Operating Instructions
MARSIC280

Ship Emission Measuring Devices

Endress+Hauser
People for Process Automation

Described product

MARSIC280

Manufacturer

Endress+Hauser SICK GmbH+Co. KG
Bergener Ring 27
01458 Ottendorf-Okrilla
Germany

Legal information

Original document

This document is an original document of Endress+Hauser SICK GmbH+Co. KG.

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Contents

1 About this document

1.1 Function of this document

These Operating Instructions describe:

- Device components
- Mounting and electrical installation
- Commissioning
- Operation
- Maintenance work required for reliable operation
- Troubleshooting
- Decommissioning

1.2 Scope of application

These Operating Instructions are only applicable for the measuring device described in the product identification.

They are not applicable for other Endress+Hauser measuring devices.

The standards referred to in these Operating Instructions are to be observed in the respective valid version.

1.3 Target groups

This Manual is intended for persons who install, commission, operate and maintain the device.

1.4 Further information

- SFU Gas Sampling Unit Operating Instructions
- SFU Gas Sampling Unit with weather hood Operating Instructions
- Sample Gas Line Operating Instructions
- BCU Operating Instructions
- Safety information (for Endress+Hauser analyzer devices)
- Optional: MPR (Meeting Point Router) Operating Instructions
- Optional: Instrument Air Conditioning Operating Instructions
- Optional: Pressure Test Tool Operating Instructions

1.5 Symbols and document conventions

1.5.1 Warning symbols

Table 1: Warning symbols

Symbol	Significance
	Hazard (general)
	Hazard by electrical voltage
	Hazard by acidic substances

Symbol	Significance
	Hazard by toxic substances
	Hazard by high temperature
	Hazard by UV radiation
	Hazard for the environment/nature/organic life

1.5.2 Warning levels / Signal words

DANGER

Risk or hazardous situation which will result in severe personal injury or death.

WARNING

Risk or hazardous situation which could result in severe personal injury or death.

CAUTION

Hazard or unsafe practice which could result in less severe or minor injuries.

Notice

Hazard which could result in property damage.

Note

Hints

1.5.3 Information symbols

Table 2: Information symbols

Symbol	Significance
	Important technical information for this product
	Important information for electrical or electronic functions

1.6 Data integrity

Endress+Hauser uses standardized data interfaces, such as standard IP technology, in its products. The focus here is on product availability and features.

Endress+Hauser always assumes that the customer is responsible for the integrity and confi-dentiality of data and rights involved in connection with using the products.

In all cases, the customer is responsible for the implementation of safety measures suitable for the respective situation, e.g., network separation, firewalls, virus protection and Patch Management.

2 Safety information

2.1 Basic safety information

- ► Read and observe these Operating Instructions.
- ► Observe all safety instructions.
- ► If anything is not clear: Please contact Endress+Hauser Customer Service.

Document retention

These Operating Instructions

- ► Must be kept for reference.
- ► Must be passed on to new owners.

Correct project planning

- Basis of this Manual is the delivery of the measuring device according to the preceding project planning and the relevant delivery state of the measuring device (see delivered System Documentation).
  - ► Contact Endress+Hauser Customer Service if you are not sure whether the measuring device corresponds to the state defined during project planning or to the delivered System Documentation.

Correct use

- Basis of this Manual is the delivery of the device according to the preceding project planning and the rele-vant delivery state of the device (see delivered System Documentation).
  - ► If you are not sure whether the device corresponds to the state defined during project planning or to the delivered system documentation: Please contact Endress+Hauser Customer Service.
- Only use the measuring device as described in “Correct use”.

The manufacturer bears no responsibility for any other use.

- Perform the specified maintenance work.
- Do not perform any work or repairs on the measuring device not described in this manual.

Do not remove, add or modify any components to or on the device unless descri-bed and specified in the official manufacturer information.

- Use only original spare parts and expendable parts from Endress+Hauser.

In case of non-compliance:

- The manufacturer's warranty becomes void.
- The device could become dangerous.
- The approval for use in potentially explosive atmospheres is no longer valid.

Special local conditions

In addition to the information in this Manual, follow all local laws, technical rules and company-internal operating and installation directives applicable wherever the device is installed.

2.1.1 Electrical safety

Hazard through electrical shock

There is a risk of electric shock when working on the measuring device with the voltage supply switched on.

- ► Before starting work on the measuring device, ensure the power supply can be switched off using a power isolating switch or circuit breaker in accordance with the valid standard.
- ► Make sure the power isolating switch is easily accessible.
- ► An additional disconnecting device is mandatory when the power isolating switch cannot be accessed or only with difficulty after installation of the device connection.
- ► Switch off the power supply before carrying out any work on the measuring device.
- ► After completion of the work or for test purposes, calibration, the voltage supply may only be activated again by authorized personnel complying with the safety regulations.

Endangerment of electrical safety through power line with incorrect rating

Electrical accidents can occur when the specifications for installation of a power line have not been adequately observed.

- ► Always observe the exact specification in the Manual when installing a power cable (see "Technical data", page 146).
- ► The user must ensure that the power cable is designed in accordance with the applicable standards.

2.1.2 Dangerous substances

Danger through leaks in the gas path with toxic gases

A leak, e.g., in purge air supply, can represent an acute danger for persons.

- ► Regularly check all gas-carrying components for leaks.
- ► Take suitable safety measures. E.g.:
  - Marking the measuring device with warning signs.
  - Marking the operating area with warning signs.
  - Ventilating the operating room sufficiently.
  - Safety-related instruction of personnel who could be in the vicinity of the installation site.

Danger through caustic condensate

Health hazard due to toxic compounds in the condensate

- ► Observe all safety regulations for the application.
- ► Take appropriate protective measures for work (e.g., by wearing a safety mask, protective gloves and acid resistant clothes).
- ► In case of contact with the skin or eyes, rinse the affected parts immediately with clear water and consult a doctor.

2.2 Warning information on device

Warning information on device

The following safety symbols are on the device:

Table 3: Warning symbols

Symbol	Significance
	Warning for general hazard
	Warning for hazard by electric voltage, possibly also by residual electric voltage

Symbol	Significance
	Warning for hazard through hot surfaces
	Warning for hazard by UV radiation

If you need to work on a subassembly marked with such a symbol:

► Read the relevant Section in these Operating Instructions
► Observe all the safety information in the relevant Section.

2.3 Intended use

MARSIC280 is a modular multi-component analyzer system for continuous measurement of exhaust gas concentrations of SO2 and CO2 from exhaust gas cleaning systems on vessels.

2.4 Unintended use

The system is designed for inside installation below deck. The system must not be installed on deck or outside.

2.5 Requirements on the personnel's qualification

Table 4: Qualification requirements

Tasks	User groups	Qualifications
Installation	Qualified personnel	• General knowledge in measurement technology, specialist device knowledge (possibly customer training at Endress+Hauser)
Electrical Installation	Qualified personnel	• Authorized electrician (authorized skilled electrician or person with similar training) • General knowledge in measurement technology, specialist device knowledge (possibly customer training at Endress+Hauser)
Initial commissioning Recommissioning	Authorized operator	• General knowledge in measurement technology, specialist device knowledge (possibly customer training at Endress+Hauser)
Decommissioning Operation Troubleshooting	• Operator / system integrator • Authorized operator	• General knowledge in measurement technology, specialist device knowledge (possibly customer training at Endress+Hauser) • Authorized electrician (authorized skilled electrician or person with similar training) • Service training

Tasks	User groups	Qualifications
Maintenance	• Operator / system integrator • Authorized operator	• General knowledge in measurement technology, specialist device knowledge (possibly customer training at Endress+Hauser) • Service training

3 Product description

3.1 Product identification

Overview

Product name	MARSIC280
Manufacturer	Endress+Hauser SICK GmbH+Co. KG, Bergener Ring 27, 01458 Ottendorf-Okrilla, Germany
Type plate	Type plates are located on the outside on the right of the housing.

Type plate

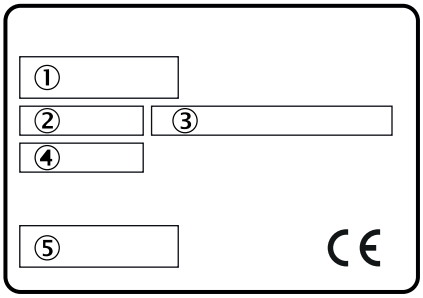


Figure 1: Analyzer type plate, schematic representation

① Product name
② Item number
③ Specification on voltage supply
④ Serial number
⑤ Barcode

3.2 Gas supply terminology

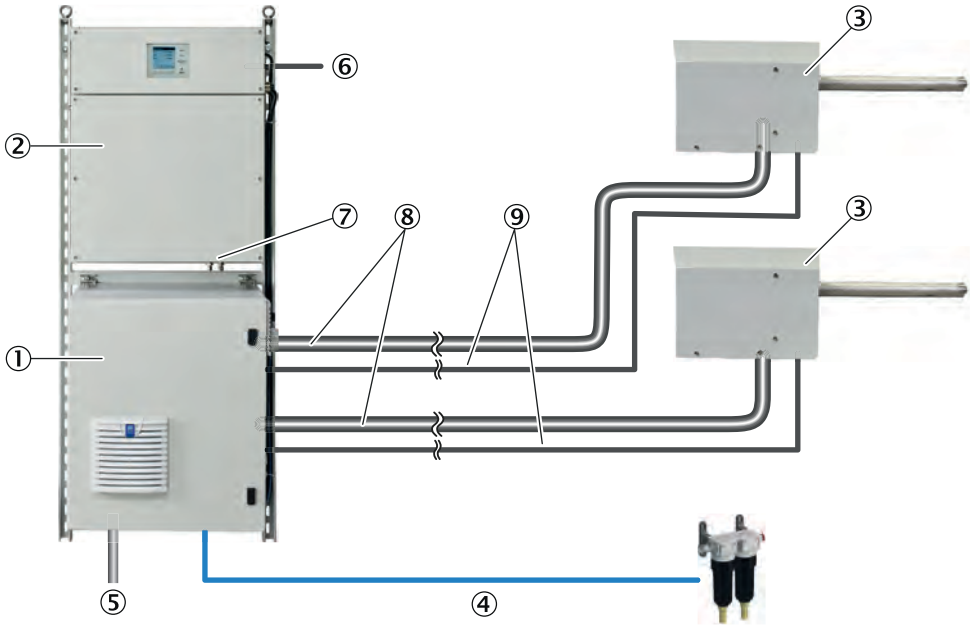
Definition of supply gases:

- Zero gas: Gas for zero point adjustment. Instrument air or nitrogen (N_2)
- Reference gas: Gas for measuring range end scale value adjustment
- Test gas: Generic term for zero and reference gas
- Instrument air: Clean compressed air

3.3 Layout and function

3.3.1 System overview

Overview



① Sample conditioning and distribution unit
② Analyzer
③ Gas sampling unit (option: 2 gas sampling units)
④ Instrument air inlet (option: Instrument air conditioning
⑤ Power supply
⑥ Interfaces: 1 x Ethernet
⑦ Sample gas outlet
⑧ Heated sample gas line (option: 2 sample gas lines)
⑨ Hose bundle line (option for 2 measuring points: 2 hose bundle lines)

Function

The system operates independently. The flue gas is extracted by a heated gas sampling unit at one or more measuring points and passed through a heated sample gas line for conditioning in the analyzer.

Operation

Operation is performed via the BCU control unit in the analyzer door.

Alternatively, operation can be performed via an external computer and the SOPAS Engineering Tool (SOPAS ET).

Check (validation) and adjustment

- Zero point adjustment
- Reference point adjustment
- Purging the gas sampling unit

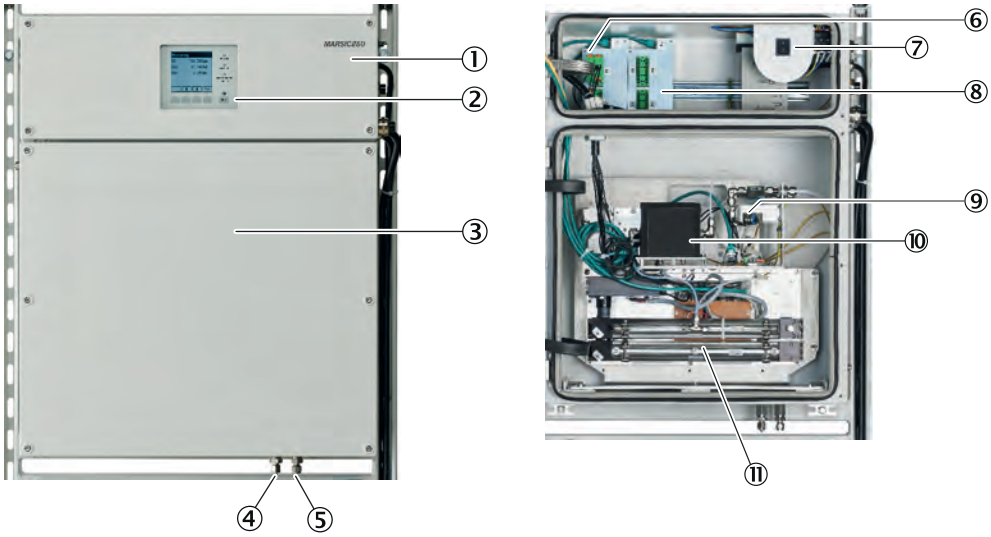
3.3.2 Analyzer

Overview

The analyzer comprises:

- Control unit
- Measurement technology
- Analog and digital interfaces

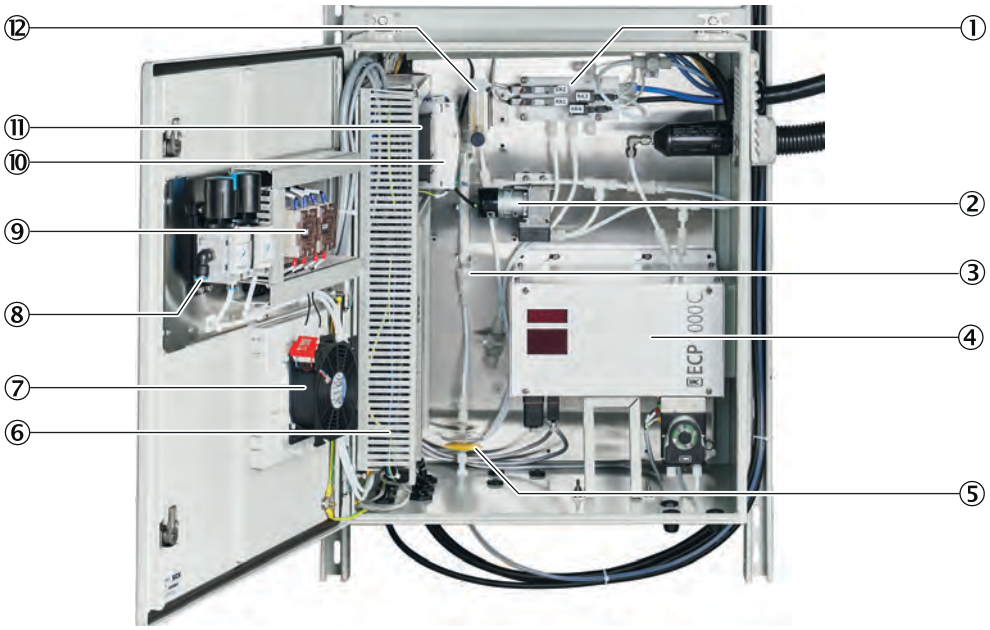
View



① Analyzer top part with electronics
② BCU control unit
③ Analyzer bottom part with measurement technology
④ Sample gas inlet
⑤ Sample gas outlet
⑥ Fuses / distribution board
⑦ Analyzer on/off switch
⑧ Data interfaces
⑨ Gas module (flow/humidity/pressure)
⑩ Analyzer module CO_2 (FINOR)
⑪ Analyzer module SO_2 (DEFOR)

3.3.3 Sample conditioning and distribution unit

View



① Valve block
② Pump
③ Filter
④ Cooler
⑤ Water trap
⑥ Voltage supply
⑦ Fan
⑧ Instrument air connection
⑨ Relay of the heating power control
⑩ Fuses
⑪ Heating control
⑫ Flowmeter

3.3.4 Gas sampling unit for indoor installation

Overview

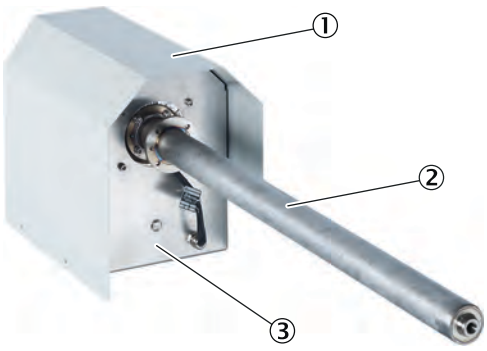


Figure 2: Gas sampling unit for indoor installation (system-specific)

① Weather protection hood
② Gas sampling tube
③ Filter housing

Prerequisites

- Flue gas extraction takes place inside.

Function

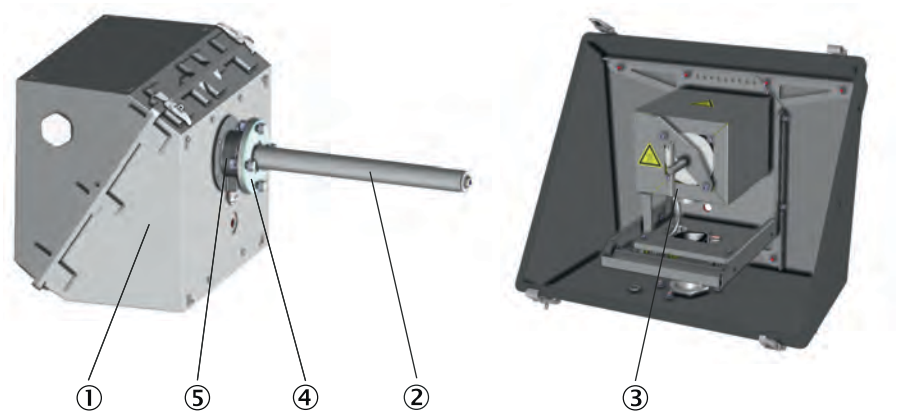
The gas extraction unit SFU extracts flue gas from the stack via the gas sampling tube. After filtration, the flue gas is passed to a measuring device for analysis.

Characteristics

- Gas sampling tube (unheated)
- Gas sampling tube reinforced for maritime application
- Gas sampling tube available in different lengths (option)
- Gas sampling unit is thermostatically controlled.
- The analyzer regulates the heating.
- When no voltage is applied, the heated sample gas line and the analyzer are purged with instrument air.

3.3.5 Gas sampling unit for outdoor installation

Overview



① Weatherproof enclosure
② Gas sampling tube
③ SFU filter housing
④ Flange
⑤ Silicone press ring seal (gas sampling tube seal)

Prerequisites

- Flue gas extraction takes place outside on the ship.

Function

The gas extraction unit SFU extracts flue gas from the stack via the gas sampling tube. After filtration, the flue gas is passed to a measuring device for analysis.

Characteristics

- Gas sampling tube unheated and without pre-filter
- Gas sampling tube available in different lengths (option)
- Gas sampling unit is thermostatically controlled.
- The analyzer regulates the heating.
- When no voltage is applied, the heated sample gas line and the analyzer are purged with instrument air.

3.3.6 Hose bundle line

Overview

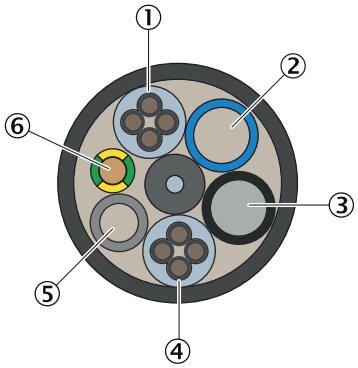


Figure 3: Hose bundle line

① Voltage supply
② PA hose blue DN6/8
③ PA hose black DN6/8
④ Signal line
⑤ PTFE hose DN4/6
⑥ Grounding conductor

Function

The hose bundle line connects the gas sampling unit with the measuring device. The hose bundle line contains the voltage supply line, signal lines and gas lines.

3.3.7 Sample gas line, heated

Overview

Figure 4: Heated sample gas line

① PT100 connections
② Voltage supply
③ Connection to gas sampling unit (without electrical connections)
④ Protective cap
⑤ Connection to measuring device (with electrical connections)
⑥ Lock nut
⑦ Cable gland

Function

The heated sample gas line leads the flue gas from the gas sampling unit to the measuring device.

Characteristics

- The sample gas line is thermostatted to prevent condensation of the flue gas.
- The measuring device regulates the heating.
- When free from voltage, the heated sample gas line is purged with instrument air.

3.3.8 Instrument air, conditioning

Overview

If the supplied instrument air does not meet the required quality, an instrument air conditioner can be connected upstream from the pressure reducer module.

Important information

NOTICE
Malfunction of the measuring device due to unsuitable instrument air
Operation with air not satisfying the specifications voids the warranty and does not ensure proper functioning of the measuring device.

► Only feed conditioned instrument air to the measuring device.
► The instrument air quality must meet the specification.

Function

The instrument air conditioning serves to condition the compressed air provided by the operator.

Additional information

A separate instrument air supply as zero gas or test gas can be connected as an alternative.

Related topics

- Instrument Air Conditioning Operating Instructions
- Instrument air quality: see "Gas supply", page 150

3.4 Interfaces

3.4.1 Extended interfaces (option)

As standard, analog and digital signals are used for device communication with customer peripherals. Alternatively, output can be performed using the Modbus-TCP protocol.

Optionally, Endress+Hauser offers various converter modules that are installed by the customer and communicate with the device via Modbus® TCP.

Optionally available
- PROFIBUS / PROFINET

Modbus

Modbus® is a communication standard for digital controls to create a connection between a »Master« device and several »Slave« devices. The Modbus protocol defines the communication commands only but not their electronic transfer; therefore it can be used with different digital interfaces (Ethernet).

The measuring device is equipped with a digital interface for data transmission in accordance with Guideline VDI 4201, Sheet 1 (General requirements) and Sheet 3 (Specific requirements for Modbus). Refer to the documentation delivered (Modbus signal list) for assignment of the Modbus registers. Only Endress+Hauser Service may perform parameter settings.

3.5 Remote maintenance (option)

Prerequisites

- An internet connection must be available.

Function

- The Endress+Hauser Meeting Point Router (MPR) is available for remote diagnostics via the internet.
- The MPR links a plant-side machine network with the Endress+Hauser remote architecture.
- A firewall which decouples the machine network from the internet or the operating company network is integrated in the MPR.

Related topics

- MPR Meeting Point Router Operating Instructions

4 Transport and storage

4.1 Transport

Overview

The measuring device is mounted on an assembly frame. Transport the assembly frame with a suitable lifting tool (e.g. a crane or lifting truck with sufficient lifting capacity) and fit it on the wall.

Important information

WARNING
When transporting the measuring device, there is a risk of crushing and impact due to the high weight.

► The measuring device may only be transported by competent persons.

NOTICE
The measuring device may only be transported and installed by qualified persons who, based on their training and knowledge as well as knowledge of the relevant regulations, can assess the tasks given and recognize the dangers involved.

Procedure

Transport via crane

1. Transport the assembly frame with the transport lugs included in the scope of delivery. Make sure the load is symmetrical at 45°.

4.2 Storage

Protective measures for long-term storage

- When gas lines have been unscrewed: Close all gas connections (with sealing plugs) to protect internal gas paths against moisture, dust or dirt penetrating
- Close off open electrical connections dust-tight
- Protect the display against sharp-edged objects. Possibly attach a suitable protective cover (e.g. made of cardboard or hard foam)
- Select a dry, well-ventilated room for storage
- Wrap the device (e.g. with stretch foil)
- When high air humidity can be expected: Include a drying agent (Silica-Gel) in the packing

5 Mounting and electrical installation

5.1 Safety

Qualification

Mounting may only be carried out by trained specialists.

The electronic installation may only be carried out by a trained electrician.

5.1.1 Equipment protection

Short-circuit protection must be provided by the customer in accordance with the applicable standards by means of fuses or circuit breakers with short-circuit protection and overload protection.

5.1.2 Disconnecting device

Install a power isolating switch or circuit breaker according to the valid standard for disconnecting the voltage supply.

Install an additional disconnecting device if a UPS is used.

Make sure the power isolating switches are easily accessible.

5.2 Scope of delivery

Please see the delivery documents for the scope of delivery.

5.3 Screw fittings

5.3.1 Installing the stainless steel screw fitting

Overview

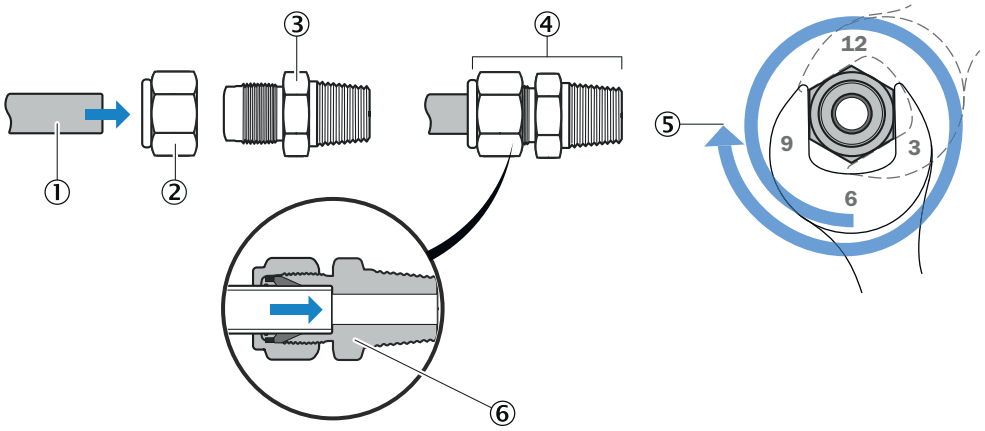


Figure 5: Stainless steel screw fitting

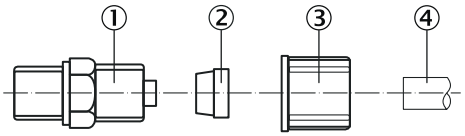
① Tube
② Cap nut
③ Fitting body
④ Tube screw fitting
⑤ Position: $1^1/_4$ revolution
⑥ Sectional view: Screw connection fixed

Procedure

1. Push tube ① into tube screw fitting ③ to the stop.
2. During initial fitting: Hold fitting body ③ steady and tighten cap nut ② with $1^1/_4$ revolutions.
3. During further fittings: Tighten cap nut ② to the previous position (the resistance increases noticeably) and then tighten slightly.

5.3.2 Using a plastic fitting

Overview



① Screw-in piece
② Clamping ring
③ Knurled nut
④ Hose

Procedure

1. Put the knurled nut and clamping ring onto the tube. Observe the position of the clamping ring.
2. Push the tube onto the screw-in piece.
3. Turn the knurled nut hand-tight.

5.3.3 Using a push-in fitting (pneumatic)

Overview

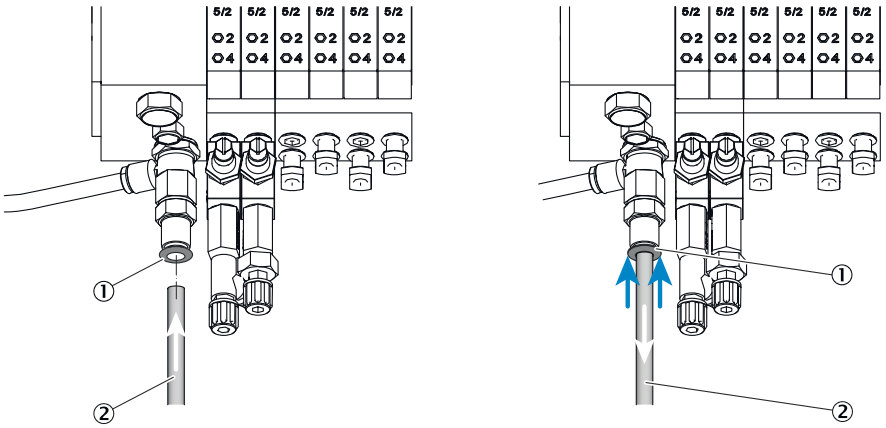


Figure 6: Push-in fitting with retaining ring (example shown)

① Retaining ring
② Tube

Procedure

Fitting the tube

1. Push the tube in.

Removing the tube

1. Press the retaining ring in.
2. Pull the tube out.

5.4 Mechanical and electrical installation

Important information

NOTICE
Observe ambient conditions.

If the measuring device is operated outside the ambient conditions, the measuring device switches to Standby mode and does not provide valid measured values. Only when the ambient conditions are met again does the measuring device provide valid measured values.

► Before installation, check that the ambient conditions at the installation location are met.

NOTICE
Observe the order of assembly.

If the assembly sequence is incorrect, there is a risk of contamination of the gas sampling unit. This can cause exhaust gas to enter the unheated analyzer and condense out.

► First connect instrument air and voltage supply.
► Only then install the gas sampling unit in the flue gas duct.

Assembly sequence

- Fit the assembly frame on the wall.
- Connect the sample gas line to the gas sampling unit SFU
- Connect the hose bundle line to the gas sampling unit SFU
- Connect the sample gas line to the sample conditioning and distribution unit
- Connect the hose bundle line to the sample conditioning and distribution unit
- Connect the discharge hose to the condensate pump
- Connect the condensate container (option)
- Connect the filling level sensor to the condensate container (option)
- Connect the valve block
- Connect the gas connections to the analyzer system
- Close the shut-off valve of the control gas
- Connect the instrument air
- Connect the power supply
- Fit the gas sampling unit SFU

Related topics

- see "Ambient conditions", page 147

5.5 Installation sequence

5.5.1 Wall fitting

Overview

The analyzer system is delivered pre-assembled on an assembly frame.

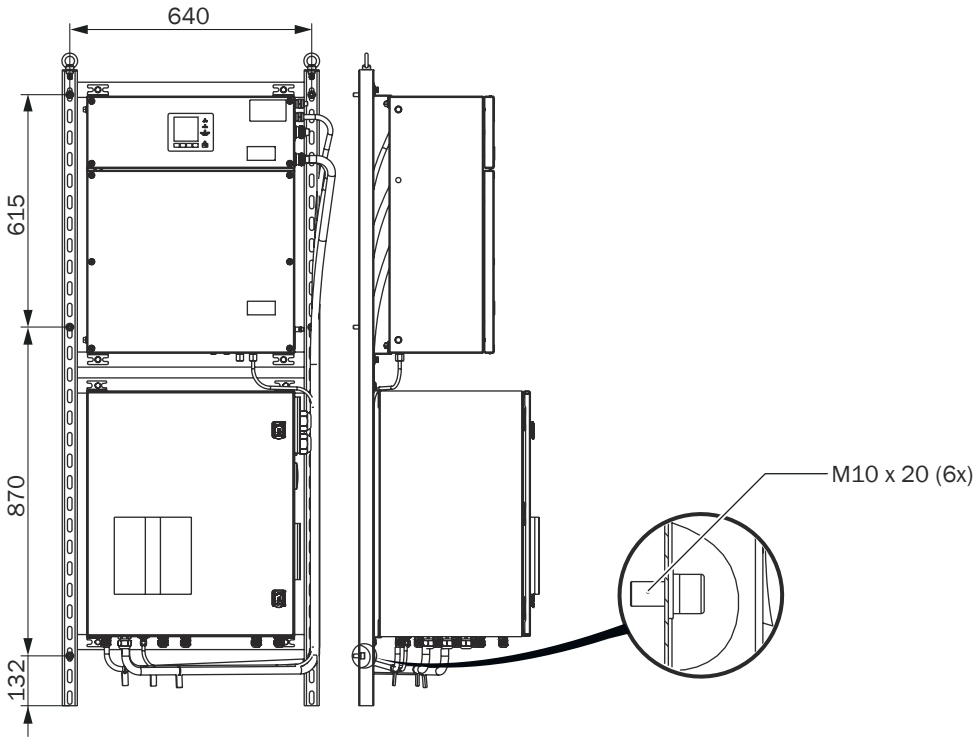


Figure 7: Positions of the screws for wall fitting

Prerequisites

- Observe clearances of the heated sample gas line.
- Observe clearances for incoming and outgoing lines (approx. 55 cm clearance above, below, to the side of the measuring device).
- Observe clearances for maintenance work.
- Ensure that the mounting location has sufficient load-bearing capacity.
- Observe appropriate ambient conditions.

Procedure

1. Fasten the assembly frame to the wall with M10 x 20 screws.

Related topics

- see "Ambient conditions", page 147
- see "Dimensional drawings", page 146

5.5.2 Fitting the gas sampling unit

Important information

NOTICE

- ► Observe the ambient conditions of the gas sampling unit.
- ► When laying the sample gas line and hose bundle line, provide sufficient length for pulling the gas sampling unit out of the flue gas duct.
- ► All connections must match the connections in the measuring device.

Related topics

- Ambient conditions: see Gas Sampling Unit Operating Instructions

5.5.2.1 Fitting the welding neck flange

Overview

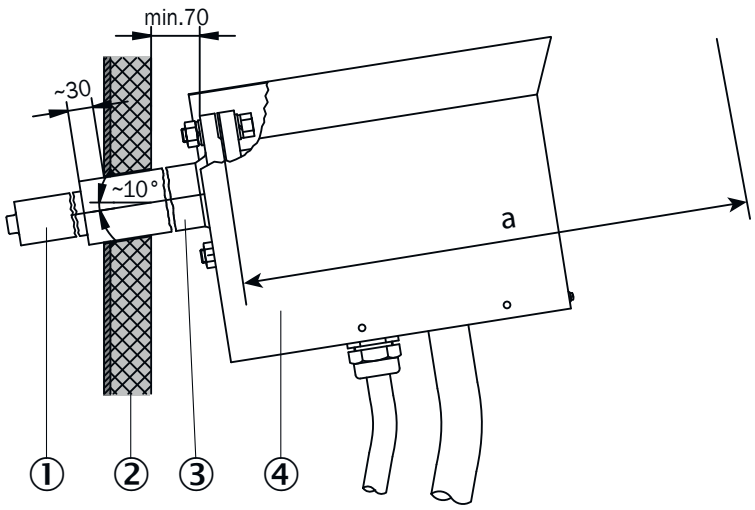


Figure 8: Welding neck flange fitting requirements

① Gas sampling tube
② Stack wall
③ Welding neck flange
④ Gas sampling probe

Important information

CAUTION DANGER OF BURNS DUE TO HOT SURFACES
Surface can become hot through operation of the device.

- ► Wear suitable protective clothes, for example, heat-resistant gloves.
- ► Switch off the device and allow the components to cool down.

DANGER RISK TO HEALTH THROUGH HOT OR TOXIC GASES IN THE MEASURING DUCT
The measuring channel can contain hot or toxic gases which can escape when opening the duct-side flange. Escaping gases can cause considerable health damage even if the measuring channel is put out of operation for the duration of the installation.

- ► Always put the measuring channel out of operation for the duration of the installation.
- ► If required, purge the measuring channel with ambient air before installation work.
- ► During installation work, always wear suitable protective clothing resp. as specified by the operating company.

Prerequisites

Minimum distance “a” must be available behind the welding neck flange to be able to service and remove the gas sampling unit.

Table 5: Minimum distance behind welding neck flange

Length of gas sampling tube	Minimum distance “a”
0.5 m	915 mm
0.8 m	1215 mm

Procedure

1. Observe minimum distance “a” behind welding neck flange.
2. Attach the flange at an angle of approx. 10°.

5.5.2.2 Fitting the gas sampling unit on the flange

Overview

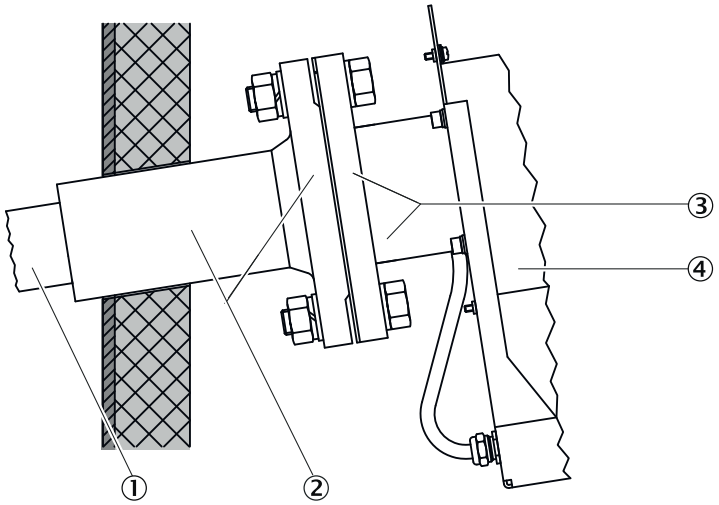


Figure 9: Fitting the gas sampling unit on the welding neck flange

① Gas sampling tube
② Welding neck flange
③ Filter housing flange
④ Filter housing

Important information

NOTICE
Risk of contamination of the gas sampling unit

► Install the gas sampling unit on the flue gas duct just before switching on the measuring device.

Prerequisites

- Gas sampling unit is heated up. Heating up time: Approx. 1.5 hours at 25 °C ambient temperature.
- Weather hood removed.

Procedure

1. Push the seal over the gas sampling tube.
2. Push the gas sampling unit with gas sampling tube into the welding neck flange. The hose outlets of the gas sampling unit must point downwards.
3. Screw the filter housing flange of the gas sampling unit to the welding neck flange.
4. Fit the weather hood.

5.5.3 Laying the sample gas lines

Overview

Figure 10: Heated sample gas line

① PT100 connections
② Voltage supply
③ Connection to gas sampling unit (without electrical connections)
④ Protective cap
⑤ Connection to measuring device (with electrical connections)
⑥ Lock nut
⑦ Cable gland

Important information

NOTICE
Protect the line from damage (chafing through vibration, mechanical load).

NOTICE
The sample gas line must not be insulated at the position of the Pt100 or led through a wall, as otherwise the sample gas line may be damaged.

NOTICE
During operation, condensate may form in the sample gas line which can damage the entire system.

► Fit the sample gas line in a downward direction

Procedure

1. Lay the end **with** the electrical connection to the measuring device.
   NOTICE | The screw connection for the housing duct must be located at the same end as the electrical connection (measuring device side).
2. Lay the end **without** electrical connection to the gas sampling unit.
3. Observe a minimum bending radius of 300 mm.
4. With two sample gas lines, the minimum distance of 100 mm must be observed over the entire length in order to avoid damage.

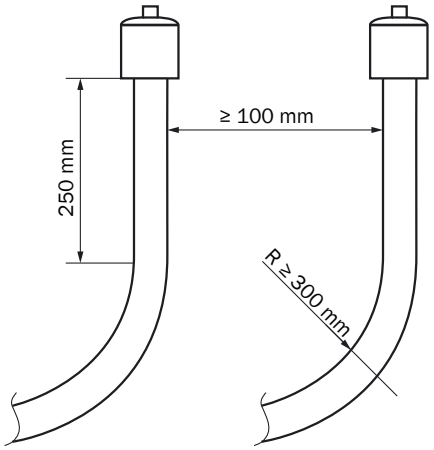


Figure 11: Lines – clearance and bending radius

5. Roll up excess length at the gas sampling unit. Leave enough length for pulling the gas sampling unit.
6. Fasten the sample gas line accordingly (e.g. on cable trays).

5.5.4 Laying the hose bundle line

Important information

NOTICE
Protect the line from damage (chafing through vibration, mechanical load).

Procedure

1. Lay the hose bundle line from the gas sampling unit to the measuring device.
   - An additional length of 2 m is required at the gas sampling unit for the internal lines.
   - An additional length of 1.5 m is required as from the housing inlet of the measuring device for the internal lines.
2. Observe a minimum bending radius of 300 mm.

