GM700
TDLS Analyzer for NH₃, HF, HCl or O₂
Measuring Probe

Installation
Operation
Maintenance
Document Information

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Original Documents
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Warning Levels / Signal Words

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

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

CAUTION
Hazard or unsafe practice which could result in personal injury or property damage.

NOTICE
Hazard which could result in property damage.

Information Symbols

Information about the use in potentially explosive atmospheres
Important technical information for this product
Important information on electric or electronic functions
Nice to know
Supplementary information
Link to information at another place

Warning Symbols

IMMEDIATE HAZARD
of severe injuries or death

Hazard (general)
Please consult the documentation.

Hazard by corrosive substances

Hazard by voltage

Hazard by unhealthy substances

Hazard by toxic substances

Hazard by laser radiation

Hazard by high temperature or hot surface
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GM700

1 Safety Information

Main hazards
Main operating information
Intended use
Responsibility of user
1.1 Main hazards

Important safety information in short form.

Operational safety

**DANGER: Hazards through defective device**

The GM700 is likely to be unsafe when it:

- Has been penetrated by moisture.
- Has been stored or operated under irregular conditions.

When safe operation is no longer possible:

▸ Put the GM700 out of operation, separate all connectors from the power supply and secure against unauthorized start-up.

**WARNING: Hazard by voltage**

▸ Pay careful attention to power supply connections.
▸ Do not interrupt protective conductor connections.

**WARNING: Hot surfaces when enclosure open**

Pay attention to hot surfaces on the measuring cell when opening the GM700 enclosure.

**WARNING: Eye injuries possible due to laser radiation**

▸ Observe all relevant information in these Operating Instructions.

1.2 Main operating information

1.2.1 Protection against hazards through gases

**WARNING: Hot and/or aggressive sample 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.
WARNING: Toxic and caustic substances in parts in contact with sample gas

- GM700 parts in contact with sample gas can contain toxic and caustic substances depending on the sample gas composition.

- When fitted in the measuring device, the reference cuvette contains the respective gases to be measured. These gases must not escape. Special care must be taken with the GME700-2 (HF) because it not only contains gaseous HF but also a certain amount of liquid (max. 0.1 g HF for 8 cm cells, max. 0.02 g for 1 cm cells). HF/hydrofluoric acid is extremely toxic and caustic. It is imperative to avoid inhaling or skin contact at all times. Particularly when there are indications of leaks or defects, wear protective clothing (protective goggles, latex gloves) and carry out work in a well ventilated room/area. Never open the cuvette under any circumstances. Check replacement cuvettes for any possible transport damage.

- Handle with care when test gases are used:
  ▶ When handling HF, keep an HF emergency set (including calcium gluconate gel) available.
  ▶ Before working on the gas path, ask the operator which gases have been applied to the GM700.
  ▶ Ask the operator whether, and how, the GM700 gas path has been cleaned.
  ▶ If necessary, clean the gas path with a suitable method.
  ▶ In case of doubt, take appropriate protective measures before working on the gas path: Ensure adequate ventilation at the workplace or work under a vent. Wear protective goggles or a safety mask, protective gloves and acid-proof protective clothes.
1.2.2 Protection against laser radiation

The GM700 laser warning sign is located on the sender/receiver unit.

Figure 1 Laser warning sign on the GM700 sender/receiver unit (example O₂ measurement)

NOTICE: Laser classes of the GM700 sender/receiver unit:

▸ Laser class 1 in normal measuring operation – the sender/receiver unit (SR-unit incl. purge air fixture) is fitted securely on the flange with tube and locked or

▸ Laser class 3R when the SR-unit is unlocked and swiveled in position and the power supply is switched on via CAN Bus cable from the evaluation unit!

The invisible laser beam within the SR-unit is not accessible when fitted. There is no risk for the human eye when looking into the optic visor on the right side of the SR-unit. The CAN connection cable to the evaluation unit must be disconnected during disassembly or maintenance work (e.g. cleaning the front window) otherwise the laser beam could be touched or accessed.
Laser capacity
The laser wavelength varies for the respective measuring components. The laser output capacity is <10 mW on the optical interface (front window) of the GM700 SR-unit. The emitted radiation is harmless to human skin.

1.2.3 Behavior during purge air failure
GM700 measuring system configurations must include immediate resp. quick measures to protect the measuring system should the purge air feed fail.

Measures for purge air feed failure
- Refer to Purge Air Unit Operating Instructions.

1.3 Intended use

1.3.1 Purpose of the device
The GM700 gas analyzer measures the sample gas component concentration, e.g. HF, NH₃, HCl or O₂ in a gas mixture (sample gas). For this purpose, the GM700 analyzer is assembled at the measuring location and measures directly onsite (in-situ measurement).

1.4 Responsibility of user

Intended users
The GM700 may be operated by competent persons only who, based on their device-specific training and knowledge of the device as well as knowledge of the relevant regulations, can assess the tasks given and recognize the dangers involved.

Correct use
- Only use the device as described in these Operating Instructions (→ p. 13, §2). The manufacturer bears no responsibility for any other use.
- Carry out the specified maintenance work.
- Do not remove, add or change any components in or on the device unless such changes are officially allowed and specified by the manufacturer. Otherwise
  - the device may become dangerous
  - the manufacturer’s warranty becomes void
  - the approval for usage in potentially explosive atmospheres becomes void.
Special local requirements
Follow local laws, regulations and company-internal operating directives applicable at the installation location.

Responsibility for dangerous substances

<table>
<thead>
<tr>
<th>WARNING: Mortal/health danger as a result of a gas path leakage</th>
</tr>
</thead>
<tbody>
<tr>
<td>When the device is used to measure toxic gases: A leak, for example in the purge air supply, can be an acute hazard for persons.</td>
</tr>
<tr>
<td>▶ Take suitable safety measures.</td>
</tr>
<tr>
<td>▶ Make sure these safety precautions are followed.</td>
</tr>
</tbody>
</table>

Safety precautions examples:
• Marking the device with warning signs
• Marking the operating area with warning signs
• Safety-related instruction of personnel who could be in the vicinity of the installation site.

Keeping documents
▶ Keep these Operating Instructions available for reference.
▶ Pass on to a new owner/operator.

Disposing of device parts harmful to the environment

<table>
<thead>
<tr>
<th>DANGER: Possible materials harmful to the environment and health</th>
</tr>
</thead>
<tbody>
<tr>
<td>GM700 components can have small shares of pollutants or hazardous substances such as low lead content in printed circuit boards. The optional permanent cuvette contains low concentrations of HF or HCl (according to device configuration, see scope of delivery).</td>
</tr>
<tr>
<td>▶ Dispose of all GM700 components according to local laws, regulations and company-internal operating directives applicable at the installation location such as:</td>
</tr>
<tr>
<td>▶ Printed circuit boards and similar electronic components</td>
</tr>
<tr>
<td>▶ Dispose of the permanent cuvette, when fitted, safely because it contain low concentrations of HCl or HF. Therefore, do not simply destroy the cuvette.</td>
</tr>
</tbody>
</table>
2 Product Overview

Product identification
GM700 system, measuring probe version, layout
Measuring principle
2.1 **Product identification**

<table>
<thead>
<tr>
<th>Product name:</th>
<th>GM700</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device versions</td>
<td>GM700 measuring probe version</td>
</tr>
<tr>
<td>Manufacturer:</td>
<td>SICK MAIHAK GmbH</td>
</tr>
<tr>
<td>Erwin-Sick-Str. 1 · 79183 Waldkirch · Germany</td>
<td></td>
</tr>
<tr>
<td>Type plates:</td>
<td>● SR-unit: On the right side</td>
</tr>
<tr>
<td></td>
<td>● On the purge air fixture</td>
</tr>
</tbody>
</table>

2.2 **GM700 system, measuring probe version, layout**

**Figure 2** GM700 system overview (measuring probe version)

**Sender/receiver unit**

The sender/receiver unit contains the optic and electronic subassemblies of the measuring system. The gas concentration is captured here and the measured value determined.

**Evaluation unit EvU**

**N₂**

For device version for O₂ measurement:

N₂ supply (provided by customer)

**CAN bus**

**Purge air unit SLV 4**

(not fitted for GPP probes)

**Interfaces for installation peripherals:**

Measured data processing

Status signals

**Inputs/outputs, analog, binary**
Measuring probe
Measuring probes in open design with integrated purge air control system (GMP) are available as well as versions with a gas permeable diaphragm not requiring purge air (GPP: Gas Permeable Probe). Both types are described as from → p. 16.

Purge air unit
To supply purge air to the SR-unit with open measuring probe (GMP) to protect against contamination and high gas temperatures. Use one purge air unit each for the SR-unit and the reflector depending on the application. The blower types for the SR-unit resp. reflector are each designed differently depending on the application.

Further information on the purge air unit
► Refer to Purge Air Unit Operating Instructions.

Evaluation unit
The evaluation unit in the GM700 measuring system serves as user interface and is responsible for measured value processing and output as well as control and monitoring functions. The EvU can be located in the vicinity of the SR-unit. It can also be located up to about 1000 meters from the sampling point, e.g. installed in the switch center or monitoring center, and performs functions such as:
• 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

<table>
<thead>
<tr>
<th>Cable type</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable (CAN bus) SR-unit – purge air fixture measuring probe, length 0.8 m</td>
<td>2 023 704</td>
</tr>
<tr>
<td>● Cable (CAN bus) SR-unit – evaluation unit, length 4 m</td>
<td></td>
</tr>
<tr>
<td>● Extensions up to 1000 m (with terminal box, No. 2020440)</td>
<td>● Scope of delivery</td>
</tr>
<tr>
<td>● Option</td>
<td></td>
</tr>
<tr>
<td>Cable 1) SR-unit purge air fixture – filter monitor of purge air unit, 5 m (only for version Cross-Duct and GMP probe)</td>
<td>2 032 143</td>
</tr>
<tr>
<td>2 cables 1) SR-unit purge air fixture – filter monitor of purge air unit, length 2 m extension (only for GMP probe)</td>
<td>6 025 923</td>
</tr>
<tr>
<td>Cable SR-unit purge air fixture – filter monitor of purge air unit, length 3 m extension (only for Cross-Duct and GMP probe version)</td>
<td>6 028 663</td>
</tr>
</tbody>
</table>

1) Included in scope of delivery

Flange with tube
To install the purge air fixtures of the SR-unit and reflector on the gas duct. The purge air fixtures are fitted on the flanges and then the SR-unit resp. reflector fitted on the purge air fixture. ANSI or DIN flanges provided by the customer can be used alternatively to the flanges supplied.
2.2.1 Measuring probe in detail

Figure 3  GPP measuring probe with ceramic filter and ceramic/Teflon filter

Integrated sensors
All probe versions have a built-in pressure sensor as well as an integrated temperature sensor PT 1000 that continually measures the medium temperature of the probe in the active measuring path. The measured data are transferred via the CAN bus interface of the measuring probe and can then be displayed on the evaluation unit.

EPA conformity
When using a GPP probe, an audit measurement conforming to EPA CFR 40 Part 60 resp. Part 75 can be carried out with the device fitted as far as usable for the application.
2.2.1.1 **GMP probe with open measuring gap**

Shortest reaction times and high temperature stability characterize the GMP series measuring probes. Continuous purge air feed is required for operation. On the current series of GMP probes, the air leaves the air outlet in the duct at 90° to the gas flow (directed purge air). The GMP probe has a locking device on the opening for sample gas that is activated with a lever on the probe flange.

![Figure 4](image)

**Figure 4** GMP measuring probe (with open measuring gap)
2.2.1.2 **GPP – gas diffusion probe in dry or wet version**

This version is more suitable for higher dust contents than GMP probes because, on GPP probes, dust particles are separated on the filter element and therefore kept away from the measuring path. The GPP (Gas Permeable Probe) should also be chosen to allow an EPA-conform audit measurement as well as for low flow speeds or irregular flow profiles.

**GPP probe advantages**

GPP probes work without purge air feed and are easy to maintain. They are equipped with an automatically controlled heater to reliably prevent condensate on the optical interfaces. The electronics for heating control, temperature and pressure measurement are located reliably protected in a sturdy cast-metal enclosure acting as measuring probe section between duct flange and SR-unit. Both the electric connections for CAN bus and power supply as well as the test gas connection with which the audit measurement according to EPA Guideline CFR 40, Part 60 or Part 75 can be carried out are located on the enclosure as shown.

2.2.1.3 **GM700 measuring probes in comparison**

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

<table>
<thead>
<tr>
<th>Measuring probe</th>
<th>GMP (open probe)</th>
<th>GPP (dry)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design</td>
<td>Active measuring path in flow direction open; purge air feed with outlet directed 90° to gas flow</td>
<td>Gas diffusion probe with ceramic filter, for dry sample gas</td>
</tr>
<tr>
<td>Gas temperature max.</td>
<td>430 °C(^1)</td>
<td></td>
</tr>
<tr>
<td>Gas test according to EPA Guideline possible</td>
<td>-</td>
<td>Yes</td>
</tr>
<tr>
<td>Purge air supply required</td>
<td>Yes</td>
<td>-</td>
</tr>
<tr>
<td>Optical interfaces heating in the probe</td>
<td>-</td>
<td>Yes, with integrated control</td>
</tr>
<tr>
<td>Sample gas flow speed</td>
<td>1...40 m/s</td>
<td>&lt; 40 m/s</td>
</tr>
<tr>
<td>Suitable for wet sample gas</td>
<td>Yes</td>
<td>-</td>
</tr>
<tr>
<td>Duct pressure, maximum</td>
<td>±120 hPa, depending on purge air supply</td>
<td>±120 hPa</td>
</tr>
</tbody>
</table>
2.2.1.4 Special versions
Apart from the standard probes described, versions made of particularly acid-proof materials (1.4539 and PVDF) are available. Special versions are manufactured on request according to customer demands.

