

Filter Monitoring Device

PFM 13 C EX



Operation Manual

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1 General

1.1 Information for operation manual

This operation manual contains the required information for intended use of the described product. It is firm part of the scope of supply, also if the possibility of separated order respectively delivery had been planned due to logistic reasons. By reasons of clarity it does not contain all details for all types of the described product and it cannot consider each possible case in operation with the product.

Read the operation manual completely and attentively. Observe the safety instructions and operation directions in this operation manual as well as the labelling at the device and the packaging. For later use keep the operation manual at a safe place.

If you should need further information or if problems should occur which are not described elaborately in this operation manual, please refer to Dr. Födisch Umweltmesstechnik AG (contact details: see cover inside).

For operation with the optional additional devices please read the technical documentations of the suppliers. The contents are at responsibility of the respective manufacturers.

1.2 Intended use

The product described in this operation manual has been developed, manufactured, tested and documented in observation of the corresponding safety standards and has left the factory in safety-related correct and tested condition.

By observing the actions and safety instructions described for configuring, assembly, intended use and upkeep, there is no danger coming up by the product itself in normal case. The correct and safe operation presupposes furthermore the proper transport, professional storage, placement and assembly as well as careful operating and upkeep.

The PFM 13 C EX is a highly sensitive system for continuous, tribo-electric in-situ filter monitoring. Thereby a qualitative monitoring of the exhaust gas is done. Depending on the configuration of the device it can be used as a filter monitoring device as well as a dust measuring device.

In case of PFM 13 C EX it is about a device of the group 1 and class A according to DIN EN 61326-1. For this reason it is intended for use in industrial sector. The connection with low-voltage power supply used for residential buildings can result in conduction-bound or radiated interference of devices in rare cases.

To keep the correct condition of the device and to achieve a proper and safe operation it must solely be used in the way described by the manufacturer. Any kind of differing use as described in this operation manual is regarded as non-intended use and can result in personal or material damage.

Non-intended use results in termination of guarantee.

1.3 Warranty

The Dr. Födisch Umweltmesstechnik AG advises that the content of this operation manual is not part of a prior or present arrangement, commitment or legal relationship or that does not change these. All liabilities result from the respective sales contract which also contains the complete and solely legal warranty regulations. These contractual warranty terms are neither extended nor limited by the contents in this operation manual.

Rebuilding and modification at the product is not permitted. Any intervention into the device as well as any kind of non-intended use results in termination of guarantee. The manufacturer assumes no liability at all.

1.4 Standards and regulations

As far as possible, the harmonised European standards have been applied to specification and production of this device. If no harmonised European standards have been applied, the standards and regulations for the Federal Republic of Germany apply.

1.5 Declaration of conformity

The filter monitoring device PFM 13 C EX has a CE label. Therewith we declare that the device in its conception and design as well as in the execution put into circulation by us corresponds to the fundamental safety and health requirements.

The device is approved in accordance with directive 2014/34/EU annex II (ATEX). The test was carried out by IBExU Institut für Sicherheitstechnik GmbH, Freiberg (European notified body no. 0637).

Device marking:  II 3D Ex ic tc IIIC T80°C Dc X

The PFM 13 C EX must not be operated in areas containing strongly charge-generating processes. Hence the PFM 13 C EX must not be used in the area of electrostatic precipitators.



NOTICE

On request the document of conformity declaration is placed at the disposal by Dr. Födisch Umweltmesstechnik AG (contact details: see cover inside).

2 Safety

The device must solely be operated in correct condition and in strict observation of the safety instructions.

Working at the device must solely be executed by qualified specialised personnel (see section 2.2 “Requirements for personnel”, page 10). Personal protective equipment according to the current legal accident prevention regulations must be worn.

Please read the safety instructions for the optional additional devices in the technical documentations of the suppliers. The contents are at responsibility of the respective manufacturers.

2.1 Safety instructions

Safety instructions serve the prevention of hazards for life and health of users or upkeep personnel respectively for avoiding material damage. In this operation manual they are emphasised by the here defined signal terms. Furthermore, special safety instructions can be characterised by additional symbols.

2.1.1 General safety instructions



DANGER

Notes with signal word “DANGER” indicate possible hazards which cause personal damage in terms of death or most serious injury in case of non-observing the safety precautions.



WARNING

Notes with signal word “WARNING” indicate possible hazards which cause personal damage in terms of simple up to serious injury in case of non-observing the safety precautions.



CAUTION

Notes with signal word “CAUTION” indicate possible hazards which cause material damage in case of non-observing the safety precautions.



NOTICE

Notes with this indication describe helpful information and tips for operation with the product and serve the avoidance of failure.

2.1.2 Specific safety instructions

**DANGER**

Hazardous voltage!
Parts of the device can be energised with hazardous voltage.
Danger of electric shock.
Any work at the device must solely be executed by qualified personnel.

**DANGER**

Explosion hazard!
Personal damage in immediate surround as well as material damage at the device and its vicinity can be caused.
The requirements on the existing EX zone must be observed.

**DANGER**

Poisonous substances!
Poisonous gases can cause serious health damage or death.
Irritating of eyes, skin or respiratory system organs can be caused.
Make all necessary safety arrangements (e.g. personal protective equipment) to assure riskless handling in the environment of the exhaust duct.

**WARNING**

Corrosive substances!
Irritating or corrosive gases or substances can cause chemical burn of body tissue and serious eye injury in case of contact.
In case of contact with skin or eyes the affected spots must be cleaned immediately!
Objects which have been contacted with irritating or corrosive gases or substances must be cleaned accurately.

**WARNING**

Hot surface!
Several device parts can develop high temperatures.
Burn of skin can be caused!
For protection against possible injury protective gloves must be worn.

2.1.3 Personal protective equipment



WEAR PROTECTIVE CLOTHING

For protection against injury at any kind of hazard protective clothing must be worn.



WEAR PROTECTIVE FOOTWEAR

For protection against possible injury protective footwear (e.g. safety shoes) must be worn.



WEAR PROTECTIVE GLOVES

For protection against possible injury at touching of device components protective gloves must be worn.



WEAR HEAD PROTECTION

For protection against possible injury by falling objects or bouncing hazard a head protection must be worn.



WEAR RESPIRATORY PROTECTION

For protection against possible suffocation hazard or injury of respiratory system organs by poisonous gases a respiratory protection must be worn.



WEAR EYE PROTECTION

For protection against possible eye irritation by corrosive gases or substances eye protection must be worn.



WEAR HEARING PROTECTION

For protection against possible hearing impairment by high noise level hearing protection must be worn.

2.2 Requirements for personnel

This operation manual is directed to technically qualified personnel which have been specially instructed or which possesses appropriate knowledge in the field of measuring, control and feedback control technology, called automation technology further on.

Qualified personnel are persons who

- are either familiar as configuring personnel with the safety concepts of automation technology
- or are instructed as operating personnel in operation with automation technology equipment and are acquainted with the contents of these instructions referring to operation
- or have been instructed as commissioning and/or service personnel to be qualified for repair of such automation technology equipment respectively who are authorised to energise, ground and tag circuits and devices/systems according to the standards of safety engineering.

The knowledge and the technically correct realisation of the safety instructions and operating directions described in this operation manual are the requirement for hazard-free assembly and commissioning as well as for safety at operation and upkeep. The specialised personnel must be familiar with the general risks and hazards and know and observe the respective safety precautions.

Unqualified interventions into the device or non-observance of the operation manual or of the affixed labels on the product can result in personal or material damage.

Any work at the device must solely be executed by qualified specialised personnel in observation of the corresponding regulations (central association of electrical engineering and industry).

2.3 Electrical power supply



DANGER

Hazardous voltage! Danger of electric shock.

Also when the device is switched off, there can be high voltage inside it.

Any work at the device must solely be executed by qualified personnel. The following requirements must be observed.

