EMISSION MONITORING SYSTEMS

since 1984 ®

SWG 100 CEM

USER MANUAL

9512EN-CEMC

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The products described in this manual are subject to continuous development and improvement. We therefore welcome any customer feedback, comments and suggestions regarding our product and its operating instructions that help to improve the product, service or documentation.

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FOR MORE INFORMATIONS ABOUT COMPANY MRU PLEASE VISIT OUR WEBSITE www.mru.eu

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CONTENT

1 Introduction and basic conditions

W002

These instructions enable safe and efficient use of the product.

The user must read and understand these instructions carefully before starting work.

The basic prerequisite for safe working is compliance with all the specified safety instructions.

1.1 Where to store the instructions

The instructions are an integral part of the product and must be kept in the immediate vicinity of the product and accessible to personnel at any time.

1.2 General information on the manual

- This manual will enable you to understand and safely operate this MRU analyser.
- Please read this manual carefully.
- Familiarise yourself with the product before using it.
- This analyser may only be used by qualified personnel and only for its intended purpose.
- Please observe all safety instructions and warnings to avoid injury and damage to the device.
- Hand over all documents if you pass the analyser on to third parties.

1.3 Safety signs

These safety instructions are based on the “SAFE principle” and are used throughout this manual:

Symbol

⚠ DANGER Signal word and color

Specific the type and source of the hazard

Specific consequences of non compliance

➢ Measures to avoid the hazard

⚠ DANGER

Refers to an imminent danger that will lead to serious physical injury or death if ignored.

⚠ WARNING

Indicates an imminent danger which, if ignored, can lead to serious physical injury, damage to property or death

⚠ CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in minor injury.

ATTENTION

Indicates a potentially hazardous situation which, if not avoided, may result in damage to the device or its surroundings.

NOTE

Indicates application tips and other particularly important information.

1.4 General important information for the system operator

MRU measuring devices are developed and manufactured in accordance with the applicable standards. Nevertheless, a failure or malfunction of individual device components is possible during the operating life of the device. It is the responsibility of the operator to consider and assess the effects of malfunctions of the device and, if necessary, to limit them by taking external measures.

ATTENTION

- ➢ The system operator must assess the effects of device malfunctions and, if necessary, limit them through external measures

Every system operator, user and technician who operates or maintains the device must be aware of the potential dangers associated with the use of the device. These dangers are explained in this manual.

ATTENTION

- Always ensure that the system is installed and operated in accordance with local regulations, provisions and standards. Hazards must be identified and suitable countermeasures taken as part of a risk assessment..

ATTENTION

Only use the device within the limits of its intended use.

- Improper use will invalidate the warranty

1.5 MRU warranty conditions

For the warranty conditions for your analyser, please consult MRU's general terms and conditions.

1.6 Disposal take-back guarantee

MRU undertakes to take back all contaminated parts supplied by us that cannot be disposed of in the "normal" way.

The return delivery must be free of charge for us. Parts containing hazardous substances are: e.g. electrochemical sensors.

1.7 Return of devices

MRU GmbH is obliged to take back all analysers delivered after 13 August 2005 for proper disposal. The device must be returned to MRU with postage prepaid.

1.8 Packaging

Keep the original carton and packing material to avoid damage in transit if you need to return the analyser to the factory.

1.9 Taking back parts containing harmful substances

MRU GmbH undertakes to take back all parts supplied by us that contain hazardous substances and cannot be disposed of in the normal way.

Parts containing hazardous substances are e.g. electrochemical sensors, batteries and accumulators.

The return delivery must be free of charge for MRU.

2 Notes on the device and safety

The instructions for use are an integral part of the product and must be read carefully before use and be available at any time.

2.1 General informations

- The operating instructions enable you to operate the device safely.
- Read the operating instructions carefully.
- Familiarise yourself with the device before using it.
- Before switching on, carry out an overall visual inspection of the device, any gas sampling probe and any attachments.
- Do not operate the device if the housing, power supply unit, supply cables or other parts are damaged.
- Any changes or modifications to the device are prohibited.
- Only operate the device within the parameters specified in the technical data.
- Only carry out maintenance and servicing work as described in the operating instructions. Observe the specified steps. Only use original spare parts.
- Do not store the device together with solvents, acids or other aggressive substances.
- Keep these operating instructions to hand so that you can refer to them if necessary.
- Hand over all documents when passing the device on to third parties.

ATTENTION

Familiarise yourself with the hazards posed by the device and observe the hazard avoidance instructions before handling the device

2.2 Qualified personnel

⚠ WARNING

Qualified Personnel

The devices may only be installed, commissioned and maintained by qualified and competent personnel.

NOTE

Protect the device against unauthorised access

2.3 Danger from gases

As intended, the device conveys gases that can be harmful to health if they escape and come into contact with people. These are primarily dangers due to a lack of oxygen, high levels of carbon dioxide and carbon monoxide. Other gases such as sulphur dioxide or nitrogen oxides can also occur and lead to health hazards.

ATTENTION

Unconnected hose lines or leaks can cause harmful gases to occur in the vicinity of the measuring device.

Ensure that the gas installation is tight.

Ventilate the area around the measuring device with sufficient fresh air.

Use personal protective equipment such as gas detectors if necessary

2.4 Mechanical Dangers

The device poses general mechanical hazards such as cuts or crushing injuries due to its own weight.

ATTENTION

Use personal protective equipment and suitable tools when handling the device.

ATTENTION

Due to the weight of the device, it must be moved and installed by at least two people

2.5 Electrical hazards

The device does not pose any particular electrical hazards, as long as the usual basic rules for electrical installations are observed.

These include the following instructions.

ATTENTION

- Always switch off the power supply before working on the open device
- Check whether the specified voltage range of the measuring device matches your supply voltage.
- Do not use the product if it is obviously damaged or if the inside of the device has come into contact with water.
- Only qualified persons should carry out electrical work on the device

2.6 Thermal hazards

The analyser does not pose any particular thermal hazards. The gas cooler module reaches temperatures of 5 °C in normal operation, the heat sink reaches temperatures of < 50 °C.

The infrared measurement technology is heated and controlled to 55 °C in normal operation.

NOTE

In the event of a fault, a malfunction of the device may cause electronic modules or software to reach higher temperatures than specified.

In this case, use personal protective equipment to protect yourself from burns.

If a heated gas sampling probe and a gas sampling line are connected, those items could be heated to a temperature of above 150 °C.

ATTENTION

Injuries possible in contact with hot surfaces.

Wear persosnal safety equipment when handling the gas probe or sample line

Allow for sufficient time ti cool those items down to low temperature after switch-off before handling the probe or sample line

2.7 Danger from leaking liquid

Condensate is usually produced during operation of the device and can be a source of danger.

⚠ DANGER

Chemical burns due to condensate

The condensate produced when drying the sample gas can be acidic. It can cause skin burns or eye damage

- ➢ Direct the condensate produced at the condensate outlet to non-hazardous areas using a hose line
- ➢ Avoid skin contact with the condensate
- ➢ In particular, avoid eye contact with the condensate.
- ➢ Rinse affected areas of skin thoroughly. Check whether a visit to the doctor is necessary.

ATTENTION

A small amount of sample gas may escape at the condensate outlet of the device

2.8 Danger from leaking acid

⚠ DANGER

Chemical burns due to sensor acid

Under certain circumstances, acid may escape from electrochemical sensors. This can cause damage to the skin or eyes

- ➢ Avoid contact with leaking acid from electrochemical sensors.
- ➢ Wear personal protective equipment when handling electrochemical sensors

3 Intended use

The analyzer is designed to determine the proportion of various gas components in a sample of combustion plant flue gas. Typical gas components here are carbon dioxide or oxygen in proportions of up to 20 vol% as well as other gas components in significantly lower concentrations such as carbon monoxide up to 10000 ppm.

The analyzer is designed for continuous operation and measures the gas composition at adjustable time intervals.

The results of the gas analysis are used to monitor emissions and optimize plant processes.

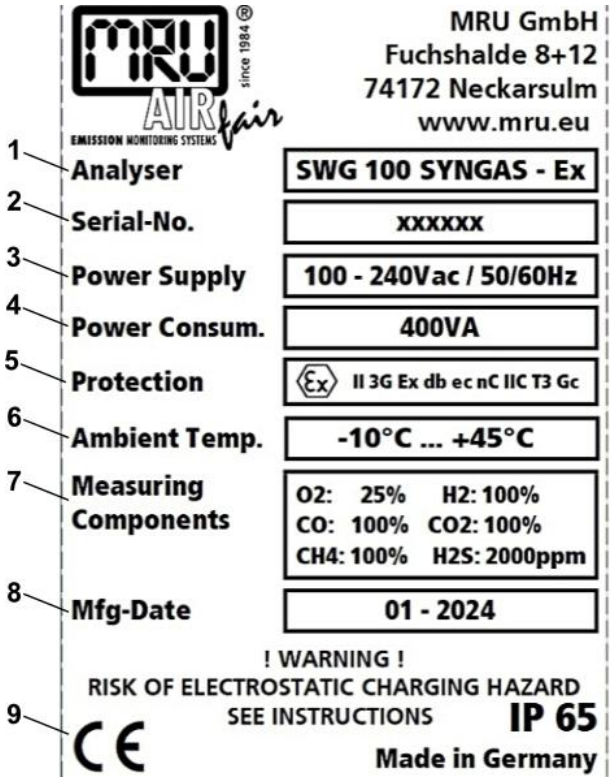
The analyzer is **not** to be used as a safety-determining component whose measurement results justify the safety of persons, the system or parts thereof.

4 Device description

The product name, serial number and further information on device identification can be found on the nameplate attached to the outside of the analyser housing.

4.1 Identification and nameplate

The configuration of your device can be found on the nameplate.



#	Designation
1	Product name
2	Serial number
3	Power supply
4	Electrical power
5	Ex-protection
6	Permitted ambient temperature

7	Detectable sample gases and their measuring ranges
8	Manufacturer date
9	Labelling

4.2 Functional description

- To analyse the gas, the analyser sucks in gas by means of a sample gas pump, which is supplied via sample gas lines. The volume flow of the sample gas is recorded and the pump is regulated in order to achieve a constant volume flow of the sample gas.
- Depending on the equipment, sample gas can be supplied from different measuring points. The analyser switches between the measuring points at an adjustable time interval. Only gas from one measuring point can be analysed at any one time.
- The gas is dried in a Peltier gas cooler, producing condensate which is discharged via a condensate pump.
- The sample gas is filtered to remove harmful dust particles
- The sample gas is fed to various analysis modules, which analyse the gas based on different measuring principles depending on the type of gas.
- The sample gas is led out of the device via a common gas outlet (VENT) after the analysis.
- The device can be operated by the user via a local operating unit. Measured values can be viewed there, and device parameterisations can also be carried out.
- The device saves individual measured values at the end of each measurement interval in an internal data memory. Permanent availability of consistent data in short time intervals is not guaranteed here; for this purpose, the user must realise external data acquisition.
- The device provides measured values via various analog or digital interfaces, which correspond to the live values or are assigned to their respective measuring point.
- The device allows the connection of test gas cylinders of known concentration. Test gas can be used manually by the user or automatically by the device itself to adjust (calibrate) the measurement technology.

4.3 Basics of analyzer technology

4.3.1 Gas extraction and gas supply

To be able to measure water-soluble components such as NO2 or SO2, heated sample probes and heated sample gas lines must generally be used. Depending on the equipment, the analyzer can regulate the temperatures of the probe and sample gas line. Please note the limits of the control engineering, especially with the heated hose: the temperature-carrying measured variable is recorded at one point along the sample hose. Sections of the sample hose upstream or downstream may have different temperatures. Ideally, the entire length of the sampling hose should be installed at the same ambient temperatures.

4.3.2 Gas supply

Gas supply is realised via a diaphragm pump. The volume flow generated by this pump is recorded and controlled by means of a differential pressure measurement via a separate bottleneck.

4.3.3 Methods used for gas analysis

The following measuring principles are used in the measuring devices, depending on the equipment:

1. O2 is measured using electrochemical gas sensors or a paramagnetic oxygen sensor
2. CO, NO, NO2, SO2 are measured using electrochemical gas sensors or NDIR infrared absorption measurement technology, depending on the equipment.
3. CO2, CH4, N2O are measured using NDIR infrared absorption measurement technology, if supported by equipment
4. H2 is measured by a thermal conductivity sensor depending on the equipment

4.4 Zeroing

All gas analysis methods used are subject to a short-term drift at the zero point, which leads to deviations from zero even if there are no target gas components in the sample gas. To correct this, the

measuring device carries out a zero-point measurement at a specified time interval. All sensor modules are purged with fresh air (zero gas) and then the displayed value of all sensors is set to zero (20.96 vol% for oxygen).

The size of the zero drift is influenced by various factors, such as temperature changes, physical or chemical changes in the sensors.

The time interval for zeroing must be adjusted by the user with regard to the size of the zero drift and the required measurement accuracy.

Typical intervals for zeroing range from a few hours to a maximum of one day.

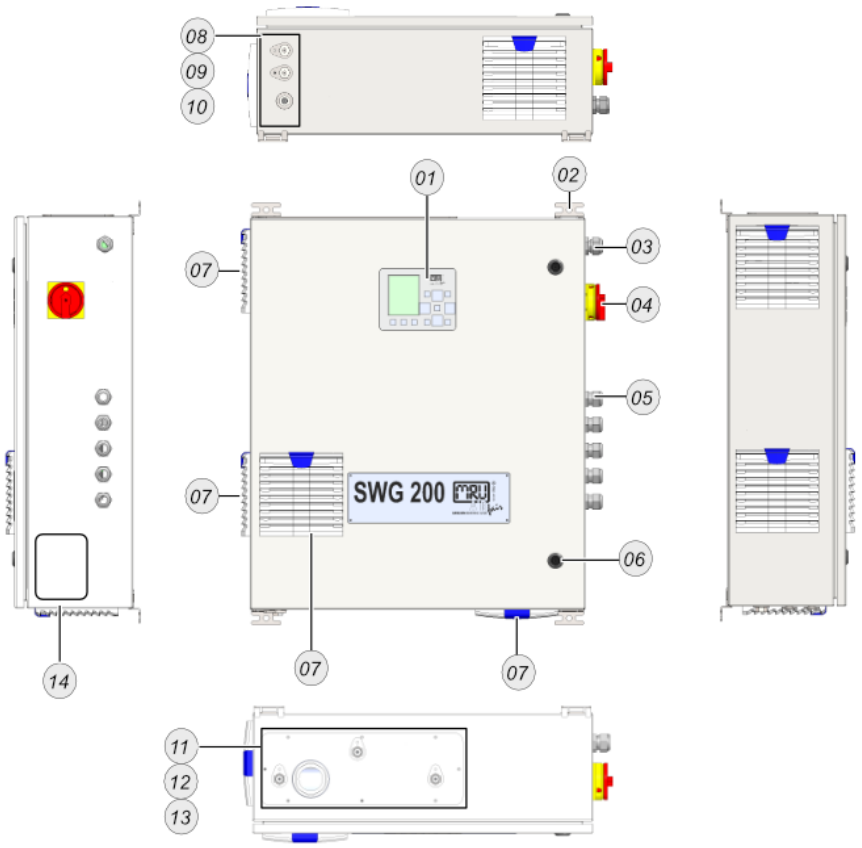
4.5 Calibration of the device

The sensitivity of each gas sensor is subject to long-term drift, which can lead to deviations from the target value. This drift can be caused by general ageing effects or wear.

To correct this, the measurement technology should be calibrated (adjusted) at regular intervals using test gases of a known concentration. This can be carried out manually by the user. Alternatively, depending on the equipment, the device can carry out an automatic adjustment using permanently connected test gas cylinders.

The time interval of the adjustments must be carried out by the user depending on the observed deviation and the required accuracy.

Typical calibration intervals range from weekly to annually.



Note: the illustration applies equally to SWG100 and SWG200.

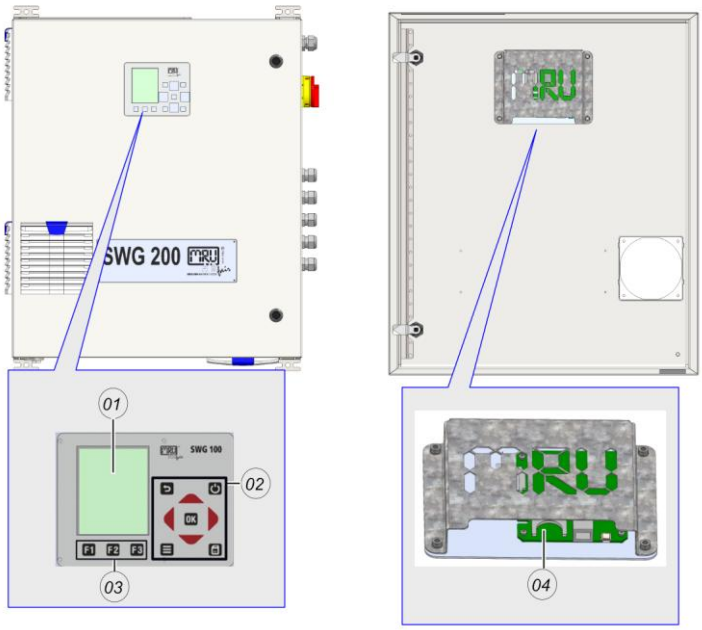
#	Description	#	Description
1	Operation unit	10	H3PO4 inlet*
2	Wall hanging	11	Zero gas inlet*
3	M32 Gland for mains	12	Calibration gas inlet*
4	Main switch	13	Sample gas inlet*
5	M12 Glands for IO Modules	14	Nameplate
6	Lock		
7	Filter-unit		
8	Condensate outlet*		
9	Vent**		

*The positions of the inlets and outlets are printed on the unit. All inlets and outlets have a G1/8 inner thread.

**The position of the vent is printed on the unit. The vent has a G1/4 inner thread.

4.6 Operation unit

The control unit is used to operate the unit. In addition, the SD card slot is located on the back of the control unit.



#	Description
1	TFT-Display
2	Control-keys
3	Function keys
4	SD-card slot.

5 Mounting the device

Here you will learn how to assemble and install the device correctly. The installation work includes:

- Set up the device,
- Wire the device electrically,
- Install and electrically connect optional accessories, such as gas sample probe or heated sample lines
- Connect the sampling lines and, if necessary, liquids.

5.1 General installation rules

NOTE

For protection class and permissible ambient temperature, see Technical specifications.

This protection class is only provided when the door is closed.

NOTE

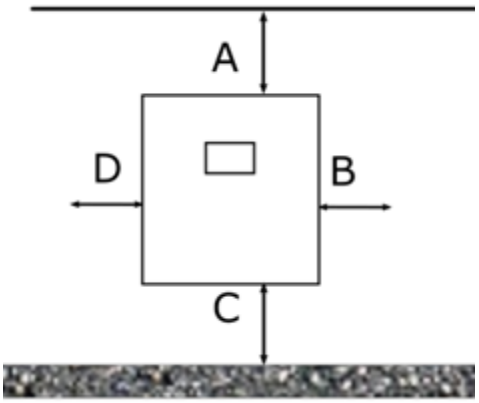
Unless expressly stated, all MRU measuring devices must be protected from direct sunlight and rain by a separate weather protection. This weather protection must be procured and installed by the operator.

A suitable installation location must fulfil the following criteria:

- The installation location should be protected from direct sunlight.
- The installation location should be protected from direct rain.
- The installation location should be easily accessible.
- The installation location should be well ventilated.
- The installation location should have sufficient space for installation work and operation.

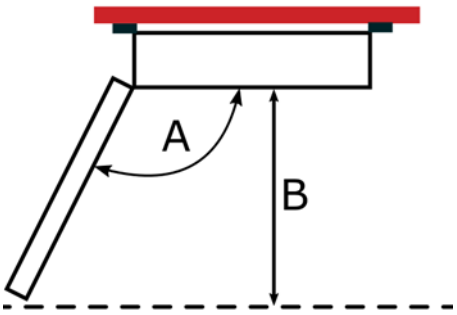
5.2 Set up the device

The installation location should maintain the following distances:



Distances to the sides

Position	Minimum distance
A	Min. 50 cm
B	Min 30 cm to the nearest wall
C	Min. 100 cm to the floor (for wall-mounted devices)
D	Min. 50 cm to the nearest wall



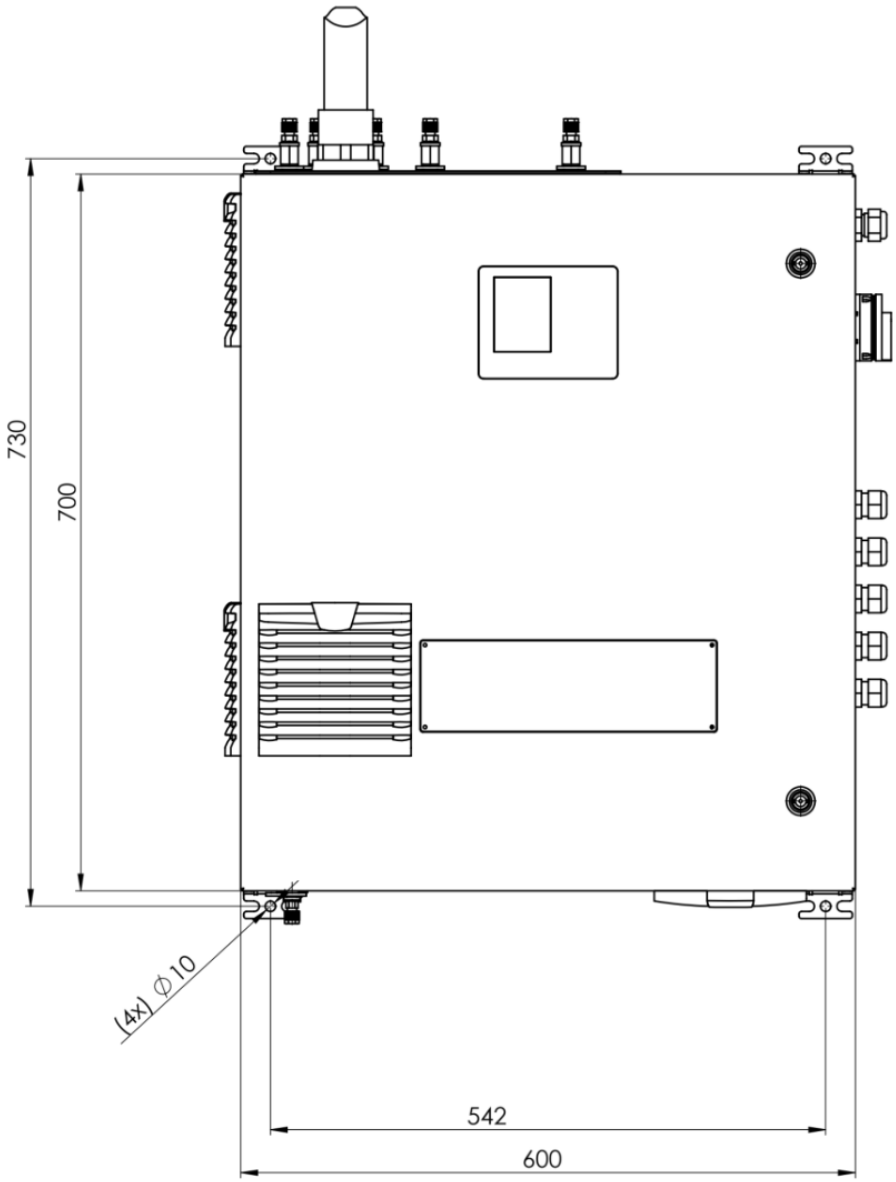
Clearance in Front

Position	Minimum distance
A	Min. 120°...180°
B	Min. 100 cm

5.2.1 Dimensions and drilling plan

Wallmounting with:

- 4xM10 screws with with appropriate strength



Dimensions and drilling plan

5.3 Connecting the power supply

This section tells you how to connect the power supply. The device is designed for 100 - 230 VAC / 47 - 60 Hz

⚠ Danger

Improper electrical installation

Risk of serious injury

- ➢ The power supply for this device should only be installed by a trained and qualified electrician.

