

Operating instructions

FS510M-ExD

Microwave sensor for material monitoring



The microwave sensor fulfills the dust explosion protection standard for the type of protection "t" - protection by enclosure.

EU type examination certificate: BVS 22 ATEX E 013 X

Operating instructions for:

FS510M-ExD (Dust-Ex version)

FS510M (not dust Ex version)

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Disclaimer

We have checked the contents of this publication for conformity with the hardware described. However, deviations cannot be ruled out, so we cannot guarantee complete conformity. The information in this publication is checked on a regular basis. Corrections and additions will be made in the following version. We are grateful for any suggestions for improvement.

Subject to technical changes

Use

The FlowSwitch FS510M-ExD is used to control the product flow in pipelines or on conveyor belts.

The signal emitted by the microwave sensor is affected by the material flowing past it. A relay contact for signalling the material movement is controlled in accordance with the microwave sensor parameterization. The microwave sensor is equipped with self-monitoring. An additional relay, which is operated on the closed-circuit principle, is available to signal a maintenance requirement. The relay contact, which is closed in the good state, offers the possibility of series connection with other contacts of other devices and thus monitoring in the form of a collective alarm.

The microwave sensor is housed in a robust flange housing and consists of a combined sender and receiver unit. Due to the non-contact measuring method, wear-free and maintenance-free operation is generally possible.

Measurements in zone 20 are also possible with an additional adapter.

Performance features

- Microwave measuring system
- Reliable measurement even with abrasive materials
- Measurement of microwave-impermeable material in open or closed systems
- Simple installation and commissioning
- Sensor with self-monitoring
- Level and status display for non-dust Ex version
- Signal message via relay contact
- Additional relay contact output for the maintenance requirement request
- 24VDC supply

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1 Safety instructions



Installation, operation and maintenance may only be carried out by qualified personnel.



The circuits in the appliance must not be accessed.

Do not repair the appliance itself, but replace it with an equivalent appliance.



The appliance complies with type of protection "t" and can be installed in zone 21.

An adapter (AD510) must be screwed on for measurements in Zone 20.

2 Classification of the safety instructions

This manual contains instructions that you must observe for your personal safety and to prevent damage to property. The instructions are highlighted by a warning triangle and shown as follows, depending on the degree of danger:



DANGER

means that death or serious bodily injury will occur, if the appropriate precautions are not taken.



WARNING

means that death or serious bodily injury may occur, if the appropriate precautions are not taken.



CAUTION

means that slight bodily injury can occur if the appropriate precautions are not taken.

CAUTION

without a warning triangle means that material damage may occur, if the appropriate precautions are not taken.



ATTENTION

means that an undesirable result or condition may occur, if the corresponding notice is not observed.

NOTE



is important information about the product, the handling of the product or the part of the documentation to which particular attention is drawn and compliance with which is recommended.

In addition to the instructions in this publication, the generally applicable safety and operating instructions must be observed. If in any case the information contained in this publication is not sufficient, our telephone service is available to provide you with further information. Please read this document carefully before installation and commissioning.

3 **General information**

This appliance has left the factory in a technically safe condition. In order to maintain this condition and to ensure safe operation of the appliance, the instructions and warnings given in these operating instructions must be observed by the user.

ATTENTION

For reasons of clarity, the instructions do not contain all detailed information on all types of the product and cannot take into account every conceivable case of installation, operation or maintenance.

Should you require further information, or should particular problems arise that are not covered in sufficient detail in the instructions, you can request the necessary information by telephone.

Furthermore, we would like to point out that the contents of the instructions are not part of a previous or existing agreement, promise or legal relationship or are intended to change these. All obligations of Mütec Instruments GmbH arise from the respective purchase contract, which also contains the complete and solely valid warranty provisions. These contractual warranty provisions are neither extended nor limited by the explanations in the instructions.

The content reflects the technical status at the time of printing. We reserve the right to make technical changes in the course of further development.

WARNING

Proper and safe operation of this microwave sensor requires proper transportation, storage, installation, assembly and maintenance. The microwave sensor may only be for the purpose specified in these operating instructions.

