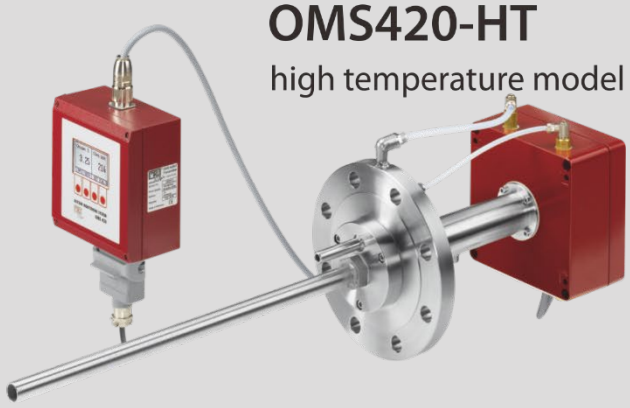
MRU since 1984 ®
AIRfair
EMISSION MONITORING SYSTEMS

OMS420 - Oxygen measuring system

MANUAL PART 2
MAINTENANCE / OPTIONS

OMS420
compact model

OMS420-RT
remote control model



OMS420-HT
high temperature model

62788-2EN

Inhalt

1. INTRODUCTION

1.1. The company MRU GmbH

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V1.41.EN 20260504

2. Safety instructions

	**⚠ DANGER** Identifies an immediate, impending hazard that, if ignored, will result in severe bodily injuries or death.
	**⚠ WARNING** Identifies an immediate, impending hazard that, if ignored, may result in severe bodily injuries, material damage or death.
	**⚠ CAUTION** Identifies a possibly dangerous situation that, if ignored, may result in minor injuries.
	***ATTENTION*** Identifies a possibly harmful situation that, if ignored, may result in damages to the device or its surroundings.
	**NOTE** Identifies user tips and other especially important information.

2.1. Basic safety instructions

- The O2 probe may only be used in original, undamaged condition and in accordance with the operation manual.
- All individuals dealing with the installation, commissioning, operation and maintenance of the analyser or probe must be qualified to do so and must strictly observe this operation manual.
- Unauthorized modifications to any part of the analyser or probe can create safety risks and are not permitted.
- Power other than that specified in this manual must never be provided to the probe.
- Service of transmitter electronics by non-skilled personnel is not allowed.
- Do not allow condensate to come into contact with the sensors.
- Do not attempt to clean the probe with water.
- The probe shall not be used in under-stoichiometric combustion conditions, due to the possible presence of flammable gases, eventually over the LEL (low explosion level).
- Power must always be provided to the probe, even during boiler shutdown, to prevent the formation of condensate which can damage the sensors.
- Do not use the probe for any purpose other than that specified in this manual.

- Exposure to corrosive gases such as silicone vapor, alkaline and heavy metals, P, Pb, high SO2, etc. will shorten the lifetime of the sensors.
- ***It is mandatory for the user to ensure that all people operating this equipment are properly trained in its operation and fully understand the operating principles of the equipment.***
- ***MRU GmbH, its affiliates, and agents cannot be held responsible in any way for damage or injuries resulting from improper use, misuse or neglect in operating this equipment.***

⚠ CAUTION

Probes installed inside flue ducts and stacks operate at elevated temperatures (often 1.000° F and higher) create danger of serious skin burns to operators if proper handling precautions and extreme care are not taken.

2.2. Intended use

The OMS420 is an In-Situ Oxygen measurement device designed for continuous oxygen and CO measurement in industrial combustion plants.
The OMS420 has the follow features:

- Compact, reliable and rugged industrial design.
- Special reference air not required (uses ambient by natural diffusion).
- True wet gas analysis and calculation of dry oxygen level if humidity of gas is known.
- Fast response time.
- Low energy consumption for both O2 and COe sensors.
- Microcontroller based electronics with backlit, graphic LCD display.
- Linearized, galvanic isolated 4 - 20 mA signal outputs for both O2 and COe.
- RS485 galvanic isolated digital data transfer (Modbus protocol RTU).
- Field replaceable transmitter
- Fast, safe and easy servicing by a single technician without removing the probe from the stack
- Dust tight and water proof enclosure IP65 (NEMA 4)
- Easy operation and maintenance

The OMS420 is used for continuous oxygen and combustion measurements. The combustion process can be optimized through the OMS420-system.

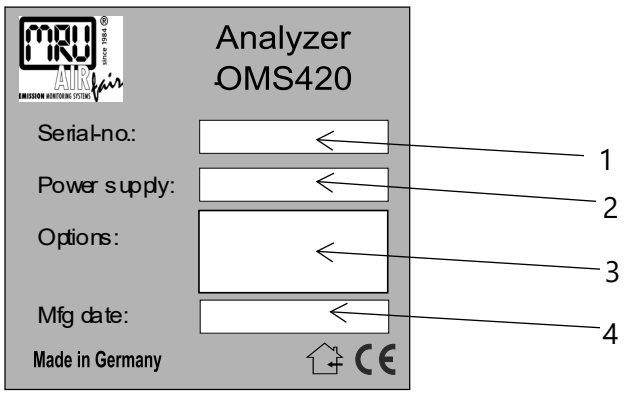
3. Product specification

Follow parts are explained in this chapter:

- Device setup.
- Type plate.
- Principe of measurement.
- Order of supply.
- Necessary materials.
- Dimensions and description of different parts,
- Mounting space.

3.1. Type plate

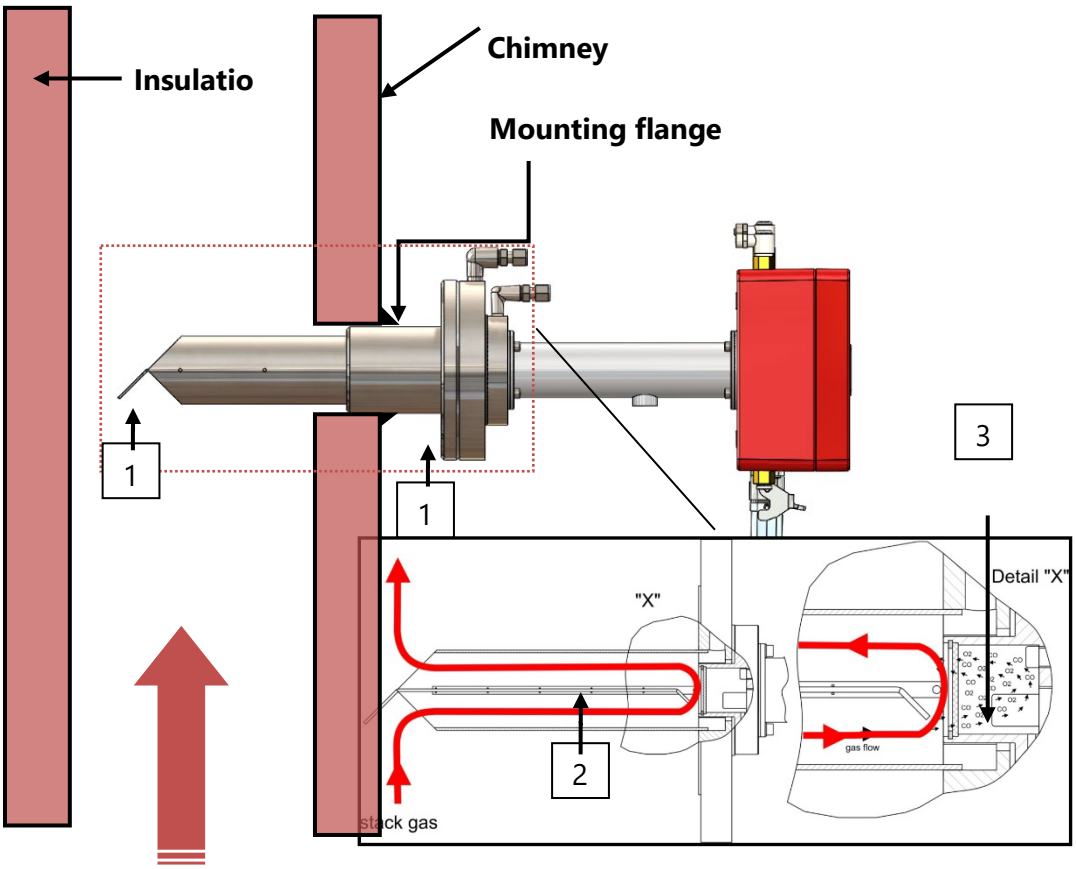
The nameplate is located on the side of the analyzer housing or, if a transmitter unit is present, on the side of the transmitter. The figure below shows the structure of the nameplate:



1	Serial-number	**3**	Installed options: O2 / Coe / Autocal.
2	Main supply: OMS420-N=24VDC OMS420-RT=100…230VAC / 50…60 Hz	**4**	Date of manufacture

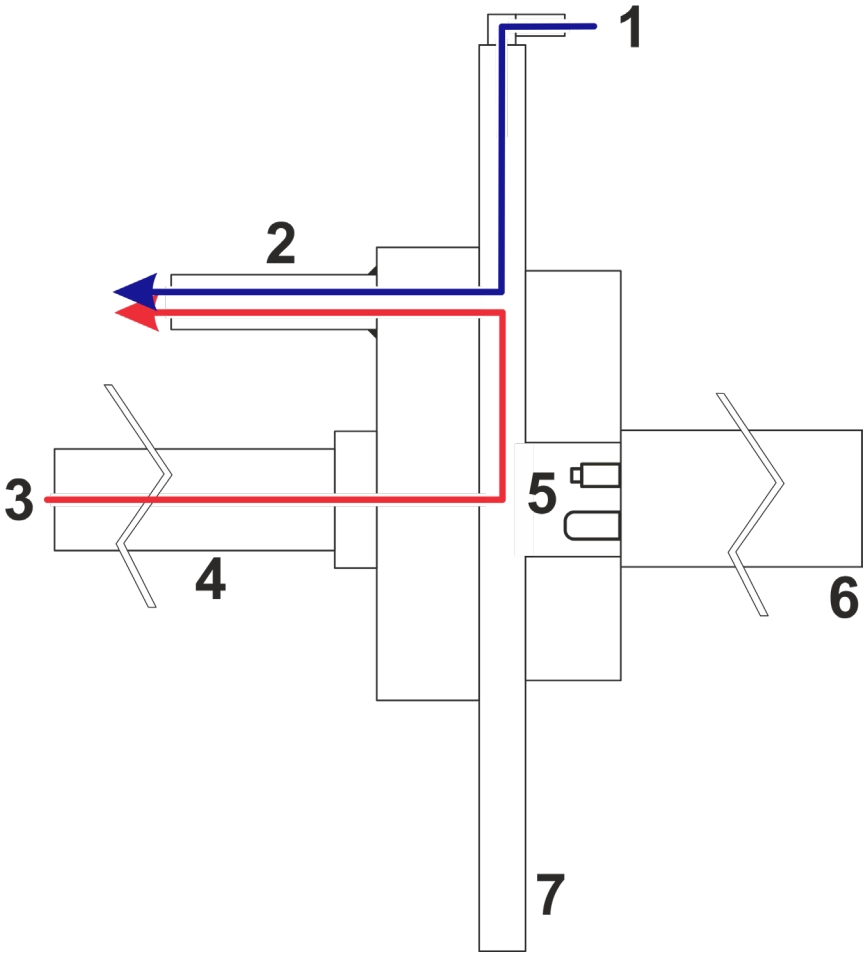
3.2. General device structure

The OMS420-Assembly is an In-situ measurement. This means, that the gas sensors come directly in contact with the sample gas and no gas preparing will be done. The advantage is a short reaction time. It is important, that the sample-gas is above the dewpoint and acid dewpoint temperature, to prevent condensation in the sensor-chamber.
The sketch below shows the measuring principle of an In-Situ measurement:



1	The mounting takes place with a common flange-connection. The peak of the half plate, inside the stack shows at the sample-gas direction. This cause, that the sample-gas is flowing through the probe, without any resistance.
2	Inside the probe is a metal plate, which shares the probe into two parts. It is a kind of a baffle plate.
3	The sensor-chamber is at the flange side, of the probe. In this sensor-chamber is the O2 sensor and the COe sensor. The sensor chamber is protected with a sinter-filter.

3.3. Strahldüse OMS420-HT

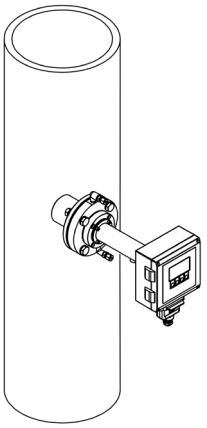


#	Beschreibung
1	Druckluftstrom (blau)
2	Strahldüse
3	Messgasstrom (rot)
4	Entnahmerohr
5	Messtechnik
6	Montagerohr zur elektronischen Steuerung
7	Montageflansch

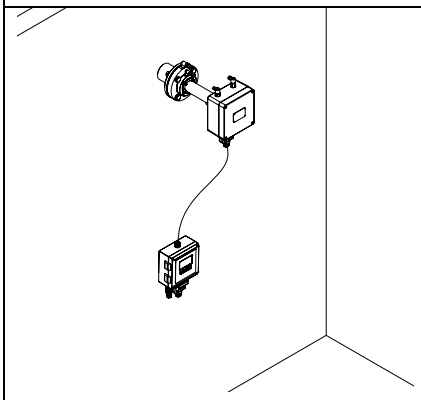
Damit das Messgas (3) besser angesaugt wird, wird ein Druckluftstrom (1 in Blau) durch die Strahldüse (2) in den Kamin eingeschossen. Die Sogwirkung des Luftdrucks (1) führt zur Ansaugung des Messgases (3 in Rot) in den Bereich der Messtechnik (5), so dass die Messung des Gases aus dem Kamin vorgenommen werden kann.

3.4. Overview and structure

The chart below shows the OMS420-models:

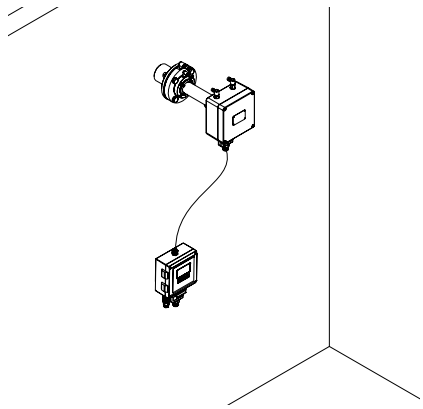


Model	OMS-420N
Power supply	24 VDC / 4A
Back purge function	✘
Operation unit	Inside Probe
4...20 mA O2:	✓
4...20 mA COe:	✓
RS485 O2:	✓
RS485 COe:	✓ (optional)
Calibration input:	✓
Auto-calibration	✘



- Oxygen combustion.
- Not easily accessible places for example stackmounting

Model	OMS-420-RT
Power supply	100...230 VAC / 50...60 Hz
Back purge function	✘
Operation unit	Separate operation unit
4...20 mA O2:	✓
4...20 mA COe:	✓
RS485 O2:	✓
RS485 COe:	✓ (optional)
Calibration input:	✓
Auto-calibration	✘

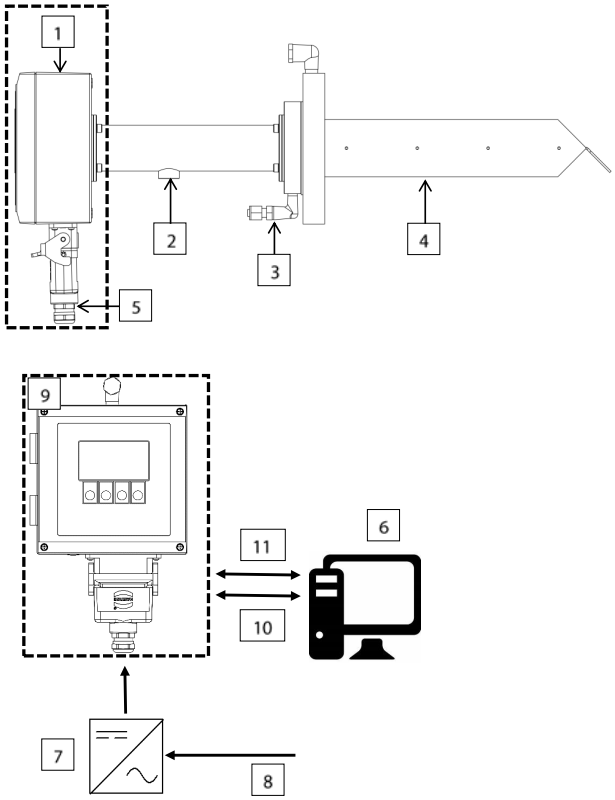


- Unclean areas.
- Not easily accessible places for example stackmounting

Model	OMS-420-RT with back purge function
Power supply	100...230 VAC / 50...60 Hz
Back purge function	✓
Operation unit	Separate operation unit
4...20 mA O2:	✓
4...20 mA COe:	✓
RS485 O2:	✓
RS485 COe:	✓ (optional)
Calibration input:	✓
Auto-calibration	available (Option: PU420)

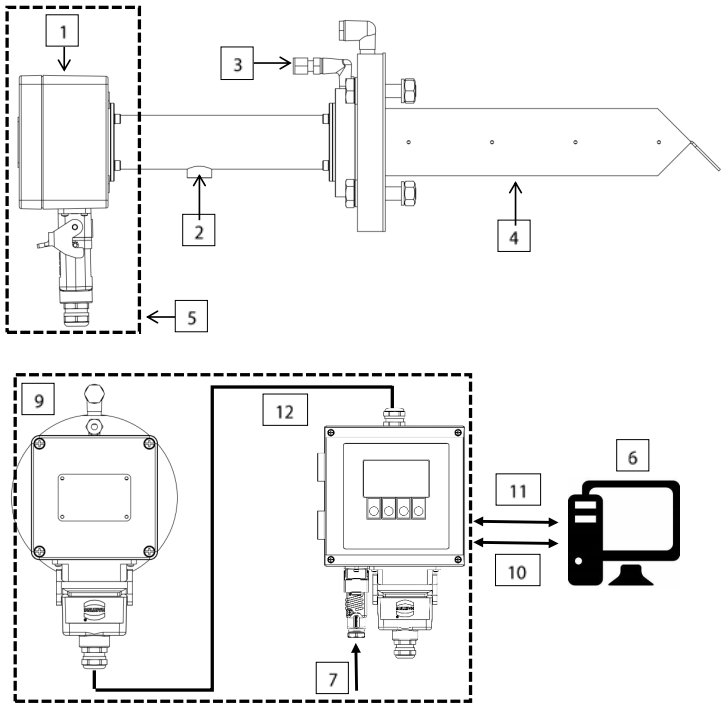
3.5. Schematic layout: OMS420 models

OMS420-N



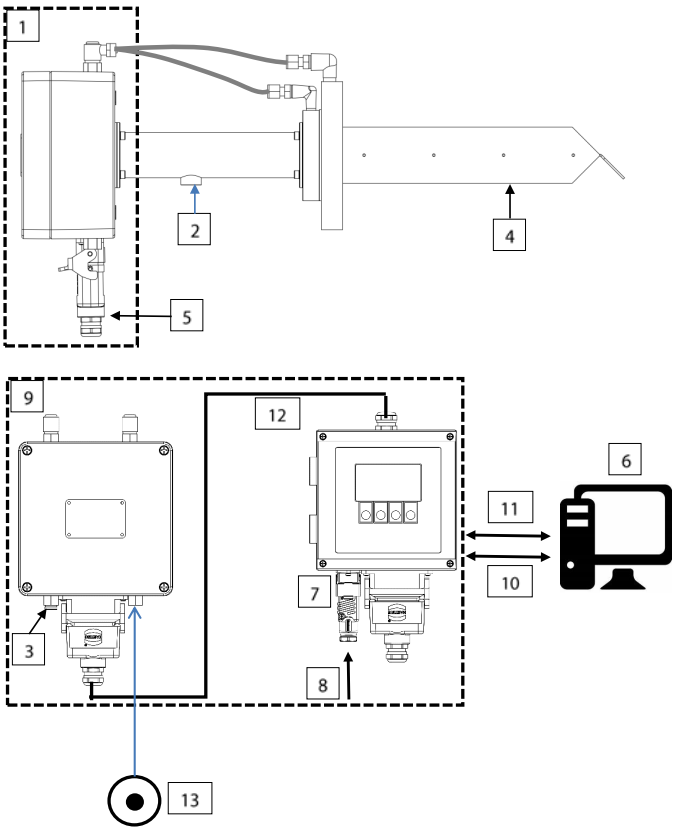
1	Operation unit	5	Plug 10-pin	9	Operation unit (front view)
2	Reference access for sensors	6	Controlroom	10	4...20 mA O2 / CO
3	Adjustment input	7	24 VDC-power supply	11	RS 485 O2 / CO
4	Probe	8	Main power supply		