ATTENTION

Damage to the device

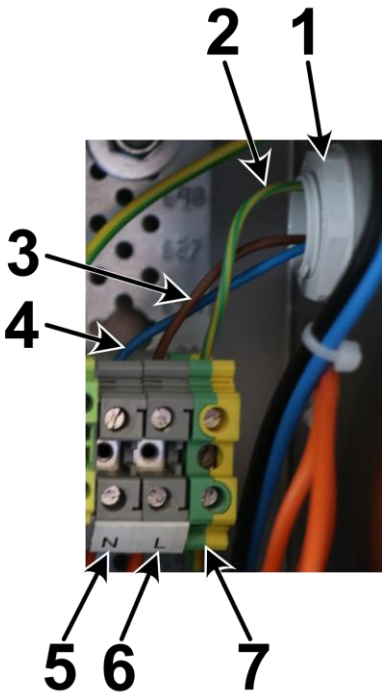
The device does not work properly

- ➢ Find out about your country-specific requirements for additional electrical protection devices.

PREREQUISITE:

- ☑ A suitable 3-wire installation cable with PE, L and N conductors and with a cross-section of 1.5 mm^2 must be available.

STEPS:



Electrical connection

#	Description
1	Cable gland
2	PE conductor
3	L conductor
4	N conductor
5	N terminal
6	L terminal
7	PE terminal

▶ Feed the 3-phase cable through the cable gland.

▶ Connect the **PE conductor** to the **PE terminal**.

▶ Connect the **L conductor** to the **L terminal**.

▶ Connect the **N conductor** to the **N terminal**.

☛ You have installed the power supply.

5.4 Connecting the phosphoric acid canister to the H3PO4 inlet

REQUIRED COMPONENTS

- ☑ Condensate connection DN4/6
- ☑ Phosphoric acid connection DN4/6
- ☑ Phosphoric acid canister
- ☑ Vent connection DN10/12

▶ Seal the thread of the DN4/6 condensate connection with PTFE tape.

▶ Screw the DN4/6 condensate connection hand-tight into the condensate inlet.

▶ Seal the thread of the DN6/4 phosphoric acid connection with PTFE tape.

▶ Screw the DN4/6 phosphoric acid connection hand-tight into the H3PO4 inlet.

▶ Seal the thread of the DN10/12 vent connection with PTFE tape.

▶ Screw the DN10/12 Vent connection hand-tight into the Vent.

✔ The fittings are mounted.

▶ Connect a DN4/6 hose to the condensate outlet and lead the hose into a condensate container.

▶ Connect a DN10/12 hose to the vent and lead the hose into an unoccupied area.

▶ Connect the phosphoric acid canister to the H3PO4 inlet.

⚠ **WARNING** – Type of danger. Instructions on how to avoid a dangerous situation.

▶ Fill the phosphoric acid canister with 10 Vol.% phosphoric acid

▶ Connect the hose of the phosphoric acid canister to the PTFE screw connection.

✔ The Vent is mounted.
✔ The phosphoric acid canister is mounted.
✔ The condensate outlet is mounted.

5.5 Connecting the alarm relay

You will find the alarm relay connection and the RS-485 connection on the mainboard.

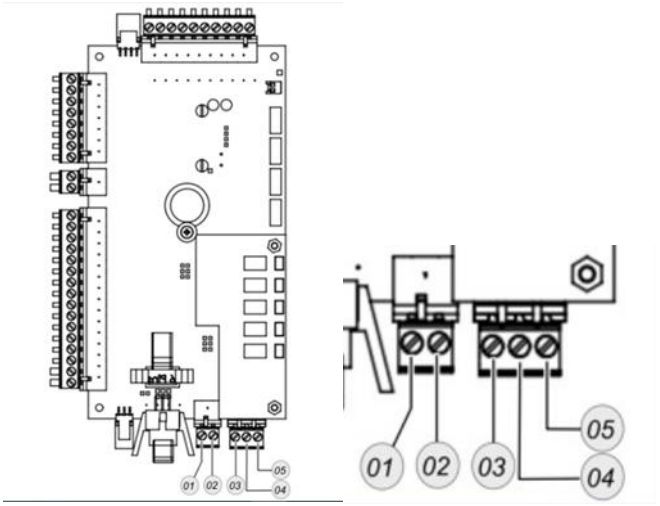
The alarm relay has the following properties:

- Potential-free
- Max. 24 VDC
- Max. 1 A

External actions (e.g. visual alarms) can be connected via the alarm relay in the event of a system error

5.6 Connecting the RS-485 interface

☛ For this Modbus protocol (RTU) see extra manual.



Left side Mainboard, right side magnified view

#	Connection	Description
1	Alarm connection	Alarm connection 1

2	Alarm connection	Alarm connection 2
3	RS-485	A_EXT+
4	RS-485	B_EXT-
5	RS-485	GND

▶ Connect the cables to the plugs.

5.7 Mounting the heating hose to the sample gas inlet

REQUIRED COMPONENTS:

- ☑ HD-heating hose
- ☑ HD-probe
- ☑ 2 x support sleeves
- ☑ HD-probe tube
- ☑ HD probe tube seal

▶ Roll out the heating hose.

The heating hose has 2 different sides. A device side A and a probe side B.

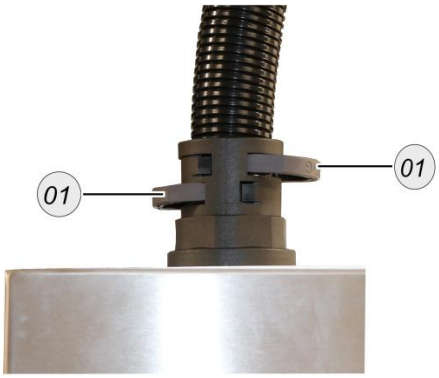
Device side A: With wiring harness

Probe side B: With probe plug

▶ Insert side A of the heating hose into the sample gas inlet of the device.

▶ Press the retaining clips 01 (see drawing) of the heating hose adapter 02 together.

✔ The heating hose is fixed.



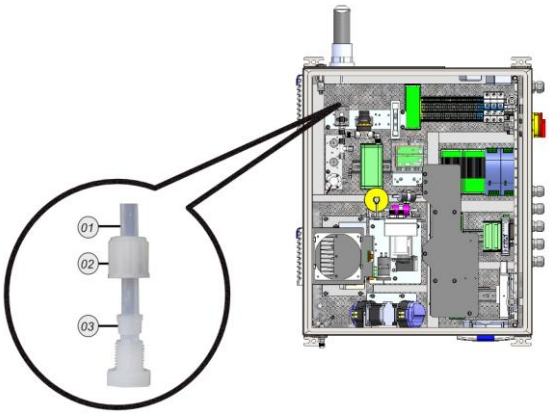
Position	Designation
1	Retaining clips

▶ Wire the wiring harness to the heating hose clamp. Proceed according to the table.

#	Cable strand colour	Function
1	Brown	L-heating hose
2	Blue	N-heating hose
3	Green	TH+ heating hose
4	White	TH- heating hose
5	Violet	L-probe
6	Yellow	N-probe
7	Green	TH+ probe
8	White	TH- probe
9*	Grey	L-backwashing
10*	Black	N-backwashing

▶ Connect the PTFE hose to the gas inlet.

Side A is fully mounted.



Position	Designation
1	PTFE-hose
2	PTFE-screw nut
3	Clamping ring

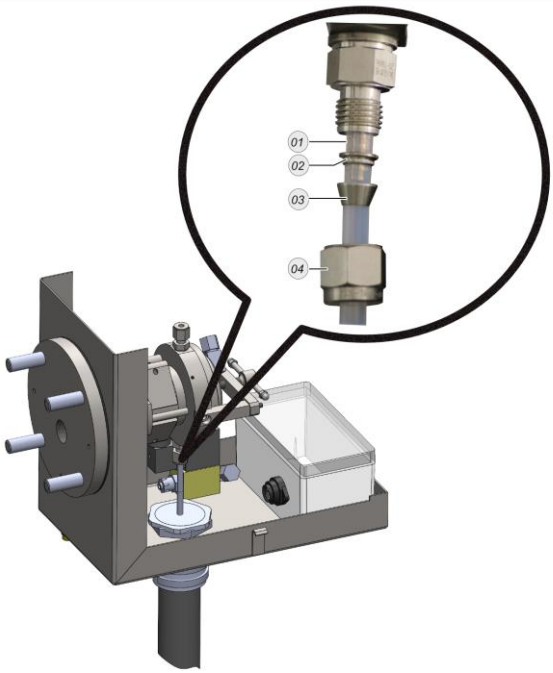
▶ Open the cover of the HD probe.

▶ Insert side B of the heating hose into the HP probe input

▶ Press the retaining clips of the heating hose adapter together.

Position	Designation
1	Retaining clips

▶ Connect the PTFE hose to the pipe fitting.

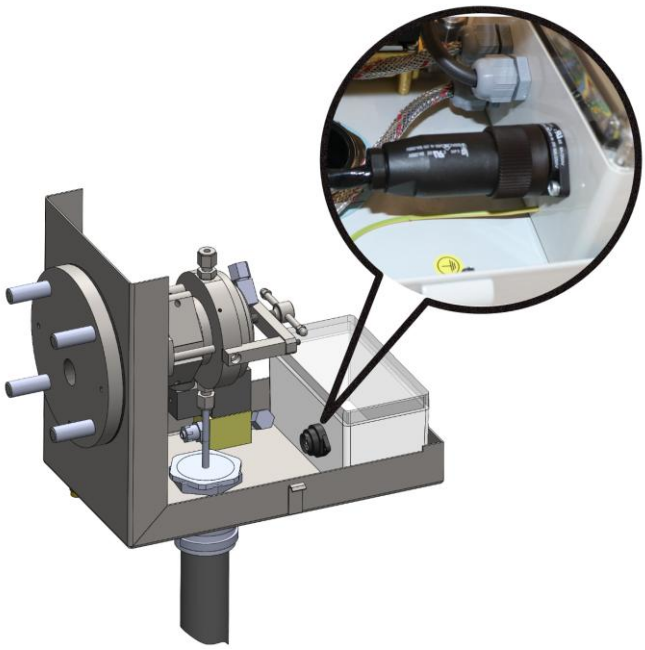


Position	Designation
1	Support sleeve
2	Upper clamping ring
3	Lower clamping ring
4	Pipe nut

NOTE

To ensure that the pipe fitting is properly sealed, turn the pipe nut 04 with an SW 18 x1.5 spanner.

▶ Insert the probe plug into the probe socket.



▶ Close the cover of the HD probe.

✔ you have fitted the heating hose with the probe and the device.

5.8 Mounting the heated sampling line on the sample gas inlet

⚠ DANGER

Fire hazard

Unrolled heated sampling line heats up and can catch fire. Burns can lead to death.

- ➢ Always unroll the heated sampling line.

⚠ WARNING

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:

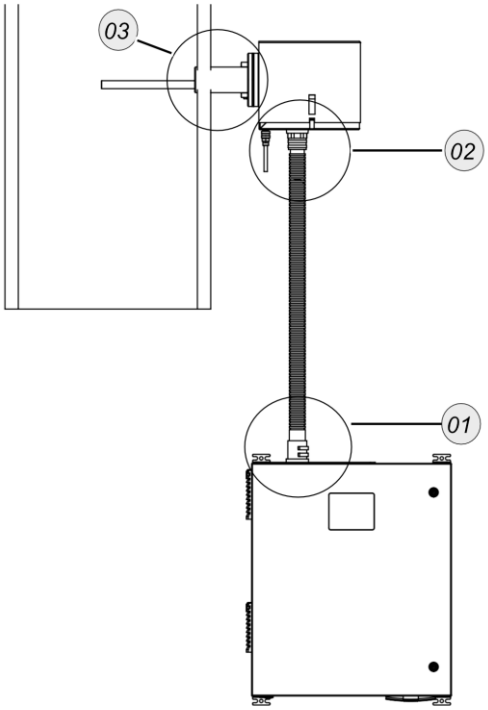
⚠ WARNING

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.

In this chapter you learn how to install the heated sampling line and the HD-probe with the device. The sketch below gives you a short introduction of the entire installation process.

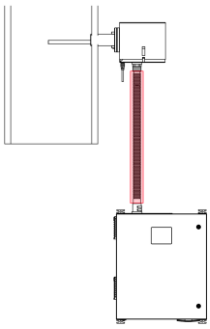


#	Side and description
1	Mounting the heated sampling line to the device
2	Mounting the heated sampling line to the HD-probe
3	Mounting the HD-probe to a measurement point.

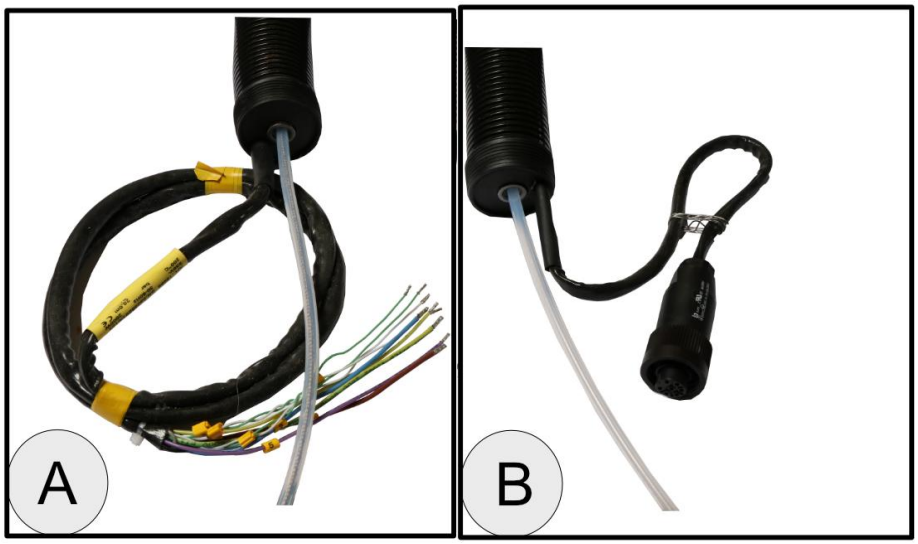
PREREQUISITE

- ☑ HD heated sampling line
- ☑ HD probe

- [x] 1x support sleeves
- [x] HD probe tube
- [x] HD probe tube seal
- [x] Female couple NS7,2 for compressed air connection



STEPS: UNROLL THE HEATED SAMPLING LINE



#	Side
A	To device
B	To HD-probe

Fig 1

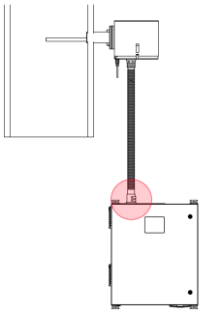
⚠ **DANGER** – Fire hazard. Unroll the heated sampling line, before use it.

▶ Unroll the heating sampling line.

The 2 ends of the heated sampling line appears.

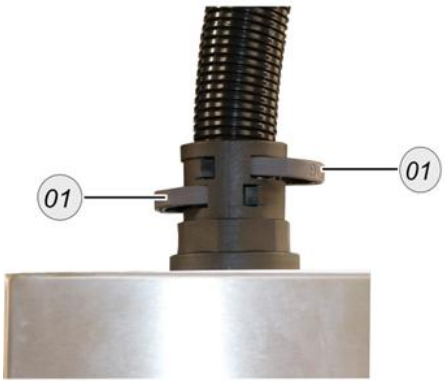
One side is for the device installation. This side has a harness (Fig1. A).

One side is for the prob installation. This side has a plug (Fig. (B))



STEPS: MOUNTED HEADED SAMPLING LINE IN DEVICE (SIDE A)

▶ Insert ***side A*** of the heated sampling line into the ***Sample gas Inlet*** of the device.



#	Description
1	Retaining clips

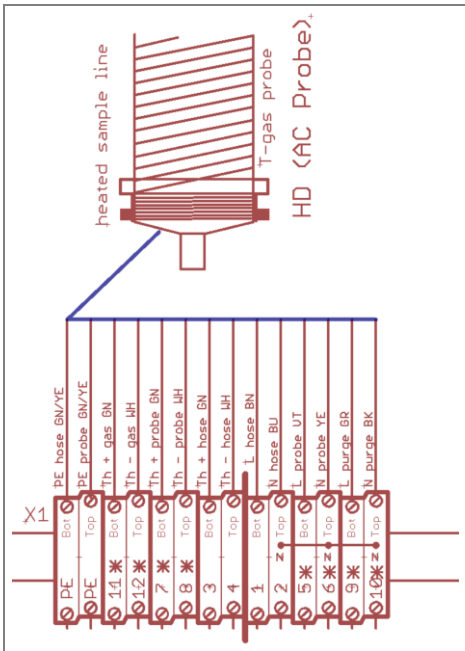
Fig.2

▶ Press the retaining clips of the heated sampling line adapter together (Fig.2 (1)).

The heating hose is fixed.

⚠ **WARNING** – Fire hazard. Wire the harness correctly. Wrong wiring cause fire.

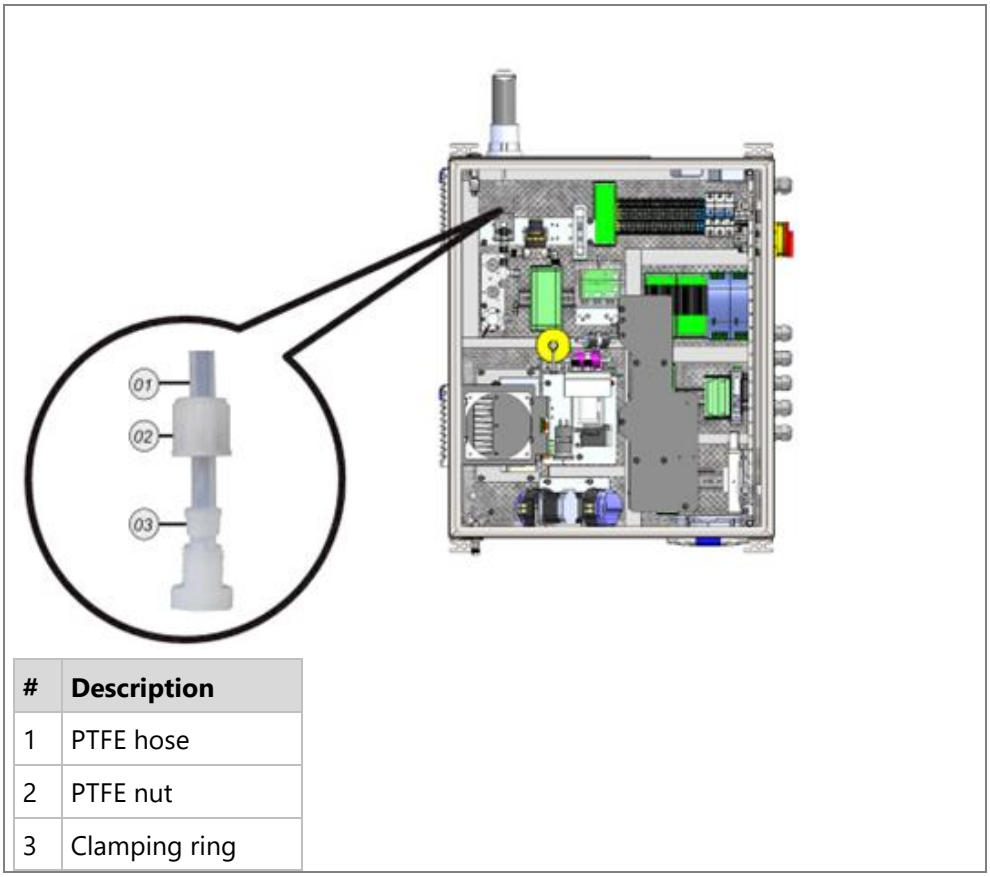
▶ Wire the wiring harness to the X1 terminal Fig. 3).



#	Cable strand colour	Function
1	Brown	L-heating hose
2	Blue	N-heating hose
3	Green	TH+ heated hose
4	White	TH- heated hose
5	Purple	L-probe
6	Yellow	N-probe
7	Green	TH+ probe
8	White	TH- probe
9	Grey	L-backwash
10*	Black	N-backwash

Fig. 3

☛ See appendix X-X for wiring diagram.

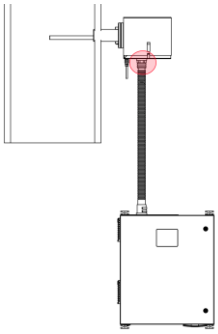


#	Description
1	PTFE hose
2	PTFE nut
3	Clamping ring

Fig.4

▶ Connect the PTFE hose to the gas inlet (Fig.3).

✔ Side A is ready mounted.