2.3 GM700 options and accessories

- **Terminal box** for CAN bus with 24 V power supply
  The optional terminal box is available for distances between SR-unit and EvU larger than 4 meters via a CAN bus cable provided by the customer. The total length of all CAN bus connections in the GM700 measuring system can be up to 1000 meters.

- **Cover plate** for purge air fixture of the sender/receiver unit
  To maintain purge air supply in cases where this must remain in operation at the measuring location when the SR-unit is dismounted.

- **Weatherproof cover** for SR-unit and purge air unit
  Required for assembly outdoors – dimensional drawings → p. 98, §9.7

- **Chart recorder**, single or multi-channel, 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 small. The following practical rule of thumb serves as guideline:
  An air heater is recommended when
  \[ \text{Gas temperature \[^\circ\text{C}\] - dew point temperature \[^\circ\text{C}\] < abs. humidity \[%\]}. \]
  Values are compared without considering the units of measure.

<table>
<thead>
<tr>
<th>Measuring probe</th>
<th>GMP (open probe)</th>
<th>GPP (dry)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurable components(^2)</td>
<td>NH(_3), HF, O(_2), HCl</td>
<td>NH(_3), O(_2), HCl(^4)</td>
</tr>
<tr>
<td>System response time (T(_{90}))</td>
<td>≥ 5 s</td>
<td>≥ 120 s</td>
</tr>
<tr>
<td>Duct diameter(^5)</td>
<td>&gt; 360 mm</td>
<td>&gt; 300 mm</td>
</tr>
<tr>
<td>Dust concentration</td>
<td>&lt; 2 g/m(^3) act.</td>
<td>&lt; 30 g/m(^3) act.</td>
</tr>
<tr>
<td>Probe lengths available [m]</td>
<td>1.0/1.5/2.0/2.5</td>
<td>1.0/1.5/2.0</td>
</tr>
<tr>
<td>Active measuring paths available [mm]</td>
<td>250/500/750/1000/1250</td>
<td>250/500/750/1000</td>
</tr>
</tbody>
</table>

1) The max. temperature used for the measurement is determined depending on the application.
2) O\(_2\) measurement requires N\(_2\) for purging
3) As from gas temperature 300 °C
4) As from a gas temperature of minimum 130 °C
5) Probes with shorter active measuring paths on request (possibly required for higher concentrations or narrower duct diameters)
2.4 **Measuring principle**

The light of the laser diode radiates through the sample gas and is then detected by a photo diode. The laser diode wavelength is set to a single absorption line of the sample gas component. This absorption line is scanned by modulating the wavelength and then the transmission signal (relation between signal sent and received) captured by a photo diode. An appropriate signal evaluation returns the magnitude of the absorption line from which the gas concentration is then calculated. This method is called Tunable Diode Laser Spectroscopy (TDLS) or Tunable Diode Laser Absorption Spectroscopy (TDLAS).

A laser specially developed for gas analysis is used as light source in the GM700. This laser diode radiates a wavelength with a narrow line width so that an absorption line can be reliably scanned. A Peltier element and a temperature sensor fitted in the laser diode enclosure ensure a precise temperature and therefore exact wavelength stabilization of the system.

The laser beam from the sender/receiver unit travels through the active measuring path and then impinges on the reflector on the other side of the gas duct. The beam is then reflected back to the sender/receiver unit. After the beam has passed through the measuring path twice, during which laser light absorption specific to the gas occurs, the light is focussed on a receiver optics.

2.4.1 **Reference cuvettes for wavelength stabilization**

The GM700 is equipped – depending on the device version - with:

- A permanently filled cuvette for the adjustment of the analyzer laser diode to the reference position of the gas absorption line (Line-Locking).
- a flow cuvette which serves to stabilize the wavelength by feeding test gas from a test gas cylinder when the measuring component concentration in the sample gas is not adequate → p. 68, § 7.5.2.

2.4.2 **Signal evaluation**

The optimized algorithms of the GM700 evaluation electronics process the measurement signal of the receiver element together with the corresponding parameters based on the TDLS measuring method. This is based on the physical characteristics of the gas molecules that absorb light energy in certain wavelengths. These optimized algorithms ensure the concentrations of sample gas components are determined without cross-sensitivities to other gases. The differential absorption measurement also eliminate dust influences.
3 Project Planning Information

Project Planning Checklist
Initial onsite installation
Preparations for electrical installation
3.1 Work steps from system selection to start-up

Application changes
If you make changes to the specifications ordered for your application or if a device is to be used for an application different to the one originally planned, please pass this information onto your local sales representative so that we can determine the application options under changed conditions and whether new adjustment/parameter settings are required.

The following steps are normally taken before starting up the measuring system

- **Project planning**
  → «Project Planning Checklist» (p. 22)
- **Initial onsite installation**
  ▶ Following preparatory work normally carried out by the customer is described on p. 25, §3.3:
  ▶ Flange assembly → p. 26, §3.3.3
  ▶ Preparation for purge air unit assembly → p. 28, §3.3.4
  ▶ Laying signal and power supply cables to the sampling point, → p. 28, §3.3.4
- **Assembly preparation** for the EvU, → p. 28, §3.3.6
  ▶ Possibly preparation of signal cables for the interface to peripheral equipment, → p. 28, §3.4
- **Device installation**
  To allow speedy start-up, the following components are normally installed ready for operation before the start-up date; see also p. 31, §4.
  - Purge air unit
  - Evaluation unit(s)
- **Start-up**
  The actual start-up is carried out by trained personnel or Customer Service. This work is described on §6 (→ p. 47). The main activities are adjustment tasks on the GM700 system related to the application.

3.2 Project Planning Checklist

Project planning, step by step
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, see p. 89, §9 and following.
<table>
<thead>
<tr>
<th>Topic</th>
<th>Task</th>
<th>Measure/determination</th>
</tr>
</thead>
</table>
| **Determine sampling point**  
Observe national regulations such as VDI 3950 | **Emission sampling point** | ► Obtain official approval for emission sampling point.  
► Provide for calibration openings at an easily accessible place.  
► Ensure the GM700 and calibration probes do not influence each other; plan the calibration connection at least 0.5 m upstream from the measuring device |
|  | **Application conditions** | ► Observe Technical Data for duct/ambient conditions!  
► Gas temperature above/below dew point (dry/wet) |
|  | **Pressure conditions at the sampling point** | ► A fitting location with partial vacuum in the duct is ideal.  
► For duct pressures > 10 mbar, contact SICK on correct selection of the purge air blower. |
| **SR-unit, reflector**  
→ p. 25, §3.3.1 | **Select suitable flange with tube** | ► The flange is designed to be installed in steel ducts; suitable flanges with tube are usually supplied with des GM700.  
► Stone stacks or ducts with thick walls demand an onsite retaining plate and, possibly, a longer version of the flange with tube; → p. 26, §3.3.3  
● → p. 89, §9 |
|  | **Duct openings selection** | ► Provide an opening of suitable size for the flange tube.  
► Plan adequate clearance for installation and maintenance activities for the duct insulation cutout.  
► Plan clearances for handling the SR-unit, reflector  
► Ensure the ambient temperature for the SR-unit resp. reflector is within the specified range.  
► For assembly outside, plan a weatherproof cover |
|  | **Tools for start-up and maintenance** | ► When working on the zero path; prerequisites: Clean ambient atmosphere free from sample gas; weatherproof: Plan the zero path or order from SICK. |

\[ D = \frac{4F}{U} \text{(Cross-sectional area)} \]

\[ U \text{(Circumference)} \]
## Purge air unit

- **Fitting location selection**
  - Plan installation location on the duct in immediate vicinity (5 m) of the GM700 SR-unit.
  - Keep purge air hoses to the respective purge air fixture (SR-unit, reflector) as short as possible (pressure loss approx. 1.2 mbar per meter). With only one purge air unit, the hose lengths to both purge air fixtures should be equal when possible.
  - Ensure secure cable laying.
  - Ensure dry and, whenever possible, dust-free intake air on the purge air unit, use a preliminary filter as necessary.
  - The intake air temperature should be between 0 and 55 °C. Heat the purge air for T < 0 °C; see air heater option (p. 19, §2.3)
  - For assembly outside, plan a weatherproof cover

## Evaluation unit

- **Determine the fitting location**
  - Plan assembling the unit at an easily accessible location
  - Ambient temperature within the specifications, p. 88, §9.1.

## 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 GM700 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 inserting and removing the SR-unit or reflector.

## Accident prevention

- Applicable (national) regulations on accident prevention must be observed.
3.3 Initial onsite installation

The work described in the following can be carried out by the customer's installers. Prerequisite is that all the required specifications have been made based on the Project Planning Checklist.

3.3.1 Assembly preparation at the sampling point

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

Figure 6 Fitting recommendation for the mounting flange and purge air unit (duct diameter not representative)
3.3.2 Uncovering the duct
▶ Remove any duct insulation to uncover an area of approx. 800 x 1500 mm (W x H) to prepare the duct for the following work.
▶ Keep the insulation material removed for later refitting resp. provide new suitable insulation material.

3.3.3 Mounting the flange with tube
SICK delivers two flanges 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.

Figure 7
Standard flange with tube

Reinforcement with junction plates recommended
Due to the weight of the sender/receiver unit, we recommend reinforcing the flange tube fixture onsite with junction plates.
**Gas-carrying duct made of stone/concrete**
An additional retaining plate with suitable opening can be manufactured for ducts not made of steel and in which the flange with tube can be welded.

### 3.3.3.1 Assembling the flange with tube

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CAUTION:</strong> Always observe safety information on → p. 8, § 1.1!</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Mark exactly the flange centerpoint on the duct wall.</td>
</tr>
<tr>
<td></td>
<td>- On ducts made of stone/concrete: Cut the duct opening out approx. 2 cm larger than the outer flange tube diameter; at the same time, plan a light downward incline of the flange tube by approx. 1°. Provide a suitable retainer plate.</td>
</tr>
<tr>
<td>2</td>
<td>Cut an opening matching the outer flange tube diameter (standard Øₐ = 133 mm) out of the duct wall resp. retainer plate.</td>
</tr>
<tr>
<td>3</td>
<td>Position the flange tube so that the marking ▲ points exactly in gas flow direction. Incline the tube slightly downwards in the duct resp. on the retainer plate (approx. 1°, → p. 25, Fig. 6) to prevent condensate deposits later between tube and probe.</td>
</tr>
<tr>
<td>4</td>
<td>Affix in the fitting position.</td>
</tr>
<tr>
<td></td>
<td>- Whenever possible, weld on junction plates as reinforcement; cf. → p. 27, Fig. 8. For ducts made of stone/concrete: Anchor the retainer plate with flange with tube welded on securely to the duct.</td>
</tr>
<tr>
<td>5</td>
<td>Weld the flange tube on.</td>
</tr>
</tbody>
</table>
3.3.4 Assembly preparation for the purge air unit (for GMP probe)

- Maximum length of cable to measuring device complies with project planning.

![Installation of purge air unit](Operating Instructions of purge air unit.)

**NOTICE: Adequate purge air pressure**
- During project planning, make sure the purge air pressure is sufficient to force the purge air into the gas duct. Please contact SICK Customer Service or your local representative when necessary.

3.3.5 Duct insulation

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

**WARNING: Observe the ambient temperature!**
The SR-unit of the GM700 is designed for a maximum ambient temperature of +50 °C. Radiant heat on the enclosure surface can, among others, create temperatures higher than the measured air temperature. Therefore, design insulation and radiation shielding so that temperature limits are reliably maintained.

3.3.6 Assembly preparation for the evaluation unit

The installation location for the evaluation unit was defined within the project planning framework (→ p. 22, §3.2). The 1000 meter maximum total cable length of all CAN bus connections in the GM700 measuring system must be considered, whereby installation close to the sampling point is recommended to facilitate system operation.

**Installation location preparation**
The evaluation unit has fastening openings in the enclosure for easy fixing.
- Based on the EvU dimensional drawing according to → p. 35, Fig. 12 resp. → p. 35, Fig. 13.
- Ensure enough space is available at the planned installation location to attach these, for wiring as well as opening 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 GM700 system components. Suitable cable ducts resp. empty conduits are installed for cables already prefabricated and delivered with the GM700 system. Suitably qualified personnel or Customer Service connect the prepared cables to the device during installation resp. start-up.