1.1.1 OMS420-RT



1	Operation unit	5	Plug 10-pin	9	Operation unit (front view)
2	Reference access for sensors	6	Controlroom	10	4...20 mA O2 / CO
3	Adjustment input	7	110...230 VAC plug	11	RS 485 O2 / CO
4	Probe	8	Main power supply	12	Communication cable

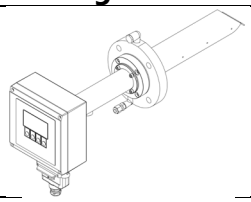
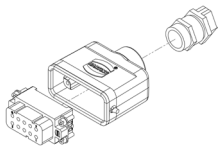
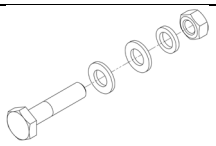
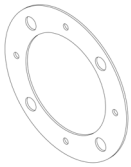
OMS420-RT back-purge function



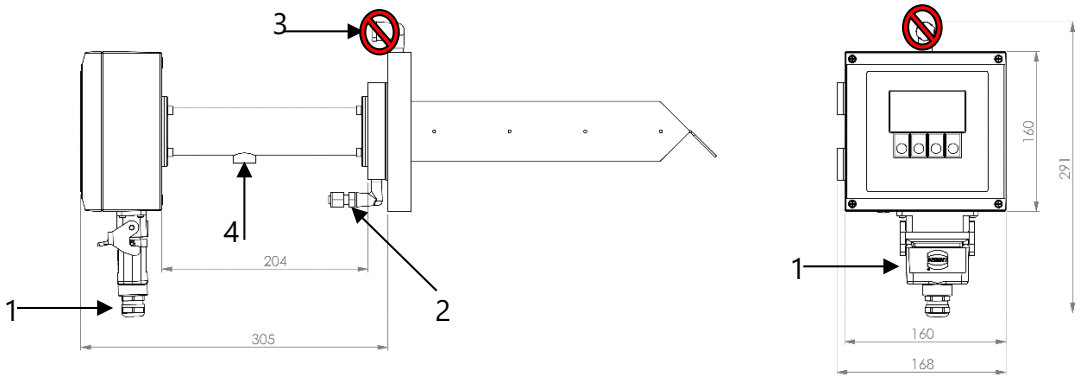
1	Operation unit	5	Plug 10-pin	9	Operation unit (front view)
2	Reference access for sensors	6	Controlroom	10	4…20 mA O2 / CO
3	Adjustment input	7	110…230 VAC plug	11	RS 485 O2 / CO
4	Probe	8	Main power supply	12	Communication cable
				13	Compressed air net 6…8 bar

3.6. Lieferumfang

OMS420-N

Abbildung	Beschreibung	Menge
	Main device: OMS420	1
	Plug for data and power supply (x1)	1
	Assembly screw set (x4)	4
	Seal (x1)	1

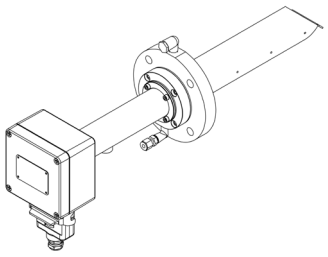
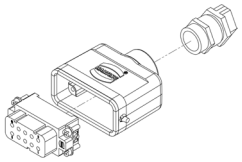
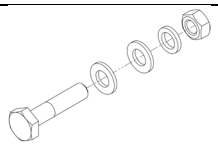
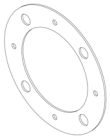
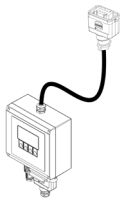
Dimensions/Assigment



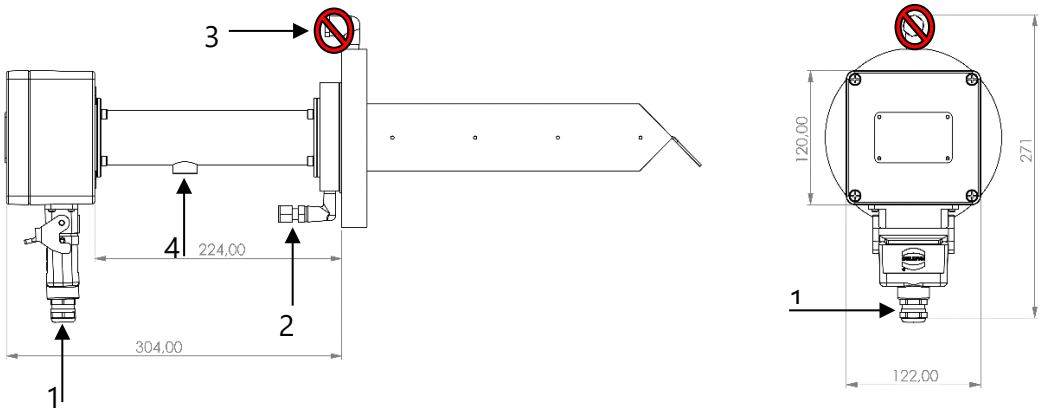
Reference:

1. Plug for 24VDC and data lines.
2. Calibration gas inlet, closed with blind way
3. No function
4. Reference inlet

OMS420-RT without back purge supply

Abbildung	Beschreibung	Menge
	Main device: OMS420	1
	Plug for data and power supply (x1)	1
	Assembly screw set (x4)	4
	Seal (x1)	1
	Transmitter unit (x1)	1

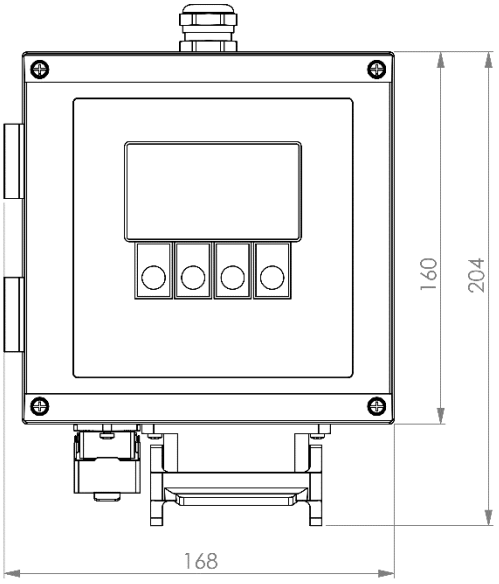
Dimensions/Assigment

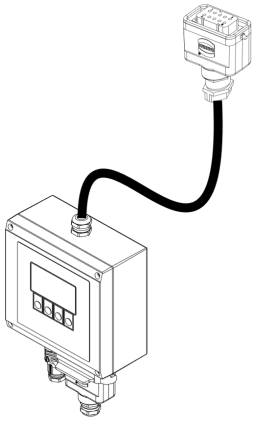


Reference:

1. Plug for data lines
2. Calibration gas inlet with blind plug.
3. No function
4. Reference inlet

Transmitter unit for remote control / for OMS-RT und OMS420-HT

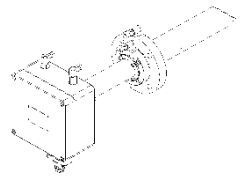
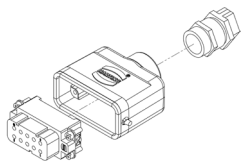
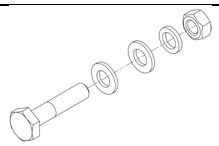
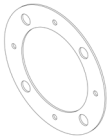
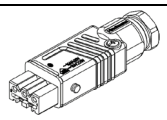
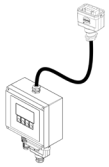




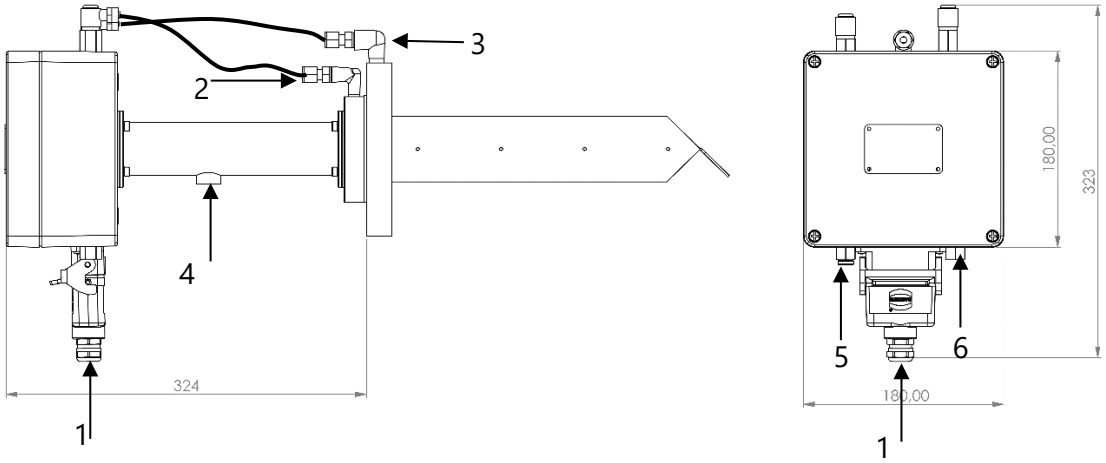
Reference:

1. Signal cable 10 m / 30 m
2. Connection for power supply
3. Connection for data plug.

OMS420-RT (with back purge function)

Abbildung	Beschreibung	Menge
	Main device: OMS420	1
	Plug for data and power supply (x1)	1
	Assembly screw set (x4)	4
	Seal (x1)	1
	Plug for power supply (x1)	1
	Transmitter unit (x1)	1

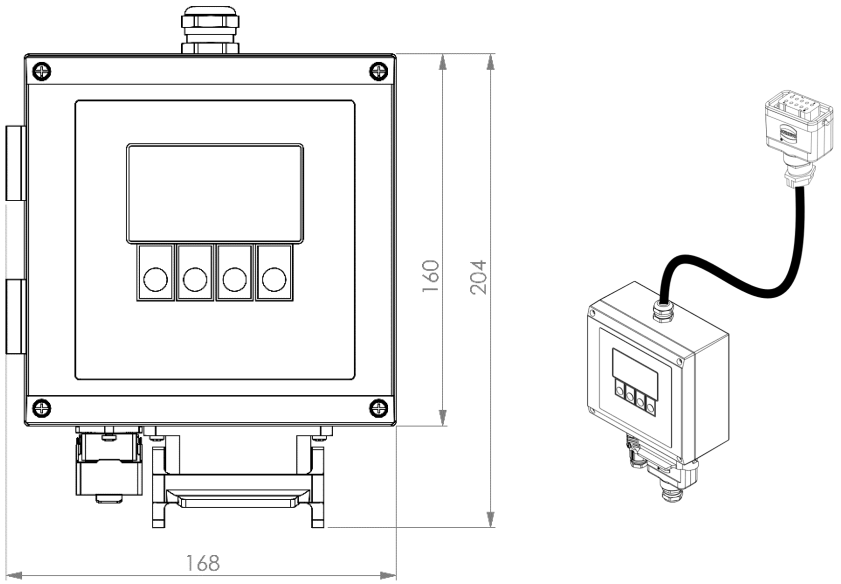
Dimensions/Assigment



Reference:

1. Plug for 24VDC and signal lines
2. Calibration gas inlet
3. Back purge plug for compressed air
4. Reference inlet
5. Calibration gas inlet for gas cylinder
6. Compressed air inlet for 2-6 bar

Transmitter unit for remote control / for OMS-RT und OMS420-HT

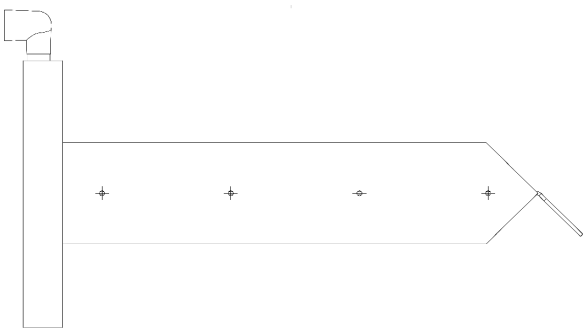


Reference:

1. Signal cable 10 m / 30 m
2. Connection for power supply
3. Connection for data plug.

3.7. Length of tubes

The graphic and chart below, shows which tubes are available.



Length of tube (X)	**Article number**
300 mm	62393
500 mm	62393A
750 mm	62393B
1000 mm	62393C
1250 mm	62393D
1500 mm	62393E
1750 mm	62393F
2000 mm	62393G

4. Mechanical installation

4.1. Overview

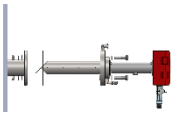
This manual explains how to mount the OMS420 mechanically and install it electrically.

The operator must install these parts correctly. The follow flow chart shows the steps, which must be done to install the OMS420-N or OMS420-RT.

	A	B	C
Concern	✗	✓	✓

A=OMS420-N
B=OMS420-RT
C=OMS420-RT mit Freispülung

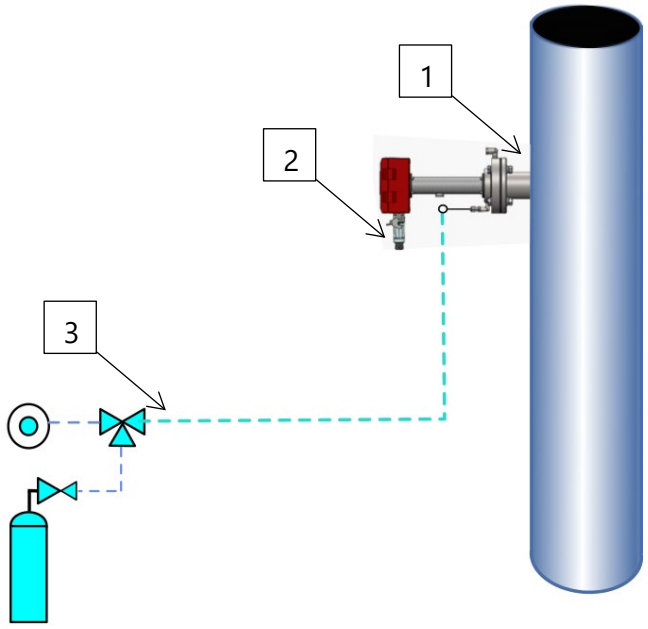
		A	B	C
Choose measurement point	*Concerns*	✓	✓	✓
↓				
Installation of mounting flange	*Concerns*	✓	✓	✓
↓				
Installation OMS420 at mounting flange	*Concerns*	✓	✓	✓
↓				
Installation transmitter unit	*Concerns*	✗	✓	✓
↓				
Power supply / dataline installation	*Concerns*	✓	✓	✓
↓				
Mounting compressed air line	*Concerns*	✗	✗	✓



4.2. Overview

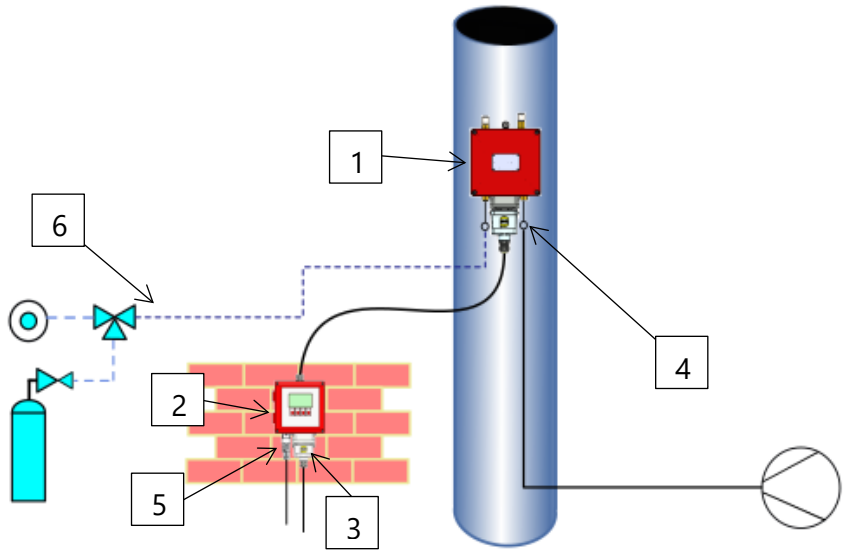
The different OMS420-Models have different features and differ in their structures. The overview below shows the entire structures, from these models and in which sections are dealt with it.

OMS420-N



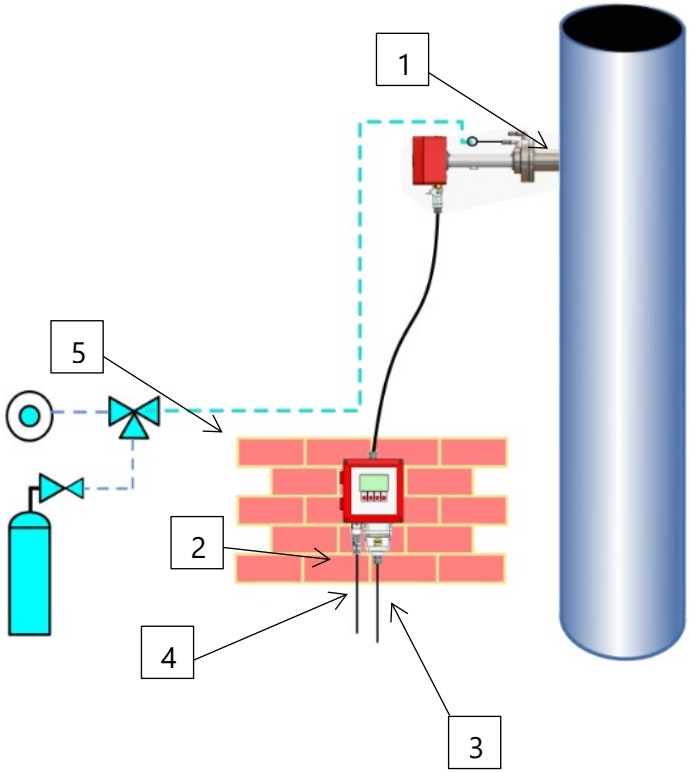
1. Attach mounting flange see chapter 4.4.
2. Powersupply and datalines see chapter 4.7.
3. Mounting of adjustment device see chapter 4.10.