STEPS: MOUNTED HEATED SAMPLING LINE TO HD-PROBE (SIDE B)

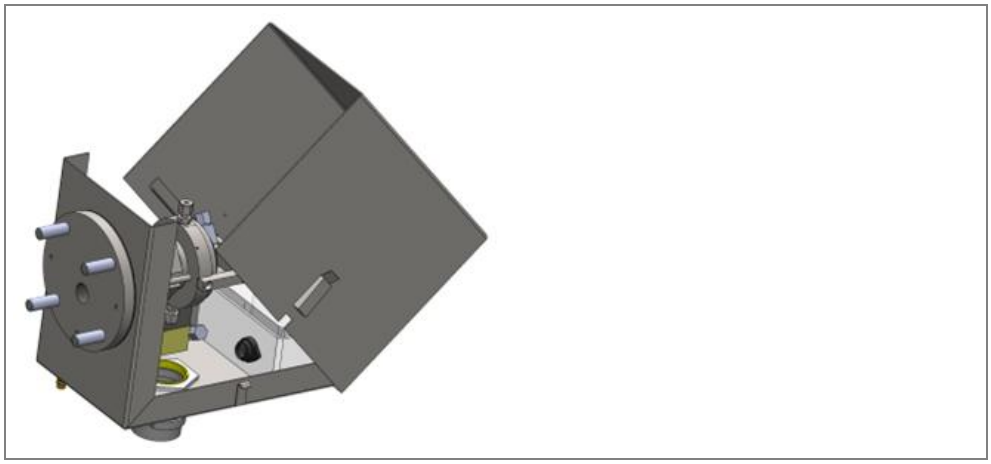
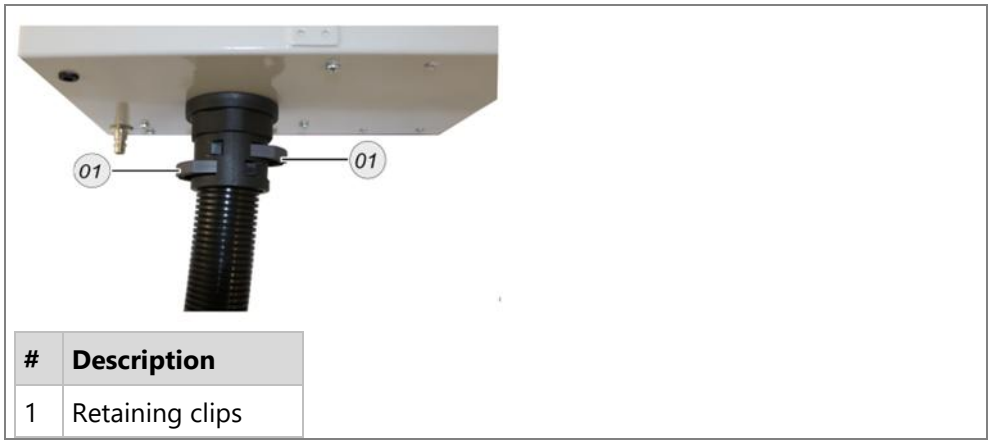


Fig.5

▶ Open the cover of the HD-probe (Fig.4).

Fig. 6

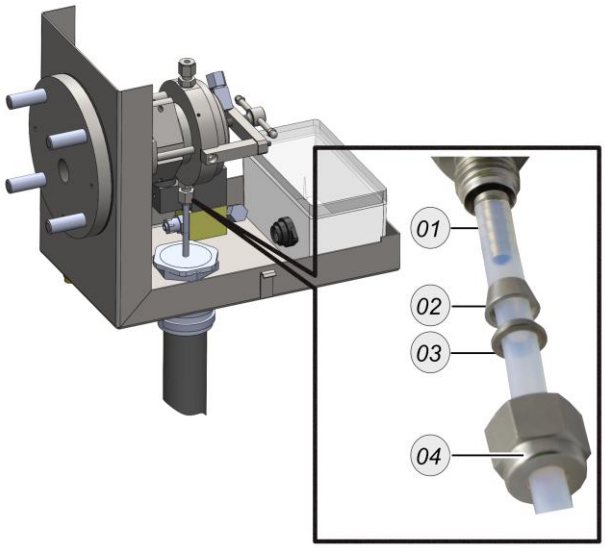
▶ Insert side B of the heated hose into the HD probe inlet (Fig. 5).



#	Description
1	Retaining clips

Fig. 7

▶ Press the retaining clips of the heated hose adapter together (Fig. 6 (1)).



#	Description
1	Support sleeve
2	Upper clamping ring
3	Lower clamping ring
4	Tube nut

Fig. 8

▶ Connect the PTFE hose to the tube fittings (Fig. 7 (1-4)).

▶ Install the PTFE hose to the sample gas outlet of the HD-Probe (Fig. 7).

NOTE

To ensure that the tube fitting is properly tight, turn the tube nut 04 with a spanner SW 18 one and a half times.

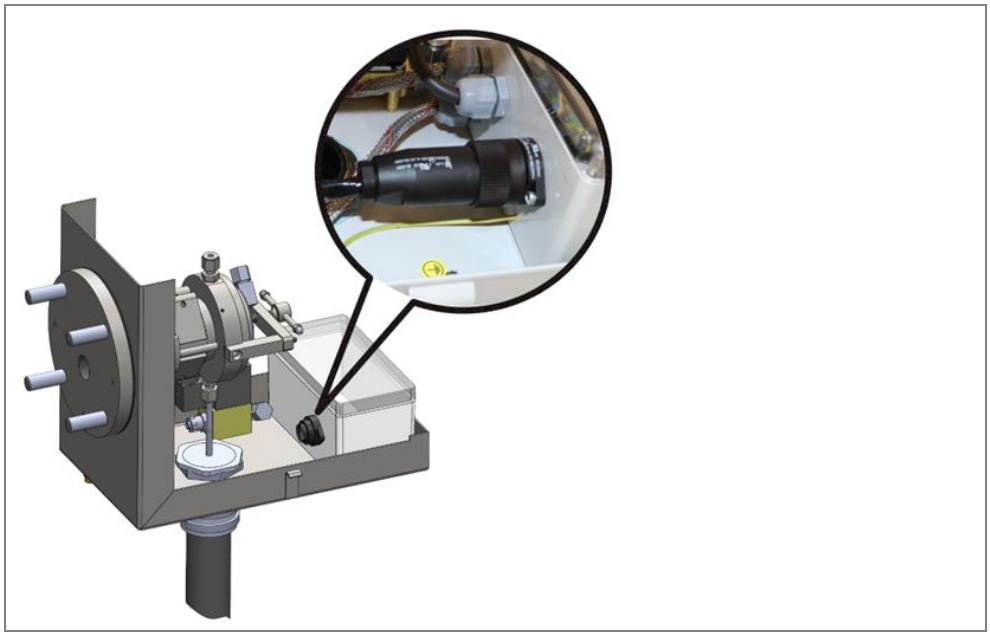
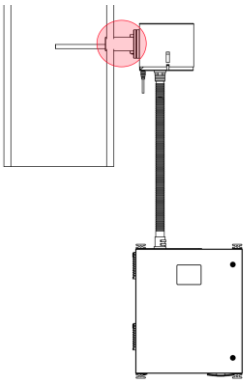


Fig. 9

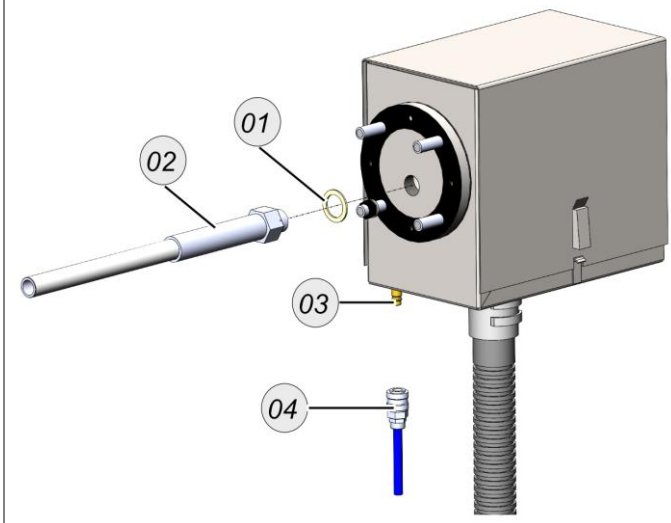
▶ Insert the probe plug into the probe socket (Fig. 8)

▶ Close the cover of the HP probe.

✔ You have mounted the heating hose with the probe and the unit.



STEPS: MOUNTING THE ADAPTER FLANGE



#	Description	#	Description
1	HD-probe sealing	2	HD-probe tube
3	Male coupling NS7,2 for compressed air	4	Female coupling NS 7,2 for compressed air.

Fig. 1

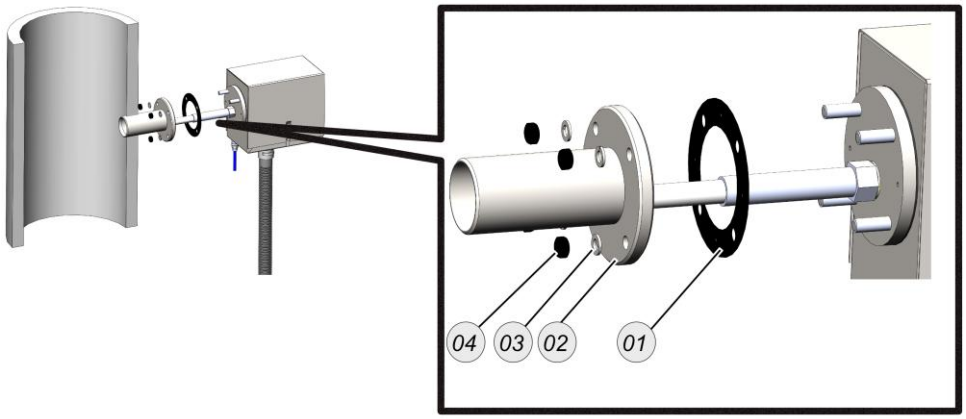
☛ Technical data about the pressure quality and value, see appendix.

▶ Bring the HD-probe tube sealing on the probe-tube.

⚠ **WARNING** – High pressure. Pressure can cause injuries and death. Only qualified personnel may connect compressed air.

⚠ **WARNING** – Do not exceed pressure range. The device is constructed for a pressure range of 0,6 to 0,8 MPa.

▶ Install a female coupling NS 7,2 for Compressed air connection.



#	Description
1	Grafit sealing
2	Adapter flange
3	Washer M12
4	Nut M12

Fig. 2

▶ Screw the probe-tube on the HD-probe.

▶ Mount the HD-probe on the adapter flange.

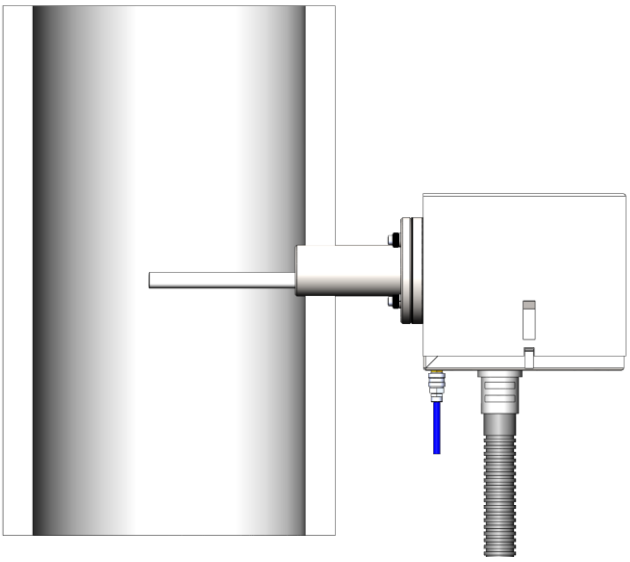


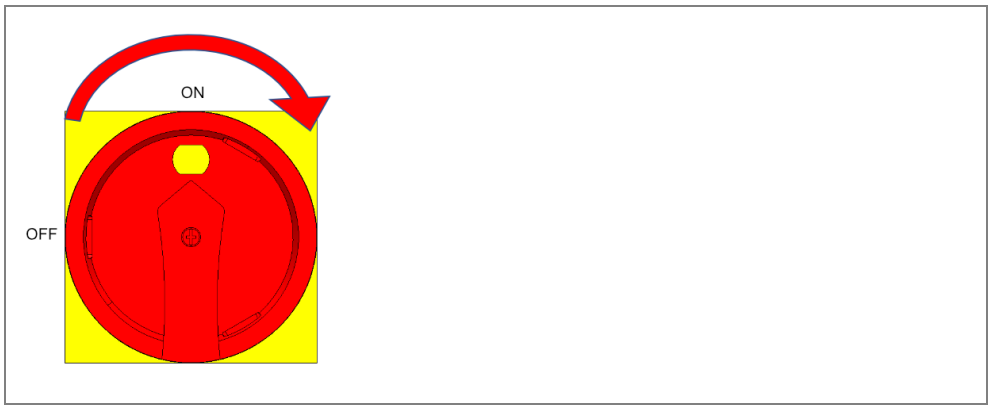
Fig. 3

✔ The HD-probe is mounted.

5.9 Switching on the unit

Switch on the device using the main switch.

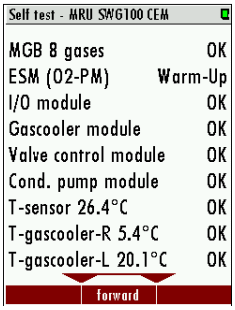
▶ Turn the main switch to the "ON" position. See picture below.



Main switch

The boot process is started. This process takes approx. 15 seconds.

Self-test is started. See picture below.



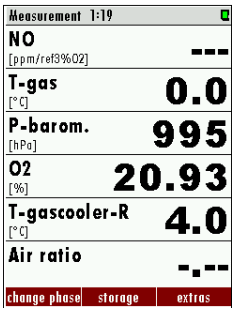
▶ Wait until the self-test is complete. This process takes approx. 5 minutes.

The main measurement window appears. The grey background means that the measurement mode is not active.

The first zeroing is started. See picture below.

▶ Wait until the device has completed the first purging phase and zeroing. This process takes approx. 5 minutes.

The device goes into measuring mode. You can recognise this by the white background. See picture below.



✔ The device is ready for measurement.

6 Operation

6.1 Operating and display elements

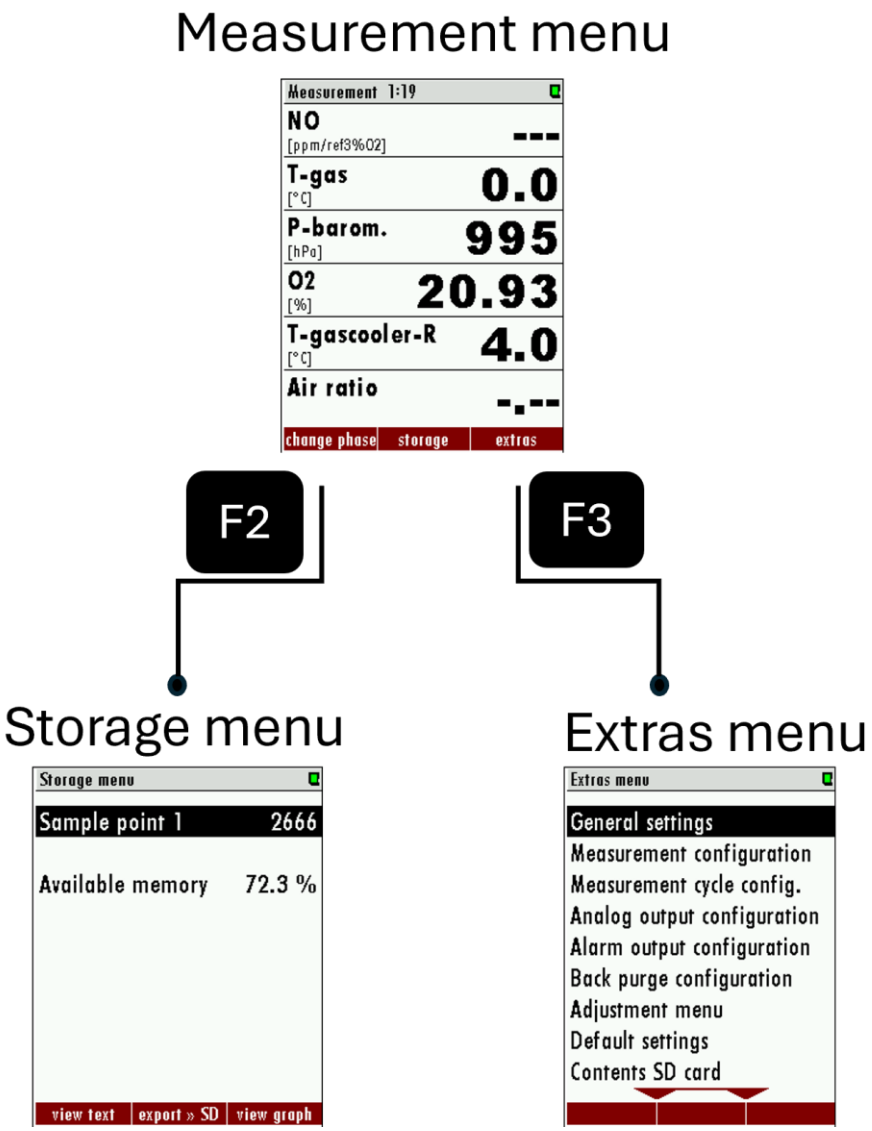
#	Symbol	Description
1		**ESC:** Cancel or go back one menu level.
2		**OK:** Confirmation button.
3		**Switching on and off**: Press this button before disconnecting the device from the mains. The device saves changed user settings and other operating data and purges the sensor modules with fresh air
4		**Arrow keys:** context-dependent functions, e.g. scroll between lines, change values, change view.
5		**Screenshot:** Press this button to save a screenshot of the current screen content to the SD card.
6		**Context menu**: Displays all available functions in the window. All functions are listed as a blue submenu.
7		**Function buttons:** Activates the functions shown on the display.

6.2 Menu structure

After switching on, the device is in the measurement menu.

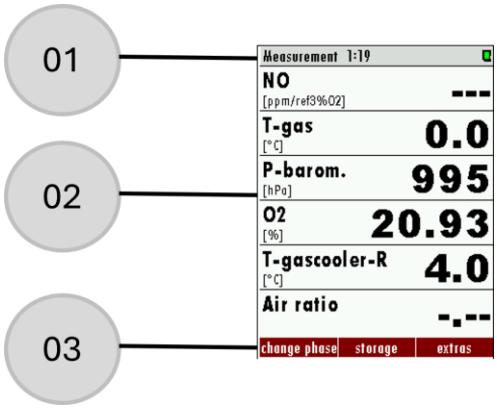
- Press the **function key** F2 to access the "STORAGE MENU".
- Press the **function key** F3 to access the "EXTRAS MENU".

Here you can see the general menu structure.



6.2.1 Measurement menu structure

Here you can see the structure of the measurement menu.



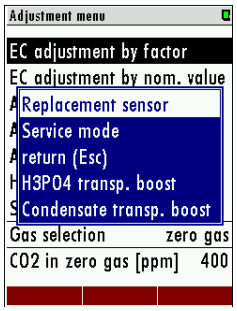
#	Designation
1	Menu bar
2	Display field
3	Function bar

6.2.2 Open context menu

In many windows, the context menu button opens an additional blue menu window.

This contains a list of all possible steps or functions in this window.

The content of this window depends on the basic window from which it was called up and therefore forms a context menu.



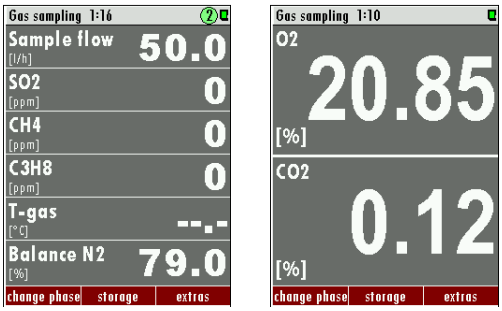
6.3 Setting options Measurement menu

You can perform the following actions in the measurement window.

- Change the display mode: Zoom / Standard
- Change measurement page.
- Display last measurement point values
- Individual configuration of the measurement window content.

6.3.1 Switch to Zoom/Standard display mode

STEPS



Comparison: Standard and zoom view

▶ Press the **menu button** ☰ in the measurement window.

Submenu opens.

▶ Select between zoom view and standard view.

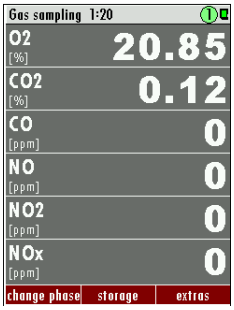
✔ The view is selected.

NOTE

For devices with only one measuring point, switching is also possible with the ***up/down arrow keys*** (◀ - ▶).

6.3.2 Change measurement page

STEPS



▶ Press the **right/left arrow key** (◀-▶).

✔ The page is changed. The page number is displayed in the title bar.

6.3.3 Display last measuring point values

You can display the last values of the measuring points that are not active.

PREREQUISITE

☑ Your device has several measuring points.

ⓘ You do not interrupt the active measurement. However, you can view the last values of the last measuring points. This has no influence on the currently active measurement.

STEPS

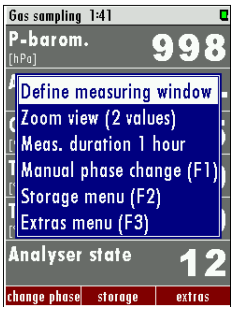
▶ Press the ***upper/lower arrow keys*** (↑-↓).

✔ In the menu you will see the values of the next measuring point.

6.3.4 Configuring the measurement window

You can change the order of the displayed measurement values in the measurement window.

STEPS



▶ Press the **menu key** ☰ in the measurement window.

The **blue submenu** appears.

▶ Select "DEFINE MEASURING WINDOW".

The measurement window is active again.

▶ Mark the position to be changed with the ***up/down arrow keys*** (↑-↓).

▶ Select the desired display value with the ***left/right arrow key*** (←-→).

▶ Press the OK-***key*** to confirm the display value.

The selected display value appears in the desired position.

▶ Confirm the change.

NOTE

The selection of the measured values shown in the display does not affect the transmission of measured values at the analog or digital interface.

However, it is possible to use the displayed measured values once as the basis for a separate address list for ModBus transmission, so that the values of interest to the user can be read out efficiently

6.4 Storage menu

6.4.1 Data storage

The measured values are stored internally in the device.

- The device can store up to 20 000 measured values.
- The device stores the current measured values at the end of the measuring cycle for each measuring point.
- As soon as the memory space is full, the device overwrites the oldest measured values (ring memory principle).