- The power supply has to be installed and secured according to the corresponding legal safety regulations and prescriptions.
- The device must be supplied by a transmitter feed unit or a micro-fuse of 0.5 AT. (In the case of use of several devices, this has to be provided for each filter monitoring device.)
- The device must only be connected to the supply voltage designated on the type plate.
- A protective separation between primary and secondary circuit is generally ensured. Low voltage which is connected must also be generated by protective separation.
- The device must always be grounded.
- Cables must be laid that an accident risk by tripping or getting caught is excluded.
- Covers:
 - The device must not be operated when covers or other parts have been removed, because current carrying parts are divested of covering in operation.
 - If not explicitly requested, work inside the device must not be executed.
 - Before opening the device it must be de-energised by exerting the pre-fuse.
 - If work at the opened device is necessary (adjustment, maintenance etc.), this work must only be executed by appropriate qualified personnel which is familiar with the hazard points and which has knowledge of avoiding hazards by proper safety precaution.

Electrical safety

If the electrical safety of the device is not given anymore, the device must be shut down and secured against unauthorised or inadvertent activation.

The electrical safety of the device is not given any more if it:

- has visible external damage
- does not work correctly anymore
- has been stored under impermissible or inappropriate conditions for any length of time
- has been encountered impermissible strain during transport

2.4 Application in potentially explosive atmospheres

Marking in accordance with directive 2014/34/EU annex III (ATEX)

- Marking:  II 3D Ex ic tc IIIC T80°C Dc X
- potentially explosive atmosphere: Zone 22 (device group II, category 3)
- max. surface temperature 80 °C
- The PFM 13 C EX must not be operated in areas containing strongly charge-generating processes. Hence the PFM 13 C EX must not be used in the area of electrostatic precipitators.

Specific conditions

- At mounting or demounting of the PFM 13 C EX the device must be de-energised.
- Out of potentially explosive atmosphere a voltage limitation has to be used. Rated voltages of 24 V DC must not exceed 25% in the event of temporary failures. In this case the use of respective equipment is recommended.
- The temperature of the measuring gas must not exceed 260 °C in continuous operation.
- The ambient temperature must be observed in continuous operation. For this purpose, between exhaust duct and probe head a heat insulation must be provided.
- Probe head:
 - In operation the probe head must be closed dust-proof. For this, the cover must be tightened to a torque of 12 Nm and secured against manual opening.
 - The protective conductor at the rear side of the probe head must be laid on PE.
 - The probe head of the PFM 13 C EX must solely be cleaned moistly.
- Cables and pipes:
 - Only certified cable glands for the therefor intended cables and pipes must be used. The selection criterions according to EN 60079-0 have to be observed.
 - In operation the cable gland of the PFM 13 C EX must be closed dust-proof. For this, the outer diameter of the connection cable must be between 8 and 13 mm.
 - The continuous operation temperature of the cable in continuous operation must be min. 5 K over the ambient temperature.

Electrical equipment

- At the input of the potentially explosive atmosphere the disconnecter of the current output must have a maximum voltage of 30 V DC.
- According to EN 60079-0 for the selection of electrical equipment in potentially dust-explosive atmospheres (independent of the explosion protection zone) the following applies:
 - The smouldering temperature of the deposited dust and the ignition temperature of the potentially explosive dust-air mixture must be known.
 - The maximum surface temperature of the PFM 13 C EX must not exceed 2/3 of the ignition temperature of the dust-air mixture.
 - The maximum surface temperature of the equipment must not exceed a value which is more than 75 K under the smouldering temperature of the concerning dust. Therefor a maximum dust layer of 5 mm applies. In the case of layer thicknesses of more than 5 mm the maximum admissible surface temperature according to EN 60079-0 must be decreased.

2.5 Components

The device as well as the single components must only be operated as original variant. In case of exchanging single elements only the original parts of the manufacturer must be used. Components are configured device-specific and hence they are not interchangeable between different devices.

2.6 Electronic components

Electrostatic discharges can cause damage at the electronic components. The following precautions must be taken:

- Electronic components must be kept away from statically charged surfaces (PVC plastics, plastic bags etc.).
- Wear a special ESD wrist band or use a grounded, antistatic working surface.

2.7 Configuration settings

Changes of configuration can endanger the safety and function of the device. Configuration settings must solely be executed by an authorised service technician or by factory personnel of the manufacturer.

3 Function

The PFM 13 C EX serves the permanent control of dust emissions. Applied as filter monitoring device it is an effective implement to detect and localise damages at filtering precipitators at early stage. Configured as dust measuring device it can be used for continuous monitoring of clean gas contents and dust contents of filtering precipitators. By the device visible and invisible exhaust plumes can be avoided. The monitoring furthermore enables directed maintenance procedures and serves the avoidance of product losses.

The measurement with the PFM 13 C EX is carried out via the tribo-electric measuring method. For that matter the measuring gas in the exhaust gas flow is gathered by means of the probe rod. By the passing as well as impinging dust particles a charge exchange takes place between these and the probe rod. From the discharged current a signal is generated which depends on the mechanical and electrical characteristics of the dust. The dust-proportional signal which is generated by the microcontroller integrated in the device is the degree for the dust content of the exhaust.

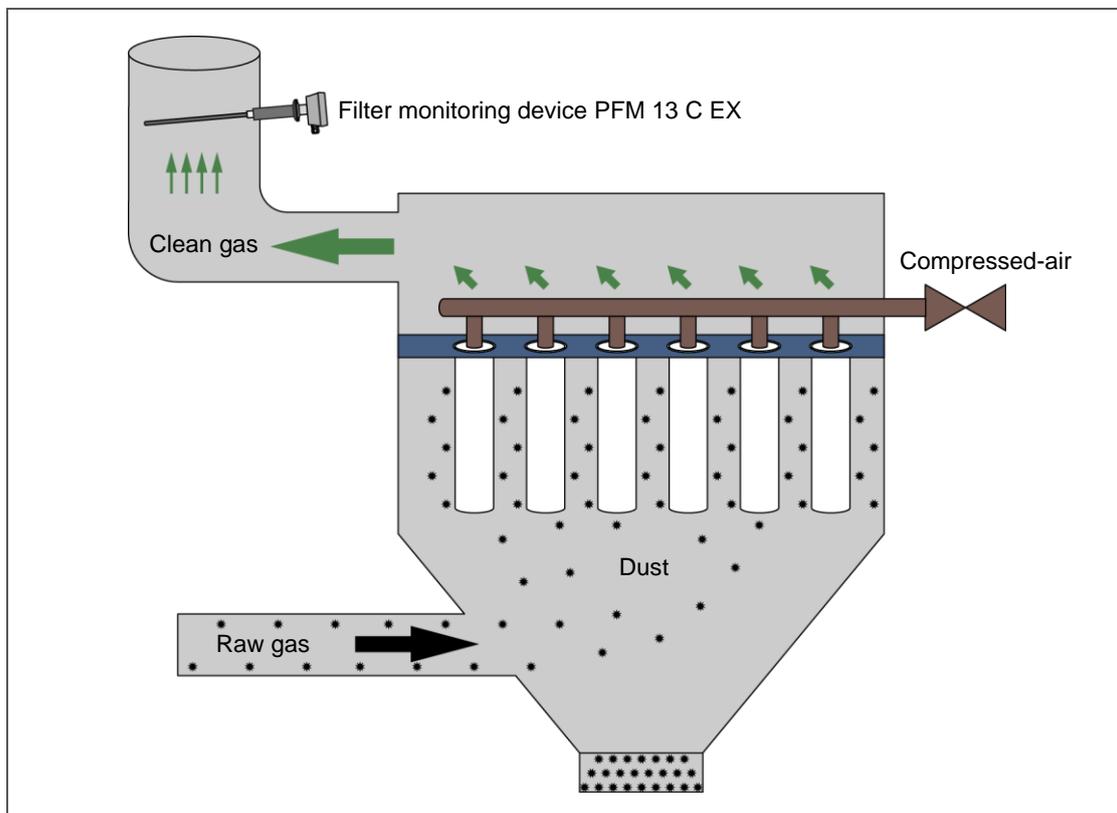


Fig. 1: Installation example for filter monitoring

The dedusting of the filtering precipitators is carried out by compressed-air impulse for example. Characteristic of this is an obvious increased dust emission for the duration of dedusting (approx. 2-3 s). By the increasing basic signal as well as by amplified signal peaks at dedusting a beginning wear of the filter system can be detected and a clear localisation of defective filter elements can be made. The output signal required for diagnostics can be determined by amplification (see section 8.1, page 27) and integration (see section 8.2, page 29).