OMS420-RT with back-purge function



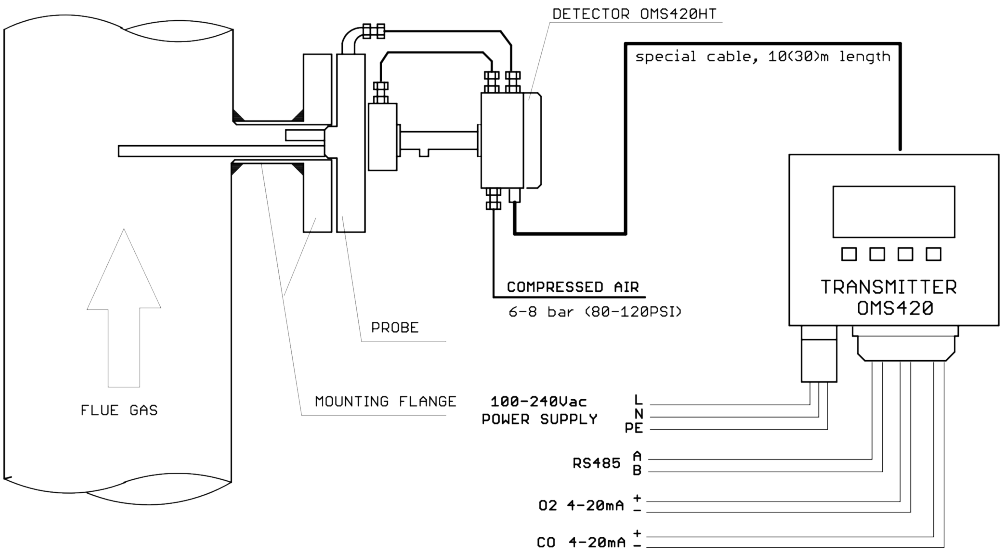
1. Attach mounting flange see chapter 4.4
2. Attach transmitter unit see chapter4.6
3. Attach datalines see chapter
4. Mounting back-purge system at compressed air net see chapter 4.9
5. Attach powersupply see chapter 4.8
6. Mounting adjustment device see chapter 4.10

OMS420-RT ohne Rückspülung



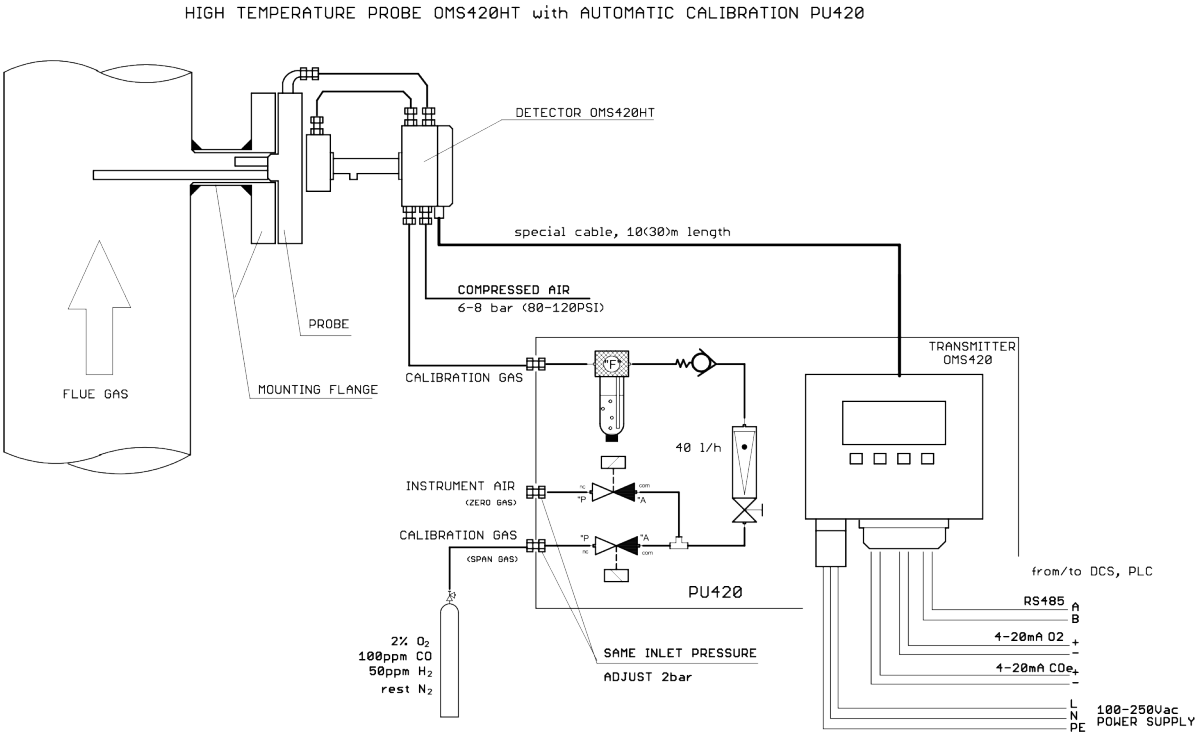
1. Attach mounting flange see chapter 4.4 and 4.5.
2. Attach transmitter unit see chapter 4.6
3. Attach datalines see chapter 4.7
4. Attach powersupply see chapter 4.8
5. Mounting adjustment device see chapter 4.10

OMS420 HT without back-purge function



6. Attach mounting flange see chapter 4.4 and 4.5.
7. Attach transmitter unit see chapter 4.6
8. Attach datalines see chapter 4.7
9. Attach powersupply see chapter 4.8
10. Mounting adjustment device see chapter 4.10

OMS420 HT with back-purge function

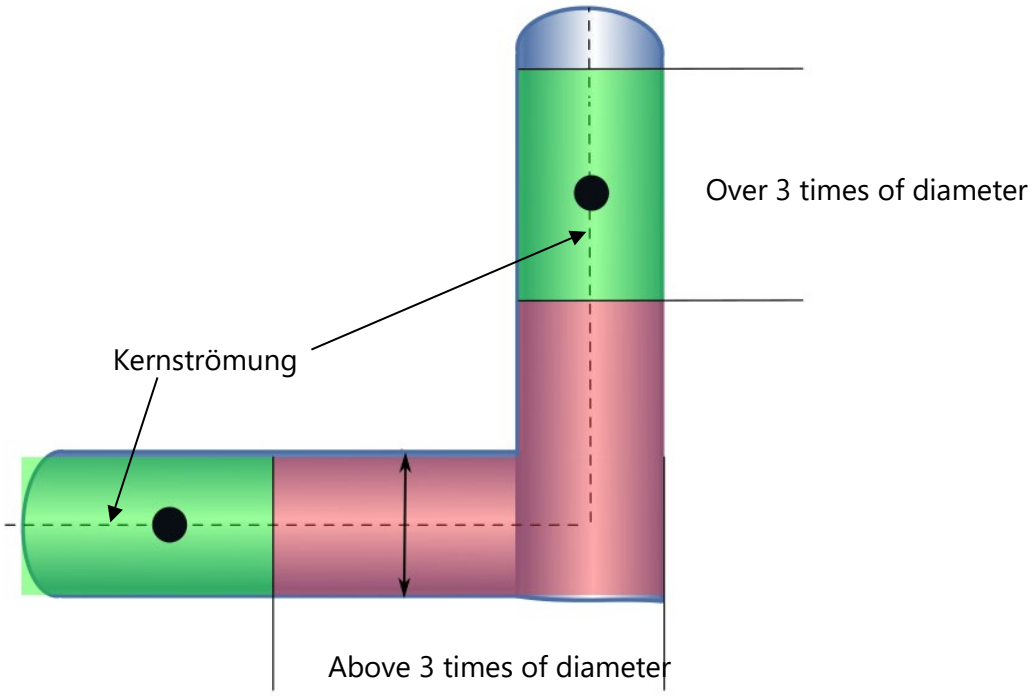


11. Attach mounting flange see chapter 4.4 and 4.5.
12. Attach transmitter unit see chapter 4.6
13. Attach datalines see chapter 4.7
14. Attach powersupply see chapter 4.8
15. Mounting adjustment device see chapter 4.10

4.3. Select measurement point

The measuring point should be in an area where the flow no longer has any particular turbulence. That is:

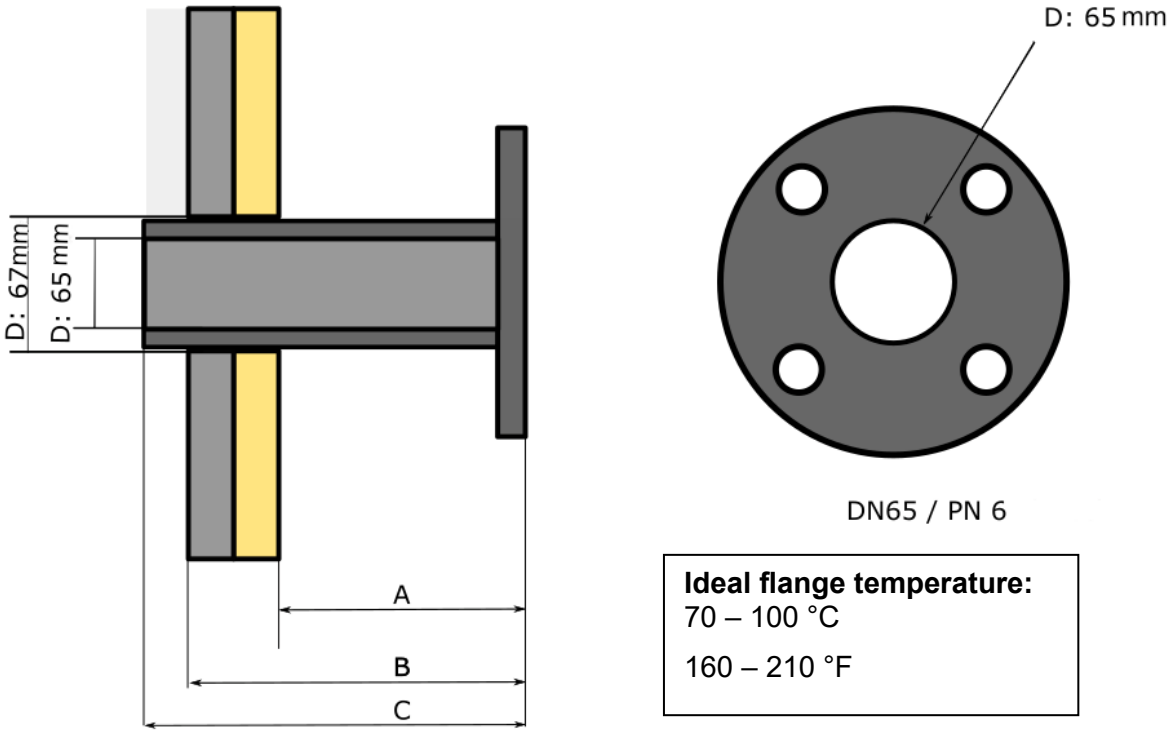
- Not directly before or after a pipe elbow. The measuring point must be at least 3 times the chimney diameter from a bend.
- The probe may be mounted both horizontally and vertically.
- The opening should have access to the core flow. This is usually the centre of the pipe.



- For installations on a metal pipe, make sure that the wall thickness can support the weight of the probe. For this purpose the mounting flange is welded to the pipe.
- For installation on a brick fireplace, it is advantageous to screw a steel plate with the correct hole diameter to the brick fireplace.

4.4. Installation of the mounting flange

The mounting flange is not scope of supply.
The sketch below shows the necessary dimensions of the mounting flange. The mounting flange has the same dimensions as a DN65/PN6 flange (dimensions as DIN2573). A steel pipe is welded onto the flange. The length of this tube depends on the probe length and the insulation thickness.



Ideal flange temperature:
70 – 100 °C
160 – 210 °F

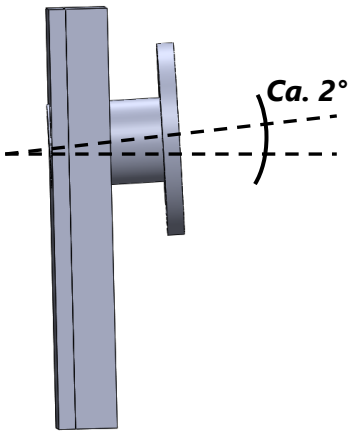
A: The distance should be short as possible. It must have enough distance to install the mounting flange correctly. The planned insulation must also be taken into account.
B: this distance takes the thickness of the insulation into account. This is the minimal length of the pipe.
C: The distance C takes into account how far the pipe goes into the chimney. This is necessary if the probe tube is larger than 1500 mm to increase stability.

The mounting flange is the basic of the mechanical installation. For a correct installation it is necessary to take some rules into account:

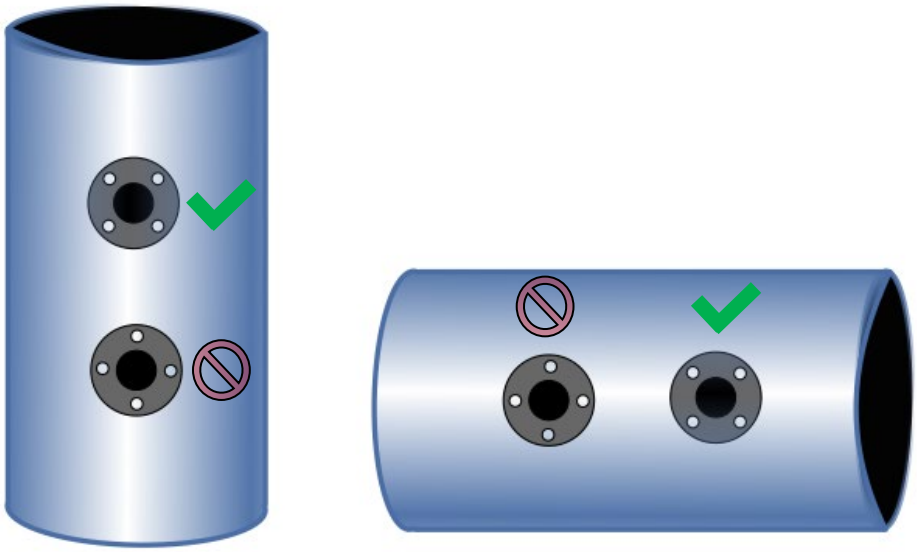
1. ***Installation side:***
   The installation location must be safe and easily accessible. The OMS420 should be installed in a location where the flow is already pronounced. Therefore, the installation location should be at least 3 times the diameter, from the last elbow.

2. ***Installation situation***
   The device can be mounted vertical and horizontal.

3. ***Orientation***
   It is advantageous if the mounting flange is inclined at least 2° against the flow, so that any moisture can drain off. The mounting flange should not be inclined upwards. The mounting flange should also be straight in the horizontal direction.

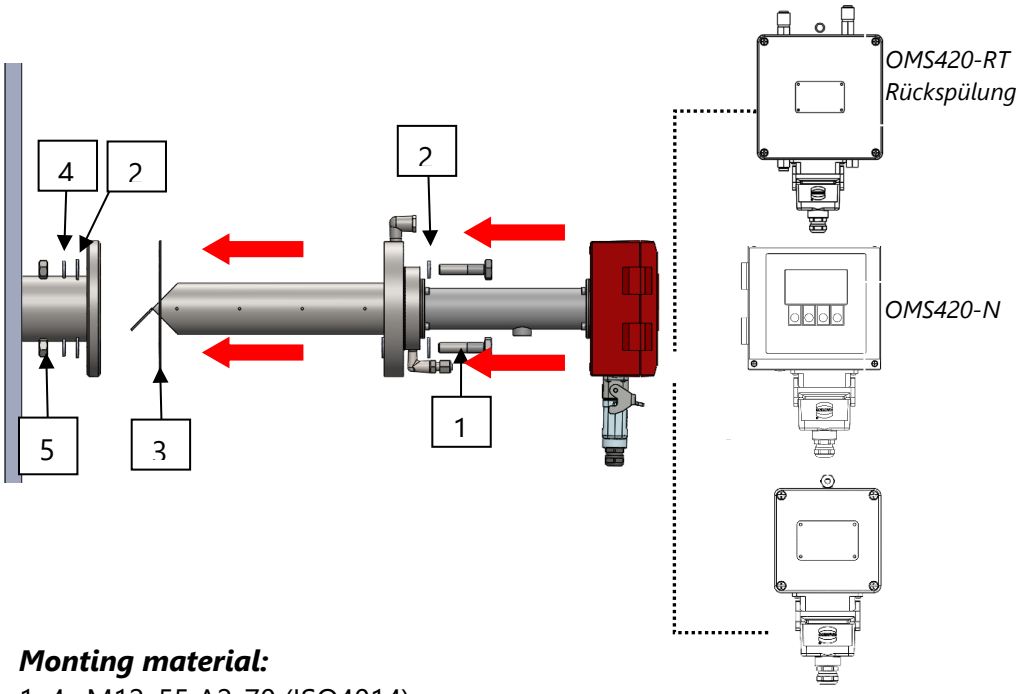


4. ***flange alignment DN65***
   The flange holes should not be aligned horizontally or vertically, but at an angle of 45°. This is the only way the probe of the OMS420 points in the right direction.



4.5. Attach OMS420 on mounting flange

After the mounting flange is installed correctly, the device will be installed at the mounting flange. All different models are installed the same way (see picture below).



Monting material:

1. 4x M12x55 A2-70 (ISO4014) screws
2. 4x Washer for M12 screws
3. 1x DN65 graphite seal
4. 4x Lock washer for M12 screws
5. 4x M12 nuts

HINT

All parts, which are needed for mounting, are scope of supply.

