OPERATING INSTRUCTIONS

GM901

Carbon Monoxide Gas Analyzer, Cross-Duct Version

SICK
Sensor Intelligence.

Described product
Product name: GM901
Variant: Cross Duct version

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

Legal information

Original document
This document is an original document of SICK AG.

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Contents

1 About this document

1.1 Function of this document

These Operating Instructions describe

- System components
- Commissioning
- Operation
- Maintenance work required for safe operation
- Troubleshooting

1.2 Scope of application

These Operating Instructions apply exclusively to the measuring device described in the product identification.

They do not apply for any other measuring devices from SICK.

The standards specified in Operating Instructions must be observed in their currently valid version.

1.3 Target groups

This Manual is intended for persons installing, operating and maintaining the device.

Operation

The device should be operated exclusively by qualified persons 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.

Installation and maintenance

Installation and maintenance may only be carried out by specialists trained for this purpose and 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 protocol

NOTE:
Observe all documents provided.

1.5 Symbols and document conventions

1.5.1 Warning symbols

Symbol	Significance
	Hazard (general)
	Hazard through electrical voltage
	Hazard through oxidizing substances
	Hazard through toxic substances
	Hazard through noxious substances
	Hazard through high temperature or hot surfaces
	Hazard for the environment/nature/organic life

1.5.2 Warning levels and 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:
Tips

1.5.3 Information symbols

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

1.6 Data integrity

SICK AG uses standardized data interfaces, such as standard IP technology, in its products. The focus here is on the availability of the products and their properties.

SICK AG always assumes the integrity and confidentiality of data and rights affected in connection with the use of the products are ensured by the customer.

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 For your safety

2.1 Intended use

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

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

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).
  ▶ If you are not sure whether the device corresponds to the state defined during project planning or to the delivered system documentation: Please contact SICK Customer Service.

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.

2.3 Troubleshooting precautions

The operator must ensure that:

- Maintenance personnel can be alerted immediately and at any time.
- Maintenance personnel are trained to be able to respond to malfunctions on the GM901 and correctly clear the operational malfunction involved.
- Suitable protective equipment, tools and auxiliary means are available at all times.
- Malfunctions are analyzed by qualified personnel, faults corrected, and operation optimized to prevent similar malfunctions in the future.

2.4 Basic measures to prevent property damage and injury to persons

Incorrect use or handling of the GM901 CO measuring device can cause personal injury or material damage.

▶ Therefore, in order to prevent damage, the relevant safety information and valid safety regulations must be observed.

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

2.5 Environment-friendly behavior

The GM901 has been designed in accordance with ecological criteria. The assemblies can be easily separated, sorted and recycled. All materials used in the GM901 are groundwater-neutral.

2.6 Responsibility for system safety

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.

2.7 Protection against hazards through gases

2.7.1 Protective measures against escaping gases

- ▶ Wear protective clothing and a protective mask in the case of hot and/or aggressive measuring gases or high dust loads.
- ▶ Never open the enclosure or switch off the purge air feed without taking appropriate protective measures when the duct is pressurized.

2.7.2 Noxious gases in device/module

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. See Table "Maximum gas amounts in SICK devices" for these gases.

Should a leakage occur, the concentrations inside the closed device could rise to a certain concentration. These concentrations are also shown in this Table.

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

Table 1: Maximum gas amounts in SICK devices

Equipment/ module(s)	Gases	Max. total amount (ml)	Max. concentration inside the device when leaks occur (defect)
GM901	CO	10 ml	350 ppm

2.7.3 Hot gases in ambient conditions with overpressure

- Purge air unit (SLV4)

WARNING: Risk of fire through hot gas escaping in installations with overpressure conditions

On installations with overpressure, the purge air hose can be severely damaged by escaping hot gas and can catch fire depending on the temperature.

On plants with overpressure and gas temperatures over 200 °C at the same time:

- ▶ Ensure reverse flow is prevented by fitting a (trip) flap or a valve.
- ▶ Regularly check the functionality of the reverse flow safeguard.

2.7.4 Behavior after purge air failure

Certain configurations of the GM901 measuring system demand immediate or short term measures to protect the measuring system should the purge air supply fail.

2.8 Electrical safety

2.8.1 Protection against hazards through electrical equipment

GM901 system components include electrical equipment designed for use in industrial high-voltage plants where the relevant standards and regulations must be observed.

- ▶ Disconnect power lines before working on power connections or live parts.

2.8.2 Electrical safety through circuit breakers properly installed

WARNING: Endangerment of electrical safety during installation and maintenance work when the power supply is not switched off

An electrical accident can occur during installation and maintenance work when the power supply to the device or lines is not switched off using a power isolating switch/ circuit breaker.

- ▶ Before starting the work on the device, ensure the power supply can be switched off using a power isolating switch/circuit breaker in accordance with DIN EN 61010.
- ▶ Make sure the power isolating switch is easily accessible.
- ▶ An additional disconnecting device is mandatory when the power isolating switch cannot be accessed or only with difficulty after installation of the device connection.
- ▶ After completion of the work or for test purposes, the power supply may only be activated again by authorized personnel complying with the safety regulations.

2.8.3 Electrical safety through lines with correct rating

WARNING: Endangerment of electrical safety through power cable with incorrect rating

Electrical accidents can occur when the specifications for replacement of a removable power cable have not been adequately observed.

- ▶ Always observe the exact specifications in the Operating Instructions (Technical Data Section) when replacing a removable power line.

2.8.4 Grounding the devices

NOTICE: Device damage through incorrect or missing 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.

3 Product description

3.1 Product identification

Product name	GM901
Device version	Cross-Duct
Manufacturer	SICK AG Erwin-Sick-Str. 1 · D-79183 Waldkirch · Germany
Type plates	• Sender unit: On the side • Receiver unit: On the side • Control unit: At the rear

3.2 Product features

The in-situ gas analyzer GM901 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 2: Actual process moisture at 0 vol. % H_2O

Default value[1] entered (vol. % H_2O)	Absolute difference to input value (vol. % H_2O)	Process temperature (°C)	Additional relative % CO 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 3: 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 4: 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
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 5: 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 CO2 in the process gas has an effect on CO measurement at high temperatures. The more the temperature increases at constant CO2 concentration, the higher the relative CO measurement error becomes. Consider the influence in the following Table.

Max. CO2 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%

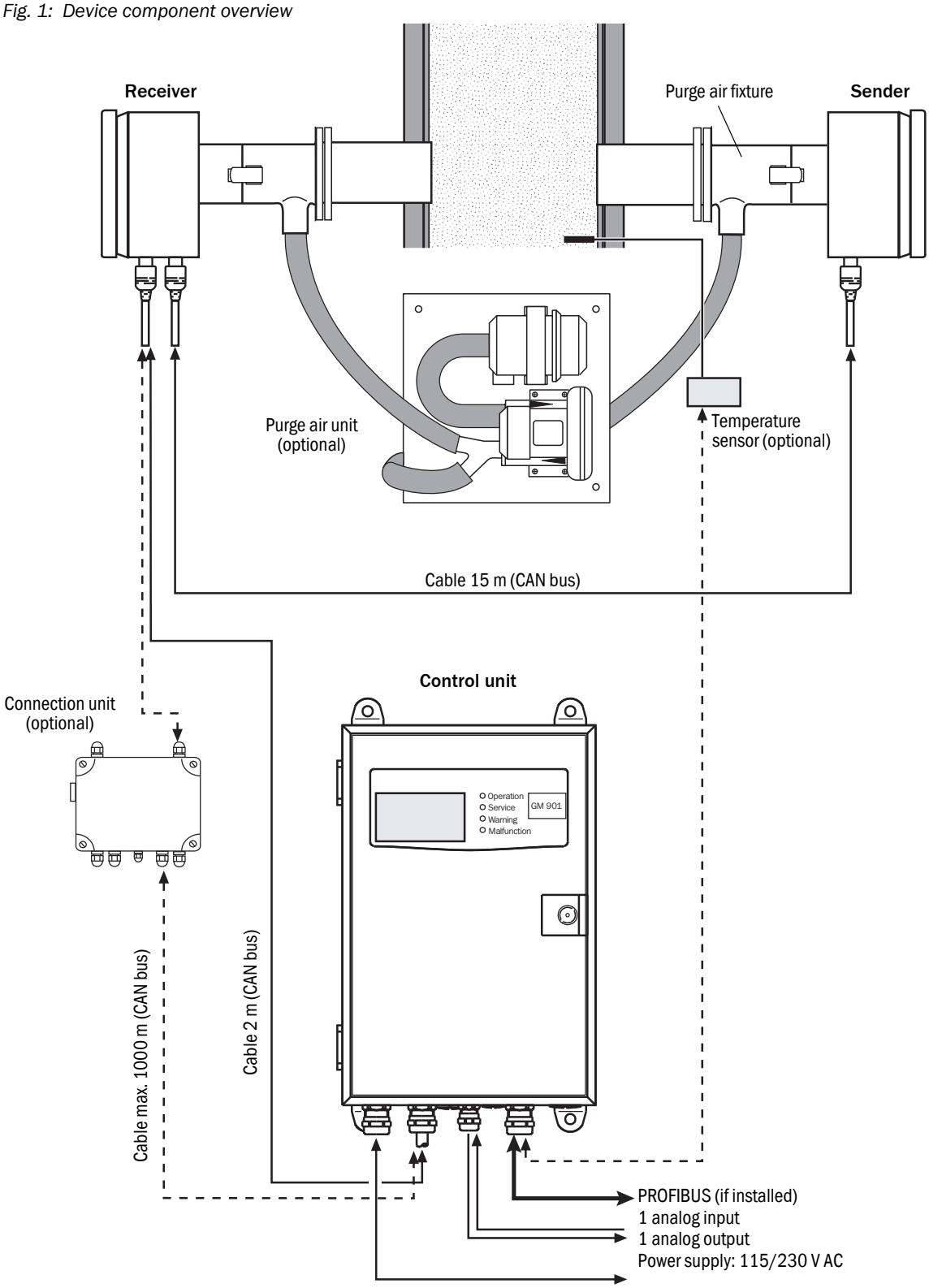
3.3 Device variants

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

	GM901 Standard	GM901 Extended calibration
Type code	GM901-05-xxxx1 or xxxx3	GM901-05-xxxx2 or xxxx4
Temperature range	Applications up to 250 °C	Applications up to 430 °C

3.4 Layout

Fig. 1: Device component overview



3.5 Standard scope of delivery

The basic version of the GM901 comprises

- Sender
- Receiver
- Control unit with connecting cable (2 m)
- Sender-receiver connection cable (15 m)

3.5.1 Control unit

The control unit 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 positioned close to the sender; 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)

3.5.2 PROFIBUS interface (if installed)

PROFIBUS connects the process control level (e.g., central computer, host, control room) to the measuring device. Measured values, status states and error messages are queried cyclically via the PROFIBUS. The GM901 supports PROFIBUS-DP-V1 with transfer rates from 9.6 to 187 kBit/s. A device master file (GSD) is available for the evaluation unit to define the interface. This contains specifications on device manufacturer, identification number, transfer rates available, etc. This GSD (Profile GSD) of the device can be easily used during project planning for the PROFIBUS.

A unique 7 bit device address (1-127) serves to identify PROFIBUS participants and can be entered when setting control unit parameters. Addresses 126 and 127 are reserved and must not be used.

NOTE:
A terminator (terminating resistor) must be plugged to the final device.

Measured values provided

Measured values provided by the GM901 are defined in the device master file (GSD) as input channels for the process control level (AI). The following Table shows the measured variables with the respective assigned units of measure:

Measured variable	CO
CO	ppm
CO	mg/m³ (s.c.)
CO	mg/m³ (a.c.)

3.6 Optional accessories

- Connection unit for distances longer than 17 m up to 1000 m
- Purge air unit to protect the optical interfaces from sender and receiver
- Flanges
- Optical adjustment device
- CO test cells with holder (SPAN test)
- Adjustment bracket to create a zero path
- Dummy flange
- Temperature sensor PT 100
- Weather protection hood

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 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

5.1.1 Information on lifting and carrying

CAUTION: Risk of injury through incorrect lifting and carrying the device

Injuries can occur due to the weight and projecting enclosure parts when the device tips over or drops. Observe the following information to avoid such accidents:

- ▶ Do not use protruding parts on the enclosure to carry the device (apart from the wall fixture or carrying grips).
- ▶ *Never* lift the device using the open device door.
- ▶ Consider the device weight before lifting.
- ▶ Observe the regulations for protective clothing (e.g., safety shoes, non-slip gloves)
- ▶ Grip underneath the device when possible to carry it safely.
- ▶ Use a hoist or transport device as an option.
- ▶ Use the help of a second person when necessary.
- ▶ Secure the device during transport.
- ▶ Before transporting, ensure obstacles that could cause falls or collisions are cleared away.

5.1.2 Information on assembly (wall fitting)

CAUTION: Accident risk through inadequate fastening of the device

- ▶ Consider the weight of the device when selecting fastenings.
- ▶ Check the load capability/state of the wall/rack on which the device is to be fitted.

5.2 Preparing the sampling point

Responsibility of the plant operator

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

NOTICE: Basis for determining the sampling point:

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

5.3 Check scope of delivery

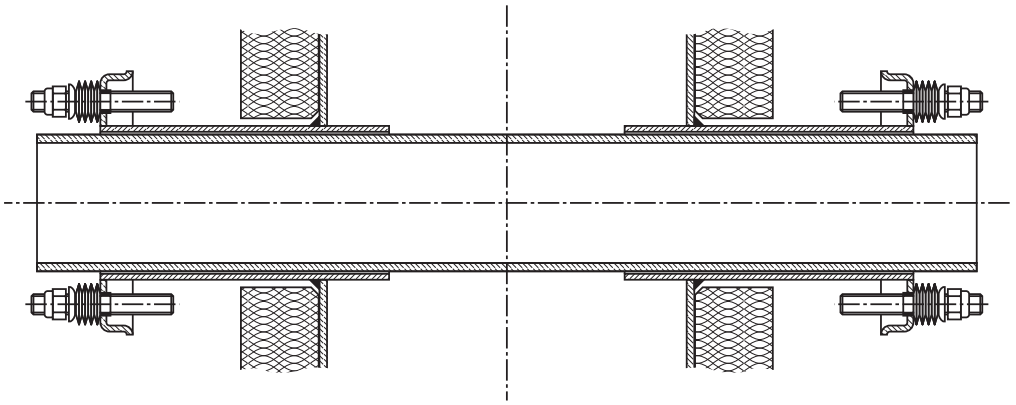
- ▶ Check the scope of delivery according to the order confirmation.
- ▶ Ensure the supply voltages indicated on the type plates correspond to the system conditions.
- ▶ Check all components for externally perfect delivery condition.

5.4 Fitting the flange with pipe

Important information on installing the flanges with tube

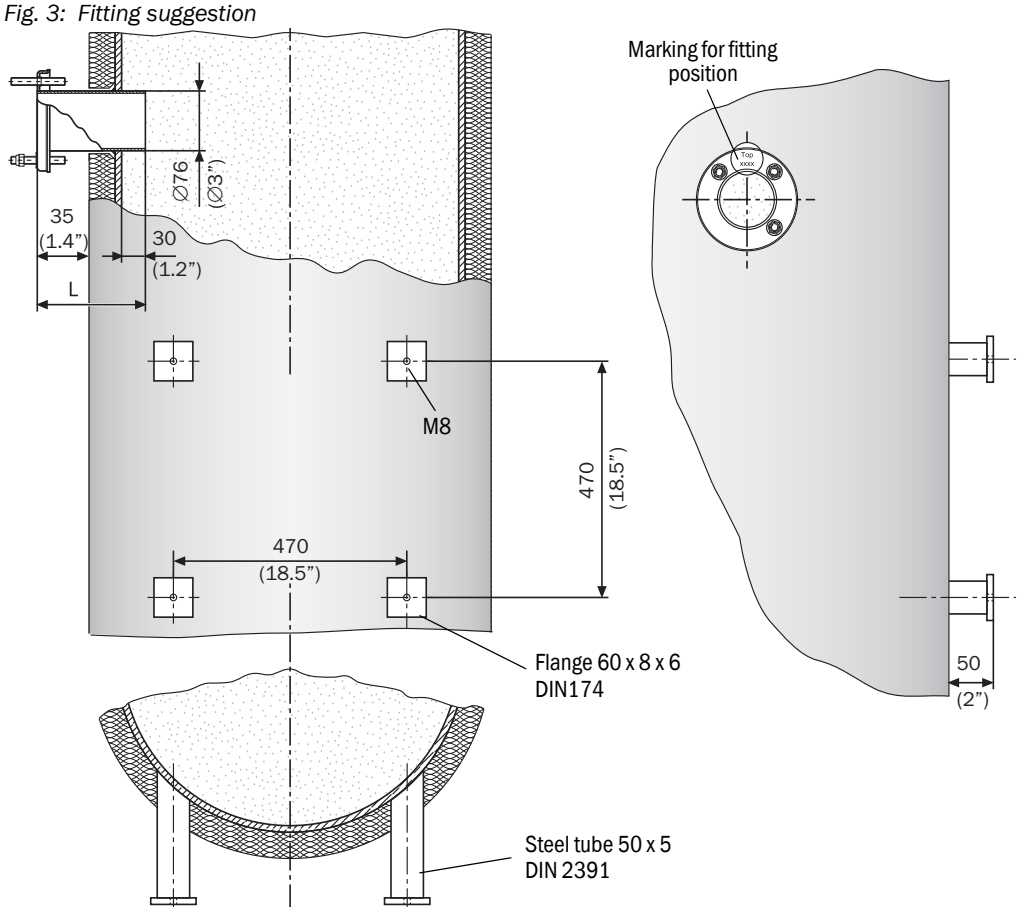
- The axes of the flanges with tube must be aligned carefully to each other during assembly. The angle deviation must be under 1°. Plan suitable reinforcements or support constructions on thin-walled steel ducts.
- On easily accessible measuring distances up to 2 m, the flanges with tube can be aligned using a suitable auxiliary tube (for standard flange diameter 70 mm).

Fig. 2: Auxiliary tube to align the flanges on measuring distances under 2 m



Use an optical adjustment device on longer or not easily accessible measuring distances.

Fig. 3: Fitting suggestion

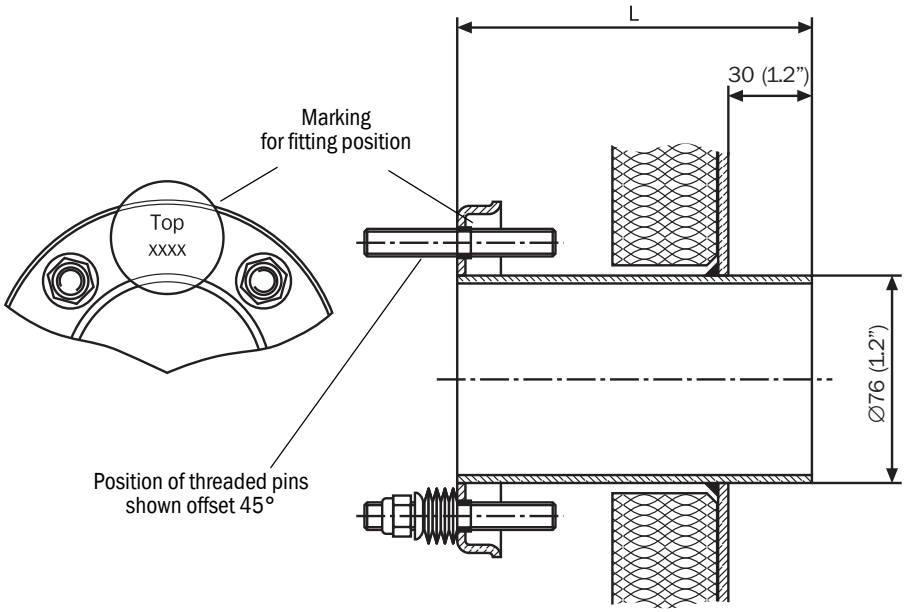


5.4.1 Installing the standard flange

NOTE: Damage to the duct opening possible!
Make sure parts cut off do not fall into the duct

- Mark the assembly position of the “flange with tube”, cut a hole with a blowtorch.
- The supports for the “flange with tube” should protrude approx. 30 mm into the duct. If necessary, adjust the tube supports.
- Tack-weld the flange with tube and maintain the exact measuring distance flange-flange and dimensions for the “Top” marking of the fitting position.

Fig. 4: Flange with tube, standard version



Standard flange with tube		
L [mm]	Part No.	Material
130	2 017 845	ST37
240	2 017 847	ST37
130	2 017 846	1.4571
240	2 017 848	1.4571
500	2 017 849	ST37
500	2 017 850	1.4571

- To align the flange with tube on-site: Use a tube (Fig. 2) or the adjustment device.

