OPERATING INSTRUCTIONS

GM901-02

Carbon Monoxide Gas Analyzer
Probe version

SICK
Sensor Intelligence.

Described product

GM901-02

Probe version

Manufacturer

SICK AG
Erwin-Sick-Str. 1
79183 Waldkirch
Germany

Legal information

Original document

This document is an original document of SICK AG.

CE

Contents

1 About this document

1.1 Function of this document

These Operating Instructions describe:

- System components
- Start-up
- Operation
- Maintenance work required for reliable operation
- Troubleshooting

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 SICK 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 installing, operating and maintaining the device.

Operation

The device may only be operated by qualified persons who, based on their device-specific training and knowledge as well as knowledge of the relevant regulations, can assess the tasks given and recognize the hazards involved.

Installation and maintenance

Installation and maintenance may only be carried out by trained specialists familiar with the installation conditions.

Please observe the information at the beginning of the respective Sections.

1.4 Further information

- Purge air unit Operating Instructions
- Final inspection record

NOTE

▶ Observe all documents provided.

1.5 Symbols and document conventions

1.5.1 Warning symbols

Table 1: Warning symbols

Symbol	Significance
	Hazard (general)
	Hazard through electrical voltage

Symbol	Significance
	Hauard through toxic substances
	Hazard through noxious substances
	Hazard through high temperature
	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

SICK AG uses standardized data interfaces such as, for example, standard IP technology, in its products. The focus here is on product availability and features.

SICK AG always assumes that the customer is responsible for the integrity and confidentiality 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

NOTICE
Responsibility of the operator in case of device malfunctions or failure

If the GM901-02 is used as a sensor in combination with control technology, the operator must ensure that a failure or malfunction on the GM901-02 cannot lead to unallowed damage or hazardous operating states.

NOTICE
Responsibility for system safety

The person setting the system up is responsible for the safety of the system in which the device is integrated.

Electrical safety

DANGER
Danger to life through electric shock

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

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

WARNING
Endangerment of electrical safety through power cable 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 specifications in the Operating Instructions (see "Technical data", page 90) for installation of a power line.

Grounding the device

NOTICE
Device damage through incorrect or non-existing grounding

During installation and maintenance work, it must be ensured that the protective grounding to the devices and/or lines involved is effective in accordance with EN 61010-1.

2.2 Intended use

2.2.1 Purpose of the device

The GM901-02 only serves to monitor CO concentrations of gases in industrial plants.

The GM901-02 measures continuously directly in the gas duct (in-situ).

2.2.2 Responsibility of user

Designated users

see "Target groups", page 7.

Correct project planning

- Basis of this Manual is the delivery of the device according to the preceding project planning (e.g., based on the SICK application questionnaire) and the relevant delivery state of the device (see delivered system documentation).
  - ▶ Contact SICK Customer Service if you are not sure whether the device corresponds to the state defined during project planning or to the delivered system documentation.

Correct use

- ▶ Use the device only as described in "Intended use".
  The manufacturer bears no responsibility for any other use.
- ▶ Carry out the specified maintenance work.
- ▶ Do not attempt any work on or repairs to the device unless described in this Manual.
  Do not remove, add or change any components in or on the device unless such changes are officially allowed and specified by the manufacturer.
  Use only original spare parts and expendable parts from SICK.
  Failure to observe these precautions could result in:
  - Voiding the manufacturer's warranty.
  - The device becoming dangerous.

Special local requirements

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

Read the Operating Instructions

- ▶ Read and observe these Operating Instructions.
- ▶ Observe all safety instructions.
- ▶ If anything is not clear: Please contact SICK Customer Service.

Retain documents

These Operating Instructions must be

- ▶ Available for reference.
- ▶ Passed on to new owners.

3 Product description

3.1 Product identification

Product name	GM901-02
Device version	CO measuring device with probe
Manufacturer	SICK AG Erwin-Sick-Str. 1 • D-79183 Waldkirch • Germany
Type plates	• Sender and receiver: Under the optics tube • Measuring probe: On the electronics housing

3.2 Product features

- The in-situ gas analyzer GM901-02 serves for continuous measurement of gas concentrations in industrial plants.
- The GM901-02 is an in-situ measuring system which means measuring is done directly in the gas carrying duct.
- Measuring components: CO and reference value temperature.
- Measuring principle: Infrared spectroscopic gas filter correlation.

3.2.1 Cross-sensitivities

Accurate temperature input is a critical factor that may be required to maintain desired measurement accuracies. The temperature of an external RTD temperature sensor should be connected to the analog input of the control unit.

The influence of temperature can be assessed in the following Table.

Process temperature	Absolute temperature error	Relative temperature error	Additional relative % measurement error
100 °C	5 °C	5%	3%
200 °C	10 °C	5%	4.8%
300 °C	15 °C	5%	6%
400 °C	20°C	5%	6.8%

The humidity in the process affects measurement accuracy. GM901 does not measure humidity, but a static humidity default value can be set.

The influence of the humidity on measurement accuracy depends on the process temperature, the absolute process humidity and the humidity input error. The effect can be assessed in the following Tables.

*Table 3: Actual process moisture at **0** vol.% H_2O*

Default value entered[1] (Vol.-% H_2O)	Absolute difference to input value (Vol.-% H_2O)	Process temperature (°C)	Additional relative % measurement error[2]
5	5	100	-2.5
5	5	200	-6.1
5	5	300	-7.6
5	5	400	-13.9

1 See Section 9.4.8
2 Based on 500 ppm CO, the uncertainty is lower for higher concentrations

*Table 4: Actual process moisture at **10** Vol.-% H_2O*

Default value entered[1] (Vol.-% H_2O)	Absolute difference to input value (Vol.-% H_2O)	Process temperature (°C)	Additional relative % CO measurement error[2]
0	-10	100	3.8
0	-10	200	9.3
0	-10	300	14.2
0	-10	400	22.2
5	-5	100	1.2
5	-5	200	2.9
5	-5	300	4.3
5	-5	400	6.8
15	5	100	-0.9
15	5	200	-2.2
15	5	300	-3.3
15	5	400	-5.2
20	10	100	-1.7
20	10	200	-4.1
20	10	300	-6.2
20	10	400	-9.6

1 See Section 9.4.8
2 Based on 500 ppm CO, the uncertainty is lower for higher concentrations

Table 5: Actual process moisture at 20 Vol.-% H_2O

Default value entered[1] (Vol.-% H_2O)	Absolute difference to input value (Vol.-% H_2O)	Process temperature (°C)	Additional relative % CO measurement error[2]
10	-10	100	1.8
10	-10	200	4.2
10	-10	300	7

Default value entered[1] (Vol.-% H_2O)	Absolute difference to input value (Vol.-% H_2O)	Process temperature (°C)	Additional relative % CO measurement error[2]
10	-10	400	10
15	-5	100	0.8
15	-5	200	1.9
15	-5	300	3.2
15	-5	400	4.5
25	5	100	-0.7
25	5	200	-1.7
25	5	300	-2.8
25	5	400	-4
30	10	100	-1.4
30	10	200	-3.3
30	10	300	-5.3
30	10	400	-7.6

1 See Section 9.4.8
2 Based on 500 ppm CO, the uncertainty is lower for higher concentrations

*Table 6: Actual process moisture at **30** Vol.-% H_2O*

Default value entered[1] (Vol.-% H_2O)	Absolute difference to input value (Vol.-% H_2O)	Process temperature (°C)	Additional relative % CO measurement error[2]
20	-10	100	1.4
20	-10	200	3.3
20	-10	300	5.9
20	-10	400	7.8
25	-5	100	0.7
25	-5	200	1.6
25	-5	300	2.8
25	-5	400	3.7
35	5	100	-0.6
35	5	200	-1.5
35	5	300	-2.6
35	5	400	-3.4
40	10	100	-1.2
40	10	200	-2.8
40	10	300	-4.9
40	10	400	-6.5

1 See Section 9.4.8
2 Based on 500 ppm CO, the uncertainty is lower for higher concentrations

The presence of CO_2 in the process gas has an effect on CO measurement at high temperatures. The more the temperature increases at constant CO_2 concentration, the higher the relative CO measurement error becomes. Consider the influence in the following Table.

Max. CO_2 concentration for 1 m	Max. temperature	Relative CO measurement error
10 Vol.-%	370 °C	2%
	400 °C	3%
	410 °C	4%
15 Vol.-%	390 °C	2%
	380 °C	3%
	360 °C	4%
20 Vol.-%	340 °C	2%
	360 °C	3%
	380 °C	4%
25 Vol.-%	370 °C	2%
	350 °C	3%
	330 °C	4%

3.3 Device variants

The following device variants are available depending on the measuring task and application:

	GM901 Standard	GM901 Extended calibration
Type code	GM901-02-xxxx1 or xxxx3	GM901-02-xxxx2 or xxxx4
Temperature range	Applications up to 250 °C	Applications up to 430 °C

3.4 Layout

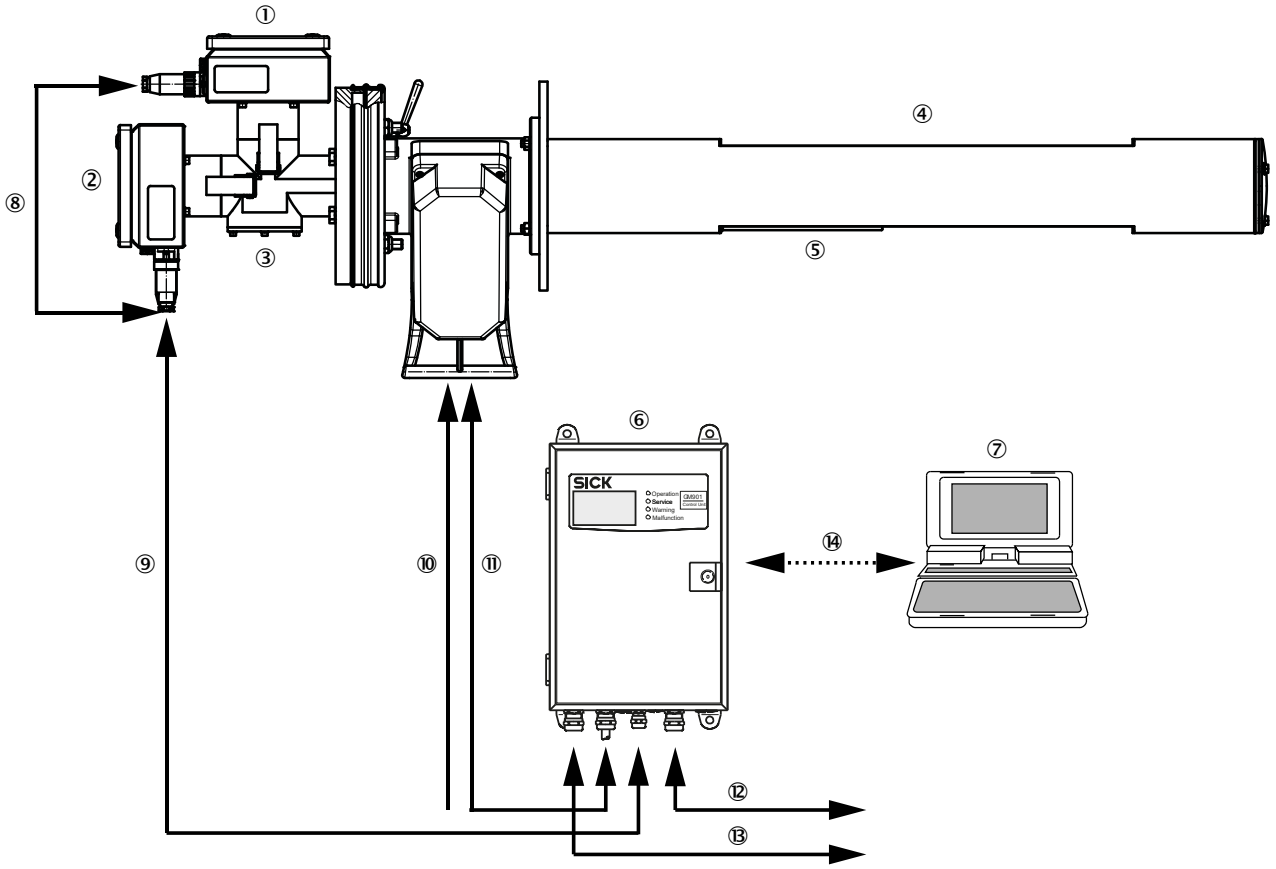


Figure 1: Device component overview

Table 7: Device components legend

	System components		Line
①	GM901-02 sender	⑧	Sender-receiver connection
②	GM901-02 receiver	⑨	CAN connection and power supply Control unit - analyzer
③	T-piece with beam splitter	⑩	Power supply 115 V / 230 V AC
④	Measuring probe	⑪	Line to temperature sensor PT1000
⑤	Temperature sensor PT1000	⑫	• Analog output signals: 1 input, 1 output • Status signals: 1 input, 3 outputs
⑥	Control unit	⑬	Power supply 115 V / 230 V AC
⑦	Service PC	⑭	RS232 interface (Service)

3.5 Measuring probes

3.5.1 Gas-testable GPP measuring probe

Figure 2: GPP measuring probe with ceramic filter

Characteristics:

- Suitable for applications with dry process gas
- Measuring probe material:
  - Standard: Stainless steel (1.4571/316 Ti)
  - On request: 1.4539
- No moving parts
- Active elements: Optical surface heaters and their controls
- PT1000 temperature sensor with SPU for gas temperature measurement
- Power supply via a plug
- Filter element for filtering dust particles
  - With ceramic filter: Dust removal for particles > 1 µm
- EPA compliant (EPA Guideline CFR 40, Part 60 or Part 75): The measuring chamber can be filled with known concentrations of test gases
- SPAN and zero point test possible: Usage as "zero path" by purging the measuring chamber with air or N_2 possible
- Pressure-resistant up to 200 mbar differential pressure to duct
- No special flow conditions in duct necessary

3.5.2 Open GMP measuring probe

Figure 3: Measuring probe with open measuring gap and PT1000 temperature sensor

Characteristics:

- Very short response times
- High temperature stability
- Continuous purge air necessary
- Air outlet in the duct 90° to gas flow
- PT1000 temperature sensor with SPU for gas temperature measurement

Gas inlet and outlet with the GMP measuring probe

The measuring probe has a closing device for the opening towards sample gas and is operated using the lever on the probe flange. This ensures a correct purge air function without an analyzer.

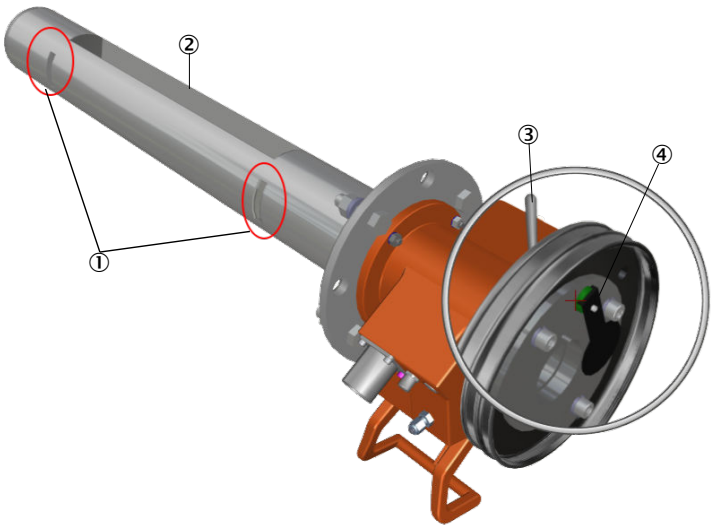


Figure 4: Closing device on the GMP measuring probe

① Purge air outlet
② Open measuring path (measuring gap)
③ Closing device lever
④ Closing device set to position "open"

GM901-02 with GMP measuring probe and purge air unit

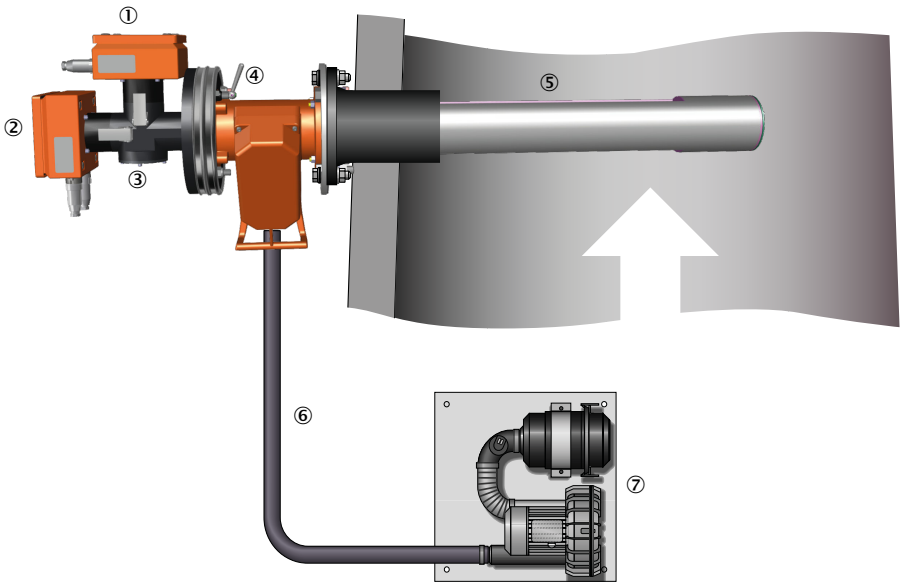


Figure 5: GMP measuring probe with purge air unit on the duct

① GM901-02 sender
② GM901-02 receiver
③ T-piece with beam splitter
④ Lever for closing device of the sample gas opening
⑤ GMP measuring probe
⑥ Purge air hose
⑦ Purge air unit SLV4

3.5.3 Measuring probes in comparison

Table 8: Measuring probes: Characteristics and usage

Characteristic	Open GMP measuring probe	Gas-testable GPP measuring probe
Type	Measuring path in flow direction open; Purge air supply with outlet aligned 90° to gas flow	Gas-testable measuring probe with ceramic filter, for dry sample gas
Max. process temperature	≤+430 °C	≤+430 °C
Gas check according to EPA specification possible	No	Yes
Purge air supply required	Yes	No
Optical surface heating in measuring probe	No	Yes, with integrated control
Suitable for wet sample gas	Yes	No
Measurable components	CO	CO
Response time (t_{90})	≥ 5 s	≥ 120 s
Duct diameter	> 360 mm	> 300 mm

Characteristic	Open GMP measuring probe	Gas-testable GPP measuring probe
Dust load	≤ 3 g/m³ Relative to 1 m measuring distance, depending on application	≤ 30 g/m³
Probe lengths available [m]	1,1	1,1
Active measuring paths available [mm]	250/500	250/500

3.6 Control unit

Control unit with connection line (4 m)

The control unit AWE serves in the measuring system as user interface and prepares and outputs the measured values and performs control and monitoring functions.

The control unit can be located in the vicinity of the sender/receiver unit. It can also be located up to about 1000 meters from the sampling point, e.g., installed in the switch center or monitoring center of the industrial plant.

Functions:

- Output of measured values, computed data and operating states
- Communication with the peripheral equipment
- Output of error messages and other status signals
- Access during service (diagnosis)

3.7 Accessories

Weather protection hood

The weatherproof cover is used when the measuring system is operated outdoors. It is available as an accessory.

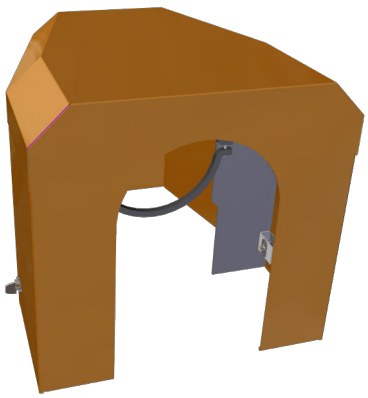


Figure 6: Weatherproof cover

Purge air unit

The purge air unit supplies filtered ambient air to the purge air attachments and protects the optical surfaces of the sender/receiver unit from contamination and high gas temperatures.

NOTE

As standard, SICK recommends a separate purge air unit for the sender/receiver unit when using the GMP measuring probe to ensure an optimal purge air supply.

If the supply of purge air is insufficient, hot and corrosive gases can destroy the measuring device within a few minutes.

Further information on the purge air unit, see Operating Instructions of the purge air unit.

Optical adjustment device

To align the sender and receiver

Figure 7: Optical adjustment device

CO test cells with holder (SPAN test)

For the yearly drift control (zero point and sensitivity)

Figure 8: CO test cell with holder in transport case

Deliverable test cells

Test cells are available depending on the application-specific measuring ranges, measuring paths and test points (e.g. 70%).

4 Transport and storage

4.1 Storage

- Clean all components of the measuring device (not the optical surfaces) with slightly moistened cleaning cloths. Use a mild cleaning agent here.
- Protect the openings of the sender/receiver-unit and measuring probe from atmospheric influences, preferably with the original transport safety devices.
- Pack all components for storage or transport. Preferably use the original packing.
- Store all components of the measuring device in a dry, clean area.

5 Mounting

5.1 Safety

WARNING
Risk of injury through improper assembly work

All assembly work must be carried out only by authorized persons who, based on their training and knowledge as well as knowledge of the relevant regulations, can assess the tasks given and recognize the hazards involved.

CAUTION
Accident risk through inadequate fastening of the device

- ▶ Consider the device weight specifications when planning the fitting supports.
- ▶ Check the load capacity/condition of the duct on which the device is to be installed.

NOTICE
Damage to device and plant through unsecured parts during installation

During installation, parts of the device or flange can fall into the duct and cause damage.

- ▶ Secure all parts with wire.

NOTICE
Damage to the measuring device due to premature installation on the stack

Unsuitable ambient conditions in the measuring duct can damage the measuring device and make commissioning impossible.

- ▶ First install the measuring device on the stack after commissioning.

5.2 Preparing the measuring point

Responsibility of the operator

- Determining the measuring point (e.g. determining a representative sampling point)
- Preparing the measuring point (e.g. load capacity of welded-on flange)

NOTICE

Basis for determining the measuring point:

- Preceding project planning
- Final inspection specifications for device
- Regulations of local authorities

5.3 Checking the scope of delivery

- ▶ Check the scope of delivery according to the order confirmation/delivery note.
- ▶ Ensure the supply voltages indicated on the type plates correspond to the system conditions.
- ▶ Check all components for externally perfect delivery condition.

5.4 Installation sequence

5.4.1 Installation steps overview

Table 9: Installation steps overview

Step	Procedure	Reference
1	Install the flange with tube.	see "Installing the flange with tube", page 25.
2	Fitting the control unit.	see "Installing the control unit", page 27.

5.4.2 Installing the flange with tube

DANGER

Health risk through hot or toxic gases/dusts in the measuring channel

The measuring duct can contain hot or toxic gases or dust deposits which can escape when opening the duct-side flange. Even if the measuring duct is out of operation during the installation, escaping gases can lead to severe damage to health.

- ▶ Always put the measuring duct out of operation for the duration of the installation.
- ▶ If required, purge the measuring duct with ambient air before starting installation work.
- ▶ Always wear suitable or company-specified protective clothing during installation work.

NOTICE

Device damage through incorrect/missing insulation of the duct when the measuring channel is hot

- ▶ When the measuring channel is hot, plan the duct and flange insulation so that the device is protected against high temperatures.