HINT

Technical data: Mechanical screws

The delivered screws have the follow data: M12x55 A2-70 (ISO4014)

Tightening torque: 50 Nm

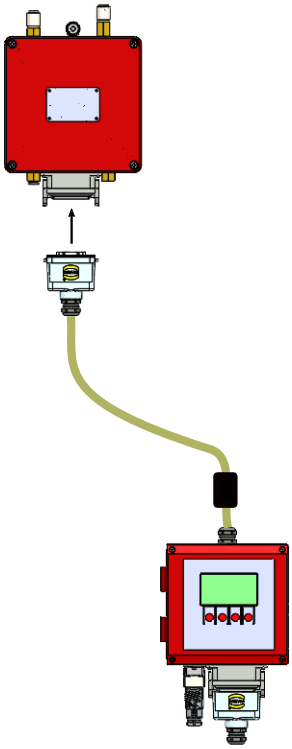
Preload force: 29100 N

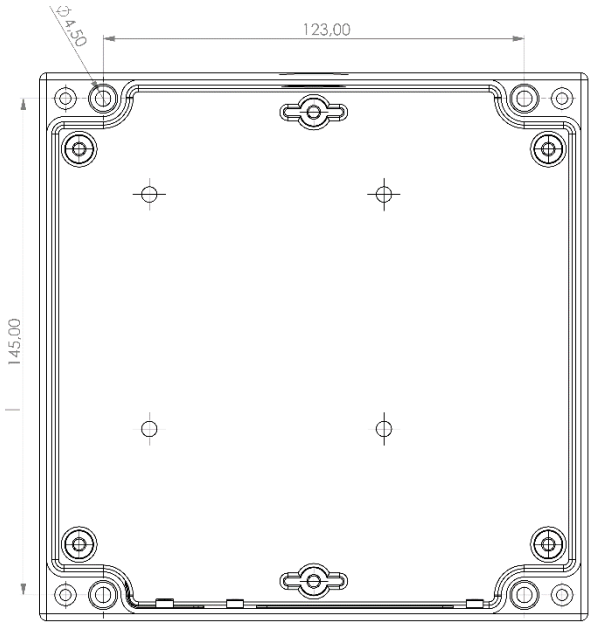
4.6. Mounting: Transmitter unit

	A	B	C
Concern	✗	✓	✓

A=OMS420-N
B=OMS420-RT
C=OMS420-RT mit Freispülung

The transmitter unit decouples the operating function from the sampling-probe. The transmitter- unit has a 10 m signal cable, which integrated the main-power supply and the data lines. This allows a remote control of the device.





The transmitter unit is connected with a 10-pin plug directly to the main device.

4.7. Electrical installation

⚠ CAUTION

Risk of electric shock from the power system voltage
This may result in severe injuries or death.

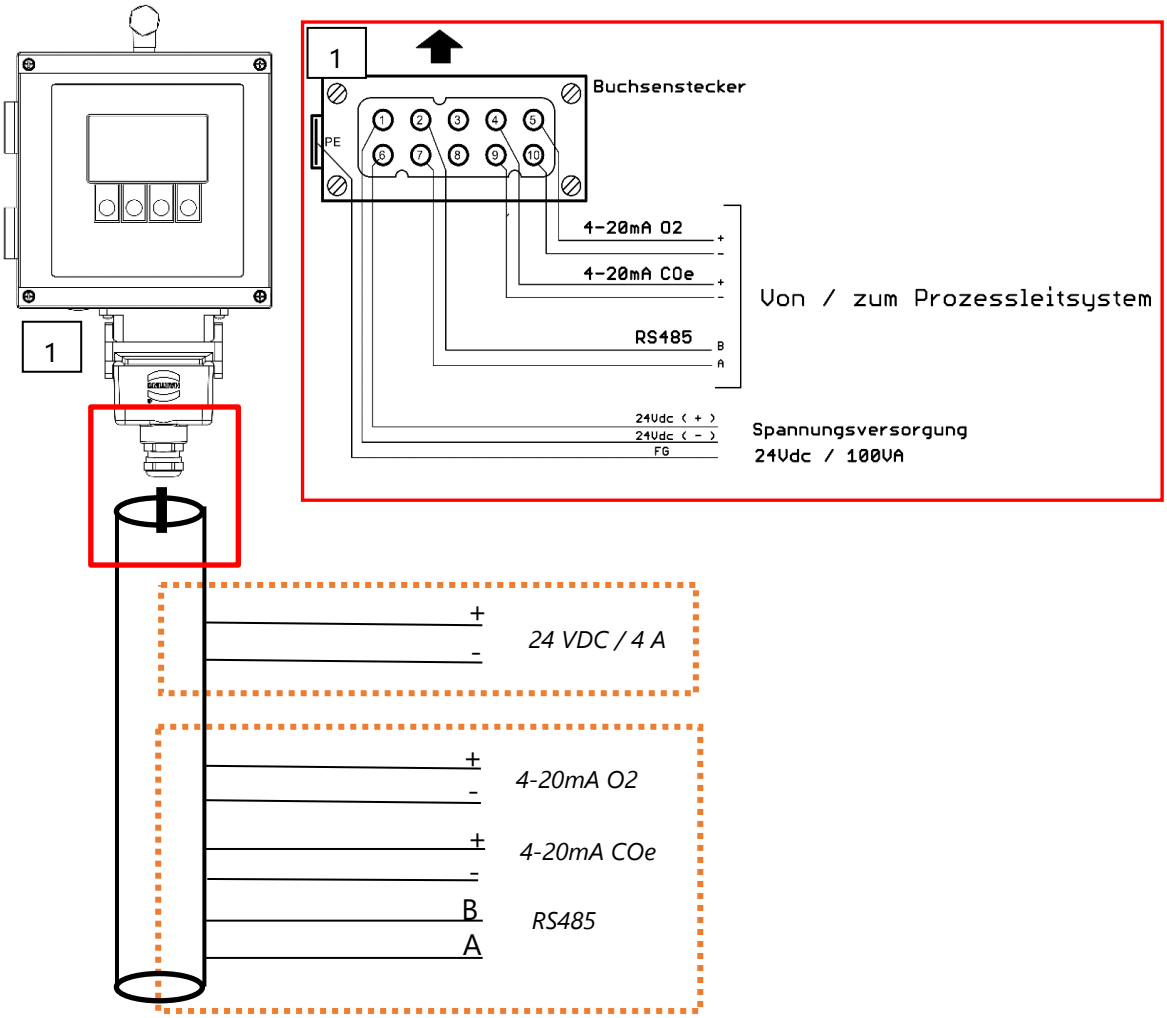
- ► Do not connect or disconnect power cables or power supplies with wet hands.
- ► Do not use any cables that have been damaged by pulling, twisting, being tied together, or extreme bending.
- ► Do not connect to an outlet where several devices have already been connected using power strips or that has been extended several times using extension cords.

OMS420-N

It will be descripted:

- How to install the power supply.
- How to install the 4-20mA data lines, for the O2 and COe sensor.
- How to install the RS485 data line for the O2 and COe sensor.

The lower sketch suspects where the different signal lines must be connected.



NOTE

Power supply

The OMS420-N needs a 24 VDC /4 A power supply. The OMS420-N is not design for a normal voltage network!

NOTE

Connector assembly

The diagrams of both connectors can be found in the appendix:

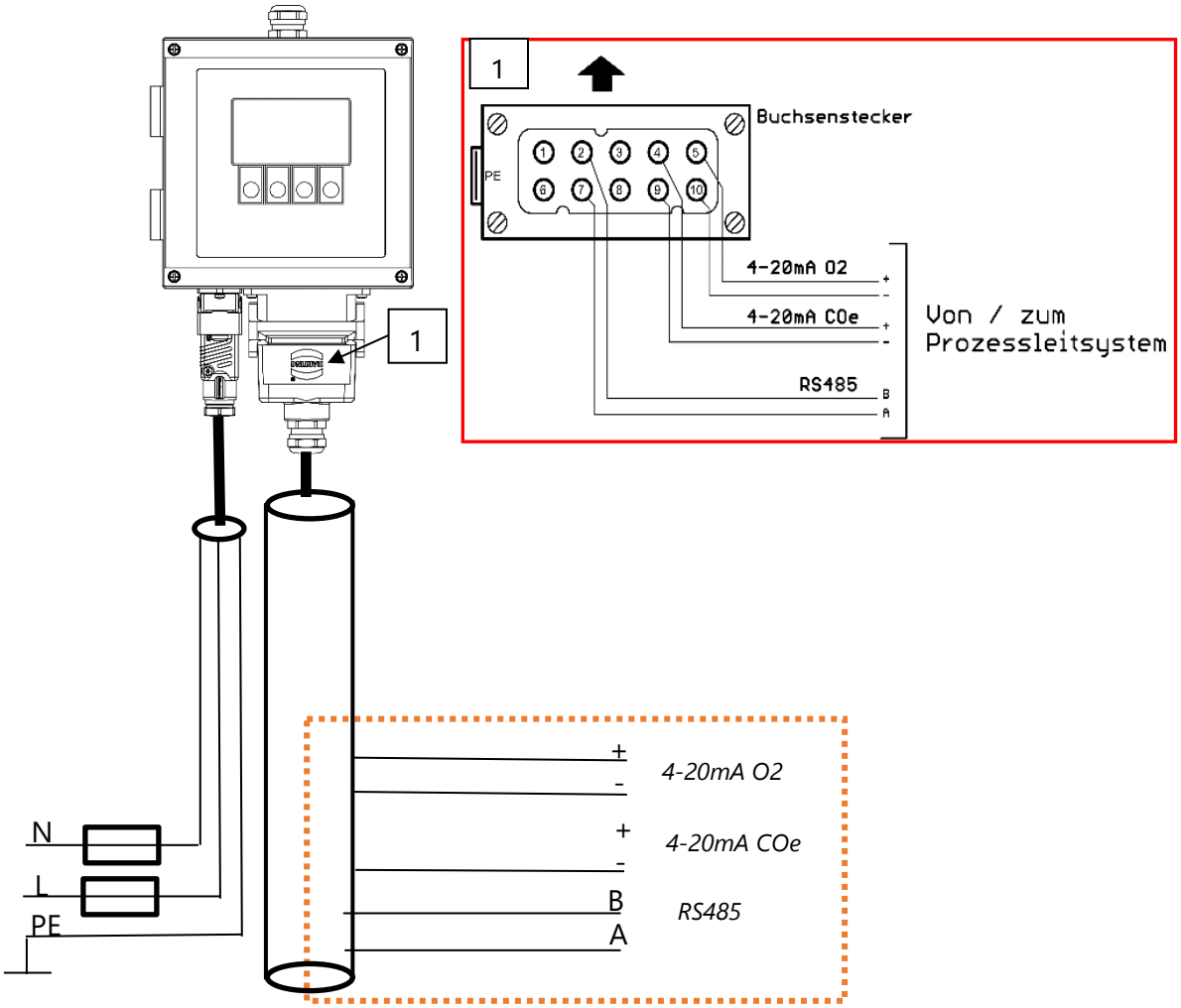
- Plug for power supply: chapter 8.5.
- 10-pin plug: chapter 8.6.

OMS420-RT

It will be descripted:

- How to install the power supply of the OMS420-RT
- How to install the data line for the 4...20 mA for the O2 and COe signals.
- How to install the RS485 data lines for the O2 and Coe signals.

The lower sketch suspects where the different signal lines and the power supply must be connected.



NOTE

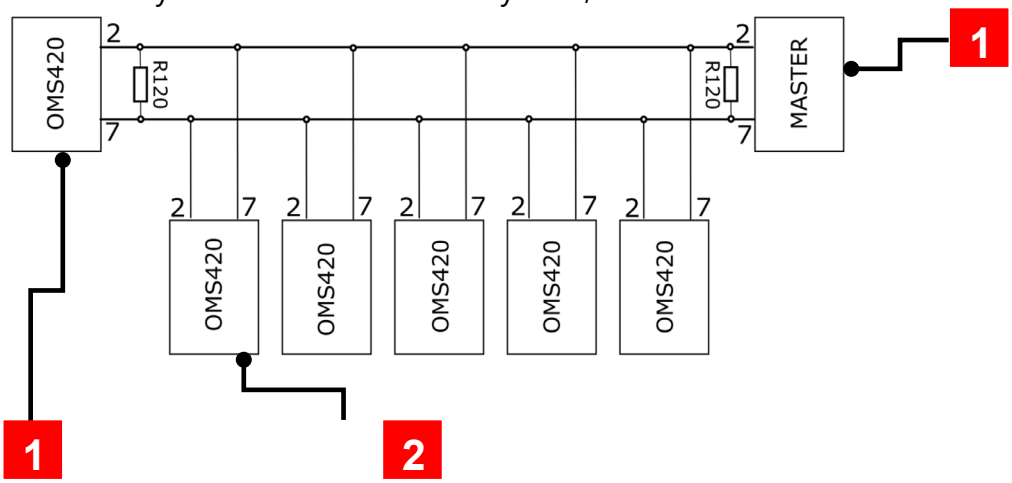
Connector assembly

The diagrams of both connectors can be found in the appendix:

- Plug for power supply: chapter 8.5.
- 10-pin plug: chapter 8.6.

4.8. Bussystem: with several slaves

If several analysers must be connected to one bus, only the analyser that is furthest away has a terminating resistor. Each connector is equipped with a wire resistor (120R) at slot 2-7.
For the analyser that are in the bus system, these must be removed.



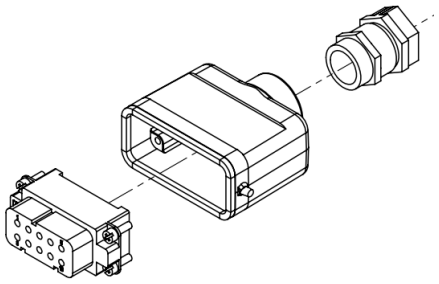
Reference:

1.	Start and terminating device → 120R terminating resistor in plug required
2.	Intermediate units → Remove terminating resistor from plug

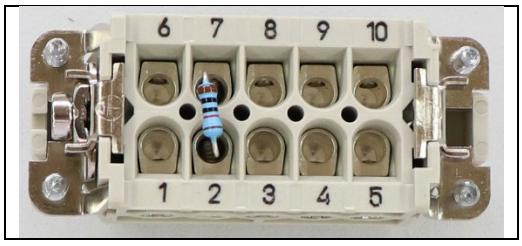
Removing the terminating resistor

If the analyser does not start or terminate, the terminating resistor must be removed from the connector.

- Unscrew and remove the connector housing.
  Terminating resistor becomes visible (R120).



- Remove the terminating resistor on pin 2-7.



- Screw the connector housing back together.
  Connector is now prepared as a non-termination initial device for RS485 bus.

4.9. Installation compressed air

⚠ CAUTION

Risk due to compressed air

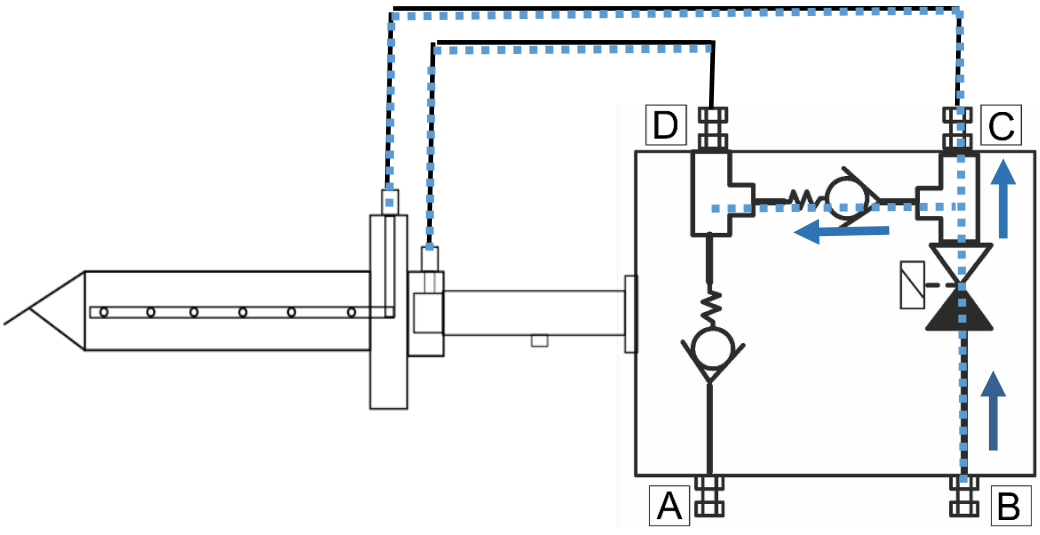
This may result in injuries.

- ► Connection with the specifications in the operating instructions.
- ► Depressurize the system before assembly installation or removal.

	A	B	C
Betrifft	✗	✗	✓

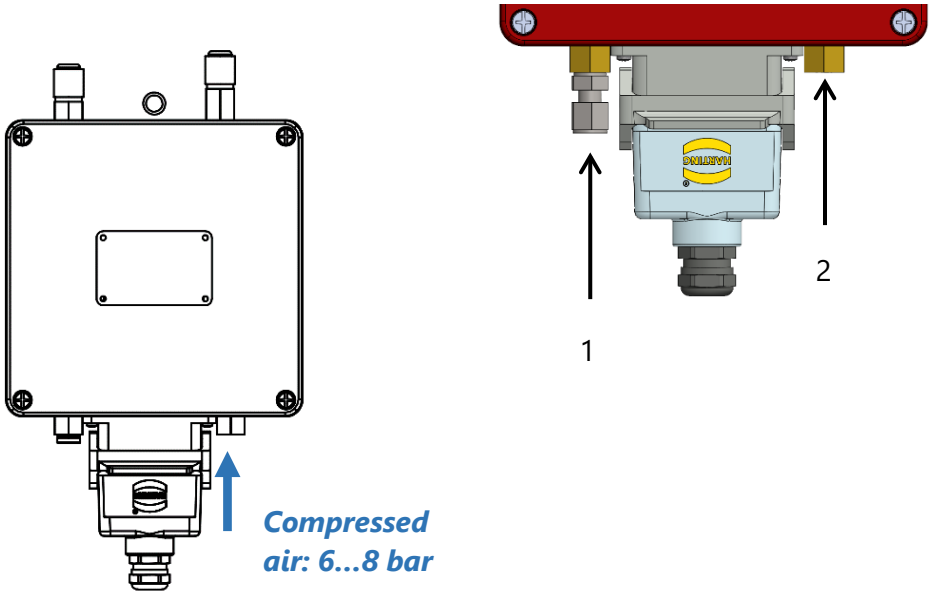
A=OMS420-N
B=OMS420-R
C=OMS420-RT mit Freispülung

The back-purge function is controlled through a solenoid valve. Through the solenoid valve the compressed air can be forwarded in the probe-channels and the sensor chamber, which will be cleaned up. The back-purge function takes place in continuous intervals, which can be set from the operator. The sketch below illustrated this: On all models equipped with a backflush function, the connection is located on the right-hand side. A **G1/8 female thread** is provided for this connection.
The diagram below shows the schematic flushing path (shown here in blue). Running parallel to this path is a balancing gas path.



Picture 1: Back-purge function. The backwash connection (C) flushes the probe tube. At the same time the backwash air goes into the sensor chamber (D) to flush the sensor. The compressed air is permanently installed at connection piece (B). A solenoid and check valve combination ensures that the compressed air can be switched by the main control unit. The adjustment connection (A) is not affected.

The OMS420-RT with back purge-function needs, for its cleaning function a compressed air connection, with 6…8 bar. The cleaning grade of the air should have class 1 (ISO 8573-1). Both the balancing gas connection and the backflushing connection are flushed. The figure below shows where this is located.



Reference:

1. Adjustment connector, for adjustment gas cylinder: G1/8 inner thead.
2. Compressed air connector: G1/8 inner thread.

Shielding

To prevent a PE-loop impedance and field interferences, it can be necessary to change the connection of the cable shield.
Default the shield is connected with the device not with the probe. In the most cases this design is stable against field interferences. Sometimes this constellation can cause problems. It can be helpful to change the connection.

It exists three different ways:

1. Shielding only on the device side (default).
2. Shielding on the device side and tube side.
3. Shielding only on the tube side.

