Dr. Födisch
Umweltmesstechnik AG

Filter Monitoring Device

PFM 13 C

Operation Manual

Dr. Födisch Umweltmesstechnik AG
Zwenkauer Strasse 159
04420 Markranstädt
Germany

Phone: +49 34205 755-0
Fax: +49 34205 755-40
E-mail: info@foedisch.de
Internet: www.foedisch.de

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Content

1 General 5
1.1 Information for operation manual 5
1.2 Intended use 5
1.3 Warranty 6
1.4 Standards and regulations 6
1.5 Declaration of conformity 6

2 Safety 7
2.1 Safety instructions 7
2.1.1 General safety instructions 7
2.1.2 Specific safety instructions 8
2.1.3 Personal protective equipment 9
2.2 Requirements for personnel 10
2.3 Electrical power supply 11
2.4 Components 12
2.5 Electronic components 12
2.6 Configuration settings 12

3 Function 13

4 Design 15
4.1 Dimensions 15
4.2 Connection assignment 16

5 Transport and scope of supply 17
5.1 Transport 17
5.2 Scope of supply 17

6 Mounting 18
6.1 Ambient conditions 18
6.2 Requirements for installation place 19
6.3 Mounting of welding sleeve 20
6.4 Adaptation of the probe rod 21
6.5 Installation of the device at the duct 22
6.6 Electrical connection 23

7 Commissioning 24

8 Operating 25
8.1 Amplification 25
8.2 Integration 27
8.3 Zero point setting 28
8.3.1 Setting of measuring zero point 28
8.3.2 Setting of device zero point 28
8.4 Limit values 29

9 Maintenance/Upkeep 30

10 Error search and failure clearance 32

11 Shutdown and Disposal 33
11.1 Shutdown 33
11.2 Disassembling 33
11.3 Storage 34
11.4 Disposal 34
12 Technical data 35
13 Spare and wear parts 36
14 Index 37

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 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 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 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.

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 device must not be operated in potentially explosive atmosphere. Explosive gas mixtures must not be measured.

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 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.

2.5 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.

2.6 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 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 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.

