

# **Modular Sample Gas Extraction System**

Probe Tubes Type 40, Type 42

Filter Units FE2, PFE2, PFE3

## **Operator's Manual**

42/23-39 EN Rev. 8





## Contents

<b>Preamble.....</b>	<b>4</b>
<b>Guide for the Installation .....</b>	<b>5</b>
<b>Safety Information .....</b>	<b>6</b>
Specified Use .....	6
Safety Information .....	7
<b>Preparing for Installation .....</b>	<b>9</b>
Structure and Function .....	9
Choosing the Sampling Point .....	9
Information on the Installation of the Wall Tube .....	10
<b>Assembly.....</b>	<b>11</b>
Unpacking.....	11
Installing Probe Tube Type 40.....	12
Installing Probe Tube Type 42.....	13
Mounting the FE2 Filter Unit .....	14
Mounting the PFE2 Filter Unit.....	16
Mounting the PFE3 Filter Unit.....	20
Assembly of the Temperature Controller .....	22
<b>Electrical Installation.....</b>	<b>24</b>
Requirements and Procedures for Electrical Connection .....	24
Electrical Connections for Probe Tube Type 42.....	26
Electrical Connections for the PFE2 Filter Unit Standard Version .....	27
Electrical Connections for the PFE2 Filter Unit with Coaxial Valves.....	32
Electrical Connections for the PFE3 Filter Unit.....	34
Electrical Connections for the Temperature Controller .....	35
<b>Operation of the Temperature Controller .....</b>	<b>36</b>
Operator Panel of the Temperature Controller .....	36
Operation of the Temperature Controller.....	37
<b>Automated Filter Cleaning.....</b>	<b>41</b>
Back-purging the Filter Element with Compressed Air.....	41
Connection of the Optional Filter Cleaning (1-stage).....	42
Connection of the Optional Filter Cleaning (2-stage).....	44
<b>Inspection and Maintenance .....</b>	<b>47</b>
Maintenance of the Filter Element of the FE2 Filter Unit .....	47
Removing the Filter Element of the FE2 Filter Unit.....	49
Removing the Filter Stone from the FE2 Filter Unit .....	51
Installation of the Filter Element of the FE2 Filter Unit.....	52
Cleaning the Filter Stone of the FE2 Filter Unit.....	52
<b>Technical Data.....</b>	<b>53</b>
Probe Tubes .....	53
Filter Units .....	53
<b>Putting out of Service and Packing .....</b>	<b>54</b>
Putting out of Service .....	54
Disposal.....	54
Packing for Return.....	55
<b>Index .....</b>	<b>56</b>

## Preamble

### Contents of this operator's manual

This Operator's Manual contains all information required to be able to install, put into operation, operate and maintain probe tubes types 40 and 42 and filter units types FE2, PFE2 and PFE3 safely and as specified.

The Operator's Manual also contains information about the operation of the temperature controller. The complete Operator's Manual of the temperature controller is a constituent of the scope of supply and delivery.

### Further information

#### Internet

You will find information on ABB Analytical products and services on the Internet at "<http://www.abb.com/analytical>".

#### Spare parts

You can order spare parts via our service "Parts OnLine". You will find Parts OnLine on the Internet at "<http://www.abb.com/partsonline>".

#### Service contact

If the information in this operator's manual does not cover a particular situation, ABB Service will be pleased to supply additional information as required.

Please contact your local service representative. For emergencies, please contact

ABB Service,  
Telephone: +49-(0)180-5-222580, Telefax: +49-(0)621-38193129031,  
E-mail: [automation.service@de.abb.com](mailto:automation.service@de.abb.com)

### Symbols and typefaces in the operator's manual

**WARNING** denotes safety instructions which must be followed when handling the device, in order to prevent danger to user.

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**NOTE** denotes information about particular features with regard to the handling of the device and the use of this operator's manual.

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**1, 2, 3, ...** denotes the reference numbers in the figures.

## Guide for the Installation

### Basic steps

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**NOTE**

Please refer to the planning documents for the installation. Please also refer to the technical data (see chapter "Technical Data" (page 53)).  
The wall tube must be installed at the sampling point before the probe is installed (see chapter "Preparing for Installation" (page 9)).

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Step	Action
1	Unpack the supplied parts (see section Unpacking (page 11)).
2	Install the probe tube (see sections Installing Probe Tube Type 40 (page 12), Installing Probe Tube Type 42 (page 13)).
3	Install the filter unit (see sections Installing the FE2 filter unit (page 14), Installing the PFE2 filter unit (page 16), Installing the PFE3 filter unit (page 20)).
4	Carry out the electrical connection (see sections Requirements and Procedures for Electrical Connection (page 24), Electrical Connections for Probe Tube Type 42 (page 26), Electrical Connections for the PFE2 Filter Unit (page 27), Electrical Connections for the PFE3 Filter Unit (page 34), Electrical Connections for the Temperature Controller (page 35)).

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After you have carried out these steps, the probe tube and the filter unit are operative.

## Safety Information

### Specified Use

#### Specified use

The probe tubes types 40 and 42, the filter units types FE2, PFE2 and PFE3 as well as the other necessary modules for operation are constituent parts of the modular gas sampling system. This is used for the continuous sampling of gases in processes.

Any other use is not as specified.

The specified use also includes taking note of this operator's manual.

## Safety Information

### Requirements for Safe Operation

In order to operate in a safe and efficient manner the device should be properly handled and stored, correctly installed and set-up, properly operated and correctly maintained.

### Personnel Qualifications

Only persons familiar with the installation, set-up, operation and maintenance of comparable devices and certified as being capable of such work should work on the device.

### Special Information and Precautions

These include

- The content of this operator's manual,
- The safety information affixed to the device,
- The applicable safety precautions for installing and operating electrical devices,
- Safety precautions for working with gases, acids, condensates, etc.

### National Regulations

The regulations, standards and guidelines cited in this operator's manual are applicable in the Federal Republic of Germany. The applicable national regulations should be followed when the device is used in other countries.

### Device Safety and Safe Operation

The device is designed and tested in accordance with the relevant safety standards and has been shipped ready for safe operation. To maintain this condition and to assure safe operation, read and follow the safety information in this operator's manual. Failure to do so can put persons at risk and can lead to device damage as well as damage to other systems and devices.

### Protective Lead Connection

The protective lead (ground) should be attached to the protective lead connector before any other connection is made.

### Risks of a Disconnected Protective Lead

The device can be hazardous if the protective lead is interrupted inside or outside the device or if the protective lead is disconnected.

## **Risks Involved in Opening the Covers**

Current-bearing components can be exposed when the covers or parts are removed, even if this can be done without tools. Current can be present at some connection points.

## **Risks Involved in Working with an Open Device**

All work on a device that is open and connected to power should only be performed by trained personnel who are familiar with the risks involved.

## **When Safe Operation can no Longer be Assured**

If it is apparent that safe operation is no longer possible, the device should be taken out of operation and secured against unauthorized use.

The possibility of safe operation is excluded:

- If the device is visibly damaged,
- If the device no longer operates,
- After prolonged storage under adverse conditions,
- After severe transport stresses.

### **WARNING EXPLOSION HAZARD**

Substitution of components may impair suitability for Class I, Division 2. I/O connectors must only be connected to Class 2 circuits.



## Preparing for Installation

### Structure and Function

#### Interaction of the components

The process gas is cleaned of dust particles by means of a heated filter in the filter unit mounted directly on the probe tube. The sample gas is subsequently transferred to the analyzer system via a sample gas pipe.

#### Possible combinations of the probe tubes and filter units

Probe tube type	Filter unit types	Type of assembly
40	FE2, PFE2, PFE3	screwed
42	FE2, PFE2, PFE3	flanged

### Choosing the Sampling Point

#### Choosing the sampling point

- Select a sampling point as per the planning documents which is suitable for extracting a representative sample flow.
- Install the wall tube with assembly flange (DN 65, PN 6, Form B to DIN 2573) at the sampling point in such a way that the probe tube can be easily installed and removed (see the section "Information about Installation of the Wall Tube" (page 10)).
- The probe tube must be easily accessible to allow maintenance work to be performed.
- Probe Tube Type 40 in the silicon-carbide version must be installed vertically.
- Protect the FE2 filter unit from direct heat radiation, rain, draughts and heavy soiling. If necessary, protect the filter unit with a protective box.

#### NOTE

In the case of emission measuring devices, the sampling point is specified by the responsible technical inspection association (DIN EN ISO/IEC 17025).

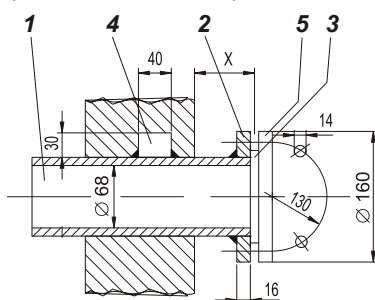
## Information on the Installation of the Wall Tube

### Installation of the wall tube

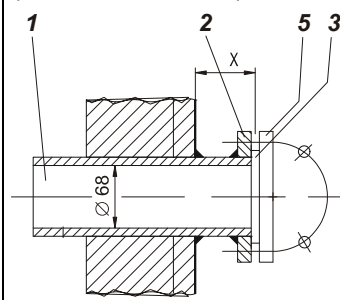
Please refer to the planning documents and the information in the chapter "Installation" (page 11) for installation of the wall tube.

Install the wall tube dependent on the installation conditions as per the following sketches.

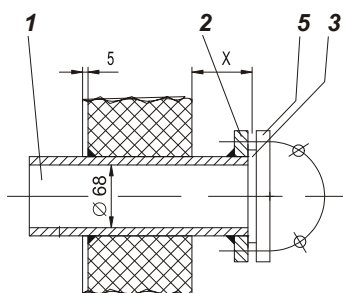
Installation of the wall tube  
in brickwork  
(dimensions in mm):



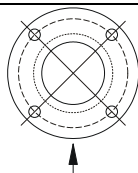
Installation of the wall tube  
in brickwork with metal sheeting  
(dimensions in mm):



Installation of the wall tube  
in an insulated sheet-metal channel  
(dimensions in mm):



<b>1</b>	Wall tube
<b>2</b>	Assembly flange DN 65, PN 6, Form B to DIN 2573
<b>3</b>	Gasket
<b>4</b>	Welded-on rectangular block
<b>5</b>	Sampling probe flange



The figure shows a view of the flange looking from the process to the filter. The arrow indicates the flow direction of the process gas.

Select the installation position of the wall tube, so that the holes are located in the position shown here.

## Assembly

## Unpacking

### Unpacking

**WARNING**  
Danger of breakage!  
Probe Tube Type 40 in the silicone carbide version is fragile.

Step	Action
1	Unpack the probe tube, the filter unit and, if applicable, the temperature controller.
2	Make sure that any accompanying accessories do not get lost.
3	Check the contents of the delivery to ensure that it is complete by comparing the actual goods with the dispatch note.

**NOTE**  
Keep the packing material for possible future transport.  
If damage has occurred during transport due to improper handling, please submit a damage report to the transport institution (railway company, post office, forwarding agency) within seven days.

## Installing Probe Tube Type 40

### WARNING

Danger of breakage!  
Probe Tube Type 40 in the silicone carbide version is fragile.

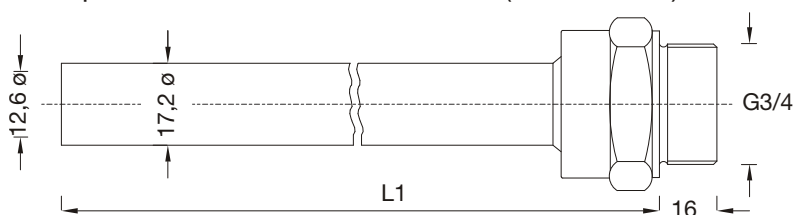
### NOTE

Probe Tube Type 40 in the silicon-carbide version must be installed vertically.

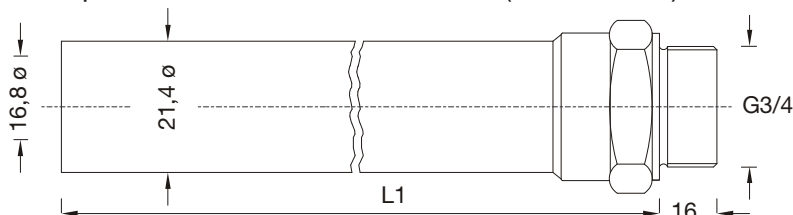
### The 3 variants of probe tube type 40

L1 = length of the probe tube (dimensions in mm)

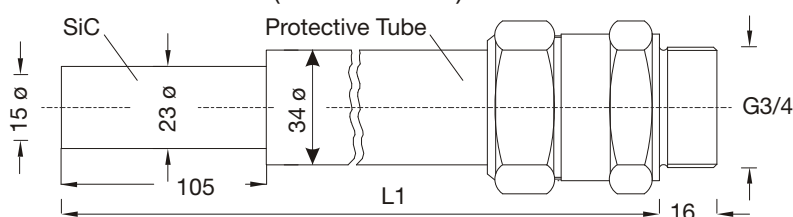
Special Steel Material No. 1.4571 (max. 450 °C)



Special Steel Material No. 1.4893 (max. 900 °C)



Silicon-Carbide (max. 1300 °C)



### Installing probe tube type 40

Step	Action
1	Install the customer-supplied wall tube with assembly flange into the wall of the flue gas duct or chimney (see section "Information about Installation of the Wall Tube" (page 10)).
2	Use the green seal from the accessories pack to seal the space between the probe tube and the wall tube.
3	Insert the pre-assembled sample gas extraction system in the wall tube.
4	Screw the assembly flange to the flange of the filter unit.