4.10. Installation: Adjustment device

HINWEIS

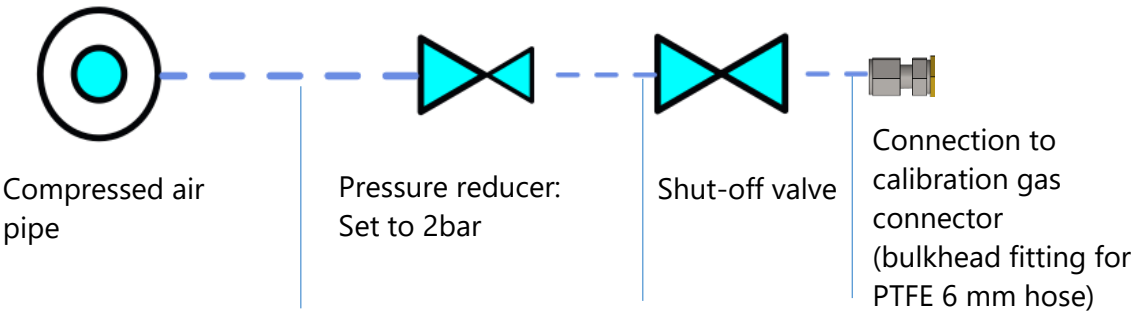
Temporary structure
The adjustment device is only set up temporarily and should be removed again after the adjustment has been carried out.

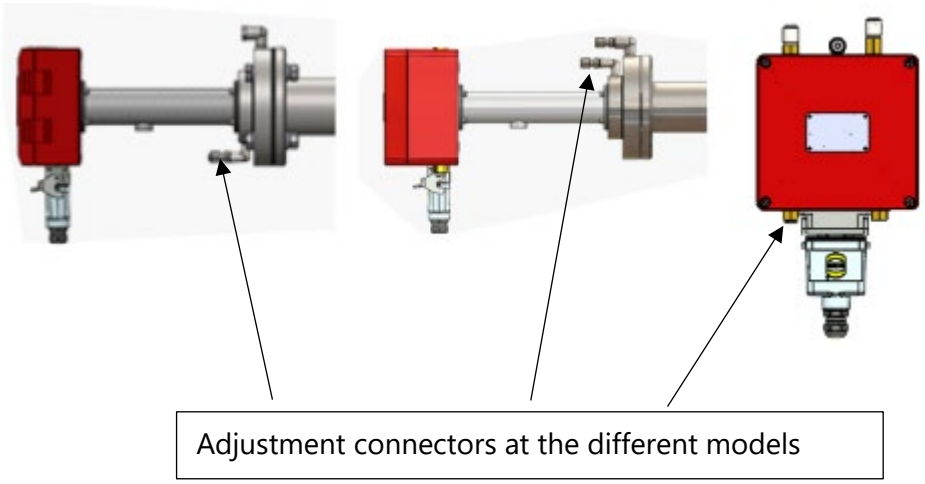
For the adjustment, a compressed air network, which is throttled down to 2 bar, and an adjustment gas cylinder must be installed at the respective adjustment connection.

In principle there is:

- **The zeropoint adjustment:** Here the compressed air network, which is throttled down to 2 bar, is connected to the adjustment connector.
- **The two-point adjustment:** Here both a compressed air network, which is throttled down to 2 bar, and an adjustment gas cylinder with an approved pressure regulator are installed.

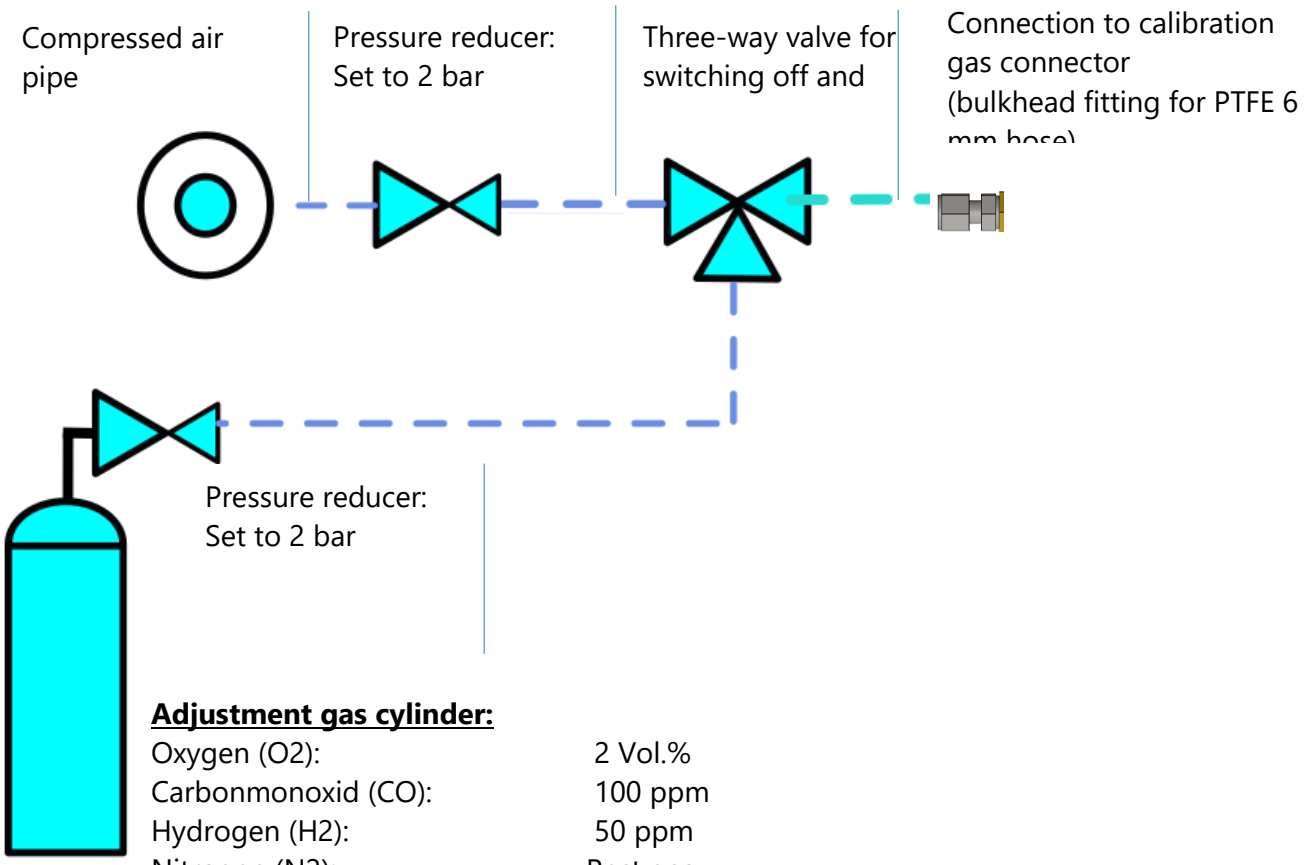
Flowchart: Zeropoint-adjustment





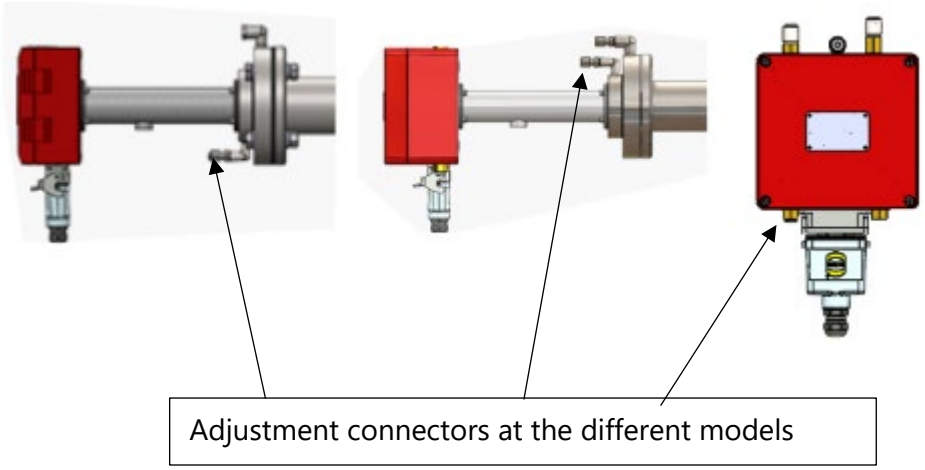
Adjustment connectors at the different models

Flowchart: Two-point adjustment



Adjustment gas cylinder:

Oxygen (O2):	2 Vol.%
Carbonmonoxid (CO):	100 ppm
Hydrogen (H2):	50 ppm
Nitrogen (N2):	Rest gas



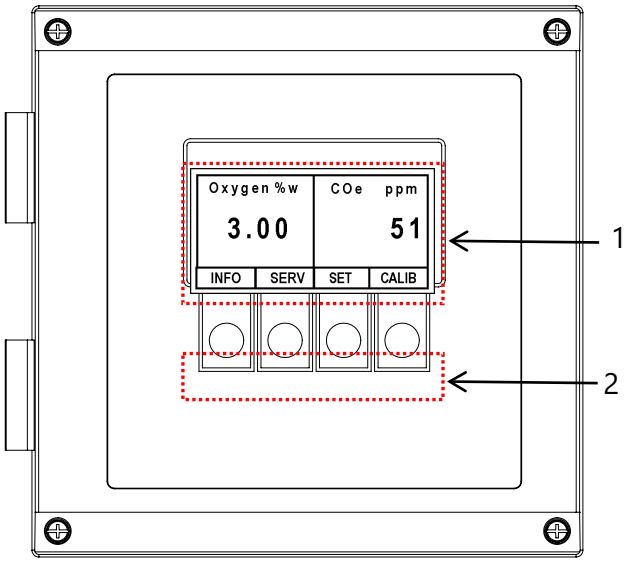
Adjustment connectors at the different models

5. Operation of the device

In this chapter the operation, of the device will be explained. Especially:

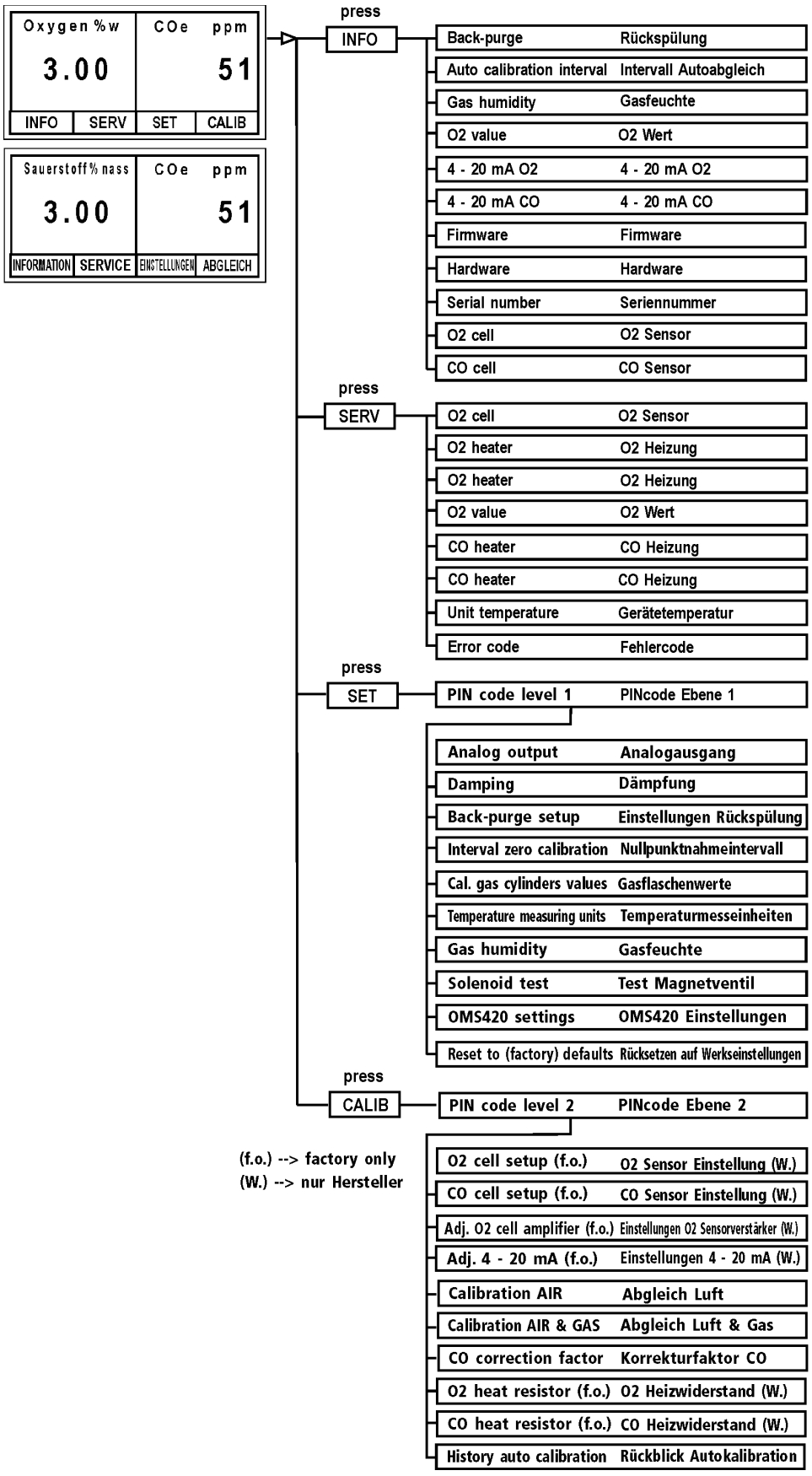
- Basic settings.
- Analog output settings.
- RS485 settings.
- Back-purge-setting.
- Calibration setting.

The menu navigation is done via four keys below the display. The functionality of the respective keys is shown at the display.

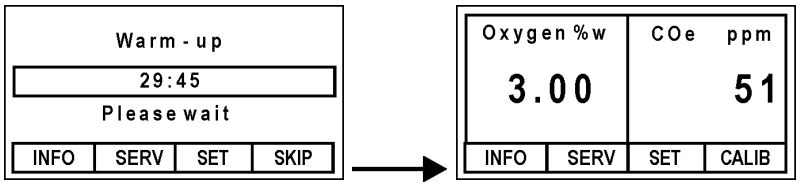


#	Description
1	Operation unit
2	Operation field

5.1. Operation menu: Overview



5.2. Warm-up



LCD will display a time count down for 30 minutes.
During warm-up, some inside measured values (heaters current and voltages) will be compared with credible thresholds and in case of "out-of-range", an error message will be displayed. After countdown, if everything is OK, the message will change from "please wait" to the main measuring menu.
The "SKIP" function is used only for service purposes, to allow the operator to access other unit functions without waiting until the end of warm-up interval time. During this time, measurement values are not credible.
During warm-up, all other menus (info, service and setting) are accessible.

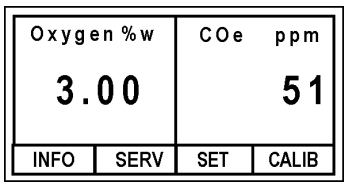
5.3. Main measuring menu

NOTE

After warm-up, the unit will start automatically by displaying the main measurement menu.

O2 real time value with 0.01% resolution

COe real time value with ppm resolution



Press "INFO" key for "info" menu

Press "SERV" key for "service" menu

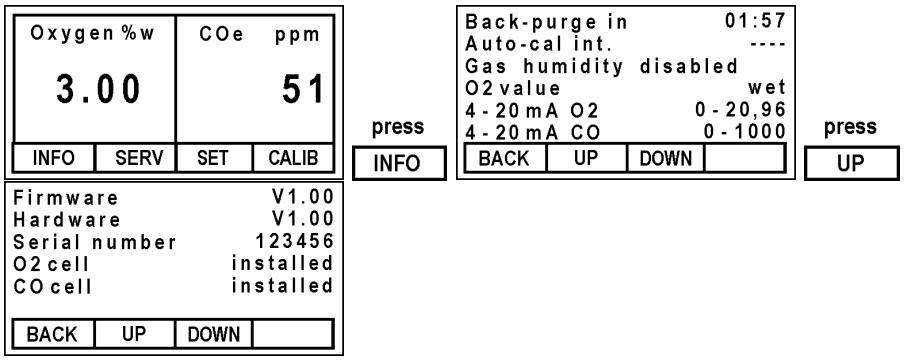
Press "SET" key for "settings" menu

Press "CALIB" key for "calibration" menu

NOTE

If between 30 min no button is pressed during the measurement, the level will be set on "0". I.e. the menus SET and CALIB are only by renewed PIN input usable.

5.4. Info menu



In the "INFO" menu the following parameters can be called up from a scroll up/down list:

- Next back-purge in hours/minutes
- Next automatic set to zero in days/hours
- If the display shows „----„ the automatic set to zero is not activated
- Gas humidity display in % 1 - 25 or disabled
- O2 value "wet" (*) wet: The O2 display is calculated to

  "dry"(*). dry: The O2 display is calculated to

  to "Set gas humidity" The gas humidity can be set by "SET"
- 4 - 20 mA 02 setting range of analog O2 output
- 4 - 20 mA COe setting range of analog COe output
- Firmware installed firmware version
- Hardware installed hardware version
- Serial number display of the serial number
- O2 sensor installed
- CO sensor installed/not installed

(*) Formula for O2 calculation dry/wet

$O2\max = 20.97\%$ oxygen content in air

$O2wet =$ measured O2-value in wet stack gas

$O2dry =$ calculated (%) O2-value dry

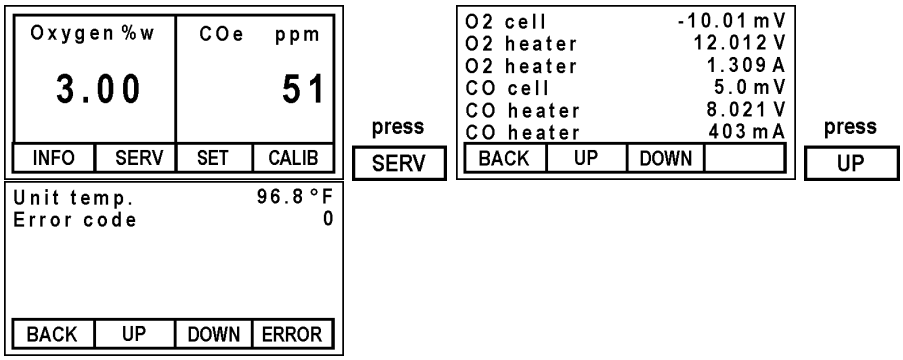
$H =$ water content (%) in stack gas, (value entered manually),

$$H = 100 \cdot \left(1 - \frac{O2wet}{O2dry}\right)$$

$$O2dry = O2wet \cdot \left(\frac{100}{100 - H}\right)$$

Therefore calculation of

5.5. Service menu



Displays actual 6 lines from a scroll up/down list with measured (A/D converter) components information.