Data storage
Special features

You can equip the device with an SD card. We recommend that you do this.

The device has a data storage strategy:

- If memory usage is 99%, the oldest 20% of the measurements are automatically saved to an SD card in CSV format and then deleted from the memory in the device.
- If the export to the SD card fails (SD card is missing or write-protected), only 4 % of the old measurements are deleted. The file name shows the date of the last measurement exported in the file e.g. "20141031.csv".

NOTE

Example:

A device with 2 measuring points and a configured measuring cycle of 32 minutes stores 2 * 24 * 60/32 = 90 measurements per day (45 per measuring point). The ring buffer provides capacity for measurements of 20000/90 = 222 days (more than 7 months).

6.4.2 Calling up the data storage menu

In the storage menu, you can view your saved data:

- View
- Export
- Transfer to other data formats.

▶ Go to the measurement window if you are not already there.

▶ Press the F2-*key* in the measurement window.

✔ You are in the storage menu.

6.4.3 Displaying stored values in text mode

To read saved measurements in text mode, proceed as follows:

▶ Enter the DATA STORAGE MENU.

▶ Press the F1-*key* = „VIEW TEXT".

The last stored measurement is displayed.

▶ Navigate through the measurements with the ***right/left-keys*** until you find your measurement.

NOTE

You can use the F3-*key* to go to the last measurement.

✔ You can continue navigating with the steps above.

6.4.4 Displaying stored values in graphic mode

To read saved measurements in graphic mode, proceed as follows:

▶ Enter the DATA STORAGE MENU.

▶ Press the F3-*key* = "VIEW GRAPHIC".

The last stored measurement is displayed.

▶ Navigate through the measurements with the ***right/left-keys*** until you find your measurement.

NOTE

You can use the F3-*key* to go to the last measurement.

✔ You can continue navigating with the steps above.

6.4.5 Export measurements to SD card

You can export your measurements as a CSV file to an SD card.

PREREQUISITE

☑ An SD card is in the device.

☑ The SD card must not be write-protected.

NOTE

The CSV format is country-specific. The respective valid CSV format is set via the "General settings" menu.

▶ Call up the DATA STORAGE MENU.

▶ Press **F2-key** = "EXPORT >> SD".

The CSV files are written to the SD card. When the process is completed successfully, a message appears.

✔ The data are saved as CSV format on the SD card.

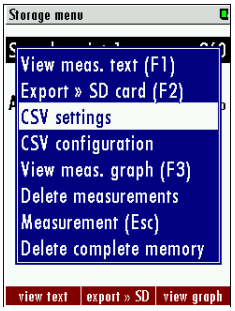
6.4.6 Setting the CSV format

You can set the CSV format directly on the device.

▶ Call up the DATA STORAGE MENU.

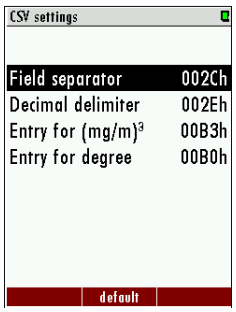
▶ Press the ***menu key*** .

The SUBMENU opens(see picture below).



▶ Open the CSV SETTINGS menu item.

The CSV SETTINGS menu opens (see picture below).



▶ Set your individual settings here.

▶ Exit the menu.

▶ Confirm the saving.

✔ The CSV settings are changed.

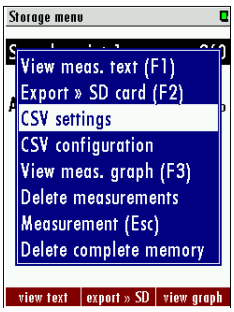
6.4.7 Change CSV configuration

You can set the CSV format directly on the device.

▶ Call up the DATA STORAGE MENU.

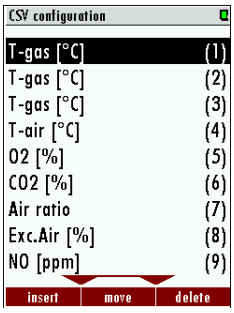
▶ Press the ***menu key*** .

The SUBMENU opens(see picture below).



▶ Open the CSV CONFIGURATION menu item.

The CSV CONFIGURATION menu opens (see picture below).



▶ Edit the CSV configuration. Use the function keys F1 F2 F3 to insert, move or remove CSV values.

Select CSV predefined list

You also have the option of selecting 3 predefined lists for the CSV format. These are:

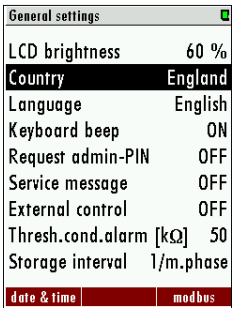
- Set maximum list: All available measured values and all 9 attachment rows are displayed here.

- Set standard list: All available measured values and 2 attachment rows are displayed here.
- Set small list: Only the basic measured values are displayed.

6.5 Menu: Extras

6.5.1 General settings

In this window, you can make basic settings for the device. Some of these can be changed directly using the arrow keys. Others, such as date/time or Modbus settings, can be accessed via submenus.



Menu path: **EXTRAS / GENERAL SETTINGS**

Setting	Operation	
LCD Brightness	Arrow keys (◀-▶)	Sets the display brightness between 20%...100%
Country	Arrow keys (◀-▶)	Controls country-specific settings
Language	Arrow keys (◀-▶)	Selecting the display language
Keyboard beep	Arrow keys (◀-▶)	ON / OFF
Request admin-PIN	Arrow keys (◀-▶)	Determines whether functions such as Adjustment are protected by PIN :ON / OFF
Service message	Arrow keys (◀-▶)	Determines whether information on service due should be displayed: ON / OFF
External control	Arrow keys (◀-▶)	Allows external control of the device processes
Condensate threshold	Arrow keys (◀-▶)	Threshold before condensate alarm is triggered, default 100 Ω; 20...100 Ω
Gas cooler	Arrow keys (◀-▶)	Defines the temperature of the gas cooler between 4...15 °C. Default 4°C
Date & Time	Function key F1	Local time
Modbus	Function key F3	Serial interface settings

Setting Modbus

Set the Modbus as follows.

▶ Open the menu: Modbus: **EXTRAS / GENERAL SETTINGS** → F3.

The menu window Modbus Slave Settings opens.

▶ Set the required baud rate, slave address and parity / stop bits.

▶ Exit the menu.

▶ Confirm the saving.

Set date & time

ⓘ The device automatically saves measured values including a time stamp. Therefore, the system clock of the device should be set correctly.

▶ Open the menu: date & time: **EXTRAS / GENERAL SETTINGS** → F1.

The menu window **DATE & TIME** opens.

▶ Set the date and time. Press the F2-***key***.

▶ Exit the menu.

▶ Confirm the saving.

NOTE

Depending on the country selected, the device automatically changes to summer time in spring and autumn. This function is active for most European countries. Whenever summer time is active, you will see a "*" in the menu timeline, i.e. 'Time *' instead of 'Time'.

6.5.2 Checking the set country and device language

NOTE

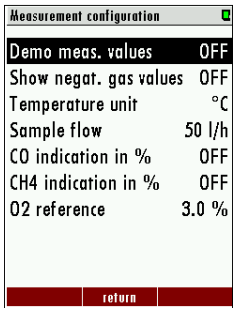
Setting the language

If the device displays a language that cannot be understood, you can switch to English by pressing the menu button and selecting 'Set english language'.

Menu: Extras / Settings

The device will automatically set some country-specific settings such as the language, date format, temperature unit, summer time function and CSV export settings.

6.5.3 Measurement configuration

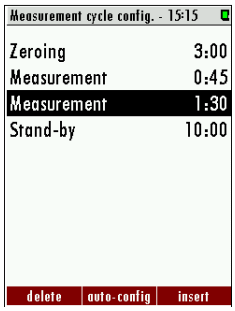


Menu path: **EXTRAS / Measurement configuration**

In this menu you can set the temperature unit used and the volume flow.

Settings	Operation	
Temperature unit	Arrow keys (◄►)	°C / F
Sample flow	Arrow keys (◄►)	30...70 l/h

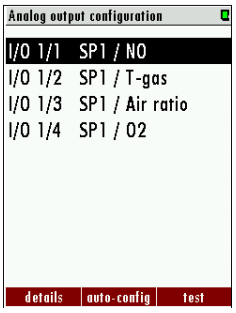
6.5.4 Measurement cycle configuration



Menu path: **EXTRAS / MEASUREMENT CYCLE CONFIG**

In this menu, you can set a measurement cycle with different phases.

6.5.5 Analog output configuration (optional)



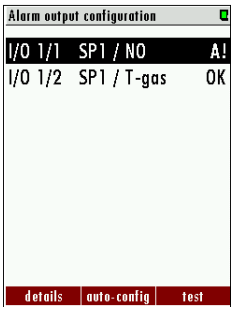
Menu path: **EXTRAS / ANALOG OUTPUT CONFIGURATION**

You can configure 4-20 mA outputs here.

NOTE

This option item is only available if you have the IO module option.

6.5.6 Alarm output configuration



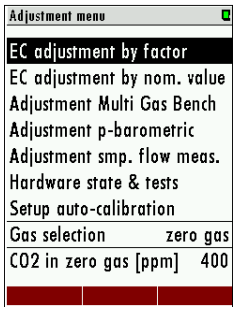
Menu path: **EXTRAS /ALARM OUTPUT CONFIGURATION**

You can configure alarm outputs here.

NOTE

This option item is only available if you have the IO module option.

6.5.7 Adjustment menu



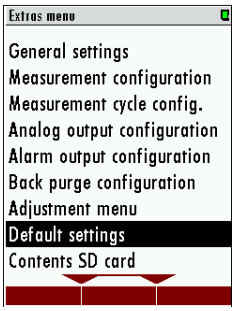
Menu path: **EXTRAS / ADJUSTMENT MENU**

In this chapter you will find all possible adjustment options. You will also find a **Hardware Status & Tests** menu here.

NOTE

The operation of the individual adjustment menus can be found in the respective measurement technology chapters.

6.5.8 Default settings



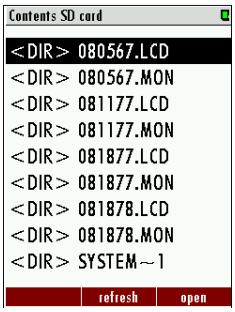
ATTENTION

All saved settings are lost here.

Menu path: **EXTRAS / DEFAULT SETTINGS**

This menu item allows you to reset all settings to the factory settings.

6.5.9 Contents SD card



Menu path: **EXTRAS / CONTENTS SD CARD**

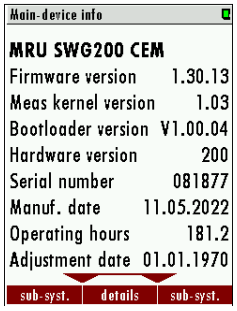
This menu item shows you the contents of your SD card.

6.5.10 Event viewer

Menu path: **EXTRAS / EVENT viewer**

In this menu, you can view various events, such as times of zeroing or error messages.

6.5.11 Device Info



Menu path: **EXTRAS / DEVICE INFO**

In this menu you get general information about your device. You can also update the various built-in modules here.

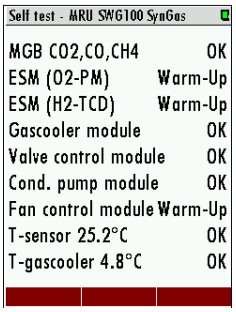
Use the function keys to scroll cyclically through the various subsystems (modules) installed in the device. You can see basic information on each subsystem in the screen shown. Further details on the subsystem with many parameter values can be viewed by pressing the **DETAILS** button.

7 Starting up the device

7.1 Warming up and self-test of the device

After switching on, the boot process of the operating software is started. This process takes approx. 15 seconds.

This is followed by the warm-up phase and a self-test of the system. The accessibility and status of installed modules are recorded. As some modules require a cool-down or warm-up time, this process takes a few minutes.



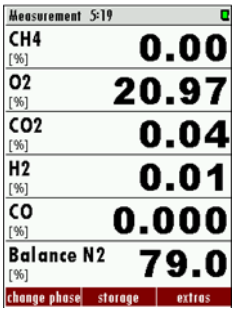
▶ Wait until the self-test is finished.

The main measurement window appears. The grey background means that the measurement mode is not active.

The first zeroing is started, in which gas is drawn in from the fresh air inlet, the measuring modules are purged and a zeroing is performed.

▶ Wait until the device has completed the first purging phase and zeroing.

The device goes into measuring mode. You can recognise this by the white background. See picture below.



✔ The device is ready for measurement and follows the set measuring cycle or an external control, if available

7.2 Making basic settings

In general, a start of operation requires some basic settings of the device to be checked or adjusted. These include in particular

- Set country: This means that country-specific features are taken into account by the software
- Set language
- Set date and time: as the measured values are stored in the data storage with a time stamp, the date and time should correspond to the local time
- When using the serial interface (ModBus), the parameters of the interface should be set on both sides of the communication partners in order to communicate successfully
- When using analog I/O signals: Adapt the analog outputs to the desired behaviour
- When using the alarm output: Adaptation of the alarm output to the desired behaviour.

You can find out how to find and operate the points in detail in the operation chapter.

As a rule, the other parameters of the basic settings can be left in the factory settings and should only be adjusted if necessary.

7.3 Setting the measuring cycle

A measuring cycle defines the sequence of phases of the device.

During operation, this sequence must be adapted to the respective measuring task.

The possible types of phases are:

- Zeroing.
- Measurement of the interior of the housing (interior monitoring for device variants for flammable gases)
- Purging (depending on the device with ambient air or nitrogen).
- Standby.
- Measurement SP. x (SP.x stands for measurement of measuring point x).

The duration of each phase can be configured. The device then runs the set measuring cycle cyclically.

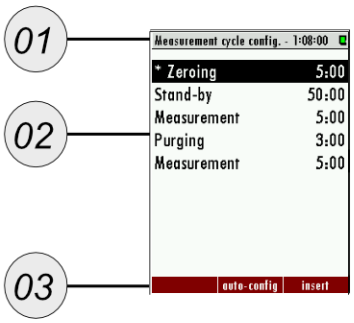
An active external control has priority over the measuring cycle set here.

7.3.1 Menu path and basic structure

Menu path: EXTRAS / MEASUREMENT CYCLE CONFIG:

In this menu you can see the currently active measuring cycle of your device.

The illustration below and the table show the meaning of the individual sections.



#	Description
1	Duration until end of measuring cycle
2	Measuring cycle list
3	Function keys

7.3.2 Navigating in the menu

You can set each phase individually. To do this, you must call up the phase submenu.

▶ Select your desired phase with the ***up/down arrow key***.

▶ Press the OK-***key***.

The phase submenu for the phase appears. In the example below for taking the zero point.

You can make individual settings here. See the following chapters.

7.3.3 Change phase type

▶ Use the up/down arrow keys to select the phase to be changed.

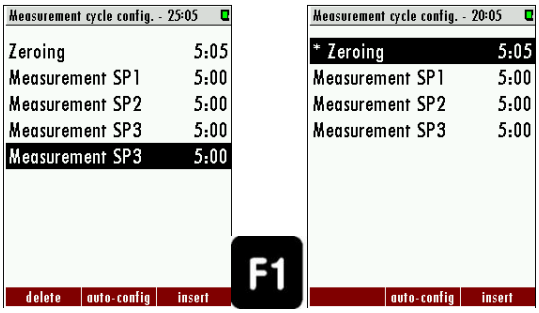
▶ Use the left/right arrow keys to select the desired phase type.

7.3.4 Delete phase

▶ Use the up/down arrow keys to select the phase to be deleted.

▶ Press the ***function key*** F1 to delete the phase.

✔ You have deleted the phase.



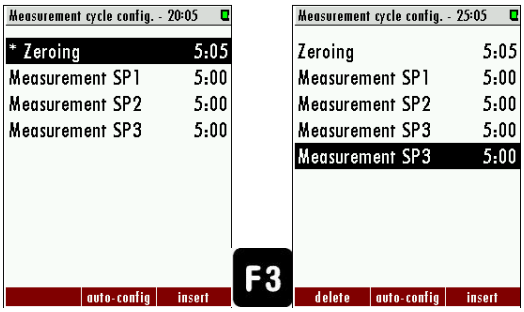
7.3.5 Insert phase

▶ Press the ***function key*** F3.

A new phase appears.

▶ Press the ***left/right arrow key*** to select your desired phase.

✔ You have inserted a new phase.



7.3.6 Insert Autoconfiguration

Two standard cycles are stored. You can insert the cycles via AUTO CONFIG.

NOTE

The autoconfigurations only contain measurements and zeroings. Other phases are deleted.

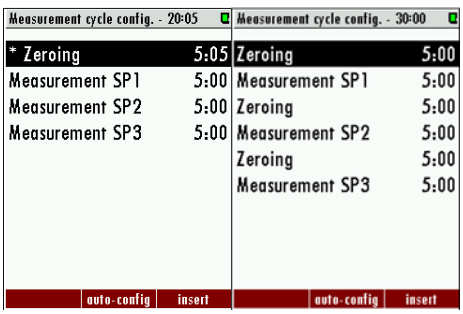
▶ Press the ***function key*** F2.

A zeroing is inserted at the beginning of the measurement cycle.

▶ Press the ***function key*** F2 again.

One zeroing per measurement is inserted.

▶ Select the standard that is reasonable for your measurement application.

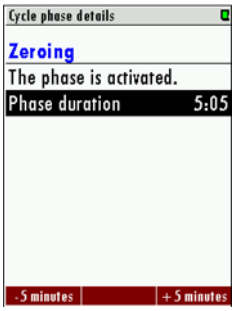


The two auto configurations in comparison.

7.3.7 Phase submenus: Setting options

Here you can find out which settings are possible in the phase submenus.

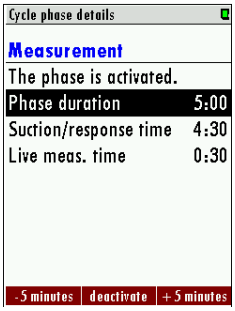
7.3.7.1 Zeroing (Cycle phase details)



In the menu, the details of the cycle phase for zeroing can be viewed and, if necessary, changed.

Zeroing	
Measuring valve	Closed
Zeroing valve	Open
Duration	Phase duration: 2 min to 24 h

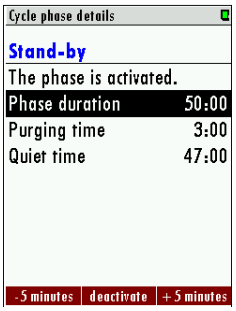
7.3.7.2 Measurement SP.x (Cycle phase details)



In the cycle phase details, the measuring time and the suction time can be changed. Each individual measuring point can be adjusted individually.

Measurement SP.x	
Measuring valve	Measuring valve of the current measuring point is open, all others are closed
Zeroing valve	Valve closed
Duration	Phase duration: 2 min to 24 h

7.3.7.3 Stand by (Cycle phase details)

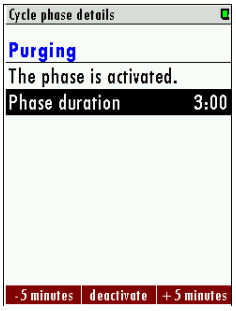


Within this cycle phase, the purging time and the quiet time can be set.

- Duration of the phase: Total standby time.
- Purge time: Purging of the device with ambient air through the zero gas inlet.
- Quiet time: The time the device is in sleep/quiet mode.

Stand by	
Measuring valve	Closed
Zero valve	Closed
Duration	Phase duration: 2 min to 24 h
Purging time	30 sec. to 1 h
Quiet time	calculated

7.3.7.4 Purging (Cycle Phase Details)

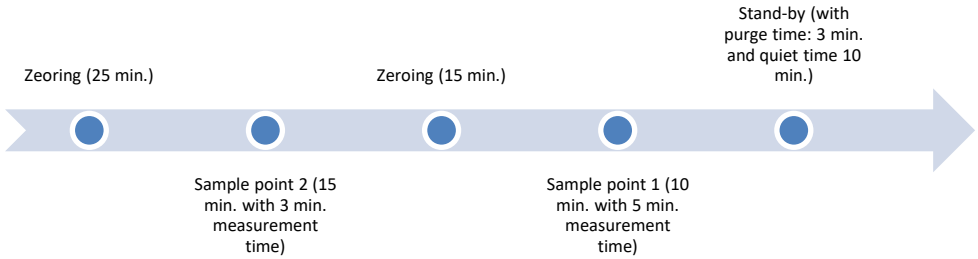


Purging is a separate configuration item for purging the device with ambient air and thus removing foreign gas from the lines and the measuring equipment. This may be necessary when switching between different measuring points that have different gases or gas concentrations.

Purging	
Measuring valve	Closed
Zero valve	open
Duration	30 sec. To 1 h

7.3.8 Example for a measurement cycle configuration

This example will show you in detail how to set a measuring cycle.



▶ Open the path: EXTRAS / MEASUREMENT CYCLE CONFIG.

The standard measuring cycle appears.

▶ Insert a zeroing.

▶ Press the OK ***key***.

The phase submenu opens.

▶ Set the zeroing to 25 min.

The zeroing has been set to 25 min.

▶ Go back to the measurement cycle configuration menu.

▶ Insert the measurement SP.2.

▶ Open the phase submenu of measurement SP.2.

▶ Change the settings.

▶ Proceed in the same way with the items measurement SP.1 and standby.

✔ The measurement cycle is set.

7.4 Cycle timer: Interception of events

The cycle timer is used to record an event from the measuring phase.

The standby or zeroing phases are set so that the event always falls within the measuring phase. An event can be, for example, the start-up of a system.

The cycle timer is characterised by the following:

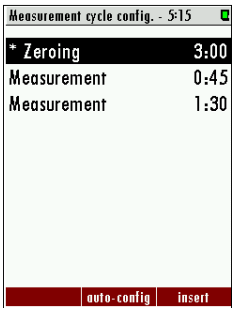
- Is prioritised above the normal set measuring cycle.
- Is deactivated in the default setting.

7.4.1 Calling up the cycle timer

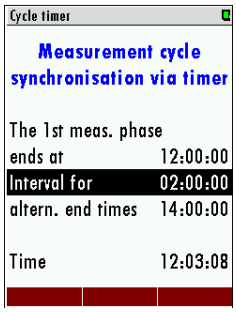
The cycle timer menu is called up as follows:

Menu path: EXTRAS / MEASUREMENT CYCLE CONFIG . / CONTEXT MENU / CYCLE TIMER

The "Cycle timer" menu window appears.