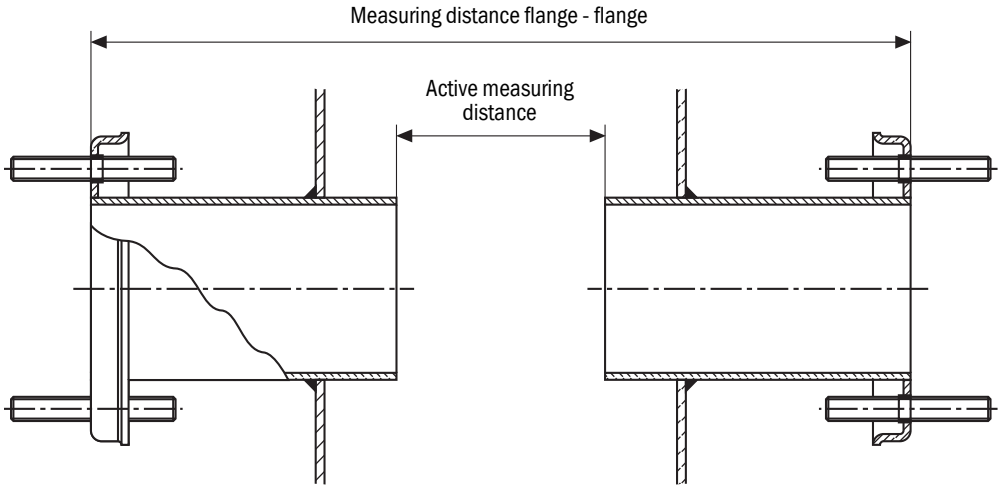
Fig. 5: Aligning the flange using an optical adjustment device

- ▶ Position the light source and the receiver part as described in Fig. 5 when using the adjustment device.

1 Align flange No. 1 until the light spot of the light source appears centered in the adjustment circle of the receiver part. Tack-weld flange 1.
2 Reposition the adjustment device swapped.
3 Align flange No. 2 and tack-weld.
During welding and alignment work, make sure the planned flange-to-flange measuring distance is observed exactly when a zero path has already been ordered or delivered. Otherwise the zero path must be adapted, see see “Creating the zero path”, page 41.

5.4.2 Measuring distance definition

Fig. 6: Measuring distance flange - flange



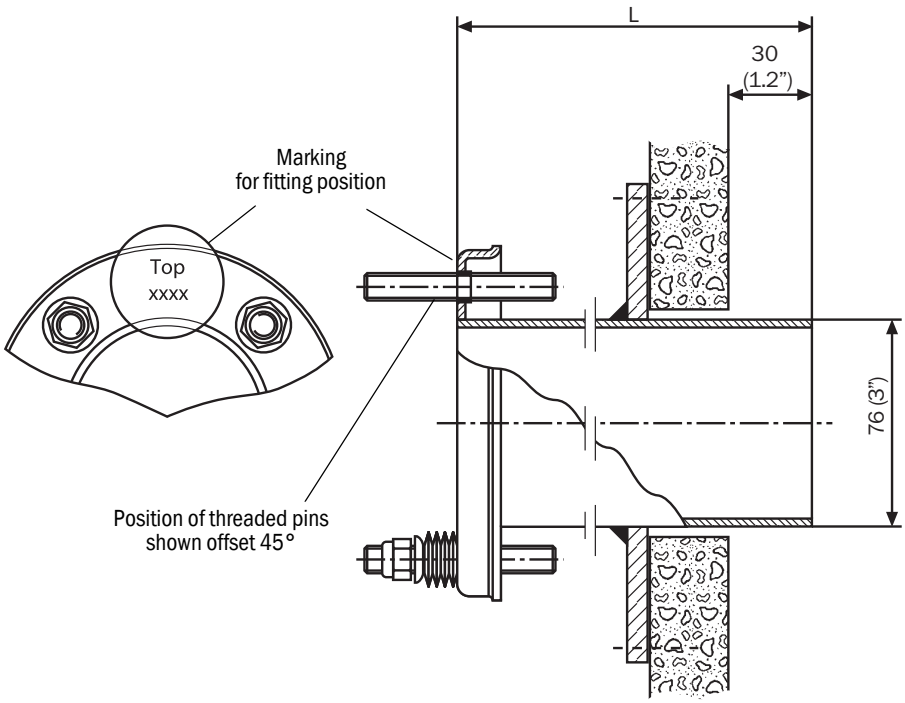
The “flanges with tube” must be aligned exactly within 1°.

- ▶ Correct the alignment when necessary. Circular-weld to finish.
- ▶ Determine and note the exact flange-flange distance and the active measuring distance length (definition, see Fig. 6). Keep the measures available for commissioning.

5.4.3 Assembly variant for brick stacks

For brick ducts, attach a suitable anchor plate to the stack wall and then weld the flanges with tube on.

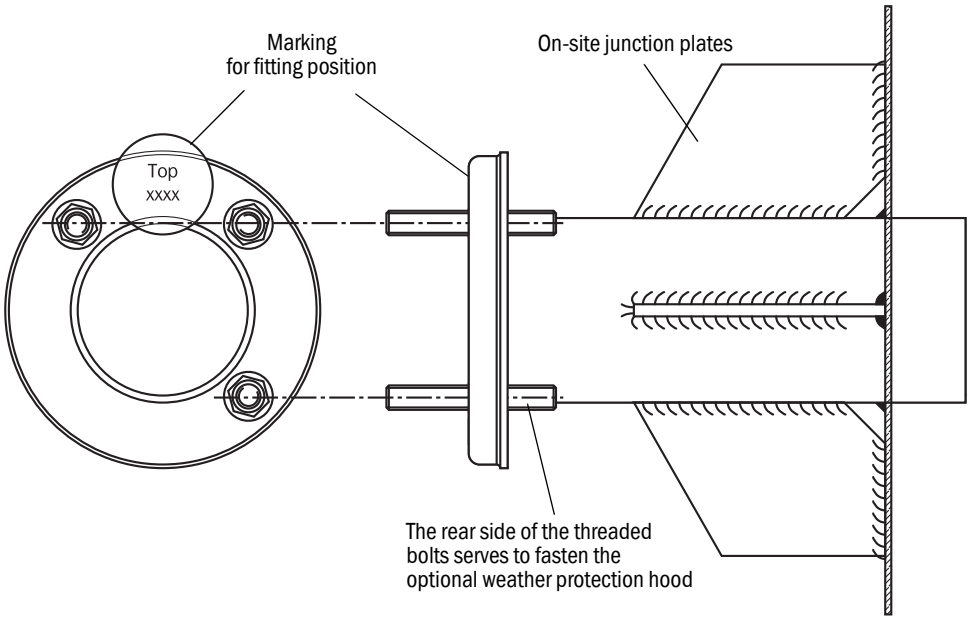
Fig. 7: Flange with tube for brick stacks



5.4.4 Assembly variant for thin-walled ducts

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

Fig. 8: Example for reinforced fitting location



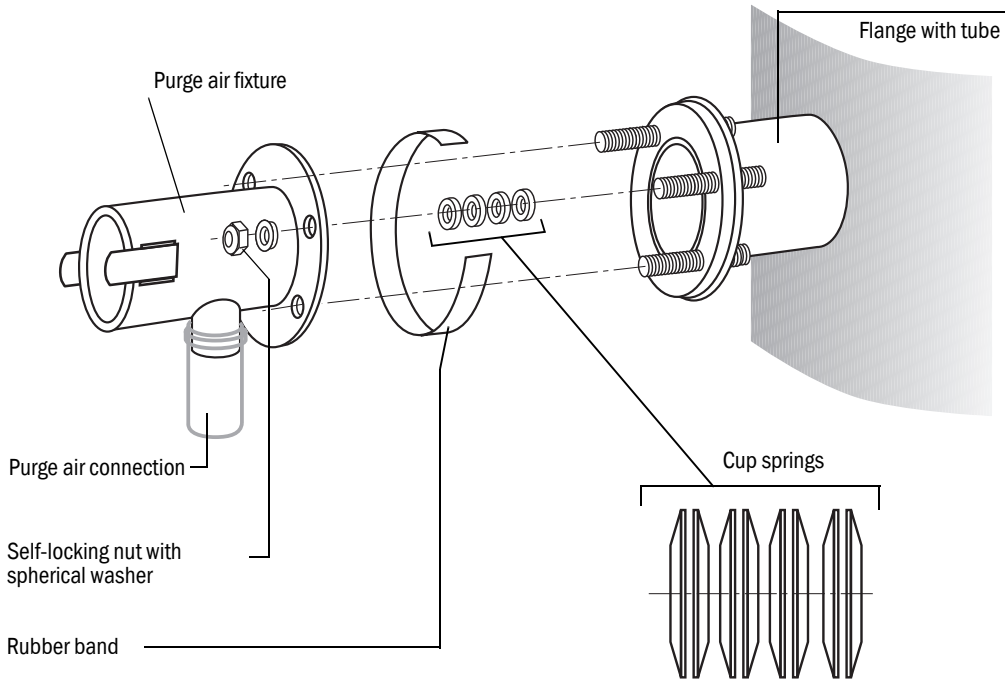
5.5 Installing the purge air unit

NOTE:
For information on the purge air unit, see the Operating Instructions of the purge air unit (SLV4).

5.6 Installing the GM901 CO measuring device

Adjust the GM901 beforehand to ensure trouble-free installation and, most important, commissioning. A CO-free environment must be available for this zero adjust. The adjustment can be made directly at the sampling point when the plant is switched off and the duct free from CO (see “Starting zero adjust”, page 41).

Fig. 9: Installing the purge air fixtures on the flange with tube



1 Purge air unit is installed, see “Installing the purge air unit”, page 27.
2 Push the purge air hoses onto the purge air fixtures and fasten with hose clamps.
3 Switch the power supply for the purge air unit on, see “Electrical connection of the purge air motor”, page 34.
4 Check that purge air is available on the purge air fixtures of the sender and receiver
5 Pull the rubber band onto the flange with tube.
6 Push 4 cup springs on each of the 3 threaded bolts.
7 Position the purge air fixtures of the sender and/or receiver on the flange.
8 Push spherical washers onto the 3 threaded bolts.
9 Turn in the self-locking nuts (SW17) and tighten so that a gap of 8.5...10 mm is between both flange plates.
10 Pull the rubber band over this connection gap.

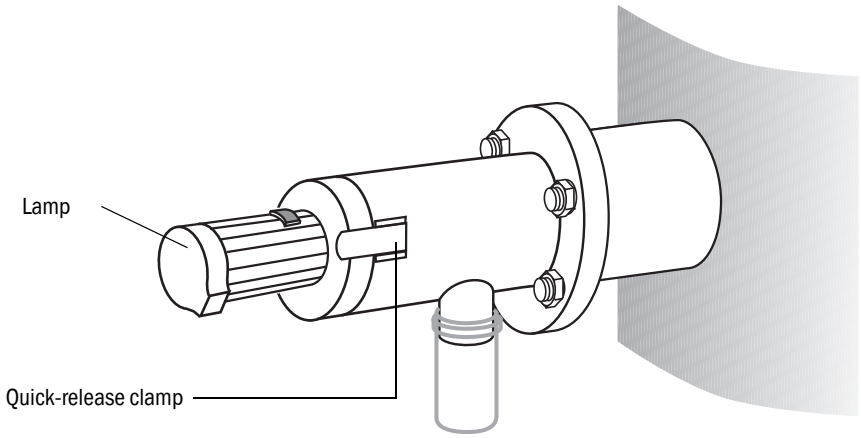
5.6.1 Aligning the optical axis

An adjustment device with a lamp and an optional adjustment tube are available for simple alignment of the purge air fixtures.

Fig. 10: Adjustment device (option)

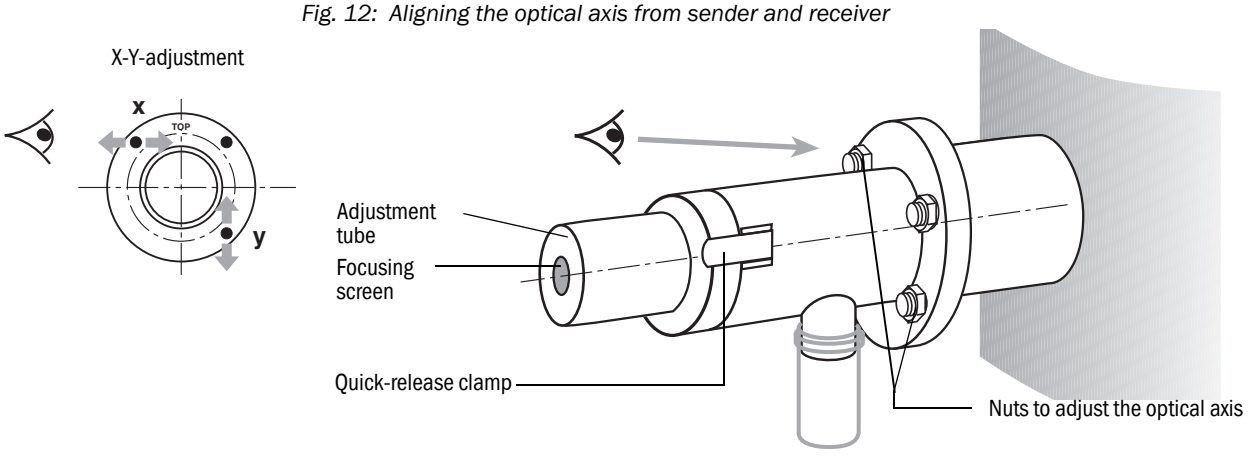
▶ Fasten the lamp on the sender over the quick-release clamps on the purge air fixture.

Fig. 11: Optical adjustment device (lamp)



▶ Fasten the adjustment tube on the receiver over the quick-release clamps on the purge air fixture.

Fig. 12: Aligning the optical axis from sender and receiver



On the receiver

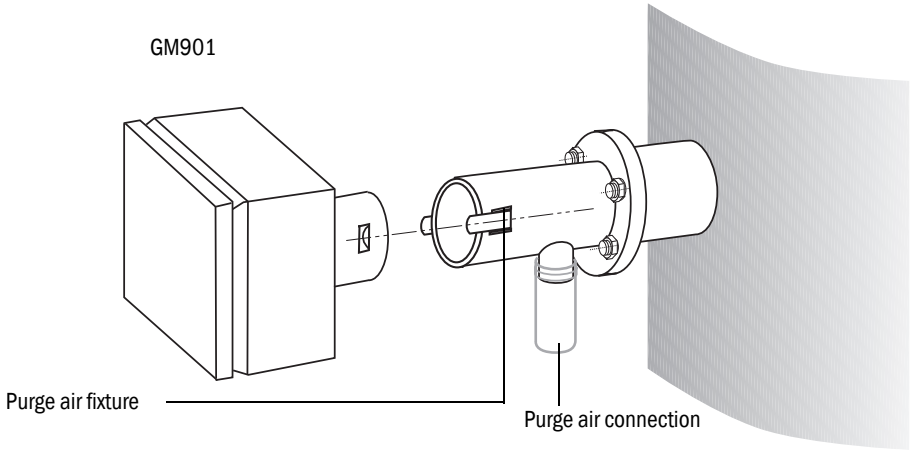
- ▶ Tighten the 2 nuts on the horizontal adjustment (X) and vertical adjustment (Y) so that the light spot is shown centered on the focusing screen of the adjustment tube.
- ▶ Swap the optical adjustment device on the purge air fixtures of the sender and/or receiver.

On the sender

- ▶ Tighten the 2 nuts on the horizontal adjustment (X) and vertical adjustment (Y) so that the light spot is shown centered on the focusing screen of the adjustment tube.
- ▶ Check the adjustment of the purge air fixtures again on both sides.

5.6.2 Installing the sender and receiver

Fig. 13: Fastening the GM901

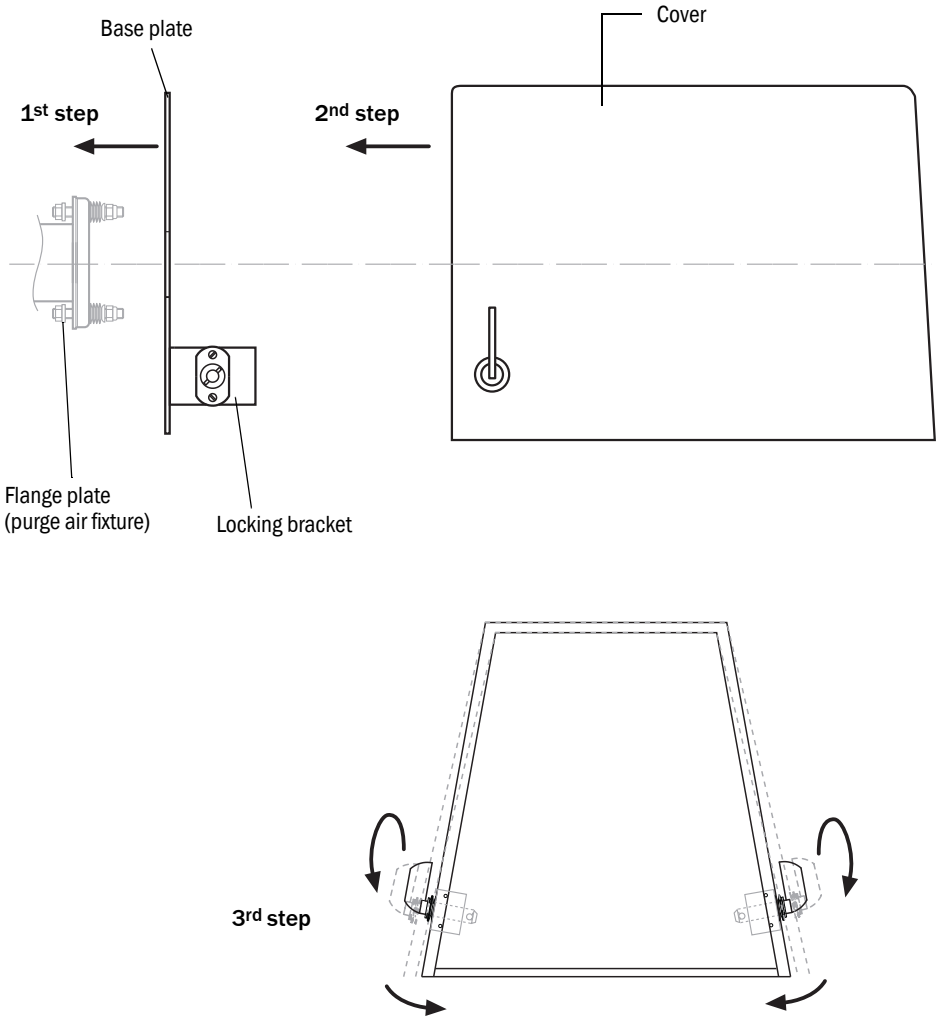


- ▶ Remove the optical adjustment device and fasten the sender and receiver using the quick-release clamps.

5.6.3 Installing the weather protection hood for the GM901

The optionally available weather protection hood comprises a base plate (with locking bracket) and a cover.

Fig. 14: Fastening the weather protection hood for the GM901



1 Push the base plate onto the side of the flange with tube and screw it to the duct-side surface of the flange plate (purge air fixture) with the threaded bolts provided.
2 Position the cover on the base plate from the top; hold the cover panels slightly apart at the side at the same time.
3 Insert the side holding catches into the counterpieces, twist and lock in.

5.7 Installing the control unit

Prerequisite

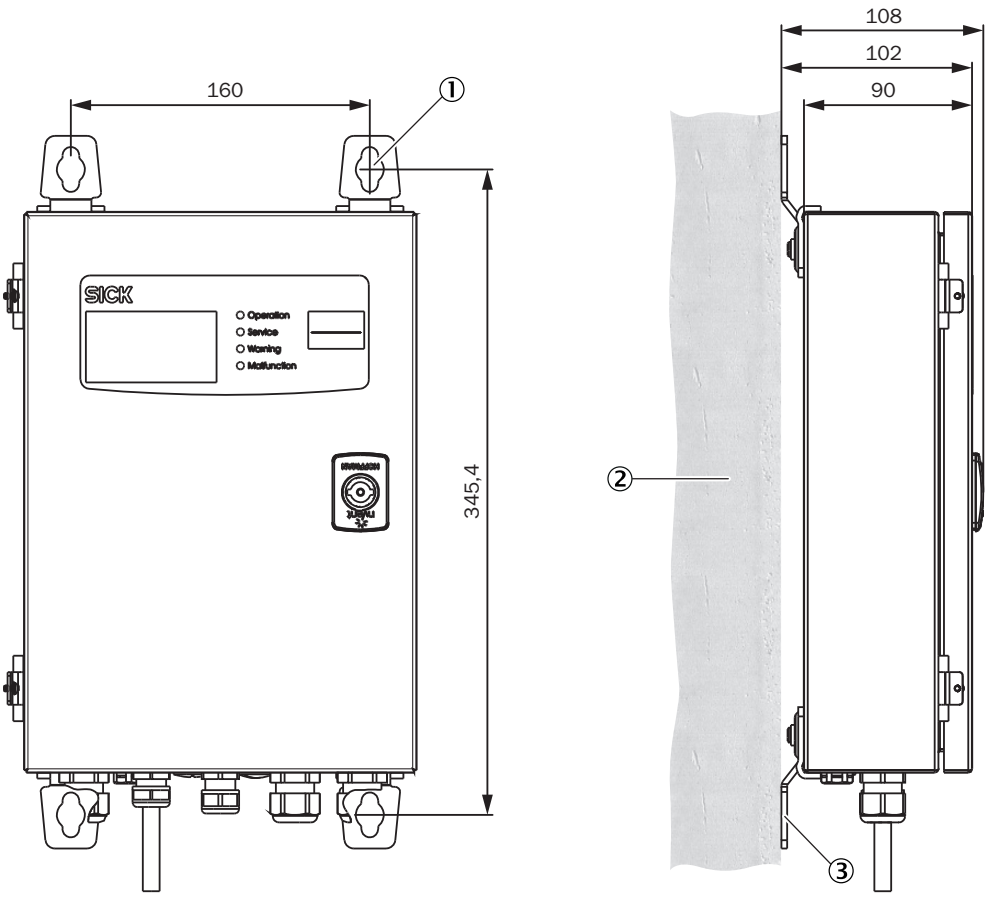
- Installation location already determined during project planning.
- The maximum line length of 1000 m for all CAN bus connections has been considered.

