OPERATING INSTRUCTIONS

GM35 Probe

Gas Analyzer for CO, N_2O, CO_2 and H_2O
Version with Measuring Probe

Installation, Operation, Maintenance

SICK
Sensor Intelligence.

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Legal Information

Original document

This document is an original document of SICK AG.

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1 Safety Information

The following information and guidelines apply to the Gas Analyzer with Measuring Probe GM35 described in this “Operating Instructions” document, and are valid for all user groups performing any work on or using the analyzer.

1.1 Permissible users

All planning, assembly, installation, start-up, maintenance and repair work must be carried out by adequately instructed personnel only and checked by skilled persons.

Persons responsible for safety must ensure the following:

- All safety-relevant work is carried out by qualified personnel only.
- Qualified persons are those who, based on their training, experience or instruction as well as their knowledge of relevant standards, regulations, accident prevention rules and plant conditions, are authorized by those responsible for safety for personnel and the plant to carry out such work. It is decisive that these persons can recognize and avoid possible hazards in a timely manner. Skilled persons are persons according to DIN VDE 0105 or IEC 364 or directly comparable standards such as DIN 0832.
- These persons have access to the documentation supplied with the system as well as the relevant technical documentation for all work carried out, and these persons adhere to the information in this documentation in order to prevent danger or damage.

1.2 Correct handling

To ensure safety precautions are observed and the device is used for its intended purpose, it is important that:

- The system be used in accordance with the technical data and specifications regarding permissible usage, assembly, connection, ambient, and operating conditions. These conditions are governed by the order documents, user information (type plates etc.), as well as the documentation supplied with the system, which includes these Operating Instructions.
- Users act in accordance with local, system-specific conditions and with due consideration paid to operational hazards and specifications.
- All measures necessary for conservation of value are observed, e.g. during transport and storage and/or maintenance and inspection.

1.3 Safety

WARNING: Risk through incorrect use

Equipment-internal protection devices can be impaired when the device is not used as defined.

- ▶ Read the Manual before installation, start-up, operation and maintenance and observe all information on using the equipment.

NOTICE: Responsibility for the safety of a system

The safety of the system in which the equipment is integrated is the responsibility of the person setting up the system.

Basic measures to prevent property damage and injury to persons

Improper usage or improper handling of Gas Analyzer GM35 can damage health or material.

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

If the GM35 is used as a sensor in combination with a control system, the operator must ensure that a failure or malfunction on the GM35 cannot lead to unallowed hazardous operating states or damage.

Protection against hazards through electrical equipment

GM35 system components include electrical equipment designed for use in industrial high-voltage plants where the relevant standards and regulations must be observed.

▶ Disconnect mains lines before working on mains connections or live parts.

Protection against hazards through gases

▶ Wear suitable protective clothing and mask when using hot and/or aggressive sample gases resp. with high dust loads.
▶ Never open the enclosure or switch off the purge air feed without taking appropriate protective measures when the duct is pressurized.

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 GM35 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.

1.4 Behavior during purge air failure

The GM35 measuring system configurations demand immediate measures to protect the measuring system should the purge air supply fail.

▶ Measures for purge air supply failure, see “Purge air failure”, page 119.

2 Product Overview

2.1 Use and proper application

The GM35 in-situ gas analyzer continuously measures the concentration of CO_2, H_2O and CO or N_2O, and in gas ducts – as single or simultaneous measurement depending on the device variant. As in-situ measuring system, the GM35 determines the measured values directly in the gas-carrying duct without extracting any samples.

- **Emission monitoring**

The GM35 determines and quantifies pollutants and reference values in gases reliably, quickly and precisely.

- **Process analysis and control**

The reliability, precision, and short response time of the GM35 are decisive advantages in the efficiency of control circuits in all processing creating CO, N_2O- and CO_2. Incinerating and drying plants are reliably monitored and efficiently controlled.

2.1.1 Conformities and certifications

Many areas of application require conformity with certain specifications. The Gas Analyzer with Measuring Probe GM35 complies with the following requirements:

- Guidelines regarding qualification tests for measuring equipment intended for continuous emission measurements
- Performance testing of ±2% precision of the measuring range end value (TÜV certified)
- Conformity according to EN 14181 and suitability for emission measurement in plants according to the 13th, 17th BImSchV and the TI Air, KAITEC certified (Korea) for components CO, CO_2 and H_2O (Cross-Duct and GMP measuring probe versions)
- Conformity with the GOST regulation, Certificate No. DE.C.31.001.A No. 11933
- Conformity with the U.S. EPA regulation CFR 40, Parts 60, 75 and 29 CFR 1310
- KAITEC certified (Korea)
- EMV conformity in accordance with EN 50081-1/EN 50082-2
- CE conformity in accordance with EC Directive EMC 89/336/EWG
- The manufacturer SICK is certified according to ISO 9001
- EC Directive LVD 2006/95/EC
- EU 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

2.1.2 Overview of standard components

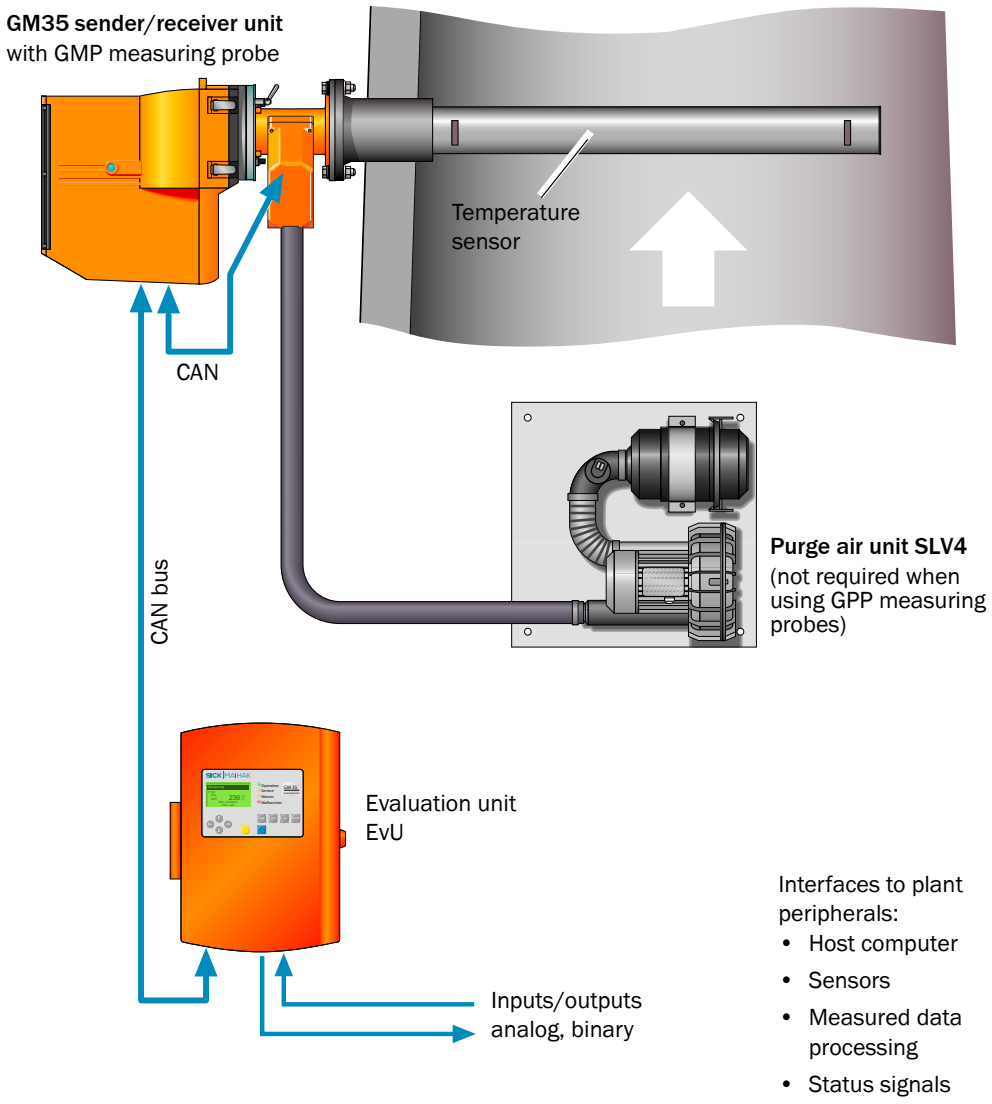


Fig. 1: GM35 system overview

- Sender/receiver unit (SR-unit)

Contains the main optical and electronic subassemblies of the measuring system. Records gas concentrations, calculates measured values, measures components CO or N_2O, CO_2 and H_2O; both singly and simultaneously in combinations.

- Measuring probe

Measuring probes are available in open design versions with integrated purge air guidance system (GMP) as well as versions with a gas-permeable diaphragm not requiring purge air (GPP: Gas Permeable Probe). Both versions are described from page 14 onwards.

- Purge air unit

Provides purge air supply for the SR-unit with a GMP measuring probe (open design) and protects against contamination and high gas temperatures. The blower types for the SR-unit resp. reflector are designed differently depending on the application.

- Evaluation unit

  The evaluation unit in the GM35 measuring systems serves as user interface and prepares and outputs the measured values and performs control and monitoring functions. The EvU can be installed near the SR-unit; if necessary, however, it can also be installed up to 1000 m from the measuring point, e.g. in a central control/monitoring room in an industrial plant.

  The evaluation unit carries out the following tasks, for example:

– Output of measured values, computed data and operating states
– Communication with the peripheral equipment
– Output of error messages and other status signals
– Control of automatic test functions and access during service (diagnosis)

- Connection cables

Cable type	Part No.
Cable*) (CAN bus), SR-unit – measuring probe, length 1.0 m	2023704
Cable[1] (CAN bus), SR-unit – evaluation unit, length 4 m	Scope of delivery
Cable*), measuring probe – filter monitor for purge air unit, length 5 m	2032143
2 cables*), measuring probe – filter monitor for purge air unit, length 2 m as extension	6025923
Cable, measuring probe – filter monitor for purge air unit, length 3 m as extension	6028663

[1] Included in scope of delivery

- **Flanges with tube**

To install the SR-unit with measuring probe on the gas duct. The purge air fixtures onto which the SR-unit and reflector are later mounted are secured to the flanges. Dimension drawing and order data, page 139. ANSI or DIN flanges provided by the customer can be used alternatively to the flanges supplied.

2.1.2.1 *Measuring probe in detail*

EPA conformity When using a GPP probe, an audit measurement in compliance with EPA CFR 40 Part 60 or Part 75 can be performed with the device mounted.

2.1.2.2 *GMP – probe with open measuring gap and vertical purge air outlet*

Shortest response times and resistance against high temperatures characterize measuring probes of the GMP series. A continuous purge air supply is required for operation. In the current GMP probe series, the air is outlet into the duct at 90° to the gas flow (directed purge air).

The GMP probe has a closing device towards the opening for sample gas and is operated using the lever on the probe flange.

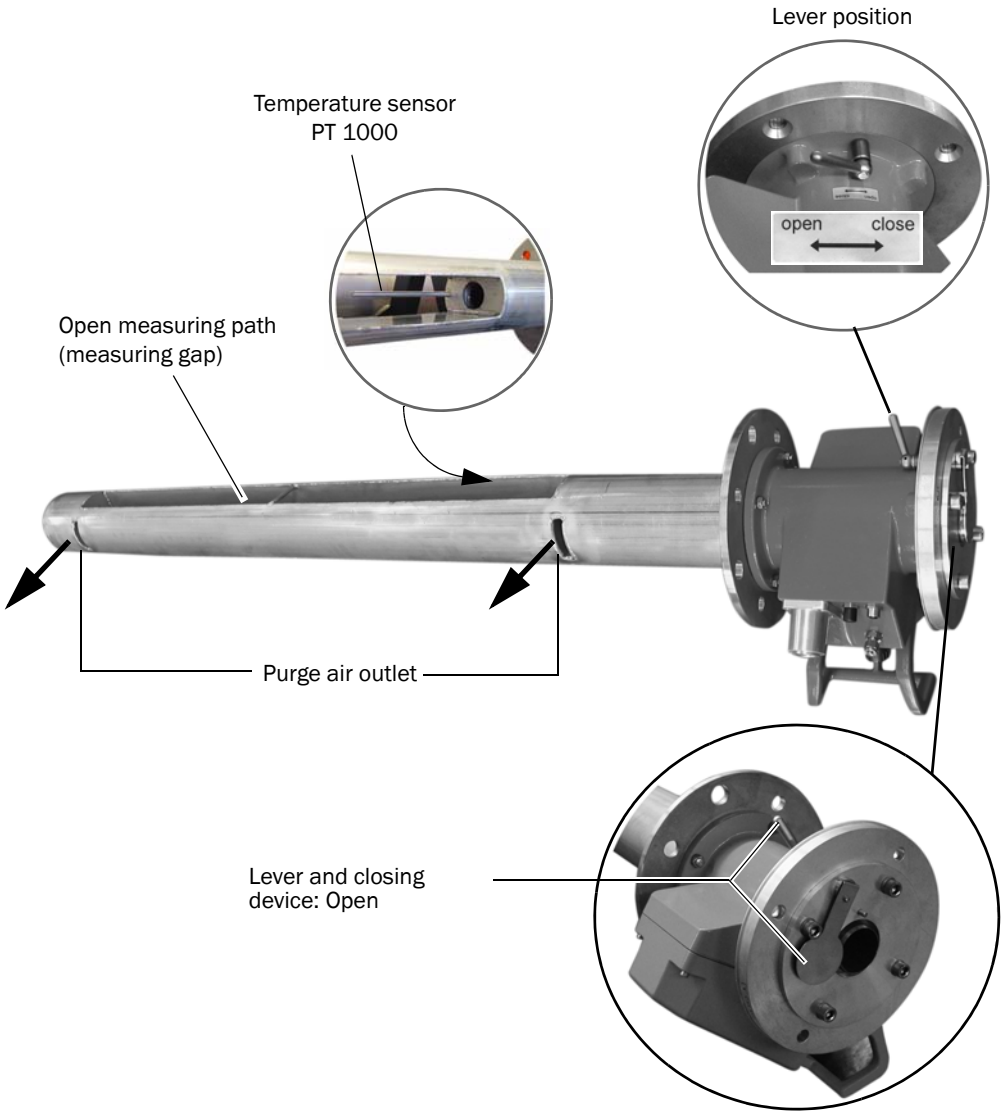


Fig. 2: GMP measuring probe (with open measuring gap)

GPP – gas diffusion probe as dry or wet version

These GPP probe versions are more suitable for higher dust contents than GMP probes because the GMP probes separate dust particles at the filter element which keeps the dust away from the measuring path. The GPP (Gas Permeable Probe) is also the best measuring probe choice for audit measurements according to EPA specifications as well as for low flow rates or irregular flow profiles.

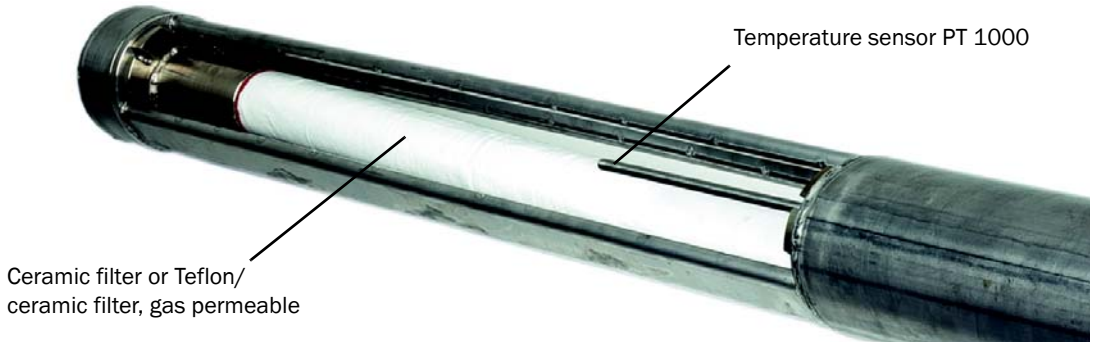


Fig. 3: Measuring gap for GPP measuring probe

The two versions of the GPP differ with regard to the respective filter making them suitable for different applications, see page 17.

Advantages of GPP probes

GPP probes do not require a purge air supply and are easy to maintain. They are fitted with an automatic heater for reliable prevention of condensate on the optical interfaces. The electronic components for the heater regulator, and temperature and pressure measurements, are located protected in a stable cast housing which forms the measuring probe section between the duct flange and the SR-unit.

The Figure below shows this housing fitted with the electrical connections for the CAN bus and power supply as well as the test gas connection which supports audit measurement according to EPA Directive CFR 40, Part 60 or Part 75.

Fig. 4: Electronic connections on the GPP probe

GM35 measuring probes in comparison

This Table shows an overview of the features of the different measuring probes. All measuring probe versions are compatible with all SR-units. The SR-unit is calibrated to the respective probe length on delivery.

Measuring probe	GMP (open probe)	GPP (dry)
Version	Measuring path open in flow direction; purge air guidance with outlet aligned 90° to gas flow	Gas diffusion probe with ceramic filter, for dry sample gas
Max. gas temperature	430 °C[1] N_20 measurement up to 180 °C	430 °C N_20 measurement up to 180 °C
Gas check according to EPA specification possible	–	Yes
Purge air supply required	Yes	–
Heating on optical interfaces in the probe	–	Yes, with integrated control
Flow rate of sample gas	1...40 m/s	< 40 m/s
Suitable for wet sample gas	Yes	–
Maximum duct pressure	±120 hPa, depending on purge air supply	±120 hPa
Measurable components[2]	CO or N_20, CO_2, H_2O	CO or N_20, CO_2, H_2O
System-response time (T_{90})	≥ 5 s	≥ 120 s
Duct diameter[3]	> 360 mm	> 300 mm
Dust concentration	< 2 g/m³ act	< 30 g/m³ act
Probe lengths available [m]	1.0/1.5/2.0/2.5	1.0/1.5/2.0
Active measuring paths available [mm]**	250/500/750/1000/1250	250/500/750/1000

Table 1: Comparison Table for GM35 measuring probes (dimension drawings, see page 128)

[1] The maximum temperature used for the measurement depends on the application.
[2] Probes are fitted with gold-plated hollow triples when CO or N20 is measured as component or with other components, otherwise probes with quartz glass are used.
[3] Probes with shorter active measuring paths are available on request (may be required for higher concentrations or smaller duct diameters)

Special versions Apart from the standard probes shown above, other versions made from materials especially resistant to acid are available (1.4539 and PVDF). Special versions can be manufactured according to customer demands on request.

2.1.3 GM35 options and accessories

- Automatic beam tracking

Ensures exact alignment of the measuring path to the probe (open and GPP version) under difficult and changing measurement conditions, such as, for example, large temperature fluctuations.

- CAN bus extension cable 15 m

A 15 m extension cable, ready for connection, is available when the evaluation unit is to be installed more than 2 m away from the SR-unit.

- Terminal box for CAN bus

For even greater distances between SR-unit and EvU, an optional terminal box can be used for the connection via the CAN bus cable provided by the customer. The total length of the CAN bus connections in the GM35 measuring system can be up to 1000 m in this case. However, the EvU is normally installed close to the SR-unit for easy operating at the measuring point. Section “Preparations for electrical installation”, page 30 describes how to use the terminal box.

- Angle flange for zero point measurement

Some adjustments must be made outside the duct in an atmosphere free from sample gas. A suitable angle flange that can be screwed to the mounting flange is available to enable carrying out these adjustments easily and directly at the measuring point. The duct is sealed and the SR-unit with measuring probe is mounted in front of the duct opening, at a right angle to the duct, using this bracket.

- Weatherproof covers for SR-unit and purge air unit

Required for outdoor installation – dimension drawings, see page 128.

- Line writer, single or multi-duct

For measured value recording. Protocol(s) can of course be produced using customer systems.

- Air heater for purge air supply

For special application conditions to prevent condensate. An air heater is required when the difference between gas temperature and dew point temperature is too low. The following practical rule of thumb serves as guideline:

An air heater is required when :

Gas temperature [°C] – dew point temperature [°C] < abs. humidity [%]

Values are compared without considering the units of measure.

2.2 Functional principle

2.2.1 Opto-electronic in-situ measuring principle

The Gas Analyzer with Measuring Probe GM35 is based on in-situ technology with opto-electronic direct measurement. Measured values are recorded through no-contact measurement directly in the gas flow across the entire duct cross-section (cross-duct). The GM35 SR-unit determines the concentration of the respective gas component based on wavelength-specific light absorption by the gas mixture in the active measuring path.

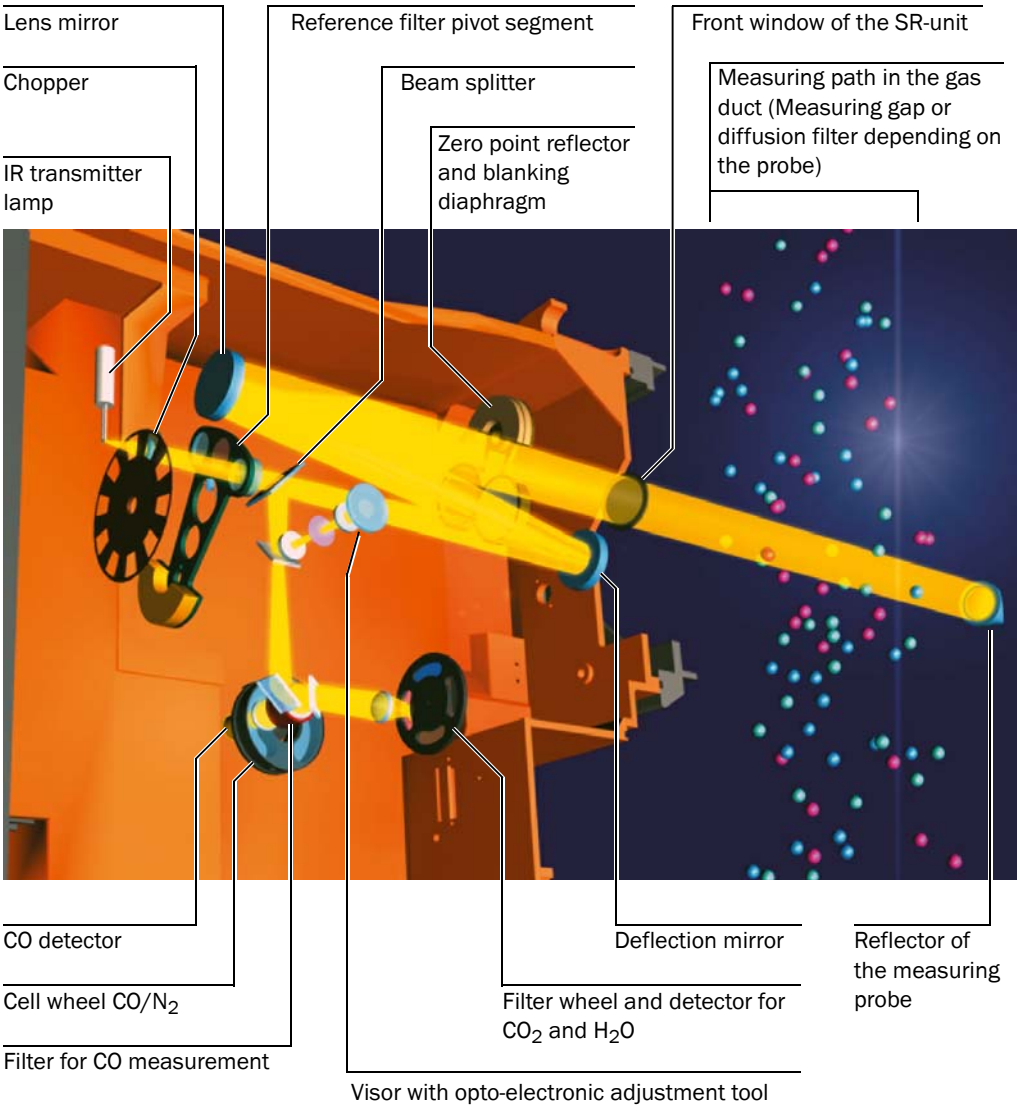


Fig. 5: Optics layout of the GM35

The beam from the sender/receiver unit (SR-unit) passes lengthwise through the active measuring path (see page 26) and is reflected by the reflector at the other end. The reflected light from the beam splitter then passes through a filter or cell wheel to detectors configured optionally to measure CO or N_20 as well as CO_2 and H_2O. By filtering the light received into its spectral components, the receiver elements record the absorption of the gas molecules at characteristic points of the spectrum in the IR range of 1.6 to 4.9 µm.

Cross-sensitivities with gases other than those to be measured are avoided by selecting these evaluation ranges within the IR spectrum in conjunction with the evaluation algorithms used (see page 20).

2.2.2 Signal evaluation

The optimized algorithms of the GM35 evaluation electronics process the measurement signals of the receiver elements together with the associated parameters in accordance with the correlation procedure with optical filters for CO_2 and H_2O and with cells filled with gas for CO or N_2O.

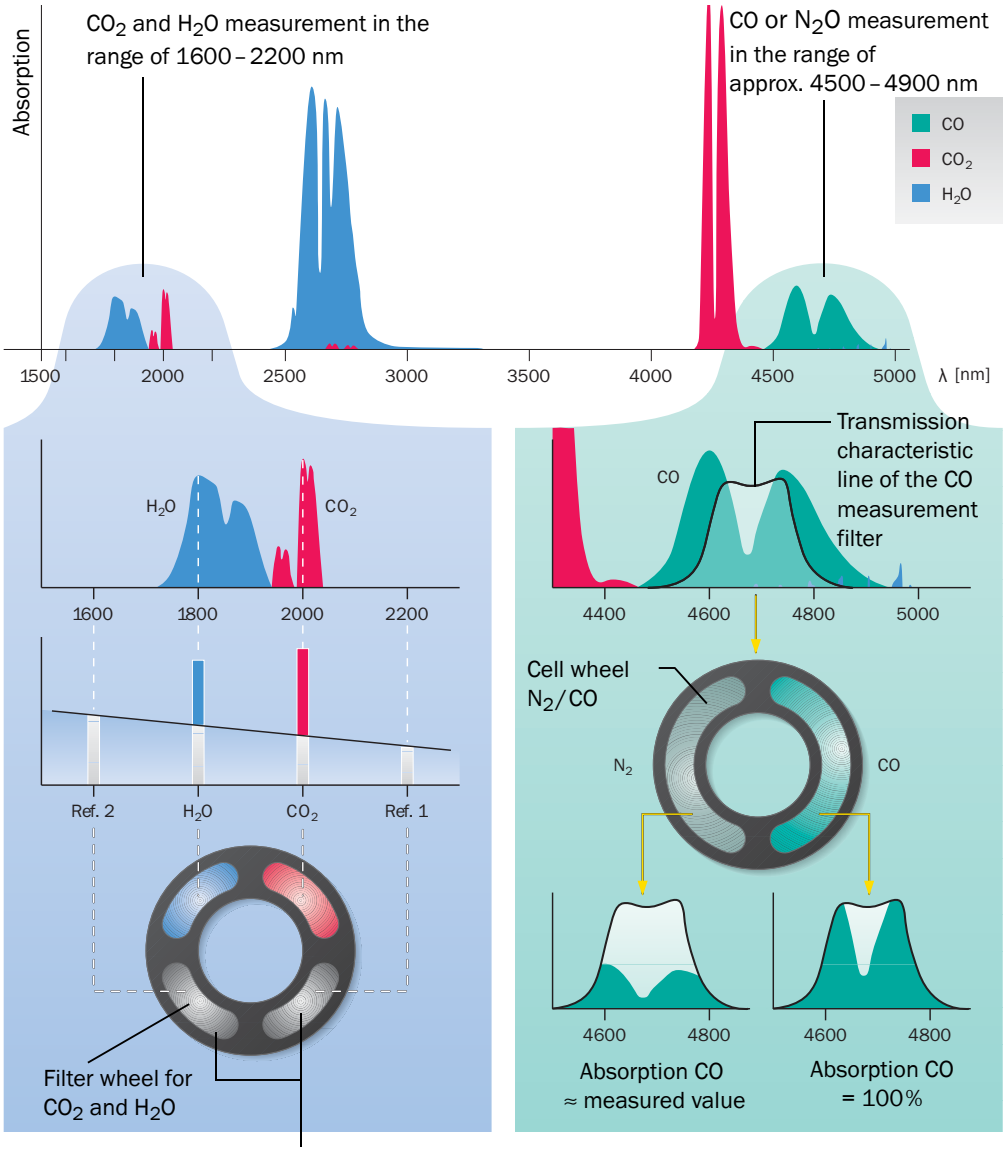


Fig. 6: Evaluation of absorption spectrums for sample gases with the GM35

2.2.3 Automatic check cycles

To ensure a consistently high level of measuring precision, the GM35 SR-unit performs a regular automatic check cycle in an adjustable interval (standard: Every 2 hours). In this check cycle, the zero point is first determined by swiveling a zero point reflector into the beam path. Reference filters are then moved into position to control the check point. The spectral properties of the device are checked using a test gas cell. If a check cycle reveals that the system is not functioning in accordance with the operation specifications, the GM35 measuring system outputs appropriate error or warning messages.

Triggering options

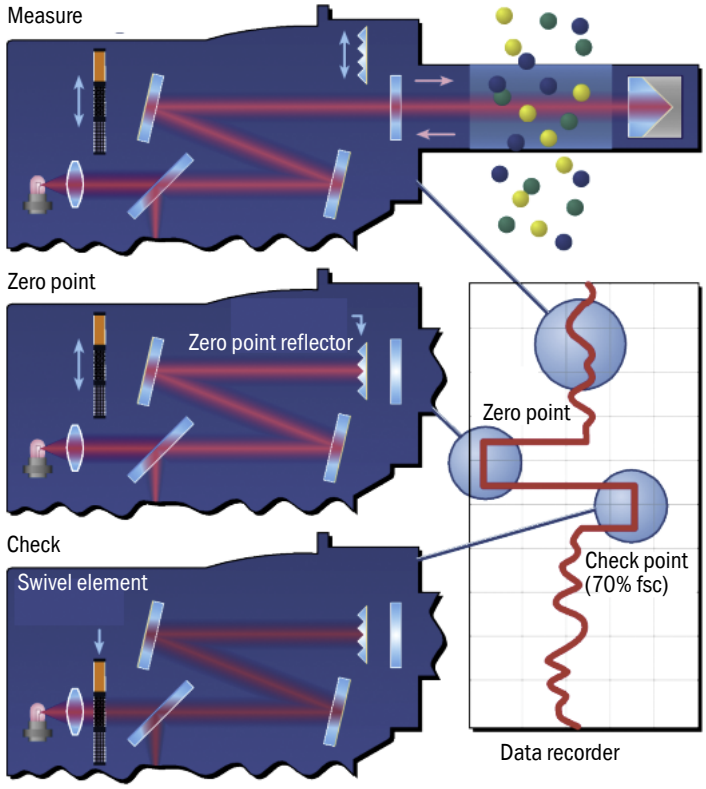
1 Di 1 (falling edge): The check cycle can also be suppressed with this function.
2 Time interval, adjustable via the menu of the EvU.

Sequence

1 Check cycle is started.
2 Internal reference measurement is executed. Signal: Relay 3 (function check)
3 The zero point and check point are output on the EvU display and the assigned analog outputs for 90 seconds each. Relay 3 remains active.

Observe the following for connecting to an emission computer: Measure the time from the start to the output to compensate differences in the device settings.

Fig. 7: Determining the check point



3 Project Planning Information

3.1 Work steps from system selection to start-up

Application changes

If the information regarding your application submitted with your purchase order has changed, or if a device is to be used for an application other than the one that was originally intended, please contact your local sales representative or our project planning department to determine whether the device(s) can be used under the new conditions, and whether readjustment or reparametrization is necessary.

The following steps are generally carried out before the measuring system is started up:

The version of the TCU-MS operating unit is selected according to the external signals to be processed or output.

- Project planning

See planning checklist below

- Initial onsite installation

  Following preparatory work normally carried out by the customer is described on page 26:

- Flange assembly, see page 27.
- – Preparation for assembling the purge air unit, see page 29.
- – Laying the signal and power supply cables to the measuring point, see *Chapter 3.9 , page -33*.
- – Preparations for installing the EvU, see “Installation preparation for the evaluation unit”, page 30.
- – Possibly preparation of signal cables for the interface to peripheral equipment, see “Preparations for electrical installation”, page 30
- Device installation

To allow speedy start-up, the following components are normally installed ready for operation before the start-up date; see “Installation”, page 36.

- – Purge air unit
- – Evaluation unit

- Start-up

The actual start-up procedure is carried out by trained personnel or SICK Customer Service. This work is described on page 53. The main activities are adjustment tasks on the GM35 system related to the application.

3.2 Project Planning Checklist

The following Checklist simplifies performing and controlling project planning measures required before start-up in the correct sequence. Technical data and dimensional drawings of system components, page 128 and following.

Topic	Task	Measure/determination
Determination of measuring point Observe national regulations such as VDI 3950	Provide for unhindered inlet and outlet paths:	
	▶ For round duct cross-sections: 3 times the duct diameter	
	▶ For rectangular cross-sections: Hydraulic diameter $D = \frac{4F\ (Cross\text{-}sectional\ area)}{U\ (Circumference)}$	
	▶ If these specifications cannot be met: Inlet path > outlet path, e.g. $^2/_3 : {}^1/_3$; uniform concentration spread whenever possible	
	Emission measuring point	▶ Obtain official approval for emission measuring point. ▶ Provide for calibration openings at easily accessible places. ▶ Ensure the GM35 and calibration probe do not influence each other; the calibration gland should be located at a minimum distance of 0.5 m away from the measuring device.
	Application conditions	▶ Observe Technical Data for duct/ambient conditions! ▶ Gas temperature above/below dew point (dry/wet)
	Installation location	▶ Acc. to FGD wet : Select a version with active measuring path ≤ 500 mm when a GMP probe is used.
	Pressure conditions at the measuring point	▶ A fitting location with partial vacuum in the duct is ideal. ▶ For duct pressures > 10 mbar, please contact SICK to select the correct purge air blower type.

Table 2: Project planning checklist

Topic	Task	Measure/determination
SR-unit, probe See *3.3.1 "Assembly preparation at the measuring point", page 26*	Select suitable flange with tube	▶ Flange fitting is planned in steel ducts as standard; corresponding flanges with tube are normally included in the GM35 scope of delivery. ▶ Brick stacks or thick-walled ducts require a holding plate, to be provided by the customer, and, if necessary, a longer flange with tube, see *Chapter 3.3.3 , page -27*. ▶ If some of the components have not yet been delivered, you may need to arrange an advance delivery of the flanges with tube so that you can mount these as part of the preparations for installation onsite.Alternatively, you can use a suitable flange prepared onsite (or ANSI flange, check the Technical Data, see page 128).
	Duct openings selection	▶ Determine the alignment of the measuring gap of the GM35 measuring probe in gas flow direction. ▶ Provide a suitably sized opening for the tube of the mounting flange. ▶ Install the flange with tube tilted slightly downwards (> 1°) to prevent condensate deposits and therefore corrosion. ▶ Provide for adequate clearance for installation and maintenance activities for the duct insulation cutout. ▶ Plan sufficient clearance for pivoting the GM35 SR-unit, removing the cable connector from the device, and pulling the measuring probe out of the duct. ▶ Ensure the ambient temperature for the GM35 SR-unit is between -20 and +55 °C (–40 °C during continuous operation). ▶ For installation outdoors, plan a weatherproof cover.
	Tools for start-up and maintenance	▶ If adjustments are to be made at the measuring point (prerequisites: clean, atmosphere free from sample gas; protected from weather): order the angle flange for zero point measurement (Part No. 2 017 833); when necessary, plan a longer version of the flange with tube to ensure sufficient distance from the duct.
Purge air unit • Only relevant when using a purge air unit, i.e. not on systems using a GPP probe • See Section 3.3.1: *Assembly preparation at the measuring point*	Fitting location selection	▶ Plan installation location on the duct in immediate vicinity (5 m) of the GM35 SR-unit. ▶ Keep the purge air hose to the measuring probe as short as possible (approx. 1.2 mbar pressure loss per meter). ▶ Ensure secure cable laying. ▶ Ensure dry and, whenever possible, dust-free intake air on the purge air unit, use a preliminary filter when necessary. ▶ The intake air temperature should be between 0 and 55 °C. For T < 0 °C, heat the purge air. ▶ Provide sufficient clearance for exchanging the filter element. ▶ Plan a weatherproof cover for installation outdoors as well as sufficient clearance for fitting (and removing) the cover.

Table 2: Project planning checklist

Topic	Task	Measure/determination
Evaluation unit • See *3.3.6 "Installation preparation for the evaluation unit", page 30*	Determine the fitting location	▶ Install the evaluation unit at an easily accessible location, preferably at the measuring point. If necessary, install it at a distance from the measuring point, whereby the total length of all CAN bus connections in the GM35 measuring system must not exceed 1000 m. ▶ Ambient temperature between –20 °C and +55 °C. ▶ During continuous operation –40 °C.
	Options for CAN bus wiring	▶ Is the 4 m CAN bus cable sufficient for the connection between EvU and SR-unit at the selected installation location? If not, select a suitable cable (see page 13): If the distance is less than 19 m: Plan a 15 m prefabricated CAN bus cable with plug-in connectors. For larger distances: Use a CAN bus terminal box and the cable provided by the customer (see page 43).
Assembly platform	Specify the assembly platform	▶ Provide a suitable working platform for installation on the outside of a duct/stack. ▶ The fitting location of the GM35 SR-unit should be about 1.3 to 1.5 m above the platform. ▶ The platform must be large enough, secured and positioned so that all device parts can be accessed without danger. This is especially important when fitting and removing the SR-unit.
Accident prevention		▶ Applicable (national) regulations on accident prevention must be observed. ▶ Always observe and follow the relevant safety information provided for the corresponding texts in these Instructions.

Table 2: Project planning checklist

3.3 Initial onsite installation

The following work can be carried out by the customer's technicians. Requirement: The project planning checklist has been processed beforehand.

3.3.1 Assembly preparation at the measuring point

This Section describes the welding work on the duct including making fixing elements onsite.

Already completed? If you have already used the separate document “Product Information and Planning Guide” to complete the work described here prior to delivery of the device, please check that the work done corresponds to the following instructions.

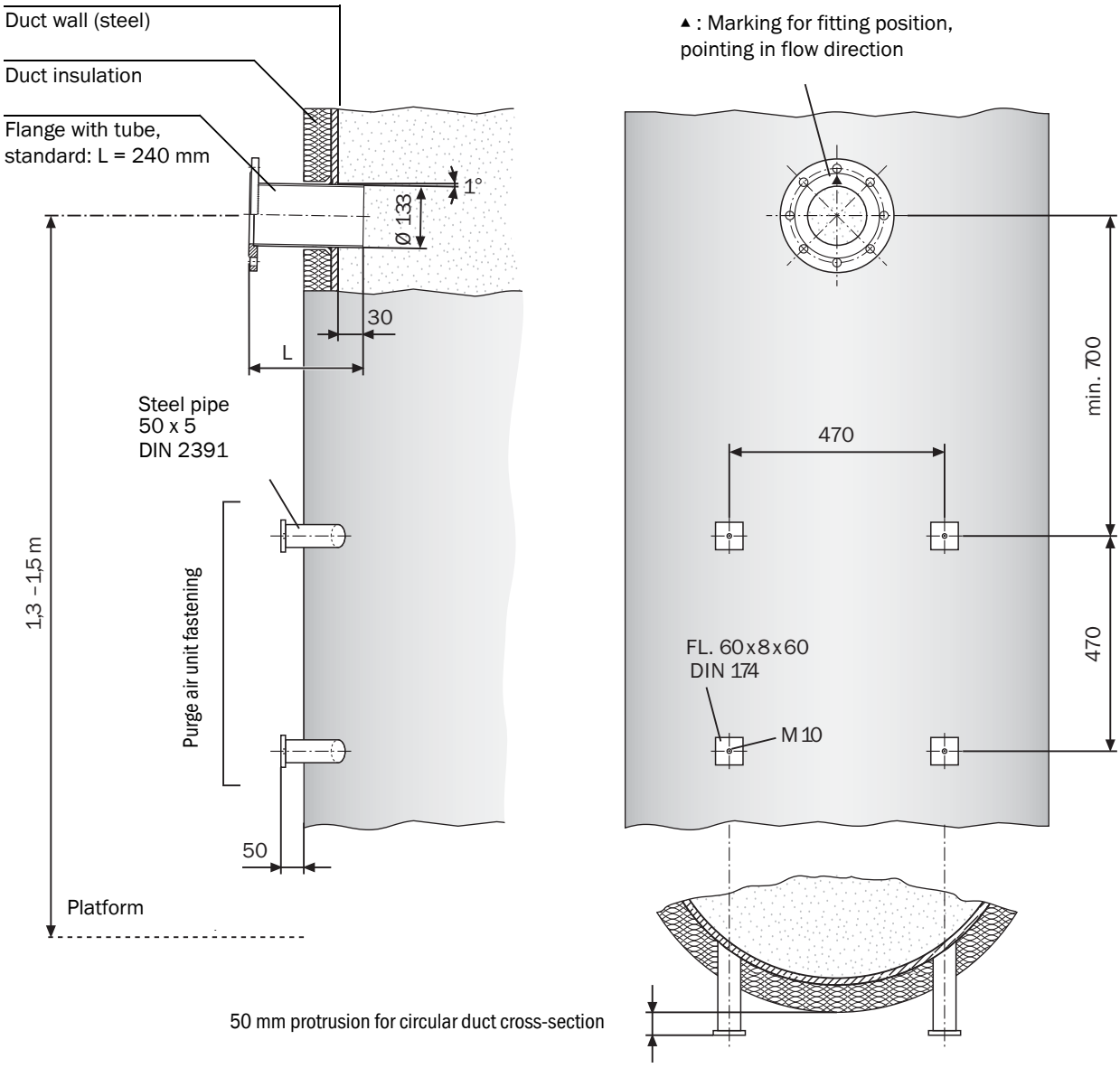


Fig. 8: Installation recommendation: Mounting flange and purge air unit (duct diameter not representative)

CAUTION: Protective measures at the measuring point

- Always shut down the installation before any work on the duct!
- Secure parts to be separated with, for example, wire binding, to prevent damage by falling objects.
- Take appropriate protective measures against hot, explosive gases or toxic gases that could possibly escape from the duct.
- Always take all necessary safety precautions during welding work to prevent explosions or fire in the duct atmosphere and on the duct insulation.
- If necessary, seal off the mounting flange with a cover securely until device assembly (e.g. for overpressure in duct).

3.3.2 Uncovering the duct

- If necessary, remove approx. 800 x 1500 mm (W x H) of the duct insulation to be able to access the duct during subsequent work.
- Keep the insulation material removed for later refitting resp. provide new suitable insulation material.

3.3.3 Installing the flange with tube

Notes on flange installation

- Standard flanges and special versions
  SICK delivers one flange with tube with 240 mm total length and 125 mm inner diameter as standard. A version with 500 mm total length is available for installation locations with thicker insulation or for stone stacks.

  Special versions can be manufactured on request. Onsite flanges, including ANSI flanges, can also be used.

- Reinforcement with junction plates recommended
  Due to the weight of the GM35 sender/receiver unit, it is recommended to reinforce the flange tube onsite with junction plates.