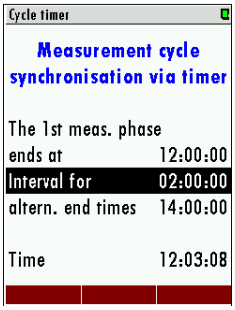
Context menu “cycle timer”



7.4.2 Menu structure

The menu is structured as follows:

1. The 1st measuring phase...ends at: Set when the 1st measuring phase ends. After the measuring phase, a zeroing starts.
2. Interval for: Length of further measurement phases. After the measuring phase, a zeroing starts.
3. Alternative end times: Display of the following measurement phase starts.
4. Time: Shows the current time.



In the example shown, the measurement phase is always

12 o'clock, 14 o'clock, 16 o'clock, 18 o'clock, 20 o'clock, 22 o'clock, 0 o'clock, 2 o'clock, 4 o'clock, 6 o'clock, 8 o'clock or 10 o'clock. This means that the zeroings (except the first one after power-on) are always started at these times

NOTE

The interval should be selected so that the total cycle duration is a multiple of this (in the example this is 2h * 4 = 8h).

7.4.3 Setting the cycle timer (example)

A measuring system consists of 3 devices. The measuring cycle of the devices should be set so that the system is permanently monitored and the zeroings do not overlap. The 3rd device serves as failure protection.

This can be achieved, for example, by the following setting:

Device A:	1st measurement phase ends at 11:20	Interval = 2 hours
Device B:	1st measurement phase ends at 12:00	Interval = 2 hours
Device C:	1st measurement phase ends at 12:40	Interval = 2 hours

Without the cycle timer, all 3 devices would run synchronously in the event of a power failure until the 1st zeroing is completed. Only then the configured cycle would start to run.

In the event of a power failure at 1 p.m., this means that all 3 devices perform the self-test at the same time and the zeroing and 1st measuring phase run synchronously. The 1st measuring phase would be completed at 20:50.

Activating the cycle timer would result in the following offset:

A:	1st measurement phase End: 21:20	2. zeroing start:21:20
B	1st measurement phase End: 20:00	2. zeroing start:20:00
C:	1st measurement phase End: 20:40	2. zeroing start:20:40

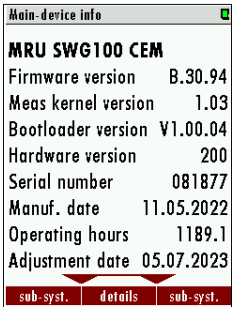
8 Maintenance of the device

8.1 Determine the status of the modules

The device consists of the control unit and a series of installed modules. These modules are independent functional units that are controlled by their own software and communicate with the control unit via an internal bus.

It is therefore essential for the correct functioning of the device that all modules are accessible ("online") and that bus communication is error-free.

Check all subsystems under EXTRAS / DEVICE INFO.



8.2 Software update

In this section you will learn how to update the firmware of the device.

In general, the following applies:

- Each module in the device can be updated.
- Updates have the programme extension, fwb.
- Depending on the firmware module, there are special abbreviations in the programme name.

8.2.1 Updating the control unit

Here you can find out how to perform an **update.**

▶ Copy the firmware to the root directory of an SD card.

▶ Insert the SD card into the SD card reader of the device.

☛ SD card reader position: .

The device emits a sound.

▶ Open the menu „EXTRAS / DEVICE-INFO“.

The DEVICE INFO window appears.

▶ Press F2 = „DETAILS“.

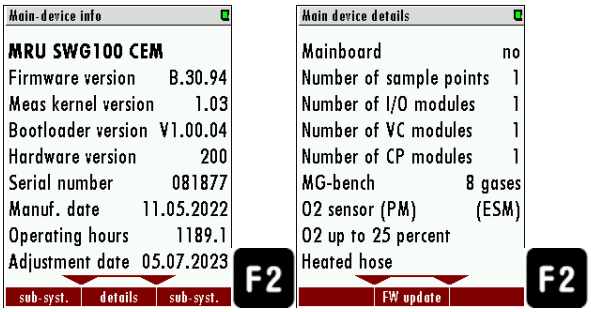
The menu „MAIN DEVICE DETAILS“ appears.

▶ Press **F2** = „UPDATE“.

The update starts.

▶ Wait until the device restarts.

✔ You have successfully performed an update.



8.2.2 Update of installed modules

▶ Copy the firmware to the root directory (root directory of an SD card).

▶ Insert the SD card into the SD card reader of the device

☛ SD card reader position: .

The device emits a sound.

▶ Open the "EXTRAS / DEVICE INFO" menu.

▶ Press the left / right arrow key

The menu „SUB. – SYSTEMS INFO“ appears.

▶ Select the "DEVICE" menu item.

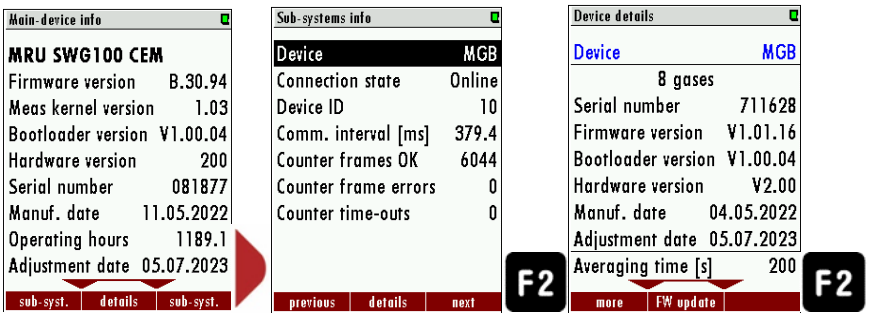
▶ Use the **left / right arrow key** to switch to the respective menu.

▶ Press **F2** = „UPDATE“.

The update starts.

▶ Wait until the device restarts.

✔ You have successfully performed an update.



The reliable function and measurement quality of the device can only be guaranteed with regular inspection and maintenance.

In addition to regular routine checks by the operator, the manufacturer recommends regular ½-yearly maintenance (2x per year) of the device by a qualified specialist company to maintain reliable function and high measurement quality.

8.3 Preparation and instruction for maintenance

For maintenance work, the main fuse in the device must be switched off. Even when the main fuse is switched off, dangerous electrical voltages are present on the primary fuse side.

If necessary, disconnect the device from the electrical supply and secure it against being switched on again.

Dangerous gases may escape during maintenance work on the gas system. The gas supply to the device must be switched off.

For electrical work as well as for work on the gas system, all nationally applicable directives must be observed at the installation location.

8.4 Regular maintenance work by the operator

All inspection and maintenance works are highly dependent on the individual conditions of use and operation on site. The specified intervals are therefore to be understood as guidelines.

Check	Recommended Interval	Action
Humidity in the device	Weekly	Remove humidity. Remove the cause of the humidity penetration.
Dirt and deposits in the device	Weekly	Remove dirt, prevent further penetration of dirt.

Dirt or humidity on fan filter	Weekly	Replace the fan filter mat.
Visually check gas lines for leaks and correct fit	Weekly	Replace gas lines if necessary
Inspect condition of gas filters and critical parts (see table)	Monthly	Exchange if necessary

The following lists the parts of the analyser that are critical to the reliable operation of the device. These parts must be replaced at intervals independent of the regular inspection.

8.5 Maintenance parts: Position overview

8.5.1 The spare parts set #13430

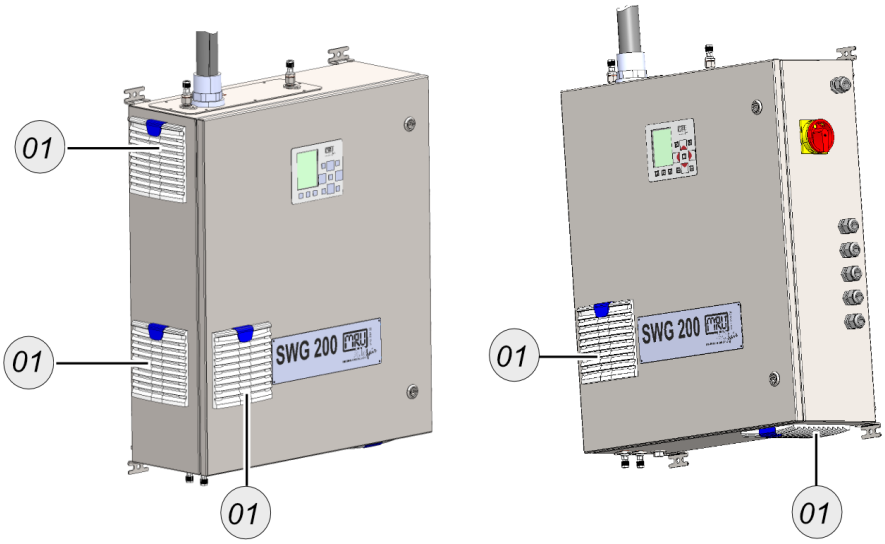
The spare parts set #13430 contains all important spare parts.
You can see them in the table below:

#	Element	Quantity	Article number
1	Filter element PTFE	1	12685
2	Inline filter SOx/NOx	2	56795
3	Inline filter activated carbon	1	65034
4	Filter mats for fan	10	60320
5	PTFE-filter	1	59059
6	Spare parts for peristaltic pumps	2	13405

1	2	3
		

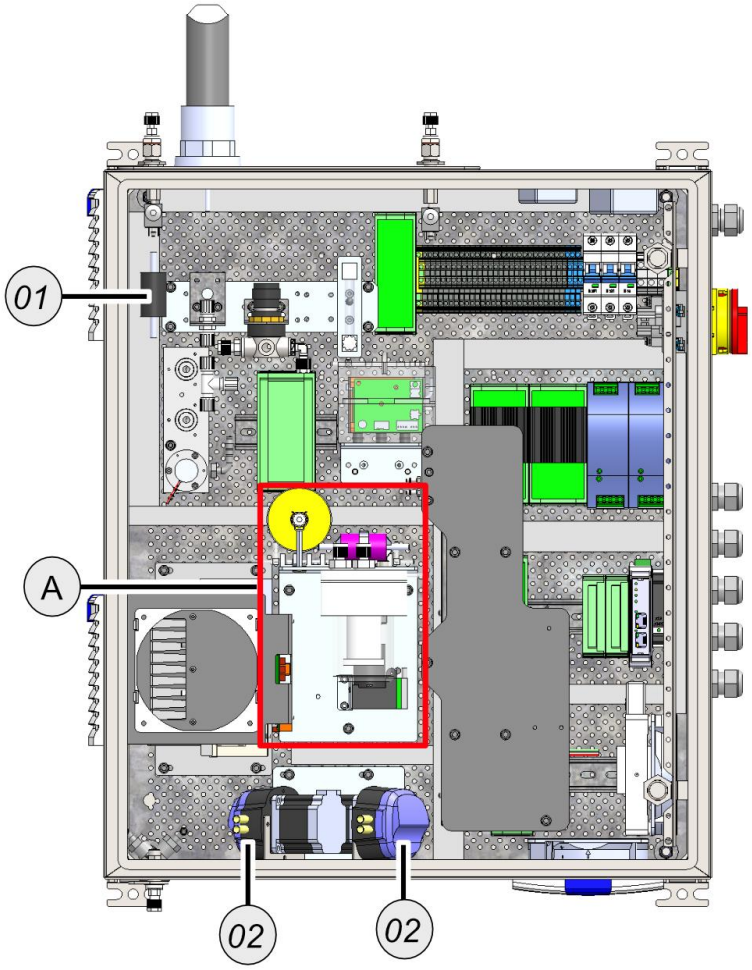
4	5	6

8.5.2 Spare part position outside



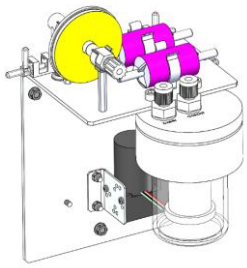
#	Element	Article number
1	Filter mats for fan	60320

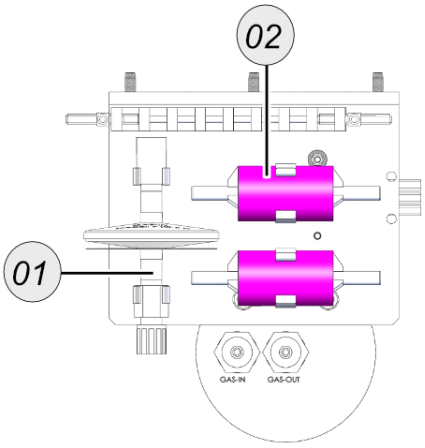
8.5.3 Spare part position inside

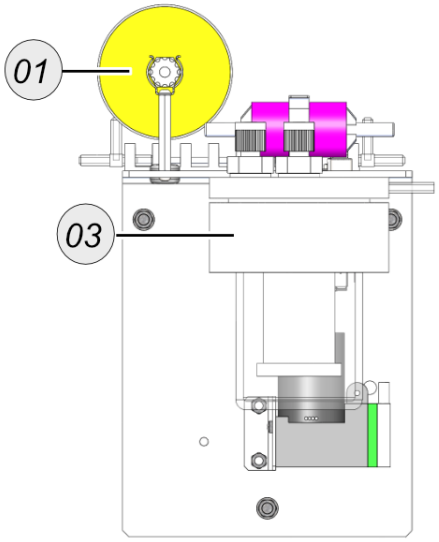


#	Element	Article number
1	Inline filter acitvated carbon	65034
2	Spare parts for peristaltic pumps	13405

Detail A







#	Element	Article number
1	PTFE filter	59059
2	Inline filter SOx/NOx	56795
3	Filter element PTFE	12685

8.5.4 Replace filter mat

PREREQUISITE

☑ New filter mat

STEPS

▶ Push the blue tab 01 of the filter housing.

The filter housing opens.

▶ Replace the filter mat 02.

✔ You have replaced the filter mat.

8.5.5 Replacing the inline SOx / NOx filter

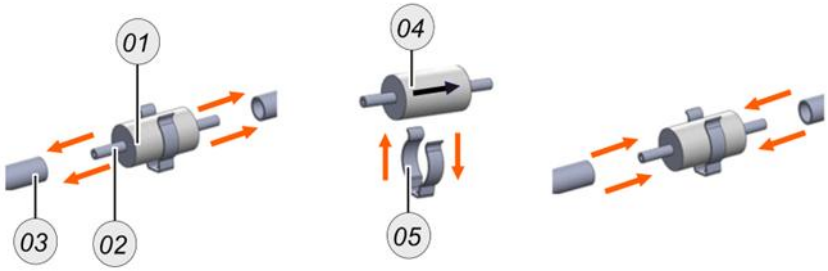
Inline-Filter SOx/NOx

Here you will learn how to replace an **inline filter**.

PREREQUISITE

▶ The device must be disconnected from the power supply before replacing.

STEPS



#	Description
1	Filter element
2	Inline filter connection
3	Hose
4	Installation direction
5	Clamp

▶ Pull the hoses 03 from the **inline filter connections** 02.

▶ Remove the used **Inline filter** from the clamp 05 if necessary.

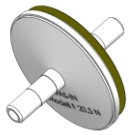
The old Inline filter 01 is removed.

▶ Attach a new **inline filter** to the clamp 05 if necessary.

▶ Reconnect the **Inline filter connections** to the hoses.

✔ You have replaced the **inline filter**.

8.5.6 Replacing the PTFE filter water stop



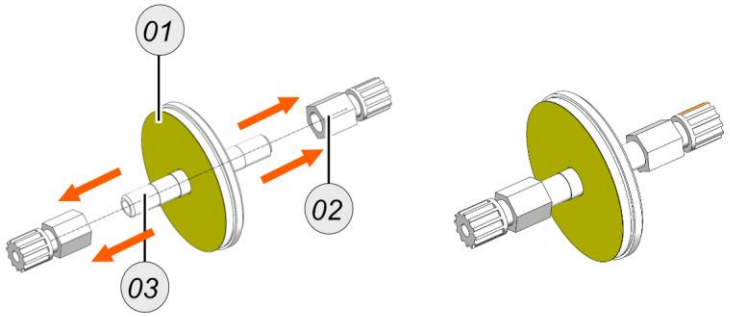
Replacing the PTFE filter water stop

Here you will learn how to replace a **PTFE filter**.

PREREQUISITE

- ☑ The device must be disconnected from the power supply before replacing.
- ☑ You will need a ***SW 16 spanner***.
- ☑ You need **PTFE sealing tape** or something comparable.

STEPS



Position	Description
1	PTFE filter
2	Threaded fitting
3	Socket

▶ Remove the old **PTFE filter** from the clamps.

▶ Unscrew the **threaded fittings** 02 with an *SW 16 spanner*.

You have removed the **PTFE filter**.

▶ Seal the **sockets** 03 of the **PTFE filter** 01 with *PTFE sealing tape*.

▶ Screw the **threaded fittings** 02 onto the sockets of the PTFE filter.

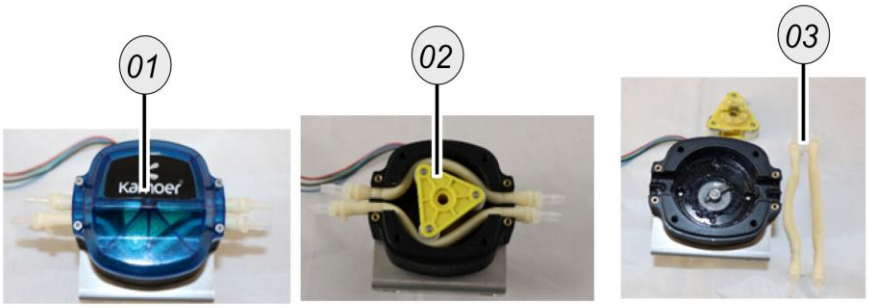
▶ Reattach the **PTFE filter** to the clamps.

✔ You have replaced the **PTFE filter**.

8.5.7 Replacing the condensate pump hose

After a certain period, you must replace the condensate pump hoses.

STEPS



#	Description
1	Peristaltic pump cover
2	Pump head
3	Condensate pump hose

- ▶ Take the hose pump cover 01 with a crosshead screwdriver.
- ▶ Remove the yellow pump head 02.
- ▶ Replace the condensate pump hoses 03 with new condensate pump hoses.
- ▶ Reinstall the yellow pump head.
- ▶ Screw the hose pump cover back into place.
- ✔ The condensate pump hoses have been replaced.

8.6 PIN code

All functions and menus that prevent the normal measuring function of the device due to changes can be protected against unauthorised access by the administrator PIN code if required.

If unauthorised persons should have access to the device, we strongly recommend that you activate the administrator PIN code.

ⓘ The PIN code is: **F1 - F1 - F3 - F2 - Arrow up - Arrow down**

ⓘ The PIN code request can be activated and deactivated in the EXTRAS – GENERAL SETTINGS menu. Deactivation requires a correct PIN code entry.

ⓘ Once the PIN code has been entered correctly, the device is in administrator mode (without password) for 10 minutes after a button is pressed. Each further button press enables a further 10 minutes of password-free operation.

8.7 General notes on test gases

Adjusting sensors always involves applying test gases of a known concentration to the device and changing the adjustment factors of the sensors so that the actual value corresponds to the target value.

It is generally recommended to adjust the test gas concentrations to the concentrations that actually occur in the sample gas.

If several measuring channels are to be calibrated, it is generally advisable to keep the test gases individually in separate gas cylinders. Some test gases can be mixed together in a test gas cylinder. Please coordinate which gas mixtures are suitable for which purpose with your supplier and, if necessary, MRU.

⚠ WARNING

High pressure

The calibration cylinder is under high pressure.

Can lead to injuries and death.

- ➢ Observe the relevant regulations when handling test gas cylinders.

⚠ WARNING

Toxic gases

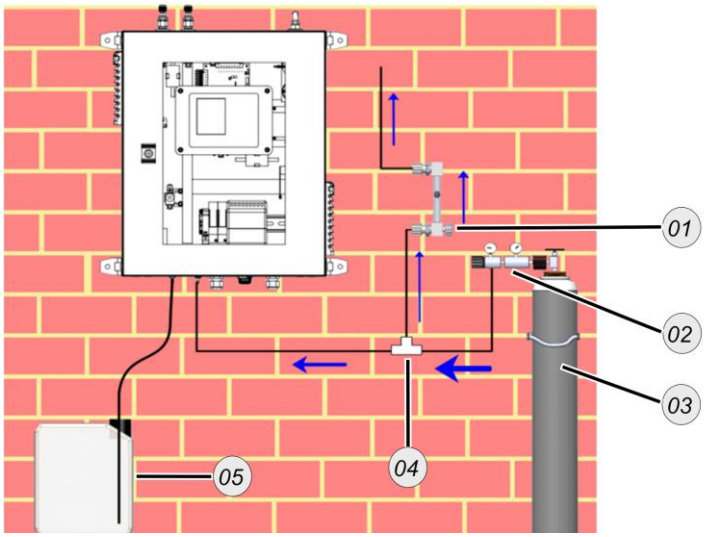
Test gas cylinders may contain gases that can cause asphyxiation or poisoning.

- ➢ Check the tightness of the test gas installation using the appropriate means
- ➢ Use personal protective equipment

8.7.1 Unpressurised gas supply

Test gas is often fed to the measuring device without pressure, as this type of gas feed corresponds to that which is usually also present in the measuring operation. For this purpose, the test gas is divided after the cylinder pressure reducer between a partial flow that is drawn in by the measuring device and a partial flow that flows out into the environment without resistance.

In order to monitor the outflow of the excess volume flow, it is advisable to install a ball flow indicator or similar in the branch to the environment.



Unpressurized test gas supply by a measuring device

#	Description
1	Flow indicator
2	Pressure reducer
3	Adjustment bottle
4	T-piece for gas splitting
5	Condensate bottle

The pressure reducer of the test gas cylinder is set so that a slight excess volume flow is released into the environment (less than 1 l/h) during operation of the measuring device.

This type of test gas supply is not suitable for permanent installation, so not for auto-calibration option of the device.

Check the technical data of the device to see which gas inlets are suitable for unpressurized gas supply.

8.7.2 Permanent installation of a test gas cylinder

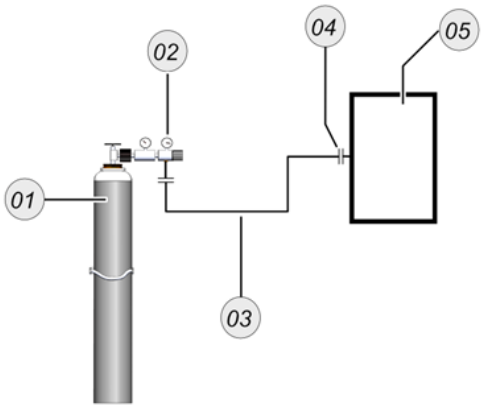
To permanently connect test gas to the measuring device, a direct connection of both components is used without splitting the volume flow.