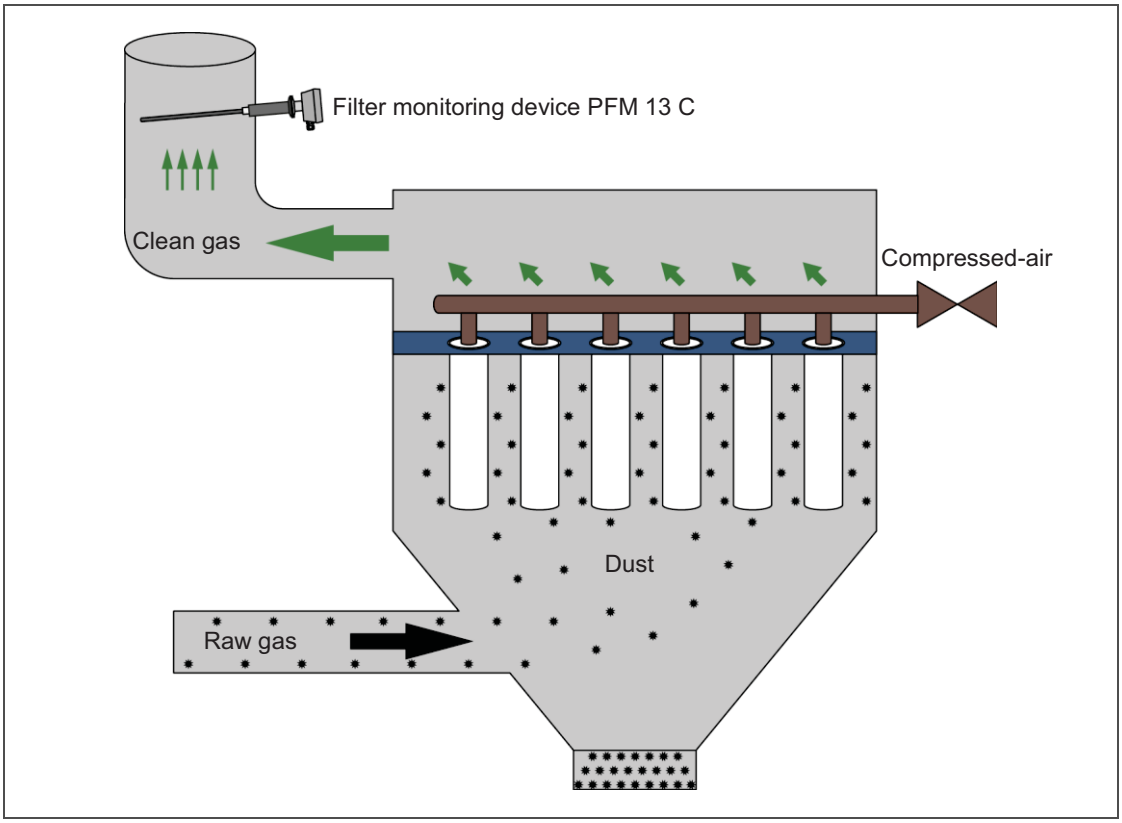

Fig. 1: Installation example for filter monitoring

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 25) and integration (see section 8.2, page 27).

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.