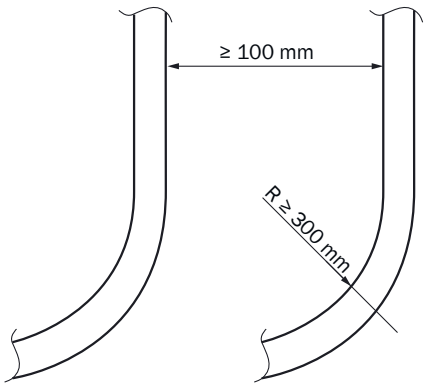


Figure 12: Lines – clearance and bending radius

3. Fasten the hose bundle line accordingly (e.g. on cable trays).

5.5.5 Fitting the sample gas line on the gas sampling unit

Important information

NOTICE
Protect the line from damage (chafing through vibration, mechanical load).

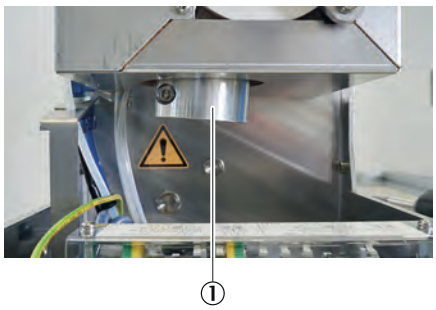
Prerequisites

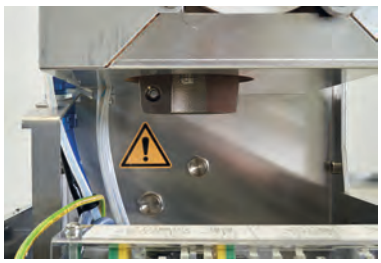
- Weather hood is removed.

Procedure

Remove the clamp.

1. Loosen screw ① of clamp ②.
2. Remove clamp ②.



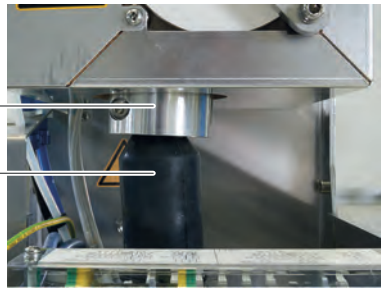


3. Open clamp ① of the strain relief of the heated sample gas line.

4. Insert sample gas line ①.

   NOTICE | Do not lead the sample gas line too far upwards, as leaks may occur.

5. Fit sample gas line ① on the gas sampling unit with the clamping ring screw connection.



6. Tighten the strain relief clamp.
7. Screw thermal bridge clamp ② on.
8. Fit the weather hood.

5.5.6 Connecting the hose bundle line to gas sampling unit (115 V)

Overview

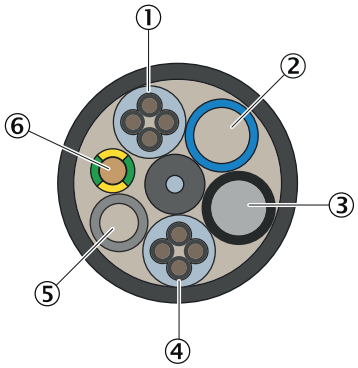


Figure 13: Hose bundle line

① Voltage supply
② PA hose blue DN6/8
③ PA hose black DN6/8
④ Signal line
⑤ PTFE hose DN4/6
⑥ Grounding conductor

No.	Designation	Function	Dimension
①	Voltage supplies	Wires 1 and 2: Gas sampling filter Wires 3 and 4: Probe tube (optional)	4 x 1.5 mm²
②	PA hose (blue)	Purging air	DN 6/8
③	PA hose (black)	Control air main valve	DN 6/8
④	Signal lines (Pt100)	Wires 1 and 2: Gas sampling filter Wires 3 and 4: Probe tube (optional)	4 x 1.0 mm²
⑤	PTFE hose (white)	Zero gas	DN 4/6
⑥	Grounding conductor (green/yellow)	Grounding	1 x 4.0 mm²

Important information

NOTICE
All connections must match the connections in the measuring device.

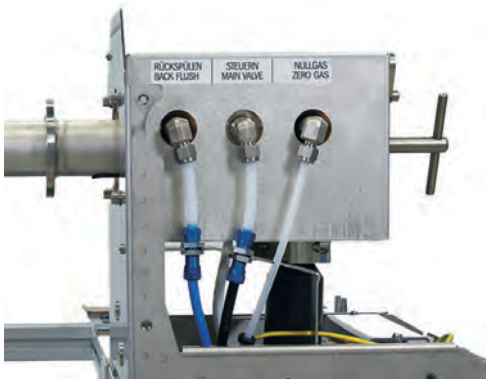
Prerequisites

- The weather hood of the gas sampling unit is dismantled.
- The hose bundle line is stripped 40 cm.

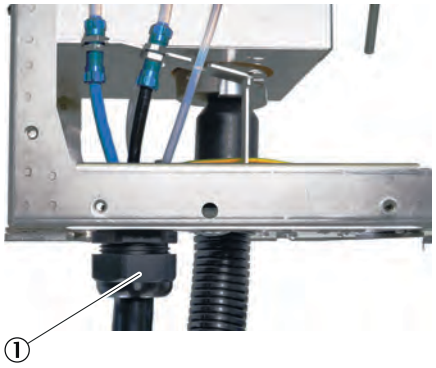
Procedure

Connecting the gas connections:

1. Guide the hose bundle line into the housing through the screw connection provided for this purpose.
2. Connect the hose bundle line.
   - Hose, black: Main valve
   - Hose, blue: Purging
   - Hose, white: Zero gas/test gas

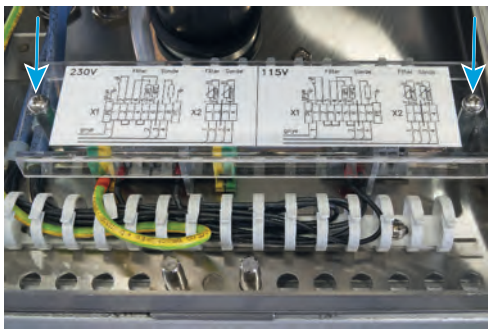


3. Tighten the screw connection of the strain relief.

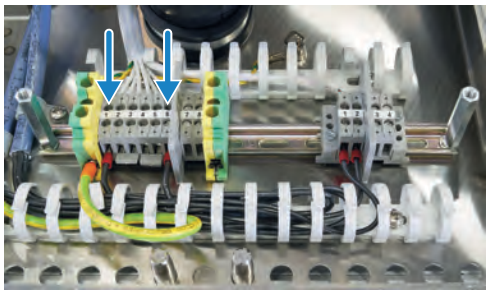


Connecting the electric lines of the hose bundle line to the gas sampling unit (115 V):

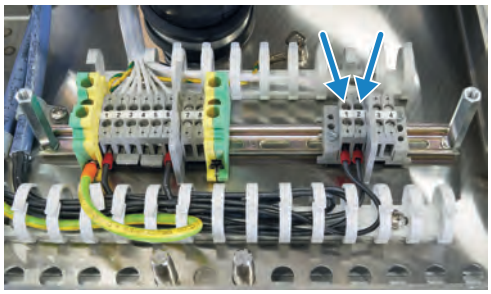
1. Strip 17 cm of insulation from the Pt100 and power supply lines.
2. Lay the Pt100 and power supply lines through the clamps to the cable duct.
3. Open cover.



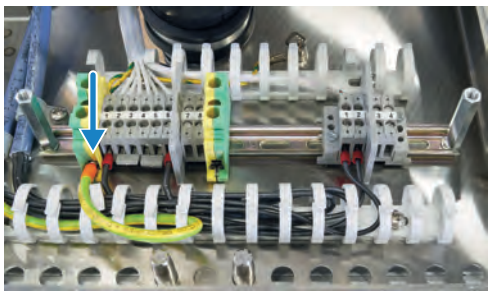
4. Connect the power supply of the gas sampling unit to X1 using the 1.5 mm^2 wires with ferrule.
   - Line 1 / wire 1 = X1 : 1
   - Line 1 / wire 2 = X1 : 6
   - Line 1 / wire 3 = reserve (do not cut off)
   - Line 1 / wire 4 = reserve (do not cut off)



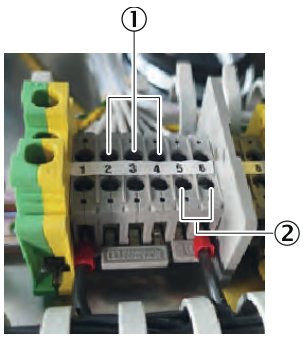
5. Connect the Pt100 lines of the gas sampling unit to X2 using the 1.0 mm² wires with ferrule.
   - Line 2 / wire 1 = X2 : 1
   - Line 2 / wire 2 = X2 : 2
   - Line 2 / wire 3 = reserve (do not cut off)
   - Line 2 / wire 4 = reserve (do not cut off)



6. Connect the PE line to connection terminal PE with ferrule.



7. Remove the enclosed two- and three-point jumpers from the bag in the cable duct.
8. Clamp the three-point jumper to contacts 2, 3 and 4 (①).
9. Clamp the two-point jumper to contacts 5 and 6 (②).



5.5.7 Connecting the hose bundle line to gas sampling unit (230 V)

Overview

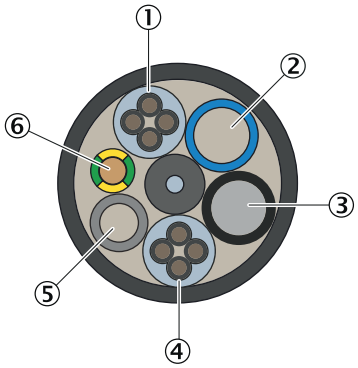


Figure 14: Hose bundle line

① Voltage supply
② PA hose blue DN6/8
③ PA hose black DN6/8
④ Signal line
⑤ PTFE hose DN4/6
⑥ Grounding conductor

No.	Designation	Function	Dimension
①	Voltage supplies	Wires 1 and 2: Gas sampling filter Wires 3 and 4: Probe tube (optional)	4 x 1.5 mm²
②	PA hose (blue)	Purging air	DN 6/8
③	PA hose (black)	Control air main valve	DN 6/8
④	Signal lines (Pt100)	Wires 1 and 2: Gas sampling filter Wires 3 and 4: Probe tube (optional)	4 x 1.0 mm²
⑤	PTFE hose (white)	Zero gas	DN 4/6
⑥	Grounding conductor (green/yellow)	Grounding	1 x 4.0 mm²

Important information

NOTICE
All connections must match the connections in the measuring device.

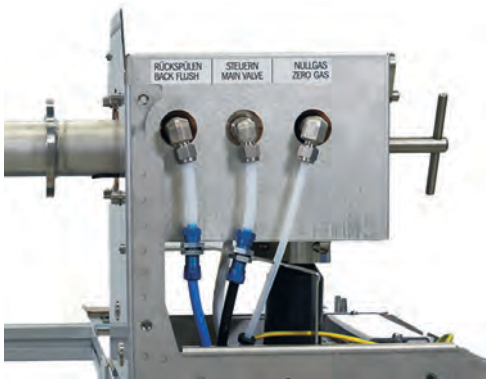
Prerequisites

- The weather hood of the gas sampling unit is dismantled.
- The hose bundle line is stripped 40 cm.

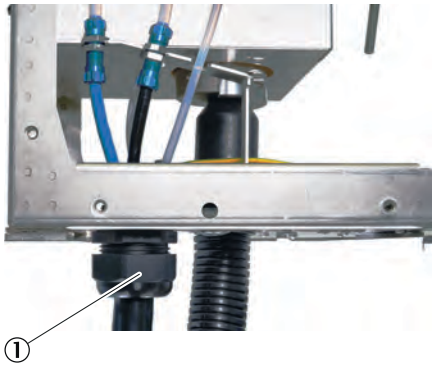
Procedure

Connecting the gas connections:

1. Guide the hose bundle line into the housing through the screw connection provided for this purpose.
2. Connect the hose bundle line.
   - Hose, black: Main valve
   - Hose, blue: Purging
   - Hose, white: Zero gas/test gas

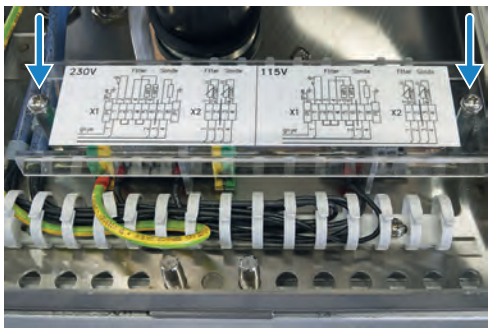


3. Tighten the screw connection of the strain relief.

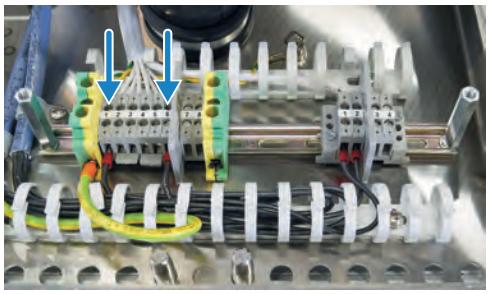


Connecting the hose bundle line to the gas sampling unit (230 V)

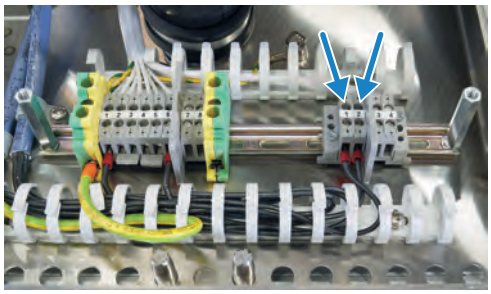
1. Strip 17 cm of insulation from the Pt100 and power supply lines.
2. Lay the Pt100 and power supply lines through the clamps to the cable duct.
3. Open cover.



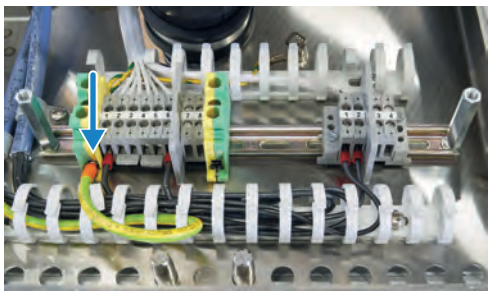
4. Connect the power supply of the gas sampling unit to X1 using the 1.5 mm² wires with ferrule.
   - Line 1 / wire 1 = X1 : 1
   - Line 1 / wire 2 = X1 : 6
   - Line 1 / wire 3 = reserve (do not cut off)
   - Line 1 / wire 4 = reserve (do not cut off)



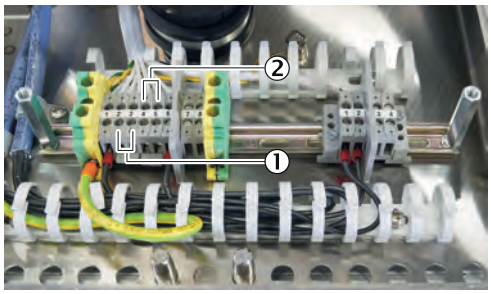
5. Connect the Pt100 lines of the gas sampling unit to X2 using the 1.0 mm² wires with ferrule.
   - Line 2 / wire 1 = X2 : 1
   - Line 2 / wire 2 = X2 : 2
   - Line 2 / wire 3 = reserve (do not cut off)
   - Line 2 / wire 4 = reserve (do not cut off)



6. Connect the PE line to connection terminal PE with ferrule.



7. Clamp a two-point jumper to contacts 2 and 3 (②).
8. Clamp a two-point jumper to contacts 4 and 5 (①).



5.5.8 Connecting the hose bundle line to the sample conditioning and distribution unit (one measuring point)

Prerequisites

- Cable ducts are open.
- The hose bundle line is stripped 1,5 cm.
- Strip 20 cm of insulation from the voltage and signal lines of the hose bundle line.

Procedure

1. Insert the hose bundle line into the duct (XL2). At the same time, keep the ground line in the top position.

2. Connect the hose bundle line to the corresponding connections of the valve block (KK0) (see wiring diagram).

3. Connect the voltage supply of the gas sampling unit using the 1.5 mm^2 lines with ferrules to XD2.
   - Line 1 / wire 1 = XD2 : 11
   - Line 1 / wire 2 = XD2 : 2
   - Line 1 / wire 3 = reserve (do not cut off)
   - Line 1 / wire 4 = reserve (do not cut off)
4. Connect the Pt100 line of the gas sampling unit using the 1.0 mm^2 lines with ferrules to XD3.
   - Line 2 / wire 1 = XD3 : 3
   - Line 2 / wire 2 = XD3 : 4
   - Line 2 / wire 3 = reserve (do not cut off)
   - Line 2 / wire 4 = reserve (do not cut off)
5. Connect the PE line to connection terminal XPE with ferrule.
6. Tighten the cable duct.

Related topics

- Wiring diagram of the measuring device

5.5.9 Connecting the hose bundle line to the sample conditioning and distribution unit (two measuring points)

Prerequisites

- Cable ducts are open.
- The hose bundle line is stripped 1,5 cm.
- Strip 20 cm of insulation from the voltage and signal lines of the hose bundle line.

Procedure

1. Insert the hose bundle line into the cable duct. At the same time, lay the ground line in the top position.
   - SP1 = XL3
   - SP2 = XL4

2. Connect the hose bundle line to the corresponding connections of the valve block (KK0) (see wiring diagram).

3. Connect the voltage supply of the gas sampling unit using the 1.5 mm^2 lines with ferrules to XD2.

   Measuring point 1:
   - Line 1 / wire 1 = XD2 : 14
   - Line 1 / wire 2 = XD2 : 3
   - Line 1 / wire 3 = reserve (do not cut off)
   - Line 1 / wire 4 = reserve (do not cut off)

   Measuring point 2:
   - Line 1 / wire 1 = XD2 : 15
   - Line 1 / wire 2 = XD2 : 4
   - Line 1 / wire 3 = reserve (do not cut off)
   - Line 1 / wire 4 = reserve (do not cut off)

4. Connect the Pt100 line of the gas sampling unit using the 1.0 mm^2 lines with ferrules to XD3.

   Measuring point 1:
   - Line 2 / wire 1 = XD3 : 3
   - Line 2 / wire 2 = XD3 : 4
   - Line 2 / wire 3 = reserve (do not cut off)
   - Line 2 / wire 4 = reserve (do not cut off)

   Measuring point 2:
   - Line 2 / wire 1 = XD3 : 7
   - Line 2 / wire 2 = XD3 : 8

- Line 2 / wire 3 = reserve (do not cut off)
- Line 2 / wire 4 = reserve (do not cut off)

5. Connect the PE line to connection terminal XPE with ferrule.
6. Tighten both cable ducts.

Related topics

- Wiring diagram of the measuring device

5.5.10 Connecting the hose bundle line to the sample conditioning and distribution unit (one measuring point)

Important information

NOTICE
Protect the line from damage (chafing through vibration, mechanical load).

NOTICE
During operation, condensate may form in the sample gas line which can damage the entire system.

► Fit the sample gas line in a downward direction

Procedure

1. Remove the protective cap from the heated sample gas line on the sample conditioning and distribution unit.
2. Insert the heated sample gas line into the gland.
   NOTICE | Pay attention to the sample gas line bending radius.
3. Tighten the lock nut from the inside.
4. Align the position and length of the heated sample gas line.
5. Connect the heated sample gas line to the cooler inlet with the clamping ring screw connection.

6. Provide strain relief for the heated sample gas line by tightening the cap nut.
7. Connect the power supply of the heated sample gas line.
   - Line 1 = XD2 / 10
   - Line 2 = XD2 / 1
8. Connect the Pt100 for the heated sample gas line.
   - Line 1 = XD3 / 1
   - Line 2 = XD3 / 2
   - Line 3 = spare (do not cut off)
   - Line 4 = spare (do not cut off)
9. Close all cable ducts.

Related topics

- Clamping ring screw connection: see "Installing the stainless steel screw fitting", page 23
- Wiring diagram of the measuring device

5.5.11 Connecting the hose bundle line to the sample conditioning and distribution unit (two measuring points)

Important information

NOTICE
Protect the line from damage (chafing through vibration, mechanical load).

NOTICE
During operation, condensate may form in the sample gas line which can damage the entire system.

► Fit the sample gas line in a downward direction

Procedure

1. Remove the protective cap from the glands for the heated sample gas lines on the sample conditioning and distribution unit.
2. Insert the heated sample gas line into the gland.
   NOTICE | Pay attention to the sample gas line bending radius.
3. Tighten the lock nut from the inside.
4. Align the position and length of the heated sample gas lines.
5. Connect the heated sample gas lines to the cooler inlet with the clamping ring screw connection.

6. Provide strain relief for the heated sample gas line by tightening the cap nut.

7. Connect the power supply of the heated sample gas line.
   Gas sampling unit 1
   - Line 1 = XD2 / 12
   - Line 2 = XD2 / 1

   Gas sampling unit 2
   - Line 1 = XD2 / 13
   - Line 2 = XD2 / 2
8. Connect the Pt100 for the heated sample gas line.
   Gas sampling unit 1
   - Line 1 = XD3 / 1
   - Line 2 = XD3 / 2
   - Line 3 = spare (do not cut off)
   - Line 4 = spare (do not cut off)

   Gas sampling unit 2
   - Line 1 = XD3 / 5
   - Line 2 = XD3 / 6
   - Line 3 = spare (do not cut off)
   - Line 4 = spare (do not cut off)
9. Close all cable ducts.

Related topics

- Clamping ring screw connection: see "Installing the stainless steel screw fitting", page 23
- Wiring diagram of the measuring device

5.5.12 Connecting the discharge hose to the condensate pump

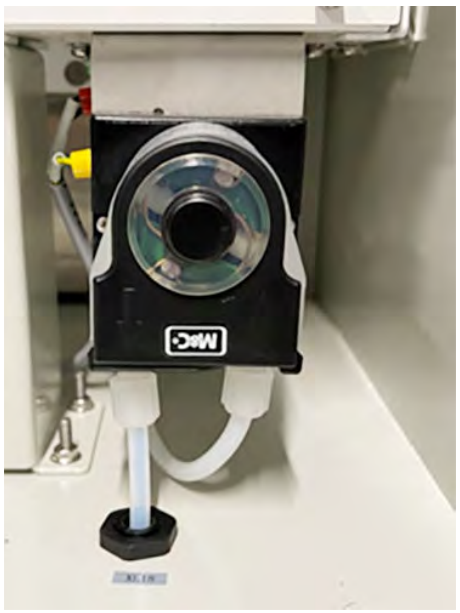
Important information

NOTICE
Condensate formation can lead to corrosion in the housing.

► Drain the condensate outlet of the cooler to the outside.

Procedure

1. Guide the condensate outlet out of the housing through the duct provided.



5.5.13 Connecting the condensate container (option)

Overview

The purpose of the condensate container is to collect condensate within the sample gas outlet in order to prevent condensate formation in the direct environment of the measuring device.

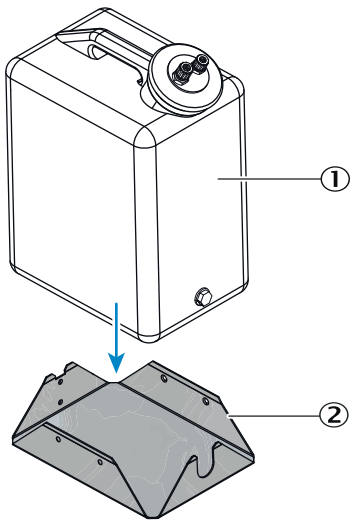


Figure 15: Condensate container

① Condensate container
② Metal stand

Important information

NOTE
To avoid condensate formation in the discharge hose, the discharge hose must be installed in a downward direction.

Prerequisites

- Discharge hose connected to condensate pump.

Procedure

1. Place the metal stand for the condensate container on the floor next to the measuring device and fasten it securely.
2. Place the condensate container in the metal stand.
3. Connect the reducer from 6 mm to 10 mm to the discharge hose of the condensate pump.
4. Connect the 10 mm hose to the smaller connection on the lid of the condensate container.
5. Connect the other end to the reducer.

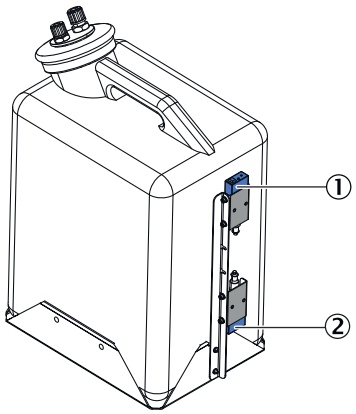
5.5.14 Connecting the filling level sensor to the condensate container (option)

Prerequisites

- Condensate container and metal stand are attached.

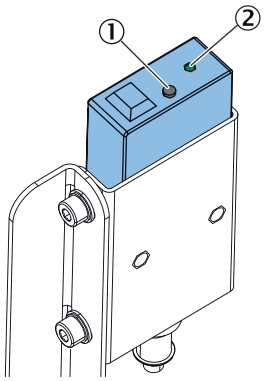
Procedure

1. Connect the cable to the level sensor.
2. Fit the level sensor on the retaining plate using the screws supplied.
3. Decide how often the condensate container has to be emptied and install the appropriate level sensor.
   - ①**At the top** of the container: Occasional emptying
   - ②**At the bottom** of the container: Frequent emptying



① Level sensor at top of the container
② Level sensor at bottom of the container

4. Insert the cable through the corresponding cable entry.
5. Lay the cable in the cable duct, strip the insulation and connect it with a ferrule.
6. Adjust the sensitivity of the level sensor with a screwdriver.



① Adjustment screw
② Status LED

- Turn adjustment screw counterclockwise until end position is reached.
- Turn clockwise until LED turns on.
- Slowly turn counterclockwise until LED turns off.
- From the point where the LED goes out, make an additional quarter turn counterclockwise.

✓ The status LED indicates whether the sensor is triggered or not and sends an alarm signal to the measuring device. The LED should be “off” when the container is empty.

Related topics

- Wiring diagram of the measuring device

5.5.15 Connecting exhaust gas lines

Important information

WARNING
Noxious and aggressive exhaust gases
The exhaust gases may contain harmful or irritating components.

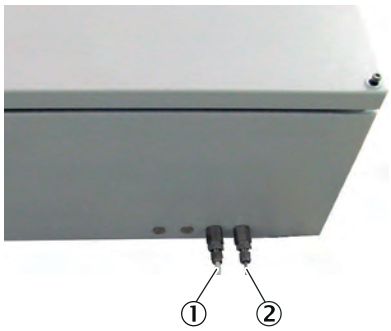
► Lead the measuring system gas outlets outdoors or into a suitable flue.
► Do not connect the exhaust gas line with the exhaust gas line of sensitive subassemblies. Aggressive gases could damage these subassemblies as a result of diffusions.

Prerequisites

- Discharge the sample gas outlet to a suitable environment.
- The sample gas outlet must be open to the ambient pressure.

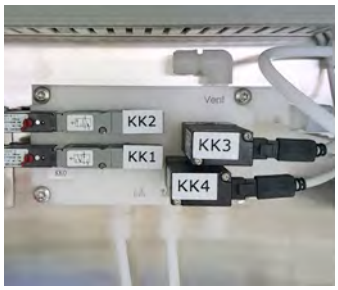
Procedure

1. Route the PTFE tubes from below into the housing.



① Sample gas inlet (front view - bottom left)
② Sample gas outlet (front view - bottom right)

2. Connect the lines to the clamping ring screw connection.
3. Route the valve block vent out through the gland provided on the sample conditioning and distribution unit and discharge to the exhaust gas.



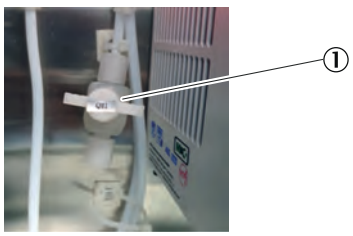
- One measuring point: Gland XL11
- Two measuring points: Gland XL13

5.5.16 Closing the shut-off valve of the control gas

Overview

The shut-off valve can be used to feed test gas to the analysis system. This must be connected to the shut-off valve with < 0.3 bar. The test gas is fed directly to the analyzer when the shut-off valve is opened.

The shut-off valve must be closed during measuring operation to ensure condensate drainage from the cooler.

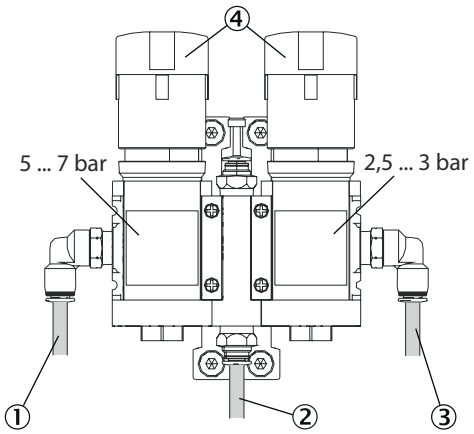


Procedure

1. Close the shut-off valve QM1 ① of the control gas connection.

5.5.17 Connecting the instrument air

Overview



① Inlet of instrument air with zero gas quality
② Connection to the measuring device (5 ... 7 bar)
③ Connection to the measuring device (2.5 ... 3 bar)
④ Pressure reducers (adjustable)

Important information

NOTICE
Instrument air that does not comply with the specifications can contaminate the entire system. This can lead to incorrect measuring results and damage the system.

► The instrument air specification must be observed:
  - Instrument air definition according to ISO 8573-1:2020
  - Particles - Class 1
  - Pressure dew point - Class 4 at 1.3 bar absolute or 300 mbar overpressure
  - Oil content - Class 2

► If the supplied instrument air does not meet the required quality, an instrument air conditioner must be connected upstream from the pressure gauge. (see "Instrument air, conditioning", page 20)

Prerequisites

- The instrument air must meet the specifications.

Procedure

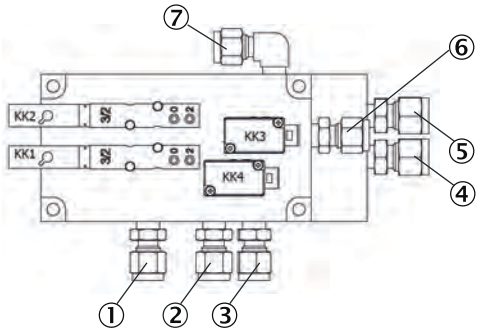
1. Connect the conditioned instrument air to the main supply of the pressure gauge at a pressure of 7 ... 10 bar.
2. Adjust the primary pressure according to the Figure.

Related topics

- Instrument air specification: see "Gas supply", page 150

5.5.18 Checking the valve block connections

Overview



① Instrument air inlet
② Zero gas inlet
③ Purge air inlet
④ Control gas inlet
⑤ Purge inlet
⑥ Calibration gas
⑦ Valve block ventilation

Important information

WARNING
Noxious and aggressive exhaust gases
The exhaust gases may contain harmful or irritating components.

- ► Lead the measuring system gas outlets outdoors or into a suitable flue.
- ► Do not connect the exhaust gas line with the exhaust gas line of sensitive subassemblies. Aggressive gases could damage these subassemblies as a result of diffusions.

Procedure

1. Compare the valve block connections with the illustration.

Related topics

- Wiring diagram of the measuring device

5.6 Socket for Service work

It is recommended to install a socket in accordance with the applicable standards near the measuring device for service work.

5.7 Electrical connection of control unit

Prerequisites

- Supply line fuses are switched off.
- Fuses of the sample conditioning and distribution unit are switched off.

Procedure

1. Lay the feed line.
2. Connect PE.

3. For a voltage supply of 115 V and 230 V: Remove and fit the bridge from the accessory pack.

4. Connect the feed line with ferrule.

Related topics

- Wiring diagram of measuring device

5.8 Connecting data communication

5.8.1 Connecting the signal line (option)

Overview

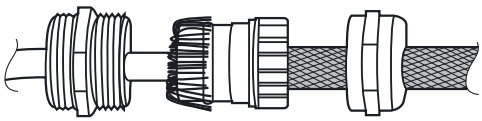


Figure 16: Signal lines connections (shielded)

Connect the signal lines according to the wiring diagram.

Procedure

1. Guide the line through the housing duct.
2. Attach the shielding according to the Figure see figure 16, page 49

5.8.2 Connecting Ethernet (option)

Overview

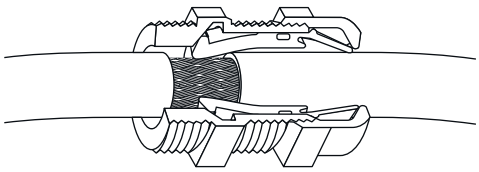


Figure 17: Ethernet connection

Procedure

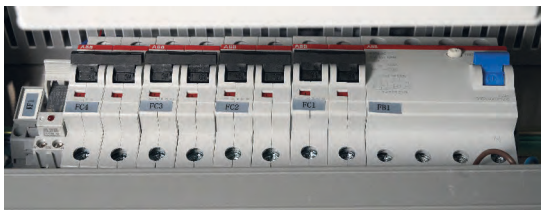
1. Guide the Ethernet cable through the Ethernet cable gland into the housing.
2. Establish a safe contact between the signal cable shield and the cable gland.
3. Establish a plug connection between the Ethernet cable and the distribution board.

6 Commissioning

6.1 Switching on

6.1.1 Switch-on procedure for one measuring point

Overview



Prerequisites

- Device is fully wired.
- Device fuses are switched off.
- Instrument air available on sample conditioning and distribution unit.
- Zero gas available on sample conditioning and distribution unit.
- A leak test was carried out.

Procedure

1. Switch on the switch in the analyzer.
2. Switch on the F1 (FB1) in the sample conditioning and distribution unit.
3. Switch on the fuse of heated sample gas line 1 (FC1).

✓ Switch on the heated sample gas line and heating controller.

4. Switch on the SFU 1 (FC2) fuse.

✓ Switch on the SFU and heating controller.

5. Switch on the fuse of the cooler, condensate pump, sample gas pump, power supply unit (FC3).

✓ Cooler turns on.

✓ Instrument air is fed to the gas sampling unit.

✓ The gas sampling unit is purged during the heating phase (standby).

✓ Condensate pump starts (direction of rotation left).

6. Switch on the analyzer fuse (FC4).

✓ Analyzer and display switch on.

✓ After the heating phase (about 2 hours), the analyzer goes into measuring mode.

6.1.2 Switch-on procedure for two measuring points

Overview

Prerequisites

- Device is fully wired.
- Device fuses are switched off.
- Instrument air available on sample conditioning and distribution unit.
- Zero gas available on sample conditioning and distribution unit.
- A leak test was carried out.

Procedure

1. Switch on the switch in the analyzer.
2. Switch on the F1 (FB1) in the sample conditioning and distribution unit.
3. Switch on the fuse of heated sample gas line 1 (FC1).

✓ Switch on the heated sample gas line and heating controller.

4. Switch on the SFU 1 (FC2) fuse.

✓ SFU and heating controller switch on.

5. Switch on the fuse of the cooler, condensate pump, sample gas pump, power supply unit (FC3).

✓ Cooler turns on.

✓ Instrument air is fed to the gas sampling unit.

✓ The gas sampling unit is purged during the heating phase (standby).

✓ Condensate pump starts (direction of rotation left).

6. Switch on the analyzer fuse (FC4).

✓ Analyzer and display switch on.

7. Switch on the fuse of heated sample gas line 2 (FC5).

✓ Heated sample gas line 2 switches on.

8. Switch on the SFU 2 (FC6) fuse.

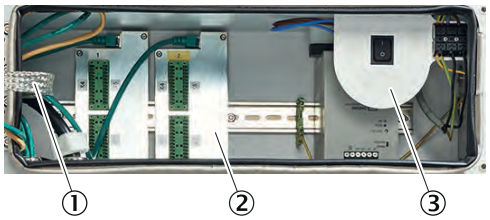
✓ SFU 2 switches on.

✓ After the heating phase (about 2 hours), the analyzer goes into measuring mode.

6.2 Connecting with SOPAS ET

Procedure

1. Connect the network cable to distribution board ①.



① Distribution board with Ethernet for MPR (optional), Modbus, service interface (LAN)

② Signal connections (I/O)

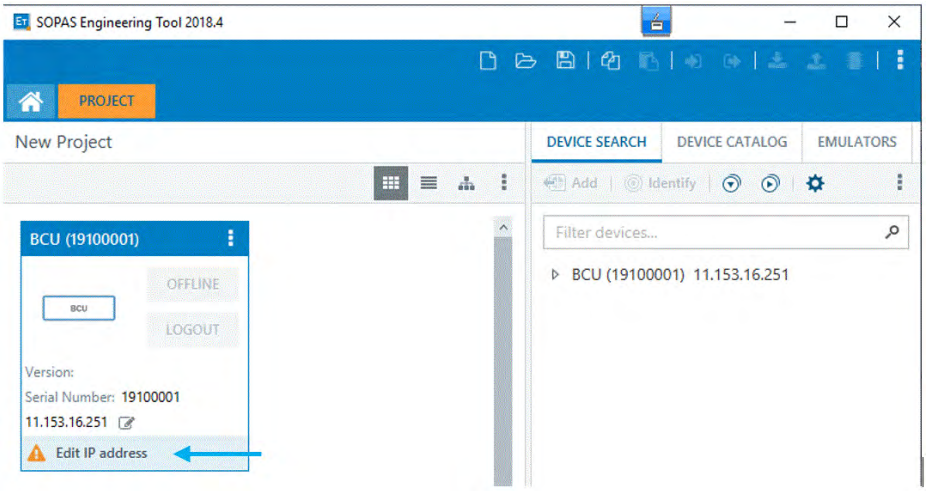
③ Power voltage connection to terminal strip

✓ Analyzer and computer are connected.

2. Open the SOPAS ET engineering tool

✓ SOPAS automatically searches for available devices in the network.

3. If only the BCU is displayed, the IP address of the analyzer is in a different number range than the laptop. This needs to be adjusted. Open the settings via “Edit IP address”.



Changing the IP address of the computer is preferable. If this is not possible, the IP address can be changed via the BCU display.
If the IP address of the device is changed on the BCU, it must be restored at the end of the work.

4. Change of IP address on the BCU display:

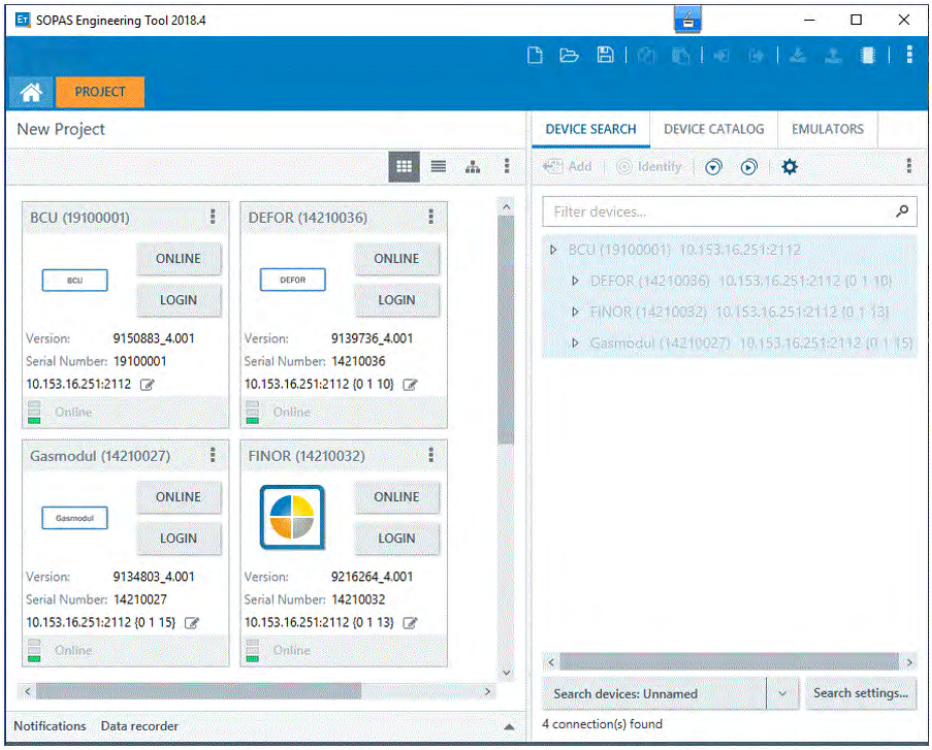
a) Open the menu.
b) Select “Login”.
c) Select “Authorized Operator”.
d) Enter the password and click “Save”.
e) Click “Back”.
f) Select “Parameter”.
g) Select “Communication”.
h) Select “LAN”.
i) Make a note of the displayed IP address during maintenance and repair work.
j) Cleck “Set”.
k) Change the IP address to the number range of the computer.
l) Cleck “Save”.
m) The IP address is changed.