## Installing Probe Tube Type 42

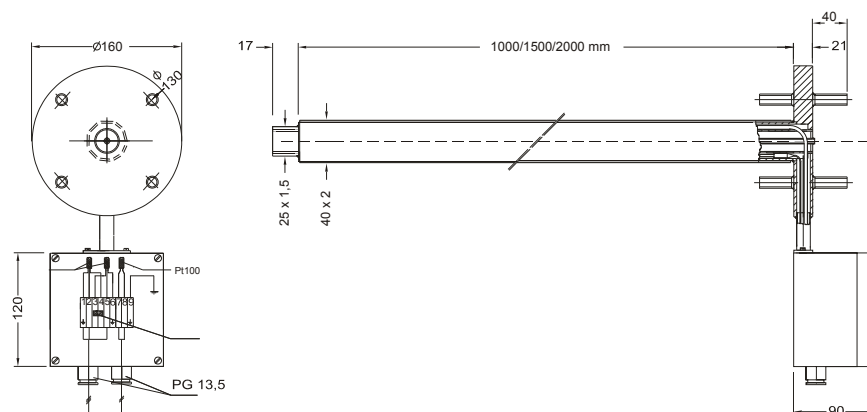
### WARNING

Corrosion risk!

Probe Tube Type 42 must be put into operation immediately after assembly and installation; otherwise there is a risk of corrosion.

### The 3 length variants of probe tube type 42

(Dimensions in mm)



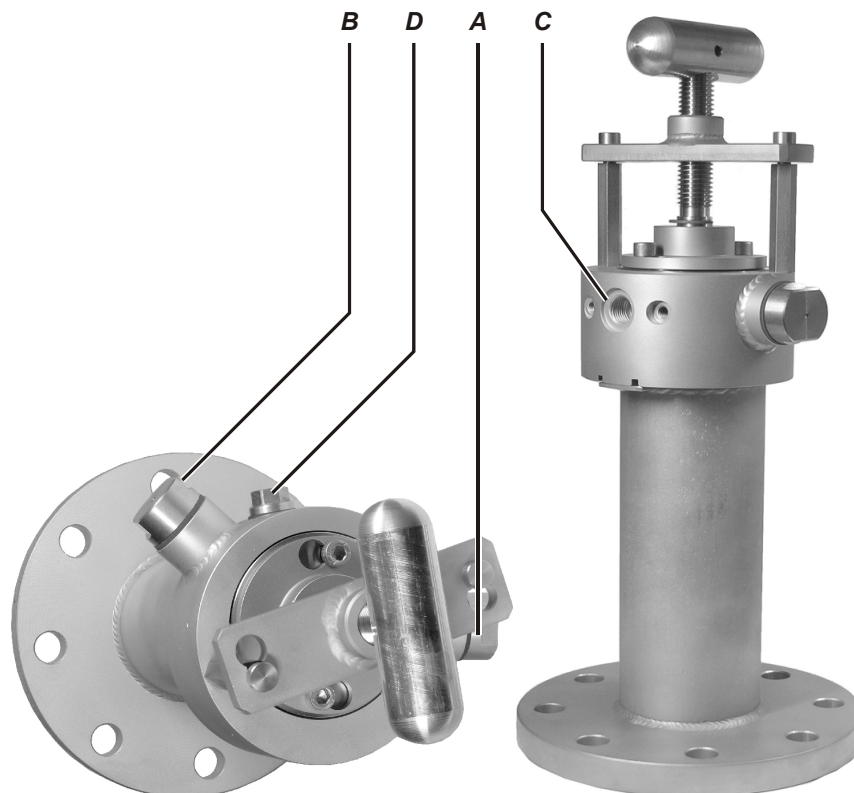
Nominal length	Dimension
Length 1	1000 mm
Length 2	1500 mm
Length 3	2000 mm

### Installing probe tube type 42

Step	Action
1	Install the customer-supplied wall tube with assembly flange into the wall of the flue gas duct or chimney (see section "Information about Installation of the Wall Tube" (page 10)).
2	Use the green sealing ring from the accessories pack to seal the space between the flange of the probe tube and the wall tube.
3	Insert the pre-assembled sample gas extraction system in the wall tube.
4	Screw the assembly flange to the flange of the filter unit.

## Mounting the FE2 Filter Unit

### Gas connections of the FE2



<b>A</b>	Screw-type blank cap (for compressed air for back-purging the filter 4 to 6 bar) G 1/2 in.
<b>B</b>	Screw-type blank cap (for compressed air for back-purging the filter and the probe tube 4 to 6 bar) G 1/2 in.
<b>C</b>	Sample gas connection G 1/4 in.
<b>D</b>	Plug, test gas connection G 1/4 in.

## Mount the FE2 filter unit on the wall tube

Carry out the assembly of the FE2 filter unit as described in the section "Mounting the PFE2 Filter Unit" (page 16).

## Connect the sample gas line

Connect the sample gas line to gas port **C** at the sample gas connection of the filter unit by means of a clamp ring screw fitting (not in the scope of supply and delivery).

### WARNING

Possible leakage!

When tightening the screw connection, relieve the pressure on the gas port, e.g. by holding back with a suitable spanner. Otherwise there is a danger that the gas port is twisted and becomes untight or breaks off.

## Connect the compressed air lines

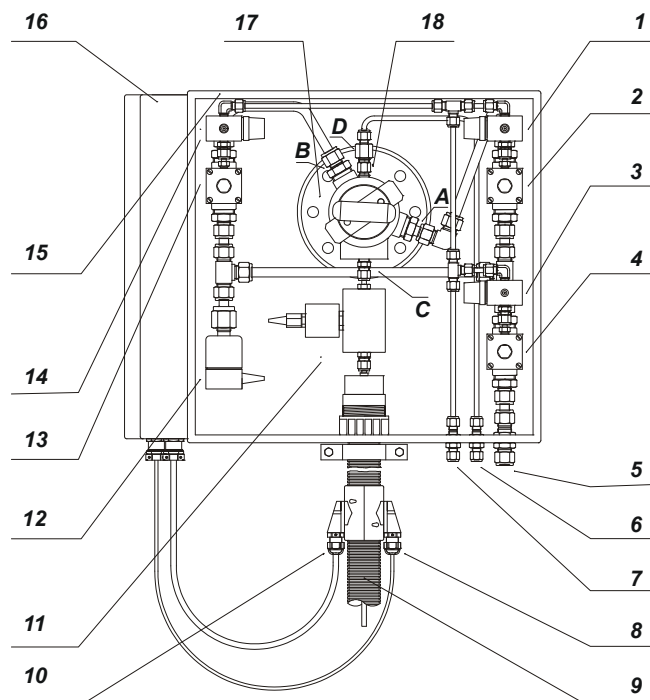
If probe back-purging is available, connect the compressed air lines to gas ports **A** and **B**.

## Connect the test gas line

If test gas is to be fed in at the probe, connect the test gas line to gas port **D**.

## Mounting the PFE2 Filter Unit

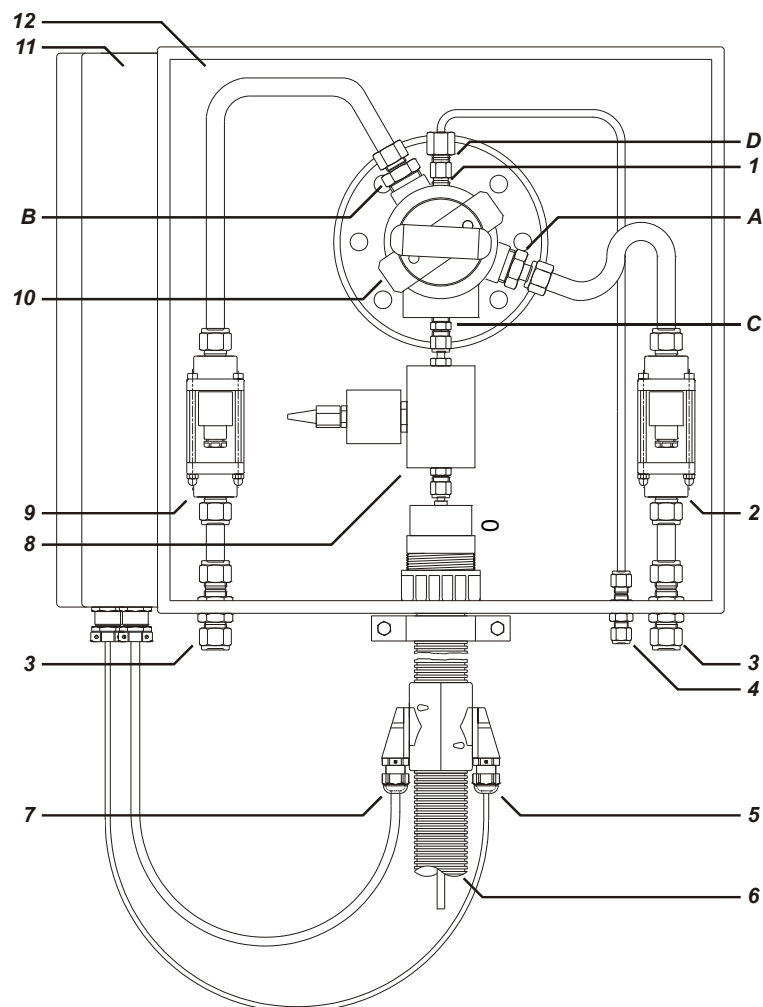
### PFE2 Standard version



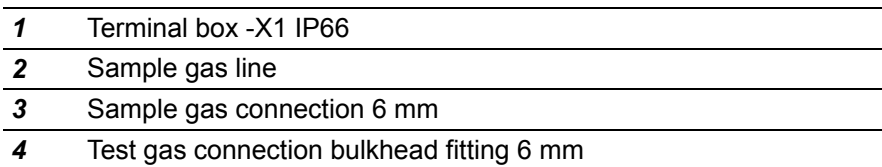
<b>1</b>	Pilot valve for cleaning filter -Y2.1
<b>2</b>	Diaphragm valve for cleaning filter -Y2.2
<b>3</b>	Pilot valve for pulsed instrument air -Y1.1
<b>4</b>	Diaphragm valve for pulsed instrument air -Y1.2
<b>5</b>	Connection for instrument air (max. 6 bar) bulkhead fitting 12 mm
<b>6</b>	Connection for test gas bulkhead fitting 6 mm
<b>7</b>	Connection for control air (max. 6 bar) bulkhead fitting 6 mm
<b>8</b>	Connection for Pt100
<b>9</b>	Heated sample gas line -E2
<b>10</b>	Power supply
<b>11</b>	Heated cutoff valve -Y5 (option)
<b>12</b>	Solenoid valve for venting -Y4
<b>13</b>	Diaphragm valve for cleaning filter surface and probe tube -Y3.2
<b>14</b>	Pilot valve for cleaning filter surface and probe tube -Y3.1
<b>15</b>	Protective case for the probe
<b>16</b>	Terminal box
<b>17</b>	Filter unit
<b>18</b>	Check valve
<b>A</b>	Connection for back-purging filter G 1/2 in. to 12 mm pipe coupling
<b>B</b>	Connection for back-purging filter surface and probe tube G 1/2 in. to 12 mm pipe coupling
<b>C</b>	Sample gas outlet G 1/4 in. to 6 mm pipe coupling
<b>D</b>	Test gas connection G 1/4 in. to 6 mm pipe coupling