Installing the flange with tube

NOTE

- Flange with tube dimensions: see "Dimension drawing, flange with tube, DN125", page 96

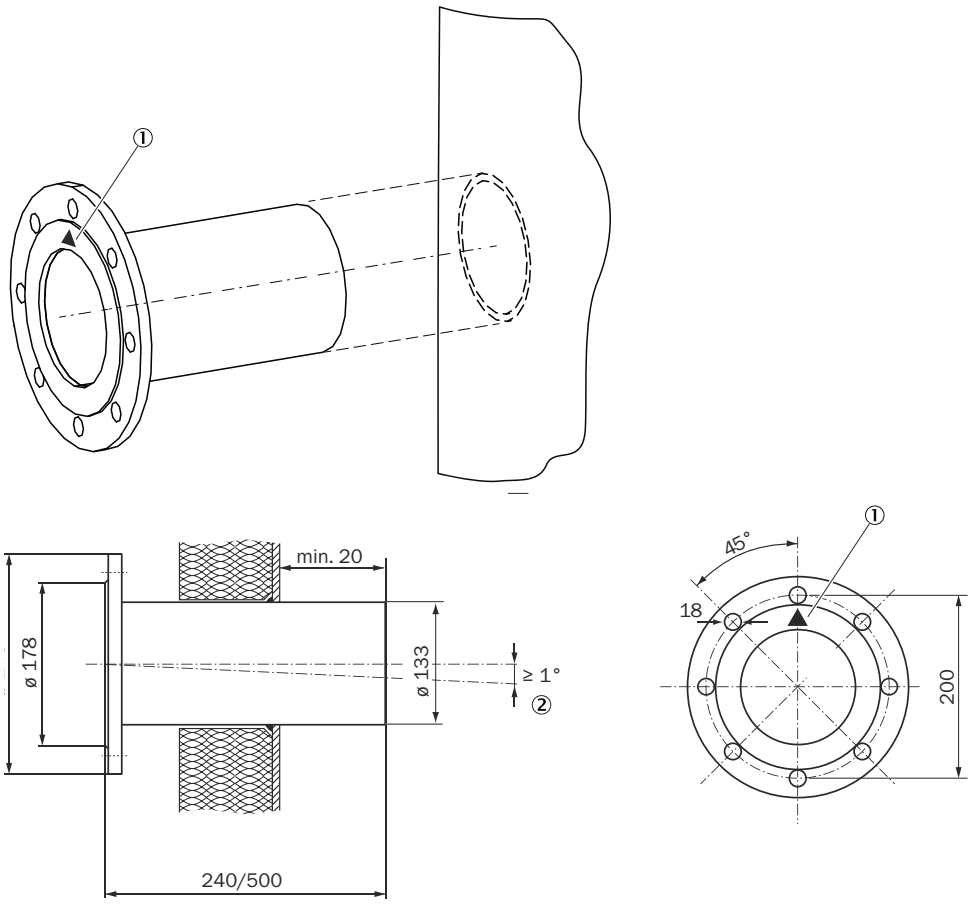


Figure 9: Flange with tube incl. orientation “TOP”

① Marking "Top"

② Tilt max. 1° (duct-side)

NOTE

Reinforcement with junction plates recommended

The device has a relatively high weight.

- Weld junction plates on on-site for reinforcement of ducts with thin walls or at fitting locations subject to vibrations.

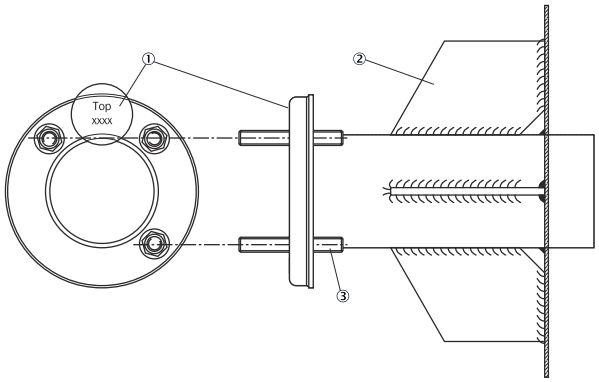


Figure 10: Flange tube with junction plates

① Marking for assembly position

② On-site junction plates

③ The rear side of the threaded bolts serves to fasten the optional weatherproof cover

Steps

1 Remove an area of 1000 mm x 800 mm of the insulation from the duct.
2 Mark the flange center point exactly on the duct wall.
   – On ducts made of stone/concrete: Duct opening approx. 2 cm larger than the flange tube outer diameter ; at the same time, plan a light downward incline of the flange tube by approx. 1° to prevent condensate collecting later between the tube and probe.
   – Provide a suitable retainer plate.
3 Cut an opening matching the flange tube outer diameter (standard Ø = 133 mm) in the duct wall and/or retainer plate.
4 Insert the flange tube so that the marking points exactly upwards (↑). Tilt the tube in the duct or on the retainer plate slightly downwards (approx. 1°).
5 Affix in the fitting position.
   – Weld on junction plates as reinforcement when possible. For ducts made of stone/concrete: Anchor the retainer plate with flange with tube welded on securely to the duct.
6 Weld the flange tube on.

5.4.3 Installing the control unit

Prerequisite

- Installation location already determined during project planning.
- The maximum line length of 1000 m for all CAN bus connections has been considered.

NOTE

Recommendation: The shorter the distance between sampling point and control unit, the easier it is to use the system.

Prepare the installation location

- Based on the control unit dimension drawing, ensure enough space is available at the planned installation location for assembly as well as opening the enclosure door.

Control unit AWE (sheet steel enclosure version)

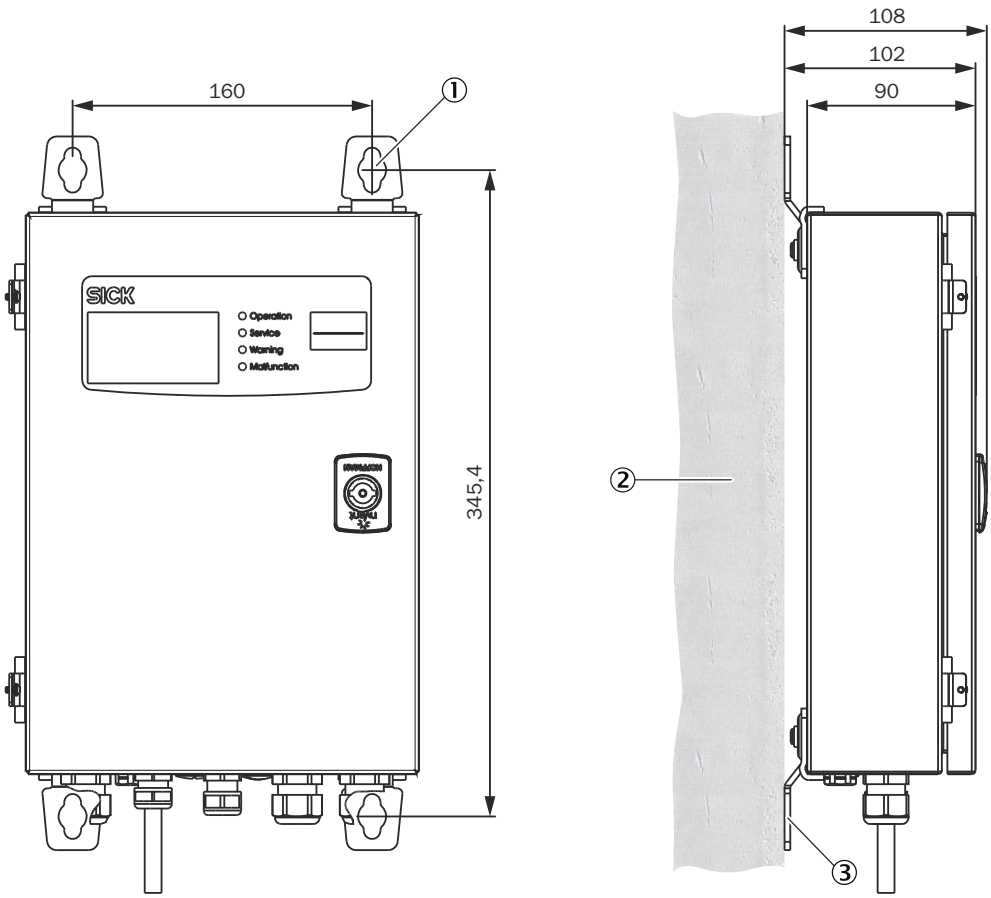


Figure 11: Fitting the control unit AWE, sheet steel enclosure (dimensions in mm)

① 4 × mounting holes ø 7.2 mm
② Installation surface
③ Fastening brackets

Steps

1. Drill the holes according to the installation drawing (Ø 7.2 mm for M8).
2. Screw the control unit tight to the four fastening brackets.

6 Electrical installation

6.1 Safety

DANGER
Danger to life through electric shock

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

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

WARNING
Endangerment of electrical safety through power cable 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 specifications in the Operating Instructions (see "Technical data", page 90) for installation of a power line.

DANGER
Electrical accident due to improper performance of the electrical work

The electrical work described in these Operating Instructions requires specialist knowledge. Electrical work can lead to serious electrical accidents if not carried out properly.

- Only let the work described in the following be carried out by electricians familiar with potential hazards.

NOTICE
Risk of device damage

Electronic components are accessible when the enclosure is open. The circuit board can be severely damaged when a contact is not grounded when the power supply is switched on.

- First switch the power supply on when the sender/receiver unit and the control unit are closed.

NOTICE
Pay attention to connection values for power supply

The control unit AWE is configured to 230 V AC on delivery.

- For 115 V AC, plug the respective bridges as shown on the connection plate of the control unit AWE.

NOTICE

Device damage through short circuit on the device

When power supply is available, signal short circuits can occur and damage the internal electronics. This is also valid for plug connections.

- ▶ Clean work is required. Do not leave any metal cuttings in the device.

6.2 Connection overview

6.2.1 Connection overview for standard version

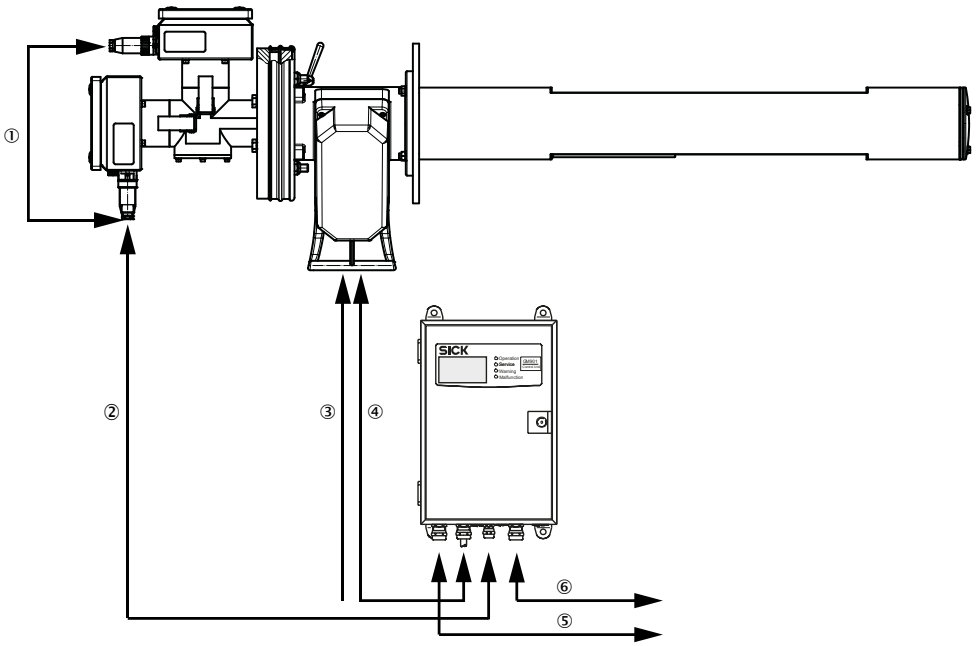


Figure 12: Electrical wiring of device components

① Sender-receiver connection
② CAN connection and power supply, control unit - analyzer
③ Power supply, purge air fixture, 115/230 V AC (GPP measuring probe)
④ Signal line, measuring probe temperature sensor, SPU on control unit analog input
⑤ Power supply, control unit: 115/230 V AC
⑥ Signal outputs, control unit:
- Analog: 1 input, 1 output
- Digital: 1 input, 3 outputs

6.2.2 Overview of control unit electrical connections

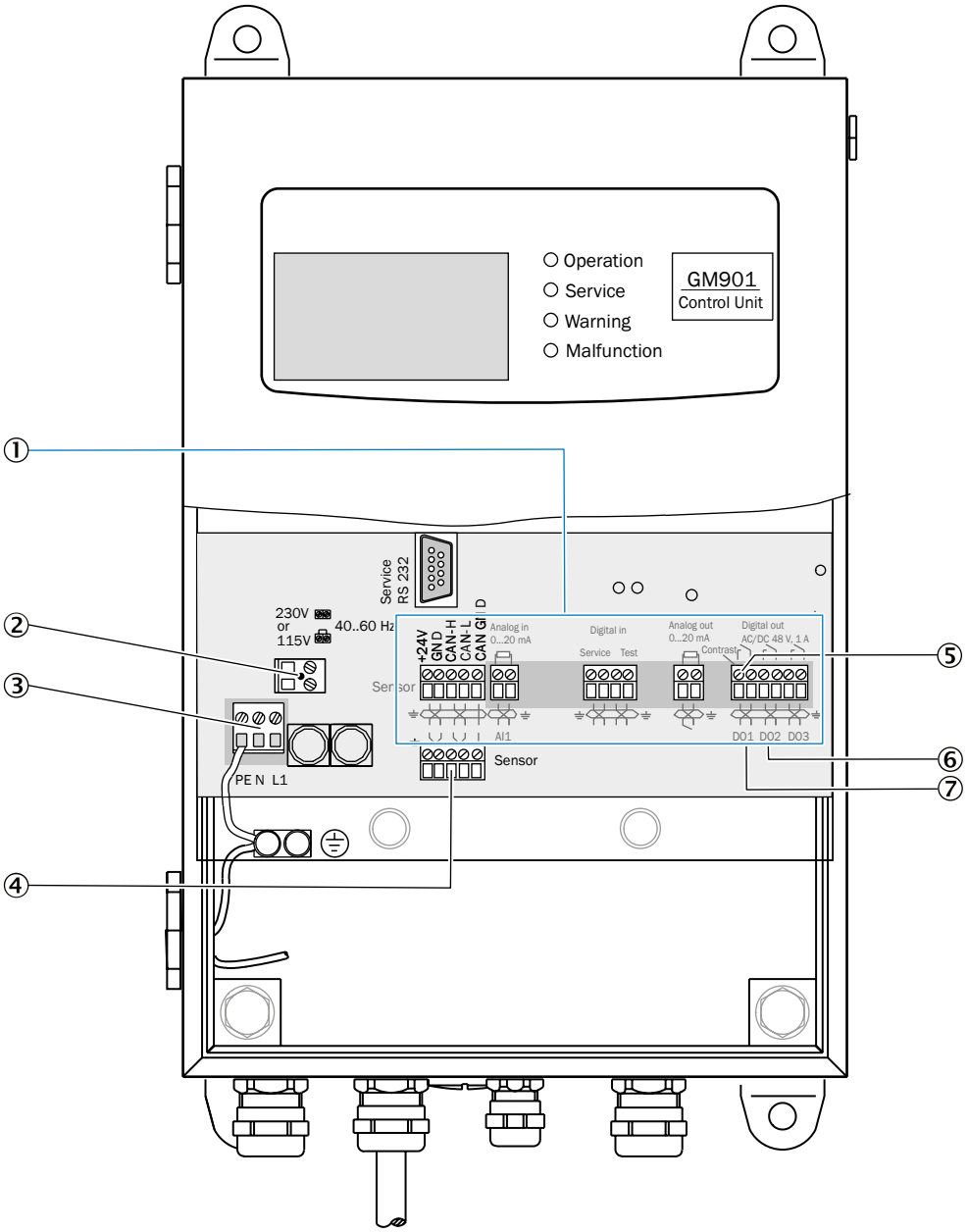


Figure 13: Electrical wiring of control unit

① Connections for wiring
② Operating voltage selection: 115 V or 230 V AC
③ Power supply:115 V/230 V AC
④ Receiver connection
⑤ Rotary potentiometer for setting display contrast
⑥ DO1 Malfunction / Maintenance
⑦ DO2 Limit

NOTE
The control unit is delivered from the factory as 230 V AC version.

6.2.2.1 Wiring of the temperature sensor

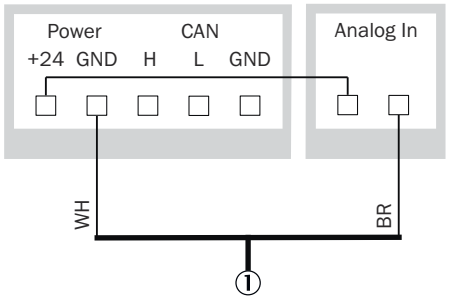


Figure 14: Wiring connections on the control unit

① Connection line, temperature sensor

NOTE

After connecting, the "External" switch in the "Temperature Input" menu must be set to "Yes" (see "Setting the use of an external temperature sensor", page 60.

6.3 Uninstalling the electrical system

DANGER

Electrical accident through bare, live lines

When uninstalling, unsecured, live lines can lead to serious accidents.

- Switch the power supply to the device off before starting uninstallation.
- If power supply is required during uninstallation: Secure all live lines during uninstallation work so that nobody can be injured.

CAUTION

Electrical accident through unsecured switches

Switches that should no longer be switched on for safety reasons can lead to serious accidents when switched on accidentally.

- Replace defective switches.
- As long as defective switches have not been replaced: Secure against being switched on accidentally with appropriate signs or safety locks.

NOTICE

Device damage through incorrect storage of electrical cables

Incorrect storage can lead to cable ends becoming damp and soiled. This can lead to device damage when restarting the device.

- Insulate cable ends.
- Protect cable ends against dirt and dampness.

7 Commissioning

7.1 Safety

Technical knowledge needed / requirements for commissioning

NOTICE

- You are basically familiar with GM901.
- You are familiar with the local situation, especially the potential hazards caused by gases in the gas duct (hot/noxious). You are capable of recognizing and preventing danger by possibly escaping gases.
- The specifications according to project planning have been complied with (see final inspection record).
- The installation location has been prepared according to the project planning.

If one of these requirements is not met:

▶ Please contact SICK Customer Service or your local representative.

Gases

DANGER

Danger to life by leaking hot and toxic gases

Hot and/or noxious gases can escape during work on the gas duct, depending on the plant conditions.

▶ Work on the gas duct may only be performed by skilled technicians who, based on their technical training and knowledge as well as knowledge of the relevant regulations, can assess the tasks given and recognize the hazards involved.

WARNING

Health risk through contact with toxic gases

The modules and devices contain enclosed potentially dangerous gases that can escape due to a defect or leak. Should a leak occur, the concentrations within the enclosed device can rise to 350 ppm.

- CO : 10 ml max. total volume.

▶ Check the condition of the seals on the device regularly.
▶ Only open the device when good ventilation is available, especially when a leak of one of the device components is suspected.

Electric system

DANGER
Danger to life through electric shock

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

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

WARNING
Endangerment of electrical safety through power cable 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 specifications in the Operating Instructions (see "Technical data", page 90) for installation of a power line.

DANGER
Electrical accident due to improper performance of the electrical work

The electrical work described in these Operating Instructions requires specialist knowledge. Electrical work can lead to serious electrical accidents if not carried out properly.

- Only let the work described in the following be carried out by electricians familiar with potential hazards.

Grounding

NOTICE
Device damage through incorrect or missing grounding

It must be ensured during installation and maintenance work that the protective grounding of the device or lines involved is established in accordance with EN 61010-1:2010.

7.1.1 Important information on GPP measuring probe

NOTICE

Observe the following information during commissioning of the GPP measuring probe to avoid damage to the measuring system and to achieve stable measurements.

- Check the filter surface visually for damage.
- Warm the measuring probe up for about 30 minutes beforehand so that the temperature of the window and triple reflector is sufficient to prevent condensation on the optical surfaces.
- Gas can escape at the measuring probe during overpressure processes when the 1/4" plug is open or loose. Air is suctioned into the measuring probe during low-pressure processes. The measured value in the chamber then drops depending on the low-pressure in the process, possibly down to zero.
- Do not damage the filter when inserting the measuring probe in the flange.

7.2 Tools required

- Fork or ring spanner set
- Optical alignment tool (not included in standard scope of delivery)

7.3 Material required

- Optics cleaning wipes without detergent
- Test tool kit for SPAN test (Part No.: 2019639)

7.4 Commissioning steps overview

Commissioning comprises two main steps:

1 Zero adjust:
The sender-receiver unit is prepared for operation with the measuring probe in an atmosphere free from sample gas.

2 Installation and commissioning at the sampling point:
The purge air unit and the sender-receiver unit are put into operation with the measuring probe. The control unit is then switched on and checked. This can then be configured for individual requirements.

Prerequisites

- Control unit is fitted and wired.
- Potential equalization is connected to the control unit.

Table 10: Commissioning steps overview

Step	Procedure	Reference
1	Remove the transport safeguards.	see "Removing the transport safety devices of the measuring probe", page 36.
2	Fit the T-piece on the measuring probe (if not already fitted at the factory).	see "Fitting the T-piece on the measuring probe", page 37.
3	Align the sender and receiver on the optical axis.	see "Aligning transmitter and receiver optically", page 37.
4	Install the sender and receiver.	see "Fitting the sender and receiver on the T-piece", page 38.
5	Connect the sender and receiver with a signal cable.	see "Connecting the sender and receiver", page 39.

Step	Procedure	Reference
6	**When using the GPP measuring probe:** Connect the power supply.	Wait for at least 30 minutes warming up time before pushing the measuring probe into the duct.
	When using the GMP measuring probe: Ensure the purge air supply is in operation.	See the purge air supply Operating instructions
7	Connect signal lines and power supply.	see "Connection overview for standard version", page 30.
8	Calibrate the measuring device.	see "Calibration", page 39.
9	Install the measuring device on the duct.	see "Fitting the measuring device on the duct", page 46.
10	Create connections to customer data system. Configure according to customer specifications.	see "Parameter", page 55.
11	Fit the weather protection hood (optional).	see "Installing the weatherproof cover", page 47.