The following figure shows an example of a zero-defect filter diagram. In the second example a strongly increased dust penetration is registered at several filter tubes. In this case the affected filter tubes must be exchanged.

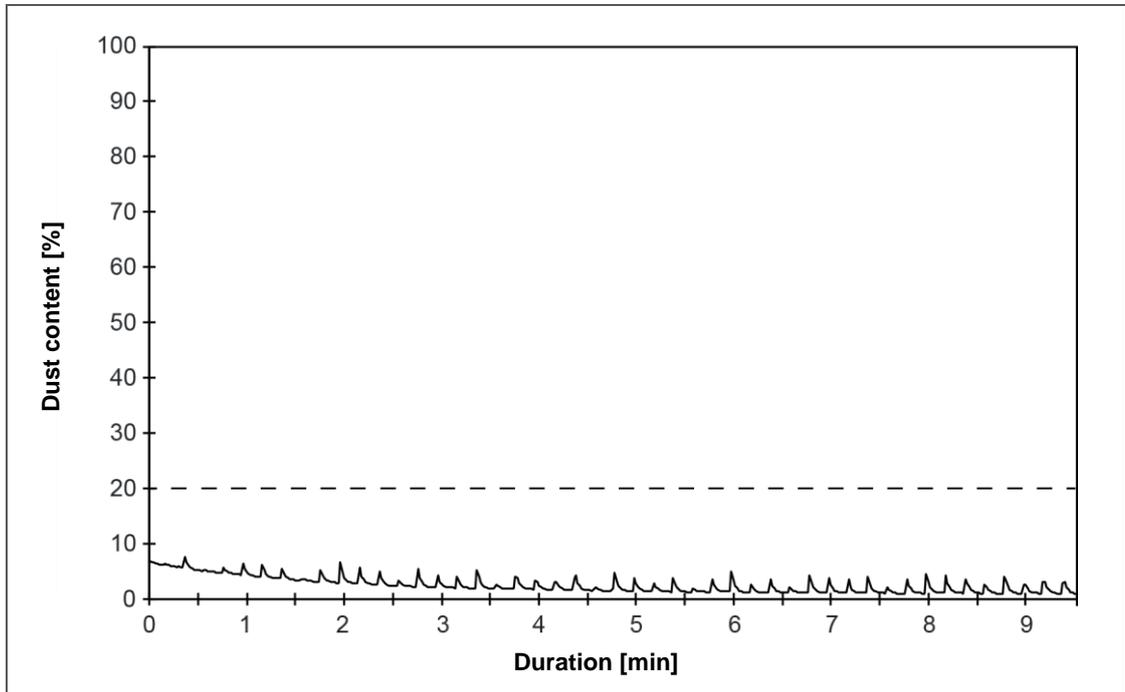


Fig. 2: Filter diagram with zero-defect filter tubes

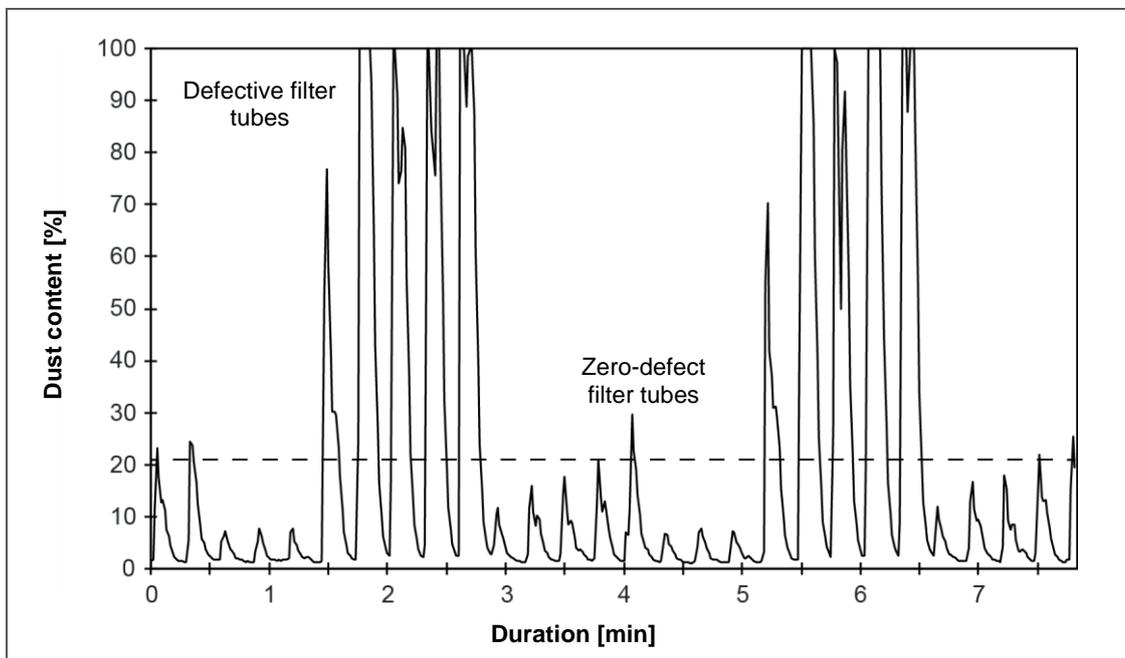


Fig. 3: Filter diagram with defective filter tubes

4 Design

The filter monitoring device PFM 13 C EX consists of an in-situ probe with probe head and probe rod. The probe rod is surrounded by a guide bushing and an insulator. Thus it is electrically isolated from the housing. In the probe head the evaluation electronics are located.

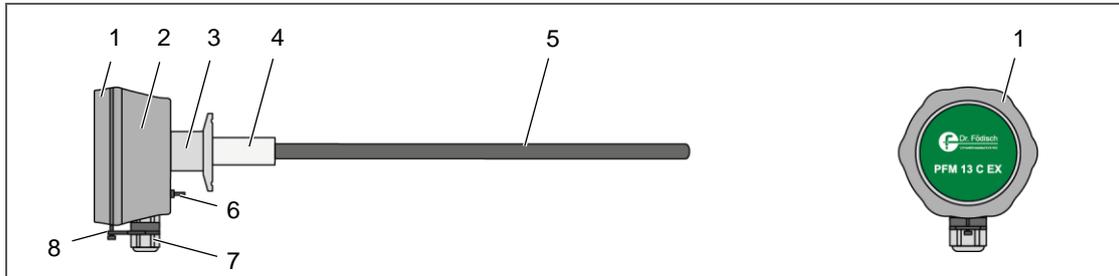


Fig. 4: Design

- | | |
|-----------------|---|
| 1 Housing cover | 5 Probe rod |
| 2 Probe head | 6 Protective conductor (for lay-on fitment) |
| 3 Guide bushing | 7 Cable gland |
| 4 Insulator | 8 Cover locking against manual opening |

4.1 Dimensions

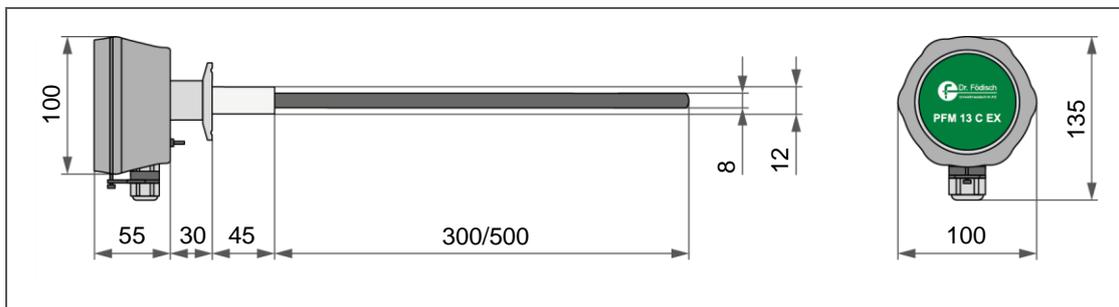


Fig. 5: Dimensions, specifications in mm



NOTICE

As standard the probe rod is delivered with the lengths of 300 mm or 500 mm. For the use of the device in smaller duct diameters the probe rod can be adapted (see section 6.4 "Adaptation of the probe rod", page 22).