## PFE2 Standard version with coaxial valves

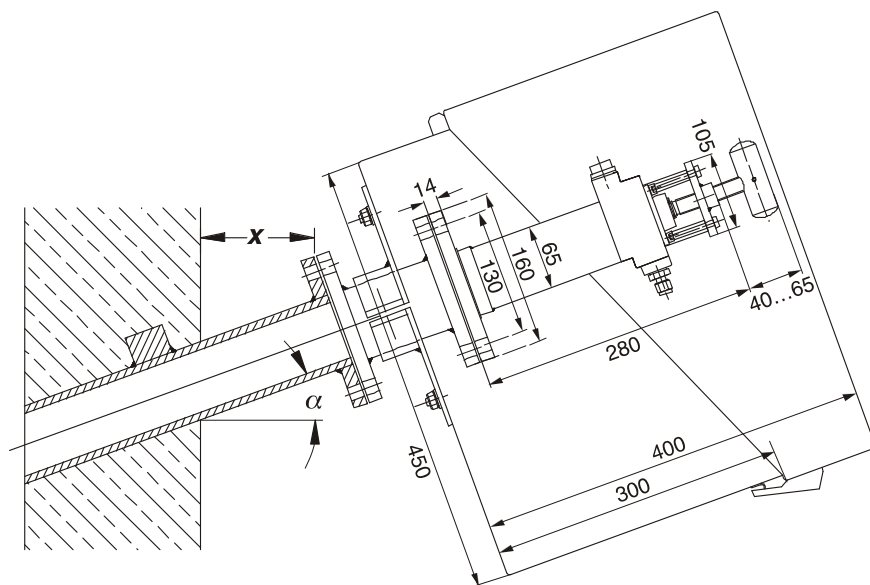


<b>1</b>	Check valve
<b>2</b>	Solenoid valve for cleaning filter -Y2
<b>3</b>	Connection for instrument air (max. 6 bar) bulkhead fitting 12 mm
<b>4</b>	Connection for test gas bulkhead fitting 6 mm
<b>5</b>	Connection for Pt100
<b>6</b>	Heated sample gas line -E2
<b>7</b>	Power supply
<b>8</b>	Heated cutoff valve -Y5 (option)
<b>9</b>	Solenoid valve for cleaning filter surface and probe tube -Y1
<b>10</b>	Filter unit
<b>11</b>	Terminal box
<b>12</b>	Protective case for the probe
<b>A</b>	Connection for back-purging filter G 1/2 in. to 12 mm pipe coupling
<b>B</b>	Connection for back-purging filter surface and probe tube G 1/2 in. to 12 mm pipe coupling
<b>C</b>	Sample gas outlet G 1/4 in. to 6 mm pipe coupling
<b>D</b>	Test gas connection G 1/4 in. to 6 mm pipe coupling

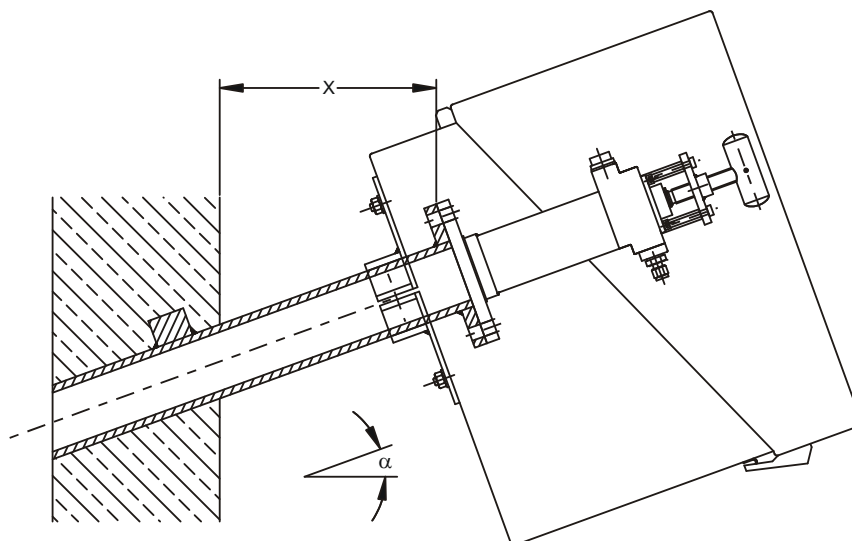


### Mount the PFE2 filter unit on the wall tube

### Installation of the PFE2 filter unit with an intermediate flange



### Installation of the PFE2 filter unit without an intermediate flange



The following table shows the minimum distance  $x_{\min}$  of the assembly flange from the wall depending on the mounting angle of the PFE2 filter unit:

Mounting angle $\alpha$	10°	15°	20°	25°	30°	35°
$x_{\min}/\text{mm}$	229	248	268	287	307	324

### Installation of the PFE2 filter unit in the basic version

The installation of the PFE2 filter unit in the basic version has to be carried out in accordance with the installation instructions for the PFE3 filter unit (page 20).

### Connect the sample gas line

Connect the sample gas line to gas port **C** or cutoff valve **11** at the sample gas outlet of the filter unit by means of a clamp ring screw fitting.

#### WARNING

Possible leakage!

When tightening the screw connection, relieve the pressure on the gas port, e.g. by holding back with a suitable spanner. Otherwise there is a danger that the gas port is twisted and becomes untight or breaks off.

### Connect the compressed air lines

If probe back-purging is available, connect the compressed air lines to gas ports **5** (instrument air) and **7** (control air). Please note the maximum permissible pressure.

### Connect the test gas line

If test gas is to be fed in at the probe, connect the test gas line to gas port **6**.

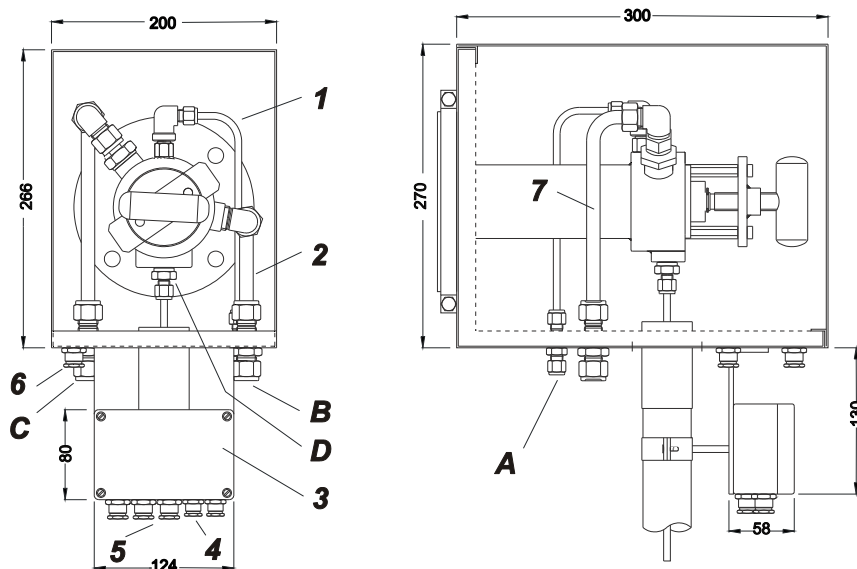
### Operation at extreme ambient temperatures

If the PFE2 filter unit is operated at ambient temperatures below  $-20\text{ }^{\circ}\text{C}$ , additional heating must be provided.

## Mounting the PFE3 Filter Unit

### Overview of the PFE3

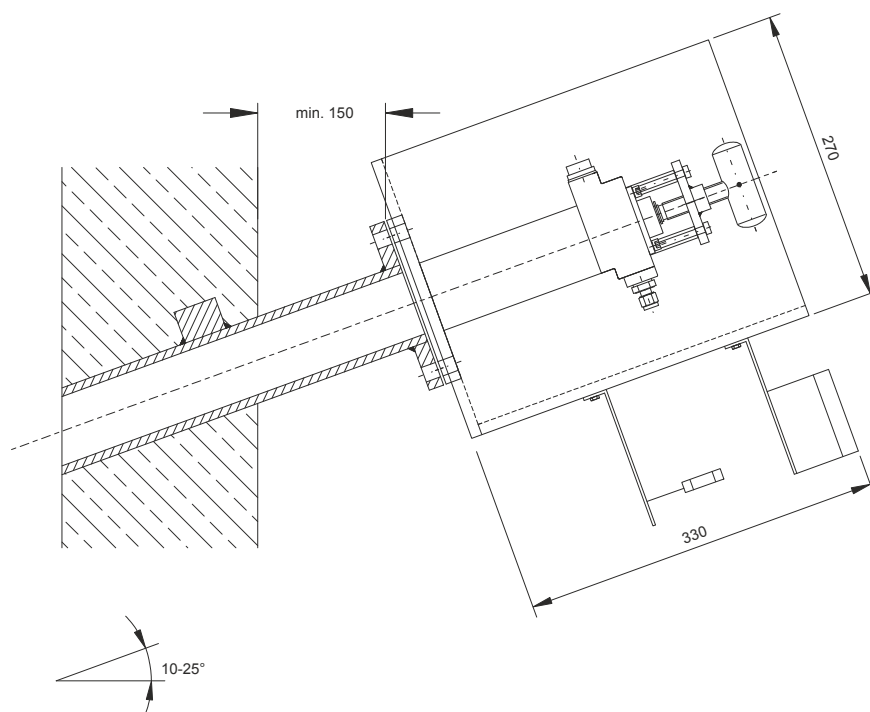
Connections on the stainless steel protective case of the PFE3 filter unit (dimensions in mm):



<b>1</b>	Tube, VA 1.4571, 6x1 mm
<b>2</b>	Tube, CU, 15x1 mm
<b>3</b>	Terminal box -X1 IP66
<b>4</b>	2 x M12x1.5 cable connectors
<b>5</b>	3 x M20x1.5 cable connectors
<b>6</b>	2 x M20x1.5 cable connectors
<b>7</b>	Tube, CU, 15x1 mm
<b>A</b>	Test gas connection with check valve, bulkhead fitting 6 mm
<b>B</b>	Back-purging of filter (max. 6 bar), bulkhead fitting 18 mm
<b>C</b>	Back-purging of filter surface and probe tube (max. 6 bar), bulkhead fitting 18 mm
<b>D</b>	Sample gas connection, male fitting 6 mm

## Mount the PFE3 filter unit on the wall tube

Carry out the assembly as shown in the following drawing (dimensions in mm):



## Connect the sample gas line

Connect the sample gas line to gas port **D** at the sample gas outlet of the filter unit by means of a clamp ring screw fitting.

### WARNING

Possible leakage!

When tightening the screw connection, relieve the pressure on the gas port, e.g. by holding back with a suitable spanner. Otherwise there is a danger that the gas port is twisted and becomes untight or breaks off.

## Connect the compressed air lines

If probe back-purging is available, connect the compressed air lines to gas ports **B** and **C**. Please note the maximum permissible pressure.

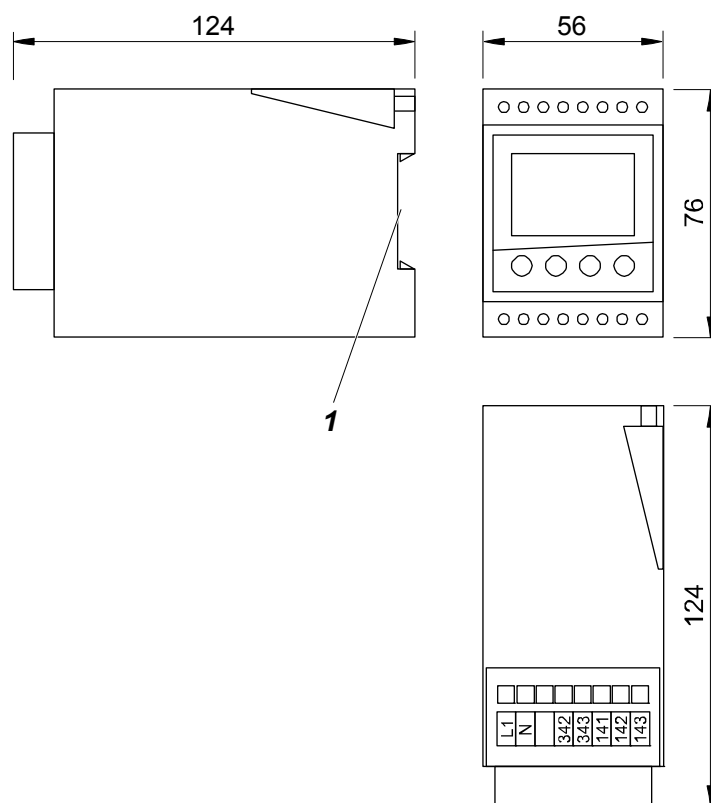
## Connect the test gas line

If test gas is to be fed in at the probe, connect the test gas line to gas port **A**.

## Assembly of the Temperature Controller

### Design of the temperature controller

(Dimensions in mm)



**1** Attachment for top-hat rail TS35

### Installation of the temperature controller

Step	Action
1	Install the temperature controller on the top-hat rail in the rail-mount housing.



## Electrical Installation

### Requirements and Procedures for Electrical Connection

**WARNING!**

Please observe the relevant national safety regulations for the construction and operation of electrical installations as well as the following safety instructions.

Before connecting the power supply, check that the operating voltage on the rating plate is the same as the mains voltage.

The protective-conductor terminal must be connected to a protective conductor before any other connections are set up.

The device can be dangerous if the protective conductor is interrupted inside or outside the device or the protective-conductor terminal is disconnected.

**WARNING!**

You must be able to disconnect the device from the power supply!

For this purpose, install a 2-pin mains isolator in the power supply line, since the device does not have its own power switch.