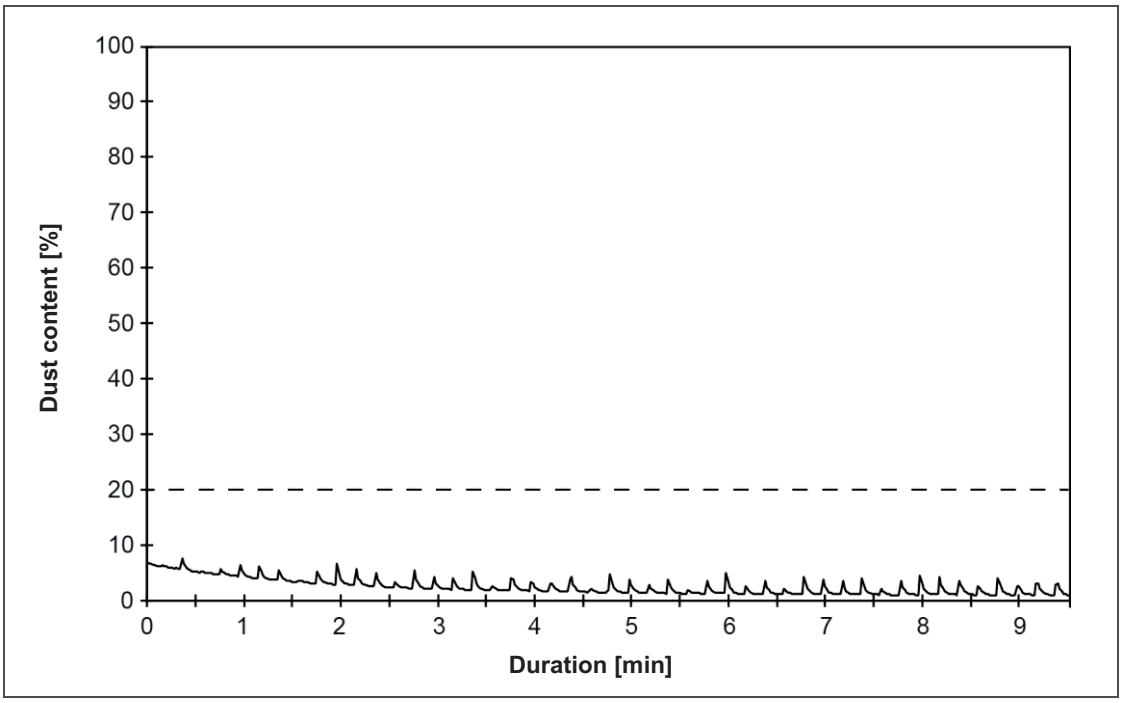

Fig. 2: Filter diagram with zero-defect filter tubes

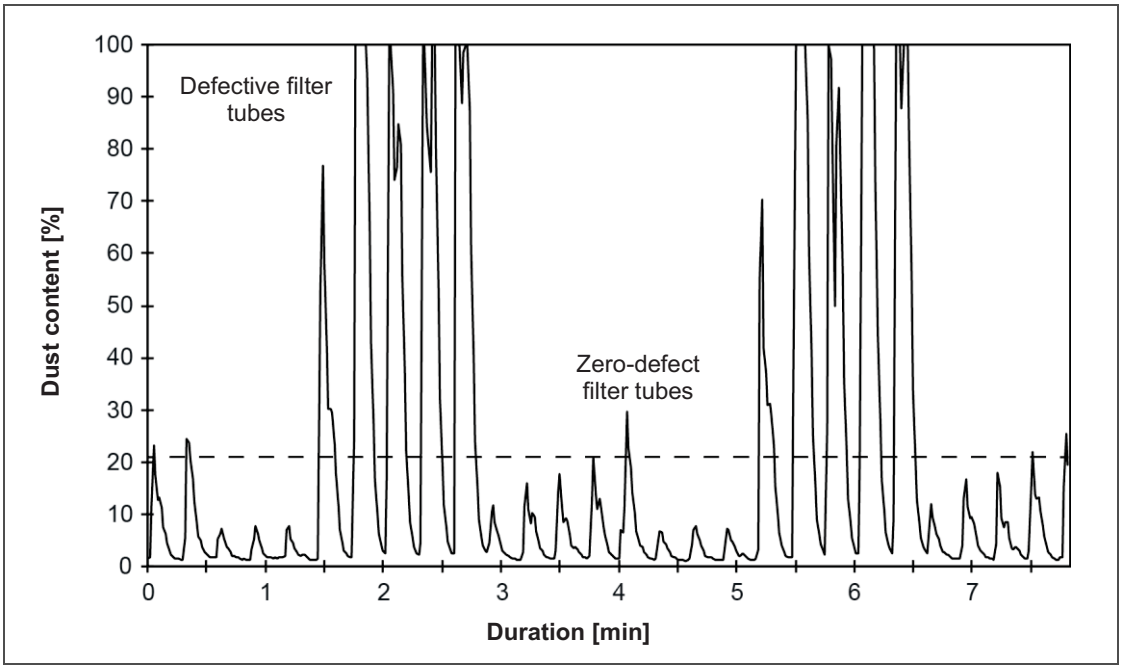

Fig. 3: Filter diagram with defective filter tubes

4 Design

The filter monitoring device PFM 13 C 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.