Press the "UP" or "DOWN" key and return back to main measuring menu by pressing "BACK".

standard value	**allowed deviation**	
O_2 cell	- 10 mV (with operation temperature and 21 % O_2)	± 5 mV
O_2 heater	12 V (depending on flange temperature)	± 2 V
O_2 heater	1,3 A (heater current)	± 0,3 A
CO cell	5 mV (after warm-up and with fresh air)	± 5 mV
CO heater	7,5 V (depending on flange temperature)	-3,0 V.... + 1 V
CO heater	0,4 A (heater current)	± 0,1 A
Unit temperature		less then 60 °C (140 °F)

Typical mV-values for COe sensor:
O2 = 3 %, CO = 200 ppm → 98,0 mV
O2 = 3 %, CO = 500 ppm → 190,0 mV
O2 = 10 %, CO = 200 ppm → 32,0 mV
O2 = 10 %, CO = 500 ppm → 93,0 mV

If the system detects an error, the plain text meaning will be displayed after pressing "ERROR" key

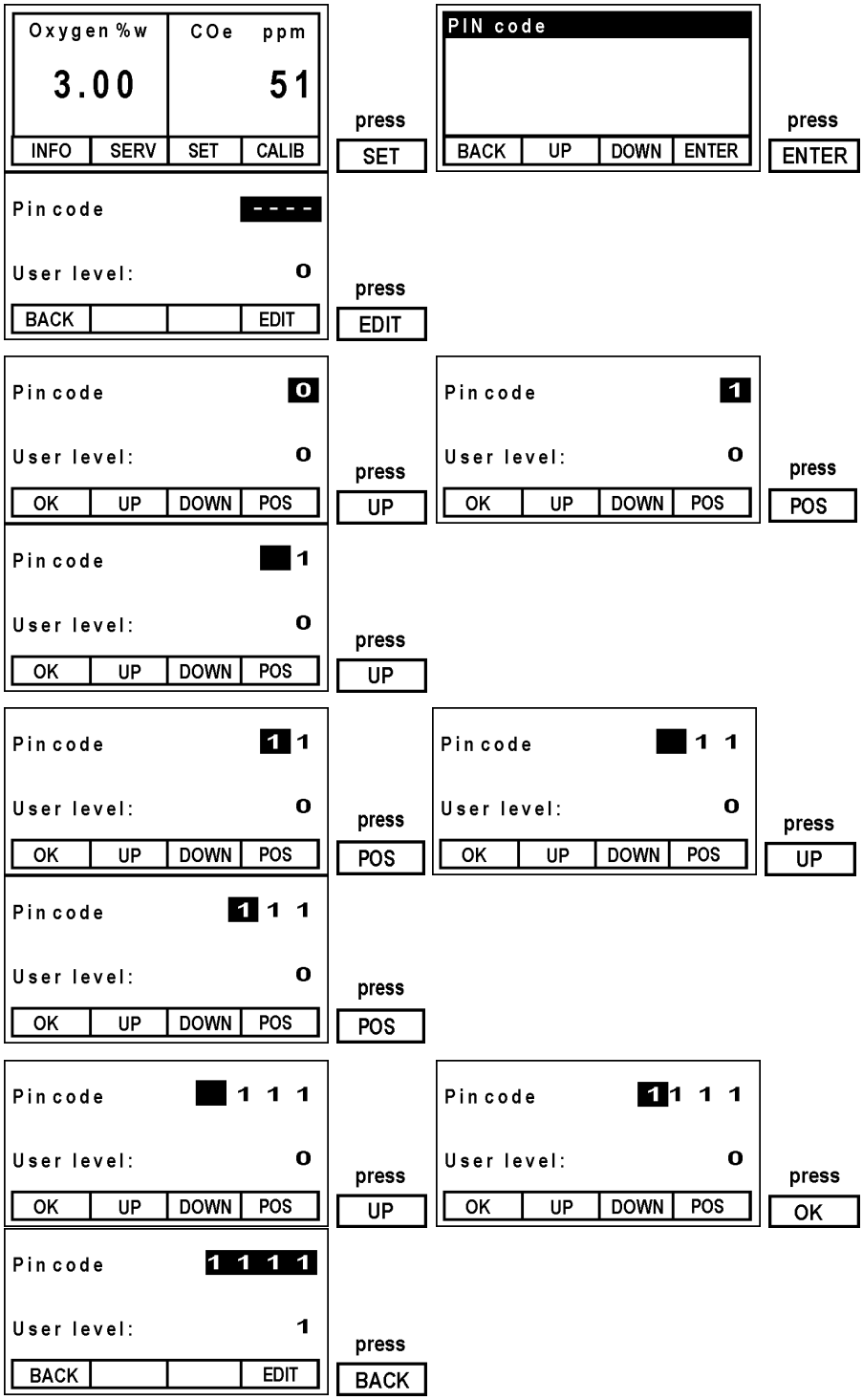
5.6. Settings menu

This menu is protected by a user level 1 PIN code.

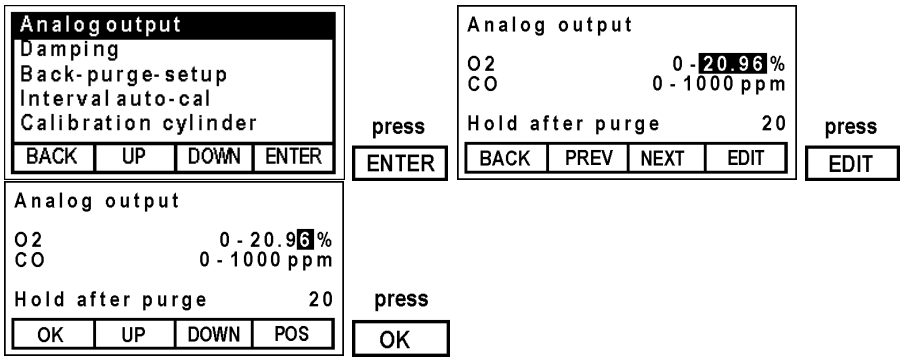
NOTE

Password for level 1: 1111

PIN code level 1



5.7. Set analog output



PREV or NEXT move cursor to values which can be changed
EDIT change value by means of UP/DOWN and POS
OK save values
BACK return to main menu

Factory defaults are: 20mA: O2 0 – 21.00 %
20mA: COe 0 – 1.000 ppm
Hold after purge typical 20 sec. (from 5 to max 200 seconds)

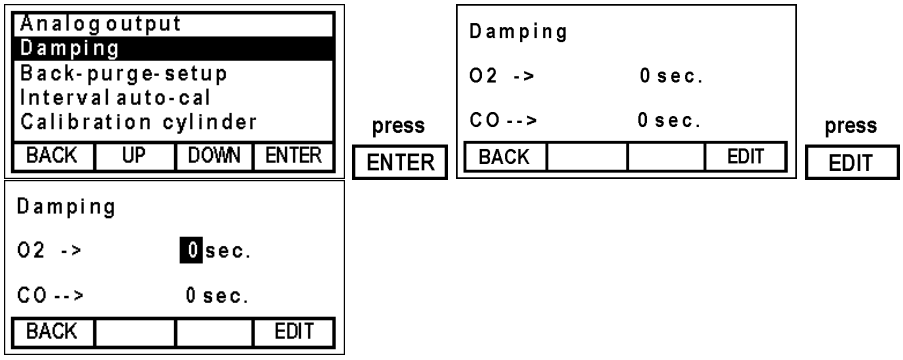
Notice: The last measured value on analog output 4-20mA after back-purge is hold even after back-purge cycle is finished.

NOTE

The last measured value on analog output 4-20mA after back purge is hold even after back-purge cycle is finished.

5.8. Damping

This function allows user to set a damping (averaging the measurement over a period of time) of measurement, in the display as well in the analog output.



PREV or NEXT move cursor to values which can be changed
EDIT change value by means of UP/DOWN and POS
OK save values
BACK return to main menu

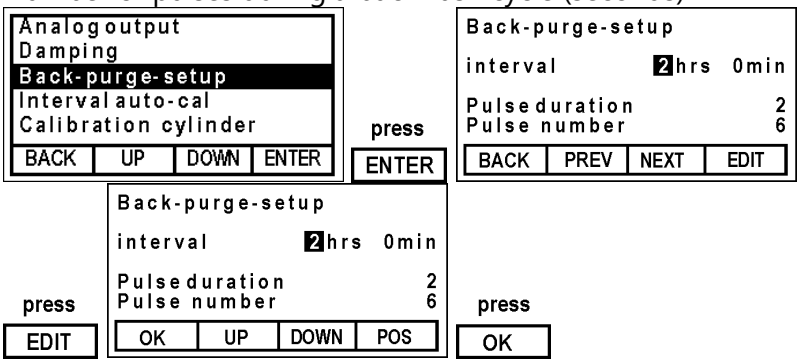
NOTE

Integration times from 0 to 30 seconds are settable, where 0 seconds means no damping.

5.9. Settings Backpurge

This function allows you to adjust the optional solenoid valve for backpurging:

- Time interval between backwashes (hours and minutes)
- Pulse width or interval time for activating the solenoid valve (opening the valve) in seconds
- Number of pulses during a backwash cycle (seconds)

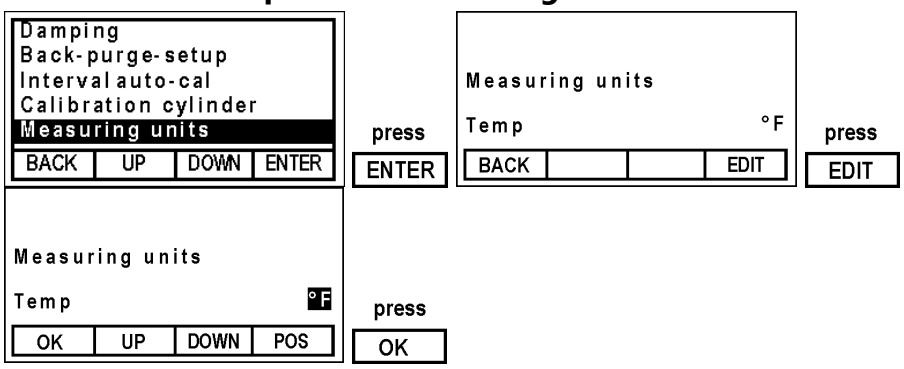


PREV oder NEXT set cursor to value you want to change
EDIT Change value with UP/DOWN and POS
OK Save value
BACK back to main menue

HINWEIS

Bei Eingabe von 0 Stunden und 0 Minuten im Zeitintervall ist die Rückspülfunktion deaktiviert.

5.10. Set temperature measuring unit

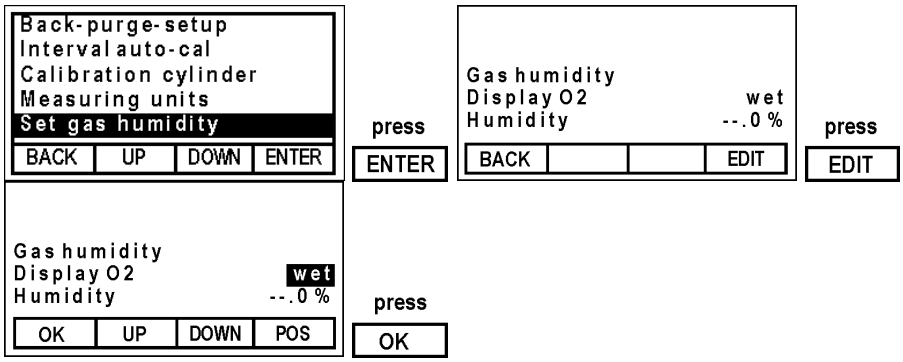


EDIT change value by means of UP/DOWN
OK save values
BACK return to main menu

Set the temperature units to °C or °F.

5.11. Set gas humidity

This function allows setting the value of gas humidity (if known) and selection of either wet oxygen measurement or dry oxygen calculation.



NEXT	move cursor to values which can be changed
EDIT	change value by means of UP/DOWN
OK	save values
BACK	return to main menu

Change value of gas humidity (XX.X %) if this is known.

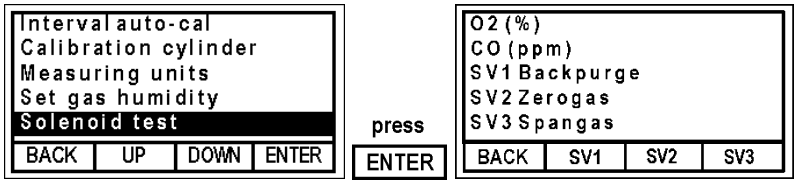
Using the formula: Humidity H % = (1 - O2wet/O2dry) x 100 the dry oxygen is calculated and displayed.

Default value for humidity = disabled

In the main menu the readings are w → wet oxygen measurement and d → dry oxygen calculation

Solenoid test

With the menu option "Solenoid test" allows to test each individual solenoid valve (if installed)



A manual switch ON or OFF of all 3 individual solenoid valves is possible.

By means of the key F1 the solenoid valve SV1 is switched ON or OFF, key F2 the solenoid valve SV2 is switched ON or OFF and with the key F3 the single solenoid valve SV3 is switched ON or OFF.

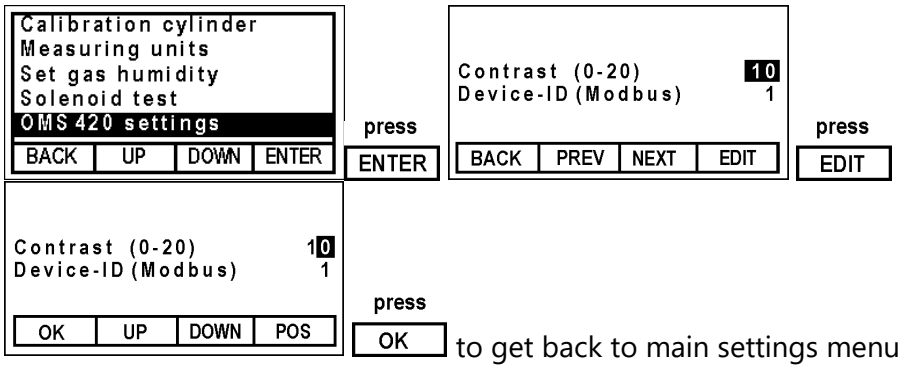
The display shows the current O2 and/or COe value(s).

⚠ CAUTION

All valves can be switched at the same time. It does not take place monitoring on a meaningful position of the single solenoid valves. This operation is only for authorized technical personal!

5.12. OMS420 settings

This function allows change of display contrast and set of transmitter address for multiple transmitter connection on the same RS485 data bus.



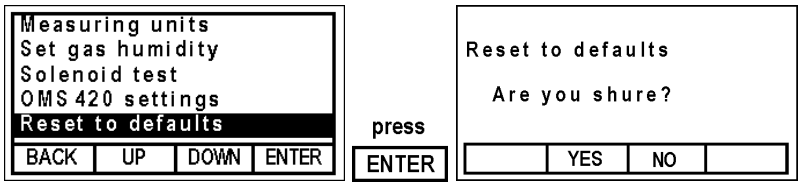
to get back to main settings menu

PREV or NEXT move cursor to values which can be changed
EDIT change value by means of UP/DOWN and POS
OK save values
BACK return to main menu

LCD – Contrast 0-20 (10 for default)

Device-ID (Modbus) Slave address (RS 485-Modbus RTU)

5.13. Reset to (factory) defaults



YES System parameters will be reset to factory defaults
NO Function will be aborted

5.13.1. Factory defaults

Auto-calibration	OFF
Back-purge	OFF
4 – 20 mA Range O2	20,96 %
4 – 20 mA range COe	1.000 ppm
O2 cylinder1	21,00 %
O2 cylinder2	2,00 %
CO cylinder1	0 ppm
CO cylinder2	500 ppm (mixture gas with additional 500 ppm H2 gas is expected!
Pulse duration	2 sec.
Numb. of pulses	6
Hold after purge	20 sec.
Unit temp.	°C

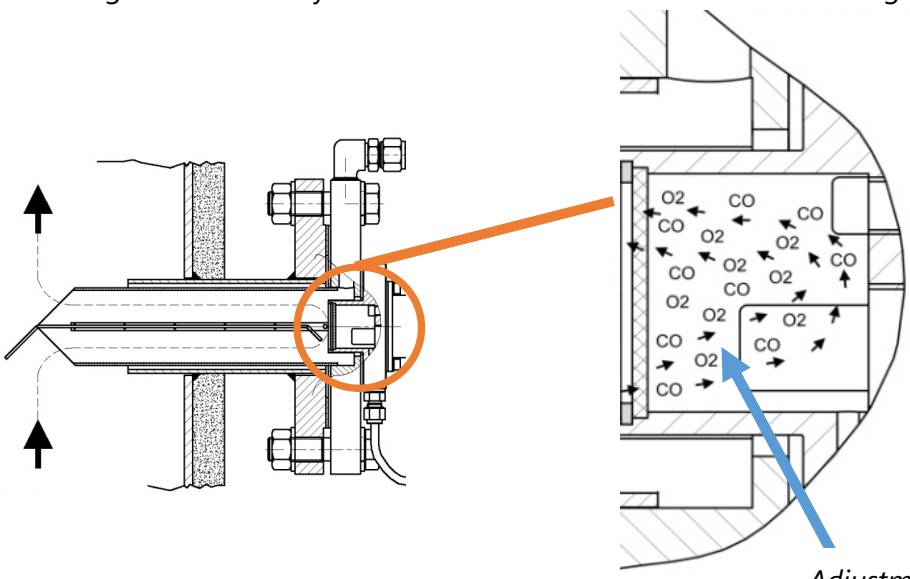
Display O2	wet
Humidity	--.- % (without)
Interval (days)	0 (auto-calibration = OFF)
Purge time (min.)	0
Auto-Cal.	AIR (only 1 point calibration)

6. Generell Information Adjustment

This chapter deals with the calibration of the various OMS420 models. Calibration is carried out using a calibration cylinder, which you must provide yourself.
It is important to always observe the safety rules and to ensure that only persons who have undergone appropriate gas training set up the calibration equipment.
The calibration is carried out in the following steps:

- Mechanical installation of the calibration device,
- Carrying out the calibration.

The sensor signals are assigned to a defined gas concentration by the adjustment.
Each instrument has an adjustment socket for the adjustment. Through this socket, the adjustment gas flows directly into the sensor chamber as shown in the figure below.



Adjustmentgas from gas cylinder

The test gas (clean fresh air/instrument air or calibration gas) flows through the hole in the small flange (sensor chamber), flushes the sensors and exits through the filter screen into the probe attached to the exhaust outlet.

The sensors also react to the water content in the sample gas (the humidity) and the measuring signal is also influenced by the volume flow. For this reason, a flow meter and a humidifier bottle can be used in addition to the adjustment gas cylinder to improve the results.

7. Structure preparations and adjustment

7.1. Definition: Adjustment

⚠ CAUTION

Risk of burns during maintenance work

Burns may result.

► Disconnect the device from the power supply before doing mainte- nance work.

► Let hot components cool down sufficiently.

⚠ WARNING

Risk from manipulations to the measuring device

Operational safety hazard

► Modifications or changes to the measuring device are not allowed.

During an adjustment, a sensor signal is generated by a known gas concentration. This sensor signal is equated with this gas concentration. There are two types of adjustment:

1. *Zero adjustment:* the sensors are exposed to normal air. The signal is assigned to the gas concentration 20.97 vol. % or 0 ppm, for CO.
2. *Two-point adjustment*: As with zero adjustment, normal air is applied. This signal is assigned to the gas concentration of 20.97 vol. % or 0 ppm. Then, with the aid of a gas cylinder, a defined gas concentration (10 vol.% O2) is applied. This is assigned to the signal.