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.

Fig. 15: Installing the control unit



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

Procedure

▶ Drill the holes according to the installation drawing (Ø 7.2 mm for M8).

▶ Screw the control unit tight to the four fastening brackets.

6 Electrical installation

6.1 Project planning

The customer must carry out the installation and final wiring on-site if not otherwise agreed with SICK.

Important information

- The standard version of the GM901 has one single purge air unit. For high duct overpressure (> 10 mbar), a more powerful fan or one purge air unit each for the sender and receiver can be used divergent from the standard version.
- A large range of purge air motors with varying performance and different power connections are available. Before starting installation, check the versions and number of purge air units delivered and change circuit planning accordingly!
- The power connection for the control unit and purge air motor must be fixed on-site.
- Install and secure a separate power supply for the control unit and for the purge air unit.
- Install a dedicated power circuit breaker switch, with a motor circuit breaker when possible, for the purge air unit in the vicinity of the measuring devices.
- Position a clearly visible warning sign to secure the switch against unintentional switch-off.
- A protective phase failure switch is recommended for 3-phase motors.

Electrical protection

- Accessories: Control unit of GM901

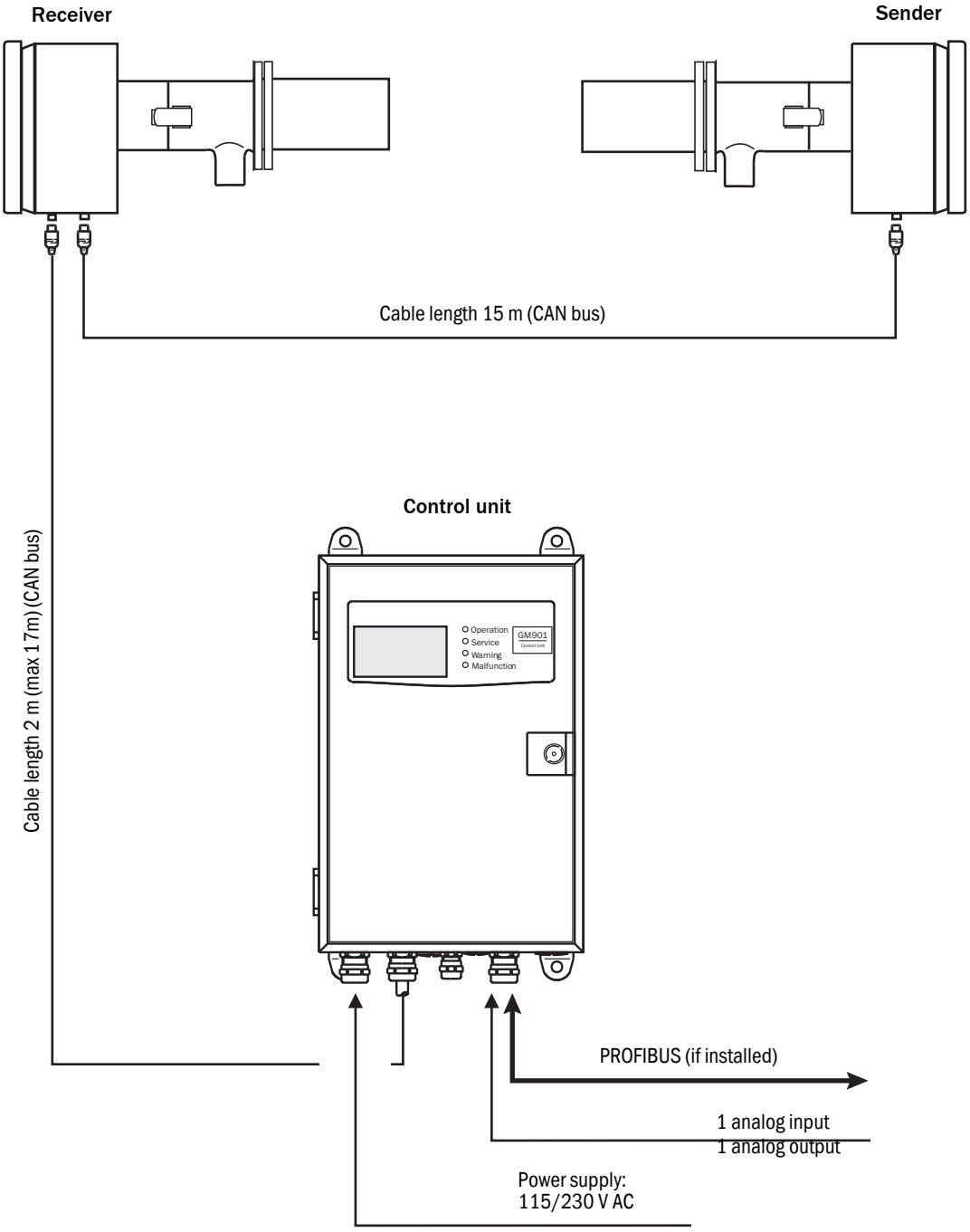
Insulation:	Protection class 1 in accordance with EN 61140
Insulation coordination:	Overvoltage category II in accordance with DIN EN 61010-1
Contamination:	Degree of contamination II in accordance with DIN EN 61010-1

To be provided by the customer on-site:

- The main power supply for the GM901 as well as for the purge air unit (3-phase)
- Signal cable according to task definition
- PE conductor for the connection on the outside of the control unit (to comply with the EMC regulations)

6.2 Electrical wiring for the standard version

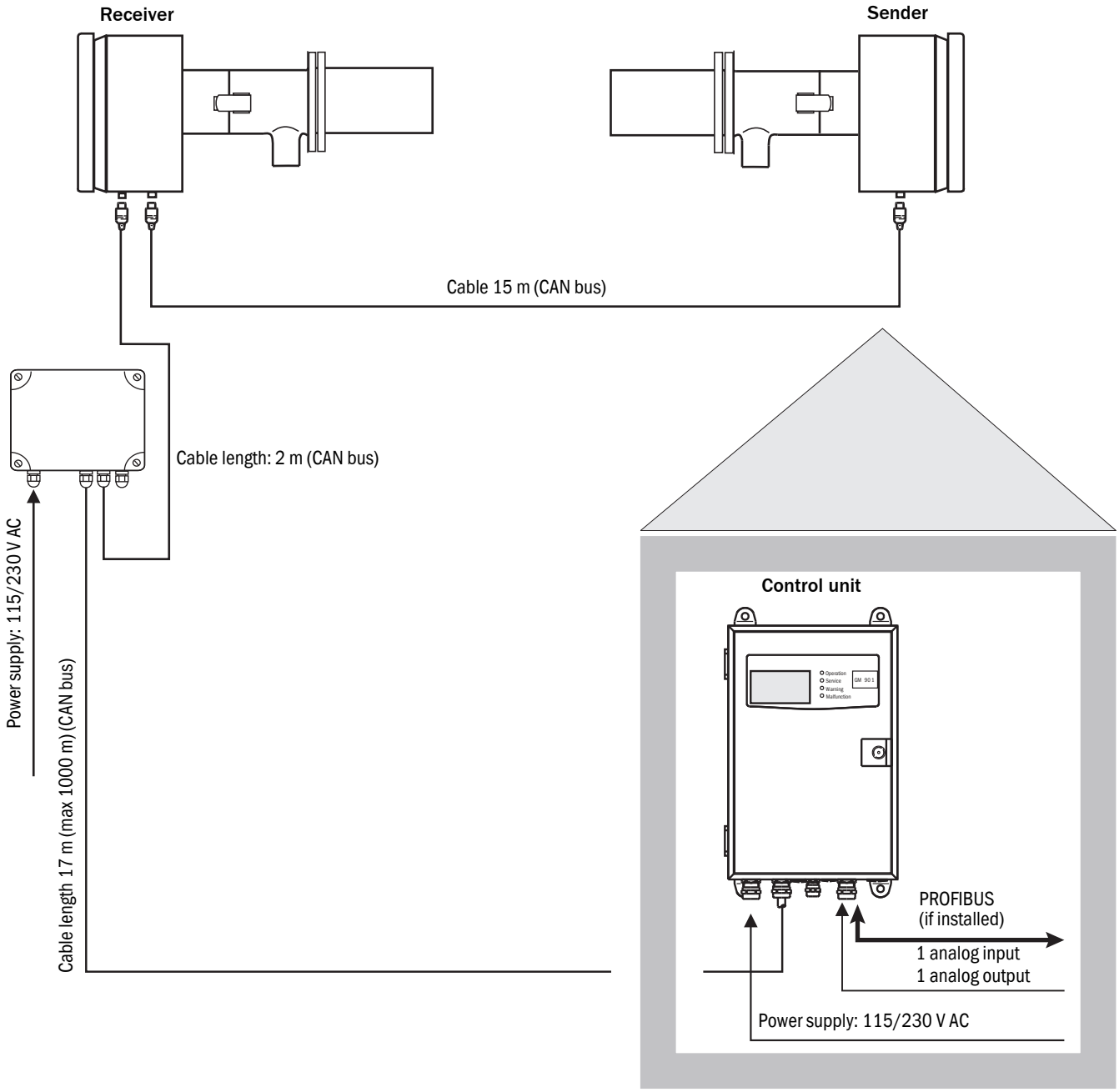
Fig. 16: Electrical connections GM901 (standard)



▶ Connect the system components as shown in Fig. 16.

6.3 Electrical wiring with connection unit

Fig. 17: Connection unit for distances up to 1000 m



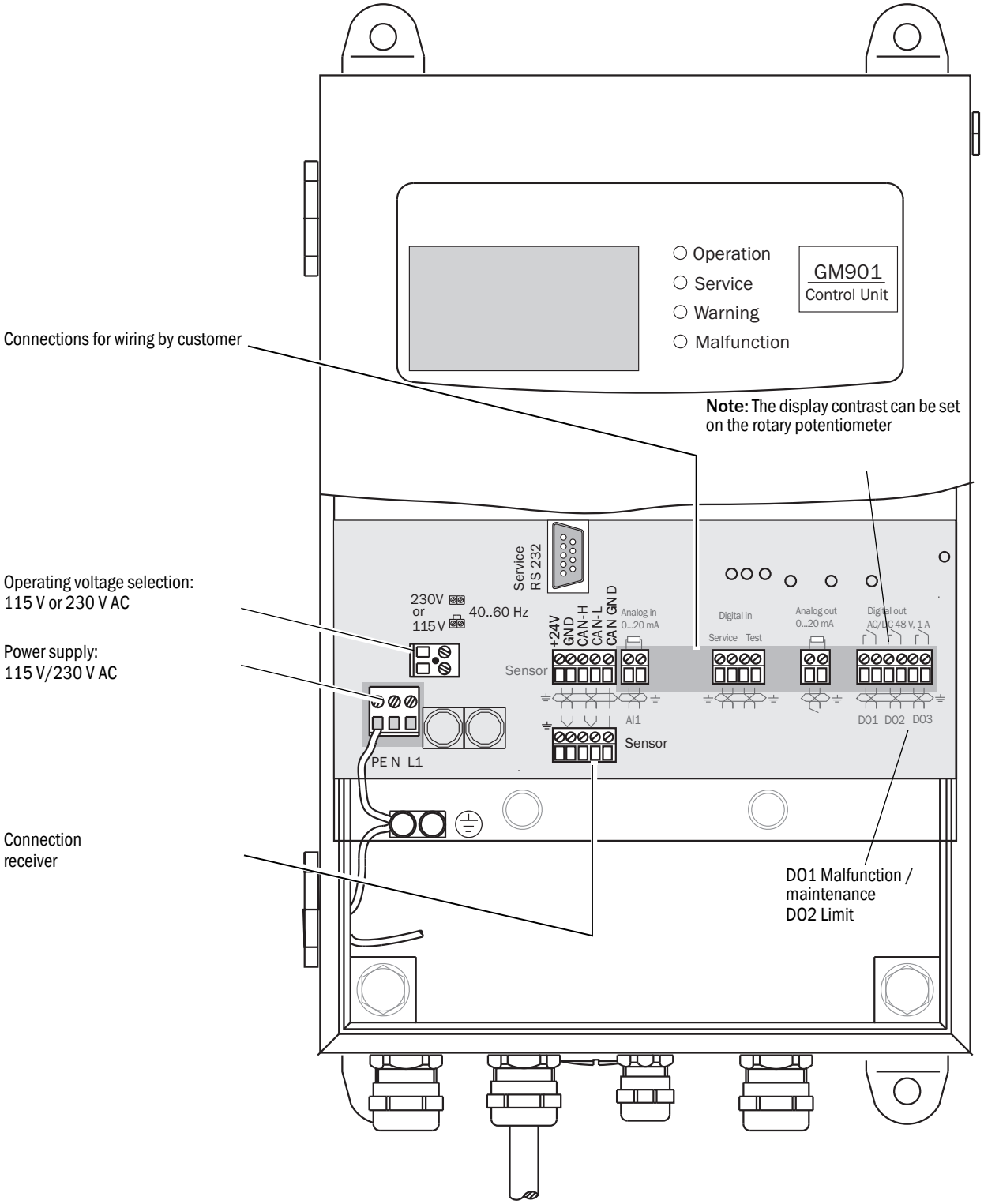
▶ Connect the system components as shown in Fig. 17.

6.4 Electrical connection of the purge air motor

NOTE:
For information on the purge air unit, see the Operating Instructions of the purge air unit (SLV4).

6.5 Electrical wiring: Control unit – standard

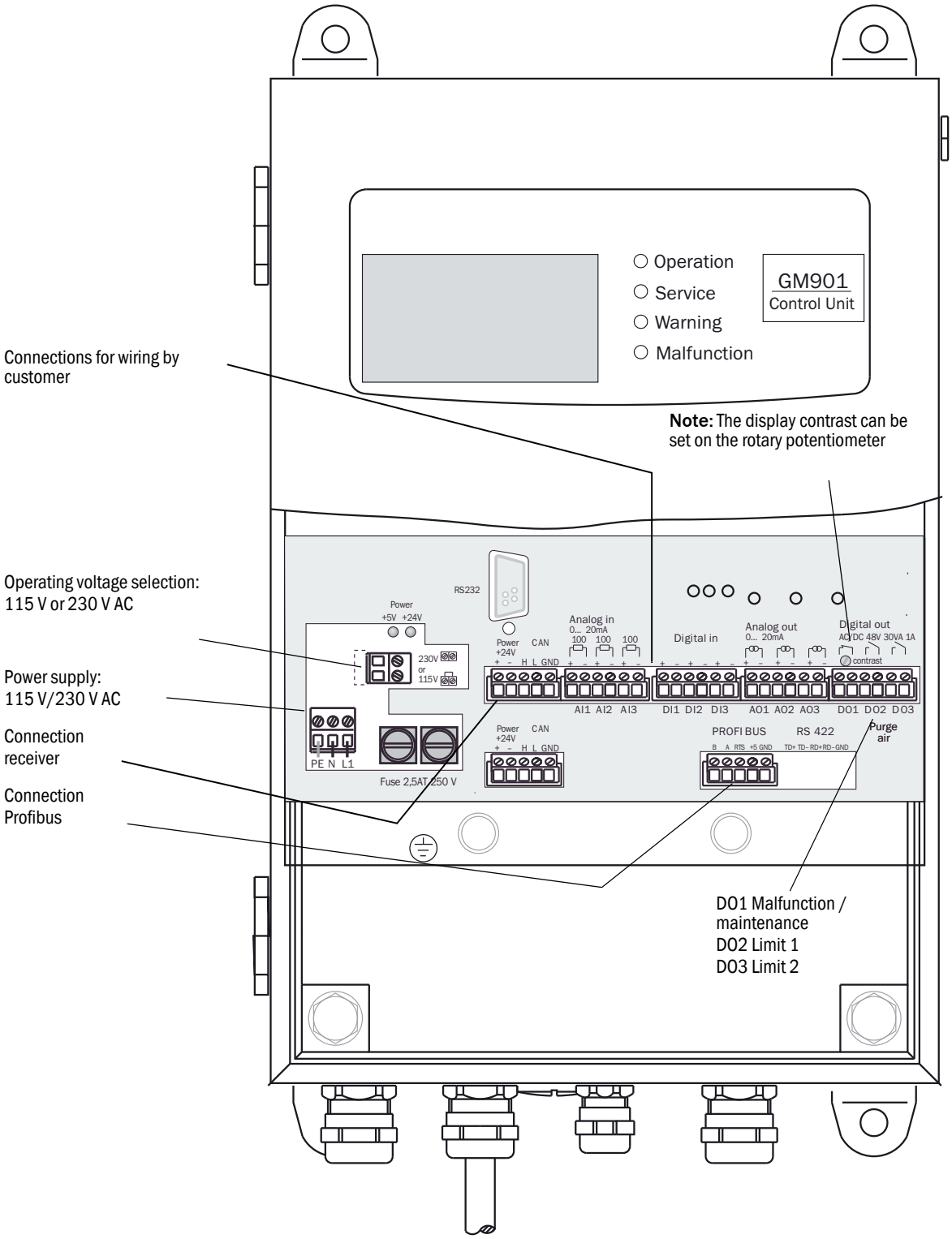
Fig. 18: Electrical connections on the control unit - standard (on-site)



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

6.6 Electrical wiring: Control unit – PROFIBUS

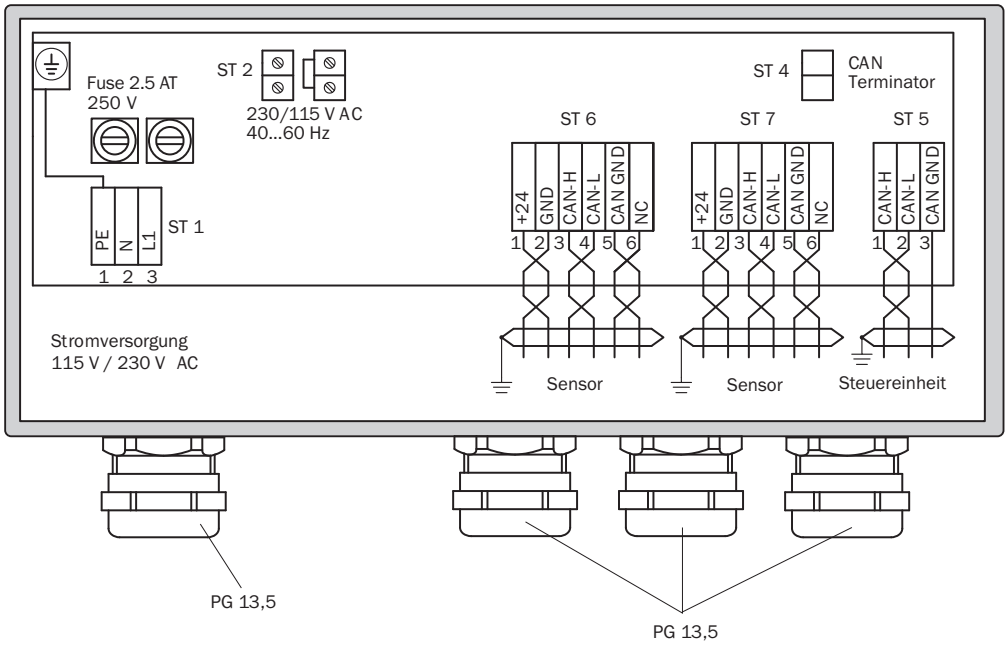
Fig. 19: Electrical connections on the control unit – PROFIBUS (on-site)



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

6.7 Electrical connections of the evaluation unit

Fig. 20: Electrical connections of the evaluation unit



Connection on the control unit – terminal strip ST 5

Cable length max. 1000 m

CAN-H / CAN-L / CAN GND

Connection on the GM901 receiver – terminal strip ST 6 or ST 7

Standard cable (2 m)

+24 V	RS
GND	GR
CAN-H	YE
CAN-L	GN
CAN-GND	BR

7 Commissioning

7.1 Requirements for commissioning

The following work must be completed or checked again before commissioning:

- Check the electric installation
- Check and function tests (fan rotation direction) of the purge air unit (option)
- Flange alignment
- Check (measure) the active measuring distance, see “Measuring distance definition”, page 25

7.2 Calibration

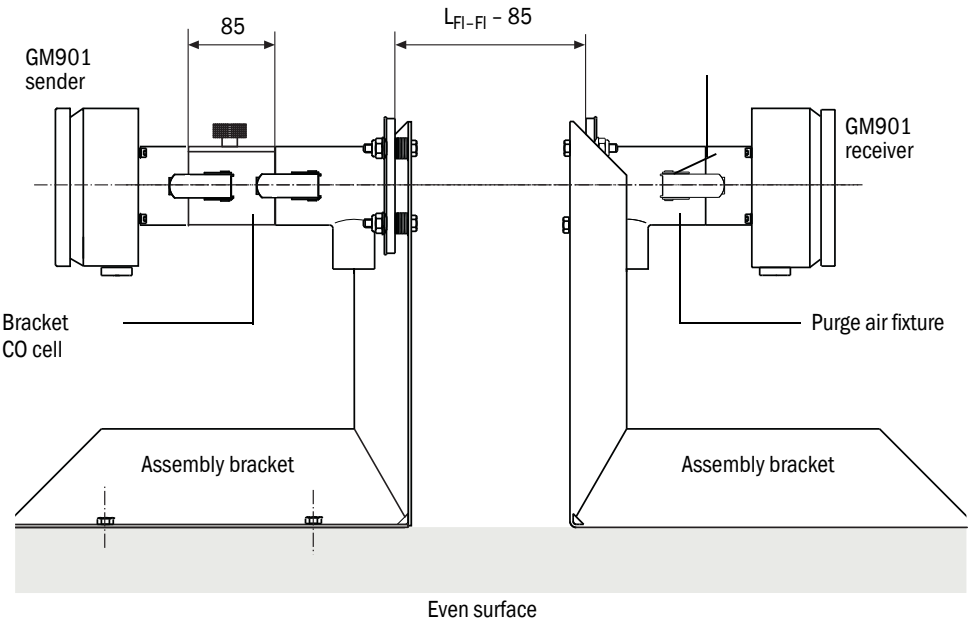
7.2.1 Prerequisites for zero adjust

- Carry out the zero adjust **only** before initial commissioning or recommissioning! The environment must be free from CO. The adjustment can be made directly at the sampling point when the plant is switched off and the duct free from CO. If this is not possible, carry out the zero adjust with the sender and receiver of the GM901 on the assembly brackets.
- The system is stable after a warm-up phase of approx. 30 minutes after switching the power supply on.
- Never align the assembly brackets during zero adjust!