DISCLAIMER

All modifications to the appliance, unless expressly mentioned and approved in the operating instructions, are the responsibility of the user.

VALIDITY



The operating instructions apply both to the described microwave sensor FS510M-ExD and to the non-dust Ex sensor FS510M, for which the adapter AD510 has no significance and can therefore be omitted.

TARGET GROUP

This data sheet is intended for the following persons:

- Qualified personnel who plan and install safety equipment for machines and systems. Developed and familiar with the regulations on occupational safety and accident prevention.
- Qualified personnel who install safety equipment for machines and systems and puts it into operation.

QUALIFIED PERSONNEL

Qualified personnel are persons who, due to their training, experience and instruction as well as their knowledge of relevant standards, regulations, accident prevention regulations and operating conditions, have been authorized by the person responsible for the safety of the system to carry out the necessary planning and activities and are able to recognize and avoid potential hazards.

PREREQUISITES

The qualified personnel must have knowledge of the following subject areas:

- Handling and knowledge of ATEX products
- Applicable EMC regulations
- Applicable regulations on occupational safety and accident prevention
- Placement or assembly of an ATEX product
- Commissioning, monitoring and maintenance of an ATEX product

SAFETY REGULATIONS

The safety regulations of the electrical engineering and the employers' liability insurance association must be observed and complied with. Failure to do so may result in death, serious injury or extensive damage to property.

be the result.

DIRECT/INDIRECT TOUCH

For all components connected to the system, protection against direct and indirect contact needs to be granted in accordance with VDE 0100 Part 410. In the event of a fault, there must be no dangerous voltage carry-over (single-fault safety).

ASSEMBLY and COMMISSIONING

Installation and commissioning may only be carried out by qualified personnel. The wiring must be carried out and tested in accordance with the specifications (see block diagram). Separate cable routing for the 24 VDC supply on the one hand and for the relay power supply on the other hand can counteract EMC influences.

Suitable/effective protective circuits are required for inductive loads on the relay circuits.

A protective circuit with suppressor diodes or varistors must always be connected in parallel to the load.

EXTERNAL OPERATION and DISPOSAL

The device must be disposed of in accordance with environmental regulations. It must be ensured, that a defective device will not be used again.

4 ATEX-relevant information

An appliance must be taken out of operation and unintentional operation prevented if it can be assumed that safe operation is no longer possible. Reasons for this assumption may be

- Visible damage
- Failure of the electrical function
- Longer storage at temperatures above 75 °C
- Heavy transportation stress

Before the appliance is put back into operation, a professional routine test must be carried out. This test should always be carried out by the manufacturer. Repair work on Ex devices may only be carried out in accordance with §9 of the Ex Ordinance (Elex V).

When installing in a partition wall between 2 dust Ex zones (e.g. zone 21 and zone 22), the zone separation must not be removed by installing the device. This requirement must be ensured by appropriate sealing and preventing unscrewing during operation. The lock nuts available for this purpose on the microwave sensor and the adapter with the SW56 must be tightened with an appropriate torque.

Installation and erection must be carried out in accordance with DIN EN 60079-14.

Instructions for opening/closing the housing cover:

- Never open in a dust atmosphere during operation
- Close the housing cover with a wrench (SW22) (see section 5.10)
- A tightening torque of 8 ... 10 Nm reliably prevents opening by hand!

Special conditions of use (X marking)



The process connection of the microwave sensor must be installed protected from UV radiation in open applications (e.g. on conveyor belts).

The temperature at the cable entry points rises to up to 74°C when the ambient temperature rises to 70°C. Approved temperature-resistant cables must be used



The permissible ambient temperature range is -10°C to +70°C and must not be exceeded or fallen short of.

The permissible process temperature range is -20°C to +90°C and must not be exceeded or fallen short of.

The permissible pressure range of 0.8 bar to 1.1 bar must be observed and must not be exceeded or fallen short of.

The normal oxygen content of air of usually 21 % (V/V) should be maintained.



The microwave sensor FS510M-ExD is approved for use/measurement in Zone 21
Only with the AD510 adapter screwed on measurement also permitted in Zone 20.