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**NOTE**

Lay the signal lines separate from the power supply lines. Carefully plan the combination of signal lines in cables.

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## What material is required?

Select the required line material as per the planning documents.

## Connect the signal lines

Step	Action
1	Unscrew the casing cover.
2	Push the cable through the conduits into the casing.
3	Connect the signal lines to the terminals according to the connecting diagrams, see sections Electrical Connections for Probe Tube Type 42 (page 26) Electrical Connections for the PFE2 Filter Unit (page 27) Electrical Connections for the PFE3 Filter Unit (page 34) Electrical Connections for the Temperature Controller (page 35)

## Connect the power supply

Before connecting the device:

- Check that the operating voltage on the rating plate is the same as the mains voltage.
- Ensure that the power supply leads are adequately fuse-protected (miniature circuit-breakers).
- Install either a mains isolator in the power supply leads or a switchable socket near the device, thus making it possible to disconnect all poles of the device and the switching units from the power supply if necessary.

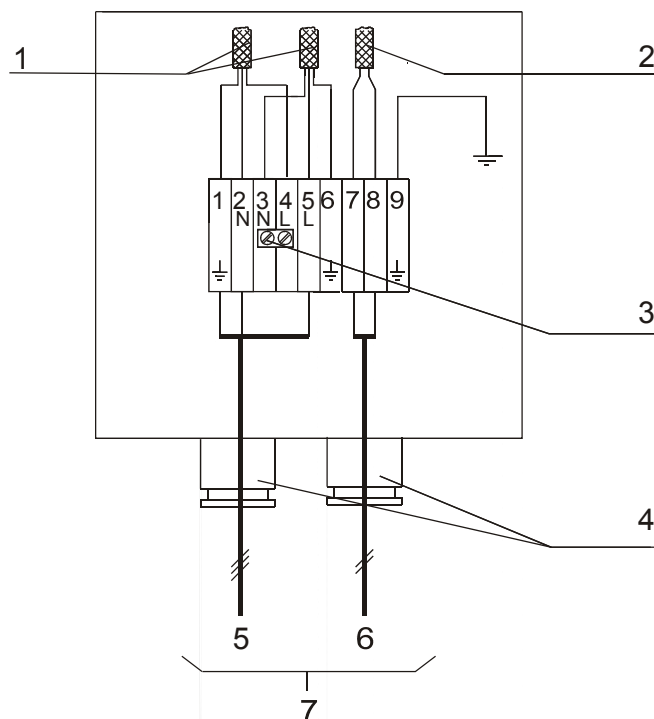
Connect the power supply as follows:

Step	Action
1	Push the cable through the conduits into the casing.
2	Connect the power supply leads to the terminals according to the connecting diagrams, see sections Electrical Connections for Probe Tube Type 42 (page 26) Electrical Connections for the PFE2 Filter Unit (page 27) Electrical Connections for the PFE3 Filter Unit (page 34) Electrical Connections for the Temperature Controller (page 35)
3	Put on the casing cover and screw it tight.
4	Connect the power supply leads to the power supply.

The gas sampling system can be put into operation after it has been connected to the power supply.

## Electrical Connections for Probe Tube Type 42

### Terminal assignment of the probe tube heater



The following table shows the individual connections of probe tube type 42 when using a probe FE2 without a protective case:

<b>1</b>	Heating
<b>2</b>	Temperature sensor Pt100
<b>3</b>	Bridge: Power supply 230 V terminals 3 + 4 (shown in the figure) Power supply 115 V terminals 2 + 3 / 4 + 5
<b>4</b>	M 20
<b>5</b>	Mains
<b>6</b>	Sensor
<b>7</b>	Connection for temperature controller

### Power consumption

The following table states the heating power for the 3 variants of probe tube type 42:

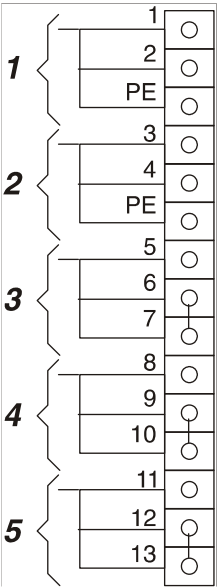
Length	Heating power
1,000 mm	400 W
1,500 mm	600 W
2,000 mm	800 W

Electrical Connections for the PFE2 Filter Unit Standard Version

Typical terminal assignment for PFE2 filter unit without protective case

NOTE:  
Please note the labeling in the terminal box.

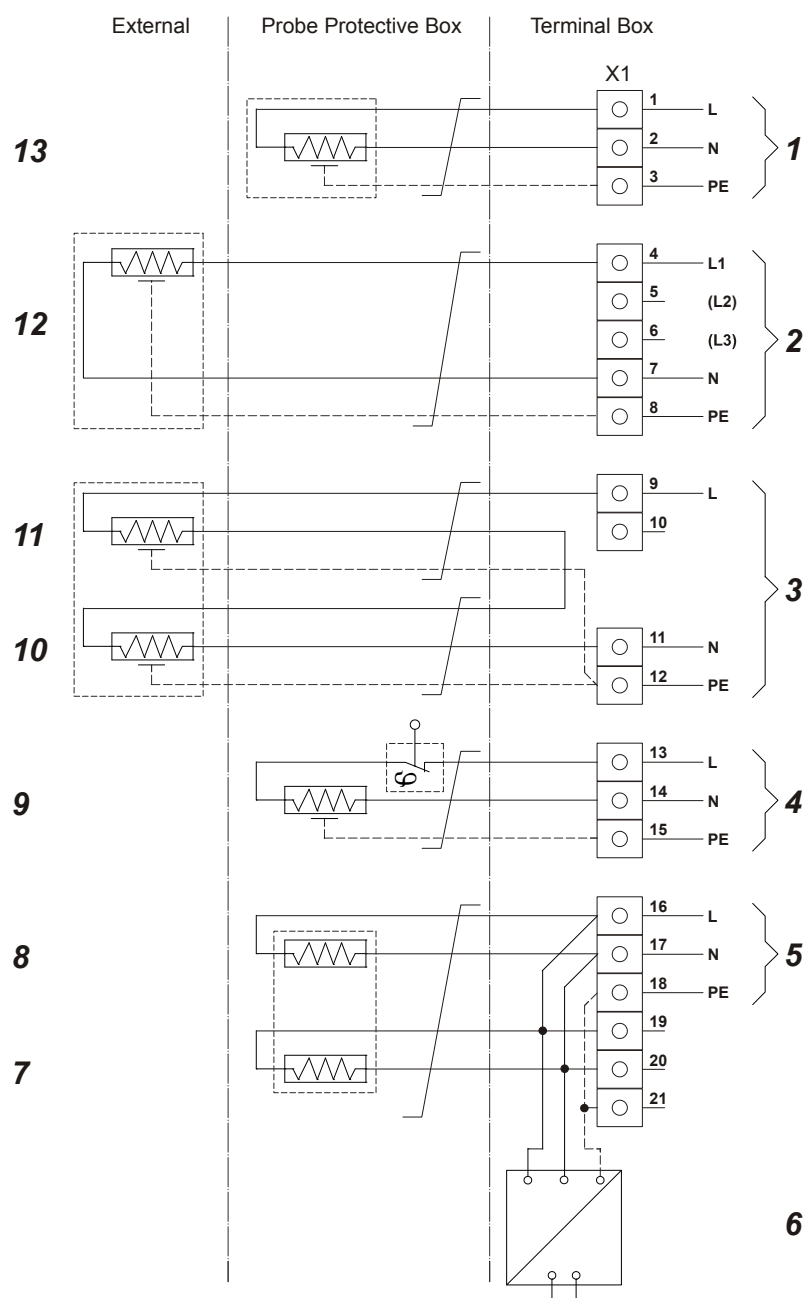
Terminal block of the PFE2 filter unit with regulated heating sleeve



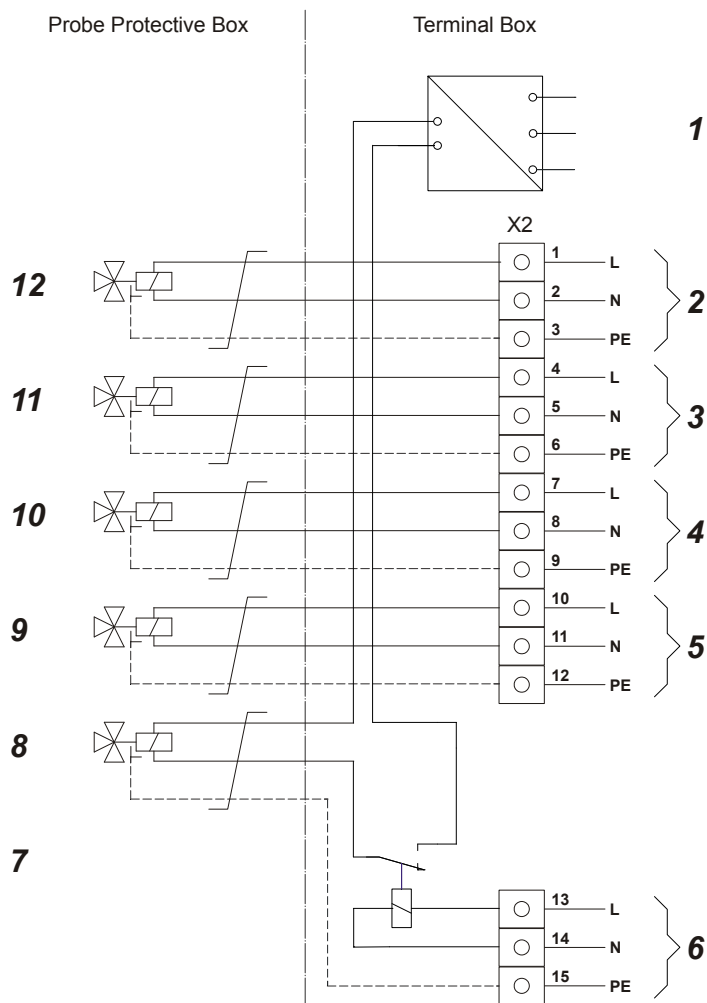
1	Filter heating
2	Sample gas line heating
3	1. Pt100 filter
4	1. Pt100 sample gas line
5	2. Pt100 filter fail-safe circuit

## Terminal assignment of PFE2 filter unit with protective case

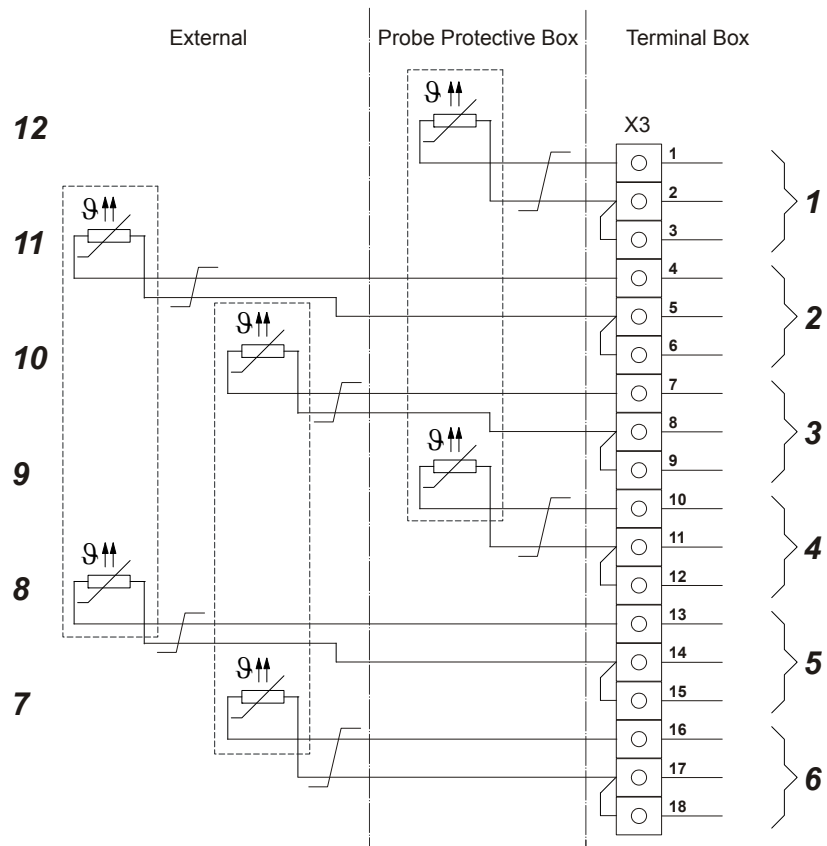
### Terminal block –X1



<b>1</b>	Supply for heating sleeve of filter unit, 230 or 115 VAC, 50...60 Hz, 250 W, to be fused by the customer with 6 A, regulation required!
<b>2</b>	Supply for sample gas line, Maximum line length with single-phase connection 230 VAC: < 35 m, 115 VAC: < 15 m, Maximum line length with three-phase connection 230 VAC: 35...60 m, 115 VAC: 15...40 m, 50...60 Hz, 90 W/m, to be fused by the customer with 16 A, regulation required!
<b>3</b>	Supply for heating of the probe tube, 115 VAC or 230 VAC, 50...60 Hz, max. 800 W, For connection to 115 VAC mains voltage, the heating elements -E3.1 and -E3.2 must be connected in parallel, to be fused by the customer with 6 A, regulation required!
<b>4</b>	Supply for anti-frost heater, 230 or 115 VAC, 50...60 Hz, 300 W, to be fused by the customer with 6 A
<b>5</b>	Supply for PTC elements and power supply unit for heated solenoid valve in the sample gas outlet, 230 or 115 VAC, 50...60 Hz, 250 W, to be fused by the customer with 6 A
<b>6</b>	Power supply unit
<b>7</b>	PTC element
<b>8</b>	PTC element
<b>9</b>	Anti-frost heater with temperature limiter (set at 30 °C)
<b>10</b>	Probe tube heating (-E3.1)
<b>11</b>	Probe tube heating (-E3.2)
<b>12</b>	Heated sample gas line
<b>13</b>	Heating sleeve of filter unit