3.4.1 Signal and power supply cables

**WARNING: Observe safety information!**
- Always observe safety information and relevant safety regulations.
- During all work on electrical equipment, disconnect such equipment from the power supply, check that the equipment is potential free and make sure that no third person can switch the equipment back on again without authorization.
- Leave the power supply switched off during the following device installation. The grounding cable must be disconnected.
Figure 9  
Circuit diagram (probe version)

Measuring probe (example: GMP)

Signal cable for:
- Filter monitor of the SLV 4 - 2 x 0.6 mm², on pressure controller with flat pin bushing 6.3 x 0.8 mm (DIN 46247)
- Pressure connection

Purge air unit SLV 4
(Standard for GMP measuring probes)

Power supply 4 x 1.5 mm²

Evaluation unit

CAN * 0.8 m

Terminal box (option)
to lengthen the CAN bus connection with a cable (1 x 2 x 0.5 mm², twisted pair, shielded) provided by the customer

Power supply (230/115 V AC) 3 x 0.75 mm²
3 binary inputs 6 x 0.5 mm²
3 analog inputs 6 x 0.5 mm²

Power supply (115/230 V AC; 50/60 Hz 4 x 1.5 mm²)
3 binary outputs 6 x 0.5 mm²
3 analog outputs 6 x 0.5 mm²

WARNING: Endangerment of electrical safety
- The power cables must be adequately dimensioned.
- The power connection must be made via a circuit-breaker switch.
- The grounding cable must be connected.
3.4.2 CAN bus wiring

Standard cables

An installation location in the vicinity of the sampling point is generally selected for the EvU so that the 4 m CAN bus cable in the scope of delivery is sufficient for cabling without additional installation effort.

Assembly away from the evaluation unit

A terminal box with a 24 V power supply unit can be delivered when the EvU is to be located at a greater 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 sampling 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:
  - Purge air units; additional motor circuit breakers and optional protective phase failure switches.
  - Evaluation unit

**WARNING:** Take precautions to prevent accidental switching off of the purge air supply.

▸ Attach a clearly visible warning against accidental switching off the separation equipment for the purge air unit.

▸ Install easily accessible cable ducts or empty conduits for the prefabricated cables to those delivered with the system (→ p. 29, Fig. 9) marked with one or two plug-in connectors. Approx. 2 m cable lengths each should be available at the sampling point for later maintenance work on the measuring system when dismounted from the duct.

▸ Lay onsite cables (shown without plugs) according to → p. 29, Fig. 9.
  - Wire cross-section specifications are recommendations from which cables for analog and binary signals can slightly deviate (not however for the CAN bus connections resp. power supply cables).
  - Start with the system internal connections of the GM700.

Status and signal cables from the EvU to the connection terminals of the customer's status/message devices can be added later as required.
4 Installation

Preparations
Fitting system components
Installing the evaluation unit
Electrical connection of system components
4.1 **Preparations**

This Section describes the assembly and installation work for the GM700 measuring system before the actual start-up. Completion of the onsite preinstallation according to p. 21, §3 is assumed.

4.1.1 **Checking the scope of delivery**

▸ Check the delivery against the belonging delivery note and make sure the complete measuring system has been delivered as ordered.

▸ Check that the specifications on power voltage and frequency on the type plates of the GM700 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 on p. 89, §9.

▸ Compliance with the specifications made during project planning (according to p. 22, §3.2) and correct performance of onsite preinstallation according to p. 25, §3.3.

**WARNING:** Power supply OFF!

During the following work, it must be ensured that the power supply to the devices and cables involved is switched off and can only be activated by the personnel carrying out the work when the work is completed resp. for test purposes and then under consideration of valid safety regulations.
4.2  

**Fitting system components**

4.2.1  

**Information on the SR-unit and measuring probe**

The GM700 SR-unit and measuring probe are first fitted on the duct during start-up (§6 (→ p. 47)) 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: Do not fit the SR-unit and measuring probe before start-up](image)

Unfavorable ambient conditions or atmosphere in the measuring channel 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.

4.3  

**Installing the purge air unit (for GMP probe)**

4.3.1  

**Terminal box with 24 V power supply unit (option)**

▸ Install the terminal box with 24 V power supply unit in the vicinity of the sampling point.
▸ Secure the enclosure using both mounting holes (Ø 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.

![Figure 10 Fitting the terminal box with power supply unit](image)
4.4 Installing the evaluation unit

The fitting location for the evaluation unit was defined during project planning (→ p. 22, §3.2) 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 sampling point.

▸ Ensure easy access without problems. In particular, make sure the swivel door of the evaluation unit can be opened without hindrance after fitting.

4.4.1 Installing the evaluation unit – sheet metal enclosure version

▸ Drill mounting holes Ø7.2 mm (for M8) at the fitting location according to the Drilling plan.

▸ Attach the evaluation unit at the installation location using the 4 planned fastening brackets with suitable screws.

Figure 11 Installing the evaluation unit (sheet metal enclosure version)
4.4.2 Installing the evaluation unit – cast-metal enclosure version

- Drill mounting holes $\Phi 7.2$ mm (for M8) at the fitting location according to the Drilling plan.

Figure 12 Mounting holes layout (Drilling plan) to fit the EvU (cast-metal enclosure)

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

Figure 13 Fitting the evaluation unit (cast-metal enclosure)

- Close and lock the cover again.
### Electrical connection of system components

Onsite preparation for electrical installation has been described in p. 28, §3.4. The cables laid as described there are now connected to the system components.

#### CAUTION: Observe safety information as well as relevant safety regulations!

During all work on electrical equipment, disconnect such equipment from the power supply, check that the equipment is potential free and make sure that no third person can switch the equipment back on again without authorization.

Electrical connections for purge air unit
-> Purge air unit Operating Instructions.

### 4.5.1 CAN bus wiring options

As already described in the project planning on p. 28, §3.4, the following options are available for wiring the CAN bus connection between SR-unit and evaluation unit:

- Standard cable, 4 m, prefabricated
- 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 p. 19, §2.3.

#### Wiring in terminal box

Connections in the terminal box are wired as follows:

**Figure 14**
Terminal box for CAN bus connection between SR-unit and evaluation unit

**CAN cable signals**

<table>
<thead>
<tr>
<th>Color</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pink</td>
<td>+24 V</td>
</tr>
<tr>
<td>Grey</td>
<td>GND</td>
</tr>
<tr>
<td>Yellow</td>
<td>CAN-H</td>
</tr>
<tr>
<td>Green</td>
<td>CAN-L</td>
</tr>
<tr>
<td>Brown</td>
<td>CAN-GND</td>
</tr>
<tr>
<td>White</td>
<td>n.c.</td>
</tr>
</tbody>
</table>

**WARNING: Endangerment of electrical safety**

- The power cables must be adequately dimensioned.
- The power connection must be made via a circuit-breaker switch.
- The grounding cable must be connected.
- Connect bridge (jumper) according to suitable voltage supply (ST2).
- Lead CAN cable (provided by customer) through the right PG screw fitting to terminal strip.
- Connect shielding on the PG screw fittings on the enclosure.
- Connect wires to terminal strip ST5 as shown in Fig. 14; check that a twisted pair cable is used for CAN-H and CAN-L. Connect the respective signals in the EvU and terminal box.

4.5.2 Electrical connection in the evaluation unit EvU

Cable laying to the evaluation unit and relevant specifications have already been shown in → p. 29, Fig. 9.
Figure 15  Evaluation unit connections

Plug this bridge for 115 V resp. 120 V voltage supply.

WARNING: Endangerment of electrical safety
- The power cables must be adequately dimensioned.
- The power connection must be made via a circuit-breaker switch.
- The grounding cable must be connected.
Open enclosure door of evaluation unit.

**WARNING: 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.

Ensure the power supply has been installed (see evaluation unit connections) according to the specifications (observe national requirements), but with the power switched off.
- Connect protective conductor (PE) to the terminal on the enclosure floor
- Lead the signal cable for inputs and outputs through the PG screw fittings on the EvU enclosure floor and wire according to p. 37, §4.5.2.
- When using the CAN cable provided by the customer, connect the wires to the “Sensor” terminal strip. Do not connect +24 V and GND (ground).

*Figure 16* See steps 1 to 4 below Connecting the CAN bus cable to the evaluation unit

1. PG screw fitting on the evaluation unit
2. CAN bus cable
3. CAN cable shielding
4. PG screw fitting on the EvU
WARNING: Burns by touching the cable glands
The temperature on the cable glands could be >60 °C.
5 Handling the Evaluation Unit

User qualifications
Operating elements
Menu overview
5.1 **User qualifications**

This Section describes how to operate the GM700 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-metal 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.

---

**Figure 17** Evaluation unit display and operating elements (shown with sheet metal enclosure)

- **Graphic display for measured value display and navigation**
- **Status LEDs to indicate operating and malfunction states**
- **Key pad for navigation and entering data**
- **Key pad for menu selection**

**Arrow keys**

Navigate, select, scroll or edit menu items, variables, units or digits.

**Enter**

Execute the selected menu contents or commands.

**Display in measuring mode**

Displays all current measured values (temperature values resp, gas concentration); Displays computed values

**LEDs**

- **Operation**
  - Measuring mode
- **Service**
  - Service mode
- **Warning**
  - Warning messages, see Diagnostic mode (diag)
- **Malfunction**
  - Device malfunction, error message, see Diagnostic mode (diag)
5.2.1 Menu overview

<table>
<thead>
<tr>
<th>Mode</th>
<th>Menu</th>
<th>Display contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring</td>
<td>Measuring operation</td>
<td>• Current measured values depending on device version</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Reference variables (wet, dry)</td>
</tr>
<tr>
<td>Diagnosis</td>
<td>Malfunction</td>
<td>• Current error messages (plain-text)</td>
</tr>
<tr>
<td></td>
<td>Warning</td>
<td>• Current warning messages (plain-text)</td>
</tr>
<tr>
<td></td>
<td>Sensor values</td>
<td>• Displays diagnostic values and control values</td>
</tr>
<tr>
<td></td>
<td>GM700</td>
<td>• Current monitored sensor values (amplification setting, internal temperature control, control values, etc.)</td>
</tr>
<tr>
<td></td>
<td>Sample</td>
<td>• Cross-Duct: OH Cross-Duct Refl.</td>
</tr>
<tr>
<td>Parameters</td>
<td>Setting</td>
<td>• Parameter settings/display of system components</td>
</tr>
</tbody>
</table>

- Display contents:
  - The header line shows the selected operating mode (e.g., parameter settings) or the menu items just selected during navigation.
  - 4 lines to show submenus, plain-text messages or settings (values)
  - Function line:
    - Use button Arrow ← to return to next higher level
    - Use button Enter to activate menu item or confirm input
    - Use button Enter to select a variable
    - When selecting a variable requiring numeric input, use buttons Arrow ↑ (↓) to set the numeric value per digit

- Password: When a password is prompted, enter the code 1 2 3 4 using ↑ (↓).
### Handling the Evaluation Unit

#### Analog Out

<table>
<thead>
<tr>
<th>Output</th>
<th>Live Zero</th>
<th>Component: e.g. HF, - , p, T</th>
<th>Range low: 0 ... 999999</th>
<th>Range high: 0 ... 999999</th>
<th>Cycle Out: No, Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0, 4 mA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Component: e.g. HF, - , p, T</td>
<td>Range low: 0 ... 999999</td>
<td>Range high: 0 ... 999999</td>
<td>Cycle Out: No, Yes</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Component: e.g. HF, - , p, T</td>
<td>Range low: 0 ... 999999</td>
<td>Range high: 0 ... 999999</td>
<td>Cycle Out: No, Yes</td>
<td></td>
</tr>
</tbody>
</table>

#### Analog In

<table>
<thead>
<tr>
<th>Input</th>
<th>Unit: °C, K, °F</th>
<th>Live Zero: 0, 2, 4 mA</th>
<th>Range low: 0 ... 15000</th>
<th>Range high: 0 ... 15000</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 T</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 p</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Coefficients

<table>
<thead>
<tr>
<th>Funct.</th>
<th>Span (HF)</th>
<th>±999</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coefficients</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Ambient Temp.

<table>
<thead>
<tr>
<th>Range</th>
<th>0 ... 50 °C, –10 ... 40 °C, –20 ... 30 °C, –30 ... 20 °C, –40 ... 10 °C</th>
</tr>
</thead>
</table>

#### t (Feed Test Gas)

<table>
<thead>
<tr>
<th>Period</th>
<th>0 ... 366 d (day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Only when permanent cuvette fitted.</td>
<td></td>
</tr>
</tbody>
</table>

#### t (delay)

| Period | 0 ... 1800 s; delay until gas enters again |

#### Delta T

| Period | 0 ... 999 °C; temperature difference at which a zero adjust is carried out |

#### Device

<table>
<thead>
<tr>
<th>Serial Number</th>
<th>Head.</th>
<th>Laser</th>
<th>EvU</th>
</tr>
</thead>
</table>

#### Software Revision

| | GMM700-X | XXXXXXX XXXX | GMM700/DSP | XXXXXXX XXXX |

#### Service

<p>| | Not defined |</p>
<table>
<thead>
<tr>
<th>Calibration</th>
<th>Check cycle</th>
<th>Start CCY (Check Cycle)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zero Adjust</td>
<td>Start ZeroAdjust</td>
<td>Password (1 2 3 4)</td>
<td>Check cycle for test purposes, e.g. after maintenance (preliminary)</td>
</tr>
<tr>
<td>Zero Adj. Stack</td>
<td>Start ZeroAdjust</td>
<td>Password (1 2 3 4)</td>
<td>Zero point determination, e.g. during start-up or after maintenance task based on the zero path</td>
</tr>
<tr>
<td>Box measuring</td>
<td>Start Meas.</td>
<td>Password (1 2 3 4)</td>
<td>Only GPP probe: Zero point determination with measuring device on gas duct</td>
</tr>
<tr>
<td>Check cycle</td>
<td>Start CCY (Check Cycle)</td>
<td></td>
<td>Check cycle for test purposes, e.g. after maintenance</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Maintenance</th>
<th>Maint. Mode</th>
<th>Mode: Off, On</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Analog Out</td>
<td>AO 1: 4 mA</td>
<td>Tests the analog outputs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AO 2: 4 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>AO 3: 12.5 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test Analog In</td>
<td>AO 1: 0 mA</td>
<td>Tests the analog inputs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AO 2: 0 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>AO 3: 0 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test Relay</td>
<td>Relay 1: On (Off)</td>
<td>Tests the relay outputs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Relay 2: On (Off)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Relay 3: Off (On)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test Digital In</td>
<td>DI 1: Open</td>
<td>Tests the digital inputs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DI 2: Open</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>DI 3: Open</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Push Diag</td>
<td>RS232</td>
<td>Outputs the complete parameter set via the RS232 Service interface</td>
<td></td>
</tr>
<tr>
<td>Reset System</td>
<td></td>
<td>Restarts the measuring system</td>
<td></td>
</tr>
<tr>
<td>Reset Parameter</td>
<td></td>
<td>Resets parameters to factory settings</td>
<td></td>
</tr>
</tbody>
</table>

**Attention:** All settings are overwritten!
GM700

6 Start-up

Start-up steps overview
Mechanical preparation
Starting operating mode
6.1 Preparations
This Section describes the standard start-up at the end of which GM700 starts measuring operation.