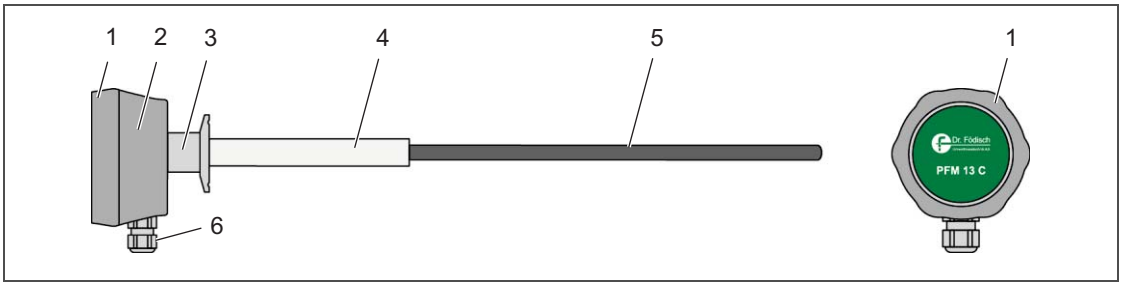

Fig. 4: Design

1 Housing cover
2 Probe head
3 Guide bushing
4 Insulator
5 Probe rod
6 Cable gland

4.1 Dimensions

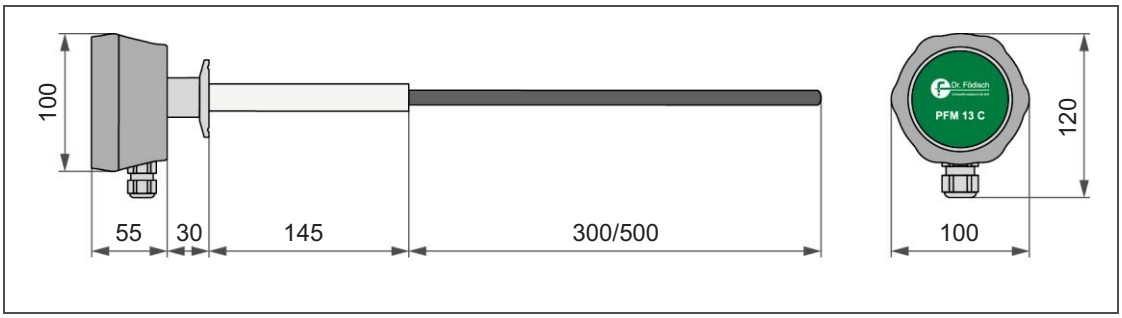

Fig. 5: Dimensions, specifications in mm

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 21).

4.2 Connection assignment

The electrical connections of the PFM 13 C 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.

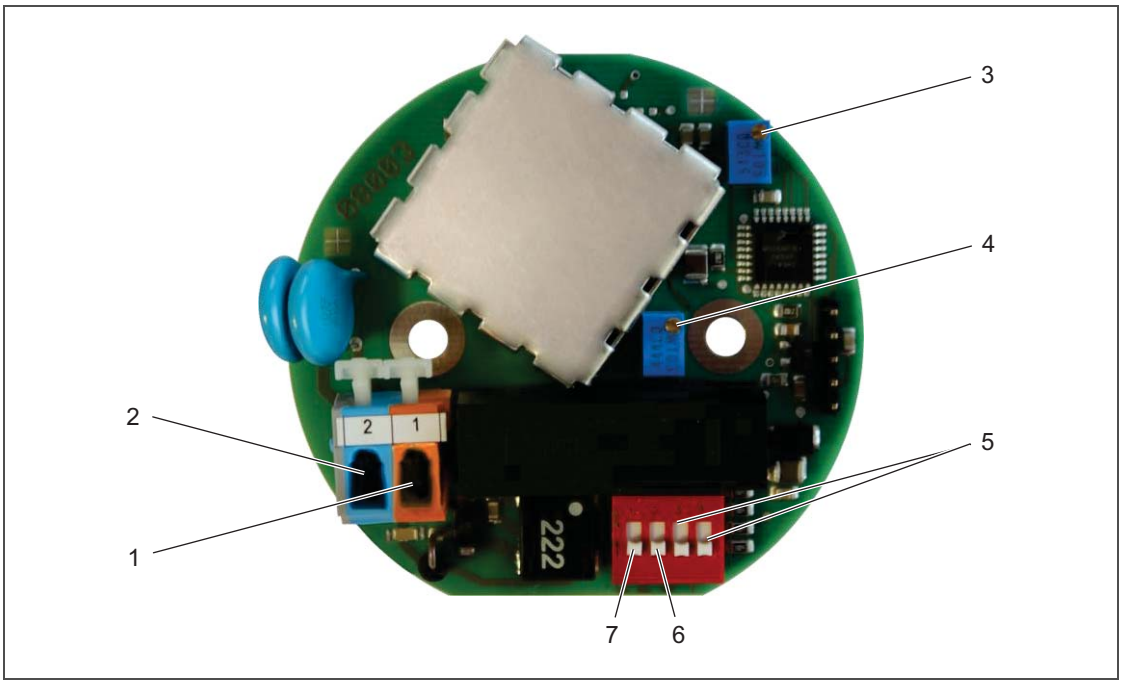

Fig. 6: Connections of the signal module

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

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
- 1 welding sleeve
- 1 sealing
- 1 Tri-Clamp fastener
- 1 operation manual

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

CAUTION
The device must not be operated in potentially explosive atmosphere.

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.