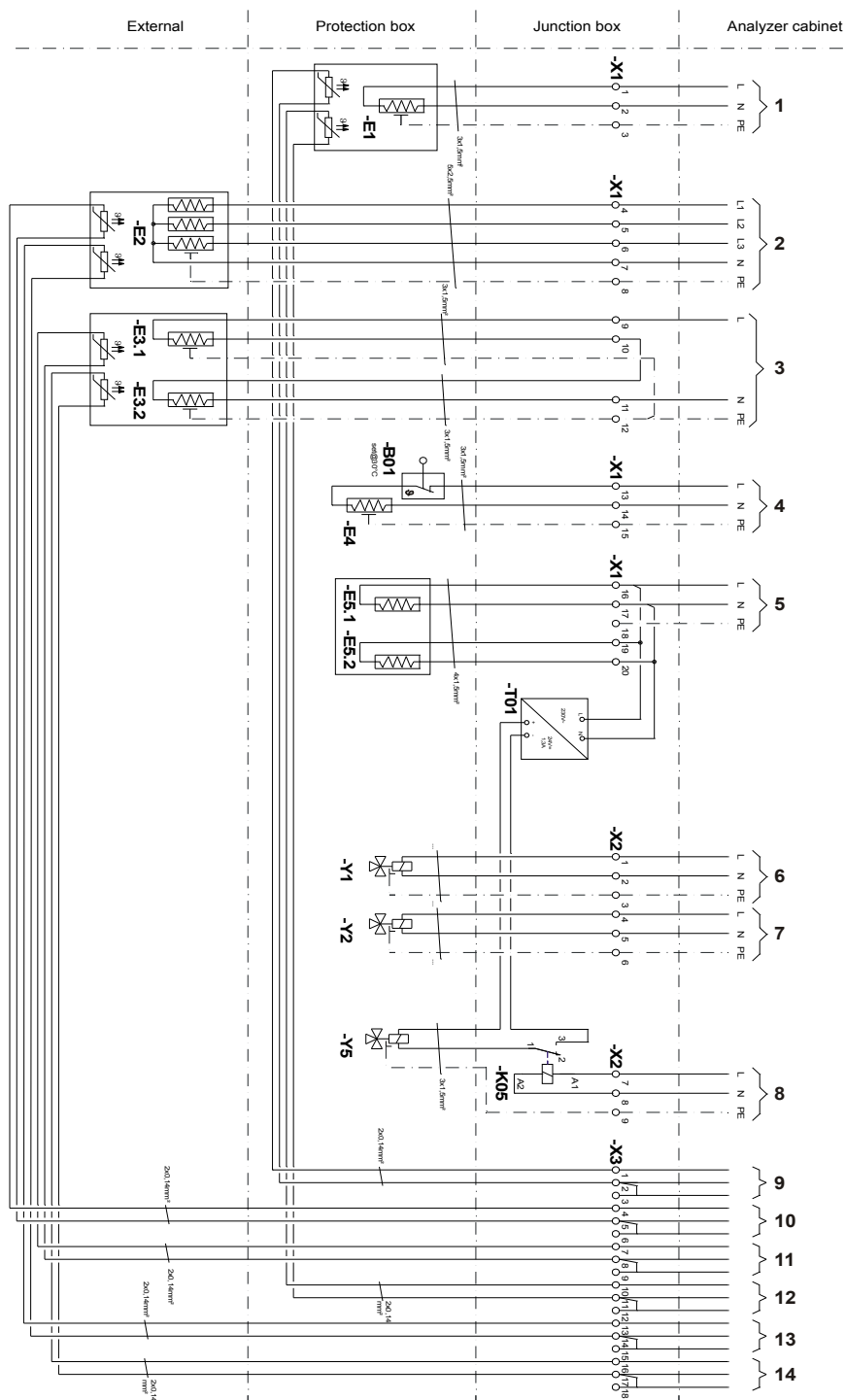
**Terminal block –X2**

<b>1</b>	Power supply unit
<b>2</b>	Supply for pilot valve -Y3.1 Clean filter surface and probe tube, 230 or 115 VAC, 50...60 Hz, 8 W, to be fused by the customer with 1 A
<b>3</b>	Supply for pilot valve -Y1.1 Pulsed instrument air, 230 or 115 VAC, 50...60 Hz, 8 W, to be fused by the customer with 1 A
<b>4</b>	Supply for pilot valve -Y2.1 Clean filter, 230 or 115 VAC, 50...60 Hz, 8 W, to be fused by the customer with 1 A
<b>5</b>	Supply for pilot valve -Y4 Venting, 230 or 115 VAC, 50...60 Hz, 8 W, to be fused by the customer with 1 A
<b>6</b>	Supply for relay -K05 for the activation of cutoff valve -Y5, 230 or 115 VAC, 50...60 Hz, to be fused by the customer with 1 A
<b>7</b>	Relay -K05
<b>8</b>	Cutoff valve -Y5
<b>9</b>	Pilot valve -Y4
<b>10</b>	Pilot valve -Y2.1
<b>11</b>	Pilot valve -Y1.1
<b>12</b>	Pilot valve -Y3.1

**Terminal block –X3**

<b>1</b>	Three wire connection for resistance thermometer Pt100 for filter unit of sample gas outlet
<b>2</b>	Three wire connection for resistance thermometer Pt100 for sample gas line
<b>3</b>	Three wire connection for resistance thermometer Pt100 for probe tube
<b>4</b>	Three wire connection for resistance thermometer Pt100 for filter unit of sample gas outlet (fail-safe circuit)
<b>5</b>	Three wire connection for resistance thermometer Pt100 for sample gas line (fail-safe circuit)
<b>6</b>	Three wire connection for resistance thermometer Pt100 for probe tube (fail-safe circuit)
<b>7</b>	Resistance thermometer Pt100 for probe tube
<b>8</b>	Resistance thermometer Pt100 for sample gas line
<b>9</b>	Resistance thermometer Pt100 for filter unit of sample gas outlet
<b>10</b>	Resistance thermometer Pt100 for probe tube
<b>11</b>	Resistance thermometer Pt100 for sample gas line
<b>12</b>	Resistance thermometer Pt100 for filter unit of sample gas outlet

## Electrical Connections for the PFE2 Filter Unit with Coaxial Valves





**Terminal block –X1**

<b>1</b>	Supply for heating sleeve of filter unit, 230 VAC, 50...60 Hz, 250 W, to be fused by the customer with 6 A, regulation required!
<b>2</b>	Supply for sample gas line, 230 VAC, 50...60 Hz, 90 W/m, max. 11 kW / 17 kW, to be fused by the customer with 16 A / 25 A, regulation required!
<b>3</b>	Supply for heating of the probe tube, 230 VAC, 50...60 Hz, max. 800 W, to be fused by the customer with 6 A, regulation required!
<b>4</b>	Supply for anti-frost heater, 230 VAC, 50...60 Hz, 300 W, to be fused by the customer with 6 A
<b>5</b>	Supply for PTC elements and power supply unit -G02 / heated solenoid valve in the sample gas outlet, 230 VAC, 50...60 Hz, 250 W, to be fused by the customer with 6 A
<b>-B01</b>	Temperature limiter (set at 30 °C)
<b>-E1</b>	Heating sleeve of filter unit
<b>-E2</b>	Heated sample gas line
<b>-E3</b>	Heated probe tube
<b>-E4</b>	Anti-frost heater
<b>-E5</b>	Heated check valve
<b>-T01</b>	Power supply unit

**Terminal block –X2**

<b>6</b>	Supply for solenoid valve -Y1 cleaning filter surface and probe tube, 230 VAC, 50...60 Hz, 8 W, to be fused by the customer with 1 A
<b>7</b>	Supply for solenoid valve -Y2 cleaning filter, 230 VAC, 50...60 Hz, 8 W, to be fused by the customer with 1 A
<b>8</b>	Supply for relay -K05 for the activation of cutoff valve -Y5, 230 VAC, 50...60 Hz, to be fused by the customer with 1 A
<b>-K05</b>	Relay
<b>-Y1</b>	Solenoid valve cleaning filter surface and probe tube
<b>-Y2</b>	Solenoid valve cleaning filter
<b>-Y5</b>	Cutoff valve

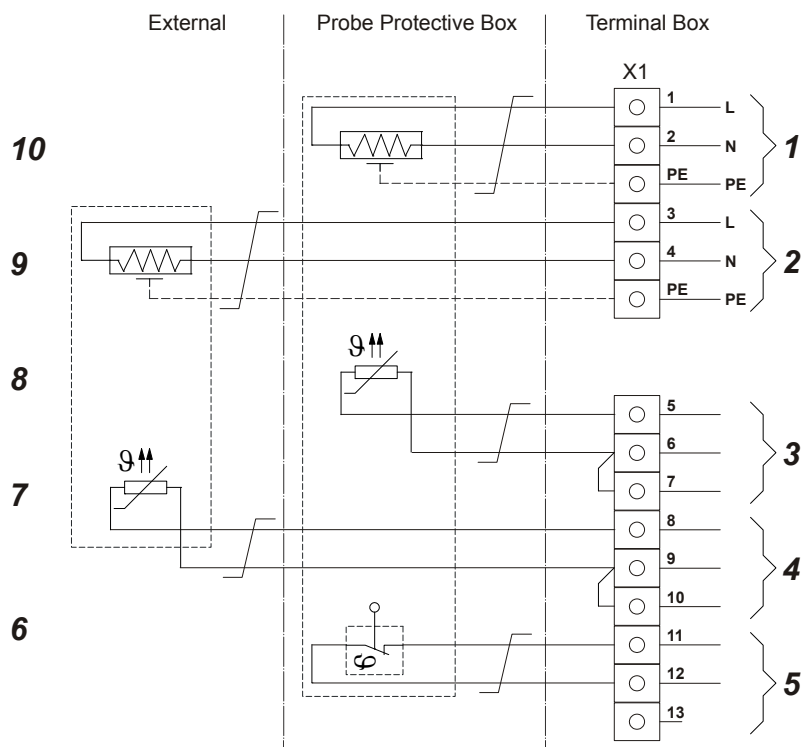
**Terminal block –X3**

<b>9</b>	Resistance thermometer Pt100 for filter unit of sample gas outlet -E1
<b>10</b>	Resistance thermometer Pt100 for sample gas line -E2
<b>11</b>	Resistance thermometer Pt100 for probe tube -E3
<b>12</b>	Resistance thermometer Pt100 for filter unit of sample gas outlet -E1 (fail-safe circuit)
<b>13</b>	Resistance thermometer Pt100 for sample gas line -E2 (fail-safe circuit)
<b>14</b>	Resistance thermometer Pt100 for probe tube -E3 (fail-safe circuit)

## Electrical Connections for the PFE3 Filter Unit

### Electrical connections

#### Terminal block –X1



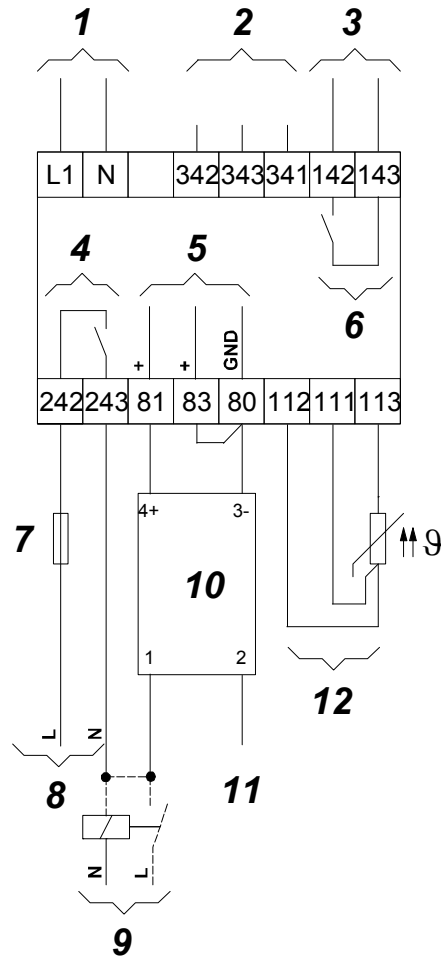
<b>1</b>	Supply for heated aluminum shells of the filter unit, 230 or 115 VAC, 50...60 Hz, 250 W, to be fused by the customer with 6 A
<b>2</b>	Supply for sample gas line, 230 or 115 VAC, 50...60 Hz, 90 W/m, max. 3600 W / 5700 W, to be fused by the customer with 16 A / 25 A, regulation required!
<b>3</b>	Three wire connection for resistance thermometer Pt100 for filter unit of sample gas outlet
<b>4</b>	Three wire connection for resistance thermometer Pt100 for sample gas line
<b>5</b>	Connection for temperature limiter
<b>6</b>	Temperature limiter (set at 140 °C) for surface of heated aluminum shells
<b>7</b>	Resistance thermometer Pt100 for sample gas line
<b>8</b>	Resistance thermometer Pt100 for filter unit of sample gas outlet
<b>9</b>	Heated sample gas line
<b>10</b>	Heated aluminum shells of the filter unit

## Electrical Connections for the Temperature Controller

### NOTE

With loads > 2 A, use a coupling relay.