6.1.1 Required qualifications and further prerequisites
Previous training by SICK or a qualified sales partner is recommended for technicians or engineers planning on performing a start-up. This training provides knowledge so that participants can recognize and handle situations that demand measures going beyond the standard procedures described here. Employees of SICK or trained sales partners can not only manage start-up but can also make recommendations for the current measuring operation as well as determining maintenance intervals based on specific installation conditions.

Standard start-up
Each individual measuring system is already configured to the individual usage conditions at the factory and therefore the standard start-up procedure described in this Section can normally be carried by qualified engineers or measurement technicians without the special training. Prerequisites are:
• Exact adherence to the application requirements specified in the order
• The possibility, during start-up, to ask the advice of a trained specialist from SICK or the respective sales partner should special questions arise that go beyond the normal scope of the standard procedures described.

Start-up procedure overview
After the general preparation which mainly deals with checking the work already carried out, it is then necessary to carry out a zero adjust with the measuring system on a measuring path free from sample gas, the zero path. This can be done either at the sampling point or another location, e.g. in a closed room. At the sampling point itself, the purge air unit, SR-unit and reflector are then put into operation in succession. Finally, the evaluation unit is switched on and checked; the parameters can then be set for the individual demands.

6.2 Start-up steps overview
Prerequisites for successful start-up:
• Installation conditions match the requirements for the measuring system (temperature, pressure).
• Sampling point must be accessible without danger or problems.
• All power supply and signal cables installed and connected.
• Apart from the SR-unit and purge air fixtures that are connected later to the duct flange, the system must be fully installed and with all electrical connections.
• Purge air supply, when fitted, must be ready for use.
• Sampling point technical data must be known:
  • Measuring range
  • Limit values
  • Inputs and outputs to be used

Start-up runs in two main steps:
• 1st main step: Zero adjust (→ p. 54, §6.3.5)
• 2nd main step: Installation and start-up at the sampling point (→ p. 54, §6.3.5)

Tools and equipment
▸ Provide the following tools and equipment:
- Personal protective equipment as required, e.g. for hot resp. aggressive sample gases
- 1 19 mm open-end wrench
- Allen key set
- Insulated screwdriver set for electrical connection work etc.

• Fastening parts included in the GM700 measuring system scope of delivery:
  - 4 each M16 x 60 screws with washers and self-locking nuts to fasten the purge air fixtures on the duct-side flange with tube
  - For each purge air fixture:
    - 3 nuts with washers and each with 10 cup springs to fasten the purge air fixtures on the SR-unit resp. reflector
  - Sealing ring to seal the SR-unit, reflector and purge air fixture connection

• Optical cleaning cloth without detergents, e.g. SICK Part No. 4003 353

6.3 Mechanical preparation

6.3.1 Checking the scope of delivery

▸ Check the SR-unit and measuring probe to ensure they are in perfect condition.
▸ Make sure the supply voltages on the type plates of the GM700 device components comply with the installation conditions.

The supply voltage of the GM700 components can be changed between 115 V and 230 V on site by the SICK service personnel when necessary.

6.3.1.1 Transport safety devices

▸ Remove the transport safety devices shown in the following as well as any protective labels 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 lock and swivel the flange fixture up (see Fig.). Keep transport safety devices as necessary.

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:
▸ Connect the power supply to the SR-unit
6.3.2 Fitting the SR-unit on the measuring probe

Fitting is identical for all measuring probe versions. The fixing parts are included in the GM700 measuring system scope of delivery.

- Place 10 cup springs each, with front ends facing each other, i.e. 5 pairs, on the three threaded pins on the flange fixture on the SR-unit. The sectional view (Fig. 26) shows the exact arrangement.
- Pull the sealing ring over the device flange and hang it loosely over the measuring probe where it is ready for use afterwards.
- Carefully mount the measuring probe with the device flange onto the three threaded pins of the flange fixture fitted with cup springs without damaging the threads.
- Fit the centering discs and tighten the nuts with a 19 mm wrench so that the cup springs are pressed together slightly.
- Leave a gap between the flange fixture of the SR-unit and the device flange of the measuring probe to allow adjustment of the optical alignment (see Fig. 26).
- 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 in Fig. 26.
If the flange fixture was removed from the SR-unit, attach it again. Insert the hinge bolt again and close the quick-release locks.

Set the lever of the probe flange to the “open” position to open the closing device on the probe to the sample gas side. See GMP measuring probe (with open measuring gap) → p. 17, Fig. 4

**WARNING:** Eye injuries possible due to laser radiation

▶ Never open or fold down the reflector during operation.

### 6.3.3 Electrical connections on the sender/receiver unit

▶ Connect cables accordingly:
  - Connect and secure CAN bus cable between SR-unit and probe.
  - Connect and secure CAN bus cable to EvU.
  - When necessary, connect the temperature sensor and the low-pressure monitor (to SLV, when fitted).
▶ Switch the power supply on.
6.3.4  Optical alignment

6.3.4.1  Optical alignment (for device version for NH₃, HF and O₂ measurement)

Alignment of the optical axis is checked using the visor on the right hand side of the SR-unit enclosure and adjusted using the screws on the mounting flange according to the L-adjustment. → p. 53, Fig. 23. The power supply for the evaluation unit must be switched on.

1  Switch to Maintenance mode

On the evaluation unit:

► Press button "maint"
► Select “Maintenance Mode” and activate with Enter
► Activate Maintenance mode

Mode: On (maintenance mode active)

2  Align the sender/receiver unit

► First turn (1.) and then pull down (2.) the lever of the built-in alignment tool to bring the alignment tool into adjustment position → Fig. 22 above.
► Look through the visor on the right enclosure side diagonally from above at the mirror with the target.
► As shown in → p. 53, Fig. 23, align the position of the light spot (red on the HF device version, green on the NH₃ device version) of the laser beam from the reflector. To do this, adjust the screws of the purge air fixture on the flange so that the light spot appears on the target in position “Circle”.

Figure 21  Connections on the SR-unit with GMP measuring probe
Figure 22 Using the alignment tool

▸ Only adjust the screws as shown in p. 53, Fig. 23.

Figure 23 Using the alignment tool

- Alignment tool lever
- Visor of the optical alignment
- LED display for rough view of optical alignment
- Target of the alignment tool
- X-alignment; horizontal
- Y-alignment; vertical
- Alignment on probe version
- (Alignment on Cross-Duct version)
▸ After successful alignment, push the lever of the alignment tool back to its original position and secure it with a quarter turn.

### 6.3.4.2 Optical alignment of device version for HCl measurement

The wavelength used for HCl measurement is not visible on the target. The power supply for the evaluation unit must be switched on.

1 **Switch to Maintenance mode**
   - On the evaluation unit:
     - Press button “maint”
     - Select **Maintenance Mode** and activate with Enter
     - Select **Adjust Optical Alignment**

   Maintenance mode/Optical Alignment is active. The EvU display switches to display the measuring channel brightness.

2 **Align the sender/receiver unit**
   - First turn (1.) and then pull down (2.) the lever of the built-in alignment tool to bring the alignment tool into adjustment position → p. 53, Fig. 23.
   - Adjust the screws of the purge air fixture on the flange so that the measuring channel brightness reaches the maximum value. The adjustment, including the warming up time, takes about 2.5 to 5 hours whereby the actual work is completed in less than 30 minutes. Devices with automatic check cycle perform the first check cycle after the warming up phase.

### 6.3.5 Zero adjust

After the evaluation unit has been connected to the power supply, a warm-up time of approx. 2.5 - 5 hours (depending on ambient conditions) is required before zero adjust can be carried out.

▸ After the warm-up phase, align the optical axis as described in → p. 52, §6.3.4.

Select menu **cal**:
- **Zero Adjust** – manual zero adjust (measuring path free from sample gas)
  - Activate Calibration mode (button “cal”), execute menu item **Zero Adjust**.

Confirm the prompt. Zero point adjustment runs and **Zero Measuring** is displayed.
6.3.6 Installing the weatherproof cover for the SR-unit

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

Figure 24 Weatherproof cover for GM700 SR-unit

The weatherproof cover is installed in two steps:

Figure 25 Weatherproof cover for GM700 SR-unit and reflector unit

1. Installing the installation plate on the flange of the purge air fixture.
   - Place the weatherproof cover on the ground turned over.
   - Open and unhinge the locks on both sides.
   - Pull the installation plate upwards and remove from the cover.

2. Installing the cover
Figure 26  Installing the cover on the purge air fixture

▸ Remove the lower mounting ring.
▸ Place installation plate (1) from the top on the rubber band of the purge air fixture. Place the mounting ring on the side of purge air fixture (2); see detailed view in Fig. 26.
▸ Re-attach lower mounting ring (3).
6.3.7 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:

▸ Based on the operator information in «Handling the Evaluation Unit», §5, check whether the measured value display is correct on the LC-Display.

If error or warning messages are displayed:

▸ Use the operator information on p. 41, §5 as well as the display of error and warning messages on p. 79, §8 to locate and rectify the error cause.

If the error cause cannot be rectified with this information, contact the Service department at SICK or your local sales partner for further advice.

▸ If necessary, parameterize the evaluation unit in accordance with the requirements of the measuring task and the installation environment → p. 41, §5.

6.3.8 Operating states

During actual operation, the following operating states can be shown on the evaluation unit display:

<table>
<thead>
<tr>
<th>Message in 1st text line</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>INIT</td>
<td>EvU initialization</td>
</tr>
<tr>
<td>INITIALISATION</td>
<td>Initializing the SR-unit</td>
</tr>
<tr>
<td>SIGNAL_ADJUST</td>
<td>Adjusting amplification to changed transmission</td>
</tr>
<tr>
<td>MEASURING</td>
<td>Measuring mode</td>
</tr>
<tr>
<td>MEASURING LL</td>
<td>Measuring mode with active tracking of laser wavelength (line-locking)</td>
</tr>
</tbody>
</table>
6.3.8.1 Gas connections on the GPP measuring probe for zero gas resp. test gas

Depending on the variant, the GM700 analyzer performs independent zero point measurements in certain intervals to ensure high precision with very small measuring ranges. A zero gas/test gas connection and a second gas connection for nitrogen purging or dynamic zeroing directly on the measuring probe are available.

An overpressure is created in the measuring path of the probe during zero or test gas feed. If this pressure is high enough, the complete sample gas is drained out of the measuring path because a gas flow runs in the reverse direction through the probe filter. The gas flow in the filter must be larger than the diffusion velocity of the gases in order to drain out the sample gas from the measuring path. The analyzer performs the zero point measurements automatically during measuring operation. They can also be triggered manually with the cal button on the evaluation unit. → p. 43, §5.2.1 and following.

Equipment

- Gas hoses:
  - Teflon hose (PTFE), type 650 P 0707, 1/4”
  - Steel pipe 1.4571, 1/4”
- Zero gas: Instrument air, class 2
- Pressure reducer
- Supply line 1/4” with cutting-clamping ring connection (Swagelok)

1 Connecting the measuring probe

- Connect zero gas (instrument air) to 1st gas inlet “Zero gas”.
  - Take off the cap nut from the gas inlet.
  - Place the cap nut and clamping rings on the open end of the gas pipe.
  - Insert the pipe in the open screw fitting.
  - Tighten the nut with an open end wrench.
2 Connecting the instrument air

- Connect the pressure reducer to the instrument air supply.
- Connect the gas hose from the probe to the pressure regulator outlet.
- Set pressure reducer to 250 kPa.

6.3.9 Gas connections for oxygen measurement

On the GM700 version for oxygen measurement, the optical paths from the SR-unit and measuring probe (outside the active measuring path) must be purged with nitrogen.

6.3.9.1 Connecting the nitrogen lines

- Connect gas connections on the SR-unit, measuring probe and N₂ purge unit according to p. 59, Fig. 29.
- Take off the cap nut from the gas inlet.
- Place the cap nut and clamping rings on the open end of the gas pipe.
- Insert the pipe in the open screw fitting.
- Tighten the nut with a 9/16" open-end wrench. Tighten the cap nut with a 9/16" open-end wrench.