Example of marking in accordance with Directive 2014/34/EU and EN 60079-0:2018 for a dust-explosion-proof appliance:

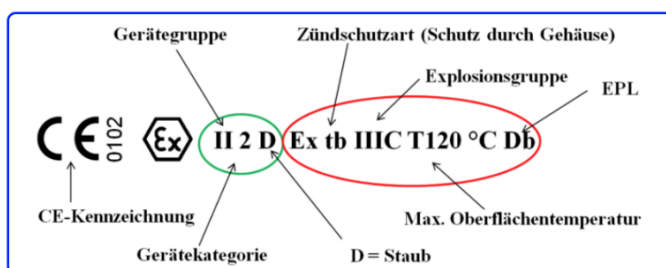



Fig. 1 Identification of a Dust Ex device

Marking on the type plate in accordance with Directive 2014/34/EU for use in the dust Ex area:

	Explosionsschutz
II	Gerätegruppe: Ex-Geräte, die nicht in Bergwerken etc. eingesetzt werden
1/2	Geräteklasse: sehr hohes Maß/hohes Maß an Sicherheit (Gerät mit Trennwand)
D	Art der Ex-Atmosphäre: Staub
Kennzeichnung der Zündschutzart:	
Ex	Explosionsschutz nach EN
ta/tb	Zündschutzart: Schutz durch Gehäuse, inkl. Schutzniveau ta/tb (Gerät mit Trennwand)
IIIC	Staubgruppe: leitfähige Stäube
T135°C	Maximale Oberflächentemperatur: 135°C
Da/Db	EPL (Equipment Protection Level): sehr hohes/hohes Schutzniveau (Staub)

CE mark: This product complies with the specifications of the EMC Directive 2014/30/EU and the ATEX Directive 2014/34/EU.


Maintenance and inspection

The microwave sensor is a maintenance-free product for material flow monitoring – as long as the instructions for correct installation given in the operating instructions are observed.

An exception could be the measurement of a more or less abrasive material in pipelines, because the orifice plate would then be subject to a certain amount of wear

It is therefore recommended to carry out an inspection at limited intervals, which can be confirmed by a photo and should be documented. A possible consultation with the manufacturer can thus be ideally supported.

5 Technical data

Ex certificate	BVS 22 ATEX E 013 X II 1/2D Ex ta/tb IIIC T ₂₀₀ 135°C Da/Db or II 2D Ex tb IIIC T135°C Db	
		
Conformity	EN IEC 60079-0:2018 EN 60079-31:2014	General requirements Protection by enclosure "t"

5.1 Electrical data

Supply circuit (KL1 and KL2)			
Voltage		DC 18...30	V
Amperage		80	mA
Max. Max. voltage	U _m	AC/DC 250	V
Relay contact circuits (KL3...KL5, KL6 and KL7)			
Switching voltage		DC 30	V
Switching current		2	A
or			
Switching voltage		AC 125	V
Switching current		0,5	A
Max. Max. voltage	U _m	AC/DC 125	V

5.2 Thermal data

Ambient temperature range	T _{ambient}	-10 to +70°C
Process temperature range	T _{process}	-20 to +90°C
Housing surface temperature	T _{max}	+135°C

5.3 Mechanical data

Housing material	Stainless steel
Sensor surface	Plastic (optional ceramic for abrasive media)
Protection class	IP 65
Weight	1.3 kg
Cable entries	M16
Connection	Screw terminals

5.4 Electrostatic discharge

Electrostatic sensitive modules can be destroyed by voltages that are far below the threshold of human perception if you touch a component or electrical connections of a module without being electrostatically discharged. The damage that occurs to a module due to an overvoltage cannot usually be detected immediately, but only becomes noticeable after a long period of operation. When handling the microwave sensor, observe the necessary safety measures against electrostatic discharge (ESD) in accordance with EN 61340-5-1 and EN 61340-5-2.