NOTE:
The purge air fixtures of the GM901 must be readjusted on the duct, see “Installing the GM901 CO measuring device”, page 27! Setting the measuring distance alters the device parameters and therefore this value must be set before the zero adjust (see “Changing the flange - flange measuring distance and the active measuring distance”, page 57).

Fig. 21: Zero path of the GM901

L_{Fl-Fl}... Measure - flange - flange of the duct measuring distance



7.2.2 Calibrating the GM901 Standard

Prerequisite

Only for devices with corresponding type code and temperature range, see “Device variants”, page 17.

Procedure

1 Perform zero adjust, (see “Zero adjust”, page 41)
2 Enter the offset correction of the zero point measurement, see “Changing the calibration values”, page 65.
3 Perform manual SPAN test (optional), see “SPAN test (optional)”, page 42.
4 Enter SPAN value, see “Changing the calibration values”, page 65.

7.2.3 Calibrating the GM901 with extended calibration

Prerequisite

Only for devices with corresponding type code and temperature range, see “Device variants”, page 17.

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 substitute temperature value to the actual ambient temperature, see “Changing the substitute temperature value”, page 58.
3 Set “Temperature Input External” to “No”, see “Setting the use of an external temperature sensor”, page 59.
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 59.
Contact SICK Service when this is not the case.
5 Set SPAN value to “1”, see “Changing the calibration values”, page 65.

Procedure

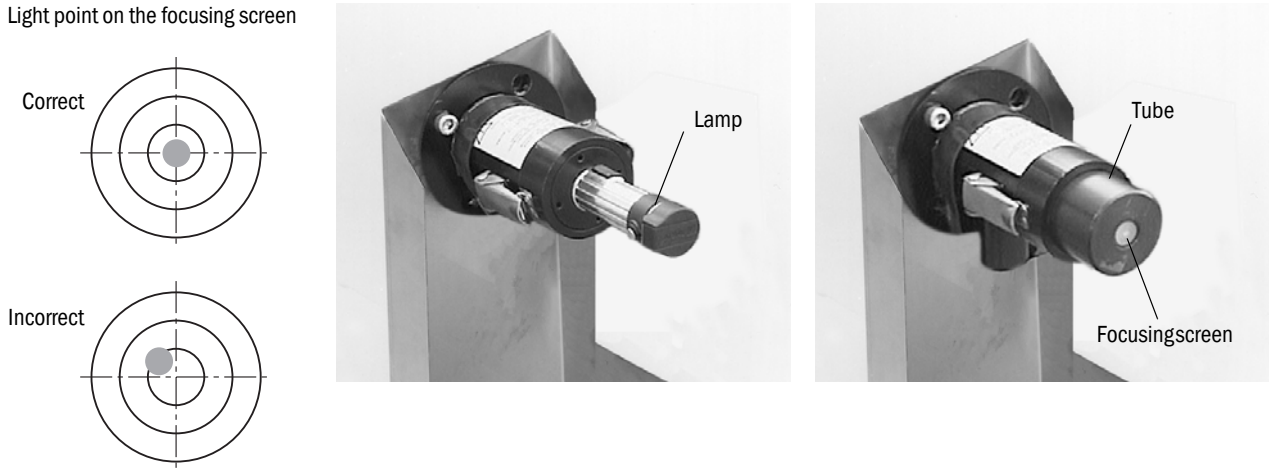
1 Perform zero adjust, (see “Zero adjust”, page 41).
2 Enter the offset correction of the zero point measurement, see “Changing the calibration values”, page 65.
3 Perform manual SPAN test (optional), see “SPAN test (optional)”, page 42. Note the SPAN value.
4 Perform calculation for high temperature SPAN value:
– Use Calculation Table “span offset calculation for units with extended calibration” (available under 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 65.
6 Reset temperature parameters to reflect process conditions, see “Temperature”, page 58.

7.2.4 Zero adjust

Creating the zero path

- Have the assembly bracket for zero adjust ready.
- Remove the purge air fixtures from the sender and receiver, and secure them on the assembly bracket (available as an option).
- Attach the holder for the CO cell, e.g., on the sender; but do **not** use a cell filled with CO when a sensitivity test is also planned.
- Adjust the assembly bracket to the flange - flange (cell holder) measure minus 85 mm of the duct measuring distance as shown in Fig. 21.
- Align the purge air fixtures optically using the adjustment device.
- Fasten the sender and receiver on the purge air fixtures.

Fig. 22: Alignment using the adjustment device (lamp, tube)



NOTE:
Do not change the alignment of the assembly brackets.

Starting zero adjust

- Press CAL on the operating panel of the control unit to start the zero adjust (see “Performing zero adjust”, page 69).

7.2.5 SPAN test (optional)

An optional manual SPAN test can be carried out for linearity control.

NOTE:
This test requires the optionally available CO cell and holder, see “Optional accessories”, page 20.

7.2.5.1 *Determining the test values*

Determine the test concentration (test cell value) using the following formula:

TW [ppm × m] = MB [ppm] × x × S [m]

TW	=	Test value
MB	=	Full scale value
S	=	Measuring distance
x	=	Test point location

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

Example:

Example values:	**Calculation:**
MB = 1500 ppm	TW [ppm × m] = MB [ppm] × x × S [m]
S = 4 m	TW [ppm × m] ×= 1500 [ppm] × 0.7 × 1 [m]
Test point at 70% of MBx = 0.7	TW [ppm × m] ×= 1050 [ppm × m]

Result:

Test value of the test cell: 1050 ppm × m

Deliverable test cell: 1600 ppm × m

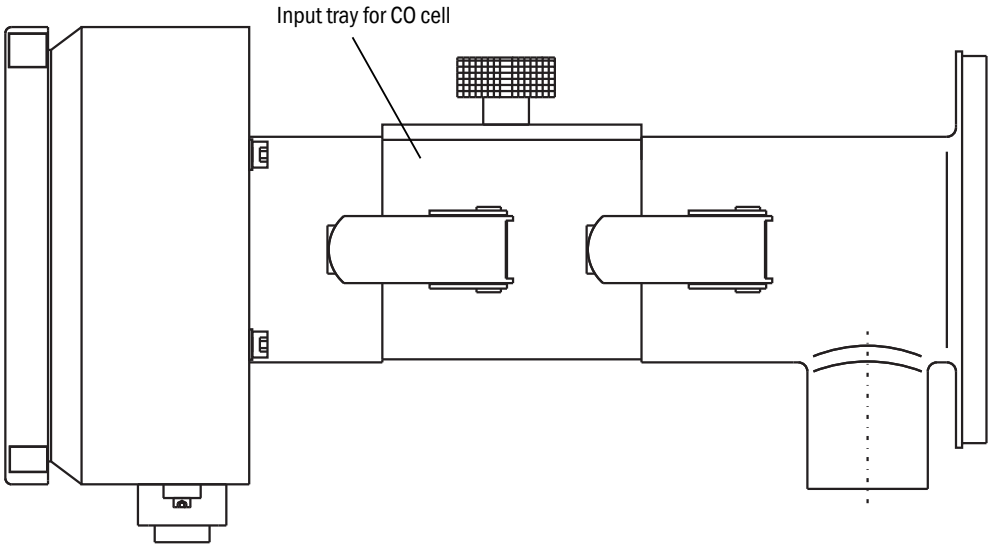
NOTE:
Only the following test cells are available:
- 1600 ppm × m
- 4000 ppm × m
- 10000 ppm × m

7.2.5.2 *Carrying out a SPAN test*

- Preparations for performing the SPAN test, see “SPAN Test”, page 70.
- Insert the test cell holder on the sender .

NOTE:
Do not insert a cell filled with CO yet.

Fig. 23: GM901 sender with test cell holder



- Press CAL on the operating panel of the control unit to start the SPAN test (see “SPAN Test”, page 70) and follow the instructions displayed.

7.3 Fitting the measuring device on the duct

- Remove the sender and receiver from the purge air fixtures.
- Remove the holder for the CO cells.
- Remove the purge air fixtures from the assembly bracket.
- Keep the zero path parts such as assembly bracket, holder for CO cells in a safe place.
- Mount the GM901 at the sampling point, see “Installing the sender and receiver”, page 29.
- Manual SPAN test (optional) for linearity control.

7.4 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	
Flange - Flange	2500 mm
Active Measuring Distance	2000 mm

Temperature	
Substitute	150 °C
External	Yes
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

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 66).

Parameter Device	
Serial Number	_ _ _ _ _ _ _ _ *Entered during final inspection*

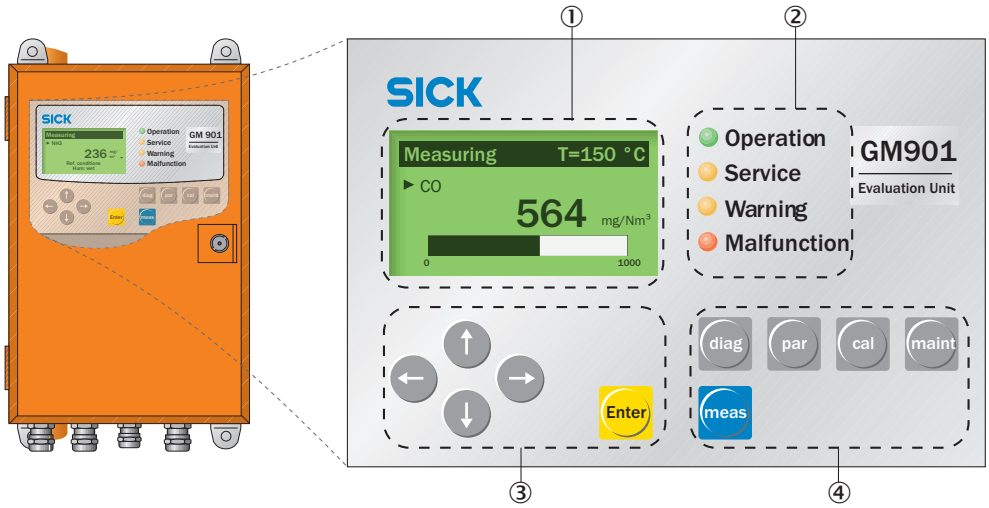
Software Revision	
Sensor Unit	_ _ _ _ _ _ _ _ _ _ _ _ *Current software version*
Evaluation Unit	_ _ _ _ _ _ _ _ _ _ _ _ *Current software version*
Configuration	_ _ _ _ *Type code of the control unit*

Service	
C1	Determined during zero adjust
C2	Determined during zero adjust
C3	
C4	Factory data assigned to the GM901 receiver.
C5	
C6	(Individual for each device)
C7	
C8	

8 Operation

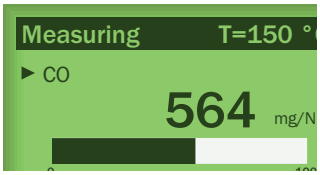
8.1 Operating and display elements

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 48
	“par”: Parameter	see “Parameters”, page 51
	“cal”: Calibration	see “Calibration”, page 68
	“maint”: Maintenance	see “Maintenance”, page 71
	“meas”: Measurement	see “Measuring mode”, page 47

8.1.2 Display

	T=150 °C	Measured value of an external temperature sensor or an internal adjustable default value
	564 mg/Nm3	Current measured value
	0	Measuring range start value, adjustable
	2000	Measuring range end value, adjustable
	t	Adjustable limit value

8.1.3 Status LEDs

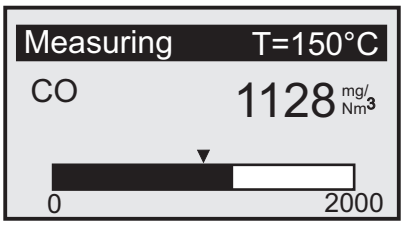
LED	Significance
OPERATION	• Measuring mode • Device is switched on. Power voltage available.
SERVICE	• Service mode
Warning	• Warning message • At least one warning message pending • Read the warning message, see Diagnosis mode (diag)
MALFUNCTION	• Device malfunction • At least one malfunction message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

9 Menus

9.1 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 46

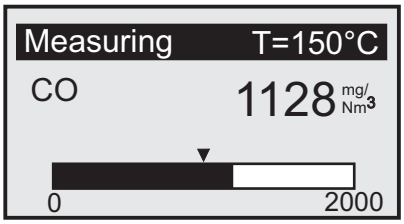
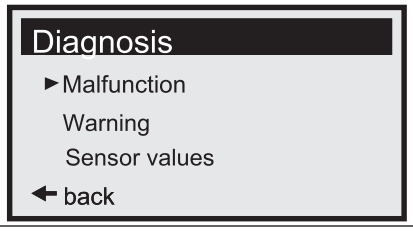
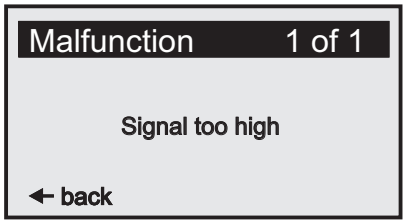
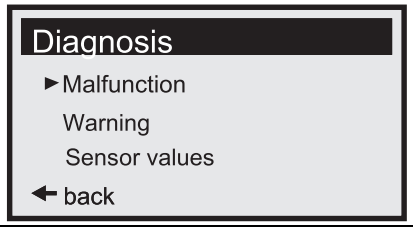
Display	Action	Note
		Press “**Meas**” for immediate return to measuring mode

9.2 Diagnosis

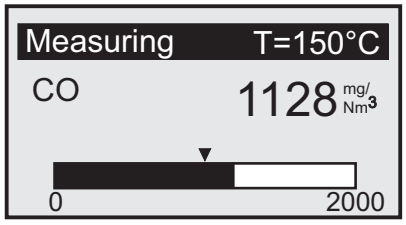
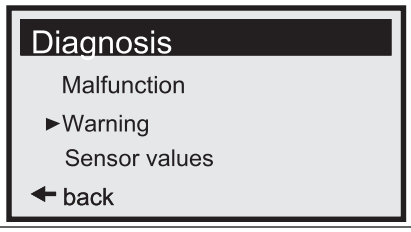
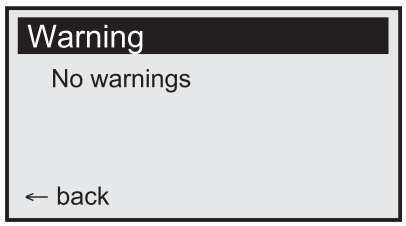
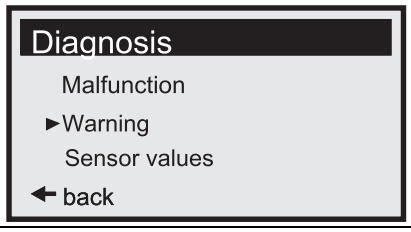
Menu “Diagnosis” serves to view the following data:

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

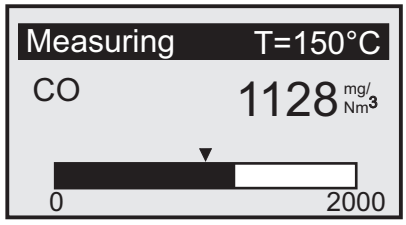
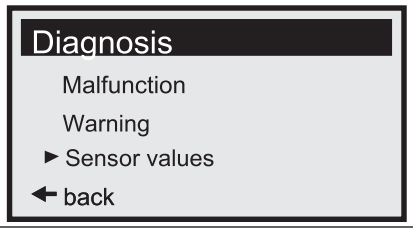
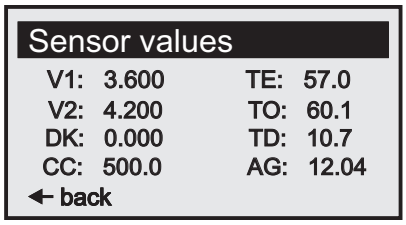
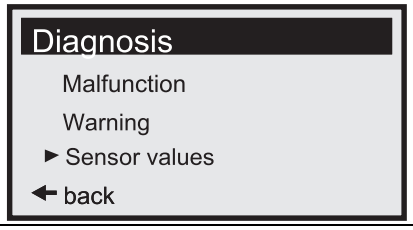
9.2.1 Viewing malfunction messages

Display	Action	Note
	Press “**diag**“	Display switches to Diagnosis mode
	▶ Select “Malfunction ” with “**Arrow down**” ▶ Press “**Enter**”	Displays malfunction messages
	▶ Press “**Arrow left**” (back)	Displays possible malfunctions, see “Malfunctions”, page 78
		

9.2.2 Viewing warning messages

Display	Action	Note
	Press “**diag**“	Display switches to Diagnosis mode
	▶ Select “Warning” with “**Arrow down**” ▶ Press “**Enter**”	Displays warning messages
	▶ Press “**Arrow left**” (back)	Displays possible warnings (see “Warnings”, page 77) and malfunctions (see “Malfunctions”, page 78)
		

9.2.3 Viewing sensor values

Display	Action	Note
	Press “**diag**“	Display switches to Diagnosis mode
	► Select “Sensor values” with “**Arrow down**” ► Press “**Enter**”	Displays sensor measured values for error diagnosis
		Use these data when completing the Diagnosis form.
		