⚠ WARNING

Dangers posed by gas cylinders

This may result in personal injury and damage to property.

► Gas cylinders must be secured to prevent them from falling over

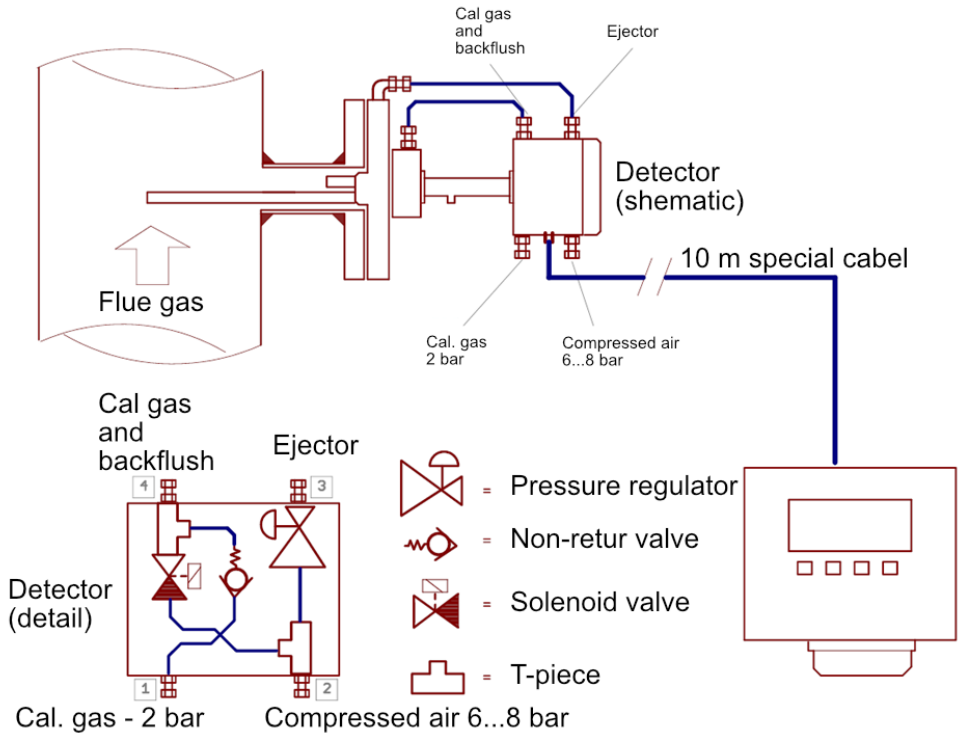
► Use only with approved pressure reducers

► To be used only by persons who have undergone gas training

Sensor inaccuracies, which occur after a certain time, can be reduced by the calibration.

In general, it is always recommended to calibrate the device once after a new installation.

7.2. Adjusting the gas flow to the sensor system using the pressure reducer



Schematic structure OMS HAT

To set up your device optimally, you need the following prerequisites:

- The device is installed in accordance with regulations.
- Compressed air between 6 and 8 bar is applied to the compressed air line [2].

Pressure reducer – no. [3] *In Schematic structure*

By adjusting the air pressure using the pressure reducer [3], the following results should be achieved:

- It should be possible to suck in gas to the sensor system with the smallest possible amount of compressed air in an acceptably short time.

Proceed as follows:

1. Turn the valve to a medium setting. The scale of the pressure reducer ranges from 1-11 If a stable measured value is put out in around 10-20 seconds after the compressed air blast, the pressure is set correctly.
2. If the value only slowly increases and stabilises after about 30 seconds, too little compressed air is used, and the gas takes too long to reach the sensors. Increase the pressure to resolve this.

To avoid using too much compressed air and to keep the filter clean, reduce the air pressure until the measurement results start to come after longer time. Then increase the pressure again until the results are stable again and available in a fast response time.

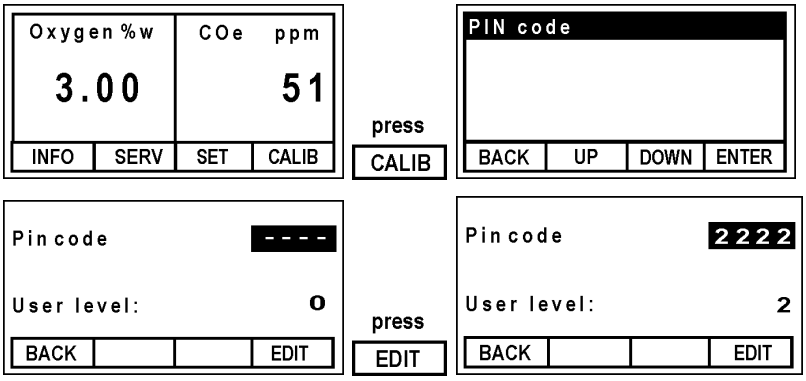
➔ You have set the gas flow to the sensor system using the pressure reducer.

7.3. Pin Code level 2 for adjustment

Adjustment with AIR (zero gas) or GAS (span gas) requires the use of level 2 pin code.

NOTE

Password for level 2: 2222



POS **position**
UP / DOWN **to change the numbers**

NOTE

Below displayed values e.g. O2 factor and offset values are examples!

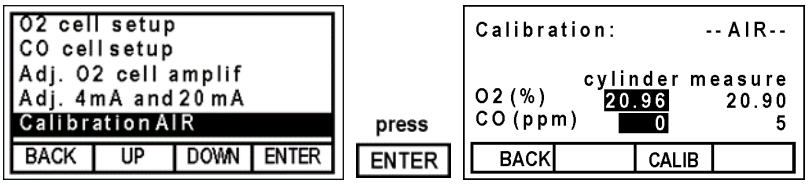
7.4. Zero point adjustment

Here you can find out how to perform a zero calibration.

REQUISITE:

☑ Pressured air (max. 2 bar).

STEPS:



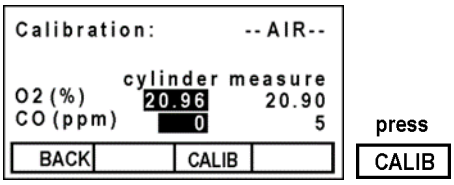
▶ Open the menu „***Calibration AIR***".

The „***Calibration AIR***" menu appears.

▶ Connect a compressed air line (max. 2 bar) to the **calibration gas inlet**.

IThe actual O2 value changes on the display.

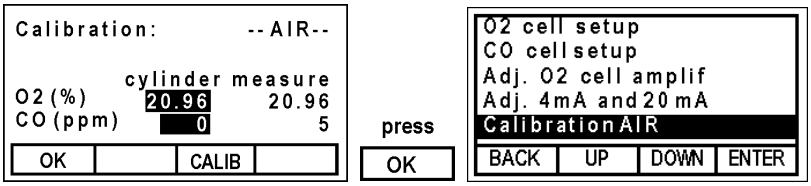
▶ Wait until the current O2 reading stops changing. This takes about 5 minutes.



▶ Press **CALIB-Key**.

▶ Wait 3 sec.

The following message appears on the bottom line „O2 o.k.".



▶ Press **OK-Key**, to leave the menu.

✔ The zero point calibration was successful.

7.5. Two-point adjustment

⚠ CAUTION

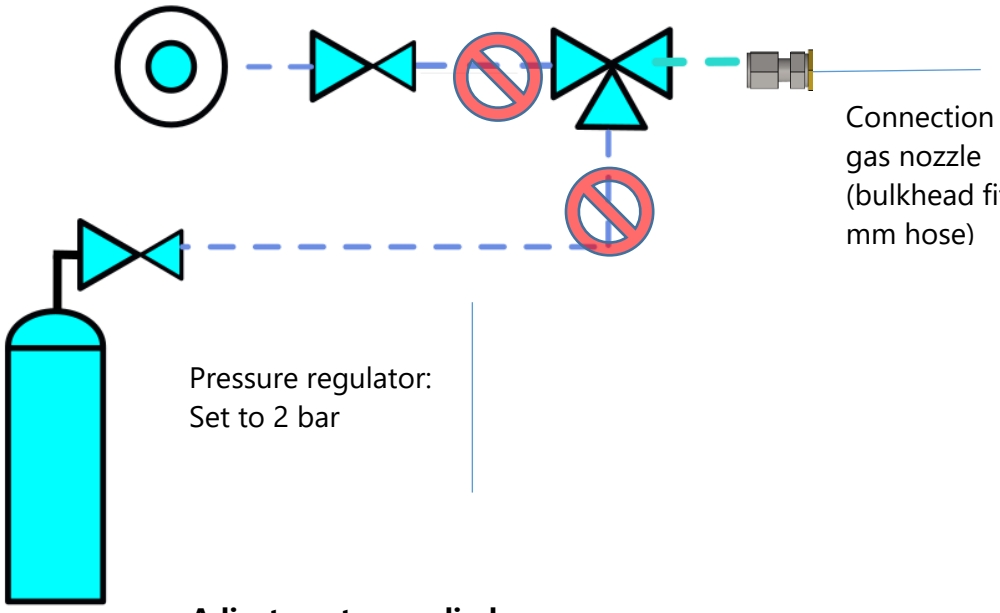
Risk due to compressed air

This may result in injuries

► Depressurize the system before assembly installation or removal

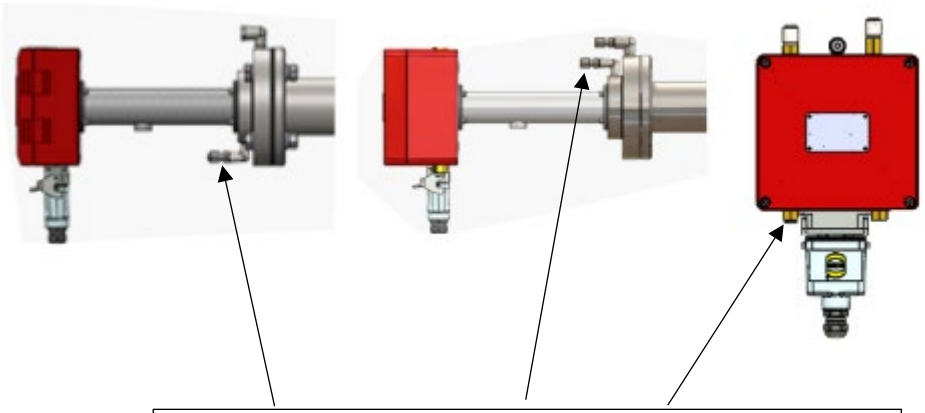
The manual two-point adjustment is carried out using compressed air and an adjustment gas cylinder. The structure is explained in more detail in the following chapters.
The procedure is carried out as follows:

1. The two-point adjustment is set up as described in the following chapters. Optionally, it is of course possible to first apply compressed air and then the adjustment gas to the calibration connection.
2. The zero point adjustment is carried out (see chapter 7.2).
3. After the zero point adjustment has been carried out, the incorrect adjustment values must be entered into the OMS420. Therefore, the wrong adjustment is connected to the calibration socket. The cylinder pressure must be set to 2 bar. Do not open the supply line yet.



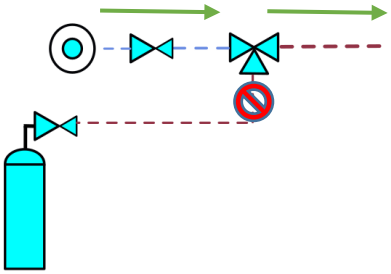
Adjustment gas cylinder:

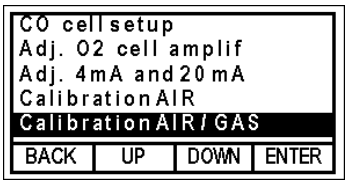
Oxygen (O2):	2 Vol.%
Carbonmonoxy (CO):	100 ppm
Hydrogen (H2):	50 ppm
Nitrogen(N2):	Rest



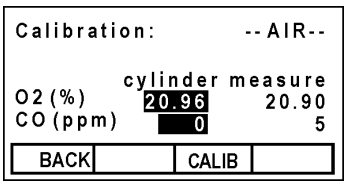
Calibration gas inlet of the different OMS420-models

First calibration must always be the zero calibration with "AIR". For this, open the compressed air way. Be sure, that the pressure reducer is set to 2 bar.





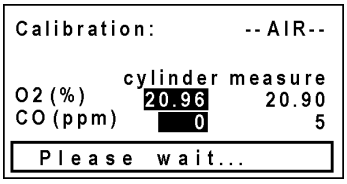
press ENTER



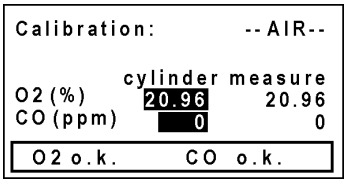
press CALIB

Wait approximately 5 minutes while instrument air is being supplied to sensors to allow signals to stabilize.

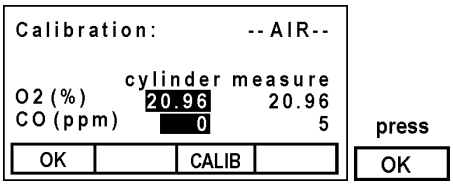
Press "CALIB" key



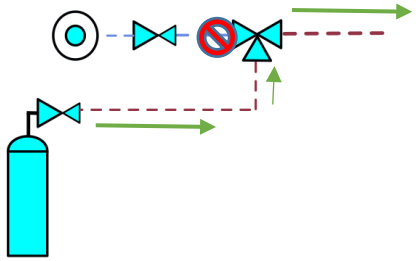
Wait for approximately 3 seconds!.

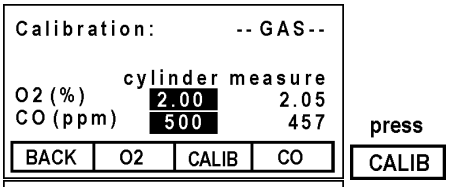


Zero gas (AIR) calibration was successful.
If calibration fails, an error message will be displayed.



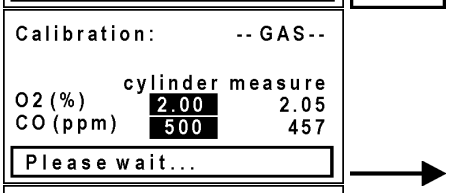
Second calibration shall be the span calibration with "GAS". For this, close the compressed air way and open the gas way, to the adjustment gas cylinder.



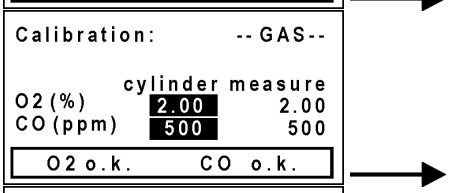


Read calibration gas cylinder values and if any change is required (other cylinder values) then edit O_2 and CO in the display by pressing "O_2" then the "CO" key.

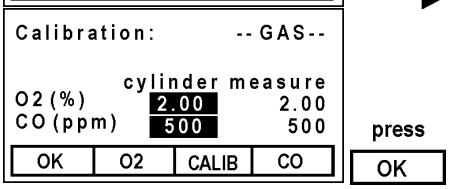
Wait approximately 5 minutes while calibration gas is being supplied to sensors to allow signals to stabilize, then press "CALIB" key.



Wait for approximately 3 seconds.



Span gas (GAS) calibration was successful.
If calibration fails, an error message will be displayed.



Return to previous setting menu.

8. Appendix

8.1. Technical data

General Data	
Operating temperature	-10°C ... +60 °C / 14 °F ... 140 °F
Rel. Humidity, non-condensing	5- 95%
Storage Temperature	-20°C ... +65°C / -4°F ... 150°F
Power supply	OMS420-N: 18VDC...24VDC, 100 W OMS420RT / OMS420HT: 100...240VAC / 50...60 Hz, 100 W
Weight	ca. 8 kg/ approx. 18 pound
Size (OMS420 only without probe tube and without remote unit)	310x170x300 mm 122.0 x 67.0 x 118.00 in
Material:	Aluminium
Housing Probe tube Protection class	Stainless steel
Interfaces	
User Interface	**Angabe**
Display type	3,5*LCD*
Number of simultaneously displayed values	2 (O2 / CO (optional))
Keyboard with qty of keys	4
Electrical I/O	
Serial interface	RS485
Protocol	Modbus RTU
Type of analog output	4 ... 20 mA
Number of output channels	2
Typ of analog input	4 ... 20 mA
Gas input and ouput	
Number of simultaneously monitored sampling points	1
Screw joint sampling point	In-Situ / DN65
Zero gas / calibration gas inlet	G1/8
Calibration gas	G1/8
Back purge function with press. Air (only OMS420 RT/HT)	
Iinlet type	G1/8
Max. inlet pressure	8 bar

Measurements	
Heated zirconium oxide cell	**O2**
Measuring Range	0 - 25%
Resolution	0,01 %
Accuracy abs./ reading	± 0,2 Vol% / 5%
Response Time T90	< 10s
Years expected lifetime	<4
Heated solid electrolyte cell	**COe**
Nom. Measuring Range	0 - 1000 ppm
Overload Range	---
Resolution	1 ppm
Accuracy abs. / reading	± 50 ppm/ 20% (0 .. 4000 ppm) 10% (> 4000 ppm)
Response Time T90	<10s
Years expected lifetime	1-3*
	**The lifespan is depending from the pollution-grade of the measurement gas flow. A higher pollution-grade shorten the lifetime of the sensor.*
Calculated values	
	CO_2
Measuring range (fuel type dependant)	0 - CO_2max
Accuracy abs.	± 0,3 Vol%
Dew point	°C
Losses qA	0 - 99,9%
Efficiency	0 - 120%
Measurement values available as	mg/Nm^3 O2 Ref mg/kWh NOx: mg/Nm3 NO2

8.2. Error codes

#	Englisch
01	Heating current<0.5A, O2 sensor not o.k.
02	Configuration Error, new adjustment required
04	Flash Error, new adjustment required Please contact your dealer (manufacturer).
08	Unit to warm, ambient temperature too high!
32	Heating current<0.1A, CO sensor not o.k.
64	Heating current<0.1A, CO sensor not o.k.
128	Calibration error, calibration factor cannot be set. Test gas cylinder is empty, filter dirty or clogged. Calibration offset value cannot be set. Instrument air supply is not available.

At the same time if several errors line up, then the error codes are to be added.

Her one example:

33 Heating current<0.5A, O2 sensor not o.k. and

Heating current<0.1A, COe sensor not o.k.

8.3. Modbus Slave specification

8.3.1. General information

• supports only the binary Modbus protocol (RTU)
• the slave modbus address is user definable from 1 to 49
• communication parameter are user definable as follows:
- 9600 baud
- 8-Bit
- even parity and 1 stop bit
• data types (used in table below):
U 16 bit unsigned integer value (0...65535)
I 16 bit signed integer value (-32768...32767)
UL 32 bit unsigned integer value (0...4.294.967.295)
L 32 bit signed integer value (-2.147.483.648...2.147.483.647)
F 3 32 bit floating point value (reads -1E38, when not available)

8.3.2. Defined registers

Available data with modbus command 4 READ INPUT REGISTERS:

PLC address	Protocol address	Data type	Number of registers	Register content
				Device info / status
40001	0	U	1	Error-Flags
40002	1	U	1	Reserved for further flags
40003	2	U	1	Status
40004	3	I	1	O2 [%] 1152 -> 11,52 %
40005	4	I	1	CO [ppm] 123 -> 123 ppm

Error Flags
Bit 0 Heating current<0.5A, O2 sensor not o.k.
Bit 1 Config error
Bit 2 Flash error
Bit 3 Unit to warm
Bit 4
Bit 5 Heating current<0.1A, COe sensor not o.k.
Bit 6
Bit 7 Calibration error

Status
Status 0 Busy
Status 2 Measurement active
Status 5 Backpurge active
Status 6 Calibration active

If the device is in the heating-up phase (switch-on process), bit 8 is additionally set.
After the "operating temperature" is reached, the bit 8 is reset.