7.5 Removing the transport safety devices of the measuring probe

7.5.1 Removing the transport safety device of the GMP measuring probe

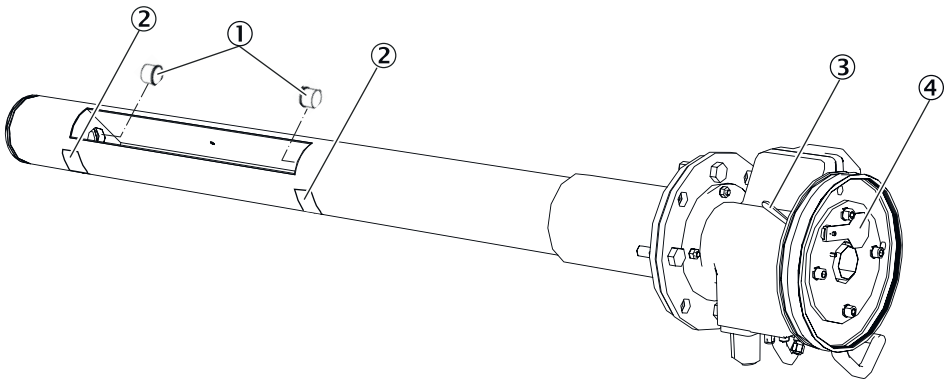


Figure 15: Transport safety device of the GMP measuring probe

① 2 × protective caps to cover the optics
② Protective stickers
③ Lever of locking device
③ Set the locking device to the “close” position

Steps

1. Remove the protective stickers.
2. Remove the protective caps.
3. Store the transport safety device.

7.5.2 Removing the transport safety device of the GPP measuring probe

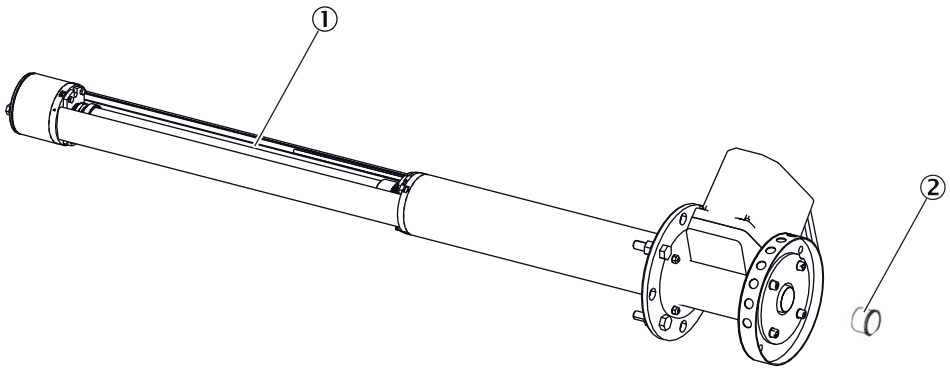


Figure 16: Transport safety device of the GPP measuring probe

① Filter with protective cover
② Protective cap for covering

Steps

1. Remove the protective cover of the filter.
2. Remove the protective cap.
3. Store the transport safety device.

7.6 Fitting the T-piece on the measuring probe

NOTE
The measuring probe is normally delivered from the factory already fitted with the T-piece.

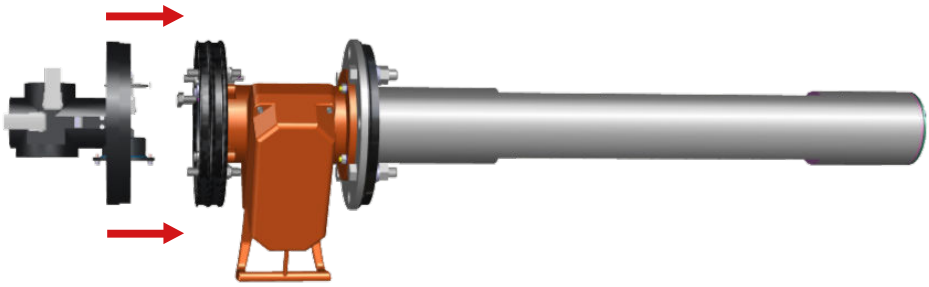
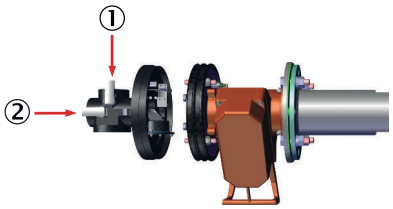


Figure 17: Fitting the T-piece on the measuring probe

7.7 Aligning transmitter and receiver optically

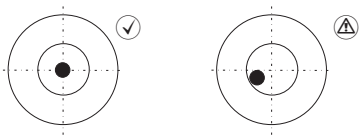
Align sender

1. Fit the optical adjustment device on the T-piece.
   - Fit the adjustment device with **light source** to the sender position.
   - Fit the adjustment device with the **focusing screen** to the receiver position.



① Sender position
② Receiver position

2. On the sender, tighten the two nuts for horizontal adjustment (X) and vertical adjustment (Y) so that the light point shown is positioned centered on the focusing screen of the adjustment tube.



Align receiver

1. On the receiver, tighten the two nuts for horizontal adjustment (X) and vertical adjustment (Y) so that the light point shown is positioned centered on the focusing screen of the adjustment tube
2. Control the adjustment in both directions.

7.8 Fitting the sender and receiver on the T-piece

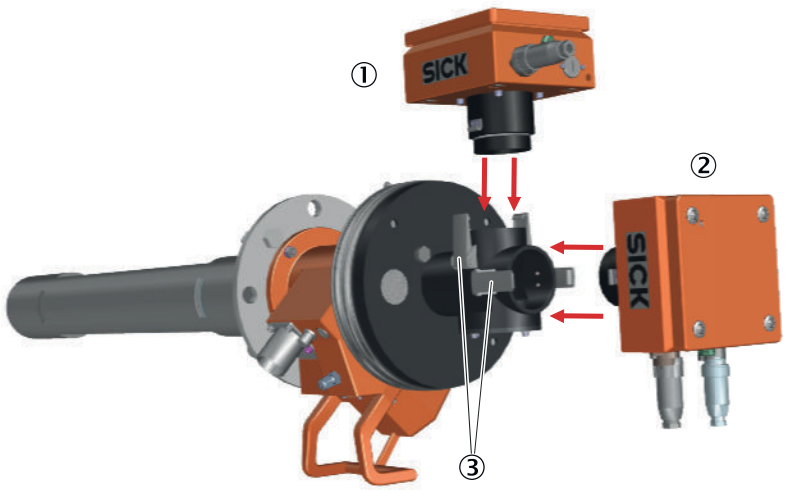


Figure 18: Fitting the sender and receiver on the T-piece

① Sender
② Receiver
③ Quick-release fasteners

Procedure

1. Position the sender on the T-piece and fasten it with the quick-release fasteners.
2. Position the receiver on the T-piece and fasten it with the quick-release fasteners.

7.9 Connecting the sender and receiver

NOTE
The two connector plugs of the connection line are configured to fit only on the corresponding port. The connection sequence is unimportant.

Figure 19: Connecting the sender and receiver

① Connection on GM901 sender
② Connection on GM901 receiver

7.10 Calibration

Perform the appropriate calibration procedure depending on the device variant:

- For GM901-02 standard: see "Calibrating the GM901-02 standard", page 39.
- For GM901-02 with extended calibration: see "Calibrating the GM901-02 with extended calibration", page 40.

7.10.1 Material required

- Test tool kit for SPAN test
- A test cell with a concentration of at least 80% of the highest desired measuring range.
  For example, if the desired measurement range is 0 - 10000 ppm, a test cell with the equivalent of at least 8000 ppm is required.

7.10.2 Calibrating the GM901-02 standard

Prerequisite

Only for devices with corresponding type code and temperature range, see "Device variants", page 15.

Procedure

1. Perform zero adjust, see "Zero adjust", page 40.
2. Enter the offset correction of the zero point measurement, see "Changing the calibration values", page 64.

3. Perform manual SPAN test (optional), see "Manual SPAN test (optional)", page 41.
4. Enter SPAN value, see "Changing the calibration values", page 64.

7.10.3 Calibrating the GM901-02 with extended calibration

Prerequisite

Only for devices with corresponding type code and temperature range, see "Device variants", page 15.

Adjustment of reference value "SPAN" for high temperatures

Analyzers with extended or high temperature calibration (430 °C) have a single calibration curve over the entire operating range. To optimize the accuracy of the analyzer at higher temperatures, a further calculation is required before entering the zero point or "SPAN" value.

This additional calculation is necessary to better compensate for the difference between the calibration of the gas cell at ambient temperature and the operating temperature of the high temperature process.

The additional calculation is **not** necessary for measured values below 1600 ppm CO because the effects of temperature changes are not as pronounced.

Preparatory work

1. Press "cal".
2. Set the default temperature value to the actual ambient temperature, see "Parameter settings for the external temperature sensor PT1000", page 59.
3. Set "Temperature Input External" to "No", see "Setting the use of an external temperature sensor", page 60.
4. Make sure algorithm coefficients C3 to C6 are set to "1". Do **not** set these values, see "Setting the use of an external temperature sensor", page 60.
   Contact SICK Service when this is not the case.
5. Set SPAN value to "1" see "Changing the calibration values", page 64.

Procedure

1. Perform zero adjust, see "Zero adjust", page 40.
2. Enter the offset correction of the zero point measurement, see "Changing the calibration values", page 64.
3. Perform manual SPAN test (optional), see "Manual SPAN test (optional)", page 41. Note the SPAN value.
4. Perform calculation for high temperature SPAN value:
   - Use Calculation Table "Span offset calculation for units with extended calibration" (available at **www.sick.com/GM901/other downloads/**).
   - Enter the noted SPAN value and the process temperature in the Calculation Table.
   - Note the high temperature SPAN value.
5. Enter the high temperature SPAN value, see "Changing the calibration values", page 64.
6. Reset temperature parameters to reflect process conditions, see "Parameter settings for the external temperature sensor PT1000", page 59.

7.11 Zero adjust

CAUTION
A zero point check or adjustment must be carried out before every initial and new commissioning.

NOTICE
The zero adjust must be carried out in a CO-free environment

- The zero adjust can be carried out directly at the sampling point when the plant is switched off.
- The zero adjust must be carried out outside the duct when the plant is in operation.

NOTE
When using the GPP measuring probe

- Purge the measuring probe with N_2.
- Allow sufficient time to clean the measuring probe.
- At least 20-60 mbar above process pressure

NOTE
The warming up phase for the measuring system takes 30 minutes. The measuring system is first stable after this period.

Prerequisites

- Ensure the optical alignment has been carried out on the measuring probe. Correct if necessary.

Performing zero adjust

1. Press "cal".
2. Menu navigation for zero adjust (select zero adjust), see "Performing zero adjust", page 70.
   The zero point adjustment is running while "Zero Measuring" is shown in the control unit display.
3. When zero adjust has completed:
   - Refit the GMP measuring probe with the measuring device on the flange, resp.
   - Terminate the N_2 purge process (GPP measuring probe).

7.11.1 Manual SPAN test (optional)

Manual SPAN test (optional) for linearity control

NOTE
This test requires the optionally available CO cell and holder, see "Accessories ", page 20.

7.11.1.1 Determining the test values

The test concentration, this means the value of the test cell, is determined with the following formula:

TW [ppm × m] = MB [ppm] × x × S [m]

TW =	Test value
MB =	Upper measuring range value
S =	Measuring path
x =	Test point location

NOTE
To convert from mg/m³ to ppm: 1 mg/m³ N = 0.8 ppm

Example:

Example values:
MB = 1500 ppm
S = 1 m
Test point at 70% of MBx = 0.7

Calculation:
TW [ppm × m] = MB [ppm] ×x × S [m]
TW [ppm × m] ×= 1500 [ppm] ×0.7 × 1 [m]
TW [ppm × m] ×= 1050 [ppm × m]

Result: Test value of the test cell: 1050 × m

NOTE
Possible deliverable test cell:

- 1600 × m
- 4000 × m
- 10000 × m

7.11.1.2 Carrying out a SPAN test

Prepare the SPAN test, see "Zero adjust", page 40.

SPAN test menu navigation, see "Performing a manual SPAN test", page 71.

1 Attach the test cell holder on the sender.

NOTICE
Do not insert a cell filled with CO yet.

2 To start the SPAN test, press "cal" on the operator panel of the control unit, see "Performing a manual SPAN test", page 71.
3 Follow the menu instructions.

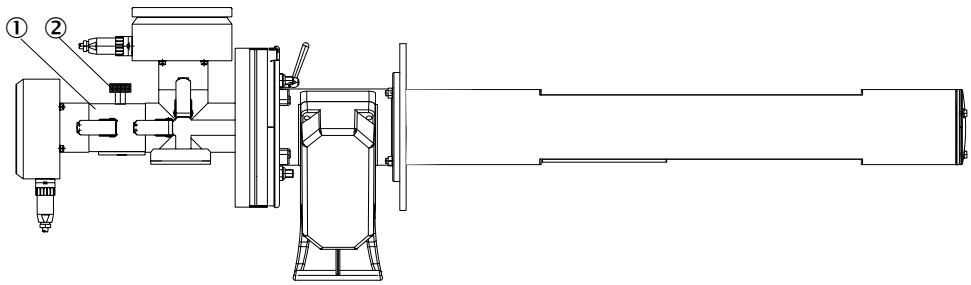


Figure 20: GM901-02 with holder for test cell

① Input compartment for CO cell
② Holder for test cell

7.11.2 Online SPAN test according to EPA Guidelines

Criterion for EPA-compliant SPAN test

- GPP (Gas-Permeation-Probe) with
  - Connection for gas inlet
  - Connection for pressure monitoring in the gas measuring chamber

Filling test or zero gas creates an overpressure in the filter element. As soon as the overpressure is high enough, it presses the exhaust gas out of the filter. This switches the gas flow through the filter element to the opposite direction. This method serves to determine the zero point and various other test points when using suitable test gases.

7.11.2.1 Carrying out a manual EPA SPAN test

Material required	Characteristics
Test gas cylinders according to the applicable EPA Guideline (N2 and test gases)	The concentration depends on the upper measuring range values to be tested
Adjustable pressure regulator for zero gas and SPAN gas	With adjustable pressure valve
1/8" line with Swagelok screw fitting	Length: Approx. 1.5 m
Pressure gauge	• An absolute pressure of 900–1100 mbar (equivalent to the pressure in the duct) • Resolution: 0.5 mbar • 1/8" Swagelok connection

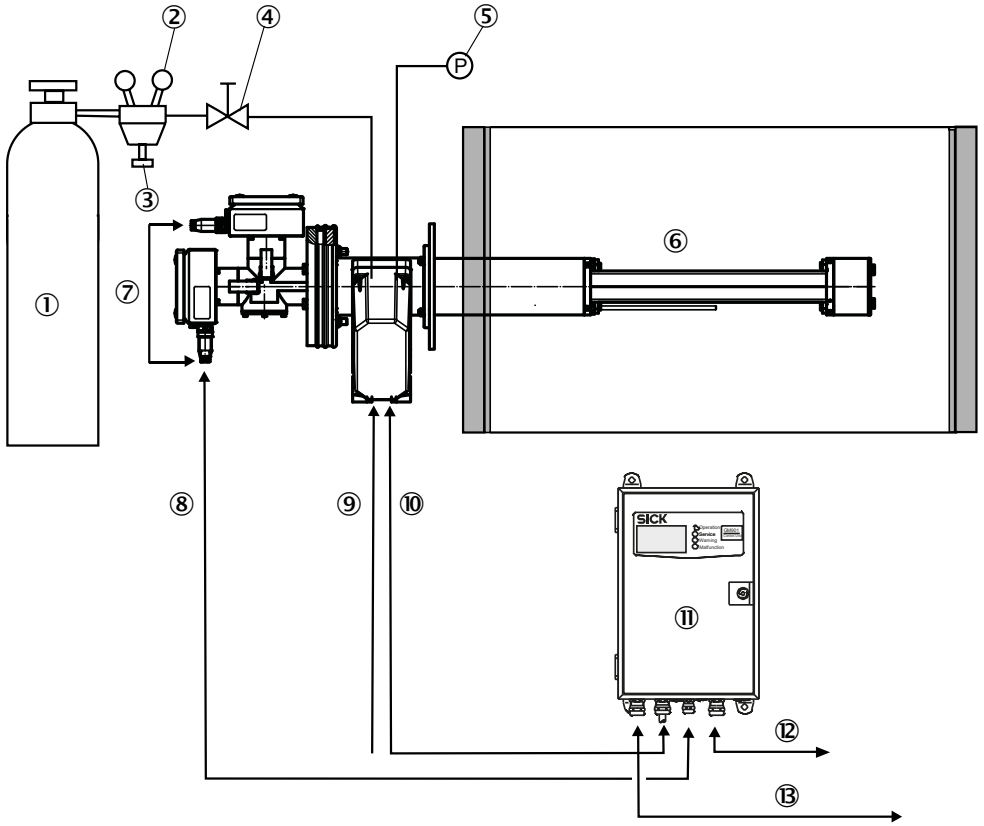


Figure 21: Equipment for the manual SPAN test

① Test gas
② Pressure gauge 1
③ Pressure regulator
④ Shut-off valve
⑤ Pressure gauge 2
⑥ Measuring probe
⑦ Sender-receiver connection
⑧ 2 m line (CAN bus and power supply)
⑨ 115 V / 230 V
⑩ Temperature sensor
⑪ Control unit
⑫ Analog/status signals
⑬ 115/230V

Preparations

1 Connect the pressure regulator and pressure gauges to the gas cylinders, secure the gas cylinders.
2 Close the shut-off valve.
3 Fit the hose between the pressure regulator and one of the two GPP connections.
4 Set the pressure on the gas cylinder to the calculated primary pressure.

NOTE
Air is suctioned into the partial vacuum channels as soon as the gas connection is opened. The measured values approach zero depending on the partial vacuum present.

5 Connect a pressure gauge to the second gas connection.
6 Read off the current measured values on the control unit display.

Measurement

1 Start the EPA-SPAN test per menu, see "SPAN test according to EPA Guidelines", page 72, or digital input.
2 Set T90 to 10 seconds.
3 Open the shut-off valve fully.
4 Observe the measured values on the display until the value is stable.
5 Read off the pressure on the second pressure gauge to correct measurement when necessary.
6 Close the valve on the pressure reducer and the gas cylinder.
7 Now terminate data recording and start the evaluation.
8 Reset the T90 value.
9 Return to measuring mode.
10 When required, repeat the procedure (preparation and measurement) with further test gases.

7.11.2.2 Carrying out a thermal adjustment

The cold test gas flow withdraws energy from the measuring probe body as it flows through the device. Long purge times can therefore effect a difference between the test gas temperature and the process temperature. The following factors influence the difference:

- Throughflow volumes of the test gas
- Measurement duration
- Gas velocity in the process

This is the reason why it is recommended to determine the SPAN points first and then the zero point because a temperature drop does not influence the zero point measurement. A break between the measurements and the reduction in gas flow reduce this effect.

7.11.2.3 One-off preliminary measurement/determining the basic setting

Each GPP measuring probe has certain production tolerances. The ideal pressure parameters for the test must be determined once before the first measurement. The GPP must be installed in the duct for this test because the length of the measuring chamber and velocity of the exhaust gases in the duct also influence the initial pressure settings.

Carrying out a one-off determination of the basic settings

1 Prepare the gas (e.g. N_2 or air), see "Carrying out a manual EPA SPAN test", page 43.
2 Start the EPA test, see "Carrying out a manual EPA SPAN test", page 43.

3 Set T90 to 10 seconds.
4 Observe the display.
5 Set the pressure regulator on the gas cylinder to 0 bar and observe the measured values.
6 Set the pressure on the pressure regulator to approx. 3 bar and observe the measured values.
7 If zero is not reached within a certain time (depending on the T90 settings of the measuring system), increase the pressure in steps until zero is stable.
8 When zero is stable, reduce the pressure in small steps again and observe the display.
9 Increase the pressure again by 0.5 bar when the display rises above zero again.
10 Note the values on gauges 1 and 2.

NOTE

These values can be used later as prelimiinary pressure settings.

The correct test gas pressure is typically between 4 mbar and 10 mbar above the process pressure.

11 Reset the T90 value.
12 Close the shut-off valve and gas cylinder.
13 Return to measuring mode.

7.11.3 Automatic SPAN test

The calibration test is carried out with different equipment depending on customer requirements.

NOTICE

Valve control as well as triggering a SPAN test must be carried out with an automatic calibration test unit from the customer.

Equipment for an automatic SPAN test

Low requirements

1 Determine the pressure settings required before starting the test.
2 Connect test gas via solenoid valves to the GPP inlet.
3 Use a gauge to set the preliminary pressure settings on the gas cylinder.

NOTE | Changes to the flow resistance in the filter can cause pressure rises or drops that then influence measuring precision (gas law).

High requirements

1 Connect test gas via solenoid valves and adjustable pressure regulator to the GPP inlet.
   - The pressure regulator serves to keep the pressure in the measuring chamber constant.
   - The control signal is generated by comparing the fine pressure measurement in the chamber with a value previously specified.

NOTE | Changes in the filter material influence the time required for purging.

7.12 Fitting the measuring device on the duct

Overview

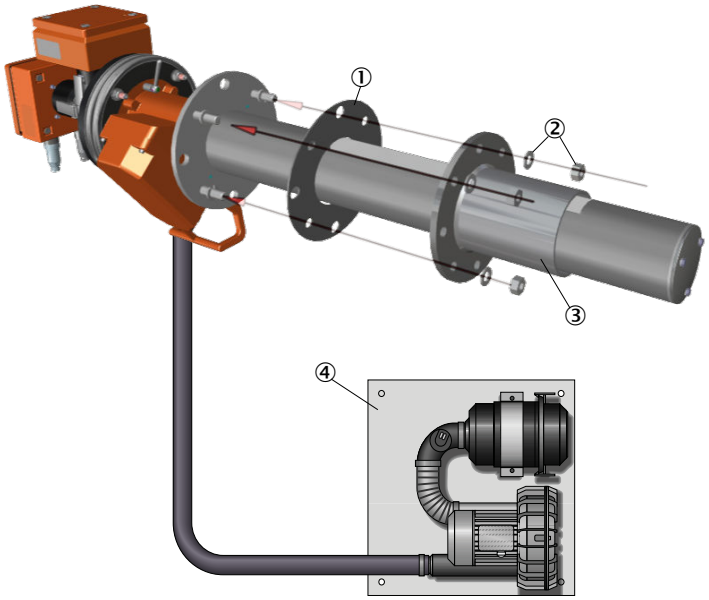


Figure 22: Installing the device on the duct flange

① Seal
② Screws M16x60 with nuts and washers
③ Flange with tube (duct-side)
④ Purge air unit SLV4 (only for GMP measuring probe)

Important information

DANGER
Health risk through hot or toxic gases/dusts in the measuring channel

The measuring duct can contain hot or toxic gases or dust deposits which can escape when opening the duct-side flange. Even if the measuring duct is out of operation during the installation, escaping gases can lead to severe damage to health.

- Always put the measuring duct out of operation for the duration of the installation.
- If required, purge the measuring duct with ambient air before starting installation work.
- Always wear suitable or company-specified protective clothing during installation work.

NOTICE
Device damage through incorrect/missing insulation of the duct when the measuring channel is hot

- When the measuring channel is hot, plan the duct and flange insulation so that the device is protected against high temperatures.

NOTICE
Avoid damage to the device

For the measuring probes:

- Measuring probe **GMP**: Ensure uninterrupted purge air feed to the measuring probe!
- Measuring probe **GPP**: Ensure uninterrupted power supply to the measuring probe to heat the optical surfaces!

Procedure

1. If present, remove the cover of the duct-side flange with tube.
2. Insert the measuring probe with fitted sender-receiver unit in the duct-side flange with tube.
   NOTICE | A seal must be present between the device flange and the duct flange.
3. Fit the measuring probe on the duct-side flange. Use the supplied mounting kit.

7.13 Installing the weatherproof cover

The weatherproof cover is installed in two steps:

1 Fit the installation plate on the flange of the purge air fixture and the measuring probe flange.
2 Place the weatherproof cover on the installation plate.

1 **Fit the installation plate on the flange of the purge air fixture:**
- ▶ Lay the weatherproof cover upside down on the floor.
- ▶ Open and unhinge the locks on both sides.
- ▶ Pull the installation plate upwards and remove it from the cover.