9.3 Parameters

The following settings can be viewed and changed:

Submenu “Parameter settings”

1 Physical Unit, see “Changing the physical unit”, page 52
2 Normalization, see “Setting the humidity correction”, page 53
3 Response Time, see “Changing the response time”, page 54
4 Measuring Range, see “Changing the measuring range”, page 55
5 Limit Value, see “Changing the limit value”, page 56
6 Meas.Distance, see “Changing the flange - flange measuring distance and the active measuring distance”, page 57
7 Temperature, see “Temperature”, page 58
8 Humidity, see “Setting the humidity content in sample gas”, page 62
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 “Setting the sample gas pressure”, page 63
12 Median Filter, see “Median Filter”, page 66

Submenu “Device”, see “Device characteristic data (Device)”, page 66

1 Serial Number
2 Software Version
3 Control Unit Configuration

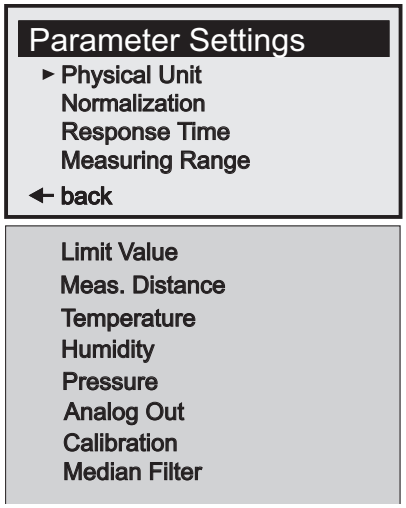
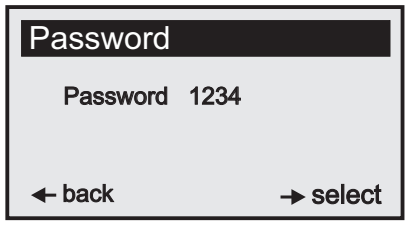
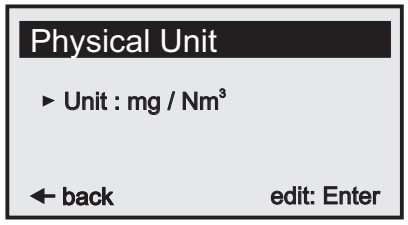
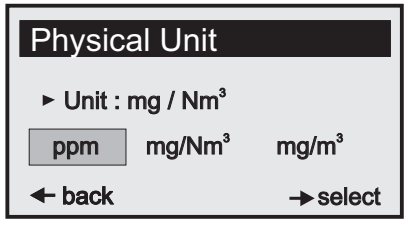
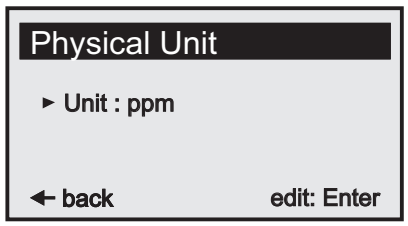
Submenu “Service”, see “Service”, page 68

1 Calibration values, device-specific

9.3.1 Changing the physical unit

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

- ppm
- mg/Nm³
- mg/m³

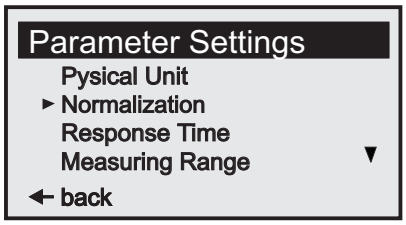
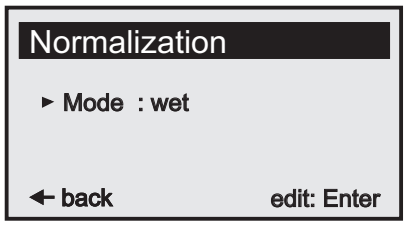
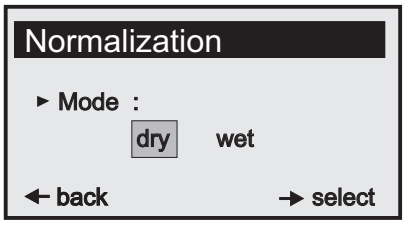
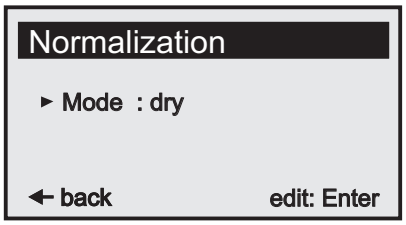
Display	Action	Note
	▶ Select “**Physical Unit**” ▶ Confirm with “**Enter**”	All parameters that can be edited are accessible in this menu
	▶ Enter password and press “**Enter**”	The password is 1234 The password remains active for 30 minutes
	▶ Press “**Enter**”	Displays the physical unit
	▶ Select with “**Arrow right**” ▶ Confirm with “**Enter**”	Selects the physical unit
	▶ Press “**Arrow left**” (back)	Display returns to selection screen

9.3.2 Setting the humidity correction

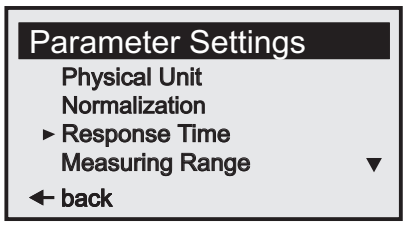
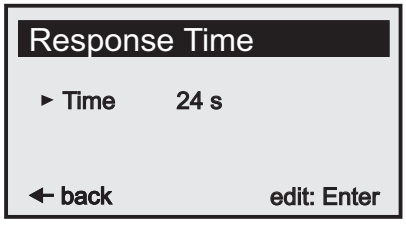
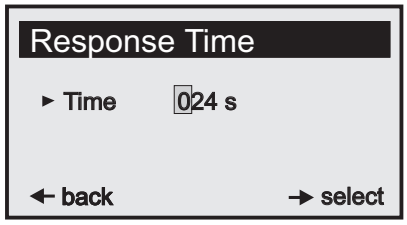
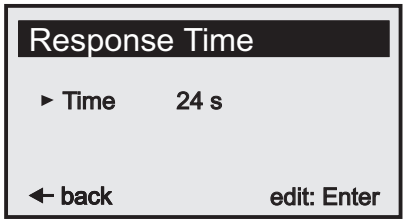
Submenu item “Normalization” serves to set whether the measured value is output calculated as “wet” or “dry”. The default value entered for H_2O is used here, see “Setting the humidity content in sample gas”, page 62.

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

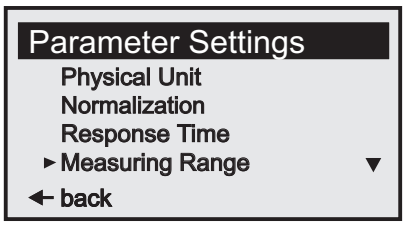
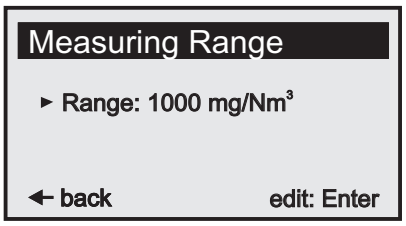
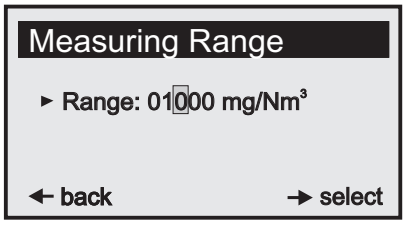
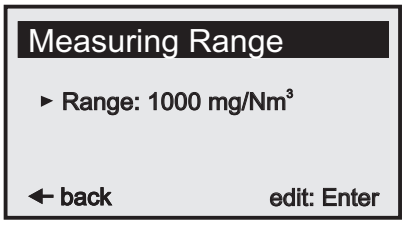
- dry
- wet

Display	Action	Note
	▶ Select “Normalization” ▶ Press “**Enter**”	Measured value normalization
	▶ Press “**Enter**”	Basic factory setting
	▶ Select with “**Arrow right**” ▶ Press “**Enter**”	Confirm with “**Enter**” to save new mode.
	▶ Press “**Arrow left**” (back)	Display returns to selection screen

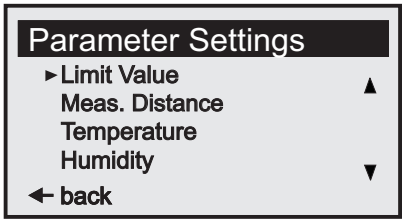
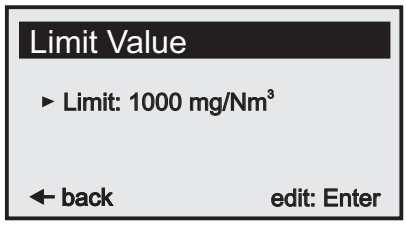
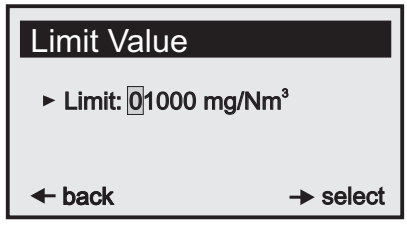
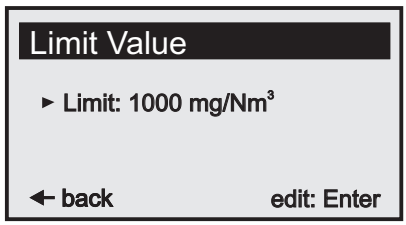
9.3.3 Changing the response time

Display	Action	Note
	▶ Select “**Response Time**” ▶ Press “**Enter**”	Response time
	▶ Press “**Enter**”	Basic factory setting: 24 s Min: 5 s Max: 360 s 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.
	▶ Select with “**Arrow right**” ▶ Enter new value with “**Arrow up**” or “**Arrow down**” ▶ Press “**Enter**”	Confirm with “**Enter**” to save new value.
	▶ Press “**Arrow left**” (back)	Display returns to selection screen

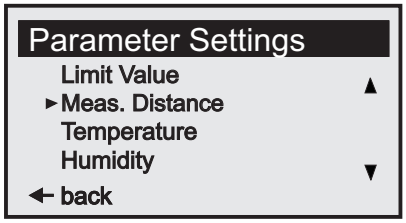
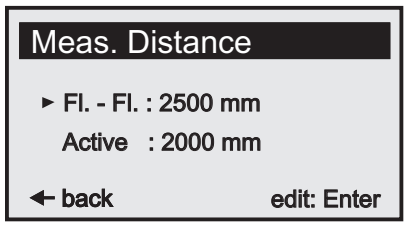
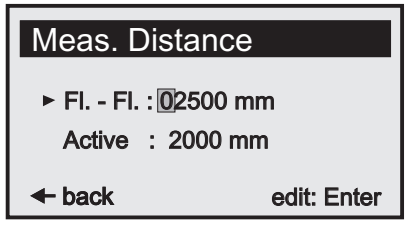
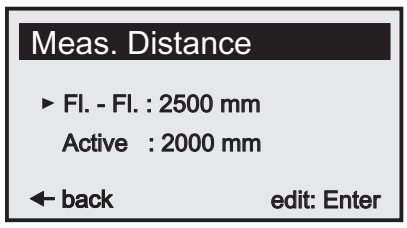
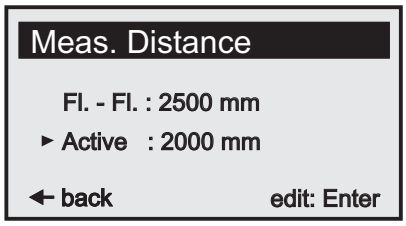
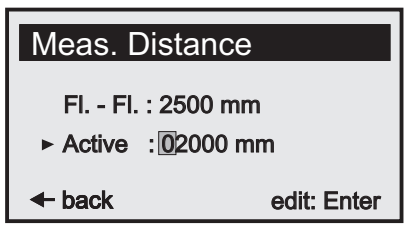
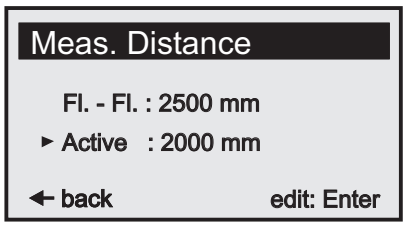
9.3.4 Changing the measuring range

Display	Action	Note
	▶ Select “**Measuring Range**” ▶ Press “**Enter**”	Measuring range
	▶ Press “**Enter**”	Basic factory setting: 1000 mg/Nm³ Min: 100 Max: 60 000
	▶ Select with “**Arrow right**” ▶ Enter new value with “**Arrow up**” or “**Arrow down**” ▶ Press “**Enter**”	Confirm with “**Enter**” to save new value.
	▶ Press “**Arrow left**” (back)	Display returns to selection screen

9.3.5 Changing the limit value

Display	Action	Note
	▶ Select “**Limit Value**” ▶ Press “**Enter**”	Limit value
	▶ Press “**Enter**”	Basic factory setting: 1000 mg/Nm3 Caution: Is the value within the selected measuring range?
	▶ Select with “**Arrow right**” ▶ Enter new value with “**Arrow up**” or “**Arrow down**” ▶ Press “**Enter**”	Confirm with “**Enter**” to save new value.
	▶ Press “**Arrow left**” (back)	Display returns to selection screen

9.3.6 Changing the flange - flange measuring distance and the active measuring distance

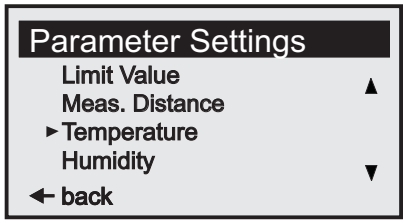
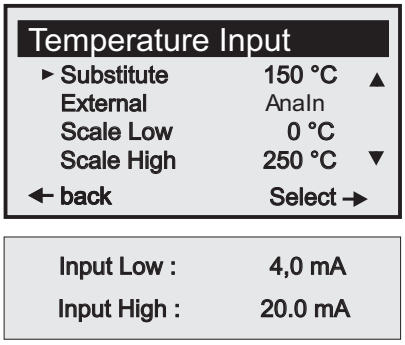
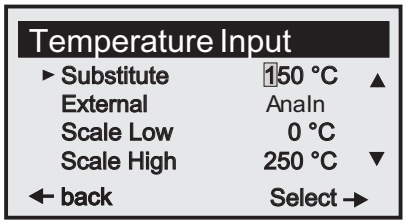
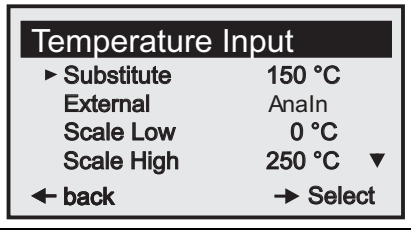
Display	Action	Note
	► Select “**Meas. Distance**” ► Press “**Enter**”	Measuring distance Setting the measuring distance alters the device parameters and therefore this value must be set before the zero adjust.
	► Select “**Fl.-Fl.**” and confirm with “**Enter**”	Basic factory setting for measuring distance Fl.-Fl.: mm 2500 mm Min: 500 mm Max: 8 000 mm
	► Select with “**Arrow right**” ► Enter new value with “**Arrow up**” or “**Arrow down**” ► Press “**Enter**”	Enter value for measuring distance flange-flange Confirm with “**Enter**” to save new value
		
	► Select “**Active** with “**Arrow down**” ► Press “**Enter**”	Enter the active measuring distance Entering the **active measuring distance** must **be very precise (+- 1%)**!
	► Select with “**Arrow right**” ► Enter new value with “**Arrow up**” or “**Arrow down**” ► Press “**Enter**”	Basic factory setting for the active measuring distance: 2000 mm Confirm with “**Enter**” to save new value
	► Press “**Arrow left**” (back)	Display returns to selection screen

9.3.7 Temperature

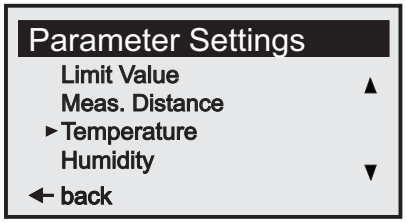
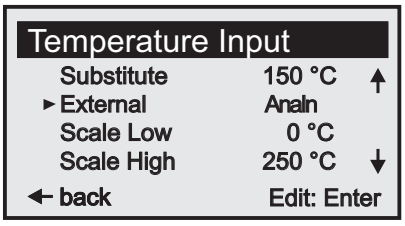
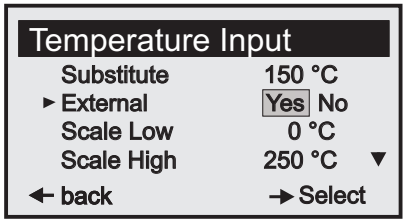
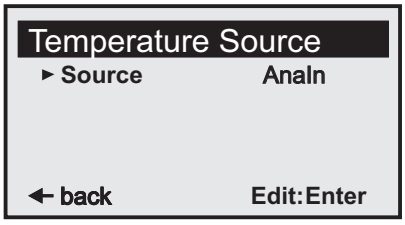
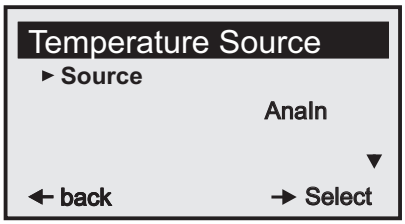
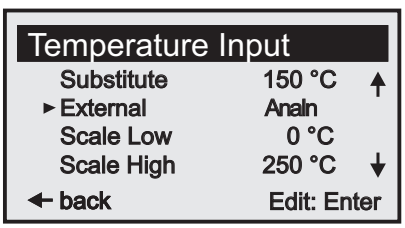
Submenu item “Temperature Input” serves to check and change the following settings.

- Substitute: Substitute 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

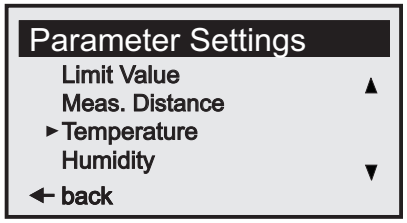
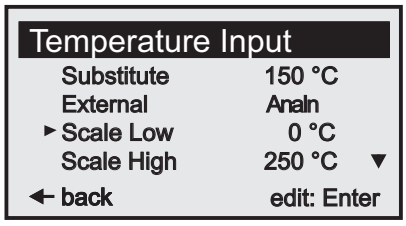
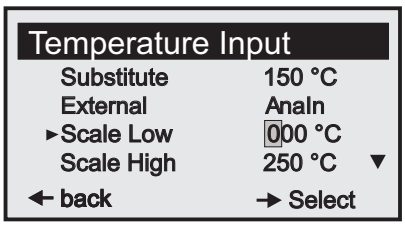
9.3.7.1 *Changing the substitute temperature value*

Display	Action	Note
	► Select “**Temperature**” ► Press “**Enter**”	Exhaust gas temperature
	► Select using “**Arrow down**” or “**Arrow up**” ► Press “**Enter**”	Enter the substitute temperature value Further input options are explained in the following screens
	► Select with “Arrow right” ► Enter new value with “**Arrow down**” or “**Arrow up**” ► Press “**Enter**”	Basic factory setting for substitute temperature value: 150 °C
		

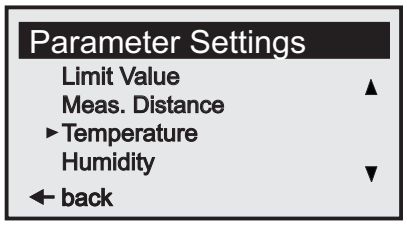
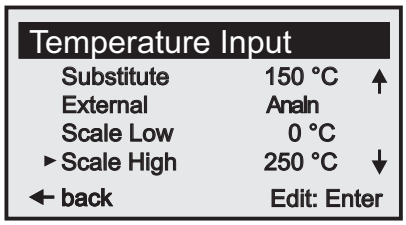
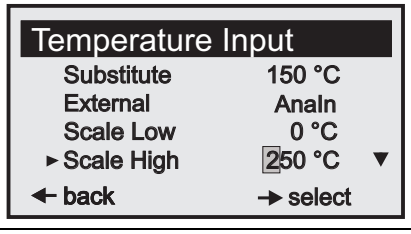
9.3.7.2 *Setting the use of an external temperature sensor*

Display	Action	Note
	► Select “**Temperature**” ► Press “**Enter**”	Exhaust gas temperature
	► Select using “**Arrow down**” or “**Arrow up**” ► Press “**Enter**”	Using an external temperature sensor
	► Select with “**Arrow right**” ► Press “**Enter**”	Confirm with “**Enter**” to save the selection
		
		
		

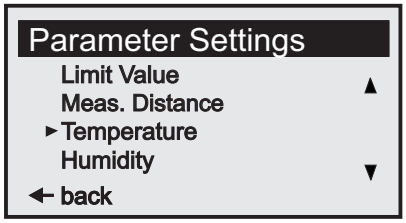
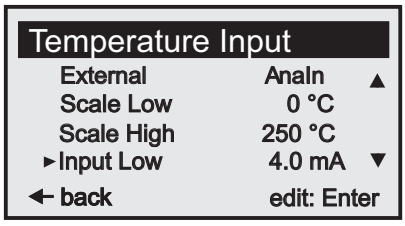
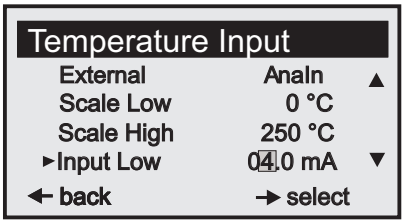
9.3.7.3 *Setting the temperature range: Lower limit value*

Display	Action	Note
	▶ Select “**Temperature**” ▶ Press “**Enter**”	Exhaust gas temperature
	▶ Select using “**Arrow down**” or “**Arrow up**” ▶ Press “**Enter**”	Basic factory setting: 0 °C
	▶ Select with “**Arrow right**” ▶ Enter new value with “**Arrow down**” or “**Arrow up**” ▶ Press “**Enter**”	Confirm with “**Enter**” to save new value

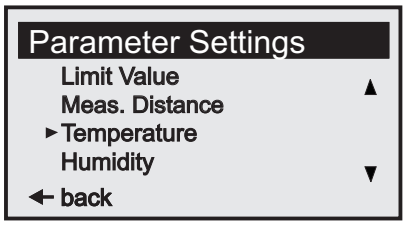
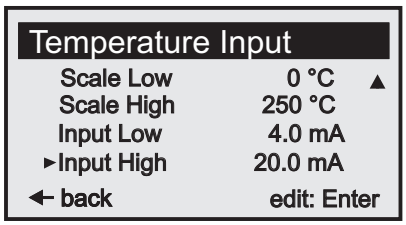
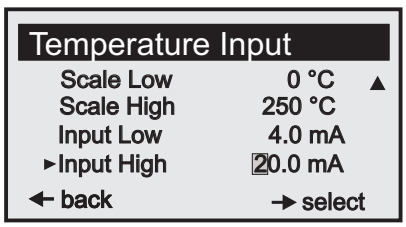
9.3.7.4 *Setting the temperature range: Upper limit value (20 mA)*