5. After changing the IP address, delete the BCU from the Project window with Del.
6. Perform the search with “Search device”.

✓ All modules installed in the device are displayed.

7. Select the modules and drag them into the Project window on the left.

✓ The connection with the device is established.



6.3 Changing the user level in SOPAS ET

Overview

The user level must be changed to use certain functions.

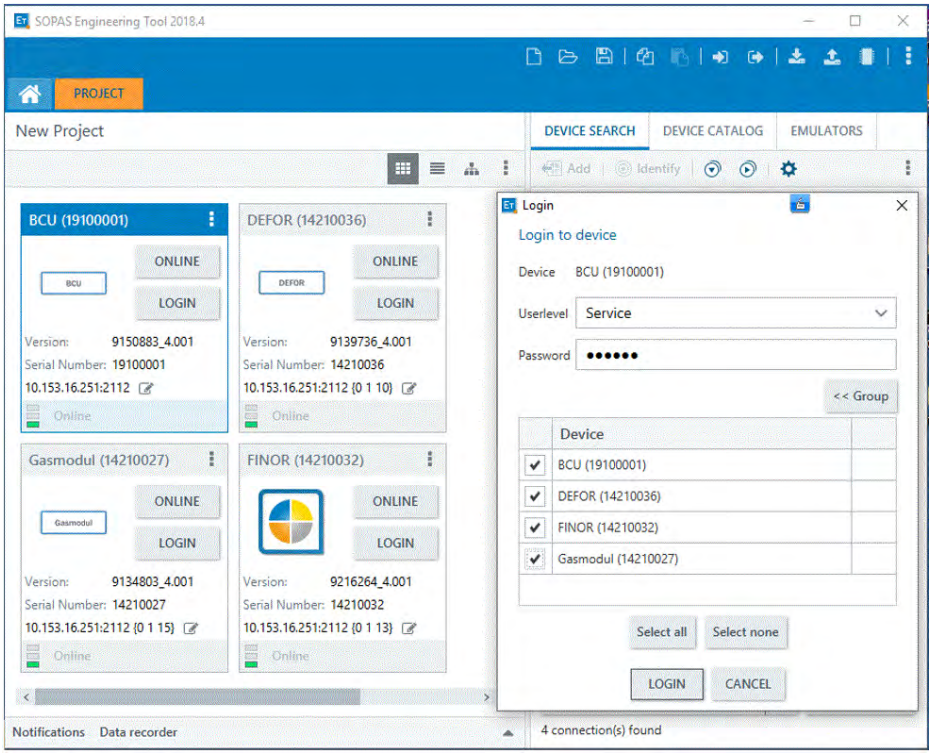
Prerequisites

- SOPAS ET is connected to the measuring device.

Procedure

1. Select the BCU module.
2. Click the “Login to device” button.

✓ The login window opens.



3. Select the user level.
4. Enter password.
5. Select “Group” and click “Select all”.

✓ User level has been changed.

6.4 Data backup and data recovery

The SOPAS data backup must be carried out before and after each commissioning, maintenance and repair for a complete documentation of the analyzer.

By importing the SOPAS data backup, an error can be reset during execution.

The data backup can also be opened off-line. This allows an appropriate expert to identify pending errors in a current backup and define the next steps to fix them.

6.4.1 Backing up the data

Overview

A data backup must be carried out before as well as after each commissioning, maintenance and repair work.

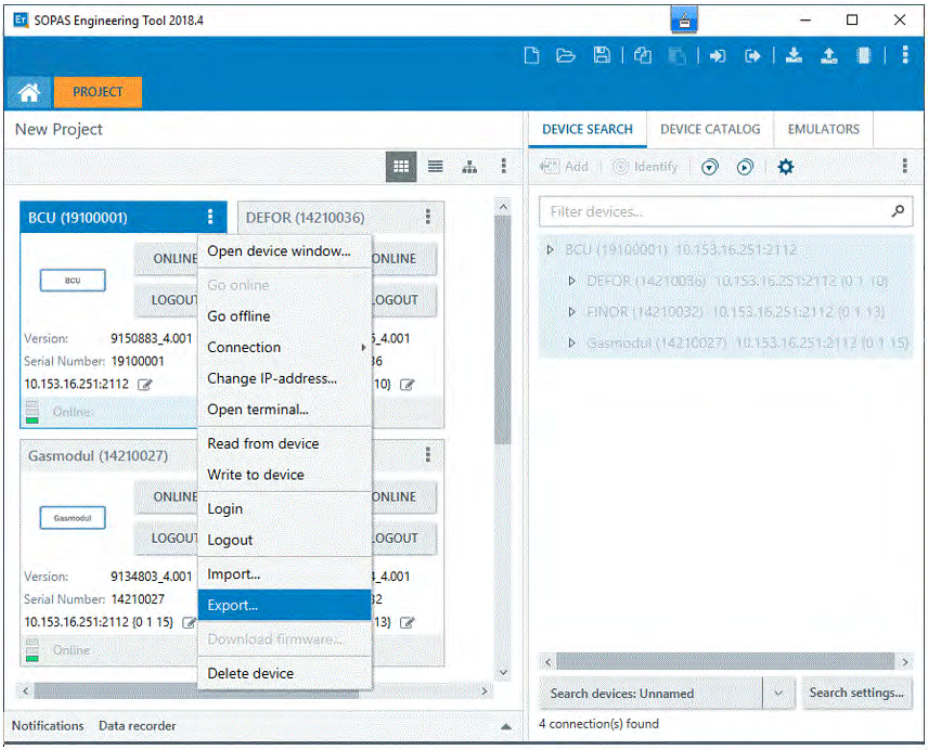
A data backup must be performed for all modules of the measuring device.

Prerequisites

- SOPAS ET is connected to the measuring device.
- Logged in with the Authorized Operator user level.

Procedure

1. Click on the three dots of the corresponding module and select “Export”.



2. Select the appropriate destination folder and click “Save”.

6.4.2 Recovering the data

Overview

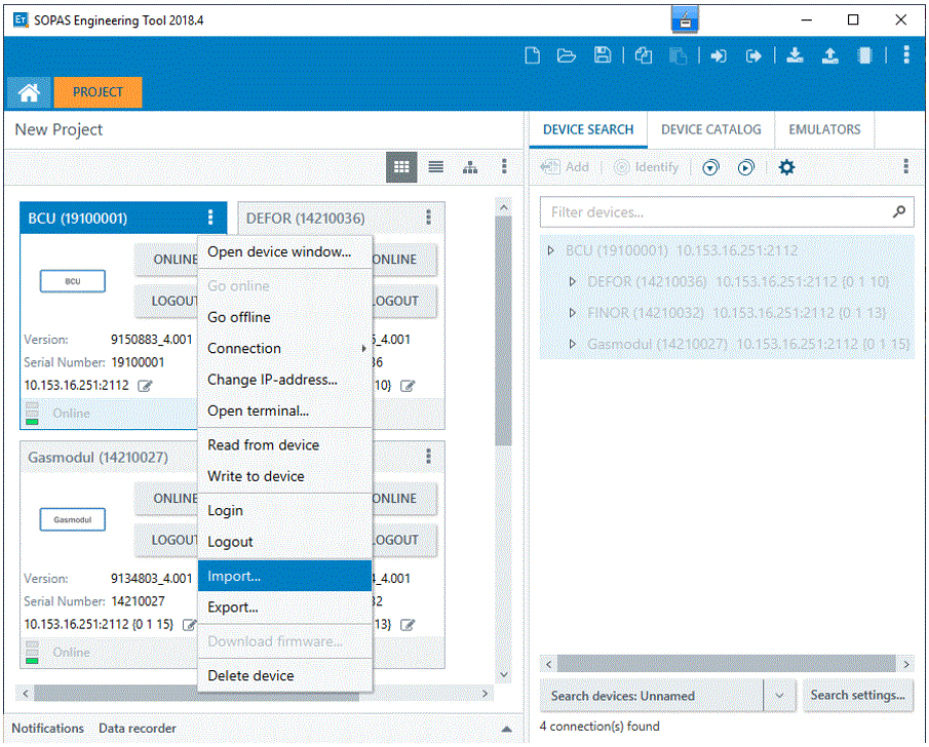
Data recovery can be used to correct erroneous data or update the system.

Prerequisites

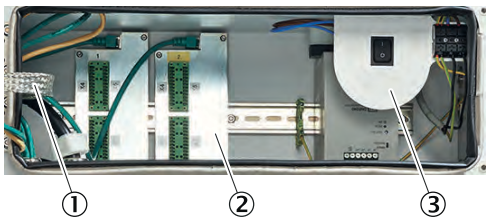
- SOPAS ET is connected to the measuring device.
- Logged in with the Authorized Operator user level.
- Data backup has been performed.

Procedure

1. Click on the three dots of the corresponding module and select “Import”.



2. Select the corresponding file and click “Open”.
3. Click “Finish” in the window that appears.
4. Click “Yes”.
5. Wait 2 minutes after the import has been performed.
6. Restart the analyzer using power switch ③.



① Distribution board with Ethernet for MPR (optional), Modbus, service interface (LAN)
② Signal connections (I/O)
③ Power voltage connection to terminal strip

6.5 Setting the maintenance condition with SOPAS ET

Overview

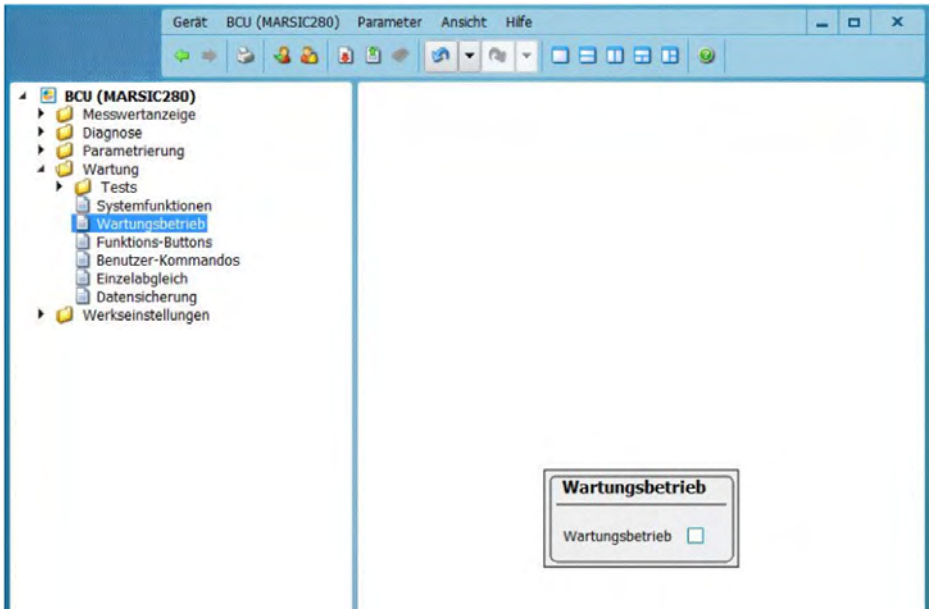
Maintenance mode is set when work or changes are carried out on the measuring device. This signals that the device is not in measuring mode.

Prerequisites

- SOPAS ET is connected to the measuring device.

Procedure

1. Open the BCU module in SOPAS ET with a double-click.
2. Select the “Maintenance mode” menu in the “Maintenance” folder.
3. Set the check mark to activate maintenance mode.



✓ Message “C Maintenance” appears in the logbook.
✓ The Maintenance LED lights.

6.6 Parameterization

6.6.1 Setting the time

Overview

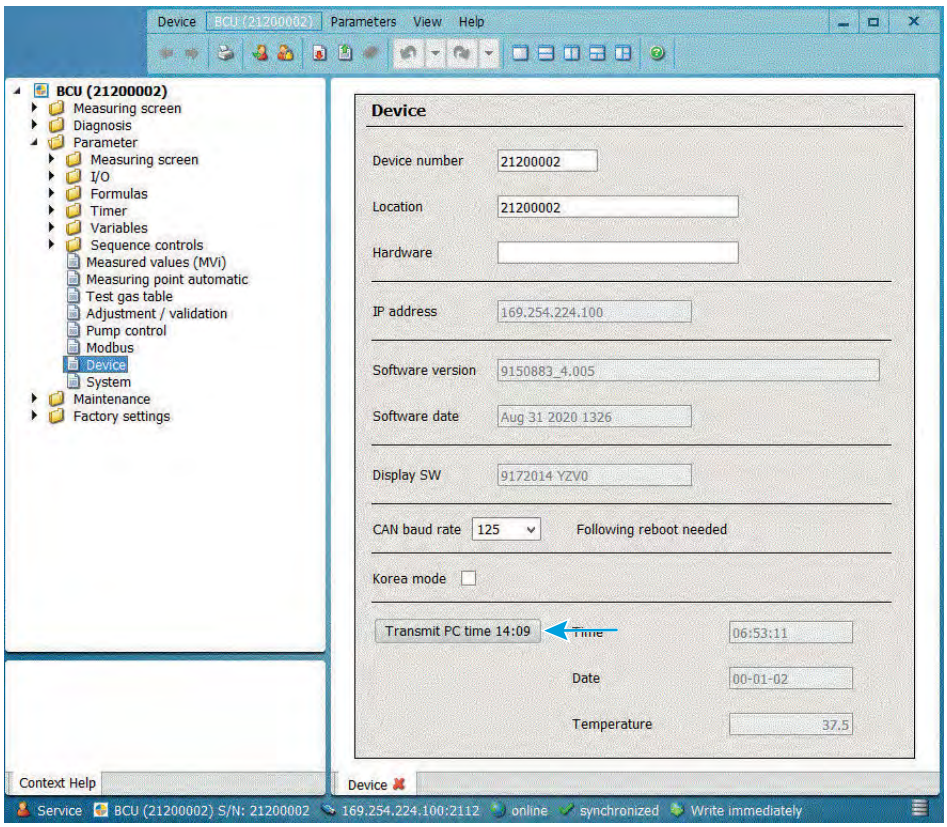


Figure 18: BCU: Internal clock

Prerequisites

- SOPAS ET is connected to the measuring device.
- The SOPAS ET user level has been changed.

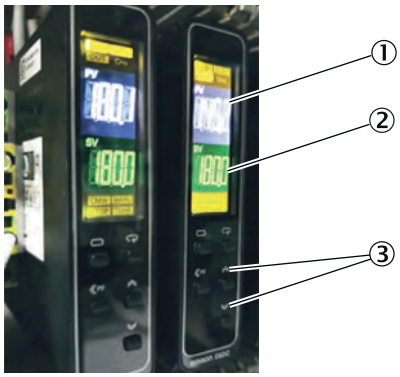
Procedure

1. Open SOPAS ET.
2. Open the BCU module with a double-click.
3. Navigate to the Parameters/Device menu.
4. Click the “Transmit PC time” button.

✓ Date and time setting are synchronized to the PC.

6.6.2 Setting the heating controller

Overview



① Actual temperature
② Temperature setpoint
③ Arrow keys for setting

The heating controller regulates the temperature of the sample gas line and the gas sampling unit.

The status signal is passed to the BCU of the analyzer when the heating controller reaches the setpoint temperature.

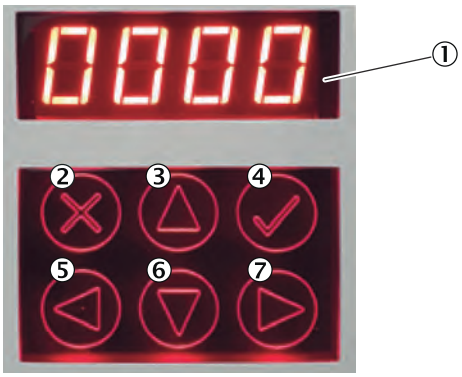
Procedure

1. Use the arrow keys on the heating controller to set the desired temperature. The recommended temperature is 180 °C.

✓ If the arrow key is not pressed for 3 seconds, the set temperature is saved as the setpoint temperature.

6.6.3 Setting the cooler temperature

Overview



① Display
② Cancel
③ Arrow up
④ Confirm
⑤ Arrow left
⑥ Arrow down
⑦ Arrow right

The cooler temperature must be set to 5 °C for condensate drainage.

The status signal is passed to the BCU of the analyzer when the cooler reaches the setpoint temperature.

Procedure

1. Press and hold the “Confirm” button.
✓ Password entry opens.
2. Use the arrow keys to enter the password.
3. Press the “Confirm” button.
4. Press and hold the “Confirm” button.
✓ Menu for setting the target temperature opens.
5. Set the temperature setpoint.
6. Press the “Confirm” button.

6.6.4 Checking the condensate pump cooler

Overview

The condensate pump of the cooler drains the condensate from the cooler into the condensate container.

Procedure

1. Check the running direction of the condensate pump.

✓ The running direction is counterclockwise.

6.6.5 Setting the system flow rate

Overview

When the setpoint temperatures of the components are reached and the instrument air is connected, the device goes into measuring mode.

In measuring mode, the pump starts and feeds the gas from the gas sampling unit through the device to the sample gas outlet.

Procedure

1. Set the flow on the flow meter to approx. 100 l/h.

6.6.6 Adjusting the flow sensor with SOPAS ET

Overview

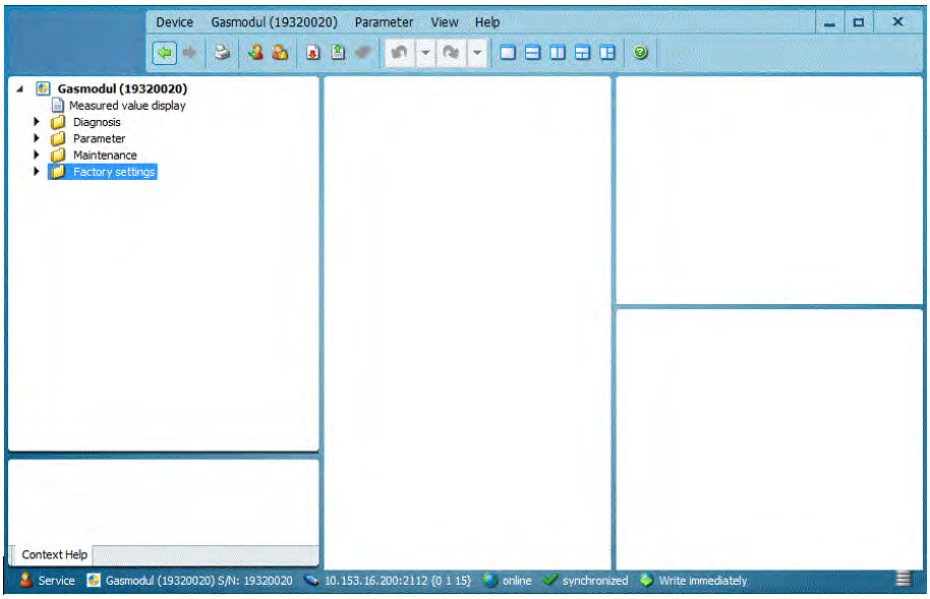
Check the measured value on the BCU when the flow rate of the device is set on the flow meter. If the display on the BCU differs, this can be corrected by an adjustment.

Prerequisites

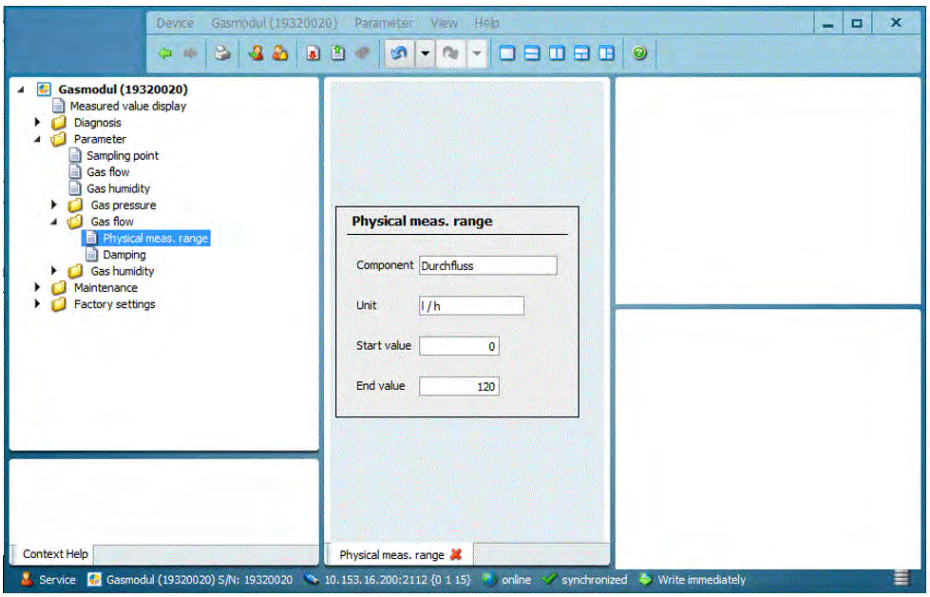
- SOPAS ET is connected to the measuring device.
- The flow rate at the flow meter has been set to 100 l/h.

Procedure

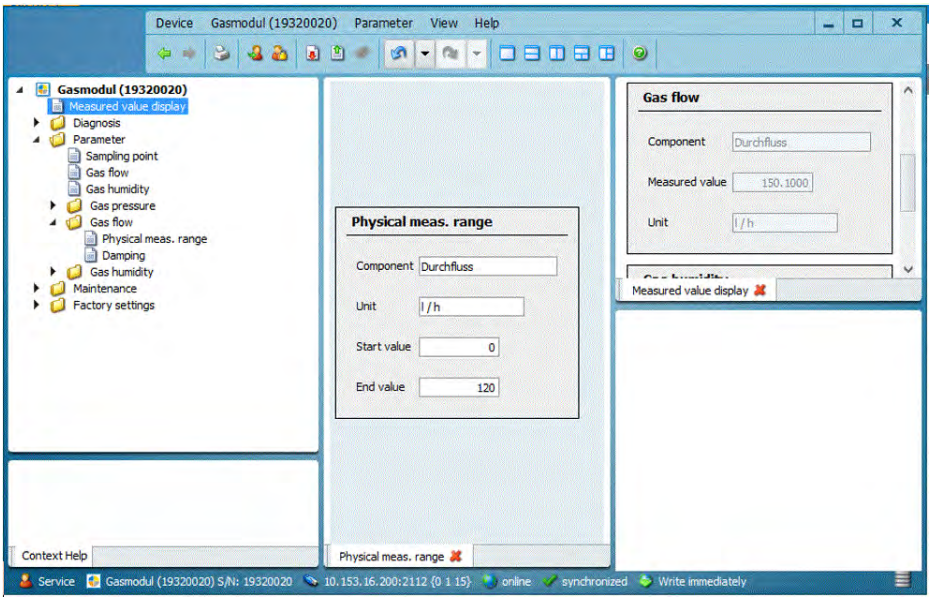
1. Open the gas module with a double-click.
2. Change the layout view.



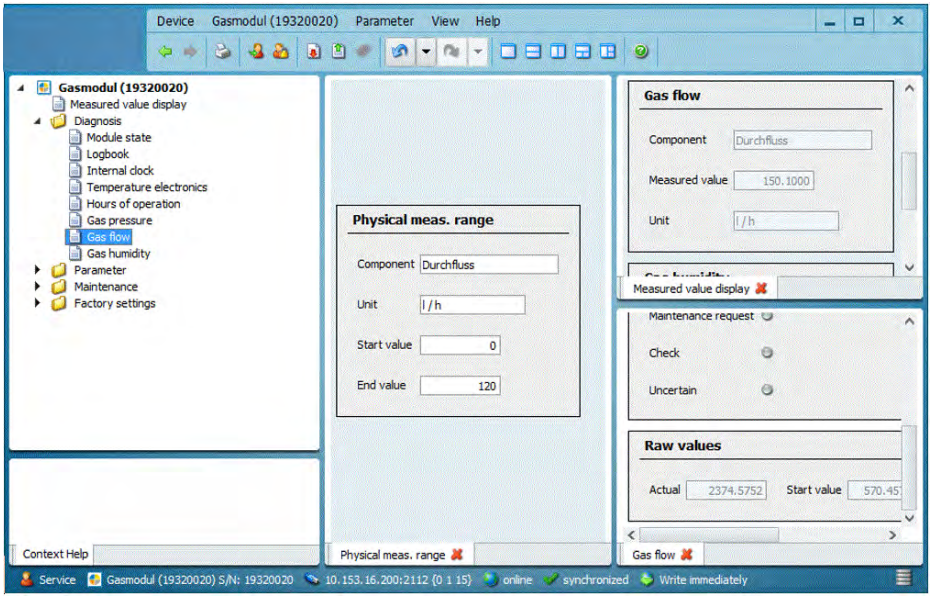
3. Check measuring range display is 100 l/h.



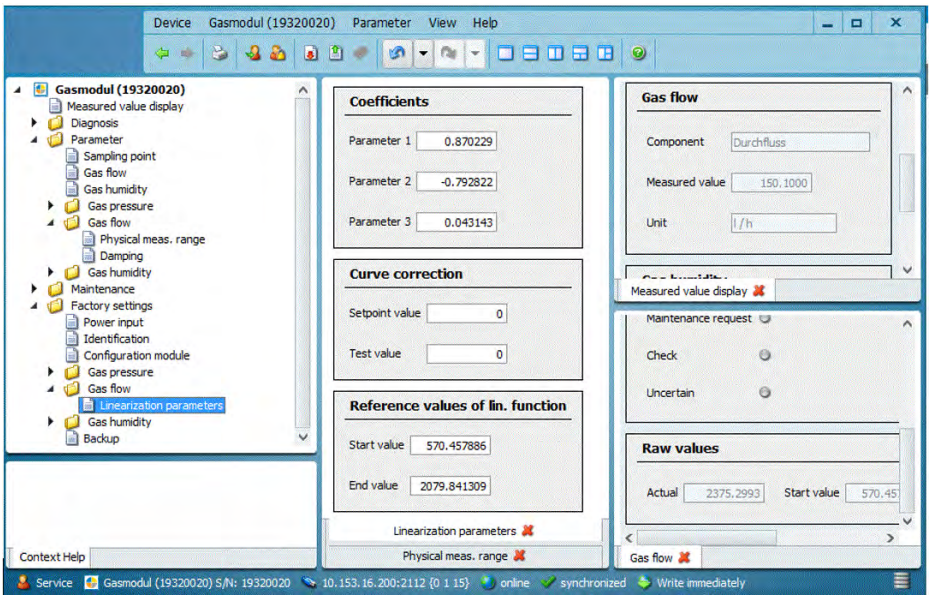
4. Drag the measuring range display to the top right of the window.



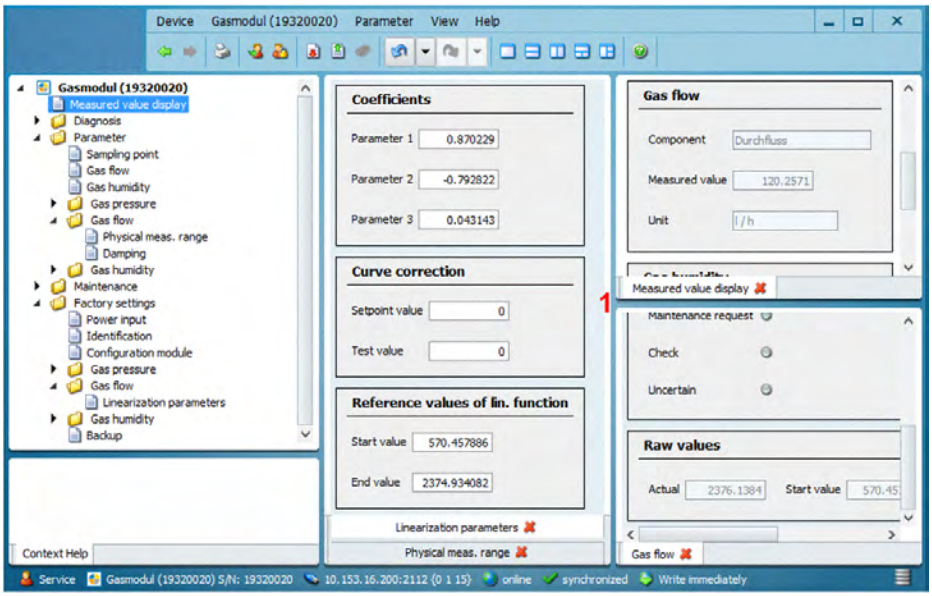
5. Drag the current raw flow sensor value to the lower right of the window.



6. Drag the linearization parameters of the flow sensor to the left window.



7. Enter the current raw value (2) as the new end value (1) in the linearization parameters.



✓ The BCU measured value display shows 100 l/h.

8. The gas inlet on the analyzer must be removed to adjust the zero point of the flow sensor.

✓ Wait about 5 minutes to obtain a stable raw value.

9. Enter the start value in the linearization parameters.

✓ The BCU measured value display shows 0 l/h.

10. Connect the sample gas connection to the analyzer.

6.6.7 Setting the measuring and purge times with SOPAS ET

Overview

The purge and measuring times determine how long measurements are taken at the corresponding measuring point.

The purge time includes the waiting time during a sample change that the gas needs to be stable in the analyzer.

The measuring time includes the measuring time of the corresponding sampling unit.

Important information

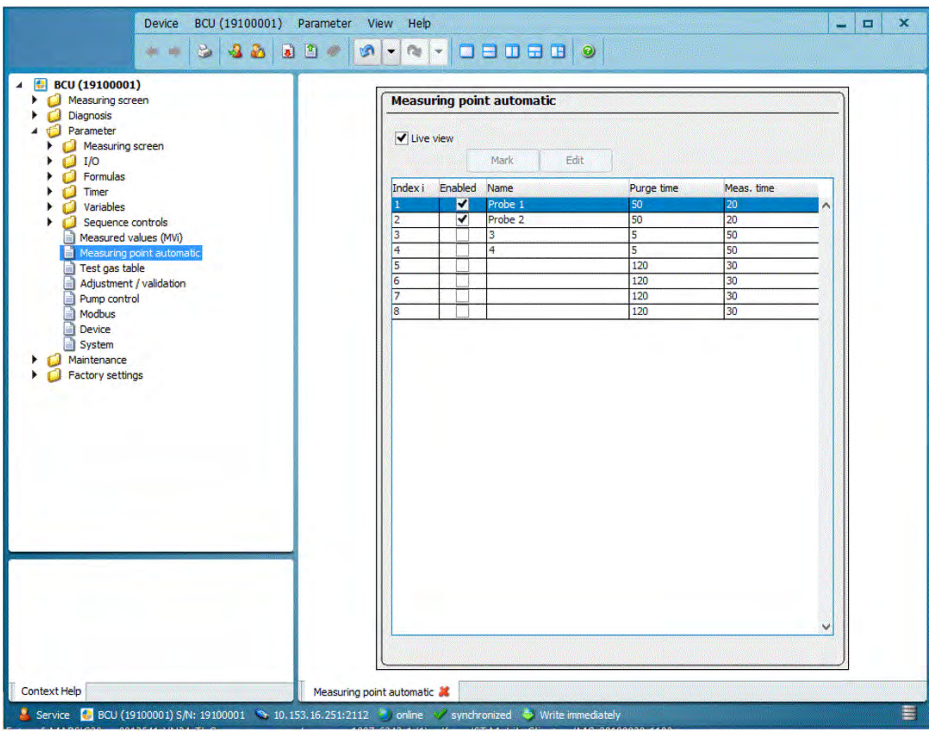
NOTE
The purge time must be at least 50 seconds. Otherwise, stable measured values cannot be guaranteed with several measuring points. The sample gas needs this time to be stable in the analyzer during a sample change.
The total time of all samples together may not exceed 285 seconds.

Prerequisites

- SOPAS ET is connected to the measuring device.

Procedure

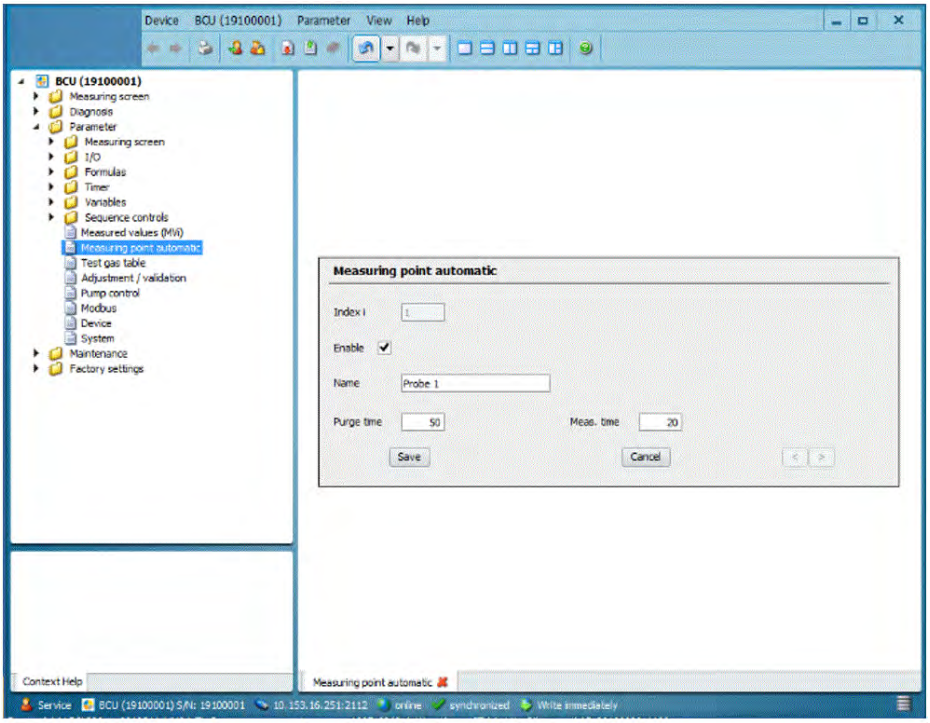
1. Open the BCU module with a double-click.
2. Open menu “Measuring point automatic” under “Parameter”.



3. Remove the check mark for “Live view”.
4. Select the appropriate measuring point.
5. Click “Edit”.

✓ The settings menu of the measuring point opens.

6. The purging and measuring times can be adapted to the actual conditions.



7. Set the check mark for “Live view” so that the settings are used by the BCU.

6.6.8 Activating and deactivating measuring points with SOPAS ET

Overview

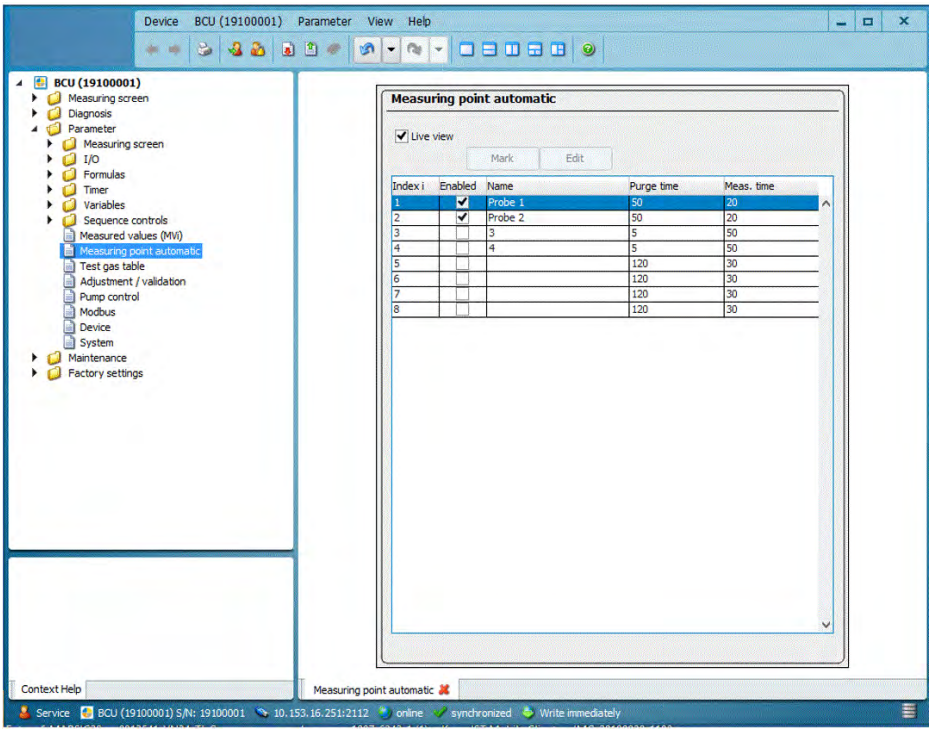
If the measuring device has more than one measuring point, unused measuring points can be deactivated if required.

Prerequisites

- SOPAS ET is connected to the measuring device.

Procedure

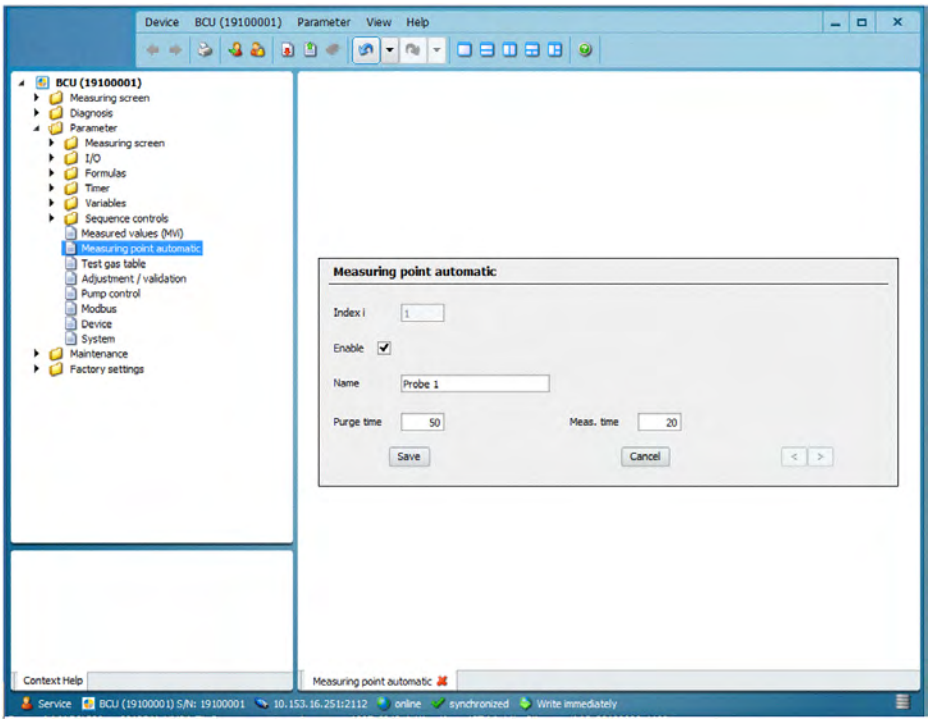
1. Open the BCU module with a double-click.
2. Open menu “Measuring point automatic” under “Parameter”.



3. Remove the check mark for “Live view”.
4. Select the appropriate measuring point.
5. Click “Edit”.

✓ The settings menu of the measuring point opens.

6. Set the “Enable” check mark to deactivate the measuring point or remove it to activate the measuring point.



7. Check “Live view” so that the settings are used by the BCU.

6.7 Carrying out a leak test

Prerequisites

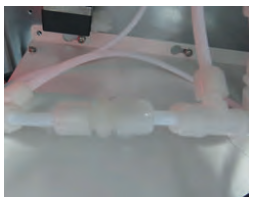
- SOPAS ET is connected to the measuring device.
- If there are several measuring points: select the corresponding measuring point before the test.

Procedure

1. Check the flow on the BCU. Normal operation 100 ... 120 l/h

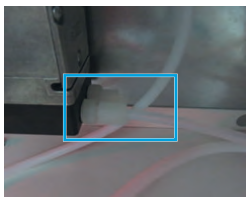
2. Mark the connection of the pump inlet and pump outlet lines.
3. Remove the pump inlet and outlet lines.