ATTENTION

Too high gas pressure in the device

Damage to the device, gas leakage

- ➢ Use suitable pressure reducers
- ➢ Observe the maximum overpressure of the device inlets (see technical data)



Connection of a gas cylinder

#	Description
1	Adjustment bottle
2	Pressure reducer (for maximum pressure see technical data)
3	Connecting hose, e.g. DN4/6 mm PTFE hose
4	Calibration gas inlet
5	Device

8.7.3 Setting test gases in the device

In principle, the measuring device supports the possibility of introducing test gas into the device via different routes. As a rule, this is done via the calibration gas inlet, but in some cases calibration gas can also be introduced via the sample gas inlet, e.g. to calibrate special features that are only present in this way (probe effects).

▶ Open the menu: EXTRAS / ADJUSTMENT MENU.

▶ Select the GAS SELECTION menu item.

▶ Use the **left / right arrow** key to set the option **measuring gas (1-X)/Zero gas/Calibr.Gas (1-X)**.

✔ You have chosen the test gas.

8.8 Calibrating the multi-gas NDIR bench

You can calibrate the NDIR measurement technology.

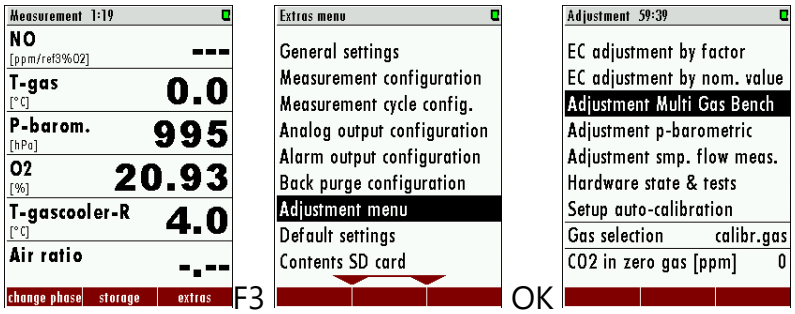
PREREQUISITE:

☑ Different calibration gas cylinders. The type of gas depends on the installed measurement technology.

ⓘ The gas concentrations should be between **70% and 90%** of the measurement range of the measurement technology.

ATTENTION

The calibration bottle must remain closed until you are instructed to open the calibration bottle.

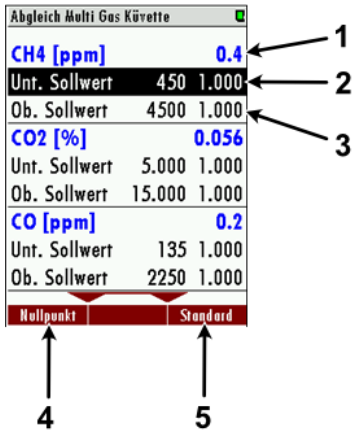


STEPS:

▶ Open the menu: Adjustment: EXTRAS / ADJUSTMENT MENU.

▶ Open "ADJUSTMENT MULTI GAS BENCH" in the adjustment menu.

The adjustment menu opens. The adjustment menu has the following structure.



Adjustment menu

#	Description
1	Gas designation with actual value
2	***Lower setpoint*** *with current setpoint concentration and factor*
3	***Upper setpoint*** *with current setpoint concentration and factor*
4	Zero point
5	Reset adjustment to default (F3 key).

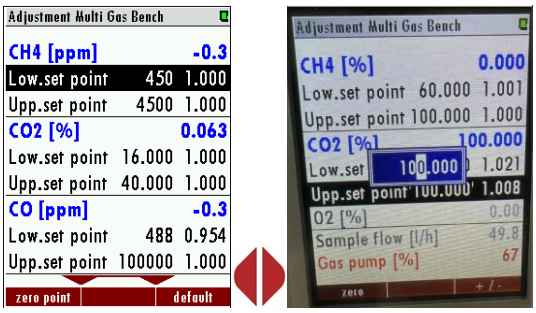
▶ Use the up/down arrow keys to select the lower setpoint value of the gas to be calibrated.

NOTE

Select the lower setpoint for a single-point adjustment.

▶ Press the right / left arrow key.

A blue window appears. The current setpoint value is entered in the blue window.



▶ Use the arrow keys to enter the target value of your calibration bottle

▶ Press the OK button to confirm

▶ Open the calibration bottle.

The actual value in the calibration window changes.

▶ Wait until the actual value no longer changes.

Inverted commas show whether you can change the actual value

NOTE

You can only carry out the adjustment when the actual concentration has reached a certain minimum value. Inverted commas show you whether this range has been reached.

▶ Press the OK button to adjust the actual value to the setpoint.

The following window appears.

▶ Confirm that you want to carry out the adjustment.

A new factor is determined.

The adjustment is saved.

✔ The adjustment is complete.

8.9 Calibrating the electrochemical O2 sensor

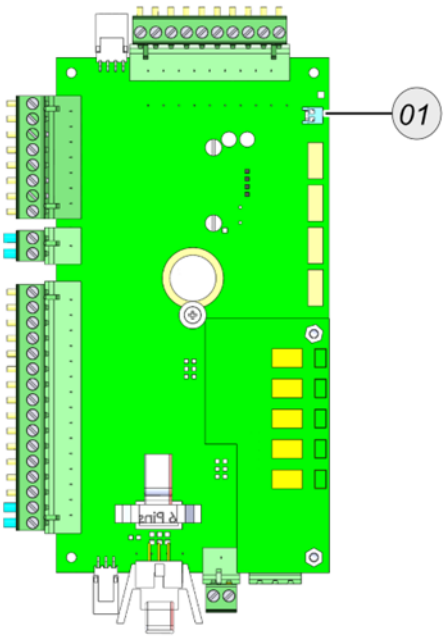
O2 Sensor

Here you can find out how to replace and calibrate an electrochemical oxygen sensor.

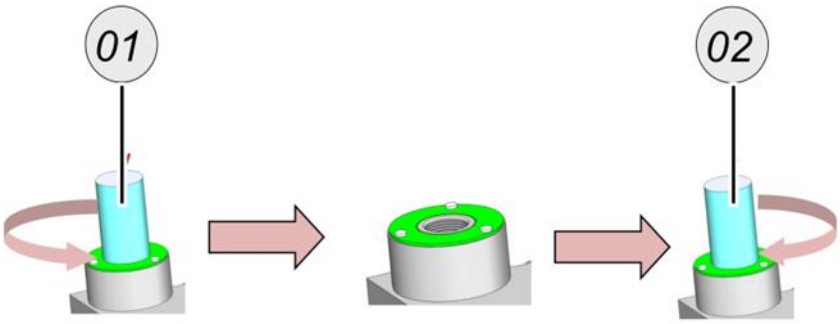
PREREQUISITE:

- ☑ O2-Sensor (Spare part)
- ☑ 100 Vol. % N2-bottle
- ☑ 10 Vol. % O2-bottle with 90 Vol.% N2
- ☑ Calibration setup must be set up

STEPS: INSTALL THE SENSOR



▶ Remove the O2 sensor to be replaced from the circuit board.



▶ Turn the O2 sensor to be replaced out of the sensor chamber.

▶ Turn the new O2 sensor into the sensor chamber.

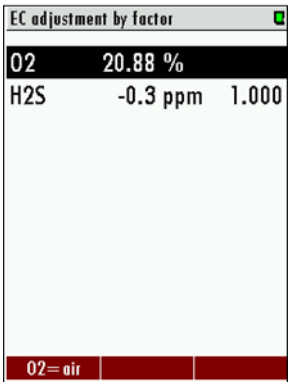
▶ Insert the new O2 sensor into the circuit board.

✔ The O2 sensor is installed.

STEPS: ADJUSTMENT

The zero point is taken at ambient air

▶ Open the adjustment menu: EXTRAS / ADJUSTMENT MENU.

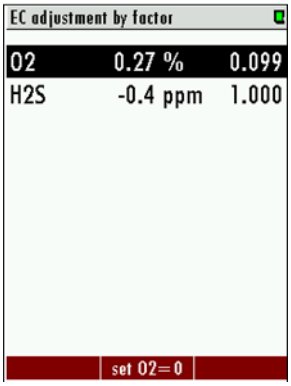


▶ Open the menu item → EC adjustment

The EC adjustment menu appears.

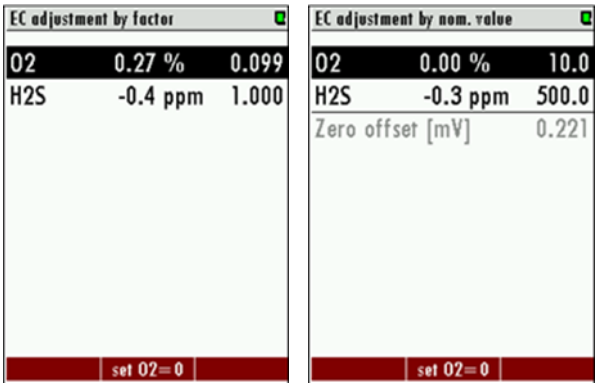
▶ Connect the 100 vol.% N2 bottle to the calibration set-up.

▶ Open the N2-bottle.



The O2 value decreases.

▶ Wait until the O2 value no longer changes.



▶ Press F2.

The O2 sensor is calibrated at the zero point(O2=0Vol.%).

▶ Connect the 10 vol % O2 bottle to the calibration set-up.

▶ Open the O2-bottle.

The O2 value decreases.

▶ Wait until the O2 value no longer changes.

▶ Press F2.

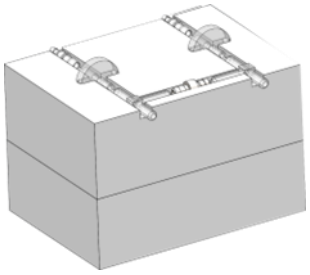
The O2 sensor is calibrated to 10 Vol.% O2.

▶ Exit the menu.

▶ Confirm save.

✔ The O2 sensor is calibrated.

8.10 Calibrating the paramagnetic O2 sensor



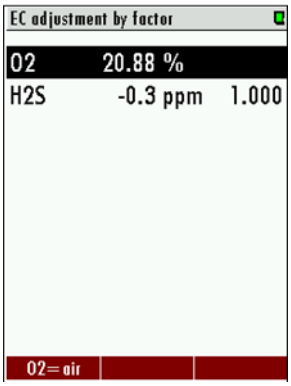
O2-Sensor

Here you can find out how to calibrate a paramagnetic oxygen sensor.

PREREQUISITE

- ☑ 100 Vol. % N2-bottle
- ☑ Calibration setup must be set up.

STEPS: ADJUSTMENT



The zero point is taken at ambient air

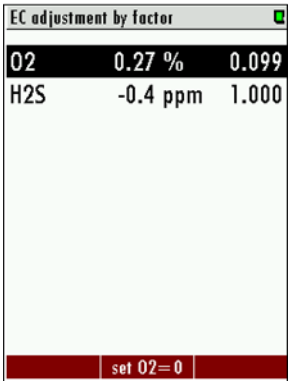
▶ Open the adjustment menu: EXTRAS / ADJUSTMENT MENU

▶ Open the menu item EC-ADJUSTMENT.

The EC adjustment menu appears.

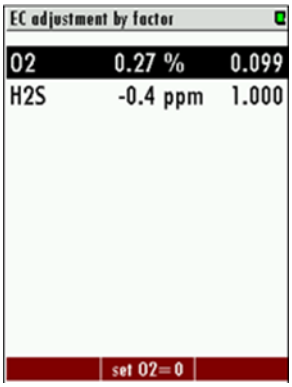
▶ Connect the 100 % vol. N2 bottle to the calibration set-up.

▶ Open the N2 bottle.



The O2 value decreases

▶ Wait until the O2 value no longer changes.



▶ Press ***F2***

The O2 sensor is calibrated at the zero point.

As an alternative, the zero point can be taken by N2-gas supply and the O2 sensor is calibrated to atmospheric oxygen

▶ Remove after zeroing the calibration bottle N2

The O2 value increases.

▶ Wait until the oxygen concentration no longer changes.

▶ Press F2.

The O2 sensor is calibrated to 20.96Vol. % O2.

▶ Exit the menu

▶ Confirm Save.

✔ The O2 sensor is calibrated.

8.11 Calibrating electrochemical sensors

⚠ WARNUNG

Connect the calibration cylinder correctly

Calibration cylinders are highly pressurised and may contain toxic gases. Can lead to death.

- ➢ Only trained personnel may connect calibration cylinders.

Here you can find out how to replace and calibrate an electrochemical sensor.

There are generally the following sensor designs:

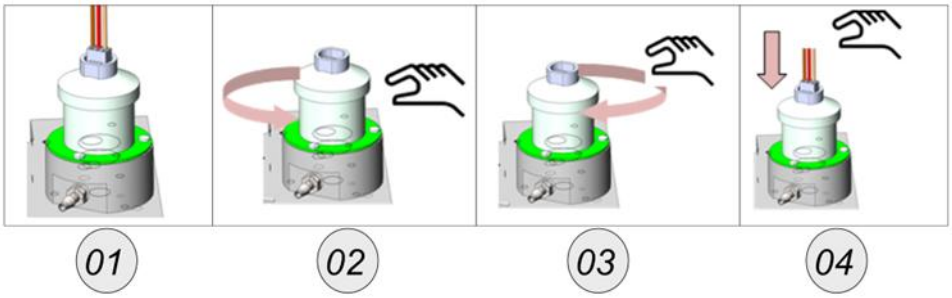
#	Model	Removal instructions
1	A	Steps: Installing sensors Model A
2	B	Steps: Installing sensors Model B
3	C	Steps: Installing sensors Model C

1	2	3
		

PREREQUISITE:

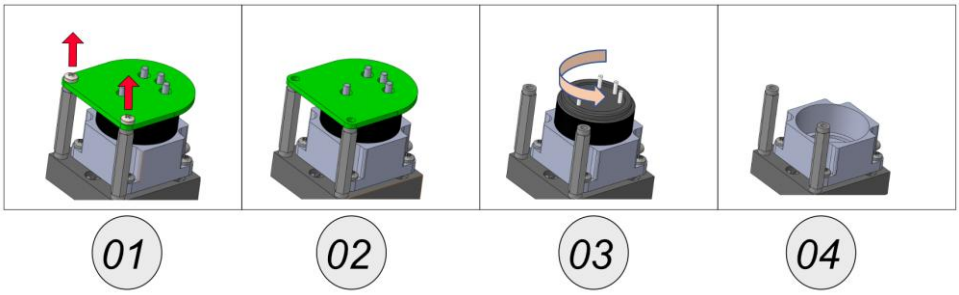
- ☑ The respective sensor
- ☑ Calibration bottle with 70 % of the upper measuring range
- ☑ Calibration setup must be set up

STEPS: INSTALL SENSORS MODEL A



- ▶ Remove the plug from the sensor (1)
- ▶ Turn the sensor to be replaced out of the sensor chamber (2).
- ▶ Turn the new sensor into the sensor chamber (3).
- ▶ Plug the connector back onto the sensor (4).
- ✔ You have replaced the sensor.

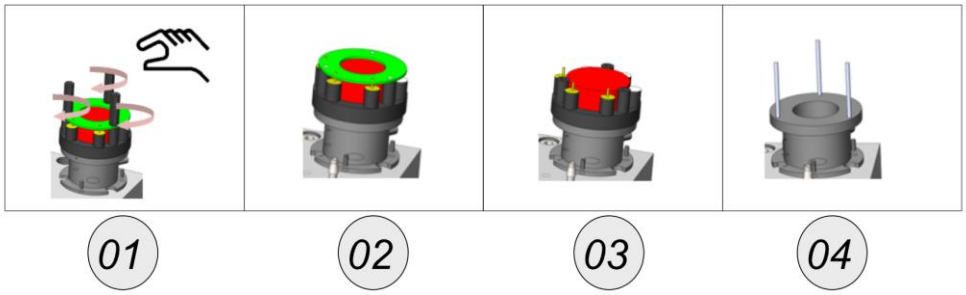
STEPS: INSTALL SENSORS MODEL B



- ▶ Unscrew the screws from the sensor board (1)
- ▶ Remove the sensor board from the sensor (2).
- ▶ Turn the sensor out of the sensor chamber (3).

  The sensor chamber can be fitted with a new sensor.
- ▶ Install the new sensor.
- ✔ You have replaced the sensor.

STEPS: INSTALL SENSORS MODEL C



▶ Unscrew the plastic holders from the circuit board (1).

▶ Remove the sensor circuit board from the sensor (2).

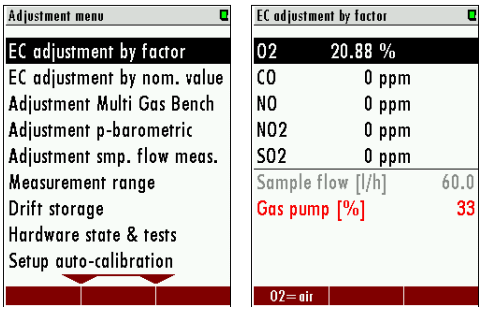
▶ Remove the sensor from the sensor chamber (3).

The sensor chamber can be fitted with a new sensor.

▶ Install the new sensor.

✔ You have replaced the sensor.

STEPS: ADJUSTMENT



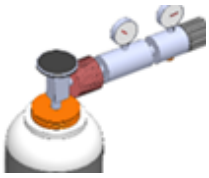
▶ Open the adjustment menu: EXTRAS / ADJUSTMENT MENU.

▶ Open the menu item EC-ADJUSTMENT.

The EC adjustment menu appears.

⚠ WARNING – High pressure. Connect the gas cylinder correctly as described in the instructions.

▶ Connect the respective calibration bottle to the calibration set up.



Open the calibration bottle now

▶ Open the calibration bottle.

The actual value changes in the calibration window.

▶ Wait until the gas value no longer changes.

▶ Change the factor using the left/right arrow key until the setpoint value of the gas cylinder is reached.

▶ The sensor is calibrated to the setpoint value.

▶ Exit the menu.

▶ Confirm Save.

✔ The sensor is calibrated.

9 Options and additional descriptions

9.1 IO module

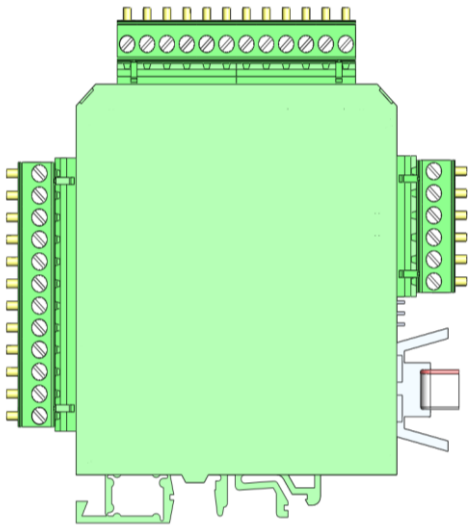
IO modules are interface modules. With **IO modules** you can:

- Transmission of measurement signals, through four separate 4-20 mA outputs,
- Two alarm outputs,
- One PT-1000 input,
- One thermocouple input (type: K),
- Four inputs, for standard 4-20 mA transducers (2-wire, 3-wire, 4-wire) with an extra power supply.
- Two inputs, for voltage transducers.
- Remote control function for the device.

This section contains contents that are not yet supported.

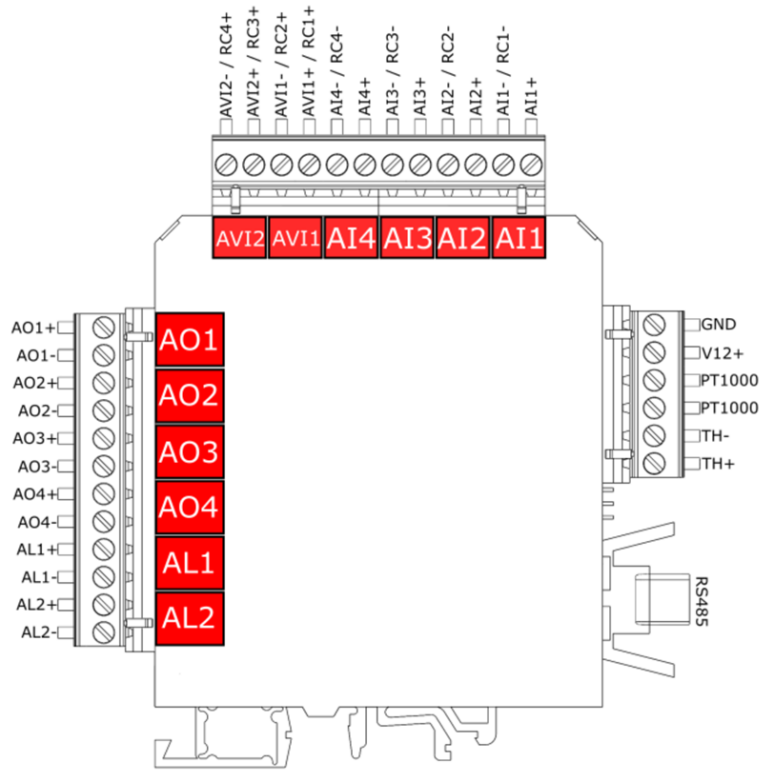
9.1.1 IO module position

The IO modules are located on the top-hat rail. The number of IO modules may vary depending on the order.



9.1.2 Pin assignment

The following pin assignment diagram shows where the different pins, with their respective functions, can be found and which pins have a double assignment.



Pin assigment of IO modul

The table shows the assignment of the respective individual pins.