4.2 Connection assignment

The electrical connections of the PFM 13 C EX are located in the probe head. The terminals at the signal module are performed as cage clamps. They serve as analogue output (4...20 mA) for output of the qualitative dust value [%] as well as for power supply (passive 2-wire transmitter). Besides the two connection clamps, there are potentiometers and switches attached at the signal module for basic setting of the device.

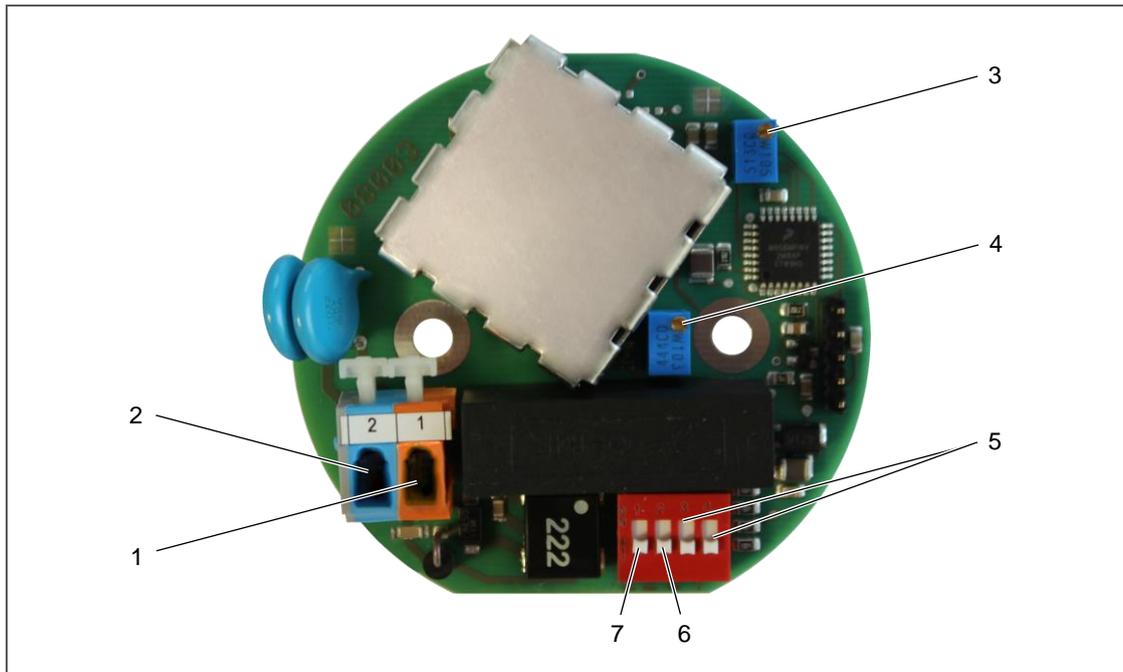


Fig. 6: Connections of the signal module

- | | |
|---|--|
| 1 Pin 1: Analogue output / Power supply connection (+) | 5 Switch 3 and 4 for setting of amplification (2x) |
| 2 Pin 2: Analogue output / Power supply connection (-) | 6 Switch 2 for switch-on/off of integration |
| 3 Potentiometer 1 for setting of measuring zero point in calibration tube | 7 Switch 1 for switchover between measuring mode / device zero point setting |
| 4 Potentiometer 2 for setting of device zero point | |



CAUTION

Manufacturer contacts!
Through wrong connection the device is damaged.
The five contact pins at the right side of the signal module must not be allocated.

5 Transport and scope of supply

5.1 Transport

The device is stored in a handling case. The probe rod is additionally packed in a protective covering.



CAUTION

Through heavy percussion at transport (e.g. by falling) susceptible elements can be damaged.

Chose appropriate means of transport.

1. Check the device as well as the packaging material for transport damage.
2. Document possibly existing damage.

5.2 Scope of supply

According to the legal sales contract the respective scope of supply is specified in the shipping documents attached to the supply.

The scope of supply includes:

- 1 filter monitoring device PFM 13 C EX
- 1 welding sleeve
- 1 sealing
- 1 Tri-Clamp fastener
- 1 operation manual
- optional: signal module and power supply module



NOTICE

Depending on purchase configuration deviations in technical design are possible.

1. Check the scope of supply for completeness and intactness.
2. Remove the packaging material.
3. Keep the packaging material for possible re-use.

6 Mounting

6.1 Ambient conditions

For correct operation of the device the following ambient conditions apply:

- Ambient temperature: -20...+50 °C
- Relative humidity: no special sensitivity
- Location free of percussion

6.2 Requirements for installation place

The installation point of the device must meet the requirements of the local valid guidelines (e.g. EN 13284-1; see Fig. 7):

- run-in zone: min. 5-fold length of the duct diameter
- run-out zone: min. 2-fold length of the duct diameter
- measuring line preferably in vertical duct

In case of doubt the installation place can be defined by a responsible measuring institute (measuring point according to §§ 26/28 BImSchG).



NOTICE

Dr. Födisch Umweltmesstechnik AG recommends run-in and run-out zones which correspond to the 5-fold length of the duct diameter (see Fig. 7).



NOTICE

To get a representative determination of the dust load above the cross section of the duct, a homogenous dust and stack gas distribution must be existent at the measuring point.

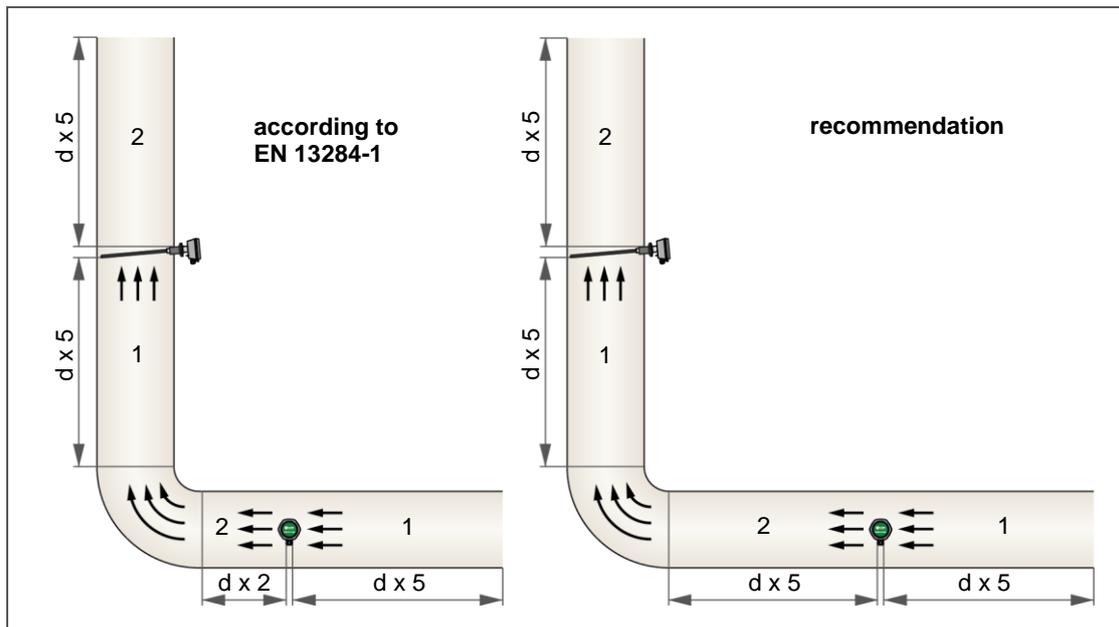


Fig. 7: Run-in and run-out zone at the measuring point

1 Run-in zone

2 Run-out zone

6.3 Mounting of welding sleeve



CAUTION

Wrong installation of the welding sleeve can result in measuring faults. The welding sleeve must be grounded. For this, it must be involved into the local potential equalisation.

