

Operating instructions

FS710E-Ex

Dust monitor with 2 switching outputs for filter monitoring



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

The dust monitor fulfills the Ex standard for the intrinsic safety of the type of protection "i".

EU type examination certificate: BVS 20 ATEX E 013

Operating instructions for:

FS710E-Ex (dust Ex version)

FS710E (not dust Ex version)

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Manufacturer:

Mütec Instruments GmbH
Bei den Kämpfen 26
21220 Seevetal
Germany

Tel: +49 (0) 4185 8083-0

Fax: +49 (0) 4185 808380

e-mail: info@muetec.de

Internet: www.muetec.de

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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

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Use

The dust monitor detects the dust load on the clean air side after a filter. In this way, filter cracks, breaks or installation errors can be reported automatically and reliably. The FS710E-Ex is suitable for all pipelines and metallic ducts with a length that exceeds 3 times the diameter. Installation is quick and easy by welding on a threaded socket. The sensor rod is inserted into the pipe and fixed in place using the screw thread. The sensor rod length should be at least 1/3 of the pipe diameter and must not touch the opposite side. A distance of at least 20 mm is recommended between the end of the rod and the opposite side. The measuring system is based on the triboelectric effect: particles that collide with each other or with the wall naturally become electrically charged. If these electrically charged particles fly past or touch the sensor rod of the FS710E-Ex, these particles are detected.

Resting particles, such as deposits, have no influence on the measurement. Therefore, subsequent installation in existing clean air ducts is possible without any problems.

The dust monitor must not be used with products that form an electrically conductive layer due to abrasion or adhesion.

Performance features

- Maintenance-free
- Automatic calibration
- 3 dust load conditions can be monitored
- 2 switching outputs
- Fault indication through different LED colors
- Protection class IP65
- Compact design
- Simple assembly

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.

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 accident prevention regulations 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 dust monitor requires proper transportation, storage, installation, assembly and maintenance. The dust sensor may only be used 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 to both the **FS710E-Ex** dust monitor described and the **FS710E**.

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 severe damage to property.

DIRECT/INDIRECT TOUCH

For all components connected to the system, protection against direct and indirect contact in accordance with VDE 0100 Part 410 needs to be granted. 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 the relay power supply on the other 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 safety instructions

The 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).

As dust Ex equipment, the electronic part of the FS 710E-Ex may be installed in an area that corresponds to category 2D or 3D. The process connection is installed on the partition wall of the measuring chamber, which separates the areas from each other and corresponds to categories 1D, 2D or 3D. The sensor rod can be inserted in a category 1D, 2D or 3D area. The requirement of zone separation must be ensured by appropriate sealing and the prevention of unscrewing during operation. The NPT screw connection available for this purpose (threaded connection on the housing of the dust monitor) must be tightened with an appropriate torque (at least 10 Nm).

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

Open/close the housing cover:

The housing cover of the FS710E-Ex must be completely closed before commissioning in a potentially explosive atmosphere and secured against unintentional opening using the locking screw.

The cover may only be opened (e.g. for calibration) in the absence of an explosive atmosphere.

Cable connection

The connection cable and the cable entry are part of the device and may only be replaced by the manufacturer.

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

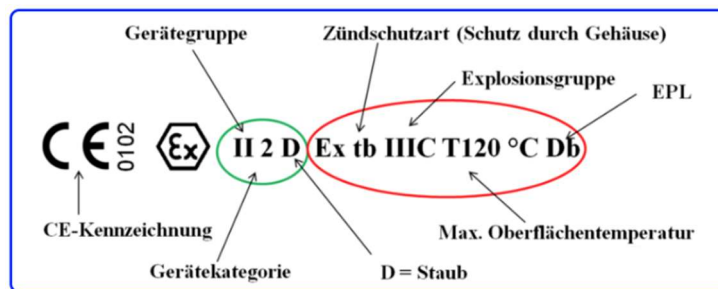


Fig. 1 Identification of a Dust Ex device

Marking on the rating plate in accordance with Directive 2014/34/EU for use in potentially explosive dust atmospheres:

	Explosionsschutz
II	Gerätegruppe: Ex-Geräte, die nicht in Bergwerken etc. eingesetzt werden
1/2	Gerätekatgorie: 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.

5 Technical data

Ex certificate		BVS 20 ATEX E 013 II 1/2D Ex ia ta/tb IIIC T200°C Da/Db
Conformity	EN IEC 60079-0:2018 EN 60079-11:2012 EN 60079-31:2014	General requirements Intrinsic safety "i" Protection by enclosure "t"

5.1 Electrical data

Supply circuit				
Rated voltage	DC	18.36	V	
Rated current		< 20	mA	
To	AC/DC	250	V	
Relay circuits				
Rated voltage	AC/DC	60	V	
Rated current		< 100	mA	
To	AC/DC	60	V	
Calibration circuit				
Rated voltage	DC	< 6	V	
Rated current strength		< 1,5	mA	
To	AC/DC	48	V	
RS485 interface circuit				
Rated voltage	DC	< 6	V	
Rated current strength		< 50	mA	
To	AC/DC	48	V	