Display	Action	Note
	▶ Select “**Temperature**” ▶ Press “**Enter**”	Exhaust gas temperature
	▶ Select using “**Arrow down**” or “**Arrow up**” ▶ Press “**Enter**”	Basic factory setting: 250 °C Max: 500 °C
	▶ Select with “**Arrow right**” ▶ Enter new value with “**Arrow down**” or “**Arrow up**” ▶ Press “**Enter**”	

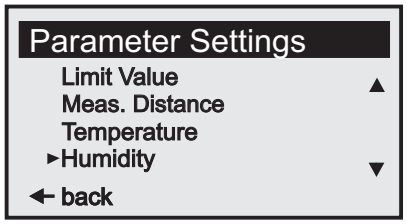
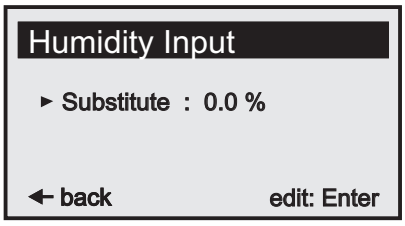
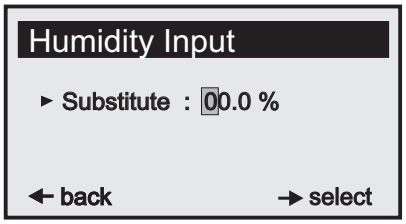
9.3.7.5 *Setting the signal: Live Zero*

Display	Action	Note
	▶ Select “**Temperature**” ▶ Press “**Enter**”	Exhaust gas temperature
	▶ Select using “**Arrow down**” or “**Arrow up**” ▶ Press “**Enter**”	Signal for measuring range start Basic factory setting: 4.0 mA
	▶ Select with “**Arrow right**” ▶ Enter new value with “**Arrow down**” or “**Arrow up**” ▶ Press “**Enter**”	Confirm with “**Enter**” to save new value

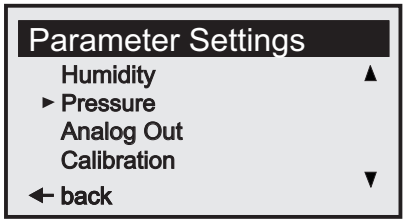
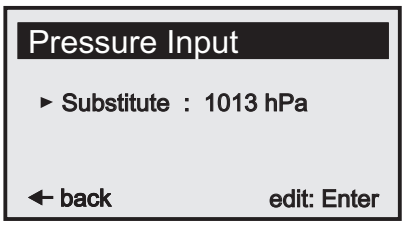
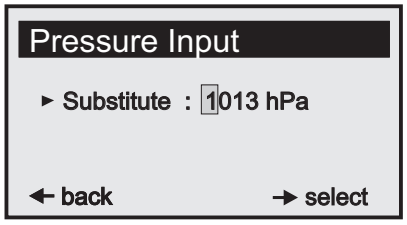
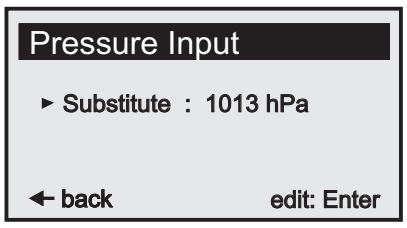
9.3.7.6 *Setting the signal: Upper output value:*

Display	Action	Note
	▶ Select “**Temperature**” ▶ Press “**Enter**”	Exhaust gas temperature
	▶ Select using “**Arrow down**” or “**Arrow up**” ▶ Press “**Enter**”	Signal for measuring range end Basic factory setting: 20.0 mA
	▶ Select with “**Arrow right**” ▶ Enter new value with “**Arrow down**” or “**Arrow up**” ▶ Press “**Enter**”	Confirm with “**Enter**” to save new value

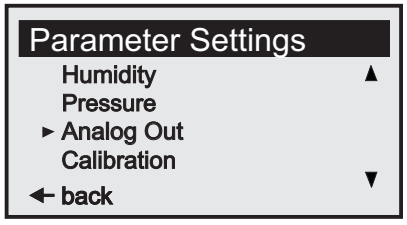
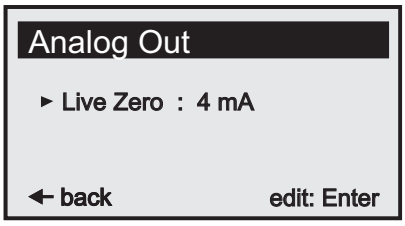
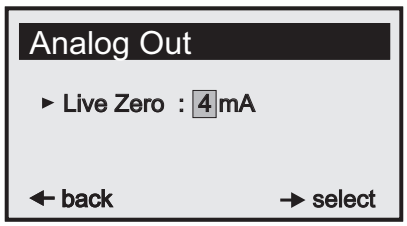
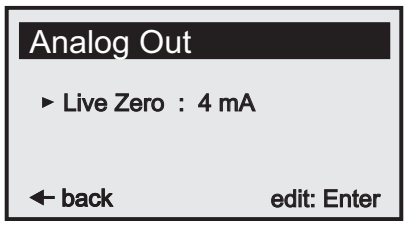
9.3.8 Setting the humidity content in sample gas

Display	Action	Note
	▶ Select “**Humidity**” Moisture ▶ Press “**Enter**”	Exhaust gas moisture
	▶ Press “**Enter**”	Basic factory setting: 0.0% This value is used to perform a gas dryness correction. Max.: 99.9%
	▶ Select with “**Arrow right**” ▶ Enter new value with “**Arrow down**” or “**Arrow up**” ▶ Press “**Enter**”	Confirm with “**Enter**” to save new value

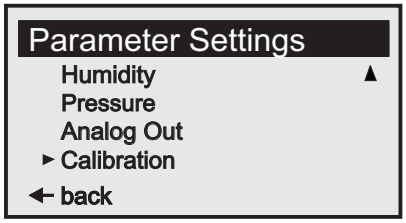
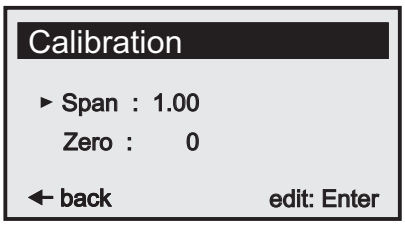
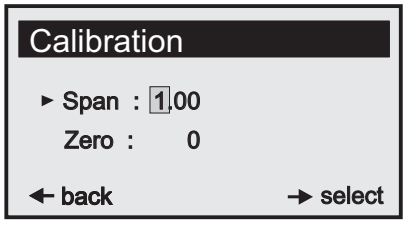
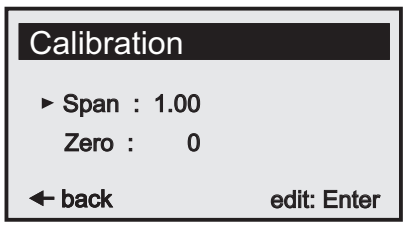
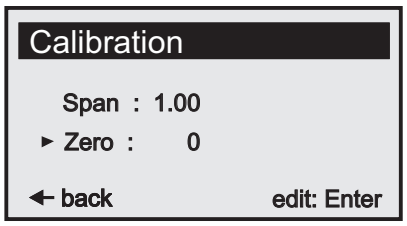
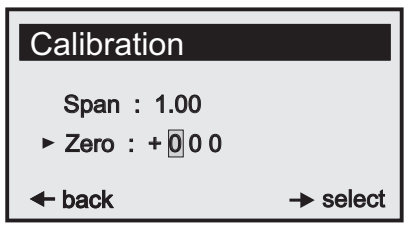
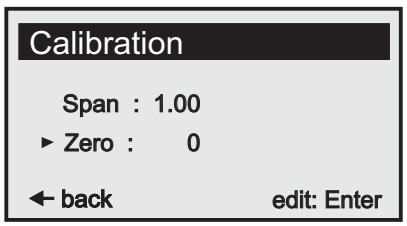
9.3.9 Setting the sample gas pressure

Display	Action	Note
	▶ Select “**Pressure**” ▶ Press “**Enter**”	Exhaust gas pressure
	▶ Press “**Enter**”	Basic factory setting: 1013 hPa Min.: 800 Max.: 1200
	▶ Select with “**Arrow right**” ▶ Enter new value with “**Arrow down**” or “**Arrow up**” ▶ Press “**Enter**”	Confirm with “**Enter**” to save new value. The pressure correction is made in ppm or Norm in the display using this value
		

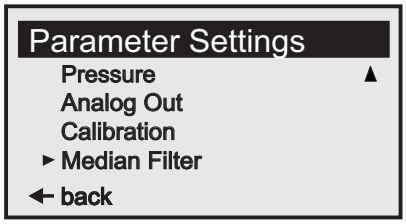
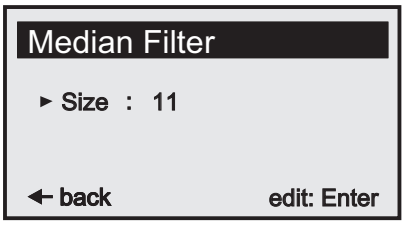
9.3.10 Changing the Live Zero value of the analog output (Analog Out)

Display	Action	Note
	► Select “**Analog Out**” ► Press “**Enter**”	Analog output/Live Zero
	► Press “**Enter**”	Basic factory setting: 4 mA
	► Select with “**Arrow right**” ► Enter new value with “**Arrow down**” or “**Arrow up**” ► Press “**Enter**”	Confirm with “**Enter**” to save new value Possible values: 0 to 4 mA
		

9.3.11 Changing the calibration values

Display	Action	Note
	▶ Select “**Calibration**” ▶ Press “**Enter**”	On-site calibration
	▶ Press “**Enter**”	SPAN / Characteristic Curve Basic factory setting: 1.00 Change possible, e.g., after successful Span test
	▶ Select with “**Arrow right**” ▶ Enter new value with “**Arrow down**” or “**Arrow up**” ▶ Press “**Enter**”	Confirm with “**Enter**” to save new value Possible setting range for Span: 0.50 ... 1.99
		
	▶ Press “**Enter**”	Basic factory setting: 0 Offset correction possible, e.g., after a reference measurement
	▶ Select with “**Arrow right**” ▶ Enter new value with “**Arrow down**” or “**Arrow up**” ▶ Press “**Enter**”	Confirm with “**Enter**” to save new value
	▶ Press “**Arrow left**” (back)	Display returns to selection screen

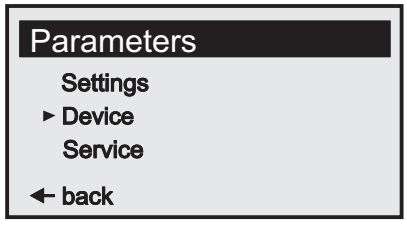
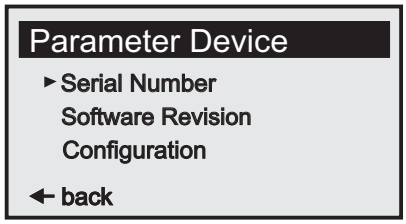
9.3.12 Median Filter

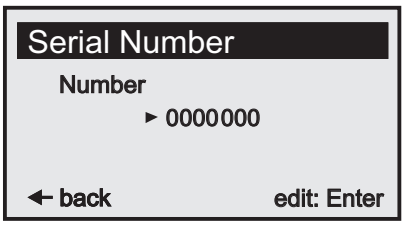
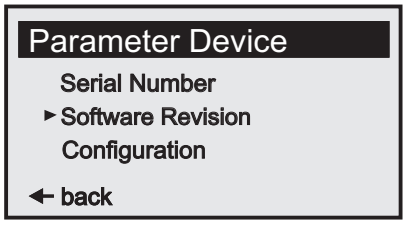
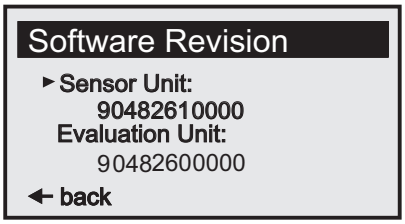
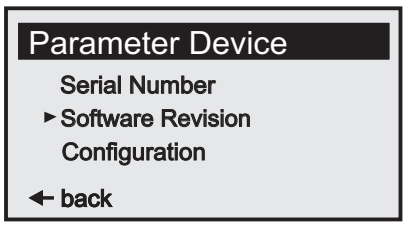
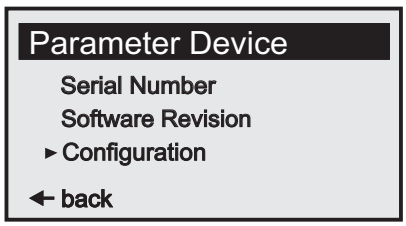
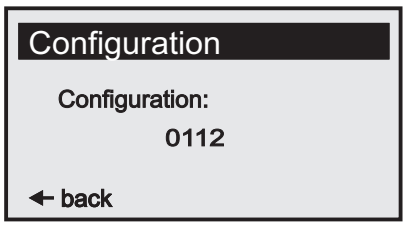
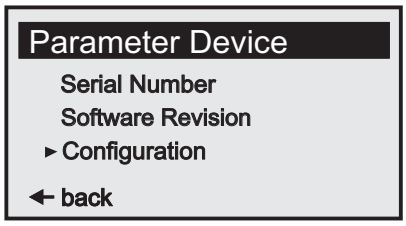
Display	Action	Note
	▶ Select “**Median Filter**” ▶ Press “**Enter**”	The median filter reduces signal noise caused by high dust concentrations or rapidly changing processes. Median Filter value: “1” = no filter “17” = highest value “11” = preset value
	▶ Select with “**Arrow right**” ▶ Enter new value with “**Arrow down**” or “**Arrow up**” ▶ Press “**Enter**”	The Median Filter adds 1 to 9 seconds to the response time according to the following formula: $\frac{(\text{Median Filter} + 1)}{2}$ 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 54)

9.3.13 Device characteristic data (Device)

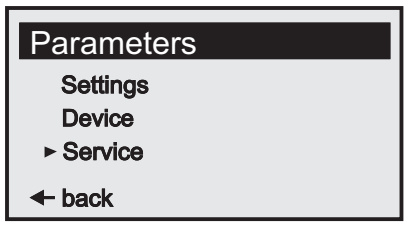
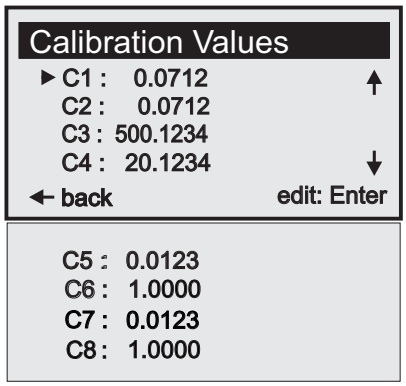
The following characteristic data can be viewed:

- Serial Number
- Software Revision
- Configuration

Display	Action	Note
	▶ Select “**Device**” ▶ Press “**Enter**”	Key device data
	▶ Press “**Enter**”	

Display	Action	Note
	► Press “**Arrow left**” (back)	Displays the device serial number
	► Select using “**Arrow down**” or “**Arrow up**” ► Press “**Enter**”	Displays the software version
	► Press “**Arrow left**” (back)	
		
	► Select using “**Arrow down**” or “**Arrow up**” ► Press “**Enter**”	Device configuration
	► Press “**Arrow left**” (back)	Displays the device configuration delivered 0112 = Standard No input possible
	► Press “**Arrow left**” (back)	

9.3.14 Service

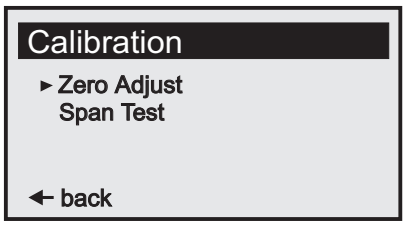
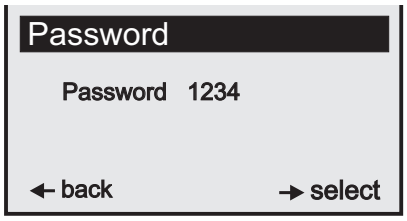
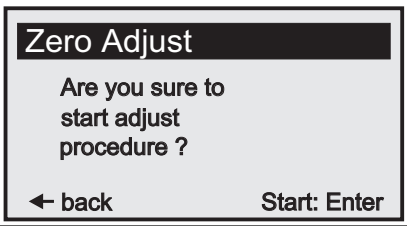
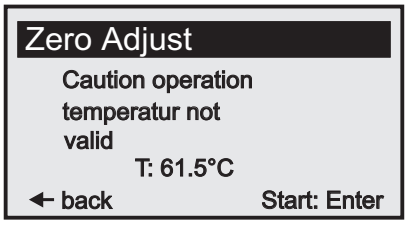
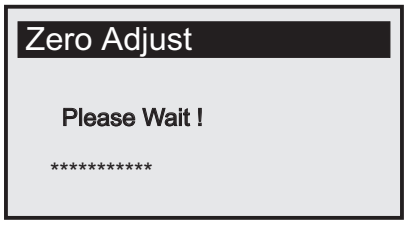
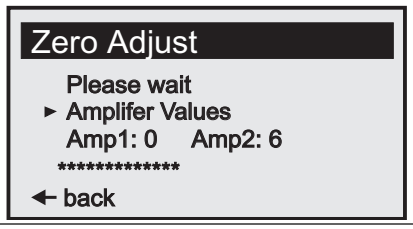
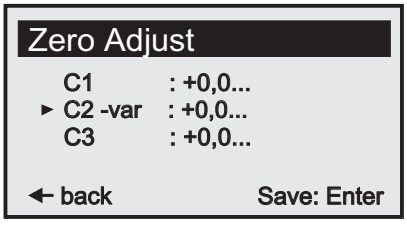
Display	Action	Note
	▶ Select using “**Arrow down**” or “**Arrow up**” ▶ Press “**Enter**”	Sensor calibration parameters Caution: Changes lead to measured value deviations
	▶ Press “**Enter**”	These values may only be changed in special cases e.g., after exchanging the receiver!

9.4 Calibration

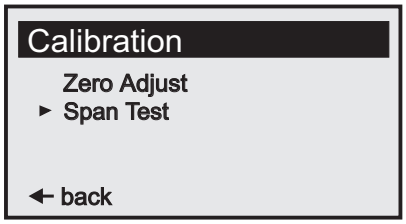
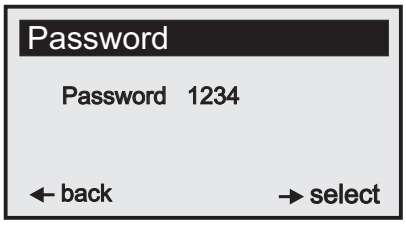
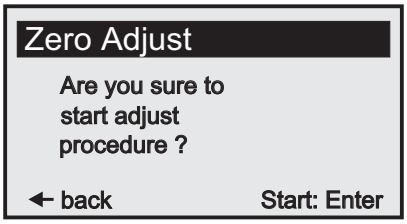
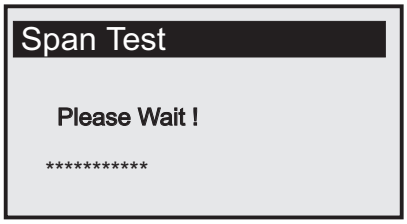
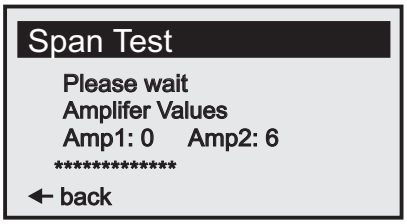
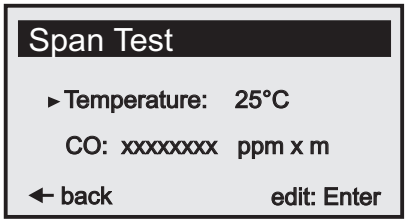
Menu “Calibration” serves to view the following submenu items:

- Zero Adjust: Zero adjust
- SPAN Test: Manual SPAN test

9.4.1 Performing zero adjust

Display	Action	Note
	► Press “**CAL**” ► Select “**Zero Adjust**” with “**Enter**”	
	► Enter password “**1234**”	Prompt only appears when a warning is pending (e.g., device temperature)
	► Confirm with “**Enter**” ► Cancel with “**Arrow left**” (back)	
		Wait until device temperature is reached Message only appears when the temperature has not yet stabilized
	► Confirm with “**Enter**” (for T=60 °C +- 0.5 °C) ► Cancel with “**Arrow left**” (back)	No inputs can be made during the calibration procedure
		No inputs can be made during the calibration procedure
	► Confirm with “**Enter**”	Data are saved

9.4.2 SPAN Test

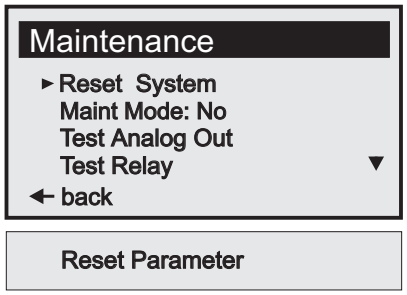
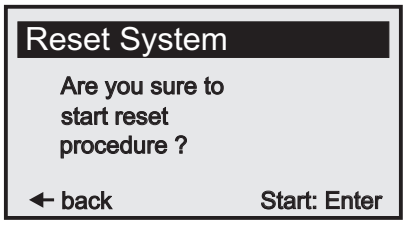
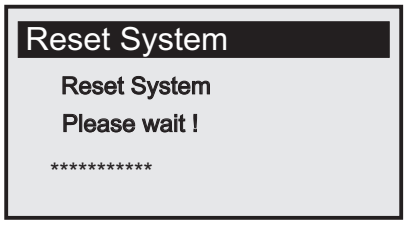
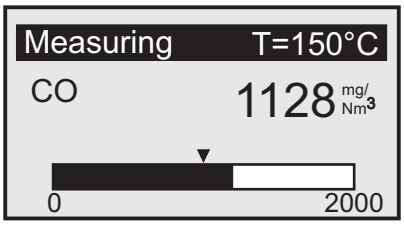
Display	Action	Note
	▶ Press “**CAL**” ▶ Select “**Span Test**” and confirm with “**Enter**”	
	▶ Enter password “**1234**”	Prompt only appears when a warning is pending (e.g., device temperature)
	▶ Confirm with “**Enter**”	Starts the zero point adjustment for the Span test
		Zero adjust is running No input possible on the device
		Zero adjust is running No input possible on the device
	▶ Edit ambient temperature ▶ Insert test cell in the holder	Set the temperature to the current ambient temperature Compare the measured value displayed with the value on the test cell Deviations can be corrected with the SPAN value when necessary, see “Changing the calibration values”, page 65). The Span factor to be set is calculated from the setpoint value (label on test cell) divided by the displayed measured value. Use “**Back**” to terminate span adjustment.