4. Connect the line ends to the coupling of the test set.



5. Connect the PTFE line of the test set to the pump inlet

   NOTICE | The total line length must be used to avoid vibrations in the gas column and associated effects on the flow sensor.



6. Connect the PTFE line to the sample gas outlet of the analyzer.
7. Close the test gas inlet of the valve block with the protective cap from the test set or, if a test bottle is connected, screw it shut.
8. Open the BCU in SOPAS ET.
9. Open the “Manual adjust” menu under “Maintenance”.
10. Remove the check mark from “Automatic”.
11. Use the arrow keys to select “Validate reference point”.
12. Press “Start”.
13. Check flow on the BCU.

✓ The flow rate must be set to <0.3 l/h.

14. Click “Stop”.
15. Return gas lines to original position.
16. Click “Automatic”.
17. Open the “System function” menu under “Maintenance”.
18. Click “Warm start”.

6.8 Adjusting

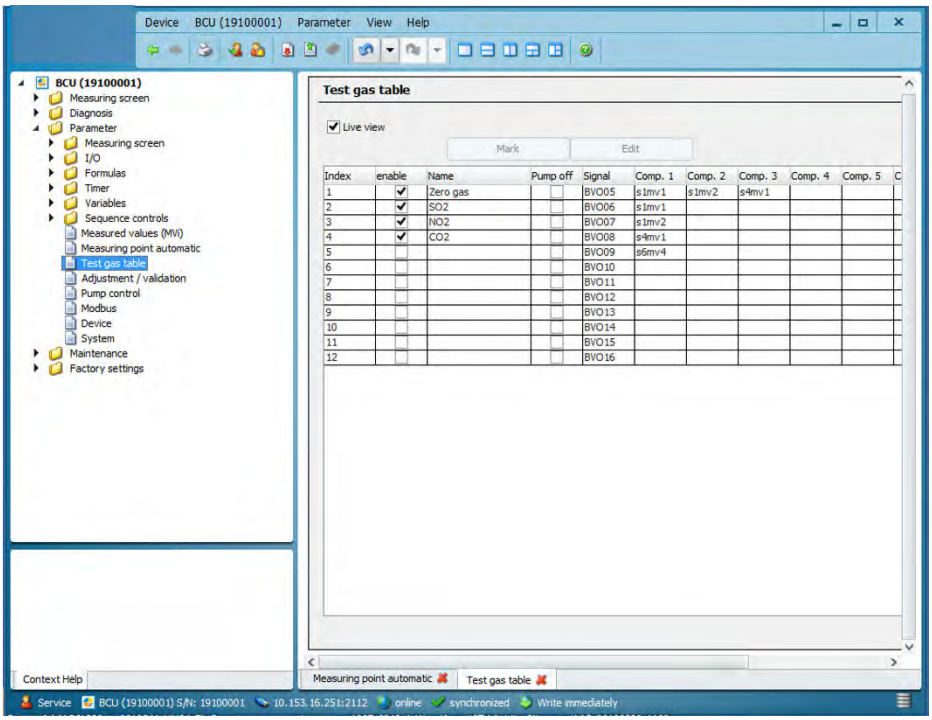
6.8.1 Setting the test gas with SOPAS ET

Overview

Before adjustment, the exact test gas concentrations must be entered in the Test Gas Table.

Procedure

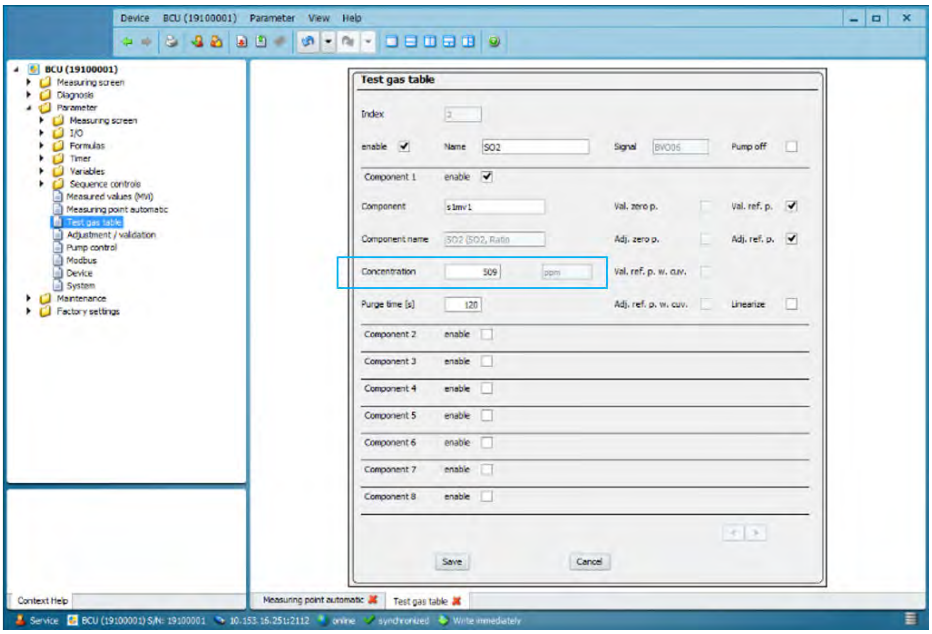
1. Check the cylinder concentration on the test gas cylinder.
2. Open the BCU module with a double-click.
3. Open the “Test gas table” menu under “Parameter”.



4. Remove the check mark for “Live view”.
5. Select the appropriate component.
6. Click “Edit”.

✓ The Test Gas settings menu opens.

7. Enter the specified test gas concentration.



8. Click “Save”.
9. Set the check mark for “Live view”.

6.8.2 Determining adjustment gas purging times with SOPAS ET

Overview

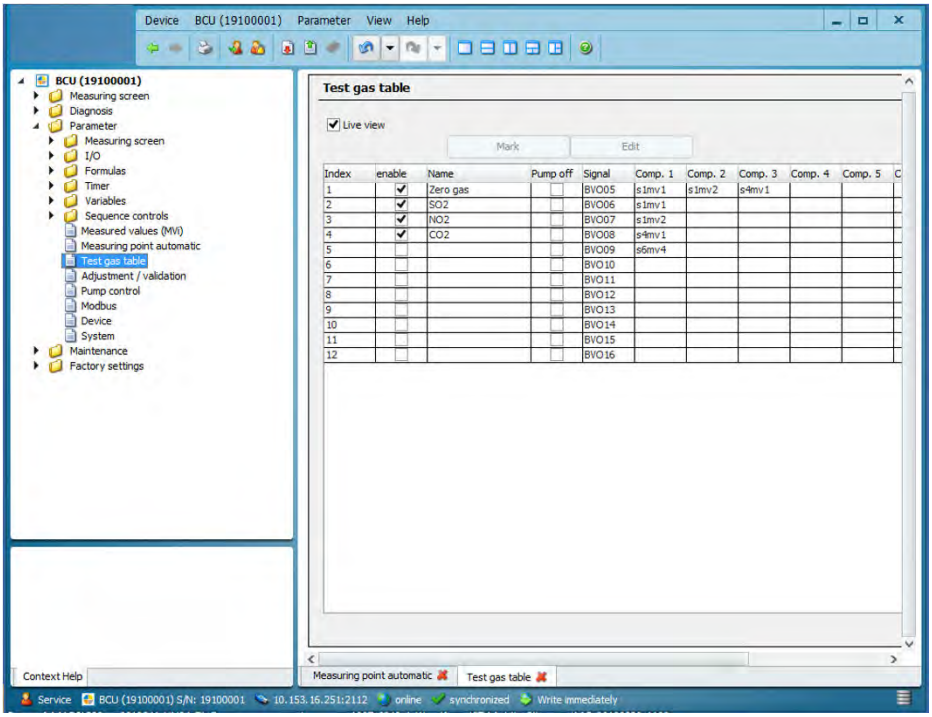
During the first adjustment of each test gas, the time required for the gas to become stable in the analyzer must be determined. This is necessary so that the adjustment can be carried out without errors.

Prerequisites

- Test gas cylinder is connected.

Procedure

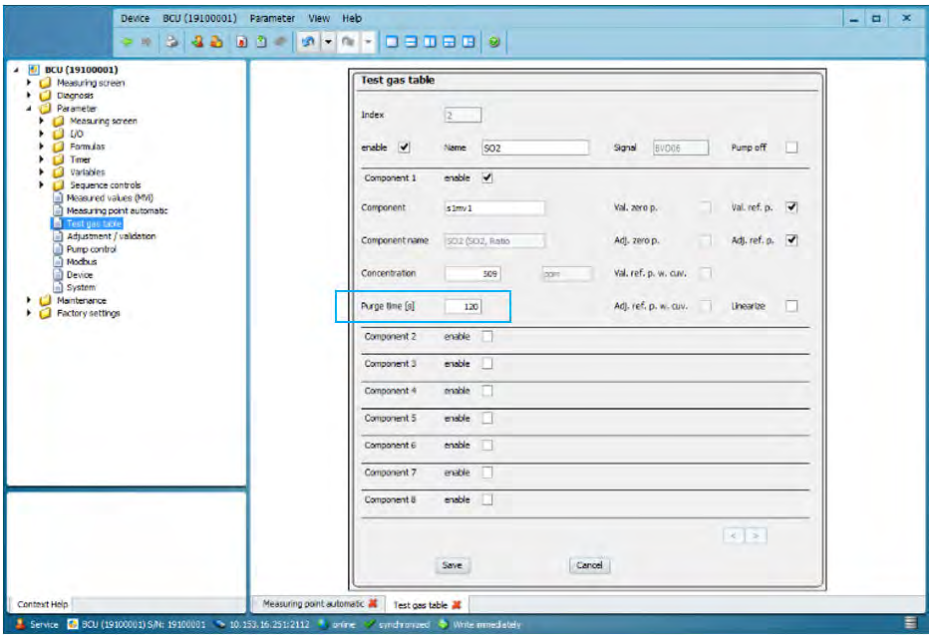
1. Open the BCU module with a double-click.
2. Open the “Test gas table” menu under “Parameter”.



3. Remove the check mark for “Live view”.
4. Select the appropriate component.
5. Click “Edit”.

✓ The Test Gas settings menu opens.

6. Enter the purge time determined.



7. Click “Save”.
8. Set the check mark for “Live view”.

6.8.3 Selecting the gas sampling unit for validation and calibration

Overview

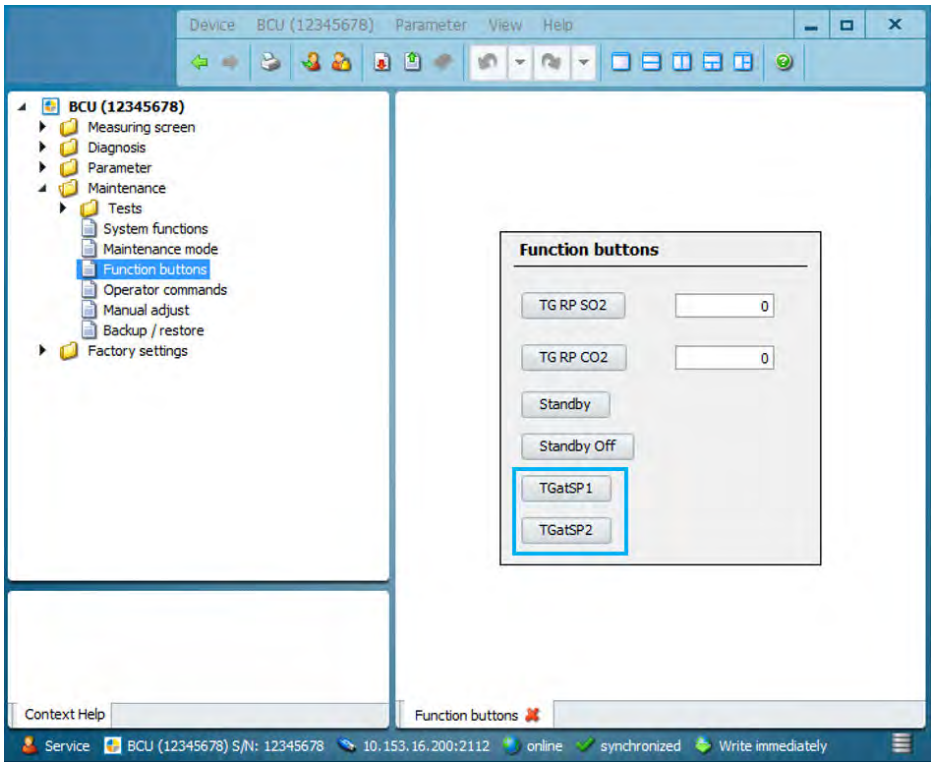
If there is more than one measuring point, the gas sampling unit to be used for validation and calibration must be selected in the BCU.

Prerequisites

- SOPAS ET is connected to the measuring device.

Procedure

1. Open the BCU module with a double-click.
2. Open the “Function buttons” menu under “Maintenance”.
3. Select the appropriate gas sampling unit.



6.8.4 Performing zero point validation and adjustment with SOPAS ET

Overview

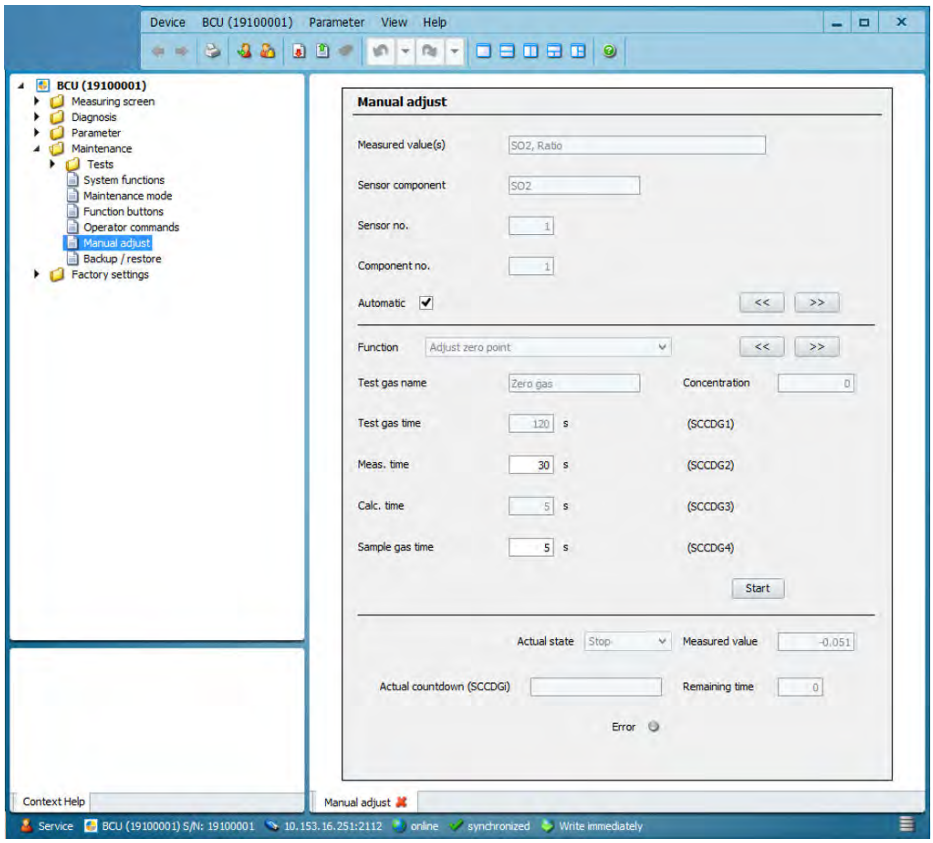
The zero point of the analyzer is adjusted with instrument air.

Prerequisites

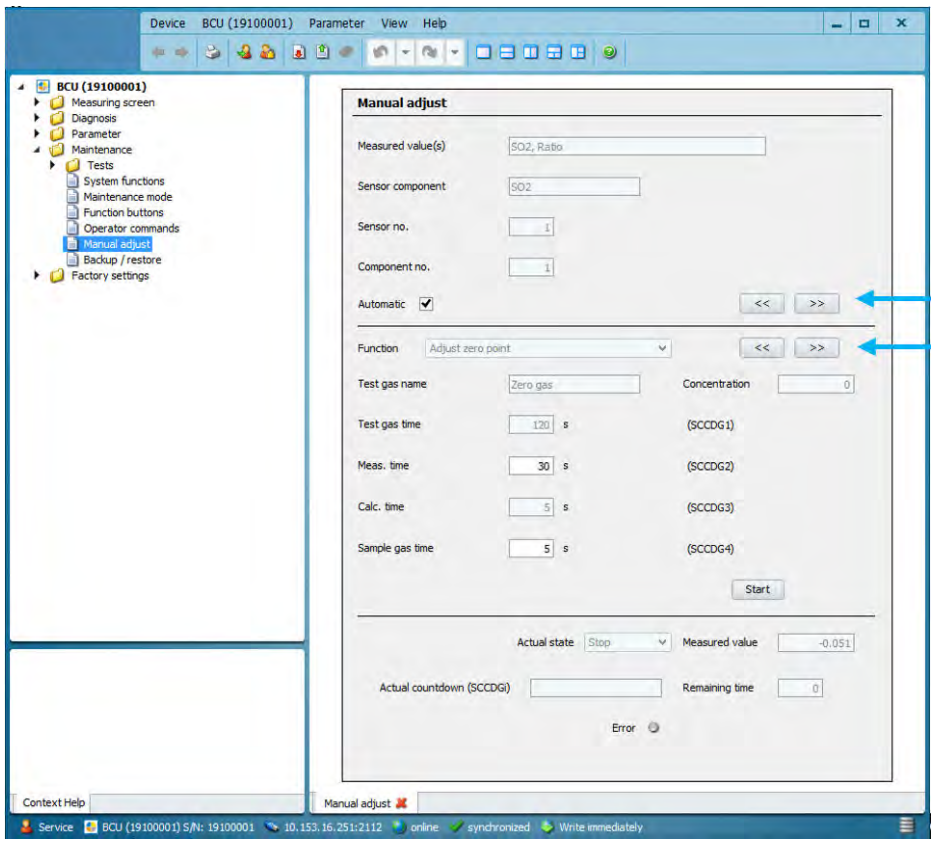
- The primary pressure of 2.5 ... 3 bar is set on the pressure gauge.
- SOPAS ET is connected to the measuring device.

Procedure

1. Open the BCU module with a double-click.
2. Open the “Manual adjust” menu under “Maintenance”.

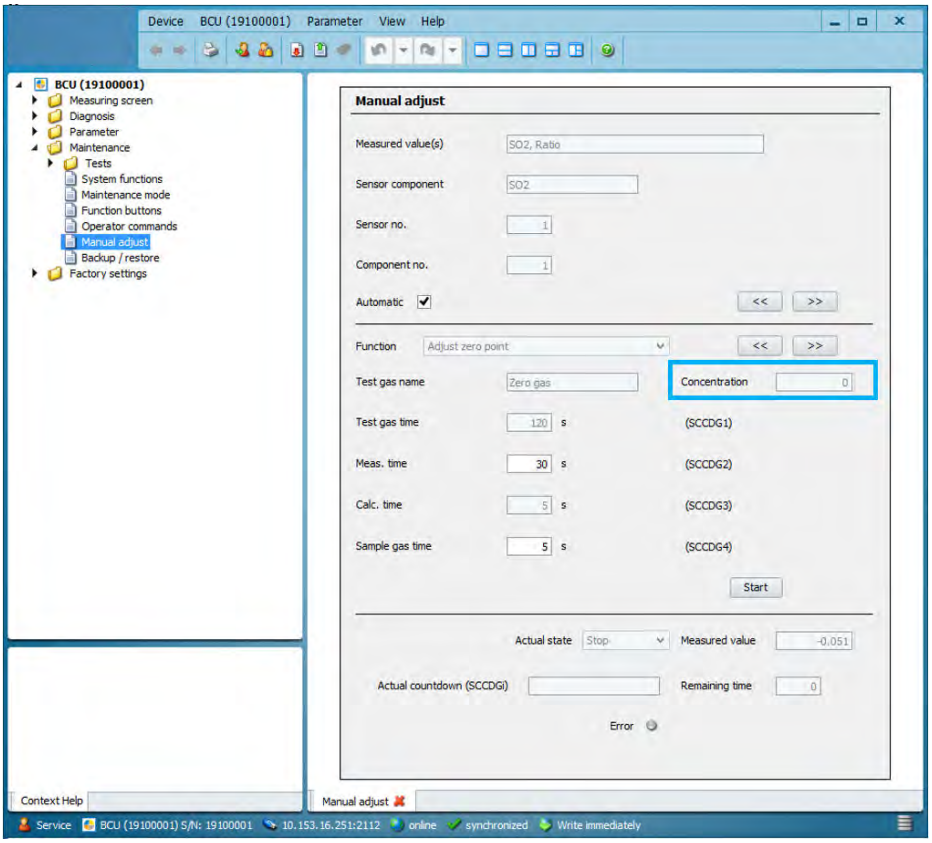


3. Select the appropriate component using the arrow keys.

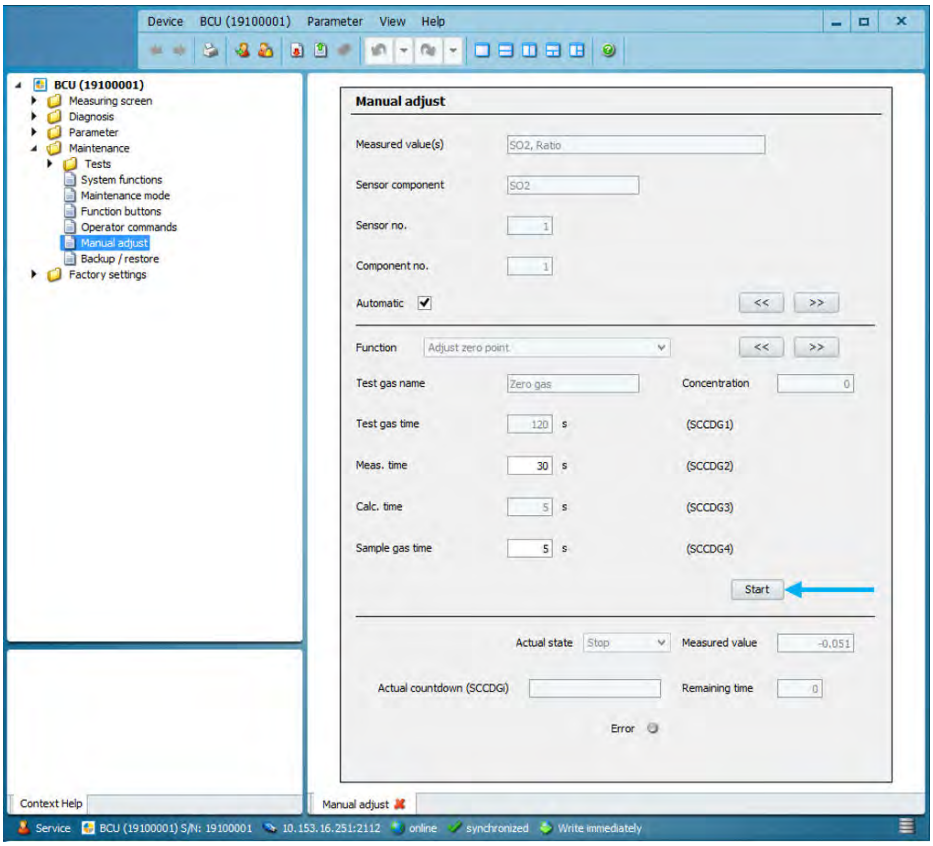


4. Use the lower arrow keys to select the corresponding function (“Validation” or “Adjust Zero Point”).

5. Check the test gas concentration.

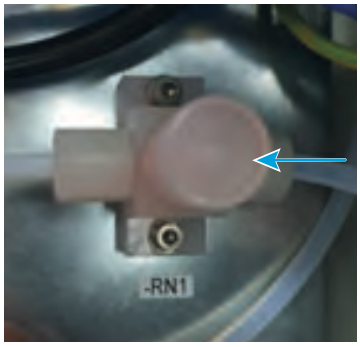


6. Click “Save”.

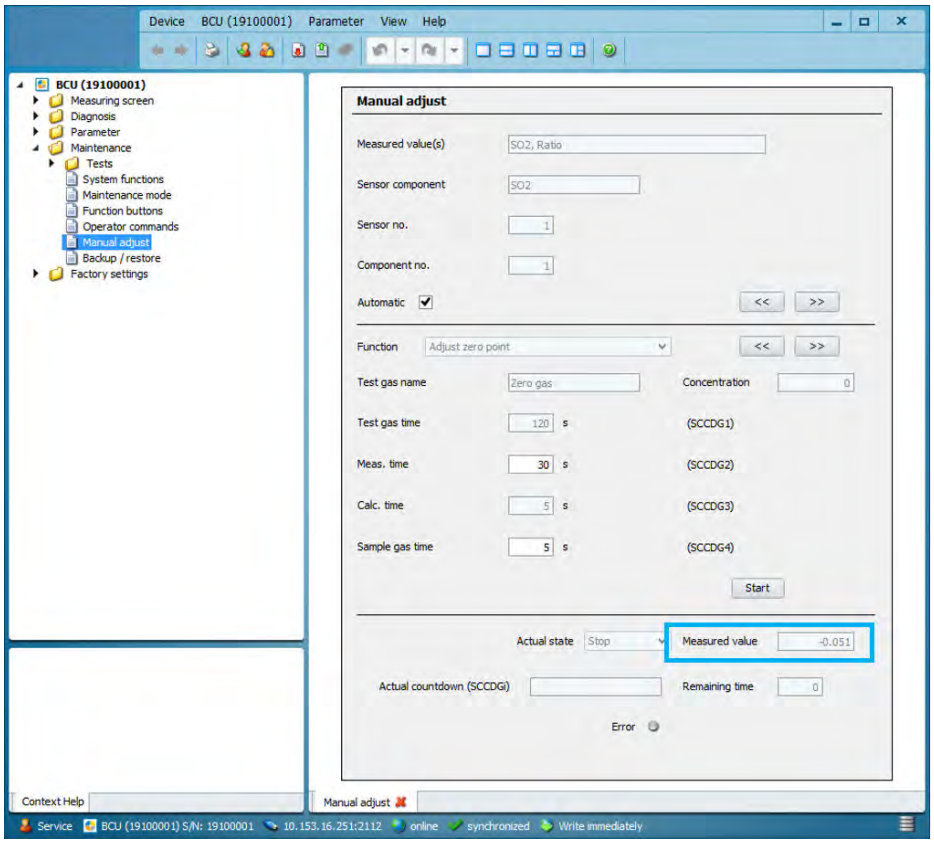


✓ The valve block releases the instrument air for zero validation/adjustment.

7. Set the flow rate on the throttle to 100 l/h. Read off the flow rate on the flow meter.



✓ Measured value displays 0 ppm.



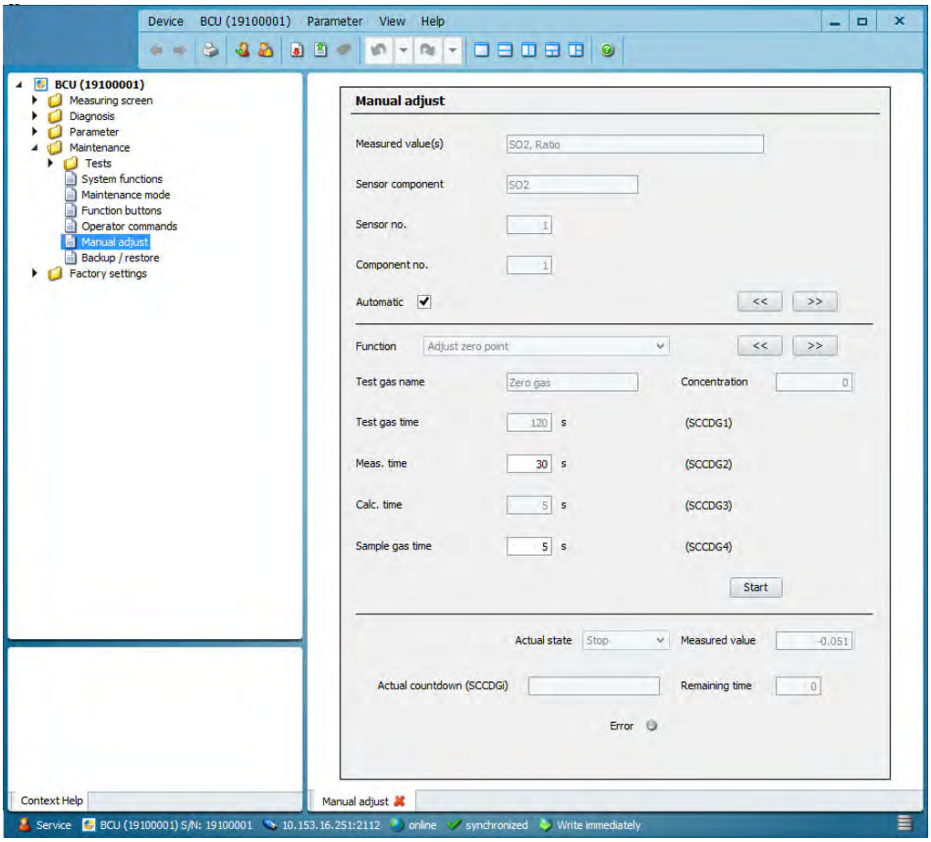
6.8.5 Performing sensitivity validation or adjustment with SOPAS ET

Prerequisites

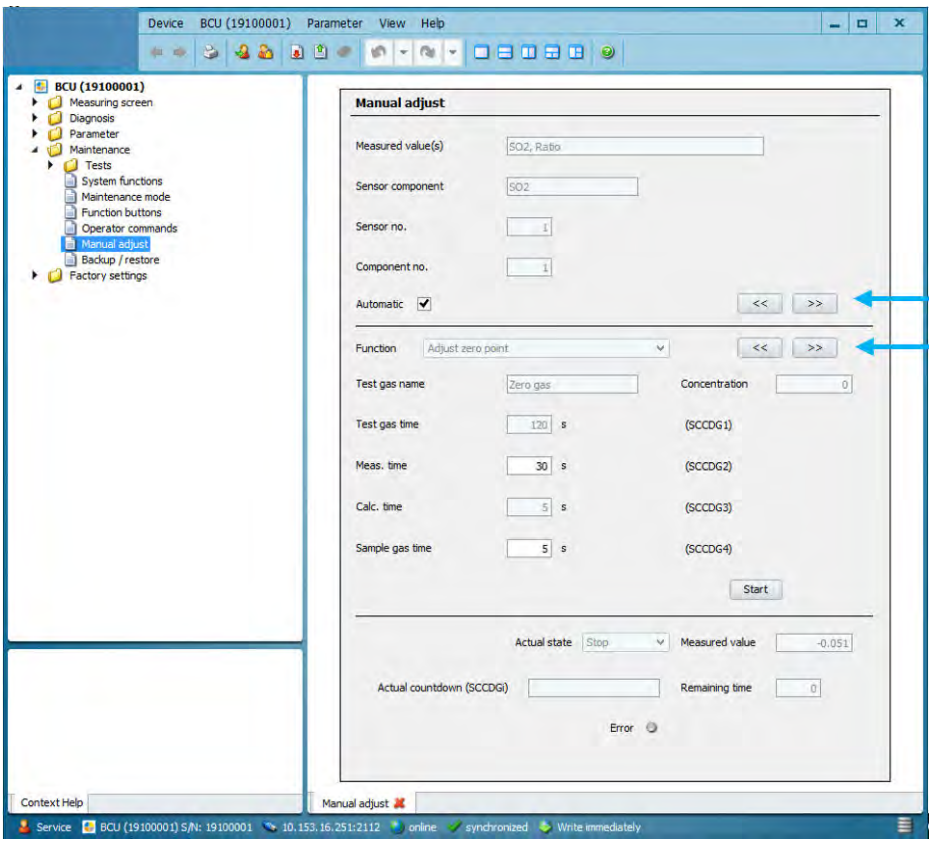
- SOPAS ET is connected to the measuring device.

Procedure

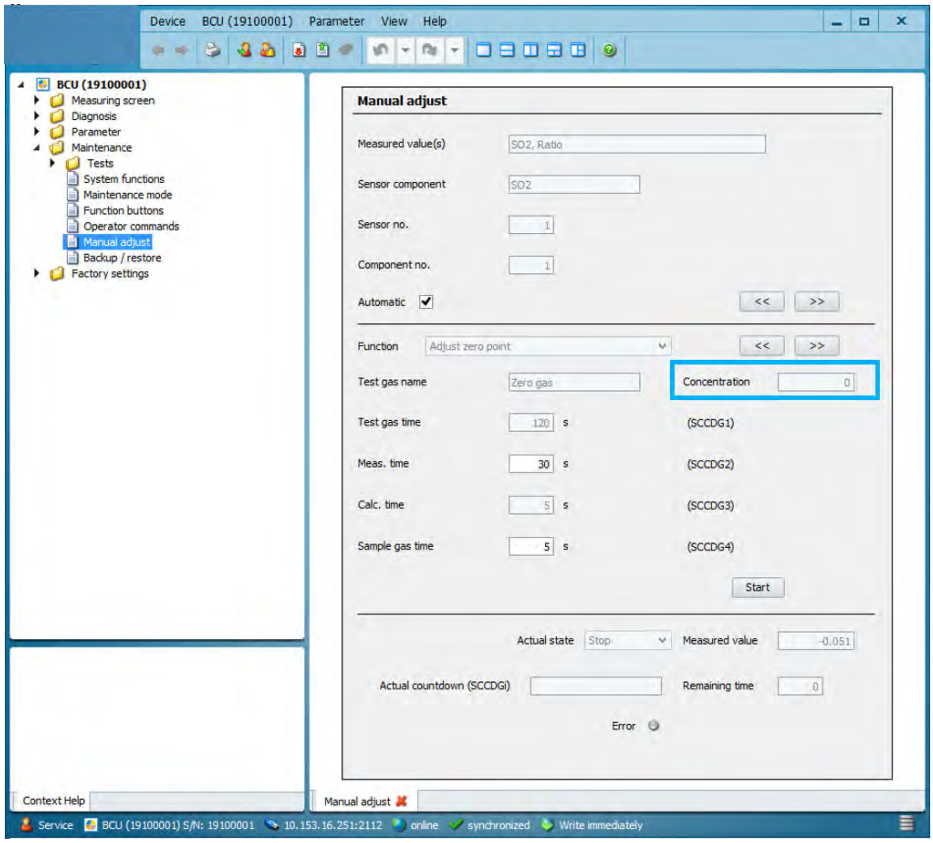
1. Open the BCU module with a double-click.
2. Open the “Manual adjust” menu under “Maintenance”.



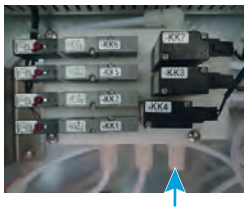
3. Select the appropriate test gas using the arrow keys.



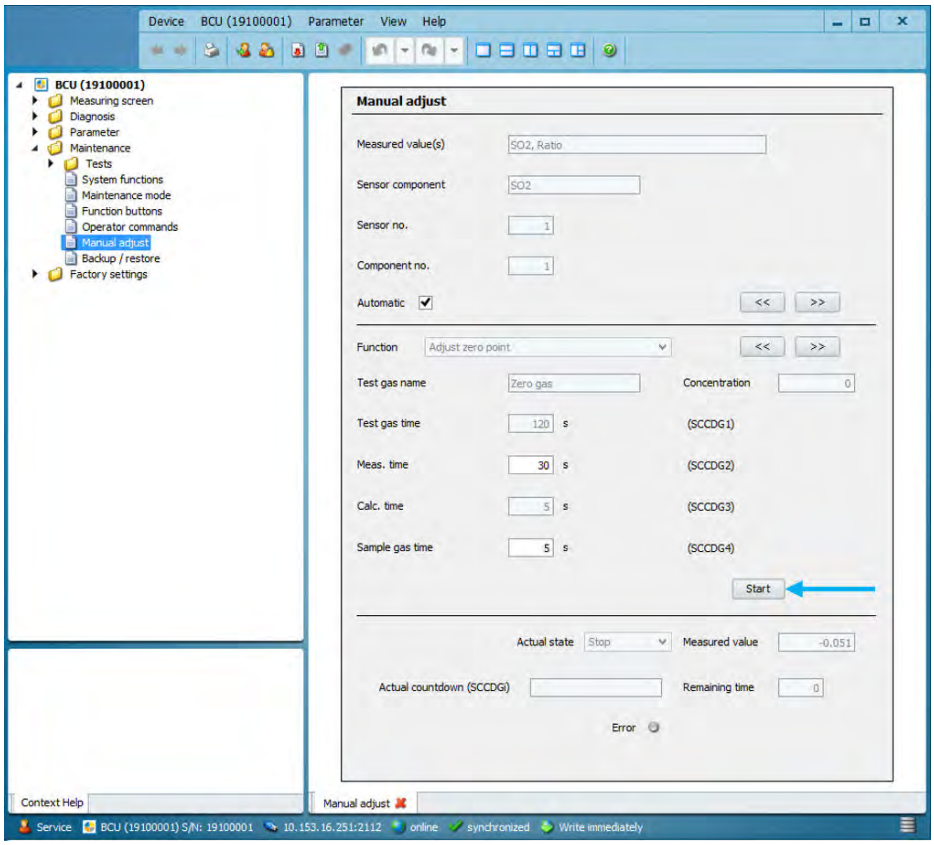
4. Use the lower arrow keys to select the “Adjust reference point” function.
5. Check the test gas concentration.



6. Connect the test gas cylinder to the valve block with 2.5 … 3 bar.



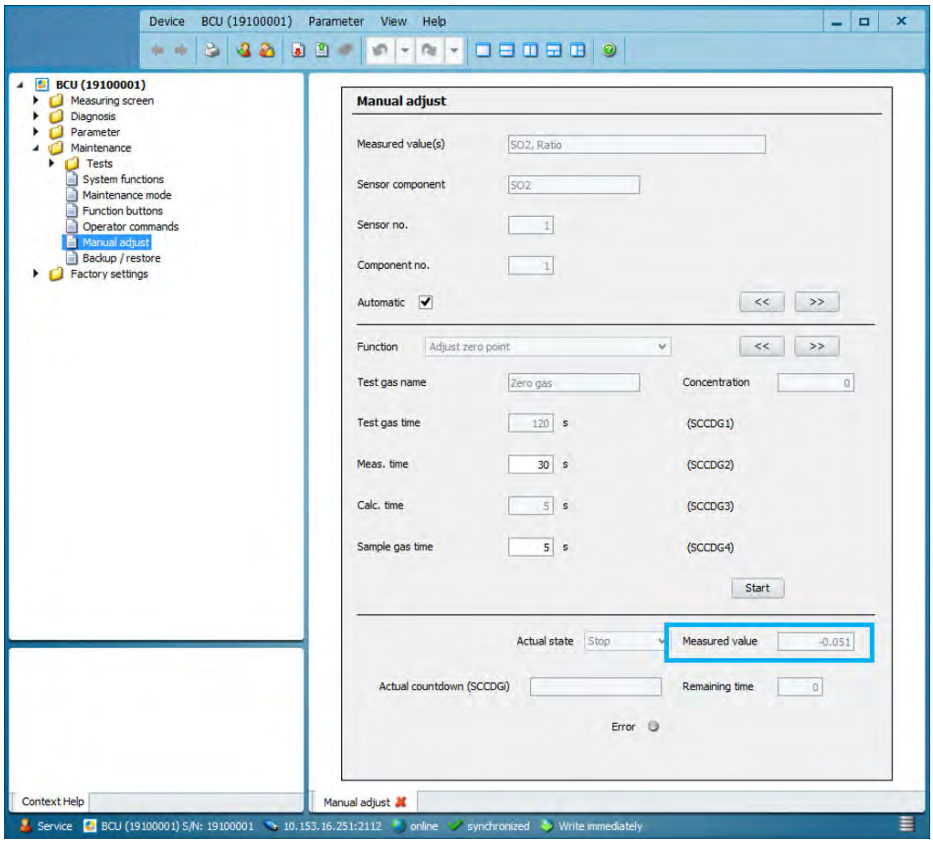
7. Click “Save”.



