MRU AIRfair since 1984 ®
EMISSION MONITORING SYSTEMS

SWG100 BIOGAS

USER MANUAL

9512EN- BIO

Die leeren Seiten der Bedienungsanleitung sind kein Fehler sondern herstellungsbedingt erforderlich!

The blank pages of the operating instructions are not a mistake but due to manufacturing required!

Пустые страницы в инструкции по эксплуатации не ошибка, а требуется производством!

Les pages vides sont pas fauses, mais dûs à la production requise!

Content

Inspect Shipment for Damage

Carefully inspect the entire shipment for damage in the presence of the shipper's agent, removing packaging material if necessary. Note any damage to packaging and/or goods on Packing List and have it signed by the shipper's agent prior to accepting the shipment. Submit damage claim to MRU immediately.
NOTE: Damage claims not received by MRU within 3 days of receipt of shipment will not be accepted.
The products described in this manual are subject to continuous development and improvement and it is therefore acknowledged that this manual may contain errors or omissions. MRU encourages customer feedback and welcomes any comments or suggestions relating to the product or documentation.
Please forward all comments or suggestions to the Customer Feedback Department at the following address:

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1 General Information

1.1. Weather and environmental conditions

The SWG100 BIOGAS analyser is designed for ambient temperatures of +5°C to +45°C (without cabinet heater) resp. -10°C to +45°C (with cabinet heater). The analyser is designed for indoor mounting. In case of outdoor mounting it is important that the analyser is sufficiently protected against rain, sun and wind. In case of outdoor mounting under extreme environmental conditions like high humidity, salty sea air, etc. further protective measures are necessary. These should be clarified with the manufacturer (MRU).

Any additional protective measures for outdoor mounting have to be provided by the plant operator. The manufacturer (MRU) consults the plant operator in choosing appropriate protective measures.

NOTE

The SWG100Biogas analyser is designed for sampling biogas with condensate of max. 14ml/min.
If the sample biogas will be very wet (high condensate of more than 14ml/min), then – to protect the SWG100-Biogas analyser – please consider special precautions to remove the condensate.
If you not have your own feasible solution for this topic, please ask MRU.

1.2. Installation instructions

Installation instructions, which are described in chapter 3 of the operation manual, have to be strictly adhered to.

⚠ WARNING

Please check correct installation before powering up the analyzer!
Please operate the analyzer only in upright position!

1.3. General important instructions for the plant operator

To guarantee continuous operation of the SWG100 BIOGAS analyser, the functions, processes and operation of the analyser have to be monitored regularly by the plant operator – especially in case of any initial installation. Thus, it will be possible to take suitable measures to improve the availability and life time of the analyser.
As the plant operator gains more experience concerning the maintenance requirements of the analyser, the monitoring frequency may be reduced to more extended periods of time.

It is important that the filter-units, listed in chapter 9.1 of the operation manual, are checked regularly and, if necessary, service parts are changed.

NOTE

In case of **not intended** use the guarantee will void. Regular controls, inspections and the exchange from polluted and exhausted filters by the operator are also an important part of the determinations "**not determined use**"- see chapter 9.1 regular maintenance work.

1.4. Important information about the user's operation manual

The users/operation manual is an important part of this delivery. It will explain how to use this analyzer properly and sets forth safety and environmentally friendly procedures.
It is the responsibility of all users to read and familiarize themselves with this manual, paying particular attention to the safety instructions.
The most important safety details are clearly marked with an attention sign.

1.5. Safety Information

The following safety procedures must be followed at all times. They are significant and essential part of this manual. Failure to follow safety procedures can result in the loss of your warranty claims.

Biogas or other similar gases (landfill gas, bio-methane, coal seam gas etc) is containing flammable gas component ***CH4*** and toxic gas component as well (***H2S*** and ***CO2***).
Analyzer is continuously sampling a certain volume (approx. 50l/h) of the sample gas, and is venting it to ambient air.
For this reason, there are two aspects which must be considered:

Toxicity danger of sample gas

⚠ WARNING

Toxic gas
Sample gas can contain toxic substances, which are harmful for health and can even cause death.

- It is the responsibility of analyzer user to ensure that person is skilled and trained in safety aspects of gases being analyzed and procedures to follow while using this instrument.
- Local regulations for possible exposure to toxic gases has to be known and obeyed by the user of the analyzer
- Using a personal gas detector inside the biogas plant is highly recommended since
  H_2S in higher (very dangerous) concentration cannot be detected by human nose. Only small concentrations around few ppm can be detected by human nose

- ***CO_2*** gas is heavier than air and therefore operator shall avoid working at underground levels. Beware of that ***CO_2*** is also odorless!
- It is not allowed to use the biogas analyzer in confined space or rooms without forced ventilation.
- Sample gas exiting the analyzer will flow in to the ambient air and only outdoor use or forced ventilation rooms are suitable for using the biogas analyzer.

no dangerous quantities poisonous or injurious gases or substances are liberated under NORMAL CONDITIONS

List of poisonous or injurious gases which are normally present in the sample gas (Biogas)	
Gas	liberated quantities
sample gas (total)	<100ml/day
CH4 (methane)	<75ml/day
CO2 (carbon dioxide)	<55ml/day
H2S (hydrogen sulfide)	<0,5ml/day
H2 (hydrogen)	<1ml/day
NH3 (ammonia)	<1ml/day

Flammable gas

⚠ WARNING

Flammable gas

Biogas contains Methane (CH4), which can be flammable.

Regarding flammable gases (e.g. ***CH_4*** methane) and operating-instruments in the hazardous areas, the user must also be able to recognize the area classification and be aware of using the instrument there. This area classification is country specific, please observe and adhere to it.

- Stationary analyzers are allowed to be mounted in hazardous area zone 2 only if they have the certificate of compliance. These instruments shall never be located in confined places or rooms without forced ventilation.

Only trained personnel should carry out installation of stationary instrument and/or maintenance, service and repair. Opening the stationary analyzer cabinet can expose personnel to injuries and shocks from electrical voltage!

Safety regulations

⚠ WARNING

Hazardous Live

Power down the system and disconnect from mains to avoid access to live parts by using a tool.

MRU GmbH assures that the analyzer complies to the essential requirements of the legal regulations of the member states of the electro-magnetic compatibility (89/336/EWG) and to the low-voltage regulations (3/23/EWG).

Specific safety regulations

No part of the analyzer, or any other metal parts & accessories shall be used as electric conductors.
The analyzer shall not be used in or under water.
The analyzer shall not be placed near or directly exposed to open fire or heat.
The analyzer shall avoid dropping.

⚠ WARNING

Acid substances

Moisture or condensate, being pumped out of the condensate outlet port can be slightly acidic.

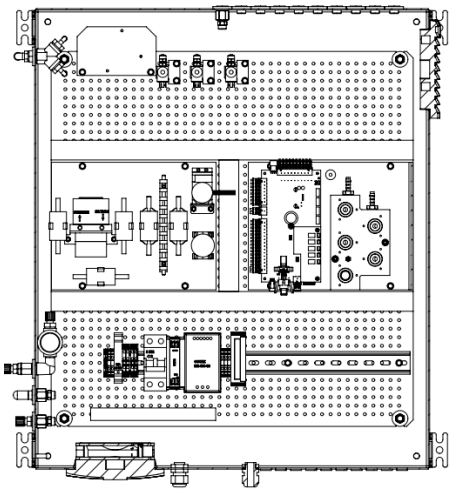
- In case of skin contact IMMEDIATELY: clean affected parts of the body.
- Avoid getting liquid in eyes.

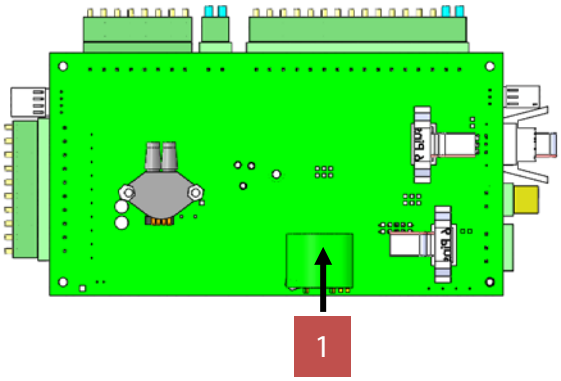
Please carefully clean all parts that come into contact with the condensate.

Battery cell

The analyzer contains battery cells at the following positions:

- Main board (1).





Follow steps must be aware:

⚠ WARNING

Switch off the power of the device

Before removing the battery the device must be switched off.

⚠ WARNING

Educated staff

It is recommended that only trained staff exchange the battery cell from the analyzer.

⚠ WARNING

Charging

Overcharging, short circuiting, reverse charging, mutilation or incineration of the cells must be avoided to prevent one or more of the following occurrences; release of toxic materials, release of hydrogen and/or oxygen gas, rise in surface temperature.

⚠ WARNING

Watch out of damage

If a cell has leaked or vented, it should be replaced immediately using protective gloves.

⚠ WARNING

Replacement of empty or damage cells
If and when necessary, these cells must be replaced with identical new ones from the same manufacturer. If a cell to be replaced is connected with other cells in series, it is recommended that the other cells be replaced with new ones at the same time.

⚠ WARNING

Watch out polarity
Reverse polarity installation of the cell in the end product must be avoided.

⚠ WARNING

Ventilation
Cell compartments containing these cells must be provided with means of ventilation to prevent possible accumulation of any released gases under abnormal conditions.

1.6. Packing

Packing regulation of 12.07.1991
If your local waste facility does not accept MRU packing materials for disposal, you may return it to MRU or our local sales representative. Packing materials returned to MRU must be returned prepaid.

1.7. Return of hazardous waste

Waste Disposal/Returns/Warranty -
MRU GmbH is required to accept the return of hazardous waste such as electro-chemical sensors that cannot be disposed of locally. Hazardous waste must be returned to MRU prepaid.

1.8. Return of analyzer

MRU GmbH is required to accept the return, for proper disposal, of all analyzers delivered after 13th of August 2005. Analyzers must be returned to MRU prepaid.

1.9. MRU Warranty conditions

The SWG100 BIOGAS warranty is 12 months.

1. The warranty on spare parts is 6 months.
2. The term of the warranty conditions starts as of the invoice date.
3. The warranty is void under the following conditions:
    - Improper use.
    - Improper application.
    - Improper mounting.
    - Deliberate or negligent destructions.
    - External influence like droping, impact, solvents, acids, gases, or transport damages. This includes damage, which is caused by exposure to high pollution and/or moisture (condensate) in the gas path.

4. As well excluded from the guarantee conditions are typical consumable- and spare parts.
5. Use of original MRU consumable parts and sensors is required to maintain the warranty.
6. Removal of tampering of the serial number type plate will void the warranty.
7. The service of a guarantee conditions will not enlarge the guarantee time. Demands because of consequential damages are excluded.
8. MRU is not responsible for the transport costs for the warranty or replacement.
9. MRU reserves the right, to determine individual conditions or exceptions. These will be separately communicated.

MRU GmbH
01.09.2014

2 Analyzer Description

2.1. Intended use

The instrument is intended for analyzing the composition of biogases / landfill gases and determine the concentration of several components like CH4, CO2, O2 and H2S. The instrument may optionally be equipped to monitor several sites in time sharing technique (cyclical one by one sampling).
In particular, the instrument is not foreseen to serve as a gas detector or safety device.

In case of unintended use, the warranty is void. Regular controls, inspections and the replacement of polluted and exhausted filters by the operator are also an important part of proper use. See chapter 9.1 regular maintenance work.

2.2. Type plate

The type plate of the analyzer contains important information about the analyzer. It can be found:

- The serial-no.
- The power supply.
- The installed measurement options.
- Date built.

The table below shows, which kind of measurement options may be installed in the analyzer.

1.	***O2, H2S, H2, CO***	**Electrochemical sensor**

2.	***CH4/CO2***	**NDIR-bench**
3.	***H2***	**Thermal conductivity detector.**

2.3. Possible applications and analyzer options

The biogas analyzer SWG100 is the industrial measuring solution to be used with:

- biogas (anaerobic digestion) plants
- cogeneration heat and power engines (CHP)
- municipal or industrial waste water treatment sites
- coal seam gas sites (coal bed methane)
- food and animal waste processing plants
- biomethane (gas to grid) plants
- landfill sites

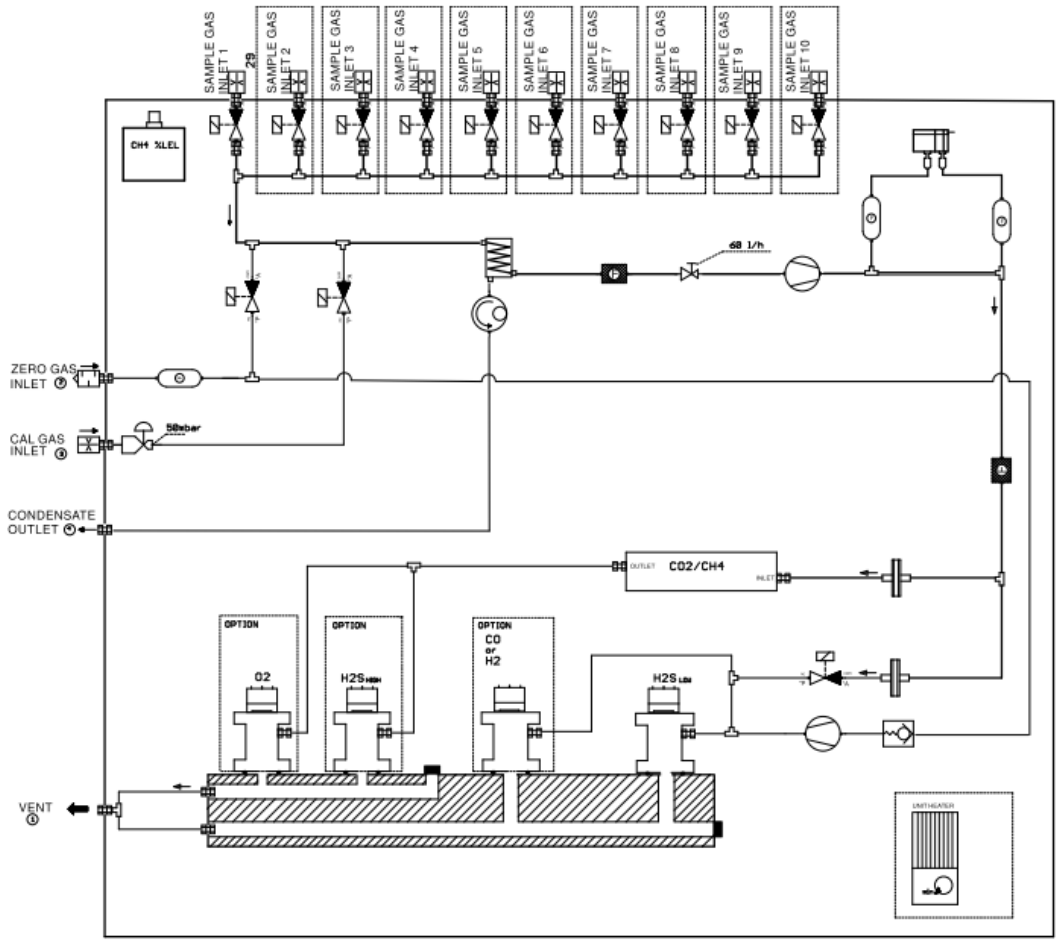
This analyzer can be equipped with additional options and/or additional accessories to full fill multiple other measuring tasks such as

- CH_4 and CO_2 NDIR measurement
- O_2 measurement with long-life EC cell
- H_2S_{low} measurement with protected EC cell using cutoff solenoid valve and air purge pump
- H_2S_{high} measurement with EC cell
- H_2 measurement with EC cell
- CO measurement with EC cell
- Electric gas cooler (Peltier) with automatic condensate draining pump
- Multiple sampling point switchover from 2x up to a maximum of 10x sites
- Module with 4 channel analog outputs/inputs 4-20mA, with 2x "fail safe" alarm relays
- Converter module of RS485 into Profibus
- Cabinet heater for freeze protection

Ask our sales representatives for available options and accessories or check out our MRU website.

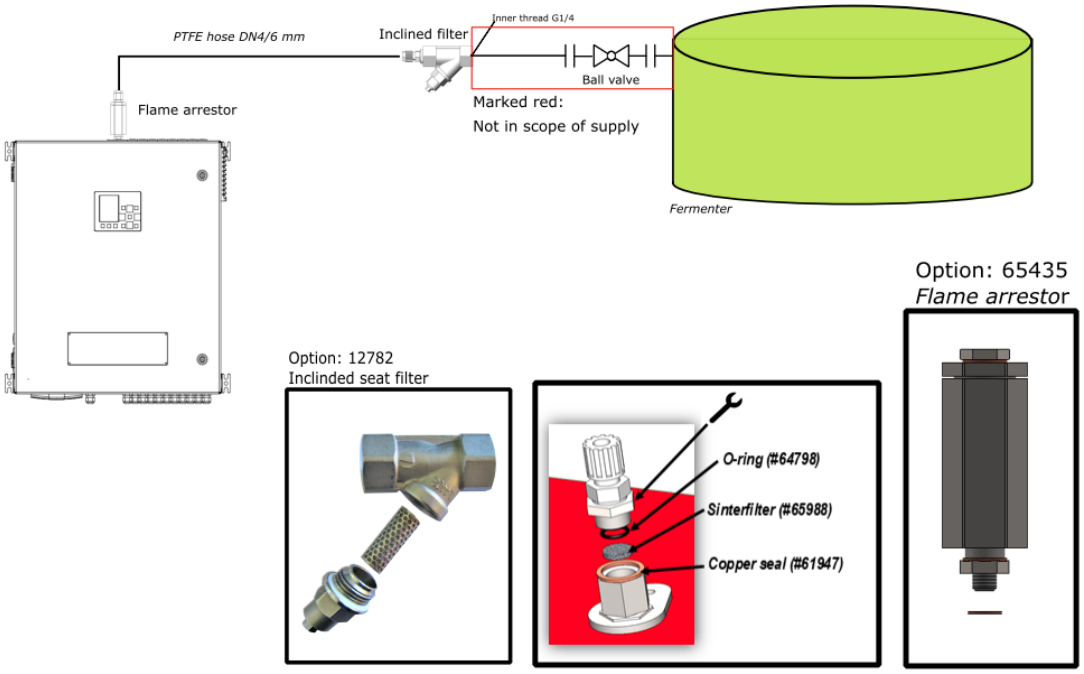
2.4. Principle of operation

- Sample gas from one or more sampling points is fed into the analyzer by dedicated ports. Internally mounted electric valves select one point at a time to feed sample gas to the analysis unit.
- The instrument is equipped with a non-dispersive infrared (NDIR) bench for analysis of ***CO2*** and ***CH4***. Two separate infrared detectors for each ***CO2*** and ***CH4*** are included, each operating with a different optical path length and stabilized by referring to a reference detector. The IR source is a highly efficient and stable IR emitter, pulsed at a frequency of several Hertz. By design NDIR technique offers good stability and selectivity together with long life time of sensor (only limited by corrosion or dust, which can be prevented or removed by regular servicing the instrument).
- The instrument is optionally equipped with a number of electro-chemical sensors ECS in order to detect gas components like oxygen ***O2*** or ***H2S***. Those sensors offer a reliable and effective way to detect the target gases. They are typically of limited life time (several years) but may be easily replaced once the end-of-life is reached.
- In regular time intervals the instrument automatically switches to purge the sensors with fresh (ambient) air for re-adjust the zero point.



Picture above: Sample gas flow diagram.

The picture below shows how the analyser should be piped. A ball valve and a prefilter is recommended.



2.5. Special functions of the analyzer

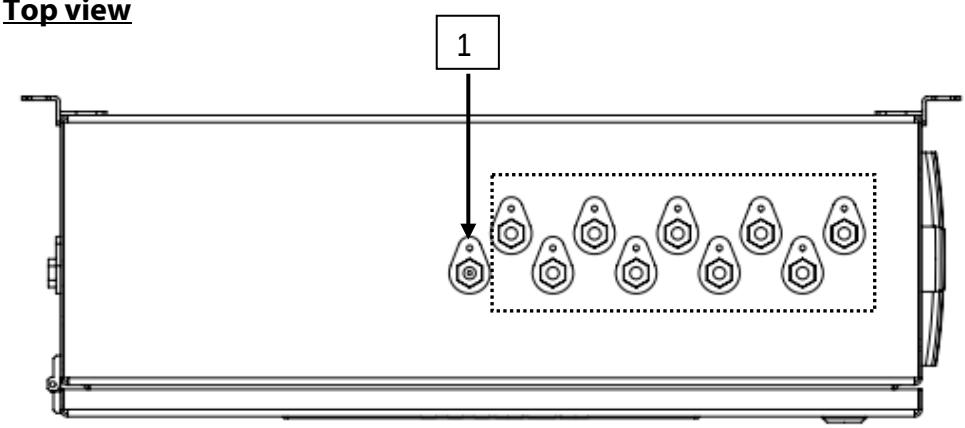
H2Slow sensor protection (optional)

The instrument may be optionally equipped with a H_2S_{low} sensor. As this sensor typically shows limited life time when experiencing high H_2S concentrations, some precautions are taken to protect the sensor:

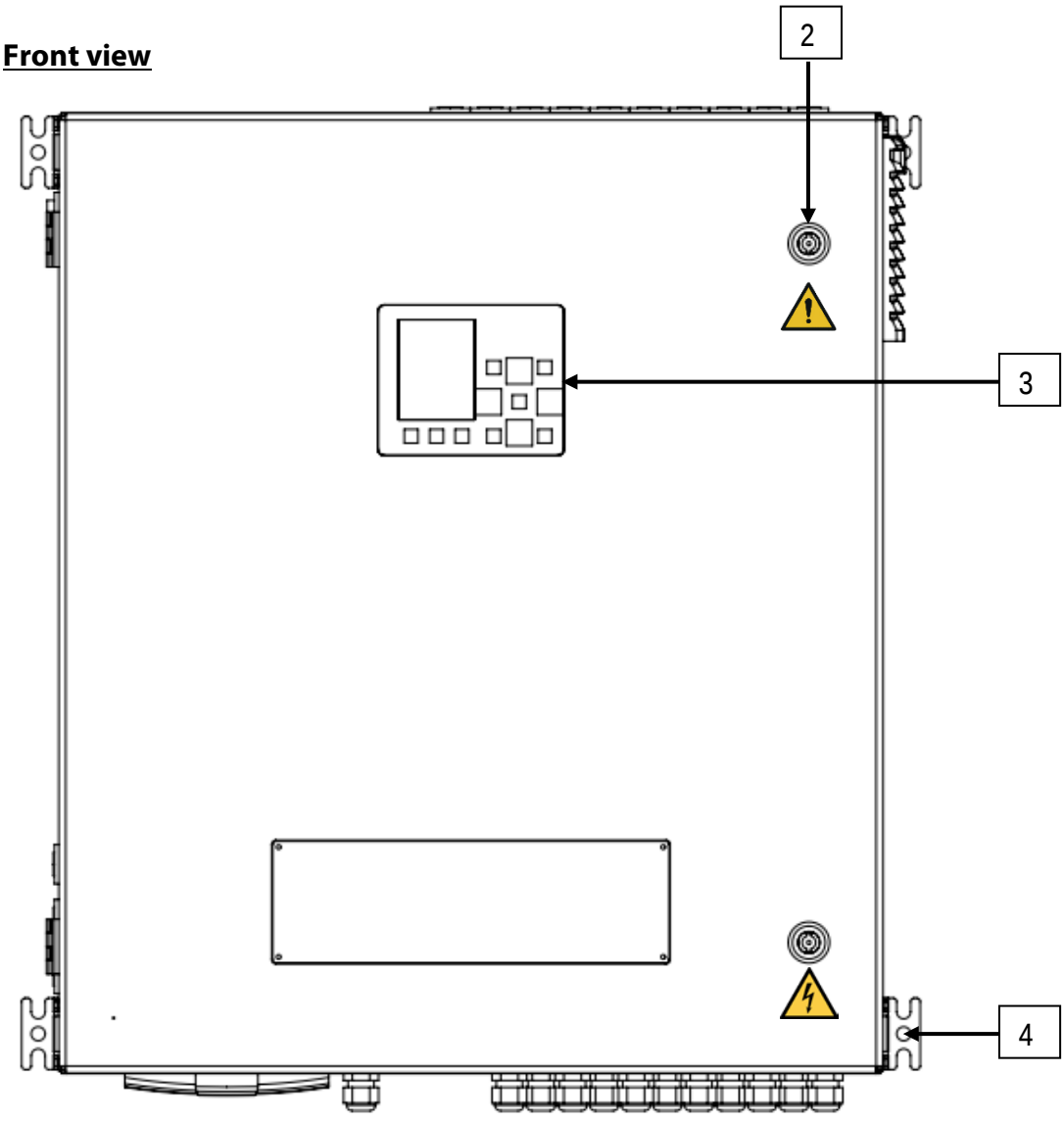
- The instrument is equipped with a cut-off solenoid valve and air purge pump to protect the H_2S_{low} sensor, without impacting the results of all other sensors.
- The purge unit is always activated after 3-10 minutes of active sensor measuring time.
- The measuring time of the H_2S_{low} sensor may be limited to less than 10 minutes by user setting
- The H_2S_{low} sensor may optionally not be included in all measuring cycles of sampling points. Instead the user may configure that the H_2S_{low} sensor is active only added at some of the measurement cycles.

2.6. Physical characteristic of the gas analyzer

Top view



Front view

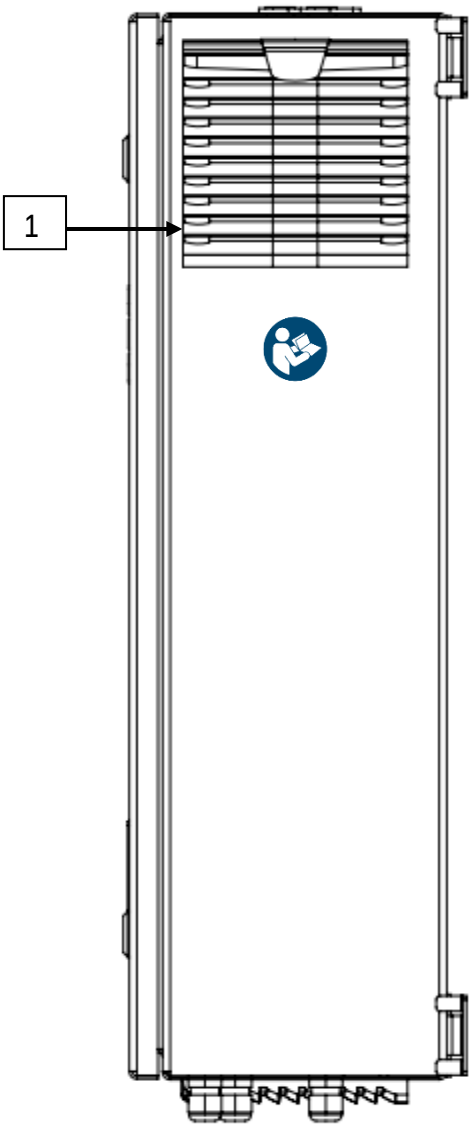


Reference:

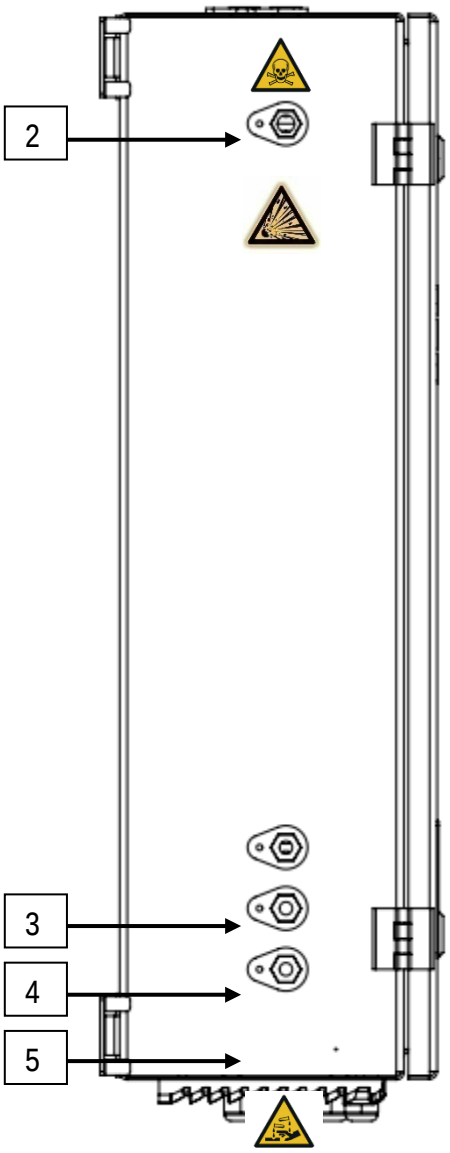
1. Gas inlet (default x1/optional max.10)
2. Cabinet lock
4. Suspension for wall mounting

3. Operation unit with display

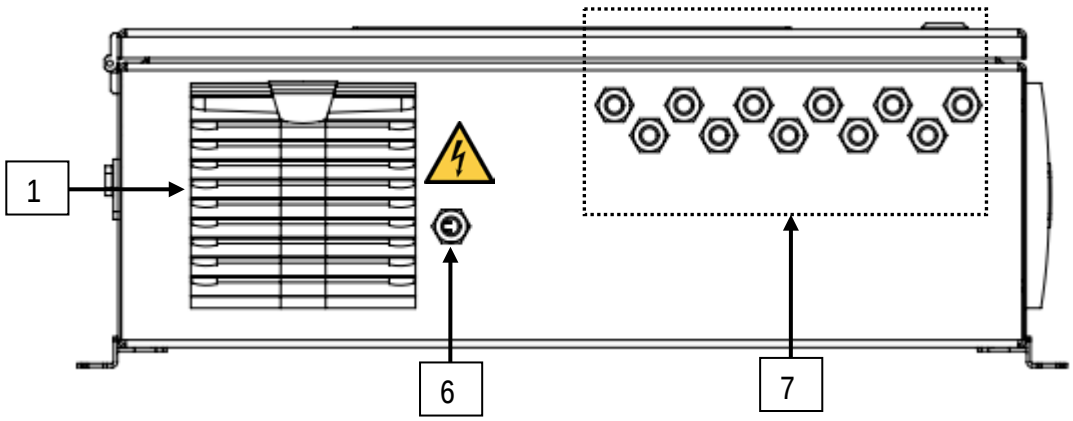
Right side view



Left side view



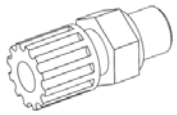
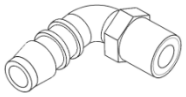
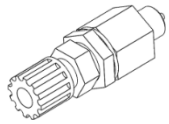
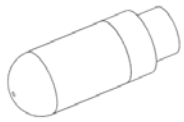
Bottom view



1. Fan filter
2. Sample gas outlet (Vent)
3. Calibration gas inlet
4. Zero gas inlet
5. Condensate outlet
6. Cable gland M16 for power supply
7. Cable gland M16 for IO

3 Scope of supply and delivery

Your analyzer is delivered in a carton box and is protected with special edge protectors.
Please do preserve the packing of your analyzer, for possible return shipment.
Inside the attachments box are different fittings:

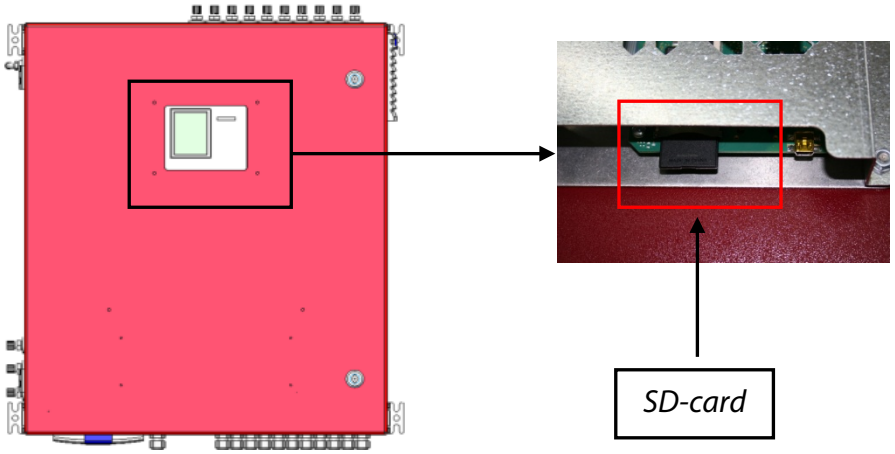
	Quantity	Description	Position
	1 piece	1/8 G outlet thread for DN4/6mm	Condensate outlet (4)
	1 piece	¼ G outlet thread 90°	Sample gas outlet (VENT) (5)
	2 pieces + 1 for every extra sample gas inlet	1/8 G outlet thread / DN 4/6mm	Sample gas inlet (1) Calibration gas inlet (2)
	1 piece	Filter 1/8 G outlet thread	Zero gas inlet (3)
	1 piece	Cabinet key	Cabinet locks
	2 pieces + 1 for every extra sample gas inlet	Copper seals for the restrictor orifice.	Sample gas inlet (1) Calibration gas inlet (2)

3.1. SD-card content

Following content are on the SD-Card:

- *Ethernet-Converter manual*
- *Profibus-Converter manual*
- *GSD-Files for profibus-converter*
- *SWG100-Bio manual (EN/DE)*
- *SWG100-Bio ModBus/Profibus specification (EN/DE)*

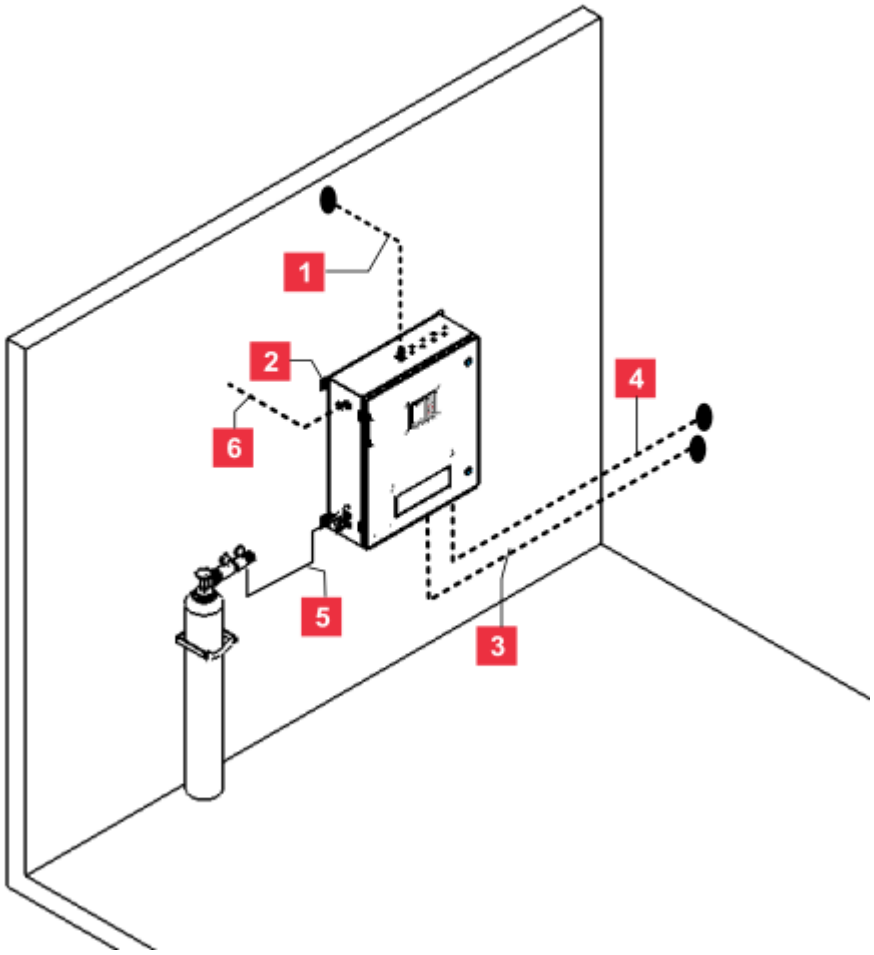
The SD-card can be found in the SD-card slot in the device (see sketch below).



4 Installation manual

4.1. Overview

This manual explains how to install the analyzer mechanically and electrically.



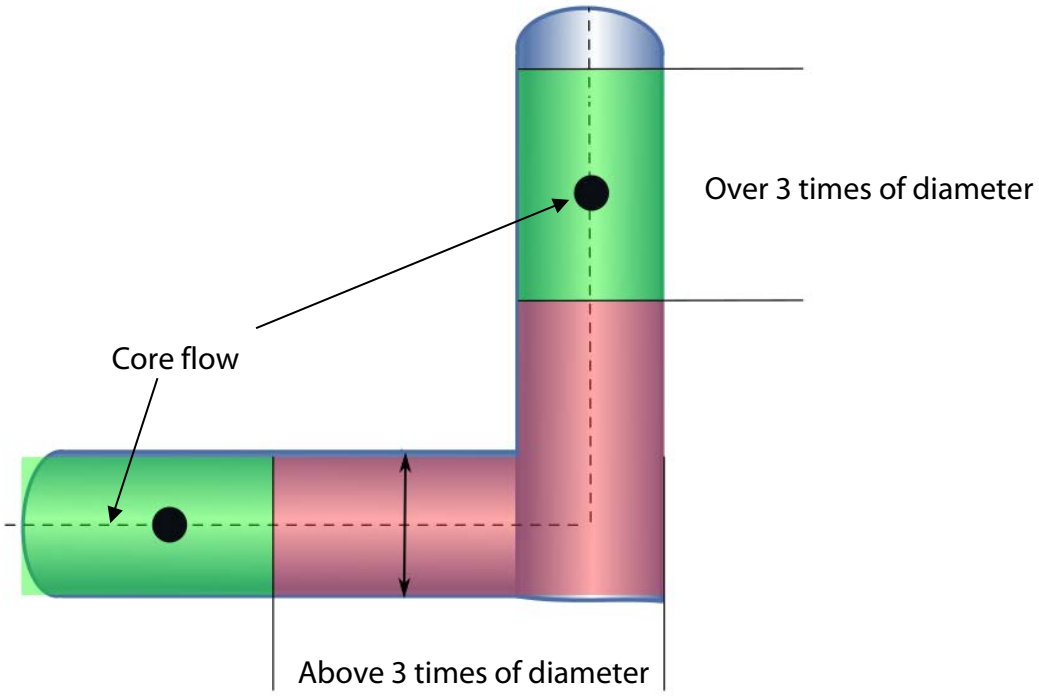
The installer must correctly assemble these parts during installation. The following diagram shows the sequence in which the installation should be carried out:

1	Preparation of the measurement points
2	Analyzer mounting
3	Power supply
4	Connect IO module to control room
5	Connect adjustment gas outlet
6	Connect sample gas outlet

4.2. Select measurement point

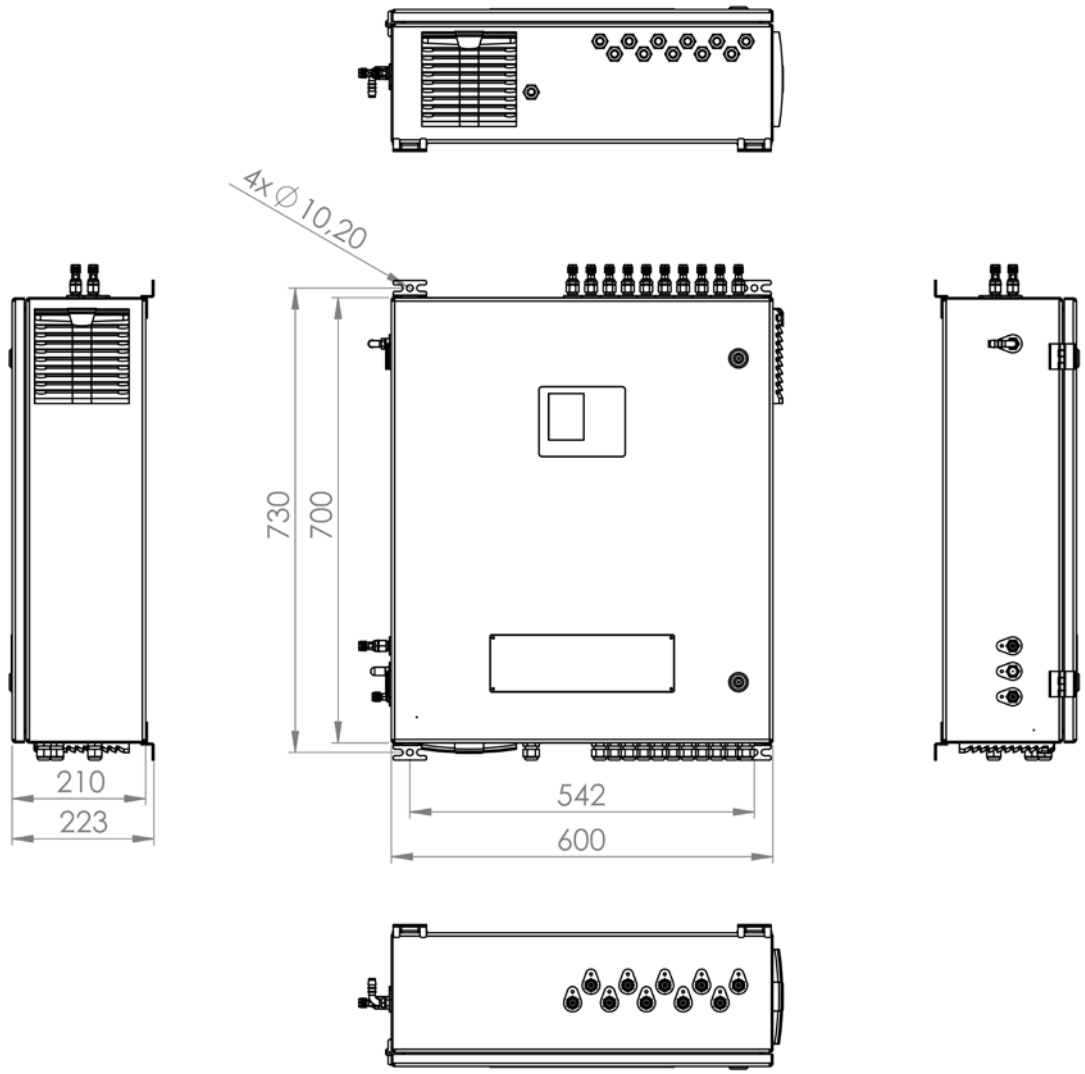
The measuring point should be in an area where the flow no longer has any particular turbulence. That is:

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



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

4.3. Installation of the analyzer



The analyzer is equipped with adapters for the wall mounting. The dimensions for the wall mounting are in the appendix.

NOTE

The suspensions can be rotated by 90°.

NOTE

Dimensions see appendix 11.2 Mechanical dimensions

ATTENTION

Operation of the analyzer

Only operate the analyzer in an upright position.