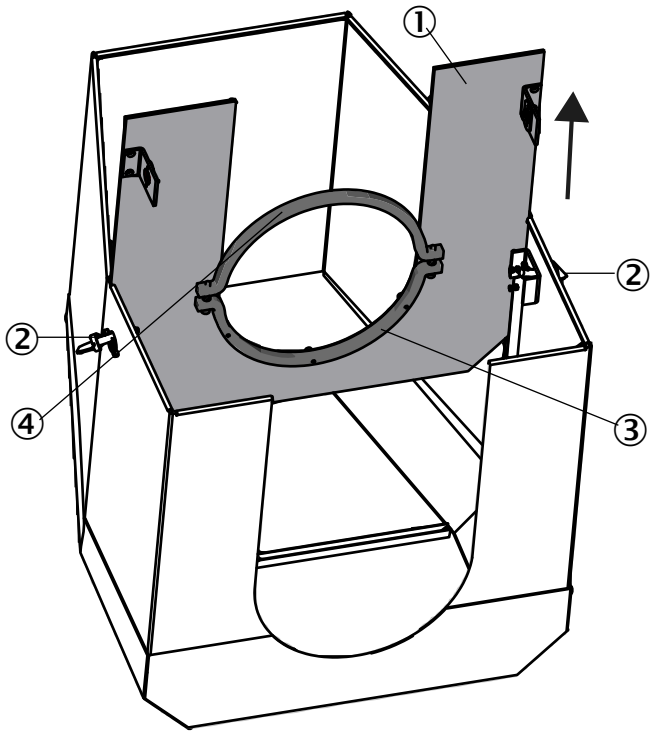


Figure 23: Removing the installation plate

① Installation plate
② Lock
③ Top mounting ring
④ Bottom mounting ring

- ▶ Remove the bottom mounting ring.
- ▶ Place the installation plate on the rubber band of the purge air fixture from the top.
- ▶ Position the mounting ring on the side of the purge air fixture.
- ▶ Screw the lower mounting ring to the upper mounting ring.

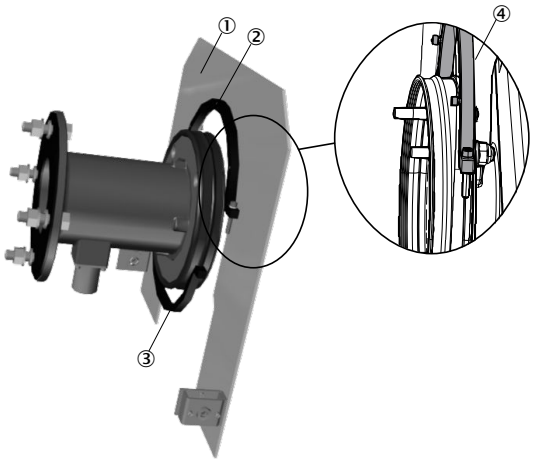


Figure 24: Detail view: Positioning the top mounting ring on the side of the purge air fixture

① Installation plate
② Top mounting ring
③ Bottom mounting ring
④ Detail view: Positioning the top mounting ring on the side of the purge air fixture.

2 **Place the weatherproof cover on the installation plate:**
- ▶ Position the cover on the installation plate from the top.
- ▶ Engage the locks and close again.

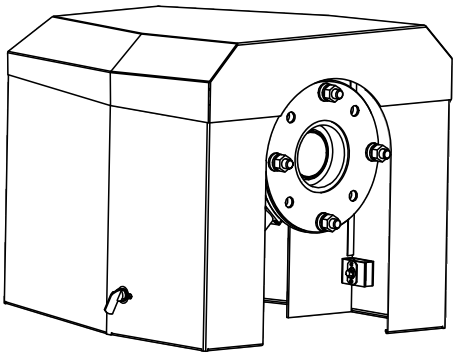


Figure 25: Placing the weatherproof cover on the installation plate

7.14 Preset parameter values

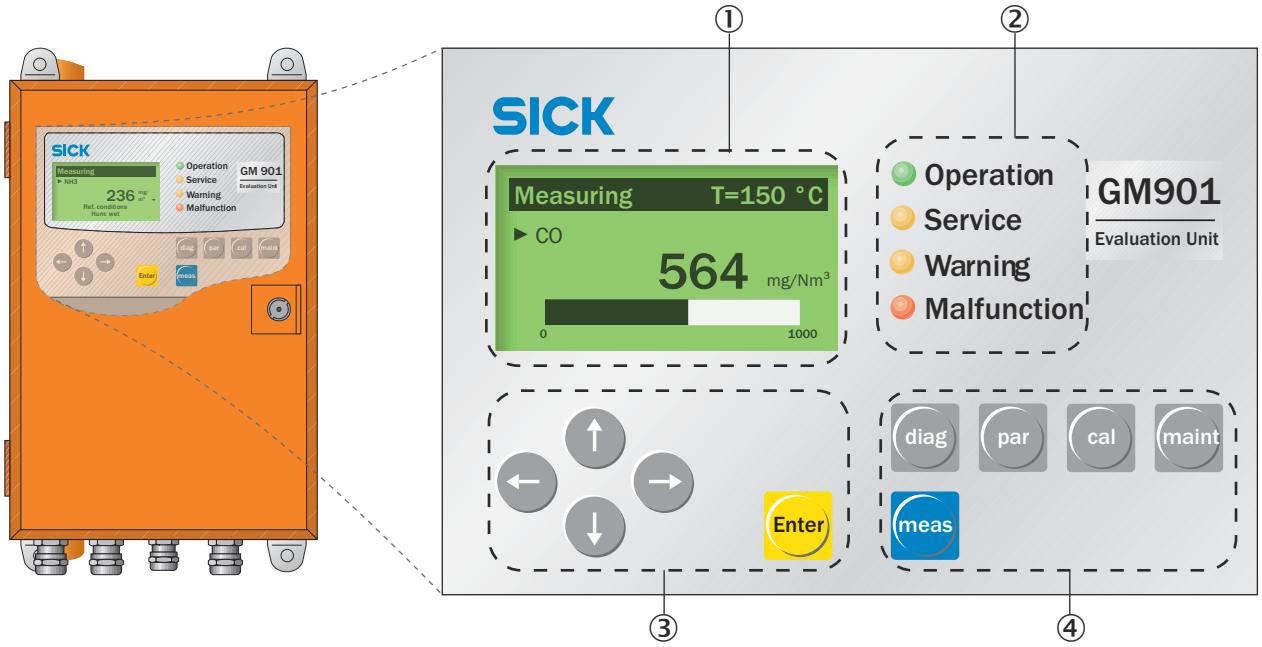
Parameter settings	
Physical unit	mg/Nm³
Normalization	wet
Response time	24 s (parameter setting) Note: The actual total response time is 30 s because the preset value (11) of the Median filter extends the response time by 6 s.
Measuring range	1000 mg/Nm³
Limit value	1000 mg/Nm³

Measuring distance	
Active measuring distance	250 or 500 mm
Temperature	
Substitute	150 °C
External	Analog in
Scale low	0 °C
Scale high	250 °C
Input low	4.0 mA
Input high	20.0 mA
Humidity	
Substitute	00.0 % (Vol.)
Pressure	
Substitute	1013 hPa (change the value to the current value when measuring in ppm)
Analog out	
Live zero	4 mA
Calibration	
Span	1.00
Zero	+000
Median Filter	
Size	11 Note: The preset value 11 adds 6 seconds to the setting value (see "Median Filter", page 65.).
Device parameters	
Serial number	Current software version
Evaluation unit	Current software version
Configuration	Type code of the control unit
Service	
C1	Determined during zero adjust
C2	Determined during zero adjust
C3	Data specified at the factory and assigned to the GM901-02 receiver (individual, per device).
C4	
C5	
C6	
C7	
C8	

8 Operation

8.1 Operating and display elements

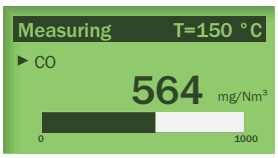
8.1.1 Control unit operating panel



①	Display	
②	Status LEDs	
③	Arrow buttons to edit units/digits • Move the cursor • Increase/decrease digits • Abort and return button (arrow left)	
	Enter	Confirm set value
④	Function buttons and submenus	
	"diag": Diagnosis	see "Diagnosis", page 54
	"par": Parameter	see "Parameter", page 55
	"cal": Calibration	see "Calibration", page 70
	"maint": Maintenance	see "Maintenance", page 73
	"meas": Measurement	see "Measuring mode", page 54

1 The basic setting parameters are default values. All individual settings, including calibration parameters, are overwritten.

8.1.2 Display



T=150 °C	Measured value of an external temperature sensor or an internal adjustable default value
564	Current measured value
0	Measuring range start value, adjustable
1000	Measuring range end value, adjustable
t	Limit value, adjustable

8.1.3 Status LEDs

Table 11: Significance of Status LEDs

LED	Significance
OPERATION	• Measuring mode • Device is switched on. Power voltage available.
SERVICE	• Service mode
Warning	• Warning message • At least one warning message pending. • Read the warning message, see Diagnosis mode (diag)
MALFUNCTION	• Device malfunction • At least one malfunction message pending. • Read the malfunction message, see Diagnosis mode (diag)

8.2 Setting the display contrast

The rotary potentiometer for setting the display contrast is located above the “Digital Out” terminal block.

▶ Use a 2 mm precision screwdriver to adjust the display contrast setting.

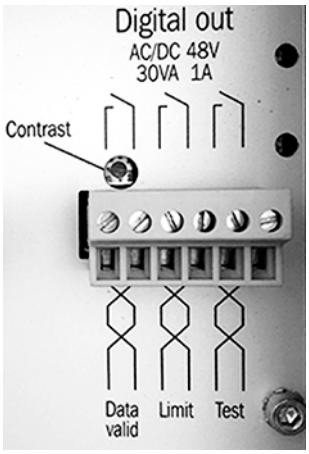


Figure 26: Rotary potentiometer for display contrast

8.3 Entering the password

- The password is always prompted for when a parameter is to be changed.
- The password is "1234".
- The password remains active for 30 minutes.

DANGER

Endangerment of system safety through parameters with incorrect settings

Entering the password allows parameters to be changed. Unauthorized changes to safety-relevant parameters can lead to unsafe operation of the measuring system and can thereby endanger plant safety.

▶ Password entry only by technicians.

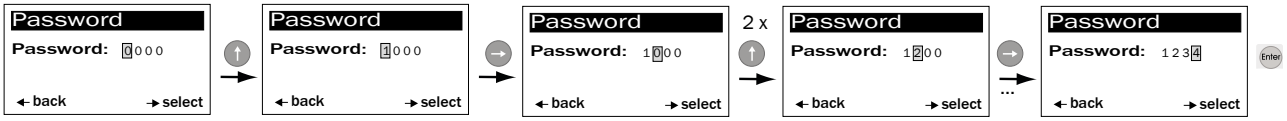


Figure 27: Entering the password

9 Menus

9.1 Safety

CAUTION
Hazard for persons and plant through unsafe operation of the measuring device

If the device is or could be in an unsafe state:

- ▶ Put the device out of operation.
- ▶ Disconnect the device from the main supply voltage and signal voltage.
- ▶ Secure the device against unallowed or unintentional start-up.

9.2 Measuring mode

The measuring mode display is shown during active measuring operation.

- The "Operation" Status LED is green.
- Explanations of the measuring mode display see "Display", page 51

The operator can switch directly to the measuring mode display from every menu item:

- ▶ Press “meas”.

9.3 Diagnosis

Menu "Diagnosis" serves to view the following data:

- Malfunction: Malfunction messages
- Warning: Warning messages
- Sensor values: Displays sensor measured values for error diagnosis

- ▶ Press "diag" on the operator panel of the evaluation unit to call up the submenu items.

9.3.1 Viewing error messages

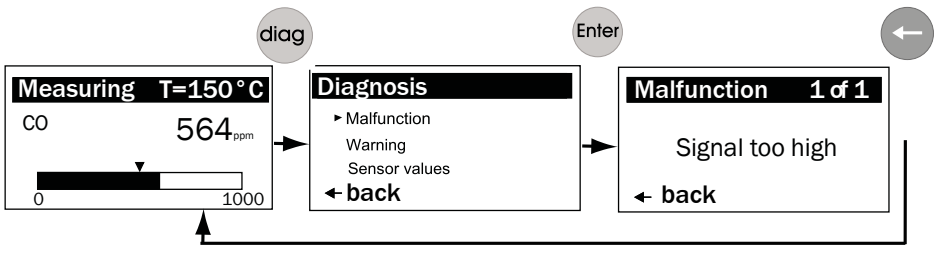


Figure 28: Viewing error messages (example)

NOTE
Table of all error messages, see "Malfunction messages", page 80.

9.3.2 Viewing warning messages

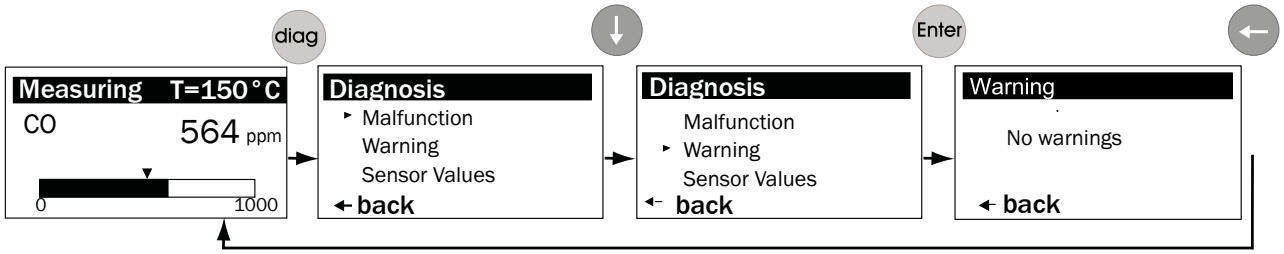


Figure 29: Viewing warning messages (example)

NOTE
Table of all warning messages, see "Warning messages", page 79.

9.3.3 Viewing sensor values

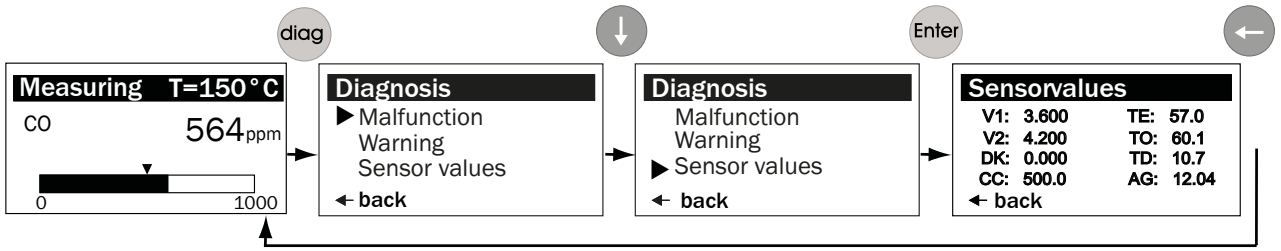


Figure 30: Viewing sensor values (example)

NOTE
Table of standard sensor values, see "Sensor values for trouble-free operation", page 84.

9.4 Parameter

The parameters currently set can be called up and changed in submenu item "Parameter settings".

Calling up parameter settings

The following parameters are available:

1 Physical Unit: see "Changing the physical unit", page 56.
2 Normalization: see "Setting the humidity correction", page 57.
3 Response Time: see "Changing the response time", page 57.
4 Measuring Range: see "Changing the measuring range", page 58.
5 Limit Value: see "Changing the limit value", page 59.
6 Meas.Distance: see "Changing the active measuring path", page 59.

7 Temperature: see "Parameter settings for the external temperature sensor PT1000", page 59.
8 Humidity: see "Setting the humidity content in sample gas", page 63.
9 Pressure: see "Setting the sample gas pressure", page 63.
10 Analog Out: see "Changing the Live Zero value of the analog output (Analog Out)", page 64.
11 Calibration: see "Changing the calibration values", page 64.

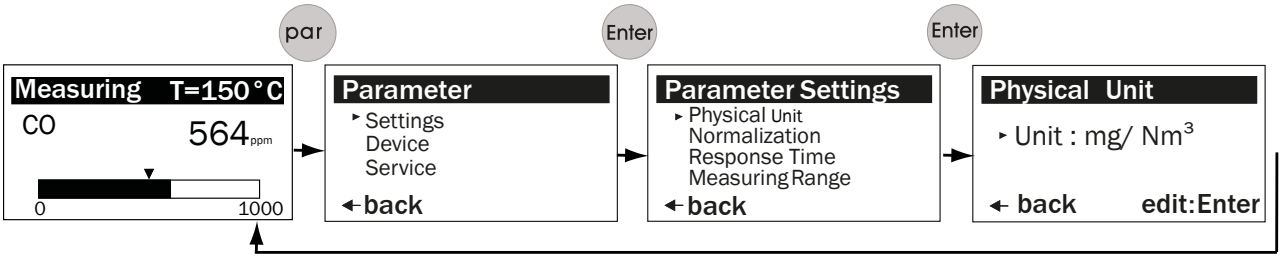


Figure 31: Path from Measuring Screen to change parameters (example)

Changing parameter settings

- ▶ Press "Enter" in the display for current parameter setting.
- ▶ Enter the password, 8.3 "Entering the password", page 52
- ▶ Press "Left arrow" after entering the new value.

Menu "Parameter Settings" is displayed again.

9.4.1 Changing the physical unit

Submenu item "Physical Unit" serves to set the physical unit for the CO value output. Available are:

- ppm
- mg/m³N
- mg/m³

1 Follow the menu path as described, see "Parameter", page 55.
2 Enter the password, see "Entering the password", page 52.
3 Enter the changes.
4 Confirm value with "Enter".
5 Press the "Left arrow" to return to menu item "Parameter Settings".

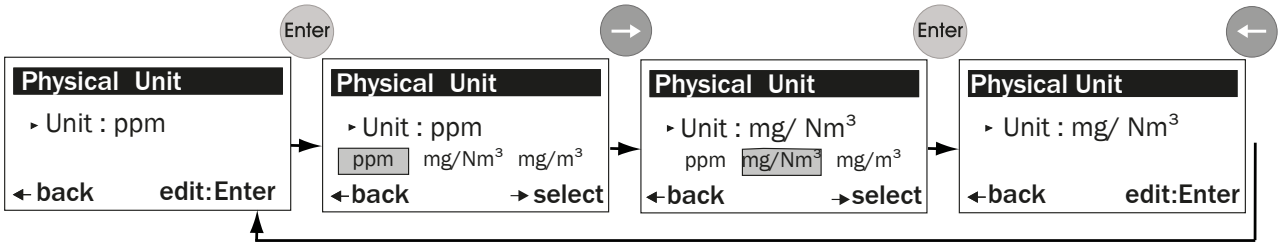


Figure 32: Changing the physical unit

9.4.2 Setting the humidity correction

Submenu item "Normalization" serves to set whether the measured value is output calculated as "wet" or "dry". The default value entered for H_2O is used here, see "Setting the humidity content in sample gas", page 63.

The damp correction is activated when "wet" is set. Available are:

- dry
- wet

1 Follow the menu path as described, see "Parameter", page 55.
2 Enter the password, see "Entering the password", page 52.
3 Enter the changes.
4 Confirm value with "Enter".
5 Press the "Left arrow" to return to menu item "Parameter Settings".

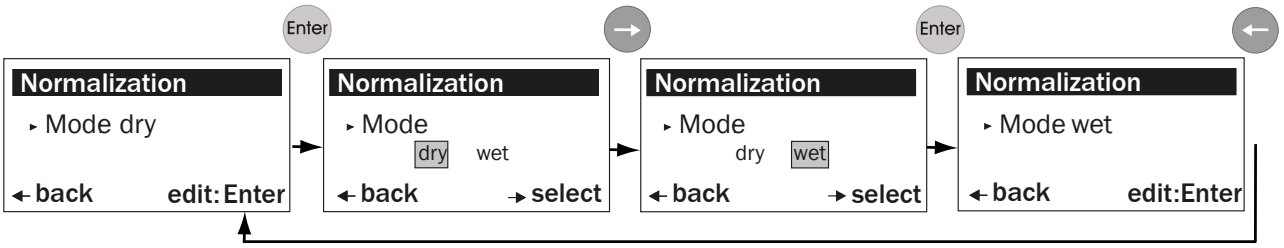


Figure 33: Selecting the humidity correction

9.4.3 Changing the response time

Submenu item "Response Time" serves to change the response time.

NOTE

Basic factory setting: 24 s.

Allowable values: 5 ... 360 s.

The actual total response time is 30s because the preset value (11) of the Median filter extends the response time by 6 s.

Contact SICK Service when you are not sure which response time should be set.

1 Follow the menu path as described, see "Parameter", page 55.
2 Enter the password, see "Entering the password", page 52.
3 Enter the changes.
4 Confirm value with "Enter".
5 Press the "Left arrow" to return to menu item "Parameter Settings".

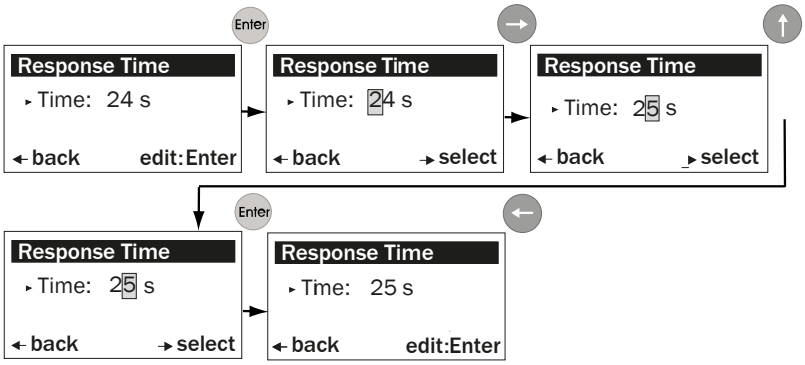


Figure 34: Changing the response time (example)

9.4.4 Changing the measuring range

Submenu item "Measuring Range" serves to change the measuring range currently set.

NOTE

Factory setting: 1000 ppm

Allowable values on the device: 100 ... 60 000 ppm

Contact SICK Service when you are not sure which value should be set for your measuring range.

1 Follow the menu path as described, see "Parameter", page 55.
2 Enter the password, see "Entering the password", page 52.
3 Enter the changes.
4 Confirm value with "Enter".
5 Press the "Left arrow" to return to menu item "Parameter Settings".

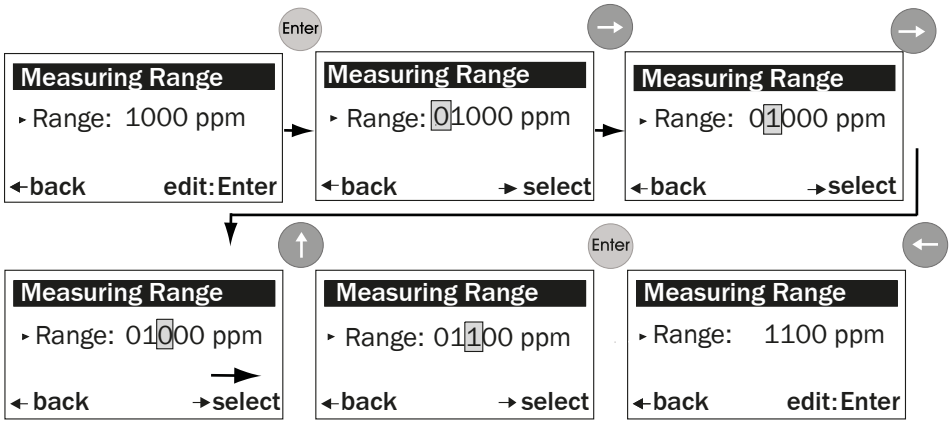


Figure 35: Changing the measuring range (example)

9.4.5 Changing the limit value

Submenu item "Limit Value" serves to change the limit value currently set.

NOTE

Factory setting: 1000 ppm.

Attention: The value must be within the selected measuring range.