When using a gas hose, an inner bushing (Part No. 5309138) must be used to support the hose and clamping ring.
6.3.9.2 Connecting the nitrogen cylinder

**Equipment**
- Nitrogen cylinder (N₂ 3.0 or better)
- Pressure reducer.
- Supply line 1/4" with cutting-clamping ring connection (Swagelok)
  - Fit a pressure reducer on the nitrogen cylinder and secure the gas cylinder against falling over.
  - Lay a line between the pressure reducer outlet and the control unit gas inlet using a 1/4" Teflon hose
  - Connect the gas connection to the “Gas” inlet of the control unit using a cutting-clamping ring connection (Swagelok).

Set pressure reducer to 2 bar.

6.3.10 Starting operating mode

**On the evaluation unit:**
- Switch Maintenance mode off:
Start-up

Mode: Off
Start Measuring mode by pressing the meas button. The analyzer now starts in Measuring mode.
▶ Check for error or warning messages, especially on the status LEDs.
▶ If error messages are displayed, clear according to p. 79, §8.
▶ Set parameters, special times and measuring range, → p. 41, §5

Selecting the ambient temperature

NOTICE: Change of temperature range
The device performs temperature stabilization after a change of the temperature range. This can take approx. half an hour depending on the environment.
• Warning message “DEV TEMP” is output
• Wait for half an hour before performing a zero adjust.

On the evaluation unit:
▶ Select a suitable ambient temperature so that the heater of the SR-unit can stabilize the optics temperatures.
▶ Activate Parameter mode.
▶ Select menu Settings, then Ambient Temp.
▶ Select the temperature range according the Table below that matches the ambient conditions at the measuring location.

Possible ambient temperature ranges (test cuvette)

<table>
<thead>
<tr>
<th>Degrees Celsius [°C]</th>
<th>Kelvin [K]</th>
<th>Degrees Fahrenheit [°F]</th>
</tr>
</thead>
<tbody>
<tr>
<td>–40 ... 10</td>
<td>233 ... 283</td>
<td>–40 ... 50</td>
</tr>
<tr>
<td>–30 ... 20</td>
<td>243 ... 293</td>
<td>–22 ... 68</td>
</tr>
<tr>
<td>–20 ... 30</td>
<td>253 ... 303</td>
<td>–4 ... 86</td>
</tr>
<tr>
<td>–10 ... 40</td>
<td>263 ... 313</td>
<td>14 ... 104</td>
</tr>
<tr>
<td>0 ... 50</td>
<td>273 ... 323</td>
<td>32 ... 122</td>
</tr>
</tbody>
</table>

Possible ambient temperature ranges (closed cuvette)

<table>
<thead>
<tr>
<th>Degrees Celsius [°C]</th>
<th>Kelvin [K]</th>
<th>Degrees Fahrenheit [°F]</th>
</tr>
</thead>
<tbody>
<tr>
<td>–40 ... 15</td>
<td>233 ... 288</td>
<td>–40 ... 59</td>
</tr>
<tr>
<td>–30 ... 25</td>
<td>243 ... 298</td>
<td>–22 ... 77</td>
</tr>
<tr>
<td>–20 ... 35</td>
<td>253 ... 308</td>
<td>–4 ... 95</td>
</tr>
<tr>
<td>–10 ... 45</td>
<td>263 ... 318</td>
<td>14 ... 104</td>
</tr>
<tr>
<td>0 ... 52</td>
<td>273 ... 325</td>
<td>32 ... 122</td>
</tr>
</tbody>
</table>

The GM700 determines the appropriate temperature for the optics heater automatically.
▶ Zero point adjustment:

NOTICE: After changing the temperature range
• Warning message “DEV TEMP” may no longer be shown.
• The temperature change should have been made approx. half an hour ago.

▶ Activate Calibration mode (button “cal”), select menu item Zero Adjust and trigger with Enter.
▶ Confirm the prompt. Zero point adjustment runs and Zero Measuring is displayed.
Starting the increased nitrogen purging for oxygen measurement

Before starting the measuring system, make sure the sealing tape which covers the gap between the SR-unit and flange plate of the sample cuvette sits tight in order to minimize gas consumption.

Evaluation unit

Press button cal; the GM700 measuring system switches to Calibration mode.

Call up menu item N2 Purging and start it by pressing Enter twice.

The display shows the message N2 Purging active, please wait.

Switch to Measuring mode

Make sure the nitrogen cylinder does not run empty. Close off the nitrogen cylinder for safety reasons when the measuring system has been shut down.

The device first performs an initializing cycle after the power supply for all GM700 components (evaluation unit, purge unit) has been switched on. The evaluation unit displays the message “Initialization”. This phase takes about 2 minutes and the device then switches independently to Measuring mode and the message “Measuring” is displayed.

The display shows the O₂ concentration measured in the sample cuvette, e.g. 11.4 percent by volume.

• Button serves to display the variables temperature (t) and pressure (p) measured in the sample cuvette as well.

• The bar chart represents a quasi analog display of the selected measured variable – scaled to the measuring range of the analog output. The left digit below the bar shows the measuring range start value and the right digit the measuring range end value.

The display and operating elements are described in detail in Section p. 42, §5.2.
GM700

7 Maintenance

Maintenance intervals
Maintenance work on SR-unit
Evaluation unit (EvU)

Controlling and tracking the laser working point during measurement
7.1 Maintenance intervals

The Version with measuring probe GM700 requires very little maintenance. This Section describes regular maintenance work to be carried out on the GM700 measuring system.

Qualifications

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 an in-depth knowledge of the relevant safety regulations.

The maintenance intervals depend on individual application conditions and should be clarified with SICK Service resp. a trained engineer or technician at the local sales partner. If no other specifications have been made, the following recommendation is applicable:

- Maintenance interval – 4 weeks

7.1.1 Maintenance protocol

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

DANGER: 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 locks without 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 run continuously.

▸ 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.

7.2 Preparation and general preparatory work

▸ Have the following equipment available for service work:

- At least the following tools: 2 x 24 mm open-end or box wrenches, 1 x 19 mm open-end or box wrench, Allen key set, insulated screwdriver set for electrical connection work
- Optical cleaning cloth without detergents, e.g. Part No. 4 003 353
- Distilled water, clean cloths and, if necessary, a dusting brush
- If the duct is pressurized, a suitable protective cover is required for the duct-side flange with tube.

Maintenance tasks for purge air unit

→ Purge air unit Operating Instructions.
7.3 Maintenance work on SR-unit

7.3.1 Visual inspection and enclosure cleaning

▸ Check the enclosure of the SR-unit for damage such as cracks for example.
▸ If a weatherproof cover is used, check its condition.
▸ Clean contaminated GM700 system components.
▸ Inspect cables thoroughly for damage and pay particular attention to any signs of abrasion or bending at cable ducts. Prefabricated cables are available as spare parts.

7.3.2 Cleaning the front window on the SR-unit

**WARNING:** Take care when the duct is pressurized!
▸ If the duct is pressurized, you must take the appropriate protective measures, 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.
▸ Fit the cover immediately on the device flange opening after swiveling the SR-unit open.

**WARNING:** Eye injuries possible due to laser radiation when the SR-unit is swiveled open!

The retina of a human eye can be damaged when a person looks directly into the laser beam for a longer time.
▸ Always switch the GM700 SR-unit off or disconnect the SR-unit CAN cable to the evaluation unit during installation work on the SR-unit or reflector! Otherwise this could result in dangerous exposure to radiation
▸ Never look directly into the laser beam! Not even with optical instruments!
▸ Never direct the laser beam at other persons!
▸ Make sure the laser beam is not aimed at reflecting surfaces.
▸ See Laser Protection Ordinance according to IEC 60825-1!

▸ Switch the GM700 off.
▸ Open the SR-unit enclosure with a control cabinet key and swivel open.
▸ Check the optical interfaces (front window) of the SR-unit for contamination and clean with an optic cleaning cloth as necessary. Do not use any detergents because these leave invisible residues that could falsify the measuring result. The cleaning cloths can be moistened with distilled water if necessary.
▸ Swivel the enclosure back in and lock to protect the cleaned optical interfaces against moisture and dust.
7.4 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?
- Open the evaluation unit door and check the following:
  - Are the cable connections OK?
  - Is the enclosure dry inside?
- If any one of these points is negative, clarify the cause when possible.
- Carry out the necessary repairs.

If the evaluation unit is damaged (e.g. LC-Display failure):
- Contact SICK Service or the local sales representative.
Controlling and tracking the laser working point during measurement

The working point of the laser needs to be tracked when the concentration in the sample gas is not sufficient. This can be done:

- Automatically using a permanently filled cuvette in the device on certain device versions
- or
- manually for device versions with a flow cuvette - when the analyzer fails to register a sufficient sample gas concentration over a typical period of 4 weeks. The analyzer is able to determine the position of the absorption line of the gas in the flow cuvette and uses this value to track the laser wavelength (line-locking), that may have shifted slowly due to ageing effects.

7.5.1 Connecting the test gas

Figure 32 Test gas connections on the SR-unit (for HF measurements)

Equipment
- Gas hose:
  - Teflon hose (PTFE), type 650 P 0707, 1/8" or
  - Stainless steel tube, 3/8"
- Pressure regulator
- Test gas cylinder

Connection on the SR-unit
- Connect test gas to the gas inlet:
  - Remove the cap on the gas inlet and outlet
  - Position the cap and fixing ring on the open end of the gas hose as shown.
  - Push the hose end into the connection
  - Tighten the nut with a 7/16" socket wrench.
- Connect the test gas drainage (i.e. in the sample gas duct) to the gas outlet of the SR-unit.

This tracking is not a setpoint/actual value comparison with the test gas concentration!

- For HF, use a test gas concentration between 100 and 300 ppm.
- For HCl, use a test gas concentration between 500 and 1500 ppm.
Starting the tracking procedure

▸ Open the main valve on the test gas cylinder
▸ Set the pressure regulator to 250 hPa
  ▸ Open the low pressure valve on the pressure regulator for about 1 minute
  ▸ After 2 minutes reopen the valve again for about another minute.

On the evaluation unit:
▸ Check the display:
  ▪ The message “Measuring LL” (for line-locking active) should appear after about 1 minute.
▸ Open the main valve again for about 1 minute if this message is not displayed.
▸ Check the display again.
▸ When the message “Measuring LD” is displayed, close the main valve of the test gas cylinder and wait until the pressure regulator is empty.
▸ Disconnect and remove the gas hoses (or lines).
▸ Close off the gas connections on the SR-unit again with the caps.

The GM700 system now starts measuring operation.
▸ Watch for malfunction messages or warnings on the status LEDs of the EvU.
▸ If malfunctions appear, follow the instructions in the Troubleshooting Table on p. 82 and following pages.

7.5.2.1 Selecting the ambient temperature range

NOTICE: Change of temperature range
The device performs temperature stabilization after a change of the temperature range. This can take approx. half an hour depending on the environment.
- Warning message “DEV TEMP” is output
- Wait 30 min. before performing filter box measurement.

On the evaluation unit:
▸ Select the appropriate ambient temperature to allow the heater of the SR-unit to stabilize the optics temperature.
  - Activate Parameter mode
  - Select Settings and then the Ambient Temp. menu.
  - Select the temperature range according the Table below that matches the ambient conditions at the measuring location.

<table>
<thead>
<tr>
<th>Possible ambient temperature ranges (test cuvette)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degrees Celsius [*C]</td>
</tr>
<tr>
<td>-40 ... 15</td>
</tr>
<tr>
<td>-30 ... 25</td>
</tr>
<tr>
<td>-20 ... 35</td>
</tr>
<tr>
<td>-10 ... 45</td>
</tr>
<tr>
<td>0 ... 50</td>
</tr>
</tbody>
</table>
The GM700 analyzer automatically determines the appropriate temperature for the optics heater.

7.5.3 Filter box measurement to check the measuring channels for NH₃, HF or HCl

The gas filter box serves to check the GM700 with test gases.

Requirements

Components required:

- Reflector enclosure with gold-plated hollow triple reflector; Part No. 2030206
- Filter box with adapter plate for the GM700

Figure 33 Components required: Filter box for GM700

---

Measured values are displayed on the EvU in mg/m³ • m (operation),

7.5.4 Determining the necessary test gas concentration

1 General calculation:

\[
\text{Test gas conc. [ppm or % by vol.]} = \frac{\text{Meas. range [ppm or % by vol.]} \times \text{act. meas. path [m]}}{0.15 \text{ m max. filter chamber length}}
\]

2 Calculating setpoint values for all 6 chamber lengths:

\[
\text{CO}_{2\text{(Target)}} = \text{Test gas conc. [ppm]} \times \frac{0.758}{273} \times \frac{353}{1013} \times \frac{\text{act. air pressure [hPa]}}{\text{L [mm]}_{\text{chamber}}} \times 0.001
\]

Conversion factor depends on the component

NH₃: 0.758, HF: 0.892, HCl: 1.628
### Comp. | Required test gas concentration
---|---
| Filter chamber lengths
| 25 mm | 50 mm | 75 mm | 100 mm | 125 mm | 150 mm
| NH₃ |  |  |  |  |  |
| HF |  |  |  |  |  |
| HCl |  |  |  |  |  |

#### 7.5.5 Installing the filter box

Figure 34  Filter box

▸ Swivel the intermediate GM700 enclosure open, remove the bolts and take off the intermediate enclosure. Store safely until filter box measurement is completed.
Position the filter box with adapter plate on the SR-unit:
- Insert the filter box in the SR-unit hinge
- Insert and fasten the bolt
- Swivel the filter box on the SR-unit in and lock with the locking device
- Fit the reflector for GM700 on the filter box.