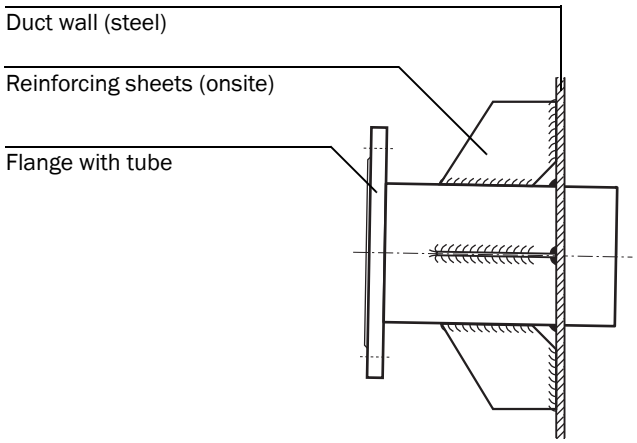


Fig. 9: Reinforcing with junction plates

- Gas-carrying duct made of brick/concrete
  An additional retaining plate with suitable opening should be manufactured for ducts not made of steel and the flange with tube then welded into the opening.

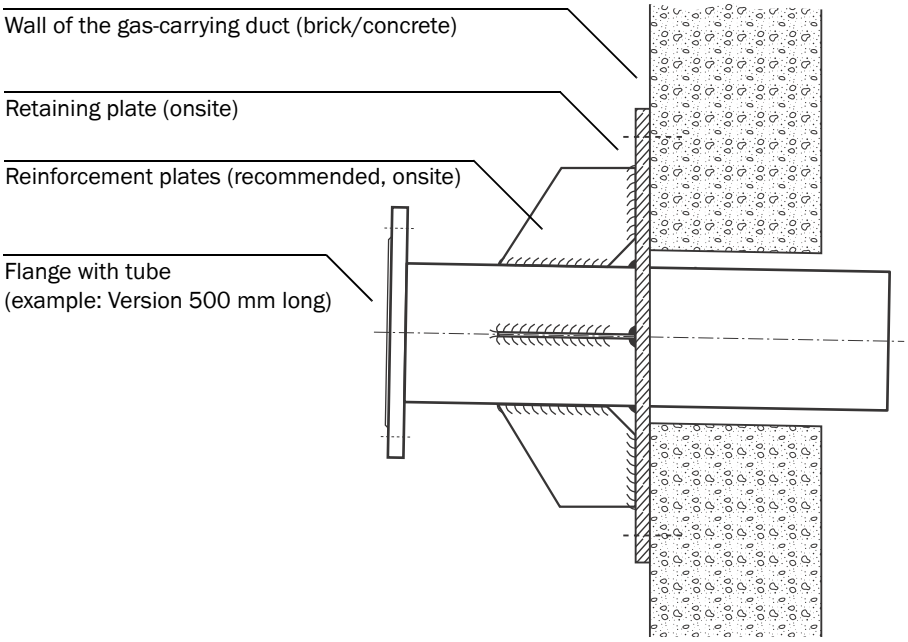


Fig. 10: Installation on a brick/concrete duct

- Using the angle flange for zero point measurement

To use the angle flange (Part No. 2 017 833) for zero point measurement, make sure the SR-unit with mounted measuring probe can be attached without hindrance to the duct using the angle flange. Avoid obstacles in the vicinity of the flange with tube, such as, for example, protruding duct insulation. A longer flange with tube or an angle flange with spacer (to be provided by the customer) may be required to ensure the distance from the duct wall is sufficient.

3.3.3.1 Installation steps: Fitting the flange with tube

NOTICE: Observe the safety information on page 26 at all times!

1 For brick/concrete ducts: Cut the duct opening approx. 2 cm larger than the flange tube outer diameter.
2 Cut an opening matching the outer flange tube diameter (standard $Ø_a$ = 133 mm) out of the duct wall resp. retainer plate.
3 Position the flange tube so that the marking ▶ points exactly in gas flow direction (compare page 26). Incline the tube slightly downwards in the duct resp. on the retainer plate (approx. 1°, see page 26) to prevent condensate deposits later between tube and probe. Affix in the fitting position.
4 Weld the flange tube on.
5 Weld on with junction plates as reinforcement when possible; see page 27 or page 28.

NOTICE: Brick/concrete ducts: Anchor the holding plate with the welded flange with tube to the duct as shown on page 28.

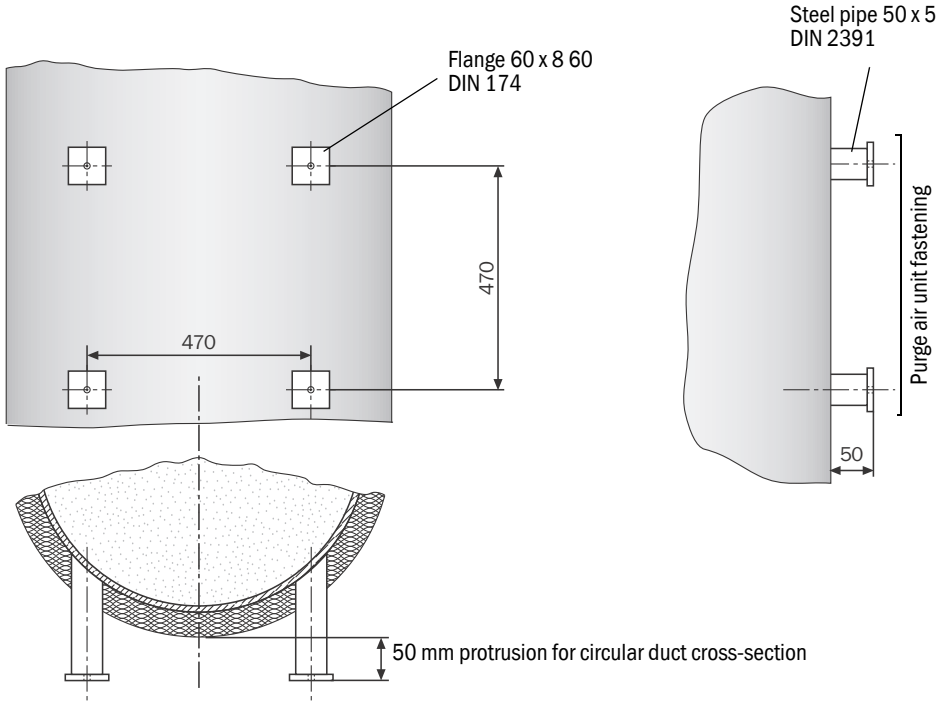
3.3.4 Installation preparation for the purge air unit

Is a purge air unit to be used?

This step is only relevant for device configurations containing a purge air unit. GM35 configurations with GPP measuring probes do not require purge air.

1 Make brackets from steel pipes (e.g. 50 x 5) with flanges (e.g. FL 60 x 8 x 60) for the four fixing points of the purge air unit ; bore M10 threads in the mounting holes.
2 Weld the brackets on as shown when using steel ducts.

For stone stacks, fit retainer plates to each steel pipe or use a different, suitable mounting for the purge air unit.



3 *Fitting recommendation for purge air units (duct diameter not representative)*

3.3.5 Duct insulation

▶ Refit the thermal duct insulation; reinforce the insulation when necessary.

CAUTION: Device failure due to high ambient temperatures
The SR-unit of the GM35 is designed for a maximum ambient temperature of +55 °C. Radiant heat on the enclosure surface can, under certain circumstances, lead to temperatures higher than the measured air temperature.

▶ Therefore, design insulation and radiation shielding so that temperature limits are reliably maintained.

3.3.6 Installation preparation for the evaluation unit

Requirements The installation location for the evaluation unit was determined during project planning. The maximum total cable length of all CAN bus connections in the GM35 measuring system of 1000 m was taken into account, bearing in mind that the closer the device is to the measuring point, the easier it is to use.

Installation location preparation

The evaluation unit is fitted with clips which enable it to be mounted easily using 4 screws, even on an uneven surface.

- ▶ Based on the dimension drawing of the EvU according to page 135, make sure sufficient space is available at the planned installation location to fit and wire the EvU as well as to pivot the enclosure door.
- ▶ Drill suitable openings as assembly points as required.

3.4 Preparations for electrical installation

The onsite supply and signal cables are laid beforehand to facilitate subsequent installation and start-up of the GM35 system components. Suitable cable ducts or conduits are installed for the prefabricated cables and delivered with the GM35 system (marked with * in “Cable routing diagram”).

The prepared cables are connected to the devices during installation or start-up by suitably qualified personnel or by SICK Customer Service.

Already completed? If you have already used the separate document “Product Information and Planning Guide” to complete the work described here prior to delivery of the device, please check that the work done corresponds to the following instructions.

3.5 Electrical protection

Evaluation units of GM35, Power Supply 24 V; SCU I/O

- Insulation: Protection class 1 in accordance with EN 61140
- Insulation coordination: Overvoltage category II in accordance with EN61010-1
- Contamination: Degree of contamination II in accordance with DIN EN 61010-1

3.6 Specifications on electric isolation of the EvU

Connections SCU I/O	
Relay contact <-> PE	860 V AC
Relay contact <-> relay contact	860 V AC
Relay contact <-> actuation	1376 V AC

Table 3: Characteristic data for electric isolation

3.6.1 Electrical installation safety information

WARNING: Hazard by voltage.

- ▶ Only allow an authorized electrician to work on the electric system.
- ▶ Observe the relevant safety regulations during all installation work.
- ▶ Take suitable protective measures against local risks and those arising from the plant.

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 and/or lines is not switched off using a disconnector switch/circuit breaker.

- Before starting the work, ensure the power supply can be switched off using a power isolating switch/circuit breaker in accordance with DIN EN 61010.
- Make sure the disconnector switch is easily accessible.
- An additional disconnecting device is mandatory when the power isolating switch is difficult to access or cannot be accessed when connecting the equipment after installation.
- The power supply may only be activated again after the work or for test purposes by personnel carrying out the work under consideration of valid safety regulations.

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

When a removable power cable is used, electrical accidents can occur when the specifications are not fully observed.

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

CAUTION: 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.

NOTICE: Responsibility for the safety of a system

The safety of the system in which the equipment is integrated is the responsibility of the person setting up the system.

WARNING: Risk of fire due to 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 as well as gas temperatures over 200 °C:

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

WARNING: Endangerment of electrical safety through heat damage to lines
When planning the lines, take into account that the connection unit can reach a temperature >60 °C due to self-heating at maximum ambient temperature.
▶ Only use lines specified for temperatures >80 °C.

3.7 Electrical protection

Evaluation units of GM35, Power Supply 24 V; SCU I/O

- Insulation: Protection class 1 in accordance with EN 61140
- Insulation coordination: Overvoltage category II in accordance with EN61010-1
- Contamination: Degree of contamination II in accordance with DIN EN 61010-1

3.8 Specifications on electric isolation of the EvU

Connections SCU I/O	
Relay contact <-> PE	860 V AC
Relay contact <-> relay contact	860 V AC
Relay contact <-> actuation	1376 V AC

Table 4: Characteristic data for electric isolation

3.9 Laying connection lines

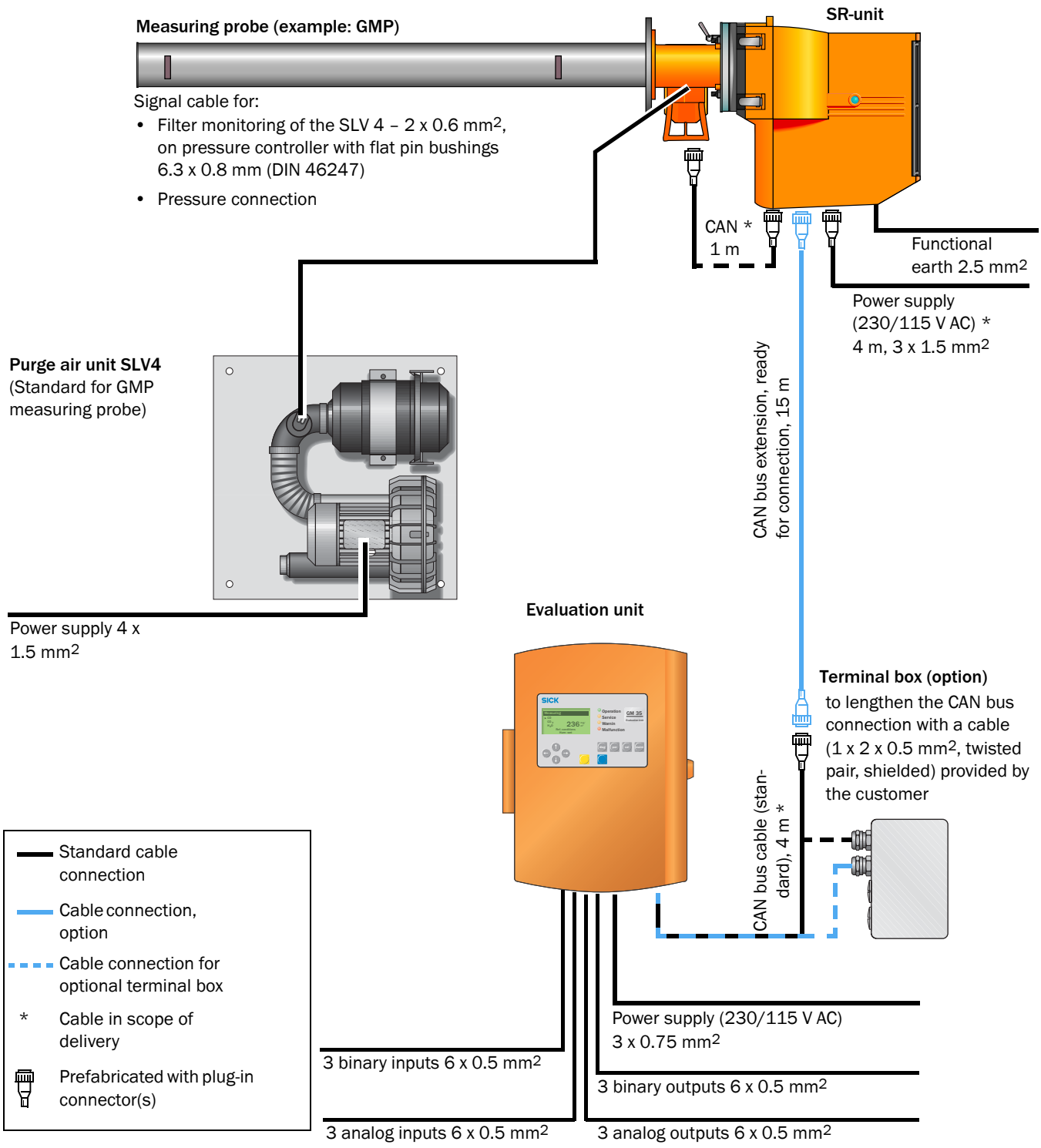


Fig. 11: Cable routing diagram

3.9.1 CAN bus wiring

Standard cables

An installation location in the vicinity of the measuring point is generally selected for the EvU so that the 4 m CAN bus cable delivered is sufficient for cabling without additional installation effort. CAN bus extensions, ready for connection with plug-in connectors, are also available in various lengths (see “Connection cables”).

Installation away from the evaluation unit

A 6-pole terminal box can be supplied when the EvU is to be located some distance from the SR-unit. This is then connected to the SR-unit using the 4 m CAN bus cable delivered with the measuring system. A customer cable suitable for CAN bus applications, 6-pole cable (twisted pair wires and shielded), then leads to the EvU. The total length of the CAN bus connections, including the one to the reflector, may be up to 1000 meters. When performing maintenance or service, it must be possible to deinstall the EvU temporarily and connect it directly to the SR-unit at the measuring point.

Laying the cables

- ▶ Provide adequate cable lengths at the connection points.
- ▶ Whenever possible, do not lay power supply cables immediately next to signal cables.
- ▶ Protect open ends of preinstalled cables against weather effects until device installation.
- ▶ Install separate power supply cables and circuit breakers for:
- – GM35 SR-unit (via connection unit or terminal strip in control cabinet)
- – Purge air units; additional motor circuit breakers and optional protective phase failure switches.
- – Evaluation unit

CAUTION: Risk of device damage due to switching off the voltage supply unintentionally

The purge air supply may not be switched off while the measuring system is on the gas duct.

- ▶ Attach clearly visible warnings against accidental switching-off to all switching devices where the purge air supply can be switched off.

WARNING: Risk of fire due to 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 as well as gas temperatures over 200 °C:

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

- ▶ Install easily accessible cable ducts or empty tubes for prefabricated cables or cables delivered with the system, see “Cable routing diagram”, page 33 (marked with one or two plug-in connectors). Approx. 2 m cable lengths each should be available at the measuring point for later maintenance work on the measuring system when dismounted from the duct.
- ▶ Lay cables provided by the customer (shown without plug-in connectors) according to see “Cable routing diagram”, page 33.

- The specifications for the lead cross-sections are recommendations whereby cables for analog and binary signals may differ slightly from these (but not the CAN bus connections or the power supply cables).
- Start with the system internal connections of the GM35.

Status and signal cables from the EvU to the connection terminals of the customer's status/signaling equipment can be connected later when required.

4 Installation

This Section describes assembling and installing the GM35 measuring system prior to the actual start-up. It is assumed that the onsite preinstallation has been completed, see “Project Planning Information”, page 22.

4.1 Preparations

4.1.1 Checking the scope of delivery

- Check the delivery against the associated delivery note and make sure the complete measuring system has been delivered as ordered. The typical scope of delivery comprises the components described in Section “Preparations for electrical installation”.
- Inspect the delivery for visible external transport damage or damage to the packing.
- Check the specifications on mains voltage and frequency on the type plates of the GM35 components match the installation conditions, delivery note and the order.

4.1.2 Installation prerequisites

The following prerequisites are applicable for the work described in the following:

- Plan safe usage/application within the limits defined in “Technical Data, Consumables and Spare Parts”, page 128.
- Compliance with the specifications made during project planning (according to “Project Planning Checklist”, page 23) and correct performance of onsite preinstallation according to “Initial onsite installation”, page 26.

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 and/or lines is not switched off using a disconnector switch/circuit breaker.

- Before starting the work, ensure the power supply can be switched off using a power isolating switch/circuit breaker in accordance with DIN EN 61010.
- Make sure the disconnector switch is easily accessible.
- An additional disconnecting device is mandatory when the power isolating switch is difficult to access or cannot be accessed when connecting the equipment after installation.

WARNING: The power supply may only be activated again after the work or for test purposes by personnel carrying out the work under consideration of valid safety regulations.

4.2 Fitting system components

4.2.1 Information on the SR-unit and measuring probe

The GM35 SR-unit and measuring probe are first fitted on the duct during start-up (see "Connecting the System Control Unit - SCU") because these components first require an adjustment away from the gas-carrying duct. To avoid problems during start-up, the SR-unit and measuring probe must be stored in a dry place free from dust, preferably at room temperature, until start-up.

CAUTION: Damage to the measuring system due to assembly of the SR-unit and/or measuring probe before start-up
Unfavorable ambient conditions or atmosphere in the measuring duct can damage the measuring system which prevents start-up. Apart from that, there is a health risk when opening the duct depending on the pressure, gas temperature and composition in the sample gas duct.

4.2.2 Installing the purge air unit

Note A dimension drawing can be seen in "Purge air unit dimension drawing", page 137. Brackets should have M8 threadholes or M8 separator bolts for fastening to the base plate.

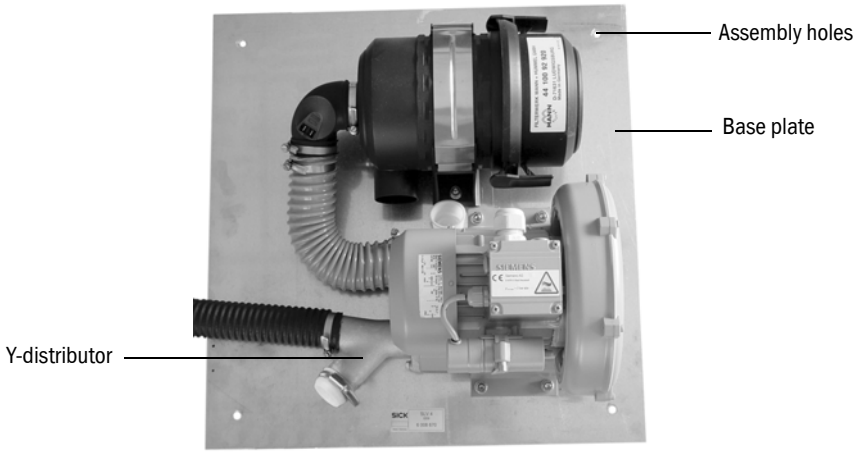


Fig. 12: Installing the purge air unit

1 Secure the base plate for the purge air unit using 4 M10 x 45 screws on the brackets provided by the customer.
2 Cut the purge air hose to a suitable length for the respective purge air fixture, attach it to the open outlet of the Y-distributor and secure it with a hose clamp.
3 Close off the hose ends when the purge air unit is not going to be used for a longer period.

If the purge air unit is not connected electrically immediately:

4 For outdoor installations, fit the weatherproof cover planned during project planning (optional in scope of delivery).
5 Protect the open end of the purge air hose from humidity or contamination until SR-unit start-up.

4.2.3 Terminal box (option)

- ▶ Install the terminal box in the vicinity of the measuring point.
- – Secure the enclosure on the two mounting holes (∅ 5 mm).
- ▶ The cable length available from the terminal box to the SR-unit is 4 m.Take the empty conduits laid for the prefabricated cables during onsite preinstallation into account.

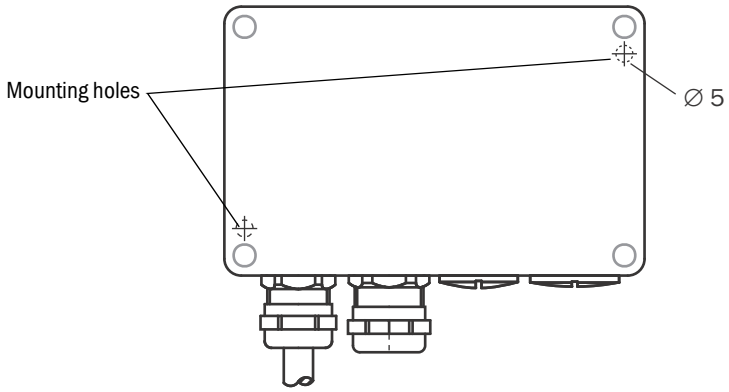


Fig. 13: Fitting the terminal box

4.3 Installing the evaluation unit

The fitting location for the evaluation unit was defined during project planning (see “Project Planning Checklist”, page 23) and prepared during onsite preinstallation as required.

- Make sure the CAN bus connection to the SR-unit selected during project planning is usable at the planned installation location. The CAN bus connection cable delivered as standard is 4 m long and serves to connect the evaluation unit directly at the measuring point.
- Ensure easy access without problems. In particular, make sure the swivel door of the evaluation unit can be opened without hindrance after fitting.

4.3.1 Installing the evaluation unit – sheet metal enclosure version

- Make ∅7.2 mm (for M8) mounting holes at the installation location according to the Drilling plan.
- Attach the evaluation unit at the installation location using the 4 planned fastening brackets with suitable screws.

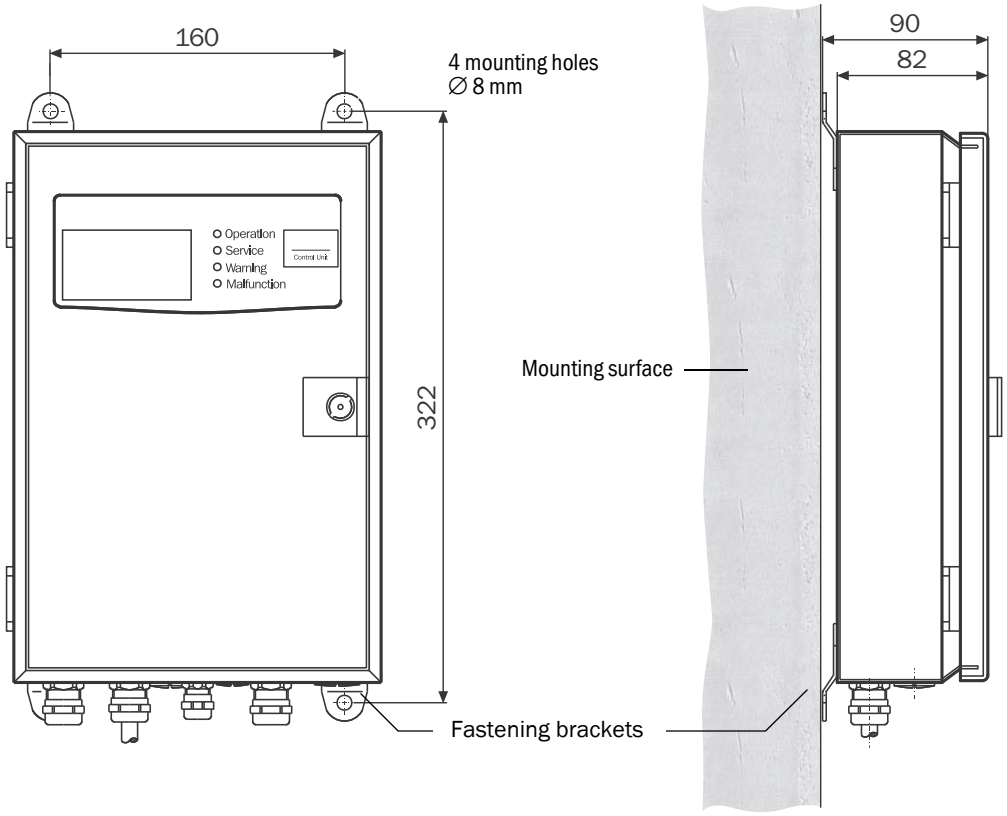


Fig. 14: Installing the evaluation unit (sheet metal enclosure version)

4.3.2 Installing the evaluation unit – cast enclosure version

1 Make ∅7.2 mm (for M8) mounting holes at the installation location according to the Drilling plan.

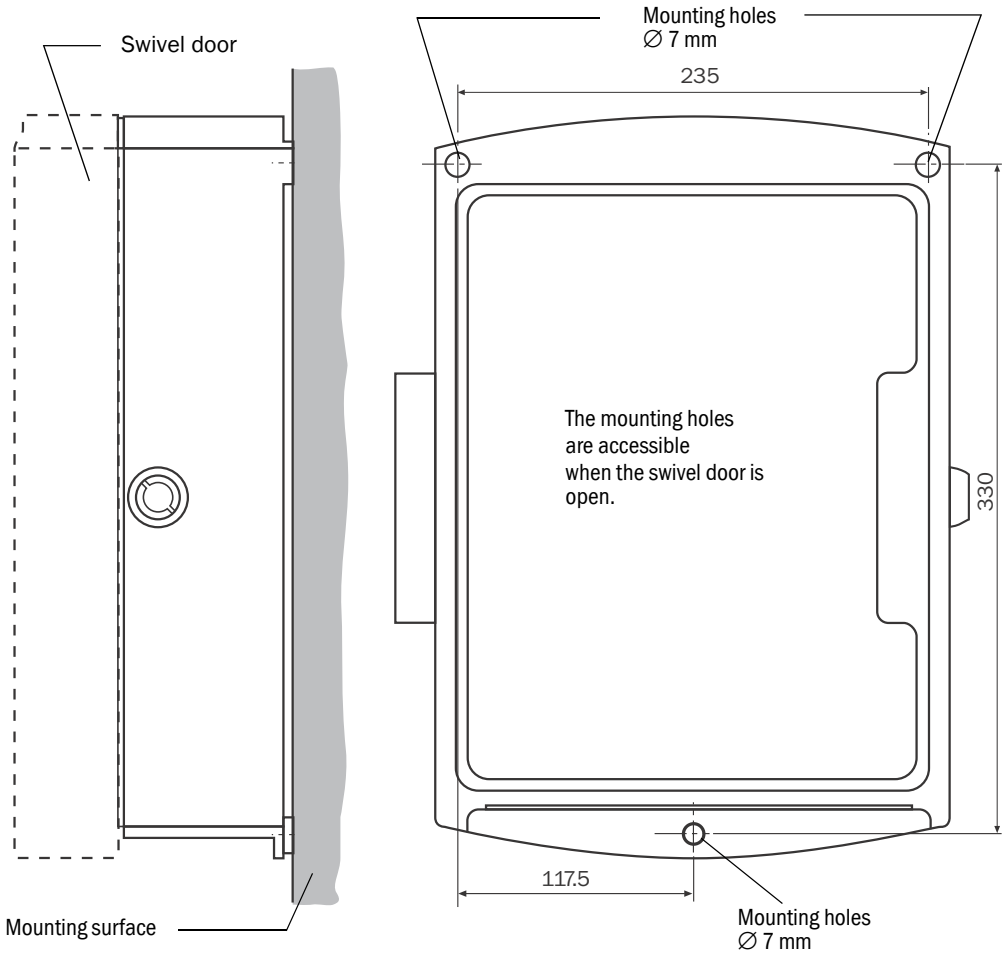


Fig. 15: Mounting holes layout (Drilling plan) to fit the EvU (cast enclosure)

2 Open the enclosure door with a control cabinet key and swivel open.
3 Attach the evaluation unit at the installation location using the 3 planned mounting holes with suitable screws (M8 x 20).

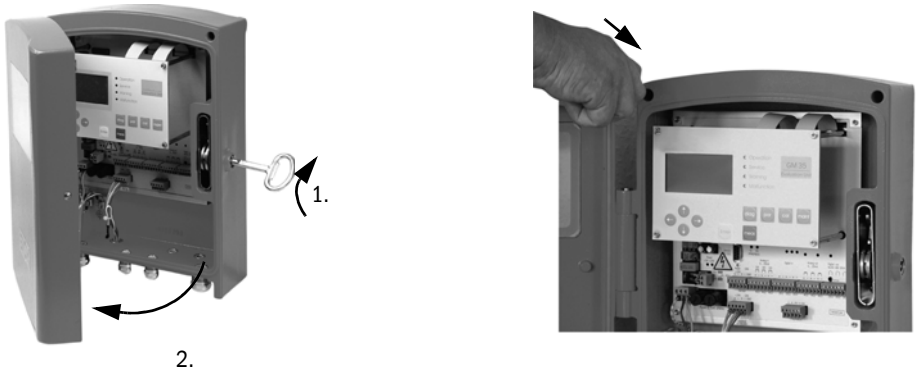


Fig. 16: Fitting the evaluation unit (cast enclosure)

4 Close and lock the door again.

4.4 Electrical connection of system components

Onsite preparation for electrical installation has been described in “Preparations for electrical installation”, page 30. The cables laid as described there are now connected to the system components.

WARNING: Observe safety information as well as relevant safety regulations!
During all work on electrical equipment, disconnect such equipment from the mains, check that the equipment is potential free and make sure no third person can switch the equipment back on again without authorization.

4.4.1 Electrical connection for the purge air unit

The technical data of the standard purge air unit are contained in “Technical Data, Consumables and Spare Parts”, page 128.

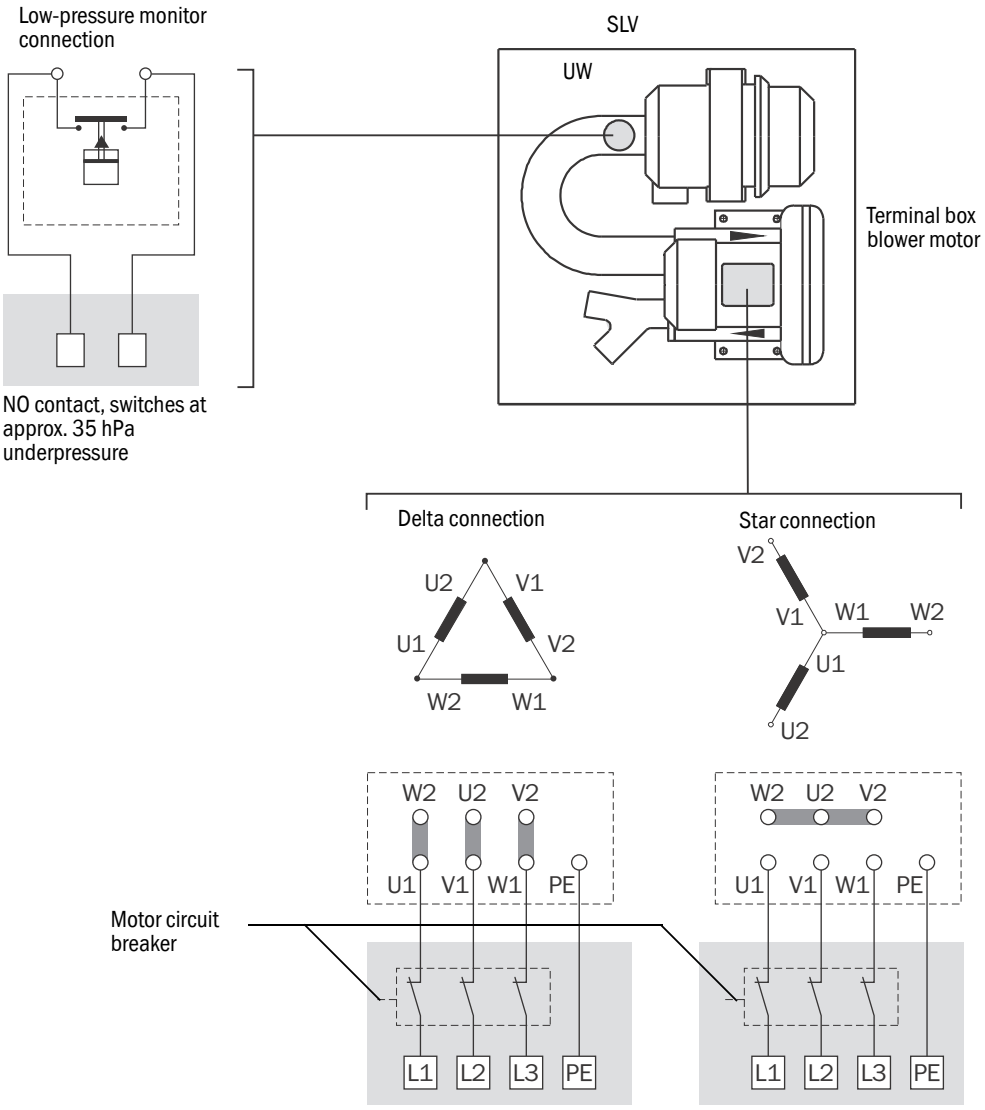


Fig. 17: Purge air unit: Electrical connections for blower motor and low-pressure monitor

1 Check the type plate to determine whether the connection values of the purge air unit delivered match the plant conditions.
2 Connect the power supply cable in the terminal box of the purge air unit as shown in “Purge air unit: Electrical connections for blower motor and low-pressure monitor”. Note that any differing connection diagrams supplied with the terminal box are valid.
3 Remove the seal at the end of the purge air hose (if present) to check whether the hose functions correctly.
4 Switch the power supply on.
5 Does the motor rotation direction match the following attributes?
– Arrow marking on the motor cover
– Arrows on the pump housing
– A strong airstream must flow out of the purge air hose.
6 If the rotation direction is wrong:
▶ Switch the power supply off.
▶ Switch two phased wires in the supply line in the terminal box (e.g. between U1 and V1).
▶ Switch the power supply back on.
▶ Make sure the rotation direction is now correct.

CAUTION: Possible damage when the purge air blower rotates in the wrong direction
Rotation in the wrong direction suctions sample gas out of the duct when the measuring system is installed. The following damage can incur when this is not prevented quickly:
- Contamination and overheating of the measuring system and the purge air unit.
- Health risks for persons in the vicinity of the purge air unit (depending on sample gas composition and/or temperature).

7 Set the motor circuit breakers in accordance with the connected loads of the purge air blower and check for correct function.
8 Connect the low-pressure monitor for filter monitoring to the signal line prepared onsite.

Note The switching signal of the low-pressure monitor is evaluated by the customer.

▶ Check the low-pressure monitor function and the connected signal function:
Cover the suction opening partially for a short time when the purge air unit is running. Use wide cardboard strips or something similar that cannot be sucked in or contaminate the filter.
▶ Switch the purge air unit power supply off until measuring system start-up.

For installations outdoors or in unprotected conditions:

▶ Protect the opening of the purge air hose against moisture and contamination until the measuring system is put into operation; refit any dummy plugs removed beforehand.
▶ Fit the weatherproof cover.

4.4.2 CAN bus wiring options

As already described in the project planning on page 30, the following options are available for wiring the CAN bus connection between SR-unit and evaluation unit:

- Standard cable, 4 m, prefabricated
- Standard cable, 4 m, as well as additional prefabricated 15 m CAN bus extension cable
- Terminal box with prefabricated 4 m long cable to SR-unit; a cable provided by the customer is used to connect to the evaluation unit.

Information on selecting a suitable type of wiring can be found under “Options for CAN bus wiring”, page 25.

Wiring in terminal box

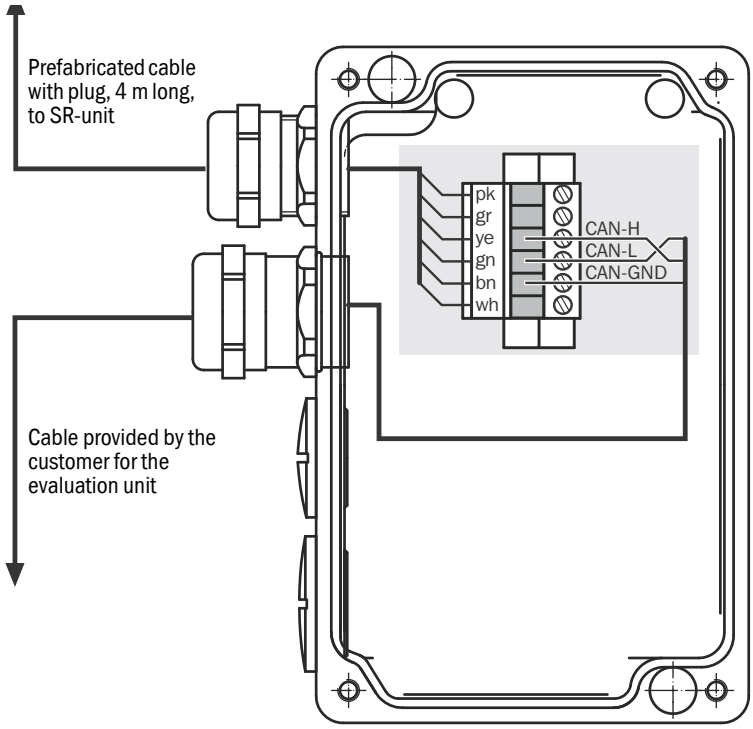


Fig. 18: Terminal box for CAN bus connection with a cable length between SR-unit and evaluation unit longer than 19 m

Wiring the connections in the terminal box

1 Lead the CAN bus cable provided by the customer through the free screw fitting of the terminal box.
2 Connect the shield on the screw fitting to the enclosure of the terminal box.
3 Connect the wires to the terminal strip as shown on page 43; make sure a twisted wire pair is used for CAN-H and CAN-L.

4.4.3 Electrical connection of the evaluation unit

Laying cables to the evaluation unit and the cable specifications have already been described in "Preparations for electrical installation", page 30, in particular in "Cable routing diagram", page 33.

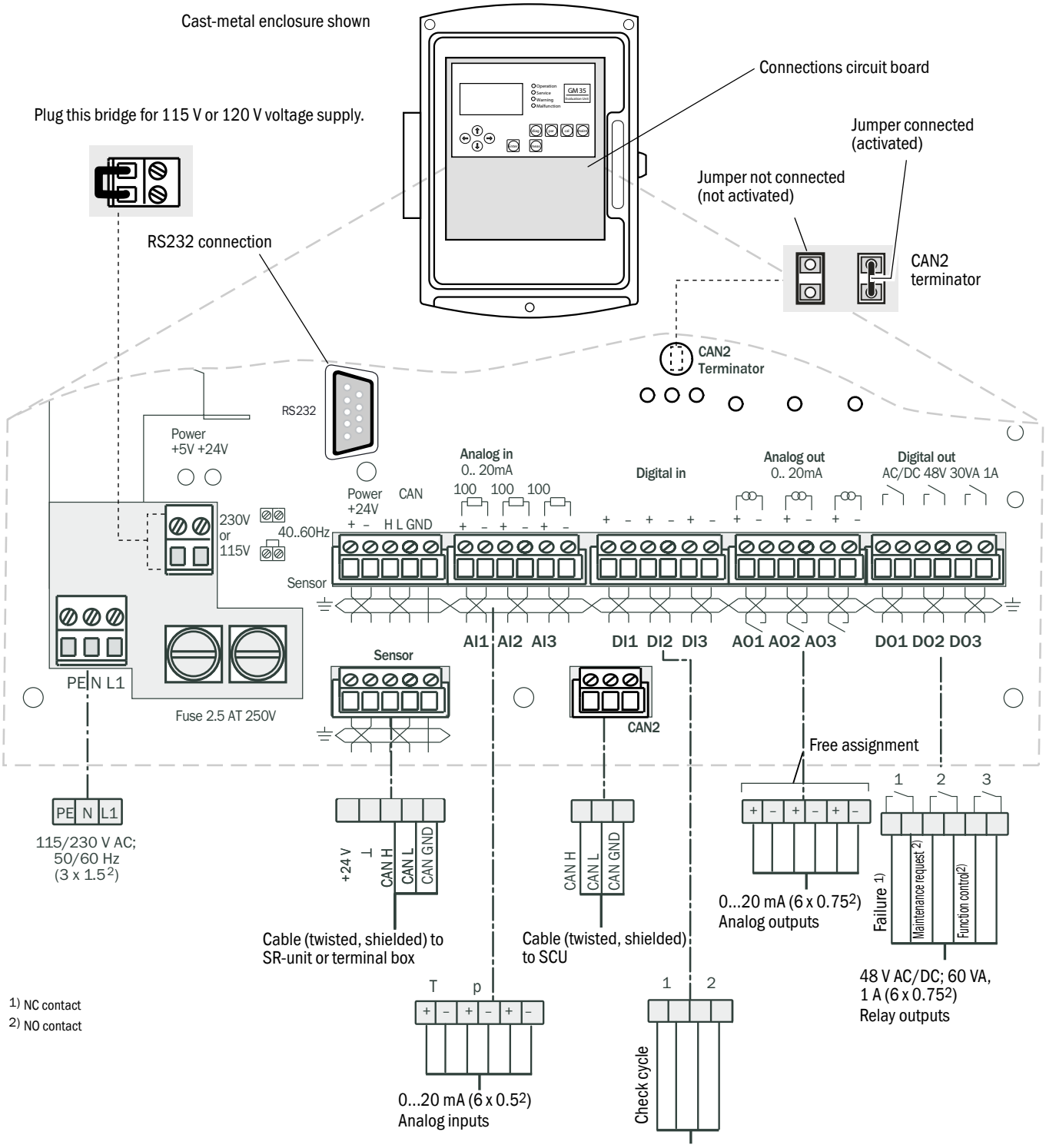


Fig. 19: Connections on the evaluation unit (cabling provided by the customer)

Make connections

1 Open enclosure door of evaluation unit.

▶ Lead the signal cable for inputs and outputs through the PG screw fittings on the EvU enclosure floor and wire according to “Connections on the evaluation unit (cabling provided by the customer)”, page 44.

Observe connection values for power supply!
The evaluation unit is configured to 230 V AC on delivery.
- ▶ Plug the respective bridges for 115 resp. 120 V AC as shown on the connection plate of the evaluation unit.
- ▶ Make sure the power supply has been installed (“Electrical connection of the evaluation unit”) in accordance with the specifications (observe national specifications) and that the power is switched off.