The device can be mounted in horizontal and vertical duct. Thereby the mounting direction of the device itself can be from side to vertical from above. At mounting of the welding sleeve from side the correct installation angle has to be observed (see Fig. 8).



CAUTION

In case of wrong installation, condensate accruing during operation can deposit at the duct wall.

To avoid deposits, the installation angle must be between 2° and 5° , so that at the later installation of the device the probe rod tends downwards into the duct. The welding sleeve must protrude into the duct at least 3 mm.

1. Furnish the measuring point allowing for the necessary run-in and run-out zone (see section 6.2, page 20).
2. Mount the welding sleeve (2, Fig. 8) at the provided aperture in the duct wall (1).



CAUTION

Wrong installation of the welding sleeve can result in measuring faults. In case of non-metallic ducts the welding sleeve must be connected with conducting material and grounded.

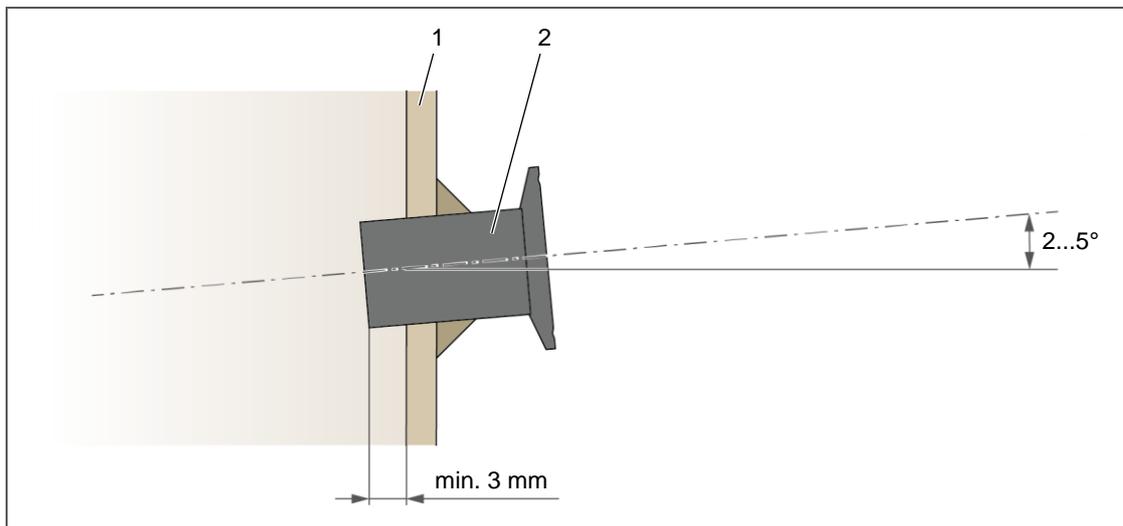


Fig. 8: Mounting of welding sleeve (side view)

1 Duct wall

2 Welding sleeve

6.4 Adaptation of the probe rod

As standard the probe rod is delivered with the lengths of 300 mm or 500 mm. For the use of the device in smaller duct diameters the probe rod can be adapted.



DANGER

Hazardous voltage!
Danger of electric shock.
Make sure that the device is de-energised.

1. Fix the device at the probe rod (device-side) tightly into a clamping fixture.
2. Saw off the non-needed part at the end of the probe rod.
3. Deburr all sharp edges.
4. Clean the device from accrued swarf.

6.5 Installation of the device at the duct



CAUTION

The ambient temperature must be observed in continuous operation. For this purpose, between exhaust duct and probe head a heat insulation must be provided.

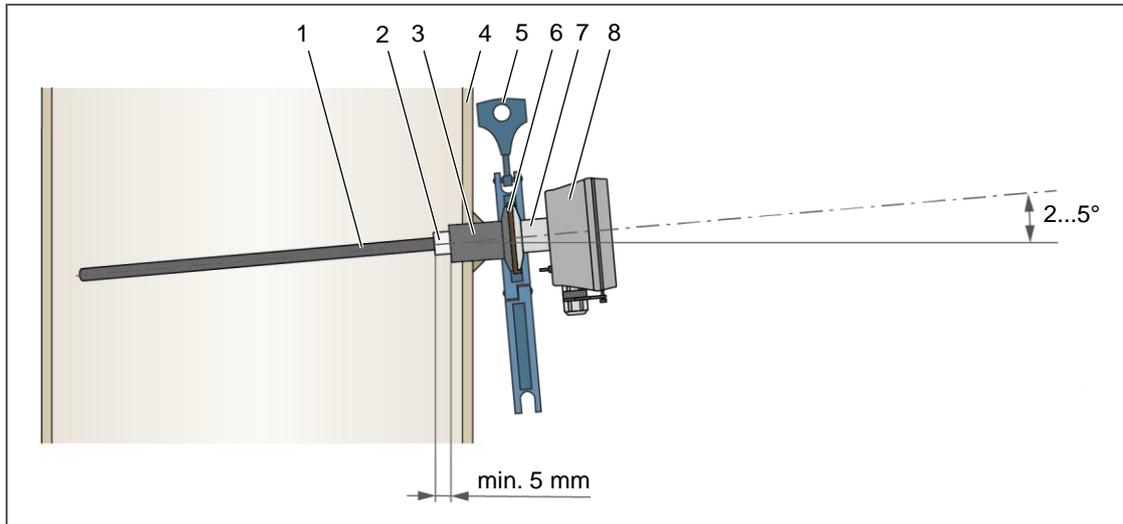


Fig. 9: Installation at duct (side view)

- | | |
|------------------|-------------------------------|
| 1 Probe rod | 5 Tri-Clamp fastener (opened) |
| 2 Insulator | 6 Sealing |
| 3 Welding sleeve | 7 Guide bushing |
| 4 Duct wall | 8 Probe head |

1. Insert the sealing (6, Fig. 9) at the screwing-in of the welding sleeve (3).
2. Lead the probe rod (1) of the device through the welding sleeve into the duct, until the guide bushing (7) abuts on the sealing (6).



CAUTION

Wrong installation of the device can result in measuring faults.

The insulator (2) must protrude into the flow at least 5 mm. Thereby it must be protected against wetness.

3. Rotate the probe head (8) into the correct position, so that the cable gland is aligned downwards.
4. Put the Tri-Clamp fastener (5) around sleeves and sealing and fix it.

6.6 Electrical connection



DANGER

Hazardous voltage!

Danger of electric shock.

Make sure that the pre-fuse of the external power supply is disconnected.

1. Release the cover locking against manual opening (8, Fig. 4, page 16) by the respective screw.
2. Rotate the housing cover (1) anti-clockwise off the probe head.



CAUTION

The housing cover is not secured against falling.

Hold the housing cover during screwing-off.

3. Lead the cable through the cable gland into the device (see Fig. 10, page 25).
4. Connect the power supply with the both pins at the signal module.
5. Tighten the cable gland until the cable is fixed and a safe hold is assured.
6. Rotate the housing cover clockwise onto the probe head until the housing is tightly closed (tightening torque 12 Nm).
7. Secure the housing cover against manual opening. For this, tighten the respective screw at the cover locking (8, Fig. 4, page 16).
8. Lay the protective conductor at the rear side of the probe head on PE.