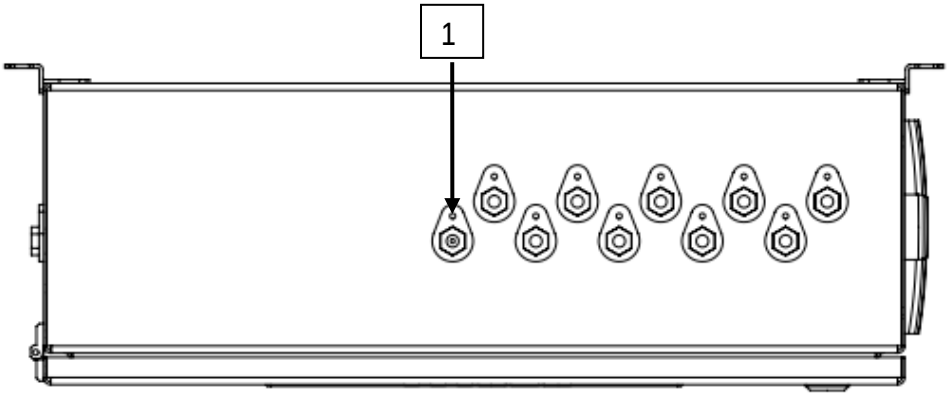
Only power the device up after it is correctly mounted.

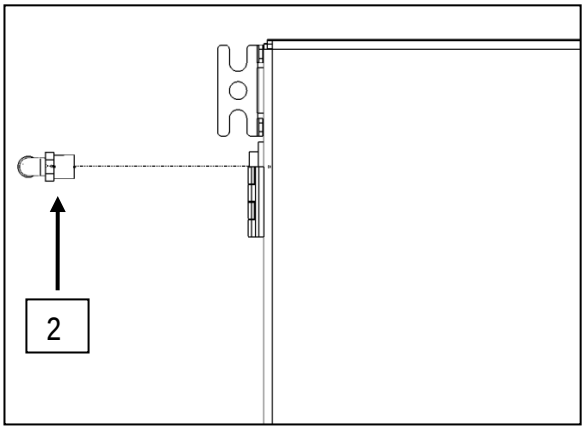
General installation rules

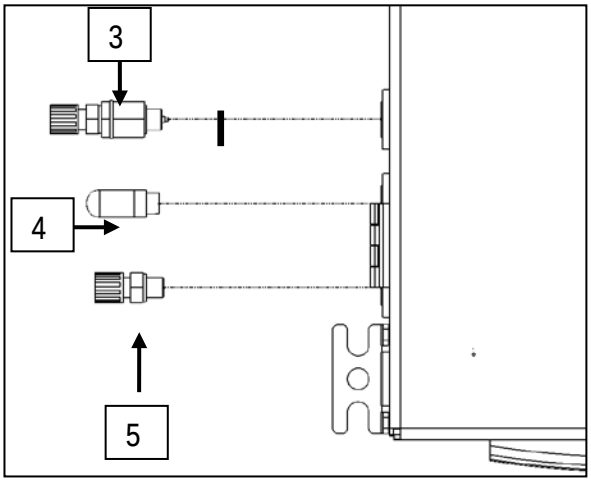
- Mount the device on a solid wall or steel rack.
- Be sure, that the air circulation is not obstructed.
- Let enough room for the tubing or piping.

For indoor installation:

Ensure that the analyzer is installed on a dry and clean place. Be sure that the room is permanently vented with fresh air.
Connect the VENT gas-outlet of the device to ambient by using adequate tube with min Ø8mm ID.


1


2


3
4
5


Calibration gas inlet
Zero gas inlet
Condensate outlet

Reference:

1. Fitting for sample gas inlet G1/8
2. Fitting for sample gas outlet G1/4
3. Fitting with flow restrictor orifice gas inlet G1/8 for calibration gas inlet
4. Fitting filter for zero gas inlet G1/8.
5. Fitting for condensate outlet

4.4. Installation: Sample gas outlet (VENT)

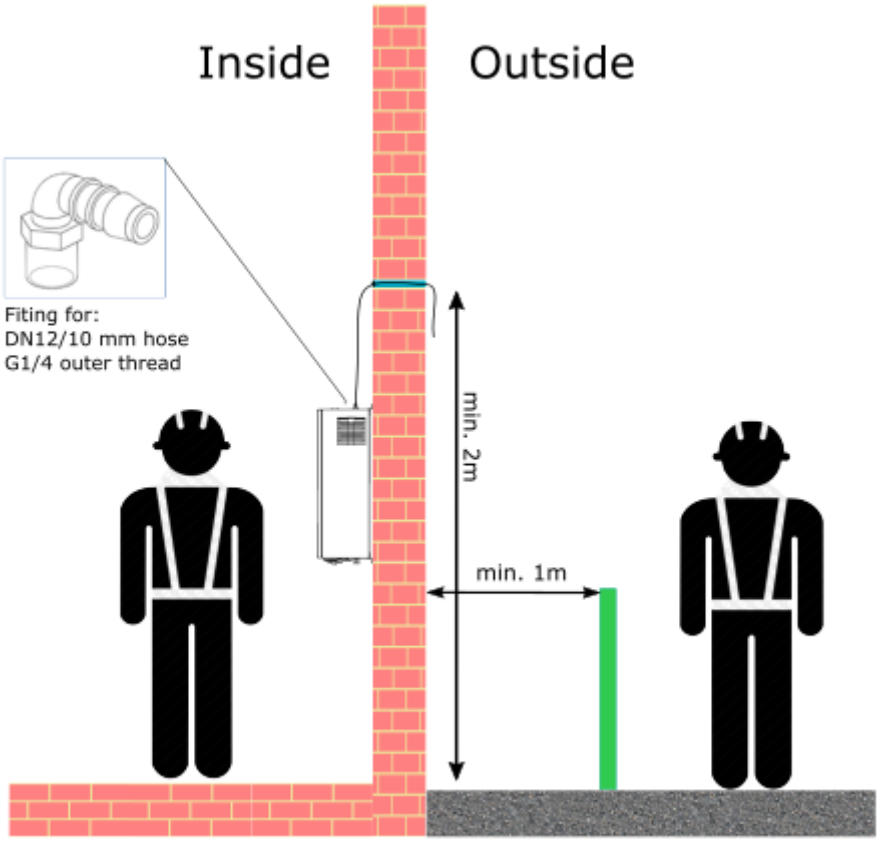
⚠ WARNING

Risk of poisoning

Exhaust gases endanger health and can even lead to death.

The sample gas flows out of the gas outlet and out of the analyzer again after the analysis is completed. Because the sample gas can be toxic, environmentally harmful or explosive, it is important to discharge this gas into a secured environment.

Therefore the following principle applies: Never let sample gas escape into the installation room, but lead it outside with a hose/pipe connection.



4.5. Installation: Calibration gas / zero gas and condensate outlet

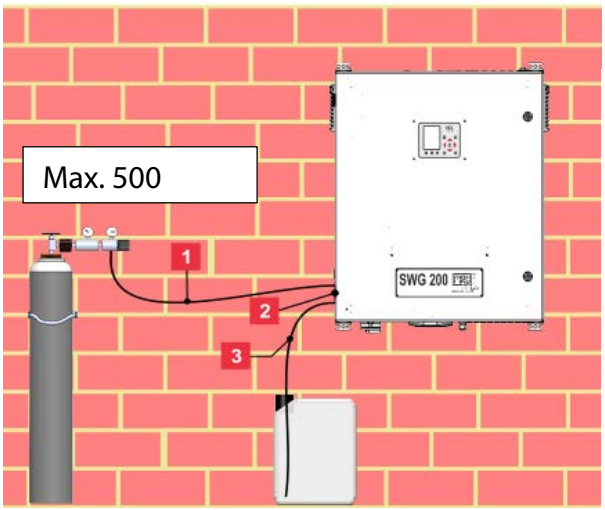
⚠ WARNING

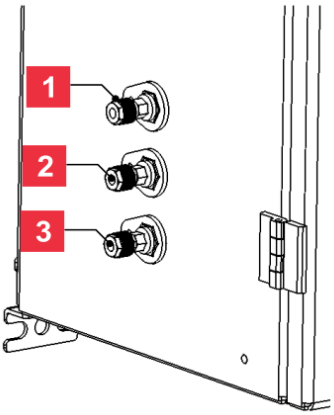
High pressure!
Gas cylinder stands under high pressure!
Can cause injuries or death.
Only educated staff should install the device.

⚠ WARNING

High pressure

- Only educated staff is allowed to install the gas cylinders on the analyzer.
- All gas cylinders must be equipped with a pressure reducer. The pressure must be set to **500 mbar**.





Reference:
1. Calibration gas inlet G1/8 for DN4/6 mm hose.
2. Zero gas inlet G1/8 for DN4/6 mm hose.
3. Condensate outlet G1/8 for DN4/6 mm hose.

Recommended gas concentration for the gas cylinder:

CO_2	Approx.39,95 Vol.%
CH_4	Approx.60,00 Vol.%
H_2S	Approx.500 ppm

4.6. Option: Autocalibration by using several gas cylinders

⚠ WARNING

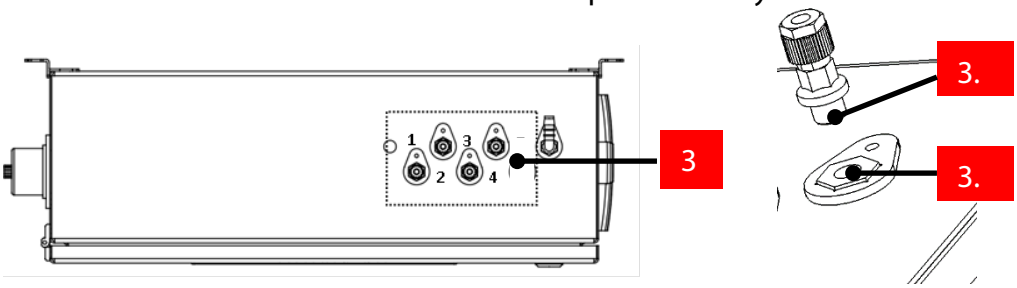
High pressure!
Gas cylinder stands under high pressure!
Can cause injuries or death.
Only educated staff should install the device.

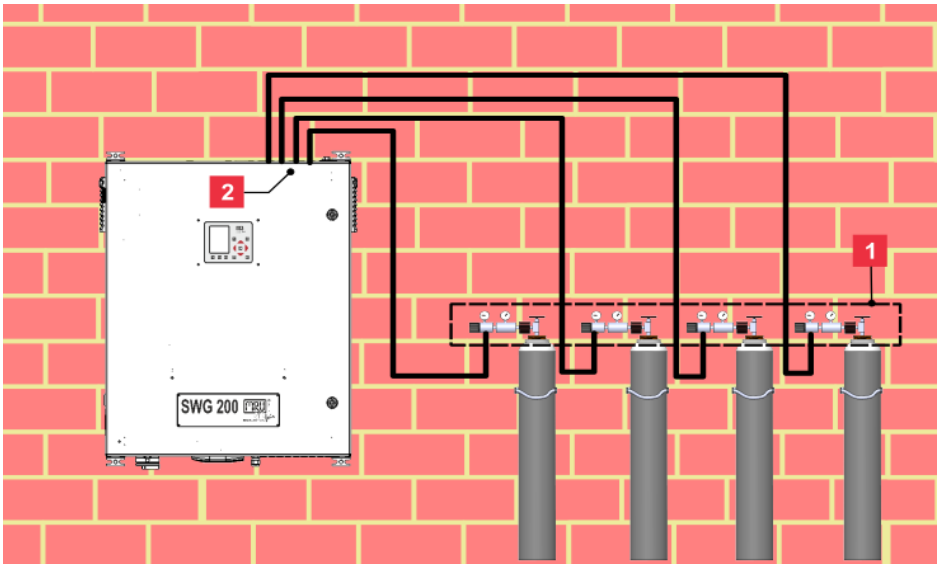
⚠ WARNING

High pressure

- Only educated staff is allowed to install the gas cylinders on the analyzer.
- All gas cylinders must be equipped with a pressure reducer. The pressure must be set to **500 mbar**.

If the analyser has the option "autocalibration by using several gas cylinders" the autocalibration inlets can be found at the top of the analys





Reference:
1. Pressure reducer. Set to 500 mbar (500 hPa).
2. Connections for autocalibration inlets (max. 4 gas cylinders).
3. Position of the autocalibration option, with several gas cylinders (max. 4).
    3.1. Hose fitting for DN 4/6 mm hose to 1/8 outer threat.
    3.2 G1/8 inner threat

Explanation of the software operation see chapter 6.5.

4.7. Connection of main power supply

⚠ WARNING

Hazardous Live

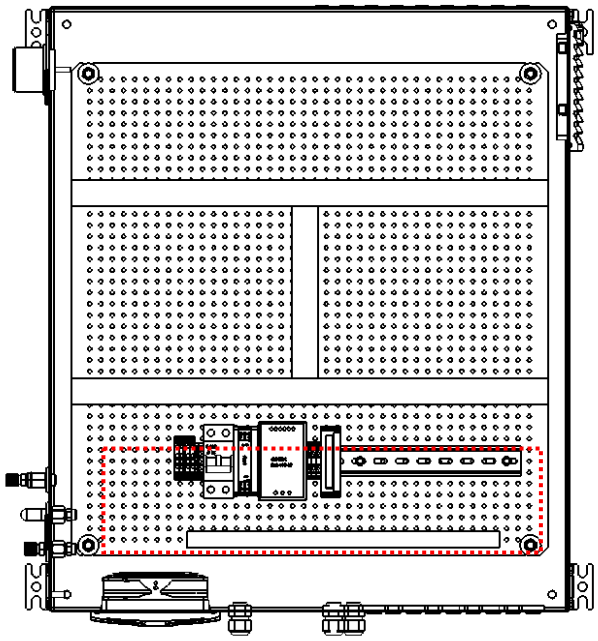
Power down the system and disconnect from mains to avoid access to live parts by using a tool.

⏚

The analyzer needs a main power supply of 100-140 V~, 50/60 Hz, 300VA.
The power supply may be found on the DIN-rail.

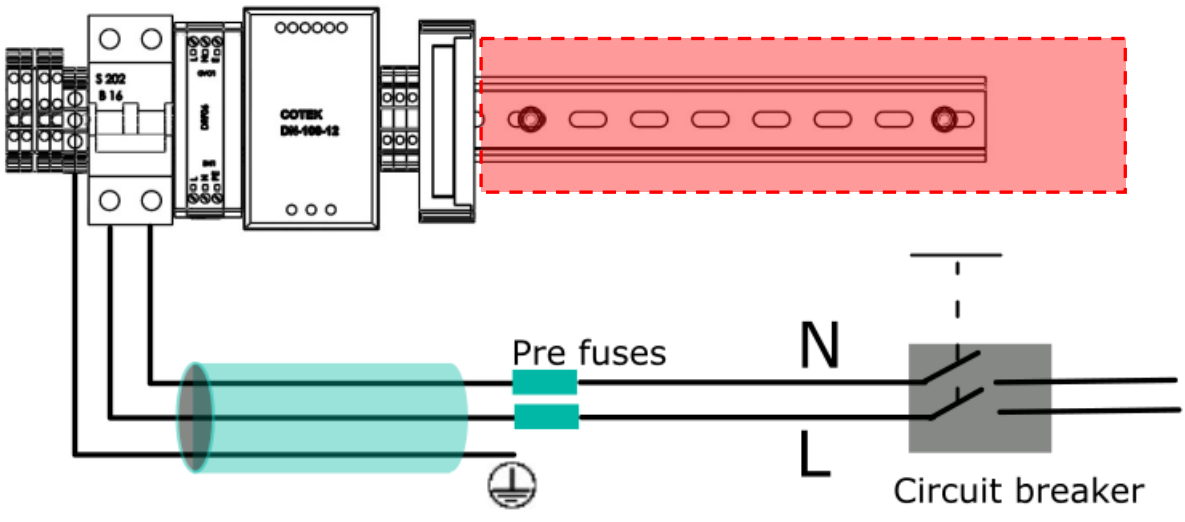
Details:

- L and N phase on the circuit breaker (**A** in sketch below).
- ⏚ on the connection terminal (**B** in sketch below.)



Position of the DIN-rail. On the DIN-rail can be found:

- Main power supply.
- I/O moduls (max. 10, 1 basic, all other optional)
- H2 TCD (optional).



Hint:
PROTECTIVE CONDUCTOR TERMINAL - a) Contact surfaces are metal

Conductor cross sections for main power supply and protective conductor, which can be used:

Type of electric line	**Conductor cross section min.-max.**
Solid	1,0-2,5 mm^2 (17-13 AWG)
Stranded	1,0-2,5 mm^2 (17-13 AWG)
Solid with ferrule (with/ or without plastic)	1,0-2,5 mm^2

Insulation	**minimum requirements**
material	PVC
thickness	>= 0.8mm
temperature range	-25...+60°C
Nominal voltage	300V

Flammability RATINGS FT-1 of CSA C22.2 No. 0.3 and VW-1 ANSI/UL 1581 are considered acceptable for insulated wire and cable.

The cables must meet the NEC, NFPA 79 and UL 508A standards.

⏚ Protective conductor connections for mains circuits must have at least the same current capacity as the mains connections.

Information for cables, which go through the cable gland M16:
It is recommended to use only electric lines with ferrules.

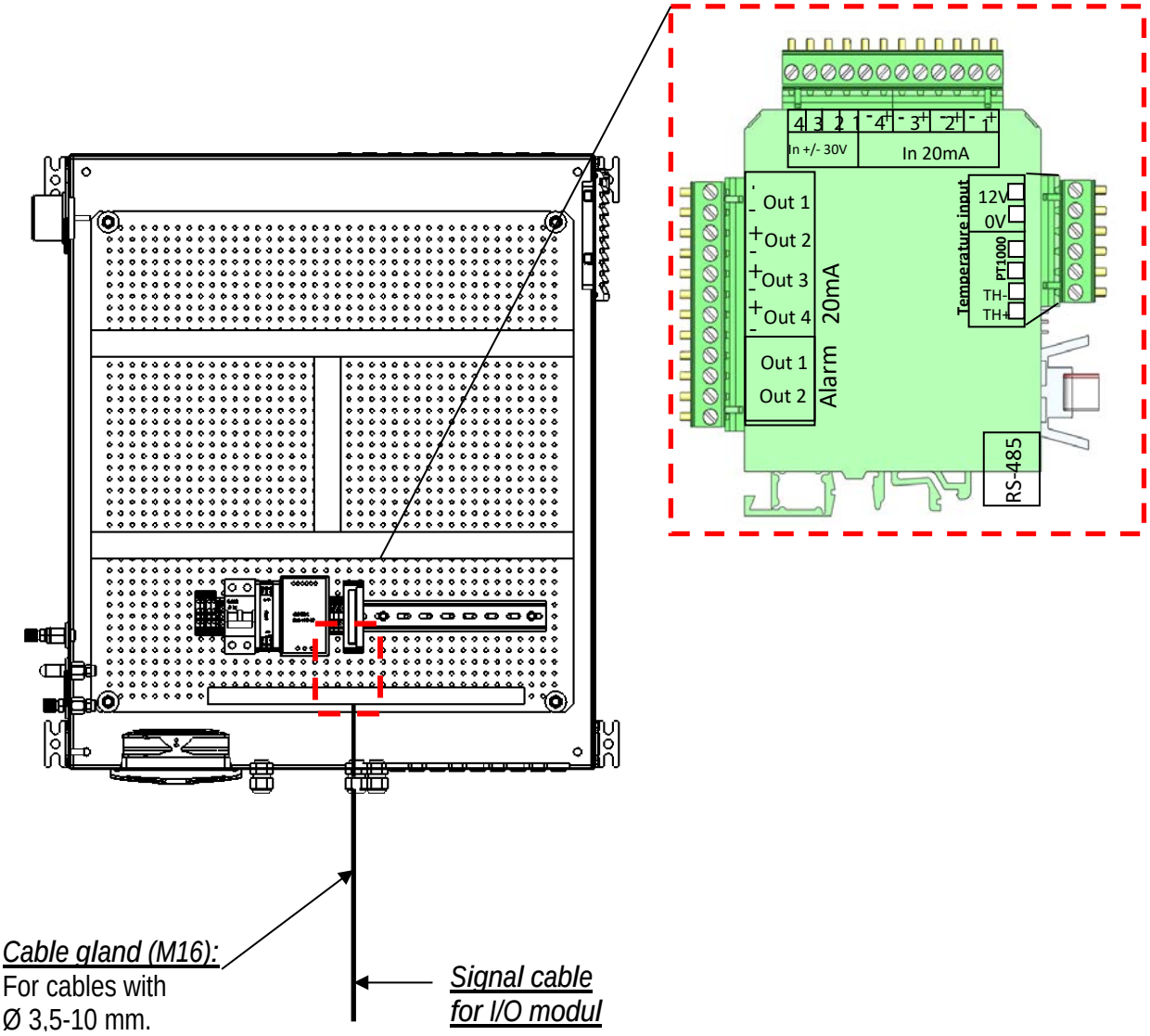
4.8. I/O modules: Installation and setting

The IO module is for monitors and allows for remote operating of the analyser. An IO module has the following features:

- Transmit 4-20 mA output.
- Trigger alarm outputs.
- Reads one PT1000.
- Reads one thermo couple.
- Reads current inputs signals (for sensors with max. 20 mA output signals).
- Reads voltage input signals (for sensors with max. 30 V output signals).
- External control of the analyser.

Connection of the I/O module

The option IO module can be found at the hat-rail. The position is shown at the sketch below.



NOTE: analog output current 4-20mA load resistor is max. 500Ohm

analog output does not require power supply alarm relays Out1 and Out2 contacts are "fail safe" type:

- open contact in case of alarm or power failure
- closed contact for normal operation

Plug connector definition:

⚠ WARNING

Electric voltage

Power the system down and protect from reconnecting, before starting maintenance work.

Slit screws

Stripping length: 7 mm
Tightening torque min.-max.: 0,5-0,6 Nm

Conductor cross sections, which can be used:

Type of electric line	**Conductor cross section min.-max.**
Solid	0,2-2,5 mm^2 (26-13 AWG)
Stranded	0,2-2,5 mm^2 (26-13 AWG)
Solid with ferrule (with/ or without plastic)	0,25-2,5 mm^2

Insulation	**minimum requirements**
material	PVC
thickness	>= 0.8mm
temperature range	-25...+60°C
Nominal voltage	300V

Flammability RATINGS FT-1 of CSA C22.2 No. 0.3 and VW-1 ANSI/UL 1581 are considered acceptable for insulated wire and cable.

The cables must meet the NEC, NFPA 79 and UL 508A standards.

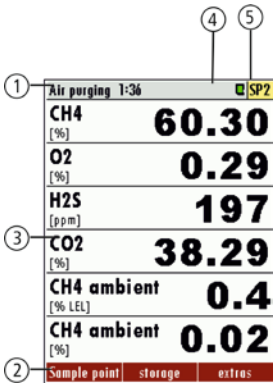
Information for cables, which go through the cable gland M16:
It is recommended to use only electric lines with ferrules.

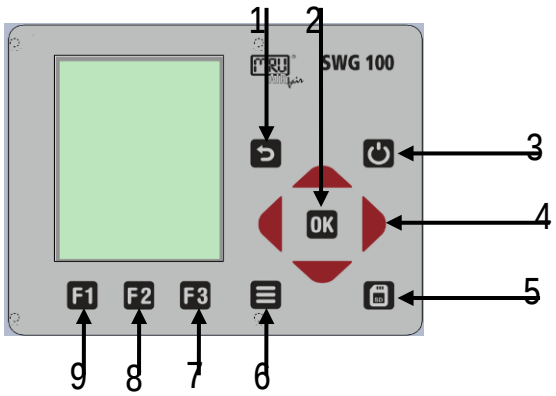
5 Operation of the analyzer (HMI)

5.1. Display and keypad

All information required to operate the analyzer is displayed as shown below.

1	Menu indication bar • "air purging" or • "gas sampling" or • "measurement"
2	Function key bar • F1 "sample point" • F2 "storage" • F3 "extras"
3	Display area of Menu • Measurement value…
4	SD-Card symbol Indication green → read- and write access • Indication yellow → only read access (SD-Card write protected)
5	Sample point number





#	Symbol	Description
1		**ESC:** abort or return to the menu above
2		**Prepare Power-Down**: Press this key before you disconnect mains. The analyzer will store changed user settings and other operational data and will purge the sensors
3		**Arrow keys**: context dependent functions, e.g. scroll in between lines, change values, change view.
4		**OK**: confirmation key, select a marked menu point.
5		**Screen shot**: press this key in order to store a screen shot of the current display contents onto the SD card.

6		**Menu key**: Will show all available functions in the window that is currently in use – also those which have an individual key on the key pad like the printer and the three function keys.
7-9		**Function Keys**: Activates the functions seen on the display (2 function key bar)

6 Analyzer commissioning manual

After the first start of the analyzer it is necessary to make some settings at the analyzer. These settings are:

- Check the country and language.
- Check the date and time of the instrument.
- Configuration of the alarm relays.
- Configuration of the Modbus.
- Configuration of the external control via relay contacts (IO module).
- Configuration of the analog outputs at the I/O module.
- Configuration of the AUX inputs at the I/O module.
- Configuration of the alarm outputs at the I/O module.
- Configuration of the auto calibration.

6.1. Check country and language

Important note:
In case the analyzer shows a language, you don't understand, you may swap the language to English by pressing the menu key and selecting the function 'Set English language'.

Use the menu EXTRAS – GENERAL SETTINGS.

The analyser will automatically set some country-typical parameters like the language, the date format, the temperature unit, the daylight-savings time function and the CSV-export settings.

6.2. Check date and time of the instrument

The analyzer stores automatically measurement values including timestamps. Therefore the instruments' system clock should be set correctly.

Use the menu EXTRAS – GENERAL SETTINGS – DATE & TIME.

In case the date & time is not correct, press the key ***F2***=modify, change date & time and then press the key ***F2***=store.

Note:
According to the selected country (see previous chapter) the analyzer automatically switches the daylight saving time in spring and autumn. This function is active for most European countries. Whenever the daylight-saving time is currently active, then you'll see a '*' in the time line of the menu, thus 'Time *' instead of 'Time'.

6.3. Configuration of the alarm relays

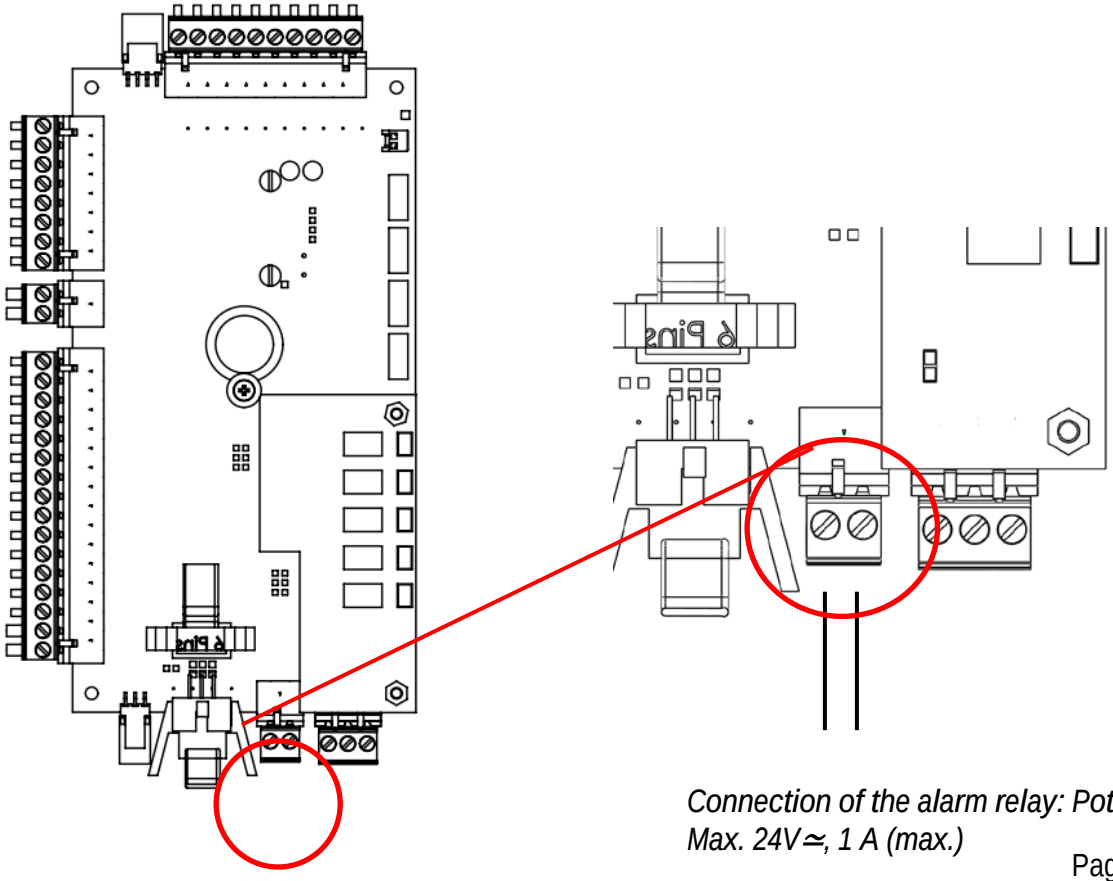
On the main PCB there is one “system alarm” relay with “fail safe” NC contact. The following errors will turn the relay from NC to NO.

1. Main board is offline (internal RS485 bus communication failure)
2. Main board is in the “bootloader” phase
3. Gas leakage inside analyzer cabinet (CH4 > 20% to 50% LEL)
4. Condensate alarm (contacts resistance < 35kΩ)
5. Low fan rotation (speed rotation < 900U/min)
6. Sample flow alarm (sample flow < 20 l/h)
7. Gas cooler high alarm (temperature > +10°C)
8. Gas cooler low alarm (temperature < +2°C)
9. Cabinet high temperature (> +55°C)
10. Cabinet low temperature (< +5°C)

Errors **1 to 5** alarm will force a measurement stop (all analog outputs are on hold or at 2mA, depending on configuration).
Errors **5 to 10** will be displayed as warning message only; analog outputs of active sampling point are live, all others are on hold.

ATTENTION

Analyzer system alarm relay is a potential-free contact, which max. 24V⎓/V~ and a current of 1A (max.)



Connection of the alarm relay: Potential-free Max. 24V⎓, 1 A (max.)

Plug connector definition for the system alarm relay

Slit screws
Stripping length: 7 mm
Tightening torque min.-max.: 0,5-0,6 Nm

Conductor cross sections, which can be used:

Type of electric line	**Conductor cross section min.-max.**
Solid	0,2-2,5 mm^2 (30-12 AWG)
Stranded	0,2-2,5 mm^2 (30-12 AWG)
Solid with ferrule (with/ or without plastic)	0,25-2,5 mm^2

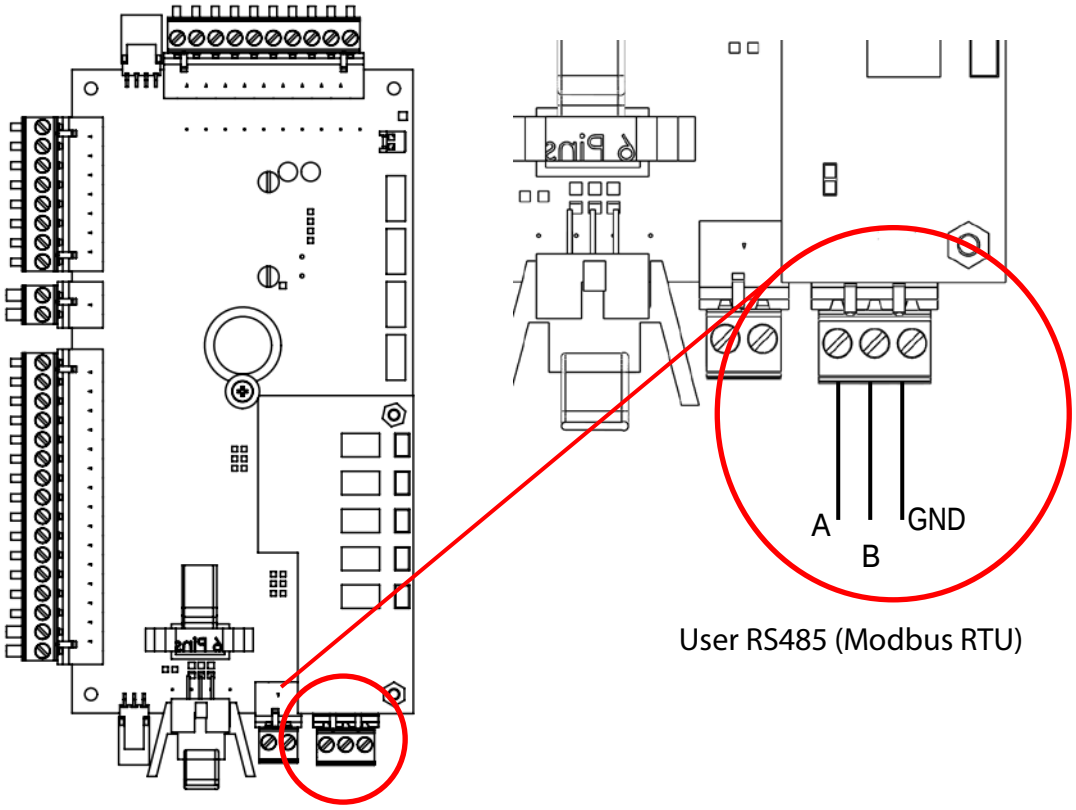
Information for cables, which go through the cable gland M16:

It is recommended to use only electric lines with ferrules.
Following analyzer errors will produce a system alarm (open contact of System Alarm relay).

6.4. Configuration of the Modbus

The Mobdbus connector can be found on the PCB-mainboard (see sketch below).

NOTE: for specification of Modbus (RTU) data transfer over RS485, please observe appendix.



User RS485 (Modbus RTU)

<u>Plug connector definition for the system alarm relay</u>

Slit screws
Stripping length: 7 mm
Tightening torque min.-max.: 0,5-0,6 Nm

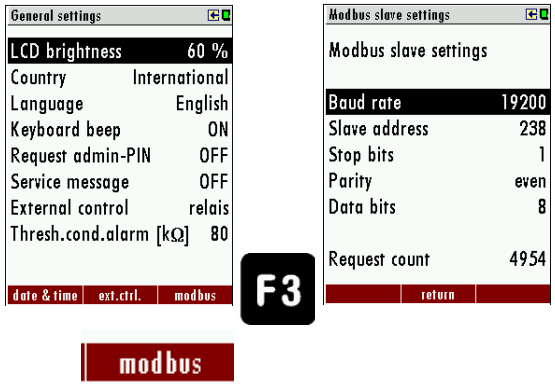
Conductor cross sections, which can be used:

Type of electric line	**Conductor cross section min.-max.**
Solid	0,2-2,5 mm^2 (30-12 AWG)
Stranded	0,2-2,5 mm^2 (30-12 AWG)
Solid with ferrule (with/ or without plastic)	0,25-2,5 mm^2

Information for cables, which go through the cable gland M16:
It is recommended to use only electric lines with ferrules.

Configuration at the analyzer

Open the path EXTRAS/ GENERAL SETTINGS.
Press F3 "Modbus".
The Modbus store settings will be open. The user can commission the slave's settings.



The following settings can be set:
Baud rate.
Slave address.
Stop bits.
Parity.
Data bits.

6.5. Autocalibration: Explanation of the software operation

➔Necessary installation work: see chapter 4.54.6 or 4.6, if the analyser has the option autocalibration individual gas cylinders.

Autocalibration: Single gas cylinder

➔Necessary installation work: see chapter 4.5

This software setting is for the autocalibration: single gas-cylinder. The option is standard, if the autocalibration several gas-cylinders is not installed.
Open the menu "Setup auto-calibration". It from: EXTRAS/ ADJUSTMENT MENU/ SETUP- AUTO.-CALIBRATION.
Select menu point "test gas composition" to set the gas composition from the calibration gas cylinder. With the arrow keys **"up/ down"** an empty area can be chosen. With the arrow keys "**left/ right**" the different gas compositions can be set.

NOTE

Gas components
In a SWG100BIO analyser the follow gas components can be set:
H2S (ppm)
CO2 (Vol.%)
CH4 (Vol. %)
O2 (Vol. %)

With **OK** the user can set the gas concentrations for the different gas compositions. First select the gas component, then press **OK**. A blue screen will show up appeared. With the arrow keys the gas concentration can be set.
After the gas composition is set, the interval for the calibration can be set, too.

NOTE

All gas concentrations are in percent! The factory from percent to ppm is: 1%= 10.000 ppm.

The user has the following options:

Leave the menu: The set gas concentrations are stored, and the auto calibration will start after the interval is reached.

Start the auto- calibration immediately: Press **F2** (start now).

During the auto calibration the stored gas concentrations are compared with the measure gas concentrations. If the gas concentrations are not differing too much, the measured values will be shown "green" on the display.
The new gas factors will be stored, after successful calibration.

Autocalibration: Several gas cylinders

➔**Necessary installation work: see chapter 4.6**

This software settings is for autocalibration: several gas cylinders. This option is optional and allows to install different calibration gas cylinders.
Open the menu "Setup auto-calibration". It from: EXTRAS/ ADJUSTMENT MENU/ SETUP- AUTO.-CALIBRATION.
Select menu point "test gas composition" to set the gas composition from the calibration gas cylinder. With the arrow keys **"up/ down"** an empty area can be chosen. With the arrow keys "**left/ right**" the different gas compositions can be set.

7 Binding to a process control system: I/O modules

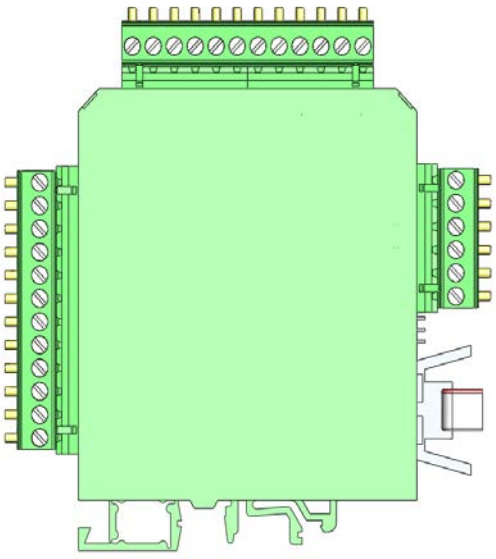
The IO module is a necessary module for the signal forwarding, into a control room.
This module is an interface for signal transmitting, remote operating and to read signals, from extern transducers.
An IO module has the following features:

- Transmit 4-20 mA output.
- Trigger alarm outputs.
- Reads one PT1000.
- Reads one thermocouple.
- Reads current inputs signals (for sensors with max. 20 mA output signals).
- Reads voltage input signals (for sensors with max. 30 V output signals).
- External control of the analyzer.

7.1. Position of the IO module inside the analyzer

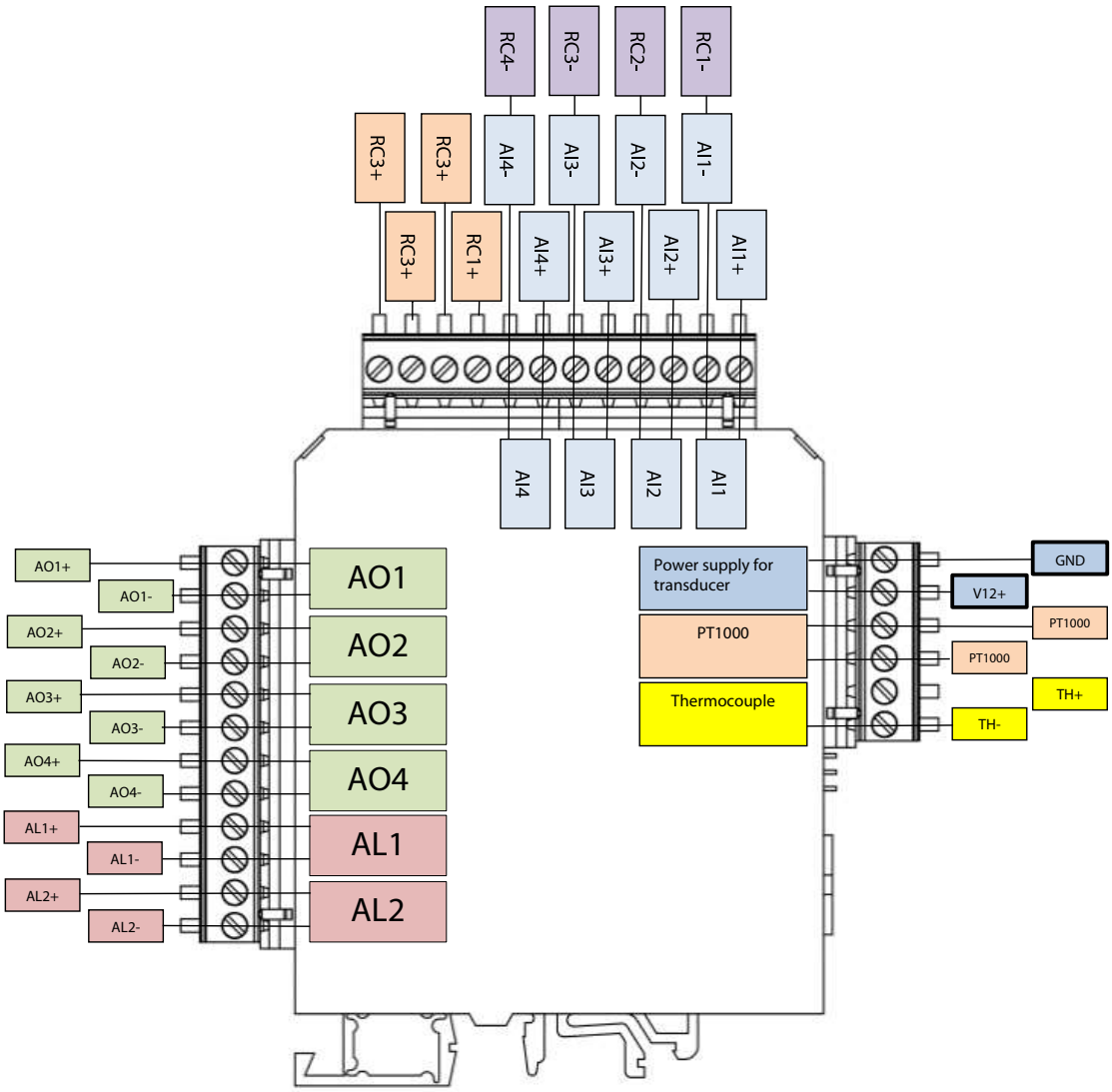
At the basic SWG100, one IO module is integrated. Optionally, an analyzer can be equipped with further IO modules (max. 10).

The IO module(s) are installed on the hat-rail (position: see sketch below).



7.2. Pin assignment

The follow pin assignment-plan shows where the different pins for the interfaces can be found and which pins has a double occupancy.