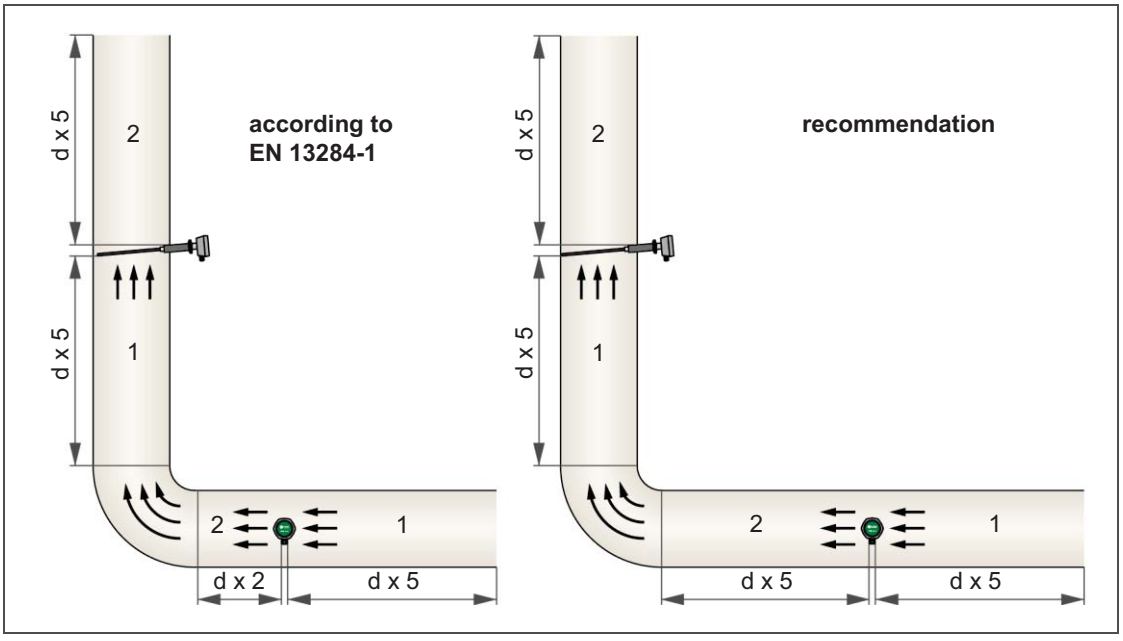

Fig. 7: Run-in and run-out zone at the measuring point

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 19).
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.

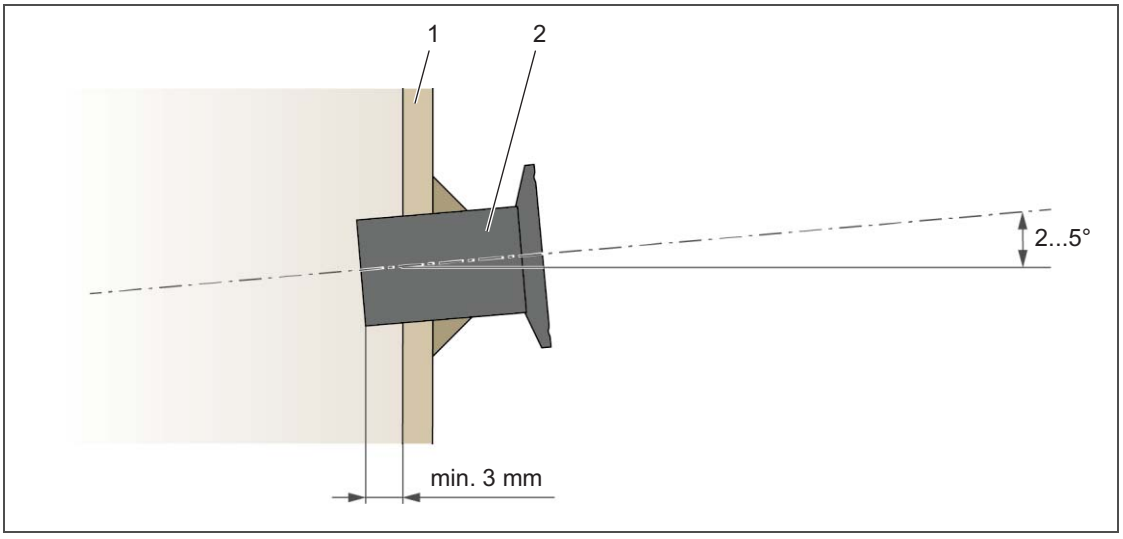

Fig. 8: Mounting of welding sleeve (side view)