Contact SICK Service when you are not sure which value should be set for your measuring range.

1 Follow the menu path as described, see "Parameter", page 55.
2 Enter the password, see "Entering the password", page 52.
3 Enter the changes.
4 Confirm value with "Enter".
5 Press the "Left arrow" to return to menu item "Parameter Settings".

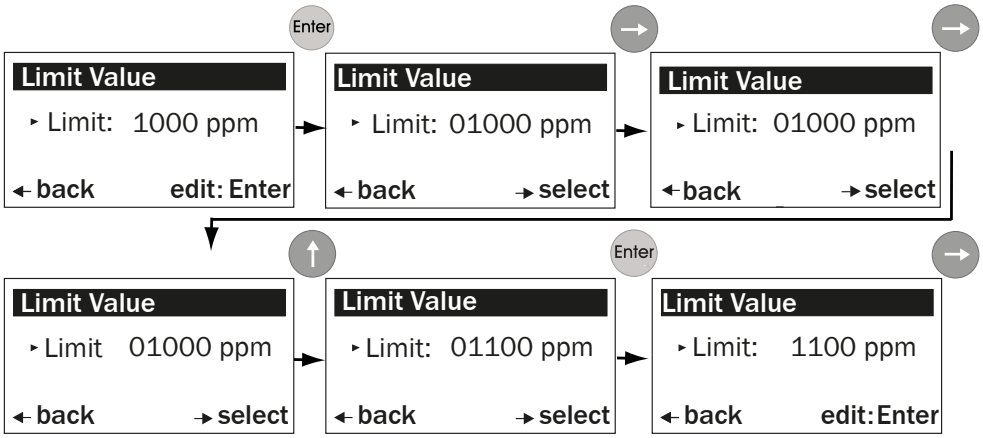


Figure 36: Setting the limit value (example)

9.4.6 Changing the active measuring path

Submenu item "Meas.Distance" serves to enter or change the value for the active measuring path.

WARNING

Adjusting the value for the active measuring path can lead to incorrect measuring results

The value set at the factory corresponds to the measuring path of the delivered measuring probe.

▶ Contact SICK Service when you want to change the values.

9.4.7 Parameter settings for the external temperature sensor PT1000

Submenu item "Temperature Input" serves to check and change the following settings.

- Substitute: Default temperature value when the temperature sensor fails
- External: Using an external temperature sensor
- Scale Low: Lower limit value for the sample gas temperature
- Scale High: Upper limit value for the sample gas temperature
- Input Low: mA signal for the lower limit value of the sample gas temperature
- Input High: mA signal for the upper limit value of the sample gas temperature

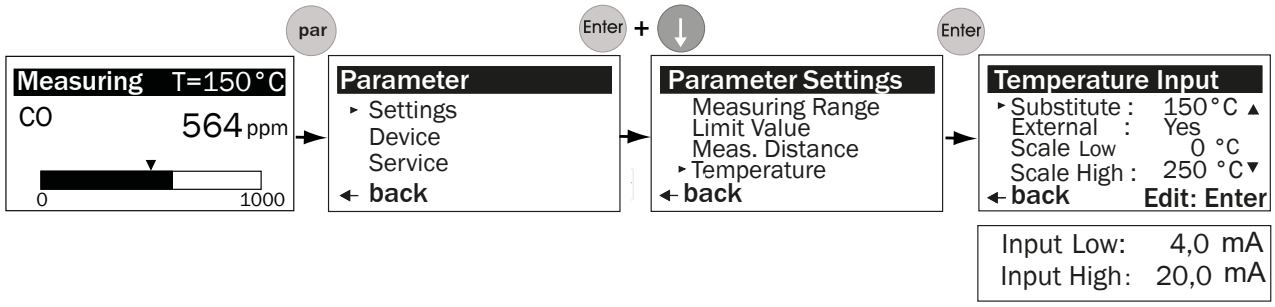


Figure 37: Setting parameters for temperature sensor PT1000

9.4.7.1 Changing the default temperature value

Submenu item "Substitute" serves to enter the default temperature value. The measuring system uses this value as temperature value when:

- The external temperature sensor fails.
- The temperature measurement is outside the configured upper limit value. The device outputs a warning message in this case.

NOTE

Factory setting: 150 °C

Allowable values: ? ... 430 °C

Contact SICK Service when you are not sure which temperature value should be set.

1 Follow the menu path as described, see "Parameter settings for the external temperature sensor PT1000", page 59.
2 Enter the password, see "Entering the password", page 52.
3 Enter the changes.
4 Confirm value with "Enter".
5 Press the "Left arrow" to return to menu item "Parameter Settings".

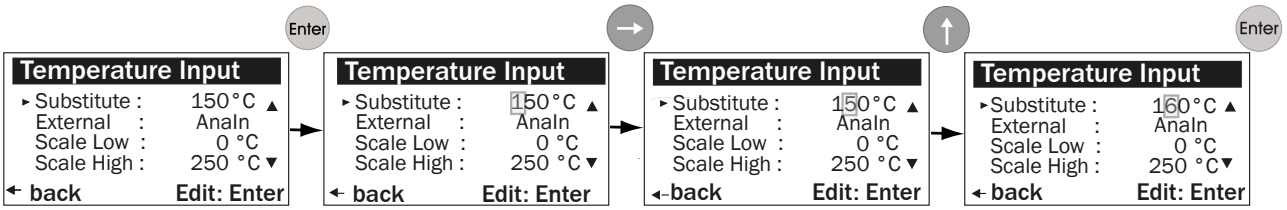


Figure 38: Setting the default temperature setting (example)

9.4.7.2 Setting the use of an external temperature sensor

Submenu item "External" serves to set a "Yes"/"No" switch as to whether an external temperature sensor (PT1000) is used. The signal runs via an analog input. "AnaIn" is shown when the switch is set to "Yes".

1 Follow the menu path as described, see "Parameter settings for the external temperature sensor PT1000", page 59.
2 Enter the password, see "Entering the password", page 52.
3 Enter the changes.
4 Confirm value with "Enter".
5 Press the "Left arrow" to return to menu item "Parameter Settings".

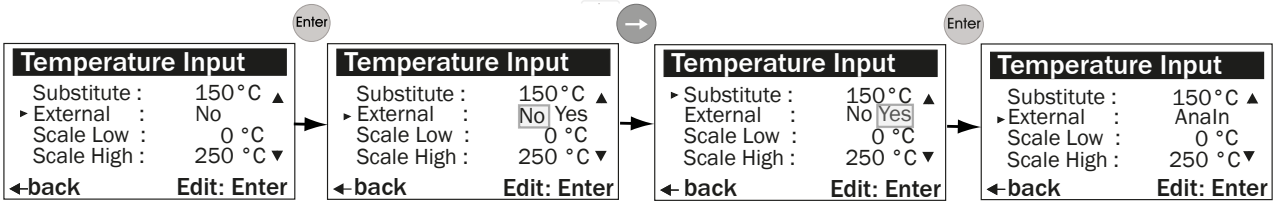


Figure 39: Activating the use of an external temperature sensor

9.4.7.3 Setting the temperature range: Lower limit value

Submenu item "Scale Low" serves to set the lower limit value for the sample gas temperature. The lower limit value corresponds to Live Zero.

NOTE

Factory setting: 0 °C

Allowable values: See Technical Data

Contact SICK Service when you are not sure which limit value should be set.

1 Follow the menu path as described, see "Parameter settings for the external temperature sensor PT1000", page 59.
2 Enter the password, see "Entering the password", page 52.
3 Enter the changes.
4 Confirm value with "Enter".
5 Press the "Left arrow" to return to menu item "Parameter Settings".

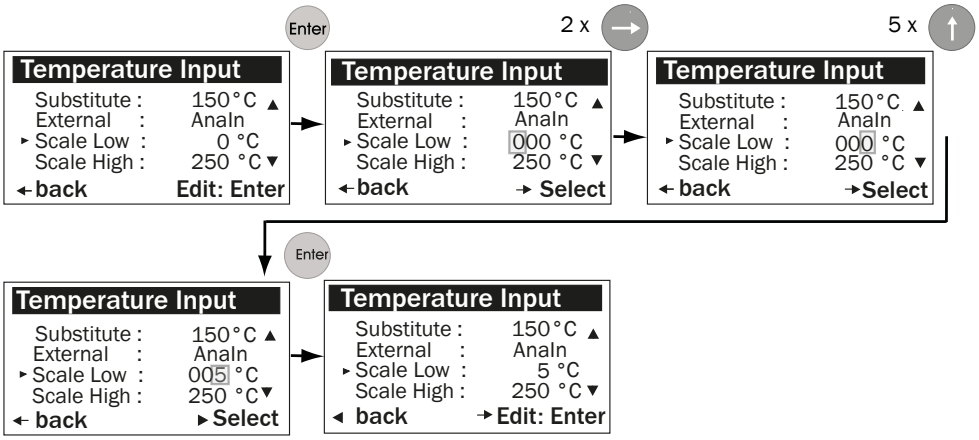


Figure 40: Setting the lower limit value for the temperature range (example) (corresponds to Live Zero)

9.4.7.4 Setting the temperature range: Upper limit value (20 mA)

Submenu item "Scale High" serves to set the upper limit value for the sample gas temperature.

NOTE

Factory setting: 250 °C

Allowable values: Max. 500 °C

Contact SICK Service when you are not sure which limit value should be set.

1 Follow the menu path as described, see "Parameter settings for the external temperature sensor PT1000", page 59.
2 Enter the password, see "Entering the password", page 52.
3 Enter the changes.
4 Confirm value with "Enter".
5 Press the "Left arrow" to return to menu item "Parameter Settings".

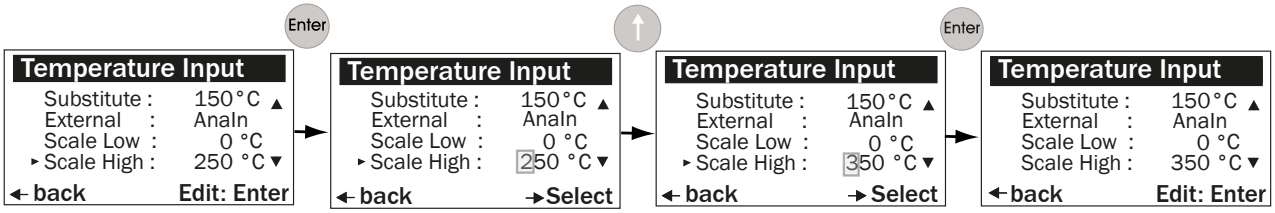


Figure 41: Setting the upper limit value for the temperature range (example)

9.4.7.5 Setting the signal: Live Zero

Submenu item "Input Low" serves to set the signal strength for the lower measuring range value (Live Zero).

NOTE
Factory setting: 4.0 mA

1 Follow the menu path as described, see "Parameter settings for the external temperature sensor PT1000", page 59.
2 Enter the password, see "Entering the password", page 52.
3 Enter the changes.
4 Confirm value with "Enter".
5 Press the "Left arrow" to return to menu item "Parameter Settings".

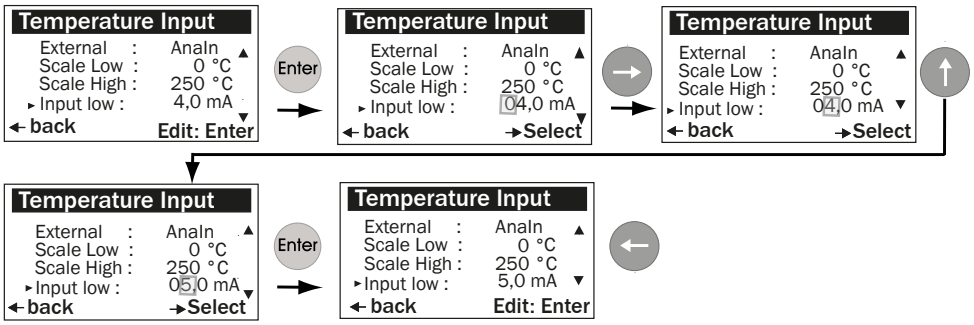


Figure 42: Setting the lower measuring range value (Live Zero) (example)

9.4.7.6 Setting the signal: Upper output value

Submenu item "Input High" serves to set the signal strength for the upper measuring range value.

NOTE
Factory setting: 20.0 mA

1 Follow the menu path as described, see "Parameter settings for the external temperature sensor PT1000", page 59.
2 Enter the password, see "Entering the password", page 52.
3 Enter the changes.

4 Confirm value with "Enter".
5 Press the "Left arrow" to return to menu item "Parameter Settings".

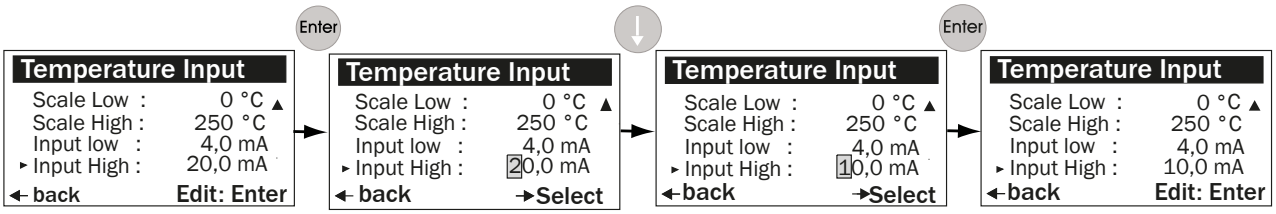


Figure 43: Changing the value for the upper output value (example)

9.4.8 Setting the humidity content in sample gas

Submenu item "Humidity" serves to set the value for the humidity content in the sample gas as default value.

NOTE

Factory basic setting: 0.0 %.

This value is used to perform a gas dryness correction.

Max. possible value: 99 %.

1 Follow the menu path as described, see "Parameter", page 55.
2 Enter the password, see "Entering the password", page 52.
3 Enter the changes.
4 Confirm value with "Enter".
5 Press the "Left arrow" to return to menu item "Parameter Settings".

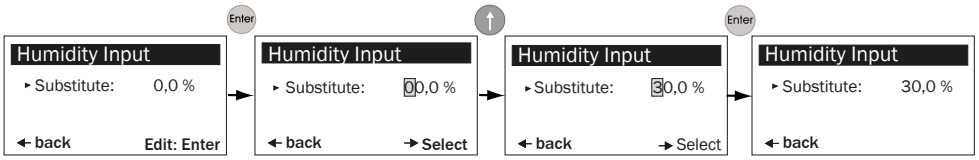


Figure 44: Entering the default value for humidity content in sample gas (example)

9.4.9 Setting the sample gas pressure

Submenu item "Pressure" serves to set the default value for the sample gas pressure. The measuring system uses this value for correction.

The pressure correction is made in ppm or Norm in the display.

NOTE

Factory setting: 1013 hPa

Min. value: 800 hPa

Max. value: 1200

1 Follow the menu path as described, see "Parameter", page 55.
2 Enter the password, see "Entering the password", page 52.
3 Enter the changes.
4 Confirm value with "Enter".
5 Press the "Left arrow" to return to menu item "Parameter Settings".

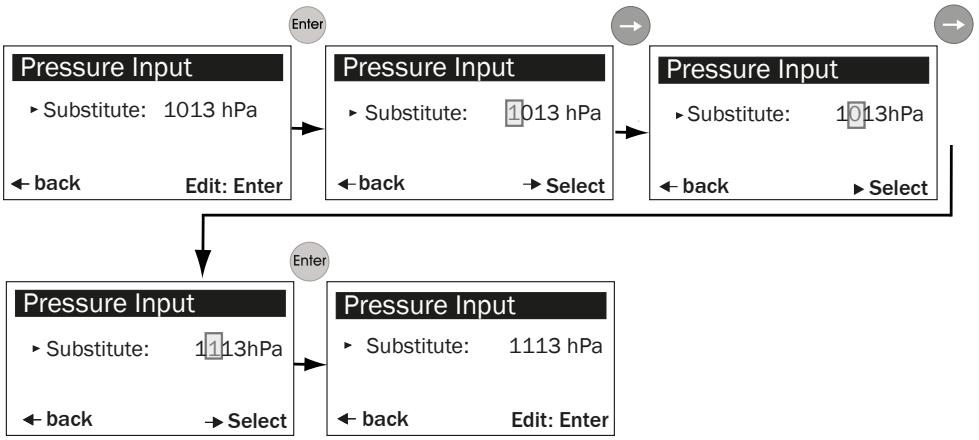


Figure 45: Entering the default value for the sample gas pressure (example)

9.4.10 Changing the Live Zero value of the analog output (Analog Out)

Submenu item "Analog Out" serves to change the Live Zero value.

NOTE
Factory setting: 4 mA
Min. value: 0 mA
Max. value: 4 mA

1 Follow the menu path as described, see "Parameter", page 55.
2 Enter the password, see "Entering the password", page 52.
3 Enter the changes.
4 Confirm value with "Enter".
5 Press the "Left arrow" to return to menu item "Parameter Settings".

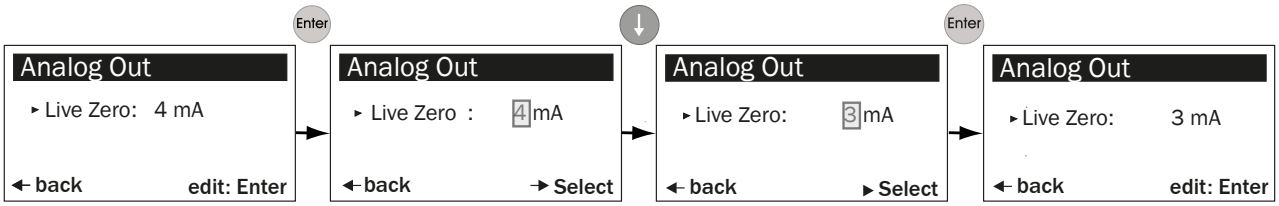


Figure 46: Changing the Live Zero value (example)

9.4.11 Changing the calibration values

Submenu item "Calibration" serves to change the characteristic gradient after a span test and the offset correction for the zero point after a reference measurement during on-site calibration.

1 Follow the menu path as described, see "Parameter", page 55.
2 Enter the password, see "Entering the password", page 52.
3 Enter the changes.
4 Confirm value with "Enter".
5 Press the "Left arrow" to return to menu item "Parameter Settings".

SPAN value

Submenu item "Span" serves to adapt the setting for the SPAN after completing the SPAN test.

Factory setting: 1.00

Possible setting range: 0 ... 1,99

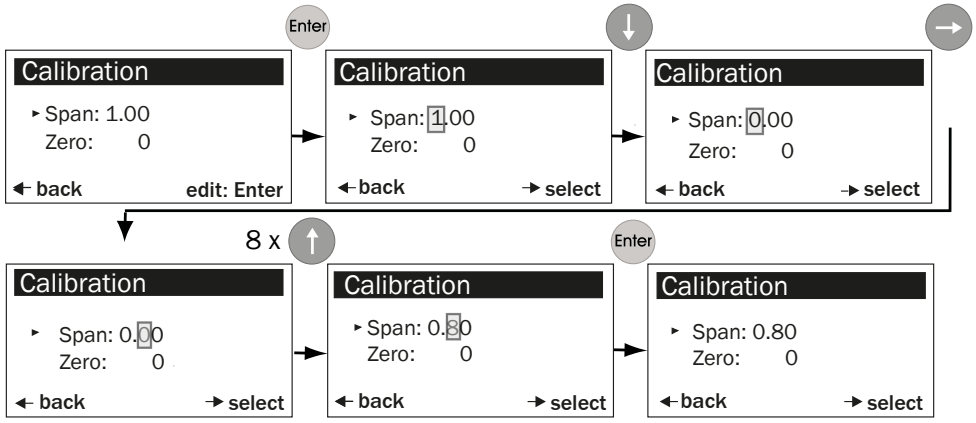


Figure 47: Changing the SPAN value (example)

Offset correction after zero point measurement

Submenu item "Zero" serves to perform an offset correction after a reference measurement.

- Factory setting: 0

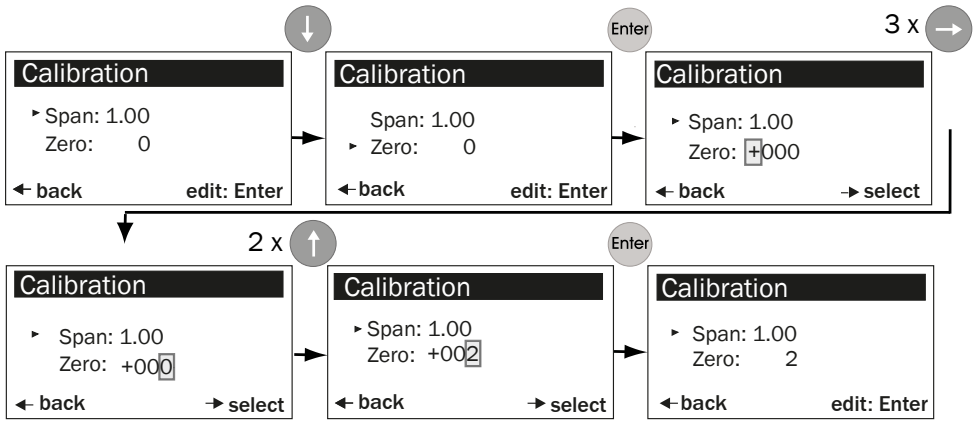


Figure 48: Changing the zero point value (example)

9.4.12 Median Filter

Submenu item "Median Filter" serves to set the median filter.

The median filter reduces signal noise caused by high dust concentrations or rapidly changing processes.

NOTE

Basic factory setting: 24 s

Min. value: 5 s

Max. value: 360 s

Median Filter value:

- „1“ = no Median Filter
- „17“ = highest value
- “11” = preset value

The Median Filter adds 1 to 9 seconds to the response time according to the following formula:
(Median Filter + 1)/2

Example:

- Desired response time: 20 s
- When Median Filter = 15: (15 +1)/2 = 8 s extension
- Enter new value "Response Time": 12 s (see "Changing the response time", page 57)

1 Follow the menu path as described, see "Parameter", page 55.
2 Enter the password, see "Entering the password", page 52.
3 Enter the changes.
4 Confirm value with "Enter".
5 Press the "Left arrow" to return to menu item "Parameter Settings".

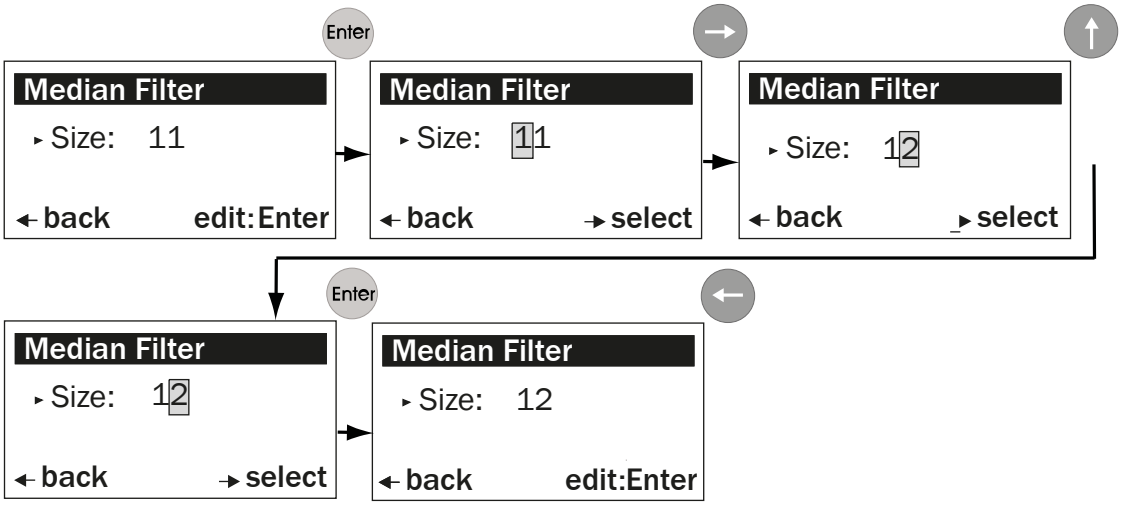


Figure 49: Changing the Median Filter value (example)

9.4.13 Device characteristic data (Device)

Menu item "Device" serves to view the device characteristic data entered at the factory.