5.5 Housing dimensions with adapter

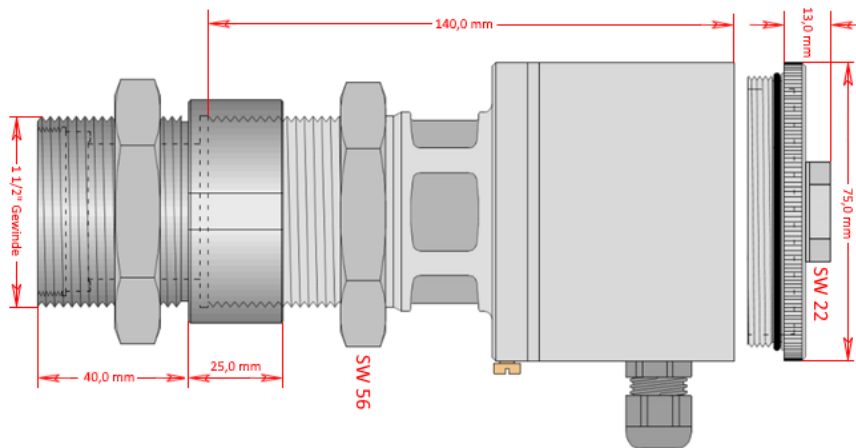


Fig. 2 microwave sensor with

5.6 Adapter AD510 for measurement in zone 20

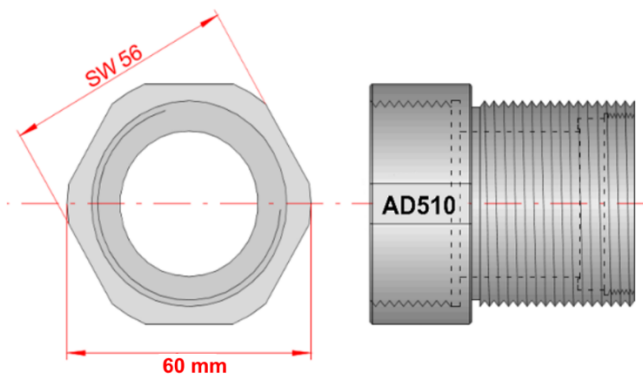


Fig. 3 Adapter AD510

5.7 Earthing via PE protective conductor

A 4 mm brass screw with a toothed lock washer is provided on the cylindrical housing for the connection to the required equipotential bonding. This ensures that a secure electrical connection with high corrosion resistance can be established for the connection of the protective conductor. A ring cable lug, which is included in the delivery, enables a cable cross-section of at least 4 mm² to be connected without any problems. This must be observed without fail for installation in Ex areas.



Fig. 4 Protective conductor

5.8 Block diagram with terminal assignment

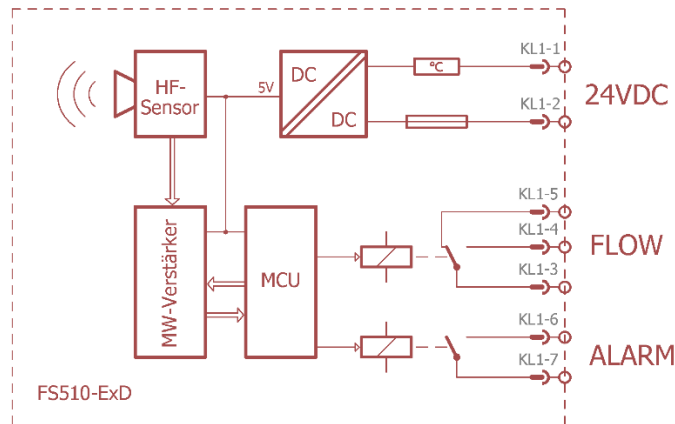


Fig. 5 microwave sensor

5.9 Nameplate



Fig. 6 Type plate of the microwave

5.10 Screw cap of the sensor housing

The ATEX standard for dust explosion protection requires that the housing of the microwave sensor must not be opened by hand. For this purpose, the housing cover has been equipped with a hexagon for a wrench size of 22 mm (SW22) so that it can be closed with a torque of 8 ... 10 m.

