radar flow detector FlowJam indicates the flow of bulk materials which move 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 nonmetallic tubes, wells, free fall distances and discharge points, is indicated by a relay.

The sensor distinguishes between two conditions:

- material flow
- material jam or standstill.

FlowJam can be adapted to extreme process conditions like high process temperature by a separating flange equipped with a window especially for microwaves.

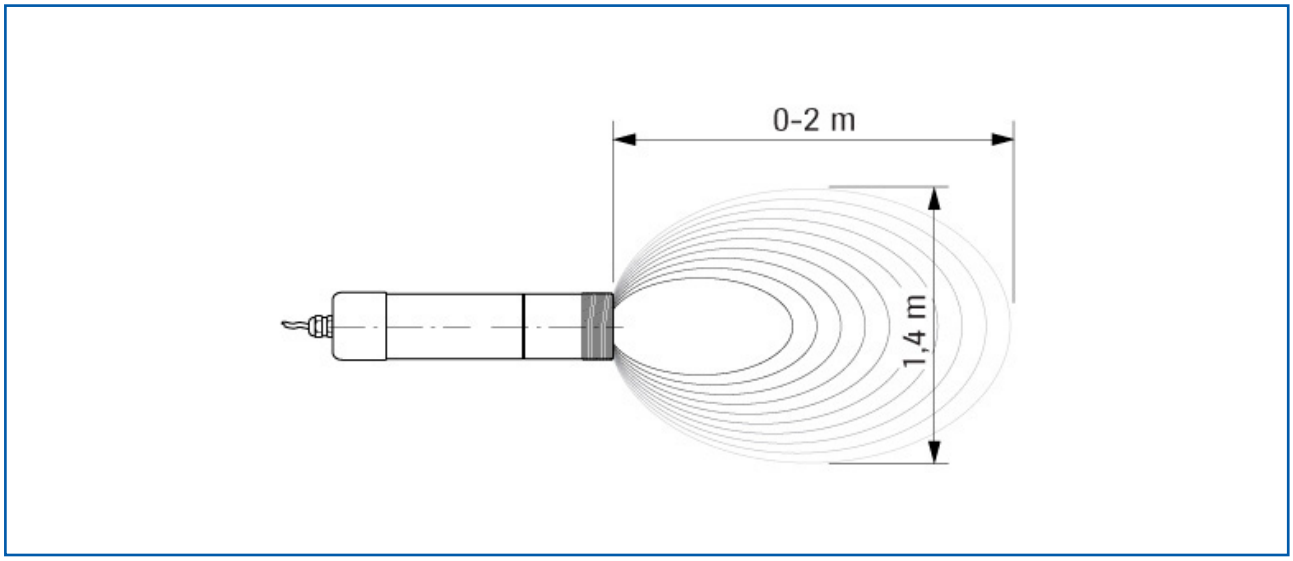


Fig. 1: Detection range

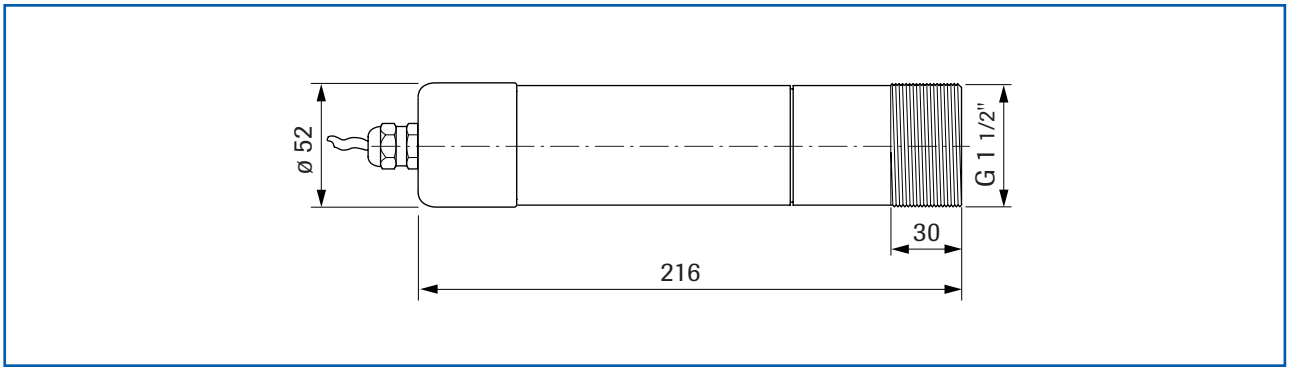


Fig. 2: Dimensioned drawing

2. Safety

The sensor FlowJam 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 warranty.

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.
- Switch off the supply voltage for all maintenance, cleaning or inspection works on the tubes or on components of the FlowJam.
- 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 instrument.

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 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 vibration-free area and that there are no moving parts within the detection range, because they 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.

For example, the sensor can be

- screwed directly into an existing thread type G 1 1/2" (fig. 3)
- fixed by a flange (fig. 4)
- mounted with the help 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 pervious for microwaves (fig. 6).

When used non-conductive dielectric tubes, detection is carried from the outside of the tube. It is not necessary to make a separate hole into the tube.