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Status (dez)	Description
0	0	0	0	0	0	0	0	0	Busy
0	0	0	0	0	0	1	0	2	Measurement active
0	0	0	0	0	1	0	1	5	Backpurge active
0	0	0	0	0	1	1	0	6	Calibration active

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8	Status (dez)	Description
reserve	reserve	reserve	reserve	reserve	reserve	reserve	1	256	Warm-up

Example:
Status: „Backpurge“ and „WARM UP“ -> 5 + 256 = 261 (16bit)

8.4. Declaration of conformity

MRU AIRfair seit 1984 EMISSIONSMESSTECHNIK	**EU-Konformitätserklärung** ***Declaration of conformity***	CE

MRU Messgeräte für Rauchgase und Umweltschutz GmbH

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Internet / *site:* www.mru.eu

Bevollmächtigte Person, für die Zusammenstellung der technischen Unterlagen
Person authorized to compile the technical documents

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Firmenname / *company:*	Messgeräte für Rauchgase und Umweltschutz GmbH
Straße / *street:*	Fuchshalde 8 + 12
Ort / *city:*	74172 Neckarsulm
Land / *country:*	Deutschland / *Germany*

Produkt/Product

Bezeichnung / *designation:*	ZrO2 Sauerstoffmesssystem *ZrO2 based oxygen monitoring system*
Produktname / *name:*	OMS 420
Funktion / *function:*	siehe Bezeichnung / *see designation*

Hiermit erklären wir, dass das oben beschriebene Produkt allen einschlägigen Bestimmungen entspricht, es erfüllt die Anforderungen der nachfolgend genannten Richtlinien und Normen:

We declare the conformity of the product with the applicable regulations listed below:

- EMV-Richtlinie / *EMV-directive* 2014/30/EU
- Niederspannungsrichtlinie / *low voltage directive* 2014/35/EU
- RoHS-Richtlinie / *RoHS directive* 2011/65/EU (RoHS II)

Neckarsulm, 01.07.2016

Erwin Hintz, Geschäftsführer / *Managing Director*

MRU seit 1984 AIRfair EMISSIONSMESSTECHNIK	**EU-Konformitätserklärung** ***Declaration of conformity***	CE

MRU Messgeräte für Rauchgase und Umweltschutz GmbH

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Person authorized to compile the technical documents

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Ort / *city:*	74172 Neckarsulm
Land / *country:*	Deutschland / *Germany*

Produkt/Product

Bezeichnung / *designation:*	ZrO2 Sauerstoffmesssystem *ZrO2 based oxygen monitoring system*
Produktname / *name:*	OMS 420 RT
Funktion / *function:*	siehe Bezeichnung / *see designation*

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- Niederspannungsrichtlinie / *low voltage directive* 2014/35/EU
- RoHS-Richtlinie / *RoHS directive* 2011/65/EU (RoHS II)

Neckarsulm, 18.12.2017

Erwin Hintz, Geschäftsführer / *Managing Director*

MRU seit 1984 AIRfair EMISSIONSMESSTECHNIK	**EU-Konformitätserklärung** ***Declaration of conformity***	CE

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Person authorized to compile the technical documents

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Ort / *city:*	74172 Neckarsulm
Land / *country:*	Deutschland / *Germany*

Produkt/Product

Bezeichnung / *designation:*	ZrO2 Sauerstoffmesssystem *ZrO2 based oxygen monitoring system*
Produktname / *name:*	OMS 420 HT
Funktion / *function:*	siehe Bezeichnung / *see designation*

Hiermit erklären wir, dass das oben beschriebene Produkt allen einschlägigen Bestimmungen entspricht, es erfüllt die Anforderungen der nachfolgend genannten Richtlinien und Normen:

We declare the conformity of the product with the applicable regulations listed below:

- EMV-Richtlinie / *EMV-directive* 2014/30/EU
- Niederspannungsrichtlinie / *low voltage directive* 2014/35/EU
- RoHS-Richtlinie / *RoHS directive* 2011/65/EU (RoHS II)

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8.5. Connector structure: Voltage connector OMS 420-N

⚠ CAUTION

Risk of electric shock from the power system voltage

This may result in severe injuries or death.

- ► Do not connect or disconnect power cables or power supplies with wet hands.
- ► Do not use any cables that have been damaged by pulling, twisting, being tied together, or extreme bending.
- ► Do not connect to an outlet where several devices have already been connected using power strips or that has been extended several times using extension cords.

⚠ WARNING

Installation by qualified personnel

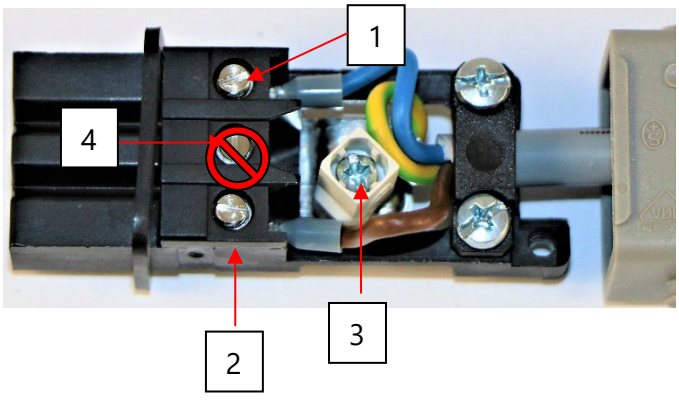
This may result in personal injury and damage to property.

- ► Installation work, such as the correct wiring of a plug, must be carried out by qualified personnel.

For the power supply an extern voltage connector is used. The picture below shows the assignment of the plug.

Number of pins:	3
Rated current:	16A
Rated voltage:	250 V
Cable diameter:	6-10 mm
Conductor cross section:	1.5 mm²

The voltage plug has one PE-taps and a PE-pin. Only the PE-taps is connected. The PE-connector must be connected with the PE-tabs not with the PE-pin (see picture below).



Reference:
1. N-conductor
2. L-conductor
3. PE-conductor
4. Not in used.

8.6. Connector structure: OMS420-RT/HT

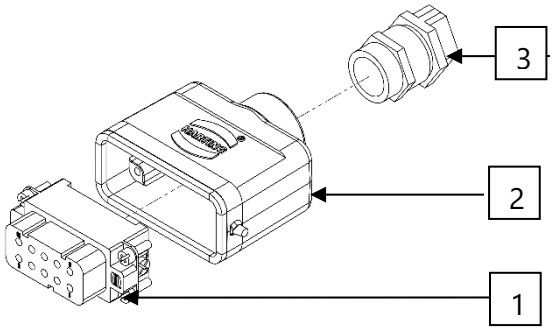
⚠ WARNING

Installation by qualified personnel

This may result in personal injury and damage to property.

► Installation work, such as the correct wiring of a plug, must be carried out by qualified personnel.

For the electrical installation, the plug with strain relief is required (included in the scope of delivery).
A distinction must be made here between whether the OMS420 is an N variant or an RT / HT variant. With the OMS420-N, the power supply is 24 VDC and is carried via the socket connector. Regardless of the type, the socket connector is always the same. The only difference is that the OMS420-N carries the power supply. You can see the structure of the socket connector in the next illustration.



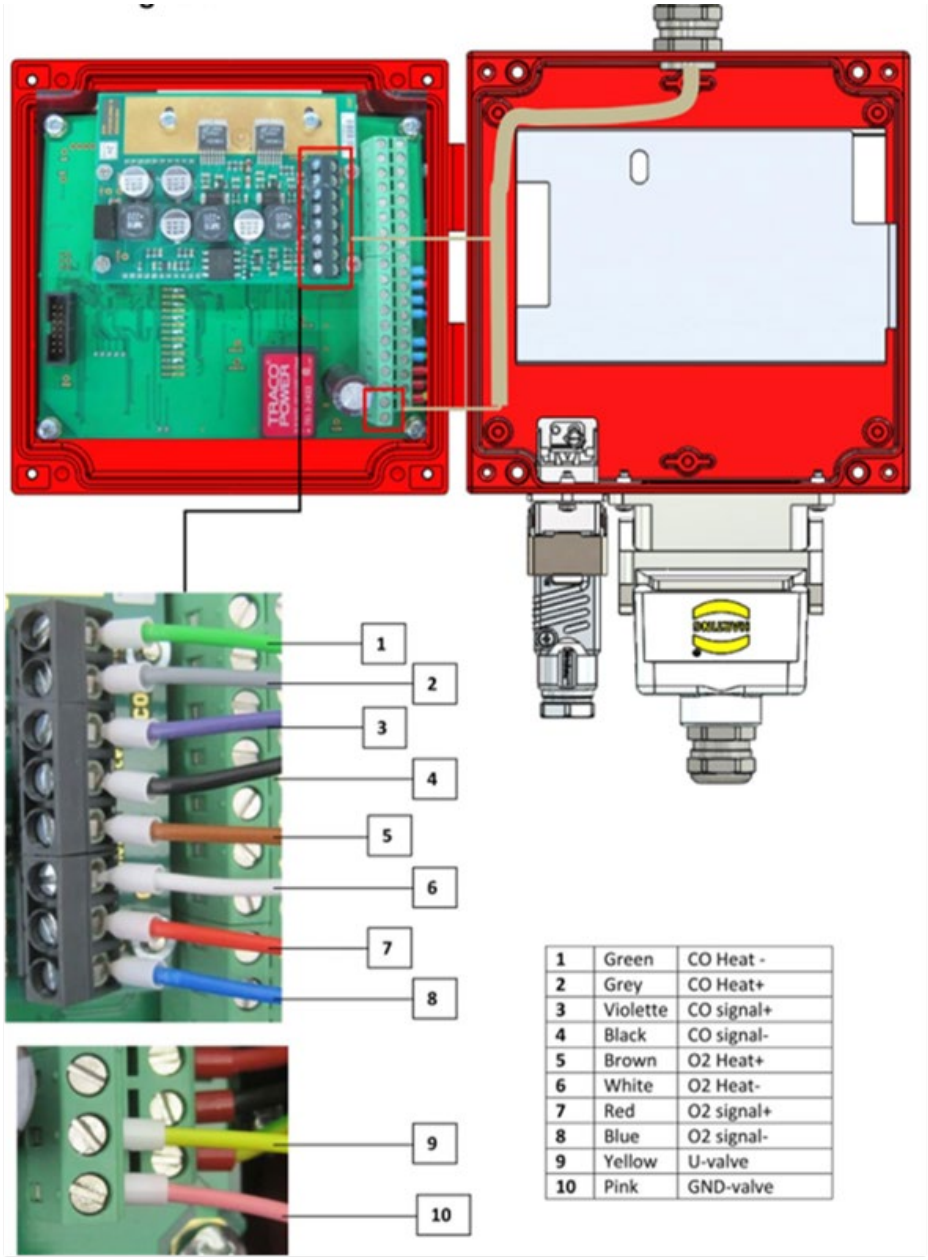
Refference:

1. Socket insert 10-pin
2. Fitting housing
3. Strain relief

- Cut the cable to the required length, strip the insulation, fit the ferrules and connect the individual wires to the plug as shown in the illustration below.

8.7. Innere Verkabelung der OMS420-RT / HT Modelle

The OMS420-RT units are supplied pre-wired. If the cable needs to be replaced or re-routed for any other reason, please refer to the wiring diagram shown below:



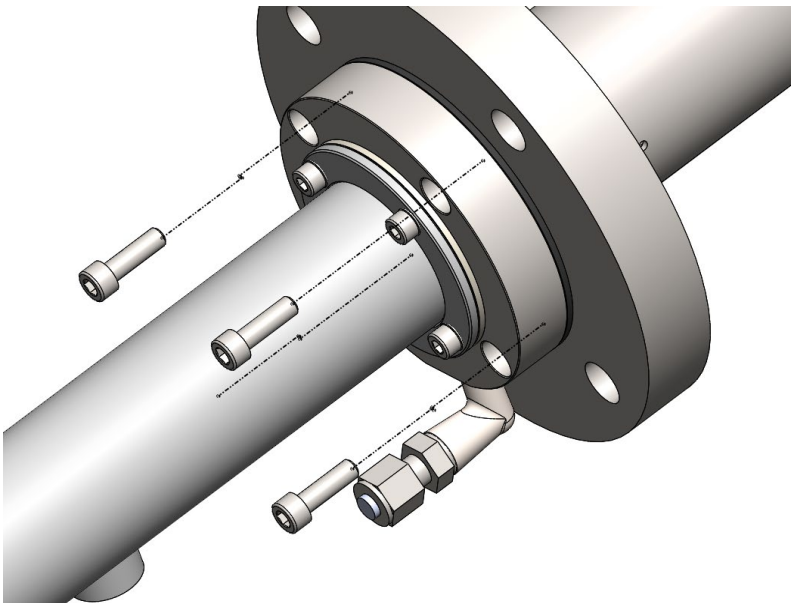
1	Green	CO Heat -
2	Grey	CO Heat+
3	Violette	CO signal+
4	Black	CO signal-
5	Brown	O2 Heat+
6	White	O2 Heat-
7	Red	O2 signal+
8	Blue	O2 signal-
9	Yellow	U-valve
10	Pink	GND-valve

8.8. Installation: Rotate the probe tube

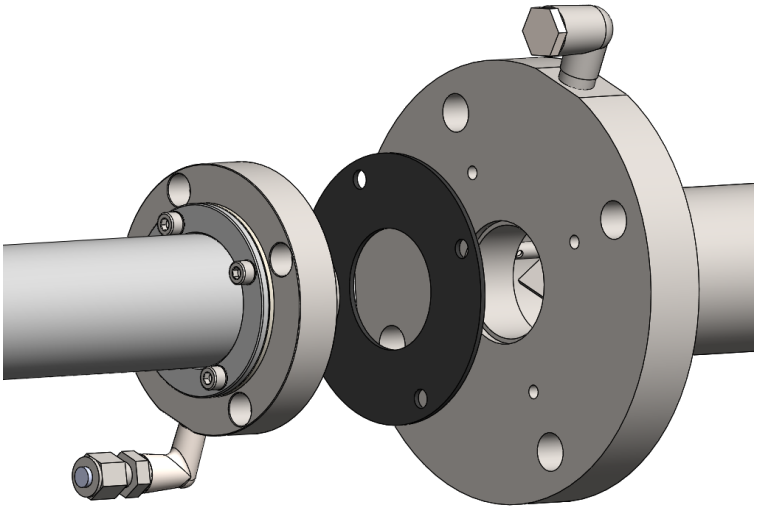
The probe is supplied connected to the measuring unit.

(Optional):
If the flow direction is not from bottom to top, the probe must be rotated. To do this, the probe must be removed from the OMS420-N.

a. First, remove the Allen screws from the OMS420 probe.

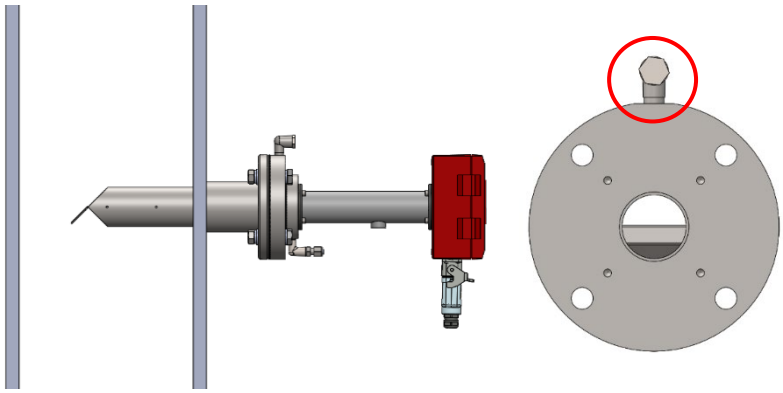


b. Replace the graphite seal before refitting the probe.

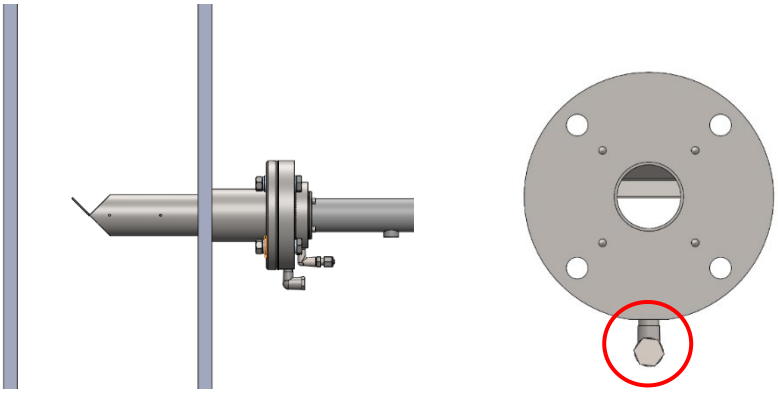


c. The following diagrams show how the probes must be installed in the flue.

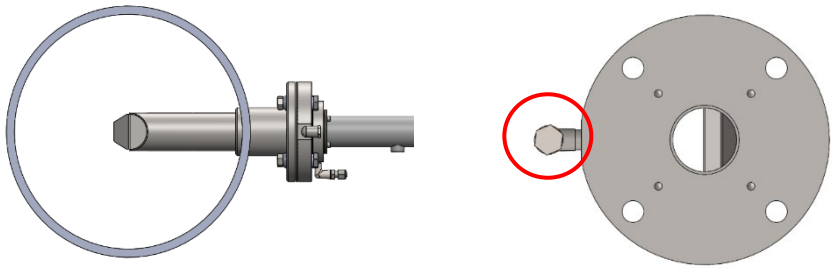
Flow direction: From bottom to top:



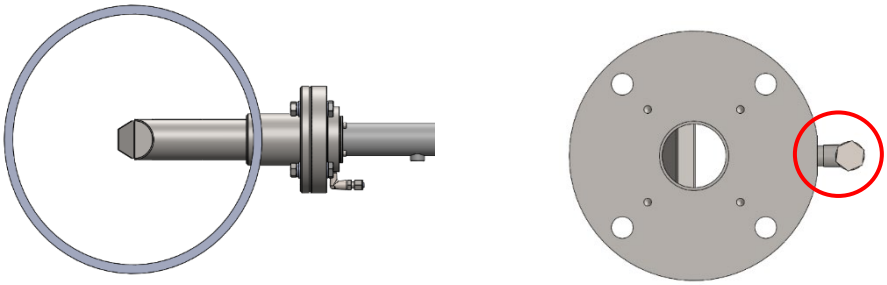
Flow direction: From top to bottom



Direction of flow: from right to left



Direction of flow: from right to left



Once the probe has been attached to the mounting flange, the OMS420 can be screwed back on.