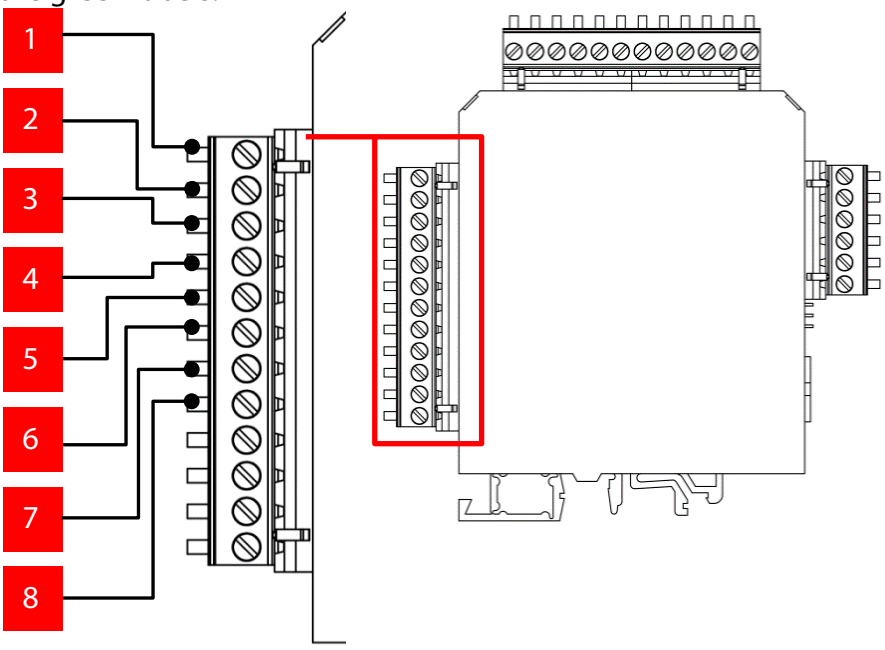


Description	Abbrevation	Pin	max. external Voltage	max. Load (for outputs)	Internal load (in inputs)	Double occupancy
Analog-Outputs 4-20 mA	AO1	AO1+	--	max. 500R	--	No
		AO1-	--	max. 500R	--	No
	AO2	AO2+	--	max. 500R	--	No
		AO2-	--	max. 500R	--	No
	AO3	AO3+	--	max. 500R	--	No
		AO3-	--	max. 500R	--	No
	AO4	AO4+	--	max. 500R	--	No
		AO4-	--	max. 500R	--	No
Alarmoutputs	AL1	AL1+	24 VDC	--	--	No
		AL1-	24 VDC	--	--	No
	AL2	AL2+	24 VDC	--	--	No
		AL2-	24 VDC	--	--	No
Analog-Input 4-20 mA	PWROUT	V12+	--	--	--	No
		GND	--	--	--	No
	AL1	AI1+	--	--	50R	No
		AI1-	--	--	50R	RC1-
	AL2	AI2+	--	--	50R	No
		AI2-	--	--	50R	RC2-
	AL3	AI3+	--	--	50R	No
		AI3-	--	--	50R	RC3-
	AL4	AI4+	--	--	50R	No
		AI4-	--	--	50R	RC4-
Remote control	RC1	RC1+	--	--	--	No
		RC1-	--	--	--	AL1-
	RC2	RC2+	--	--	--	No
		RC2-	--	--	--	AL2-
	RC3	RC3+	--	--	--	No
		RC3-	--	--	--	AL3-
	RC4	RC4+	--	--	--	No
		RC4-	--	--	--	AL4-
Analog-Input 0-10V	AVL1	AVL1+	--	--	--	JMP1_out
		AVL1-	--	--	--	JMP2_out
	AVL2	AVL2+	--	--	--	JMP3_out
		AVL2-	--	--	--	JMP4_out

7.3. Analog outputs 4-20 mA

Hardware-side

Every IO module has four 4…20 mA outputs. The outputs are marked at with the green labels.



Reference:

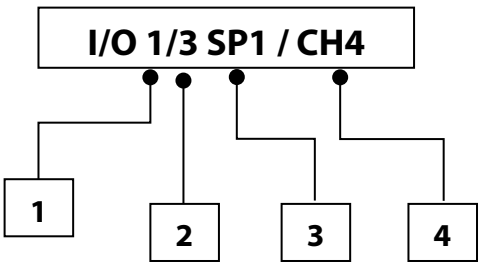
1	Analog output 1 plus	2	Analog output 1 minus
3	Analog output 2 plus	4	Analog output 2 minus
5	Analog output 3 plus	6	Analog output 3 minus
7	Analog output 4 plus	8	Analog output 4 minus

Information for connection:

Conductor cross section: 0,2…2,5 mm²
Max. Load (for output): 500 Ohm

Software-settings

- Open the menu: EXTRAS/ANALOG OUTPUT CONFIGURATION (1).
- The overview screen appears. This menu shows, how much analog-outputs are available and how the analog outputs are occupied.
- At the overview screen all analog-outputs are listed. The amount of the analog-outputs is dependent from the amount of the installed IO-modules. Every IO module has 4 analog-outputs. If two IO modules are installed, the entire amount of analog-outputs is eight. At the list, the user finds the information which analog signal is carry out at which analog-output channel. The follow list-notation can be found (example):



Reference:

1. The number of the IO module. 1 means, first IO module.

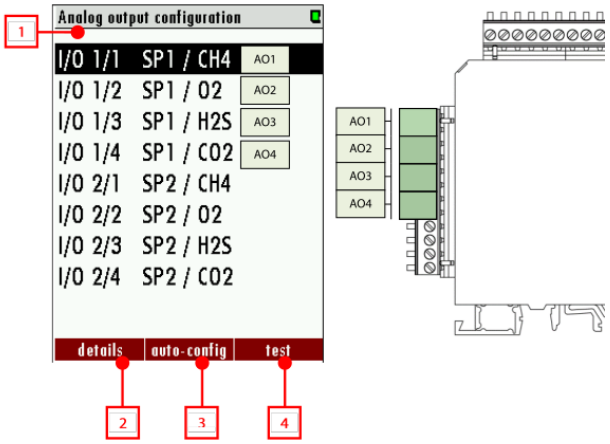
2. The value of the analog-output. 3 means, the third analog-output.

3. The sample point, from where the signal comes. SP1 means, the first sample point.

4. The signal-name. CH4 means, that this analog-output transfers CH4 signal.

This example means: At the third channel of the first IO module, the CH4 signal from the first sample point will be transferred.

At the sketch below, the menu-screen and the analog-outputs at the first, of two IO modules are shown.



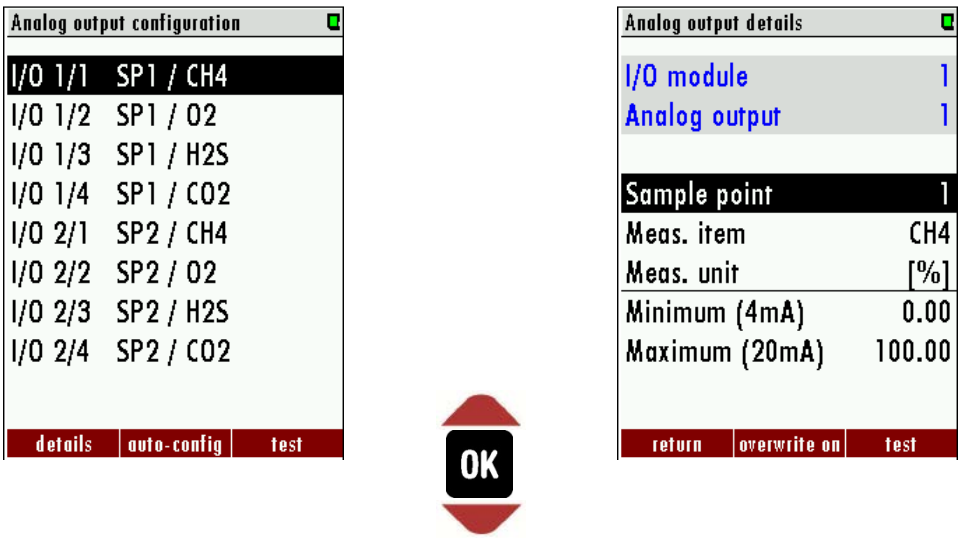
- ***List of the installed analog output ports (1):*** At this list the operator can select, which analog-output should be configured. To select an analog-output, move the up/down arrow keys.

- ***Details (2):*** Here the operator can open the configuration screen for the selected output port. To open the details-menu, push ***F1*** or ***OK***.

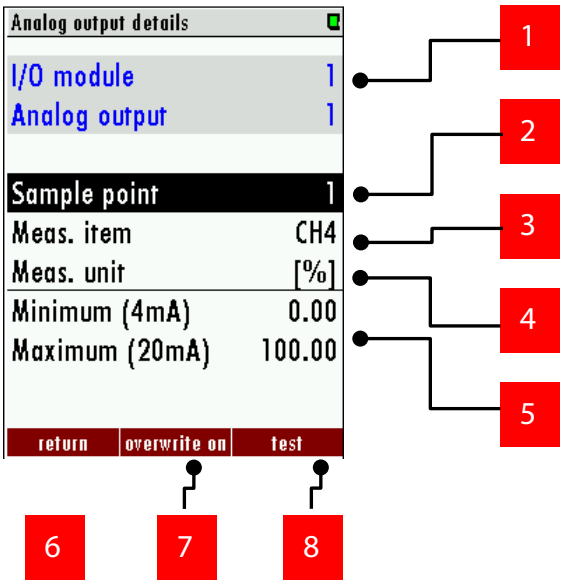
- ***Auto configuration (3):*** If the operator pushes this key (***F2***) the output pins would be configured by default values.

- ***Test (4):*** The test-menu is for testing the analog outputs. To open the test-menu, push ***F3*** or ***OK***.

The navigation inside the menu taken place with the ***up/down*** arrow keys. With the ***OK*** key, the analog-output can be edited:



The settings for an analog-output can be change in the "Analog output details" menu. See the screenshot below.



Reference:

1	***Section (1):*** Shows the operator, which analog-output will be changed.
2	***Sample point (2):*** The operator can select the sample point. This means, that the analog-output signal from the choose sample point will be transmitted to the process control system.
3	***Meas. Item (3):*** At this point the operator selects the measurement item, which should be transmitted. At the chart below, the typical measurements items are listed. Basically, all measurement-channels, which can be measured, can be selected at this point.
4	***Meas. Unit (4):*** This point shows, which unit the transmit signal have. This point cannot be changed.
5	***Minimum (4mA) (5):*** Here the operator entering the equivalent measurement value, for a current of 4 mA. ***Maximum (20mA) (5):*** Here the operator entering the equivalent measurement value, for a current of 20 mA. The IO module will create the linear relation.
6	***Return (6):*** Leave the menu. Alternate push F1.
7	***Overwrite on (7):*** A function to simulate values. If the overwrite function is activated, the set value will be transferred to the DCS.
8	***Test (8):*** Further to a test-menu. Alternate push F3.

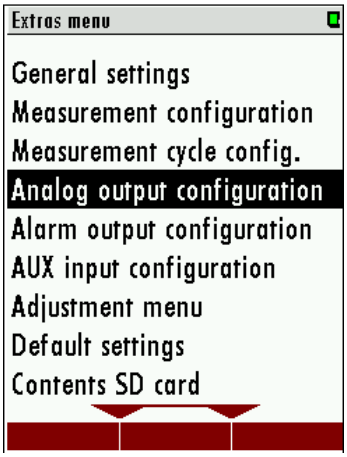
1. *Example: 4-20 mA signal outputs to control room*

Starting position:

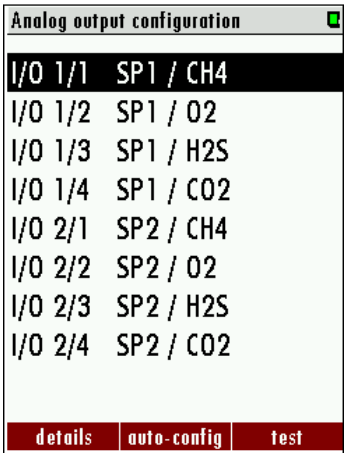
A plan wants to read the measurement values from the CO2 channel to their DCS[1]. The SWG100 has only one IO module and three sample points. All outputs are free. The CO2 values from the second sample point should be logged in the control room.

Follow steps must be done to do this:

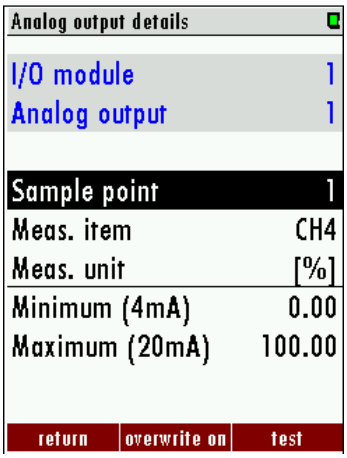
- Wiring the analog-output 1 with the DCS: Wiring the analog-output (AO1+/AO1-) with the DCS. For this, use a wiring with a conductor cross section between 0,2…2,5 mm².
- In the next step output 1 must be configured at the SWG100. To do this, open the menu: EXTRAS/ CONFIGURATE ANALOG OUTPUTS. The following menu overview will be appeared (see screenshot below). To configure the IO1, select the first record (channel I/O 1/1 SP1 / CH4) in the list and open it.



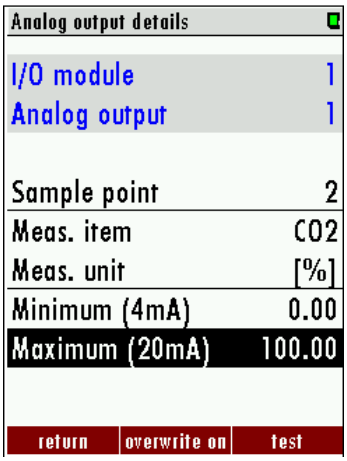
Select ANALOG OUTPUT and **OK**



- The follow screen appears. To configurate the channel 1, the red marked positions must be changed:



Set points here with



[1] DCS=Distributed Control System

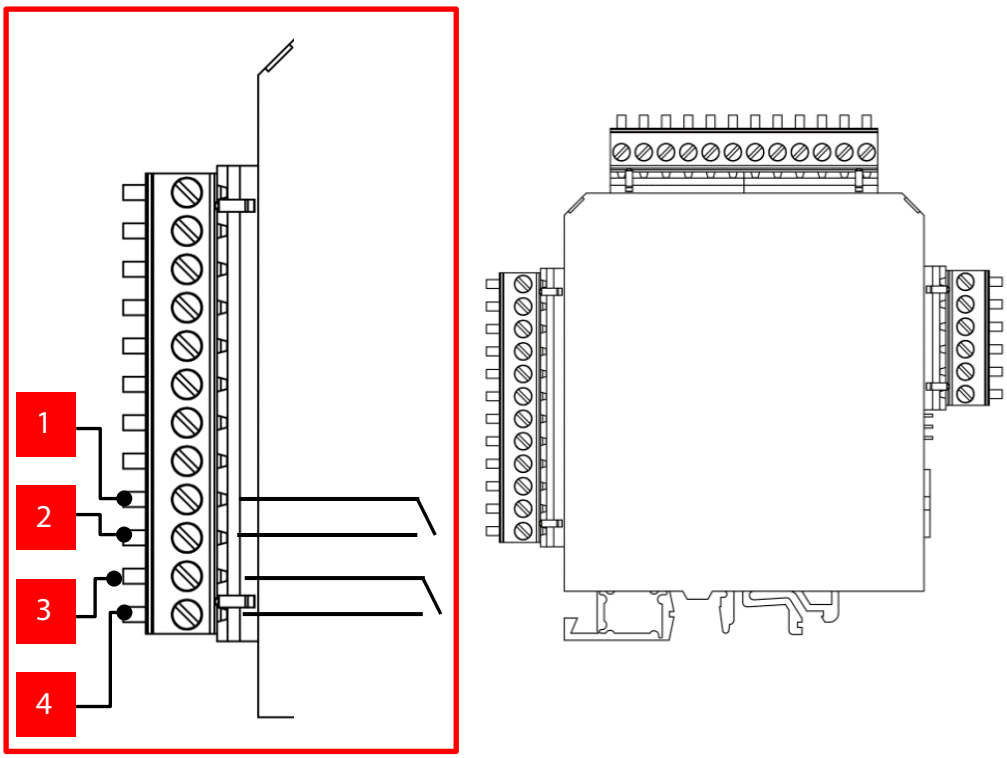
arrow keys
and **OK**

- In the last step the menu must be closed. Confirm the store message. The 4-20 mA output is now configuring.

7.4. Alarm outputs

Hardware side:

Every IO module has two alarm outputs. The position of the alarm-outputs are marked with the red labels.



Reference:

1	1 Alarm Relay +
2	1 Alarm Relay -
3	2 Alarm Relay +
4	2 Alarm Relay -

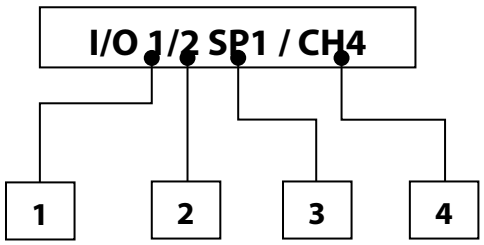
Information for connection:

Conductor cross section:	0,2…2,5 mm²
Relays-type:	Normally open
Voltage supply:	max. 24 VDC

Software-side

- Open the menu: EXTRAS/ANALOG OUTPUT CONFIGURATION (1).
- The overview screen appears. This menu shows, how much alarm-outputs are available and how the alarm outputs are occupied.

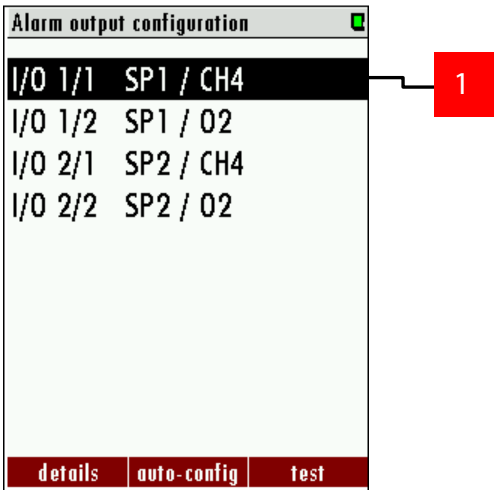
  At the overview screen all alarm-outputs are listed. The amount of the alarm-outputs is dependent from the amount of the installed IO-modules. Every IO module has 2 alarm-outputs. If two IO modules are installed, the entire amount of alarm-outputs is four. At the list, the user finds the information which alarm signal is carry out at which alarm-output channel. The follow list-notation can be found (example):



Reference:

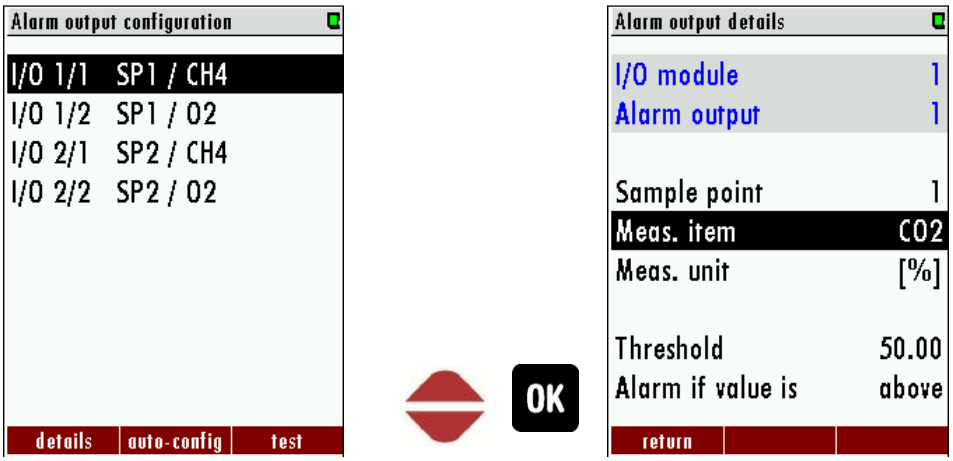
1. The number of the IO module. 1 means, first IO module.
2. The value of the alarm-output. 2 means, the second alarm-output.
3. The sample point, from where the signal come. SP1 means, the first sample point.
4. The signal-name. CH4 means, that this alarm-output monitors the CH4 channel.

This example means: At the second channel of the first IO module, the CH4 signal from the first sample point will be transferred.
At the sketch below, the menu-screen and the analog-outputs at the first, of two IO modules are shown.

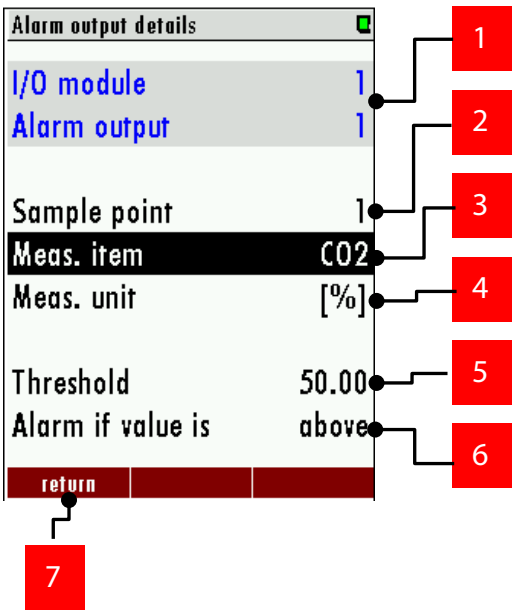


2 3 4

- ***List of the installed alarmoutput ports (1):*** At this list the operator can select, which alarm output should be configured.
- ***Details (2):*** Here the operator can open the configuration screen for the selected alarm output. To open the details-menu, push ***F1*** or ***OK***.
- ***Auto configuration (3):*** If the operator pushes this key (***F2***) the output pins would be configured by default values.
- ***Test (4):*** The test-menu is for testing the alarm outputs. To open the test-menu, push ***F3*** or ***OK***.



The settings for an alarm-output can be changed in the "Alarm output details" menu. See the screenshot below.



Reference:

1	Section (1): Shows the operator, which alarm-output will be change.
2	Sample point (2): The operator can select the sample point. This means, that the alarm-output signal from the choose sample point will be transmitted to the process control system.
3	Meas. Item (3): At this point the operator selects the measurement item, which should be monitored. At the chart below, the typical measurements items are counted. Basically, all measurement-channels, which can be measured, can be selected at this point.
4	Meas. Unit (4): This point shows, which unit the transmit signal have. This point cannot be changed.
5	Threshold (5): Here the threshold will be determined.
6	Alarm of value is (6): The operator can determine, if the alarm will be triggered above the determine threshold, or below the threshold.
7	Return (7): Leave the menu. Alternate push F1.

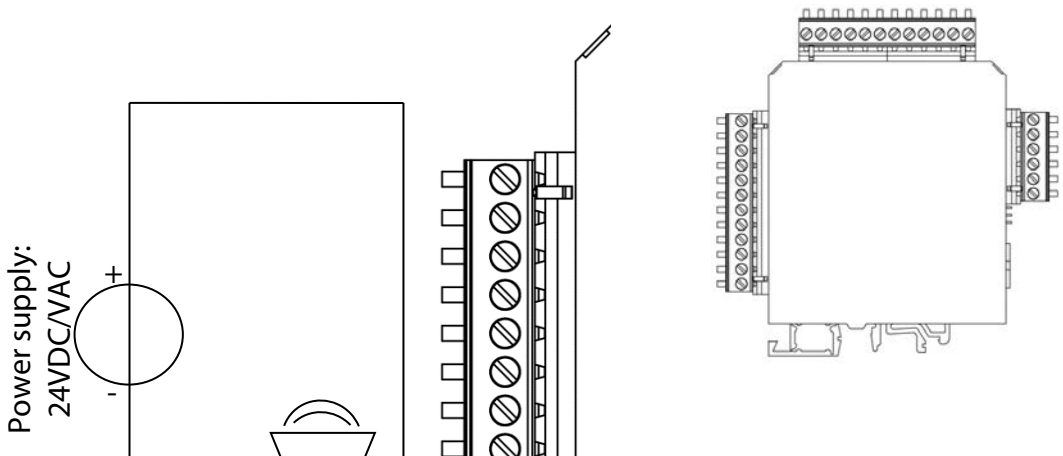
Example: Alarm output to control room

Starting position:

A warning light should be installed inside the plan. It should be power up, if the H2S concentration is ***over*** 550 ppm in the ***sample point 2***. The SWG100 has ***one IO module***. Both alarm outputs are not connected.

Follow steps must be done:

- Both alarm outputs are equipped with a potential-free relay. The maximal voltage of the power supply is 24 VDC. So, the operator must provide a 24 VDC power supply and a warning light, which works with 24 VDC.

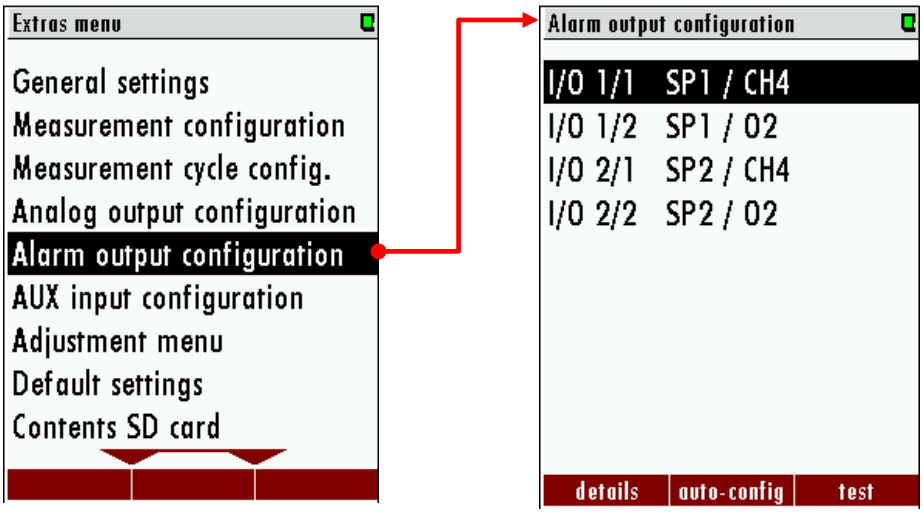


Beeper

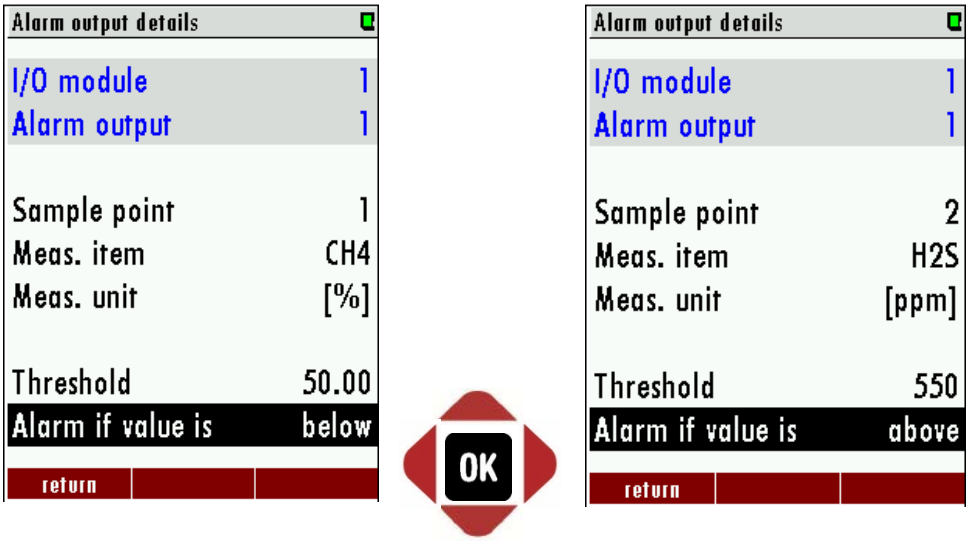
Relays: Normally open

Electric consumer: max. 1

- Connect the parts with the relay inside the IO module.
- In the next step the alarm 1 must be configured at the SWG100. To do this, open the menu: EXTRAS/ ALARM OUTPUT CONFIGURATION. The following menu overview will be appeared (see screenshot below). To configure the alarm 1, select the first record (channel I/O 1/1 SP1 / CH4) in the list and open it.



- The follow screen appears. To configurate the channel 1, the red marked positions must be changed:

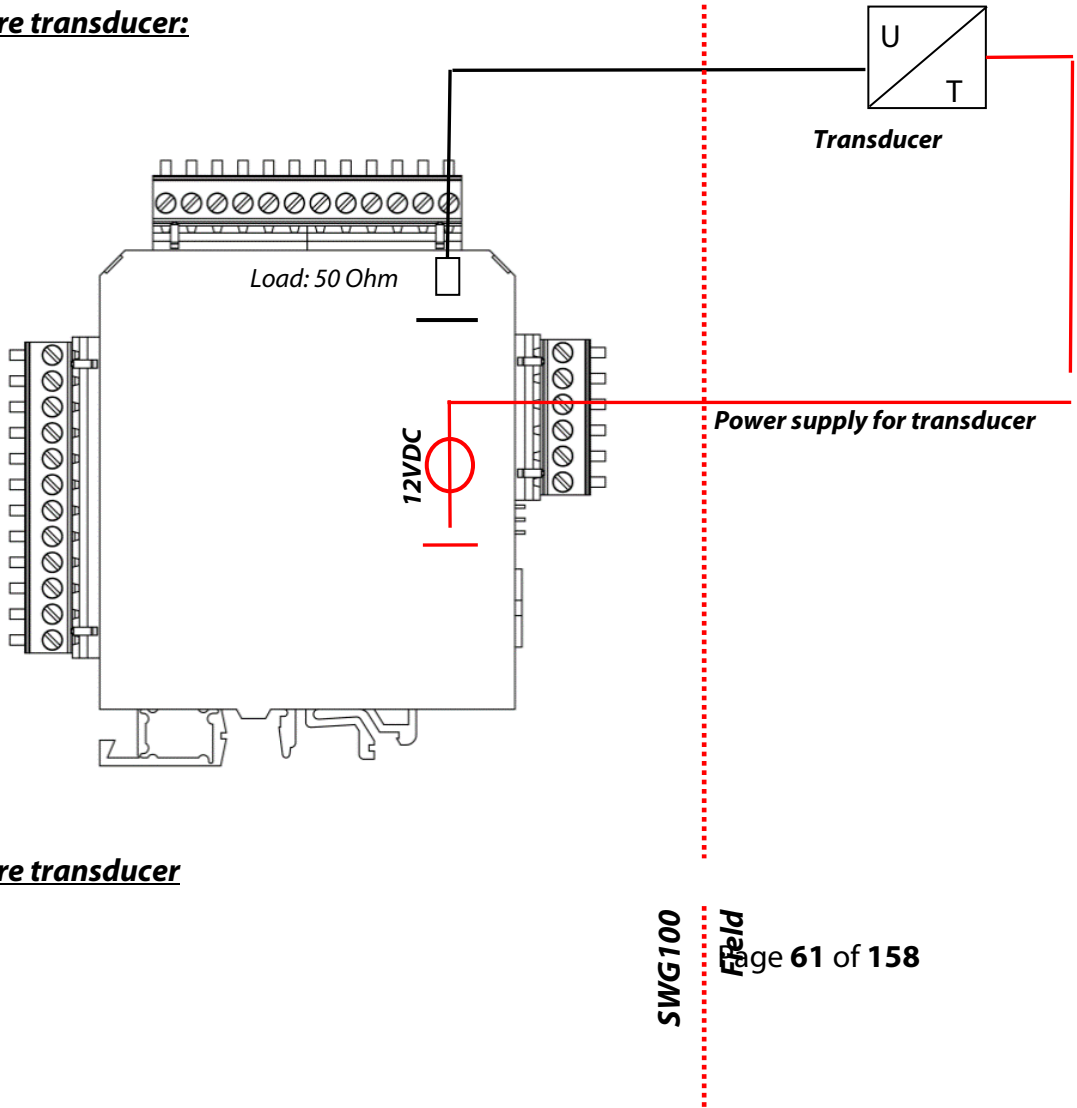


7.5. Analog inputs (4-20 mA)

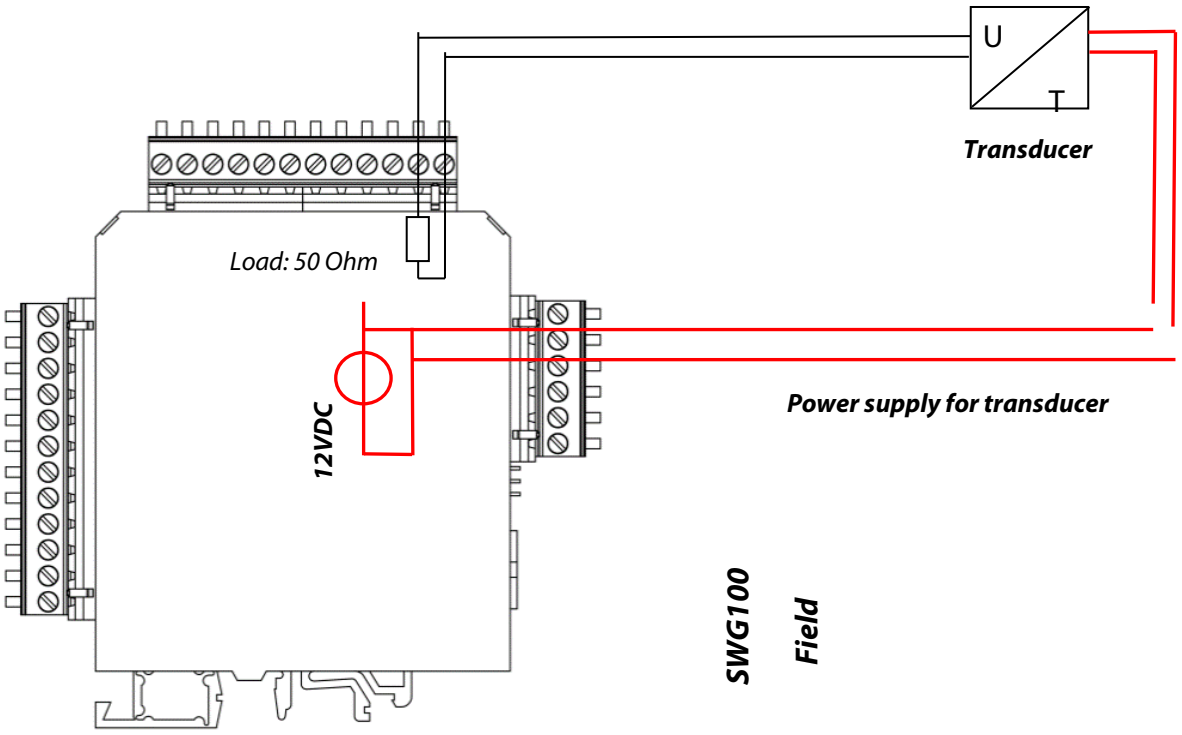
Hardware-side:

The analog inputs are on the top of the IO module. They are marked with a blue label. Through the help of the analog inputs, the IO module can read all common 4-20 mA transducer in the analyzer directly. The IO module has a separate 12 V power source, for the supply of the transducer. At the sketch below, the inputs and the power supply, for the transducer are marked.

2-wire transducer:



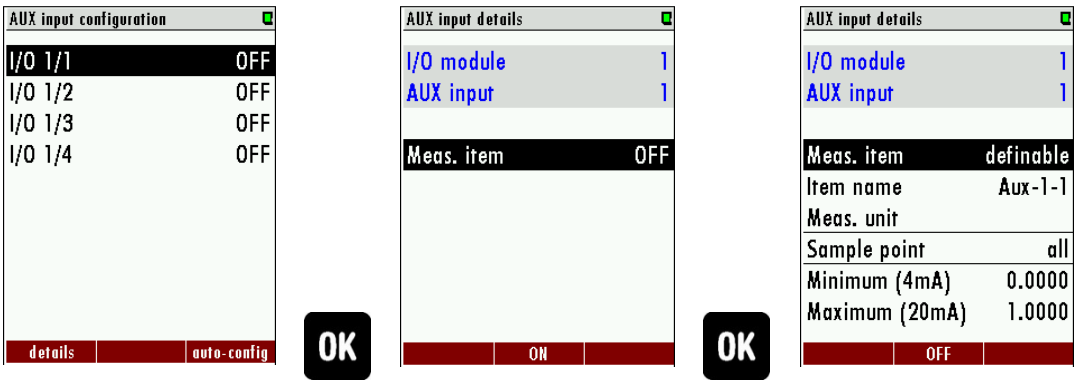
4-wire transducer



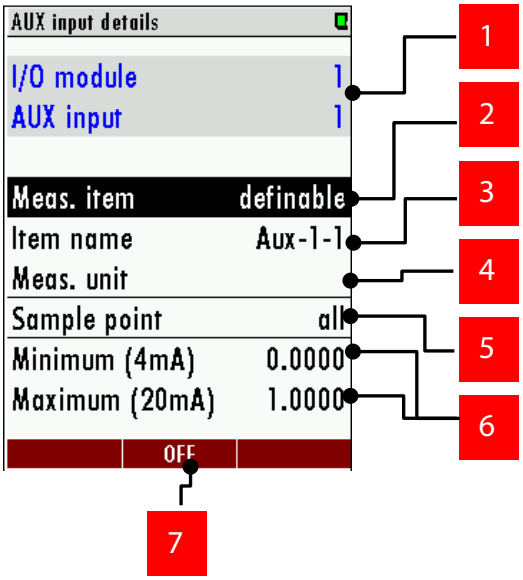
Software-side

- Open the menu: EXTRAS/AUX INPUT CONFIGURATION (1).
- The overview screen appears. At the overview-screen, the installed AUX-inputs are listed. Every IO module has four AUX-inputs. At the default settings all AUX-inputs are deactivated (OFF at the overview-screen).
- To activate an AUX-input, push ***F1*** (=details). The different IO-inputs can be selected with the up/down arrow keys.
- After one AUX-input is selected, the measurement item must be activated. To do this, turn the measurement item from OFF to definable.
- The measurement item "definable" is an individually measurement configuration, where the user can configure by himself.

The measurement item "definable" is an individual configuration channel. The menu "AUX input details" contains some pre-configurated settings, like for temperature, or pressure sensors.



The structure of the menu “AUX input details”, for the channel “definable” is given at the screenshot below.



Reference:

1 Show the operator, which analog-input will be changed.

2 The operator can select the sample point. This means, that the analog-output signal from the choose sample point will be transmitted to the process control system.

3 At this point the operator selects the measurement item, which should be transmitted. At the chart below, the typical measurements items are counted. Basically, all measurement-channels, which can be measured, can be selected at this point.

4 The dimension of the measurement item (example: %,ppm…)

5 This point shows, which unit the transmit signal have. This point cannot be changed.

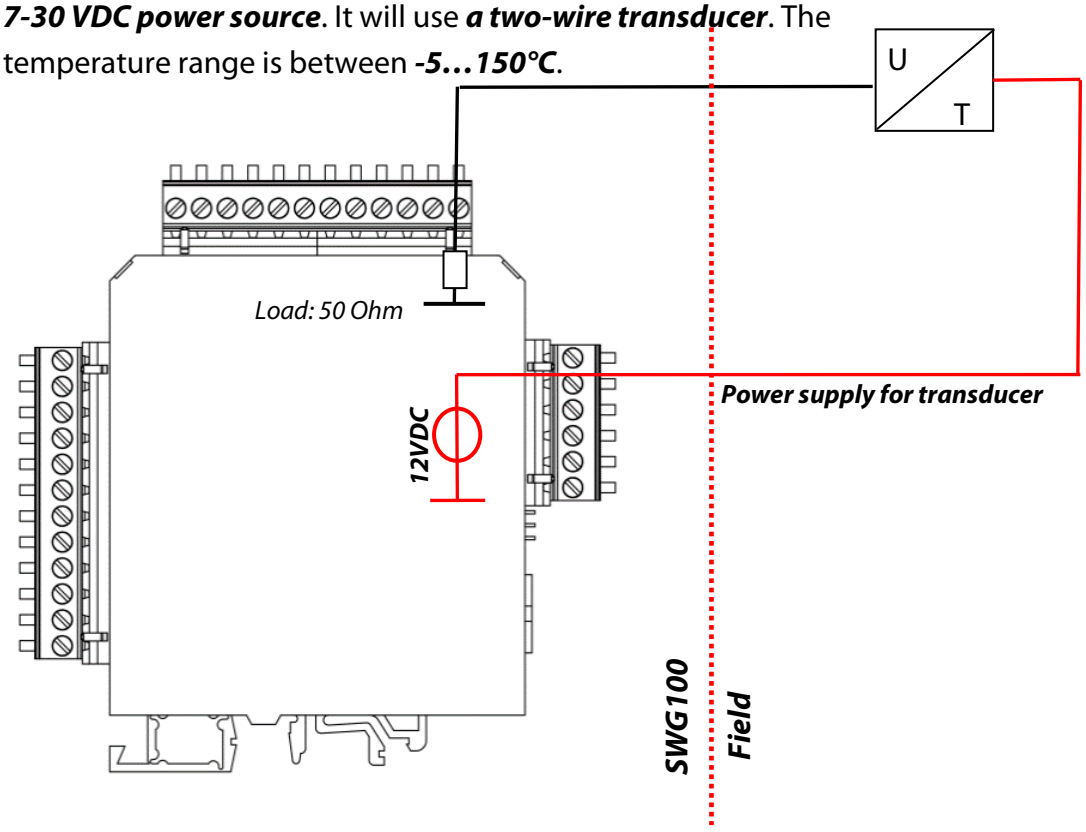
6 Here the operator entering the equivalent measurement value, for a current of 4 mA.

6 Here the operator entering the equivalent measurement value, for a current of 20 mA. The IO module will create the linear relation.

7 Leave the menu. Alternate push ***F2***.

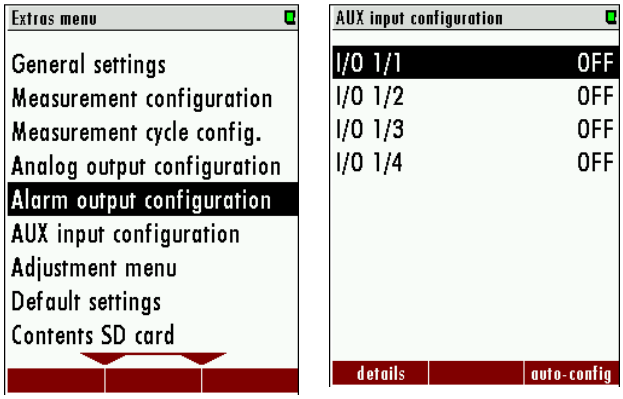
Example: Read 4-20 mA signal from an external temperature sensor

An operator wants to read an external temperature sensor signal inside a SWG100. The temperature sensor gives a 4-20 mA signal out and needs ***a 7-30 VDC power source***. It will use ***a two-wire transducer***. The temperature range is between ***-5…150°C***.



After the sensor is connected to the IO-module correctly, the sensor must be configured at the SWG100.