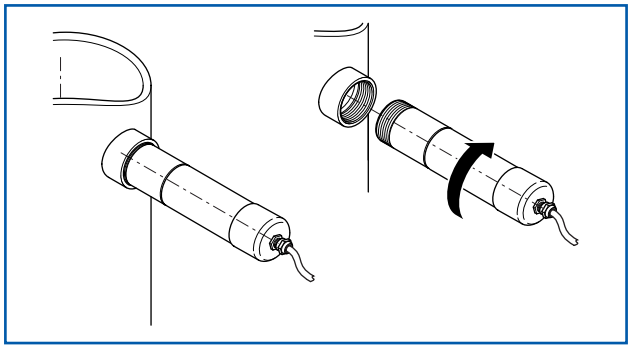


Fig. 3: Thread mounting

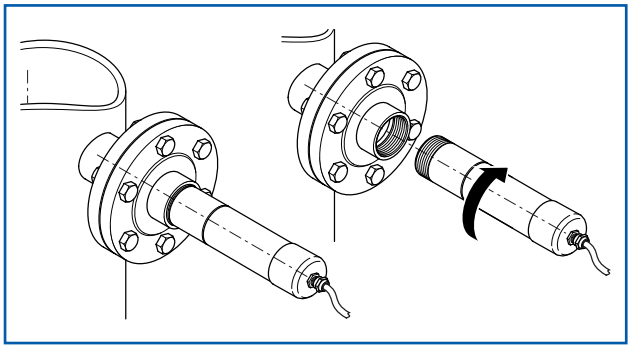


Fig. 4: Flange mounting

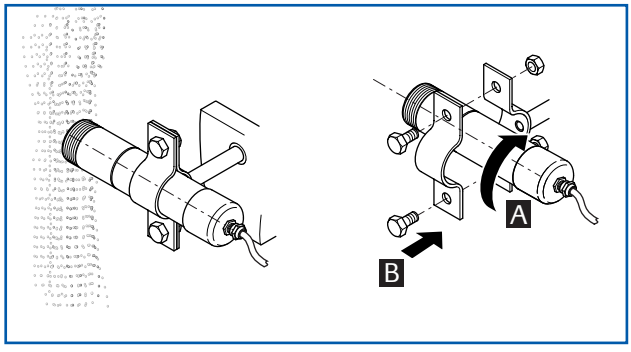


Fig. 5: Mounting with pipe clamp

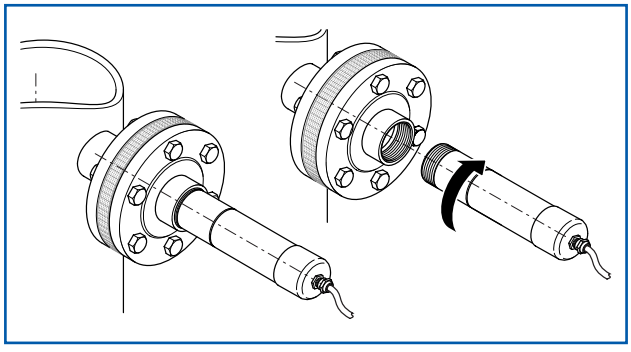


Fig. 6: Mounting with separating flange

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 FlowJam is installed directly above a conveyor belt or if the bulk material to be detected does not show much profile, the sensor should be mounted at an angle of approx. 70 - 80° (fig. 7).

Based on the formular for the Doppler frequency, the following relations can be pointed out:
Df = 2 (V* cos α/C) fo (Fig. 8)

V = resulting speed
Df = frequency shift
fo = transmitter frequency
α = angle of the sensor to flow direction of the bulk material

Angle approx. 90°: mainly the change of the surface profile is measured.