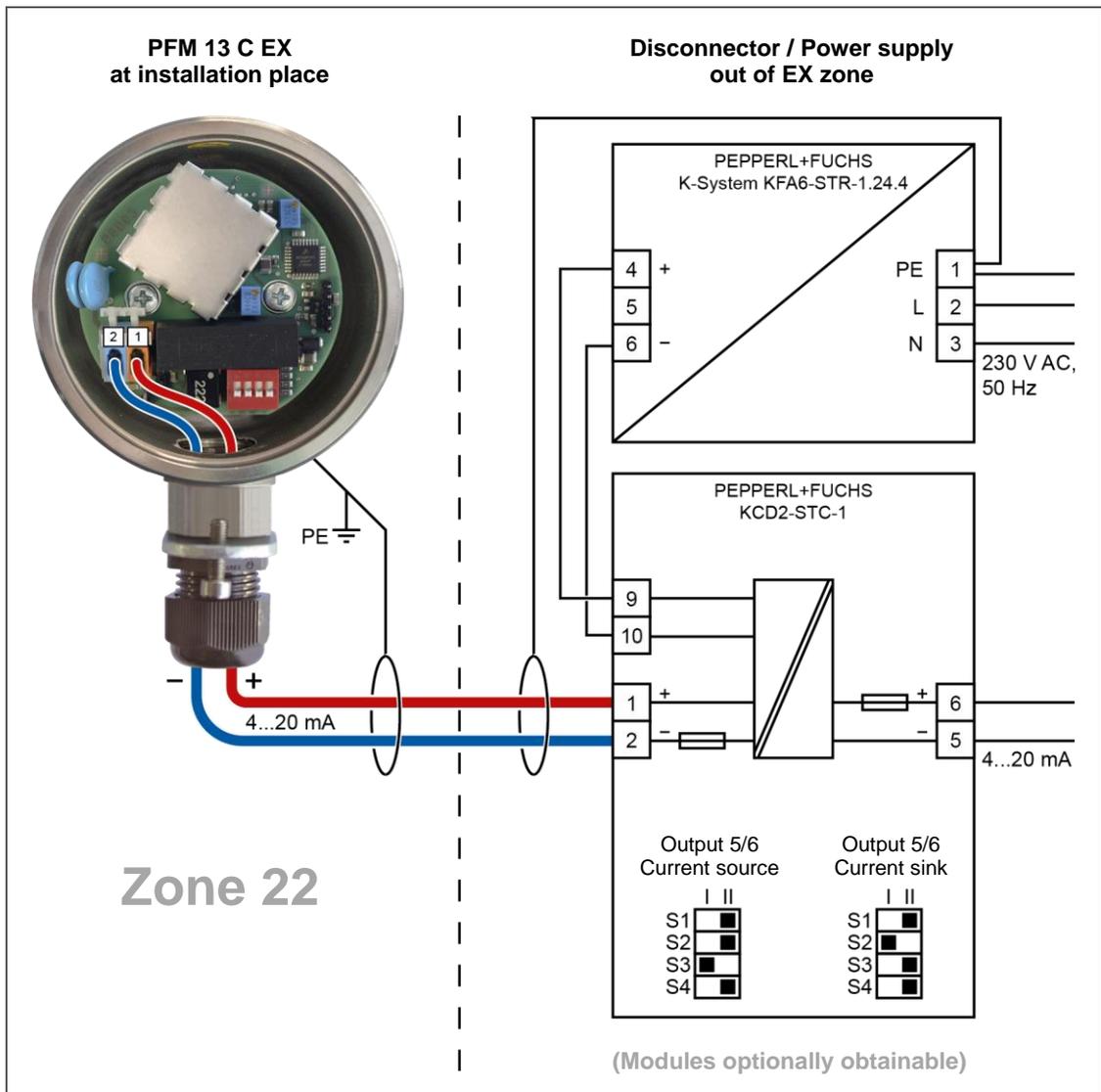


Fig. 10: Electrical connection

7 Commissioning



DANGER

Hazardous voltage!

Parts of the device can be energised with hazardous voltage.

Danger of electric shock.

Any work at the device must solely be executed by qualified personnel.

1. Connect the pre-fuse of the external power supply.
 - › The device is ready for operation.
2. Check the displayed measuring values for plausibility.
3. Check the setting of the amplification (see section 8.1, page 27). If necessary, adjust the amplification of the output signal.
4. If necessary, adjust the setting of the integration (see section 8.2, page 29).

8 Operating



CAUTION

Incorrect operating can cause false measuring results, interferences in measuring process or material damage.

Basic requirement for safe operating is exact knowledge of the functioning of the device. Operating must solely be executed by qualified personnel (see section 2.2 "Requirements for personnel", page 10).

The measuring signal (4...20 mA) is output as qualitative dust value (0...100%) via the analogue output.

For setting of the device there are basic operating elements attached at the signal module (see Fig. 6, page 17):

- switch 1 for switchover between measuring mode and device zero point setting
- switch 2 for switch-on/off of integration
- switch 3 and 4 for setting of amplification
- potentiometer 1 for setting of measuring zero point in calibration tube
- potentiometer 2 for setting of device zero point

8.1 Amplification

For adjusting the sensitivity of the device relating to the incoming measuring signal the amplification must be set manually. For this, at the signal module there are the switches 3 and 4 (5, Fig. 6, page 17).

The amplification levels are defined by the setting of both switches. Combinations for the selection of the amplification levels are as follows:

Level	Amplification	Switch setting	
		Switch 3	Switch 4
0	0.5-fold	up	up
1	1-fold	down	up
2	2-fold	up	down
3	4-fold	down	down

Tab. 1: Allocation of amplification levels

Adjust the amplification

1. Release the cover locking against manual opening (8, Fig. 4, page 16) by the respective screw.
2. Rotate the housing cover (1) anti-clockwise off the probe head.

**CAUTION**

The housing cover is not secured against falling.
Hold the housing cover during screwing-off.

3. Switch the integration off. For this, set switch 2 (6, Fig. 6, page 17) up.
4. Choose amplification level 3. For this, set switch 3 and 4 (5) down.

**NOTICE**

In measuring mode the switch 1 (7, Fig. 6, page 17) must be set down (measuring mode).
Otherwise, the device has a constant device zero point output.

**NOTICE**

In normal operation (between the dedusting cycles of the filter system) the dust value should be approx. 3%...25% (approx. 4.5...8 mA).
If the measuring signal is not in the amplification range 3, a filter defect is possible.

5. In the case of a too high output signal, choose a different amplification level. For this, set the switches 3 and 4 to the respective combination (see Tab. 1, page 27).
 - › The device zero point is pre-set by factory to 3.8 mA.
6. If necessary, adjust the measuring zero point in the calibration tube (see section 8.3.1, page 30).
 - › The device is adapted to the local conditions and ready for operation.
7. Rotate the housing cover clockwise onto the probe head until the housing is tightly closed (tightening torque 12 Nm).
8. Secure the housing cover against manual opening. For this, tighten the respective screw at the cover locking (8, Fig. 4, page 16).

8.2 Integration

The integration is switched on/off via switch 2 (6, Fig. 6, page 17) at the signal module. The measuring signal is averaged in a defined interval. Thereby the output signal is smoothed (e.g. in case of application of the device as gravimetrically calibrated dust measuring device).

For diagnostics of the filter system the integration can be switched off, so that the development of the current dust concentration at the clean gas side can be observed at the output device. Because of the small integration time a signal with higher curves is output (e.g. in case of application as filter monitoring device). Through a clear increasing of the output signal a possible error of the filter system can be detected in this way at early stage.

Switch the integration on/off

1. Release the cover locking against manual opening (8, Fig. 4, page 16) by the respective screw.
2. Rotate the housing cover (1) anti-clockwise off the probe head.



CAUTION

The housing cover is not secured against falling.
Hold the housing cover during screwing-off.

3. Switch the integration on/off. For this, set switch 2 (6, Fig. 6, page 17) down/up.



NOTICE

The smoothing interval for the analogue output at switched-on switch 2 (set down) is 30 s as standard.

4. Rotate the housing cover clockwise onto the probe head until the housing is tightly closed (tightening torque 12 Nm).
5. Secure the housing cover against manual opening. For this, tighten the respective screw at the cover locking (8, Fig. 4, page 16).

8.3 Zero point setting

8.3.1 Setting of measuring zero point

**NOTICE**

For the setting of the measuring zero point the device has to be operated in a calibration tube.