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

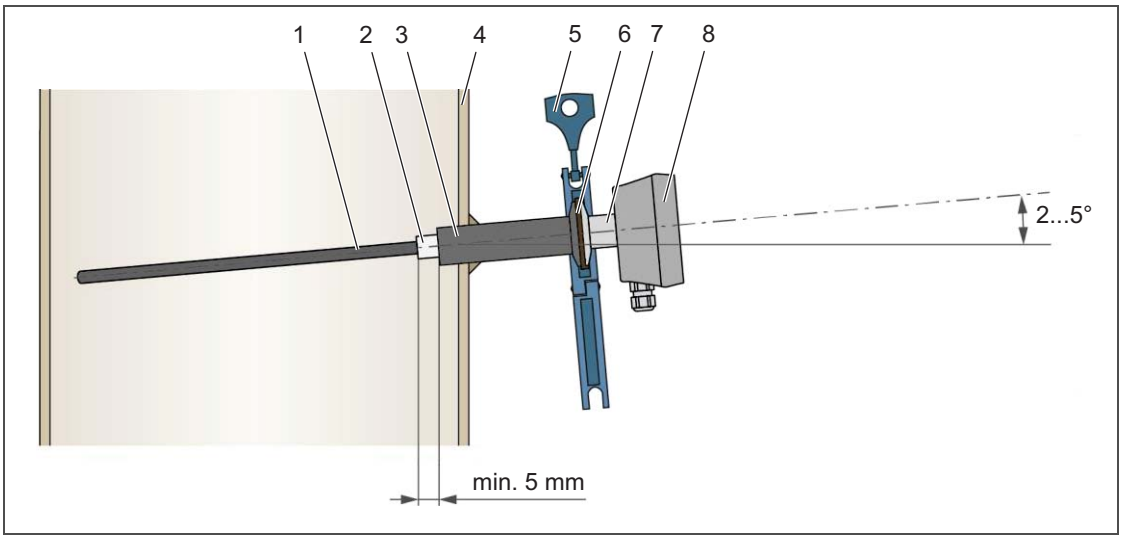

Fig. 9: Installation at duct (side view)

1 Probe rod
2 Insulator
3 Welding sleeve
4 Duct wall
5 Tri-Clamp fastener (opened)
6 Sealing
7 Guide bushing
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. Rotate the housing cover (1, Fig. 4, page 15) anti-clockwise off the probe head.

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

2. Lead the cable through the cable gland into the device (see Fig. 10).
3. Connect the power supply with the both pins at the signal module.