9.5 Maintenance

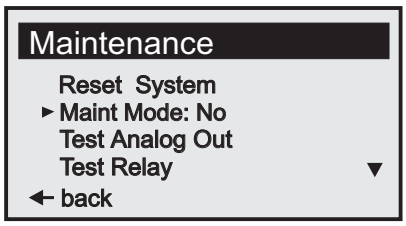
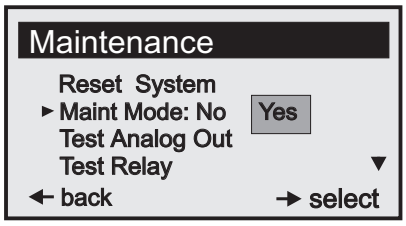
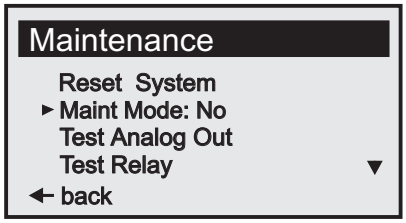
Menu “Maintenance” serves to view the following submenu items:

- 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

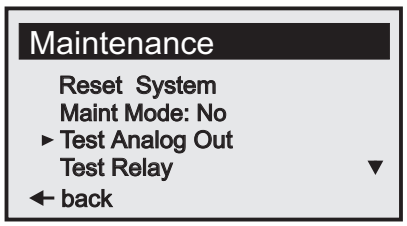
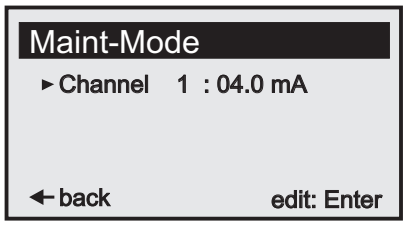
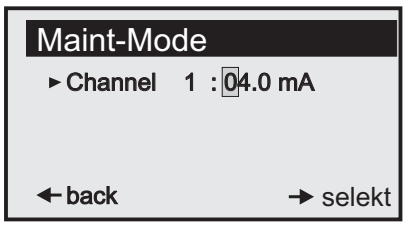
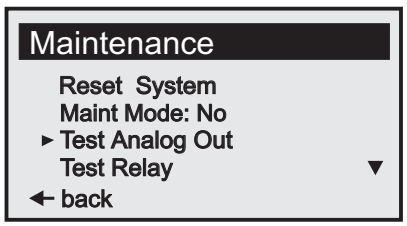
9.5.1 Reset System

Display	Action	Note
	► Select using “**Arrow down**” or “**Arrow up**” ► Press “**Enter**”	Restarts the device
	► Press “**Enter**”	
		No input possible on the device
		Device is restarted

9.5.2 Maintenance mode

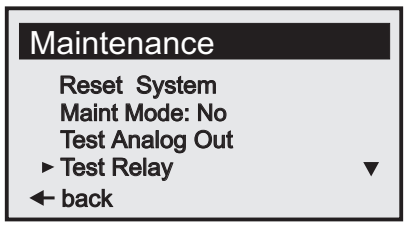
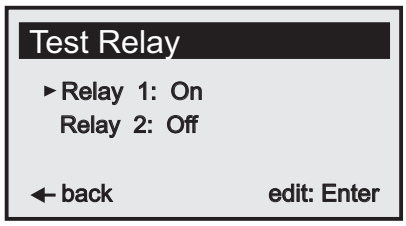
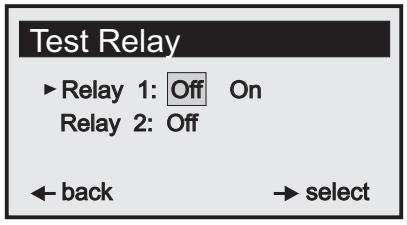
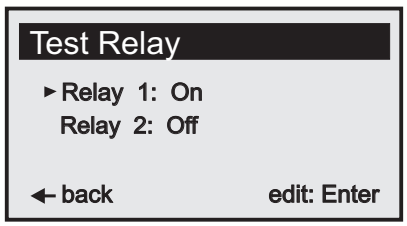
Display	Action	Note
	▶ Select using “**Arrow down**” or “**Arrow up**” ▶ Press “**Enter**”	
	▶ Select with “**Arrow right**” ▶ Press “**Enter**”	Switches display to Maintenance mode when “**Yes**” is selected Output relay drops out Analog output retains last value
		

9.5.3 Test analog output

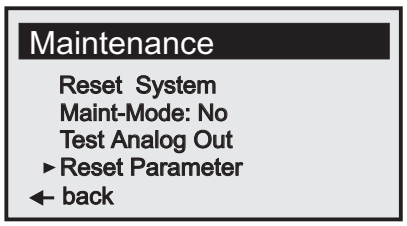
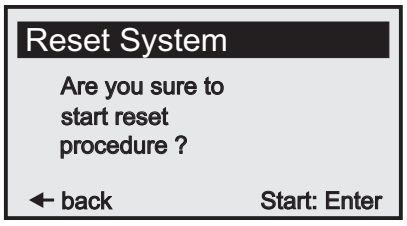
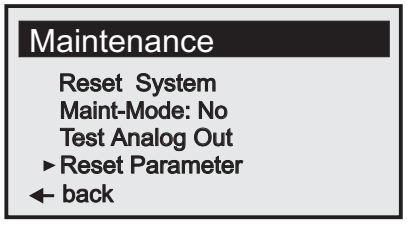
Display	Action	Note
	▶ Press “**Enter**”	
	▶ Press “**Enter**”	The set value must be output on the analog output
	▶ Select with “**Arrow right**” ▶ Enter new value with “**Arrow down**” or “**Arrow up**” ▶ Press “**Enter**”	
		

NOTE:
Analog-In can be tested using the displayed sample gas temperature.

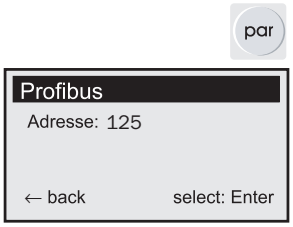
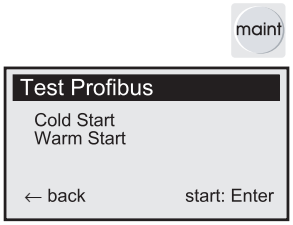
9.5.4 Test relay

Display	Action	Note
	▶ Select using “**Arrow down**” or “**Arrow up**” ▶ Press “**Enter**”	Tests relay 1 and relay 2
	▶ Select using “**Arrow down**” or “**Arrow up**” ▶ Press “**Enter**”	
	▶ Select with “**Arrow right**” ▶ Press “**Enter**”	
		

9.5.5 Reset Parameter

Display	Action	Note
	▶ Press “**Enter**”	
	▶ Press “**Enter**”	**Caution:** All values are reset to default. Calibration data will be lost!
		No input possible on the device

9.6 Connecting the PROFIBUS during commissioning (if installed)

	▶ Activate Parameter mode (**par**). ▶ Call up menu Profibus and select address. ▶ Use the arrow keys to enter the corresponding 7 bit address and acknowledge.
	▶ Activate Maintenance mode (**maint**) and call up the Profibus menu. ▶ Perform menu item Cold Start. This initializes the PROFIBUS software with the new addresses. The device master file (GSD) can now be configured via the PROFIBUS Master for operation of the GM901.

10 Maintenance

10.1 General

Maintenance tasks are principally application-dependent because the influences are also individual. This is why the maintenance interval is typically determined based on experience.

10.2 Maintenance interval of individual components of GM901 CO systems

GM901 (sender, receiver, control unit)

Interval	Action
Half-yearly	▶ Check optics and optical equipment for cleanness and clean as required
Yearly	▶ Drift check (zero point/adjust and sensitivity check with test cells)

11 Troubleshooting

11.1 Warnings

Message	Possible cause	Action
Analog input temperature out of range	• Input signal (0 ... 20 mA) of the temperature measurement is outside the parameterized limits, the system continues running with the substitute temperature value	▶ Check temperature sensor ▶ Check cable connection ▶ Check parameterization (see "Temperature", page 58)
Temperature low, no humidity correction	• Measured gas temperature is so low that it is assumed the plant has been switched off. This means no cross-sensitivity correction is performed for exhaust gas humidity	▶ Check temperature sensor ▶ Check parameterization (see "Temperature", page 58). The switching point is at 70 °C or half the value of the substitute temperature depending on which value is lower ▶ No action required when the plant is switched off
Sensor low signal	• Dust content too high • Fog formation • Optical surfaces of device contaminated • Device not adjusted correctly • Lamp defective	▶ Check device alignment ▶ Clean optical surfaces ▶ Check for free light path through the duct ▶ Check lamp ▶ Still warning message after carrying out the actions ▶ New zero adjust
Warming up	• The required operating temperature is not already reached shortly after the device is switched on, the measured values displayed can be outside the tolerance	▶ Wait approx. 30 minutes
Out of range	• The measured value exceeds the specified measuring range by more than 5%	▶ Set the measuring range to a higher value (see "Changing the measuring range", page 55)

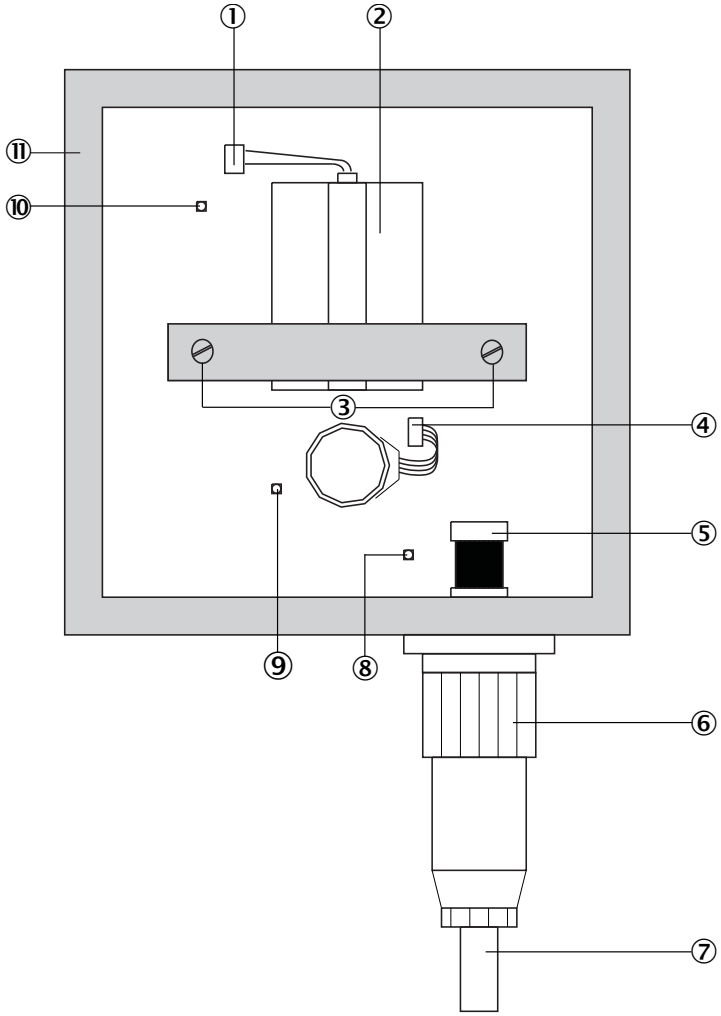
11.2 Malfunctions

Message	Possible cause	Action
EEPROM Parameter	• Invalid parameters • Control unit defective	▶ Reset parameters (see “Reset Parameter”, page 75) ▶ Parameterize again ▶ New zero adjust
Sensor communication	• Data communication between receiver unit and control unit interrupted	▶ Check cable connection and correct seat of the plug connection ▶ Further measures see “Further tips on troubleshooting”, page 79
Sensor amplifier has reached maximum value	• Erroneous device adjustment • Optical surfaces contaminated • Light path interrupted	▶ Check device alignment ▶ Clean optical surfaces ▶ Check for free light path
Sensor no signal	• Erroneous device adjustment • Optical surfaces contaminated • Light path interrupted • Receiver unit defective	▶ Check device alignment ▶ Clean optical surfaces ▶ Check for free light path through the duct
Signal too high	• Measuring distance Fl.-Fl. shorter than 0.5 m	▶ Correct measuring distance flange - flange
IR source fault	• Infrared lamp defective • Power supply defective	 Risk of burns! Lamp very hot in operation! ▶ Check lamp plug connector ▶ Exchange sender unit when necessary
Chopper fault	• Chopper in sender unit defective	 Risk of burns! Lamp very hot in operation! ▶ Check chopper plug connection in sender unit ▶ Exchange sender unit when necessary
Device not ready, warming up	• The required operating temperature is not reached shortly after switching on • Device not ready for measuring	▶ Wait approx. 30 minutes
Motor fault	• Motor in the receiver unit defective	▶ Exchange receiver unit

11.3 Further tips on troubleshooting

11.3.1 Troubleshooting on the sender

Fig. 24: Troubleshooting on the sender



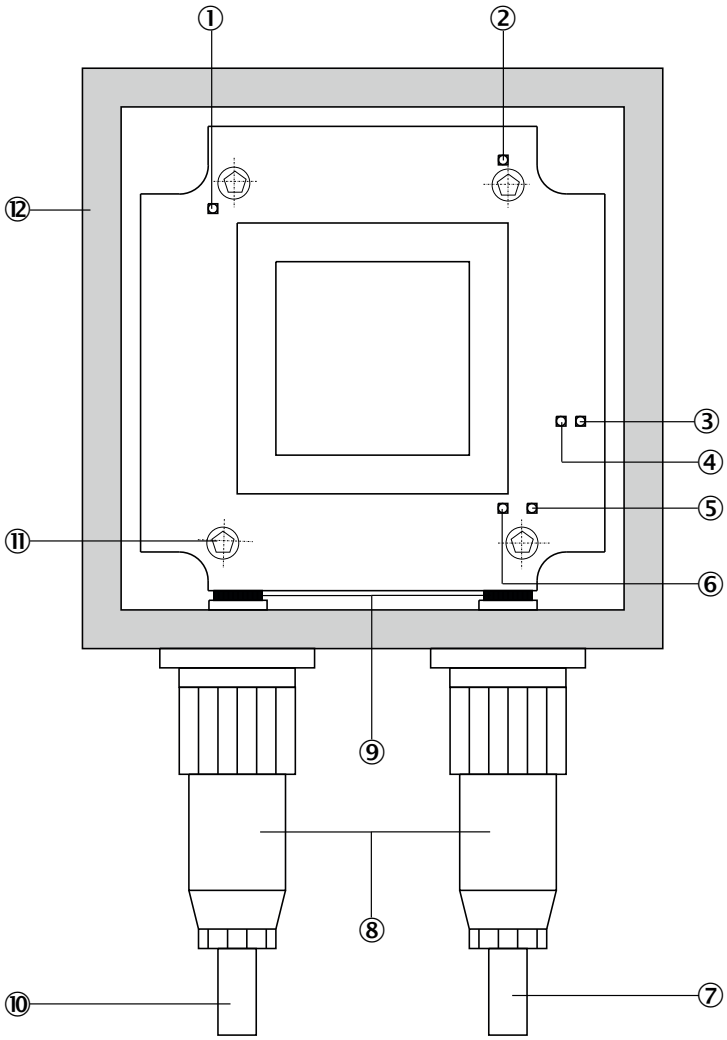
NOTE: Loosening the 2 adjustment screws causes the sender to be adjusted incorrectly!

▶ New adjustment only possible at the factory!

①	IR source: Plug connection
②	IR source ⚠ Risk of burns! The infrared lamp becomes extremely hot during operation!
③	Adjustment screws
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	Adjustment screw: 4 x
⑫	Sender housing

11.3.2 Troubleshooting on receiver

Fig. 25: Troubleshooting on receiver



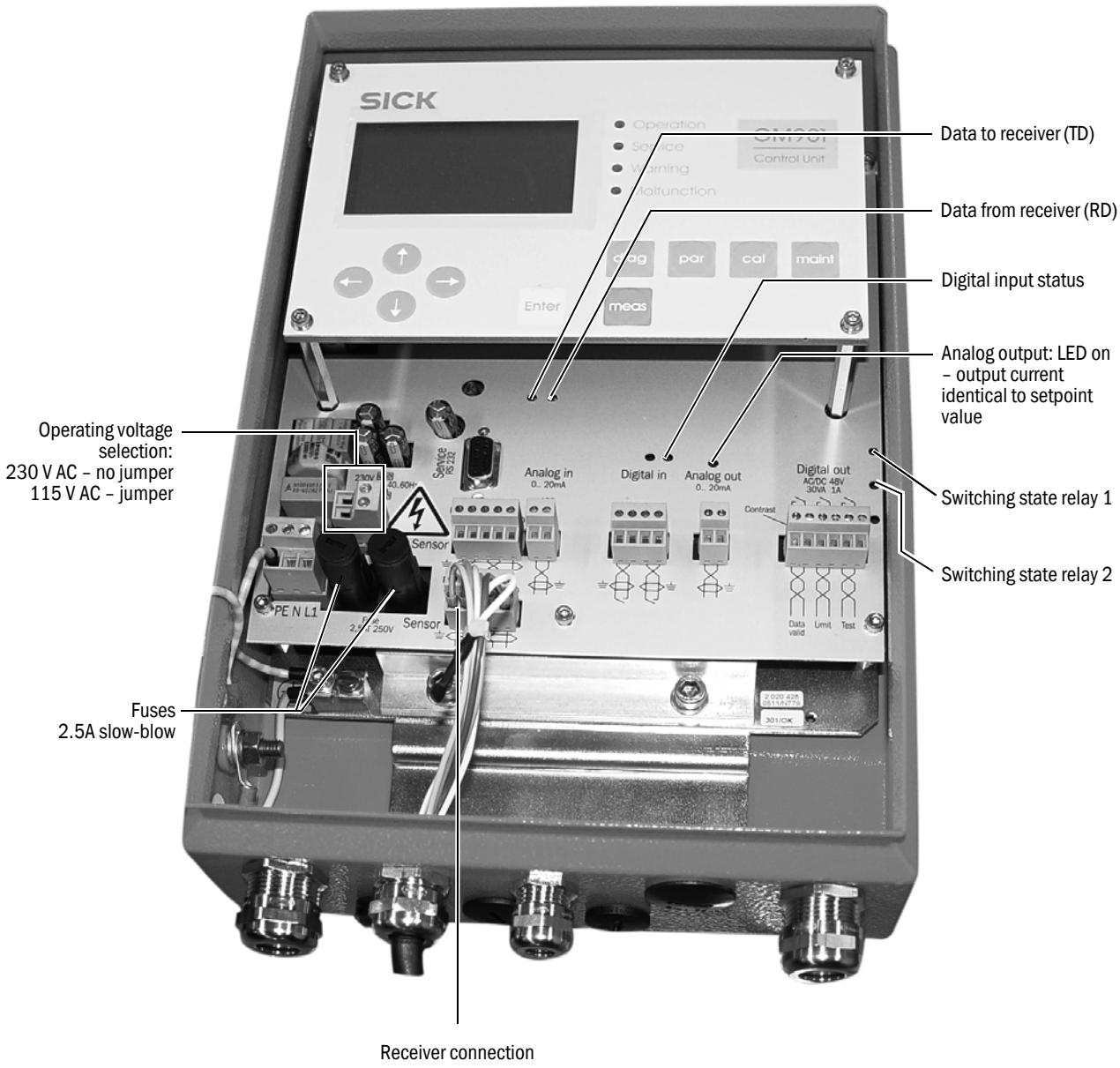
NOTE: Loosening the 4 adjustment screws causes the receiver to be adjusted incorrectly!

▶ New adjustment only possible at the factory!