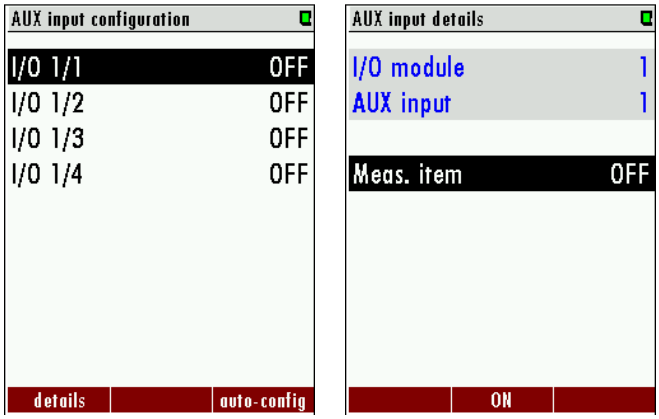
- Open the menu: AUX-input configuration. This menu can be found at the path: Extras/AUX-input.



- First the operator sees an overview, which shows with kinds of sensors are mounted at the IO-module. In this example, there is no transducer mounted at the SWG100.
- To configure a new sensor, push ***F1***.
- The follow screen appears. Here, the sensor can get an individual name.

- At the toolbar, the operator can select the options:

  - Details (F1): Here the select analog-inputs can be configured. If ***F1*** is pressed the follow screen appears.



This screen means, that no transducer is configurated. Meas. Item is OFF (default). With the ON key (F2) or the arrow right/ left key, the operator can skip inside the menu.

  - If the AUX input is activated, the follow screen appears. At this screen the operator can define the incoming signal.

    - Meas. Item: This is the skip menu-point. Push the right/ left arrow key, to activate another define AUX-input.

    - Item name: Here the operator can enter a name for the AUX-input. To enter a name, press the OK key. An alphabet will appear, where the operator can enter a name.

7.6. Configuration of the external control (Option: IO module)

This feature requires an I/O module (optional) and the function must be activated.

This feature can be used for the external control of the analyzer. With the help of the external control follow operations can be done:

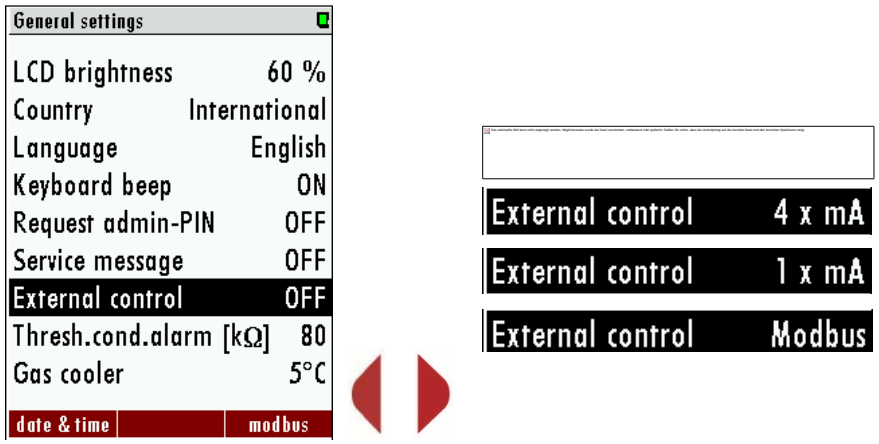
- Externally controlled sampling point selection,
- Stand-by.

The commands will be given by a 4-bit binary number, which will be built through four external signals. The pins for the signal are shown in the sketch below. It exists two different types to set the four pins:

- Potential free relay contacts.
- 4-20 mA signal inputs.
- Through one 4...20mA input.
- Through Modbus (RTU).

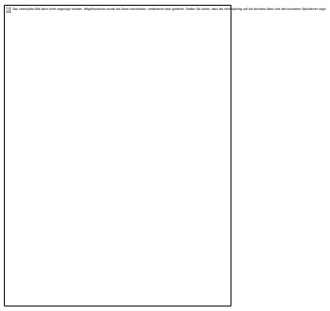
The settings-menu can be found at the path: EXTRAS/GENERAL SETTINGS-> EXTERNAL CONTROL.

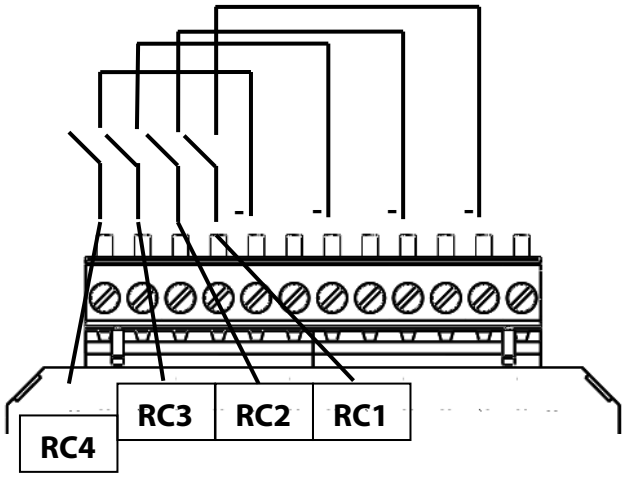
The user can set three different types for the external control. The types can be found at the sketch below.



Connection of the external control via relay contact

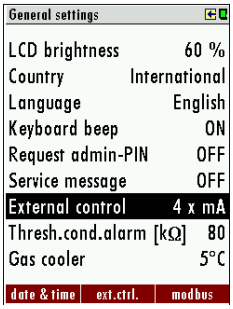
This feature can be used for externally controlled sampling point selection, zeroing and stand-by, using external potential free relay contacts, see also diagram in $4.4
The relay contacts build a 4-bit binary number: **RC4 - RC3 - RC2 - RC1**
open=0, closed=1.
Let us tell this number 'status number'.

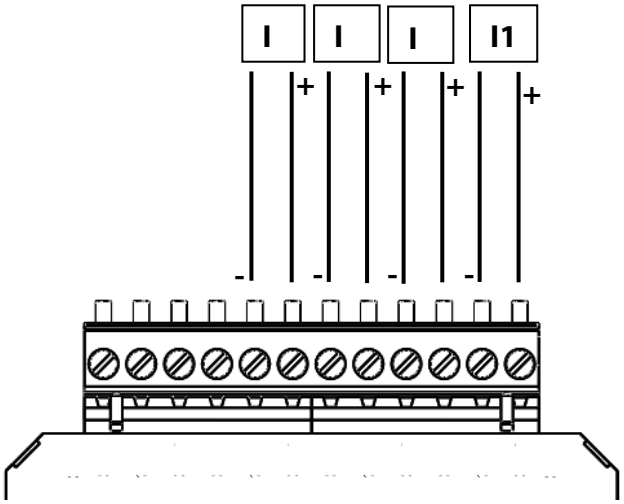




Status of external signal source				Status number	Description
RC4	RC3	RC2	RC1	-	-
0	0	0	0	0	Automatic sampling point switching
0	0	0	1	1	Analyzer is sampling the point SP1 (*1, *2)
0	0	1	0	2	Analyzer is sampling the point SP2 (*1, *2)
0	0	1	1	3	Analyzer is sampling the point SP3 (*1, *2)
0	1	0	0	4	Analyzer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

Connection of the external control via 4-20 mA input signals



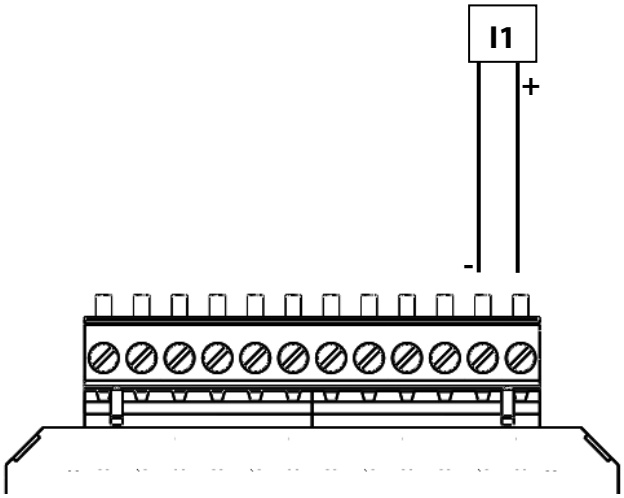


The signal inputs built a 4-bit binary number: **I4 – I3 – I2 – I1: 0-11 mA=open=0; 11/12-20 mA=closed=1.**

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	Analyzer is sampling the point SP1 (*1, *2)
0	0	1	0	2	Analyzer is sampling the point SP2 (*1, *2)
0	0	1	1	3	Analyzer is sampling the point SP3 (*1, *2)
0	1	0	0	4	Analyzer is sampling the point SP4 (*1, *2)
0	1	0	1	5	Analyzer is sampling the point SP5 (*1, *2)
0	1	1	0	6	Analyzer is sampling the point SP6 (*1, *2)
0	1	1	1	7	Analyzer is sampling the point SP7 (*1, *2)
1	0	0	0	8	Analyzer is sampling the point SP8 (*1, *2)
1	0	0	1	9	Analyzer is sampling the point SP9 (*1, *2)
1	0	1	0	10	Analyzer is sampling the point SP10 (*1, *2)
1	0	1	1	11	Analyzer is “stand-by” (*3)
1	1	0	0	12	Purge phase with protected H2S sensor
1	1	0	1	13	Auto Calibration
1	1	1	0	14	Remote reset of all system alarms
1	1	1	1	15	Analyzer is “stand-by” (*3)

Connection of the external control via one 4-20 mA input signal

The user has the opportunity to control the analyzer with only the first 4-20mA input (see sketch below). The different commands will be given by the changing of the current signal. The offset-signal is 4 mA. Every 1 mA step describes a condition of for the external control. Overall, the analyzer can take 16 different statuses. The first status is by 5 mA (4 mA+1 mA) the second is by 6 mA (4 mA + 2 mA) and so on until the 20-mA signal is reached.



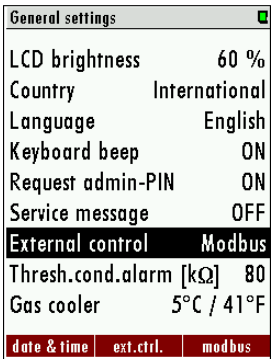
The connection of the one 4-20 mA signal is a two-wire connection.

Status of external signal source I [mA]	Status number	Description
4	0	Automatic sampling point switching
5	1	Analyzer is sampling the point SP1 (*1, *2)
6	2	Analyzer is sampling the point SP2 (*1, *2)
7	3	Analyzer is sampling the point SP3 (*1, *2)
8	4	Analyzer is sampling the point SP4 (*1, *2)
9	5	Analyzer is sampling the point SP5 (*1, *2)
10	6	Analyzer is sampling the point SP6 (*1, *2)
11	7	Analyzer is sampling the point SP7 (*1, *2)
12	8	Analyzer is sampling the point SP8 (*1, *2)
13	9	Auto Calibration
14	10	Analyzer is sampling the point SP10 (*1, *2)
15	11	Analyzer is “stand-by” (*3)
16	12	Purge phase with protected H2S sensor
17	13	Auto Calibration

Status of external signal source I [mA]	Status number	Description
18	14	Remote reset of all system alarms
19	15	Analyzer is “stand-by” (*3)

Connection of the external control via Modbus

A further option is, to control the external control via Modbus. To do this, follow steps must be done:



- Connect the RS485 to Modbus converter to the Modbus connector found at the main pcb. A description can be found in the chapter 7.4.

- Set the external control: Open the menu point "General settings": EXTRAS/GENERAL SETTINGS. Select the menu-point "EXTERNAL CONTROL"→MODBUS.

- The master writes a value on the address 6000, the value is the same than with external control via digital or analog inputs:

Status number values	Description
0	Automatic sampling point switching
1	Analyzer is sampling the point SP1 (*1, *2)
2	Analyzer is sampling the point SP2 (*1, *2)
3	Analyzer is sampling the point SP3 (*1, *2)
4	Analyzer is sampling the point SP4 (*1, *2)
5	Analyzer is sampling the point SP5 (*1, *2)
6	Analyzer is sampling the point SP6 (*1, *2)
7	Analyzer is sampling the point SP7 (*1, *2)
8	Analyzer is sampling the point SP8 (*1, *2)
9	Analyzer is sampling the point SP9 (*1, *2)
10	Analyzer is sampling the point SP10 (*1, *2)
11	Analyzer is "stand-by" (*3)
12	Purge phase with protected H2S sensor
13	Auto Calibration
14	Remote reset of all system alarms
15	Analyzer is "stand-by" (*3)

Configuration at the analyzer

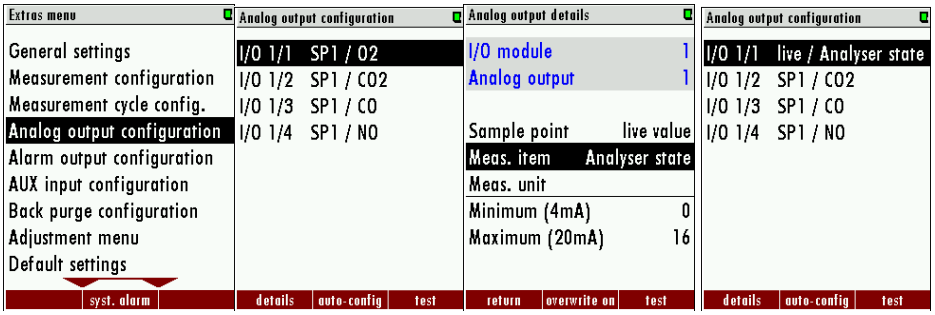
1. Open the path: EXTRAS/GENERAL SETTINGS.
2. Switch the menu-point "External control" from "***OFF***" to "***Relais***"/"***4x mA***" or "***1 x mA***" (dependent from the connected signal input.). When the external control is activated an arrow symbol will appear at the title line.
3. If a valid input state (>0) is present, an arrow in the title line will appear. The analyzer is now slave and will perform the measurement until it gets another command from the master unit. Some external control settings can be configured. This can be found at the path: EXTRA/GENERAL SETTINGS then ***F2***= ext.crtl.
   The user has the opportunity to set the zeroing time, suction/response time and stand-by purge time.

Case 1: Stand-by
The Stand-by modus will be activated if the input state is higher than the number of sample points (example: 4 sample points and input state 5…15). The Stand-by modus has the following pass:
- Purging with zero gas (for the configured duration)
- Standby until the input state is below or equal the number of sample points (e.g. 4 sample points and input state 1.4)

Case 2: External control of a sample point
-Zeroing: First the zeroing will be done. The duration of the zeropoint can be set at the menu ext. crtl. (see point "***configurated at the analyzer***" in the same chapter).
-Gas sampling: The gas sampling is for purging the entire system and give the analyzer enough time for response. (Response time). To set the suction/ response time, see point "***configurated at the analyzer***" in the same chapter.
-Measurement: The measurement will be started after the response/ suction time is finished. It will be only abort if the user changes the status of the external signal sources. The chart below shows the possible statues, which can be set at the analyzer:
(*1): Whenever the selected sample point will be changed, then the analyzer will start a zeroing before measuring the new sample point.
(*2): Not only status numbers 4 to 15, but all status numbers larger than the number of installed sample points will start the "stand-by" (example: when you have 4 sample points, then status numbers 5 to 15 will trigger "stand-by").
(*3): When the status number changes to a "stand-by" number, then the analyzer will purge the sensors, then it will close all solenoid valves and switch off the gas pump. When the status number changes back to a value less or equal to the number of installed sample points, then a "set to zero" cycle will start and afterwards the selected sample point will be measured.
Note: The "stand-by" status can easily be used to initiate just a zeroing without any "stand-by" and without changing the sample point.
Example : - status number=1 (for any time period, recommended max. 1 hour)
- status number=15 (for a few seconds, recommended min. 10 seconds)
- status number=1 (for any time period, recommended max. 1 hour)
After installation and power-up of the analyzer few steps should be processed in order to operate the instrument properly.

7.7. Analyser states

The IO module, of the analyser, can read out the status of the analyser. To set this feature, open the path: EXTRAS / ANALOG OUTPUT DETAILS (see pictures below).



Each 1 mA steps represent a function. The chart below shows the different states:

#	mA-Signal	Function
0	4,0 mA	Power-On / self test
1	5,0 mA	Measuring sample point 1
2	6,0 mA	Measuring sample point 2
3	7,0 mA	Measuring sample point 3
4	8,0 mA	Measuring sample point 4
5	9,0 mA	Measuring sample point 5
6	10,0 mA	Measuring sample point 6
7	11,0 mA	Measuring sample point 7
8	12,0 mA	Measuring sample point 8
9	13,0 mA	Measuring sample point 9
10	14,0 mA	Measuring sample point 10
11	15,0 mA	Zeroing
12	16,0 mA	Gas sampling (from any sample point)
13	17,0 mA	System Alarm (measurement halted)
14	18,0 mA	Manual calibration in progress
15	19,0 mA	Automatic calibration in progress
16	20,0 mA	Stand-By

7.8. Cycle configuration

Path and default setting

EXTRA/ MEASUREMENT CYCLE CONFIG.

When the menu "MEASUREMENT CYCLE CONFIG." is selected the user definable setting for the measurement cycle will appear (see screenshot below).

Screenshot shows default setting, when the „MEASUREMENT CYCLE CONFIG." will be started the first time.

General information

The menu point "CYCLE CONFIGURATION" allows the user to configure an individual measurement cycle. Every installed sample point can be configured. For the configuration the user has the following phases, which can be selected:

- Zeroing.
- Purging.
- Stand-by.
- Measurement SPx (SPx stands for Sample point 1, 2…).

The configuration is performed with the three function keys ***F1***, ***F2*** and ***F3***.

- ***F1***: Delete a phase.
- ***F2***: Make an Auto-config.
- ***F3***: Insert a new phase.
- ***OK***: View/change phase details
- ***Left/right***: Change the phase type.

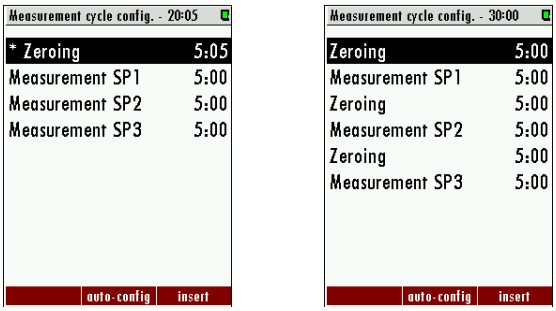
Auto configuration

With ***F2*** the "Auto-config." can be selected. The user can select one of two default cycle configurations.

- One zeroing / cycle.
- One zeroing / sample point.

The first program is for applications where the different measurement points have almost the same gas concentrations. The zeroing is not necessary at every change of the measurement SPX.

The second program is for applications where the different measurement points have different gas concentrations. A zeroing is recommended after every measurement point change.
The screenshots below show the “One zeroing / cycle” and “One zeroing / sample point” in comparison.

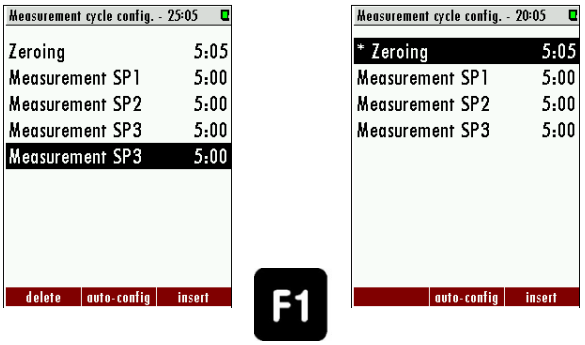


The two auto-configurations, which can be selected.

Depending on the analyser type, the first or the first and second phase cannot be deleted, deactivated or moved to another position.

Delete a phase

With ***F1*** a phase can be deleted. To do this, select the phase, which should be deleted and press ***F1***.

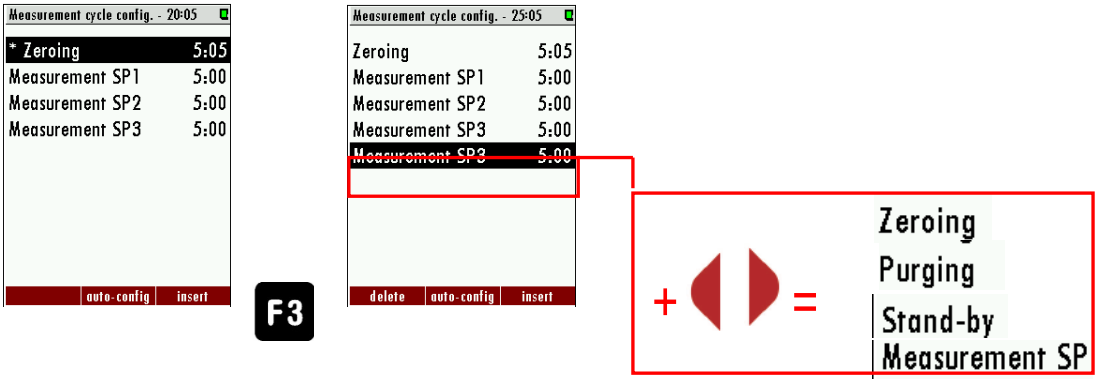


Screenshot shows how a phase can be deleted. In this example the last phase “Measurement SP3” is deleted.

Insert a phase

With ***F3*** a new phase is inserted in the measurement cycle. With the ***right/left arrow keys*** the different phase types can be selected.

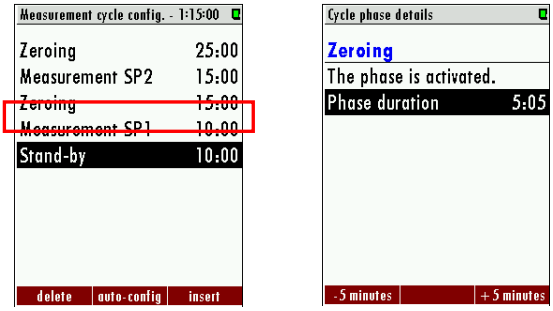
In the title-bar the entire cycle time is shown. It is called “Measurement cycle config.”
With ***OK*** the “Cycle phase details” can be shown and changed.



Configuration of the phase details

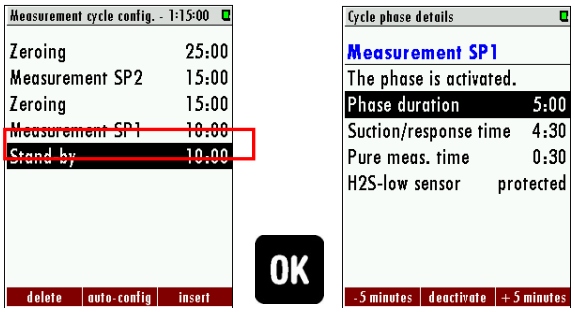
In this chapter the different cycle phase details will be explained.

Zeroing (Cycle phase details): In the cycle phase detail "ZEROING" the zeroing time can be configured.



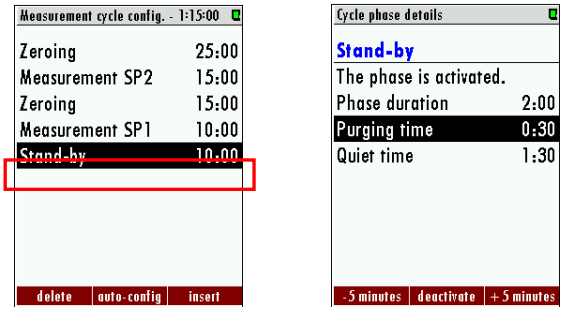
ZEROING	
Measuring site valv	Valves closed
Zeroing valve	Valve open
Duration	2min to 1 h
Recommendation	5min., in general not to be changed by user as depending only on analyzer internal setup

Measurement SPX (Cycle phase details): In the cycle phase details of "Sample point X" the measurement time and the suction delay can be configured. Each sample point can be configured individually. In the cycle phase details the following times can be set:



MEASUREMENT SPx	
Measuring site valves	Valve of selected site is open, others closed
Zeroing valve	Valve closed
Duration	Phase duration: 2 min. to 24 h Suction/response time: 30 sec. to 1h Pure measurement: calculated H2S-low: Activated/protect (Optional)

Stand-by (cycle phase details): In the cycle phase details "Stand-by" the sleep mode time can be configured. In the cycle phase details the following times can be set:

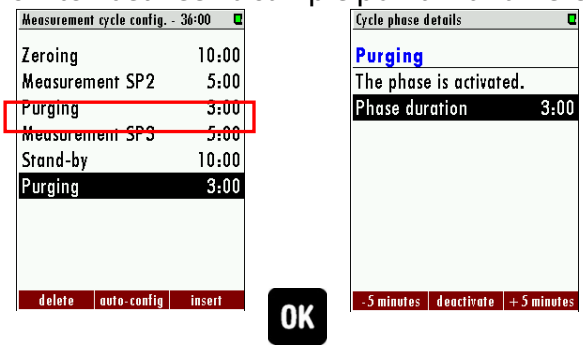


OK

- *Phase duration:* Entire Stand-by time (Purging time + Quiet time = Phase time).
- *Purging time:* The time, to purge the analyser with ambient air, through the zero gas inlet.
- *Quiet time:* The time, where the analyser is in the pure stand-by mode.

STAND-BY	
Measuring site valves	Valves closed
Zeroing valve	Valve closed
Duration	Phase duration: 2 min to 24h Purging time: 30 sec. to 1h Quiet time: calculated

Purging (cycle phase details): The purging is a separate configuration point to purge the analyser with ambient air through the zero gas inlet. It can be helpful, if the analyser must switch between a sample point with different sample gas concentrations.



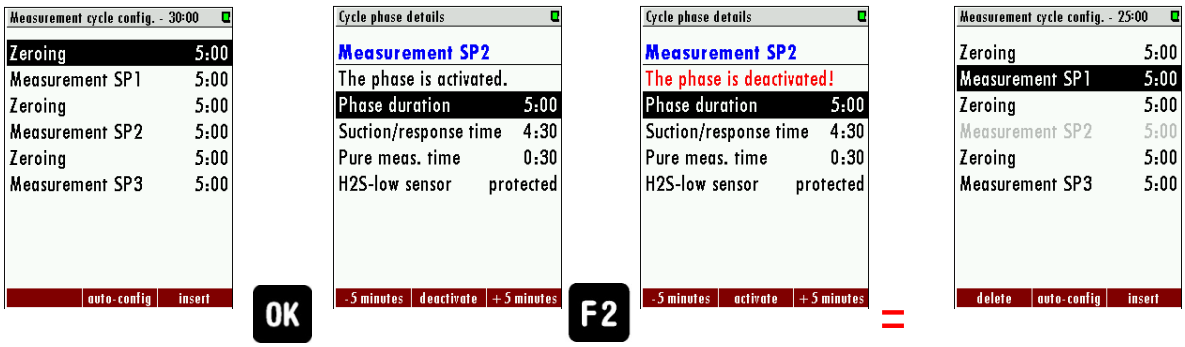
PURGING	
Measuring site valves	Valves closed
Zeroing valve	Valve open
Duration	30 sec. to 1 h

Activated/deactivated a phase

The user has the opportunity to deactivate a phase in the measurement configuration cycle. This could be necessary for example if a sample point is temporarily not in use. The activation and deactivation of a phase can be done in the cycle phase details of the concerning phase.

Example for the deactivation of a phase

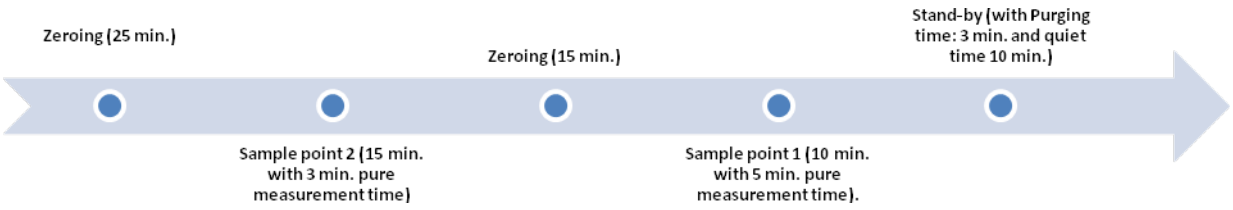
In this example the “Measurement SP2” will be deactivated. The deactivated phase is grey out.



Example for a measurement cycle configuration

In this chapter an individual measurement cycle should be created with the features described at the chapters below.

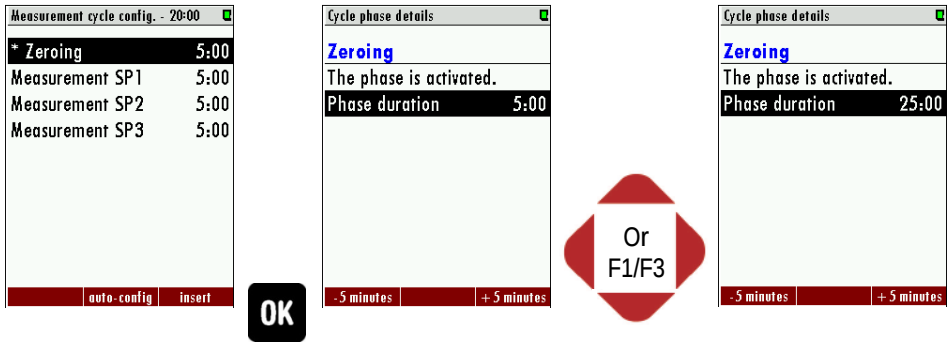
The measurement cycle should have the following sequence:



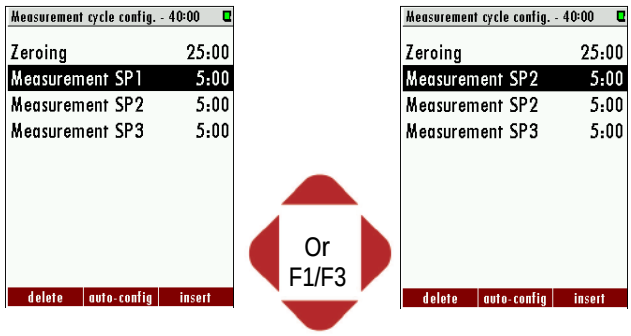
Following points must be done to configure the individual measurement cycle:

1. Open the measurement cycle config. menu: Path: EXTRA/ MEASUREMENT CYCLE CONFIG.

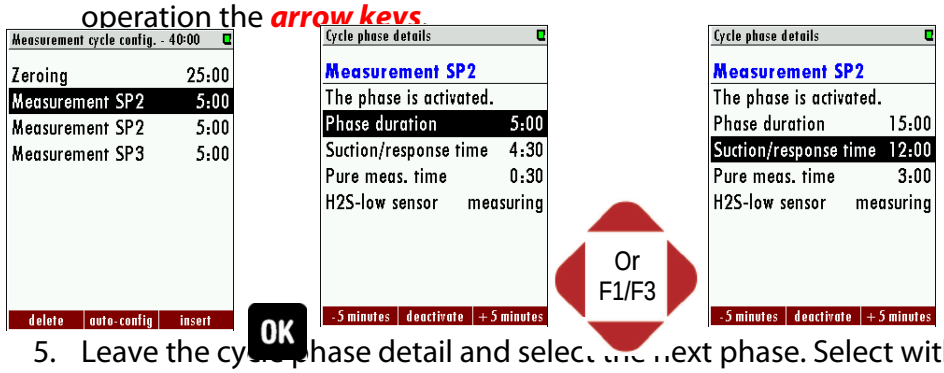
2. The default measurement cycle will appear. Open the cycle phase detail of the first zeroing and adjust the phase duration at 25 min.



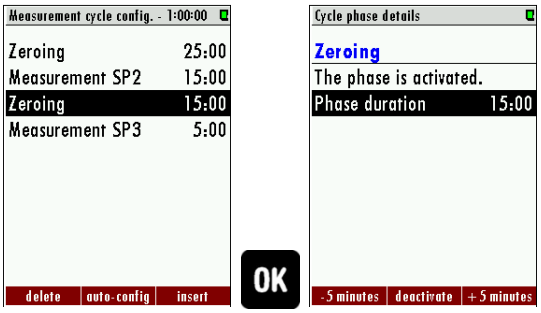
3. Leave the cycle phase detail and select the second point. Switch with the ***left/right arrow keys*** until the measurement SP2 is selected.



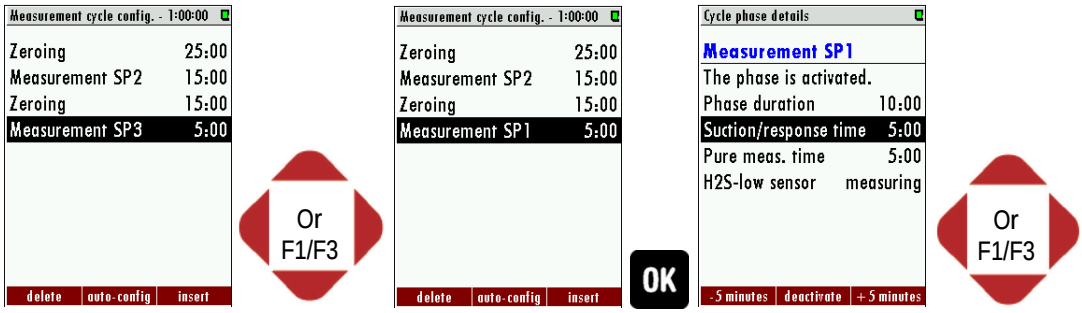
4. Open with the ***OK*** key the cycle phase detail of the measurement SP2. Adjust the duration-phase at 15 min. and the suction/response time until the pure meas. time has the value of 3 min. Use for this operation the ***arrow keys***.



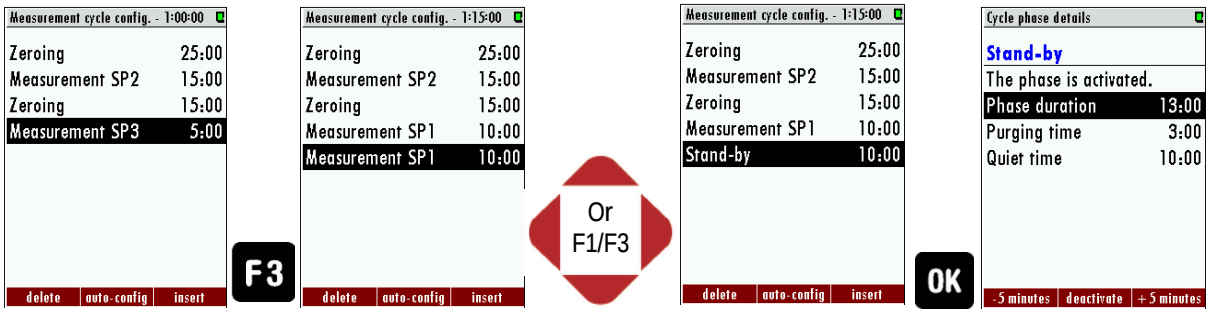
5. Leave the cycle phase detail and select the next phase. Select with the ***left/right arrow keys*** the phase "zeroing" and go in the cycle phase detail. Adjust the phase-duration at 15 min. and leave the cycle phase detail.



6. Switch to the next point and select with the ***left/right arrow key*** the measurement SP1. Go in the cycle phase detail of the measurement SP1. Here adjust the duration-phase 10 min. and the pure measurement time: 5 min.



7. At last push ***F3*** key for insert a new phase and select with the ***left/right arrow*** key the "Stand-by" phase. Go into the cycle phase detail and adjust the Purging time at 3 min. and the Quiet-time at 10 min.



Leave the menu and safe the adjustments. The individual configuration is done.

7.10. Administrator PIN code

All functions and menus which may disturb the analyzer's normal measurement can be protected against unauthorized access by activating the administrator PIN code request.

We highly recommend activating this function, when unauthorized persons could access the analyzer.

The PIN code is: **F1 - F1 - F3 - F2 - Up - Down**
The PIN code request can be activated and deactivated in the menu Extras/General settings:
The deactivation of the PIN code request requires at least one time PIN code input.

Once the user has inputted the correct administrator PIN code the analyzer will stay in administrator mode (password free) for 10min after last time key press. Each key acting will trigger another 10 minute password free operation.

7.11. Power-On of analyzer

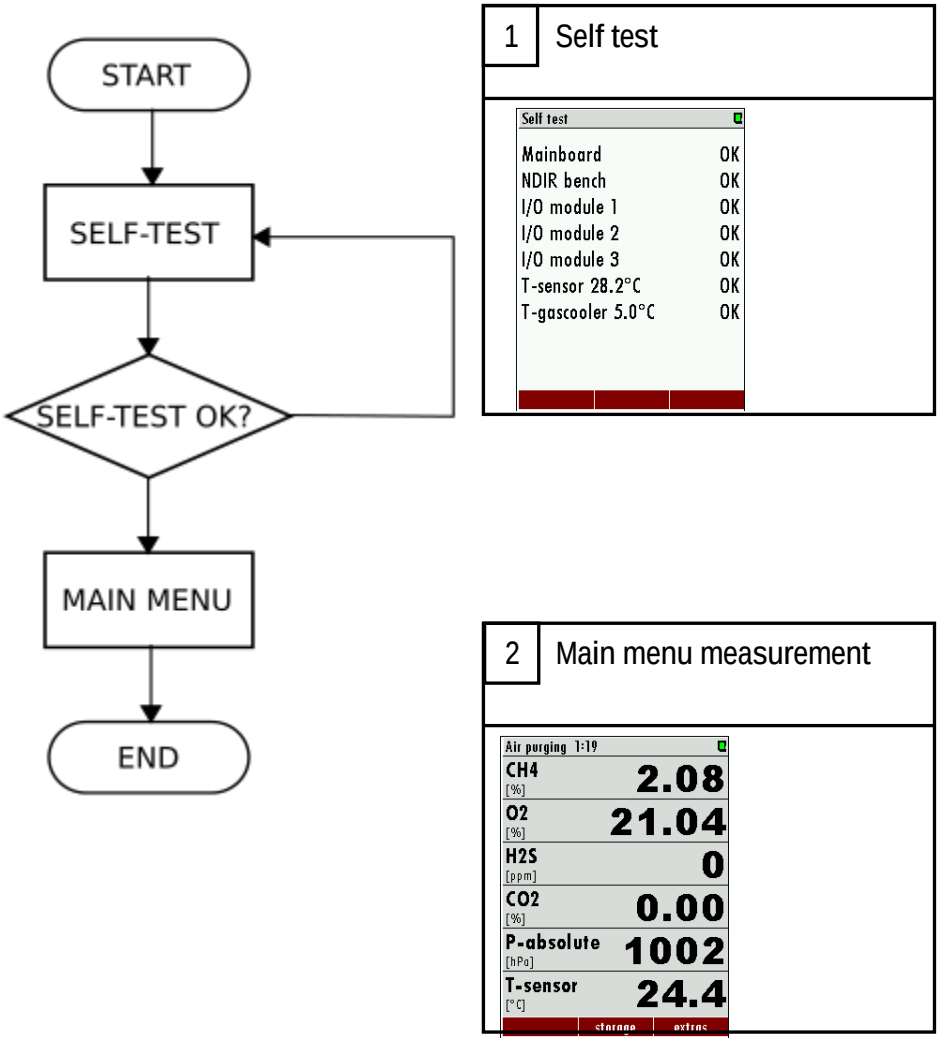
When the analyzer is connected with mains power (Power-On) it will start the system boot process which usually takes very few seconds. Then the display will show the self-test menu.

8 Operating the analyzer

This chapter has the follow structure:

- In the first part it will be explained, how to start the analyzer and the self-test menu.
- Part three shows the submenu, which are listed at the EXTRA menu.
- Part four shows the store menu.

8.1. General process of the measurement cycle



Self-Test

The first menu to be displayed after Power-On is the self-test menu. The analyzer won't leave this menu before all sub-systems will be connected and the gas cooler (option) has reached the target operation temperature.

During the self-test phase

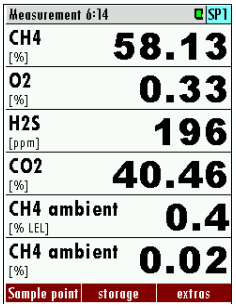
- the gas pump is switched off
- all analog outputs will deliver 2mA
- all alarm outputs will have alarm status (open contacts)

Usually the self-test will be left automatically as soon as all conditions for measurement are satisfied. Then the first zeroing will be started.

If one of the internal RS485 bus participants are issuing alarm (faulty) status, the user can still leave the self-test manually by pressing F2='forward' (PIN code requested), even if not all sub-systems or the gas cooler are ready.
NOTE: this is for service purpose only!

Main menu measurement

This menu is the root of all menus and will be shown automatically as soon as the self-test is finished. The title bar you can see on the left the current measurement cycle status and how long it lasts and the actual sampling point number. In the middle section of the actual measurement values are displayed.

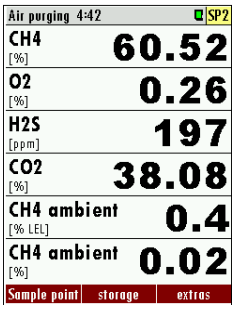


Representation during the status "measurement"

The title bar you can see on the left "measurement" and the remaining measurement duration, and the right **light blue highlighted** sampling point number SPx (x = 1 to 10) that is being measured. In the middle section of the menu, the current (live) values are displayed.

Representation outside the status of "measurement"

The title bar you can see on the left "air purging" or "gas sampling SPx" and the remaining duration of the current status. On the top right you can see the **yellow highlighted** sampling point number SPx previously measured or that you have selected for display and their measuring values are held until it is measured again. In the middle section of the menu held measured values of these measurement sites are displayed.



Change the Display Zoom / Standard

Two display modes are available:

- standard view mode with 6 values per page, up to 4 pages (indicating up to 24 values)
- zoom view mode with 2 values per page, up to 6 pages (indicating up to 12 values)

The indication mode can be swapped with the menu key and the selection of zoom view or standard view.
For devices with just one measuring point the switching is additional possible with the arrow keys up / down.

Change the displayed page

Use the arrow keys left / right can be changed in both display modes the page. The new page number is displayed in the title bar for a moment just after the successful change.

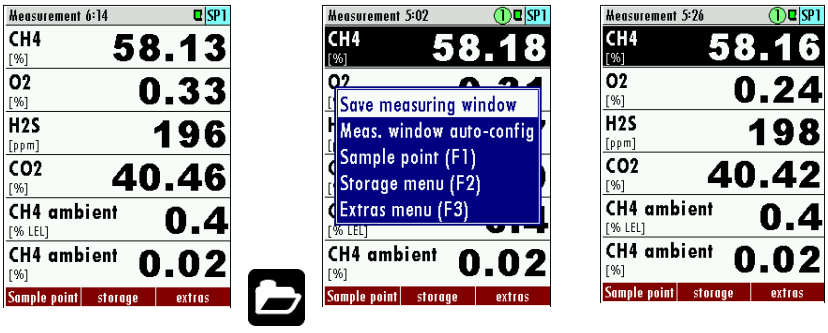
Change sampling point displayed

For analyzers with several measuring points can used the arrow keys up / down the displayed (not measured) measuring point can be changed. In this way you can get an overview very quickly over the last measured values for all points. In the background, the analyzer uses the measurement cycle continues uninterrupted. However, once a measurement phase is completed, the display automatically switches to the actual measurement location.