Connect the temperature controller as shown in the following connection diagram:

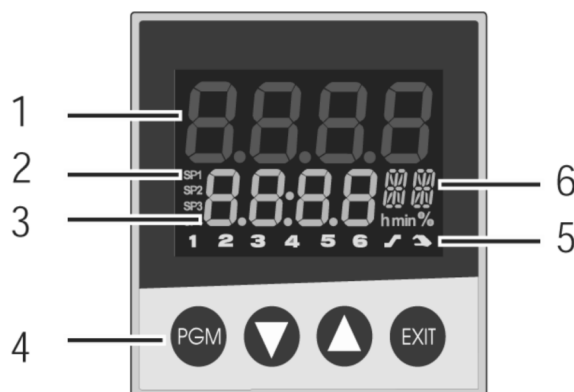


<b>1</b>	110...240 VAC, -15 / + 10%, 48...63 Hz
<b>2</b>	Unassigned connections 342, 343 and 341
<b>3</b>	Binary output 1
<b>4</b>	Alarm 2 limiter, max. 230 V / 3 A
<b>5</b>	0 / 12 V
<b>6</b>	Alarm 1 temperature, max. 230 V / 3 A
<b>7</b>	Fuse M2A
<b>8</b>	Binary output 2
<b>9</b>	Coupling relay, use for load current > 2 A
<b>10</b>	Solid state relay TYA 432-100/30
<b>11</b>	Load output
<b>12</b>	Resistance thermometer Pt100 DIN

## Operation of the Temperature Controller

### Operator Panel of the Temperature Controller

#### Operator panel of the temperature controller



<b>1</b>	7-segment display, red, four-digit Decimal place configurable (automatic adjustment on exceeding the display capacity) Basic setting: actual value
<b>2</b>	Display of active set point, green Basic setting: SP1 Possible display values: SP1, SP2, SP3, SP4 (SP = set point)
<b>3</b>	7-segment display, green, four-digit Decimal place configurable, is also used for the user guidance display of parameter and level symbols Basic setting: set point
<b>4</b>	Function keys
<b>5</b>	Signaling, yellow Display of: <ul style="list-style-type: none"> <li>▪ Switch positions of binary outputs 1...6</li> <li>▪ Ramp/program function active</li> <li>▪ Manual operation active</li> </ul>
<b>6</b>	16-segment display + units, green, two-digit Display of: <ul style="list-style-type: none"> <li>▪ Unit °C/°F</li> <li>▪ Characters for h, min and %</li> </ul>

## Operation of the Temperature Controller

### WARNING

Danger of damage to the regulated device!

You may not make any changes to set points and limits which do not comply with the specified use of the regulated device.

Alterations to the preset set points may therefore only be carried out by trained technical personnel.

### Existing settings

The temperature controller is configured in the factory for the temperature control application.

### Changing settings

### WARNING

Electric shock!


You must disconnect the voltage for the current circuit, in which the electrical equipment is integrated, when putting the device out of service. Otherwise there is a danger of electric shock.

If the pre-set limits have to be changed for structural reasons, you must proceed as described in the following. We recommend that you also refer to the separately enclosed Operator's Manual of the controller.

Step	Action
1	Remove the controller from the rail-mount housing.
2	Remove the hardware bridge between terminals 80 and 83.
3	Remove the level locking, as described in the section "Level locking".
4	Make any requisite changes to set points as described in the section "Selection of a function": <ul style="list-style-type: none"> <li>▪ Operator level OPr</li> <li>▪ Process data Proc</li> <li>▪ Configuration level Conf</li> <li>▪ Limit comparator LC</li> <li>▪ Alter alarm thresholds AL               <ul style="list-style-type: none"> <li>AL1 = temperature alarm</li> <li>AL2 = thermal cut-out</li> <li>SP1 = set point 1 - service temperature</li> </ul> </li> </ul>
5	Complete the input as described in the section "Input values".
6	Reinsert the wire jumper between terminals 80 and 83.
7	Reinstall the controller in the rail-mount housing.








## Level concept for operation

The operator functions and displays are divided into 3 levels.

Level	Description		
1	Standard display		
			
	The display is in the display mode.		
2	Selection level Here you can choose between: <ul style="list-style-type: none"> <li>▪ Operator level (Display: OPr)</li> <li>▪ Parameter level (Display: PArA)</li> <li>▪ Configuration level (Display: ConF)</li> </ul>		
3	Operator level (Display: OPr) Choice between <ul style="list-style-type: none"> <li>▪ Process data (Display: Proc)</li> <li>▪ User data: (Display: USEr)</li> <li>▪ Program data: (Display: Pro)</li> </ul>	Parameter level (Display: PArA) Choice between <ul style="list-style-type: none"> <li>▪ Set of parameters 1: (Display: PAr 1)</li> <li>▪ Set of parameters 2: (Display: PAr 2)</li> </ul>	Configuration level (Display: ConF) Choice between <ul style="list-style-type: none"> <li>▪ Analog inputs: (Display: InP)</li> <li>▪ Controller: (Display: Cntr)</li> <li>▪ Sensor: (Display: Pro)</li> <li>▪ Limit comparators Display: LC)</li> <li>▪ Outputs (Display: OutP)</li> <li>▪ Binary functions (Display: bi nF)</li> <li>▪ Display (Display: di SP)</li> <li>▪ Timer (Display: tFct)</li> <li>▪ Interfaces (Display: IntF)</li> </ul>

Note: if you do not press a key in the operator panel within 30 seconds, the device automatically switches back to the standard display mode.

## Selection of a function







Step	Action
1	<p>You are in the standard display: in another display:</p> <p>Go to Step 2. Press key  for more than 2 seconds to go to the standard display:</p>
2	Press key  to go to the selection level.
3	<p>Select the desired level with key  or key :</p> <p>OPr for the operator level</p> <p>PArA for the parameter level</p> <p>ConF for the configuration level</p>
4	Press key  to select one of these levels.
5	Select the desired function in the following level with  or key  .

## Level locking

Access to the individual levels can be locked by inputting a code number. The following values can be selected via the function keys:





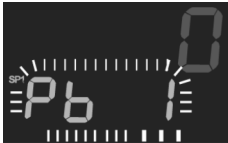




Code	Operator level	Parameter level	Configuration level
0	free	free	free
1	free	free	locked
2	free	locked	locked
3	locked	locked	locked

The preset default value for the code is "0".  
You can select one of the other codes as follows:

Step	Action
1	To input the code, simultaneously press  and  > 5 s.
2	<p>Start the code change with .</p> <p>Result: The display blinks.</p>
3	Select the code with  and  .
4	Return to the standard display with  .

## Input values

The symbol for the parameter is shown in the bottom display during input. Proceed as follows for the value input:

Step	Action
1	Select the parameter with  or  .
	
2	Change to the input mode with  . Result: The lower display blinks.
	
3	Change the value with  or  .
	The change is made dynamically through the length of the key press.
4	If you wish to apply the set value permanently: <ul style="list-style-type: none"><li>▪ Press  or</li><li>▪ wait 2 s.</li></ul> If you do not wish to apply the value: <ul style="list-style-type: none"><li>▪ Press .</li></ul>



## Automated Filter Cleaning

### Back-purging the Filter Element with Compressed Air

#### Purpose of the back-purging

Automated filter cleaning can be provided to maintain the operability of the filter unit. This is carried out by back-purging with pulsed compressed air. The dirt particles are detached from the filter surface by the pulsed compressed air and blown into the process area.

The following are considered in this chapter:

- The relevant connections for the respective filter unit.
- The recommended program runs for the pulsed compressed air.

#### Requirements for the compressed air

You require clean, oil- and grease free instrument air with a pressure level of 4 to 6 bar.

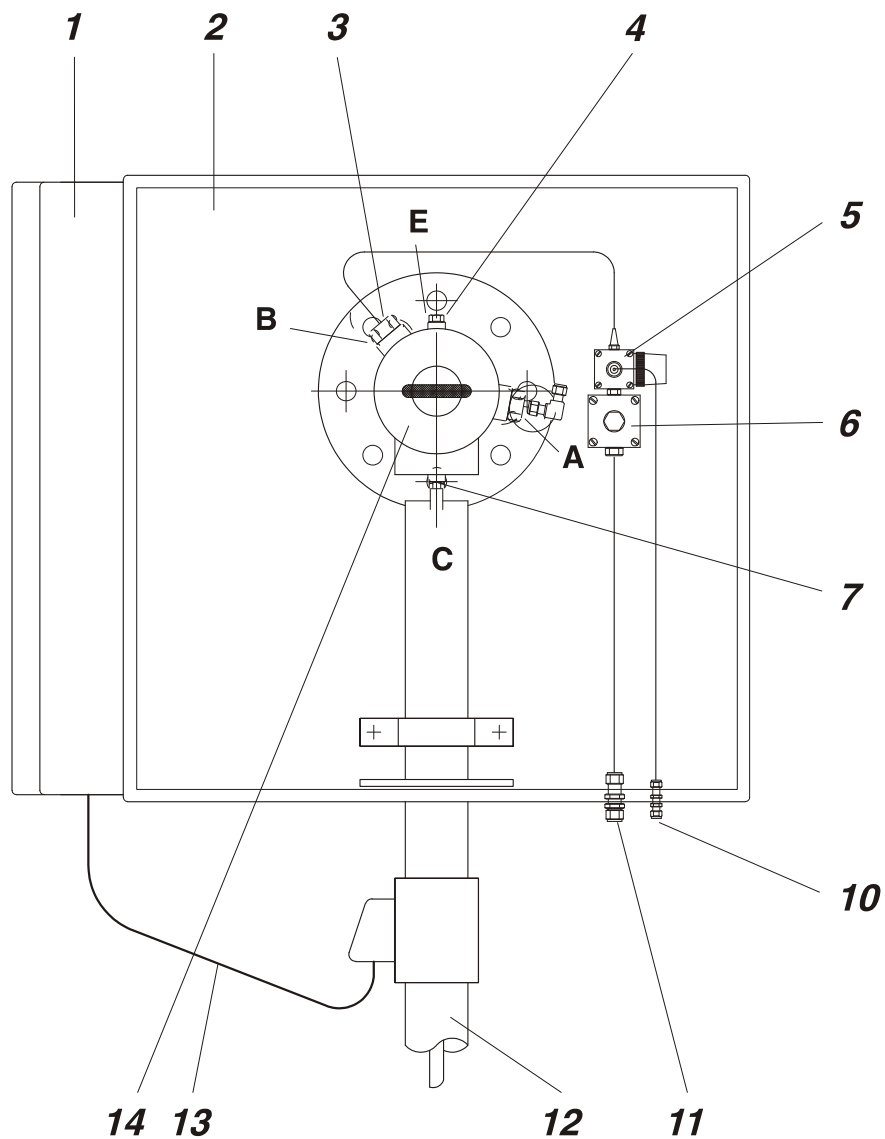
#### Cleaning intervals

Select the cleaning and maintenance intervals to suit your individual operating conditions.

Irrespective of your operational routine intervals, it is necessary to clean the filter when it becomes blocked by particles of dust, dirt or corrosion. These circumstances become apparent when there is a pressure drop at the sample gas outlet.