Fig. 20: EvU power connection

GM35 SR-unit or terminal box connection:

▶ If the customer supplied CAN cable is used, connect the wires to terminal strip “Sensor”, see page 44. Do not connect +24 V and GND (earth).

Connection to the SCU (System Control Unit):

▶ If the customer supplied CAN cable is used, connect the wires to terminal strip “CAN2”, see page 44.

▶ Activate the terminating resistor of the CAN bus when the EvU is connected to the start or end of the CAN bus, see page 44:
  - ▶ Connect the jumper for the CAN2 terminator.

▶ Deactivate the terminating resistor for the CAN bus when the EvU is not connected to the start or the end of the CAN bus, see page 44:
  - ››› **No jumper may be connected to the CAN2 terminator.**

See steps 1 to 4 below.

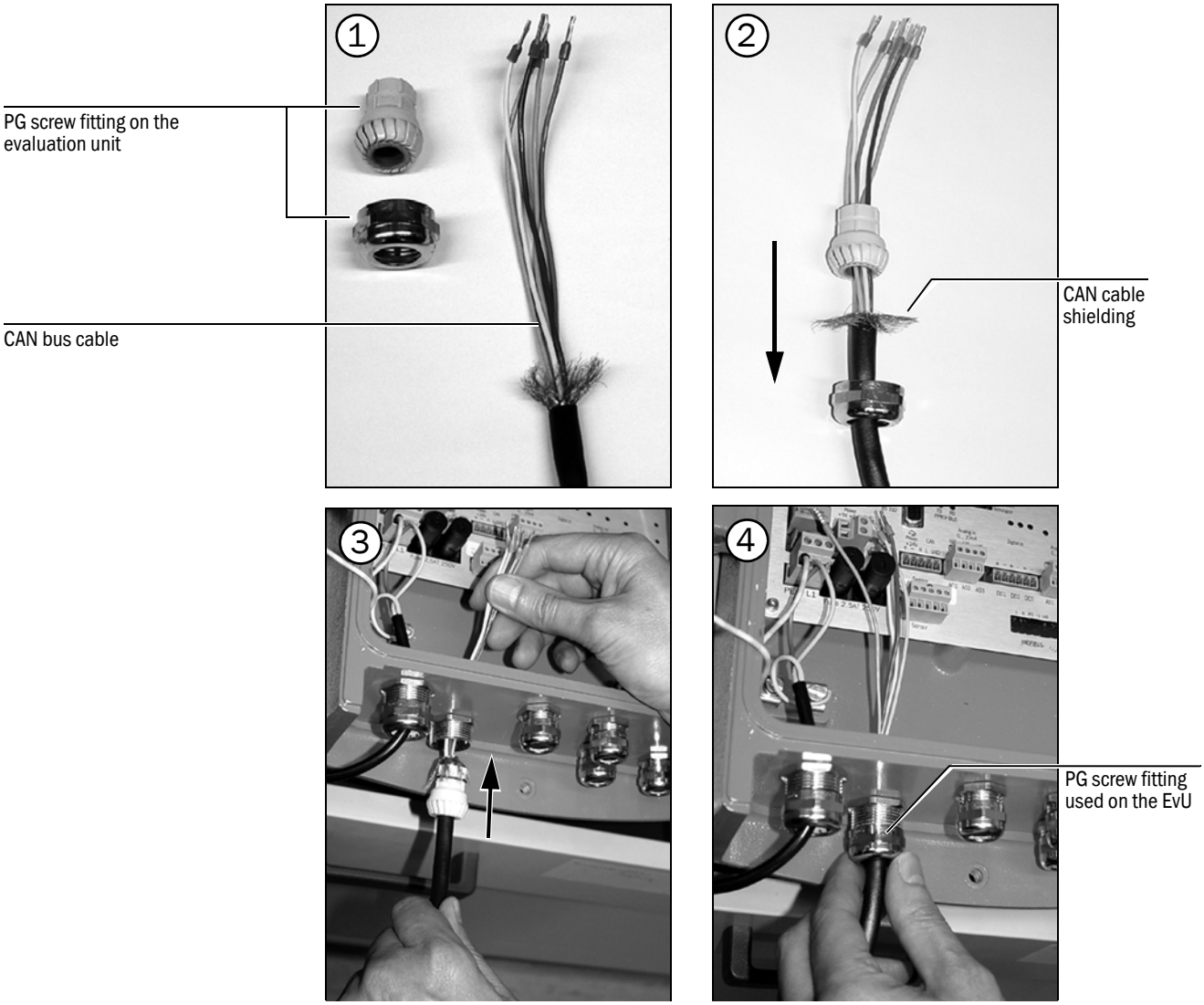


Fig. 21: Attaching the CAN bus cable to the evaluation unit

5 Handling the Evaluation Unit

5.1 User qualifications

This Section describes how to operate the GM35 measuring system with the evaluation unit (EvU). The evaluation unit is available with either a sheet metal enclosure (protection class IP 65) or a cast enclosure (protection class IP 67). The work described in this Section can be carried out by qualified customer operating personnel. Setting parameters does however demand comprehensive knowledge of the measuring system, measuring technology and specific measuring task.

5.2 Operating elements

The evaluation unit of the analysis system serves to display, enter and set parameters and control functions on the system. The operator panel with the display, status indicators and key pad is accessible when the enclosure door is opened.

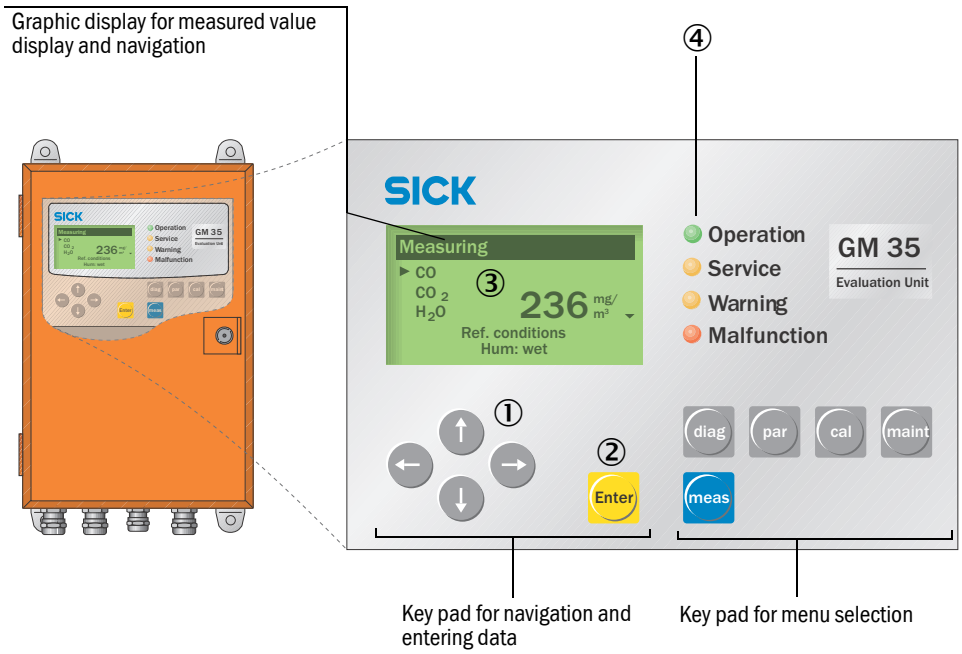


Fig. 22: Display and operating elements on the evaluation unit

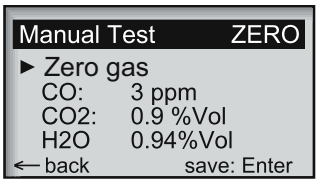
①	**Arrow buttons**	Navigate, select, scroll or edit menu items, variables, units or digits.
②	**Enter**	Executes the selected menu contents or commands.
③	**Display in Measuring mode**	Displays all current measured values (temperature values or CO concentration); Displays all calculated values, e.g. CO_2 dry.
④	**LEDs** • Operation • Service • Warning • Malfunction	Measuring Service mode Warning messages, see Diagnosis mode (diag) Device malfunction, error message, see Diagnosis mode (diag)

5.2.1 Function buttons and menu overview

meas	**Measuring**	
	• CO2875 ppm	Current measured value of the selected measured variable; the display shows the measured values of the current measured variables such as CO_2, H_2O, temperature and pressure when selected
	• Reference conditions	Shows the parameterized reference conditions (humidity, temperature and pressure)
diag	**Diagnosis**	
	• Malfunction	Current error messages (plain-text)
	• Warning	Current warning messages (plain-text)
	• Sensor Values	Displays diagnosis values
	• Check values	Displays check values of the measured component (CO or N_2O, CO_2, H_2O)
	• Optical alignment	Displays the optical alignment
par	**Parameters**	
	• Parametrization	Sets/displays system component parameters
	• Device	Displays the serial number (evaluation unit) and software version (system components)
	• Service	Displays calibration coefficients of the measuring components
cal	**Calibration**	
	• Check cycle	For test purposes, e.g., after maintenance work on the analyzer
	• Zero point	Zero point determination, e,g,, for startup procedures
	• Box Measuring	Starts filter box measurement (control filter, test gas)
	• Manual Test	Manual test by feeding test gases
	• Press. sensor adjust.	Starts the adjustment procedure for the pressure sensor
	• Temp. sensor adjust.	Starts the adjustment procedure for the temperature sensor
maint	**Maintenance**	
	• Maintenance mode	Activates maintenance mode
	• Optical alignment	Optical alignment of the SR-unit and reflector
	• Tests	Tests analog and relay outputs
	• Reset System	System cold start
	• Reset Parameter	Resets parameters to the factory settings

Table 5: Function buttons and menu overview

5.2.2 Display contents



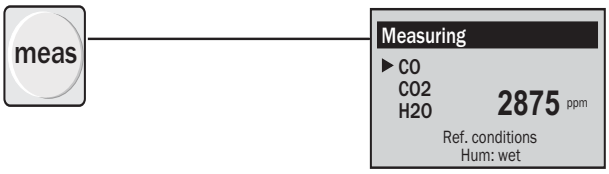
- The header line shows the selected operating mode (e.g. parameter settings) or the menu items just selected during navigation.
- Four lines for submenus, plain-text messages or settings (values)
- Function line:

← back	To return to a higher level menu, use the **Arrow** ← button
save: Enter	To activate menu items or confirm entries, use the **Enter** button
select	To select a value, use the **Enter** button
↑ (↓)	When selecting a variable for which a number is to be entered, use the **Arrow** ↑ (↓) buttons to select the value for each digit
Password	When prompted for the password, enter **1 2 3 4** with ↑ (↓).

5.2.3 Menu structure

5.2.3.1 *Menu structure Measuring Mode*

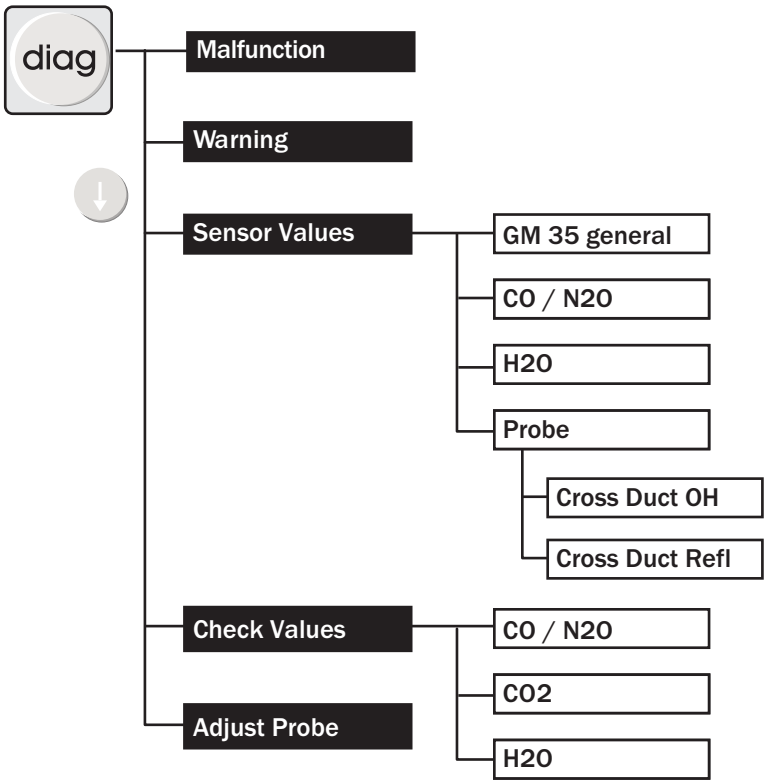
Fig. 23: Menu Operation



Measuring

5.2.3.2 *Menu structure Diagnosis*

Menu Diagnosis



Diagnosis
Plain-text messages,
see page 121.
Plain-text messages,
see page 124.
Current monitoring values of the sensors (amplifier settings, internal temperature controls, etc.)

Cross-Duct version:
- Sender/receiver unit (OH)

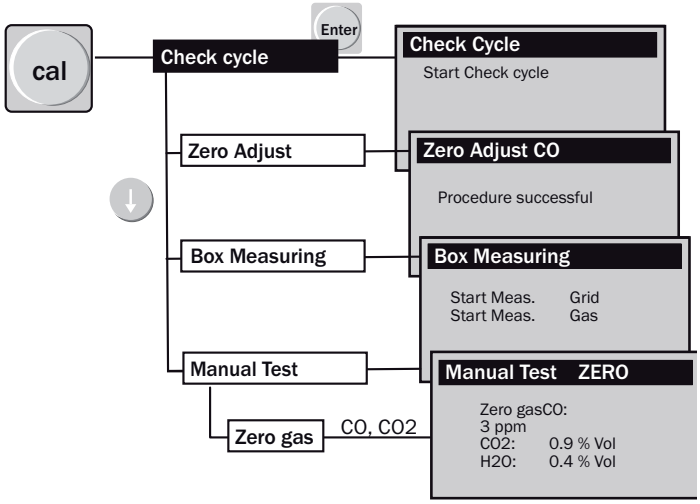
Reflector

Check values

Displays the optical alignment of the SR-unit and reflector in Measuring mode.

5.2.3.3 *Menu structure Calibration*

Fig. 24: Menu Calibration



Calibration
Check cycle for test purposes, for example, after maintenance work

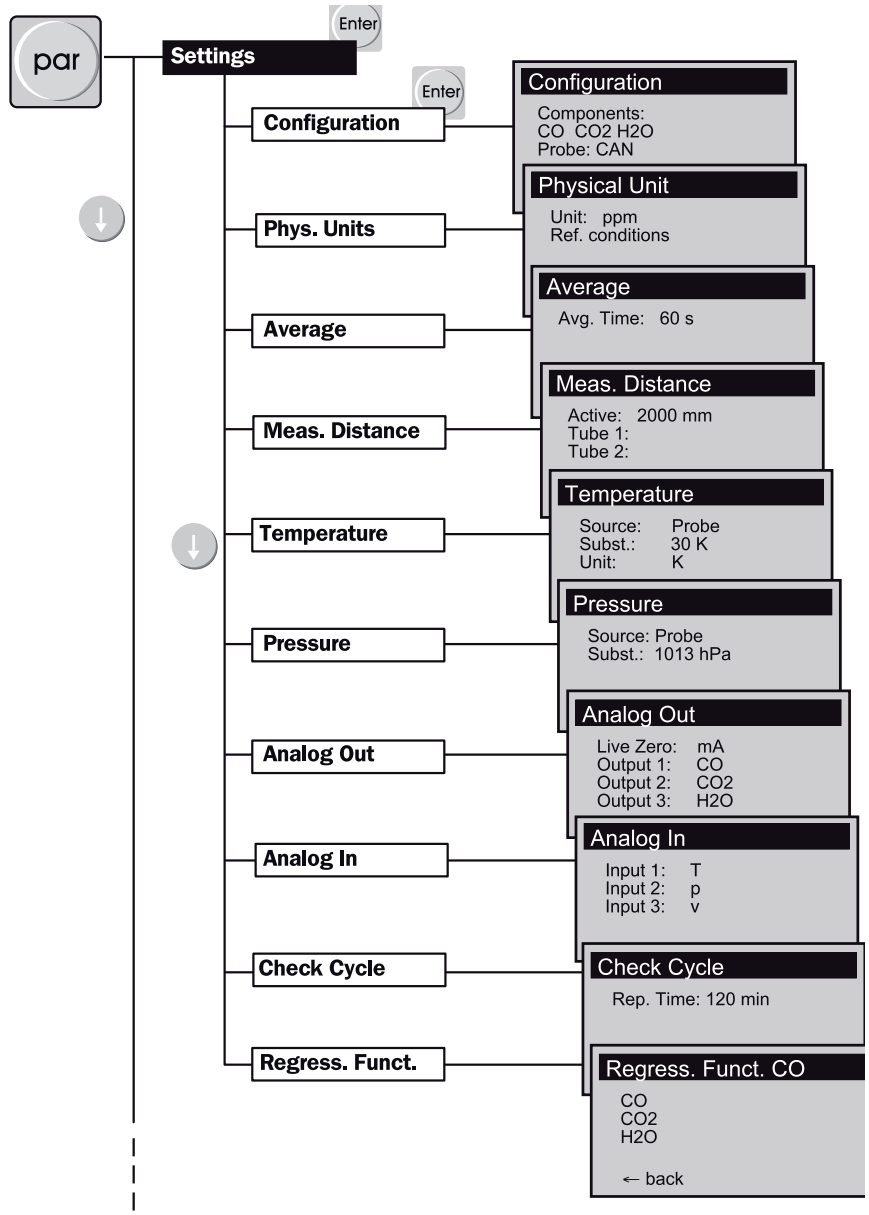
Zero adjust with ambient air, e.g., during start-up

Filter box measurement for
- control filter (H2O channel, CO2 for high concentrations).
– test gas (CO, N2O, up to 15 Vol% CO2).

Manual test (CO, N2O, CO2, H2O),
e.g. with zero gas
Adjustment of device-internal pressure and temperature measurement to reference measurements

5.2.3.4 *Menu structure Configuration*

Table 6: Menu Configuration/Settings



Parametrization

Configuration:

Measuring components:

- CO or N2O, CO2, H2O
- CAN connection (probe or cross-duct)

Physical Unit:
Unit and reference value settings for individual gases

Average:
Averaging time settings for the system

Meas.Distance:
Averaging time settings for the system

Temperature:
Temperature setting: Source (probe/ replacement/AI1) and unit (K, °C, °F)

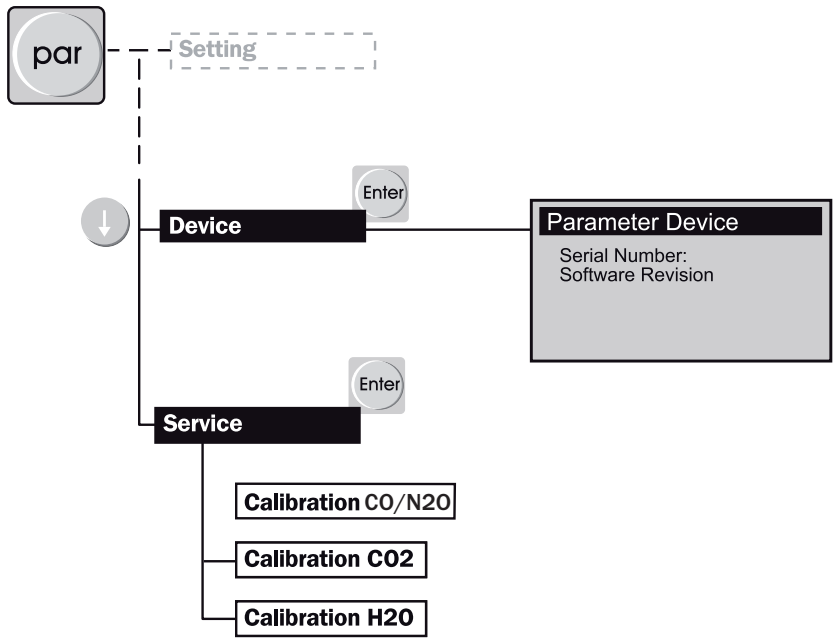
Pressure:
Pressure setting: Source (probe/ replacement/AI2)

Analog Out:
Analog output settings: Live-zero, comp. (CO or N_2O, CO_2, H_2O, O_2, T, p - -) -display range, cycle output

Analog In:
Analog input settings: e.g., AI1 unit (K, °C, °F), live-zero (0, 2, 4 mA, read-in range)

Check Cycle:
Check cycle interval setting: 0...1440 min

Regress. Funct. CO:
Regression function comp.: CO2/H2O
Span: 0.50...1.99,
Zero: 0...±9999.9



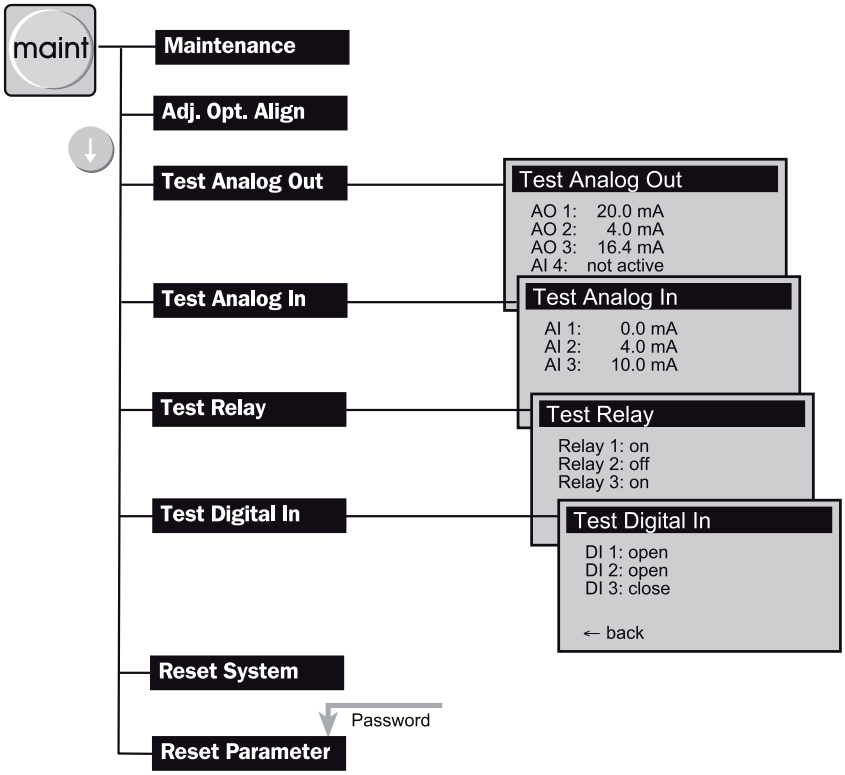
Configuration, continued:

Device:
Parameter Device: Retrieving the device information:
- Serial numbers
- Software version

Service area
- Calibration CO/N_2O
- Calibration CO_2
- Calibration H_2O

5.2.3.5 *Menu structure Maintenance Mode (Maint)*

Table 7: Menu Maintenance



Maintenance mode
Maintenance switch: On/off
Adj.Opt.Align:
- Function for optical alignment of the SR-unit and reflector

Test of analog outputs

Test of analog inputs

Test of relay outputs

Test of digital inputs

System restart

Reset:
Default parameter settings active

6 Connecting the System Control Unit - SCU

As an option, the GM35 can be operated and configured via an SCU. The SCU is a control unit for comfortable, powerful analyzer control. The following actions can be performed on the GM35 via the SCU:

- Control, parameter setting and display.
- Processing and saving measured values.
- Remote diagnosis.

The SCU is connected to the GM35 evaluation unit via a system bus and is operated via a touchscreen or a PC with SOPAS software installed.

Further information on the SCU → “SCU” Operating Instructions.

6.1 SCU connection to the GM35

CAUTION: Higher malfunction susceptibility when used in unspecified ambient conditions

- ▶ Take all measures possible to protect equipment/module against dampness, liquids or contamination.
- ▶ Protect the equipment/module against mechanical or thermal stress.

6.1.1 Electrical connection of the SCU to the GM35

The electrical connection of the SCU to the GM35 is described in “Connection to the SCU (System Control Unit):”, page 45.

6.1.2 Configuring and operating using SOPAS

Operator menus and measured value displays are also available on an external PC via Ethernet for user comfort (with the engineering tool SOPAS ET).

The ***S***ICK ***O***pen ***P***ortal for ***A***pplications and ***S***ystems (SOPAS) is a software for communication with analyzers and sensors.

Access to the GM35 is possible via:

- a direct serial connection (RS232) to the evaluation unit.
- an Ethernet connection via an SCU operating unit to the evaluation unit.

- PC with SOPAS ET software (page 55).

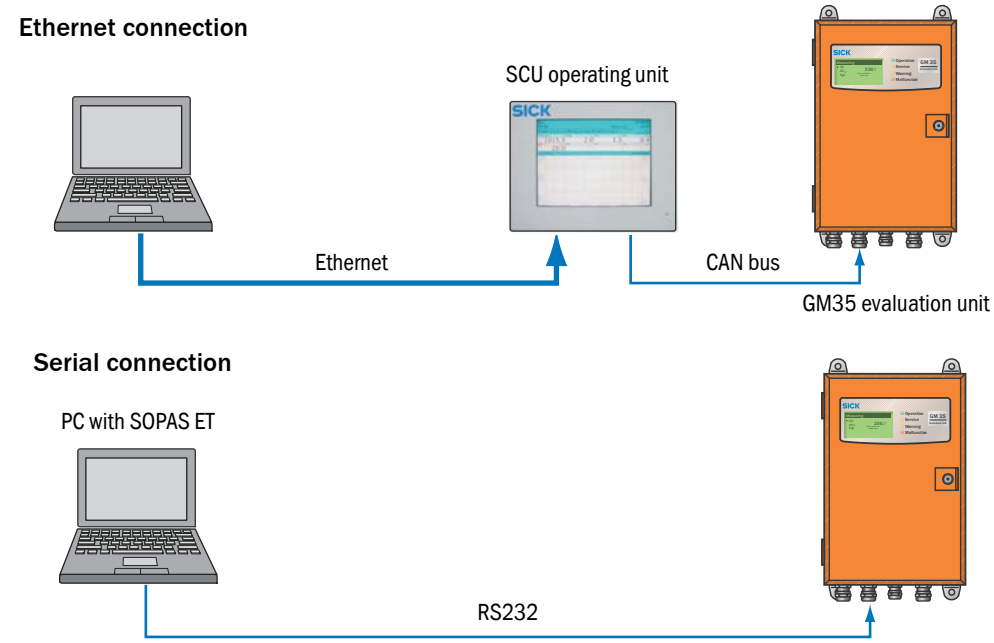


Fig. 25: GM35 connection options

The menu structure and presentation are principally identical on the SCU or on the PC with SOPAS ET. The presentation on the SCU is adapted to the smaller monitor.

For more information on the SOPAS concept, see the Help menu of SOPAS ET.

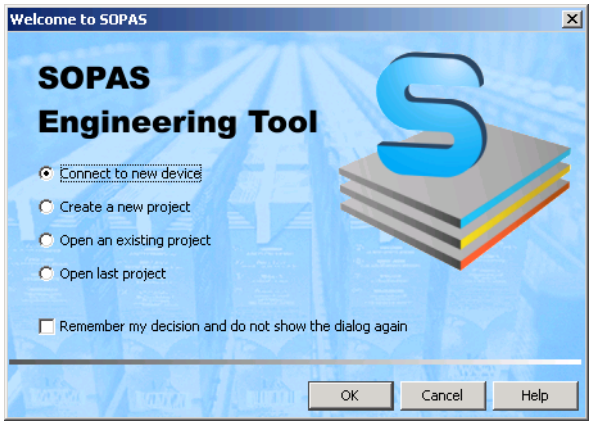
6.1.3 Connecting the GM35 evaluation unit via the SCU operating unit

The IP address of the SCU is required to connect to the SCU operating unit and then to the GM35. When necessary, contact the responsible Network administrator and request the required IP address.

Connection options

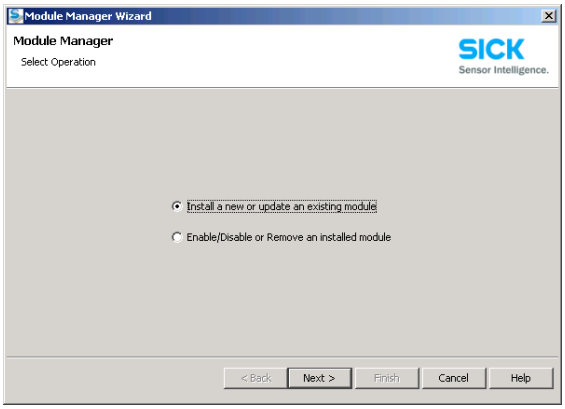
- First connection (initial installation): Install the device description file (SDD; jar), see “Connect to the SCU operating unit:”, page 55.
- Reconnect: Without a saved project, see “Perform a network scan:”, page 56.
- Reconnect: Open a saved project, see “Load the device parameters:”, page 56.

1. Start SOPAS ET.
2. Connect to the SCU operating unit:
   - ▶ Confirm the selection *“Connect to new device”* in the *“Welcome to SOPAS”* with **OK**. Follow the instructions of the Connection Wizard.



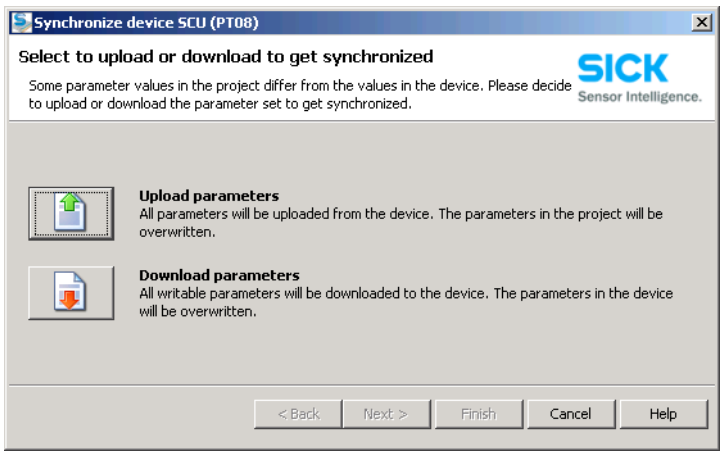
   - ▶ In the *Connection Wizard*, select **SCU** under *“Connect to specific device”* and continue with **Next**.
   - ▶ Under *“Detected devices”*, select the desired SCU with the appropriate IP address and continue with **Next**.

     The selected SCU is added to the project tree.
3. Install the GM35 device description file (SDD; jar) during the initial installation (no longer necessary afterwards):
   - ▶ Call up the **Module Manager** in the **Tools** menu. At the same time, save the project just generated before closing; acknowledge the message with YES.
   - ▶ In the Module Manager Wizard, select *“Install new module”* and continue with **Next**.

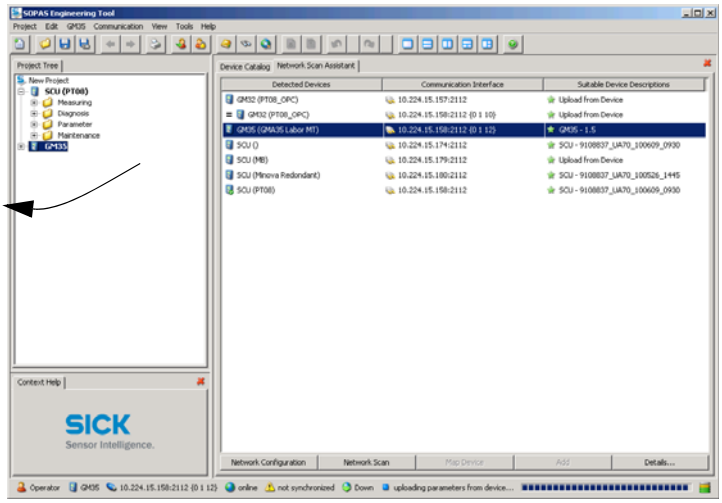


   - ▶ Load the GM35 device description file (e.g., from the device CD).

4. Load the device parameters:
   - ▶ Reopen the project previously saved.
   - ▶ Click the Upload parameters button in “Synchronize device SCU”



5. Perform a network scan:
   - ▶ Click the Network button in the Network Wizard window and then continue with **OK** as soon as the scan process has finished.
   - ▶ If the Network Wizard window is not displayed, call up the Network Wizard in the “View” menu or click the telescope symbol.
   - ▶ After the network scan, click the desired GM35 in the list shown (using the device name or IP address for identification) and then *“Insert”* it in the project tree. To do this, drag the GM35 symbol (e.g., GM35 - 1.5) of the device catalog in the menu tree. Double-clicking the desired device in the device catalog has the same effect.

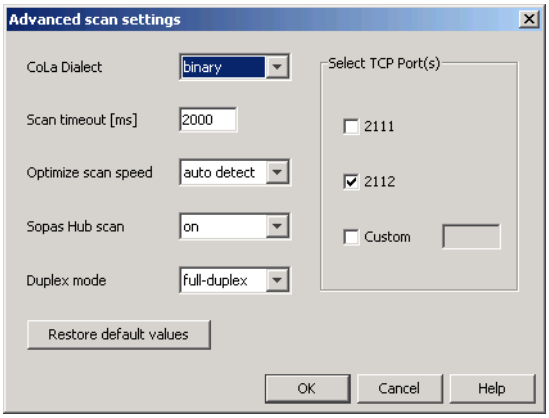


   - ▶ Project tree with connected SCU and GM35

If an error occurs, e.g.:

- *“No sensor found at address ... “*:
  - ▶ Switch the sensor on or check the connection, e.g. the Ethernet connection.
- Perform a network scan, see “Perform a network scan:”, page 56.
- Devices have been found; the connected GM35 is shown in the device list but is marked with a red warning symbol “not available”. The device description file has not been installed.
  - ▶ see “Load the device parameters:”, page 56.
  - ▶ Start a new project and then perform step “Perform a network scan:”.

- If this is not successful, check the network configuration and set the following standard values.
- To do this, click the “Network Configuration” button and then the “Advanced” button in the window that appears, and then enter the parameters as shown.



- Perform a new network scan and follow the instructions from step “Perform a network scan:”.

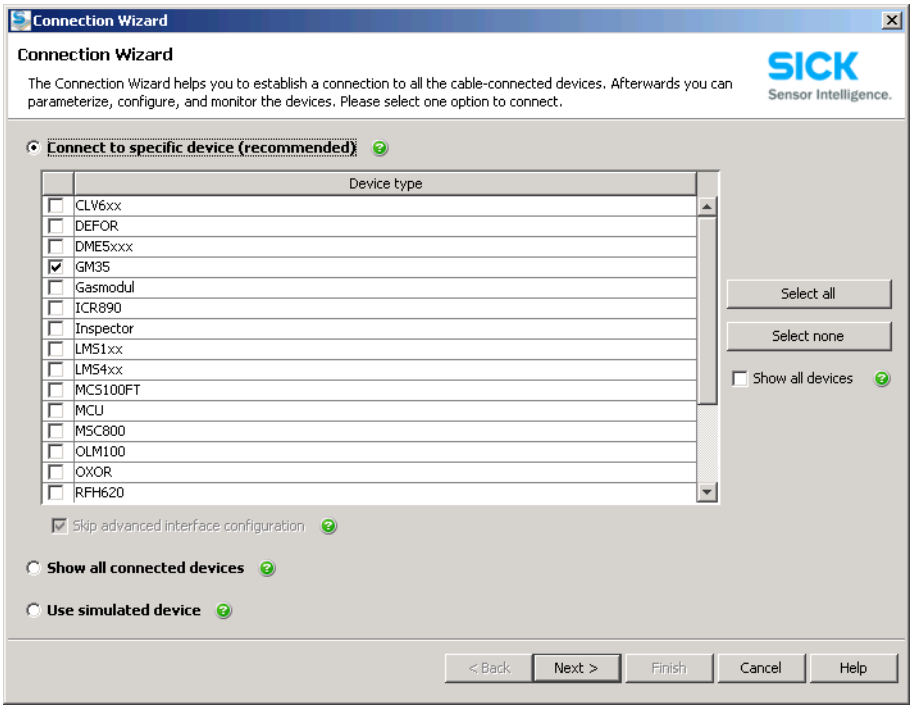
6.1.4 Direct serial connection to the GM35 evaluation unit

Use a serial interface cable (RS232) with a plug (Sub-D, 9-pole) and a socket to connect the GM35 evaluation unit to a PC/laptop.

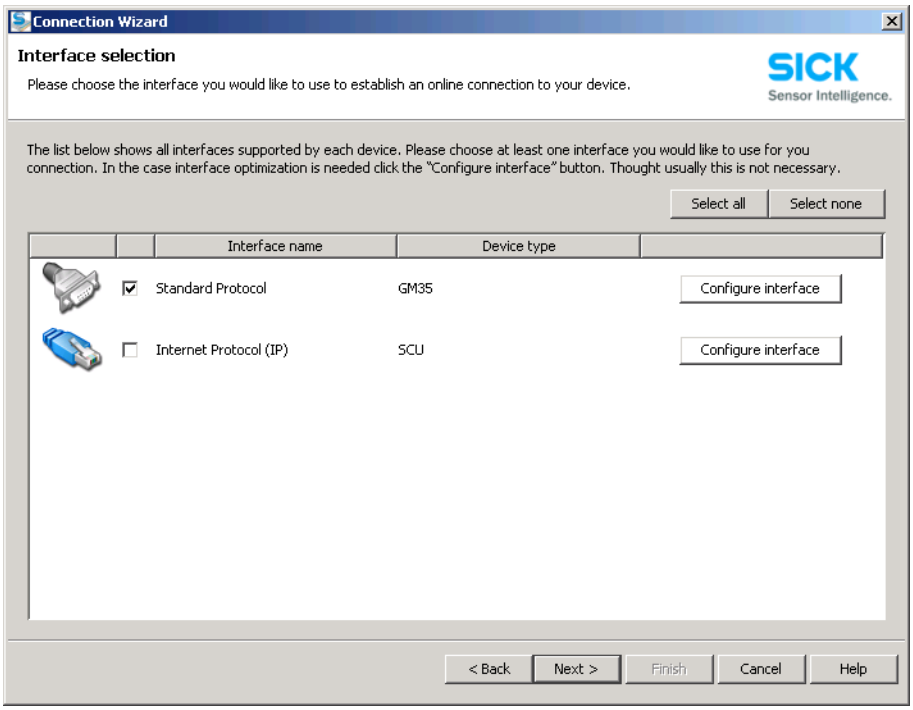
- Connecting the PC with SOPAS ET directly to the GM35 evaluation unit via a serial interface cable:
  - Connect the interface cable to the Sub-D socket of the EvU (“Connections on the evaluation unit (cabling provided by the customer)”, page 44) and to the Sub-D plug of the PC.
- Use the connection options according to “Connecting the GM35 evaluation unit via the SCU operating unit”, page 55 onwards:

1. Start SOPAS
2. Connect to the device
   - Confirm the selection *“Connect to new device”* in the *“Welcome to SOPAS”* with **OK**. Follow the instructions of the Connection Wizard.

- In the *Connection Wizard*, select **GM35** under *"Connect to specific device"* and continue with **Next**

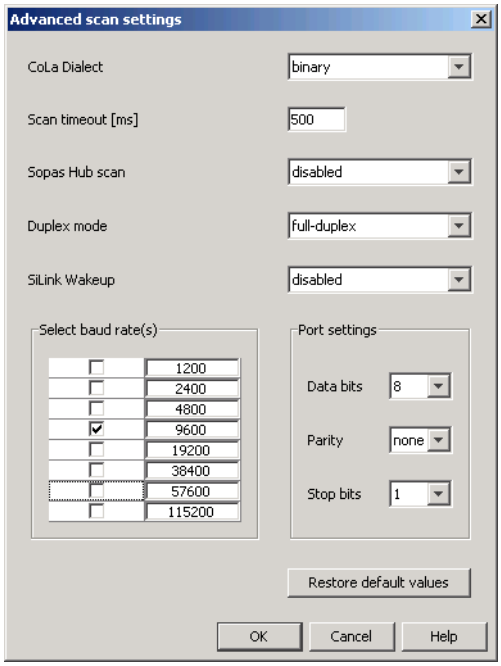


- Select the GM35 under *"Devices found"* and continue with **Next**.
- Select "Standard Protocol" under interface selection.



- Check the protocol settings and adapt when necessary:

– Click on “Configure interface” and check the following settings, and adapt when necessary.



– Continue with “OK”.

▶ Continue the Connection Wizard with **Next**

The selected GM35 is added to the project tree.

If an error occurs, see page 56.

6.1.5 Changing the user level

1. Menu: */Tools/Login*
2. In *UserLevel* dialog window: Click *Authorized Client*.

Fig. 26: User level

3. Enter password:

User level	Password
Authorized Client	HIDE[1]
Service	GM35SERVICE*)

[1] Upper case mandatory

4. “*Login*”

The current user level in SOPAS ET is shown in the bottom left corner.