Carry out filter box measurement
- Switch the filter box on; the warm-up phase takes about 2.5 hours.
- Switch on the zero gas pump or connect a different zero gas.
- Switch all chamber valves to “Zero gas” and the Measure/Purge valve to “Purge”.

Figure 35  Installing the filter box on the GM700

Figure 36  Installing the filter box on the measuring device
On the EvU:

▸ After about 3 minutes, call Box measuring in menu cal (button cal) and select the option “gas”.
▸ Enter password “1 2 3 4”.
▸ The measuring device now starts a zero adjust and then switches to operating mode “Box measuring”.

Figure 37  
Control elements on the filter box

▸ Connect test gas; set the primary pressure to approx. 1000 hPa (1 bar).
▸ Note the diameters of individual chambers resp. chamber combinations of the filter box and the concentration values; see Section 9.6.1, page 96.
▸ At the same time, set the respective filter chambers to “Test gas”.
▸ Switch the Measure/Purge valve to “Purge” for 2 to 3 minutes (until the measured value level has stabilized) and then to “Measure”.
▸ The overpressure from the purge phase now dissipates.
▸ When the measured value has stabilized again, read off and note the value.

Restart measuring mode

▸ Purge the filter box with zero gas

On the EvU:

▸ Exit “Box measuring” operating mode with the Return button
▸ Disassemble the filter box with plate and reflector from the SR-unit and store safely
▸ Refit the SR-unit back onto the sampling point in the correct position.
7.6 Checking the gas analyzer with test cell GMK10

Special characteristics of a measuring component or also the availability of test gases with the precision required for reference materials require the generation of the span gas from aqueous solutions with known content. This is the standard case for GM700-2 (HF).

A test gas system with hose pump, scales and evaporator is required in addition to the heated test cell GMK10 (example: Hovacal).

Requirements

**WARNING: Aggressive and corrosive gases**

All materials used must be suitable for the measuring components, e.g. HCl, HF.

- The manufacturer recommends to exclusively use the evaporator of the test gas system for this check.

Components required:

- Zero path; Part No. 46483
- Test cell GMK10 with heated sample gas line
- Settings of the test gas system (Hovacal)
  - Consider the following when entering the nominal value of the concentration (mg/m³):
    - Test cell length of 150 mm
    - Test gas temperature depending on setting (120 ... 140 °C)
    - Measured value output in mg/m³ in the operating state relative to an active measuring path length of 1 m (1000 mm)

- Nominal value input (in the standard state; 0 °C, 1013 hPa) in the test gas system (Hovacal):
  - Example: Test value = 5 mg/m³

<table>
<thead>
<tr>
<th>Nominal value</th>
<th>Test cell</th>
<th>Test value 1000 mm</th>
<th>Test value 150 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input</td>
<td>1000 mm</td>
<td>150 mm</td>
<td></td>
</tr>
<tr>
<td>5 mg/m³</td>
<td>5 mg/m³</td>
<td>33.3 mg/m³</td>
<td></td>
</tr>
</tbody>
</table>

- The actual display on the device is shown as operating state:
  - Output Device = Test value \* \(\frac{273°C}{273°C + \text{Temp Cell}}\) = 5 mg/m³ \* \(\frac{273°C}{393°C}\) = 3.47 mg/m³
  - Comparison of actual display with entered nominal value:
    - Test value = Output Device \* \(\frac{273°C}{273°C + \text{Temp Cell}}\) = 3.47 mg/m³ \* \(\frac{393°C}{273°C}\) = 5 mg/m³

- Aqueous solution of test component (e.g. 0.01 M for HF)
- Distilled water
- Nitrogen 4.6 or better (compressed gas cylinder)
- Length of hose for safe discharge of the test gas
- Measurement of ambient air pressure

On the evaluation unit:

- Set the measuring system to maintenance mode before removing the device from the sampling point.
- On the evaluation unit:
  - Press button “maint”
  - Select “Maintenance Mode” and activate maintenance operation
7.6.1 Assembly of the GM700 components with the test cell GMK10

Figure 38 Assembly of the GM700 components and the test cell

- Remove the SR-unit and the measuring probe from the sampling point.
- Use the 4 M16 screws to fit the GMK10 with device flange to the measuring probe.

Installation of GM700 components
➔ p. 33, 4.2.

- Perform connections on the GMK10:
  - Connect the cables for energy supply.
  - Connect the sample gas line
  - Connect the hose for gas drainage from the test gas system to the gas outlet
- Prepare the test gas system and put it into operation. Refer to separate Operating Instructions etc. of the test gas system.

Figure 39 Connections of the GMK10 test cell
7.6.2 Carrying out measurement

1 Step: Checking optical alignment

- The CAN line from the SR-unit to the purge air fixture may not be connected, the system switches to using the default values for pressure and temperature.

- If necessary, disconnect this CAN line. Connect the other connections of the measuring system, → p. 51, §6.3.3

- Connect the sample gas line from the test gas system.

- If necessary, connect the power supply for all GM700 components

2 Step: Settings:

- As standard, the temperature of the test cell and the heated sample gas line is 120 °C. Temperatures up to 140 °C are possible depending on the application.

- Check the temperature on the GMK10.
  - Check the temperature indicator on the GMK10 cover.
  - Set the desired temperature accordingly when the indicator does not show 120 °C.
  - Remove the cover of the GMK10 and set the temperature on the temperature controller. If required, see separate Operating Instructions of the temperature controller.
3 Step: Set the evaporator temperature on the test gas generator to 180 °C. The test cell is purged with nitrogen during the warming up phase.

**Warming up time: Approx. one hour**
Measurement can begin after a warming up time of at least one hour. However, we recommend to first purge the system by evaporating pure water.

**NOTICE: Software version UD81 or higher**
Software version UD81 or higher must be installed in the GM700 measuring system for this procedure!

4 Step: Perform measurement:
- When stable conditions exist – to be seen by the trend of the measured values – activate boxmeasuring mode on the GM700 EvU
  - On the EvU: Call up menu cal with the cal button, activate “Boxmeasuring” and start with Enter.
  - Enter password “1 2 3 4”.

The measuring device now starts a zero adjust and then switches to operating mode “Box measuring”. As for each filter box measurement, the system first performs a temporary zero adjust and then changes to boxmeasuring mode. The output of the measured values is performed analog to standard filter box measurement in mg/m³ (during operation, relative to 1 m active measuring path).
Since the setpoint setting at the test gas system (Hovacal) is "standard", correct the value comparison (ambient) pressure and (test cell) temperature. → p. 69, «Requirements».

### Recommendation

- To prevent pressure build-up in the measuring cell, do not use higher flow rates than **4 l/min.** for the measurements.
- Pay attention to the unhindered discharge of the sample gas at the gas outlet.
- The standard solution used for the test must be chosen so that the H₂O concentration of the generated test gas does not exceed 30% by volume at any test point. **Typical value for HF: 0.01M.**

5 Step: Terminate the measurement

After termination of boxmeasuring mode ("back" button), the conditions for normal measuring mode are reestablished, e.g. indication of measured value as parameterized.

- Terminate the measurement with the "back" button.
- Reinstall the GM700 SR and reflector unit to the purge air fixtures at the sampling point and continue Measuring mode.

### NOTICE: Purge the measuring system with evaporated distilled water

- After the end of the measurements, the system **must** be purged with vaporized distilled water until the zero point is reached again!
- Before switching off the heaters, the system must be purged with dry nitrogen for a minimum of 5 minutes.
- Make gas connections → p. 58, 6.3.8.1.
8 Troubleshooting and Clearing Malfunctions

Malfunction categories/possible effects
- Purge air failure
- Troubleshooting and clearing malfunctions, evaluation unit
Malfunction categories/possible effects

This Section explains how to detect, diagnose and clear malfunctions on des Gas analyzers GM700. 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.

Malfunctions on des GM700 are categorized according to their 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 GM700. Section p. 80, §8.2 describes the necessary emergency and protective measures.

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 enclosure temperature of the GM700 SR-unit
- Rapid increase in contamination on optical interfaces of the SR-unit
- Hose for the purge air supply to the purge air fixture is loose or visibly damaged

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

Integrated monitoring and diagnosis system
The GM700 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 conditions occur. Depending on the anticipated effects, the messages of the system components are categorized into error messages and warning messages: 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.
8.3.1 Display and retrieval of messages on the evaluation unit

<table>
<thead>
<tr>
<th>Component/Tool</th>
<th>Signals</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front panel</td>
<td>Warning LED goes on</td>
<td>Functional impairment on system that will not directly lead to corrupt measured values.</td>
</tr>
<tr>
<td></td>
<td>Malfunction LED blinks</td>
<td>Functional impairment on system that can lead to system failure or restricted function.</td>
</tr>
<tr>
<td>Error Storage Table</td>
<td>Call menu Malfunction</td>
<td>Plain-text message(s) for errors that have occurred to localize and clear the problem. See “Troubleshooting Table”.</td>
</tr>
<tr>
<td>Warning Storage Table</td>
<td>Call menu Warning</td>
<td>Plain-text message(s) for pending warnings</td>
</tr>
<tr>
<td>Output</td>
<td>Relay 1 inactive¹)</td>
<td>Group malfunction</td>
</tr>
</tbody>
</table>

¹) The relay is active during normal operation (no malfunctions), i.e. the contact is closed.

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.

<table>
<thead>
<tr>
<th>Error indication</th>
<th>Possible causes</th>
<th>Clearance</th>
</tr>
</thead>
<tbody>
<tr>
<td>● LED Malfunction blinks; (LED Warning could go on)</td>
<td>Plain-text error messages indicate possible causes</td>
<td>➤ Start Diagnosis mode (diag):</td>
</tr>
<tr>
<td>● Relay 1: Group malfunction</td>
<td></td>
<td>– Call menu Malfunction (resp. Warning)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>– Check and clear the specified malfunction.</td>
</tr>
</tbody>
</table>
8.3.2 Troubleshooting and clearing malfunctions, evaluation unit

| 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 |

*Corrupt Parameters*

- Reset Memory
- Start: Enter

*Fuses*

- Open the EvU enclosure
- Check fuses and replace when necessary

*Power supply*

- Check the indicator for the 24 V/5V supply and, if necessary, remove the screw terminal (CAN) of the signal cable to the SR-unit.  
  - If these indicators only light up when the connector has been removed, check the cabling first.  
  - If no error is found, connect the system components one by one  
    - Only connect the cable between the EvU and SR-unit  
    - Connect the cable to the reflector