1. Release the cover locking against manual opening (8, Fig. 4, page 16) by the respective screw.
2. Rotate the housing cover (1) anti-clockwise off the probe head.

**CAUTION**

The housing cover is not secured against falling.
Hold the housing cover during screwing-off.

3. Set switch 1 (7, Fig. 6, page 17) down (measuring mode).
4. Turn the potentiometer 1 (3) with the aid of a screwdriver until the measuring zero point of 4 mA is output.
5. Check the displayed measuring values for plausibility.
6. Rotate the housing cover clockwise onto the probe head until the housing is tightly closed (tightening torque 12 Nm).
7. Secure the housing cover against manual opening. For this, tighten the respective screw at the cover locking (8, Fig. 4, page 16).

8.3.2 Setting of device zero point



CAUTION

The device zero point is pre-set by factory to 3.8 mA. Settings must solely be executed by service personnel of Dr. Födisch Umweltmesstechnik AG.

1. Release the cover locking against manual opening (8, Fig. 4, page 16) by the respective screw.
2. Rotate the housing cover (1) anti-clockwise off the probe head.



CAUTION

The housing cover is not secured against falling. Hold the housing cover during screwing-off.

3. Set switch 1 (7, Fig. 6, page 17) up (device zero point setting).
4. Connect a multimeter in-line with the device.
5. Turn the potentiometer 2 (4) with the aid of a screwdriver until the device zero point of 3.8 mA is displayed at the multimeter.
6. Set switch 1 (7) down (measuring mode).
7. Rotate the housing cover clockwise onto the probe head until the housing is tightly closed (tightening torque 12 Nm).
8. Secure the housing cover against manual opening. For this, tighten the respective screw at the cover locking (8, Fig. 4, page 16).

9 Maintenance/Upkeep



DANGER

Explosion hazard!

Personal damage in immediate surround as well as material damage at the device and its vicinity can be caused.

The requirements on the existing EX zone must be observed.



NOTICE

The provision of guarantee items requires an execution of maintenance in due form.

Any work at the device must solely be executed by qualified personnel.

Executed maintenance/upkeep work must be documented according to the legal regulations.

The maintenance work has the following target:

- Preservation of measurement precision
- Warranty of operational safety
- Increment of service life

The following maintenance/upkeep work must be executed:

Component	Action	Maintenance interval
All device components	Cleaning	6 months
Sealing	Check / Exchange	6 months

Tab. 2: Maintenance/upkeep work



NOTICE

The frequency of cleaning work which has to be carried out depends on the chosen measuring point resp. the measuring medium, particularly the dust concentration, and the environmental and climatic conditions.

Cleaning and exchange of the sealing



DANGER

Explosion hazard!

Cleaning of the probe head with a dry cloth can cause charge generation.
The probe head of the PFM 13 C EX must solely be cleaned moistly.

1. Clean the probe head with a clean, lint-free and moist cloth.
2. Disconnect the pre-fuse of the external power supply and secure it against resetting.



WARNING

Hot surface!

Several device parts can develop high temperatures.

Burn hazard!

Before working at the device it must be cooled down.

3. Wait until the device has cooled down.



DANGER

Open ducts with harmful gases, high temperatures or high pressure can cause serious health damage, injury or death.

Disassembling of the device must solely be executed at standstill of the system.

4. Release the protective conductor at the rear side of the probe head from PE.
5. Release the Tri-Clamp fastener (5, Fig. 9, page 23) and remove it.
6. Remove the device from the duct.
7. Clean the insulator (2) and the probe rod (1) with a clean, lint-free and moist cloth.
8. Clean the welding sleeve and the Tri-Clamp fastener.
9. Exchange the sealing (6) at the welding sleeve with a new one.
10. Insert the new sealing (6) at the screwing-in of the welding sleeve (3).
11. Lead the probe rod (1) of the device through the welding sleeve into the duct, until the guide bushing (7) abuts on the sealing (6).
12. Rotate the probe head (8) into the correct position, so that the cable gland is aligned downwards.
13. Put the Tri-Clamp fastener (5) around sleeves and sealing and fix it.
14. Lay the protective conductor at the rear side of the probe head on PE.
15. Connect the pre-fuse of the external power supply.
 - › The device is ready for operation.

10 Error search and failure clearance



CAUTION

Failure clearance must be executed by qualified personnel.

Possible failures can be recognised by means of the output current value. For this, compare the following specified table.

Error/failure	Cause	Action
0 mA / no current value output	missing power supply; damaged cable	<ul style="list-style-type: none"> • Check the power supply connections for correct fit. • Check the power supply cable for kinks and cracks resp. break. Exchange the possibly damaged cable.
Current value < 3.8 mA	device zero point is faulty; device is defective	<ul style="list-style-type: none"> • Check the setting of the device zero point. Correct the device zero point if necessary (see section 8.3.2, page 31). • In the case of a device defect, please send the device for repair to Dr. Födisch Umweltmesstechnik AG.
Current value > 3.8 mA and < 4 mA	device zero point is faulty	<ul style="list-style-type: none"> • Check the setting of the device zero point. Correct the device zero point if necessary (see section 8.3.2, page 31).
Current value > 20 mA	amplification too high; device is defective	<ul style="list-style-type: none"> • Check the setting of the amplification and adjust it if necessary (see section 8.1, page 27). • In the case of a device defect, please send the device for repair to Dr. Födisch Umweltmesstechnik AG.

Tab. 3: Error search and failure clearance



NOTICE

In case of upcoming errors or failure which cannot be eliminated, please refer to Dr. Födisch Umweltmesstechnik AG (contact details: see cover inside).

11 Shutdown and Disposal

11.1 Shutdown



DANGER

Hazardous voltage!
Parts of the device can be energised with hazardous voltage.
Danger of electric shock.
Any work at the device must solely be executed by qualified personnel.

1. Disconnect the pre-fuse of the external power supply and secure it against resetting.

11.2 Disassembling



DANGER

Open ducts with harmful gases, high temperatures or high pressure can cause serious health damage, injury or death.
Disassembling of welding sleeve and probe must solely be executed at standstill of the system.



WARNING

Hot surface!
Several device parts can develop high temperatures.
Burn hazard!
Before working at the device it must be cooled down.

1. Release the protective conductor at the rear side of the probe head from PE.
2. Release the Tri-Clamp fastener (5, Fig. 9, page 23) and remove it.
3. Remove the device from the duct.
4. Disconnect the electrical connections from the device:
 - a) Release the cover locking against manual opening (8, Fig. 4, page 16) by the respective screw.
 - b) Rotate the housing cover (1) anti-clockwise off the probe head.



CAUTION

The housing cover is not secured against falling.
Hold the housing cover during screwing-off.

- c) Disconnect the power supply from the both pins (1 and 2, Fig. 6, page 17) of the signal module.
- d) Release the cable gland (7, Fig. 4, page 16).
- e) Lead the cable through the cable gland out of the device.
- f) Rotate the housing cover clockwise onto the probe head until the housing is tightly closed.

5. Remove the sealing (6, Fig. 9, page 23) from the screwing-in of the welding sleeve (3).
6. If necessary, demount the welding sleeve from the duct.
7. Store all cables safe and care for correct storage of the device as well as other components.

11.3 Storage

For correct storage of the device the following ambient conditions apply:

- Ambient temperature: 0 ... +50 °C
- Relative humidity: max. 90% (non-condensing)
- Storage in rooms (outdoor storage not permissible)
- Protection against wetness

11.4 Disposal



NOTICE

The disposal must be executed according to the country-specific legal environmental protection regulations. The device must be treated as hazardous waste.