5.2 Thermal data

Storage and operating temperature range	T _{ambient}	-10 to +70°C
Process temperature range	T _{process}	-10 to +180°C

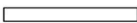
5.3 Mechanical data

Process pressure	0.8 to 1.1 bar
Housing material	Aluminum
Sensor rod	V4A
Isolator abrasive	PPS
Protection class	IP 65
Weight	0.7 kg

5.4 Electrostatic discharge

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

5.5 Electrical connection

grün		Kalibrierung (IN)
weiss		Kalibrierung (GND)
gelb		Versorgung (+24V)
braun		Versorgung (0V)
rosa		Halbleiterrelais 1
rot		Halbleiterrelais 1
grau		Halbleiterrelais 2
blau		Halbleiterrelais 2

The dust sensor is supplied with a ready-made cable (3 m length, 5.9 mm diameter and 8 x 0.14 mm² cores). The insulation is made of PVC or a halogen-free special compound.

Fig. 2 8-wire connection cable

5.6 Earthing

For the required potential equalization, there is a 4 mm brass screw with toothed washer for the connection on the cylindrical housing. This ensures safe electrical conductivity with high corrosion resistance for the connection of the protective conductor. A ring cable lug supplied enables problem-free connection for a cable cross-section of at least 4 mm².

In the case of installation in a potentially explosive dust atmosphere, equipotential bonding must be carried out.

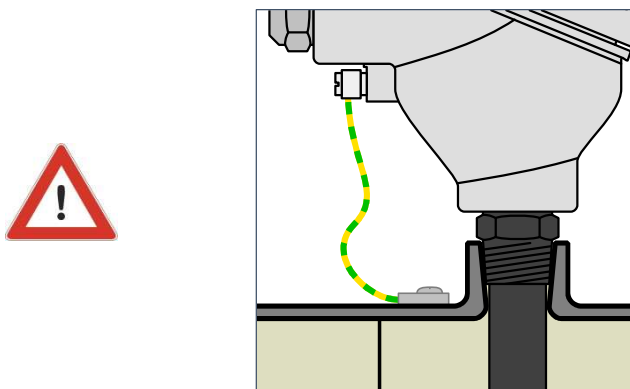


Fig. 3 Earth

5.7 Block diagram

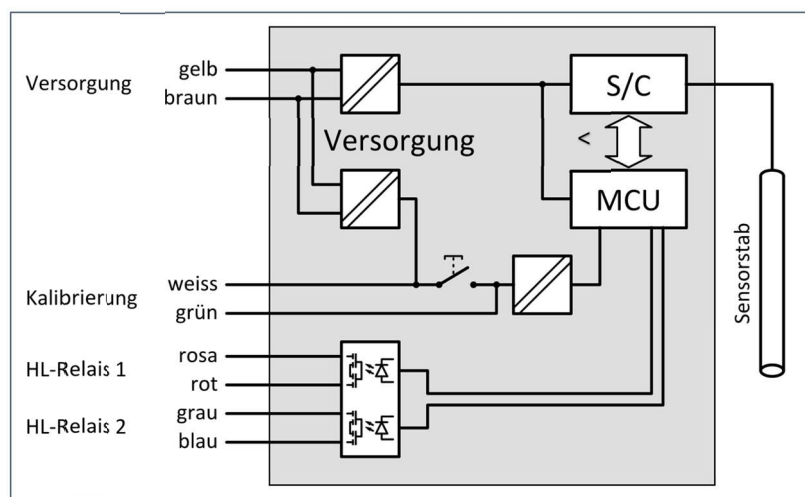


Fig. 4 Block diagram

5.8 Dimensions

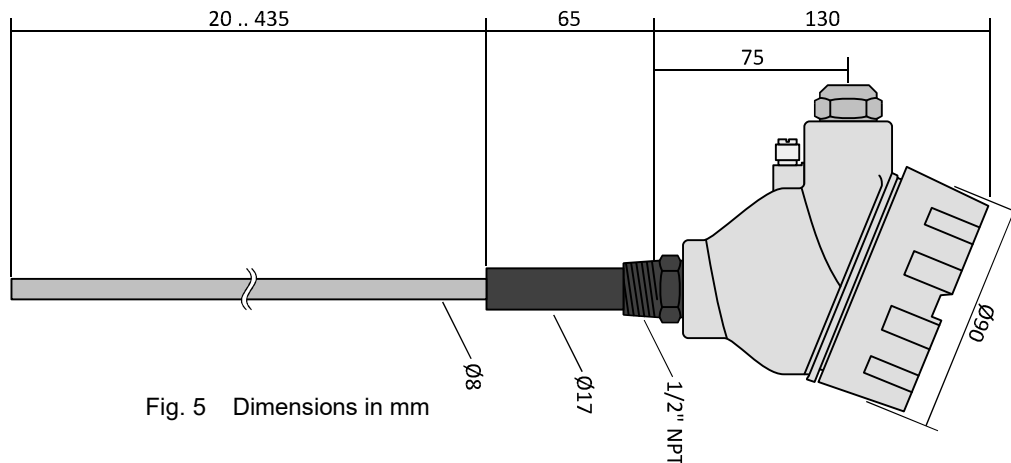


Fig. 5 Dimensions in mm

5.9 Nameplate



Fig. 6 Nameplate

5.10 Assembly

Installation position

The inlet or outlet distance to the FS710E-Ex should be 3 times the nominal diameter.