The following characteristic data are available:

1 Serial Number
2 Software Revision
3 Configuration

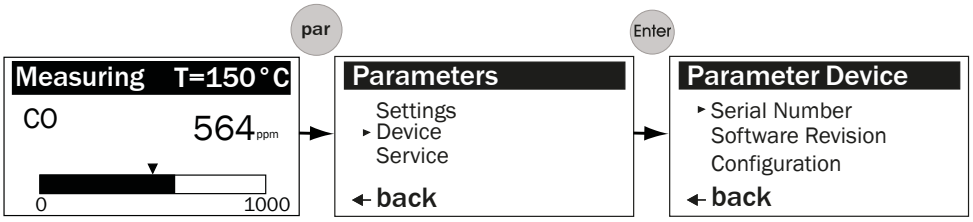


Figure 50: Path from Measuring Screen to Device Characteristic Data

9.4.13.1 Calling up the serial number

Submenu item "Serial Number" serves to retrieve the serial numbers of the measuring device and evaluation unit.

NOTE

The respective 8-character serial numbers of the evaluation unit and measuring device must match the serial numbers on the type plates.

Changing the serial numbers can lead to SICK Service no longer being able to provide technical support.

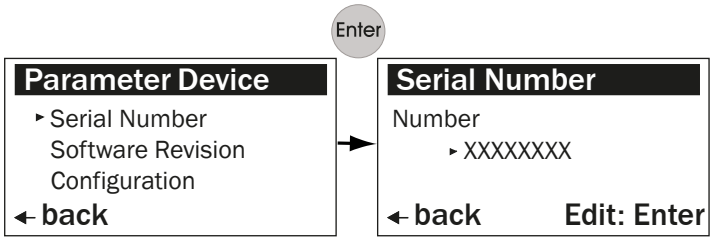


Figure 51: Calling up the serial number

9.4.13.2 Calling up the software version

Submenu item "Software Revision" serves to retrieve the software version of the measuring device and control unit.

NOTE

This value is updated automatically when Service updates the software. The customer cannot change this entry.

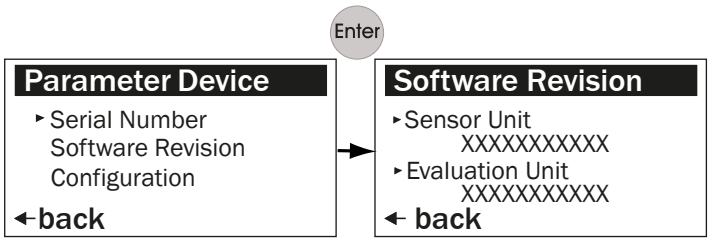


Figure 52: Calling up the current software version

9.4.13.3 Viewing the device configuration

Submenu item "Configuration" serves to retrieve the code for the device configuration.

NOTE

The standard display for the device configuration delivered is 0212.

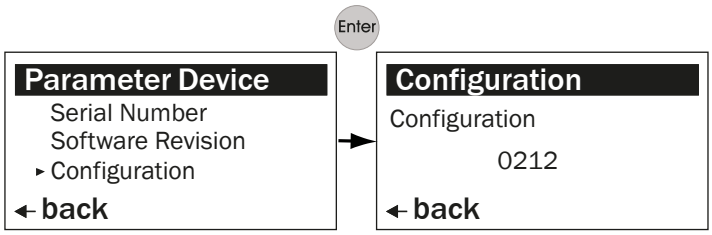


Figure 53: Viewing the device configuration

9.4.14 Service

Menu item "Service" serves to retrieve and change the device calibration data set.

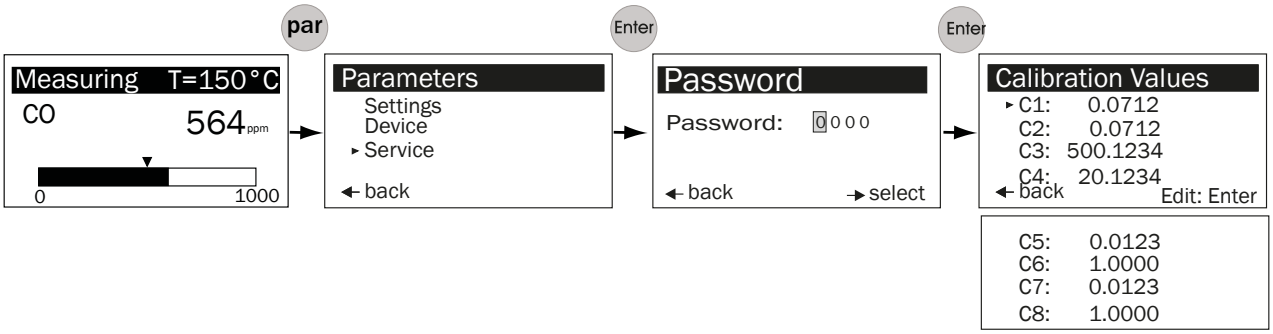


Figure 54: Calling up the device calibration data

9.4.14.1 Changing the device calibration parameters

WARNING
Endangerment of system safety through calibration parameters with incorrect settings

The calibration values can be changed after the password has been entered. This is only necessary in special cases, e.g., exchanging the sender lamp. Changing the calibration values without the necessary technical knowledge can lead to measured value deviations that can endanger safe operation of the plant.

- Only change the calibration parameters when you have sufficient technical knowledge of the device calibration.
- Only pass the password on to authorized persons.

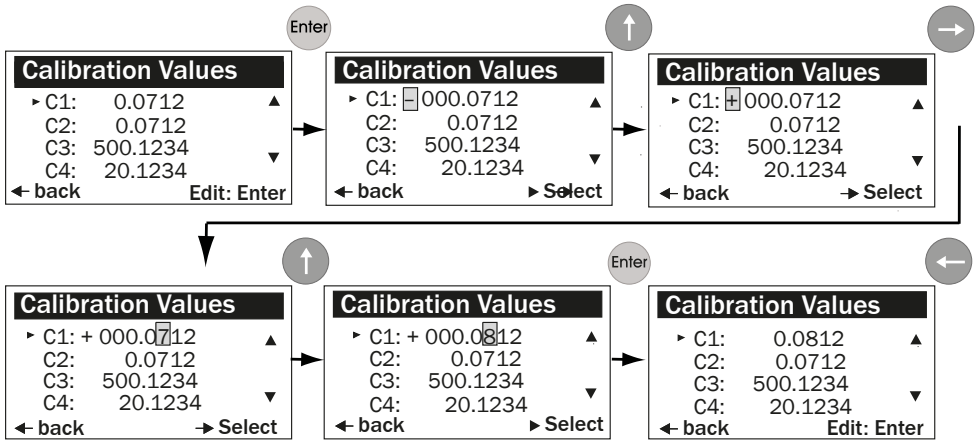


Figure 55: Changing device calibration data

9.5 Calibration

Menu "Calibration" serves to retrieve the following submenu items:

- Zero Adjust: Zero adjust
- SPAN Test: Manual SPAN test
- EPA SPAN Test: SPAN test according to EPA Guidelines

9.5.1 Performing zero adjust

Submenu item "Zero Adjust" serves to perform the zero adjust.

NOTE

- The adjust process is started when the prompt "Are you sure to start adjust procedure" is confirmed with "Enter". Making entries during the process or aborting are not possible.
- The adjust first starts when the device temperature stabilizes at 60 °C (± 0.5 °C). Warming up time depending on ambient conditions; 30 - 60 minutes.
- Press "Enter" to save the data when the zero adjust has completed.

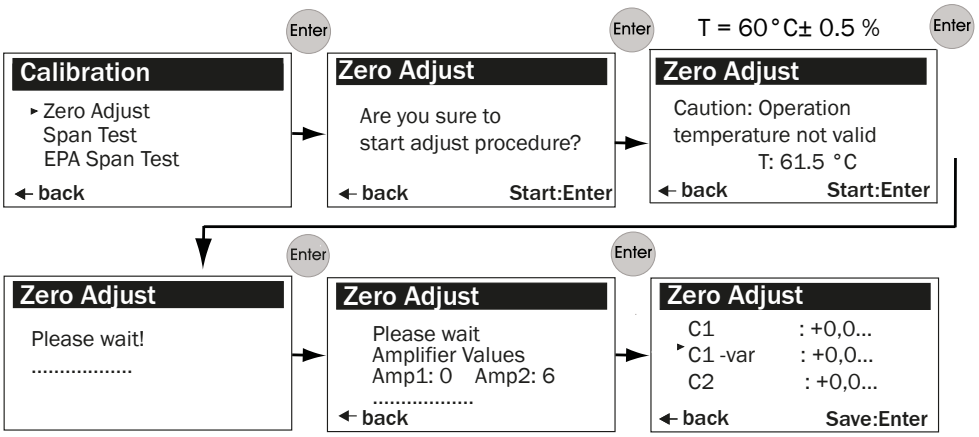


Figure 56: Performing zero adjust

9.5.2 Performing a manual SPAN test

Submenu item "SPAN Test" serves to perform the zero adjust and the sensitivity tests

NOTICE
The SPAN test must be performed in a "Zero Path" duct.
Zero Path: Duct with a CO concentration = 0.

- The adjust process for the SPAN test is started when the prompt "Are you sure to start adjust procedure" is confirmed with "Enter". Making entries during the process or aborting are not possible.
- The adjust first starts when the device temperature stabilizes at 60 °C (± 0.5 °C). Warming up time depending on ambient conditions; 30 - 60 minutes.
- Press "Enter" to save the data when the zero adjust has completed.
- The temperature is set to the standard value. Enter the current ambient temperature.
- Compare the measured value displayed for CO with that on the test cell (setpoint value). Correct deviations:
  - ▶ The SPAN value to be set = measured value displayed: Nominal value.
  - ▶ Enter the SPAN value under menu item par/calibration.

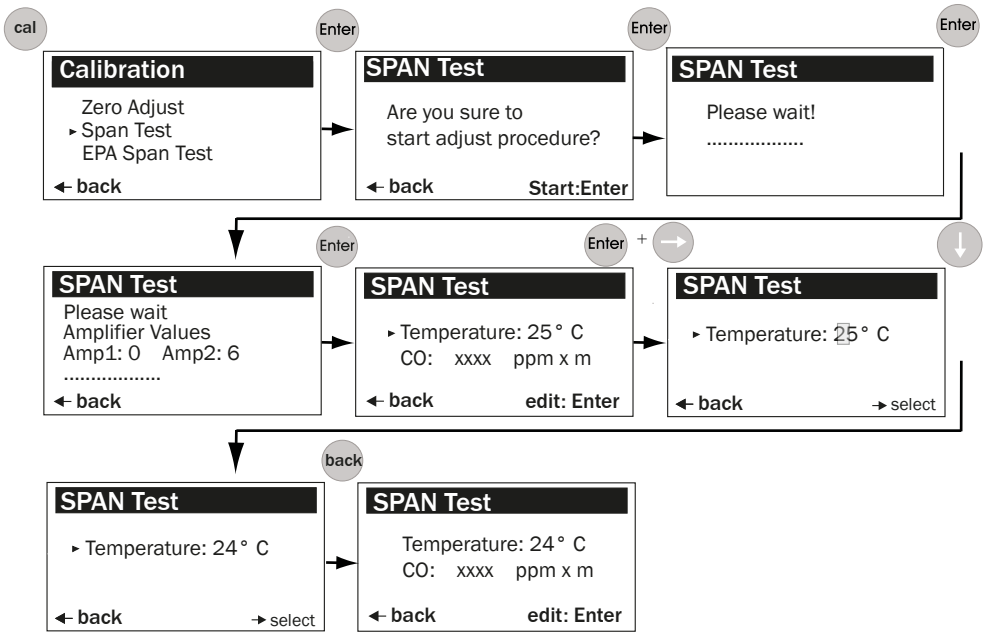


Figure 57: Performing a manual SPAN test

9.5.3 SPAN test according to EPA Guidelines

Submenu item "SPAN Test" serves to perform the zero adjust and the sensitivity test according to the EPA Guidlines.

NOTICE
This SPAN test is only possible with a GPP measuring probe.

NOTICE
The SPAN test must be performed in a "Zero Path" duct.
Zero Path: Duct with a CO concentration = 0.

1 The test is activated by pressing "Enter" in menu item "EPA Span Test". It can also be started with a binary signal. Making entries during the process or aborting are not possible.
2 The display switches to the measuring mode screen. The status indicator is "Span Test".
3 The test relay is activated.
4 The humidity correction is deactivated because the test gases do not contain any humidity.
5 Deviations of the SPAN test value against the expected value can be adjusted in submenu item "SPAN Parameter", see "Changing the calibration values", page 64.
6 Calculating the SPAN value to be set:
   ▶ Actual value (test gas concentration) : value displayed.
7 If the SPAN parameter is already set to value 1, the SPAN value to be set must be calculated differently:
   ▶ Actual value (test gas concentration) x value displayed.
8 Deviations of the zero point can be adjusted in submenu item "ZERO", see "Changing the calibration values", page 64.
9 **Recommendation: Perform zero adjust.**
10 The EPA SPAN test is terminated using the "Left arrow" or "meas" button.

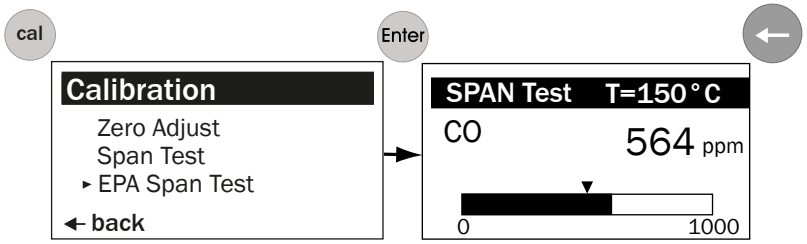


Figure 58: Performing a manual SPAN test

9.6 Maintenance

Menu "Maintenance" serves to retrieve the following submenu items:

- Reset System: Restart system
- Maint Mode: Set Maintenance mode
- Test Analog Out: Check the power value on the analog output
- Test Relay: Relay test
- Reset Parameter: Reset parameters to the default setting

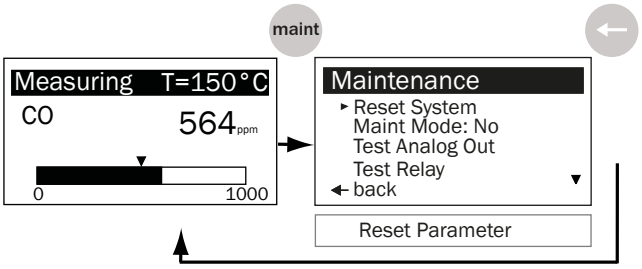


Figure 59: Path from Measuring Screen to change parameters (example)

9.6.1 Measuring system restart

Submenu item "Reset System" serves to restart the system.

▶ Switch to the Service menu with "maint", see "Maintenance", page 73.

NOTE

- A restart cannot be interrupted or terminated.
- The restart takes a few seconds.
- An input is not possible.

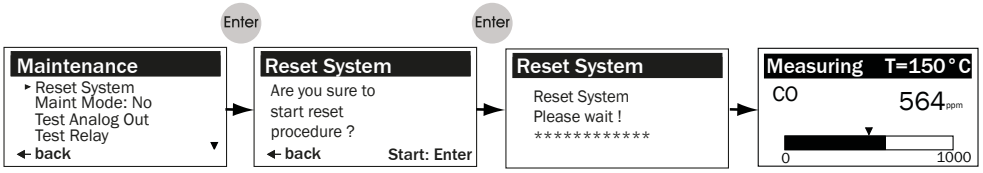


Figure 60: Restarting the system

9.6.2 Activating/deactivating maintenance mode

When maintenance mode is active, the output relay drops off and the analog output holds the last value.

NOTE

Select "Yes" and press "Enter" to activate maintenance mode.

The "Service" LED is on as long as maintenance mode is activated.

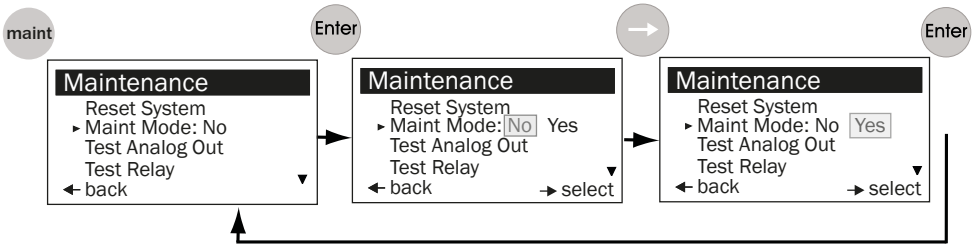


Figure 61: Activating/deactivating maintenance mode

9.6.3 Setting the test analog output

NOTICE

The device switches to maintenance mode as soon as submenu item "Test Analog Out" is activated.

- LED "Service" goes on.
- The device switches back to measuring mode as soon as the right arrow button for "back" is pressed in the submenu.

Submenu "Test Analog Out" serves to change the mA value for the analog output and then check the value output.

NOTE

- Zero Point: see "Setting the signal: Live Zero", page 62.
- Upper output value: see "Setting the signal: Upper output value", page 62.

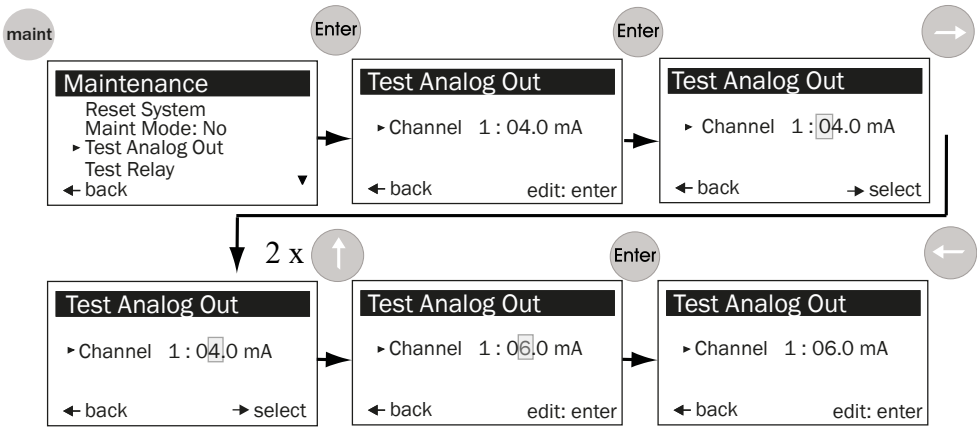


Figure 62: Setting the analog value

9.6.4 Test relay

Submenu "Test Relay" serves to test relays 1, 2 and 3.

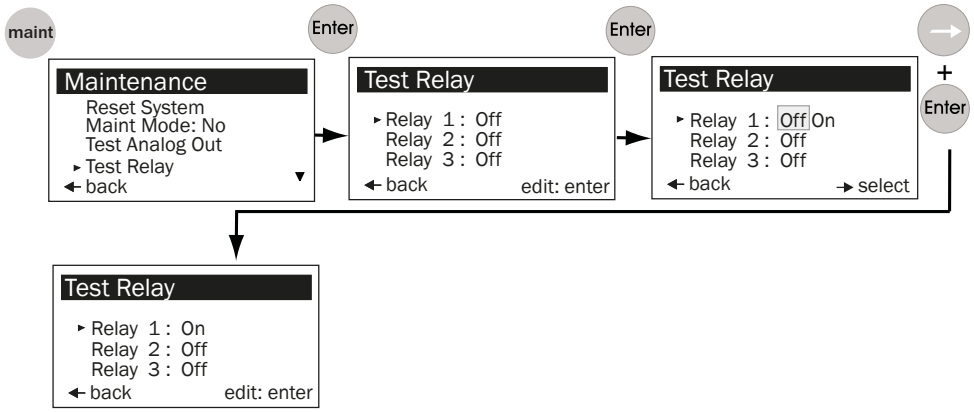


Figure 63: Testing relays 1, 2 and 3

9.6.5 Reset Parameter

Submenu "Reset Parameter" serves to reset all parameters to the factory settings.

NOTE

The password is necessary to reset the parameters to the factory settings.

- The device switches to maintenance mode.
- LED "Service" goes on.

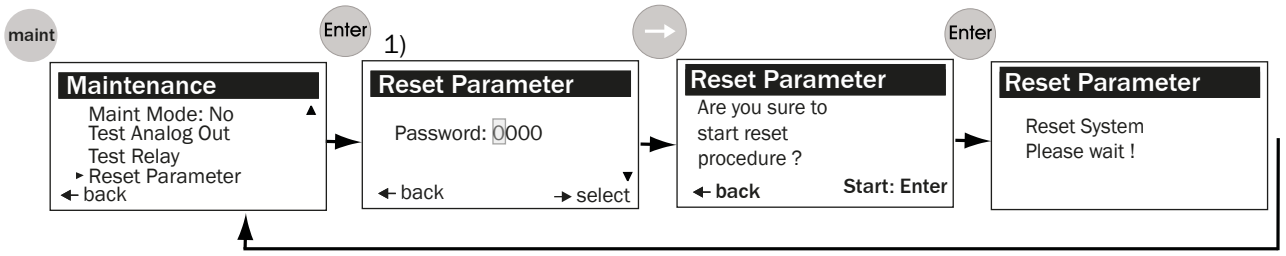


Figure 64: Resetting parameters to the factory settings

Entering the password, see "Entering the password", page 52.

NOTE

Factory settings for parameters, see "Preset parameter values", page 49.

10 Maintenance

10.1 Safety

Electricity

DANGER

Danger to life through electric shock

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

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

Noxious gas

WARNING

Health risk through contact with toxic gases

The modules and devices contain enclosed potentially dangerous gases that can escape due to a defect or leak. Should a leak occur, the concentrations within the enclosed device can rise to 350 ppm.

- CO : 10 ml max. total volume.

- ▶ Check the condition of the seals on the device regularly.
- ▶ Only open the device when good ventilation is available, especially when a leak of one of the device components is suspected.

When using a purge air unit

NOTICE

Risk of device damage when the purge air is switched off too soon

Hot and contaminated gas can cause device damage when the purge air is switched off when the measuring device is still fitted in the gas duct.

- ▶ Do not switch the purge air unit off as long as the measuring device is still in the gas duct.

10.2 Preparatory work

NOTE

Some maintenance tasks will cause the measuring device to switch to malfunction

- Activate Maintenance mode before starting the work.

NOTE

- Ensure good accessibility to the device in accordance with valid accident prevention regulations.
- Provide suitable work platforms/pedestals.

10.3 Visual inspection

Table 12: Visual inspection

Interval	Visual inspection	Remarks
Daily	Check active malfunction and warning messages.	
Monthly	Check ambient conditions.	
Half-yearly	Check measured values for plausibility.	
Half-yearly	Check device for damage.	• Check all hose fittings for tight seat. • Check the housings of the sender and receiver for mechanical damage. • Check flanges and screw fittings for tight seat.
Half-yearly	Check electrical connections and cables.	• Check all cables for damage. Pay attention to chafe marks and kinks on cable ducts. • Check all electric connections for freedom from corrosion and tight seat. • Check grounding conductors are free from corrosion.