6.1.6 Menu overview (menu tree)

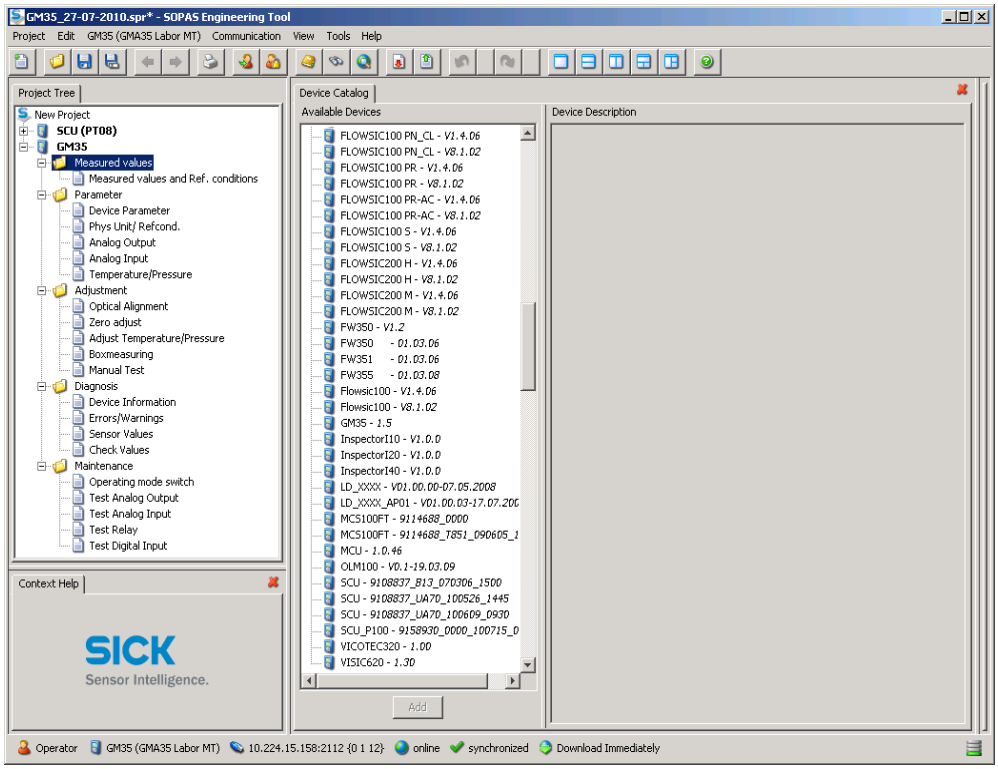


Fig. 27: GM35 menu tree

6.1.7 Measured values

Menu GM35/Measured values

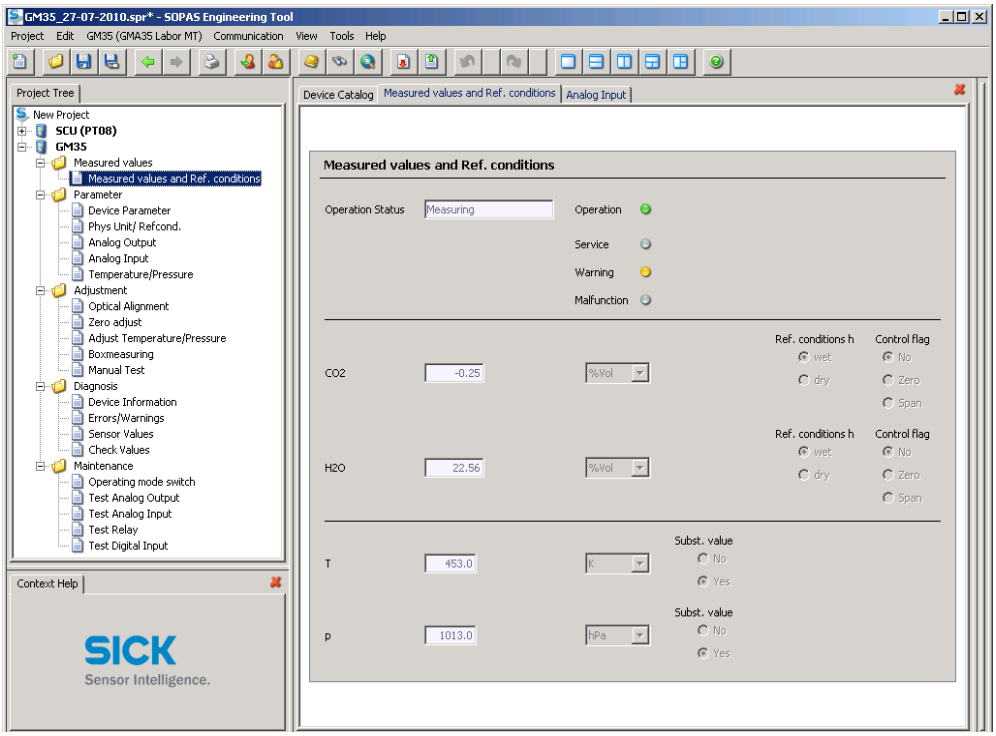


Fig. 28: Menu: Measured values and Ref. conditions

This menu shows:

- Measuring operation of the analyzer
- Current measured values and reference conditions

6.1.8 Menu Parameter

Menu GM35/Parameter/Device Parameter

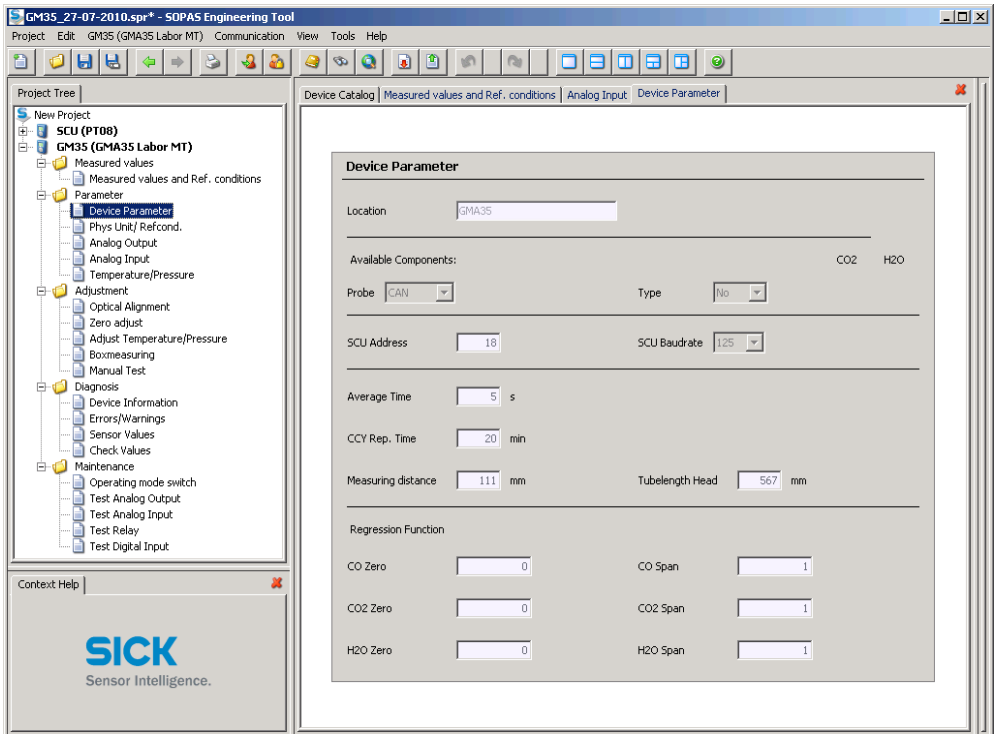


Fig. 29: Menu: Device Parameter

This menu serves to make the following settings:

- Available measuring components (CO, CO_2, H_2O)
- Connected device components (CAN connection: Probe, type or cross-duct)
- Network connection (SCU/GM35 address, baud rate)
- Average time
- Control cycle interval (CCY Rep. Time)
- Active measuring path (Measuring distance)
- Regression function of the measuring components (zero point, span point)

Physical units and reference values (Menu GM35/Parameter/Phys. Unit/Refcond.)

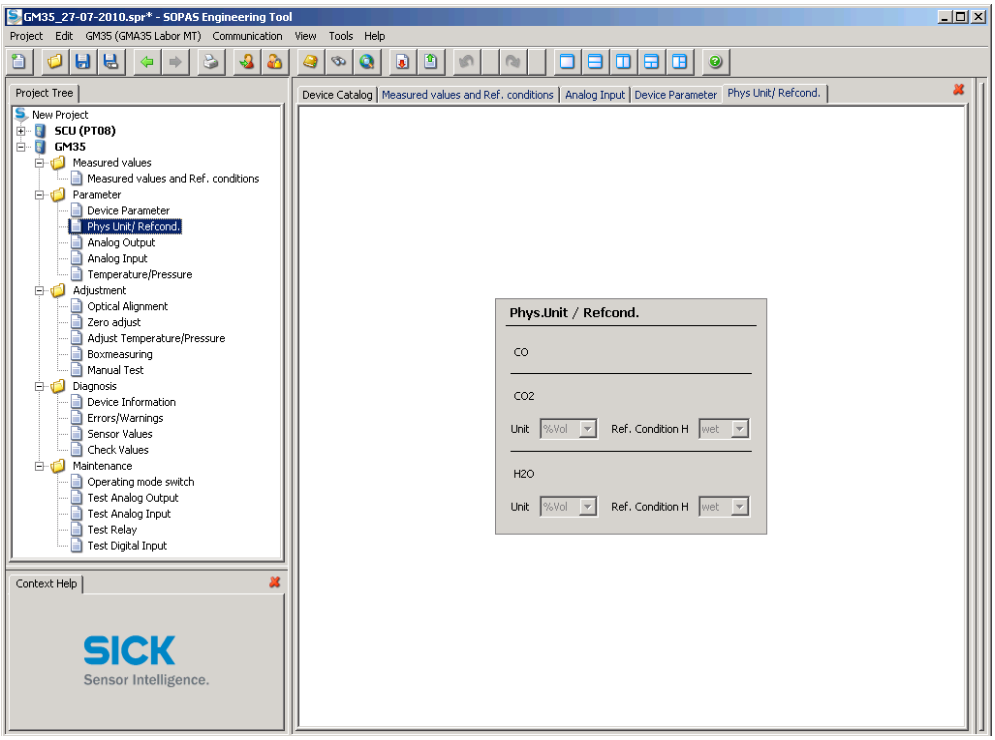


Fig. 30: Menu: Phys. Units and Ref cond.

This menu serves to make the following settings:

- Physical units (**mg/m**^{3}, % by vol., ppm)
- Reference values (temperature, pressure)

Analog outputs (Menu GM35/Parameter/Analog Output)

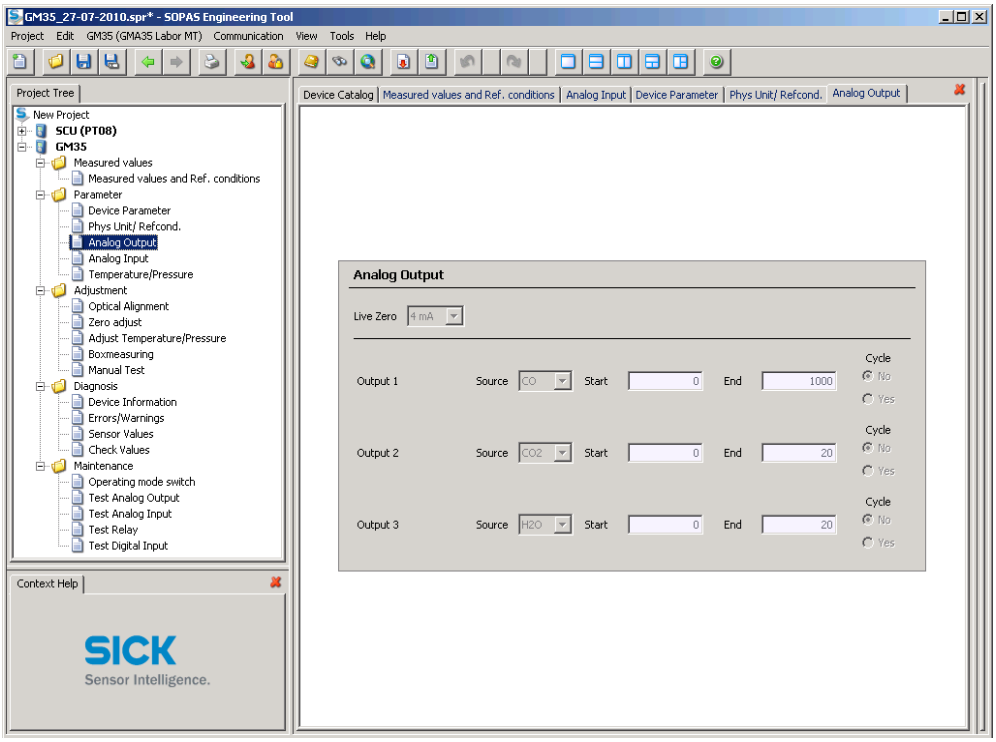


Fig. 31: Menu: Analog Output

This menu serves to set the following for 3 analog outputs:

- Live Zero (0, **4** mA)
- Allocation of the outputs to a parameter (**CO** or N_2O, **CO_2**, **H_2O**, T, p) with start and end values for the display range as well as setting the check cycle (yes, no).

Analog inputs (Menu GM35/Parameter/Analog Input)

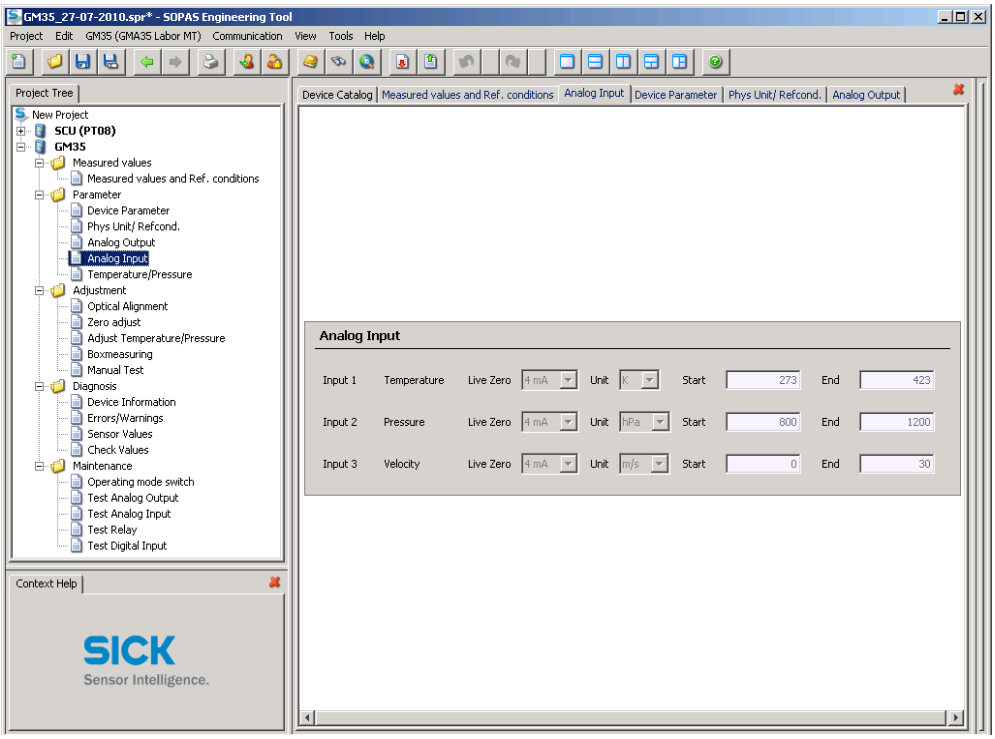


Fig. 32: Menu: Analog Input

This menu serves to set the following for 3 analog inputs:

- Analog input 1: Temperature: Live Zero (0, 2, **4** mA), unit assignment (**K**, °C, °F), start and end values for the read-in range.
- Analog input 2: Pressure: Live Zero (0, 2, **4** mA), unit assignment (hPa), start and end values for the read-in range.
- Analog input 3: Speed: Live Zero (0, 2, **4** m/s), unit assignment (m/s, ft/s), start and end values for the read-in range.

Temperature/pressure (Menu GM35/Parameter/Temperature/Pressure)

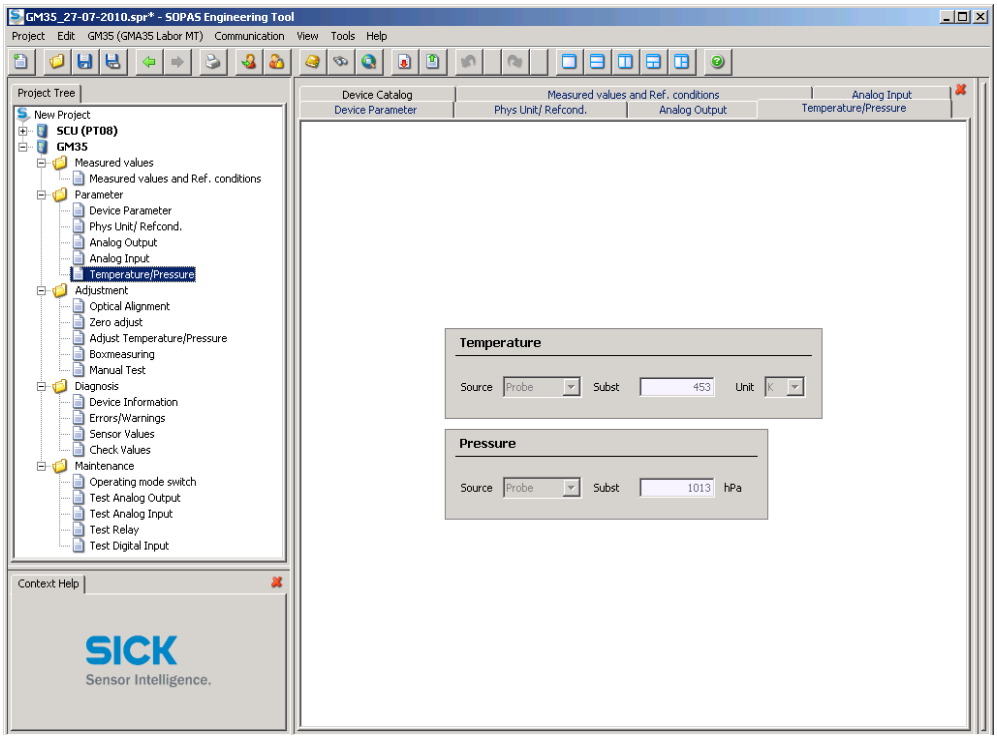


Fig. 33: Menu: Temperature/Pressure

This menu serves to set the reference values for temperature and pressure:

- Temperature: Source (**Probe**, Analog In, Subst.(default value)) and unit.
- Pressure: Live Zero source (**Probe**, Analog In, Subst.(default value)).

6.1.9 Menu Adjustment

Menu GM35/Adjustment/Optical Alignment

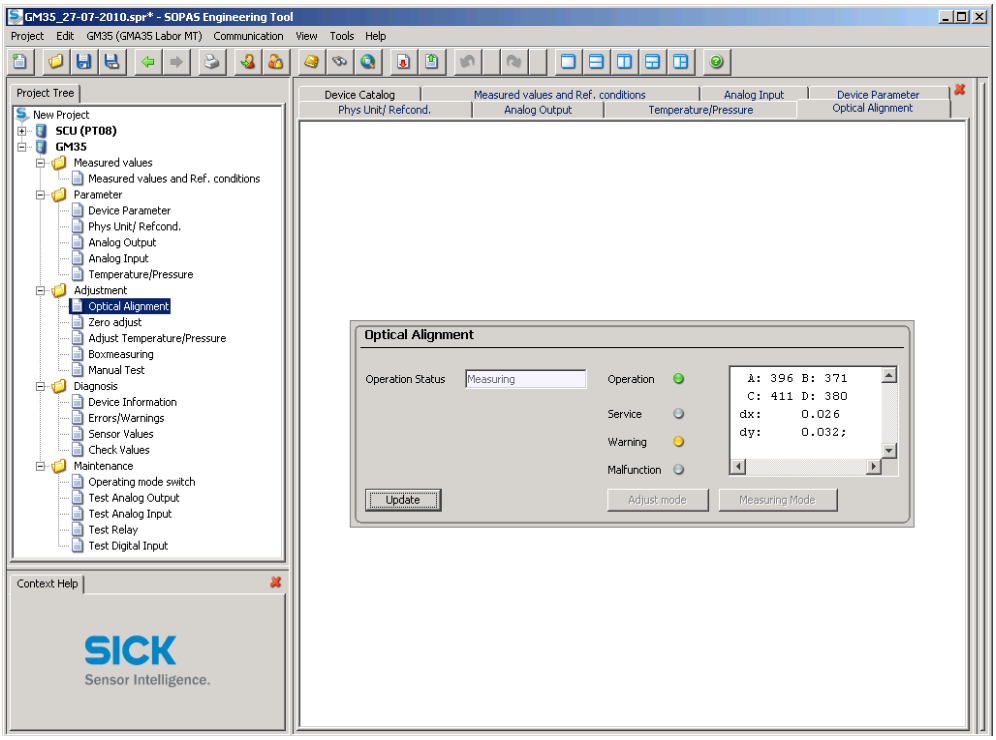


Fig. 34: Menu: Optical Alignment

This menu serves to check the GM35 optical alignment:

- **Update:** Displays the current alignment.
- **Adjust mode:** Moves the mirror to the reference position on devices with mirror tracking.
- **Measuring Mode:** Switches to Measuring mode, e.g. after using Adjust mode. Mirror tracking is active again and therefore current measured values are displayed.

Menu GM35/Adjustment/Zero adjust

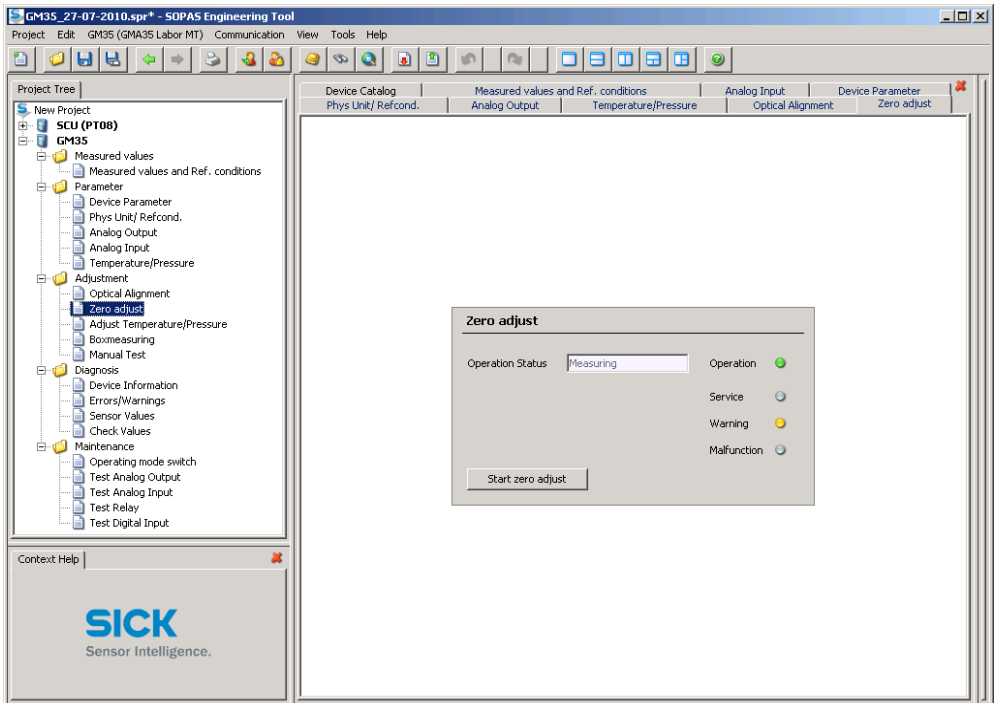


Fig. 35: Menu: Zero adjust

This menu serves to perform a zero adjust with ambient air, for example during start-up.

Menu GM35/Adjustment/Adjust Temperature/Pressure

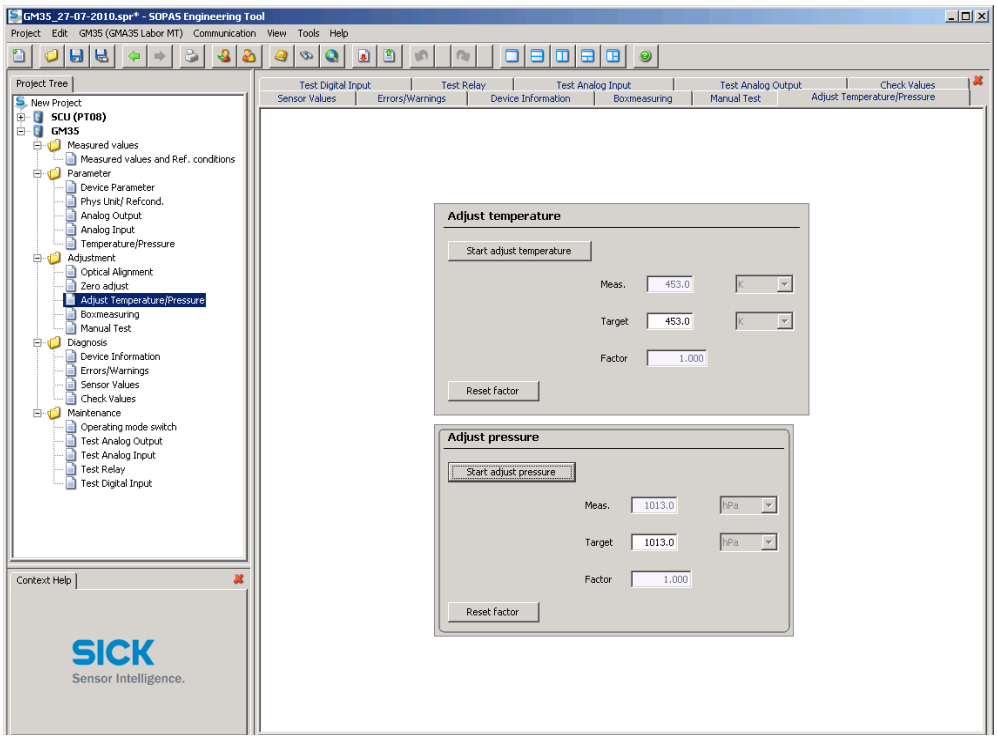


Fig. 36: Menu: Adjust Temperature/Pressure

This menu serves to recalibrate the system's own pressure and temperature sensors.

Menu GM35/Adjustment/Boxmeasuring

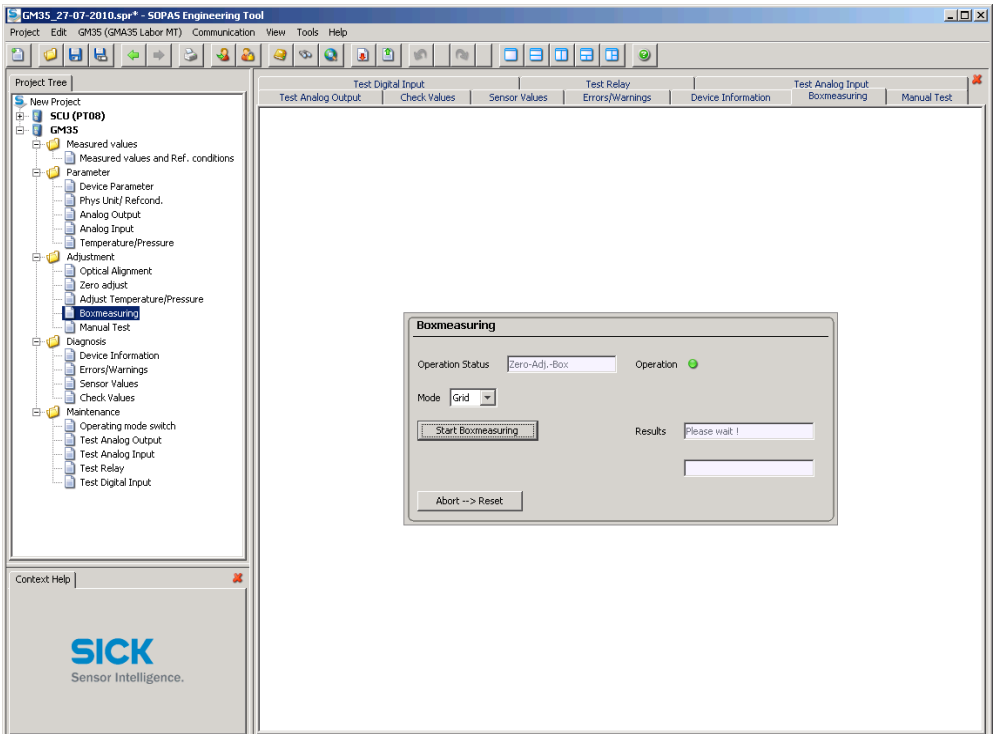


Fig. 37: Menu: Boxmeasuring

This menu serves to perform filter box measurement:

- **Mode:** Selection of measuring method.
- Control filter (Grid) for H_2O and CO_2 for high concentrations.
- **Start Boxmeasuring:** Starts filter box measurement.
- **Abort –> Reset:** Stops filter box measurement and discards the results.

Menu GM35/Adjustment/Manual Test

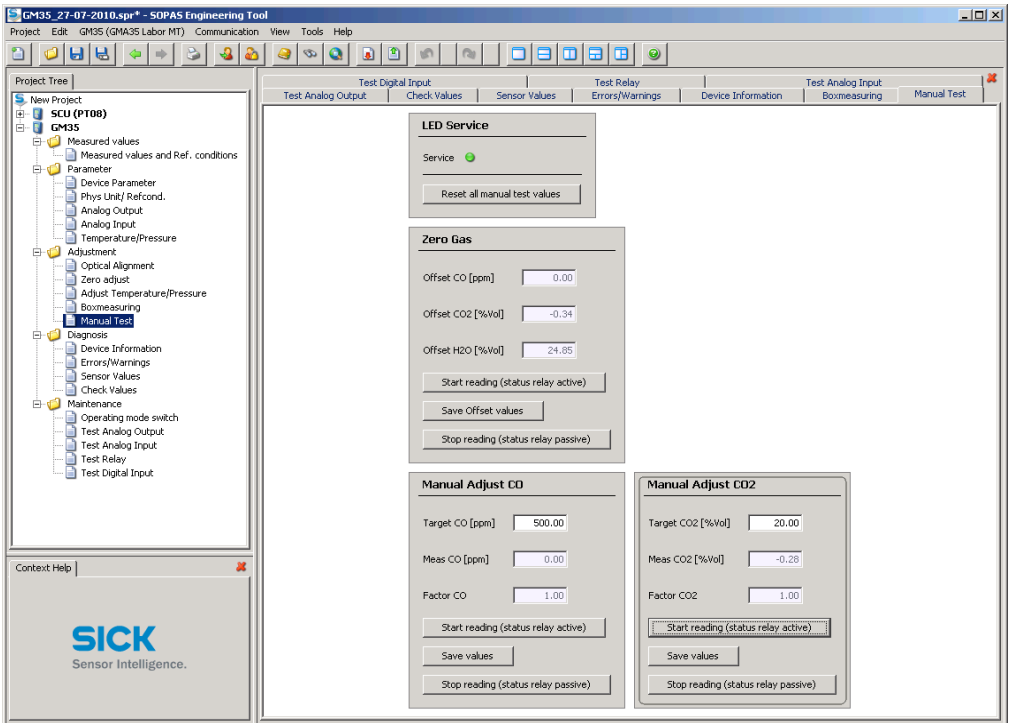


Fig. 38: Menu: Manual Test

This menu serves to perform a manual test of the measuring components, e.g., with zero gas:

- Zero Gas
- Manual Adjust CO, N_2O
- Manual Adjust CO_2

6.1.10 Menu Diagnosis

Menu GM35/Diagnosis/Device Information

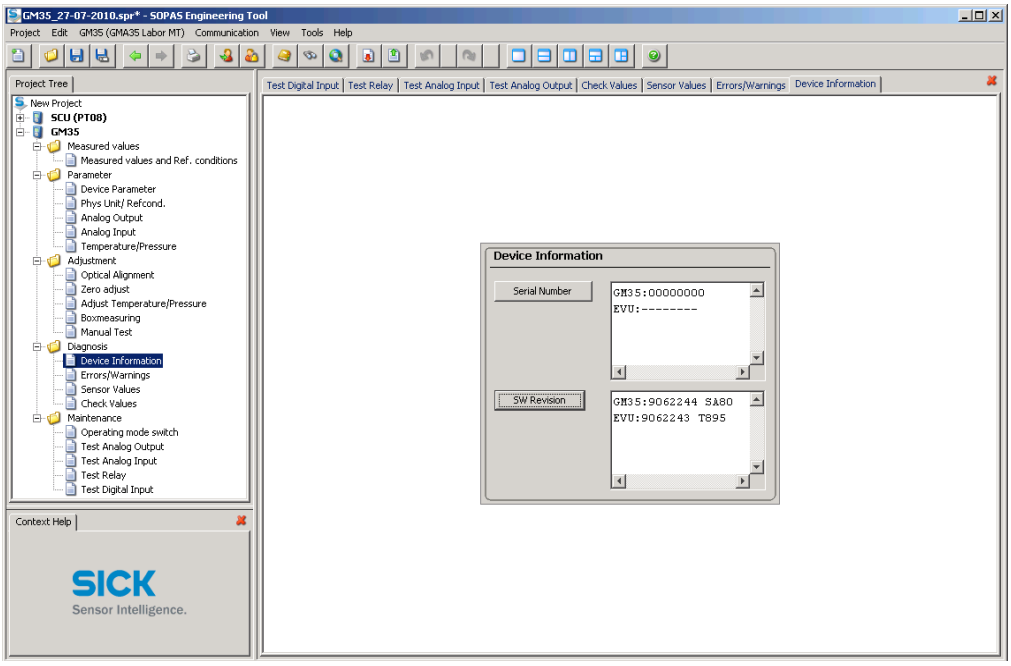


Fig. 39: Menu: Device Information

This menu serves to read out device information:

- Serial No.
- Software revision (SW Revision)

Menu GM35/Diagnosis/Errors/Warnings

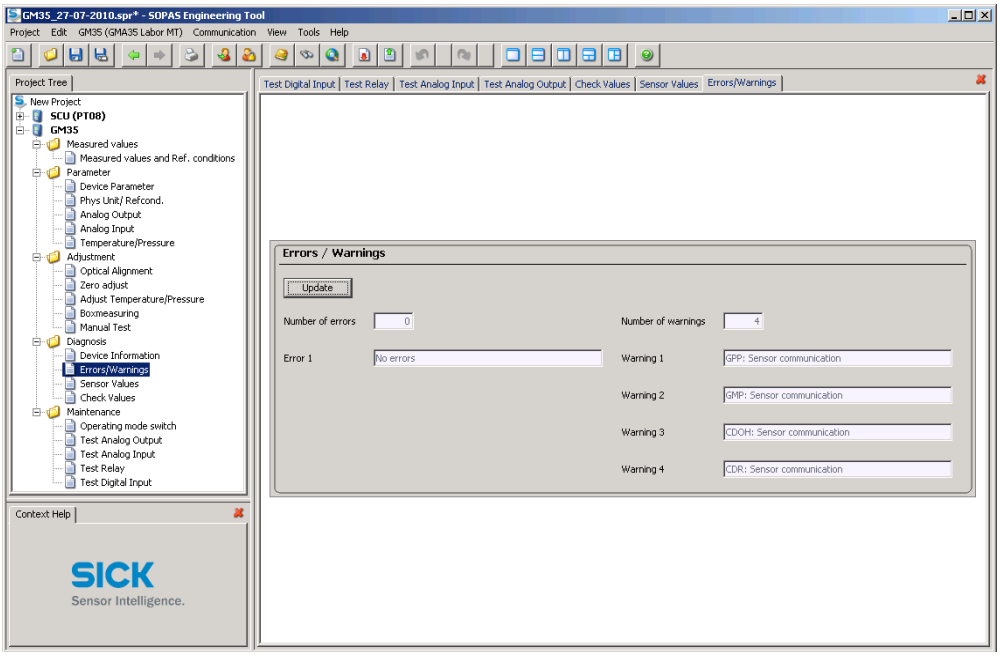


Fig. 40: Menu: Errors/Warnings

This menu displays the error messages and warnings as soon as **Update** is clicked.

Menu GM35/Diagnosis/Sensor Values

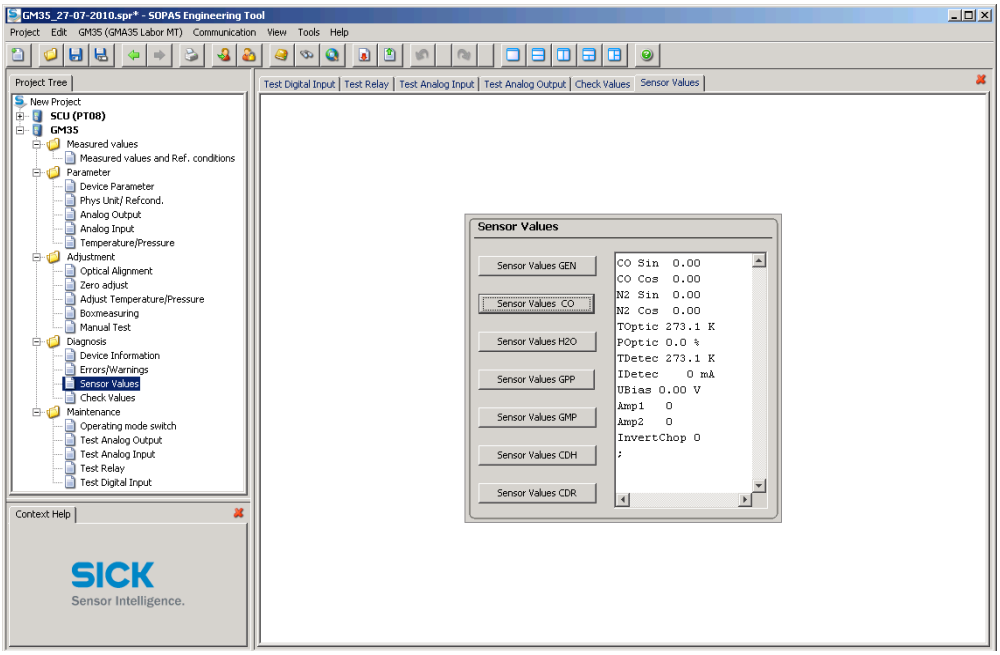


Fig. 41: Menu: Sensor Values

This menu serves to inquire the internal diagnosis values of sensors and device components.

Menu GM35/Diagnosis/Check Values

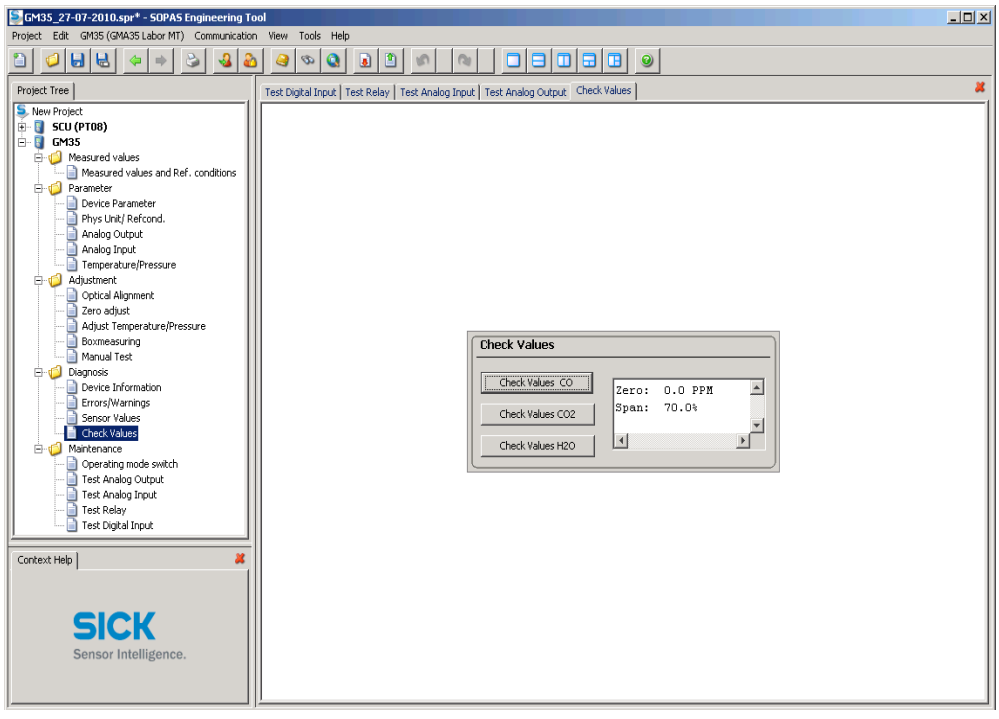


Fig. 42: Menu: Check Values

This menu serves to inquire the control values for the measuring components.

6.1.11 Menu Maintenance

Menu GM35/Maintenance/Operating mode switch

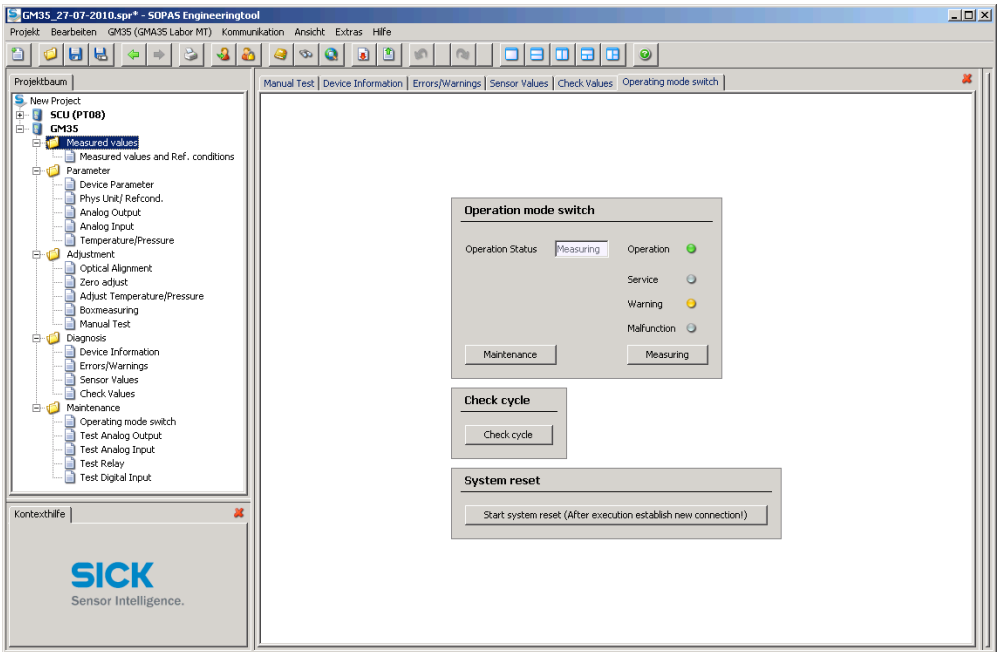


Fig. 43: Menu: Operating mode switch

This menu serves to switch between Measuring mode and Maintenance mode:

- Switch between measuring and maintenance.
- Trigger check cycle.
- Restart system (System reset).

Menu GM35/Maintenance/Test Analog Output

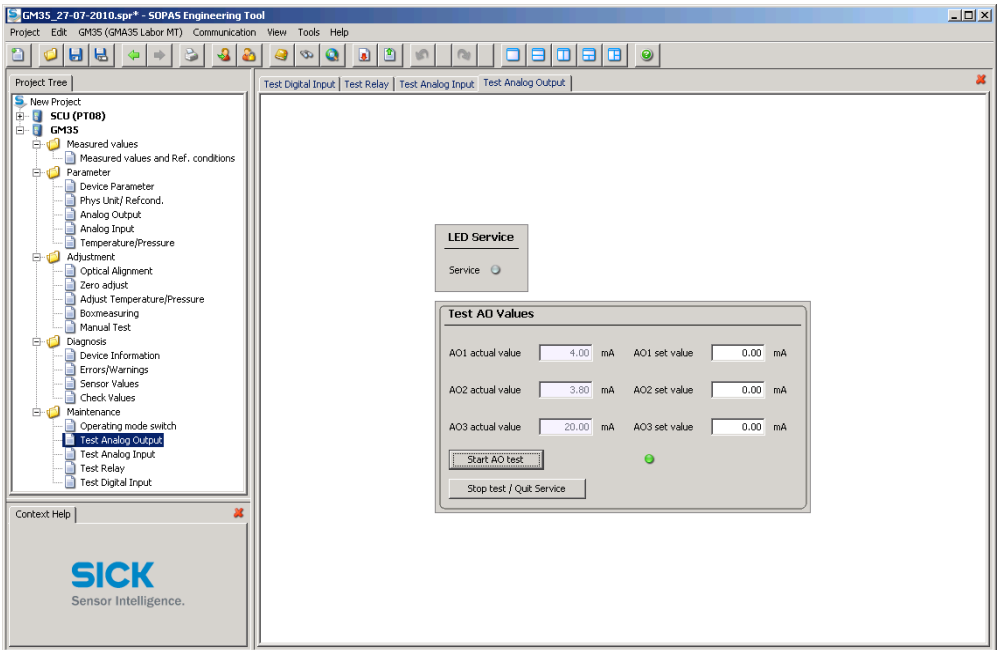


Fig. 44: Menu: Test Analog Output

This menu serves to test the 3 analog outputs:

- Test analog outputs

Menu GM35/Maintenance/Test Analog Input

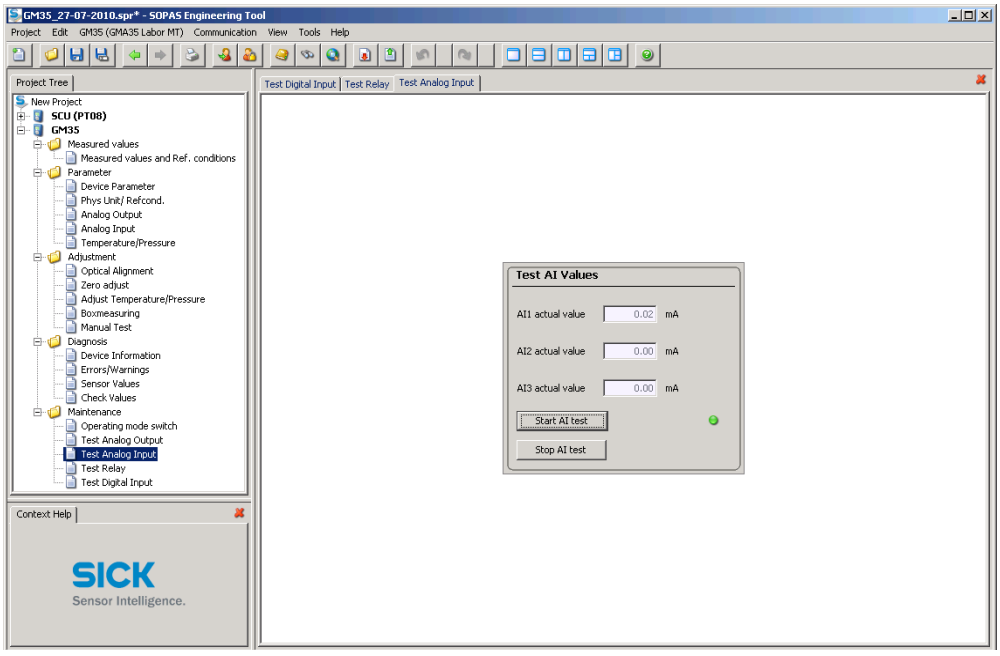


Fig. 45: Menu: Test Analog Input

This menu serves to test the 3 analog inputs.