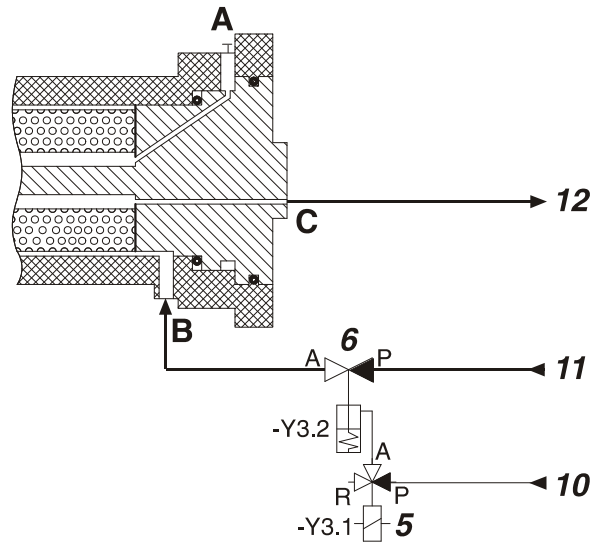
## Connection of the Optional Filter Cleaning (1-stage)

### Filter unit PFE2: Connections for back-purging (1-stage)



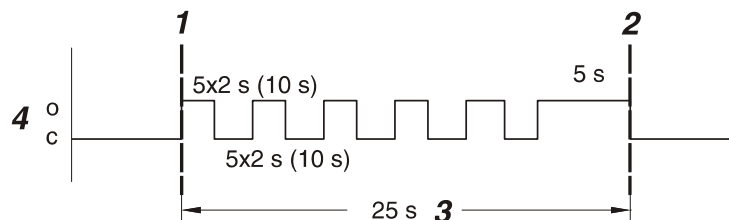
<b>1</b>	Terminal box
<b>2</b>	Protective case for the probe
<b>3</b>	B Bulkhead fitting (for compressed air 4...6 bar)
<b>4</b>	E plug, test gas connection
<b>5</b>	Pilot valve -Y3.1 for cleaning filter surface and probe tube
<b>6</b>	Diaphragm valve -Y3.2 for cleaning filter surface and probe tube
<b>7</b>	C Sample gas connection
<b>10</b>	Bulkhead fitting 6 mm control air 2...6 bar
<b>11</b>	Bulkhead fitting 12 mm compressed air 4...6 bar
<b>12</b>	Heated sample gas line
<b>13</b>	Power supply for heated line
<b>14</b>	FE2 filter unit

### Piping diagram for 1-stage back-purging



<b>5</b>	Pilot valve -Y3.1 for cleaning filter surface and probe tube
<b>6</b>	Diaphragm valve -Y3.2 for cleaning filter surface and probe tube
<b>10</b>	Control air 2...6 bar
<b>11</b>	Compressed air for back-purging 4...6 bar
<b>12</b>	Sample gas line

### Recommended program run for pulsed compressed air for 1-stage back-purging

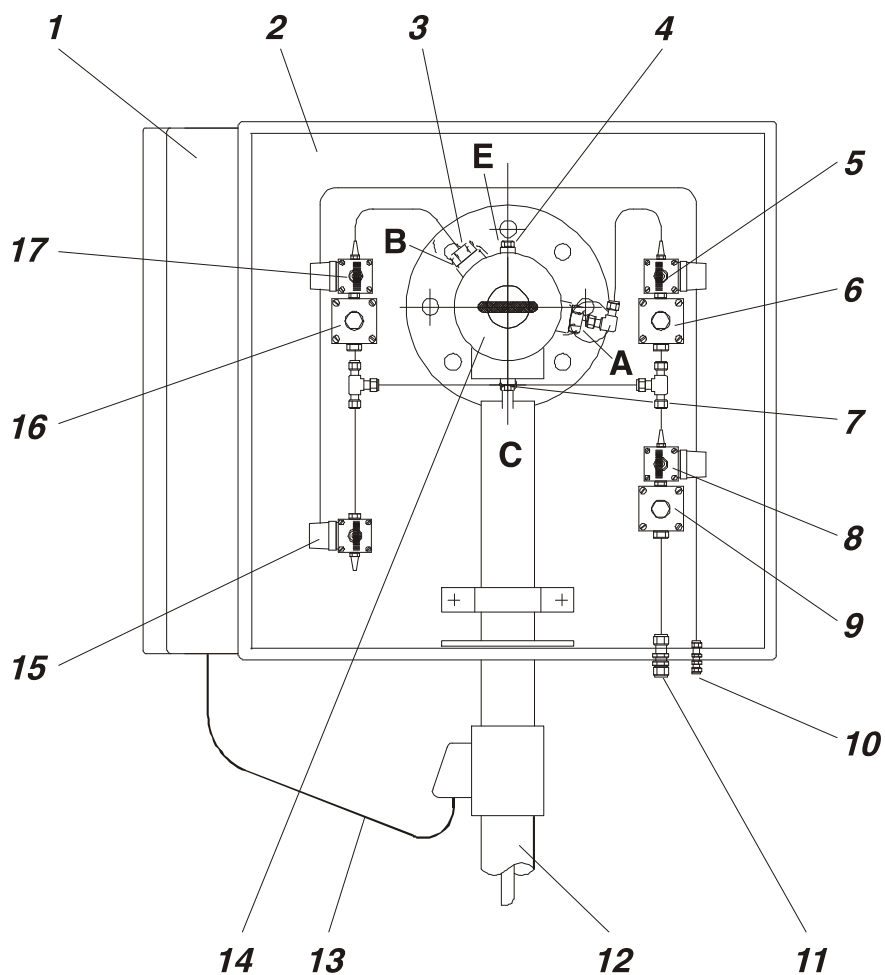


<b>1</b>	Start cleaning
<b>2</b>	End cleaning
<b>3</b>	Cleaning cycle
<b>4</b>	Pilot valve/diaphragm valve -Y3.1/-Y3.2 for cleaning filter surface and probe tube
<b>o</b>	Open
<b>c</b>	Closed

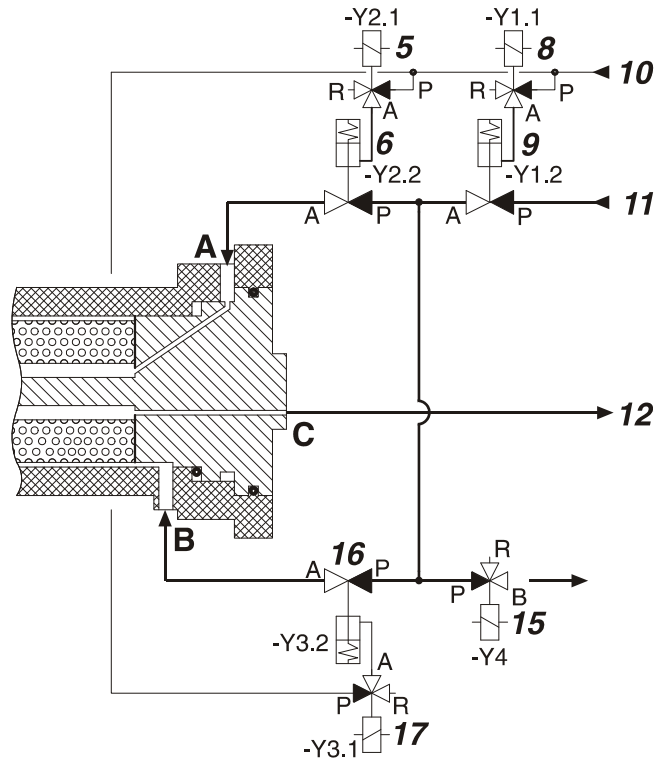
## Connection of the Optional Filter Cleaning (2-stage)

### Filter unit PFE2 standard version

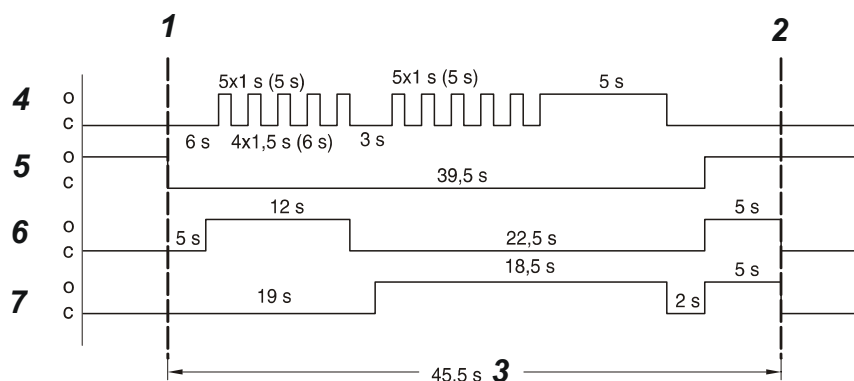
Connections for back-purging 2-stage



Piping diagram for 2-stage back-purging



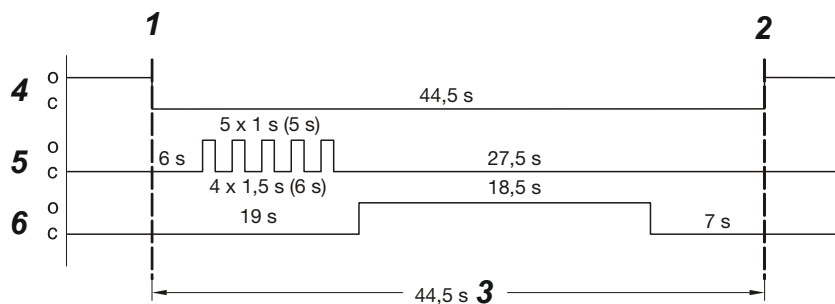
<b>1</b>	Terminal box
<b>2</b>	Protective case for the probe
<b>3</b>	B Bulkhead fitting (for compressed air 4...6 bar)
<b>4</b>	E plug, test gas connection
<b>5</b>	Pilot valve -Y2.1 for cleaning filter
<b>6</b>	Diaphragm valve -Y2.2 for cleaning filter
<b>7</b>	C Sample gas connection
<b>8</b>	Pilot valve for pulsed compressed air -Y1.1
<b>9</b>	Diaphragm valve for pulsed compressed air -Y1.2
<b>10</b>	Bulkhead fitting 6 mm control air 2...6 bar
<b>11</b>	Bulkhead fitting 12 mm compressed air 4...6 bar
<b>12</b>	Heated sample gas line
<b>13</b>	Power supply for heated line
<b>14</b>	FE2 filter unit
<b>15</b>	Solenoid valve for venting -Y4
<b>16</b>	Diaphragm valve -Y3.2 for cleaning filter surface and probe tube
<b>17</b>	Pilot valve -Y3.1 for cleaning filter surface and probe tube

**Recommended program run for 2-stage back-purging**

<b>1</b>	Start cleaning
<b>2</b>	End cleaning
<b>3</b>	Cleaning cycle
<b>4</b>	-Y1.1/-Y1.2: Pulsed compressed air
<b>5</b>	-Y4: Venting
<b>6</b>	-Y2.1/-Y2.2: For cleaning filter
<b>7</b>	-Y3.1/-Y3.2: For cleaning filter surface and probe tube
<b>o</b>	Open
<b>c</b>	Closed

**Filter unit PFE2 with coaxial valves****Connections**

see section "Mounting the PFE2 filter unit" (page 16)

**Recommended program run for 2-stage back-purging**

<b>1</b>	Start cleaning
<b>2</b>	End cleaning
<b>3</b>	Cleaning cycle
<b>4</b>	Cutoff valve -Y5
<b>5</b>	Solenoid valve for cleaning filter -Y2
<b>6</b>	Solenoid valve for cleaning filter surface and probe tube -Y1
<b>o</b>	Open
<b>c</b>	Closed

## Inspection and Maintenance

### Maintenance of the Filter Element of the FE2 Filter Unit

**WARNING**

Danger of burns!

The work described in this chapter requires specialist knowledge. As a result, it may only be carried out by persons who are qualified and specially trained. The metal parts may have high temperatures as a result of operation.

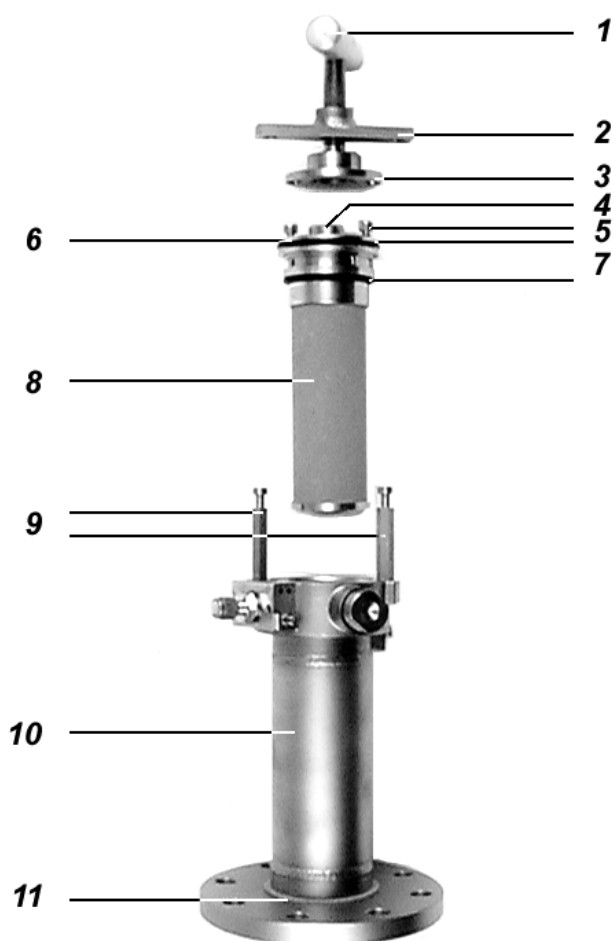
#### Interval for cleaning the filter element

The service life of the filter depends on the operating conditions. Remove it as required, so that you can visibly eliminate the dirt accumulation mechanically or exchange it.