Configuration of the measurement window (display content)

The measuring values selection and arrangement is user configurable in both display modes.
Press the content menu key and select the function 'Define measuring window'. A cursor (inverted line) will appear. The cursor can be moved with the arrow keys up and down. The arrow keys left and right will change the measuring value in the selected line. When the cursor is moved over the top or under the bottom line, then the next definable page will show up.

As soon as you have finished the configuration, press the ESC key (or press again the menu key and select the function 'Save measuring window'). You will be asked, whether the changed settings shall be stored or discarded. Select 'keep them' in order to store your changes.



8.2. Protective measures for electrochemical H2S sensors

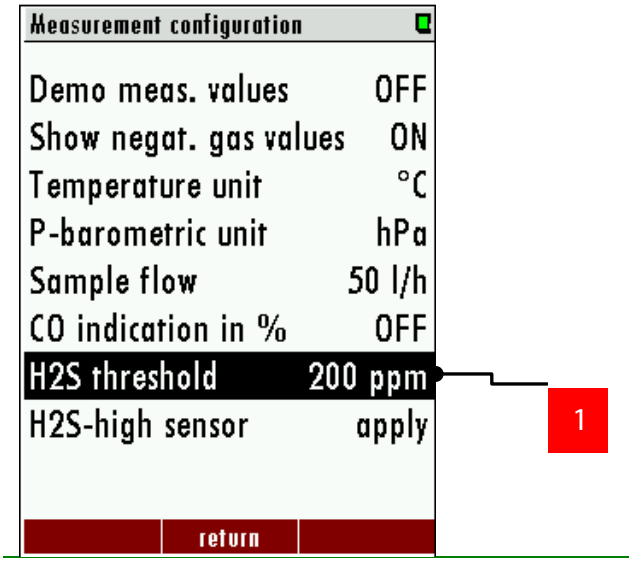
The analyser measures H2S according to the electronic measuring principle. These are measuring cells that trigger an electrochemical reaction when they come into contact with the target gas. The cells are consumed over time and must therefore be replaced approximately every 2 years. The short form of electrochemical sensors is ECS (ECS=electrochemical sensor).
There are two types of H2S-ECS:

- H2S-low sensors: these sensors are designed to measure low concentrations of H2S. They have a higher accuracy, but will be destroyed if the H2S concentration is too high.
- H2S-high sensors: These sensors are intended for high H2S concentrations. Their accuracy is not as good as that of H2S-high sensors, but they are not destroyed if the H2S concentration is too high.

Basically, it depends on the gas composition to be measured which sensor should be used. A combination of both sensors is also possible in the analyser.

Setting: H2S low ECS and free flush function

Since H2S low ECS are destroyed by high concentrations, the analyser has a free-purge function if such a sensor is optionally installed. The sensor does not permanently measure the sample gas but is only switched on during the measurement cycle. After the measurement is finished, the sensor is switched off and purged with ambient air by a free-purge pump so that no H2S remains in the sensor chamber.
In addition, an H2S threshold can be set. When the threshold is reached, the sensor is switched off and flushed with fresh air.
To set the threshold, see path: EXTRAS / GENERAL SETTINGS.



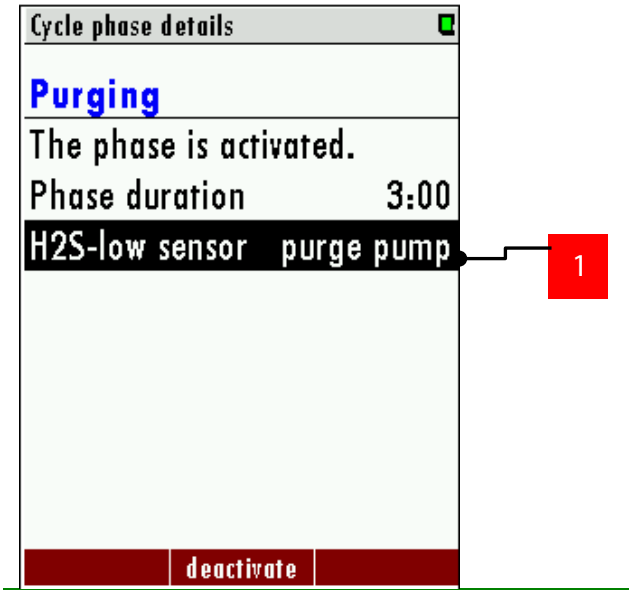
Reference:

1. H2S threshold / range 25-800 ppm

Setting: Flushing when changing the measuring point

Since the H2S accumulates in the measuring lines, it can be useful to flush the lines when changing the measuring point. A flushing phase can be set in the configuration measuring cycle menu, which is intended specifically for flushing the H2S sensors.

- Call up the Configuration measuring cycle menu: under EXTRAS / CONFIGURATION MEASUREMENT CYCLE.
- Insert a flushing phase with "Insert" (F3) at the desired position.
- Go to the details of the cycle phase. To do this, select Flush and press the OK key.
- Select the "H2S low sensor" option.
- You can choose between two settings.



Reference:

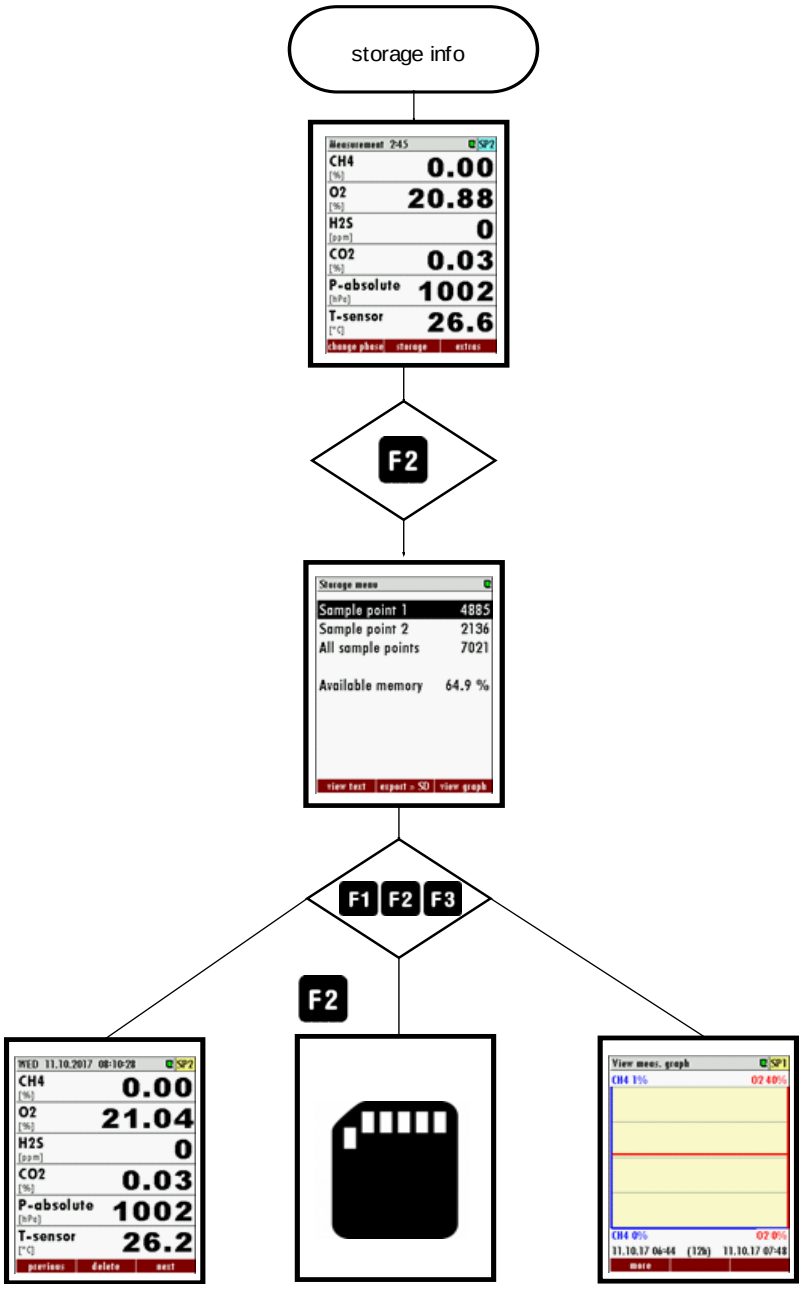
1. Setting H2S-low-sensor:
   Purge pump: Purge pump from H2S-low-sensor will be activated.
   Zero gas: Normal zero point air is used for purging.

8.3. Data Storage Menu

The data storage menu can be reached by pressing ***F2*=*'storage'*** in the measurement menu:
The menu provides an overview of stored measurements of each sample point and of the memory usage.

NOTE

DATA STORAGE
The analyzer makes use of an internal flash memory to store measurement values automatically.



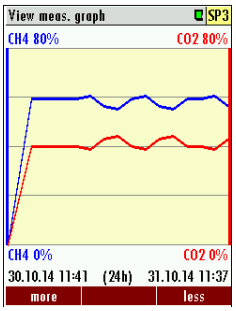
General information about the data storage

Data storage strategy is as follows:

- The analyser may store up to 20,000 measurement points (including all relevant data).
- At the end of each measurement cycle (per sampling point) the current values will be stored.
- The memory is used as a ring buffer. As soon as the memory is completely occupied, the latest measurements will replace the oldest measurements.

Specifically:
If the used memory is 99%, then the oldest 20% of the measurements will automatically be exported to SD card in CSV format and then deleted from the memory. In case the SD card export doesn't succeed (SD Card missing or read-only), then only the oldest 4% of the measurements will be deleted.
The file names reflect the date of the most recent measurement contained in the export file, e.g. "20141031.csv".

Example:
An analyser with 2 sample points and a total configured cycle time of 32 minutes saves 2 * 24 * 60/32 = 90 measurements per day (45 of each sample point). So the ring buffer will provide measurements of the last 20000/90 = 222 days (more than 7 months).

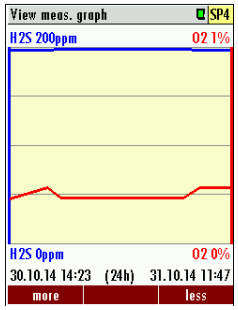


View stored measurements in text mode

This function can be reached from the Data Storage Menu by selecting one or all sample points and by pressing F1='view text':

When entering the menu the latest stored measurement will be displayed. With the keys F1='previous' and F3='next' the measurements can be browsed (***F3*** will lead to the oldest measurement when the latest was displayed before - wrap-around).

You may delete a single measurement here, usually you won't need this function. The arrow keys have the same function than in the measurement menu.



View stored measurements in graphic mode

This function can be reached from the Data Storage Menu by selecting one sample point (not all) and by pressing ***F3='view graph'***:
Two curves for one pair of data are shown at the same time in one diagram. The used scales are determined automatically and can't be changed by the user.

The offered pairs of data are determined by the setting of the zoom values in the measurement menu. The displayed pair of data can be changed by pressing the arrow keys up or down.

When entering the menu the measurements of the last 24 hours will be displayed. This interval can be changed by pressing the keys ***F1***=more or ***F3***='less'.

Export of measurements to SD card

This function is used to export the measurements from the analyzer to a PC. The used format is CSV (comma-separated values). Many computer programs are able to read this format, e.g. spread sheet calculation programs.

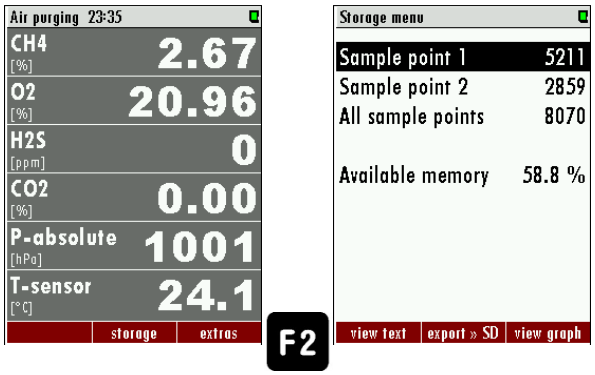
The CSV format is not exactly the same in all countries. The analyser selects a fitting format variation according to the selected country. Nevertheless the CSV output can be changed the Data Storage Menu.

This function is only available, when a SD card is inserted and is not write protected. The export can be started in the Data Storage Menu by selecting one or all sample points and by pressing ***F2='export >> SD'***. The created files have names like 'BIOxxxxx.csv', in which the xxxxx are continuing 5 digit numbers with leading zeros.

The 1st line of the created file is a column header with the following information: Sample point number, Date, Time and all measurements. The following lines contain the data.

CSV-configuration settings

1. Push „store“ (***F2***) in the main-menu.



2. Open the context-menu in the store-menu. Select the menu-point “CSV-configuration” in the context-menu.

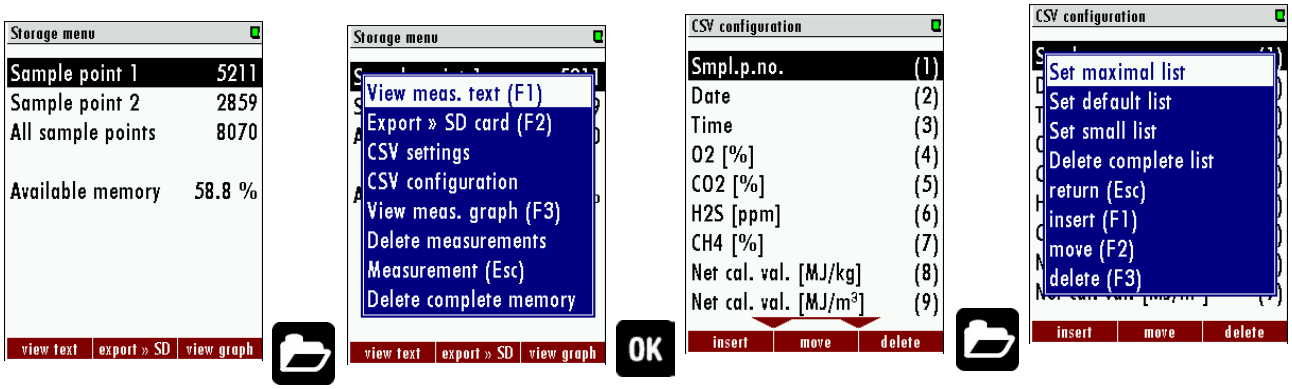
3. It appears a list of all configured csv-datas. With the keys ***F1***, ***F2*** and F3 the user can navigate through the configuration-menu. The single keys mean:

    - F1=insert: Insert an entry below the cursor-position.
    - F2=move: Move the entry from the cursor-position to another one.
    - F3=delete: Delete the entry from the list.

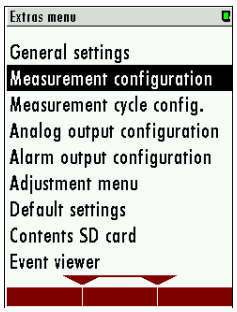
4. Inside the CSV-configuration, the user can change between three predefined lists. To open the selection of these, open the context-menu inside the CSV-configuration-menu and select one of the lists. The lists get the follow features:

    - Set maximal list: In this list all available measurement values and all 9 asset lines are pictured.
    - Set default list: In this list all available measurement values and 2 asset lines are pictured.

5. Set small list: In this list the general measurement values are pictured.



8.4. Extra menu: Overview

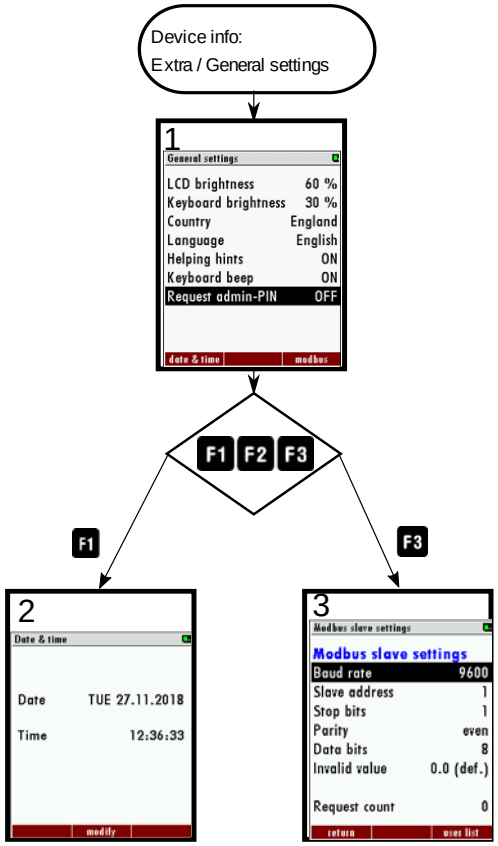


- General settings
- Measurement configuration
- Measurement cycle config.
- Analog output configuration
- Alarm output configuration
- Adjustment menu
- Default settings
- Content SD card
- Even viewer

General settings

Path: EXTRA/GENERAL SETTINGS

Structure:



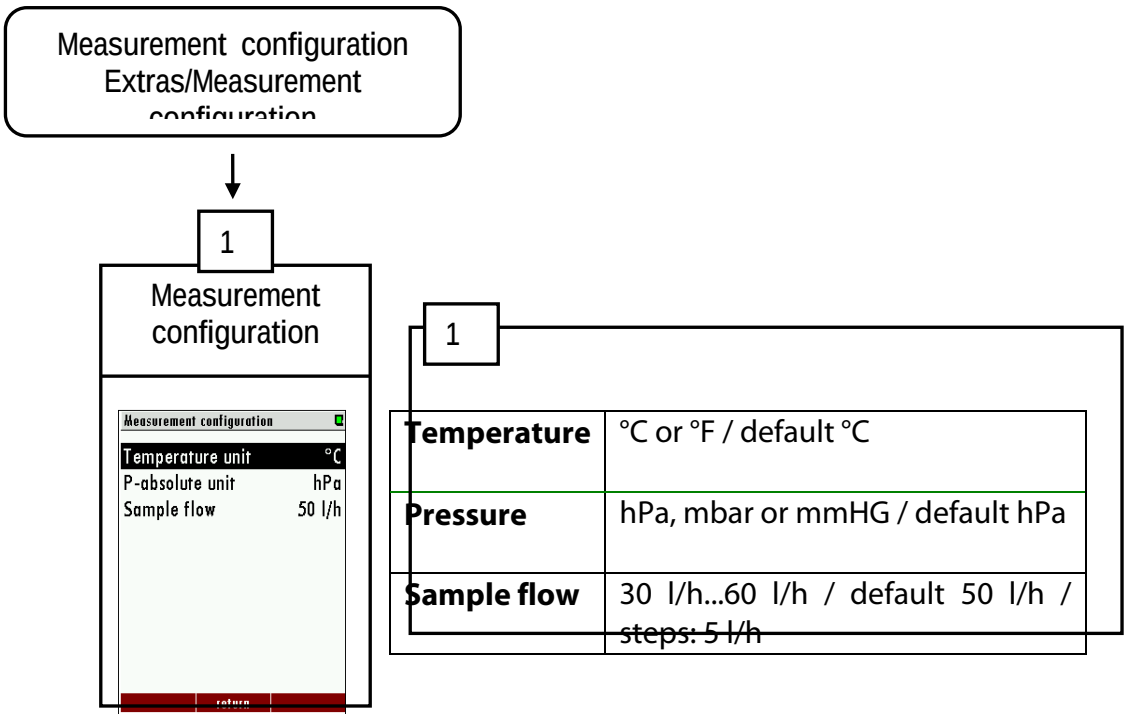
LCD brightness	10% until 100% / default 60% / 5% steps
Country	Diverse /default English
Language	Diverse / default English
Keyboard beep	***ON*** or ***OFF*** / default ***ON***
Request admin-PIN	***ON*** or ***OFF*** / default ***ON***
Service message	***ON*** or ***OFF*** / default ***ON***

3:	
Baud rate	9600 or 19600
Parity and stop bits	Even / 1 or None / 2
Slave address	0...238

Measurement configuration

Path: EXTRA/MEASUREMENT CONFIGURATION

Structure:



Temperature	°C or °F / default °C
Pressure	hPa, mbar or mmHG / default hPa
Sample flow	30 l/h...60 l/h / default 50 l/h / steps: 5 l/h

Measurement cycle config.
See chapter 7.10.

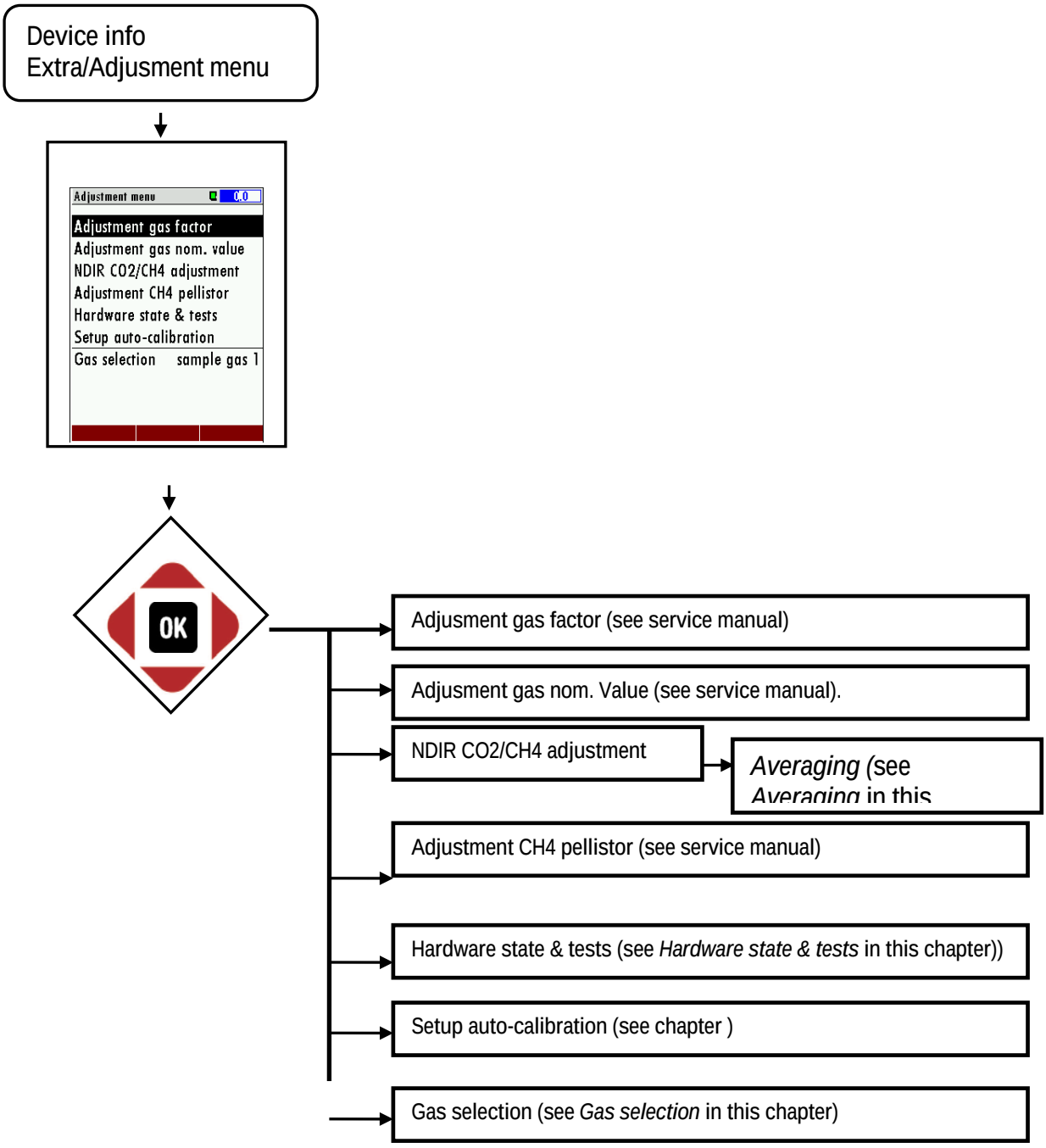
Analog output configuration
See chapter 7.6.

Alarm output configuration
See chapter 7.3.

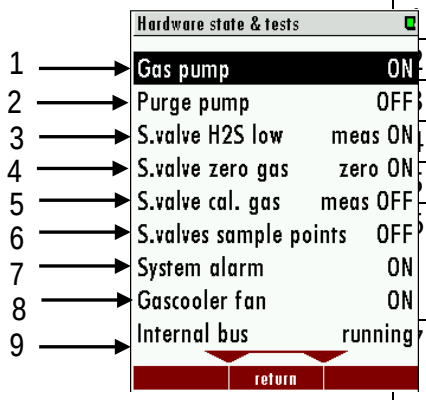
Adjustment menu

Path: EXTRAS/ADJUSTMENT MENU

Structure:

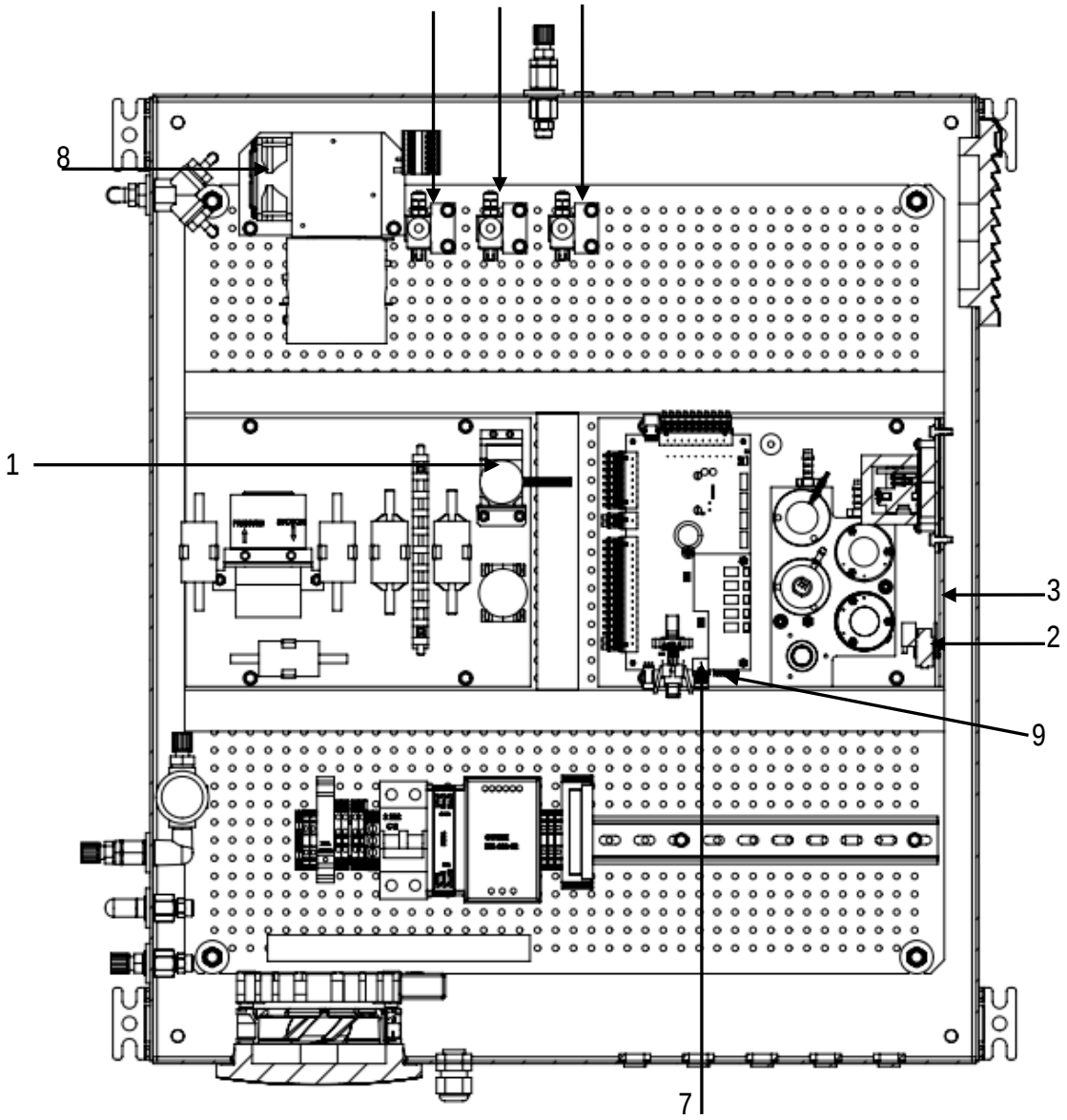


Hardware state & tests:



#	Hardware	Settings
	Gas pump	**ON** or **OFF**
	Purge pump (optional)	**ON** or **OFF**
	Solenoid valve H2S low (optional)	**ON** or **OFF**
	Solenoid valve zero gas	**ON** or **OFF**
	Solenoid valve cal. Gas	**ON** or **OFF**
	Solenoid valve sample points	**ON** or **OFF** able to skip to the next one
	System alarm	**ON (NO)** or **OFF (NC)**
8	Gascooler fan	**ON** or **OFF**
9	Internal bus	**RUNNING** or **QUIET**

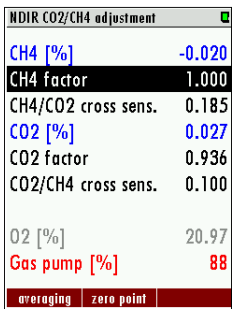
5 4 6



Adjustment of the average-time for CO2/CH4 NDIR-bench (optional)

If the analyser is equipped with a CO2/CH4 NDIR-bench, the user has the possibility to set the average time.

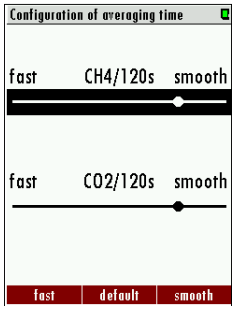
1. Open the path: Extras/ Adjustment menu/ NDIR CO2/CH4 adjustment.



2. Open “averaging” with the ***F1***-key.

3. Configuration of averaging time: In this menu is able to set the averaging time with the ***left/ right arrow keys*** and the ***F1*** or ***F3*** keys.

The fast averaging time : 20 s
The smooth averaging time : 240 s



NOTE

Effect of the average time

A smooth averaging time smooths the measurement signal but increase the response time of the measurement signal.

Default configuration

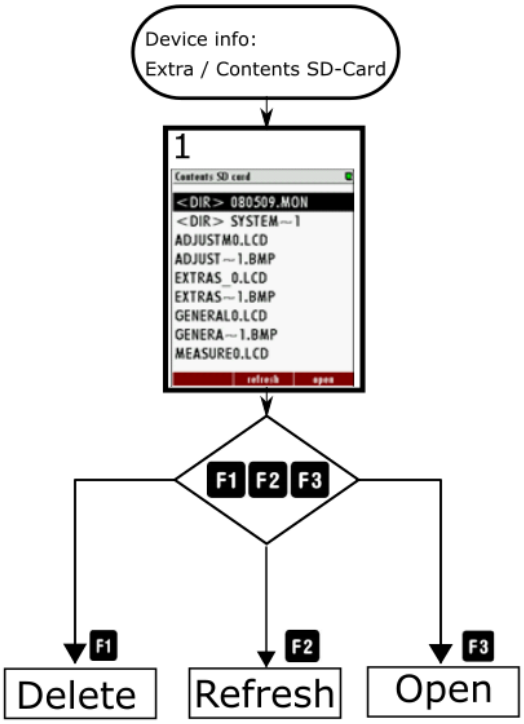
Use the menu MEASUREMENT -> EXTRAS –> DEFAULT SETTINGS for the default configuration:

DEFAULT CONFIGURATION				
Parameter	**Analog output 4-20mA**		**Alarm output relay contact**	
	4mA	**20mA**	**open**	
CH4 [%]	0	100	less than	50
O2 [%]	0	25	more than	1
H2S [ppm]	0	1000	more than	300
CO2 [%]	0	100	more than	50
H2 [ppm]	0	500	more than	500
	0	500	more than	500
CH4 ambient [%]	0	5	more than	1
CH4 ambient [%LEL]	0	100	more than	20
Temperature sensor [°C]	0	50	more than	50
Fan rotation [rpm]	0	2000	less than	1200
Pump rotation [rpm]	0	5000	less than	1500
Sample flow [l/hr]	0	60	less than	30
Temperature cooler [°C]	0	20	more than	10
Net calorific value [MJ/kg]	0	40	less than	30
Gross calorific value [MJ/kg]	0	40	less than	30
Net calorific value [MJ/m3]	0	40	less than	30
Gross calorific value [MJ/m3]	0	40	less than	30

Contents SD card

Path: EXTRAS/ CONTENT SD CARD

Structure:



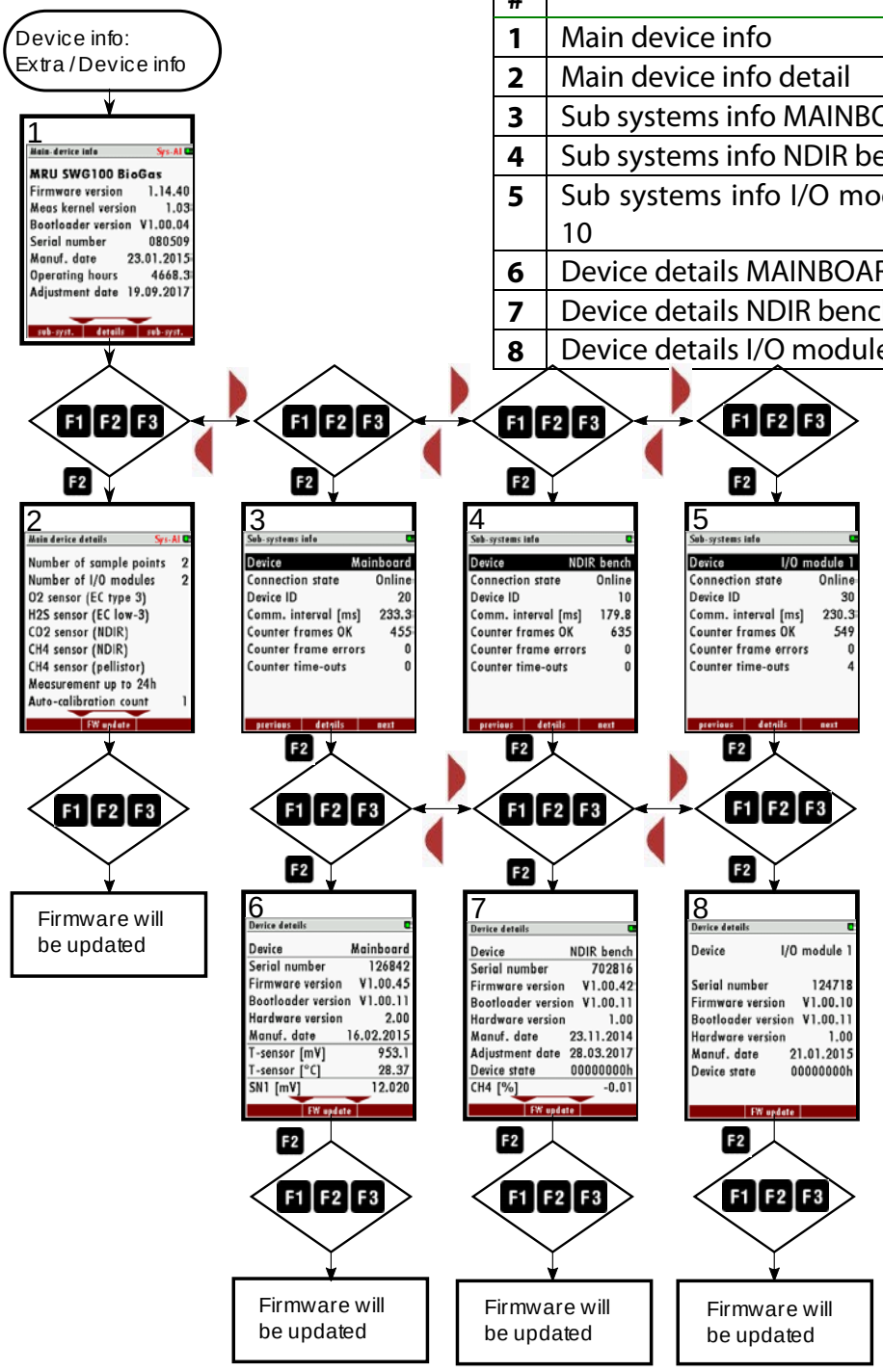
1	Overview of the stored datas on the SD card.
2	Skip the cursor on the first position.
3	Open the file. User can view the stored screenshots.
4	Open the file. User can view the stored screenshots.

Device info

Path: EXTRAS/DEVICE INFO

Structure:

#	
1	Main device info
2	Main device info detail
3	Sub systems info MAINBOARD
4	Sub systems info NDIR bench
5	Sub systems info I/O module 1-max. 10
6	Device details MAINBOARD
7	Device details NDIR bench
8	Device details I/O module 1-max. 10

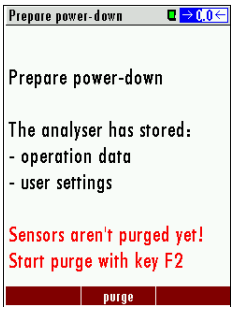


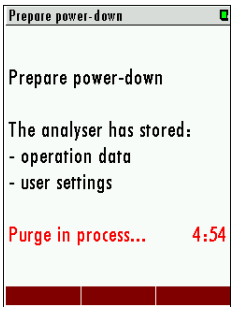
Power-Down of analyzer

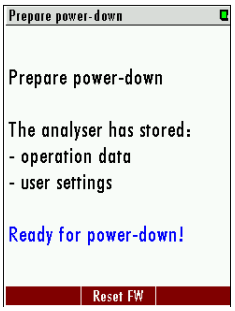
Before the analyzer is disconnected from mains, it should be prepared for the Power-Down, because

- operational data should be stored
- eventually changed user settings should be stored
- the sensors should be purged with fresh air

Press the ***OFF*** key in any menu in order to prepare the analyzer for the Power-Down. The analyzer will store operational data and user settings and will offer to start a sensor purge cycle:







Start the purge cycle with the ***F2*** key (PIN code requested). The analyzer will purge the sensors with fresh air and will indicate a count-down. Then the analyzer will be ready for power-down.

Now it's not possible to continue directly the ordinary measurement process. Only power-down by disconnecting mains or a software restart by pressing ***F2***='Reset FW' is offered.

Note:
You also may enter this menu by pressing the ***OFF*** key and leave it by pressing the ESC key (without starting the purge cycle) , when you just want to store operational data and user settings.

Backup/restore all individual user-settings

It's a quite amount of work to configure the analyzer, especially when the analyzer has several sample points, several IO-modules and when the analog outputs are used. Therefore, we recommend to back up all your found settings on the SD card.

In order to back up the settings, do the following:

- use the menu EXTRAS.
- insert an SD card (without write-protection)
- press the menu key and select the function 'Export user settings'

The analyzer will write the backup file 'settings.usr' to the SD card.

In order to restore the settings, do the following:

- use the menu EXTRAS.

- insert an SD card containing the backup file 'settings.usr'
- press the menu key and select the function 'Import user settings'

The analyzer will replace the current settings by the settings from the backup file.

8.5. Update the firmware

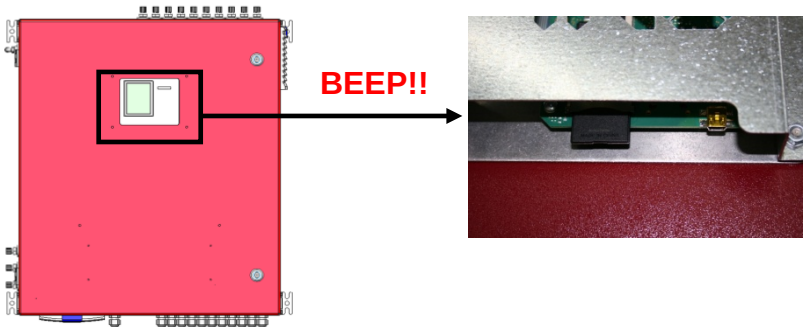
The analyzer and different installed options can be updated if it is necessary. Following options can be updated:

- The firmware for the analyzer.
- The firmware for the pcb- mainboard.
- The firmware for the NDIR-bench.
- The firmware for the installed I/O modules.

General steps for the firmware-update

1. Copy the actual firmware for the analyzer or the firmware from the option on a SD-card. Be sure, that the firmware is in the mean root of the SD-card. All firmware updates have the ending “fwb”.

2. Put the SD-card on the card slot on the operation unit. The card slot can be found inside the door (see sketch below).

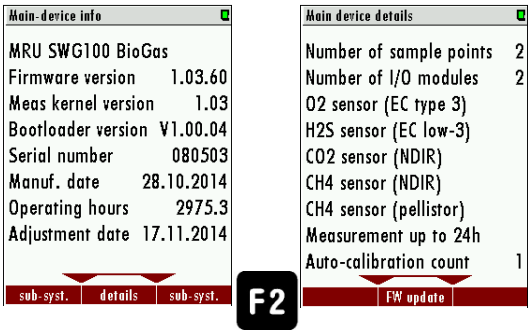


3. If the SD-card is recognized, the analyzer will make a noise.

4. Open the path: EXTRA/DEVICE INFO. Dependent from the firmware update it can be necessary to open the different submenus.

Update the analyzer (Firmware-Updates with filename “1106.fwb”)

1. Open the path: EXTRA/DEVICE INFO

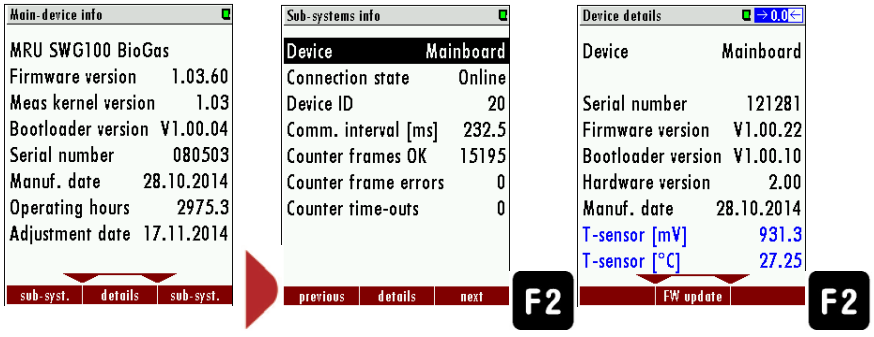


2. Press ***F2 = details*** to open the details for the main device menu.

3. Press ***F2 = FW update***. The analyzer will start the update from the SD-card.

Update the pcb-mainboard (Firmware-Update with filename “1106mb.fwb”)

1. Open the path: EXTRA/DEVICE INFO



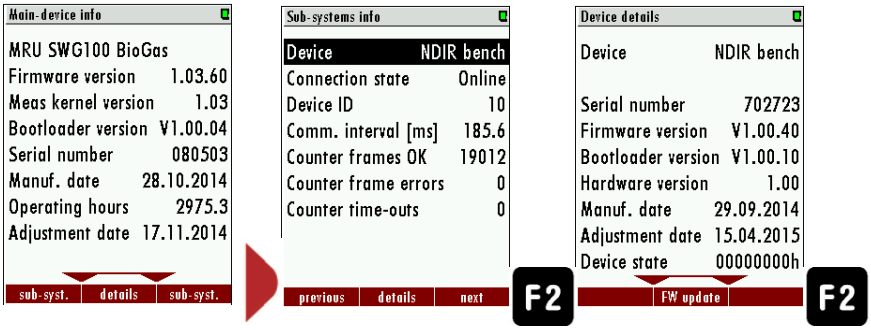
2. Press ***F3 = sub.syst***. to open the menu “SUB SYSTEMS INFO”.