Menu GM35/Maintenance/Test Relay

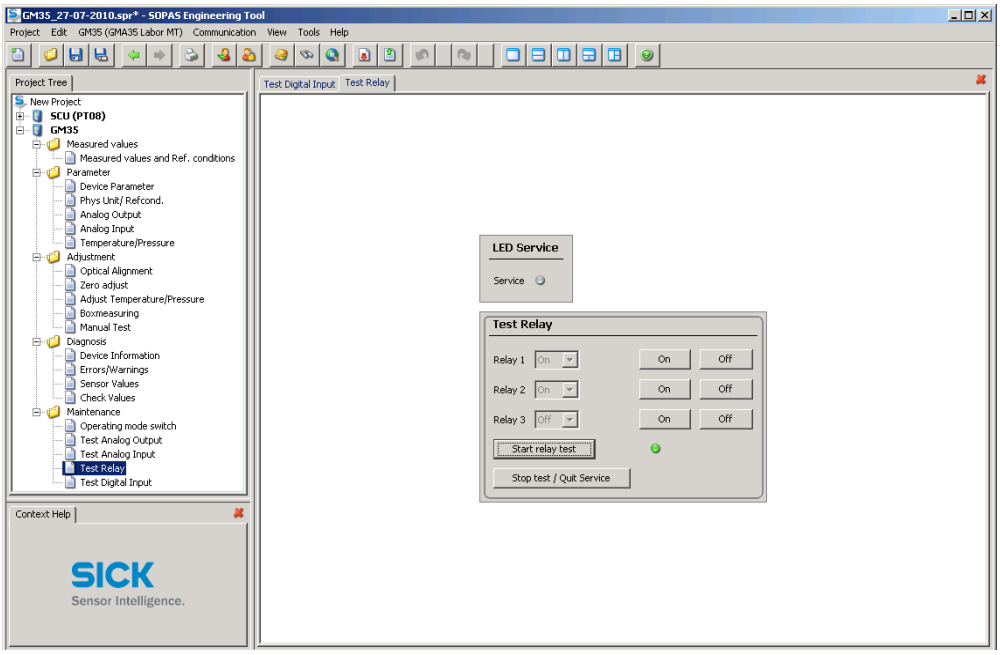


Fig. 46: Menu: Test Analog Output

This menu serves to test the 3 relay outputs.

- Test relay outputs.

Menu GM35/Maintenance/Test Digital Input

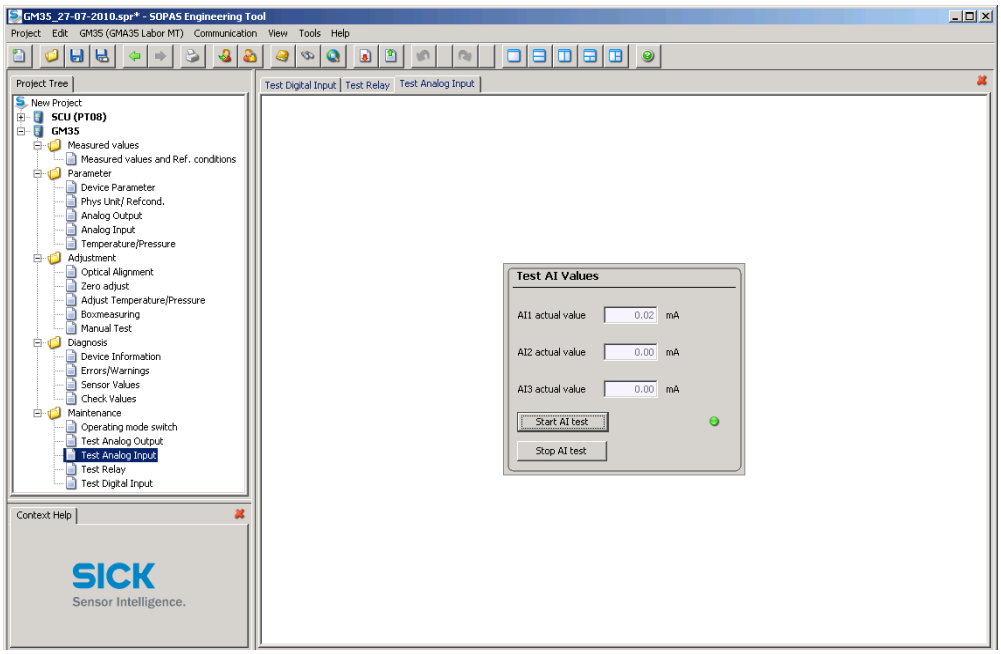


Fig. 47: Menu: Test Digital Input

This menu serves to test the 3 digital inputs.

7 Start-up

This Section describes the standard start-up at the end of which the Gas Analyzer with Measuring Probe GM35 starts measuring operation.

7.1 Preparations

7.1.1 Required qualifications and further prerequisites

Previous training by SICK or a qualified sales partner is recommend for technicians and engineers performing start-up. This training provides knowledge so that participants can recognize and handle situations that demand measures going beyond the standard procedures described here. Apart from the start-up itself, employees of SICK or trained sales partners are also able to make recommendations for the actual measuring operation as well as to define the maintenance interval based on the specific plant conditions.

Standard start-up

Each single measuring system is already configured to the individual application at the factory and therefore the standard start-up procedure described in this Section can however usually be performed by qualified engineers or measurement technicians without requiring special training. Prerequisites are:

- Exact adherence to the application requirements specified in the order
- The possibility to consult a trained specialist of SICK or the respective sales partner should special questions arise during start-up that go beyond the scope of the standard procedures described here.

7.1.2 Start-up procedure overview

After the general preparations, primarily involving checking work already done, the SR-unit with the measuring probe is now prepared for operation in an atmosphere free from sample gas. This can be done either at the measuring point or another location, e.g. in a closed room. At the measuring point itself, the purge air unit and SR-unit with measuring probe are then put into operation in succession. Finally, the evaluation unit is switched on and checked; the EvU parameters can then be set for individual demands.

7.2 General preparation

Consult the relevant personnel and their logs, and check the site to make sure the work described in the previous Sections has been carried out correctly and completely:

- Project Planning Information
- Initial onsite installation
- Installation of system components

Prerequisites for successful start-up:

- Installation conditions match the requirements for the measuring system (temperature, pressure).
- Measuring point must be accessible without danger or problems.
- Flanges with tube are properly installed on the device and precisely aligned.
- All power supply and signal cables are installed and connected.
- The system, apart from the SR-unit, reflector and purge air fixtures which are attached to the duct flanges later, must be fully installed and wired.
- The purge air supply must be ready to function.

7.2.1 Required tools and materials for the installation

Tools	Required for
2 x 24 mm open-ended spanners or ring spanners	Installing the measuring probe on the duct
1 x 19 mm open-ended spanner or ring spanner	Installing the measuring probe on the SR-unit and optical adjustment
Allen key set	
Insulated screwdriver set	Electrical connection work
Materials	
Optical cleaning cloths without detergents	SICK Part No. 4003353
Adhesive, recommendation: quick-drying epoxy resin adhesive	Attaching the fixing bolts on the SR-unit.
Personal protective equipment	Work on gas ducts with hot or aggressive sample gases.

Fixing parts (included in scope of delivery)	Required for
4 x M 16 x 60 screws with washers and self-locking nuts	Fixing the probe on the duct-side flange.
3 x nuts with washers and 10 cup springs each	Fixing the probe on the SR-unit (compare page 80).
Sealing ring	Sealing the connection between measuring probe and SR-unit.

For adjustment:

Required material	Adjustment at the measuring point	Adjustment at a different location
Angle flange (Part No.: 2017833)	x	
Test bracket provided by the customer (replacement for angle flange)	x	x
Power supply cable with suitable device connector, 1 x for SR-unit, 1 x for GPP measuring probe, Part No. 2017519		x

7.3 Mechanical preparations for the SR-unit and reflector

WARNING: Avoid hazards through sample gases!

To avoid health hazards, the following work step may not be carried out during the preparation described in this Section but first within the scope of the respective descriptions in the following Sections.

- Connecting the power supply to the SR-unit
- Fitting an angle flange or the measuring probe on the sample gas duct

7.3.1 Checking the scope of delivery

- Check the exterior of the SR-unit and measuring probe to ensure they are not damaged.
- Make sure the supply voltage on the type plate of the SR-unit complies with the plant conditions.
- If a GPP measuring probe is to be used, also check the supply voltage specified on the type plate of the measuring probe.

The supply voltage of the GM35 SR-unit and measuring probe can be changed between 115 V and 230 V on site by the SICK Service when necessary.

7.3.2 Transport safety devices

- Remove the transport safety devices shown below as well as any protective stickers, marked as such, depending on the device version.
- The front cover of the SR-unit is clamped between the flange fixture and enclosure. To remove it, open the four quick-release fasteners and swivel the flange fixture up (see Fig.). Keep the transport safety devices as required.

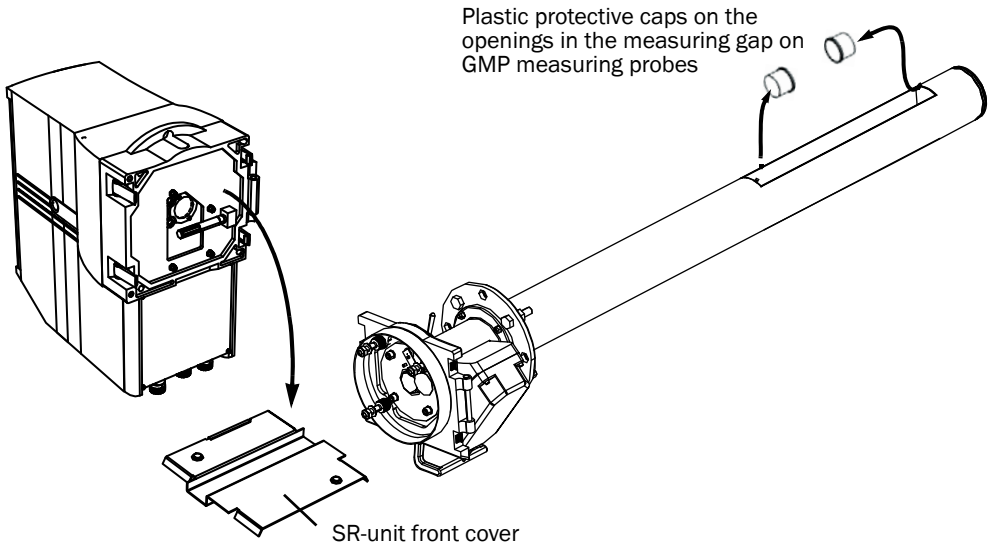


Fig. 48: Transport safety devices to be removed from the SR-unit and measuring probe

7.3.3 Cleaning the optical interface

- Check the optical interfaces of the SR-unit (the front window) and the reflector for soiling and clean with an optical cleaning cloth when necessary, see “Cleaning the optical interfaces on the SR-unit”, page 104.

NOTICE: Do not use detergents because their residues, not visible to the naked eye, will falsify measurement results. If necessary, use distilled water.

7.4 Aligning the measuring probe in flow direction

The measuring gap must be aligned in gas flow direction so that the gas can flow through unhindered. The SR-unit should normally be operated in a vertical position and, because the alignment of the device flange to the SR-unit is fixed, the measuring probe must then be aligned by rotating the device flange.

If the flow angle for the measuring system is already known at the factory on the basis of the project planning data, the probe is usually aligned on delivery. However, alignment can also be carried out onsite as described in the following.

Measuring gap
The measuring gap is aligned in sample gas flow direction.

Mounting flange
For mounting on the duct-side flange with tube already mounted in sample gas flow direction during onsite preparations, see page 36.

Device flange
The alignment of the device flange on the SR-unit is determined by the three holes and spacer bolts of the SR-unit. The vertical axis of the SR-unit to the device flange is shown by the broken line in the Figure.

Fixing the device flange
The device flange can be rotated steplessly against the measuring probe by loosening the fixing screws.

Fig. 49: Measuring probe (e.g. GPP): Flange and angular alignment of the measuring gap

The SR-unit should be mounted vertically and therefore the alignment of the device flange serves as reference for the vertical axis shown by the “top” and “bottom” points on page 79. The angle of rotation of the probe against the vertical axis of the device flange is equal to the angle of the gas flow direction against the vertical axis and, therefore, to the alignment of the flange with tube on the duct side.

Changing the alignment of the measuring probe:

1 Using an Allen key, loosen the screws on the fixing ring that secures the device flange to the measuring probe.
2 Turn the device flange so that the measuring gap is aligned against the vertical axis of the SR-unit (see page 79) in the flow direction of the sample gas duct.
3 Fix the device flange in this position by tightening the screws on the fixing ring again.

7.4.1 Installing the SR-unit on the measuring probe

The measuring probe can be fitted on the SR-unit already installed. To ease handling and to avoid unnecessary mechanical stress on the SR-unit, the flange fixture can be removed beforehand and the measuring probe installed on it separately.

Removing the flange fixture (optional)

1 If the flange fixture is no longer swiveled open from the previous work steps:
   ▶ Loosen the 4 quick-release fasteners on the SR-unit enclosure.
   ▶ Swivel the flange fixture out.
2 Pull the hinge bolt on the left of the enclosure upwards out of the hinge and remove the flange fixture.
3 Fit the measuring probe on the flange fixture just removed as described in the following.

Installing the measuring probe

The installation procedure is identical for all measuring probe versions. The fixing parts are supplied with the GM35 measuring system.

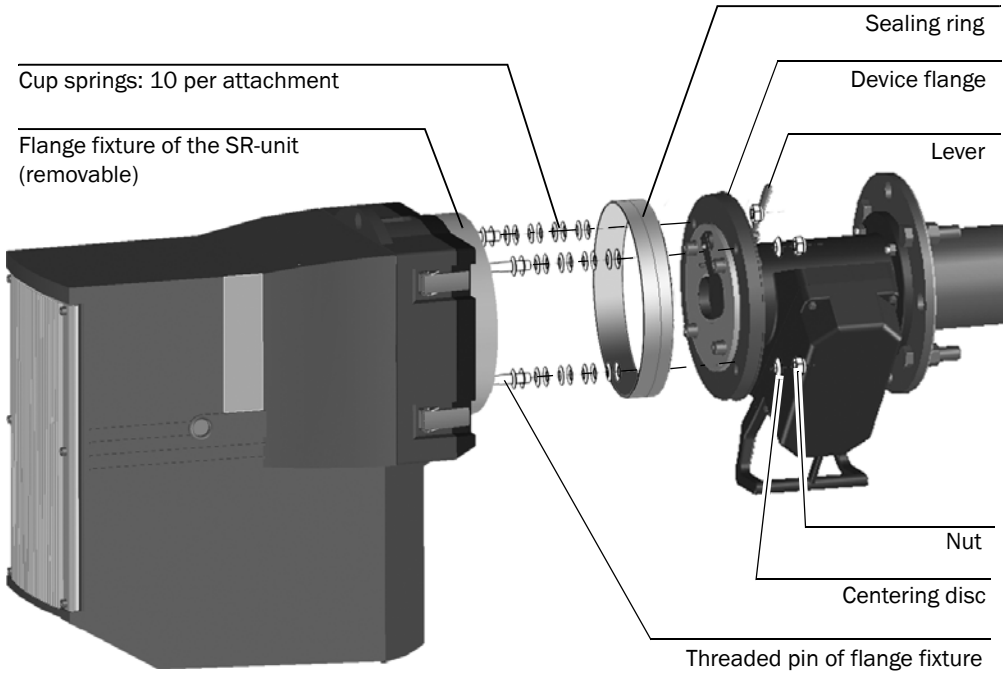


Fig. 50: Fixing the measuring probe on the SR-unit (Fig.: GMP measuring probe)

1 Place 10 cup springs in each case, with the front ends facing each other, that is, 5 pairs, on the three threaded pins on the flange fixture of the SR-unit. The sectional view (see page 81) shows the exact arrangement.
2 Pull the sealing ring over the device flange and hang it loosely over the measuring probe where it is then ready for use.
3 Carefully position the measuring probe with the device flange on the three threaded pins fitted with cup springs on the flange fixture without damaging the threads.
4 Fit the centering discs and tighten the nuts using a 19 mm wrench so that the cup springs are pressed together slightly.

5 A constant gap of approx. 3–4 mm should remain between the flange fixture of the SR-unit and the device flange of the measuring probe to allow adjustment of the optical alignment (see page 81).
6 Close the gap with the sealing ring so that the ring rests on the smooth surfaces of the flange fixture and device flange, as shown on page 81.

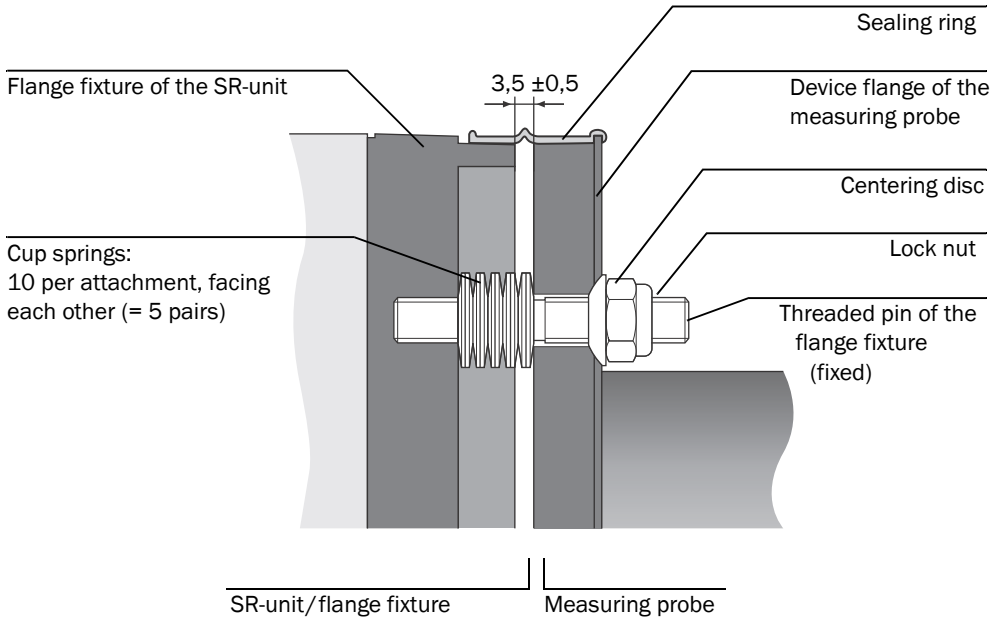


Fig. 51: Cross-section of the connection fitted between the SR-unit and measuring probe

7 If the flange fixture was removed from the SR-unit, attach it again. Insert the hinge bolt again and close the quick-release fasteners.
8 Set the lever on the probe flange to “open” to open the closing device of the probe in sample gas direction, see “GMP measuring probe (with open measuring gap)”, page 15 and see “Fixing the measuring probe on the SR-unit (Fig.: GMP measuring probe)”, page 80.

7.5 Adjustment work

7.5.1 Prerequisites and location selection for adjustment work

The GM35 must always be adjusted in an atmosphere free from sample gas and dust, i.e. before being installed. The only exception to this are newly assembled installation environments that have not been put into operation yet, whereby it can be ensured that the sample gas duct remains flooded with ambient air free from sample gas and dust while the work described below is being carried out. In this case, a flange with tube already mounted on the sample gas duct (which has not been used yet) can serve as a bracket during adjustments, whereby the prerequisites in the following apply for an adjustment at the measuring point.

Note Adjustment or calibration with test gases using a GPP measuring probe is a special case; see page 119.

Otherwise, the following options are available:

Adjustment at the measuring point

The following requirements must be fulfilled:

- Dry ambient atmosphere free from sample gas and dust
- The power supply for the GM35 measuring system is already installed and available
- Suitable bracket, to which the measuring probe with attached SR-unit can be secured horizontally outside the sample gas duct. Sufficient ground clearance must be provided on the underside of the SR-unit for the plug-in connectors.

WARNING: Health risks during the installation of the angle flange

The following risks can occur on the duct-side flange with tube during installation of the angle flange:

- Burns through
  - escaping, hot or aggressive sample gases
  - hot components
- Injuries of the skin and respiratory system due to toxic gases in the measuring duct.
- Injuries due to overpressure in the sample gas duct.

▶ If necessary, use suitable protective equipment or a different bracket.

▶ Observe the detailed safety instructions, see “Installing the GM35 SR-unit and measuring probe on the duct”, page 89.

If the angle flange cannot be used on the duct-side flange for safety or space (duct insulation) reasons, it can be screwed or welded into position at a different fixing point within range of the connection cables.

If the cable length is adequate and sufficient space is available, the SR-unit can also be adjusted on the ground at the measuring point (see following Section).

Adjustment at a separate location

Alternatively, adjustment can be carried out at a different location away from the measuring point, whereby the same basic requirements apply.

Adjustment can be carried out using a stable bracket together with the angle flange, or also on the ground. The SR-unit can either be placed on the left side of the enclosure with the measuring probe fitted (so that the right side with the visor points upwards), or, if the SR-unit is arranged vertically, a secure support can be used to ensure the necessary ground clearance for cable connections.

As already specified in Section "Project Planning Information", an additional three-pole cable with matching device connector, 2 017 519, is required for the power supply for the SR-unit as well as the measuring probe when the probe is a GPP version. These cables are connected to a suitable AC voltage supply with protective contact. A standard plug can be easily attached to the open cable end in this case. If cables of this type are not available (e.g. because adjustment was initially planned at the measuring point), the relevant cables must be removed from the measuring point and reinstalled after the adjustment has been carried out.

After adjustment, the SR-unit and measuring probe are transported to the measuring point to start measuring operation.

Time required

The adjustment procedure, including warming up time, lasts approx. 2.5 to 5 hours, whereby the actual work usually requires less than 30 minutes, with the remaining time required for the warm-up procedure. Other activities, such as start-up on the purge air supply (see page 88), can be carried out at the measuring point during the warming up time. Nevertheless, due to the long warming up time, it can be better to carry out the adjustment at a different location when the measuring point is difficult to access.

Choosing the location

Choose a suitable location to carry out the adjustment work based on the above information and project planning data. Make sure the requirements listed above are fulfilled at this location.

7.5.2 Adjustment preparations

1. Once the measuring system, consisting of the SR-unit and measuring probe, has been completely assembled, mount it on the bracket to be used for adjustment (e.g. on the angle flange).
2. If the adjustment is to made on the ground, support the measuring system securely, ensuring sufficient ground clearance for connecting the power supply cable on the underside of the device (see page 84), or lay the SR-unit on the left-hand side of the enclosure. The right-hand side of the SR-unit with the visor must remain accessible in all cases.
3. Connect the 4-pole round plug-in connector on the power supply cable provided for the adjustment to the corresponding terminal on the underside of the SR-unit.Secure the plug-in connector with the knurled ring.
4. Connect the 4-pole round plug-in connector of the signal cable for the evaluation unit to the underside of the SR-unit.Secure the plug-in connector with the knurled ring.
   For further start-up steps for starting measuring operation on the evaluation unit, see page 93.
5. If a GPP measuring probe is used, connect its power supply also using a cable of the same type.
6. Switch the power supply on.

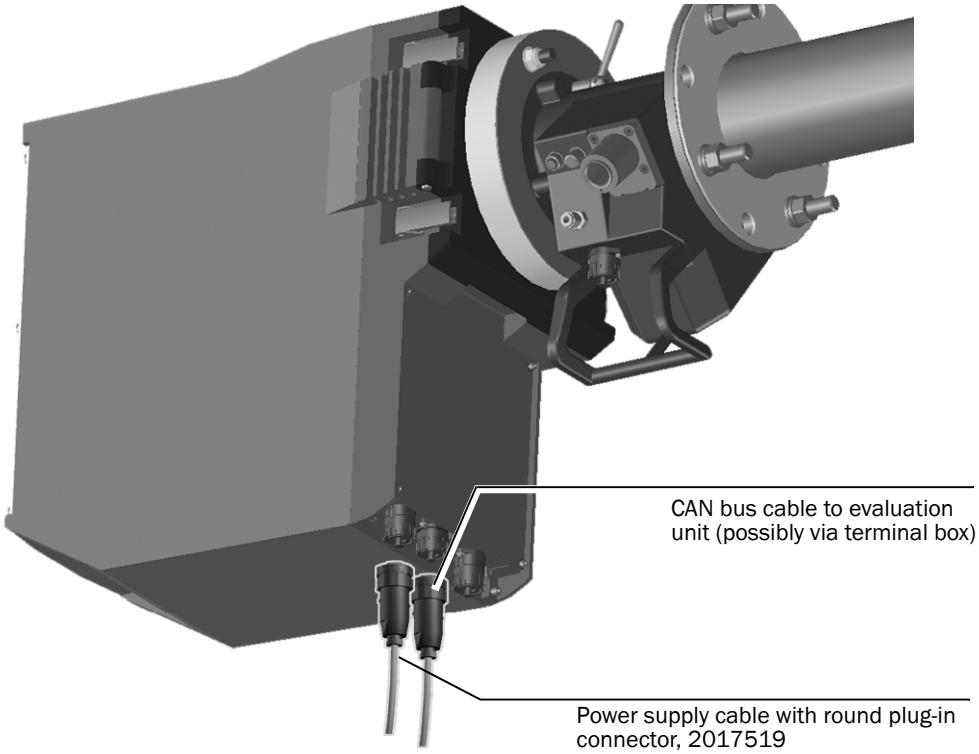


Fig. 52: Connecting the power supply to the SR-unit for adjusting the measuring system

7.5.3 Aligning the optical axis of the measuring probe

To ensure correct measuring function, the optical axis of the measuring probe must be aligned exactly to the light beam of the SR-unit. To do this, adjust the 2 screws on the device flange, see page 111 below.
2 options are available for checking the probe position in XY direction:

- On the visor on the right side of the SR-unit enclosure, see page 111
- On the EvU display after switching to Maintenance mode (**maint**) and calling up menu **ADJ. OPT ALIGN**, see page 86.
  This menu item must always be carried out when the “Automatic Alignment Control” option is implemented in the GM35 SR-unit.

Checking on the visor

Check the alignment of the optical axis using the visor on the right-hand side of the SR-unit enclosure and by making adjustments on the probe fixing on the device flange.

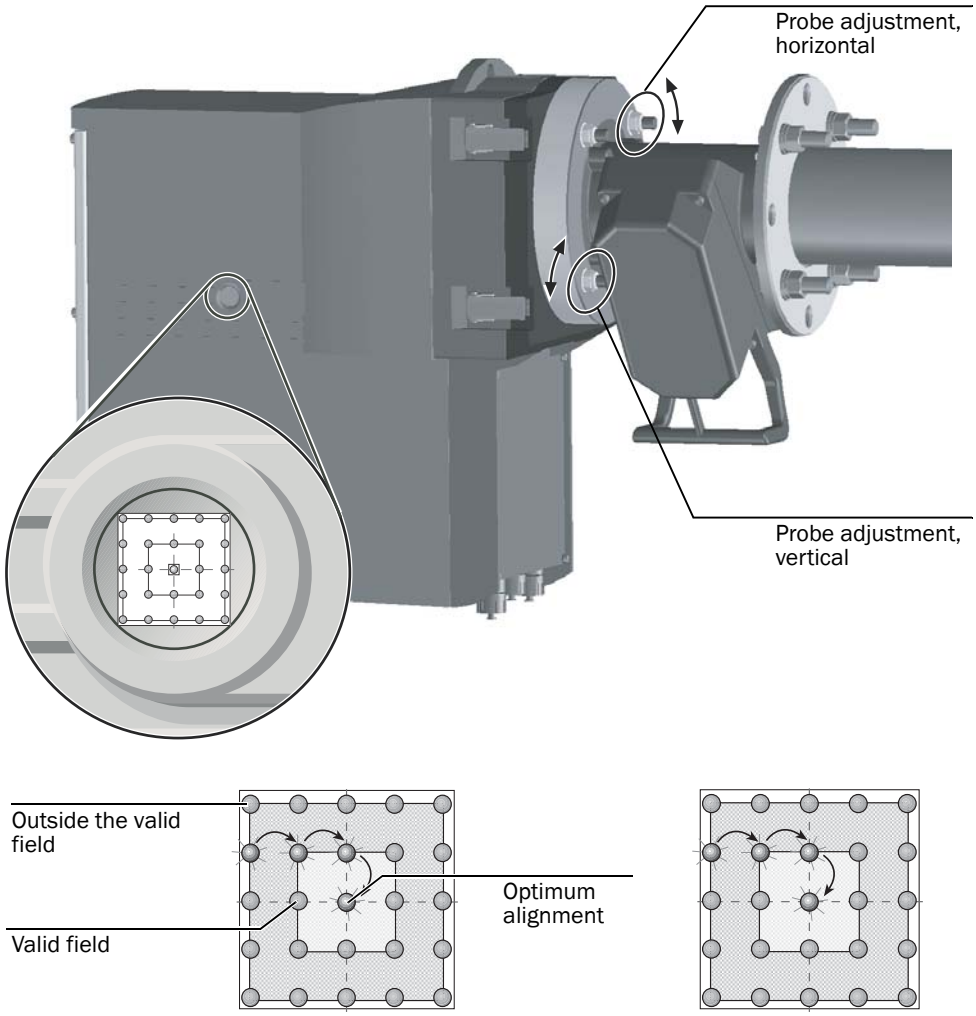


Fig. 53: Aligning the optical axis

Visor The visor indicates the alignment of the optical axis between the SR-unit and the reflector in the probe using a 5 x 5 LED matrix. The LEDs light up to represent the position of the light beam on the reflector at the probe end. The cross hairs show three fields for aligning the probe.

- ▶ Adjust the optical alignment as shown in "Aligning the optical axis" by adjusting two screws on the device flange with a 19 mm wrench whilst observing the light position of the LED at the same time.

  Horizontal probe adjustment causes the light spot to shift horizontally on the visor and vertical adjustment causes a vertical shift. Alignment is correct when the lit LED is located within the valid field within the cross hairs, or is completely within the inner ring marking of the cross hairs.

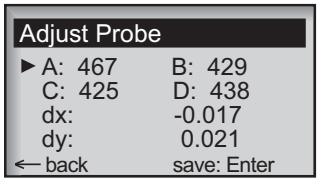
Display in the LED matrix	Meaning
LED in the middle lights up	Optimum analyzer alignment.
A LED in the inner quadrant lights up	Alignment within half the tolerance.
A LED in the outer quadrant lights up	Alignment at tolerance limits, correction required.
A LED in the outer quadrant blinks	Alignment outside tolerance limits, correction required.
LED in the middle blinks	No signal, reflector not “seen” by the SR-unit because, for example, the alignment is completely wrong, no probe is installed, reflector strongly contaminated.
LEDs in middle row light up sequentially	No alignment possible during warming up phase, check cycle or reference cycle.

Table 8: Significance of the visor LED matrix

Checking the EvU display

Before starting:

1 Press the **maint** button, select menu item **ADJ. OPT. ALIGN** and call up with **Enter**
2 The optical reference position is now approached on devices with automatic beam tracking.
3 Check the display:



4 Adjust the two screws on the device flange with a 19 mm wrench (see “Aligning the optical axis”) until the display shows.
   – the values for dx and dy are less than or equal to ±0.1 (dx...value for horizontal position or adjustment)
   (dy...value for vertical position or adjustment).

Values A, B, C and D are values of device-internal parameters. They should be in the range 450...650.

5 If the valid range for A to D cannot be reached even after adjusting the screws several times and the values for dx and dy are ≤ 0.1, check the warning and error messages in Diagnosis mode, (see “Menu structure”, page 49), and take the appropriate maintenance or servicing measures, see “Integrated monitoring and diagnosis system”, page 120.

6 Switch to Measuring mode:
▶ Press **meas**.

7.5.4 Performing zero adjust

After the GM35 SR-unit and the measuring probe, and evaluation unit as necessary, have been connected to the power supply, a warming up time of approx. 2.5 - 5 hours (depending on ambient conditions) is required before the zero adjust.

- ▶ Allow the warming up phase (approx. 2.5 hours) to elapse after the SR-unit has been connected to the power supply, and, when using a GPP measuring probe, until the warming up phase for the probe has also elapsed.
- ▶ If not already done, carry out optical axis alignment as described in Section “Aligning the optical axis of the measuring probe”.

The cal menu offers the following menu items:

- **Zero Adjust – normal zero adjust (measuring path free from measuring components)**
- **Zero Adjust Stack** – zero adjust with the GPP measuring probe installed in the duct purged with dry zero gas (e.g. nitrogen), see “Test Gas Measurement with GPP Measuring Probes”, page 96.

1 Activate Calibration mode (“cal” button), use the arrow buttons to select menu item **Zero Adjust** or **Zero Adjust Stack** and then trigger with the “Enter” button.
2 Confirm the prompt. Zero adjust runs and **Please wait** is displayed.

When zero adjust has completed, either a positive confirmation or an error message is displayed.

Adjustment successful

- ▶ Switch to Measuring mode or define further parameter settings.

Adjustment not possible

An error message indicates that a malfunction occurred during the adjustment procedure. The flashing “Malfunction” LED indicates that one or more error messages are pending.

- ▶ Switch to Diagnosis mode and rectify the problem, see “Troubleshooting and Clearing Malfunctions”, page 119.

7.6 Starting measuring operation

This Section describes the final preparations at the measuring point at which the Gas Analyzer with Measuring Probe GM35 starts measuring operation.

For this purpose, the SR-unit with mounted measuring probe must be installed at the measuring point.

- If adjustment was carried out away from the measuring point, carefully transport the adjusted SR-unit with measuring probe to the measuring point.

CAUTION: Follow the work sequence
To prevent damage to health and the measuring system, carry out the steps described in the following in the specified sequence. Always observe the relevant safety information. Only position the SR-unit with measuring probe in the sample gas duct in accordance with page 89. In systems using a purge air supply, the purge air supply must be put into operation first as described on page 88.

7.6.1 Starting up the purge air supply

Only when purge air is used

This Section is only applicable for GM35 configurations with GMP probe for which a purge air supply is used. If the GPP probe is used, go to page 89. The purge air unit has already been installed and checked ready for operation during device installation (see page 37).

- Connect the short hose piece on the pressure difference sensor securely to the purge air connection of the GMP measuring probe with a hose clamp.
- Connect the two 6.3 mm flat pin bushings of the installed signal cable to terminals 2 and 3 (NO and COM, NC contact) of the pressure difference sensor.

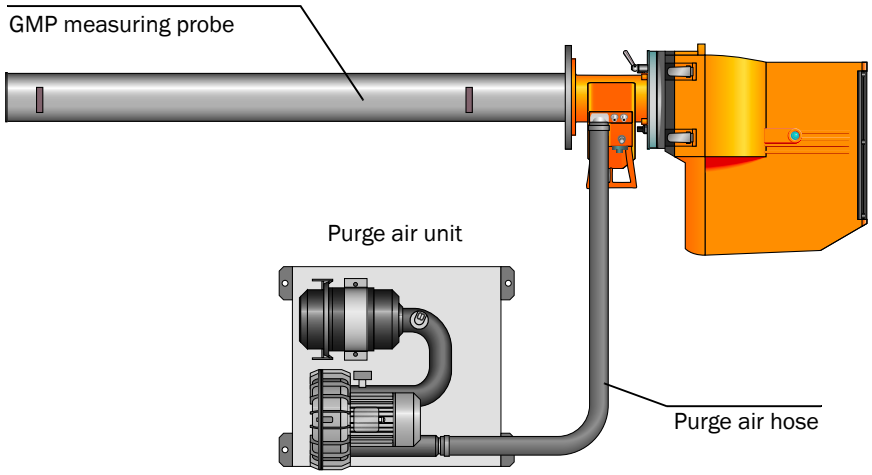


Fig. 54: Purge air connection

Connecting the purge air supply to the SR-unit

1 Position the SR-unit with measuring probe in the immediate vicinity of the flange with tube installed on the sample gas duct to connect the purge air hose, and to insert the measuring system in the duct with the purge air supply running.

   If the angle flange, Part No. 2 017 833, was used for adjustment, the measuring system is usually already located directly at the duct-side flange.

2 Switch the power supply for the purge air unit on briefly to check the function and to remove any dust that may have penetrated the purge air hose.

3 Connect the purge air hose from the purge air unit to the purge air connection of the measuring probe using a hose clamp, or to the pressure controller when used (see page 88).
4 Switch the purge air supply on.

Purge air supply is now activated and protects the measuring system against contamination and overheating. Purge air supply must never be switched off while the measuring probe is in the sample gas duct.

5 If not already done so, attach clearly visible warnings on all switch devices that can switch off the purge air supply to prevent it from being deactivated inadvertently.

7.6.2 GPP measuring probes: Power supply

If a GPP measuring probe is used, the optical interfaces must be heated to the necessary operating temperature before the measuring probe is inserted in the duct:

1 Connect the GPP measuring probe to the power supply.
If the power supply cable of the measuring probe to be used for continuous measuring operation cannot be connected until the measuring probe is inserted in the duct, or if it cannot be switched on, use a temporary power supply cable similar to the one that may have been used for the zero adjust (page 87).
2 Wait until the operating temperature of the optical interfaces in the measuring probe has been reached.
3 Leave the power supply connected while inserting the measuring probe in the duct (see page 89) and while it is inside the duct.

7.6.3 Installing the GM35 SR-unit and measuring probe on the duct

WARNING: Protection against hazards through hot resp. aggressive gases

▶ Wear suitable protective clothing (mask, gloves, working clothing and other) to avoid health risks and other hazards when opening the sample gas duct.

If the protective clothing does not allow safe working on the open sample gas duct under the current conditions or if the sample gas duct is in operation and cannot be opened as this would allow gas to escape or air to enter the duct:

Contact the persons responsible to have the sample gas duct shut down for the duration of the installation procedure and, when possible, have the duct flushed with ambient air to ensure safe installation.

▶ If present, remove the cover on the duct-side flange with tube.

▶ Insert the measuring probe with mounted SR-unit in the duct-side flange with tube. When using a GMP measuring probe, the purge air supply must remain connected to the measuring probe and in constant operation. The power supply to GPP measuring probes for heating the optical interfaces must not be interrupted.

▶ Fit the measuring probe to the duct-side flange using the set of fixing parts delivered as described on page 90. The set of fixing parts comprises 4 M16x60 screws, each with nut and 2 washers.

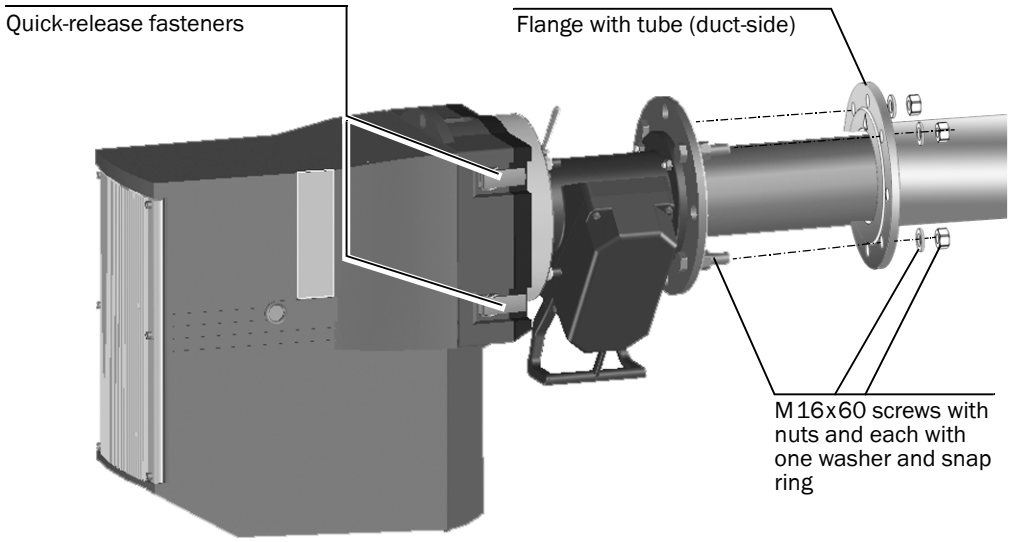


Fig. 55: Installing the SR-unit with measuring probe on the duct-side flange

7.6.4 Electrical connections and checking the optical alignment

The cables laid previously and the cables connected in the connection unit (see “Cable routing diagram”, page 33) as well as the CAN bus cable for the measuring probe are now connected to the SR-unit.