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

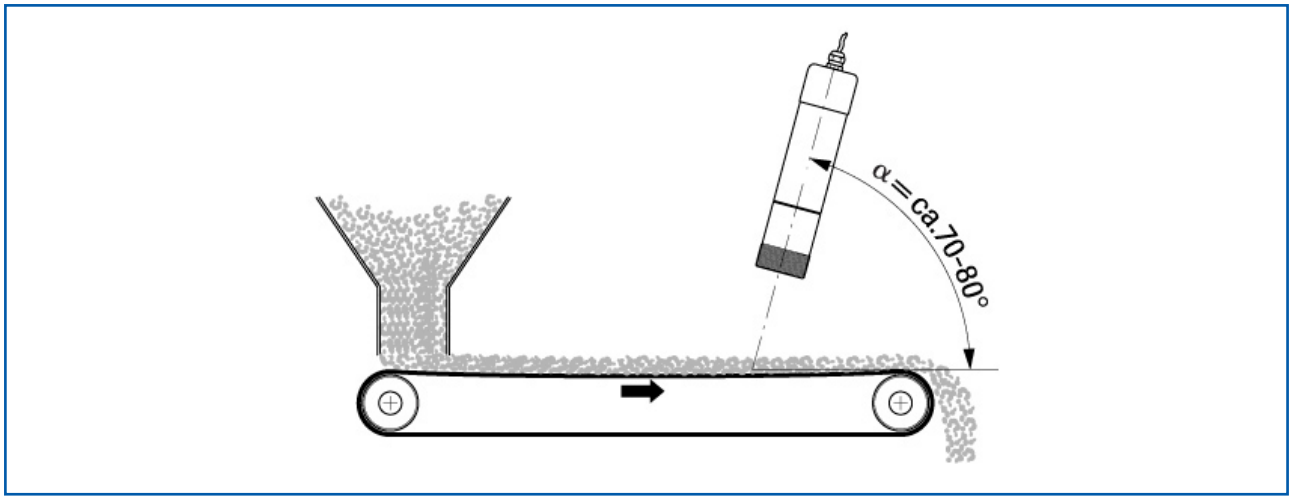


Fig. 7: Installation above conveyor belt

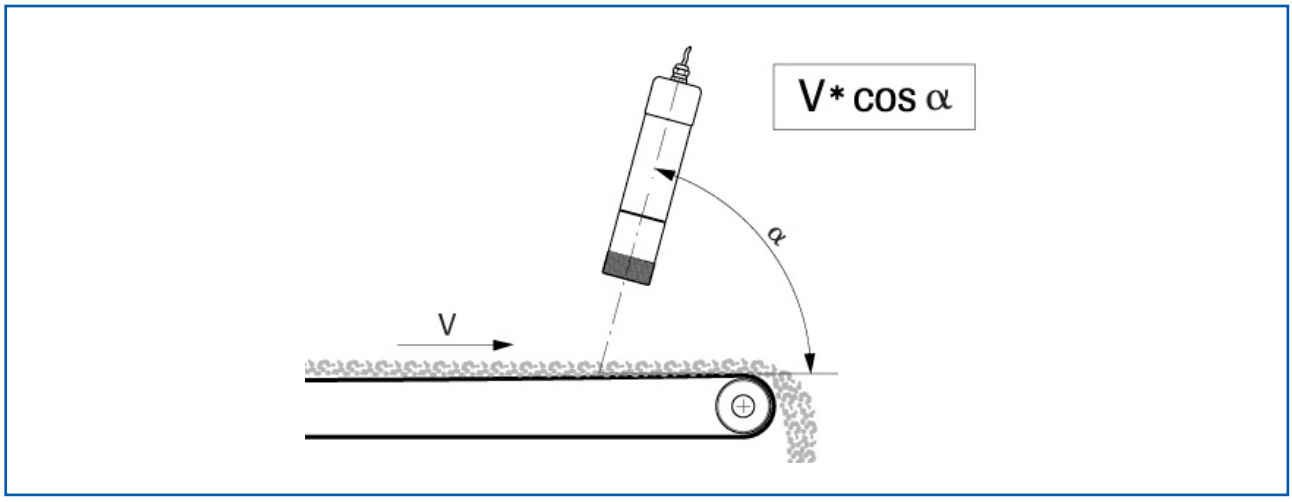