✓ The valve block releases the test gas for sensitivity validation or adjustment.

8. Set the flow on the flow reducer to approx. 100 l/h. Read off the flow rate on the flow meter.

✓ Current measured value displays the sample gas concentration of the test gas.



6.8.6 Setting automatic validation and adjustment with SOPAS ET

Overview

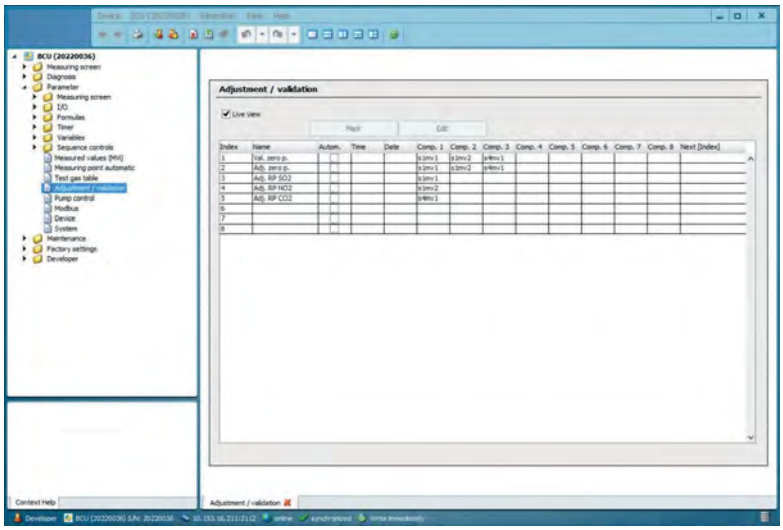
Automatic validation and adjustment is not set up by default.

Prerequisites

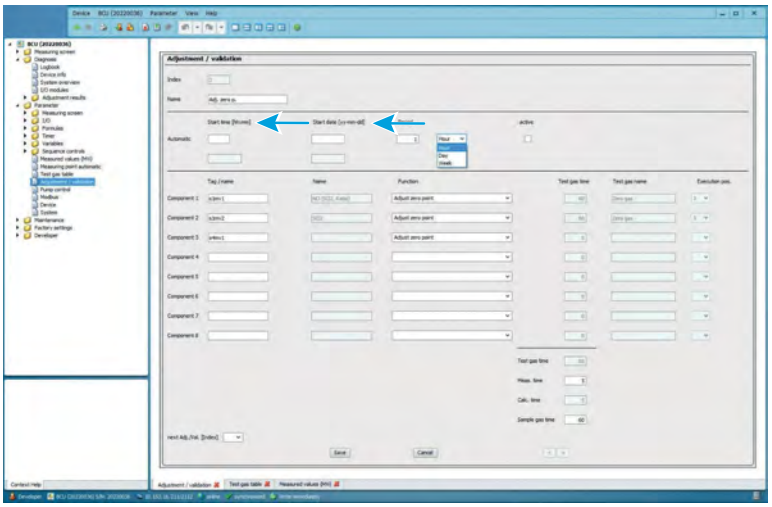
- SOPAS ET is connected to the measuring device.
- The instrument air complies with the specification given (see "Connecting the instrument air", page 47).

Procedure

1. Open the BCU module with a double-click.
2. Open the “Adjustment/validation” menu via “Parameter”.



3. Remove the check mark for “Live view”.
4. Select the appropriate component.
5. Click “Edit”.
6. Set up the validation/adjustment:
   - Start time = desired time (hh:mm)
   - Start date = desired date for the first start (yy-mm-dd)
   - Period = Repeat interval and frequency (Hour, Day, Week)
   - Active = Activation of automatic adjustment



7. Click “Save”.
8. Set the check mark for “Live view”.

6.9 Activating Standby mode

Overview

Activating Standby mode directs the instrument air to the gas sampling unit. This purges the entire system.

A zero point validation is started automatically which takes about 8 minutes. This allows the MARSIC280 to check its zero point with instrument air.

The MARSIC280 then goes into Standby mode. Purging of the entire system is continued.

Important information

CAUTION
Noxious gases may escape during maintenance and repair work.

► Before carrying out maintenance and repair work, put the measuring system in Standby mode to purge it with instrument air.

NOTICE
When the scrubber is not in operation, soiling can damage the entire system.

► When the scrubber is not in operation, the entire system must be set to Standby mode.

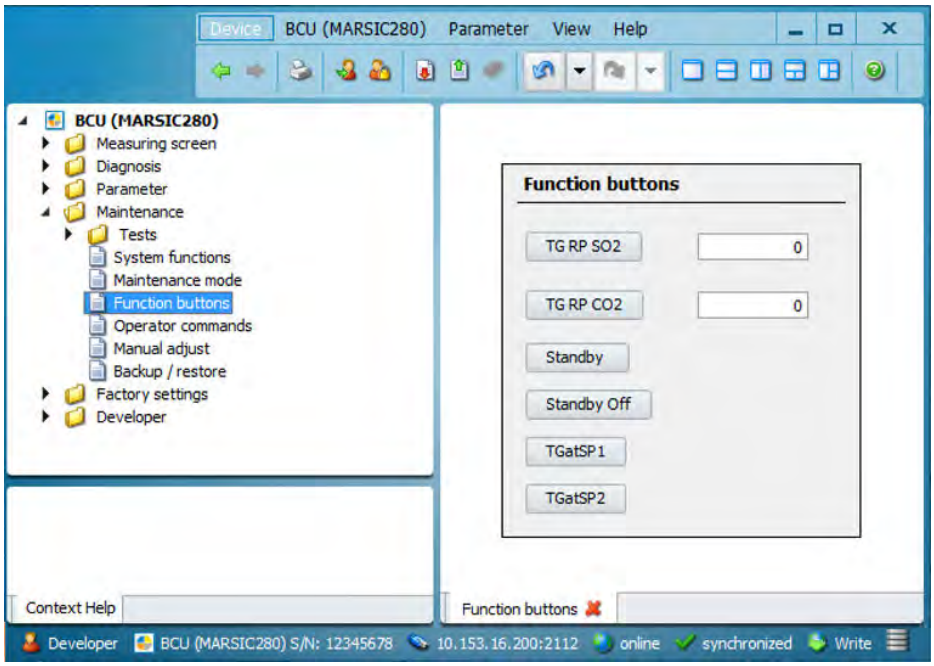
NOTE
If Standby mode has been activated, it can only be deactivated again after the automatic zero point validation has been completed.

Prerequisites

- SOPAS ET is connected to the measuring device.

Procedure

1. Open the BCU module with a double-click.
2. Open the “Function buttons” menu in the “Maintenance” folder.
3. Press “Standby”.



✓ Purge the gas sampling unit and the device with instrument air.
4. Check the flow rate of the instrument air is 100 l/h. If necessary, correct the flow rate at the throttle.
✓ An automatic zero point validation with instrument air is performed, this takes about 8 minutes.
✓ The device goes into Standby mode.

Related topics

- Activating Standby mode via the Modbus input: see "Setting Modbus functions", page 88
- Activating Standby mode via the display: see "Activating Standby mode on the display", page 90
- Activating Standby mode via the digital input: See wiring diagram

6.10 Recognizing the safe operating state

6.10.1 Recognizing the safe operating state

Prerequisites

- A leak tightness check was successfully performed.

Procedure

1. Check the power supply is within the specification.
2. Check clean instrument air is connected and available according to specification.
3. Check the flow rate is approx. 100 l/h.
4. Check all housing doors are closed.
5. Check only the green LED lights on the display.
6. Check all measured values are plausible.

6.11 Setting up customer interfaces

6.11.1 Analog signals

6.11.1.1 Setting analog outputs with SOPAS ET

Overview

The analog outputs are preset.

Table 6: Factory setting of the analog outputs

	Analog output	Measuring component	Output range 1	Output range 2
1	4 ... 20 mA	SO_2	0 ... 500 ppm	0 ... 100 ppm
2	4 ... 20 mA	CO_2	0 ... 25 Vol%	0 ... 5 Vol%
3	4 ... 20 mA	Ratio	0 ... 5 ppm/V%	n/a
4	4 ... 20 mA	Flow	0 ... 100 l/h	n/a

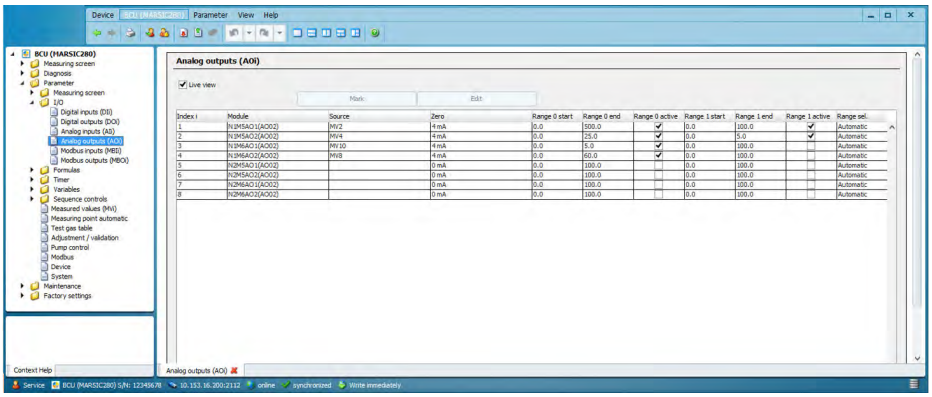
If necessary, the output ranges can be changed.

Prerequisites

- SOPAS ET is connected to the measuring device.

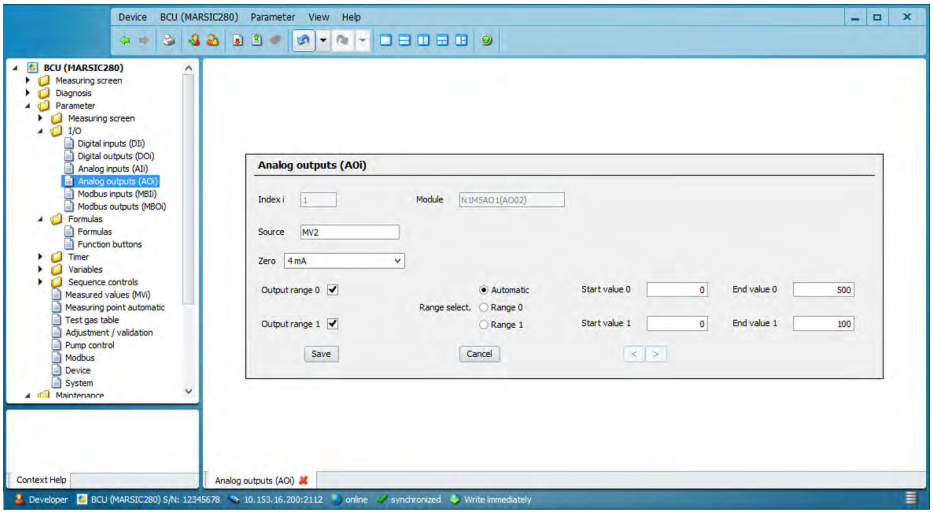
Procedure

1. Open the BCU module with a double-click.
2. Open the “Analog outputs” menu via “Parameter” and “I/O”.



3. Remove the check mark for “Live view”.
4. Mark the corresponding analog output.
5. Click “Edit”.
6. Change the output ranges. The start value is always 4 mA and the end value 20 mA.
7. Activate the required output areas with a check mark.

✓ Switching is automatically controlled with two active output ranges.



8. Click “Save”.

6.11.1.2 Testing analog outputs with SOPAS ET

Overview

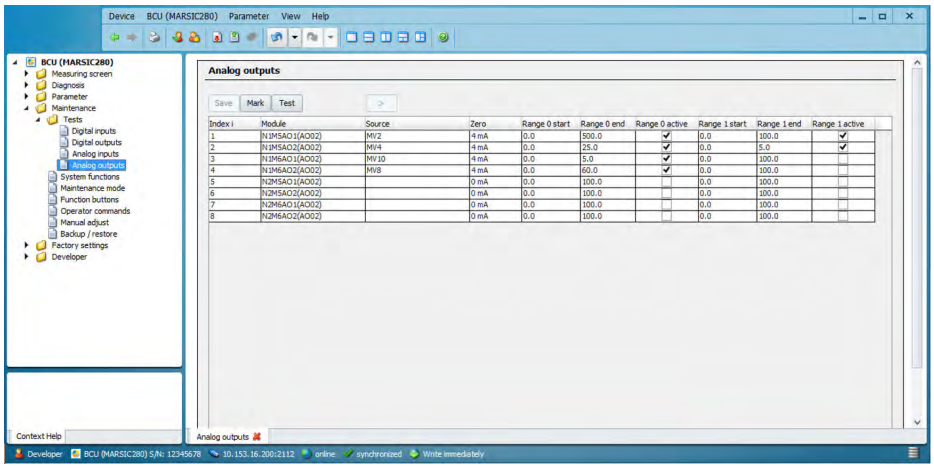
Testing the analog outputs checks whether they output correctly.

Prerequisites

- SOPAS ET is connected to the measuring device.

Procedure

1. Open the BCU module with a double-click.
2. Open the “Analog outputs” menu via “Maintenance” and “Tests”.



3. Mark the analog output to be tested.
4. Click “Save”.

✓ The Test menu is displayed.

5. Enter the configured end value as the test value.
6. Check on the I/O module that the output is 20 mA.
7. The measured mA value can be readjusted when it deviates from the defined test value.

Additional information

Other concentrations can also be specified as test values. AO(n)O [mA] shows the expected value output by the I/O module.

Table 7: Measuring points of I/O module analog outputs

I/O module	Analog output	Measuring point mA
I/O module 1	Analog output 1	X7 pin 5/6
I/O module 1	Analog output 2	X7 pin 7/8
I/O module 1	Analog output 3	X7 pin 9/10
I/O module 1	Analog output 4	X7 pin 11/12
I/O module 1	Analog output 5	X7 pin 5/6
I/O module 1	Analog output 6	X7 pin 7/8
I/O module 1	Analog output 7	X7 pin 9/10
I/O module 1	Analog output 8	X7 pin 11/12

6.11.1.3 Adjusting analog outputs with SOPAS ET

Overview

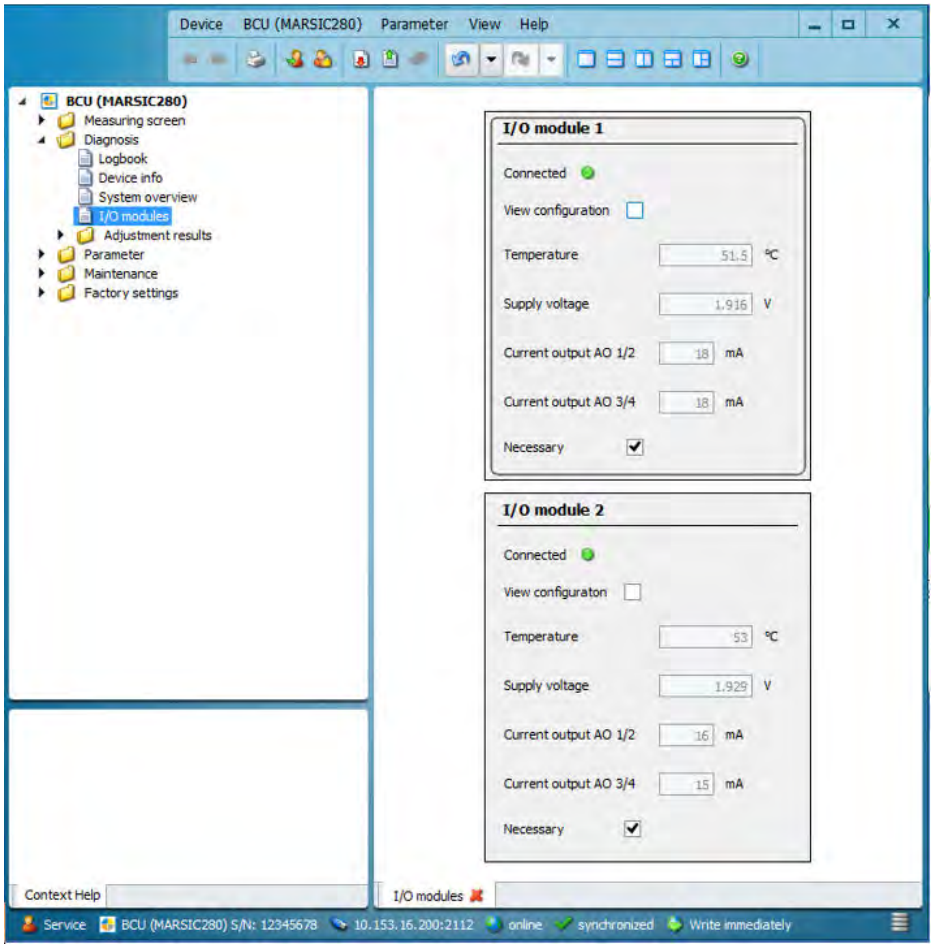
The analog outputs can be readjusted in the event of deviations of the output.

Prerequisites

- SOPAS ET is connected to the device.

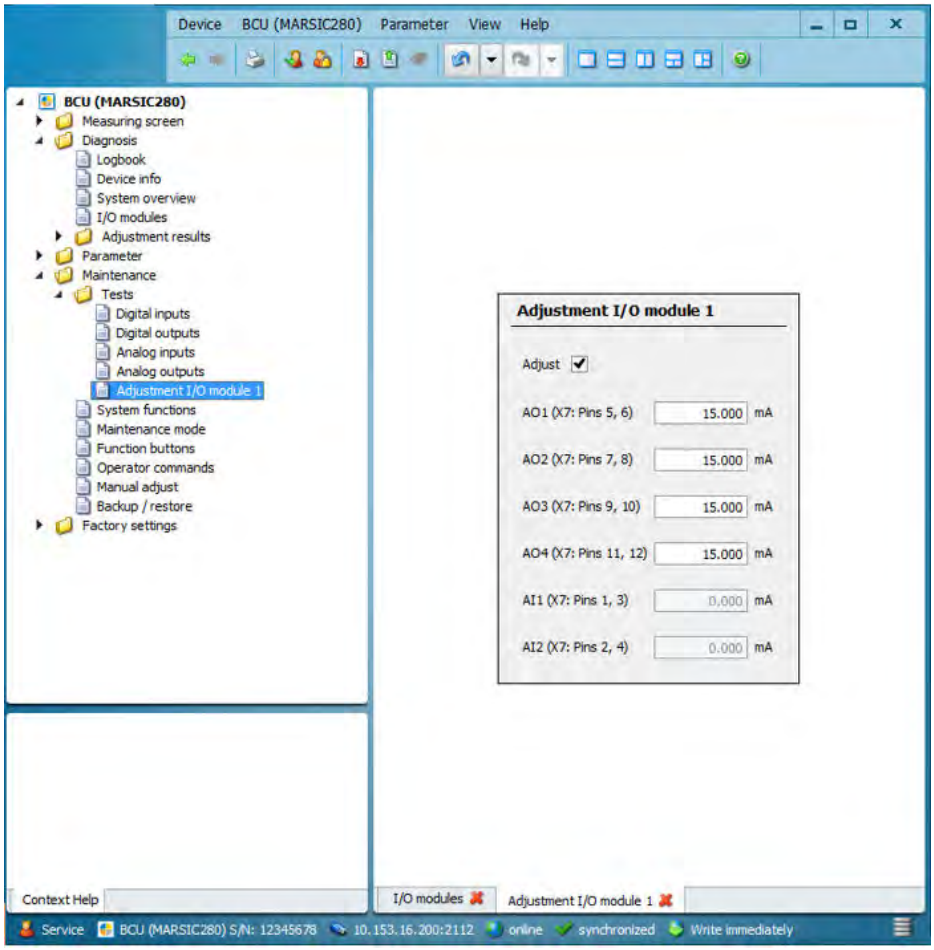
Procedure

1. Open the BCU module with a double-click.
2. Open the “I/O modules” menu under “Diagnosis”.



3. Check the “View Configuration” box for the I/O module to be adjusted.
4. Open the “Adjust I/O module” menu under “Maintenance” and “Tests”.
5. Check the “Adjust” box.

✓ The I/O module outputs 15 mA at all outputs.



6. Measure the mA output of the analog output to be adjusted.
7. If there are deviations, enter the measured value in the adjustment and confirm with Enter.
8. Remove the check mark for “Adjust”.
9. Open the “I/O modules” menu under “Diagnosis”.
10. Remove the check mark for “View configuration”.

6.11.2 Modbus functions

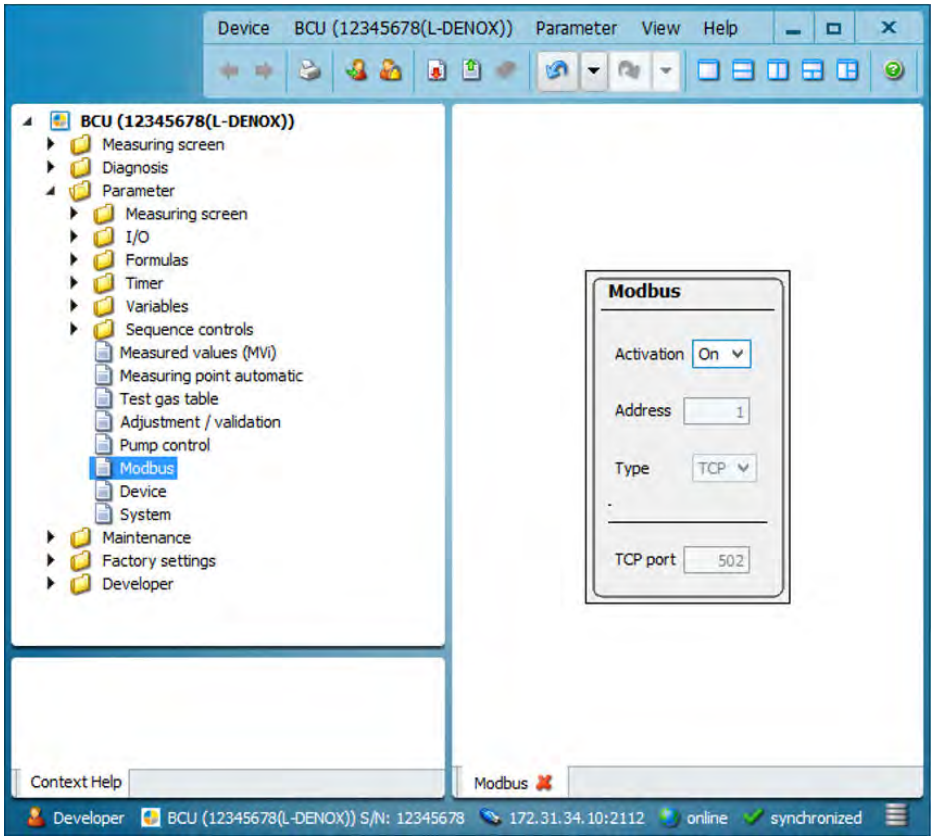
6.11.2.1 Activating Modbus functions

Prerequisites

- SOPAS ET is connected to the measuring device.

Procedure

1. Open the BCU module with a double-click.
2. Select menu “Modbus” from “Parameter”.



3. Select “Type” from the “TCP” selection menu.
4. Set “Activation” to “on”.

6.11.2.2 Measured value inquiry MBO DESOX

Important information

NOTE
The Modbus addresses in the following Tables are valid when the addressing of the PLC starts with “0”.

► If the PLC can only start addressing at “1”, a “1” must be added to the Modbus address (e.g. 89+1=90).

TAG / Component	Modbus address	FC code	Length / number of registers	Format	Value
MV2 / SO2	89	03	2	Float AB CD	
MV4 / CO2	131	03	2	Float AB CD	
MV5 / ---					
MV6 / Pressure	173	03	2	Float AB CD	
MV7 / ---					
MV8 / Flow	215	03	2	Float AB CD	
MV10 / Ratio	257	03	2	Float AB CD	
IV2 / ext. Standby	276	03	1	Bit by bit	Bit 0 (LSB): 1 ext. Standby active

TAG / Component	Modbus address	FC code	Length / number of registers	Format	Value
IV1 (lower 16 bits) / active measuring point, condensate container full	297	03	1	Bit by bit	Bit 0 (LSB)*: 1 Probe 1 active Bit 1 *: 1 Probe 2 active Bit 2 : 1 Condensate container full
IV1 (upper 16 bits) / NAMUR Status	298	03	1	Bit by bit	Bit 0 (LSB): 1 Failure Bit 1: 1 Maintenance request Bit 2: 1 Function control Bit 3: 1 Indefinite Bit 4: 1 Extended

* Invalid when system in standby

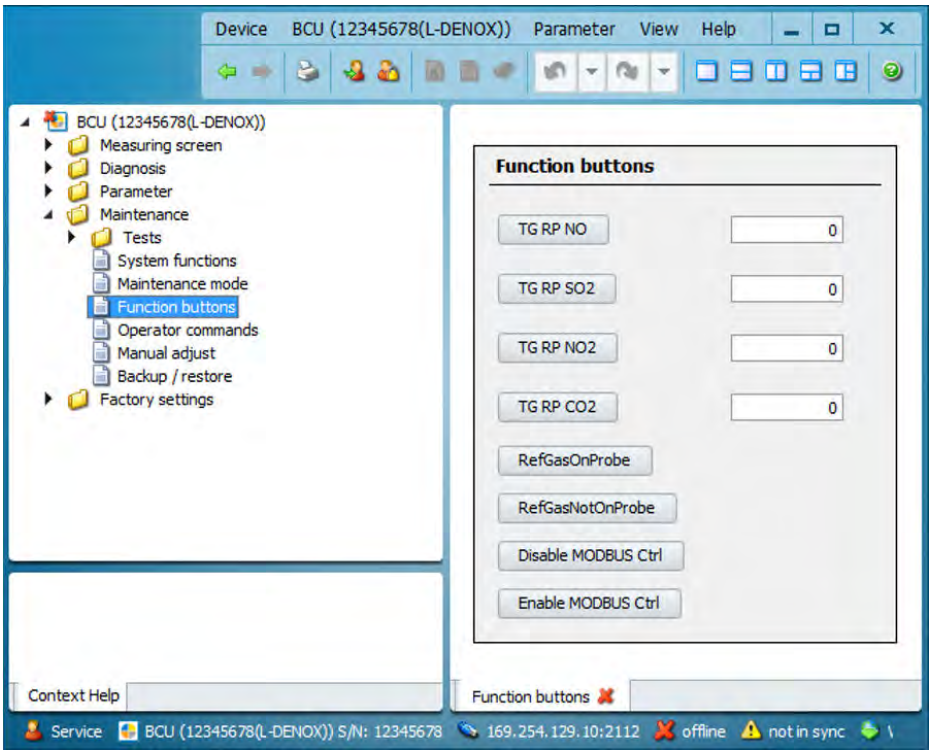
6.11.2.3 Enabling Modbus inputs

Prerequisites

- SOPAS ET is connected to the measuring device.

Procedure

1. Open the BCU module with a double-click.
2. Open the “Function buttons” menu under “Maintenance”.



3. Click “Enable MODBUS Ctrl”.

✓ Modbus inputs are activated.

6.11.2.4 Setting Modbus functions

Important information

NOTE
The Modbus addresses in the following Tables are valid when the addressing of the PLC starts with “0”.

► If the PLC can only start addressing at “1”, a “1” must be added to the Modbus address (e.g. 89+1=90).

Activating the Modbus functions

Command	Modbus address	FC code	Format	Value
Enabling Modbus inputs	1388	16	Float AB CD	Unequal 0.0: Enable Disable 0.0:

Setting the system to Standby via MBI1

Command	Modbus address	FC code	Format	Value
Enable standby	1370	16	Float AB CD	Unequal 0.0: Enable Disable 0.0:

Enabling and disabling a measuring point via MBI2MBI3

The device automatically detects the number of measuring points. The connected measuring points can be enabled or disabled via Modbus inputs MBI2 and MBI3.

Command	Modbus address	FC code	Format	Value
Disable probe 1	1373	16	Float AB CD	Unequal 0.0: Disable 0.0: Enable
Disable probe 2	1376	16	Float AB CD	Unequal 0.0: Disable 0.0: Enable

Validation of all zero points via MBI4

Command	Modbus address	FC code	Format	Value
Validation of all zero points	1379	16	Float AB CD	Unequal 0.0: Start 0.0: Reset to be able to start again later

Adjustment of all zero points via MBI5

Command	Modbus address	FC code	Format	Value
Adjustment of all zero points	1382	16	Float AB CD	Unequal 0.0: Start 0.0: Reset to be able to start again later

Adjustment of all reference points (SO2, CO2) via MBI6

Command	Modbus address	FC code	Format	Value
Adjustment of all reference points	1385	16	Float AB CD	Unequal 0.0: Start 0.0: Reset to be able to start again later

7 Operation

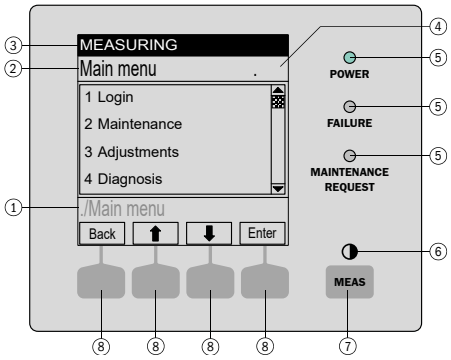
7.1 Operating and display elements

Important information

NOTE
The display lighting can possibly switch off automatically after a certain time.

► To reactivate the display lighting: Press the left or right function button

Operating and display elements



① Current menu branch
② Current menu
③ Status bar
④ Menu number
⑤ LEDs
⑥ Contrast: Press the **MEAS** button for several seconds
⑦ **MEAS** button: Measuring Screen
⑧ Function button (function is displayed)
ENTER
MENU, etc.

7.1.1 LED

LED	Significance/ possible causes
POWER	The device is switched on, mains voltage is available
FAILURE	At least one status flag**F** is activated
MAINTE-NANCE REQUEST	At least one status flag **M**, **C** or **U** is activated for at least one measured value, Analyzer module or sensor
	The **Maintenance mode** state is activated manually

7.1.2 Function buttons

The current function of the function buttons is shown on the display.

Display	Function
MEAS	Back to the Measuring screen from any menu. • Press <Save> to store any changes made. Otherwise the changes are lost.
	◐ To set the contrast: Press the MEAS button for longer than 2 seconds.
Back	Back to the higher level menu. Press <Save> to store any changes made. Otherwise the changes are lost.
Diag	**Diag** is shown only when a message is pending. To display the message: Press this button.

Display	Function
Enter	Call up/start selected menu function
Menu	Call up the main menu. If the **Menu>** button is not shown: First press **MEAS**.
Save	Save input/exit
Set	Start setting
Select	Select function/character
Start	Start procedure
⬆	In a selection list: Move cursor upwards
	During input: Next character
⬇	Move cursor downwards
⬅	Move cursor to the left
➡	Move cursor to the right

7.2 Setting the maintenance signal

Overview

The maintenance condition is set for maintenance and repair work on the device. This signals that the device is not in measuring mode.

Procedure

1. Press “Menu”.
2. Select menu “2 Maintenance”.
3. Select menu “1 Maintenance mode”.
4. Selecting “On” sets the maintenance signal. Selecting “Off” switches the maintenance signal off.
5. Press “Save” to confirm.

7.3 Activating Standby mode on the display

Overview

Activating Standby mode directs the instrument air to the gas sampling unit. This purges the entire system.

A zero point validation is started automatically which takes about 8 minutes. This allows the MARSIC280 to check its zero point with instrument air.

The MARSIC280 then goes into Standby mode. Purging of the entire system is continued.

Important information

CAUTION
Noxious gases may escape during maintenance and repair work.

► Before carrying out maintenance and repair work, put the measuring system in Standby mode to purge it with instrument air.

NOTICE
When the scrubber is not in operation, soiling can damage the entire system.

► When the scrubber is not in operation, the entire system must be set to Standby mode.

NOTE
If Standby mode has been activated, it can only be deactivated again after the automatic zero point validation has been completed.

Prerequisites

- User level Authorized Operator is active.

Procedure

1. Open the menu.
2. Open 5 Parameters.
3. Open 10 Specials.
4. Open 2 Customer functions.
5. Enable 3 Standby

✓ Purge the gas sampling unit and the device with instrument air.

6. Check the flow rate of the instrument air is 100 l/h. If necessary, correct the flow rate at the throttle.

✓ An automatic zero point validation with instrument air is performed, this takes about 8 minutes.

✓ The device goes into Standby mode.

7. Standby mode is deactivated manually in menus 5 - 10 - 2 - 4.

Related topics

- Activating Standby mode via the Modbus input: see "Setting Modbus functions", page 88
- Activating Standby mode via the display: see "Activating Standby mode", page 79
- Activating Standby mode via the digital input: See wiring diagram

7.4 Activating and deactivating measuring points

Overview

If the measuring device has more than one measuring point, unused measuring points can be deactivated if required.

Procedure

1. Press “Menu”.
2. Select menu “5 Parameter”.
3. Select menu “10 Special”.
4. Select menu “1 Meas. Pt (MP)”.
5. Select the appropriate measuring point.
6. Select menu “1 On/Off”.
7. Selecting “On” activates the measuring point. Selecting “Off” deactivates the measuring point.
8. Press “Save” to confirm.

7.5 Setting the measuring and purging times

Overview

The purging and measuring times determine how long measurements are taken at the corresponding measuring point.

The purge time includes the waiting time during a sample change that the gas needs to be stable in the analyzer.

The measuring time includes the actual measuring time of the corresponding sampling unit.

Important information

NOTE
The purge time must be at least 50 seconds. Otherwise, stable measured values cannot be guaranteed with several measuring points. The sample gas needs this time to be stable in the analyzer during a sample change.

The total time of all samples together may not exceed 285 seconds.

Procedure

1. Press “Menu”.
2. Select menu “5 Parameter”.
3. Select menu “10 Special”.
4. Select menu “1 Measuring point automatic”.
5. Select menu “1 Meas. Pt (MP)”.
6. Select the appropriate measuring point.
7. The purging time can be changed with menu item “3 Purge time”. The measuring time can be changed with “4 Meas. time”.
8. The times are changed using the arrow keys.
9. Press “Save” to confirm.

7.6 Setting the test gas

Overview

Before adjustment, the exact test gas concentrations must be entered in the Test Gas Table.

Procedure

1. Check the cylinder concentration on the test gas cylinder.
2. Press “Menu”.
3. Select menu “3 Adjustments”.
4. Select menu “5 Settings”.
5. Select menu “1 Test gases”.
6. Select the appropriate component for which a test gas setting is to be made.
7. Select menu “5 Usage”.
8. Select the appropriate component.
9. Select menu “3 Concentration”.
10. Enter the test gas concentration using the arrow keys.
11. Press “Save“ to confirm the input.

7.7 Determining adjustment gas purging times

Overview

During the first adjustment of each test gas, the time required for the gas to become stable in the analyzer must be determined. This is necessary so that the adjustment can be carried out without errors.

Procedure

1. Feed test gas. Measure the time until the test gas is stable in the analyzer.
2. Press “Menu”.
3. Select menu “3 Adjustments”.
4. Select menu “5 Settings”.

5. Select menu “1 Test gases”.
6. Select the appropriate component.
7. Select menu “5 Usage”.
8. Select menu “4 Purge time”.
9. Enter the purge time determined using the arrow keys.
10. Press “Save” to confirm.

7.8 Performing zero point validation and adjustment

Overview

The zero point of the analyzer is adjusted with instrument air.

Prerequisites

- The primary pressure of 2.5 ... 3 bar is set on the pressure gauge.

Procedure

1. Press “Menu”.
2. Select menu “Adjustment”.
3. Select the measuring component to be adjusted.
4. Start zero point adjustment with menu item “2 zero point adjustment”.
✓ Window opens with prompt “Automatic?”.
5. Press “Enter” to confirm.
✓ Window opens with prompt “Zero point adj Start?”.
6. Press the “Enter” button to confirm.
✓ Zero point adjustment starts.
7. Set the flow rate on the throttle to 100 l/h. Read off the flow rate on the flow meter at the same time.

7.9 Performing sensitivity validation or adjustment

Procedure

1. Press “Menu”.
2. Select menu “3 Adjustments”.
3. Select the measuring component to be calibrated.
4. Connect the test gas cylinder to the valve block with 2.5 ... 3 bar.
5. Select menu “6 Reference point adjustment” and confirm with “Enter”.
✓ Window opens with prompt “Automatic?”.
6. Press the “Enter” button to confirm.
✓ Window opens with prompt “Automatic?”.
7. Press the “Enter” button to confirm.
✓ Reference point adjustment starts. .
8. Set the flow on the flow reducer to approx. 100 l/h. Read off the flow rate on the flow meter at the same time.

7.10 Programming automatic adjustment and validation

Overview

Automatic validation and adjustment is not set up by default.

Procedure

1. Press “Menu”.
2. Select menu 3 “Adjustment”.
3. Select menu “5 Settings”.
4. Select menu “2 Automatic”.

5. Select the appropriate component.
6. Select “1 Active”.
7. Selecting “On” activates automatic validation and adjustment.
8. Select menu “2 Interval”.
9. Set the interval frequency using the arrow keys and confirm with “Save”.
10. Select menu “3 Time unit”.
11. Repeat selection (every hour, day, week).
12. Select menu “4 Start date”.
13. Use the arrow keys to set the date for val. / adj. and confirm with “Save”.
14. Use the arrow keys to set the time for the first automatic val. / adj. and confirm with “Save”.

7.11 Switching the device off

Important information

CAUTION
Poisoning hazard through sample gas

Sample gas may be present in the components in contact with the sample gas after switching off.

► Set the measuring device to Standby mode before turning it off.

Prerequisites

- The instrument was purged with instrument air for 10 minutes in Standby mode.

Procedure

1. Switch off the instrument via a separate main switch or via the FI (FB1) switch in the sample conditioning and distribution unit.
2. In case of prolonged shutdown: Pull the gas extraction unit out of the stack.

8 Menus

8.1 Password

Overview

There are 2 user levels, each with its own password.

The passwords are identical for operation via the control unit as well as for operation via SOPAS ET.

The passwords can be changed.

Password

User level	Password (case-sensitive)
MARSIC	EMI
Authorized operator	HIDE

Related topics

- BCU Operating Instructions

8.2 Menu tree

O = This menu is visible for the “Operator” user levels
M = This menu is additionally visible for the “MARSIC” user level
A = Authorized operator (xxx)

Menu level	O/M/A
Login	**O**
Auth. operator	O
Service	O
Logout	O
MARSIC	O
Maintenance	**M**
Maintenance mode	M
Reset BCU	M
Adjustments	**M**
Adjustment	A
Group functions	M
Settings	M
Test gases	M
Diagnosis	**O**
Status	O
Measured values	O
Modules	O
Limit values	O
Logbooks	O
Logbook compl.	O
Logbook F, M, C, U, E	O
Results	O
Adjustment results	O
Validation results	O
Parameters	**M**
Date - Time	M
Special	M
Customer functions.	M
Language	**O**

9 Maintenance

9.1 Safety

Requirements for the maintenance personnel

- Only allow an authorized electrician to work on the electrical system or electrical subassemblies.
- The technician must be familiar with the exhaust gas technology of the operator's plant (hazard by overpressure and toxic and hot flue gases) and be able to avoid hazards when working on gas ducts.
- The technician must be familiar with handling compressed gas cylinders (test gases).
- The technician must be able to avoid hazards caused by noxious test gases.
- The technician must be familiar with gas lines and their screw fittings (be able to ensure gas-tight connections).

9.2 Maritime Hotline

If you have questions about malfunctions or maintenance work, you can contact the Maritime Hotline (24/7).

Phone: +49 7681 2024194

E-mail: service-maritime@endress-ehs.com.

9.3 Data backup and data recovery

The SOPAS data backup must be carried out before and after each commissioning, maintenance and repair for a complete documentation of the analyzer.

By importing the SOPAS data backup, an error can be reset during execution.