10.4 Maintenance plan

Table with Maintenance plan for users

Table with Maintenance plan for Service

10.4.1 Maintenance Table for sender/receiver unit

Table 13: Maintenance intervals for sender/receiver unit

Interval	Maintenance work	Remarks
Half-yearly	Check device for damage and contamination.	Clean the respective housings if contaminated.
	Clean optical surfaces.	
	Exchange wearing parts as necessary.	
	Perform zero point check.	
	Check optical alignment.	
	Check condition of weatherproof cover when used.	Remove contamination.

10.4.2 Maintenance Table for GPP measuring probe

Table 14: Maintenance intervals for GPP measuring probe

Interval	Maintenance work	Remarks
Half-yearly	Clean outer surfaces of measuring probe.	
	Clean optical surfaces.	
As required	Exchange the sinter filter.	
	Exchange the heaters.	
	Exchange the optical parts.	

10.4.3 Maintenance Table for purge air unit

Table 15: Maintenance intervals for purge air unit

Interval	Maintenance work	Remarks
Application-dependent (see maintenance request)	Exchange filter element.	Part No. for filter element and task description, see Operating Instructions SLV4.
	Check the hose and hose clamp.	Task description, see Operating Instructions SLV4.
	Exchange the purge air filter.	
	Check fan motor noise.	
	Check the purge air heater (optional).	
	Check the function of the filter and differential pressure sensor (optional).	

10.4.4 Maintenance Table for GMP measuring probe

Table 16: Maintenance intervals for GMP measuring probe

Interval	Maintenance work	Remarks
Half-yearly	Clean outer surfaces of measuring probe.	
	Clean optical surfaces.	
As required	Exchange the optical parts.	

10.4.5 Final maintenance work

NOTE
Record all maintenance work done in a Maintenance Manual.

11 Troubleshooting

11.1 Warning messages

Table 17: Warning messages in the Diagnosis menu

Message	Possible causes	Measures
Analog input temperature out of range	Input signal (0 ... 20 mA) of the temperature measurement is outside the configured limits, the system continues running with the default temperature value.	Check the temperature sensor.
		Check the cable connection.
		Check the parameter settings: see "Setting the signal: Live Zero", page 62, see "Setting the signal: Upper output value", page 62.
Temperature low, no humidity correction	Measured gas temperature is so low that it is assumed the plant has been switched off. This means the cross-sensitivity correction for exhaust gas humidity is not performed.	No measures required when the plant is switched off
		Check the parameter settings: see "Setting the signal: Live Zero", page 62, see "Setting the signal: Upper output value", page 62.
		The switching point is at 70 °C or half the value of the default temperature depending on which value is lower.
		Check the temperature sensor.
Sensor low signal	Dust content too high (outside the calibration data from project planning).	Observe the ambient conditions in the technical data.
	Fog formation.	
	Optical surfaces contaminated.	Clean the optical interfaces.
	Device disadjusted.	Check device alignment.
	Lamp defective.	Check lamp, exchange when necessary.
		Check for free light path through the duct.
		If warning messages still occur after carrying out the measures: New zero adjust.
Warming up	The required operating temperature is not reached shortly after switching on. Displayed measured values could be outside the tolerance.	Observe warming up time of approx. 30 minutes.
Out of range	The measured value exceeds the specified measuring range.	Set the measuring range to a higher value: see "Changing the measuring range", page 58

11.2 Malfunction messages

Table 18: Malfunction message for Diagnosis menu

Message	Possible causes	Measures
EEPROM Parameter	Invalid parameter.	Perform reset parameter: see "Reset Parameter", page 75.
		Reconfigure.
		New zero adjust.
	Control unit defective.	Contact SICK Service.
Sensor communication	Data communication between receiver unit and control unit interrupted.	Check cable connection and correct seating of the plug connector.
		Further measures, see "Communication error between control unit and receiver", page 84.
Sensor amplifier has reached maximum value	Erroneous device adjustment.	Check device alignment, realign when necessary.
	Optical surfaces contaminated.	Clean the optical interfaces.
	Light path interrupted.	Check for free light path through the duct.
Sensor no signal	Erroneous device adjustment.	Check device alignment, realign when necessary.
	Optical surfaces contaminated.	Clean the optical interfaces.
		Check for free light path through the duct.
	Receiver unit defective.	Exchange receiver unit.
IR source fault	Infrared module defective.	Check lamp plug connector.  Risk of burns! Lamp is very hot when in operation. ▶ Let the device cool down before checking. ▶ Wear protective gloves.
		Check sender/receiver unit, exchage when necessary.
Chopper fault	Chopper in sender unit defective.	Check lamp plug connector.  Risk of burns! Lamp is very hot when in operation. ▶ Let the device cool down before checking. ▶ Wear protective gloves.
		Check sender/receiver unit, exchange when necessary.
Device not ready, warming up	The required operational temperature is not reached shortly after switching on.	Observe warming up time of approx. 30 minutes.
	Device is not capable of measuring.	
Motor fault	Motor in receiver unit defective.	Exchange receiver unit.

11.3 Troubleshooting on the sender

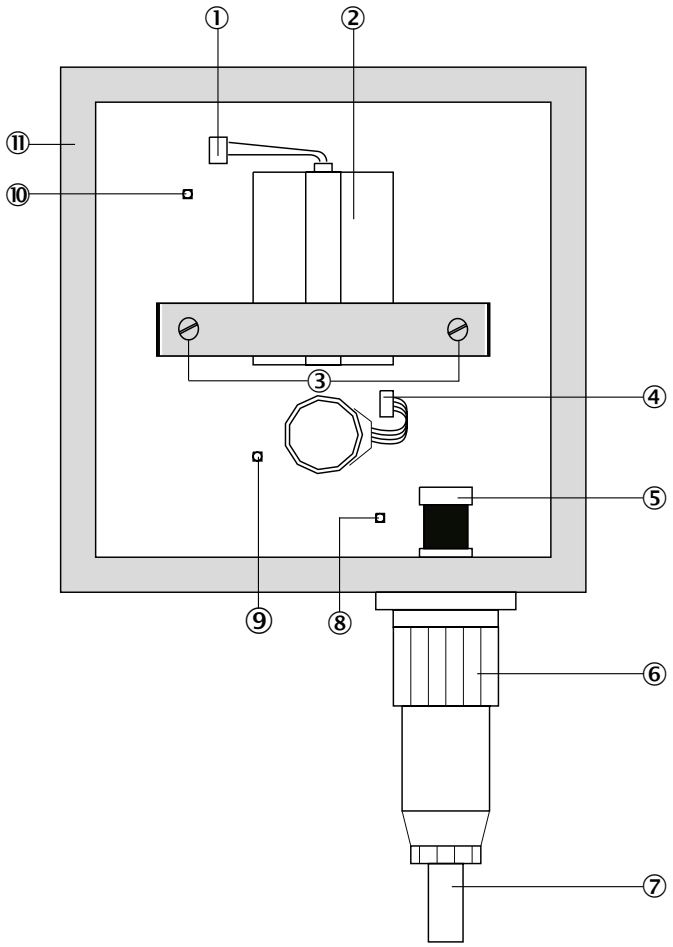


Figure 65: Sender

① IR source: Plug connection
② IR source

Risk of burns!
The infrared lamp becomes extremely hot during operation!
③ Adjustment screws: 4 x

Disadjustment through adjusting the adjustment screws!
Readjustment is only possible at the factory
④ Chopper motor plug
⑤ Internal plug
⑥ External plug
⑦ Receiver cable
⑧ LED: On when voltage connected for motor and logic module
⑨ LED: On when voltage for IR source connected
⑩ LED: On when the lamp is on and the chopper disk rotates
⑪ Sender housing

11.4 Troubleshooting on receiver

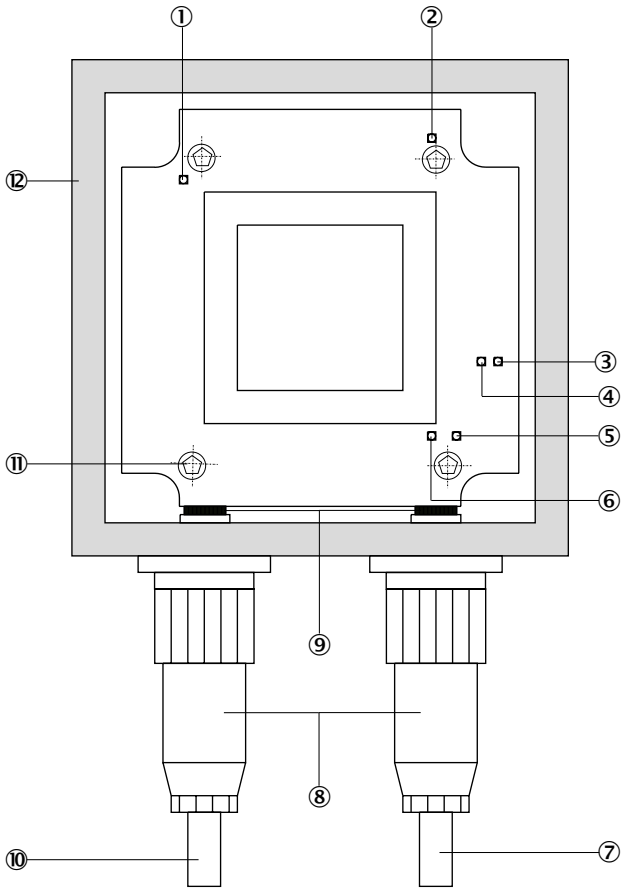


Figure 66: Receiver

① LED: On when operation is uninterrupted
② LED as status indicator for optics heating:

- On continuously: Ambient temperature too high
- Blinks: Normal operation
- Off: Ambient temperature too low

③ LED: Communication to control unit (TD)
④ LED: Communication from control unit (RD)
⑤ LED: Blinks when the cell disk in the receiver rotates and receives chopper signal.
⑥ LED: Blinks when the motor of the cell disk rotates
⑦ Line to sender
⑧ Outer plug-in connector
⑨ Inner plug-in connector
⑩ Line to control unit
⑪ Adjustment screws: 4 x

Disadjustment through adjusting the adjustment screws!
Readjustment is only possible at the factory.

⑫ Receiver housing

11.5 Troubleshooting on the control unit

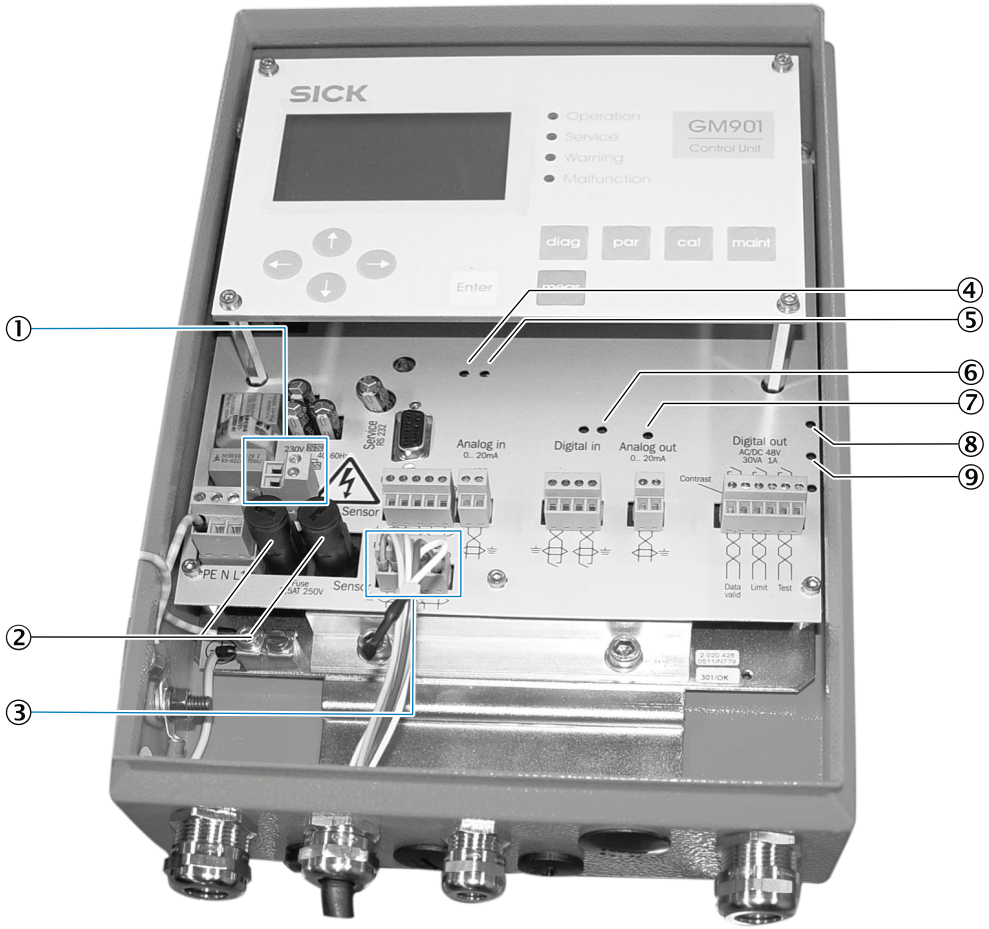


Figure 67: Control unit

① Operating voltage selection: 230 V AC – no bridge, 115 V AC – bridge
② Fuses, 2.5 AT
③ Receiver connection
④ Data to receiver (TD)
⑤ Data from receiver (RD)
⑥ Digital input status
⑦ Analog output: LED on – output current identical to nominal value
⑧ Switching state relay 1
⑨ Switching state relay 2

Device shows no reaction

1. Check power supply.
2. Check operating voltage set.
3. Check fuses in control unit.
4. Check display for 24 V / 5 V supply in the control unit, when doing so, remove the plug-in terminal on the cable to the receiver when necessary.
5. If the displays only light up with the plug connector disconnected, first check the wiring.
6. If no error is found, connect the system components one after each other:
   a) Connect only the cable from the control unit to the receiver.
   b) Connect the receiver.

c) Lay the cable from the receiver to the sender.
d) Connect the sender.

7. If the error occurs again, it has been triggered by the last component connected which must then be exchanged.

11.6 Communication error between control unit and receiver

Error message: "Sensor Communication"

The receiver sends data continually to the control unit, an error message is generated automatically when no data is received there.

Check following connections:

1 Control unit -> receiver.
2 Line connection on the plug-in terminal in the control unit.
3 Cable to receiver.
4 Outer plug-in connector on receiver.
5 Inner plug-in connector in receiver.

11.6.1 Sensor values for trouble-free operation

All values refer to a warmed up device in operation withing the specific limits.

Calling up the sensor values: see "Viewing sensor values", page 55.

Table 19: Sensor values

Unit	Description	Min. value	Typical value	Max. value
V1	Signal voltage 1	0.5 V	Depending on the current conditions	<5.0
V2	Signal voltage 2	0.5 V	Depending on the current conditions	<5.0
DK	Variation k-value	0	Depending on the current conditions	
CC	Peltier current	0 mA	Dependent on the ambient temperature	1200 mA
TE	Temperature electronics	20°C	Dependent on the ambient temperature	80 °C
TO	Temperatur optics	50 °C	60 °C	80 °C
TD	Detector temperature	9 °C	10.7 °C	12 °C
A	Amplifier setting	00.00	Dependent on the measuring path	31.31

NOTE

Please contact SICK Service for remote diagnosis should the sensor values of the GM901-02 be outside these value ranges.

▶ Use the form, see "Remote Diagnosis, GM901 Sensor Values", page 85.

11.6.2 Remote Diagnosis, GM901 Sensor Values

Company:	**Date:**
Contact person:	**Plant:**
Email:	**Telefon:**

Malfunction messages
Malfunction message 1: _____
Malfunction message 2: _____
Warning messages
Warning message 1: _____
Warning message 2: _____
Sensor values
V1: _____ CC:_____ TD: _____
V2:_____ TE:_____ AG:_____
DK: _____ TO:_____
Parameters
- Physical Unit: _____
- Normalization: _____
- Response time: _____
- Measuring range:
- Measuring distance Fl.-Fl.: _____ Active:_____
- Temperature Substitute: _____ External: _____
  Scale Low: _____ Scale High:_____
  Scale High: _____ Input High: _____
- Humidity Substitute: _____
- Pressure Substitute: _____
- Analog Out: Active Zero: _____
- Calibration SPAN: _____ Zero: _____

Device
- Serial Number: _____
- Software Revision Sensor Unit: _____ Evaluation Unit: _____
- Configuration No: _____

Service C1: _____ C2: _____
C3: _____ C4: _____
C5: _____ C6: _____
C7: _____ C8: _____

Current measuring conditions
Measured value: _____
Exhaust gas temperature: _____
Ambient temperature: _____

11.7 Measures after purge air failure (when using the GMP measuring probe)

Failure of the purge air supply can cause the following damage:

- Damage/destruction of the sender/receiver unit through hot and corrosive gas.
- With overpressure, gas can penetrate the purge air compressor and filter via the purge air hose and damage these system parts.

Measures:

1 Open the quick-release fasteners on the sender/receiver unit and remove the device.
2 As protective measure, especially with overpressure, close off the flange opening with heat-resistant material (blind flange, optional).
3 Clear the failure cause (see Operating Instructions for purge air supply) or exchange the purge air supply.
4 Connect the purge air supply.
5 Refit the units and switch on again.

12 Decommissioning

12.1 Safety information on shutting down

DANGER

Health risk though pressure and hot or toxic gases

Dangerous pressures, hot or toxic gases can escape when opening the duct depending on the process gas characteristics.

- Before removing the sender, receiver and probe, be sure all safety measures that prevent gas escaping uncontrolled have been taken.

DANGER

Health hazard through contamination

Depending on the composition of the gas in the measuring duct, the measuring device components could be contaminated with substances which could result in serious health damage.

- Decontaminate the measuring device components before storage.
- Wear the specified protective clothing for all work with contaminated measuring device components.

12.2 Materials and tools required

Table 20: Materials and tools required for shutting down

Materials and tools required	Required for
Insulated screwdriver set	Electrical connections
TORX screwdriver, size 10	GPP probe
Allen key	Connections
19 mm open-ended spanner or ring spanner	Flange screw fitting
2 x 24 mm open-ended spanners or ring spanners	
Cleaning cloths	Cleaning the housing
Personal protective equipment	Protection when working on the stack
Flange cover	Closing off the stack
SICK original transport safeguards and packaging	Storing the measuring device

12.3 Disassembling the sender and receiver

Disassembling the measuring device is recommended for longer plant standstills.

NOTE

The analyzer must be removed from the gas duct when:

- The optional purge air unit is taken out of operation on device versions with GMP measuring probe.
- The heating is no longer in operation on device versions with GPP measuring probe.

Procedure

1 Disconnect the device from the power supply.
2 Disconnect the cable plug on the sender/receiver unit. For longer storage: Protect the cable plug against damp and dirt.
3 Take the sender and receiver off the T-piece:
   ▶ Undo the quick-release fasteners
   ▶ Take the sender or receiver off
4 Remove the probe.
5 Close off the opening on the T-piece with an optional blind flange.

NOTE

The optical adjustment remains intact.

12.4 Storage

WARNING

Risk of chemical burns/poisoning through caustic/toxic residues on components with sample gas contact

After the device has been decommissioned or removed from the measuring channel, process gas residues can exist as deposits on components with sample gas contact (e.g., gas filter, gas-carrying lines etc.). These residues can be odorless or invisible depending on the gas mixture in the duct. Without protective clothing, contact with such contaminated components can lead to severe burns or poisoning.

- ▶ Take appropriate protective measures for work (e.g., by wearing a safety mask, protective gloves and acid resistant clothes).
- ▶ In case of contact with skin or the eyes, rinse immediately with clear water and consult a doctor.
- ▶ Decontaminate all contaminated components according to regulations after disassembly.

1 Clean the outside of all housings, the measuring probe and all other components with slightly moistened cleaning cloths. A mild cleaning agent can be used.
2 Protect the openings on the SR-unit and measuring probe against atmospheric conditions. Refit transport safeguards.
3 Pack the device for storage or transport (preferably in the original packing).
4 Store the device and all belonging components in a dry, clean room.

12.5 Disposal

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

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 and measuring probe could be contaminated by pollutants.
  - ▶ Decontaminate the measuring probe and filter before disposal.

13 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.