3. Press ***F2 = details***, to open the details from the mainboard. Be sure, that the device is “Mainboard” to update the pcb-mainboard.

4. The Update will start from the SD-card, if a firmware with the filename “1106mb.fwb” is at the SD-card.

Update the NDIR-bench (Firmware-Update with filename “1106ndir.fwb”)

1. Open the path: EXTRA/DEVICE INFO



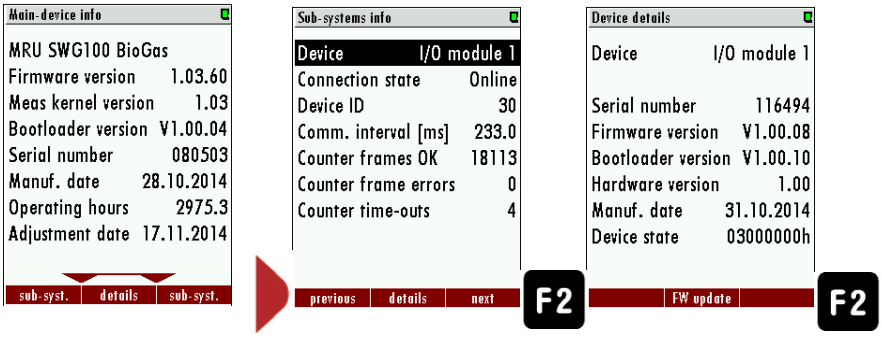
2. Press ***F3 = sub.syst***. to open the menu "SUB SYSTEMS INFO".

3. Press ***F2 = details***, to open the details from the NDIR bench. Be sure, that the device is "NDIR bench" to update the NDIR-bench.

4. The Update will start from the SD-card, if a firmware with the filename "1106ndir.fwb" is at the SD-card.

Update the IO modules (Firmware-Update with filename "1106iom.fwb")

1. Open the path: EXTRA/DEVICE INFO



2. Press ***F3 = sub.syst***. to open the menu "SUB SYSTEMS INFO".

3. Press ***F2 = details***, to open the details from the I/O module. Be sure, that the device is "Mainboard" to update the I/O module.

4. The Update will start from the SD-card, if a firmware with the filename "1106iom.fwb" is at the SD-card.

9 Service and maintenance

For a reliable function and high measurement quality it is necessary to inspect and service the analyser regularly.

Besides the regular routine control by the operator (see chapter 9.1.-) MRU recommends a regular bi-annual maintenance at a minimum, which must carry by a qualified technician.

⚠ DANGER

Apply personality safety equipment, against high H_2S concentrations before open the device.

Under special conditions the device can accumulate with toxic gases.

- ► Measure the atmosphere, around the device, before opening it.
- ► After the opening of the device, ventilate sufficiently.

9.1. Preparing and information about the maintenance

It is important to power off the mains supply before the maintenance can be started. Even if the main fuse is powered off, dangerous voltage is present.
It can be required to cut off the electric supply and save this from an accidental switch-on.
For maintenance work on the gas analyser, please take care that dangerous and toxic gases may leak. The gas supply must be cut-off.
It is important to comply with all country and local codes.

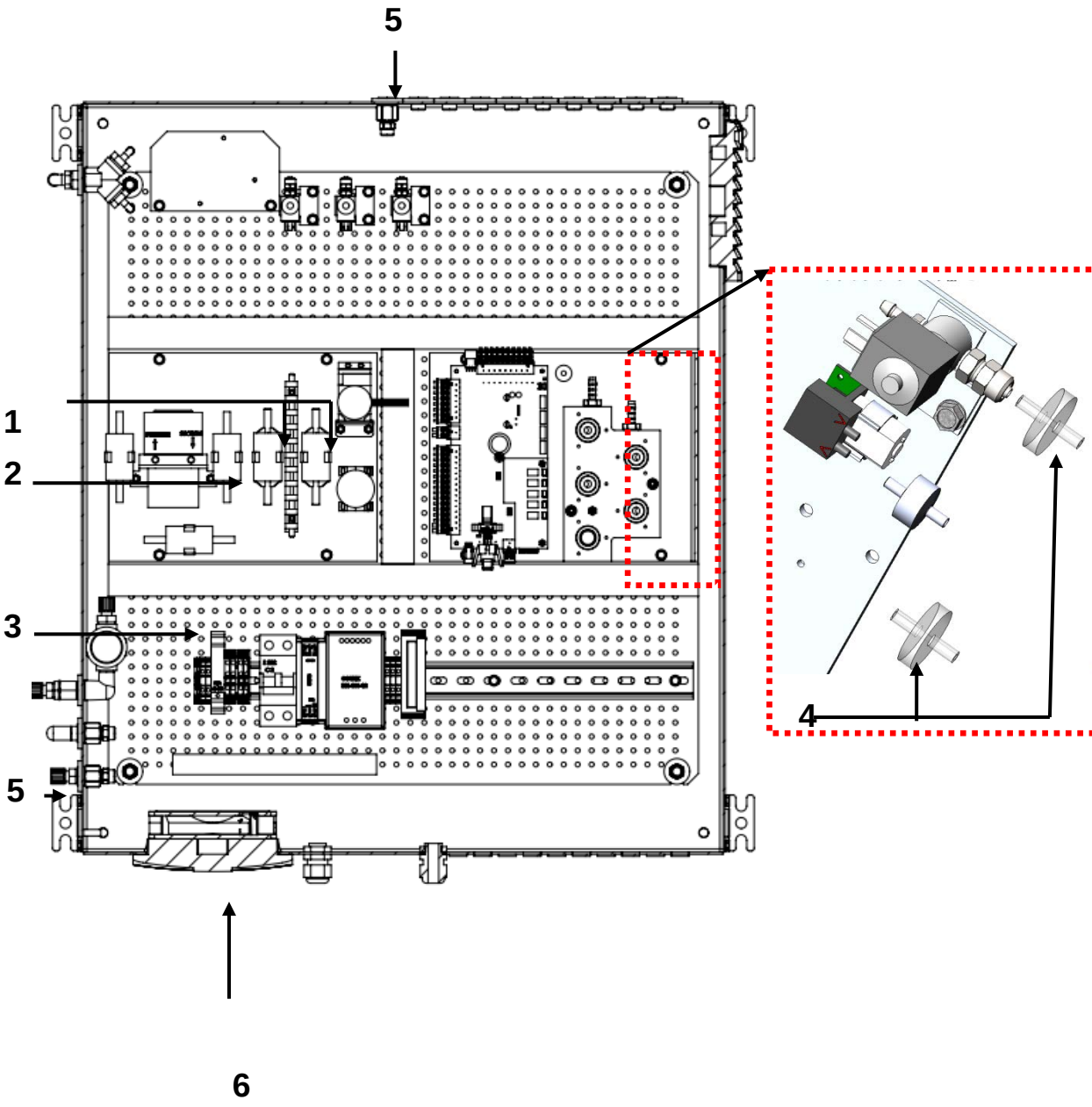
9.2. Regular maintenance work by the operator

All inspections- and maintenance works are dependent from individual operating conditions, and site. The specified intervals below are only benchmarks.

Review	Recommended intervals	Actions
Moisture in the analyzer.	Weekly	Remove the moisture. Call vendor specialist.
Dirt and depositions in analyzer.	Weekly	Remove the dirt, prevent further penetration of dirt. Inform vendor.
Dirt and moisture in the filter-unit	Weekly	Exchange the filter- unit.
Testing the gas pipes of leakage with a “Gas Leak Detector”.	Weekly	Tighten or exchange the gas pipe if it is necessary
Inspecting the conditions of the gas filters	Every month	Exchange if is necessary
Inspecting the conditions of the Filter mats	Weekly	Exchange if necessary

In the follow chapters there will be introduced some service parts, which are important for the reliable operation. These parts are independent from the regular checks and must be replaced in a minimum interval of minimum 6 months.

9.3. Position and overview of the service-parts



Description of the different service parts, please see next page.

Content of the service-set (offer-number: 66174)
Single components can be offered under their article number directly.

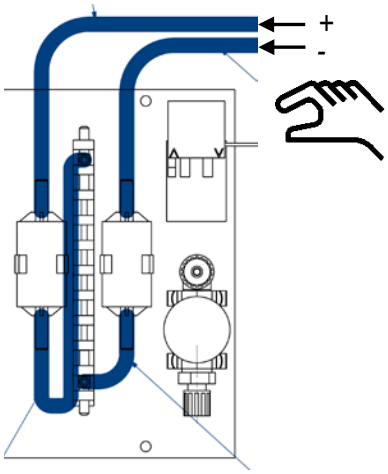
#	Image	name	Interval	Quantity	Offer-number
1		Acid-gas filter	New state: purple beads Used: white beads Life time: 2-6 month, dependent of gas concentrations. Visual inspection is necessary.	2 pieces	56795
2		Dust- and particle filter	New state: white Used: dark/black Life time: 6 month, dependent of the dust- and dirt concentration. Visual inspection is necessary.	1 piece	65533
3		Dust- and particle filter (fine filter)	New state: white Used: dark/black Life time: 12 month, dependent of the dust- and dirt concentration. Visual inspection is necessary.	1 piece	66088
4		PTFE-filer	New state: white Must be changed, if the PTFE filter is blocked. The analyzer shows the warning ***"Gas flow is too low"***.	2 pieces	51513
5		Sintered filter	New state: sintered surface Must be changed, if the PTFE filter is blocked. The analyzer shows the warning ***"Gas flow is too low"***.	2 pieces	65988
6		Filter mat for the fan-unit	New state: white Used: dark/black, dependent of the dust- and dirt concentration. Visual inspection is necessary.	1 UP (5 pieces)	60320

Position 1: Acid-gas filter (#56795)

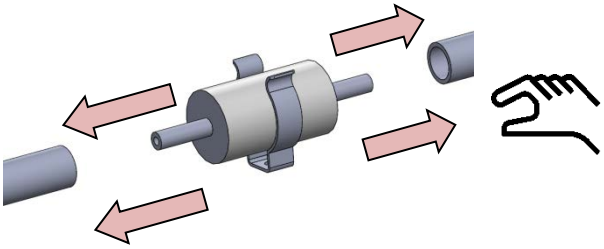
Required materials 2x Acid gas filter (#56795), contained in the service- set.
Required tools: Needle-nose pliers.
Exchange interval: Exchange necessary, if filter turns from purple to white.

Mounting direction: Irrelevant

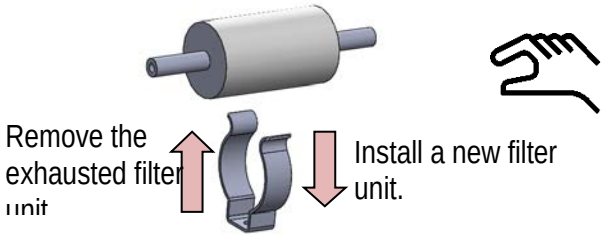
Steps:

1. Remove exhausted acid gas filter from the clips. 2. Pull the Viton tubes from the exhausted acid gas filter. If it is necessary, use needle- nose pliers. 3. Plug the Viton tubes on the new acid gas filters. Be sure, that the tubing is correct. (The single tubes are signed with "+" and "-", see sketch on the right side.)	

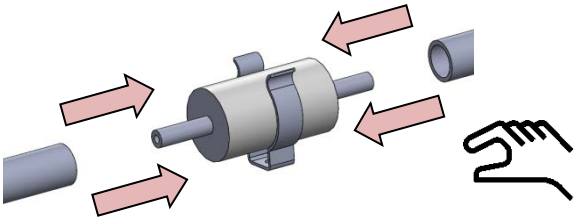
Steps:



Pull the Viton-tubes from the filter unit. If it is necessary, pliers can be used to solve the tubes from the filter unit.



Remove the exhausted filter unit from the clip.

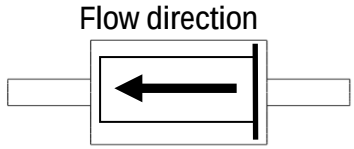


Plug the Viton tubes on the filter unit. Push the filter unit on the clip.

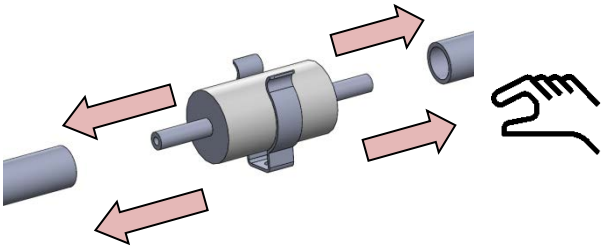
Position 2 and 3: Dust- and particle filter (#65533 and #66088)

Required materials: Dust- and particle filter (#65533 and #66088) contained in the service set.
Required tools: needle-nose pliers.
Exchange interval: Exchange necessary, if the filter gets dark or black.

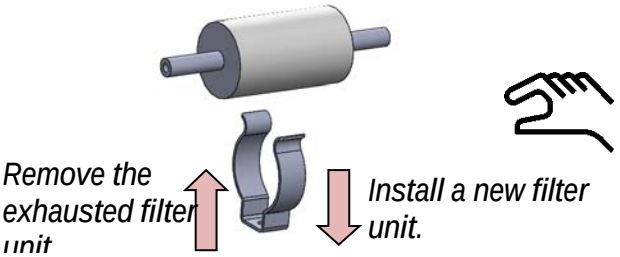
Mounting direction:



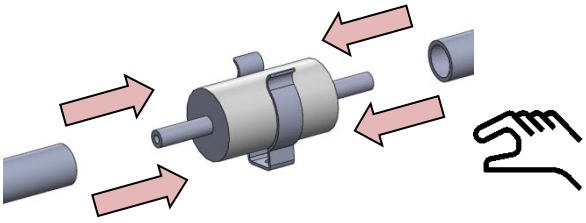
Steps:



Pull the Viton-tubes from the filter unit with the hand. If it is necessary, pliers can be used to solve the tubes from the filter unit.



Remove the exhausted filter unit from the clip.



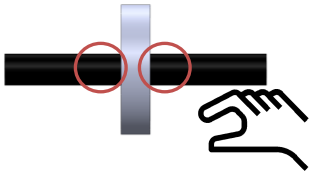
Plug the viton tubes on the filter unit. Push the filter unit on the clip.

Position 4: PTFE Filter (#51513)

Required materials: PTFE filter (#51513) contained in the service set.
Required tools: needle-nose pliers.
Exchange interval: Exchange necessary, if gas flow is too low.

Mounting direction: Irrelevant

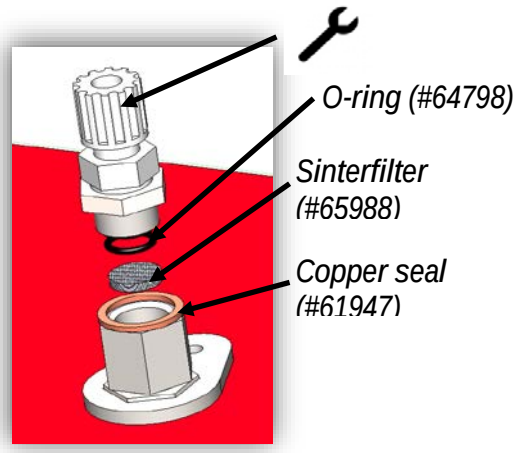
Steps:

Pull the exhausted filter-unit from the viton tube and exchange it with a new one. If it necessary, the tube can be solved from the tube with a needle-nose pliers.	

Position 5: Sintered filters (#65988)

Required materials: Sintered filters (65988), contained in the service-set.
Required tools: Spanner (range:17)
Exchange interval: Every 2 month, dependent from the dust- and pollution load.

Steps:

1. Remove the gas tube. Be sure, that no process gas emits in the environment. The upper part from the nozzle can be removed with a spanner (range 17). 2. Inside of the nozzle is a sintered filter tablet with an O-ring. Remove the exhausted sintered filter tablet and the O-ring and exchange both parts through a new one. The compensation parts can be found in the service-set. 3. The gas tube can now connect with the nozzle again.	

Position 6: Filter mats (#60320)

Required materials: 2x filter mats (#60320) contained in the service-set.
Exchange interval: Exchange necessary, when the fan speed is reduced.

Steps:

Open the filter-unit by pulling the blue lash.	
Replace the exhausted filter mat through a new one.	
Close the cover from the filter unit.	

9.4. Cleaning and decontamination

Outside of the Device:

- Clean the Device with a damp cloth.
- Avoid aggressive cleaning agents, as these can damage the surface.

Inside the Device:

- Power down the system before cleaning the inside.
- Water or other cleaning fluids must not come into contact with the electronics, electrical contacts or electrical components.
- Use a vacuum cleaner to clean electrical components.
- Other than electrical components can be cleaned with a damp cloth.
- Avoid aggressive cleaning agents.

9.5. Troubleshooting

Error	Possible causes	Solutions
Display does not work.	- System is not power-up.	- connect main power supply. - power up automatic fuse. - contact customer support.
Analyzer powers down by itself.	- The fan is defective. - Filter mat from the fan is clogged. - The protection switch has been triggered.	- exchange the fan. - exchange the filter mat. - Internal short circuit. Contact an electrician to determine cause of defect.
Gas cooler unit does not work.	- The device is not ready, after a new start of the analyzer. - The ambient temperature is too hot. - The gas cooler unit is defective.	- wait until the gas cooler-unit is ready. - be sure, that ambient temperature is within operating range. -Contact customer support.

10 Technical specification

Allgemein		**General**
Deutsch	**Angabe**	**English**
Betriebstemperatur(ohne Frostschutzheizung)	+5°C ... +45 °C / 41 °F ... 113 °F	Operating temperature (w/o heating)
Betriebstemperatur (mit optionaler Frostschutzheizung)	-10 °C ... +45°C / 14 °F ... 113 °F	Operating temperature (with internal heating, option)
Rel. Luftfeuchtigkeit bei Betrieb, nicht-kondensierend	95%	Rel. Humidity, non-condensing
Lagertemperatur	-20°C ... +50°C / -4°F ... 122°F	Storage Temperature
Schutzart	IP54	Protection Class
Aufstellbedingungen	Ausschließlich für den Einsatz in Innenräumen. Geschützt vor direkter Sonneneinstrahlung. do not expose to direct sun light. Indoor use.	Installation Requirements
Aufstellhöhe	<2000m	Altitude
Verschmutzungsgrad	2	Pollution Degree
Akku intern, Pufferzeit für Sensor Bias	NiMH, 3 Monate / 3 months	Internal Battery Pack, buffer time for sensor bias
Stromversorgung	120-230 Vac, or120 Vac, 50/60HZ, 300 VA	Power supply
Überspannungskategorie	2	Overvoltage Category
Lautstärke	<70dB(A)	Sound level
Gewicht, typisch mit Sensoren, Gaskühler	25 kg / 55 lbs	Weight, typically incl sensors and gas cooler unit
Maße	600x700x210 mm 23.6x 27.6 x8.3 in	Size
Gehäusematerial	Aluminium/Aluminum	Housing material
Stoßfestigkeitsgrad	IK07	Protection level
max. Unterdruckbereich der Gaspumpe	300 hPa	Max suction range gas pump
typischer Gasdurchfluss	50 l/h	gas flow typ.

Schnittstellen		**Interfaces**
Deutsch	**Angabe**	**English**
Benutzerschittstelle	**Angabe**	**User Interface**
Anzeigetyp	3,5*TFT*	Display type
Anzahl gleichzeitig angezeigter Messwerte	6	Number of siultaneously displayed values
Tastatur mit Anzahl Tasten	12	Keyboard with qty of keys
Elektrische Aus-/Eingänge		**Electrical I/O**
Serielle Schnittstelle	RS485	Serial interface
Protokoll	Modbus RTU	Protocol
Typ Analogausgang	4 ... 20 mA	Type of analog output
Anzahl Ausgangskanäle pro I/O-Modul (optional)	4	Number of output channels per I/O module (optional)
Typ Analogeingang	4 ... 20 mA	Type of analog input
Anzahl Eingangskanäle pro I/O - Modul (optional)	4	Number of input channels per I/O module (optional)
Anzahl Alarmausgänge pro I/O - Modul (über Relais)	2	Number of alarm ouput signal via relays
Spezifikation Alarmausgang I/O Modul (Relais)	max. 24V≃ max. 1A≃	Alarm circuit rating of I/O module (Relay)
maximal mögliche Anzahl I/O - Module	10	Max number of I/O modules to be equipped
Systemalarm-Ausgang	Relaiskontakt relay contact	system alarm output
Spezifikation des Systemalarm-Ausgangs	max. 24V≃ max. 1A≃	system alarm rating (Relay)
Gas Ein- und Ausgänge		**Gas input and ouput**
Anzahl <u>parallel</u> zu überwachender Messstellen	1	Number of <u>simultaneously</u> monitored sampling points
Anzahl Messgaseingänge (serielle Umschaltung)	10	Number of sampling points (serial sampling point switching)

Gehäuseverschraubung Messgaseingang	G1/8	Screw joint sampling point
Gasausgang	G1/8	gas output
Frischluft (für Nullpunktnahme)	G1/8	Fresh air (for zeroing)
Kalibriergas	optional, G1/8	Calibration gas

10.1. Technical specification: Electrochemical sensors

Deutsch	Angaben zur Messgenauigkeit	English
Elektrochemischer Sensor	**O2 Long Life**	**Electrochemical Sensor**
Messbereich	0 .. 21 %	Measuring Range
Auflösung	0,01 %	Resolution
Genauigkeit abs.	± 0,2 Vol%	Abs. Accuracy
Ansprechzeit T90	< 20s	Response Time T90
Jahre erwartete Lebensdauer an Luft	2	Years expected lifetime (@air)
Elektrochemischer Sensor	**H2S low200**	**Electrochemical Sensor**
Messbereich	0-200 ppm	Measuring Range
Auflösung	1 ppm	Resolution
Überlastbereich	< 1000 ppm	Overload Range
Genauigkeit abs.	±5 ppm / 5% (0 … 200 ppm) 10% (> 200 ppm)	Abs. Accuracy
Ansprechzeit T90	< 40s	Response Time T90
Jahre erwartete Lebensdauer an Luft	2	Years expected lifetime (@air)
Elektrochemischer Sensor	**H2S high10.000**	**Electrochemical Sensor**
Messbereich	0-10000 ppm	Measuring Range
Auflösung	1 ppm	Resolution
Überlastbereich	< 50000 ppm	Overload Range
Genauigkeit abs.	± 50 ppm / 5% (0 … 10000 ppm) 10% (> 10000 ppm)	Abs. Accuracy
Ansprechzeit T90	< 90s	Response Time T90
Jahre erwartete Lebensdauer an Luft (abhängig von gewähltem Sensor)	2	Years expected lifetime (@air) (Depending on chosen sensor)
Elektrochemischer Sensor	**H2S low2000**	**Electrochemical Sensor**
Messbereich	0-2000 ppm	Measuring Range
Auflösung	1 ppm	Resolution
Überlastbereich	< 5000 ppm	Overload Range
Genauigkeit abs.	< 5% (0…500 ppm)	Abs. Accuracy

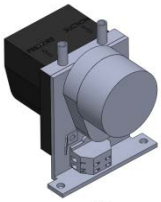
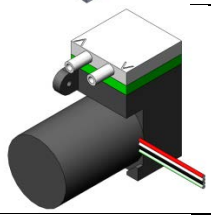
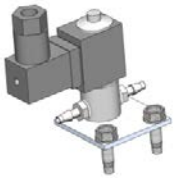
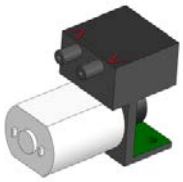
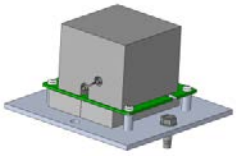
	<15% (501…2500 ppm)	
Ansprechzeit T90	< 35s	Response Time T90
Jahre erwartete Lebensdauer an Luft (abhängig von gewähltem Sensor)		Years expected lifetime (@air) (Depending on chosen sensor)
Elektrochemischer Sensor	**CO/4000**	**Electrochemical Sensor**
Messbereich	0-4000 ppm	Measuring Range
Auflösung	1 ppm	Resolution
Überlastbereich	< 10000 ppm	Overload Range
Genauigkeit abs.		Abs. Accuracy
Ansprechzeit T90	< 40s	Response Time T90
Jahre erwartete Lebensdauer an Luft	3	Years expected lifetime (@air) (Depending on chosen sensor)
Elektrochemischer Sensor	**H2/1000**	**Electrochemical Sensor**
Nominaler Messbereich	0-1000 ppm	Nom. Measuring Range
Überlastbereich	< 2000 ppm	Overload Range
Auflösung	1 ppm	Resolution
Genauigkeit absolut / vom Messwert	5% (0 … 1000 ppm) 10% (> 1000 ppm)	Accuracy abs. / reading
Ansprechzeit T90	< 50s	Response Time T90

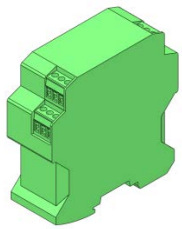
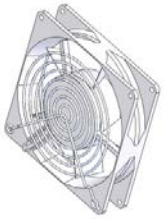
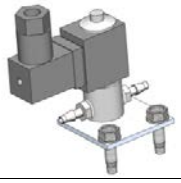
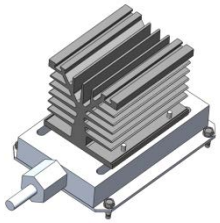
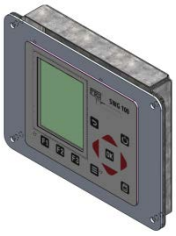
10.2. Technical specification: NDIR-benches

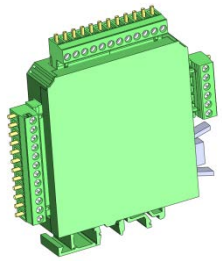
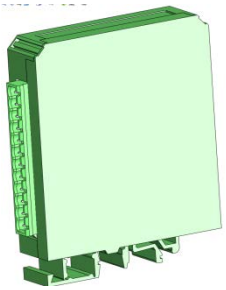
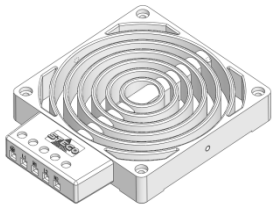
Nicht-dispersive Infrarotmessung (NDIR)	**CO_2/CH_4/100 %**	**Non-dispersive Infrared Measurement (NDIR)**
Nominaler Messbereich	0-100 Vol%	Nom. Measuring Range
Auflösung	0,01 Vol%	Resolution
Genauigkeit abs. /vom Messwert	± 0,3 Vol% / 3%	Accuracy abs./reading
Ansprechzeit T90	< 35 s	Response Time T90

11 APPENDIX

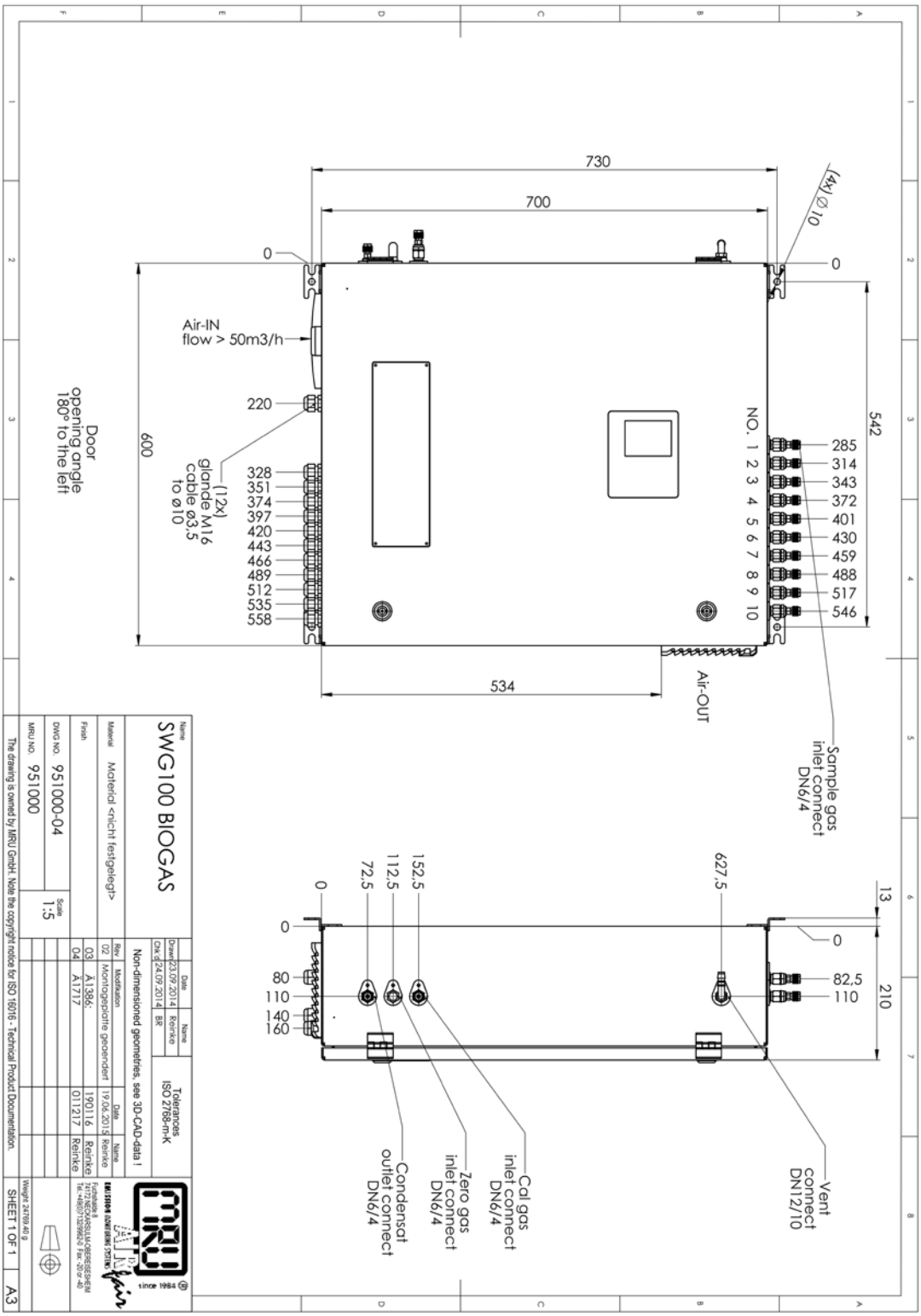
11.1. Spare parts list

Article	Description – Serial number
	*Gas cooler - #60467HT* *Required to dry the sample gas*
	*Condensate pump - #11230* *Required to drain the condensate*
	*Sample gas pump - #65032* *Used for sample gas pumping*
	*H2S solenoid valve - #65470* *Required for cut-off sample gas supply to H_2S_{low} sensor.*
	*H2S purge pump - #54150* *Required for air purging of H_2S_{low} sensor.*
	*NDIR CH_4/CO_2 - #65128* *Infrared measuring device of CH_4 and CO_2*
	*Power supply - #64845* *Input: 100-240 V~ / 47-63 Hz* *Output: 12 V ⎓ / 90 W*

	Power supply - #65325 Only for use in hazardous area Zone 2
	Axial fan - #65097 For ventilation of analyzer cabinet
	Solenoid valve - #65470 Used for sampling point switching.
	CxHy gas detector - #65469 Required for monitoring the CH4 concentration inside analyzer cabinet
	Heater - #65425 Used for freeze protection of analyzer cabinet Only for use in hazardous area Zone 2
	Display and operation unit #65133 Control unit for the user.

	***I/O-Module #65179 + #65430*** ***Used for analog output data transfer and sample point switching.*** -
	***I/O Module - #65179*** ***Used for analog output data transfer***
	***Heater #65734*** ***Used for freeze protection of analyzer cabinet installed in safe area***

11.2. Mechanical dimensions

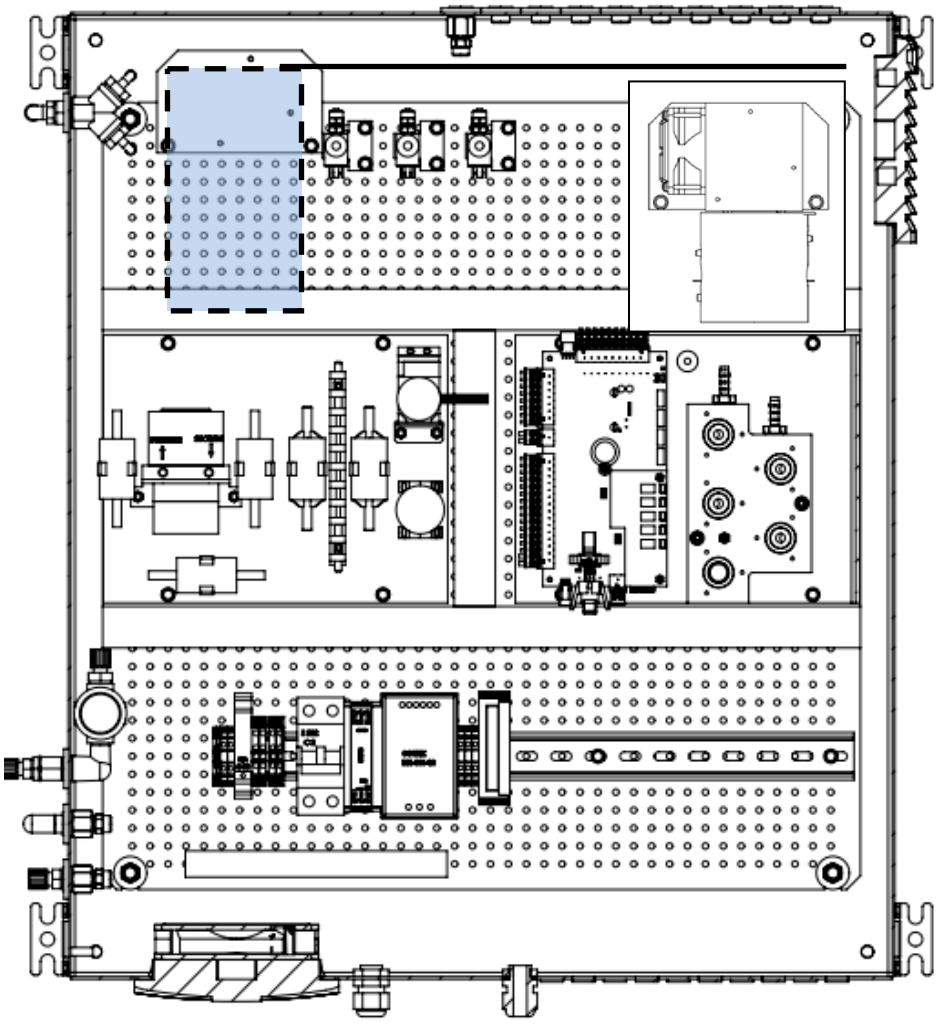


12 Purchase options of the analyzer

In this chapter the different available options are explained. The chapter shows:

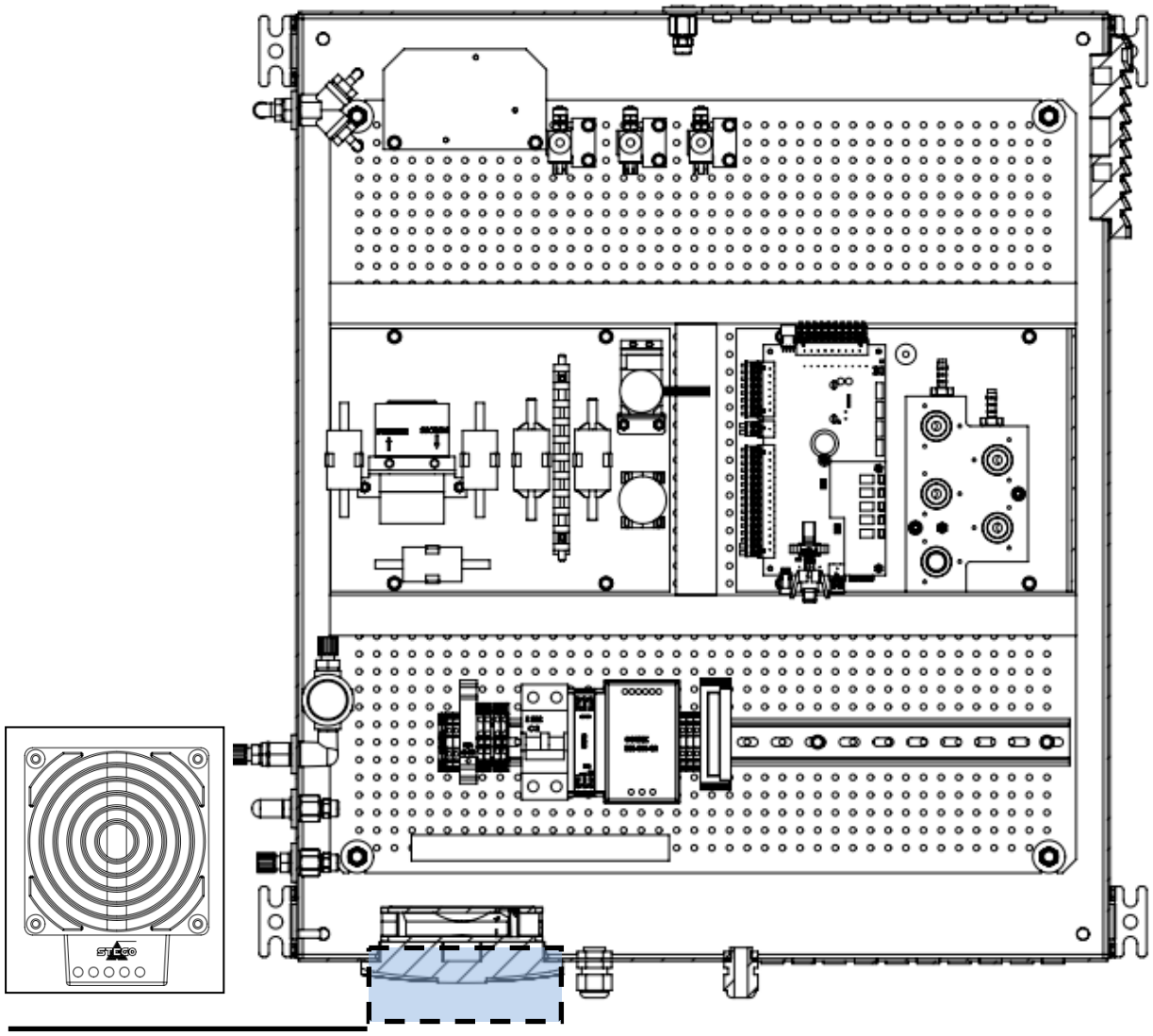
- The place of the options in the analyzer.
- The characteristic of the options.
- How to install the option if it is necessary.

12.1. Option: Electric sample gas cooler



The gas cooler-unit is equipped with a peltier-element. It is for drying the gas feed of a dew point of 5°C. it is recommended to use this option if the gas feed from the biogas has a high moisture content.
This option must be purchased separate, because it is not contain in the basic version.

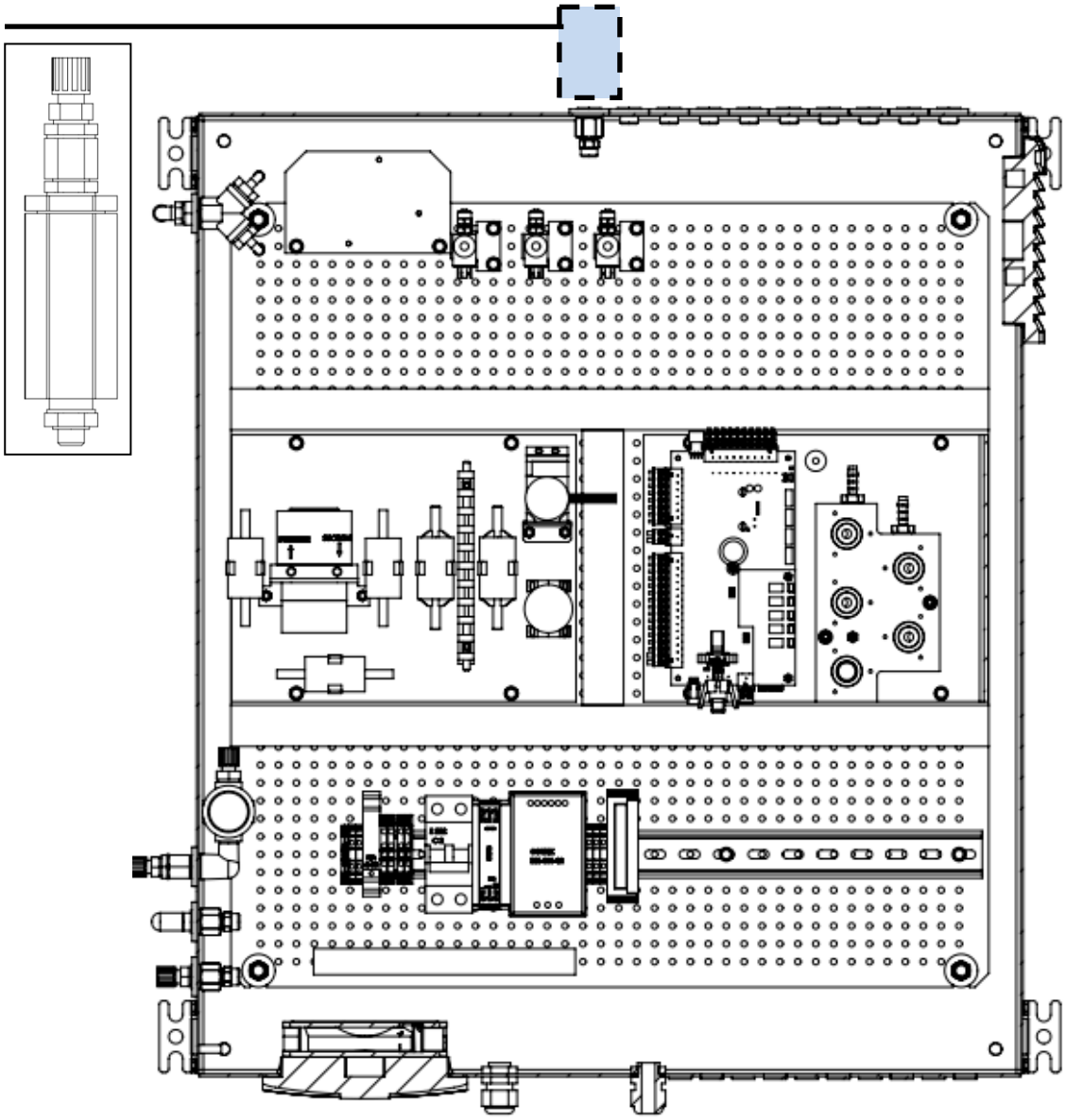
12.2. Option: Cabinet heater



The feature cabinet heater is necessary to operate the analyzer at low ambient air temperatures (-10°C … +5°C). The device starts heating, when the ambient temperature is fallen <18°C. The electrical power from the cabinet heater is 200 Watt.