The data backup can also be opened off-line. This allows an appropriate expert to identify pending errors in a current backup and define the next steps to fix them.

9.3.1 Backing up the data

Overview

A data backup must be carried out before as well as after each commissioning, maintenance and repair work.

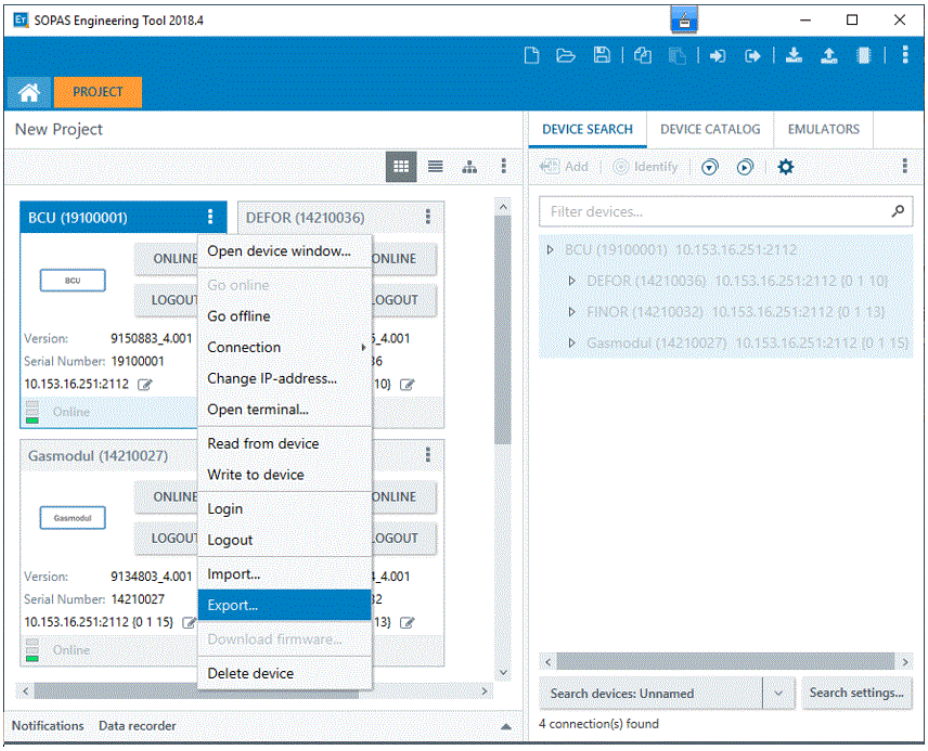
A data backup must be performed for all modules of the measuring device.

Prerequisites

- SOPAS ET is connected to the measuring device.
- Logged in with the Authorized Operator user level.

Procedure

1. Click on the three dots of the corresponding module and select “Export”.



2. Select the appropriate destination folder and click “Save”.

9.3.2 Recovering the data

Overview

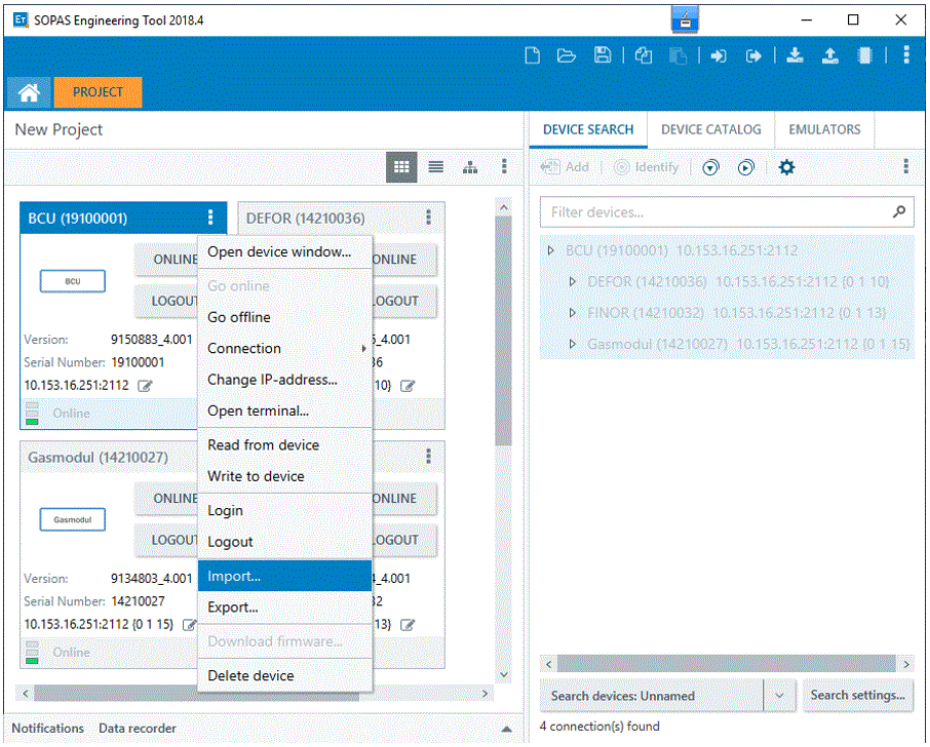
Data recovery can be used to correct erroneous data or update the system.

Prerequisites

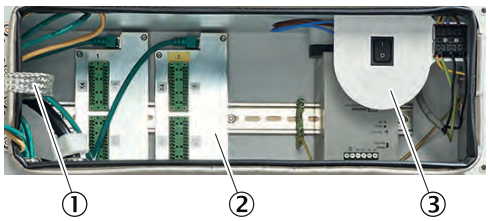
- SOPAS ET is connected to the measuring device.
- Logged in with the Authorized Operator user level.
- Data backup has been performed.

Procedure

1. Click on the three dots of the corresponding module and select “Import”.



2. Select the corresponding file and click “Open”.
3. Click “Finish” in the window that appears.
4. Click “Yes”.
5. Wait 2 minutes after the import has been performed.
6. Restart the analyzer using power switch ③.



① Distribution board with Ethernet for MPR (optional), Modbus, service interface (LAN)
② Signal connections (I/O)
③ Power voltage connection to terminal strip

9.4 Status messages

9.4.1 Opening the logbook

Overview

The logbook displays the error messages present on the device. The Status column shows whether a maintenance or error message is active.

Status “On” = active message

Status “Off” = message no longer pending

Important information

NOTE
The device must heat up for about two hours. Many error messages can be related to an operating temperature that has not been reached.

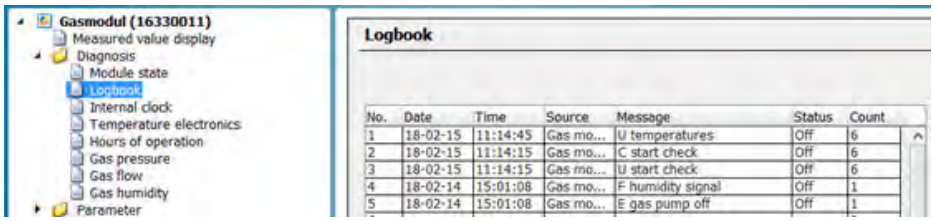
Therefore the logbook should only be checked after the heating time.

Prerequisites

- SOPAS ET is connected to the measuring device.

Procedure

1. Select menu “Logbook” in the “Diagnosis” folder.



2. Check the messages from the measuring modules (DEFOR, FINOR, Gas module) before those from the BCU.

Related topics

- see "Logbook description", page 136

9.5 Maintenance plan

Overview

This Maintenance plan describes the maintenance work specified by the manufacturer.

Perform checks in accordance with the guidelines to be applied by the operator in accordance with the intervals described therein.

Maintenance intervals

Table 8: Maintenance intervals

Interval[1)]	Maintenance work	Remark
1 W	Check pending messages (Logbook).	see "Logbook description", page 136
	Check of the system	see "Regular checks", page 102
	Gas sampling unit • Carry out a visual inspection of the gas sampling filter. • Adjust the maintenance interval depending on the application load.	see "Setting the system flow rate", page 60 see "Servicing the gas sampling unit", page 105
1 M	Gas sampling unit • Replace the gas sampling filter, at the latest when the flow rate is < 50 l/h.	see "Servicing the gas sampling unit", page 105
	Sample conditioning and distribution unit • Check the filter pads. • Clean or replace the filter pads as necessary.	see "Replacing the filter pad", page 119
	Analyzer • Check the exhaust hose to see if blocked or kinked. • Clean or replace the exhaust hose as necessary.	see "Connecting exhaust gas lines", page 45

Interval[1]	Maintenance work	Remark
3 M	Check the settings including test gas supply on the measuring device.	see "Adjusting", page 68
6 M	Perform a leak tightness check.	see "Carrying out a leak test", page 67
	Replace the hose of the condensate pump.	see "Replacing the condensate pump hose", page 114
1 Y[2]	**Gas sampling unit** • Replace the non-return valve. • Clean the probe tube. • Clean the sample gas line. • Clean the housing.	see "Servicing the gas sampling unit", page 105
	Sample conditioning and distribution unit • Replace the water trap.	see "Replacing the water trap", page 117
	Analyzer • Replace the exhaust gas hose.	see "Connecting exhaust gas lines", page 45
	• Check setting of pressure reducer module.	see "Connecting the instrument air", page 47
	Maintain the instrument air conditioning.	See Instrument Air Conditioning Operating Instructions
	Save device data.	see "Data backup and data recovery", page 54
	Complete Service Report and Checklist.	
2 Y[2] [3]	**Sample conditioning and distribution unit** • Replace the filter pads	see "Replacing the filter pad", page 119
	Replace the sample gas pump.	Training required[2]
4 Y[2] [3]	Replace the DEFOR module	Training required[2] see "Replacing the DEFOR module", page 126

1) 1 D = Daily, 1 W = Weekly, 1 M = Monthly, 3 M = Every 3 months, 6 M = Every 6 months, 1 Y = Yearly, 2 Y = Every 2 years, 4 Y = Every 4 years
2) Maintenance must be performed by Endress+Hauser Service, service partner or certified customer.
3) Include all annual maintenance activities as well.

9.6 Consumable, wearing and spare parts

Table 9: Recommended consumables, wear and spare parts for maintenance

Part No.	Description	Installation location
2043616	Maintenance kit “Gas sampling filter”	Gas sampling unit
5310158	Non-return valve, 25 psi, NPT male thread 1/4″, material stainless steel, Viton®	Gas sampling unit
2126575	Water trap, membrane 0.1 µ, material PP, PTFE, max. gas flow 400 l/h, max. gas temperature 80 °C, incl. screw fittings, straight for hose outer Ø 6 mm, nner Ø 4 mm	Sample conditioning and distribution unit
2075806	Pump hose kit, for hose pump SR25	Sample conditioning and distribution unit
2099754	Hose, outer Ø 6 mm, inner Ø 4 mm, length 10 m, material PTFE	Sample conditioning and distribution unit
5306678	Filter pad, 173 mm x 173 mm, material chemical fiber	Sample conditioning and distribution unit
5333331	Filter pad, 120 mm x 120 mm, material chemical fiber	Sample conditioning and distribution unit
2124472	Filter element kit	Instrument air conditioning
5343885	Condensate drain valve “AM10”	Instrument air conditioning

Table 10: Further spare parts

Part No.	Description	Installation location
5313623	Adapter fitting, for hose outer Ø 6 mm, inner Ø 4 mm, tube Ø 6 mm, material PVDF	Analyzer unit

Part No.	Description	Installation location
2077536	Analyzer module “DEFOR DeSOx”	Analyzer unit
2118763	Analyzer module “DEFOR DeSOx”, refurbished	Analyzer unit
2077535	Analyzer module “DeSOx”, complete, mounting plate with module “DEFOR DeSOx”, module “FINOR” and Gas module	Analyzer unit
2075572	Analyzer module “FINOR”'	Analyzer unit
2050770	Electronic card “Distributor”	Analyzer unit
2062251	Microfuse, 20 mm x 5 mm, F, 10.0 A, 250 V	Analyzer unit
2075527	Front door complete, with display and BCU control unit, for analyzer upper section	Analyzer unit
2074292	Gas module, complete	Analyzer unit
2050775	I/O module for carrier rail mounting	Analyzer unit
2077458	Insulating cover, for analyzer module “FINOR”'	Analyzer unit
2050772	Power supply unit, 24 V, 1.0 A	Analyzer unit
2062254	H Hose, outer Ø 4 mm, inner Ø 2.5 mm, material PTFE	Analyzer unit
2077894	Door seals, for upper and lower doors	Analyzer unit
2050768	Connection line “CAN bus”, length 0.5 m, color yellow, between electronic card “Distributor” and control unit SCU	Analyzer unit
2066761	Connection line “CAN bus”, length 0.5 m, color green, between electronic card “Distributor” and sensor module, I/O module, control unit BCU	Analyzer unit
5309091	Cabinet key, with double bit	Analyzer unit, sample conditioning and distribution unit
2060250	Bellows valve, for extraction filter	Gas sampling unit
5318509	Shrink hose, 50.8 mm to 13.2 mm, material PTFE, transparent	Gas sampling unit
2126714	Throttle valve, connections 6 mm, material PVDF	Sample conditioning and distribution unit
2126715	2-way ball valve, connections 6 mm, material PVDF	Sample conditioning and distribution unit
2112880	Pressure reducer module, complete, for instrument air connection	Sample conditioning and distribution unit
2126624	Flow meter, 25 l/h ... 250 l/h, G 1/8″	Sample conditioning and distribution unit
6075004	Filter fan, 204 mm x 204 mm, 24 V DC, color RAL7035	Sample conditioning and distribution unit
6061819	Semi-coductor relay, 5 V DC ... 24 V DC. 20 A, 220 V AC	Sample conditioning and distribution unit
5344051	Jet stream heat exchanger ECM-2HC, sample gas connections 6 mm, condensate outlet G 3/8″, material Hastelloy®	Sample conditioning and distribution unit
5322629	Jet stream heat exchanger ECM-2PV, sample gas connections 6 mm, condensate outlet G 3/8″, material PVDF	Sample conditioning and distribution unit
6072450	Condensate hose pump, 230 V / 115 V, 50 Hz / 60 Hz, 0.3 l/h	Sample conditioning and distribution unit
2126702	Sample gas pump, 24 V DC, max. 3.9 l/min, max. 0.5 bar	Sample conditioning and distribution unit
6073641	Power supply unit, 85 V AC ... 264 V AC, 24 V DC, 5 A, for rail mounting	Sample conditioning and distribution unit
2126701	Quartz wool filter element, complete with connections	Sample conditioning and distribution unit
2126625	Relay kit, 24 V DC, 8 A	Sample conditioning and distribution unit
2118338	Non-return valve, 0.2 bar, for hose outer Ø 6 mm, inner Ø 4 mm, material PVDF, FKM	Sample conditioning and distribution unit
5332215	Bulkhead screw connection, straight, for hose outer Ø 6 mm, inner Ø 4 mm, material PVDF	Sample conditioning and distribution unit
5314862	Cabinet outlet filter, 148.5 mm x 148.5 mm x 24 mm	Sample conditioning and distribution unit
6075721	Circuit breaker “C10A”, 2 poles, 400 V AC, 10 A	Sample conditioning and distribution unit
6054080	Circuit breaker “C16A”, 2 poles, 400 V AC, 16 A	Sample conditioning and distribution unit
6065827	Circuit breaker “C6A”, 2 poles, 400 V AC, 6 A	Sample conditioning and distribution unit
6075795	FI circuit breaker 25A/0A03 4P	Sample conditioning and distribution unit
6074987	Temperature controller, 24 V DC	Sample conditioning and distribution unit
5334787	T-fitting for hose outer Ø 6 mm, inner Ø 4 mm, material PVDF	Sample conditioning and distribution unit
2126711	Valve block, 4-fold, pre-assembled	Sample conditioning and distribution unit

Part No.	Description	Installation location
2126712	Valve block, 7-fold, pre-assembled	Sample conditioning and distribution unit
2123058	Sample gas cooler “ECP100C”, complete, for one measuring point, incl. condensate pump, 115 V AC ... 230 V AC, 50/60 Hz	Sample conditioning and distribution unit
2123047	Sample gas cooler “ECP100C”, complete, for two measuring points, incl. condensate pump, 115 V AC ... 230 V AC, 50/60 Hz	Sample conditioning and distribution unit
6048122	Plug, RJ45, CAT5e, 8-pin	Sample conditioning and distribution unit
5343485	Instrument air conditioning module, 2-stage, filter 0.01 µm, max. 400 l/min, max. 16 bar	Sample conditioning and distribution unit
2128599	Cabinet lock	Sample conditioning and distribution unit
6073408	Block contactor, 3-pole, 24 V DC, 25 A, 3 x make contact (NO)	Sample conditioning and distribution unit
2024400	Condensate tank, with vent cover, capacity 30 l, material HDPE	Sample conditioning and distribution unit
6020479	Capacitive proximity sensor CQ35-25NPP-KC1	Sample conditioning and distribution unit
2075791	Screw fitting kit, Swagelok®	Further spare parts
5329980	Hose cutter, for hoses with outer Ø 4 mm ... 14 mm, material plastic	Further spare parts, Service material

9.7 Regular checks

9.7.1 Checking the device and environment

Procedure

1. Check the instrument air quality (see "Connecting the instrument air", page 47).
2. Check the ambient temperatures according to specification (see "Ambient conditions", page 147).
3. Check the gas sampling filter.
4. Check all fastening screws of the housing for tight seat.
5. Check the condensate outlet for clogging. Check the fill level of the collecting container, if required.
6. Check PTFE lines for kinks.
7. Check all hose fittings for tight seat.
8. Check analyzer cabinets for cleanness, dryness and freedom from corrosion.
9. Check all electric connections for freedom from corrosion and tight seat.
10. Check grounding conductors are free from corrosion.
11. Check the test gases:
    - Use-by date
    - Fill level
    - Condition of cylinders

9.7.2 Checking operation

Procedure

1. Check the display of the control unit for pending error messages.
2. Check measured values for plausibility.
3. Check the flow on the flowmeter (in the distribution unit): Approx. 100 l/h. Set on the flowmeter if required.
4. Check that the sample gas line is significantly warmer than the ambient temperature. This checks whether the sample gas line is heating.

9.7.3 Checking the sample gas fine filter

Overview

The sample gas fine filter is located in the distribution unit.

Procedure

1. Check the sample gas fine filter for contamination (discoloring).

✓ White color: The sample gas fine filter is OK.
If heavily contaminated, replace the sample gas fine filter.

Related topics

- see "Replacing the sample gas fine filter", page 113

9.7.4 Checking the water trap

Overview

The water trap is located in the sample conditioning and distribution unit.

The gas flow is blocked when the water trap is saturated.

Procedure

1. Check the water trap for contamination (discoloration) or replace after one year.
   The water trap must be replaced when heavily soiled.

Related topics

- Replacing the water trap: see "Replacing the water trap", page 117

9.8 Checking the DEFOR hours of operation

Overview

The DEFOR lamp must be replaced regularly for maintenance reasons.

- Replace the DESOX-DEFOR module after 4 years (35 000 hours)

Procedure

1. Open the “Hours of operation” menu in the “Diagnosis” folder.
2. Check the hours of operation of the DEFOR lamp and replace when necessary.

9.9 Cleaning

9.9.1 Cleaning surfaces and parts with media contact

Important information

NOTICE
Device damage through incorrect cleaning.

Incorrect cleaning can lead to device damage.

- Only use recommended cleaning agents.
- Do not use sharp objects for cleaning.

Procedure

1. Remove loose contamination with compressed air.
2. Remove adhering contamination with a mild soap solution and a soft cloth. Make sure electrical parts do not come into contact with liquids.

9.9.2 Cleaning the display

Overview

The display must be cleaned regularly from the outside to ensure heat dissipation and thus operation.

Important information

NOTICE
Device damage through incorrect cleaning.

Incorrect cleaning can lead to device damage.

- Only use recommended cleaning agents.
- Do not use sharp objects for cleaning.

Procedure

1. Wipe the surface with a damp soft cloth and wipe again with a dry soft cloth.
2. If the frames are heavily soiled, do not use acidic or abrasive cleaners, as these attack the surface structure. Use neutral soap sud or limescale remover specially suitable for the surface.
3. Use 2-propanol/isopropanol (isomeric alcohol) for disinfection.

9.10 Setting the maintenance condition with SOPAS ET

Overview

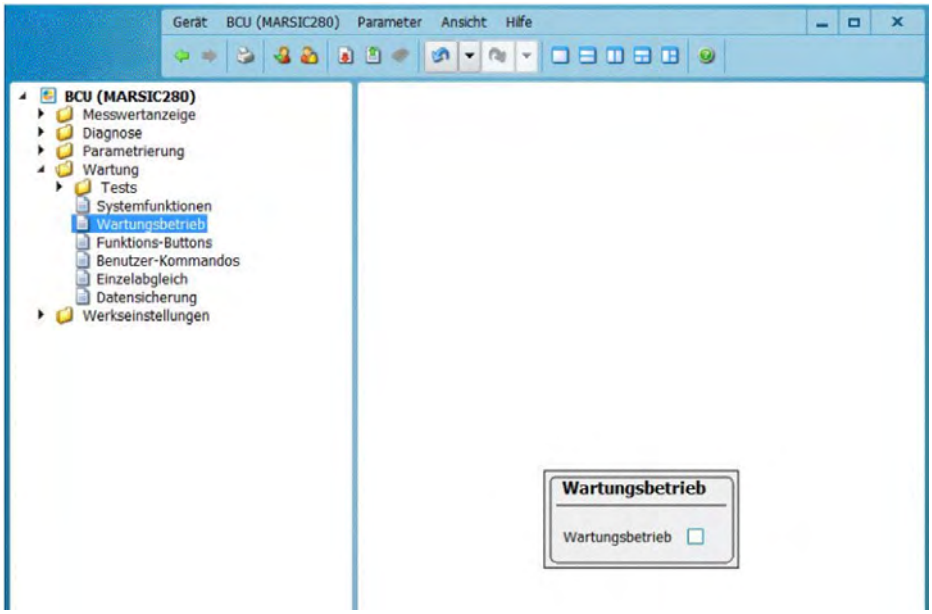
Maintenance mode is set when work or changes are carried out on the measuring device. This signals that the device is not in measuring mode.

Prerequisites

- SOPAS ET is connected to the measuring device.

Procedure

1. Open the BCU module in SOPAS ET with a double-click.
2. Select the “Maintenance mode” menu in the “Maintenance” folder.
3. Set the check mark to activate maintenance mode.



✓ Message “C Maintenance” appears in the logbook.
✓ The Maintenance LED lights.

9.11 Maintenance work

9.11.1 Servicing the gas sampling unit

Important information

WARNING
Risk of injury by a heavy load

The weather hood housing including the sampling system with flange weighs approx. 30 kg.

► Use proper lifting techniques to lift or move the device.
► Lift the unit by the housing. If necessary, remove the cover in order to grip the device better and reduce the weight.
► Always work in pairs.

DANGER
Health risk through dangerous sample gas

If dangerous sample gas is applied to the SFU: The operator is responsible for safe handling of the sample gas.

► In addition to these Operating Instructions, observe all local laws, technical rules, and company-internal instructions valid at the site where the SFU is installed.
► Operate the SFU only in rooms with adequate installation OR install suitable gas monitoring equipment.
► Channel sample gas off safely.

DANGER
Hazard through sample gas pressure

The stacks can have underpressure or overpressure.

► Observe information from the plant operator.

DANGER
Risk of burns on hot surfaces

Filter housing, flanges and sample gas line can be hot.

► Allow the surface of the device parts to cool down to body temperature or wear suitable protective gloves.

DANGER
Danger to life by electric voltage

► Only allow an authorized electrician to work on the electrical system.

Procedure

DANGER

Overview
1. Switch analyzer to “Maintenance”: Menu: Maintenance → Maintenance signal.
2. Switch analyzer to “Stand-by”: Menu: Maintenance → System maintenance.

3. Purge the mesuring system for 10 minutes in this state.
4. Shut off instrument air externally when the gas sampling unit must be removed.
5. Switch off the fuse of the gas sampling unit in the measuring system. Details see “Related topics”.
6. Remove the weather protection hood or housing. Details see “Related topics”.
7. Check all gas connections:
   - Optical condition
   - Tight seat
   - Leak tightness:
     The leak tightness check is performed via the connected measuring system. Details see “Related topics”.
8. Check the gas flow rate on the control unit display or on the flowmeter (see "", page 67).
   - Only replace the glass fiber fine filter at the latest when the flow rate indicator shows < 50 l/h; otherwise continue with step 10.
9. Replace the fine glass fiber filter with a new filter element. Details see “Related topics”.
   NOTICE | Fine filter must **not** be cleaned!
10. Replace the non-return valves. Details see “Related topics”.
11. Reset the timemeter: Menu: Diagnosis → System param. → Counter Op. Hrs.→ Filter sampling system.
12. Reset the Stand-by and Maintenance signals.

Related topics

- Switch off fuse: See system documentation of the measuring device
- Remove the weather protection hood or housing. See Gas Sampling Unit Operating Instructions
- Replace the glass fiber fine filter: see "Replacing the glass fiber filter element", page 106
- Replace the non-return valves: see "Replacing the non-return valves", page 109

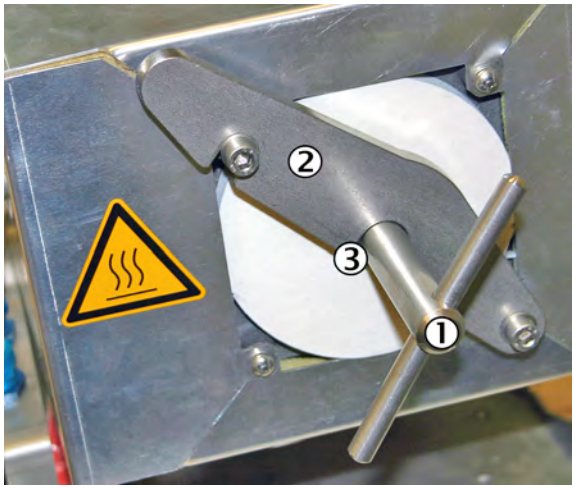
9.11.1.1 Replacing the glass fiber filter element

Procedure

Replacing the fine filter cartridge:

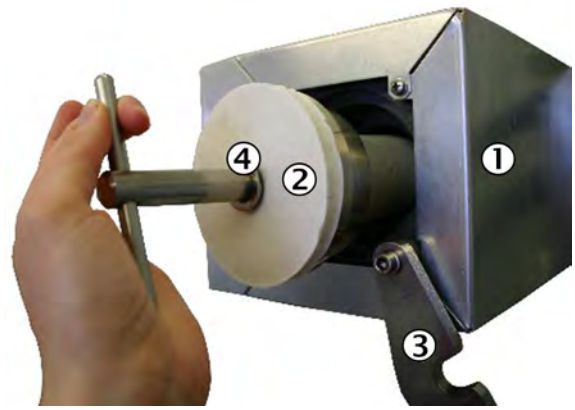
NOTICE | **Do not** loosen the screws of the retaining bracket!

1. Loosen the rotary handle counterclockwise.



① Rotary handle
② Mounting bracket
③ Pressure disk (covered)

2. Swivel the mounting bracket to the right.



① Filter housing
② Filter cover
③ Mounting bracket
④ Pressure disk

3. Pull out the filter cover with glass fiber filter element using the rotary handle.

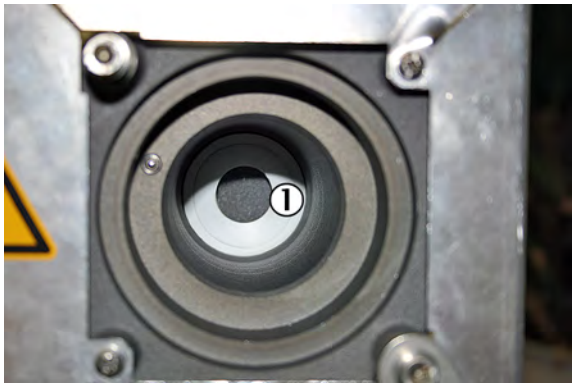
CAUTION DANGER OF BURNS DUE TO HOT SURFACES
Surface can become hot through operation of the device.

► Wear suitable protective clothes, for example, heat-resistant gloves.
► Switch off the device and allow the components to cool down.

CAUTION
Risk of injury due to high weight

► Do not drop the filter cover.

4. If the filter cover is hot: Place the filter cover on a heat-resistant mat.
5. Pull out the bottom flat seal with a hook.

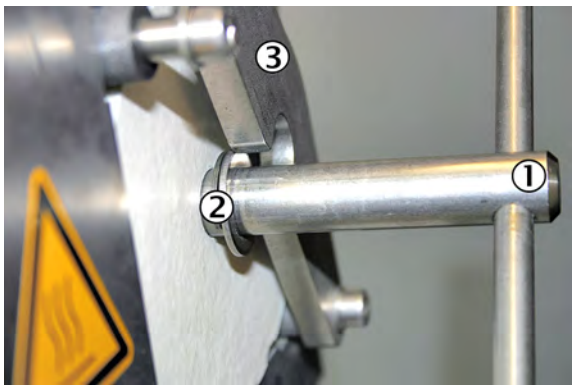


① Bottom flat seal

6. Loosen the glass fiber filter element from the filter handle by opening the spiral thread.

① O-ring
② Glass fiber filter element
③ Rotary handle

7. Insert new bottom flat seal.
8. Renew the O-ring in the filter cover.
9. Place the new glass fiber filter element on the filter cover. Tighten the spiral thread.
   If one side of the filter element has a groove: The groove must point in the direction of the filter cover.
10. Fit the filter cover.



① Rotary handle
② Pressure disk
③ Mounting bracket

11. Swing back the mounting bracket. Make sure that the pressure disk is behind the mounting bracket.

12. Tighten the rotary handle clockwise.
13. Refit the weather hood.

9.11.1.2 Replacing the non-return valves

Overview

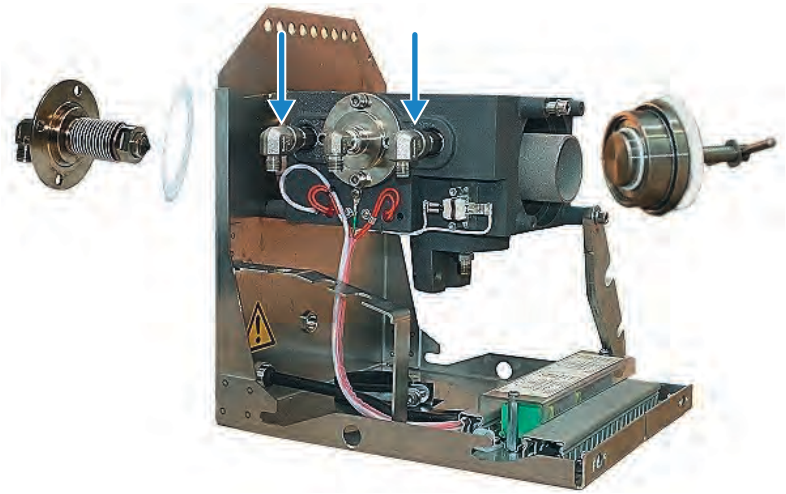


Figure 19: Gas sampling unit

There are two non-return valves installed below the sheet metal trim in the valve block.

Procedure

1. Remove the 90° screw-in fittings and insulation.
2. Fit new valves with Teflon tape.

NOTICE
Observe the alignment of the non-return valves!

- Arrow must point in housing direction.

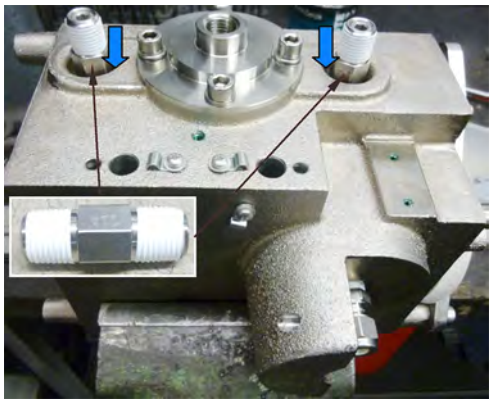


Figure 20: Position of non-return valves

3. Perform a leak tightness test after completing the work.

9.11.2 Replacing the sample gas line

9.11.2.1 Switching the analyzer off

Procedure

1. Switch analyzer to “Stand-by”: Menu: Maintenance → System maintenance.
2. Flush system for 10 minutes in this state.
3. Switch system off at the external power disconnection unit.

9.11.2.2 Removing the sample gas line

Procedure

1. Remove the sample gas line on the gas sampling unit.
2. Unscrew the sample gas line in the measuring device.
3. Disconnect electric connections in the analyzer.
4. Pull the sample gas line out of the analyzer.

9.11.2.3 Laying the sample gas lines

Overview

Figure 21: Heated sample gas line

① PT100 connections
② Voltage supply
③ Connection to gas sampling unit (without electrical connections)
④ Protective cap
⑤ Connection to measuring device (with electrical connections)
⑥ Lock nut
⑦ Cable gland

Important information

NOTICE
Protect the line from damage (chafing through vibration, mechanical load).

NOTICE
The sample gas line must not be insulated at the position of the Pt100 or led through a wall, as otherwise the sample gas line may be damaged.

NOTICE
During operation, condensate may form in the sample gas line which can damage the entire system.

► Fit the sample gas line in a downward direction

Procedure

1. Lay the end **with** the electrical connection to the measuring device.
   NOTICE | The screw connection for the housing duct must be located at the same end as the electrical connection (measuring device side).
2. Lay the end **without** electrical connection to the gas sampling unit.
3. Observe a minimum bending radius of 300 mm.
4. With two sample gas lines, the minimum distance of 100 mm must be observed over the entire length in order to avoid damage.

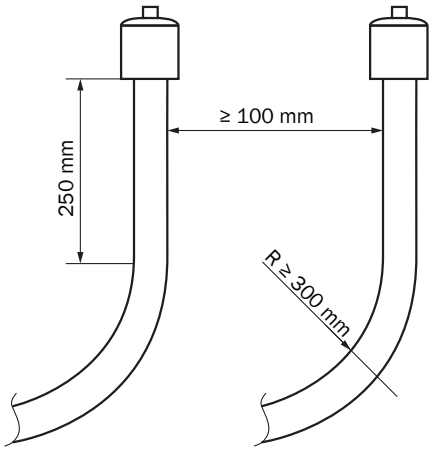


Figure 22: Lines – clearance and bending radius

5. Roll up excess length at the gas sampling unit. Leave enough length for pulling the gas sampling unit.
6. Fasten the sample gas line accordingly (e.g. on cable trays).

9.11.2.4 Fitting the sample gas line on the gas sampling unit

Important information

NOTICE
Protect the line from damage (chafing through vibration, mechanical load).

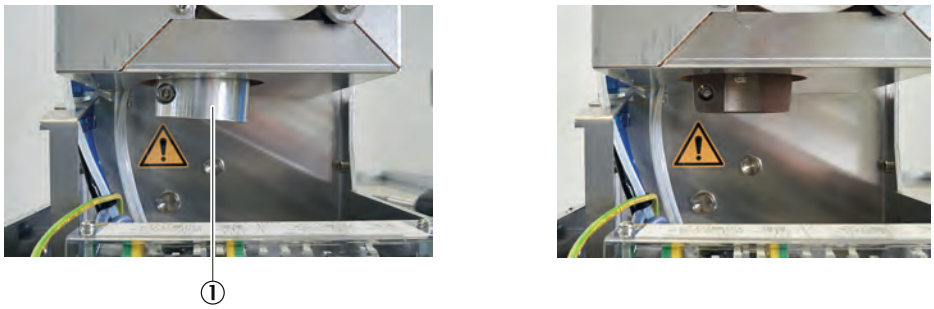
Prerequisites

- Weather hood is removed.

Procedure

Remove the clamp.

1. Loosen screw ① of clamp ②.
2. Remove clamp ②.

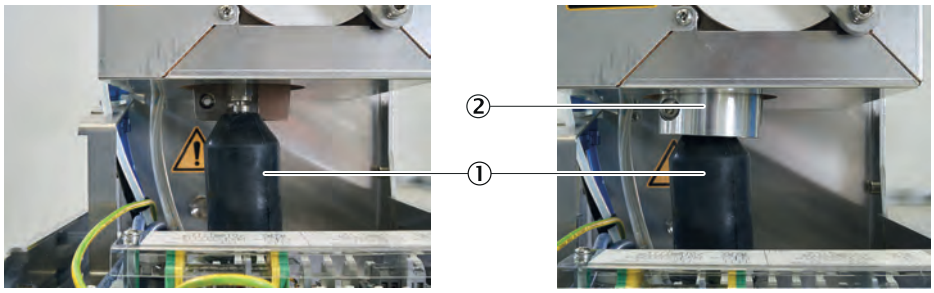


3. Open clamp ① of the strain relief of the heated sample gas line.

4. Insert sample gas line ①.

   NOTICE | Do not lead the sample gas line too far upwards, as leaks may occur.

5. Fit sample gas line ① on the gas sampling unit with the clamping ring screw connection.



6. Tighten the strain relief clamp.
7. Screw thermal bridge clamp ② on.
8. Fit the weather hood.

9.11.2.5 Swapping the temperature sensors on the sample gas line

Overview

- The heated sample gas line has two PT100 temperature sensors.
- One serves as reserve.

Figure 23: Sample gas line

① 2 × PT100 connections (1 as reserve)

Procedure

1. Disconnect defective temperature sensor.
2. Connect reserve.

9.11.3 Replacing the sample gas fine filter

Overview

Figure 24: Sample gas fine filter (system-specific)

Important information

NOTE
The component is system-specific. The described procedure is therefore exemplary and can deviate.

Prerequisites

- Measuring device is switched off.

Procedure

1. Loosen the cap nut of the sample gas tubes and pull the tubes out of the screw connection. Make sure the clamping rings do not get lost.
2. Take out the filter.

3. Insert the new filter. The fitting direction of the sample gas fine filter is irrelevant
4. Reattach the tube connections.
5. Check gas tightness of the sample gas path.

Related topics

- Further information on attaching the tube connections: see "Using a plastic fitting", page 24
- Further information on the leak test: see "Carrying out a leak test", page 67

9.11.4 Replacing the condensate pump hose

Prerequisites

- Measuring device is switched off.

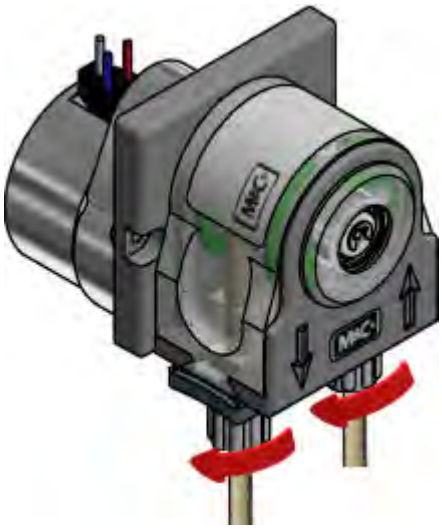
Important information

WARNING
Health hazard due to toxic compounds in the condensate

► Observe all safety regulations for the application.
► In case of contact with the skin or eyes, rinse the affected parts immediately with clear water and consult a doctor.

Procedure

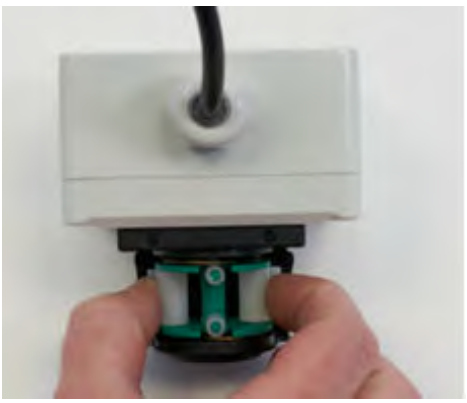
1. Loosen tube connections on the pump.



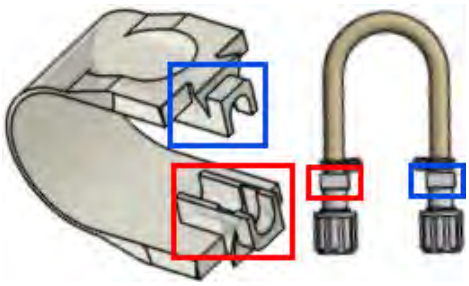
2. Press the wrapping tape roll together at the grip recesses and turn the S-bolt clockwise to the stop.