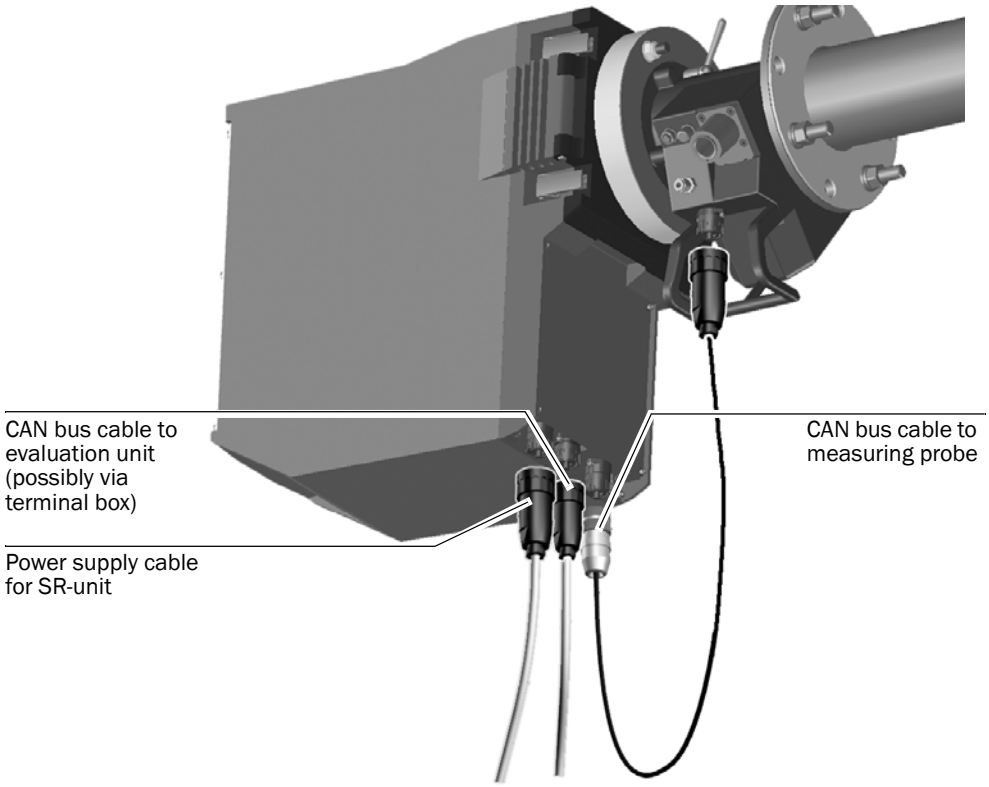


Fig. 56: Cable connections on the underside of the SR-unit

1 Connect the CAN bus cable between SR-unit and measuring probe to the socket provided on the measuring probe.
2 Connect the prefabricated or preinstalled cables to the underside of the SR-unit as shown on page 90.

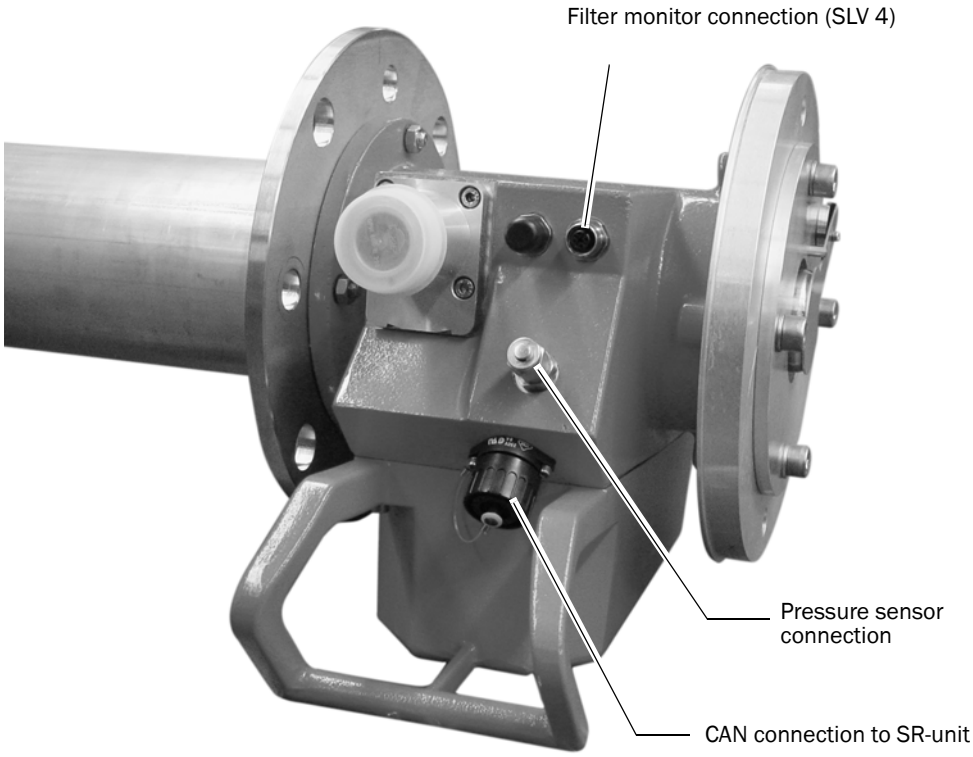


Fig. 57: Connections on the GMP probe

3 Make sure all screwed connections on both the SR-unit and measuring probe are tight so that the plug-in connectors sit securely.
4 Connect the functional earth cable to the screw-type terminal provided.
5 Switch the power supply on.
6 When using a GPP measuring probe that was supplied with power via a temporary cable during installation, connect the second prefabricated power supply cable with 4-pole round plug-in connector to the measuring probe instead of the temporary cable; see wiring diagram on page 33. Make sure that the power supply of the GPP measuring probe is not interrupted too long.
7 With the measuring system installed, and after a sufficient wait time of approx. 30 minutes to ensure that the operating temperature has been reached, check the optical alignment again.
8 To do this, call up menu **Adjust Probe** again on the EvU and check the displayed values, see page 86.
9 Reactivate Measuring mode:

– **Quit the Diag menu with <– back or**
– Press **meas**

Regular measuring operation now starts.

7.6.5 Weatherproof cover

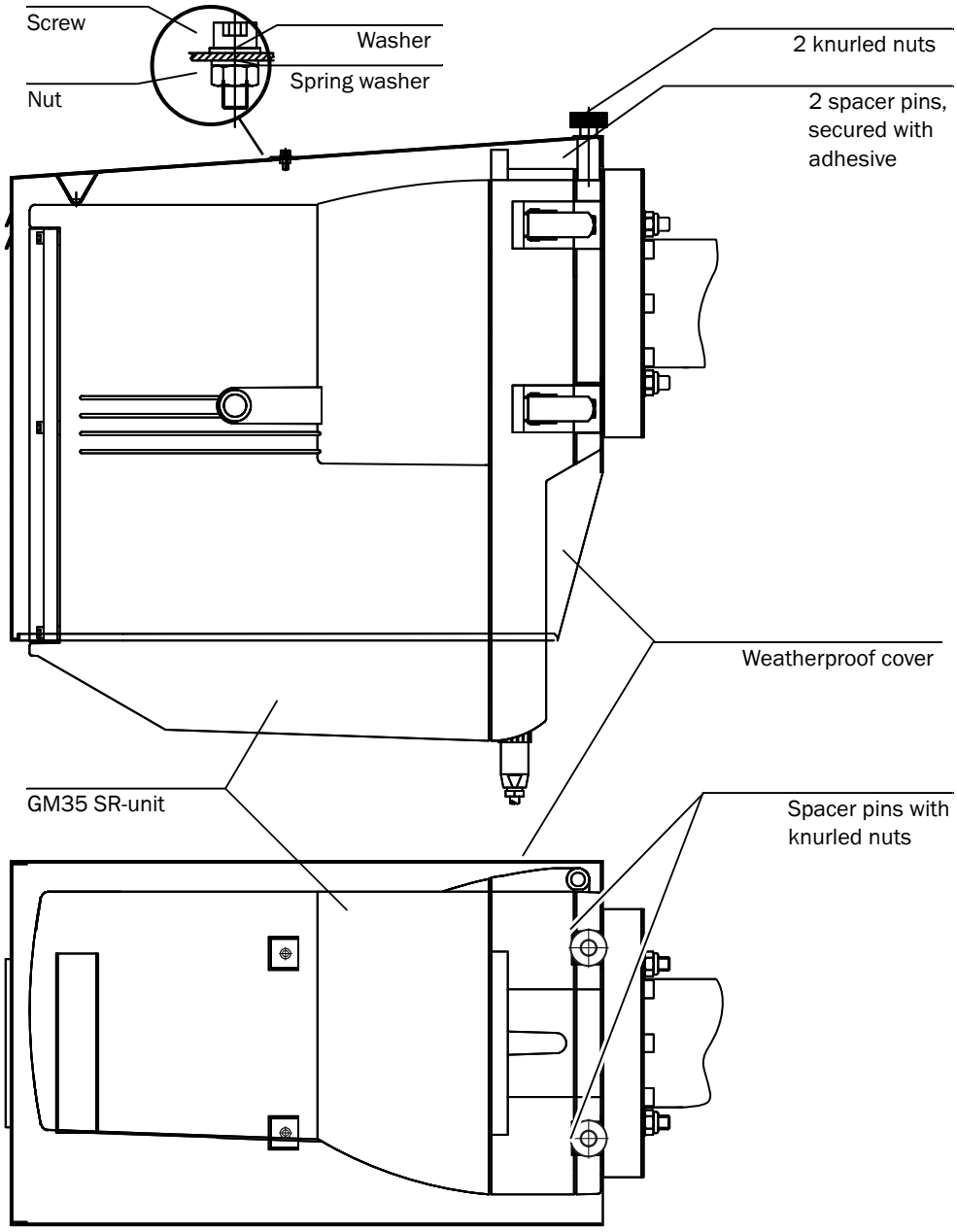


Fig. 58: Fitting the weatherproof cover for the GM35 SR-unit

1 As shown on page 92, bond the two spacer pins supplied centered on the flange fixture of the SR-unit at a distance of 170 mm to each other, i.e. so that each pin is 85 mm from the center. A quick-drying epoxy resin adhesive is best here.
2 Seal the two unused mounting holes in the center of the weatherproof cover with dummy screws as shown in "Fitting the weatherproof cover for the GM35 SR-unit", page 92.
3 Position the weatherproof cover on the SR-unit. The threads of the spacer pins now protrude through the front fixing holes of the weatherproof cover.
4 Secure the weatherproof cover in position with the two knurled nuts.

7.6.6 Evaluation unit start-up

The evaluation unit is configured with a standard parameter set at the factory and, therefore, is ready to start measuring operation immediately. With the exception of the following steps, therefore, no additional measures are required for start-up for standard applications:

- ▶ After starting up the GM35 SR-unit, switch on the power supply to the evaluation unit, if not already on.
- ▶ Based on the operator information in Section "Handling the Evaluation Unit", check whether the measured value display on the LC display is correct.

» If error or warning messages are displayed:

- ▶ Use the operator information, see "Handling the Evaluation Unit", page 47 as well as the display of error and warning messages in Section "Integrated monitoring and diagnosis system", page 120 to locate and rectify the error cause.
- ▶ If the cause of the fault cannot be rectified with this information, contact SICK Service or the responsible sales partner for further coordination.

- ▶ If necessary, parameterize the evaluation unit in accordance with the requirements of the plant environment. Required information, see "Maintenance", page 99.

7.6.7 Setting up the SCU System Control Unit

Basic procedure and further information on the SCU
→ Operating Instructions "SCU".

The following index values serve to access the GM35 measured values and parameters.

Mapping Table

Measured values on SCU – Measured value (MV)

Index	Measured value
MV01	H2O (g/m3, % by vol. [1]
MV02	CO (N_2O) (mg/m3, ppm) 1)
MV03	CO2 (mg/m3, ppm)1)
MV04	T (K)
MV05	P (hPa)

[1] Unit set during parametrization

Control values on SCU – Monitor values (MO)

Index	Measured value
M001	H2O_Zero (g/m3, % by vol.) [1]
M002	H2O_Span (%) [2]
M003	CO (N_2O)_Zero (mg/m3, ppm) 1)
M004	CO (N_2O)_Span (%) 2)
M005	CO2_Zero (g/m3, % by vol.) 1)
M006	CO2_Span (%) 2)

[1] Unit set during parametrization
[2] Percentage deviation.

Operating state of the GM35 – State (S)

Index	Operating state
S02	Measuring
S04	Maintenance
S04	RCycle
S05	CCycle

Diagnosis Table – DiagFlags (F01-F32, M01-M32)

Index	Diagnosis message (F ... Failure, M ... Maintenance)
F01	Sensor communication
F02	Incompatible device
F03	H2O EEPROM
F04	CO (N_2O) EEPROM
F05	CO (N_2O) com.
F06	Zero com.
F07	CO (N_2O) CUVETTE com.
F08	H2O CUVETTE com.
F09	Filter com.
F010	VISOR com.
F011	CO (N_2O) temp. detec.
F012	H2O temp. detec.
F013	CO (N_2O) div. Zero
F014	H2O div. Zero
F015	VISOR fault
F016	VISOR init.
F017	H2O Motor fault
F018	CO (N_2O)Motor fault
F019	H2O Ampl. Max
F020	CO (N_2O) Ampl. Max
F021	H2O not ready
F022	CO (N_2O) not ready
F023	H2O Sig. High
F024	CO (N_2O) Sig. High
F025	H2O No signal
F026	CO (N_2O) No signal
F027	VISOR No signal
F028	Mirror com.
F029	Mirror adj. End
F030	CO (N_2O) CUVETTE range
F031	Flag_031 = Reserve
F032	Flag_032 = Reserve
M01	AI T overrun
M02	AI p overrun
M03	AI v overrun
M04	AO0 ZEROPT.
M05	AO1 ZEROPT.
M06	AO2 ZEROPT.
M07	AO3 ZEROPT.
M08	AO4 ZEROPT.
M09	AO5 ZEROPT.
M10	AO6 ZEROPT.
M11	AO7 ZEROPT.

Index	Diagnosis message (F ... Failure, M ... Maintenance)
M12	A08 ZEROPT.
M13	Flag_045
M14	Flag_046
M15	Flag_047
M16	Flag_048
M17	MR Adjustment
M18	Chopper freq.
M19	HYGRO com.
M20	H2O Low signal
M21	CO (N_2O) Low signal
M22	HYGRO internal
M23	MIRROR adj.
M24	H2O Reference
M25	CO2 Reference
M26	CO (N_2O) Reference
M27	VISOR amplifier
M28	Software version
M29	CO (N_2O) CUVETTE range
M30	Flag_062
M31	Probe message
M32	Probe com.

8 Test Gas Measurement with GPP Measuring Probes

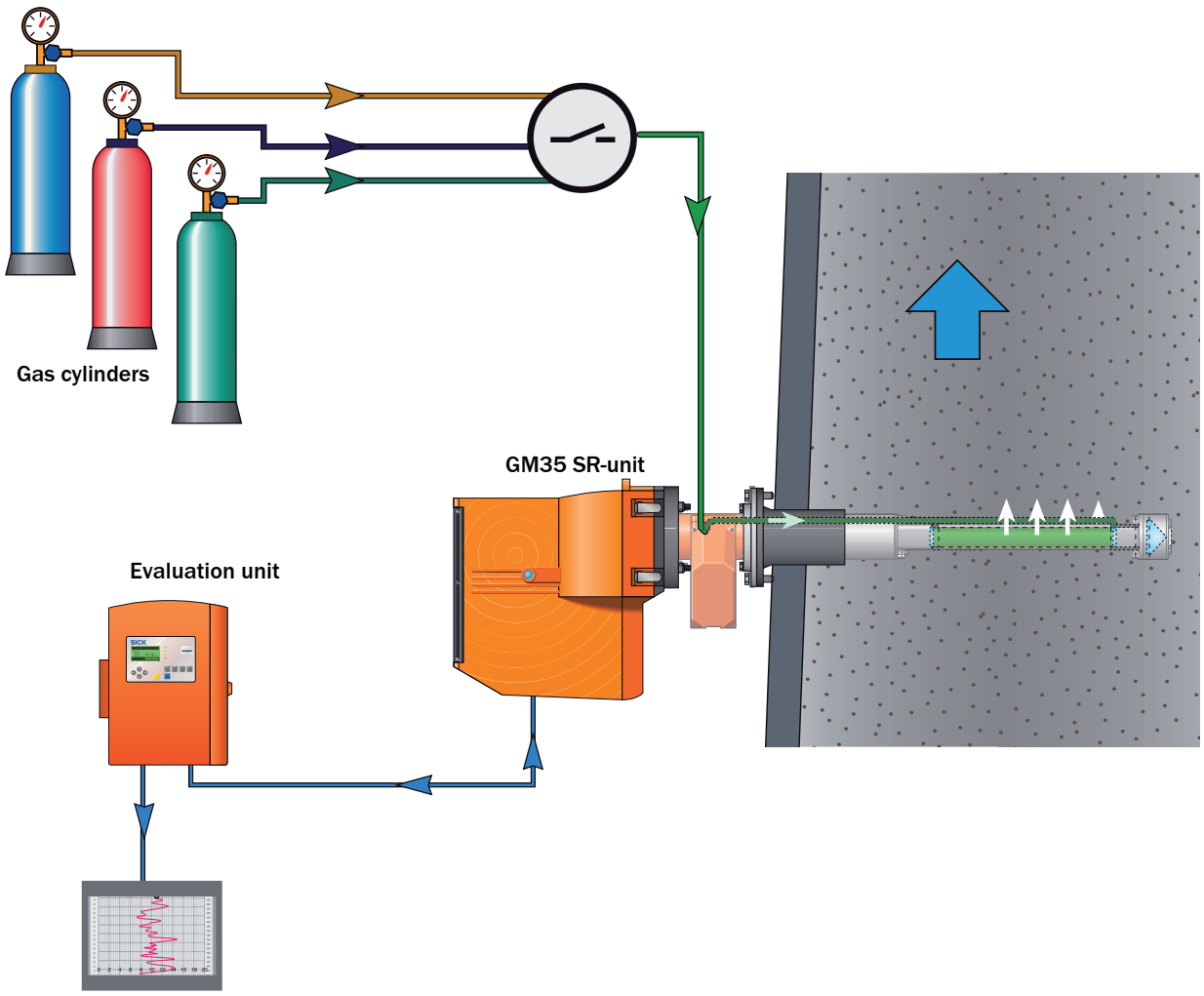


Fig. 59: Test gas measurement on the GM35

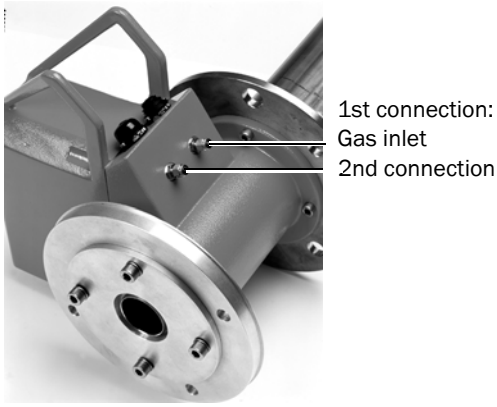
The GPP measuring probe supports on-line gas tests. For this purpose, the GPP probe is equipped with a gas connection for conducting test gas measurements. The second connection can be used

to check pressure measurement, for sample extraction for comparison measurements, to increase the test gas quantity for test purposes.

Feeding test or zero gas creates overpressure in the filter element. If the overpressure is high enough, the entire sample gas is forced out of the filter element by a gas flow that is formed in the opposite direction through the filter element. The flow within the filter element must be greater than the diffusion rate of the gases to ensure the sample gas is forced out of the filter element.

This method can be used for measuring the zero point with nitrogen or air, as well as for measuring test points with the relevant gases and concentrations.

Fig. 60: Gas connections on the GPP measuring probe



8.1 One-off preliminary measurement/determining the settings

Every GPP is subject to certain fluctuations in production that cannot be compensated, or only with extreme effort (e.g., porosity of the filter frit) and the filters can have different lengths and different materials, so that ideal pressure parameters for test gas measurement must be determined before the first measurement. The GPP remains installed in the gas duct.

Preparations For zero gas, as above (e.g., N_2 or air)

1 Start manual test.
2 Set the pressure reducer to 0 bar, open the valve fully
3 Set the pressure to approx. 3 bar and observe the measured values and, if zero is not reached after a certain period of time (30 s, depending on the T_{90} setting of the analyzer), increase the pressure gradually until zero is reached.
4 When zero is reached reliably, reduce the pressure gradually, observe the measured values, and when the values are higher than zero again, increase the pressure again by approx. 0.5 bar.
5 Note the pressure on the pressure gauge display on the EvU, these values can be used in future as default values for pressure values. The differential pressure is in the range > 2 mbar < 30 mbar.
6 Close the valve on the pressure reducer; close the gas cylinder.

8.2 Manual gas test

The following equipment must be available for the manual test method:

Equipment

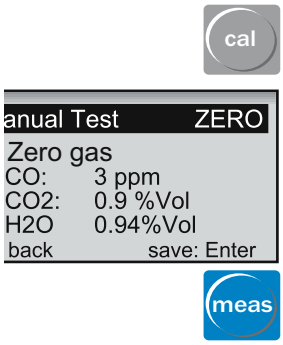
- Test gas cylinders (N_2 and gases to be tested), concentrations according to the selected measuring range.
- Pressure gauge / pressure reducer.
- 1/4" supply line with Swagelok screw fitting.

Preparations

- Fit pressure gauges/pressure reducers to the gas cylinders and secure the cylinders against falling over.
- Connect the line between pressure reducer and test gas connection (1st connection) on the GPP.
- Set the pressure gauge to the default pressure (see On-off preliminary measurement/ determining the settings).

Perform measurement

Evaluation unit



1 Switch to Calibration mode and select menu item **Manual Test**.
   – Choose the test gas, e.g., N_2 as zero gas and
   – start measurement with **Enter**
2 Open the valve on the pressure reducer fully.
3 Note the measured value display on the EvU and, if required, save the values with **save**.
4 Close the valve on the pressure reducer; close the gas cylinder.
5 Repeat the procedure (preparation and measurement) with the other required test gases.
6 Switch to Measuring mode.

9 Maintenance

The Gas Analyzer with Measuring Probe GM35 requires very little maintenance. This Section describes regular maintenance work to be carried out on the GM35 measuring system.

Qualification

Inspection and maintenance tasks described in this Section can be carried out by Service technicians familiar with the device based on the information in these Operating Instructions and having in-depth knowledge of the relevant safety regulations.

Maintenance intervals

Maintenance intervals depend on individual application conditions and should be clarified with SICK Service resp. with a trained engineer or technician at the local sales partner.

If no other specifications have been made, the following recommendation is applicable:

- Maintenance interval – 6 weeks

Maintenance protocol

Recommendation

Keep a log of maintenance work done. A simple notebook recording maintenance dates, work done, special observations, and required consumables and spare parts is adequate.

9.1 Safety

CAUTION: Important safety information for all service work

Always observe the following information when carrying out service work to avoid injury or damage to the measuring system:

- Wear suitable protective clothing and a protective mask when the sample gas is hot and/or aggressive or has a high dust load, or when the sample gas duct is pressurized. Never open the enclosure or disengage the quick-release fasteners without first taking suitable protective measures.
- If the conditions in the sample gas duct are particularly problematic and hinder or prevent work on the open duct, despite the use of protective equipment, the maintenance work must be carried out when the sample gas duct is out of service or after it has been flooded with ambient air.
- The purge air supply must operate constantly, and the SR-unit must not be opened or swiveled up as long as it is attached directly on the measuring duct.
- If visual inspection of the power supply cable reveals damage to the insulation or strain-relief clamp, switch off the power supply to the cable in question immediately. The work must be performed in the specified sequence, with the result that the measuring system must be removed before the cables on the purge air unit are checked.

WARNING: Health risk through contact with toxic gases

The device contains enclosed potentially dangerous gases that can escape due to a defect or leak.

If a leak occurs, the concentrations inside the enclosed device can increase up to the following concentration.

CO and N_2O: max. total volume 10 ml

Max. concentration inside the device with a leak (defect): 350 ppm

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

WARNING: Hazard through overpressure in cavities!

With GPP probes, overpressure can arise in the reflector compartment or in the gas lines, e.g., through deposits of penetrating liquid, when the probe comes into contact with the hot sample gas. Open connections carefully, make visual and continuity checks.

- ▶ Make regular visual and continuity checks of the cavities.
- ▶ At the same time, take all precautionary measures described in the Operating Instructions when opening the connections.

9.2 Preparation and general preparatory work

Have the following equipment available for service work:

- Personal protective clothing and equipment (see safety information above)
- Means of communicating (telephone/cellular phone/mobile radio) with the personnel responsible for operating the plant as well as with the signaling control room
- Maintenance protocol
- At least the following tools:

Table 9: Required tools for maintenance work

Tools	Required for
2 x 24 mm open-ended spanners or ring spanners	Installing the measuring probe on the duct.
Open-ended spanner or ring spanner 19 mm	Installing the measuring probe on the SR-unit and optical adjustment.
Allen key set	
Sealing ring	Sealing the connection between measuring probe and SR-unit.
Insulated screwdriver set	Electrical connection work
TORX screwdriver, size 10	GPP probes
Materials	
Optical cleaning cloths without detergents	SICK Part No. 4003353
Distilled water	Moistening the cleaning cloths.
Clean cleaning cloths and a dusting brush	Cleaning the enclosure as well as internal cleaning of the purge air filter housing.
Adhesive, recommendation: quick-drying epoxy resin two-component adhesive	Fixing the SR-unit: fixing bolts.
Personal protective equipment	Work on gas ducts with hot or aggressive sample gases.

Spare parts	Required for
Replacement filter, Part No. 5 306 091	Purge air unit.
Replacement sealing ring	Sealing the connection between measuring probe and SR-unit.

- For a secure disassembly of the SR-unit with installed probe from the gas duct:
  - Suitable support to lay the SR-unit on with mounted measuring probe and attached plug-in connectors that protrude on the underside securely without them being damaged.
  - Alternatively, the angle flange that was perhaps used during start-up is well suited as bracket during maintenance work. High sample gas temperatures or space restrictions (duct insulation), however, can restrict the use of an angle flange.
  - If no angle flange is used, a suitable protective cover is required for the duct-side flange with tube to prevent gases from escaping from the duct when the measuring probe has been removed.
- Coordinate the repair activities, and the associated interruption in measuring operation, with the persons responsible for operating the plant.

All other service activities are carried out at the measuring point:

- Check that all the system components of the measuring system are present.
- Check the ambient conditions:
  - Do the ambient conditions regarding dust, temperature, and air humidity still match the intended conditions, or have they changed (for example, as a result of structural measures)?

9.3 Maintenance work on SR-unit and measuring probe

9.3.1 Taking the SR-unit with measuring probe off the sample gas duct

1 Remove the weatherproof cover of the SR-unit
   ▶ Unscrew the two knurled nuts on the top and lift the cover from the SR-unit.
2 Switch the power supply to the SR-unit off.

NOTICE: Leave the purge air supply switched on.

3 If no angle flange and no suitable support is available to lay the SR-unit together with the measuring probe with cable connections still connected down on the floor without damage:
   ▶ Unscrew the locking sleeves of the three plug-in connectors on the underside of the SR-unit and remove the plug-in connectors.
   ▶ Loosen the cable clamp for the functional earth and remove the cable.
4 Following the safety information, see “Safety”, page 99 exactly, and, in particular using suitable protective equipment, remove the SR-unit and mounted measuring probe out of the sample gas duct.
   »» To do this, loosen the four screw connections as shown on page 103 using two 24 mm wrenches, and remove the measuring probe with the SR-unit attached out of the sample gas duct without tilting it.

NOTICE: Quick-release fasteners on the SR-unit on the measuring duct
- When the GMP measuring probe is used: Do not open the quick-release fasteners.
- When the GPP measuring probe is used and/or if there is partial vacuum in the sample gas duct: Quick-release fasteners can be opened.

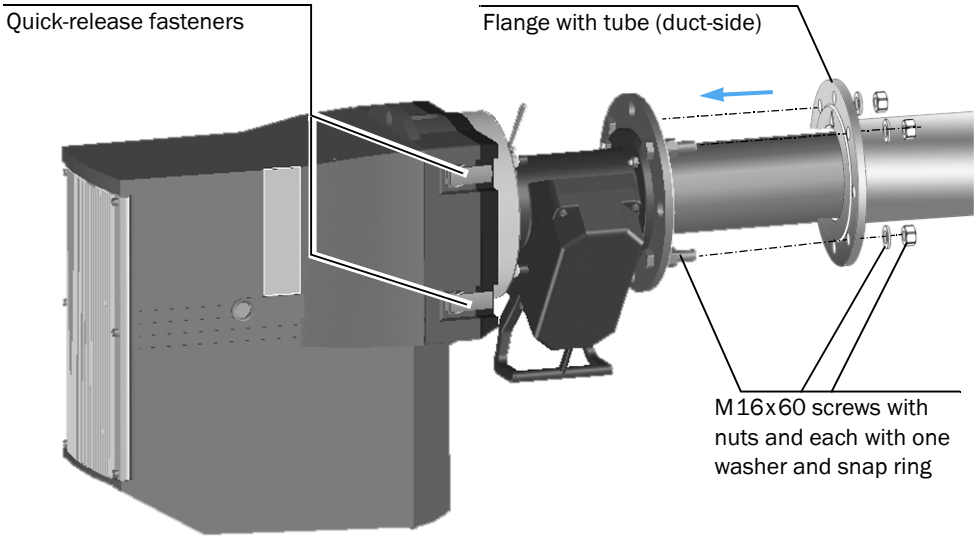


Fig. 61: Removing the measuring probe with attached SR-unit from the duct-side flange

5 Carefully lay the SR-unit with mounted measuring probe on the ground, either on a prepared bracket or, if the angle flange is to be used, on its side to prevent the cables on the underside being damaged.
   ▶ Insert the measuring probe with SR-unit in the angle flange from the right as shown, and secure it with at least two screws. The arrangement is important to allow the SR-unit to be swiveled forwards.

6 If the duct-side flange with tube is not sealed by the angle flange:
   ▶ Seal the duct-side flange with tube using a suitable protective cover to prevent gases or dust escaping from the duct.

If the system is equipped with a purge air supply, the supply can now be switched off. It can often be useful, however, to leave the purge air supply running (see also following warning). Detailed information on switching off the purge air unit, see “Maintenance work on the purge air supply”, page 106.

Risk of burns when touching the hot measuring probe
If the sample gas duct is operated at high temperatures, the measuring probe will remain hot for a long time after it has been removed.
- ▶ Wear protective clothing during work on the hot probe.
- ▶ GMP measuring probes cool down faster when the purge air supply remains switched on for a while.

9.3.2 Visual inspection and enclosure cleaning

- ▶ Check the measuring probe for corrosion, damage, and any obvious signs of condensate or dirt deposits. If the probe is damaged or shows excessive condensate deposits, contact SICK Service or your local sales representative.
- ▶ Check the sealing ring between the SR-unit and measuring probe (see “Removing the measuring probe with attached SR-unit from the duct-side flange”, page 103) seating is correct as well as for brittleness and replace it when necessary.
- ▶ Check the enclosure of the SR-unit for damage such as cracks,
- ▶ If a weatherproof cover is used, check its condition and whether the securing pins on the top of the SR-unit are secure. If necessary, apply new epoxy resin adhesive.
- ▶ Clean the visor on the right side of the SR-unit.
- ▶ Clean the entire enclosure of the SR-unit when contaminated.
- ▶ Check cables for damage. Pay special attention to any signs of abrasion or bending at cable entries and take protective measures when necessary. The prefabricated cables are available as spare parts; contact SICK AG Service when necessary.

9.3.3 Cleaning the optical interfaces on the SR-unit

WARNING: Take care when the duct is pressurized!
- ▶ If the duct is pressurized, appropriate protective measures must be taken, in particular wear a protective mask.
- ▶ Prepare a suitable cover for the opening on the device flange of the SR-unit and keep it available.
- ▶ Once the SR-unit has been opened, place the cover on the opening of the device flange immediately.

1 Check the optical interface on the SR-unit (front window, see page 108) for contamination and, if necessary, clean with an optical cleaning cloth. Do not use any detergents because these leave invisible residues that could falsify the measuring result. The cleaning cloths can however be moistened with distilled water when necessary.
2 Close and lock the SR-unit enclosure again and seal off the connection to the flange fixture with the four quick-release fasteners to protect the cleaned optical interface against humidity or dust.
3 When a purge air supply is fitted (GMP measuring probe):
   ▶ Continue with the maintenance for the purge air unit (page 106).

4 For GM35 measuring systems without a purge air supply (GPP measuring probe):
▶ Continue with, see “Resuming Measuring mode”, page 109.

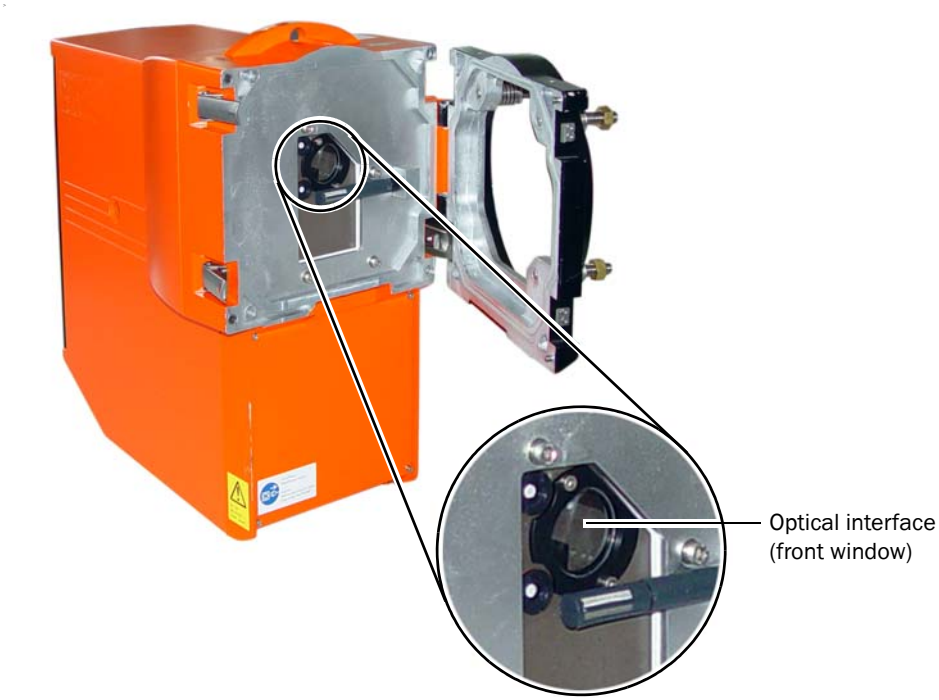


Fig. 62: Optical interface

9.4 Maintenance work on the purge air supply

9.4.1 Safety

Hot gases in ambient conditions with overpressure

WARNING: Risk of fire due to 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 as well as gas temperatures over 200 °C:

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

CAUTION: Device damage due to switching off the purge air unit too soon

When the purge air unit is switched off while the measuring probe is still in the measuring duct, coarse contamination can reach and damage the SR-unit.

- ▶ Only switch off the purge air unit after the measuring probe has been removed from the measuring duct.

9.4.2 General information on maintenance work on the purge air supply

This Section is only applicable for devices with purge air supply, i.e. when a GMP measuring probe is used.

The reliability of the purge air supply system is essential for ensuring the availability of the measuring system. Maintenance of the purge air supply is straightforward, but should be carried out extremely carefully.

Prerequisites for purge air supply maintenance:

- The measuring probe with the SR-unit is located outside the sample gas duct; if the duct contains a partial vacuum that is sufficient to flush it adequately with ambient air when the purge air supply is removed, the measuring probe can remain inside the sample gas duct while the purge air unit is being maintained.
- The SR-unit is fully open on the flange fixture so that any dust blown through the purge air hose during maintenance is not deposited on the optical interfaces of the SR-unit and measuring probe. In addition, the purge air hose should also be disconnected from the measuring probe during maintenance as described below.

9.4.3 Preparation and general inspection

1. With the purge air unit switched on, disconnect the purge air hose from the purge air inlet of the measuring probe or optional pressure difference sensor to prevent any dust that has been released during maintenance from being deposited on the optical interfaces of the measuring probe and SR-unit.
2. Switch off the power supply (three phase) for the purge air unit and attach a suitable warning to prevent it from being switched on again inadvertently during maintenance.
3. Remove the weatherproof cover, if fitted, from the purge air unit.
4. If there are noticeable external signs of contamination, clean the enclosure of the purge air unit and, if possible, locate the cause of the contamination. The frequency with which a filter change is necessary primarily depends on the dust content of the ambient air.

5 Make sure cables are not damaged along the whole length and connections are not loose, and check cables for corrosion and humidity.
6 Check the purge air hose carefully for damage. Pay special attention to points subjected to mechanical strain, such as on the hose clamps.
7 Check all remaining hose clamps on the purge air hose, purge air unit, and hose piece of the pressure difference sensor (option) to ensure these are secure, and tighten if necessary.
8 Pay particular attention that the dummy plug, which seals the second purge air outlet on some purge air unit versions, is securely in place.

9.4.4 Checking and replacing the purge air filter

The frequency with which the purge air filter has to be replaced depends on the dust content or contamination of the ambient air. Replacement is necessary at the latest when the low-pressure monitor at the filter outlet trips and signals a filter change is necessary.

In newly installed measuring systems, it is recommended to remove the filter element during the very first maintenance to check the level of contamination. This result helps to determine the filter replacement frequency.

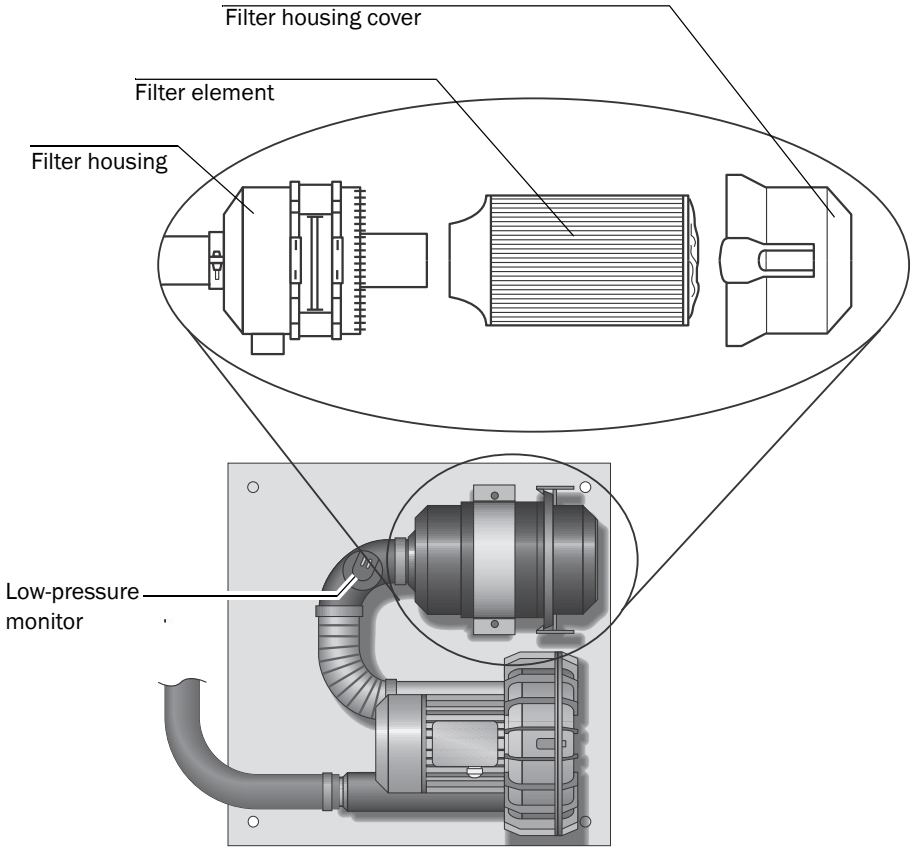


Fig. 63: Replacing the purge air filter element

NOTICE: Correct handling during filter maintenance
- Avoid creating dust clouds to prevent any contamination penetrating the measuring system.
- Do not use any detergents because deposits will falsify measurement results. Use clean cloths, that can be moistened with water only, when necessary.

1 Have a new filter element available.
2 Remove the filter housing cover by releasing the two snap locks on the side.
3 Pull the filter element, turn counterclockwise, out of the filter housing.
4 Clean the inside of the filter housing using a cloth and brush. Use only water and no detergents at all because detergent deposits can falsify measurement results later.

»» If it is still uncertain whether the filter element is to be replaced:
- ▶ Check the filter element for deposits, without creating any dust clouds.
- ▶ If the filter element is not contaminated significantly, it can be reinstalled instead of a new filter.

5 To install the new (or previous, uncontaminated) filter element, secure it to the spindle in the filter housing by turning/pressing it counterclockwise.
6 Fit the filter housing cover and align it with the filter housing so that the two snap locks on the side click into position.

9.4.5 Restarting and checking the purge air unit

1 Make sure that any dust possibly escaping from the open end of the purge air hose when the purge air unit is switched on again cannot be deposited on the measuring system:
   – Align the open end of the purge air hose so that the air flow can escape unhindered without creating dust clouds in the direction of the measuring system or measuring probe.
   – After the measuring probe has been taken out of the duct, cover the purge air inlet on the measuring probe temporarily to protect it from dust.
2 Switch the power supply to the purge air unit on and let it run briefly (approx. 2 min.) to remove any loose dust. The purge air hose is not yet connected to the measuring probe. When connecting, knock the filter housing lightly to remove any dust particles.
3 While the purge air unit is switched on, reconnect the purge air hose to the purge air inlet on the measuring probe or optional pressure difference sensor. Make sure the hose clamp is secure.
4 With the purge air unit switched on, check whether
   – a uniform air current is created at the open end of the measuring probe
   – the blower is operating quietly, without any noticeable vibrations or irregular noises.
5 Test whether the low-pressure monitor to monitor the filter and the connected signal unit are functioning correctly:
   ▶ Instruct the control room personnel, where the filter monitor signals are received, to monitor the signals.
   ▶ Partly cover the extraction aperture of the air filter briefly using a piece of cardboard or similar object (must not be sucked in or contaminate the filter).
   ▶ Check whether the low-pressure monitor responds by signaling that a filter change is necessary.

9.5 Resuming Measuring mode

9.5.1 Inserting in the sample gas duct

1 Make sure the SR-unit is securely mounted on the flange fixture, and therefore on the measuring probe, with the four quick-release fasteners.
2 If a purge air supply is used, make sure it is in operation and remains switched on from this point onwards.

WARNING: Hazard through hot, aggressive or pressurized sample gases
When carrying out the activities below, observe the safety instructions on page 99 at all times to prevent any hazards to health.

If the angle flange, Part No. 2 017 833, is used:

3 Remove the measuring probe with mounted SR-unit from the angle flange.
4 Disassemble the angle flange from the duct-side flange with tube.

If an angle flange is not used:

1 Remove the protective cover, when fitted, from the duct-side flange with tube.
2 Insert the measuring probe with mounted SR-unit in the duct-side flange with tube.
3 As shown in “Removing the measuring probe with attached SR-unit from the duct-side flange”, page 103, mount the measuring probe on the duct-side flange using the parts (4 screws M16x60, each with nut and 2 washers) removed earlier.
4 When using a GPP measuring probe, it is important to restore the power supply quickly (see “Electrical connection”, page 110) so that the optical interfaces in the measuring probe are heated again as fast as possible.

9.5.2 Electrical connection

1 If the plug-in connectors and cable for the functional earth on the underside of the SR-unit were removed, connect these again. Tighten the sleeves to secure the plug-in connectors. The arrangement is shown on page 90.
2 Make sure the cables are laid correctly, without tensile loading.
3 When using a GPP measuring probe, make sure the separate power supply cable is connected correctly.
4 Switch the power supply of the SR-unit on again.

9.5.3 Checking and adjusting the optical alignment of GM35

Check the alignment of the optical axis using the visor on the right-hand side of the SR-unit enclosure and by making adjustments on the probe fixing on the device flange. The function "**ADJ. OPT. ALIGN**" must be activated on systems with automatic alignment, see "Aligning the optical axis of the measuring probe", page 84.