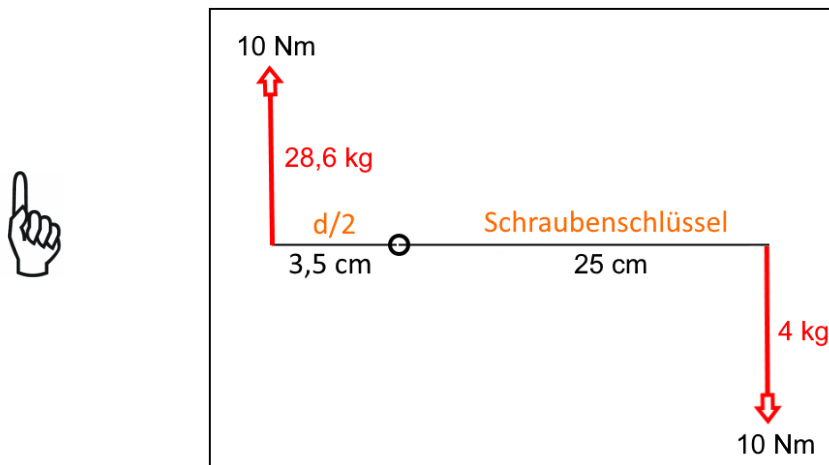


Fig. 7 Minimum torque with wrench

5.11 Mounting accessories

Weld-in adapter (ESA):

ESA_Type 1:	22,5mm length	Material: Steel
ESA_Type 2:	22,5mm length	Material: stainless steel V4A
ESA_Type 3:	48.0mm length	Material: stainless steel V4A
ESA_Type 4:	angled 45°	Material: steel

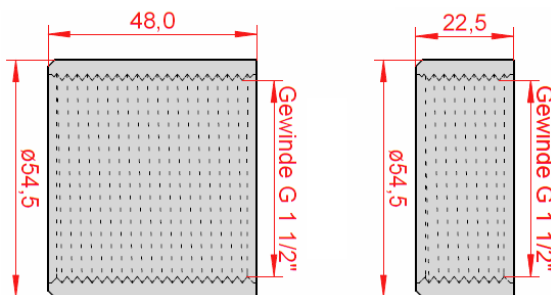


Fig. 8 Dimensions of the Cylinder sleeve

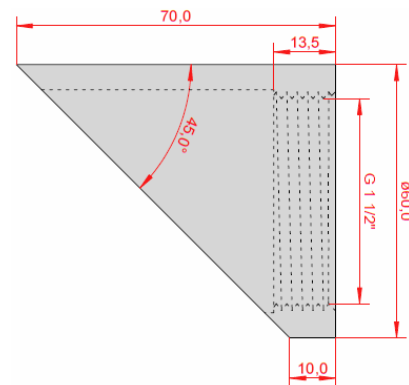


Fig. 9 Dimensions of the 45° socket

Type 1-3: This mounting should be favored when measuring microwave-permeable or microwave-impermeable material with higher velocities.

Type 4: This mounting should be favored when measuring microwave-impermeable material at low speeds.

Type 5: Adapter with mounting plate made of stainless steel (V2A)

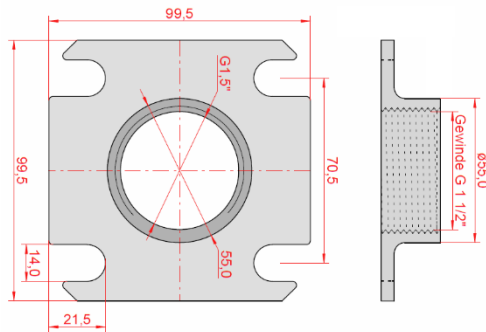


Fig. 10 Dimensions of the Adapters

The material of the pipe or shaft must be made of microwave-permeable material. If this is not the case, an artificial measuring chamber can be created by completely encasing the sensor area with a microwave-impermeable material, for example a metal sheet or metal foil.

6 Assembly instructions

The sensor is installed in a stainless steel housing. There is an external thread on this housing through which the sensor can be screwed into a socket and fixed with a nut.

The sensor should be installed where the greatest material distribution in the process is to be expected and where the material flow is as constant as possible.

To prevent moisture from penetrating through the cable gland, the cable glands should face downwards.

If several microwave sensors are operated in the immediate vicinity in the same product path, it must be ensured that they do not influence each other.