3. Remove the wrapping tape roll and pull the old pump hose out of the guide using the hose sleeves.

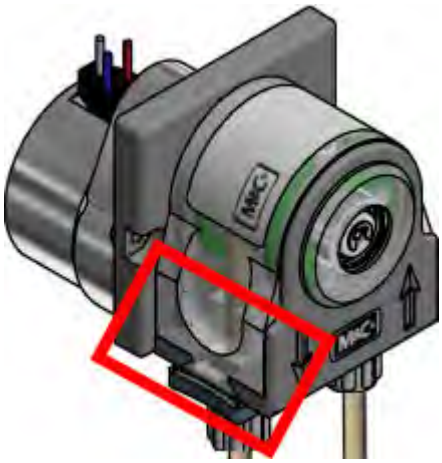
4. Press the press rollers together and check whether spring tension is present, if not, replace the complete hose pump.



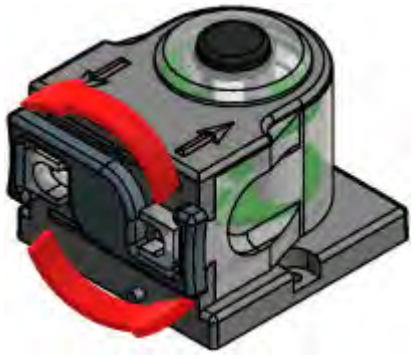
5. Insert the new pump hose with hose nozzles into the guides of the wrapping tape roll.



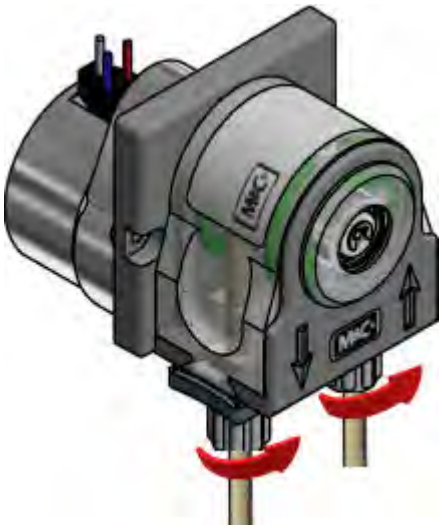
6. Insert the wrapping tape roll complete with hose into the dovetail guide of the pump body.



7. Press the wrapping tape roll together at the grip recesses and turn the S-bolt counter-clockwise to the stop.



8. Reconnect the tube connections on the pump.



9.11.5 Replacing the water trap

Overview

Figure 25: Water trap (system-specific)

Important information

CAUTION
Poisoning hazard through sample gas

Sample gas may be present in the components in contact with the sample gas after switching off.

► Set the measuring device to Standby mode before turning it off.

WARNING
Health hazard due to toxic compounds in the condensate

► Observe all safety regulations for the application.
► In case of contact with the skin or eyes, rinse the affected parts immediately with clear water and consult a doctor.

NOTE
The component is system-specific. The described procedure is therefore exemplary and can deviate.

Prerequisites

- Measuring device is switched off.

Procedure

1. Note the date of installation on the new water trap.
2. Loosen the cap nuts of the sample gas hoses on the water trap side.
3. Pull the hoses out of the screw fitting.
4. Insert a new water trap.
5. Reattach the tube connections.
6. Check the gas tightness of the sample gas path.

Related topics

- Further information on attaching the tube connections: see "Using a plastic fitting", page 24
- Further information on the leak test: see "Carrying out a leak test", page 67

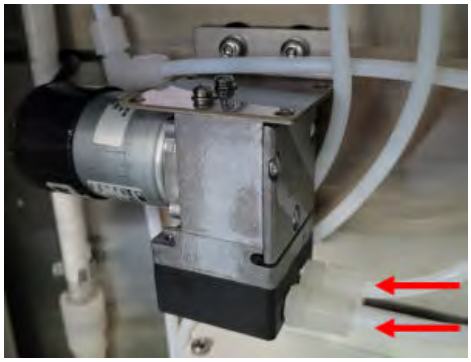
9.11.6 Replacing the sample gas pump

Prerequisites

- The device is switched off.

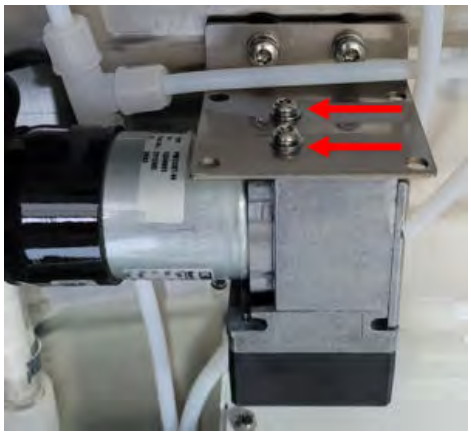
Procedure

1. Loosen the gas connections of the pump.

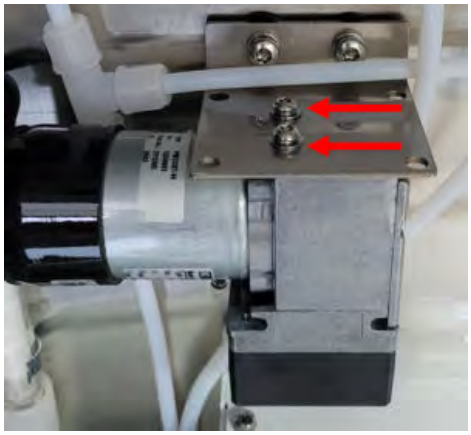


2. Disconnect the voltage supply.

3. Loosen the fixing screws of the pump.

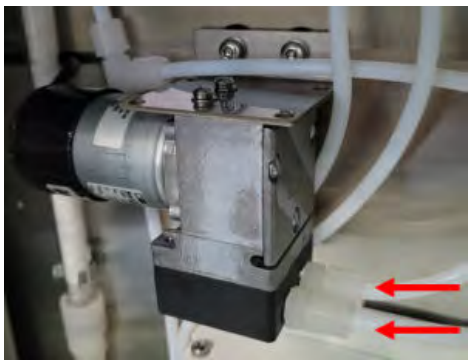


4. Remove the sample gas pump.
5. Insert the sample gas pump.
6. Insert and tighten the screws.



7. Connect the voltage supply.

8. Connect the gas connections of the pump.



9.11.7 Replacing the filter pad

Important information

NOTICE
Dirt can get into the measuring device when replacing the filter pad.

► Only replace the filter pad when the measuring device is switched off.

Prerequisites

- Measuring device is switched off.

Procedure

1. Open the cover of the fan.
2. Take filter pad out.
3. Insert new filter pad.
4. Close the cover.

9.11.8 Emptying the condensate container.

Important information

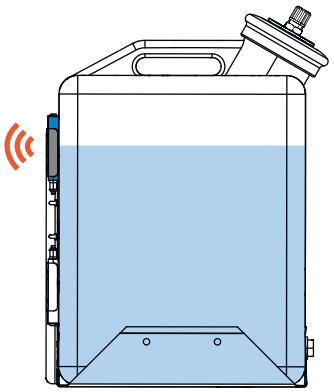
CAUTION
Risk of chemical burns by acid gas

Acid condensate could escape when working on the sample gas lines and the associated assemblies.

- ► Take appropriate protective measures for work (e.g., by wearing a safety mask, protective gloves and acid resistant clothes)
- ► In case of contact with the eyes, rinse immediately with clear water and consult a doctor.

Procedure

1. Empty the condensate container when the alarm signal is triggered.



✓ The alarm stops automatically after emptying the container.

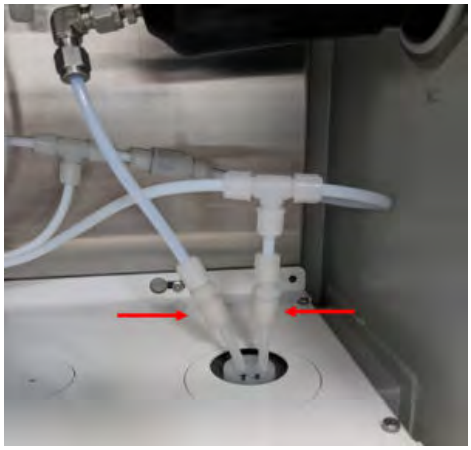
9.11.9 Cleaning the cooler stage

Prerequisites

- The measuring device is switched off.

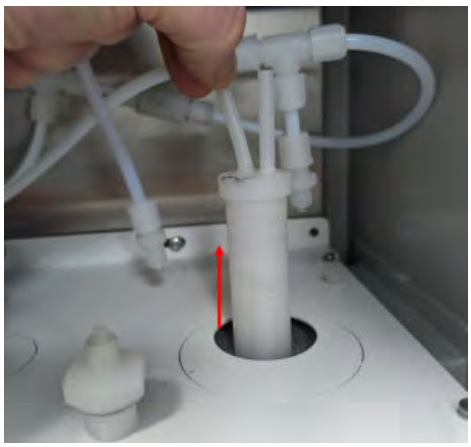
Procedure

1. Remove the sample gas inlet and outlet of the cooler stage.



2. Disconnect the condensate outlet and condensate pump.

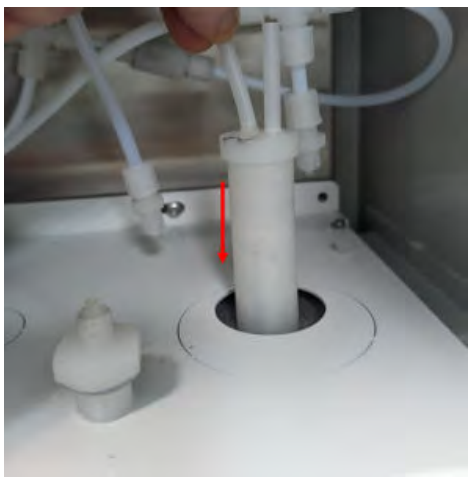
3. Remove the cooler stage.



4. Clean the inside of the cooler stage with water and dry with instrument air.

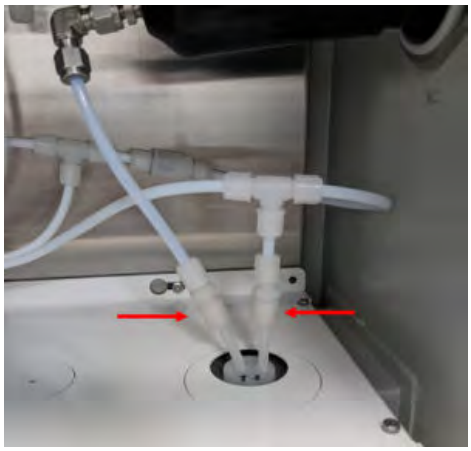
5. Apply a thin layer of heat-conducting paste to the cooler stage.

6. Insert the cleaned cooler stage.



7. Connect the condensate connection of the cooler stage to the condensate pump.

8. Connect the sample gas inlet and outlet of the cooler stage.



9.11.10 Replacing the analyzer module

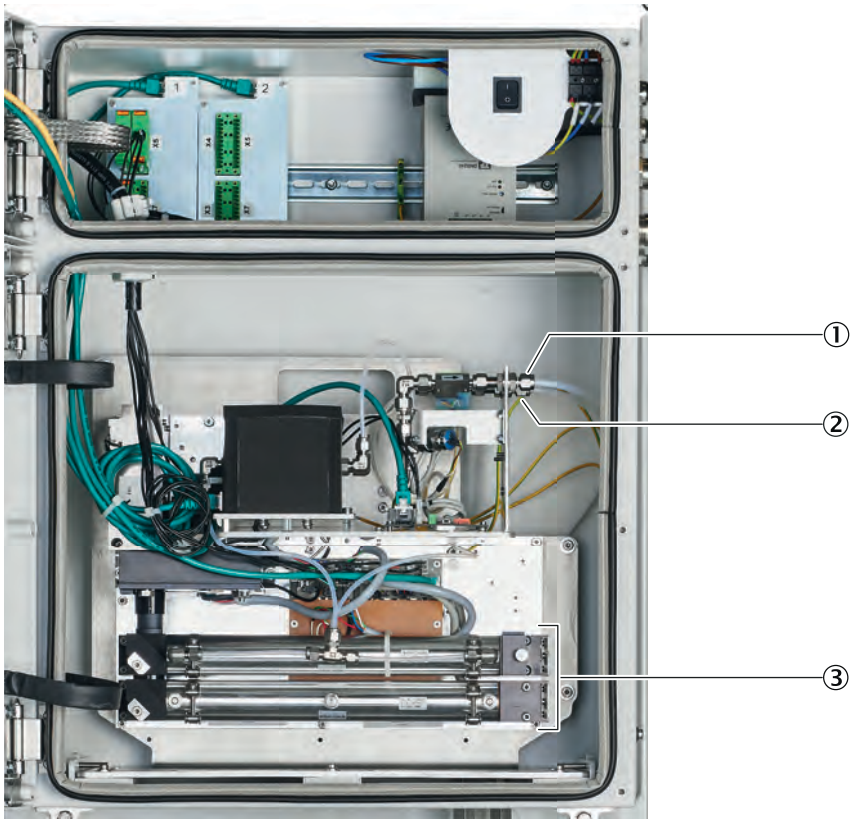
9.11.10.1 Remove the complete analyzer module

Overview

The complete analyzer module contains all measuring modules.

It is located in the analyzer lower part.

It can be removed complete with all modules.



① Sample gas inlet (rear)
② Sample gas outlet (front)
③ Complete analyzer module

Important information

WARNING
The UV lamp emits UV radiation. Exposure to UV radiation may result in eye or skin irritation.

► Use suitable shielding during operation of the UV lamp.

Prerequisites

- The measuring device is switched off and secured against being switched on again.

Procedure

1. Unscrew and fold open the housing door of the analyzer bottom part.
2. Unscrew the grounding conductors on the side panel.
3. Mark and unscrew the sample gas inlet and gas outlet at the connections of the complete analyzer module.
4. 3 RJ45 plugs (CAN-Bus): Press latch and pull off.
5. 3 24 V plugs: Press latch and pull off.
6. Unscrew 7 black screws from the base plate.
7. Pull the complete analyzer module by the grip handles to the front and lift out

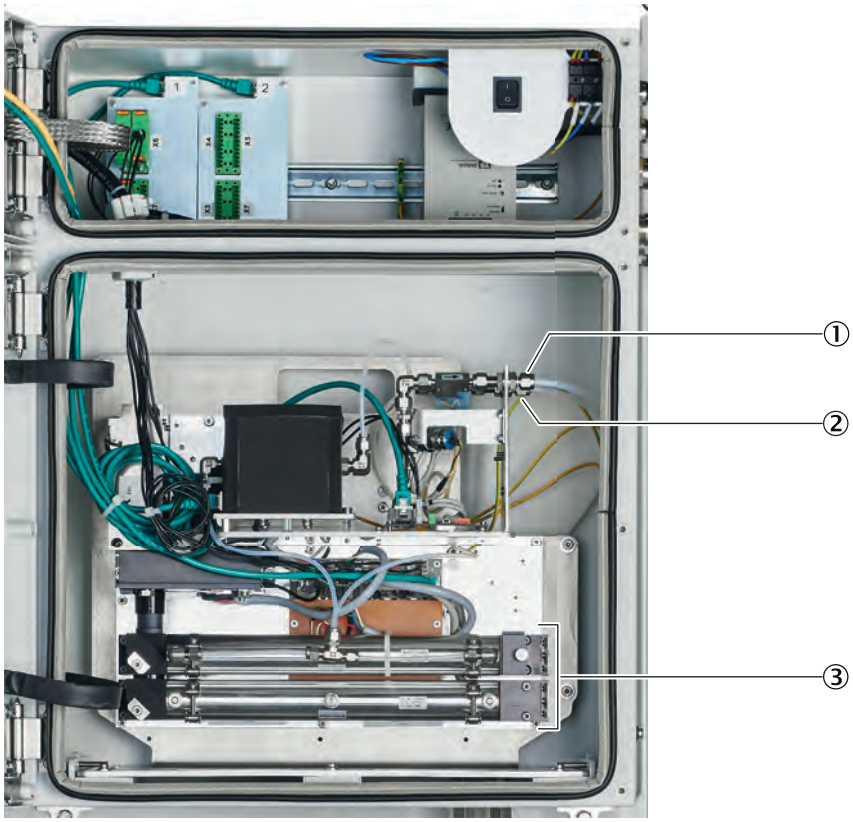
9.11.10.2 Fit the complete analyzer module

Overview

The complete analyzer module contains all measuring modules.

It is located in the analyzer lower part.

It can be removed complete with all modules.



① Sample gas inlet (rear)
② Sample gas outlet (front)
③ Complete analyzer module

Important information

WARNING
The UV lamp emits UV radiation. Exposure to UV radiation may result in eye or skin irritation.

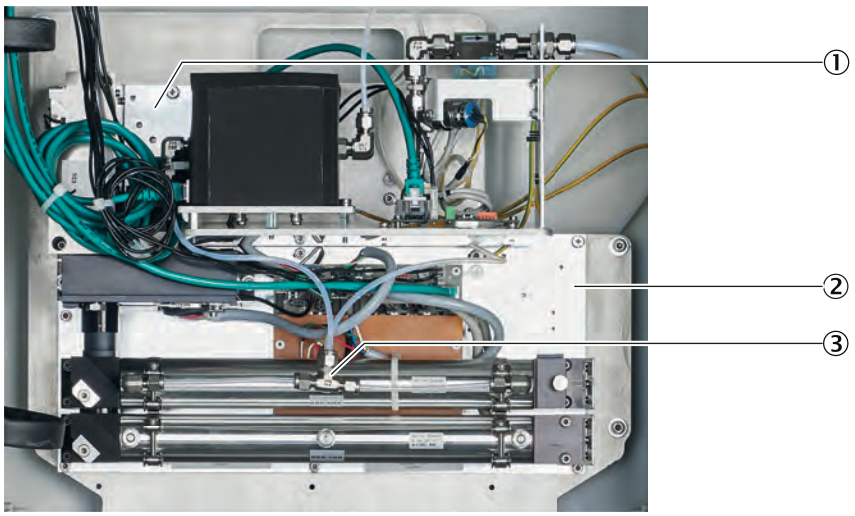
► Use suitable shielding during operation of the UV lamp.

Procedure

1. Push the complete analyzer module in the housing.
   Make sure not to crimp any lines.
2. Screw 7 black screws tight.
3. Screw the grounding conductor to the side panel.
4. 3 RJ45 plugs: Connect (any position).
5. 3 x 24-V plugs: Connect (any position, protected against twisting).
6. Connect the sample gas inlet (rear) according to the marking made.
7. Connect the sample gas outlet (front).
8. Check gas tightness of the sample gas path.

9.11.10.3 Replacing the DEFOR module

Overview



① Bracket of FINOR module and gas module
② Gas paths
③ Base plate of the DEFOR module

Important information

WARNING
The UV lamp emits UV radiation. Exposure to UV radiation may result in eye or skin irritation.

► Use suitable shielding during operation of the UV lamp.

Prerequisites

- The measuring device is switched off and secured against being switched on again.

Procedure

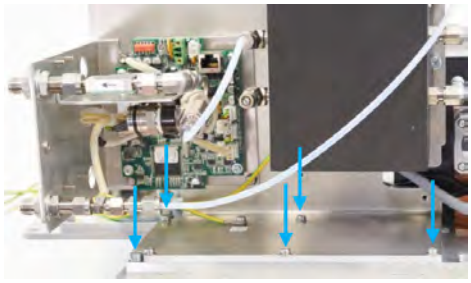
Removing

1. Switch off the fuse FC8 (analyzer) in the sample conditioning and distribution unit.
2. Check the analyzer is free from voltage.

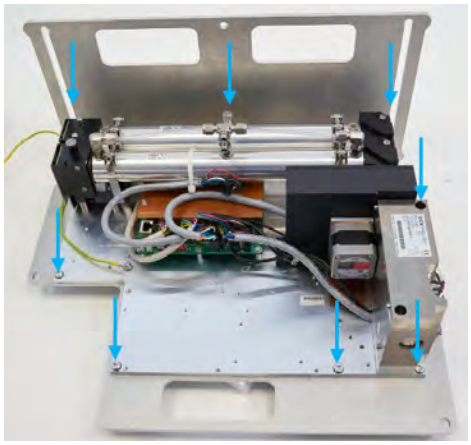
✓ All LEDs of the display must be off.

3. Unscrew and fold open the housing door of the analyzer bottom part.
4. RJ45 plug (CAN Bus): Press latch and pull off.
5. 24 V plug: Press latch and pull off.
6. Remove the gas paths on the DEFOR module.

7. Loosen the bracket of the FINOR module and the gas module.



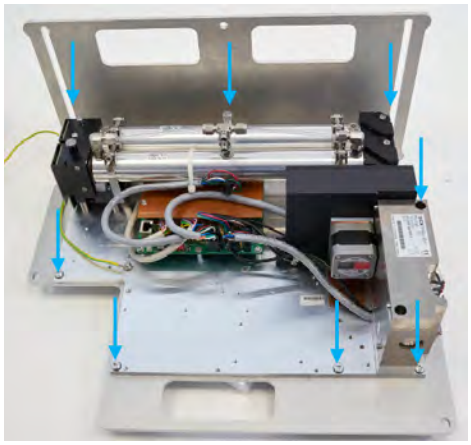
8. Loosen the base plate of the DEFOR module.



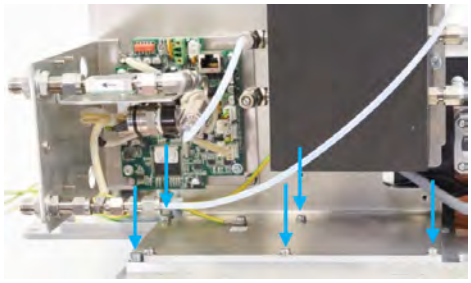
9. Remove the DEFOR module.

Fitting

1. Insert the DEFOR module.
2. Screw the base plate of the DEFOR module tight.



3. Screw the bracket of FINOR module and gas module tight.



4. Connect the gas paths of the DEFOR module.

   - Top connection: Sample gas inlet
   - Bottom connection: Sample gas outlet

5. Connect the 24 V plug (protected against twisting).
6. Connect the RJ45 plug.
7. Test the gas tightness.

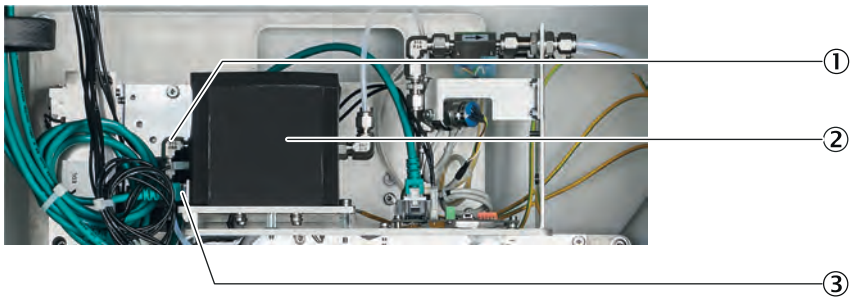
   ⚠ **WARNING** | Leaks in the gas path can release toxic gases.

8. Close the housing door of the analyzer bottom part.

9.11.10.4 Replacing the CO_2 module (FINOR)

Overview

The FINOR module (measurement of CO_2) is in the analyzer bottom part.



① Position of 24 V plug
② FINOR module
③ Position of RJ45 plug

Prerequisites

- The measuring device is switched off and secured against being switched on again.

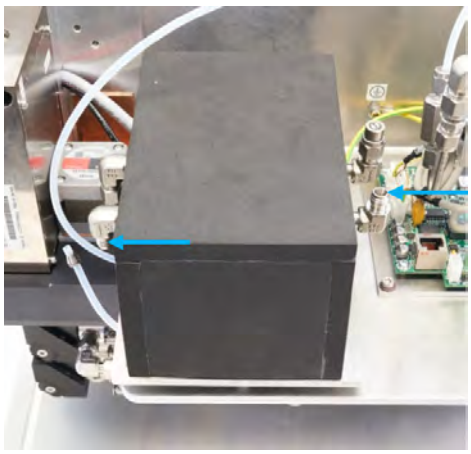
Procedure

Removing

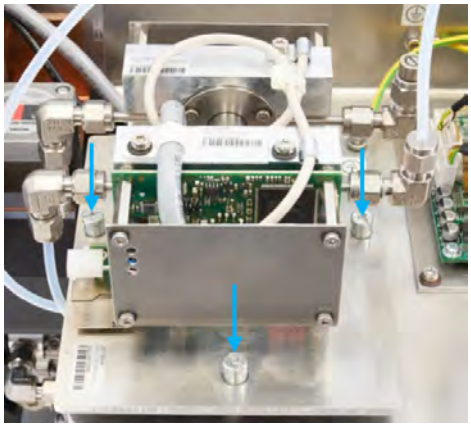
1. Switch off the fuse FC8 (analyzer) in the sample conditioning and distribution unit.
2. Switch off the analyzer on/off switch.
3. Check the analyzer is free from voltage.

✓ All LEDs of the display must be OFF.

4. Unscrew and fold open the housing door of the analyzer bottom part.
5. RJ45 plug (CAN Bus): Press latch and pull off.
6. 24 V plug: Press latch and pull off.
7. Unscrew the gas inlet and gas outlet.



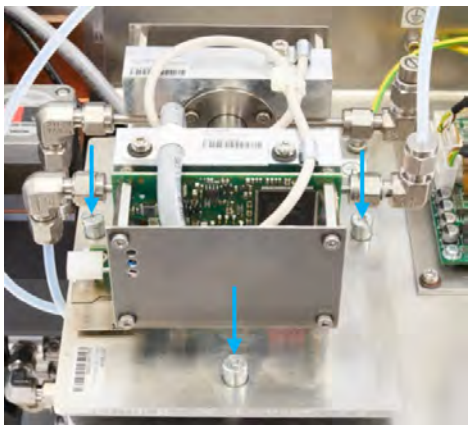
8. Unscrew 3 screws (1 screw under the insulating cover) on the base plate.



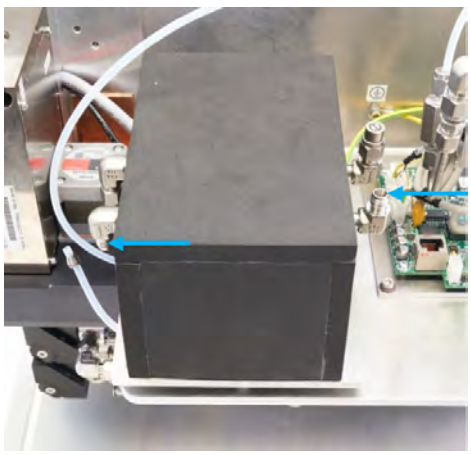
9. Unscrew the grounding conductor on the module.
10. Take the FINOR module out.

Fitting

1. Screw the grounding conductor to the module.
2. Set the FINOR module (with insulating cover) on the base plate. The electric connections point to the left.
3. Screw 3 screws to the base plate.



4. Connect the gas inlet and gas outlet.



5. Connect the RJ45 plug.
6. Connect the 24 V plug (protected against twisting).

Note: If you have installed several modules: The positions of the RJ45 connectors and 24 V connectors are arbitrary.

7. Test the gas tightness.
8. Close the housing door of the analyzer bottom part again.

9.11.10.5 Replacing the gas module

Overview

The gas module (measurement of flow, humidity and pressure) is in the analyzer bottom part.

① 2 gas connections
② Gas module

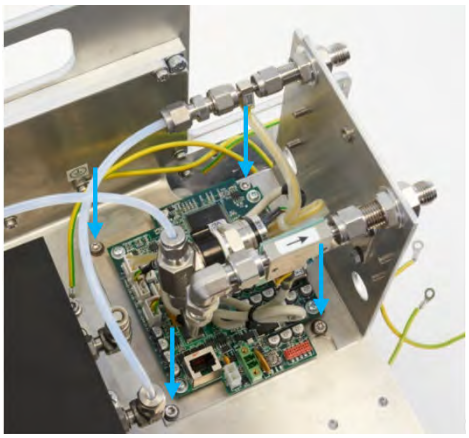
Prerequisites

- The measuring device is switched off and secured against being switched on again.

Procedure

Removing

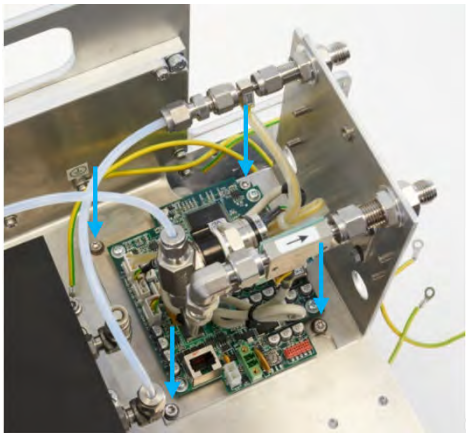
1. Remove the complete analyzer module.
2. Mark and unscrew 2 gas connections from the gas module.
3. 24 V plug: Press latch and pull off.
4. Unscrew 4 screws of the gas module at the bottom of the analyzer module.



5. Take the gas module off.

Fitting

1. Screw the gas module onto the complete analyzer module.



2. Connect the sample gas inlet according to the marking made.
3. Connect the 24 V plug (protected against twisting).
4. Connect the sample gas outlet according to the marking made.
5. Refit the complete analyzer module.

9.11.11 Replacing the analyzer door with control unit

9.11.11.1 Removing the analyzer door with BCU control unit

Overview

The BCU control unit is delivered completely assembled with the analyzer door, hinges and ground strap.

The control unit has a standard configuration and is configured ready for use.

Prerequisites

- The measuring device is switched off and secured against being switched on again.

Procedure

1. On the display (BCU), unlock and pull the RJ45 plug (yellow) and RJ45 plug (green) off.
2. Remove the line from the door.
3. Unscrew the ground strap from the device (not from the door).
   Keep the hexagon socket screw and 3 washers.
4. Mark the installation position of the hinges on the analyzer hosing (for easier alignment of door after installation).
5. Secure door against falling.
6. Loosen the nuts of the hinges on the analyzer housing and keep them for further use.
7. Carefully take the door off to avoid damage to the gasket.

9.11.11.2 Fitting the analyzer door with BCU control unit

Overview

The BCU control unit is delivered completely assembled with the analyzer door, hinges and ground strap.

The control unit has a standard configuration and is configured ready for use.

Important information

NOTE
Onsite settings must be performed individually.

For individual settings: Inform your contact person when ordering so that the settings can be adopted.

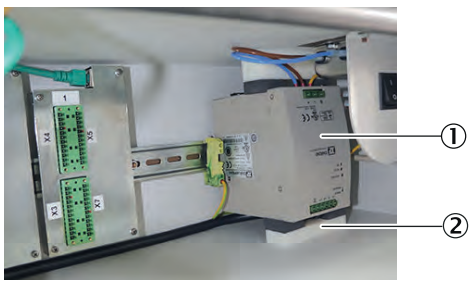
Procedure

1. Position the door on the analyzer housing.
2. Attach the door with the 4 nuts lightly on the housing.
3. Align the hinges according to the marking and tighten fully.
4. Attach the ground strap in the analyzer housing.
5. The sequence of the washers and spring washers for the screw connection is shown on the attachment in the door.
6. Insert the RJ45 plug (yellow) in the bottom socket and the RJ45 plug (green) in the top socket on the display.
7. Fasten the line to the door
8. Close the door and check the fit (screw connections).

9.11.12 Replacing the power supply unit

9.11.12.1 Remove the analyzer power supply unit

Overview



① Power supply unit
② Bottom damping block

Important information

DANGER
Danger to life by electric voltage

There is a risk of electric shock when working on the measuring device with the voltage supply switched on.

- ► Only allow an authorized electrician to work on the electrical system.
- ► Only work on the electrical system when the measuring device is disconnected from the power supply.

Prerequisites

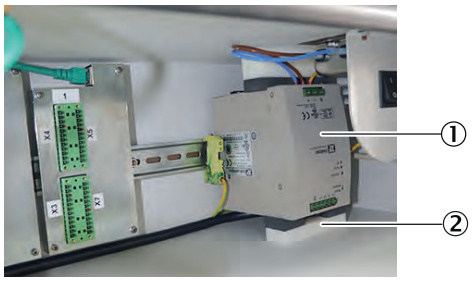
- The measuring device is switched off and secured against being switched on again.

Procedure

1. Switch off the fuse FC8 (power supply unit) in the sample conditioning and distribution unit.
2. Check the analyzer is free from voltage.
✓ All LEDs of the display are OFF.
3. Open the upper housing door of the analyzer.
4. Pull out the bottom damping block.
(Do not pull out the top damping block).
5. Pull the DIN rail/spring attachment at the power supply unit upwards and take the power supply unit off the DIN rail.
NOTICE | Do not rip the electric lines off.
6. Disconnect all electric lines.
7. Take out the power supply unit.

9.11.12.2 Fit the analyzer power supply unit

Overview



① Power supply unit
② Bottom damping block

Important information

DANGER
Danger to life by electric voltage
There is a risk of electric shock when working on the measuring device with the voltage supply switched on.

► Only allow an authorized electrician to work on the electrical system.
► Only work on the electrical system when the measuring device is disconnected from the power supply.

Procedure

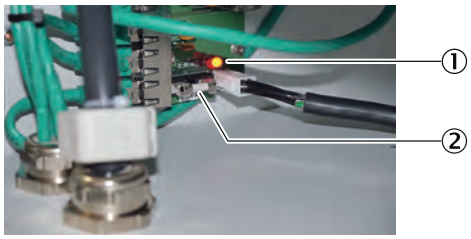
1. Connect the grounding cable.
2. Connect the power supply.
3. Connect the 24 V power supply. Observe the polarity.
4. Hang the power supply unit from below into the DIN rail and press upwards until the DIN rail/spring attachment latches in.
5. Push the bottom damping block between the power supply unit and the bottom plate.
6. Close the housing door of the analyzer top part again.
7. Switch the fuse in the sample conditioning and distribution unit on again.
If the power supply unit whistles: Switch the fuse off immediately and check the 24 V polarity of the voltage connection on the power supply unit.
8. Close the housing door of the sample conditioning and distribution unit again.

9.11.13 Replacing the analyzer fuse

Overview

The analyzer fuse is on the left in the analyzer top part.

Used fuse: F 10A0 250 V D5*20



① LED
② Fuse

LED on	Fuse is okay
LED off	Fuse is defective

Important information

DANGER
Danger to life by electric voltage

There is a risk of electric shock when working on the measuring device with the voltage supply switched on.

► Only allow an authorized electrician to work on the electrical system.
► Only work on the electrical system when the measuring device is disconnected from the power supply.

Prerequisites

- The measuring device is switched off and secured against being switched on again.

Procedure

1. Switch off the on/off switch in the top part of the analyzer.
2. Check the analyzer is free from voltage.
✓ All LEDs of the display must be OFF.
3. Replace the fuse.
   Important: Only use a fuse with identical characteristics.
4. Switch the On/Off switch on again.
5. Close the housing door again.

10 Troubleshooting

10.1 Safety

Requirements for the maintenance personnel

- Only allow an authorized electrician to work on the electrical system or electrical subassemblies.
- The technician must be familiar with the exhaust gas technology of the operator's plant (hazard by overpressure and toxic and hot flue gases) and be able to avoid hazards when working on gas ducts.
- The technician must be familiar with handling compressed gas cylinders (test gases).
- The technician must be able to avoid hazards caused by noxious test gases.
- The technician must be familiar with gas lines and their screw fittings (be able to ensure gas-tight connections).

10.2 Maritime Hotline

If you have questions about malfunctions or maintenance work, you can contact the Maritime Hotline (24/7).

Phone: +49 7681 2024194

E-mail: service-maritime@endress-ehs.com.