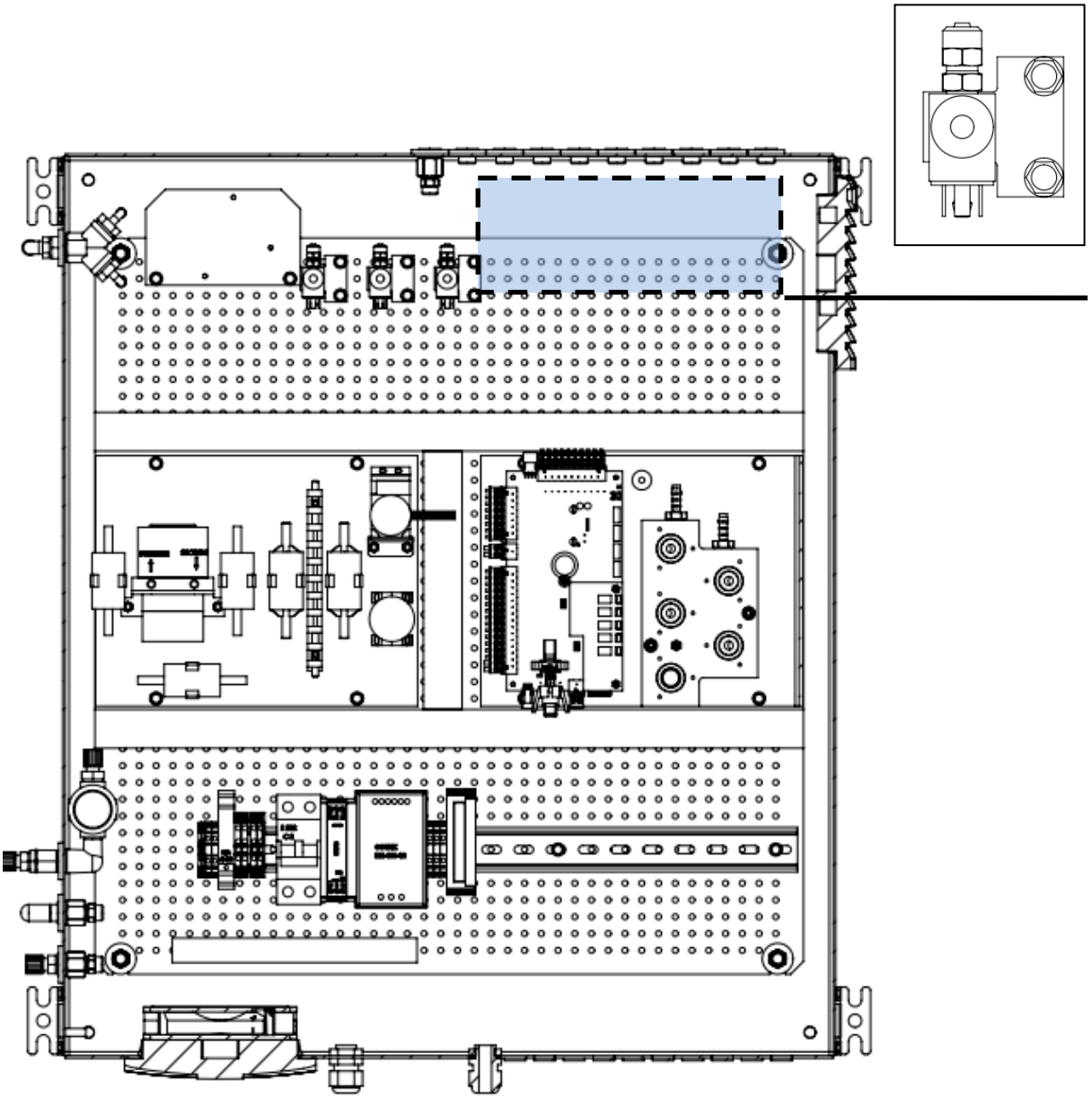
This option exists in a 230 V~ and an 115V~ variant.

12.3. Option: Flame arrester



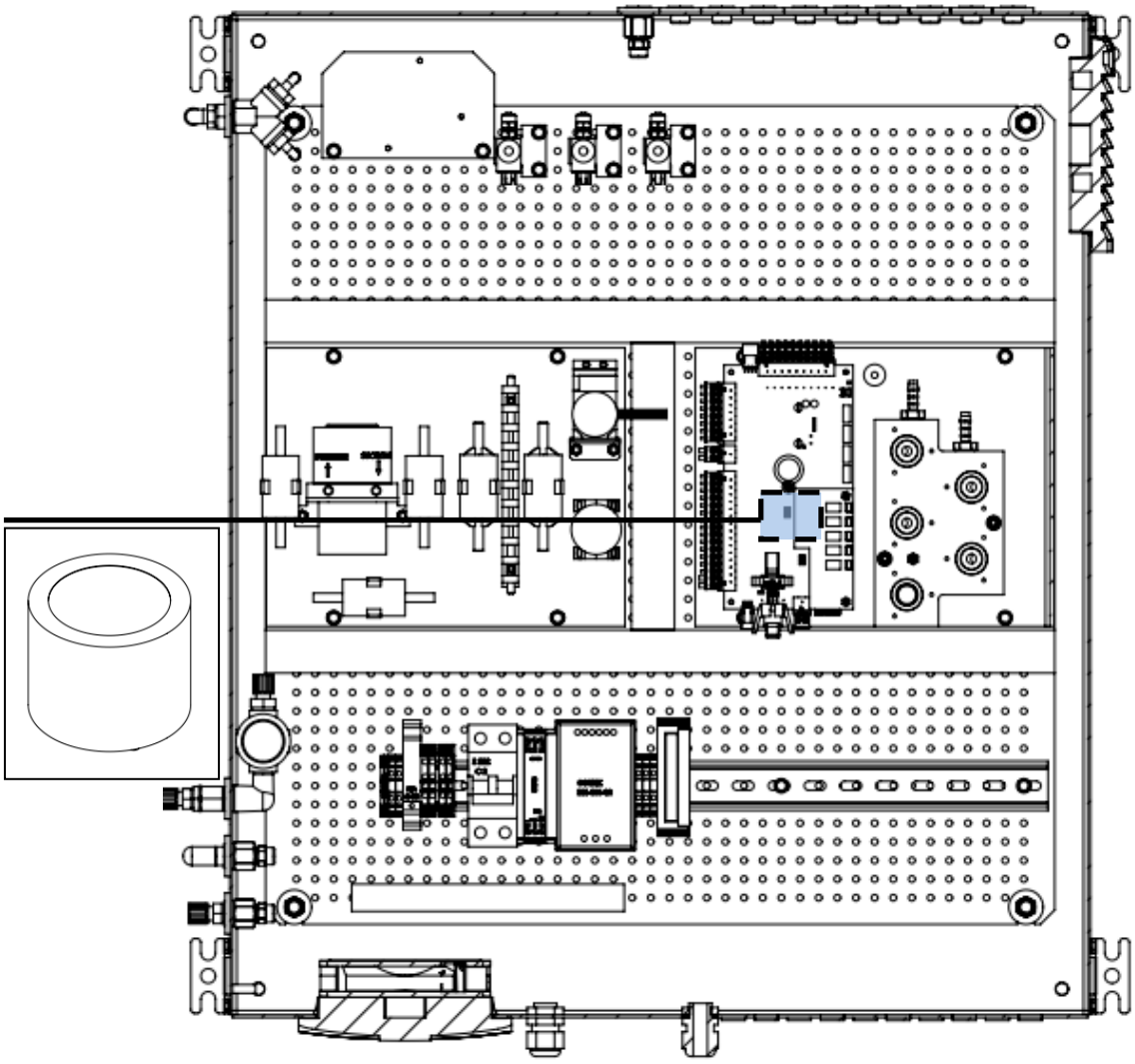
It can be necessary to install separate flame arresters at the sample gas inlets. The flame arrester, which can be purchase by MRU, has permission for ATEX areas zone 2 (DIN EN ISO 16852).

12.4. Option: Multiple sample point switching and monitoring (time sharing)



The analyser is by default equipped with one sample point (see market above). It can be offered with several sample points (max. 10). The sample points are not measured simultaneously but one at a time (round robin technique). The sample points can be set in the menu “Cycle configuration” (see chapter 6.10).

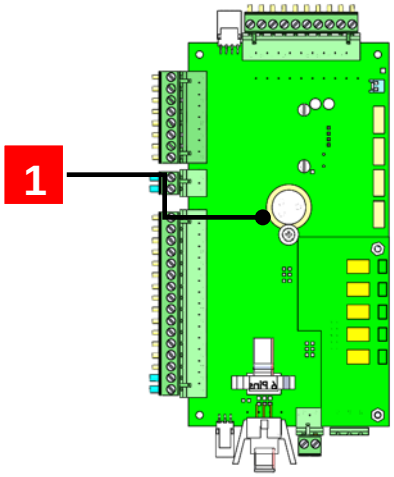
12.5. Option: Gas detector (%LEL CH4) to monitor air inside analyzer cabinet



With this option the CH4 concentration inside the analyser can be determined and monitored. This menu is only installed, if the gas detector is installed.

Konfiguration

- Power the system down.
- Unscrew the security screw on the exhausted LEL (low explosive level - combustible gases) sensor from inside cabinet (see sketch below.)

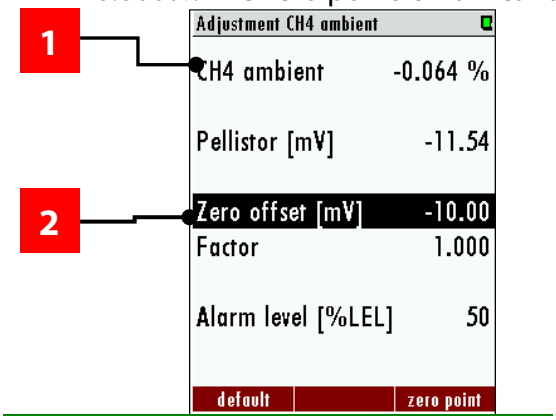


Reference:
1. LEL gas detector.

- Remove the exhausted LEL sensor from the pcb main board and replace it with a new one.
- Fix the new LEL sensor to the pcb main board with the security screw.
- Calibration of LEL inside cabinet gas detector:

Set the zero offset

- Be sure, that ***no combustible gas is in the ambient air***. For this use a gas sniffer, to detect eventually gases.
- In the "adjustment CH4 int. cabinet" menu can be found the points *Zero offset* and *CH4 ambient*. Select the *Zero offset* and press F3= zero point → CH_4 ambient shows 0.000%. The zero point is now calibrated.



Reference:
1. Zero offset [mV]: Turn on this point to calibrate the zero offset.

2. CH4 ambient: Shows the measured gas concentration from the analyser. If the CxHy ambient sensor is not calibrated, the CH4 ambient concentration is unequal to 0.000 %

Set the span point:

To calibrate the ***span point, a calibration gas cylinder and a special calibration cap is needed***. MRU recommends a calibration bottle with a CH4 concentration between 2-4 % in synthetic air. The concentration chart shows the CH4- concentration and the equivalent LEL concentrations.

Ideally, the calibration gas cylinder (can) is equipped with a pressure reducer and flow regulator. These gas cans have the advantage that they are small and easy to transport and do not build too much pressure. Gas pressure cans are available for different CH4 concentrations.

Figure: Pressure gas can with mounted pressure reducer.

Figure: #12397 LEL sensor calibration adapter.

Concentration chart

The CxHy ambient sensor is calibrated at LEL [%]. The chart below shows the CH4 concentration in Vol.% and the equivalent LEL [%].

	ATTENTION
	Do not use gas cylinders with a CH4 concentration above 5 % LEL. Concentration may destroy the sensor.

Installation of the LEL sensor calibration adapter

- Put the calibration cap on the CxHy ambient sensor. Tube the cap with a pressure gas can.

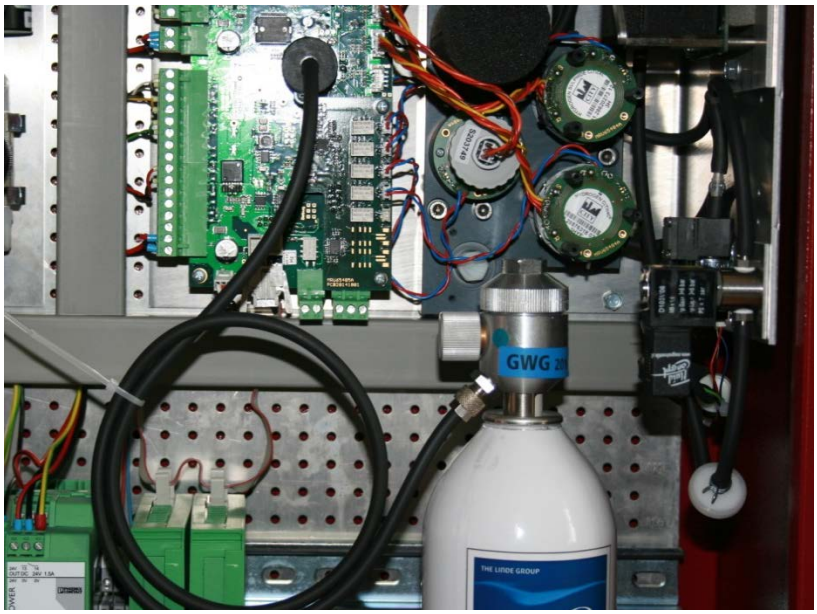
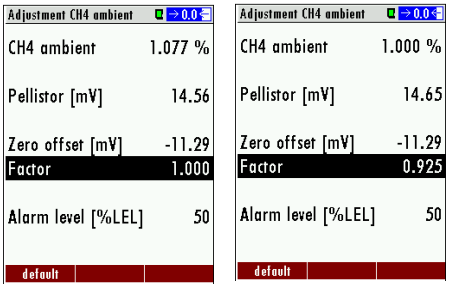


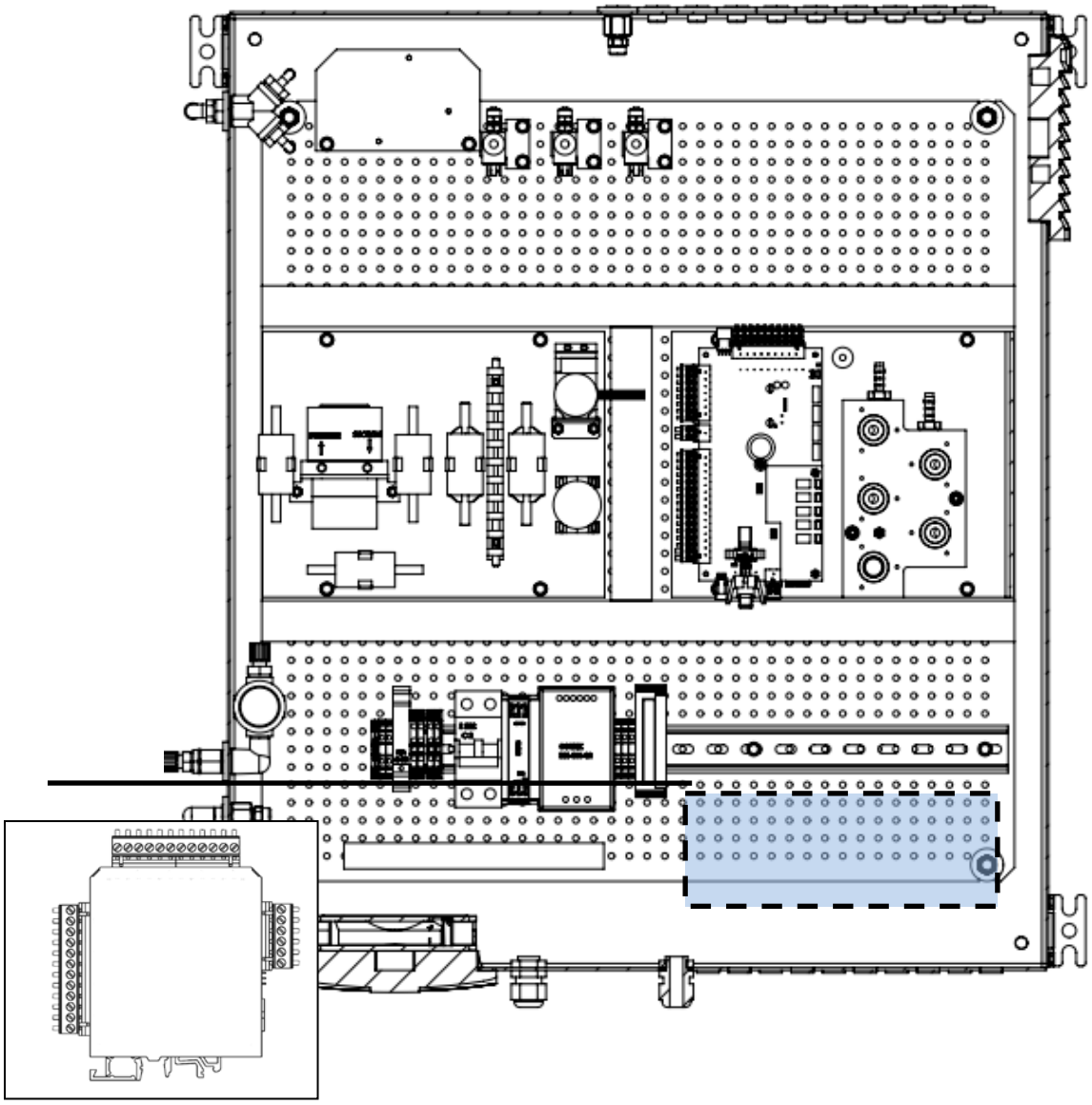
Figure: Installation of the calibration cap with a pressure gas can.

- Wait until the gas concentration in the menu is steady. Change the factor until the gas concentration in the display is equal to the calibration gas bottle concentration.
- Open the adjustment CH4 ambient menu, which can be found on the path: Extras/ Adjustment menu/Adjustment CH4 ambient. The follow screen will appear (see screenshot below.)
- The LEL cabinet gas detector (sensor) is calibrated now.



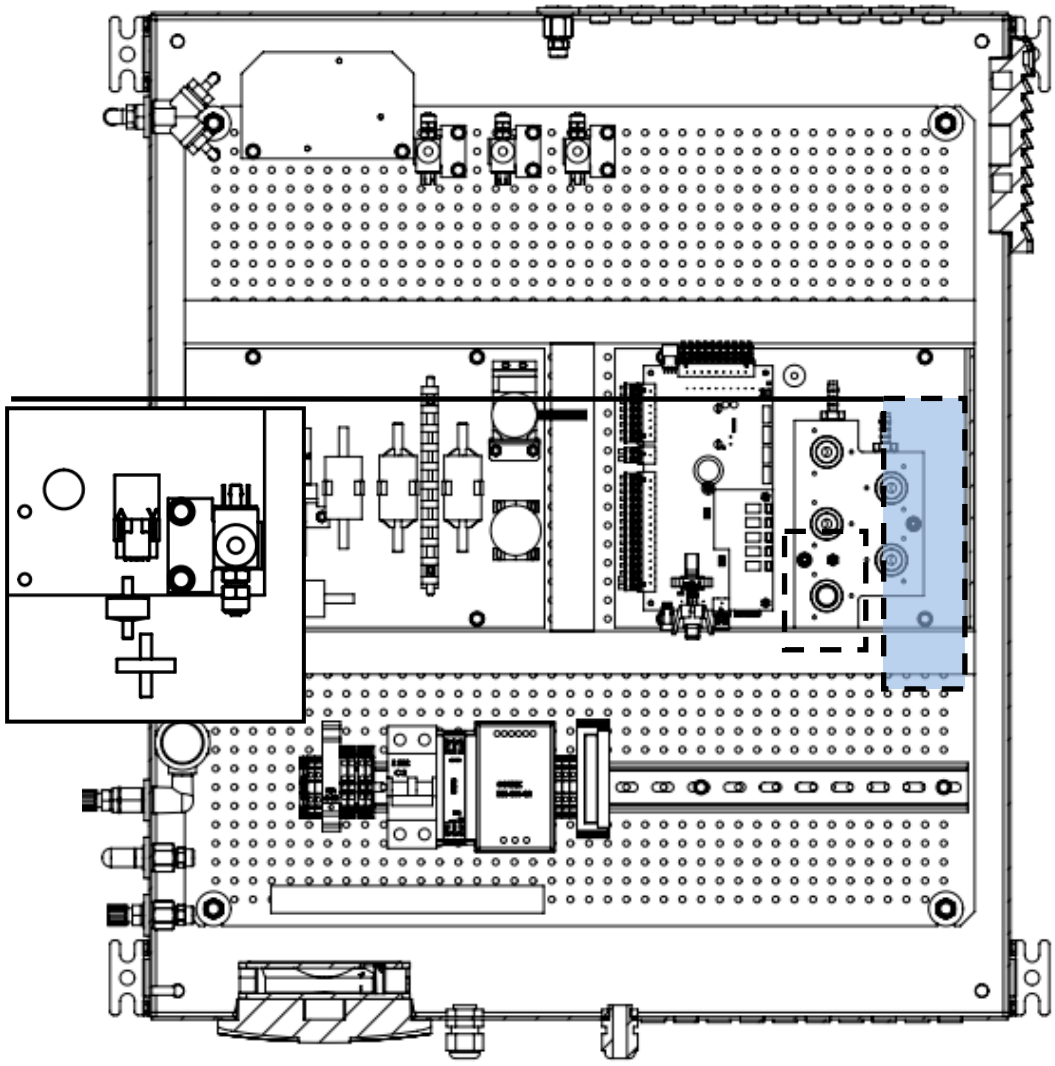
Factor: Turn on the factor, to calibrate the span of the CH4. For this look at the point CH4 ambient. The gas concentration on the analyzer must have the same concentration like on the calibrations gas cylinder.

12.6. Option: Extra IO module with 4 channel 4-20 mA



The analyser is by default equipped with one IO module (see market above). It can be offered with a different number of IO modules (max.10). Every single installed IO module can be driven independent from each other. The different IO modules can be set in the menu “” (see chapter 0).

12.7. Option: H2S electrochemical cell measurement 0-2000ppm/4000ppm

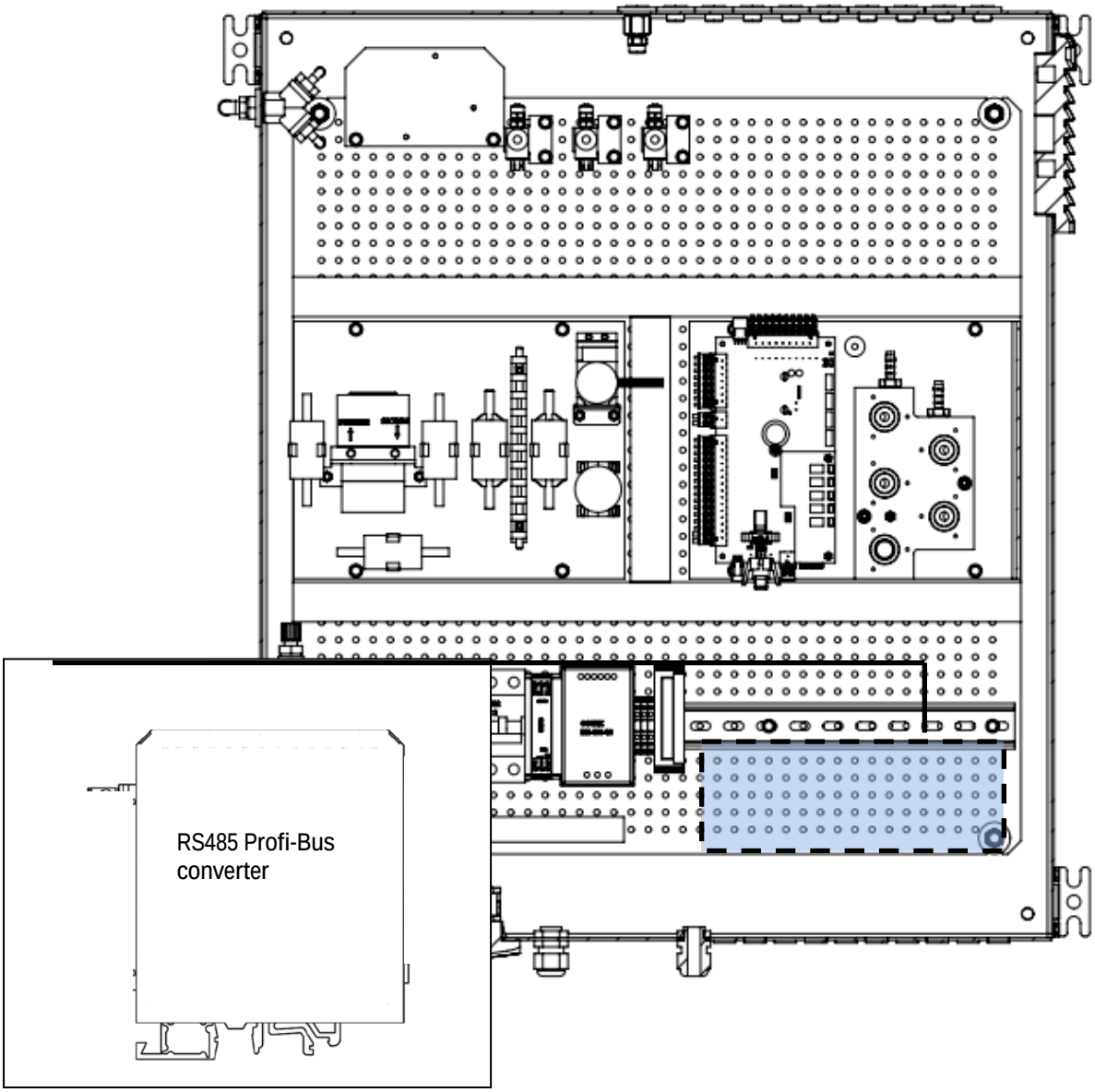


The H_2S electrochemical sensor is offered with two different functions:

- Without cut-off solenoid valve and air purge pump.
- With cut-off solenoid valve and air rising pump.

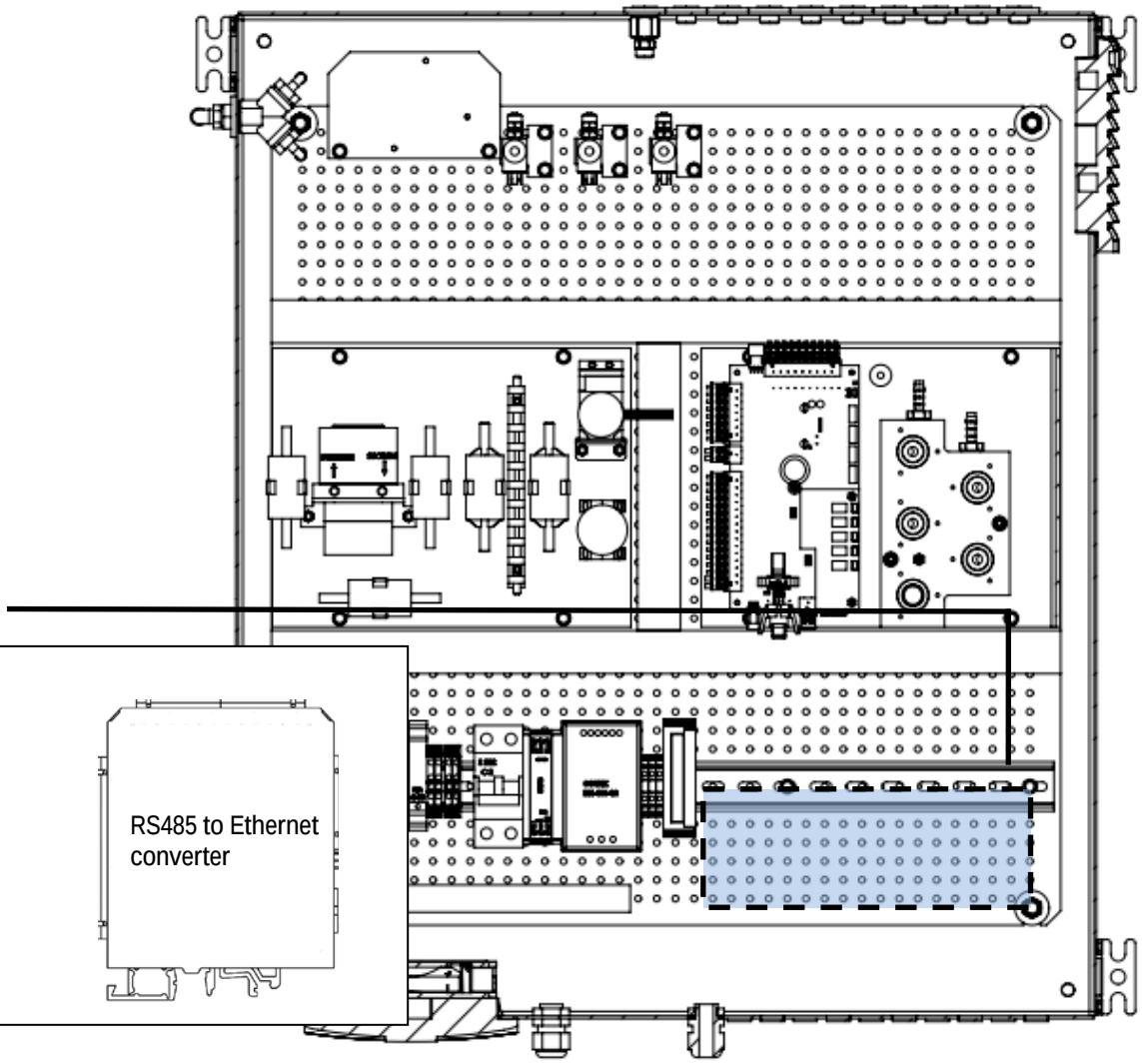
The cut-off solenoid valve with air rising pump have the advantage, that the electrochemical sensor can be purge with ambient air, after the sensor has determined the sample gas. This enhances the live time of the sensor.

12.8. Option: RS485 Profi-Bus converter



Normally the analyzer communication is Modbus RTU. If it is wanted, a RS485-Modbus/ Profibus converter can be installed at the DIN-rail. This hat-rail module will be explained in a separate manual.

12.9. Option: RS485 to Ethernet converter

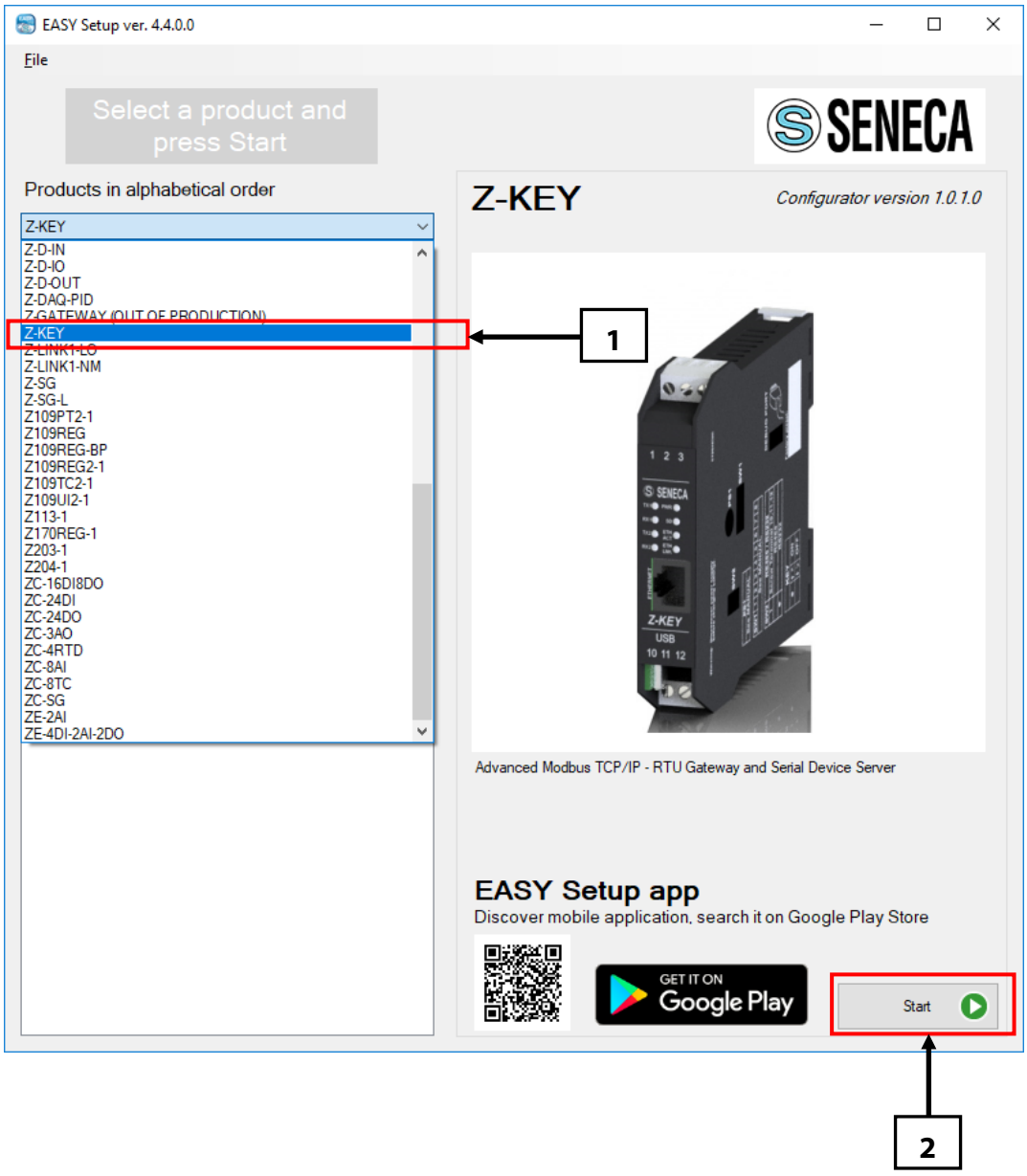


Normally the analyzer communication is Modbus RTU. If it is wanted, a RS485-Modbus/Ethernet Bus converter can be installed at the DIN-rail. This hat-rail module will be explained in a separate manual.

12.10. Configuration of the Ethernet module

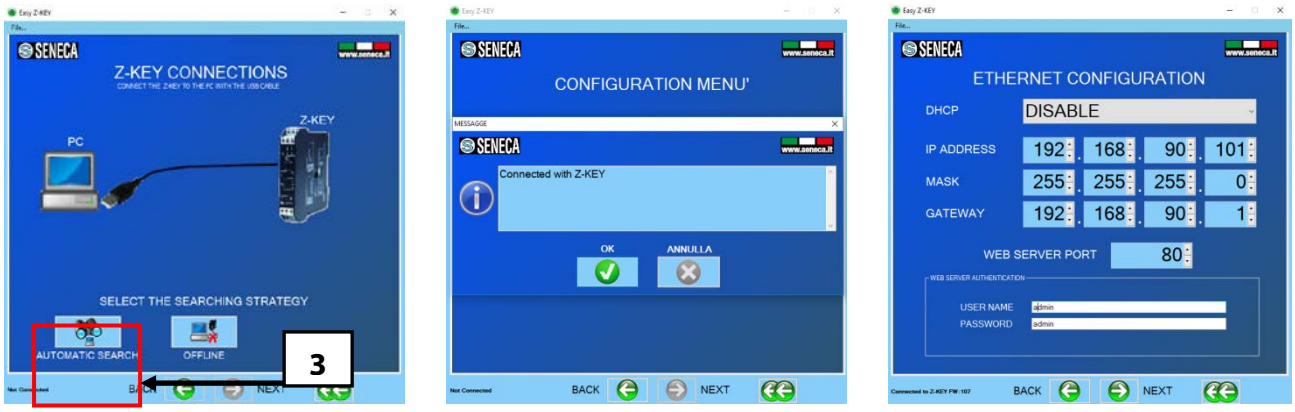
1. Start the software “Easy setup”.

   - The following screen will appear. Select Z-Key at the register called “Products in alphabetical order” (market with 1 in screenshot).
   - Push the “Start” key (market with 2 in screenshot).



2. The following screen appears. To test the communication pushes the key “Test” (1). The current IP-address, which is saved at the module will appear.

3. Get back in the menu and push the key “Setup” (2). Connect the Ethernetmodule with an USB-port of a pc. Then the key “Automatic search” (3). A screen appears, allowing to set the TCP protocol. After a correct TCP is set push the key “Next”.



4. At the next screen push the key “Send IP configuration to Z-key”. The settings will be written to the module.

ATTENTION

. It can happen that the following message will appear:

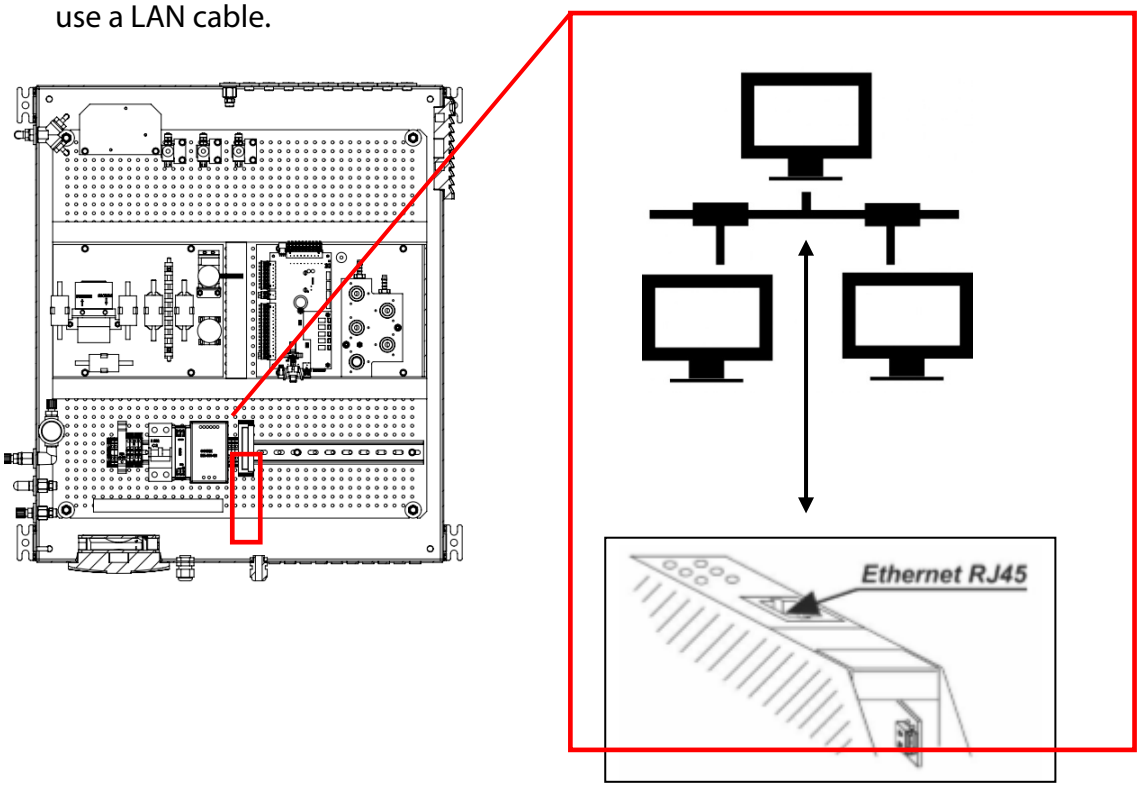
Just confirm the message and test, whether the settings are set. Normally the message can be ignored.

5. The settings are saved at the module now.

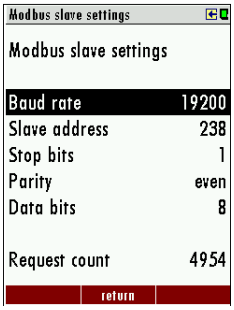
Adjustment of the SWG100 with the Ethernet

After the settings are configurated the analyzer can be connected with the Ethernet.

1. Connect the Ethernet module with the network. For the connection use a LAN cable.



2. Open the path Extras/General settings, at the analyzer. Push ***F3=Modbus***. At this menu the Modbus slave parameters can be



Example:
Baud rate: 19200
Slave address: 238
Stop bits: 1
Parity: even
Data bits: 8

Picture: The screenshot shows an example of a Modbus slave settings.

3. In the next step it is necessary to build a connection between the analyzer and the network. To do this open the browser at a pc and open the webserver with the address:

http://192.xxx.xxx.xxx/maintenance/index.html

	Important
	. **With the test modus for the alarm outputs of the IO module, the alarm relays at the IO modules and the relay at the PCB mainboard can be activated.**

	Important
	The 192.xxxx.xxx.xxx is the IP-address, which is configurated at the module (see chapter xx).

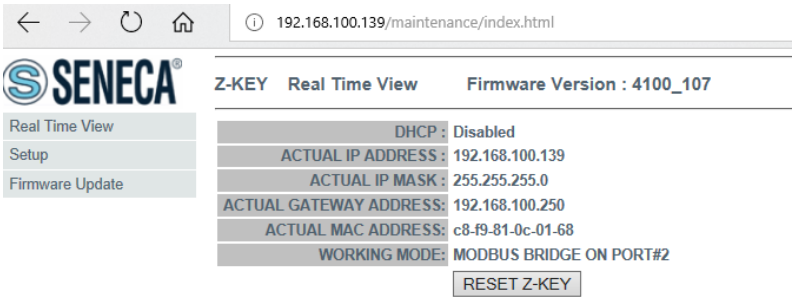
Example:
The IP-address of the module is 192.168.100.154, then the correct address to invoke the webserver is: http://192.168.100.154/maintenance/index.html.