The sensor should be mounted in such a way that no material can be deposited in front of it. Furthermore, it should be mounted in such a way that abrasive materials cannot damage the sensor. It is recommended that the sensor is mounted flush with the inner wall.

Various mounting options are shown below:



Fig. 11 Mounting on conveyor belt

The sensor detects the contours of the surface. A studded belt can influence the measurement. The measuring range or space can be limited by metal plates.

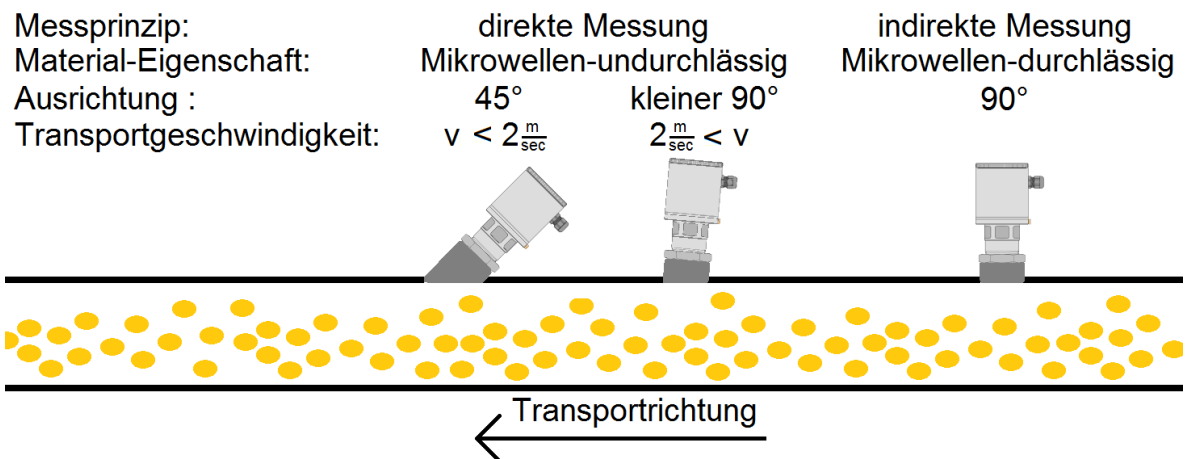


Fig. 12 Installation in the pipe system

The sensor detects the change in the contours of the material or the distribution in the measuring range. The material should not be able to deposit in front of the sensor.

7 Parameterization of the microwave sensor

All settings are made in the microwave sensor using a rotary switch, two buttons and a potentiometer.

The feedback for each parameter is provided by a multi-colored bar graph display.

All operating elements are accessible by removing the housing cover. To prevent damage to the appliance, we advise against removing the inner cover. Unauthorized tampering with the appliance will invalidate the operating permit and warranty.

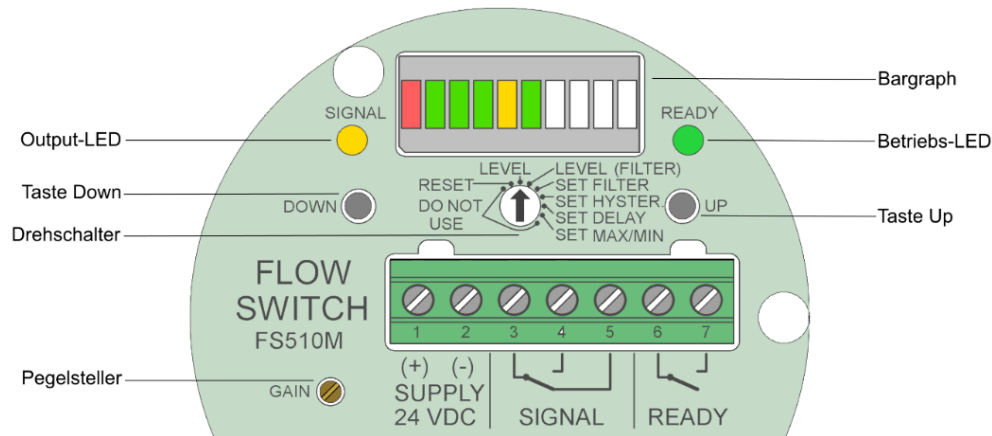


Fig. 13 Representation of all operating and display

Bar graph: The bargraph is used for the analog display of various parameters, such as the field strength or of the material flow.