13.1 System GM901-02

Table 21: Technical data, System GM901-02

Description	In-situ gas analyzer for emission monitoring and process measurement
Measured variable	CO
Maximum number of measured variables	1
Measuring principles	Gas filter correlation
Measuring ranges CO	500 ... 20 000 ppm (depending on the active measuring path and gas temperature)
Precision	± 5% of the upper measuring range value
Process temperature	• Up to 250 °C, standard • With extended calibration (recommended for process temperatures : ≤ +430 °C)
Process gas humidity	Non-condensing
Ambient temperature	–20 °C ... +55 °C
Conformities	• TÜV type examination (Cross-Duct) • GPP measuring probe: U.S. EPA compliant
Electrical safety	EC
Degree of protection	IP 65 /NEMA 4
Dimensions (W x H x D)	367 mm x 418 mm x 1,414 mm (details see dimension drawings)
Installation	One fitting location on duct
Power supply	
Supply voltage	115 V / 230 V
Power frequency	50 / 60 Hz
Max. power input	≤ 60 VA
Control functions	Manual span point test with gas-filled cell

13.2 Sender/receiver unit

Table 22: Technical data, sender/receiver unit

Dimensions	see "Dimension drawing, sender-receiver unit with GMP measuring probe", page 94
Weight	6 kg
Lamp service life	Approx. 20 000 operating hours

13.3 Open GMP measuring probe

Table 23: Technical data, open GMPmeasuring probe

Description	Measuring probe in open design version with integrated purge air guidance system

Measuring distance	see Dimension drawing
Accuracy	• Pressure sensor: 1 % • Temperature sensor: 1 %
Process temperature	≤ +430 °C
Process pressure	–60 ... +30 hPa, depending on purge air supply
Dust load	≤ 3 g/m³ Relative to 1 m measuring distance, depending on application
Degree of protection	IP66
Dimensions (W × H × D)	see Dimension drawing
Weight	see Dimension drawing
Material, media contact	Stainless steel 1.4571, stainless steel 1.4539
Power supply	Supply via sender/receiver unit
Auxiliary gas connections	Purge air: Hose nozzle 40 mm
Built-in components	• Flow monitor for purge air monitoring • Temperature sensor PT1000 • Pressure sensor

13.4 Gas-testable GPP measuring probe

Table 24: Technical data, gas-testable GPP measuring probe

Description	Measuring probe with gas permeable filter element for adjustment with test gas
Measuring distance	see Dimension drawing
Accuracy	• Pressure sensor: 1% • Temperature sensor: 1%
Process temperature	≤ +430 °C
Process pressure	–120 ... +200 hPa
Dust load	≤ 30 g/m³
Degree of protection	IP65
Dimensions (W × H × D)	see Dimension drawing
Weight	see Dimension drawing
Material, media contact	Stainless steel 1.4571, stainless steel 1.4539, ceramic, PTFE
Power supply	• Voltage: 115 V AC / 230 V AC ± 10% • Frequency: 50 / 60 Hz • Power input: ≤ 150 W
Auxiliary gas connections	Test gas: Clamping ring screw connection 1/4"
Built-in components	• Temperature sensor PT1000 • Pressure sensor • Heating of optical surfaces

13.5 Control unit AWE, standard version (Part No.: 2020428, 2021433)

Table 25: Technical data, AWE control unit

Description	The control unit serves as user interface, for data processing and output as well as control and monitoring functions.
Degree of protection	IP65

Analog outputs	**1 output:** • 0/4 ... 20 mA, 500 Ω
Analog inputs	**1 input:** • 0 ... 20 mA, 100 Ω for gas temperature
Digital outputs	**2 relay contacts:** • 48 V AC, 1 A, 60 W / 48 V DC, 1 A, 30 W • **Relay 1:** N/O contact, normally open, for device malfunction, potential-free • **Relay 2 :** N/O contact, normally open, for limit value overrun, potential-free
Digital inputs	**1 input:** • +24 V
Serial	✓ • Type of field bus integration: RS-232 • Function: Proprietary Service Interface
PROFIBUS DP	No
CAN bus	✓ Function: Internal System bus
Display	LC-Display Status LEDs: Operation, Service, Warning, Malfunction
Input	Arrow buttons Function buttons
Operation	Menu-guided operation via LC-display and membrane keyboard
Version	Sheet steel enclosure
Dimensions (W × H × D)	200 mm × 300 mm × 90 mm
Weight	4.3 kg
Power supply	• Voltage: 115 V / 230 V AC, plus 10% tolerance • Frequency: 50 Hz / 60 Hz • Power input : ≤ 50 W

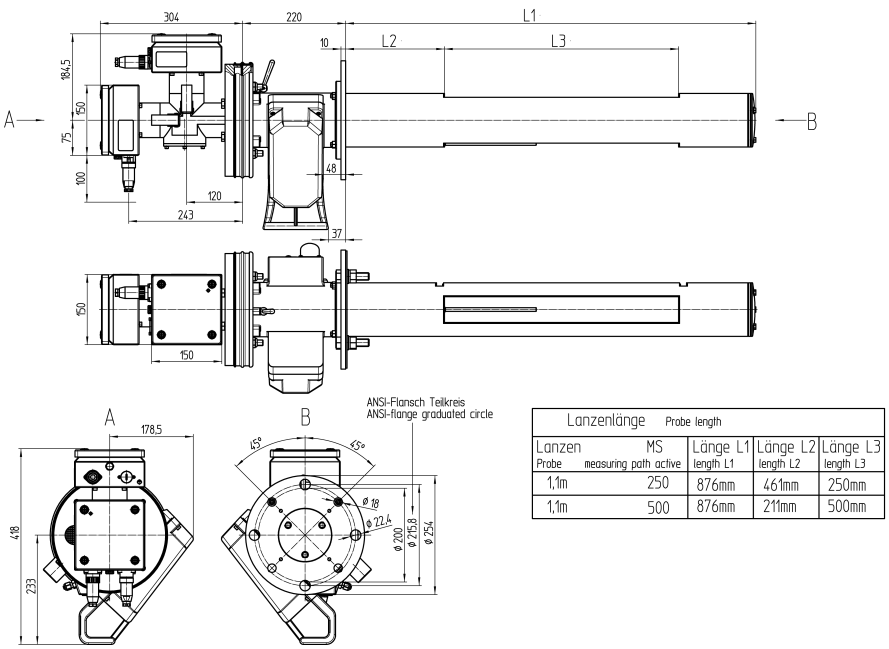
13.6 Control unit AWE with extended connectivity (Part No.: 2027607, 2084045)

Table 26: Technical data, AWE control unit

Description	The control unit serves as user interface, for data processing and output as well as control and monitoring functions.
Degree of protection	IP65
Analog outputs	**3 outputs:** • 0/4 ... 20 mA, 500 Ω • Galvanically isolated
Analog inputs	**1 input:** • 0 ... 20 mA, 100 Ω
Analog inputs	**2 inputs:** • 0 ... 20 mA, 100 Ω for gas temperature

Digital outputs	3 relay contacts: • 48 V AC, 1 A, 60 W / 48 V DC, 1 A, 30 W For AWE 2027607: • **Relay 1 :** N/O contact, normally open - for device malfunction, potential-free • **Relays 2 and 3:** N/O contact, normally open - for limit value overrun, potential-free For AWE 2084045: • **Relay 1 :** N/O contact, normally open - for device malfunction, potential-free • **Relays 2 and 3:** N/O contact, normally closed – for limit value overrun, potential-free
Digital inputs	3 inputs: • +24 V
Serial	✓ • Type of field bus integration: RS-232 • Function: Proprietary Service Interface
PROFIBUS DP	✓ Only for AWE 2027607
CAN bus	✓ Function: Internal System bus
Display	LC-Display Status LEDs: Operation, Service, Warning, Malfunction
Input	Arrow buttons Function buttons
Operation	Menu-guided operation via LC-display and membrane keyboard
Version	Sheet steel enclosure
Dimensions (W × H × D)	200 mm × 300 mm × 90 mm
Weight	4.3 kg
Power supply	• Voltage: 115 V / 230 V AC, plus 10% tolerance • Frequency: 50 Hz / 60 Hz • Power input : ≤ 50 W

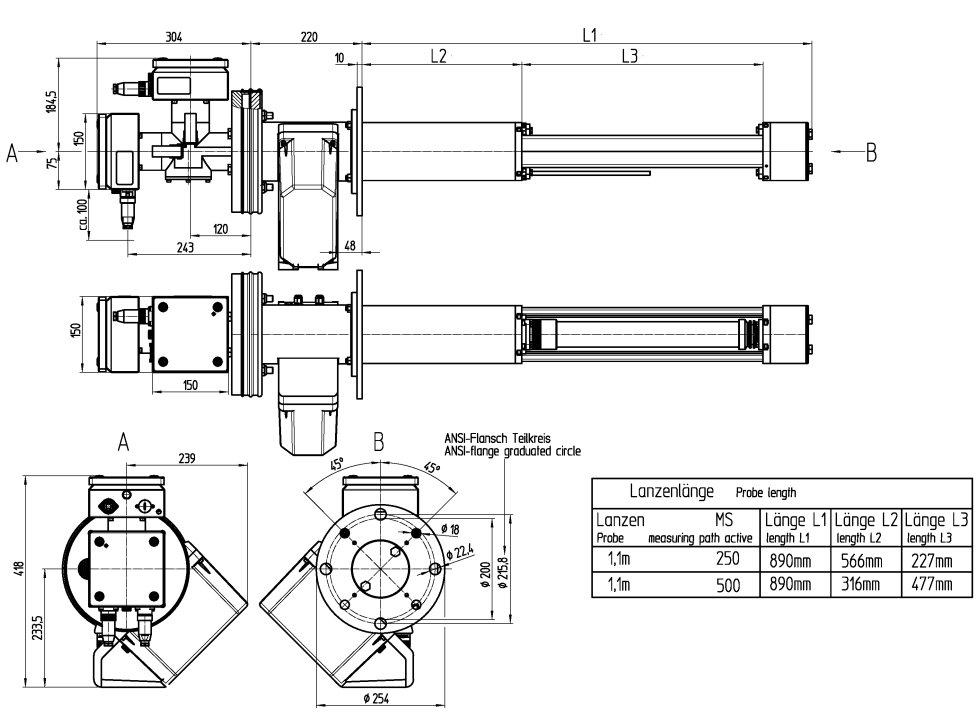
13.7 Dimension drawing, sender-receiver unit with GMP measuring probe



Lanzenlänge Probe length				
Lanzen Probe	MS measuring path active	Länge L1 length L1	Länge L2 length L2	Länge L3 length L3
1,1m	250	876mm	461mm	250mm
1,1m	500	876mm	211mm	500mm

Figure 68: Dimensions, GM901-02 sender-receiver unit with GMP measuring probe (all specifications in mm)

13.8 Dimension drawing, sender/receiver unit with GPP measuring probe



Lanzenlänge Probe length				
Lanzen Probe	MS measuring path active	Länge L1 length L1	Länge L2 length L2	Länge L3 length L3
1,1m	250	890mm	566mm	227mm
1,1m	500	890mm	316mm	477mm

Figure 69: Dimensions, GM901-02 sender-receiver unit with GMP measuring probe (all specifications in mm)

13.9 Dimension drawing, control units

Control unit AWE (sheet steel enclosure version)

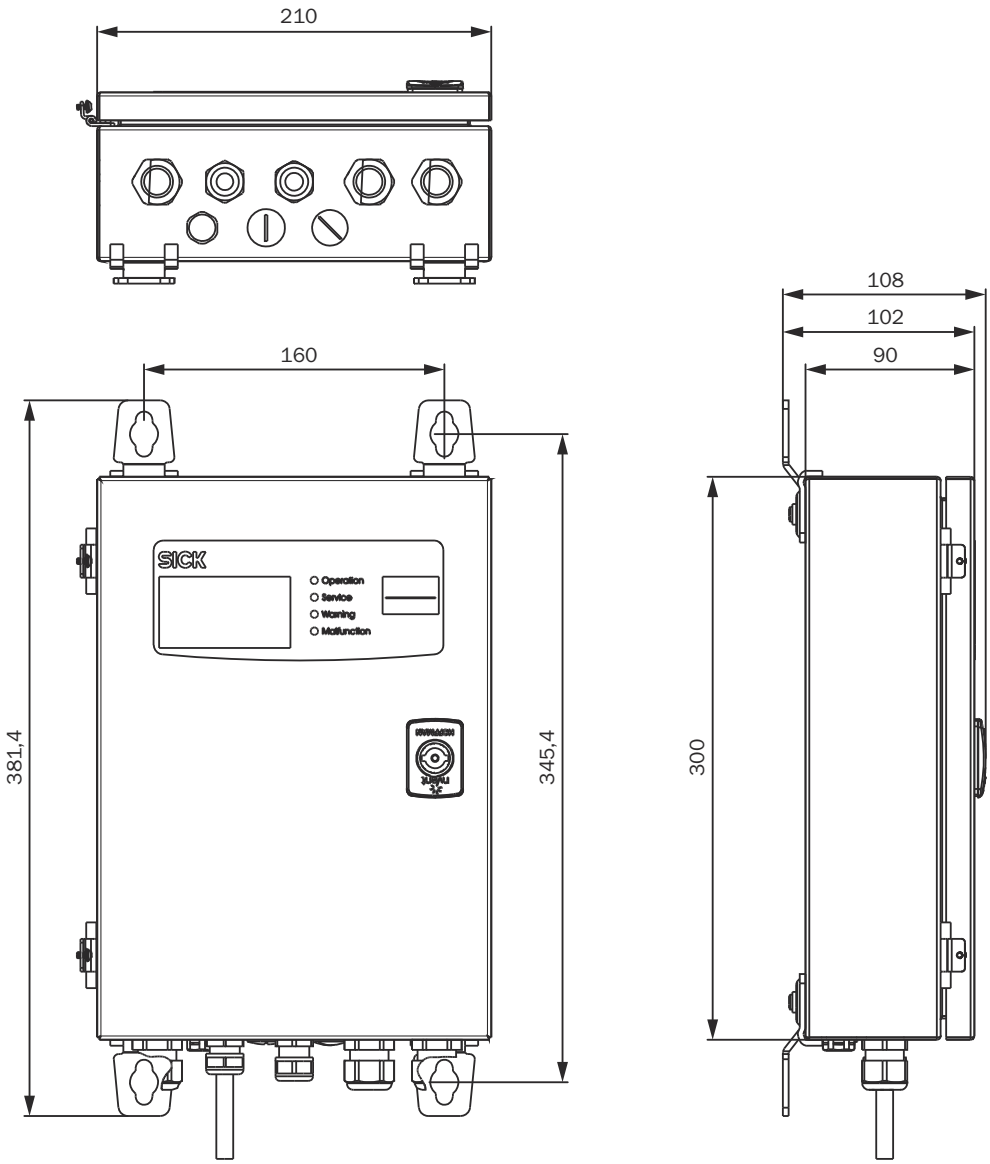


Figure 70: Control unit AWE (sheet steel enclosure version), dimensions in mm

13.10 Dimension drawing, flange with tube, DN125

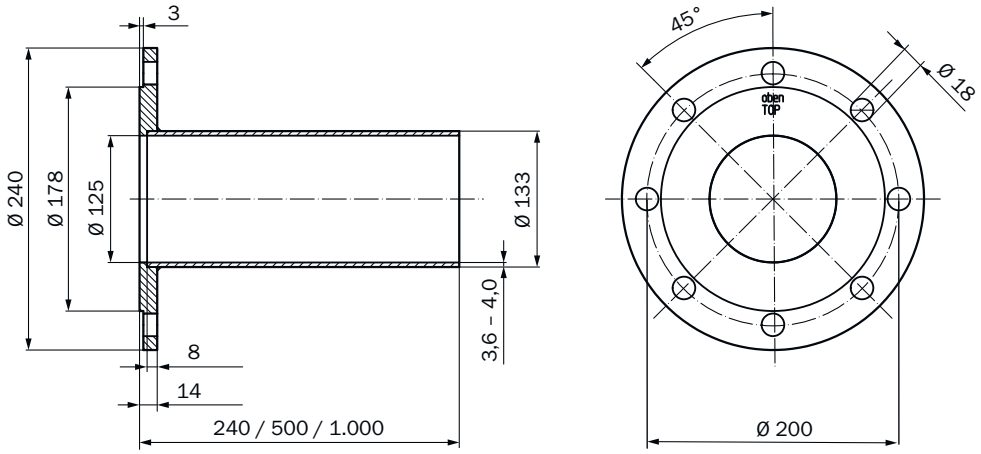


Figure 71: Flange with tube, DN125 (dimensions in mm)

13.11 Dimension drawing, weather hoods

Weatherproof cover for sender/receiver unit

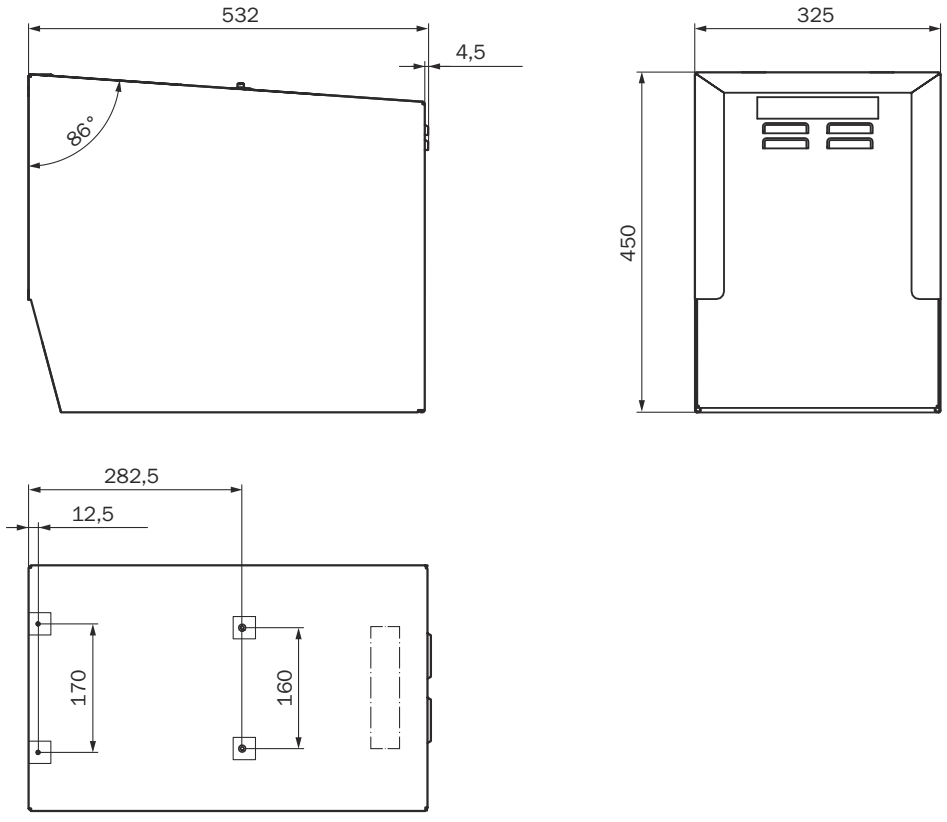


Figure 72: Weather hood for sender/receiver unit (dimensions in mm)

14 Ordering information

14.1 Expendable, wearing and spare parts

Available parts are listed on the product page on the Internet:

- www.sick.com

14.2 Accessories

Table 27: Accessory part numbers

Designation	Quantity	Part No.
Optical adjustment device	1	2020436
Purge air unit with distributor and 5 m hose (only for GMP measuring probe)	1	1012424
Purge air hose	Per meter	5304683
Weatherproof cover for purge air unit	1	5306108
Weatherproof cover for GM901 sender / receiver	2	2702407
Weather protection hood for GM901 control unit	1	4029146
Operating Instructions, English	1	8008250
Filter element	1	5306091
Test case for SPAN test with holder and up to 3 cells	1	2019639
Cell CO 1,600 ppm	1	2020626
Cell CO 4,000 ppm	1	2019768
Cell CO 10,000 ppm	1	2019769

15 Annex

15.1 Dimensional drawing, control unit

NOTE
This control unit is no longer available.

Control unit AWE (sheet steel enclosure version)

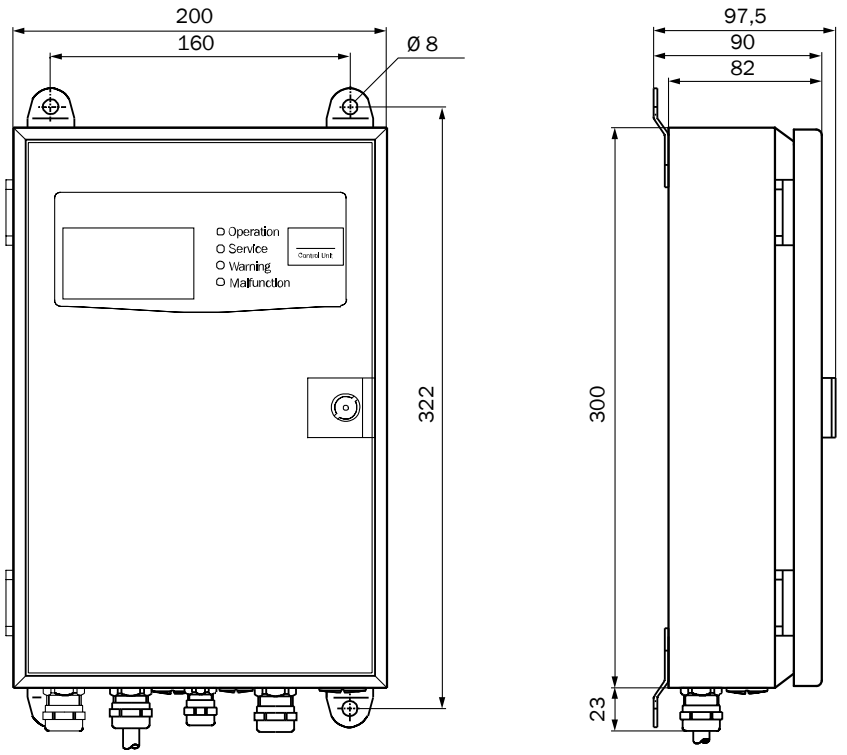
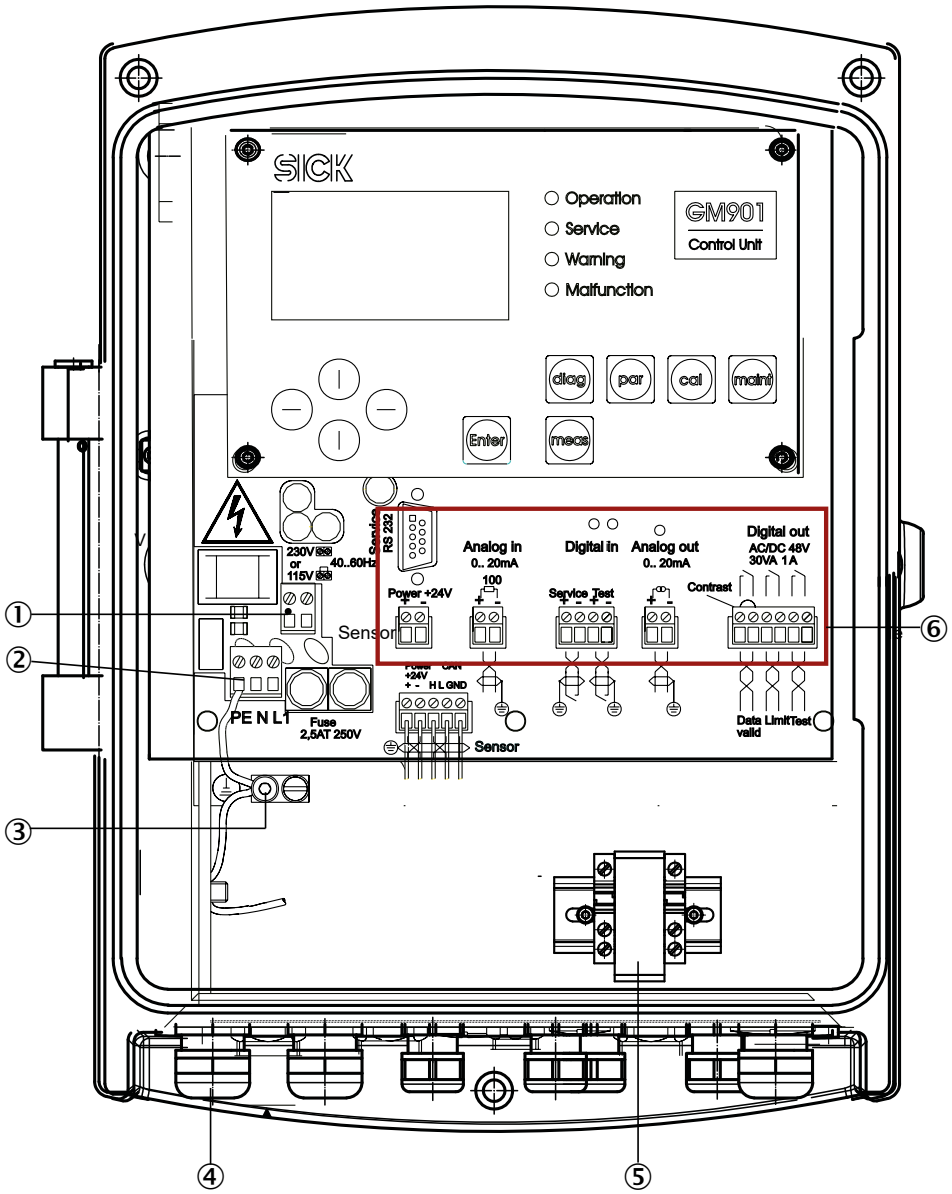


Figure 73: Fitting the control unit AWE (sheet steel enclosure version), dimensions in mm

15.2 Overview of AWE control unit electrical connections (cast metal enclosure)

NOTE
This control unit is no longer available.



① Cable bridge: Operating voltage selection:115 V or 230 V
② Power supply: 115 V / 230 V
③ Potential equalization connection
④ Screw cap for power supply cable
⑤ Measuring transducer for PT1000 -> 20mA
⑥ Terminals for wiring by customer

Connect new measuring probe to control unit AWE (cast metal enclosure)

For new probes delivered after November 15, 2019, the connection is made to the analog input and not to the temperature transducer.

Connecting the measuring probe

- ▶ Connect the white wire to 24 V GND.
- ▶ Connect the brown wire to analog input (right terminal).
- ▶ Connect the jumper cable between the +24 V terminal and the left terminal of the analog input.

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