10.3 Malfunctions

10.3.1 Logbook description

Table 11: Logbook description

			Logbook text (Display)	Logbook text (SOPAS ET)	Description	Interpretation and possibly correction
Gas module						
	DEFOR					
		FINOR				
X	X	X	F MV calculation	F MV calculation	Error in measured value calculation; measured value > +50% of measurement span	Gas concentration too high. Component settings changed. Check sensor system adjustment.
X*	X	X	F Zero drift	F Zero drift	Zero point drift limit value exceeded by more than 20%	Check test gas, check setpoint value; check measuring system
X*	X	X	F Span drift	F Span drift	Span drift limit value exceeded by more than 20%	Check test gas, check setpoint value; check measuring system
X	X	X	U MV overflow	U MV overflow	Measuring range exceeded by more than 20% of measurement span	Gas concentration too high, component settings changed, check sensor system adjustment
X	X	X	U ADC value	U ADC value	Overmodulation of measuring signal, no reso-lution possible	Gas concentration too high, detector damaged, optical active measuring path contaminated or mechanically misadjusted
	X	X	U pressure value absent	U pressure value absent	InProcessValue pressure not received	Gas module available? Pressure component available on gas module? Pressure in Auxiliary value Table of BCU?
	X	X	M pressure value absent	M pressure value absent	InProcessValue pressure not received	Gas module available? Pressure component available on gas module? Pressure in Auxiliary value Table of BCU?
X*	X	X	M Zero drift	M Zero drift	Zero drift limit value exceeded	Check test gas, check setpoint value; check measuring system
X*	X	X	M Span drift	M Span drift	Span drift limit value exceeded	Check test gas, check setpoint value; check measuring system
X*	X	X	M zero gas error	M Zero gas	Zero point adjustment not saved; drift limit value exceeded by > 50%	Check test gas, check setpoint value; check measuring system
X*	X	X	M Span gas error	M Span gas	Span point adjustment not saved; drift limit value exceeded by > 50%	Check test gas, check setpoint value; check measuring system

			Logbook text (Display)	Logbook text (SOPAS ET)	Description	Interpretation and possibly correction
Gas module						
	DEFOR					
		FINOR				
X*	X	X	C Test gas active	C Test gas active	Test gas is in system	At least one component in the system is being adjusted/validated
X*	X	X	C Adj/val	C Adj/val	Validation or adjustment activated, sensor or system is checked	Status message, wait until procedure has completed
	X	X	E No A/D reference	E no A/D reference / E No IR reference	No zero gas AD reference values	Replace complete analyzer module
	X	X	U Pressure value FCU	U Pressure value FCU	InProcessValue pressure has F, C and/or U flag	Check pressure component of gas module, observe further gas module messages
	X		F Motor 1	F Motor 1	DEFOR: Initialization of motor 1 incorrect	Restart device. If error is repeated, replace complete analyzer module
	X		F Motor 2	F Motor 2	DEFOR: Initialization of motor 2 incorrect	Restart device. If error is repeated, replace complete analyzer module
	X		F Motor 3	F Motor 3	DEFOR: Initialization of motor 3 incorrect	Restart device. If error is repeated, replace complete analyzer module
X	X		F Measuring detector	F Measuring detector	DEFOR: Error message from measured value detector	Restart device. If error is repeated, replace complete analyzer module
	X		F Ref.-detector	F Ref.-detector	DEFOR: Error message from reference value detector	Restart device. If error is repeated, replace complete analyzer module
	X		F Motor 1 position	F Motor 1 position	Motor 1 position error	Restart device. If error is repeated, replace complete analyzer module
	X		F Motor 2 position	F Motor 2 position	Motor 2 position error	Restart device. If error is repeated, replace complete analyzer module
	X		F Motor 3 position	F Motor 3 position	Motor 3 position error	Restart device. If error is repeated, replace complete analyzer module
	X		M Extraneous light	M Extraneous light	Extraneous light has penetrated the measuring system	Device open, extraneous light has penetrated the measuring system
	X		M Mirror	M Mirror	Mirror error	Restart device. If error is repeated, replace complete analyzer module
	X		M Beam splitter	M Beam splitter	Beam splitter error	Restart device. If error is repeated, replace complete analyzer module
	X		M Filter	M Filter	Filter error	Restart device. If error is repeated, replace complete analyzer module
	X	X	M UV source intensity / M IR intensity	M UV source intensity / M IR intensity	Source intensity below maintenance request threshold	Replace complete analyzer module
X	X	X	C maintenance mode	C Maintenance active	Maintenance active	Status message, check active, maintenance active
X	X	X	C Start test	C Start test	Start check	Function checks active after switching on
X	X	X	U maintenance mode	U Maintenance active	Maintenance active	Maintenance active, measured values unreliable, no action required
X	X	X	U Start test	U Start test	Start check	Function checks active after switching on, no action required
	X		U Extraneous light	U Extraneous light	Extraneous light has penetrated the measuring system	Measured value unreliable, device open, extraneous light has penetrated the measuring system
	X		U Mirror	U Mirror	Mirror error	Restart device. If error is repeated, replace complete analyzer module
	X		U Beam splitter	U Beam splitter	Beam splitter error	Restart device. If error is repeated, replace complete analyzer module
	X		U Filter	U Filter	Filter error	Restart device. If error is repeated, replace complete analyzer module
	X	X	U UV source intensity / U IR intensity	U UV source intensity / U IR intensity	Source intensity below uncertain threshold	Restart device. If error is repeated, replace complete analyzer module
	X		U position motor 1	U position motor 1	Motor 1 position error	Motor 1 has not found the zero position. Restart device. If error is repeated, replace complete analyzer module
	X		U position motor 2	U position motor 2	Motor 2 position error	Motor 2 has not found the zero position. Restart device. If error is repeated, replace complete analyzer module

			Logbook text (Display)	Logbook text (SOPAS ET)	Description	Interpretation and possibly correction
Gas module						
	DEFOR					
		FINOR				
	X		U position motor 3	U position motor 3	Motor 3 position error	Motor 3 has not found the zero position. Restart device. If error is repeated, replace complete analyzer module
X	X	X	U Temperatures	U Temperatures	Mainboard temperature >75 °C and/or heater(s) not in nominal range	Temperature on electronics too high, defective heaters, check further logbook messages
	X		E Motor 1 Temperature	E Motor 1 Temperature	Temperature of motor control 1 too high	Replace complete analyzer module
	X		E Motor 2 Temperature	E Motor 2 Temperature	Temperature of motor control 2 too high	Replace complete analyzer module
	X		E Motor 3 Temperature	E Motor 3 Temperature	Temperature of motor control 3 too high	Replace complete analyzer module
	X		E motor 1 V reduced	E motor 1 V reduced	Speed of motor 1 reduced	For information only
	X		E motor 2 V reduced	E motor 2 V reduced	Speed of motor 2 reduced	For information only
	X		E motor 3 V reduced	E motor 3 V reduced	Speed of motor 2 reduced	For information only
X	X	X		No entry (E adj/val)	At least one component of this sensor is being adjusted/validated	Test gas is in gas path. No action required, wait until the procedure has completed
X			E gas pump	E gas pump	Status of sample gas pump	Status of sample gas pump
X	X	X	E Gas pump off	E Gas pump off	Switch off request from gas pump sensor	Status message, switch off request from gas pump sensor. Check further logbook messages
X			E Gas flow low	E Gas flow low	Message Gasflow below threshold	Check sample gas paths for clogging, check pump and replace, as required
X			E Gas flow error	E Gas flow error	Message Gas flow more than 20% below threshold	Check sample gas paths for clogging, check pump and replace, as required
X			F Humidity signal	F Humidity signal	Threshold for humidity detection exceeded	Device switches off because of humidity detected in the gas path. Service required for drying
	X		E Detector synchronization	E Detector synchronization	Error during synchronized AD conversion	Error in program sequence, restart device. If error is repeated, replace complete analyzer module
	X	X	F Heater 1	F Heater 1	Heater 1 sensor or power control defective	Ambient temperature outside specification or sensor module is defective and must be replaced.
	X		F Heater 2	F Heater 2	Heater 2 sensor or power control defective	Ambient temperature outside specification or sensor module is defective and must be replaced.
	X		F Heater 3	F Heater 3	Heater 3 sensor or power control defective	Ambient temperature outside specification or sensor module is defective and must be replaced.
	X		F Heater 4	F Heater 4	Heater 4 sensor or power control defective	Ambient temperature outside specification or sensor module is defective and must be replaced.
	X		F Heater 5	F Heater 5	Heater 5 sensor or power control defective	Ambient temperature outside specification or sensor module is defective and must be replaced.
X	X	X	E SPI 1	E SPI 1	Malfunction of SPI 1 data transmission	Malfunction in program sequence, no action possible. Restart device. If error is repeated, replace module
	X	X	E SPI 2	E SPI 2	Malfunction of SPI 2 data transmission	Malfunction in program sequence, no action possible. Restart device. If error is repeated, replace module
	X		E I2C 1	E I2C 1	Malfunction of I2C 1 data transmission	Malfunction in program sequence, no action possible. Restart device. If error is repeated, replace module
	X	X	E I2C 2	E I2C 2	Malfunction of I2C 2 data transmission	Malfunction in program sequence, no action possible. Restart device. If error is repeated, replace module
X	X	X	E I2C 3	E I2C 3	Malfunction of I2C 3 data transmission	Malfunction in program sequence, no action possible. Restart device. If error is repeated, replace module

			Logbook text (Display)	Logbook text (SOPAS ET)	Description	Interpretation and possibly correction
Gas module						
	DEFOR					
		FINOR				
X	X	X	F EEPROM	F EEPROM	EEPROM malfunction	Malfunction in program sequence, no action possible. Restart device. If error is repeated, replace module
X	X	X	E LM75	E LM75	Malfunction of LM75 (temperature measurement)	Malfunction in program sequence, no action possible. Restart device. If error is repeated, replace module
	X	X	F Config. invalid	F Config. invalid	Error in configuration	Error when loading sensor parameters, restart device
	X	X	F Program sequence	F Program sequence	Error in program timing	Malfunction in program sequence, no action possible. Restart device. If error is repeated, replace module
X	X	X	F Start	F Start	Error in initialization	Malfunction in program sequence, no action possible. Restart device. If error is repeated, replace module
X	X	X	F Loading config.	F Loading config.	Error when loading a configuration	Error when loading sensor parameters, restart device
X	X	X	E CAN	E CAN	CAN bus error	Malfunction in program sequence, no action possible. Restart device. If error is repeated, replace module
	X	X	F UV source / U IR source	F UV lamp /U IR source	Error on UV lamp or IR source	Restart device. If error is repeated, replace complete analyzer module
	X		F Measuring detector	F Measuring detector	Error message from measured value detector	Restart device. If error is repeated, replace complete analyzer module
	X		F Ref.-detector	F Ref.-detector	Error message from reference value detector	Restart device. If error is repeated, replace complete analyzer module
	X		M UV source aged	M UV source aged	Limit value of lamp aging reached	UV lamp must be replaced soon. Complete analyzer module must be replaced soon.
	X		M contamination	M contamination	Measuring system contaminated	Check the filter. Restart device. If error is repeated, replace complete analyzer module
	X	X	F UV intensity / F IR intensity	F UV intensity / F IR intensity	Source intensity below uncertain threshold	Replace complete analyzer module
X	X	X	E Backup factory settings	E backup factory settings	Backup of factory settings	Message only displayed when backup failed, repeat backup;
X	X	X	E Backup user settings	E backup user settings	Backup of user settings	Message only displayed when backup failed, repeat backup;
X	X	X		No entry	Sensor received a signal from BCU that at least one component is adjusted/validated in the system	Test gas is in the system. No action required
	X		E Gains increased	E Gains increased	ADC gains were increased due to lamp intensity losses	For information only
BCU						
			Configuration loading error	F Configuration loading error	An error was detected when the internal configuration was loaded	Can be performed after the firmware update. Perform a warm start. Memory defective when repeated. *2
			Memory allocation error	F Memory error	Error determined during internal memory management.	No safe operation existing. Software overflow or memory error. Perform a warm start. *2
			Start check	C Start test	Start check. Check functions active after switching on	Check functions active for approx. 2 minutes after switching on
			Stack overflow	Stack overflow	Error in program management	No safe operation existing. Software overflow or memory error. *2
			TCP error A	TCP error A	Error on Ethernet interface	Error in Ethernet network, error in TCP protocol. Restart device. *2
			CAN error	CAN error	Error on CAN Open interface	Error in CAN protocol or network, check CAN wiring in device or system. *3
			IO module 1 lost	F IO module 1 lost	Connection to first IO module lost	Interruption of network connection to first IO module. Check internal network cables.
			IO module 2 lost	F IO module 2 lost	Connection to second IO module lost	Interruption of network connection to second IO module. Check internal network cables.
			Sensor meas. value error	Sensor meas. value error		Check further logbook entries.

			Logbook text (Display)	Logbook text (SOPAS ET)	Description	Interpretation and possibly correction
Gas module						
	DEFOR					
		FINOR				
			Sequence control program error	Sequence control program error	Sequence control program error	Check further logbook entries. Restart device. *2
			SPI 1 error	SPI 1 error	Error in communication in SPI channel 1	Contamination on PCB or defective hardware. *2
			SPI 2 error	SPI 2 error	Error in communication in SPI channel 2	Contamination on PCB or defective hardware. *2
			I2C 1 error	I2C 1 error	Error in communication in I2C channel 1	Contamination on PCB or defective hardware. Restart device *2
			I2C 2 error	I2C 2 error	Error in communication in I2C channel 2	Contamination on PCB or defective hardware. Restart device *2
			I2C 3 error	I2C 3 error	Error in communication in I2C channel 3	Contamination on PCB or defective hardware. Restart device *2
			SD error	SD error	Error during writing or reading the SD card	If the error occurs several times, the SD card must be replaced. *2
			SD card defect	F SD card defective	SD card cannot be processed	Check correct installation of SD-card. Replace SD card if necessary.*2
			LM75	LM75	Error message from temperature sensor IC	Contamination on PCB or defective hardware. *2
			Sensor lost	F Sensor lost	Error: Connection to DEFOR sensor lost	Check wiring to DEFOR sensor. Restart device. Replace complete analyzer module if necessary
			Sensor lost	F Sensor lost	Error: Connection to FINOR sensor lost	Check wiring to FINOR sensor. Restart device. Replace complete analyzer module if necessary
			Sensor lost	F Sensor lost	Error: Connection to Gas module lost	Check wiring to gas module. Restart device. Replace complete analyzer module if necessary
			Sensor	U Sensor	DEFOR sensor status uncertain	Check status messages at sensor and clear messages
			Sensor	U Sensor	FINOR sensor status uncertain	Check status messages at sensor and clear messages
			Sensor	U Sensor	Gas module status uncertain	Check status messages at sensor and clear messages
			Sensor registration error	Sensor registration error	Error during DEFOR sensor registration	Check sensor wiring. Restart device.
			Sensor registration error	Sensor registration error	Error during FINOR sensor registration	Check sensor wiring. Restart device.
			Sensor registration error	Sensor registration error	Error during Gas module sensor registration	Check sensor wiring. Restart device.
			Sensor error A	Sensor error A	Error in data communication to DEFOR sensor	Check sensor wiring. Restart device.
			Sensor error A	Sensor error A	Error in data communication to FINOR sensor	Check sensor wiring. Restart device.
			Sensor error A	Sensor error A	Error in data communication to gas module	Check sensor wiring. Restart device.
			Sensor error B	Sensor error B	Error in data communication to DEFOR sensor	Check sensor wiring. Restart device.
			Sensor error B	Sensor error B	Error in data communication to FINOR sensor	Check sensor wiring. Restart device.
			Sensor error B	Sensor error B	Error in data communication to gas module	Check sensor wiring. Restart device.
			Sensor de-registration error	Sensor de-registration error	Error during registration of a module	Check sensor wiring. Restart device.
			Measuring screen	Measuring screen	Error in display parameters	Error in BCU configuration display parameters
			Tag: Formula	Tag: Formula	Error in formula interpreter	Error in BCU configuration in formula part
			Cyclic trigger	Cyclic trigger	Error in timer configuration	Error in BCU during timer configuration
			Adj./Val.	Adj./Val.	Error in adjustment/validation configuration	Error in BCU in adjustment/validation configuration
			Factory settings backup failed	Factory settings backup failed	Backup of factory settings failed	Error during data backup. Repeat data backup
			User settings backup failed	User settings backup failed	Backup of user settings failed	Error during data backup. Repeat data backup
			Manual adjust	C Manual adjust	A manually started manual adjust is active	Status message. A manually started procedure for manual adjust is active.

			Logbook text (Display)	Logbook text (SOPAS ET)	Description	Interpretation and possibly correction
Gas module						
	DEFOR					
		FINOR				
			Adj./Val.	C Adj./Val.	Automatic adjustment / validation is active	Status message. An automatic procedure for adjustment / validation is active.
			Sensor	F Sensor	Error message from DEFOR sensor module	Status messages. Check logbook messages.
			Sensor	F Sensor	Error message from FINOR sensor module	Status messages. Check logbook messages.
			Sensor	F Sensor	Error message from Gas module	Status messages. Check logbook messages.
			Measured value	F Meas. value	Status message for meas. value Failure	Status can be output by the Sensor module or be generated in the BCU. Check logbooks.
			Measured value	M Meas. value	Status message for meas. value Maintenance	Status can be output by the Sensor module or be generated in the BCU. Check logbooks.
			Measured value	C Meas. value	Status message for meas. value check	Status can be output by the Sensor module or be generated in the BCU. Check logbooks.
			Measured value	U Meas. value	Status message for meas. value Uncertain	Status can be output by the Sensor module or be generated in the BCU. Check logbooks.
			Sensor	M Sensor	Maintenance message from DEFOR sensor module	Status messages from sensor. Evaluate logbook messages
			Sensor	M Sensor	Maintenance message from FINOR sensor module	Status messages from sensor. Evaluate logbook messages
			Sensor	M Sensor	Maintenance message from Gas module	Status messages from sensor. Evaluate logbook messages
			Sensor	C Sensor	Check message from DEFOR sensor module	Status messages from sensor. Evaluate logbook messages
			Sensor	M Sensor	Check message from FINOR sensor module	Status messages from sensor. Evaluate logbook messages
			Sensor	M Sensor	Check message from Gas module	Status messages from sensor. Evaluate logbook messages
			Reboot by user	C Reboot by user	Reboot by user	Reboot by user
			Tag: BVS Table	Tag: BVS Table	Incorrect parameter in BVSi Table	Error in BCU configuration in BVSi Table
			Fct. Button / Customer fct.	Fct. Button / Customer fct.	Incorrect parameter for function buttons	Error in BCU configuration for function buttons
			Adj./Val. error	Adj./Val. error	Incorrect parameter in Adjustment/Validation Table	Error in BCU configuration for adjustment / validation parameters
			Tag: BVI Table	Tag: BVI Table	Incorrect parameter in BVi Table	Error in BCU configuration in BVi Table
			Tag: Measured value config.	Tag: Measured value config.	Incorrect parameter in MVi Table	Error in BCU configuration in MVi Table
			Tag: Modbus output	Tag: Modbus output	Incorrect parameter in Modbus Table	Error in BCU configuration in Modbus Table
			Tag: Analog output	Tag: Analog output	Incorrect parameter for analog outputs	Error in BCU configuration for analog outputs. Check and correct settings
			Tag: Digital output	Tag: Digital output	Incorrect parameter for digital outputs	Error in BCU configuration for digital outputs
			Tag: Test gas Table	Tag: Test gas Table	Incorrect parameter in Test Gas Table	Error in BCU configuration in Test Gas Table
			AO range	AO range	Incorrect parameter for analog output ranges	Error in BCU configuration for analog output ranges.
			F0 failure (formula res.)	F F0 failure (formula res.)	Failure group message for device	Failure group message for device. Check further logbook entries.
			C0 check (formula res.)	C C0 check (formula res.)	Check group message for device	Check group message for device. Check further logbook entries.
			U0 uncertain (formula res.)	U U0 uncertain (formula res.)	Uncertain group message for device	Uncertain group message for device. Check further logbook entries.
			M0 maint. request (formula res.)	M M0 maint. request (formula res.)	Maintenance group message for device	Maintenance group message for device. Check further logbook entries.
			BVI1 Start Adj./Val. 1	BVI1 Start Adj./Val. 1	Input to start function 1 adjustment / validation	Start of function status indicator was activated
			BVI2 Start Adj./Val. 2	BVI2 Start Adj./Val. 2	Input to start function 2 adjustment / validation	Start of function status indicator was activated
			BVI3 Start Adj./Val. 3	BVI3 Start Adj./Val. 3	Input to start function 3 adjustment / validation	Start of function status indicator was activated

			Logbook text (Display)	Logbook text (SOPAS ET)	Description	Interpretation and possibly correction
Gas module						
	DEFOR					
		FINOR				
			BVI4 Start Adj./Val. 4	BVI4 Start Adj./Val. 4	Input to start function 4 adjustment / validation	Start of function status indicator was activated
			BVI5 Start Adj./Val. 5	BVI5 Start Adj./Val. 5	Input to start function 5 adjustment / validation	Start of function status indicator was activated
			BVI6 Start Adj./Val. 6	BVI6 Start Adj./Val. 6	Input to start function 6 adjustment / validation	Start of function status indicator was activated
			BVI7 Start Adj./Val. 7	BVI7 Start Adj./Val. 7	Input to start function 7 adjustment / validation	Start of function status indicator was activated
			BVI8 Start Adj./Val. 8	BVI8 Start Adj./Val. 8	Input to start function 8 adjustment / validation	Start of function status indicator was activated
			BVI9 Abort Adj./Val.	BVI9 Abort Adj./Val.	Input to abort the activated adjustment / validation	Status indicator. Abort adjustment / validation procedure
			BVI10 Failure	F BVI10 Failure	Input for failure message for device status	Status indicator, a failure message is generated via an external input.
			BVI11 Maint. Request	M BVI11 Maintenance Request	Input for maintenance message for device status	Status indicator, a maintenance request was triggered via the assigned input.
			BVI12 Pump off	BVI12 Pump off	Input for pump switch-off for the device	Status indicator. Stop command for gas pump was activated.
			BVI13 Test gas fault	M BVI13 Test gas fault	Input for message of a test gas fault	Status indicator, a test gas fault was triggered via the assigned input.
			BVI14 Lock Adj/Val.	BVI14 Lock Adj/Val.	Input for an adjustment and validation lock	Status indicator. Lock for adjustments or validations has been set.
			BVG1 Start Adj./Val. 1	BVG1 Start Adj./Val. 1	Automatic adjustment/validation function was manually started	Status indicator. Display of active function. Function runs with a time limit
			BVG2 Start Adj./Val. 2	BVG2 Start Adj./Val. 2	Automatic adjustment/validation function was manually started	Status indicator. Display of active function. Function runs with a time limit
			BVG3 Start Adj./Val. 3	BVG3 Start Adj./Val. 3	Automatic adjustment/validation function was manually started	Status indicator. Display of active function. Function runs with a time limit
			BVG4 Start Adj./Val. 4	BVG4 Start Adj./Val. 4	Automatic adjustment/validation function was manually started	Status indicator. Display of active function. Function runs with a time limit
			BVG5 Start Adj./Val. 5	BVG5 Start Adj./Val. 5	Automatic adjustment/validation function was manually started	Status indicator. Display of active function. Function runs with a time limit
			BVG6 Start Adj./Val. 6	BVG6 Start Adj./Val. 6	Automatic adjustment/validation function was manually started	Status indicator. Display of active function. Function runs with a time limit
			BVG7 Start Adj./Val. 7	BVG7 Start Adj./Val. 7	Automatic adjustment/validation function was manually started	Status indicator. Display of active function. Function runs with a time limit
			BVG8 Start Adj./Val. 8	BVG8 Start Adj./Val. 8	Automatic adjustment/validation function was manually started	Status indicator. Display of active function. Function runs with a time limit
			BVG9 Abort Adj./Val.	BVG9 Abort Adj./Val.	Automatic adjustment/validation function was manually started	Status indicator. Display of active function.
			BVG11 Maintenance mode	C BVG11 maintenance	Maintenance status is activated	Status indicator. Display of active function.
			BVG12 Pump off	BVG12 Pump off	Gas pump was manually switched off.	Status indicator
			BVO1 Pump off	BVO1 Pump off	Internal or external gas pump is switched off	Status indicator. “Pump off” activated
			BVO4 Sample gas	BVO4 Sample gas	Sample gas path is switched	Status indicator. No test gas is active. The sample gas path to the measuring point is switched
			BVO5 Test gas 1	BVO5 Test gas 1	Test gas No. 1 is active for adjustment or validation	Status message. Device in Check status. Test gas 1 is active.
			BVO6 Test gas 2	BVO6 Test gas 2	Test gas No. 2 is active for adjustment or validation	Status message. Device in Check status. Test gas 2 is active.
			BVO7 Test gas 3	BVO7 Test gas 3	Test gas No. 3 is active for adjustment or validation	Status message. Device in Check status. Test gas 3 is active.
			BVO8 Test gas 4	BVO8 Test gas 4	Test gas No. 4 is active for adjustment or validation	Status message. Device in Check status. Test gas 4 is active.
			BVO9 Test gas 5	BVO9 Test gas 5	Test gas No. 5 is active for adjustment or validation	Status message. Device in Check status. Test gas 5 is active.
			BVO10 Test gas 6	BVO10 Test gas 6	Test gas No. 6 is active for adjustment or validation	Status message. Device in Check status. Test gas 6 is active.

			Logbook text (Display)	Logbook text (SOPAS ET)	Description	Interpretation and possibly correction
Gas module						
	DEFOR					
		FINOR				
			Limit value 1	U Limit 1	Limit value 1 of measured value MVi triggered with status U link	Gas flow monitoring. Check gas paths. Check sample gas pump, replace sample gas pump as required
			Limit value 2	F Limit value 2	Limit value 2 of measured value MVi triggered with status U link	Gas flow monitoring. Check gas paths. Check sample gas pump, replace sample gas pump as required
			Timeout	F Timeout	Measured value update from sensor failed with status F link	Check sensor connection. Restart device. *3
			BVS Flow (Gas module)	F BVS Flow (Gas module)	Internal gas flow monitoring message with device status Fault	Status of internal gas flow monitoring. Check tubing, check flow sensor calibration, check logbook. Check pump status. Replace sample gas pump as required
			BVS Flow (Gas module)	U BVS Flow (Gas module)	Internal gas flow monitoring message with device status Uncertain	Status of internal gas flow monitoring. Check tubing, check flow sensor calibration, check logbook. Check pump status. Replace sample gas pump as required
			BVS Moisture (Gas module)	F BVS Moisture (Gas module)	Check message from internal moisture sensor linked with device status Fault	Status of internal moisture sensor. Dry the measuring system. Dry the gas lines. Service required for drying
			BVS Standby	C BVS Standby	External Standby message linked with device status Check	Check status of external standby message. Check cables and signal paths. Switch setting on Standby
			BVS Sample conditioning 1	C BVS Sample conditioning	Message from sample conditioning linked with device status Check	Check sampling probe and cooler of measuring point 1. Check cables and signal paths. Replace components as required
			BVS Sample conditioning 2	C BVS Sample conditioning	Message from sample conditioning linked with device status Check	Check sampling probe and cooler of measuring point 2. Check cables and signal paths. Replace components as required
			BVS Sample conditioning 3	C BVS Sample conditioning	Message from sample conditioning linked with device status Check	Check sampling probe and cooler of measuring point 3. Check cables and signal paths. Replace components as required
			BVS Sample conditioning 4	C BVS Sample conditioning	Message from sample conditioning linked with device status Check	Check sampling probe and cooler of measuring point 4. Check cables and signal paths. Replace components as required

* Only for O_2 on Gas module

*2 Replace BCU module. After replacement, update the number of measuring points and the test gas concentration.

*3 Check network cables between the modules and external. If the error cannot be corrected *2

11 Decommissioning

11.1 Switching off

11.1.1 Switching the device off

Important information

CAUTION
Poisoning hazard through sample gas

Sample gas may be present in the components in contact with the sample gas after switching off.

► Set the measuring device to Standby mode before turning it off.

Prerequisites

- The instrument was purged with instrument air for 10 minutes in Standby mode.

Procedure

1. Switch off the instrument via a separate main switch or via the FI (FB1) switch in the sample conditioning and distribution unit.
2. In case of prolonged shutdown: Pull the gas extraction unit out of the stack.

11.2 Transport

Procedure

1. Protect the device before transport.
2. Use the original packaging for transport or alternatively a suitable padded stable packaging.
   A transport container with adequate stability can also be used.
3. Protect the device with padding from shocks and vibrations.
4. Thoroughly secure the device in place inside the transport container. Make sure there is sufficient space between the analyzer and the walls of the transport container.

11.3 Return delivery

11.3.1 Shipping for repair

Overview

You can find all information on the repair flat rates, Repair Form (incl. Non-Risk Declara-tion and return information) at www.endress.com.

Important information

NOTE
Without the Non-Risk Declaration, the device will either be cleaned by a third-party company at the customer's expense or the package will not be accepted.

Procedure

1. Contact your local Endress+Hauser representative. Addresses: See last page of Operating Instructions.
2. Clean device.

3. Fill in the Repair Form including the Non-Risk Declaration and send it in advance to the Endress+Hauser representative by e-mail.
4. Pack the unit carefully and shockproof in the original packaging for transport.
5. Enclose the Repair Form and attach it to the outside of the packaging.

11.3.2 Cleaning the device before returning

Important information

NOTICE
Device damage through incorrect cleaning.

- Close the housing before cleaning so that no fluid can penetrate.
- Do not use a high-pressure cleaner, aggressive mechanical or chemical cleaning agents.

Prerequisites

- Device is voltage-free.

Procedure

Clean surfaces and parts with media contact

1. Remove loose contamination with compressed air.
2. Remove adhering contamination with a mild soap solution and a soft cloth.
3. Do **not** clean optical surfaces.

11.4 Disposal

Important information

NOTE
The following subassemblies contain substances that may have to be disposed of separately:

- Electronics: Capacitors, rechargeable batteries, batteries.
- Display: Liquid of LC display.
- Sample gas filter: Could be be contaminated with pollutants.
- All lines with sample gas contact could be contaminated with pollutants.

Disposal of the device

The device can easily be disassembled into its components which can then be sent to the respective raw material recycling facilities.

12 Technical data

12.1 Dimensional drawings

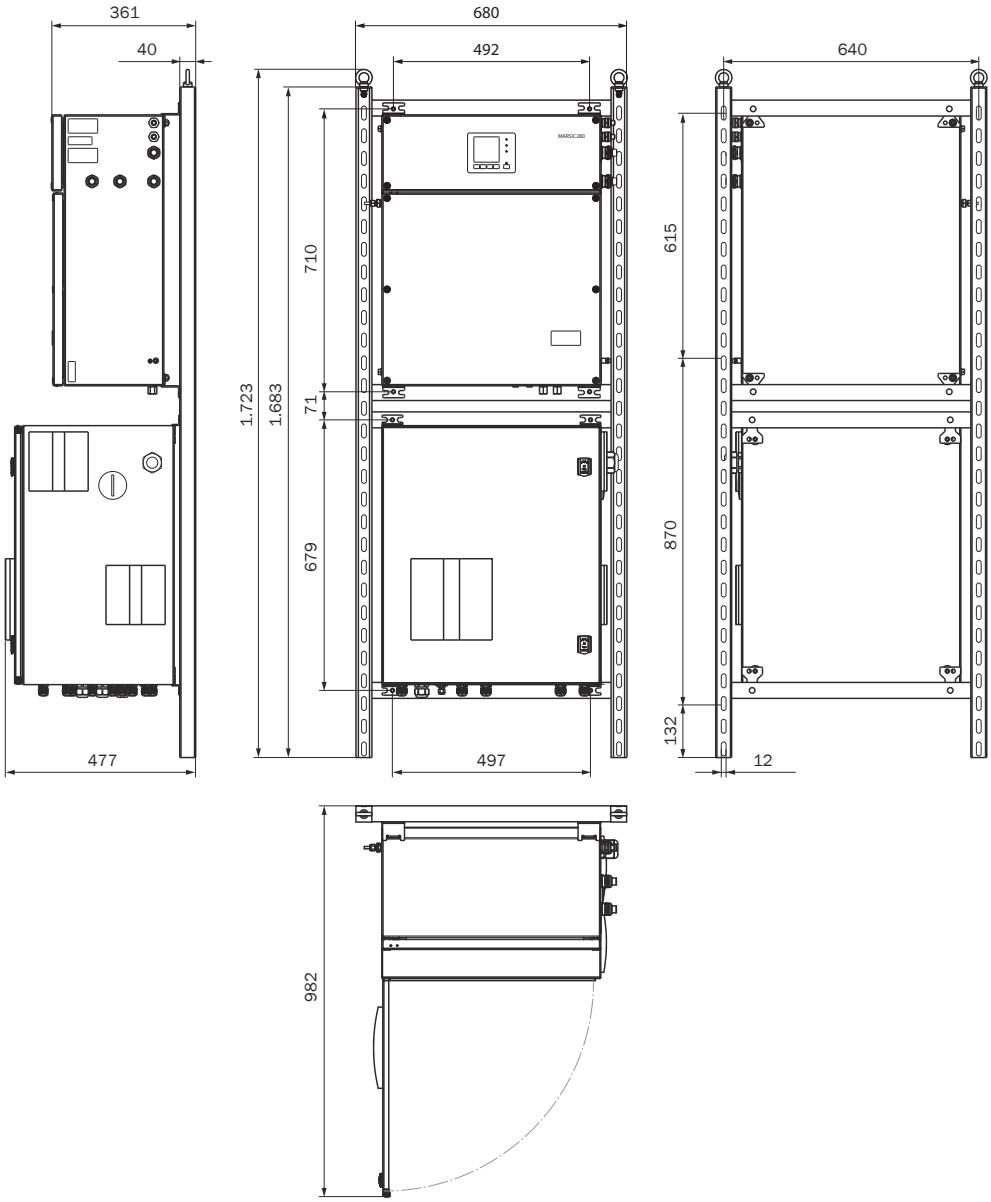


Figure 26: Dimensional drawing MARSIC280

All dimensions in the dimension drawing are in mm.

12.2 Technical data

NOTE
The technical data depend to some extent on the individual equipment of your device.

► See the enclosed System Description for the configuration of your device.

12.2.1 Measured values

Table 12: Measured variables

Number of measured variables	
Number of measured variables	CO_2, SO_2

Table 13: Measuring method

Measuring method	
Measuring method	NDIR spectroscopy, NDUV spectroscopy

Table 14: Sample volume

Sample volume	
Sample volume	80 ... 120 l/h

Table 15: Measuring ranges

Component	Measuring range
CO_2	0 ... 25% by volume
SO_2	0 ... 100 ppm / 0 ... 500 ppm

Table 16: Measured value characteristics

Measured value characteristics	
Measuring precision	< 1% of the respective full scale value
Detection limit	< 0.5% of the respective full scale value
Sensitivity drift	< 2% of the respective full scale value per week
Zero point drift	< 2% of the respective full scale value per week
Reference point drift	< 2% of the respective full scale value per week
Setting time t_{90}	15 ... 30 s, including sample gas path and gas sampling unit

12.2.2 Ambient conditions

Ambient conditions	
Altitude	Max. 2,000 m (above sea level)
Ambient temperature	+5 ... +45 °C
Storage temperature	-20 ... +70 °C
Ambient pressure	900 ... 1100 hPa
Ambient humidity	≤ 90%, non-condensing
Degree of contamination	2
Overvoltage category	2

12.2.3 Sample gas conditions

Table 17: Sample gas characteristics

Sample gas at the sampling point	Property
Process temperature	10 ... 550 °C
Sample gas temperature subassembly: • Sample gas probe • Sample gas line • Cell	Temperature: • Approx. 180 °C • Approx. 180 °C • Approx. 60 °C
Process pressure	–200 ... +200 hPa relative

Sample gas at the sampling point	Property
Dust load	< 200 mg/m³

12.2.4 Housing

Table 18: Design

Design	
Dimensions	see "Dimensional drawings", page 146
Installation	Wall fitting
Weight	• Analyzer unit: 37 kg • Sample conditioning and distribution unit: 52 kg • Complete system on assembly frame: 110 kg
Materials with media contact	• Stainless steel 1.4547 • PTFE • FKM • Platinum • Nickel • Aluminium • Calcium fluoride • PVDF • Hastelloy
Protection class	IP 54

12.2.5 Interfaces and protocols

Table 19: Interfaces and protocols

Interfaces and protocols	
Display	LC-Display Status-LEDs: “Power”, “Maintenance request” and “Malfunction”
Analog outputs	8 outputs: 0 ... 24 mA Galvanically isolated
Analog inputs	2 inputs: 0 ... 20 mA
Digital outputs	16 outputs: 1-pole changeover switch, 3 connections
Digital inputs	8 inputs: 42 V
Communication interface	Modbus Ethernet Type of field bus integration: TCP Function: Connection to OPC server

I/O module

Description	TRUE	Type	Only for two measuring points
Status, sample gas cooler	Alarm	DI	
Status, SP1 (HSL&SFU)	Okay	DI	
Status, SP2 (HSL&SFU)	Okay	DI	x
I-Air alarm	Alarm	DI	

Description	TRUE	Type	Only for two measuring points
Condensate vessel status	Alarm	DI	
Zero		DI	
Zero point calibration, remote	Adjust	DI	
External status (scrubber on/off and standby active manually)	Standby	DI	
Failure / Uncertain		DO	
MAINTENANCE REQUEST		DO	
Standby		DO	
Pump on analyzer		DO	
Control SP1		DO	
Backpurge SP1		DO	
Test gas SP1		DO	
Calibration switch (between span and zero)		DO	
Control SP2		DO	x
Backpurge SP2		DO	x
Test gas SP2		DO	x
SP1 running		DO	x
SP2 running		DO	x
Zero		DO	

12.2.6 Power supply

Table 20: Power supply

Power supply	
Voltage	115 V / 230 V / 400 V ±10%
Voltage	Connection to typical power supplies possible
Frequency	50 Hz / 60 Hz
Power input	With 230 V AC: ≤ 8 A[1]
Power consumption • Analyzer unit • Sample conditioning and distribution unit: 52 kg • Heated sample gas line • Gas sampling unit • Heated probe tube	Power consumption • ≤ 300 VA • ≤ 300 VA • ≤ 95 VA/m • ≤ 450 VA • ≤ 450 VA

1 Without sample gas line and filter unit

12.2.7 Line cross-sections

Table 21: Line cross-sections (relative to leads with ferrules)

	Line type	Screw connection clamping range	Permissible cross-section
Remote Control	Shielded line with DNV approval Lay shield on EMC gland on both sides	7 ... 12 mm Analyzer unit	0.25 ... 1.5 mm²

	Line type	Screw connection clamping range	Permissible cross-section
• Analog outputs • Digital outputs	Shielded line Lay shield on EMC gland on both sides	9 ... 16 mm Analyzer unit	0.14 ... 1.5 mm²
Digital inputs	Shielded line Lay shield on EMC gland on both sides	9 ... 16 mm Sample conditioning and distribution unit	0.14 ... 1.5 mm²
Power supply	Unshielded line	13 ... 18 mm Sample conditioning and distribution unit	1.5 ... 6 mm²
Ethernet / network	Min. KAT5 Lay shield one-sided on EMC gland	7 ... 12 mm Analyzer unit	RJ45 plug

12.2.8 Gas supply

Important information

NOTICE

Malfunction of the measuring device due to unsuitable instrument air

Operation with air not satisfying the specifications voids the warranty and does not ensure proper functioning of the measuring device.

► Only feed conditioned instrument air to the measuring device.
► The instrument air quality must meet the specification.

Supply gases

Table 22: Supply gases

Gas	Quality	Inlet pressure	Flow rate
Instrument air	Particle size max. 5 µm Pressure dew point max. 3 °C Oil content max. 0.1 mg/m³ ISO 8573-1:2021 [1:4:2]		

12.2.8.1 Tube connections

Table 23: Tube connections

Connection	Dimension
Instrument air	Hose coupling DN 4/6
Test gas inlet	Hose coupling DN 4/6
Gas outlet on the analyzer	6 mm clamping ring screw connection
Gas outlet, sample conditioning and distribution unit	6/4 mm screw connection

12.2.9 Heated sample gas line

Table 24: Sample gas line - characteristics

Sample gas line	
Length	Max. 35 m certified, longer sample gas lines on request
Ambient temperature	–20 ... 80 °C
Working temperature	Max. 200 °C
Temperature control	2 x Pt100 (1 as reserve)

Sample gas line	
Power supply	115 V or 230 V
Power consumption	90 VA/m
Protection class	IP 54

12.3 Torques for screw fittings

Overview

Tighten all screw connections, for which no tightening torque or no pretension force is specified in drawings or Assembly Instructions, according to VDI 2230.

Exceptions to this rule are all connections with screws that are not screw connections in the real sense. This includes hose clips, cable glands, screw fittings, gas connections, screws for circuit boards etc. Tighten these screw fittings as evenly as possible with a much lower torque (hose clips 1 Nm, other screw fittings according to manufacturer specifications).

Select the next lowest torque valid for the screw for mixed materials and special screws such as relieved screws.

The basic friction coefficient is (screw fittings without lubrication) μk=μG=0.14. The calculated values are valid for room temperature (T=20 °C).

Torques

Table 25: Torques

Dimension	Slope P	Tightening torque M_A (Nm) according to strength class (see screw head)							
		3.6	4.6 A2-50 A4-50	5.6 Alu	A2-70 A4-70	A2-80 A4-80	8.8 Titan	10.9	12.9
M 1.6	0.4	0.05	0.05	0.05	0.11	0.16	0.19	0.26	0.31
M 2	0.45	0.1	0.1	0.11	0.22	0.32	0.39	0.55	0.66
M 2.5	0.45	0.21	0.22	0.23	0.46	0.67	0.81	1.13	1.36
M 3	0.5		0.54	1	1.2	1.39	1.51	1.98	2.37
M 3.5	0.6		0.85	1.3	1.54	1.75	1.9	2.6	3.2
M 4	0.7		1.02	2	2.5	3	3.3	4.8	5.6
M 5	0.8		2	2.7	4.2	5.6	6.5	9.5	11.2
M 6	1		3.5	4.6	7.3	9.7	11.3	16.5	19.3
M 8	1.25		8.4	11	17.5	23.3	27.3	40.1	46.9
M 10	1.5		17	22	35	47	54	79	93
M 12	1.75		29	39	60	79	93	137	160
M 14	2		46	62	94	126	148	218	255
M 16	2		71	95	144	192	230	338	395
M 18	2.5		97	130	199	266	329	469	549
M 20	2.5		138	184	281	374	464	661	773
M 22	2.5		186	250	376	508	634	904	1057
M 24	3		235	315	485	645	798	1136	1329
M 27	3		350	470	708	947	1176	1674	1959
M 30	3.5		475	635	969	1289	1597	2274	2662
M 33	3.5		645	865	1319	1746	2161	3078	3601

Dimension	Slope P	Tightening torque M_A (Nm) according to strength class (see screw head)							
M 36	4		1080	1440	1908	2350	2778	3957	4631
M 39	4		1330	1780	2416	3016	3597	5123	5994

13 Annex

13.1 Licenses

13.1.1 Liability disclaimer

The firmware for this device has been developed using Open Source Software. Any changes to the Open-Source components are in the general responsibility of the user. All warranty claims are excluded in this case.

The following exclusion of liability applies to the GPL components in relation to the rights holders: This program is distributed in the hope that it will be of use, but with no guarantee of this; neither is there any implied guarantee of marketability or suitability for a particular purpose. Refer to the GNU General Public License for details.

With regard to the other Open-Source components, we refer to the liability disclaimers of the copyright holders in the licence texts on the CD delivered.

13.1.2 Software licences

In this product, Endress+Hauser uses unchanged and, as far is necessary and in compliance with relevant licence conditions, changed Open Source Software.

The firmware of this device is therefore subject to the copyrights listed on the CD delivered. Please refer to the storage medium delivered for a complete list of the Open Source programs used as well as the relevant licence conditions.

13.1.3 Source codes

The source codes for the Open Source programs used in this device can be requested using the following email address: Please enter “Open Source Software” as subject.

8030498/AE00/V3-0/2024-06

www.addresses.endress.com

Endress+Hauser