12 Technical data

Filter monitoring device PFM 13 C EX	
Housing	compact device; IP 65; protection class 1
Dimensions	approx. 100 mm x 135 mm x 430/630 mm (w x h x d)
Weight	approx. 0.9 kg
Probe	tribo-electric probe consisting of probe rod and probe head; probe rod: electrically isolated from housing, length: 300/500 mm (possible to shorten mechanically); immersion depth: approx. 310/510 mm (dependent on application)
Operating	switches at signal module
Ambient temperature	-20...+50 °C
Relative humidity	no special sensitivity
Dew-point spread	min. +5 K
Measuring gas temperature	max. 260 °C
Flow velocity	min. 3 m/s
Measuring range of dust	0...100% (qualitative)
Amplification levels	4
Operational availability	immediately after switch-on of power supply
Calibration	by gravimetric comparison measurements (for trend measurement and filter analyses not required)
Analogue output	4...20 mA, 2-wire transmitter, galvanically isolated to device ground, burden max. 480 Ω
Process connection	welding sleeve with Tri-Clamp fastener
Cable gland / tightening zone	M20 x 1.5 / 9...13 mm
Power supply	2-wire transmitter (4...20 mA); min. 15 V DC / max. 30 V DC

Tab. 4: Technical data

13 Spare and wear parts

For placing a purchase order of spare and wear parts please refer to Dr. Födisch Umweltmesstechnik AG (contact details: see cover inside).

Element/Component	Quantity	Item number
Adapter flange Tri-Clamp, ½" outside thread	1	ETLF 01009
Locking ring (Tri-Clamp fastener)	1	ETLF 01006
Reducing piece, 1" outside thread, ½" inside thread	1	ETLF 01018
Sealing	1	ETLF 01005
Signal module	1	ETLF 01031
Welding sleeve	1	ETLF 01004

Tab. 5: Spare and wear parts

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15 Appendix

PFM 13 C EX • DECLARATION OF CONFORMITY

Filter Monitoring Device

Declaration of Conformity

Herewith we declare that the product designated below in its conception and design as well as in the execution put into circulation by us corresponds to the fundamental safety and health requirements of the following directives.

Manufacturer: Dr. Födisch Umweltmesstechnik AG
Zwenkauer Strasse 159
04420 Markranstädt
Germany

Product: Filter monitoring device PFM 13 C EX

Directives: ATEX directive 2014/34/EU (potentially explosive atmospheres)
EMC directive 2014/30/EU (electromagnetic compatibility)
RoHS directive 2011/65/EU (RoHS II)

The following national or harmonised European standards for industrial sector have been applied:

- DIN EN 55011:2018-05: Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement
- DIN EN 60529:2014-09: Degrees of protection provided by enclosures (IP Code)
- DIN EN 61010-1:2011-07: Safety requirements for electrical equipment for measurement, control and laboratory use – General requirements
- DIN EN 61326-1:2013-07: Electrical equipment for measurement, control and laboratory use – EMC requirements – General requirements
- DIN EN 61000-3-2:2015-03: EMC – Limits for harmonic current emissions
- DIN EN 61000-3-3:2020-07: EMC – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems
- DIN EN 61000-4-2:2009-12: EMC – Electrostatic discharge immunity test
- DIN EN 61000-4-3:2011-04: EMC – Radiated, radio-frequency, electromagnetic field immunity test
- DIN EN 61000-4-4:2013-04: EMC – Electrical fast transient/burst immunity test
- DIN EN 61000-4-5:2019-03: EMC – Surge immunity test
- DIN EN 61000-4-6:2014-08: EMC – Immunity to conducted disturbances, induced by radio-frequency fields
- DIN EN 61000-4-11:2019-06: EMC – Voltage dips, short interruptions and voltage variations immunity tests
- DIN EN 61000-6-2:2019-11: EMC – Immunity for industrial environments
- DIN EN 61000-6-4:2011-09: EMC – Emission standard for industrial environments
- EN IEC 60079-0:2018 ATEX – Explosive atmospheres - Part 0: Equipment - General requirements
- EN 60079-11:2012 ATEX – Explosive atmospheres - Part 11: Equipment protection by intrinsic safety "i"
- EN 60079-31:2014 ATEX – Explosive atmospheres - Part 31: Equipment dust ignition protection by enclosure "m"

For the device there is an EC-type examination from 27th July 2021 according to directive 2014/34/EU (ATEX). The operation manual for the device is existing in German and English as standard. On request it will be made available in other languages.

Markranstädt, 28th Oktober 2022



Dr.-Ing. Holger Födisch
CEO

This declaration certifies conformance with the above mentioned directives. Affirmation of attributes in a legal sense is not included. Safety declarations and installation instructions given in the product documentations have to be considered. In the case of a change at the product not co-ordinated with us this explanation loses its validity.

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[1] **TYPE EXAMINATION CERTIFICATE - Translation**

[2] for non-electrical products of equipment-groups I and II,
equipment-categories M2 and 2 plus products of equipment-category 3

[3] Type examination certificate number **IBExU19ATEXB008 X** | Issue 1

[4] Product: **Filter Monitoring Device**
Type: PFM 13 C Ex

[5] Manufacturer: Dr. Födisch Umweltmesstechnik AG

[6] Address: Zwenkauer Straße 159
04420 Markranstädt
GERMANY

[7] This product and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.

[8] IBExU Institut für Sicherheitstechnik GmbH certifies that this product has been found to comply with the essential health and safety requirements relating to the design and construction of products intended for use in potentially explosive atmospheres given in Annex II to Directive 2014/34/EU of the European Parliament and of the Council, dated 26 February 2014.

The examination and test results are recorded in the confidential test report IB-21-3-0038/2.

[9] Compliance with the essential health and safety requirements has been assured by compliance with: EN IEC 60079-0:2018, EN 60079-11:2012 and EN 60079-31:2014 except in respect of those requirements listed at item [18] of the schedule.

[10] If the sign "X" or "U" is placed after the certificate number, it indicates that the product is subject to the specific conditions of use specified in the schedule to this certificate.

[11] This type examination certificate relates only to the design of the specified equipment and not to specific items of equipment subsequently manufactured or supplied.

[12] The marking of the product shall include the following depending on the components used:

II 3D Ex ic tc IIIC T80 °C Dc X

$-20\text{ °C} \leq T_{\text{amb}} \leq +50\text{ °C}$

IBExU Institut für Sicherheitstechnik GmbH
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Institut für Sicherheitstechnik GmbH
Fuchsmühlenweg 7
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Telefon (03731) 3805-0
Telefax (03731) 38 05 10

Certificates without signature and stamp are not valid. Certificates may only be duplicated completely and unchanged. In case of dispute, the German text shall prevail.

Dipl.-Ing. Willamowski

- Stamp -

Freiberg, 2021-07-27

[13] **Schedule**

[14] **Certificate number IBExU19ATEXB008 X | Issue 1**

[15] **Description of product**

The PFM 13 C Ex filter monitoring device is used for monitoring the residual dust in ducts. The complete filter monitoring device is intended for installation in hazardous areas of Zone 22. It is equipped with an intrinsically safe triboelectric probe.

Technical data:

Ambient temperature: -20 °C up to +50 °C
Degree of protection of housing: IP6X according to EN 60529

Electrical data

Supply circuit: 15 V AC, 20 mA
U_m: 30 V AC

Variations compared issue 0 to type examination certificate:

The filter monitoring device complies with the current standards.

[16] **Test report**

The test results are recorded in the confidential test report IB-21-3-0038/2 of 2021-07-27. The test documents are part of the test report and they are listed there.

Summary of the test results

The PFM 13 C Ex is a filter monitoring device meets the requirements of explosion protection for electrical equipment of equipment group II and category 3D in types of protection equipment dust ignition protection by enclosure "t" and intrinsic safety "i" for dusts of explosion group IIIC and surface temperature T80 °C.

[17] **Specific conditions of use**

- The equipment must not be installed in areas containing strongly charge-generating processes.
- The temperature of the sample gas must not exceed +260 °C in continuous operation.

[18] **Essential health and safety requirements**

In addition to the essential health and safety requirements (EHSRs) covered by the standards listed at item [9], the following are considered relevant to this product, and conformity is demonstrated in the test report:
None

[19] **Drawings and Documents**

The documents are listed in the test report.

IBExU Institut für Sicherheitstechnik GmbH
Fuchsmühlenweg 7
09599 Freiberg, GERMANY

By order


Dipl.-Ing. Willamowski

Freiberg, 2021-07-27