If the filter stone is obviously damaged, replace it with a new one. The interval also depends on the operating conditions. You can determine this during operation.

## Components of the FE2 filter unit

(Photo similar to product)



<b>1</b>	T-handle
<b>2</b>	Bridge
<b>3</b>	Detaching disk
<b>4</b>	Locking screw
<b>5</b>	Removal screws
<b>6</b>	Flange
<b>7</b>	O-ring seals
<b>8</b>	Filter stone
<b>9</b>	Bridge holding device
<b>10</b>	Casing
<b>12</b>	Socket-head hex screw



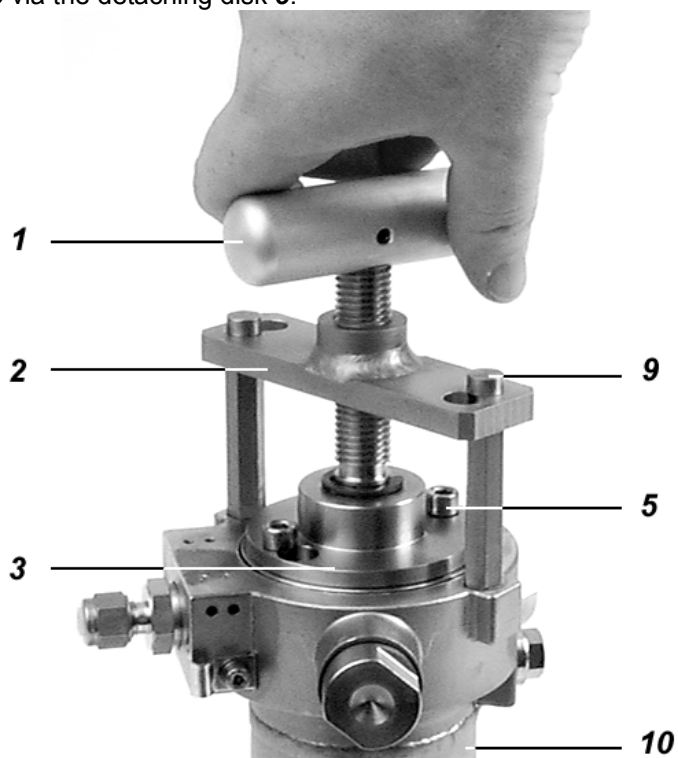
## Removing the Filter Element of the FE2 Filter Unit

### NOTE

Never undo or tighten up the hexagon screws 5! They have been adjusted at the factory, so that the detaching disk 3 can be easily moved.

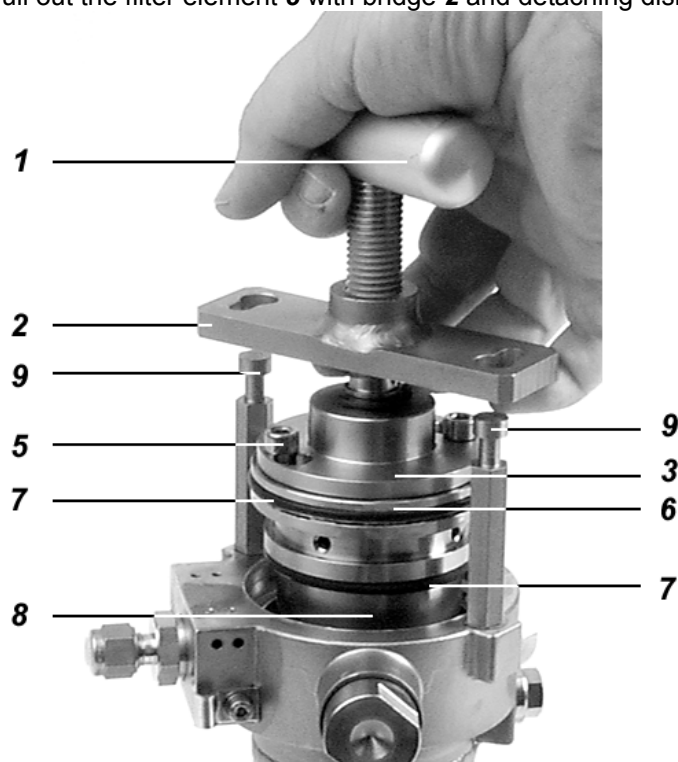
### Removing the filter element

Step	Action
1	Turn the T-handle <b>1</b> of the filter removal device <b>1–3</b> in a counter-clockwise direction. This pulls the filter element <b>8</b> out of the casing <b>10</b> via the detaching disk <b>3</b> .



2	Turn bridge <b>2</b> , until it can be pulled off the bridge holding device <b>9</b> through the elongated holes.
---	---

- 3 Pull out the filter element **8** with bridge **2** and detaching disk **3**.



- 4 Turn the detaching disk **3**, until it can be pulled off the hexagon screws **5** through the elongated holes.



## Removing the Filter Stone from the FE2 Filter Unit

### WARNING


Health hazard!

Dependent on the substances which it comes into contact with during operation, the filter element could be contaminated with toxic or corrosive substances. Always wear suitable protective clothing for cleaning work.

### Removing the filter stone from the filter element

To carry out this work, you require:

- Spanner NW 22
- Hexagon key
- A new filter stone (with new O-rings from the accessory set)

Step	Action
1	Screw off locking screw <b>4</b> with the spanner NW 22.
2	Screw out the locking screw <b>4</b> .
	
3	Screw out the hexagon socket screw <b>12</b> with the hexagon key.
4	Take out the filter stone.
5	Insert a new filter stone.
6	Replace the O-ring seals <b>7</b> if required.

## Installation of the Filter Element of the FE2 Filter Unit

### Installation of the filter element of the FE2 filter unit

To install the filter element **8**, carry out steps 1 to 4 (see section "Removing the Filter Element of the FE2 Filter Unit" (page 49)) in the reverse order.

## Cleaning the Filter Stone of the FE2 Filter Unit

### Cleaning the filter stone

**WARNING**

Health hazard!

Dependent on the substances which it comes into contact with during operation, the filter element could be contaminated with toxic or corrosive substances. Always wear suitable protective clothing for cleaning work.

Step	Action
1	Clean the filter stone <b>8</b> .
2	Replace the O-ring seals if required.
3	To install the filter element <b>8</b> , carry out steps 1 to 4 (see section "Removing the Filter Element of the FE2 Filter Unit" (page 49)) in the reverse order.

## Technical Data

### Probe Tubes

#### Permissible operating parameters

Sampling conditions	Type 40	Type 42 (heated)
Operating pressure $p_{abs}$	50...500 kPa (0.5...5.0 bar)	200 kPa (2 bar)
Operating temperature	Stainless steel material no. 1.4571: max. 450 °C Stainless steel material no. 1.4571 (coated): max. 180 °C Stainless steel material no. 1.4893: max. 900 °C Silicone carbide (max. length 1.000 mm): max. 1300 °C	max. 200 °C
Heating temperature	–	max. 200 °C, regulated
Flow rate	max. 300 l/h	max. 250 l/h
Velocity of flow	max. 12 m/s	max. 12 m/s (> 1,000 mm: max. 7 m/s)
Pressure drop	approx. 10 hPa (mbar) at 30...90 l/h flow	approx. 10 hPa (mbar) at 30...90 l/h flow

### Filter Units

#### Process gas sampling conditions

Pressure $p_{abs}$	50...600 kPa (0.5...6 bar)
Temperature	max. 200 °C (coated 180 °C <sup>1)</sup> )
Flow rate	30...500 l/h, relative to 100 kPa (1 bar) and 0 °C
Pressure drop	approx. 0.6 hPa at 100 l/h
Dust content	max. 3 g/m <sup>3</sup> (application recommendation), max. 40 g/m <sup>3</sup> with probe tube type 40 with purging facility <sup>1)</sup>
	1) only FE2 and PFE2

#### Filter characteristics

Filter fineness	0.3 µm
Seal integrity	10 <sup>-4</sup> hPa l/s

#### Environmental conditions

Ambient temperature	-20...+45 °C
Degree of protection of case	IP54

## Putting out of Service and Packing

### Putting out of Service

**WARNING**

Danger of burns!

The work described in this chapter requires specialist knowledge. As a result, it may only be carried out by persons who are qualified and specially trained. The metal parts may have high temperatures as a result of operation.

**WARNING**

Electric shock!

You must disconnect the voltage for the current circuit, in which the electrical equipment is integrated, when putting the device out of service. Otherwise there is a danger of electric shock.

**WARNING**

Health hazard!

Dependent on the substances which it comes into contact with during operation, the filter element could be contaminated with toxic or corrosive substances. Always wear suitable protective clothing for cleaning work.

### Putting the gas sampling system out of service

Step	Action
1	Clean the filter (see Chapter "Inspection and Maintenance" (page 47)).
2	Disconnect the power supply to the gas sampling system.
3	Remove the gas sampling system from the assembly flange of the bushing tube and hermetically seal the assembly flange with a blind flange.
4	Hermetically seal the connections of the gas sampling system.

## Disposal

### Disposing of the filter stone

Depending on the service conditions, the filter stone could be contaminated with dangerous substances. Depending on the contamination, the filter stone must be disposed of according to good professional practice and in accordance with the currently applicable statutory regulations.

## Packing for Return

### Packing the probe tube or filter unit

- 1 If the original packing material is no longer available, wrap the device in bubble foil or corrugated cardboard. When shipping overseas, also heat-seal the device air-tight in 0.2 mm thick polyethylene, including a desiccant (e.g. silica gel). The amount of desiccant used should be adequate for the package volume and the probable shipping time (at least 3 months).
- 2 Pack the device in an adequately large box lined with shock absorbent material (e.g. foam material). The thickness of the cushioning material should be adequate for the weight of the device and the mode of shipping. The box should also be lined with a double layer of bitumen paper for overseas shipping.
- 3 Mark the box "Fragile! Handle with care!".

## Index

### A

Assembly • 10, 11  
Assembly of the Temperature Controller • 22  
Automated Filter Cleaning • 41

### B

Back-purging the Filter Element with  
Compressed Air • 41

### C

Choosing the Sampling Point • 9  
Cleaning the Filter Stone of the FE2 Filter Unit  
• 52  
Connection of the Optional Filter Cleaning (1-  
stage) • 42  
Connection of the Optional Filter Cleaning (2-  
stage) • 44

### D

Disposal • 54

### E

Electrical Connections for Probe Tube Type 42  
• 5, 25, 26  
Electrical Connections for the PFE2 Filter Unit  
Standard Version • 5, 25, 27  
Electrical Connections for the PFE2 Filter Unit  
with Coaxial Valves • 32  
Electrical Connections for the PFE3 Filter Unit  
• 5, 25, 34  
Electrical Connections for the Temperature  
Controller • 5, 25, 35  
Electrical Installation • 24

### F

Filter Units • 53

### G

Grounding conductor • 7  
Guide for the Installation • 5

### I

Information on the Installation of the Wall Tube  
• 9, 10, 12, 13  
Inspection and Maintenance • 47, 54  
Installation of the Filter Element of the FE2  
Filter Unit • 52  
Installing Probe Tube Type 40 • 5, 12  
Installing Probe Tube Type 42 • 5, 13  
Intended application • 7

### M

Maintenance of the Filter Element of the FE2  
Filter Unit • 47  
Mounting the FE2 Filter Unit • 5, 14  
Mounting the PFE2 Filter Unit • 5, 15, 16, 46  
Mounting the PFE3 Filter Unit • 5, 19, 20

### O

Operation of the Temperature Controller • 36,  
37  
Operator Panel of the Temperature Controller •  
36

### P

Packing for Return • 55  
Preamble • 4  
Preparing for Installation • 5, 9  
Probe Tubes • 53  
Putting out of Service • 54  
Putting out of Service and Packing • 54

### R

Removing the Filter Element of the FE2 Filter  
Unit • 49, 52  
Removing the Filter Stone from the FE2 Filter  
Unit • 51  
Requirements and Procedures for Electrical  
Connection • 5, 24

### S

Safety Information • 6, 7  
Specified Use • 6  
Structure and Function • 9

### T

Technical Data • 5, 53

### U

Unpacking • 5, 11





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