Description	Abbreviation	PINs	Max. external voltage	Burden	Measuring resistor	Double assignment
Analog outputs 4-20 mA	AO1	AO1+ / AO1-	--	500R	--	No
	AO2	AO2+ / AO2-	--	500R	--	No
	AO3	AO3+ / AO3-	--	500R	--	No
	AO4	AO4+ / AO4-	--	500R	--	No
Alarm outputs	AL1	AL1+ / AL1-	24 VDC	500R	--	No
	AL2	AL2+ / AL2-	24 VDC	500R	--	No
Analog inputs 4-20 mA	PWROUT	V12+ / GND	--	--	--	No
	AI1	AI1+ / AI1-	--	--	50R	AI1- = RC1-
	AI2	AI2+ / AI2-	--	--	50R	AI2- = RC2-
	AI3	AI3+ / AI3-	--	--	50R	AI3- = RC3-
	AI4	AI4+ / AI4-	--	--	50R	AI4- = RC4-
Remote control	RC1	RC1+ / RC1-	--	--	--	RC1- = AI1-
	RC2	RC2+ / RC2-	--	--	--	RC2- = AI2-
	RC3	RC3+ / RC3-	--	--	--	RC3- = AI3-
	RC4	RC4+ / RC4-	--	--	--	RC4- = AI4-
Analog inputs 0-10 V	AVI1	AVI1+ / AVI1-	--	--	--	JMP1_out = AVI1+ JMP2_out = AVI1-
	AVI2	AVI2+ / AVI2-	--	--	--	JMP3_out = AVI2+ JMP4_out = AVI2-

9.1.3 Analog outputs 4-20 mA (AO1-AO4)

Installation/Connection

☛ Assignment: See 1.1.2 Pin assignment

Setting up analog output

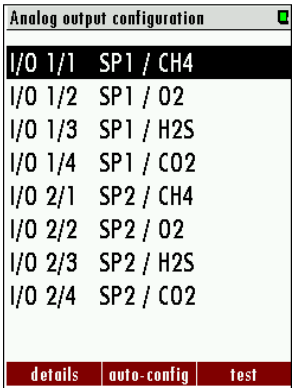
You can set up to 4 analog outputs per IO module.

Prerequisite: The IO module option is installed.

▶ Open the path "EXTRAS / ANALOG OUTPUT CONFIGURATION" path.

▶ Select the respective IO output and confirm with "DETAILS".

The setting window of the IO output appears.

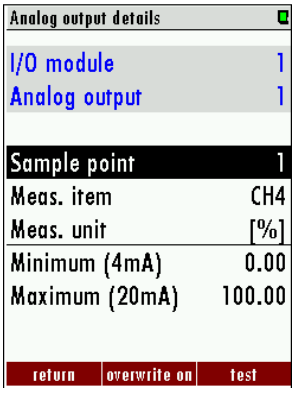


Selection window: MS1 = measuring point 1 , I/O 1/1 = first IO module at the first 4-20 mA output.

▶ Select the measuring point and the measured variable.

▶ Apply the minimum (4 mA) and maximum (20 mA) for the measured variable.

The analog output is now configured.



Setting the measuring point, the measured variable and the range for a 4-20 mA output.

9.1.4 Alarm Output Setting (AL1-AL2)

Installation/Connection

☛ Assignment: See 9.1.2 Pin assignment.

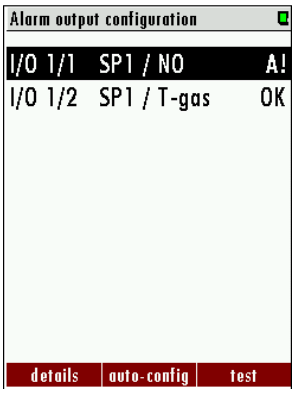
Setting the alarm output

You can set up 2 alarm outputs per IO module.

Prerequisite: The IO module option is installed.

▶ Open the path "EXTRAS / CONFIGURE ALARM OUTPUTS".

▶ Select the respective alarm output and confirm with "Details".



Selection window: MS1 = measuring point 1, I/O 1/1 = first IO module at the first alarm output.

The setting window of the alarm output appears.

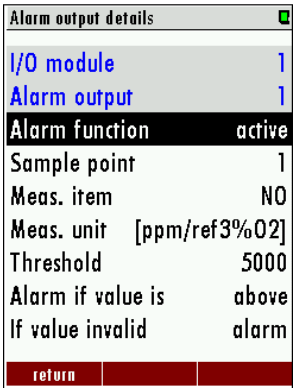
▶ Select the measuring point and the measured variable here.

▶ Enter the threshold value.

▶ Under "Alarm if value is..." you can set whether the alarm is triggered below the threshold value or when the threshold value is exceeded.

▶ Under "If value invalid" you can set whether an alarm is triggered or the device switches off.

✔ The alarm output is now configured.



Setting the measuring point, the measured variable, the limit value and the alarm side (exceeding or falling below).

9.1.5 AUX input for transducers (AI1-AI4)

☛ Assignment: See 9.1.2 Pin assignment

The following 4-20 mA transducers can be read in at the AUX inputs:

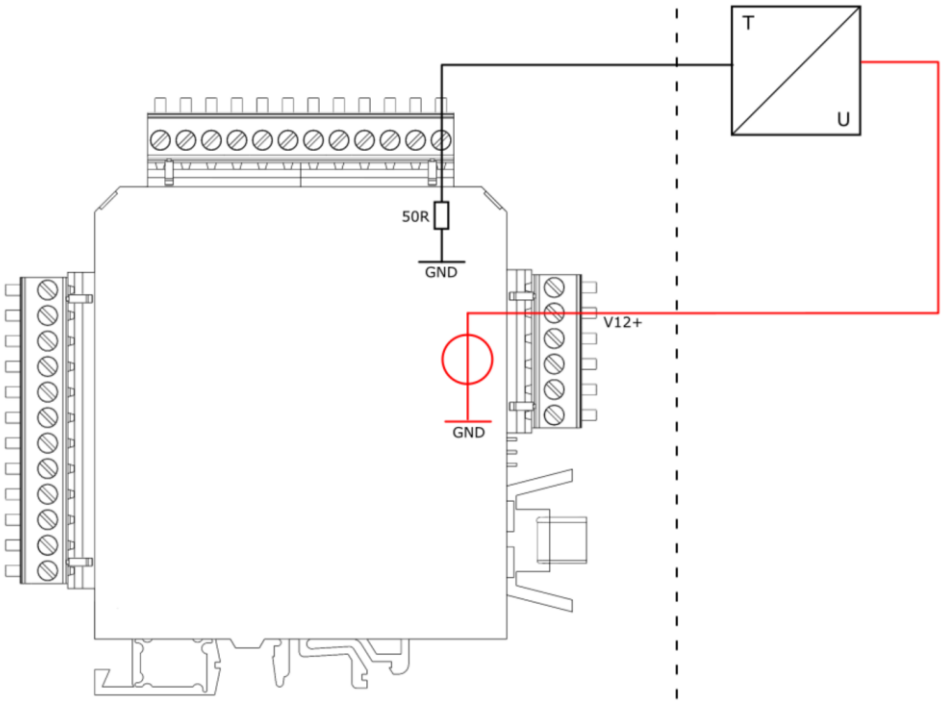
- 2-wire transducer
- 4-wire transducer

The IO module has a separate 12V power supply for the connected transducers.

AUX input: Technical data

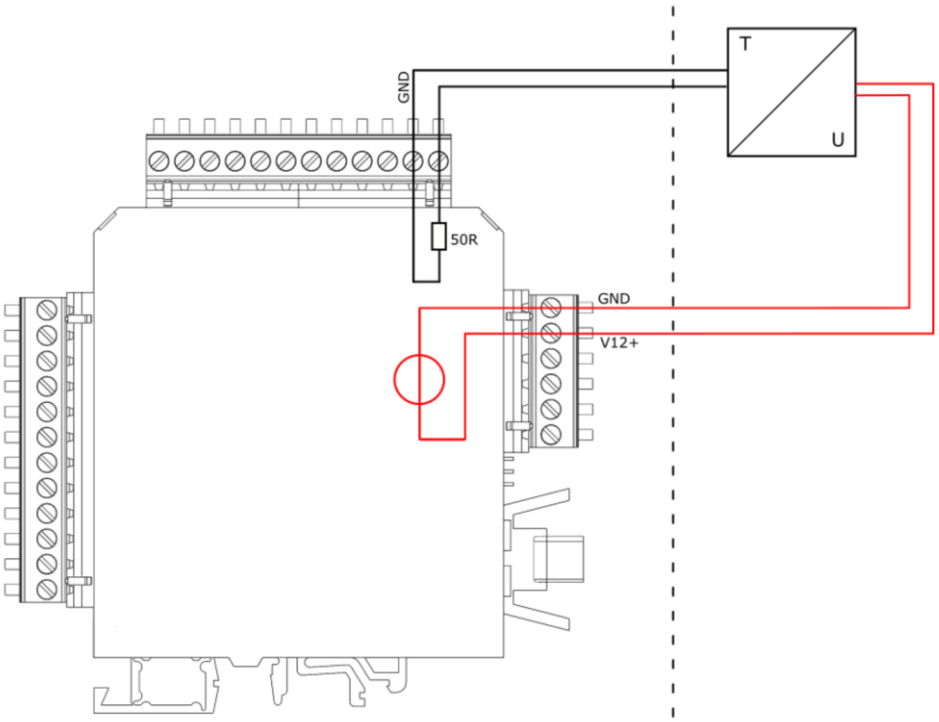
- Measuring resistor: 50 Ohm
- Power supply: 12 VDC / 200 mA

Connection: 2-wire transducer



2-wire transducer, connected to the 12 VDC of the IO module.

Connection: 4-wire transducer



4-wire transducer, connected to the 12 VDC supply of the IO module.

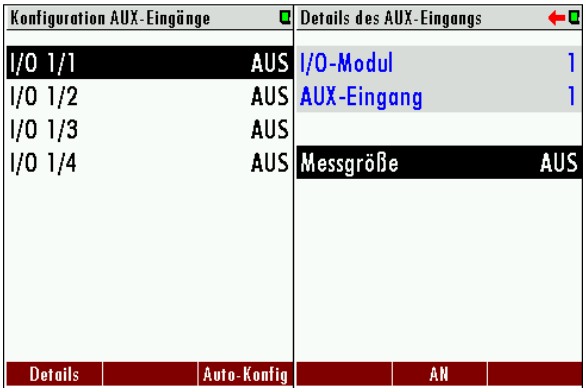
9.1.6 Set up AUX input

You can assign 4 AUX inputs per IO module.

Prerequisite: An IO module is installed.

▶ Open the path "EXTRAS / CONFIGURATION AUX INPUTS".

▶ Select and activate the respective AUX input.



Selection window example: I/O 1/1 = first IO module at the first AUX input.

The setting window of the AUX input appears.

▶ In this window, the measured variable can be selected. In addition, an individual AUX input can be created under "ADJUSTABLE".

▶ Create the minimum (4 mA) and maximum (20 mA) for the measured variable.

9.1.7 Configuration External Control (Option: I/O Module)

To use this function, an I/O module must be present and the function must be enabled.

With this function it is possible to control the device remotely. The following operations can be carried out with the help of the external control:

- Sampling.
- Triggering a stand-by mode.
- The commands are given by a 4-digit binary code, which is transmitted by four external signals. There are a total of three different transmission paths:
- Through four potential-free relays.
- Through four 4...20 mA inputs.
- Through one 4...20 mA input.
- Through the RS 485 interface.

Setting up external control

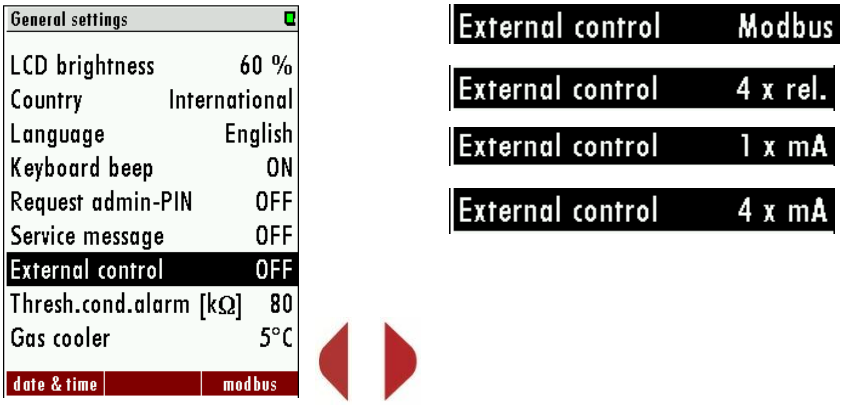
An external control can be set up on an IO module via the upper analog outputs.

▶ Open the path "EXTRAS / GENERAL SETTINGS".

▶ Select "EXTERNAL CONTROL" here.

▶ Use the ***left/right arrow keys*** to select the desired external control.

ⓘ By selecting the external control, the device can be controlled remotely.



Activating the external control with the respective 4 possible options.

By activating the external control, a small arrow appears in the upper bar.

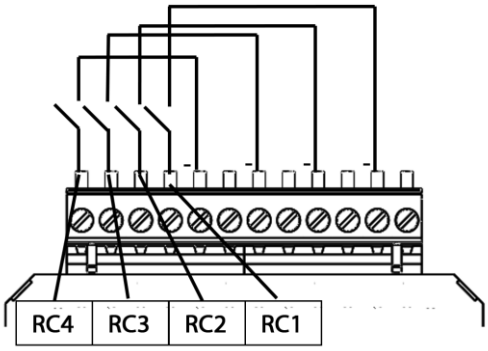
▶ You can set the zero point time, the suction / reaction time or the purging time before stand-by in the menu "General settings" with F2 (=ext Ctrl.).

After everything has been set, the external remote control must be wired.

Connecting the external control through 4 relays

This function can be used for external switching between the tapping points. For this purpose, four external relays (e.g. from a PLC) are connected to the module inputs.

The four relays together form a binary 4-bit code: RC4-RC3-RC2-RC1.



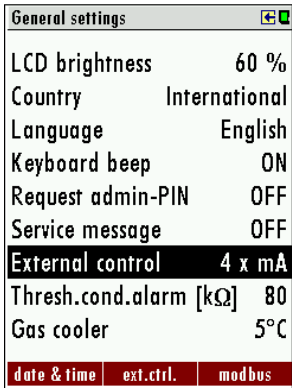
Status of external signal source				Status number	Description
RC4	RC3	RC2	RC1		
0	0	0	0	0	Automatic sampling point switching
0	0	0	1	1	Device is sampling at the point SP1 (*1, *2)
0	0	1	0	2	Device r is sampling at the point SP2 (*1, *2)
0	0	1	1	3	Device is sampling at the point SP3 (*1, *2)
0	1	0	0	4	Device is sampling at the point SP4 (*1, *2)
0	1	0	1	5	Device is sampling at the point SP5 (*1, *2)
0	1	1	0	6	Device is sampling at the point SP6 (*1, *2)
0	1	1	1	7	Device is sampling at the point SP7 (*1, *2)
1	0	0	0	8	Device is sampling at the point SP8 (*1, *2)
1	0	0	1	9	Device is sampling at the point SP9 (*1, *2)
1	0	1	0	10	Device is sampling at the point SP10 (*1, *2)
1	0	1	1	11	Device is “stand-by” (*3)
1	1	0	0	12	Purge phase for H2S-low-sensor **
1	1	0	1	13	Auto-Calibration
1	1	1	0	14	Reset of all system alarms
1	1	1	1	15	Device is “stand-by” (*3)

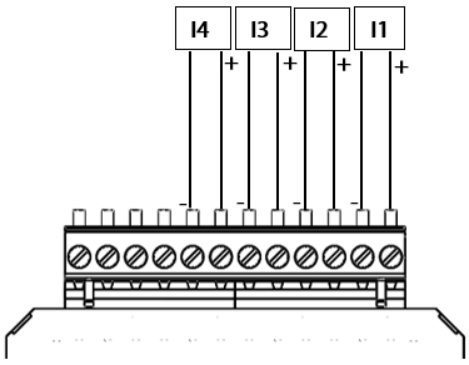
**only SWG100-BIOGAS.

Here means: 0= Open / 1=Closed.

Connecting an external control through four 4-20 mA input signals

The 4-bit status number is formed by four 4...20 mA signals. I4-I3-I2-I1 thereby are: 0-11 mA = 0 signal (low) / 11/12-20 mA =1 signal (high).

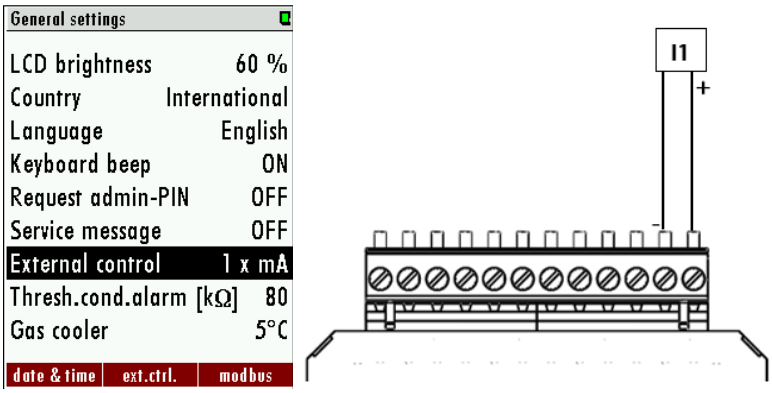




Status of external signal source				Status number	Description
I4	I3	I2	I1		
0	0	0	0	0	Automatic sampling point switching
0	0	0	1	1	Device is sampling at the point SP1 (*1, *2)
0	0	1	0	2	Device is sampling at the point SP2 (*1, *2)
0	0	1	1	3	Device is sampling at the point SP3 (*1, *2)
0	1	0	0	4	Device is sampling at the point SP4 (*1, *2)
0	1	0	1	5	Device is sampling at the point SP5 (*1, *2)
0	1	1	0	6	Device is sampling at the point SP6 (*1, *2)
0	1	1	1	7	Device is sampling at the point SP7 (*1, *2)
1	0	0	0	8	Device is sampling at the point SP8 (*1, *2)
1	0	0	1	9	Device is sampling at the point SP9 (*1, *2)
1	0	1	0	10	Device is sampling at the point SP10 (*1, *2)
1	0	1	1	11	Device is “stand-by” (*3)
1	1	0	0	12	Purge phase for H2S-low-sensor **
1	1	0	1	13	Auto-Calibration
1	1	1	0	14	Reset of all system alarms
1	1	1	1	15	Device is “stand-by” (*3)

Connecting an external control 4-20 mA input signal (via one input)

The user has the possibility to control the device externally by only one input signal (see sketch below). Different commands are given by the current level at measurement input I1. The zero signal corresponds to 4 mA. Each 1 mA level describes a state. Thus, the external control can assume up to 16 states. The first state corresponds to 5 mA (4 mA+1 mA) the second to 6 mA (4 mA+2mA) etc. until the signal reaches 20 mA.



Status of the external signal source	Status number	Description
4	0	Automatic sampling point switching
5	1	Device is sampling at the point SP1 (*1, *2)
6	2	Device is sampling at the point SP2 (*1, *2)
7	3	Device is sampling at the point SP3 (*1, *2)
8	4	Device is sampling at the point SP4 (*1, *2)
9	5	Device is sampling at the point SP5 (*1, *2)
10	6	Device is sampling at the point SP6 (*1, *2)
11	7	Device is sampling at the point SP7 (*1, *2)
12	8	Device is sampling at the point SP8 (*1, *2)
13	9	Device is sampling at the point SP9 (*1, *2)
14	10	Device is sampling at the point SP10 (*1, *2)
15	11	Device is “stand-by” (*3)
16	12	Purge phase for H2S-low-sensor **
17	13	Auto-Calibration
18	14	Reset of all system alarms
19	15	Device is “stand-by” (*3)

General notes on external control

Case 1: Stand-by

The stand-by mode is activated when the status number exceeds the number of installed measuring points (example: 4 installed measuring points and active status number is 5). A stand-by mode has the following sequence:

- Purging via zero gas connection (depends on configured time).
- Stand-by mode until a status number is entered that corresponds to an installed measuring point.

Case 2: Active external control for a measuring point

- Zero point: First a zero point is taken. The running time of the zeroing can be set in the ext.Str menu.
- Gas suction: During the gas suction phase, the entire system is purged with sample gas to reach the T90 time of the analyser.
- Measurement: The measurement is started after the "gas suction" phase. The device remains in measurement mode until the signal from the external control is changed. The table below shows the possible status numbers that can be assumed by the analyser.

(*1): Each time the measuring point is changed, the analyser takes a zero before measuring at the next measuring point.

(*2): Not only 11 to 15, but all status numbers greater than the number of installed measuring points will start the "stand-by" status.

(Example: if there are 4 measuring points, status numbers 5 to 15 will be set to "stand-by").

(*3): When the status number changes to a "stand-by" number, the sensors are purged, all solenoid valves are closed and the gas pump is switched off. If the status number changes to a smaller or the same number of installed measuring points, then a zeroing cycle begins and then measurement starts at the selected measuring point.

NOTE

The "stand-by" status can simply be used to start only one zero point measurement without "stand-by" and without changing the measuring point.

Example: - Status number=1 (for each time period, recommended max. 1 hour)

- Status number=15 (for a few seconds, recommended min. 10 seconds).

9.2 Option: Perform auto-calibration

With the auto-calibration option, your device can carry out an adjustment automatically at predefined time intervals.

⚠ WARNING

High pressure

Gas cylinders are under high pressure. High pressure can lead to injuries and death.

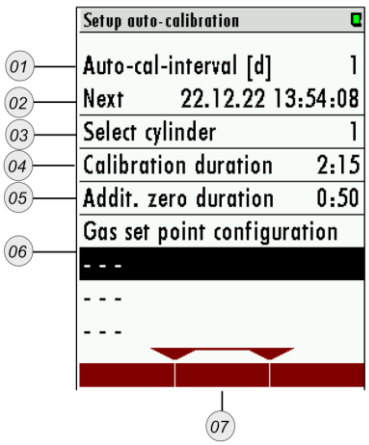
➢ Only trained persons may connect and operate gas cylinders.

▶ Connect the calibration cylinders to **calibration gas inlet 1**, **calibration gas inlet 2** etc.

- **WARNING** High pressure. Gas cylinders must be fitted with a pressure reducer.
- **WARNING -** Set the pressure range. Do not set pressure reducers above 500 hPa.

▶ Open the menu: EXTRAS / ADJUSTMENT MENU / AUTO CALIBRATION

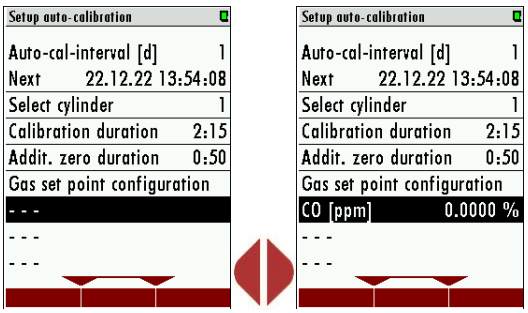
ⓘ The menu SETUP AUTO-CALIBRATION has the following structure.