Fig. 8: Determination of sensor's angle

4. Electrical Connection

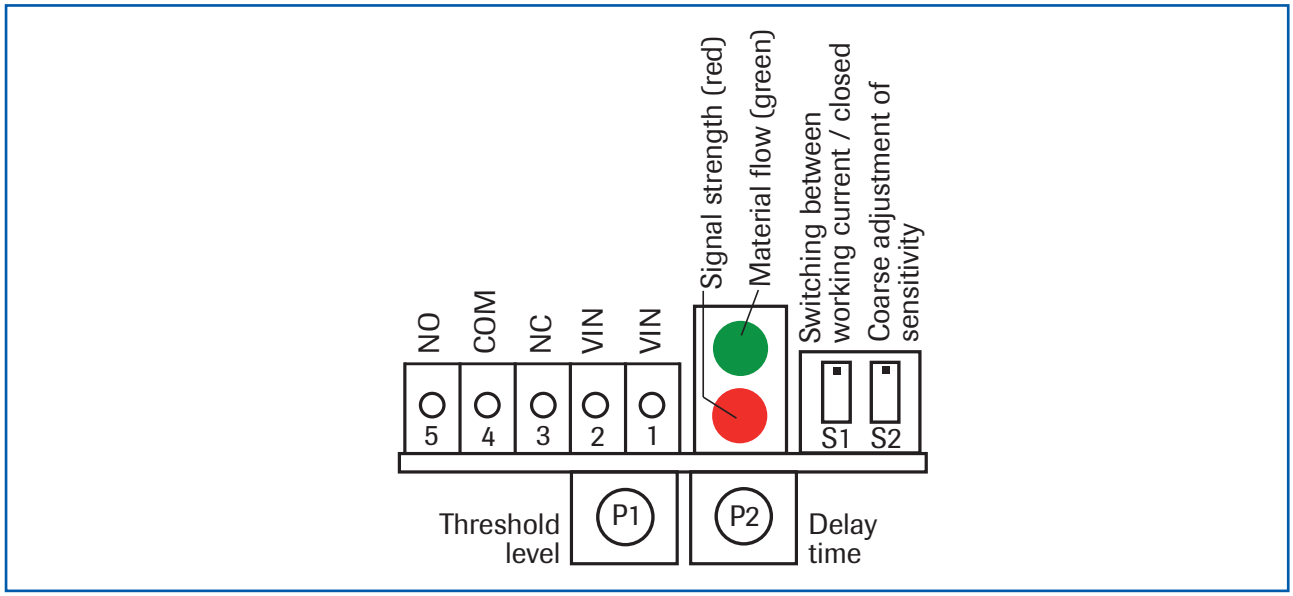


Fig. 9: Terminal and operational controls

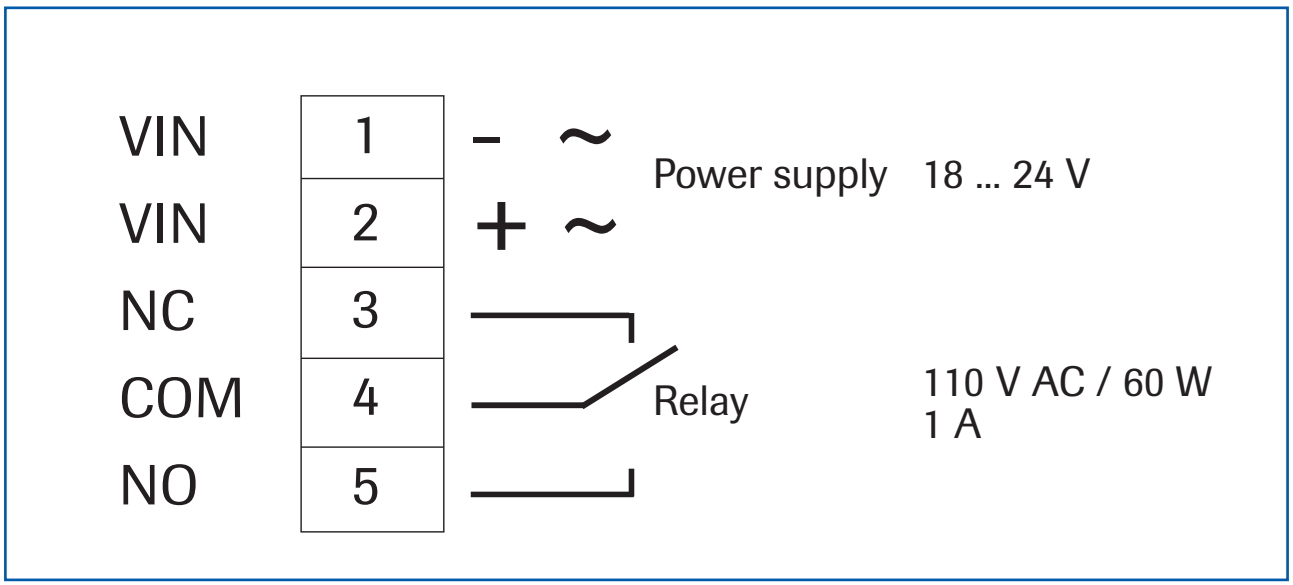


Fig. 10: Wiring diagram for sensor

For connection a 5-wired cable 5 x 0,25 mm² should be used.

5. Commissioning

All operational controls required for the calibration are shown in fig. 11.

Control elements:

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

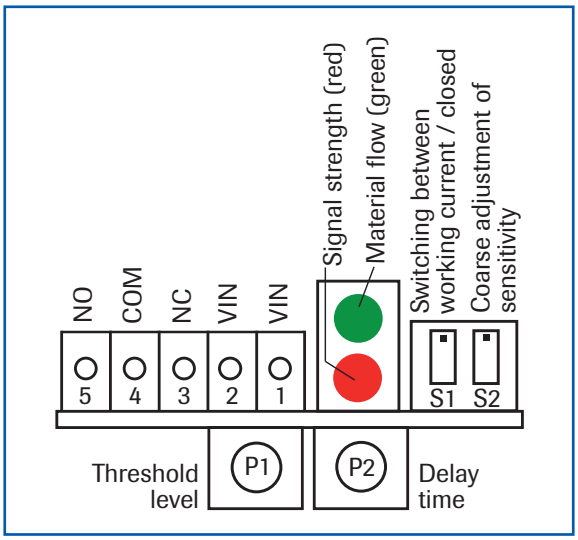


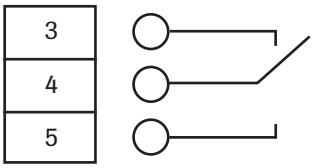
Fig. 11: Position of operating controls

Switch S1

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

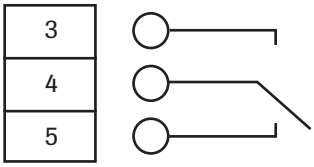
Position ”2” (off) causes alarm in case of material flow:

- material flow - relay is attracted
  - contacts 4 + 5 closed
- no material flow - relay is released
  - contacts 3 + 4 closed



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

- material flow - relay is released
  - contacts 3 + 4 closed
- no material flow - relay is attracted
  - contacts 4 + 5 closed



LED 1

LED 1 (red) indicates the signal strength by its brightness: that means, 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

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

Adjustment of sensitivity

Therefor use switch S2, potentiometer P1 and potentiometer P2.

The default status for the control elements is as follows
(setting for initial commissioning):

- P1 (fine adjustment of sensitivity): fully counter-clockwise, min. sensitivity
- S2 (coarse adjustment of sensitivity): switch at (on), less sensitivity
- P2 (delay time): fully counter-clockwise, minimal delay of 1 s

Now start your system in order to guarantee material flow. In consequence LED 1 must light-up. If LED 1 doesn't light-up, switch S2 has to be set on (off). If there is still no indication, either the sensor has to be aligned differently, and/or you probably need a sensor with high sensitivity.

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

Increase the sensitivity until LED 2 indicates and the relay switches (off) or (on).

If you interrupt the material flow, both LED have to go out, whereas LED 2 indication stops not before end of delay time.

Finally 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 with the highest possible sensitivity, the following points must be checked:

- properties of the material flow (see e.g. fig. 7)
- 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 sensitivity adjusted on S2 and P1, it is very likely that the sensor detects the motion of any moving on vibrating part.

Attention: Does LED 1 indicate continuously, then either there is no connection between sensor and transmitter, or the sensor is broken!

7. Notice

- Avoidance of reflection by vibration or moving line parts
- Setting of the sensitivity by potentiometer P1 up to the switching threshold (LED 2 lightening)

8. Declaration of conformity

Conforms to the following Product Specifications:

Number: 89/336/EEC

Text: Electromagnetic Compatibility

The product herewith complies to requirements of the EMC directive 89/336/EEC:

Reference No.	Date	Reference No.	Date
DIN EN 55011	2007	DIN EN 61000-4-3	1997
DIN EN 61000-1		DIN EN 61000-6-1	2002
DIN EN 61000-3-2	2001	DIN EN 61000-6-2	2000
DIN EN 61000-3-3	2001	DIN EN 61000-6-3	2002

9. Technical Data

Housing	Stainless steel 1.4571
Protective system	IP 65
Process temperature	-20 … + 80 °C -20 … + 220 °C (with process-adapter) Max. 1000 °C (with ceramic-flange)
Ambient temperature	- 20 ... + 60 °C
Dimensions	see Fig. 2
Max. working pressure	1 bar
Detection range	0 ... 2 m (dependent on application)
Min. required material speed for detection	0.1 m/s
Power supply	18 ... 24 V DC / AC
Power consumption	approx. 1.7 VA
Current consumption	70 mA at 24 V
Relay max. Voltage Current Capacity	 250 V AC 1 A AC 60 W
Fall-delay time	1 s ... 15 s (continously adjustable)
Measuring frequency	K-Band 24.125 GHz / ± 100 MHz
Transmitting power	max. 5 mW
Approvals	FTZ and PTT
Weight	1.0 kg

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