Output LED: This LED indicates the status of the signal relay.

Operating LED: The sensor is equipped with fault detection and the status is displayed with the READY LED is displayed.

Rotary switch:	Reset:	Reset settings
	Level:	Field strength in sensor mode
	Level (filter):	Averaged filter value of the field strength
	SET Filter:	Setting the filter time
	SET Hysteresis:	Switching hysteresis of the signal relay
	SET Delay:	Switching delay of the signal relay
	SET MAX/MIN:	Limit value setting for the signal relay

Down & Up button: The buttons are used to set the selected parameter.

Level controller: In operating mode, the field strength of the material flow is displayed on the bargraph. Adjustment is carried out using the level control.

The setting of the microwave sensor is explained below. The rotary switch for function selection and the buttons for changing the setting are required for this. The bar graph and the LEDs provide visual support.

Reset all settings:

Step_1: Set the rotary switch to RESET.

Step_2: The right-hand green LED of the bar graph display and the READY LED flash to indicate this mode.

Step_3: For a RESET, both buttons (Up and Down) must be pressed for 10 seconds. As an acknowledgement, the first orange bar flashes on the bar graph display, followed by the remaining bars. As soon as all bars are involved, the parameters are reset to the default values.



After a RESET, all settings must be made again.

Level / current field strength in sensor mode:

Step_1: Set the rotary switch to Level.

Step_2: The flow rate must correspond to the set flow rate. The amplification (field strength) is set using the level control.

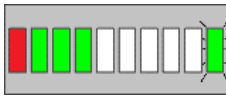


Fig. 14 Representation of the current field

Step_3: Finally, the flow rate should be changed in order to display the field strength on the bar graph display.



The switching threshold for the signal contact is shown on the bar graph display with the 5th bar shown in yellow.

Level (filter) / average value of the field strength in sensor mode:

Step_1: Set the rotary switch to Level (filter).

Step_2: This is the operating mode with the current, averaged field strength. The flow rate must be equal to the set flow rate for MIN/MAX monitoring.

Step_3: The field strength is set using the level control.
 MIN monitoring: Field strength should correspond to a minimum of 6 segments
 MAX monitoring: Field strength should correspond to a maximum of 4 segments

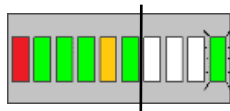


Fig. 15 MIN monitoring

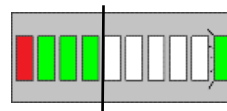


Fig. 16 MAX monitoring

Step_4: The flow rate must be reduced for MIN monitoring. The switching process must take place when the flow rate falls below the 5th element (yellow LED).



The switching point is indicated by the 5th segment of the bargraph (yellow LED). During commissioning, ensure that a maximum of 7 segments of the bar graph display are activated. The end of the measuring range is symbolized by the right-hand red LED on the bar graph.

Filter time setting:

Step_1: Set the rotary switch to Filter.

Step_2: The 9 time settings are made using the Up and Down buttons.