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	Cable to sender
⑧	Outer plug-in connector
⑨	Inner plug-in connector
⑩	Cable to control unit
⑪	Adjustment screw: 4 x
⑫	Receiver housing

11.3.3 Troubleshooting on the control unit

Fig. 26: Troubleshooting on the control unit – Standard



Device shows no reaction:

- ▶ Check power supply.
- ▶ Check operating voltage set.
- ▶ Check fuse in control unit.
- ▶ Check indicator 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.

  Check the cables first when these displays are only on when the plug connections are disconnected.

If no error is found, connect the system components one after each other.

1 Only the cable from the control unit to the receiver
2 Connect the receiver.
3 Lay the cable from the receiver to the sender.
4 Connect the sender.

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

Communication between control unit and receiver interrupted

Error messages: Sensor communication

The receiver sends data continuously to the control unit, an inquiry is sent automatically when nothing is received there.

Check following connections:

- Connection between control unit and receiver
- Cable connection on the plug-in terminal in the control unit
- Cable to receiver
- External plug connection on receiver
- Internal plug connections in receiver

Sensor values

The sensor values shown in the Table are valid for uninterrupted, steady state operation within specified limits.

To view these data, see “Diagnosis”, page 48, or press **diag**.

Unit	Description	Min. Value	Typ. Value	Max.Value
V1	Signal-Value 1	0.5 V	Dependent on current conditions	5.0 V
V2	Signal-Value 2	0.5 V	Dependent on current conditions	5.0 V
DK	Variability of k-Value	0	Dependent on current conditions	
CC	Cooler Current	0 mA	Dependent on current conditions	1200 mA
TE	Temperature of Electronic Unit	20 °C	Dependent on current conditions	80 °C
TO	Temperature of Optic Unit	50 °C	60 °C	80 °C
TD	Detector Temperature	9 °C	10.7 °C	12 °C
AM	Amplifier Gain	00.00	Dependent on the measuring distance	31.31

If the sensor values of the GM901 are outside these value ranges, please contact SICK Customer Service for remote diagnosis.

12 Shutting down

12.1 Disassembling the sender and receiver

It is recommended to disassemble the GM901 during long periods of plant shutdowns. It is essential to disassemble the GM901 when the optional purge air unit is also put out of operation.

WARNING: Hot, toxic gases escaping!
Toxic gases can escape from the duct when the sender and receiver are removed from the flange!
- ▶ Take appropriate protective measures

Procedure

- ▶ Disconnect the device from the power supply.
- ▶ Disconnect the cable plugs on the sender and receiver. Protect the cable plugs against moisture and dirt when not used for a longer period of time.
- ▶ Take the sender and receiver off the purge air fixtures (loosen quick-release fasteners).
- ▶ Close off the purge air fixtures with an optional dummy flange.

NOTE:
The optical adjustment of the purge air fixtures remains intact.

12.2 Deinstallation

Observe safety information according to VDE and national guidelines:

- ▶ During deinstallation, make sure no live lines are accessible unsecured.
- ▶ Always insulate open cable ends with suitable auxiliary means to protect against dirt and moisture.

Secure switches that should not be switched on again for safety reasons with signs and safeguards to prevent unintentional switching.

12.3 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 assemblies contain substances that may have to be disposed of separately:
- Electronics: Capacitors, rechargeable batteries, batteries.
- Display: Liquid of LC display.

13 Technical data

13.1 System GM901-05

Description		In-situ gas analyzer for emission monitoring and process measurement
Measured variable		CO
Measuring principles		Gas filter correlation
Measuring ranges	CO	0 ... 500 ppm / 0 ... 20 000 ppm (relative to 1 m measuring distance)
Response time (t90)		5 s ... 360 s
Precision		± 5% of full scale value
Ambient temperature		–20 °C ... +55 °C
Conformities		TÜV Type Approval
Electrical safety		CE
Mounting		Mounting flange, DN125, PN6 Mounting flange, ANSI, 5"
Control functions		Manual span point test with gas-filled cell

13.2 Sender unit

Description	Sender unit of measuring system
Measuring distance	0.5 m ... 8.0 m
Process temperature	≤ +250 °C, standard ≤ +430 °C, with extended calibration
Process pressure	≤ 30 hPa Depending on purge air supply
Process gas humidity	Non-condensing
Electrical safety	CE
Degree of protection	IP 65 /NEMA 4
Dimensions (W x H x D)	150 mm x 169 mm x 241 mm Details, see dimension drawings
Weight	3 kg incl. purge air fixture
Power supply	Voltage: 24 V DC Supply via control unit

13.3 Receiver unit

Description	Receiver unit of measuring system
Measuring distance	0.5 m ... 8.0 m
Process temperature	≤ +250 °C, standard ≤ +430 °C, with extended calibration
Process pressure	≤ 30 hPa Depending on purge air supply
Process gas humidity	Non-condensing
Electrical safety	CE
Degree of protection	IP 65 /NEMA 4
Dimensions (W x H x D)	150 mm x 169 mm x 405 mm Details, see dimension drawings
Weight	3 kg incl. purge air fixture
Power supply	Voltage: 24 V DC Supply via control unit

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

Description	The control unit serves as user interface, for data processing and output as well as control and monitoring functions.
Electrical safety	CE
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 VA / 48 V DC, 1 A, 30 W • Relay 1: NO contact, normally open - for device malfunction, potential-free • Relay 2: NO 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
Type	Sheet steel enclosure
Dimensions (W × H × D)	210 mm × 381.4 mm × 108 mm (Details, see Dimension drawings)
Weight	4.3 kg
Power supply	Voltage: 115 V / 230 V AC, plus 10% tolerance Frequency: 50 Hz / 60 Hz Power input: ≤ 50 VA

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

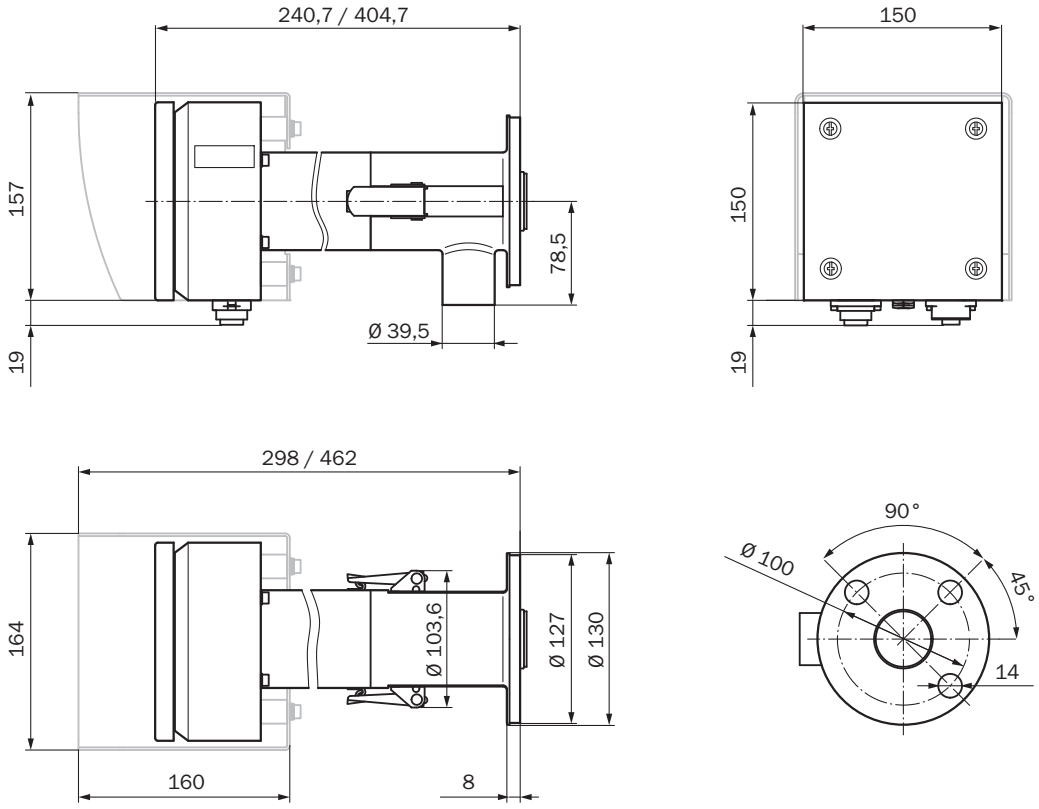
Description	The control unit serves as user interface, for data processing and output as well as control and monitoring functions.
Electrical safety	CE
Degree of protection	IP65
Analog outputs	3 outputs: 0/4 ... 20 mA, 500 Ω Galvanically isolated
Analog inputs	1 input: 0 ... 20 mA, 100 Ω, for gas temperature
Digital outputs	3 relay contacts: • 48 V AC, 1 A, 60 VA / 48 V DC, 1 A, 30 W
	For AWE 2027607: • Relay 1: NO contact, normally open - for device malfunction, potential-free • Relays 2 and 3: NO contact, normally open - for limit value overrun, potential-free
	For AWE 2084045: • Relay 1: NO contact, normally open - for device malfunction, potential-free • Relays 2 and 3: NO 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 Type of field bus integration: RS-485
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
Type	Sheet steel enclosure
Dimensions (W × H × D)	210 mm × 381.4 mm × 108 mm (Details, see Dimension drawings)
Weight	4.3 kg
Power supply	Voltage: 115 V / 230 V AC, plus 10% tolerance Frequency: 50 Hz / 60 Hz Power input: ≤ 50 VA

13.6 Connection unit

Description	To extend the CAN bus connection with a line provided by the customer
Electrical safety	CE
Degree of protection	IP 65 /NEMA 4
Dimensions (W × H × D)	175 mm x 110.5 mm x 57 mm (details see dimension drawings)
Weight	3 kg
Power supply	Voltage: 115 V / 230 V AC, plus 10% tolerance Frequency: 50 / 60 Hz Power input: ≤ 60 VA
Built-in components	Integrated 24 V power supply unit for supply of the sender/receiver unit

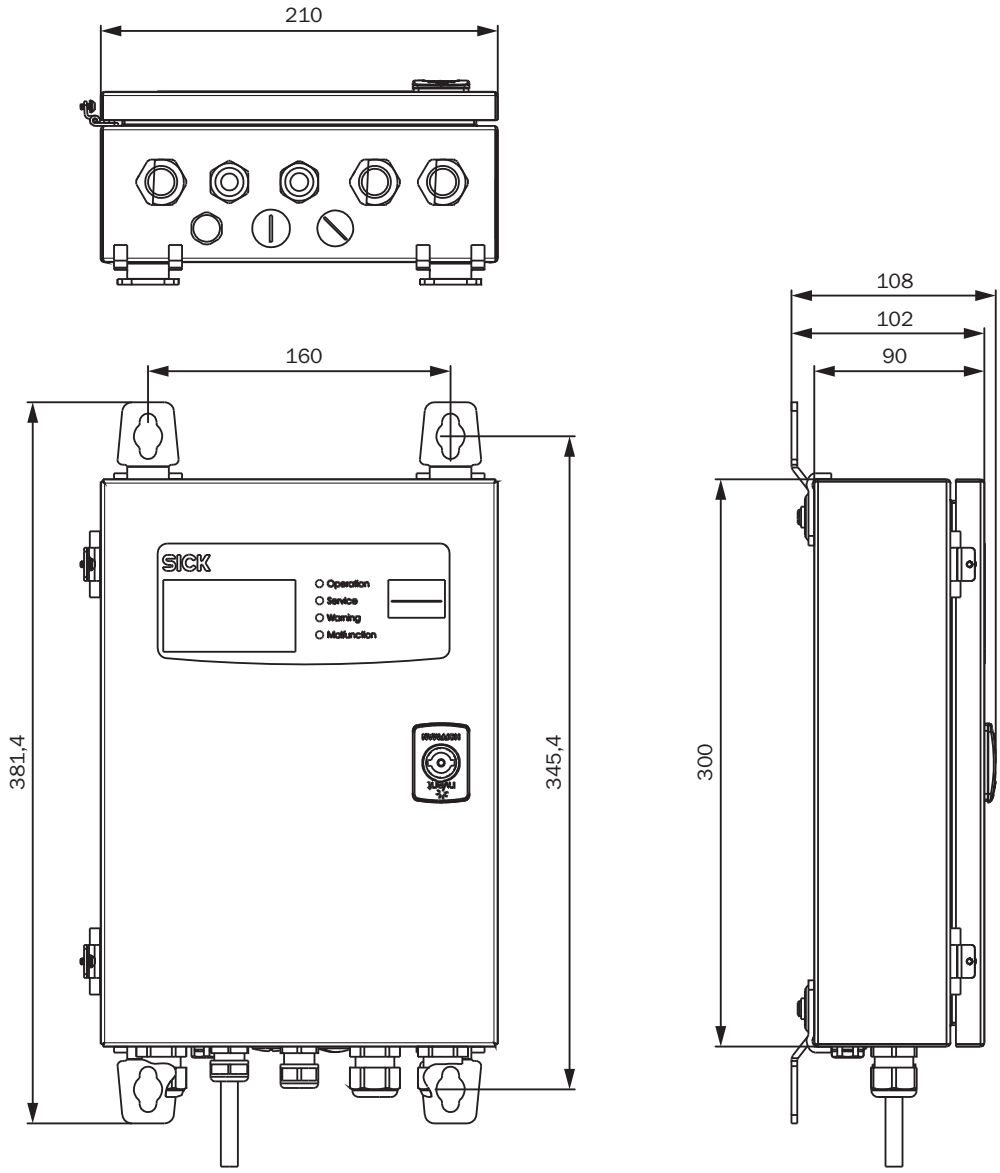
13.7 Dimension drawing, sender/receiver unit

Fig. 27: Sender or receiver unit (dimensions in mm)



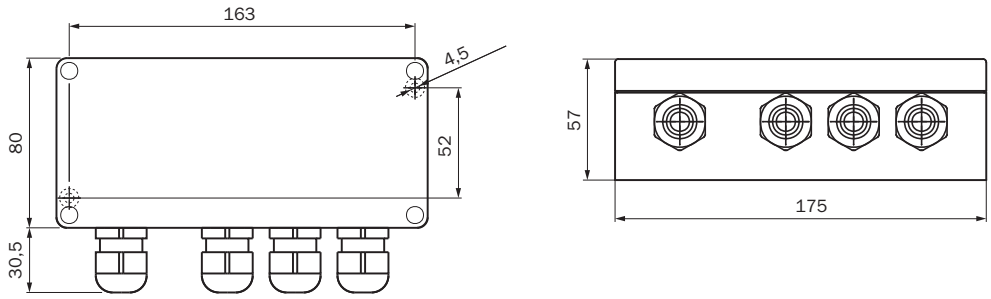
13.8 Dimensional drawing, control unit

Fig. 28: Control unit AWE (sheet steel enclosure version), dimensions in mm



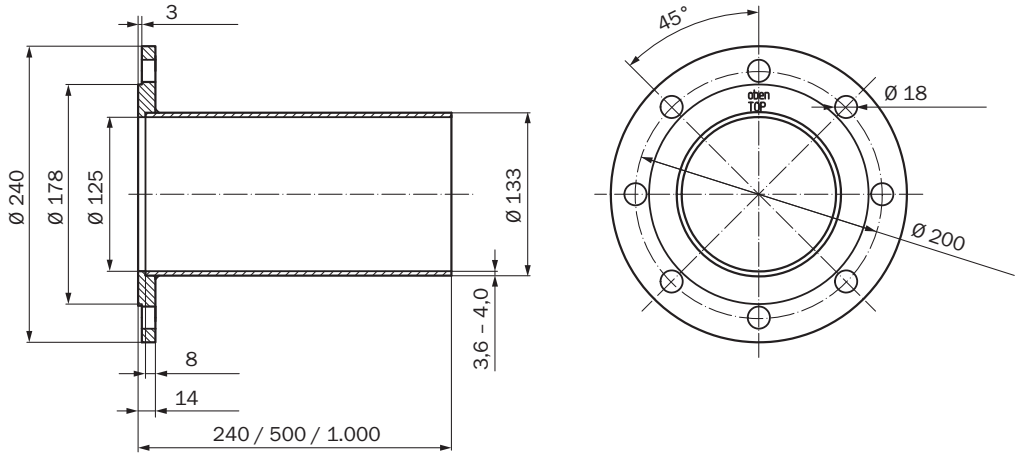
13.9 Dimension drawing, connection unit

Fig. 29: Connection unit (dimensions in mm)



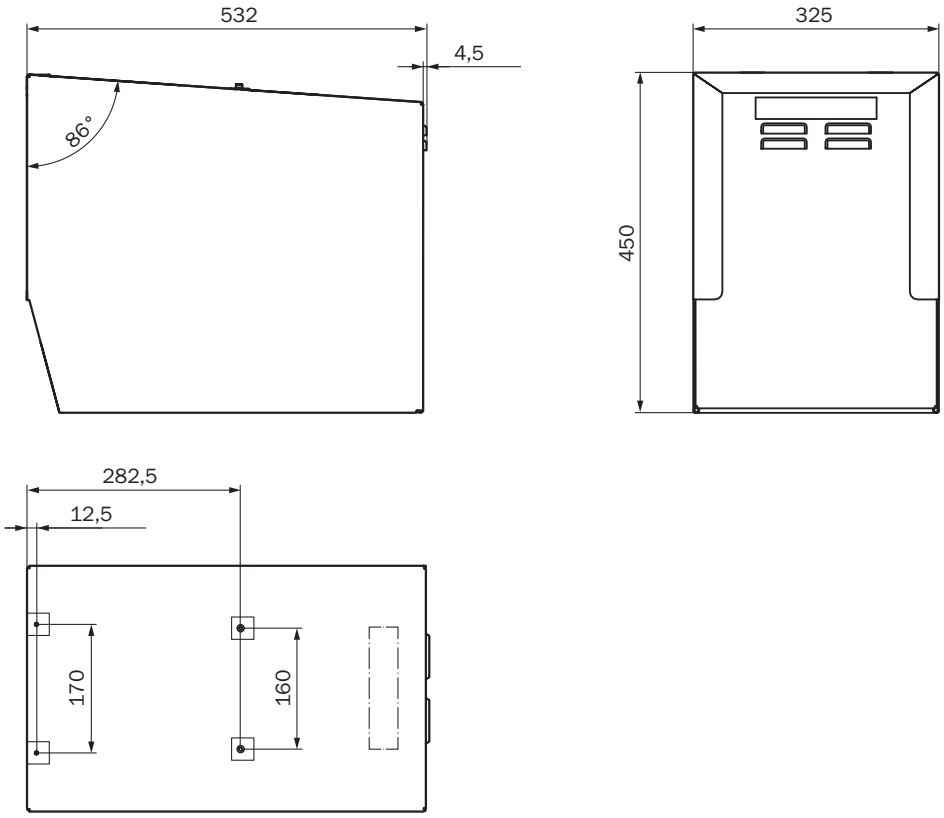
13.10 Dimension drawing, flange with tube, DN125

Fig. 30: Flange with tube, DN125 (dimensions in mm)



13.11 Dimension drawing, weather protection hood, sender/receiver unit

Fig. 31: Weather protection hood for sender/receiver unit (dimensions in mm)



14 Order data

14.1 Spare parts

Designation	Quantity	Part No.
Sender GM901-05 without purge air fixture	1	2 032 400
Receiver GM901-05 without purge air fixture, replacement part (only available when defective part returned)	1	2 020 655
Receiver GM901-05	1	2 032 347
Control unit GM901	1	2 043 414
Receiver connecting cable	1	2 020 447
Connection cable, length 15 m	1	2 020 439
PCB module control unit	1	2 061 631
Membrane keyboard control unit GM901	1	6 020 400
Cell wheel with motor (serial numbers ≥ 16508000)	1	2 091 937
Cell wheel with motor (serial numbers < 16508000)	1	2 091 938

Battery for real-time clock in the control unit	Type CR2032

14.2 Options, accessories

Designation	Quantity	Part No.
Optical adjustment device	1	2 020 436
Assembly bracket for zero path	2	2 020 445
Purge air unit with distributor and 5 m hose	1	1 012 424
Purge air hose D = 40 m	1	5 304 683
Connection unit with power supply 230 V/24 V for sender and receiver	1	2 020 440
5 m extension cable		2 020 437
10 m extension cable		2 020 438
15 m extension cable		2 020 439
Weather protection hood for purge air unit	1	5 306 108
Weather protection hood for GM901 control unit	1	4 029 146
Protection device, blind flange with seal	2	2 020 435
Protection device, air filter kit	1	2 020 442
Purge air fixture for zero adjust	2	2 020 021
Filter element	1	5 306 091
Test tool kit for SPAN test	1	2 019 639
Adapter flange GM910 -> GM901	1	2 019 369
SPAN test cell CO 1,600 ppm	1	2127629
SPAN test cell CO 4,000 ppm	1	2127627
SPAN test cell CO 10,000 ppm	1	2127628

15 Conformities

The technical version of the control unit complies with the following EC directives and EN standards:

- EC Directive LVD 2006/95/EC
- EC Directive EMC 2004/108/EC

Applied EN standards:

- EN 61010-1, Safety requirements for electrical equipment for measurement, control and laboratory use
- EN 61326, Electrical equipment for measurement, control and laboratory use - EMC requirements

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