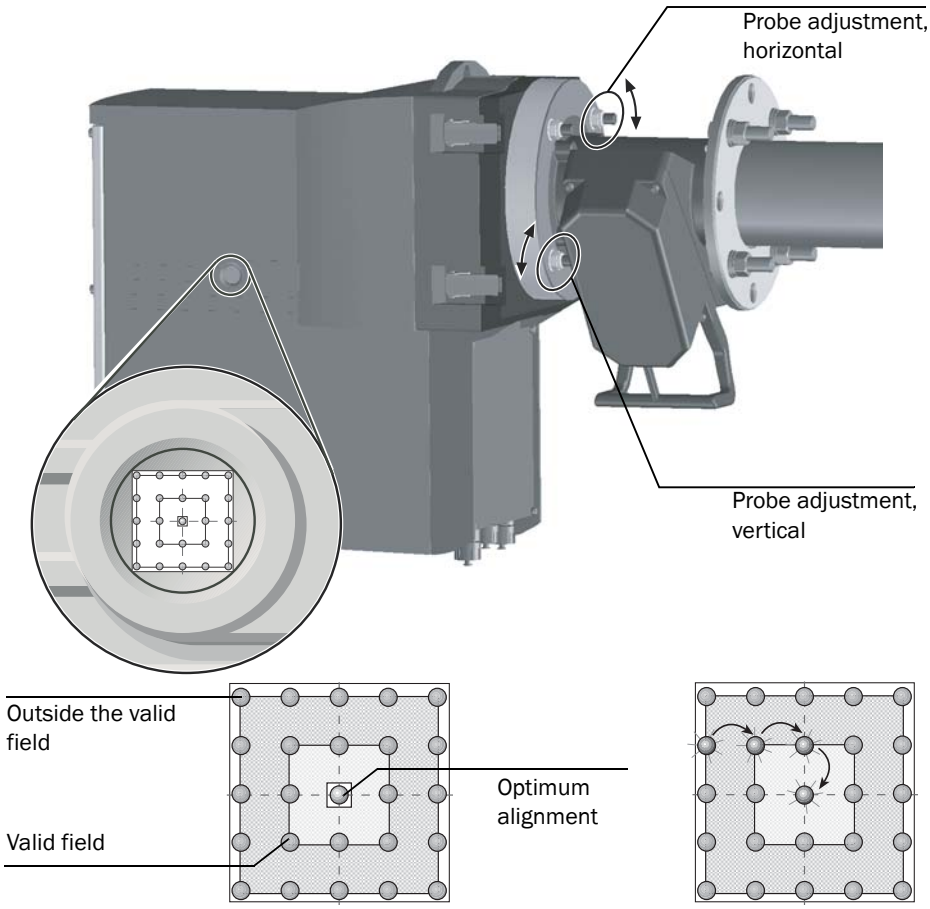


Fig. 64: Aligning the optical axis

Visor The visor indicates the alignment of the optical axis between the SR-unit and the reflector in the probe using a 5 x 5 LED matrix. The LEDs light up to represent the position of the light beam on the reflector at the probe end. The cross hairs show three fields for aligning the probe.

1 Adjust the optical alignment as shown on page 111 by adjusting two screws on the device flange with a 19 mm wrench whilst observing the light position of the LED at the same time.
2 Horizontal probe adjustment causes the light spot to shift horizontally on the visor and vertical adjustment causes a vertical shift.
3 Alignment is correct when the lit LED is located within the valid field within the cross hairs, or is completely within the inner ring marking of the cross hairs.

Note For further information and significance of the LED matrix display on the GM35, see "Checking the EvU display", page 86.

9.5.4 Completing maintenance work at the measuring point

- ▶ If the SR-unit was equipped with a weatherproof cover, refit it again.
- ▶ Note work done, special observations, information for future maintenance work as well as requirements for parts that need to be ordered in the Maintenance protocol.

9.6 Evaluation unit (EvU)

The evaluation unit is designed for maintenance-free operation over the entire service life of the measuring system. If the evaluation unit is mounted outdoors, the following simple checks should be carried out regularly due to the load resulting from changing weather conditions:

- Visual inspection
  - Is the enclosure undamaged and the fitting intact?
  - Does the enclosure front door open and close easily?
  - Is the enclosure window free from moisture?
  - Does the illuminated LC display on the evaluation unit function correctly?

1 Open the evaluation unit door and check the following:

WARNING: Risk of injury through exposed electrical connections
The electrical connections are exposed when the evaluation unit door is open.
- ▶ Observe the relevant safety regulations.

  - Are the cable connections OK?
  - Is the enclosure dry inside?

If the answer to any one of these questions in this Section (page 112) is not “yes”:

- ▶ Clarify the cause.
- ▶ Carry out any repairs necessary.

If the evaluation unit is damaged (e.g. LC display failure):

- ▶ Contact SICK Service or the local sales representative.

9.7 Box measuring: Checking the measuring ducts for CO or N_2O and CO_2

The gas filter box serves to check the CO (N_2O) and CO_2 measuring duct of the GM35 with test gases; for CO_2 up to a concentration-measuring path product of 15 % by vol. x m).

Requirements Components required:

- Reflector enclosure with gold-plated hollow triple reflector; Part No. 2030206.
- Filter box adapter plate with cutout section for the humidity sensor (front of the SR-unit).

Note CO or N_2O measured values are displayed on the EvU in **mg/m³ • m** (operation),

CO_2 measured values are displayed in **g/m³ • m** (operation).

9.7.1 Determining the necessary test gas concentration

1 General calculation:

$$\text{Test gas conc. [ppm or \% by vol.]} = \frac{\text{Meas. range [ppm or \% by vol.]} \bullet \text{Actual meas. path [m]}}{\text{0.15 m max. filter box length}}$$

2 Calculating setpoint values for all 6 chamber lengths:

$$CO_{nom.} = \text{Test gas conc. [ppm]} \bullet 1.25 \bullet \frac{273}{353} \bullet \frac{\text{Act. air pressure [hPa]}}{1013} \bullet L\,[mm]_{chamber} \bullet 0.001$$

$$N_2O_{nom.} = \text{Test gas conc. [ppm]} \bullet 1.963 \bullet \frac{273}{353} \bullet \frac{\text{Act. air pressure [hPa]}}{1013} \bullet L\,[mm]_{chamber} \bullet 0.001$$

$$CO_{2\,nom.} = \text{Test gas conc. [\% by vol.]} \bullet 1.963 \bullet \frac{273}{353} \bullet \frac{\text{Act. air pressure [hPa]}}{1013} \bullet L\,[mm]_{chamber} \bullet 0.001$$

Comp.	Required test gas concentration					
	Filter chamber lengths					
	25 mm	50 mm	75 mm	100 mm	125 mm	150 mm
CO						
CO_2						

9.7.2 Carrying out measurement

1 Open the SR-unit and swivel to the side.
2 Attach the filter box with the adapter plate to the SR-unit and secure using quick-release fasteners. Take care not to damage the humidity sensor of the SR-unit!
3 Fit the reflector for the GM35.

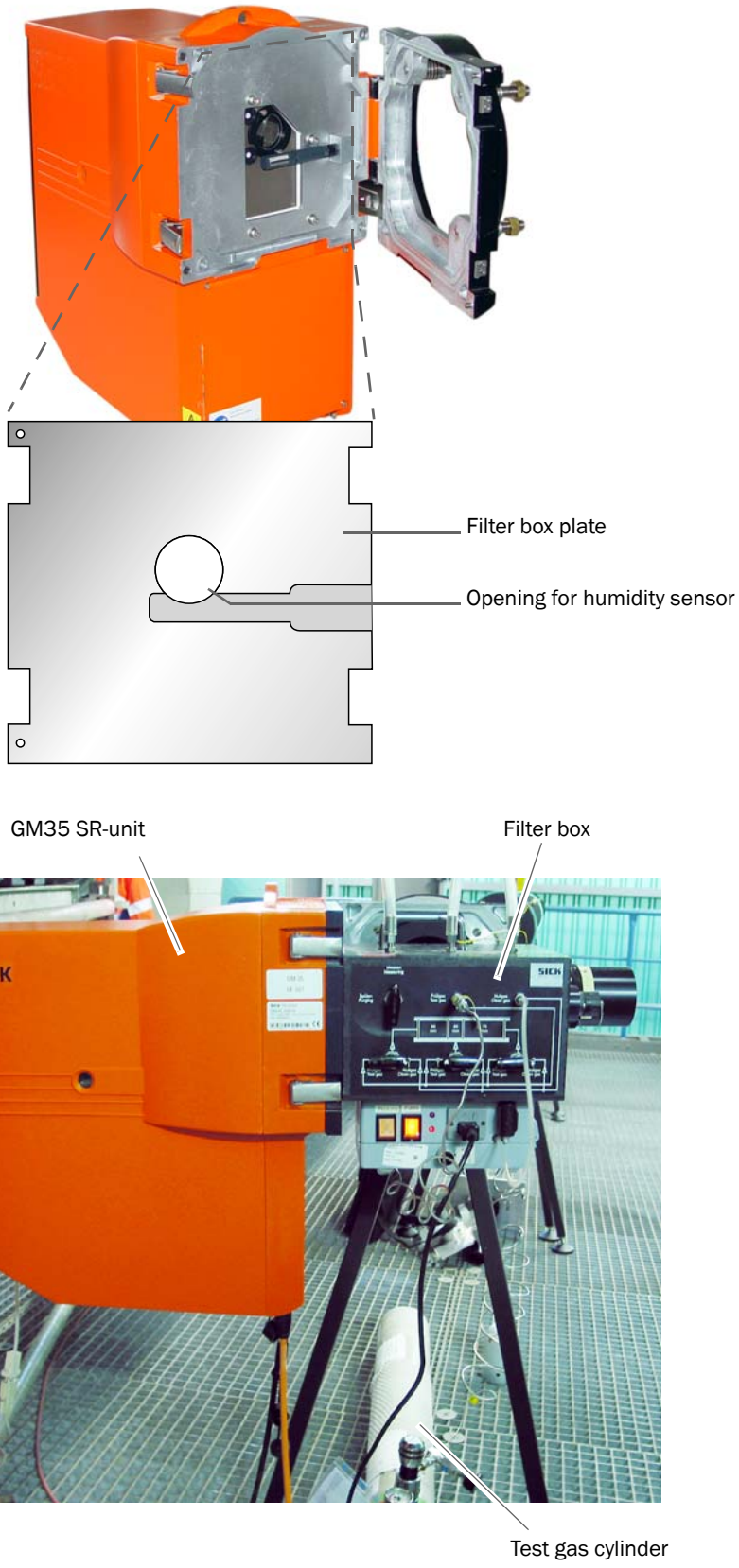


Fig. 65: Installing the filter box

4 Switch the filter box on; the warming up phase takes about 2.5 hours.
5 Switch on the zero gas pump or connect a different zero gas.
6 Switch all chamber valves to “Zero gas” and switch the **Measuring**/**Purging** valve to “Purging”.

On the EvU:

7 After about 3 minutes, select menu **Box measuring** in menu **cal** (**cal** button) then option “gas”.
8 Enter password “**1 2 3 4**”.
9 The measuring device carries out a zero adjust and then switches to operating mode “**Box measuring**”.

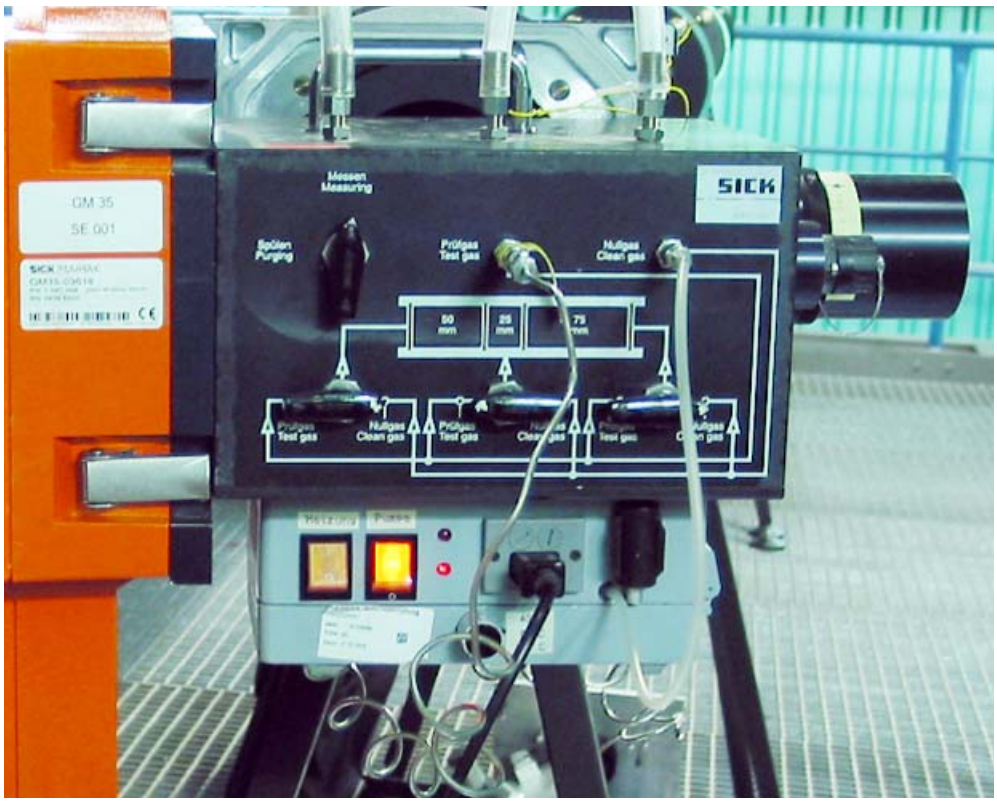


Fig. 66: Control elements on the filter box

10 Connect test gas; set the primary pressure to approx. 1000 hPa (1 bar).
11 Note the diameters of the individual chambers/chamber combinations in the filter box and the concentration values; see “Determining the necessary test gas concentration”, page 113.
- ▶ When doing so, set the valves for the relevant filter chambers to “**Test gas**”.
- ▶ Switch the **Measuring**/**Purging** valve to “Purging” for 2 to 3 minutes (until the measured value has stabilized) and then to “Measuring”.
- ▶ The overpressure from the purge phase now dissipates.
- ▶ When the measured value has stabilized again, read off and note the value.

9.7.3 Restart Measuring mode

1 Purge the filter box with zero gas

On the EvU:

2 Exit operating mode “**Box measuring**” by pressing **back**.
3 Disassemble the filter box with plate and reflector from the SR-unit and store safely
4 Refit the SR-unit back onto the measuring point in the correct position.

9.8 Box measuring: Checking the measuring ducts for H_2O and CO_2

The grid filter box serves for checking the H_2O and CO_2 measuring duct (for products with very high concentration measuring paths) of the GM35. Box measuring is based on light absorption of grid filters (output of measured extinction).

Requirements Components required:

- Grid filter box RMF
- Filter box adapter plate with threaded holes to attach the grid filter box.

Note Measured value are displayed as extinction for both measuring ducts (H_2O, CO_2).

9.8.1 Setpoint values

The RMF grid filters are calibrated. The setpoint values for the individual filters are shown on the label on the enclosure. Filters with extinction values up to 0.8, suitable for the application range of the GM35, are used. Higher extinction values exceed the warning or malfunction threshold for not sufficient signal level.

9.8.2 Carrying out measurement

1 Open the SR-unit and swivel to the side.
2 Attach the RMF filter box with the adapter plate to the SR-unit and secure using the quick-release fasteners: Take care not to damage the humidity sensor of the SR-unit!
3 Install the reflector and set the operating lever to “**GM35**”.

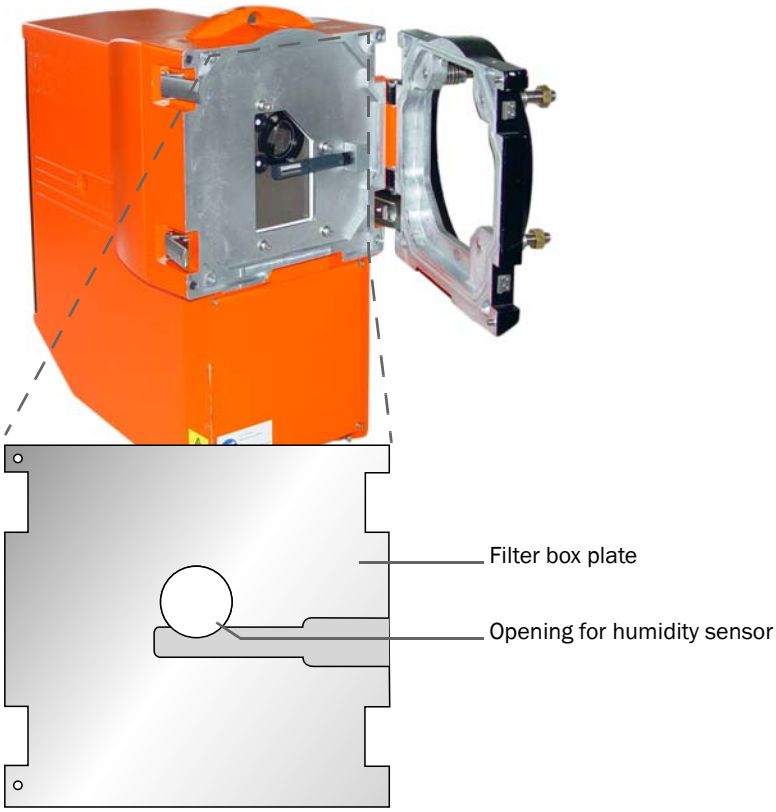


Fig. 67: Installing the filter box

4 Insert the push rod for filter selection completely; at the same time, make sure the filter is swiveled out.

On the EvU:

5 Select filter box mode “**Grid**”

6 Enter the password “**1 2 3 4**” and wait for scaling to complete.

Measurement can start as soon as the display shows the extinction values for H_2O and CO_2.

7 Select the different positions of the push rod sequentially and swivel the appropriate filter in
8 When the measured value has stabilized again, read off and note the value.

Fig. 68: Measured value display on the EvU

9.8.3 Restart Measuring mode

On the EvU:

1 Exit operating mode “**Box measuring**” by pressing **back**.
2 Disassemble the filter box with plate and reflector from the SR-unit and store safely
3 Refit the SR-unit back onto the measuring point in the correct position.

10 Troubleshooting and Clearing Malfunctions

This Section shows how Gas Analyzer GM35 malfunctions can be recognized, diagnosed and cleared. It is primarily aimed at the operating personnel responsible for the current operation of the measuring system as well as maintenance technicians responsible for clearing malfunctions.

10.1 Malfunction categories/possible effects

GM35 malfunctions are categorized according to the anticipated effects:

Damage to the measuring system itself

Depending on the installation conditions and measuring system version, a purge air failure could cause damage to the GM35. “Purge air failure” describes the necessary emergency and protective measures.

10.2 Purge air failure

Failure of the purge air supply demands measures to be taken immediately or within a short time, depending on the installation conditions, to protect the measuring system. A purge air failure, however, rarely occurs in practice. It is still however wise to be prepared for such an occurrence to prevent damage to the measuring system.

Indications of a potential purge air failure

- Error message on systems that are equipped with a pressure difference sensor
- Purge air unit power supply failure
- Increase in the enclosure temperature of the GM35 SR-unit
- Rapid increase in contamination on the optical interface of the SR-unit
- Hose for the purge air supply to the purge air fixture is visibly loose or damaged.

Tools for troubleshooting

- Suitable protective equipment (protective clothing, protective gloves, etc.) that enable the gas duct to be opened safely and the SR-unit as well as the measuring probe removed under the given installation conditions (hot/corrosive/noxious/dusty sample gases, overpressure in the duct).
- 2 wrenches to remove the measuring probe and, possibly, other tools required to restore the power supply.
- Flange cover to seal off the flange opening when the measuring system is removed.

10.3 Integrated monitoring and diagnosis system

The GM35 is equipped with an integrated system that constantly monitors the operating state of the SR-unit and evaluation unit. Appropriate messages are generated and logged in the devices for subsequent evaluation should any deviations from normal operating states occur.

Messages for the two system components are categorized into error messages and warning messages depending on the anticipated effects:

- Warning messages are generated if the measurement results are not (yet) directly affected by the change in the system state. Nevertheless, it is important that the cause(s) be investigated and corrected, e.g. by means of maintenance measures, to avoid further malfunctions and damage to the device in particular.
- Error messages are generated when measuring operation is no longer possible or no longer reliable.

These warning and error messages are stored in the integrated message memory of the evaluation unit.

Message signaling and retrieval on the evaluation unit

Operation
Service
Warning
Malfunction

Component/Tool	Signal	Remark
Front panel Evaluation unit	**Warning LED** goes on	Functional impairment on system that will not directly lead to corrupt measured values.
	Malfunction LED blinks	Functional impairment on system that can lead to system failure or restricted function. *See error memory, logbook.*

Diagnosis mode

diag

Diagnosis
▶ Malfunction
Warning
Sensor values
Check values
← back

Error memory	▶ Call up menu **Error**	Plain-text message(s) for errors that have occurred to localize and clear the problem. See “Troubleshooting Table”.
Warning memory	▶ Call up menu **Warning**	Plain-text message(s) for pending warnings.
Output for problems (malfunction, error message)	Relay 1 inactive*	Group malfunction.

* The relay is active during normal operation (no malfunction), i.e. the contact is closed.

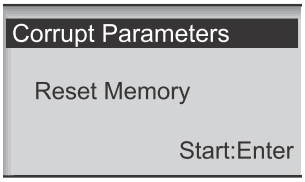
Procedure

Troubleshooting Table

If a warning or malfunction is signaled, first call up pending error messages in the Error menu. Then localize the possible cause and clear the malfunction; see Troubleshooting Table.

Error indication	Possible cause	Clearance
• **LED Malfunction** blinks; (**LED Warning** could go on) • Relay 1: **Group malfunction**	Plain-text error messages indicate possible causes	▶ Start **Diagnosis mode (diag)**: – Call up menu **Error** (or **Warning**) – Check and clear the specified malfunction.

10.3.1 Troubleshooting and clearing malfunctions, evaluation unit

Error description/message	Component/possible cause	Clearance
Evaluation unit not responding	Evaluation unit: • Evaluation unit power supply defective.	▶ Check power supply on all system components: – If necessary, provide power supply on site. – If necessary, check/reconnect connections on the system components.
	Evaluation unit: • Incorrect operating voltage.	▶ Check operating voltage set on the evaluation unit: – If necessary, change setting.
	Evaluation unit: • Defective fuse.	▶ Check fuse in the evaluation unit: – If necessary, replace fuse.
	Evaluation unit: • No defect localized yet.	▶ Disconnect all system components from the power supply and reconnect one at a time. ▶ Check the CAN bus cable from the evaluation unit to the SR-unit resp. terminal box.
	Evaluation unit: • Error occurs again.	▶ Replace the last component connected, contact Service.
	Evaluation unit: • 24V/5V supply defective.	▶ Check 24V/5V supply, replace evaluation unit resp. electronic board module; contact Service.
	Evaluation unit: • Inconsistent data detected in parameter memory.	▶ Press Enter to restart the system; the factory parameter settings are then active; ▶ If necessary, reconfigure the parameters. ▶ If the same error message occurs again, replace the EvU and contact Service

10.3.2 Error messages for the GM35 SR-unit

The following error messages, which can be displayed on the evaluation unit, refer to the GM35 SR-unit.

Error message	Component/possible causes	Clearance
Air purge low SLV	Volume flow is below the set threshold.	▶ Check purge air supply (blower, hoses), exchange filter on purge air blower when necessary, see “Checking and replacing the purge air filter”, page 107.
CO Ampl. Max **N_2O Ampl. max**	CO (N_2O) measurement amplifier above dynamic range.	▶ Check alignment; see page 111. ▶ Cleaning optical interfaces, see page 104. ▶ Contact Service.
CO com. N_2O **com.**	CO_2/H_2O module not connected to CO (**N_2O**) module.	▶ Check cable connection and correct seat of the plug connection; repair in the GM35 when necessary ▶ If the error cannot be cleared: Contact Service.
CO CUVETTE com. N_2O **CUVETTE com.**	CO (N_2O) module not connected to CO cell motor.	▶ Contact Service.
CO CUVETTE range N20 CUVETTE range	• CO (**N_2O**) duct in reference cycle outside expected range. • CO (**N_2O**) cell may be leaking.	▶ Exchange the measurement module or contact Service.
CO div. Zero N_2O **div. zero**	CO (N_2O) module adjustment data invalid.	▶ Contact Service.

Error message	Component/possible causes	Clearance
CO EEPROM N_2O **EEPROM**	Invalid parameter set for CO (N_2O) module.	▶ Reset parameters! ▶ Call up Maintenance mode (maint). ▶ Trigger menu item Reset Parameters. ▶ Carry out zero adjust on GM35; see page 87. ▶ Contact Service.
CO Motor fault N_2O **Motor fault**	Motor fault of CO (N_2O) filter wheel.	▶ Contact Service.
CO No signal N20 No signal	• CO (**N_2O**) signals too low, measurement not possible. • Dust content too high. • CO detector or IR source defective. H2O, CO2 measuring ducts continue to run.	▶ Check contamination; clean optical interfaces (see page 104f). ▶ Check optical alignment, see page 111. ▶ Exchange IR source or measurement module, or contact Service.
CO Sig. High N20 Sig. High	CO (N_2O) signals distorted, H2O, CO2 measuring ducts continue to run.	▶ Carry out zero adjust, see page 87.
CO temp. detec. N_2O **temp. detec.**	CO (N_2O) detector temperature outside tolerance	▶ Contact Service.
EI too hot SLV	Electronics too hot.	▶ Improve SR-unit cooling system.
Filter com.	CO_2/H_2O module not connected to motor of check filter.	▶ Contact Service.
H2O Ampl. Max	CO_2/H_2O measurement amplifier above dynamic range.	▶ Check alignment; see page 111. ▶ Cleaning optical interfaces, see page 104. ▶ Contact Service.
H2O CUVETTE com.	CO_2/H_2O module not connected to motor of cell.	▶ Contact Service.
H2O div. Zero	CO_2/H_2O module adjustment data invalid.	▶ Carry out zero adjust, see page 87. ▶ Contact Service.
H2O EEPROM	Invalid parameter set for CO_2/H_2O module.	▶ Reset parameters! – Call up Maintenance mode (maint). – Trigger menu item Reset Parameters. ▶ Carry out zero adjust on GM35; see page 87. ▶ Contact Service.
H2O Motor fault	Motor fault on CO_2/H_2O filter wheel.	▶ Contact Service.
H2O No signal	• H2O signals too low; measurement not possible. • Dust content too high. • H2O detector or IR source defective. • CO (N_2O) measuring duct continues to run.	▶ Check contamination; clean optical interfaces (see page 104f). ▶ Check optical alignment, see page 111. ▶ Exchange IR source or measurement module, or contact Service.
H2O Sig. High	CO_2/H_2O measurement signal distorted.	▶ Readjustment necessary, see page 87. ▶ Contact Service if necessary.
H2O temp. detec.	CO_2/H_2O detector temperature outside tolerance.	▶ Contact Service

Error message	Component/possible causes	Clearance
Mirror adj. End	Automatic beam tracking at end stop, further tracking not possible.	▶ Check alignment; see page 111. ▶ Contact Service.
Mirror com.	No communication with automatic beam tracking; measurement continues to run.	▶ Contact Service.
Sensor communication	No connection between EvU and GM35.	▶ Check CAN connection, repair if necessary.
VISOR com.	CO_2/H_2O module not connected to visor unit.	▶ Check cable connection is secure with correct seat; repair if necessary. ▶ If the error cannot be cleared: Contact Service.
VISOR fault	Visor unit data invalid or signals distorted.	▶ Check alignment; see page 111. ▶ If no display seen in visor during alignment or if message remains despite correct alignment, contact Service.
VISOR init.	Visor default setting invalid.	▶ Contact Service.
VISOR No signal	• Visor signals too low. • Dust content too high. • IR source defective. Measurement continues to run.	▶ Check contamination; clean optical interfaces (see page 104f). ▶ Check optical alignment, see page 111. ▶ Exchange IR source or contact Service.
Zero com.	CO_2/H_2O module not connected to motor of zero point reflector.	▶ Check cable connection is secure with correct seat; repair if necessary. ▶ If the error cannot be cleared: Contact Service.

10.3.3 Error messages for the measuring probe

The following error messages can be displayed on the evaluation unit via menu **malfunction**.

Error message	Component/possible causes	Clearance
Sensor communication	No connection between evaluation unit and measuring probe.	▶ Check CAN connection, repair when necessary ▶ Check power plug on the probe, repair when necessary.
EEPROM defective	Permanent memory is not initialized or defective.	▶ Contact Service.

10.3.4 Warning messages for the GM35 SR-unit

Warning message	Component/possible causes	Clearance
Chopper freq.	Chopper disk frequency outside tolerance.	▶ Exchange lamp module; contact Service.
CO Low sig. N_2O Low sig.	• CO (**N_2O**) measuring duct contaminated. • Dust content too high. • IR source aged.	▶ Check contamination; clean optical interfaces (see page 104f). ▶ Check optical alignment, see page 111. ▶ Exchange IR source or contact Service.
CO not ready N_2O **not ready**	• CO (**N_2O**) measurement not yet ready. • Signal distorted. • Warming up phase.	▶ Wait approx. 30 minutes until the operating temperature is reached. ▶ Contact Service if necessary.
CO Reference N_2O Reference	Deviating control value measurement too high.	▶ Carry out zero adjust on GM35; see page 87. ▶ Perform maintenance, see page 99. ▶ Contact Service if necessary.
CO2 Reference	Deviating control value measurement too high.	▶ Carry out zero adjust on GM35; see page 87. ▶ Perform maintenance, see page 99. ▶ Contact Service if necessary.
H2O Low sig.	• H2O measuring duct contaminated. • Dust content too high. • IR source aged.	▶ Check contamination; clean optical interfaces (page 104f). ▶ Check optical alignment, see page 111. ▶ Exchange IR source or contact Service.
H2O not ready	• CO_2/H_2O measurement not yet ready. • Signal distorted. • Warming up phase.	▶ Wait approx. 30 minutes until the operating temperature is reached. ▶ Contact Service if necessary.

Warning message	Component/possible causes	Clearance
H2O Reference	Deviating control value measurement too high.	▶ Carry out zero adjust on GM35; see page 87. ▶ Perform maintenance, see page 99. ▶ Contact Service if necessary.
HYGRO com	No connection between CO_2/H_2O module and humidity sensor.	▶ Check cable connection is secure with correct seat; repair if necessary. ▶ Switch to default value. ▶ If the error cannot be cleared: Contact Service.
HYGRO com.	“Hygro” communication interrupted. • Sensor defective or cable broken. • Contact problem.	▶ System switches to default value ▶ Check cable connections. ▶ Exchange sensor.
HYGRO internal	No communication with internal humidity sensor. • Sensor defective. • Cable broken.	▶ Check cable connections. ▶ Exchange sensor.
MIRROR adj.	Automatic beam tracking: Deviation of optical axis is greater than area that can be tracked.	▶ Realign optical axis between SR-unit and reflector, see page 111.
MR Adjustment	Visor unit shows deviation (> 0.5 of setpoint position).	▶ Realign optical axis between SR-unit and reflector; see page 111.
Software version	EvU and SR-unit incompatible.	▶ Install compatible (current) software for EvU and SR-unit. ▶ Contact Service if necessary.
VISOR amplifier	Amplifier in visor at limit.	▶ Check contamination; clean optical interfaces, (page 104f). ▶ Exchange IR source or contact Service.

10.3.5 Warning messages for the measuring probes

Service requirement–message on the EvU	Component/possible causes	Clearance
El too hot	Electronics too hot.	▶ Improve GPP cooling.
Heater defect	Heater defective.	▶ Repair heater.
Heating too low	Setpoint temperature not reached.	▶ Set setpoint temperature lower. ▶ Contact Service.
I_Heat < 1.5 A	Heating current too low (GPP).	▶ Check heating control cable, repair when necessary.
I_Heat no signal	No heating current (GPP).	▶ Check heating control.
P no signal	No signal from pressure sensor.	▶ Check pressure sensor cable, repair when necessary.
P out of range	Pressure sensor without valid measured value.	▶ Check pressure sensor, repair when necessary.
[t] no signal	No signal from temperature sensor.	▶ Check temperature sensor cable, repair when necessary.

10.3.6 Further tips on troubleshooting

Troubleshooting on the evaluation unit

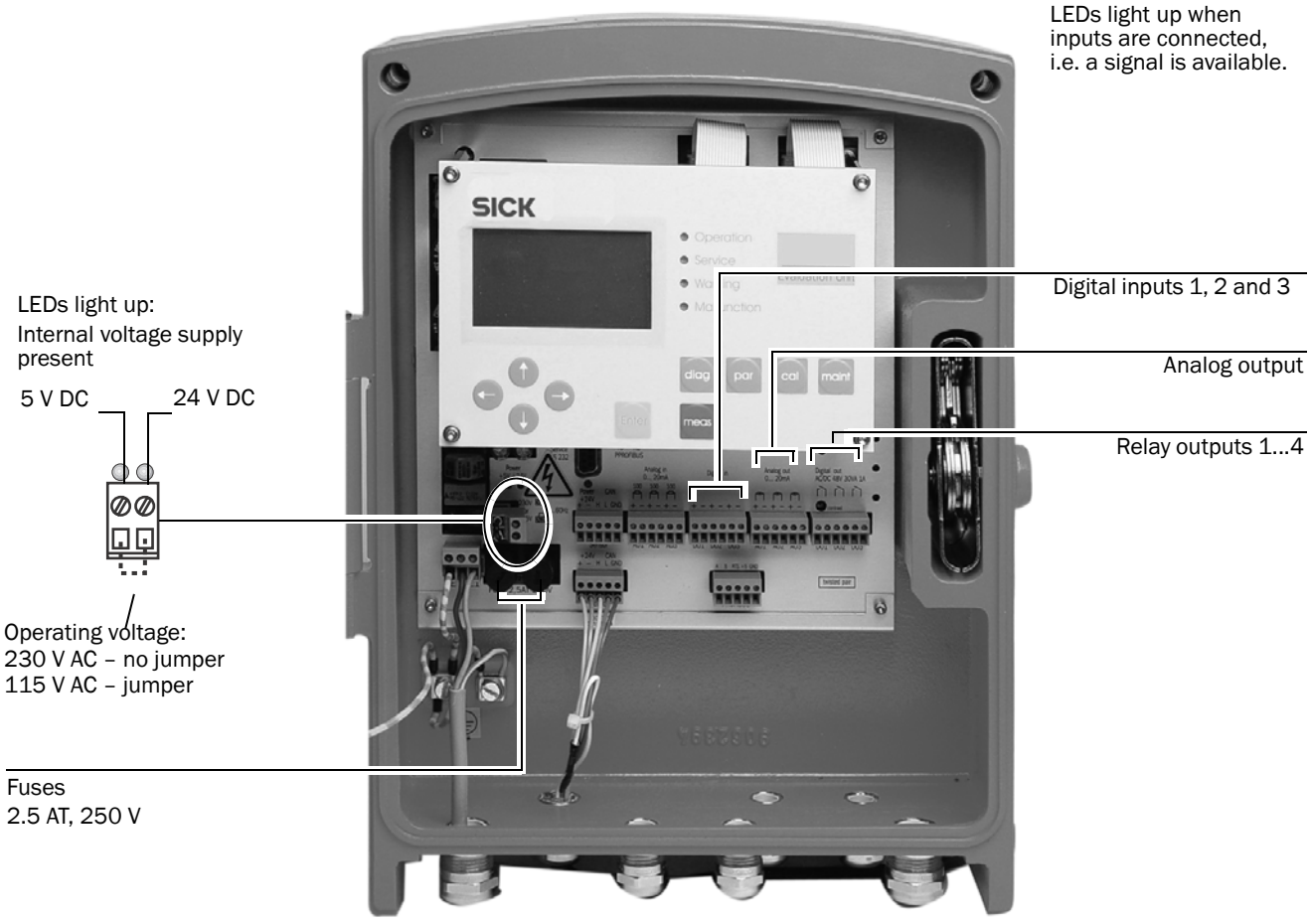


Fig. 69: LED displays, signals and fuses on the evaluation unit

Evaluation unit not responding

1 Check power supply on GM35.
2 Check operating voltage set.
3 Check fuse in evaluation unit.
4 Check indicator for 24 V -/5V supply in the evaluation unit, when doing so, remove the plug-in terminal on the cable to the receiver when necessary.
5 If these indicators only light up when the plug-in connector has been removed, check the cabling first.

Communication fault between evaluation unit and GM35 SR-unit.

Error message: **Sensor Communication???**

The receiver sends a constant stream of data to the evaluation unit; if this is not received, a prompt is output automatically.

Check following connections:

1 Connection between evaluation unit and SR-unit.
2 Cable connection on the plug-in terminal in the evaluation unit.
3 Cable to SR-unit.
4 Outer plug-in connectors on SR-unit.
5 Inner plug-in connectors in SR-unit.

11 Technical Data, Consumables and Spare Parts

All the technical data are provisional specifications for GM35 applications. The GM35 analyzer is calibrated for specific applications once all the technical details have been clarified.

11.1 Data Tables

11.1.1 Measuring components and accuracy

The minimum measuring range end values for the measuring components available with the different device version are specified for a 1 m measuring gap. The maximum measuring range end value for 1 m measuring gap is for

- CO: 25,000 **mg/m³**
- N_2O: 5,000 mg/m³
- H_2O and CO_2: 100 % by vol.

All the data refer to devices calibrated at the factory.

Measured Data	
Measuring path	Depending on the probe: Measuring gap 0.25...1.75 m
Measuring ranges	For 1 m actual measuring path • CO: 0...225 **mg/m³** • **N_2O: 0... 120 mg/m³** • CO_2: 0...22.5 % by vol. • H_2O: 0...25 % by vol.
Accuracy	Stability relative to measuring range end value • Zero point: ± 2% • Sensitivity: ± 2% (in maintenance interval)
Suitability test	2001/80/EC and EN 2000/76/EC[1]

[1] Cross-Duct and GMP version for CO,N_2O, CO_2, H_2O

Combining measuring components

Minimum and maximum measuring range end values only apply to individual components. Extremely small or large end values for different components cannot be combined in all cases.