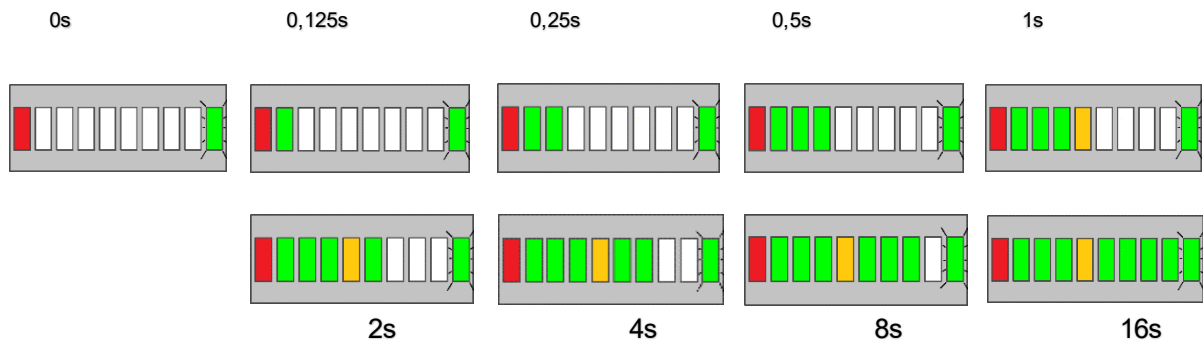


Fig. 17 Filter time display



The selection of the filter time must be adapted to the material flow. If the time selected is too short, a pulsating material flow may cause the display to flicker under Level (filter). If the time selected is too long, the long averaging time may result in a stagnation of the material transport not being detected.

Hysteresis

Step_1: Set the rotary switch to hysteresis.

Step_2: The hysteresis is changed using the Up and Down buttons. The switching threshold is symbolically located in the middle of the display. The size of the set value is shown by the green LEDs around the symbolic switching threshold.

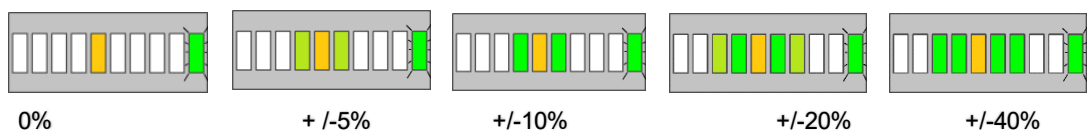


Fig. 18 Hysteresis display



If the hysteresis selected is too small, the signal contact may switch continuously. If the hysteresis is set too high, a change in material flow may no longer be detected.

Delay // Switching delay for the signal relay

Step_1: Set the rotary switch to Delay.

Step_2: The time delay is set using the Up and Down buttons.

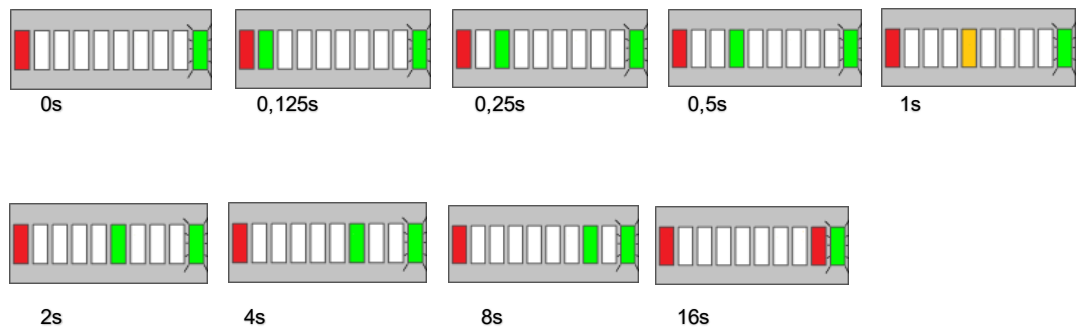


Fig. 19 Switching delay for signal relay



The selection of the optimum switching delay depends on the respective process and should be adapted to it. If the time selected is too short, a pulsating material flow may cause the relay to switch frequently. If the time selected is too long, short interruptions in the material flow may not be detected.

MAX/MIN selection for signal

- Step_1: Set the rotary switch to MAX/MIN.
- Step_2: The relay contact opens or closes according to its setting.
- Step_3: The new function is selected using the Up and Down buttons.

Condition / Selection	Bar graph display	Switching threshold	Signal LED	Signal contact	Operating LED	Ready contact
min. Value		undercut				
		exceeded				
max. value		undercut				
		exceeded				
Error case resp. Malfunction	Not applicable	not relevant	undefined	undefined		
No auxiliary energy						

Fig. 20 Status table



In the event of an error, the signal relay does not necessarily drop out and the signal LED does not expire.

The READY contact of the relay, which is operated according to the closed-circuit principle, signals a maintenance requirement. The relay contact, which is closed in the good state, offers the option of series connection with other contacts of other devices and thus collective alarm monitoring.



The READY relay is equipped with a switch-on delay of 1 second.