4. The webserver-address is protected with a password. The default password is:

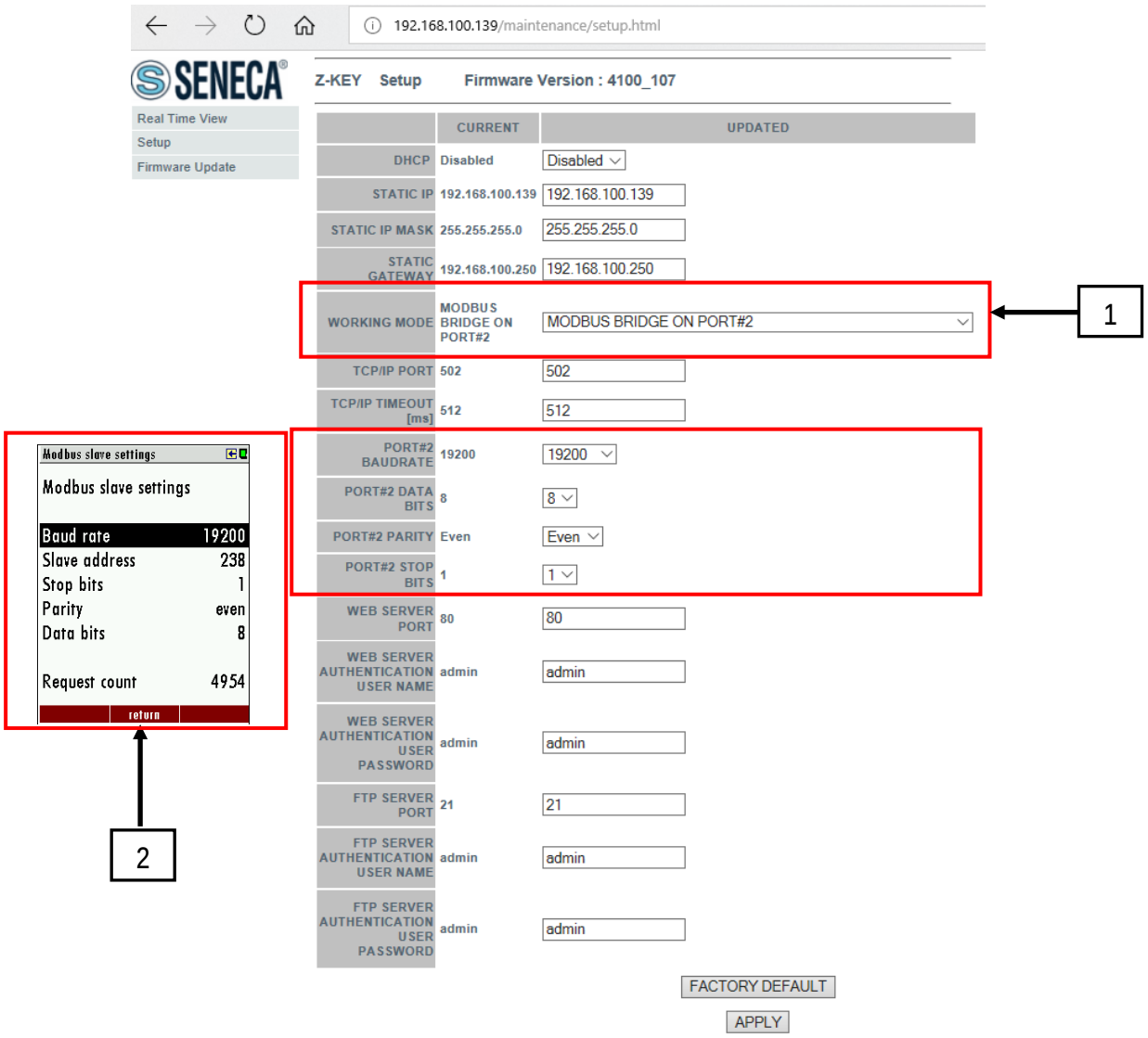
    a. Username: admin

    b. Password: admin.

5. The following screen appears.



6. Push "Setup". A list with the actual adjustments will be appeared.



At this protocol the following adjustments must be set:

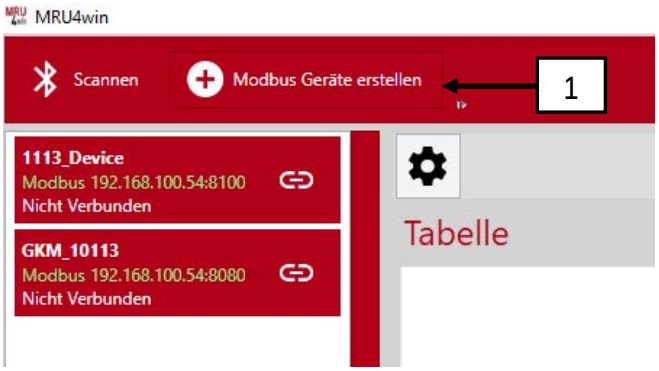
6. Working mode: MODBUS BRIDGE ON PORT#2 (1).
7. Baudrate (2):
8. Data Bits (2).

9. Parity (2).
10. Stop Bits (2).

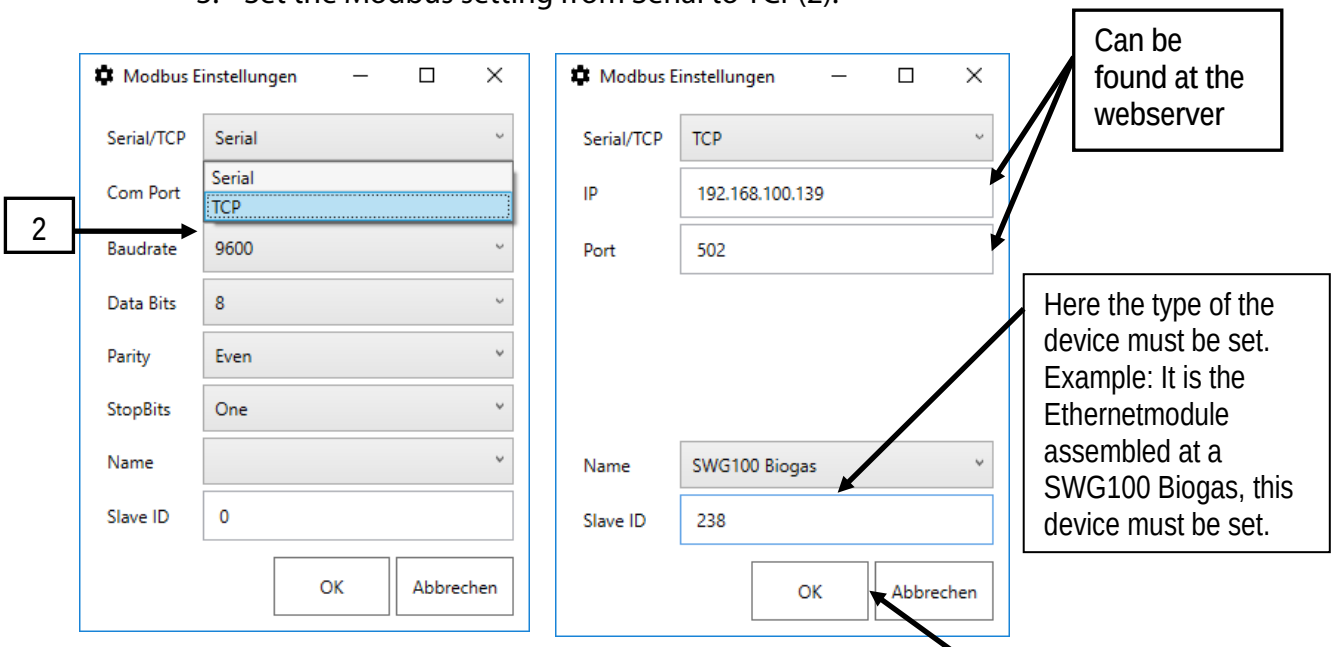
The baudrate, data bits, parity and stop bits must be the same like at the SWG100. After the settings are done, push the key “Apply”.

Connection the SWG100 with MRU4WIN

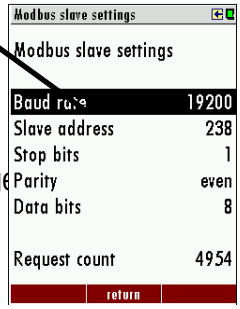
1. Open MRU4WIN.
2. Push the key “Create new Modbus device” (1).



3. Set the Modbus setting from Serial to TCP(2).



4. In the menu the following points must be set:

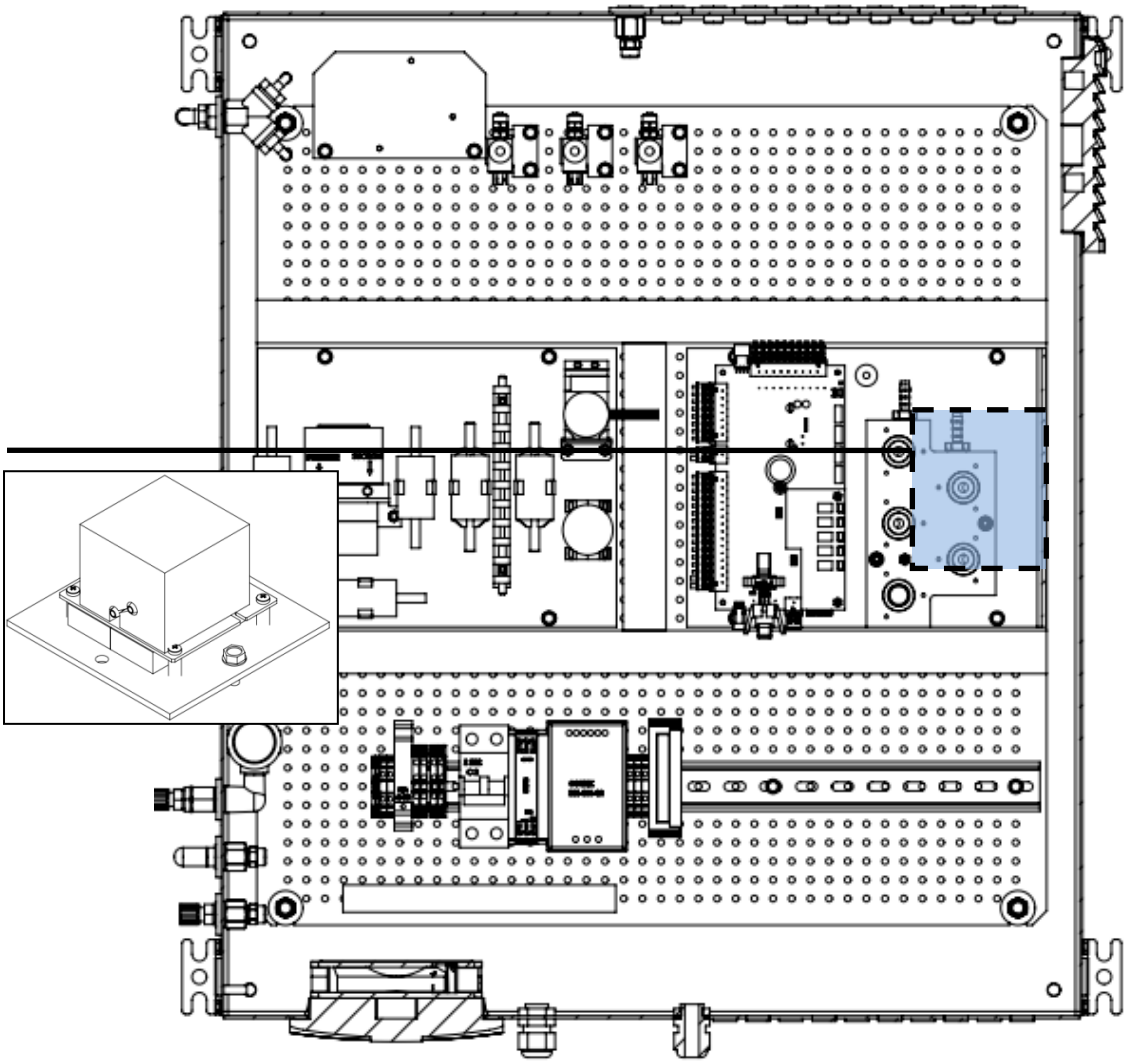


- IP-Address
- Port number
- Device
- Slave-ID

The slave ID can be found at the modbus settings (see screenshot). The port number (called Port at the setting) can be found at the Ethernet protocol (see chapter 1.1 point 6).

5. The new created device can be found at the left side of the MRU4WIN screen. Activated it and start the logging.

12.11. Option: NDIR-bench for CH4/CO2 analysis, 0-100% / 0-100%



This NDIR-bench is for biogas at AD plants. It detects ***CH_4*** and ***CO_2*** in percent range.

This chapter shows, how to adjust the different type of NDIR-benches. The procedure is for all kind of NDIR-benches the same.

ATTENTION

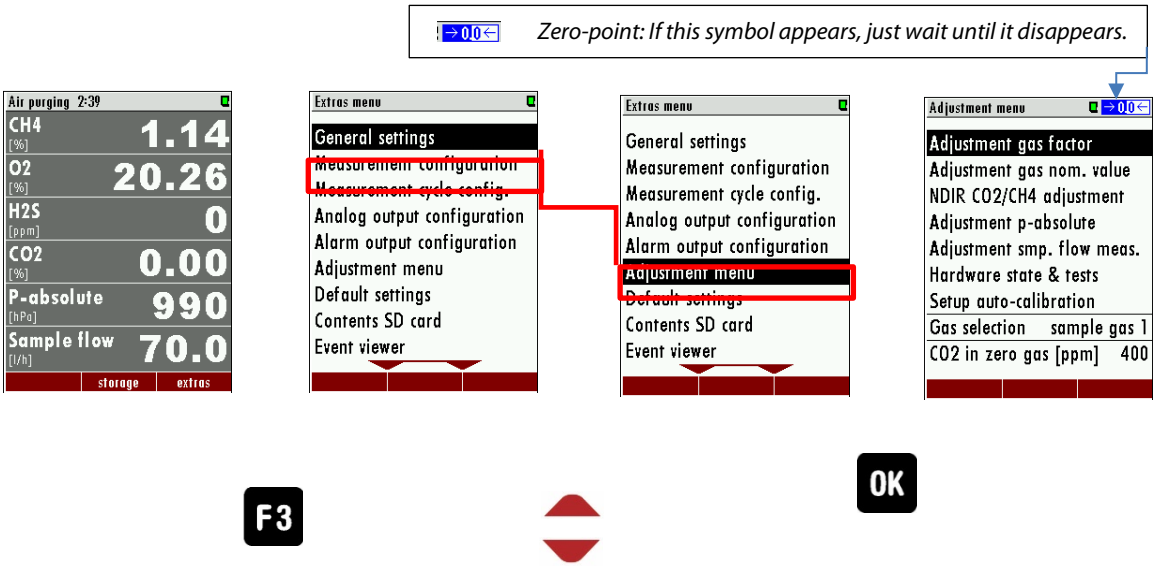
Close door

During the entire adjustment, the cabinet door must be closed.

ATTENTION

The PIN-Code is: F1 – F3 – F2 – F2 – UP - DOWN

1. Select the menu: EXTRAS/ADJUSTMENT MENU and input the 6 symbols password.

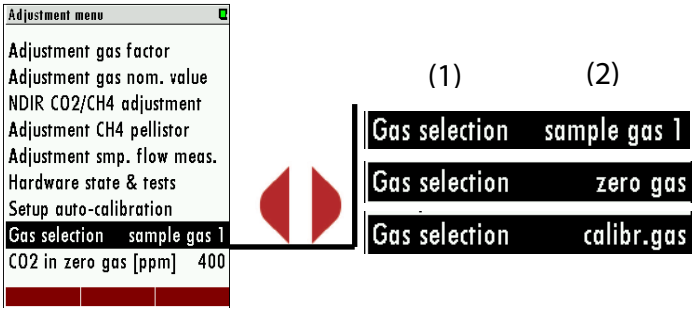


2. Select the menu point "***gas selection (1)***": Here the user can choose between:

   a. Zero gas inlet. *Sucks gas from zero-gas inlet, if activated.*
   b. Calibration gas inlet. *Sucks gas from calibration gas inlet, if activated.*
   c. Sample gas. *Sucks gas from sample-gas inlet, if activated.*

   } (2)

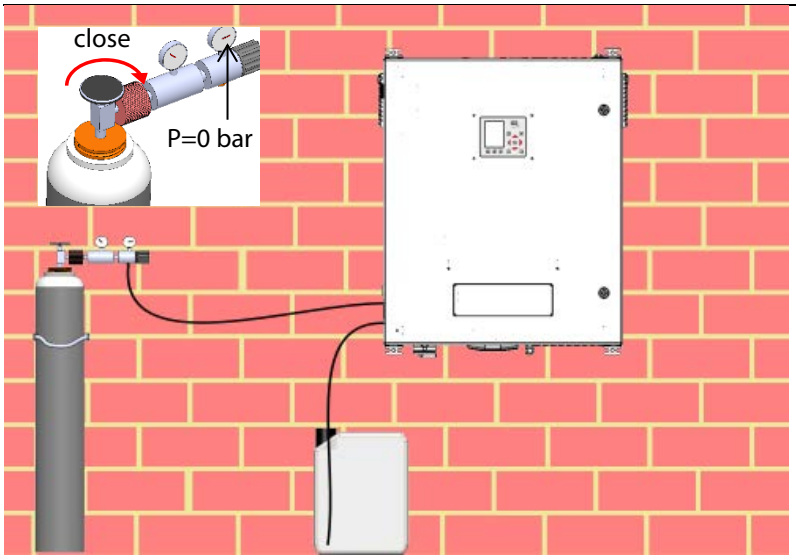
   The screenshot below shows the different gas inlets and their position at the analyser.


Adjustment menu
Adjustment gas factor
Adjustment gas nom. value
NDIR CO2/CH4 adjustment
Adjustment CH4 pellistor
Adjustment smp. flow meas.
Hardware state & tests
Setup auto-calibration
Gas selection sample gas 1
CO2 in zero gas [ppm] 400
(1)
(2)
Gas selection sample gas 1
Gas selection zero gas
Gas selection calibr.gas

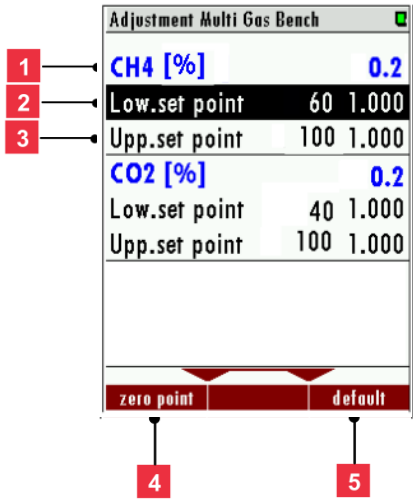
3. Mounting the adjustment gas cylinder: The pressure reducer must be set at max. 500 mbar. The adjustment gas cylinder remains closed.

⚠ WARNING

High pressure!
Gas cylinder stands under high pressure!
Can cause injuries or death.
Only educated staff should install the device.



4. Open NDIR cuvette menu: Open the menu EXTRAS/ADJUSTMENT MENU/NDIR CO2/CH4 ADJUSTMENT. Here the values should now be close to zero. The menu has the follow structure:



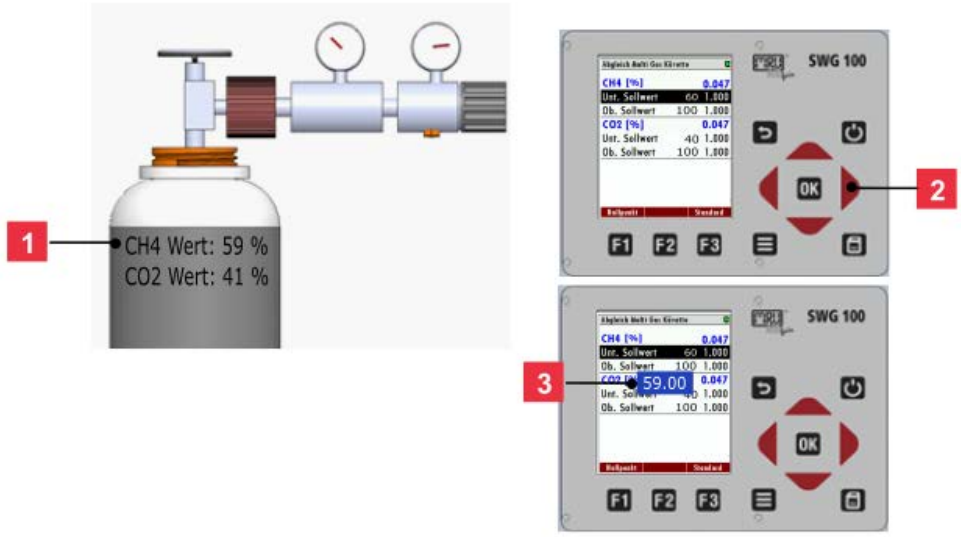
Reference:

1. Sample gas channel with current values (acutal value)

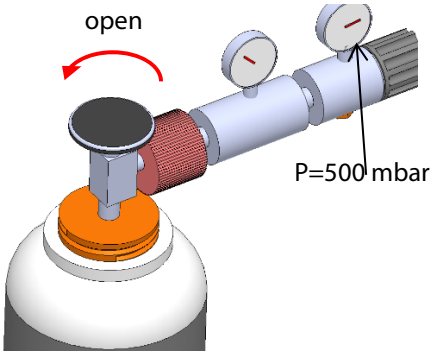
2. Lower set point, with set gas cylinder value and factor

3. Upper set point, with set gas cylinder value and factor
4. Manual execution of the zero point
5. Reset to standard adjustment.

Preferences: Enter the set point from the gas adjustment cylinder into the menu (see 1). To do this, mark the lower set value and press the left and / or right arrow key (see 2). A blue window appears in which the target value can be entered (see 3). This must be done for both CH4 and CO2.

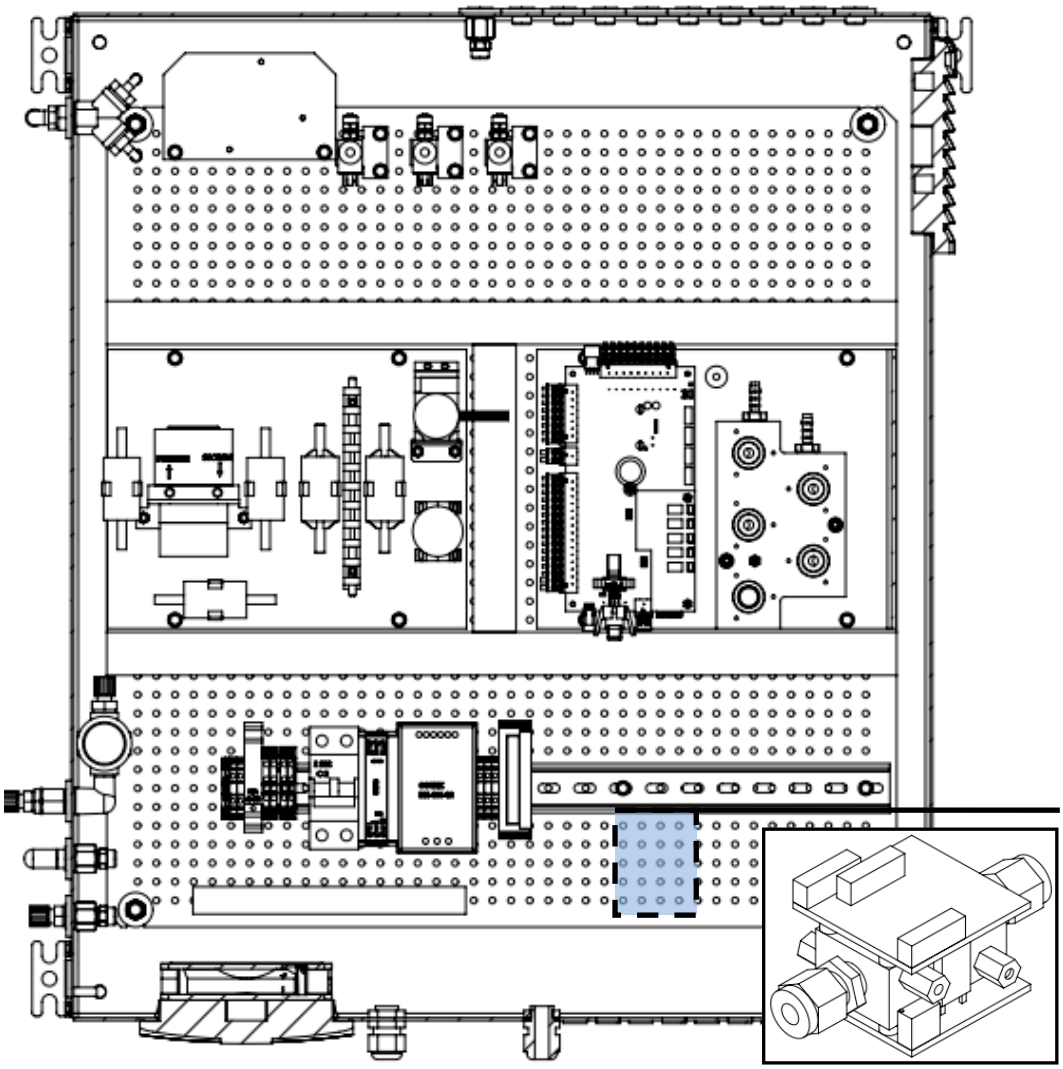


Open adjustment gas cylinder: Open the adjustment gas cylinder. The actual value changes. After 1 until 2 minutes the values should no longer change. If the value is adjustable, the set value is shown in quotation marks.



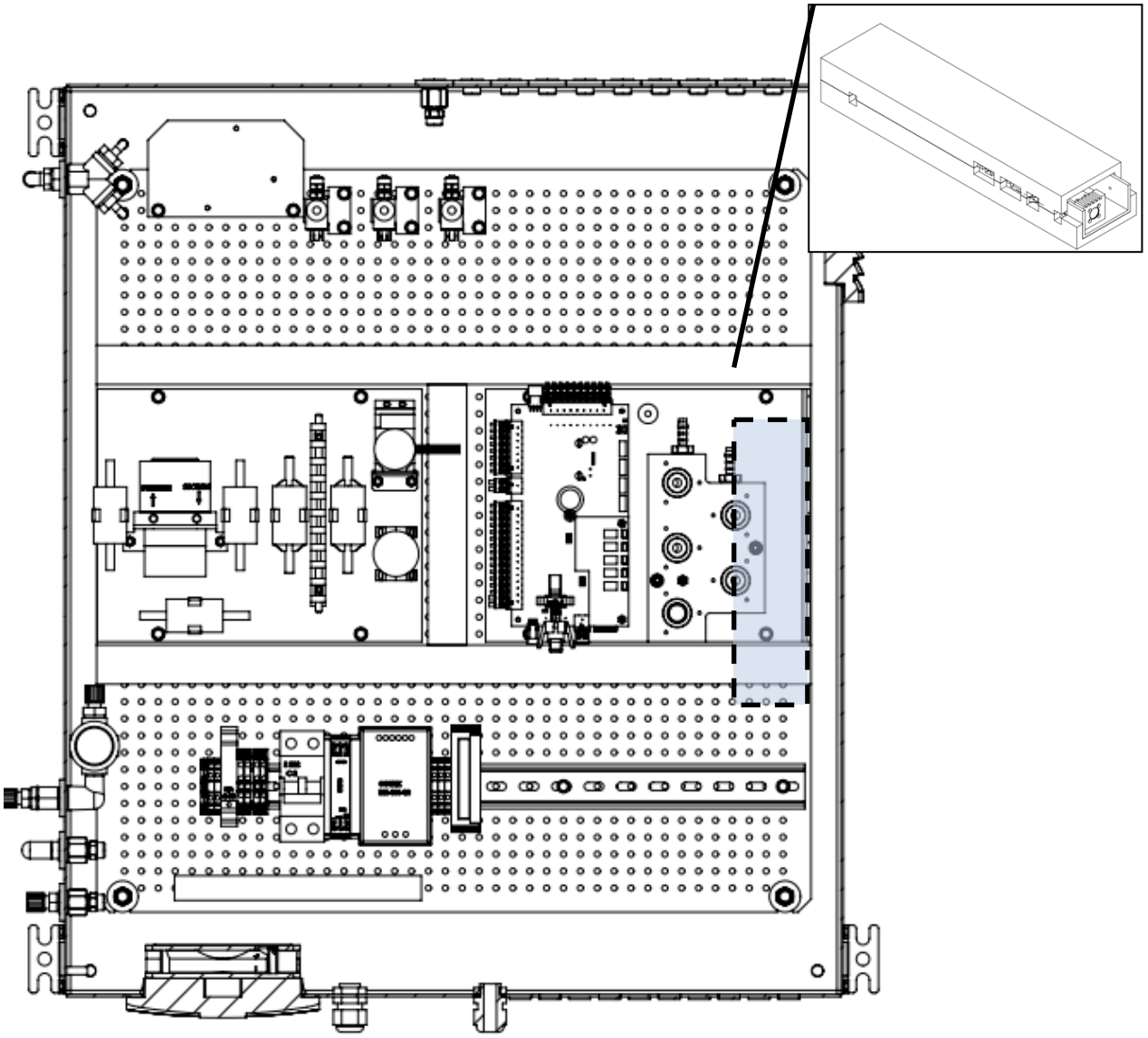
Set a new adjustment factor: Finally, pressing the OK key sets the new adjustment factor. This must be done for CH4 and for CO2.
During the whole adjustment procedure, only the lower setpoint value is changed. The upper set point remains unchanged. This is only adjusted if the accuracy in the 100 % range is to be improved. For this purpose a 100 % CH4 and a 100 % CO2 clean gas cylinder is required.

12.12. Option: H2 thermal conductivity detector measurement 0-100%

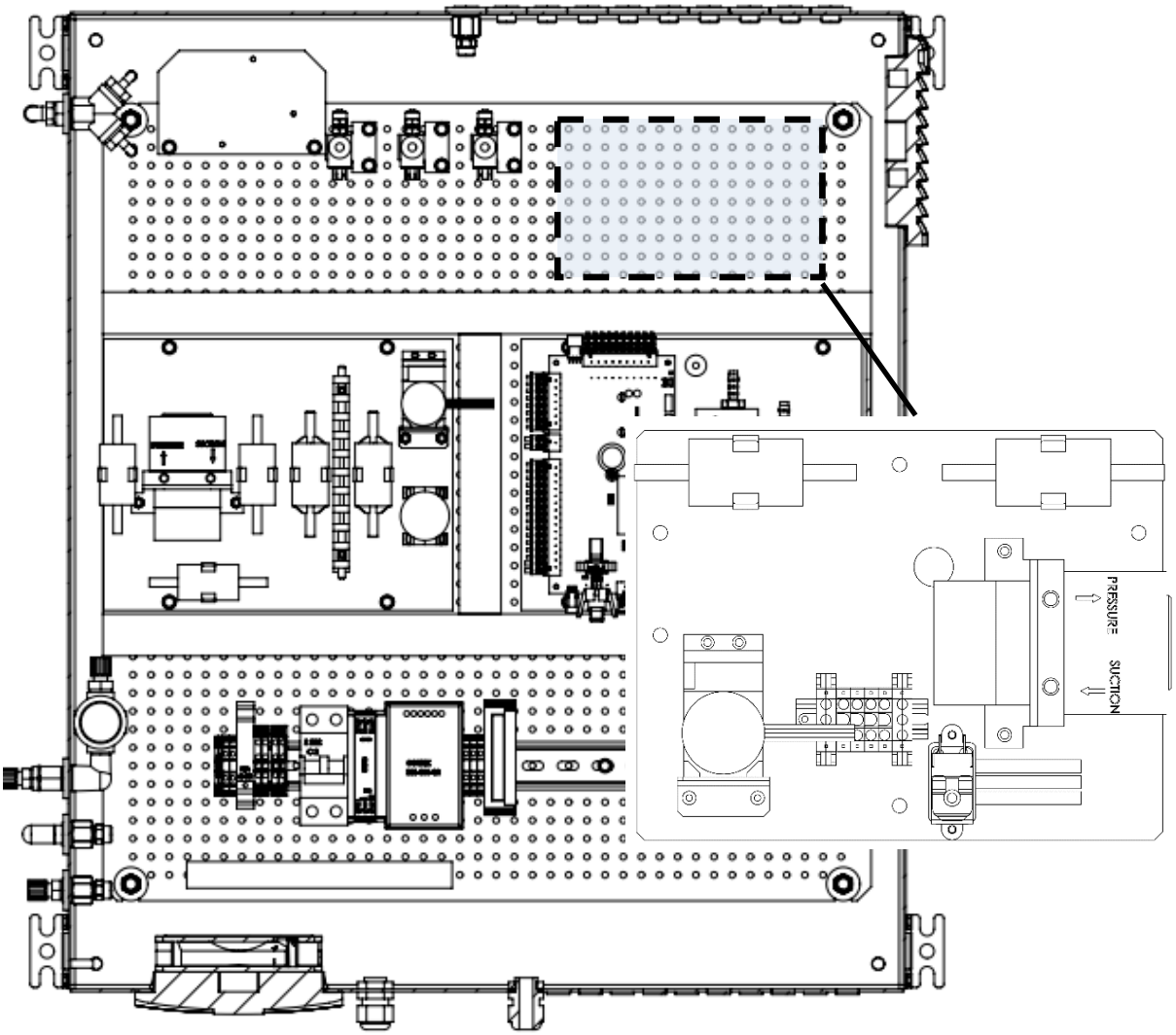


It can equip the analyzer with a H_2 thermal conductivity detector, with a measurement range from 0-100%.

12.13. Option: NDIR-bench for 0-3.000ppm CO2/0-3.000…30.000ppm CH4

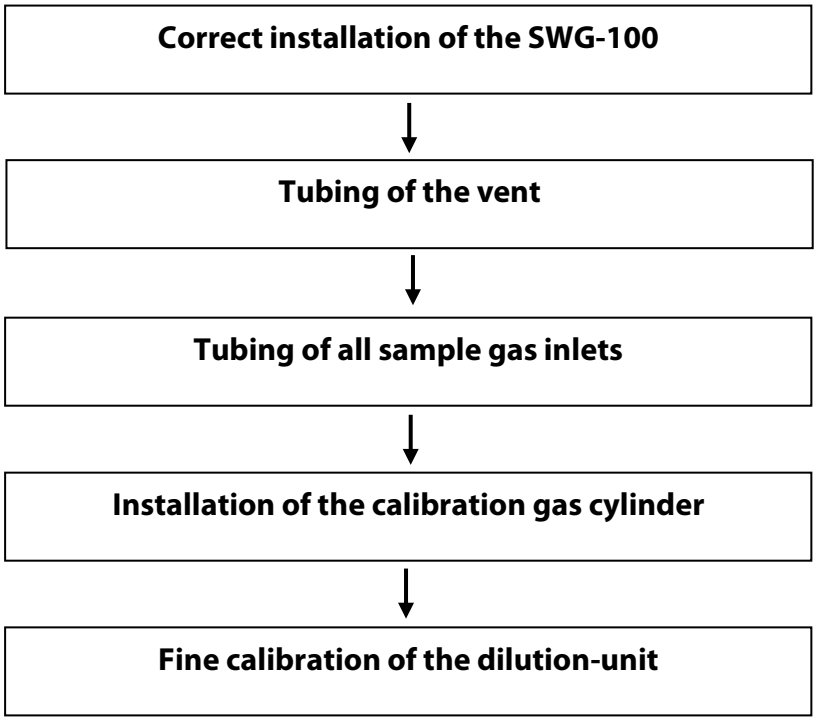


12.14. Option: Dilution-unit for H2S and CO electrochemical sensors



Dilution-unit

The dilution-unit, inside the analyser dilute the sample gas flow with a define ratio. The unit is preadjusted. The operator must do a fine calibration of the device, to improve the accuracy of the measurement. For the fine calibration it is indispensable to tube the vent and all sample gas inlets, before making the actual calibration. The correct order for the fine calibration is shown in the flow chart.



Furthermore, it can be necessary due to abrasion and contamination effects to recalibrate the dilution-unit.

Correct installation of the SWG100

See chapter 5.2.

Tubing of all sample gas inlets

See chapter 5.2.

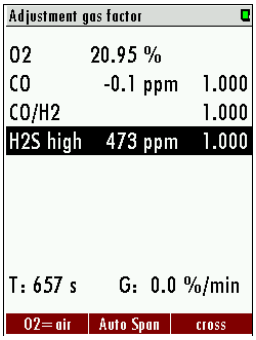
Installation of the calibration gas cylinder

See chapter 7.11. For the calibration of the dilution-unit, MRU recommends a gas cylinder with a min. concentration of 500 ppm, from the target gas.

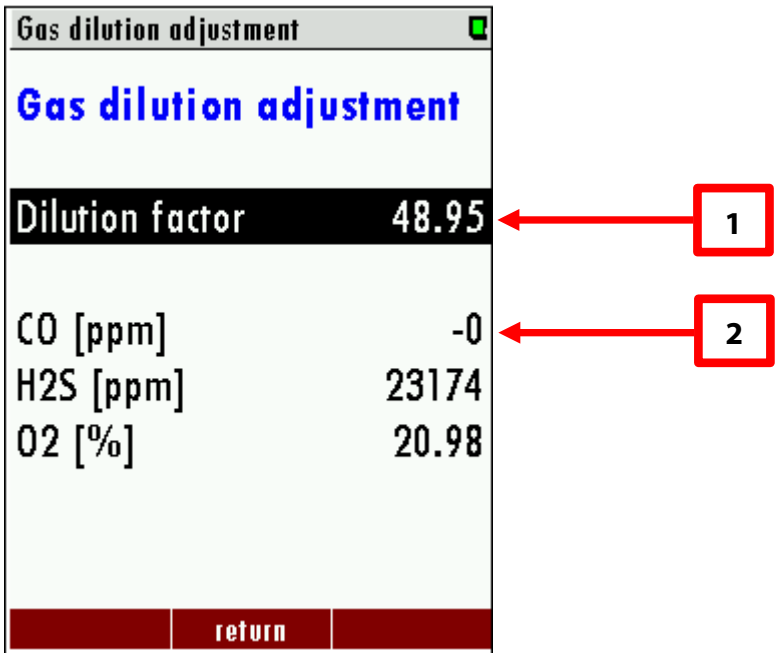
Fine calibration of the dilution-unit

Follow steps must be done, for the fine calibration of the dilution-unit. The steps below show the entire adjustment on the example of a H2S-sensors.

1. Installation of the calibration gas cylinder (gas cylinder for the undilute calibration).
2. Adjustment of the undilute electrochemical sensor.
    a. Open the path: EXTRAS/ ADJUSTMENT MENU/ ADJUSTMENT GAS FACTOR
    b. Select the electrochemical sensor, which should be adjusted.



    c. Impinge the device with the calibration gas. Wait until the gas concentration, of the sensor will not change anymore.
    d. The actual value is displayed at the screen. This actual value must be adjusted with the set point, from the gas cylinder. To do this, changes with the right/left arrow keys the gas factor until the actual value is adjusted with the set point.
3. Adjustment of the dilution-unit.
    a. Installation of the calibration gas cylinder, for the dilution-unit. This gas cylinder must have a min. concentration of 500 ppm of the target gas.
    b. Open the path: EXTRAS/ADJUSTMENT MENU/ GAS DILUTION ADJUSTMENT.
    c. The follow screen appears. The menu has the follow structure:



i. ***Dilution factor (1):*** Means the dilution ratio. For example: the value 50 means a ratio from 1:50. Hence, 10,000 ppm pure H2S, for example, will dilute to 200 ppm. The mathematical basic formula is:

$C_{pure}=C_{Dilution}*f_{Dilution}$

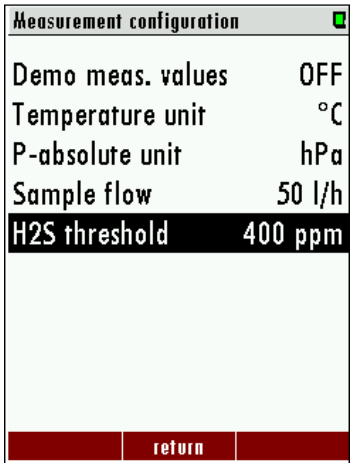
Cpure= Undilution gas concentration [in ppm].
CDilution=Dilute gas concentration [in ppm].
fDilution=Dilution factor [do dimension].

ii. ***Dilutable gases and the actual values (2):*** This show the dilutable gases and the calculated undiluted actual gas concentration value (C_{pure}).

d. To fine calibrate the dilution-unit select the dilutable gas and impinge the analyser with the calibration gas. Wait until the gas concentration will not change anymore. Shift with the right/left arrow keys the dilution factor, until the actual value has the gas concentration of the calibration gas cylinder.

Software-settings

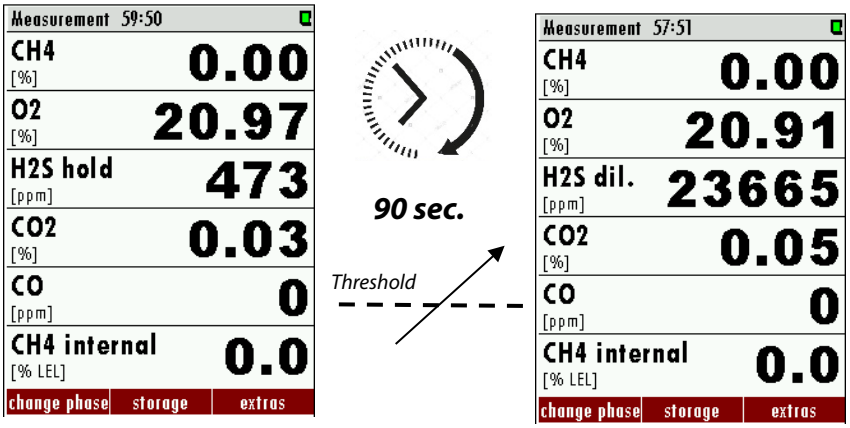
The operator can do following settings.



- Threshold: The operator can change the threshold. If the value is above this threshold, the dilution will turn on.
    - The path for this setting is: EXTRAS/MEASUREMENT CONFIGURATION.
    - Marked the setting "threshold" with the cursor. With the left/right arrow keys the value can be changed.
    - Leaving the menu and confirm the modification.

Setting the dilution cycle

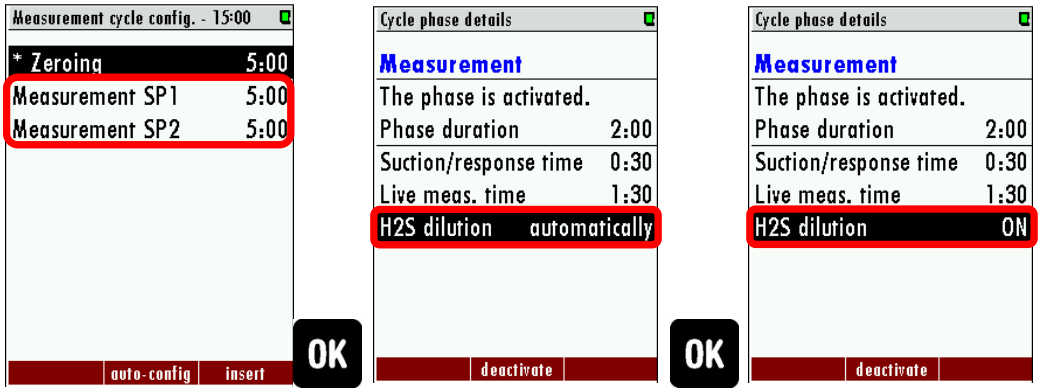
In the default setting the dilution is set automatically. This means, the first cycle will be measured dilute. If the gas concentration is under the threshold, the next cycle will be measured undiluted. If the sample gas concentration will reach the threshold again, the dilution will be activated. During the activation, the measurement value will be hold for 90 sec. At the display, the dilute measurement value will be displayed with "hold". After the 90 sec. the life-values will turn on again.



The operator can change the dilution settings, from every measurement phase setting, from "automatically" to "ON". ON means, the dilution is permanent activate for this measurement phase. Other measurement phases are not affected. For example: If the SWG-100 has a sample gas junction, with three sample gas inlets and the dilution-setting from sample gas-inlet 1 is permanently activated (ON), the two other sample gas-inlets are further set to automatically.

To change the dilution setting follow steps must be done:

- Open the path: EXTRAS/MEASUREMENT CYCLE CONFIG.
- Open the measurement phase, from the sample-point, which should be set.
- Press the OK key, to turn into the detail menu of the measurement phase.
- Change the dilution from “automatically” to “ON”.



13 Declaration of conformity

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

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

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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*

V3.30