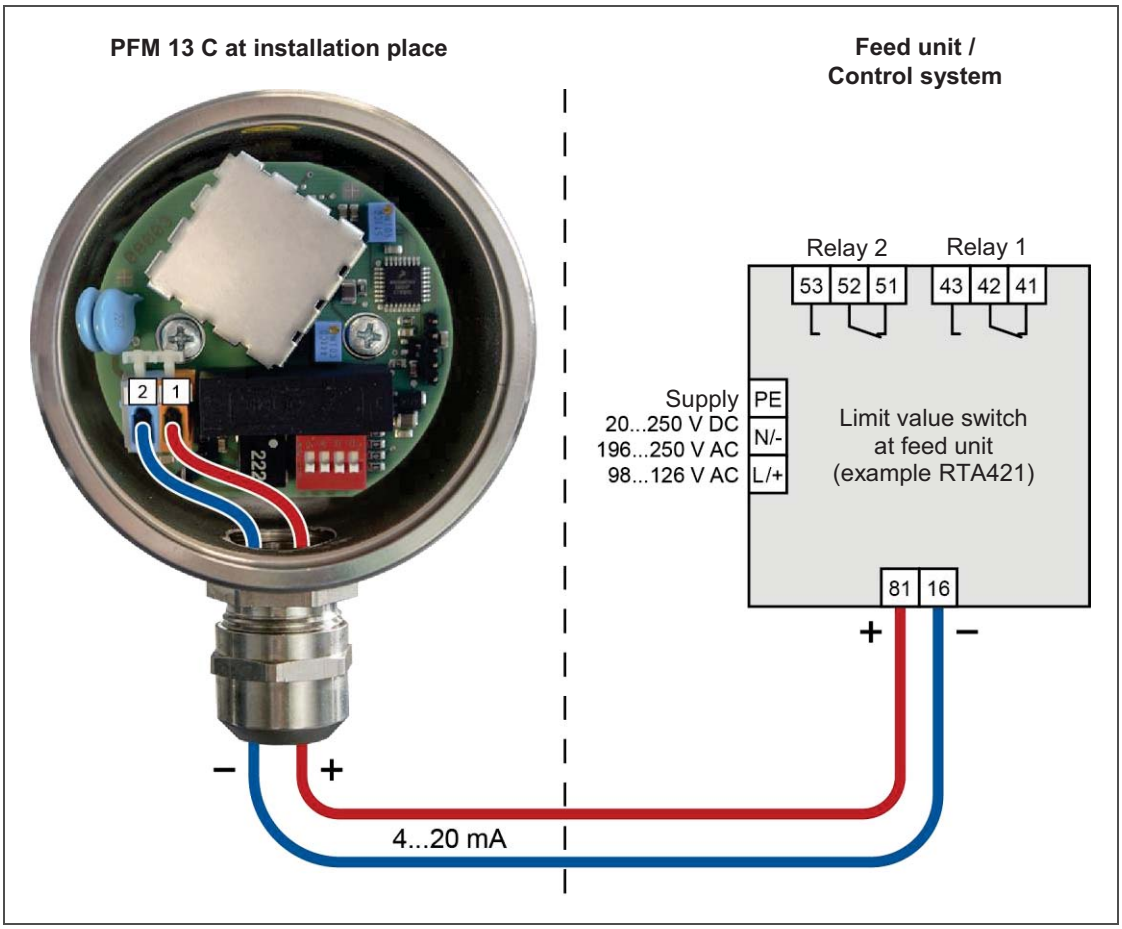

Fig. 10: Electrical connection

4. Tighten the cable gland until the cable is fixed and a safe hold is assured.
5. Rotate the housing cover clockwise onto the probe head until the housing is tightly closed.

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 25). If necessary, adjust the amplification of the output signal.
4. If necessary, adjust the setting of the integration (see section 8.2, page 27).
5. Set the limit values (see section 8.4, 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 16):

- 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 16).

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. Rotate the housing cover (1, Fig. 4, page 15) anti-clockwise off the probe head.

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

2. Switch the integration off. For this, set switch 2 (6, Fig. 6, page 16) up.
3. Choose amplification level 3. For this, set switch 3 and 4 (5) down.

NOTICE
In measuring mode the switch 1 (7, Fig. 6, page 16) 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.

4. 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 25).
   › The device zero point is pre-set by factory to 3.8 mA.
5. If necessary, adjust the measuring zero point in the calibration tube (see section 8.3.1, page 28).
   › The device is adapted to the local conditions and ready for operation.
6. Rotate the housing cover clockwise onto the probe head until the housing is tightly closed.

8.2 Integration

The integration is switched on/off via switch 2 (6, Fig. 6, page 16) 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. Rotate the housing cover (1, Fig. 4, page 15) anti-clockwise off the probe head.

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

2. Switch the integration on/off. For this, set switch 2 (6, Fig. 6, page 16) down/up.

NOTICE
When the integration is switched off, the adjusted limit values (see section 8.4, page 29) can be exceeded by possible dedusting peaks.

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

3. Rotate the housing cover clockwise onto the probe head until the housing is tightly closed.

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. Rotate the housing cover (1, Fig. 4, page 15) anti-clockwise off the probe head.

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

2. Set switch 1 (7, Fig. 6, page 16) down (measuring mode).
3. Turn the potentiometer 1 (3) with the aid of a screwdriver until the measuring zero point of 4 mA is output.
4. Check the displayed measuring values for plausibility.
5. Rotate the housing cover clockwise onto the probe head until the housing is tightly closed.

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 Umwelt-messtechnik AG.

1. Rotate the housing cover (1, Fig. 4, page 15) anti-clockwise off the probe head.

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

2. Set switch 1 (7, Fig. 6, page 16) up (device zero point setting).
3. Connect a multimeter in-line with the device.
4. 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.
5. Set switch 1 (7) down (measuring mode).
6. Rotate the housing cover clockwise onto the probe head until the housing is tightly closed.