Influence of the probe version

The measuring range values are valid for an active measuring gap of 1 m. Depending on the measuring gap MDI used, all the measuring ranges are increased or reduced by the factor 1/MDI [m]. The following factors apply for standard probe versions:

Active measuring gap [mm]	**Factor for full scale value (FS)**
1250	FS * 0,8
1000	FS * 1
750	FS * 1.33
500	FS * 2
250	FS * 4

11.1.2 Stability

Requirement	Stability relative to FS	Time frame
Zero point	± 2%	• Acc. to U.S.-EPA over 7 days • Without intervention and acc. to the minimum requirements during the maintenance interval of at least 3 months
Sensitivity	± 2%	

11.1.3 GM35-system components

GM35 Sender/receiver unit	
Measuring principle	In-situ, IR filter or gas correlation
Light source	IR source
Detectors	PbS and PbSe
Response time (t_{90})	5 ... 300 s with GMP measuring probe (open probe version); tested for suitability with 35 s
Averaging	Can be parameterized as floating integral over 5 to 300 seconds
Interfaces	CAN bus (electrically isolated) for transferring data within the GM35 measuring system RS232 (Service interface)
Indicators	• Status LED (operation: green, maintenance: yellow, malfunction/ failure: red) • Displays the optical alignment
Protection class	IP 65 / NEMA 4x
Max. sample gas temperature	• 430 °C • N_2O : Up to 180 °C
Ambient temperature	–20 to +55 °C; other temperatures on request (tested for suitability according to minimum requirement –20 ... 50 °C)
Temperature change	Max. 10 °C/h
Ambient humidity	Max. 96 % rF
Humidity condensation	Humidity condensation on optical interfaces not allowed
Shock and vibration	As defined in EN 61010-1
Storage temperature	–30 to +55 °C
Power supply	115/230 V AC ±10%, 48 – 62 Hz
Power input	350 VA max.
Dimensions (W x H x D)	291 x 530 x 570 mm
Weight	29 kg

GM35 measuring probes	GMP 35	GPP 35
Design	Measuring path in flow direction open; purge air supply required	Gas diffusion measuring probe; versions for dry and wet sample gas available
Reflector	The reflectors for all GM35 variants for the CO measuring duct are gold-plated; reflectors for other versions are hollow triples made of quartz.	
Integrated sensors	For sample gas temperature and pressure	For sample gas temperature and pressure
Data transfer	CAN bus (electrically isolated)	CAN bus (electrically isolated)
Heating the optical interfaces	–	Yes, with built-in heating control
Power supply	–	Separate supply: 115/230 V AC; 50/ 60 Hz, power input max. 150 VA
Dimensions and active measuring paths	see page 132	see page 134
Weight	Max. 25 kg	Max. 45 kg

Purge air unit	
Power supply (three-phase)	• Δ 200–240 V, Y 345–415 V at 50 Hz • Δ 220–275 V, Y 380–480 V at 60 Hz
Rated current	• Δ 2.6 A / Y 1.5 A at 50 Hz • Δ 2.3 A / Y 1.3 A at 60 Hz
Motor rating	• 0.35 kW at 50 Hz • 0.45 kW at 60 Hz
Flow rate	Min. 40 m³/h
Dimensions (W x H x D)	550 x 550 x 270 mm
Weight	14 kg

GM35 Evaluation unit (EvU)		
Connections/interfaces		
Data transmission within the GM35 measuring system		CAN bus • Max. line length 1000 m • Electrically isolated • Connects EvU, SR-unit, measuring probe
Service interface for PC		RS 232 • Connection via 9-pole Sub-D socket • Modem capability
Analog outputs	3 pcs	Output range: 0–20 mA, max. 500 Ω, electrically isolated, live zero adjustable to 4 mA
	A1–A3	Measured values; assignment can be set individually
Analog input		0 ... 20 mA, 100 Ω
Status outputs	3 pcs	Relay, NO contacts DC max. 30 W, 48 V, 1 A; AC max. 60 VA, 48 V, 1 A
	R1	Failure
	R2	Maintenance request
	R3	Function control
Status inputs	3 pcs	Inputs for connecting potential-free contacts (loadable with 24 V; supplied by GM35 evaluation unit)
	E1	Check cycle
	E2	Autocal GM35 in preparation
Power supply		
Voltage/frequency		115/230 V AC ±10%; 50/60 Hz
Power input		50 VA max.
Dimensions, weight, protection class		
Protection class		IP 65 / NEMA 4x
Dimensions		Dimension drawing, see page 135

11.2 Dimension drawings

11.2.1 GM35 SR-unit dimensions

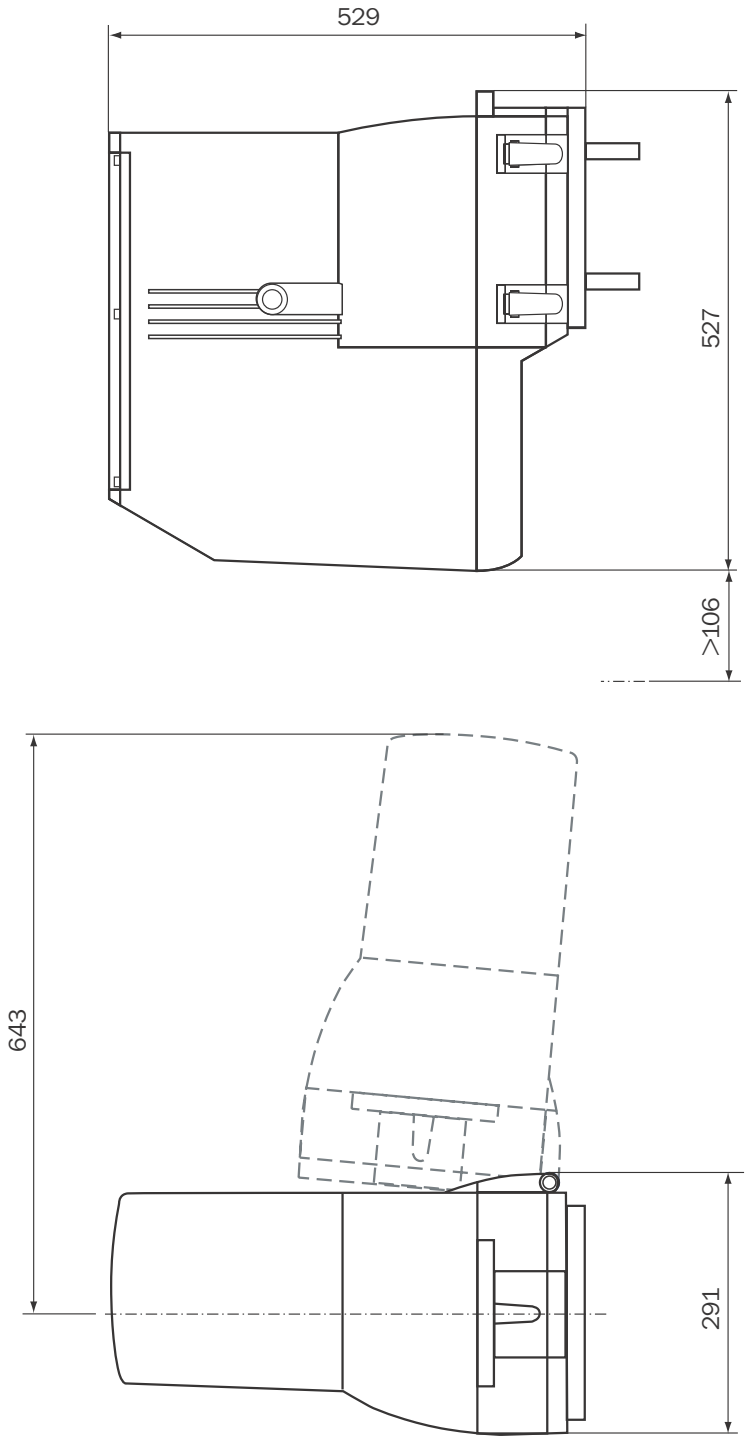


Fig. 70: GM35 SR-unit dimensions

11.2.2 Open measuring probe - GMP, dimensions

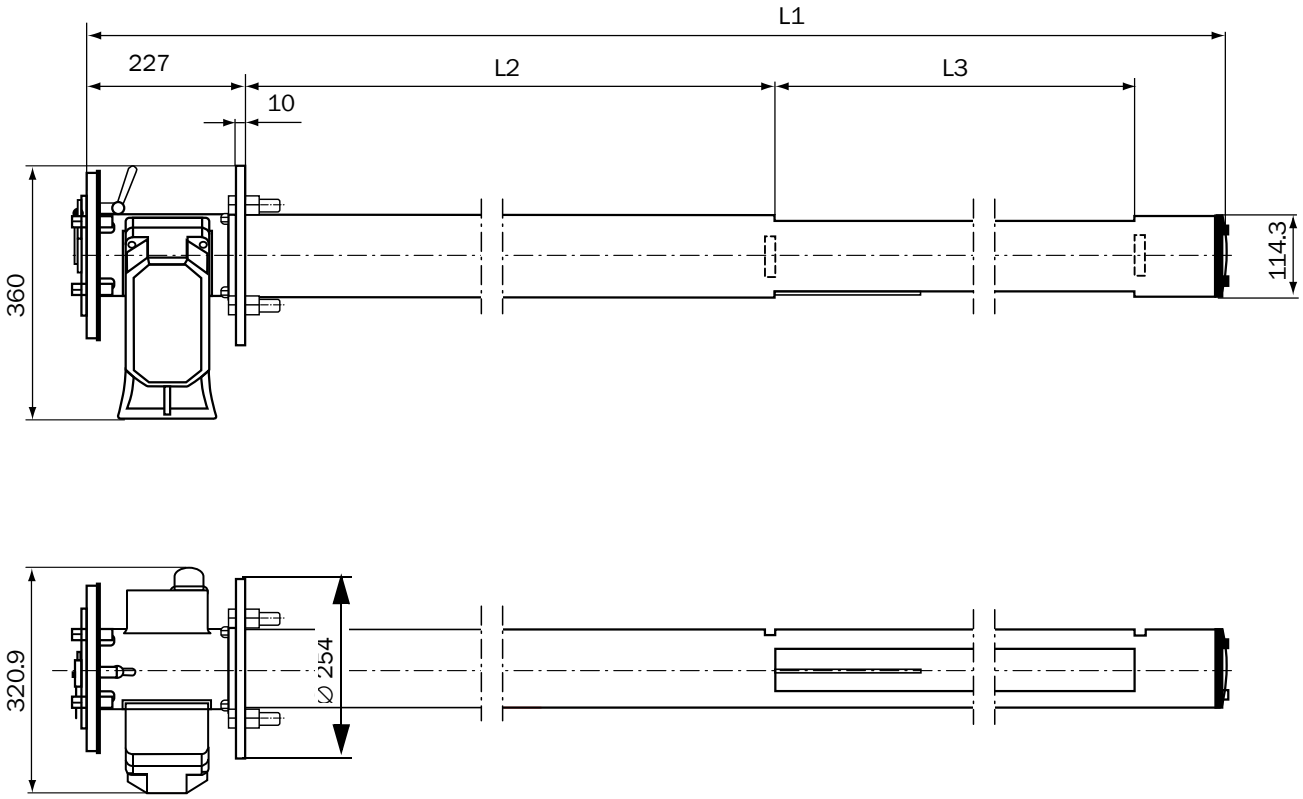


Fig. 71: GMP measuring probe dimensions

GMP measuring probes Dimensions Table

GMP measuring probes		**Measuring gap (active measuring distance)**					
		250	**500**	**750**	**1000**	**1250**	**1750**
Nominal probe length	**L1** [mm]	**L2** [mm]	**L2** [mm]	**L2** [mm]	**L2** [mm]	**L2** [mm]	**L2** [mm]
0.9 m	935	296	46	–	–	–	–
1.5 m	1644	1004.5	754.5	504.5	254.5	–	–
2 m	2128	1489	1239	989	739	489	–
2.5 m	2628	1988	1738	1488	1238	988	488
Application-specific lengths on request							

11.2.3 GPP measuring probes dimensions

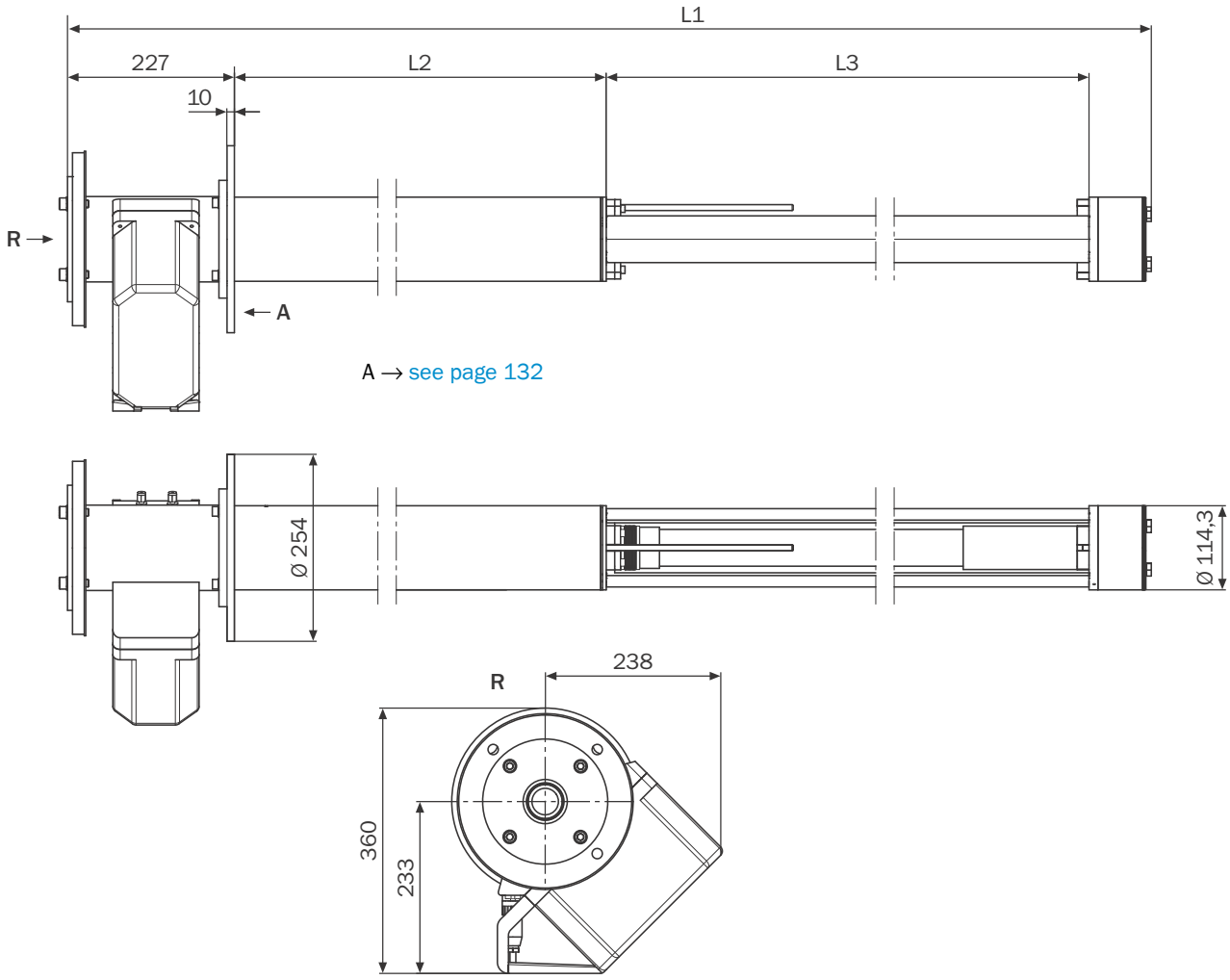


Fig. 72: GPP measuring probes dimensions

GPP measuring probes Dimensions Table

GPP measuring probes		**Measuring gap L3 (active measuring path) [mm]**			
		250	**500**	**750**	**1000**
		227	**477**	**727**	**977**
Nominal probe length	**L1** [mm]	**L2** [mm]	**L2** [mm]	**L2** [mm]	**L2** [mm]
1,0 m	904	353	103	–	–
1.5 m	1614	1063	813	563	313
2.0 m	2098	1547	1297	1047	797
2.5 m	2598	2047	1797	1547	1297
Application-specific lengths on request					

11.2.4 Dimension drawing of GM35 evaluation unit, sheet metal enclosure

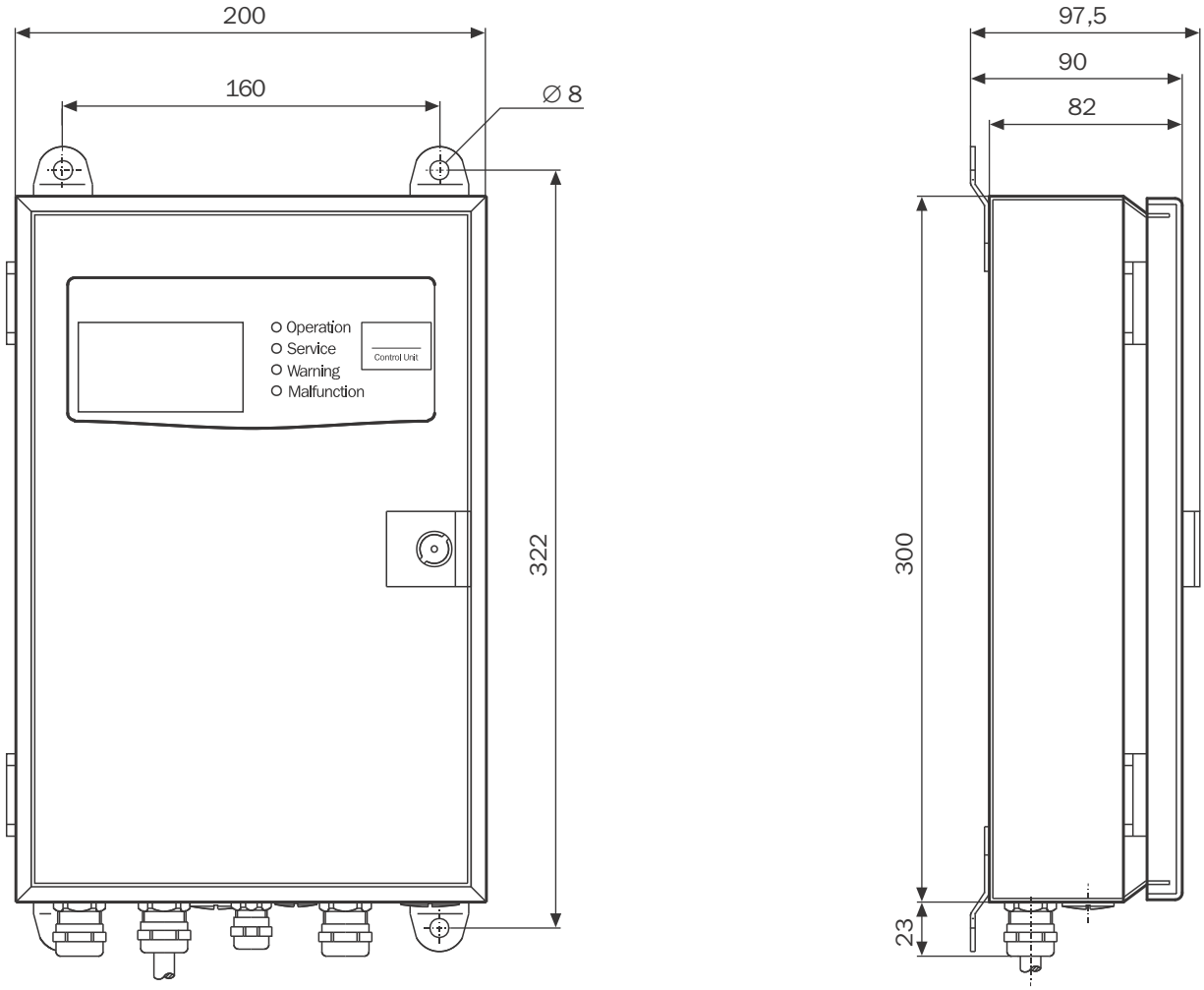


Fig. 73: Dimensions of GM35 evaluation unit, sheet metal enclosure version

11.2.5 Dimension drawing for GM35 evaluation unit, cast enclosure

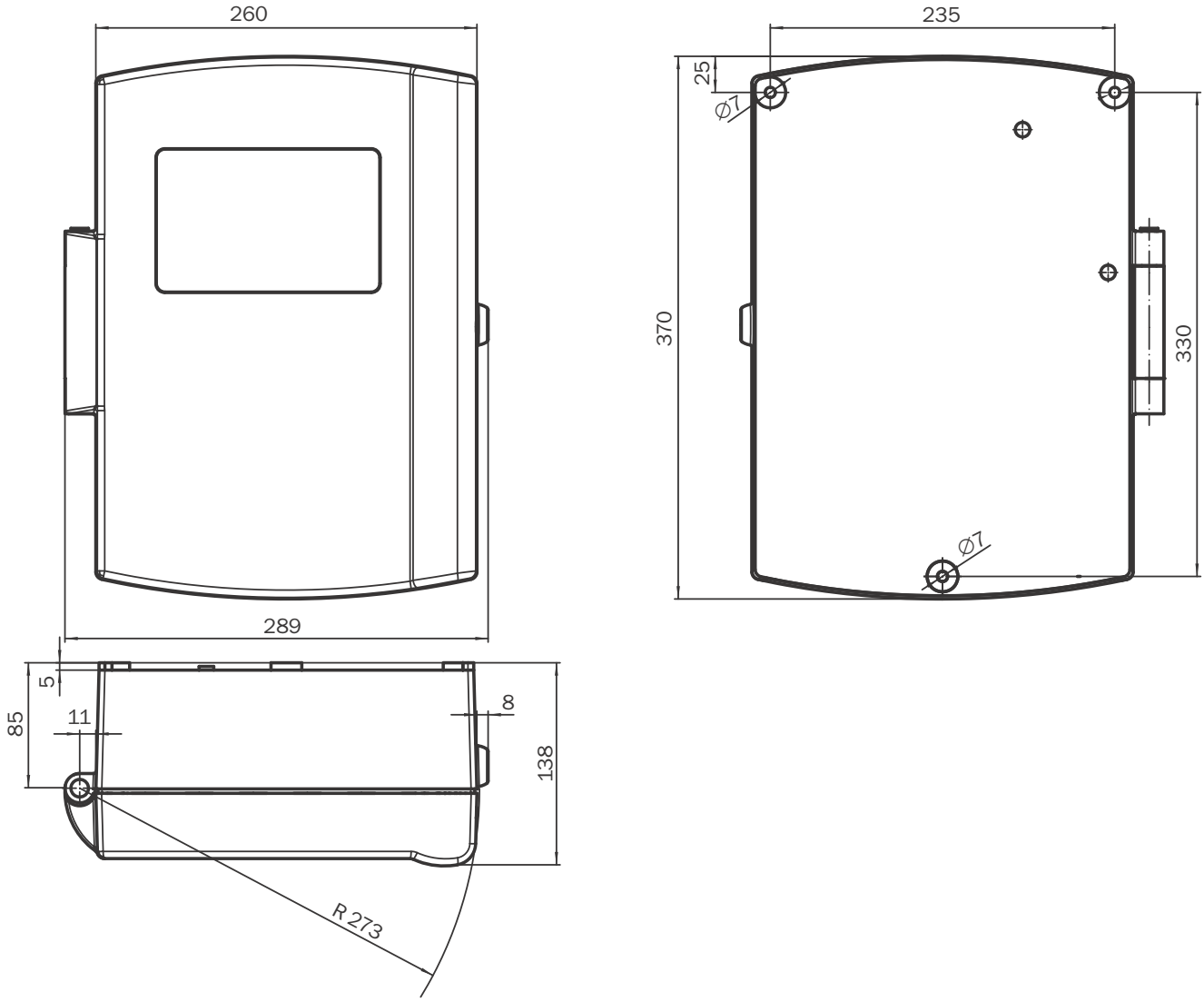


Fig. 74: Dimensions of GM35 evaluation unit, cast enclosure version

11.2.6 Purge air unit dimension drawing

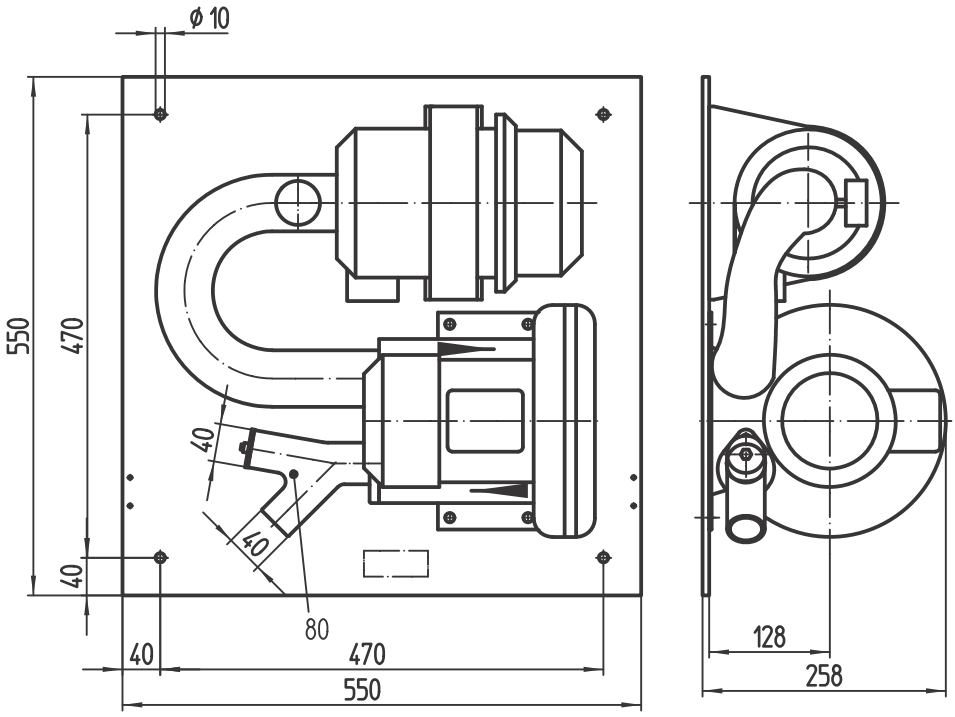


Fig. 75: SLV4 dimensions

11.2.7 Weatherproof covers dimension drawings

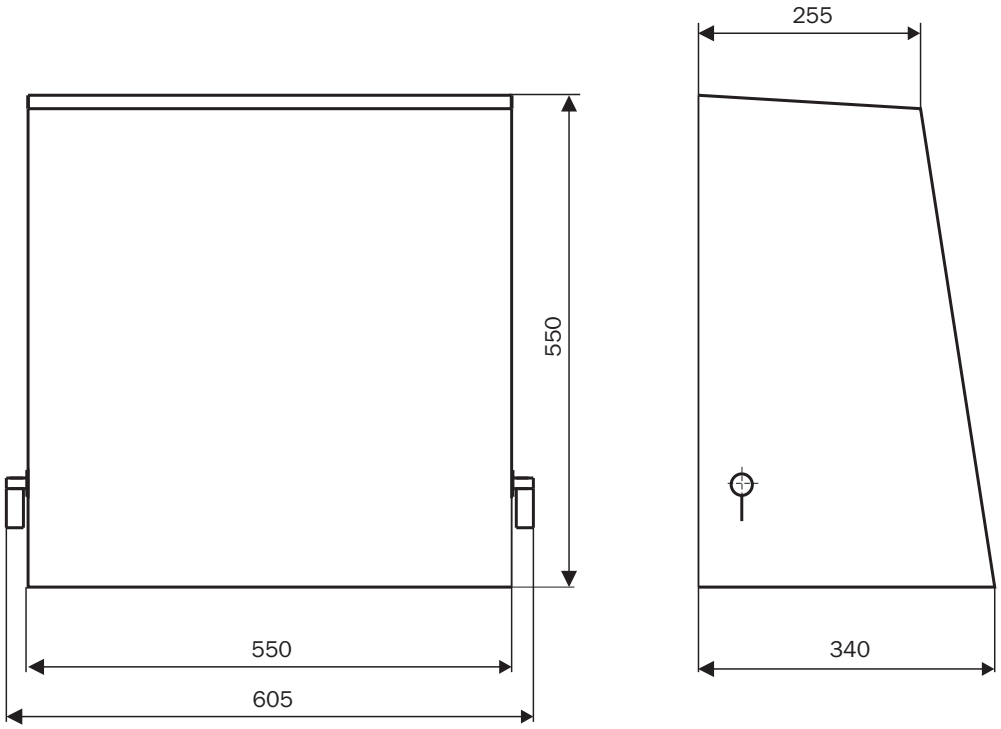


Fig. 76: Weatherproof cover for purge air unit

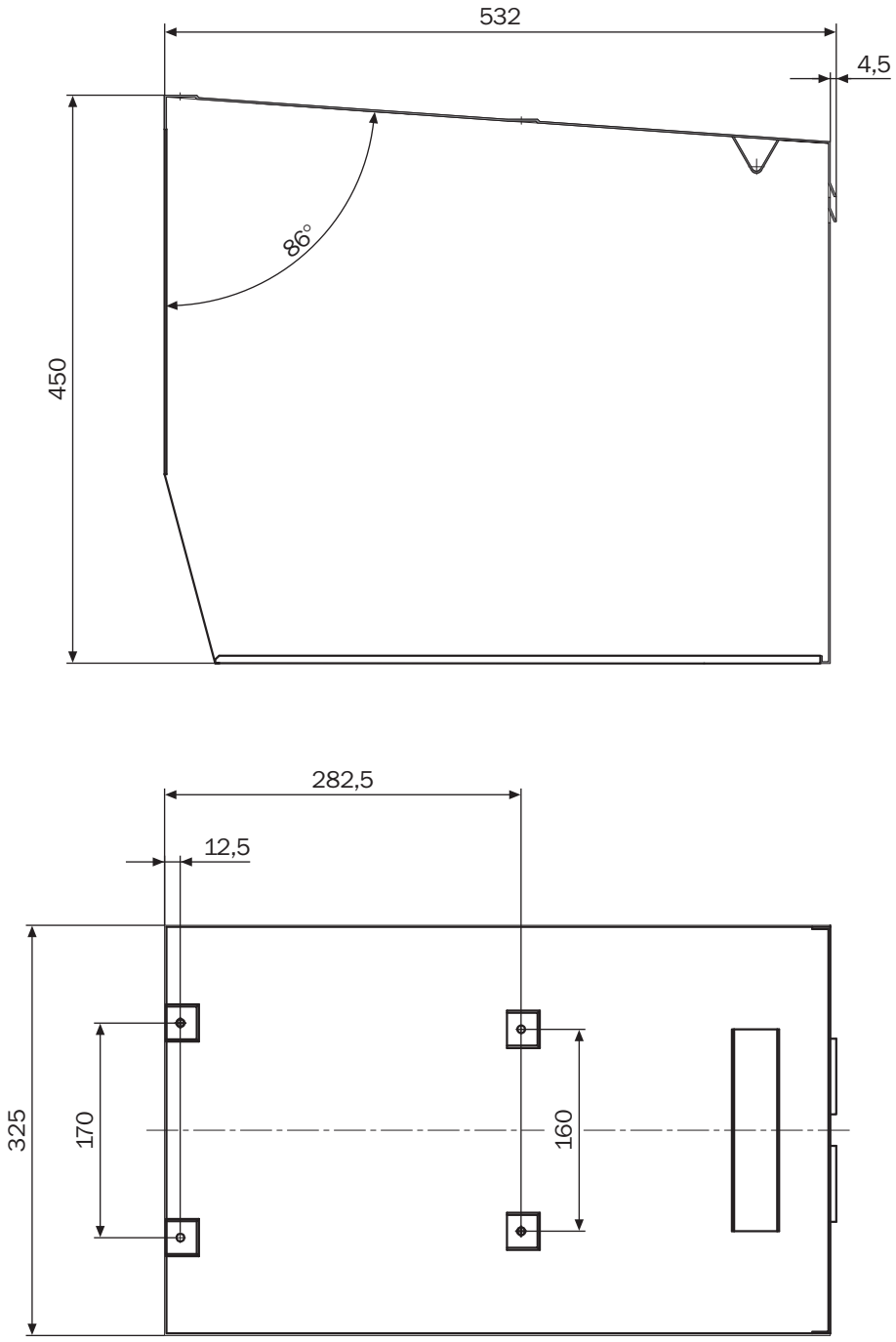


Fig. 77: Weatherproof cover for GM35 SR-unit

11.2.8 Terminal box for CAN bus connection, dimension drawing

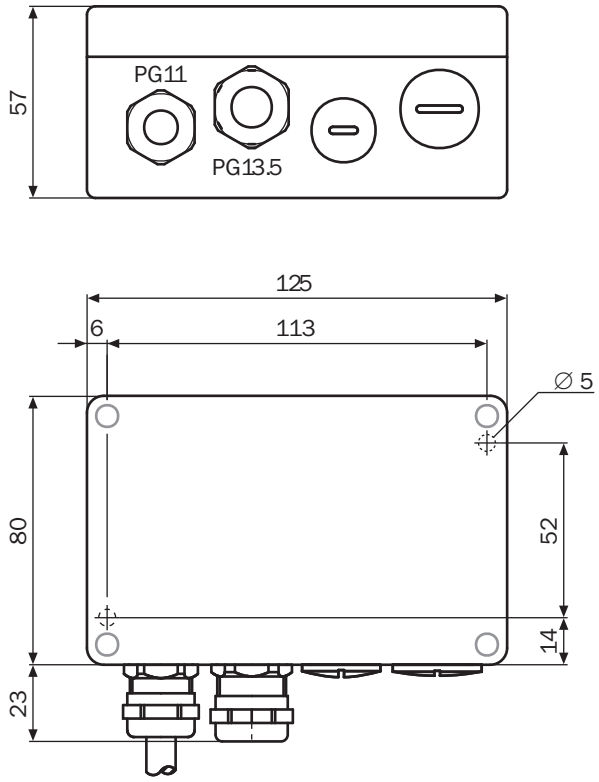
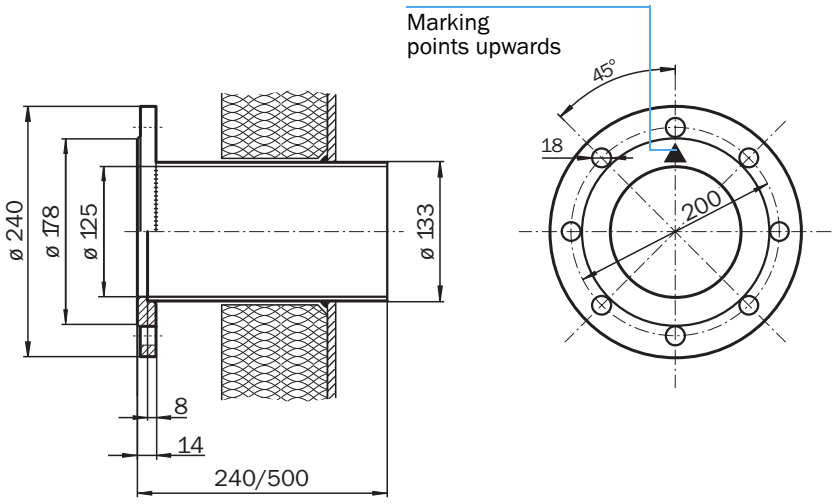


Fig. 78: Terminal box dimensions for CAN bus (option); Part No. 2 031 677

11.2.9 Flange with tube, dimension drawing and Version Table



Versions deliverable from stock

Part No.	Material	Length [mm]
2016807	ST37	240
2016808	1.4571	240
2017785	ST37	500
2017786	1.4571	500

Fig. 79: Flanges with tube for the GM35 available from stock

Alternatively, an ANSI flange provided by the customer can be used.

Fig. 80: Flange with tube for installing the GM35 SR-unit on the duct

11.3 Consumables and spare parts

Please contact your local sales partner for order data for further spare parts as well as prices and packing units.

11.3.1 Consumable parts for 2-years operation

Part No.	Name
4 003 353	Optical cleaning cloth
5 306 091	Filter element, Micro-Top-Element (for GMP probe)
4 034 658	Triple, gold-plated, for CO measuring duct

11.3.2 Spare parts for the sender/receiver unit

Part No.	Name
2 060 797	Measuring module, CO, calibrated
2 061 616	Measuring module N_2O, calibrated
2 060 801	Measuring module, H_2O/CO_2, calibrated
2 023 540	IR source module and chopper
2 030 344	Power supply module
2 030 345	VIS visor module
2 058 773	Sensor for ambient humidity, hygroclip
2 058 671	Plug, wired, hygroclip connection
2 023 518	Pivoted section, control filter CO
2 064 480	Pivoted segment, control filter N_2O
2 017 325	Pivoted segment, NPR
2 023 515	Motor with electronic board (NPR)
2 023 516	Frame for front window
2 023 513	N_2O cell
2 023 448	Motor with electronic board (control filter segment)
2 017 339	Cover, SR-unit with visor and heating
2 017 334	Cover, SR enclosure
2 023 527	Plug, mains connection
2 020 020	CAN connection, SR-unit, plug
2 020 432	CAN connection, SR-unit, socket
2 024 027	Cable harness
2 023 799	Temperature sensor, heating control, SR enclosure
2 029 931	Pressure equalization element (SR-unit)
2 023 687	CAN bus cable, evaluation unit – SR-unit 3 x 2 x 0.74, 4 m long
2 023 688	Power cable, SR-unit or probe 3 x 1.5, 4 m long
2 023 704	CAN bus cable, probe – SR-unit 3 x 2 x 0.74, 0.6 m long
5 700 484	Cup spring
5 700 494	Spherical washer

Part No.	Name
5 700 472	Nut, self-locking, M12
2 017 329	Hinge pin
4 041 347	Sealing tape for flange, 235 x 35 x 2, Neoprene for GMP
2 025 615	Sealing tape for flange, 235 x 35 x 2, Neoprene/Teflon for GPP
2 027 404	Metal sheet, transport protection
2 032 126	Spare parts set, filter wheel housing with motor and lens H_2O
2 032 125	Spare parts set, cell wheel housing with motor and lens CO, N_2O
2 031 571	Spare parts set, automatic beam tracking, R960 PL2M5, probe 2.5 m
2 031 572	Spare parts set, automatic beam tracking, R878 PL1M5–2M, probe 1.5...2 m
2 031 582	Spare parts set, automatic beam tracking, R788 PL1M0, probe 1.0 m

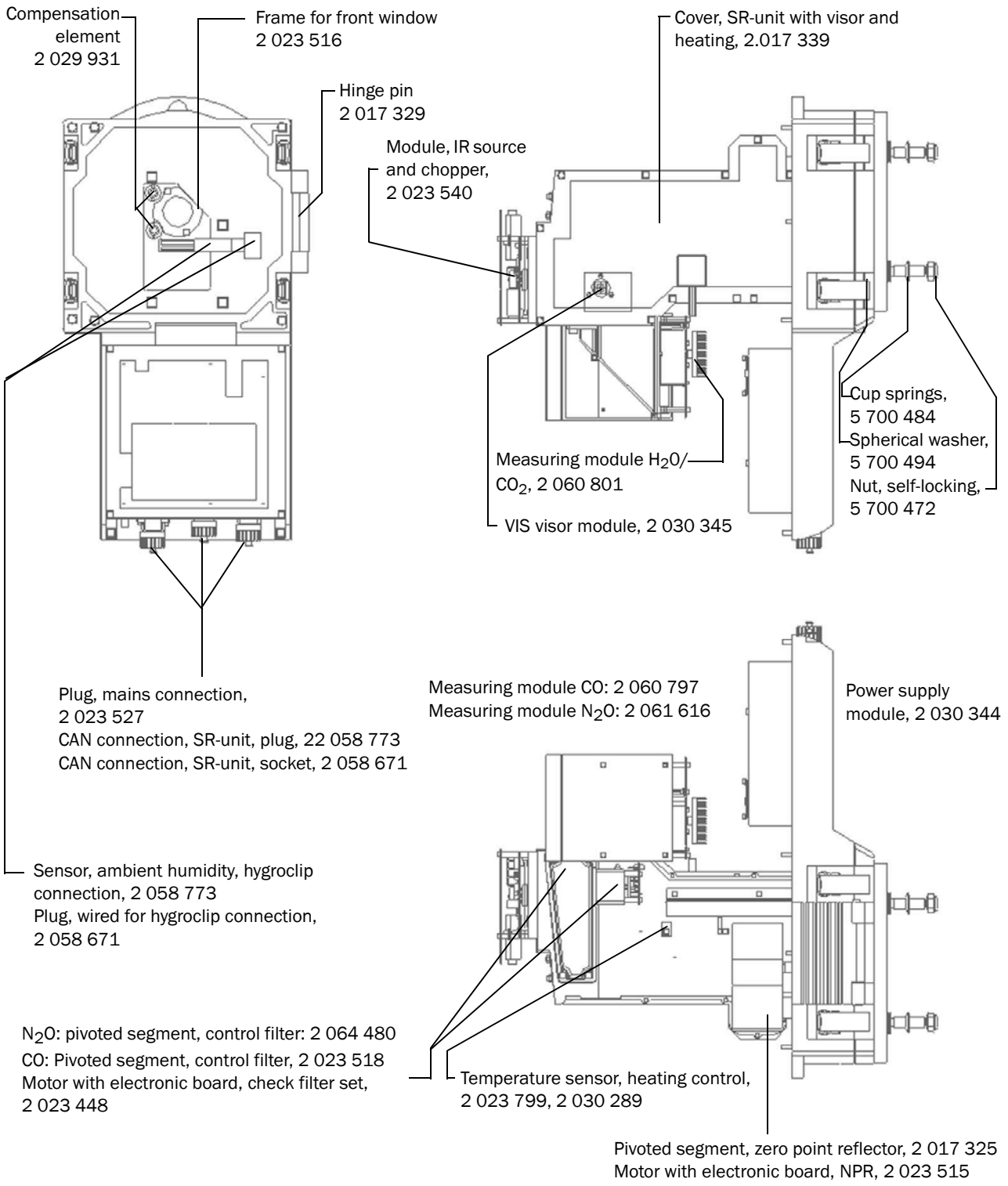


Fig. 81: Spare parts assignment for GM35 SR-unit

11.3.3 Probe spare parts

Part No.	Name
2 023 596	PCB IO GPP
2 032 767	PCB IO GMP
4 038 337	Heating triple, 48 V with terminal
2 030 190	Spare parts set, heating, front window, GPP
2 030 191	Spare parts set, heating, reflector, GPP
4 028 407	Closure lid
4 034 658	Triple, gold-coated, for CO (N_2O) measurement, GM35 probe
2 030 468	Conversion kit, gold triple to Suprasil 300, 0.9 m
2 030 472	Conversion kit, gold triple to Suprasil 300, 1.5 m
2 030 473	Conversion kit, gold triple to Suprasil 300, 2.0 m
2 030 475	Conversion kit, gold triple to Suprasil 300, 2.5 m
2 026 457	Spare parts set, filter cartridge, L=250, ceramic
2 026 459	Spare parts set, filter cartridge, L=500, ceramic
2 026 460	Spare parts set, filter cartridge, L=750, ceramic
2 026 461	Spare parts set, filter cartridge, L=1000, ceramic
2 030 236	Spare parts set, filter cartridge, L=750, Teflon/ceramic
2 030 237	Spare parts set, filter cartridge, L=1000, Teflon/ceramic
2 017 832	Temperature sensor, PT 1000, length 610 mm
2 017 831	Temperature sensor, PT 1000, length 910 mm, probe 1.5 m, 500 measuring gap
2 017 830	Temperature sensor, PT 1000, length 1100 mm
2 018 181	Temperature sensor, PT 1000, length 1410 mm, probe 2 m, 500 measuring gap
2 018 203	Temperature sensor, PT 1000, length 1610 mm
2 024 211	Spare parts set, seal, GPP 35, 420 °C
4 041 347	Sealing tape for flange, 235 x 35 x 2, Neoprene for GMP
2 025 615	Sealing tape for flange, 235 x 35 x 2, Neoprene/Teflon for GPP
4 039 022	Seal, G x P 35 126/116 x x7, graphite
5 312 881	Pressure compensation element

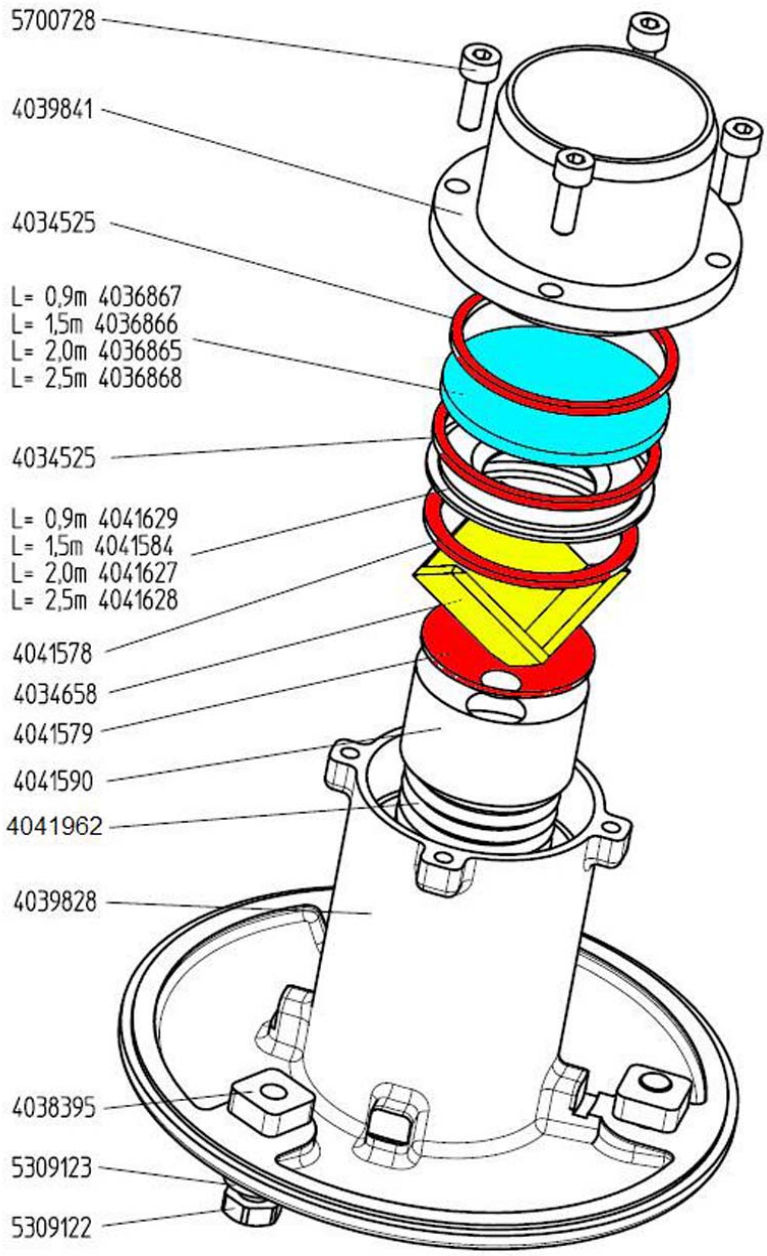


Fig. 82: GMP probe spare parts layout

11.3.4 Spare parts for the evaluation unit

Part No.	Name
2 021 795	PCB system control
6 021 782	Fuse 250 V, D8.5 x 8
6 020 125	Locking cap, fuse D5 x 20
6 007 328	Jumper, pluggable
6 020 400	Membrane keyboard

Part No.	Name
2 017 329	Hinge pin
6 010 378	Lithium battery 3.00 V CR2032

11.3.5 Spare parts for purge air unit

Part No.	Name
5 306 090	Air filter, complete, Europiclon
5 306 091	Filter element, Micro-Top-Element
4 708 971	Distributor, 2xDN40
4 022 766	Purge air hose, DN40, length 5 m
5 700 520	Hose clamp, DN40-60x12

11.3.6 Spare parts, miscellaneous

Part No.	Name
2 023 688	Mains cable for SR-unit or probe, 4 m, 3 x 1.5^2
2 023 687	Connection cable, evaluation unit – sensor, 4 m
2 023 704	CAN-bus cable, SR-unit - probe, 0.6 m, 3 x 2 x0.75^2

11.3.7 Fixing accessories

Fixing accessories, measuring probe - flange

Part No.	Name
5 700 457	Screw, 6 Kt M16x60-A2
5 700 482	Washer, A17-A2
5 700 471	Nut, 6 Kt M16 A2
5 700 480	Lock washer, A16

Fixing accessories, SR-unit - measuring probe

Part No.	Name
5 700 484	Cup springs A25
5 700 472	Nut, SSI M12
5 700 494	Spherical washer
2 017 329	Hinge pin for GM35 flange fixture
4 023 743	Sealing tape

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