*Display for 24/5 V*

- Jumper: Open: 230 V AC  
  Plugged: 115 V

*Fuses:*

- 2.5 AT, 250 V

*Screw terminals (CAN) for SR-unit*
## 8.3.3 Error messages

<table>
<thead>
<tr>
<th>Error message</th>
<th>Component/possible causes</th>
<th>Clearance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air purge low SLV</td>
<td>The volume flow is below the set limit.</td>
<td>Check the purge air supply (blower, hoses), if necessary, exchange filter on purge air blower, → Purge air unit Operating Instructions.</td>
</tr>
<tr>
<td>CD: Filter watch SLV</td>
<td>Low-pressure monitor of purge air unit switches on binary input</td>
<td>Check the purge air supply (blower, hoses), if necessary, exchange filter on purge air blower, → Purge air unit Operating Instructions.</td>
</tr>
<tr>
<td>CD: P No Signal SLV</td>
<td>No signal from pressure sensor</td>
<td>Check connection and cable connection of pressure sensor on purge air fixture and repair if necessary</td>
</tr>
<tr>
<td>CD: P out of range SLV</td>
<td>Sample gas pressure &lt; 500 or &gt; 1200 hPa/mbar</td>
<td>Check resp. replace pressure sensor</td>
</tr>
<tr>
<td>CD: T Air Sign. SLV</td>
<td>Broken sensor resp. no temperature sensor (purge air temperature) connected</td>
<td>Check connection and cable connection of temperature sensor (purge air temperature) on purge air fixture and repair if necessary</td>
</tr>
<tr>
<td>CD: [t] No Signal SLV</td>
<td>Broken sensor resp. no temperature sensor (exhaust gas temperature) connected</td>
<td>Check connection and cable connection of temperature sensor (exhaust gas temperature) on purge air fixture and repair if necessary</td>
</tr>
<tr>
<td>CDOH: No communication SLV</td>
<td>CAN connection EvU – purge air fixture SR interrupted</td>
<td>Check CAN connection; disconnect and reconnect plug, repair if necessary</td>
</tr>
<tr>
<td>CDR: No communication SLV</td>
<td>CAN connection EvU – purge air fixture reflector interrupted</td>
<td>Check CAN connection; disconnect and reconnect plug, repair if necessary</td>
</tr>
<tr>
<td>DSP: BOOT ERROR</td>
<td>Error during start process</td>
<td>Restart device</td>
</tr>
<tr>
<td>DSP...Digital Signal Processor</td>
<td></td>
<td>- Press maint button to activate maintenance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Trigger menu Reset System or switch device off and on again</td>
</tr>
<tr>
<td>DSP: INV PARA</td>
<td>Incompatible software (SR-unit) Invalid values entered</td>
<td>Check software version, contact Service if necessary</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Correct erroneous values</td>
</tr>
<tr>
<td>DSP: NO RESP</td>
<td>Electronics communication problem (SR-unit)</td>
<td>Restart device, see above</td>
</tr>
<tr>
<td></td>
<td></td>
<td>If not successful, contact Service</td>
</tr>
<tr>
<td>EEPROM: CONTROL</td>
<td>Invalid microcontroller parameters (SR-unit)</td>
<td>Restart device, see above</td>
</tr>
<tr>
<td></td>
<td></td>
<td>If not successful, contact Service</td>
</tr>
<tr>
<td>EEPROM: LASER</td>
<td>Invalid laser parameters</td>
<td>Restart device, see above</td>
</tr>
<tr>
<td></td>
<td></td>
<td>If not successful, contact Service</td>
</tr>
<tr>
<td>FIT: DIV BY 0</td>
<td>Error during signal evaluation</td>
<td>Check parameters measuring distance, substitute for temperature and pressure and correct if necessary</td>
</tr>
<tr>
<td></td>
<td>- Incorrect parameter values</td>
<td>Restart device, see above</td>
</tr>
<tr>
<td></td>
<td>- Hardware defective</td>
<td>If not successful, contact Service</td>
</tr>
<tr>
<td>Error message</td>
<td>Component/possible causes</td>
<td>Clearance</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>------------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| FIT: NO CONV                  | Error during signal evaluation:                                                          | ▶ Check parameters [measuring distance, substitute for temperature and pressure](#)  
▶ Increase parameter [Average](#)  
Attention: Only by trained personnel!  
▶ Restart device, see above  
▶ If not successful, contact Service |
| FIT: S MATRIX                 | Error during signal evaluation:                                                          | ▶ Check parameters [measuring distance, substitute for temperature and pressure](#)  
and correct if necessary  
▶ Restart device, see above  
▶ If not successful, contact Service |
| Incompatible device          | Incompatible software (SR-unit)                                                          | ▶ Check software version  
▶ Contact Service                                                             |
| INIT: NO LINE                 | No absorption line found                                                                  | ▶ Restart device, see above  
▶ If not successful, contact Service                                           |
| LD: PELT ERROR                | Temperature measurement on Peltier element defective:                                     | ▶ Restart device, see above  
▶ If not successful, contact Service                                           |
| LD...laser diode              |                                                                                          |                                                                           |
| LD: TEMP ERROR                | Laser wavelength adjustment outside allowed range:                                        | ▶ Restart device, see above  
▶ If not successful, contact Service                                           |
| MEAS: M PLAUS                 | Measuring results from measuring channel not plausible:                                  | ▶ Check parameters [measuring path, substitute for temperature and pressure](#)  
▶ Increase parameter [Average](#)  
Attention: Only by trained personnel!  
▶ Restart device, see above  
▶ If not successful, contact Service |
| MEAS: R PLAUS                 | Measuring results from measuring channel not plausible:                                  | ▶ Restart device, see above  
▶ If not successful, contact Service                                           |
| MEAS: REF CONC                | Gas concentration in reference cuvette too low                                             | ▶ Exchange reference cuvette  
▶ Contact Service                                                              |
| (only for devices with closed cuvette) |                                                                                       |                                                                           |
| Sensor communication          | SR-unit not connected correctly                                                           | ▶ Check CAN connection and repair if necessary                              |
### Troubleshooting and Clearing Malfunctions

<table>
<thead>
<tr>
<th>Error message</th>
<th>Component/possible causes</th>
<th>Clearance</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIG: DARK VALUE</td>
<td>Dark values of receiver element too high:</td>
<td>▶ Contact Service</td>
</tr>
<tr>
<td></td>
<td>● Possible hardware defect</td>
<td></td>
</tr>
<tr>
<td>SIG: K HIGH</td>
<td>Monitoring channel signal too high</td>
<td>▶ Contact Service</td>
</tr>
<tr>
<td>SIG: K LOW</td>
<td>Monitoring channel signal too low</td>
<td>▶ Contact Service</td>
</tr>
<tr>
<td>SIG: M HIGH</td>
<td>Measuring channel signal too high</td>
<td>▶ Contact Service</td>
</tr>
<tr>
<td>SIG: M LOW</td>
<td>Measuring channel signal too low:</td>
<td>▶ Clean front window, p. 65, §7.3.2</td>
</tr>
<tr>
<td></td>
<td>● Optical interfaces (front window) of SR-unit or reflector contaminated</td>
<td>▶ Check optical alignment and correct if necessary, p. 52, §6.3.4</td>
</tr>
<tr>
<td></td>
<td>● Optical axes alignment too inaccurate</td>
<td>▶ If not successful, contact Service</td>
</tr>
<tr>
<td></td>
<td>● Hardware defect</td>
<td></td>
</tr>
<tr>
<td>SIG: R HIGH</td>
<td>Reference channel signal too high</td>
<td>▶ Contact Service</td>
</tr>
<tr>
<td>SIG: R LOW</td>
<td>Reference channel signal too low</td>
<td>▶ Contact Service</td>
</tr>
<tr>
<td>Z MEAS: RANGE</td>
<td>Unallowed results during zero gas measurement:</td>
<td>▶ Check zero gas supply and repair if necessary</td>
</tr>
<tr>
<td>(only for devices with NH3 measurement)</td>
<td>● Zero gas missing</td>
<td>▶ Clean front window, p. 65, §7.3.2</td>
</tr>
<tr>
<td></td>
<td>● Optical interfaces (front window) of SR-unit or reflector contaminated</td>
<td>▶ Check optical alignment and correct if necessary, p. 52, §6.3.4</td>
</tr>
<tr>
<td></td>
<td>● Optical axes alignment too inaccurate</td>
<td></td>
</tr>
</tbody>
</table>
### 8.3.4 Warning messages

<table>
<thead>
<tr>
<th>Warning message</th>
<th>Component/possible causes</th>
<th>Clearance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed Test Gas</td>
<td>No detectable sample gas concentration (see Interval)</td>
<td>➤ Feed test gas</td>
</tr>
</tbody>
</table>
| FIT: LINEPOS    | Deviation of absorption line position:  
  ● Line not adjusted perfectly during start process | ➤ Wait until the warning message disappears after a few minutes  
  ➤ Restart device  
  - Activate Maintenance mode with maint button  
  - Trigger menu item Reset System or  
  - switch device off and on again  
  - If not successful, contact Service |
| H2O Undef. (only for GM700-8) | Monitoring measurability of H2O:  
  ● This warning appears when the gas temperature drops below the switch threshold set | “—” appears on the EvU display. This signals that no value is available. The warning message disappears again as soon as the temperature exceeds the switch threshold |
| MEAS: REF CONC (only for devices with closed cuvette) | Gas concentration in reference cuvette too low; measurement still possible | ➤ Plan and prepare reference cuvette replacement |
| DEV: TEMP       | Optic of SR-unit out of allowed temperature range:  
  ● Warm-up phase after switching on  
  ● Ambient temperature too high | ➤ Wait until the temperature has stabilized  
  ➤ Select different ambient temperature range, → p. 68, § 7.5.2.1  
  ➤ Cool device |
### 8.3.5 Further tips on troubleshooting

Figure 41 Troubleshooting the evaluation unit LED displays, signals and fuses

---

**Evaluation unit not responding**

- Check the power supply on the GM700, check the operating voltage set.
- Check the fuse in the evaluation unit; check the 24 V/5 V supply indicator in the evaluation unit, when doing so, remove the plug-in terminal on the cable to the receiver.
- If these indicators only light up when the plug-in connector has been removed, check the cabling first.

**Communication fault between evaluation unit and GM700 SR-unit**

Error message: **Sensor Communication??**

Check following connections:

- Connection between evaluation unit and SR-unit.
- Cable connection on the plug-in terminal in the evaluation unit.
- Cable to SR-unit.
- Outer plug-in connectors on SR-unit.
- Inner plug-in connectors in SR-unit.
9 Technical Data, Expendable and Spare Parts

Approvals
Accessories, expendable and spare parts
9.1 Approvals

9.1.1 Compliances

The technical design of this device complies with the following EC directives and EN standards:

- EC Directive RL 2006/95/EC
- EMC Directive 2004/108/EC
- Safety Requirements Electrical Equipment EN 61010-1
- Electrical Equipment for Measurement EN 61326-1
- Safety of Laser Products IEC 60825

Date of validity: 04.09.2013

9.1.2 Electrical protection

- Insulation: Protection class I in accordance with EN 61010-1.
- Insulation classification: Overvoltage category in accordance with EN 61010-1.
- Contamination: The device operates safely in an environment up to contamination level 2 in accordance with EN 61010-1 (usual, non-conductive contamination, moisture condensation).

9.2 Measuring components and accuracy

<table>
<thead>
<tr>
<th>Measured data</th>
<th>Depending on the respective probe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring path</td>
<td>NH₃ 0...30 ppm</td>
</tr>
<tr>
<td>Smallest range recommended</td>
<td>0...5000 ppm</td>
</tr>
<tr>
<td>Largest range recommended</td>
<td>0.6 ppm ppm, mg/m³, % by vol.</td>
</tr>
<tr>
<td>Min. detection limit</td>
<td>Physical unit</td>
</tr>
<tr>
<td>Stability</td>
<td>Zero point: ±2%</td>
</tr>
<tr>
<td>Accuracy</td>
<td>&lt;2% ... &lt;5%, depending on the application</td>
</tr>
<tr>
<td>Linearity</td>
<td>&lt; 1%</td>
</tr>
</tbody>
</table>

1) For 20 °C, 1000 hPa, 1 m measuring path

Combination of measuring components

Minimum and maximum measuring range end values are only applicable for single components. Extremely small or large end values for different components cannot be combined in all cases.
### Technical data, GM700 system components

<table>
<thead>
<tr>
<th><strong>Sender/receiver unit</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring principle</td>
<td>TDLS (Tunable Diode Laser Spectroscopy)</td>
</tr>
<tr>
<td>Light source</td>
<td>Laser diode</td>
</tr>
<tr>
<td></td>
<td>Wavelength:</td>
</tr>
<tr>
<td>Reaction time</td>
<td>1 ... 360 s; adjustable</td>
</tr>
<tr>
<td>Interfaces</td>
<td>RS232 (service)</td>
</tr>
<tr>
<td></td>
<td>CAN bus (GM700 components)</td>
</tr>
<tr>
<td>Indicators</td>
<td>Status LED (operation: green, maintenance: yellow, malfunction/error: red)</td>
</tr>
<tr>
<td>Protection class</td>
<td>IP 65</td>
</tr>
<tr>
<td>Sample gas temperature</td>
<td>0 ... +430 °C</td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>Cuvette, filled with gas: -40 ... +52 °C; adjustable in ranges</td>
</tr>
<tr>
<td></td>
<td>With test cuvette: -40 ... +50 °C; adjustable in ranges</td>
</tr>
<tr>
<td>Temperature drift</td>
<td>Max. 10 °C/h</td>
</tr>
<tr>
<td>Ambient humidity</td>
<td>&lt;85% rel. humidity (above dew point)</td>
</tr>
<tr>
<td>Impact resistance</td>
<td>According to EN 61010-1</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-40 to +55 °C</td>
</tr>
<tr>
<td>Power supply</td>
<td>24 V DC, 1.7 A max. (supplied by evaluation unit)</td>
</tr>
<tr>
<td>Dimensions</td>
<td>L x W x H: 239 x 272 x 330 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>13 kg</td>
</tr>
</tbody>
</table>
## Measuring probes

<table>
<thead>
<tr>
<th></th>
<th>GMP</th>
<th>GPP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Design</strong></td>
<td>Measuring path in flow direction open; purge air supply required</td>
<td>Gas diffusion measuring probe; versions for dry sample gas available</td>
</tr>
</tbody>
</table>
| **Integrated sensors** | Connections for:  
  - Flow monitor to monitor purge air feed  
  - Temperature sensor PT1000 to measure the gas temperature  
  - Pressure sensor | |
| **Data transfer** | CAN bus (electrically isolated)                                      | Yes, with integrated heating control                                 |
| **Heating for optical interfaces** | –                                                                   | Yes, with integrated heating control                                 |
| **Power supply** | –                                                                   | Separate supply: 115/230 V AC; 50/60 Hz, power input max. 150 VA     |
| **Dimensions and active measuring path** | → p. 94                                                            | → p. 95                                                            |
| **Weight**       | Max. 25 kg                                                          | Max. 45 kg                                                          |

## Evaluation unit (EvU)

### Connections/interfaces

| **Data transmission within the GM700 measuring system** | CAN bus  
Cable length max. 1000 m, electrically isolated, connects EvU, SR-unit |
| **Service interface for PC** | RS 232;  
connection via 9-pole Sub-D socket, modem capability |
| **Analog outputs** | 3  
Output range: 0–20 mA, max. 500 Ω, electrically isolated, live zero can be set to 4 mA  
| A1  
A2  
A3 | Measured values; assignment can be set individually  
| **Analog inputs** | 0 ... 20 mA, 100 Ω, optional for gas temperature, gas pressure |
| **Relays** | 3  
Relay; DC max. 30 W, 48 V, 1 A; AC max. 60 VA, 48 V, 1 A  
| R1 | Failure (N/C contact)  
| R2 | Maintenance requirement (N/O contact)  
| R3 | Function control (N/O contact) |
| **Digital inputs** | 3  
Inputs to connect potential-free contacts (loadable with 24 V; supply from the GM700 evaluation unit)  
| DI1 | Set device to Maintenance mode  
| DI2 | Trigger check cycle  
| DI3 | Unused |
| **Power supply** | Voltage/frequency 115/230 V AC −10%/+6%; 50/60 Hz  
Power input 50 VA max.  
Dimensions, weight, protection class  
Protection class IP 65 / NEMA 4x  
Dimensions See dimensional drawing, → p. 96 |
9.3 **GM700 sender/receiver unit dimensions**