8.4 Limit values

NOTICE
The setting of limit values must be carried out at the limit value switch of an optional feed unit or in the subsequent control system (see section 6.6, page 23).
For operation with the optional additional devices please read the technical documentations of the suppliers. The contents are at responsibility of the respective manufacturers.

For the monitoring of the status signals two separate limit values in the range of 4...20 mA (0...100%) can be set.

NOTICE
When the integration (see section 8.2, page 27) is switched off, the adjusted limit values can be exceeded by possible dedusting peaks.

9 Maintenance/Upkeep

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

1. Clean the probe head with a clean, lint-free 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 Tri-Clamp fastener (5, Fig. 9, page 22) and remove it.
5. Remove the device from the duct.
6. Clean the insulator (2) and the probe rod (1) with a clean, lint-free cloth.
7. Clean the welding sleeve and the Tri-Clamp fastener.
8. Exchange the sealing (6) at the welding sleeve with a new one.
9. Insert the new sealing (6) at the screwing-in of the welding sleeve (3).
10. 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).
11. Rotate the probe head (8) into the correct position, so that the cable gland is aligned downwards.
12. Put the Tri-Clamp fastener (5) around sleeves and sealing and fix it.
13. 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	• 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	• Check the setting of the device zero point. Correct the device zero point if necessary (see section 8.3.2, page 28). • 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	• Check the setting of the device zero point. Correct the device zero point if necessary (see section 8.3.2, page 28).
Current value > 20 mA	amplification too high; device is defective	• Check the setting of the amplification and adjust it if necessary (see section 8.1, page 25). • 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 Tri-Clamp fastener (5, Fig. 9, page 22) and remove it.
2. Remove the device from the duct.
3. Disconnect the electrical connections from the device:
   a) Rotate the housing cover (1, Fig. 4, page 15) anti-clockwise off the probe head.

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

   b) Disconnect the power supply from the both pins (1 and 2, Fig. 6, page 16) of the signal module.
   c) Release the cable gland (6, Fig. 4, page 15).
   d) Lead the cable through the cable gland out of the device.
   e) Rotate the housing cover clockwise onto the probe head until the housing is tightly closed.
4. Remove the sealing (6, Fig. 9, page 22) from the screwing-in of the welding sleeve (3).
5. If necessary, demount the welding sleeve from the duct.
6. 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	
Housing	compact device; IP 65; protection class 1
Dimensions	approx. 100 mm x 120 mm x 530/730 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. 410/610 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. 280 °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

14 Index

A

Ambient conditions
- Operation 18
- Storage 34

Amplification 25
Application fields 5, 13

C

Cable gland 15
Calibration tube 28
CE label 6
Cleaning 30
Commissioning 24
Components 12
Configuration
- Safety instructions 12

Conformity 6
Connection assignment 16
Current values 32

D

Design 15
Dimensions 15
Disassembling 33
Disposal 34

E

Electrical connection 23
Electrical power supply 11
Electrical safety 11
Electronic components 12
Error search 32

F

Failure clearance 32
Filter diagram 14
Function 13

G

Guide bushing 15

H

Housing cover 15

I

Information 5
Installation 18
Installation place, requirements 19
Insulator 15
Integration 27
Intended use 5

L

Limit values 29

M

Maintenance 30
Measuring method 13
Measuring point 19
Mounting 18
- Electrical connection 23
- Installation of the device 22
- Probe rod adaptation 21
- Welding sleeve 20

O

Operating 25

P

Personal protective equipment 9
Personnel, requirements 10
Potentiometers 16
Power supply 11
- Connection 16

Probe head 15
Probe rod 15
- Adaptation 21

Protective equipment 9

R

Regulations 6
Run-in zone 19
Run-out zone 19

S

Safety instructions 7
Scope of supply 17
Sealing 22
Shutdown 33
Signal module 16
Spare parts 36
Standards 6
Storage 34
Switches 16

T

Technical data 35
Transport 17
Tri-Clamp fastener 22

U

Upkeep 30
Use, intended 5

W

Warranty 6
Wear parts 36
Welding sleeve 20

Z

Zero point
- Device zero point 28
- Measuring zero point 28