#	Description
1	Setting the auto-cal interval
2	Set next auto-calibration
3	Selecting the connection
4	Calibration duration

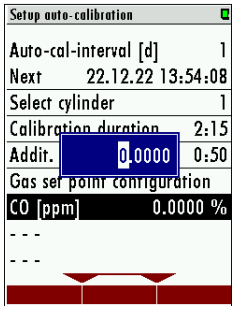
5	Zero time
6	Setpoint of the calibration bottle

- Use the ***left/right arrow keys*** (◀-▶) to set for which Calibration gas inlet (1 to max. 5) 3 the settings should apply
- Use the ***left/right arrow keys*** (◀-▶) to set your desired auto calibration interval 1
- Use the ***left/right arrow key*** (◀-▶) to set the date and time for the start of the interval 2
- Use the ***left/right arrow key*** (◀-▶) to set your desired calibration period 4
- Use the ***left/right arrow key*** (◀-▶) to set your desired zero time 5
- Go to the list "GAS SET POINT CONFIGURATION" 6
- Select the first gas component of your adjustment gas cylinder with the ***left/right arrow key*** (◀-▶).

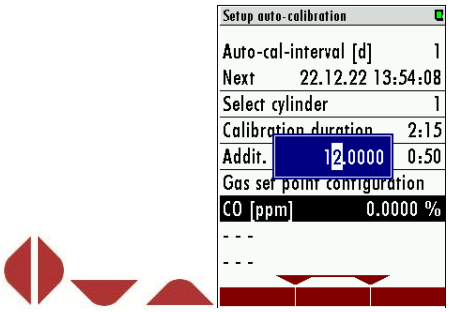


- Press the **OK*-key*** to set the setpoint.

  A blue input window appears.



- Use the ***arrow keys*** to set the setpoint of the gas component in the blue input window.



▶ Press the OK-*key* to confirm the entry.

▶ Continue with the steps to enter all gas components in the adjustment gas cylinder in list 6.

▶ Carry out the same steps for any other adjustment bottles.

✔ You have configured the auto adjustment.

☛ If you want to start the adjustment as specified, exit the menu and confirm the settings.

☛ If you want to start the auto calibration immediately, press F2 = START NOW 7.

9.3 Option: Profibus-converter

The Profibus converter allows a direct communication between Modbus (RTU) and a Profibus interface.

- The option is only available from firmware V1.01.70.
- Transfer multibyte values in Motorola ® Order (Big Endian).
- CRC16 at the end of each frame is transmitted with Intel ® Order (Little Endian). In case the master system needs Little Endian Order.
- 16bit values in frame swap bytes 0▪ 1.
- 32bit values in data swap byte 0▪ 3 and bytes 0▪ 2.
- All addresses shown here are decimal and not hexadecimal.
- All readable addresses are 32bit values.
- The device accepts for reading only even addresses and even register numbers.

The data types used are:

- U32: 32 bit unsigned integer values (0...4,292,967,259).
- FL: 32 bit floating point values (reads -1E38 if not included).
- Some values are only optional (e.g. gas cooler).

The data types used are:

- U32: 32 bit unsigned integer values (0...4,292,967,259).
- FL: 32 bit floating point values (reads -1E38 if not included).
- Some values are only optional (e.g. gas cooler).

9.3.1 Connect device with Profibus

Prerequisite

- 9-Pin SUB connector cable.

9.3.2 Connection to device

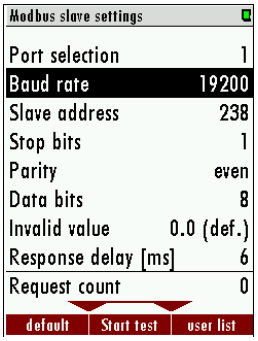
03 = Connection A, 04 = , 05 = GND (insolate Ground), 06 = Positiv Connection, 07 = , 08 = Connection B

9.3.3 Device settings

The settings are as followed:

▶ Under the menu EXTRAS/GENERAL SETTINGS → MODBUS (F3) set the parameters.

ⓘ The request parameters increase by a correct connection.



9.3.4 Special information about Modbus-Slave function

The device can work as a Modbus slave via RS232 or RS485 (possible with an external RS232/RS485 adapter).

- Supports RS485 interface with 2/4 wire function (half/full duplex).
- Supports Modbus binary protocol (RTU) only.
- Supports the Modbus command Read Holding Register (command no. 3).
- Supports the Modbus command Read Input Register (command no. 4).
- The slave Modbus address can be set by the user between 1 and 238.

The communication parameters can be defined by the user as follows:

- 9600 or 19200 baud (recommend 19200)
- Even, odd or no parity
- 1 or 2 Stopp-Bits.
- With a read command max. 63 32-Bitvalues can be read (126 Modbus registers).

9.3.5 Special information about Profibus – Slave function

- The Profibus slave function requires a Modbus Profibus converter "Seneca HD67561" installed and configured in the measuring device.
- The Profibus ID is normally set to 84 by MRU.

10 Technical data

10.1 General technical data

Operating temperature (without frost protection heating)	+5°C ... +45 °C / 41 °F ... 113 °F
operating temperature (with optional frost protection heating),	-10 °C ... +45°C / 14 °F ... 113 °F
Rel. humidity during operation, non-condensing	< 95%
Storage temperature	-20°C ... +50°C / -4°F ... 122°F
Protection class	IP54
Installation conditions	Protected from direct sunlight and rain
Suitable for Ex zone	no
Power supply without probe and heating hose	100 - 240 V, 200 W
Weight, typical with sensors, gas cooler	50 kg / 105 lbs
Dimensions (HxWxD)	700x600x210 mm 23.6x 27.6 x8.3 in
Housing material	Stainless steel

Max. negative pressure range of the gas pump	300 hPa
Permissible overpressure at the gas inlet	200 hPa
Typical gas flow	50 l/h

10.2 Interfaces

Parameters	Specification
Display type	3,5*TFT*
Number of simultaneously displayed measured values	6
Keyboard with number of keys	12
Electrical outputs/inputs	
Serial interface	RS485
Protocol	Modbus RTU
Analog output type	4 ... 20 mA
Number of output channels per I/O module (optional))	4
Analog input type	4 ... 20 mA
Number of input channels per I/O module (optional)	4

Number of alarm outputs per I/O module (via relay)	2
Maximum possible number of I/O modules	2
System alarm output	Relay contact

10.3 Gas inlets and outlets

Number of measuring points to be monitored in parallel	1
Number of sample gas inputs (serial switchover)	2
Permissible overpressure at the calibration gas inlet:	< +500 hPa

10.4 O2 measurement (depending on equipment)

Electrochemical sensor	
Measuring range	0 .. 25%
Resolution	0,01%
Accuracy abs.	± 0,25 Vol%
Response time T90	< 40s
Years expected operating life in air	5

Paramagnetic sensor	
Measuring range	0 Vol% ... 25 Vol%
Resolution	0,01 Vol%
Accuracy	0,1 Vol%
Response time T90 *(@60l/h)*	< 30s

10.5 NDIR measurement technology (depending on equipment)

Gas	Comment	Measuring range 0 - min ... max	Resolution	Repeatability	8h-Drift	Linearity
NO		0 - 200...4.000 ppm	0,1 ppm	2 ppm / 1% rdg.	2 ppm / 1% rdg.	1% m.r.
NO2	without H3PO4	0 - 300 ... 1000 ppm	0,1 ppm	5 ppm / 1% rdg.	5 ppm / 1% rdg.	1% m.r.
	with H3PO4	0 - 150...1000 ppm	0,1 ppm	1 ppm / 1% rdg.	2 ppm / 1% rdg.	1% m.r.
SO2	without H3PO4	0 - 300...4.000 ppm	0,1 ppm	5 ppm / 1% rdg.	5 ppm / 1% rdg.	1% m.r.
	With H3PO4	0 - 150...4.000 ppm	0,1 ppm	2 ppm / 1% rdg.	2 ppm / 1% rdg.	1% m.r.
CO2		0 - 40 Vol%	0,01 Vol%	0,2 Vol% / 1% rdg.	0,2 Vol% / 1% rdg.	1% m.r.
CO		0 - 175...10.000 ppm	0,1 ppm	2 ppm / 1% rdg.	2 ppm/ 1% rdg.	1% m.r.
N2O		0 - 100...500 ppm	0,1 ppm	2 ppm/ 1% rdg	2 ppm/ 1% rdg.	1% m.r.
CH4		0 - 500...10.000 ppm	0,1 ppm	10 ppm/ 1% rdg	2 ppm/	1% m.r.

Gas	Comment	Measuring range 0 - min ... max	Resolution	Repeatability	8h-Drift	Linearity
					1% rdg.	
C3H8		0 - 200...5.000 ppm	0,1 ppm	2 ppm / 1% rdg.	2 ppm/ 1% rdg.	1% m.r.

11 Declaration of conformity

EU-Konformitätserklärung

Declaration of conformity

CE

MRU Messgeräte für Rauchgase und Umweltschutz GmbH

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E-Mail / *mail:* info@mru.de
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Bevollmächtigte Person, für die Zusammenstellung der technischen Unterlagen
Person authorized to compile the technical documents

Name / *name:*	Dierk Ahrends
Funktion / *function:*	QM-Beauftragter / *QM- Representative*
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:*	Gasanalysator *Gas analyser*
Produktname / *name:*	SWG100
Funktion / *function:*	Gasanalyse / *gas analysis*

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, 20.06.2016

Erwin Hintz, Geschäftsführer / *Managing Director*

12 Appendix

As an appendix to these operating instructions, you will find some documents with details on the mechanical and electrical implementation of the device and, if necessary, documents from the company's suppliers.

13 Addendum SWG100 CEMcompact

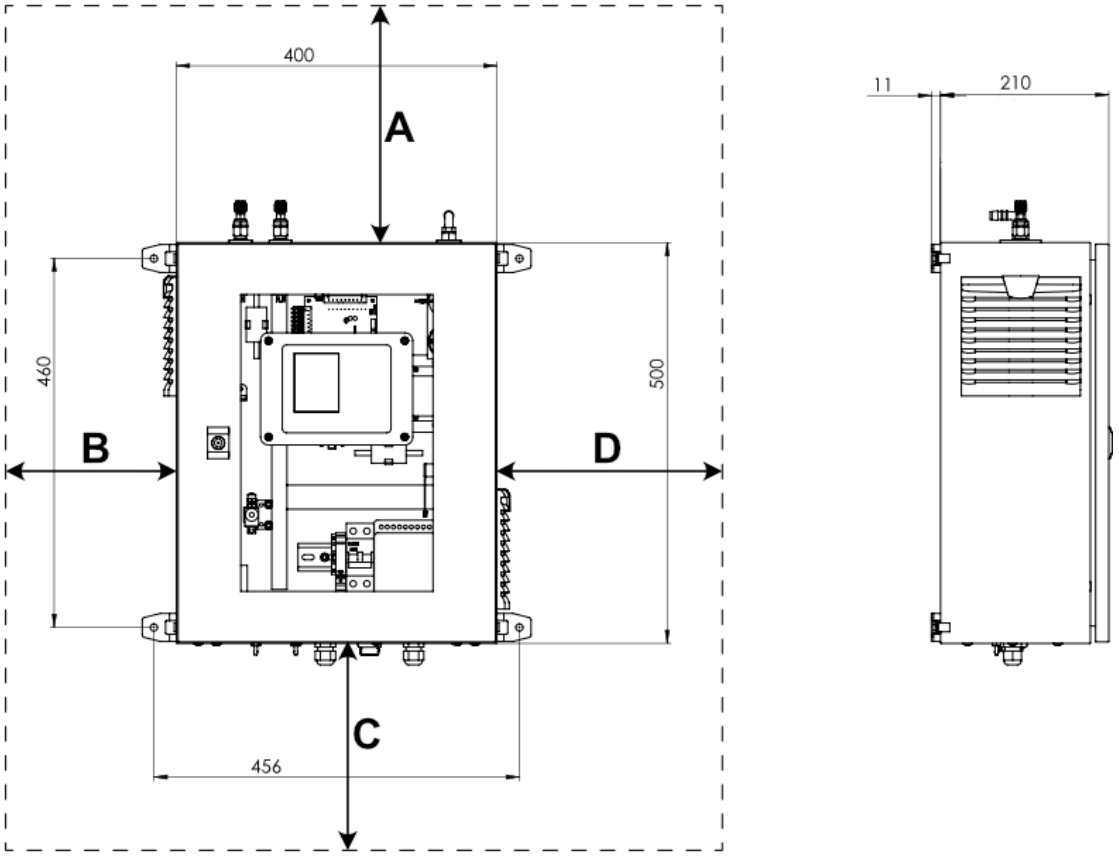
The SWG100 CEMcompact has a similar design to the SWG 100CEM. The housing is more compact and does not include a gas cooler. Please note that the SWG100 CEMcompact does not have a condensate trap.

ATTENTION

Damage to the device

Incorrect measurement

- ➢ Ensure that the sample gas cannot condense in the device.
- ➢ Check whether additional gas treatment is required to prevent damage to the device.



External dimensions and installation instructions for SWG100 CEMcompact

#	Spacing
A	Min. 50 cm up to the next overhang / ceiling
B	Min. 30 cm to the next wall
C	Min. 100 cm to the floor (for wall-mounted devices)
D	Min. 50 cm to the next wall

13.1 General data

Specification	Value
Operating temperature (w/o heating)	+ 5°C ... + 45 °C / 41 °F ... 113 °F
Operating temperature (with internal heating, option)	- 10 °C ... + 45°C / 14 °F ... 113 °F
Rel. Humidity, non-condensing	< 95%
Storage Temperature	- 20°C ... + 50°C / - 4°F ... 122°F
Protection Class	IP54
Installation Requirements	Do not expose to direct sun light or rain
Internal Battery Pack, buffer time for sensor bias	NiMH, 3 months
Power supply	100 - 240 V, 200 W
Weight, typically incl 2 sensors, gas cooler	20 kg / 44 lbs
Size (without mounting bracket and connections)	500x433x210 mm (HxBxT)
Housing material	Lacquered steel
Window	Glass
Max. suction range gas pump (blocked suction)	- 650 hPa
The unit is intended to be operated in intervals, non-continuously	

Permissible overpressure at gas inlet	
Under pressure (depending on equipment)	- 100 hPa
Overpressure	50 hPa
Gas flow typ.	50 l/h

13.2 User Interfaces

User Interface	**Value**
Display type	3,5TFT
Number of simultaneously displayed values	6
Keyboard with qty of keys	12
Electrical I/O	
Serial interface	RS485
Protocol	Modbus RTU
Type of analog output	4 ... 20 mA
Number of output channels per I/ modul (optional)	4
Typ of analog input	4 ... 20 mA
Number of input channels per I/ modul (optional)	4
Number of alarm ouput signal via relays	2
Max number of modules to be equipped (I/O module, Profibus, Profinet and Ethernet converter)	2
System alarm output	Relay contact
Gas input and ouput	

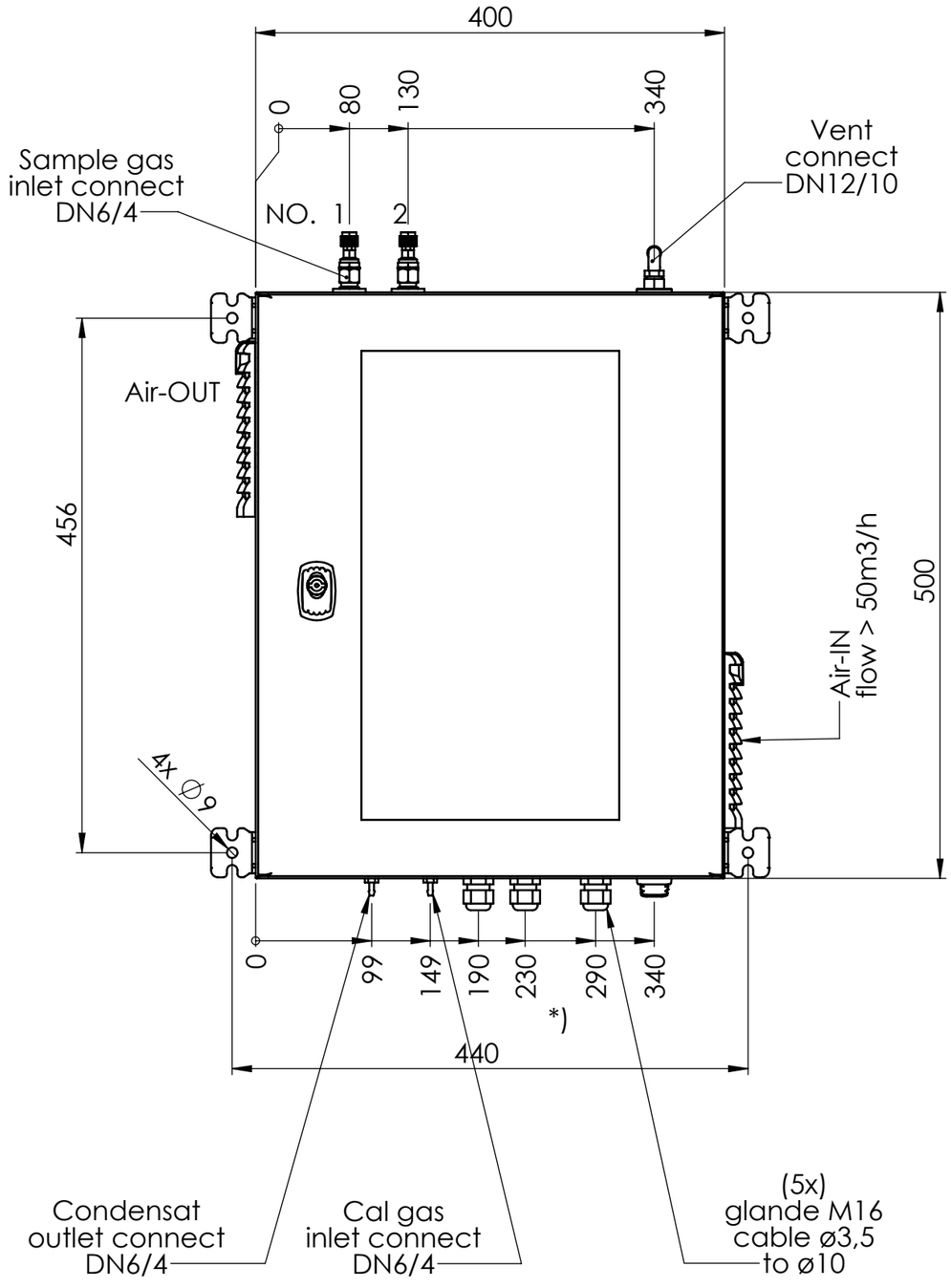
Number of simultaneously monitored sampling points	1
Number of sampling points (serial sampling point switching)	2
Screw joint sampling point	G1/8
Gas output	G1/4
Fresh air (for zeroing) / Calibration gas	DN 4/6

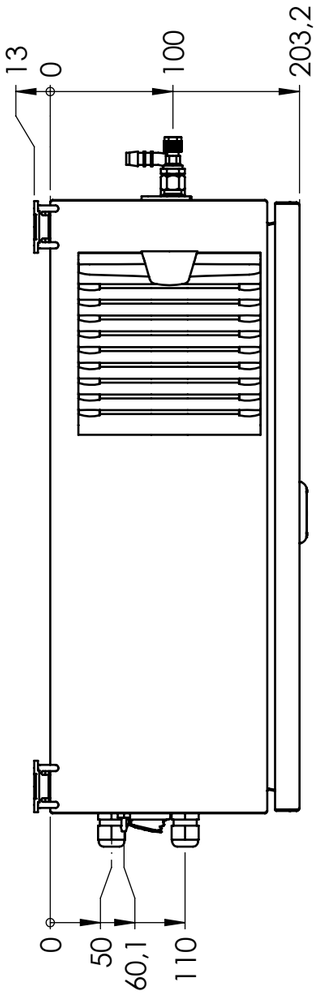
13.3 Measuring technology

Specification	Value
O2- measurement	
Electrochemical Sensor	O2
Measuring Range	0 - 25 Vol%
Resolution	0,01 Vol%
Abs. Accuracy	± 0,25 Vol%
Response Time T90	< 20s
Years expected lifetime (@air)	2
Paramagnetic sensor	O2
Measuring Range	0 - 25 Vol%
Resolution	0,01 Vol%
Abs. Accuracy	± 0,1 Vol%
Response Time T90	< 20s
Electrochemical sensors	
Electrochemical sensor	CO
Nom. Measuring Range	0 - 10000 ppm
Overload Range	20000 ppm
Resolution	1ppm

Accuracy abs./reading	±10ppm 5% (0 ... 10000 ppm) 10% (>10000 ppm)
Response Time T90	≤ 40s
Years expected lifetime (@air)	2
Electrochemical sensor	NO
Nom. Measuring Range	0 - 1000 ppm
Overload Range	5000 ppm
Resolution	1ppm
Accuracy abs./reading	± 10 ppm 5% (0 ... 1000 ppm) 10 % (>1000 ppm)
Response Time T90	≤ 40s
Years expected lifetime (@air)	2
Non-dispersive Infrared Measurement (NDIR)	**CO2**
Nom. Measuring Range	0 ... 50 Vol%
Resolution	0,01 Vol%
Accuracy abs./reading	± 0,3 Vol% / 3%
Response Time T90	< 35 s
Non-dispersive Infrared Measurement (NDIR)	**CO2, CO, CH4**
	CO2
Nom. Measuring Range	0 ... 50 Vol.%
Resolution	0,0 Vol%
Accuracy abs./reading	± 0,1 Vol% /2%
Response Time T90	<50s
	CO
Nom. Measuring Range	0 ... 100.000 ppm

Resolution	1 ppm
Accuracy abs./reading	± 20 ppm / 2%
Response Time T90	< 50s
	CH4
Nom. Measuring Range	0 ... 40.000 ppm
Resolution	1 ppm
Accuracy abs./reading	± 10 ppm / 2%
Response Time T90	< 50s





Door
opening angle
130° to the right

*) optional

Name: SWG100 Compact				Date	Name	Tolerances ISO 2768-m-K
			Drawn	07.03.2016	Reinke	
			Chk´d	30.01.2025	Keller	
			Non-dimensioned geometries, see 3D-CAD-data !			
Material: Material <nicht festgelegt>		Rev	Modifikation		Date	Name
		02	CAD berichtigt, neue Anschl-Lage		30.01.2025	Keller
Finish		03				
		04				
DWG NO. 951020-02	Scale 1:5	05				
		06				
MRU NO. 951020		07				

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unbemaßte Werkstückkanten nach DIN ISO 13715

Weight 15460.40 g

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