![Diagram of GM700 sender/receiver unit dimensions](image)
9.3.1 Open measuring probe – GMP dimensions

<table>
<thead>
<tr>
<th>GMP measuring probes</th>
<th>Measuring gap L3 (active measuring path) [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>250</td>
</tr>
<tr>
<td>Nominal probe length</td>
<td>L1 [mm]</td>
</tr>
<tr>
<td>0.9 m</td>
<td>935</td>
</tr>
<tr>
<td>1.5 m</td>
<td>1644</td>
</tr>
<tr>
<td>2 m</td>
<td>2128</td>
</tr>
<tr>
<td>2.5 m</td>
<td>2628</td>
</tr>
</tbody>
</table>

Application-specific lengths on request
9.3.2 GPP measuring probes dimensions

<table>
<thead>
<tr>
<th>GPP measuring probes</th>
<th>Length L3 [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>227</td>
</tr>
<tr>
<td>Nominal probe length</td>
<td>L1 [mm]</td>
</tr>
<tr>
<td>0.9 m</td>
<td>904</td>
</tr>
<tr>
<td>1.5 m</td>
<td>1614</td>
</tr>
<tr>
<td>2.0 m</td>
<td>2098</td>
</tr>
<tr>
<td>2.5 m</td>
<td>2598</td>
</tr>
<tr>
<td>Application-specific lengths on request</td>
<td></td>
</tr>
</tbody>
</table>
9.4 Flange with tube dimensions

Versions deliverable from stock

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Material</th>
<th>Length [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016807</td>
<td>ST37</td>
<td>240</td>
</tr>
<tr>
<td>2016808</td>
<td>1.4571</td>
<td>240</td>
</tr>
<tr>
<td>2017785</td>
<td>ST37</td>
<td>500</td>
</tr>
<tr>
<td>2017786</td>
<td>1.4571</td>
<td>500</td>
</tr>
</tbody>
</table>

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

9.5 GM700 evaluation unit, sheet metal enclosure version, dimensions
9.6 GM700 evaluation unit, sheet metal version, dimensions
9.7 Weatherproof cover for GM700 SR-unit

9.8 Terminal box dimensions for CAN bus (option); Part No. 2020440
9.9 **Accessories, expendable and spare parts**

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

9.9.1 **Consumable parts for 2-years operation**

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 003 353</td>
<td>Optical cleaning cloth</td>
</tr>
<tr>
<td>6 010 378</td>
<td>Lithium battery 3.00 V CR2032</td>
</tr>
<tr>
<td>5 312 881</td>
<td>Pressure compensation element</td>
</tr>
</tbody>
</table>

9.9.2 **Spare parts for the sender/receiver unit**

<table>
<thead>
<tr>
<th>Description</th>
<th>Part No. for measuring components</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>O₂</td>
</tr>
<tr>
<td>Spare parts set, laser diode, sender unit</td>
<td>2034526</td>
</tr>
<tr>
<td>Spare parts set, receiver module, measuring channel</td>
<td>2034524</td>
</tr>
<tr>
<td>Spare parts set, receiver module</td>
<td></td>
</tr>
<tr>
<td>Monitor channel</td>
<td>2034525</td>
</tr>
<tr>
<td>Reference channel</td>
<td>2043570</td>
</tr>
<tr>
<td>Spare parts set, PCB heater</td>
<td>2034523</td>
</tr>
<tr>
<td>Spare parts set, PCB processor</td>
<td>2034541</td>
</tr>
<tr>
<td>Spare parts set, optics body module</td>
<td>2034522</td>
</tr>
<tr>
<td>Spare parts set, reference cuvette:</td>
<td></td>
</tr>
<tr>
<td>Purge cuvette</td>
<td>–</td>
</tr>
<tr>
<td>Permanent cuvette</td>
<td>2034545</td>
</tr>
<tr>
<td>Spare parts set, alignment tool</td>
<td>2034780</td>
</tr>
<tr>
<td>Spare parts set, fiber optics with threaded sleeve</td>
<td>2030791</td>
</tr>
<tr>
<td>Spare parts set, insulation (optic body)</td>
<td>2030738</td>
</tr>
<tr>
<td>Spare parts set, PCB CAN cable connector (socket)</td>
<td>2030740</td>
</tr>
<tr>
<td>Spare parts set, PCB CAN cable connector (plug)</td>
<td></td>
</tr>
<tr>
<td>Spare parts set, flange mounting kit</td>
<td>2039628</td>
</tr>
<tr>
<td>Spare parts set, lever (for alignment tool)</td>
<td>2030742</td>
</tr>
<tr>
<td>Spare parts set, clamping ring bolt</td>
<td>2030741</td>
</tr>
<tr>
<td>Bulkhead fitting 1/8&quot;</td>
<td>5306073</td>
</tr>
</tbody>
</table>

9.9.3 **Spare parts for the measuring probe**

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 023 596</td>
<td>PCB IO GPP</td>
</tr>
<tr>
<td>2 032 767</td>
<td>PCB IO GMP</td>
</tr>
<tr>
<td>4 038 337</td>
<td>Heater triple 48 V with terminal</td>
</tr>
<tr>
<td>2 030 190</td>
<td>Spare parts set, heater, GPP front window</td>
</tr>
<tr>
<td>2 030 191</td>
<td>Spare parts set, heater, GPP reflector</td>
</tr>
<tr>
<td>Part No.</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>4 049 466</td>
<td>Wedge for GMP reflector and GPP window</td>
</tr>
<tr>
<td>4 034 658</td>
<td>Triple, gold-coated</td>
</tr>
<tr>
<td>2 026 457</td>
<td>Spare parts set, filter insert L=250, ceramic</td>
</tr>
<tr>
<td>2 026 459</td>
<td>Spare parts set, filter insert L=500, ceramic</td>
</tr>
<tr>
<td>2 026 460</td>
<td>Spare parts set, filter insert L=750, ceramic</td>
</tr>
<tr>
<td>2 026 461</td>
<td>Spare parts set, filter insert L=1000, ceramic</td>
</tr>
<tr>
<td>2 030 236</td>
<td>Spare parts set, filter cartridge L=750, Teflon/ceramic</td>
</tr>
<tr>
<td>2 030 237</td>
<td>Spare parts set, filter cartridge L=1000, Teflon/ceramic</td>
</tr>
<tr>
<td>2 017 832</td>
<td>Temperature sensor PT 1000, length 610 mm</td>
</tr>
<tr>
<td>2 017 831</td>
<td>Temperature sensor PT 1000, length 910 mm, probe 1.5 m, 500 measuring gap</td>
</tr>
<tr>
<td>2 017 830</td>
<td>Temperature sensor PT 1000, length 1100 mm</td>
</tr>
<tr>
<td>2 018 181</td>
<td>Temperature sensor PT 1000, length 1410 mm, probe 2 m, 500 measuring gap</td>
</tr>
<tr>
<td>2 018 203</td>
<td>Temperature sensor PT 1000, length 1610 mm</td>
</tr>
<tr>
<td>2 032 919</td>
<td>Spare parts set, GPP seal, 420 °C</td>
</tr>
<tr>
<td>4 041 347</td>
<td>Sealing tape for flange 235 x 35 x 2, neoprene for GMP</td>
</tr>
<tr>
<td>2 025 615</td>
<td>Sealing tape for flange 235 x 35 x 2, neoprene/Teflon for GPP</td>
</tr>
<tr>
<td>4 039 022</td>
<td>Seal G x P 35 126/116 x x7, graphite</td>
</tr>
<tr>
<td>5 312 881</td>
<td>Pressure compensation element</td>
</tr>
</tbody>
</table>
### 9.9.4 Spare parts for the evaluation unit

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 021 795</td>
<td>PCB system control</td>
</tr>
<tr>
<td>6 021 782</td>
<td>Fuse 250 V, D8.5 x 8</td>
</tr>
<tr>
<td>6 020 125</td>
<td>Locking cap, fuse D5 x 20</td>
</tr>
<tr>
<td>6 007 328</td>
<td>Jumper, pluggable</td>
</tr>
<tr>
<td>6 020 400</td>
<td>Membrane keyboard</td>
</tr>
<tr>
<td>2 017 329</td>
<td>Hinge pin</td>
</tr>
<tr>
<td>6 010 378</td>
<td>Lithium battery 3.00 V CR2032</td>
</tr>
</tbody>
</table>

### 9.9.5 Fixing accessories

#### Fixing accessories for measuring probe – flange

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 700 457</td>
<td>Screw, 6 Kt M16 x 60-A2</td>
</tr>
<tr>
<td>5 700 482</td>
<td>Washer, A17-A2</td>
</tr>
<tr>
<td>5 700 471</td>
<td>Nut, 6 Kt M16 A2</td>
</tr>
<tr>
<td>5 700 480</td>
<td>Spring washer, A16</td>
</tr>
</tbody>
</table>

#### Fixing accessories for SR-unit - measuring probe

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 700 484</td>
<td>Cup springs A25</td>
</tr>
<tr>
<td>5 700 472</td>
<td>Nut SSI M12</td>
</tr>
<tr>
<td>5 700 494</td>
<td>Spherical washer</td>
</tr>
<tr>
<td>2 017 329</td>
<td>Hinge pin for GM700 flange fixture</td>
</tr>
<tr>
<td>4 023 743</td>
<td>Sealing tape</td>
</tr>
</tbody>
</table>
9.9.6  **Spare parts assignment for sender/receiver unit**

Figure 42  Spare parts assignment for GM700 SR-unit

- Optical Fiber
- Hinge pin, set
- Connector male
- Connector female
- Slide rod
- Alignment assembly
- Heater
- Detector module
  - Characteristics channel *)
- Module laser diode
- Reference cell
- Detector module reference channel *)
- Processor PCB
- Detector module
  - Laser diode
  - NH₃ measurement
- Insulation

*) Identical
Figure 43  
Spare parts assignment for GM700 SR-unit - intermediate enclosure and flange fixture

**SR-unit – intermediate enclosure**

- **2030740**
  - Socket
  - CAN cable connector

- **2030739**
  - Plug
  - CAN cable connector

- **5306073**
  - Bulkhead fitting

**SR-unit: Flange fixture**

- **2039628**
  - Fixing set, flange

- **2030741**
  - Clamping ring bolt

- **2030742**
  - Lever for alignment tool
Figure 44  Spare parts assignment for reflector GMP probe
Figure 45  
Spare parts assignment GPP probe: Flange part

Figure 46  
Spare parts assignment GPP probe: Reflector side
Figure 47
Spare parts assignment GPP probe: Window

- 4034394 Graphite 53.5x40x1
- 4034380 Graphite 55.5x5x3
- 4034826 Graphite 42.3x3x2
- 4049466 Window 42x2
- 5700833 screw M5x35
- 4035977 Window Heater (spare set 300198 for probes -2340000)
- 4036079 Graphite 11x8x2.5
- 5305247 Ring for Window
- 5309123 screw M6x10
- 5309125 screw M6x10
- 5309123 washer A5

Subject to change without notice
10.1 **Positioning the probe reflector when the probe must be realigned**

Only necessary when the measuring probe must be realigned in flow direction (e.g. from vertical to horizontal direction) but the SR-unit must sit vertically.

**Figure 48** Aligning the measuring probe

The reflector in the probe end must, in accordance with the probe rotation (e.g. at 90°), be turned in the opposite direction to this rotation (e.g. –90°) so that the alignment of the optical beam path to SR-unit is maintained.

- Loosen the 3 screws on the probe end (screws with nuts remain on the reflector enclosure); turn the cover 30° to the right and pull the reflector unit out.
Loosen the screw connections in the reflector holder and remove it.
Take both holders and the wedge with the graphite seals out.
Take the hollow triple with the triple holder out, position it in the new probe alignment in the appropriate position (e.g. –90°).
Swap the socket and slotted screws: The socket screw must be rotated in the triple holder groove.

The socket screw shows the position of the hollow triple. It must always point towards the connector on the SR-unit so that the alignment is correct.
Reassemble the reflector components in the reverse sequence (insert the reflector and turn approx. 30° to the left to stop) and secure the reflector unit on the probe end.
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E-Mail info@sick.be
Brasil
Phone +55 11 3215-4900
E-Mail sac@sick.com.br
Canada
Phone +1 905 771 14 44
E-Mail information@sick.com
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Phone +420 2 57 91 18 50
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E-Mail ggh@sick.com.hk
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E-Mail info@sick.de
España
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Phone +972-4-6881000
E-Mail info@sick-sensors.com
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Phone +39 02 27 43 41
E-Mail info@sick.it
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E-Mail info@sick.ae
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1 (800) 325-7425 - tollfree
E-Mail info@sickusa.com

More representatives and agencies at www.sick.com