Sensor mounting

To mount the sensor, a threaded sleeve must be welded on at a 90° angle to the pipe axis.

The FS710E-Ex is inserted into the pipe through the threaded socket and screwed tight.

The sensor rod should be at least 1/3 of the nominal diameter of the pipe.

The sensor rod must not come into contact with the opposite side or any other metallic parts.

It is therefore recommended to maintain a minimum distance of 20 mm between the opposite side and the end of the sensor rod.

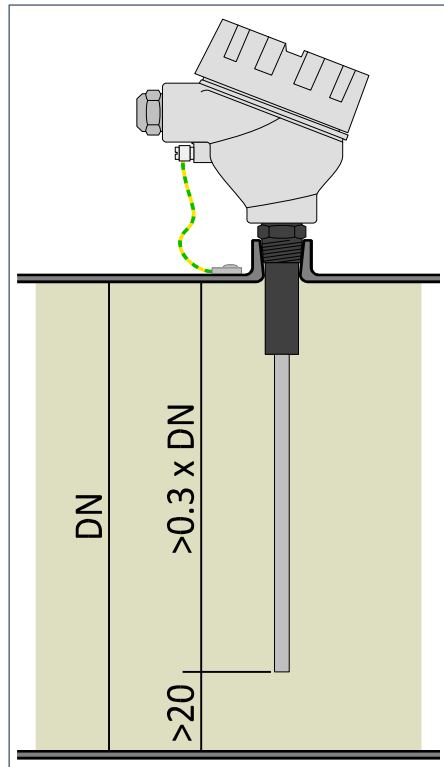


Fig. 7 Assembly

6 Commissioning, calibration and operation

Commissioning

If the measuring device is connected to the 24V supply, the *LED indicator* flashes blue for about one second. The switching outputs are open during this time. As soon as the LED has changed color, the device is ready for operation or calibration.

Calibration

The FS710E is supplied pre-calibrated. If the particle load in the good condition is too high, recalibration can be carried out at any time to define a new good condition.

To activate the calibration, press and hold the *calibration button* or connect the two *calibration lines*, green and white (see also Fig. 2 and 4).

The LED lights up blue during this time and starts flashing after approx. three seconds. The flashing of the LED signals the start of the calibration process. No values are recorded during the first minute. Please close the lid again during this time and restore normal operating conditions. After the first minute, the LED changes to turquoise. In the next ten minutes, the device registers the signals of the dust load in the pipe and defines a new good status. Please avoid irregularities in the process during this time and do not touch the device. If the measured values are too high (touching or excessive dust concentration), the device falls into the error state, which is indicated by the LED flashing red. This state can only be cleared by restarting the calibration or disconnecting the power supply.

The switching outputs are open during the entire calibration process. Once the calibration has been completed, the device is automatically in operating mode.

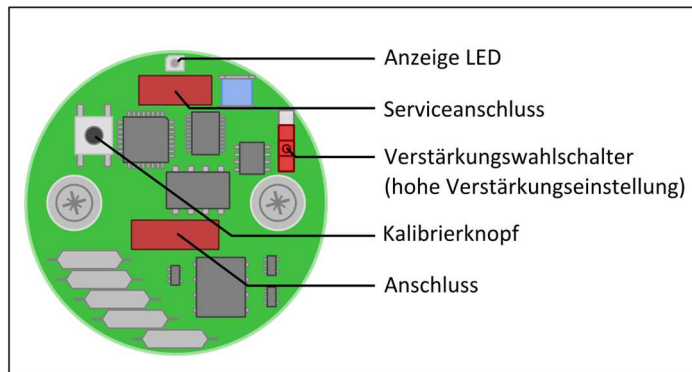


Fig. 8 Circuit board

After a successful calibration, it is recommended to test the various alarm states of the sensor. To do this, manually increase the dust load at the measuring point and observe the various switching points of the sensor. The color of the LED changes from green (good status) to yellow (pre-alarm) to red (main alarm) when the dust load is increased.

Operation

During operation, the emerging particle load is continuously recorded and classified into three different load categories. The load category depends on the size of the particles and is indicated both by the two switching outputs and by color of the LED indicator, as shown in Table 1.

	Partikelbelastung	Status	LED	Schaltausgang 1	Schaltausgang 2
Belastungskategorie I	gering	Gutzustand	grün	geschlossen	geschlossen
Belastungskategorie II	mittel	Voralarm (Warnung)	gelb	offen	geschlossen
Belastungskategorie III	hoch	Hauptalarm	rot	geschlossen	offen

Fig. 8 Load categories

7 Maintenance and servicing

When using the dust monitor with abrasive substances, the housing parts exposed to the product flow must be checked regularly for dimensions. The permissible material loss must not exceed 1 mm. The transmission behavior of the dust monitor is also stable over long periods of time, which eliminates the need for regular recalibration or similar. No other maintenance work is required.